PACIFIC OPERATORS OFFSHORE
CARPINTERI, CALIFORNIA

HOGAN PLATFORM

JIP - TRIAL APPLICATION OF API RP 2A SECTION 17

PLATFORM ASSESSMENT AND FEEDBACK TO THE API TG 92-5

93203-FR-01

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PLATFORM ASSESSMENT
AND
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1.0 PLATFORM INFORMATION

This section provides a brief description of Pacific Offshore Operator's Hogan Platform general and specific characteristics.

1.1 GENERAL CHARACTERISTICS

Hogan Platform is located about 3.5 miles offshore Carpinteria, California, in Federal Lease OCS P-0166. This conventional twelve-legged platform was installed in a 155 ft water depth site in 1968. While the integrated drilling and production facilities were originally designed to accommodate sixty-six wells, at present only 39 of the conductors are in place and the drilling rig is not on the platform.

The platform has successfully resisted operating cyclic and extreme environmental loads since 1968. However, any future revisions to the platform will require requalification of the platform in accordance with the draft Section 17 of API RP 2A.

Some of the pertinent general characteristics of the platform are summarized on Table 1.1-1. As indicated on the Table, the drilling rig was removed following the completion of the drilling program. Platform inspections also resulted in some modification of the platform in the 1980s.

1.2 SPECIFIC CHARACTERISTICS

The platform deck structure is currently supporting about 2,720 kips of equipment and variable loads. Although a drilling rig is not on the structure, a drilling rig and associated items (i.e., setback, hook load) was considered in-place to account for a potential future drilling program.

The structural steel weight of the deck and the jacket structure was estimated to be about 5,100 kips. This total includes the weight of the piles within each of the 12 legs. The platform legs are typically 40 inches in diameter with a wall thickness of 0.50 inches. The leg joint chords are typically one inch thick and provide just adequate room for 36 inch diameter piles within.

The diagonal braces on each elevation typically vary from 24 inches in diameter at the jacket base to 18 inches in diameter near the water surface. The plan level braces typically vary from 18 inches in diameter at the jacket base to 12.75 inches in diameter near the water surface. While most brace members have a wall thickness of 0.375 inches, 0.50 inch thickness is provided to all members in the wave splash zone to provide sacrificial steel.

Some of the other specific information directly applicable to the trial application of Section 17 of API RP 2A, including original design basis and applied loading, is summarized on Table 1.2-1.

TABLE 1.1-1 GENERAL CHARACTERISTICS

CHARACTERISTIC	DESCRIPTION	COMMENTS
1. GENERAL INFORMATION		
Owner - Original	Phillips et al	
- Current	Pacific Offshore Op.	
Function	Drilling/Production	
Location	Southern California	In 155 feet water
Configuration	12-legged conventional	Piles grouted to legs
No. of Wells	66 slots	39 wells
Manning Levels	?	
Performance History	Good	
2. ORIGINAL DESIGN		
Design Contractor	McDermott	
Design Drwgs/Specs.	Yes	
Design Code	Unknown	
Design Criteria - Wave	?	Only a 43 feet wave at max. tide will hit the lower chord bottom
- Wind	?	
- Seismic	Yes	
Deck Clearance Elev.	+32.0 feet	
Operational Criteria	?	
Soil Data	Yes	
Pile Size & Penetration	12 - 36"	
Conductor Size & Penetration	39 - 18"	
Appurtenances	Fenders (4)	
3. CONSTRUCTION		
Fabr/Install Contractors/Date	McDermott	
"As Built" Drawings	?	
Construction Specifications	?	
Material Traceability Records	?	
Pile & Cond. Driving Records	?	
Pile Grouting Records	?	
4. PLATFORM HISTORY		
Environmental Loads		
Operating Loads	Reduction > 700 kips	
Survey/Maint. Records	Yes	
Repair Descriptions & Dates	Yes	
Modification Descr. & Dates	Yes, 1981/1982	
5. PRESENT CONDITION		
Deck Configuration	As-designed	
Deck Loads	Reduced to 2720 kips	
Deck Clearance Measurements	?	
Prod. & Storage Inventory	?	
Appurtenances		
Wells - No., Size etc.	39 - 18-inch	
Level I Surveys (Above Water)	Yes	
Level II Surveys (Below Water)	Yes	

NOTE: See Section 1.2 for specific data

TABLE 1.2-1 SPECIFIC CHARACTERISTICS

CHARACTERISTIC	DESCRIPTION	COMMENTS
1. ENVIRONMENTAL LOADING		
Wind Loading - Unknown	?	Glenn report (1981) lists:
Wave Loading - Unknown	?	H_{max} 35.0' @ 12.0 sec. &
Seismic Loading -		Crest elev. as +27.7'
Original Base Shear - X dir (kips)	1,695	ORIGINAL DESIGN
Associated O.M. (kip-ft)	268,063	LOADS FOR PLATFORM
Original Base Shear - Z dir (kips)	1,761	FROM 1967
Associated O.M. (kip-ft)	278,567	
1981 Base Shear - X dir (kips)	1,567	1981 McDermott Data
Associated O.M. (kip-ft)	243,608	prior to revisions
1981 Base Shear - Z dir (kips)	1,593	
Associated O.M. (kip-ft)	248,823	
2. OTHER LOADING		
Weight of Deck Equipment		
and Steel - 1967 Estimate	7,320	With two drilling rigs
- 1981 Estimate	4,580	With no drilling rigs
Weight of Jacket and		
and Appurtenances	3,122	Including piles within
Weight of Piles - above ML	included above	legs
- below ML		
Net Buoyancy - Buoyancy minus		
ballast/grout	1,400	
3. MEMBER SIZES		
Legs with Pin Piles	40.0" OD x 0.50"	
Pin Piles	+ 36.0" OD x 1.500"	
Diagonal Braces - Max.	24.0" OD x 0.375"	
Diagonal Braces- Min.	24.0" OD x 0.375"	
Plan Level Braces - Max.	18.0" OD x 0.375"	
Plan Level Braces - Min.	12.75" OD x 0.375"	

PART A: PLATFORM ASSESSMENT

A.1 PLATFORM SELECTION

An existing platform is to undergo the assessment process if any of the following conditions listed occurs:

- Addition of personnel
- Addition of facilities
- Increased loading on the structure
- Damage found during inspections

Several platforms were reviewed to identify one for the trial application API RP 2A, Section 17. Hogan platform, located offshore Carpinteria, Southern California was chosen for two reasons:

(1) The review of available data has shown that none of the platform assessment initiators listed above has occurred. However, applicable platform design criteria, methodology for the computation of applied loads and the formulations for determining component member and joint capacities have changed substantially. Thus, Hogan platform is likely to be subjected to an earthquake loading much more severe than that envisioned only fifteen years ago. Thus, Hogan platform was considered suitable for trial application of Section 17.

(2) Hogan platform may be used to drill additional wells in the near future, requiring careful assessment of the platform reserve capacity to resist both increased deck loading and a more severe seismic loading. Thus, Hogan platform is well suited for trial application.

A.2 CONDITION ASSESSMENT

A.2.1 General

Assessment of the platform was made to document all pertinent parameters that were grouped under the categories of:

- General information
- Original design
- Construction
- Platform history
- Present condition

The summary findings on the above categories are presented on Table 1.1-1. While the structure appears to be in good condition for a unit to have been in operation for over 25 years, however, it has been subjected to modifications over the years.

A.2.2 Surveys

Surveys carried out over the years and the current assessment indicate the following:

- Pin piles within each leg were grouted, thus increasing platform load carrying capacity.
- Drilling rig and some of the associated equipment were removed. Thus, the overall design functional loads are in excess of current deck loading.
- Platform did sustain some damage over the years, including cracked joints and dented/lost tubulars. Corrective measures were taken in the 1980s.

A.3 CATEGORIZATION

The exposure categories applicable to Hogan platform are as follows:

A.3.1 Life Safety

Of the three categories for life safety, the one applicable "**manned, non-evacuated**" is underlined:

- **Manned, non-evacuated**
- Manned, evacuated
- Unmanned

A.3.2 Environmental Impact

Environmental impact is defined either as "significant" or "insignificant." This platform is identified to have **"significant"** impact due to its operational characteristics.

This categorization results in the selection of the following assessment criteria:

For Design Level (**DL**) Analysis:	Extratropical storm is considered for platform site. Maximum applicable wave height is 34.0 feet. Strength Level Earthquake (SLE) spectra was developed.
For Ultimate Strength (**US**) Analysis:	Storm wave height for ultimate strength analysis should yield an acceptable RSR. A 46.0 feet wave crest reaching lower deck chord may be considered. Ductility Level Earthquake (DLE) spectra was defined to yield a base shear equal to twice the SLE base shear.

A.4 DESIGN BASIS CHECKS

The first query on determining the design basis checks is the location of the platform. Hogan platform is Offshore Southern California, subjected to much higher seismic loading than loading associated with extreme extratropical storms. It was designed to meet a reasonable seismic loading. However, seismic criteria applicable to both onshore and offshore design work in California has become more severe in the last two decades.

Thus, the platform requires sequential analysis checks as discussed in the following section.

A.5 ANALYSIS CHECKS

A.5.1 Design Criteria and Loads

Metocean criteria used during the original design are not known. Glenn report of 1981 recommends the use of 35.0 feet maximum wave height for this location. Current API requirements for this site require the use of 34.0 feet with an associated wave period of 12.0 seconds.

- Maximum wave and wind loading on the platform, based on 20th Ed. of API RP 2A, is 625 kips along platform x-axis.
- Maximum wave and wind loading on the platform, based on 20th Ed. of API RP 2A, is 601 kips along platform y-axis.

The original design is based on a 1,695 kip base shear acting along the platform x-axis while a 1,763 kip base shear is acting along the platform y-axis. The original base shears are much higher than storm environment loads computed now. The same design base shears are likely to be lower than seismic loads based on current criteria.

Application of draft Section 17 requirements resulted in the selection of wave heights, wave periods, current velocities and the computation of a series of parameters. A summary of omnidirectional metocean criteria is presented in Appendix A.

A complete computer model of the platform was developed and the environmental loads generated based on the metocean criteria summarized in Appendix A. Resulting base shear and overturning moments are summarized on Table A.5.3-2.

A.5.2 Screening

During the development of draft Section 17 an approach defined as "screening" to allow passing of the platform based on the assessment of applied loading was considered. Establishing the adequacy of a platform based on such a simplified procedure requires a thorough understanding of applied loads on the platform and the response of the platform to these applied loads.

Since substantial uncertainties exist as to the design basis, applied loading, stress distribution within the platform as well as the condition of the platform components, the "screening" procedure is considered not applicable.

A.5.3 Design Level Analysis

Deck Height Criteria:

Based on Section 17, applicable extratropical storm wave height of 34 feet can have a crest height of about +28 feet during high tide. Since the lower deck chord is at +32 feet elevation the crest clears the deck with ample freeboard.

For the ductility level extreme storm, the wave crest may reach the lower deck of the platform. However, this is academic as the storm environment loads do not control the overall platform design or its survivability.

Other Parameters:

Other parameters used in the determination of the applied environmental loads are summarized on Table A.5.3-1.

TABLE A.5.3-1

DESCRIPTION	MAGNITUDE	COMMENTS
Storm Tide (ft)	6.0	
Marine Growth from		
Inspections h > 5'	0.0	Inches on diameter
h = 0'	6.0	
h = -155'	1.0	
Drag Coefficient		
C_d @ h > 5'	0.65	
C_d @ h < 5'	1.05	
Inertia Coefficient		
C_m @ h > 5'	1.6	
C_m @ h < 5'	1.2	
Wave Spreading Factor	1.00	

The SLE response spectrum acceleration used in this study is defined with the following formulas for Pseudo Acceleration PSA (defined in "g"):

$PSA = 0.25$ for period $T < 0.05$ seconds

$PSA = 100\ T^{2.0}$ for $0.05 < T < 0.10$ seconds

$PSA = 1.00$ for $0.10 < T < 0.50$ seconds

$PSA = 0.392\ T^{-1.352}$ for $0.50 < T < 4.00$ seconds

The appropriate design response acceleration spectra for Hogan platform was not available. Based on an input from Fugro West, Inc. (See Appendix AAA9. References) a response spectrum (i.e., acceleration versus period) given above was prepared for this study. Although this SLE spectra is assumed to be conservative and appropriate (i.e., for this study), any future work would require an SLE spectra developed based on seismic hazard analysis.

Applied Loads:

Storm environmental loads generated for the **DL** analysis range from a low of 601 kips to a high of 625 kips (See Table A5.3-2). Application of SLE response spectra yields base shears of 2,474 kips along the x-axis and 2,283 kips along the y-axis, respectively. Applying 100% SLE loading along both x- and y-axes result in an overall diagonal resultant load of over 3300 kips, the actual magnitude depending on whether a SRSS or a CQC method is chosen.

Table A5.3-2 provides a summary of the applied loads on the platform.

TABLE A.5.3-2 ENVIRONMENTAL LOADING BASED ON DESIGN LEVEL ANALYSIS

DIRECTION DESCTIPTION	PLATFORM X-AXIS	PLATFORM Y-AXIS	COMMENTS
WAVE DATA Height (ft) Period (sec) **SLE Criteria**	 34.0 12.4 See Appendices	 34.0 12.4	 Omnidirectional
BASE SHEAR (kips) Wind, Wave and Current SLE	 625.0 2,474.0	 601.0 2,283.0	 SLE Controls Design Resultant diagonal 3,355 kips

Analysis Validation:

The computer model was first validated by applying symmetrical quality control loads at the deck level in the x-, y-, z-axes and verifying the load path by reviewing the reactions. The applied functional and environmental loads were validated and the platform reactions reviewed.

Platform distortions at the jacket/pile interface and the deck level were then reviewed for their compatibility with the applied loads and the range of viable foundation response.

Member Utilizations:

Platform response to the Design Level loading meets the design criteria. As-designed jacket member utilizations are generally within the allowable limits. However, application of a more severe seismic loading (i.e., an average of 40% increase over original design base shears) results in more than a dozen members exceeding the allowable 1.0 utilization ratio. However, half of these members are within 10% of the limiting ratio and can be shown to meet the criteria by computing member slenderness ratios as a function of supporting joint rigidities.

Based on the SLE spectra used, only four members have excessive combined stress levels. Should this spectra prove to be appropriate, these four members will require further review to determine appropriate corrective measures.

Joint Utilizations

The joint utilization checks reveal that many joint cans do not meet the 20th edition of API RP 2A. A majority of the overutilizations noted fail to meet Section 2.3.6e of the API RP 2A. This requirement, not in existence at the time of the platform design, stipulates that all joint cans are to be designed to the full capacity of the member connecting to the joint. The objective of Section 2.3.6e is to prevent premature collapsing of a platform due to the unzipping effect of joints failing in advance of the members connected to them. However, it should be noted that:

- All primary brace members are connected to leg cans. The leg cans, typically one inch thick, are grouted to the 36 inch pile within the legs. Thus, provided grouting was performed properly, the primary joint cans have the capacity to resist full component member loads.

- Some of the joints not meeting the objective of Section 2.3.6e are internal plan level brace-to-brace connections. Stress levels are generally low and the joints are not likely to develop their full capacities.

The joint cans adjacent to the conductor framing area at each level require further scrutiny. Actual condition of such joints (i.e., defects, cracks, etc.) may have a greater impact on the load path at each plan level.

A.5.4 Ultimate Strength Level Analysis

A Ductility Level Earthquake (DLE) Push Over analysis (i.e., Ultimate Strength) was performed at a load level equal to twice the SLE loading. Thus, the base shears associated with loading along the x- and y-axes were 4,950 and 4,565 kips, respectively. Since the recommended loading combination is to apply 100%, 100%, and 50% of the loading along platform X-, Y- and Z-directions, the resultant lateral DLE loading was equal to 6,710 kips. Push Over analysis was performed up to 140% of the DLE (i.e., 2.8 times the SLE) loading, where the analysis solution failed to converge.

PART A: PLATFORM ASSESSMENT

Deck Height Criteria:

The deck height criteria will be met for extratropical storm waves more than 25% higher than the design level 34.0 feet wave. However, seismic loading controls Hogan platform assessment and no additional effort was expended in evaluating an ultimate strength level wave height.

Environmental Loads:

Ductility Level Earthquake loading was taken equal to be twice the design (i.e., strength) level loading applied on the platform. As stated above, the base shears associated with the DLE loading were 4,950 kips along the x-axis and 4,565 kips along the y-axis, yielding a resultant base shear equal to 6,710 kips along the diagonal axes.

Analysis Validation:

The ultimate strength level analysis model used for the Push Over study is essentially the same as the strength level analysis model and further discussed in Section 7. Applied load paths and platform deformations were reviewed and found to be valid.

Platform Response and Member Capacities:

A total of 29 load increments were applied to reach to the 9,394 kip base shear level, which is 2.8 times the SLE base shear of 3,355 kips. The first tubular to reach its capacity is the 36-inch diameter stab-on leg extending from one platform corner to the deck directly above. This event is associated with load increment no. 11, when the applied lateral load along the platform diagonal axis is equal to 3,690 kips and the deck level lateral displacement is 4.6 inches. It should be noted that the first member to reach capacity does so at a base shear level 10% above the SLE base shear of 3,355 kips. As expected, the next component to reach capacity is the adjacent stab-on leg at load increment no.12. Both legs reach the capacity, forming single hinges.

As illustrated on Table A7.2-1, the next series of components reaching their capacity are the tubular braces in buckling mode, forming double hinges. The components reaching their capacities are also identified on Figures in the Appendices. As illustrated on these figures, the components reaching their capacity are either tubular leg members or brace members connecting the legs.

The upper bound collapse load for Hogan platform may be taken as 2.8 times the SLE load (i.e., Reserve Strength Ratio, RSR = 2.8) when all of the joint cans have the capacity to carry loading associated with full member capacities. This conclusion is valid even if some of the joint can capacities are degraded due to possible grouting imperfections. However, if a large number of joint cans are grouted improperly and may not be developing the connecting member capacities, platform response to the applied loads will change and the RSR will be reduced.

Considering that component members to reach capacity first were the stab-on legs and the number of diagonal braces reaching capacity did not occur until load step 18 (i.e., RSR = 1.8) a 2.0 RSR should be achieved even with joint cans not having full capacity. A more comprehensive Push Over analysis, accounting for elasto-plastic capacity of each joint based on "as-is" condition, should confirm the validity of adequacy of RSR. One such approach, accounting for joint can deformations, was attempted during this study. However, time constraints of the study and lack of information on "as-is" condition of the joint cans did not allow incorporation of joint deformation/capacity parameter into this study.

Further discussion on the findings is presented in Section 7.

A.6 MITIGATION ALTERNATIVES

The structure is able to resist environmental loads more than twice the strength level loading.

Thus, while no mitigation alternatives are considered at present, key diagonal members and joint cans are identified for a closer review during next planned platform inspection. When such a review is performed, an up-to-date SLE response spectra based on a seismic hazard analysis should be developed.

A.7 SUMMARY OF FINDINGS AND CONCLUSIONS

A.7.1 Design Level Analysis

Platform Deformations

The deck displacements are linear with increase in the applied loads for the design level analysis. At full design level loading the deck lateral displacements average about 7 inches.

Member Utilizations

Application of a more severe seismic loading (i.e., an average of 40% increase over original design base shears) results in more than a dozen members exceeding the allowable 1.0 utilization ratio. However, half of these members are within 10% of the limiting ratio and can be shown to meet the criteria by computing member slenderness ratios as a function of supporting joint rigidities.

Implication of Findings - Conclusions

Based on the SLE spectra used, only four members have excessive combined stress levels. Should this spectra prove to be appropriate, these four members will require further review to determine appropriate corrective measures.

A.7.2 Ultimate Strength Level Analysis

An ultimate strength level analysis consisted of pushover analyses of the platform by applying 100% of the DLE loading in both platform X- and Y-axes and applying 50% of the DLE loading along the vertical Z-axis of the platform. Hogan platform has an RSR of over 2.8. At the 29th load increment, with the resultant lateral load (i.e., base shear) of 9,394 kips, the analysis solution failed to converge.

Hogan structure is over 25 years old and some of the components (both tubulars and joints) will not have their "as-designed" capacities. However, even accounting for some degradation, platform appears to have adequate reserve capacity.

Tracking of Components Reaching Capacity

The pushover analysis was performed until the structure collapsed. Each member component's "capacity ratio" was tracked for each incremental load step. Members reaching capacity are noted on figures with the member number, incremental load step number and whether a single or a double hinge was formed. These figures are presented in the Appendices. A tabular summary of these findings is presented on Table A7.2-1.

Platform Response and Reseve Capacity

The platform response was linear up to load increment (i.e., step) 18 when the resultant base shear reached 6,039 kips (i.e, RSR of 1.8). Platform nonlinearity increased beyond this load step until a converging solution was not obtained on step 29 at RSR of 2.8.

Conclusions

For the purposes of this trial application only, the ultimate strength level analysis indicates that this platform would pass the requalification assessment based on the Draft API RP2A Section 17 requirements.

Load Step	Lateral Displ. at Deck (in.)	Lateral Load (kips)	Elements at Capacity	Component Capacity Mode	Remarks
2	0.91	671			
4	1.82	1,420			
6	2.74	2,013			
8	3.67	2,684			
10	4.59	3,355	None		
11		3,690	XVD35	Single Hinge	DH Step 12
12	5.52	4,026	XVC35	Single Hinge	DH Step 13
14	6.53	4,697	DAB11	Buckling-DH	
			DAB14	Buckling-DH	
			DAB34	Buckling-DH	
			XVB15	Double Hinge	
15		5,032	DD211	Buckling-SH	DH Step 16
			DD214	Buckling-DH	
			DAB21	Buckling-DH	
			DAB24	Buckling-SH	DH Step 16
16	7.56	5,368	213	Buckling-DH	
			DAB13	Buckling-SH	DH Step 17
			DBC12	Buckling-DH	
17		5,703	DC211	Buckling-SH	DH Step 17
			DB211	Buckling-SH	DH Step 18
			DD213	Buckling-DH	
			DBC13	Buckling-DH	
			DBC14	Buckling-DH	
			DBC22	Buckling-DH	
18	8.60	6,039	D104	Tension-DH	
			313	Buckling-DH	
			413	Buckling-DH	
			D404	Buckling-DH	
			DD212	Buckling-DH	
			DAB12	Buckling-DH	
			DAB22	Buckling-DH	
			DAB23	Buckling-SH	DH Step 19
			DAB33	Buckling-DH	
			DBC11	Buckling-SH	DH Step 20
			DBC21	Buckling-SH	DH Step 21
			DBC32	Buckling-DH	
			DBC34	Buckling-SH	DH Step 19
			XVB25	Buckling-SH	DH Step 22
19		6,274	XVD25	Buckling-DH	
			D504	Buckling-DH	
20	10.23	6,710	113	Buckling-DH	
			D204	Buckling-DH	
			DA211	Buckling-SH	DH Step 22
			DAB31	Buckling-DH	
			DAB32	Buckling-DH	
21		7,045	DAB33	Buckling-DH	
			DBC23	Buckling-DH	
			DBC31	Buckling-SH	
			XVC25	Buckling-DH	DH Step 23

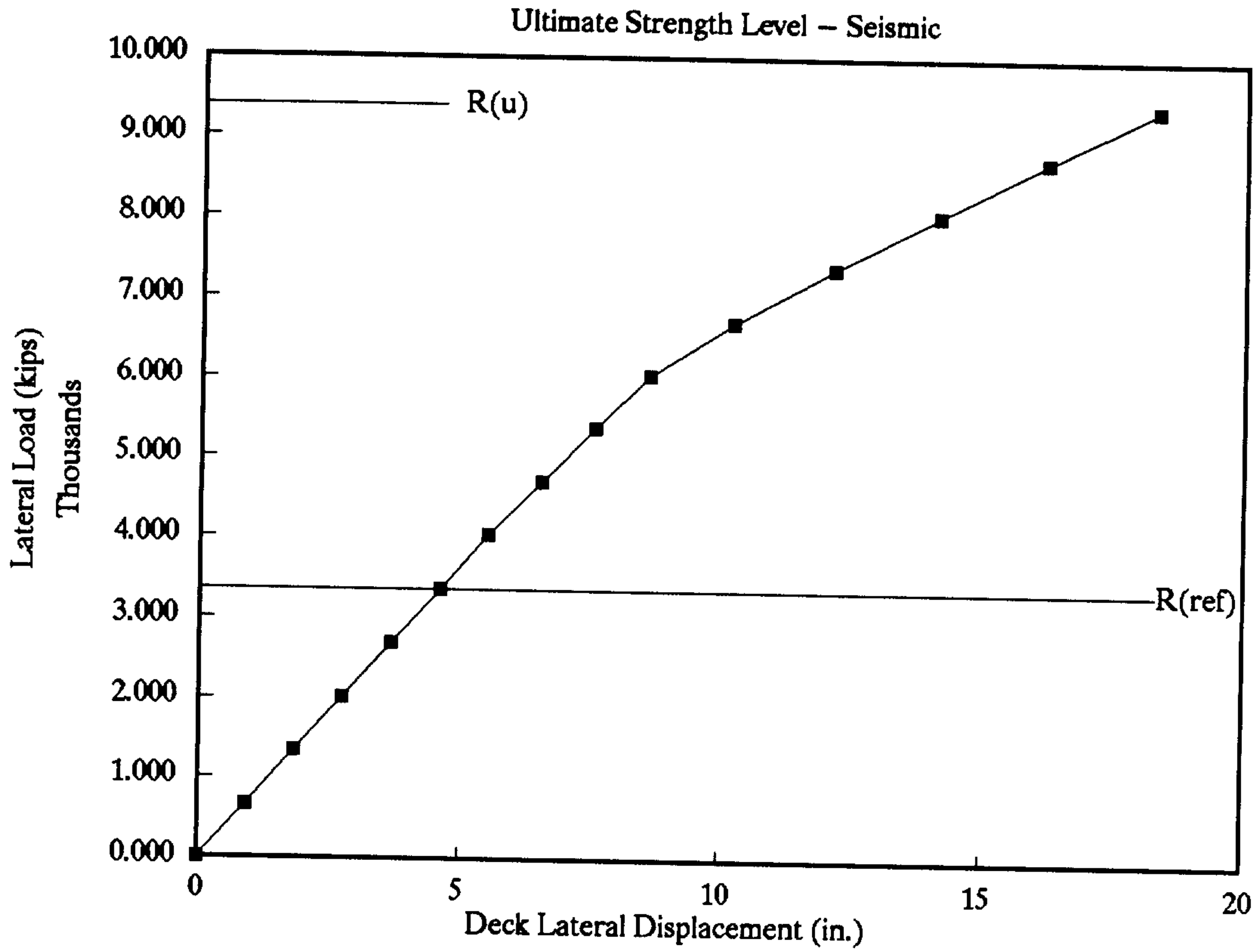
SH = Single Hinge, DH = Double Hinge

Table A7.2-1 (Sheet 1 of 2)
Ultimate Strength Analysis Results - Ductility Level Earthquake

Load Step	Lateral Displ. at Deck (in.)	Lateral Load (kips)	Elements at Capacity	Component Capacity Mode	Remarks
22	12.17	7,381	DC214	Buckling-DH	DH Step 27
			B501	Buckling-SH	DH Step 24
23		7,716	D304	Buckling-DH	
			DB214	Buckling-SH	
			T116	Single Hinge	
24	14.17	8,052	B104	Buckling-DH	
			323	Buckling-DH	
			A404	Buckling-DH	
			DBC24	Buckling-DH	
25		8,387	A104	Buckling-DH	
			B204	Buckling-DH	
			333	Buckling-DH	
			B404	Buckling-DH	
			DA212	Buckling-DH	
			DA213	Buckling-DH	
			XVD15	Single Hinge	DH Step 29
26	16.21	8,723	133	Buckling-SH	DH Step 27
			233	Buckling-DH	
			433	Buckling-DH	
			533	Buckling-SH	DH Step 27
			A204	Buckling-DH	
			C304	Buckling-DH	
			DA214	Buckling-SH	DH Step 27
			DCD14	Tension-DH	
			DCD21	Tension-SH	DH Step 29
			DC231	Tension-SH	DH Step 29
			XVB35	Single Hinge	
			T117	Single Hinge	
27		9,058	B304	Buckling-DH	
			C104	Buckling-SH	
			D501	Single Hinge	
			DCD11	Tension-SH	
			TA17	Single Hinge	
			TB17	Single Hinge	
28	18.31	9,394	423	Buckling-DH	
			513	Buckling-DH	
			T111	Single Hinge	
			T112	Single Hinge	
29	Collapse	9,394 +/-			

SH = Single Hinge, DH = Double Hinge

Table A7.2-1 (Sheet 2 of 2)
Ultimate Strength Analysis Results - Ductility Level Earthquake



Reference Level Load, (S_{ref})	n/a
Strength Level Earthquake Load (SLE)	3,355 kips
Ultimate Strength Level Load (USL)	6,710 kips
Ultimate Capacity (R_u)	9,394 kips
Reserve Strength Ratio (RSR) - to SLE	2.8
Platform Failure Mode: Jacket, Pile, Soils, etc.	

Figure 7.2-1
Ultimate Strength Level Load-Displacement Results - Platform Diagonal Axis

PART A: PLATFORM ASSESSMENT

APPENDIX AA

METOCEAN CRITERIA SUMMARY

RESPONSE SPECTRUM ACCELERATION

PART A: PLATFORM ASSESSMENT

METOCEAN CRITERIA SUMMARY

METOCEAN CRITERIA FOR EACH DIRECTION	DRAFT DLA	SEC. 17 DLE	API RP 20TH	COMMENTS
NORTH				
Wave Height, H(ft)	34.0		45.0	API RP 2A 20TH
Wave Period, T (sec)	12.0		12.6	Range 35-55
Current				1/18 slope taken
Blockage Factor	0.80		0.80	Assumed same
Velocity (knots)	1.00		1.00	
Velocity (fps)	1.67		1.67	
Direction	North		North	
Wave dir V (fps)	1.67		1.67	
Computed Parameters				
V / gT	0.004		0.004	
d / gT^2	0.035		0.035	
T_s / T	1.035		1.035	
Apparent Period, T_s	12.4		13.0	
H / gT_s^2	0.007		0.008	
d / gT_s^2	0.033		0.030	
Wind (1 hr at 10m)				
velocity (knots)	45		50	
velocity (mph)	52		58	
SOUTH				
Wave Height, H(ft)	34.0		45.0	API RP 2A 20TH
Wave Period, T (sec)	12.0		12.6	Range 35-55
Current				1/18 slope taken
Blockage Factor	0.80		0.80	Assumed same
Velocity (knots)	1.00		1.00	
Velocity (fps)	1.67		1.67	
Direction	South		South	
Wave dir V (fps)	1.67		1.67	
Computed Parameters				
V / gT	0.004		0.004	
d / gT^2	0.035		0.035	
T_s / T	1.035		1.035	
Apparent Period, T_s	12.4		13.0	
H / gT_s^2	0.007		0.008	
d / gT_s^2	0.033		0.030	
Wind (1 hr at 10m)				
velocity (knots)	45		50	
velocity (mph)	52		58	

RESPONSE SPECTRA ACCELERATION

PERIOD (SEC)	PSEUDO ACCELERATION (% g)	COMMENTS
0.00	0.25	Constant PSA = 0.25 to T = 0.05 sec
0.05	0.25	
0.07	0.49	T > 0.05 sec
0.09	0.64	PSA = 100 $T^{2.0}$
0.10	0.81	T < 0.10 sec
0.30	1.00	T > 0.10 sec
0.50	1.00	PSA = 1.0 to T < 0.50 sec
0.75	0.578	T > 0.50 sec
1.00	0.392	PSA = 0.392 $T^{-1.392}$
1.50	0.227	to T < 4.0 sec
2.00	0.154	
2.50	0.114	
3.00	0.089	
4.00	0.060	
1000.0	0.001	

APPENDIX AAA

ANALYSIS DETAILS

PART A: PLATFORM ASSESSMENT

AAA1. INTRODUCTION

This section presents the background information applicable to the assessment of Hogan platform. The analysis details discussed in this section relate to the computer modeling, applied loads, analytical procedure and the specifics of some of the findings.

AAA2. COMPUTER MODEL

The platform jacket, deck and foundation structure and applicable appurtenances, including conductors, caissons and risers, were modelled using the structure analysis and design software ASADS (Advanced Structures Analysis and Design System).

TOPOLOGY

A three-dimensional space frame computer model generated for the **DL** analyses was revised to meet the **US** level "Push Over" analysis objectives. Conductor, caisson and riser members were modelled only for the purpose of load generation. The conductors offer substantial resistance to applied environmental loading and were included in the analysis. Member sizes were taken from available platform sketches and work undertaken by others.

PROPERTIES

Tubular members were typically input as one-segment prismatic tubulars with specified outside diameter and thickness. Built-up plate or wide flange girder members were input as one-segment prismatic girder members unless specific size variations are indicated on the drawings. Input will be further revised to reflect on-going design effort.

Equivalent pile-soil matrices were determined for a range of nonlinear foundation response to **DL** and **US** analysis loadings. The validity of the assumed matrices was confirmed prior to the initiation of "Push Over" analysis. At each step of the **US** analysis, platform stiffness matrices were recomputed.

Jacket appurtenances consist of conductors, caissons, and risers. These are all included in the model for load generation. Only the structural members remain active for the Push Over analyses.

AAA3. FUNCTIONAL AND ENVIRONMENTAL LOADS

FUNCTIONAL LOADS

Deck equipment and variables load were computed based on available information. The following table provides a summary of functional loads.

All equipment and variable loads were input as concentrated loads at the upper and lower deck levels. Steel selfweight, buoyancy and ballast were internally computed.

LOADING	DESCRIPTION	MAGNITUDE	COMMENTS
1	All Deck Equipment and Variables	2,521.5	
2	Drilling Rig & Variables	1,425.0	Planned future utilization of rig
'DEAD'	Steel Selfweight	5,102.0	
'BUOYANCY'	Net Buoyancy	-2,053.0	Buoyancy minus ballast

ENVIRONMENTAL LOODS

Although environmental loads do not control platform assessment, based on API RP 2A recommendations wind, wave and current loads acting on the Hogan platform were generated. A resultant load of 625 kips along the platform x-axis and 601 kips along the platform y-axis are substantially smaller than the Strength Level Earthquake loads.

AAA4. MASS MODEL

The mass model of the platform was generated to accurately represent Hogan platform. The mass model incorporated the deck mass, jacket mass, appurtenance mass, added mass, mass due to marine growth and contained mass. Added mass is the mass of water assumed to move in unison with the member as it displaces through the water and is dependent on the direction of movement of the member. For tubulars moving perpendicular to its axis, a value of mass numerically equal to the water mass displaced by the submerged member will be used. contained mass is the fluid contained or enclosed by the members.

For this analysis, the water depth was taken to be mean sea level (MSL). All members below MSL will therefore have added mass. All jacket leg members below MSL are assumed to be flooded; all other members will be assumed to be unflooded.

All platform mass were appropriately lumped at modelled nodes in a manner that ensures the overall center of mass is maintained. The total platform mass output was confirmed during the execution of analyses.

COMPUTER GENERATED MASS

The program ASADS calculates the added mass, entrained water mass, marine growth mass and structure mass for every active tubular and conical structure member in the model. Structure mass is determined for all member types excepting equivalent stiffness matrices.

The added mass is assumed equal to the displaced water mass of all tubulars below MSL. The contained water mass is generated for all flooded members. Marine growth is accounted for on all applicable members when evaluating added mass. The marine growth mass were generated based on the design marine growth profile specified and the outside diameter of the jacket members.

The structure mass of all modelled members was generated based on the member properties in the model. An allowance was made to account for additional node and stiffening steel. Sacrificial steel thickness provided to all members in the splash zone were neglected for stress determination but its mass were included for mass and load generation.

The pile mass above mudline and attributable hydrodynamic mass were internally generated by ASADS. Total foundation mass was output and confirmed prior to analysis.

EXPLICITLY INPUT MASS

The mass that cannot be automatically generated by ASADS, such as deck equipment and flare structure, were hand-calculated prior to analysis and allocated to the appropriate center of gravity positions on the model.

Masses on the deck were lumped at primary truss intersection nodes according to the overall center of mass. Weights for consumable or variable items were included in the deck mass while live loads such as the hook load were not.

Mass due to non-modelled components were explicitly input; all other mass was internally generated by ASADS based on input member properties. Conductors, caissons and risers were modelled for the purposes of mass generation. Total deck mass was output and confirmed prior to the analysis.

AAA5. PLATFORM CHARACTERISTICS AND BASIC LOAD CASES

The mass model generated is summarized in the following table:

LOADING	DESCRIPTION	MASS-X	MASS-Y	MASS-Z
A	INERTIAL	172.9	172.9	172.9
B	ADDED	31.0	32.0	19.9
C	FLOODED	34.0	34.0	34.0
D	MARINE GRO	87.8	87.8	87.8
E	ADDED JOINT	205.3	205.3	110.0
TOTAL		531.0	532.0	424.5

The platform primary natural periods computed were 1.98 and 1.92 seconds along platform x- and y-axes. Overall dynamic participation factors were 0.96, 1.06, and 1.05 along the platform x-, y-, and z-axes. Platform principal mode deformations are illustrated on a series of figures at the end of Appendix AAA.

AAA6. BASIC LOAD CASES

STILLWATER LOAD CASES

This section summarizes dead, live, buoyancy and ballast load conditions implemented on completed **DL** analysis and the revisions introduced for **US** level analysis.

Dead loading was generated by ASADS for all beam-type members based on input cross-sectional areas and input or assumed weight densities. Dead load for facilities, equipment, non-modelled appurtenances and other significant structure (e.g. mudmats) was hand-calculated and explicitly input at the appropriate location.

Generalized area loads were developed based on equipment weights applied to the deck structure.

Deck area live loads were modelled per the Design Basis with appropriate reductions for the primary platform structure in recognition of the fact that not all areas will be loaded simultaneously to their design live load. Deck area live loads were modelled as linear live loads on adjacent modelled girders as a function of deck beam framing orientation. Deck area live load conditions were developed for each deck level and may be further subdivided to allow subsequent load combinations utilizing varying combinations of live load.

Buoyancy loads were generated by ASADS for all tubular members below MSL.

DL AND US LEVEL "PUSH OVER" LOAD COMBINATIONS

Stillwater condition loads were combined with the seismic loads applied along all three orthogonal axes of the platform.

Load Factors and Stillwater Condition

A stillwater loading combination developed consisting of the following load conditions for both **SLE** and **DLE** analyses were used for the analysis:

- Deck facilities and equipment and other load
- Deck live load
- Jacket and deck dead (self weight) load
- Jacket buoyancy load

DL and US Level Load Combination

The loading combinations consist of the stillwater load condition and seismic loading. For the Design Level (DL or SLE) analysis loads generated were combined accordingly:

- Stillwater condition + 100% of DL level in X direction + 100% of DL level in Y direction + 50% of DL in Z direction

For the Ultimate Strength (US or DLE) level incrementally increasing lateral load condition was used:

- Stillwater condition + 100% of US level in X direction +100% of US level in Y direction + 50% of US level in Z direction

AAA7. ANALYSIS METHOD AND VALIDATION

GENERAL METHODOLOGY

DL analysis was performed following standard procedures and require no further discussion. The US Level analyses require further discussion. It may be performed by implementing either one of the following methods:

- Push-Over Method
- Time-Domain Method
- Equivalent Method

The Time-Domain Method will accurately capture structural dynamic response due to excitational loads. An alternate Equivalent Method (such as Serrahn's FOURDYN, Reference 4), utilizing a Frequency-Domain method that incorporates dynamic modes (each with its own participating factor through the use of Fourier Series) can be effectively used to capture dynamic response of the structure to excitational loads. Since the Grand Isle platform dynamic response to excitational loads will be negligible, both of the methods described are not applicable for such platforms.

A Push-Over Method was used in the project to effectively track the performance of platform by incrementally increasing the applied loads. The **US** analysis results are directly applicable for Push Over analysis. A fraction of this loading was applied on the platform and incrementally increased after each step. The following generalized steps were taken:

- Apply stillwater load condition; reformulate component stiffness and iterate if any component reaches capacity.
- Incrementally apply the pushover loading, reformulate the component stiffnesses for components reaching capacity.
- Iterate to find the solution for each increment of load application.
- Conclude the analysis at structure collapse or at the application of predefined loading level **(US or higher)**, whichever occurs first.

To conservatively assess the overall reserve capacity of the platform an initial Push Over analysis was first performed for the actual **US** loading. This effort indicated total number of components reaching capacity and overall load absorption capacity of the platform.

LINEAR VERSUS NONLINEAR BEHAVIOR

All jacket tubular members were modelled as nonlinear beam-column members. Deck non-tubular members were not expected to reach capacity; thus for the purposes of analysis efficiency, all non-tubular deck members were modelled as linear truss (strut) members. Piles were modelled as non-linear beam-columns with additional orthogonal linear strut elements to properly model the pile head loads and resultant pile response during the analysis.

Understressed component members and members contributing little to overall resistance of the platform to increased Push-Over loading could have been defined as linear members since such members are expected to perform elastically throughout the ultimate strength level Push Over analysis. However, all jacket members were defined as non-linear beam-columns to validate the assumption. Deck girders and beams, secondary members, and non-structural members were considered to be good candidates for such a definition and some of these were modeled as linear struts. Analysis validation included review of all members to ensure that the elastic behavior assumption for these members were maintained.

Those members defined to have nonlinear behavior can be defined by material stress-strain relationship in resisting applied axial compression or tension and bending. When a member reaches its yield load capacity, its post-yield capacity is determined. Initially, post failure may be defined to be zero capacity. However, since such an approach is conservative and will lead to erroneous tracking of any potential collapse mechanism, components reaching their capacities were defined as a function of their properties and deformations. Two basic types of linear/nonlinear elements can be used to define member behavior:

- Strut Elements: Platform braces expected to fail primarily in axial tension/yielding or axial compression/buckling may be modeled with strut-type elements which account for reductions in strength and stiffness after yielding/buckling. Typically, member slenderness and D/t ratios influence performance of such members.

  The assumed post-yield/buckling capacity is the yield/buckling capacity. This is equivalent to a strain-hardening ratio of 0.0.

- Beam-Column Elements: Platform legs, piles and other members with low slenderness ratios and high bending stresses will be defined as Beam-Column Elements. These members are primarily expected to fail due to high bending stresses with increases in the applied loading. Beam-Column elements will effectively account for axial and bending interaction and facilitate definition of reduction in capacity with progressive elasto-plastic hinge formation.

ANALYSIS VALIDATION

A linear analysis is not considered to be valid unless it is compatible with the nonlinear foundation system. At the beginning of **DL** analysis, pile top reactions and displacements were obtained for the highest utilized pile and compared with the nonlinear pile response. Typically, if adequate compatibility is not obtained, revised equivalent pile stiffnesses are determined. The global stiffness analysis will then be rerun and another compatibility check performed until adequate pile compatibility is obtained.

Same approach is implemented in the Push-Over analysis. Since static equivalent loading is applied, the pile-structure interaction can be automatically accounted for and compatibility achieved at each step of the analysis. However, an automated pile-structure interaction option was not used during the analysis of the platform and instead, compatibilities checked at predefined load increments manually.

Other validation efforts include, but are not limited to the following:

- The assumption of elastic behavior for selected members was verified for these members at the end of the **US** level analysis.

- The effect of member post-failure capacities on the overall platform behavior and reserve strength was reviewed to assess their impact on failure path.

AAA8. MEMBER AND JOINT DESIGN

Member forces and moments obtained from the **DL** loading combinations previously discussed was used for member strength and stability checks. In general, all tubular members and joint chords were checked against the requirements of API RP 2A, 20th Edition (Reference 2). Wide flange shapes and truss connections were generally checked against the requirements of AISC, 9th Edition (Reference 3).

LIMITING STRESSES

The **DL** design loading combinations were checked against 1.70 times basic allowable stresses; i.e. 70 percent increase in basic allowable stresses. The stillwater loading was also checked at basic allowable stresses.

JACKET MEMBERS AND JOINTS

All tubular members were checked for adequacy against the following failure modes:

- yield
- local buckling
- column buckling
- bending alone
- shear
- external hydrostatic pressure
- combined axial and bending
- combined axial, bending and external hydrostatic pressure

Column buckling effective length factors (K) for all members were based on API RP 2A recommendations.

For code checking, unbraced lengths were taken as the joint-to-joint (work point to work point) length for all members provided that they are adequately braced in orthogonal directions. For bracing members which may be supported in only one direction, two member unbraced lengths were computed, each length being the actual unbraced length in that direction.

Bending moment reduction factors (Cm) for all members were based on the recommendations of API RP 2A. In general, utilization ratios were determined at the two ends and at midspan. The target utilization ratio for members reaching capacity was defined as 1.0.

Member utilization ratios were summarized by member and by utilization ratio for all utilizations at each **US** step to facilitate review of potential failure paths.

Unstiffened simple tubular joints were checked for punching shear in accordance with API recommendations. The target joint utilization for failure definition was 1.00.

The punching shear check utilized API RP 2A's "nominal loads method" to determine punching shear utilizations. It should be noted that all joints were checked to meet the requirements of API RP 2A, Section 4.1.1-1.

FOUNDATIONS

Foundation members consist of piles and the pile/jacket interfaces. The piles were modeled as non-linear "Beam-Column" elements and checked against degradation of their load carrying capacity due to elasto-plastic hinge action.

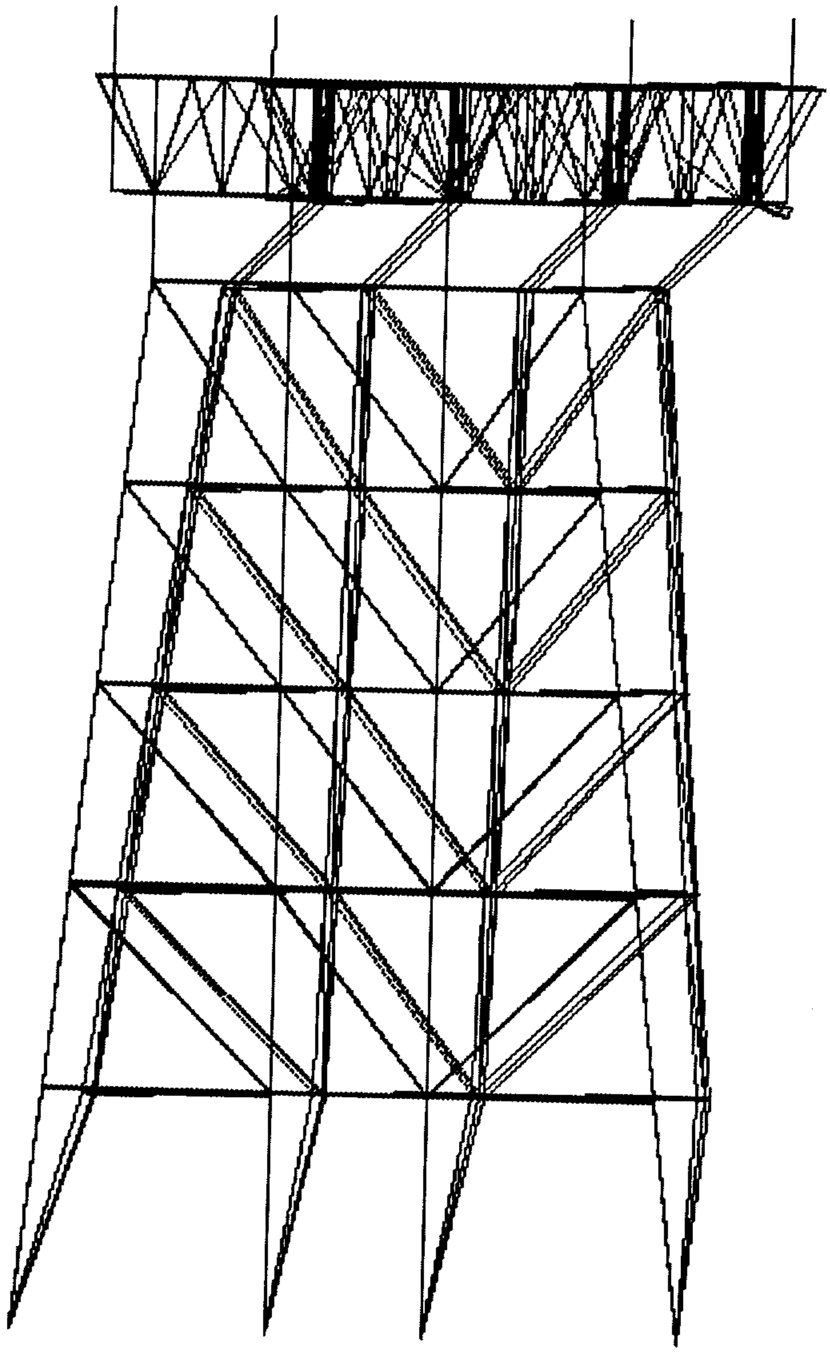
Since the plastic hinge formation occurs due to combined axial compression and bending effects, elasto-plastic capacity of piles were determined for a range of load combinations and deformations.

AAA9. REFERENCES

1. Letter entitled: "Cursory Preliminary Review of Seismic Hazard, Platforms Hogan and Houchin, Federal OCS P-0166, Carpinteria Offshore Field", transmitted by Fugro West, Inc. to Pacific Offshore Operators, Inc., dated May 20, 1994.
2. American Petroleum Institute, "Recommended Practice for Planning, Designing and Constructing Fixed Offshore Platforms," API RP 2A, 20th Edition, July 1993.
3. American Institute of Steel Construction, "Manual of Steel Construction - Allowable Stress Design," Ninth Edition, 1989.
4. Moses, Fred, API PRAC PROJECT 83-22, "Implementation of a Reliability Based API RP 2A Format, Appendix E by C.S. Serrahn: Dynamic Response Using Fourier Series Loadings", American Petroleum Institute, January 1985.

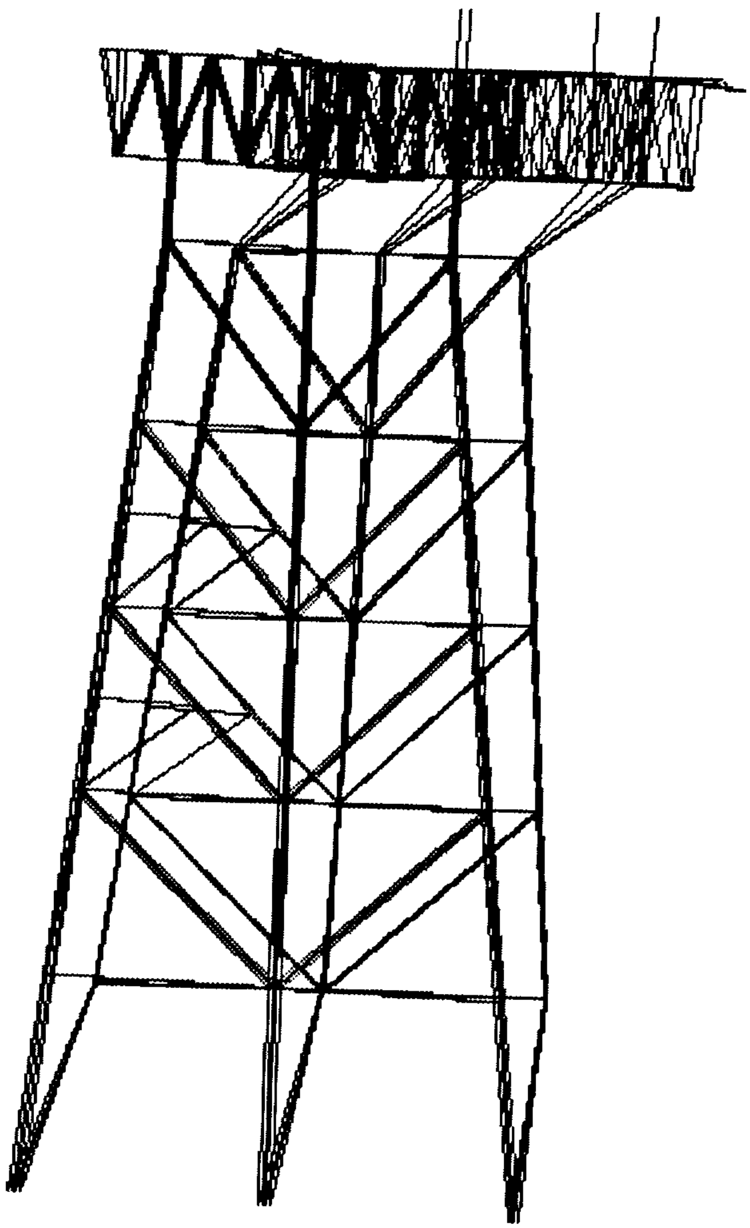
MODE SHAPES

AND ASSOCIATED PERIODS



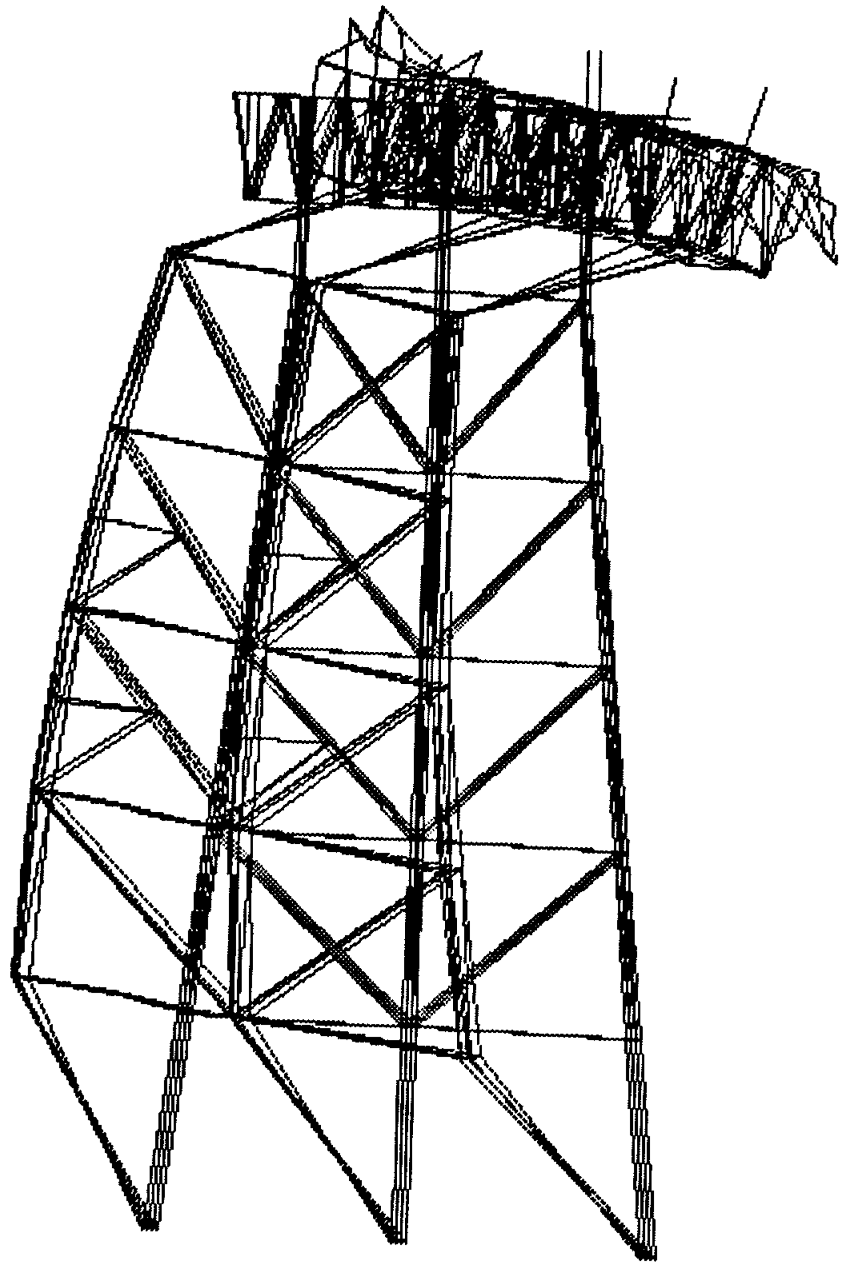
FIRST LATERAL MODE ALONG X-AXIS

T = 1.98 Sec



FIRST LATERAL MODE ALONG Y-AXIS

T = 1.92 Sec



SECOND LATERAL MODE ALONG X-AXIS

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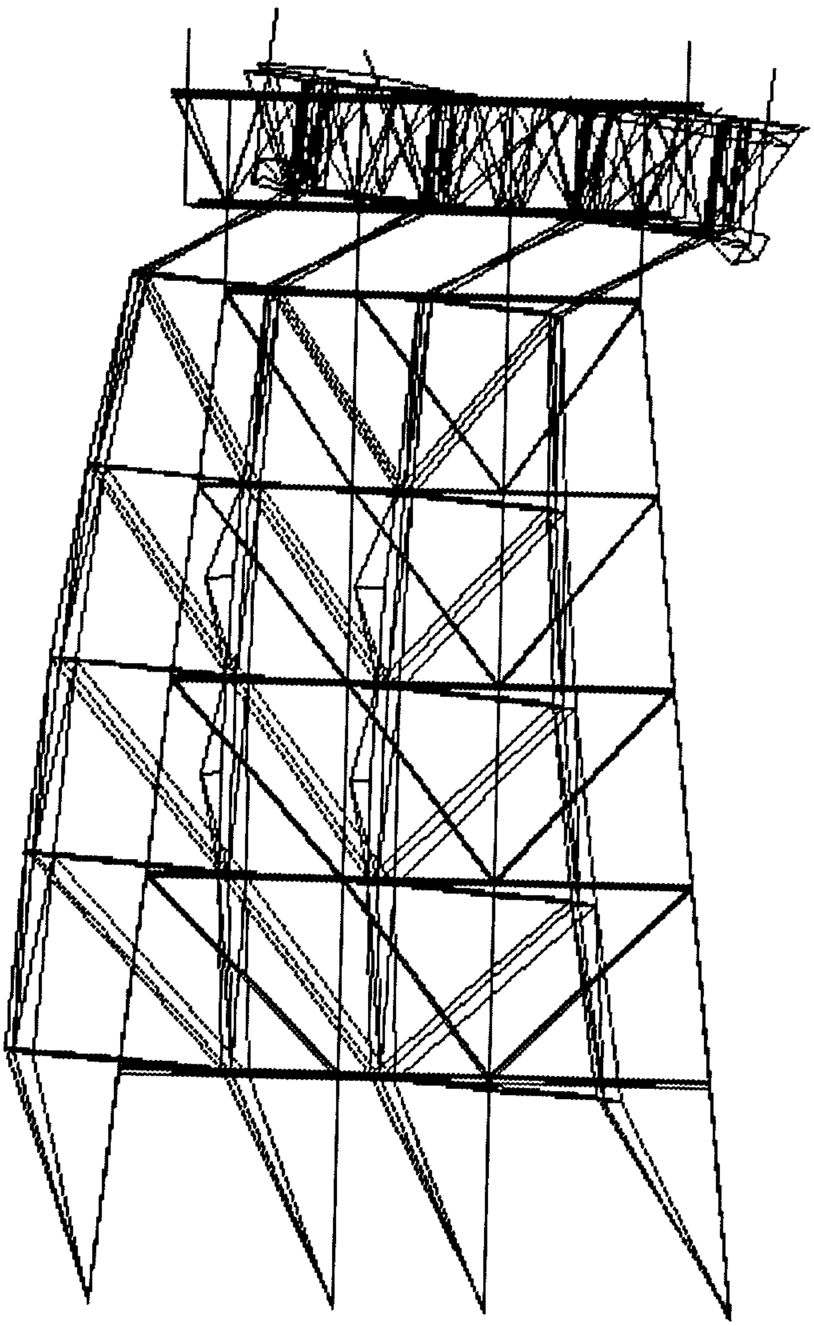

SECOND LATERAL MODE ALONG Y-AXIS

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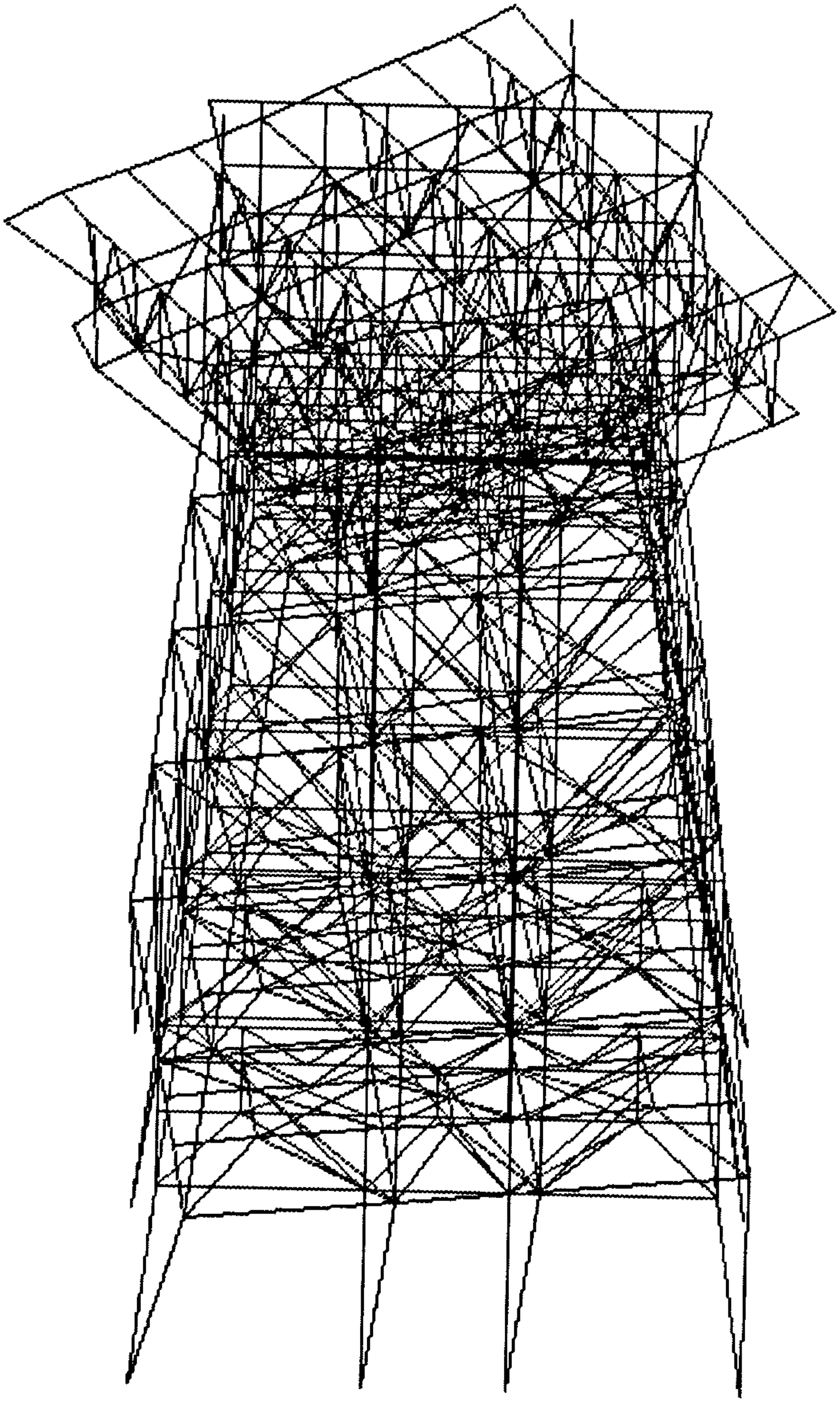
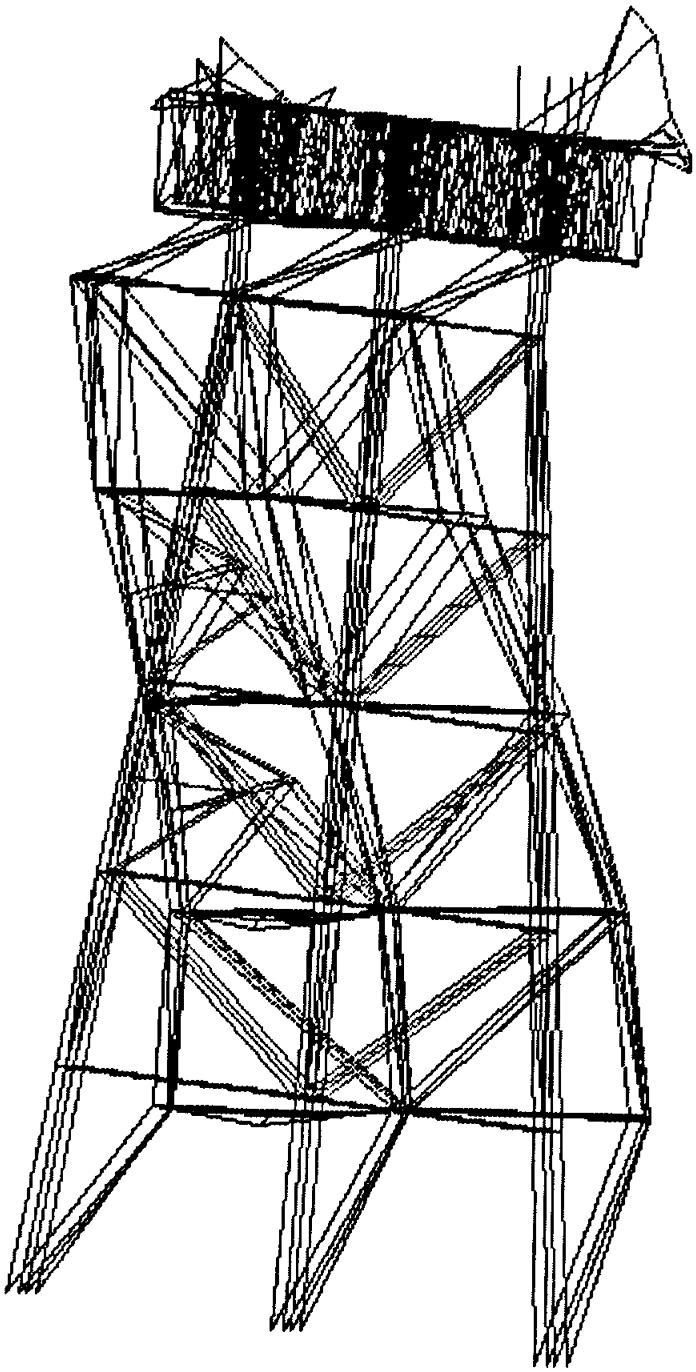


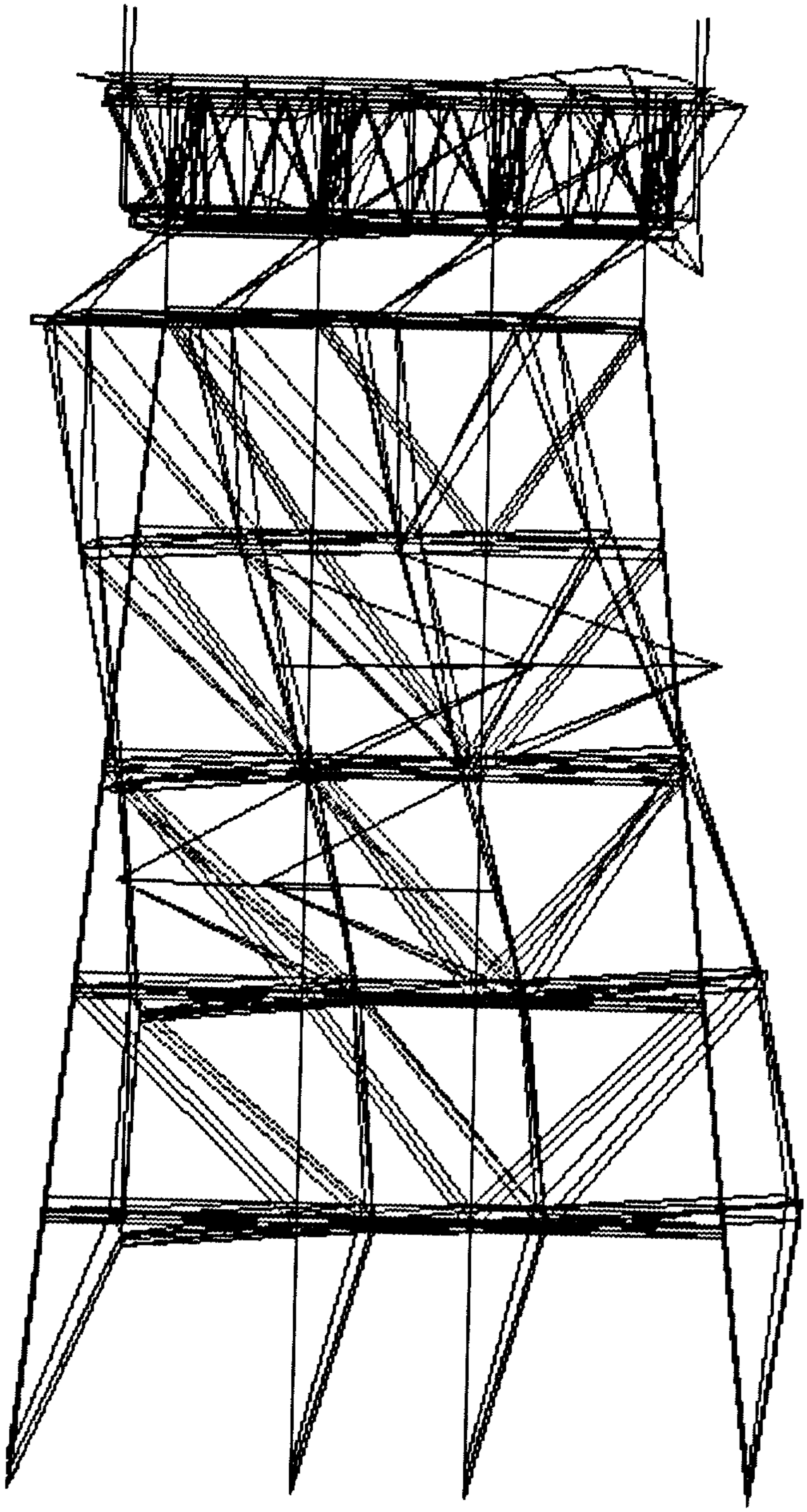
FIRST TORSIONAL MODE

T = 0.90 Sec



THIRD LATERAL MODE ALONG X-AXIS

T = 0.56 Sec



THIRD LATERAL MODE ALONG Y-AXIS

T = 0.48 Sec

COMPONENT MEMBER

UTILIZATION CHECKS FOR THE

STRENGTH LEVEL EARTHQUAKE

```
*******************************************
*  PRINT OUTPUT FROM INTERNAL DATABASE  *
*  UNITS: INCH  KIP  SEC  DEG DEGF      *
*******************************************
```

API WSD: RP 2A EDITION 20 STRENGTH AND BUCKLING CODE CHECK SUMMARY (BY UTILIZATION)

MEMBER ID	CONTROL LOAD	MEMBER DIAMETER	MEMBER THICKNESS	AXIAL Fa	BENDING Fby	BENDING Fbz	TOTAL Fa+Fb	--kL/r-- Y	--kL/r-- Z	MAX UTIL	CRIT MODE	DESIGN THICK	DESIGN UTIL
'D201'	'SLE'	1.800E+01	3.750E-01	9.492E+00	7.806E+01	2.087E+00	8.758E+01	88	36	2.522	(COMP+BEND)		
'D202'	'SLE'	1.800E+01	3.750E-01	9.405E+00	-5.805E+01	-1.477E+00	6.748E+01	110	39	2.521	(COMP+BEND)		
'D203'	'SLE'	1.800E+01	3.750E-01	9.301E+00	7.579E+01	-3.537E+00	8.517E+01	88	27	2.436	(COMP+BEND)		
'C301'	'SLE'	1.600E+01	3.750E-01	-9.455E+00	5.557E+01	-4.681E+00	6.522E+01	89	30	1.844	(TENS+HYDRO)		
'D102'	'SLE'	1.800E+01	3.750E-01	7.233E+00	-2.931E+01	-7.754E-01	3.655E+01	121	39	1.401	(COMP+BEND)		
'C302'	'SLE'	1.600E+01	3.750E-01	-9.438E+00	-3.712E+01	2.474E+00	4.664E+01	89	74	1.324	(TENS+HYDRO)		
'VC1B'	'SLE'	4.000E+01	5.000E-01	3.805E+01	8.969E-01	-7.296E-01	3.921E+01	35	35	1.258	(COMP+BEND)		
'D103'	'SLE'	1.800E+01	3.750E-01	7.187E+00	3.530E+01	-3.289E+00	4.264E+01	97	27	1.255	(COMP+BEND)		
'VC2B'	'SLE'	4.000E+01	5.000E-01	3.754E+01	-7.569E-01	-6.830E-01	3.856E+01	34	34	1.236	(COMP+BEND)		
'D101'	'SLE'	1.800E+01	3.750E-01	7.284E+00	3.297E+01	-2.496E+00	4.034E+01	97	56	1.202	(COMP+BEND)		
'CD209'	'SLE'	1.400E+01	3.750E-01	7.600E+00	1.978E+01	-1.566E+00	2.744E+01	125	44	1.170	(COMP+BEND)		
'B501'	'SLE'	1.275E+01	3.750E-01	1.237E+01	2.026E+01	8.608E+00	3.439E+01	88	13	1.151	(COMP+BEND)		
'C501'	'SLE'	1.275E+01	3.750E-01	1.475E+01	1.434E+01	-4.188E+00	2.969E+01	88	13	1.111	(COMP+BEND)		
'VD2B'	'SLE'	4.000E+01	5.000E-01	3.222E+01	-7.747E-01	8.067E-01	3.333E+01	35	35	1.067	(COMP+BEND)		
'VB2B'	'SLE'	4.000E+01	5.000E-01	3.194E+01	-7.161E-01	-6.631E-01	3.291E+01	34	34	1.054	(COMP+BEND)		
'VA1B'	'SLE'	4.000E+01	5.000E-01	3.137E+01	8.267E-01	-9.001E-01	3.260E+01	35	35	1.044	(COMP+BEND)		
'VD3B'	'SLE'	4.000E+01	5.000E-01	3.109E+01	-9.121E-01	7.567E-01	3.227E+01	35	35	1.034	(COMP+BEND)		
'VC3B'	'SLE'	4.000E+01	5.000E-01	3.102E+01	-8.682E-01	-6.200E-01	3.209E+01	35	35	1.027	(COMP+BEND)		
'VB1B'	'SLE'	4.000E+01	5.000E-01	2.930E+01	8.024E-01	-7.205E-01	3.037E+01	35	35	.972	(COMP+BEND)		
'VB3B'	'SLE'	4.000E+01	5.000E-01	2.834E+01	-8.332E-01	-6.054E-01	2.937E+01	35	35	.940	(COMP+BEND)		
'VA2B'	'SLE'	4.000E+01	5.000E-01	2.751E+01	-6.612E-01	-8.034E-01	2.855E+01	35	35	.913	(COMP+BEND)		
'VD1B'	'SLE'	4.000E+01	5.000E-01	2.630E+01	8.136E-01	7.665E-01	2.741E+01	35	35	.876	(COMP+BEND)		
'DC212'	'SLE'	2.000E+01	3.750E-01	1.038E+01	-3.263E+00	-1.412E+01	2.487E+01	46	92	.874	(COMP+BEND)		
'DC213'	'SLE'	1.800E+01	3.750E-01	1.107E+01	-3.470E+00	-1.115E+01	2.275E+01	48	96	.856	(COMP+BEND)		
'DB213'	'SLE'	1.800E+01	3.750E-01	1.016E+01	-3.493E+00	-1.209E+01	2.274E+01	48	96	.825	(COMP+BEND)		
'B503'	'SLE'	1.275E+01	3.750E-01	9.039E+00	1.709E+01	1.976E+00	2.625E+01	88	31	.824	(COMP+BEND)		
'D501'	'SLE'	1.275E+01	3.750E-01	9.658E+00	1.395E+01	-1.005E+01	2.685E+01	88	16	.822	(COMP+BEND)		
'D301'	'SLE'	1.600E+01	3.750E-01	8.499E+00	1.626E+01	2.636E+00	2.497E+01	89	30	.783	(COMP+BEND)		
'DCD14'	'SLE'	1.600E+01	3.750E-01	1.381E+01	1.727E+00	-3.928E+00	1.810E+01	96	96	.772	(COMP+BEND)		
'AB110'	'STLWTR'	2.400E+01	3.750E-01	9.373E-01	-2.015E+00	4.554E-03	2.953E+00	99	99	.725	(TENS+HYDRO)		
'CD110'	'STLWTR'	2.400E+01	3.750E-01	1.123E+00	-2.019E+00	6.464E-02	3.143E+00	99	99	.722	(TENS+HYDRO)		
'CD202'	'SLE'	1.400E+01	3.750E-01	4.550E+00	-2.641E+01	1.398E+00	3.099E+01	58	58	.720	(COMP+BEND)		
'BC110'	'STLWTR'	2.400E+01	3.750E-01	9.812E-01	-1.616E+00	4.150E-03	2.597E+00	86	86	.717	(TENS+HYDRO)		
'A501'	'SLE'	1.275E+01	3.750E-01	6.452E+00	1.727E+01	9.770E+00	2.630E+01	88	16	.717	(COMP+BEND)		
'AB209'	'SLE'	1.400E+01	3.750E-01	7.970E+00	6.106E+00	8.410E-01	1.413E+01	125	44	.716	(COMP+BEND)		
'DAB34'	'SLE'	1.600E+01	3.750E-01	1.282E+01	-1.270E+00	3.961E+00	1.698E+01	96	96	.713	(COMP+BEND)		
'DA211'	'STLWTR'	2.400E+01	3.750E-01	1.226E+00	1.217E+00	1.945E-01	2.458E+00	82	82	.708	(TENS+HYDRO)		
'DA231'	'STLWTR'	2.400E+01	3.750E-01	1.374E+00	-9.350E-01	9.145E-02	2.314E+00	82	82	.708	(HYD. COMPR)		

'DB211'	'STLWTR'	2.400E+01	3.750E-01	1.447E+00	1.253E+00	-6.725E-02	2.702E+00	82	82	.708	(HYD. COMPR)
'DB231'	'STLWTR'	2.400E+01	3.750E-01	1.360E+00	-8.044E-01	-4.585E-02	2.165E+00	82	82	.708	(HYD. COMPR)
'DC211'	'STLWTR'	2.400E+01	3.750E-01	1.668E+00	1.110E+00	4.425E-02	2.779E+00	82	82	.708	(HYD. COMPR)
'DC231'	'STLWTR'	2.400E+01	3.750E-01	1.264E+00	-9.180E-01	2.029E-02	2.182E+00	82	82	.708	(HYD. COMPR)
'DD211'	'STLWTR'	2.400E+01	3.750E-01	1.517E+00	1.141E+00	-1.683E-01	2.671E+00	82	82	.708	(HYD. COMPR)
'DD231'	'STLWTR'	2.400E+01	3.750E-01	1.121E+00	-1.011E+00	-7.560E-02	2.136E+00	82	82	.708	(HYD. COMPR)
'DBC11'	'STLWTR'	2.400E+01	3.750E-01	1.043E+00	-2.764E-01	-5.828E-01	1.688E+00	67	67	.708	(HYD. COMPR)
'DBC21'	'STLWTR'	2.400E+01	3.750E-01	1.170E+00	1.517E-01	-5.473E-01	1.738E+00	67	67	.708	(HYD. COMPR)
'DBC31'	'STLWTR'	2.400E+01	3.750E-01	1.313E+00	7.565E-02	-5.933E-01	1.911E+00	67	67	.708	(HYD. COMPR)
'DCD13'	'SLE'	1.600E+01	3.750E-01	1.285E+01	1.393E+00	-2.091E+00	1.537E+01	102	102	.705	(COMP+BEND)
411	'SLE'	1.275E+01	3.750E-01	1.063E+01	3.568E+00	-1.337E+00	1.444E+01	112	89	.700	(COMP+BEND)
'DC212B'	'SLE'	2.000E+01	3.750E-01	9.419E+00	-2.205E+00	-1.001E+01	1.967E+01	46	92	.693	(COMP+BEND)
'DB212'	'SLE'	2.000E+01	3.750E-01	9.377E+00	-2.815E+00	-9.416E+00	1.920E+01	46	92	.677	(COMP+BEND)
'VC15A'	'SLE'	2.400E+01	1.000E+00	1.976E+01	-3.166E+00	-3.034E+00	2.415E+01	22	22	.670	(COMP+BEND)
'A503'	'SLE'	1.275E+01	3.750E-01	7.861E+00	1.351E+01	3.061E+00	2.171E+01	88	38	.669	(COMP+BEND)
421	'SLE'	1.275E+01	3.750E-01	1.037E+01	3.302E+00	6.230E-01	1.373E+01	112	89	.668	(COMP+BEND)
'DCD21'	'SLE'	2.000E+01	3.750E-01	1.378E+01	7.275E-01	1.716E+00	1.564E+01	93	93	.665	(COMP+BEND)
'VA3B'	'SLE'	4.000E+01	5.000E-01	1.988E+01	-6.935E-01	-6.672E-01	2.084E+01	35	35	.665	(COMP+BEND)
'C503'	'SLE'	1.275E+01	3.750E-01	8.295E+00	1.218E+01	-2.905E+00	2.082E+01	88	38	.659	(COMP+BEND)
'D302'	'SLE'	1.600E+01	3.750E-01	8.497E+00	-1.131E+01	-2.008E+00	1.998E+01	89	74	.655	(COMP+BEND)
288	'SLE'	1.400E+01	3.750E-01	6.085E-01	-2.315E+01	9.815E-01	2.378E+01	39	34	.652	(TENS+HYDRO)
'DCD24'	'SLE'	1.600E+01	3.750E-01	1.193E+01	7.920E-01	-3.671E+00	1.568E+01	95	95	.648	(COMP+BEND)
'DC213B'	'SLE'	1.800E+01	3.750E-01	9.526E+00	-2.065E+00	-7.492E+00	1.730E+01	48	96	.646	(COMP+BEND)
'D503'	'SLE'	1.275E+01	3.750E-01	7.554E+00	1.306E+01	-3.547E+00	2.109E+01	88	38	.643	(COMP+BEND)
'DD213'	'SLE'	1.800E+01	3.750E-01	1.292E+01	-1.761E+00	-6.571E-01	1.480E+01	96	96	.642	(COMP+BEND)
532	'SLE'	1.275E+01	3.750E-01	9.062E+00	4.939E+00	9.087E-01	1.408E+01	110	88	.626	(COMP+BEND)
'DD214'	'SLE'	1.800E+01	5.000E-01	1.151E+01	-4.278E+00	1.260E+00	1.597E+01	90	90	.622	(COMP+BEND)
'DCD11'	'SLE'	2.000E+01	3.750E-01	1.246E+01	-1.021E+00	2.091E+00	1.479E+01	94	94	.621	(COMP+BEND)
'D502'	'SLE'	1.275E+01	3.750E-01	7.691E+00	-7.635E+00	-7.190E-01	1.536E+01	110	55	.620	(COMP+BEND)
'DCD34'	'SLE'	1.600E+01	3.750E-01	1.106E+01	-1.212E+00	-3.721E+00	1.497E+01	96	96	.612	(COMP+BEND)
'DAB11'	'SLE'	2.000E+01	3.750E-01	1.236E+01	-1.257E+00	-1.818E+00	1.457E+01	94	94	.612	(COMP+BEND)
'B502'	'SLE'	1.275E+01	3.750E-01	6.843E+00	-9.119E+00	7.456E-01	1.599E+01	110	55	.605	(COMP+BEND)
'DCD12'	'SLE'	1.800E+01	3.750E-01	1.182E+01	7.459E-01	-1.965E+00	1.393E+01	97	97	.601	(COMP+BEND)
'B210'	'SLE'	1.075E+01	3.650E-01	1.371E+01	-1.975E+00	4.864E+00	1.896E+01	65	26	.596	(COMP+BEND)
'C203'	'SLE'	1.800E+01	3.750E-01	7.579E+00	1.074E+01	-2.902E+00	1.870E+01	88	27	.591	(COMP+BEND)
'B103'	'STLWTR'	1.800E+01	3.750E-01	7.859E-01	9.671E+00	-8.553E-03	1.046E+01	97	27	.586	(TENS+HYDRO)
'D210'	'SLE'	1.075E+01	3.650E-01	1.919E+00	-2.229E+01	-1.342E+00	2.425E+01	111	52	.585	(TENS+HYDRO)
'D404'	'SLE'	1.400E+01	3.750E-01	1.136E+01	3.171E+00	-1.057E+00	1.470E+01	91	91	.585	(COMP+BEND)
213	'SLE'	1.600E+01	3.750E-01	1.148E+01	2.751E+00	-1.620E+00	1.467E+01	91	91	.584	(COMP+BEND)
231	'SLE'	1.600E+01	3.750E-01	9.181E+00	2.558E+00	1.027E+00	1.194E+01	113	91	.582	(COMP+BEND)
'B201'	'SLE'	1.800E+01	3.750E-01	8.295E+00	9.045E+00	-1.817E+00	1.752E+01	88	36	.582	(COMP+BEND)
313	'SLE'	1.400E+01	3.750E-01	1.100E+01	3.207E+00	-1.511E+00	1.455E+01	93	93	.581	(COMP+BEND)
321	'SLE'	1.400E+01	3.750E-01	8.537E+00	3.106E+00	4.070E-01	1.167E+01	116	93	.574	(COMP+BEND)
'DCD23'	'SLE'	1.600E+01	3.750E-01	1.085E+01	-5.744E-01	-1.846E+00	1.278E+01	102	102	.573	(COMP+BEND)
'C103'	'SLE'	1.800E+01	3.750E-01	7.337E+00	9.067E+00	-1.892E+00	1.660E+01	97	27	.573	(COMP+BEND)
'C201'	'SLE'	1.800E+01	3.750E-01	8.317E+00	8.407E+00	-2.473E+00	1.708E+01	88	36	.569	(COMP+BEND)
113	'SLE'	1.800E+01	3.750E-01	8.989E+00	2.249E+00	-2.223E+00	1.215E+01	112	89	.566	(COMP+BEND)
'VB15A'	'SLE'	2.400E+01	1.000E+00	1.630E+01	-2.921E+00	3.093E+00	2.056E+01	22	22	.565	(COMP+BEND)
224	'SLE'	1.600E+01	3.750E-01	7.554E+00	5.123E+00	-2.076E+00	1.308E+01	113	37	.564	(COMP+BEND)
531	'SLE'	1.275E+01	3.750E-01	9.097E+00	5.466E+00	1.084E+00	1.467E+01	96	77	.561	(COMP+BEND)

220	'SLE'	1.600E+01	3.750E-01	7.553E+00	5.072E+00	-1.731E+00	1.291E+01	113	37	.561	(COMP+BEND)
'DAB21'	'SLE'	2.000E+01	3.750E-01	1.155E+01	6.099E-01	-1.770E+00	1.342E+01	93	93	.561	(COMP+BEND)
'DCD22'	'SLE'	1.800E+01	3.750E-01	1.119E+01	7.130E-01	-1.692E+00	1.302E+01	97	97	.559	(COMP+BEND)
'VD15A'	'SLE'	2.400E+01	1.000E+00	1.592E+01	-3.214E+00	-3.047E+00	2.035E+01	22	22	.557	(COMP+BEND)
'DD233'	'SLE'	1.800E+01	3.750E-01	1.123E+01	1.551E+00	6.468E-01	1.291E+01	96	96	.553	(COMP+BEND)
'VC25A'	'SLE'	2.400E+01	1.000E+00	1.569E+01	3.135E+00	-2.687E+00	1.982E+01	22	27	.553	(COMP+BEND)
'DB212B'	'SLE'	2.000E+01	3.750E-01	8.500E+00	-1.883E+00	-6.733E+00	1.549E+01	46	92	.553	(COMP+BEND)
'B203'	'STLWTR'	1.800E+01	3.750E-01	5.577E-01	9.808E+00	-7.216E-02	1.037E+01	88	27	.546	(TENS+HYDRO)
'C202'	'SLE'	1.800E+01	3.750E-01	6.964E+00	-6.385E+00	6.407E-01	1.338E+01	110	39	.541	(COMP+BEND)
'DBC34'	'SLE'	1.600E+01	3.750E-01	8.868E+00	-1.252E+00	4.091E+00	1.315E+01	101	101	.540	(COMP+BEND)
'DAB22'	'SLE'	1.800E+01	3.750E-01	1.101E+01	4.388E-01	1.435E+00	1.251E+01	97	97	.539	(COMP+BEND)
'A502'	'SLE'	1.275E+01	3.750E-01	5.957E+00	-8.868E+00	-7.011E-01	1.485E+01	110	55	.538	(COMP+BEND)
'AB201'	'SLE'	1.400E+01	3.750E-01	1.119E+01	6.637E+00	7.116E-01	1.787E+01	58	58	.531	(COMP+BEND)
'DAB33'	'SLE'	1.600E+01	3.750E-01	9.994E+00	-5.299E-01	1.750E+00	1.182E+01	102	102	.528	(COMP+BEND)
'DD212'	'SLE'	2.000E+01	3.750E-01	1.077E+01	1.951E+00	-5.955E-01	1.281E+01	92	92	.525	(COMP+BEND)
521	'SLE'	1.275E+01	3.750E-01	8.236E+00	5.809E+00	9.156E-01	1.412E+01	96	77	.524	(COMP+BEND)
'DAB12'	'SLE'	1.800E+01	3.750E-01	1.044E+01	-1.053E+00	1.451E+00	1.223E+01	97	97	.523	(COMP+BEND)
'D504'	'SLE'	1.275E+01	3.750E-01	9.182E+00	5.186E+00	-1.292E+00	1.453E+01	88	88	.521	(COMP+BEND)
412	'SLE'	1.275E+01	3.750E-01	7.796E+00	3.376E+00	2.499E+00	1.200E+01	110	88	.515	(COMP+BEND)
533	'SLE'	1.275E+01	3.750E-01	8.402E+00	5.069E+00	1.257E+00	1.362E+01	96	77	.514	(COMP+BEND)
'DAB32'	'SLE'	1.800E+01	3.750E-01	1.034E+01	-5.153E-01	1.488E+00	1.191E+01	97	97	.512	(COMP+BEND)
'C102'	'SLE'	1.800E+01	3.750E-01	6.200E+00	-4.862E+00	3.289E-01	1.107E+01	121	39	.510	(COMP+BEND)
331	'SLE'	1.400E+01	3.750E-01	9.723E+00	3.042E+00	8.008E-01	1.287E+01	93	93	.508	(COMP+BEND)
'DC214'	'SLE'	1.800E+01	5.000E-01	9.644E+00	-3.591E+00	4.996E-01	1.327E+01	90	90	.506	(COMP+BEND)
'DB214'	'SLE'	1.800E+01	5.000E-01	9.631E+00	-3.559E+00	-4.309E-01	1.322E+01	90	90	.504	(COMP+BEND)
'DCD33'	'SLE'	1.600E+01	3.750E-01	9.564E+00	-5.879E-01	-1.636E+00	1.130E+01	102	102	.504	(COMP+BEND)
'DCD31'	'SLE'	2.000E+01	3.750E-01	1.031E+01	7.468E-01	1.648E+00	1.212E+01	94	94	.502	(COMP+BEND)
'AB109'	'SLE'	1.600E+01	3.750E-01	5.985E+00	6.005E+00	1.271E+00	1.212E+01	117	47	.501	(COMP+BEND)
431	'SLE'	1.275E+01	3.750E-01	9.836E+00	3.088E+00	8.824E-01	1.305E+01	89	89	.501	(COMP+BEND)
'DA234'	'SLE'	1.800E+01	5.000E-01	9.131E+00	4.094E+00	-8.975E-01	1.332E+01	90	90	.499	(COMP+BEND)
'DC232'	'SLE'	2.000E+01	3.750E-01	1.037E+01	-1.764E+00	-4.884E-01	1.220E+01	92	92	.499	(COMP+BEND)
'DAB23'	'SLE'	1.600E+01	3.750E-01	9.503E+00	-3.237E-01	1.701E+00	1.123E+01	102	102	.498	(COMP+BEND)
'C502'	'SLE'	1.275E+01	3.750E-01	6.481E+00	-6.143E+00	-2.939E-01	1.263E+01	110	55	.498	(COMP+BEND)
'D204'	'SLE'	1.800E+01	3.750E-01	1.012E+01	2.485E+00	-1.124E+00	1.285E+01	88	88	.497	(COMP+BEND)
'DAB14'	'SLE'	1.600E+01	3.750E-01	-1.410E+01	1.474E+00	4.116E+00	1.848E+01	96	96	.493	(TEN +BEND)
'DB234'	'SLE'	1.800E+01	5.000E-01	9.049E+00	3.968E+00	5.476E-01	1.305E+01	90	90	.489	(COMP+BEND)
'D304'	'SLE'	1.600E+01	3.750E-01	9.526E+00	3.084E+00	-9.221E-01	1.274E+01	89	89	.487	(COMP+BEND)
221	'SLE'	1.600E+01	3.750E-01	7.036E+00	3.837E+00	-6.258E-01	1.092E+01	113	61	.487	(COMP+BEND)
'DBC22'	'SLE'	1.600E+01	3.750E-01	9.484E+00	4.267E-01	1.501E+00	1.104E+01	101	101	.487	(COMP+BEND)
522	'SLE'	1.275E+01	3.750E-01	6.663E+00	5.298E+00	7.587E-01	1.202E+01	110	88	.487	(COMP+BEND)
'DCD32'	'SLE'	1.800E+01	3.750E-01	9.746E+00	-6.389E-01	-1.535E+00	1.141E+01	97	97	.486	(COMP+BEND)
'D104'	'SLE'	1.800E+01	3.750E-01	9.004E+00	2.384E+00	1.283E+00	1.171E+01	97	97	.482	(COMP+BEND)
'DA233'	'SLE'	1.800E+01	3.750E-01	9.830E+00	1.470E+00	-3.635E-01	1.134E+01	96	96	.482	(COMP+BEND)
'DD234'	'SLE'	1.800E+01	5.000E-01	8.600E+00	4.307E+00	1.173E+00	1.306E+01	90	90	.481	(COMP+BEND)
'DBC12'	'SLE'	1.600E+01	3.750E-01	9.069E+00	1.299E+00	1.339E+00	1.093E+01	101	101	.478	(COMP+BEND)
'B211'	'SLE'	1.075E+01	3.650E-01	9.679E+00	-4.718E+00	-3.974E+00	1.585E+01	65	26	.477	(COMP+BEND)
232	'SLE'	1.400E+01	3.750E-01	8.790E+00	2.508E+00	4.982E-01	1.135E+01	100	80	.477	(COMP+BEND)
222	'SLE'	1.400E+01	3.750E-01	8.553E+00	2.911E+00	6.184E-01	1.153E+01	100	80	.477	(COMP+BEND)
'DB213B'	'SLE'	1.800E+01	5.000E-01	6.673E+00	-6.445E-01	-6.967E+00	1.367E+01	48	96	.473	(COMP+BEND)
'VD25A'	'SLE'	2.400E+01	1.000E+00	1.322E+01	3.236E+00	-2.726E+00	1.745E+01	22	22	.473	(COMP+BEND)

'DC233'	'SLE'	1.800E+01	3.750E-01	9.666E+00	1.390E+00	-4.109E-01	1.112E+01	96	96	.470	(COMP+BEND)
'DAB31'	'SLE'	2.000E+01	3.750E-01	9.604E+00	6.133E-01	-1.697E+00	1.141E+01	94	94	.470	(COMP+BEND)
'VB35A'	'SLE'	2.400E+01	1.000E+00	1.331E+01	2.813E+00	2.623E+00	1.716E+01	22	22	.468	(COMP+BEND)
'VC35A'	'SLE'	2.400E+01	1.000E+00	1.321E+01	3.040E+00	-2.595E+00	1.721E+01	22	22	.468	(COMP+BEND)
188	'SLE'	1.075E+01	3.650E-01	7.215E-01	-1.660E+01	1.179E+00	1.736E+01	68	60	.466	(TENS+HYDRO)
432	'SLE'	1.275E+01	3.750E-01	7.558E+00	2.655E+00	8.240E-01	1.034E+01	110	88	.465	(COMP+BEND)
'DBC32'	'SLE'	1.600E+01	3.750E-01	8.880E+00	-4.086E-01	1.452E+00	1.039E+01	101	101	.458	(COMP+BEND)
'B301'	'SLE'	1.600E+01	3.750E-01	7.418E+00	5.056E+00	3.820E+00	1.376E+01	89	30	.458	(COMP+BEND)
'CD109'	'SLE'	1.600E+01	3.750E-01	4.629E+00	7.812E+00	-1.505E+00	1.258E+01	117	47	.456	(COMP+BEND)
'DBC33'	'SLE'	1.600E+01	3.750E-01	8.877E+00	-5.266E-01	1.326E+00	1.030E+01	101	101	.456	(COMP+BEND)
'DA214'	'SLE'	1.800E+01	5.000E-01	8.210E+00	-3.973E+00	-1.265E+00	1.238E+01	90	90	.455	(COMP+BEND)
'VB25A'	'SLE'	2.400E+01	1.000E+00	1.274E+01	2.898E+00	2.731E+00	1.672E+01	22	22	.454	(COMP+BEND)
513	'SLE'	1.275E+01	3.750E-01	8.297E+00	5.473E+00	-1.796E+00	1.406E+01	77	77	.453	(COMP+BEND)
'B101'	'STLWTR'	1.800E+01	3.750E-01	8.062E-01	6.255E+00	8.593E-03	7.061E+00	97	45	.450	(TENS+HYDRO)
133	'SLE'	1.800E+01	3.750E-01	7.249E+00	2.229E+00	1.221E+00	9.791E+00	112	89	.450	(COMP+BEND)
'DD232'	'SLE'	2.000E+01	3.750E-01	9.122E+00	-1.915E+00	7.489E-01	1.118E+01	92	92	.450	(COMP+BEND)
'DB233'	'SLE'	1.800E+01	3.750E-01	9.208E+00	1.389E+00	-2.758E-01	1.062E+01	96	96	.448	(COMP+BEND)
'B102'	'STLWTR'	1.800E+01	3.750E-01	7.036E-01	-5.998E+00	-8.684E-03	6.702E+00	121	39	.445	(TENS+HYDRO)
131	'SLE'	1.800E+01	3.750E-01	7.216E+00	1.905E+00	1.584E+00	9.694E+00	112	89	.445	(COMP+BEND)
223	'SLE'	1.600E+01	3.750E-01	6.390E+00	3.589E+00	-1.488E+00	1.028E+01	113	61	.445	(COMP+BEND)
'CD510'	'SLE'	1.275E+01	3.750E-01	5.276E+00	5.754E+00	5.124E-01	1.105E+01	117	117	.444	(COMP+BEND)
233	'SLE'	1.600E+01	3.750E-01	8.688E+00	2.655E+00	-9.264E-01	1.150E+01	91	91	.443	(COMP+BEND)
'C101'	'SLE'	1.800E+01	3.750E-01	5.964E+00	6.825E+00	-1.966E+00	1.307E+01	97	45	.441	(COMP+BEND)
'DAB24'	'SLE'	1.600E+01	3.750E-01	-1.239E+01	-5.471E-01	4.018E+00	1.645E+01	95	95	.438	(TEN +BEND)
422	'SLE'	1.275E+01	3.750E-01	8.653E+00	3.031E+00	5.534E-01	1.173E+01	88	88	.438	(COMP+BEND)
'B302'	'SLE'	1.600E+01	3.750E-01	7.469E+00	-4.463E+00	-2.141E+00	1.242E+01	89	74	.435	(COMP+BEND)
'DB232'	'SLE'	2.000E+01	3.750E-01	9.037E+00	-1.604E+00	-4.038E-01	1.069E+01	92	92	.433	(COMP+BEND)
'C304'	'SLE'	1.600E+01	3.750E-01	8.480E+00	2.940E+00	4.162E-01	1.145E+01	89	89	.433	(COMP+BEND)
'A401'	'SLE'	1.400E+01	3.750E-01	8.445E+00	2.601E+00	-1.044E+00	1.125E+01	91	91	.433	(COMP+BEND)
413	'SLE'	1.275E+01	3.750E-01	-1.154E+01	3.186E+00	-1.985E+00	1.529E+01	112	89	.432	(TENS+HYDRO)
'DA212'	'SLE'	2.000E+01	3.750E-01	9.041E+00	1.352E+00	7.755E-01	1.060E+01	92	92	.432	(COMP+BEND)
333	'SLE'	1.400E+01	3.750E-01	8.155E+00	2.924E+00	9.459E-01	1.123E+01	93	93	.432	(COMP+BEND)
'DBC23'	'SLE'	1.600E+01	3.750E-01	8.390E+00	-3.337E-01	1.412E+00	9.840E+00	101	101	.430	(COMP+BEND)
385	'SLE'	1.400E+01	3.750E-01	3.057E+00	1.526E+01	-1.745E+00	1.842E+01	45	50	.430	(COMP+BEND)
433	'SLE'	1.275E+01	3.750E-01	8.382E+00	2.856E+00	9.759E-01	1.140E+01	89	89	.430	(COMP+BEND)
'BC201'	'SLE'	1.400E+01	3.750E-01	9.352E+00	4.385E+00	1.740E+00	1.407E+01	61	61	.429	(COMP+BEND)
'B204'	'SLE'	1.800E+01	3.750E-01	8.894E+00	2.179E+00	-4.726E-01	1.112E+01	88	88	.429	(COMP+BEND)
'DA232'	'SLE'	2.000E+01	3.750E-01	8.888E+00	-1.579E+00	4.814E-01	1.054E+01	92	92	.428	(COMP+BEND)
'A210'	'SLE'	1.075E+01	3.650E-01	5.931E+00	-4.282E+00	-2.059E+00	1.068E+01	111	52	.428	(COMP+BEND)
'DA213'	'SLE'	1.800E+01	3.750E-01	8.695E+00	-1.203E+00	7.387E-01	1.011E+01	96	96	.426	(COMP+BEND)
'BC510'	'SLE'	1.275E+01	3.750E-01	3.757E+00	7.935E+00	-4.608E-01	1.171E+01	124	124	.425	(COMP+BEND)
511	'SLE'	1.275E+01	3.750E-01	7.249E+00	6.277E+00	-1.405E+00	1.368E+01	77	77	.424	(COMP+BEND)
'AB510'	'SLE'	1.275E+01	3.750E-01	4.250E+00	7.695E+00	-7.201E-01	1.198E+01	117	117	.424	(COMP+BEND)
'B404'	'SLE'	1.400E+01	3.750E-01	8.269E+00	2.554E+00	4.674E-01	1.087E+01	91	91	.420	(COMP+BEND)
'B202'	'SLE'	1.800E+01	3.750E-01	5.054E+00	-6.234E+00	-6.052E-01	1.132E+01	110	39	.417	(COMP+BEND)
311	'SLE'	1.400E+01	3.750E-01	7.631E+00	3.121E+00	-1.212E+00	1.098E+01	93	93	.415	(COMP+BEND)
'A204'	'SLE'	1.800E+01	3.750E-01	8.610E+00	1.914E+00	9.396E-01	1.074E+01	88	88	.414	(COMP+BEND)
'DC234'	'SLE'	1.800E+01	5.000E-01	7.412E+00	3.899E+00	6.778E-01	1.137E+01	90	90	.411	(COMP+BEND)
523	'SLE'	1.275E+01	3.750E-01	6.414E+00	4.995E+00	1.163E+00	1.154E+01	96	77	.411	(COMP+BEND)
'B104'	'SLE'	1.800E+01	3.750E-01	7.741E+00	2.288E+00	3.429E-01	1.006E+01	97	97	.410	(COMP+BEND)

121	'SLE'	1.800E+01	3.750E-01	5.820E+00	3.914E+00	-4.793E-01	9.764E+00	112	54	.409	(COMP+BEND)
'C404'	'SLE'	1.400E+01	3.750E-01	7.937E+00	2.684E+00	5.704E-01	1.068E+01	91	91	.408	(COMP+BEND)
'C204'	'SLE'	1.800E+01	3.750E-01	8.331E+00	2.364E+00	3.699E-01	1.072E+01	88	88	.408	(COMP+BEND)
124	'SLE'	1.800E+01	3.750E-01	5.483E+00	4.309E+00	-1.782E+00	1.015E+01	112	36	.404	(COMP+BEND)
'AB501'	'SLE'	1.275E+01	3.750E-01	4.890E+00	1.143E+01	3.363E+00	1.681E+01	41	41	.404	(COMP+BEND)
'B304'	'SLE'	1.600E+01	3.750E-01	7.947E+00	2.601E+00	4.161E-01	1.058E+01	89	89	.400	(COMP+BEND)
'VD35A'	'SLE'	2.400E+01	1.000E+00	1.081E+01	3.198E+00	-2.627E+00	1.494E+01	22	22	.399	(COMP+BEND)
'A104'	'SLE'	1.800E+01	3.750E-01	7.563E+00	1.695E+00	1.394E+00	9.758E+00	97	97	.398	(COMP+BEND)
'A504'	'SLE'	1.275E+01	3.750E-01	6.670E+00	4.868E+00	-1.061E+00	1.165E+01	88	88	.395	(COMP+BEND)
120	'SLE'	1.800E+01	3.750E-01	5.099E+00	4.728E+00	-1.923E+00	1.020E+01	112	36	.393	(COMP+BEND)
'B504'	'SLE'	1.275E+01	3.750E-01	6.598E+00	4.958E+00	-8.419E-01	1.163E+01	88	88	.393	(COMP+BEND)
'AB507'	'STLWTR'	1.275E+01	3.750E-01	1.063E+00	-8.969E+00	4.954E-01	1.005E+01	49	49	.393	(COMP+BEND)
386	'SLE'	1.400E+01	3.750E-01	2.911E+00	1.326E+01	-8.353E-01	1.619E+01	78	87	.392	(COMP+BEND)
312	'SLE'	1.400E+01	3.750E-01	6.392E+00	3.190E+00	2.487E+00	1.044E+01	100	80	.392	(COMP+BEND)
'VA35A'	'SLE'	2.400E+01	1.000E+00	1.076E+01	2.670E+00	2.649E+00	1.452E+01	22	22	.391	(COMP+BEND)
582	'SLE'	1.275E+01	3.750E-01	7.485E+00	-2.633E+00	3.887E+00	1.218E+01	43	77	.390	(COMP+BEND)
211	'SLE'	1.600E+01	3.750E-01	7.214E+00	2.942E+00	-1.279E+00	1.042E+01	91	91	.386	(COMP+BEND)
'A304'	'SLE'	1.600E+01	3.750E-01	7.653E+00	2.428E+00	-7.431E-01	1.019E+01	89	89	.385	(COMP+BEND)
111	'SLE'	1.800E+01	3.750E-01	5.914E+00	2.536E+00	-1.399E+00	8.810E+00	112	89	.384	(COMP+BEND)
'D401'	'SLE'	1.400E+01	3.750E-01	-1.040E+01	2.854E+00	1.156E+00	1.348E+01	91	91	.382	(TENS+HYDRO)
'AB101'	'SLE'	1.600E+01	3.750E-01	6.850E+00	6.311E+00	-7.263E-01	1.320E+01	64	64	.379	(COMP+BEND)
'DAB13'	'SLE'	1.600E+01	3.750E-01	-1.081E+01	1.024E+00	1.663E+00	1.276E+01	102	102	.378	(TENS+HYDRO)
332	'SLE'	1.400E+01	3.750E-01	6.737E+00	2.618E+00	5.525E-01	9.412E+00	100	80	.378	(COMP+BEND)
'B111'	'SLE'	1.075E+01	3.650E-01	6.983E+00	-5.696E+00	-1.644E+00	1.291E+01	65	26	.376	(COMP+BEND)
'B110'	'SLE'	1.075E+01	3.650E-01	8.683E+00	-2.564E+00	-1.700E+00	1.176E+01	65	26	.375	(COMP+BEND)
'AB508'	'STLWTR'	1.275E+01	3.750E-01	-9.892E-01	8.566E+00	-2.521E-01	9.559E+00	49	49	.374	(TEN +BEND)
'AB108'	'STLWTR'	1.600E+01	3.750E-01	7.371E-01	5.993E+00	-2.844E-02	6.730E+00	39	39	.372	(TENS+HYDRO)
212	'SLE'	1.400E+01	3.750E-01	6.236E+00	3.028E+00	-1.677E+00	9.697E+00	100	80	.371	(COMP+BEND)
'VA15A'	'SLE'	2.400E+01	1.000E+00	9.824E+00	-2.689E+00	3.091E+00	1.392E+01	22	22	.369	(COMP+BEND)
586	'SLE'	1.275E+01	3.750E-01	7.503E+00	-1.335E+00	-3.315E+00	1.108E+01	43	77	.368	(COMP+BEND)
322	'SLE'	1.400E+01	3.750E-01	7.553E+00	3.045E+00	6.382E-01	1.066E+01	80	80	.368	(COMP+BEND)
'C401'	'SLE'	1.400E+01	3.750E-01	-9.732E+00	2.826E+00	-1.316E+00	1.285E+01	91	91	.365	(TENS+HYDRO)
'DBC14'	'SLE'	1.600E+01	3.750E-01	-9.239E+00	2.031E+00	4.257E+00	1.396E+01	101	101	.364	(TEN +BEND)
'DBC13'	'SLE'	1.600E+01	3.750E-01	-1.007E+01	1.552E+00	1.391E+00	1.216E+01	101	101	.361	(TENS+HYDRO)
584	'SLE'	1.275E+01	3.750E-01	5.637E+00	5.814E+00	2.249E+00	1.187E+01	49	88	.361	(COMP+BEND)
123	'SLE'	1.800E+01	3.750E-01	5.111E+00	3.637E+00	8.081E-01	8.837E+00	112	54	.361	(COMP+BEND)
595	'SLE'	1.275E+01	3.750E-01	8.154E+00	3.916E+00	-1.357E+00	1.230E+01	49	55	.360	(COMP+BEND)
298	'SLE'	1.400E+01	3.750E-01	5.823E-01	-1.232E+01	1.765E+00	1.303E+01	39	34	.355	(TENS+HYDRO)
'VC11'	'SLE'	4.000E+01	1.750E+00	1.031E+01	1.530E+00	-5.993E-01	1.195E+01	38	38	.355	(COMP+BEND)
'C104'	'SLE'	1.800E+01	3.750E-01	6.526E+00	2.274E+00	-3.851E-01	8.832E+00	97	97	.351	(COMP+BEND)
594	'SLE'	1.275E+01	3.750E-01	7.045E+00	5.074E+00	-1.958E+00	1.248E+01	49	55	.348	(COMP+BEND)
'BC208'	'SLE'	1.400E+01	3.750E-01	7.670E+00	4.163E+00	-2.253E+00	1.240E+01	49	49	.348	(COMP+BEND)
'CD508'	'SLE'	1.275E+01	3.750E-01	5.000E+00	8.997E+00	-1.798E+00	1.418E+01	49	49	.347	(COMP+BEND)
192	'SLE'	1.075E+01	3.650E-01	5.586E+00	-7.869E+00	1.234E+00	1.355E+01	51	46	.346	(COMP+BEND)
'BC302'	'SLE'	1.400E+01	3.750E-01	1.316E+00	-1.282E+01	-2.874E+00	1.445E+01	53	53	.344	(TENS+HYDRO)
'B401'	'SLE'	1.400E+01	3.750E-01	-9.147E+00	2.791E+00	-1.013E+00	1.212E+01	91	91	.344	(TENS+HYDRO)
'AB502'	'SLE'	1.275E+01	3.750E-01	-4.146E+00	-9.614E+00	-3.188E+00	1.427E+01	41	41	.343	(TEN +BEND)
'CD502'	'SLE'	1.275E+01	3.750E-01	5.442E+00	-7.843E+00	-3.175E+00	1.390E+01	41	41	.342	(COMP+BEND)
'A110'	'SLE'	1.075E+01	3.650E-01	4.854E+00	-6.111E+00	-1.177E+00	1.108E+01	89	52	.342	(COMP+BEND)
323	'SLE'	1.400E+01	3.750E-01	-8.589E+00	3.000E+00	-8.177E-01	1.170E+01	93	93	.341	(TENS+HYDRO)

'VA25A'	'SLE'	2.400E+01	1.000E+00	8.955E+00	2.722E+00	2.711E+00	1.280E+01	22	22	.339	(COMP+BEND)
'D211'	'SLE'	1.075E+01	3.650E-01	2.259E+00	1.017E+01	1.692E+00	1.257E+01	111	37	.336	(COMP+BEND)
'CD501'	'SLE'	1.275E+01	3.750E-01	-4.690E+00	7.644E+00	4.933E+00	1.379E+01	41	41	.335	(TEN +BEND)
'VC12B'	'SLE'	4.000E+01	1.750E+00	9.213E+00	2.417E+00	3.153E-01	1.165E+01	19	38	.334	(COMP+BEND)
'DBC24'	'SLE'	1.600E+01	3.750E-01	-8.449E+00	-4.030E-01	4.230E+00	1.270E+01	101	101	.332	(TEN +BEND)
'VC21'	'SLE'	4.000E+01	1.750E+00	9.642E+00	-1.258E+00	-8.853E-01	1.118E+01	38	38	.331	(COMP+BEND)
423	'SLE'	1.275E+01	3.750E-01	-8.554E+00	2.974E+00	9.392E-01	1.167E+01	89	89	.331	(TENS+HYDRO)
'A103'	'STLWTR'	1.800E+01	3.750E-01	7.799E-01	2.353E+00	3.195E-01	3.155E+00	97	27	.329	(TENS+HYDRO)
'VC12'	'SLE'	4.000E+01	1.750E+00	9.185E+00	-1.730E+00	1.357E+00	1.138E+01	19	38	.329	(COMP+BEND)
512	'SLE'	1.275E+01	3.750E-01	4.795E+00	5.537E+00	1.676E+00	1.058E+01	88	88	.327	(COMP+BEND)
293	'SLE'	1.400E+01	3.750E-01	8.929E+00	-1.173E+00	1.674E+00	1.097E+01	39	44	.327	(COMP+BEND)
'A404'	'SLE'	1.400E+01	3.750E-01	-8.908E+00	2.472E+00	7.185E-01	1.148E+01	91	91	.327	(TENS+HYDRO)
'AB202'	'SLE'	1.400E+01	3.750E-01	4.923E+00	-5.640E+00	1.204E+00	1.069E+01	84	84	.325	(COMP+BEND)
585	'SLE'	1.275E+01	3.750E-01	5.522E+00	3.837E+00	2.272E+00	9.981E+00	49	88	.322	(COMP+BEND)
'VD21'	'SLE'	4.000E+01	1.750E+00	8.616E+00	-2.348E+00	1.059E+00	1.119E+01	38	38	.320	(COMP+BEND)
'A202'	'SLE'	1.800E+01	3.750E-01	4.703E+00	-2.646E+00	-2.298E+00	8.208E+00	110	39	.320	(COMP+BEND)
'C504'	'SLE'	1.275E+01	3.750E-01	5.178E+00	4.608E+00	7.964E-01	9.854E+00	88	88	.320	(COMP+BEND)
'AB102'	'STLWTR'	1.600E+01	3.750E-01	7.392E-01	-4.651E+00	1.659E-02	5.390E+00	79	79	.320	(TENS+HYDRO)
'A101'	'STLWTR'	1.800E+01	3.750E-01	7.787E-01	1.873E+00	2.819E-02	2.652E+00	97	56	.318	(TENS+HYDRO)
'A102'	'STLWTR'	1.800E+01	3.750E-01	7.787E-01	-1.782E+00	-4.011E-02	2.561E+00	121	39	.316	(TENS+HYDRO)
132	'SLE'	1.600E+01	3.750E-01	6.351E+00	2.144E+00	9.486E-01	8.695E+00	87	69	.315	(COMP+BEND)
294	'SLE'	1.400E+01	3.750E-01	7.209E+00	3.294E+00	-2.535E+00	1.137E+01	45	40	.315	(COMP+BEND)
'A203'	'SLE'	1.800E+01	3.750E-01	4.717E+00	4.778E+00	2.344E+00	1.004E+01	88	27	.313	(COMP+BEND)
282	'SLE'	1.400E+01	3.750E-01	6.166E+00	-3.313E+00	-4.015E-01	9.503E+00	78	70	.313	(COMP+BEND)
'BC108'	'SLE'	1.600E+01	3.750E-01	6.612E+00	5.053E+00	-8.411E-01	1.173E+01	42	42	.312	(COMP+BEND)
292	'SLE'	1.400E+01	3.750E-01	5.839E+00	-6.131E+00	-1.601E+00	1.218E+01	39	44	.312	(COMP+BEND)
'A201'	'SLE'	1.800E+01	3.750E-01	4.714E+00	4.801E+00	1.873E+00	9.867E+00	88	36	.310	(COMP+BEND)
'CD507'	'SLE'	1.275E+01	3.750E-01	-4.913E+00	-7.536E+00	1.512E+00	1.260E+01	49	49	.310	(TEN +BEND)
'BC207'	'SLE'	1.400E+01	3.750E-01	6.904E+00	-3.746E+00	-1.660E+00	1.100E+01	49	49	.309	(COMP+BEND)
'VC13'	'SLE'	4.000E+01	1.750E+00	8.321E+00	2.463E+00	6.518E-01	1.087E+01	19	38	.308	(COMP+BEND)
'AB208'	'STLWTR'	1.400E+01	3.750E-01	5.098E-01	6.004E+00	-8.553E-02	6.514E+00	45	45	.308	(TENS+HYDRO)
'CD302'	'SLE'	1.400E+01	3.750E-01	2.660E+00	-9.935E+00	2.358E+00	1.287E+01	42	42	.303	(COMP+BEND)
'CD102'	'SLE'	1.600E+01	3.750E-01	3.460E+00	-8.729E+00	1.653E+00	1.234E+01	64	64	.302	(COMP+BEND)
'AB303'	'SLE'	1.400E+01	3.750E-01	6.341E+00	2.645E+00	1.528E+00	9.395E+00	72	72	.301	(COMP+BEND)
'CD107'	'STLWTR'	1.600E+01	3.750E-01	6.907E-01	-4.061E+00	-4.900E-02	4.752E+00	39	39	.300	(TENS+HYDRO)
'CD210'	'STLWTR'	2.000E+01	3.750E-01	6.765E-01	-4.189E-01	-3.618E-02	1.097E+00	107	107	.297	(HYD. COMPR)
'BC210'	'STLWTR'	2.000E+01	3.750E-01	5.093E-01	-4.267E-01	4.923E-03	9.361E-01	97	97	.297	(HYD. COMPR)
'AB210'	'STLWTR'	2.000E+01	3.750E-01	5.863E-01	-5.426E-01	-3.727E-03	1.129E+00	107	107	.297	(HYD. COMPR)
'VC22'	'SLE'	4.000E+01	1.750E+00	8.654E+00	1.014E+00	8.939E-01	1.001E+01	37	37	.296	(COMP+BEND)
'A301'	'SLE'	1.600E+01	3.750E-01	5.144E+00	3.221E+00	1.584E+00	8.733E+00	89	30	.295	(COMP+BEND)
'VA11'	'SLE'	4.000E+01	1.750E+00	8.657E+00	8.550E-01	-8.368E-01	9.853E+00	38	38	.295	(COMP+BEND)
286	'SLE'	1.400E+01	3.750E-01	4.834E+00	4.941E+00	3.732E-01	9.789E+00	78	70	.294	(COMP+BEND)
'VC13B'	'SLE'	4.000E+01	1.750E+00	8.182E+00	-1.586E+00	9.960E-01	1.006E+01	19	38	.291	(COMP+BEND)
'VB11'	'SLE'	4.000E+01	1.750E+00	8.184E+00	1.542E+00	7.284E-01	9.890E+00	38	38	.289	(COMP+BEND)
'DC213D'	'SLE'	1.600E+01	3.750E-01	-2.680E+00	3.962E-01	-7.105E+00	9.796E+00	45	45	.289	(TENS+HYDRO)
'VB21'	'SLE'	4.000E+01	1.750E+00	8.311E+00	1.240E+00	-5.482E-01	9.667E+00	38	38	.286	(COMP+BEND)
'A302'	'SLE'	1.600E+01	3.750E-01	5.145E+00	2.641E+00	1.673E+00	8.271E+00	89	74	.286	(COMP+BEND)
'VD22'	'SLE'	4.000E+01	1.750E+00	7.734E+00	2.037E+00	8.273E-01	9.933E+00	38	38	.285	(COMP+BEND)
'VB12B'	'SLE'	4.000E+01	1.750E+00	7.782E+00	-1.628E+00	-1.385E+00	9.919E+00	19	38	.284	(COMP+BEND)
'VD31'	'SLE'	4.000E+01	1.750E+00	8.589E+00	-5.540E-01	4.992E-01	9.335E+00	38	38	.283	(COMP+BEND)

'D110'	'SLE'	1.075E+01	3.650E-01	1.917E+00	-9.978E+00	-9.397E-01	1.194E+01	89	52	.283	(COMP+BEND)
'CD201'	'SLE'	1.400E+01	3.750E-01	2.972E+00	7.610E+00	-1.350E+00	1.070E+01	84	84	.280	(COMP+BEND)
'VB12'	'SLE'	4.000E+01	1.750E+00	7.627E+00	-1.611E+00	-1.371E+00	9.742E+00	19	38	.279	(COMP+BEND)
'DC212D'	'SLE'	1.600E+01	3.750E-01	2.599E+00	6.280E-01	-8.974E+00	1.160E+01	50	50	.274	(COMP+BEND)
'CD101'	'STLWTR'	1.600E+01	3.750E-01	5.657E-01	3.169E+00	-3.657E-02	3.735E+00	79	79	.274	(TENS+HYDRO)
'VD11'	'SLE'	4.000E+01	1.750E+00	7.097E+00	2.465E+00	7.586E-01	9.676E+00	38	38	.273	(COMP+BEND)
'VC31'	'SLE'	4.000E+01	1.750E+00	8.436E+00	-3.465E-01	-2.868E-01	8.885E+00	38	38	.272	(COMP+BEND)
'AB301'	'SLE'	1.400E+01	3.750E-01	5.778E+00	4.065E+00	1.089E+00	9.986E+00	42	42	.267	(COMP+BEND)
'VD32'	'SLE'	4.000E+01	1.750E+00	7.504E+00	-1.368E+00	8.175E-01	9.098E+00	38	38	.266	(COMP+BEND)
'VC14'	'SLE'	4.000E+01	1.750E+00	7.481E+00	1.547E+00	-4.399E-01	9.089E+00	38	38	.265	(COMP+BEND)
'BC202'	'SLE'	1.400E+01	3.750E-01	5.917E+00	-2.636E+00	-1.033E+00	8.749E+00	61	61	.265	(COMP+BEND)
112	'SLE'	1.600E+01	3.750E-01	4.616E+00	2.706E+00	2.003E+00	7.983E+00	87	69	.263	(COMP+BEND)
'BC107'	'STLWTR'	1.600E+01	3.750E-01	8.385E-01	-2.968E+00	-1.640E-02	3.806E+00	42	42	.259	(TENS+HYDRO)
122	'SLE'	1.600E+01	3.750E-01	5.439E+00	2.744E+00	6.054E-01	8.250E+00	69	69	.258	(COMP+BEND)
'VC32'	'SLE'	4.000E+01	1.750E+00	7.715E+00	-6.695E-01	4.109E-01	8.501E+00	38	38	.256	(COMP+BEND)
'VD12'	'SLE'	4.000E+01	1.750E+00	6.783E+00	2.114E+00	7.312E-01	9.020E+00	38	38	.256	(COMP+BEND)
'DB213D'	'SLE'	1.600E+01	5.000E-01	-1.730E+00	6.269E-01	-7.082E+00	8.840E+00	45	45	.254	(TENS+HYDRO)
'VB13'	'SLE'	4.000E+01	1.750E+00	6.902E+00	1.890E+00	6.914E-01	8.915E+00	19	38	.254	(COMP+BEND)
'VA12'	'SLE'	4.000E+01	1.750E+00	7.301E+00	6.989E-01	-1.108E+00	8.612E+00	38	38	.254	(COMP+BEND)
'VC23'	'SLE'	4.000E+01	1.750E+00	7.272E+00	-1.218E+00	-5.868E-01	8.624E+00	37	37	.253	(COMP+BEND)
'VA21'	'SLE'	4.000E+01	1.750E+00	7.335E+00	-8.933E-01	-8.182E-01	8.547E+00	38	38	.253	(COMP+BEND)
'VB22'	'SLE'	4.000E+01	1.750E+00	7.348E+00	8.895E-01	-8.289E-01	8.564E+00	37	37	.253	(COMP+BEND)
384	'SLE'	1.400E+01	3.750E-01	3.259E+00	6.737E+00	1.671E+00	1.020E+01	45	50	.247	(COMP+BEND)
'VB13B'	'SLE'	4.000E+01	1.750E+00	6.794E+00	-1.505E+00	9.752E-01	8.587E+00	19	38	.246	(COMP+BEND)
'CD303'	'SLE'	1.400E+01	3.750E-01	2.434E+00	7.593E+00	-1.291E+00	1.014E+01	72	72	.244	(COMP+BEND)
'CD207'	'SLE'	1.400E+01	3.750E-01	2.595E+00	-7.282E+00	-2.353E+00	1.025E+01	45	45	.244	(COMP+BEND)
284	'SLE'	1.400E+01	3.750E-01	5.738E+00	2.448E+00	1.716E+00	8.728E+00	45	40	.244	(COMP+BEND)
'VB31'	'SLE'	4.000E+01	1.750E+00	7.559E+00	-1.814E-01	3.093E-01	7.918E+00	38	38	.243	(COMP+BEND)
'A111'	'STLWTR'	1.075E+01	3.650E-01	5.093E-01	4.618E+00	2.689E-02	5.127E+00	111	37	.243	(TENS+HYDRO)
'BC101'	'STLWTR'	1.600E+01	3.750E-01	7.203E-01	2.238E+00	1.593E-02	2.959E+00	61	61	.241	(TENS+HYDRO)
194	'SLE'	1.075E+01	3.650E-01	4.766E+00	3.541E+00	8.603E-01	8.411E+00	59	52	.238	(COMP+BEND)
181	'STLWTR'	1.075E+01	3.650E-01	5.257E-01	4.516E+00	-2.907E-03	5.042E+00	68	60	.237	(TENS+HYDRO)
'VD33'	'SLE'	4.000E+01	1.750E+00	6.530E+00	-1.396E+00	7.531E-01	8.116E+00	38	38	.235	(COMP+BEND)
'VD23'	'SLE'	4.000E+01	1.750E+00	6.388E+00	-1.568E+00	8.642E-01	8.178E+00	38	38	.234	(COMP+BEND)
581	'SLE'	1.275E+01	3.750E-01	-4.262E+00	-5.030E+00	9.655E-01	9.383E+00	43	77	.234	(TEN +BEND)
'VB32'	'SLE'	4.000E+01	1.750E+00	6.943E+00	-6.332E-01	-5.470E-01	7.780E+00	38	38	.233	(COMP+BEND)
'VC33'	'SLE'	4.000E+01	1.750E+00	6.376E+00	-1.411E+00	5.928E-01	7.906E+00	38	38	.229	(COMP+BEND)
'BC102'	'STLWTR'	1.600E+01	3.750E-01	9.327E-01	-1.937E+00	-4.329E-02	2.870E+00	61	61	.229	(TENS+HYDRO)
'AB107'	'STLWTR'	1.600E+01	3.750E-01	7.702E-01	1.764E+00	-3.532E-02	2.534E+00	49	39	.228	(TENS+HYDRO)
'VD13'	'SLE'	4.000E+01	1.750E+00	6.279E+00	1.238E+00	1.043E+00	7.898E+00	38	38	.228	(COMP+BEND)
'A211'	'SLE'	1.075E+01	3.650E-01	2.906E+00	3.290E+00	8.072E-01	6.294E+00	111	37	.224	(COMP+BEND)
'BC508'	'SLE'	1.275E+01	3.750E-01	-2.497E+00	6.685E+00	-1.633E+00	9.379E+00	54	54	.224	(TEN +BEND)
'VA22'	'SLE'	4.000E+01	1.750E+00	6.637E+00	5.619E-01	-5.476E-01	7.422E+00	38	38	.222	(COMP+BEND)
596	'SLE'	1.275E+01	3.750E-01	5.196E+00	1.301E+00	-2.254E+00	7.798E+00	43	48	.221	(COMP+BEND)
'BC507'	'SLE'	1.275E+01	3.750E-01	2.496E+00	-6.638E+00	1.176E+00	9.237E+00	54	54	.221	(COMP+BEND)
'VB14'	'SLE'	4.000E+01	1.750E+00	6.462E+00	9.277E-01	-1.979E-01	7.410E+00	38	38	.220	(COMP+BEND)
592	'SLE'	1.275E+01	3.750E-01	4.507E+00	-2.005E+00	-3.037E+00	8.146E+00	43	48	.219	(COMP+BEND)
'VB23'	'SLE'	4.000E+01	1.750E+00	6.385E+00	-6.507E-01	7.065E-01	7.345E+00	37	37	.218	(COMP+BEND)
285	'SLE'	1.400E+01	3.750E-01	4.248E+00	3.934E+00	-1.113E+00	8.337E+00	45	40	.217	(COMP+BEND)
'VA13'	'SLE'	4.000E+01	1.750E+00	6.202E+00	6.110E-01	-1.016E+00	7.387E+00	38	38	.217	(COMP+BEND)

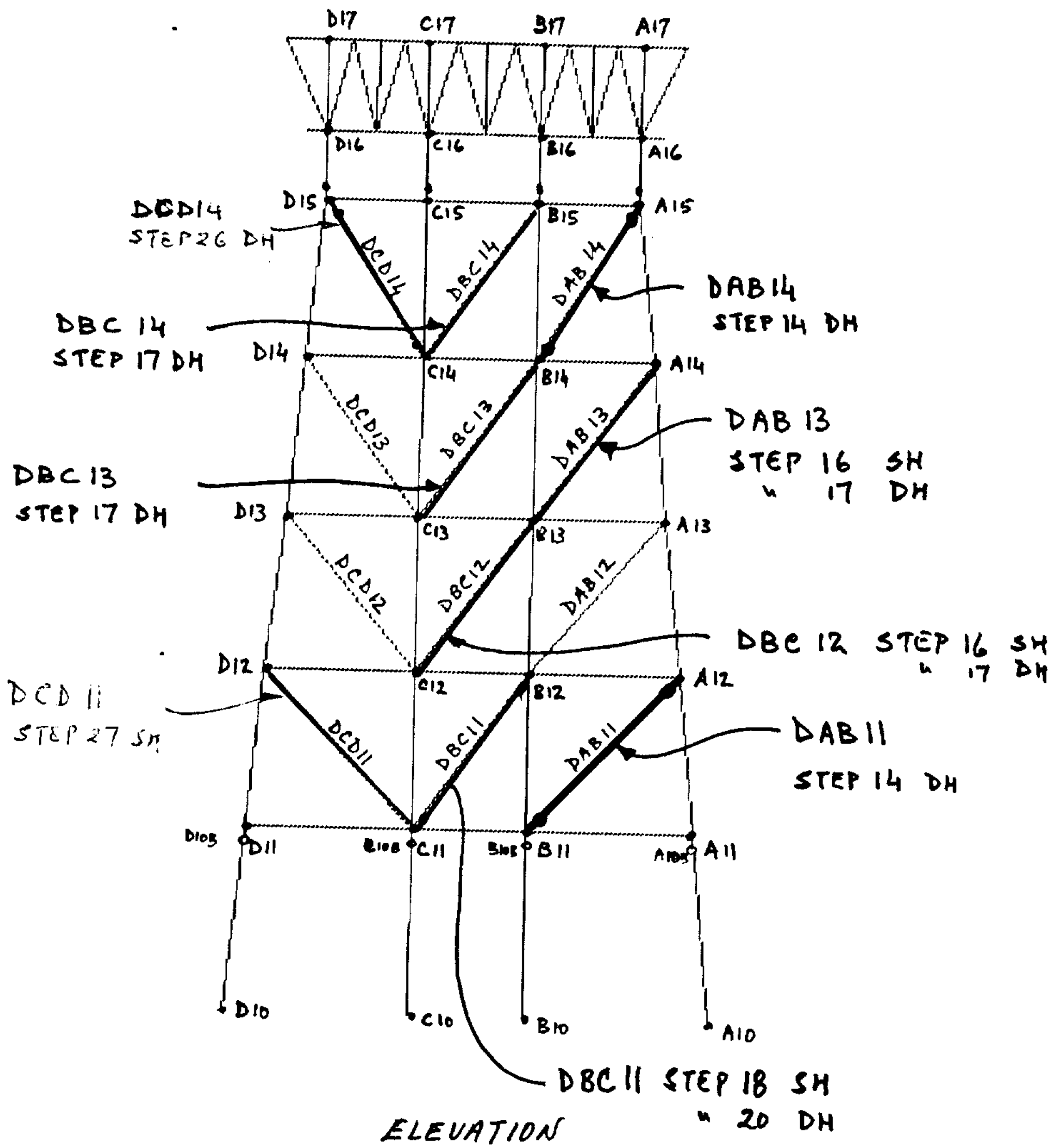
382	'SLE'	1.400E+01	3.750E-01	3.344E+00	3.528E+00	1.076E+00	7.032E+00	78	87	.214	(COMP+BEND)
'CD108'	'STLWTR'	1.600E+01	3.750E-01	8.104E-01	-1.053E+00	-1.847E-02	1.863E+00	49	39	.213	(TENS+HYDRO)
591	'SLE'	1.275E+01	3.750E-01	-4.303E+00	-3.835E+00	-1.445E+00	8.401E+00	43	48	.212	(TEN +BEND)
'VD14'	'SLE'	4.000E+01	1.750E+00	5.885E+00	1.179E+00	8.112E-01	7.316E+00	38	38	.212	(COMP+BEND)
'CD301'	'SLE'	1.400E+01	3.750E-01	2.209E+00	5.969E+00	-1.941E+00	8.486E+00	78	78	.211	(COMP+BEND)
'VB33'	'SLE'	4.000E+01	1.750E+00	6.139E+00	-7.416E-01	-6.527E-01	7.127E+00	38	38	.211	(COMP+BEND)
'VC24'	'SLE'	4.000E+01	1.750E+00	5.981E+00	-9.968E-01	-4.647E-01	7.081E+00	37	30	.208	(COMP+BEND)
197	'STLWTR'	1.075E+01	3.650E-01	5.836E-01	-3.754E+00	5.707E-02	4.338E+00	51	46	.202	(TENS+HYDRO)
388	'SLE'	1.400E+01	3.750E-01	5.278E-01	-7.128E+00	-9.311E-01	7.717E+00	26	29	.201	(TENS+HYDRO)
296	'SLE'	1.400E+01	3.750E-01	4.394E+00	3.007E+00	7.173E-01	7.486E+00	39	44	.201	(COMP+BEND)
'BC501'	'SLE'	1.275E+01	3.750E-01	1.779E+00	5.967E+00	3.069E+00	8.489E+00	46	46	.200	(COMP+BEND)
'D111'	'SLE'	1.075E+01	3.650E-01	1.612E+00	5.608E+00	-7.506E-01	7.270E+00	111	37	.200	(COMP+BEND)
198	'SLE'	1.075E+01	3.650E-01	7.185E-01	-6.857E+00	-1.059E+00	7.657E+00	68	60	.199	(TENS+HYDRO)
'AB302'	'SLE'	1.400E+01	3.750E-01	3.355E+00	-2.605E+00	-1.916E+00	6.589E+00	78	78	.196	(COMP+BEND)
295	'SLE'	1.400E+01	3.750E-01	3.535E+00	3.989E+00	1.189E+00	7.697E+00	45	40	.195	(COMP+BEND)
'VA23'	'SLE'	4.000E+01	1.750E+00	5.364E+00	1.130E+00	-8.380E-01	6.771E+00	38	38	.195	(COMP+BEND)
'DC212C'	'SLE'	1.600E+01	3.750E-01	2.912E+00	9.272E-01	-4.274E+00	7.286E+00	66	66	.192	(COMP+BEND)
281	'STLWTR'	1.400E+01	3.750E-01	4.828E-01	3.305E+00	1.812E-02	3.788E+00	39	34	.191	(TENS+HYDRO)
'DB212D'	'SLE'	1.600E+01	3.750E-01	2.327E+00	5.724E-01	5.584E+00	7.940E+00	50	50	.191	(COMP+BEND)
'VD24'	'SLE'	4.000E+01	1.750E+00	5.151E+00	-1.291E+00	7.372E-01	6.638E+00	38	38	.190	(COMP+BEND)
'VD34'	'SLE'	4.000E+01	1.750E+00	5.051E+00	-1.379E+00	7.411E-01	6.617E+00	38	38	.188	(COMP+BEND)
'VC34'	'SLE'	4.000E+01	1.750E+00	5.166E+00	-1.196E+00	4.473E-01	6.443E+00	38	38	.186	(COMP+BEND)
'BC502'	'SLE'	1.275E+01	3.750E-01	2.128E+00	-4.723E+00	-2.859E+00	7.649E+00	46	46	.183	(COMP+BEND)
191	'STLWTR'	1.075E+01	3.650E-01	5.451E-01	3.265E+00	1.307E-01	3.812E+00	68	60	.183	(TENS+HYDRO)
'VA31'	'SLE'	4.000E+01	1.750E+00	5.248E+00	-4.459E-01	-6.061E-01	6.000E+00	38	38	.179	(COMP+BEND)
297	'STLWTR'	1.400E+01	3.750E-01	4.093E-01	-2.916E+00	5.640E-02	3.326E+00	39	44	.179	(TENS+HYDRO)
'VA32'	'SLE'	4.000E+01	1.750E+00	5.124E+00	-5.808E-01	-6.660E-01	6.008E+00	38	38	.177	(COMP+BEND)
'VB24'	'SLE'	4.000E+01	1.750E+00	5.139E+00	7.581E-01	4.196E-01	6.005E+00	37	37	.177	(COMP+BEND)
193	'SLE'	1.075E+01	3.650E-01	3.713E+00	2.481E+00	1.050E+00	6.407E+00	51	46	.176	(COMP+BEND)
'VA14'	'SLE'	4.000E+01	1.750E+00	4.913E+00	6.113E-01	-8.407E-01	5.953E+00	38	38	.174	(COMP+BEND)
'VB34'	'SLE'	4.000E+01	1.750E+00	4.901E+00	-8.760E-01	-4.721E-01	5.896E+00	38	38	.172	(COMP+BEND)
291	'STLWTR'	1.400E+01	3.750E-01	4.918E-01	2.824E+00	1.716E-01	3.321E+00	39	34	.172	(TENS+HYDRO)
'CD208'	'SLE'	1.400E+01	3.750E-01	2.799E+00	-3.701E+00	-1.090E+00	6.658E+00	56	45	.171	(COMP+BEND)
598	'SLE'	1.275E+01	3.750E-01	-4.062E+00	-2.210E+00	1.150E+00	6.554E+00	43	48	.170	(TEN +BEND)
'BC301'	'SLE'	1.400E+01	3.750E-01	1.009E+00	5.979E+00	1.985E+00	7.309E+00	53	53	.169	(COMP+BEND)
'AB207'	'SLE'	1.400E+01	3.750E-01	3.452E+00	2.138E+00	-1.369E+00	5.990E+00	56	45	.167	(COMP+BEND)
'AB310'	'SLE'	1.800E+01	3.750E-01	2.241E+00	2.547E+00	6.343E-01	4.866E+00	107	107	.167	(COMP+BEND)
'DC213C'	'SLE'	1.600E+01	3.750E-01	2.966E+00	1.400E+00	2.852E+00	6.143E+00	62	62	.167	(COMP+BEND)
'VA33'	'SLE'	4.000E+01	1.750E+00	4.653E+00	-6.871E-01	-6.285E-01	5.585E+00	38	38	.163	(COMP+BEND)
588	'SLE'	1.275E+01	3.750E-01	-3.256E+00	-1.056E+00	-2.890E+00	6.333E+00	43	77	.160	(TEN +BEND)
195	'SLE'	1.075E+01	3.650E-01	2.901E+00	2.881E+00	7.245E-01	5.872E+00	59	52	.158	(COMP+BEND)
'DB212C'	'STLWTR'	1.600E+01	3.750E-01	7.427E-01	3.549E-01	5.048E-04	1.098E+00	66	66	.152	(HYD. COMPR)
'VA24'	'SLE'	4.000E+01	1.750E+00	4.177E+00	8.504E-01	-7.319E-01	5.299E+00	38	38	.152	(COMP+BEND)
'VA34'	'SLE'	4.000E+01	1.750E+00	3.996E+00	-8.302E-01	-8.599E-01	5.192E+00	38	38	.148	(COMP+BEND)
196	'SLE'	1.075E+01	3.650E-01	3.675E+00	1.268E+00	-2.622E-01	4.970E+00	51	46	.147	(COMP+BEND)
'DB213C'	'SLE'	1.600E+01	5.000E-01	2.208E+00	1.391E+00	3.134E+00	5.637E+00	62	62	.145	(COMP+BEND)
182	'SLE'	1.075E+01	3.650E-01	2.332E+00	-1.629E+00	1.373E-01	3.967E+00	103	91	.145	(COMP+BEND)
'CD310'	'SLE'	1.800E+01	3.750E-01	2.355E+00	9.435E-01	-3.709E-01	3.369E+00	107	107	.138	(COMP+BEND)
'BC310'	'SLE'	1.800E+01	3.750E-01	1.838E+00	2.460E+00	-5.125E-01	4.351E+00	100	100	.137	(COMP+BEND)
184	'SLE'	1.075E+01	3.650E-01	2.659E+00	2.133E+00	5.376E-01	4.859E+00	59	52	.135	(COMP+BEND)

'CD410'	'SLE'	1.800E+01	3.750E-01	2.552E+00	8.832E-01	4.991E-01	3.566E+00	94	94	.133	(COMP+BEND)
'AB410'	'SLE'	1.800E+01	3.750E-01	-1.479E+00	2.527E+00	9.044E-01	4.163E+00	94	94	.130	(TENS+HYDRO)
186	'SLE'	1.075E+01	3.650E-01	1.595E+00	2.564E+00	4.476E-01	4.198E+00	103	91	.129	(COMP+BEND)
'BC410'	'SLE'	1.800E+01	3.750E-01	-1.443E+00	2.232E+00	4.789E-01	3.726E+00	94	94	.118	(TENS+HYDRO)
185	'STLWTR'	1.075E+01	3.650E-01	5.956E-01	1.359E+00	-4.634E-02	1.956E+00	59	52	.113	(TENS+HYDRO)
381	'STLWTR'	1.400E+01	3.750E-01	3.078E-01	7.299E-01	2.714E-02	1.038E+00	26	29	.073	(TENS+HYDRO)

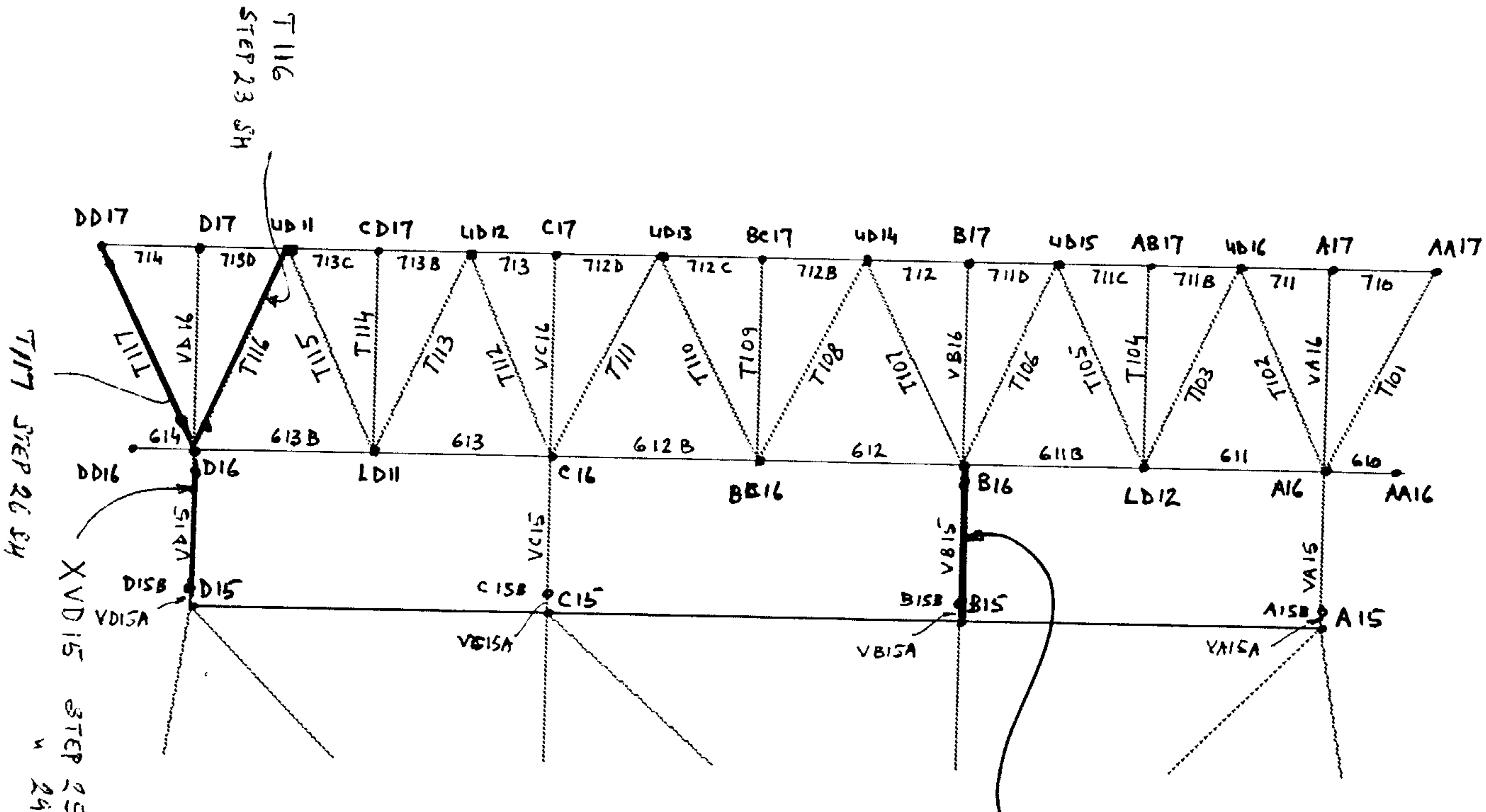
Summary Table Complete For 406 Members and 2 Loading Conditions
Time to Process API Code Check = 798.68 Sec.

TRACKING PLATFORM

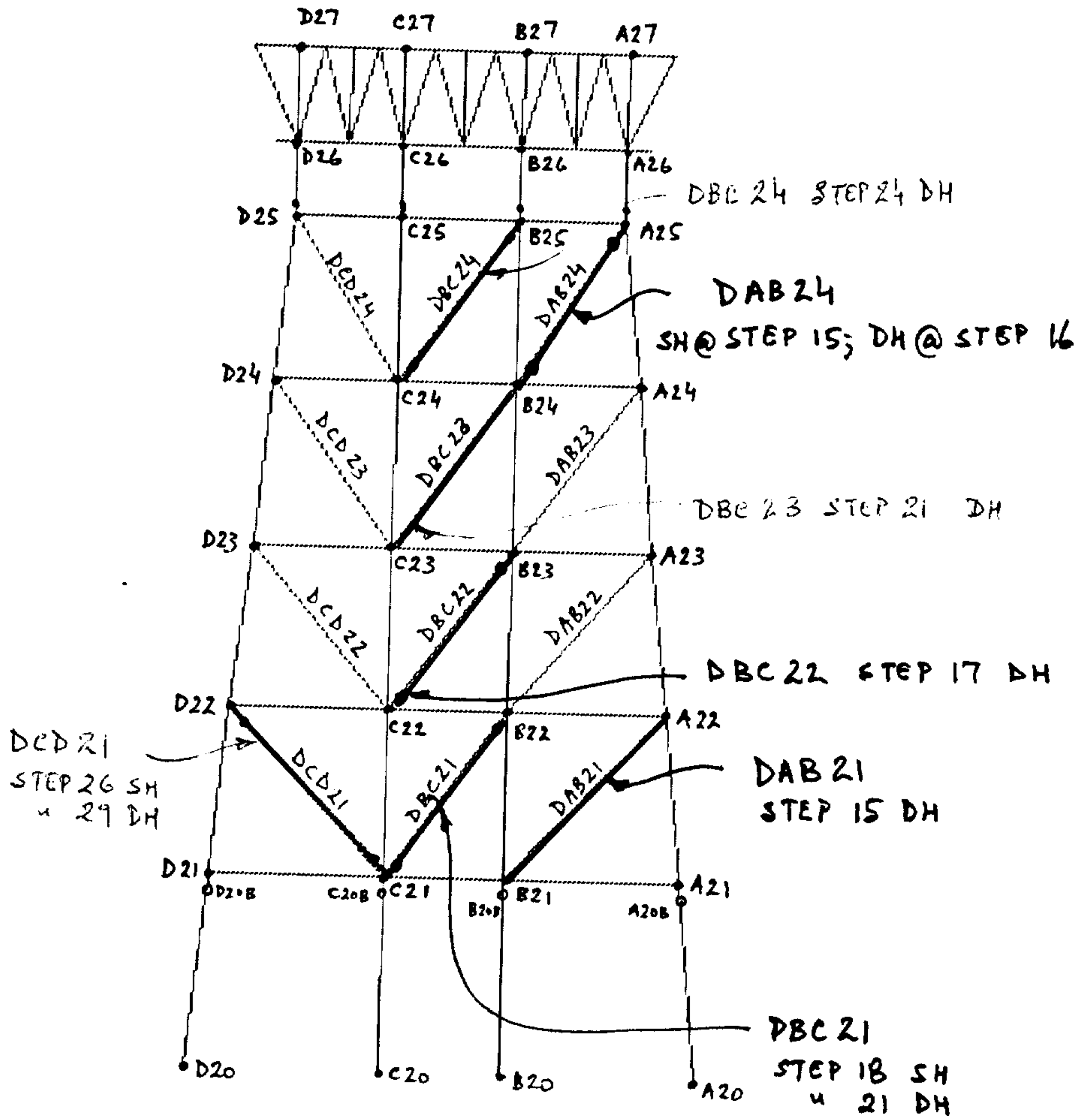
COMPONENTS REACHING CAPACITY



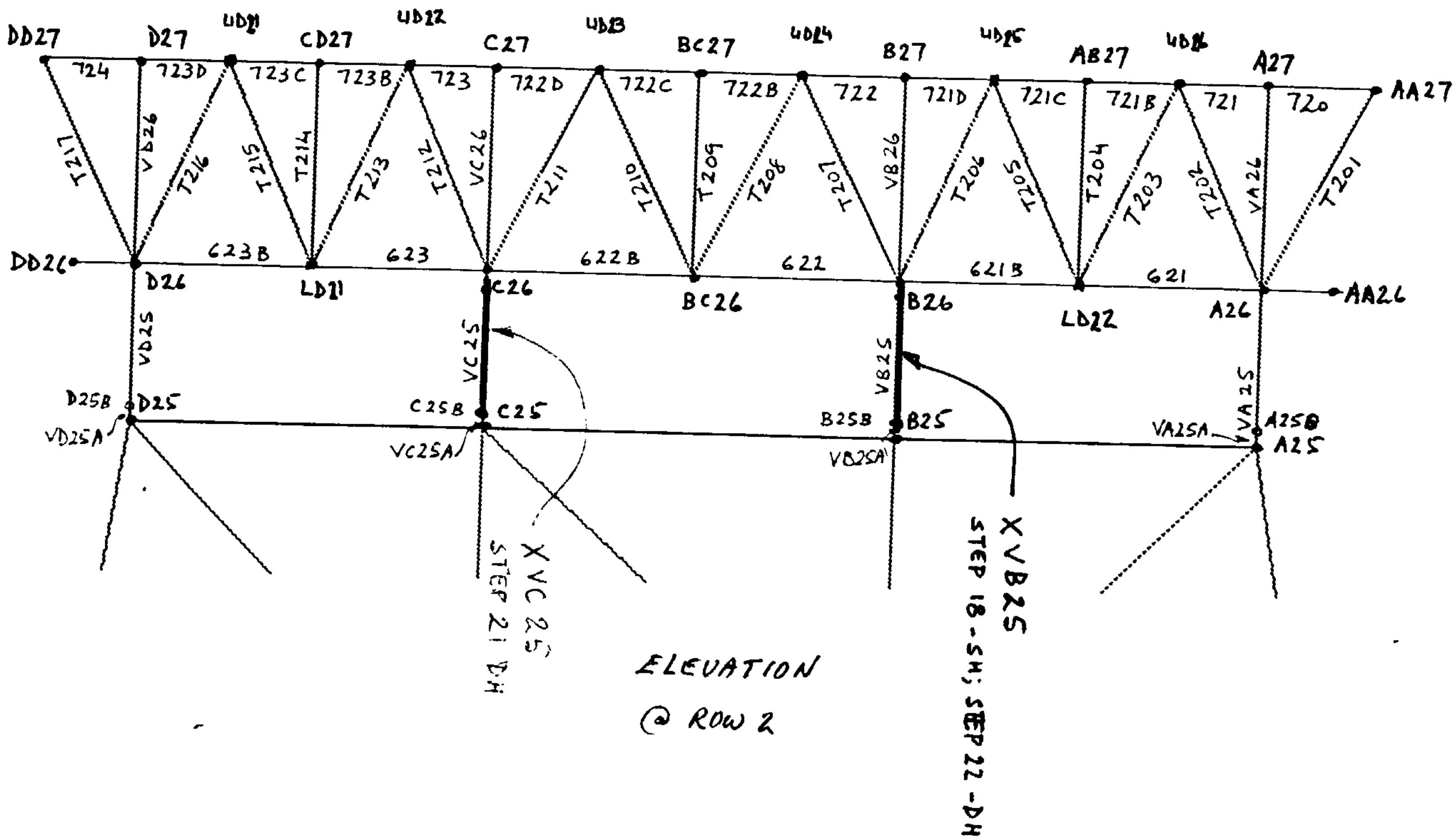
ELEVATION
@ ROW 1



ELEVATION
@ Row 1

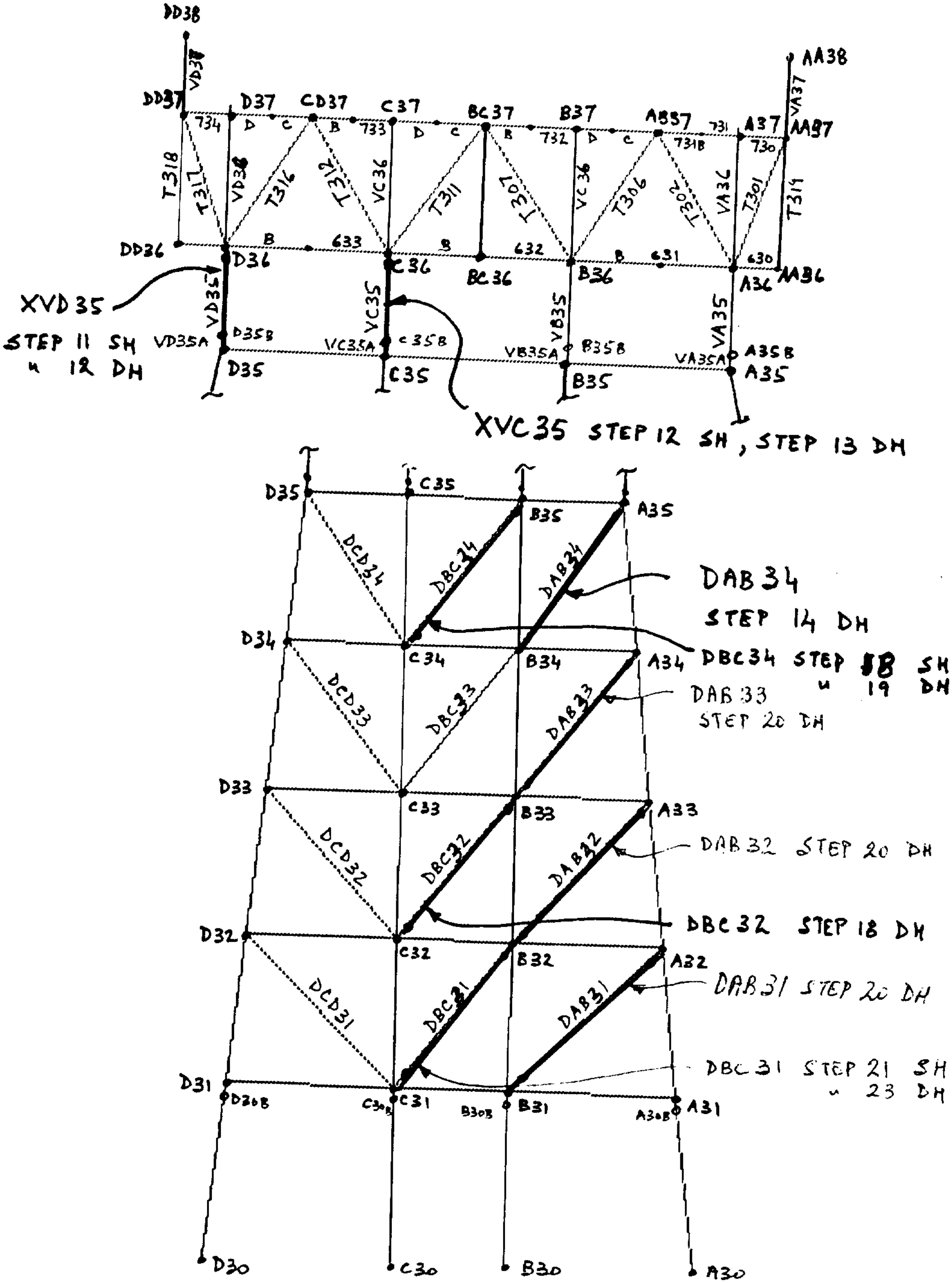


ELEVATION
@ ROW 2



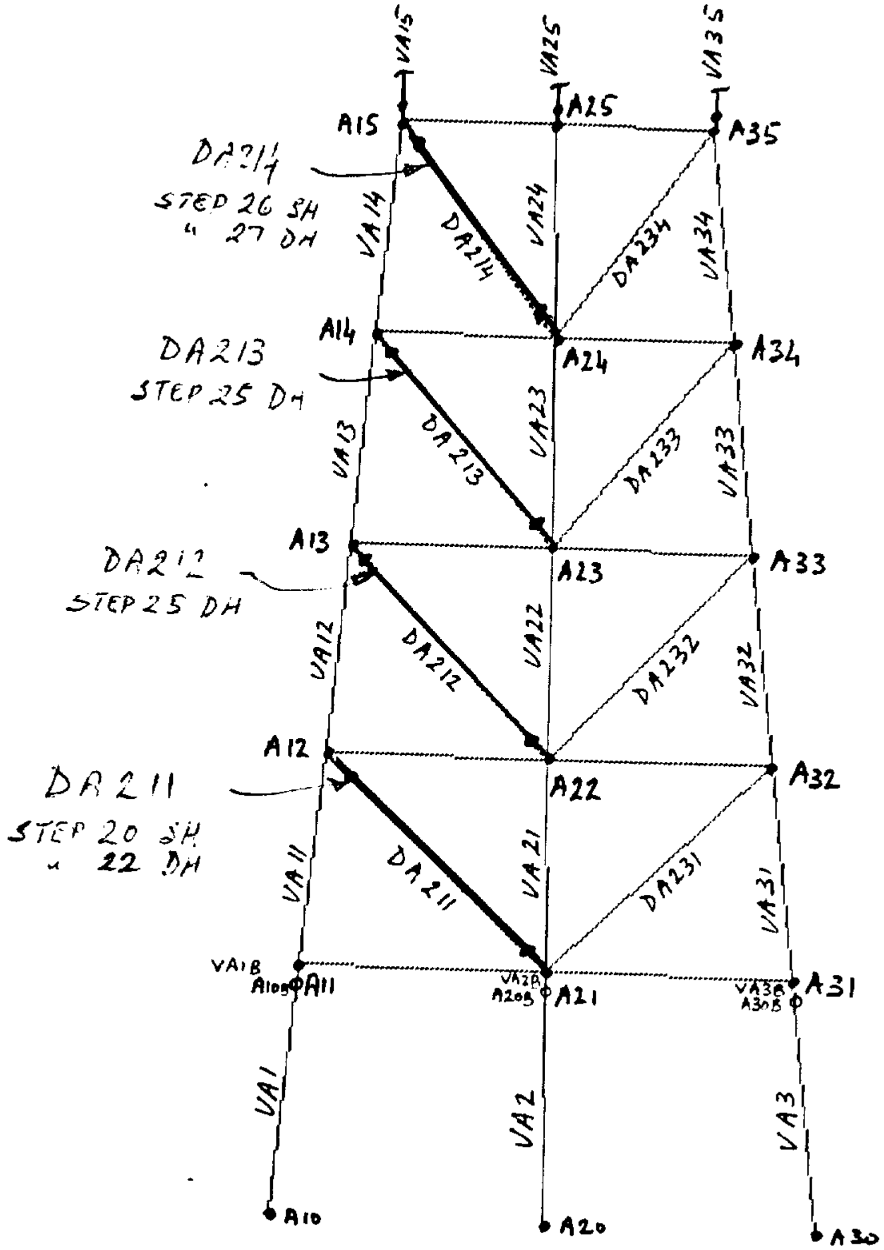
ELEVATION

@ ROW 2

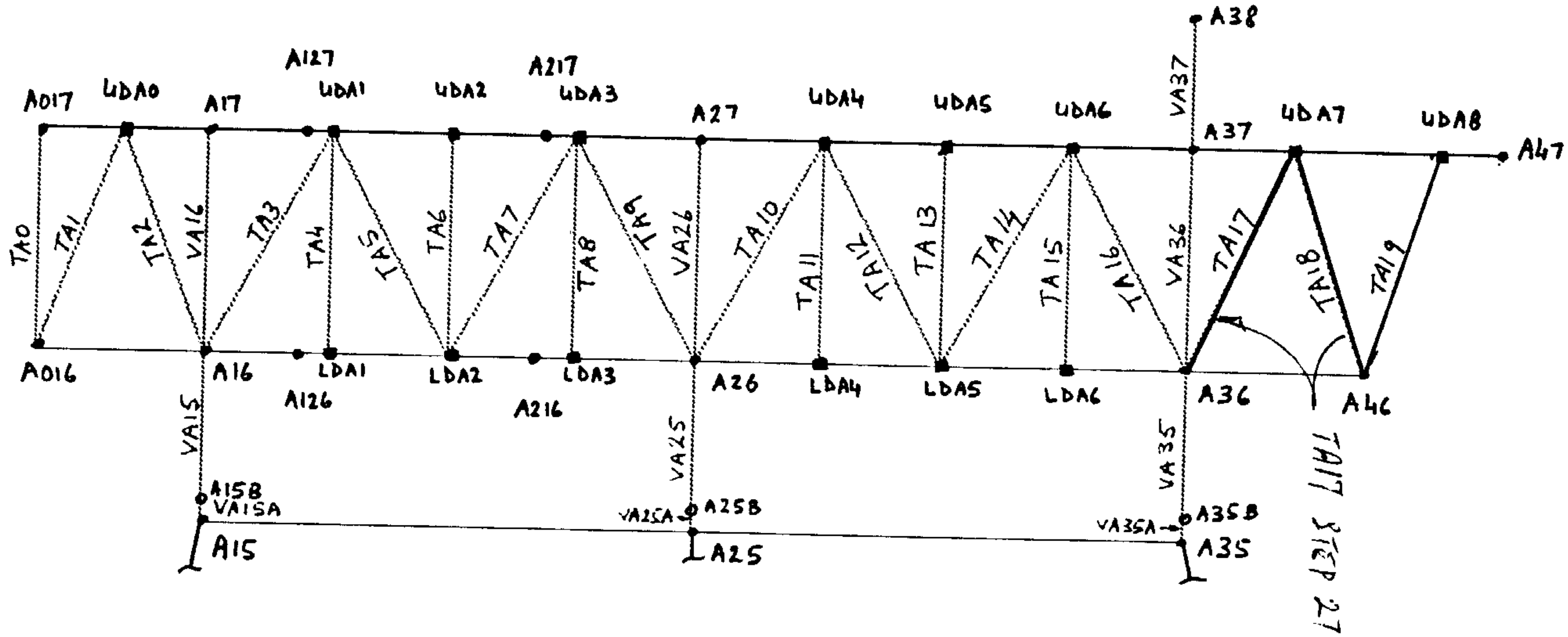


ELEVATION @

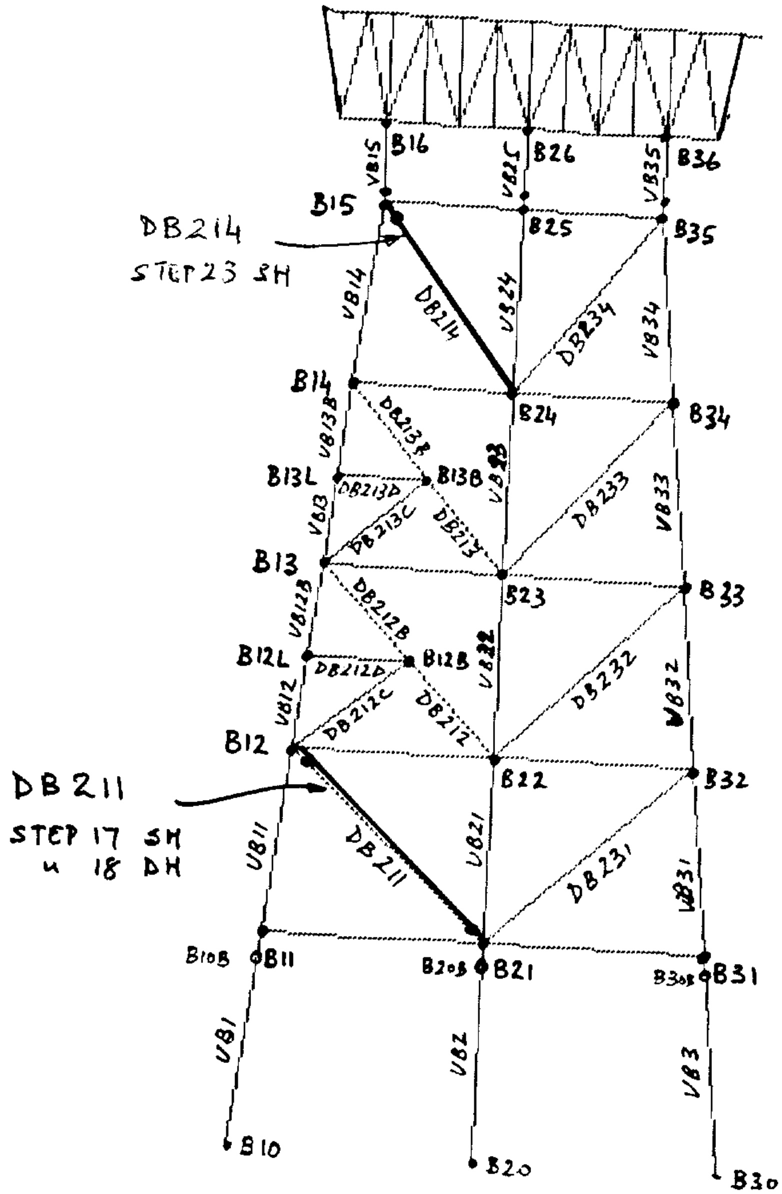
ROW 3



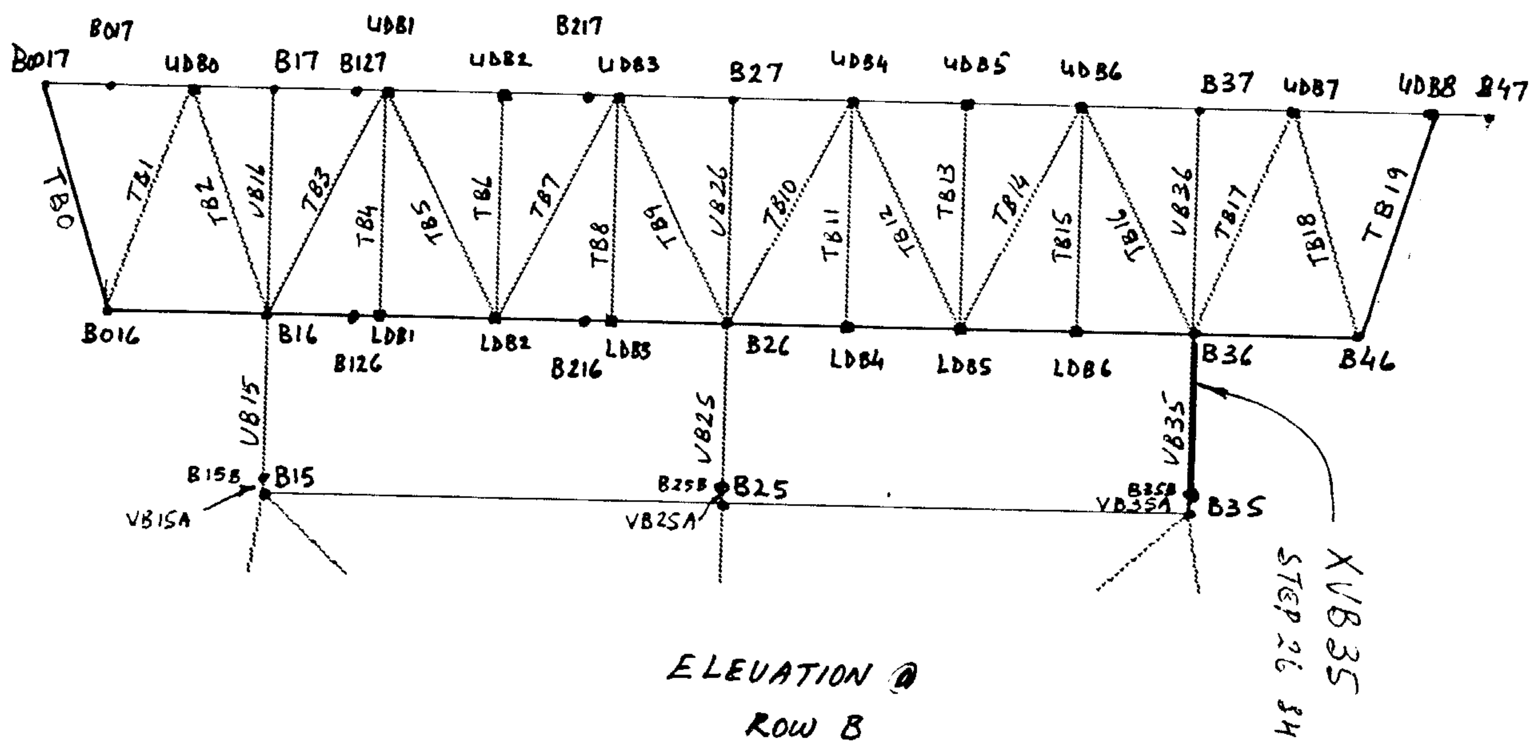
ELEVATION @
ROW A



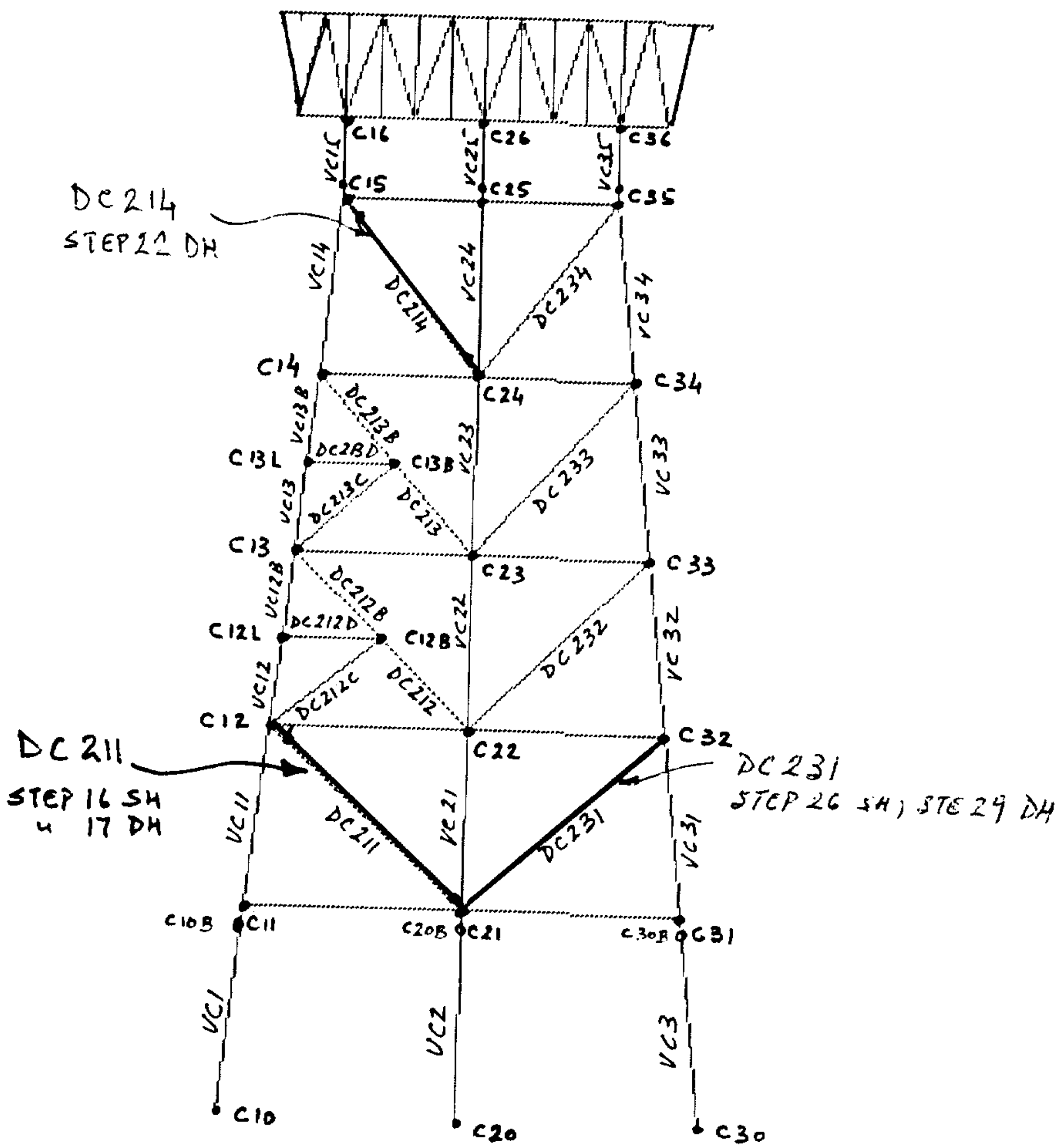
ELEVATION @
ROW A



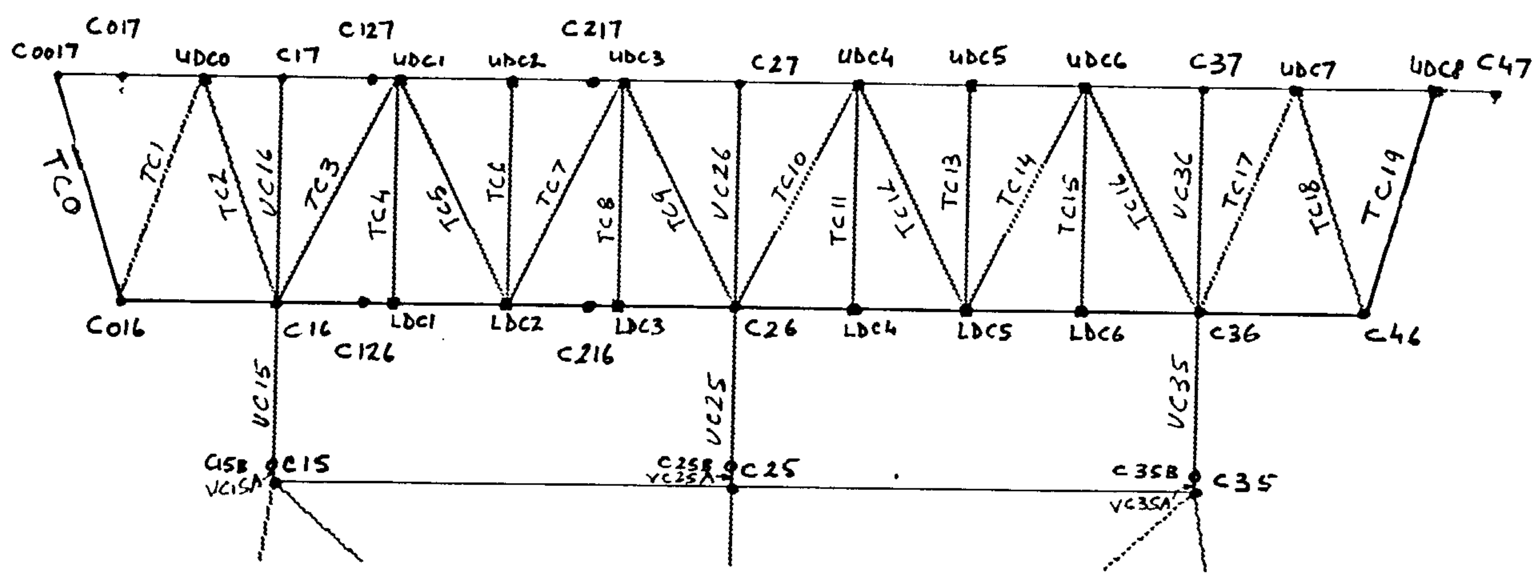
ELEVATION @
ROW B



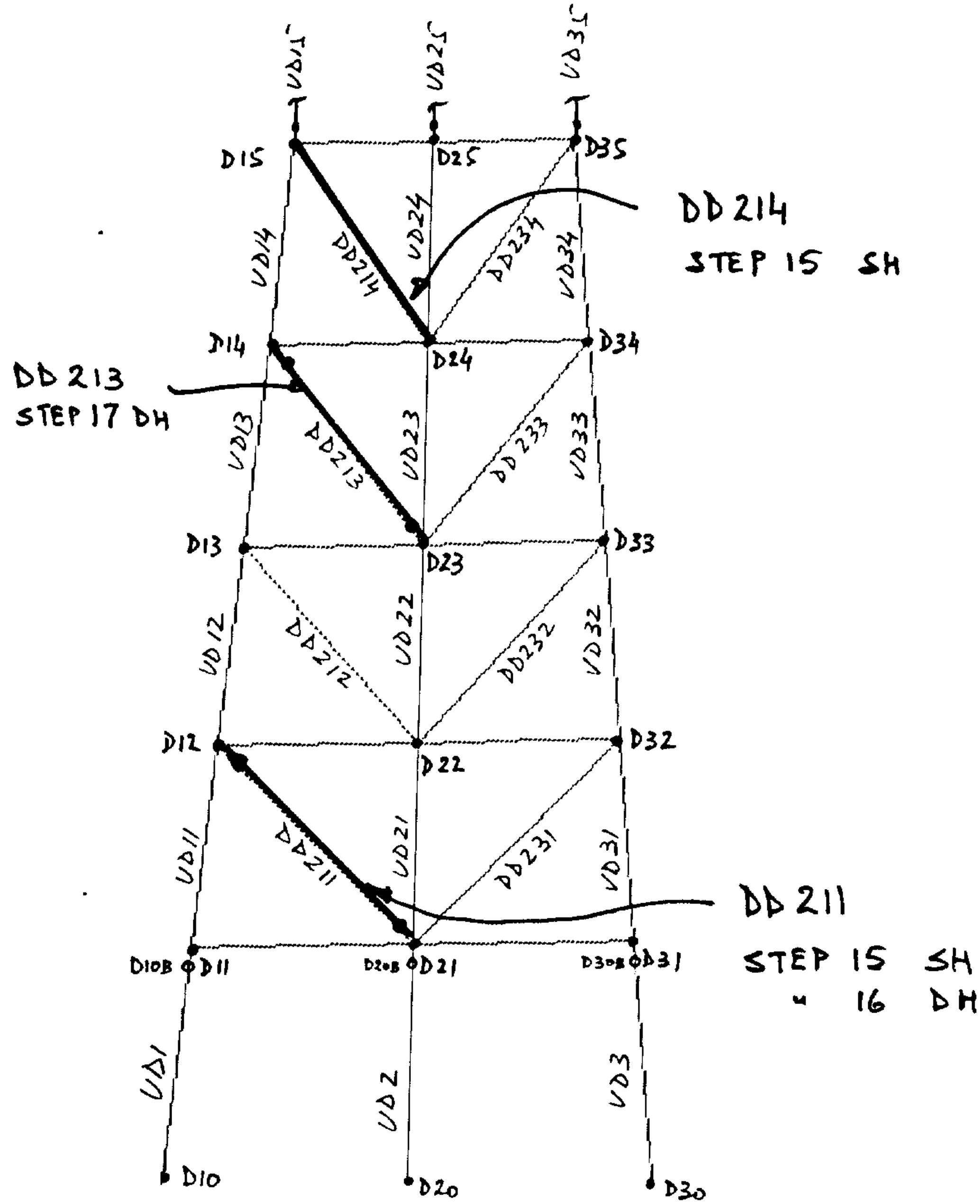
ELEVATION @
ROW B



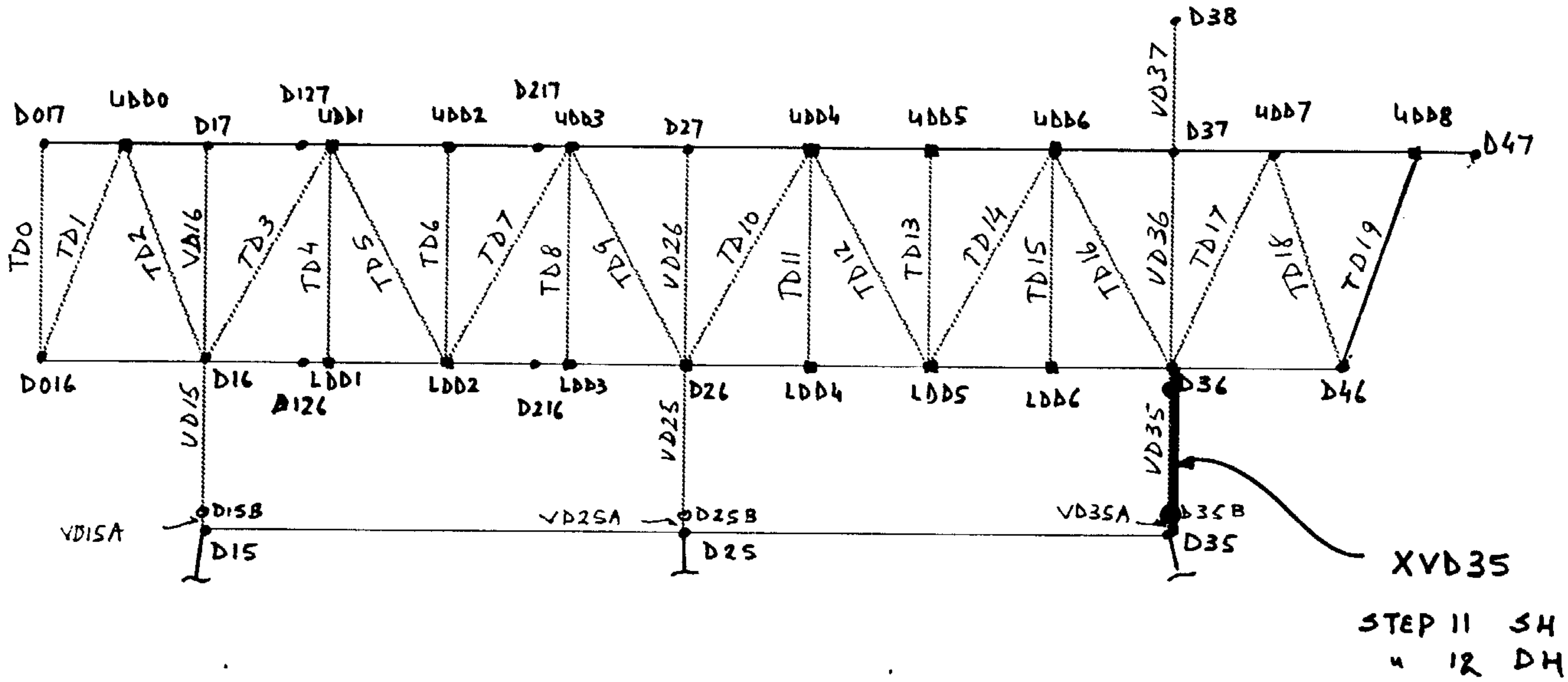
ELEVATION @
ROW C



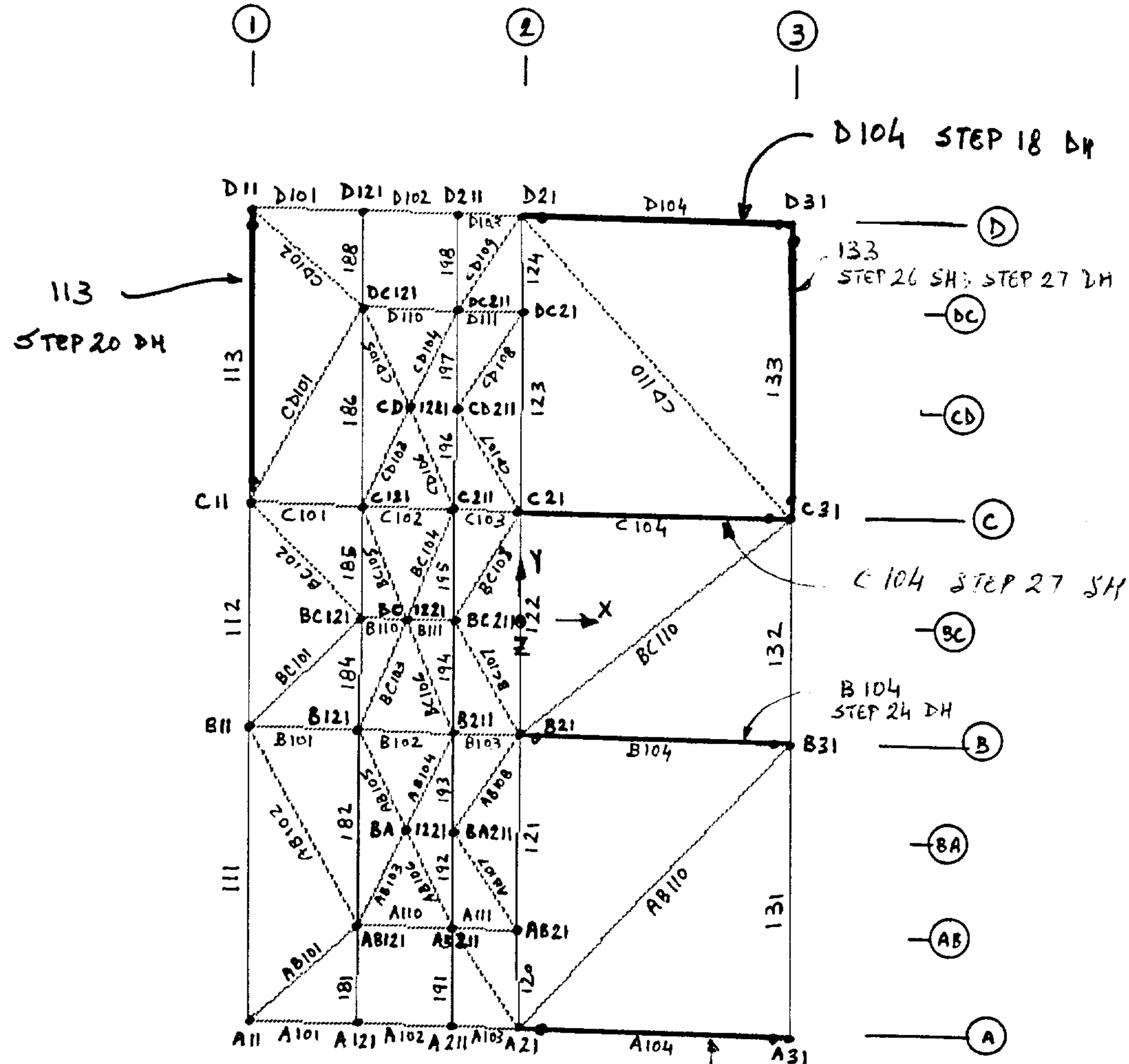
ELEVATION @
ROW C



ELEVATION @
ROW D

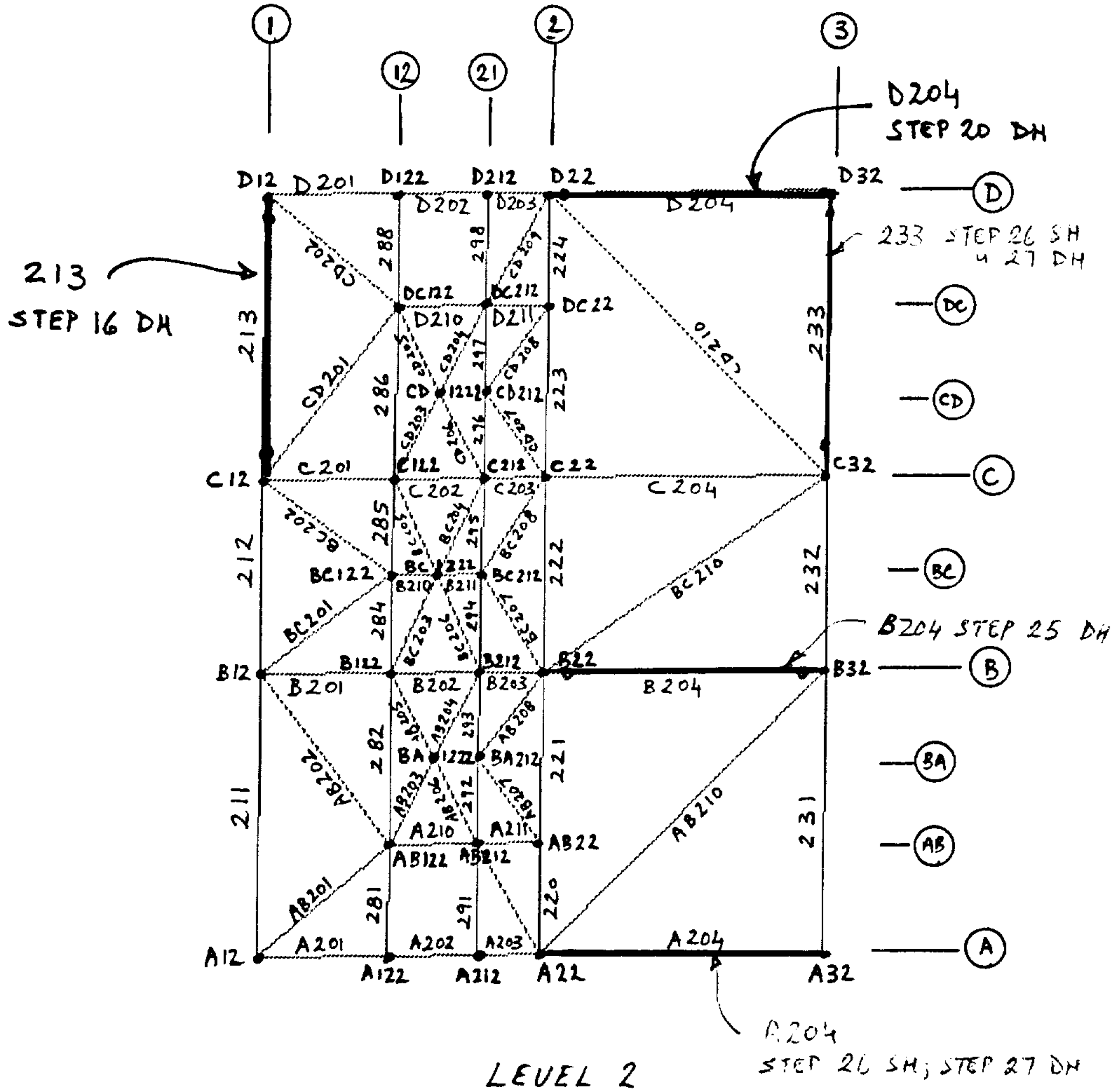


ELEVATION @
ROW D



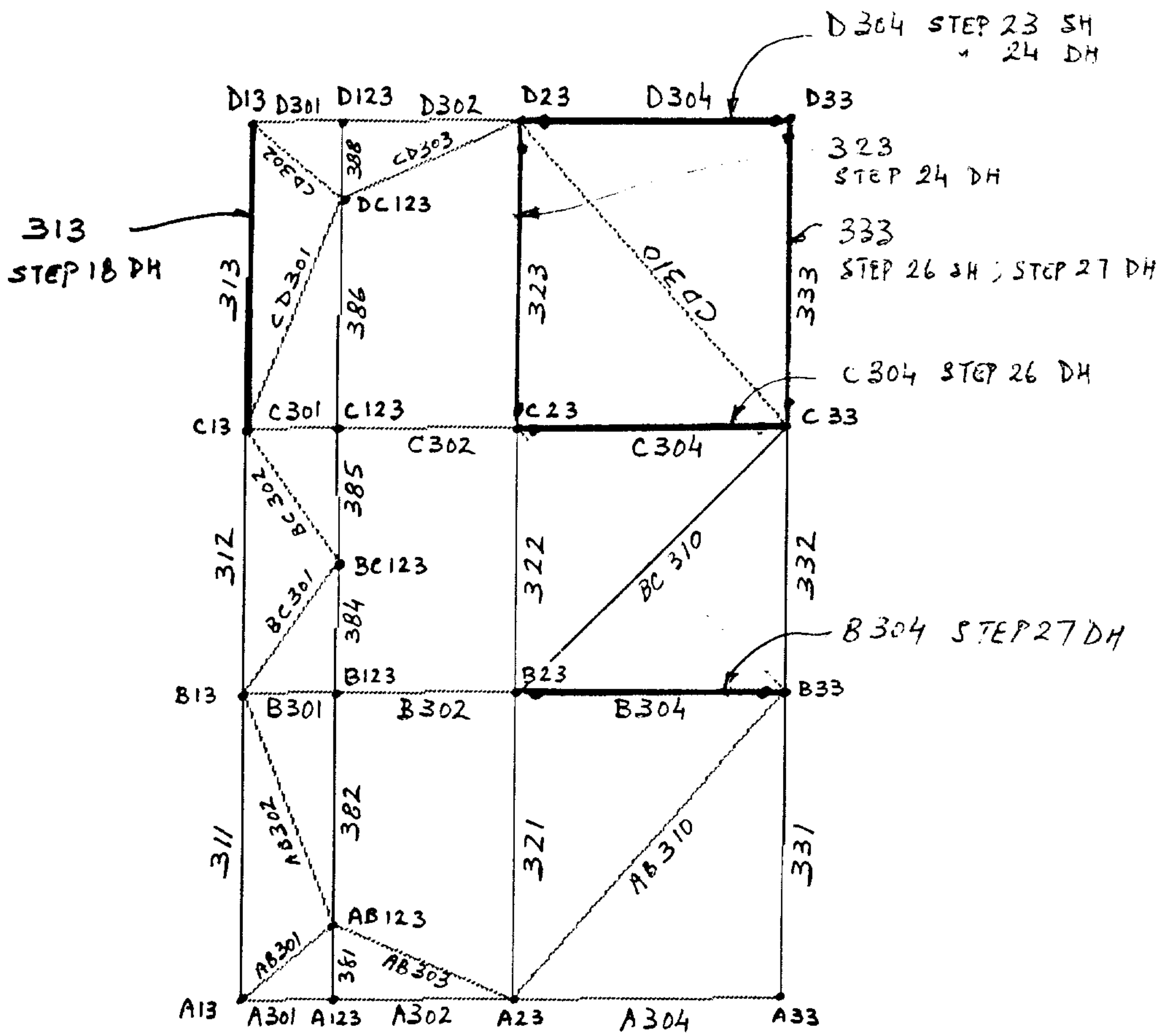
LEVEL 1

(ELEV. -155'-0")



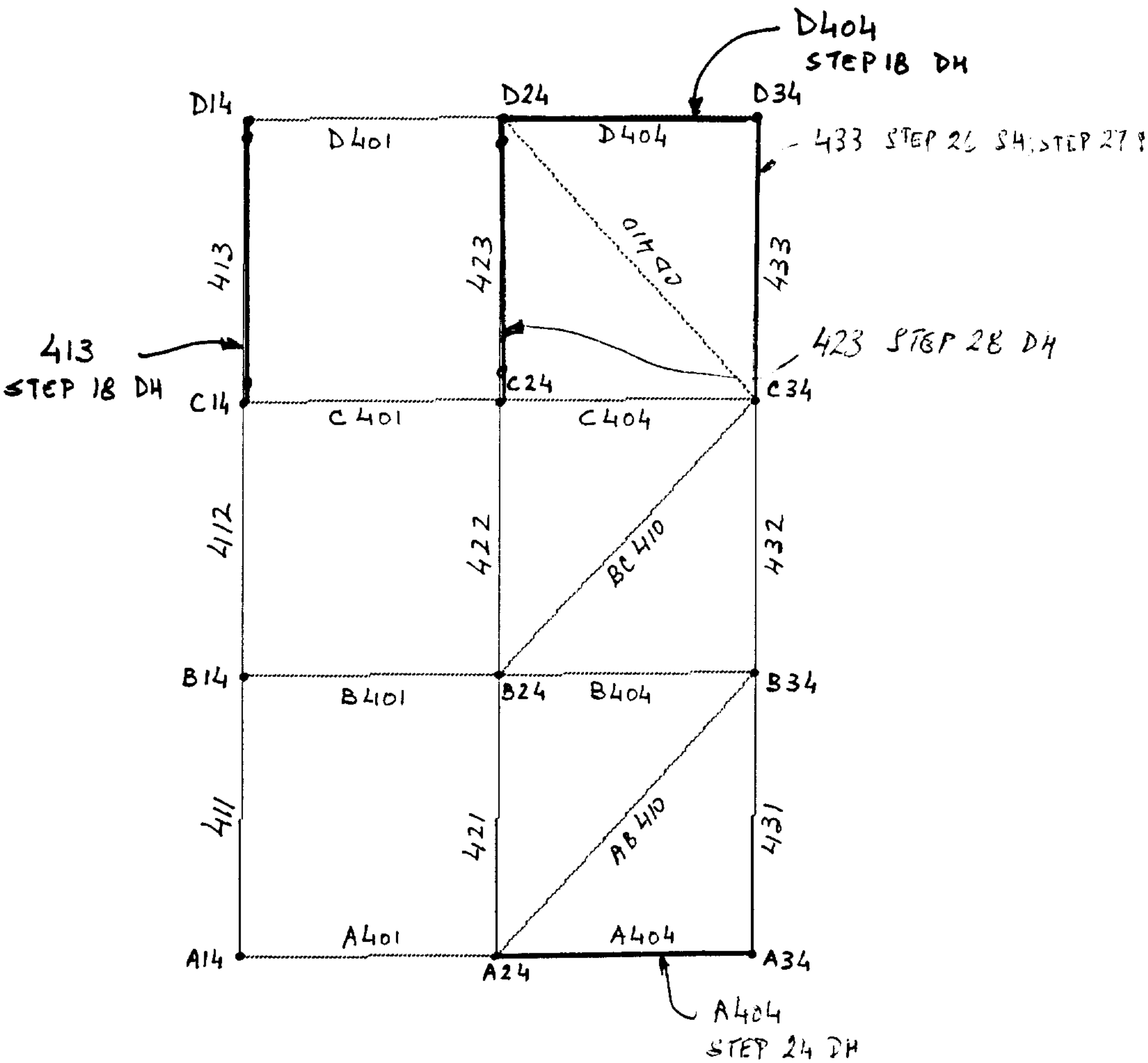
LEVEL 2

(ELEV - 112'-6")



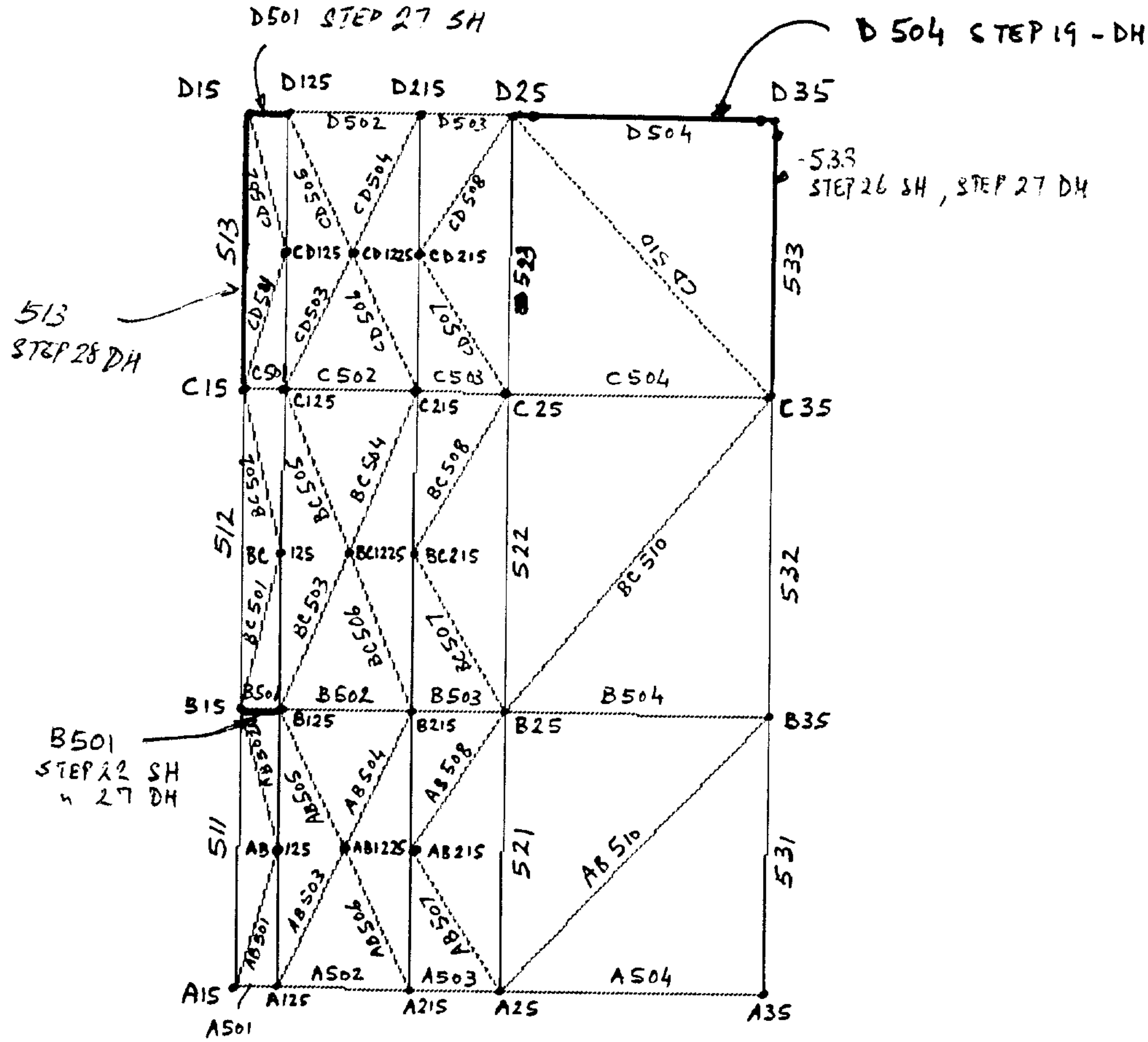
LEVEL 3

(ELEV. -70'-6")



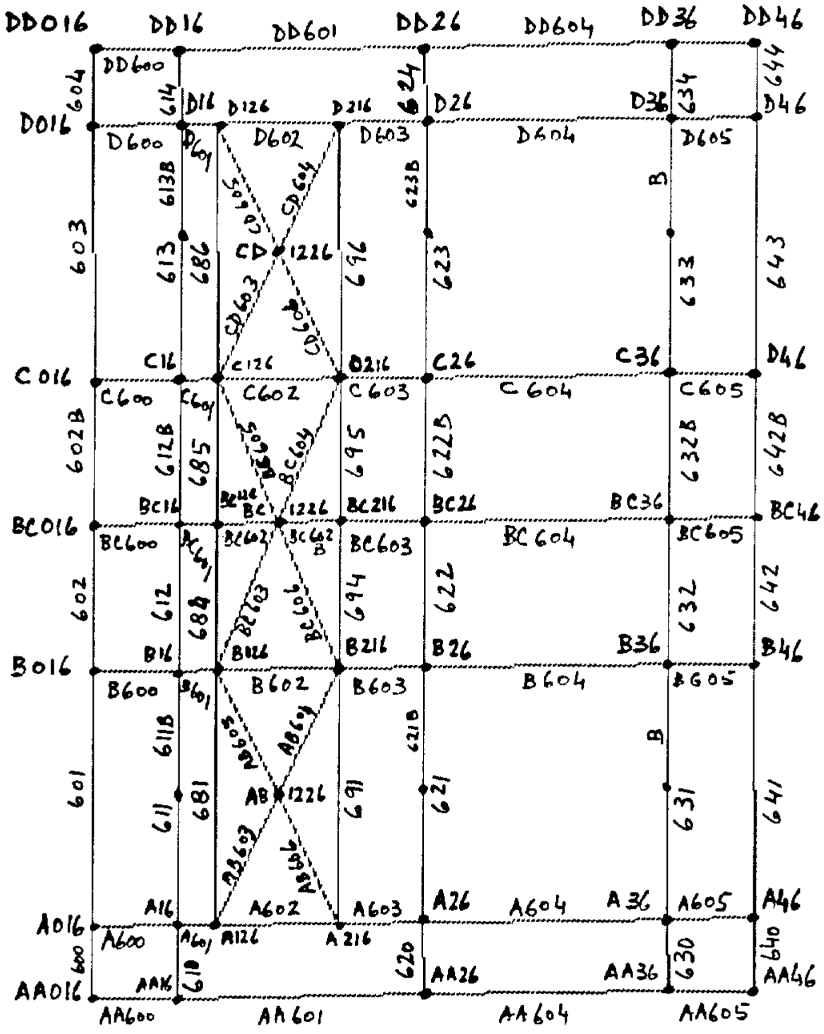
LEVEL 4

(ELEV. -28'-6")



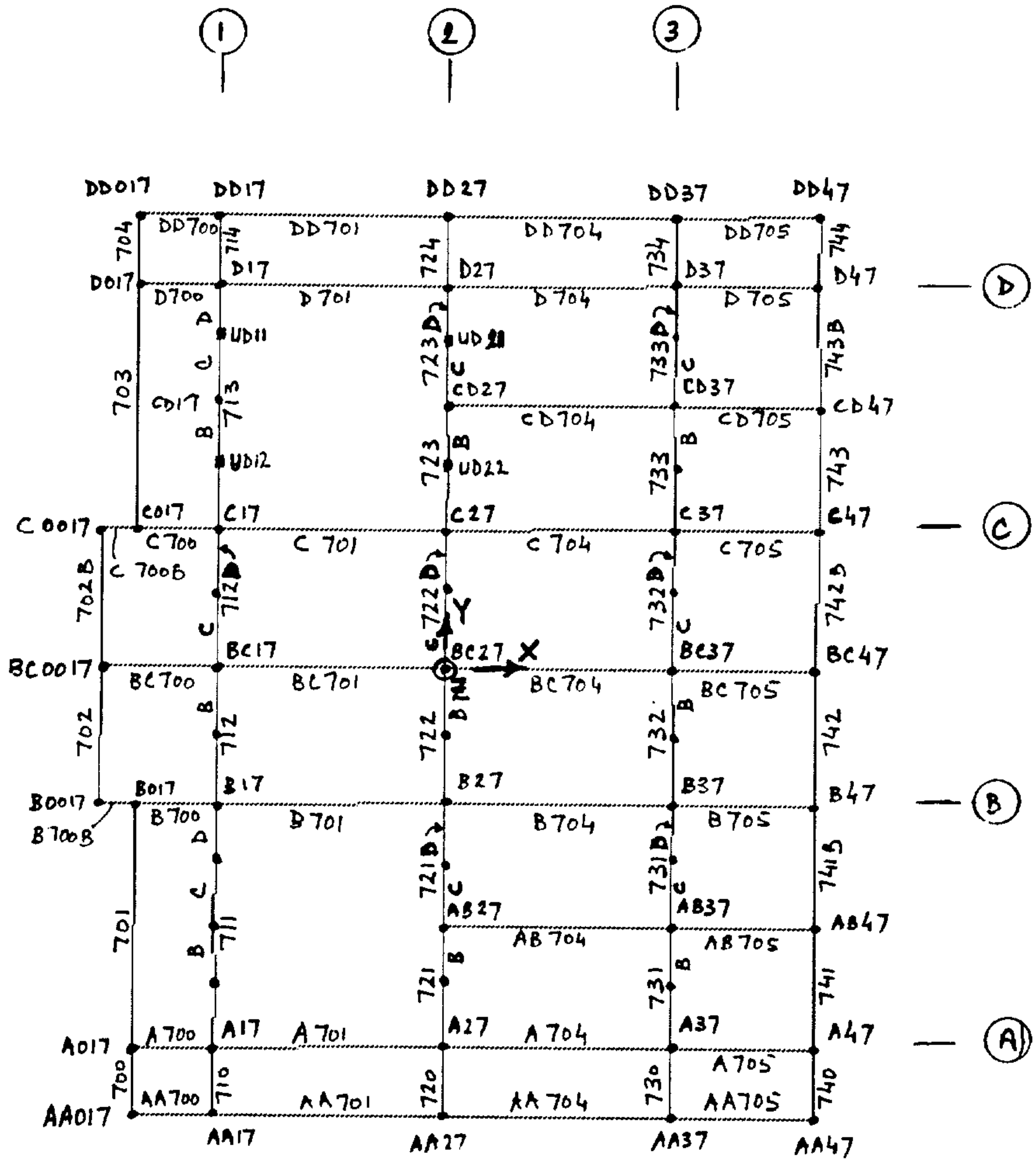
LEVEL 5

(ELEV. + 13'-6")



LEVEL 6

(ELEV. +32'-0")



LEVEL 7

(ELEV. +56'-0")

PART B: FEEDBACK TO THE API TG 92-5

COMMENTS ON JOINT DESIGN AND ANALYSIS

Most of the comments on Draft Section 17 were discussed during the execution of this JIP and corrective measures were taken. One very important comment affecting not only Section 17 but also Sections 2 and 4 is provided to ensure that a corrective measure is considered by the Subcommittee on Fixed Structures.

- Section 4.1 of API RP 2A states that the "joints develop the strength required by design loads, but not less than 50% of the effective strength of the member".
- Section 2.3.6e of API RP 2A provides additional guidelines, stating that if the horizontal ground motion is 0.05g or greater, the joints for the primary structural members should be sized for the capacity of the member connected to the joint.

The approach taken by API has worked well for the Gulf of Mexico where the storm loading controls the design and seismic design is not considered, and for offshore Southern California where the seismic loading controls the design.

For an area such as the South China Sea or offshore Trinidad, the controlling design condition is the typhoon/hurricane event. However, the structure also needs to be analyzed for seismic loads. While the seismic loading may require that a brace be sized 24-inch diameter with 0.5 inch wall thickness, the storm event may require a 1.0 inch wall thickness. Thus, while the correct procedure is to determine the seismic capacity required for strength level seismic design and ensure that the joint is capable of resisting loads associated with full member capacity (i.e., to achieve API's objective; namely prevention of an unzipping effect), Section 2.3.6e may be misinterpreted and the designer/analyst may provide joint resistance for full capacity of the member designed for the extreme storm environment.

We do not necessarily endorse the 50% rule. We also understand the basis for the two contradictory requirements to be due to both the differences in the recurrence intervals considered for storm (100 versus 500 years) and the earthquake (200 versus 2,000 years) and the characteristics of the applied loading and structure response to the applied loads.

Please consider inserting a statement in Section 2.3.6e, indicating that the recommendation is applicable to members capacities controlled by seismic design.