



**KOONTZ BRYANT  
JOHNSON WILLIAMS**

FORMERLY CBC ENGINEERS

April 20, 2022

Contech Engineered Solutions LLC  
9025 Centre Pointe Drive  
Suite 400  
West Chester, OH 45069

Attn: Mr. Erik Early, P.E.  
Design Engineer – Drainage, Plate, and Specialty Products

Re: Peer Review of CANDE Finite Element Analyses, Design of Spread Footing Foundations, Design of Concrete Headwalls and Wingwalls, and Preparation of Load Rating Calculations for a BridgeCor Box (705931); Sterling Ranch, El Paso County, Colorado; KBJW Report No. 24879D-1-0422-05

Ladies and Gentlemen:

Koontz Bryant Johnson Williams, Inc. (KBJW, formerly CBC Engineers and Associates, Ltd.) is pleased to submit our report for the above referenced project. This report contains the peer review of the CANDE finite element analyses, design of spread footing foundations, design of concrete headwalls and wingwalls, and preparation of load rating calculations for the above referenced structure. Others are responsible for all other aspects of the design of the structure including but not limited to backfill evaluation, hydraulics, settlement, and scour/abrasion/corrosion, and the only responsibility of KBJW is as referenced above.

If you have any questions, please contact us.

Respectfully submitted,

Koontz Bryant Johnson Williams, Inc.

Deepa Nair, M.S., P.E.  
Project Engineer

Mitchell T. Hardert, P.E.  
Chief Engineer



DN/MTH/mt

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## **SECTION I**

**TEXT**

## 1.0 AUTHORIZATION

Authorization to proceed with this project was given by Mr. Erik Early of Contech Engineered Solutions LLC. Work was to proceed in accordance with KBJW Quotation No. 22-170-05 dated April 4, 2022, and the terms and conditions of the Master Agreement for Engineering Services dated July 30, 2009.

## 2.0 STRUCTURE DESCRIPTION

The proposed project consists of a BridgeCor box structure with an inside span of 38'-1" and an inside rise of 11'-11". The 15" x 5-½" deep corrugated structural plates for the BridgeCor box structure are proposed to be 7 gage (0.188"). The actual design height of cover over the structure is reported to be 5.0 feet above the crown @ 120 pcf (2.0 ft. min. select backfill above the crown of the structure). The design live load considered in the evaluation is the HL-93 live loading.

TABLE 1  
STRUCTURE CHARACTERISTICS

Number of Structures	1
Structure Type	BridgeCor Box
Inside Span (ft.-in.)	38'-1"
Inside Rise (ft.-in.)	11'-11"
Gage	7 gage (0.188")
Live Load	HL-93
Design Cover (ft.)	5.0' at 120 pcf

## 3.0 FOUNDATION EVALUATION

We have been provided a geotechnical report for this project location prepared by Entech Engineering, Inc. (their project no. 200045) dated November 4, 2021, and revised on March 24, 2022. We have also been provided an addendum table with updated bearing capacity recommendations prepared by Entech Engineering, Inc. (their project no. 211647 reported to be applicable to this project). Entech recommends the footings for the proposed BridgeCor box be founded on sandstone bedrock and be designed for a factored bearing resistance of 8,700 psf (Ultimate Bearing Resistance of 14,500 psf) based on a 0.60 resistance factor and a minimum permanent footing embedment depth of 5 feet.

Addendum table with updated bearing capacities not provided for review. The referenced Entech Engineering report for Job No. 211647 for Briargate Parkway over Sand Creek does not indicate the bearing pressure noted here. Please provide addendum/report for verification.



We have accordingly designed the spread footings for a factored bearing resistance of 8,700 psf. A friction factor of 0.34 has also been utilized based on an ultimate friction coefficient of 0.40 with the recommended 0.85 sliding resistance factor. It should be noted that KBJW has not made any independent evaluation of the foundation and/or geotechnical conditions. We are relying totally on the information furnished to us as being correct and indicative of the bearing capacity and friction factor at the actual structure location. We recommend that a geotechnical engineer examine the foundation materials once the foundation has been excavated, and that the bearing capacity and friction factor be field verified before the footings are constructed. All recommendations in the project geotechnical report should be followed during construction. The footings should be permanently buried to provide frost protection in accordance with the geotechnical report and regional design requirements. Any foundation improvement required to achieve the recommended factored bearing resistance and friction factor, and to protect against frost and scour and settlement, is the responsibility of others than KBJW.

#### **4.0 FOOTING EVALUATION**

The load on a footing consists of the load on top of the structure carried by each leg of the structure, which is equal to the unit weight of the soil times the height of cover over the structure divided into each leg; plus the weight of the soil on the outside edges of the footing outside the structure, plus the weight of the structure itself plus the live load. The weight of the soil over the footings that is excavated can be deducted from the pressure at the bottom of the footing in the consideration of the net bearing capacity. The footing also must be designed for any horizontal thrust which is created by the angle of entry into the footing. Since the structure has a span of 38'-1" and a rise of 11'-11", the structure does enter the footing at an angle and there is, therefore, a horizontal component to the footing reactions. The horizontal portion of the reaction is toward the outside of the structure. The factored loading of the footing is  $R_h = 4,695$  plf,  $R_v = 38,232$  plf (from CANDE structural run as per AASHTO LRFD Specifications). Figure 1 shows the loads on the footing.

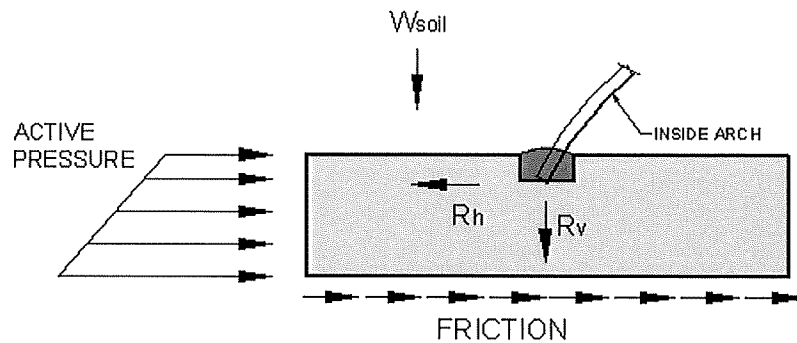


Figure 1

The footings for the structure are to be concrete spread footings and have been designed for the above referenced loading. Based on the factored bearing resistance of 8,700 psf, the width of the footings must be 6'-6" with a minimum thickness of 48". The steel required in the footings is #6 bars at 6" on center at the bottom, #6 bars at 6" on center at the top, and #6 longitudinal reinforcement bars evenly spaced around the perimeter. The typical cross section of the footings for the structure is attached in Appendix B.

## 5.0 REVIEW OF CANDE ANALYSIS

The CANDE finite element analyses for the proposed BridgeCor box structure is based on AASHTO – LRFD Bridge Design Specifications considering the specific requirements of Section 12 for deep corrugated steel plate profiles using the CANDE 2019 computer model with elasticity based correction for live load distribution.

CANDE analyses have been performed for the structure considering the design height of cover of 5.0 feet at 120 pcf with HL-93 live loading. Based on the analyses of the proposed structure, the governing live load is HL-93 live load over the structure with the design height of cover of 5.0 feet above the crown of the structure. The 15" x 5-½" deep corrugated steel plates are proposed to be 7 gage (0.188"). The design calculations are based on the AASHTO-LRFD Bridge Design Specifications considering the specific requirements of Section 12 for deep corrugated steel plate profiles, using the CANDE 2019 computer model. The select backfill material above and around the proposed BridgeCor structure (modeled to extend to at least 12.67 feet outside the springline of the BridgeCor box, and to 2.0 ft. min. over the crown of the structure) has been modeled in the provided CANDE analyses as an SW-95 material (gravelly sand with 95% relative compaction as per

AASHTO T-99) with the established hyperbolic stress-strain parameters for this material designation and an in-place unit weight of 120 pcf. The general embankment fill material outside the select backfill zone has been modeled in the provided CANDE analyses as an SM-90 material (silty sand with 90% relative compaction as per AASHTO T-99) with the established hyperbolic stress-strain parameters for this material designation and an in-place unit weight of 120 pcf. The in-situ material at the project location has been considered as a stiff soil with  $E=3,000$  psi.

Based on the reviewed Contech CANDE analyses, with deep corrugated steel with a thickness of 7 gage (0.188"), it is the opinion of this office that the structural analyses and resultant plate gage for the proposed BridgeCor box conform to industry standards for the structure type. The CANDE finite element analyses performed using the soil structure interaction model indicate that the proposed BridgeCor box structure given the proposed installation conditions and proposed material properties, meets AASHTO LRFD Bridge Design Specification strength criteria including wall area, buckling, seam strength and combined moment and thrust criterion. We have not made an independent verification of the background site road and structure elevations and geotechnical data used in the design calculations and understand all initial assumptions and data are correct as presented to us. The actual in-service performance of the installed structure will be highly dependent on their conformity to the attributes modeled in the CANDE analyses, including but not limited to the geometry and strength parameters of the BridgeCor box and the various soil zones. The soil parameters utilized in the CANDE analyses, including the type and strength characteristics of the foundation material, road fill/in-situ soil outside the select backfill zone, and the structural backfill must be available in the field (and verified by the project geotechnical engineer) during the installation of the structure in order for the actual performance of the proposed structure to be in agreement with the calculated performance from the CANDE analyses. Deviations between the actual installed conditions and the modeled conditions will result in changes in the expected performance of the structure.

We have accordingly included in this report the calculations, and they are attached in Appendix A. The select backfill around and over the proposed BridgeCor box arch must be placed and compacted in strict conformance with the project specifications, the manufacturer's requirements, and accepted industry standards. The backfill material around the structure must be placed in balanced steps. The backfill must be brought up relatively level on both sides of the structure as recommended by the structure manufacturer. If the backfill on one side is much higher than the



backfill on the other, the unbalanced soil pressure may distort the structure. Therefore, care must be exercised to maintain balanced loading on the structure during any backfilling operations and the structure must be properly backfilled to maintain this balanced loading.

## **6.0 DESIGN OF CONCRETE HEADWALLS AND WINGWALLS**

Concrete headwalls have been designed to be connected to the inlet and outlet ends of the structure. The maximum height of the headwalls is 19.0 feet above the top of the footings at the outlet end and 18.5 feet above the top of the footings at the inlet end. The length of the headwall at the ends is about 43.0' as shown on the drawings. The design of any required vehicle barriers is the responsibility of others than KBJW. There is a wingwall connected to the headwall on each side of the structure as shown on the drawings, with expansion joints between the headwalls and wingwalls as shown on the drawings. The required geometry of the headwalls and wingwalls should be verified prior to construction.

The design of the reinforced concrete headwalls has been performed for dead loads, and lateral loads from soil and live load surcharge (240 psf). No unbalanced hydrostatic loading or impact loading has been considered. The dimensions and reinforcing steel have been designed using AASHTO LRFD factored loads to resist the loads applied to the wall, and to protect against temperature and shrinkage effects. The walls have been designed to be founded on BridgeCor box spread footings as shown on the drawings.

The Bridge-Cor structure will be tied into the headwalls with 3/4" diameter hook bolts as shown on the construction drawings. The bolts will be placed on 16-inch centers all the way around the barrel. Double nuts will be used to attach each bolt to the corrugated plate. Dimensions and the reinforcing steel required for the headwalls is as shown on the attached drawings in Appendix B. The calculations are attached in Appendix A.

The wingwalls at both sides have been designed to carry the lateral soil pressure resulting from the maximum backfill above the footings considering a maximum backfill slope of 3H:1V backfill behind the wingwalls. The dimensions and reinforcing steel have also been designed using AASHTO LRFD factored loads to resist the loads applied to the wingwalls, and to protect

against temperature and shrinkage effects. The foundations for the wingwalls have been designed for a factored bearing pressure of the foundation bedrock of 8,700 psf and a friction factor of 0.34 based on an ultimate friction coefficient of 0.40 with the recommended 0.85 sliding resistance factor as described previously. The permanent finished groundline at the wingwalls must be maintained at the elevations above the bottom of the walls at all times as shown on the drawings to provide passive soil resistance against sliding. Dimensions and the reinforcing steel required for the wingwalls are as shown on the attached drawings in Appendix B. The calculations are attached in Appendix A.

The backfill behind the headwalls should meet the requirements of the select backfill for the BridgeCor structure and should have a minimum internal friction angle of 36 degrees with a maximum unit weight of 120 pcf. The select backfill behind the wingwalls must be a well-graded, angular, durable granular material placed and compacted to achieve a minimum internal friction angle of 36 degrees and a maximum unit weight of 120 pcf. These values to be field verified.

## 7.0 LOAD RATING PROCEDURE

The load carrying capability of the deep corrugated buried corrugated metal culvert has been analyzed in accordance with the *Manual for Bridge Evaluation (AASHTO)* as well as the provisions of the *NCSPA Design Data Sheet No. 19, AASHTO LRFD Bridge Design Specifications, Section 12.8.9 for deep corrugated structures (LRFR rating) for design vehicles, and CDOT Bridge Load Rating Manual* using the LRFR methodology. AASHTO LRFD Bridge Design Specifications state that finite element analyses shall be performed in the analysis of deep corrugated structures and CANDE is specifically referenced in AASHTO. CANDE is a computer program for the structural analysis, design, and evaluation of buried culverts with consideration of the soil-structure systems. We have accordingly utilized the finite element computer program CANDE for the load rating evaluation of the Bridge-Cor structure. Combined soil-structure interaction system models were developed using CANDE and the models subjected to earth and live loads for the detailed investigation of the performance of the structure for the various live load cases mentioned above. All design parameters including but not limited to, the structure properties, in-situ soil properties, and backfill soil properties, utilized in the CANDE finite element analysis for the structure have been

utilized in the load rating evaluation. The load ratings have been performed assuming that the in-place condition of the Bridge-Cor arch is as per the design characteristics, and that no deformation, deflection, corrosion, or any other type of distress is present in the Bridge-Cor arch structure. Deviations from these considered conditions will affect the load ratings presented herein, and if observed, should be investigated and evaluated as necessary. The structure is to be rated for HL-93 design live load, CDOT Legal Trucks, Specialized Hauling Vehicles, CDOT Permit Vehicles, and FHWA Emergency Vehicles as per CDOT Bridge Load Rating Manual with minimum cover conditions over the structure in traffic areas.

Inventory and Operating load ratings for the design loads have been performed for the Bridge-Cor structure. An earth load factor of 1.5 and a live load factor of 1.35 for operating load ratings and a live load factor of 1.75 for inventory load ratings have been utilized for the design loads. An earth load factor of 1.5 and a live load factor of 1.45 for operating load ratings have been utilized for the CDOT Legal Trucks, and Specialized Hauling Vehicles. An earth load factor of 1.5 and a live load factor of 1.3 for operating load ratings have been utilized for the Permit Live Load Vehicles and Emergency Vehicles. The actual pipe wall thrusts (critical for deep corrugated structures) from the earth dead loads and live loads as obtained from the CANDE analyses for the various live loads have been utilized in the load rating of the structure. These loads are used in in-house developed load rating spreadsheets following the provisions of the *NCSPA Design Data Sheet No. 19, Manual for Bridge Evaluation (AASHTO)*, and *AASHTO LRFD Bridge Design Specifications* to analyze the structure for the defined dead loads and live loads (pipe-wall thrusts obtained from CANDE runs) for each load rating using the appropriate load/resistance factors (depending on LRFR), in order to compute the rating factors for wall strength, individually for the structures.

AASHTO LRFD Design Specifications Section 12.8.9 for deep corrugated structures state that in addition to the strength limit state criteria for wall area, buckling and seam resistance, the combined effects criteria of factored thrust and moment must be met for the structures at all stages of construction. For LRFR methodology, the structure is further modeled with the operating/inventory loads obtained based on the critical strength rating factor to verify that it meets AASHTO LRFD Design Specifications Section 12.8.9 combined effects criteria of factored thrust and moment. If the combined effects criteria of factored thrust and moment are not met for the computed loads, the



operating and inventory rating factors for the various live loads are reduced to a level whereby the combined effects criteria is met.

The lowest load rating factor based on either wall strength or the factored thrust-moment criteria of the structure for LRFR methodology is the controlling load rating factor for the specific vehicle being considered. The Load Rating is calculated from the load factors and the Gross Vehicle Weight (GVW) using the following equations:

- 1) Operating Loads (tons)

$$\text{Load} = \text{RF}_o(\text{GVW})$$

- 2) Inventory Loads (tons)

$$\text{Load} = \text{RF}_i(\text{GVW})$$

The results of the calculations are as follows:

TABLE 2  
LOAD RATINGS (LRFR METHODOLOGY)

VEHICLE		OPERATING LOAD		INVENTORY LOAD	
LIVE LOAD	GROSS VEHICLE WEIGHT (tons)	RF <sub>o</sub>	LOAD RATING (tons)	RF <sub>i</sub>	LOAD RATING (tons)
HL-93 Tandem	25.0	2.47	61.8	1.98	49.5
HL-93 Truck	36.0	3.26	117.4	2.58	92.9
Type 3	27.0	3.05	82.4	--	--
Type 3S2	42.5	3.05	129.6	--	--
Type 3-2	42.5	3.16	134.3	--	--
SU4	27.0	3.23	87.2	--	--
SU5	31.0	3.23	100.1	--	--
SU6	34.75	3.23	112.2	--	--
SU7	38.75	2.91	112.8	--	--
NRL	40.0	2.75	110.0	--	--
EV2	28.75	3.28	94.3	--	--
EV3	43.0	2.13	91.6	--	--
Permit Truck	96.0	2.28	218.9	--	--
Modified Tandem	50.0	2.47	123.5	--	--

The calculations based on the AASHTO LRFD Bridge Design Specifications, CDOT Bridge Load Rating Manual, Manual for Bridge Evaluation (AASHTO) and "NCSPA Design Data Sheet No. 19 - 1995" are attached in Appendix A.

## **8.0 SCOUR**

It is beyond the scope of this report to evaluate scour and it is the responsibility of others than KBJW. The depth of all foundations should be evaluated for scour before the foundations are constructed, and scour countermeasures (by others) provided as necessary to protect the footings.

## **9.0 WARRANTY**

Our professional services have been performed, our findings obtained and our recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. No other warranty, expressed or implied, is made.

This report has been prepared for the exclusive use of Contech Engineered Solutions LLC for specific application to the structure herein described. Specific recommendations have been provided in the various sections of the report. The report shall, therefore, be used in its entirety. This report is not a bidding document and shall not be used for that purpose. Anyone reviewing this report must interpret and draw their own conclusions regarding specific construction techniques and methods chosen. KBJW is not responsible for the independent conclusions, opinions or recommendations made by others.

**SECTION II**

**SPECIFICATIONS**



## **I – GENERAL**

### **1.0 STANDARDS AND DEFINITIONS**

#### **1.1 STANDARDS** - All standards refer to latest edition unless otherwise noted.

- 1.1.1** ASTM D-698-70 (Method C) "Standard Test Methods for Moisture. Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.5 kg.) Rammer and 12-inch (305-mm) Drop".
- 1.1.2** ASTM D-2922 "Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear methods (Shallow Depth)".
- 1.1.3** ASTM D-1556 "Standard Test Method for Density of Soil in place by the Sand-Cone Method".
- 1.1.4** ASTM D-1557 "Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort."
- 1.1.5** All construction and materials shall be in accordance with the latest AASHTO LRFD Bridge Design Specifications.

#### **1.2 DEFINITIONS**

- 1.2.1** Owner - In these specifications the word "Owner" shall mean El Paso County, Colorado
- 1.2.2** Engineer - In these specifications the word "Engineer" shall mean the Owner designated engineer.
- 1.2.3** Design Engineer - In these specifications the words "Design Engineer" shall mean KBJW, Inc.
- 1.2.4** Contractor - In these specifications the word "Contractor" shall mean the firm or corporation undertaking the execution of any work under the terms of these specifications.
- 1.2.5** Approved - In these specifications the word "approved" shall refer to the approval of the Engineer or his designated representative.
- 1.2.6** As Directed - In these specifications the words "as directed" shall refer to the directions to the Contractor from the Owner or his designated representative.

## **2.0 GENERAL CONDITIONS**

- 2.1** The Contractor shall furnish all labor, material and equipment and perform all work and services except those set out and furnished by the Owner, necessary to complete in a satisfactory manner the site preparation, excavation, filling, compaction, grading, footing construction, endwall construction as shown on the plans and as described therein.

This work shall consist of all mobilization clearing and grading, grubbing, stripping, removal of existing material unless otherwise stated, preparation of the land to be filled, filling of the land, spreading and compaction of the fill, and all subsidiary work necessary to complete the grading of the cut and fill areas to conform with the lines, grades, slopes, and specifications.

This work is to be accomplished under the observation of the Owner or his designated representative.

- 2.2** Prior to bidding the work, the Contractor shall examine, investigate and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site, including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation as he may deem necessary for the planning and proper execution of the work.

If conditions other than those indicated are discovered by the Contractor, the Owner should be notified immediately. The material which the Contractor believes to be a changed condition should not be disturbed so that the owner can investigate the condition.

- 2.3** The construction shall be performed under the direction of an experienced engineer who is familiar with the design plan.

## **I – BRIDGECOR FOOTINGS**

### **1.0 EXCAVATION FOR FOOTINGS**

- 1.1** Footing excavation shall consist of the removal of all material, of whatever nature, necessary for the construction of foundations.
- 1.2** It shall be the responsibility of the Contractor to identify and relocate all existing utilities which conflict with the proposed footing locations shown on the plan. The Contractor must call the appropriate utility company at least 48 hours before any excavation to request exact field location of utilities, and coordinate removal and installation of all utilities with the respective utility company.
- 1.3** The side of all excavations shall be cut to prevent sliding or caving of the material above the footings.
- 1.4** Excavated material shall be disposed in accordance with the plan established by the Engineer.
- 1.5** The footings are designed for a factored bearing resistance of 8,700 psf (Ultimate Bearing Resistance of 14,500 psf) based on a 0.60 resistance factor in accordance with the updated recommendations by Entech Engineering, Inc for a minimum permanent footing embedment depth of 5 feet. A friction factor of 0.34 has also been utilized based on an ultimate friction coefficient of 0.40 and the recommended sliding resistance factor of 0.85. These shall be verified in the field before construction. The evaluation and design of any required foundation improvement to achieve the recommended factored bearing resistance and friction factor, and to protect against frost and scour and settlement, is the responsibility of others than KBJW. All recommendations in the project geotechnical report shall be followed during construction.
- 1.6** Care must be exercised to ensure that heavy equipment is not operated adjacent to the footings. Heavy equipment shall not be allowed any closer than 5 feet to the footings.

### **2.0 CONCRETE FOOTING DIMENSIONS**

- 2.1** The footings shall be reinforced in accordance with the construction drawings.



### III – HEADWALLS AND WINGWALLS

- 1.0 The headwalls and wingwalls shall consist of reinforced concrete conforming to Chapter IV of these specifications, and AASHTO LRFD Bridge Design Specifications having a minimum compression strength of 4,000 psi.
- 2.0 Reinforcing steel shall conform to ASTM A-615, Grade 60, having minimum yield strength of 60,000 psi.
- 3.0 The headwalls shall be anchored to the BridgeCor box in the manner shown on the plans and shall be formed and poured in accordance with the plan dimensions.
- 4.0 Round weep holes spaced not over 5 feet on center shall be placed in the walls above finished grade as shown on the construction drawings. A granular envelope, consisting of #57 stone (clean  $\frac{3}{4}$ " aggregate) or equivalent, shall be placed behind each weep hole for a distance of approximately 1 foot from all edges of the weep hole. A free-draining geotextile screen shall be placed between the weep hole and the stone to prevent erosion of the stone.
- 5.0 The select backfill behind the headwalls must be a well-graded, angular, durable granular material conforming to the select backfill specifications for the BridgeCor arch placed and compacted to achieve a minimum internal friction angle of 36 degrees and a maximum unit weight of 120 pcf. The material must be placed in strict conformance with the project specifications, the manufacturer's requirements, and industry standards. The select backfill behind the wingwalls must be a well-graded, angular, durable granular material placed and compacted to achieve a minimum internal friction angle of 36 degrees and a maximum unit weight of 120 pcf. These values to be field verified.
- 6.0 All Federal, State, and Local regulations shall be strictly adhered to relative to excavation side-slope geometry and any required excavation shoring.

## **IV – CONCRETE FOR FOOTINGS AND ENDWALLS**

### **1.0 CODES AND STANDARDS**

- 1.1** Reinforced concrete shall conform to the requirements of Colorado DOT Standards and Section V of the AASHTO LRFD Bridge Design Specifications having a minimum compressive strength of 4,000 psi.

### **2.0 STANDARDS FOR MATERIALS**

- 2.1** Portland Cement - Conforming to ASTM Specification C-150, Type I or II.
- 2.2** Water - The water shall be drinkable, clean free from injurious amounts of oils, acids, alkalis, organic materials, or deleterious substances.
- 2.3** Aggregates - Fine and coarse aggregates shall conform to current ASTM Specification C-33 "Specification for Concrete Aggregates" except that local aggregates which have been shown by tests and by actual service to produce satisfactory qualities may be used when approved by the Engineer.
- 2.4** Submittals - Test data and/or certifications to the Owner shall be furnished upon request.

### **3.0 PROPORTIONING OF CONCRETE**

#### **3.1 COMPOSITION**

- 3.1.1** The concrete shall be composed of cement, fine aggregate, coarse aggregate and water.
- 3.1.2** The concrete shall be homogeneous, readily placeable and uniformly workable and shall be proportioned in accordance with ACI-211.1.
- 3.1.3** Proportions shall be established on the basis of field experience with the materials to be employed. The amount of water used shall not exceed the maximum 0.45 water/cement ratio, and shall be reduced as necessary to produce concrete of the specified consistency at the time of placement.
- 3.1.4** An air-entraining admixture, conforming to the requirements of ASTM C260, shall be used in all concrete furnished under this contract. The quantity of admixture shall be such as to produce an air content in the freshly mixed concrete of 6 percent plus or minus 1 percent as determined in accordance with ASTM C231 or C173.

**3.2** Qualities Required - As indicated in the table below:

TABLE IV-1  
QUALITIES REQUIRED

ITEM	QUALITY REQUIRED
AASHTO Class	A
Type of Cement	I or II
Compressive Strength $f_c$ @ 28 days	4,000 psi
Slump, inches	2 - 4 in.

**3.3** Maximum Size of Coarse Aggregates - Maximum size of coarse aggregates shall not be larger than 19 mm (3/4 inches).

**3.4** Rate of Hardening of Concrete - Concrete mix shall be adjusted to produce the required rate of hardening for varied climatic conditions:

Under 40°F Ambient Temperature – All work to be in accordance with the recommendations of ACI-306R "Cold Weather Concreting."

**4.0** **MIXING AND PLACING**

**4.1** Equipment - Ready Mix Concrete shall be used and shall conform to the "Specifications for Ready-Mix Concrete," ASTM C-94. Approval is required prior to using job mixed concrete.

**4.2** Preparation - All work shall be in accordance with ACI-304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete." All construction debris and extraneous matter shall be removed from within the forms. Concrete shall be placed on clean surfaces, free from water. Concrete that has to be dropped four (4) feet or more shall be placed through a tremie.

**4.3** All concrete shall be consolidated by internal mechanical vibration immediately after placement. Vibrators shall be of a size appropriate for the work, capable of transmitting vibration to concrete at frequencies of not less than 4,500 impulses per minute.

**5.0** **FORM WORK**

**5.1** Forms shall be of wood, steel or other approved material and shall be set and held true to the dimensions, lines and grades of the structure prior to and during the placement of concrete.

**5.2** Forms shall not be removed until the concrete has sufficient strength to prevent concrete damage and/or drainage.

## **6.0 CURING**

- 6.1** Fresh concrete shall be protected from rains, flowing water and mechanical injury for a period of seven (7) days. Loads shall not be placed on the concrete until it has reached its design strength.

## **7.0 REINFORCING STEEL**

### **7.1 MATERIAL**

- 7.1.1** All reinforcing bars shall be deformed bars (ASTM-A615) Grade 60.

### **7.2 BENDING AND SPLICING**

- 7.2.1** Bar reinforcement shall be cut and bent to the shapes shown on the plans. Fabrication tolerances shall be in accordance with ACI 315. All bars shall be bent cold, unless otherwise permitted.
- 7.2.2** All reinforcement shall be furnished in the full lengths indicated on the plans unless otherwise permitted. Except for splices shown on the plans and splices for No. 5 or smaller bars, splicing of bars will not be permitted without written approval. Splices shall be staggered as far as possible.
- 7.2.3** In lapped splices, the bars shall be placed and wired in such a manner as to maintain the minimum distance to the surface of the concrete shown on the plans.
- 7.2.4** Substitution of different size bars will be permitted only when authorized by the engineer. The substituted bars shall have an area equivalent to the design area, or larger.

### **7.3 PLACING AND FASTENING**

- 7.3.1** Steel reinforcement shall be accurately placed as shown on the plans and firmly held in position during the placing and setting of concrete. Bars shall be tied at all intersections around the perimeter of each mat and at not less than 2-foot centers or at every intersection, whichever is greater, elsewhere. Welding of cross bars (tack welding) will not be permitted for assembly of reinforcement.
- 7.3.2** Reinforcing steel shall be supported in its proper position by use of mortar blocks, wire bar supports, supplementary bars or other approved devices. Such devices shall be of such height and placed at sufficiently frequent intervals so as to maintain the distance between the reinforcing and the formed surface or the top surface within 1/4 inch of that indicated on the plans.

## **V - FILTER FABRIC (GEOTEXTILE SCREEN)**

- 1.0** Filter fabric shall be placed at all locations shown on the construction drawings, and as necessary between all dissimilar materials to prevent soil migration and to maintain a soil-tight system.
- 2.0** Filter fabric cloth shall conform to Contech specification for C60-NW or equivalent and shall meet the following ASTM tests:
  - 2.1** ASTM D4751 - Apparent opening size equal to #70 U.S. Standard Sieve Size.
  - 2.2** ASTM D4632 (Grab Tensile Test) - Minimum Strength = 160 pounds.
  - 2.3** ASTM D4632 (Grab Elongation) - 30-70%.
  - 2.4** ASTM D4533 (Trapezoidal Tear) - Minimum Strength = 60 pounds.
  - 2.5** ASTM D4355 (Stabilized for Heat and Ultra-Violet Degradation) - 70% strength retained.
- 3.0** The minimum fabric coefficient of permeability (ASTM D4491) shall be 0.24 cm/sec.
- 4.0** The fabric shall be non-woven with a minimum thickness (ASTM D5199) of 60 mils.
- 5.0** Fabric shall not be placed over sharp or angular rocks that could tear or puncture it.
- 6.0** Care should be exercised to prevent any puncturing or rupture of the filter fabric. Should such rupture occur, the damaged area should be covered with a patch of filter fabric using an overlap minimum of one (1) foot.



**APPENDIX A**

**CALCULATIONS**



**BRIDGECOR ARCH ( 38'-1" X 11'-11") FOOTING . . . . LRFD FACTORED**

(AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS)

Project No: CBC

24879

Project Title:

Sdterling Ranch Rd., El Paso County, CO

$$R_v = (V_{dl} + V_{LL}) \times \cos(A)^\circ$$

Vertical Footing Reaction Component

$$R_h = (V_{dl} + V_{LL}) \times \sin(A)^\circ$$

Horizontal Footing Reaction Component

$$V_{dl} = (H_2 \times S - A_t) \times \gamma / 2$$

Gamma = Unit Weight of Soil

120 pcf

$$V_{LL} = n \cdot (AL) / (L_w + 2 \times H_1)$$

S=	38.083	ft	Span
R=	11.92	ft	Rise
H=	5		Height of cover above the crown
H1=	16.590	ft.	Height of cover above the footing to traffic surf
H2=	16.590	ft.	Height of cover above the springline
A°=	7	°	Return angle
At =	355	sq.ft.	Area of the top portion above springline
AL =	50000	lbs.	HL-93
n =	2		Traffic lanes
Lw =	8	ft.	Lane width

$$V_{dl} = 16607.82 \text{ lbs/ft.}$$

$$R_v = 18894.3$$

$$R_h = 2319.93$$

$$V_{LL} = 2428.36 \text{ lbs/ft.}$$

$$R_{vd} = 16484 \quad R_{hd} = 2023.98$$

**Factored Footing Reaction AASHTO LRFD SECTION 3.4.1-1 STRENGTH LIMIT CASE**

LOAD FACTORS:

Beta Coefficient = 1.25 for Dead Load

= 1.75 for Live Load

= 1.95 for Vertical Earth Press.

$$R_{vu} = 28944 \text{ lbs/ft.}$$

$$R_{hu} = 3553.88 \text{ lbs/ft.}$$

**Factored Footing Reaction AASHTO LRFD (FROM CANDE) STRENGTH LIMIT CASE**

$$R_{vu} = 38232.9 \text{ lbs/ft.}$$

$$R_{hu} = 4694.40 \text{ lbs/ft.}$$

BRIDGECOR ARCH ( 38'-1" X 11'-11" ) FOOTING DESIGN : LRFD FACTORED

(AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS)

Project No: CBC

24879

Project Title: Sdterling Ranch Rd., El Paso County, CO

Structure Size:

BridgeCor

Span, S (ft)= 38.083 Rise, R (ft)= 11.92  
Factored bearing capacity (psf) 8700

DATA

HEIGHT OF COVER (ft)	5.00
Hc to INVERT (ft)	16.59
Rvfac (plf)	38232.9
Rrfac (plf)	4694.4
ALL. BEARING (psf)	8,700

REGRADE ANALYSIS

"

( 14,500 )

FOOTING GEOMETRY

WIDTH, B (ft)	6.50
OUTSIDE WIDTH, w (ft)	3.75
THICKNESS, t (ft)	3.670
HEIGHT, h (ft)	4.000

FOOTING LOADS

SOIL WEIGHT, Ws1 (plf)	9705.15
MOMENT ARM (ft)	1.875
CONCRETE WEIGHT, Wc1 (plf)	4875.0
MOMENT ARM (ft)	3.25
Rvfac (plf)	38232.9
MOMENT ARM (ft)	3.75
Rrfac (plf)	-4694.4
MOMENT ARM (ft)	3.670

OUTSIDE SOIL PRESSURE

At rest COEFFICIENT, Ko	0.4
Prec (psf)	1101.9
Ptri (psf)	285.7
Frec (plf)	4407.6
MOMENT ARM (ft)	2.00
Ftri (plf)	531.4
MOMENT ARM (ft)	1.3

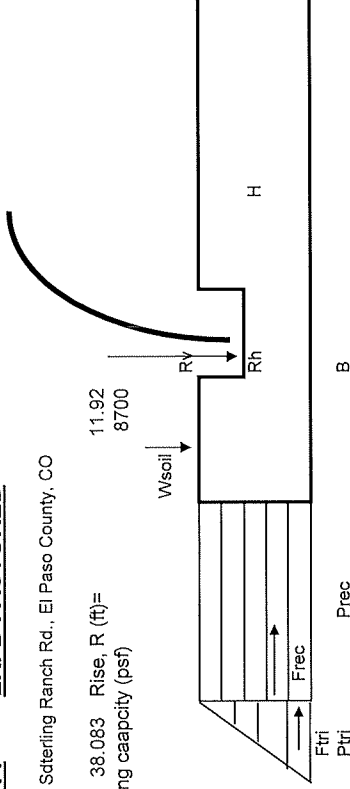
BEARING PRESSURE CALCULATION

SUM OF VERTICALS, Q (plf)	52813.0
SUM OF MOMENTS, Mo (ft-#ft)	169709.5
ECCENTRICITY, e (ft)	-0.0366
BEARING PRESSURES, q (psf)	
MAXIMUM PRESSURE (ksf)	8218

( CLOCKWISE POSITIVE )

B/6 = 1.0833

< 0.6\*(14500)



AFTER STRUCTURE INSTALLATION

SLIDING CALCULATIONS (STATI f=0.34

SLIDING FORCE (lbs/ft) 4938.99  
RESISTING FORCE (lbs/ft) 10163.13  
C.D.R 2.06

OVERTURNING CALCULATIONS:

OVERTURNING MOMENT (lbs-ft/ft) 9523.74  
RESITING MOMENT(lbs/ft) 9654.9  
C.D.R 10.14

BEFORE STRUCTURE INSTALLATION (TEMPORARY)

SLIDING CALCULATIONS (STATIC f=0.34

100 PSF SURCHARGE FROM CONSTRUCTION LOADS  
SLIDING FORCE (lbs/ft) 1231.36  
RESISTING FORCE (lbs/ft) 1491.75  
C.D.R 1.21

OVERTURNING CALCULATIONS:

OVERTURNING MOMENT (lbs-ft/ft) 2108.48  
RESITING MOMENT(lbs/ft) 11407.50  
C.D.R 5.41

**BRIDGECOR ARCH ( 38'-1" X 11'-11" ) FOOTING DESIGN :**

(AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS)

Project No: CBC      24879      Project Title:      Sdterling Ranch Rd., El Paso County, CO

Structure Size:      BridgeCor      Span, S (ft)=      38.083      Rise, R (ft)=      11.92  
Factored bearing caapcity (psf)      8700

**DATA**

Cantilever Length :  
Footing width:  
Concrete Beam :

b=      3.75      ft.  
h=      6.50      ft.  
d =      12      in.  
dv=      44      in.  
f' c =      40.63      in.  
f' c =      36.56      in.  
f' c =      4000      psi

Factored      Bending Moment @ arch connection Mu=

59,059.49      ft.-lb  
ft.-lb

(See attached calculations for the reinforcement)

Max. Factored pressure @ arch connection=

8167.31      psf

Shear @ the arch connection

Vu =      31062.91      lbs

Required Depth :

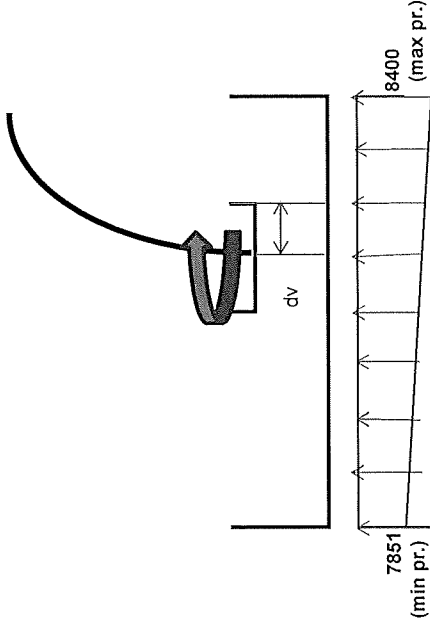
d = Vu/(0.85x2x(f'c)<sup>0.5</sup> x b

d=

24.08 in. <

40.63 in. provided

O.K. for SHEAR



## BRIDGECOR ARCH FOOTING DESIGN :

(AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS)

Project No: CBC

24879

Project Title:

Sterling Ranch Rd., CO

### 1.0 CHECK FOR THE DISTRIBUTION OF REINFORCEMENT FOR FLEXURAL CRACKING CONTROL:

#### AASHTO LRFD SPECIFICATIONS SECTION 5.7.3.4

Size of the bar #	#6
Width of the footing, b (in)	12.0
Net design depth, d (in)	40.63
dc(in)	3.38
bar diameter (in)	0.75
c/s area of the bar(in^2)	0.44
spacing(in)	6.0
no: of bars (n)	2.00
Area of steel, As(in^2)	0.88
fy(kips/in^2)	60
f'c(kips/in^2)	4000
M( ft-kips) (service load moment)	39.37
M( ft-kips) (factored load moment)	59.1
γ e (exposure factor)	0.75
fss (ksi)	13.3

$$\beta s = 1 + \frac{dc}{0.7(h - dc)} = 1.108$$

Note:  $s_{act} < 700\gamma e / \beta s.fss - 2 d_e$   
 $700\gamma e / \beta s.fss - 2 d_e = 28.8$  O.K

### 2.0 CHECK FOR MINIMUM REINFORCEMENT FOR CRACKING CONTROL: AASHTO LRFD SPECIFICATION 5.7.3.3.2

Total Depth (in)	48		
fcr(psi)	lg(in^4)	yt	Mcr (ft-k)
480.0	110592.0	24.0	184.3

Criterion:

$\phi Mn \geq$  the lesser of Mcr and 1.33 Mu

3.0	Mu(ft-kips)	a(in)(assumed)	b(in)	d(in)	As (in^2)	a cal(in)
(1.33Mu)	78.55	0.64	12.0	40.6	0.43	0.64
	As provided =	0.88 sq.in				
	$\phi Mn$ (ft-kips)	> 1.33 Mu(ft-Kips)				O.K

### 4.0 CHECK FOR TEMPERATURE AND SHRINKAGE REINFORCEMENT: AASHTO LRFD SPECIFICATIONS SECTION 5.10.8

$$As = 0.00186 b.h$$

For longitudinal bars : b=	78
h=	48
No of bars prov =	20 min
As =	8.8 #6 longitudinal bars
As req=	7.0
For transverse bars: b=	12
h=	48
No: of bars prov	4.00
As req=	1.07
As prov=	1.76

**CONCRETE HEADWALL DESIGN**  
CBC # 24879 (Downstream)  
BRIDGECOR, STERLING RANCH RD., EL PASO, CO  
( TOP BEAM)

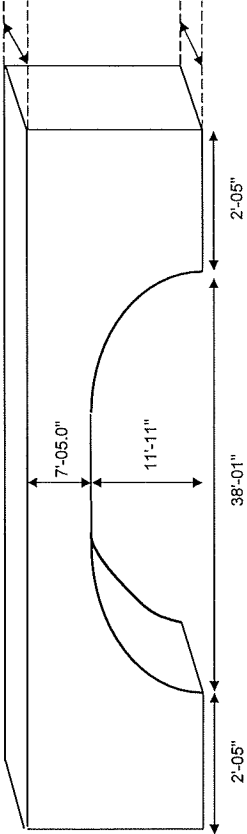
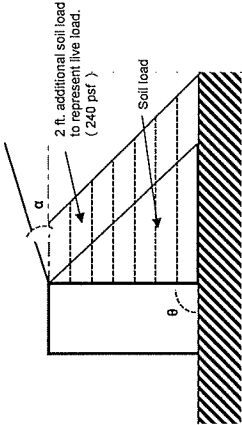
Material Properties:  
120 pcf =  $\gamma_{\text{soil}}$   
150 pcf =  $\gamma_{\text{concrete}}$   
36° =  $\phi'$   
4,000 psi = Concrete strength  
60,000 psi = Steel yield strength  
Cast-in-Place = Type of Structure

Analysis based on:  
Active conditions  
0.26 =  $K_a$  - horizontal  
240 psf Surcharge from Moment Slab  
0 Kip Impact Load

Shape: Round/Ellipse/Pipe Arch  
11.92 ft = Rise  
38.08 ft = Span (skewed)  
7.42 ft = Height of cover  
0.00 ft = Stickup  
2.45 ft = Left end width of headwall  
2.45 ft = Right end width of headwall  
24.0 in = Top Thickness  
24.0 in = Bottom Thickness

Headwall/Soil Interface:  
90.0° =  $\theta$ , Angle of Headwall to Horizontal  
0.0° =  $\alpha$ , Soil Angle of Inclination  
0.0° =  $\delta$ , Soil-Concrete Interface Friction Angle

FIGURE 1



TOP BEAM - HORIZONTAL BENDING

BRIDGECOR, STERLING RANCH RD., EL PASO, CO  
E:H=1.5, L:L=1.75 (Static Strength Case)  
E:H=1.5, L:L=0.5, EQ=1.0 (Extreme Event Case)

DATA

Concrete Strength $f_c$	4,000 psi
Steel Yield Strength $f_y$	60,000 psi
Length L	40.54 ft
Thickness h	24.00 in
[Height of Cover + Stickup] b	7.42 ft

UNFACTORED LOADS - Active conditions

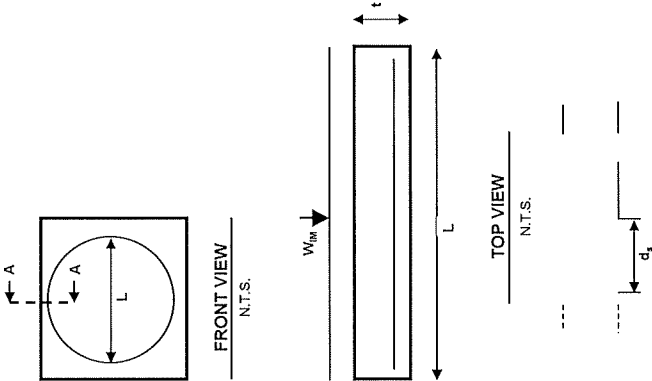
Earth Surcharge Load $W_{sur}$	463.01 plf
Soil Load $W_{soil}$	858.88 plf
Skewed loads (plf)	0.00

FACTORED LOADS - Active conditions

Earth Surcharge Load $W_{sur}$	810.26 plf
Soil Load $W_{soil}$	1288.32 plf
Skewed loads (plf)	0.00

RESULTS

Max. Unfactored Moment $M_u$ (earth) (static)	271.56 k-ft
Max. Factored Moment $M_u$ (lateral) (static)	431.13 k-ft
Max. Unfactored Moment $M_u$ (vertical) (static)	0.00
Max. factored Moment $M_u$ (vertical) (static)	0.00



$\eta_R = 1$   
 $\gamma_{ES} = 1.75$   
 $\gamma_{EH} = 1.50$



# CONCRETE HEADWALL DESIGN

CBC #

24879

AASHTO LRFD SPECIFICATIONS SECTION 5.7.3.4

TOP BEAM

Size of the bar #	#7
Width of the beam, b (in)	89.0
Net design depth, d (in)	20.31
dc(in)	3.69
bar diameter (in)	0.875
c/s area of the bar(in^2)	0.6
spacing(in)	8.0
no: of bars (n)	11.0
Area of steel, As(in^2)	6.6
fy(kips/in^2)	60
f'c(kips/in^2)	4000
M( ft-kips) (service load moment)	271.56
M( ft-kips) (factored load moment)	431.1
γ e (exposure factor)	0.75
fss (ksi)	24.9
$\beta_s = 1 + \frac{dc}{0.7(h - dc)}$	1.259

Note:  $s_{act} < 700\gamma_e/\beta_s.f_{ss} - 2 d_c$   
 $700\gamma_e/\beta_s.f_{ss} - 2 d_c$  9.4 O.K

## 2.0 CHECK FOR MINIMUM REINFORCEMENT FOR CRACKING CONTROL:

AASHTO LRFD SPECIFICATION 5.7.3.3.2

Total Depth (in)		24	
fc <sub>r</sub> (psi)	I <sub>g</sub> (in^4)	y <sub>t</sub>	M <sub>cr</sub> (ft-k)
480.0	102574.1	12.0	341.9

Criterion:

$\phi Mn \geq$  the lesser of Mcr and 1.33 Mu

3.0	Mu(ft-kips)	a(in)(assumed)	b(in)	d(in)	As (in^2)	a cal(in)
(Mu)	431.13	0.96	89.0	20.3	4.83	0.96
	As provided =		6.6 sq.in			
	$\phi Mn$ (ft-kips)		> 1.33 Mu(ft-Kips)			

O.K

Shear Capacity of top beam:

Maxium factored shear load (kips) 42.5  
 bv=24 in. dv=20.31 in

$\epsilon = (M_u/dv + V_u)/E_s.A_s$  0.001552947 f'c=4.0 ksi Es=29000 ksi

$\beta = 4.8/(1 + 750.\epsilon)$  2.22  $\Phi V_c$  (kips)= 114.1

END BEAM - BENDING AT BOTTOM

BRIDGECOR, STERLING RANCH RD., EL PASO, CO  
E.H = 1.5, L.L = 1.75 (Static Strength Case)  
E.H=1.5, L.L=0.5, EQ=1.0 (Extreme Event Case)

DATA

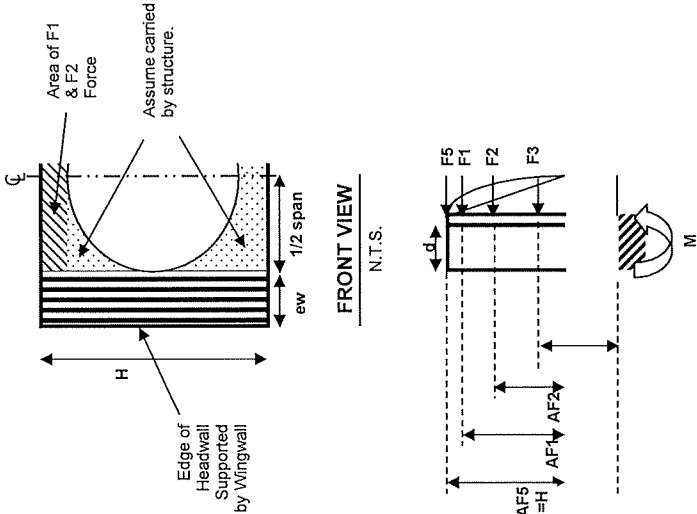
Concrete Strength $f_c$	4,000 psi
Steel Yield Strength $f_y$	60,000 psi
Height H	19.00 ft
Thickness h	24.00 in
End Width b	2.45 ft
Length L = 1/2 Span	19.04 ft

FORCES AND MOMENT ARMS

	Unfact.	Fact.	
$F_r$ ES Force - Top Beam (kips)	8.82	15.43	$\eta_R = 1$
Moment Arm			$\gamma_{ES} = 1.75$
$F_r$ Soil Force - Top Beam (kips)	16.35	24.53	$\gamma_{EH} = 1.5$
Moment Arm	14.05 ft		
$F1$ ES Force - End Beam (kips)	2.90	5.08	$\gamma_{ES} = 1.75$
Moment Arm	9.50 ft		$\gamma_{EH} = 1.5$
$F2$ Soil Force - End Beam (kips)	13.80	20.70	
Moment Arm	6.33 ft		
Skewed Load (kips)	0.00 ft	0.00	
Moment Arm	11.58 ft		

RESULTS

Max. Moment (elastic) including additional loads (see attached)	479.61 k-ft	760.02
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## CONCRETE HEADWALL DESIGN

CBC #

24879

(Upstream)

AASHTO LRFD SPECIFICATIONS SECTION 5.7.3.4

END BEAM

Size of the bar #	#9
Width of the beam, $b$ (in)	29.40
Net design depth, $d$ (in)	20.87
$d_c$ (in)	3.13
bar diameter (in)	1.128
c/s area of the bar ( $\text{in}^2$ )	1
spacing (in)	4.5
no: of bars ( $n$ )	5.0
Area of steel, $A_s$ ( $\text{in}^2$ )	10.0
$f_y$ (kips/in <sup>2</sup> )	60
$f'_c$ (kips/in <sup>2</sup> )	4000
$M$ (ft-kips) (service load moment)	479.61
$M$ (ft-kips) (factored load moment)	760.0
$\gamma_e$ (exposure factor)	0.75
$f_{ss}$ (ksi)	31.9
$\beta_s = 1 + \frac{d_c}{0.7(h - d_c)}$	1.214

Note:  $s_{act} < 700\gamma_e / \beta_s f_{ss} - 2 d_c$

$700\gamma_e / \beta_s f_{ss} - 2 d_c$  7.3 O.K

### 2.0 CHECK FOR MINIMUM REINFORCEMENT FOR CRACKING CONTROL:

AASHTO LRFD SPECIFICATION 5.7.3.3.2

Total Depth (in)		24	
<i>fcr</i> (psi)	<i>lg</i> (in^4)	<i>yt</i>	<i>Mcr</i> (ft-k)
480.0	33868.8	12.0	112.9

Criterion:

$\phi M_n \geq \text{the lesser of } M_{cr} \text{ and } 1.33 M_u$

3.0	$M_u$ (ft-kips)	$a$ (in) (assumed)	$b$ (in)	$d$ (in)	$A_s$ (in <sup>2</sup> )	$a_{cal}$ (in)
( $M_u$ )	760.02	5.61	29.4	20.9	9.35	5.61
	$A_s \text{ provided} =$		10.0 sq.in			
	$\phi M_n$ (ft-kips) $> 1.33 M_u$ (ft-Kips)					O.K

**CONCRETE HEADWALL DESIGN**  
CBC # 24879 (Upstream)  
BRIDGECOR, STERLING RANCH RD., EL PASO, CO  
( TOP BEAM)

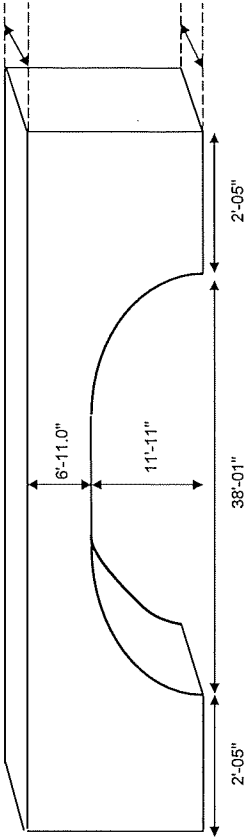
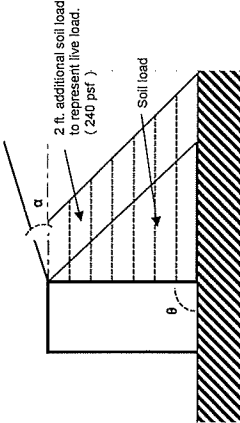
Material Properties:  
120 pcf =  $\gamma_{soil}$   
150 pcf =  $\gamma_{concrete}$   
 $36^\circ = \phi$   
4,000 psi = Concrete strength  
60,000 psi = Steel yield strength  
Cast-in-Place = Type of Structure

Analysis based on:  
Active conditions  
 $0.26 = K_a$  - horizontal  
240 psf Surcharge from Moment Slab  
0 kip Impact Load

Shape: Round/Ellipse/Pipe Arch  
11.92 ft = Rise  
38.08 ft = Span (skewed)  
6.92 ft = Height of cover  
0.00 ft = Stickup  
2.45 ft = Left end width of headwall  
2.45 ft = Right end width of headwall  
12.0 in = Top Thickness  
12.0 in = Bottom Thickness

Headwall/Soil Interface:  
 $90.0^\circ = \theta$ , Angle of Headwall to Horizontal  
 $0.0^\circ = \alpha$ , Soil Angle of Inclination  
 $0.0^\circ = \delta$ , Soil-Concrete Interface Friction Angle

FIGURE 1



TOP BEAM - HORIZONTAL BENDING

BRIDGE COR, STERLING RANCH RD., EL PASO, CO  
E.H = 1.5, L.L = 1.75 (Static Strength Case)  
E.H = 1.5, L.L = 0.5, EQ = 1.0 (Extreme Event Case)

DATA

Concrete Strength $f'_c$	4,000 psi
Steel Yield Strength $f_y$	60,000 psi
Length L	40.54 ft
Thickness h	24.00 in
[Height of Cover + Stickup] b	6.92 ft

UNFACTORED LOADS - Active conditions

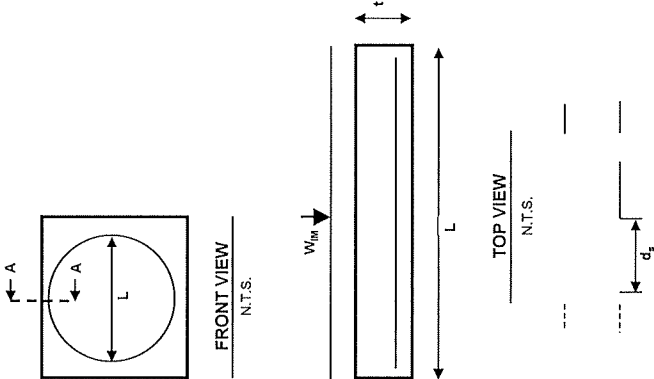
Earth Surcharge Load $W_{sur}$	431.81 plf
Soil Load $W_{soil}$	747.03 plf
Skewed loads (plf)	0.00

FACTORED LOADS - Active conditions

Earth Surcharge Load $W_{sur}$	755.66 plf
Soil Load $W_{soil}$	1120.54 plf
Skewed loads (plf)	0.00

RESULTS

Max. Unfactored Moment $M_s$ (lateral) (static)	242.18 k-ft
Max. Factored Moment $M_u$ (lateral) (static)	385.44 k-ft
Max. Unfactored Moment $M_s$ (vertical) (static)	0.00
Max. factored Moment $M_u$ (vertical) (static)	0.00



$\eta_R = 1$   
 $\gamma_{ES} = 1.75$   
 $\gamma_{EH} = 1.50$



# CONCRETE HEADWALL DESIGN

CBC #

24879

AASHTO LRFD SPECIFICATIONS SECTION 5.7.3.4

TOP BEAM

Size of the bar #	#7
Width of the beam, $b$ (in)	83.0
Net design depth, $d$ (in)	20.31
$d_c$ (in)	3.69
bar diameter (in)	0.875
c/s area of the bar (in <sup>2</sup> )	0.6
spacing (in)	8.0
no: of bars ( $n$ )	10.0
Area of steel, $A_s$ (in <sup>2</sup> )	6.0
$f_y$ (kips/in <sup>2</sup> )	60
$f'_c$ (kips/in <sup>2</sup> )	4000
$M$ (ft-kips) (service load moment)	242.18
$M$ (ft-kips) (factored load moment)	385.4
$\gamma_e$ (exposure factor)	0.75
$f_{ss}$ (ksi)	24.4
$\beta_s = 1 + \frac{d_c}{0.7(h - d_c)}$	1.259

Note:	$s_{act} < 700\gamma_e / \beta_s f_{ss} - 2 d_c$
$700\gamma_e / \beta_s f_{ss} - 2 d_c$	9.7 O.K

## 2.0 CHECK FOR MINIMUM REINFORCEMENT FOR CRACKING CONTROL:

AASHTO LRFD SPECIFICATION 5.7.3.3.2

Total Depth (in)		24	
<i>fcr</i> (psi)	<i>lg</i> (in^4)	<i>yt</i>	<i>Mcr</i> (ft-k)
480.0	95616.0	12.0	318.7

Criterion:

$\phi M_n \geq$  the lesser of  $M_{cr}$  and  $1.33 M_u$

3.0	$M_u$ (ft-kips)	$a$ (in) (assumed)	$b$ (in)	$d$ (in)	$A_s$ (in <sup>2</sup> )	$a_{cal}$ (in)
( $M_u$ )	385.44	0.92	83.0	20.3	4.31	0.92
	$A_s$ provided =		6.0 sq.in			
	$\phi M_n$ (ft-kips)	> 1.33 $M_u$ (ft-Kips)				O.K

Shear Capacity of top beam:

Maxium factored shear load (kips)	38.0		
bv=24 in. dv=20.31 in			
$\epsilon=(Mu/dv+Vu)/Es.As$	0.001527226	$f_c=4.0$ ksi	$Es=29000$ ksi
$\beta=4.8/(1+750.\epsilon)$	2.24	$\Phi V_c$ (kips)=	107.3

END BEAM - BENDING AT BOTTOM

BRIDGECOR, STERLING RANCH RD., EL PASO, CO

E:H = 1.5, L:L = 1.75 (Static Strength Case)

E:H = 1.5, I:I = 0.5, EQ = 1.0 (Extreme Event Case)

DATA

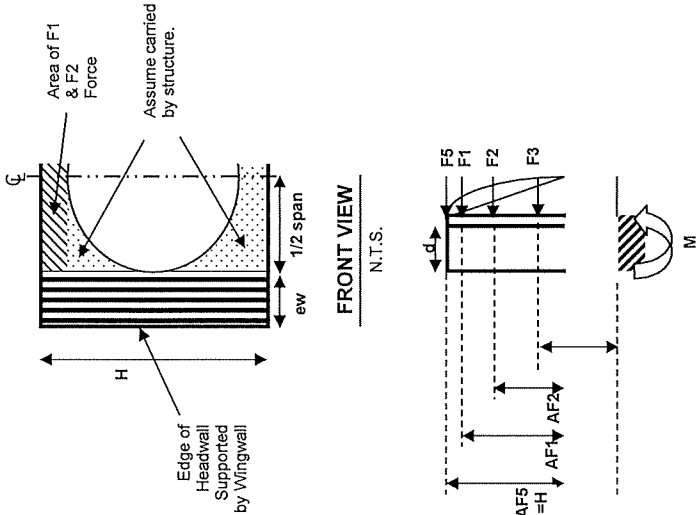
Concrete Strength $f_c$	4,000 psi
Steel Yield Strength $f_y$	60,000 psi
Height H	18.50 ft
Thickness h	24.00 in
End Width b	2.45 ft
Length L = 1/2 Span	19.04 ft

FORCES AND MOMENT ARMS

	Unfact.	Fact.	
$F_1$ ES Force - Top Beam (kips)	8.22	14.39	$\eta_R = 1$
Moment Arm		15.04 ft	$\gamma_{ES} = 1.75$
$F_1$ Soil Force - Top Beam (kips)	14.22	21.34	$\gamma_{EH} = 1.5$
Moment Arm		13.89 ft	
$F_1$ ES Force - End Beam (kips)	2.83	4.95	$\gamma_{ES} = 1.75$
Moment Arm		9.25 ft	$\gamma_{EH} = 1.5$
$F_2$ Soil Force - End Beam (kips)	13.08	19.62	
Moment Arm		6.17 ft	
Skewed Load (kips)	0.00 ft	0.00	
Moment Arm		11.58 ft	

RESULTS

Max. Moment (static) including additional loads (see attached)	428.02 k-ft	679.49
--	-------------	--------



# CONCRETE HEADWALL DESIGN

CBC # 24879

(Upstream)

AASHTO LRFD SPECIFICATIONS SECTION 5.7.3.4

END BEAM

Size of the bar #	#9
Width of the beam, b (in)	29.40
Net design depth, d (in)	20.87
dc(in)	3.13
bar diameter (in)	1.128
c/s area of the bar(in^2)	1
spacing(in)	4.5
no: of bars (n)	5.0
Area of steel, As(in^2)	10.0
fy(kips/in^2)	60
f'c(kips/in^2)	4000
M( ft-kips) (service load moment)	428.02
M( ft-kips) (factored load moment)	679.5
γ e (exposure factor)	0.75
fss (ksi)	27.9
$\beta s = 1 + \frac{dc}{0.7(h - dc)}$	1.214

Note:  $s_{act} < 700\gamma e / \beta s.fss - 2 dc$   
 $700\gamma e / \beta s.fss - 2 dc$  9.2 O.K

## 2.0 CHECK FOR MINIMUM REINFORCEMENT FOR CRACKING CONTROL:

AASHTO LRFD SPECIFICATION 5.7.3.3.2

Total Depth (in)		24	
fc <sub>r</sub> (psi)	I <sub>g</sub> (in <sup>4</sup> )	yt	M <sub>cr</sub> (ft-k)
480.0	33868.8	12.0	112.9

Criterion:

$\phi Mn \geq$  the lesser of Mcr and 1.33 Mu

3.0	Mu(ft-kips)	a(in)(assumed)	b(in)	d(in)	As (in^2)	a cal(in)
(Mu)	679.49	4.92	29.4	20.9	8.20	4.92
	As provided =	10.0 sq.in				
	$\phi Mn(ft-kips) > 1.33 Mu(ft-Kips)$					O.K

WINGWALL DESIGN:

Maximum height of wingwalls (ft)	19	Width of toe (ft.)	1	Load (factored)
Minimum height of wingwalls (ft)	15	Width of heel (ft.)	16.25	
Wall height at 1/3 length (ft)	17.67	Total length of footing (ft)	18.5	
Backslope	3H:1V	Depth of footings (ft)	4	
Active pressure coefficient ka	0.32			
Width (ft.)	1.25			
Loads (Vertical) on the wall per ft.				
Weight (lbs)	3312.5	L.F for Sliding and overturning	Load (factored)	L.F for bearing
Weight of footings (lbs)	11100			
Weight of soil backfill (lbs)	34450			
Weight of sloped backfill (lbs)	3900			
Horizontal Load (lbs)			Load (factored)	
Earth Pressure (lbs)	12001.89	L.F for bearing	Load (factored)	Load (factored)
Live load Pressure (lbs)	1870.42439			
Sliding Check				
Sliding Force (factored)	21276.0775	CDR=	1.04	
Resisting Force (factored)=f. V+Passive	22145.325			
Passive Pressure (lbs)	6000			
Overturning Check				
Overturning Moment (lbs-ft)		C.D.R=	2.05	
Live Load Pressure (lbs-ft)	25297.07			
Earth Pressure (lbs-ft)	108215.23			
Total Resisting Moment (lbs-ft)	423491.906			
Total Overturning Moment (lbs-ft)	206592.71			
Bearing Pressure Calcs:				
Total Overturning Moment (lbs-ft)		5012.90	<8,700 psf	
Total Resisting Moment (lbs-ft)	206592.71			
Net Moment (lbs-ft)	666049.14			
e (ft)	459456.43			
	-2.48			
Max. Pressure (psf)				

125 Westpark Rd.  
 Centerville, OH 45459

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 Registration #: RP-1110505 RP9.27

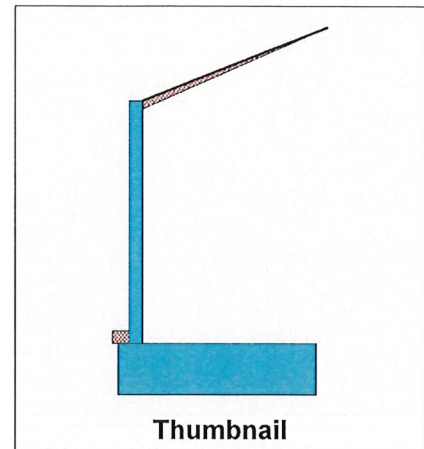
## Cantilevered Retaining Wall Design

### Criteria

Retained Height	=	19.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	3.00 : 1
Height of Soil over Toe	=	12.00 in
Water height over heel	=	0.0 ft

### Soil Data

Allow Soil Bearing	=	8,700.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	34.0 psf/ft
Toe Active Pressure	=	34.0 psf/ft
Passive Pressure	=	480.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing  Soil Friction	=	0.340
Soil height to ignore for passive pressure	=	0.00 in



### Surcharge Loads

Surcharge Over Heel	=	240.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
NOT Used for Sliding & Overturning		

### Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

### Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	0.0 psf

### Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

### Design Summary

#### Wall Stability Ratios

Overturning	=	3.58 OK
Sliding	=	1.67 OK
Total Bearing Load	=	57,114 lbs
...resultant ecc.	=	25.86 in
Soil Pressure @ Toe	=	5,245 psf OK
Soil Pressure @ Heel	=	930 psf OK
Allowable	=	8,700 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	7,343 psf
ACI Factored @ Heel	=	1,302 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	26.6 psi OK
Allowable	=	94.9 psi
Sliding Calcs (Vertical Component NOT Used)		
Lateral Sliding Force	=	15,235.0 lbs
less 100% Passive Force	=	- 6,000.0 lbs
less 100% Friction Force	=	- 19,418.7 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	0.0 lbs OK

### Stem Construction

Design Height Above Ftg	ft =	Stem OK 0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	15.00
Rebar Size	=	# 8
Rebar Spacing	=	6.00
Rebar Placed at	=	Edge

#### Design Data

fb/FB + fa/Fa	=	0.952
Total Force @ Section	lbs =	11,118.0
Moment....Actual	ft-# =	76,704.0
Moment....Allowable	=	80,590.1
Shear....Actual	psi =	74.1
Shear....Allowable	psi =	94.9
Wall Weight	=	187.5
Rebar Depth 'd'	in =	12.50
LAP SPLICE IF ABOVE	in =	35.40
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	13.28
Lap splice above base reduced by stress ratio		

#### Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Medium Weight
Masonry Design Method	=	ASD

#### Concrete Data

f'c	psi =	4,000.0
Fy	psi =	60,000.0

### Load Factors

Building Code	
Dead Load	1.250
Live Load	1.750
Earth, H	1.500
Wind, W	1.000
Seismic, E	1.000



125 Westpark Rd.  
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## Cantilevered Retaining Wall Design

### Footing Dimensions & Strengths

Toe Width = 1.00 ft  
 Heel Width = 17.50  
 Total Footing Width = 18.50  
 Footing Thickness = 48.00 in  
 Key Width = 0.00 in  
 Key Depth = 0.00 in  
 Key Distance from Toe = 0.00 ft  
 f'c = 4,000 psi Fy = 60,000 psi  
 Footing Concrete Density = 150.00 pcf  
 Min. As % = 0.0018  
 Cover @ Top 2.00 @ Btm = 3.00 in

### Footing Design Results

	Toe	Heel
Factored Pressure	= 7,343	1,302 psf
Mu' : Upward	= 3,617	405,388 ft-#
Mu' : Downward	= 504	659,980 ft-#
Mu: Design	= 3,113	254,592 ft-#
Actual 1-Way Shear	= 0.00	26.55 psi
Allow 1-Way Shear	= 94.87	94.87 psi
Toe Reinforcing	= # 8 @ 6.00 in	
Heel Reinforcing	= # 8 @ 6.00 in	
Key Reinforcing	= None Spec'd	

#### Other Acceptable Sizes & Spacings

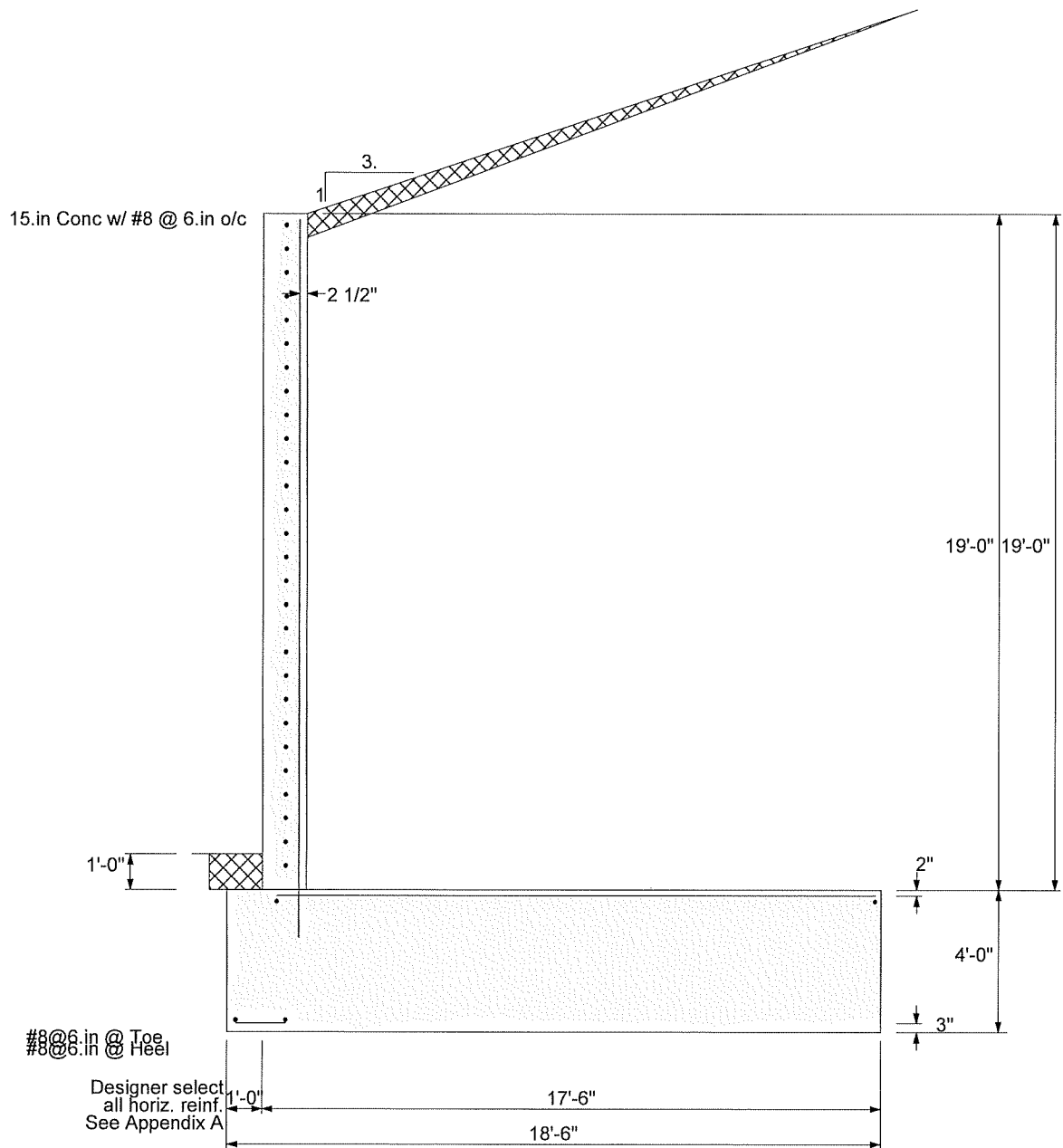
Toe: Not req'd, Mu < S \* Fr  
 Heel: #4@ 1.50 in, #5@ 2.25 in, #6@ 3.25 in, #7@ 4.50 in, #8@ 5.75 in, #9@ 7.25 in  
 Key: No key defined

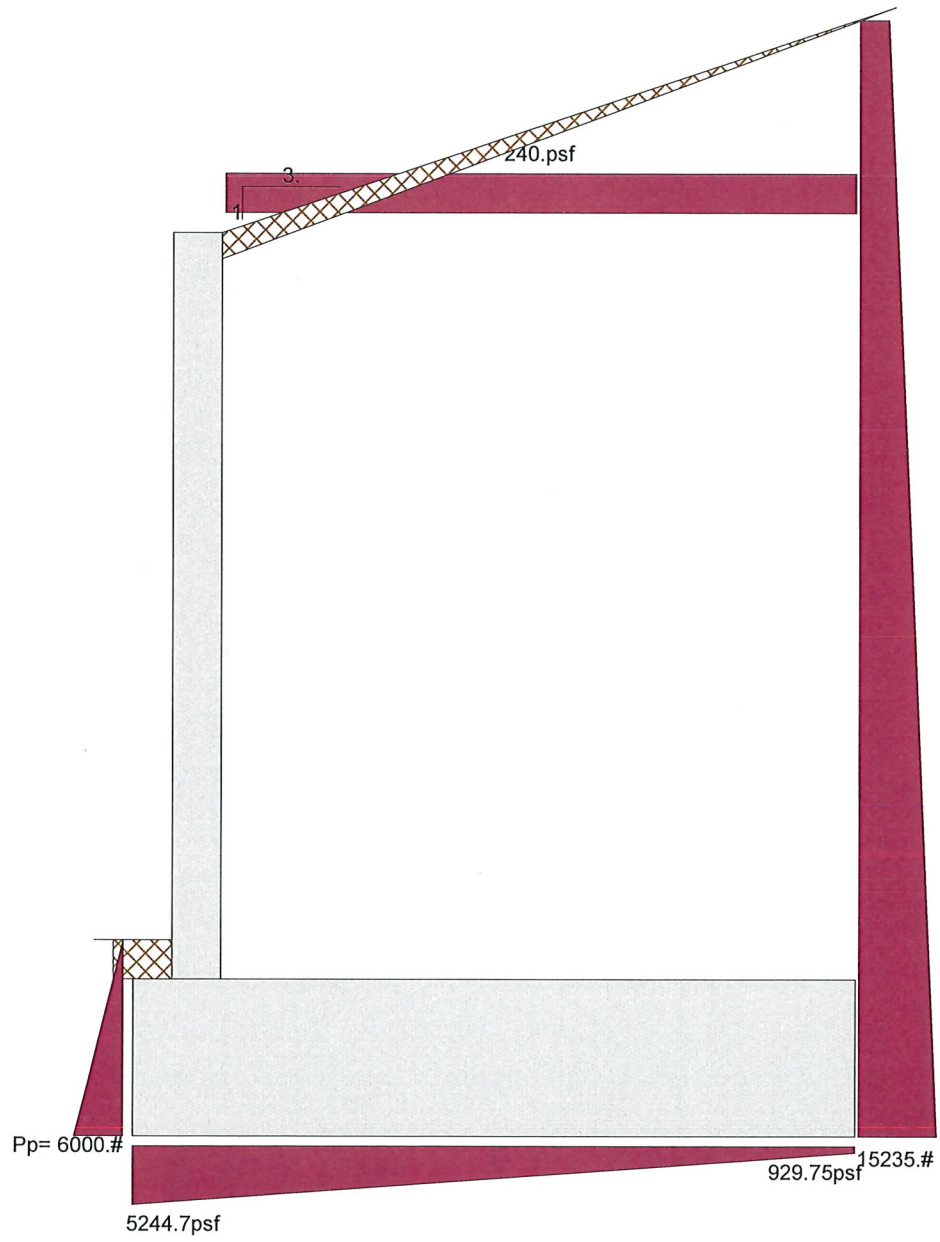
### Summary of Overturning & Resisting Forces & Moments

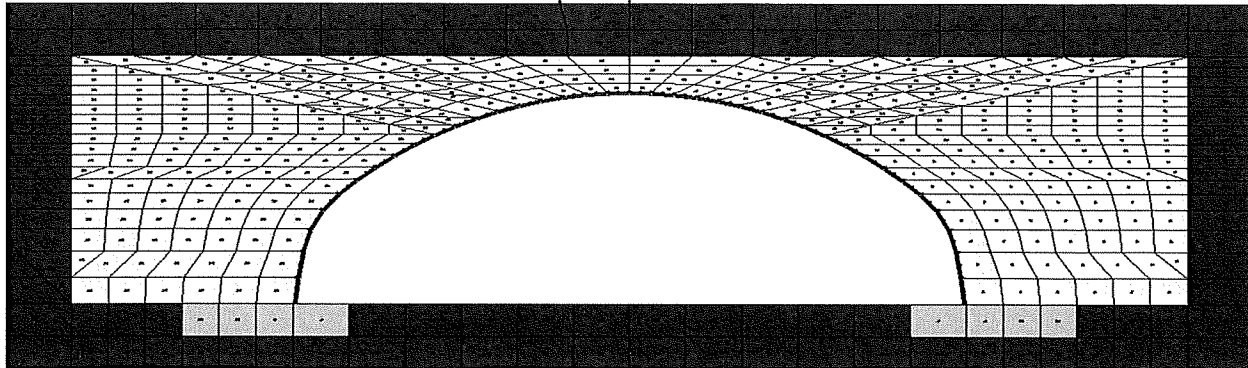
.....OVERTURNING.....				.....RESISTING.....					
Item		Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#	
Heel Active Pressure	=	13,727.6	9.47	130,031.0	Soil Over Heel	=	37,050.0	10.38	384,393.8
Surcharge over Heel	=	1,932.3	14.21	27,455.2	Sloped Soil Over Heel	=	5,281.3	13.08	69,096.4
Toe Active Pressure	=	-425.0	1.67	-708.3	Surcharge Over Heel	=			
Surcharge Over Toe	=				Adjacent Footing Load	=			
Adjacent Footing Load	=				Axial Dead Load on Stem	=			
Added Lateral Load	=				* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=				Soil Over Toe	=	120.0	0.50	60.0
					Surcharge Over Toe	=			
					Stem Weight(s)	=	3,562.5	1.63	5,789.1
					Earth @ Stem Transitions	=			
					Footing Weight	=	11,100.0	9.25	102,675.0
					Key Weight	=			
					Vert. Component	=			
Total	=	15,235.0	O.T.M. =	156,778.0	Total =	57,113.8 lbs	R.M. =	562,014.2	
Resisting/Overturning Ratio			=	3.58					
Vertical Loads used for Soil Pressure	=		57,113.8	lbs					
Vertical component of active pressure NOT used for soil pressure									

\* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

DESIGNER NOTES:







## HL-93 TANDEM

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage HL-93 TANDEM

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000  
SEAM STRENGTH FAILURE ..... 0.67000  
FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

-----

REVIEW SYSTEM INPUT DATA

FINITE ELEMENT INPUT CONTROLS (PREP)

THE DATA TO BE RUN IS ENTITLED ...

BRIDGECOR

PRINT AND PLOT CONTROL CODES ...

PRINT CONTROL FOR MESH DATA-----	3
PLOT FILE CONTROL MESH & RESULS-----	3
PRINT FINITE ELEMENT RESULTS -----	1
INPUT DATA CHECK CODE-----	0

BANDWIDTH MINIMIZER IS ON, MINBW----- 1

KEY NUMBERS DESCRIBING MESH ...

THE NUMBER OF LOAD STEPS IS-----	23
TOTAL NUMBER OF NODES IS-----	1204
TOTAL NUMBER OF ELEMENTS IS-----	1167
TOTAL NUMBER OF BEAM ELEMENTS IS-----	38
MAX NUMBER OF BOUNDARY CONDITIONS IS---	101

CONTINUOUS LOAD SCALING IS NOT ACTIVATED.

NODAL INPUT DATA TO GENERATE COORDINATES

NODE NUMBER	GENERATE CODE	NODE INCR.	X-AXIS COORD.	Y-AXIS COORD.	SPACING PARAMETER	ARC RADIUS
1	0	1	231.304	0.000	1.00	0.00
2	0	1	228.758	18.070	1.00	0.00
3	0	1	225.306	35.988	1.00	0.00

4	0	1	220.131	51.091	1.00	0.00
5	0	1	211.657	64.621	1.00	0.00
6	0	1	200.328	75.871	1.00	0.00
7	0	1	187.985	85.125	1.00	0.00
8	0	1	175.215	93.781	1.00	0.00
9	0	1	162.047	101.819	1.00	0.00
10	0	1	148.512	109.220	1.00	0.00
11	0	1	134.639	115.968	1.00	0.00
12	0	1	120.460	122.048	1.00	0.00
13	0	1	106.008	127.445	1.00	0.00
14	0	1	91.315	132.148	1.00	0.00
15	0	1	76.415	136.145	1.00	0.00
16	0	1	61.341	139.428	1.00	0.00
17	0	1	46.128	141.990	1.00	0.00
18	0	1	30.810	143.823	1.00	0.00
19	0	1	15.423	144.925	1.00	0.00
20	0	1	0.000	145.293	1.00	0.00
21	0	1	-15.423	144.925	1.00	0.00
22	0	1	-30.810	143.823	1.00	0.00
23	0	1	-46.128	141.990	1.00	0.00
24	0	1	-61.341	139.428	1.00	0.00
25	0	1	-76.415	136.145	1.00	0.00
26	0	1	-91.315	132.148	1.00	0.00
27	0	1	-106.008	127.445	1.00	0.00
28	0	1	-120.460	122.048	1.00	0.00
29	0	1	-134.639	115.968	1.00	0.00
30	0	1	-148.512	109.220	1.00	0.00
31	0	1	-162.047	101.819	1.00	0.00
32	0	1	-175.215	93.781	1.00	0.00
33	0	1	-187.985	85.125	1.00	0.00
34	0	1	-200.328	75.871	1.00	0.00
35	0	1	-211.657	64.621	1.00	0.00
36	0	1	-220.131	51.091	1.00	0.00
37	0	1	-225.306	35.988	1.00	0.00
38	0	1	-228.758	18.070	1.00	0.00
39	0	1	-231.304	0.000	1.00	0.00
40	0	1	228.758	18.070	1.00	0.00
41	0	1	225.306	35.988	1.00	0.00
42	0	1	220.131	51.091	1.00	0.00
43	0	1	211.657	64.621	1.00	0.00
44	0	1	200.328	75.871	1.00	0.00
45	0	1	187.985	85.125	1.00	0.00
46	0	1	175.215	93.781	1.00	0.00
47	0	1	162.047	101.819	1.00	0.00
48	0	1	148.512	109.220	1.00	0.00
49	0	1	134.639	115.968	1.00	0.00
50	0	1	120.460	122.048	1.00	0.00
51	0	1	106.008	127.445	1.00	0.00
52	0	1	91.315	132.148	1.00	0.00
53	0	1	76.415	136.145	1.00	0.00
54	0	1	61.341	139.428	1.00	0.00
55	0	1	46.128	141.990	1.00	0.00
56	0	1	30.810	143.823	1.00	0.00
57	0	1	15.423	144.925	1.00	0.00
58	0	1	0.000	145.293	1.00	0.00
59	0	1	-15.423	144.925	1.00	0.00
60	0	1	-30.810	143.823	1.00	0.00
61	0	1	-46.128	141.990	1.00	0.00
62	0	1	-61.341	139.428	1.00	0.00
63	0	1	-76.415	136.145	1.00	0.00
64	0	1	-91.315	132.148	1.00	0.00
65	0	1	-106.008	127.445	1.00	0.00
66	0	1	-120.460	122.048	1.00	0.00
67	0	1	-134.639	115.968	1.00	0.00
68	0	1	-148.512	109.220	1.00	0.00
69	0	1	-162.047	101.819	1.00	0.00
70	0	1	-175.215	93.781	1.00	0.00
71	0	1	-187.985	85.125	1.00	0.00
72	0	1	-200.328	75.871	1.00	0.00
73	0	1	-211.657	64.621	1.00	0.00
74	0	1	-220.131	51.091	1.00	0.00
75	0	1	-225.306	35.988	1.00	0.00
76	0	1	-228.758	18.070	1.00	0.00
77	0	1	228.758	18.070	1.00	0.00
78	0	1	225.306	35.988	1.00	0.00
79	0	1	220.131	51.091	1.00	0.00
80	0	1	211.657	64.621	1.00	0.00
81	0	1	200.328	75.871	1.00	0.00
82	0	1	187.985	85.125	1.00	0.00
83	0	1	175.215	93.781	1.00	0.00
84	0	1	162.047	101.819	1.00	0.00

85	0	1	148.512	109.220	1.00	0.00
86	0	1	134.639	115.968	1.00	0.00
87	0	1	120.460	122.048	1.00	0.00
88	0	1	106.008	127.445	1.00	0.00
89	0	1	91.315	132.148	1.00	0.00
90	0	1	76.415	136.145	1.00	0.00
91	0	1	61.341	139.428	1.00	0.00
92	0	1	46.128	141.990	1.00	0.00
93	0	1	30.810	143.823	1.00	0.00
94	0	1	15.423	144.925	1.00	0.00
95	0	1	0.000	145.293	1.00	0.00
96	0	1	-15.423	144.925	1.00	0.00
97	0	1	-30.810	143.823	1.00	0.00
98	0	1	-46.128	141.990	1.00	0.00
99	0	1	-61.341	139.428	1.00	0.00
100	0	1	-76.415	136.145	1.00	0.00
101	0	1	-91.315	132.148	1.00	0.00
102	0	1	-106.008	127.445	1.00	0.00
103	0	1	-120.460	122.048	1.00	0.00
104	0	1	-134.639	115.968	1.00	0.00
105	0	1	-148.512	109.220	1.00	0.00
106	0	1	-162.047	101.819	1.00	0.00
107	0	1	-175.215	93.781	1.00	0.00
108	0	1	-187.985	85.125	1.00	0.00
109	0	1	-200.328	75.871	1.00	0.00
110	0	1	-211.657	64.621	1.00	0.00
111	0	1	-220.131	51.091	1.00	0.00
112	0	1	-225.306	35.988	1.00	0.00
113	0	1	-228.758	18.070	1.00	0.00
114	0	1	0.000	169.293	1.00	0.00
115	0	1	0.000	151.293	1.00	0.00
116	0	1	0.000	157.293	1.00	0.00
117	0	1	0.000	163.293	1.00	0.00
118	0	1	0.000	0.000	1.00	0.00
119	0	1	0.000	-21.794	1.00	0.00
120	0	1	383.344	0.000	1.00	0.00
121	0	1	383.344	18.070	1.00	0.00
122	0	1	383.344	35.988	1.00	0.00
123	0	1	383.344	51.091	1.00	0.00
124	0	1	383.344	64.621	1.00	0.00
125	0	1	383.344	75.871	1.00	0.00
126	0	1	383.344	85.125	1.00	0.00
127	0	1	383.344	93.781	1.00	0.00
128	0	1	383.344	101.819	1.00	0.00
129	0	1	383.344	109.220	1.00	0.00
130	0	1	383.344	115.968	1.00	0.00
131	0	1	256.644	0.000	1.00	0.00
132	0	1	281.984	0.000	1.00	0.00
133	0	1	307.324	0.000	1.00	0.00
134	0	1	332.664	0.000	1.00	0.00
135	0	1	358.004	0.000	1.00	0.00
136	0	1	165.727	115.968	1.00	0.00
137	0	1	196.815	115.968	1.00	0.00
138	0	1	227.903	115.968	1.00	0.00
139	0	1	258.991	115.968	1.00	0.00
140	0	1	290.079	115.968	1.00	0.00
141	0	1	321.167	115.968	1.00	0.00
142	0	1	352.256	115.968	1.00	0.00
143	0	1	254.522	18.070	1.00	0.00
144	0	1	280.286	18.070	1.00	0.00
145	0	1	306.051	18.070	1.00	0.00
146	0	1	331.815	18.070	1.00	0.00
147	0	1	357.579	18.070	1.00	0.00
148	0	1	247.883	35.988	1.00	0.00
149	0	1	270.460	35.988	1.00	0.00
150	0	1	293.037	35.988	1.00	0.00
151	0	1	315.613	35.988	1.00	0.00
152	0	1	338.190	35.988	1.00	0.00
153	0	1	360.767	35.988	1.00	0.00
154	0	1	243.447	51.091	1.00	0.00
155	0	1	266.763	51.091	1.00	0.00
156	0	1	290.079	51.091	1.00	0.00
157	0	1	313.395	51.091	1.00	0.00
158	0	1	336.711	51.091	1.00	0.00
159	0	1	360.028	51.091	1.00	0.00
160	0	1	236.183	64.621	1.00	0.00
161	0	1	260.710	64.621	1.00	0.00
162	0	1	285.237	64.621	1.00	0.00
163	0	1	309.764	64.621	1.00	0.00
164	0	1	334.290	64.621	1.00	0.00
165	0	1	358.817	64.621	1.00	0.00

166	0	1	226.473	75.871	1.00	0.00
167	0	1	252.618	75.871	1.00	0.00
168	0	1	278.763	75.871	1.00	0.00
169	0	1	304.908	75.871	1.00	0.00
170	0	1	331.054	75.871	1.00	0.00
171	0	1	357.199	75.871	1.00	0.00
172	0	1	215.893	85.125	1.00	0.00
173	0	1	243.802	85.125	1.00	0.00
174	0	1	271.710	85.125	1.00	0.00
175	0	1	299.619	85.125	1.00	0.00
176	0	1	327.527	85.125	1.00	0.00
177	0	1	355.435	85.125	1.00	0.00
178	0	1	201.231	93.781	1.00	0.00
179	0	1	227.247	93.781	1.00	0.00
180	0	1	253.263	93.781	1.00	0.00
181	0	1	279.279	93.781	1.00	0.00
182	0	1	305.295	93.781	1.00	0.00
183	0	1	331.312	93.781	1.00	0.00
184	0	1	357.328	93.781	1.00	0.00
185	0	1	189.709	101.819	1.00	0.00
186	0	1	217.372	101.819	1.00	0.00
187	0	1	245.034	101.819	1.00	0.00
188	0	1	272.696	101.819	1.00	0.00
189	0	1	300.358	101.819	1.00	0.00
190	0	1	328.020	101.819	1.00	0.00
191	0	1	355.682	101.819	1.00	0.00
192	0	1	177.866	109.220	1.00	0.00
193	0	1	207.220	109.220	1.00	0.00
194	0	1	236.574	109.220	1.00	0.00
195	0	1	265.928	109.220	1.00	0.00
196	0	1	295.282	109.220	1.00	0.00
197	0	1	324.636	109.220	1.00	0.00
198	0	1	353.990	109.220	1.00	0.00
199	0	1	383.344	169.293	1.00	0.00
200	0	1	383.344	122.634	1.00	0.00
201	0	1	383.344	129.299	1.00	0.00
202	0	1	383.344	135.965	1.00	0.00
203	0	1	383.344	142.630	1.00	0.00
204	0	1	383.344	149.296	1.00	0.00
205	0	1	383.344	155.962	1.00	0.00
206	0	1	383.344	162.627	1.00	0.00
207	0	1	165.727	122.634	1.00	0.00
208	0	1	196.815	129.299	1.00	0.00
209	0	1	227.903	135.965	1.00	0.00
210	0	1	258.991	142.630	1.00	0.00
211	0	1	290.079	149.296	1.00	0.00
212	0	1	321.167	155.962	1.00	0.00
213	0	1	352.256	162.627	1.00	0.00
214	0	1	196.815	122.634	1.00	0.00
215	0	1	227.903	122.634	1.00	0.00
216	0	1	258.991	122.634	1.00	0.00
217	0	1	290.079	122.634	1.00	0.00
218	0	1	321.167	122.634	1.00	0.00
219	0	1	352.256	122.634	1.00	0.00
220	0	1	227.903	129.299	1.00	0.00
221	0	1	258.991	129.299	1.00	0.00
222	0	1	290.079	129.299	1.00	0.00
223	0	1	321.167	129.299	1.00	0.00
224	0	1	352.256	129.299	1.00	0.00
225	0	1	258.991	135.965	1.00	0.00
226	0	1	290.079	135.965	1.00	0.00
227	0	1	321.167	135.965	1.00	0.00
228	0	1	352.256	135.965	1.00	0.00
229	0	1	290.079	142.630	1.00	0.00
230	0	1	321.167	142.630	1.00	0.00
231	0	1	352.256	142.630	1.00	0.00
232	0	1	321.167	149.296	1.00	0.00
233	0	1	352.256	149.296	1.00	0.00
234	0	1	352.256	155.962	1.00	0.00
235	0	1	42.594	169.293	1.00	0.00
236	0	1	85.187	169.293	1.00	0.00
237	0	1	127.781	169.293	1.00	0.00
238	0	1	170.375	169.293	1.00	0.00
239	0	1	212.969	169.293	1.00	0.00
240	0	1	255.562	169.293	1.00	0.00
241	0	1	298.156	169.293	1.00	0.00
242	0	1	340.750	169.293	1.00	0.00
243	0	1	22.215	151.017	1.00	0.00
244	0	1	29.008	157.109	1.00	0.00
245	0	1	35.801	163.201	1.00	0.00
246	0	1	44.405	150.191	1.00	0.00



247	0	1	57.999	156.558	1.00	0.00
248	0	1	71.593	162.925	1.00	0.00
249	0	1	62.459	147.450	1.00	0.00
250	0	1	78.789	152.911	1.00	0.00
251	0	1	95.120	158.371	1.00	0.00
252	0	1	111.451	163.832	1.00	0.00
253	0	1	83.148	145.401	1.00	0.00
254	0	1	104.955	151.374	1.00	0.00
255	0	1	126.761	157.347	1.00	0.00
256	0	1	148.568	163.320	1.00	0.00
257	0	1	99.174	141.670	1.00	0.00
258	0	1	121.933	147.194	1.00	0.00
259	0	1	144.692	152.719	1.00	0.00
260	0	1	167.451	158.244	1.00	0.00
261	0	1	190.210	163.768	1.00	0.00
262	0	1	118.690	138.339	1.00	0.00
263	0	1	146.064	144.529	1.00	0.00
264	0	1	173.439	150.720	1.00	0.00
265	0	1	200.813	156.911	1.00	0.00
266	0	1	228.188	163.102	1.00	0.00
267	0	1	133.458	133.423	1.00	0.00
268	0	1	160.907	139.402	1.00	0.00
269	0	1	188.357	145.380	1.00	0.00
270	0	1	215.807	151.358	1.00	0.00
271	0	1	243.257	157.336	1.00	0.00
272	0	1	270.706	163.314	1.00	0.00
273	0	1	147.996	127.953	1.00	0.00
274	0	1	175.533	133.859	1.00	0.00
275	0	1	203.069	139.765	1.00	0.00
276	0	1	230.605	145.670	1.00	0.00
277	0	1	258.141	151.576	1.00	0.00
278	0	1	285.677	157.481	1.00	0.00
279	0	1	313.214	163.387	1.00	0.00
280	0	1	38.551	0.000	1.00	0.00
281	0	1	77.101	0.000	1.00	0.00
282	0	1	115.652	0.000	1.00	0.00
283	0	1	154.202	0.000	1.00	0.00
284	0	1	192.753	0.000	1.00	0.00
285	0	1	231.304	-21.794	1.00	0.00
286	0	1	383.344	-21.794	1.00	0.00
287	0	1	256.644	-21.794	1.00	0.00
288	0	1	281.984	-21.794	1.00	0.00
289	0	1	307.324	-21.794	1.00	0.00
290	0	1	332.664	-21.794	1.00	0.00
291	0	1	358.004	-21.794	1.00	0.00
292	0	1	38.551	-21.794	1.00	0.00
293	0	1	77.101	-21.794	1.00	0.00
294	0	1	115.652	-21.794	1.00	0.00
295	0	1	154.202	-21.794	1.00	0.00
296	0	1	192.753	-21.794	1.00	0.00
297	0	1	-383.344	0.000	1.00	0.00
298	0	1	-383.344	18.070	1.00	0.00
299	0	1	-383.344	35.988	1.00	0.00
300	0	1	-383.344	51.091	1.00	0.00
301	0	1	-383.344	64.621	1.00	0.00
302	0	1	-383.344	75.871	1.00	0.00
303	0	1	-383.344	85.125	1.00	0.00
304	0	1	-383.344	93.781	1.00	0.00
305	0	1	-383.344	101.819	1.00	0.00
306	0	1	-383.344	109.220	1.00	0.00
307	0	1	-383.344	115.968	1.00	0.00
308	0	1	-256.644	0.000	1.00	0.00
309	0	1	-281.984	0.000	1.00	0.00
310	0	1	-307.324	0.000	1.00	0.00
311	0	1	-332.664	0.000	1.00	0.00
312	0	1	-358.004	0.000	1.00	0.00
313	0	1	-165.727	115.968	1.00	0.00
314	0	1	-196.815	115.968	1.00	0.00
315	0	1	-227.903	115.968	1.00	0.00
316	0	1	-258.991	115.968	1.00	0.00
317	0	1	-290.079	115.968	1.00	0.00
318	0	1	-321.167	115.968	1.00	0.00
319	0	1	-352.256	115.968	1.00	0.00
320	0	1	-254.522	18.070	1.00	0.00
321	0	1	-280.286	18.070	1.00	0.00
322	0	1	-306.051	18.070	1.00	0.00
323	0	1	-331.815	18.070	1.00	0.00
324	0	1	-357.579	18.070	1.00	0.00
325	0	1	-247.883	35.988	1.00	0.00
326	0	1	-270.460	35.988	1.00	0.00
327	0	1	-293.037	35.988	1.00	0.00

328	0	1	-315.613	35.988	1.00	0.00
329	0	1	-338.190	35.988	1.00	0.00
330	0	1	-360.767	35.988	1.00	0.00
331	0	1	-243.447	51.091	1.00	0.00
332	0	1	-266.763	51.091	1.00	0.00
333	0	1	-290.079	51.091	1.00	0.00
334	0	1	-313.395	51.091	1.00	0.00
335	0	1	-336.711	51.091	1.00	0.00
336	0	1	-360.028	51.091	1.00	0.00
337	0	1	-236.183	64.621	1.00	0.00
338	0	1	-260.710	64.621	1.00	0.00
339	0	1	-285.237	64.621	1.00	0.00
340	0	1	-309.764	64.621	1.00	0.00
341	0	1	-334.290	64.621	1.00	0.00
342	0	1	-358.817	64.621	1.00	0.00
343	0	1	-226.473	75.871	1.00	0.00
344	0	1	-252.618	75.871	1.00	0.00
345	0	1	-278.763	75.871	1.00	0.00
346	0	1	-304.908	75.871	1.00	0.00
347	0	1	-331.054	75.871	1.00	0.00
348	0	1	-357.199	75.871	1.00	0.00
349	0	1	-215.893	85.125	1.00	0.00
350	0	1	-243.802	85.125	1.00	0.00
351	0	1	-271.710	85.125	1.00	0.00
352	0	1	-299.619	85.125	1.00	0.00
353	0	1	-327.527	85.125	1.00	0.00
354	0	1	-355.435	85.125	1.00	0.00
355	0	1	-201.231	93.781	1.00	0.00
356	0	1	-227.247	93.781	1.00	0.00
357	0	1	-253.263	93.781	1.00	0.00
358	0	1	-279.279	93.781	1.00	0.00
359	0	1	-305.295	93.781	1.00	0.00
360	0	1	-331.312	93.781	1.00	0.00
361	0	1	-357.328	93.781	1.00	0.00
362	0	1	-189.709	101.819	1.00	0.00
363	0	1	-217.372	101.819	1.00	0.00
364	0	1	-245.034	101.819	1.00	0.00
365	0	1	-272.696	101.819	1.00	0.00
366	0	1	-300.358	101.819	1.00	0.00
367	0	1	-328.020	101.819	1.00	0.00
368	0	1	-355.682	101.819	1.00	0.00
369	0	1	-177.866	109.220	1.00	0.00
370	0	1	-207.220	109.220	1.00	0.00
371	0	1	-236.574	109.220	1.00	0.00
372	0	1	-265.928	109.220	1.00	0.00
373	0	1	-295.282	109.220	1.00	0.00
374	0	1	-324.636	109.220	1.00	0.00
375	0	1	-353.990	109.220	1.00	0.00
376	0	1	-383.344	169.293	1.00	0.00
377	0	1	-383.344	122.634	1.00	0.00
378	0	1	-383.344	129.299	1.00	0.00
379	0	1	-383.344	135.965	1.00	0.00
380	0	1	-383.344	142.630	1.00	0.00
381	0	1	-383.344	149.296	1.00	0.00
382	0	1	-383.344	155.962	1.00	0.00
383	0	1	-383.344	162.627	1.00	0.00
384	0	1	-165.727	122.634	1.00	0.00
385	0	1	-196.815	129.299	1.00	0.00
386	0	1	-227.903	135.965	1.00	0.00
387	0	1	-258.991	142.630	1.00	0.00
388	0	1	-290.079	149.296	1.00	0.00
389	0	1	-321.167	155.962	1.00	0.00
390	0	1	-352.256	162.627	1.00	0.00
391	0	1	-196.815	122.634	1.00	0.00
392	0	1	-227.903	122.634	1.00	0.00
393	0	1	-258.991	122.634	1.00	0.00
394	0	1	-290.079	122.634	1.00	0.00
395	0	1	-321.167	122.634	1.00	0.00
396	0	1	-352.256	122.634	1.00	0.00
397	0	1	-227.903	129.299	1.00	0.00
398	0	1	-258.991	129.299	1.00	0.00
399	0	1	-290.079	129.299	1.00	0.00
400	0	1	-321.167	129.299	1.00	0.00
401	0	1	-352.256	129.299	1.00	0.00
402	0	1	-258.991	135.965	1.00	0.00
403	0	1	-290.079	135.965	1.00	0.00
404	0	1	-321.167	135.965	1.00	0.00
405	0	1	-352.256	135.965	1.00	0.00
406	0	1	-290.079	142.630	1.00	0.00
407	0	1	-321.167	142.630	1.00	0.00
408	0	1	-352.256	142.630	1.00	0.00

409	0	1	-321.167	149.296	1.00	0.00
410	0	1	-352.256	149.296	1.00	0.00
411	0	1	-352.256	155.962	1.00	0.00
412	0	1	-42.594	169.293	1.00	0.00
413	0	1	-85.187	169.293	1.00	0.00
414	0	1	-127.781	169.293	1.00	0.00
415	0	1	-170.375	169.293	1.00	0.00
416	0	1	-212.969	169.293	1.00	0.00
417	0	1	-255.562	169.293	1.00	0.00
418	0	1	-298.156	169.293	1.00	0.00
419	0	1	-340.750	169.293	1.00	0.00
420	0	1	-22.215	151.017	1.00	0.00
421	0	1	-29.008	157.109	1.00	0.00
422	0	1	-35.801	163.201	1.00	0.00
423	0	1	-44.405	150.191	1.00	0.00
424	0	1	-57.999	156.558	1.00	0.00
425	0	1	-71.593	162.925	1.00	0.00
426	0	1	-62.459	147.450	1.00	0.00
427	0	1	-78.789	152.911	1.00	0.00
428	0	1	-95.120	158.371	1.00	0.00
429	0	1	-111.451	163.832	1.00	0.00
430	0	1	-83.148	145.401	1.00	0.00
431	0	1	-104.955	151.374	1.00	0.00
432	0	1	-126.761	157.347	1.00	0.00
433	0	1	-148.568	163.320	1.00	0.00
434	0	1	-99.174	141.670	1.00	0.00
435	0	1	-121.933	147.194	1.00	0.00
436	0	1	-144.692	152.719	1.00	0.00
437	0	1	-167.451	158.244	1.00	0.00
438	0	1	-190.210	163.768	1.00	0.00
439	0	1	-118.690	138.339	1.00	0.00
440	0	1	-146.064	144.529	1.00	0.00
441	0	1	-173.439	150.720	1.00	0.00
442	0	1	-200.813	156.911	1.00	0.00
443	0	1	-228.188	163.102	1.00	0.00
444	0	1	-133.458	133.423	1.00	0.00
445	0	1	-160.907	139.402	1.00	0.00
446	0	1	-188.357	145.380	1.00	0.00
447	0	1	-215.807	151.358	1.00	0.00
448	0	1	-243.257	157.336	1.00	0.00
449	0	1	-270.706	163.314	1.00	0.00
450	0	1	-147.996	127.953	1.00	0.00
451	0	1	-175.533	133.859	1.00	0.00
452	0	1	-203.069	139.765	1.00	0.00
453	0	1	-230.605	145.670	1.00	0.00
454	0	1	-258.141	151.576	1.00	0.00
455	0	1	-285.677	157.481	1.00	0.00
456	0	1	-313.214	163.387	1.00	0.00
457	0	1	-38.551	0.000	1.00	0.00
458	0	1	-77.101	0.000	1.00	0.00
459	0	1	-115.652	0.000	1.00	0.00
460	0	1	-154.202	0.000	1.00	0.00
461	0	1	-192.753	0.000	1.00	0.00
462	0	1	-231.304	-21.794	1.00	0.00
463	0	1	-383.344	-21.794	1.00	0.00
464	0	1	-256.644	-21.794	1.00	0.00
465	0	1	-281.984	-21.794	1.00	0.00
466	0	1	-307.324	-21.794	1.00	0.00
467	0	1	-332.664	-21.794	1.00	0.00
468	0	1	-358.004	-21.794	1.00	0.00
469	0	1	-38.551	-21.794	1.00	0.00
470	0	1	-77.101	-21.794	1.00	0.00
471	0	1	-115.652	-21.794	1.00	0.00
472	0	1	-154.202	-21.794	1.00	0.00
473	0	1	-192.753	-21.794	1.00	0.00
474	0	1	-383.344	-45.767	1.00	0.00
475	0	1	-358.004	-45.767	1.00	0.00
476	0	1	-332.664	-45.767	1.00	0.00
477	0	1	-307.324	-45.767	1.00	0.00
478	0	1	-281.984	-45.767	1.00	0.00
479	0	1	-256.644	-45.767	1.00	0.00
480	0	1	-231.304	-45.767	1.00	0.00
481	0	1	-192.753	-45.767	1.00	0.00
482	0	1	-154.202	-45.767	1.00	0.00
483	0	1	-115.652	-45.767	1.00	0.00
484	0	1	-77.101	-45.767	1.00	0.00
485	0	1	-38.551	-45.767	1.00	0.00
486	0	1	0.000	-45.767	1.00	0.00
487	0	1	38.551	-45.767	1.00	0.00
488	0	1	77.101	-45.767	1.00	0.00
489	0	1	115.652	-45.767	1.00	0.00

490	0	1	154.202	-45.767	1.00	0.00
491	0	1	192.753	-45.767	1.00	0.00
492	0	1	231.304	-45.767	1.00	0.00
493	0	1	256.644	-45.767	1.00	0.00
494	0	1	281.984	-45.767	1.00	0.00
495	0	1	307.324	-45.767	1.00	0.00
496	0	1	332.664	-45.767	1.00	0.00
497	0	1	358.004	-45.767	1.00	0.00
498	0	1	383.344	-45.767	1.00	0.00
499	0	1	-383.344	-72.138	1.00	0.00
500	0	1	-358.004	-72.138	1.00	0.00
501	0	1	-332.664	-72.138	1.00	0.00
502	0	1	-307.324	-72.138	1.00	0.00
503	0	1	-281.984	-72.138	1.00	0.00
504	0	1	-256.644	-72.138	1.00	0.00
505	0	1	-231.304	-72.138	1.00	0.00
506	0	1	-192.753	-72.138	1.00	0.00
507	0	1	-154.202	-72.138	1.00	0.00
508	0	1	-115.652	-72.138	1.00	0.00
509	0	1	-77.101	-72.138	1.00	0.00
510	0	1	-38.551	-72.138	1.00	0.00
511	0	1	0.000	-72.138	1.00	0.00
512	0	1	38.551	-72.138	1.00	0.00
513	0	1	77.101	-72.138	1.00	0.00
514	0	1	115.652	-72.138	1.00	0.00
515	0	1	154.202	-72.138	1.00	0.00
516	0	1	192.753	-72.138	1.00	0.00
517	0	1	231.304	-72.138	1.00	0.00
518	0	1	256.644	-72.138	1.00	0.00
519	0	1	281.984	-72.138	1.00	0.00
520	0	1	307.324	-72.138	1.00	0.00
521	0	1	332.664	-72.138	1.00	0.00
522	0	1	358.004	-72.138	1.00	0.00
523	0	1	383.344	-72.138	1.00	0.00
524	0	1	-383.344	-101.145	1.00	0.00
525	0	1	-358.004	-101.145	1.00	0.00
526	0	1	-332.664	-101.145	1.00	0.00
527	0	1	-307.324	-101.145	1.00	0.00
528	0	1	-281.984	-101.145	1.00	0.00
529	0	1	-256.644	-101.145	1.00	0.00
530	0	1	-231.304	-101.145	1.00	0.00
531	0	1	-192.753	-101.145	1.00	0.00
532	0	1	-154.202	-101.145	1.00	0.00
533	0	1	-115.652	-101.145	1.00	0.00
534	0	1	-77.101	-101.145	1.00	0.00
535	0	1	-38.551	-101.145	1.00	0.00
536	0	1	0.000	-101.145	1.00	0.00
537	0	1	38.551	-101.145	1.00	0.00
538	0	1	77.101	-101.145	1.00	0.00
539	0	1	115.652	-101.145	1.00	0.00
540	0	1	154.202	-101.145	1.00	0.00
541	0	1	192.753	-101.145	1.00	0.00
542	0	1	231.304	-101.145	1.00	0.00
543	0	1	256.644	-101.145	1.00	0.00
544	0	1	281.984	-101.145	1.00	0.00
545	0	1	307.324	-101.145	1.00	0.00
546	0	1	332.664	-101.145	1.00	0.00
547	0	1	358.004	-101.145	1.00	0.00
548	0	1	383.344	-101.145	1.00	0.00
549	0	1	-383.344	-133.054	1.00	0.00
550	0	1	-358.004	-133.054	1.00	0.00
551	0	1	-332.664	-133.054	1.00	0.00
552	0	1	-307.324	-133.054	1.00	0.00
553	0	1	-281.984	-133.054	1.00	0.00
554	0	1	-256.644	-133.054	1.00	0.00
555	0	1	-231.304	-133.054	1.00	0.00
556	0	1	-192.753	-133.054	1.00	0.00
557	0	1	-154.202	-133.054	1.00	0.00
558	0	1	-115.652	-133.054	1.00	0.00
559	0	1	-77.101	-133.054	1.00	0.00
560	0	1	-38.551	-133.054	1.00	0.00
561	0	1	0.000	-133.054	1.00	0.00
562	0	1	38.551	-133.054	1.00	0.00
563	0	1	77.101	-133.054	1.00	0.00
564	0	1	115.652	-133.054	1.00	0.00
565	0	1	154.202	-133.054	1.00	0.00
566	0	1	192.753	-133.054	1.00	0.00
567	0	1	231.304	-133.054	1.00	0.00
568	0	1	256.644	-133.054	1.00	0.00
569	0	1	281.984	-133.054	1.00	0.00
570	0	1	307.324	-133.054	1.00	0.00

571	0	1	332.664	-133.054	1.00	0.00
572	0	1	358.004	-133.054	1.00	0.00
573	0	1	383.344	-133.054	1.00	0.00
574	0	1	-383.344	-168.153	1.00	0.00
575	0	1	-358.004	-168.153	1.00	0.00
576	0	1	-332.664	-168.153	1.00	0.00
577	0	1	-307.324	-168.153	1.00	0.00
578	0	1	-281.984	-168.153	1.00	0.00
579	0	1	-256.644	-168.153	1.00	0.00
580	0	1	-231.304	-168.153	1.00	0.00
581	0	1	-192.753	-168.153	1.00	0.00
582	0	1	-154.202	-168.153	1.00	0.00
583	0	1	-115.652	-168.153	1.00	0.00
584	0	1	-77.101	-168.153	1.00	0.00
585	0	1	-38.551	-168.153	1.00	0.00
586	0	1	0.000	-168.153	1.00	0.00
587	0	1	38.551	-168.153	1.00	0.00
588	0	1	77.101	-168.153	1.00	0.00
589	0	1	115.652	-168.153	1.00	0.00
590	0	1	154.202	-168.153	1.00	0.00
591	0	1	192.753	-168.153	1.00	0.00
592	0	1	231.304	-168.153	1.00	0.00
593	0	1	256.644	-168.153	1.00	0.00
594	0	1	281.984	-168.153	1.00	0.00
595	0	1	307.324	-168.153	1.00	0.00
596	0	1	332.664	-168.153	1.00	0.00
597	0	1	358.004	-168.153	1.00	0.00
598	0	1	383.344	-168.153	1.00	0.00
599	0	1	-434.435	-168.153	1.00	0.00
600	0	1	-434.435	-133.054	1.00	0.00
601	0	1	-434.435	-101.145	1.00	0.00
602	0	1	-434.435	-72.138	1.00	0.00
603	0	1	-434.435	-45.767	1.00	0.00
604	0	1	-434.435	-21.794	1.00	0.00
605	0	1	-434.435	0.000	1.00	0.00
606	0	1	-434.435	18.070	1.00	0.00
607	0	1	-434.435	35.988	1.00	0.00
608	0	1	-434.435	51.091	1.00	0.00
609	0	1	-434.435	64.621	1.00	0.00
610	0	1	-434.435	75.871	1.00	0.00
611	0	1	-434.435	85.125	1.00	0.00
612	0	1	-434.435	93.781	1.00	0.00
613	0	1	-434.435	101.819	1.00	0.00
614	0	1	-434.435	109.220	1.00	0.00
615	0	1	-434.435	115.968	1.00	0.00
616	0	1	-434.435	122.634	1.00	0.00
617	0	1	-434.435	129.299	1.00	0.00
618	0	1	-434.435	135.965	1.00	0.00
619	0	1	-434.435	142.630	1.00	0.00
620	0	1	-434.435	149.296	1.00	0.00
621	0	1	-434.435	155.962	1.00	0.00
622	0	1	-434.435	162.627	1.00	0.00
623	0	1	-434.435	169.293	1.00	0.00
624	0	1	-468.469	-168.153	1.00	0.00
625	0	1	-468.469	-133.054	1.00	0.00
626	0	1	-468.469	-101.145	1.00	0.00
627	0	1	-468.469	-72.138	1.00	0.00
628	0	1	-468.469	-45.767	1.00	0.00
629	0	1	-468.469	-21.794	1.00	0.00
630	0	1	-468.469	0.000	1.00	0.00
631	0	1	-468.469	18.070	1.00	0.00
632	0	1	-468.469	35.988	1.00	0.00
633	0	1	-468.469	51.091	1.00	0.00
634	0	1	-468.469	64.621	1.00	0.00
635	0	1	-468.469	75.871	1.00	0.00
636	0	1	-468.469	85.125	1.00	0.00
637	0	1	-468.469	93.781	1.00	0.00
638	0	1	-468.469	101.819	1.00	0.00
639	0	1	-468.469	109.220	1.00	0.00
640	0	1	-468.469	115.968	1.00	0.00
641	0	1	-468.469	122.634	1.00	0.00
642	0	1	-468.469	129.299	1.00	0.00
643	0	1	-468.469	135.965	1.00	0.00
644	0	1	-468.469	142.630	1.00	0.00
645	0	1	-468.469	149.296	1.00	0.00
646	0	1	-468.469	155.962	1.00	0.00
647	0	1	-468.469	162.627	1.00	0.00
648	0	1	-468.469	169.293	1.00	0.00
649	0	1	-492.564	-168.153	1.00	0.00
650	0	1	-492.564	-133.054	1.00	0.00
651	0	1	-492.564	-101.145	1.00	0.00

652	0	1	-492.564	-72.138	1.00	0.00
653	0	1	-492.564	-45.767	1.00	0.00
654	0	1	-492.564	-21.794	1.00	0.00
655	0	1	-492.564	0.000	1.00	0.00
656	0	1	-492.564	18.070	1.00	0.00
657	0	1	-492.564	35.988	1.00	0.00
658	0	1	-492.564	51.091	1.00	0.00
659	0	1	-492.564	64.621	1.00	0.00
660	0	1	-492.564	75.871	1.00	0.00
661	0	1	-492.564	85.125	1.00	0.00
662	0	1	-492.564	93.781	1.00	0.00
663	0	1	-492.564	101.819	1.00	0.00
664	0	1	-492.564	109.220	1.00	0.00
665	0	1	-492.564	115.968	1.00	0.00
666	0	1	-492.564	122.634	1.00	0.00
667	0	1	-492.564	129.299	1.00	0.00
668	0	1	-492.564	135.965	1.00	0.00
669	0	1	-492.564	142.630	1.00	0.00
670	0	1	-492.564	149.296	1.00	0.00
671	0	1	-492.564	155.962	1.00	0.00
672	0	1	-492.564	162.627	1.00	0.00
673	0	1	-492.564	169.293	1.00	0.00
674	0	1	-512.643	-168.153	1.00	0.00
675	0	1	-512.643	-133.054	1.00	0.00
676	0	1	-512.643	-101.145	1.00	0.00
677	0	1	-512.643	-72.138	1.00	0.00
678	0	1	-512.643	-45.767	1.00	0.00
679	0	1	-512.643	-21.794	1.00	0.00
680	0	1	-512.643	0.000	1.00	0.00
681	0	1	-512.643	18.070	1.00	0.00
682	0	1	-512.643	35.988	1.00	0.00
683	0	1	-512.643	51.091	1.00	0.00
684	0	1	-512.643	64.621	1.00	0.00
685	0	1	-512.643	75.871	1.00	0.00
686	0	1	-512.643	85.125	1.00	0.00
687	0	1	-512.643	93.781	1.00	0.00
688	0	1	-512.643	101.819	1.00	0.00
689	0	1	-512.643	109.220	1.00	0.00
690	0	1	-512.643	115.968	1.00	0.00
691	0	1	-512.643	122.634	1.00	0.00
692	0	1	-512.643	129.299	1.00	0.00
693	0	1	-512.643	135.965	1.00	0.00
694	0	1	-512.643	142.630	1.00	0.00
695	0	1	-512.643	149.296	1.00	0.00
696	0	1	-512.643	155.962	1.00	0.00
697	0	1	-512.643	162.627	1.00	0.00
698	0	1	-512.643	169.293	1.00	0.00
699	0	1	-532.640	-168.153	1.00	0.00
700	0	1	-532.640	-133.054	1.00	0.00
701	0	1	-532.640	-101.145	1.00	0.00
702	0	1	-532.640	-72.138	1.00	0.00
703	0	1	-532.640	-45.767	1.00	0.00
704	0	1	-532.640	-21.794	1.00	0.00
705	0	1	-532.640	0.000	1.00	0.00
706	0	1	-532.640	18.070	1.00	0.00
707	0	1	-532.640	35.988	1.00	0.00
708	0	1	-532.640	51.091	1.00	0.00
709	0	1	-532.640	64.621	1.00	0.00
710	0	1	-532.640	75.871	1.00	0.00
711	0	1	-532.640	85.125	1.00	0.00
712	0	1	-532.640	93.781	1.00	0.00
713	0	1	-532.640	101.819	1.00	0.00
714	0	1	-532.640	109.220	1.00	0.00
715	0	1	-532.640	115.968	1.00	0.00
716	0	1	-532.640	122.634	1.00	0.00
717	0	1	-532.640	129.299	1.00	0.00
718	0	1	-532.640	135.965	1.00	0.00
719	0	1	-532.640	142.630	1.00	0.00
720	0	1	-532.640	149.296	1.00	0.00
721	0	1	-532.640	155.962	1.00	0.00
722	0	1	-532.640	162.627	1.00	0.00
723	0	1	-532.640	169.293	1.00	0.00
724	0	1	-552.636	-168.153	1.00	0.00
725	0	1	-552.636	-133.054	1.00	0.00
726	0	1	-552.636	-101.145	1.00	0.00
727	0	1	-552.636	-72.138	1.00	0.00
728	0	1	-552.636	-45.767	1.00	0.00
729	0	1	-552.636	-21.794	1.00	0.00
730	0	1	-552.636	0.000	1.00	0.00
731	0	1	-552.636	18.070	1.00	0.00
732	0	1	-552.636	35.988	1.00	0.00

733	0	1	-552.636	51.091	1.00	0.00
734	0	1	-552.636	64.621	1.00	0.00
735	0	1	-552.636	75.871	1.00	0.00
736	0	1	-552.636	85.125	1.00	0.00
737	0	1	-552.636	93.781	1.00	0.00
738	0	1	-552.636	101.819	1.00	0.00
739	0	1	-552.636	109.220	1.00	0.00
740	0	1	-552.636	115.968	1.00	0.00
741	0	1	-552.636	122.634	1.00	0.00
742	0	1	-552.636	129.299	1.00	0.00
743	0	1	-552.636	135.965	1.00	0.00
744	0	1	-552.636	142.630	1.00	0.00
745	0	1	-552.636	149.296	1.00	0.00
746	0	1	-552.636	155.962	1.00	0.00
747	0	1	-552.636	162.627	1.00	0.00
748	0	1	-552.636	169.293	1.00	0.00
749	0	1	-401.413	18.070	1.00	0.00
750	0	1	-419.332	35.988	1.00	0.00
751	0	1	-447.965	64.621	1.00	0.00
752	0	1	-459.214	75.871	1.00	0.00
753	0	1	-477.125	93.781	1.00	0.00
754	0	1	-485.162	101.819	1.00	0.00
755	0	1	-499.312	115.968	1.00	0.00
756	0	1	-505.977	122.634	1.00	0.00
757	0	1	-519.309	135.965	1.00	0.00
758	0	1	-525.974	142.630	1.00	0.00
759	0	1	-539.305	155.962	1.00	0.00
760	0	1	-545.971	162.627	1.00	0.00
761	0	1	-642.636	-168.153	1.00	0.00
762	0	1	-642.636	-133.054	1.00	0.00
763	0	1	-642.636	-101.145	1.00	0.00
764	0	1	-642.636	-72.138	1.00	0.00
765	0	1	-642.636	-45.767	1.00	0.00
766	0	1	-642.636	-21.794	1.00	0.00
767	0	1	-642.636	0.000	1.00	0.00
768	0	1	-642.636	18.070	1.00	0.00
769	0	1	-642.636	35.988	1.00	0.00
770	0	1	-642.636	51.091	1.00	0.00
771	0	1	-642.636	64.621	1.00	0.00
772	0	1	-642.636	75.871	1.00	0.00
773	0	1	-642.636	85.125	1.00	0.00
774	0	1	-642.636	93.781	1.00	0.00
775	0	1	-642.636	101.819	1.00	0.00
776	0	1	-642.636	109.220	1.00	0.00
777	0	1	-642.636	115.968	1.00	0.00
778	0	1	-642.636	122.634	1.00	0.00
779	0	1	-642.636	129.299	1.00	0.00
780	0	1	-642.636	135.965	1.00	0.00
781	0	1	-642.636	142.630	1.00	0.00
782	0	1	-642.636	149.296	1.00	0.00
783	0	1	-642.636	155.962	1.00	0.00
784	0	1	-642.636	162.627	1.00	0.00
785	0	1	-642.636	169.293	1.00	0.00
786	0	1	-732.636	-168.153	1.00	0.00
787	0	1	-732.636	-133.054	1.00	0.00
788	0	1	-732.636	-101.145	1.00	0.00
789	0	1	-732.636	-72.138	1.00	0.00
790	0	1	-732.636	-45.767	1.00	0.00
791	0	1	-732.636	-21.794	1.00	0.00
792	0	1	-732.636	0.000	1.00	0.00
793	0	1	-732.636	18.070	1.00	0.00
794	0	1	-732.636	35.988	1.00	0.00
795	0	1	-732.636	51.091	1.00	0.00
796	0	1	-732.636	64.621	1.00	0.00
797	0	1	-732.636	75.871	1.00	0.00
798	0	1	-732.636	85.125	1.00	0.00
799	0	1	-732.636	93.781	1.00	0.00
800	0	1	-732.636	101.819	1.00	0.00
801	0	1	-732.636	109.220	1.00	0.00
802	0	1	-732.636	115.968	1.00	0.00
803	0	1	-732.636	122.634	1.00	0.00
804	0	1	-732.636	129.299	1.00	0.00
805	0	1	-732.636	135.965	1.00	0.00
806	0	1	-732.636	142.630	1.00	0.00
807	0	1	-732.636	149.296	1.00	0.00
808	0	1	-732.636	155.962	1.00	0.00
809	0	1	-732.636	162.627	1.00	0.00
810	0	1	-732.636	169.293	1.00	0.00
811	0	1	-822.636	-168.153	1.00	0.00
812	0	1	-822.636	-133.054	1.00	0.00
813	0	1	-822.636	-101.145	1.00	0.00

814	0	1	-822.636	-72.138	1.00	0.00
815	0	1	-822.636	-45.767	1.00	0.00
816	0	1	-822.636	-21.794	1.00	0.00
817	0	1	-822.636	0.000	1.00	0.00
818	0	1	-822.636	18.070	1.00	0.00
819	0	1	-822.636	35.988	1.00	0.00
820	0	1	-822.636	51.091	1.00	0.00
821	0	1	-822.636	64.621	1.00	0.00
822	0	1	-822.636	75.871	1.00	0.00
823	0	1	-822.636	85.125	1.00	0.00
824	0	1	-822.636	93.781	1.00	0.00
825	0	1	-822.636	101.819	1.00	0.00
826	0	1	-822.636	109.220	1.00	0.00
827	0	1	-822.636	115.968	1.00	0.00
828	0	1	-822.636	122.634	1.00	0.00
829	0	1	-822.636	129.299	1.00	0.00
830	0	1	-822.636	135.965	1.00	0.00
831	0	1	-822.636	142.630	1.00	0.00
832	0	1	-822.636	149.296	1.00	0.00
833	0	1	-822.636	155.962	1.00	0.00
834	0	1	-822.636	162.627	1.00	0.00
835	0	1	-822.636	169.293	1.00	0.00
836	0	1	-912.636	-168.153	1.00	0.00
837	0	1	-912.636	-133.054	1.00	0.00
838	0	1	-912.636	-101.145	1.00	0.00
839	0	1	-912.636	-72.138	1.00	0.00
840	0	1	-912.636	-45.767	1.00	0.00
841	0	1	-912.636	-21.794	1.00	0.00
842	0	1	-912.636	0.000	1.00	0.00
843	0	1	-912.636	18.070	1.00	0.00
844	0	1	-912.636	35.988	1.00	0.00
845	0	1	-912.636	51.091	1.00	0.00
846	0	1	-912.636	64.621	1.00	0.00
847	0	1	-912.636	75.871	1.00	0.00
848	0	1	-912.636	85.125	1.00	0.00
849	0	1	-912.636	93.781	1.00	0.00
850	0	1	-912.636	101.819	1.00	0.00
851	0	1	-912.636	109.220	1.00	0.00
852	0	1	-912.636	115.968	1.00	0.00
853	0	1	-912.636	122.634	1.00	0.00
854	0	1	-912.636	129.299	1.00	0.00
855	0	1	-912.636	135.965	1.00	0.00
856	0	1	-912.636	142.630	1.00	0.00
857	0	1	-912.636	149.296	1.00	0.00
858	0	1	-912.636	155.962	1.00	0.00
859	0	1	-912.636	162.627	1.00	0.00
860	0	1	-912.636	169.293	1.00	0.00
861	0	1	434.435	-168.153	1.00	0.00
862	0	1	434.435	-133.054	1.00	0.00
863	0	1	434.435	-101.145	1.00	0.00
864	0	1	434.435	-72.138	1.00	0.00
865	0	1	434.435	-45.767	1.00	0.00
866	0	1	434.435	-21.794	1.00	0.00
867	0	1	434.435	0.000	1.00	0.00
868	0	1	434.435	18.070	1.00	0.00
869	0	1	434.435	35.988	1.00	0.00
870	0	1	434.435	51.091	1.00	0.00
871	0	1	434.435	64.621	1.00	0.00
872	0	1	434.435	75.871	1.00	0.00
873	0	1	434.435	85.125	1.00	0.00
874	0	1	434.435	93.781	1.00	0.00
875	0	1	434.435	101.819	1.00	0.00
876	0	1	434.435	109.220	1.00	0.00
877	0	1	434.435	115.968	1.00	0.00
878	0	1	434.435	122.634	1.00	0.00
879	0	1	434.435	129.299	1.00	0.00
880	0	1	434.435	135.965	1.00	0.00
881	0	1	434.435	142.630	1.00	0.00
882	0	1	434.435	149.296	1.00	0.00
883	0	1	434.435	155.962	1.00	0.00
884	0	1	434.435	162.627	1.00	0.00
885	0	1	434.435	169.293	1.00	0.00
886	0	1	468.469	-168.153	1.00	0.00
887	0	1	468.469	-133.054	1.00	0.00
888	0	1	468.469	-101.145	1.00	0.00
889	0	1	468.469	-72.138	1.00	0.00
890	0	1	468.469	-45.767	1.00	0.00
891	0	1	468.469	-21.794	1.00	0.00
892	0	1	468.469	0.000	1.00	0.00
893	0	1	468.469	18.070	1.00	0.00
894	0	1	468.469	35.988	1.00	0.00



895	0	1	468.469	51.091	1.00	0.00
896	0	1	468.469	64.621	1.00	0.00
897	0	1	468.469	75.871	1.00	0.00
898	0	1	468.469	85.125	1.00	0.00
899	0	1	468.469	93.781	1.00	0.00
900	0	1	468.469	101.819	1.00	0.00
901	0	1	468.469	109.220	1.00	0.00
902	0	1	468.469	115.968	1.00	0.00
903	0	1	468.469	122.634	1.00	0.00
904	0	1	468.469	129.299	1.00	0.00
905	0	1	468.469	135.965	1.00	0.00
906	0	1	468.469	142.630	1.00	0.00
907	0	1	468.469	149.296	1.00	0.00
908	0	1	468.469	155.962	1.00	0.00
909	0	1	468.469	162.627	1.00	0.00
910	0	1	468.469	169.293	1.00	0.00
911	0	1	492.564	-168.153	1.00	0.00
912	0	1	492.564	-133.054	1.00	0.00
913	0	1	492.564	-101.145	1.00	0.00
914	0	1	492.564	-72.138	1.00	0.00
915	0	1	492.564	-45.767	1.00	0.00
916	0	1	492.564	-21.794	1.00	0.00
917	0	1	492.564	0.000	1.00	0.00
918	0	1	492.564	18.070	1.00	0.00
919	0	1	492.564	35.988	1.00	0.00
920	0	1	492.564	51.091	1.00	0.00
921	0	1	492.564	64.621	1.00	0.00
922	0	1	492.564	75.871	1.00	0.00
923	0	1	492.564	85.125	1.00	0.00
924	0	1	492.564	93.781	1.00	0.00
925	0	1	492.564	101.819	1.00	0.00
926	0	1	492.564	109.220	1.00	0.00
927	0	1	492.564	115.968	1.00	0.00
928	0	1	492.564	122.634	1.00	0.00
929	0	1	492.564	129.299	1.00	0.00
930	0	1	492.564	135.965	1.00	0.00
931	0	1	492.564	142.630	1.00	0.00
932	0	1	492.564	149.296	1.00	0.00
933	0	1	492.564	155.962	1.00	0.00
934	0	1	492.564	162.627	1.00	0.00
935	0	1	492.564	169.293	1.00	0.00
936	0	1	512.643	-168.153	1.00	0.00
937	0	1	512.643	-133.054	1.00	0.00
938	0	1	512.643	-101.145	1.00	0.00
939	0	1	512.643	-72.138	1.00	0.00
940	0	1	512.643	-45.767	1.00	0.00
941	0	1	512.643	-21.794	1.00	0.00
942	0	1	512.643	0.000	1.00	0.00
943	0	1	512.643	18.070	1.00	0.00
944	0	1	512.643	35.988	1.00	0.00
945	0	1	512.643	51.091	1.00	0.00
946	0	1	512.643	64.621	1.00	0.00
947	0	1	512.643	75.871	1.00	0.00
948	0	1	512.643	85.125	1.00	0.00
949	0	1	512.643	93.781	1.00	0.00
950	0	1	512.643	101.819	1.00	0.00
951	0	1	512.643	109.220	1.00	0.00
952	0	1	512.643	115.968	1.00	0.00
953	0	1	512.643	122.634	1.00	0.00
954	0	1	512.643	129.299	1.00	0.00
955	0	1	512.643	135.965	1.00	0.00
956	0	1	512.643	142.630	1.00	0.00
957	0	1	512.643	149.296	1.00	0.00
958	0	1	512.643	155.962	1.00	0.00
959	0	1	512.643	162.627	1.00	0.00
960	0	1	512.643	169.293	1.00	0.00
961	0	1	532.640	-168.153	1.00	0.00
962	0	1	532.640	-133.054	1.00	0.00
963	0	1	532.640	-101.145	1.00	0.00
964	0	1	532.640	-72.138	1.00	0.00
965	0	1	532.640	-45.767	1.00	0.00
966	0	1	532.640	-21.794	1.00	0.00
967	0	1	532.640	0.000	1.00	0.00
968	0	1	532.640	18.070	1.00	0.00
969	0	1	532.640	35.988	1.00	0.00
970	0	1	532.640	51.091	1.00	0.00
971	0	1	532.640	64.621	1.00	0.00
972	0	1	532.640	75.871	1.00	0.00
973	0	1	532.640	85.125	1.00	0.00
974	0	1	532.640	93.781	1.00	0.00
975	0	1	532.640	101.819	1.00	0.00

976	0	1	532.640	109.220	1.00	0.00
977	0	1	532.640	115.968	1.00	0.00
978	0	1	532.640	122.634	1.00	0.00
979	0	1	532.640	129.299	1.00	0.00
980	0	1	532.640	135.965	1.00	0.00
981	0	1	532.640	142.630	1.00	0.00
982	0	1	532.640	149.296	1.00	0.00
983	0	1	532.640	155.962	1.00	0.00
984	0	1	532.640	162.627	1.00	0.00
985	0	1	532.640	169.293	1.00	0.00
986	0	1	552.636	-168.153	1.00	0.00
987	0	1	552.636	-133.054	1.00	0.00
988	0	1	552.636	-101.145	1.00	0.00
989	0	1	552.636	-72.138	1.00	0.00
990	0	1	552.636	-45.767	1.00	0.00
991	0	1	552.636	-21.794	1.00	0.00
992	0	1	552.636	0.000	1.00	0.00
993	0	1	552.636	18.070	1.00	0.00
994	0	1	552.636	35.988	1.00	0.00
995	0	1	552.636	51.091	1.00	0.00
996	0	1	552.636	64.621	1.00	0.00
997	0	1	552.636	75.871	1.00	0.00
998	0	1	552.636	85.125	1.00	0.00
999	0	1	552.636	93.781	1.00	0.00
1000	0	1	552.636	101.819	1.00	0.00
1001	0	1	552.636	109.220	1.00	0.00
1002	0	1	552.636	115.968	1.00	0.00
1003	0	1	552.636	122.634	1.00	0.00
1004	0	1	552.636	129.299	1.00	0.00
1005	0	1	552.636	135.965	1.00	0.00
1006	0	1	552.636	142.630	1.00	0.00
1007	0	1	552.636	149.296	1.00	0.00
1008	0	1	552.636	155.962	1.00	0.00
1009	0	1	552.636	162.627	1.00	0.00
1010	0	1	552.636	169.293	1.00	0.00
1011	0	1	401.413	18.070	1.00	0.00
1012	0	1	419.332	35.988	1.00	0.00
1013	0	1	447.965	64.621	1.00	0.00
1014	0	1	459.214	75.871	1.00	0.00
1015	0	1	477.125	93.781	1.00	0.00
1016	0	1	485.162	101.819	1.00	0.00
1017	0	1	499.312	115.968	1.00	0.00
1018	0	1	505.977	122.634	1.00	0.00
1019	0	1	519.309	135.965	1.00	0.00
1020	0	1	525.974	142.630	1.00	0.00
1021	0	1	539.305	155.962	1.00	0.00
1022	0	1	545.971	162.627	1.00	0.00
1023	0	1	642.636	-168.153	1.00	0.00
1024	0	1	642.636	-133.054	1.00	0.00
1025	0	1	642.636	-101.145	1.00	0.00
1026	0	1	642.636	-72.138	1.00	0.00
1027	0	1	642.636	-45.767	1.00	0.00
1028	0	1	642.636	-21.794	1.00	0.00
1029	0	1	642.636	0.000	1.00	0.00
1030	0	1	642.636	18.070	1.00	0.00
1031	0	1	642.636	35.988	1.00	0.00
1032	0	1	642.636	51.091	1.00	0.00
1033	0	1	642.636	64.621	1.00	0.00
1034	0	1	642.636	75.871	1.00	0.00
1035	0	1	642.636	85.125	1.00	0.00
1036	0	1	642.636	93.781	1.00	0.00
1037	0	1	642.636	101.819	1.00	0.00
1038	0	1	642.636	109.220	1.00	0.00
1039	0	1	642.636	115.968	1.00	0.00
1040	0	1	642.636	122.634	1.00	0.00
1041	0	1	642.636	129.299	1.00	0.00
1042	0	1	642.636	135.965	1.00	0.00
1043	0	1	642.636	142.630	1.00	0.00
1044	0	1	642.636	149.296	1.00	0.00
1045	0	1	642.636	155.962	1.00	0.00
1046	0	1	642.636	162.627	1.00	0.00
1047	0	1	642.636	169.293	1.00	0.00
1048	0	1	732.636	-168.153	1.00	0.00
1049	0	1	732.636	-133.054	1.00	0.00
1050	0	1	732.636	-101.145	1.00	0.00
1051	0	1	732.636	-72.138	1.00	0.00
1052	0	1	732.636	-45.767	1.00	0.00
1053	0	1	732.636	-21.794	1.00	0.00
1054	0	1	732.636	0.000	1.00	0.00
1055	0	1	732.636	18.070	1.00	0.00
1056	0	1	732.636	35.988	1.00	0.00

1057	0	1	732.636	51.091	1.00	0.00
1058	0	1	732.636	64.621	1.00	0.00
1059	0	1	732.636	75.871	1.00	0.00
1060	0	1	732.636	85.125	1.00	0.00
1061	0	1	732.636	93.781	1.00	0.00
1062	0	1	732.636	101.819	1.00	0.00
1063	0	1	732.636	109.220	1.00	0.00
1064	0	1	732.636	115.968	1.00	0.00
1065	0	1	732.636	122.634	1.00	0.00
1066	0	1	732.636	129.299	1.00	0.00
1067	0	1	732.636	135.965	1.00	0.00
1068	0	1	732.636	142.630	1.00	0.00
1069	0	1	732.636	149.296	1.00	0.00
1070	0	1	732.636	155.962	1.00	0.00
1071	0	1	732.636	162.627	1.00	0.00
1072	0	1	732.636	169.293	1.00	0.00
1073	0	1	822.636	-168.153	1.00	0.00
1074	0	1	822.636	-133.054	1.00	0.00
1075	0	1	822.636	-101.145	1.00	0.00
1076	0	1	822.636	-72.138	1.00	0.00
1077	0	1	822.636	-45.767	1.00	0.00
1078	0	1	822.636	-21.794	1.00	0.00
1079	0	1	822.636	0.000	1.00	0.00
1080	0	1	822.636	18.070	1.00	0.00
1081	0	1	822.636	35.988	1.00	0.00
1082	0	1	822.636	51.091	1.00	0.00
1083	0	1	822.636	64.621	1.00	0.00
1084	0	1	822.636	75.871	1.00	0.00
1085	0	1	822.636	85.125	1.00	0.00
1086	0	1	822.636	93.781	1.00	0.00
1087	0	1	822.636	101.819	1.00	0.00
1088	0	1	822.636	109.220	1.00	0.00
1089	0	1	822.636	115.968	1.00	0.00
1090	0	1	822.636	122.634	1.00	0.00
1091	0	1	822.636	129.299	1.00	0.00
1092	0	1	822.636	135.965	1.00	0.00
1093	0	1	822.636	142.630	1.00	0.00
1094	0	1	822.636	149.296	1.00	0.00
1095	0	1	822.636	155.962	1.00	0.00
1096	0	1	822.636	162.627	1.00	0.00
1097	0	1	822.636	169.293	1.00	0.00
1098	0	1	912.636	-168.153	1.00	0.00
1099	0	1	912.636	-133.054	1.00	0.00
1100	0	1	912.636	-101.145	1.00	0.00
1101	0	1	912.636	-72.138	1.00	0.00
1102	0	1	912.636	-45.767	1.00	0.00
1103	0	1	912.636	-21.794	1.00	0.00
1104	0	1	912.636	0.000	1.00	0.00
1105	0	1	912.636	18.070	1.00	0.00
1106	0	1	912.636	35.988	1.00	0.00
1107	0	1	912.636	51.091	1.00	0.00
1108	0	1	912.636	64.621	1.00	0.00
1109	0	1	912.636	75.871	1.00	0.00
1110	0	1	912.636	85.125	1.00	0.00
1111	0	1	912.636	93.781	1.00	0.00
1112	0	1	912.636	101.819	1.00	0.00
1113	0	1	912.636	109.220	1.00	0.00
1114	0	1	912.636	115.968	1.00	0.00
1115	0	1	912.636	122.634	1.00	0.00
1116	0	1	912.636	129.299	1.00	0.00
1117	0	1	912.636	135.965	1.00	0.00
1118	0	1	912.636	142.630	1.00	0.00
1119	0	1	912.636	149.296	1.00	0.00
1120	0	1	912.636	155.962	1.00	0.00
1121	0	1	912.636	162.627	1.00	0.00
1122	0	1	912.636	169.293	1.00	0.00
1123	0	1	-912.636	187.293	1.00	0.00
1124	0	1	-822.636	187.293	1.00	0.00
1125	0	1	-732.636	187.293	1.00	0.00
1126	0	1	-642.636	187.293	1.00	0.00
1127	0	1	-552.636	187.293	1.00	0.00
1128	0	1	-532.640	187.293	1.00	0.00
1129	0	1	-512.643	187.293	1.00	0.00
1130	0	1	-492.564	187.293	1.00	0.00
1131	0	1	-468.469	187.293	1.00	0.00
1132	0	1	-434.435	187.293	1.00	0.00
1133	0	1	-383.344	187.293	1.00	0.00
1134	0	1	-340.750	187.293	1.00	0.00
1135	0	1	-298.156	187.293	1.00	0.00
1136	0	1	-255.562	187.293	1.00	0.00
1137	0	1	-212.969	187.293	1.00	0.00

1138	0	1	-170.375	187.293	1.00	0.00
1139	0	1	-127.781	187.293	1.00	0.00
1140	0	1	-85.187	187.293	1.00	0.00
1141	0	1	-42.594	187.293	1.00	0.00
1142	0	1	0.000	187.293	1.00	0.00
1143	0	1	42.594	187.293	1.00	0.00
1144	0	1	85.187	187.293	1.00	0.00
1145	0	1	127.781	187.293	1.00	0.00
1146	0	1	170.375	187.293	1.00	0.00
1147	0	1	212.969	187.293	1.00	0.00
1148	0	1	255.562	187.293	1.00	0.00
1149	0	1	298.156	187.293	1.00	0.00
1150	0	1	340.750	187.293	1.00	0.00
1151	0	1	383.344	187.293	1.00	0.00
1152	0	1	434.435	187.293	1.00	0.00
1153	0	1	468.469	187.293	1.00	0.00
1154	0	1	492.564	187.293	1.00	0.00
1155	0	1	512.643	187.293	1.00	0.00
1156	0	1	532.640	187.293	1.00	0.00
1157	0	1	552.636	187.293	1.00	0.00
1158	0	1	642.636	187.293	1.00	0.00
1159	0	1	732.636	187.293	1.00	0.00
1160	0	1	822.636	187.293	1.00	0.00
1161	0	1	912.636	187.293	1.00	0.00
1162	0	1	-912.636	205.293	1.00	0.00
1163	0	1	-822.636	205.293	1.00	0.00
1164	0	1	-732.636	205.293	1.00	0.00
1165	0	1	-642.636	205.293	1.00	0.00
1166	0	1	-552.636	205.293	1.00	0.00
1167	0	1	-532.640	205.293	1.00	0.00
1168	0	1	-512.643	205.293	1.00	0.00
1169	0	1	-492.564	205.293	1.00	0.00
1170	0	1	-468.469	205.293	1.00	0.00
1171	0	1	-434.435	205.293	1.00	0.00
1172	0	1	-383.344	205.293	1.00	0.00
1173	0	1	-340.750	205.293	1.00	0.00
1174	0	1	-298.156	205.293	1.00	0.00
1175	0	1	-255.562	205.293	1.00	0.00
1176	0	1	-212.969	205.293	1.00	0.00
1177	0	1	-170.375	205.293	1.00	0.00
1178	0	1	-127.781	205.293	1.00	0.00
1179	0	1	-85.187	205.293	1.00	0.00
1180	0	1	-48.000	205.293	1.00	0.00
1181	0	1	0.000	205.293	1.00	0.00
1182	0	1	42.594	205.293	1.00	0.00
1183	0	1	85.187	205.293	1.00	0.00
1184	0	1	127.781	205.293	1.00	0.00
1185	0	1	170.375	205.293	1.00	0.00
1186	0	1	212.969	205.293	1.00	0.00
1187	0	1	255.562	205.293	1.00	0.00
1188	0	1	298.156	205.293	1.00	0.00
1189	0	1	340.750	205.293	1.00	0.00
1190	0	1	383.344	205.293	1.00	0.00
1191	0	1	434.435	205.293	1.00	0.00
1192	0	1	468.469	205.293	1.00	0.00
1193	0	1	492.564	205.293	1.00	0.00
1194	0	1	512.643	205.293	1.00	0.00
1195	0	1	532.640	205.293	1.00	0.00
1196	0	1	552.636	205.293	1.00	0.00
1197	0	1	642.636	205.293	1.00	0.00
1198	0	1	732.636	205.293	1.00	0.00
1199	0	1	822.636	205.293	1.00	0.00
1200	0	1	912.636	205.293	1.00	0.00
1201	0	1	-570.636	187.293	1.00	0.00
1202	0	1	-588.636	205.293	1.00	0.00
1203	0	1	570.636	187.293	1.00	0.00
1204	0	1	588.636	205.293	1.00	0.00

ALL ELEMENT DATA AS INPUT "I" AND GENERATED

ELEMENT NUMBER	NODE-CONNECTIVITY				MATERIAL NUMBER	CONSTR. INCR.	ELEMENT TYPE	BAND WIDTH	GENERATION INCREMENTS
	I	J	K	L					
I 1	38	39	0	0	1	1	BEAM	6	1, 0, 0
I 2	37	38	0	0	1	1	BEAM	6	1, 0, 0
I 3	36	37	0	0	1	1	BEAM	6	1, 0, 0
I 4	35	36	0	0	1	1	BEAM	6	1, 0, 0
I 5	34	35	0	0	1	1	BEAM	6	1, 0, 0
I 6	33	34	0	0	1	1	BEAM	6	1, 0, 0
I 7	32	33	0	0	1	1	BEAM	6	1, 0, 0
I 8	31	32	0	0	1	1	BEAM	6	1, 0, 0
I 9	30	31	0	0	1	1	BEAM	6	1, 0, 0

I	10	29	30	0	0	1	1	BEAM	6	1, 0, 0
I	11	28	29	0	0	1	1	BEAM	6	1, 0, 0
I	12	27	28	0	0	1	1	BEAM	6	1, 0, 0
I	13	26	27	0	0	1	1	BEAM	6	1, 0, 0
I	14	25	26	0	0	1	1	BEAM	6	1, 0, 0
I	15	24	25	0	0	1	1	BEAM	6	1, 0, 0
I	16	23	24	0	0	1	1	BEAM	6	1, 0, 0
I	17	22	23	0	0	1	1	BEAM	6	1, 0, 0
I	18	21	22	0	0	1	1	BEAM	6	1, 0, 0
I	19	20	21	0	0	1	1	BEAM	6	1, 0, 0
I	20	19	20	0	0	1	1	BEAM	6	1, 0, 0
I	21	18	19	0	0	1	1	BEAM	6	1, 0, 0
I	22	17	18	0	0	1	1	BEAM	6	1, 0, 0
I	23	16	17	0	0	1	1	BEAM	6	1, 0, 0
I	24	15	16	0	0	1	1	BEAM	6	1, 0, 0
I	25	14	15	0	0	1	1	BEAM	6	1, 0, 0
I	26	13	14	0	0	1	1	BEAM	6	1, 0, 0
I	27	12	13	0	0	1	1	BEAM	6	1, 0, 0
I	28	11	12	0	0	1	1	BEAM	6	1, 0, 0
I	29	10	11	0	0	1	1	BEAM	6	1, 0, 0
I	30	9	10	0	0	1	1	BEAM	6	1, 0, 0
I	31	8	9	0	0	1	1	BEAM	6	1, 0, 0
I	32	7	8	0	0	1	1	BEAM	6	1, 0, 0
I	33	6	7	0	0	1	1	BEAM	6	1, 0, 0
I	34	5	6	0	0	1	1	BEAM	6	1, 0, 0
I	35	4	5	0	0	1	1	BEAM	6	1, 0, 0
I	36	3	4	0	0	1	1	BEAM	6	1, 0, 0
I	37	2	3	0	0	1	1	BEAM	6	1, 0, 0
I	38	1	2	0	0	1	1	BEAM	6	1, 0, 0
I	39	464	462	39	308	2	1	QUAD	852	1, 0, 0
I	40	462	473	461	39	2	1	QUAD	870	1, 0, 0
I	41	296	285	1	284	2	1	QUAD	592	1, 0, 0
I	42	285	287	131	1	2	1	QUAD	574	1, 0, 0
I	43	1	131	143	77	3	2	QUAD	286	1, 0, 0
I	44	131	132	144	143	3	2	QUAD	28	1, 0, 0
I	45	132	133	145	144	3	2	QUAD	28	1, 0, 0
I	46	133	134	146	145	3	2	QUAD	28	1, 0, 0
I	47	134	135	147	146	3	2	QUAD	28	1, 0, 0
I	48	135	120	121	147	3	2	QUAD	56	1, 0, 0
I	49	77	143	148	78	3	3	QUAD	144	1, 0, 0
I	50	143	144	149	148	3	3	QUAD	14	1, 0, 0
I	51	144	145	150	149	3	3	QUAD	14	1, 0, 0
I	52	145	146	151	150	3	3	QUAD	14	1, 0, 0
I	53	146	147	152	151	3	3	QUAD	14	1, 0, 0
I	54	147	121	153	152	3	3	QUAD	66	1, 0, 0
I	55	121	122	153	0	3	3	TRI.	66	1, 0, 0
I	56	78	148	154	79	3	4	QUAD	154	1, 0, 0
I	57	148	149	155	154	3	4	QUAD	16	1, 0, 0
I	58	149	150	156	155	3	4	QUAD	16	1, 0, 0
I	59	150	151	157	156	3	4	QUAD	16	1, 0, 0
I	60	151	152	158	157	3	4	QUAD	16	1, 0, 0
I	61	152	153	159	158	3	4	QUAD	16	1, 0, 0
I	62	153	122	123	159	3	4	QUAD	76	1, 0, 0
I	63	79	154	160	80	3	5	QUAD	164	1, 0, 0
I	64	154	155	161	160	3	5	QUAD	16	1, 0, 0
I	65	155	156	162	161	3	5	QUAD	16	1, 0, 0
I	66	156	157	163	162	3	5	QUAD	16	1, 0, 0
I	67	157	158	164	163	3	5	QUAD	16	1, 0, 0
I	68	158	159	165	164	3	5	QUAD	16	1, 0, 0
I	69	159	123	124	165	3	5	QUAD	86	1, 0, 0
I	70	80	160	166	81	3	6	QUAD	174	1, 0, 0
I	71	160	161	167	166	3	6	QUAD	16	1, 0, 0
I	72	161	162	168	167	3	6	QUAD	16	1, 0, 0
I	73	162	163	169	168	3	6	QUAD	16	1, 0, 0
I	74	163	164	170	169	3	6	QUAD	16	1, 0, 0
I	75	164	165	171	170	3	6	QUAD	16	1, 0, 0
I	76	165	124	125	171	3	6	QUAD	96	1, 0, 0
I	77	81	166	172	82	3	7	QUAD	184	1, 0, 0
I	78	166	167	173	172	3	7	QUAD	16	1, 0, 0
I	79	167	168	174	173	3	7	QUAD	16	1, 0, 0
I	80	168	169	175	174	3	7	QUAD	16	1, 0, 0
I	81	169	170	176	175	3	7	QUAD	16	1, 0, 0
I	82	170	171	177	176	3	7	QUAD	16	1, 0, 0
I	83	171	125	126	177	3	7	QUAD	106	1, 0, 0
I	84	82	172	178	83	3	8	QUAD	194	1, 0, 0
I	85	172	173	179	178	3	8	QUAD	16	1, 0, 0
I	86	173	174	180	179	3	8	QUAD	16	1, 0, 0
I	87	174	175	181	180	3	8	QUAD	16	1, 0, 0
I	88	175	176	182	181	3	8	QUAD	16	1, 0, 0
I	89	176	177	183	182	3	8	QUAD	16	1, 0, 0
I	90	177	126	184	183	3	8	QUAD	118	1, 0, 0

I	91	126	127	184	0	3	8	TRI.	118	1, 0, 0
I	92	83	178	185	84	3	9	QUAD	206	1, 0, 0
I	93	178	179	186	185	3	10	QUAD	18	1, 0, 0
I	94	179	180	187	186	3	10	QUAD	18	1, 0, 0
I	95	180	181	188	187	3	10	QUAD	18	1, 0, 0
I	96	181	182	189	188	3	10	QUAD	18	1, 0, 0
I	97	182	183	190	189	3	10	QUAD	18	1, 0, 0
I	98	183	184	191	190	3	10	QUAD	18	1, 0, 0
I	99	184	127	128	191	3	10	QUAD	130	1, 0, 0
I	100	84	185	192	85	3	9	QUAD	218	1, 0, 0
I	101	185	186	193	192	3	11	QUAD	18	1, 0, 0
I	102	186	187	194	193	3	11	QUAD	18	1, 0, 0
I	103	187	188	195	194	3	11	QUAD	18	1, 0, 0
I	104	188	189	196	195	3	11	QUAD	18	1, 0, 0
I	105	189	190	197	196	3	11	QUAD	18	1, 0, 0
I	106	190	191	198	197	3	11	QUAD	18	1, 0, 0
I	107	191	128	129	198	3	11	QUAD	142	1, 0, 0
I	108	85	192	136	86	3	9	QUAD	216	1, 0, 0
I	109	192	193	137	136	3	12	QUAD	116	1, 0, 0
I	110	193	194	138	137	3	12	QUAD	116	1, 0, 0
I	111	194	195	139	138	3	12	QUAD	116	1, 0, 0
I	112	195	196	140	139	3	12	QUAD	116	1, 0, 0
I	113	196	197	141	140	3	12	QUAD	116	1, 0, 0
I	114	197	198	142	141	3	12	QUAD	116	1, 0, 0
I	115	198	129	130	142	3	12	QUAD	140	1, 0, 0
I	116	86	136	207	0	3	9	TRI.	244	1, 0, 0
I	117	136	137	214	207	3	13	QUAD	158	1, 0, 0
I	118	137	138	215	214	3	13	QUAD	158	1, 0, 0
I	119	138	139	216	215	3	13	QUAD	158	1, 0, 0
I	120	139	140	217	216	3	13	QUAD	158	1, 0, 0
I	121	140	141	218	217	3	13	QUAD	158	1, 0, 0
I	122	141	142	219	218	3	13	QUAD	158	1, 0, 0
I	123	142	130	200	219	3	13	QUAD	180	1, 0, 0
I	124	207	214	208	0	3	14	TRI.	16	1, 0, 0
I	125	214	215	220	208	3	14	QUAD	26	1, 0, 0
I	126	215	216	221	220	3	14	QUAD	14	1, 0, 0
I	127	216	217	222	221	3	14	QUAD	14	1, 0, 0
I	128	217	218	223	222	3	14	QUAD	14	1, 0, 0
I	129	218	219	224	223	3	14	QUAD	14	1, 0, 0
I	130	219	200	201	224	3	14	QUAD	50	1, 0, 0
I	131	208	220	209	0	3	15	TRI.	26	1, 0, 0
I	132	220	221	225	209	3	15	QUAD	34	1, 0, 0
I	133	221	222	226	225	3	15	QUAD	12	1, 0, 0
I	134	222	223	227	226	3	15	QUAD	12	1, 0, 0
I	135	223	224	228	227	3	15	QUAD	12	1, 0, 0
I	136	224	201	202	228	3	15	QUAD	56	1, 0, 0
I	137	209	225	210	0	3	16	TRI.	34	1, 0, 0
I	138	225	226	229	210	3	16	QUAD	40	1, 0, 0
I	139	226	227	230	229	3	16	QUAD	10	1, 0, 0
I	140	227	228	231	230	3	16	QUAD	10	1, 0, 0
I	141	228	202	203	231	3	16	QUAD	60	1, 0, 0
I	142	210	229	211	0	3	17	TRI.	40	1, 0, 0
I	143	229	230	232	211	3	17	QUAD	44	1, 0, 0
I	144	230	231	233	232	3	17	QUAD	8	1, 0, 0
I	145	231	203	204	233	3	17	QUAD	62	1, 0, 0
I	146	211	232	212	0	3	18	TRI.	44	1, 0, 0
I	147	232	233	234	212	3	18	QUAD	46	1, 0, 0
I	148	233	204	205	234	3	18	QUAD	62	1, 0, 0
I	149	212	234	213	0	3	19	TRI.	46	1, 0, 0
I	150	234	205	206	213	3	19	QUAD	60	1, 0, 0
I	151	213	206	199	0	3	19	TRI.	30	1, 0, 0
I	152	86	207	87	0	3	9	TRI.	244	1, 0, 0
I	153	207	208	273	0	3	14	TRI.	134	1, 0, 0
I	154	208	209	274	0	3	15	TRI.	134	1, 0, 0
I	155	209	210	276	275	3	16	QUAD	136	1, 0, 0
I	156	210	211	277	276	3	17	QUAD	136	1, 0, 0
I	157	211	212	278	277	3	18	QUAD	136	1, 0, 0
I	158	212	213	279	278	3	19	QUAD	136	1, 0, 0
I	159	213	199	242	279	3	19	QUAD	162	1, 0, 0
I	160	87	273	88	0	3	9	TRI.	374	1, 0, 0
I	161	273	274	267	0	3	15	TRI.	16	1, 0, 0
I	162	274	275	269	268	3	16	QUAD	16	1, 0, 0
I	163	275	276	269	0	3	16	TRI.	16	1, 0, 0
I	164	276	277	270	0	3	17	TRI.	16	1, 0, 0
I	165	277	278	271	0	3	18	TRI.	16	1, 0, 0
I	166	278	279	241	272	3	19	QUAD	78	1, 0, 0
I	167	279	242	241	0	3	19	TRI.	78	1, 0, 0
I	168	88	267	262	89	3	9	QUAD	360	1, 0, 0
I	169	267	268	263	262	3	16	QUAD	14	1, 0, 0
I	170	268	269	263	0	3	16	TRI.	14	1, 0, 0
I	171	269	270	264	0	3	17	TRI.	14	1, 0, 0

I	172	270	271	265	0	3	18	TRI.	14	1, 0, 0
I	173	271	272	240	266	3	19	QUAD	66	1, 0, 0
I	174	272	241	240	0	3	19	TRI.	66	1, 0, 0
I	175	89	262	257	90	3	9	QUAD	348	1, 0, 0
I	176	262	263	257	0	3	16	TRI.	14	1, 0, 0
I	177	263	264	259	258	3	17	QUAD	14	1, 0, 0
I	178	264	265	260	259	3	18	QUAD	14	1, 0, 0
I	179	265	266	261	260	3	19	QUAD	14	1, 0, 0
I	180	266	240	239	261	3	19	QUAD	56	1, 0, 0
I	181	90	257	253	91	3	9	QUAD	336	1, 0, 0
I	182	257	258	254	253	3	17	QUAD	12	1, 0, 0
I	183	258	259	254	0	3	17	TRI.	12	1, 0, 0
I	184	259	260	255	0	3	18	TRI.	12	1, 0, 0
I	185	260	261	238	256	3	19	QUAD	48	1, 0, 0
I	186	261	239	238	0	3	19	TRI.	48	1, 0, 0
I	187	91	253	249	92	3	9	QUAD	326	1, 0, 0
I	188	253	254	250	249	3	17	QUAD	12	1, 0, 0
I	189	254	255	251	250	3	18	QUAD	12	1, 0, 0
I	190	255	256	252	251	3	19	QUAD	12	1, 0, 0
I	191	256	238	237	252	3	19	QUAD	40	1, 0, 0
I	192	92	249	246	93	3	9	QUAD	316	1, 0, 0
I	193	249	250	247	246	3	17	QUAD	10	1, 0, 0
I	194	250	251	248	247	3	18	QUAD	10	1, 0, 0
I	195	251	252	236	248	3	19	QUAD	34	1, 0, 0
I	196	252	237	236	0	3	19	TRI.	34	1, 0, 0
I	197	93	246	243	94	3	9	QUAD	308	1, 0, 0
I	198	246	247	244	243	3	17	QUAD	10	1, 0, 0
I	199	247	248	245	244	3	18	QUAD	10	1, 0, 0
I	200	248	236	235	245	3	19	QUAD	28	1, 0, 0
I	201	94	243	115	95	3	9	QUAD	300	1, 0, 0
I	202	243	244	116	115	3	17	QUAD	260	1, 0, 0
I	203	244	245	117	116	3	18	QUAD	260	1, 0, 0
I	204	245	235	114	117	3	19	QUAD	264	1, 0, 0
I	205	119	292	280	118	1	1	QUAD	350	1, 0, 0
I	206	292	293	281	280	1	1	QUAD	28	1, 0, 0
I	207	293	294	282	281	1	1	QUAD	28	1, 0, 0
I	208	294	295	283	282	1	1	QUAD	28	1, 0, 0
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I	231	18	93	56	0	17	9	FACE	152	1, 0, 0
I	232	19	94	57	0	18	9	FACE	152	1, 0, 0
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I	235	312	311	323	324	3	2	QUAD	28	1, 0, 0
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I	321	391	384	385	0	3	14	TRI.	16	1, 0, 0
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I	329	405	404	407	408	3	16	QUAD	10	1, 0, 0
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I	347	387	453	454	388	3	17	QUAD	136	1, 0, 0
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I	355	453	447	454	0	3	17	TRI.	16	1, 0, 0
I	356	454	448	455	0	3	18	TRI.	16	1, 0, 0
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I	358	456	418	419	0	3	19	TRI.	78	1, 0, 0
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I	360	444	439	440	445	3	16	QUAD	14	1, 0, 0
I	361	445	440	446	0	3	16	TRI.	14	1, 0, 0
I	362	446	441	447	0	3	17	TRI.	14	1, 0, 0
I	363	447	442	448	0	3	18	TRI.	14	1, 0, 0
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I	365	449	417	418	0	3	19	TRI.	66	1, 0, 0
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I	367	439	434	440	0	3	16	TRI.	14	1, 0, 0
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I	727	269	276	270	0	3	17	TRI.	16	1, 0, 0
I	728	270	277	271	0	3	18	TRI.	16	1, 0, 0
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I	998	992	1029	1030	993	1	1	QUAD	78	1, 0, 0
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I	1045	1053	1078	1079	1054	1	1	QUAD	54	1, 0, 0
I	1046	1054	1079	1080	1055	1	1	QUAD	54	1, 0, 0
I	1047	1055	1080	1081	1056	1	1	QUAD	54	1, 0, 0
I	1048	1056	1081	1082	1057	1	1	QUAD	54	1, 0, 0
I	1049	1057	1082	1083	1058	1	1	QUAD	54	1, 0, 0
I	1050	1058	1083	1084	1059	1	1	QUAD	54	1, 0, 0
I	1051	1059	1084	1085	1060	1	1	QUAD	54	1, 0, 0
I	1052	1060	1085	1086	1061	1	1	QUAD	54	1, 0, 0
I	1053	1061	1086	1087	1062	1	1	QUAD	54	1, 0, 0
I	1054	1062	1087	1088	1063	1	1	QUAD	54	1, 0, 0
I	1055	1063	1088	1089	1064	1	1	QUAD	54	1, 0, 0
I	1056	1064	1089	1090	1065	1	1	QUAD	54	1, 0, 0
I	1057	1065	1090	1091	1066	1	1	QUAD	54	1, 0, 0
I	1058	1066	1091	1092	1067	1	1	QUAD	54	1, 0, 0
I	1059	1067	1092	1093	1068	1	1	QUAD	54	1, 0, 0
I	1060	1068	1093	1094	1069	1	1	QUAD	54	1, 0, 0
I	1061	1069	1094	1095	1070	1	1	QUAD	54	1, 0, 0
I	1062	1070	1095	1096	1071	1	1	QUAD	54	1, 0, 0

I 1063	1071	1096	1097	1072	1	1	QUAD	54	1, 0, 0
I 1064	1073	1098	1099	1074	1	1	QUAD	54	1, 0, 0
I 1065	1074	1099	1100	1075	1	1	QUAD	54	1, 0, 0
I 1066	1075	1100	1101	1076	1	1	QUAD	54	1, 0, 0
I 1067	1076	1101	1102	1077	1	1	QUAD	54	1, 0, 0
I 1068	1077	1102	1103	1078	1	1	QUAD	54	1, 0, 0
I 1069	1078	1103	1104	1079	1	1	QUAD	54	1, 0, 0
I 1070	1079	1104	1105	1080	1	1	QUAD	54	1, 0, 0
I 1071	1080	1105	1106	1081	1	1	QUAD	54	1, 0, 0
I 1072	1081	1106	1107	1082	1	1	QUAD	54	1, 0, 0
I 1073	1082	1107	1108	1083	1	1	QUAD	54	1, 0, 0
I 1074	1083	1108	1109	1084	1	1	QUAD	54	1, 0, 0
I 1075	1084	1109	1110	1085	1	1	QUAD	54	1, 0, 0
I 1076	1085	1110	1111	1086	1	1	QUAD	54	1, 0, 0
I 1077	1086	1111	1112	1087	1	1	QUAD	54	1, 0, 0
I 1078	1087	1112	1113	1088	1	1	QUAD	54	1, 0, 0
I 1079	1088	1113	1114	1089	1	1	QUAD	54	1, 0, 0
I 1080	1089	1114	1115	1090	1	1	QUAD	54	1, 0, 0
I 1081	1090	1115	1116	1091	1	1	QUAD	54	1, 0, 0
I 1082	1091	1116	1117	1092	1	1	QUAD	54	1, 0, 0
I 1083	1092	1117	1118	1093	1	1	QUAD	54	1, 0, 0
I 1084	1093	1118	1119	1094	1	1	QUAD	54	1, 0, 0
I 1085	1094	1119	1120	1095	1	1	QUAD	54	1, 0, 0
I 1086	1095	1120	1121	1096	1	1	QUAD	54	1, 0, 0
I 1087	1096	1121	1122	1097	1	1	QUAD	54	1, 0, 0
I 1088	860	835	1124	1123	1	1	QUAD	580	1, 0, 0
I 1089	835	810	1125	1124	1	1	QUAD	632	1, 0, 0
I 1090	810	785	1126	1125	1	1	QUAD	684	1, 0, 0
I 1091	785	748	1201	1126	1	1	QUAD	908	1, 0, 0
I 1092	748	723	1128	1127	4	20	QUAD	812	1, 0, 0
I 1093	723	698	1129	1128	4	20	QUAD	864	1, 0, 0
I 1094	698	673	1130	1129	4	20	QUAD	916	1, 0, 0
I 1095	673	648	1131	1130	4	20	QUAD	968	1, 0, 0
I 1096	648	623	1132	1131	4	20	QUAD	1020	1, 0, 0
I 1097	623	376	1133	1132	4	20	QUAD	1516	1, 0, 0
I 1098	376	419	1134	1133	4	20	QUAD	1518	1, 0, 0
I 1099	419	418	1135	1134	4	20	QUAD	1436	1, 0, 0
I 1100	418	417	1136	1135	4	20	QUAD	1440	1, 0, 0
I 1101	417	416	1137	1136	4	20	QUAD	1444	1, 0, 0
I 1102	416	415	1138	1137	4	20	QUAD	1448	1, 0, 0
I 1103	415	414	1139	1138	4	20	QUAD	1452	1, 0, 0
I 1104	414	413	1140	1139	4	20	QUAD	1456	1, 0, 0
I 1105	413	412	1141	1140	4	20	QUAD	1460	1, 0, 0
I 1106	412	114	1142	1141	4	20	QUAD	2058	1, 0, 0
I 1107	114	235	1143	1142	4	20	QUAD	2060	1, 0, 0
I 1108	235	236	1144	1143	4	20	QUAD	1820	1, 0, 0
I 1109	236	237	1145	1144	4	20	QUAD	1820	1, 0, 0
I 1110	237	238	1146	1145	4	20	QUAD	1820	1, 0, 0
I 1111	238	239	1147	1146	4	20	QUAD	1820	1, 0, 0
I 1112	239	240	1148	1147	4	20	QUAD	1820	1, 0, 0
I 1113	240	241	1149	1148	4	20	QUAD	1820	1, 0, 0
I 1114	241	242	1150	1149	4	20	QUAD	1820	1, 0, 0
I 1115	242	199	1151	1150	4	20	QUAD	1906	1, 0, 0
I 1116	199	885	1152	1151	4	20	QUAD	1908	1, 0, 0
I 1117	885	910	1153	1152	4	20	QUAD	538	1, 0, 0
I 1118	910	935	1154	1153	4	20	QUAD	490	1, 0, 0
I 1119	935	960	1155	1154	4	20	QUAD	442	1, 0, 0
I 1120	960	985	1156	1155	4	20	QUAD	394	1, 0, 0
I 1121	985	1010	1157	1156	4	20	QUAD	346	1, 0, 0
I 1122	1010	1047	1158	1203	1	1	QUAD	388	1, 0, 0
I 1123	1047	1072	1159	1158	1	1	QUAD	226	1, 0, 0
I 1124	1072	1097	1160	1159	1	1	QUAD	178	1, 0, 0
I 1125	1097	1122	1161	1160	1	1	QUAD	130	1, 0, 0
I 1126	1123	1124	1163	1162	1	1	QUAD	82	1, 0, 0
I 1127	1124	1125	1164	1163	1	1	QUAD	82	1, 0, 0
I 1128	1125	1126	1165	1164	1	1	QUAD	82	1, 0, 0
I 1129	1126	1201	1202	1165	1	1	QUAD	154	1, 0, 0
I 1130	1127	1128	1167	1166	4	21	QUAD	82	1, 0, 0
I 1131	1128	1129	1168	1167	4	21	QUAD	82	1, 0, 0
I 1132	1129	1130	1169	1168	4	21	QUAD	82	1, 0, 0
I 1133	1130	1131	1170	1169	4	21	QUAD	82	1, 0, 0
I 1134	1131	1132	1171	1170	4	21	QUAD	82	1, 0, 0
I 1135	1132	1133	1172	1171	4	21	QUAD	82	1, 0, 0
I 1136	1133	1134	1173	1172	4	21	QUAD	82	1, 0, 0
I 1137	1134	1135	1174	1173	4	21	QUAD	82	1, 0, 0
I 1138	1135	1136	1175	1174	4	21	QUAD	82	1, 0, 0
I 1139	1136	1137	1176	1175	4	21	QUAD	82	1, 0, 0
I 1140	1137	1138	1177	1176	4	21	QUAD	82	1, 0, 0
I 1141	1138	1139	1178	1177	4	21	QUAD	82	1, 0, 0
I 1142	1139	1140	1179	1178	4	21	QUAD	82	1, 0, 0
I 1143	1140	1141	1180	1179	4	21	QUAD	82	1, 0, 0

I 1144	1141	1142	1181	1180	4	21	QUAD	82	1, 0, 0
I 1145	1142	1143	1182	1181	4	21	QUAD	82	1, 0, 0
I 1146	1143	1144	1183	1182	4	21	QUAD	82	1, 0, 0
I 1147	1144	1145	1184	1183	4	21	QUAD	82	1, 0, 0
I 1148	1145	1146	1185	1184	4	21	QUAD	82	1, 0, 0
I 1149	1146	1147	1186	1185	4	21	QUAD	82	1, 0, 0
I 1150	1147	1148	1187	1186	4	21	QUAD	82	1, 0, 0
I 1151	1148	1149	1188	1187	4	21	QUAD	82	1, 0, 0
I 1152	1149	1150	1189	1188	4	21	QUAD	82	1, 0, 0
I 1153	1150	1151	1190	1189	4	21	QUAD	82	1, 0, 0
I 1154	1151	1152	1191	1190	4	21	QUAD	82	1, 0, 0
I 1155	1152	1153	1192	1191	4	21	QUAD	82	1, 0, 0
I 1156	1153	1154	1193	1192	4	21	QUAD	82	1, 0, 0
I 1157	1154	1155	1194	1193	4	21	QUAD	82	1, 0, 0
I 1158	1155	1156	1195	1194	4	21	QUAD	82	1, 0, 0
I 1159	1156	1157	1196	1195	4	21	QUAD	82	1, 0, 0
I 1160	1203	1158	1197	1204	1	1	QUAD	94	1, 0, 0
I 1161	1158	1159	1198	1197	1	1	QUAD	82	1, 0, 0
I 1162	1159	1160	1199	1198	1	1	QUAD	82	1, 0, 0
I 1163	1160	1161	1200	1199	1	1	QUAD	82	1, 0, 0
I 1164	748	1127	1201	0	4	20	TRI.	908	1, 0, 0
I 1165	1201	1127	1166	1202	4	21	QUAD	152	1, 0, 0
I 1166	1010	1203	1157	0	4	20	TRI.	388	1, 0, 0
I 1167	1157	1203	1204	1196	4	21	QUAD	96	1, 0, 0

BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -90.98	F = 0.000
1181	23	F = 0.000	F = -90.98	F = 0.000
1180	22	F = 0.000	F = -90.98	F = 0.000
1180	23	F = 0.000	F = -90.98	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000

839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FORWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4

6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
 (ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
 YOUNGS MODULUS= 0.3000E+04  
 POISSONS RATIO= 0.3000E+00  
 CONFINED MOD.= 0.4038E+04  
 LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
 YOUNGS MODULUS= 0.3500E+07  
 POISSONS RATIO= 0.1800E+00  
 CONFINED MOD.= 0.3800E+07  
 LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
  
 ENTERING ELEMENT RATIO..... 0.5000  
  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95

COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 48.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
 SCALED MODULUS NUMBER ZK ..... 950.0000  
 MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000

20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 21

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 21  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.380E+00 -0.981E+00	0.341E+01 0.200E+01	-0.433E-10 -0.266E+04	-0.103E+05 -0.103E+05	0.155E+03 0.602E+03
2	-228.76 18.07	-0.505E+00 -0.970E+00	-0.827E+01 -0.248E+01	-0.304E+04 -0.271E+04	-0.200E+05 -0.105E+05	0.169E+03 0.658E+03
3	-225.31 35.99	-0.598E+00 -0.959E+00	-0.200E+02 -0.696E+01	-0.632E+04 -0.281E+04	-0.306E+05 -0.109E+05	0.151E+03 0.586E+03
4	-220.13 51.09	-0.626E+00 -0.955E+00	-0.338E+02 -0.284E+01	-0.836E+04 -0.291E+04	-0.373E+05 -0.113E+05	0.610E+02 0.237E+03
5	-211.66 64.62	-0.598E+00 -0.980E+00	-0.308E+02 0.785E+01	-0.832E+04 -0.287E+04	-0.370E+05 -0.111E+05	-0.855E+02 -0.332E+03



6	-200.33 75.87	-0.530E+00 -0.106E+01	-0.205E+02 0.727E+01	-0.560E+04 -0.272E+04	-0.280E+05 -0.106E+05	-0.195E+03 -0.759E+03
7	-187.99 85.12	-0.450E+00 -0.117E+01	-0.132E+02 0.388E+01	-0.210E+04 -0.262E+04	-0.167E+05 -0.102E+05	-0.183E+03 -0.711E+03
8	-175.22 93.78	-0.366E+00 -0.131E+01	-0.124E+02 0.360E+01	0.190E+03 -0.255E+04	-0.105E+05 -0.992E+04	-0.108E+03 -0.420E+03
9	-162.05 101.82	-0.288E+00 -0.144E+01	-0.122E+02 0.352E+01	0.140E+04 -0.249E+04	-0.141E+05 -0.969E+04	-0.378E+02 -0.147E+03
10	-148.51 109.22	-0.221E+00 -0.158E+01	-0.113E+02 0.328E+01	0.155E+04 -0.244E+04	-0.143E+05 -0.948E+04	0.269E+02 0.105E+03
11	-134.64 115.97	-0.165E+00 -0.171E+01	-0.511E+01 0.148E+01	0.770E+03 -0.240E+04	-0.117E+05 -0.934E+04	0.394E+02 0.153E+03
12	-120.46 122.05	-0.118E+00 -0.183E+01	-0.114E+00 0.253E-01	0.529E+03 -0.239E+04	-0.109E+05 -0.930E+04	-0.335E+02 -0.130E+03
13	-106.01 127.44	-0.783E-01 -0.195E+01	-0.130E+02 0.379E+01	0.201E+04 -0.236E+04	-0.154E+05 -0.917E+04	-0.444E+02 -0.172E+03
14	-91.31 132.15	-0.487E-01 -0.206E+01	-0.684E+01 0.198E+01	0.210E+04 -0.231E+04	-0.155E+05 -0.899E+04	-0.149E+01 -0.580E+01
15	-76.42 136.15	-0.282E-01 -0.215E+01	-0.750E+01 0.219E+01	0.225E+04 -0.228E+04	-0.159E+05 -0.887E+04	0.696E+00 0.270E+01
16	-61.34 139.43	-0.158E-01 -0.223E+01	-0.721E+01 0.212E+01	0.226E+04 -0.225E+04	-0.158E+05 -0.874E+04	0.742E+01 0.288E+02
17	-46.13 141.99	-0.975E-02 -0.229E+01	-0.680E+01 0.200E+01	0.217E+04 -0.222E+04	-0.154E+05 -0.862E+04	0.102E+02 0.397E+02
18	-30.81 143.82	-0.853E-02 -0.234E+01	-0.629E+01 0.185E+01	0.206E+04 -0.219E+04	-0.149E+05 -0.850E+04	0.739E+01 0.287E+02
19	-15.42 144.93	-0.105E-01 -0.237E+01	-0.631E+01 0.185E+01	0.202E+04 -0.216E+04	-0.147E+05 -0.839E+04	0.228E+01 0.885E+01
20	0.00 145.29	-0.142E-01 -0.238E+01	-0.627E+01 0.232E+00	0.203E+04 -0.214E+04	-0.146E+05 -0.833E+04	-0.204E+01 -0.794E+01
21	15.42 144.93	-0.182E-01 -0.238E+01	-0.630E+01 -0.186E+01	0.209E+04 -0.216E+04	-0.149E+05 -0.838E+04	-0.640E+01 -0.249E+02
22	30.81 143.82	-0.211E-01 -0.236E+01	-0.627E+01 -0.184E+01	0.219E+04 -0.218E+04	-0.153E+05 -0.849E+04	-0.117E+02 -0.453E+02
23	46.13 141.99	-0.211E-01 -0.233E+01	-0.682E+01 -0.200E+01	0.237E+04 -0.221E+04	-0.160E+05 -0.860E+04	-0.144E+02 -0.559E+02
24	61.34 139.43	-0.166E-01 -0.227E+01	-0.724E+01 -0.213E+01	0.252E+04 -0.224E+04	-0.165E+05 -0.872E+04	-0.110E+02 -0.428E+02
25	76.42 136.15	-0.575E-02 -0.220E+01	-0.745E+01 -0.217E+01	0.256E+04 -0.228E+04	-0.168E+05 -0.885E+04	-0.424E+01 -0.165E+02
26	91.31	0.134E-01	-0.757E+01	0.247E+04	-0.167E+05	0.330E+01

	132.15	-0.211E+01	-0.219E+01	-0.231E+04	-0.898E+04	0.128E+02
27	106.01	0.422E-01	-0.103E+02	0.226E+04	-0.162E+05	0.310E+02
	127.44	-0.201E+01	-0.299E+01	-0.235E+04	-0.914E+04	0.120E+03
28	120.46	0.816E-01	-0.173E+01	0.132E+04	-0.133E+05	0.120E+02
	122.05	-0.189E+01	-0.468E+00	-0.238E+04	-0.925E+04	0.467E+02
29	134.64	0.131E+00	-0.854E+01	0.169E+04	-0.146E+05	-0.217E+02
	115.97	-0.176E+01	-0.247E+01	-0.240E+04	-0.934E+04	-0.842E+02
30	148.51	0.192E+00	-0.101E+02	0.178E+04	-0.150E+05	0.747E+01
	109.22	-0.162E+01	-0.290E+01	-0.244E+04	-0.950E+04	0.291E+02
31	162.05	0.265E+00	-0.114E+02	0.126E+04	-0.136E+05	0.564E+02
	101.82	-0.148E+01	-0.329E+01	-0.249E+04	-0.970E+04	0.219E+03
32	175.22	0.350E+00	-0.118E+02	-0.153E+03	-0.104E+05	0.117E+03
	93.78	-0.133E+01	-0.344E+01	-0.255E+04	-0.992E+04	0.453E+03
33	187.99	0.440E+00	-0.127E+02	-0.251E+04	-0.180E+05	0.184E+03
	85.12	-0.118E+01	-0.376E+01	-0.261E+04	-0.102E+05	0.715E+03
34	200.33	0.524E+00	-0.201E+02	-0.597E+04	-0.291E+05	0.190E+03
	75.87	-0.106E+01	-0.714E+01	-0.272E+04	-0.106E+05	0.740E+03
35	211.66	0.595E+00	-0.309E+02	-0.857E+04	-0.378E+05	0.794E+02
	64.62	-0.983E+00	-0.881E+01	-0.287E+04	-0.111E+05	0.309E+03
36	220.13	0.626E+00	-0.339E+02	-0.854E+04	-0.379E+05	-0.656E+02
	51.09	-0.957E+00	0.254E+01	-0.292E+04	-0.114E+05	-0.255E+03
37	225.31	0.599E+00	-0.201E+02	-0.643E+04	-0.310E+05	-0.155E+03
	35.99	-0.960E+00	0.702E+01	-0.282E+04	-0.110E+05	-0.601E+03
38	228.76	0.507E+00	-0.832E+01	-0.309E+04	-0.202E+05	-0.172E+03
	18.07	-0.971E+00	0.249E+01	-0.272E+04	-0.106E+05	-0.670E+03
39	231.30	0.381E+00	0.348E+01	-0.335E-10	-0.104E+05	-0.157E+03
	0.00	-0.982E+00	-0.204E+01	-0.267E+04	-0.104E+05	-0.612E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 21

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.32466E-03	-0.32466E-03	.23514	0.00000
2	-0.62720E-03	-0.34900E-04	.45427	0.00000
3	-0.95977E-03	0.27411E-03	.69514	0.00000
4	-0.11701E-02	0.46016E-03	.84751	0.00000
5	-0.11607E-02	0.46149E-03	.84069	0.00000
6	-0.87805E-03	0.21401E-03	.63595	0.00000
7	-0.52425E-03	-0.11406E-03	.37970	0.00000
8	-0.29265E-03	-0.32974E-03	.23882	0.00000
9	-0.16704E-03	-0.44097E-03	.31938	0.00000
10	-0.14672E-03	-0.44829E-03	.32469	0.00000
11	-0.21802E-03	-0.36829E-03	.26674	0.00000
12	-0.24007E-03	-0.34332E-03	.24866	0.00000
13	-0.92016E-04	-0.48365E-03	.35030	0.00000
14	-0.77129E-04	-0.48732E-03	.35296	0.00000
15	-0.58993E-04	-0.49754E-03	.36035	0.00000
16	-0.54005E-04	-0.49441E-03	.35809	0.00000
17	-0.58780E-04	-0.48193E-03	.34905	0.00000
18	-0.65856E-04	-0.46767E-03	.33872	0.00000
19	-0.66059E-04	-0.46054E-03	.33356	0.00000

20	-0.63217E-04	-0.45946E-03	.33277	0.00000
21	-0.59329E-04	-0.46636E-03	.33778	0.00000
22	-0.52735E-04	-0.47983E-03	.34753	0.00000
23	-0.38905E-04	-0.50077E-03	.36270	0.00000
24	-0.28110E-04	-0.51924E-03	.37607	0.00000
25	-0.28106E-04	-0.52730E-03	.38191	0.00000
26	-0.40588E-04	-0.52309E-03	.37886	0.00000
27	-0.66020E-04	-0.50769E-03	.36771	0.00000
28	-0.16199E-03	-0.41857E-03	.30316	0.00000
29	-0.12824E-03	-0.45791E-03	.33165	0.00000
30	-0.12439E-03	-0.47191E-03	.34180	0.00000
31	-0.18140E-03	-0.42705E-03	.30930	0.00000
32	-0.32606E-03	-0.29620E-03	.23616	0.00000
33	-0.56390E-03	-0.73804E-04	.40842	0.00000
34	-0.91392E-03	0.25103E-03	.66193	0.00000
35	-0.11858E-02	0.48634E-03	.85885	0.00000
36	-0.11889E-02	0.47657E-03	.86113	0.00000
37	-0.97181E-03	0.28350E-03	.70386	0.00000
38	-0.63350E-03	-0.31007E-04	.45883	0.00000
39	-0.32581E-03	-0.32581E-03	.23598	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 21

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.26127	0.00000	0.06826
2	-0.26641	-0.17121	0.24219
3	-0.27589	-0.35667	0.43279
4	-0.28568	-0.47127	0.55288
5	-0.28136	-0.46893	0.54809
6	-0.26720	-0.31568	0.38707
7	-0.25684	-0.11857	0.18454
8	-0.25043	0.01072	0.07344
9	-0.24465	0.07918	0.13903
10	-0.23942	0.08717	0.14450
11	-0.23592	0.04344	0.09909
12	-0.23474	0.02985	0.08495
13	-0.23163	0.11321	0.16686
14	-0.22712	0.11857	0.17016
15	-0.22393	0.12677	0.17692
16	-0.22067	0.12731	0.17600
17	-0.21757	0.12232	0.16965
18	-0.21468	0.11615	0.16224
19	-0.21189	0.11403	0.15893
20	-0.21031	0.11454	0.15877
21	-0.21153	0.11766	0.16240
22	-0.21429	0.12346	0.16938
23	-0.21715	0.13351	0.18067
24	-0.22024	0.14197	0.19048
25	-0.22348	0.14430	0.19425
26	-0.22681	0.13948	0.19092
27	-0.23085	0.12767	0.18096
28	-0.23361	0.07417	0.12874
29	-0.23585	0.09530	0.15092
30	-0.23994	0.10046	0.15803
31	-0.24483	0.07101	0.13095
32	-0.25038	-0.00863	0.07132
33	-0.25660	-0.14167	0.20751
34	-0.26673	-0.33675	0.40789
35	-0.28145	-0.48336	0.56257
36	-0.28664	-0.48145	0.56361
37	-0.27696	-0.36287	0.43957
38	-0.26738	-0.17416	0.24565
39	-0.26220	0.00000	0.06875

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 21

LRFD STRENGTH-LIMIT RATIOS AT STEP 21, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
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MATERIAL THRUST (psi)	36	11351.	30800.	0.369
BUCKLING THRUST (psi)	36	11351.	49069.	0.231
SEAM THRUST (psi)	36	11351.	21914.	0.518
PLASTIC-PENETRATE (%)	0	0.00	90.00	0.000
COMBINED T&M Ratio	36	0.564	1.000	0.564

LRFD SERVICE PERFORMANCE AT STEP 21, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.62
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.12
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.487E+00 -0.104E+01	0.880E+01 0.380E+01	-0.506E-10 -0.310E+04	-0.120E+05 -0.120E+05	0.220E+03 0.854E+03
2	-228.76 18.07	-0.658E+00 -0.103E+01	-0.771E+01 -0.233E+01	-0.392E+04 -0.315E+04	-0.244E+05 -0.122E+05	0.202E+03 0.786E+03
3	-225.31 35.99	-0.787E+00 -0.101E+01	-0.242E+02 -0.845E+01	-0.752E+04 -0.326E+04	-0.360E+05 -0.127E+05	0.173E+03 0.672E+03
4	-220.13 51.09	-0.837E+00 -0.100E+01	-0.404E+02 -0.107E+02	-0.999E+04 -0.344E+04	-0.440E+05 -0.134E+05	0.816E+02 0.317E+03
5	-211.66 64.62	-0.816E+00 -0.102E+01	-0.385E+02 0.526E+01	-0.102E+05 -0.348E+04	-0.440E+05 -0.135E+05	-0.805E+02 -0.313E+03
6	-200.33 75.87	-0.745E+00 -0.110E+01	-0.259E+02 0.922E+01	-0.742E+04 -0.334E+04	-0.361E+05 -0.130E+05	-0.199E+03 -0.774E+03
7	-187.99 85.12	-0.654E+00 -0.124E+01	-0.152E+02 0.450E+01	-0.389E+04 -0.322E+04	-0.246E+05 -0.125E+05	-0.186E+03 -0.722E+03
8	-175.22 93.78	-0.553E+00 -0.140E+01	-0.138E+02 0.399E+01	-0.160E+04 -0.314E+04	-0.172E+05 -0.122E+05	-0.113E+03 -0.440E+03
9	-162.05 101.82	-0.452E+00 -0.158E+01	-0.138E+02 0.396E+01	-0.272E+03 -0.308E+04	-0.128E+05 -0.120E+05	-0.479E+02 -0.186E+03
10	-148.51 109.22	-0.357E+00 -0.176E+01	-0.130E+02 0.372E+01	0.401E+02 -0.302E+04	-0.118E+05 -0.117E+05	0.146E+02 0.568E+02
11	-134.64	-0.272E+00	-0.113E+02	-0.522E+03	-0.131E+05	0.603E+02

	115.97	-0.196E+01	0.324E+01	-0.296E+04	-0.115E+05	0.234E+03
12	-120.46 122.05	-0.194E+00 -0.216E+01	0.949E+00 0.326E+00	-0.159E+04 -0.294E+04	-0.163E+05 -0.114E+05	0.292E+00 0.114E+01
13	-106.01 127.44	-0.122E+00 -0.237E+01	-0.984E+01 0.280E+01	-0.258E+03 -0.291E+04	-0.121E+05 -0.113E+05	-0.694E+02 -0.270E+03
14	-91.31 132.15	-0.602E-01 -0.259E+01	-0.381E+01 0.104E+01	0.876E+03 -0.288E+04	-0.139E+05 -0.112E+05	-0.101E+03 -0.393E+03
15	-76.42 136.15	-0.105E-01 -0.280E+01	-0.990E+01 0.278E+01	0.322E+04 -0.284E+04	-0.210E+05 -0.110E+05	-0.131E+03 -0.507E+03
16	-61.34 139.43	0.243E-01 -0.299E+01	-0.105E+02 0.296E+01	0.526E+04 -0.279E+04	-0.272E+05 -0.108E+05	-0.106E+03 -0.413E+03
17	-46.13 141.99	0.440E-01 -0.314E+01	-0.107E+02 0.302E+01	0.681E+04 -0.274E+04	-0.318E+05 -0.107E+05	-0.740E+02 -0.287E+03
18	-30.81 143.82	0.507E-01 -0.324E+01	-0.104E+02 0.293E+01	0.776E+04 -0.269E+04	-0.346E+05 -0.105E+05	-0.400E+02 -0.155E+03
19	-15.42 144.93	0.488E-01 -0.329E+01	-0.115E+02 0.200E+01	0.815E+04 -0.265E+04	-0.356E+05 -0.103E+05	0.277E+01 0.108E+02
20	0.00 145.29	0.434E-01 -0.327E+01	-0.117E+02 -0.337E+01	0.765E+04 -0.267E+04	-0.342E+05 -0.104E+05	0.563E+02 0.219E+03
21	15.42 144.93	0.400E-01 -0.320E+01	-0.894E+01 -0.252E+01	0.626E+04 -0.271E+04	-0.300E+05 -0.105E+05	0.885E+02 0.344E+03
22	30.81 143.82	0.431E-01 -0.307E+01	-0.840E+01 -0.236E+01	0.466E+04 -0.276E+04	-0.252E+05 -0.107E+05	0.932E+02 0.362E+03
23	46.13 141.99	0.558E-01 -0.292E+01	-0.789E+01 -0.222E+01	0.304E+04 -0.280E+04	-0.203E+05 -0.109E+05	0.877E+02 0.341E+03
24	61.34 139.43	0.796E-01 -0.274E+01	-0.787E+01 -0.223E+01	0.158E+04 -0.283E+04	-0.159E+05 -0.110E+05	0.762E+02 0.296E+03
25	76.42 136.15	0.114E+00 -0.255E+01	-0.824E+01 -0.234E+01	0.317E+03 -0.287E+04	-0.122E+05 -0.112E+05	0.657E+02 0.255E+03
26	91.31 132.15	0.159E+00 -0.236E+01	-0.504E+01 -0.143E+01	-0.787E+03 -0.291E+04	-0.137E+05 -0.113E+05	0.315E+02 0.122E+03
27	106.01 127.44	0.210E+00 -0.217E+01	-0.815E+01 -0.234E+01	-0.933E+03 -0.294E+04	-0.143E+05 -0.114E+05	-0.491E+01 -0.191E+02
28	120.46 122.05	0.269E+00 -0.200E+01	-0.364E+01 -0.104E+01	-0.843E+03 -0.296E+04	-0.141E+05 -0.115E+05	-0.534E+02 -0.207E+03
29	134.64 115.97	0.333E+00 -0.183E+01	-0.153E+02 -0.438E+01	0.567E+03 -0.300E+04	-0.134E+05 -0.117E+05	-0.485E+02 -0.189E+03
30	148.51 109.22	0.407E+00 -0.166E+01	-0.113E+02 -0.324E+01	0.548E+03 -0.306E+04	-0.136E+05 -0.119E+05	0.133E+02 0.518E+02
31	162.05 101.82	0.490E+00 -0.150E+01	-0.128E+02 -0.368E+01	0.753E+02 -0.311E+04	-0.123E+05 -0.121E+05	0.537E+02 0.209E+03

32	175.22	0.580E+00	-0.136E+02	-0.116E+04	-0.160E+05	0.109E+03
	93.78	-0.134E+01	-0.395E+01	-0.318E+04	-0.123E+05	0.423E+03
33	187.99	0.672E+00	-0.159E+02	-0.331E+04	-0.229E+05	0.185E+03
	85.12	-0.119E+01	-0.405E+01	-0.325E+04	-0.126E+05	0.718E+03
34	200.33	0.756E+00	-0.261E+02	-0.687E+04	-0.343E+05	0.206E+03
	75.87	-0.107E+01	-0.350E+01	-0.332E+04	-0.129E+05	0.800E+03
35	211.66	0.820E+00	-0.373E+02	-0.974E+04	-0.435E+05	0.891E+02
	64.62	-0.990E+00	-0.230E+01	-0.340E+04	-0.132E+05	0.346E+03
36	220.13	0.836E+00	-0.388E+02	-0.967E+04	-0.430E+05	-0.733E+02
	51.09	-0.973E+00	0.119E+02	-0.332E+04	-0.129E+05	-0.285E+03
37	225.31	0.784E+00	-0.231E+02	-0.733E+04	-0.350E+05	-0.166E+03
	35.99	-0.984E+00	0.805E+01	-0.314E+04	-0.122E+05	-0.647E+03
38	228.76	0.653E+00	-0.742E+01	-0.382E+04	-0.237E+05	-0.197E+03
	18.07	-0.100E+01	0.224E+01	-0.303E+04	-0.118E+05	-0.766E+03
39	231.30	0.482E+00	0.823E+01	-0.535E-10	-0.116E+05	-0.214E+03
	0.00	-0.102E+01	-0.357E+01	-0.298E+04	-0.116E+05	-0.832E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.37750E-03	-0.37750E-03	.27342	0.00000
2	-0.76655E-03	-0.99048E-06	.55519	0.00000
3	-0.11304E-02	0.33587E-03	.81872	0.00000
4	-0.13936E-02	0.55511E-03	1.0094	0.00663
5	-0.14180E-02	0.56844E-03	1.0271	0.01881
6	-0.11316E-02	0.31652E-03	.81962	0.00000
7	-0.77203E-03	-0.12368E-04	.55916	0.00000
8	-0.53972E-03	-0.22682E-03	.39090	0.00000
9	-0.40177E-03	-0.34872E-03	.29099	0.00000
10	-0.36394E-03	-0.37177E-03	.26926	0.00000
11	-0.41233E-03	-0.31059E-03	.29864	0.00000
12	-0.51303E-03	-0.20342E-03	.37157	0.00000
13	-0.38019E-03	-0.32986E-03	.27537	0.00000
14	-0.26547E-03	-0.43627E-03	.31598	0.00000
15	-0.32796E-04	-0.66033E-03	.47826	0.00000
16	0.17273E-03	-0.85362E-03	.61825	0.00000
17	0.32982E-03	-0.99837E-03	.72309	0.00000
18	0.42900E-03	-0.10857E-02	.78631	0.00000
19	0.47095E-03	-0.11181E-02	.80981	0.00000
20	0.42155E-03	-0.10716E-02	.77614	0.00000
21	0.27929E-03	-0.94127E-03	.68174	0.00000
22	0.11855E-03	-0.79080E-03	.57276	0.00000
23	-0.44149E-04	-0.63781E-03	.46195	0.00000
24	-0.19161E-03	-0.49974E-03	.36195	0.00000
25	-0.31951E-03	-0.38134E-03	.27619	0.00000
26	-0.43109E-03	-0.27750E-03	.31223	0.00000
27	-0.44894E-03	-0.26699E-03	.32515	0.00000
28	-0.44321E-03	-0.27883E-03	.32100	0.00000
29	-0.31059E-03	-0.42117E-03	.30504	0.00000
30	-0.31958E-03	-0.42645E-03	.30887	0.00000
31	-0.37244E-03	-0.38714E-03	.28040	0.00000
32	-0.50101E-03	-0.27403E-03	.36287	0.00000
33	-0.71889E-03	-0.73072E-04	.52068	0.00000
34	-0.10758E-02	0.26481E-03	.77915	0.00000
35	-0.13642E-02	0.53591E-03	.98807	0.00000
36	-0.13488E-02	0.53855E-03	.97691	0.00000
37	-0.10972E-02	0.33188E-03	.79467	0.00000
38	-0.74269E-03	0.31652E-05	.53791	0.00000
39	-0.36373E-03	-0.36373E-03	.26344	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.30380	0.00000	0.09229
2	-0.30884	-0.22130	0.31668
3	-0.31970	-0.42385	0.52606
4	-0.33736	-0.56326	0.67707
5	-0.34158	-0.57380	0.69048
6	-0.32798	-0.41861	0.52619
7	-0.31562	-0.21959	0.31921
8	-0.30843	-0.09045	0.18558
9	-0.30198	-0.01533	0.10653
10	-0.29603	0.00226	0.08990
11	-0.29089	-0.02941	0.11402
12	-0.28828	-0.08950	0.17260
13	-0.28571	-0.01455	0.09618
14	-0.28236	0.04937	0.12910
15	-0.27890	0.18140	0.25918
16	-0.27397	0.29668	0.37174
17	-0.26901	0.38394	0.45630
18	-0.26422	0.43784	0.50765
19	-0.26039	0.45934	0.52715
20	-0.26157	0.43162	0.50004
21	-0.26637	0.35282	0.42377
22	-0.27050	0.26286	0.33603
23	-0.27441	0.17161	0.24691
24	-0.27818	0.08907	0.16646
25	-0.28200	0.01787	0.09740
26	-0.28512	-0.04440	0.12569
27	-0.28807	-0.05260	0.13558
28	-0.29053	-0.04752	0.13192
29	-0.29444	0.03197	0.11866
30	-0.30018	0.03089	0.12100
31	-0.30564	0.00425	0.09766
32	-0.31186	-0.06561	0.16287
33	-0.31867	-0.18669	0.28823
34	-0.32631	-0.38752	0.49400
35	-0.33329	-0.54926	0.66035
36	-0.32603	-0.54557	0.65186
37	-0.30794	-0.41310	0.50792
38	-0.29757	-0.21560	0.30415
39	-0.29271	0.00000	0.08568

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	13527.	30800.	0.439
BUCKLING THRUST (psi)	5	13527.	50149.	0.270
SEAM THRUST (psi)	5	13527.	21914.	0.617
PLASTIC-PENETRATE (%)	5	1.88	90.00	0.021
COMBINED T&M Ratio	5	0.690	1.000	0.690

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.97
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.19

HANDLING FACTOR RATIO = $(\text{SPAN}^2/\text{EI})/\text{FF}$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*



\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage HL-93 TANDEM-INV  
LIVE LOADS X 1.98 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
DENSITY OF METAL (PCI)..... 0.28400E+00  
MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000  
SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -180.0	F = 0.000
1181	23	F = 0.000	F = -180.0	F = 0.000
1180	22	F = 0.000	F = -180.0	F = 0.000
1180	23	F = 0.000	F = -180.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000

855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20

22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000

36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.591E+00 -0.111E+01	0.165E+02 0.622E+01	-0.105E-09 -0.356E+04	-0.138E+05 -0.138E+05	0.310E+03 0.120E+04
2	-228.76 18.07	-0.825E+00 -0.108E+01	-0.603E+01 -0.186E+01	-0.523E+04 -0.360E+04	-0.303E+05 -0.140E+05	0.239E+03 0.927E+03
3	-225.31 35.99	-0.100E+01 -0.106E+01	-0.285E+02 -0.995E+01	-0.912E+04 -0.373E+04	-0.428E+05 -0.145E+05	0.187E+03 0.725E+03
4	-220.13 51.09	-0.108E+01 -0.104E+01	-0.471E+02 -0.144E+02	-0.120E+05 -0.395E+04	-0.440E+05 -0.154E+05	0.933E+02 0.363E+03
5	-211.66 64.62	-0.107E+01 -0.106E+01	-0.458E+02 -0.126E+01	-0.123E+05 -0.408E+04	-0.440E+05 -0.158E+05	-0.845E+02 -0.328E+03
6	-200.33 75.87	-0.995E+00 -0.115E+01	-0.326E+02 0.116E+02	-0.926E+04 -0.397E+04	-0.440E+05 -0.154E+05	-0.204E+03 -0.794E+03
7	-187.99 85.12	-0.891E+00 -0.130E+01	-0.178E+02 0.529E+01	-0.572E+04 -0.382E+04	-0.326E+05 -0.148E+05	-0.176E+03 -0.686E+03
8	-175.22 93.78	-0.769E+00 -0.149E+01	-0.149E+02 0.435E+01	-0.358E+04 -0.374E+04	-0.257E+05 -0.145E+05	-0.103E+03 -0.400E+03
9	-162.05 101.82	-0.641E+00 -0.172E+01	-0.151E+02 0.434E+01	-0.220E+04 -0.367E+04	-0.211E+05 -0.143E+05	-0.465E+02 -0.181E+03
10	-148.51	-0.517E+00	-0.138E+02	-0.170E+04	-0.193E+05	0.404E+01

	109.22	-0.197E+01	0.393E+01	-0.360E+04	-0.140E+05	0.157E+02
11	-134.64 115.97	-0.398E+00 -0.223E+01	-0.214E+02 0.614E+01	-0.179E+04 -0.353E+04	-0.193E+05 -0.137E+05	0.107E+03 0.414E+03
12	-120.46 122.05	-0.285E+00 -0.252E+01	0.222E+01 0.705E+00	-0.436E+04 -0.348E+04	-0.271E+05 -0.135E+05	0.887E+02 0.345E+03
13	-106.01 127.44	-0.177E+00 -0.284E+01	-0.394E+01 0.113E+01	-0.379E+04 -0.346E+04	-0.253E+05 -0.135E+05	-0.624E+02 -0.242E+03
14	-91.31 132.15	-0.762E-01 -0.319E+01	0.198E+01 0.684E+00	-0.155E+04 -0.344E+04	-0.182E+05 -0.134E+05	-0.211E+03 -0.819E+03
15	-76.42 136.15	0.955E-02 -0.355E+01	-0.124E+02 0.343E+01	0.374E+04 -0.340E+04	-0.248E+05 -0.132E+05	-0.292E+03 -0.114E+04
16	-61.34 139.43	0.728E-01 -0.389E+01	-0.143E+02 0.392E+01	0.853E+04 -0.333E+04	-0.394E+05 -0.129E+05	-0.245E+03 -0.953E+03
17	-46.13 141.99	0.111E+00 -0.417E+01	-0.149E+02 0.411E+01	0.123E+05 -0.326E+04	-0.440E+05 -0.127E+05	-0.176E+03 -0.684E+03
18	-30.81 143.82	0.125E+00 -0.435E+01	-0.154E+02 0.429E+01	0.147E+05 -0.319E+04	-0.440E+05 -0.124E+05	-0.942E+02 -0.366E+03
19	-15.42 144.93	0.124E+00 -0.442E+01	-0.171E+02 0.922E+00	0.155E+05 -0.314E+04	-0.440E+05 -0.122E+05	0.708E+01 0.275E+02
20	0.00 145.29	0.116E+00 -0.435E+01	-0.181E+02 -0.511E+01	0.143E+05 -0.318E+04	-0.440E+05 -0.124E+05	0.129E+03 0.501E+03
21	15.42 144.93	0.113E+00 -0.417E+01	-0.117E+02 -0.319E+01	0.110E+05 -0.325E+04	-0.440E+05 -0.126E+05	0.206E+03 0.802E+03
22	30.81 143.82	0.124E+00 -0.390E+01	-0.104E+02 -0.285E+01	0.712E+04 -0.331E+04	-0.350E+05 -0.129E+05	0.222E+03 0.863E+03
23	46.13 141.99	0.152E+00 -0.358E+01	-0.851E+01 -0.233E+01	0.310E+04 -0.336E+04	-0.227E+05 -0.131E+05	0.211E+03 0.818E+03
24	61.34 139.43	0.200E+00 -0.324E+01	-0.741E+01 -0.207E+01	-0.503E+03 -0.340E+04	-0.148E+05 -0.132E+05	0.173E+03 0.674E+03
25	76.42 136.15	0.263E+00 -0.290E+01	-0.790E+01 -0.224E+01	-0.334E+04 -0.344E+04	-0.238E+05 -0.134E+05	0.130E+03 0.504E+03
26	91.31 132.15	0.335E+00 -0.259E+01	-0.830E+00 -0.254E+00	-0.545E+04 -0.347E+04	-0.304E+05 -0.135E+05	0.333E+02 0.129E+03
27	106.01 127.44	0.412E+00 -0.232E+01	-0.453E+01 -0.133E+01	-0.511E+04 -0.348E+04	-0.294E+05 -0.135E+05	-0.898E+02 -0.349E+03
28	120.46 122.05	0.489E+00 -0.209E+01	-0.717E+01 -0.207E+01	-0.320E+04 -0.350E+04	-0.235E+05 -0.136E+05	-0.165E+03 -0.640E+03
29	134.64 115.97	0.568E+00 -0.189E+01	-0.239E+02 -0.687E+01	-0.373E+03 -0.356E+04	-0.150E+05 -0.138E+05	-0.919E+02 -0.357E+03
30	148.51 109.22	0.653E+00 -0.170E+01	-0.121E+02 -0.346E+01	-0.612E+03 -0.364E+04	-0.160E+05 -0.141E+05	0.155E+02 0.601E+02

31	162.05 101.82	0.745E+00 -0.151E+01	-0.140E+02 -0.403E+01	-0.104E+04 -0.370E+04	-0.176E+05 -0.144E+05	0.430E+02 0.167E+03
32	175.22 93.78	0.842E+00 -0.134E+01	-0.155E+02 -0.452E+01	-0.206E+04 -0.377E+04	-0.211E+05 -0.146E+05	0.938E+02 0.364E+03
33	187.99 85.12	0.937E+00 -0.118E+01	-0.199E+02 -0.434E+01	-0.400E+04 -0.384E+04	-0.274E+05 -0.149E+05	0.187E+03 0.726E+03
34	200.33 75.87	0.102E+01 -0.106E+01	-0.322E+02 0.165E+01	-0.785E+04 -0.389E+04	-0.395E+05 -0.151E+05	0.234E+03 0.908E+03
35	211.66 64.62	0.108E+01 -0.987E+00	-0.413E+02 0.894E+01	-0.113E+05 -0.383E+04	-0.440E+05 -0.149E+05	0.109E+03 0.422E+03
36	220.13 51.09	0.108E+01 -0.979E+00	-0.426E+02 0.130E+02	-0.112E+05 -0.366E+04	-0.440E+05 -0.142E+05	-0.799E+02 -0.310E+03
37	225.31 35.99	0.991E+00 -0.100E+01	-0.263E+02 0.918E+01	-0.854E+04 -0.345E+04	-0.400E+05 -0.134E+05	-0.175E+03 -0.681E+03
38	228.76 18.07	0.809E+00 -0.103E+01	-0.566E+01 0.174E+01	-0.488E+04 -0.334E+04	-0.281E+05 -0.130E+05	-0.224E+03 -0.869E+03
39	231.30 0.00	0.577E+00 -0.105E+01	0.150E+02 -0.570E+01	-0.349E-11 -0.330E+04	-0.128E+05 -0.128E+05	-0.288E+03 -0.112E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.43405E-03	-0.43405E-03	.31437	0.00000
2	-0.94975E-03	0.70732E-04	.68788	0.00000
3	-0.13441E-02	0.43548E-03	.97348	0.00000
4	-0.17181E-02	0.70766E-03	1.2444	0.13910
5	-0.17919E-02	0.73055E-03	1.2978	0.16301
6	-0.13877E-02	0.41911E-03	1.0051	0.00389
7	-0.10241E-02	0.92336E-04	.74177	0.00000
8	-0.80502E-03	-0.10688E-03	.58305	0.00000
9	-0.66214E-03	-0.23240E-03	.47957	0.00000
10	-0.60470E-03	-0.27391E-03	.43797	0.00000
11	-0.60438E-03	-0.25581E-03	.43774	0.00000
12	-0.84959E-03	0.12396E-05	.61533	0.00000
13	-0.79252E-03	-0.52442E-04	.57400	0.00000
14	-0.57095E-03	-0.26893E-03	.41353	0.00000
15	-0.49665E-04	-0.77949E-03	.56456	0.00000
16	0.42570E-03	-0.12378E-02	.89654	0.00000
17	0.81672E-03	-0.16383E-02	1.1866	0.10493
18	0.11241E-02	-0.20377E-02	1.4759	0.20780
19	0.12438E-02	-0.22095E-02	1.6003	0.24001
20	0.10817E-02	-0.19715E-02	1.4279	0.19351
21	0.68000E-03	-0.14774E-02	1.0700	0.04481
22	0.29150E-03	-0.10984E-02	.79554	0.00000
23	-0.10726E-03	-0.71193E-03	.51563	0.00000
24	-0.46391E-03	-0.36583E-03	.33600	0.00000
25	-0.74563E-03	-0.94038E-04	.54004	0.00000
26	-0.95446E-03	0.10908E-03	.69129	0.00000
27	-0.92229E-03	0.74180E-04	.66799	0.00000
28	-0.73848E-03	-0.11464E-03	.53486	0.00000
29	-0.47066E-03	-0.39789E-03	.34089	0.00000
30	-0.50351E-03	-0.38415E-03	.36468	0.00000
31	-0.55231E-03	-0.34994E-03	.40002	0.00000
32	-0.66101E-03	-0.25827E-03	.47876	0.00000
33	-0.85933E-03	-0.78402E-04	.62239	0.00000
34	-0.12396E-02	0.29172E-03	.89780	0.00000
35	-0.16019E-02	0.64583E-03	1.1602	0.09843
36	-0.15632E-02	0.65590E-03	1.1322	0.08223



37	-0.12546E-02	0.41229E-03	.90866	0.00000
38	-0.88331E-03	0.68400E-04	.63976	0.00000
39	-0.40237E-03	-0.40237E-03	.29143	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.34930	0.00000	0.12201
2	-0.35370	-0.29499	0.42009
3	-0.36560	-0.51441	0.64807
4	-0.38769	-0.67400	0.82431
5	-0.40008	-0.69140	0.85146
6	-0.38973	-0.52228	0.67417
7	-0.37494	-0.32274	0.46332
8	-0.36692	-0.20181	0.33644
9	-0.35994	-0.12422	0.25378
10	-0.35353	-0.09562	0.22061
11	-0.34612	-0.10076	0.22056
12	-0.34135	-0.24595	0.36247
13	-0.33999	-0.21393	0.32952
14	-0.33795	-0.08731	0.20151
15	-0.33363	0.21097	0.32228
16	-0.32679	0.48087	0.58766
17	-0.31970	0.69090	0.79311
18	-0.31270	0.82618	0.92396
19	-0.30854	0.87364	0.96884
20	-0.31202	0.80850	0.90586
21	-0.31909	0.62048	0.72230
22	-0.32468	0.40177	0.50719
23	-0.32962	0.17479	0.28344
24	-0.33387	-0.02835	0.13982
25	-0.33786	-0.18835	0.30250
26	-0.34016	-0.30743	0.42314
27	-0.34126	-0.28805	0.40450
28	-0.34327	-0.18033	0.29817
29	-0.34948	-0.02104	0.14317
30	-0.35717	-0.03450	0.16207
31	-0.36304	-0.05850	0.19030
32	-0.36990	-0.11642	0.25324
33	-0.37732	-0.22574	0.36811
34	-0.38139	-0.44265	0.58811
35	-0.37594	-0.63703	0.77836
36	-0.35903	-0.63204	0.76094
37	-0.33892	-0.48184	0.59670
38	-0.32790	-0.27511	0.38263
39	-0.32381	0.00000	0.10485

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	15843.	30800.	0.514
BUCKLING THRUST (psi)	5	15843.	49979.	0.317
SEAM THRUST (psi)	5	15843.	21914.	0.723
PLASTIC-PENETRATE (%)	19	24.00	90.00	0.267
COMBINED T&M Ratio	19	0.969	1.000	0.969

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%)..... 1.41

RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.28
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage HL-93 TANDEM-OPR  
 LIVE LOADS X 2.47 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$   
 EXECUTION MODE ..... ANALYS  
 SOLUTION LEVEL ..... #3 USER  
 METHODOLOGY (LRFD OR SERVICE) ... LRFD  
 NUMBER OF PIPE-ELEMENT GROUPS .... 1  
 MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
 NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
 AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
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MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000  
SEAM STRENGTH FAILURE ..... 0.67000  
FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -225.0	F = 0.000
1181	23	F = 0.000	F = -225.0	F = 0.000
1180	22	F = 0.000	F = -225.0	F = 0.000
1180	23	F = 0.000	F = -225.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000

1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE            MESH-NODE            CONNECTED-GROUP-ELEMENTS

SEQUENCE	NUMBER	FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95

COHESION INTERCEPT C ..... 0.0000

FRICTION ANGLE PHIO (DEG)..... 48.0000

10-FOLD REDUCTION IN PHIO(DEG).. 8.0000

SCALED MODULUS NUMBER ZK ..... 950.0000

MODULUS EXPONENT ZN ..... 0.6000

FAILURE RATIO RF ..... 0.7000

INIT. BULK MODULUS NUMBER BI.... 74.8000

ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0

ENTERING ELEMENT RATIO..... 0.5000

ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90

COHESION INTERCEPT C ..... 0.0000

FRICTION ANGLE PHIO (DEG)..... 32.0000

10-FOLD REDUCTION IN PHIO(DEG).. 4.0000

SCALED MODULUS NUMBER ZK ..... 300.0000

MODULUS EXPONENT ZN ..... 0.2500

FAILURE RATIO RF ..... 0.7000

BULK MODULUS NUMBER BK ..... 250.0000

BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000

14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.350	Factor for load step #22
23	1.350	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.582E+00 -0.110E+01	0.165E+02 0.618E+01	-0.688E-10 -0.353E+04	-0.137E+05 -0.137E+05	0.322E+03 0.125E+04
2	-228.76 18.07	-0.821E+00 -0.108E+01	-0.561E+01 -0.174E+01	-0.541E+04 -0.357E+04	-0.307E+05 -0.139E+05	0.244E+03 0.949E+03
3	-225.31 35.99	-0.100E+01 -0.105E+01	-0.277E+02 -0.967E+01	-0.936E+04 -0.369E+04	-0.434E+05 -0.143E+05	0.184E+03 0.717E+03
4	-220.13 51.09	-0.108E+01 -0.104E+01	-0.466E+02 -0.143E+02	-0.121E+05 -0.391E+04	-0.440E+05 -0.152E+05	0.872E+02 0.339E+03

5	-211.66 64.62	-0.107E+01 -0.105E+01	-0.453E+02 -0.162E+01	-0.123E+05 -0.404E+04	-0.440E+05 -0.157E+05	-0.899E+02 -0.350E+03
6	-200.33 75.87	-0.997E+00 -0.114E+01	-0.325E+02 0.116E+02	-0.923E+04 -0.394E+04	-0.440E+05 -0.153E+05	-0.208E+03 -0.808E+03
7	-187.99 85.12	-0.892E+00 -0.129E+01	-0.180E+02 0.536E+01	-0.566E+04 -0.378E+04	-0.323E+05 -0.147E+05	-0.175E+03 -0.681E+03
8	-175.22 93.78	-0.770E+00 -0.149E+01	-0.147E+02 0.429E+01	-0.358E+04 -0.370E+04	-0.255E+05 -0.144E+05	-0.998E+02 -0.388E+03
9	-162.05 101.82	-0.643E+00 -0.172E+01	-0.147E+02 0.423E+01	-0.224E+04 -0.363E+04	-0.211E+05 -0.141E+05	-0.463E+02 -0.180E+03
10	-148.51 109.22	-0.518E+00 -0.196E+01	-0.132E+02 0.378E+01	-0.169E+04 -0.357E+04	-0.191E+05 -0.139E+05	-0.118E+01 -0.457E+01
11	-134.64 115.97	-0.399E+00 -0.223E+01	-0.226E+02 0.648E+01	-0.165E+04 -0.349E+04	-0.187E+05 -0.136E+05	0.108E+03 0.421E+03
12	-120.46 122.05	-0.287E+00 -0.251E+01	0.230E+01 0.735E+00	-0.441E+04 -0.344E+04	-0.271E+05 -0.134E+05	0.101E+03 0.392E+03
13	-106.01 127.44	-0.179E+00 -0.283E+01	-0.304E+01 0.866E+00	-0.403E+04 -0.343E+04	-0.258E+05 -0.133E+05	-0.561E+02 -0.218E+03
14	-91.31 132.15	-0.777E-01 -0.318E+01	0.271E+01 0.919E+00	-0.177E+04 -0.341E+04	-0.188E+05 -0.132E+05	-0.215E+03 -0.837E+03
15	-76.42 136.15	0.879E-02 -0.355E+01	-0.125E+02 0.344E+01	0.367E+04 -0.336E+04	-0.245E+05 -0.131E+05	-0.300E+03 -0.117E+04
16	-61.34 139.43	0.727E-01 -0.389E+01	-0.143E+02 0.394E+01	0.858E+04 -0.329E+04	-0.395E+05 -0.128E+05	-0.251E+03 -0.975E+03
17	-46.13 141.99	0.111E+00 -0.417E+01	-0.149E+02 0.411E+01	0.124E+05 -0.322E+04	-0.440E+05 -0.125E+05	-0.180E+03 -0.698E+03
18	-30.81 143.82	0.126E+00 -0.436E+01	-0.155E+02 0.431E+01	0.148E+05 -0.315E+04	-0.440E+05 -0.122E+05	-0.962E+02 -0.374E+03
19	-15.42 144.93	0.124E+00 -0.442E+01	-0.172E+02 0.109E+01	0.157E+05 -0.310E+04	-0.440E+05 -0.121E+05	0.824E+01 0.320E+02
20	0.00 145.29	0.117E+00 -0.435E+01	-0.181E+02 -0.511E+01	0.145E+05 -0.314E+04	-0.440E+05 -0.122E+05	0.133E+03 0.517E+03
21	15.42 144.93	0.114E+00 -0.416E+01	-0.116E+02 -0.316E+01	0.110E+05 -0.321E+04	-0.440E+05 -0.125E+05	0.211E+03 0.822E+03
22	30.81 143.82	0.125E+00 -0.389E+01	-0.105E+02 -0.287E+01	0.708E+04 -0.327E+04	-0.347E+05 -0.127E+05	0.229E+03 0.889E+03
23	46.13 141.99	0.154E+00 -0.357E+01	-0.831E+01 -0.227E+01	0.291E+04 -0.332E+04	-0.219E+05 -0.129E+05	0.218E+03 0.848E+03
24	61.34 139.43	0.202E+00 -0.322E+01	-0.701E+01 -0.195E+01	-0.819E+03 -0.336E+04	-0.156E+05 -0.131E+05	0.178E+03 0.693E+03



25	76.42 136.15	0.265E+00 -0.288E+01	-0.709E+01 -0.201E+01	-0.371E+04 -0.340E+04	-0.247E+05 -0.132E+05	0.127E+03 0.494E+03
26	91.31 132.15	0.337E+00 -0.258E+01	-0.397E+00 -0.137E+00	-0.570E+04 -0.342E+04	-0.310E+05 -0.133E+05	0.235E+02 0.914E+02
27	106.01 127.44	0.413E+00 -0.231E+01	-0.443E+01 -0.129E+01	-0.516E+04 -0.343E+04	-0.294E+05 -0.133E+05	-0.101E+03 -0.394E+03
28	120.46 122.05	0.489E+00 -0.209E+01	-0.763E+01 -0.219E+01	-0.307E+04 -0.345E+04	-0.229E+05 -0.134E+05	-0.171E+03 -0.665E+03
29	134.64 115.97	0.566E+00 -0.188E+01	-0.241E+02 -0.691E+01	-0.210E+03 -0.351E+04	-0.143E+05 -0.137E+05	-0.916E+02 -0.356E+03
30	148.51 109.22	0.651E+00 -0.169E+01	-0.119E+02 -0.340E+01	-0.481E+03 -0.359E+04	-0.155E+05 -0.140E+05	0.173E+02 0.672E+02
31	162.05 101.82	0.743E+00 -0.151E+01	-0.139E+02 -0.399E+01	-0.922E+03 -0.365E+04	-0.171E+05 -0.142E+05	0.441E+02 0.171E+03
32	175.22 93.78	0.839E+00 -0.133E+01	-0.155E+02 -0.450E+01	-0.197E+04 -0.372E+04	-0.206E+05 -0.145E+05	0.957E+02 0.372E+03
33	187.99 85.12	0.934E+00 -0.118E+01	-0.199E+02 -0.431E+01	-0.395E+04 -0.380E+04	-0.270E+05 -0.148E+05	0.191E+03 0.741E+03
34	200.33 75.87	0.102E+01 -0.105E+01	-0.317E+02 0.156E+01	-0.787E+04 -0.384E+04	-0.394E+05 -0.149E+05	0.237E+03 0.923E+03
35	211.66 64.62	0.108E+01 -0.983E+00	-0.407E+02 0.821E+01	-0.114E+05 -0.379E+04	-0.440E+05 -0.147E+05	0.111E+03 0.433E+03
36	220.13 51.09	0.107E+01 -0.976E+00	-0.423E+02 0.130E+02	-0.113E+05 -0.362E+04	-0.440E+05 -0.141E+05	-0.753E+02 -0.293E+03
37	225.31 35.99	0.989E+00 -0.998E+00	-0.255E+02 0.890E+01	-0.875E+04 -0.342E+04	-0.405E+05 -0.133E+05	-0.173E+03 -0.674E+03
38	228.76 18.07	0.804E+00 -0.102E+01	-0.536E+01 0.165E+01	-0.502E+04 -0.331E+04	-0.285E+05 -0.129E+05	-0.229E+03 -0.889E+03
39	231.30 0.00	0.568E+00 -0.105E+01	0.148E+02 -0.559E+01	-0.162E-10 -0.327E+04	-0.127E+05 -0.127E+05	-0.298E+03 -0.116E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.43061E-03	-0.43061E-03	.31188	0.00000
2	-0.96354E-03	0.91879E-04	.69787	0.00000
3	-0.13634E-02	0.46300E-03	.98745	0.00000
4	-0.17327E-02	0.72816E-03	1.2550	0.14305
5	-0.17936E-02	0.74127E-03	1.2991	0.16289
6	-0.13798E-02	0.41988E-03	.99934	0.00000
7	-0.10139E-02	0.90909E-04	.73435	0.00000
8	-0.80043E-03	-0.10266E-03	.57973	0.00000
9	-0.66116E-03	-0.22491E-03	.47886	0.00000
10	-0.60047E-03	-0.27011E-03	.43490	0.00000
11	-0.58698E-03	-0.26479E-03	.42513	0.00000
12	-0.84952E-03	0.10222E-04	.61528	0.00000
13	-0.81098E-03	-0.25471E-04	.58737	0.00000

14	-0.58883E-03	-0.24260E-03	.42647	0.00000
15	-0.51734E-04	-0.76841E-03	.55654	0.00000
16	0.43548E-03	-0.12385E-02	.89699	0.00000
17	0.83615E-03	-0.16508E-02	1.1956	0.10859
18	0.11532E-02	-0.20675E-02	1.4974	0.21324
19	0.12758E-02	-0.22451E-02	1.6260	0.24550
20	0.11043E-02	-0.19897E-02	1.4411	0.19684
21	0.68954E-03	-0.14769E-02	1.0697	0.04442
22	0.29163E-03	-0.10887E-02	.78850	0.00000
23	-0.12121E-03	-0.68816E-03	.49842	0.00000
24	-0.48968E-03	-0.32999E-03	.35466	0.00000
25	-0.77595E-03	-0.53012E-04	.56200	0.00000
26	-0.97287E-03	0.13891E-03	.70463	0.00000
27	-0.92168E-03	0.85397E-04	.66755	0.00000
28	-0.72013E-03	-0.12122E-03	.52157	0.00000
29	-0.44896E-03	-0.40809E-03	.32517	0.00000
30	-0.48494E-03	-0.39120E-03	.35123	0.00000
31	-0.53524E-03	-0.35528E-03	.38766	0.00000
32	-0.64547E-03	-0.26198E-03	.46750	0.00000
33	-0.84797E-03	-0.77891E-04	.61416	0.00000
34	-0.12360E-02	0.29983E-03	.89522	0.00000
35	-0.16048E-02	0.65821E-03	1.1623	0.09904
36	-0.15722E-02	0.67169E-03	1.1387	0.08533
37	-0.12714E-02	0.43632E-03	.92082	0.00000
38	-0.89411E-03	0.85674E-04	.64758	0.00000
39	-0.39929E-03	-0.39929E-03	.28920	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.34653	0.00000	0.12008
2	-0.35073	-0.30509	0.42810
3	-0.36229	-0.52794	0.65919
4	-0.38394	-0.68165	0.82906
5	-0.39637	-0.69443	0.85154
6	-0.38624	-0.52022	0.66940
7	-0.37139	-0.31937	0.45730
8	-0.36338	-0.20170	0.33375
9	-0.35653	-0.12611	0.25322
10	-0.35030	-0.09550	0.21821
11	-0.34273	-0.09313	0.21060
12	-0.33771	-0.24852	0.36257
13	-0.33657	-0.22706	0.34034
14	-0.33454	-0.10008	0.21200
15	-0.33000	0.20717	0.31607
16	-0.32310	0.48388	0.58828
17	-0.31598	0.69845	0.79829
18	-0.30895	0.83679	0.93224
19	-0.30465	0.88481	0.97762
20	-0.30803	0.81646	0.91134
21	-0.31510	0.62313	0.72242
22	-0.32071	0.39900	0.50185
23	-0.32567	0.16389	0.26995
24	-0.32982	-0.04616	0.15494
25	-0.33355	-0.20898	0.32024
26	-0.33556	-0.32138	0.43398
27	-0.33650	-0.29111	0.40434
28	-0.33854	-0.17312	0.28773
29	-0.34486	-0.01181	0.13074
30	-0.35254	-0.02710	0.15138
31	-0.35832	-0.05202	0.18042
32	-0.36514	-0.11085	0.24418
33	-0.37254	-0.22260	0.36139
34	-0.37670	-0.44396	0.58587
35	-0.37195	-0.64092	0.77927
36	-0.35576	-0.63815	0.76471
37	-0.33600	-0.49363	0.60653
38	-0.32529	-0.28322	0.38904
39	-0.32133	0.00000	0.10325

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	15696.	30800.	0.510
BUCKLING THRUST (psi)	5	15696.	49613.	0.316
SEAM THRUST (psi)	5	15696.	21914.	0.716
PLASTIC-PENETRATE (%)	19	24.55	90.00	0.273
COMBINED T&M Ratio	19	0.978	1.000	0.978

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.65
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.33
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR HL-93 TANDEM

X-coordinate (in.)		Y-coordinate (in.)	Thrust (DL) Tot <sub>fac</sub>	Thrust (DL) Tot <sub>is</sub>	Thrust (DL+LL) Tot <sub>LLfac</sub>	Thrust (LL) T <sub>lis</sub>	Thrust Load Rating	Thrust Load Rating
			factored from CANDE	unfactored	factored from CANDE	unfactored	INV	OPR
			Load Step 21	TDL <sub>fac</sub> /1.575	Load Step 23	(Tot <sub>LLfac</sub> -Tot <sub>fac</sub> )/1.75	(T <sub>Opp</sub> -Tot <sub>is</sub> 1.5)/T <sub>lis</sub> *1.75	(T <sub>Opp</sub> -Tot <sub>is</sub> 1.5)/T <sub>lis</sub> *1.35
			kips/ft.	kips/ft.	kips/ft.			
-231.304		0	-31.94	-20.28	-37.14	2.97	7.28	9.44
-228.758		18.07	-32.57	-20.68	-37.76	2.96	7.19	9.32
-225.306		35.988	-33.73	-21.42	-39.09	3.06	6.75	8.75
-220.131		51.091	-34.93	-22.18	-41.25	3.61	5.54	7.19
-211.657		64.621	-34.40	-21.84	-41.76	4.21	4.83	6.26
-200.328		75.871	-32.67	-20.74	-40.10	4.25	5.00	6.49
-187.985		85.125	-31.40	-19.94	-38.59	4.11	5.34	6.92
-175.215		93.781	-30.62	-19.44	-37.71	4.05	5.52	7.15
-162.047		101.819	-29.91	-18.99	-36.92	4.01	5.68	7.36
-148.512		109.22	-29.27	-18.59	-36.20	3.96	5.84	7.57
-134.639		115.968	-28.85	-18.31	-35.57	3.84	6.07	7.87
-120.46		122.048	-28.70	-18.22	-35.25	3.74	6.26	8.11
-106.008		127.445	-28.32	-17.98	-34.93	3.78	6.25	8.10
-91.315		132.148	-27.77	-17.63	-34.52	3.86	6.20	8.03
-76.415		136.145	-27.38	-17.38	-34.10	3.84	6.28	8.14
-61.341		139.428	-26.98	-17.13	-33.50	3.72	6.54	8.47
-46.128		141.99	-26.60	-16.89	-32.89	3.59	6.83	8.86
-30.81		143.823	-26.25	-16.67	-32.31	3.46	7.15	9.27
-15.423		144.925	-25.91	-16.45	-31.84	3.39	7.36	9.54
0		145.293	-25.71	-16.33	-31.98	3.58	6.99	9.06
15.423		144.925	-25.86	-16.42	-32.57	3.83	6.51	8.44
30.81		143.823	-26.20	-16.64	-33.07	3.93	6.31	8.18
46.128		141.99	-26.55	-16.86	-33.55	4.00	6.14	7.97
61.341		139.428	-26.93	-17.10	-34.01	4.05	6.02	7.80
76.415		136.145	-27.32	-17.35	-34.48	4.09	5.91	7.66
91.315		132.148	-27.73	-17.61	-34.86	4.07	5.88	7.62
106.008		127.445	-28.23	-17.92	-35.22	4.00	5.92	7.67
120.46		122.048	-28.56	-18.14	-35.52	3.98	5.90	7.65
134.639		115.968	-28.84	-18.31	-36.00	4.09	5.70	7.39
148.512		109.22	-29.34	-18.63	-36.70	4.21	5.48	7.10
162.047		101.819	-29.93	-19.01	-37.37	4.25	5.35	6.94
175.215		93.781	-30.61	-19.44	-38.13	4.30	5.21	6.75
187.985		85.125	-31.37	-19.92	-38.96	4.34	5.06	6.56
200.328		75.871	-32.61	-20.71	-39.90	4.16	5.11	6.63
211.657		64.621	-34.41	-21.85	-40.75	3.62	5.60	7.26
220.131		51.091	-35.05	-22.25	-39.86	2.75	7.25	9.40
225.306		35.988	-33.86	-21.50	-37.65	2.16	9.52	12.34
228.758		18.07	-32.69	-20.76	-36.38	2.11	10.07	13.05
231.304		0	-32.06	-20.35	-35.79	2.13	10.12	13.12

Thrust Load Rating=

4.83

6.26

BEAM OUTPUT FOR HL-93 TANDEM

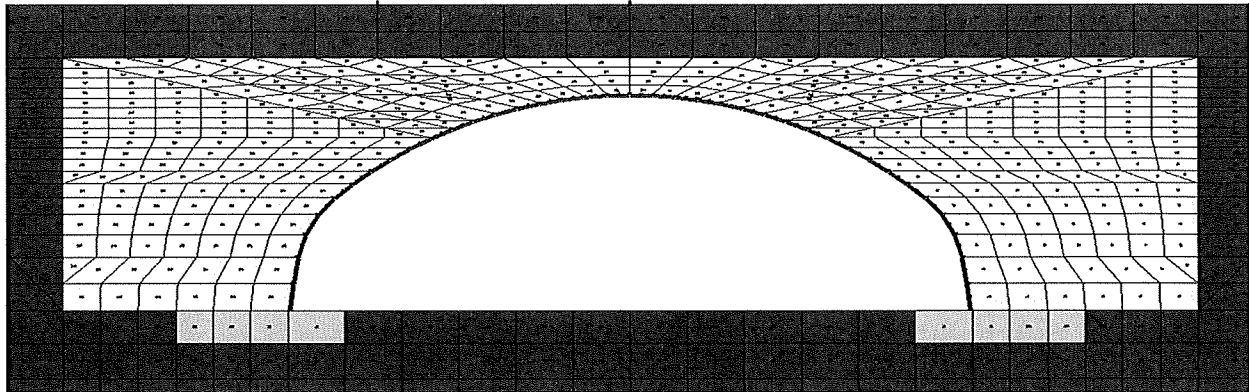
$V_{OL}=1.5$ ,  $YDL=1.75$  (INV), 1.35 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) $M_{DL}/ft$		Moment (DL) $M_{DL}$		Moment (DL+LL) $M_{DL+LL}/ft$		Moment (LL) $M_{LL}$		Moment Load Rating	
		factored from CANDE		unfactored $M_{DL}/1.575$		factored from CANDE		unfactored $(M_{DL+LL}/1.75)$		INV $(M_{Cap}-M_{DL+LL})/M_{LL+1.75}$	
		Load Step 21		kip-ft/ft		Load Step 23		kip-ft/ft			
-231.304	0	0.00		0.00		0.00		0.00			
-228.758	18.07	-3.04		-1.93		-3.92		0.51		16.76	
-225.306	35.988	-6.32		-4.02		-7.52		0.68		9.86	
-220.131	51.091	-8.36		-5.31		-9.99		0.93		6.02	
-211.657	64.621	-8.32		-5.28		-10.18		1.06		5.30	
-200.328	75.871	-5.60		-3.55		-7.42		1.04		6.82	
-187.985	85.125	-2.10		-1.34		-3.89		1.02		8.80	
-175.215	93.781	0.19		0.12		-1.60		1.03		9.81	
-162.047	101.819	1.40		0.89		-0.27		0.96		12.71	
-148.512	109.22	1.55		0.98		0.04		0.86		10.83	
-134.639	115.968	0.77		0.49		-0.52		0.74		13.19	
-120.46	122.048	0.53		0.34		-1.59		1.21		8.16	
-106.008	127.445	2.01		1.27		-0.26		1.29		7.00	
-91.315	132.148	2.10		1.34		0.88		0.70		12.85	
-76.415	136.145	2.25		1.43		3.22		0.55		16.14	
-61.341	139.428	2.26		1.43		5.26		1.72		5.20	
-46.128	141.99	2.17		1.38		6.81		2.65		3.39	
-30.81	143.823	2.06		1.31		7.76		3.26		2.77	
-15.423	144.925	2.02		1.28		8.15		3.50		2.59	
0	145.293	2.03		1.29		7.65		3.21		2.82	
15.423	144.925	2.09		1.32		6.26		2.38		3.79	
30.81	143.823	2.19		1.39		4.66		1.41		6.35	
46.128	141.99	2.37		1.50		3.04		0.39		22.97	
61.341	139.428	2.52		1.60		1.58		0.54		16.39	
76.415	136.145	2.56		1.62		0.32		1.28		6.84	
91.315	132.148	2.47		1.57		-0.79		1.86		4.73	
106.008	127.445	2.26		1.44		-0.93		1.83		4.89	
120.46	122.048	1.32		0.84		-0.84		1.23		7.66	
134.639	115.968	1.69		1.07		0.57		0.64		14.39	
148.512	109.22	1.78		1.13		0.55		0.70		13.03	
162.047	101.819	1.26		0.80		0.08		0.68		14.00	
175.215	93.781	-0.15		-0.10		-1.16		0.58		17.45	
187.985	85.125	-2.51		-1.60		-3.31		0.46		19.27	
200.328	75.871	-5.97		-3.79		-6.87		0.51		13.43	
211.657	64.621	-8.57		-5.44		-9.74		0.67		8.22	
220.131	51.091	-8.54		-5.42		-9.67		0.65		8.48	
225.306	35.988	-6.43		-4.09		-7.33		0.51		13.08	
228.758	18.07	-3.09		-1.96		-3.82		0.42		20.19	
231.304	0	0.00		0.00		0.00		0.00			

Moment Load Rating=  
Actual Load Rating (from CANDE)

2.59  
1.98

3.36  
2.47



## HL-93 TRUCK

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage HL-93 TRUCK

EXECUTION MODE ..... ANALYS  
 SOLUTION LEVEL ..... #3 USER  
 METHODOLOGY (LRFD OR SERVICE) ... LRFD  
 NUMBER OF PIPE-ELEMENT GROUPS .... 1  
 MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
 NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
 AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
 AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
 COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
 (FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -116.5	F = 0.000
1181	23	F = 0.000	F = -116.5	F = 0.000
1177	22	F = 0.000	F = -116.5	F = 0.000
1177	23	F = 0.000	F = -116.5	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000

911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP



BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FORWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0

ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000

10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 21

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 21  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.380E+00 -0.981E+00	0.341E+01 0.200E+01	0.367E-10 -0.266E+04	-0.103E+05 -0.103E+05	0.155E+03 0.602E+03
2	-228.76 18.07	-0.505E+00 -0.970E+00	-0.827E+01 -0.248E+01	-0.304E+04 -0.271E+04	-0.200E+05 -0.106E+05	0.169E+03 0.658E+03
3	-225.31 35.99	-0.598E+00 -0.959E+00	-0.200E+02 -0.696E+01	-0.633E+04 -0.281E+04	-0.306E+05 -0.109E+05	0.151E+03 0.586E+03

4	-220.13 51.09	-0.626E+00 -0.955E+00	-0.338E+02 -0.284E+01	-0.836E+04 -0.291E+04	-0.373E+05 -0.113E+05	0.610E+02 0.237E+03
5	-211.66 64.62	-0.598E+00 -0.980E+00	-0.308E+02 0.786E+01	-0.832E+04 -0.287E+04	-0.370E+05 -0.111E+05	-0.855E+02 -0.332E+03
6	-200.33 75.87	-0.530E+00 -0.106E+01	-0.205E+02 0.727E+01	-0.560E+04 -0.272E+04	-0.280E+05 -0.106E+05	-0.195E+03 -0.759E+03
7	-187.99 85.12	-0.450E+00 -0.117E+01	-0.132E+02 0.388E+01	-0.210E+04 -0.262E+04	-0.167E+05 -0.102E+05	-0.183E+03 -0.711E+03
8	-175.22 93.78	-0.366E+00 -0.131E+01	-0.124E+02 0.360E+01	0.188E+03 -0.255E+04	-0.105E+05 -0.992E+04	-0.108E+03 -0.420E+03
9	-162.05 101.82	-0.288E+00 -0.144E+01	-0.122E+02 0.352E+01	0.140E+04 -0.249E+04	-0.140E+05 -0.969E+04	-0.378E+02 -0.147E+03
10	-148.51 109.22	-0.221E+00 -0.158E+01	-0.113E+02 0.328E+01	0.154E+04 -0.244E+04	-0.143E+05 -0.948E+04	0.269E+02 0.105E+03
11	-134.64 115.97	-0.165E+00 -0.171E+01	-0.512E+01 0.148E+01	0.768E+03 -0.240E+04	-0.117E+05 -0.934E+04	0.394E+02 0.153E+03
12	-120.46 122.05	-0.118E+00 -0.183E+01	-0.116E+00 0.288E-01	0.527E+03 -0.239E+04	-0.109E+05 -0.930E+04	-0.335E+02 -0.130E+03
13	-106.01 127.44	-0.782E-01 -0.195E+01	-0.130E+02 0.378E+01	0.200E+04 -0.236E+04	-0.154E+05 -0.917E+04	-0.444E+02 -0.173E+03
14	-91.31 132.15	-0.485E-01 -0.206E+01	-0.683E+01 0.198E+01	0.210E+04 -0.231E+04	-0.155E+05 -0.899E+04	-0.174E+01 -0.677E+01
15	-76.42 136.15	-0.280E-01 -0.215E+01	-0.750E+01 0.219E+01	0.225E+04 -0.228E+04	-0.159E+05 -0.887E+04	0.356E+00 0.138E+01
16	-61.34 139.43	-0.156E-01 -0.223E+01	-0.723E+01 0.212E+01	0.227E+04 -0.225E+04	-0.158E+05 -0.874E+04	0.721E+01 0.280E+02
17	-46.13 141.99	-0.954E-02 -0.229E+01	-0.682E+01 0.201E+01	0.218E+04 -0.222E+04	-0.154E+05 -0.862E+04	0.102E+02 0.398E+02
18	-30.81 143.82	-0.834E-02 -0.234E+01	-0.631E+01 0.185E+01	0.207E+04 -0.219E+04	-0.149E+05 -0.850E+04	0.761E+01 0.296E+02
19	-15.42 144.93	-0.103E-01 -0.237E+01	-0.632E+01 0.185E+01	0.203E+04 -0.216E+04	-0.147E+05 -0.839E+04	0.263E+01 0.102E+02
20	0.00 145.29	-0.140E-01 -0.238E+01	-0.626E+01 0.211E+00	0.203E+04 -0.214E+04	-0.146E+05 -0.833E+04	-0.174E+01 -0.678E+01
21	15.42 144.93	-0.180E-01 -0.238E+01	-0.629E+01 -0.186E+01	0.208E+04 -0.216E+04	-0.148E+05 -0.838E+04	-0.627E+01 -0.244E+02
22	30.81 143.82	-0.209E-01 -0.236E+01	-0.626E+01 -0.184E+01	0.218E+04 -0.218E+04	-0.153E+05 -0.849E+04	-0.117E+02 -0.453E+02
23	46.13 141.99	-0.209E-01 -0.233E+01	-0.682E+01 -0.200E+01	0.236E+04 -0.221E+04	-0.159E+05 -0.860E+04	-0.144E+02 -0.561E+02

24	61.34 139.43	-0.164E-01 -0.227E+01	-0.724E+01 -0.213E+01	0.251E+04 -0.224E+04	-0.165E+05 -0.872E+04	-0.111E+02 -0.431E+02
25	76.42 136.15	-0.553E-02 -0.220E+01	-0.745E+01 -0.217E+01	0.256E+04 -0.228E+04	-0.168E+05 -0.885E+04	-0.430E+01 -0.167E+02
26	91.31 132.15	0.136E-01 -0.211E+01	-0.757E+01 -0.219E+01	0.247E+04 -0.231E+04	-0.167E+05 -0.898E+04	0.324E+01 0.126E+02
27	106.01 127.44	0.424E-01 -0.201E+01	-0.103E+02 -0.299E+01	0.226E+04 -0.235E+04	-0.162E+05 -0.914E+04	0.309E+02 0.120E+03
28	120.46 122.05	0.818E-01 -0.189E+01	-0.174E+01 -0.469E+00	0.131E+04 -0.238E+04	-0.133E+05 -0.925E+04	0.120E+02 0.466E+02
29	134.64 115.97	0.131E+00 -0.176E+01	-0.854E+01 -0.247E+01	0.169E+04 -0.240E+04	-0.146E+05 -0.934E+04	-0.217E+02 -0.842E+02
30	148.51 109.22	0.192E+00 -0.162E+01	-0.101E+02 -0.290E+01	0.178E+04 -0.244E+04	-0.150E+05 -0.950E+04	0.747E+01 0.290E+02
31	162.05 101.82	0.266E+00 -0.148E+01	-0.114E+02 -0.329E+01	0.126E+04 -0.249E+04	-0.136E+05 -0.970E+04	0.564E+02 0.219E+03
32	175.22 93.78	0.350E+00 -0.133E+01	-0.118E+02 -0.344E+01	-0.152E+03 -0.255E+04	-0.104E+05 -0.992E+04	0.116E+03 0.453E+03
33	187.99 85.12	0.440E+00 -0.118E+01	-0.127E+02 -0.376E+01	-0.251E+04 -0.261E+04	-0.180E+05 -0.102E+05	0.184E+03 0.715E+03
34	200.33 75.87	0.524E+00 -0.106E+01	-0.201E+02 -0.714E+01	-0.597E+04 -0.272E+04	-0.291E+05 -0.106E+05	0.190E+03 0.740E+03
35	211.66 64.62	0.595E+00 -0.983E+00	-0.309E+02 -0.880E+01	-0.857E+04 -0.287E+04	-0.378E+05 -0.111E+05	0.794E+02 0.309E+03
36	220.13 51.09	0.626E+00 -0.956E+00	-0.339E+02 0.255E+01	-0.854E+04 -0.292E+04	-0.379E+05 -0.114E+05	-0.656E+02 -0.255E+03
37	225.31 35.99	0.599E+00 -0.960E+00	-0.201E+02 0.702E+01	-0.643E+04 -0.282E+04	-0.310E+05 -0.110E+05	-0.155E+03 -0.601E+03
38	228.76 18.07	0.507E+00 -0.971E+00	-0.832E+01 0.249E+01	-0.309E+04 -0.272E+04	-0.202E+05 -0.106E+05	-0.172E+03 -0.670E+03
39	231.30 0.00	0.381E+00 -0.982E+00	0.348E+01 -0.204E+01	-0.349E-11 -0.267E+04	-0.104E+05 -0.104E+05	-0.157E+03 -0.612E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 21

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.32467E-03	-0.32467E-03	.23515	0.00000
2	-0.62725E-03	-0.34881E-04	.45430	0.00000
3	-0.95983E-03	0.27414E-03	.69518	0.00000
4	-0.11702E-02	0.46021E-03	.84757	0.00000
5	-0.11608E-02	0.46153E-03	.84073	0.00000
6	-0.87812E-03	0.21408E-03	.63600	0.00000
7	-0.52437E-03	-0.11393E-03	.37979	0.00000
8	-0.29281E-03	-0.32958E-03	.23871	0.00000
9	-0.16723E-03	-0.44078E-03	.31924	0.00000

10	-0.14693E-03	-0.44808E-03	.32454	0.00000
11	-0.21823E-03	-0.36809E-03	.26660	0.00000
12	-0.24029E-03	-0.34311E-03	.24851	0.00000
13	-0.92278E-04	-0.48339E-03	.35011	0.00000
14	-0.77178E-04	-0.48729E-03	.35293	0.00000
15	-0.58456E-04	-0.49810E-03	.36076	0.00000
16	-0.52985E-04	-0.49544E-03	.35883	0.00000
17	-0.57580E-04	-0.48312E-03	.34991	0.00000
18	-0.64864E-04	-0.46864E-03	.33943	0.00000
19	-0.65573E-04	-0.46100E-03	.33389	0.00000
20	-0.63383E-04	-0.45930E-03	.33266	0.00000
21	-0.59865E-04	-0.46588E-03	.33742	0.00000
22	-0.53364E-04	-0.47925E-03	.34711	0.00000
23	-0.39505E-04	-0.50021E-03	.36229	0.00000
24	-0.28608E-04	-0.51878E-03	.37574	0.00000
25	-0.28489E-04	-0.52696E-03	.38166	0.00000
26	-0.40885E-04	-0.52283E-03	.37867	0.00000
27	-0.66212E-04	-0.50754E-03	.36760	0.00000
28	-0.16207E-03	-0.41853E-03	.30313	0.00000
29	-0.12830E-03	-0.45789E-03	.33164	0.00000
30	-0.12443E-03	-0.47191E-03	.34179	0.00000
31	-0.18142E-03	-0.42708E-03	.30932	0.00000
32	-0.32602E-03	-0.29628E-03	.23613	0.00000
33	-0.56379E-03	-0.73947E-04	.40834	0.00000
34	-0.91378E-03	0.25085E-03	.66183	0.00000
35	-0.11857E-02	0.48620E-03	.85877	0.00000
36	-0.11889E-02	0.47653E-03	.86109	0.00000
37	-0.97180E-03	0.28350E-03	.70385	0.00000
38	-0.63351E-03	-0.30994E-04	.45884	0.00000
39	-0.32581E-03	-0.32581E-03	.23598	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 21

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.26128	0.00000	0.06827
2	-0.26642	-0.17123	0.24222
3	-0.27590	-0.35670	0.43283
4	-0.28569	-0.47131	0.55293
5	-0.28136	-0.46896	0.54813
6	-0.26719	-0.31572	0.38711
7	-0.25684	-0.11864	0.18461
8	-0.25043	0.01063	0.07335
9	-0.24465	0.07907	0.13893
10	-0.23942	0.08705	0.14438
11	-0.23592	0.04332	0.09898
12	-0.23474	0.02972	0.08483
13	-0.23164	0.11306	0.16671
14	-0.22713	0.11855	0.17014
15	-0.22394	0.12709	0.17724
16	-0.22067	0.12790	0.17659
17	-0.21756	0.12301	0.17034
18	-0.21467	0.11672	0.16280
19	-0.21188	0.11431	0.15920
20	-0.21032	0.11445	0.15868
21	-0.21155	0.11736	0.16212
22	-0.21431	0.12311	0.16904
23	-0.21717	0.13318	0.18034
24	-0.22026	0.14169	0.19020
25	-0.22350	0.14409	0.19404
26	-0.22683	0.13931	0.19076
27	-0.23086	0.12757	0.18087
28	-0.23362	0.07414	0.12871
29	-0.23587	0.09527	0.15091
30	-0.23995	0.10044	0.15802
31	-0.24484	0.07101	0.13096
32	-0.25040	-0.00860	0.07130
33	-0.25661	-0.14160	0.20745
34	-0.26675	-0.33665	0.40781
35	-0.28146	-0.48329	0.56251
36	-0.28664	-0.48142	0.56358
37	-0.27696	-0.36287	0.43957
38	-0.26738	-0.17417	0.24566
39	-0.26220	0.00000	0.06875

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 21

LRFD STRENGTH-LIMIT RATIOS AT STEP 21, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	36	11351.	30800.	0.369
BUCKLING THRUST (psi)	36	11351.	49071.	0.231
SEAM THRUST (psi)	36	11351.	21914.	0.518
PLASTIC-PENETRATE (%)	0	0.00	90.00	0.000
COMBINED T&M Ratio	36	0.564	1.000	0.564

LRFD SERVICE PERFORMANCE AT STEP 21, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.62
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.12
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020
STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23	

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23

UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.484E+00 -0.108E+01	0.825E+01 0.370E+01	0.440E-10 -0.321E+04	-0.125E+05 -0.125E+05	0.219E+03 0.853E+03
2	-228.76 18.07	-0.644E+00 -0.107E+01	-0.854E+01 -0.258E+01	-0.399E+04 -0.327E+04	-0.251E+05 -0.127E+05	0.211E+03 0.820E+03
3	-225.31 35.99	-0.763E+00 -0.105E+01	-0.253E+02 -0.886E+01	-0.780E+04 -0.339E+04	-0.374E+05 -0.132E+05	0.186E+03 0.724E+03
4	-220.13 51.09	-0.801E+00 -0.105E+01	-0.410E+02 -0.404E+01	-0.105E+05 -0.352E+04	-0.440E+05 -0.137E+05	0.901E+02 0.350E+03
5	-211.66 64.62	-0.767E+00 -0.108E+01	-0.372E+02 0.113E+02	-0.107E+05 -0.346E+04	-0.440E+05 -0.135E+05	-0.851E+02 -0.331E+03
6	-200.33 75.87	-0.682E+00 -0.117E+01	-0.242E+02 0.861E+01	-0.770E+04 -0.328E+04	-0.367E+05 -0.127E+05	-0.221E+03 -0.860E+03
7	-187.99 85.12	-0.578E+00 -0.132E+01	-0.147E+02 0.435E+01	-0.365E+04 -0.315E+04	-0.236E+05 -0.123E+05	-0.219E+03 -0.853E+03
8	-175.22 93.78	-0.465E+00 -0.150E+01	-0.142E+02 0.410E+01	-0.773E+03 -0.308E+04	-0.144E+05 -0.120E+05	-0.144E+03 -0.560E+03
9	-162.05 101.82	-0.358E+00 -0.169E+01	-0.145E+02 0.415E+01	0.976E+03 -0.301E+04	-0.147E+05 -0.117E+05	-0.663E+02 -0.258E+03

10	-148.51 109.22	-0.261E+00 -0.188E+01	-0.134E+02 0.381E+01	0.147E+04 -0.295E+04	-0.160E+05 -0.115E+05	0.804E+01 0.312E+02
11	-134.64 115.97	-0.179E+00 -0.207E+01	-0.746E+01 0.213E+01	0.926E+03 -0.290E+04	-0.142E+05 -0.113E+05	0.304E+02 0.118E+03
12	-120.46 122.05	-0.108E+00 -0.225E+01	-0.198E+01 0.562E+00	0.726E+03 -0.288E+04	-0.135E+05 -0.112E+05	-0.336E+02 -0.130E+03
13	-106.01 127.44	-0.480E-01 -0.243E+01	-0.143E+02 0.409E+01	0.215E+04 -0.284E+04	-0.177E+05 -0.110E+05	-0.433E+02 -0.168E+03
14	-91.31 132.15	-0.115E-02 -0.260E+01	-0.625E+01 0.176E+01	0.225E+04 -0.280E+04	-0.179E+05 -0.109E+05	-0.180E+02 -0.700E+02
15	-76.42 136.15	0.333E-01 -0.275E+01	-0.809E+01 0.229E+01	0.289E+04 -0.276E+04	-0.197E+05 -0.107E+05	-0.388E+02 -0.151E+03
16	-61.34 139.43	0.561E-01 -0.288E+01	-0.802E+01 0.228E+01	0.361E+04 -0.273E+04	-0.218E+05 -0.106E+05	-0.442E+02 -0.172E+03
17	-46.13 141.99	0.683E-01 -0.298E+01	-0.815E+01 0.232E+01	0.440E+04 -0.269E+04	-0.241E+05 -0.104E+05	-0.474E+02 -0.184E+03
18	-30.81 143.82	0.717E-01 -0.306E+01	-0.815E+01 0.231E+01	0.518E+04 -0.265E+04	-0.264E+05 -0.103E+05	-0.478E+02 -0.186E+03
19	-15.42 144.93	0.690E-01 -0.309E+01	-0.999E+01 0.281E+01	0.591E+04 -0.261E+04	-0.285E+05 -0.101E+05	-0.320E+02 -0.124E+03
20	0.00 145.29	0.639E-01 -0.308E+01	-0.117E+02 -0.266E+01	0.613E+04 -0.261E+04	-0.292E+05 -0.101E+05	0.120E+02 0.467E+02
21	15.42 144.93	0.602E-01 -0.302E+01	-0.952E+01 -0.272E+01	0.542E+04 -0.265E+04	-0.271E+05 -0.103E+05	0.514E+02 0.200E+03
22	30.81 143.82	0.619E-01 -0.292E+01	-0.880E+01 -0.249E+01	0.434E+04 -0.269E+04	-0.240E+05 -0.105E+05	0.666E+02 0.259E+03
23	46.13 141.99	0.719E-01 -0.279E+01	-0.823E+01 -0.233E+01	0.311E+04 -0.273E+04	-0.203E+05 -0.106E+05	0.698E+02 0.271E+03
24	61.34 139.43	0.918E-01 -0.264E+01	-0.810E+01 -0.230E+01	0.190E+04 -0.277E+04	-0.167E+05 -0.108E+05	0.657E+02 0.255E+03
25	76.42 136.15	0.122E+00 -0.247E+01	-0.824E+01 -0.234E+01	0.786E+03 -0.281E+04	-0.134E+05 -0.109E+05	0.599E+02 0.233E+03
26	91.31 132.15	0.161E+00 -0.230E+01	-0.540E+01 -0.154E+01	-0.218E+03 -0.284E+04	-0.117E+05 -0.111E+05	0.314E+02 0.122E+03
27	106.01 127.44	0.209E+00 -0.213E+01	-0.855E+01 -0.246E+01	-0.402E+03 -0.288E+04	-0.124E+05 -0.112E+05	0.382E+01 0.148E+02
28	120.46 122.05	0.263E+00 -0.196E+01	-0.343E+01 -0.975E+00	-0.496E+03 -0.290E+04	-0.128E+05 -0.113E+05	-0.404E+02 -0.157E+03
29	134.64 115.97	0.324E+00 -0.181E+01	-0.142E+02 -0.407E+01	0.732E+03 -0.294E+04	-0.137E+05 -0.114E+05	-0.427E+02 -0.166E+03



30	148.51	0.394E+00	-0.112E+02	0.741E+03	-0.139E+05	0.128E+02
	109.22	-0.165E+01	-0.321E+01	-0.300E+04	-0.116E+05	0.499E+02
31	162.05	0.475E+00	-0.127E+02	0.279E+03	-0.127E+05	0.541E+02
	101.82	-0.149E+01	-0.364E+01	-0.305E+04	-0.119E+05	0.210E+03
32	175.22	0.563E+00	-0.135E+02	-0.964E+03	-0.151E+05	0.110E+03
	93.78	-0.133E+01	-0.392E+01	-0.311E+04	-0.121E+05	0.429E+03
33	187.99	0.653E+00	-0.156E+02	-0.314E+04	-0.221E+05	0.186E+03
	85.12	-0.118E+01	-0.358E+01	-0.318E+04	-0.124E+05	0.724E+03
34	200.33	0.736E+00	-0.253E+02	-0.671E+04	-0.335E+05	0.205E+03
	75.87	-0.106E+01	-0.377E+01	-0.326E+04	-0.127E+05	0.799E+03
35	211.66	0.800E+00	-0.365E+02	-0.956E+04	-0.427E+05	0.890E+02
	64.62	-0.987E+00	-0.295E+01	-0.333E+04	-0.130E+05	0.346E+03
36	220.13	0.817E+00	-0.381E+02	-0.951E+04	-0.423E+05	-0.717E+02
	51.09	-0.969E+00	0.110E+02	-0.327E+04	-0.127E+05	-0.279E+03
37	225.31	0.766E+00	-0.227E+02	-0.720E+04	-0.344E+05	-0.165E+03
	35.99	-0.979E+00	0.790E+01	-0.310E+04	-0.120E+05	-0.640E+03
38	228.76	0.640E+00	-0.752E+01	-0.372E+04	-0.232E+05	-0.194E+03
	18.07	-0.996E+00	0.226E+01	-0.299E+04	-0.116E+05	-0.754E+03
39	231.30	0.473E+00	0.762E+01	0.652E-11	-0.114E+05	-0.207E+03
	0.00	-0.101E+01	-0.338E+01	-0.294E+04	-0.114E+05	-0.805E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.39196E-03	-0.39196E-03	.28389	0.00000
2	-0.78775E-03	-0.99216E-05	.57055	0.00000
3	-0.11742E-02	0.34782E-03	.85043	0.00000
4	-0.14550E-02	0.59383E-03	1.0538	0.03627
5	-0.14703E-02	0.62227E-03	1.0649	0.04283
6	-0.11504E-02	0.35102E-03	.83318	0.00000
7	-0.74062E-03	-0.28880E-04	.53641	0.00000
8	-0.45109E-03	-0.30024E-03	.32672	0.00000
9	-0.27200E-03	-0.46242E-03	.33492	0.00000
10	-0.21653E-03	-0.50245E-03	.36391	0.00000
11	-0.26361E-03	-0.44430E-03	.32180	0.00000
12	-0.28057E-03	-0.42216E-03	.30576	0.00000
13	-0.13658E-03	-0.55686E-03	.40332	0.00000
14	-0.12171E-03	-0.56029E-03	.40580	0.00000
15	-0.54974E-04	-0.61901E-03	.44833	0.00000
16	0.20088E-04	-0.68493E-03	.49608	0.00000
17	0.10101E-03	-0.75662E-03	.54800	0.00000
18	0.18172E-03	-0.82803E-03	.59972	0.00000
19	0.25845E-03	-0.89462E-03	.64795	0.00000
20	0.27963E-03	-0.91539E-03	.66299	0.00000
21	0.20562E-03	-0.85187E-03	.61699	0.00000
22	0.95233E-04	-0.75199E-03	.54465	0.00000
23	-0.30315E-04	-0.63635E-03	.46089	0.00000
24	-0.15300E-03	-0.52322E-03	.37895	0.00000
25	-0.26620E-03	-0.41955E-03	.30387	0.00000
26	-0.36806E-03	-0.32559E-03	.26658	0.00000
27	-0.38993E-03	-0.31153E-03	.28242	0.00000
28	-0.40232E-03	-0.30548E-03	.29139	0.00000
29	-0.28710E-03	-0.42982E-03	.31131	0.00000
30	-0.29297E-03	-0.43759E-03	.31694	0.00000
31	-0.34478E-03	-0.39920E-03	.28913	0.00000
32	-0.47373E-03	-0.28558E-03	.34311	0.00000
33	-0.69392E-03	-0.81384E-04	.50259	0.00000

34	-0.10514E-02	0.25746E-03	.76150	0.00000
35	-0.13387E-02	0.52563E-03	.96959	0.00000
36	-0.13265E-02	0.52850E-03	.96073	0.00000
37	-0.10798E-02	0.32474E-03	.78207	0.00000
38	-0.72806E-03	-0.15017E-05	.52732	0.00000
39	-0.35871E-03	-0.35871E-03	.25980	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.31543	0.00000	0.09949
2	-0.32096	-0.22484	0.32786
3	-0.33251	-0.43996	0.55052
4	-0.34544	-0.59058	0.70991
5	-0.33970	-0.60247	0.71787
6	-0.32163	-0.43400	0.53745
7	-0.30963	-0.20574	0.30161
8	-0.30232	-0.04361	0.13500
9	-0.29552	0.05504	0.14237
10	-0.28930	0.08265	0.16634
11	-0.28485	0.05223	0.13337
12	-0.28276	0.04093	0.12088
13	-0.27902	0.12149	0.19934
14	-0.27442	0.12678	0.20209
15	-0.27119	0.16304	0.23659
16	-0.26752	0.20380	0.27536
17	-0.26380	0.24791	0.31751
18	-0.26006	0.29189	0.35952
19	-0.25598	0.33331	0.39884
20	-0.25582	0.34544	0.41088
21	-0.26003	0.30568	0.37330
22	-0.26426	0.24491	0.31474
23	-0.26825	0.17518	0.24714
24	-0.27209	0.10702	0.18105
25	-0.27593	0.04433	0.12046
26	-0.27911	-0.01228	0.09018
27	-0.28225	-0.02266	0.10233
28	-0.28480	-0.02799	0.10910
29	-0.28847	0.04125	0.12447
30	-0.29396	0.04180	0.12822
31	-0.29936	0.01573	0.10535
32	-0.30553	-0.05439	0.14773
33	-0.31196	-0.17706	0.27439
34	-0.31946	-0.37835	0.48040
35	-0.32716	-0.53892	0.64595
36	-0.32108	-0.53621	0.63930
37	-0.30381	-0.40600	0.49831
38	-0.29356	-0.21002	0.29620
39	-0.28867	0.00000	0.08333

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	4	13679.	30800.	0.444
BUCKLING THRUST (psi)	4	13679.	49820.	0.275
SEAM THRUST (psi)	4	13679.	21914.	0.624
PLASTIC-PENETRATE (%)	5	4.28	90.00	0.048
COMBINED T&M Ratio	5	0.718	1.000	0.718

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.90
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.18
HANDLING FACTOR RATIO = $(SPAN^2/EI)/FF$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage HL-93 TRUCK-INV

LIVE LOADS X 2.58 FOR COMBINED THRUST MOMENT TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08

POISSONS RATIO OF METAL (-) ..... 0.30000E+00

YIELD STRESS OF METAL (PSI)..... 0.44000E+05

LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05

DENSITY OF METAL (PCI)..... 0.28400E+00

MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730

MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860

SECTION MODULUS (IN\*\*3/IN) ..... 0.32170

PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000

BUCKLING STRESS FAILURE..... 0.70000

SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000

ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)

(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE. (D)	Y-FORCE(F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -300.0	F = 0.000
1181	23	F = 0.000	F = -300.0	F = 0.000
1177	22	F = 0.000	F = -300.0	F = 0.000
1177	23	F = 0.000	F = -300.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000
856	1	D = 0.000	F = 0.000	D = 0.000
857	1	D = 0.000	F = 0.000	D = 0.000

858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23

25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000



LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.650E+00 -0.125E+01	0.195E+02 0.732E+01	0.404E-10 -0.414E+04	-0.161E+05 -0.161E+05	0.369E+03 0.143E+04
2	-228.76 18.07	-0.891E+00 -0.122E+01	-0.662E+01 -0.209E+01	-0.619E+04 -0.419E+04	-0.355E+05 -0.163E+05	0.279E+03 0.108E+04
3	-225.31 35.99	-0.107E+01 -0.120E+01	-0.327E+02 -0.115E+02	-0.107E+05 -0.433E+04	-0.440E+05 -0.168E+05	0.211E+03 0.820E+03
4	-220.13 51.09	-0.113E+01 -0.119E+01	-0.543E+02 -0.529E+01	-0.138E+05 -0.450E+04	-0.440E+05 -0.175E+05	0.106E+03 0.413E+03
5	-211.66 64.62	-0.108E+01 -0.123E+01	-0.507E+02 0.154E+02	-0.141E+05 -0.442E+04	-0.440E+05 -0.172E+05	-0.766E+02 -0.298E+03
6	-200.33 75.87	-0.959E+00 -0.137E+01	-0.307E+02 0.109E+02	-0.111E+05 -0.419E+04	-0.440E+05 -0.163E+05	-0.226E+03 -0.878E+03
7	-187.99 85.12	-0.806E+00 -0.159E+01	-0.155E+02 0.463E+01	-0.653E+04 -0.404E+04	-0.360E+05 -0.157E+05	-0.250E+03 -0.972E+03
8	-175.22 93.78	-0.636E+00 -0.186E+01	-0.166E+02 0.478E+01	-0.268E+04 -0.396E+04	-0.237E+05 -0.154E+05	-0.192E+03 -0.745E+03
9	-162.05 101.82	-0.468E+00 -0.215E+01	-0.189E+02 0.534E+01	0.145E+03 -0.387E+04	-0.155E+05 -0.150E+05	-0.103E+03 -0.400E+03
10	-148.51 109.22	-0.313E+00 -0.246E+01	-0.173E+02 0.488E+01	0.132E+04 -0.379E+04	-0.188E+05 -0.147E+05	-0.490E+01 -0.190E+02

11	-134.64 115.97	-0.177E+00 -0.276E+01	-0.105E+02 0.296E+01	0.113E+04 -0.373E+04	-0.180E+05 -0.145E+05	0.317E+02 0.123E+03
12	-120.46 122.05	-0.584E-01 -0.307E+01	-0.516E+01 0.144E+01	0.117E+04 -0.370E+04	-0.180E+05 -0.144E+05	-0.235E+02 -0.914E+02
13	-106.01 127.44	0.420E-01 -0.337E+01	-0.182E+02 0.513E+01	0.267E+04 -0.364E+04	-0.225E+05 -0.142E+05	-0.171E+02 -0.663E+02
14	-91.31 132.15	0.123E+00 -0.365E+01	-0.303E+01 0.788E+00	0.248E+04 -0.360E+04	-0.217E+05 -0.140E+05	-0.246E+02 -0.956E+02
15	-76.42 136.15	0.185E+00 -0.392E+01	-0.814E+01 0.223E+01	0.418E+04 -0.357E+04	-0.269E+05 -0.139E+05	-0.108E+03 -0.420E+03
16	-61.34 139.43	0.228E+00 -0.416E+01	-0.894E+01 0.245E+01	0.652E+04 -0.353E+04	-0.340E+05 -0.137E+05	-0.144E+03 -0.561E+03
17	-46.13 141.99	0.252E+00 -0.435E+01	-0.107E+02 0.295E+01	0.923E+04 -0.348E+04	-0.422E+05 -0.135E+05	-0.159E+03 -0.617E+03
18	-30.81 143.82	0.260E+00 -0.447E+01	-0.113E+02 0.312E+01	0.118E+05 -0.342E+04	-0.440E+05 -0.133E+05	-0.152E+03 -0.591E+03
19	-15.42 144.93	0.255E+00 -0.449E+01	-0.177E+02 0.503E+01	0.140E+05 -0.336E+04	-0.440E+05 -0.130E+05	-0.885E+02 -0.344E+03
20	0.00 145.29	0.247E+00 -0.441E+01	-0.224E+02 -0.585E+01	0.143E+05 -0.336E+04	-0.440E+05 -0.131E+05	0.615E+02 0.239E+03
21	15.42 144.93	0.244E+00 -0.421E+01	-0.143E+02 -0.395E+01	0.115E+05 -0.344E+04	-0.440E+05 -0.134E+05	0.184E+03 0.714E+03
22	30.81 143.82	0.255E+00 -0.392E+01	-0.130E+02 -0.354E+01	0.763E+04 -0.351E+04	-0.374E+05 -0.136E+05	0.230E+03 0.894E+03
23	46.13 141.99	0.286E+00 -0.358E+01	-0.984E+01 -0.269E+01	0.316E+04 -0.357E+04	-0.237E+05 -0.139E+05	0.238E+03 0.925E+03
24	61.34 139.43	0.336E+00 -0.321E+01	-0.797E+01 -0.222E+01	-0.104E+04 -0.362E+04	-0.173E+05 -0.141E+05	0.205E+03 0.798E+03
25	76.42 136.15	0.403E+00 -0.285E+01	-0.743E+01 -0.211E+01	-0.444E+04 -0.366E+04	-0.280E+05 -0.142E+05	0.152E+03 0.590E+03
26	91.31 132.15	0.478E+00 -0.253E+01	0.700E+00 -0.214E+00	-0.681E+04 -0.368E+04	-0.355E+05 -0.143E+05	0.299E+02 0.116E+03
27	106.01 127.44	0.555E+00 -0.226E+01	-0.371E+01 -0.111E+01	-0.616E+04 -0.369E+04	-0.335E+05 -0.143E+05	-0.122E+03 -0.472E+03
28	120.46 122.05	0.630E+00 -0.203E+01	-0.963E+01 -0.278E+01	-0.357E+04 -0.371E+04	-0.255E+05 -0.144E+05	-0.194E+03 -0.754E+03
29	134.64 115.97	0.705E+00 -0.184E+01	-0.255E+02 -0.731E+01	-0.485E+03 -0.379E+04	-0.162E+05 -0.147E+05	-0.101E+03 -0.393E+03
30	148.51 109.22	0.787E+00 -0.165E+01	-0.125E+02 -0.360E+01	-0.656E+03 -0.387E+04	-0.171E+05 -0.150E+05	0.108E+02 0.421E+02

31	162.05	0.874E+00	-0.146E+02	-0.954E+03	-0.182E+05	0.356E+02
	101.82	-0.147E+01	-0.421E+01	-0.393E+04	-0.153E+05	0.138E+03
32	175.22	0.966E+00	-0.169E+02	-0.183E+04	-0.212E+05	0.907E+02
	93.78	-0.131E+01	-0.492E+01	-0.400E+04	-0.156E+05	0.352E+03
33	187.99	0.106E+01	-0.219E+02	-0.378E+04	-0.275E+05	0.199E+03
	85.12	-0.116E+01	-0.829E+00	-0.406E+04	-0.158E+05	0.772E+03
34	200.33	0.114E+01	-0.336E+02	-0.795E+04	-0.404E+05	0.255E+03
	75.87	-0.104E+01	0.495E+01	-0.405E+04	-0.157E+05	0.991E+03
35	211.66	0.119E+01	-0.420E+02	-0.117E+05	-0.440E+05	0.124E+03
	64.62	-0.973E+00	0.131E+02	-0.393E+04	-0.153E+05	0.480E+03
36	220.13	0.118E+01	-0.432E+02	-0.117E+05	-0.440E+05	-0.744E+02
	51.09	-0.971E+00	0.132E+02	-0.373E+04	-0.145E+05	-0.289E+03
37	225.31	0.108E+01	-0.268E+02	-0.907E+04	-0.419E+05	-0.174E+03
	35.99	-0.998E+00	0.933E+01	-0.352E+04	-0.137E+05	-0.677E+03
38	228.76	0.872E+00	-0.466E+01	-0.534E+04	-0.299E+05	-0.235E+03
	18.07	-0.103E+01	0.146E+01	-0.341E+04	-0.133E+05	-0.912E+03
39	231.30	0.611E+00	0.175E+02	0.743E-11	-0.131E+05	-0.321E+03
	0.00	-0.106E+01	-0.641E+01	-0.337E+04	-0.131E+05	-0.125E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.50492E-03	-0.50492E-03	.36570	0.00000
2	-0.11152E-02	0.92981E-04	.80773	0.00000
3	-0.16031E-02	0.52358E-03	1.1611	0.10457
4	-0.22072E-02	0.88934E-03	1.5987	0.26693
5	-0.22657E-02	0.94351E-03	1.6410	0.27576
6	-0.16310E-02	0.58179E-03	1.1813	0.11312
7	-0.11302E-02	0.14439E-03	.81857	0.00000
8	-0.74427E-03	-0.22111E-03	.53906	0.00000
9	-0.45809E-03	-0.48638E-03	.35227	0.00000
10	-0.33372E-03	-0.59077E-03	.42788	0.00000
11	-0.34424E-03	-0.56554E-03	.40961	0.00000
12	-0.33658E-03	-0.56486E-03	.40912	0.00000
13	-0.18390E-03	-0.70486E-03	.51051	0.00000
14	-0.19694E-03	-0.68035E-03	.49276	0.00000
15	-0.27428E-04	-0.84333E-03	.61080	0.00000
16	0.20583E-03	-0.10662E-02	.77225	0.00000
17	0.47625E-03	-0.13247E-02	.95943	0.00000
18	0.75051E-03	-0.16075E-02	1.1642	0.09617
19	0.10286E-02	-0.19589E-02	1.4188	0.19354
20	0.10633E-02	-0.20131E-02	1.4580	0.20556
21	0.71238E-03	-0.15673E-02	1.1351	0.08185
22	0.31663E-03	-0.11728E-02	.84942	0.00000
23	-0.12671E-03	-0.74393E-03	.53881	0.00000
24	-0.54281E-03	-0.33968E-03	.39315	0.00000
25	-0.87918E-03	-0.13584E-04	.63677	0.00000
26	-0.11129E-02	0.21467E-03	.80607	0.00000
27	-0.10511E-02	0.15075E-03	.76125	0.00000
28	-0.80144E-03	-0.10443E-03	.58046	0.00000
29	-0.50897E-03	-0.41428E-03	.36863	0.00000
30	-0.53567E-03	-0.40770E-03	.38797	0.00000
31	-0.57230E-03	-0.38615E-03	.41451	0.00000
32	-0.66676E-03	-0.30976E-03	.48292	0.00000
33	-0.86342E-03	-0.12575E-03	.62536	0.00000
34	-0.12689E-02	0.28211E-03	.91904	0.00000
35	-0.16792E-02	0.68190E-03	1.2162	0.12644
36	-0.16477E-02	0.70777E-03	1.1934	0.11337
37	-0.13143E-02	0.45503E-03	.95191	0.00000
38	-0.93738E-03	0.10524E-03	.67892	0.00000

39      -0.41155E-03      -0.41155E-03      .29807      0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/ (P-resist)	FACTORED MOMENT-RATIO M/ (M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.40634	0.00000	0.16511
2	-0.41132	-0.34925	0.51844
3	-0.42501	-0.60191	0.78254
4	-0.44152	-0.77635	0.97129
5	-0.43381	-0.79504	0.98323
6	-0.41079	-0.62337	0.79212
7	-0.39666	-0.36844	0.52578
8	-0.38844	-0.15123	0.30212
9	-0.38003	0.00818	0.15260
10	-0.37199	0.07430	0.21268
11	-0.36607	0.06397	0.19798
12	-0.36272	0.06599	0.19755
13	-0.35761	0.15059	0.27848
14	-0.35300	0.13974	0.26434
15	-0.35037	0.23585	0.35861
16	-0.34621	0.36771	0.48757
17	-0.34139	0.52059	0.63713
18	-0.33604	0.66663	0.77956
19	-0.32930	0.79209	0.90053
20	-0.32985	0.80727	0.91607
21	-0.33785	0.64852	0.76266
22	-0.34449	0.43054	0.54921
23	-0.35032	0.17842	0.30114
24	-0.35509	-0.05872	0.18481
25	-0.35923	-0.25022	0.37926
26	-0.36144	-0.38377	0.51441
27	-0.36226	-0.34740	0.47864
28	-0.36450	-0.20148	0.33434
29	-0.37149	-0.02737	0.16538
30	-0.37959	-0.03699	0.18108
31	-0.38566	-0.05381	0.20254
32	-0.39293	-0.10320	0.25759
33	-0.39802	-0.21324	0.37166
34	-0.39706	-0.44835	0.60601
35	-0.38612	-0.66052	0.80961
36	-0.36604	-0.66191	0.79590
37	-0.34575	-0.51145	0.63099
38	-0.33484	-0.30139	0.41350
39	-0.33119	0.00000	0.10969

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	4	17484.	30800.	0.568
BUCKLING THRUST (psi)	4	17484.	49384.	0.354
SEAM THRUST (psi)	4	17484.	21914.	0.798
PLASTIC-PENETRATE (%)	5	27.58	90.00	0.306
COMBINED T&M Ratio	5	0.983	1.000	0.983

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%)..... 1.45  
 RISE HEIGHT OF VERTICAL DEFLECTION (IN)..... 145.29

RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.29
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage HL-93 TRUCK-OPR  
LIVE LOADS X 3.26 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE .....	ANALYS
SOLUTION LEVEL .....	#3 USER
METHODOLOGY (LRFD OR SERVICE) ...	LRFD
NUMBER OF PIPE-ELEMENT GROUPS ....	1
MAXIMUM ITERATIONS PER STEP .....	-99

PIPE ELEMENT TYPE .....	STEEL
NUMBER OF BEAM ELEMENTS .....	38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN .....	2
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NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK...	4
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IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
MOM. OF INERTIA (IN**4/IN) .....	0.97860
SECTION MODULUS (IN**3/IN) .....	0.32170

PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000  
SEAM STRENGTH FAILURE ..... 0.67000  
FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -380.0	F = 0.000
1181	23	F = 0.000	F = -380.0	F = 0.000
1177	22	F = 0.000	F = -380.0	F = 0.000
1177	23	F = 0.000	F = -380.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000

839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4

6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
 (ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
 YOUNGS MODULUS= 0.3000E+04  
 POISSONS RATIO= 0.3000E+00  
 CONFINED MOD.= 0.4038E+04  
 LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
 YOUNGS MODULUS= 0.3500E+07  
 POISSONS RATIO= 0.1800E+00  
 CONFINED MOD.= 0.3800E+07  
 LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95



COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 48.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
 SCALED MODULUS NUMBER ZK ..... 950.0000  
 MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000

20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.350	Factor for load step #22
23	1.350	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.641E+00 -0.125E+01	0.197E+02 0.733E+01	0.295E-10 -0.413E+04	-0.161E+05 -0.161E+05	0.388E+03 0.151E+04
2	-228.76 18.07	-0.891E+00 -0.122E+01	-0.598E+01 -0.190E+01	-0.648E+04 -0.418E+04	-0.364E+05 -0.162E+05	0.287E+03 0.111E+04
3	-225.31 35.99	-0.107E+01 -0.120E+01	-0.317E+02 -0.111E+02	-0.110E+05 -0.431E+04	-0.440E+05 -0.168E+05	0.206E+03 0.799E+03
4	-220.13 51.09	-0.114E+01 -0.118E+01	-0.541E+02 -0.529E+01	-0.139E+05 -0.448E+04	-0.440E+05 -0.174E+05	0.941E+02 0.366E+03
5	-211.66 64.62	-0.109E+01 -0.123E+01	-0.511E+02 0.155E+02	-0.141E+05 -0.440E+04	-0.440E+05 -0.171E+05	-0.820E+02 -0.319E+03

6	-200.33 75.87	-0.964E+00 -0.136E+01	-0.307E+02 0.109E+02	-0.110E+05 -0.416E+04	-0.440E+05 -0.162E+05	-0.224E+03 -0.869E+03
7	-187.99 85.12	-0.811E+00 -0.158E+01	-0.152E+02 0.453E+01	-0.656E+04 -0.402E+04	-0.360E+05 -0.156E+05	-0.248E+03 -0.964E+03
8	-175.22 93.78	-0.640E+00 -0.186E+01	-0.165E+02 0.474E+01	-0.270E+04 -0.394E+04	-0.237E+05 -0.153E+05	-0.192E+03 -0.745E+03
9	-162.05 101.82	-0.472E+00 -0.215E+01	-0.190E+02 0.538E+01	0.134E+03 -0.385E+04	-0.154E+05 -0.150E+05	-0.102E+03 -0.396E+03
10	-148.51 109.22	-0.317E+00 -0.246E+01	-0.175E+02 0.493E+01	0.127E+04 -0.377E+04	-0.186E+05 -0.146E+05	-0.271E+00 -0.105E+01
11	-134.64 115.97	-0.180E+00 -0.276E+01	-0.108E+02 0.304E+01	0.990E+03 -0.371E+04	-0.175E+05 -0.144E+05	0.410E+02 0.159E+03
12	-120.46 122.05	-0.607E-01 -0.307E+01	-0.440E+01 0.122E+01	0.850E+03 -0.367E+04	-0.169E+05 -0.143E+05	-0.168E+02 -0.654E+02
13	-106.01 127.44	0.412E-01 -0.337E+01	-0.180E+02 0.507E+01	0.235E+04 -0.362E+04	-0.214E+05 -0.141E+05	-0.171E+02 -0.665E+02
14	-91.31 132.15	0.124E+00 -0.366E+01	-0.220E+01 0.555E+00	0.220E+04 -0.358E+04	-0.208E+05 -0.139E+05	-0.321E+02 -0.125E+03
15	-76.42 136.15	0.189E+00 -0.394E+01	-0.821E+01 0.225E+01	0.415E+04 -0.355E+04	-0.267E+05 -0.138E+05	-0.121E+03 -0.469E+03
16	-61.34 139.43	0.234E+00 -0.419E+01	-0.900E+01 0.247E+01	0.670E+04 -0.351E+04	-0.345E+05 -0.136E+05	-0.155E+03 -0.602E+03
17	-46.13 141.99	0.259E+00 -0.438E+01	-0.108E+02 0.299E+01	0.959E+04 -0.346E+04	-0.433E+05 -0.134E+05	-0.167E+03 -0.649E+03
18	-30.81 143.82	0.267E+00 -0.451E+01	-0.115E+02 0.316E+01	0.123E+05 -0.340E+04	-0.440E+05 -0.132E+05	-0.157E+03 -0.611E+03
19	-15.42 144.93	0.262E+00 -0.454E+01	-0.180E+02 0.515E+01	0.146E+05 -0.333E+04	-0.440E+05 -0.130E+05	-0.890E+02 -0.346E+03
20	0.00 145.29	0.254E+00 -0.445E+01	-0.228E+02 -0.499E+01	0.148E+05 -0.333E+04	-0.440E+05 -0.130E+05	0.684E+02 0.266E+03
21	15.42 144.93	0.251E+00 -0.423E+01	-0.146E+02 -0.403E+01	0.118E+05 -0.341E+04	-0.440E+05 -0.132E+05	0.197E+03 0.767E+03
22	30.81 143.82	0.263E+00 -0.393E+01	-0.131E+02 -0.359E+01	0.761E+04 -0.348E+04	-0.372E+05 -0.135E+05	0.248E+03 0.964E+03
23	46.13 141.99	0.295E+00 -0.357E+01	-0.964E+01 -0.263E+01	0.278E+04 -0.354E+04	-0.224E+05 -0.138E+05	0.257E+03 0.100E+04
24	61.34 139.43	0.347E+00 -0.319E+01	-0.705E+01 -0.195E+01	-0.176E+04 -0.358E+04	-0.194E+05 -0.139E+05	0.217E+03 0.845E+03
25	76.42 136.15	0.415E+00 -0.283E+01	-0.571E+01 -0.162E+01	-0.527E+04 -0.362E+04	-0.304E+05 -0.141E+05	0.145E+03 0.565E+03
26	91.31	0.491E+00	0.926E+00	-0.735E+04	-0.370E+05	0.104E+02

	132.15	-0.251E+01	-0.286E+00	-0.364E+04	-0.141E+05	0.405E+02
27	106.01	0.567E+00	-0.353E+01	-0.638E+04	-0.340E+05	-0.142E+03
	127.44	-0.224E+01	-0.105E+01	-0.365E+04	-0.142E+05	-0.552E+03
28	120.46	0.640E+00	-0.106E+02	-0.346E+04	-0.250E+05	-0.206E+03
	122.05	-0.202E+01	-0.306E+01	-0.367E+04	-0.143E+05	-0.802E+03
29	134.64	0.714E+00	-0.257E+02	-0.302E+03	-0.155E+05	-0.102E+03
	115.97	-0.183E+01	-0.738E+01	-0.375E+04	-0.146E+05	-0.396E+03
30	148.51	0.794E+00	-0.124E+02	-0.493E+03	-0.164E+05	0.122E+02
	109.22	-0.164E+01	-0.354E+01	-0.383E+04	-0.149E+05	0.475E+02
31	162.05	0.880E+00	-0.145E+02	-0.797E+03	-0.176E+05	0.366E+02
	101.82	-0.147E+01	-0.418E+01	-0.389E+04	-0.151E+05	0.142E+03
32	175.22	0.971E+00	-0.170E+02	-0.169E+04	-0.207E+05	0.939E+02
	93.78	-0.130E+01	-0.494E+01	-0.396E+04	-0.154E+05	0.365E+03
33	187.99	0.106E+01	-0.219E+02	-0.372E+04	-0.271E+05	0.205E+03
	85.12	-0.115E+01	-0.251E+00	-0.401E+04	-0.156E+05	0.798E+03
34	200.33	0.114E+01	-0.329E+02	-0.801E+04	-0.405E+05	0.261E+03
	75.87	-0.103E+01	0.459E+01	-0.400E+04	-0.155E+05	0.101E+04
35	211.66	0.120E+01	-0.414E+02	-0.118E+05	-0.440E+05	0.127E+03
	64.62	-0.967E+00	0.129E+02	-0.389E+04	-0.151E+05	0.494E+03
36	220.13	0.118E+01	-0.428E+02	-0.119E+05	-0.440E+05	-0.694E+02
	51.09	-0.966E+00	0.131E+02	-0.369E+04	-0.143E+05	-0.270E+03
37	225.31	0.108E+01	-0.257E+02	-0.933E+04	-0.426E+05	-0.175E+03
	35.99	-0.993E+00	0.896E+01	-0.349E+04	-0.136E+05	-0.679E+03
38	228.76	0.869E+00	-0.472E+01	-0.545E+04	-0.301E+05	-0.241E+03
	18.07	-0.102E+01	0.148E+01	-0.338E+04	-0.131E+05	-0.936E+03
39	231.30	0.602E+00	0.163E+02	-0.453E-10	-0.130E+05	-0.325E+03
	0.00	-0.105E+01	-0.601E+01	-0.334E+04	-0.130E+05	-0.126E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.50400E-03	-0.50400E-03	.36504	0.00000
2	-0.11415E-02	0.12189E-03	.82679	0.00000
3	-0.16496E-02	0.56447E-03	1.1947	0.12144
4	-0.22391E-02	0.91308E-03	1.6217	0.27231
5	-0.22485E-02	0.93997E-03	1.6285	0.27218
6	-0.16219E-02	0.58068E-03	1.1747	0.10951
7	-0.11295E-02	0.14958E-03	.81810	0.00000
8	-0.74371E-03	-0.21610E-03	.53865	0.00000
9	-0.45636E-03	-0.48254E-03	.34950	0.00000
10	-0.33554E-03	-0.58324E-03	.42243	0.00000
11	-0.35538E-03	-0.54851E-03	.39727	0.00000
12	-0.36506E-03	-0.53085E-03	.38448	0.00000
13	-0.21296E-03	-0.67082E-03	.48586	0.00000
14	-0.22137E-03	-0.65146E-03	.47184	0.00000
15	-0.28307E-04	-0.83828E-03	.60715	0.00000
16	0.22589E-03	-0.10819E-02	.78361	0.00000
17	0.51393E-03	-0.13578E-02	.98340	0.00000
18	0.80861E-03	-0.16735E-02	1.2121	0.11798
19	0.11041E-02	-0.20652E-02	1.4958	0.21599

20	0.11316E-02	-0.21076E-02	1.5265	0.22441
21	0.74688E-03	-0.15985E-02	1.1577	0.09285
22	0.31806E-03	-0.11663E-02	.84475	0.00000
23	-0.16060E-03	-0.70236E-03	.50870	0.00000
24	-0.60846E-03	-0.26594E-03	.44069	0.00000
25	-0.95538E-03	0.72089E-04	.69196	0.00000
26	-0.11608E-02	0.27297E-03	.84076	0.00000
27	-0.10675E-02	0.17785E-03	.77319	0.00000
28	-0.78496E-03	-0.11054E-03	.56853	0.00000
29	-0.48623E-03	-0.42724E-03	.35216	0.00000
30	-0.51488E-03	-0.41874E-03	.37291	0.00000
31	-0.55202E-03	-0.39654E-03	.39981	0.00000
32	-0.64807E-03	-0.31854E-03	.46938	0.00000
33	-0.85193E-03	-0.12635E-03	.61703	0.00000
34	-0.12694E-02	0.29377E-03	.91940	0.00000
35	-0.16897E-02	0.70008E-03	1.2238	0.12930
36	-0.16662E-02	0.73165E-03	1.2068	0.11908
37	-0.13356E-02	0.48431E-03	.96732	0.00000
38	-0.94420E-03	0.11938E-03	.68386	0.00000
39	-0.40780E-03	-0.40780E-03	.29536	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.40559	0.00000	0.16451
2	-0.41028	-0.36522	0.53355
3	-0.42347	-0.62166	0.80099
4	-0.43950	-0.78449	0.97765
5	-0.43150	-0.79288	0.97907
6	-0.40834	-0.62141	0.78815
7	-0.39432	-0.36975	0.52524
8	-0.38620	-0.15251	0.30167
9	-0.37779	0.00757	0.15030
10	-0.36969	0.07160	0.20827
11	-0.36371	0.05583	0.18811
12	-0.36049	0.04792	0.17788
13	-0.35561	0.13235	0.25881
14	-0.35121	0.12433	0.24767
15	-0.34869	0.23414	0.35572
16	-0.34445	0.37805	0.49669
17	-0.33954	0.54105	0.65633
18	-0.33411	0.69401	0.80563
19	-0.32723	0.82290	0.92998
20	-0.32706	0.83437	0.94134
21	-0.33451	0.66410	0.77599
22	-0.34133	0.42909	0.54560
23	-0.34723	0.15660	0.27717
24	-0.35183	-0.09901	0.22280
25	-0.35541	-0.29701	0.42332
26	-0.35725	-0.41446	0.54209
27	-0.35799	-0.36000	0.48816
28	-0.36033	-0.19495	0.32479
29	-0.36756	-0.01705	0.15215
30	-0.37566	-0.02779	0.16892
31	-0.38167	-0.04494	0.19062
32	-0.38894	-0.09525	0.24653
33	-0.39363	-0.20974	0.36469
34	-0.39257	-0.45186	0.60598
35	-0.38212	-0.66699	0.81300
36	-0.36237	-0.67136	0.80267
37	-0.34252	-0.52606	0.64339
38	-0.33189	-0.30744	0.41759
39	-0.32818	0.00000	0.10770

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
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MATERIAL THRUST (psi)	4	17404.	30800.	0.565
BUCKLING THRUST (psi)	4	17404.	49073.	0.355
SEAM THRUST (psi)	4	17404.	21914.	0.794
PLASTIC-PENETRATE (%)	4	27.23	90.00	0.303
COMBINED T&M Ratio	5	0.979	1.000	0.979

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.72
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.34
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR HL-93 TRUCK

Y<sub>DL</sub>=1.5, Y<sub>DL</sub>=1.75 (INV), 1.35 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) T <sub>DLfac</sub> factored from CANDE	Thrust (DL) T <sub>DL</sub> unfactored	Thrust (DL+LL) T <sub>DL+LLfac</sub> factored from CANDE	Thrust (LL) T <sub>LL</sub> unfactored	Thrust Load Rating INV	Thrust Load Rating OPR
		Load Step 21	T <sub>DLfac</sub> /1.575	Load Step 23	(T <sub>DL+LLfac</sub> -T <sub>DLfac</sub> )/1.75	(T <sub>Cap</sub> -T <sub>DL+LL</sub> )/T <sub>LL+1.75</sub>	(T <sub>Cap</sub> -T <sub>DL+LL</sub> )/T <sub>LL+1.35</sub>
		kips/ft.	kips/ft.	kips/ft.			
-231.304	0	-31.95	-20.28	-38.57	3.78	5.72	7.42
-228.758	18.07	-32.58	-20.68	-39.24	3.81	5.59	7.25
-225.306	35.988	-33.73	-21.42	-40.66	3.95	5.23	6.78
-220.131	51.091	-34.93	-22.18	-42.24	4.17	4.80	6.22
-211.657	64.621	-34.40	-21.84	-41.53	4.08	4.98	6.46
-200.328	75.871	-32.67	-20.74	-39.33	3.80	5.59	7.24
-187.985	85.125	-31.40	-19.94	-37.86	3.69	5.95	7.71
-175.215	93.781	-30.62	-19.44	-36.96	3.63	6.17	8.00
-162.047	101.819	-29.91	-18.99	-36.13	3.55	6.40	8.30
-148.512	109.22	-29.27	-18.59	-35.37	3.49	6.63	8.59
-134.639	115.968	-28.85	-18.31	-34.83	3.42	6.82	8.85
-120.46	122.048	-28.70	-18.22	-34.57	3.35	6.98	9.05
-106.008	127.445	-28.32	-17.98	-34.12	3.31	7.13	9.25
-91.315	132.148	-27.77	-17.63	-33.55	3.30	7.24	9.38
-76.415	136.145	-27.38	-17.38	-33.16	3.30	7.31	9.47
-61.341	139.428	-26.98	-17.13	-32.71	3.27	7.44	9.64
-46.128	141.99	-26.60	-16.89	-32.25	3.23	7.60	9.85
-30.81	143.823	-26.25	-16.67	-31.80	3.17	7.80	10.12
-15.423	144.925	-25.91	-16.45	-31.30	3.08	8.09	10.49
0	145.293	-25.72	-16.33	-31.28	3.18	7.88	10.21
15.423	144.925	-25.87	-16.42	-31.79	3.39	7.37	9.55
30.81	143.823	-26.20	-16.64	-32.31	3.49	7.10	9.20
46.128	141.99	-26.55	-16.86	-32.80	3.57	6.89	8.93
61.341	139.428	-26.93	-17.10	-33.27	3.62	6.73	8.72
76.415	136.145	-27.33	-17.35	-33.74	3.66	6.59	8.55
91.315	132.148	-27.73	-17.61	-34.13	3.65	6.55	8.49
106.008	127.445	-28.23	-17.92	-34.51	3.59	6.59	8.54
120.46	122.048	-28.56	-18.14	-34.82	3.58	6.57	8.51
134.639	115.968	-28.84	-18.31	-35.27	3.68	6.35	8.23
148.512	109.22	-29.34	-18.63	-35.94	3.77	6.11	7.92
162.047	101.819	-29.94	-19.01	-36.60	3.81	5.97	7.74
175.215	93.781	-30.62	-19.44	-37.36	3.85	5.81	7.53
187.985	85.125	-31.38	-19.92	-38.14	3.87	5.68	7.36
200.328	75.871	-32.61	-20.71	-39.06	3.88	5.78	7.49
211.657	64.621	-34.41	-21.85	-40.00	3.19	6.36	8.24
220.131	51.091	-35.05	-22.25	-39.26	2.41	8.29	10.75
225.306	35.988	-33.86	-21.50	-37.15	1.88	10.98	14.23
228.758	18.07	-32.69	-20.76	-35.89	1.83	11.61	15.05
231.304	0	-32.06	-20.35	-35.30	1.85	11.67	15.13

Thrust Load Rating=

4.80

6.22

BEAM OUTPUT FOR HL-93 TRUCK

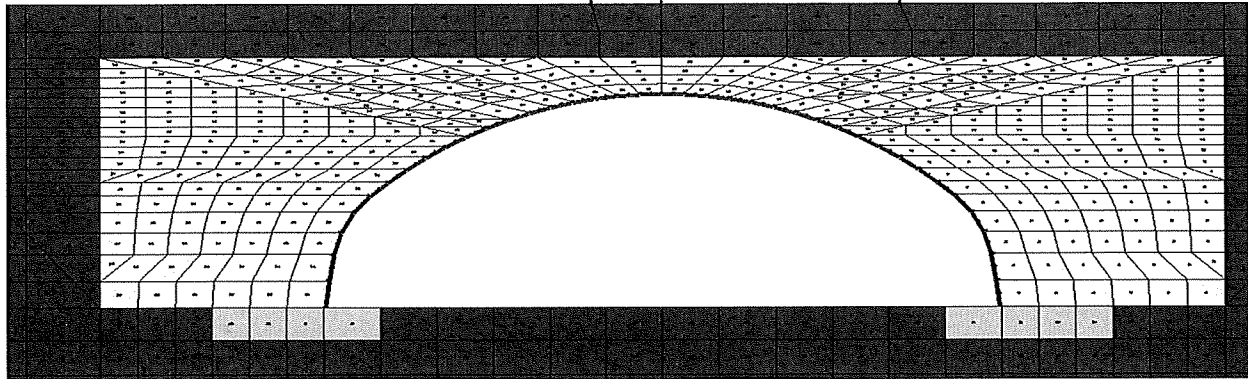
Y<sub>0</sub>=1.5, YDL=1.75 (INV), 1.35 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>b,DC</sub> factored from CANDE	Moment (DL) M <sub>b,LS</sub> unfactored M <sub>b,DC</sub> /1.575	Moment (DL+LL) M <sub>b,LL+DC</sub> factored from CANDE	Moment (LL) M <sub>b,LS</sub> unfactored (M <sub>b,LL+DC</sub> -M <sub>b,DC</sub> )/1.75	Moment Load Rating INV (M <sub>cap</sub> -M <sub>b,LS</sub> *1.5)/M <sub>b,LS</sub> *1.75	Moment Load Rating OPR (M <sub>cap</sub> -M <sub>b,LS</sub> *1.5)/M <sub>b,LS</sub> *1.35
		Load Step 21 kips-ft/ft.		Load Step 23 kips-ft/ft.			
-231.304	0	0.00	0.00	0.00	0.00		
-228.758	18.07	-3.04	-1.93	-3.99	0.54	15.66	20.29
-225.306	35.988	-6.33	-4.02	-7.80	0.84	7.96	10.32
-220.131	51.091	-8.36	-5.31	-10.47	1.21	4.64	6.02
-211.657	64.621	-8.32	-5.28	-10.68	1.35	4.16	5.40
-200.328	75.871	-5.60	-3.55	-7.70	1.20	5.93	7.69
-187.985	85.125	-2.10	-1.34	-3.65	0.88	10.21	13.24
-175.215	93.781	0.19	0.12	-0.77	0.55	18.29	23.72
-162.047	101.819	1.40	0.89	0.98	0.24	38.58	50.01
-148.512	109.22	1.54	0.98	1.47	0.04	208.77	270.63
-134.639	115.968	0.77	0.49	0.93	0.09	107.85	139.80
-120.46	122.048	0.53	0.33	0.73	0.11	86.94	112.70
-106.008	127.445	2.00	1.27	2.15	0.09	106.10	137.54
-91.315	132.148	2.10	1.33	2.25	0.08	108.10	140.13
-76.415	136.145	2.25	1.43	2.89	0.36	24.51	31.77
-61.341	139.428	2.27	1.44	3.61	0.77	11.60	15.04
-46.128	141.99	2.18	1.38	4.40	1.27	7.09	9.19
-30.81	143.823	2.07	1.31	5.18	1.77	5.09	6.60
-15.423	144.925	2.03	1.29	5.91	2.22	4.08	5.29
0	145.293	2.03	1.29	6.13	2.34	3.87	5.01
15.423	144.925	2.08	1.32	5.42	1.91	4.73	6.13
30.81	143.823	2.18	1.39	4.34	1.23	9.42	7.60
46.128	141.99	2.36	1.50	3.11	0.43	20.84	27.02
61.341	139.428	2.51	1.60	1.90	0.35	25.02	32.43
76.415	136.145	2.56	1.62	0.79	1.01	8.67	11.24
91.315	132.148	2.47	1.57	-0.22	1.54	5.74	7.44
106.008	127.445	2.26	1.44	-0.40	1.52	5.86	7.60
120.46	122.048	1.31	0.83	-0.50	1.03	9.12	11.83
134.639	115.968	1.69	1.07	0.73	0.55	16.88	21.88
148.512	109.22	1.78	1.13	0.74	0.59	15.46	20.04
162.047	101.819	1.26	0.80	0.28	0.56	16.91	21.92
175.215	93.781	-0.15	-0.10	-0.96	0.46	21.71	28.15
187.985	85.125	-2.51	-1.59	-3.14	0.36	24.46	31.71
200.328	75.871	-5.97	-3.79	-6.71	0.42	16.35	21.20
211.657	64.621	-8.57	-5.44	-9.56	0.56	9.74	12.63
220.131	51.091	-8.54	-5.42	-9.51	0.56	9.93	12.87
225.306	35.988	-6.43	-4.09	-7.20	0.44	15.23	19.74
228.758	18.07	-3.09	-1.96	-3.72	0.36	23.33	30.24
231.304	0	0.00	0.00	0.00	0.00		

Moment Load Rating=  
Actual Load Rating (from CANDE)

3.87  
2.58  
5.01  
3.26





### TYPE 3

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage TYPE 3

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2,MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
 COMBINED MOMENT-THRUST CRITERION... 0.90000

## BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -72.78	F = 0.000
1181	23	F = 0.000	F = -72.78	F = 0.000
1180	22	F = 0.000	F = -72.78	F = 0.000
1180	23	F = 0.000	F = -72.78	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000

861	1	D =	0.000	D =	0.000	D =	0.000
886	1	D =	0.000	D =	0.000	D =	0.000
911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1185	22	F =	0.000	F =	-50.94	F =	0.000
1185	23	F =	0.000	F =	-50.94	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

# BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

## MATERIAL DESCRIPTION FOR SOILS AND INTERFACE (ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL

WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 48.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
 SCALED MODULUS NUMBER ZK ..... 950.0000  
 MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000

6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.475E+00 -0.103E+01	0.800E+01 0.353E+01	-0.324E-10 -0.303E+04	-0.118E+05 -0.118E+05	0.210E+03 0.816E+03
2	-228.76 18.07	-0.641E+00 -0.102E+01	-0.775E+01 -0.234E+01	-0.378E+04 -0.308E+04	-0.237E+05 -0.120E+05	0.197E+03 0.765E+03

3	-225.31 35.99	-0.766E+00 -0.999E+00	-0.235E+02 -0.820E+01	-0.730E+04 -0.319E+04	-0.351E+05 -0.124E+05	0.169E+03 0.655E+03
4	-220.13 51.09	-0.815E+00 -0.989E+00	-0.394E+02 -0.104E+02	-0.968E+04 -0.336E+04	-0.431E+05 -0.131E+05	0.763E+02 0.296E+03
5	-211.66 64.62	-0.795E+00 -0.101E+01	-0.376E+02 0.382E+01	-0.979E+04 -0.341E+04	-0.437E+05 -0.133E+05	-0.843E+02 -0.328E+03
6	-200.33 75.87	-0.727E+00 -0.109E+01	-0.255E+02 0.889E+01	-0.700E+04 -0.329E+04	-0.345E+05 -0.128E+05	-0.201E+03 -0.780E+03
7	-187.99 85.12	-0.641E+00 -0.121E+01	-0.151E+02 0.448E+01	-0.348E+04 -0.316E+04	-0.231E+05 -0.123E+05	-0.186E+03 -0.721E+03
8	-175.22 93.78	-0.544E+00 -0.137E+01	-0.137E+02 0.397E+01	-0.122E+04 -0.309E+04	-0.158E+05 -0.120E+05	-0.111E+03 -0.433E+03
9	-162.05 101.82	-0.450E+00 -0.154E+01	-0.136E+02 0.391E+01	0.464E+02 -0.302E+04	-0.119E+05 -0.118E+05	-0.454E+02 -0.176E+03
10	-148.51 109.22	-0.364E+00 -0.171E+01	-0.129E+02 0.370E+01	0.297E+03 -0.296E+04	-0.124E+05 -0.115E+05	0.173E+02 0.674E+02
11	-134.64 115.97	-0.286E+00 -0.188E+01	-0.102E+02 0.295E+01	-0.343E+03 -0.291E+04	-0.124E+05 -0.113E+05	0.567E+02 0.220E+03
12	-120.46 122.05	-0.215E+00 -0.207E+01	0.324E+00 0.133E+00	-0.128E+04 -0.289E+04	-0.152E+05 -0.112E+05	-0.419E+01 -0.163E+02
13	-106.01 127.44	-0.150E+00 -0.226E+01	-0.106E+02 0.304E+01	-0.948E+01 -0.286E+04	-0.112E+05 -0.111E+05	-0.607E+02 -0.236E+03
14	-91.31 132.15	-0.950E-01 -0.245E+01	-0.456E+01 0.127E+01	0.838E+03 -0.283E+04	-0.136E+05 -0.110E+05	-0.781E+02 -0.303E+03
15	-76.42 136.15	-0.508E-01 -0.264E+01	-0.961E+01 0.271E+01	0.268E+04 -0.279E+04	-0.192E+05 -0.109E+05	-0.102E+03 -0.395E+03
16	-61.34 139.43	-0.196E-01 -0.282E+01	-0.997E+01 0.283E+01	0.426E+04 -0.275E+04	-0.239E+05 -0.107E+05	-0.814E+02 -0.316E+03
17	-46.13 141.99	-0.161E-02 -0.296E+01	-0.100E+02 0.286E+01	0.545E+04 -0.270E+04	-0.274E+05 -0.105E+05	-0.556E+02 -0.216E+03
18	-30.81 143.82	0.516E-02 -0.306E+01	-0.965E+01 0.274E+01	0.617E+04 -0.265E+04	-0.295E+05 -0.103E+05	-0.301E+02 -0.117E+03
19	-15.42 144.93	0.406E-02 -0.311E+01	-0.105E+02 0.284E+01	0.649E+04 -0.261E+04	-0.303E+05 -0.101E+05	0.121E+01 0.470E+01
20	0.00 145.29	-0.652E-03 -0.312E+01	-0.103E+02 -0.218E+01	0.616E+04 -0.260E+04	-0.293E+05 -0.101E+05	0.385E+02 0.150E+03
21	15.42 144.93	-0.469E-02 -0.308E+01	-0.843E+01 -0.240E+01	0.524E+04 -0.264E+04	-0.266E+05 -0.103E+05	0.590E+02 0.229E+03
22	30.81 143.82	-0.419E-02 -0.300E+01	-0.794E+01 -0.225E+01	0.420E+04 -0.268E+04	-0.235E+05 -0.104E+05	0.596E+02 0.232E+03

23	46.13 141.99	0.366E-02 -0.289E+01	-0.776E+01 -0.220E+01	0.320E+04 -0.272E+04	-0.205E+05 -0.106E+05	0.532E+02 0.207E+03
24	61.34 139.43	0.207E-01 -0.275E+01	-0.795E+01 -0.226E+01	0.233E+04 -0.275E+04	-0.179E+05 -0.107E+05	0.450E+02 0.175E+03
25	76.42 136.15	0.477E-01 -0.260E+01	-0.829E+01 -0.235E+01	0.157E+04 -0.279E+04	-0.157E+05 -0.109E+05	0.393E+02 0.153E+03
26	91.31 132.15	0.849E-01 -0.244E+01	-0.657E+01 -0.186E+01	0.885E+03 -0.283E+04	-0.137E+05 -0.110E+05	0.210E+02 0.818E+02
27	106.01 127.44	0.132E+00 -0.227E+01	-0.101E+02 -0.290E+01	0.716E+03 -0.287E+04	-0.134E+05 -0.111E+05	0.153E+02 0.596E+02
28	120.46 122.05	0.188E+00 -0.210E+01	-0.323E+01 -0.903E+00	0.239E+03 -0.289E+04	-0.120E+05 -0.113E+05	-0.178E+02 -0.690E+02
29	134.64 115.97	0.254E+00 -0.193E+01	-0.127E+02 -0.363E+01	0.112E+04 -0.293E+04	-0.149E+05 -0.114E+05	-0.328E+02 -0.127E+03
30	148.51 109.22	0.331E+00 -0.176E+01	-0.119E+02 -0.339E+01	0.113E+04 -0.298E+04	-0.151E+05 -0.116E+05	0.168E+02 0.653E+02
31	162.05 101.82	0.420E+00 -0.158E+01	-0.132E+02 -0.378E+01	0.489E+03 -0.304E+04	-0.133E+05 -0.118E+05	0.678E+02 0.264E+03
32	175.22 93.78	0.519E+00 -0.141E+01	-0.135E+02 -0.391E+01	-0.106E+04 -0.311E+04	-0.154E+05 -0.121E+05	0.128E+03 0.498E+03
33	187.99 85.12	0.620E+00 -0.124E+01	-0.148E+02 -0.439E+01	-0.355E+04 -0.318E+04	-0.234E+05 -0.124E+05	0.198E+03 0.769E+03
34	200.33 75.87	0.712E+00 -0.111E+01	-0.251E+02 -0.838E+01	-0.722E+04 -0.330E+04	-0.353E+05 -0.128E+05	0.206E+03 0.801E+03
35	211.66 64.62	0.785E+00 -0.103E+01	-0.379E+02 -0.539E+01	-0.100E+05 -0.343E+04	-0.440E+05 -0.133E+05	0.852E+02 0.331E+03
36	220.13 51.09	0.809E+00 -0.100E+01	-0.396E+02 0.929E+01	-0.994E+04 -0.340E+04	-0.440E+05 -0.132E+05	-0.784E+02 -0.305E+03
37	225.31 35.99	0.764E+00 -0.101E+01	-0.239E+02 0.833E+01	-0.748E+04 -0.323E+04	-0.358E+05 -0.126E+05	-0.174E+03 -0.676E+03
38	228.76 18.07	0.641E+00 -0.103E+01	-0.796E+01 0.240E+01	-0.386E+04 -0.312E+04	-0.241E+05 -0.121E+05	-0.202E+03 -0.785E+03
39	231.30 0.00	0.477E+00 -0.104E+01	0.795E+01 -0.353E+01	-0.726E-10 -0.307E+04	-0.119E+05 -0.119E+05	-0.214E+03 -0.831E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.36902E-03	-0.36902E-03	.26727	0.00000
2	-0.74360E-03	-0.69379E-05	.53857	0.00000
3	-0.11005E-02	0.32358E-03	.79705	0.00000
4	-0.13538E-02	0.53442E-03	.98052	0.00000
5	-0.13705E-02	0.53876E-03	.99264	0.00000



6	-0.10836E-02	0.28227E-03	.78482	0.00000
7	-0.72468E-03	-0.46579E-04	.52487	0.00000
8	-0.49586E-03	-0.25762E-03	.35914	0.00000
9	-0.36427E-03	-0.37332E-03	.27039	0.00000
10	-0.33255E-03	-0.39044E-03	.28278	0.00000
11	-0.38888E-03	-0.32191E-03	.28166	0.00000
12	-0.47749E-03	-0.22770E-03	.34583	0.00000
13	-0.35030E-03	-0.34845E-03	.25371	0.00000
14	-0.26316E-03	-0.42658E-03	.30896	0.00000
15	-0.79402E-04	-0.60173E-03	.43582	0.00000
16	0.80824E-04	-0.75040E-03	.54350	0.00000
17	0.20226E-03	-0.86029E-03	.62309	0.00000
18	0.27883E-03	-0.92580E-03	.67053	0.00000
19	0.31513E-03	-0.95140E-03	.68908	0.00000
20	0.28353E-03	-0.91878E-03	.66545	0.00000
21	0.18900E-03	-0.83345E-03	.60365	0.00000
22	0.82907E-04	-0.73681E-03	.53365	0.00000
23	-0.19130E-04	-0.64383E-03	.46631	0.00000
24	-0.10878E-03	-0.56319E-03	.40790	0.00000
25	-0.18741E-03	-0.49380E-03	.35765	0.00000
26	-0.25844E-03	-0.43113E-03	.31226	0.00000
27	-0.27961E-03	-0.41923E-03	.30363	0.00000
28	-0.32974E-03	-0.37633E-03	.27257	0.00000
29	-0.24807E-03	-0.46634E-03	.33776	0.00000
30	-0.25405E-03	-0.47359E-03	.34301	0.00000
31	-0.32319E-03	-0.41856E-03	.30315	0.00000
32	-0.48243E-03	-0.27507E-03	.34941	0.00000
33	-0.73340E-03	-0.41764E-04	.53119	0.00000
34	-0.11068E-02	0.30249E-03	.80160	0.00000
35	-0.13970E-02	0.55991E-03	1.0118	0.00834
36	-0.13844E-02	0.55461E-03	1.0027	0.00189
37	-0.11245E-02	0.33552E-03	.81445	0.00000
38	-0.75721E-03	-0.48636E-05	.54843	0.00000
39	-0.37462E-03	-0.37462E-03	.27133	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.29697	0.00000	0.08819
2	-0.30200	-0.21295	0.30415
3	-0.31261	-0.41165	0.50937
4	-0.32970	-0.54582	0.65452
5	-0.33469	-0.55191	0.66393
6	-0.32243	-0.39483	0.49879
7	-0.31033	-0.19602	0.29232
8	-0.30318	-0.06887	0.16079
9	-0.29679	0.00262	0.09070
10	-0.29091	0.01673	0.10136
11	-0.28601	-0.01936	0.10116
12	-0.28375	-0.07220	0.15272
13	-0.28116	-0.00053	0.07958
14	-0.27753	0.04724	0.12426
15	-0.27407	0.15099	0.22610
16	-0.26942	0.24028	0.31287
17	-0.26478	0.30715	0.37725
18	-0.26032	0.34822	0.41599
19	-0.25602	0.36611	0.43166
20	-0.25561	0.34755	0.41288
21	-0.25931	0.29556	0.36280
22	-0.26311	0.23695	0.30618
23	-0.26676	0.18058	0.25174
24	-0.27039	0.13135	0.20446
25	-0.27410	0.08857	0.16370
26	-0.27747	0.04992	0.12691
27	-0.28119	0.04036	0.11943
28	-0.28411	0.01347	0.09419
29	-0.28746	0.06309	0.14573
30	-0.29279	0.06346	0.14919
31	-0.29846	0.02757	0.11665
32	-0.30480	-0.05994	0.15284
33	-0.31191	-0.19993	0.29722
34	-0.32362	-0.40737	0.51210
35	-0.33677	-0.56560	0.67901
36	-0.33387	-0.56049	0.67195
37	-0.31747	-0.42204	0.52283

38	-0.30664	-0.21748	0.31151
39	-0.30147	0.00000	0.09089

# ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

## LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	35	13336.	30800.	0.433
BUCKLING THRUST (psi)	35	13336.	49954.	0.267
SEAM THRUST (psi)	35	13336.	21914.	0.609
PLASTIC-PENETRATE (%)	35	0.83	90.00	0.009
COMBINED T&M Ratio	35	0.679	1.000	0.679

## LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.90
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.18
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage TYPE 3-OPR

LIVE LOADS X 3.05 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
DENSITY OF METAL (PCI)..... 0.28400E+00  
MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000

SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000

ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE. (D)	Y-FORCE(F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -222.0	F = 0.000
1181	23	F = 0.000	F = -222.0	F = 0.000
1180	22	F = 0.000	F = -222.0	F = 0.000
1180	23	F = 0.000	F = -222.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000

854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1185	22	F =	0.000	F =	-155.4	F =	0.000
1185	23	F =	0.000	F =	-155.4	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17

19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000

INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000

33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.450	Factor for load step #22
23	1.450	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.615E+00 -0.111E+01	0.184E+02 0.676E+01	0.149E-10 -0.363E+04	-0.141E+05 -0.141E+05	0.347E+03 0.135E+04
2	-228.76 18.07	-0.882E+00 -0.109E+01	-0.496E+01 -0.156E+01	-0.579E+04 -0.367E+04	-0.323E+05 -0.143E+05	0.253E+03 0.983E+03
3	-225.31 35.99	-0.109E+01 -0.106E+01	-0.283E+02 -0.989E+01	-0.981E+04 -0.379E+04	-0.440E+05 -0.147E+05	0.183E+03 0.713E+03
4	-220.13 51.09	-0.118E+01 -0.103E+01	-0.478E+02 -0.147E+02	-0.125E+05 -0.401E+04	-0.440E+05 -0.156E+05	0.829E+02 0.322E+03
5	-211.66 64.62	-0.118E+01 -0.104E+01	-0.466E+02 -0.855E+01	-0.127E+05 -0.420E+04	-0.440E+05 -0.163E+05	-0.103E+03 -0.402E+03
6	-200.33 75.87	-0.111E+01 -0.113E+01	-0.350E+02 0.108E+02	-0.929E+04 -0.415E+04	-0.440E+05 -0.161E+05	-0.224E+03 -0.870E+03
7	-187.99 85.12	-0.101E+01 -0.128E+01	-0.199E+02 0.591E+01	-0.556E+04 -0.400E+04	-0.328E+05 -0.156E+05	-0.178E+03 -0.690E+03
8	-175.22 93.78	-0.891E+00 -0.147E+01	-0.156E+02 0.454E+01	-0.358E+04 -0.391E+04	-0.263E+05 -0.152E+05	-0.915E+02 -0.356E+03
9	-162.05	-0.767E+00	-0.153E+02	-0.239E+04	-0.224E+05	-0.375E+02



	101.82	-0.169E+01	0.438E+01	-0.384E+04	-0.149E+05	-0.146E+03
10	-148.51 109.22	-0.645E+00 -0.193E+01	-0.134E+02 0.383E+01	-0.197E+04 -0.378E+04	-0.208E+05 -0.147E+05	0.305E+01 0.119E+02
11	-134.64 115.97	-0.527E+00 -0.220E+01	-0.260E+02 0.745E+01	-0.193E+04 -0.369E+04	-0.204E+05 -0.144E+05	0.130E+03 0.506E+03
12	-120.46 122.05	-0.415E+00 -0.248E+01	0.258E+00 0.730E-01	-0.534E+04 -0.364E+04	-0.308E+05 -0.142E+05	0.155E+03 0.603E+03
13	-106.01 127.44	-0.305E+00 -0.281E+01	0.290E+01 0.918E+00	-0.593E+04 -0.364E+04	-0.326E+05 -0.141E+05	-0.416E+02 -0.162E+03
14	-91.31 132.15	-0.198E+00 -0.318E+01	-0.119E+00 0.576E-02	-0.304E+04 -0.362E+04	-0.235E+05 -0.141E+05	-0.235E+03 -0.913E+03
15	-76.42 136.15	-0.105E+00 -0.357E+01	-0.125E+02 0.343E+01	0.255E+04 -0.358E+04	-0.219E+05 -0.139E+05	-0.309E+03 -0.120E+04
16	-61.34 139.43	-0.341E-01 -0.395E+01	-0.152E+02 0.418E+01	0.779E+04 -0.351E+04	-0.379E+05 -0.136E+05	-0.263E+03 -0.102E+04
17	-46.13 141.99	0.104E-01 -0.428E+01	-0.159E+02 0.436E+01	0.119E+05 -0.343E+04	-0.440E+05 -0.133E+05	-0.188E+03 -0.730E+03
18	-30.81 143.82	0.302E-01 -0.451E+01	-0.159E+02 0.440E+01	0.145E+05 -0.336E+04	-0.440E+05 -0.130E+05	-0.103E+03 -0.402E+03
19	-15.42 144.93	0.316E-01 -0.463E+01	-0.182E+02 0.292E+01	0.156E+05 -0.330E+04	-0.440E+05 -0.128E+05	0.247E+01 0.961E+01
20	0.00 145.29	0.249E-01 -0.461E+01	-0.177E+02 -0.502E+01	0.146E+05 -0.332E+04	-0.440E+05 -0.129E+05	0.123E+03 0.478E+03
21	15.42 144.93	0.211E-01 -0.447E+01	-0.115E+02 -0.315E+01	0.115E+05 -0.339E+04	-0.440E+05 -0.132E+05	0.190E+03 0.738E+03
22	30.81 143.82	0.293E-01 -0.425E+01	-0.107E+02 -0.291E+01	0.798E+04 -0.344E+04	-0.382E+05 -0.134E+05	0.199E+03 0.774E+03
23	46.13 141.99	0.544E-01 -0.396E+01	-0.882E+01 -0.241E+01	0.436E+04 -0.349E+04	-0.271E+05 -0.136E+05	0.185E+03 0.720E+03
24	61.34 139.43	0.981E-01 -0.364E+01	-0.812E+01 -0.226E+01	0.116E+04 -0.354E+04	-0.174E+05 -0.138E+05	0.149E+03 0.580E+03
25	76.42 136.15	0.159E+00 -0.331E+01	-0.887E+01 -0.249E+01	-0.136E+04 -0.358E+04	-0.182E+05 -0.139E+05	0.112E+03 0.435E+03
26	91.31 132.15	0.232E+00 -0.300E+01	-0.253E+01 -0.712E+00	-0.332E+04 -0.361E+04	-0.243E+05 -0.140E+05	0.296E+02 0.115E+03
27	106.01 127.44	0.315E+00 -0.271E+01	-0.796E+01 -0.227E+01	-0.315E+04 -0.363E+04	-0.239E+05 -0.141E+05	-0.611E+02 -0.237E+03
28	120.46 122.05	0.403E+00 -0.245E+01	-0.630E+01 -0.179E+01	-0.213E+04 -0.366E+04	-0.208E+05 -0.142E+05	-0.124E+03 -0.481E+03
29	134.64 115.97	0.497E+00 -0.220E+01	-0.221E+02 -0.629E+01	0.125E+03 -0.372E+04	-0.148E+05 -0.145E+05	-0.799E+02 -0.310E+03

30	148.51	0.603E+00	-0.142E+02	-0.130E+03	-0.152E+05	0.219E+02
	109.22	-0.197E+01	-0.403E+01	-0.380E+04	-0.148E+05	0.852E+02
31	162.05	0.718E+00	-0.154E+02	-0.964E+03	-0.180E+05	0.687E+02
	101.82	-0.174E+01	-0.440E+01	-0.387E+04	-0.150E+05	0.267E+03
32	175.22	0.840E+00	-0.156E+02	-0.260E+04	-0.234E+05	0.123E+03
	93.78	-0.152E+01	-0.454E+01	-0.394E+04	-0.153E+05	0.478E+03
33	187.99	0.961E+00	-0.191E+02	-0.505E+04	-0.313E+05	0.202E+03
	85.12	-0.132E+01	-0.567E+01	-0.403E+04	-0.156E+05	0.786E+03
34	200.33	0.107E+01	-0.344E+02	-0.905E+04	-0.440E+05	0.236E+03
	75.87	-0.117E+01	-0.953E+01	-0.417E+04	-0.162E+05	0.918E+03
35	211.66	0.115E+01	-0.477E+02	-0.126E+05	-0.440E+05	0.114E+03
	64.62	-0.107E+01	0.466E+01	-0.423E+04	-0.165E+05	0.441E+03
36	220.13	0.116E+01	-0.481E+02	-0.127E+05	-0.440E+05	-0.747E+02
	51.09	-0.106E+01	0.148E+02	-0.408E+04	-0.159E+05	-0.290E+03
37	225.31	0.107E+01	-0.284E+02	-0.998E+04	-0.440E+05	-0.185E+03
	35.99	-0.108E+01	0.994E+01	-0.386E+04	-0.150E+05	-0.720E+03
38	228.76	0.874E+00	-0.516E+01	-0.587E+04	-0.328E+05	-0.259E+03
	18.07	-0.111E+01	0.163E+01	-0.374E+04	-0.145E+05	-0.101E+04
39	231.30	0.617E+00	0.181E+02	-0.990E-10	-0.144E+05	-0.353E+03
	0.00	-0.113E+01	-0.668E+01	-0.370E+04	-0.144E+05	-0.137E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.44271E-03	-0.44271E-03	.32064	0.00000
2	-0.10123E-02	0.11717E-03	.73321	0.00000
3	-0.14201E-02	0.49528E-03	1.0285	0.02056
4	-0.18313E-02	0.77456E-03	1.3264	0.17294
5	-0.18980E-02	0.77429E-03	1.3747	0.19357
6	-0.14136E-02	0.40022E-03	1.0239	0.01816
7	-0.10302E-02	0.54079E-04	.74616	0.00000
8	-0.82664E-03	-0.12812E-03	.59871	0.00000
9	-0.70203E-03	-0.23504E-03	.50847	0.00000
10	-0.65312E-03	-0.26816E-03	.47304	0.00000
11	-0.63878E-03	-0.26192E-03	.46265	0.00000
12	-0.96500E-03	0.76915E-04	.69893	0.00000
13	-0.10216E-02	0.13483E-03	.73993	0.00000
14	-0.73839E-03	-0.14496E-03	.53480	0.00000
15	-0.18790E-03	-0.68576E-03	.49668	0.00000
16	0.33205E-03	-0.11880E-02	.86045	0.00000
17	0.75668E-03	-0.16175E-02	1.1715	0.09975
18	0.10961E-02	-0.20620E-02	1.4935	0.21574
19	0.12541E-02	-0.22937E-02	1.6613	0.25734
20	0.11017E-02	-0.20550E-02	1.4884	0.21362
21	0.71697E-03	-0.15572E-02	1.1278	0.07760
22	0.35863E-03	-0.11988E-02	.86826	0.00000
23	-0.80503E-06	-0.85166E-03	.61683	0.00000
24	-0.31803E-03	-0.54520E-03	.39488	0.00000
25	-0.56964E-03	-0.30411E-03	.41258	0.00000
26	-0.76408E-03	-0.11661E-03	.55340	0.00000
27	-0.74993E-03	-0.13627E-03	.54315	0.00000
28	-0.65392E-03	-0.23894E-03	.47362	0.00000
29	-0.44129E-03	-0.46570E-03	.33730	0.00000
30	-0.47579E-03	-0.45042E-03	.34460	0.00000
31	-0.56537E-03	-0.37737E-03	.40948	0.00000
32	-0.73410E-03	-0.22672E-03	.53169	0.00000

33	-0.98317E-03	0.10877E-05	.71209	0.00000
34	-0.13914E-02	0.37506E-03	1.0078	0.00608
35	-0.18802E-02	0.75262E-03	1.3618	0.18972
36	-0.18674E-02	0.78197E-03	1.3525	0.18372
37	-0.14480E-02	0.50459E-03	1.0487	0.03445
38	-0.10290E-02	0.11710E-03	.74529	0.00000
39	-0.45090E-03	-0.45090E-03	.32657	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.35627	0.00000	0.12693
2	-0.36019	-0.32650	0.45624
3	-0.37179	-0.55313	0.69136
4	-0.39386	-0.70732	0.86245
5	-0.41184	-0.71593	0.88554
6	-0.40753	-0.52398	0.69007
7	-0.39277	-0.31343	0.46771
8	-0.38417	-0.20192	0.34951
9	-0.37705	-0.13499	0.27716
10	-0.37070	-0.11128	0.24870
11	-0.36242	-0.10894	0.24028
12	-0.35734	-0.30118	0.42888
13	-0.35682	-0.33429	0.46161
14	-0.35544	-0.17154	0.29788
15	-0.35154	0.14392	0.26749
16	-0.34442	0.43940	0.55802
17	-0.33688	0.67015	0.78363
18	-0.32954	0.82041	0.92901
19	-0.32376	0.88228	0.98709
20	-0.32564	0.82180	0.92784
21	-0.33256	0.64785	0.75845
22	-0.33806	0.45020	0.56449
23	-0.34301	0.24595	0.36361
24	-0.34735	0.06567	0.18632
25	-0.35158	-0.07676	0.20036
26	-0.35437	-0.18716	0.31274
27	-0.35659	-0.17739	0.30454
28	-0.35927	-0.11996	0.24903
29	-0.36495	0.00706	0.14025
30	-0.37268	-0.00733	0.14623
31	-0.37933	-0.05435	0.19824
32	-0.38661	-0.14667	0.29613
33	-0.39517	-0.28452	0.44067
34	-0.40894	-0.51060	0.67783
35	-0.41557	-0.70881	0.88151
36	-0.40078	-0.71386	0.87448
37	-0.37865	-0.56294	0.70632
38	-0.36693	-0.33130	0.46594
39	-0.36286	0.00000	0.13167

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	35	16456.	30800.	0.534
BUCKLING THRUST (psi)	35	16456.	49258.	0.334
SEAM THRUST (psi)	35	16456.	21914.	0.751
PLASTIC-PENETRATE (%)	19	25.73	90.00	0.286
COMBINED T&M Ratio	19	0.987	1.000	0.987

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.65
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.33
HANDLING FACTOR RATIO = $(\text{SPAN}^2/\text{EI})/\text{FF}$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR TYPE 3 TRUCK

Y<sub>0</sub>=1.5, YDL= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) T <sub>DLac</sub> factored from CANDE	Thrust (DL) T <sub>DLs</sub> unfactored TDLfac/1.575 kips/ft.	Thrust (DL+LL) T <sub>DL+LLac</sub> factored from CANDE	Thrust (LL) T <sub>LLs</sub> unfactored (T <sub>DL+LL</sub> -T <sub>DLac</sub> )/1.75	Thrust Load Rating OPR (T <sub>DL+LL</sub> -T <sub>DLac</sub> )/T <sub>LLs</sub> *1.45
		Load Step 21 kips/ft.		Load Step 23 kips/ft.		
-231.304	0	-31.95	-20.28	-36.31	2.49	10.48
-228.758	18.07	-32.57	-20.68	-36.93	2.49	10.35
-225.306	35.988	-33.73	-21.42	-38.22	2.56	9.74
-220.131	51.091	-34.93	-22.18	-40.31	3.08	7.87
-211.657	64.621	-34.40	-21.84	-40.92	3.73	6.59
-200.328	75.871	-32.67	-20.74	-39.42	3.86	6.65
-187.985	85.125	-31.40	-19.94	-37.94	3.74	7.09
-175.215	93.781	-30.62	-19.44	-37.07	3.68	7.33
-162.047	101.819	-29.91	-18.99	-36.29	3.64	7.54
-148.512	109.22	-29.27	-18.59	-35.57	3.60	7.76
-134.639	115.968	-28.85	-18.31	-34.97	3.50	8.05
-120.46	122.048	-28.70	-18.22	-34.69	3.42	8.26
-106.008	127.445	-28.32	-17.98	-34.38	3.46	8.25
-91.315	132.148	-27.77	-17.63	-33.93	3.52	8.20
-76.415	136.145	-27.38	-17.38	-33.51	3.50	8.32
-61.341	139.428	-26.98	-17.13	-32.94	3.41	8.63
-46.128	141.99	-26.60	-16.89	-32.37	3.30	8.99
-30.81	143.823	-26.25	-16.67	-31.83	3.19	9.37
-15.423	144.925	-25.91	-16.45	-31.30	3.08	9.77
0	145.293	-25.71	-16.33	-31.25	3.16	9.56
15.423	144.925	-25.86	-16.42	-31.71	3.34	9.03
30.81	143.823	-26.20	-16.64	-32.17	3.41	8.77
46.128	141.99	-26.55	-16.86	-32.62	3.47	8.57
61.341	139.428	-26.93	-17.10	-33.06	3.50	8.40
76.415	136.145	-27.33	-17.35	-33.51	3.54	8.25
91.315	132.148	-27.73	-17.61	-33.93	3.54	8.17
106.008	127.445	-28.23	-17.92	-34.38	3.52	8.13
120.46	122.048	-28.56	-18.14	-34.74	3.53	8.04
134.639	115.968	-28.84	-18.31	-35.15	3.61	7.82
148.512	109.22	-29.34	-18.63	-35.80	3.69	7.55
162.047	101.819	-29.94	-19.01	-36.49	3.75	7.33
175.215	93.781	-30.61	-19.44	-37.27	3.80	7.11
187.985	85.125	-31.37	-19.92	-38.14	3.86	6.86
200.328	75.871	-32.61	-20.71	-39.57	3.97	6.47
211.657	64.621	-34.41	-21.85	-41.18	3.87	6.34
220.131	51.091	-35.04	-22.25	-40.82	3.30	7.30
225.306	35.988	-33.86	-21.50	-38.82	2.83	8.79
228.758	18.07	-32.69	-20.76	-37.49	2.74	9.35
231.304	0	-32.06	-20.35	-36.86	2.75	9.50

Thrust Load Rating=

6.34

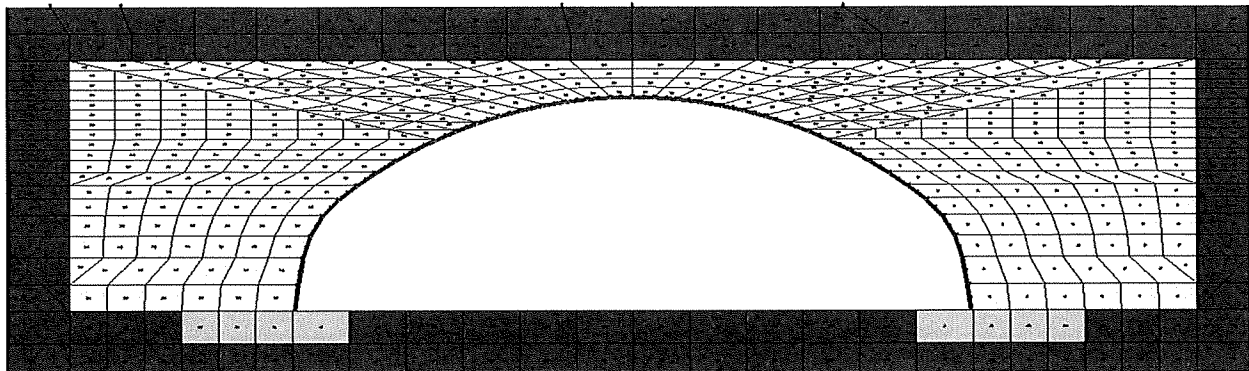
BEAM OUTPUT FOR TYPE 3 TRUCK

Y<sub>0</sub>=1.5, YDI= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DL</sub> /ft. factored from CANDE	Moment (DL) M <sub>DL</sub> unfactored M <sub>DL</sub> /ft./1.575	Moment (DL+LL) M <sub>DL+LL</sub> factored from CANDE	Moment (LL) M <sub>LL</sub> unfactored (M <sub>DL+LL</sub> -M <sub>DL</sub> )/1.75	Moment Load Rating OPR (M <sub>DL+LL</sub> -M <sub>DL</sub> )/1.45
		kips-ft/ft.		kips-ft/ft.		
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-3.78	0.42	24.28
-225.306	35.988	-6.32	-4.02	-7.30	0.56	14.55
-220.131	51.091	-8.36	-5.31	-9.68	0.76	8.96
-211.657	64.621	-8.32	-5.28	-9.79	0.84	8.08
-200.328	75.871	-5.60	-3.55	-7.00	0.80	10.70
-187.985	85.125	-2.10	-1.34	-3.48	0.78	13.86
-175.215	93.781	0.19	0.12	-1.22	0.81	15.05
-162.047	101.819	1.40	0.89	0.05	0.78	14.61
-148.512	109.22	1.55	0.98	0.30	0.71	15.75
-134.639	115.968	0.77	0.49	-0.34	0.64	18.47
-120.46	122.048	0.53	0.34	-1.28	1.03	11.52
-106.008	127.445	2.01	1.27	-0.01	1.15	9.49
-91.315	132.148	2.10	1.33	0.84	0.72	15.05
-76.415	136.145	2.25	1.43	2.68	0.25	43.92
-61.341	139.428	2.26	1.43	4.26	1.14	9.41
-46.128	141.99	2.17	1.38	5.45	1.87	5.78
-30.81	143.823	2.06	1.31	6.17	2.35	4.64
-15.423	144.925	2.02	1.28	6.49	2.55	4.28
0	145.293	2.03	1.29	6.16	2.36	4.63
15.423	144.925	2.09	1.33	5.24	1.80	6.04
30.81	143.823	2.19	1.39	4.20	1.15	9.42
46.128	141.99	2.37	1.50	3.20	0.48	22.50
61.341	139.428	2.52	1.60	2.33	0.11	97.09
76.415	136.145	2.56	1.63	1.57	0.57	18.67
91.315	132.148	2.48	1.57	0.89	0.91	11.70
106.008	127.445	2.26	1.44	0.72	0.88	12.19
120.46	122.048	1.31	0.83	0.24	0.61	18.61
134.639	115.968	1.69	1.07	1.12	0.32	34.39
148.512	109.22	1.78	1.13	1.13	0.37	29.75
162.047	101.819	1.26	0.80	0.84	0.44	26.07
175.215	93.781	-0.15	-0.10	-1.06	0.52	23.43
187.985	85.125	-2.51	-1.60	-3.55	0.59	17.97
200.328	75.871	-5.97	-3.79	-7.22	0.72	11.64
211.657	64.621	-8.57	-5.44	-10.03	0.83	7.95
220.131	51.091	-8.54	-5.42	-9.94	0.80	8.30
225.306	35.988	-6.43	-4.08	-7.48	0.60	13.38
228.758	18.07	-3.09	-1.96	-3.86	0.44	23.29
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating=  
Actual Load Rating (from CANDE)

4.28  
3.05



## TYPE 3S2

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage TYPE 3S2

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08

POISSONS RATIO OF METAL (-) ..... 0.30000E+00

YIELD STRESS OF METAL (PSI)..... 0.44000E+05

LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05

DENSITY OF METAL (PCI)..... 0.28400E+00

MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
 COMBINED MOMENT-THRUST CRITERION... 0.90000

## BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -72.78	F = 0.000
1181	23	F = 0.000	F = -72.78	F = 0.000
1180	22	F = 0.000	F = -72.78	F = 0.000
1180	23	F = 0.000	F = -72.78	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000



911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1185	22	F =	0.000	F =	-43.67	F =	0.000
1185	23	F =	0.000	F =	-43.67	F =	0.000
1172	22	F =	0.000	F =	-60.00	F =	0.000
1172	23	F =	0.000	F =	-60.00	F =	0.000
1173	22	F =	0.000	F =	-60.00	F =	0.000
1173	23	F =	0.000	F =	-60.00	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FORWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000

4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.463E+00 -0.107E+01	0.702E+01 0.328E+01	-0.418E-11 -0.308E+04	-0.120E+05 -0.120E+05	0.189E+03 0.734E+03
2	-228.76	-0.624E+00	-0.868E+01	-0.351E+04	-0.231E+05	0.190E+03

	18.07	-0.105E+01	-0.261E+01	-0.313E+04	-0.122E+05	0.738E+03
3	-225.31 35.99	-0.747E+00 -0.104E+01	-0.244E+02 -0.850E+01	-0.703E+04 -0.325E+04	-0.345E+05 -0.126E+05	0.172E+03 0.667E+03
4	-220.13 51.09	-0.795E+00 -0.103E+01	-0.400E+02 -0.815E+01	-0.951E+04 -0.341E+04	-0.428E+05 -0.132E+05	0.822E+02 0.319E+03
5	-211.66 64.62	-0.777E+00 -0.105E+01	-0.378E+02 0.518E+01	-0.971E+04 -0.343E+04	-0.435E+05 -0.133E+05	-0.801E+02 -0.311E+03
6	-200.33 75.87	-0.710E+00 -0.112E+01	-0.254E+02 0.904E+01	-0.698E+04 -0.329E+04	-0.345E+05 -0.128E+05	-0.200E+03 -0.775E+03
7	-187.99 85.12	-0.625E+00 -0.125E+01	-0.151E+02 0.448E+01	-0.345E+04 -0.317E+04	-0.230E+05 -0.123E+05	-0.186E+03 -0.724E+03
8	-175.22 93.78	-0.530E+00 -0.140E+01	-0.138E+02 0.399E+01	-0.118E+04 -0.310E+04	-0.157E+05 -0.120E+05	-0.112E+03 -0.435E+03
9	-162.05 101.82	-0.437E+00 -0.157E+01	-0.137E+02 0.393E+01	0.828E+02 -0.303E+04	-0.120E+05 -0.118E+05	-0.452E+02 -0.176E+03
10	-148.51 109.22	-0.352E+00 -0.174E+01	-0.129E+02 0.370E+01	0.318E+03 -0.297E+04	-0.125E+05 -0.115E+05	0.180E+02 0.700E+02
11	-134.64 115.97	-0.275E+00 -0.191E+01	-0.103E+02 0.296E+01	-0.336E+03 -0.292E+04	-0.124E+05 -0.114E+05	0.574E+02 0.223E+03
12	-120.46 122.05	-0.206E+00 -0.209E+01	0.301E+00 0.127E+00	-0.129E+04 -0.290E+04	-0.153E+05 -0.113E+05	-0.328E+01 -0.128E+02
13	-106.01 127.44	-0.143E+00 -0.228E+01	-0.106E+02 0.304E+01	-0.389E+02 -0.287E+04	-0.113E+05 -0.112E+05	-0.601E+02 -0.234E+03
14	-91.31 132.15	-0.880E-01 -0.247E+01	-0.455E+01 0.127E+01	0.800E+03 -0.283E+04	-0.135E+05 -0.110E+05	-0.780E+02 -0.303E+03
15	-76.42 136.15	-0.444E-01 -0.266E+01	-0.962E+01 0.272E+01	0.264E+04 -0.280E+04	-0.191E+05 -0.109E+05	-0.102E+03 -0.396E+03
16	-61.34 139.43	-0.137E-01 -0.283E+01	-0.999E+01 0.284E+01	0.422E+04 -0.275E+04	-0.238E+05 -0.107E+05	-0.817E+02 -0.317E+03
17	-46.13 141.99	0.397E-02 -0.297E+01	-0.101E+02 0.286E+01	0.541E+04 -0.270E+04	-0.273E+05 -0.105E+05	-0.560E+02 -0.217E+03
18	-30.81 143.82	0.105E-01 -0.307E+01	-0.967E+01 0.275E+01	0.614E+04 -0.266E+04	-0.294E+05 -0.103E+05	-0.305E+02 -0.119E+03
19	-15.42 144.93	0.933E-02 -0.312E+01	-0.105E+02 0.285E+01	0.646E+04 -0.262E+04	-0.303E+05 -0.102E+05	0.765E+00 0.297E+01
20	0.00 145.29	0.457E-02 -0.313E+01	-0.103E+02 -0.219E+01	0.614E+04 -0.261E+04	-0.292E+05 -0.101E+05	0.378E+02 0.147E+03
21	15.42 144.93	0.546E-03 -0.308E+01	-0.842E+01 -0.240E+01	0.523E+04 -0.265E+04	-0.265E+05 -0.103E+05	0.579E+02 0.225E+03
22	30.81 143.82	0.110E-02 -0.300E+01	-0.792E+01 -0.224E+01	0.421E+04 -0.269E+04	-0.235E+05 -0.104E+05	0.581E+02 0.226E+03

23	46.13 141.99	0.906E-02 -0.289E+01	-0.777E+01 -0.220E+01	0.324E+04 -0.272E+04	-0.206E+05 -0.106E+05	0.513E+02 0.199E+03
24	61.34 139.43	0.263E-01 -0.275E+01	-0.802E+01 -0.228E+01	0.239E+04 -0.276E+04	-0.182E+05 -0.107E+05	0.435E+02 0.169E+03
25	76.42 136.15	0.536E-01 -0.260E+01	-0.836E+01 -0.238E+01	0.165E+04 -0.280E+04	-0.160E+05 -0.109E+05	0.386E+02 0.150E+03
26	91.31 132.15	0.914E-01 -0.244E+01	-0.708E+01 -0.201E+01	0.963E+03 -0.284E+04	-0.140E+05 -0.110E+05	0.245E+02 0.952E+02
27	106.01 127.44	0.139E+00 -0.227E+01	-0.100E+02 -0.287E+01	0.678E+03 -0.287E+04	-0.133E+05 -0.112E+05	0.214E+02 0.833E+02
28	120.46 122.05	0.197E+00 -0.209E+01	-0.281E+01 -0.783E+00	0.121E+03 -0.290E+04	-0.117E+05 -0.113E+05	-0.162E+02 -0.629E+02
29	134.64 115.97	0.263E+00 -0.192E+01	-0.130E+02 -0.371E+01	0.103E+04 -0.294E+04	-0.146E+05 -0.114E+05	-0.326E+02 -0.127E+03
30	148.51 109.22	0.341E+00 -0.175E+01	-0.118E+02 -0.335E+01	0.997E+03 -0.299E+04	-0.147E+05 -0.116E+05	0.178E+02 0.693E+02
31	162.05 101.82	0.429E+00 -0.157E+01	-0.131E+02 -0.375E+01	0.363E+03 -0.305E+04	-0.130E+05 -0.118E+05	0.665E+02 0.259E+03
32	175.22 93.78	0.527E+00 -0.140E+01	-0.134E+02 -0.389E+01	-0.115E+04 -0.311E+04	-0.157E+05 -0.121E+05	0.125E+03 0.487E+03
33	187.99 85.12	0.628E+00 -0.123E+01	-0.149E+02 -0.443E+01	-0.357E+04 -0.319E+04	-0.235E+05 -0.124E+05	0.195E+03 0.757E+03
34	200.33 75.87	0.719E+00 -0.110E+01	-0.252E+02 -0.781E+01	-0.721E+04 -0.330E+04	-0.352E+05 -0.128E+05	0.204E+03 0.794E+03
35	211.66 64.62	0.791E+00 -0.102E+01	-0.379E+02 -0.485E+01	-0.100E+05 -0.343E+04	-0.440E+05 -0.133E+05	0.845E+02 0.328E+03
36	220.13 51.09	0.814E+00 -0.997E+00	-0.395E+02 0.974E+01	-0.990E+04 -0.339E+04	-0.439E+05 -0.132E+05	-0.783E+02 -0.304E+03
37	225.31 35.99	0.768E+00 -0.101E+01	-0.237E+02 0.829E+01	-0.745E+04 -0.322E+04	-0.357E+05 -0.125E+05	-0.173E+03 -0.672E+03
38	228.76 18.07	0.644E+00 -0.102E+01	-0.788E+01 0.238E+01	-0.384E+04 -0.311E+04	-0.240E+05 -0.121E+05	-0.201E+03 -0.781E+03
39	231.30 0.00	0.478E+00 -0.104E+01	0.798E+01 -0.354E+01	-0.180E-10 -0.306E+04	-0.119E+05 -0.119E+05	-0.213E+03 -0.829E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.37545E-03	-0.37545E-03	.27193	0.00000
2	-0.72483E-03	-0.39701E-04	.52498	0.00000
3	-0.10821E-02	0.28995E-03	.78374	0.00000
4	-0.13436E-02	0.51254E-03	.97317	0.00000

5	-0.13658E-02	0.52903E-03	.98920	0.00000
6	-0.10824E-02	0.27894E-03	.78396	0.00000
7	-0.72307E-03	-0.50051E-04	.52370	0.00000
8	-0.49320E-03	-0.26209E-03	.35722	0.00000
9	-0.36159E-03	-0.37774E-03	.27359	0.00000
10	-0.33129E-03	-0.39338E-03	.28492	0.00000
11	-0.38903E-03	-0.32342E-03	.28176	0.00000
12	-0.47940E-03	-0.22746E-03	.34722	0.00000
13	-0.35401E-03	-0.34643E-03	.25640	0.00000
14	-0.26766E-03	-0.42379E-03	.30694	0.00000
15	-0.84022E-04	-0.59880E-03	.43370	0.00000
16	0.76230E-04	-0.74747E-03	.54138	0.00000
17	0.19786E-03	-0.85754E-03	.62110	0.00000
18	0.27477E-03	-0.92336E-03	.66876	0.00000
19	0.31151E-03	-0.94938E-03	.68761	0.00000
20	0.28049E-03	-0.91733E-03	.66440	0.00000
21	0.18705E-03	-0.83309E-03	.60339	0.00000
22	0.82820E-04	-0.73828E-03	.53472	0.00000
23	-0.16646E-04	-0.64785E-03	.46922	0.00000
24	-0.10362E-03	-0.56991E-03	.41277	0.00000
25	-0.18075E-03	-0.50208E-03	.36364	0.00000
26	-0.25186E-03	-0.43966E-03	.31844	0.00000
27	-0.28438E-03	-0.41667E-03	.30178	0.00000
28	-0.34226E-03	-0.36578E-03	.26493	0.00000
29	-0.25803E-03	-0.45830E-03	.33193	0.00000
30	-0.26757E-03	-0.46208E-03	.33467	0.00000
31	-0.33640E-03	-0.40723E-03	.29495	0.00000
32	-0.49194E-03	-0.26732E-03	.35630	0.00000
33	-0.73708E-03	-0.39838E-04	.53385	0.00000
34	-0.11056E-02	0.30063E-03	.80073	0.00000
35	-0.13930E-02	0.55755E-03	1.0089	0.00633
36	-0.13783E-02	0.55210E-03	.99829	0.00000
37	-0.11190E-02	0.33430E-03	.81045	0.00000
38	-0.75385E-03	-0.40880E-05	.54599	0.00000
39	-0.37260E-03	-0.37260E-03	.26986	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/ (P-resist)	FACTORED MOMENT-RATIO M/ (M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.30214	0.00000	0.09129
2	-0.30763	-0.19805	0.29268
3	-0.31874	-0.39661	0.49821
4	-0.33442	-0.53656	0.64840
5	-0.33669	-0.54773	0.66108
6	-0.32329	-0.39352	0.49804
7	-0.31108	-0.19455	0.29132
8	-0.30391	-0.06681	0.15917
9	-0.29749	0.00467	0.09317
10	-0.29159	0.01795	0.10297
11	-0.28667	-0.01896	0.10115
12	-0.28442	-0.07283	0.15372
13	-0.28184	-0.00219	0.08162
14	-0.27822	0.04513	0.12254
15	-0.27475	0.14881	0.22429
16	-0.27009	0.23811	0.31105
17	-0.26544	0.30508	0.37554
18	-0.26097	0.34634	0.41445
19	-0.25666	0.36448	0.43036
20	-0.25625	0.34625	0.41191
21	-0.25995	0.29489	0.36246
22	-0.26374	0.23735	0.30691
23	-0.26738	0.18246	0.25395
24	-0.27101	0.13479	0.20824
25	-0.27475	0.09288	0.16837
26	-0.27825	0.05429	0.13171
27	-0.28208	0.03824	0.11781
28	-0.28490	0.00680	0.08797
29	-0.28823	0.05789	0.14097
30	-0.29359	0.05622	0.14242
31	-0.29922	0.02047	0.11001
32	-0.30551	-0.06493	0.15827
33	-0.31261	-0.20155	0.29928
34	-0.32389	-0.40649	0.51139
35	-0.33615	-0.56380	0.67680
36	-0.33246	-0.55802	0.66855

37	-0.31574	-0.42009	0.51978
38	-0.30497	-0.21673	0.30974
39	-0.29985	0.00000	0.08991

# ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

## LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	13333.	30800.	0.433
BUCKLING THRUST (psi)	5	13333.	49727.	0.268
SEAM THRUST (psi)	5	13333.	21914.	0.608
PLASTIC-PENETRATE (%)	35	0.63	90.00	0.007
COMBINED T&M Ratio	35	0.677	1.000	0.677

## LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.90
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.18
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*



\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage TYPE 3S2-OPR  
LIVE LOADS X 3.05 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
DENSITY OF METAL (PCI)..... 0.28400E+00  
MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2  
NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4  
IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000  
SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -222.0	F = 0.000
1181	23	F = 0.000	F = -222.0	F = 0.000
1180	22	F = 0.000	F = -222.0	F = 0.000
1180	23	F = 0.000	F = -222.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000

855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1185	22	F =	0.000	F =	-133.2	F =	0.000
1185	23	F =	0.000	F =	-133.2	F =	0.000
1172	22	F =	0.000	F =	-183.2	F =	0.000
1172	23	F =	0.000	F =	-183.2	F =	0.000
1173	22	F =	0.000	F =	-183.2	F =	0.000
1173	23	F =	0.000	F =	-183.2	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14

16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000

FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000

30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.450	Factor for load step #22
23	1.450	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.595E+00 -0.120E+01	0.156E+02 0.612E+01	-0.196E-10 -0.372E+04	-0.145E+05 -0.145E+05	0.267E+03 0.104E+04
2	-228.76 18.07	-0.830E+00 -0.117E+01	-0.782E+01 -0.238E+01	-0.469E+04 -0.377E+04	-0.292E+05 -0.147E+05	0.220E+03 0.856E+03
3	-225.31 35.99	-0.102E+01 -0.115E+01	-0.313E+02 -0.109E+02	-0.848E+04 -0.391E+04	-0.415E+05 -0.152E+05	0.191E+03 0.742E+03
4	-220.13 51.09	-0.110E+01 -0.113E+01	-0.500E+02 -0.153E+02	-0.116E+05 -0.415E+04	-0.440E+05 -0.161E+05	0.109E+03 0.423E+03
5	-211.66 64.62	-0.111E+01 -0.114E+01	-0.478E+02 -0.181E+01	-0.122E+05 -0.429E+04	-0.440E+05 -0.167E+05	-0.769E+02 -0.299E+03
6	-200.33 75.87	-0.104E+01 -0.121E+01	-0.341E+02 0.121E+02	-0.921E+04 -0.419E+04	-0.440E+05 -0.163E+05	-0.208E+03 -0.808E+03
7	-187.99 85.12	-0.946E+00 -0.136E+01	-0.193E+02 0.573E+01	-0.561E+04 -0.403E+04	-0.331E+05 -0.157E+05	-0.176E+03 -0.685E+03
8	-175.22 93.78	-0.833E+00 -0.154E+01	-0.157E+02 0.458E+01	-0.359E+04 -0.394E+04	-0.265E+05 -0.153E+05	-0.949E+02 -0.369E+03

9	-162.05 101.82	-0.714E+00 -0.175E+01	-0.154E+02 0.445E+01	-0.238E+04 -0.387E+04	-0.224E+05 -0.150E+05	-0.396E+02 -0.154E+03
10	-148.51 109.22	-0.596E+00 -0.199E+01	-0.135E+02 0.387E+01	-0.196E+04 -0.380E+04	-0.209E+05 -0.148E+05	0.223E+01 0.868E+01
11	-134.64 115.97	-0.482E+00 -0.224E+01	-0.262E+02 0.751E+01	-0.194E+04 -0.372E+04	-0.205E+05 -0.144E+05	0.131E+03 0.508E+03
12	-120.46 122.05	-0.374E+00 -0.252E+01	0.288E+00 0.789E-01	-0.539E+04 -0.366E+04	-0.310E+05 -0.142E+05	0.156E+03 0.606E+03
13	-106.01 127.44	-0.267E+00 -0.284E+01	0.275E+01 0.873E+00	-0.599E+04 -0.366E+04	-0.328E+05 -0.142E+05	-0.410E+02 -0.160E+03
14	-91.31 132.15	-0.163E+00 -0.320E+01	-0.114E+00 0.630E-02	-0.314E+04 -0.364E+04	-0.239E+05 -0.142E+05	-0.234E+03 -0.911E+03
15	-76.42 136.15	-0.714E-01 -0.359E+01	-0.125E+02 0.344E+01	0.245E+04 -0.361E+04	-0.216E+05 -0.140E+05	-0.309E+03 -0.120E+04
16	-61.34 139.43	-0.186E-02 -0.396E+01	-0.152E+02 0.419E+01	0.769E+04 -0.353E+04	-0.376E+05 -0.137E+05	-0.264E+03 -0.103E+04
17	-46.13 141.99	0.417E-01 -0.428E+01	-0.159E+02 0.438E+01	0.118E+05 -0.346E+04	-0.440E+05 -0.134E+05	-0.189E+03 -0.736E+03
18	-30.81 143.82	0.608E-01 -0.451E+01	-0.160E+02 0.444E+01	0.145E+05 -0.338E+04	-0.440E+05 -0.131E+05	-0.105E+03 -0.407E+03
19	-15.42 144.93	0.619E-01 -0.462E+01	-0.183E+02 0.289E+01	0.156E+05 -0.332E+04	-0.440E+05 -0.129E+05	0.175E+01 0.678E+01
20	0.00 145.29	0.550E-01 -0.459E+01	-0.179E+02 -0.505E+01	0.145E+05 -0.334E+04	-0.440E+05 -0.130E+05	0.123E+03 0.479E+03
21	15.42 144.93	0.513E-01 -0.445E+01	-0.115E+02 -0.315E+01	0.114E+05 -0.341E+04	-0.440E+05 -0.133E+05	0.190E+03 0.739E+03
22	30.81 143.82	0.595E-01 -0.422E+01	-0.106E+02 -0.290E+01	0.789E+04 -0.347E+04	-0.380E+05 -0.135E+05	0.198E+03 0.771E+03
23	46.13 141.99	0.848E-01 -0.393E+01	-0.874E+01 -0.239E+01	0.429E+04 -0.352E+04	-0.270E+05 -0.137E+05	0.182E+03 0.708E+03
24	61.34 139.43	0.129E+00 -0.361E+01	-0.811E+01 -0.225E+01	0.115E+04 -0.356E+04	-0.174E+05 -0.138E+05	0.145E+03 0.562E+03
25	76.42 136.15	0.190E+00 -0.328E+01	-0.888E+01 -0.249E+01	-0.129E+04 -0.360E+04	-0.180E+05 -0.140E+05	0.106E+03 0.413E+03
26	91.31 132.15	0.264E+00 -0.297E+01	-0.414E+01 -0.117E+01	-0.315E+04 -0.364E+04	-0.239E+05 -0.141E+05	0.352E+02 0.137E+03
27	106.01 127.44	0.347E+00 -0.268E+01	-0.747E+01 -0.214E+01	-0.325E+04 -0.366E+04	-0.243E+05 -0.142E+05	-0.481E+02 -0.187E+03
28	120.46 122.05	0.435E+00 -0.241E+01	-0.552E+01 -0.156E+01	-0.237E+04 -0.369E+04	-0.217E+05 -0.143E+05	-0.122E+03 -0.473E+03

29	134.64 115.97	0.530E+00 -0.217E+01	-0.228E+02 -0.650E+01	-0.395E+02 -0.374E+04	-0.147E+05 -0.146E+05	-0.795E+02 -0.309E+03
30	148.51 109.22	0.635E+00 -0.193E+01	-0.138E+02 -0.393E+01	-0.371E+03 -0.382E+04	-0.160E+05 -0.149E+05	0.237E+02 0.920E+02
31	162.05 101.82	0.749E+00 -0.170E+01	-0.151E+02 -0.433E+01	-0.117E+04 -0.389E+04	-0.188E+05 -0.151E+05	0.644E+02 0.250E+03
32	175.22 93.78	0.869E+00 -0.149E+01	-0.157E+02 -0.456E+01	-0.269E+04 -0.396E+04	-0.238E+05 -0.154E+05	0.116E+03 0.451E+03
33	187.99 85.12	0.987E+00 -0.130E+01	-0.197E+02 -0.585E+01	-0.501E+04 -0.405E+04	-0.313E+05 -0.157E+05	0.199E+03 0.774E+03
34	200.33 75.87	0.109E+01 -0.115E+01	-0.347E+02 -0.726E+01	-0.902E+04 -0.418E+04	-0.440E+05 -0.162E+05	0.239E+03 0.928E+03
35	211.66 64.62	0.117E+01 -0.106E+01	-0.469E+02 0.683E+01	-0.126E+05 -0.421E+04	-0.440E+05 -0.164E+05	0.115E+03 0.445E+03
36	220.13 51.09	0.117E+01 -0.104E+01	-0.475E+02 0.146E+02	-0.126E+05 -0.404E+04	-0.440E+05 -0.157E+05	-0.768E+02 -0.299E+03
37	225.31 35.99	0.108E+01 -0.107E+01	-0.283E+02 0.989E+01	-0.992E+04 -0.382E+04	-0.440E+05 -0.148E+05	-0.185E+03 -0.719E+03
38	228.76 18.07	0.882E+00 -0.109E+01	-0.507E+01 0.160E+01	-0.584E+04 -0.370E+04	-0.325E+05 -0.144E+05	-0.257E+03 -0.998E+03
39	231.30 0.00	0.620E+00 -0.112E+01	0.182E+02 -0.670E+01	-0.471E-10 -0.366E+04	-0.142E+05 -0.142E+05	-0.350E+03 -0.136E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.45375E-03	-0.45375E-03	.32864	0.00000
2	-0.91725E-03	-0.32328E-05	.66435	0.00000
3	-0.13036E-02	0.35047E-03	.94418	0.00000
4	-0.16969E-02	0.64192E-03	1.2291	0.13522
5	-0.18214E-02	0.69785E-03	1.3192	0.17492
6	-0.14096E-02	0.38824E-03	1.0209	0.01608
7	-0.10381E-02	0.55886E-04	.75185	0.00000
8	-0.83113E-03	-0.12992E-03	.60197	0.00000
9	-0.70409E-03	-0.23904E-03	.50995	0.00000
10	-0.65500E-03	-0.27212E-03	.47440	0.00000
11	-0.64203E-03	-0.26431E-03	.46501	0.00000
12	-0.97219E-03	0.78577E-04	.70414	0.00000
13	-0.10304E-02	0.13801E-03	.74630	0.00000
14	-0.75034E-03	-0.13871E-03	.54345	0.00000
15	-0.20098E-03	-0.67835E-03	.49132	0.00000
16	0.31922E-03	-0.11808E-02	.85523	0.00000
17	0.74403E-03	-0.16089E-02	1.1653	0.09700
18	0.10843E-02	-0.20526E-02	1.4866	0.21419
19	0.12431E-02	-0.22849E-02	1.6549	0.25628
20	0.10906E-02	-0.20468E-02	1.4824	0.21231
21	0.70497E-03	-0.15497E-02	1.1224	0.07497
22	0.34683E-03	-0.11926E-02	.86374	0.00000
23	-0.10495E-04	-0.84744E-03	.61378	0.00000
24	-0.32181E-03	-0.54679E-03	.39603	0.00000
25	-0.56553E-03	-0.31352E-03	.40960	0.00000
26	-0.75116E-03	-0.13568E-03	.54404	0.00000
27	-0.76376E-03	-0.12931E-03	.55317	0.00000
28	-0.68036E-03	-0.21878E-03	.49277	0.00000
29	-0.46048E-03	-0.45278E-03	.33351	0.00000



30	-0.50256E-03	-0.43012E-03	.36399	0.00000
31	-0.58851E-03	-0.36037E-03	.42624	0.00000
32	-0.74609E-03	-0.22071E-03	.54038	0.00000
33	-0.98331E-03	-0.50485E-05	.71219	0.00000
34	-0.13896E-02	0.37098E-03	1.0065	0.00507
35	-0.18812E-02	0.75984E-03	1.3625	0.18952
36	-0.18552E-02	0.78410E-03	1.3437	0.17979
37	-0.14362E-02	0.50342E-03	1.0402	0.02862
38	-0.10211E-02	0.11885E-03	.73956	0.00000
39	-0.44615E-03	-0.44615E-03	.32314	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.36516	0.00000	0.13334
2	-0.37038	-0.26421	0.40140
3	-0.38352	-0.47814	0.62524
4	-0.40730	-0.65313	0.81903
5	-0.42106	-0.68714	0.86443
6	-0.41079	-0.51944	0.68818
7	-0.39521	-0.31623	0.47242
8	-0.38670	-0.20270	0.35224
9	-0.37949	-0.13443	0.27844
10	-0.37305	-0.11068	0.24984
11	-0.36469	-0.10919	0.24219
12	-0.35957	-0.30374	0.43303
13	-0.35908	-0.33775	0.46669
14	-0.35773	-0.17680	0.30478
15	-0.35382	0.13799	0.26318
16	-0.34668	0.43361	0.55380
17	-0.33911	0.66505	0.78004
18	-0.33173	0.81632	0.92636
19	-0.32593	0.87870	0.98493
20	-0.32785	0.81799	0.92548
21	-0.33480	0.64296	0.75506
22	-0.34030	0.44499	0.56079
23	-0.34521	0.24193	0.36110
24	-0.34950	0.06504	0.18719
25	-0.35370	-0.07285	0.19796
26	-0.35684	-0.17791	0.30525
27	-0.35935	-0.18340	0.31253
28	-0.36179	-0.13343	0.26432
29	-0.36747	-0.00223	0.13726
30	-0.37529	-0.02094	0.16178
31	-0.38181	-0.06595	0.21172
32	-0.38902	-0.15187	0.30321
33	-0.39769	-0.28278	0.44094
34	-0.40986	-0.50891	0.67689
35	-0.41305	-0.71054	0.88115
36	-0.39667	-0.71275	0.87009
37	-0.37469	-0.55965	0.70004
38	-0.36304	-0.32952	0.46132
39	-0.35904	0.00000	0.12891

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	16674.	30800.	0.541
BUCKLING THRUST (psi)	5	16674.	48773.	0.342
SEAM THRUST (psi)	5	16674.	21914.	0.761
PLASTIC-PENETRATE (%)	19	25.63	90.00	0.285
COMBINED T&M Ratio	19	0.985	1.000	0.985

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.64
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.33
HANDLING FACTOR RATIO = $(\text{SPAN}^2/EI)/FF$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR TYPE 352 TRUCK

Y<sub>D1</sub>=1.5, Y<sub>D1</sub>= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) Tot <sub>tec</sub>		Thrust (DL) Tot <sub>ts</sub>		Thrust (DL+LL) Tot <sub>LLtec</sub>		Thrust (LL) Tot <sub>ts</sub>		Thrust Load Rating	
		factored from CANDE		unfactored		factored from CANDE		unfactored		OPR	
		Load Step 21		TDI <sub>fac</sub> /1.575		Load Step 23		(Tot <sub>LLtec</sub> -Tot <sub>LLts</sub> )/1.75		(Tot <sub>LLtec</sub> -Tot <sub>LLts</sub> )/Tot <sub>LLts</sub> *1.45	
		Kips/ft.		Kips/ft.		Kips/ft.					
-231.304	0	-31.95	-20.28	-36.94	2.86			2.86		9.16	
-228.758	18.07	-32.58	-20.68	-37.61	2.88			2.88		8.94	
-225.306	35.988	-33.73	-21.42	-38.97	2.99			2.99		8.34	
-220.131	51.091	-34.93	-22.18	-40.89	3.41			3.41		7.10	
-211.657	64.621	-34.40	-21.84	-41.17	3.87			3.87		6.34	
-200.328	75.871	-32.66	-20.74	-39.53	3.92			3.92		6.54	
-187.985	85.125	-31.40	-19.93	-38.04	3.79			3.79		6.99	
-175.215	93.781	-30.61	-19.44	-37.16	3.74			3.74		7.22	
-162.047	101.819	-29.90	-18.99	-36.37	3.70			3.70		7.44	
-148.512	109.22	-29.27	-18.58	-35.65	3.65			3.65		7.65	
-134.639	115.968	-28.84	-18.31	-35.05	3.55			3.55		7.94	
-120.46	122.048	-28.69	-18.22	-34.78	3.47			3.47		8.14	
-106.008	127.445	-28.31	-17.98	-34.46	3.51			3.51		8.13	
-91.315	132.148	-27.76	-17.63	-34.02	3.57			3.57		8.08	
-76.415	136.145	-27.37	-17.38	-33.59	3.55			3.55		8.20	
-61.341	139.428	-26.97	-17.13	-33.02	3.46			3.46		8.51	
-46.128	141.99	-26.59	-16.89	-32.45	3.35			3.35		8.86	
-30.81	143.823	-26.24	-16.66	-31.91	3.24			3.24		9.23	
-15.423	144.925	-25.90	-16.45	-31.38	3.13			3.13		9.62	
0	145.293	-25.71	-16.32	-31.33	3.21			3.21		9.41	
15.423	144.925	-25.86	-16.42	-31.78	3.39			3.39		8.90	
30.81	143.823	-26.20	-16.63	-32.25	3.46			3.46		8.65	
46.128	141.99	-26.55	-16.86	-32.69	3.51			3.51		8.46	
61.341	139.428	-26.92	-17.09	-33.14	3.55			3.55		8.30	
76.415	136.145	-27.32	-17.35	-33.59	3.58			3.58		8.14	
91.315	132.148	-27.73	-17.60	-34.02	3.60			3.60		8.04	
106.008	127.445	-28.22	-17.92	-34.49	3.58			3.58		7.98	
120.46	122.048	-28.56	-18.13	-34.83	3.59			3.59		7.91	
134.639	115.968	-28.83	-18.31	-35.24	3.66			3.66		7.70	
148.512	109.22	-29.33	-18.62	-35.90	3.75			3.75		7.43	
162.047	101.819	-29.93	-19.00	-36.59	3.80			3.80		7.22	
175.215	93.781	-30.61	-19.43	-37.35	3.86			3.86		7.01	
187.985	85.125	-31.37	-19.92	-38.22	3.92			3.92		6.77	
200.328	75.871	-32.61	-20.70	-39.60	4.00			4.00		6.43	
211.657	64.621	-34.40	-21.84	-41.10	3.83			3.83		6.41	
220.131	51.091	-35.04	-22.25	-40.65	3.21			3.21		7.52	
225.306	35.988	-33.86	-21.50	-38.60	2.71			2.71		9.17	
228.758	18.07	-32.69	-20.75	-37.29	2.63			2.63		9.76	
231.304	0	-32.05	-20.35	-36.66	2.63			2.63		9.90	

Thrust Load Rating=

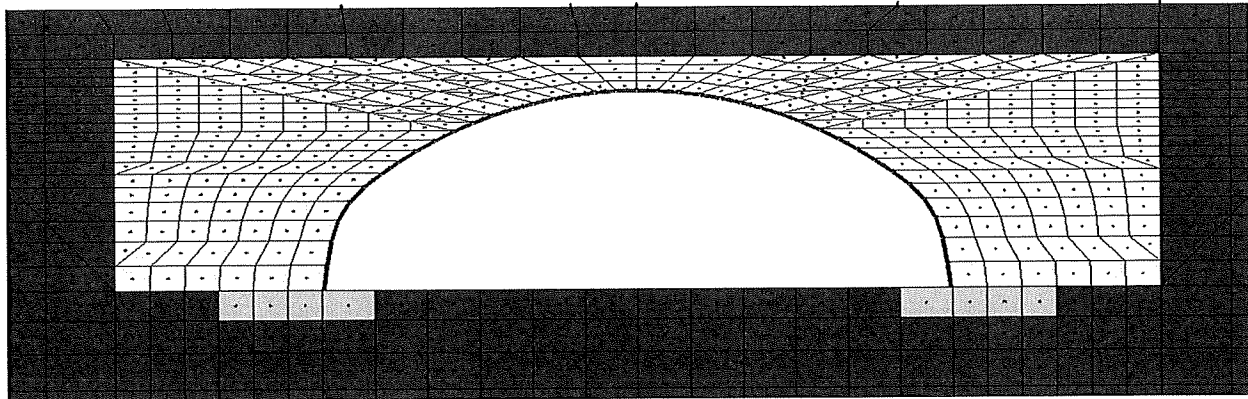
6.34

BEAM OUTPUT FOR TYPE 3S2 TRUCK

Y<sub>0</sub>=1.5, YDL= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DL</sub> factored from CANDE Load Step 21 Kips-ft/ft.	Moment (DL) M <sub>DL</sub> unfactored M <sub>DL</sub> /1.575	Moment (DL+LL) M <sub>DL+LL</sub> factored from CANDE Load Step 23 Kips-ft/ft.	Moment (LL) M <sub>LL</sub> unfactored (M <sub>DL+LL</sub> -M <sub>DL</sub> )/1.75	Moment Load Rating OPR (M <sub>Cap</sub> -M <sub>DL</sub> *1.5)/M <sub>LL</sub> *1.45
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-3.51	0.27	37.78
-225.306	35.988	-6.33	-4.02	-7.03	0.40	20.04
-220.131	51.091	-8.36	-5.31	-9.51	0.66	10.24
-211.657	64.621	-8.32	-5.28	-9.71	0.80	8.51
-200.328	75.871	-5.60	-3.55	-6.98	0.79	10.88
-187.985	85.125	-2.10	-1.33	-3.45	0.77	14.12
-175.215	93.781	0.19	0.12	-1.18	0.79	15.43
-162.047	101.819	1.41	0.89	0.08	0.76	15.00
-148.512	109.22	1.55	0.98	0.32	0.70	16.01
-134.639	115.968	0.77	0.49	-0.34	0.63	18.56
-120.46	122.048	0.53	0.34	-1.29	1.04	11.43
-106.008	127.445	2.01	1.28	-0.04	1.17	9.34
-91.315	132.148	2.11	1.34	0.80	0.75	14.57
-76.415	136.145	2.25	1.43	2.64	0.22	48.74
-61.341	139.428	2.26	1.44	4.22	1.12	9.61
-46.128	141.99	2.17	1.38	5.41	1.85	5.85
-30.81	143.823	2.06	1.31	6.14	2.33	4.68
-15.423	144.925	2.02	1.28	6.46	2.54	4.31
0	145.293	2.03	1.29	6.14	2.35	4.65
15.423	144.925	2.09	1.32	5.23	1.80	6.06
30.81	143.823	2.19	1.39	4.21	1.15	9.37
46.128	141.99	2.36	1.50	3.24	0.50	21.50
61.341	139.428	2.51	1.59	2.39	0.07	152.90
76.415	136.145	2.55	1.62	1.65	0.52	20.50
91.315	132.148	2.46	1.56	0.96	0.86	12.41
106.008	127.445	2.25	1.43	0.68	0.90	11.97
120.46	122.048	1.31	0.83	0.12	0.68	16.80
134.639	115.968	1.69	1.07	1.03	0.38	29.56
148.512	109.22	1.78	1.13	1.00	0.45	24.79
162.047	101.819	1.26	0.80	0.36	0.51	22.30
175.215	93.781	-0.15	-0.09	-1.15	0.57	21.23
187.985	85.125	-2.51	-1.59	-3.57	0.61	17.38
200.328	75.871	-5.96	-3.79	-7.21	0.71	11.73
211.657	64.621	-8.56	-5.44	-10.00	0.82	8.10
220.131	51.091	-8.53	-5.42	-9.90	0.78	8.55
225.306	35.988	-6.43	-4.08	-7.45	0.58	13.82
228.758	18.07	-3.09	-1.96	-3.84	0.43	23.67
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating= 4.31  
Actual Load Rating (from CANDE) 3.05



## TYPE 3-2

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage TYPE 3-2

EXECUTION MODE ..... ANALYS  
 SOLUTION LEVEL ..... #3 USER  
 METHODOLOGY (LRFD OR SERVICE) ... LRFD  
 NUMBER OF PIPE-ELEMENT GROUPS .... 1  
 MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
 NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
 POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
 YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
 LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
 DENSITY OF METAL (PCI)..... 0.28400E+00  
 MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
 AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
 AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
 (FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -72.78	F = 0.000
1181	23	F = 0.000	F = -72.78	F = 0.000
1180	22	F = 0.000	F = -72.78	F = 0.000
1180	23	F = 0.000	F = -72.78	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000

936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1176	22	F =	0.000	F =	-43.67	F =	0.000
1176	23	F =	0.000	F =	-43.67	F =	0.000
1185	22	F =	0.000	F =	-60.00	F =	0.000
1185	23	F =	0.000	F =	-60.00	F =	0.000
1190	22	F =	0.000	F =	-60.00	F =	0.000
1190	23	F =	0.000	F =	-60.00	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03



CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000

5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.482E+00 -0.106E+01	0.816E+01 0.361E+01	-0.415E-10 -0.312E+04	-0.121E+05 -0.121E+05	0.214E+03 0.833E+03
2	-228.76	-0.646E+00	-0.807E+01	-0.386E+04	-0.243E+05	0.202E+03

	18.07	-0.104E+01	-0.244E+01	-0.317E+04	-0.123E+05	0.785E+03
3	-225.31 35.99	-0.770E+00 -0.102E+01	-0.243E+02 -0.848E+01	-0.749E+04 -0.328E+04	-0.360E+05 -0.128E+05	0.174E+03 0.677E+03
4	-220.13 51.09	-0.814E+00 -0.102E+01	-0.403E+02 -0.854E+01	-0.995E+04 -0.345E+04	-0.440E+05 -0.134E+05	0.791E+02 0.308E+03
5	-211.66 64.62	-0.790E+00 -0.104E+01	-0.380E+02 0.734E+01	-0.101E+05 -0.345E+04	-0.440E+05 -0.134E+05	-0.863E+02 -0.335E+03
6	-200.33 75.87	-0.717E+00 -0.112E+01	-0.253E+02 0.899E+01	-0.719E+04 -0.330E+04	-0.352E+05 -0.128E+05	-0.208E+03 -0.809E+03
7	-187.99 85.12	-0.625E+00 -0.126E+01	-0.151E+02 0.448E+01	-0.348E+04 -0.318E+04	-0.232E+05 -0.123E+05	-0.196E+03 -0.763E+03
8	-175.22 93.78	-0.524E+00 -0.142E+01	-0.140E+02 0.405E+01	-0.104E+04 -0.310E+04	-0.153E+05 -0.121E+05	-0.120E+03 -0.467E+03
9	-162.05 101.82	-0.425E+00 -0.159E+01	-0.140E+02 0.402E+01	0.342E+03 -0.303E+04	-0.129E+05 -0.118E+05	-0.493E+02 -0.192E+03
10	-148.51 109.22	-0.336E+00 -0.177E+01	-0.131E+02 0.376E+01	0.616E+03 -0.297E+04	-0.135E+05 -0.116E+05	0.181E+02 0.702E+02
11	-134.64 115.97	-0.257E+00 -0.195E+01	-0.958E+01 0.276E+01	-0.556E+02 -0.292E+04	-0.115E+05 -0.114E+05	0.538E+02 0.209E+03
12	-120.46 122.05	-0.186E+00 -0.213E+01	0.828E-01 0.649E-01	-0.865E+03 -0.290E+04	-0.140E+05 -0.113E+05	-0.107E+02 -0.416E+02
13	-106.01 127.44	-0.122E+00 -0.232E+01	-0.113E+02 0.322E+01	0.480E+03 -0.288E+04	-0.127E+05 -0.112E+05	-0.609E+02 -0.237E+03
14	-91.31 132.15	-0.685E-01 -0.251E+01	-0.488E+01 0.136E+01	0.125E+04 -0.284E+04	-0.149E+05 -0.110E+05	-0.712E+02 -0.277E+03
15	-76.42 136.15	-0.265E-01 -0.269E+01	-0.953E+01 0.270E+01	0.294E+04 -0.280E+04	-0.200E+05 -0.109E+05	-0.932E+02 -0.362E+03
16	-61.34 139.43	0.246E-02 -0.285E+01	-0.989E+01 0.281E+01	0.439E+04 -0.275E+04	-0.243E+05 -0.107E+05	-0.745E+02 -0.290E+03
17	-46.13 141.99	0.186E-01 -0.298E+01	-0.997E+01 0.284E+01	0.546E+04 -0.271E+04	-0.275E+05 -0.105E+05	-0.504E+02 -0.196E+03
18	-30.81 143.82	0.240E-01 -0.307E+01	-0.959E+01 0.272E+01	0.610E+04 -0.266E+04	-0.293E+05 -0.103E+05	-0.264E+02 -0.103E+03
19	-15.42 144.93	0.221E-01 -0.312E+01	-0.105E+02 0.242E+01	0.636E+04 -0.262E+04	-0.300E+05 -0.102E+05	0.347E+01 0.135E+02
20	0.00 145.29	0.171E-01 -0.311E+01	-0.104E+02 -0.262E+01	0.599E+04 -0.262E+04	-0.288E+05 -0.102E+05	0.406E+02 0.158E+03
21	15.42 144.93	0.132E-01 -0.307E+01	-0.853E+01 -0.243E+01	0.502E+04 -0.267E+04	-0.260E+05 -0.104E+05	0.617E+02 0.240E+03
22	30.81 143.82	0.142E-01 -0.298E+01	-0.808E+01 -0.229E+01	0.392E+04 -0.271E+04	-0.227E+05 -0.105E+05	0.630E+02 0.245E+03

23	46.13 141.99	0.226E-01 -0.286E+01	-0.782E+01 -0.222E+01	0.286E+04 -0.274E+04	-0.195E+05 -0.107E+05	0.569E+02 0.221E+03
24	61.34 139.43	0.400E-01 -0.272E+01	-0.789E+01 -0.225E+01	0.192E+04 -0.278E+04	-0.168E+05 -0.108E+05	0.476E+02 0.185E+03
25	76.42 136.15	0.669E-01 -0.257E+01	-0.821E+01 -0.234E+01	0.114E+04 -0.282E+04	-0.145E+05 -0.110E+05	0.396E+02 0.154E+03
26	91.31 132.15	0.103E+00 -0.241E+01	-0.598E+01 -0.170E+01	0.473E+03 -0.285E+04	-0.126E+05 -0.111E+05	0.149E+02 0.581E+02
27	106.01 127.44	0.148E+00 -0.225E+01	-0.101E+02 -0.289E+01	0.486E+03 -0.289E+04	-0.127E+05 -0.112E+05	0.308E+01 0.120E+02
28	120.46 122.05	0.202E+00 -0.209E+01	-0.395E+01 -0.111E+01	0.224E+03 -0.292E+04	-0.120E+05 -0.113E+05	-0.260E+02 -0.101E+03
29	134.64 115.97	0.264E+00 -0.193E+01	-0.127E+02 -0.364E+01	0.117E+04 -0.295E+04	-0.151E+05 -0.115E+05	-0.363E+02 -0.141E+03
30	148.51 109.22	0.338E+00 -0.176E+01	-0.120E+02 -0.343E+01	0.124E+04 -0.301E+04	-0.155E+05 -0.117E+05	0.135E+02 0.525E+02
31	162.05 101.82	0.423E+00 -0.159E+01	-0.134E+02 -0.382E+01	0.658E+03 -0.307E+04	-0.140E+05 -0.119E+05	0.656E+02 0.255E+03
32	175.22 93.78	0.518E+00 -0.142E+01	-0.137E+02 -0.397E+01	-0.859E+03 -0.313E+04	-0.148E+05 -0.122E+05	0.128E+03 0.496E+03
33	187.99 85.12	0.617E+00 -0.126E+01	-0.151E+02 -0.448E+01	-0.334E+04 -0.321E+04	-0.228E+05 -0.125E+05	0.200E+03 0.777E+03
34	200.33 75.87	0.707E+00 -0.113E+01	-0.253E+02 -0.771E+01	-0.707E+04 -0.332E+04	-0.349E+05 -0.129E+05	0.210E+03 0.815E+03
35	211.66 64.62	0.779E+00 -0.105E+01	-0.381E+02 -0.581E+01	-0.993E+04 -0.345E+04	-0.440E+05 -0.134E+05	0.871E+02 0.339E+03
36	220.13 51.09	0.802E+00 -0.103E+01	-0.399E+02 0.814E+01	-0.984E+04 -0.344E+04	-0.440E+05 -0.134E+05	-0.792E+02 -0.308E+03
37	225.31 35.99	0.757E+00 -0.103E+01	-0.243E+02 0.849E+01	-0.735E+04 -0.328E+04	-0.356E+05 -0.127E+05	-0.175E+03 -0.680E+03
38	228.76 18.07	0.635E+00 -0.105E+01	-0.844E+01 0.254E+01	-0.373E+04 -0.316E+04	-0.239E+05 -0.123E+05	-0.198E+03 -0.771E+03
39	231.30 0.00	0.473E+00 -0.106E+01	0.743E+01 -0.340E+01	-0.162E-10 -0.311E+04	-0.121E+05 -0.121E+05	-0.203E+03 -0.791E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.38039E-03	-0.38039E-03	.27551	0.00000
2	-0.76370E-03	-0.10099E-04	.55313	0.00000
3	-0.11311E-02	0.32996E-03	.81921	0.00000
4	-0.13909E-02	0.55013E-03	1.0074	0.00528

5	-0.14023E-02	0.55938E-03	1.0156	0.01100
6	-0.11034E-02	0.29844E-03	.79913	0.00000
7	-0.72675E-03	-0.47692E-04	.52637	0.00000
8	-0.48008E-03	-0.27632E-03	.34771	0.00000
9	-0.33671E-03	-0.40337E-03	.29215	0.00000
10	-0.30253E-03	-0.42260E-03	.30608	0.00000
11	-0.36200E-03	-0.35116E-03	.26219	0.00000
12	-0.43840E-03	-0.26960E-03	.31752	0.00000
13	-0.30385E-03	-0.39745E-03	.28786	0.00000
14	-0.22405E-03	-0.46777E-03	.33879	0.00000
15	-0.55269E-04	-0.62789E-03	.45476	0.00000
16	0.91848E-04	-0.76361E-03	.55307	0.00000
17	0.20252E-03	-0.86288E-03	.62497	0.00000
18	0.27073E-03	-0.92015E-03	.66645	0.00000
19	0.30063E-03	-0.94021E-03	.68097	0.00000
20	0.26453E-03	-0.90472E-03	.65527	0.00000
21	0.16435E-03	-0.81463E-03	.59002	0.00000
22	0.52742E-04	-0.71265E-03	.51615	0.00000
23	-0.56067E-04	-0.61306E-03	.44402	0.00000
24	-0.15160E-03	-0.52660E-03	.38140	0.00000
25	-0.23248E-03	-0.45492E-03	.32949	0.00000
26	-0.30153E-03	-0.39385E-03	.28526	0.00000
27	-0.30473E-03	-0.39947E-03	.28933	0.00000
28	-0.33401E-03	-0.37769E-03	.27355	0.00000
29	-0.24654E-03	-0.47386E-03	.34320	0.00000
30	-0.24582E-03	-0.48787E-03	.35335	0.00000
31	-0.30975E-03	-0.43817E-03	.31735	0.00000
32	-0.46574E-03	-0.29810E-03	.33733	0.00000
33	-0.71680E-03	-0.65005E-04	.51916	0.00000
34	-0.10949E-02	0.28506E-03	.79303	0.00000
35	-0.13898E-02	0.54757E-03	1.0066	0.00471
36	-0.13793E-02	0.54120E-03	.99899	0.00000
37	-0.11170E-02	0.31779E-03	.80901	0.00000
38	-0.74940E-03	-0.22242E-04	.54277	0.00000
39	-0.37910E-03	-0.37910E-03	.27457	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.30612	0.00000	0.09371
2	-0.31136	-0.21784	0.31478
3	-0.32235	-0.42234	0.52624
4	-0.33830	-0.56107	0.67551
5	-0.33906	-0.56691	0.68187
6	-0.32388	-0.40521	0.51011
7	-0.31162	-0.19629	0.29340
8	-0.30435	-0.05890	0.15153
9	-0.29779	0.01927	0.10795
10	-0.29177	0.03471	0.11984
11	-0.28696	-0.00313	0.08548
12	-0.28488	-0.04879	0.12995
13	-0.28218	0.02706	0.10668
14	-0.27837	0.07045	0.14794
15	-0.27488	0.16552	0.24109
16	-0.27030	0.24728	0.32035
17	-0.26572	0.30797	0.37858
18	-0.26131	0.34425	0.41253
19	-0.25735	0.35868	0.42491
20	-0.25760	0.33799	0.40435
21	-0.26166	0.28299	0.35146
22	-0.26553	0.22125	0.29176
23	-0.26924	0.16101	0.23350
24	-0.27289	0.10840	0.18287
25	-0.27659	0.06430	0.14080
26	-0.27981	0.02669	0.10498
27	-0.28335	0.02738	0.10767
28	-0.28637	0.01263	0.09463
29	-0.28987	0.06571	0.14973
30	-0.29522	0.06997	0.15712
31	-0.30095	0.03712	0.12769
32	-0.30735	-0.04846	0.14292
33	-0.31458	-0.18841	0.28737
34	-0.32587	-0.39891	0.50510
35	-0.33888	-0.56001	0.67485
36	-0.33723	-0.55515	0.66888

37	-0.32158	-0.41475	0.51816
38	-0.31049	-0.21020	0.30660
39	-0.30508	0.00000	0.09307

# ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

## LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	13427.	30800.	0.436
BUCKLING THRUST (psi)	5	13427.	49776.	0.270
SEAM THRUST (psi)	5	13427.	21914.	0.613
PLASTIC-PENETRATE (%)	5	1.10	90.00	0.012
COMBINED T&M Ratio	5	0.682	1.000	0.682

## LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.89
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.18
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage TYPE 3-2 OPR  
LIVE LOADS X 3.16 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
DENSITY OF METAL (PCI)..... 0.28400E+00  
MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000  
SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -230.0	F = 0.000
1181	23	F = 0.000	F = -230.0	F = 0.000
1180	22	F = 0.000	F = -230.0	F = 0.000
1180	23	F = 0.000	F = -230.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000



855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1176	22	F =	0.000	F =	-138.0	F =	0.000
1176	23	F =	0.000	F =	-138.0	F =	0.000
1185	22	F =	0.000	F =	-189.8	F =	0.000
1185	23	F =	0.000	F =	-189.8	F =	0.000
1190	22	F =	0.000	F =	-189.8	F =	0.000
1190	23	F =	0.000	F =	-189.8	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14

16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000

FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000

30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.450	Factor for load step #22
23	1.450	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.642E+00 -0.118E+01	0.197E+02 0.721E+01	0.204E-10 -0.389E+04	-0.151E+05 -0.151E+05	0.376E+03 0.146E+04
2	-228.76 18.07	-0.909E+00 -0.115E+01	-0.500E+01 -0.160E+01	-0.622E+04 -0.393E+04	-0.346E+05 -0.153E+05	0.269E+03 0.105E+04
3	-225.31 35.99	-0.111E+01 -0.112E+01	-0.297E+02 -0.104E+02	-0.104E+05 -0.406E+04	-0.440E+05 -0.158E+05	0.186E+03 0.724E+03
4	-220.13 51.09	-0.120E+01 -0.110E+01	-0.514E+02 -0.158E+02	-0.131E+05 -0.430E+04	-0.440E+05 -0.167E+05	0.750E+02 0.291E+03
5	-211.66 64.62	-0.118E+01 -0.112E+01	-0.508E+02 0.193E+01	-0.130E+05 -0.440E+04	-0.440E+05 -0.171E+05	-0.105E+03 -0.409E+03
6	-200.33 75.87	-0.109E+01 -0.122E+01	-0.358E+02 0.127E+02	-0.968E+04 -0.426E+04	-0.440E+05 -0.166E+05	-0.217E+03 -0.844E+03
7	-187.99 85.12	-0.979E+00 -0.139E+01	-0.190E+02 0.563E+01	-0.598E+04 -0.410E+04	-0.345E+05 -0.159E+05	-0.181E+03 -0.705E+03
8	-175.22 93.78	-0.845E+00 -0.161E+01	-0.155E+02 0.451E+01	-0.373E+04 -0.401E+04	-0.272E+05 -0.156E+05	-0.107E+03 -0.417E+03

9	-162.05 101.82	-0.706E+00 -0.185E+01	-0.158E+02 0.452E+01	-0.218E+04 -0.394E+04	-0.221E+05 -0.153E+05	-0.538E+02 -0.209E+03
10	-148.51 109.22	-0.571E+00 -0.212E+01	-0.152E+02 0.432E+01	-0.146E+04 -0.387E+04	-0.196E+05 -0.150E+05	0.379E+00 0.147E+01
11	-134.64 115.97	-0.443E+00 -0.241E+01	-0.229E+02 0.655E+01	-0.149E+04 -0.379E+04	-0.193E+05 -0.147E+05	0.113E+03 0.440E+03
12	-120.46 122.05	-0.324E+00 -0.271E+01	0.175E+01 0.546E+00	-0.417E+04 -0.373E+04	-0.275E+05 -0.145E+05	0.986E+02 0.383E+03
13	-106.01 127.44	-0.210E+00 -0.305E+01	-0.475E+01 0.135E+01	-0.363E+04 -0.372E+04	-0.257E+05 -0.145E+05	-0.549E+02 -0.214E+03
14	-91.31 132.15	-0.105E+00 -0.342E+01	0.156E+01 0.552E+00	-0.141E+04 -0.370E+04	-0.188E+05 -0.144E+05	-0.206E+03 -0.801E+03
15	-76.42 136.15	-0.162E-01 -0.379E+01	-0.134E+02 0.369E+01	0.394E+04 -0.365E+04	-0.265E+05 -0.142E+05	-0.289E+03 -0.112E+04
16	-61.34 139.43	0.493E-01 -0.415E+01	-0.150E+02 0.413E+01	0.874E+04 -0.358E+04	-0.411E+05 -0.139E+05	-0.241E+03 -0.937E+03
17	-46.13 141.99	0.885E-01 -0.444E+01	-0.156E+02 0.430E+01	0.125E+05 -0.351E+04	-0.440E+05 -0.136E+05	-0.172E+03 -0.670E+03
18	-30.81 143.82	0.104E+00 -0.463E+01	-0.161E+02 0.447E+01	0.149E+05 -0.343E+04	-0.440E+05 -0.133E+05	-0.918E+02 -0.357E+03
19	-15.42 144.93	0.102E+00 -0.470E+01	-0.180E+02 0.140E+01	0.157E+05 -0.339E+04	-0.440E+05 -0.132E+05	0.103E+02 0.401E+02
20	0.00 145.29	0.937E-01 -0.463E+01	-0.188E+02 -0.533E+01	0.144E+05 -0.342E+04	-0.440E+05 -0.133E+05	0.134E+03 0.519E+03
21	15.42 144.93	0.904E-01 -0.445E+01	-0.123E+02 -0.336E+01	0.110E+05 -0.349E+04	-0.440E+05 -0.136E+05	0.210E+03 0.817E+03
22	30.81 143.82	0.101E+00 -0.418E+01	-0.113E+02 -0.308E+01	0.698E+04 -0.355E+04	-0.355E+05 -0.138E+05	0.225E+03 0.876E+03
23	46.13 141.99	0.129E+00 -0.386E+01	-0.909E+01 -0.249E+01	0.282E+04 -0.361E+04	-0.228E+05 -0.140E+05	0.213E+03 0.828E+03
24	61.34 139.43	0.176E+00 -0.352E+01	-0.779E+01 -0.217E+01	-0.859E+03 -0.365E+04	-0.169E+05 -0.142E+05	0.171E+03 0.665E+03
25	76.42 136.15	0.237E+00 -0.318E+01	-0.781E+01 -0.221E+01	-0.367E+04 -0.369E+04	-0.258E+05 -0.144E+05	0.118E+03 0.457E+03
26	91.31 132.15	0.308E+00 -0.288E+01	0.151E+01 -0.485E+00	-0.553E+04 -0.372E+04	-0.316E+05 -0.144E+05	-0.941E+01 -0.366E+02
27	106.01 127.44	0.383E+00 -0.262E+01	-0.842E+01 -0.245E+01	-0.417E+04 -0.374E+04	-0.275E+05 -0.145E+05	-0.133E+03 -0.516E+03
28	120.46 122.05	0.460E+00 -0.239E+01	-0.111E+02 -0.317E+01	-0.198E+04 -0.377E+04	-0.208E+05 -0.147E+05	-0.160E+03 -0.622E+03

29	134.64 115.97	0.541E+00 -0.217E+01	-0.215E+02 -0.613E+01	0.384E+03 -0.384E+04	-0.161E+05 -0.149E+05	-0.894E+02 -0.347E+03
30	148.51 109.22	0.633E+00 -0.196E+01	-0.152E+02 -0.432E+01	0.465E+03 -0.392E+04	-0.167E+05 -0.152E+05	0.969E+01 0.376E+02
31	162.05 101.82	0.736E+00 -0.176E+01	-0.163E+02 -0.467E+01	-0.186E+03 -0.399E+04	-0.161E+05 -0.155E+05	0.654E+02 0.254E+03
32	175.22 93.78	0.847E+00 -0.156E+01	-0.165E+02 -0.479E+01	-0.179E+04 -0.407E+04	-0.214E+05 -0.158E+05	0.128E+03 0.497E+03
33	187.99 85.12	0.959E+00 -0.138E+01	-0.199E+02 -0.591E+01	-0.433E+04 -0.416E+04	-0.296E+05 -0.162E+05	0.214E+03 0.833E+03
34	200.33 75.87	0.106E+01 -0.123E+01	-0.351E+02 -0.799E+01	-0.856E+04 -0.429E+04	-0.433E+05 -0.167E+05	0.248E+03 0.965E+03
35	211.66 64.62	0.113E+01 -0.114E+01	-0.491E+02 0.175E+01	-0.122E+05 -0.437E+04	-0.440E+05 -0.170E+05	0.118E+03 0.460E+03
36	220.13 51.09	0.114E+01 -0.112E+01	-0.499E+02 0.153E+02	-0.123E+05 -0.424E+04	-0.440E+05 -0.165E+05	-0.777E+02 -0.302E+03
37	225.31 35.99	0.106E+01 -0.114E+01	-0.302E+02 0.105E+02	-0.952E+04 -0.401E+04	-0.440E+05 -0.156E+05	-0.187E+03 -0.727E+03
38	228.76 18.07	0.868E+00 -0.117E+01	-0.648E+01 0.201E+01	-0.548E+04 -0.388E+04	-0.321E+05 -0.151E+05	-0.247E+03 -0.960E+03
39	231.30 0.00	0.622E+00 -0.120E+01	0.172E+02 -0.652E+01	-0.180E-10 -0.383E+04	-0.149E+05 -0.149E+05	-0.324E+03 -0.126E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.47482E-03	-0.47482E-03	.34390	0.00000
2	-0.10867E-02	0.12696E-03	.78707	0.00000
3	-0.15286E-02	0.52805E-03	1.1071	0.07190
4	-0.19996E-02	0.81570E-03	1.4483	0.21985
5	-0.20059E-02	0.79229E-03	1.4528	0.22343
6	-0.14701E-02	0.42690E-03	1.0648	0.04716
7	-0.10825E-02	0.83227E-04	.78402	0.00000
8	-0.85284E-03	-0.12549E-03	.61769	0.00000
9	-0.69313E-03	-0.26711E-03	.50202	0.00000
10	-0.61439E-03	-0.32876E-03	.44499	0.00000
11	-0.60681E-03	-0.31642E-03	.43950	0.00000
12	-0.86236E-03	-0.48644E-04	.62459	0.00000
13	-0.80776E-03	-0.99844E-04	.58504	0.00000
14	-0.58873E-03	-0.31369E-03	.42641	0.00000
15	-0.61362E-04	-0.83013E-03	.60125	0.00000
16	0.41581E-03	-0.12895E-02	.93392	0.00000
17	0.81699E-03	-0.17170E-02	1.2436	0.13271
18	0.11322E-02	-0.21496E-02	1.5569	0.23430
19	0.12518E-02	-0.23285E-02	1.6865	0.26472
20	0.10730E-02	-0.20507E-02	1.4853	0.21449
21	0.64862E-03	-0.15085E-02	1.0926	0.05925
22	0.24720E-03	-0.11142E-02	.80697	0.00000
23	-0.16467E-03	-0.71538E-03	.51813	0.00000
24	-0.52937E-03	-0.36173E-03	.38341	0.00000
25	-0.80835E-03	-0.92733E-04	.58547	0.00000
26	-0.99246E-03	0.85605E-04	.71882	0.00000
27	-0.86253E-03	-0.49101E-04	.62471	0.00000
28	-0.65362E-03	-0.26697E-03	.47340	0.00000
29	-0.43088E-03	-0.50588E-03	.36639	0.00000
30	-0.43269E-03	-0.52340E-03	.37909	0.00000

31	-0.50497E-03	-0.46860E-03	.36574	0.00000
32	-0.67087E-03	-0.32178E-03	.48590	0.00000
33	-0.93013E-03	-0.84814E-04	.67367	0.00000
34	-0.13580E-02	0.31108E-03	.98359	0.00000
35	-0.18387E-02	0.68919E-03	1.3317	0.18118
36	-0.18324E-02	0.71791E-03	1.3271	0.17711
37	-0.14180E-02	0.44027E-03	1.0270	0.02009
38	-0.10078E-02	0.61999E-04	.72990	0.00000
39	-0.46704E-03	-0.46704E-03	.33827	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.38211	0.00000	0.14601
2	-0.38617	-0.35083	0.49996
3	-0.39830	-0.58806	0.74670
4	-0.42163	-0.73777	0.91554
5	-0.43211	-0.73377	0.92049
6	-0.41808	-0.54605	0.72084
7	-0.40208	-0.33697	0.49863
8	-0.39366	-0.21025	0.36522
9	-0.38638	-0.12315	0.27244
10	-0.37950	-0.08257	0.22659
11	-0.37149	-0.08394	0.22194
12	-0.36657	-0.23522	0.36959
13	-0.36520	-0.20463	0.33800
14	-0.36311	-0.07951	0.21136
15	-0.35872	0.22223	0.35090
16	-0.35153	0.49294	0.61651
17	-0.34417	0.70299	0.82144
18	-0.33689	0.83782	0.95132
19	-0.33225	0.88415	0.99453
20	-0.33555	0.81350	0.92609
21	-0.34294	0.61829	0.73590
22	-0.34885	0.39353	0.51522
23	-0.35411	0.15919	0.28459
24	-0.35856	-0.04846	0.17702
25	-0.36257	-0.20686	0.33832
26	-0.36490	-0.31163	0.44478
27	-0.36682	-0.23514	0.36969
28	-0.37042	-0.11177	0.24898
29	-0.37693	0.02168	0.16375
30	-0.38471	0.02622	0.17422
31	-0.39174	-0.01051	0.16398
32	-0.39942	-0.10091	0.26045
33	-0.40839	-0.24435	0.41114
34	-0.42127	-0.48249	0.65995
35	-0.42914	-0.68783	0.87199
36	-0.41624	-0.69332	0.86658
37	-0.39312	-0.53672	0.69126
38	-0.38055	-0.30923	0.45405
39	-0.37585	0.00000	0.14127

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	17112.	30800.	0.556
BUCKLING THRUST (psi)	5	17112.	49211.	0.348
SEAM THRUST (psi)	5	17112.	21914.	0.781
PLASTIC-PENETRATE (%)	19	26.47	90.00	0.294
COMBINED T&M Ratio	19	0.995	1.000	0.995

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.65
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.33
HANDLING FACTOR RATIO = $(\text{SPAN}^2/\text{EI})/\text{FF}$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*



BEAM OUTPUT FOR TYPE 3-2 TRUCK Y<sub>DL</sub>=1.5, Y<sub>DL</sub>= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (ft.)	Thrust (DL) T <sub>DLsec</sub>		Thrust (DL) T <sub>DLs</sub>		Thrust (DL+LL) T <sub>DL+LLsec</sub>		Thrust (LL) T <sub>LLs</sub>		Thrust Load Rating
		factored from CANDE	Load Step 21	unfactored	T <sub>DLsec</sub> /1.575	factored from CANDE	Load Step 23	unfactored	(T <sub>DL+LLsec</sub> -T <sub>DLsec</sub> )/1.75	
		kips/ft.	kips/ft.	kips/ft.	kips/ft.	kips/ft.	kips/ft.			(T <sub>cap</sub> -T <sub>DLs</sub> *1.5)/T <sub>LLs</sub> *1.45
-231.304	0	-31.94	-20.28	-37.43				3.13		8.34
-228.758	18.07	-32.57	-20.68	-38.07				3.14		8.19
-225.306	35.988	-33.73	-21.42	-39.41				3.25		7.69
-220.131	51.091	-34.93	-22.18	-41.36				3.68		6.58
-211.657	64.621	-34.39	-21.84	-41.46				4.04		6.08
-200.328	75.871	-32.66	-20.74	-39.60				3.97		6.48
-187.985	85.125	-31.39	-19.93	-38.10				3.83		6.92
-175.215	93.781	-30.61	-19.44	-37.21				3.77		7.16
-162.047	101.819	-29.90	-18.99	-36.41				3.72		7.39
-148.512	109.22	-29.27	-18.58	-35.68				3.66		7.62
-134.639	115.968	-28.84	-18.31	-35.09				3.57		7.89
-120.46	122.048	-28.69	-18.22	-34.83				3.51		8.06
-106.008	127.445	-28.31	-17.98	-34.50				3.54		8.07
-91.315	132.148	-27.76	-17.63	-34.04				3.59		8.06
-76.415	136.145	-27.37	-17.38	-33.61				3.56		8.18
-61.341	139.428	-26.97	-17.13	-33.05				3.47		8.47
-46.128	141.99	-26.59	-16.88	-32.49				3.37		8.81
-30.81	143.823	-26.24	-16.66	-31.95				3.26		9.16
-15.423	144.925	-25.90	-16.44	-31.47				3.18		9.47
0	145.293	-25.71	-16.32	-31.50				3.31		9.14
15.423	144.925	-25.86	-16.42	-31.99				3.51		8.60
30.81	143.823	-26.20	-16.63	-32.47				3.58		8.35
46.128	141.99	-26.55	-16.85	-32.92				3.64		8.15
61.341	139.428	-26.92	-17.09	-33.37				3.68		8.00
76.415	136.145	-27.32	-17.35	-33.82				3.71		7.86
91.315	132.148	-27.72	-17.60	-34.21				3.71		7.80
106.008	127.445	-28.22	-17.92	-34.65				3.67		7.78
120.46	122.048	-28.55	-18.13	-35.01				3.69		7.69
134.639	115.968	-28.83	-18.31	-35.44				3.78		7.46
148.512	109.22	-29.33	-18.62	-36.10				3.87		7.21
162.047	101.819	-29.93	-19.00	-36.80				3.92		7.00
175.215	93.781	-30.61	-19.43	-37.58				3.98		6.78
187.985	85.125	-31.37	-19.92	-38.46				4.05		6.54
200.328	75.871	-32.61	-20.70	-39.84				4.14		6.22
211.657	64.621	-34.41	-21.85	-41.43				4.02		6.11
220.131	51.091	-35.05	-22.25	-41.23				3.53		6.82
225.306	35.988	-33.87	-21.50	-39.32				3.12		7.99
228.758	18.07	-32.69	-20.76	-37.96				3.01		8.52
231.304	0	-32.06	-20.36	-37.30				2.99		8.71

Thrust Load Rating=

6.08

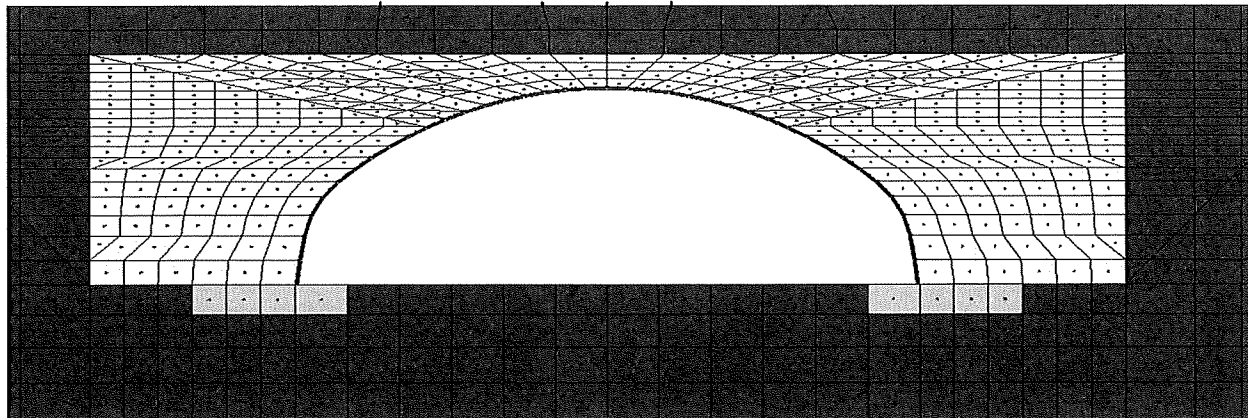
BEAM OUTPUT FOR TYPE 3-2 TRUCK

Y<sub>0</sub>=1.5, YD<sub>L</sub>= 1.45 (OPR)

BEAM OUTPUT FOR TYPE 3-2 TRUCK							
X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DCL</sub> factored from CANDE Load Step 21 kips-ft./ft.	Moment (DL) M <sub>DLS</sub> unfactored M <sub>DCL</sub> /1.575	Moment (DL+LL) M <sub>DCL+LL</sub> factored from CANDE Load Step 23 kips-ft./ft.	Moment (LL) M <sub>LLS</sub> unfactored (M <sub>DCL+LL</sub> -M <sub>DCL</sub> )/1.75	Moment Load Rating	
						OPR	(M <sub>OP</sub> -M <sub>DCL</sub> *1.5)/M <sub>LLS</sub> *1.45
-231.304	0	0.00	0.00	0.00	0.00		
-228.758	18.07	-3.04	-1.93	-3.86	0.47		21.73
-225.306	35.988	-6.33	-4.02	-7.49	0.67		12.18
-220.131	51.091	-8.36	-5.31	-9.95	0.91		7.44
-211.657	64.621	-8.31	-5.28	-10.05	0.99		6.84
-200.328	75.871	-5.60	-3.55	-7.19	0.91		9.45
-187.985	85.125	-2.10	-1.33	-3.48	0.79		13.80
-175.215	93.781	0.19	0.12	-1.04	0.71		17.18
-162.047	101.819	1.41	0.89	0.34	0.61		18.64
-148.512	109.22	1.55	0.98	0.62	0.53		21.11
-134.639	115.968	0.77	0.49	-0.06	0.47		24.84
-120.46	122.048	0.53	0.34	-0.87	0.80		14.89
-106.008	127.445	2.01	1.28	0.48	0.88		12.49
-91.315	132.148	2.11	1.34	1.25	0.49		22.16
-76.415	136.145	2.25	1.43	2.94	0.39		27.62
-61.341	139.428	2.26	1.44	4.39	1.21		8.87
-46.128	141.99	2.17	1.38	5.46	1.88		5.76
-30.81	143.823	2.06	1.31	6.10	2.31		4.72
-15.423	144.925	2.02	1.28	6.36	2.48		4.41
0	145.293	2.03	1.29	5.99	2.27		4.82
15.423	144.925	2.08	1.32	5.02	1.68		6.49
30.81	143.823	2.18	1.38	3.92	1.00		10.87
46.128	141.99	2.35	1.50	2.86	0.29		37.46
61.341	139.428	2.50	1.59	1.92	0.33		32.07
76.415	136.145	2.54	1.61	1.14	0.80		13.21
91.315	132.148	2.46	1.56	0.47	1.13		9.38
106.008	127.445	2.26	1.44	0.49	1.02		10.60
120.46	122.048	1.33	0.84	0.22	0.63		18.06
134.639	115.968	1.70	1.08	1.17	0.31		36.45
148.512	109.22	1.79	1.14	1.24	0.32		35.10
162.047	101.819	1.27	0.81	0.66	0.35		32.68
175.215	93.781	-0.14	-0.09	-0.86	0.41		29.79
187.985	85.125	-2.51	-1.59	-3.34	0.48		22.27
200.328	75.871	-5.97	-3.79	-7.07	0.63		13.22
211.657	64.621	-8.57	-5.44	-9.93	0.78		8.54
220.131	51.091	-8.54	-5.42	-9.84	0.75		8.91
225.306	35.988	-6.44	-4.09	-7.35	0.53		15.30
228.758	18.07	-3.09	-1.96	-3.73	0.36		28.03
231.304	0	0.00	0.00	0.00	0.00		

Moment Load Rating=  
Actual Load Rating (from CANDE)

4.41  
3.16



SU4

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage SU4

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08

POISSONS RATIO OF METAL (-) ..... 0.30000E+00

YIELD STRESS OF METAL (PSI)..... 0.44000E+05

LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05

DENSITY OF METAL (PCI)..... 0.28400E+00

MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2,MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
 COMBINED MOMENT-THRUST CRITERION... 0.90000

## BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -61.86	F = 0.000
1181	23	F = 0.000	F = -61.86	F = 0.000
1182	22	F = 0.000	F = -61.86	F = 0.000
1182	23	F = 0.000	F = -61.86	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000

911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-29.11	F =	0.000
1180	23	F =	0.000	F =	-29.11	F =	0.000
1177	22	F =	0.000	F =	-43.66	F =	0.000
1177	23	F =	0.000	F =	-43.66	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FORWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL

WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 48.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
 SCALED MODULUS NUMBER ZK ..... 950.0000  
 MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000

6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.477E+00 -0.105E+01	0.804E+01 0.356E+01	-0.540E-12 -0.308E+04	-0.120E+05 -0.120E+05	0.213E+03 0.827E+03
2	-228.76 18.07	-0.642E+00 -0.103E+01	-0.794E+01 -0.240E+01	-0.383E+04 -0.313E+04	-0.241E+05 -0.122E+05	0.200E+03 0.778E+03



3	-225.31 35.99	-0.765E+00 -0.101E+01	-0.239E+02 -0.835E+01	-0.742E+04 -0.324E+04	-0.357E+05 -0.126E+05	0.172E+03 0.667E+03
4	-220.13 51.09	-0.811E+00 -0.100E+01	-0.398E+02 -0.942E+01	-0.984E+04 -0.341E+04	-0.438E+05 -0.133E+05	0.765E+02 0.297E+03
5	-211.66 64.62	-0.788E+00 -0.103E+01	-0.379E+02 0.512E+01	-0.991E+04 -0.344E+04	-0.440E+05 -0.134E+05	-0.886E+02 -0.344E+03
6	-200.33 75.87	-0.717E+00 -0.111E+01	-0.255E+02 0.905E+01	-0.701E+04 -0.331E+04	-0.346E+05 -0.129E+05	-0.209E+03 -0.814E+03
7	-187.99 85.12	-0.628E+00 -0.124E+01	-0.152E+02 0.449E+01	-0.331E+04 -0.318E+04	-0.226E+05 -0.124E+05	-0.196E+03 -0.763E+03
8	-175.22 93.78	-0.530E+00 -0.140E+01	-0.140E+02 0.405E+01	-0.884E+03 -0.311E+04	-0.148E+05 -0.121E+05	-0.120E+03 -0.467E+03
9	-162.05 101.82	-0.435E+00 -0.156E+01	-0.140E+02 0.401E+01	0.493E+03 -0.304E+04	-0.133E+05 -0.118E+05	-0.499E+02 -0.194E+03
10	-148.51 109.22	-0.350E+00 -0.174E+01	-0.132E+02 0.378E+01	0.771E+03 -0.298E+04	-0.140E+05 -0.116E+05	0.173E+02 0.673E+02
11	-134.64 115.97	-0.275E+00 -0.191E+01	-0.915E+01 0.263E+01	0.917E+02 -0.293E+04	-0.117E+05 -0.114E+05	0.499E+02 0.194E+03
12	-120.46 122.05	-0.208E+00 -0.208E+01	-0.120E+01 0.348E+00	-0.619E+03 -0.291E+04	-0.132E+05 -0.113E+05	-0.838E+01 -0.326E+02
13	-106.01 127.44	-0.148E+00 -0.226E+01	-0.123E+02 0.354E+01	0.522E+03 -0.288E+04	-0.128E+05 -0.112E+05	-0.407E+02 -0.158E+03
14	-91.31 132.15	-0.980E-01 -0.243E+01	-0.552E+01 0.156E+01	0.836E+03 -0.283E+04	-0.136E+05 -0.110E+05	-0.379E+02 -0.147E+03
15	-76.42 136.15	-0.581E-01 -0.261E+01	-0.886E+01 0.252E+01	0.192E+04 -0.280E+04	-0.168E+05 -0.109E+05	-0.602E+02 -0.234E+03
16	-61.34 139.43	-0.294E-01 -0.277E+01	-0.873E+01 0.249E+01	0.293E+04 -0.276E+04	-0.198E+05 -0.107E+05	-0.557E+02 -0.217E+03
17	-46.13 141.99	-0.118E-01 -0.291E+01	-0.857E+01 0.244E+01	0.387E+04 -0.272E+04	-0.226E+05 -0.106E+05	-0.517E+02 -0.201E+03
18	-30.81 143.82	-0.399E-02 -0.302E+01	-0.846E+01 0.240E+01	0.473E+04 -0.268E+04	-0.251E+05 -0.104E+05	-0.478E+02 -0.186E+03
19	-15.42 144.93	-0.380E-02 -0.309E+01	-0.885E+01 0.252E+01	0.550E+04 -0.264E+04	-0.274E+05 -0.103E+05	-0.398E+02 -0.155E+03
20	0.00 145.29	-0.797E-02 -0.313E+01	-0.984E+01 0.100E+01	0.605E+04 -0.261E+04	-0.290E+05 -0.101E+05	-0.196E+02 -0.763E+02
21	15.42 144.93	-0.126E-01 -0.312E+01	-0.986E+01 -0.283E+01	0.612E+04 -0.262E+04	-0.292E+05 -0.102E+05	0.869E+01 0.338E+02
22	30.81 143.82	-0.135E-01 -0.306E+01	-0.932E+01 -0.265E+01	0.571E+04 -0.267E+04	-0.281E+05 -0.104E+05	0.318E+02 0.124E+03

23	46.13 141.99	-0.676E-02 -0.295E+01	-0.970E+01 -0.275E+01	0.498E+04 -0.271E+04	-0.260E+05 -0.105E+05	0.515E+02 0.200E+03
24	61.34 139.43	0.107E-01 -0.282E+01	-0.973E+01 -0.276E+01	0.390E+04 -0.276E+04	-0.228E+05 -0.107E+05	0.722E+02 0.281E+03
25	76.42 136.15	0.406E-01 -0.265E+01	-0.943E+01 -0.267E+01	0.249E+04 -0.280E+04	-0.186E+05 -0.109E+05	0.887E+02 0.345E+03
26	91.31 132.15	0.829E-01 -0.247E+01	-0.537E+01 -0.150E+01	0.882E+03 -0.284E+04	-0.138E+05 -0.110E+05	0.695E+02 0.270E+03
27	106.01 127.44	0.136E+00 -0.228E+01	-0.792E+01 -0.226E+01	0.812E+02 -0.287E+04	-0.114E+05 -0.112E+05	0.370E+02 0.144E+03
28	120.46 122.05	0.198E+00 -0.209E+01	-0.163E+01 -0.446E+00	-0.488E+03 -0.289E+04	-0.128E+05 -0.112E+05	-0.256E+02 -0.995E+02
29	134.64 115.97	0.269E+00 -0.191E+01	-0.145E+02 -0.416E+01	0.686E+03 -0.293E+04	-0.135E+05 -0.114E+05	-0.387E+02 -0.150E+03
30	148.51 109.22	0.349E+00 -0.173E+01	-0.112E+02 -0.320E+01	0.551E+03 -0.298E+04	-0.133E+05 -0.116E+05	0.200E+02 0.776E+02
31	162.05 101.82	0.440E+00 -0.155E+01	-0.128E+02 -0.366E+01	-0.592E+02 -0.304E+04	-0.120E+05 -0.118E+05	0.623E+02 0.242E+03
32	175.22 93.78	0.538E+00 -0.138E+01	-0.132E+02 -0.383E+01	-0.147E+04 -0.310E+04	-0.166E+05 -0.121E+05	0.117E+03 0.456E+03
33	187.99 85.12	0.638E+00 -0.122E+01	-0.149E+02 -0.442E+01	-0.375E+04 -0.317E+04	-0.240E+05 -0.123E+05	0.185E+03 0.721E+03
34	200.33 75.87	0.727E+00 -0.109E+01	-0.254E+02 -0.759E+01	-0.724E+04 -0.329E+04	-0.353E+05 -0.128E+05	0.197E+03 0.766E+03
35	211.66 64.62	0.797E+00 -0.101E+01	-0.377E+02 -0.416E+01	-0.994E+04 -0.340E+04	-0.440E+05 -0.132E+05	0.808E+02 0.314E+03
36	220.13 51.09	0.817E+00 -0.986E+00	-0.392E+02 0.104E+02	-0.980E+04 -0.335E+04	-0.435E+05 -0.130E+05	-0.785E+02 -0.305E+03
37	225.31 35.99	0.769E+00 -0.996E+00	-0.235E+02 0.819E+01	-0.738E+04 -0.318E+04	-0.353E+05 -0.124E+05	-0.171E+03 -0.664E+03
38	228.76 18.07	0.643E+00 -0.101E+01	-0.773E+01 0.233E+01	-0.381E+04 -0.307E+04	-0.238E+05 -0.119E+05	-0.199E+03 -0.773E+03
39	231.30 0.00	0.477E+00 -0.103E+01	0.801E+01 -0.353E+01	-0.394E-11 -0.302E+04	-0.117E+05 -0.117E+05	-0.212E+03 -0.824E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.37578E-03	-0.37578E-03	.27217	0.00000
2	-0.75588E-03	-0.84903E-05	.54746	0.00000
3	-0.11194E-02	0.32812E-03	.81075	0.00000
4	-0.13758E-02	0.54360E-03	.99648	0.00000
5	-0.13862E-02	0.54614E-03	1.0040	0.00287

6	-0.10869E-02	0.28044E-03	.78722	0.00000
7	-0.71065E-03	-0.65189E-04	.51471	0.00000
8	-0.46510E-03	-0.29267E-03	.33686	0.00000
9	-0.32267E-03	-0.41880E-03	.30333	0.00000
10	-0.28808E-03	-0.43842E-03	.31754	0.00000
11	-0.34840E-03	-0.36630E-03	.26530	0.00000
12	-0.41498E-03	-0.29425E-03	.30056	0.00000
13	-0.29987E-03	-0.40166E-03	.29091	0.00000
14	-0.26416E-03	-0.42725E-03	.30945	0.00000
15	-0.15456E-03	-0.52854E-03	.38281	0.00000
16	-0.50334E-04	-0.62262E-03	.45095	0.00000
17	0.46103E-04	-0.70911E-03	.51359	0.00000
18	0.13508E-03	-0.78838E-03	.57100	0.00000
19	0.21498E-03	-0.85850E-03	.62179	0.00000
20	0.27193E-03	-0.90847E-03	.65799	0.00000
21	0.27698E-03	-0.91691E-03	.66410	0.00000
22	0.23176E-03	-0.88225E-03	.63899	0.00000
23	0.15566E-03	-0.81683E-03	.59161	0.00000
24	0.44412E-04	-0.71671E-03	.51910	0.00000
25	-0.98650E-04	-0.58487E-03	.42360	0.00000
26	-0.26016E-03	-0.43220E-03	.31303	0.00000
27	-0.34215E-03	-0.35799E-03	.25929	0.00000
28	-0.40035E-03	-0.30505E-03	.28996	0.00000
29	-0.29002E-03	-0.42378E-03	.30693	0.00000
30	-0.31011E-03	-0.41756E-03	.30243	0.00000
31	-0.37636E-03	-0.36481E-03	.27259	0.00000
32	-0.52198E-03	-0.23447E-03	.37806	0.00000
33	-0.75273E-03	-0.21163E-04	.54518	0.00000
34	-0.11067E-02	0.30537E-03	.80153	0.00000
35	-0.13842E-02	0.55442E-03	1.0025	0.00181
36	-0.13645E-02	0.54673E-03	.98828	0.00000
37	-0.11070E-02	0.33185E-03	.80176	0.00000
38	-0.74637E-03	-0.23739E-05	.54058	0.00000
39	-0.36812E-03	-0.36812E-03	.26662	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.30241	0.00000	0.09145
2	-0.30756	-0.21604	0.31064
3	-0.31838	-0.41843	0.51980
4	-0.33487	-0.55485	0.66698
5	-0.33802	-0.55858	0.67284
6	-0.32450	-0.39525	0.50056
7	-0.31218	-0.18658	0.28404
8	-0.30491	-0.04984	0.14281
9	-0.29835	0.02779	0.11680
10	-0.29233	0.04346	0.12891
11	-0.28758	0.00517	0.08788
12	-0.28538	-0.03490	0.11634
13	-0.28228	0.02942	0.10911
14	-0.27821	0.04715	0.12454
15	-0.27486	0.10810	0.18365
16	-0.27078	0.16543	0.23875
17	-0.26678	0.21831	0.28948
18	-0.26287	0.26694	0.33604
19	-0.25894	0.31031	0.37736
20	-0.25613	0.34121	0.40682
21	-0.25749	0.34511	0.41142
22	-0.26174	0.32202	0.39053
23	-0.26603	0.28111	0.35189
24	-0.27052	0.22002	0.29320
25	-0.27503	0.14055	0.21619
26	-0.27859	0.04973	0.12734
27	-0.28172	0.00458	0.08395
28	-0.28383	-0.02755	0.10811
29	-0.28722	0.03867	0.12116
30	-0.29279	0.03106	0.11679
31	-0.29823	-0.00334	0.09228
32	-0.30438	-0.08311	0.17575
33	-0.31139	-0.21147	0.30844
34	-0.32242	-0.40817	0.51213
35	-0.33388	-0.56039	0.67186
36	-0.32906	-0.55248	0.66075
37	-0.31190	-0.41592	0.51320

38	-0.30128	-0.21507	0.30583
39	-0.29624	0.00000	0.08776

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	13386.	30800.	0.435
BUCKLING THRUST (psi)	5	13386.	49978.	0.268
SEAM THRUST (psi)	5	13386.	21914.	0.611
PLASTIC-PENETRATE (%)	5	0.29	90.00	0.003
COMBINED T&M Ratio	5	0.673	1.000	0.673

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.90
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.18
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage SU4-OPR  
LIVE LOADS X 3.23 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
MOM. OF INERTIA (IN**4/IN) .....	0.97860
SECTION MODULUS (IN**3/IN) .....	0.32170
PLASTIC SECTION MOD(IN**3/IN) .....	0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING .....	0.70000
BUCKLING STRESS FAILURE.....	0.70000
SEAM STRENGTH FAILURE .....	0.67000

FULL PLASTIC PENETRATION..... 0.90000

ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -200.0	F = 0.000
1181	23	F = 0.000	F = -200.0	F = 0.000
1182	22	F = 0.000	F = -200.0	F = 0.000
1182	23	F = 0.000	F = -200.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000

856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-94.10	F =	0.000
1180	23	F =	0.000	F =	-94.10	F =	0.000
1177	22	F =	0.000	F =	-141.1	F =	0.000
1177	23	F =	0.000	F =	-141.1	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17

19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000



INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000

33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.450	Factor for load step #22
23	1.450	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.634E+00 -0.115E+01	0.195E+02 0.711E+01	0.583E-11 -0.382E+04	-0.148E+05 -0.148E+05	0.371E+03 0.144E+04
2	-228.76 18.07	-0.906E+00 -0.113E+01	-0.490E+01 -0.156E+01	-0.616E+04 -0.386E+04	-0.342E+05 -0.150E+05	0.266E+03 0.104E+04
3	-225.31 35.99	-0.111E+01 -0.110E+01	-0.293E+02 -0.102E+02	-0.103E+05 -0.398E+04	-0.440E+05 -0.155E+05	0.186E+03 0.722E+03
4	-220.13 51.09	-0.121E+01 -0.107E+01	-0.500E+02 -0.153E+02	-0.130E+05 -0.422E+04	-0.440E+05 -0.164E+05	0.741E+02 0.288E+03
5	-211.66 64.62	-0.120E+01 -0.109E+01	-0.494E+02 -0.544E+01	-0.129E+05 -0.438E+04	-0.440E+05 -0.170E+05	-0.116E+03 -0.452E+03
6	-200.33 75.87	-0.111E+01 -0.119E+01	-0.360E+02 0.126E+02	-0.931E+04 -0.429E+04	-0.440E+05 -0.167E+05	-0.237E+03 -0.920E+03
7	-187.99 85.12	-0.100E+01 -0.135E+01	-0.197E+02 0.582E+01	-0.532E+04 -0.413E+04	-0.326E+05 -0.160E+05	-0.197E+03 -0.764E+03
8	-175.22 93.78	-0.879E+00 -0.155E+01	-0.161E+02 0.468E+01	-0.295E+04 -0.404E+04	-0.249E+05 -0.157E+05	-0.114E+03 -0.443E+03
9	-162.05	-0.752E+00	-0.164E+02	-0.141E+04	-0.198E+05	-0.522E+02

	101.82	-0.178E+01	0.470E+01	-0.396E+04	-0.154E+05	-0.203E+03
10	-148.51 109.22	-0.629E+00 -0.202E+01	-0.158E+02 0.449E+01	-0.853E+03 -0.389E+04	-0.178E+05 -0.151E+05	0.101E+02 0.394E+02
11	-134.64 115.97	-0.515E+00 -0.228E+01	-0.204E+02 0.583E+01	-0.116E+04 -0.381E+04	-0.184E+05 -0.148E+05	0.106E+03 0.413E+03
12	-120.46 122.05	-0.409E+00 -0.255E+01	-0.280E+01 0.818E+00	-0.350E+04 -0.376E+04	-0.255E+05 -0.146E+05	0.106E+03 0.410E+03
13	-106.01 127.44	-0.308E+00 -0.285E+01	-0.885E+01 0.253E+01	-0.369E+04 -0.374E+04	-0.260E+05 -0.145E+05	0.177E+02 0.686E+02
14	-91.31 132.15	-0.214E+00 -0.318E+01	0.426E+00 0.168E+00	-0.316E+04 -0.372E+04	-0.243E+05 -0.144E+05	-0.940E+02 -0.365E+03
15	-76.42 136.15	-0.131E+00 -0.353E+01	-0.112E+02 0.312E+01	0.281E+03 -0.368E+04	-0.152E+05 -0.143E+05	-0.186E+03 -0.725E+03
16	-61.34 139.43	-0.644E-01 -0.389E+01	-0.114E+02 0.315E+01	0.378E+04 -0.363E+04	-0.259E+05 -0.141E+05	-0.185E+03 -0.720E+03
17	-46.13 141.99	-0.194E-01 -0.422E+01	-0.116E+02 0.319E+01	0.719E+04 -0.357E+04	-0.362E+05 -0.139E+05	-0.178E+03 -0.692E+03
18	-30.81 143.82	0.458E-02 -0.450E+01	-0.124E+02 0.340E+01	0.104E+05 -0.351E+04	-0.440E+05 -0.136E+05	-0.160E+03 -0.623E+03
19	-15.42 144.93	0.109E-01 -0.470E+01	-0.127E+02 0.349E+01	0.130E+05 -0.345E+04	-0.440E+05 -0.134E+05	-0.131E+03 -0.508E+03
20	0.00 145.29	0.632E-02 -0.479E+01	-0.162E+02 0.345E+01	0.150E+05 -0.339E+04	-0.440E+05 -0.132E+05	-0.694E+02 -0.270E+03
21	15.42 144.93	0.548E-03 -0.476E+01	-0.175E+02 -0.440E+01	0.153E+05 -0.340E+04	-0.440E+05 -0.132E+05	0.304E+02 0.118E+03
22	30.81 143.82	0.460E-02 -0.460E+01	-0.153E+02 -0.420E+01	0.137E+05 -0.347E+04	-0.440E+05 -0.135E+05	0.121E+03 0.471E+03
23	46.13 141.99	0.279E-01 -0.433E+01	-0.155E+02 -0.427E+01	0.107E+05 -0.354E+04	-0.440E+05 -0.138E+05	0.193E+03 0.750E+03
24	61.34 139.43	0.760E-01 -0.398E+01	-0.149E+02 -0.409E+01	0.656E+04 -0.362E+04	-0.344E+05 -0.141E+05	0.258E+03 0.100E+04
25	76.42 136.15	0.150E+00 -0.358E+01	-0.110E+02 -0.305E+01	0.141E+04 -0.368E+04	-0.187E+05 -0.143E+05	0.285E+03 0.111E+04
26	91.31 132.15	0.245E+00 -0.318E+01	-0.917E-01 -0.913E-02	-0.367E+04 -0.372E+04	-0.259E+05 -0.145E+05	0.195E+03 0.760E+03
27	106.01 127.44	0.352E+00 -0.280E+01	0.401E-01 -0.185E-01	-0.594E+04 -0.373E+04	-0.329E+05 -0.145E+05	0.195E+02 0.756E+02
28	120.46 122.05	0.463E+00 -0.248E+01	0.592E-01 -0.892E-02	-0.534E+04 -0.372E+04	-0.311E+05 -0.145E+05	-0.158E+03 -0.613E+03
29	134.64 115.97	0.576E+00 -0.219E+01	-0.272E+02 -0.786E+01	-0.190E+04 -0.378E+04	-0.206E+05 -0.147E+05	-0.126E+03 -0.491E+03

30	148.51 109.22	0.695E+00 -0.192E+01	-0.133E+02 -0.377E+01	-0.209E+04 -0.386E+04	-0.215E+05 -0.150E+05	0.430E+01 0.167E+02
31	162.05 101.82	0.818E+00 -0.167E+01	-0.152E+02 -0.436E+01	-0.255E+04 -0.393E+04	-0.232E+05 -0.153E+05	0.393E+02 0.153E+03
32	175.22 93.78	0.942E+00 -0.145E+01	-0.158E+02 -0.460E+01	-0.370E+04 -0.400E+04	-0.270E+05 -0.156E+05	0.903E+02 0.351E+03
33	187.99 85.12	0.106E+01 -0.126E+01	-0.206E+02 -0.614E+01	-0.562E+04 -0.409E+04	-0.334E+05 -0.159E+05	0.179E+03 0.697E+03
34	200.33 75.87	0.116E+01 -0.111E+01	-0.356E+02 -0.693E+01	-0.942E+04 -0.421E+04	-0.440E+05 -0.164E+05	0.230E+03 0.893E+03
35	211.66 64.62	0.123E+01 -0.103E+01	-0.468E+02 0.107E+02	-0.129E+05 -0.421E+04	-0.440E+05 -0.164E+05	0.109E+03 0.425E+03
36	220.13 51.09	0.123E+01 -0.102E+01	-0.474E+02 0.145E+02	-0.128E+05 -0.401E+04	-0.440E+05 -0.156E+05	-0.806E+02 -0.313E+03
37	225.31 35.99	0.113E+01 -0.105E+01	-0.282E+02 0.985E+01	-0.101E+05 -0.379E+04	-0.440E+05 -0.147E+05	-0.185E+03 -0.720E+03
38	228.76 18.07	0.908E+00 -0.108E+01	-0.471E+01 0.150E+01	-0.596E+04 -0.367E+04	-0.328E+05 -0.143E+05	-0.258E+03 -0.100E+04
39	231.30 0.00	0.628E+00 -0.111E+01	0.188E+02 -0.685E+01	0.565E-10 -0.363E+04	-0.141E+05 -0.141E+05	-0.357E+03 -0.139E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.46597E-03	-0.46597E-03	.33749	0.00000
2	-0.10722E-02	0.13039E-03	.77659	0.00000
3	-0.15077E-02	0.52830E-03	1.0920	0.06240
4	-0.19711E-02	0.81787E-03	1.4276	0.21170
5	-0.19851E-02	0.78574E-03	1.4377	0.21812
6	-0.14337E-02	0.38557E-03	1.0384	0.02915
7	-0.10223E-02	0.16025E-04	.74041	0.00000
8	-0.77985E-03	-0.20468E-03	.56483	0.00000
9	-0.62086E-03	-0.34492E-03	.44967	0.00000
10	-0.55723E-03	-0.39089E-03	.40358	0.00000
11	-0.57815E-03	-0.35111E-03	.41874	0.00000
12	-0.80062E-03	-0.11726E-03	.57987	0.00000
13	-0.81587E-03	-0.96337E-04	.59091	0.00000
14	-0.76129E-03	-0.14531E-03	.55139	0.00000
15	-0.42195E-03	-0.47677E-03	.34532	0.00000
16	-0.73235E-04	-0.81146E-03	.58772	0.00000
17	0.26646E-03	-0.11371E-02	.82354	0.00000
18	0.58458E-03	-0.14427E-02	1.0449	0.03058
19	0.88773E-03	-0.17926E-02	1.2983	0.15367
20	0.11478E-02	-0.21578E-02	1.5629	0.23509
21	0.11941E-02	-0.22363E-02	1.6197	0.24943
22	0.96959E-03	-0.19143E-02	1.3865	0.18502
23	0.61963E-03	-0.14890E-02	1.0784	0.05135
24	0.19854E-03	-0.10807E-02	.78272	0.00000
25	-0.31216E-03	-0.58663E-03	.42488	0.00000
26	-0.81120E-03	-0.96206E-04	.58753	0.00000
27	-0.10335E-02	0.12472E-03	.74855	0.00000
28	-0.97522E-03	0.67084E-04	.70633	0.00000
29	-0.64562E-03	-0.27577E-03	.46760	0.00000
30	-0.67483E-03	-0.26784E-03	.48876	0.00000
31	-0.72752E-03	-0.23083E-03	.52693	0.00000
32	-0.84852E-03	-0.12758E-03	.61456	0.00000

33	-0.10473E-02	0.49263E-04	.75852	0.00000
34	-0.14348E-02	0.40531E-03	1.0392	0.02939
35	-0.19437E-02	0.80095E-03	1.4078	0.20513
36	-0.18846E-02	0.81147E-03	1.3649	0.18689
37	-0.14468E-02	0.52016E-03	1.0479	0.03360
38	-0.10289E-02	0.13320E-03	.74523	0.00000
39	-0.44310E-03	-0.44310E-03	.32093	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.37499	0.00000	0.14062
2	-0.37898	-0.34764	0.49126
3	-0.39091	-0.58365	0.73646
4	-0.41374	-0.73497	0.90615
5	-0.42955	-0.72930	0.91381
6	-0.42114	-0.52507	0.70242
7	-0.40489	-0.30014	0.46408
8	-0.39615	-0.16626	0.32320
9	-0.38861	-0.07976	0.23078
10	-0.38150	-0.04808	0.19362
11	-0.37391	-0.06563	0.20544
12	-0.36933	-0.19754	0.33394
13	-0.36705	-0.20799	0.34272
14	-0.36480	-0.17806	0.31113
15	-0.36162	0.01585	0.14662
16	-0.35598	0.21340	0.34012
17	-0.35031	0.40571	0.52843
18	-0.34452	0.58467	0.70336
19	-0.33861	0.73360	0.84826
20	-0.33289	0.84327	0.95408
21	-0.33352	0.86171	0.97295
22	-0.34040	0.77074	0.88661
23	-0.34756	0.60565	0.72644
24	-0.35496	0.36978	0.49578
25	-0.36165	0.07934	0.21013
26	-0.36512	-0.20668	0.33999
27	-0.36567	-0.33481	0.46853
28	-0.36541	-0.30129	0.43482
29	-0.37074	-0.10691	0.24436
30	-0.37931	-0.11765	0.26152
31	-0.38562	-0.14358	0.29228
32	-0.39276	-0.20840	0.36266
33	-0.40158	-0.31697	0.47824
34	-0.41359	-0.53105	0.70211
35	-0.41335	-0.72805	0.89891
36	-0.39387	-0.72316	0.87830
37	-0.37195	-0.56712	0.70546
38	-0.36042	-0.33593	0.46584
39	-0.35659	0.00000	0.12716

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	17010.	30800.	0.552
BUCKLING THRUST (psi)	5	17010.	49193.	0.346
SEAM THRUST (psi)	5	17010.	21914.	0.776
PLASTIC-PENETRATE (%)	21	24.94	90.00	0.277
COMBINED T&M Ratio	21	0.973	1.000	0.973

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.74
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.35
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR SU4 TRUCK

YOL=1.5, YDL= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) TOLfac factored from CANDE	Thrust (DL) TOLus unfactored	Thrust (DL+LL) TOLLLfac factored from CANDE	Thrust (LL) TOLus unfactored	Thrust Load Rating
		Load Step 21 kips/ft.	TOLFac/1.575 kips/ft.	Load Step 23 kips/ft.	(TOLLLfac-TOLus)/1.75	OPR (TOLus-TOLus*1.5)/TOLus*1.45
-231.304	0	-31.95	-20.28	-36.97	2.87	9.10
-228.758	18.07	-32.57	-20.68	-37.61	2.87	8.95
-225.306	35.988	-33.73	-21.42	-38.93	2.97	8.41
-220.131	51.091	-34.93	-22.18	-40.94	3.44	7.04
-211.657	64.621	-34.40	-21.84	-41.33	3.96	6.20
-200.328	75.871	-32.67	-20.74	-39.68	4.00	6.41
-187.985	85.125	-31.41	-19.94	-38.17	3.86	6.86
-175.215	93.781	-30.62	-19.44	-37.28	3.80	7.10
-162.047	101.819	-29.92	-18.99	-36.48	3.75	7.33
-148.512	109.22	-29.28	-18.59	-35.74	3.69	7.55
-134.639	115.968	-28.85	-18.32	-35.16	3.61	7.81
-120.46	122.048	-28.70	-18.23	-34.89	3.54	8.00
-106.008	127.445	-28.32	-17.98	-34.51	3.54	8.06
-91.315	132.148	-27.77	-17.63	-34.02	3.57	8.10
-76.415	136.145	-27.38	-17.39	-33.61	3.56	8.19
-61.341	139.428	-26.98	-17.13	-33.11	3.50	8.40
-46.128	141.99	-26.60	-16.89	-32.62	3.44	8.63
-30.81	143.823	-26.25	-16.67	-32.14	3.37	8.88
-15.423	144.925	-25.91	-16.45	-31.66	3.29	9.17
0	145.293	-25.72	-16.33	-31.32	3.20	9.45
15.423	144.925	-25.86	-16.42	-31.48	3.21	9.39
30.81	143.823	-26.20	-16.64	-32.00	3.32	9.03
46.128	141.99	-26.55	-16.86	-32.53	3.41	8.69
61.341	139.428	-26.93	-17.10	-33.08	3.51	8.38
76.415	136.145	-27.33	-17.35	-33.63	3.60	8.11
91.315	132.148	-27.73	-17.61	-34.06	3.62	8.00
106.008	127.445	-28.23	-17.92	-34.45	3.55	8.05
120.46	122.048	-28.56	-18.14	-34.70	3.51	8.09
134.639	115.968	-28.84	-18.31	-35.12	3.59	7.86
148.512	109.22	-29.34	-18.63	-35.80	3.69	7.55
162.047	101.819	-29.94	-19.01	-36.46	3.73	7.36
175.215	93.781	-30.62	-19.44	-37.22	3.77	7.16
187.985	85.125	-31.37	-19.92	-38.07	3.83	6.93
200.328	75.871	-32.61	-20.71	-39.42	3.89	6.61
211.657	64.621	-34.41	-21.85	-40.82	3.66	6.70
220.131	51.091	-35.05	-22.25	-40.23	2.96	8.13
225.306	35.988	-33.86	-21.50	-38.14	2.44	10.19
228.758	18.07	-32.69	-20.76	-36.84	2.37	10.83
231.304	0	-32.06	-20.35	-36.22	2.38	10.96

Thrust Load Rating=

6.20

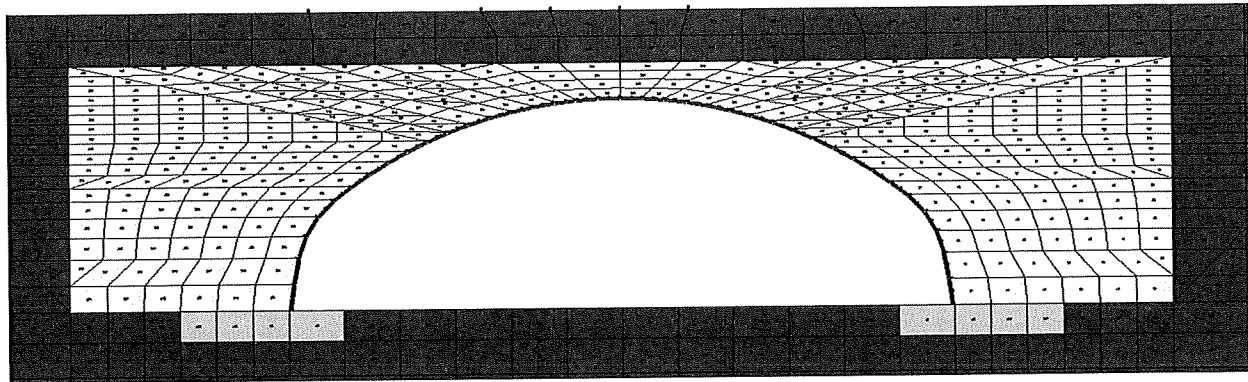
Y<sub>DL</sub>=1.5, Y<sub>DL</sub>= 1.45 (OPR)

BEAM OUTPUT FOR S4A TRUCK

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DLfac</sub> factored from CANDE Load Step 21 kips-ft/ft.	Moment (DL) M <sub>DLs</sub> unfactored M <sub>DLfac</sub> /1.575	Moment (DL+LL) M <sub>DL+LLfac</sub> factored from CANDE Load Step 23 kips-ft/ft.	Moment (LL) M <sub>LLs</sub> unfactored (M <sub>DL+LLfac</sub> -M <sub>DLfac</sub> )/1.75	Moment Load Rating OPR (M <sub>DL+LLfac</sub> -1.5)/M <sub>LLs</sub> *1.45
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-3.83	0.45	22.60
-225.306	35.988	-6.33	-4.02	-7.42	0.63	12.95
-220.131	51.091	-8.36	-5.31	-9.84	0.85	7.99
-211.657	64.621	-8.32	-5.28	-9.91	0.91	7.48
-200.328	75.871	-5.60	-3.55	-7.01	0.81	10.64
-187.985	85.125	-2.10	-1.33	-3.31	0.69	15.78
-175.215	93.781	0.19	0.12	-0.88	0.61	19.76
-162.047	101.819	1.40	0.89	0.49	0.52	21.75
-148.512	109.22	1.55	0.98	0.77	0.44	25.35
-134.639	115.968	0.77	0.49	0.09	0.39	30.28
-120.46	122.048	0.53	0.34	-0.62	0.66	18.15
-106.008	127.445	2.01	1.27	0.52	0.85	12.90
-91.315	132.148	2.10	1.33	0.84	0.72	15.08
-76.415	136.145	2.24	1.42	1.92	0.19	58.02
-61.341	139.428	2.25	1.43	2.93	0.39	27.64
-46.128	141.99	2.16	1.37	3.87	0.98	11.10
-30.81	143.823	2.05	1.30	4.73	1.53	7.13
-15.423	144.925	2.02	1.28	5.50	1.99	5.49
0	145.293	2.03	1.29	6.05	2.30	4.76
15.423	144.925	2.09	1.33	6.12	2.30	4.73
30.81	143.823	2.20	1.40	5.71	2.00	5.39
46.128	141.99	2.38	1.51	4.98	1.49	7.19
61.341	139.428	2.53	1.61	3.90	0.78	13.52
76.415	136.145	2.56	1.63	2.49	0.04	256.09
91.315	132.148	2.47	1.57	0.88	0.91	11.71
106.008	127.445	2.26	1.43	0.08	1.24	8.67
120.46	122.048	1.31	0.83	-0.49	1.03	11.11
134.639	115.968	1.68	1.07	0.69	0.57	19.54
148.512	109.22	1.78	1.13	0.55	0.70	15.84
162.047	101.819	1.26	0.80	-0.06	0.75	15.23
175.215	93.781	-0.16	-0.10	-1.47	0.75	16.14
187.985	85.125	-2.51	-1.60	-3.75	0.71	15.01
200.328	75.871	-5.97	-3.79	-7.24	0.72	11.51
211.657	64.621	-8.57	-5.44	-9.94	0.78	8.49
220.131	51.091	-8.54	-5.42	-9.80	0.72	9.23
225.306	35.988	-6.43	-4.09	-7.38	0.54	14.93
228.758	18.07	-3.09	-1.96	-3.81	0.41	24.67
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating=  
Actual Load Rating (from CANDE)4.73  
3.23





## SU5

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage SU5

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08

POISSONS RATIO OF METAL (-) ..... 0.30000E+00

YIELD STRESS OF METAL (PSI)..... 0.44000E+05

LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05

DENSITY OF METAL (PCI)..... 0.28400E+00

MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
 COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
 (FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -61.86	F = 0.000
1181	23	F = 0.000	F = -61.86	F = 0.000
1182	22	F = 0.000	F = -61.86	F = 0.000
1182	23	F = 0.000	F = -61.86	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000

911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-29.11	F =	0.000
1180	23	F =	0.000	F =	-29.11	F =	0.000
1179	22	F =	0.000	F =	-29.11	F =	0.000
1179	23	F =	0.000	F =	-29.11	F =	0.000
1176	22	F =	0.000	F =	-43.67	F =	0.000
1176	23	F =	0.000	F =	-43.67	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000

4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.486E+00 -0.106E+01	0.851E+01 0.373E+01	-0.105E-10 -0.315E+04	-0.122E+05 -0.122E+05	0.219E+03 0.850E+03

2	-228.76 18.07	-0.653E+00 -0.104E+01	-0.801E+01 -0.242E+01	-0.392E+04 -0.320E+04	-0.246E+05 -0.124E+05	0.204E+03 0.792E+03
3	-225.31 35.99	-0.778E+00 -0.103E+01	-0.245E+02 -0.857E+01	-0.757E+04 -0.331E+04	-0.364E+05 -0.129E+05	0.175E+03 0.679E+03
4	-220.13 51.09	-0.824E+00 -0.102E+01	-0.407E+02 -0.911E+01	-0.100E+05 -0.348E+04	-0.440E+05 -0.135E+05	0.789E+02 0.307E+03
5	-211.66 64.62	-0.800E+00 -0.104E+01	-0.385E+02 0.649E+01	-0.101E+05 -0.350E+04	-0.440E+05 -0.136E+05	-0.881E+02 -0.342E+03
6	-200.33 75.87	-0.727E+00 -0.113E+01	-0.258E+02 0.916E+01	-0.722E+04 -0.335E+04	-0.355E+05 -0.130E+05	-0.210E+03 -0.817E+03
7	-187.99 85.12	-0.634E+00 -0.126E+01	-0.153E+02 0.454E+01	-0.349E+04 -0.322E+04	-0.234E+05 -0.125E+05	-0.198E+03 -0.768E+03
8	-175.22 93.78	-0.533E+00 -0.142E+01	-0.141E+02 0.409E+01	-0.103E+04 -0.315E+04	-0.154E+05 -0.122E+05	-0.121E+03 -0.470E+03
9	-162.05 101.82	-0.435E+00 -0.160E+01	-0.142E+02 0.405E+01	0.368E+03 -0.308E+04	-0.131E+05 -0.120E+05	-0.503E+02 -0.195E+03
10	-148.51 109.22	-0.346E+00 -0.178E+01	-0.132E+02 0.379E+01	0.661E+03 -0.302E+04	-0.138E+05 -0.117E+05	0.167E+02 0.647E+02
11	-134.64 115.97	-0.266E+00 -0.195E+01	-0.951E+01 0.273E+01	0.177E+02 -0.297E+04	-0.116E+05 -0.115E+05	0.505E+02 0.196E+03
12	-120.46 122.05	-0.196E+00 -0.214E+01	-0.291E-01 0.304E-01	-0.713E+03 -0.295E+04	-0.137E+05 -0.115E+05	-0.160E+02 -0.621E+02
13	-106.01 127.44	-0.133E+00 -0.232E+01	-0.122E+02 0.348E+01	0.715E+03 -0.292E+04	-0.136E+05 -0.113E+05	-0.605E+02 -0.235E+03
14	-91.31 132.15	-0.802E-01 -0.251E+01	-0.677E+01 0.191E+01	0.138E+04 -0.287E+04	-0.155E+05 -0.112E+05	-0.512E+02 -0.199E+03
15	-76.42 136.15	-0.392E-01 -0.269E+01	-0.946E+01 0.268E+01	0.254E+04 -0.284E+04	-0.189E+05 -0.110E+05	-0.610E+02 -0.237E+03
16	-61.34 139.43	-0.105E-01 -0.285E+01	-0.914E+01 0.260E+01	0.351E+04 -0.279E+04	-0.218E+05 -0.109E+05	-0.504E+02 -0.196E+03
17	-46.13 141.99	0.640E-02 -0.298E+01	-0.880E+01 0.250E+01	0.433E+04 -0.275E+04	-0.241E+05 -0.107E+05	-0.430E+02 -0.167E+03
18	-30.81 143.82	0.132E-01 -0.309E+01	-0.846E+01 0.239E+01	0.503E+04 -0.271E+04	-0.262E+05 -0.105E+05	-0.389E+02 -0.151E+03
19	-15.42 144.93	0.127E-01 -0.315E+01	-0.891E+01 0.253E+01	0.566E+04 -0.267E+04	-0.280E+05 -0.104E+05	-0.319E+02 -0.124E+03
20	0.00 145.29	0.824E-02 -0.318E+01	-0.978E+01 0.222E+00	0.608E+04 -0.265E+04	-0.292E+05 -0.103E+05	-0.135E+02 -0.524E+02
21	15.42 144.93	0.381E-02 -0.315E+01	-0.984E+01 -0.282E+01	0.605E+04 -0.267E+04	-0.292E+05 -0.104E+05	0.123E+02 0.478E+02

22	30.81 143.82	0.355E-02 -0.308E+01	-0.949E+01 -0.269E+01	0.559E+04 -0.271E+04	-0.279E+05 -0.105E+05	0.344E+02 0.134E+03
23	46.13 141.99	0.113E-01 -0.297E+01	-0.980E+01 -0.278E+01	0.481E+04 -0.276E+04	-0.257E+05 -0.107E+05	0.540E+02 0.210E+03
24	61.34 139.43	0.300E-01 -0.282E+01	-0.985E+01 -0.280E+01	0.368E+04 -0.280E+04	-0.223E+05 -0.109E+05	0.742E+02 0.288E+03
25	76.42 136.15	0.612E-01 -0.265E+01	-0.956E+01 -0.270E+01	0.223E+04 -0.285E+04	-0.180E+05 -0.111E+05	0.904E+02 0.351E+03
26	91.31 132.15	0.105E+00 -0.246E+01	-0.519E+01 -0.145E+01	0.582E+03 -0.289E+04	-0.130E+05 -0.112E+05	0.685E+02 0.266E+03
27	106.01 127.44	0.159E+00 -0.227E+01	-0.780E+01 -0.223E+01	-0.170E+03 -0.292E+04	-0.119E+05 -0.113E+05	0.315E+02 0.123E+03
28	120.46 122.05	0.221E+00 -0.209E+01	-0.193E+01 -0.536E+00	-0.627E+03 -0.294E+04	-0.134E+05 -0.114E+05	-0.319E+02 -0.124E+03
29	134.64 115.97	0.292E+00 -0.191E+01	-0.150E+02 -0.429E+01	0.625E+03 -0.297E+04	-0.135E+05 -0.116E+05	-0.414E+02 -0.161E+03
30	148.51 109.22	0.372E+00 -0.172E+01	-0.113E+02 -0.323E+01	0.496E+03 -0.303E+04	-0.133E+05 -0.118E+05	0.192E+02 0.747E+02
31	162.05 101.82	0.462E+00 -0.155E+01	-0.129E+02 -0.369E+01	-0.951E+02 -0.309E+04	-0.123E+05 -0.120E+05	0.607E+02 0.236E+03
32	175.22 93.78	0.559E+00 -0.137E+01	-0.134E+02 -0.388E+01	-0.148E+04 -0.315E+04	-0.168E+05 -0.122E+05	0.115E+03 0.448E+03
33	187.99 85.12	0.658E+00 -0.121E+01	-0.153E+02 -0.453E+01	-0.372E+04 -0.322E+04	-0.241E+05 -0.125E+05	0.185E+03 0.720E+03
34	200.33 75.87	0.746E+00 -0.108E+01	-0.259E+02 -0.668E+01	-0.723E+04 -0.333E+04	-0.354E+05 -0.129E+05	0.200E+03 0.776E+03
35	211.66 64.62	0.815E+00 -0.101E+01	-0.380E+02 -0.349E+01	-0.999E+04 -0.344E+04	-0.440E+05 -0.134E+05	0.832E+02 0.323E+03
36	220.13 51.09	0.834E+00 -0.986E+00	-0.395E+02 0.112E+02	-0.986E+04 -0.337E+04	-0.438E+05 -0.131E+05	-0.777E+02 -0.302E+03
37	225.31 35.99	0.783E+00 -0.996E+00	-0.236E+02 0.823E+01	-0.744E+04 -0.319E+04	-0.355E+05 -0.124E+05	-0.171E+03 -0.663E+03
38	228.76 18.07	0.654E+00 -0.101E+01	-0.759E+01 0.229E+01	-0.388E+04 -0.308E+04	-0.240E+05 -0.120E+05	-0.200E+03 -0.778E+03
39	231.30 0.00	0.484E+00 -0.103E+01	0.842E+01 -0.366E+01	-0.576E-11 -0.303E+04	-0.118E+05 -0.118E+05	-0.217E+03 -0.843E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.38375E-03	-0.38375E-03	.27794	0.00000
2	-0.77305E-03	-0.74020E-05	.55990	0.00000



3	-0.11420E-02	0.33409E-03	.82712	0.00000
4	-0.14041E-02	0.55498E-03	1.0170	0.01195
5	-0.14152E-02	0.56108E-03	1.0250	0.01744
6	-0.11124E-02	0.29542E-03	.80570	0.00000
7	-0.73296E-03	-0.53083E-04	.53086	0.00000
8	-0.48477E-03	-0.28302E-03	.35111	0.00000
9	-0.33979E-03	-0.41153E-03	.29806	0.00000
10	-0.30362E-03	-0.43261E-03	.31333	0.00000
11	-0.36039E-03	-0.36384E-03	.26352	0.00000
12	-0.42915E-03	-0.28998E-03	.31082	0.00000
13	-0.28623E-03	-0.42575E-03	.30836	0.00000
14	-0.21570E-03	-0.48539E-03	.35156	0.00000
15	-0.97863E-04	-0.59386E-03	.43012	0.00000
16	0.21844E-05	-0.68326E-03	.49487	0.00000
17	0.86574E-04	-0.75746E-03	.54861	0.00000
18	0.15998E-03	-0.82115E-03	.59474	0.00000
19	0.22622E-03	-0.87769E-03	.63569	0.00000
20	0.26960E-03	-0.91560E-03	.66315	0.00000
21	0.26508E-03	-0.91597E-03	.66341	0.00000
22	0.21466E-03	-0.87621E-03	.63462	0.00000
23	0.13276E-03	-0.80516E-03	.58316	0.00000
24	0.16645E-04	-0.70033E-03	.50723	0.00000
25	-0.13043E-03	-0.56463E-03	.40894	0.00000
26	-0.29517E-03	-0.40869E-03	.29601	0.00000
27	-0.37231E-03	-0.33914E-03	.26966	0.00000
28	-0.41949E-03	-0.29726E-03	.30382	0.00000
29	-0.30178E-03	-0.42373E-03	.30690	0.00000
30	-0.32145E-03	-0.41821E-03	.30290	0.00000
31	-0.38590E-03	-0.36736E-03	.27950	0.00000
32	-0.52840E-03	-0.24028E-03	.38270	0.00000
33	-0.75626E-03	-0.30150E-04	.54774	0.00000
34	-0.11118E-02	0.29944E-03	.80523	0.00000
35	-0.13934E-02	0.55547E-03	1.0092	0.00652
36	-0.13737E-02	0.55065E-03	.99496	0.00000
37	-0.11155E-02	0.33668E-03	.80792	0.00000
38	-0.75466E-03	0.22370E-05	.54658	0.00000
39	-0.37005E-03	-0.37005E-03	.26802	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/ (P-resist)	FACTORED MOMENT-RATIO M/ (M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.30882	0.00000	0.09537
2	-0.31403	-0.22132	0.31994
3	-0.32508	-0.42669	0.53237
4	-0.34155	-0.56613	0.68279
5	-0.34342	-0.57091	0.68885
6	-0.32874	-0.40696	0.51503
7	-0.31628	-0.19653	0.29656
8	-0.30894	-0.05832	0.15376
9	-0.30231	0.02074	0.11213
10	-0.29624	0.03729	0.12505
11	-0.29141	0.00100	0.08592
12	-0.28936	-0.04023	0.12396
13	-0.28648	0.04033	0.12240
14	-0.28210	0.07796	0.15754
15	-0.27833	0.14338	0.22085
16	-0.27405	0.19814	0.27324
17	-0.26995	0.24398	0.31686
18	-0.26604	0.28361	0.35439
19	-0.26213	0.31910	0.38782
20	-0.25994	0.34260	0.41017
21	-0.26190	0.34140	0.40999
22	-0.26619	0.31533	0.38619
23	-0.27056	0.27112	0.34432
24	-0.27510	0.20725	0.28293
25	-0.27967	0.12551	0.20373
26	-0.28322	0.03282	0.11303
27	-0.28627	-0.00959	0.09154
28	-0.28840	-0.03533	0.11851
29	-0.29193	0.03525	0.12047
30	-0.29762	0.02797	0.11655
31	-0.30309	-0.00536	0.09723
32	-0.30930	-0.08329	0.17895
33	-0.31643	-0.20989	0.31002
34	-0.32686	-0.40793	0.51477

35	-0.33713	-0.56330	0.67696
36	-0.33119	-0.55627	0.66596
37	-0.31337	-0.41977	0.51797
38	-0.30276	-0.21879	0.31046
39	-0.29780	0.00000	0.08868

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	13599.	30800.	0.442
BUCKLING THRUST (psi)	5	13599.	50053.	0.272
SEAM THRUST (psi)	5	13599.	21914.	0.621
PLASTIC-PENETRATE (%)	5	1.74	90.00	0.019
COMBINED T&M Ratio	5	0.689	1.000	0.689

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.92
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.18
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage SU5-OPR  
LIVE LOADS X 3.23 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
DENSITY OF METAL (PCI)..... 0.28400E+00  
MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000

SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000

ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)

(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -200.0	F = 0.000
1181	23	F = 0.000	F = -200.0	F = 0.000
1182	22	F = 0.000	F = -200.0	F = 0.000
1182	23	F = 0.000	F = -200.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000

856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-94.11	F =	0.000
1180	23	F =	0.000	F =	-94.11	F =	0.000
1179	22	F =	0.000	F =	-94.11	F =	0.000
1179	23	F =	0.000	F =	-94.11	F =	0.000
1176	22	F =	0.000	F =	-141.2	F =	0.000
1176	23	F =	0.000	F =	-141.2	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...  
 THE NUMBER OF DATA ERRORS IS----- 0  
 THE NUMBER OF SOIL MATERIALS IS----- 4  
 THE NUMBER OF PIPE-TYPE GROUPS IS----- 1  
 THE NUMBER OF INTERFACE MATERIALS IS--- 37  
 BAND WIDTH ESTIMATE (MAX)----- 2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15

17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000

FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000

31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.450	Factor for load step #22
23	1.450	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.658E+00 -0.120E+01	0.210E+02 0.762E+01	0.404E-10 -0.400E+04	-0.156E+05 -0.156E+05	0.395E+03 0.153E+04
2	-228.76 18.07	-0.942E+00 -0.117E+01	-0.469E+01 -0.152E+01	-0.653E+04 -0.404E+04	-0.360E+05 -0.157E+05	0.277E+03 0.108E+04
3	-225.31 35.99	-0.116E+01 -0.114E+01	-0.304E+02 -0.107E+02	-0.108E+05 -0.417E+04	-0.440E+05 -0.162E+05	0.187E+03 0.725E+03
4	-220.13 51.09	-0.125E+01 -0.111E+01	-0.529E+02 -0.162E+02	-0.135E+05 -0.441E+04	-0.440E+05 -0.172E+05	0.721E+02 0.280E+03
5	-211.66 64.62	-0.124E+01 -0.113E+01	-0.527E+02 -0.198E+01	0.133E+05 -0.455E+04	-0.440E+05 -0.177E+05	-0.112E+03 -0.436E+03
6	-200.33 75.87	-0.115E+01 -0.124E+01	-0.377E+02 0.134E+02	-0.985E+04 -0.444E+04	-0.440E+05 -0.172E+05	-0.224E+03 -0.870E+03
7	-187.99 85.12	-0.103E+01 -0.141E+01	-0.199E+02 0.588E+01	-0.606E+04 -0.426E+04	-0.354E+05 -0.166E+05	-0.183E+03 -0.709E+03
8	-175.22	-0.893E+00	-0.159E+02	-0.381E+04	-0.281E+05	-0.107E+03



	93.78	-0.163E+01	0.462E+01	-0.418E+04	-0.162E+05	-0.415E+03
9	-162.05 101.82	-0.751E+00 -0.188E+01	-0.162E+02 0.463E+01	-0.223E+04 -0.410E+04	-0.229E+05 -0.159E+05	-0.554E+02 -0.215E+03
10	-148.51 109.22	-0.613E+00 -0.216E+01	-0.158E+02 0.449E+01	-0.144E+04 -0.403E+04	-0.201E+05 -0.157E+05	-0.124E+01 -0.482E+01
11	-134.64 115.97	-0.483E+00 -0.245E+01	-0.221E+02 0.632E+01	-0.141E+04 -0.395E+04	-0.197E+05 -0.153E+05	0.103E+03 0.399E+03
12	-120.46 122.05	-0.362E+00 -0.276E+01	0.282E+01 0.883E+00	-0.374E+04 -0.389E+04	-0.268E+05 -0.151E+05	0.659E+02 0.256E+03
13	-106.01 127.44	-0.248E+00 -0.310E+01	-0.902E+01 0.255E+01	-0.248E+04 -0.387E+04	-0.228E+05 -0.150E+05	-0.702E+02 -0.273E+03
14	-91.31 132.15	-0.145E+00 -0.346E+01	-0.646E+01 0.178E+01	-0.479E+03 -0.383E+04	-0.164E+05 -0.149E+05	-0.133E+03 -0.517E+03
15	-76.42 136.15	-0.583E-01 -0.383E+01	-0.129E+02 0.359E+01	0.283E+04 -0.378E+04	-0.235E+05 -0.147E+05	-0.164E+03 -0.636E+03
16	-61.34 139.43	0.659E-02 -0.418E+01	-0.123E+02 0.338E+01	0.580E+04 -0.372E+04	-0.325E+05 -0.145E+05	-0.147E+03 -0.570E+03
17	-46.13 141.99	0.485E-01 -0.449E+01	-0.117E+02 0.319E+01	0.850E+04 -0.366E+04	-0.407E+05 -0.142E+05	-0.137E+03 -0.531E+03
18	-30.81 143.82	0.691E-01 -0.473E+01	-0.118E+02 0.320E+01	0.110E+05 -0.361E+04	-0.440E+05 -0.140E+05	-0.128E+03 -0.497E+03
19	-15.42 144.93	0.730E-01 -0.490E+01	-0.124E+02 0.339E+01	0.132E+05 -0.355E+04	-0.440E+05 -0.138E+05	-0.111E+03 -0.431E+03
20	0.00 145.29	0.675E-01 -0.495E+01	-0.158E+02 0.215E+01	0.148E+05 -0.350E+04	-0.440E+05 -0.136E+05	-0.601E+02 -0.234E+03
21	15.42 144.93	0.623E-01 -0.488E+01	-0.177E+02 -0.455E+01	0.150E+05 -0.352E+04	-0.440E+05 -0.137E+05	0.321E+02 0.125E+03
22	30.81 143.82	0.683E-01 -0.468E+01	-0.159E+02 -0.438E+01	0.133E+05 -0.359E+04	-0.440E+05 -0.140E+05	0.123E+03 0.478E+03
23	46.13 141.99	0.946E-01 -0.438E+01	-0.160E+02 -0.439E+01	0.102E+05 -0.367E+04	-0.440E+05 -0.143E+05	0.198E+03 0.768E+03
24	61.34 139.43	0.146E+00 -0.400E+01	-0.153E+02 -0.422E+01	0.589E+04 -0.375E+04	-0.329E+05 -0.146E+05	0.264E+03 0.103E+04
25	76.42 136.15	0.224E+00 -0.358E+01	-0.109E+02 -0.302E+01	0.557E+03 -0.381E+04	-0.166E+05 -0.148E+05	0.288E+03 0.112E+04
26	91.31 132.15	0.323E+00 -0.316E+01	-0.464E-01 -0.117E-01	-0.457E+04 -0.385E+04	-0.292E+05 -0.150E+05	0.191E+03 0.743E+03
27	106.01 127.44	0.433E+00 -0.278E+01	0.822E-01 -0.188E-01	-0.677E+04 -0.386E+04	-0.360E+05 -0.150E+05	0.834E+01 0.324E+02
28	120.46 122.05	0.545E+00 -0.245E+01	0.854E-01 0.263E-02	-0.597E+04 -0.385E+04	-0.335E+05 -0.150E+05	-0.176E+03 -0.682E+03

29	134.64 115.97	0.658E+00 -0.216E+01	-0.283E+02 -0.808E+01	-0.221E+04 -0.391E+04	-0.221E+05 -0.152E+05	-0.142E+03 -0.551E+03
30	148.51 109.22	0.774E+00 -0.190E+01	-0.137E+02 -0.392E+01	-0.226E+04 -0.400E+04	-0.225E+05 -0.155E+05	-0.477E+01 -0.185E+02
31	162.05 101.82	0.895E+00 -0.165E+01	-0.156E+02 -0.448E+01	-0.258E+04 -0.406E+04	-0.238E+05 -0.158E+05	0.307E+02 0.119E+03
32	175.22 93.78	0.102E+01 -0.144E+01	-0.165E+02 -0.481E+01	-0.359E+04 -0.414E+04	-0.272E+05 -0.161E+05	0.841E+02 0.327E+03
33	187.99 85.12	0.113E+01 -0.125E+01	-0.221E+02 -0.655E+01	-0.545E+04 -0.423E+04	-0.334E+05 -0.164E+05	0.183E+03 0.712E+03
34	200.33 75.87	0.123E+01 -0.110E+01	-0.369E+02 -0.326E+01	-0.942E+04 -0.433E+04	-0.440E+05 -0.168E+05	0.243E+03 0.946E+03
35	211.66 64.62	0.130E+01 -0.102E+01	-0.471E+02 0.138E+02	-0.132E+05 -0.428E+04	-0.440E+05 -0.166E+05	0.120E+03 0.467E+03
36	220.13 51.09	0.129E+01 -0.102E+01	-0.478E+02 0.146E+02	-0.131E+05 -0.405E+04	-0.440E+05 -0.158E+05	-0.762E+02 -0.296E+03
37	225.31 35.99	0.118E+01 -0.105E+01	-0.283E+02 0.987E+01	-0.104E+05 -0.383E+04	-0.440E+05 -0.149E+05	-0.185E+03 -0.720E+03
38	228.76 18.07	0.944E+00 -0.108E+01	-0.438E+01 0.140E+01	-0.620E+04 -0.371E+04	-0.337E+05 -0.144E+05	-0.265E+03 -0.103E+04
39	231.30 0.00	0.646E+00 -0.111E+01	0.195E+02 -0.707E+01	-0.726E-10 -0.368E+04	-0.143E+05 -0.143E+05	-0.371E+03 -0.144E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.48832E-03	-0.48832E-03	.35368	0.00000
2	-0.11297E-02	0.14324E-03	.81822	0.00000
3	-0.15971E-02	0.55833E-03	1.1567	0.10038
4	-0.21193E-02	0.85984E-03	1.5350	0.24793
5	-0.21194E-02	0.82330E-03	1.5350	0.25102
6	-0.15151E-02	0.42397E-03	1.0974	0.06933
7	-0.11116E-02	0.71386E-04	.80510	0.00000
8	-0.88139E-03	-0.13722E-03	.63837	0.00000
9	-0.71744E-03	-0.28267E-03	.51963	0.00000
10	-0.63122E-03	-0.35125E-03	.45718	0.00000
11	-0.61920E-03	-0.34339E-03	.44847	0.00000
12	-0.84000E-03	-0.10992E-03	.60839	0.00000
13	-0.71391E-03	-0.22942E-03	.51707	0.00000
14	-0.51368E-03	-0.42024E-03	.37205	0.00000
15	-0.18527E-03	-0.73674E-03	.53360	0.00000
16	0.11215E-03	-0.10192E-02	.73817	0.00000
17	0.38281E-03	-0.12758E-02	.92402	0.00000
18	0.64070E-03	-0.15304E-02	1.1084	0.06896
19	0.90085E-03	-0.18449E-02	1.3362	0.16907
20	0.11209E-02	-0.21603E-02	1.5646	0.23759
21	0.11470E-02	-0.22107E-02	1.6011	0.24719
22	0.91420E-03	-0.18795E-02	1.3612	0.17853
23	0.55356E-03	-0.14506E-02	1.0507	0.03489
24	0.11802E-03	-0.10316E-02	.74715	0.00000
25	-0.41085E-03	-0.51961E-03	.37634	0.00000
26	-0.91490E-03	-0.24121E-04	.66264	0.00000
27	-0.11301E-02	0.18976E-03	.81849	0.00000
28	-0.10525E-02	0.11302E-03	.76230	0.00000

29	-0.69236E-03	-0.26058E-03	.50146	0.00000
30	-0.70739E-03	-0.26741E-03	.51234	0.00000
31	-0.74696E-03	-0.24394E-03	.54100	0.00000
32	-0.85448E-03	-0.15472E-03	.61888	0.00000
33	-0.10476E-02	0.15306E-04	.75874	0.00000
34	-0.14505E-02	0.39173E-03	1.0506	0.03790
35	-0.20094E-02	0.82699E-03	1.4553	0.22165
36	-0.19592E-02	0.85120E-03	1.4190	0.20585
37	-0.14899E-02	0.54979E-03	1.0791	0.05356
38	-0.10577E-02	0.15198E-03	.76610	0.00000
39	-0.44829E-03	-0.44829E-03	.32469	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.39298	0.00000	0.15443
2	-0.39693	-0.36797	0.52552
3	-0.40921	-0.61027	0.77772
4	-0.43308	-0.76029	0.94785
5	-0.44690	-0.75276	0.95248
6	-0.43531	-0.55564	0.74514
7	-0.41855	-0.34196	0.51715
8	-0.40986	-0.21511	0.38310
9	-0.40242	-0.12568	0.28762
10	-0.39532	-0.08093	0.23721
11	-0.38732	-0.07973	0.22975
12	-0.38222	-0.21104	0.35713
13	-0.37957	-0.14005	0.28412
14	-0.37579	-0.02701	0.16823
15	-0.37100	0.15941	0.29705
16	-0.36497	0.32703	0.46023
17	-0.35931	0.47945	0.60855
18	-0.35384	0.62061	0.74581
19	-0.34829	0.74396	0.86526
20	-0.34368	0.83621	0.95433
21	-0.34543	0.84691	0.96624
22	-0.35257	0.75129	0.87559
23	-0.35997	0.57765	0.70723
24	-0.36759	0.33231	0.46744
25	-0.37439	0.03144	0.17161
26	-0.37784	-0.25749	0.40026
27	-0.37836	-0.38152	0.52468
28	-0.37802	-0.33692	0.47982
29	-0.38344	-0.12481	0.27184
30	-0.39224	-0.12718	0.28103
31	-0.39871	-0.14541	0.30438
32	-0.40608	-0.20228	0.36717
33	-0.41537	-0.30725	0.47978
34	-0.42496	-0.53115	0.71174
35	-0.41970	-0.74156	0.91771
36	-0.39791	-0.74154	0.89987
37	-0.37594	-0.58582	0.72714
38	-0.36446	-0.34969	0.48252
39	-0.36076	0.00000	0.13015

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	17697.	30800.	0.575
BUCKLING THRUST (psi)	5	17697.	48991.	0.361
SEAM THRUST (psi)	5	17697.	21914.	0.808
PLASTIC-PENETRATE (%)	5	25.10	90.00	0.279
COMBINED T&M Ratio	21	0.966	1.000	0.966

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.81
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.36
HANDLING FACTOR RATIO = $(SPAN^2/EI)/FF$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR SUS TRUCK

Y<sub>0</sub>=1.5, YD= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) T <sub>DLfac</sub> factored from CANDE Load Step 21 kips/ft.	Thrust (DL) T <sub>DLs</sub> unfactored TDI <sub>fac</sub> /1.575 kips/ft.	Thrust (DL+LL) T <sub>DL+LLfac</sub> factored from CANDE Load Step 23 kips/ft.	Thrust (LL) T <sub>LLs</sub> unfactored (T <sub>DL+LLfac</sub> -T <sub>DLfac</sub> )/1.75	Thrust Load Rating OPR (T <sub>Opp</sub> -T <sub>DLs</sub> *1.5)/T <sub>LLs</sub> *1.45
-231.304	0	-31.94	-20.28	-37.76	3.32	7.87
-228.758	18.07	-32.57	-20.68	-38.40	3.33	7.73
-225.306	35.988	-33.73	-21.42	-39.75	3.44	7.26
-220.131	51.091	-34.93	-22.18	-41.76	3.90	6.19
-211.657	64.621	-34.40	-21.84	-41.99	4.33	5.66
-200.328	75.871	-32.68	-20.75	-40.19	4.30	5.97
-187.985	85.125	-31.41	-19.94	-38.67	4.15	6.39
-175.215	93.781	-30.63	-19.44	-37.77	4.08	6.61
-162.047	101.819	-29.92	-19.00	-36.96	4.03	6.83
-148.512	109.22	-29.28	-18.59	-36.22	3.97	7.03
-134.639	115.968	-28.85	-18.32	-35.63	3.87	7.27
-120.46	122.048	-28.71	-18.23	-35.38	3.81	7.41
-106.008	127.445	-28.32	-17.98	-35.03	3.83	7.45
-91.315	132.148	-27.77	-17.63	-34.49	3.84	7.53
-76.415	136.145	-27.39	-17.39	-34.03	3.80	7.68
-61.341	139.428	-26.99	-17.14	-33.51	3.73	7.89
-46.128	141.99	-26.61	-16.89	-33.01	3.66	8.11
-30.81	143.823	-26.25	-16.67	-32.53	3.58	8.34
-15.423	144.925	-25.91	-16.45	-32.05	3.51	8.59
0	145.293	-25.72	-16.33	-31.78	3.47	8.73
15.423	144.925	-25.86	-16.42	-32.02	3.52	8.56
30.81	143.823	-26.20	-16.64	-32.55	3.63	8.25
46.128	141.99	-26.55	-16.86	-33.08	3.73	7.96
61.341	139.428	-26.93	-17.10	-33.64	3.83	7.68
76.415	136.145	-27.33	-17.35	-34.20	3.92	7.44
91.315	132.148	-27.74	-17.61	-34.63	3.94	7.34
106.008	127.445	-28.23	-17.92	-35.00	3.87	7.39
120.46	122.048	-28.56	-18.14	-35.26	3.83	7.41
134.639	115.968	-28.84	-18.31	-35.69	3.92	7.20
148.512	109.22	-29.34	-18.63	-36.39	4.03	6.91
162.047	101.819	-29.94	-19.01	-37.06	4.07	6.75
175.215	93.781	-30.62	-19.44	-37.82	4.12	6.57
187.985	85.125	-31.38	-19.92	-38.69	4.18	6.35
200.328	75.871	-32.61	-20.71	-39.96	4.20	6.12
211.657	64.621	-34.41	-21.85	-41.22	3.89	6.31
220.131	51.091	-35.05	-22.25	-40.49	3.11	7.75
225.306	35.988	-33.86	-21.50	-38.32	2.54	9.78
228.758	18.07	-32.69	-20.76	-37.02	2.47	10.38
231.304	0	-32.06	-20.36	-36.41	2.49	10.48

Thrust Load Rating=

5.66

BEAM OUTPUT FOR S15 TRUCK

Y0=1.5, YDL= 1.45 (OPR)

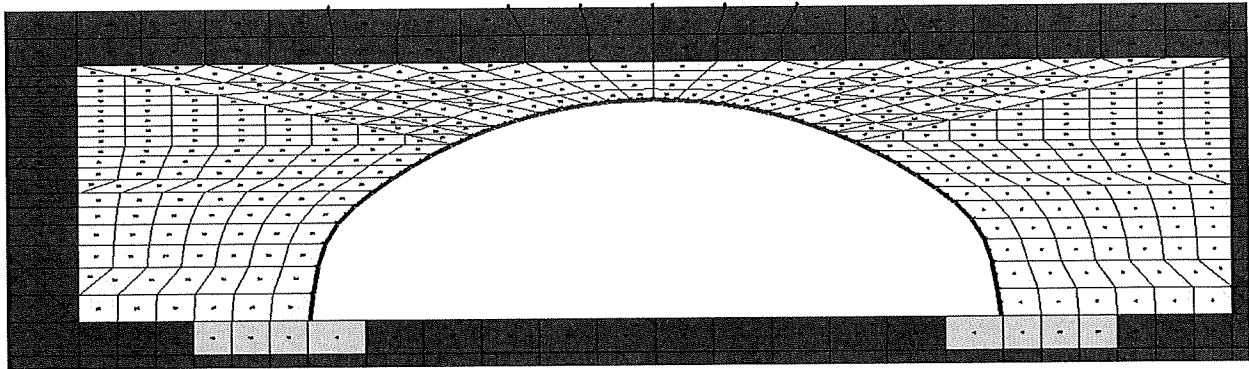
X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DLac</sub> factored from CANDE Load Step 21 Kips-ft/ft.	Moment (DL) M <sub>DLs</sub> unfactored M <sub>DLac</sub> /1.575	Moment (DL+LL) M <sub>DL+LLac</sub> factored from CANDE Load Step 23 Kips-ft/ft.	Moment (LL) M <sub>LLs</sub> unfactored (M <sub>DL+LLac</sub> -M <sub>DLac</sub> )/1.75	Moment Load Rating OPR (M <sub>DL+LLac</sub> -1.5)/M <sub>LLs</sub> +1.45
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-3.92	0.51	20.21
-225.306	35.988	-6.32	-4.02	-7.57	0.71	11.42
-220.131	51.091	-8.36	-5.30	-10.04	0.96	7.04
-211.657	64.621	-8.31	-5.28	-10.12	1.04	6.57
-200.328	75.871	-5.59	-3.55	-7.22	0.93	9.26
-187.985	85.125	-2.10	-1.33	-3.49	0.79	13.73
-175.215	93.781	0.19	0.12	-1.03	0.70	17.29
-162.047	101.819	1.41	0.89	0.37	0.59	19.09
-148.512	109.22	1.55	0.98	0.66	0.51	22.19
-134.639	115.968	0.77	0.49	0.02	0.43	27.32
-120.46	121.048	0.53	0.33	-0.71	0.71	16.84
-106.008	127.445	1.99	1.27	0.72	0.73	15.00
-91.315	132.148	2.08	1.32	1.38	0.40	27.44
-76.415	136.145	2.23	1.41	2.54	0.18	59.58
-61.341	139.428	2.24	1.42	3.51	0.73	14.85
-46.128	141.99	2.16	1.37	4.33	1.24	8.77
-30.81	143.823	2.06	1.31	5.03	1.70	6.43
-15.423	144.925	2.03	1.29	5.66	2.07	5.27
0	145.293	2.04	1.30	6.08	2.30	4.74
15.423	144.925	2.10	1.34	6.05	2.26	4.82
30.81	143.823	2.21	1.40	5.59	1.93	5.59
46.128	141.99	2.39	1.52	4.81	1.38	7.73
61.341	139.428	2.53	1.61	3.68	0.65	16.23
76.415	136.145	2.57	1.63	2.23	0.19	54.34
91.315	132.148	2.47	1.57	0.58	1.08	9.85
106.008	127.445	2.26	1.43	-0.17	1.39	7.77
120.46	122.048	1.31	0.83	-0.63	1.10	10.32
134.639	115.968	1.68	1.07	0.63	0.60	18.44
148.512	109.22	1.78	1.13	0.50	0.73	15.17
162.047	101.819	1.25	0.80	-0.10	0.77	14.83
175.215	93.781	-0.16	-0.10	-1.48	0.75	16.12
187.985	85.125	-2.51	-1.60	-3.72	0.69	15.37
200.328	75.871	-5.97	-3.79	-7.23	0.72	11.57
211.657	64.621	-8.57	-5.44	-9.99	0.81	8.18
220.131	51.091	-8.54	-5.42	-9.86	0.76	8.77
225.306	35.988	-6.43	-4.09	-7.44	0.58	13.93
228.758	18.07	-3.09	-1.96	-3.88	0.45	22.62
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating=  
Actual Load Rating (from CANDE)

4.74  
3.23

City of Moraine Spreadsheet RFP Wax Park Splash Pad  
Wax park Splash Pad  
Hydrogeology Exploration, Testing, and Analysis

		Total Estimate
Drilling and Well Installation	\$	13,000.00
Laboratory Perm Testing	\$	4,000.00
Cardno Consulting	\$	21,250.00
Todd's Weik Total	\$	6,100.00
Slug Testing	\$	6,720.00
Well Development	\$	3,360.00
Researching Flood/River heights	\$	2,080.00
Oversight	\$	2,500.00
Hourly Rates		
Cyrus	\$	90.00
Tammy	\$	120.00
Tim	\$	90.00



## SU6

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage SU6

EXECUTION MODE ..... ANALYS  
 SOLUTION LEVEL ..... #3 USER  
 METHODOLOGY (LRFD OR SERVICE) ... LRFD  
 NUMBER OF PIPE-ELEMENT GROUPS .... 1  
 MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
 NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
 AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1



## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

## BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -61.86	F = 0.000
1181	23	F = 0.000	F = -61.86	F = 0.000
1182	22	F = 0.000	F = -61.86	F = 0.000
1182	23	F = 0.000	F = -61.86	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000

936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-29.11	F =	0.000
1180	23	F =	0.000	F =	-29.11	F =	0.000
1179	22	F =	0.000	F =	-29.11	F =	0.000
1179	23	F =	0.000	F =	-29.11	F =	0.000
1176	22	F =	0.000	F =	-43.67	F =	0.000
1176	23	F =	0.000	F =	-43.67	F =	0.000
1183	22	F =	0.000	F =	-29.11	F =	0.000
1183	23	F =	0.000	F =	-29.11	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...  
 THE NUMBER OF DATA ERRORS IS----- 0  
 THE NUMBER OF SOIL MATERIALS IS----- 4  
 THE NUMBER OF PIPE-TYPE GROUPS IS----- 1  
 THE NUMBER OF INTERFACE MATERIALS IS--- 37  
 BAND WIDTH ESTIMATE (MAX)----- 2060

\* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000

3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD	X-DISP.	N-PRES.	MOMENT	MAX-STRESS	SHEAR
	Y-COORD	Y-DISP.	S-PRES.	THRUST	HOOP-STRESS	S-STRESS
1	-231.30	-0.496E+00	0.907E+01	0.131E-10	-0.123E+05	0.225E+03
	0.00	-0.106E+01	0.390E+01	-0.317E+04	-0.123E+05	0.876E+03

2	-228.76 18.07	-0.669E+00 -0.105E+01	-0.780E+01 -0.236E+01	-0.401E+04 -0.322E+04	-0.250E+05 -0.125E+05	0.206E+03 0.800E+03
3	-225.31 35.99	-0.798E+00 -0.103E+01	-0.247E+02 -0.861E+01	-0.765E+04 -0.334E+04	-0.368E+05 -0.130E+05	0.174E+03 0.675E+03
4	-220.13 51.09	-0.847E+00 -0.102E+01	-0.410E+02 -0.104E+02	-0.101E+05 -0.351E+04	-0.440E+05 -0.137E+05	0.766E+02 0.298E+03
5	-211.66 64.62	-0.826E+00 -0.104E+01	-0.394E+02 0.434E+01	-0.101E+05 -0.356E+04	-0.440E+05 -0.138E+05	-0.916E+02 -0.356E+03
6	-200.33 75.87	-0.755E+00 -0.112E+01	-0.267E+02 0.949E+01	-0.718E+04 -0.343E+04	-0.356E+05 -0.133E+05	-0.212E+03 -0.824E+03
7	-187.99 85.12	-0.664E+00 -0.125E+01	-0.157E+02 0.466E+01	-0.346E+04 -0.329E+04	-0.236E+05 -0.128E+05	-0.196E+03 -0.762E+03
8	-175.22 93.78	-0.565E+00 -0.141E+01	-0.143E+02 0.415E+01	-0.105E+04 -0.322E+04	-0.158E+05 -0.125E+05	-0.118E+03 -0.460E+03
9	-162.05 101.82	-0.468E+00 -0.159E+01	-0.143E+02 0.410E+01	0.305E+03 -0.315E+04	-0.132E+05 -0.122E+05	-0.483E+02 -0.188E+03
10	-148.51 109.22	-0.380E+00 -0.176E+01	-0.134E+02 0.384E+01	0.574E+03 -0.309E+04	-0.138E+05 -0.120E+05	0.178E+02 0.690E+02
11	-134.64 115.97	-0.301E+00 -0.194E+01	-0.101E+02 0.290E+01	-0.818E+02 -0.304E+04	-0.121E+05 -0.118E+05	0.540E+02 0.210E+03
12	-120.46 122.05	-0.231E+00 -0.212E+01	-0.467E+00 0.141E+00	-0.911E+03 -0.301E+04	-0.145E+05 -0.117E+05	-0.778E+01 -0.302E+02
13	-106.01 127.44	-0.168E+00 -0.231E+01	-0.121E+02 0.345E+01	0.367E+03 -0.298E+04	-0.127E+05 -0.116E+05	-0.530E+02 -0.206E+03
14	-91.31 132.15	-0.115E+00 -0.250E+01	-0.658E+01 0.186E+01	0.966E+03 -0.294E+04	-0.144E+05 -0.114E+05	-0.493E+02 -0.192E+03
15	-76.42 136.15	-0.722E-01 -0.268E+01	-0.965E+01 0.274E+01	0.216E+04 -0.290E+04	-0.180E+05 -0.113E+05	-0.623E+02 -0.242E+03
16	-61.34 139.43	-0.418E-01 -0.285E+01	-0.932E+01 0.265E+01	0.316E+04 -0.286E+04	-0.209E+05 -0.111E+05	-0.520E+02 -0.202E+03
17	-46.13 141.99	-0.231E-01 -0.300E+01	-0.897E+01 0.255E+01	0.403E+04 -0.282E+04	-0.235E+05 -0.109E+05	-0.451E+02 -0.175E+03
18	-30.81 143.82	-0.148E-01 -0.312E+01	-0.871E+01 0.246E+01	0.479E+04 -0.277E+04	-0.257E+05 -0.108E+05	-0.408E+02 -0.159E+03
19	-15.42 144.93	-0.144E-01 -0.320E+01	-0.890E+01 0.253E+01	0.546E+04 -0.273E+04	-0.276E+05 -0.106E+05	-0.350E+02 -0.136E+03
20	0.00 145.29	-0.186E-01 -0.324E+01	-0.970E+01 0.134E+01	0.597E+04 -0.270E+04	-0.291E+05 -0.105E+05	-0.199E+02 -0.774E+02
21	15.42 144.93	-0.235E-01 -0.323E+01	-0.973E+01 -0.279E+01	0.611E+04 -0.271E+04	-0.295E+05 -0.105E+05	0.199E+01 0.773E+01
22	30.81	-0.250E-01	-0.927E+01	0.586E+04	-0.289E+05	0.194E+02

	143.82	-0.318E+01	-0.263E+01	-0.276E+04	-0.107E+05	0.754E+02
23	46.13 141.99	-0.191E-01 -0.309E+01	-0.990E+01 -0.280E+01	0.537E+04 -0.280E+04	-0.276E+05 -0.109E+05	0.359E+02 0.140E+03
24	61.34 139.43	-0.226E-02 -0.295E+01	-0.102E+02 -0.290E+01	0.454E+04 -0.285E+04	-0.252E+05 -0.111E+05	0.579E+02 0.225E+03
25	76.42 136.15	0.279E-01 -0.278E+01	-0.103E+02 -0.292E+01	0.331E+04 -0.289E+04	-0.215E+05 -0.113E+05	0.810E+02 0.315E+03
26	91.31 132.15	0.720E-01 -0.259E+01	-0.746E+01 -0.209E+01	0.173E+04 -0.294E+04	-0.168E+05 -0.114E+05	0.803E+02 0.312E+03
27	106.01 127.44	0.129E+00 -0.239E+01	-0.839E+01 -0.238E+01	0.529E+03 -0.298E+04	-0.132E+05 -0.116E+05	0.627E+02 0.244E+03
28	120.46 122.05	0.197E+00 -0.219E+01	-0.323E+00 -0.673E-01	-0.484E+03 -0.300E+04	-0.132E+05 -0.116E+05	-0.113E+02 -0.441E+02
29	134.64 115.97	0.274E+00 -0.199E+01	-0.151E+02 -0.432E+01	0.633E+03 -0.303E+04	-0.137E+05 -0.118E+05	-0.348E+02 -0.135E+03
30	148.51 109.22	0.362E+00 -0.179E+01	-0.115E+02 -0.327E+01	0.377E+03 -0.309E+04	-0.132E+05 -0.120E+05	0.255E+02 0.990E+02
31	162.05 101.82	0.460E+00 -0.160E+01	-0.131E+02 -0.375E+01	-0.339E+03 -0.315E+04	-0.133E+05 -0.122E+05	0.674E+02 0.262E+03
32	175.22 93.78	0.566E+00 -0.141E+01	-0.134E+02 -0.389E+01	-0.186E+04 -0.321E+04	-0.183E+05 -0.125E+05	0.122E+03 0.472E+03
33	187.99 85.12	0.671E+00 -0.124E+01	-0.150E+02 -0.447E+01	-0.421E+04 -0.328E+04	-0.258E+05 -0.128E+05	0.187E+03 0.728E+03
34	200.33 75.87	0.765E+00 -0.111E+01	-0.263E+02 -0.937E+01	-0.772E+04 -0.341E+04	-0.372E+05 -0.132E+05	0.197E+03 0.766E+03
35	211.66 64.62	0.837E+00 -0.102E+01	-0.396E+02 -0.404E+01	-0.104E+05 -0.354E+04	-0.440E+05 -0.138E+05	0.789E+02 0.307E+03
36	220.13 51.09	0.857E+00 -0.100E+01	-0.408E+02 0.116E+02	-0.102E+05 -0.348E+04	-0.440E+05 -0.135E+05	-0.827E+02 -0.321E+03
37	225.31 35.99	0.806E+00 -0.101E+01	-0.245E+02 0.855E+01	-0.771E+04 -0.329E+04	-0.367E+05 -0.128E+05	-0.176E+03 -0.682E+03
38	228.76 18.07	0.673E+00 -0.103E+01	-0.757E+01 0.229E+01	-0.406E+04 -0.318E+04	-0.250E+05 -0.124E+05	-0.207E+03 -0.804E+03
39	231.30 0.00	0.497E+00 -0.105E+01	0.934E+01 -0.397E+01	0.174E-10 -0.313E+04	-0.122E+05 -0.122E+05	-0.229E+03 -0.888E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.38676E-03	-0.38676E-03	.28012	0.00000
2	-0.78461E-03	-0.16134E-05	.56827	0.00000
3	-0.11532E-02	0.33955E-03	.83523	0.00000

4	-0.14156E-02	0.55774E-03	1.0252	0.01767
5	-0.14256E-02	0.55607E-03	1.0325	0.02265
6	-0.11185E-02	0.28305E-03	.81012	0.00000
7	-0.73913E-03	-0.64538E-04	.53533	0.00000
8	-0.49538E-03	-0.28973E-03	.35879	0.00000
9	-0.35446E-03	-0.41401E-03	.29986	0.00000
10	-0.32060E-03	-0.43263E-03	.31334	0.00000
11	-0.37840E-03	-0.36244E-03	.27407	0.00000
12	-0.45648E-03	-0.27879E-03	.33062	0.00000
13	-0.32825E-03	-0.39981E-03	.28957	0.00000
14	-0.26451E-03	-0.45288E-03	.32801	0.00000
15	-0.14373E-03	-0.56429E-03	.40870	0.00000
16	-0.39877E-04	-0.65728E-03	.47605	0.00000
17	0.49332E-04	-0.73609E-03	.53313	0.00000
18	0.12849E-03	-0.80528E-03	.58324	0.00000
19	0.19941E-03	-0.86635E-03	.62748	0.00000
20	0.25312E-03	-0.91246E-03	.66087	0.00000
21	0.26473E-03	-0.92670E-03	.67119	0.00000
22	0.23527E-03	-0.90758E-03	.65734	0.00000
23	0.18238E-03	-0.86527E-03	.62669	0.00000
24	0.95352E-04	-0.78957E-03	.57187	0.00000
25	-0.29834E-04	-0.67620E-03	.48976	0.00000
26	-0.18920E-03	-0.52727E-03	.38189	0.00000
27	-0.31128E-03	-0.41452E-03	.30023	0.00000
28	-0.41265E-03	-0.31817E-03	.29887	0.00000
29	-0.30770E-03	-0.43122E-03	.31232	0.00000
30	-0.33989E-03	-0.41338E-03	.29940	0.00000
31	-0.41669E-03	-0.35046E-03	.30179	0.00000
32	-0.57269E-03	-0.21009E-03	.41479	0.00000
33	-0.81053E-03	0.10058E-04	.58705	0.00000
34	-0.11685E-02	0.33713E-03	.84634	0.00000
35	-0.14506E-02	0.58519E-03	1.0506	0.03434
36	-0.14229E-02	0.57372E-03	1.0306	0.02116
37	-0.11529E-02	0.35052E-03	.83504	0.00000
38	-0.78348E-03	0.82348E-05	.56745	0.00000
39	-0.38141E-03	-0.38141E-03	.27625	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.31124	0.00000	0.09687
2	-0.31636	-0.22634	0.32642
3	-0.32739	-0.43150	0.53869
4	-0.34491	-0.57004	0.68901
5	-0.34946	-0.57224	0.69436
6	-0.33618	-0.40515	0.51816
7	-0.32338	-0.19500	0.29957
8	-0.31591	-0.05945	0.15924
9	-0.30921	0.01721	0.11283
10	-0.30308	0.03238	0.12424
11	-0.29810	-0.00461	0.09347
12	-0.29586	-0.05137	0.13890
13	-0.29295	0.02069	0.10651
14	-0.28866	0.05445	0.13777
15	-0.28489	0.12157	0.20273
16	-0.28052	0.17847	0.25716
17	-0.27633	0.22704	0.30340
18	-0.27232	0.26992	0.34408
19	-0.26836	0.30808	0.38009
20	-0.26530	0.33693	0.40732
21	-0.26636	0.34440	0.41535
22	-0.27052	0.33036	0.40354
23	-0.27478	0.30284	0.37834
24	-0.27934	0.25580	0.33383
25	-0.28409	0.18684	0.26755
26	-0.28829	0.09772	0.18083
27	-0.29205	0.02984	0.11513
28	-0.29406	-0.02731	0.11378
29	-0.29732	0.03571	0.12411
30	-0.30310	0.02124	0.11311
31	-0.30868	-0.01914	0.11443
32	-0.31497	-0.10482	0.20402
33	-0.32209	-0.23720	0.34095
34	-0.33454	-0.43524	0.54715
35	-0.34725	-0.58709	0.70767



36	-0.34135	-0.57663	0.69314
37	-0.32287	-0.43460	0.53885
38	-0.31194	-0.22886	0.32616
39	-0.30694	0.00000	0.09421

# ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

## LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	13838.	30800.	0.449
BUCKLING THRUST (psi)	5	13838.	49995.	0.277
SEAM THRUST (psi)	5	13838.	21914.	0.632
PLASTIC-PENETRATE (%)	35	3.43	90.00	0.038
COMBINED T&M Ratio	35	0.708	1.000	0.708

## LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.94
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.19
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage SU6-OPR  
LIVE LOADS X 3.23 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
MOM. OF INERTIA (IN**4/IN) .....	0.97860
SECTION MODULUS (IN**3/IN) .....	0.32170
PLASTIC SECTION MOD(IN**3/IN) .....	0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING .....	0.70000
BUCKLING STRESS FAILURE.....	0.70000
SEAM STRENGTH FAILURE .....	0.67000

FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -200.0	F = 0.000
1181	23	F = 0.000	F = -200.0	F = 0.000
1182	22	F = 0.000	F = -200.0	F = 0.000
1182	23	F = 0.000	F = -200.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000

855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-94.11	F =	0.000
1180	23	F =	0.000	F =	-94.11	F =	0.000
1179	22	F =	0.000	F =	-94.11	F =	0.000
1179	23	F =	0.000	F =	-94.11	F =	0.000
1176	22	F =	0.000	F =	-141.2	F =	0.000
1176	23	F =	0.000	F =	-141.2	F =	0.000
1183	22	F =	0.000	F =	-94.11	F =	0.000
1183	23	F =	0.000	F =	-94.11	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12

14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000

MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000

28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.450	Factor for load step #22
23	1.450	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.677E+00 -0.120E+01	0.221E+02 0.791E+01	0.822E-10 -0.408E+04	-0.158E+05 -0.158E+05	0.415E+03 0.161E+04
2	-228.76 18.07	-0.984E+00 -0.117E+01	-0.423E+01 -0.138E+01	-0.686E+04 -0.412E+04	-0.373E+05 -0.160E+05	0.285E+03 0.111E+04
3	-225.31 35.99	-0.122E+01 -0.114E+01	-0.305E+02 -0.107E+02	-0.113E+05 -0.424E+04	-0.440E+05 -0.165E+05	0.185E+03 0.718E+03
4	-220.13 51.09	-0.133E+01 -0.111E+01	-0.537E+02 -0.165E+02	-0.139E+05 -0.448E+04	-0.440E+05 -0.174E+05	0.646E+02 0.251E+03
5	-211.66 64.62	-0.132E+01 -0.113E+01	-0.536E+02 -0.736E+01	-0.136E+05 -0.467E+04	-0.440E+05 -0.181E+05	-0.127E+03 -0.493E+03
6	-200.33 75.87	-0.123E+01 -0.123E+01	-0.395E+02 0.140E+02	-0.976E+04 -0.458E+04	-0.440E+05 -0.178E+05	-0.240E+03 -0.934E+03
7	-187.99 85.12	-0.111E+01 -0.140E+01	-0.211E+02 0.626E+01	-0.577E+04 -0.440E+04	-0.351E+05 -0.171E+05	-0.189E+03 -0.733E+03
8	-175.22	-0.979E+00	-0.166E+02	-0.352E+04	-0.277E+05	-0.104E+03

	93.78	-0.162E+01	0.482E+01	-0.431E+04	-0.168E+05	-0.406E+03
9	-162.05 101.82	-0.840E+00 -0.186E+01	-0.171E+02 0.490E+01	-0.201E+04 -0.423E+04	-0.227E+05 -0.164E+05	-0.470E+02 -0.183E+03
10	-148.51 109.22	-0.706E+00 -0.213E+01	-0.157E+02 0.446E+01	-0.142E+04 -0.416E+04	-0.206E+05 -0.162E+05	0.688E+01 0.267E+02
11	-134.64 115.97	-0.580E+00 -0.242E+01	-0.236E+02 0.675E+01	-0.147E+04 -0.407E+04	-0.204E+05 -0.158E+05	0.115E+03 0.446E+03
12	-120.46 122.05	-0.462E+00 -0.272E+01	0.113E+01 0.352E+00	-0.412E+04 -0.402E+04	-0.285E+05 -0.156E+05	0.961E+02 0.374E+03
13	-106.01 127.44	-0.349E+00 -0.305E+01	-0.802E+01 0.229E+01	-0.349E+04 -0.401E+04	-0.264E+05 -0.156E+05	-0.410E+02 -0.159E+03
14	-91.31 132.15	-0.246E+00 -0.342E+01	-0.498E+01 0.138E+01	-0.175E+04 -0.397E+04	-0.209E+05 -0.154E+05	-0.130E+03 -0.504E+03
15	-76.42 136.15	-0.157E+00 -0.380E+01	-0.138E+02 0.383E+01	0.177E+04 -0.392E+04	-0.207E+05 -0.153E+05	-0.172E+03 -0.670E+03
16	-61.34 139.43	-0.883E-01 -0.417E+01	-0.131E+02 0.361E+01	0.488E+04 -0.386E+04	-0.302E+05 -0.150E+05	-0.149E+03 -0.581E+03
17	-46.13 141.99	-0.428E-01 -0.450E+01	-0.124E+02 0.341E+01	0.764E+04 -0.380E+04	-0.385E+05 -0.148E+05	-0.134E+03 -0.521E+03
18	-30.81 143.82	-0.189E-01 -0.478E+01	-0.126E+02 0.343E+01	0.101E+05 -0.374E+04	-0.440E+05 -0.145E+05	-0.119E+03 -0.464E+03
19	-15.42 144.93	-0.127E-01 -0.499E+01	-0.124E+02 0.340E+01	0.122E+05 -0.368E+04	-0.440E+05 -0.143E+05	-0.102E+03 -0.395E+03
20	0.00 145.29	-0.175E-01 -0.509E+01	-0.153E+02 0.357E+01	0.139E+05 -0.362E+04	-0.440E+05 -0.141E+05	-0.610E+02 -0.237E+03
21	15.42 144.93	-0.243E-01 -0.509E+01	-0.160E+02 -0.412E+01	0.143E+05 -0.363E+04	-0.440E+05 -0.141E+05	0.827E+01 0.322E+02
22	30.81 143.82	-0.228E-01 -0.496E+01	-0.142E+02 -0.388E+01	0.134E+05 -0.369E+04	-0.440E+05 -0.143E+05	0.678E+02 0.263E+03
23	46.13 141.99	-0.373E-02 -0.473E+01	-0.153E+02 -0.419E+01	0.116E+05 -0.376E+04	-0.440E+05 -0.146E+05	0.119E+03 0.463E+03
24	61.34 139.43	0.397E-01 -0.440E+01	-0.157E+02 -0.429E+01	0.868E+04 -0.383E+04	-0.419E+05 -0.149E+05	0.179E+03 0.695E+03
25	76.42 136.15	0.111E+00 -0.402E+01	-0.156E+02 -0.427E+01	0.475E+04 -0.391E+04	-0.299E+05 -0.152E+05	0.237E+03 0.920E+03
26	91.31 132.15	0.208E+00 -0.361E+01	-0.633E+01 -0.173E+01	-0.749E+02 -0.396E+04	-0.156E+05 -0.154E+05	0.219E+03 0.851E+03
27	106.01 127.44	0.325E+00 -0.320E+01	-0.293E+00 -0.857E-01	-0.347E+04 -0.398E+04	-0.263E+05 -0.155E+05	0.818E+02 0.318E+03
28	120.46 122.05	0.455E+00 -0.281E+01	0.579E-01 -0.936E-02	-0.394E+04 -0.399E+04	-0.277E+05 -0.155E+05	-0.105E+03 -0.409E+03



29	134.64 115.97	0.592E+00 -0.246E+01	-0.291E+02 -0.826E+01	-0.140E+04 -0.405E+04	-0.201E+05 -0.157E+05	-0.712E+02 -0.277E+03
30	148.51 109.22	0.739E+00 -0.213E+01	-0.127E+02 -0.359E+01	-0.279E+04 -0.414E+04	-0.247E+05 -0.161E+05	0.573E+02 0.223E+03
31	162.05 101.82	0.893E+00 -0.183E+01	-0.136E+02 -0.390E+01	-0.409E+04 -0.420E+04	-0.290E+05 -0.163E+05	0.620E+02 0.241E+03
32	175.22 93.78	0.104E+01 -0.156E+01	-0.151E+02 -0.441E+01	-0.545E+04 -0.427E+04	-0.335E+05 -0.166E+05	0.822E+02 0.319E+03
33	187.99 85.12	0.119E+01 -0.133E+01	-0.212E+02 -0.631E+01	-0.720E+04 -0.436E+04	-0.393E+05 -0.169E+05	0.158E+03 0.613E+03
34	200.33 75.87	0.130E+01 -0.116E+01	-0.393E+02 -0.139E+02	-0.107E+05 -0.453E+04	-0.440E+05 -0.176E+05	0.213E+03 0.828E+03
35	211.66 64.62	0.138E+01 -0.106E+01	-0.525E+02 0.132E+02	-0.141E+05 -0.456E+04	-0.440E+05 -0.177E+05	0.104E+03 0.406E+03
36	220.13 51.09	0.138E+01 -0.106E+01	-0.521E+02 0.160E+02	-0.140E+05 -0.433E+04	-0.440E+05 -0.168E+05	-0.795E+02 -0.309E+03
37	225.31 35.99	0.126E+01 -0.109E+01	-0.300E+02 0.105E+02	-0.112E+05 -0.409E+04	-0.440E+05 -0.159E+05	-0.190E+03 -0.737E+03
38	228.76 18.07	0.100E+01 -0.113E+01	-0.412E+01 0.135E+01	-0.677E+04 -0.397E+04	-0.365E+05 -0.154E+05	-0.282E+03 -0.109E+04
39	231.30 0.00	0.676E+00 -0.116E+01	0.218E+02 -0.778E+01	-0.226E-10 -0.393E+04	-0.153E+05 -0.153E+05	-0.406E+03 -0.158E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.49722E-03	-0.49722E-03	.36012	0.00000
2	-0.11706E-02	0.16685E-03	.84786	0.00000
3	-0.16703E-02	0.59919E-03	1.2097	0.12760
4	-0.22335E-02	0.90826E-03	1.6177	0.27145
5	-0.22123E-02	0.84784E-03	1.6023	0.27174
6	-0.15265E-02	0.39716E-03	1.1056	0.07578
7	-0.11001E-02	0.25682E-04	.79674	0.00000
8	-0.86957E-03	-0.18209E-03	.62981	0.00000
9	-0.71251E-03	-0.31983E-03	.51606	0.00000
10	-0.64552E-03	-0.36885E-03	.46753	0.00000
11	-0.64037E-03	-0.35349E-03	.46380	0.00000
12	-0.89314E-03	-0.88477E-04	.64688	0.00000
13	-0.82868E-03	-0.14819E-03	.60019	0.00000
14	-0.65513E-03	-0.31378E-03	.47449	0.00000
15	-0.30616E-03	-0.65110E-03	.47158	0.00000
16	0.51318E-05	-0.94646E-03	.68550	0.00000
17	0.28221E-03	-0.12086E-02	.87539	0.00000
18	0.53375E-03	-0.14481E-02	1.0488	0.03401
19	0.76982E-03	-0.17119E-02	1.2399	0.13347
20	0.97941E-03	-0.19873E-02	1.4393	0.20446
21	0.10391E-02	-0.20808E-02	1.5071	0.22440
22	0.91182E-03	-0.19118E-02	1.3847	0.18809
23	0.68630E-03	-0.16294E-02	1.1801	0.10740
24	0.37964E-03	-0.13138E-02	.95153	0.00000
25	-0.12934E-04	-0.93978E-03	.68066	0.00000
26	-0.49067E-03	-0.47606E-03	.35538	0.00000
27	-0.82476E-03	-0.14720E-03	.59736	0.00000
28	-0.87053E-03	-0.10157E-03	.63051	0.00000

29	-0.62977E-03	-0.35698E-03	.45613	0.00000
30	-0.77648E-03	-0.23262E-03	.56239	0.00000
31	-0.91068E-03	-0.11333E-03	.65959	0.00000
32	-0.10523E-02	0.11640E-04	.76213	0.00000
33	-0.12331E-02	0.17072E-03	.89308	0.00000
34	-0.16436E-02	0.50590E-03	1.1904	0.12231
35	-0.23195E-02	0.93566E-03	1.6799	0.28840
36	-0.22322E-02	0.94714E-03	1.6167	0.26783
37	-0.16358E-02	0.60853E-03	1.1848	0.11369
38	-0.11451E-02	0.17664E-03	.82934	0.00000
39	-0.47964E-03	-0.47964E-03	.34739	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.40014	0.00000	0.16011
2	-0.40390	-0.38662	0.54976
3	-0.41610	-0.63459	0.80772
4	-0.44009	-0.78125	0.97493
5	-0.45810	-0.76616	0.97602
6	-0.44997	-0.55048	0.75295
7	-0.43230	-0.32541	0.51229
8	-0.42316	-0.19873	0.37779
9	-0.41539	-0.11351	0.28606
10	-0.40816	-0.07998	0.24657
11	-0.39991	-0.08293	0.24285
12	-0.39498	-0.23260	0.38861
13	-0.39307	-0.19671	0.35121
14	-0.38986	-0.09867	0.25067
15	-0.38518	0.09971	0.24808
16	-0.37877	0.27507	0.41854
17	-0.37277	0.43096	0.56992
18	-0.36699	0.57133	0.70601
19	-0.36130	0.68912	0.81965
20	-0.35563	0.78165	0.90813
21	-0.35593	0.80693	0.93362
22	-0.36217	0.75454	0.88570
23	-0.36873	0.65208	0.78805
24	-0.37587	0.48951	0.63079
25	-0.38335	0.26792	0.41487
26	-0.38898	-0.00422	0.15553
27	-0.39109	-0.19586	0.34882
28	-0.39115	-0.22228	0.37528
29	-0.39705	-0.07885	0.23650
30	-0.40604	-0.15721	0.32208
31	-0.41204	-0.23049	0.40026
32	-0.41872	-0.30754	0.48287
33	-0.42746	-0.40579	0.58851
34	-0.44486	-0.60470	0.80260
35	-0.44790	-0.79528	0.99589
36	-0.42529	-0.79005	0.97092
37	-0.40168	-0.63130	0.79264
38	-0.38967	-0.38206	0.53390
39	-0.38599	0.00000	0.14899

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	18141.	30800.	0.589
BUCKLING THRUST (psi)	5	18141.	48433.	0.375
SEAM THRUST (psi)	5	18141.	21914.	0.828
PLASTIC-PENETRATE (%)	35	28.84	90.00	0.320
COMBINED T&M Ratio	35	0.996	1.000	0.996

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.86
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.37
HANDLING FACTOR RATIO = $(SPAN^2/EI)/FF$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR SU6 TRUCK

Y<sub>DL</sub>=1.5, YDL= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) T <sub>DLac</sub> factored from CANDE	Thrust (DL) T <sub>DL</sub> unfactored TDI <sub>fac</sub> /1.575 kips/ft.	Thrust (DL+LL) T <sub>DL+LLac</sub> factored from CANDE	Thrust (LL) T <sub>LL</sub> unfactored (T <sub>DL+LLac</sub> -T <sub>DLac</sub> )/1.75	Thrust Load Rating OPR (T <sub>cap</sub> -T <sub>DL+LL</sub> )/T <sub>LL</sub> *1.45
		Load Step 21 kips/ft.		Load Step 23 kips/ft.		
-231.304	0	-31.94	-20.28	-38.06	3.49	7.49
-228.758	18.07	-32.57	-20.68	-38.68	3.49	7.37
-225.306	35.988	-33.73	-21.42	-40.03	3.60	6.94
-220.131	51.091	-34.93	-22.18	-42.17	4.14	5.84
-211.657	64.621	-34.40	-21.84	-42.73	4.76	5.16
-200.328	75.871	-32.68	-20.75	-41.10	4.82	5.33
-187.985	85.125	-31.41	-19.94	-39.54	4.65	5.70
-175.215	93.781	-30.63	-19.45	-38.63	4.57	5.91
-162.047	101.819	-29.92	-19.00	-37.81	4.51	6.10
-148.512	109.22	-29.28	-18.59	-37.06	4.44	6.28
-134.639	115.968	-28.85	-18.32	-36.45	4.34	6.49
-120.46	122.048	-28.71	-18.23	-36.17	4.27	6.63
-106.008	127.445	-28.33	-17.98	-35.82	4.28	6.66
-91.315	132.148	-27.78	-17.64	-35.29	4.30	6.72
-76.415	136.145	-27.39	-17.39	-34.83	4.25	6.85
-61.341	139.428	-26.99	-17.14	-34.30	4.18	7.04
-46.128	141.99	-26.61	-16.89	-33.79	4.10	7.23
-30.81	143.873	-26.26	-16.67	-33.30	4.02	7.43
-15.423	144.925	-25.91	-16.45	-32.81	3.94	7.64
0	145.293	-25.72	-16.33	-32.44	3.84	7.87
15.423	144.925	-25.86	-16.42	-32.57	3.83	7.87
30.81	143.873	-26.20	-16.63	-33.08	3.93	7.61
46.128	141.99	-26.55	-16.86	-33.60	4.03	7.37
61.341	139.428	-26.93	-17.10	-34.15	4.13	7.13
76.415	136.145	-27.33	-17.35	-34.74	4.23	6.89
91.315	132.148	-27.73	-17.61	-35.25	4.29	6.73
106.008	127.445	-28.23	-17.92	-35.71	4.27	6.69
120.46	122.048	-28.56	-18.14	-35.95	4.22	6.72
134.639	115.968	-28.84	-18.31	-36.35	4.29	6.56
148.512	109.22	-29.34	-18.63	-37.06	4.41	6.31
162.047	101.819	-29.94	-19.01	-37.74	4.46	6.16
175.215	93.781	-30.61	-19.44	-38.51	4.51	5.99
187.985	85.125	-31.37	-19.92	-39.38	4.58	5.80
200.328	75.871	-32.61	-20.71	-40.90	4.74	5.43
211.657	64.621	-34.41	-21.85	-42.46	4.60	5.34
220.131	51.091	-35.05	-22.25	-41.74	3.82	6.31
225.306	35.988	-33.87	-21.50	-39.48	3.21	7.76
228.758	18.07	-32.70	-20.76	-38.14	3.11	8.25
231.304	0	-32.06	-20.36	-37.53	3.12	8.34

Thrust Load Rating=

5.16

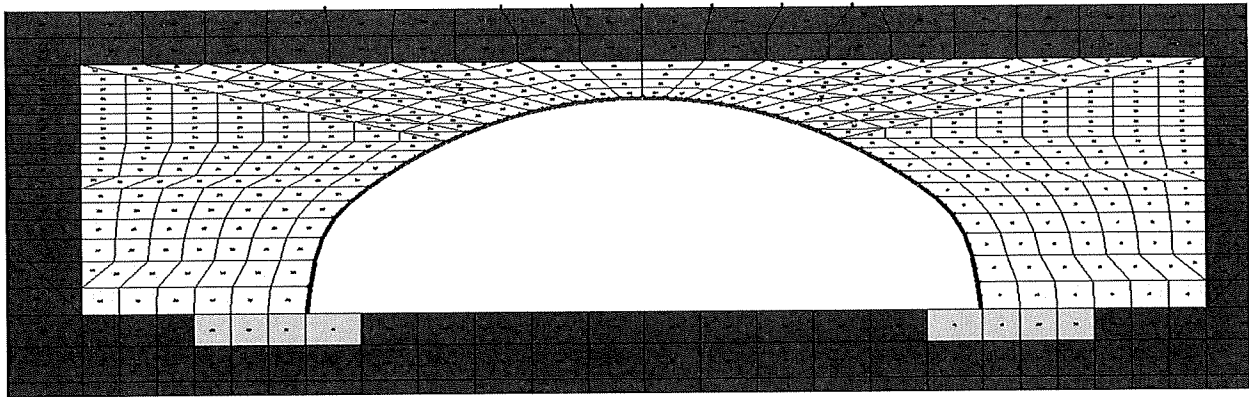
BEAM OUTPUT FOR SU6 TRUCK

Y<sub>0</sub>=1.5, YDL= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DL</sub> factored from CANDE	Moment (DL) M <sub>DL</sub> unfactored M <sub>DL</sub> /1.575	Moment (DL+LL) M <sub>DL+LL</sub> factored from CANDE	Moment (LL) M <sub>LL</sub> unfactored (M <sub>DL+LL</sub> -M <sub>DL</sub> )*1.5/M <sub>LL</sub> *1.45	Moment Load Rating OPR
		Load Step 21 kips-ft./ft.		Load Step 23 kips-ft./ft.		
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-4.01	0.56	18.37
-225.306	35.988	-6.32	-4.01	-7.65	0.76	10.68
-220.131	51.091	-8.35	-5.30	-10.11	1.00	6.76
-211.657	64.621	-8.31	-5.28	-10.15	1.05	6.48
-200.328	75.871	-5.59	-3.55	-7.18	0.91	9.44
-187.985	85.125	-2.10	-1.33	-3.46	0.78	13.99
-175.215	93.781	0.19	0.12	-1.05	0.71	17.00
-162.047	101.819	1.41	0.89	0.31	0.63	17.99
-148.512	109.22	1.55	0.98	0.57	0.56	20.20
-134.639	115.968	0.77	0.49	-0.08	0.49	24.11
-120.46	122.048	0.53	0.33	-0.91	0.82	14.51
-106.008	127.445	1.99	1.27	0.37	0.93	11.79
-91.315	132.148	2.08	1.32	0.97	0.63	17.16
-76.415	136.145	2.22	1.41	2.16	0.04	278.42
-61.341	139.428	2.24	1.42	3.16	0.53	20.40
-46.128	141.99	2.16	1.37	4.03	1.07	10.16
-30.81	143.823	2.06	1.31	4.79	1.56	6.99
-15.423	144.925	2.02	1.28	5.46	1.97	5.56
0	145.293	2.03	1.29	5.97	2.25	4.85
15.423	144.925	2.09	1.33	6.11	2.29	4.75
30.81	143.823	2.20	1.40	5.86	2.09	5.18
46.128	141.99	2.39	1.52	5.37	1.70	6.28
61.341	139.428	2.54	1.62	4.54	1.14	9.30
76.415	136.145	2.58	1.64	3.31	0.42	25.37
91.315	132.148	2.49	1.58	1.73	0.43	24.49
106.008	127.445	2.27	1.44	0.53	0.99	10.84
120.46	122.048	1.31	0.83	-0.48	1.02	11.14
134.639	115.968	1.68	1.07	0.63	0.60	18.60
148.512	109.22	1.77	1.13	0.38	0.80	13.91
162.047	101.819	1.25	0.79	-0.34	0.91	12.59
175.215	93.781	-0.16	-0.10	-1.86	0.97	12.53
187.985	85.125	-2.52	-1.60	-4.21	0.96	11.00
200.328	75.871	-5.98	-3.79	-7.72	1.00	8.37
211.657	64.621	-8.57	-5.44	-10.41	1.05	6.31
220.131	51.091	-8.54	-5.42	-10.23	0.96	6.90
225.306	35.988	-6.44	-4.09	-7.71	0.73	11.05
228.758	18.07	-3.09	-1.96	-4.06	0.55	18.46
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating=  
Actual Load Rating (from CANDE)

4.75  
3.23



SU7

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage SU7

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08

POISSONS RATIO OF METAL (-) ..... 0.30000E+00

YIELD STRESS OF METAL (PSI)..... 0.44000E+05

LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05

DENSITY OF METAL (PCI)..... 0.28400E+00

MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
 (FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -61.86	F = 0.000
1181	23	F = 0.000	F = -61.86	F = 0.000
1182	22	F = 0.000	F = -61.86	F = 0.000
1182	23	F = 0.000	F = -61.86	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000

936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-29.11	F =	0.000
1180	23	F =	0.000	F =	-29.11	F =	0.000
1179	22	F =	0.000	F =	-29.11	F =	0.000
1179	23	F =	0.000	F =	-29.11	F =	0.000
1176	22	F =	0.000	F =	-43.67	F =	0.000
1176	23	F =	0.000	F =	-43.67	F =	0.000
1183	22	F =	0.000	F =	-29.11	F =	0.000
1183	23	F =	0.000	F =	-29.11	F =	0.000
1184	22	F =	0.000	F =	-29.11	F =	0.000
1184	23	F =	0.000	F =	-29.11	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060



\* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.    NORMAL-ANGLE    COEF-FRICTION    TENSILE-RUPTURE    INITIAL-GAP

1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD	X-DISP.	N-PRES.	MOMENT	MAX-STRESS	SHEAR
	Y-COORD	Y-DISP.	S-PRES.	THRUST	HOOP-STRESS	S-STRESS
1	-231.30	-0.503E+00	0.946E+01	0.240E-10	-0.124E+05	0.230E+03

	0.00	-0.106E+01	0.401E+01	-0.318E+04	-0.124E+05	0.895E+03
2	-228.76 18.07	-0.679E+00 -0.105E+01	-0.764E+01 -0.231E+01	-0.408E+04 -0.324E+04	-0.252E+05 -0.126E+05	0.207E+03 0.805E+03
3	-225.31 35.99	-0.812E+00 -0.103E+01	-0.247E+02 -0.864E+01	-0.771E+04 -0.335E+04	-0.370E+05 -0.130E+05	0.173E+03 0.672E+03
4	-220.13 51.09	-0.864E+00 -0.102E+01	-0.413E+02 -0.112E+02	-0.102E+05 -0.353E+04	-0.440E+05 -0.137E+05	0.753E+02 0.293E+03
5	-211.66 64.62	-0.844E+00 -0.104E+01	-0.397E+02 0.350E+01	-0.102E+05 -0.359E+04	-0.440E+05 -0.140E+05	-0.944E+02 -0.367E+03
6	-200.33 75.87	-0.774E+00 -0.112E+01	-0.272E+02 0.853E+01	-0.715E+04 -0.347E+04	-0.357E+05 -0.135E+05	-0.215E+03 -0.835E+03
7	-187.99 85.12	-0.685E+00 -0.125E+01	-0.162E+02 0.478E+01	-0.340E+04 -0.335E+04	-0.236E+05 -0.130E+05	-0.196E+03 -0.761E+03
8	-175.22 93.78	-0.587E+00 -0.141E+01	-0.145E+02 0.420E+01	-0.103E+04 -0.327E+04	-0.159E+05 -0.127E+05	-0.116E+03 -0.451E+03
9	-162.05 101.82	-0.491E+00 -0.158E+01	-0.144E+02 0.413E+01	0.285E+03 -0.320E+04	-0.133E+05 -0.124E+05	-0.464E+02 -0.180E+03
10	-148.51 109.22	-0.404E+00 -0.175E+01	-0.135E+02 0.387E+01	0.529E+03 -0.314E+04	-0.138E+05 -0.122E+05	0.188E+02 0.732E+02
11	-134.64 115.97	-0.327E+00 -0.193E+01	-0.104E+02 0.300E+01	-0.139E+03 -0.309E+04	-0.124E+05 -0.120E+05	0.563E+02 0.219E+03
12	-120.46 122.05	-0.257E+00 -0.211E+01	-0.823E+00 0.244E+00	-0.103E+04 -0.306E+04	-0.151E+05 -0.119E+05	-0.238E+01 -0.925E+01
13	-106.01 127.44	-0.194E+00 -0.230E+01	-0.120E+02 0.344E+01	0.143E+03 -0.303E+04	-0.122E+05 -0.118E+05	-0.475E+02 -0.185E+03
14	-91.31 132.15	-0.141E+00 -0.249E+01	-0.648E+01 0.183E+01	0.684E+03 -0.299E+04	-0.137E+05 -0.116E+05	-0.473E+02 -0.184E+03
15	-76.42 136.15	-0.976E-01 -0.267E+01	-0.975E+01 0.277E+01	0.188E+04 -0.295E+04	-0.173E+05 -0.115E+05	-0.625E+02 -0.243E+03
16	-61.34 139.43	-0.662E-01 -0.285E+01	-0.942E+01 0.268E+01	0.291E+04 -0.290E+04	-0.203E+05 -0.113E+05	-0.529E+02 -0.206E+03
17	-46.13 141.99	-0.465E-01 -0.300E+01	-0.909E+01 0.258E+01	0.380E+04 -0.286E+04	-0.229E+05 -0.111E+05	-0.465E+02 -0.181E+03
18	-30.81 143.82	-0.372E-01 -0.313E+01	-0.890E+01 0.252E+01	0.460E+04 -0.282E+04	-0.253E+05 -0.110E+05	-0.421E+02 -0.164E+03
19	-15.42 144.93	-0.362E-01 -0.322E+01	-0.897E+01 0.254E+01	0.531E+04 -0.278E+04	-0.273E+05 -0.108E+05	-0.364E+02 -0.142E+03
20	0.00 145.29	-0.403E-01 -0.327E+01	-0.979E+01 0.208E+01	0.587E+04 -0.274E+04	-0.289E+05 -0.107E+05	-0.221E+02 -0.860E+02
21	15.42 144.93	-0.456E-01 -0.328E+01	-0.970E+01 -0.274E+01	0.605E+04 -0.275E+04	-0.295E+05 -0.107E+05	-0.148E+01 -0.576E+01

22	30.81 143.82	-0.480E-01 -0.324E+01	-0.910E+01 -0.258E+01	0.589E+04 -0.279E+04	-0.292E+05 -0.108E+05	0.129E+02 0.501E+02
23	46.13 141.99	-0.436E-01 -0.316E+01	-0.984E+01 -0.279E+01	0.555E+04 -0.283E+04	-0.283E+05 -0.110E+05	0.262E+02 0.102E+03
24	61.34 139.43	-0.285E-01 -0.303E+01	-0.103E+02 -0.291E+01	0.490E+04 -0.288E+04	-0.264E+05 -0.112E+05	0.464E+02 0.180E+03
25	76.42 136.15	-0.606E-04 -0.287E+01	-0.103E+02 -0.290E+01	0.387E+04 -0.292E+04	-0.234E+05 -0.114E+05	0.680E+02 0.264E+03
26	91.31 132.15	0.431E-01 -0.268E+01	-0.873E+01 -0.245E+01	0.251E+04 -0.297E+04	-0.193E+05 -0.115E+05	0.755E+02 0.294E+03
27	106.01 127.44	0.101E+00 -0.248E+01	-0.954E+01 -0.270E+01	0.123E+04 -0.301E+04	-0.155E+05 -0.117E+05	0.750E+02 0.291E+03
28	120.46 122.05	0.171E+00 -0.227E+01	0.283E-01 -0.571E-01	-0.104E+03 -0.304E+04	-0.121E+05 -0.118E+05	0.521E+01 0.202E+02
29	134.64 115.97	0.252E+00 -0.206E+01	-0.144E+02 -0.412E+01	0.797E+03 -0.307E+04	-0.144E+05 -0.119E+05	-0.281E+02 -0.109E+03
30	148.51 109.22	0.344E+00 -0.186E+01	-0.119E+02 -0.337E+01	0.513E+03 -0.313E+04	-0.137E+05 -0.122E+05	0.282E+02 0.110E+03
31	162.05 101.82	0.448E+00 -0.165E+01	-0.135E+02 -0.385E+01	-0.300E+03 -0.319E+04	-0.133E+05 -0.124E+05	0.741E+02 0.288E+03
32	175.22 93.78	0.560E+00 -0.145E+01	-0.136E+02 -0.393E+01	-0.197E+04 -0.325E+04	-0.188E+05 -0.126E+05	0.130E+03 0.506E+03
33	187.99 85.12	0.672E+00 -0.127E+01	-0.150E+02 -0.446E+01	-0.447E+04 -0.332E+04	-0.268E+05 -0.129E+05	0.195E+03 0.757E+03
34	200.33 75.87	0.771E+00 -0.113E+01	-0.263E+02 -0.937E+01	-0.810E+04 -0.345E+04	-0.386E+05 -0.134E+05	0.200E+03 0.778E+03
35	211.66 64.62	0.848E+00 -0.104E+01	-0.402E+02 -0.673E+01	-0.108E+05 -0.360E+04	-0.440E+05 -0.140E+05	0.770E+02 0.299E+03
36	220.13 51.09	0.872E+00 -0.102E+01	-0.420E+02 0.111E+02	-0.106E+05 -0.357E+04	-0.440E+05 -0.139E+05	-0.878E+02 -0.341E+03
37	225.31 35.99	0.821E+00 -0.103E+01	-0.253E+02 0.884E+01	-0.794E+04 -0.338E+04	-0.378E+05 -0.131E+05	-0.181E+03 -0.704E+03
38	228.76 18.07	0.686E+00 -0.105E+01	-0.765E+01 0.232E+01	-0.420E+04 -0.326E+04	-0.258E+05 -0.127E+05	-0.213E+03 -0.828E+03
39	231.30 0.00	0.507E+00 -0.106E+01	0.999E+01 -0.420E+01	-0.481E-10 -0.321E+04	-0.125E+05 -0.125E+05	-0.238E+03 -0.923E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
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1	-0.38838E-03	-0.38838E-03	.28129	0.00000
2	-0.79225E-03	0.29752E-05	.57381	0.00000
3	-0.11606E-02	0.34392E-03	.84058	0.00000
4	-0.14232E-02	0.56049E-03	1.0308	0.02142
5	-0.14324E-02	0.55494E-03	1.0375	0.02604
6	-0.11206E-02	0.27413E-03	.81164	0.00000
7	-0.73982E-03	-0.76419E-04	.53584	0.00000
8	-0.49963E-03	-0.29774E-03	.36187	0.00000
9	-0.36254E-03	-0.41808E-03	.30281	0.00000
10	-0.33104E-03	-0.43425E-03	.31452	0.00000
11	-0.38993E-03	-0.36273E-03	.28242	0.00000
12	-0.47361E-03	-0.27314E-03	.34302	0.00000
13	-0.35578E-03	-0.38365E-03	.27787	0.00000
14	-0.29768E-03	-0.43120E-03	.31231	0.00000
15	-0.17640E-03	-0.54311E-03	.39336	0.00000
16	-0.70655E-04	-0.63787E-03	.46199	0.00000
17	0.21736E-04	-0.71973E-03	.52129	0.00000
18	0.10493E-03	-0.79278E-03	.57419	0.00000
19	0.17883E-03	-0.85668E-03	.62047	0.00000
20	0.23790E-03	-0.90669E-03	.65669	0.00000
21	0.25561E-03	-0.92550E-03	.67032	0.00000
22	0.23472E-03	-0.91471E-03	.66250	0.00000
23	0.19633E-03	-0.88668E-03	.64220	0.00000
24	0.12719E-03	-0.82873E-03	.60023	0.00000
25	0.21262E-04	-0.73446E-03	.53195	0.00000
26	-0.11726E-03	-0.60692E-03	.43958	0.00000
27	-0.24701E-03	-0.48783E-03	.35332	0.00000
28	-0.38044E-03	-0.36015E-03	.27554	0.00000
29	-0.29643E-03	-0.45199E-03	.32737	0.00000
30	-0.33132E-03	-0.43134E-03	.31241	0.00000
31	-0.41774E-03	-0.35922E-03	.30256	0.00000
32	-0.58875E-03	-0.20419E-03	.42642	0.00000
33	-0.84178E-03	0.31006E-04	.60968	0.00000
34	-0.12105E-02	0.36875E-03	.87676	0.00000
35	-0.15037E-02	0.61795E-03	1.0891	0.05799
36	-0.14711E-02	0.59713E-03	1.0655	0.04371
37	-0.11869E-02	0.36267E-03	.85964	0.00000
38	-0.80818E-03	0.11931E-04	.58534	0.00000
39	-0.39181E-03	-0.39181E-03	.28378	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.31255	0.00000	0.09768
2	-0.31759	-0.22987	0.33073
3	-0.32860	-0.43490	0.54288
4	-0.34676	-0.57287	0.69311
5	-0.35255	-0.57372	0.69801
6	-0.34061	-0.40318	0.51919
7	-0.32844	-0.19177	0.29964
8	-0.32084	-0.05836	0.16130
9	-0.31410	0.01606	0.11472
10	-0.30793	0.02984	0.12466
11	-0.30285	-0.00786	0.09958
12	-0.30047	-0.05795	0.14823
13	-0.29753	0.00806	0.09658
14	-0.29328	0.03860	0.12461
15	-0.28951	0.10600	0.18982
16	-0.28509	0.16396	0.24524
17	-0.28086	0.21433	0.29322
18	-0.27677	0.25950	0.33610
19	-0.27275	0.29933	0.37372
20	-0.26910	0.33086	0.40328
21	-0.26955	0.34142	0.41407
22	-0.27361	0.33226	0.40712
23	-0.27778	0.31306	0.39023
24	-0.28228	0.27632	0.35601
25	-0.28697	0.21845	0.30081
26	-0.29139	0.14155	0.22646
27	-0.29568	0.06961	0.15704
28	-0.29799	-0.00586	0.09466
29	-0.30115	0.04497	0.13566
30	-0.30687	0.02891	0.12308
31	-0.31263	-0.01692	0.11466
32	-0.31906	-0.11116	0.21296

33	-0.32624	-0.25229	0.35872
34	-0.33871	-0.45652	0.57125
35	-0.35355	-0.60916	0.73415
36	-0.35007	-0.59548	0.71803
37	-0.33165	-0.44793	0.55792
38	-0.32039	-0.23707	0.33971
39	-0.31531	0.00000	0.09942

# ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

## LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	35	14001.	30800.	0.455
BUCKLING THRUST (psi)	35	14001.	49920.	0.280
SEAM THRUST (psi)	35	14001.	21914.	0.639
PLASTIC-PENETRATE (%)	35	5.80	90.00	0.064
COMBINED T&M Ratio	35	0.734	1.000	0.734

## LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.95
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.19
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage SU7-OPR  
LIVE LOADS X 2.91 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
MOM. OF INERTIA (IN**4/IN) .....	0.97860
SECTION MODULUS (IN**3/IN) .....	0.32170
PLASTIC SECTION MOD(IN**3/IN) .....	0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING .....	0.70000
BUCKLING STRESS FAILURE.....	0.70000
SEAM STRENGTH FAILURE .....	0.67000



FULL PLASTIC PENETRATION..... 0.90000

ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)

(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -180.0	F = 0.000
1181	23	F = 0.000	F = -180.0	F = 0.000
1182	22	F = 0.000	F = -180.0	F = 0.000
1182	23	F = 0.000	F = -180.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000
856	1	D = 0.000	F = 0.000	D = 0.000

857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-84.70	F =	0.000
1180	23	F =	0.000	F =	-84.70	F =	0.000
1179	22	F =	0.000	F =	-84.70	F =	0.000
1179	23	F =	0.000	F =	-84.70	F =	0.000
1176	22	F =	0.000	F =	-127.0	F =	0.000
1176	23	F =	0.000	F =	-127.0	F =	0.000
1183	22	F =	0.000	F =	-84.70	F =	0.000
1183	23	F =	0.000	F =	-84.70	F =	0.000
1184	22	F =	0.000	F =	-84.70	F =	0.000
1184	23	F =	0.000	F =	-84.70	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12

14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000

MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000

28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.450	Factor for load step #22
23	1.450	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.662E+00 -0.118E+01	0.209E+02 0.755E+01	0.513E-10 -0.397E+04	-0.154E+05 -0.154E+05	0.398E+03 0.155E+04
2	-228.76 18.07	-0.957E+00 -0.115E+01	-0.442E+01 -0.143E+01	-0.658E+04 -0.400E+04	-0.360E+05 -0.156E+05	0.278E+03 0.108E+04
3	-225.31 35.99	-0.118E+01 -0.112E+01	-0.298E+02 -0.104E+02	-0.109E+05 -0.413E+04	-0.440E+05 -0.160E+05	0.183E+03 0.713E+03
4	-220.13 51.09	-0.128E+01 -0.109E+01	-0.520E+02 -0.160E+02	-0.135E+05 -0.436E+04	-0.440E+05 -0.170E+05	0.646E+02 0.251E+03
5	-211.66 64.62	-0.128E+01 -0.111E+01	-0.515E+02 -0.804E+01	-0.132E+05 -0.455E+04	-0.440E+05 -0.177E+05	-0.130E+03 -0.506E+03
6	-200.33 75.87	-0.120E+01 -0.120E+01	-0.385E+02 0.115E+02	-0.929E+04 -0.449E+04	-0.440E+05 -0.175E+05	-0.248E+03 -0.963E+03
7	-187.99 85.12	-0.109E+01 -0.136E+01	-0.213E+02 0.632E+01	-0.521E+04 -0.433E+04	-0.330E+05 -0.168E+05	-0.194E+03 -0.754E+03
8	-175.22	-0.963E+00	-0.168E+02	-0.298E+04	-0.257E+05	-0.103E+03

	93.78	-0.157E+01	0.487E+01	-0.423E+04	-0.165E+05	-0.400E+03
9	-162.05 101.82	-0.836E+00 -0.179E+01	-0.169E+02 0.484E+01	-0.159E+04 -0.416E+04	-0.211E+05 -0.162E+05	-0.424E+02 -0.165E+03
10	-148.51 109.22	-0.713E+00 -0.204E+01	-0.155E+02 0.441E+01	-0.114E+04 -0.408E+04	-0.194E+05 -0.159E+05	0.118E+02 0.460E+02
11	-134.64 115.97	-0.598E+00 -0.230E+01	-0.222E+02 0.635E+01	-0.134E+04 -0.400E+04	-0.197E+05 -0.156E+05	0.111E+03 0.430E+03
12	-120.46 122.05	-0.490E+00 -0.258E+01	-0.729E-02 0.459E-01	-0.386E+04 -0.396E+04	-0.274E+05 -0.154E+05	0.929E+02 0.361E+03
13	-106.01 127.44	-0.387E+00 -0.288E+01	-0.845E+01 0.242E+01	-0.342E+04 -0.394E+04	-0.259E+05 -0.153E+05	-0.290E+02 -0.113E+03
14	-91.31 132.15	-0.292E+00 -0.322E+01	-0.480E+01 0.134E+01	-0.202E+04 -0.391E+04	-0.215E+05 -0.152E+05	-0.113E+03 -0.438E+03
15	-76.42 136.15	-0.209E+00 -0.357E+01	-0.132E+02 0.371E+01	0.115E+04 -0.386E+04	-0.186E+05 -0.150E+05	-0.158E+03 -0.612E+03
16	-61.34 139.43	-0.145E+00 -0.392E+01	-0.126E+02 0.351E+01	0.400E+04 -0.380E+04	-0.272E+05 -0.148E+05	-0.139E+03 -0.541E+03
17	-46.13 141.99	-0.102E+00 -0.424E+01	-0.121E+02 0.335E+01	0.658E+04 -0.374E+04	-0.350E+05 -0.145E+05	-0.127E+03 -0.492E+03
18	-30.81 143.82	-0.789E-01 -0.451E+01	-0.124E+02 0.340E+01	0.893E+04 -0.368E+04	-0.421E+05 -0.143E+05	-0.113E+03 -0.439E+03
19	-15.42 144.93	-0.725E-01 -0.472E+01	-0.122E+02 0.333E+01	0.109E+05 -0.362E+04	-0.440E+05 -0.141E+05	-0.962E+02 -0.374E+03
20	0.00 145.29	-0.769E-01 -0.484E+01	-0.149E+02 0.419E+01	0.125E+05 -0.356E+04	-0.440E+05 -0.138E+05	-0.574E+02 -0.223E+03
21	15.42 144.93	-0.842E-01 -0.486E+01	-0.149E+02 -0.362E+01	0.129E+05 -0.356E+04	-0.440E+05 -0.138E+05	0.432E+01 0.168E+02
22	30.81 143.82	-0.855E-01 -0.478E+01	-0.130E+02 -0.358E+01	0.123E+05 -0.361E+04	-0.440E+05 -0.140E+05	0.499E+02 0.194E+03
23	46.13 141.99	-0.725E-01 -0.460E+01	-0.141E+02 -0.388E+01	0.110E+05 -0.367E+04	-0.440E+05 -0.143E+05	0.864E+02 0.336E+03
24	61.34 139.43	-0.384E-01 -0.435E+01	-0.145E+02 -0.399E+01	0.888E+04 -0.374E+04	-0.421E+05 -0.145E+05	0.132E+03 0.512E+03
25	76.42 136.15	0.208E-01 -0.403E+01	-0.144E+02 -0.394E+01	0.594E+04 -0.381E+04	-0.333E+05 -0.148E+05	0.176E+03 0.684E+03
26	91.31 132.15	0.106E+00 -0.366E+01	-0.989E+01 -0.270E+01	0.230E+04 -0.387E+04	-0.222E+05 -0.150E+05	0.181E+03 0.703E+03
27	106.01 127.44	0.213E+00 -0.329E+01	-0.471E+01 -0.129E+01	-0.857E+03 -0.391E+04	-0.178E+05 -0.152E+05	0.109E+03 0.425E+03
28	120.46 122.05	0.336E+00 -0.292E+01	-0.371E-01 -0.781E-02	-0.224E+04 -0.392E+04	-0.222E+05 -0.152E+05	-0.395E+02 -0.153E+03

29	134.64 115.97	0.472E+00 -0.258E+01	-0.232E+02 -0.656E+01	-0.715E+03 -0.397E+04	-0.176E+05 -0.154E+05	-0.473E+02 -0.184E+03
30	148.51 109.22	0.620E+00 -0.225E+01	-0.137E+02 -0.386E+01	-0.177E+04 -0.405E+04	-0.212E+05 -0.157E+05	0.470E+02 0.183E+03
31	162.05 101.82	0.777E+00 -0.193E+01	-0.155E+02 -0.441E+01	-0.306E+04 -0.412E+04	-0.255E+05 -0.160E+05	0.781E+02 0.304E+03
32	175.22 93.78	0.937E+00 -0.165E+01	-0.149E+02 -0.434E+01	-0.496E+04 -0.419E+04	-0.317E+05 -0.163E+05	0.115E+03 0.448E+03
33	187.99 85.12	0.109E+01 -0.141E+01	-0.191E+02 -0.570E+01	-0.725E+04 -0.427E+04	-0.392E+05 -0.166E+05	0.177E+03 0.689E+03
34	200.33 75.87	0.122E+01 -0.122E+01	-0.375E+02 -0.133E+02	-0.109E+05 -0.444E+04	-0.440E+05 -0.173E+05	0.211E+03 0.818E+03
35	211.66 64.62	0.131E+01 -0.111E+01	-0.530E+02 0.111E+01	-0.142E+05 -0.456E+04	-0.440E+05 -0.177E+05	0.977E+02 0.380E+03
36	220.13 51.09	0.132E+01 -0.109E+01	-0.534E+02 0.164E+02	-0.141E+05 -0.443E+04	-0.440E+05 -0.172E+05	-0.831E+02 -0.323E+03
37	225.31 35.99	0.122E+01 -0.112E+01	-0.307E+02 0.107E+02	-0.112E+05 -0.418E+04	-0.440E+05 -0.162E+05	-0.194E+03 -0.753E+03
38	228.76 18.07	0.979E+00 -0.115E+01	-0.441E+01 0.144E+01	-0.678E+04 -0.405E+04	-0.368E+05 -0.158E+05	-0.285E+03 -0.111E+04
39	231.30 0.00	0.671E+00 -0.119E+01	0.219E+02 -0.788E+01	-0.999E-10 -0.401E+04	-0.156E+05 -0.156E+05	-0.408E+03 -0.159E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.48361E-03	-0.48361E-03	.35027	0.00000
2	-0.11303E-02	0.15364E-03	.81868	0.00000
3	-0.15979E-02	0.56960E-03	1.1573	0.10020
4	-0.21045E-02	0.86344E-03	1.5242	0.24386
5	-0.20879E-02	0.80558E-03	1.5122	0.24441
6	-0.14588E-02	0.36030E-03	1.0566	0.04296
7	-0.10357E-02	-0.20135E-04	.75013	0.00000
8	-0.80693E-03	-0.22597E-03	.58444	0.00000
9	-0.66225E-03	-0.35139E-03	.47965	0.00000
10	-0.60931E-03	-0.38663E-03	.44131	0.00000
11	-0.61922E-03	-0.35706E-03	.44849	0.00000
12	-0.85947E-03	-0.10585E-03	.62250	0.00000
13	-0.81386E-03	-0.14710E-03	.58946	0.00000
14	-0.67385E-03	-0.27914E-03	.48805	0.00000
15	-0.35897E-03	-0.58288E-03	.42216	0.00000
16	-0.73275E-04	-0.85321E-03	.61796	0.00000
17	0.18563E-03	-0.10976E-02	.79499	0.00000
18	0.42190E-03	-0.13198E-02	.95588	0.00000
19	0.62722E-03	-0.15203E-02	1.1011	0.06499
20	0.81253E-03	-0.17292E-02	1.2524	0.13713
21	0.86903E-03	-0.18034E-02	1.3062	0.15818
22	0.78285E-03	-0.17070E-02	1.2363	0.13106
23	0.63032E-03	-0.15380E-02	1.1139	0.07254
24	0.40960E-03	-0.13220E-02	.95748	0.00000
25	0.11450E-03	-0.10437E-02	.75589	0.00000
26	-0.24725E-03	-0.69654E-03	.50449	0.00000
27	-0.56011E-03	-0.39296E-03	.40567	0.00000
28	-0.69661E-03	-0.25939E-03	.50454	0.00000

29	-0.55370E-03	-0.41427E-03	.40103	0.00000
30	-0.66659E-03	-0.32111E-03	.48280	0.00000
31	-0.80102E-03	-0.20312E-03	.58016	0.00000
32	-0.99446E-03	-0.27427E-04	.72026	0.00000
33	-0.12288E-02	0.18618E-03	.89001	0.00000
34	-0.16530E-02	0.53559E-03	1.1973	0.12444
35	-0.23344E-02	0.94352E-03	1.6907	0.29094
36	-0.22737E-02	0.94627E-03	1.6468	0.27733
37	-0.16559E-02	0.60290E-03	1.1993	0.12182
38	-0.11560E-02	0.16728E-03	.83724	0.00000
39	-0.48956E-03	-0.48956E-03	.35457	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/ (P-resist)	FACTORED MOMENT-RATIO M/ (M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.38919	0.00000	0.15147
2	-0.39300	-0.37116	0.52560
3	-0.40499	-0.61357	0.77758
4	-0.42833	-0.75933	0.94280
5	-0.44641	-0.74433	0.94361
6	-0.44067	-0.52413	0.71832
7	-0.42484	-0.29357	0.47406
8	-0.41561	-0.16794	0.34067
9	-0.40786	-0.08986	0.25621
10	-0.40074	-0.06437	0.22496
11	-0.39283	-0.07578	0.23010
12	-0.38842	-0.21785	0.36872
13	-0.38667	-0.19274	0.34225
14	-0.38346	-0.11410	0.26114
15	-0.37898	0.06472	0.20835
16	-0.37280	0.22545	0.36443
17	-0.36697	0.37095	0.50561
18	-0.36128	0.50346	0.63399
19	-0.35569	0.61460	0.74112
20	-0.34962	0.70372	0.82596
21	-0.34907	0.72972	0.85157
22	-0.35466	0.69197	0.81775
23	-0.36063	0.61913	0.74919
24	-0.36712	0.50055	0.63532
25	-0.37387	0.33478	0.47456
26	-0.37976	0.12988	0.27409
27	-0.38349	-0.04832	0.19538
28	-0.38467	-0.12639	0.27436
29	-0.38949	-0.04030	0.19200
30	-0.39743	-0.09987	0.25781
31	-0.40404	-0.17283	0.33608
32	-0.41118	-0.27954	0.44861
33	-0.41954	-0.40903	0.58504
34	-0.43602	-0.61482	0.80493
35	-0.44800	-0.79884	0.99955
36	-0.43445	-0.79352	0.98227
37	-0.41019	-0.63329	0.80154
38	-0.39782	-0.38251	0.54077
39	-0.39397	0.00000	0.15521

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	35	17741.	30800.	0.576
BUCKLING THRUST (psi)	35	17741.	48673.	0.364
SEAM THRUST (psi)	35	17741.	21914.	0.810
PLASTIC-PENETRATE (%)	35	29.09	90.00	0.323
COMBINED T&M Ratio	35	1.000	1.000	1.000



LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.73
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.35
HANDLING FACTOR RATIO = $(\text{SPAN}^2/EI)/FF$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR SU7 TRUCK

Y<sub>0</sub>=1.5, YDL= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) T <sub>0Lac</sub>		Thrust (DL) T <sub>0Ls</sub>		Thrust (DL+LL) T <sub>0Llac</sub>		Thrust (LL) T <sub>0Ls</sub>		Thrust Load Rating	
		factored from CANDE		unfactored		factored from CANDE		unfactored		OPR	
		Load Step 21		TDI <sub>fac</sub> /1.575		Load Step 23		(T <sub>0Llac</sub> -T <sub>0Llac</sub> )/1.75		(T <sub>0Llac</sub> -T <sub>0Llac</sub> )/1.45	
		Kips/ft.		Kips/ft.		Kips/ft.					
-231.304	0	-31.94	-20.28	-38.21	3.59						7.29
-228.758	18.07	-32.57	-20.68	-38.83	3.58						7.19
-225.306	35.988	-33.73	-21.41	-40.18	3.69						6.78
-220.131	51.091	-34.92	-22.17	-42.40	4.27						5.66
-211.657	64.621	-34.40	-21.84	-43.11	4.97						4.93
-200.328	75.871	-32.67	-20.74	-41.65	5.13						5.01
-187.985	85.125	-31.41	-19.94	-40.16	5.00						5.30
-175.215	93.781	-30.62	-19.44	-39.23	4.92						5.49
-162.047	101.819	-29.92	-18.99	-38.41	4.85						5.66
-148.512	109.22	-29.28	-18.59	-37.65	4.79						5.83
-134.639	115.968	-28.85	-18.32	-37.03	4.68						6.03
-120.46	122.048	-28.70	-18.22	-36.74	4.59						6.16
-106.008	127.445	-28.32	-17.98	-36.38	4.60						6.20
-91.315	132.148	-27.77	-17.63	-35.86	4.62						6.25
-76.415	136.145	-27.38	-17.39	-35.40	4.58						6.36
-61.341	139.428	-26.99	-17.13	-34.86	4.50						6.54
-46.128	141.99	-26.61	-16.89	-34.34	4.42						6.71
-30.81	143.823	-26.25	-16.67	-33.84	4.34						6.89
-15.423	144.925	-25.91	-16.45	-33.35	4.25						7.08
0	145.293	-25.71	-16.33	-32.90	4.11						7.36
15.423	144.925	-25.86	-16.42	-32.96	4.06						7.43
30.81	143.823	-26.20	-16.63	-33.45	4.15						7.22
46.128	141.99	-26.55	-16.86	-33.96	4.24						7.01
61.341	139.428	-26.92	-17.10	-34.51	4.34						6.79
76.415	136.145	-27.32	-17.35	-35.09	4.44						6.58
91.315	132.148	-27.73	-17.61	-35.63	4.51						6.41
106.008	127.445	-28.23	-17.92	-36.15	4.53						6.31
120.46	122.048	-28.56	-18.14	-36.44	4.50						6.31
134.639	115.968	-28.84	-18.31	-36.82	4.56						6.18
148.512	109.22	-29.34	-18.63	-37.52	4.68						5.96
162.047	101.819	-29.93	-19.01	-38.23	4.74						5.80
175.215	93.781	-30.61	-19.44	-39.01	4.80						5.63
187.985	85.125	-31.37	-19.92	-39.89	4.87						5.45
200.328	75.871	-32.61	-20.70	-41.41	5.03						5.11
211.657	64.621	-34.41	-21.85	-43.23	5.04						4.87
220.131	51.091	-35.05	-22.25	-42.80	4.43						5.44
225.306	35.988	-33.87	-21.50	-40.55	3.82						6.52
228.758	18.07	-32.70	-20.76	-39.17	3.70						6.93
231.304	0	-32.06	-20.36	-38.55	3.71						7.03

Thrust Load Rating=

4.87

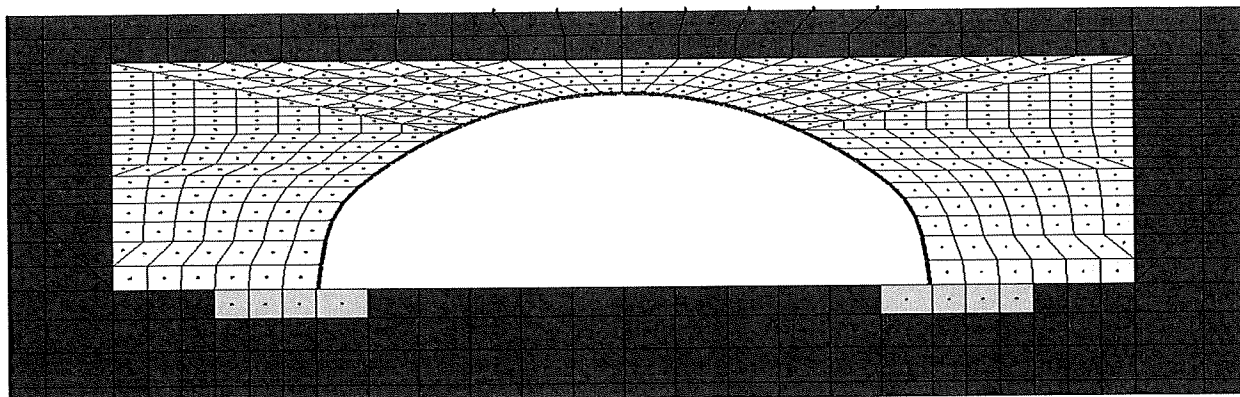
BEAM OUTPUT FOR SU7 TRUCK

Y0=1.5, YDL= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DL</sub> factored from CANDE	Moment (DL) M <sub>DL</sub> unfactored	Moment (DL+LL) M <sub>DL+LL</sub> factored from CANDE	Moment (LL) M <sub>LL</sub> unfactored	Moment Load Rating
		Load Step 21 kips-ft.	M <sub>DL</sub> /1.575	Load Step 23 kips-ft.	(M <sub>DL+LL</sub> -M <sub>DL</sub> )/1.75	(M <sub>DL+LL</sub> -M <sub>DL</sub> )/M <sub>LL</sub> *1.45
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-4.08	0.59	17.26
-225.306	35.988	-6.32	-4.01	-7.71	0.79	10.21
-220.131	51.091	-8.35	-5.30	-10.16	1.03	6.57
-211.657	64.621	-8.31	-5.28	-10.17	1.06	6.39
-200.328	75.871	-5.59	-3.55	-7.15	0.89	9.64
-187.985	85.125	-2.10	-1.33	-3.40	0.75	14.60
-175.215	93.781	0.20	0.12	-1.03	0.70	17.25
-162.047	101.819	1.41	0.89	0.28	0.64	17.65
-148.512	109.22	1.55	0.98	0.53	0.58	19.28
-134.639	115.968	0.77	0.49	-0.14	0.52	22.56
-120.46	122.048	0.53	0.33	-1.03	0.89	13.41
-106.008	127.445	1.99	1.27	0.14	1.06	10.35
-91.315	132.148	2.08	1.32	0.68	0.80	13.68
-76.415	136.145	2.22	1.41	1.88	0.20	54.86
-61.341	139.428	2.24	1.42	2.91	0.38	28.26
-46.128	141.99	2.16	1.37	3.80	0.94	11.55
-30.81	143.823	2.05	1.30	4.60	1.46	7.49
-15.423	144.925	2.02	1.28	5.31	1.88	5.82
0	145.293	2.03	1.29	5.87	2.19	4.98
15.423	144.925	2.09	1.32	6.05	2.27	4.80
30.81	143.823	2.20	1.39	5.89	2.11	5.12
46.128	141.99	2.38	1.51	5.55	1.81	5.90
61.341	139.428	2.54	1.61	4.90	1.35	7.85
76.415	136.145	2.59	1.64	3.87	0.74	14.35
91.315	132.148	2.50	1.59	2.51	0.00	2400.05
106.008	127.445	2.28	1.45	1.23	0.60	18.02
120.46	122.048	1.32	0.84	-0.10	0.81	14.05
134.639	115.968	1.69	1.07	0.80	0.51	21.94
148.512	109.22	1.78	1.13	0.51	0.72	15.37
162.047	101.819	1.25	0.79	-0.30	0.89	12.90
175.215	93.781	-0.16	-0.10	-1.97	1.03	11.75
187.985	85.125	-2.52	-1.60	-4.47	1.12	9.50
200.328	75.871	-5.98	-3.80	-8.10	1.21	6.89
211.657	64.621	-8.58	-5.44	-10.80	1.27	5.21
220.131	51.091	-8.54	-5.42	-10.56	1.15	5.76
225.306	35.988	-6.44	-4.09	-7.94	0.86	9.32
228.758	18.07	-3.09	-1.96	-4.20	0.64	16.05
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating=  
Actual Load Rating (from CANDE)

4.80  
2.91



NRL

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage NRL

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
 COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
 (FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -61.86	F = 0.000
1181	23	F = 0.000	F = -61.86	F = 0.000
1182	22	F = 0.000	F = -61.86	F = 0.000
1182	23	F = 0.000	F = -61.86	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000

911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-29.11	F =	0.000
1180	23	F =	0.000	F =	-29.11	F =	0.000
1179	22	F =	0.000	F =	-29.11	F =	0.000
1179	23	F =	0.000	F =	-29.11	F =	0.000
1177	22	F =	0.000	F =	-21.83	F =	0.000
1177	23	F =	0.000	F =	-21.83	F =	0.000
1183	22	F =	0.000	F =	-29.11	F =	0.000
1183	23	F =	0.000	F =	-29.11	F =	0.000
1184	22	F =	0.000	F =	-29.11	F =	0.000
1184	23	F =	0.000	F =	-29.11	F =	0.000
1185	22	F =	0.000	F =	-29.11	F =	0.000
1185	23	F =	0.000	F =	29.11	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS----- 0  
 THE NUMBER OF SOIL MATERIALS IS----- 4

THE NUMBER OF PIPE-TYPE GROUPS IS----- 1  
 THE NUMBER OF INTERFACE MATERIALS IS--- 37  
 BAND WIDTH ESTIMATE (MAX)----- 2060

\* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
 (ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
 YOUNGS MODULUS= 0.3000E+04  
 POISSONS RATIO= 0.3000E+00  
 CONFINED MOD.= 0.4038E+04  
 LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
 YOUNGS MODULUS= 0.3500E+07  
 POISSONS RATIO= 0.1800E+00  
 CONFINED MOD.= 0.3800E+07  
 LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES



MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD	X-DISP.	N-PRES.	MOMENT	MAX-STRESS	SHEAR
	Y-COORD	Y-DISP.	S-PRES.	THRUST	HOOP-STRESS	S-STRESS

1	-231.30 0.00	-0.502E+00 -0.105E+01	0.959E+01 0.403E+01	-0.691E-11 -0.315E+04	-0.122E+05 -0.122E+05	0.231E+03 0.898E+03
2	-228.76 18.07	-0.680E+00 -0.103E+01	-0.744E+01 -0.225E+01	-0.407E+04 -0.320E+04	-0.251E+05 -0.124E+05	0.206E+03 0.801E+03
3	-225.31 35.99	-0.815E+00 -0.101E+01	-0.245E+02 -0.854E+01	-0.768E+04 -0.331E+04	-0.367E+05 -0.128E+05	0.172E+03 0.667E+03
4	-220.13 51.09	-0.868E+00 -0.100E+01	-0.409E+02 -0.122E+02	-0.101E+05 -0.350E+04	-0.440E+05 -0.136E+05	0.760E+02 0.295E+03
5	-211.66 64.62	-0.851E+00 -0.102E+01	-0.394E+02 0.259E+01	-0.102E+05 -0.357E+04	-0.440E+05 -0.139E+05	-0.922E+02 -0.358E+03
6	-200.33 75.87	-0.782E+00 -0.110E+01	-0.273E+02 0.787E+01	-0.718E+04 -0.346E+04	-0.358E+05 -0.135E+05	-0.212E+03 -0.824E+03
7	-187.99 85.12	-0.694E+00 -0.123E+01	-0.161E+02 0.478E+01	-0.349E+04 -0.335E+04	-0.239E+05 -0.130E+05	-0.192E+03 -0.746E+03
8	-175.22 93.78	-0.597E+00 -0.139E+01	-0.143E+02 0.416E+01	-0.118E+04 -0.327E+04	-0.164E+05 -0.127E+05	-0.113E+03 -0.441E+03
9	-162.05 101.82	-0.502E+00 -0.156E+01	-0.142E+02 0.408E+01	0.119E+03 -0.320E+04	-0.128E+05 -0.124E+05	-0.465E+02 -0.181E+03
10	-148.51 109.22	-0.415E+00 -0.173E+01	-0.134E+02 0.385E+01	0.390E+03 -0.314E+04	-0.134E+05 -0.122E+05	0.167E+02 0.651E+02
11	-134.64 115.97	-0.336E+00 -0.191E+01	-0.106E+02 0.304E+01	-0.233E+03 -0.309E+04	-0.127E+05 -0.120E+05	0.545E+02 0.212E+03
12	-120.46 122.05	-0.266E+00 -0.209E+01	-0.626E+00 0.189E+00	-0.110E+04 -0.306E+04	-0.153E+05 -0.119E+05	-0.471E+01 -0.183E+02
13	-106.01 127.44	-0.202E+00 -0.228E+01	-0.121E+02 0.345E+01	0.132E+03 -0.303E+04	-0.122E+05 -0.118E+05	-0.511E+02 -0.199E+03
14	-91.31 132.15	-0.147E+00 -0.248E+01	-0.667E+01 0.189E+01	0.729E+03 -0.299E+04	-0.139E+05 -0.116E+05	-0.491E+02 -0.191E+03
15	-76.42 136.15	-0.104E+00 -0.267E+01	-0.978E+01 0.278E+01	0.193E+04 -0.295E+04	-0.175E+05 -0.115E+05	-0.627E+02 -0.244E+03
16	-61.34 139.43	-0.716E-01 -0.284E+01	-0.943E+01 0.268E+01	0.296E+04 -0.290E+04	-0.205E+05 -0.113E+05	-0.528E+02 -0.205E+03
17	-46.13 141.99	-0.516E-01 -0.300E+01	-0.908E+01 0.258E+01	0.385E+04 -0.286E+04	-0.231E+05 -0.111E+05	-0.464E+02 -0.180E+03
18	-30.81 143.82	-0.421E-01 -0.313E+01	-0.890E+01 0.252E+01	0.465E+04 -0.282E+04	-0.254E+05 -0.110E+05	-0.420E+02 -0.163E+03
19	-15.42 144.93	-0.410E-01 -0.322E+01	-0.894E+01 0.254E+01	0.535E+04 -0.278E+04	-0.274E+05 -0.108E+05	-0.366E+02 -0.142E+03
20	0.00 145.29	-0.451E-01 -0.327E+01	-0.980E+01 0.224E+01	0.590E+04 -0.274E+04	-0.290E+05 -0.107E+05	-0.224E+02 -0.869E+02

21	15.42 144.93	-0.504E-01 -0.328E+01	-0.972E+01 -0.280E+01	0.609E+04 -0.274E+04	-0.296E+05 -0.107E+05	-0.136E+01 -0.527E+01
22	30.81 143.82	-0.529E-01 -0.324E+01	-0.908E+01 -0.258E+01	0.591E+04 -0.279E+04	-0.292E+05 -0.108E+05	0.132E+02 0.512E+02
23	46.13 141.99	-0.484E-01 -0.316E+01	-0.983E+01 -0.279E+01	0.556E+04 -0.283E+04	-0.283E+05 -0.110E+05	0.263E+02 0.102E+03
24	61.34 139.43	-0.334E-01 -0.304E+01	-0.102E+02 -0.290E+01	0.489E+04 -0.287E+04	-0.264E+05 -0.112E+05	0.461E+02 0.179E+03
25	76.42 136.15	-0.507E-02 -0.288E+01	-0.103E+02 -0.289E+01	0.387E+04 -0.292E+04	-0.234E+05 -0.114E+05	0.673E+02 0.262E+03
26	91.31 132.15	0.380E-01 -0.269E+01	-0.859E+01 -0.241E+01	0.251E+04 -0.297E+04	-0.193E+05 -0.115E+05	0.735E+02 0.286E+03
27	106.01 127.44	0.955E-01 -0.249E+01	-0.965E+01 -0.273E+01	0.128E+04 -0.301E+04	-0.157E+05 -0.117E+05	0.729E+02 0.283E+03
28	120.46 122.05	0.166E+00 -0.228E+01	-0.145E+00 -0.812E-02	-0.432E+02 -0.303E+04	-0.119E+05 -0.118E+05	0.547E+01 0.213E+02
29	134.64 115.97	0.247E+00 -0.207E+01	-0.143E+02 -0.409E+01	0.835E+03 -0.306E+04	-0.145E+05 -0.119E+05	-0.270E+02 -0.105E+03
30	148.51 109.22	0.340E+00 -0.186E+01	-0.119E+02 -0.338E+01	0.548E+03 -0.312E+04	-0.138E+05 -0.121E+05	0.292E+02 0.113E+03
31	162.05 101.82	0.444E+00 -0.165E+01	-0.135E+02 -0.385E+01	-0.278E+03 -0.318E+04	-0.132E+05 -0.124E+05	0.757E+02 0.294E+03
32	175.22 93.78	0.556E+00 -0.146E+01	-0.136E+02 -0.393E+01	-0.197E+04 -0.325E+04	-0.187E+05 -0.126E+05	0.132E+03 0.514E+03
33	187.99 85.12	0.668E+00 -0.128E+01	-0.149E+02 -0.444E+01	-0.449E+04 -0.332E+04	-0.269E+05 -0.129E+05	0.197E+03 0.765E+03
34	200.33 75.87	0.768E+00 -0.113E+01	-0.262E+02 -0.933E+01	-0.813E+04 -0.345E+04	-0.387E+05 -0.134E+05	0.201E+03 0.781E+03
35	211.66 64.62	0.846E+00 -0.104E+01	-0.402E+02 -0.695E+01	-0.108E+05 -0.360E+04	-0.440E+05 -0.140E+05	0.768E+02 0.299E+03
36	220.13 51.09	0.870E+00 -0.102E+01	-0.420E+02 0.110E+02	-0.106E+05 -0.357E+04	-0.440E+05 -0.139E+05	-0.882E+02 -0.343E+03
37	225.31 35.99	0.820E+00 -0.103E+01	-0.253E+02 0.885E+01	-0.794E+04 -0.338E+04	-0.378E+05 -0.131E+05	-0.181E+03 -0.705E+03
38	228.76 18.07	0.685E+00 -0.105E+01	-0.768E+01 0.233E+01	-0.420E+04 -0.326E+04	-0.257E+05 -0.127E+05	-0.213E+03 -0.828E+03
39	231.30 0.00	0.507E+00 -0.106E+01	0.997E+01 -0.419E+01	0.197E-11 -0.321E+04	-0.125E+05 -0.125E+05	-0.237E+03 -0.922E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER	OUTER-FIBER	STRAIN RATIO	FRACTION OF
------	-------------	-------------	--------------	-------------

	STRAIN	STRAIN	MAX-TO-YIELD	WALL YIELDED
1	-0.38360E-03	-0.38360E-03	.27783	0.00000
2	-0.78712E-03	0.76854E-05	.57009	0.00000
3	-0.11521E-02	0.34565E-03	.83442	0.00000
4	-0.14139E-02	0.56005E-03	1.0241	0.01682
5	-0.14292E-02	0.55649E-03	1.0351	0.02441
6	-0.11227E-02	0.27770E-03	.81315	0.00000
7	-0.74842E-03	-0.67663E-04	.54206	0.00000
8	-0.51400E-03	-0.28334E-03	.37227	0.00000
9	-0.37881E-03	-0.40196E-03	.29113	0.00000
10	-0.34473E-03	-0.42081E-03	.30478	0.00000
11	-0.39914E-03	-0.35372E-03	.28909	0.00000
12	-0.48110E-03	-0.26586E-03	.34845	0.00000
13	-0.35692E-03	-0.38277E-03	.27723	0.00000
14	-0.29336E-03	-0.43562E-03	.31551	0.00000
15	-0.17107E-03	-0.54841E-03	.39720	0.00000
16	-0.65219E-04	-0.64325E-03	.46589	0.00000
17	0.26659E-04	-0.72461E-03	.52482	0.00000
18	0.10938E-03	-0.79719E-03	.57739	0.00000
19	0.18266E-03	-0.86048E-03	.62323	0.00000
20	0.24174E-03	-0.91022E-03	.65925	0.00000
21	0.25897E-03	-0.92836E-03	.67239	0.00000
22	0.23657E-03	-0.91616E-03	.66355	0.00000
23	0.19699E-03	-0.88693E-03	.64239	0.00000
24	0.12686E-03	-0.82797E-03	.59968	0.00000
25	0.20826E-04	-0.73355E-03	.53129	0.00000
26	-0.11688E-03	-0.60670E-03	.43942	0.00000
27	-0.24246E-03	-0.49173E-03	.35615	0.00000
28	-0.37415E-03	-0.36574E-03	.27099	0.00000
29	-0.29231E-03	-0.45528E-03	.32975	0.00000
30	-0.32744E-03	-0.43434E-03	.31458	0.00000
31	-0.41518E-03	-0.36094E-03	.30070	0.00000
32	-0.58798E-03	-0.20413E-03	.42586	0.00000
33	-0.84339E-03	0.33456E-04	.61084	0.00000
34	-0.12133E-02	0.37248E-03	.87877	0.00000
35	-0.15061E-02	0.62065E-03	1.0908	0.05897
36	-0.14725E-02	0.59843E-03	1.0665	0.04435
37	-0.11871E-02	0.36265E-03	.85976	0.00000
38	-0.80782E-03	0.11454E-04	.58508	0.00000
39	-0.39185E-03	-0.39185E-03	.28381	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.30870	0.00000	0.09530
2	-0.31363	-0.22975	0.32811
3	-0.32449	-0.43294	0.53824
4	-0.34334	-0.57026	0.68814
5	-0.35067	-0.57330	0.69627
6	-0.34001	-0.40481	0.52042
7	-0.32837	-0.19678	0.30461
8	-0.32083	-0.06668	0.16961
9	-0.31416	0.00669	0.10539
10	-0.30803	0.02199	0.11688
11	-0.30293	-0.01313	0.10490
12	-0.30056	-0.06222	0.15255
13	-0.29763	0.00747	0.09606
14	-0.29332	0.04112	0.12716
15	-0.28950	0.10908	0.19289
16	-0.28507	0.16709	0.24836
17	-0.28084	0.21717	0.29604
18	-0.27676	0.26206	0.33866
19	-0.27274	0.30154	0.37592
20	-0.26898	0.33299	0.40534
21	-0.26935	0.34322	0.41576
22	-0.27345	0.33321	0.40799
23	-0.27762	0.31333	0.39040
24	-0.28211	0.27601	0.35559
25	-0.28678	0.21807	0.30031
26	-0.29115	0.14159	0.22636
27	-0.29542	0.07206	0.15933
28	-0.29771	-0.00243	0.09107
29	-0.30081	0.04711	0.13760
30	-0.30652	0.03090	0.12486

31	-0.31229	-0.01568	0.11320
32	-0.31873	-0.11096	0.21254
33	-0.32590	-0.25347	0.35967
34	-0.33833	-0.45840	0.57287
35	-0.35331	-0.61054	0.73537
36	-0.35008	-0.59620	0.71876
37	-0.33172	-0.44797	0.55801
38	-0.32044	-0.23682	0.33950
39	-0.31534	0.00000	0.09944

# ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

## LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	35	13991.	30800.	0.454
BUCKLING THRUST (psi)	35	13991.	49897.	0.280
SEAM THRUST (psi)	35	13991.	21914.	0.638
PLASTIC-PENETRATE (%)	35	5.90	90.00	0.066
COMBINED T&M Ratio	35	0.735	1.000	0.735

## LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.96
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.19
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage NRL-OPR  
LIVE LOADS X 2.75 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
MOM. OF INERTIA (IN**4/IN) .....	0.97860
SECTION MODULUS (IN**3/IN) .....	0.32170
PLASTIC SECTION MOD(IN**3/IN) .....	0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING .....	0.70000
BUCKLING STRESS FAILURE.....	0.70000
SEAM STRENGTH FAILURE .....	0.67000

FULL PLASTIC PENETRATION..... 0.90000

ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -170.0	F = 0.000
1181	23	F = 0.000	F = -170.0	F = 0.000
1182	22	F = 0.000	F = -170.0	F = 0.000
1182	23	F = 0.000	F = -170.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000
856	1	D = 0.000	F = 0.000	D = 0.000

857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-79.90	F =	0.000
1180	23	F =	0.000	F =	-79.90	F =	0.000
1179	22	F =	0.000	F =	-79.90	F =	0.000
1179	23	F =	0.000	F =	-79.90	F =	0.000
1177	22	F =	0.000	F =	-59.90	F =	0.000
1177	23	F =	0.000	F =	-59.90	F =	0.000
1183	22	F =	0.000	F =	-79.90	F =	0.000
1183	23	F =	0.000	F =	-79.90	F =	0.000
1184	22	F =	0.000	F =	-79.90	F =	0.000
1184	23	F =	0.000	F =	-79.90	F =	0.000
1185	22	F =	0.000	F =	-79.90	F =	0.000
1185	23	F =	0.000	F =	-79.90	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS----	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10



12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000

SCALED MODULUS NUMBER ZK ..... 950.0000  
 MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000

26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

# LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.450	Factor for load step #22
23	1.450	Factor for load step #23

# STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.651E+00 -0.114E+01	0.202E+02 0.731E+01	0.113E-10 -0.382E+04	-0.149E+05 -0.149E+05	0.385E+03 0.150E+04
2	-228.76 18.07	-0.948E+00 -0.111E+01	-0.443E+01 -0.142E+01	-0.640E+04 -0.386E+04	-0.349E+05 -0.150E+05	0.272E+03 0.106E+04
3	-225.31 35.99	-0.118E+01 -0.108E+01	-0.291E+02 -0.102E+02	-0.106E+05 -0.398E+04	-0.440E+05 -0.155E+05	0.185E+03 0.720E+03
4	-220.13 51.09	-0.129E+01 -0.105E+01	-0.498E+02 -0.153E+02	-0.133E+05 -0.421E+04	-0.440E+05 -0.164E+05	0.705E+02 0.274E+03
5	-211.66 64.62	-0.129E+01 -0.106E+01	-0.489E+02 -0.116E+02	-0.132E+05 -0.442E+04	-0.440E+05 -0.172E+05	-0.130E+03 -0.507E+03
6	-200.33 75.87	-0.121E+01 -0.115E+01	-0.379E+02 0.717E+01	-0.920E+04 -0.442E+04	-0.440E+05 -0.172E+05	-0.255E+03 -0.992E+03
7	-187.99	-0.111E+01	-0.220E+02	-0.502E+04	-0.323E+05	-0.196E+03

	85.12	-0.130E+01	0.652E+01	-0.429E+04	-0.167E+05	-0.761E+03
8	-175.22 93.78	-0.991E+00 -0.150E+01	-0.168E+02 0.488E+01	-0.288E+04 -0.420E+04	-0.253E+05 -0.163E+05	-0.978E+02 -0.380E+03
9	-162.05 101.82	-0.870E+00 -0.171E+01	-0.163E+02 0.469E+01	-0.163E+04 -0.412E+04	-0.211E+05 -0.160E+05	-0.395E+02 -0.154E+03
10	-148.51 109.22	-0.753E+00 -0.195E+01	-0.152E+02 0.434E+01	-0.120E+04 -0.405E+04	-0.195E+05 -0.157E+05	0.993E+01 0.386E+02
11	-134.64 115.97	-0.643E+00 -0.220E+01	-0.217E+02 0.621E+01	-0.139E+04 -0.397E+04	-0.198E+05 -0.154E+05	0.104E+03 0.404E+03
12	-120.46 122.05	-0.539E+00 -0.246E+01	-0.805E+00 0.269E+00	-0.380E+04 -0.393E+04	-0.271E+05 -0.153E+05	0.902E+02 0.351E+03
13	-106.01 127.44	-0.440E+00 -0.276E+01	-0.876E+01 0.251E+01	-0.346E+04 -0.391E+04	-0.259E+05 -0.152E+05	-0.216E+02 -0.839E+02
14	-91.31 132.15	-0.348E+00 -0.308E+01	-0.463E+01 0.130E+01	-0.227E+04 -0.387E+04	-0.221E+05 -0.151E+05	-0.103E+03 -0.399E+03
15	-76.42 136.15	-0.268E+00 -0.342E+01	-0.130E+02 0.363E+01	0.724E+03 -0.383E+04	-0.171E+05 -0.149E+05	-0.149E+03 -0.581E+03
16	-61.34 139.43	-0.205E+00 -0.377E+01	-0.123E+02 0.344E+01	0.345E+04 -0.377E+04	-0.254E+05 -0.146E+05	-0.134E+03 -0.520E+03
17	-46.13 141.99	-0.162E+00 -0.408E+01	-0.120E+02 0.332E+01	0.595E+04 -0.371E+04	-0.329E+05 -0.144E+05	-0.123E+03 -0.478E+03
18	-30.81 143.82	-0.139E+00 -0.436E+01	-0.122E+02 0.335E+01	0.825E+04 -0.365E+04	-0.398E+05 -0.142E+05	-0.111E+03 -0.430E+03
19	-15.42 144.93	-0.132E+00 -0.457E+01	-0.121E+02 0.332E+01	0.102E+05 -0.359E+04	-0.440E+05 -0.140E+05	-0.945E+02 -0.367E+03
20	0.00 145.29	-0.136E+00 -0.470E+01	-0.149E+02 0.418E+01	0.118E+05 -0.353E+04	-0.440E+05 -0.137E+05	-0.553E+02 -0.215E+03
21	15.42 144.93	-0.144E+00 -0.475E+01	-0.142E+02 -0.214E+01	0.123E+05 -0.352E+04	-0.440E+05 -0.137E+05	0.220E+01 0.855E+01
22	30.81 143.82	-0.147E+00 -0.470E+01	-0.128E+02 -0.355E+01	0.117E+05 -0.356E+04	-0.440E+05 -0.138E+05	0.433E+02 0.168E+03
23	46.13 141.99	-0.137E+00 -0.455E+01	-0.134E+02 -0.371E+01	0.106E+05 -0.362E+04	-0.440E+05 -0.141E+05	0.757E+02 0.294E+03
24	61.34 139.43	-0.108E+00 -0.433E+01	-0.138E+02 -0.380E+01	0.884E+04 -0.368E+04	-0.418E+05 -0.143E+05	0.113E+03 0.439E+03
25	76.42 136.15	-0.561E-01 -0.405E+01	-0.137E+02 -0.376E+01	0.635E+04 -0.375E+04	-0.343E+05 -0.146E+05	0.149E+03 0.579E+03
26	91.31 132.15	0.211E-01 -0.372E+01	-0.100E+02 -0.275E+01	0.327E+04 -0.381E+04	-0.250E+05 -0.148E+05	0.153E+03 0.595E+03
27	106.01 127.44	0.121E+00 -0.337E+01	-0.769E+01 -0.213E+01	0.569E+03 -0.385E+04	-0.167E+05 -0.150E+05	0.109E+03 0.422E+03

28	120.46 122.05	0.239E+00 -0.302E+01	-0.101E+00 -0.638E-02	-0.114E+04 -0.387E+04	-0.186E+05 -0.150E+05	-0.141E+02 -0.549E+02
29	134.64 115.97	0.372E+00 -0.268E+01	-0.202E+02 -0.568E+01	0.588E+00 -0.391E+04	-0.152E+05 -0.152E+05	-0.422E+02 -0.164E+03
30	148.51 109.22	0.520E+00 -0.235E+01	-0.149E+02 -0.418E+01	-0.780E+03 -0.399E+04	-0.179E+05 -0.155E+05	0.407E+02 0.158E+03
31	162.05 101.82	0.680E+00 -0.203E+01	-0.166E+02 -0.473E+01	-0.214E+04 -0.406E+04	-0.224E+05 -0.158E+05	0.929E+02 0.361E+03
32	175.22 93.78	0.846E+00 -0.174E+01	-0.152E+02 -0.441E+01	-0.445E+04 -0.414E+04	-0.299E+05 -0.161E+05	0.144E+03 0.560E+03
33	187.99 85.12	0.101E+01 -0.148E+01	-0.173E+02 -0.518E+01	-0.728E+04 -0.422E+04	-0.390E+05 -0.164E+05	0.197E+03 0.766E+03
34	200.33 75.87	0.115E+01 -0.128E+01	-0.355E+02 -0.126E+02	-0.111E+05 -0.438E+04	-0.440E+05 -0.170E+05	0.207E+03 0.805E+03
35	211.66 64.62	0.125E+01 -0.116E+01	-0.541E+02 -0.101E+02	-0.141E+05 -0.458E+04	-0.440E+05 -0.178E+05	0.903E+02 0.351E+03
36	220.13 51.09	0.127E+01 -0.113E+01	-0.549E+02 0.169E+02	-0.141E+05 -0.453E+04	-0.440E+05 -0.176E+05	-0.834E+02 -0.324E+03
37	225.31 35.99	0.118E+01 -0.115E+01	-0.313E+02 0.110E+02	-0.113E+05 -0.428E+04	-0.440E+05 -0.166E+05	-0.196E+03 -0.760E+03
38	228.76 18.07	0.960E+00 -0.119E+01	-0.469E+01 0.152E+01	-0.681E+04 -0.415E+04	-0.373E+05 -0.161E+05	-0.288E+03 -0.112E+04
39	231.30 0.00	0.668E+00 -0.122E+01	0.219E+02 -0.793E+01	0.197E-11 -0.411E+04	-0.160E+05 -0.160E+05	-0.412E+03 -0.160E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.46630E-03	-0.46630E-03	.33773	0.00000
2	-0.10948E-02	0.15288E-03	.79297	0.00000
3	-0.15444E-02	0.56046E-03	1.1186	0.07777
4	-0.20360E-02	0.86026E-03	1.4746	0.22627
5	-0.20528E-02	0.81720E-03	1.4868	0.23418
6	-0.14397E-02	0.35873E-03	1.0428	0.03283
7	-0.10129E-02	-0.34571E-04	.73364	0.00000
8	-0.79316E-03	-0.23102E-03	.57447	0.00000
9	-0.66135E-03	-0.34389E-03	.47900	0.00000
10	-0.61125E-03	-0.37669E-03	.44272	0.00000
11	-0.62004E-03	-0.34859E-03	.44908	0.00000
12	-0.84925E-03	-0.10819E-03	.61509	0.00000
13	-0.81352E-03	-0.13901E-03	.58921	0.00000
14	-0.69329E-03	-0.25126E-03	.50213	0.00000
15	-0.39626E-03	-0.53747E-03	.38927	0.00000
16	-0.12320E-03	-0.79553E-03	.57618	0.00000
17	0.12855E-03	-0.10330E-02	.74819	0.00000
18	0.35976E-03	-0.12503E-02	.90556	0.00000
19	0.55875E-03	-0.14371E-02	1.0409	0.02826
20	0.73502E-03	-0.16214E-02	1.1743	0.10214
21	0.79090E-03	-0.16862E-02	1.2213	0.12334
22	0.72756E-03	-0.16207E-02	1.1739	0.10222
23	0.59983E-03	-0.14884E-02	1.0780	0.05158
24	0.41345E-03	-0.13117E-02	.95005	0.00000

25	0.16241E-03	-0.10765E-02	.77968	0.00000
26	-0.14484E-03	-0.78331E-03	.56733	0.00000
27	-0.41395E-03	-0.52498E-03	.38023	0.00000
28	-0.58251E-03	-0.36108E-03	.42190	0.00000
29	-0.47698E-03	-0.47710E-03	.34555	0.00000
30	-0.56246E-03	-0.41030E-03	.40738	0.00000
31	-0.70430E-03	-0.28615E-03	.51010	0.00000
32	-0.93846E-03	-0.70705E-04	.67971	0.00000
33	-0.12248E-02	0.19544E-03	.88710	0.00000
34	-0.16671E-02	0.56225E-03	1.2075	0.12848
35	-0.23309E-02	0.93635E-03	1.6882	0.29082
36	-0.23068E-02	0.93715E-03	1.6708	0.28549
37	-0.16818E-02	0.59861E-03	1.2181	0.13206
38	-0.11703E-02	0.15833E-03	.84765	0.00000
39	-0.50100E-03	-0.50100E-03	.36286	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.37526	0.00000	0.14082
2	-0.37902	-0.36068	0.50434
3	-0.39078	-0.60054	0.75325
4	-0.41343	-0.75189	0.92281
5	-0.43384	-0.74337	0.93158
6	-0.43419	-0.51886	0.70738
7	-0.42149	-0.28281	0.46046
8	-0.41210	-0.16250	0.33233
9	-0.40448	-0.09177	0.25537
10	-0.39752	-0.06781	0.22583
11	-0.38975	-0.07847	0.23037
12	-0.38525	-0.21422	0.36264
13	-0.38327	-0.19498	0.34188
14	-0.38006	-0.12778	0.27222
15	-0.37571	0.04082	0.18197
16	-0.36967	0.19435	0.33101
17	-0.36394	0.33577	0.46822
18	-0.35833	0.46541	0.59381
19	-0.35278	0.57581	0.70027
20	-0.34675	0.66471	0.78495
21	-0.34509	0.69116	0.81025
22	-0.34952	0.66241	0.78457
23	-0.35530	0.59982	0.72606
24	-0.36145	0.49869	0.62933
25	-0.36780	0.35813	0.49341
26	-0.37347	0.18456	0.32404
27	-0.37780	0.03210	0.17483
28	-0.37968	-0.06401	0.20816
29	-0.38390	0.00003	0.14741
30	-0.39142	-0.04399	0.19719
31	-0.39853	-0.12087	0.27970
32	-0.40607	-0.25084	0.41573
33	-0.41419	-0.41055	0.58210
34	-0.42977	-0.62473	0.80944
35	-0.44994	-0.79794	1.00038
36	-0.44473	-0.79459	0.99237
37	-0.41986	-0.63652	0.81280
38	-0.40721	-0.38408	0.54989
39	-0.40318	0.00000	0.16256

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	35	17818.	30800.	0.578
BUCKLING THRUST (psi)	35	17818.	48668.	0.366
SEAM THRUST (psi)	35	17818.	21914.	0.813

PLASTIC-PENETRATE (%)	35	29.08	90.00	0.323
COMBINED T&M Ratio	35	1.000	1.000	1.000

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.70
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.34
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR NRL TRUCK

YOL=1.5, YDL= 1.45 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DU) TOLac factored from CANDE Load Step 21 kips/ft.	Thrust (DL) TOLs unfactored TDLfac/1.5/75 kips/ft.	Thrust (DL+L) TOL+Lac factored from CANDE Load Step 23 kips/ft.	Thrust (LL) TOLs unfactored (TOL+Lac-TOLs)/1.75	Thrust Load Rating OPR (TOL+TOL+L)/TOL+L+5
-231.304	0	-31.94	-20.28	-37.74	3.32	7.88
-228.758	18.07	-32.57	-20.68	-38.35	3.30	7.79
-225.306	35.988	-33.72	-21.41	-39.67	3.40	7.35
-220.131	51.091	-34.92	-22.17	-41.98	4.03	6.00
-211.657	64.621	-34.40	-21.84	-42.88	4.84	5.07
-200.328	75.871	-32.67	-20.74	-41.57	5.09	5.05
-187.985	85.125	-31.40	-19.94	-40.15	5.00	5.30
-175.215	93.761	-30.62	-19.44	-39.23	4.92	5.49
-162.047	101.819	-29.91	-18.99	-38.41	4.86	5.66
-148.512	109.22	-29.27	-18.59	-37.66	4.79	5.82
-134.639	115.968	-28.85	-18.31	-37.04	4.68	6.02
-120.46	122.048	-28.70	-18.22	-36.75	4.60	6.15
-106.008	127.445	-28.32	-17.98	-36.39	4.61	6.19
-91.315	132.148	-27.77	-17.63	-35.86	4.62	6.25
-76.415	136.145	-27.38	-17.39	-35.40	4.58	6.36
-61.341	139.428	-26.98	-17.13	-34.86	4.50	6.54
-46.128	141.99	-26.60	-16.89	-34.34	4.42	6.71
-30.81	143.823	-26.25	-16.67	-33.84	4.34	6.89
-15.423	144.925	-25.91	-16.45	-33.35	4.25	7.08
0	145.293	-25.71	-16.33	-32.89	4.10	7.38
15.423	144.925	-25.86	-16.42	-32.93	4.04	7.46
30.81	143.823	-26.20	-16.63	-33.43	4.14	7.24
46.128	141.99	-26.55	-16.86	-33.94	4.23	7.02
61.341	139.428	-26.92	-17.09	-34.49	4.33	6.81
76.415	136.145	-27.32	-17.35	-35.06	4.43	6.60
91.315	132.148	-27.73	-17.60	-35.60	4.50	6.43
106.008	127.445	-28.22	-17.92	-36.12	4.51	6.34
120.46	122.048	-28.56	-18.13	-36.40	4.48	6.33
134.639	115.968	-28.83	-18.31	-36.78	4.54	6.21
148.512	109.22	-29.33	-18.62	-37.48	4.65	5.99
162.047	101.819	-29.93	-19.00	-38.18	4.72	5.83
175.215	93.761	-30.61	-19.44	-38.97	4.78	5.66
187.985	85.125	-31.37	-19.92	-39.85	4.84	5.48
200.328	75.871	-32.61	-20.70	-41.37	5.00	5.14
211.657	64.621	-34.41	-21.85	-43.20	5.02	4.89
220.131	51.091	-35.06	-22.26	-42.80	4.43	5.44
225.306	35.988	-33.87	-21.51	-40.56	3.82	6.51
228.758	18.07	-32.70	-20.76	-39.18	3.70	6.93
231.304	0	-32.07	-20.36	-38.56	3.71	7.03

Thrust Load Rating=

4.89



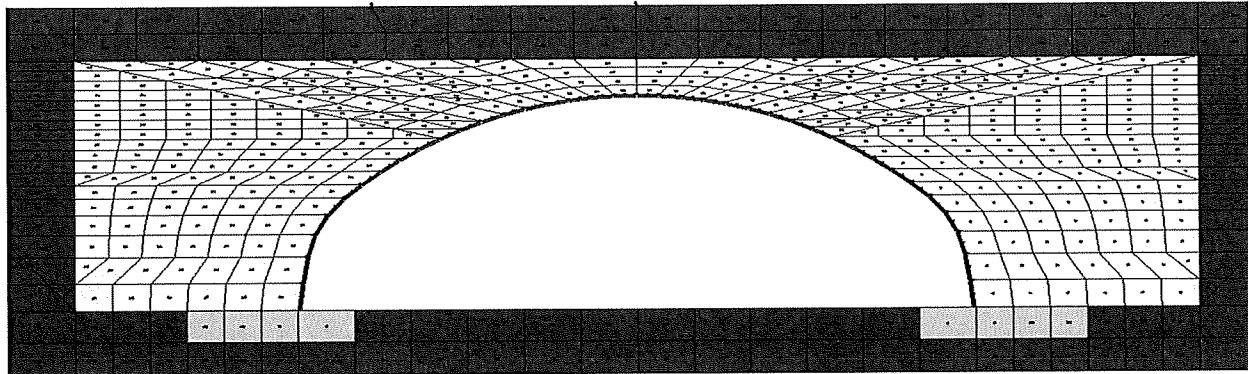
BEAM OUTPUT FOR NRL TRUCK

Y<sub>0</sub>=1.5, YDL= 1.45 (OPR)

BEAM OUTPUT FOR NRL TRUCK										
X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>brac</sub>		Moment (DL) M <sub>bus</sub>		Moment (DL+LL) M <sub>brac</sub>		Moment (LL) M <sub>bus</sub>		Moment Load Rating
		factored from CANDE		unfactored		factored from CANDE		unfactored		
		Load Step 21		M <sub>brac</sub> /1.575		Load Step 23		[M <sub>DL,LL</sub> ac-M <sub>brac</sub> ac]/1.75		
		kips-ft/ft.				kips-ft/ft.				
-231.304	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-4.07	-1.93	-7.68	0.59	0.77	17.29	
-225.306	35.988	-6.32	-4.01	-8.35	-4.01	-10.11	1.01	1.06	10.47	
-220.131	51.091	-8.35	-5.30	-8.31	-5.30	-10.17	1.06	0.91	6.74	
-211.657	64.621	-8.31	-5.28	-5.59	-3.55	-7.18	0.80	0.91	9.46	
-200.328	75.871	-5.59	-3.55	-2.10	-1.33	-3.49	0.79	0.80	13.66	
-187.985	85.125	-2.10	-1.33	0.20	0.12	-1.18	0.79	0.79	15.40	
-175.215	93.781	0.20	0.12	1.41	0.89	0.12	0.74	0.74	15.37	
-162.047	101.819	1.41	0.89	1.55	0.98	0.39	0.66	0.66	16.96	
-148.512	109.22	1.55	0.98	0.77	0.49	-0.23	0.57	0.57	20.45	
-134.639	115.968	0.77	0.49	0.53	0.34	-1.10	0.93	0.93	12.78	
-120.46	122.048	0.53	0.34	2.00	1.27	0.13	1.06	1.06	10.28	
-106.008	127.445	2.00	1.27	2.08	1.32	0.73	0.77	0.77	14.13	
-91.315	132.148	2.08	1.32	2.22	1.41	1.93	0.17	0.17	65.09	
-76.415	136.145	2.22	1.41	2.24	1.42	2.96	0.41	0.41	26.08	
-61.341	139.428	2.24	1.42	2.16	1.37	3.85	0.97	0.97	11.20	
-46.128	141.99	2.16	1.37	2.05	1.30	4.65	1.48	1.48	7.36	
-30.81	143.823	2.05	1.30	2.02	1.28	5.35	1.90	1.90	5.75	
-15.423	144.925	2.02	1.28	2.03	1.29	5.90	2.22	2.22	4.93	
0	145.293	2.03	1.29	2.08	1.32	6.09	2.29	2.29	4.76	
15.423	144.925	2.08	1.32	2.19	1.39	5.91	2.12	2.12	5.09	
30.81	143.823	2.19	1.39	2.37	1.51	5.56	1.82	1.82	5.89	
46.128	141.99	2.37	1.51	2.53	1.61	4.89	1.35	1.35	7.85	
61.341	139.428	2.53	1.61	2.58	1.64	3.87	0.74	0.74	14.35	
76.415	136.145	2.58	1.64	2.50	1.59	2.51	0.01	0.01	1420.61	
91.315	132.148	2.50	1.59	2.29	1.45	1.28	0.58	0.58	18.67	
106.008	127.445	2.29	1.45	1.33	0.84	-0.04	0.78	0.78	14.53	
120.46	122.048	1.33	0.84	1.70	1.08	0.84	0.49	0.49	22.65	
134.639	115.968	1.70	1.08	1.48	1.13	0.55	0.71	0.71	15.68	
148.512	109.22	1.79	1.13	1.26	0.80	-0.28	0.88	0.88	13.01	
162.047	101.819	1.26	0.80	-0.16	-0.10	-1.97	1.03	1.03	11.75	
175.215	93.781	-0.16	-0.10	-2.52	-1.60	-4.49	1.13	1.13	9.40	
187.985	85.125	-2.52	-1.60	-5.98	-3.80	-8.13	1.23	1.23	6.79	
200.328	75.871	-5.98	-3.80	-8.58	-5.45	-10.83	1.28	1.28	5.16	
211.657	64.621	-8.58	-5.45	-8.54	-5.42	-10.57	1.16	1.16	5.73	
220.131	51.091	-8.54	-5.42	-6.44	-4.09	-7.94	0.86	0.86	9.33	
225.306	35.988	-6.44	-4.09	-3.09	-1.96	-4.20	0.63	0.63	16.13	
228.758	18.07	-3.09	-1.96	0.00	0.00	0.00	0.00	0.00		
231.304	0	0.00	0.00							

Moment Load Rating=  
Actual Load Rating (from CANDE)

4.76  
2.75



EV2

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage EV2

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08

POISSONS RATIO OF METAL (-) ..... 0.30000E+00

YIELD STRESS OF METAL (PSI)..... 0.44000E+05

LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05

DENSITY OF METAL (PCI)..... 0.28400E+00

MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
MOM. OF INERTIA (IN**4/IN) .....	0.97860
SECTION MODULUS (IN**3/IN) .....	0.32170
PLASTIC SECTION MOD(IN**3/IN) .....	0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING .....	0.70000
BUCKLING STRESS FAILURE.....	0.70000
SEAM STRENGTH FAILURE .....	0.67000
FULL PLASTIC PENETRATION.....	0.90000
ALLOWABLE % DEFLECTION (SERVICE)...	5.00000
COMBINED MOMENT-THRUST CRITERION...	0.90000

## BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -121.9	F = 0.000
1181	23	F = 0.000	F = -121.9	F = 0.000
1177	22	F = 0.000	F = -87.35	F = 0.000
1177	23	F = 0.000	F = -87.35	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000

911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS----	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0

ENTERING ELEMENT RATIO..... 0.5000

ORIGINAL FORMULATION, ... NEWDS = 0

#### HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95

COHESION INTERCEPT C ..... 0.0000

FRICTION ANGLE PHIO (DEG)..... 48.0000

10-FOLD REDUCTION IN PHIO(DEG).. 8.0000

SCALED MODULUS NUMBER ZK ..... 950.0000

MODULUS EXPONENT ZN ..... 0.6000

FAILURE RATIO RF ..... 0.7000

INIT. BULK MODULUS NUMBER BI.... 74.8000

ULT. VOLUMETRIC STRAIN EU ..... 0.0200

#### PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

#### CONTROLS FOR DUNCAN SOIL MODEL WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0

ENTERING ELEMENT RATIO..... 0.5000

ORIGINAL FORMULATION, ... NEWDS = 0

#### HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90

COHESION INTERCEPT C ..... 0.0000

FRICTION ANGLE PHIO (DEG)..... 32.0000

10-FOLD REDUCTION IN PHIO(DEG).. 4.0000

SCALED MODULUS NUMBER ZK ..... 300.0000

MODULUS EXPONENT ZN ..... 0.2500

FAILURE RATIO RF ..... 0.7000

BULK MODULUS NUMBER BK ..... 250.0000

BULK MODULUS EXPONENT BM ..... 0.0000

#### INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000

10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.475E+00 -0.107E+01	0.785E+01 0.354E+01	-0.451E-10 -0.315E+04	-0.122E+05 -0.122E+05	0.213E+03 0.827E+03
2	-228.76 18.07	-0.635E+00 -0.105E+01	-0.837E+01 -0.253E+01	-0.386E+04 -0.320E+04	-0.245E+05 -0.124E+05	0.205E+03 0.795E+03

3	-225.31 35.99	-0.753E+00 -0.104E+01	-0.246E+02 -0.860E+01	-0.757E+04 -0.332E+04	-0.364E+05 -0.129E+05	0.179E+03 0.696E+03
4	-220.13 51.09	-0.793E+00 -0.103E+01	-0.405E+02 -0.662E+01	-0.101E+05 -0.347E+04	-0.440E+05 -0.135E+05	0.837E+02 0.325E+03
5	-211.66 64.62	-0.764E+00 -0.106E+01	-0.373E+02 0.108E+02	-0.103E+05 -0.343E+04	-0.440E+05 -0.133E+05	-0.852E+02 -0.331E+03
6	-200.33 75.87	-0.685E+00 -0.115E+01	-0.241E+02 0.859E+01	-0.735E+04 -0.325E+04	-0.355E+05 -0.126E+05	-0.216E+03 -0.838E+03
7	-187.99 85.12	-0.587E+00 -0.129E+01	-0.148E+02 0.437E+01	-0.343E+04 -0.313E+04	-0.228E+05 -0.122E+05	-0.211E+03 -0.819E+03
8	-175.22 93.78	-0.482E+00 -0.146E+01	-0.141E+02 0.407E+01	-0.735E+03 -0.306E+04	-0.142E+05 -0.119E+05	-0.134E+03 -0.522E+03
9	-162.05 101.82	-0.381E+00 -0.164E+01	-0.143E+02 0.408E+01	0.850E+03 -0.299E+04	-0.143E+05 -0.116E+05	-0.585E+02 -0.228E+03
10	-148.51 109.22	-0.290E+00 -0.181E+01	-0.133E+02 0.379E+01	0.122E+04 -0.292E+04	-0.152E+05 -0.114E+05	0.141E+02 0.546E+02
11	-134.64 115.97	-0.212E+00 -0.199E+01	-0.801E+01 0.230E+01	0.577E+03 -0.288E+04	-0.130E+05 -0.112E+05	0.410E+02 0.159E+03
12	-120.46 122.05	-0.144E+00 -0.217E+01	-0.171E+01 0.489E+00	0.126E+03 -0.286E+04	-0.115E+05 -0.111E+05	-0.196E+02 -0.763E+02
13	-106.01 127.44	-0.849E-01 -0.234E+01	-0.133E+02 0.381E+01	0.136E+04 -0.282E+04	-0.152E+05 -0.110E+05	-0.379E+02 -0.147E+03
14	-91.31 132.15	-0.371E-01 -0.251E+01	-0.552E+01 0.155E+01	0.148E+04 -0.278E+04	-0.154E+05 -0.108E+05	-0.249E+02 -0.970E+02
15	-76.42 136.15	-0.460E-03 -0.267E+01	-0.800E+01 0.227E+01	0.232E+04 -0.275E+04	-0.179E+05 -0.107E+05	-0.513E+02 -0.199E+03
16	-61.34 139.43	0.250E-01 -0.282E+01	-0.796E+01 0.226E+01	0.326E+04 -0.271E+04	-0.207E+05 -0.105E+05	-0.570E+02 -0.222E+03
17	-46.13 141.99	0.396E-01 -0.294E+01	-0.817E+01 0.232E+01	0.426E+04 -0.267E+04	-0.236E+05 -0.104E+05	-0.597E+02 -0.232E+03
18	-30.81 143.82	0.450E-01 -0.303E+01	-0.832E+01 0.235E+01	0.525E+04 -0.263E+04	-0.265E+05 -0.102E+05	-0.579E+02 -0.225E+03
19	-15.42 144.93	0.435E-01 -0.307E+01	-0.101E+02 0.288E+01	0.613E+04 -0.259E+04	-0.291E+05 -0.101E+05	-0.393E+02 -0.153E+03
20	0.00 145.29	0.387E-01 -0.308E+01	-0.118E+02 -0.171E+01	0.647E+04 -0.258E+04	-0.301E+05 -0.100E+05	0.747E+01 0.290E+02
21	15.42 144.93	0.348E-01 -0.303E+01	-0.970E+01 -0.277E+01	0.582E+04 -0.262E+04	-0.283E+05 -0.102E+05	0.508E+02 0.198E+03
22	30.81 143.82	0.360E-01 -0.294E+01	-0.872E+01 -0.247E+01	0.473E+04 -0.266E+04	-0.250E+05 -0.103E+05	0.684E+02 0.266E+03
23	46.13	0.454E-01	-0.821E+01	0.348E+04	-0.213E+05	0.724E+02



	141.99	-0.282E+01	-0.232E+01	-0.270E+04	-0.105E+05	0.281E+03
24	61.34 139.43	0.649E-01 -0.267E+01	-0.806E+01 -0.229E+01	0.223E+04 -0.274E+04	-0.176E+05 -0.106E+05	0.694E+02 0.270E+03
25	76.42 136.15	0.949E-01 -0.250E+01	-0.816E+01 -0.232E+01	0.106E+04 -0.278E+04	-0.141E+05 -0.108E+05	0.643E+02 0.250E+03
26	91.31 132.15	0.135E+00 -0.233E+01	-0.533E+01 -0.151E+01	-0.198E+02 -0.281E+04	-0.110E+05 -0.109E+05	0.362E+02 0.141E+03
27	106.01 127.44	0.183E+00 -0.216E+01	-0.845E+01 -0.243E+01	-0.285E+03 -0.284E+04	-0.119E+05 -0.110E+05	0.889E+01 0.345E+02
28	120.46 122.05	0.239E+00 -0.199E+01	-0.307E+01 -0.866E+00	-0.463E+03 -0.287E+04	-0.126E+05 -0.111E+05	-0.373E+02 -0.145E+03
29	134.64 115.97	0.301E+00 -0.183E+01	-0.141E+02 -0.404E+01	0.742E+03 -0.290E+04	-0.136E+05 -0.113E+05	-0.415E+02 -0.161E+03
30	148.51 109.22	0.373E+00 -0.166E+01	-0.111E+02 -0.319E+01	0.727E+03 -0.296E+04	-0.138E+05 -0.115E+05	0.143E+02 0.557E+02
31	162.05 101.82	0.456E+00 -0.150E+01	-0.126E+02 -0.362E+01	0.230E+03 -0.301E+04	-0.124E+05 -0.117E+05	0.562E+02 0.219E+03
32	175.22 93.78	0.546E+00 -0.134E+01	-0.132E+02 -0.384E+01	-0.106E+04 -0.308E+04	-0.152E+05 -0.120E+05	0.112E+03 0.433E+03
33	187.99 85.12	0.638E+00 -0.119E+01	-0.153E+02 -0.456E+01	-0.324E+04 -0.315E+04	-0.223E+05 -0.122E+05	0.185E+03 0.718E+03
34	200.33 75.87	0.722E+00 -0.107E+01	-0.252E+02 -0.433E+01	-0.676E+04 -0.324E+04	-0.336E+05 -0.126E+05	0.202E+03 0.787E+03
35	211.66 64.62	0.787E+00 -0.991E+00	-0.365E+02 -0.345E+01	-0.957E+04 -0.332E+04	-0.427E+05 -0.129E+05	0.870E+02 0.338E+03
36	220.13 51.09	0.805E+00 -0.972E+00	-0.381E+02 0.105E+02	-0.950E+04 -0.327E+04	-0.422E+05 -0.127E+05	-0.729E+02 -0.283E+03
37	225.31 35.99	0.757E+00 -0.982E+00	-0.227E+02 0.792E+01	-0.718E+04 -0.310E+04	-0.344E+05 -0.120E+05	-0.166E+03 -0.644E+03
38	228.76 18.07	0.633E+00 -0.998E+00	-0.764E+01 0.230E+01	-0.370E+04 -0.299E+04	-0.231E+05 -0.116E+05	-0.194E+03 -0.753E+03
39	231.30 0.00	0.469E+00 -0.101E+01	0.741E+01 -0.331E+01	-0.171E-10 -0.294E+04	-0.114E+05 -0.114E+05	-0.205E+03 -0.796E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.38391E-03	-0.38391E-03	.27806	0.00000
2	-0.76757E-03	-0.13703E-04	.55593	0.00000
3	-0.11425E-02	0.33339E-03	.82750	0.00000
4	-0.14086E-02	0.56271E-03	1.0202	0.01414
5	-0.14201E-02	0.58243E-03	1.0285	0.01968
6	-0.11133E-02	0.32036E-03	.80636	0.00000
7	-0.71658E-03	-0.46703E-04	.51900	0.00000

8	-0.44429E-03	-0.30094E-03	.32179	0.00000
9	-0.28137E-03	-0.44725E-03	.32393	0.00000
10	-0.23735E-03	-0.47606E-03	.34480	0.00000
11	-0.29476E-03	-0.40739E-03	.29506	0.00000
12	-0.33622E-03	-0.36071E-03	.26126	0.00000
13	-0.21188E-03	-0.47652E-03	.34513	0.00000
14	-0.19466E-03	-0.48319E-03	.34996	0.00000
15	-0.10876E-03	-0.56139E-03	.40660	0.00000
16	-0.12647E-04	-0.64829E-03	.46954	0.00000
17	0.89829E-04	-0.74141E-03	.53699	0.00000
18	0.19064E-03	-0.83271E-03	.60311	0.00000
19	0.28232E-03	-0.91395E-03	.66195	0.00000
20	0.31618E-03	-0.94541E-03	.68474	0.00000
21	0.24883E-03	-0.88685E-03	.64232	0.00000
22	0.13744E-03	-0.78602E-03	.56930	0.00000
23	0.10114E-04	-0.66856E-03	.48422	0.00000
24	-0.11669E-03	-0.55132E-03	.39930	0.00000
25	-0.23584E-03	-0.44168E-03	.31989	0.00000
26	-0.34462E-03	-0.34076E-03	.24960	0.00000
27	-0.37437E-03	-0.31876E-03	.27115	0.00000
28	-0.39482E-03	-0.30444E-03	.28596	0.00000
29	-0.28173E-03	-0.42641E-03	.30884	0.00000
30	-0.28995E-03	-0.43175E-03	.31271	0.00000
31	-0.34506E-03	-0.38998E-03	.28245	0.00000
32	-0.47801E-03	-0.27218E-03	.34621	0.00000
33	-0.69965E-03	-0.68237E-04	.50674	0.00000
34	-0.10541E-02	0.26474E-03	.76347	0.00000
35	-0.13384E-02	0.52795E-03	.96938	0.00000
36	-0.13257E-02	0.52831E-03	.96015	0.00000
37	-0.10781E-02	0.32267E-03	.78087	0.00000
38	-0.72538E-03	-0.44755E-05	.52537	0.00000
39	-0.35877E-03	-0.35877E-03	.25985	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.30895	0.00000	0.09545
2	-0.31436	-0.21792	0.31674
3	-0.32557	-0.42664	0.53263
4	-0.34019	-0.56959	0.68532
5	-0.33675	-0.57838	0.69178
6	-0.31907	-0.41444	0.51624
7	-0.30713	-0.19364	0.28797
8	-0.29986	-0.04144	0.13136
9	-0.29318	0.04795	0.13390
10	-0.28706	0.06900	0.15141
11	-0.28253	0.03256	0.11238
12	-0.28043	0.00708	0.08572
13	-0.27700	0.07650	0.15322
14	-0.27275	0.08340	0.15780
15	-0.26965	0.13084	0.20355
16	-0.26595	0.18374	0.25447
17	-0.26218	0.24029	0.30902
18	-0.25835	0.29582	0.36256
19	-0.25415	0.34580	0.41039
20	-0.25319	0.36468	0.42879
21	-0.25672	0.32829	0.39420
22	-0.26097	0.26694	0.33505
23	-0.26494	0.19618	0.26638
24	-0.26879	0.12564	0.19788
25	-0.27262	0.05950	0.13382
26	-0.27578	-0.00111	0.07717
27	-0.27890	-0.01607	0.09386
28	-0.28136	-0.02612	0.10529
29	-0.28494	0.04182	0.12301
30	-0.29039	0.04099	0.12532
31	-0.29576	0.01299	0.10046
32	-0.30186	-0.05950	0.15062
33	-0.30898	-0.18252	0.27799
34	-0.31763	-0.38124	0.48213
35	-0.32611	-0.53950	0.64585
36	-0.32083	-0.53592	0.63886
37	-0.30398	-0.40493	0.49733
38	-0.29367	-0.20839	0.29463
39	-0.28872	0.00000	0.08336

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	4	13472.	30800.	0.437
BUCKLING THRUST (psi)	4	13472.	49872.	0.270
SEAM THRUST (psi)	4	13472.	21914.	0.615
PLASTIC-PENETRATE (%)	5	1.97	90.00	0.022
COMBINED T&M Ratio	5	0.692	1.000	0.692

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	0.89
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.18
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage EV2-OPR  
LIVE LOADS X 3.28 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
DENSITY OF METAL (PCI)..... 0.28400E+00  
MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000  
SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -400.0	F = 0.000
1181	23	F = 0.000	F = -400.0	F = 0.000
1177	22	F = 0.000	F = -286.5	F = 0.000
1177	23	F = 0.000	F = -286.5	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000

856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS----	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FORWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21

23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHI0 (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHI0(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000



37            170.54            0.30000            50.00000            0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.300	Factor for load step #22
23	1.300	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.613E+00 -0.119E+01	0.179E+02 0.670E+01	-0.651E-10 -0.389E+04	-0.151E+05 -0.151E+05	0.359E+03 0.140E+04
2	-228.76 18.07	-0.852E+00 -0.117E+01	-0.592E+01 -0.186E+01	-0.600E+04 -0.394E+04	-0.340E+05 -0.153E+05	0.269E+03 0.105E+04
3	-225.31 35.99	-0.103E+01 -0.115E+01	-0.297E+02 -0.104E+02	-0.103E+05 -0.407E+04	-0.440E+05 -0.158E+05	0.194E+03 0.753E+03
4	-220.13 51.09	-0.109E+01 -0.113E+01	-0.512E+02 -0.129E+02	-0.130E+05 -0.428E+04	-0.440E+05 -0.166E+05	0.822E+02 0.320E+03
5	-211.66 64.62	-0.106E+01 -0.116E+01	-0.493E+02 0.149E+02	-0.130E+05 -0.426E+04	-0.440E+05 -0.166E+05	-0.943E+02 -0.366E+03
6	-200.33 75.87	-0.961E+00 -0.128E+01	-0.312E+02 0.111E+02	-0.986E+04 -0.403E+04	-0.440E+05 -0.157E+05	-0.223E+03 -0.867E+03
7	-187.99 85.12	-0.833E+00 -0.146E+01	-0.164E+02 0.488E+01	-0.571E+04 -0.388E+04	-0.328E+05 -0.151E+05	-0.222E+03 -0.865E+03
8	-175.22 93.78	-0.690E+00 -0.169E+01	-0.159E+02 0.458E+01	-0.258E+04 -0.380E+04	-0.228E+05 -0.148E+05	-0.155E+03 -0.604E+03
9	-162.05 101.82	-0.546E+00 -0.195E+01	-0.174E+02 0.495E+01	-0.399E+03 -0.372E+04	-0.157E+05 -0.145E+05	-0.766E+02 -0.298E+03
10	-148.51	-0.413E+00	-0.164E+02	0.374E+03	-0.153E+05	0.103E+02

	109.22	-0.221E+01	0.466E+01	-0.364E+04	-0.142E+05	0.399E+02
11	-134.64 115.97	-0.293E+00 -0.248E+01	-0.146E+02 0.417E+01	-0.843E+02 -0.358E+04	-0.142E+05 -0.139E+05	0.789E+02 0.307E+03
12	-120.46 122.05	-0.185E+00 -0.276E+01	-0.302E+01 0.865E+00	-0.140E+04 -0.354E+04	-0.181E+05 -0.138E+05	0.464E+02 0.180E+03
13	-106.01 127.44	-0.871E-01 -0.304E+01	-0.128E+02 0.364E+01	-0.800E+03 -0.351E+04	-0.161E+05 -0.136E+05	0.186E+01 0.725E+01
14	-91.31 132.15	-0.135E-02 -0.334E+01	0.581E+00 0.254E+00	-0.658E+03 -0.348E+04	-0.156E+05 -0.135E+05	-0.689E+02 -0.268E+03
15	-76.42 136.15	0.704E-01 -0.365E+01	-0.862E+01 0.239E+01	0.221E+04 -0.345E+04	-0.203E+05 -0.134E+05	-0.171E+03 -0.664E+03
16	-61.34 139.43	0.124E+00 -0.394E+01	-0.920E+01 0.254E+01	0.553E+04 -0.340E+04	-0.304E+05 -0.132E+05	-0.196E+03 -0.760E+03
17	-46.13 141.99	0.158E+00 -0.419E+01	-0.110E+02 0.303E+01	0.909E+04 -0.335E+04	-0.413E+05 -0.130E+05	-0.200E+03 -0.776E+03
18	-30.81 143.82	0.172E+00 -0.437E+01	-0.119E+02 0.326E+01	0.124E+05 -0.329E+04	-0.440E+05 -0.128E+05	-0.180E+03 -0.701E+03
19	-15.42 144.93	0.172E+00 -0.446E+01	-0.176E+02 0.500E+01	0.150E+05 -0.322E+04	-0.440E+05 -0.125E+05	-0.107E+03 -0.415E+03
20	0.00 145.29	0.165E+00 -0.442E+01	-0.227E+02 -0.342E+01	0.156E+05 -0.321E+04	-0.440E+05 -0.125E+05	0.523E+02 0.203E+03
21	15.42 144.93	0.162E+00 -0.425E+01	-0.151E+02 -0.418E+01	0.129E+05 -0.327E+04	-0.440E+05 -0.127E+05	0.190E+03 0.740E+03
22	30.81 143.82	0.173E+00 -0.398E+01	-0.129E+02 -0.353E+01	0.884E+04 -0.334E+04	-0.405E+05 -0.130E+05	0.250E+03 0.971E+03
23	46.13 141.99	0.203E+00 -0.364E+01	-0.969E+01 -0.264E+01	0.402E+04 -0.340E+04	-0.257E+05 -0.132E+05	0.265E+03 0.103E+04
24	61.34 139.43	0.253E+00 -0.328E+01	-0.685E+01 -0.188E+01	-0.641E+03 -0.345E+04	-0.154E+05 -0.134E+05	0.230E+03 0.894E+03
25	76.42 136.15	0.321E+00 -0.292E+01	-0.538E+01 -0.151E+01	-0.435E+04 -0.349E+04	-0.271E+05 -0.135E+05	0.160E+03 0.623E+03
26	91.31 132.15	0.397E+00 -0.259E+01	0.109E+01 -0.351E+00	-0.666E+04 -0.350E+04	-0.343E+05 -0.136E+05	0.278E+02 0.108E+03
27	106.01 127.44	0.476E+00 -0.232E+01	-0.307E+01 -0.911E+00	-0.601E+04 -0.351E+04	-0.323E+05 -0.136E+05	0.123E+03 -0.478E+03
28	120.46 122.05	0.553E+00 -0.209E+01	-0.906E+01 -0.261E+01	-0.339E+04 -0.353E+04	-0.243E+05 -0.137E+05	-0.196E+03 -0.763E+03
29	134.64 115.97	0.631E+00 -0.188E+01	-0.255E+02 -0.732E+01	-0.277E+03 -0.360E+04	-0.149E+05 -0.140E+05	-0.986E+02 -0.383E+03
30	148.51 109.22	0.717E+00 -0.169E+01	-0.120E+02 -0.342E+01	-0.572E+03 -0.368E+04	-0.161E+05 -0.143E+05	0.178E+02 0.694E+02

31	162.05	0.809E+00	-0.141E+02	-0.992E+03	-0.176E+05	0.427E+02
	101.82	-0.150E+01	-0.405E+01	-0.374E+04	-0.145E+05	0.166E+03
32	175.22	0.905E+00	-0.159E+02	-0.200E+04	-0.210E+05	0.952E+02
	93.78	-0.133E+01	-0.464E+01	-0.381E+04	-0.148E+05	0.370E+03
33	187.99	0.100E+01	-0.207E+02	-0.399E+04	-0.275E+05	0.195E+03
	85.12	-0.117E+01	-0.419E+01	-0.389E+04	-0.151E+05	0.760E+03
34	200.33	0.108E+01	-0.325E+02	-0.805E+04	-0.403E+05	0.247E+03
	75.87	-0.105E+01	0.223E+01	-0.393E+04	-0.153E+05	0.960E+03
35	211.66	0.114E+01	-0.414E+02	-0.117E+05	-0.440E+05	0.119E+03
	64.62	-0.979E+00	0.101E+02	-0.386E+04	-0.150E+05	0.463E+03
36	220.13	0.113E+01	-0.429E+02	-0.117E+05	-0.440E+05	-0.721E+02
	51.09	-0.975E+00	0.131E+02	-0.368E+04	-0.143E+05	-0.280E+03
37	225.31	0.104E+01	-0.257E+02	-0.914E+04	-0.419E+05	-0.175E+03
	35.99	-0.100E+01	0.895E+01	-0.348E+04	-0.135E+05	-0.680E+03
38	228.76	0.841E+00	-0.502E+01	-0.530E+04	-0.296E+05	-0.237E+03
	18.07	-0.103E+01	0.156E+01	-0.337E+04	-0.131E+05	-0.922E+03
39	231.30	0.587E+00	0.156E+02	-0.108E-10	-0.129E+05	-0.315E+03
	0.00	-0.106E+01	-0.583E+01	-0.333E+04	-0.129E+05	-0.122E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.47473E-03	-0.47473E-03	.34384	0.00000
2	-0.10658E-02	0.10506E-03	.77193	0.00000
3	-0.15132E-02	0.51288E-03	1.0959	0.06539
4	-0.19785E-02	0.80573E-03	1.4329	0.21470
5	-0.19693E-02	0.80456E-03	1.4263	0.21220
6	-0.14580E-02	0.47213E-03	1.0560	0.04005
7	-0.10307E-02	0.83529E-04	.74651	0.00000
8	-0.71477E-03	-0.21225E-03	.51769	0.00000
9	-0.49269E-03	-0.41489E-03	.35684	0.00000
10	-0.40801E-03	-0.48097E-03	.34835	0.00000
11	-0.44461E-03	-0.42816E-03	.32202	0.00000
12	-0.56809E-03	-0.29582E-03	.41145	0.00000
13	-0.50585E-03	-0.34977E-03	.36638	0.00000
14	-0.48809E-03	-0.35973E-03	.35351	0.00000
15	-0.20556E-03	-0.63582E-03	.46051	0.00000
16	0.12466E-03	-0.95458E-03	.69138	0.00000
17	0.47820E-03	-0.12953E-02	.93814	0.00000
18	0.82656E-03	-0.16612E-02	1.2031	0.11275
19	0.11746E-02	-0.21304E-02	1.5430	0.22684
20	0.12591E-02	-0.22623E-02	1.6385	0.25035
21	0.89458E-03	-0.17424E-02	1.2620	0.13716
22	0.45437E-03	-0.12696E-02	.91957	0.00000
23	-0.23311E-04	-0.80660E-03	.58420	0.00000
24	-0.48323E-03	-0.35811E-03	.34999	0.00000
25	-0.84913E-03	-0.93302E-06	.61500	0.00000
26	-0.10774E-02	0.22273E-03	.78037	0.00000
27	-0.10145E-02	0.15784E-03	.73475	0.00000
28	-0.76162E-03	-0.99869E-04	.55162	0.00000
29	-0.46632E-03	-0.41224E-03	.33775	0.00000
30	-0.50498E-03	-0.39345E-03	.36574	0.00000
31	-0.55327E-03	-0.35969E-03	.40072	0.00000
32	-0.66011E-03	-0.27015E-03	.47810	0.00000
33	-0.86352E-03	-0.85203E-04	.62542	0.00000
34	-0.12636E-02	0.30586E-03	.91519	0.00000
35	-0.16632E-02	0.68783E-03	1.2046	0.12016
36	-0.16356E-02	0.71033E-03	1.1846	0.10866

37	-0.13159E-02	0.46775E-03	.95306	0.00000
38	-0.92785E-03	0.10631E-03	.67202	0.00000
39	-0.40600E-03	-0.40600E-03	.29405	0.00000

# COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/ (P-resist)	FACTORED MOMENT-RATIO M/ (M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.38204	0.00000	0.14596
2	-0.38658	-0.33846	0.48790
3	-0.39901	-0.58046	0.73966
4	-0.42024	-0.73349	0.91009
5	-0.41841	-0.73319	0.90826
6	-0.39544	-0.55609	0.71247
7	-0.38112	-0.32209	0.46734
8	-0.37301	-0.14526	0.28440
9	-0.36519	-0.02249	0.15585
10	-0.35770	0.02109	0.14904
11	-0.35118	-0.00476	0.12808
12	-0.34762	-0.07870	0.19954
13	-0.34428	-0.04512	0.16365
14	-0.34114	-0.03710	0.15348
15	-0.33855	0.12437	0.23899
16	-0.33394	0.31197	0.42349
17	-0.32878	0.51266	0.62075
18	-0.32311	0.69723	0.80162
19	-0.31617	0.84786	0.94782
20	-0.31484	0.88127	0.98039
21	-0.32117	0.72882	0.83197
22	-0.32805	0.49836	0.60597
23	-0.33394	0.22642	0.33794
24	-0.33854	-0.03617	0.15078
25	-0.34204	-0.24518	0.36218
26	-0.34392	-0.37584	0.49412
27	-0.34469	-0.33887	0.45768
28	-0.34664	-0.19129	0.31145
29	-0.35351	-0.01563	0.14060
30	-0.36150	-0.03224	0.16292
31	-0.36735	-0.05596	0.19091
32	-0.37431	-0.11273	0.25284
33	-0.38174	-0.22498	0.37071
34	-0.38537	-0.45368	0.60219
35	-0.37880	-0.65941	0.80290
36	-0.36116	-0.66043	0.79086
37	-0.34127	-0.51559	0.63205
38	-0.33057	-0.29894	0.40822
39	-0.32673	0.00000	0.10675

## ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

### LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	4	16641.	30800.	0.540
BUCKLING THRUST (psi)	4	16641.	49488.	0.336
SEAM THRUST (psi)	4	16641.	21914.	0.759
PLASTIC-PENETRATE (%)	20	25.04	90.00	0.278
COMBINED T&M Ratio	20	0.980	1.000	0.980

### LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.71
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RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.34
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR EV2 TRUCK

Y0=1.5, YD1= 1.30 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) T <sub>DLfac</sub>		Thrust (DL) T <sub>DLs</sub>		Thrust (DL+LL) T <sub>DL+LLfac</sub>		Thrust (LL) T <sub>LLs</sub>		Thrust Load Rating	
		factored from CANDE		unfactored		factored from CANDE		unfactored		OPR	
		Load Step 21		TD <sub>fac</sub> /1.575		Load Step 23		(T <sub>DL+LLfac</sub> -T <sub>DLfac</sub> )/1.75		(T <sub>OPR</sub> -T <sub>DL+LLs</sub> )/T <sub>LLs</sub> *1.30	
		Kips/ft.		Kips/ft.		Kips/ft.					
-231.304	0	-31.95	-20.28	-37.78	3.33	-37.78	3.33		8.76		
-228.758	18.07	-32.57	-20.68	-38.44	3.35	-38.44	3.35		8.57		
-225.306	35.988	-33.73	-21.42	-39.81	3.47	-39.81	3.47		8.03		
-220.131	51.091	-34.93	-22.18	-41.59	3.81	-41.59	3.81		7.08		
-211.657	64.621	-34.40	-21.84	-41.17	3.87	-41.17	3.87		7.07		
-200.328	75.871	-32.67	-20.74	-39.01	3.62	-39.01	3.62		7.90		
-187.985	85.125	-31.41	-19.94	-37.55	3.51	-37.55	3.51		8.42		
-175.215	93.781	-30.62	-19.44	-36.66	3.45	-36.66	3.45		8.73		
-162.047	101.819	-29.92	-18.99	-35.85	3.39	-35.85	3.39		9.04		
-148.512	109.22	-29.28	-18.59	-35.10	3.33	-35.10	3.33		9.35		
-134.639	115.968	-28.85	-18.32	-34.54	3.26	-34.54	3.26		9.66		
-120.46	122.048	-28.70	-18.23	-34.29	3.19	-34.29	3.19		9.89		
-106.008	127.445	-28.33	-17.98	-33.87	3.17	-33.87	3.17		10.05		
-91.315	132.148	-27.77	-17.63	-33.35	3.19	-33.35	3.19		10.11		
-76.415	136.145	-27.38	-17.39	-32.97	3.19	-32.97	3.19		10.18		
-61.341	139.428	-26.98	-17.13	-32.52	3.16	-32.52	3.16		10.37		
-46.128	141.99	-26.60	-16.89	-32.06	3.12	-32.06	3.12		10.61		
-30.81	143.823	-26.25	-16.67	-31.59	3.05	-31.59	3.05		10.93		
-15.423	144.925	-25.91	-16.45	-31.07	2.95	-31.07	2.95		11.38		
0	145.293	-25.72	-16.33	-30.96	2.99	-30.96	2.99		11.26		
15.423	144.925	-25.87	-16.42	-31.39	3.16	-31.39	3.16		10.66		
30.81	143.823	-26.21	-16.64	-31.91	3.26	-31.91	3.26		10.24		
46.128	141.99	-26.56	-16.86	-32.39	3.34	-32.39	3.34		9.93		
61.341	139.428	-26.93	-17.10	-32.86	3.39	-32.86	3.39		9.69		
76.415	136.145	-27.33	-17.35	-33.33	3.43	-33.33	3.43		9.49		
91.315	132.148	-27.74	-17.61	-33.72	3.42	-33.72	3.42		9.43		
106.008	127.445	-28.23	-17.92	-34.10	3.35	-34.10	3.35		9.51		
120.46	122.048	-28.57	-18.14	-34.40	3.33	-34.40	3.33		9.49		
134.639	115.968	-28.84	-18.31	-34.84	3.43	-34.84	3.43		9.17		
148.512	109.22	-29.34	-18.63	-35.51	3.52	-35.51	3.52		8.82		
162.047	101.819	-29.94	-19.01	-36.16	3.56	-36.16	3.56		8.62		
175.215	93.781	-30.62	-19.44	-36.91	3.59	-36.91	3.59		8.39		
187.985	85.125	-31.38	-19.92	-37.78	3.66	-37.78	3.66		8.09		
200.328	75.871	-32.62	-20.71	-38.84	3.55	-38.84	3.55		8.07		
211.657	64.621	-34.42	-21.85	-39.87	3.12	-39.87	3.12		8.77		
220.131	51.091	-35.05	-22.25	-39.23	2.39	-39.23	2.39		11.26		
225.306	35.988	-33.86	-21.50	-37.17	1.89	-37.17	1.89		14.71		
228.758	18.07	-32.69	-20.76	-35.91	1.84	-35.91	1.84		15.58		
231.304	0	-32.06	-20.36	-35.30	1.85	-35.30	1.85		15.70		

Thrust Load Rating=

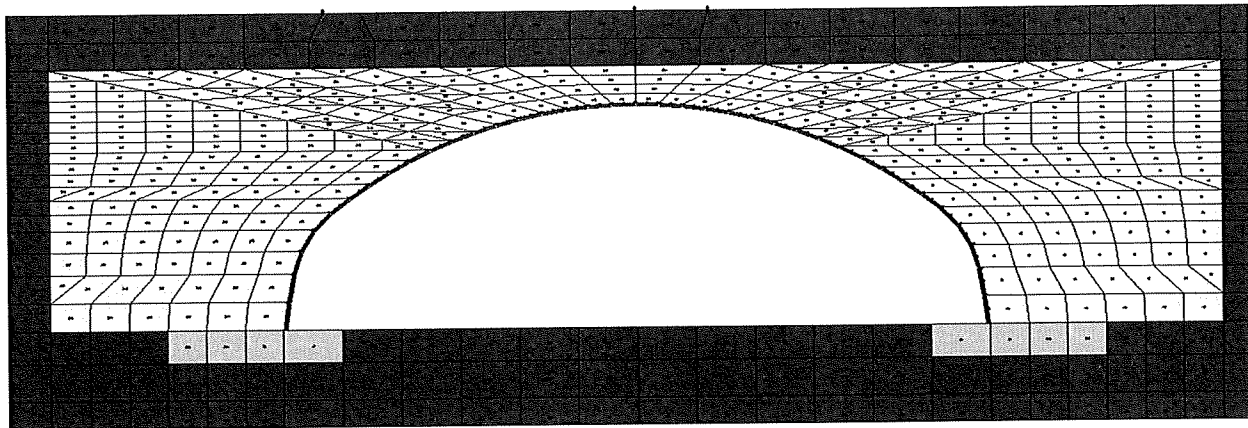
7.07

Y<sub>DL</sub>=1.5, Y<sub>DL</sub>= 1.30 (OPR)

BEAM OUTPUT FOR EV2 TRUCK

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DL</sub> factored from CANDE		Moment (DL) M <sub>DL</sub> unfactored		Moment (DL+LL) M <sub>DL+LL</sub> factored from CANDE		Moment (LL) M <sub>LL</sub> unfactored		Moment Load Rating	
		Load Step 21 kips-ft/ft.		M <sub>DL</sub> /1.575		Load Step 23 kips-ft/ft.		(M <sub>DL+LL</sub> -M <sub>DL</sub> )*1.5)/M <sub>LL</sub> *1.30		OPR	
-231.304	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
-228.758	18.07	-3.04	-1.93	-4.02	-3.86	-7.57	0.47	0.71	0.71	24.20	12.75
-225.306	35.988	-6.32	-4.02	-5.31	-10.10	-10.26	1.00	1.11	1.00	7.58	6.84
-220.131	51.091	-8.32	-5.28	-3.55	-1.34	-0.73	0.53	0.31	0.31	40.37	69.50
-211.657	64.621	-5.60	-1.34	0.12	0.85	1.22	0.18	0.11	0.11	122.75	58.56
-200.328	75.871	-2.11	0.19	0.89	0.49	0.58	0.23	0.37	0.37	32.98	33.83
-187.985	85.125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	341.43	21.33
-175.215	93.781	1.40	0.76	0.52	1.27	1.36	0.36	0.04	0.04	10.18	6.70
-162.047	101.819	1.54	0.76	0.33	1.34	1.48	0.56	0.19	0.19	5.20	4.81
-148.512	109.22	0.52	2.00	1.27	1.43	2.32	2.14	2.14	2.14	5.68	8.28
-134.639	115.968	0.52	2.11	1.32	1.39	3.26	0.84	0.84	0.84	18.70	72.93
-120.46	122.048	2.00	2.27	1.39	1.50	4.26	0.16	0.16	0.16	13.78	8.34
-106.008	127.445	2.11	2.07	1.32	1.59	5.25	0.86	0.86	0.86	8.26	12.52
-91.315	132.148	2.26	2.03	1.29	1.62	6.13	1.02	1.02	1.02	22.97	20.54
-76.415	136.145	2.08	2.51	1.29	1.57	6.47	0.60	0.60	0.60	21.70	26.30
-61.341	139.428	2.18	2.36	1.39	1.50	5.82	0.59	0.59	0.59	28.55	20.59
-46.128	141.99	2.19	2.07	1.32	1.59	4.73	0.41	0.41	0.41	12.98	13.44
-30.81	143.823	2.07	2.03	1.29	1.57	3.48	0.55	0.55	0.55	21.03	32.92
-15.423	144.925	2.51	2.55	1.59	1.62	2.23	0.00	0.00	0.00		
0	145.293	2.08	2.03	1.29	1.57	1.06	0.00	0.00	0.00		
15.423	144.925	2.18	2.36	1.39	1.50	0.23	0.52	0.52	0.52	26.30	28.55
30.81	143.823	2.36	2.51	1.59	1.62	-0.29	0.45	0.45	0.45	20.59	12.98
46.128	141.99	2.55	2.47	1.57	1.62	-0.46	1.45	1.45	1.45	8.26	12.52
61.341	139.428	2.26	2.18	1.44	1.57	0.74	0.54	0.54	0.54	22.97	20.54
76.415	136.145	1.31	1.69	0.83	1.07	0.73	0.59	0.59	0.59	21.70	26.30
91.315	132.148	1.78	1.26	1.13	1.07	0.23	0.52	0.52	0.52	28.55	20.59
106.008	127.445	1.26	-0.15	0.80	0.80	-1.06	0.41	0.41	0.41	12.98	13.44
120.46	122.048	-2.51	-2.51	-1.59	-1.59	-3.24	0.55	0.55	0.55	21.03	32.92
134.639	115.968	-5.97	-5.97	-3.79	-3.79	-6.76	0.00	0.00	0.00		
148.512	109.22	-8.57	-8.57	-5.44	-5.44	-9.57	0.00	0.00	0.00		
162.047	101.819	-5.60	-5.60	-3.55	-3.55	-7.35	0.00	0.00	0.00		
175.215	93.781	-2.11	0.19	0.89	0.49	-0.73	0.00	0.00	0.00		
187.985	85.125	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
200.328	75.871	1.40	0.76	0.52	1.27	1.36	0.36	0.04	0.04		
211.657	64.621	1.54	0.76	0.33	1.34	1.48	0.56	0.19	0.19		
220.131	51.091	0.52	2.00	1.27	1.43	2.32	2.14	2.14	2.14		
225.306	35.988	0.52	2.11	1.32	1.39	3.26	0.84	0.84	0.84		
228.758	18.07	2.00	2.27	1.32	1.50	4.26	0.16	0.16	0.16		
231.304	0	2.27	2.07	1.32	1.59	5.25	0.86	0.86	0.86		

Moment Load Rating= 4.81  
Actual Load Rating (from CANDE) 3.28



### EV3

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage EV3

EXECUTION MODE ..... ANALYS

SOLUTION LEVEL ..... #3 USER

METHODOLOGY (LRFD OR SERVICE) ... LRFD

NUMBER OF PIPE-ELEMENT GROUPS .... 1

MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL

NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08

POISSONS RATIO OF METAL (-) ..... 0.30000E+00

YIELD STRESS OF METAL (PSI)..... 0.44000E+05

LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05

DENSITY OF METAL (PCI)..... 0.28400E+00

MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1



## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
 COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
 (FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE. (D)	Y-FORCE(F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -112.8	F = 0.000
1181	23	F = 0.000	F = -112.8	F = 0.000
1182	22	F = 0.000	F = -112.8	F = 0.000
1182	23	F = 0.000	F = -112.8	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000

911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1176	22	F =	0.000	F =	-87.34	F =	0.000
1176	23	F =	0.000	F =	-87.34	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

# BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

# HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 48.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
 SCALED MODULUS NUMBER ZK ..... 950.0000  
 MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

# PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

# CONTROLS FOR DUNCAN SOIL MODEL WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

# HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

# INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000

8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.522E+00 -0.108E+01	0.105E+02 0.433E+01	-0.178E-10 -0.327E+04	-0.127E+05 -0.127E+05	0.245E+03 0.950E+03
2	-228.76 18.07	-0.706E+00 -0.106E+01	-0.742E+01 -0.225E+01	-0.428E+04 -0.332E+04	-0.262E+05 -0.129E+05	0.213E+03 0.828E+03

3	-225.31 35.99	-0.845E+00 -0.104E+01	-0.253E+02 -0.884E+01	-0.797E+04 -0.343E+04	-0.381E+05 -0.133E+05	0.174E+03 0.676E+03
4	-220.13 51.09	-0.899E+00 -0.103E+01	-0.422E+02 -0.121E+02	-0.104E+05 -0.363E+04	-0.440E+05 -0.141E+05	0.725E+02 0.282E+03
5	-211.66 64.62	-0.881E+00 -0.105E+01	-0.409E+02 0.306E+01	-0.104E+05 -0.369E+04	-0.440E+05 -0.144E+05	-0.102E+03 -0.398E+03
6	-200.33 75.87	-0.810E+00 -0.113E+01	-0.283E+02 0.765E+01	-0.716E+04 -0.358E+04	-0.362E+05 -0.139E+05	-0.224E+03 -0.872E+03
7	-187.99 85.12	-0.721E+00 -0.126E+01	-0.169E+02 0.501E+01	-0.328E+04 -0.346E+04	-0.236E+05 -0.135E+05	-0.201E+03 -0.780E+03
8	-175.22 93.78	-0.623E+00 -0.142E+01	-0.151E+02 0.436E+01	-0.890E+03 -0.338E+04	-0.159E+05 -0.131E+05	-0.116E+03 -0.450E+03
9	-162.05 101.82	-0.528E+00 -0.159E+01	-0.149E+02 0.427E+01	0.400E+03 -0.331E+04	-0.141E+05 -0.129E+05	-0.431E+02 -0.167E+03
10	-148.51 109.22	-0.442E+00 -0.176E+01	-0.140E+02 0.402E+01	0.571E+03 -0.324E+04	-0.144E+05 -0.126E+05	0.250E+02 0.970E+02
11	-134.64 115.97	-0.366E+00 -0.194E+01	-0.117E+02 0.336E+01	-0.215E+03 -0.319E+04	-0.131E+05 -0.124E+05	0.708E+02 0.275E+03
12	-120.46 122.05	-0.297E+00 -0.212E+01	-0.318E+01 0.931E+00	-0.143E+04 -0.316E+04	-0.167E+05 -0.123E+05	0.351E+02 0.136E+03
13	-106.01 127.44	-0.234E+00 -0.231E+01	-0.117E+02 0.337E+01	-0.108E+04 -0.313E+04	-0.155E+05 -0.121E+05	0.148E+01 0.574E+01
14	-91.31 132.15	-0.177E+00 -0.251E+01	-0.420E+01 0.119E+01	-0.120E+04 -0.309E+04	-0.157E+05 -0.120E+05	-0.226E+02 -0.879E+02
15	-76.42 136.15	-0.128E+00 -0.272E+01	-0.842E+01 0.239E+01	-0.230E+02 -0.306E+04	-0.120E+05 -0.119E+05	-0.708E+02 -0.275E+03
16	-61.34 139.43	-0.888E-01 -0.293E+01	-0.792E+01 0.224E+01	0.141E+04 -0.302E+04	-0.161E+05 -0.117E+05	-0.884E+02 -0.344E+03
17	-46.13 141.99	-0.616E-01 -0.314E+01	-0.807E+01 0.227E+01	0.316E+04 -0.298E+04	-0.214E+05 -0.116E+05	-0.107E+03 -0.416E+03
18	-30.81 143.82	-0.466E-01 -0.332E+01	-0.883E+01 0.247E+01	0.516E+04 -0.294E+04	-0.275E+05 -0.114E+05	-0.117E+03 -0.453E+03
19	-15.42 144.93	-0.426E-01 -0.346E+01	-0.949E+01 0.265E+01	0.716E+04 -0.289E+04	-0.335E+05 -0.112E+05	-0.113E+03 -0.439E+03
20	0.00 145.29	-0.462E-01 -0.354E+01	-0.129E+02 0.369E+01	0.894E+04 -0.284E+04	-0.388E+05 -0.110E+05	-0.757E+02 -0.294E+03
21	15.42 144.93	-0.520E-01 -0.357E+01	-0.132E+02 -0.259E+01	0.964E+04 -0.283E+04	-0.410E+05 -0.110E+05	-0.853E+01 -0.332E+02
22	30.81 143.82	-0.537E-01 -0.351E+01	-0.118E+02 -0.331E+01	0.919E+04 -0.288E+04	-0.397E+05 -0.112E+05	0.489E+02 0.190E+03
23	46.13	-0.452E-01	-0.120E+02	0.794E+04	-0.361E+05	0.947E+02

	141.99	-0.339E+01	-0.336E+01	-0.293E+04	-0.114E+05	0.368E+03
24	61.34 139.43	-0.217E-01 -0.321E+01	-0.116E+02 -0.326E+01	0.591E+04 -0.299E+04	-0.300E+05 -0.116E+05	0.137E+03 0.531E+03
25	76.42 136.15	0.190E-01 -0.299E+01	-0.106E+02 -0.298E+01	0.326E+04 -0.304E+04	-0.220E+05 -0.118E+05	0.166E+03 0.645E+03
26	91.31 132.15	0.762E-01 -0.275E+01	-0.289E+01 -0.774E+00	0.279E+03 -0.308E+04	-0.128E+05 -0.120E+05	0.126E+03 0.488E+03
27	106.01 127.44	0.146E+00 -0.250E+01	-0.566E+01 -0.161E+01	-0.111E+04 -0.310E+04	-0.155E+05 -0.121E+05	0.454E+02 0.176E+03
28	120.46 122.05	0.225E+00 -0.227E+01	-0.605E+00 -0.157E+00	-0.155E+04 -0.312E+04	-0.169E+05 -0.121E+05	-0.534E+02 -0.208E+03
29	134.64 115.97	0.311E+00 -0.205E+01	-0.185E+02 -0.530E+01	0.179E+03 -0.316E+04	-0.128E+05 -0.123E+05	-0.541E+02 -0.210E+03
30	148.51 109.22	0.408E+00 -0.183E+01	-0.115E+02 -0.328E+01	-0.180E+03 -0.322E+04	-0.131E+05 -0.125E+05	0.269E+02 0.104E+03
31	162.05 101.82	0.513E+00 -0.162E+01	-0.134E+02 -0.384E+01	-0.907E+03 -0.328E+04	-0.156E+05 -0.127E+05	0.652E+02 0.253E+03
32	175.22 93.78	0.624E+00 -0.143E+01	-0.137E+02 -0.398E+01	-0.240E+04 -0.335E+04	-0.205E+05 -0.130E+05	0.117E+03 0.456E+03
33	187.99 85.12	0.734E+00 -0.125E+01	-0.156E+02 -0.465E+01	-0.469E+04 -0.342E+04	-0.279E+05 -0.133E+05	0.184E+03 0.714E+03
34	200.33 75.87	0.830E+00 -0.111E+01	-0.279E+02 -0.991E+01	-0.817E+04 -0.355E+04	-0.392E+05 -0.138E+05	0.197E+03 0.764E+03
35	211.66 64.62	0.902E+00 -0.103E+01	-0.413E+02 -0.281E+01	-0.109E+05 -0.368E+04	-0.440E+05 -0.143E+05	0.787E+02 0.306E+03
36	220.13 51.09	0.919E+00 -0.101E+01	-0.424E+02 0.130E+02	-0.107E+05 -0.359E+04	-0.440E+05 -0.140E+05	-0.858E+02 -0.334E+03
37	225.31 35.99	0.861E+00 -0.102E+01	-0.255E+02 0.889E+01	-0.806E+04 -0.339E+04	-0.382E+05 -0.132E+05	-0.178E+03 -0.694E+03
38	228.76 18.07	0.716E+00 -0.104E+01	-0.715E+01 0.217E+01	-0.435E+04 -0.328E+04	-0.263E+05 -0.127E+05	-0.215E+03 -0.836E+03
39	231.30 0.00	0.525E+00 -0.106E+01	0.112E+02 -0.454E+01	-0.199E-10 -0.323E+04	-0.125E+05 -0.125E+05	-0.249E+03 -0.969E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.39861E-03	-0.39861E-03	.28870	0.00000
2	-0.82235E-03	0.12803E-04	.59561	0.00000
3	-0.11958E-02	0.35854E-03	.86609	0.00000
4	-0.14637E-02	0.57597E-03	1.0602	0.04072
5	-0.14653E-02	0.56081E-03	1.0613	0.04177
6	-0.11351E-02	0.26159E-03	.82209	0.00000
7	-0.74205E-03	-0.10222E-03	.53745	0.00000

8	-0.49912E-03	-0.32551E-03	.36150	0.00000
9	-0.36464E-03	-0.44268E-03	.32062	0.00000
10	-0.34003E-03	-0.45145E-03	.32697	0.00000
11	-0.41001E-03	-0.36802E-03	.29696	0.00000
12	-0.52511E-03	-0.24535E-03	.38032	0.00000
13	-0.48630E-03	-0.27617E-03	.35222	0.00000
14	-0.49373E-03	-0.25995E-03	.35760	0.00000
15	-0.37540E-03	-0.37091E-03	.27190	0.00000
16	-0.23102E-03	-0.50558E-03	.36618	0.00000
17	-0.54968E-04	-0.67195E-03	.48668	0.00000
18	0.14512E-03	-0.86179E-03	.62418	0.00000
19	0.34544E-03	-0.10511E-02	.76131	0.00000
20	0.52603E-03	-0.12187E-02	.88266	0.00000
21	0.59553E-03	-0.12856E-02	.93115	0.00000
22	0.54527E-03	-0.12467E-02	.90297	0.00000
23	0.41711E-03	-0.11320E-02	.81987	0.00000
24	0.21259E-03	-0.94132E-03	.68178	0.00000
25	-0.53249E-04	-0.68903E-03	.49905	0.00000
26	-0.34839E-03	-0.40272E-03	.29168	0.00000
27	-0.48703E-03	-0.26963E-03	.35275	0.00000
28	-0.53135E-03	-0.22868E-03	.38484	0.00000
29	-0.36739E-03	-0.40240E-03	.29145	0.00000
30	-0.41053E-03	-0.37538E-03	.29733	0.00000
31	-0.48848E-03	-0.31150E-03	.35379	0.00000
32	-0.64209E-03	-0.17381E-03	.46505	0.00000
33	-0.87406E-03	0.39996E-04	.63306	0.00000
34	-0.12300E-02	0.36366E-03	.89086	0.00000
35	-0.15249E-02	0.61865E-03	1.1044	0.06727
36	-0.14865E-02	0.60454E-03	1.0767	0.05061
37	-0.11998E-02	0.37262E-03	.86897	0.00000
38	-0.82446E-03	0.25039E-04	.59714	0.00000
39	-0.39372E-03	-0.39372E-03	.28516	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.32078	0.00000	0.10290
2	-0.32574	-0.24141	0.34752
3	-0.33690	-0.44931	0.56281
4	-0.35586	-0.58762	0.71425
5	-0.36253	-0.58373	0.71516
6	-0.35146	-0.40372	0.52725
7	-0.33971	-0.18495	0.30036
8	-0.33181	-0.05019	0.16028
9	-0.32484	0.02256	0.12808
10	-0.31847	0.03221	0.13363
11	-0.31306	-0.01214	0.11014
12	-0.31001	-0.08087	0.17698
13	-0.30680	-0.06074	0.15487
14	-0.30326	-0.06758	0.15955
15	-0.30030	-0.00130	0.09148
16	-0.29639	0.07937	0.16721
17	-0.29250	0.17835	0.26390
18	-0.28837	0.29107	0.37422
19	-0.28395	0.40370	0.48433
20	-0.27871	0.50434	0.58202
21	-0.27768	0.54378	0.62089
22	-0.28225	0.51801	0.59767
23	-0.28765	0.44779	0.53054
24	-0.29322	0.33356	0.41954
25	-0.29867	0.18378	0.27299
26	-0.30223	0.01571	0.10705
27	-0.30446	-0.06284	0.15554
28	-0.30582	-0.08749	0.18102
29	-0.30974	0.01012	0.10606
30	-0.31623	-0.01016	0.11016
31	-0.32189	-0.05116	0.15477
32	-0.32830	-0.13536	0.24314
33	-0.33561	-0.26422	0.37685
34	-0.34859	-0.46068	0.58219
35	-0.36075	-0.61407	0.74421
36	-0.35273	-0.60123	0.72565
37	-0.33283	-0.45453	0.56530
38	-0.32167	-0.24556	0.34903
39	-0.31685	0.00000	0.10039



ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	14356.	30800.	0.466
BUCKLING THRUST (psi)	5	14356.	50062.	0.287
SEAM THRUST (psi)	5	14356.	21914.	0.655
PLASTIC-PENETRATE (%)	35	6.73	90.00	0.075
COMBINED T&M Ratio	35	0.744	1.000	0.744

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.07
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.21
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage EV3-OPR

LIVE LOADS X 2.13 FOR COMBINED MOMENT THRUST TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
DENSITY OF METAL (PCI)..... 0.28400E+00  
MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000

SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000

ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)

(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -240.0	F = 0.000
1181	23	F = 0.000	F = -240.0	F = 0.000
1182	22	F = 0.000	F = -240.0	F = 0.000
1182	23	F = 0.000	F = -240.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000

856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1176	22	F =	0.000	F =	-185.8	F =	0.000
1176	23	F =	0.000	F =	-185.8	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19

21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000

ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000

35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.300	Factor for load step #22
23	1.300	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.602E+00 -0.113E+01	0.168E+02 0.627E+01	-0.196E-10 -0.364E+04	-0.141E+05 -0.141E+05	0.341E+03 0.133E+04
2	-228.76 18.07	-0.848E+00 -0.111E+01	-0.529E+01 -0.166E+01	-0.569E+04 -0.368E+04	-0.320E+05 -0.143E+05	0.252E+03 0.981E+03
3	-225.31 35.99	-0.104E+01 -0.108E+01	-0.274E+02 -0.959E+01	-0.970E+04 -0.380E+04	-0.440E+05 -0.148E+05	0.177E+03 0.689E+03
4	-220.13 51.09	-0.112E+01 -0.106E+01	-0.471E+02 -0.144E+02	-0.122E+05 -0.401E+04	-0.440E+05 -0.156E+05	0.625E+02 0.243E+03
5	-211.66 64.62	-0.111E+01 -0.108E+01	-0.462E+02 -0.355E+01	-0.119E+05 -0.415E+04	-0.440E+05 -0.161E+05	-0.128E+03 -0.499E+03
6	-200.33 75.87	-0.103E+01 -0.116E+01	-0.343E+02 0.629E+01	-0.810E+04 -0.410E+04	-0.411E+05 -0.159E+05	-0.249E+03 -0.969E+03
7	-187.99 85.12	-0.936E+00 -0.131E+01	-0.200E+02 0.593E+01	-0.397E+04 -0.398E+04	-0.278E+05 -0.155E+05	-0.203E+03 -0.789E+03
8	-175.22 93.78	-0.829E+00 -0.148E+01	-0.164E+02 0.475E+01	-0.167E+04 -0.389E+04	-0.203E+05 -0.151E+05	-0.108E+03 -0.422E+03
9	-162.05 101.82	-0.722E+00 -0.167E+01	-0.162E+02 0.463E+01	-0.403E+03 -0.381E+04	-0.161E+05 -0.148E+05	-0.397E+02 -0.154E+03

10	-148.51 109.22	-0.623E+00 -0.187E+01	-0.153E+02 0.436E+01	-0.171E+03 -0.374E+04	-0.151E+05 -0.145E+05	0.237E+02 0.921E+02
11	-134.64 115.97	-0.532E+00 -0.208E+01	-0.183E+02 0.527E+01	-0.807E+03 -0.367E+04	-0.168E+05 -0.143E+05	0.107E+03 0.417E+03
12	-120.46 122.05	-0.447E+00 -0.230E+01	-0.563E+01 0.164E+01	-0.310E+04 -0.362E+04	-0.237E+05 -0.141E+05	0.119E+03 0.464E+03
13	-106.01 127.44	-0.366E+00 -0.254E+01	-0.103E+02 0.295E+01	-0.402E+04 -0.359E+04	-0.265E+05 -0.140E+05	0.711E+02 0.276E+03
14	-91.31 132.15	-0.288E+00 -0.282E+01	-0.104E+01 0.318E+00	-0.467E+04 -0.357E+04	-0.284E+05 -0.139E+05	-0.112E+02 -0.437E+02
15	-76.42 136.15	-0.215E+00 -0.313E+01	-0.787E+01 0.223E+01	-0.286E+04 -0.354E+04	-0.227E+05 -0.138E+05	-0.111E+03 -0.431E+03
16	-61.34 139.43	-0.153E+00 -0.346E+01	-0.729E+01 0.203E+01	-0.244E+03 -0.350E+04	-0.144E+05 -0.136E+05	-0.161E+03 -0.624E+03
17	-46.13 141.99	-0.106E+00 -0.380E+01	-0.842E+01 0.232E+01	0.323E+04 -0.346E+04	-0.235E+05 -0.135E+05	-0.204E+03 -0.794E+03
18	-30.81 143.82	-0.784E-01 -0.411E+01	-0.105E+02 0.288E+01	0.722E+04 -0.341E+04	-0.357E+05 -0.133E+05	-0.221E+03 -0.859E+03
19	-15.42 144.93	-0.683E-01 -0.437E+01	-0.115E+02 0.315E+01	0.111E+05 -0.335E+04	-0.440E+05 -0.130E+05	-0.211E+03 -0.819E+03
20	0.00 145.29	-0.715E-01 -0.455E+01	-0.179E+02 0.506E+01	0.146E+05 -0.328E+04	-0.440E+05 -0.128E+05	-0.140E+03 -0.546E+03
21	15.42 144.93	-0.791E-01 -0.460E+01	-0.181E+02 -0.205E+01	0.159E+05 -0.326E+04	-0.440E+05 -0.127E+05	-0.171E+02 -0.665E+02
22	30.81 143.82	-0.798E-01 -0.452E+01	-0.163E+02 -0.453E+01	0.151E+05 -0.331E+04	-0.440E+05 -0.129E+05	0.931E+02 0.362E+03
23	46.13 141.99	-0.627E-01 -0.431E+01	-0.157E+02 -0.433E+01	0.126E+05 -0.338E+04	-0.440E+05 -0.132E+05	0.182E+03 0.706E+03
24	61.34 139.43	-0.209E-01 -0.400E+01	-0.151E+02 -0.417E+01	0.857E+04 -0.346E+04	-0.401E+05 -0.134E+05	0.258E+03 0.100E+04
25	76.42 136.15	0.475E-01 -0.364E+01	-0.115E+02 -0.315E+01	0.340E+04 -0.353E+04	-0.243E+05 -0.137E+05	0.298E+03 0.116E+04
26	91.31 132.15	0.139E+00 -0.325E+01	-0.178E+00 0.650E-03	-0.193E+04 -0.357E+04	-0.199E+05 -0.139E+05	0.219E+03 0.853E+03
27	106.01 127.44	0.246E+00 -0.288E+01	-0.302E-01 -0.149E-01	-0.462E+04 -0.357E+04	-0.283E+05 -0.139E+05	0.519E+02 0.202E+03
28	120.46 122.05	0.360E+00 -0.254E+01	0.206E-01 -0.336E-02	-0.460E+04 -0.357E+04	-0.282E+05 -0.139E+05	-0.117E+03 -0.456E+03
29	134.64 115.97	0.479E+00 -0.224E+01	-0.244E+02 -0.703E+01	-0.187E+04 -0.362E+04	-0.199E+05 -0.141E+05	-0.994E+02 -0.386E+03
30	148.51	0.603E+00	-0.131E+02	-0.223E+04	-0.213E+05	0.162E+02



	109.22	-0.196E+01	-0.370E+01	-0.370E+04	-0.144E+05	0.630E+02
31	162.05	0.733E+00	-0.139E+02	-0.294E+04	-0.238E+05	0.471E+02
	101.82	-0.170E+01	-0.398E+01	-0.377E+04	-0.146E+05	0.183E+03
32	175.22	0.862E+00	-0.148E+02	-0.413E+04	-0.277E+05	0.886E+02
	93.78	-0.147E+01	-0.433E+01	-0.383E+04	-0.149E+05	0.344E+03
33	187.99	0.985E+00	-0.193E+02	-0.599E+04	-0.338E+05	0.168E+03
	85.12	-0.128E+01	-0.572E+01	-0.392E+04	-0.152E+05	0.653E+03
34	200.33	0.109E+01	-0.342E+02	-0.951E+04	-0.440E+05	0.211E+03
	75.87	-0.112E+01	-0.104E+02	-0.406E+04	-0.158E+05	0.821E+03
35	211.66	0.116E+01	-0.463E+02	-0.127E+05	-0.440E+05	0.970E+02
	64.62	-0.104E+01	0.646E+01	-0.412E+04	-0.160E+05	0.377E+03
36	220.13	0.117E+01	-0.469E+02	-0.125E+05	-0.440E+05	-0.826E+02
	51.09	-0.103E+01	0.144E+02	-0.395E+04	-0.154E+05	-0.321E+03
37	225.31	0.107E+01	-0.277E+02	-0.982E+04	-0.440E+05	-0.185E+03
	35.99	-0.105E+01	0.967E+01	-0.373E+04	-0.145E+05	-0.718E+03
38	228.76	0.869E+00	-0.510E+01	-0.574E+04	-0.319E+05	-0.253E+03
	18.07	-0.108E+01	0.160E+01	-0.362E+04	-0.140E+05	-0.985E+03
39	231.30	0.606E+00	0.175E+02	-0.426E-10	-0.139E+05	-0.342E+03
	0.00	-0.111E+01	-0.647E+01	-0.357E+04	-0.139E+05	-0.133E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.44385E-03	-0.44385E-03	.32147	0.00000
2	-0.10037E-02	0.10582E-03	.72694	0.00000
3	-0.14105E-02	0.48384E-03	1.0216	0.01572
4	-0.17671E-02	0.72796E-03	1.2799	0.15487
5	-0.17437E-02	0.67679E-03	1.2629	0.14999
6	-0.12898E-02	0.29038E-03	.93417	0.00000
7	-0.87248E-03	-0.98211E-04	.63192	0.00000
8	-0.63730E-03	-0.31134E-03	.46158	0.00000
9	-0.50426E-03	-0.42571E-03	.36523	0.00000
10	-0.47305E-03	-0.43978E-03	.34262	0.00000
11	-0.52641E-03	-0.36894E-03	.38126	0.00000
12	-0.74401E-03	-0.13953E-03	.53887	0.00000
13	-0.83027E-03	-0.45646E-04	.60134	0.00000
14	-0.89098E-03	0.20944E-04	.64531	0.00000
15	-0.71103E-03	-0.15343E-03	.51498	0.00000
16	-0.45122E-03	-0.40358E-03	.32681	0.00000
17	-0.10684E-03	-0.73759E-03	.53422	0.00000
18	0.28855E-03	-0.11207E-02	.81170	0.00000
19	0.68029E-03	-0.15058E-02	1.0906	0.05721
20	0.11028E-02	-0.20432E-02	1.4798	0.21058
21	0.12968E-02	-0.23475E-02	1.7003	0.26530
22	0.11740E-02	-0.21655E-02	1.5684	0.23501
23	0.83917E-03	-0.17062E-02	1.2358	0.12788
24	0.41396E-03	-0.12580E-02	.91112	0.00000
25	-0.98430E-04	-0.76262E-03	.55235	0.00000
26	-0.62288E-03	-0.24717E-03	.45114	0.00000
27	-0.88651E-03	0.14766E-04	.64207	0.00000
28	-0.88454E-03	0.13049E-04	.64065	0.00000
29	-0.62373E-03	-0.25984E-03	.45175	0.00000
30	-0.66964E-03	-0.23376E-03	.48500	0.00000
31	-0.74575E-03	-0.17261E-03	.54013	0.00000
32	-0.87005E-03	-0.64885E-04	.63016	0.00000
33	-0.10617E-02	0.10621E-03	.76897	0.00000
34	-0.14247E-02	0.43286E-03	1.0319	0.02369
35	-0.18793E-02	0.78144E-03	1.3611	0.18740

36	-0.18188E-02	0.78084E-03	1.3173	0.16854
37	-0.14134E-02	0.50265E-03	1.0237	0.01708
38	-0.10011E-02	0.11937E-03	.72509	0.00000
39	-0.43592E-03	-0.43592E-03	.31573	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/ (P-resist)	FACTORED MOMENT-RATIO M/ (M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.35719	0.00000	0.12758
2	-0.36128	-0.32072	0.45124
3	-0.37266	-0.54727	0.68615
4	-0.39405	-0.68642	0.84170
5	-0.40740	-0.66996	0.83593
6	-0.40214	-0.45678	0.61850
7	-0.39058	-0.22382	0.37637
8	-0.38171	-0.09422	0.23992
9	-0.37420	-0.02271	0.16273
10	-0.36730	-0.00962	0.14453
11	-0.36026	-0.04552	0.17531
12	-0.35552	-0.17473	0.30112
13	-0.35245	-0.22681	0.35103
14	-0.35008	-0.26361	0.38616
15	-0.34784	-0.16119	0.28217
16	-0.34395	-0.01377	0.13207
17	-0.33978	0.18233	0.29778
18	-0.33484	0.40737	0.51949
19	-0.32926	0.62684	0.73525
20	-0.32223	0.82119	0.92502
21	-0.31958	0.89780	0.99993
22	-0.32475	0.85081	0.95628
23	-0.33212	0.70786	0.81817
24	-0.33961	0.48330	0.59863
25	-0.34647	0.19200	0.31204
26	-0.35009	-0.10861	0.23117
27	-0.35077	-0.26053	0.38357
28	-0.35067	-0.25946	0.38243
29	-0.35553	-0.10519	0.23159
30	-0.36351	-0.12600	0.25814
31	-0.36953	-0.16568	0.30223
32	-0.37620	-0.23275	0.37427
33	-0.38447	-0.33761	0.48542
34	-0.39867	-0.53637	0.69530
35	-0.40415	-0.71601	0.87935
36	-0.38795	-0.70735	0.85786
37	-0.36625	-0.55350	0.68764
38	-0.35480	-0.32390	0.44978
39	-0.35081	0.00000	0.12307

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	16133.	30800.	0.524
BUCKLING THRUST (psi)	5	16133.	49381.	0.327
SEAM THRUST (psi)	5	16133.	21914.	0.736
PLASTIC-PENETRATE (%)	21	26.53	90.00	0.295
COMBINED T&M Ratio	21	1.000	1.000	1.000

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%)..... 1.76

RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.35
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR EV3 TRUCK

YDL=1.5, YDL= 1.30 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) TDLfac factored from CANDE	Thrust (DL) TDLs unfactored	Thrust (DL+LL) TDL+LLfac factored from CANDE	Thrust (LL) TLLs unfactored	Thrust Load Rating
		Load Step 21	TDLfac/1.575	Load Step 23	(TDL+LLfac-TDLs)/1.75	OPR
		kips/ft.	kips/ft.	kips/ft.		(Tcap-TDLs*1.5)/TLLs*1.30
-231.304	0	-31.95	-20.28	-39.22	4.16	7.02
-228.758	18.07	-32.58	-20.68	-39.83	4.14	6.93
-225.306	35.988	-33.74	-21.42	-41.19	4.26	6.54
-220.131	51.091	-34.93	-22.18	-43.51	4.90	5.50
-211.657	64.621	-34.41	-21.85	-44.33	5.67	4.83
-200.328	75.871	-32.67	-20.75	-42.97	5.88	4.87
-187.985	85.125	-31.41	-19.94	-41.54	5.79	5.11
-175.215	93.781	-30.62	-19.44	-40.57	5.68	5.30
-162.047	101.819	-29.92	-19.00	-39.72	5.60	5.47
-148.512	109.22	-29.28	-18.59	-38.94	5.52	5.64
-134.639	115.968	-28.85	-18.32	-38.28	5.39	5.84
-120.46	122.048	-28.71	-18.23	-37.91	5.26	6.00
-106.008	127.445	-28.33	-17.99	-37.51	5.25	6.06
-91.315	132.148	-27.78	-17.64	-37.08	5.32	6.06
-76.415	136.145	-27.39	-17.39	-36.72	5.33	6.10
-61.341	139.428	-26.99	-17.13	-36.24	5.29	6.20
-46.128	141.99	-26.61	-16.89	-35.76	5.23	6.32
-30.81	143.823	-26.25	-16.67	-35.26	5.15	6.48
-15.423	144.925	-25.91	-16.45	-34.72	5.03	6.67
0	145.293	-25.72	-16.33	-34.08	4.78	7.06
15.423	144.925	-25.87	-16.42	-33.95	4.62	7.28
30.81	143.823	-26.21	-16.64	-34.51	4.74	7.03
46.128	141.99	-26.56	-16.86	-35.17	4.92	6.73
61.341	139.428	-26.94	-17.10	-35.85	5.10	6.44
76.415	136.145	-27.33	-17.35	-36.52	5.25	6.20
91.315	132.148	-27.74	-17.61	-36.95	5.27	6.12
106.008	127.445	-28.23	-17.92	-37.23	5.14	6.20
120.46	122.048	-28.57	-18.14	-37.39	5.04	6.28
134.639	115.968	-28.84	-18.31	-37.87	5.16	6.09
148.512	109.22	-29.34	-18.63	-38.67	5.33	5.83
162.047	101.819	-29.94	-19.01	-39.36	5.38	5.69
175.215	93.781	-30.62	-19.44	-40.14	5.44	5.54
187.985	85.125	-31.38	-19.92	-41.03	5.52	5.36
200.328	75.871	-32.62	-20.71	-42.62	5.72	5.02
211.657	64.621	-34.42	-21.85	-44.11	5.54	4.94
220.131	51.091	-35.05	-22.25	-43.13	4.62	5.83
225.306	35.988	-33.87	-21.50	-40.69	3.90	7.11
228.758	18.07	-32.69	-20.76	-39.33	3.79	7.55
231.304	0	-32.06	-20.36	-38.74	3.82	7.62

Thrust Load Rating=

4.83

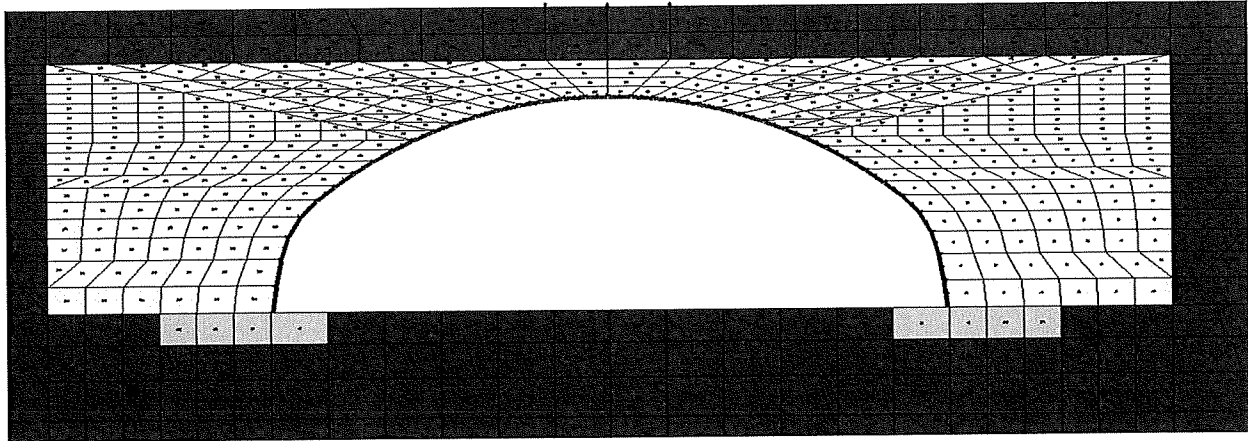
BEAM OUTPUT FOR EV3 TRUCK

Y<sub>D</sub>=1.5, YDL= 1.30 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>b,DC</sub> factored from CANDE Load Step 21 kips-ft/ft.	Moment (DL) M <sub>b,LS</sub> unfactored M <sub>b,DC</sub> /1.575	Moment (DL+LL) M <sub>b,LL+DC</sub> factored from CANDE Load Step 23 kips-ft/ft.	Moment (LL) M <sub>b,LS</sub> unfactored (M <sub>b,LL+DC</sub> -M <sub>b,DC</sub> )/1.75	Moment Load Rating OPR (M <sub>cap</sub> -M <sub>b,DC</sub> *1.5)/M <sub>b,LS</sub> *1.30
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-4.28	0.71	16.10
-225.306	35.988	-6.33	-4.02	-7.97	0.94	9.63
-220.131	51.091	-8.36	-5.31	-10.42	1.18	6.41
-211.657	64.621	-8.32	-5.28	-10.35	1.16	6.52
-200.328	75.871	-5.60	-3.55	-7.16	0.89	10.73
-187.985	85.125	-2.10	-1.34	-3.28	0.67	18.05
-175.215	93.781	0.19	0.12	-0.89	0.62	21.99
-162.047	101.819	1.40	0.89	0.40	0.57	22.14
-148.512	109.22	1.54	0.98	0.57	0.55	22.64
-134.639	115.968	0.77	0.49	-0.22	0.56	23.41
-120.46	122.048	0.52	0.33	-1.43	1.12	11.89
-106.008	127.445	2.00	1.27	-1.08	1.76	6.94
-91.315	132.148	2.10	1.34	-1.20	1.89	6.43
-76.415	136.145	2.25	1.43	-0.02	1.50	9.24
-61.341	139.428	2.27	1.44	1.41	0.49	24.44
-46.128	141.99	2.18	1.38	3.16	0.56	21.50
-30.81	143.823	2.07	1.31	5.16	1.77	6.88
-15.423	144.925	2.03	1.29	7.16	2.93	4.16
0	145.293	2.03	1.29	8.94	3.95	3.09
15.423	144.925	2.09	1.33	9.64	4.32	2.81
30.81	143.823	2.19	1.39	9.19	4.00	3.02
46.128	141.99	2.37	1.51	7.94	3.18	3.75
61.341	139.428	2.52	1.60	5.91	1.94	6.10
76.415	136.145	2.56	1.62	3.26	0.40	29.40
91.315	132.148	2.46	1.56	0.28	1.25	9.50
106.008	127.445	2.26	1.43	-1.11	1.93	6.24
120.46	122.048	1.31	0.83	-1.55	1.64	7.77
134.639	115.968	1.69	1.07	0.18	0.86	14.44
148.512	109.22	1.78	1.13	-0.18	1.12	11.05
162.047	101.819	1.26	0.80	-0.91	1.24	10.31
175.215	93.781	-0.15	-0.10	-2.40	1.28	10.56
187.985	85.125	-2.51	-1.59	-4.69	1.24	9.53
200.328	75.871	-5.97	-3.79	-8.17	1.26	7.40
211.657	64.621	-8.57	-5.44	-10.89	1.32	5.58
220.131	51.091	-8.54	-5.42	-10.66	1.21	6.11
225.306	35.988	-6.44	-4.09	-8.06	0.93	9.65
228.758	18.07	-3.09	-1.96	-4.35	0.72	15.78
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating=  
Actual Load Rating (from CANDE)

2.81  
2.13



## COLORADO PERMIT

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage COLORADO PERMIT

EXECUTION MODE ..... ANALYS  
 SOLUTION LEVEL ..... #3 USER  
 METHODOLOGY (LRFD OR SERVICE) ... LRFD  
 NUMBER OF PIPE-ELEMENT GROUPS .... 1  
 MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
 NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
 AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

## SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
MOM. OF INERTIA (IN**4/IN) .....	0.97860
SECTION MODULUS (IN**3/IN) .....	0.32170
PLASTIC SECTION MOD(IN**3/IN) .....	0.44780

NOTE: AASHTO COMBINED T&amp;M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING .....	0.70000
BUCKLING STRESS FAILURE.....	0.70000
SEAM STRENGTH FAILURE .....	0.67000
FULL PLASTIC PENETRATION.....	0.90000
ALLOWABLE % DEFLECTION (SERVICE)...	5.00000
COMBINED MOMENT-THRUST CRITERION...	0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -78.86	F = 0.000
1181	23	F = 0.000	F = -78.86	F = 0.000
1182	22	F = 0.000	F = -78.86	F = 0.000
1182	23	F = 0.000	F = -78.86	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000

886	1	D =	0.000	D =	0.000	D =	0.000
911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-78.86	F =	0.000
1180	23	F =	0.000	F =	-78.86	F =	0.000
1170	22	F =	0.000	F =	-90.98	F =	0.000
1170	23	F =	0.000	F =	-90.98	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...  
 THE NUMBER OF DATA ERRORS IS----- 0  
 THE NUMBER OF SOIL MATERIALS IS----- 4  
 THE NUMBER OF PIPE-TYPE GROUPS IS----- 1  
 THE NUMBER OF INTERFACE MATERIALS IS--- 37  
 BAND WIDTH ESTIMATE (MAX)----- 2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*



# BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

## MATERIAL DESCRIPTION FOR SOILS AND INTERFACE (ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
 YOUNGS MODULUS= 0.3000E+04  
 POISSONS RATIO= 0.3000E+00  
 CONFINED MOD.= 0.4038E+04  
 LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
 YOUNGS MODULUS= 0.3500E+07  
 POISSONS RATIO= 0.1800E+00  
 CONFINED MOD.= 0.3800E+07  
 LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000

5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.498E+00 -0.106E+01	0.984E+01 0.414E+01	-0.360E-10 -0.317E+04	-0.123E+05 -0.123E+05	0.225E+03 0.874E+03
2	-228.76	-0.681E+00	-0.762E+01	-0.399E+04	-0.249E+05	0.202E+03

	18.07	-0.104E+01	-0.230E+01	-0.322E+04	-0.125E+05	0.785E+03
3	-225.31 35.99	-0.821E+00 -0.102E+01	-0.251E+02 -0.875E+01	-0.756E+04 -0.333E+04	-0.364E+05 -0.129E+05	0.173E+03 0.671E+03
4	-220.13 51.09	-0.879E+00 -0.101E+01	-0.415E+02 -0.127E+02	-0.101E+05 -0.353E+04	-0.440E+05 -0.137E+05	0.815E+02 0.317E+03
5	-211.66 64.62	-0.866E+00 -0.103E+01	-0.399E+02 0.111E+01	-0.102E+05 -0.362E+04	-0.440E+05 -0.141E+05	-0.875E+02 -0.340E+03
6	-200.33 75.87	-0.801E+00 -0.110E+01	-0.281E+02 0.719E+01	-0.732E+04 -0.353E+04	-0.365E+05 -0.137E+05	-0.207E+03 -0.805E+03
7	-187.99 85.12	-0.716E+00 -0.123E+01	-0.166E+02 0.493E+01	-0.374E+04 -0.342E+04	-0.249E+05 -0.133E+05	-0.183E+03 -0.713E+03
8	-175.22 93.78	-0.619E+00 -0.138E+01	-0.144E+02 0.418E+01	-0.160E+04 -0.334E+04	-0.179E+05 -0.130E+05	-0.104E+03 -0.405E+03
9	-162.05 101.82	-0.523E+00 -0.155E+01	-0.142E+02 0.408E+01	-0.422E+03 -0.327E+04	-0.140E+05 -0.127E+05	-0.402E+02 -0.156E+03
10	-148.51 109.22	-0.434E+00 -0.173E+01	-0.134E+02 0.383E+01	-0.212E+03 -0.321E+04	-0.131E+05 -0.125E+05	0.190E+02 0.737E+02
11	-134.64 115.97	-0.351E+00 -0.192E+01	-0.134E+02 0.386E+01	-0.820E+03 -0.315E+04	-0.148E+05 -0.122E+05	0.748E+02 0.291E+03
12	-120.46 122.05	-0.275E+00 -0.212E+01	-0.700E+00 0.231E+00	-0.229E+04 -0.312E+04	-0.193E+05 -0.121E+05	0.351E+02 0.136E+03
13	-106.01 127.44	-0.203E+00 -0.233E+01	-0.924E+01 0.264E+01	-0.162E+04 -0.310E+04	-0.171E+05 -0.120E+05	-0.354E+02 -0.138E+03
14	-91.31 132.15	-0.138E+00 -0.256E+01	-0.263E+01 0.718E+00	-0.839E+03 -0.307E+04	-0.145E+05 -0.119E+05	-0.899E+02 -0.349E+03
15	-76.42 136.15	-0.824E-01 -0.280E+01	-0.101E+02 0.283E+01	0.159E+04 -0.304E+04	-0.167E+05 -0.118E+05	-0.136E+03 -0.530E+03
16	-61.34 139.43	-0.406E-01 -0.302E+01	-0.104E+02 0.293E+01	0.385E+04 -0.299E+04	-0.236E+05 -0.116E+05	-0.121E+03 -0.470E+03
17	-46.13 141.99	-0.140E-01 -0.322E+01	-0.105E+02 0.296E+01	0.579E+04 -0.293E+04	-0.294E+05 -0.114E+05	-0.994E+02 -0.386E+03
18	-30.81 143.82	-0.151E-02 -0.338E+01	-0.104E+02 0.293E+01	0.732E+04 -0.288E+04	-0.340E+05 -0.112E+05	-0.752E+02 -0.292E+03
19	-15.42 144.93	0.865E-04 -0.348E+01	-0.111E+02 0.313E+01	0.840E+04 -0.284E+04	-0.371E+05 -0.110E+05	0.442E+02 -0.172E+03
20	0.00 145.29	-0.432E-02 -0.352E+01	-0.117E+02 0.223E+00	0.883E+04 -0.281E+04	-0.384E+05 -0.109E+05	-0.185E+01 -0.720E+01
21	15.42 144.93	-0.897E-02 -0.349E+01	-0.111E+02 -0.315E+01	0.845E+04 -0.283E+04	-0.373E+05 -0.110E+05	0.406E+02 0.158E+03
22	30.81 143.82	-0.809E-02 -0.340E+01	-0.104E+02 -0.291E+01	0.742E+04 -0.288E+04	-0.343E+05 -0.112E+05	0.714E+02 0.277E+03

23	46.13 141.99	0.330E-02 -0.325E+01	-0.105E+02 -0.295E+01	0.596E+04 -0.293E+04	-0.299E+05 -0.114E+05	0.951E+02 0.370E+03
24	61.34 139.43	0.286E-01 -0.306E+01	-0.104E+02 -0.293E+01	0.409E+04 -0.298E+04	-0.243E+05 -0.116E+05	0.117E+03 0.454E+03
25	76.42 136.15	0.690E-01 -0.284E+01	-0.996E+01 -0.280E+01	0.189E+04 -0.303E+04	-0.177E+05 -0.118E+05	0.132E+03 0.512E+03
26	91.31 132.15	0.123E+00 -0.261E+01	-0.342E+01 -0.939E+00	-0.459E+03 -0.307E+04	-0.133E+05 -0.119E+05	0.908E+02 0.353E+03
27	106.01 127.44	0.188E+00 -0.239E+01	-0.638E+01 -0.182E+01	-0.135E+04 -0.309E+04	-0.162E+05 -0.120E+05	0.207E+02 0.805E+02
28	120.46 122.05	0.260E+00 -0.217E+01	-0.203E+01 -0.576E+00	-0.146E+04 -0.311E+04	-0.166E+05 -0.121E+05	-0.610E+02 -0.237E+03
29	134.64 115.97	0.339E+00 -0.197E+01	-0.179E+02 -0.513E+01	0.248E+03 -0.315E+04	-0.130E+05 -0.122E+05	-0.553E+02 -0.215E+03
30	148.51 109.22	0.427E+00 -0.177E+01	-0.116E+02 -0.330E+01	0.112E+02 -0.321E+04	-0.125E+05 -0.125E+05	0.216E+02 0.841E+02
31	162.05 101.82	0.524E+00 -0.158E+01	-0.133E+02 -0.381E+01	-0.615E+03 -0.327E+04	-0.146E+05 -0.127E+05	0.599E+02 0.233E+03
32	175.22 93.78	0.628E+00 -0.139E+01	-0.138E+02 -0.402E+01	-0.199E+04 -0.334E+04	-0.192E+05 -0.130E+05	0.112E+03 0.437E+03
33	187.99 85.12	0.731E+00 -0.123E+01	-0.162E+02 -0.480E+01	-0.419E+04 -0.341E+04	-0.263E+05 -0.133E+05	0.184E+03 0.714E+03
34	200.33 75.87	0.821E+00 -0.109E+01	-0.279E+02 -0.699E+01	-0.773E+04 -0.352E+04	-0.377E+05 -0.137E+05	0.203E+03 0.788E+03
35	211.66 64.62	0.890E+00 -0.101E+01	-0.401E+02 -0.112E+01	-0.106E+05 -0.361E+04	-0.440E+05 -0.140E+05	0.847E+02 0.329E+03
36	220.13 51.09	0.906E+00 -0.995E+00	-0.413E+02 0.127E+02	-0.104E+05 -0.352E+04	-0.440E+05 -0.137E+05	-0.820E+02 -0.319E+03
37	225.31 35.99	0.847E+00 -0.101E+01	-0.249E+02 0.869E+01	-0.786E+04 -0.332E+04	-0.373E+05 -0.129E+05	-0.175E+03 -0.680E+03
38	228.76 18.07	0.704E+00 -0.103E+01	-0.715E+01 0.217E+01	-0.422E+04 -0.321E+04	-0.256E+05 -0.125E+05	-0.210E+03 -0.815E+03
39	231.30 0.00	0.517E+00 -0.105E+01	0.106E+02 -0.436E+01	-0.353E-10 -0.316E+04	-0.123E+05 -0.123E+05	-0.241E+03 -0.936E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.38616E-03	-0.38616E-03	.27969	0.00000
2	-0.78183E-03	-0.29046E-05	.56626	0.00000
3	-0.11432E-02	0.33097E-03	.82802	0.00000
4	-0.14140E-02	0.55278E-03	1.0241	0.01695

5	-0.14440E-02	0.55896E-03	1.0458	0.03159
6	-0.11443E-02	0.28338E-03	.82880	0.00000
7	-0.78143E-03	-0.51759E-04	.56597	0.00000
8	-0.56319E-03	-0.25104E-03	.40790	0.00000
9	-0.44002E-03	-0.35768E-03	.31870	0.00000
10	-0.41198E-03	-0.37057E-03	.29838	0.00000
11	-0.46420E-03	-0.30430E-03	.33621	0.00000
12	-0.60435E-03	-0.15698E-03	.43772	0.00000
13	-0.53577E-03	-0.22007E-03	.38804	0.00000
14	-0.45621E-03	-0.29249E-03	.33042	0.00000
15	-0.21503E-03	-0.52559E-03	.38068	0.00000
16	0.11496E-04	-0.73971E-03	.53576	0.00000
17	0.20648E-03	-0.92228E-03	.66799	0.00000
18	0.36178E-03	-0.10655E-02	.77168	0.00000
19	0.47321E-03	-0.11647E-02	.84360	0.00000
20	0.51875E-03	-0.12037E-02	.87181	0.00000
21	0.47911E-03	-0.11698E-02	.84726	0.00000
22	0.37273E-03	-0.10755E-02	.77896	0.00000
23	0.22391E-03	-0.93873E-03	.67990	0.00000
24	0.35291E-04	-0.76245E-03	.55223	0.00000
25	-0.18518E-03	-0.55427E-03	.40145	0.00000
26	-0.41868E-03	-0.32918E-03	.30324	0.00000
27	-0.50846E-03	-0.24532E-03	.36826	0.00000
28	-0.52153E-03	-0.23661E-03	.37773	0.00000
29	-0.35994E-03	-0.40838E-03	.29578	0.00000
30	-0.39097E-03	-0.39315E-03	.28475	0.00000
31	-0.45903E-03	-0.33909E-03	.33247	0.00000
32	-0.60117E-03	-0.21283E-03	.43541	0.00000
33	-0.82532E-03	-0.71461E-05	.59776	0.00000
34	-0.11834E-02	0.32386E-03	.85710	0.00000
35	-0.14780E-02	0.59231E-03	1.0705	0.04699
36	-0.14469E-02	0.58598E-03	1.0480	0.03258
37	-0.11715E-02	0.36093E-03	.84846	0.00000
38	-0.80328E-03	0.19951E-04	.58179	0.00000
39	-0.38571E-03	-0.38571E-03	.27936	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.31077	0.00000	0.09657
2	-0.31576	-0.22516	0.32486
3	-0.32684	-0.42615	0.53297
4	-0.34632	-0.56820	0.68813
5	-0.35530	-0.57783	0.70407
6	-0.34642	-0.41270	0.53271
7	-0.33526	-0.21092	0.32332
8	-0.32763	-0.09023	0.19757
9	-0.32098	-0.02380	0.12683
10	-0.31488	-0.01197	0.11112
11	-0.30923	-0.04622	0.14184
12	-0.30634	-0.12932	0.22317
13	-0.30413	-0.09126	0.18375
14	-0.30126	-0.04732	0.13808
15	-0.29801	0.08977	0.17858
16	-0.29302	0.21715	0.30301
17	-0.28802	0.32629	0.40924
18	-0.28314	0.41257	0.49273
19	-0.27826	0.47348	0.55091
20	-0.27561	0.49790	0.57386
21	-0.27792	0.47665	0.55388
22	-0.28278	0.41864	0.49860
23	-0.28762	0.33608	0.41891
24	-0.29259	0.23060	0.31621
25	-0.29754	0.10669	0.19522
26	-0.30092	-0.02587	0.11643
27	-0.30330	-0.07607	0.16806
28	-0.30506	-0.08236	0.17542
29	-0.30915	0.01400	0.10958
30	-0.31551	0.00063	0.10018
31	-0.32114	-0.03467	0.13781
32	-0.32753	-0.11226	0.21953
33	-0.33496	-0.23651	0.34871
34	-0.34585	-0.43570	0.55531
35	-0.35453	-0.59581	0.72150
36	-0.34555	-0.58632	0.70573

37	-0.32614	-0.44296	0.54933
38	-0.31519	-0.23797	0.33731
39	-0.31040	0.00000	0.09635

# ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

## LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	5	14070.	30800.	0.457
BUCKLING THRUST (psi)	5	14070.	50004.	0.281
SEAM THRUST (psi)	5	14070.	21914.	0.642
PLASTIC-PENETRATE (%)	35	4.70	90.00	0.052
COMBINED T&M Ratio	35	0.722	1.000	0.722

## LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.06
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.21
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage COLORADO --PERMIT-OPR  
LIVE LOADS X 2.28 FOR COMBINED MOMENT TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN**2/IN) .....	0.25730
MOM. OF INERTIA (IN**4/IN) .....	0.97860
SECTION MODULUS (IN**3/IN) .....	0.32170
PLASTIC SECTION MOD(IN**3/IN) .....	0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING .....	0.70000
BUCKLING STRESS FAILURE.....	0.70000
SEAM STRENGTH FAILURE .....	0.67000



FULL PLASTIC PENETRATION..... 0.90000  
ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -180.0	F = 0.000
1181	23	F = 0.000	F = -180.0	F = 0.000
1182	22	F = 0.000	F = -180.0	F = 0.000
1182	23	F = 0.000	F = -180.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000

856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1180	22	F =	0.000	F =	-180.0	F =	0.000
1180	23	F =	0.000	F =	-180.0	F =	0.000
1170	22	F =	0.000	F =	-207.7	F =	0.000
1170	23	F =	0.000	F =	-207.7	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17

19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000

INIT. BULK MODULUS NUMBER BI.... 74.8000  
ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 32.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
SCALED MODULUS NUMBER ZK ..... 300.0000  
MODULUS EXPONENT ZN ..... 0.2500  
FAILURE RATIO RF ..... 0.7000  
BULK MODULUS NUMBER BK ..... 250.0000  
BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000

33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.300	Factor for load step #22
23	1.300	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23

UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.578E+00 -0.112E+01	0.167E+02 0.627E+01	-0.797E-10 -0.354E+04	-0.138E+05 -0.138E+05	0.308E+03 0.120E+04
2	-228.76 18.07	-0.827E+00 -0.109E+01	-0.588E+01 -0.182E+01	-0.523E+04 -0.359E+04	-0.302E+05 -0.139E+05	0.235E+03 0.914E+03
3	-225.31 35.99	-0.102E+01 -0.106E+01	-0.285E+02 -0.991E+01	-0.908E+04 -0.371E+04	-0.426E+05 -0.144E+05	0.183E+03 0.711E+03
4	-220.13 51.09	-0.111E+01 -0.104E+01	-0.467E+02 -0.143E+02	-0.119E+05 -0.393E+04	-0.440E+05 -0.153E+05	0.898E+02 0.349E+03
5	-211.66 64.62	-0.112E+01 -0.105E+01	-0.445E+02 -0.825E+01	-0.122E+05 -0.411E+04	-0.440E+05 -0.160E+05	-0.103E+03 -0.400E+03
6	-200.33 75.87	-0.105E+01 -0.112E+01	0.343E+02 0.467E+01	-0.869E+04 -0.411E+04	-0.430E+05 -0.160E+05	-0.233E+03 -0.907E+03
7	-187.99 85.12	-0.959E+00 -0.126E+01	-0.207E+02 0.614E+01	-0.480E+04 -0.400E+04	-0.305E+05 -0.156E+05	-0.183E+03 -0.713E+03
8	-175.22 93.78	-0.852E+00 -0.144E+01	-0.161E+02 0.468E+01	-0.288E+04 -0.391E+04	-0.242E+05 -0.152E+05	-0.873E+02 -0.339E+03
9	-162.05 101.82	-0.741E+00 -0.163E+01	-0.152E+02 0.436E+01	-0.187E+04 -0.384E+04	-0.207E+05 -0.149E+05	-0.301E+02 -0.117E+03

10	-148.51 109.22	-0.632E+00 -0.185E+01	-0.134E+02 0.384E+01	-0.162E+04 -0.378E+04	-0.197E+05 -0.147E+05	0.968E+01 0.376E+02
11	-134.64 115.97	-0.528E+00 -0.209E+01	-0.255E+02 0.732E+01	-0.175E+04 -0.369E+04	-0.198E+05 -0.144E+05	0.132E+03 0.515E+03
12	-120.46 122.05	-0.429E+00 -0.234E+01	-0.356E+01 0.105E+01	-0.520E+04 -0.364E+04	-0.303E+05 -0.141E+05	0.183E+03 0.710E+03
13	-106.01 127.44	-0.330E+00 -0.263E+01	0.309E+01 0.954E+00	-0.675E+04 -0.362E+04	-0.351E+05 -0.141E+05	0.143E+02 0.557E+02
14	-91.31 132.15	-0.231E+00 -0.298E+01	-0.347E-01 0.112E-01	-0.477E+04 -0.361E+04	-0.289E+05 -0.140E+05	-0.181E+03 -0.702E+03
15	-76.42 136.15	-0.141E+00 -0.336E+01	-0.108E+02 0.300E+01	-0.398E+02 -0.358E+04	-0.140E+05 -0.139E+05	-0.267E+03 -0.104E+04
16	-61.34 139.43	-0.696E-01 -0.374E+01	-0.133E+02 0.368E+01	0.477E+04 -0.351E+04	-0.285E+05 -0.137E+05	-0.249E+03 -0.969E+03
17	-46.13 141.99	-0.211E-01 -0.410E+01	-0.138E+02 0.378E+01	0.893E+04 -0.345E+04	-0.412E+05 -0.134E+05	-0.205E+03 -0.797E+03
18	-30.81 143.82	0.401E-02 -0.438E+01	-0.140E+02 0.384E+01	0.122E+05 -0.338E+04	-0.440E+05 -0.131E+05	-0.153E+03 -0.593E+03
19	-15.42 144.93	0.102E-01 -0.457E+01	-0.152E+02 0.423E+01	0.145E+05 -0.331E+04	-0.440E+05 -0.129E+05	-0.856E+02 -0.332E+03
20	0.00 145.29	0.542E-02 -0.465E+01	-0.157E+02 0.178E+00	0.153E+05 -0.327E+04	-0.440E+05 -0.127E+05	-0.283E+01 -0.110E+02
21	15.42 144.93	0.384E-03 -0.459E+01	-0.152E+02 -0.426E+01	0.146E+05 -0.331E+04	-0.440E+05 -0.129E+05	0.802E+02 0.312E+03
22	30.81 143.82	0.571E-02 -0.441E+01	-0.139E+02 -0.382E+01	0.124E+05 -0.338E+04	-0.440E+05 -0.131E+05	0.147E+03 0.571E+03
23	46.13 141.99	0.296E-01 -0.414E+01	-0.138E+02 -0.377E+01	0.922E+04 -0.344E+04	-0.420E+05 -0.134E+05	0.199E+03 0.774E+03
24	61.34 139.43	0.767E-01 -0.379E+01	-0.133E+02 -0.367E+01	0.515E+04 -0.351E+04	-0.297E+05 -0.136E+05	0.243E+03 0.944E+03
25	76.42 136.15	0.147E+00 -0.342E+01	-0.105E+02 -0.290E+01	0.445E+03 -0.357E+04	-0.153E+05 -0.139E+05	0.258E+03 0.100E+04
26	91.31 132.15	0.236E+00 -0.304E+01	-0.759E-01 0.106E-01	-0.411E+04 -0.361E+04	-0.268E+05 -0.140E+05	0.170E+03 0.660E+03
27	106.01 127.44	0.336E+00 -0.269E+01	0.301E-01 -0.177E-01	-0.594E+04 -0.361E+04	-0.325E+05 -0.140E+05	-0.890E+00 -0.346E+01
28	120.46 122.05	0.437E+00 -0.239E+01	0.198E+01 -0.610E+00	-0.499E+04 -0.361E+04	-0.296E+05 -0.140E+05	-0.187E+03 -0.729E+03
29	134.64 115.97	0.541E+00 -0.213E+01	-0.314E+02 -0.898E+01	-0.829E+03 -0.368E+04	-0.169E+05 -0.143E+05	-0.133E+03 -0.517E+03

30	148.51 109.22	0.651E+00 -0.188E+01	-0.121E+02 -0.345E+01	-0.141E+04 -0.377E+04	-0.191E+05 -0.147E+05	0.264E+02 0.102E+03
31	162.05 101.82	0.767E+00 -0.165E+01	-0.142E+02 -0.409E+01	-0.208E+04 -0.383E+04	-0.214E+05 -0.149E+05	0.495E+02 0.192E+03
32	175.22 93.78	0.887E+00 -0.143E+01	-0.154E+02 -0.449E+01	-0.328E+04 -0.390E+04	-0.254E+05 -0.152E+05	0.948E+02 0.368E+03
33	187.99 85.12	0.100E+01 -0.125E+01	-0.203E+02 -0.603E+01	-0.525E+04 -0.399E+04	-0.318E+05 -0.155E+05	0.183E+03 0.711E+03
34	200.33 75.87	0.110E+01 -0.110E+01	-0.343E+02 -0.439E+01	-0.910E+04 -0.409E+04	-0.440E+05 -0.159E+05	0.231E+03 0.898E+03
35	211.66 64.62	0.117E+01 -0.102E+01	-0.448E+02 0.911E+01	-0.126E+05 -0.408E+04	-0.440E+05 -0.159E+05	0.107E+03 0.417E+03
36	220.13 51.09	0.117E+01 -0.101E+01	-0.461E+02 0.141E+02	-0.124E+05 -0.390E+04	-0.440E+05 -0.152E+05	-0.818E+02 -0.318E+03
37	225.31 35.99	0.107E+01 -0.104E+01	-0.274E+02 0.956E+01	-0.971E+04 -0.368E+04	-0.440E+05 -0.143E+05	-0.184E+03 -0.716E+03
38	228.76 18.07	0.868E+00 -0.107E+01	-0.508E+01 0.159E+01	-0.567E+04 -0.357E+04	-0.315E+05 -0.139E+05	-0.251E+03 -0.975E+03
39	231.30 0.00	0.604E+00 -0.109E+01	0.172E+02 -0.637E+01	0.584E-10 -0.353E+04	-0.137E+05 -0.137E+05	-0.337E+03 -0.131E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.43210E-03	-0.43210E-03	.31296	0.00000
2	-0.94712E-03	0.72239E-04	.68598	0.00000
3	-0.13373E-02	0.43312E-03	.96859	0.00000
4	-0.17060E-02	0.70344E-03	1.2356	0.13500
5	-0.17850E-02	0.71746E-03	1.2928	0.16156
6	-0.13488E-02	0.34637E-03	.97691	0.00000
7	-0.95673E-03	-0.20083E-04	.69294	0.00000
8	-0.75798E-03	-0.19674E-03	.54899	0.00000
9	-0.65079E-03	-0.28609E-03	.47135	0.00000
10	-0.61847E-03	-0.30274E-03	.44794	0.00000
11	-0.62101E-03	-0.27991E-03	.44978	0.00000
12	-0.95070E-03	0.63807E-04	.68857	0.00000
13	-0.11000E-02	0.21587E-03	.79673	0.00000
14	-0.90566E-03	0.24357E-04	.65595	0.00000
15	-0.44036E-03	-0.43259E-03	.31894	0.00000
16	0.36521E-04	-0.89384E-03	.64738	0.00000
17	0.45086E-03	-0.12914E-02	.93536	0.00000
18	0.80150E-03	-0.16566E-02	1.1998	0.11225
19	0.10913E-02	-0.20362E-02	1.4748	0.20960
20	0.12102E-02	-0.22101E-02	1.6007	0.24249
21	0.11046E-02	-0.20556E-02	1.4888	0.21357
22	0.82346E-03	-0.16834E-02	1.2193	0.12076
23	0.47911E-03	-0.13189E-02	.95521	0.00000
24	0.74473E-04	-0.93083E-03	.67417	0.00000
25	-0.39241E-03	-0.47927E-03	.34713	0.00000
26	-0.84084E-03	-0.38879E-04	.60900	0.00000
27	-0.10199E-02	0.13903E-03	.73867	0.00000
28	-0.92747E-03	0.46442E-04	.67174	0.00000
29	-0.52949E-03	-0.36783E-03	.38350	0.00000
30	-0.59798E-03	-0.32223E-03	.43310	0.00000
31	-0.67019E-03	-0.26479E-03	.48540	0.00000
32	-0.79632E-03	-0.15578E-03	.57675	0.00000
33	-0.99934E-03	0.25687E-04	.72380	0.00000

34	-0.13866E-02	0.38806E-03	1.0043	0.00331
35	-0.18497E-02	0.76963E-03	1.3397	0.17907
36	-0.17908E-02	0.77373E-03	1.2971	0.15993
37	-0.13967E-02	0.49818E-03	1.0116	0.00846
38	-0.98833E-03	0.11811E-03	.71583	0.00000
39	-0.43018E-03	-0.43018E-03	.31157	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.34774	0.00000	0.12092
2	-0.35203	-0.29466	0.41859
3	-0.36383	-0.51178	0.64415
4	-0.38572	-0.67067	0.81945
5	-0.40326	-0.68650	0.84912
6	-0.40336	-0.49002	0.65272
7	-0.39305	-0.27075	0.42524
8	-0.38416	-0.16224	0.30981
9	-0.37698	-0.10542	0.24754
10	-0.37067	-0.09127	0.22866
11	-0.36251	-0.09860	0.23001
12	-0.35686	-0.29326	0.42061
13	-0.35577	-0.38038	0.50695
14	-0.35461	-0.26884	0.39459
15	-0.35125	-0.00224	0.12562
16	-0.34496	0.26894	0.38793
17	-0.33823	0.50364	0.61804
18	-0.33161	0.68949	0.79946
19	-0.32494	0.81706	0.92265
20	-0.32139	0.86448	0.96778
21	-0.32466	0.82258	0.92799
22	-0.33132	0.69998	0.80975
23	-0.33789	0.51973	0.63390
24	-0.34458	0.29060	0.40933
25	-0.35074	0.02511	0.14813
26	-0.35398	-0.23182	0.35712
27	-0.35443	-0.33500	0.46062
28	-0.35450	-0.28152	0.40720
29	-0.36106	-0.04673	0.17709
30	-0.37027	-0.07971	0.21681
31	-0.37621	-0.11719	0.25872
32	-0.38310	-0.18516	0.33192
33	-0.39177	-0.29630	0.44979
34	-0.40177	-0.51297	0.67439
35	-0.40081	-0.70883	0.86948
36	-0.38286	-0.70163	0.84821
37	-0.36149	-0.54766	0.67834
38	-0.35016	-0.31983	0.44245
39	-0.34619	0.00000	0.11985

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	6	15973.	30800.	0.519
BUCKLING THRUST (psi)	6	15973.	48667.	0.328
SEAM THRUST (psi)	6	15973.	21914.	0.729
PLASTIC-PENETRATE (%)	20	24.25	90.00	0.269
COMBINED T&M Ratio	20	0.968	1.000	0.968

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1



PERCENT VERTICAL DEFLECTION (%).....	1.79
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.36
HANDLING FACTOR RATIO = $(\text{SPAN}^2/\text{EI})/\text{FF}$ .....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR COLORADO PERMIT Y<sub>0</sub>=1.5, YD=1.30 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) T <sub>01ac</sub> factored from CANDE Load Step 21 kips/ft.	Thrust (DL) T <sub>01s</sub> unfactored TDI <sub>ac</sub> /1.575 kips/ft.	Thrust (DL+LL) T <sub>01LLac</sub> factored from CANDE Load Step 23 kips/ft.	Thrust (LL) T <sub>01s</sub> unfactored [T <sub>01LLac</sub> -T <sub>01ac</sub> ]/1.75	Thrust Load Rating OPR [T <sub>01ac</sub> -T <sub>01s</sub> ]/T <sub>01s</sub> *1.30
-231.304	0	-31.95	-20.28	-38.00	3.46	8.43
-228.758	18.07	-32.57	-20.68	-38.61	3.45	8.33
-225.306	-225.988	-33.73	-21.42	-39.96	3.56	7.83
-220.131	51.091	-34.93	-22.18	-42.34	4.24	6.37
-211.657	64.621	-34.40	-21.84	-43.44	5.16	5.30
-200.328	75.871	-32.67	-20.74	-42.36	5.53	5.17
-187.985	85.125	-31.41	-19.94	-40.99	5.48	5.40
-175.215	93.781	-30.62	-19.44	-40.06	5.39	5.59
-162.047	101.819	-29.92	-18.99	-39.25	5.33	5.75
-148.512	109.22	-29.28	-18.59	-38.50	5.27	5.90
-134.699	115.968	-28.85	-18.32	-37.81	5.12	6.14
-120.46	122.048	-28.33	-17.98	-37.46	5.00	6.31
-106.008	127.445	-27.77	-17.63	-37.19	5.06	6.28
-91.315	132.148	-27.38	-17.39	-36.83	5.18	6.22
-76.415	136.145	-26.98	-17.13	-36.44	5.17	6.28
-61.341	139.428	-26.25	-16.89	-35.83	5.05	6.49
-46.128	141.99	-25.72	-16.67	-35.22	4.92	6.72
-30.81	143.823	-25.91	-16.45	-34.62	4.78	6.97
-15.423	144.925	-25.87	-16.33	-34.02	4.64	7.24
0	145.293	-25.72	-16.42	-33.70	4.56	7.40
15.423	144.925	-25.87	-16.64	-33.98	4.78	7.25
30.81	143.823	-26.21	-16.86	-35.17	4.92	6.98
46.128	141.99	-26.56	-17.10	-35.77	5.05	6.73
61.341	139.428	-26.93	-17.35	-36.38	5.17	6.50
76.415	136.145	-27.33	-17.61	-36.79	5.18	6.29
91.315	132.148	-27.74	-17.92	-37.08	5.06	6.23
106.008	127.445	-28.23	-18.14	-37.30	4.99	6.30
120.46	122.048	-28.57	-18.31	-37.80	5.12	6.34
134.639	115.968	-28.84	-18.63	-38.58	5.28	6.14
148.512	109.22	-29.34	-19.01	-39.27	5.33	5.89
162.047	101.819	-29.94	-19.44	-40.05	5.39	5.75
175.215	93.781	-30.62	-19.92	-40.96	5.47	5.59
187.985	85.125	-31.38	-20.71	-42.29	5.53	5.41
200.328	75.871	-32.62	-21.85	-43.35	5.10	5.19
211.657	64.621	-34.42	-22.25	-42.25	4.11	5.36
220.131	51.091	-35.05	-21.50	-39.88	3.44	6.54
225.306	35.988	-33.86	-20.76	-38.54	3.34	8.08
228.758	18.07	-32.69	-20.36	-37.95	3.37	8.57
231.304	0	-32.06	-20.36	-37.95	3.37	8.64

Thrust Load Rating=

5.17

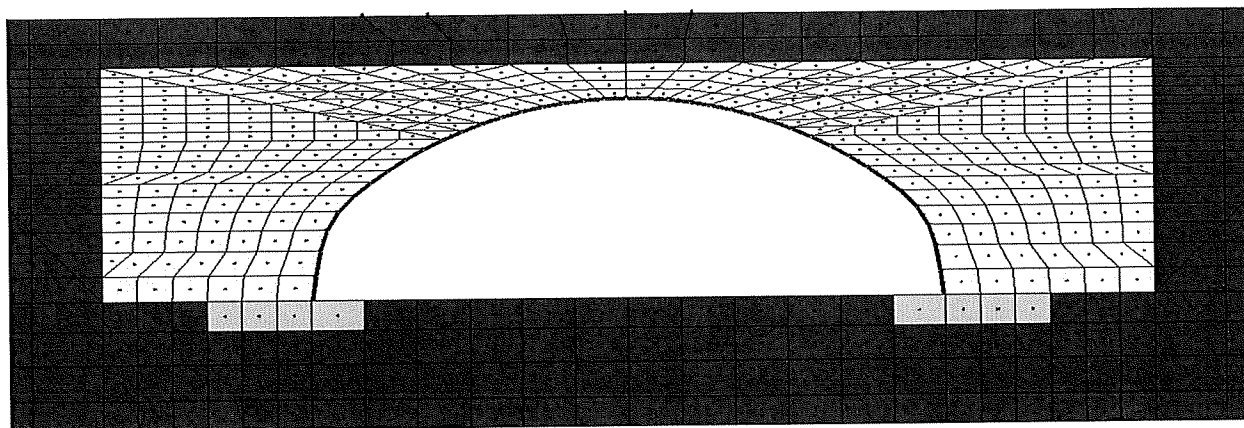
BEAM OUTPUT FOR COLORADO PERMIT

Y<sub>0</sub>=1.5, YD<sub>1</sub>=1.30 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DLac</sub> factored from CANDE	Moment (DL) M <sub>DLs</sub> unfactored	Moment (DL+LL) M <sub>DL+LLac</sub> factored from CANDE	Moment (LL) M <sub>LLs</sub> unfactored	Moment Load Rating (M <sub>DLac</sub> -M <sub>DLs</sub> +1.5)/M <sub>LLs</sub> *1.30
		Load Step 21 kips-ft/ft.	M <sub>DLac</sub> /1.575	Load Step 23 kips-ft/ft.	(M <sub>DL+LLac</sub> -M <sub>DLac</sub> )/1.75	OPR
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-3.99	0.55	20.95
-225.306	35.988	-6.32	-4.02	-7.56	0.70	12.84
-220.131	51.091	-8.36	-5.31	-10.08	0.98	7.69
-211.657	64.621	-8.32	-5.28	-10.25	1.10	6.87
-200.328	75.871	-5.60	-3.55	-7.32	0.98	9.74
-187.985	85.125	-2.11	-1.34	-3.74	0.93	12.98
-175.215	93.781	0.19	0.12	-1.60	1.02	13.27
-162.047	101.819	1.40	0.89	-0.42	1.04	12.16
-148.512	109.22	1.54	0.98	-0.21	1.00	12.53
-134.639	115.968	0.76	0.49	-0.82	0.91	14.49
-120.46	122.048	0.52	0.33	-2.29	1.61	8.26
-106.008	127.445	2.00	1.27	-1.62	2.07	5.90
-91.315	132.148	2.11	1.34	-0.84	1.68	7.21
-76.415	136.145	2.26	1.43	1.59	0.38	31.55
-61.341	139.428	2.27	1.44	3.85	0.90	13.32
-46.128	141.99	2.19	1.39	5.79	2.06	5.87
-30.81	143.823	2.07	1.32	7.32	3.00	4.06
-15.423	144.925	2.03	1.29	8.40	3.64	3.35
0	145.293	2.03	1.29	8.83	3.89	3.14
15.423	144.925	2.08	1.32	8.45	3.64	3.34
30.81	143.823	2.18	1.39	7.42	2.99	4.03
46.128	141.99	2.36	1.50	5.96	2.06	5.81
61.341	139.428	2.51	1.59	4.09	0.90	31.19
76.415	136.145	2.55	1.62	1.89	0.38	7.09
91.315	132.148	2.47	1.57	-0.46	1.67	5.83
106.008	127.445	2.26	1.44	-1.35	2.06	8.02
120.46	122.048	1.31	0.83	-1.46	1.59	15.11
134.639	115.968	1.69	1.07	0.25	0.82	12.23
148.512	109.22	1.78	1.13	0.01	1.01	11.91
162.047	101.819	1.26	0.80	-0.61	1.07	12.91
175.215	93.781	-0.15	-0.10	-1.99	1.05	12.31
187.985	85.125	-2.51	-1.59	-4.19	0.96	9.27
200.328	75.871	-5.97	-3.79	-7.73	1.00	6.49
211.657	64.621	-8.57	-5.44	-10.57	1.14	6.98
220.131	51.091	-8.54	-5.42	-10.40	1.06	11.04
225.306	35.988	-6.43	-4.09	-7.86	0.81	17.65
228.758	18.07	-3.09	-1.96	-4.22	0.65	
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating=  
Actual Load Rating (from CANDE)

3.14  
2.28



## MODIFIED TANDEM

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage MODIFIED TANDEM

EXECUTION MODE ..... ANALYS  
 SOLUTION LEVEL ..... #3 USER  
 METHODOLOGY (LRFD OR SERVICE) ... LRFD  
 NUMBER OF PIPE-ELEMENT GROUPS .... 1  
 MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
 NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI).....	0.29000E+08
POISSONS RATIO OF METAL (-) .....	0.30000E+00
YIELD STRESS OF METAL (PSI).....	0.44000E+05
LONGITUDINAL SEAM STRENGTH (PSI)...	0.32707E+05
DENSITY OF METAL (PCI).....	0.28400E+00
MODULUS OF UPPER BI-SLOPE (PSI)....	0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
 AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
 MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
 SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
 PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
 AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
 BUCKLING STRESS FAILURE..... 0.70000  
 SEAM STRENGTH FAILURE ..... 0.67000  
 FULL PLASTIC PENETRATION..... 0.90000  
 ALLOWABLE % DEFLECTION (SERVICE)... 5.00000  
 COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT  
 (FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
 (ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE(F) -OR- X-DISPLACE.(D)	Y-FORCE(F) -OR- Y-DISPLACE.(D)	MOMENT(F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -90.98	F = 0.000
1181	23	F = 0.000	F = -90.98	F = 0.000
1182	22	F = 0.000	F = -90.98	F = 0.000
1182	23	F = 0.000	F = -90.98	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000

911	1	D =	0.000	D =	0.000	D =	0.000
936	1	D =	0.000	D =	0.000	D =	0.000
961	1	D =	0.000	D =	0.000	D =	0.000
986	1	D =	0.000	D =	0.000	D =	0.000
1023	1	D =	0.000	D =	0.000	D =	0.000
1048	1	D =	0.000	D =	0.000	D =	0.000
1073	1	D =	0.000	D =	0.000	D =	0.000
1098	1	D =	0.000	D =	0.000	D =	0.000
837	1	D =	0.000	F =	0.000	D =	0.000
838	1	D =	0.000	F =	0.000	D =	0.000
839	1	D =	0.000	F =	0.000	D =	0.000
840	1	D =	0.000	F =	0.000	D =	0.000
841	1	D =	0.000	F =	0.000	D =	0.000
842	1	D =	0.000	F =	0.000	D =	0.000
843	1	D =	0.000	F =	0.000	D =	0.000
844	1	D =	0.000	F =	0.000	D =	0.000
845	1	D =	0.000	F =	0.000	D =	0.000
846	1	D =	0.000	F =	0.000	D =	0.000
847	1	D =	0.000	F =	0.000	D =	0.000
848	1	D =	0.000	F =	0.000	D =	0.000
849	1	D =	0.000	F =	0.000	D =	0.000
850	1	D =	0.000	F =	0.000	D =	0.000
851	1	D =	0.000	F =	0.000	D =	0.000
852	1	D =	0.000	F =	0.000	D =	0.000
853	1	D =	0.000	F =	0.000	D =	0.000
854	1	D =	0.000	F =	0.000	D =	0.000
855	1	D =	0.000	F =	0.000	D =	0.000
856	1	D =	0.000	F =	0.000	D =	0.000
857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1178	22	F =	0.000	F =	-90.98	F =	0.000
1178	23	F =	0.000	F =	-90.98	F =	0.000
1177	22	F =	0.000	F =	-90.98	F =	0.000
1177	23	F =	0.000	F =	-90.98	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...  
 THE NUMBER OF DATA ERRORS IS----- 0  
 THE NUMBER OF SOIL MATERIALS IS----- 4  
 THE NUMBER OF PIPE-TYPE GROUPS IS----- 1  
 THE NUMBER OF INTERFACE MATERIALS IS--- 37  
 BAND WIDTH ESTIMATE (MAX)----- 2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS	
		FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18
20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL

WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 48.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
 SCALED MODULUS NUMBER ZK ..... 950.0000  
 MODULUS EXPONENT ZN ..... 0.6000  
 FAILURE RATIO RF ..... 0.7000  
 INIT. BULK MODULUS NUMBER BI.... 74.8000  
 ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
 WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
 ENTERING ELEMENT RATIO..... 0.5000  
 ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90  
 COHESION INTERCEPT C ..... 0.0000  
 FRICTION ANGLE PHIO (DEG)..... 32.0000  
 10-FOLD REDUCTION IN PHIO(DEG).. 4.0000  
 SCALED MODULUS NUMBER ZK ..... 300.0000  
 MODULUS EXPONENT ZN ..... 0.2500  
 FAILURE RATIO RF ..... 0.7000  
 BULK MODULUS NUMBER BK ..... 250.0000  
 BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000



6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000
34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.750	Factor for load step #22
23	1.750	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
 UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.534E+00 -0.113E+01	0.114E+02 0.474E+01	-0.142E-10 -0.348E+04	-0.135E+05 -0.135E+05	0.258E+03 0.100E+04
2	-228.76	-0.717E+00	-0.808E+01	-0.455E+04	-0.279E+05	0.228E+03

	18.07	-0.111E+01	-0.246E+01	-0.354E+04	-0.137E+05	0.886E+03
3	-225.31 35.99	-0.851E+00 -0.109E+01	-0.276E+02 -0.966E+01	-0.851E+04 -0.366E+04	-0.407E+05 -0.142E+05	0.193E+03 0.749E+03
4	-220.13 51.09	-0.898E+00 -0.109E+01	-0.449E+02 -0.769E+01	-0.113E+05 -0.383E+04	-0.440E+05 -0.149E+05	0.927E+02 0.360E+03
5	-211.66 64.62	-0.864E+00 -0.112E+01	-0.417E+02 0.127E+02	-0.115E+05 -0.379E+04	-0.440E+05 -0.147E+05	-0.884E+02 -0.343E+03
6	-200.33 75.87	-0.774E+00 -0.122E+01	-0.266E+02 0.949E+01	-0.841E+04 -0.359E+04	-0.401E+05 -0.139E+05	-0.228E+03 -0.887E+03
7	-187.99 85.12	-0.664E+00 -0.138E+01	-0.157E+02 0.464E+01	-0.419E+04 -0.346E+04	-0.264E+05 -0.134E+05	-0.228E+03 -0.887E+03
8	-175.22 93.78	-0.542E+00 -0.157E+01	-0.152E+02 0.437E+01	-0.115E+04 -0.338E+04	-0.167E+05 -0.131E+05	-0.152E+03 -0.591E+03
9	-162.05 101.82	-0.425E+00 -0.178E+01	-0.157E+02 0.446E+01	0.772E+03 -0.330E+04	-0.152E+05 -0.128E+05	-0.725E+02 -0.282E+03
10	-148.51 109.22	-0.319E+00 -0.199E+01	-0.143E+02 0.406E+01	0.138E+04 -0.323E+04	-0.168E+05 -0.126E+05	0.388E+01 0.151E+02
11	-134.64 115.97	-0.227E+00 -0.220E+01	-0.851E+01 0.241E+01	0.944E+03 -0.318E+04	-0.153E+05 -0.124E+05	0.278E+02 0.108E+03
12	-120.46 122.05	-0.148E+00 -0.240E+01	-0.261E+01 0.735E+00	0.809E+03 -0.316E+04	-0.148E+05 -0.123E+05	-0.365E+02 -0.142E+03
13	-106.01 127.44	-0.818E-01 -0.260E+01	-0.157E+02 0.447E+01	0.236E+04 -0.312E+04	-0.194E+05 -0.121E+05	-0.439E+02 -0.170E+03
14	-91.31 132.15	-0.295E-01 -0.278E+01	-0.853E+01 0.241E+01	0.244E+04 -0.306E+04	-0.195E+05 -0.119E+05	-0.318E+01 -0.124E+02
15	-76.42 136.15	0.920E-02 -0.295E+01	-0.852E+01 0.241E+01	0.271E+04 -0.302E+04	-0.202E+05 -0.118E+05	-0.156E+02 -0.608E+02
16	-61.34 139.43	0.356E-01 -0.311E+01	-0.817E+01 0.232E+01	0.316E+04 -0.299E+04	-0.214E+05 -0.116E+05	-0.289E+02 -0.112E+03
17	-46.13 141.99	0.510E-01 -0.323E+01	-0.792E+01 0.224E+01	0.383E+04 -0.295E+04	-0.234E+05 -0.115E+05	-0.451E+02 -0.175E+03
18	-30.81 143.82	0.571E-01 -0.333E+01	-0.805E+01 0.227E+01	0.475E+04 -0.291E+04	-0.261E+05 -0.113E+05	-0.605E+02 -0.235E+03
19	-15.42 144.93	0.560E-01 -0.340E+01	-0.901E+01 0.256E+01	0.583E+04 -0.287E+04	-0.293E+05 -0.112E+05	-0.655E+02 -0.255E+03
20	0.00 145.29	0.511E-01 -0.342E+01	-0.112E+02 0.689E+00	0.682E+04 -0.284E+04	-0.323E+05 -0.111E+05	-0.448E+02 -0.174E+03
21	15.42 144.93	0.465E-01 -0.338E+01	-0.118E+02 -0.339E+01	0.717E+04 -0.286E+04	-0.334E+05 -0.111E+05	-0.219E+01 -0.851E+01
22	30.81 143.82	0.470E-01 -0.330E+01	-0.112E+02 -0.316E+01	0.673E+04 -0.291E+04	-0.323E+05 -0.113E+05	0.387E+02 0.150E+03

23	46.13 141.99	0.572E-01 -0.316E+01	-0.114E+02 -0.321E+01	0.571E+04 -0.297E+04	-0.293E+05 -0.115E+05	0.732E+02 0.284E+03
24	61.34 139.43	0.805E-01 -0.298E+01	-0.111E+02 -0.315E+01	0.410E+04 -0.302E+04	-0.245E+05 -0.117E+05	0.105E+03 0.409E+03
25	76.42 136.15	0.118E+00 -0.277E+01	-0.105E+02 -0.295E+01	0.203E+04 -0.307E+04	-0.183E+05 -0.119E+05	0.128E+03 0.497E+03
26	91.31 132.15	0.170E+00 -0.255E+01	-0.372E+01 -0.102E+01	-0.291E+03 -0.311E+04	-0.130E+05 -0.121E+05	0.912E+02 0.354E+03
27	106.01 127.44	0.231E+00 -0.234E+01	-0.665E+01 -0.189E+01	-0.119E+04 -0.314E+04	-0.159E+05 -0.122E+05	0.234E+02 0.911E+02
28	120.46 122.05	0.300E+00 -0.213E+01	-0.227E+01 -0.641E+00	-0.135E+04 -0.315E+04	-0.164E+05 -0.123E+05	-0.565E+02 -0.220E+03
29	134.64 115.97	0.376E+00 -0.193E+01	-0.176E+02 -0.506E+01	0.294E+03 -0.320E+04	-0.133E+05 -0.124E+05	-0.532E+02 -0.207E+03
30	148.51 109.22	0.461E+00 -0.174E+01	-0.117E+02 -0.333E+01	0.884E+02 -0.326E+04	-0.129E+05 -0.127E+05	0.202E+02 0.784E+02
31	162.05 101.82	0.554E+00 -0.156E+01	-0.134E+02 -0.384E+01	-0.498E+03 -0.332E+04	-0.144E+05 -0.129E+05	0.577E+02 0.224E+03
32	175.22 93.78	0.654E+00 -0.138E+01	-0.140E+02 -0.408E+01	-0.182E+04 -0.338E+04	-0.188E+05 -0.132E+05	0.110E+03 0.429E+03
33	187.99 85.12	0.754E+00 -0.122E+01	-0.167E+02 -0.496E+01	-0.399E+04 -0.346E+04	-0.259E+05 -0.135E+05	0.185E+03 0.721E+03
34	200.33 75.87	0.843E+00 -0.109E+01	-0.284E+02 -0.514E+01	-0.759E+04 -0.356E+04	-0.374E+05 -0.138E+05	0.209E+03 0.814E+03
35	211.66 64.62	0.910E+00 -0.101E+01	-0.400E+02 0.755E-01	-0.106E+05 -0.362E+04	-0.440E+05 -0.141E+05	0.906E+02 0.352E+03
36	220.13 51.09	0.923E+00 -0.992E+00	-0.412E+02 0.126E+02	-0.104E+05 -0.352E+04	-0.440E+05 -0.137E+05	-0.800E+02 -0.311E+03
37	225.31 35.99	0.861E+00 -0.101E+01	-0.249E+02 0.870E+01	-0.790E+04 -0.333E+04	-0.375E+05 -0.129E+05	-0.174E+03 -0.677E+03
38	228.76 18.07	0.714E+00 -0.103E+01	-0.697E+01 0.211E+01	-0.428E+04 -0.322E+04	-0.258E+05 -0.125E+05	-0.211E+03 -0.819E+03
39	231.30 0.00	0.523E+00 -0.105E+01	0.110E+02 -0.447E+01	-0.253E-10 -0.317E+04	-0.123E+05 -0.123E+05	-0.245E+03 -0.953E+03

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.42473E-03	-0.42473E-03	.30762	0.00000
2	-0.87498E-03	0.12101E-04	.63373	0.00000
3	-0.12769E-02	0.38375E-03	.92486	0.00000
4	-0.16029E-02	0.64663E-03	1.1610	0.09880

5	-0.16212E-02	0.67145E-03	1.1742	0.10489
6	-0.12574E-02	0.38243E-03	.91072	0.00000
7	-0.82965E-03	-0.13080E-04	.60090	0.00000
8	-0.52340E-03	-0.30000E-03	.37909	0.00000
9	-0.32740E-03	-0.47794E-03	.34616	0.00000
10	-0.26007E-03	-0.52870E-03	.38292	0.00000
11	-0.29620E-03	-0.48044E-03	.34797	0.00000
12	-0.30641E-03	-0.46414E-03	.33617	0.00000
13	-0.15031E-03	-0.60989E-03	.44173	0.00000
14	-0.13590E-03	-0.61099E-03	.44253	0.00000
15	-0.10405E-03	-0.63360E-03	.45890	0.00000
16	-0.55598E-04	-0.67284E-03	.48732	0.00000
17	0.14006E-04	-0.73338E-03	.53117	0.00000
18	0.10786E-03	-0.81808E-03	.59252	0.00000
19	0.21875E-03	-0.91914E-03	.66571	0.00000
20	0.31877E-03	-0.10124E-02	.73327	0.00000
21	0.35042E-03	-0.10489E-02	.75968	0.00000
22	0.30128E-03	-0.10123E-02	.73317	0.00000
23	0.19488E-03	-0.91854E-03	.66528	0.00000
24	0.32042E-04	-0.76875E-03	.55679	0.00000
25	-0.17681E-03	-0.57279E-03	.41486	0.00000
26	-0.40760E-03	-0.35084E-03	.29521	0.00000
27	-0.49856E-03	-0.26613E-03	.36109	0.00000
28	-0.51603E-03	-0.25333E-03	.37375	0.00000
29	-0.36108E-03	-0.41848E-03	.30309	0.00000
30	-0.38901E-03	-0.40626E-03	.29425	0.00000
31	-0.45323E-03	-0.35612E-03	.32827	0.00000
32	-0.59042E-03	-0.23495E-03	.42763	0.00000
33	-0.81159E-03	-0.32666E-04	.58781	0.00000
34	-0.11748E-02	0.30663E-03	.85089	0.00000
35	-0.14792E-02	0.59036E-03	1.0713	0.04759
36	-0.14521E-02	0.58988E-03	1.0517	0.03498
37	-0.11769E-02	0.36524E-03	.85237	0.00000
38	-0.80950E-03	0.24988E-04	.58630	0.00000
39	-0.38642E-03	-0.38642E-03	.27987	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/(P-resist)	FACTORED MOMENT-RATIO M/(M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.34180	0.00000	0.11683
2	-0.34720	-0.25643	0.37698
3	-0.35940	-0.48005	0.60922
4	-0.37596	-0.63766	0.77900
5	-0.37199	-0.64817	0.78655
6	-0.35207	-0.47403	0.59798
7	-0.33909	-0.23604	0.35103
8	-0.33132	-0.06458	0.17435
9	-0.32405	0.04352	0.14852
10	-0.31738	0.07765	0.17838
11	-0.31250	0.05326	0.15091
12	-0.31005	0.04559	0.14173
13	-0.30588	0.13285	0.22641
14	-0.30053	0.13733	0.22765
15	-0.29681	0.15307	0.24117
16	-0.29310	0.17842	0.26433
17	-0.28946	0.21604	0.29983
18	-0.28578	0.26766	0.34933
19	-0.28182	0.32893	0.40835
20	-0.27910	0.38480	0.46270
21	-0.28104	0.40449	0.48347
22	-0.28609	0.37971	0.46155
23	-0.29118	0.32185	0.40664
24	-0.29643	0.23148	0.31935
25	-0.30162	0.11446	0.20544
26	-0.30518	-0.01641	0.10954
27	-0.30769	-0.06719	0.16186
28	-0.30957	-0.07594	0.17177
29	-0.31367	0.01659	0.11498
30	-0.32000	0.00499	0.10739
31	-0.32567	-0.02807	0.13413
32	-0.33211	-0.10275	0.21305
33	-0.33971	-0.22516	0.34056
34	-0.34933	-0.42824	0.55027
35	-0.35575	-0.59553	0.72209
36	-0.34594	-0.58874	0.70841

37	-0.32657	-0.44577	0.55242
38	-0.31567	-0.24122	0.34087
39	-0.31097	0.00000	0.09670

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	4	14888.	30800.	0.483
BUCKLING THRUST (psi)	4	14888.	49806.	0.299
SEAM THRUST (psi)	4	14888.	21914.	0.679
PLASTIC-PENETRATE (%)	5	10.49	90.00	0.117
COMBINED T&M Ratio	5	0.787	1.000	0.787

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.02
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.20
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

\*\*\* WELCOME TO CANDE-2019 (Version April 1, 2019) \*\*\*

MASTER CONTROL AND PIPE-TYPE DATA FOR PROBLEM # 1

USER TITLE: Box 37S 5.0ft Cover 7Gage MODIFIED TANDEM-OPR  
LIVE LOADS X 2.47 FOR COMBINED MOMENT TO BE  $\leq 1.0$

EXECUTION MODE ..... ANALYS  
SOLUTION LEVEL ..... #3 USER  
METHODOLOGY (LRFD OR SERVICE) ... LRFD  
NUMBER OF PIPE-ELEMENT GROUPS .... 1  
MAXIMUM ITERATIONS PER STEP ..... -99

PIPE ELEMENT TYPE ..... STEEL  
NUMBER OF BEAM ELEMENTS ..... 38

STEEL ELEMENT PROPERTIES ARE AS FOLLOWS:

YOUNGS MODULUS OF METAL (PSI)..... 0.29000E+08  
POISSONS RATIO OF METAL (-) ..... 0.30000E+00  
YIELD STRESS OF METAL (PSI)..... 0.44000E+05  
LONGITUDINAL SEAM STRENGTH (PSI)... 0.32707E+05  
DENSITY OF METAL (PCI)..... 0.28400E+00  
MODULUS OF UPPER BI-SLOPE (PSI).... 0.00000E+00

MATERIAL CHARACTER CODE, NONLIN ..... 2

NONLIN=2, MEANS BILINEAR ELASTIC-PLASTIC

LARGE DEFORMATION/BUCKLING CODE, IBUCK... 4

IBUCK=4, MEANS LARGE DEFORMATION THEORY FOR GROUP  
AND SIMPLIFIED BUCKLING PREDICTION, AASHTO 12.8.9.6-1

SECTION PROPERTIES OF CROSS-SECTION:

THRUST AREA (IN\*\*2/IN) ..... 0.25730  
MOM. OF INERTIA (IN\*\*4/IN) ..... 0.97860  
SECTION MODULUS (IN\*\*3/IN) ..... 0.32170  
PLASTIC SECTION MOD(IN\*\*3/IN) ..... 0.44780

NOTE: AASHTO COMBINED T&M CRITERION 12.8.9.5 IS ACTIVATED.

LRFD RESISTANCE FACTORS FOR STRENGTH-LIMIT STATES  
AND DEFLECTION LIMIT AT SERVICE LOAD

THRUST STRESS YIELDING ..... 0.70000  
BUCKLING STRESS FAILURE..... 0.70000  
SEAM STRENGTH FAILURE ..... 0.67000

FULL PLASTIC PENETRATION..... 0.90000

ALLOWABLE % DEFLECTION (SERVICE)... 5.00000

COMBINED MOMENT-THRUST CRITERION... 0.90000

BOUNDARY CONDITIONS AS GENERATED FROM INPUT

(FORCE=LBS/INCH; MOMENT=IN-LBS/INCH; DISPLACEMENT=INCHES; ROTATION=DEGREES)  
(ONLY BEAM-ELEMENT NODES CAN SUSTAIN AN APPLIED MOMENT OR ROTATION)

BOUNDARY NODE	LOAD STEP	X-FORCE (F) -OR- X-DISPLACE. (D)	Y-FORCE (F) -OR- Y-DISPLACE. (D)	MOMENT (F) -OR- ROTATION (D)
1181	22	F = 0.000	F = -225.0	F = 0.000
1181	23	F = 0.000	F = -225.0	F = 0.000
1182	22	F = 0.000	F = -225.0	F = 0.000
1182	23	F = 0.000	F = -225.0	F = 0.000
574	1	D = 0.000	D = 0.000	D = 0.000
575	1	D = 0.000	D = 0.000	D = 0.000
576	1	D = 0.000	D = 0.000	D = 0.000
577	1	D = 0.000	D = 0.000	D = 0.000
578	1	D = 0.000	D = 0.000	D = 0.000
579	1	D = 0.000	D = 0.000	D = 0.000
580	1	D = 0.000	D = 0.000	D = 0.000
581	1	D = 0.000	D = 0.000	D = 0.000
582	1	D = 0.000	D = 0.000	D = 0.000
583	1	D = 0.000	D = 0.000	D = 0.000
584	1	D = 0.000	D = 0.000	D = 0.000
585	1	D = 0.000	D = 0.000	D = 0.000
586	1	D = 0.000	D = 0.000	D = 0.000
587	1	D = 0.000	D = 0.000	D = 0.000
588	1	D = 0.000	D = 0.000	D = 0.000
589	1	D = 0.000	D = 0.000	D = 0.000
590	1	D = 0.000	D = 0.000	D = 0.000
591	1	D = 0.000	D = 0.000	D = 0.000
592	1	D = 0.000	D = 0.000	D = 0.000
593	1	D = 0.000	D = 0.000	D = 0.000
594	1	D = 0.000	D = 0.000	D = 0.000
595	1	D = 0.000	D = 0.000	D = 0.000
596	1	D = 0.000	D = 0.000	D = 0.000
597	1	D = 0.000	D = 0.000	D = 0.000
598	1	D = 0.000	D = 0.000	D = 0.000
599	1	D = 0.000	D = 0.000	D = 0.000
624	1	D = 0.000	D = 0.000	D = 0.000
649	1	D = 0.000	D = 0.000	D = 0.000
674	1	D = 0.000	D = 0.000	D = 0.000
699	1	D = 0.000	D = 0.000	D = 0.000
724	1	D = 0.000	D = 0.000	D = 0.000
761	1	D = 0.000	D = 0.000	D = 0.000
786	1	D = 0.000	D = 0.000	D = 0.000
811	1	D = 0.000	D = 0.000	D = 0.000
836	1	D = 0.000	D = 0.000	D = 0.000
861	1	D = 0.000	D = 0.000	D = 0.000
886	1	D = 0.000	D = 0.000	D = 0.000
911	1	D = 0.000	D = 0.000	D = 0.000
936	1	D = 0.000	D = 0.000	D = 0.000
961	1	D = 0.000	D = 0.000	D = 0.000
986	1	D = 0.000	D = 0.000	D = 0.000
1023	1	D = 0.000	D = 0.000	D = 0.000
1048	1	D = 0.000	D = 0.000	D = 0.000
1073	1	D = 0.000	D = 0.000	D = 0.000
1098	1	D = 0.000	D = 0.000	D = 0.000
837	1	D = 0.000	F = 0.000	D = 0.000
838	1	D = 0.000	F = 0.000	D = 0.000
839	1	D = 0.000	F = 0.000	D = 0.000
840	1	D = 0.000	F = 0.000	D = 0.000
841	1	D = 0.000	F = 0.000	D = 0.000
842	1	D = 0.000	F = 0.000	D = 0.000
843	1	D = 0.000	F = 0.000	D = 0.000
844	1	D = 0.000	F = 0.000	D = 0.000
845	1	D = 0.000	F = 0.000	D = 0.000
846	1	D = 0.000	F = 0.000	D = 0.000
847	1	D = 0.000	F = 0.000	D = 0.000
848	1	D = 0.000	F = 0.000	D = 0.000
849	1	D = 0.000	F = 0.000	D = 0.000
850	1	D = 0.000	F = 0.000	D = 0.000
851	1	D = 0.000	F = 0.000	D = 0.000
852	1	D = 0.000	F = 0.000	D = 0.000
853	1	D = 0.000	F = 0.000	D = 0.000
854	1	D = 0.000	F = 0.000	D = 0.000
855	1	D = 0.000	F = 0.000	D = 0.000
856	1	D = 0.000	F = 0.000	D = 0.000

857	1	D =	0.000	F =	0.000	D =	0.000
858	1	D =	0.000	F =	0.000	D =	0.000
859	1	D =	0.000	F =	0.000	D =	0.000
860	1	D =	0.000	F =	0.000	D =	0.000
1123	1	D =	0.000	F =	0.000	D =	0.000
1162	1	D =	0.000	F =	0.000	D =	0.000
1161	1	D =	0.000	F =	0.000	D =	0.000
1200	1	D =	0.000	F =	0.000	D =	0.000
1099	1	D =	0.000	F =	0.000	D =	0.000
1100	1	D =	0.000	F =	0.000	D =	0.000
1101	1	D =	0.000	F =	0.000	D =	0.000
1102	1	D =	0.000	F =	0.000	D =	0.000
1103	1	D =	0.000	F =	0.000	D =	0.000
1104	1	D =	0.000	F =	0.000	D =	0.000
1105	1	D =	0.000	F =	0.000	D =	0.000
1106	1	D =	0.000	F =	0.000	D =	0.000
1107	1	D =	0.000	F =	0.000	D =	0.000
1108	1	D =	0.000	F =	0.000	D =	0.000
1109	1	D =	0.000	F =	0.000	D =	0.000
1110	1	D =	0.000	F =	0.000	D =	0.000
1111	1	D =	0.000	F =	0.000	D =	0.000
1112	1	D =	0.000	F =	0.000	D =	0.000
1113	1	D =	0.000	F =	0.000	D =	0.000
1114	1	D =	0.000	F =	0.000	D =	0.000
1115	1	D =	0.000	F =	0.000	D =	0.000
1116	1	D =	0.000	F =	0.000	D =	0.000
1117	1	D =	0.000	F =	0.000	D =	0.000
1118	1	D =	0.000	F =	0.000	D =	0.000
1119	1	D =	0.000	F =	0.000	D =	0.000
1120	1	D =	0.000	F =	0.000	D =	0.000
1121	1	D =	0.000	F =	0.000	D =	0.000
1122	1	D =	0.000	F =	0.000	D =	0.000
1178	22	F =	0.000	F =	-225.0	F =	0.000
1178	23	F =	0.000	F =	-225.0	F =	0.000
1177	22	F =	0.000	F =	-225.0	F =	0.000
1177	23	F =	0.000	F =	-225.0	F =	0.000

\* \* \* \* \* COMPLETED MESH GENERATION \* \* \* \* \*

BRIDGECOR

CALCULATED KEY NUMBERS ...

THE NUMBER OF DATA ERRORS IS-----	0
THE NUMBER OF SOIL MATERIALS IS-----	4
THE NUMBER OF PIPE-TYPE GROUPS IS-----	1
THE NUMBER OF INTERFACE MATERIALS IS---	37
BAND WIDTH ESTIMATE (MAX)-----	2060

\* \* \* \* \* MESH DATA HAS BEEN SAVED ON UNIT 14 \* \* \* \* \*

BEAM-NODE SEQUENCE NUMBERS FOR EACH GROUP

BEAM-ELEMENT GROUP NUMBER = 1

BEAM-NODE SEQUENCE	MESH-NODE NUMBER	CONNECTED-GROUP-ELEMENTS FOREWARD-#	BACKWARD-#
1	39	1	0
2	38	2	1
3	37	3	2
4	36	4	3
5	35	5	4
6	34	6	5
7	33	7	6
8	32	8	7
9	31	9	8
10	30	10	9
11	29	11	10
12	28	12	11
13	27	13	12
14	26	14	13
15	25	15	14
16	24	16	15
17	23	17	16
18	22	18	17
19	21	19	18



20	20	20	19
21	19	21	20
22	18	22	21
23	17	23	22
24	16	24	23
25	15	25	24
26	14	26	25
27	13	27	26
28	12	28	27
29	11	29	28
30	10	30	29
31	9	31	30
32	8	32	31
33	7	33	32
34	6	34	33
35	5	35	34
36	4	36	35
37	3	37	36
38	2	38	37
39	1	0	38

MATERIAL DESCRIPTION FOR SOILS AND INTERFACE  
(ALL DENSITY UNITS ARE pcf, ALL MODULUS UNITS ARE psi)

PROPERTIES FOR MATERIAL 1 \*\*\*\*\*In Situ

DENSITY = 0.10000E+01  
  
YOUNGS MODULUS= 0.3000E+04  
POISSONS RATIO= 0.3000E+00  
CONFINED MOD.= 0.4038E+04  
LATERAL COEFF.= 0.4286E+00

PROPERTIES FOR MATERIAL 2 \*\*\*\*\*Footing

DENSITY = 0.15000E+03  
  
YOUNGS MODULUS= 0.3500E+07  
POISSONS RATIO= 0.1800E+00  
CONFINED MOD.= 0.3800E+07  
LATERAL COEFF.= 0.2195E+00

PROPERTIES FOR MATERIAL 3 \*\*\*\*\*SW95

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH SELIG HYPERBOLIC BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0  
ENTERING ELEMENT RATIO..... 0.5000  
ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SW95  
  
COHESION INTERCEPT C ..... 0.0000  
FRICTION ANGLE PHIO (DEG)..... 48.0000  
10-FOLD REDUCTION IN PHIO(DEG).. 8.0000  
SCALED MODULUS NUMBER ZK ..... 950.0000  
MODULUS EXPONENT ZN ..... 0.6000  
FAILURE RATIO RF ..... 0.7000  
INIT. BULK MODULUS NUMBER BI.... 74.8000

ULT. VOLUMETRIC STRAIN EU ..... 0.0200

PROPERTIES FOR MATERIAL 4 \*\*\*\*\*SM90

DENSITY = 0.12000E+03

CONTROLS FOR DUNCAN SOIL MODEL  
WITH DUNCAN POWER-LAW BULK MODULUS FORMULATION

LRFD STRESS CONTROL..... 0

ENTERING ELEMENT RATIO..... 0.5000

ORIGINAL FORMULATION, ... NEWDS = 0

HYPERBOLIC STRESS-STRAIN PARAMETERS

SOIL CLASSIFICATION .....SM90

COHESION INTERCEPT C ..... 0.0000

FRICTION ANGLE PHIO (DEG)..... 32.0000

10-FOLD REDUCTION IN PHIO(DEG).. 4.0000

SCALED MODULUS NUMBER ZK ..... 300.0000

MODULUS EXPONENT ZN ..... 0.2500

FAILURE RATIO RF ..... 0.7000

BULK MODULUS NUMBER BK ..... 250.0000

BULK MODULUS EXPONENT BM ..... 0.0000

INTERFACE ELEMENT MATERIAL-GROUP PROPERTIES

MAT. NO.	NORMAL-ANGLE	COEF-FRICTION	TENSILE-RUPTURE	INITIAL-GAP
1	9.46	0.30000	50.00000	0.00000
2	12.34	0.30000	50.00000	0.00000
3	25.49	0.30000	50.00000	0.00000
4	38.63	0.30000	50.00000	0.00000
5	51.77	0.30000	50.00000	0.00000
6	54.50	0.30000	50.00000	0.00000
7	57.23	0.30000	50.00000	0.00000
8	59.97	0.30000	50.00000	0.00000
9	62.70	0.30000	50.00000	0.00000
10	65.43	0.30000	50.00000	0.00000
11	68.16	0.30000	50.00000	0.00000
12	70.89	0.30000	50.00000	0.00000
13	73.62	0.30000	50.00000	0.00000
14	76.35	0.30000	50.00000	0.00000
15	79.08	0.30000	50.00000	0.00000
16	81.81	0.30000	50.00000	0.00000
17	84.54	0.30000	50.00000	0.00000
18	87.27	0.30000	50.00000	0.00000
19	90.00	0.30000	50.00000	0.00000
20	92.73	0.30000	50.00000	0.00000
21	95.46	0.30000	50.00000	0.00000
22	98.19	0.30000	50.00000	0.00000
23	100.92	0.30000	50.00000	0.00000
24	103.65	0.30000	50.00000	0.00000
25	106.38	0.30000	50.00000	0.00000
26	109.11	0.30000	50.00000	0.00000
27	111.84	0.30000	50.00000	0.00000
28	114.57	0.30000	50.00000	0.00000
29	117.31	0.30000	50.00000	0.00000
30	120.03	0.30000	50.00000	0.00000
31	122.77	0.30000	50.00000	0.00000
32	125.50	0.30000	50.00000	0.00000
33	128.23	0.30000	50.00000	0.00000

34	141.37	0.30000	50.00000	0.00000
35	154.51	0.30000	50.00000	0.00000
36	167.66	0.30000	50.00000	0.00000
37	170.54	0.30000	50.00000	0.00000

LRFD TOTAL LOAD FACTORS PER LOAD STEP

LOAD STEP	LOAD FACTOR	USER COMMENT
1	1.575	Factor for load step #1
2	1.575	Factor for load step #2
3	1.575	Factor for load step #3
4	1.575	Factor for load step #4
5	1.575	Factor for load step #5
6	1.575	Factor for load step #6
7	1.575	Factor for load step #7
8	1.575	Factor for load step #8
9	1.575	Factor for load step #9
10	1.575	Factor for load step #10
11	1.575	Factor for load step #11
12	1.575	Factor for load step #12
13	1.575	Factor for load step #13
14	1.575	Factor for load step #14
15	1.575	Factor for load step #15
16	1.575	Factor for load step #16
17	1.575	Factor for load step #17
18	1.575	Factor for load step #18
19	1.575	Factor for load step #19
20	1.575	Factor for load step #20
21	1.575	Factor for load step #21
22	1.300	Factor for load step #22
23	1.300	Factor for load step #23

STEEL, FACTORED-EVALUATION FOR GROUP 1, LOAD-STEP 23

STRUCTURAL RESPONSES OF STEEL-GROUP 1, LOAD STEP 23  
UNITS INCH-LB SYSTEM: (FORCE = LB/IN, MOMENT = IN-LB/IN, STRESS = PSI)

NODE	X-COORD Y-COORD	X-DISP. Y-DISP.	N-PRES. S-PRES.	MOMENT THRUST	MAX-STRESS HOOP-STRESS	SHEAR S-STRESS
1	-231.30 0.00	-0.658E+00 -0.126E+01	0.213E+02 0.777E+01	-0.327E-11 -0.422E+04	-0.164E+05 -0.164E+05	0.413E+03 0.160E+04
2	-228.76 18.07	-0.927E+00 -0.123E+01	-0.515E+01 -0.166E+01	-0.681E+04 -0.426E+04	-0.377E+05 -0.166E+05	0.292E+03 0.114E+04
3	-225.31 35.99	-0.113E+01 -0.120E+01	-0.316E+02 -0.111E+02	-0.113E+05 -0.440E+04	-0.440E+05 -0.171E+05	0.195E+03 0.757E+03
4	-220.13 51.09	-0.120E+01 -0.119E+01	-0.560E+02 -0.143E+02	-0.140E+05 -0.463E+04	-0.440E+05 -0.180E+05	0.746E+02 0.290E+03
5	-211.66 64.62	-0.116E+01 -0.122E+01	-0.547E+02 0.166E+02	-0.138E+05 -0.461E+04	-0.440E+05 -0.179E+05	-0.990E+02 -0.385E+03
6	-200.33 75.87	-0.104E+01 -0.135E+01	-0.332E+02 0.118E+02	-0.106E+05 -0.435E+04	-0.440E+05 -0.169E+05	0.229E+03 -0.891E+03
7	-187.99 85.12	-0.900E+00 -0.156E+01	-0.167E+02 0.496E+01	-0.619E+04 -0.420E+04	-0.355E+05 -0.163E+05	-0.240E+03 -0.932E+03
8	-175.22 93.78	-0.739E+00 -0.182E+01	-0.170E+02 0.489E+01	-0.261E+04 -0.411E+04	-0.241E+05 -0.160E+05	-0.177E+03 -0.688E+03
9	-162.05 101.82	-0.580E+00 -0.210E+01	-0.190E+02 0.538E+01	-0.296E+02 -0.403E+04	-0.157E+05 -0.156E+05	-0.919E+02 -0.357E+03

10	-148.51 109.22	-0.433E+00 -0.239E+01	-0.174E+02 0.490E+01	0.988E+03 -0.394E+04	-0.184E+05 -0.153E+05	0.157E+00 0.611E+00
11	-134.64 115.97	-0.303E+00 -0.268E+01	-0.111E+02 0.313E+01	0.758E+03 -0.388E+04	-0.174E+05 -0.151E+05	0.347E+02 0.135E+03
12	-120.46 122.05	-0.189E+00 -0.298E+01	-0.454E+01 0.127E+01	0.718E+03 -0.385E+04	-0.172E+05 -0.150E+05	-0.276E+02 -0.107E+03
13	-106.01 127.44	-0.913E-01 -0.327E+01	-0.188E+02 0.532E+01	0.241E+04 -0.379E+04	-0.222E+05 -0.147E+05	-0.282E+02 -0.110E+03
14	-91.31 132.15	-0.123E-01 -0.355E+01	-0.981E+01 0.273E+01	0.238E+04 -0.373E+04	-0.219E+05 -0.145E+05	0.146E+02 0.569E+02
15	-76.42 136.15	0.490E-01 -0.381E+01	-0.868E+01 0.242E+01	0.274E+04 -0.369E+04	-0.229E+05 -0.143E+05	-0.185E+02 -0.720E+02
16	-61.34 139.43	0.934E-01 -0.406E+01	-0.813E+01 0.226E+01	0.372E+04 -0.365E+04	-0.258E+05 -0.142E+05	-0.626E+02 -0.243E+03
17	-46.13 141.99	0.122E+00 -0.427E+01	-0.828E+01 0.228E+01	0.540E+04 -0.361E+04	-0.308E+05 -0.140E+05	-0.108E+03 -0.420E+03
18	-30.81 143.82	0.135E+00 -0.445E+01	-0.947E+01 0.261E+01	0.771E+04 -0.357E+04	-0.378E+05 -0.139E+05	-0.141E+03 -0.549E+03
19	-15.42 144.93	0.136E+00 -0.457E+01	-0.108E+02 0.298E+01	0.103E+05 -0.352E+04	-0.440E+05 -0.137E+05	-0.153E+03 -0.593E+03
20	0.00 145.29	0.131E+00 -0.461E+01	-0.159E+02 0.297E+01	0.127E+05 -0.347E+04	-0.440E+05 -0.135E+05	-0.112E+03 -0.434E+03
21	15.42 144.93	0.126E+00 -0.455E+01	-0.184E+02 -0.399E+01	0.137E+05 -0.347E+04	-0.440E+05 -0.135E+05	-0.109E+02 -0.425E+02
22	30.81 143.82	0.130E+00 -0.438E+01	-0.166E+02 -0.462E+01	0.126E+05 -0.354E+04	-0.440E+05 -0.138E+05	0.936E+02 0.364E+03
23	46.13 141.99	0.153E+00 -0.412E+01	-0.163E+02 -0.450E+01	0.999E+04 -0.362E+04	-0.440E+05 -0.141E+05	0.178E+03 0.692E+03
24	61.34 139.43	0.199E+00 -0.378E+01	-0.156E+02 -0.432E+01	0.599E+04 -0.370E+04	-0.330E+05 -0.144E+05	0.251E+03 0.974E+03
25	76.42 136.15	0.270E+00 -0.340E+01	-0.113E+02 -0.313E+01	0.904E+03 -0.377E+04	-0.175E+05 -0.146E+05	0.282E+03 0.109E+04
26	91.31 132.15	0.360E+00 -0.301E+01	-0.709E-01 -0.108E-01	-0.410E+04 -0.360E+04	-0.275E+05 -0.148E+05	0.190E+03 0.739E+03
27	106.01 127.44	0.461E+00 -0.266E+01	0.485E-01 -0.183E-01	-0.622E+04 -0.381E+04	-0.341E+05 -0.148E+05	0.986E+01 0.383E+02
28	120.46 122.05	0.564E+00 -0.236E+01	0.560E-01 0.370E-02	-0.540E+04 -0.381E+04	-0.316E+05 -0.148E+05	-0.171E+03 -0.666E+03
29	134.64 115.97	0.667E+00 -0.209E+01	-0.282E+02 -0.806E+01	-0.167E+04 -0.386E+04	-0.202E+05 -0.150E+05	-0.136E+03 -0.528E+03

30	148.51 109.22	0.775E+00 -0.185E+01	-0.134E+02 -0.381E+01	-0.176E+04 -0.395E+04	-0.208E+05 -0.153E+05	-0.583E+00 -0.227E+01
31	162.05 101.82	0.888E+00 -0.162E+01	-0.153E+02 -0.441E+01	-0.208E+04 -0.401E+04	-0.221E+05 -0.156E+05	0.320E+02 0.124E+03
32	175.22 93.78	0.100E+01 -0.141E+01	-0.167E+02 -0.485E+01	-0.307E+04 -0.409E+04	-0.254E+05 -0.159E+05	0.868E+02 0.337E+03
33	187.99 85.12	0.111E+01 -0.123E+01	-0.223E+02 -0.660E+01	-0.499E+04 -0.418E+04	-0.318E+05 -0.163E+05	0.191E+03 0.742E+03
34	200.33 75.87	0.121E+01 -0.109E+01	-0.361E+02 -0.296E+00	-0.911E+04 -0.426E+04	-0.440E+05 -0.166E+05	0.252E+03 0.980E+03
35	211.66 64.62	0.128E+01 -0.101E+01	-0.457E+02 0.131E+02	-0.130E+05 -0.419E+04	-0.440E+05 -0.163E+05	0.126E+03 0.489E+03
36	220.13 51.09	0.127E+01 -0.101E+01	-0.467E+02 0.143E+02	-0.130E+05 -0.398E+04	-0.440E+05 -0.155E+05	-0.725E+02 -0.282E+03
37	225.31 35.99	0.116E+01 -0.104E+01	-0.274E+02 0.955E+01	-0.103E+05 -0.376E+04	-0.440E+05 -0.146E+05	-0.184E+03 -0.716E+03
38	228.76 18.07	0.925E+00 -0.107E+01	-0.452E+01 0.144E+01	-0.611E+04 -0.364E+04	-0.332E+05 -0.142E+05	-0.263E+03 -0.102E+04
39	231.30 0.00	0.631E+00 -0.110E+01	0.183E+02 -0.667E+01	-0.526E-10 -0.361E+04	-0.140E+05 -0.140E+05	-0.364E+03 -0.141E+04

STRAIN AND YIELDING DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	INNER-FIBER STRAIN	OUTER-FIBER STRAIN	STRAIN RATIO MAX-TO-YIELD	FRACTION OF WALL YIELDED
1	-0.51469E-03	-0.51469E-03	.37278	0.00000
2	-0.11845E-02	0.14442E-03	.85789	0.00000
3	-0.17104E-02	0.59104E-03	1.2388	0.14326
4	-0.23028E-02	0.90936E-03	1.6679	0.28707
5	-0.22401E-02	0.88017E-03	1.6225	0.27543
6	-0.15966E-02	0.51321E-03	1.1564	0.10234
7	-0.11155E-02	0.91558E-04	.80793	0.00000
8	-0.75600E-03	-0.24682E-03	.54755	0.00000
9	-0.49379E-03	-0.48801E-03	.35764	0.00000
10	-0.38453E-03	-0.57725E-03	.41809	0.00000
11	-0.39945E-03	-0.54729E-03	.39639	0.00000
12	-0.39915E-03	-0.53923E-03	.39055	0.00000
13	-0.22748E-03	-0.69809E-03	.50561	0.00000
14	-0.22279E-03	-0.68747E-03	.49792	0.00000
15	-0.18302E-03	-0.71746E-03	.51964	0.00000
16	-0.82943E-04	-0.80822E-03	.58537	0.00000
17	0.86105E-04	-0.96768E-03	.70087	0.00000
18	0.31631E-03	-0.11872E-02	.85986	0.00000
19	0.57355E-03	-0.14336E-02	1.0383	0.02636
20	0.84826E-03	-0.17455E-02	1.2642	0.14064
21	0.97171E-03	-0.19191E-02	1.3900	0.18625
22	0.83222E-03	-0.17484E-02	1.2663	0.14249
23	0.53328E-03	-0.14165E-02	1.0260	0.01838
24	0.13324E-03	-0.10350E-02	.74960	0.00000
25	-0.37131E-03	-0.54760E-03	.39661	0.00000
26	-0.86327E-03	-0.64374E-04	.62524	0.00000
27	-0.10711E-02	0.14211E-03	.77574	0.00000
28	-0.99118E-03	0.63051E-04	.71789	0.00000
29	-0.63387E-03	-0.30775E-03	.45909	0.00000
30	-0.65349E-03	-0.30978E-03	.47331	0.00000
31	-0.69280E-03	-0.28625E-03	.50178	0.00000
32	-0.79837E-03	-0.19893E-03	.57824	0.00000
33	-0.99724E-03	-0.23383E-04	.72228	0.00000

34	-0.14092E-02	0.36965E-03	1.0206	0.01602
35	-0.19483E-02	0.80967E-03	1.4111	0.20582
36	-0.19136E-02	0.84061E-03	1.3859	0.19348
37	-0.14720E-02	0.55116E-03	1.0661	0.04512
38	-0.10404E-02	0.15163E-03	.75355	0.00000
39	-0.43973E-03	-0.43973E-03	.31849	0.00000

COMBINED THRUST AND MOMENT DIAGNOSTICS OF STEEL-GROUP 1, LOAD STEP 23

NODE	FACTORED THRUST-RATIO P/ (P-resist)	FACTORED MOMENT-RATIO M/ (M-resist)	FACTORED COMBINED-RATIO AASHTO 12.8.9.5
1	-0.41420	0.00000	0.17156
2	-0.41850	-0.38414	0.55928
3	-0.43139	-0.63901	0.82511
4	-0.45418	-0.78857	0.99486
5	-0.45199	-0.77872	0.98302
6	-0.42705	-0.59792	0.78029
7	-0.41201	-0.34892	0.51867
8	-0.40351	-0.14719	0.31001
9	-0.39505	-0.00167	0.15774
10	-0.38700	0.05571	0.20548
11	-0.38095	0.04274	0.18786
12	-0.37758	0.04049	0.18306
13	-0.37243	0.13604	0.27474
14	-0.36627	0.13432	0.26847
15	-0.36233	0.15449	0.28577
16	-0.35858	0.20965	0.33823
17	-0.35472	0.30461	0.43044
18	-0.35043	0.43462	0.55741
19	-0.34550	0.57921	0.69858
20	-0.34037	0.71605	0.83190
21	-0.34085	0.77180	0.88799
22	-0.34757	0.71165	0.83246
23	-0.35513	0.56316	0.68927
24	-0.36283	0.33769	0.46934
25	-0.36975	0.05096	0.18767
26	-0.37326	-0.23093	0.37026
27	-0.37378	-0.35069	0.49040
28	-0.37346	-0.30474	0.44421
29	-0.37888	-0.09427	0.23782
30	-0.38760	-0.09936	0.24959
31	-0.39395	-0.11752	0.27271
32	-0.40129	-0.17328	0.33431
33	-0.41067	-0.28151	0.45016
34	-0.41810	-0.51396	0.68877
35	-0.41116	-0.73060	0.89966
36	-0.39024	-0.73392	0.88621
37	-0.36885	-0.58209	0.71814
38	-0.35763	-0.34458	0.47248
39	-0.35387	0.00000	0.12523

ASSESSMENT SUMMARY STEEL-GROUP 1, LOAD-STEP 23

LRFD STRENGTH-LIMIT RATIOS AT STEP 23, FOR STEEL GROUP # 1

DESIGN-CRITERION	CONTROL NODE	FACTORED DEMAND	FACTORED CAPACITY	RATIO VALUE
MATERIAL THRUST (psi)	4	17966.	30800.	0.584
BUCKLING THRUST (psi)	4	17986.	48568.	0.370
SEAM THRUST (psi)	4	17986.	21914.	0.821
PLASTIC-PENETRATE (%)	4	28.71	90.00	0.319
COMBINED T&M Ratio	4	0.995	1.000	0.995

LRFD SERVICE PERFORMANCE AT STEP 23, FOR STEEL GROUP # 1

PERCENT VERTICAL DEFLECTION (%).....	1.78
RISE HEIGHT OF VERTICAL DEFLECTION (IN).....	145.29
RATIO OF VERTICAL DEFLECTION TO ALLOWABLE (-).....	0.36
HANDLING FACTOR RATIO = (SPAN**2/EI)/FF.....	0.38
SPAN LENGTH FOR HANDLING AND BUCKLING (IN).....	462.61
FLEXIBILITY FACTOR (FF) FOR HANDLING (IN/LB) .....	0.020

\* \* \* \* NORMAL EXIT FROM CANDE \* \* \* \*

BEAM OUTPUT FOR MOD TANDEM							Y <sub>0</sub> =1.5, Y <sub>D</sub> = 1.30 (OPR)
X-coordinate (in.)	Y-coordinate (in.)	Thrust (DL) T <sub>DLfac</sub> factored from CANDE	Thrust (DL) T <sub>DLs</sub> unfactored	Thrust (DL+LL) T <sub>DL+LLfac</sub> factored from CANDE	Thrust (LL) T <sub>LLs</sub> unfactored	Thrust Load Rating OPR	
		Load Step 21 kips/ft.	T <sub>DLfac</sub> /1.575 kips/ft.	Load Step 23 kips/ft.	(T <sub>DL+LLfac</sub> -T <sub>DLfac</sub> )/1.75	(T <sub>OPR</sub> -T <sub>DLs</sub> *1.5)/T <sub>LLs</sub> *1.30	
-231.304	0	-31.94	-20.28	-41.79	5.63	5.18	
-228.758	18.07	-32.57	-20.68	-42.45	5.65	5.08	
-225.306	35.988	-33.73	-21.41	-43.94	5.84	4.77	
-220.131	51.091	-34.93	-22.18	-45.97	6.31	4.28	
-211.657	64.621	-34.41	-21.85	-45.48	6.33	4.32	
-200.328	75.871	-32.68	-20.75	-43.05	5.92	4.83	
-187.985	85.125	-31.42	-19.95	-41.46	5.74	5.15	
-175.215	93.781	-30.63	-19.45	-40.51	5.64	5.34	
-162.047	101.819	-29.93	-19.00	-39.62	5.54	5.53	
-148.512	109.22	-29.29	-18.60	-38.81	5.44	5.72	
-134.639	115.968	-28.86	-18.32	-38.21	5.34	5.88	
-120.46	122.048	-28.72	-18.23	-37.91	5.25	6.00	
-106.008	127.445	-28.34	-17.99	-37.40	5.18	6.14	
-91.315	132.148	-27.79	-17.64	-36.75	5.12	6.29	
-76.415	136.145	-27.39	-17.39	-36.29	5.08	6.39	
-61.341	139.428	-26.99	-17.14	-35.84	5.05	6.49	
-46.128	141.99	-26.61	-16.90	-35.39	5.02	6.59	
-30.81	143.823	-26.26	-16.67	-34.94	4.96	6.72	
-15.423	144.925	-25.92	-16.46	-34.46	4.88	6.88	
0	145.293	-25.73	-16.33	-34.13	4.80	7.02	
15.423	144.925	-25.87	-16.43	-34.36	4.85	6.93	
30.81	143.823	-26.21	-16.64	-34.98	5.01	6.66	
46.128	141.99	-26.56	-16.86	-35.60	5.17	6.41	
61.341	139.428	-26.94	-17.11	-36.24	5.32	6.18	
76.415	136.145	-27.34	-17.36	-36.88	5.45	5.97	
91.315	132.148	-27.74	-17.62	-37.31	5.47	5.90	
106.008	127.445	-28.24	-17.93	-37.62	5.36	5.95	
120.46	122.048	-28.57	-18.14	-37.85	5.30	5.97	
134.639	115.968	-28.85	-18.32	-38.35	5.43	5.79	
148.512	109.22	-29.35	-18.63	-39.13	5.59	5.56	
162.047	101.819	-29.95	-19.01	-39.82	5.64	5.43	
175.215	93.781	-30.63	-19.44	-40.61	5.70	5.28	
187.985	85.125	-31.39	-19.93	-41.54	5.80	5.10	
200.328	75.871	-32.63	-20.71	-42.71	5.76	4.97	
211.657	64.621	-34.42	-21.86	-43.50	5.18	5.28	
220.131	51.091	-35.06	-22.26	-42.30	4.14	6.50	
225.306	35.988	-33.87	-21.51	-39.93	3.46	8.02	
228.758	18.07	-32.70	-20.76	-38.60	3.37	8.49	
231.304	0	-32.07	-20.36	-38.02	3.40	8.55	

Thrust Load Rating= 4.28



BEAM OUTPUT FOR MOD TANDEM

YDL=1.5, YDL= 1.30 (OPR)

X-coordinate (in.)	Y-coordinate (in.)	Moment (DL) M <sub>DLfac</sub> Factored from CANDE Load Step 21 kips-ft/ft.	Moment (DL) M <sub>DLs</sub> unfactored M <sub>DLfac</sub> /1.575	Moment (DL+LL) M <sub>DL+LLfac</sub> Factored from CANDE Load Step 23 kips-ft/ft.	Moment (LL) M <sub>LLs</sub> unfactored (M <sub>DL+LLfac</sub> -M <sub>DLfac</sub> )/1.75	Moment Load Rating OPR (M <sub>DL+LLfac</sub> -M <sub>DLs</sub> )/M <sub>LLs</sub> *1.30
-231.304	0	0.00	0.00	0.00	0.00	
-228.758	18.07	-3.04	-1.93	-4.55	0.86	13.26
-225.306	35.988	-6.32	-4.01	-8.51	1.25	7.23
-220.131	51.091	-8.35	-5.30	-11.31	1.69	4.47
-211.657	64.621	-8.31	-5.28	-11.49	1.82	4.17
-200.328	75.871	-5.59	-3.55	-8.41	1.61	5.96
-187.985	85.125	-2.10	-1.34	-4.19	1.19	10.20
-175.215	93.781	0.18	0.11	-1.15	0.76	17.87
-162.047	101.819	1.39	0.88	0.77	0.35	35.90
-148.512	109.22	1.53	0.97	1.38	0.09	146.61
-134.639	115.968	0.75	0.48	0.94	0.11	119.33
-120.46	122.048	0.51	0.32	0.81	0.17	77.35
-106.008	127.445	1.99	1.26	2.36	0.21	58.55
-91.315	132.148	2.10	1.34	2.44	0.19	63.87
-76.415	136.145	2.26	1.43	2.71	0.26	46.12
-61.341	139.428	2.27	1.44	3.16	0.51	23.56
-46.128	141.99	2.18	1.39	3.83	0.94	12.82
-30.81	143.823	2.07	1.32	4.75	1.53	7.95
-15.423	144.925	2.03	1.29	5.83	2.17	5.61
0	145.293	2.04	1.30	6.82	2.73	4.46
15.423	144.925	2.10	1.33	7.17	2.90	4.19
30.81	143.823	2.20	1.40	6.73	2.59	4.66
46.128	141.99	2.38	1.51	5.71	1.90	6.27
61.341	139.428	2.52	1.60	4.10	0.90	13.09
76.415	136.145	2.56	1.62	2.03	0.30	39.13
91.315	132.148	2.46	1.56	-0.29	1.57	7.54
106.008	127.445	2.25	1.43	-1.19	1.97	6.11
120.46	122.048	1.31	0.83	-1.35	1.52	8.39
134.639	115.968	1.68	1.07	0.29	0.79	15.66
148.512	109.22	1.78	1.13	0.09	0.96	12.83
162.047	101.819	1.25	0.80	-0.50	1.00	12.73
175.215	93.781	-0.16	-0.10	-1.82	0.95	14.24
187.985	85.125	-2.51	-1.60	-3.99	0.85	14.00
200.328	75.871	-5.97	-3.79	-7.59	0.93	10.03
211.657	64.621	-8.57	-5.44	-10.56	1.14	6.51
220.131	51.091	-8.54	-5.42	-10.44	1.09	6.83
225.306	35.988	-6.44	-4.09	-7.90	0.84	10.68
228.758	18.07	-3.09	-1.96	-4.28	0.68	16.81
231.304	0	0.00	0.00	0.00	0.00	

Moment Load Rating=  
Actual Load Rating (from CANDE)

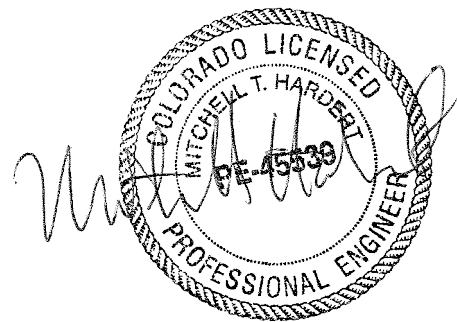
4.17  
2.47


## **APPENDIX B**

### **PRINTS**

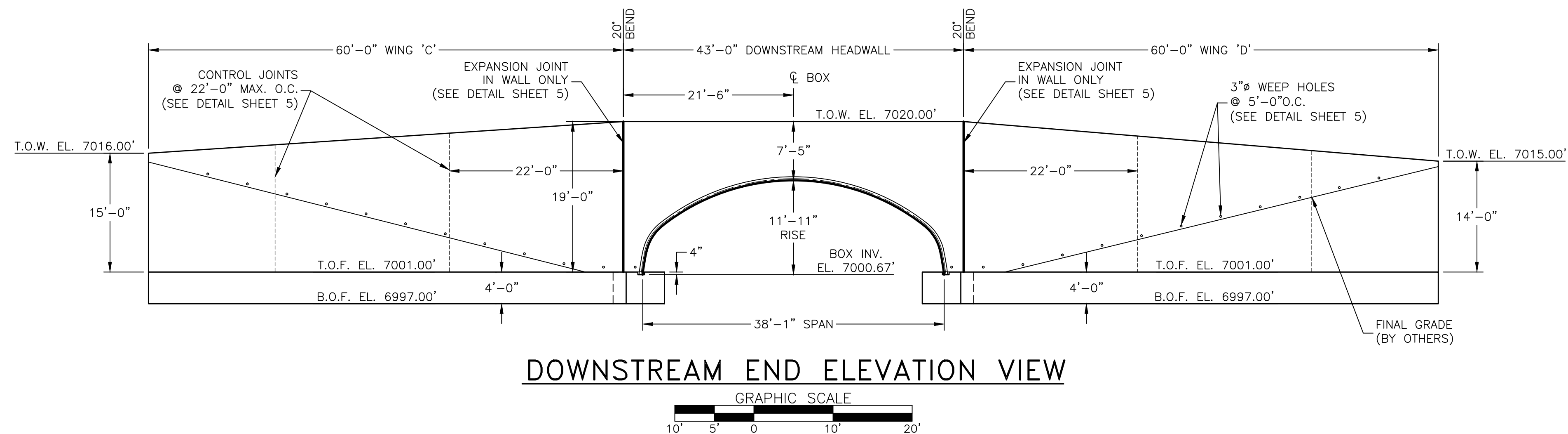
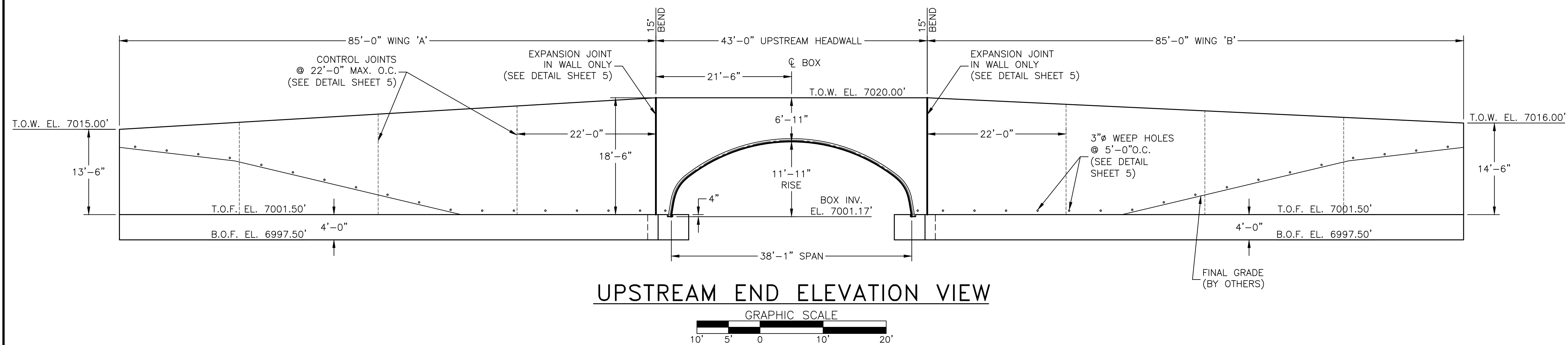
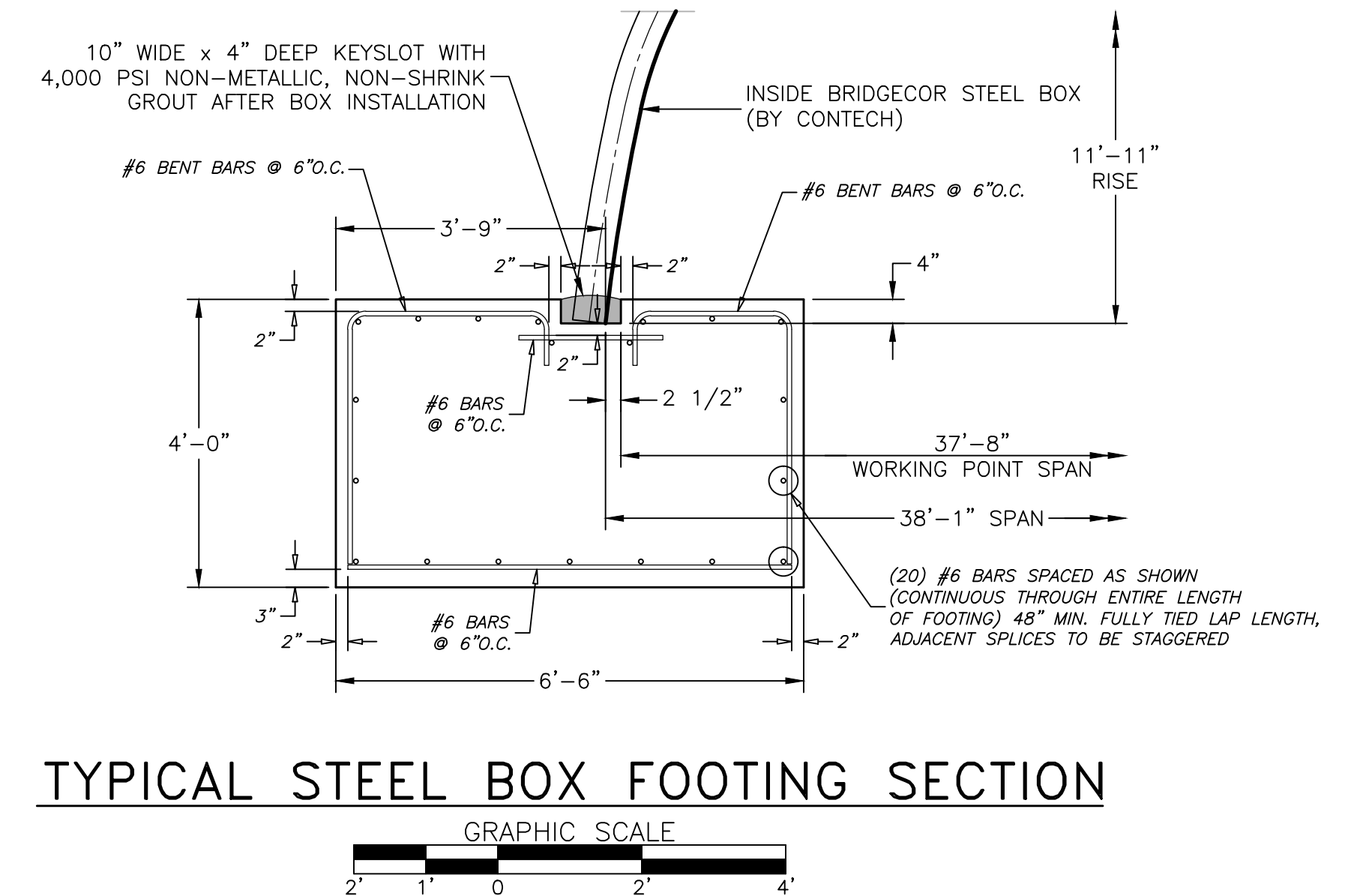
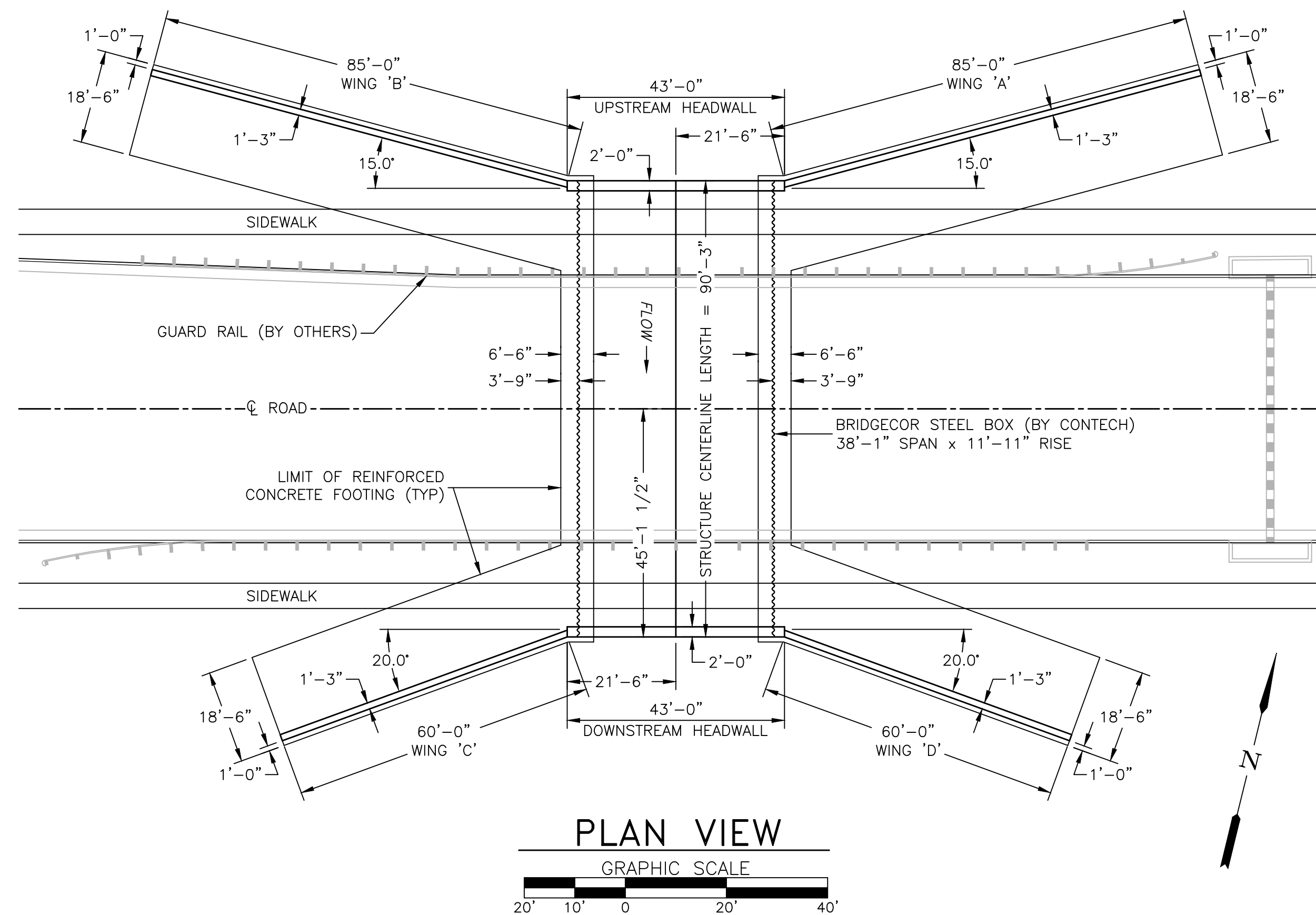
CONTECH ENGINEERED SOLUTIONS, LLC  
Design of Concrete Spread Footing Foundations,  
Concrete Headwalls and Wingwalls for a BridgeCOR  
Steel Box (705931); Sterling Ranch Road,  
El Paso County, Colorado

INDEX	
1.	TITLE SHEET / INDEX
2.	PLAN, ELEVATIONS & FOOTING DETAIL
3.	UPSTREAM HEADWALL DETAILS
4.	DOWNSTREAM HEADWALL DETAILS
5.	WINGWALL SECTION & TYPICAL DETAILS
6.	SPECIFICATIONS

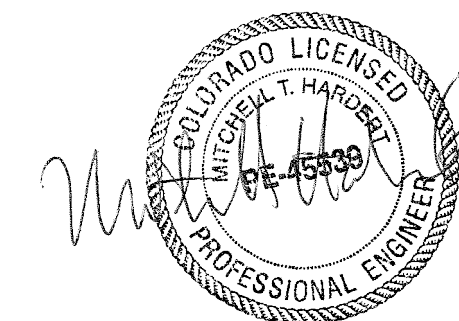


<div><div><div>KOONTZ BRYANT JOHNSON WILLIAMS</div></div><div>Formerly CBC Engineers</div></div> <div>TITLE SHEET / INDEX</div> <table><tr><td>Drawn By</td><td>DJH</td><td>Date</td><td>4/18/22</td></tr><tr><td>Approved By</td><td></td><td>Date</td><td></td></tr><tr><td>Scale</td><td>GRAPHIC</td><td>Project No.</td><td>KBJW-24879</td></tr><tr><td>Rev.</td><td>-</td><td>Sheet</td><td>1 OF 6</td></tr></table> <div>CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado</div>				Drawn By	DJH	Date	4/18/22	Approved By		Date		Scale	GRAPHIC	Project No.	KBJW-24879	Rev.	-	Sheet	1 OF 6
Drawn By	DJH	Date	4/18/22																
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Scale	GRAPHIC	Project No.	KBJW-24879																
Rev.	-	Sheet	1 OF 6																




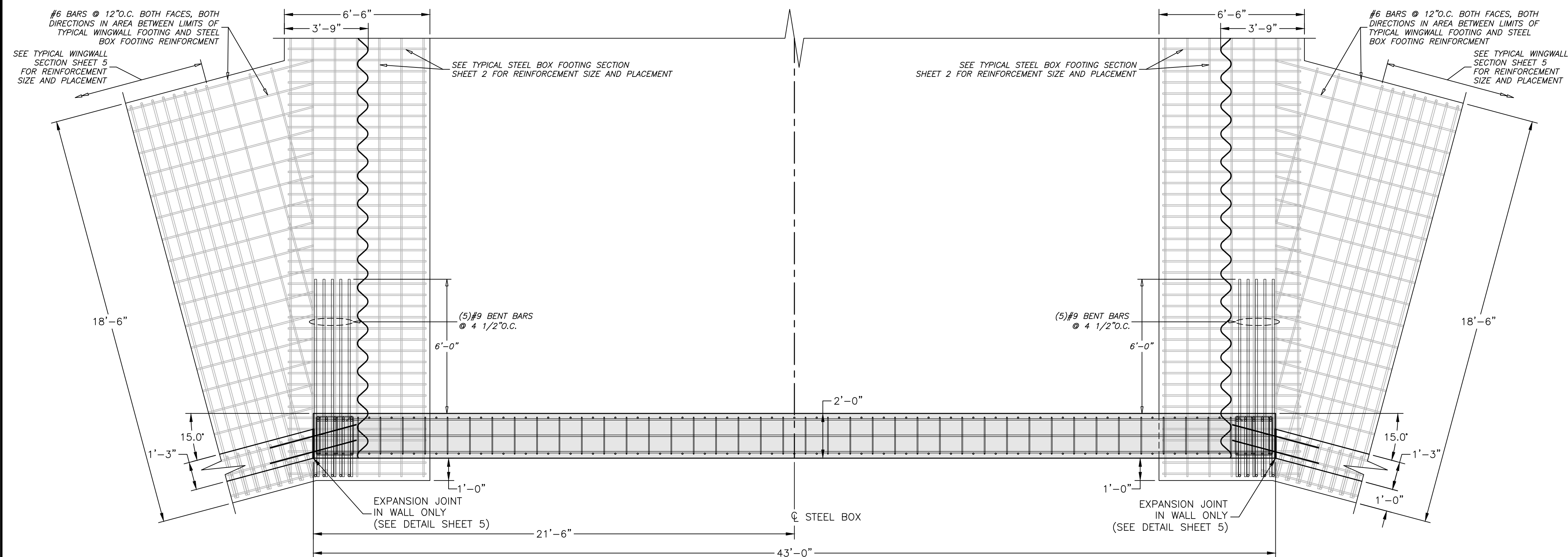


- NOTES:**
- 1.) CONCRETE SHALL BE  $f'_c = 4,000$  psi.
  - 2.) ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60.
  - 3.) FOOTING IS DESIGNED FOR A 8,700 psf FACTORED BEARING RESISTANCE, AND A FRICTION FACTOR (ULTIMATE) OF 0.4. THESE VALUES MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
  - 4.) SCOUR IS NOT ADDRESSED HEREIN AND IS THE RESPONSIBILITY OF OTHERS THAN CBC ENGINEERS.

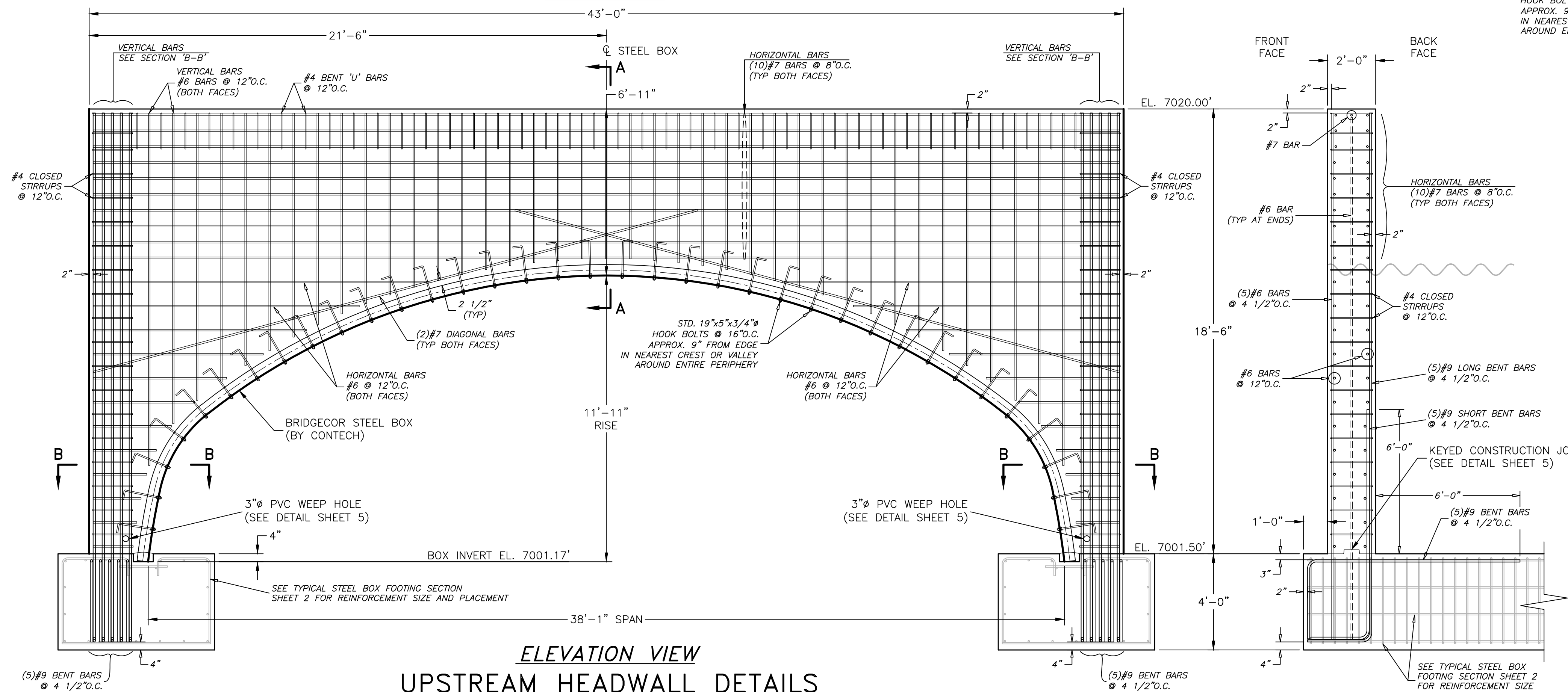


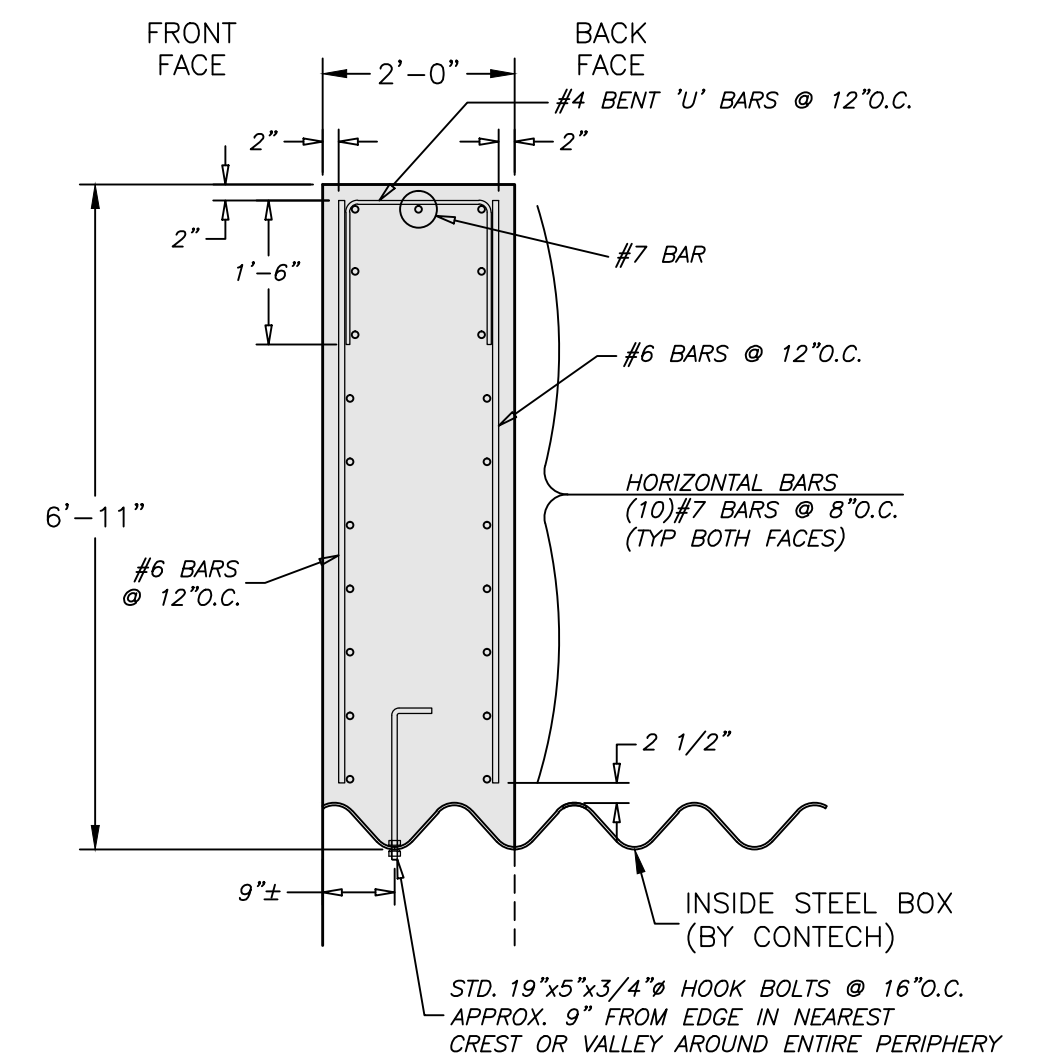
 <p>KCON<b>TZ</b> BRYANT JOHNSON WILLIAMS  Formerly CBC Engineers</p>			
<h2 style="text-align: center;">PLAN, ELEVATIONS &amp; FOOTING DETAIL</h2>			
Drawn By  <div>DJH</div>	Date  <div>4/18/22</div>	CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a Bridge/COR Steel Box (705931), Sterling Ranch Road, El Paso County, Colorado	
Approved By	Date		
Scale	Project No.	Rev.	Sheet
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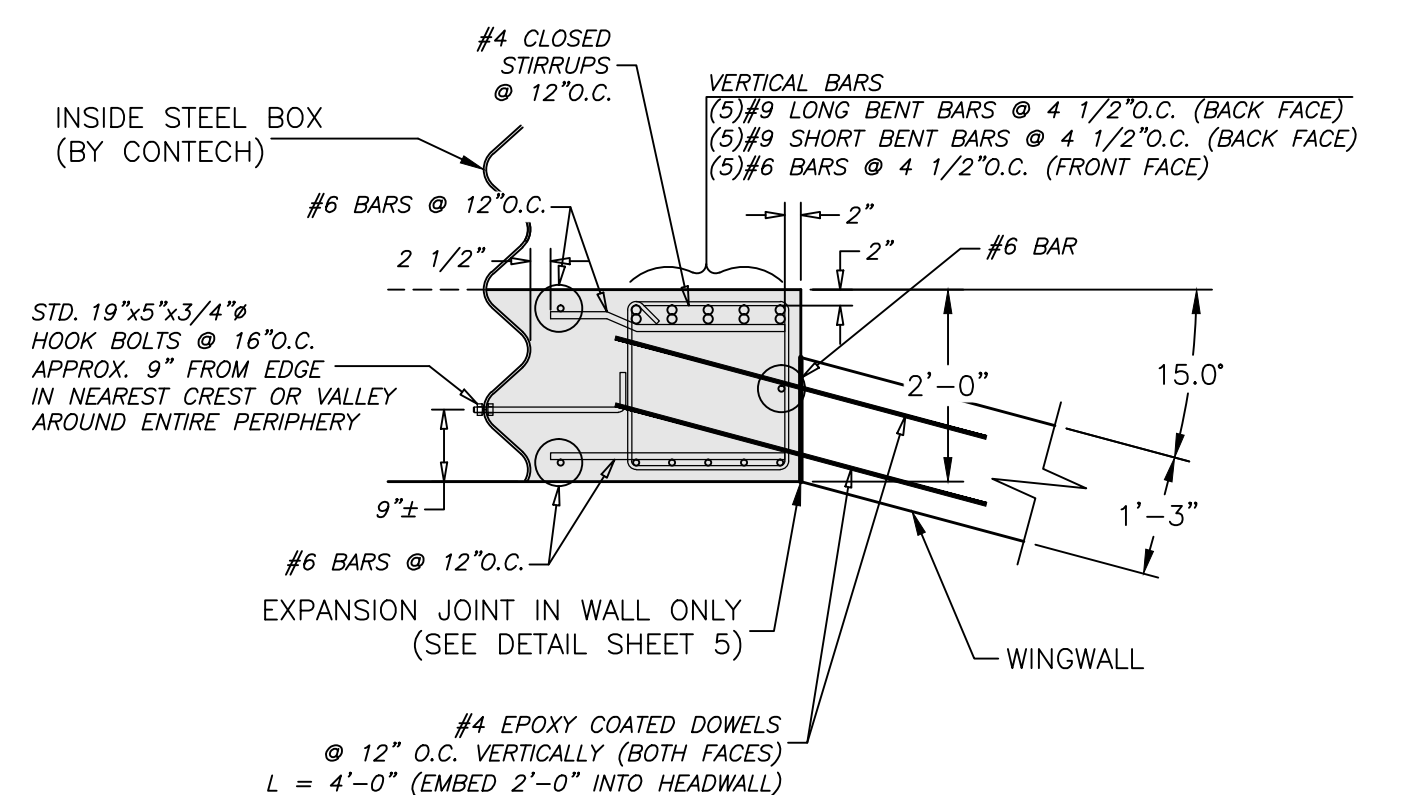
PLAN VIEW



ELEVATION VIEW  
UPSTREAM HEADWALL DETAILS



SECTION 'A-A'




NOTE:  
RIGHT SIDE OF HEADWALL IS DEPICTED IN THIS VIEW.  
LEFT SIDE OF HEADWALL IS SYMMETRICAL TO THIS DESIGN.

SECTION 'B-B'



**NOTES:**

- 1.) CONCRETE SHALL BE  $f'_c = 4,000$  psi.
- 2.) ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60.
- 3.) FOOTING IS DESIGNED FOR A 8,700 psf FACTORED BEARING RESISTANCE, AND A FRICTION FACTOR (ULTIMATE) OF 0.4. THESE VALUES MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
- 4.) SCOUR IS NOT ADDRESSED HEREIN AND IS THE RESPONSIBILITY OF OTHERS THAN CBC ENGINEERS.

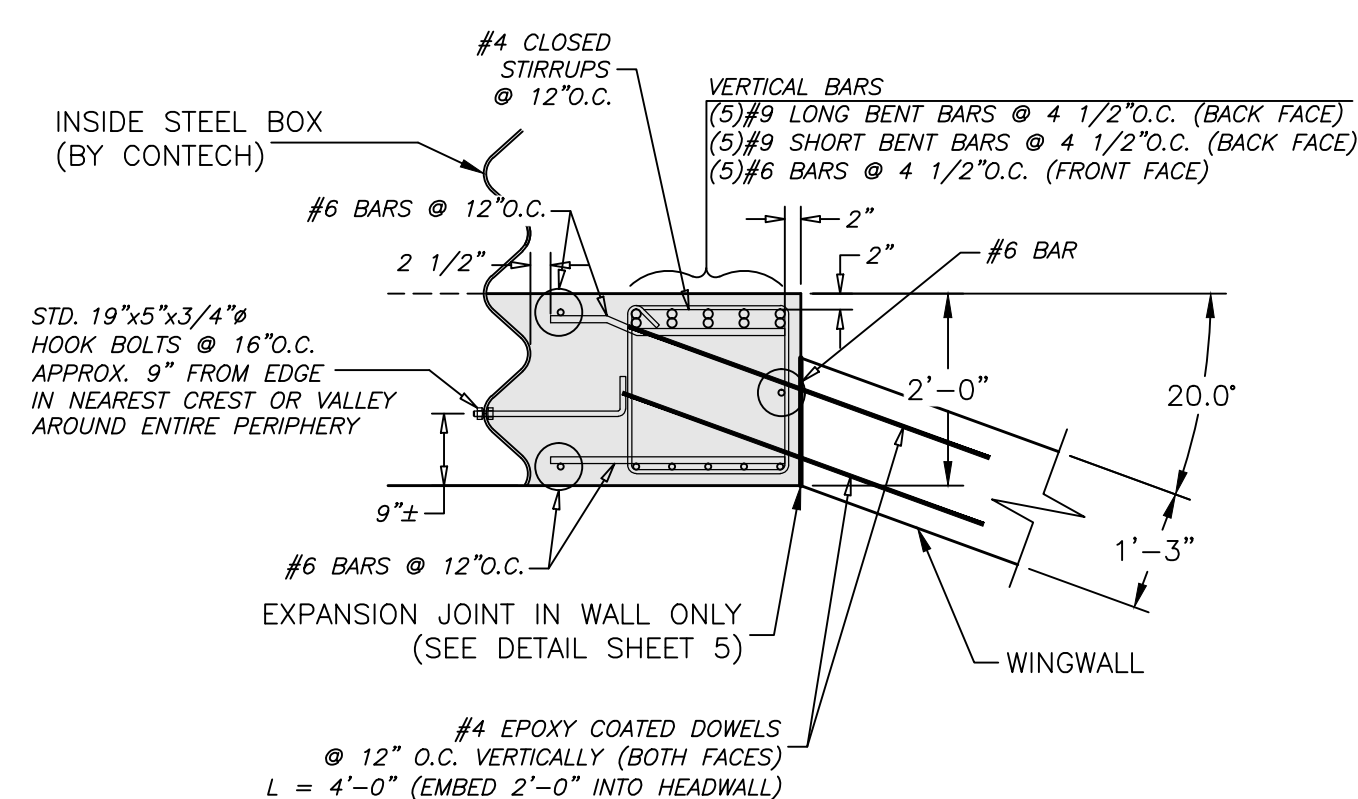
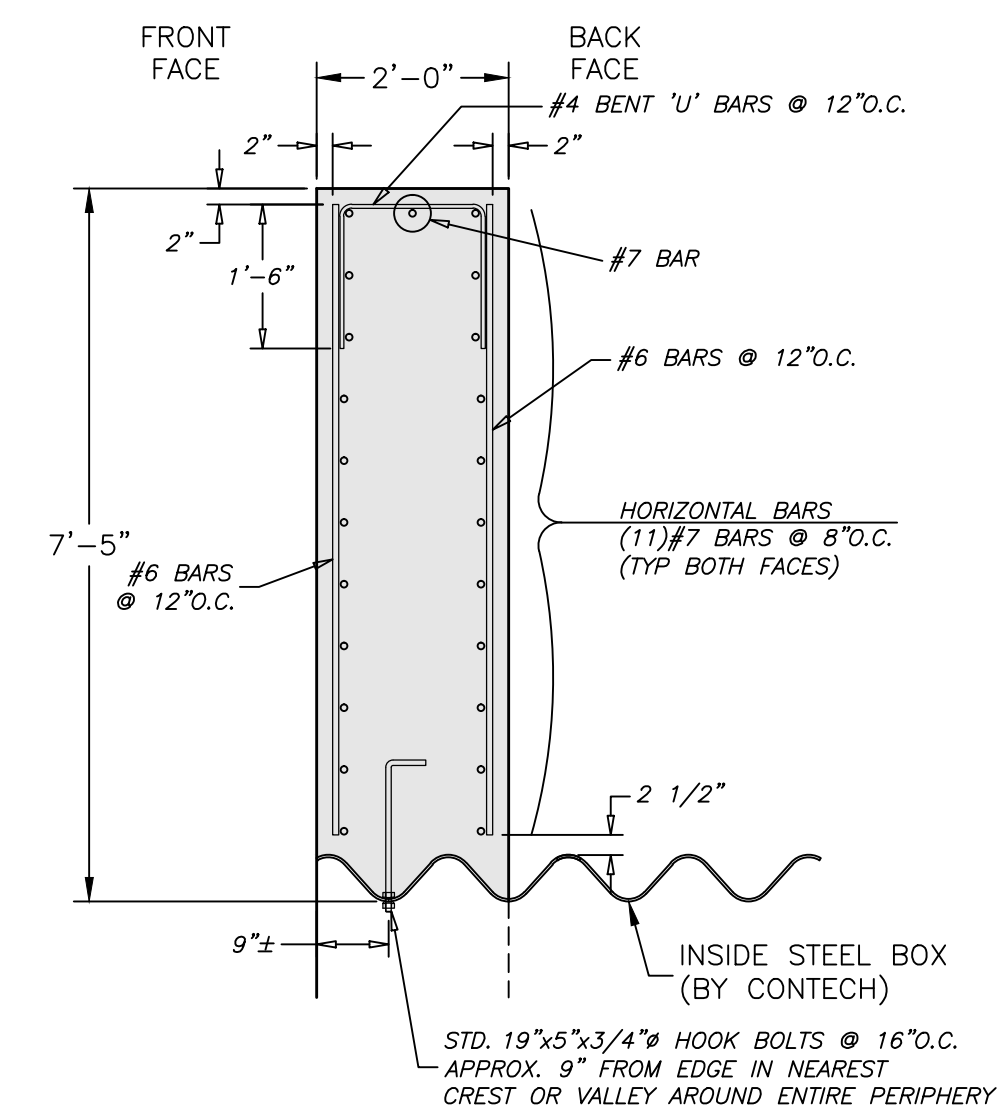
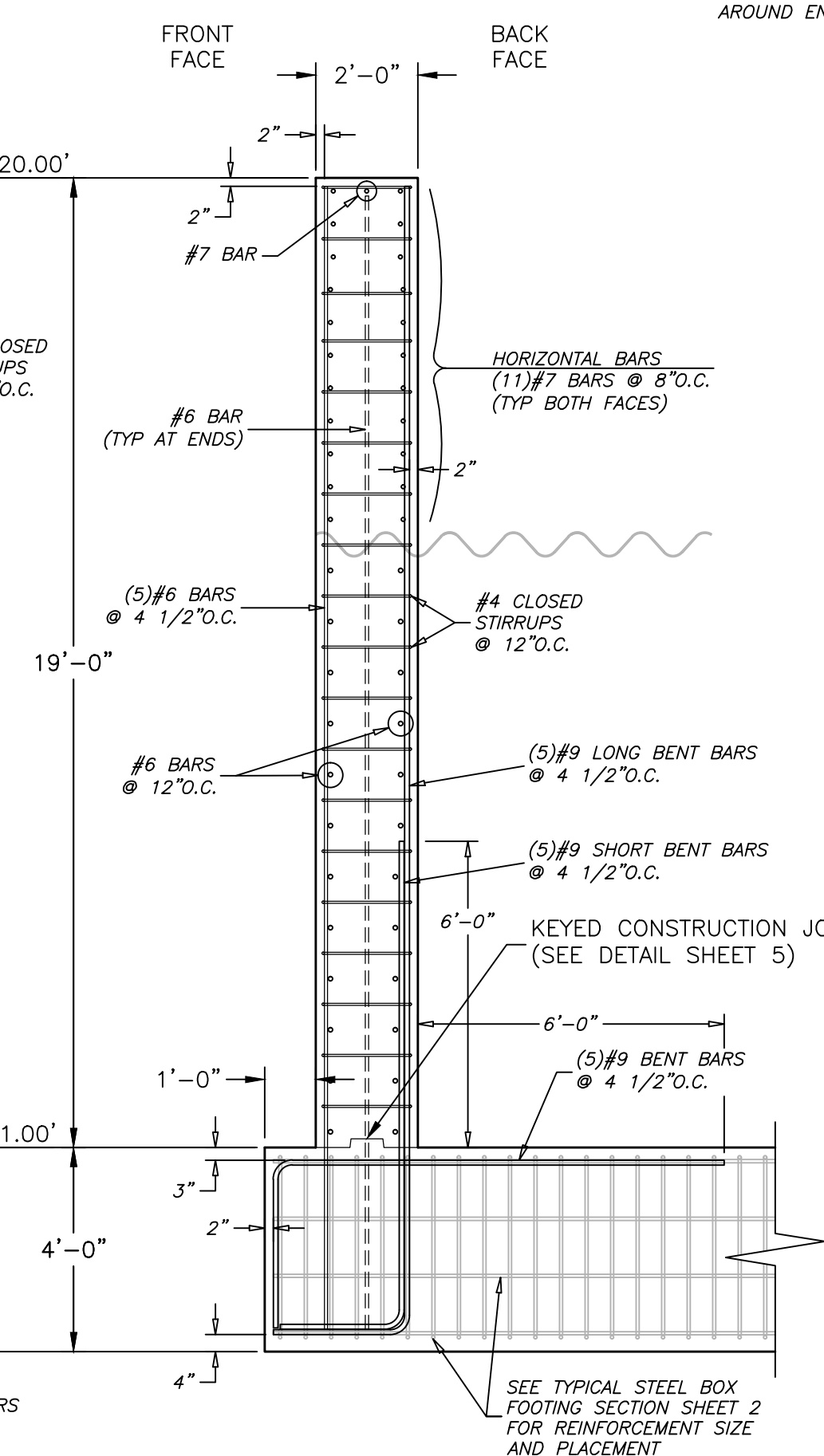
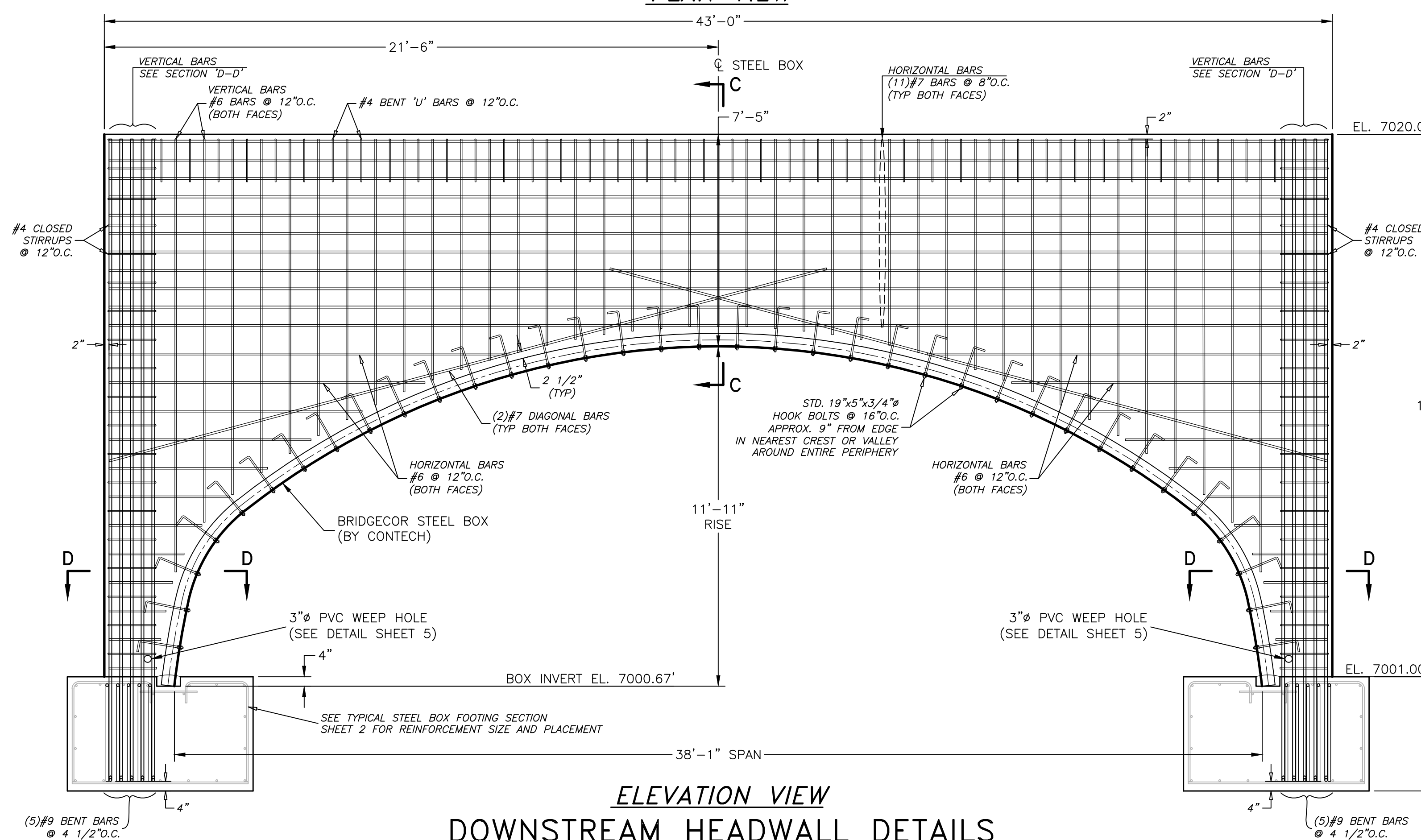
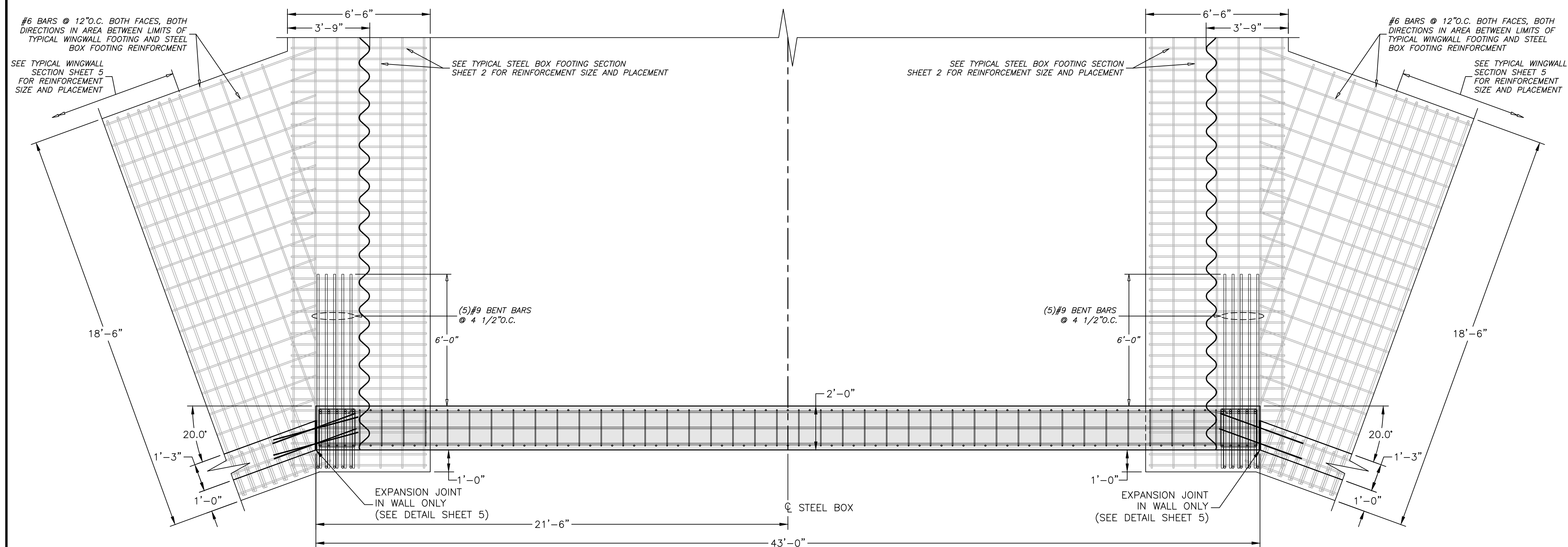



**KOONTZ  
BRYANT  
JOHNSON  
WILLIAMS**

Formerly CBC Engineers

## UPSTREAM HEADWALL DETAILS

Drawn By	Date	<b>CONTECH ENGINEERED SOLUTIONS, LLC</b> Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a Bridge/COR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado		
DJH	4/18/22			
Approved By	Date			
Scale		Project No.	Rev.	Sheet
GRAPHIC		KBJW-24879	-	3 OF 6



NOTE:  
RIGHT SIDE OF HEADWALL IS DEPICTED IN THIS VIEW.  
LEFT SIDE OF HEADWALL IS SYMMETRICAL TO THIS DESIGN

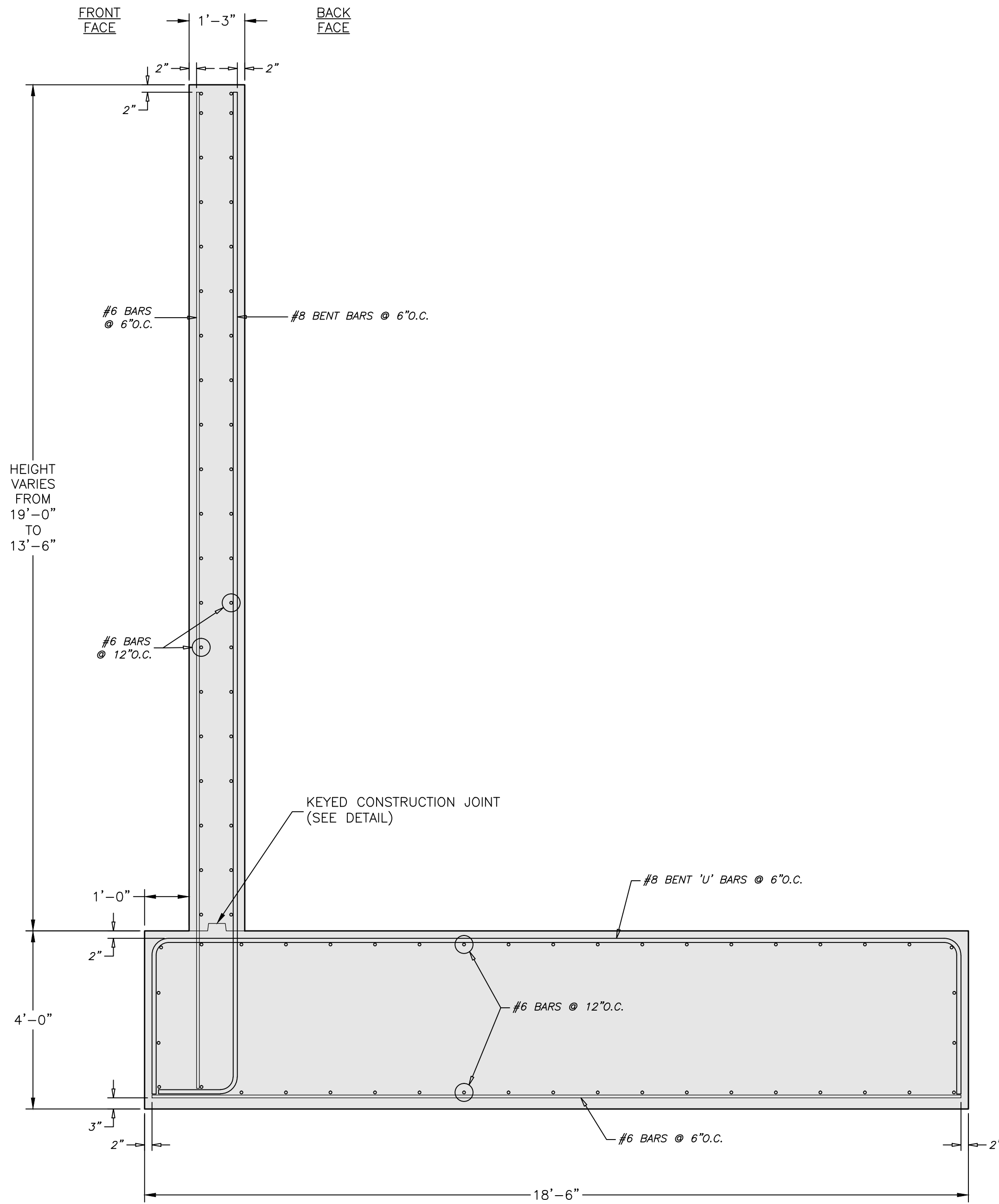
**NOTES:**

- 1.) CONCRETE SHALL BE  $f'_c = 4,000$  psi.
- 2.) ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60.
- 3.) FOOTING IS DESIGNED FOR A 8,700 psf FACTORED BEARING RESISTANCE, AND A FRICTION FACTOR (ULTIMATE) OF 0.4. THESE VALUES MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
- 4.) SCOUR IS NOT ADDRESSED HEREIN AND IS THE RESPONSIBILITY OF OTHERS THAN CBC ENGINEERS.

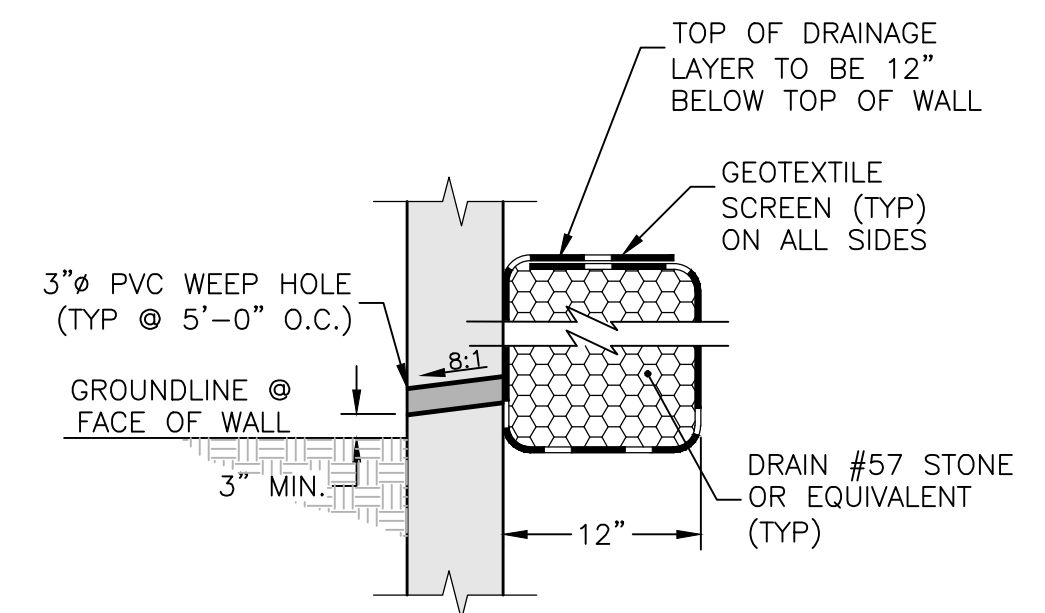


## DOWNSTREAM HEADWALL DETAILS

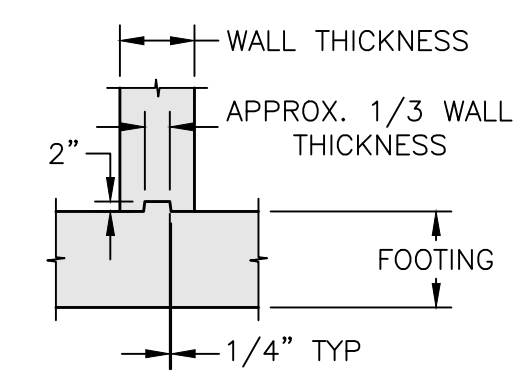
Drawn By DJH		Date 4/18/22		CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931), Sterling Ranch Road, El Paso County, Colorado		
Approved By		Date				
Scale GRAPHIC		Project No. KBJW-24879		Rev. -	Sheet 4 OF 6	



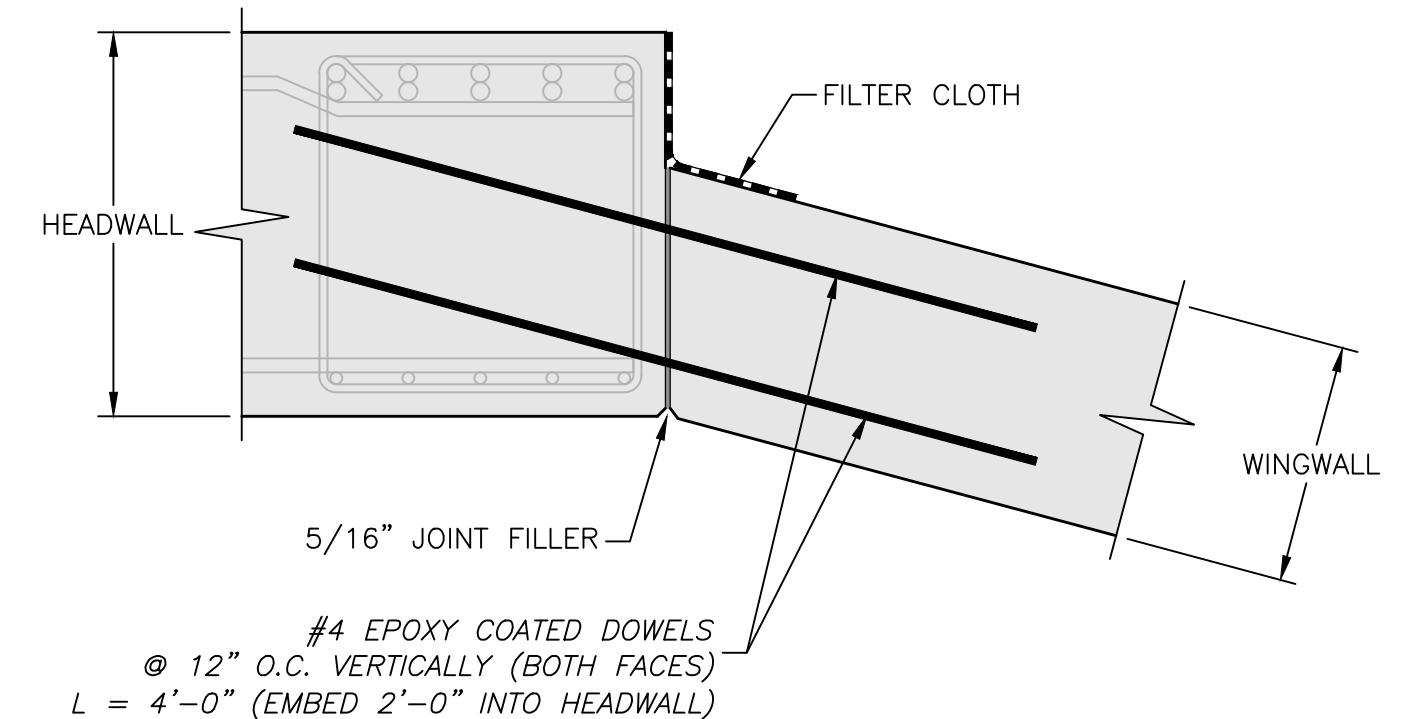
TYPICAL WINGWALL SECTION VIEW



WEEP HOLE DETAIL  
NOT TO SCALE

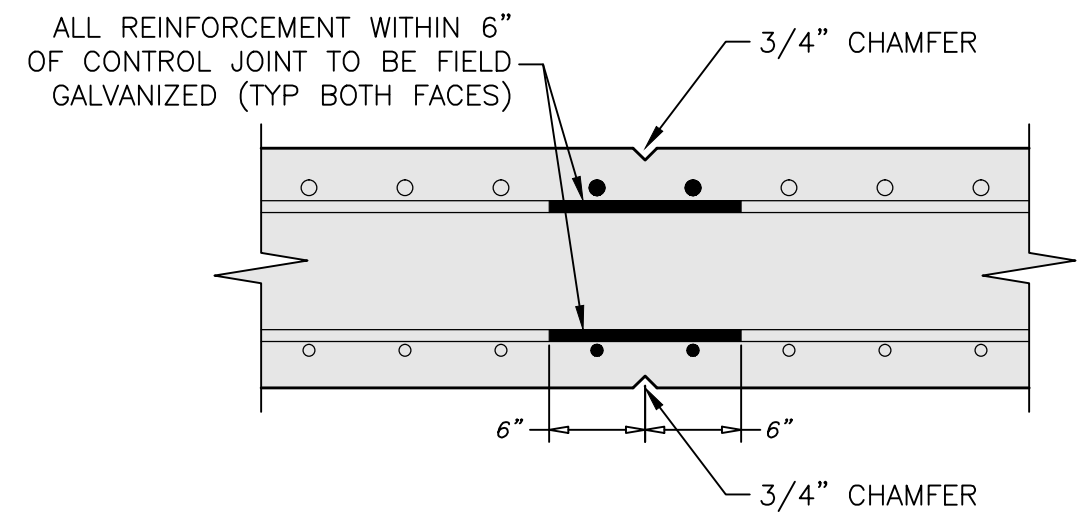


KEYED CONSTRUCTION JOINT DETAIL  
NOT TO SCALE



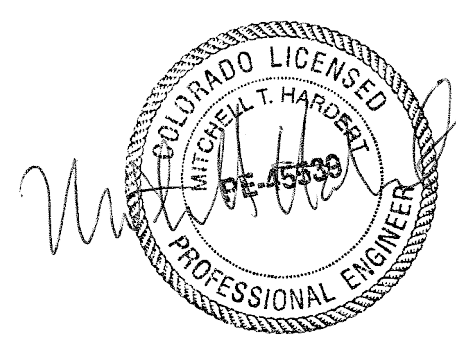
EXPANSION JOINT DETAIL  
NOT TO SCALE

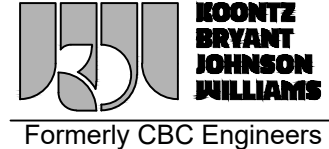
NOTES FOR EXPANSION JOINT:  
A FILTER CLOTH THREE FEET IN WIDTH AND DOUBLE THICKNESS SHALL BE APPLIED TO ALL TRANSVERSE JOINTS IN THE FOOTING AND WALLS. THE MATERIAL SHALL BE CENTERED ON THE JOINT AND THE EDGES SEALED WITH A MASTIC OR WITH TWO SIDED TAPE. THE FILTER CLOTH SHALL BE A GEOTEXTILE MEETING THE APPROVAL OF THE ENGINEER.



CONTROL JOINT TYPICAL DETAIL  
(@ 22'-0" MAX.)  
NO SCALE

- NOTES:
- 1.) CONCRETE SHALL BE  $f'_c = 4,000$  psi.
  - 2.) ALL REINFORCEMENT SHALL BE ASTM A-615, GRADE 60.
  - 3.) FOOTING IS DESIGNED FOR A 8,700 psf FACTORED BEARING RESISTANCE, AND A FRICTION FACTOR (ULTIMATE) OF 0.4. THESE VALUES MUST BE FIELD VERIFIED PRIOR TO CONSTRUCTION.
  - 4.) SCOUR IS NOT ADDRESSED HEREIN AND IS THE RESPONSIBILITY OF OTHERS THAN CBC ENGINEERS.



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JOHNSON  
WILLIAMS**  
Formerly CBC Engineers

WINGWALL SECTION & TYPICAL DETAILS			
Drawn By <b>DJH</b>	Date <b>4/18/22</b>	CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado	
Approved By	Date	Project No. <b>KBJW-24879</b>	Rev. <b>-</b>
Scale <b>GRAPHIC</b>		Sheet <b>5 OF 6</b>	



I – GENERAL

1.0 STANDARDS AND DEFINITIONS

1.1 STANDARDS - All standards refer to latest edition unless otherwise noted.

- 1.1.1 ASTM D-698-70 (Method C) "Standard Test Methods for Moisture, Density Relations of Soils and Soil Aggregate Mixtures Using 5.5-lb (2.5 kg.) Rammer and 12-inch (305-mm) Drop".
- 1.1.2 ASTM D-2922 "Standard Test Method for Density of Soil and Soil Aggregate in Place by Nuclear methods (Shallow Depth)".
- 1.1.3 ASTM D-1556 "Standard Test Method for Density of Soil in place by the Sand-Cone Method".
- 1.1.4 ASTM D-1557 "Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort."
- 1.1.5 All construction and materials shall be in accordance with the latest AASHTO LRFD Bridge Design Specifications.

1.2 DEFINITIONS

- 1.2.1 Owner - In these specifications the word "Owner" shall mean El Paso County, Colorado
- 1.2.2 Engineer - In these specifications the word "Engineer" shall mean the Owner designated engineer.
- 1.2.3 Design Engineer - In these specifications the words "Design Engineer" shall mean KBJW, Inc.
- 1.2.4 Contractor - In these specifications the word "Contractor" shall mean the firm or corporation undertaking the execution of any work under the terms of these specifications.
- 1.2.5 Approved - In these specifications the word "approved" shall refer to the approval of the Engineer or his designated representative.
- 1.2.6 As Directed - In these specifications the words "as directed" shall refer to the directions to the Contractor from the Owner or his designated representative.

2.0 GENERAL CONDITIONS

- 2.1 The Contractor shall furnish all labor, material and equipment and perform all work and services except those set out and furnished by the Owner, necessary to complete in a satisfactory manner the site preparation, excavation, filling, compaction, grading, footing construction, endwall construction as shown on the plans and as described therein.

This work shall consist of all mobilization clearing and grading, grubbing, stripping, removal of existing material unless otherwise stated, preparation of the land to be filled, filling of the land, spreading and compaction of the fill, and all subsidiary work necessary to complete the grading of the cut and fill areas to conform with the lines, grades, slopes, and specifications.

This work is to be accomplished under the observation of the Owner or his designated representative.

- 2.2 Prior to bidding the work, the Contractor shall examine, investigate and inspect the construction site as to the nature and location of the work, and the general and local conditions at the construction site, including, without limitation, the character of surface or subsurface conditions and obstacles to be encountered on and around the construction site; and shall make such additional investigation as he may deem necessary for the planning and proper execution of the work.

If conditions other than those indicated are discovered by the Contractor, the Owner should be notified immediately. The material which the Contractor believes to be a changed condition should not be disturbed so that the owner can investigate the condition.

- 2.3 The construction shall be performed under the direction of an experienced engineer who is familiar with the design plan.

I – BRIDGECOR FOOTINGS

1.0 EXCAVATION FOR FOOTINGS

- 1.1 Footing excavation shall consist of the removal of all material, of whatever nature, necessary for the construction of foundations.
- 1.2 It shall be the responsibility of the Contractor to identify and relocate all existing utilities which conflict with the proposed footing locations shown on the plan. The Contractor must call the appropriate utility company at least 48 hours before any excavation to request exact field location of utilities, and coordinate removal and installation of all utilities with the respective utility company.
- 1.3 The side of all excavations shall be cut to prevent sliding or caving of the material above the footings.
- 1.4 Excavated material shall be disposed in accordance with the plan established by the Engineer.

- 1.5 The footings are designed for a factored bearing resistance of 8,700 psf (Ultimate Bearing Resistance of 14,500 psf) based on a 0.60 resistance factor in accordance with the updated recommendations by Entech Engineering, Inc for a minimum permanent footing embedment depth of 5 feet. A friction factor of 0.34 has also been utilized based on an ultimate friction coefficient of 0.40 and the recommended sliding resistance factor of 0.85. These shall be verified in the field before construction. The evaluation and design of any required foundation improvement to achieve the recommended factored bearing resistance and friction factor, and to protect against frost and scour and settlement, is the responsibility of others than KBJW. All recommendations in the project geotechnical report shall be followed during construction.

- 1.6 Care must be exercised to ensure that heavy equipment is not operated adjacent to the footings. Heavy equipment shall not be allowed any closer than 5 feet to the footings.

2.0 CONCRETE FOOTING DIMENSIONS

- 2.1 The footings shall be reinforced in accordance with the construction drawings.

III – HEADWALLS AND WINGWALLS

- 1.0 The headwalls and wingwalls shall consist of reinforced concrete conforming to Chapter IV of these specifications, and AASHTO LRFD Bridge Design Specifications having a minimum compression strength of 4,000 psi.
- 2.0 Reinforcing steel shall conform to ASTM A-615, Grade 60, having minimum yield strength of 60,000 psi.
- 3.0 The headwalls shall be anchored to the BridgeCor box in the manner shown on the plans and shall be formed and poured in accordance with the plan dimensions.
- 4.0 Round weep holes spaced not over 5 feet on center shall be placed in the walls above finished grade as shown on the construction drawings. A granular envelope, consisting of #57 stone (clean ¾" aggregate) or equivalent, shall be placed behind each weep hole for a distance of approximately 1 foot from all edges of the weep hole. A free-draining geotextile screen shall be placed between the weep hole and the stone to prevent erosion of the stone.
- 5.0 The select backfill behind the headwalls must be a well-graded, angular, durable granular material conforming to the select backfill specifications for the BridgeCor arch placed and compacted to achieve a minimum internal friction angle of 36 degrees and a maximum unit weight of 120 pcf. The material must be placed in strict conformance with the project specifications, the manufacturer's requirements, and industry standards. The select backfill behind the wingwalls must be a well-graded, angular, durable granular material placed and compacted to achieve a minimum internal friction angle of 36 degrees and a maximum unit weight of 120 pcf. These values to be field verified.
- 6.0 All Federal, State, and Local regulations shall be strictly adhered to relative to excavation side-slope geometry and any required excavation shoring.

IV – CONCRETE FOR FOOTINGS AND ENDWALLS

1.0 CODES AND STANDARDS

- 1.1 Reinforced concrete shall conform to the requirements of Colorado DOT Standards and Section V of the AASHTO LRFD Bridge Design Specifications having a minimum compressive strength of 4,000 psi.

2.0 STANDARDS FOR MATERIALS

- 2.1 Portland Cement - Conforming to ASTM Specification C-150, Type I or II.
- 2.2 Water - The water shall be drinkable, clean free from injurious amounts of oils, acids, alkalis, organic materials, or deleterious substances.
- 2.3 Aggregates - Fine and coarse aggregates shall conform to current ASTM Specification C-33 "Specification for Concrete Aggregates" except that local aggregates which have been shown by tests and by actual service to produce satisfactory qualities may be used when approved by the Engineer.
- 2.4 Submittals - Test data and/or certifications to the Owner shall be furnished upon request.

3.0 PROPORTIONING OF CONCRETE

3.1 COMPOSITION

- 3.1.1 The concrete shall be composed of cement, fine aggregate, coarse aggregate and water.
- 3.1.2 The concrete shall be homogeneous, readily placeable and uniformly workable and shall be proportioned in accordance with ACI-211.1.
- 3.1.3 Proportions shall be established on the basis of field experience with the materials to be employed. The amount of water used shall not exceed the maximum 0.45 water/cement ratio, and shall be reduced as necessary to produce concrete of the specified consistency at the time of placement.
- 3.1.4 An air-entraining admixture, conforming to the requirements of ASTM C260, shall be used in all concrete furnished under this contract. The quantity of admixture shall be such as to produce an air content in the freshly mixed concrete of 6 percent plus or minus 1 percent as determined in accordance with ASTM C231 or C173.

- 3.2 Qualities Required - As indicated in the table below:

TABLE IV-1 QUALITIES REQUIRED	
ITEM	QUALITY REQUIRED
AASHTO Class	A
Type of Cement	I or II
Compressive Strength <i>f</i> <sub>c</sub> @ 28 days	4,000 psi
Slump, inches	2 - 4 in.

- 3.3 Maximum Size of Coarse Aggregates - Maximum size of coarse aggregates shall not be larger than 19 mm (3/4 inches).
- 3.4 Rate of Hardening of Concrete - Concrete mix shall be adjusted to produce the required rate of hardening for varied climatic conditions:
- Under 40°F Ambient Temperature – All work to be in accordance with the recommendations of ACI-306R "Cold Weather Concreting."

4.0 MIXING AND PLACING

- 4.1 Equipment - Ready Mix Concrete shall be used and shall conform to the "Specifications for Ready-Mix Concrete," ASTM C-94. Approval is required prior to using job mixed concrete.
- 4.2 Preparation - All work shall be in accordance with ACI-304, "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete." All construction debris and extraneous matter shall be removed from within the forms. Concrete shall be placed on clean surfaces, free from water. Concrete that has to be dropped four (4) feet or more shall be placed through a tremie.
- 4.3 All concrete shall be consolidated by internal mechanical vibration immediately after placement. Vibrators shall be of a size appropriate for the work, capable of transmitting vibration to concrete at frequencies of not less than 4,500 impulses per minute.

5.0 FORM WORK

- 5.1 Forms shall be of wood, steel or other approved material and shall be set and held true to the dimensions, lines and grades of the structure prior to and during the placement of concrete.
- 5.2 Forms shall not be removed until the concrete has sufficient strength to prevent concrete damage and/or drainage.
- 6.0 CURING
- 6.1 Fresh concrete shall be protected from rains, flowing water and mechanical injury for a period of seven (7) days. Loads shall not be placed on the concrete until it has reached its design strength.

7.0 REINFORCING STEEL

7.1 MATERIAL

- 7.1.1 All reinforcing bars shall be deformed bars (ASTM-A615) Grade 60.

7.2 BENDING AND SPLICING

- 7.2.1 Bar reinforcement shall be cut and bent to the shapes shown on the plans. Fabrication tolerances shall be in accordance with ACI 315. All bars shall be bent cold, unless otherwise permitted.
- 7.2.2 All reinforcement shall be furnished in the full lengths indicated on the plans unless otherwise permitted. Except for splices shown on the plans and splices for No. 5 or smaller bars, splicing of bars will not be permitted without written approval. Splices shall be staggered as far as possible.

- 7.2.3 In lapped splices, the bars shall be placed and wired in such a manner as to maintain the minimum distance to the surface of the concrete shown on the plans.

- 7.2.4 Substitution of different size bars will be permitted only when authorized by the engineer. The substituted bars shall have an area equivalent to the design area, or larger.

7.3 PLACING AND FASTENING

- 7.3.1 Steel reinforcement shall be accurately placed as shown on the plans and firmly held in position during the placing and setting of concrete. Bars shall be tied at all intersections around the perimeter of each mat and at not less than 2-foot centers or at every intersection, whichever is greater, elsewhere. Welding of cross bars (tack welding) will not be permitted for assembly of reinforcement.
- 7.3.2 Reinforcing steel shall be supported in its proper position by use of mortar blocks, wire bar supports, supplementary bars or other approved devices. Such devices shall be of such height and placed at sufficiently frequent intervals so as to maintain the distance between the reinforcing and the formed surface or the top surface within 1/4 inch of that indicated on the plans.

V - FILTER FABRIC (GEOTEXTILE SCREEN)

- 1.0 Filter fabric shall be placed at all locations shown on the construction drawings, and as necessary between all dissimilar materials to prevent soil migration and to maintain a soil-tight system.
- 2.0 Filter fabric cloth shall conform to Contech specification for C60-NW or equivalent and shall meet the following ASTM tests:

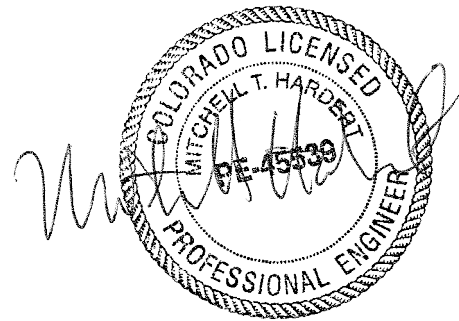
- 2.1 ASTM D4751 - Apparent opening size equal to #70 U.S. Standard Sieve Size.
- 2.2 ASTM D4632 (Grab Tensile Test) - Minimum Strength = 160 pounds.
- 2.3 ASTM D4632 (Grab Elongation) - 30-70%.
- 2.4 ASTM D4533 (Trapezoidal Tear) - Minimum Strength = 60 pounds.
- 2.5 ASTM D4355 (Stabilized for Heat and Ultra-Violet Degradation) - 70% strength retained.

- 3.0 The minimum fabric coefficient of permeability (ASTM D4491) shall be 0.24 cm/sec.

- 4.0 The fabric shall be non-woven with a minimum thickness (ASTM D5199) of 60 mils.

- 5.0 Fabric shall not be placed over sharp or angular rocks that could tear or puncture it.

- 6.0 Care should be exercised to prevent any puncturing or rupture of the filter fabric. Should such rupture occur, the damaged area should be covered with a patch of filter fabric using an overlap minimum of one (1) foot.



<div><div></div><div><b>SPECIFICATIONS</b></div><table><tr><td>Drawn By <b>DJH</b></td><td>Date <b>4/18/22</b></td><td colspan="2">CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado</td></tr><tr><td>Approved By</td><td>Date</td><td>Scale <b>GRAPHIC</b></td><td>Project No. <b>KBJW-24879</b></td></tr><tr><td></td><td></td><td>Rev. <b>-</b></td><td>Sheet <b>6 OF 6</b></td></tr></table></div>				Drawn By <b>DJH</b>	Date <b>4/18/22</b>	CONTECH ENGINEERED SOLUTIONS, LLC Design of Concrete Spread Footing Foundations, Concrete Headwalls and Wingwalls for a BridgeCOR Steel Box (705931); Sterling Ranch Road, El Paso County, Colorado		Approved By	Date	Scale <b>GRAPHIC</b>	Project No. <b>KBJW-24879</b>			Rev. <b>-</b>	Sheet <b>6 OF 6</b>
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