Universitetet i Stavanger

Faculty of Science and Technology

MASTER THESIS

Study program/specialization: Structural and Material Engineering/ Offshore construction	Spring semester, 2015 Open access
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Faculty supervisor: Associate Professor S.A.Sudath C Siriwardane	
Title of thesis: Design, modeling, analysis and calculation of offshore module structure	
Credits (ECTS: 30	
Key words: Design and modeling of offshore module Structural analysis of offshore module ALS, dropped object impact load calculation Design, check of Pad eyes Design check of bolts and welded connection	Pages: 55 + Appendices: 151 Stavanger, 8 June-2015

PREFACE

This master thesis represent the final part of my study, master degree in structural and material technology with specialization in offshore structure engineering at the Faculty of science and material technology at University of Stavanger. The thesis was proposed by the Structural Department of Aker Solution in Stavanger. The work was carried out under the supervision of Mr. Sudath Siriwardane at the University of Stavanger in the spring 2015.

The aim of this thesis was to do the whole process of designing, modeling, calculation and analyzing of an offshore module structure. This includes all relevant conditions, such as transport, offshore lifting, inplace and accidental dropped object scenario.

I would like to take this opportunity to thank Mr. Christian Brun at Aker Solutions for providing the thesis, and also my internal supervisor Associate Professor Mr. Sudath Siriwardane at the faculty of Science and Material technology at University of Stavanger for his valuable support and guidance throughout the writing and working on this thesis. Finally I would like to thank my all family members, relatives, and friends and specially to thank my wife for her support and encouragement during all these five years study program at the University of Stavanger.

Gholam Sakhi Sakha

Stavanger 8-June-2015

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1.0 INTRODUCTION

The analysis, design and construction of offshores structures is arguably one of the most demanding set of task faced by the engineering profession. Over and above the usual conditions and situations met by land based structures offshore structures have the added complication of being placed in an ocean environment where hydrodynamic interaction effects and dynamic response become major consideration in their design.

1.1 BACKGROUND OF THE THESIS

Norwegian offshore petroleum industries are in the period in which modifications of existing platforms are often the chosen solution for the realization of development needs. As fields will age well pressure often drops, and this can be compensated by the injection of water or gas.

As part of modification work on “Black Gold PH” platform a new gas injection module shall be installed on the one side of existing platform. The offshore module needs to be protected from accidental dropped objects due to crane operations on the weather deck of platform. The new offshore module shall measure 10.0m, 5.50m, 9.50m (length, width, height).

Photo by Øyvind Hagen - Statoil

Figure 1.1 “Black Gold PH” (source: design brief**)**

This thesis covers design and analysis of the offshore module structure. Design, modeling, analysis and calculation are done according to prevailing standards regulations and industry practices.

1.2 AIM OF THE THESIS

The main object of this thesis is design, analyses and calculation of an offshore module structure to ensure the required safety and serviceability requirements against different loads and load combination (i.e. dropped object impact load, explosion load, live load, dead load, wind load, barge acceleration load and earthquake load) by considering all phases such as transportation, installation and normal operation.

The structure shall be designed for housing 12 gas injection pumps, each estimated of weigh around 1500kg. The 12 gas injection pumps must be installed on the first and second floor of module and each floor shall be housing for 6 pumps. Pumps shall be installed on onshore and the module shall be transported and lifted.

Apart to above major objective, other goals of this thesis are,

- Learn to use FES (finite element software) Staad.ProV8i and Mathcad 14.0 programs for structural analysis, design and calculation.
- Evaluation and implementation of relevant rules, standard and regulations for offshore construction and offshore activities in Norwegian continental shelf (NCF).
- Design optimization of profile types to achieve economical design with respect to strength and weight considering, inplace, lift and transport condition.
- Design of lifting accessories equipment and pad eyes.
- Use of Microsoft word 2010 and Microsoft excel 2010 programs

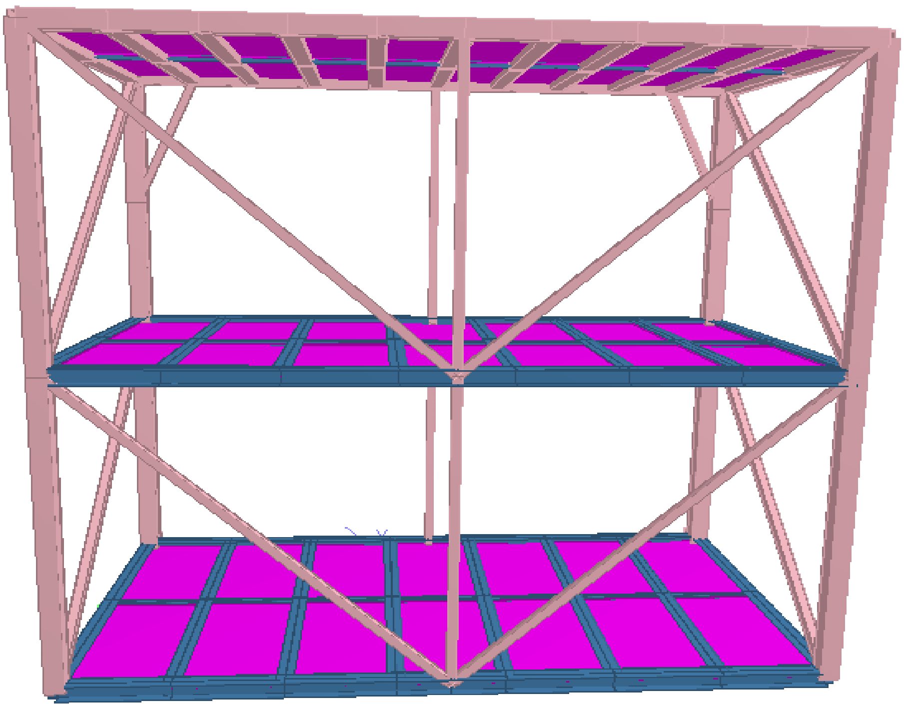


Figure 1.2 (3D) view offshore module structure (source: Staad.Pro)

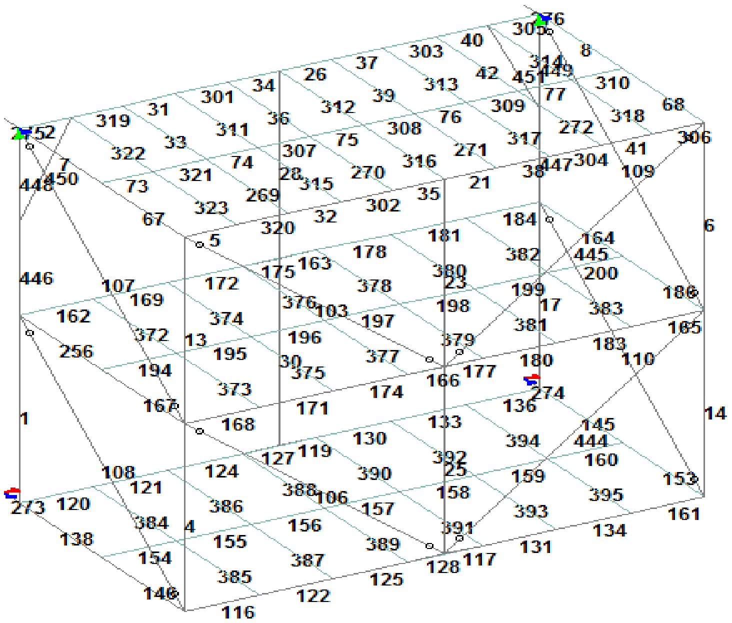


Figure 1.3 offshore module with members number (source: Staad. Pro)

1.3 ABBREVIATIONS

ALS	Accidental Limit State
BLC	Basic Load Case
COG	Centre of Gravity
COGE	Centre of Gravity Envelope
EQ	Earthquake
FES	Finite Element Software
DAF	Dynamic Amplification Factor
DC	Design Class
DNV	Det Norske Veritas
DOP	Dropped Objects Protection
EC3	Euro Code 3
LC	Load Combination
MF	Material Factor
NS	Norwegian Standard
N-001	Norsok Standard N-001
N-003	Norsok Standard N-003
N-004	Norsok Standard N-004
NPD	Norwegian Petroleum Department
SI	System International
SKL	Skew Load Factor
SLS	Serviceability limit state
SWL	Still Water Level
UF	Utilization Factor
ULS	Ultimate Limit State
WLL	Working Limit Load
WCF	Weight Contingency Factor

2.0 SUMMARY

This master thesis based on a design brief which is issued by Aker Solutions. In connection with modification work on “Black Gold PH” production platform, a new gas injection module shall be installed on the existing production platform. The module needs to be protected from accidental dropped objects due to crane activities on weather deck.

The main objective of this thesis is design, modeling, structural analysis and calculation of an offshore module structure to ensure the required safety and serviceability requirements against different loads and load combination (i.e. dropped object impact load, explosion load, fire load, live load, dead load, wind load and earthquake) by considering all phases such as transportation, installation and normal operation. For this purpose a Design Brief was issued by Aker Solutions [ref./1/].

In addition to the main purpose of this thesis these goals were achieved:

- Learned to use Staad.ProV8i and Mathcad 14.0 programs for structural analysis, design and calculations.
- Evaluation and implementation of relevant rules and regulations for offshore construction.
- Optimize and selection of profile types to achieve optimal design with respect to strength and weight considering, inplace, lift and transport condition.
- Design of lifting points and pad eyes.
- Plastic analysis and design of dropped object protection (ALS).

The structural design and analyses were done in three phases First the offshore module structure had to be proven adequate for the normal operational conditional, including an accidental dropped object scenario, explosion scenario and fire action. Secondly it had to withstand the strain imposed by barge during transportation and finally it had to be lifted inplace. The analyses show that the designed offshore module structure has enough capacity to withstand all conditions with good safety margin. Analyses result show that the most critical condition is the accidental dropped object, with a resulting UF=1.00. Normal operating condition inplace with resulted in a utilization factor 0.984.

Transport condition resulted in a UF of 0.973. In lifting condition the highest utilization factor is 0.996. All utilization factors are well within the acceptable limit criteria, UF≤1.00.

The members with highest utilization factors for all conditions are presented in the following tables.

Inplace condition:

Table 2.1 members with highest utilization ratios wind action ULS-a/b.

Members number	*Section type*	*Utilization factor*	*Clause*	*Load combination*
2	TUB 250X250X16	0.617	Stable	103
40	TUB 250X250X16	0.622	Stable	101
449	TUB 120 X120X10	0.855	Stable	103
451	TUB 120 X120X10	0.855	Stable	101
184	HE 240 B	0.941	Stable	101

Table 2.2 members with highest utilization ratio earthquake action ULS-a/b

Members number	*Section type*	*Utilization factor*	*Clause*	*Load combination*
2	TUB 250X250X16	0.540	Stable	123
108	TUB 120 X120X10	0.578	Stable	123
450	TUB 120 X120X10	0.728	Stable	123
23	TUB 120 X120X10	0.758	Stable	121
162	HE 240 B	0.821	Stable	123

Table 2.3 members with highest utilization ratios earthquake action ALS

Members number	*Section type*	*Utilization factor*	*Clause*	*Load combination*
120	HE 240 B	0.770	Stable	163
136	HE 240 B	0.770	Stable	161
450	TUB 120 X120X10	0.846	Stable	161
162	HE 240 B	0.879	Stable	163
184	HE 240 B	0.879	Stable	161

Table 2.4 members with highest utilization ratios explosion action ALS

Members number	*Section type*	*Utilization factor*	*Clause*	*Load combination*
392	HE 220 B	0,918	Stable	312
388	HE 220 B	0.974	Stable	312
389	HE 220 B	0.974	Stable	312
390	HE 220 B	0.974	Stable	312
184	HE 240 B	0.984	Stable	311

Table 2.5 members with highest utilization ratios fire action ALS

Members number	*Section type*	*Utilization factor*	*Clause*	*Load combination*
450	TUB X120X120X10	0.654	Stable	411
451	TUB 120X120X10	0.654	Stable	411
162	HE 240 B	0.664	Stable	411
184	HE 240 B	0.664	Stable	411
23	TUB 120X120X10	0.668	Stable	411

Transport condition:

Table 2.6 members with highest utilization ratios barge acceleration ULS-a

Members number	*Section type*	*Utilization factor*	*Clause*	*Load combination*
458	TUB 120X120X6	0.339	Stable	193
460	TUB 120X120X6	0.390	Stable	193
455	TUB 120X120X6	0.403	Stable	191
456	TUB 120X120X6	0.403	Stable	195

Table 2.7 members with highest utilization ratios barge acceleration ULS-b

Members number	*Section type*	*Utilization factor*	*Clause*	*Load combination*
456	TUB 120X120X6	0.559	Stable	215
455	TUB 120X120X6	0.560	Stable	211
458	TUB 140X140X8	0.793	Stable	213
560	TUB 140X140X8	0.793	Stable	213

Lifting condition:

Table 2.8 members with highest utilizations ratios ULS-a

Members number	*Section type*	*Utilization factor*	*Clause*	*Load combination*
162	HE 240 B	0.514	Stable	513
184	HE 240 B	0.514	Stable	513
308	HE 140 B	0.994	Stable	512
75	HE 140 B	0.996	Stable	512

The accidental dropped object UF= 1.00 refers to the deck beams on top of the structure.

3.0 COMPUTER MODELING

3.1 GENERAL

The offshore module structure is analyzed and designed by use of the FES (finite element software) Staad.ProV8i.engineering program. The coordinate system used is such that y is pointing upwards, x is pointing horizontal (East) and z is pointing also horizontal (South). The modeling in Staad.ProV8i is done in the system lines which means that all profiles and plates are placed at the section centroid line and the connection between the profiles are as default full strength (rigid) connection.

Loading orientation on the structural member usually influence the selection of section profile types of the structural members. Selection of section properties are based on the structural member responses during transverse- and axial loading. The designed model represented in this thesis is result of a long process and some profiles were replaced during modeling and designing of offshore module structure until achieved the suitable profiles to meet the design limit criteria specially profiles which are used on the top of offshore module must be designed and analyzed to withstand dropped object load. Profiles used for designing of module structure are standard profiles which are available in Staad.ProV8i.database. Finally the following cross sections have been used in this thesis.

1. TUB 250*250* 16 (mm) for top of module
2. TUB 300*300*16 (mm) for main columns to be connected to the platform
3. TUB 250*250*8 (mm) for columns at front view at two corners
4. TUB 120*120*10(mm) for columns at the middle of module
5. TUB 120*120*6 (mm) braces at east and west side of module
6. TUB 140*140*8 (mm) braces at north and south side of module
7. HE-A 140*133*5.5 (mm) longitudinal beams in all floor
8. HE-B 240*240*10 (mm) edge beams on first and second floor
9. HE-B 220*220*9 (mm) transvers beams on first and second floor

3.2 UNITS

The fundamental units (database unites) that used in the analyses are the following SI unites or multiples of:

Length: meter (m)

Mass: Kilo gram (kg)

Time: seconds (s)

3.3 STAAD.ProV8i

Staad.Pro (structural analysis and design for professionals), is a finite element software developed by Bentley. The program is capable of analyzing advanced structures in almost every kind of material. It calculates stress, deformation and internal force. Different codes can be used to check the structure stability.

Staad.Pro is the structural engineering professional's choice for steel and concrete structures. This structural software enables structural modeling designing and analysis for a wide variety of steel and concrete structures including commercial, residential building, industrial structures, pipe-racks, bridges and towers [ref/16].

3.4 MATHCAD 15.0

Mathcad is the most comprehensive, yet practical, engineering calculation software available. Mathcad 14.0 is designed to help engineers achieve best practices within the overall Product Development process through increased productivity, collaboration enablement and process improvement [ref/17].

4.0 DESIGN CONSIDERATION

GENERAL

All the analyses and calculations are based according to the regulations, specification and standards related to design of offshore structure and some of them listed as follow.

NORSOK N-001	Structural design
NORSOK N-003	Action and action effect
NORSOK N-004	Design of steel structures
NORSOK R-002	Lifting equipment
EC3, NS-EN 1993-1-1	Design of steel structures: general rules and rules for building
EC3, NS-EN 1993-1-5	Design of steel structure: plated structural elements
EC3, NS-EN 1993-1-8	Design of steel structure: design of joints

4.1 MATERIAL QUALITY AND PROPERTIES

Table 4.1 steel quality [ref /13/] (table 3.1, EC3 NS EN 1993-1-1, design of steel structure)

Steel class	f_y	f_u
S355	355 Mpa	490 Mpa
S420	420 Mpa	520 Mpa

All standards profiles have steel quality of **S355**. Plates and welded profiles have steel quality of **S420**.

Material properties: Design Brief [ref /1/]

Density	ρ = 7850	kg/m^3
Young's modulus	E = 210000	N/mm^2
Poisson ratio	υ = 0.3	
Shear modulus	G = 81000	N/mm^2

Details of bolts

Bolt class	F_{yb}	f_{ub}
8.8	640 Mpa	800 Mpa

Bolt details are taken from table 3.1 EC3 1-8, [ref. /5/]

4.2 DESISGN BASIS AND ACCEPTANCE CRITERIA

The following categories of limit states have been considered in this thesis according to the structural design brief:

SLS- serviceability limit state

ULS- Ultimate Limit State

ALS- Accident Limit State

The initial design of offshore module structure is done considering the ALS dropped object scenario (impact effect of dropped object, overall plastic collapse and local damage to plastic deformation), by means of theoretical approach. Staad.ProV8i was used to analyze the other ULS and ALS conditions.

4.3 LIMIT STATE ACCEPTANCE CRITERIA

1. SLS- which is determined on the basis of criteria applicable to functional capability or to durability properties under normal operations and deformation for ordinary live load shall not exceed L/200.

2. ULS- utilizations factor shall not exceed 1.00, which is determined on the basis of criteria applicable to functional capability or properties under normal operations.

3. ALS- accidental condition does not specify any limit for deformations other than the structure shall not collapse. The limit state is that the offshore module structure must withstand and absorb the impact energy without damaging the instrument unit that has been installed on the first and second floor of the module.

4.4 DESIGN LOAD CATAGORIES

Fixed offshore platform are unique structure since they extend to the ocean floor and their main function is to hold industrial equipment that services oil and gas production and drilling.

Robust design of offshore structure depends on accurate specification of the applied load and the strength of the construction material used. Most loads that laterally affect the platform, such as wind and waves are variable, so the location of the platform determines the metocean data. In general, the loads that act on the platform are:

- Gravity loads
- Live loads
- Wind loads
- Wave loads
- Current loads
- Earthquakes load
- Installation loads
- Accidental loads

Four kinds of basic loads have been evaluated in this analysis and design. These are:

- Permanent loads
- Variable loads
- Environmental loads
- Accidental loads

Table 4.4 load categories

P	Permanents loads	Self-weight of structure
L	Live loads	Variable operating loads
E	Environmental loads	Wind and earthquake
A	Accidental loads	Dropped object load

4.5 LOAD AND MATERIAL FACTORS

The design factors applied to different actions for different limit state and analyses are according to NORSOK N-001 [ref/2/] and are listed in the table 4.5.

Table 4.5 load and material factor

Limit state	Loading condition	P	L	E	A	Material coefficient
ULS-a	Ordinary	1.30	1.30	0.70	-	1.15
ULS-b	Extreme	1.00	1.00	1.30	-	1.15
ALS		1.00	1.00	-	1.00	1.00

Combination action

Environmental action intensities for ULS and ALS combination based on annual exceedance probabilities. Earthquake actions are combined with other environmental actions according to the NORSOK N-003 [ref /3/].

Table 4.5.1 combination of environmental actions

Limit state	Wind	Earthquake
ULS	10^{-2}	
		10^{-2}
ALS		10^{-4}

All the load cases have been considered for design and analyses of new offshore module structure listed in following tables.

Table 4.5.2 all dead load cases from different directions for in place design phase

load cases	Description	KN	Direction
1	selfweight	432.82	- Y
11	selfweight	432.82	+ X
21	selfweight	432.82	+ Z
2	Secondry steel	98.37	- Y
12	Secondry steel	98.37	+ X
22	Secondry steel	98.37	+ Z
3	Equipment load	211.9	- Y
13	Equipment load	211.9	+ X
23	Equipment load	211.9	+ Z

Table 4.5.3 all live load cases from different directions in inplace

Load cases	Description	KN	Direction
4	Functional live load	460.55	- Y
14	Functional live load	460.55	+ X
24	Functional live load	460.55	+ Z
5	Laydown load	825.27	- Y
15	Laydown load	825.27	+ X
25	Laydown load	825.27	+ Z
31	Wind load	93.89	+ X
32	Wind load	93.89	- X
33	Wind load	123.43	+ Z
34	Wind load	140.12	- Z
41	Earthquake 100 year	87.40	+ X
42	Earthquake 100 year	87.40	- X
43	Earthquake 100 year	26.45	+ Z
44	Earthquake 100 year	26.45	- Z
45	Earthquake 100 year	77.40	+ Y
46	Earthquake 100 year	77.40	- Y
51	Eearthquake 10 000 year	436.88	+ X
52	Eearthquake 10 000 year	436.88	- X
53	Eearthquake 10 000 year	120.32	+ Z
54	Eearthquake 10 000 year	120.32	- Z
55	Eearthquake 10 000 year	799.6	+ Y
56	Eearthquake 10 000 year	799.6	- Y

Table 4.5.4 all live load cases from different directions for transport design phase

Load cases	Description	KN	Direction
61	Wind load in transport	44.70	+ X
62	Wind load in transport	44.70	- X
63	Wind load in transport	61.80	+ Z
64	Wind load in transport	61.80	- Z
71	Barge acceleration	421.17	+ X
72	Barge acceleration	421.17	- X
73	Barge acceleration	614.10	+ Z
74	Barge acceleration	614.10	- Z
75	Barge acceleration	247.96	+ Y
76	Barge acceleration	318.81	- Y

4.6 PERMENANT LOAD

Permanents loads are gravity loads that will not vary in magnitude, position or direction during the period considered. Examples are:

- Mass of structure
- Mass of permanent ballast and equipment
- Cabling
- Dry weight of piping
- Fireproofing/insulation

Permanent loads are used in this thesis are the self-weight of the module structure, the outfitting steel structure, and the dead weight of equipment which are the dry weight of 12 gas injection pumps each estimated to weight around 1500 kg with a 20% contingency has been used. All permanent loads will be multiplied with weight contingency factor of 1.10.

Basic Load case 1, 11, 21 structural self-weight:

The self-weight of the module structure is generated by Staad.ProV8i automatically, based on the cross sections and the steel weight. This load is achieved by applying an acceleration of 1.0g in the negative y-direction for the whole structure. The values of self-weight of the module are same inn all 3 directions and must be taken in account for earthquake action calculation.

Basic Load case 2, 12, 22 secondary/ or outfitting steel:

The self-weight of the module structure generated by Staad Pro must be multiplied by a factor of 0.25g to count for the secondary or outfitting steel. Secondary or outfitting steel counts for the weight of the structure generated by taking in consideration welding and fire protection.

The value of secondary or outfitting steel is same in all 3 directions and must be taken in account for earthquake action calculation.

Basic load case 4, 14, 24 equipment load:

The offshore module structure must be designed for housing 12 gas injection pumps, each estimated to weigh around 1500kg. The equipment load is total dry weight of these 12 pumps which shall be located on the first and second floor of the module. A 20% contingency factor should be included to cover uncertainties in the equipment load. The pumps have foot print measures 2.0*0.75m and located on transvers beams as shown in the following figure. Equipment load applied as evenly distributed load over a length 2.0 m on the mentioned beams. The value of equipment load is same in all 3 directions and must be taken in account for earthquake action calculation.

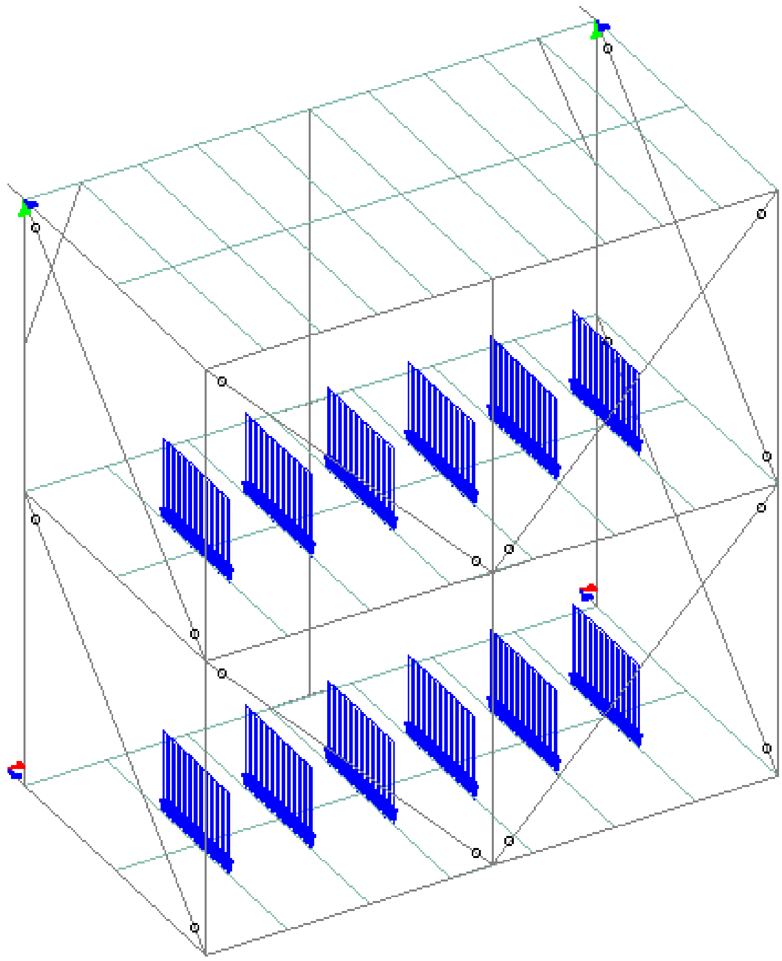


Figure 4.1 equipment load, (source: Staad Pro**)**

4.7 LIVE LOAD

General

Live loads are loads which may vary in magnitude, position and direction during the life of structure.

Variable Functional loads

Variable functional loads are loads which may vary magnitude, position and direction during the period under consideration, and which are related to operation and normal use of the structure. Examples are:

- Personnel
- Stored materials, equipment, gas, fluid and fluid pressure
- Crane operational loads
- Loads associated with installation operations
- Loads associated with drilling operations
- Loads from variable ballast and equipment

During the life of the platform, generally all floor and roof area can be subjected to operational loads in addition to known permanent equipment loads. Since the exact nature of these live load is not known at the state design, all deck area designed to carry some general live loads in addition to permanent loads of equipment, piping etc.

The characteristics value of a variable functional load is the maximum (or minimum) specified value, which produce the most unfavorable load effects in the structure under consideration. The specified value shall be determined on the basis of relevant specifications.

Variable functional loads on the deck area of topside structure are based on Table D1from offshore standard DNV- OS-C101, 2011.

Variable functional loads have been used for design analysis in this thesis are as 5.0kN/m^2 distributed load for area between equipment in first and second floor of offshore module, and 15.0kN/m^2 distributed load on lay down areas on the top deck of module structure.

Basic load case 4-14-24 variable functional loads:

The variable functional load according to DNV-OS-C101 [ref/15] is 5.0kN/m^2 and this load has applied on the area between equipment in the first and second floor of offshore module where the 12 gas injection pumps located. The variable functional load applied in such a way that value of load varying from where pumps are located comparing to the rest of area.

Detailed calculation of variable functional load is presented in appendix B.

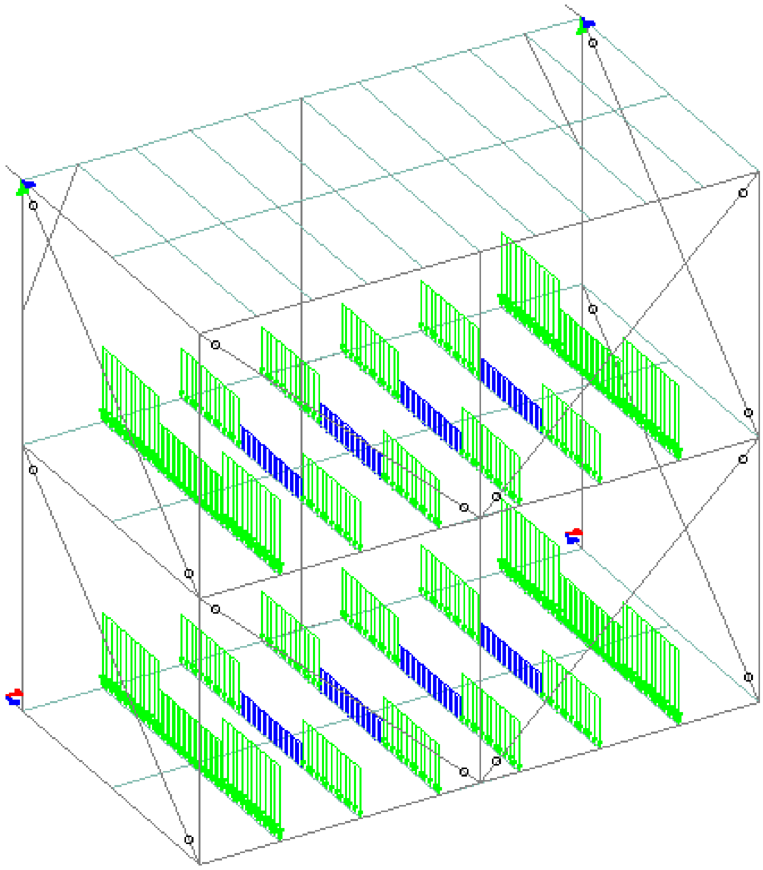


Figure 4.1 variable functional load (source: Staad. Pro)

Variable functional load has the same value in all 3 directions and must be taken in account in case of earthquake action calculation.

Basic Load case 5, 15, 25 laydown load:

The laydown load according to DNV-OS-C101 [ref/9] Table D1 shall be 15.0kN/m^2. This load applied to the top of the module structure. The total load is 15.0 kN/m^2 multiplied to A, where A is the laydown area. The total load is divided by the total length of all beams located, an applied as evenly distributed line load on all relevant members.

Detail calculation of laydown load presented in appendix B

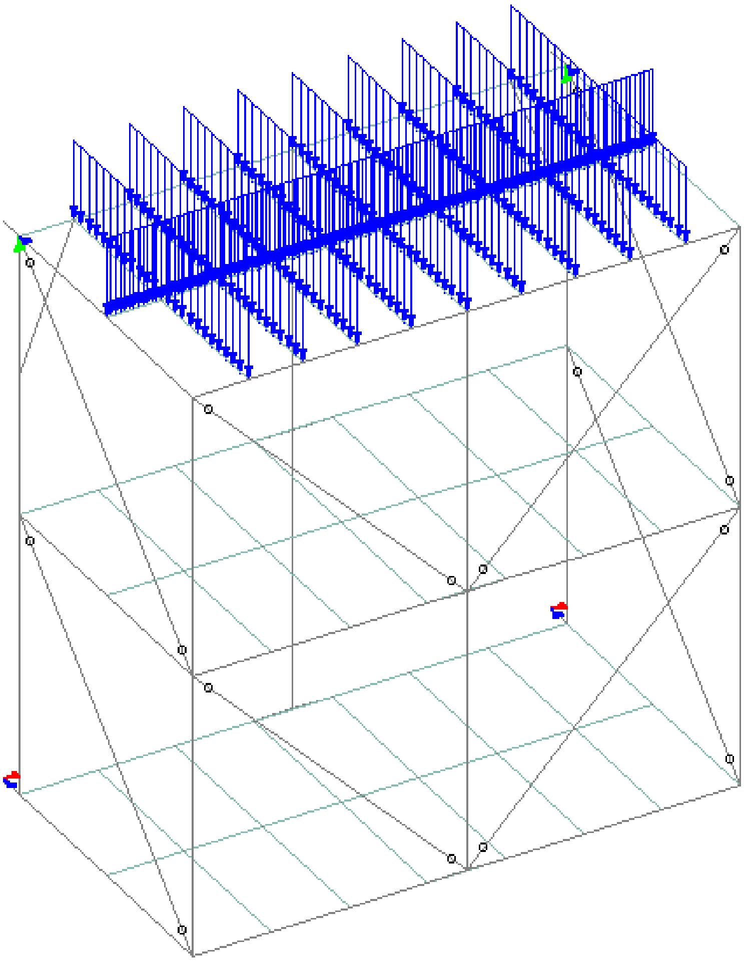


Figure 4.3 laydown load (source: Staad.ProV8i)

Laydown loads have the same value in 3 directions and must be taken in account case of earthquake action calculation.

4.8 ENVIRONMENTAL ACTION

Environmental loads are loads caused by environmental phenomena, which may vary in magnitude, position and direction during the period under consideration, and which are related to operation and normal use of the installation. Environmental loads to be used for design shall be based on environmental data for specific location and operation question, and are to be determined by use of relevant methods applicable for the location /operation talking into account type of structure, size, shape and response characteristics.

According to the regulation, the environmental actions shall be determined with the stipulated probabilities of exceedance. Characteristic actions for the design of structure in the in-place condition are defined by annual exceedance probabilities of 10^{-2} and 10^{-4}.

Examples are:

- Hydrodynamic loads induced by wave and current
- Inertia forces
- Wind
- Earthquake
- Tidal effect
- Marine growth
- Ice and snow

Environmental loads are considered in these thesis include wind, and earthquake.

Ice and snow loads are not considered relevant for these analyses. Ice from sea spray is only relevant for structures located below 25.0 meters above sea level.

Snow loads according to NORSOK N-003 [ref. /3/] shall be $0.5kN/m^2$. Snow loads are only to be combined with 10 year wind and therefore considered negligible.

Wave load is not relevant for structures positioned higher than 25.0 meters above sea level. It is considered that the offshore module structure presented on this report has sufficient height above sea level to avoid direct wave action.

4.8.1 WIND ACTION

Basic Load case, 11- 14 wind load

The most important design consideration for an offshore platform are the storm wind and storm wave loadings it will be subjected to during its service life. Structure or structural components that are not very sensetive to wind gusts may be calculated by considering the wind action as static.

In the case of structure or structural parts where the maximum dimenstion is less than approximately 50 m, 3 s wind gusts used when calculating static wind action.

In case of structure or structural parts where the maximum length is greather than 50 m,the mean period for wind may be increased to 15 s.

The wind load which is applied on the module structure is based on static wind load and basic information is presented below.

The global ULS inplace analyses will be based on the 3-second gust wind ($L < 50m$). For simplicity the wind load in the module analyses will be based on a constant wind speed at an elevation located 2/3 of the module structure height, and module can be assumed to 50% solid. It means that wind load acting on the structure in practice is 50 % total wind load.

The static wind load is calculated in accordance to NORSOK N-003 section 6.3.3. For extreme conditions, variation of the wind velocity as a function of height and the mean period is calculated by use of the following formulas:

The wind loads are calculated by the following formula:

$$P = \frac{1}{2} \cdot \rho \cdot Cs \cdot A \cdot Um^2 \cdot \sin(\alpha)$$

Where:

ρ = 1.225 kg/m^3 mass density of air

Cs = shape coefficient shall be obtained from DNV-RP-C205,

A = area of a member or surface area normal to the direction of the force

Um = wind speed

α = angle between wind and exposed area

The characteristic wind velocity u (z,t)(m/s) at a height z(m) above sea level and corresponding averaging time period t less than or equal to may be calculated as:

$U(z,t) = Uz\ [1-0.41Iu(z)\ \ln(t/t_0)]$

Where, the 1 h mean wind speed U(z)(m/s) is given by

$U(z) = U_0[1+C\ \ln(z/10)]$

$C = 5.73 * 10^{-2}\ (1 + 0.15\ U_0)^{0.5}$

The turbulence intensity factor Iu (z) is given by

$Iu(z) = 0.061[1+0.043U_0](z/10)^{-0.22}$

U_0 (m/s) is the 1 h mean wind speed at 10m

Calculation of static wind and wind action on offshore module structure is presented in appendix B.

Direction	Sector prob.	Weibull parameters			Annual probability of exceedance		
		Shape	Scale	Location	0.63	10^{-1}	10^{-2}
	%	-	m/s	m/s	m/s	m/s	m/s
0°	8.98	2.169	9.46	0.15	23	26	29
30°	4.06	1.916	7.07	0.33	18	22	24
60°	2.62	1.504	5.29	0.80	17	21	25
90°	3.95	1.718	7.54	0.45	22	26	30
120°	7.88	2.630	12.52	-1.11	25	28	30
150°	10.08	2.530	11.19	-0.32	24	27	29
180°	11.07	2.250	9.48	0.53	23	26	29
210°	11.14	2.245	10.18	0.12	24	28	30
240°	10.14	2.302	10.77	-0.42	24	28	31
270°	9.75	2.250	11.03	-0.41	25	29	32
300°	9.27	1.901	9.04	0.80	25	30	33
330°	11.04	2.124	10.00	0.36	25	29	32
0° - 360°	100.00	2.133	9.96	0.07	28	31	34

Table 5-1 Black Gold field, reference wind speeds

Figure 4.4 reference wind speeds for design of wind action (source design brief)

Wave loads

Wave loads are not relevant for the new module which is located above 25 m mean water level and has sufficient air gap to avoid wave action on offshore module structure.

Ice and snow loads

Ice from sea spray is not relevant for structure located higher than 25m above sea level. The new offshore module is about 33m above sea level and therefore ice loads are ignored in this thesis. Ice from atmospheric action according to design brief shall be 90 N/m^2 is small when compared with other loads and has not been considered in analysis.

Snow load according to design brief shall be taken as 250N/m^2. The snow load is relatively small compared to the other loads on the deck area and concluded that snow load will not affect global analysis in this thesis and can be neglected.

4.8.2 EARTHQUAKE ACTION

Basic Load case, 41- 46 10^{-2} year(ULS) and Basic Load case, 51-56 10^{-4} year(ALS)

Earthquake action should be determined on the basis of the relevant tectonic condition, and the historical seismological data. Measured time histories of earthquakes in the relevant area or other area with similar tectonic conditions may be adopted.

Earthquake motion at the location described by means of response spectra or standardized time histories with the peak ground acceleration to characterize the maximum motion.

The earthquake motion can be described by two orthogonally horizontal oscillatory motions and one vertical motion acting simultaneously. These motion components are assumed to be statically independent. One of the horizontal excitations should be parallel to the main structural axis, with the major component directed to obtain the maximum value for the response quantity considered. Unless more accurate calculations are performed, the orthogonal horizontal component may be set equal to 2/3 of the major component and the vertical component equal to 2/3 of major component, referred to bedrock.

When determining earthquake action on to the structure, interaction between the soil, the structure and surrounding water should be taken into consideration. When time histories are used, the load effect should be calculated for at least three sets of time histories. The mean value of the maximum values of calculated action effects from the time history analysis may be taken as basis for design. The time series shall be selected in such a way that they are representative of earthquake on the Norwegian continental shelf at the given probability of exceedance.

Earthquake design include ULS check of components based on earthquake with annual probability of occurrence 10^{-2} and appropriate action and material factor as well as an ALS check of overall structure to prevent its collapse during earthquakes with an annual probability of exceedance of 10^{-4} with appropriate action in and material factors.

Normally the ALS requirement will be governing, implying that earthquakes with annual probability of exceedance of 10^{-2} can be disregarded.

The assessment of earthquake effects should be carried out with a refinement of analysis methodology that is consistent with the importance of such effects.

Structures shall resist accelerations due to earthquake. The 10^{2} years ULS earthquake and 10^{4} years ALS earthquake are both considered in the analysis. The considered values for accelerations respect to the elevation of the structure are listed in table 3-4 below. Reference earthquake accelerations were given in the design brief [ref. /1/] and applied accordingly in the analysis.

Table 4.8.2 earthquake acceleration

Earthquake acceleration 10^{-2} year	Earthquake acceleration 10^{-4}· year
X= 0.0441g	X= 0.2176g
Y= 0.0390g	Y= 0.2523g
Z= 0.0133g	Z= 0.0589g

The values of earthquake accelerations presented in the above table were calculated from the reference earthquake acceleration given in design brief. For detailed calculation refer to appendix B.

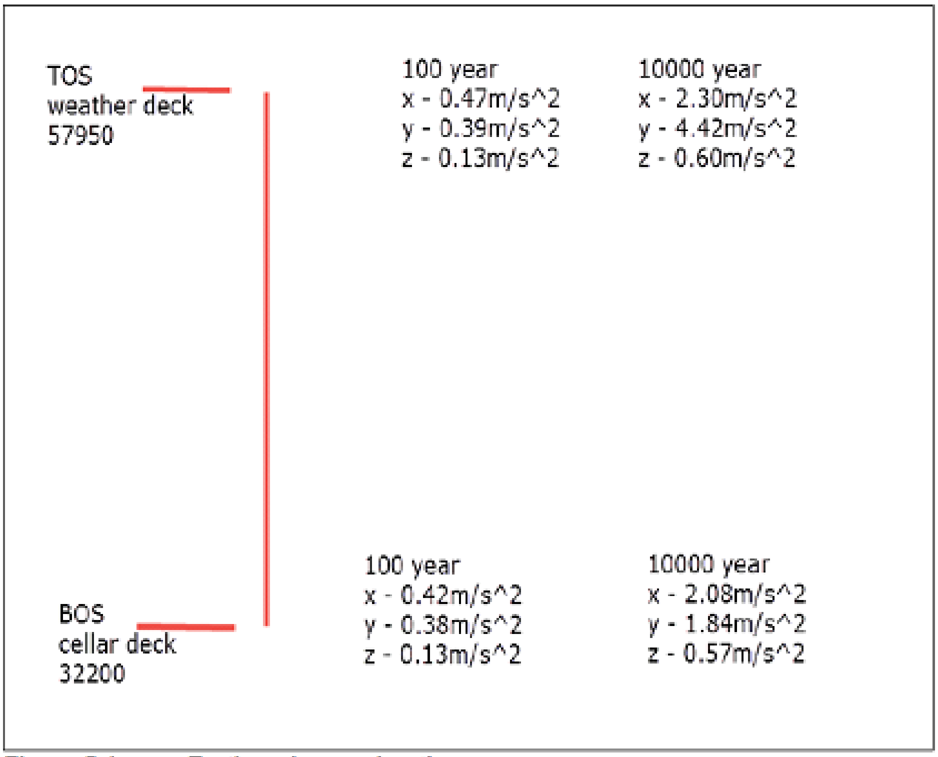


Figure 5-1 Earthquake accelerations

Figure 4.5 reference earthquake accelerations (source: design brief).

4.9 ACCIDENTAL LOADS

Accidental loads can be defined as fires and explosions, impact from ships, dropped object and helicopter crash. Impacts loads from ships and helicopter crash have not been considered in these analyses. The accidental loads have been considered in these thesis are dropped object accidental load which is defined as a 7.0 tons container falling from a height of 3.0 meters, explosion load and fire loads. The module structure must withstand the impact force and prevent damaging of instruments which are located inside of the module structure. The initial plastic design of module structure is based on the impact effect of a dropped object, plastic hinge development and local damage due to the plastic deformation.

4.9.1 Dropped object

The dropped object action is characterized by kinetic energy governed by the mass of the object and the velocity of the object at the instant of impact. In most cases the major part of the kinetic energy has to be dissipated as strain energy in the impacted component and possibly in the dropped object. Generally this involves large plastic strain and significant structural damage to the impacted component. The strain energy dissipation is estimated from force deformation relationship for the component and object, where the deformations in the component shall comply with ductility and stability requirements.

The load bearing functions of the structure shall remain with the damages imposed by a dropped object. Dropped objects are rarely critical to global integrity of the installation and will mostly cause local damage. The structural effect from dropped object may either be determined by nonlinear dynamic finite element analyses or by energy consideration combined with simple elastic plastic methods as given in A.4.2 to A4.5 in NORSOK N-004, [ref/4/].

In this thesis impact effect of dropped object calculation done by using energy considerations combined with simple elastic-plastic method. This method is the most conservative method and based on fully plastic collapse mechanism.

Dropped object impact detailed calculations are presented in Appendix C.

4.9.2 Explosion loads

Explosion loads are characterized by temporal and spatial pressure distribution. The most important temporal parameters are rise time, maximum pressure and pulse duration.
For components and sub structure the explosion pressure shall normally be considered uniformly distributed. On global level the spatial distribution is normally non-uniform both with respect to pressure and duration.
The response to loads may either be determined by non-linear dynamic finite element analysis or by simple calculation model based on SDOF (single degree of freedom) analogies and elastic- plastic methods of analysis.

If none-linear dynamic finite element analysis is applied all effect described in the following paragraphs shall either be implicitly covered the modelling adopted or subjected to special consideration, whenever relevant.
In the sample calculation models the component is transformed to a single spring-mass system exposed to an equivalent load pulse by means suitable shape function for the displacements in the elastic and elastic-plastic range. The shape function allow calculation of the characteristic resistance curve and equivalent mass in the elastic and elastic-plastic range as well as the fundamental period of vibration for the SDOF system in the elastic range.
Provided that the temporal variation of the pressure can be assumed to be triangular, the maximum displacement of the component can be calculated from design charts for the (SDOF) single degree of freedom system as a function of pressure duration versus fundamental period of vibration and equivalent load amplitude versus maximum resistance in the elastic range. The maximum displacement shall comply with ductility and stability requirements for the component.
The load bearing function of the structure shall remain intact with the damage imposed by the explosion loads. In addition, the residual strength requirements given in section A.7

NORSOK N-004 shall be comply with. In this thesis explosion action calculation based on the simple method (SDOF) analysis and the explosion loads have been defined in design brief. The module is subjected to internal blast pressure of 0.06Mpa. In analysis of explosion loads on offshore module two different scenarios have been considered. It has been assumed that the explosion will happen in first floor or in the second floor. Calculation results are presented in appendix C.

4.9.3 Fire loads

The characteristic fire structural action is temperature rise in exposed member. The temporal and spatial variation of temperature depends on the fire intensity, whether or not the structural members are fully or partly engulfed by the flame and what extend the members are insulted. Structural steel expands at elevated temperature and internal stresses are developed in redundant structures. These stresses are most often a moderate significance with respect to global integrity. The heating cause also progressive loss of strength and stiffness and is, in redundant structures, accompanied by redistribution of forces on from members with low strength to members that retain their load bearing capacity. A substantial loss of load bearing capacity of individual members and subassemblies may take place, but load bearing function of the installation shall remain intact with during exposure to the fire action.
Structural analysis may be performed on either

- individual members
- Subassemblies entire system.

The assessment of fire load effect and mechanical response shall be based on either

- simple calculation methods applied to individual member,
- general calculation method or combination

Simple calculation methods may give overly conservative results. General calculation methods in which engineering principle are applied in a realistic methods to specific applications. In this thesis simple calculation method has been used for analysis of fire action on new offshore module structure as temperature domain and results are presented in appendix C.
Calculation done according to EC3 NS-EN 1993-1-2:2005 + NA: 2009 .Design of steel structures part 1-2: general rules structural fire design. [ref/14].

5.0 DESIGN CONSIDERATION TRANSPORT PHASE

During transportation of the module structure from the fabrication yard to its offshore location, the forces that will affect structure depend upon the structure's weight and geometry and the support condition supplied by the barge or by buoyancy, as well as on the environmental condition that prevail during transportation.

The transport analysis will consider ULS-a/b load conditions. Relevant loads are the module self-weight, secondary/ or outfitting steel, dead weight of pumps, barge accelerations and wind. Barge accelerations calculation are done in according to the simplified motion criteria presented in (DNV 1996) rules for planning and execution of marine operation part 2 and chapter 2 section 2.2.3.[ref/6]. The conditions for using simplified criteria are;

- towing in open sea on a flat top barge with length greater than 80m,
- barge natural period in roll equal or less than 7 sec.,
- object positioned closed to middle of the ship and with no part overhanging the barge sides, and
- object weight less than 500 tons

Wind loads and barge accelerations are applied in eight directions at 45 degrees interval covering the complete rosette. They will always be applied in the same direction

5.1 BARGE ACTION IN TRANSPORT

Basic Load case, 41-46 barge acceleration in transport:

The barge acceleration calculated according to (DNV 1996) Marine Operation part2. Refer to appendix B, for detailed calculation.

Table 4.1 barge accelerations in transport

Direction	Acceleration	Axis
+x	0.5945g	Horizontal
-x	-0.5945g	Horizontal
+z	0.8668g	Horizontal
-z	-0.8668g	Horizontal
+y	0.35g	Vertical
-y	-0.45g	Vertical

5.2 WIND ACTION IN TRANSPORT

Basic Load case, 61- 64 wind action in transport:

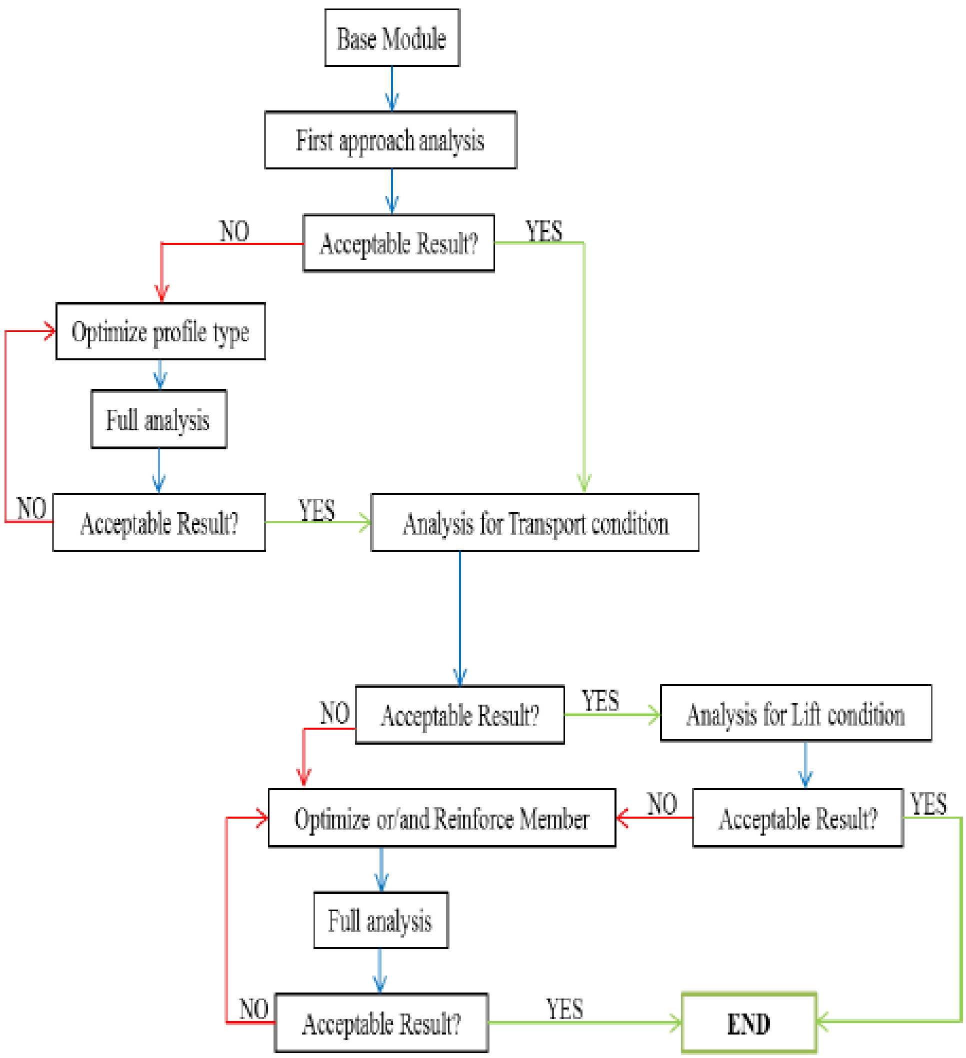
During the transportation of module from onshore to the offshore field the module will be subjected to wind from all directions.

The wind pressure (1.0 KN/m^2) in transport is taken form (DNV 1996) Marine Operations part 2. Result of wind action calculation represented in appendix B.

6.0 GLOBAL STRUCTURAL ANALYSIS AND DESIGN OPTIMIZATION

The aim of structural design analysis is to obtain a structure that will be able to withstand all loads and deformations to which it is likely to be subjected throughout its expected life with a suitable margin of safety. The offshore module structure must also fit the serviceability requirements during normal operation.

It is necessary to consider all three stages as different members may be critical in different conditions. In practice the offshore module structure must be analyzed for all three conditions. Structural analyses were therefore carried out for three primary load conditions, inplace, lift and transportation. The structural analysis and design optimization flow chart presented below shows procedure has been done to overcome optimized and well integrated structure for inplace, transport and lifting condition.



6.1 INPLACE CONDITION

Inplace load combinations shall consider ULS-a, ULS-b and ALS load conditions with contribution from relevant load types as defined in chapter 4. Load combinations are established to give maximum footing reactions at the interface between the offshore module structure and the existing production platform structure, and resulting stresses in the structure.

Environmental loads, wind and earthquake, shall be considered acting from eight different directions at 45 degrees interval covering the complete rosette, but in this thesis wind action has been considered for five directions during in place design.

The module structure is analyzed for wind with average recurrence period of 100 years. Considering the module structure height above water level, Ice load is neglected in these analyses. Considering the small load magnitude of 0.5 KN/m^2 it is concluded that the snow load can be neglected in the global analyses.

Load combinations for inplace analyses are performed in Staad.ProV8i.

6.1.1 ULS INPLACE DESIGN CHECK ACCORDING TO EC3

The objective of structural analysis is to determine load effects on the structure such as displacement, deformation, stress and other structural responses. These load effects define the sizing of structural components and are used for checking resistance strength of these components. The structure shall comply with limit state criteria defined by design rules and codes.

The structural analysis of the module structure for inplace condition is based on the linear elastic behavior of the structure. As mentioned earlier the module structure is exposed to different loads. The structural weight and permanent loads are considered as time-independent loads. Further, the environmental loads are considered as time-dependent loads. Different wind durations are calculated and 3.0 second wind gust is selected and applied to compute the static wind load for 100 year return period.

These analyses are performed and results presented for each condition and all members of the structure have utilization factor less than UF≤1.00 for the applied loads in inplace operational condition. This means that the members have sufficient capacity to withstand the applied loads.

6.1.2 SLS DESIGN CHECK

The objective of this analysis is to satisfy the service ability limit criteria of the new offshore module structure to make sure that the module remains functional for its intended use.

The new module structure has sufficient capacity under ULS design check and the analysis is conservative. This result indicates that the structure has sufficient capacity under service limit state too. Because the SLS criteria states that the load and material factor is 1.0 for dead and live load and no environmental load will be included. Therefore it has been concluded that the SLS criteria satisfied during normal use and no need for further check.

6.2 LIFTING CONDITION

The purpose of lifting analysis is to ensure that lifting operation offshore shall be performed in safe manner and in accordance with the prevailing regulations.

The module will be lifted onto the platform by a heavy lift vessel. All lifting factors and design of lifting pad eyes shall be according to NORSOK R-002. There are several lifting methods such as single hook, multiple hooks, spreader bar, no spreader, lifting frame, three part sling arrangement, four part sling arrangement etc.

In this case the lifting arrangement used is steel wire with four-sling arrangement which is directly hooked on to a single hook on the crane vessel.

Vessel motion, crane motion and object motion are important issues that must be considered carefully during lifting operation.

Vessel motion

Vessel motion can be defined by the six degrees of freedom (DOF) that is experienced by a vessel at sea. The six DOF motions comprise of three translation and three rotational motions. The importance of each of the six DOF in marine operation varies, depending on the type of operation, for instance:

- Heave is most important for vertical operations.
- Roll is most important for crane operation over the side.

The rotational motions (roll, yaw and pitch) are the same for all point of vessel, while the translational motions (heave, surge and sway) are coupled and dependent on the motions of the other degrees of freedom.

Crane motion

Motion in the carne can be a challenging issue during lifting and installing new equipment on platforms. The motion can be caused by several different factors where wind, wave and snap load are the most common. Wind can cause some motion in the crane, but in cases of strong wind the lifting operation will be postponed.

Object motion

The motion of object can be caused by the same factor as motion in the crane. Wind will cause movement on the object depending on the design and area of the object. For the offshore module structure there are no large surfaces hence the motion caused by the wind can be neglected. These motions are topics that are too broad to explain in this thesis and therefore mentioned here very briefly.

In according to the design brief the offshore module structure will be lifted by using four points sling arrangement which is shown in the following figure.

F.7.2.2 Lifting set terminology

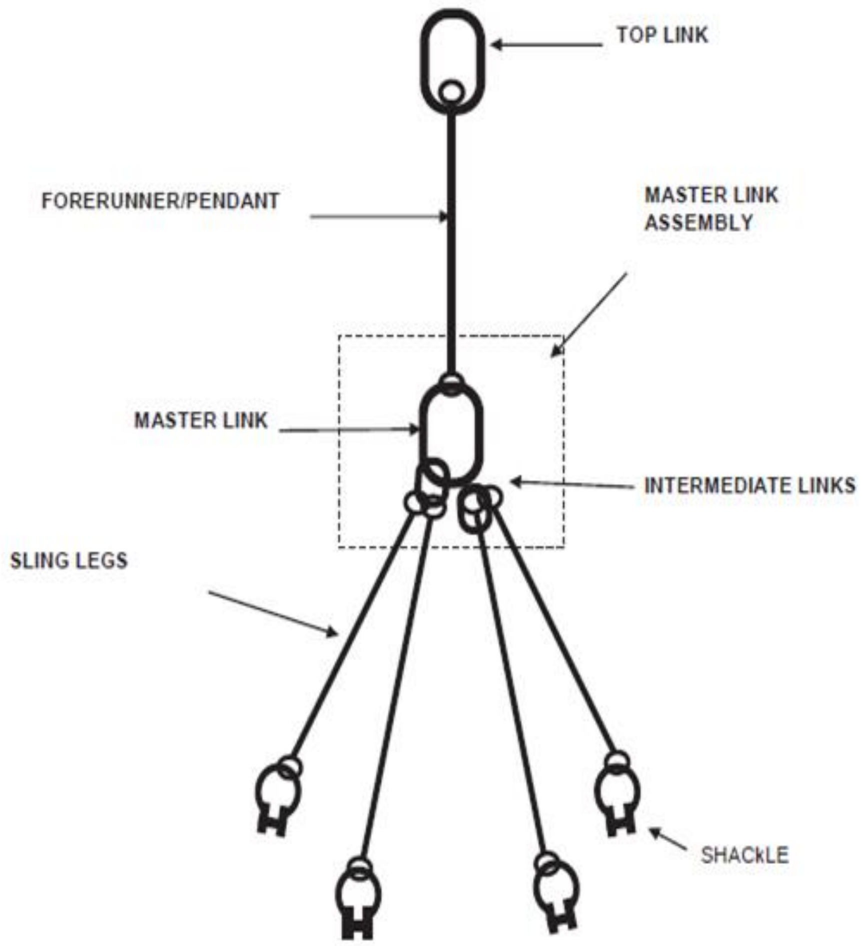


Figure F.3 - Terminology

Figure 6.1 Four point sling arrangement (source: NORSOK R-002)

For lifting condition the governing load condition is ULS-a. Load factors such as Center Of Gravity factor, Dynamic amplification factor, Skew load factor, Design factor and Center of Gravity envelope factor must be calculated and applied to find the total lifting load. An additional consequence factor is applied to various part of the module structure depending on their criticality during lifting operations. In this report all calculations are done according to the lifting equipment standard NORSOK R-002 [ref. /7/].

The members are categorized in three groups:

1. Single critical members, these are members connected to the lifting point and are assigned a consequence factor of 1.25
2. Reduced critical members, these are main members not connected to the lifting points, and assigned a factor of 1.10.
3. None critical members, these are members considered to have no impact on the lifting operation, and are assigned a consequence factor of 1.00.

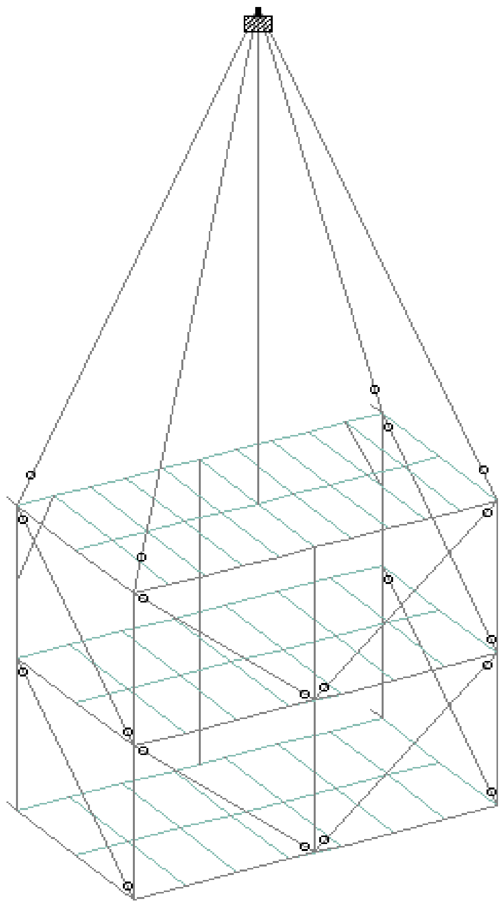


Figure 6.2 lifting design model (source: Staad.ProV8i)

6.2.1 LIFTING DESIGN LOAD FACTOR

Load factors relevant for lifting design are summarized and presented as follows:

Center of gravity (COG)

When completing lift operation of a structure it desirable to have lifting hook placed above the object's center of gravity to ensure that vertical the hook to prevent the object from tilting when it's lifted into the air. To cover the uncertainties in weight and center of gravity a factor is multiplied with the estimated weight of structure to obtain a design weight to be used for further analysis in lifting. From NORSOK R-002 we can find two different COG factors can be used for lifting analysis.

For weighed object or object with a sample weight pattern: $W_{COG} = 1.0$

For un-weighted object or object with a complex weight pattern: $W_{COG} = 1.1$

In this thesis factor of $W_{COG} = 1.1$ is used in lifting analysis.

Dynamic Amplification Factor (DAF)

Offshore lifting is exposed to significant dynamic effects that shall be taken into account by applying an appropriate dynamic amplification factor.

The NORSOK R-002 uses different DAF factors for offshore and onshore lifts. Offshore lift means the lift from the boat on to the platform, every lift operation inside the platform is classified as onshore. From section F.2.3.5 in NORSOK R-002 we can see that onshore lift under 50 tones should use 1.5 as DAF factor. For offshore lifts over 50 tones the following equation shall be used to obtain DAF factor.

$$DAF = 1.70 - 0.004 * WLL \text{ for } WLL > 50 \text{ tones} \quad (F.2\text{-}2)$$

Working load limit

The working load limit (WLL) for the complete is defined as follow:

$$WLL = W^{*}\, W_{.CF}$$

Where

WLL = weight of the lifted object W including weight contingency factor and excluding the sling set

W = estimated weight of the lifted object

W_{CF} = weight contingency factor

Skew Load Factor (SKL)

Skew loads are additional loads from redistribution due to equipment and fabrication tolerances and other uncertainties with respect to force distribution in the rigging arrangement. The skew load (SKL) is used as a safety factor to secure extra loads which are encountered because of mismatches in sling length. This may arise as a consequence of human failure or fabrication failure.

Single hook four point lift without spreader bar the skew load factor can be taken 1.25 according to NORSOK R-002 section F.7.2.3.4 (Table F.3).

Design Factor (DF)

Design factor is combination of the consequence factor (γc) and partial load factor (γp). The partial load factor is 1.34 for all cases from the NORSOK R-002, but the consequence factor varies from 1.00 to 1.25. In this present case and most other cases when the lifting pad eyes are attached directly to the object, the consequence factor will be 1.25 which resulting that the design factor will be 1.68.

Design load factor DF defined as: $DF = \gamma_p * \gamma_c$

Where:

γ_p = partial load factor

γ_C = consequence factor

These factors (DF) are variable for different members of module structure. They have been selected as listed below in table 6.2.1

Table 6.2.1 DF factors (NORSOK R-002)

ELEMENT CATEGORY	γ_p	γ_c	**DF =** $\gamma_p * \gamma_c$
Lifting points including attachment to object Single critical elements supporting the lifting point	1.34	1.25	1.68
Lifting equipment (spreader bar, shackles, sling etc.)	1.34	1.25	1.68
Main elements which are supporting the lift point	1.34	1.10	1.48
Other structural elements of the lifted object	1.34	1.00	1.34

Finally these factors were used for analysis of module structure under lifting condition.

WCF = 1.10

COG = 1.10

DAF = 1.4316

SKL = 1.25

ULS-a = 1.30

γ_C = 1.00/1.10/1.25

- Lifting points γ_{tot} = WCF*COG*DAF*SKL*ULS-a*γ_c = 3.5186
- Main element γ_{tot}= WCF*COG*DAF*SKL*ULS-a*γ_c = 3.1000
- Other element γ_{tot} =WCF*COG*DAF*SKL*ULS-a*γ_c =2.8149

6.3 TRANSPORT CONDITION

The new structure shall be fabricated on onshore, and transported to the" Block Gold filed PH" on a barge where wind load and barge acceleration shall be calculated according to (DNV1996) Rules for planning and execution of marine operation.

Marine operations shall be properly planned at all stages of a project or operation. The marine operation shall as far as feasible be based on the use of well proven principles, techniques, system and equipment. The feasibility of extending proven technology shall be thoroughly documented.

Marine operation manuals shall be prepared and shall cover all phases of the work, from start of operations for the operation to completed demobilizations, and including organization and communication and a program for familiarization of personnel, a description of and procedure and acceptance criteria for testing/commission of all equipment to be used for the operations, description of Vessel and sites, detailed procedure for all stages of the operations, towing routes with estimated sailing time and possible ports of refuge , definition of decision , hold and approval points and criteria for starting of each phase of the operation, acceptable tolerances, monitoring and reporting details, verification that the operation have been completed in accordance with the design and requirement stated in standard and regulation for marine operations.

Environmental criteria to be adopted for the planning of transportation shall have a return period of 10 years for the pertinent season and area. Less severe criteria may be used for inshore transportation routes where suitable ports of refuge along the route have been identified, provided an equivalent overall safety is maintained.

Design of grillages and sea-fastening shall facilitate load out and subsequent release, shall provide adequate vertical and horizontal support and shall be such that the welding and flame-cutting do not inflict damage to the transported object. The contribution from friction shall be disregarded in the design of sea-fastening and grillage. The transportation barge shall be equipped with access ladders, minimum one on each side.

The sea fastenings fix the offshore module structure to the barge that transports it from the fabrication yard to its offshore location. The module must be fixed to the barge in order to withstand barge motions in rough sea. The sea fastenings are determined by the positions of the framing in the module as well as the hard points of the barge. A structural analysis will be run again, taking into consideration the fixation points and the movement of the barge. This phase requires cooperation between the installation company and the engineering firm that performed the design. Cooperation between the installation's company and engineering company in early phase of the project is important for safe transportation and installation of the module.

Transportation in open sea is a challenging phase in offshore projects. Careful planning is required to achieve a safe transport.

Transporting can be done on a flattop barge or on the deck of the heavy lift vessel [HLV].

In this thesis a standard North Sea Barge, UGLAND UR 171, has been selected for the transportation of the module structure. E-mail: from Aker Solutions,[ref /10/].

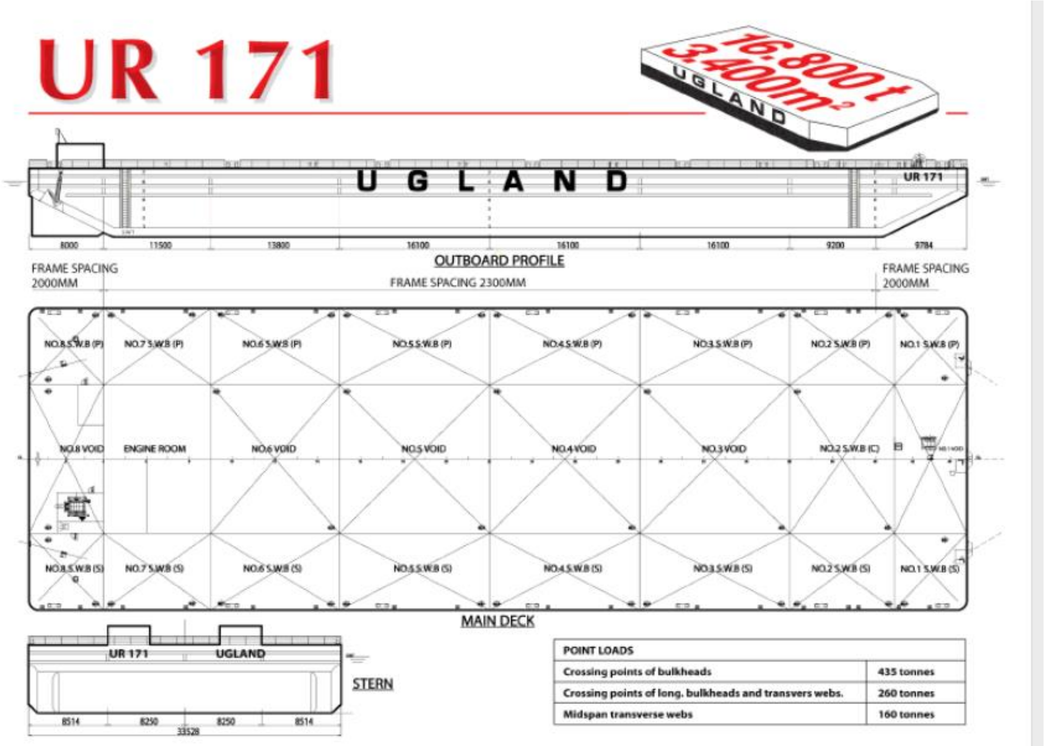


Figure 6.3 Standard barge uses in North Sea Oil industry (Aker Solutions**).**

Barge accelerations are action loads which will be applied on the module structure in transportation condition. The intention with barge acceleration calculation is to identify applicable accelerations for the barge tow and to calculate the acceleration load that will be imposed on the structure. The applicable barge accelerations are calculated and applied according to DNV, Guidelines for marine transportations [ref./6/]

During transport the module structure will be subjected to both wind and barge acceleration action. The governing loads action during transport is self-weight of offshore module structure, wind load and barge accelerations. The calculation results for wind and barge accelerations in transport condition are presented in appendix B.

7 0 DESIGN CHECK OF PADEYES

7.1 LOCAL ANALYSIS OF PADEYES

The lifting arrangement chosen for the new offshore module structure calls for 4 pad eyes to be installed on top of the structure. The pad eyes are to be considered as temporary and removed before the module structure enters in its normal use. Several calculation methods are available, but in this thesis NORSOK R-002 lifting equipment design used. In this thesis the pad eyes TYPE 2 (WLL≤ 50T) [ref. /7/] is used for lifting of offshore module structure.

The following stresses are evaluated and presented:

- Pin hole stress
- Main plate stress
- Cheek plate stress
- welds

Pad eye body is usually welded to main structure. In some occasion main body may be welded to a plate and bolted to main structure for easier removal. Stress checks shall be done on body and welded connection. In this thesis the pad eyes will be welded to main beam on the top of the module structure.

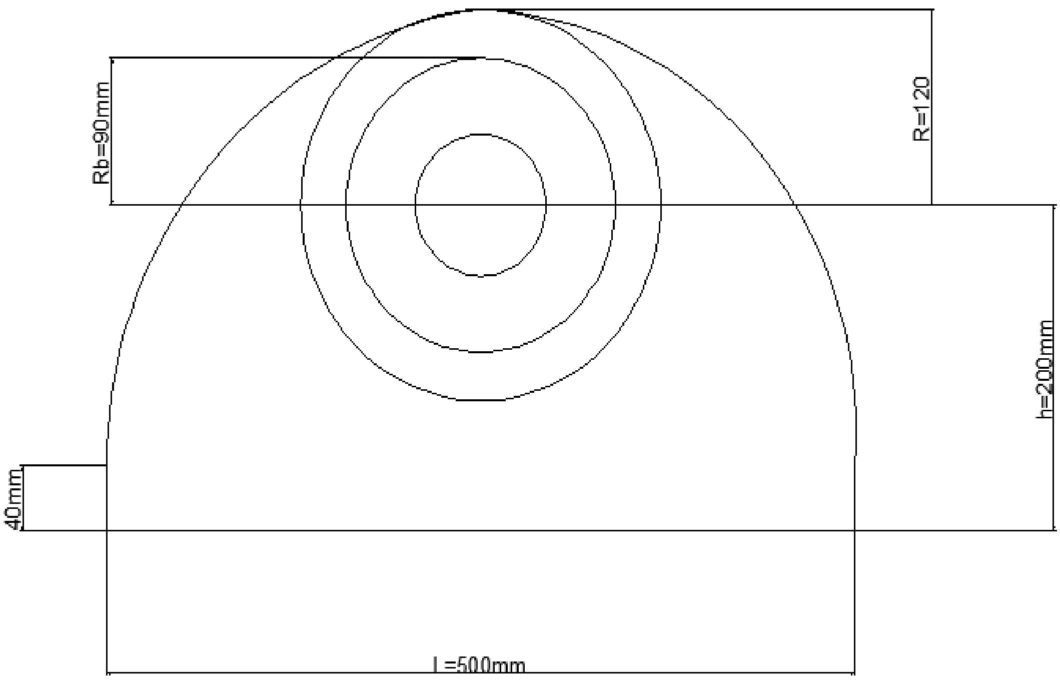


Figure 7.1 pad eyes (Autodesk)

All loads are to be transferred from main structure to the pad eye structures. The pad eyes have been designed in according NORSOK R-002 lifting equipment design.

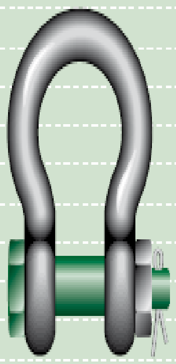
The lifting slings must have sufficient length so that angle of the slings meets the criteria set.

To minimize transverse loading on the pad eyes, they should be tilted to match the angle of sling.

Lifting gear such as sling and shackles are not part of this report. Pin size is based on the highest sling load and a green pin is chosen from www.greenpin [ref. /9/].

Offshore module structure has a total self-weight under lifting 77.31 tones and therefore has been chosen a standard shackles for working load limit of 85 tones. A copy of data sheet of a standard green pin and shackle is shown in the following figure.

Shackles



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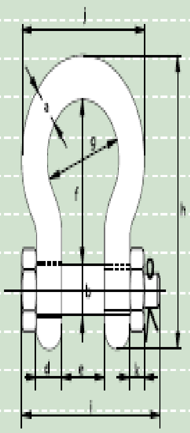

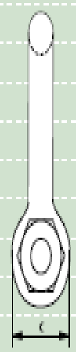

Green Pin® Standard Shackles

bow shackles with safety bolt

- **Material** : bow and pin high tensile steel, Grade 6, quenched and tempered
- **Safety Factor** : MBL equals 6 x WLL
- **Standard** : EN 13889 and meets performance requirements of US Fed. Spec. RR-C-271 Type IVA Class 3, Grade A
- **Finish** : hot dipped galvanized
- **Temperature Range** : -20°C up to +200°C
- **Certification** : at no extra charges this product can be supplied with a works certificate, 3.1 material certificate, manufacturer test certificate, EC Declaration of Conformity and all shackles starting from 2 t can be supplied with DNV 2.7-1 certificate.
- **Note** : for details on dimensions and tolerances please consult our CAD drawings, these are available on request.

working load limit	diameter bow	diameter pin	diameter eye	width eye	width inside	length inside	width bow	length	length bolt	width	thickness nut	weight each
	a	b	c	d	e	f	g	h	i	j	k	
t	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	kg
0.5	7	8	16.5	7	12	29	20	48.5	42	34	4	0.06
0.75	9	10	20	9	13.5	32	22	56	50	40	5	0.11
1	10	11	22.5	10	17	36.5	26	63.5	60	46	8	0.16
1.5	11	13	26.5	11	19	43	29	74	67	51	11	0.22
2	13.5	16	34	13	22	51	32	89	82	58	13	0.42
3.25	16	19	40	16	27	64	43	110	98	75	17	0.74
4.75	19	22	46	19	31	76	51	129	114	89	19	1.18
6.5	22	25	52	22	36	83	58	144	130	102	22	1.77
8.5	25	28	59	25	43	95	68	164	150	118	25	2.58
9.5	28	32	66	28	47	108	75	185	166	131	27	3.66
12	32	35	72	32	51	115	83	201	178	147	30	4.91
13.5	35	38	80	35	57	133	92	227	197	162	33	6.54
17	38	42	88	38	60	146	99	249	202	175	19	8.19
25	45	50	103	45	74	178	126	300	249	216	23	14.22
35	50	57	111	50	83	197	138	331	269	238	26	19.85
42.5	57	65	130	57	95	222	160	377	301	274	29	28.33
55	65	70	145	65	105	260	180	433	330	310	32	39.59
85	75	83	162	73	127	329	190	527	380	340	39	62

1 2 3 4 5

Figure 7.2 standard shackles. (greenpin.com)

Calculation result of local analysis of pad eyes presented in appendix D.

8.0 DESIGN CHECK OF CONNECTIONS

8.1 BOLTED CONNECTIONS

The module structure will be connected by bolts to the main column of existing production platform by their two lower support point. The bolt connection is checked according to NS-EN EC3 1993 1-8 [ref. /5/] section 3.4.1 and 3.6.1. Results are presented in appendix E.

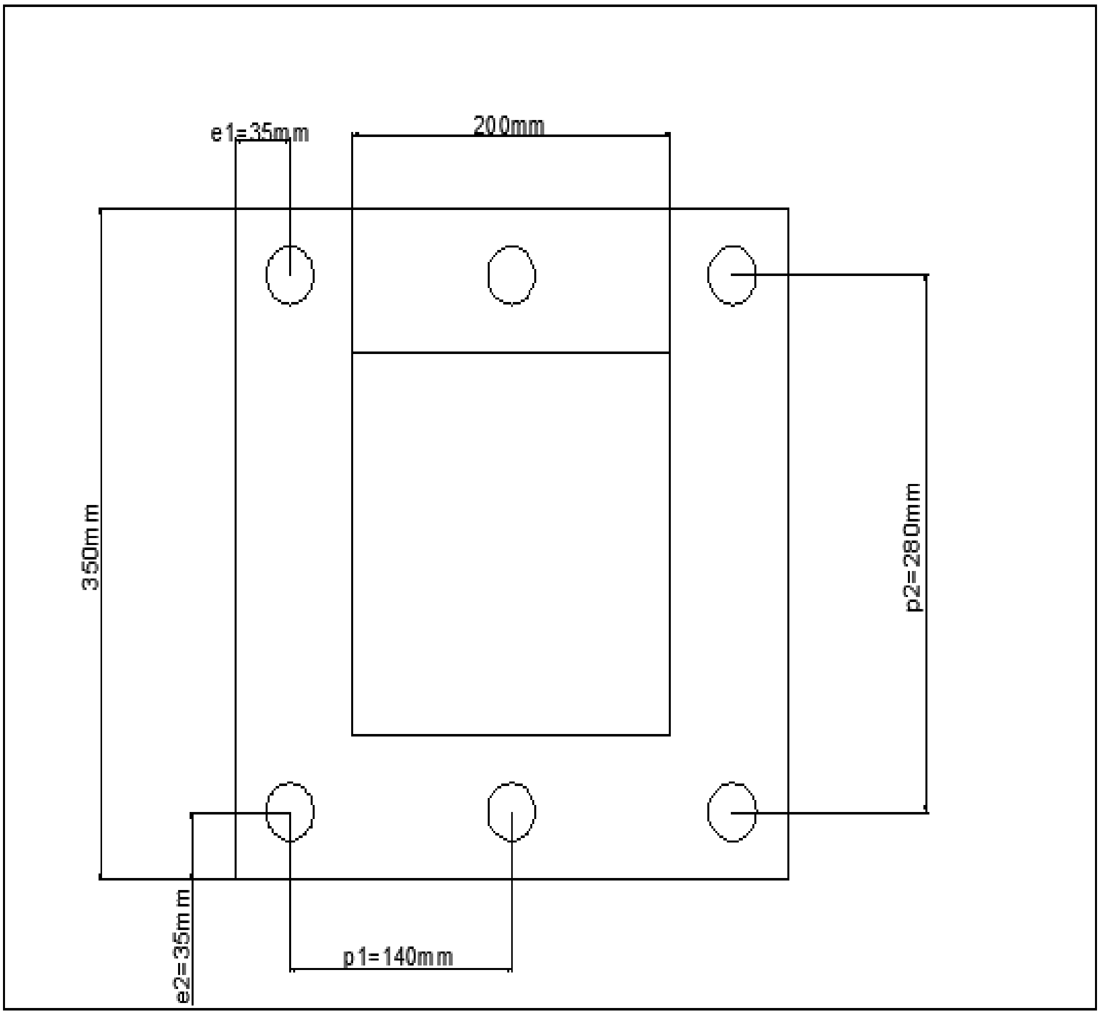

Figure 7.2 Sketch of plate and bolts for bottom support of new module (Auto desk)

8.2 WELDED CONNECTIONS

All welds on the module structure are in general full pen welds and not subjected to further checks. However, the welded connection between the column and plates which are going to connect the bottom support of the new module to the existing platform are 8 mm fillet welds. These welds are checked according to EC3 1993-1-8 section 4.5 and have enough capacity to withstand to the prevailing forces. The highest joint force will be resulted in inplace phase from earthquake 10^{-4} years (ALS) load combination and therefore weld capacity has been checked in the most critical joint with highest axial force on each member. Analyses result from Staad. Prov8i show that highest tensile axial force happen at node 9. For calculation results refer to the appendix E.

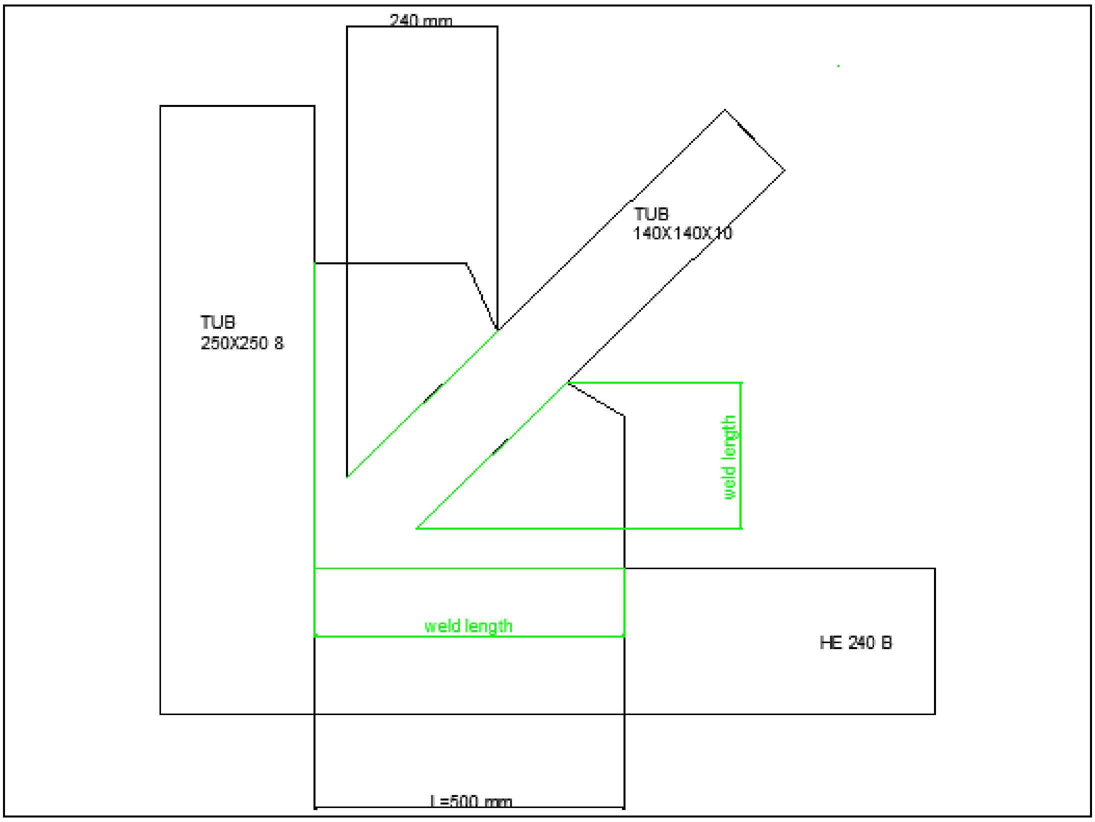

Figure 7.3 sketch of joint between braces and main beams (Auto desk)

9.0 CONCLUSIONS

The main objective of this thesis was to do design, analysis and calculation of an offshore module to obtain a proper weighed structure that has sufficient capacity and strength with respect to normal operation, transportation and installation phases. Apart from these factors the goal of design analysis and optimization of profile types in this structure is to achieve that has high safety with respect to life, environment and economic risk.

In this master thesis structural analysis and design of the gas injection module structure to ensure the required safety and serviceability requirements against different load and load combinations (i.e. dropped object impact load, explosion load, fire load, live load, wind load and earthquake) by considering all phases such as inplace, transport and lifting condition, were done to obtain the main goals.

The module structure was designed, modeled and analyzed by using the Staad. ProV8i. New offshore module structure designed and analyzed for three different conditions, inplace, transport and offshore lifting condition. In inplace the module structure has been designed and modeled to withstand against all loads and load combination assumed to occur during the estimated life period for normal operation. Global structural analysis is done in Staad.Pro.V8i and results show that the designed offshore module structure has sufficient capacity to withstand normal operating loads, such as wind, laydown loads, earthquake loads. Highest utilization factor from the Staad.Pro analyses is 0.941 which is less than the design limit criteria, UF≤1.00.

In inplace the module structure is going to be subjected dropped object impact load scenario, explosion loads and fire loads. The calculation of affected beams in case of dropped object impact load based on fully plastic criteria were done to show that the module structure has enough capacity to withstand dropped object impact load without damaging the instruments which are going to be installed under the offshore module structure. Resulting UF from hand calculations is 1.00.

Explosion loads are the second accidental loads that have been considered that might be happen in inplce phase. Structural analysis was done by Staad Pro and results obtained by analysis shows that the UF in this cases are within the acceptance limit criteria set in design basis and highest UF = 0.984 which is less than the UF≤1.00.

Fire action is the last accidental loads which have been considered for inplace condition, simple calculation method has been used to check module capacity against fire action. Hand calculations were done for the most effected beams with the highest bending moment and results shows that the new offshore module structure must be protected against fire loads to fulfill the design limit criteria basis.

Transport was the second step in the analysis. This condition was also analyzed by the Staad.Pro.V8i. Structural analysis of this model shows that the designed model has enough capacity in most of the members to withstand the imposed loads during transportation. But braces are used in the south and north part of the module had utilization factors more than their capacity (UF>1.00) and therefore some temporary braces used to prevent failing of the members and fulfill the criteria was set in design limit criteria. The temporary braces used only during the transportation and shall be removed before the module will be placed to its final position. After putting two extra braces structural analysis was run again for transportation phase the result shows that module has enough capacity and the highest utilization factor is (UF= 0.973) which is small compared to design limit criteria UF≤1.00 analysis results are presented in appendix A.

Third step comprise the lifting condition and design of pad eyes. The structural analysis was run for lifting condition and analysis results shows that the module has enough capacity during offshore lifting, the highest utilization factor for lifting analysis is 0.996 which is fairly modest compared design limit criteria UF≤1.00. Suitable pad eyes were chosen according NORSOK R-002 lifting equipment for lifting design and necessary calculations were done to check that pad eyes have enough capacity to withstand subjected load during lifting of module structure. Calculation results show that pad eyes have utilization factors as (UF= 0.595) which are less than UF≤1.00 defined in design limit criteria.

Finally a check of bolted connections sewing the module structure to the main column of existing production platform “Black Gold Filed PH” had to be done. Calculation and design check were done in according to Euro code3-1-8[Table 3.3] section 3.4.1 and 3.6.1 Calculation results show that bolted connections have enough capacity to withstand imposed load.

According to my experience on working with this thesis i would like to mention some steps to be considered during the design and analysis of such offshore module until we reach to the suitable cross section for initial design.

- It is advisable to do analysis for each condition separately, by starting with initial design for inplace condition and identify the most critical load cases that might have great impact on selection of profile types such as accidental loads (dropped object impact load on top of module, explosion loads).
- Secondly we shall run analyses for all load cases that might happen during the life of offshore module for normal use of structure and guess initial cross section for this condition.
- The module shall be analyzed and checked for transportation condition to show that offshore module with the selected profiles is suitable for this phase ae well. If the results from different analyses are acceptable then we can run analyses for lifting condition to check the module capacity for this phase.

When we get some initial profiles then we can follow the structural analysis and optimization flow chart which was presented in chapter 6.

This proposed methodology in this thesis provides a very good platform for practicing engineers who are going to analysis and design of offshore module structures in future. The accuracy and the efficiency are the main advantages of proposed methodology.

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[17] WWW.PTC.COM (MATHCAD 15)

11.0 APPENDICES

- APPENDIX A STAAD.ProV8i ANALYSIS- INPUT AND OUTPUT FILES
- APPENDIX B BASIC LOAD CASES AND LOAD COMBINATION
- APPENDIX C ALS CONDITION AND DOP IMPACT CALCULATION
- APPENDIX D DESIGN CHECK OF PAD EYES
- APPENDIX E DESIGN CHECK OF CONNECTION

APENDICES

APENDIX A

GEOMETRY

STAAD PRO INPUT FILE INPLACE DESIG

STAAD PRO INPUT FILE TRANSPORT DESIGN

STAAD PRO INPUT LIFTING DESIN

STAAD PRO OUT PUT FILE ANALYSIS INPLACE DESIGN

A.1 GEOMETRY

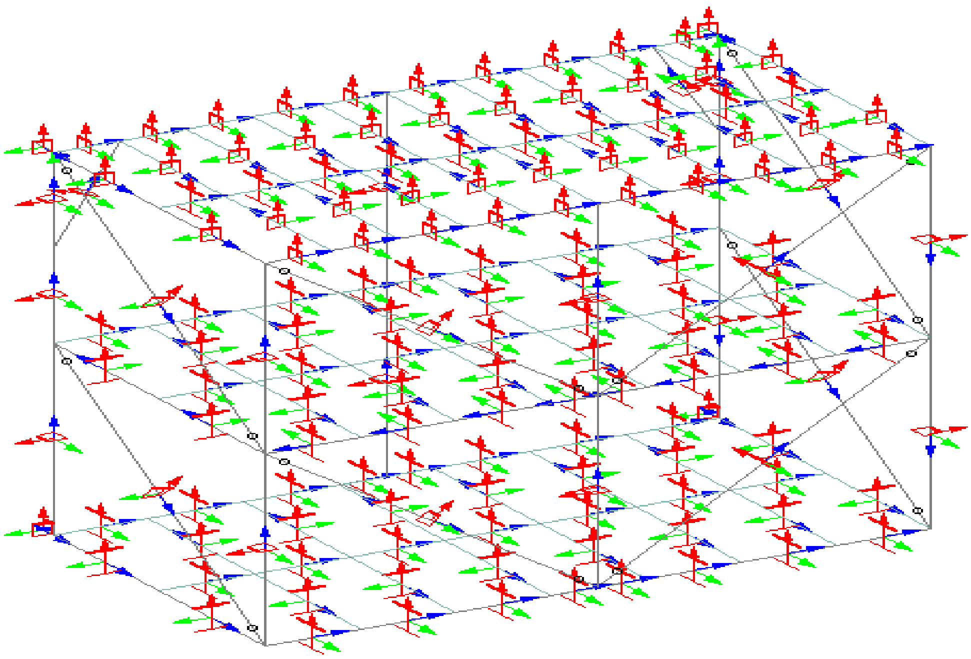

Figure Error! No text of specified style in document.**-1a beam local coordinate axes**

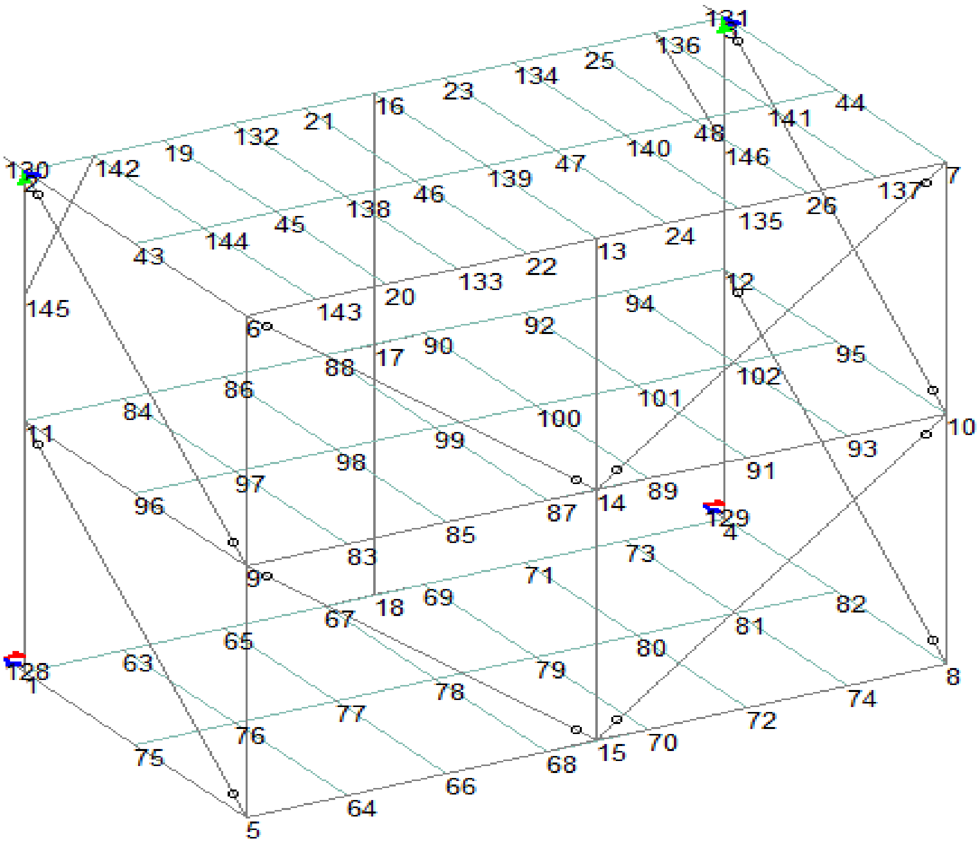

Figure Error! No text of specified style in document.**-2b All members with nod numbers**

BASIC LOAD CASES in inplace

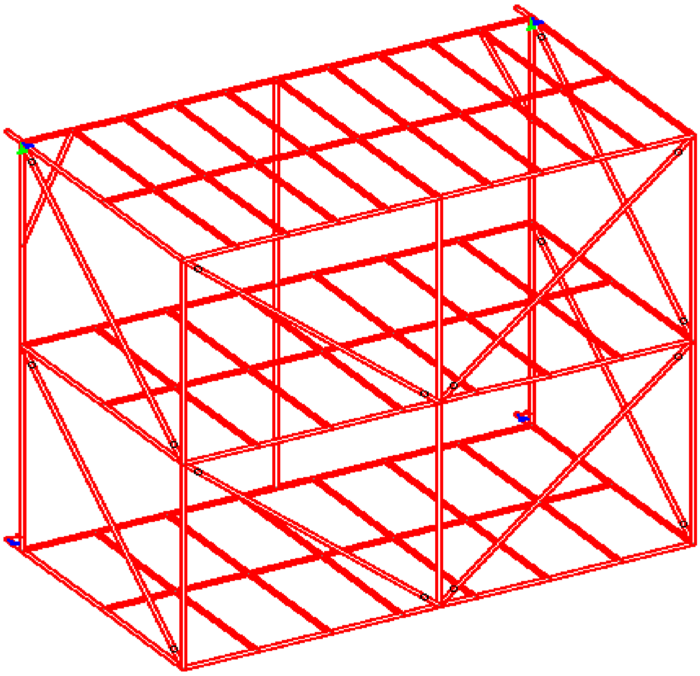

Figure Error! No text of specified style in document.**-3** **LC1, self- weight accelerated downwards**

LC11and LC21are identical to LC 1, but accelerated horizontally.

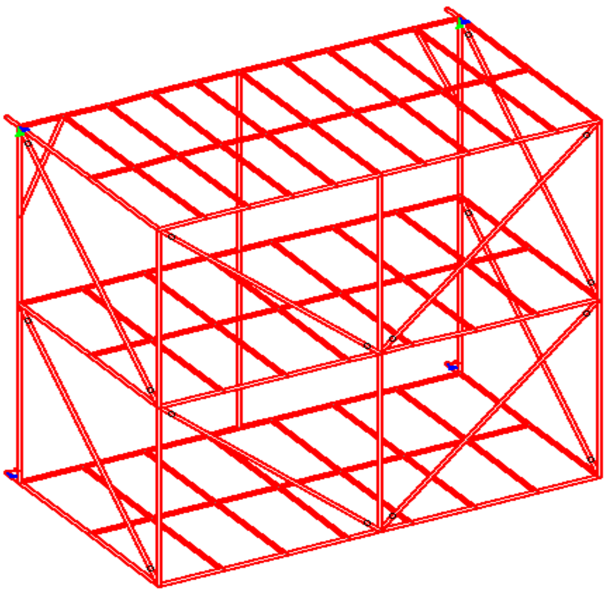

Figure Error! No text of specified style in document.**-4** **LC2 secondary steel, -y direction**

LC12 and LC22 are identical to LC 2, but accelerated horizontally

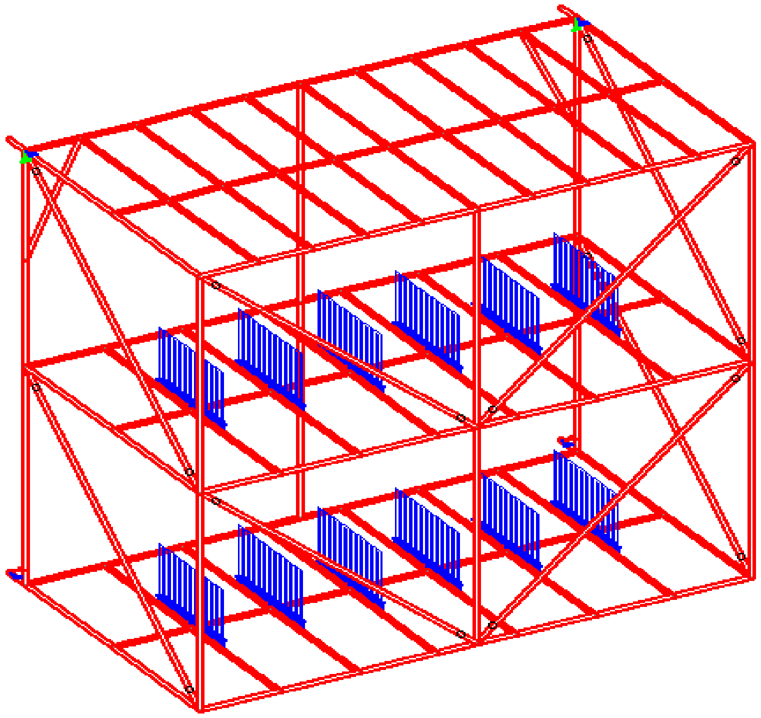

Figure Error! No text of specified style in document.**-4 LC3 equipment dead load accelerated downward, -y direction**

LC13 and LC23 are identical to LC 3, but accelerated horizontally

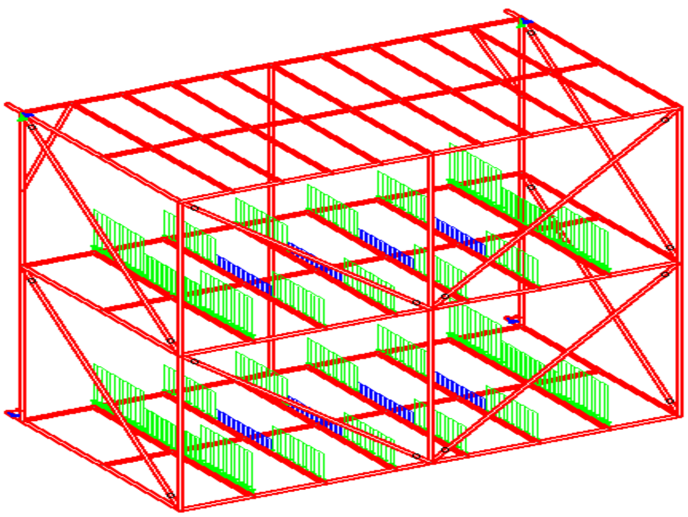

Figure Error! No text of specified style in document.**-5 LC4 Functional live load accelerated downward, -y direction**

LC14 and LC24 are identical to LC4, but accelerated horizontally

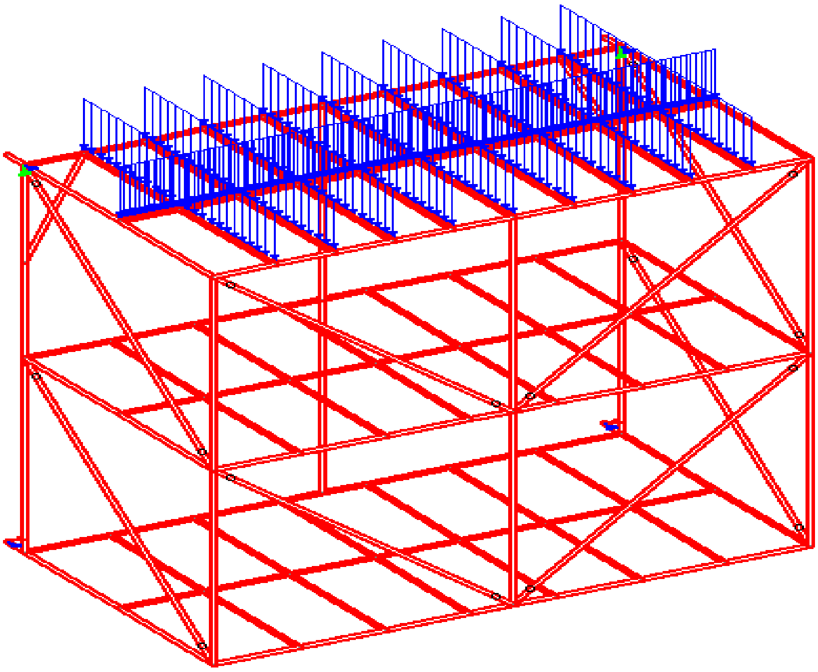

Figure Error! No text of specified style in document.**-6** **LC5 Laydown load accelerated downward, -y direction**

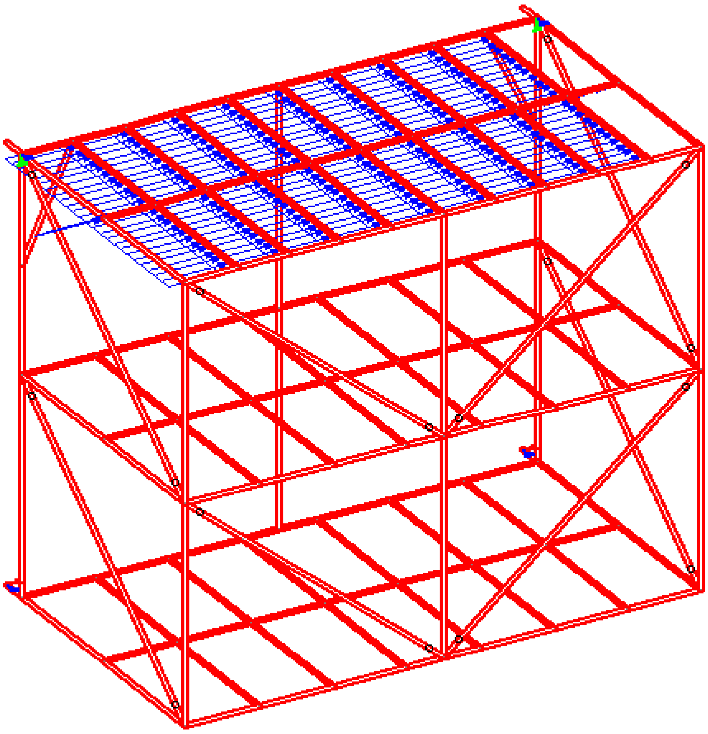

Figure Error! No text of specified style in document.**-7** **LC5 Laydown load, + x direction**

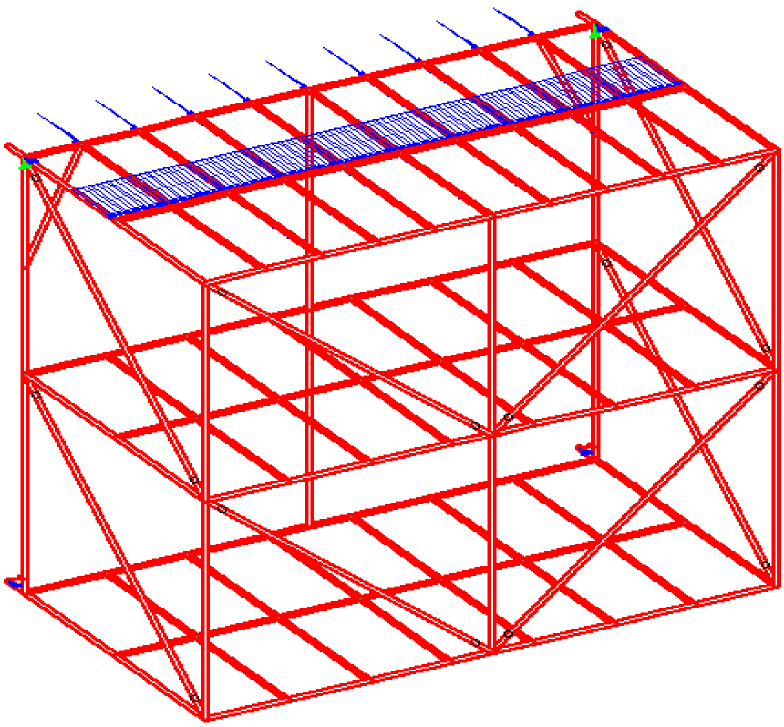

Figure Error! No text of specified style in document.**-8** **LC5 Laydown load, + Z direction**

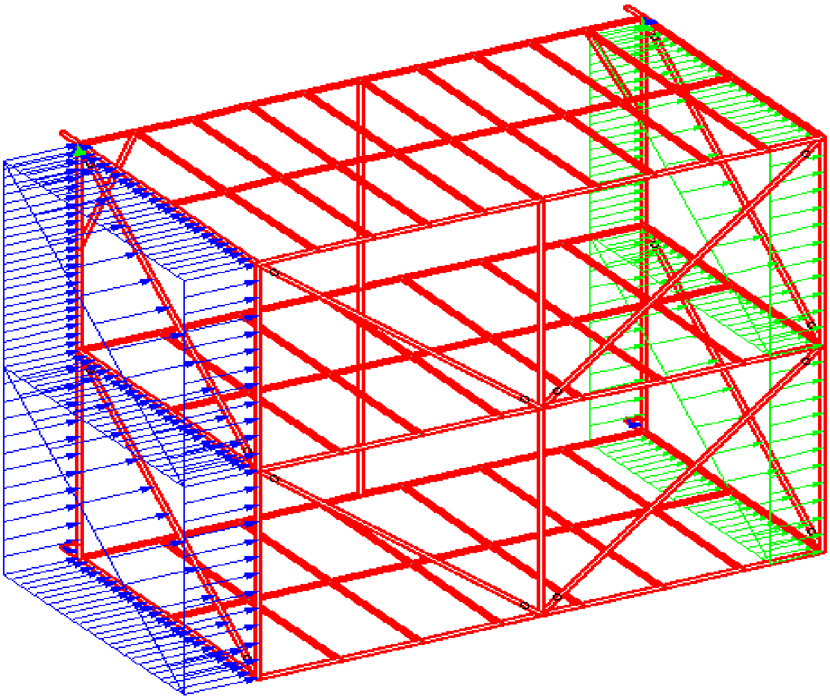

Figure Error! No text of specified style in document.**-9** **LC31 wind action inplace, +X direction**

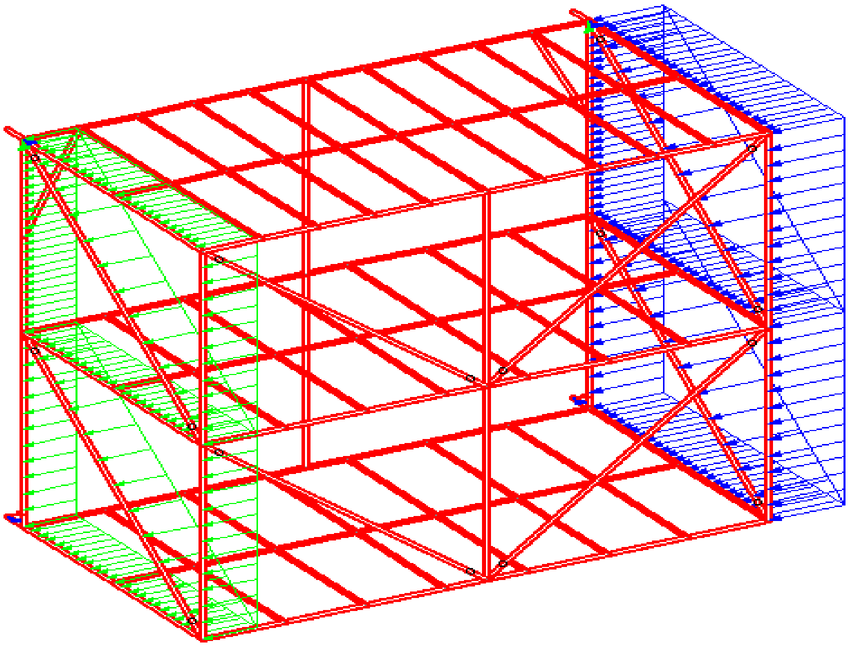

Figure Error! No text of specified style in document.**-10** **LC32 wind action inplace, -X direction**

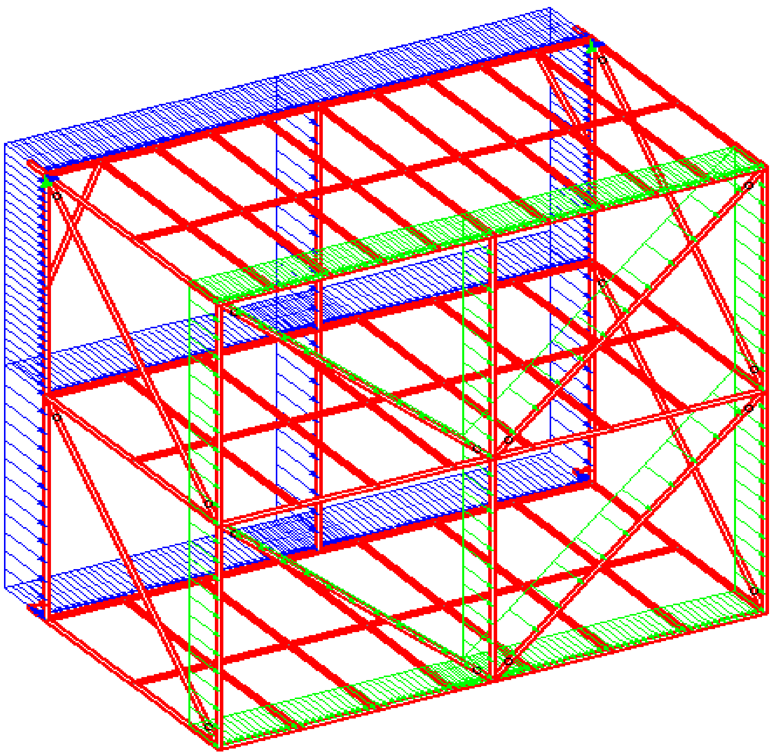

Figure Error! No text of specified style in document.**-1** **L33 wind action inplace, +Z direction**

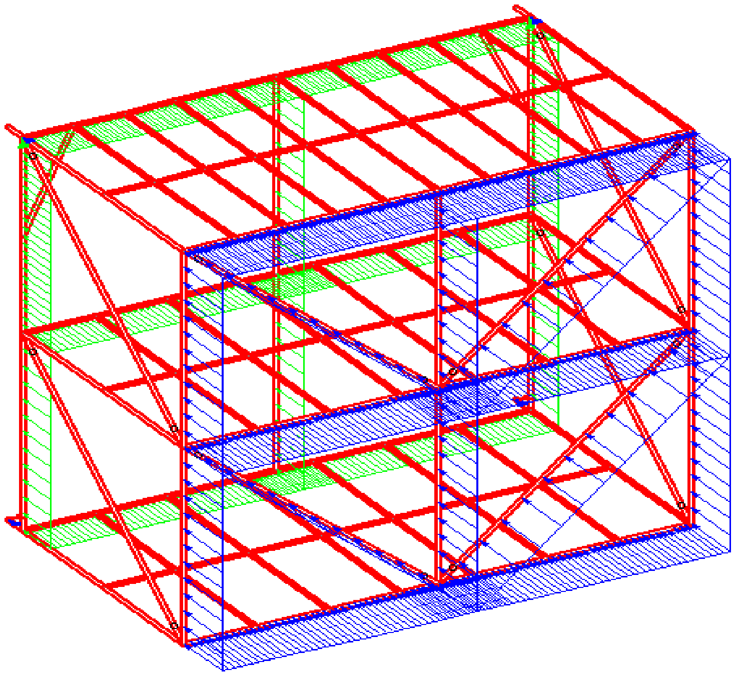

Figure Error! No text of specified style in document.**-12** **LC34 wind action inplace, -Z direction**

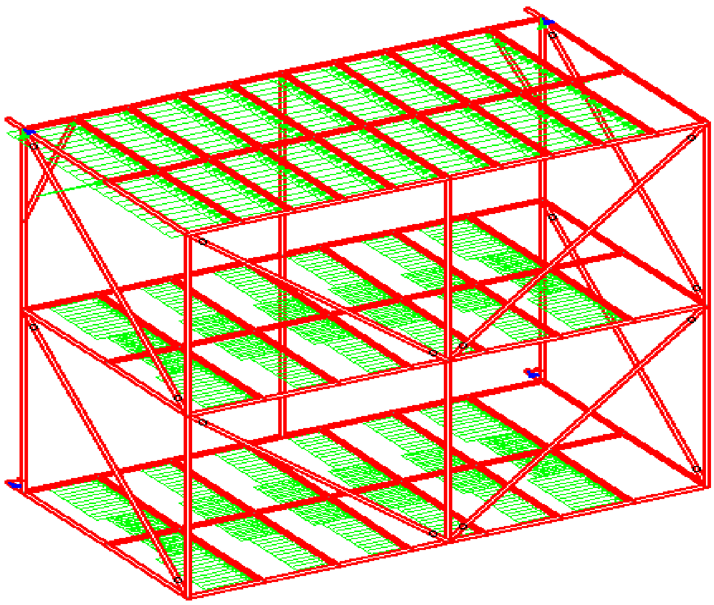

Figure Error! No text of specified style in document.**-13** **LC41 earthquake 100 year , +X direction**

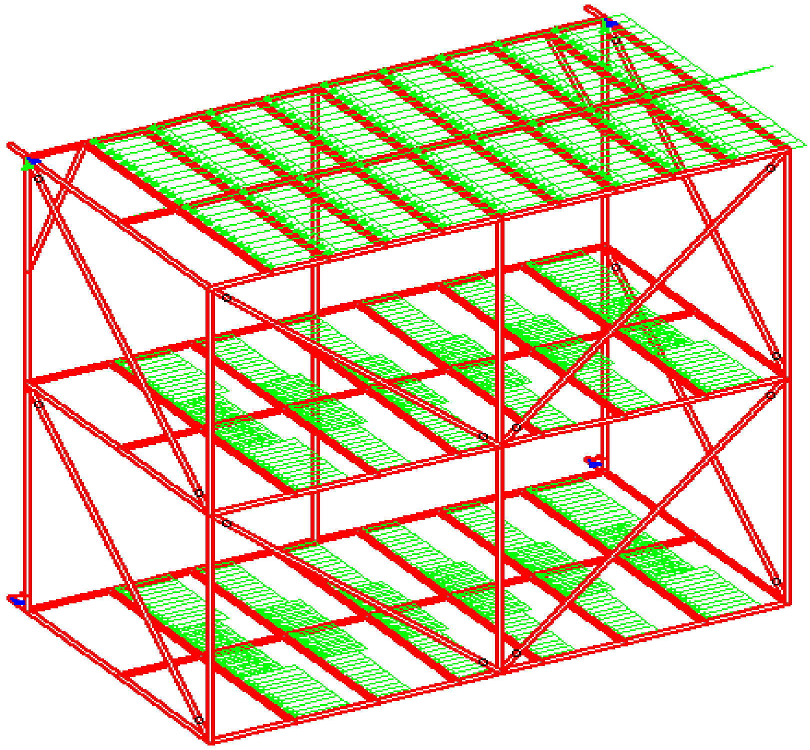

Figure Error! No text of specified style in document.**-14** **LC42 earthquake 100year, -X direction**

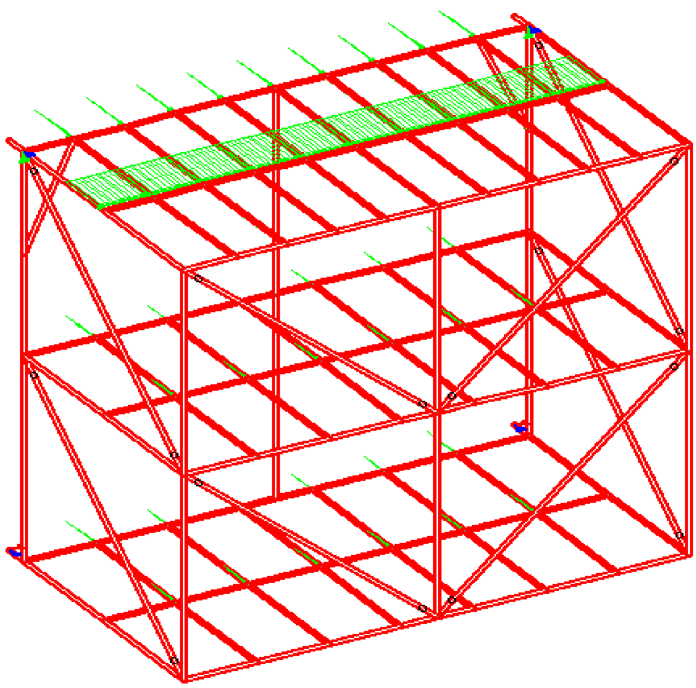

Figure Error! No text of specified style in document.**-15** **LC43 earthquake 100 year, +Z direction**

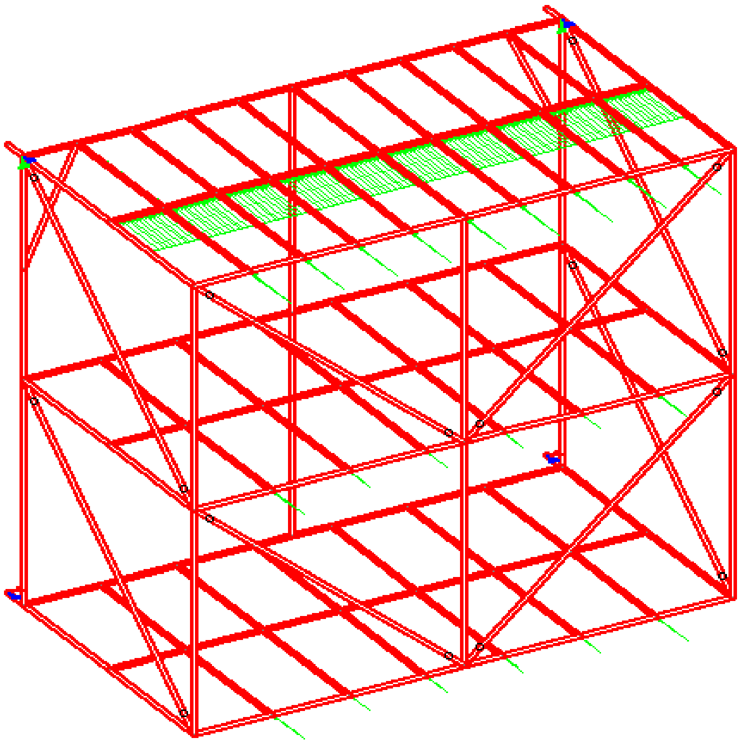

Figure Error! No text of specified style in document.**-16** **LC44 earthquake 100 year, -Z direction**

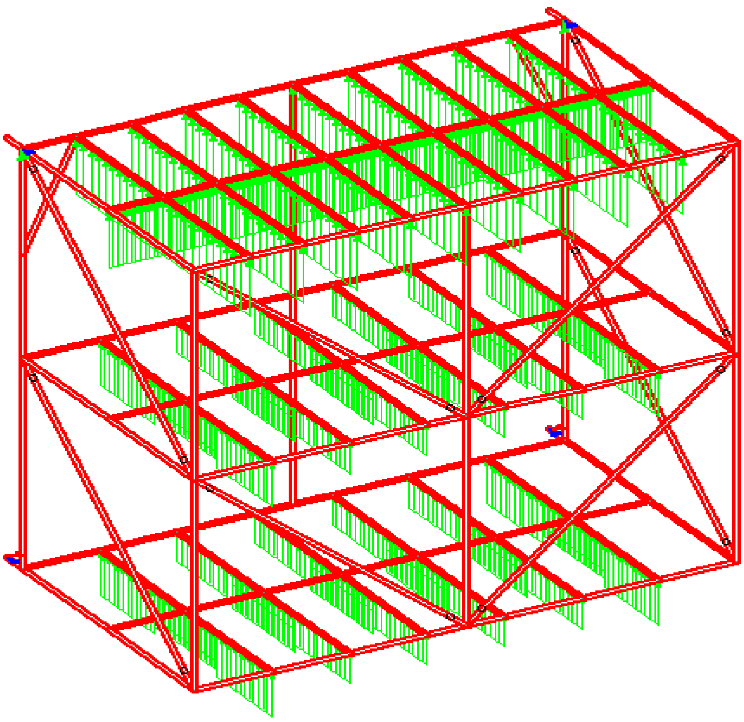

Figure Error! No text of specified style in document.**-17** **LC45 earthquake 100 year, +Y direction**

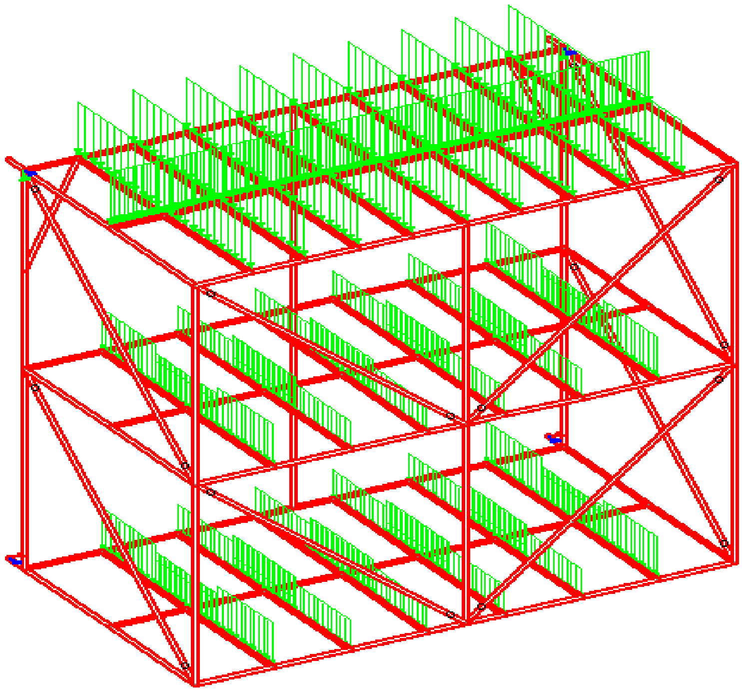

Figure Error! No text of specified style in document.**-8** **LC46 earthquake 100 year, -Y direction**

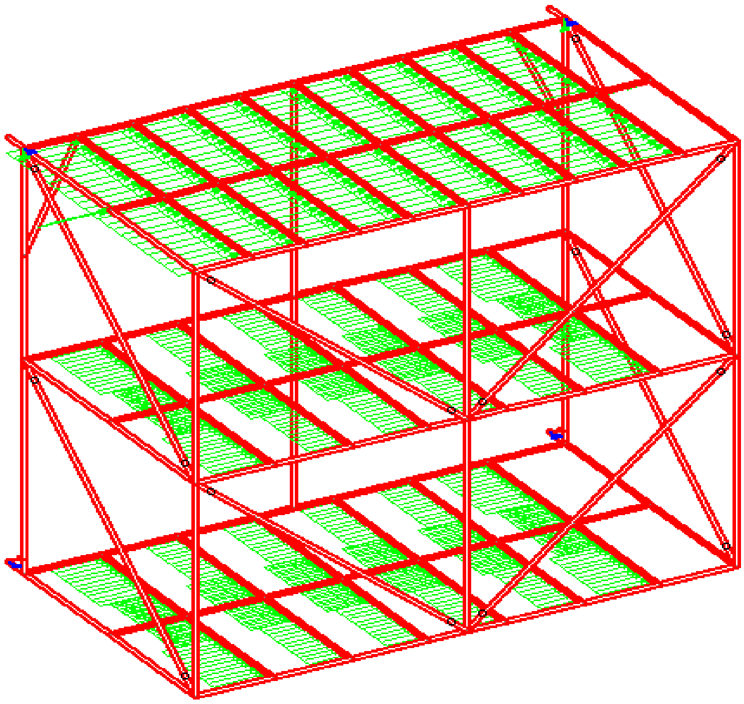

Figure Error! No text of specified style in document.**-19** **LC 51 earthquake 10000 year, +X direction**

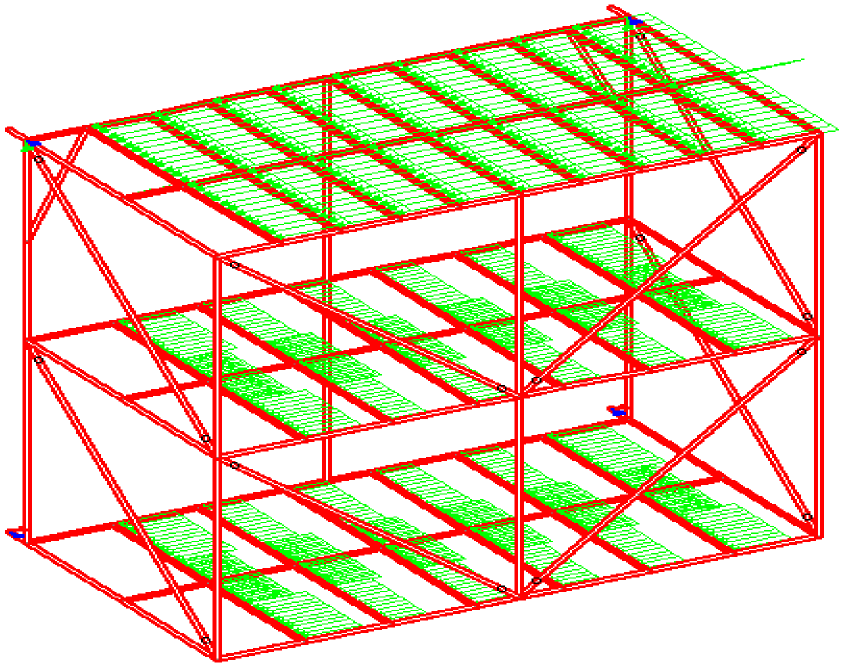

Figure Error! No text of specified style in document.**-20** **LC52 earthquake 10000 year, -X direction**

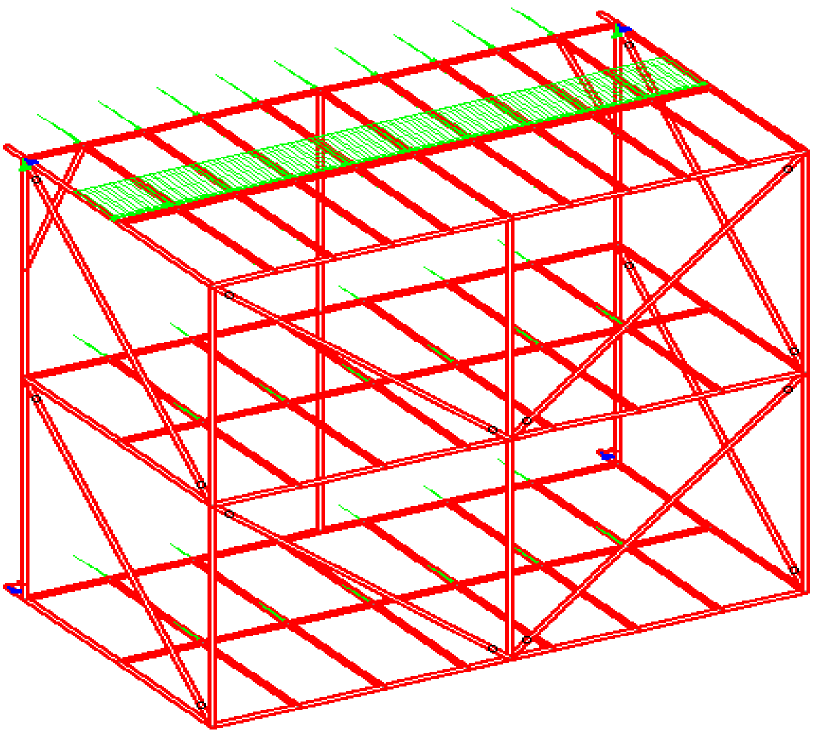

Figure Error! No text of specified style in document.**-21** **LC53 earthquake 10000 year, +Z direction**

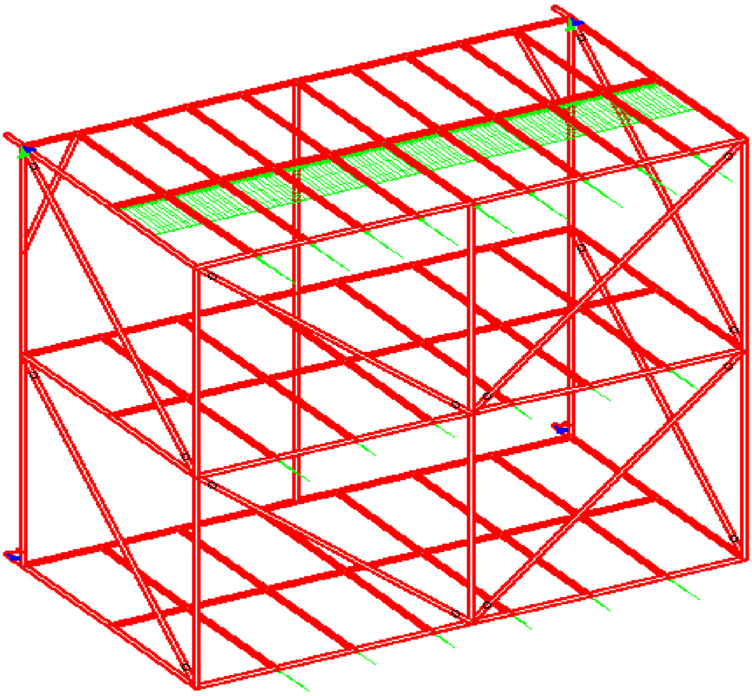

Figure Error! No text of specified style in document.**-22** **LC54 earthquake 10000 year, -Z direction**

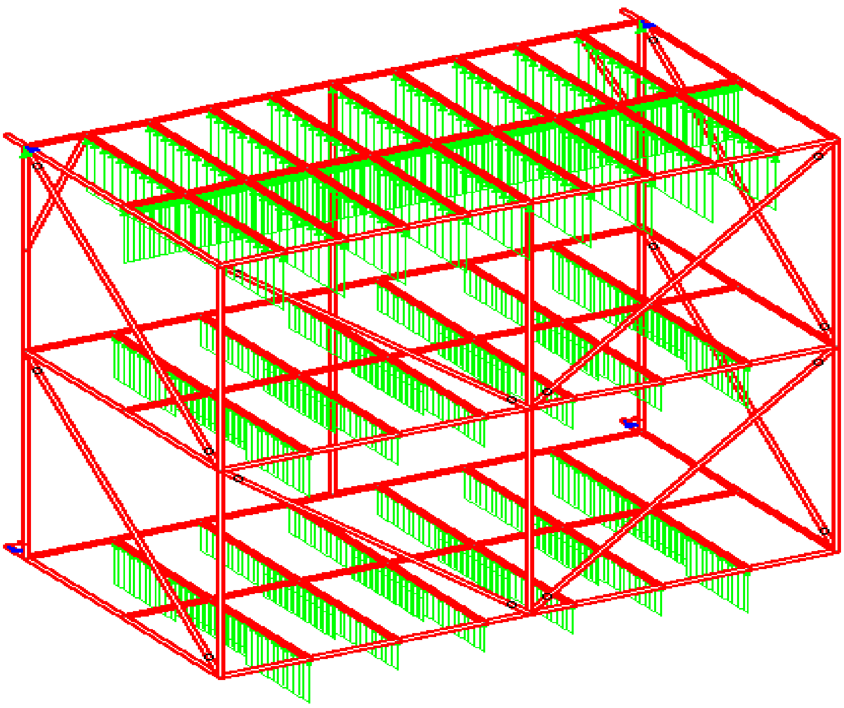

Figure Error! No text of specified style in document.**-23** **LC55 earthquake 10000 year, +Y direction**

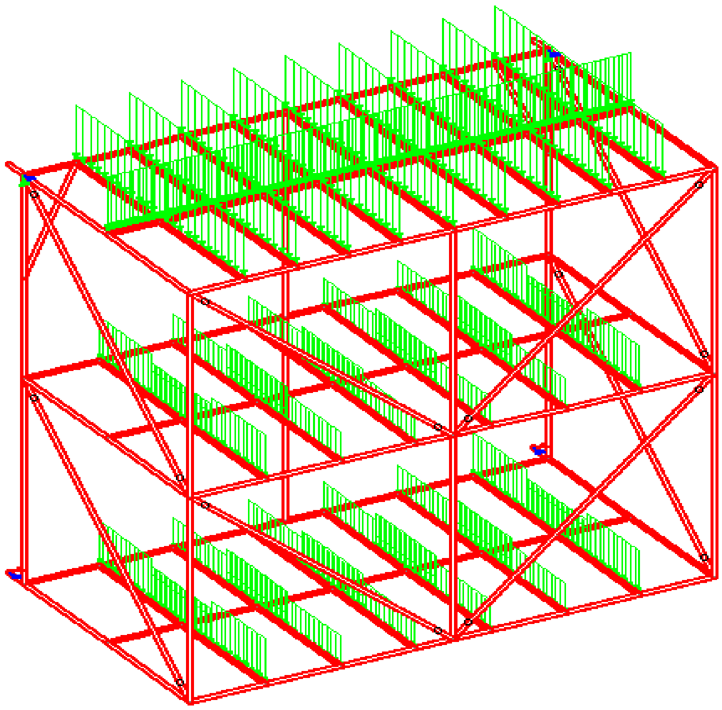

Figure Error! No text of specified style in document.**-24** **LC56 earthquake 10000 year, -Y direction**

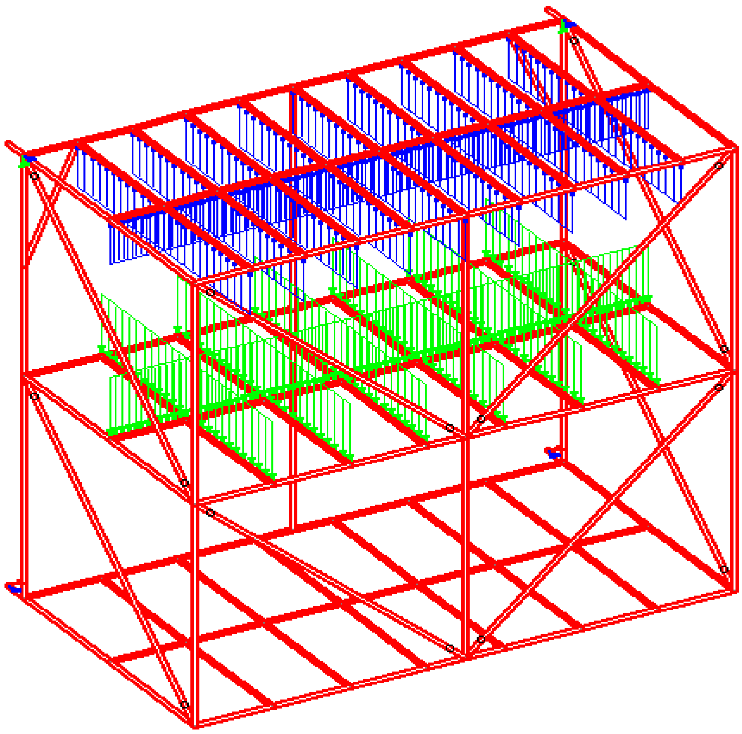

Figure Error! No text of specified style in document.**-25** **LC 300 explosion loads at second floor**

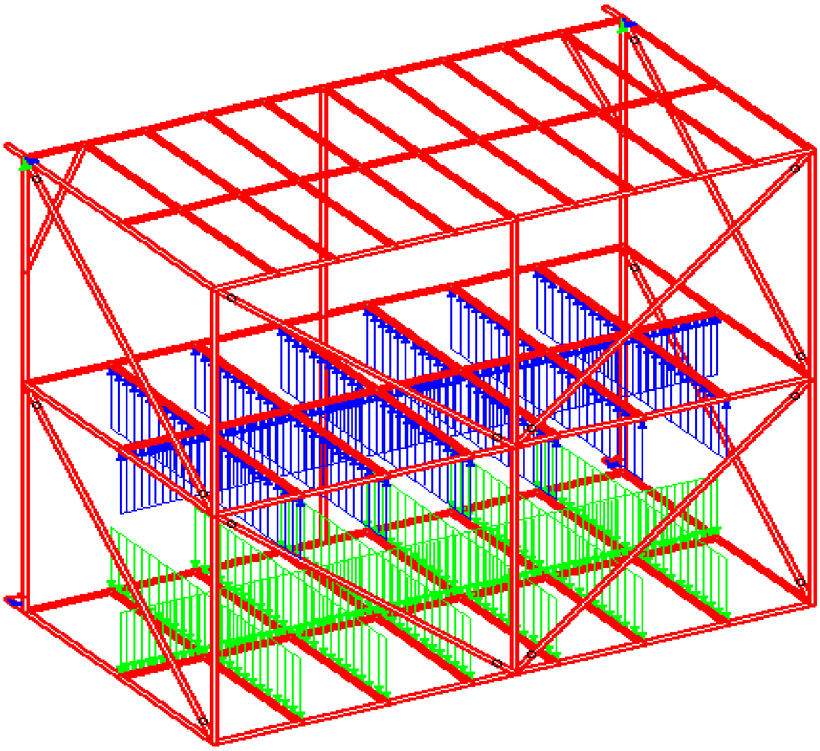

Figure Error! No text of specified style in document.**-26** **LC 301 explosion loads at first floor**

Basic load cases in transport

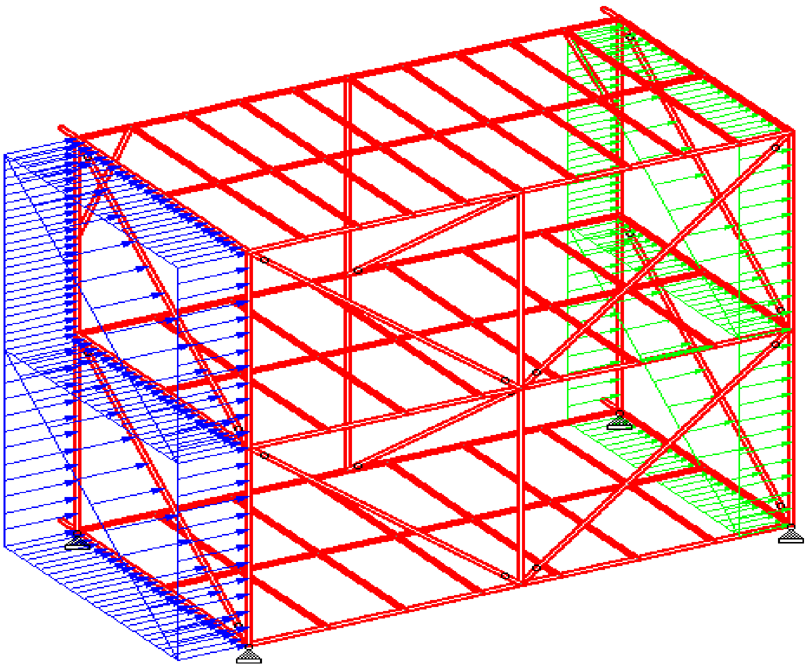

Figure Error! No text of specified style in document.**-27** **LC61 wind action transport, +X direction**

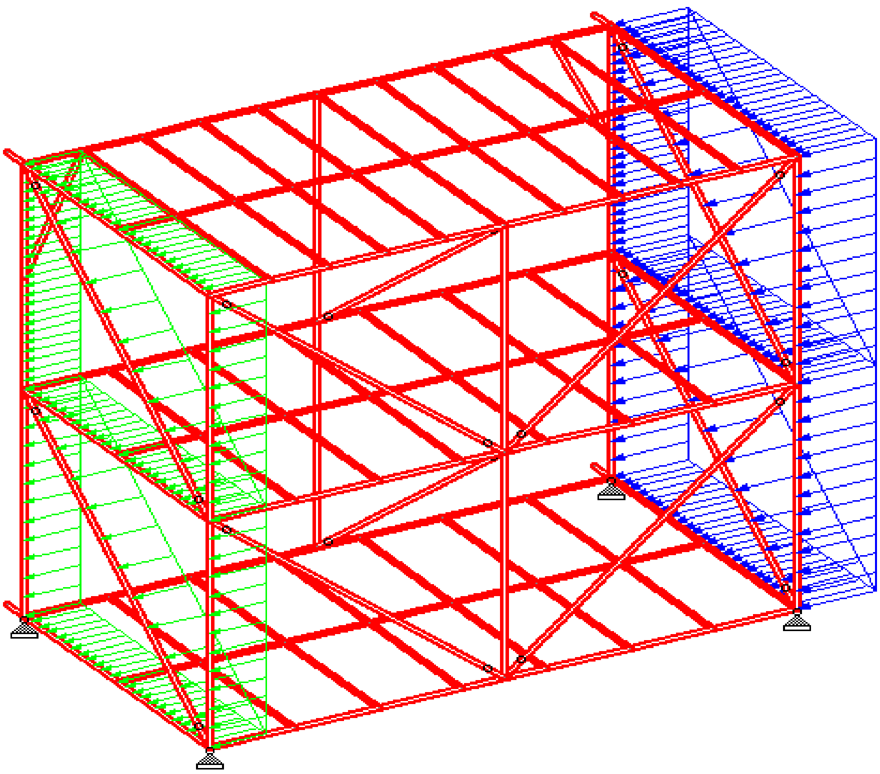

Figure Error! No text of specified style in document.**-28** **LC62 wind action transport, -X direction**

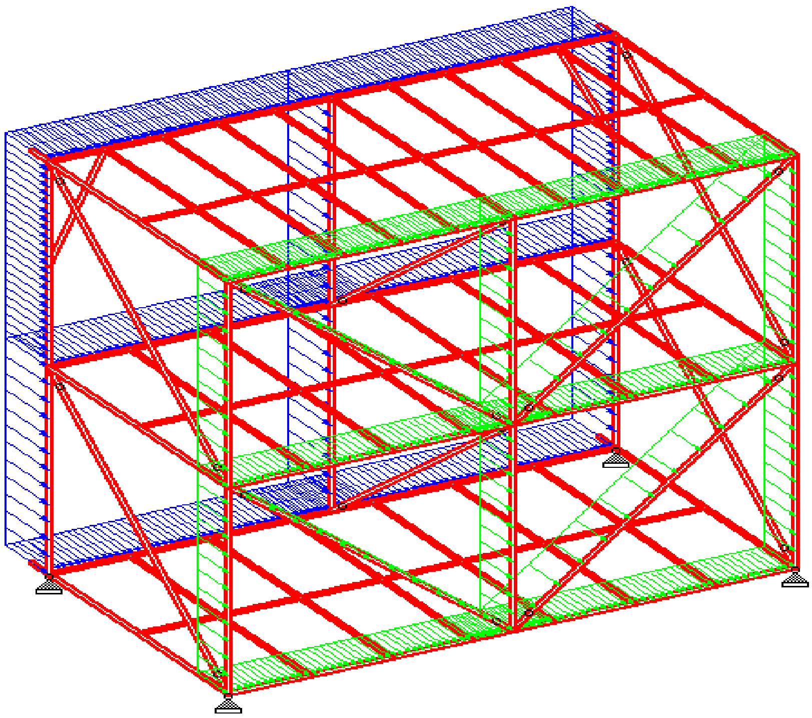

Figure Error! No text of specified style in document.**-29** **LC53 wind action transport, + Z direction**

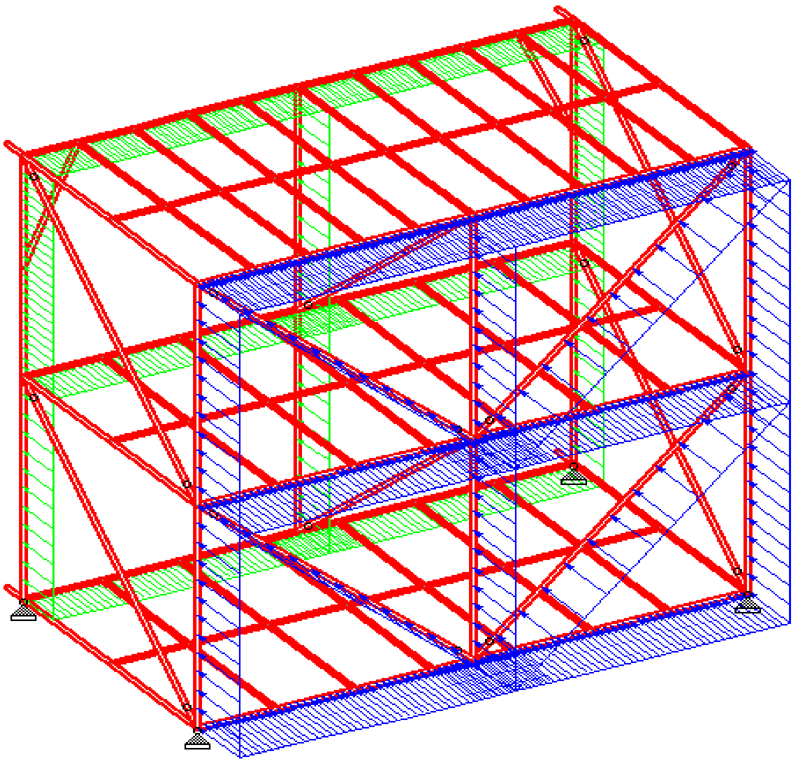

Figure Error! No text of specified style in document.**-30** **LC54 wind action transport, -Z direction**

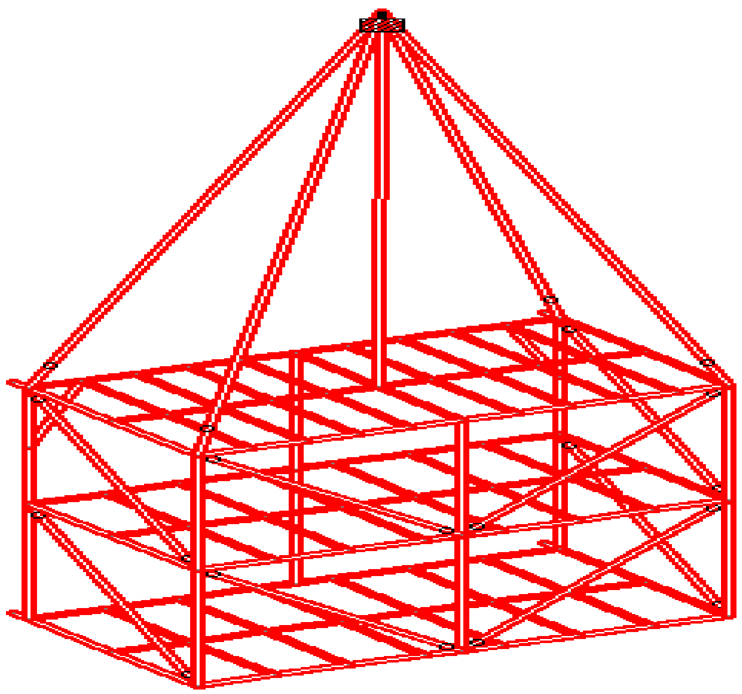

Figure Error! No text of specified style in document.**-31** **LC1 self-weight lifting phase**

A.2 STAAD. Pro INPUTFILE INPLACE DESIGN

STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 5-Jan-15
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 0 0 0; 2 0 9.5 0; 3 10 9.5 0; 4 10 0 0; 5 0 0 5.5; 6 0 9.5 5.5; 7 10 9.5 5.5;
8 10 0 5.5; 9 0 4.75 5.5; 10 10 4.75 5.5; 11 0 4.75 0; 12 10 4.75 0;
13 5 9.5 5.5; 14 5 4.75 5.5; 15 5 0 5.5; 16 5 9.5 0; 17 5 4.75 0; 18 5 0 0;
19 2 9.5 0; 20 2 9.5 5.5; 21 4 9.5 0; 22 4 9.5 5.5; 23 6 9.5 0; 24 6 9.5 5.5;
25 8 9.5 0; 26 8 9.5 5.5; 43 0 9.5 2.75; 44 10 9.5 2.75; 45 2 9.5 2.75;
46 4 9.5 2.75; 47 6 9.5 2.75; 48 8 9.5 2.75; 63 1.429 0 0; 64 1.429 0 5.5;
65 2.858 0 0; 66 2.858 0 5.5; 67 4.287 0 0; 68 4.287 0 5.5; 69 5.716 0 0;
70 5.716 0 5.5; 71 7.145 0 0; 72 7.145 0 5.5; 73 8.574 0 0; 74 8.574 0 5.5;
75 0 0 2.75; 76 1.429 0 2.75; 77 2.858 0 2.75; 78 4.287 0 2.75;
79 5.716 0 2.75; 80 7.145 0 2.75; 81 8.574 0 2.75; 82 10 0 2.75;
83 1.429 4.75 5.5; 84 1.429 4.75 0; 85 2.858 4.75 5.5; 86 2.858 4.75 0;
87 4.287 4.75 5.5; 88 4.287 4.75 0; 89 5.716 4.75 5.5; 90 5.716 4.75 0;
91 7.145 4.75 5.5; 92 7.145 4.75 0; 93 8.574 4.75 5.5; 94 8.574 4.75 0;
95 10 4.75 2.75; 96 0 4.75 2.75; 97 1.429 4.75 2.75; 98 2.858 4.75 2.75;
99 4.287 4.75 2.75; 100 5.716 4.75 2.75; 101 7.145 4.75 2.75;
102 8.574 4.75 2.75; 128 0 0 -0.5; 129 10 0 -0.5; 130 0 9.5 -0.5;
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136 9 9.5 0; 137 9 9.5 5.5; 138 3 9.5 2.75; 139 5 9.5 2.75; 140 7 9.5 2.75;
141 9 9.5 2.75; 142 1 9.5 0; 143 1 9.5 5.5; 144 1 9.5 2.75; 145 0 7.125 0;
146 10 7.125 0;
MEMBER INCIDENCES
1 1 11; 2 2 142; 4 5 9; 5 6 143; 6 7 10; 7 2 43; 8 3 44; 13 9 6; 14 10 8;
17 12 4; 21 13 24; 23 14 13; 25 15 14; 26 16 23; 28 17 16; 30 18 17; 31 19 132;
32 20 133; 33 19 45; 34 21 16; 35 22 13; 36 21 46; 37 23 134; 38 24 135;
39 23 47; 40 25 136; 41 26 137; 42 25 48; 67 43 6; 68 44 7; 73 43 144;
74 45 138; 75 46 139; 76 47 140; 77 48 141; 103 6 14; 106 9 15; 107 2 9;
108 11 5; 109 3 10; 110 12 8; 116 5 64; 117 15 70; 119 18 69; 120 1 63;
121 63 65; 122 64 66; 124 65 67; 125 66 68; 127 67 18; 128 68 15; 130 69 71;
131 70 72; 133 71 73; 134 72 74; 136 73 4; 138 1 75; 145 4 82; 146 75 5;
153 82 8; 154 75 76; 155 76 77; 156 77 78; 157 78 79; 158 79 80; 159 80 81;
160 81 82; 161 74 8; 162 11 84; 163 17 90; 164 12 95; 165 10 93; 166 14 87;
167 9 96; 168 83 9; 169 84 86; 171 85 83; 172 86 88; 174 87 85; 175 88 17;
177 89 14; 178 90 92; 180 91 89; 181 92 94; 183 93 91; 184 94 12; 186 95 10;
194 96 97; 195 97 98; 196 98 99; 197 99 100; 198 100 101; 199 101 102;
200 102 95; 256 96 11; 269 20 45; 270 22 46; 271 24 47; 272 26 48; 273 128 1;
274 129 4; 275 130 2; 276 131 3; 301 132 21; 302 133 22; 303 134 25;
304 135 26; 305 136 3; 306 137 7; 307 138 46; 308 139 47; 309 140 48;
310 141 44; 311 132 138; 312 16 139; 313 134 140; 314 136 141; 315 133 138;
316 13 139; 317 135 140; 318 137 141; 319 142 19; 320 143 20; 321 144 45;
322 142 144; 323 143 144; 372 97 84; 373 97 83; 374 98 86; 375 98 85;
376 99 88; 377 99 87; 378 100 90; 379 100 89; 380 101 92; 381 101 91;
382 102 94; 383 102 93; 384 76 63; 385 76 64; 386 77 65; 387 77 66; 388 78 67;
389 78 68; 390 79 69; 391 79 70; 392 80 71; 393 80 72; 394 81 73; 395 81 74;

```
444 15 10; 445 14 7; 446 11 145; 447 12 146; 448 145 2; 449 146 3; 450 145 142;
451 146 136;
ELEMENT INCIDENCES SHELL
396 2 142 144 43; 397 142 19 45 144; 398 19 132 138 45; 399 132 21 46 138;
400 21 16 139 46; 401 16 23 47 139; 402 23 134 140 47; 403 134 25 48 140;
404 25 136 141 48; 405 136 3 44 141; 406 43 144 143 6; 407 144 45 20 143;
408 45 138 133 20; 409 138 46 22 133; 410 46 139 13 22; 411 139 47 24 13;
412 47 140 135 24; 413 140 48 26 135; 414 48 141 137 26; 415 141 44 7 137;
416 11 84 97 96; 417 84 86 98 97; 418 86 88 99 98; 419 88 90 100 99;
420 90 92 101 100; 421 92 94 102 101; 422 94 12 95 102; 423 96 97 83 9;
424 97 98 85 83; 425 98 99 87 85; 426 99 100 89 87; 427 100 101 91 89;
428 101 102 93 91; 429 102 95 10 93; 430 1 63 76 75; 431 63 65 77 76;
432 65 67 78 77; 433 67 69 79 78; 434 69 71 80 79; 435 71 73 81 80;
436 73 4 82 81; 437 75 76 64 5; 438 76 77 66 64; 439 77 78 68 66;
440 78 79 70 68; 441 79 80 72 70; 442 80 81 74 72; 443 81 82 8 74;
*****
ELEMENT PROPERTY
396 TO 443THICKNESS 0.01
DEFINE MATERIAL START
ISOTROPIC STEEL
E 2.1e+008
POISSON 0.3
DENSITY 78.5
ALPHA 1.2e-005
DAMP 0.03
END DEFINE MATERIAL
*****
MEMBER PROPERTY EUROPEAN
1 17 446 TO 449 TABLE ST TUB30030016
103 106 444 445 TABLE ST TUB1201206
116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 153 161 -
162 TO 169 171 172 174 175 177 178 180 181 183 184 186 256 TABLE ST HE240B
73 TO 77 154 TO 160 194 TO 200 307 TO 310 321 TABLE ST HE140A
372 TO 395 TABLE ST HE220B
273 TO 276 TABLE ST TUB20020010
2 5 7 8 21 26 31 TO 42 67 68 269 TO 272 301 TO 306 311 TO 320 322 -
323 TABLE ST TUB25025016
23 25 28 30 450 451 TABLE ST TUB12012010
4 6 13 14 TABLE ST TUB2502508
107 TO 110 TABLE ST TUB1401408
CONSTANTS
MATERIAL STEEL ALL
****
SUPPORTS
128 129 ENFORCED BUT FY MX MY MZ
2 3 ENFORCED BUT FX MX MY MZ
**************************************
* SYETEM GENERATED SELF WEIGHT *
**************************************
MEMBER RELEASE
110 START MY
```

110 END MY
109 START MY
109 END MY
108 START MY
108 END MY
107 START MY
107 END MY
444 START MY
444 END MY
106 START MY
106 END MY
103 START MY
103 END MY
445 START MY
445 END MY
LOAD 1 LOADTYPE Dead TITLE SYSTEM GENERATED SELF WEIGHT - Y
SELFWEIGHT Y -1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
LOAD 11 LOADTYPE Dead TITLE SYSTEM GENERATED SELFWEIGHT + X
SELFWEIGHT X 1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
LOAD 21 LOADTYPE Dead TITLE SYSTEM GENERATED SELF WEIGHT + Z
SELFWEIGHT Z 1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
LOAD 2 LOADTYPE Dead TITLE SECONDRY/OUTFITTING STEEL - Y
SELFWEIGHT Y -0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
LOAD 12 LOADTYPE Dead TITLE SECONDRY/OUTFITTING STEEL + X
SELFWEIGHT X 0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
LOAD 22 LOADTYPE Dead TITLE SECONDRY/OUTFITTING STEEL + Z
SELFWEIGHT Z 0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
****
* EQUIPMENT LOAD *
****
LOAD 3LOADTYPE Dead TITLE DEAD WEIGHT EQUIPMENT - Y
MEMBER LOAD
372 TO 395 UNI GY -8.829 0 1

LOAD 13LOADTYPE Dead TITLE DEAD WEIGHT EQUIPMENT + X
MEMBER LOAD
372 TO 395 UNI GX 8.829 0 1
LOAD 23LOADTYPE Dead TITLE DEAD WEIGHT EQUIPMENT + Z
MEMBER LOAD
372 TO 395 UNI GZ 8.829 0 1

****
* FUNCTIONNAL VARIABLE LOAD*
****
LOAD 4 LOADTYPE Live TITLE FUNCTIONAL LIVE LOADS - Y
MEMBER LOAD
374 TO 381 386 TO 393 UNI GY -3.4 0 1
372 373 382 TO 385 394 395 UNI GY -6.975 0 1
374 TO 381 386 TO 393 UNI GY -7.15 1 2.75
372 373 382 TO 385 394 395 UNI GY -10.725 1 2.75
LOAD 14 LOADTYPE Live TITLE FUNCTIONAL LIVE LOADS + X
MEMBER LOAD
374 TO 381 386 TO 393 UNI GX 3.4 0 1
372 373 382 TO 385 394 395 UNI GX 6.975 0 1
374 TO 381 386 TO 393 UNI GX 7.15 1 2.75
372 373 382 TO 385 394 395 UNI GX 10.725 1 2.75
LOAD 24 LOADTYPE Live TITLE FUNCTIONAL LIVE LOADS + Z
MEMBER LOAD
374 TO 381 386 TO 393 UNI GZ 3.4 0 1
372 373 382 TO 385 394 395 UNI GZ 6.975 0 1
374 TO 381 386 TO 393 UNI GZ 7.15 1 2.75
372 373 382 TO 385 394 395 UNI GZ 10.725 1 2.75
****
* LAY DOWN LOAD*
****
LOAD 5 LOADTYPE Live REDUCIBLE TITLE LAYDOWN LOAD - Y
MEMBER LOAD
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GY -13.87
LOAD 15 LOADTYPE Live REDUCIBLE TITLE LAYDOWN LOAD + X
MEMBER LOAD
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GX 13.87
LOAD 25 LOADTYPE Live REDUCIBLE TITLE LAYDOWN LOAD + Z
MEMBER LOAD
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GZ 13.87
****
* WIND LOAD INPLACE*
****
LOAD 31 LOADTYPE Live TITLE WIND + X
MEMBER LOAD
1 4 7 13 67 107 108 138 146 167 256 446 448 UNI GX 1.1
6 8 14 17 68 109 110 145 153 164 186 447 449 UNI GX 0.7765
LOAD 32 LOADTYPE Live TITLE WIND - X
MEMBER LOAD
6 8 14 17 68 109 110 145 153 164 186 447 449 UNI GX -1.1
1 4 7 13 67 107 108 138 146 167 256 446 448 UNI GX -0.7765

LOAD 33 LOADTYPE Live TITLE WIND + Z
MEMBER LOAD
1 2 17 26 28 30 31 34 37 40 119 TO 121 124 127 130 133 136 162 163 169 172 -
175 178 181 184 301 303 305 319 446 TO 449 UNI GZ 1.1
4 TO 6 13 14 21 23 25 32 35 38 41 103 106 116 117 122 125 128 131 134 161 -
302 304 306 320 444 445 UNI GZ 0.7765
LOAD 34 LOADTYPE Live TITLE WIND - Z
MEMBER LOAD
4 TO 6 13 14 21 23 25 32 35 38 41 103 106 116 117 122 125 128 131 134 161 -
165 166 168 171 174 177 180 183 302 304 306 320 444 445 UNI GZ -1.1
1 2 17 26 28 30 31 34 37 40 119 TO 121 124 127 130 133 136 162 163 169 172 -
175 178 181 184 301 303 305 319 446 TO 449 UNI GZ -0.7765
****
* SEISMIC LOAD EQ 100 YEAR *
****
LOAD 41 LOADTYPE Seismic TITLE EQ 100 + X
SELFWEIGHT X 0.04412 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT X 0.011 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GX 0.39 0 1
374 TO 381 386 TO 393 UNI GX 0.15 0 1
372 373 382 TO 385 394 395 UNI GX 0.3077 0 1
374 TO 381 386 TO 393 UNI GX 0.3154 1 2.75
372 373 382 TO 385 394 395 UNI GX 0.4732 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GX 0.612
LOAD 42 LOADTYPE Seismic TITLE EQ 100 - X
SELFWEIGHT X -0.04412 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 -
68 73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 -
134 136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 -
194 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT X -0.011 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GX -0.39 0 1
374 TO 381 386 TO 393 UNI GX -0.15 0 1
372 373 382 TO 385 394 395 UNI GX -0.3077 0 1
374 TO 381 386 TO 393 UNI GX -0.3154 1 2.75
372 373 382 TO 385 394 395 UNI GX -0.4732 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GX -0.612
LOAD 43 LOADTYPE Seismic TITLE EQ 100 + Z
SELFWEIGHT Z 0.0133 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -

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195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT Z 0.003325 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 -
68 73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 -
134 136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 -
194 TO 200 256 269 TO 276 301 TO 323 372 TO 447
MEMBER LOAD
372 TO 395 UNI GZ 0.1174 0 1
374 TO 381 386 TO 393 UNI GZ 0.045 0 1
372 373 382 TO 385 394 395 UNI GZ 0.093 0 1
374 TO 381 386 TO 393 UNI GZ 0.095 1 2.75
372 373 382 TO 385 394 395 UNI GZ 0.1426 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GZ 0.1844
LOAD 44 LOADTYPE Seismic TITLE EQ 100 - Z
SELFWEIGHT Z -0.0133 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT Z -0.003325 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 -
68 73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 -
134 136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 -
194 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GZ -0.1174 0 1
374 TO 381 386 TO 393 UNI GZ -0.045 0 1
372 373 382 TO 385 394 395 UNI GZ -0.093 0 1
374 TO 381 386 TO 393 UNI GZ -0.095 1 2.75
372 373 382 TO 385 394 395 UNI GZ -0.1426 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GZ -0.1844
LOAD 45 LOADTYPE Seismic TITLE EQ 100 + Y
SELFWEIGHT Y 0.039 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT Y 0.0097 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GY 0.3447 0 1
374 TO 381 386 TO 393 UNI GY 0.1327 0 1
372 373 382 TO 385 394 395 UNI GY 0.272 0 1
374 TO 381 386 TO 393 UNI GY 0.2788 1 2.75
372 373 382 TO 385 394 395 UNI GY 0.418 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GY 0.54
LOAD 46 LOADTYPE Seismic TITLE EQ 100 - Y
SELFWEIGHT Y -0.039 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT Y -0.0097 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
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136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GY -0.3447 0 1
374 TO 381 386 TO 393 UNI GY -0.1327 0 1
372 373 382 TO 385 394 395 UNI GY -0.272 0 1
374 TO 381 386 TO 393 UNI GY -0.2788 1 2.75
372 373 382 TO 385 394 395 UNI GY -0.418 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GY -0.54
*******************************
* SEISMIC LOAD EQ 10000 YEAR *
*******************************
LOAD 51 LOADTYPE Seismic TITLE EQ 10000 + X
SELFWEIGHT X 0.218 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT X 0.0545 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GX 1.9251 0 1
374 TO 381 386 TO 393 UNI GX 0.9376 0 1
372 373 382 TO 385 394 395 UNI GX 1.5206 0 1
374 TO 381 386 TO 393 UNI GX 1.5587 1 2.75
372 373 382 TO 385 394 395 UNI GX 2.338 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GX 3.0237
LOAD 52 LOADTYPE Seismic TITLE EQ 10000 - X
SELFWEIGHT X -0.218 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT X -0.0545 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GX -1.9251 0 1
374 TO 381 386 TO 393 UNI GX -0.9376 0 1
372 373 382 TO 385 394 395 UNI GX -1.5206 0 1
374 TO 381 386 TO 393 UNI GX -1.5587 1 2.75
372 373 382 TO 385 394 395 UNI GX -2.338 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GX -3.0237
LOAD 53 LOADTYPE Seismic TITLE EQ 10000 + Z
SELFWEIGHT Z 0.06 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT Z 0.015 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
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136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GZ 0.53 0 1
374 TO 381 386 TO 393 UNI GZ 0.26 0 1
372 373 382 TO 385 394 395 UNI GZ 0.42 0 1
374 TO 381 386 TO 393 UNI GZ 0.43 1 2.75
372 373 382 TO 385 394 395 UNI GZ 0.6435 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GZ 0.8322
LOAD 54 LOADTYPE Seismic TITLE EQ 10000 - Z
SELFWEIGHT Z -0.06 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT Z -0.015 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GZ -0.53 0 1
374 TO 381 386 TO 393 UNI GZ -0.26 0 1
372 373 382 TO 385 394 395 UNI GZ -0.42 0 1
374 TO 381 386 TO 393 UNI GZ -0.43 1 2.75
372 373 382 TO 385 394 395 UNI GZ -0.6435 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GZ -0.8322
LOAD 55 LOADTYPE Seismic TITLE EQ 10000 + Y
SELFWEIGHT Y 0.402 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT Y 0.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
372 TO 395 UNI GY 3.5493 0 1
374 TO 381 386 TO 393 UNI GY 1.3668 0 1
372 373 382 TO 385 394 395 UNI GY 2.804 0 1
374 TO 381 386 TO 393 UNI GY 2.8743 1 2.75
372 373 382 TO 385 394 395 UNI GY 4.3115 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GY 5.5757
LOAD 56 LOADTYPE Seismic TITLE EQ 10000 - Y
SELFWEIGHT Y -0.402 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
SELFWEIGHT Y -0.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 103 106 TO 110 116 117 119 TO 122 124 125 127 128 130 131 133 134 -
136 138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 -
195 TO 200 256 269 TO 276 301 TO 323 372 TO 451
MEMBER LOAD
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372 TO 395 UNI GY -3.5493 0 1
374 TO 381 386 TO 393 UNI GY -1.3668 0 1
372 373 382 TO 385 394 395 UNI GY -2.804 0 1
374 TO 381 386 TO 393 UNI GY -2.8743 1 2.75
372 373 382 TO 385 394 395 UNI GY -4.3115 1 2.75
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GY -5.5757
********************
* EXPLOSION LOAD *
********************
LOAD 300 LOADTYPE Accidental TITLE EXPLOSION LOAD
MEMBER LOAD
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GY 22.1848
194 TO 200 372 TO 383 UNI GY -30.6977
LOAD 301 LOADTYPE Accidental TITLE EXPLOSION LOAD
MEMBER LOAD
194 TO 200 372 TO 383 UNI GY 30.6977
154 TO 160 384 TO 395 UNI GY -30.6977
***********************************
* WIND LOAD COMBINATION ULS-A *
************************************
LOAD COMB 101 INPLACE: ULS-A WIND + X
1 1.3 2 1.3 3 1.3 4 1.3 5 1.3 31 0.7
LOAD COMB 102 INPLACE: ULS-A WIND + X - Z
1 1.3 2 1.3 3 1.3 4 1.3 5 1.3 31 0.495 34 0.495
LOAD COMB 103 INPLACE: ULS-A WIND - X
1 1.3 2 1.3 3 1.3 4 1.3 5 1.3 32 0.7
LOAD COMB 104 INPLACE: ULS-A WIND - X - Z
1 1.3 2 1.3 3 1.3 4 1.3 5 1.3 32 0.495 34 0.495
LOAD COMB 105 INPLACE: ULS-A WIND - Z
1 1.3 2 1.3 3 1.3 4 1.3 5 1.3 34 0.7
LOAD COMB 111 INPLACE: ULS-B WIND + X
1 1.0 2 1.0 3 1.0 4 1.0 5 1.0 31 1.3
LOAD COMB 112 INPLACE: ULS-B WIND + X - Z
1 1.0 2 1.0 3 1.0 4 1.0 5 1.0 31 0.919 34 0.919
LOAD COMB 113 INPLACE: ULS-B WIND - X
1 1.0 2 1.0 3 1.0 4 1.0 5 1.0 32 1.3
LOAD COMB 114 INPLACE: ULS-B WIND - X - Z
1 1.0 2 1.0 3 1.0 4 1.0 5 1.0 32 0.919 34 0.919
LOAD COMB 115 INPLACE: ULS-B WIND - Z
1 1.0 2 1.0 3 1.0 4 1.0 5 1.0 34 0.919
********************************************
* EQ 100 YEAR INPLACE ULS-A COMBINATION *
*********************************************
LOAD COMB 121 INPLACE:  ULS-A EQ 100 + X - Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 41 0.7 46 0.7
LOAD COMB 122 INPLACE: ULS-A EQ 100 + X - Z - Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 41 0.495 44 0.495 46 0.7
LOAD COMB 123 INPLACE: ULS-A EQ 100 - X - Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 42 0.7 46 0.7
LOAD COMB 124 INPLACE: ULS-A EQ 100 - X + Z - Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 42 0.495 43 0.495 46 0.7
```

LOAD COMB 125 INPLACE: ULS- A EQ 100 + Z - Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 43 0.7 46 0.7
LOAD COMB 126 INPLACE: ULS-A EQ 100 + Z + X - Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 43 0.495 41 0.495 46 0.7
LOAD COMB 127 INPLACE: ULS-A EQ 100 - Z- Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 44 0.7 46 0.7
LOAD COMB 128 INPLACE: ULS-A EQ 100 - Z - X - Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 44 0.495 42 0.495 46 0.7
LOAD COMB 131 INPLACE: ULS-A EQ 100 + X +Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 41 0.7 45 0.7
LOAD COMB 132 INPLACE: ULS-A EQ 100 +X - Z + Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 41 0.495 44 0.495 45 0.7
LOAD COMB 133 INPLACE: ULS-A EQ 100 - X + Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 42 0.7 45 0.7
LOAD COMB 134 INPLACE: ULS-A EQ 100 - X + Z + Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 42 0.495 43 0.495 45 0.7
LOAD COMB 135 INPLACE: ULS-A EQ 100 + Z + Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 43 0.7 45 0.7
LOAD COMB 136 INPLACE: ULS-A EQ 100 +Z + X + Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 43 0.495 41 0.495 45 0.7
LOAD COMB 137 INPLACE: ULS-A EQ 100 - Z + Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 44 0.7 45 0.7
LOAD COMB 138 INPLACE: ULS-A EQ 100 - Z - X + Y
1 1.3 2 1.3 3 1.3 4 0.975 5 0.975 44 0.495 42 0.495 45 0.7

****
* EQ 100 YEAR LOAD COMBINATION ULS-B *
****
LOAD COMB 141 INPLACE: ULS-B EQ 100 + X - Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 41 1.3 46 1.3
LOAD COMB 142 INPLACE: ULS-B EQ 100 + X - Z - Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 41 0.919 44 0.919 46 1.3
LOAD COMB 143 INPLACE: ULS-B EQ 100 - X - Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 42 1.3 46 1.3
LOAD COMB 144 INPLACE: ULS-B EQ 100 - X + Z - Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 42 0.919 43 0.919 46 1.3
LOAD COMB 145 INPLACE: ULS-B EQ 100 + Z - Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 43 1.3 46 1.3
LOAD COMB 146 INPLACE: ULS-B EQ 100 + Z + X - Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 43 0.919 41 0.919 46 1.3
LOAD COMB 147 INPLACE: ULS-B EQ 100 - Z - Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 44 1.3 46 1.3
LOAD COMB 148 INPLACE: ULS-B E Q 100 - Z - X - Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 44 0.919 42 0.919 46 1.3
LOAD COMB 151 INPLACE: ULS-B EQ 100 + X + Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 41 1.3 45 1.3
LOAD COMB 152 INPLACE: ULS-B EQ 100 + X - Z + Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 41 0.919 44 0.919 45 1.3
LOAD COMB 153 INPLACE: ULS- B EQ 100 - X + Y
1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 42 1.3 45 1.3
LOAD COMB 154 INPLACE: ULS-B EQ 100 - X + Z + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 42 0.919 43 0.919 45 1.3

LOAD COMB 155 INPLACE: ULS-B EQ 100 + Z + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 43 1.3 45 1.3

LOAD COMB 156 INPLACE: ULS-B EQ 100 + Z + X + Y

1 1.0 12 1.0 3 1.0 4 0.75 5 0.75 43 0.919 41 0.919 45 1.3

LOAD COMB 157 INPLACE: ULS-B EQ 100 - Z + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 44 1.3 45 1.3

LOAD COMB 158 INPLACE: ULS-B EQ 100 - Z - X + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 44 0.919 42 0.919 45 1.3

****

* EQ 10000 YEAR LOAD COMBINATION ALS *

****

LOAD COMB 161 INPLACE: ALS EQ 10000 + X - Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 51 1.0 56 1.0

LOAD COMB 162 INPLACE: ALS EQ 10000 + X - Z - Y

1 1.0 2 1.0 3 1.0 14 0.75 5 0.75 51 0.707 54 0.707 56 1.0

LOAD COMB 163 INPLACE: ALS EQ 10000 - X - Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 52 1.0 56 1.0

LOAD COMB 164 INPLACE: ALS EQ 10000 - X + Z - Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 52 0.707 53 0.707 56 1.0

LOAD COMB 165 INPLACE: ALS EQ 10000 + Z - Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 53 1.0 56 1.0

LOAD COMB 166 INPLACE: ALS EQ 10000 + Z + X - Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 53 0.707 51 0.707 56 1.0

LOAD COMB 167 INPLACE: ALS EQ 10000 - Z - Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 54 1.0 56 1.0

LOAD COMB 168 INPLACE: ALS EQ 10000 - Z - X - Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 54 0.707 52 0.707 56 1.0

LOAD COMB 171 INPLACE: ALS EQ 10000 + X +Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 51 1.0 55 1.0

LOAD COMB 172 INPLACE: ALS EQ 10000 + X - Z + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 51 0.707 54 0.707 55 1.0

LOAD COMB 173 INPLACE: ALS EQ 10000 - X + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 52 1.0 55 1.0

LOAD COMB 174 INPLACE: ALS EQ 10000 - X + Z + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 52 0.707 53 0.707 55 1.0

LOAD COMB 175 INPLACE: ALS EQ 10000 + Z + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 53 1.0 55 1.0

LOAD COMB 176 INPLACE: ALS EQ 10000 + Z + X + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 53 0.707 51 0.707 55 1.0

LOAD COMB 177 INPLACE: ALS EQ 10000 - Z + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 54 1.0 55 1.0

LOAD COMB 178 INPLACE: ALS EQ 10000 - Z - X + Y

1 1.0 2 1.0 3 1.0 4 0.75 5 0.75 54 0.707 52 0.707 55 1.0

****

* EXPLOSION LOAD COMBINATION *

****

LOAD COMB 311 ALS EXPLOSION LOAD

1 1.0 2 1.0 3 1.0 4 1.0 5 1.0 300 1.0

LOAD COMB 312 ALS EXPLOSION LOAD

```
1 1.0 2 1.0 3 1.0 4 1.0 5 1.0 301 1.0
***************************
* FIRE LOADCOMBINATION *
***************************
LOAD COMB 411 ALS FIRE LOAD
1 1.0 2 1.0 3 1.0 4 1.0 5 1.0
PERFORM ANALYSIS PRINT STATICS CHECK
**
LOAD LIST 101 TO 105
PARAMETER 1
CODE EC3
BEAM 1 ALL
GM0 1.15 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
**
LOAD LIST 111 TO 115
PARAMETER 2
CODE EC3
BEAM 1 ALL
GM0 1.15 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
**
LOAD LIST 121 TO 128
PARAMETER 3
CODE EC3
BEAM 1 ALL
GM0 1.15 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
**
LOAD LIST 131 TO 138
PARAMETER 4
CODE EC3
BEAM 1 ALL
GM0 1.15 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
```

```
**
LOAD LIST 141 TO 148
PARAMETER 5
CODE EC3
BEAM 1 ALL
GM0 1.15 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
***
LOAD LIST 151 TO 158
PARAMETER 6
CODE EC3
BEAM 1 ALL
GM0 1.15 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
**
LOAD LIST 161 TO 168
PARAMETER 7
CODE EC3
BEAM 1 ALL
GM0 1 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
**
LOAD LIST 171 TO 178
PARAMETER 8
CODE EC3
BEAM 1 ALL
GM0 1.15 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS

LOAD LIST 311 312
PARAMETER 9
CODE EC3
BEAM 1 ALL
GM0 1 ALL
TRACK 0 ALL
```

```
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
**
LOAD LIST 411
PARAMETER 9
CODE EC3
BEAM 1 ALL
GM0 1 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
***
FINIS
```

A.3 STAAD.Pro INPUT FILE TRANSPORT DESIGN

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 5-Jan-15
JOB NAME Master Thesis Spring 2015
JOB CLIENT University of  Stavanger
ENGINEER NAME Gholam Sakhi Sakha
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 0 0 0; 2 0 9.5 0; 3 10 9.5 0; 4 10 0 0; 5 0 0 5.5; 6 0 9.5 5.5; 7 10 9.5 5.5;
8 10 0 5.5; 9 0 4.75 5.5; 10 10 4.75 5.5; 11 0 4.75 0; 12 10 4.75 0;
13 5 9.5 5.5; 14 5 4.75 5.5; 15 5 0 5.5; 16 5 9.5 0; 17 5 4.75 0; 18 5 0 0;
19 2 9.5 0; 20 2 9.5 5.5; 21 4 9.5 0; 22 4 9.5 5.5; 23 6 9.5 0; 24 6 9.5 5.5;
25 8 9.5 0; 26 8 9.5 5.5; 43 0 9.5 2.75; 44 10 9.5 2.75; 45 2 9.5 2.75;
46 4 9.5 2.75; 47 6 9.5 2.75; 48 8 9.5 2.75; 63 1.429 0 0; 64 1.429 0 5.5;
65 2.858 0 0; 66 2.858 0 5.5; 67 4.287 0 0; 68 4.287 0 5.5; 69 5.716 0 0;
70 5.716 0 5.5; 71 7.145 0 0; 72 7.145 0 5.5; 73 8.574 0 0; 74 8.574 0 5.5;
75 0 0 2.75; 76 1.429 0 2.75; 77 2.858 0 2.75; 78 4.287 0 2.75;
79 5.716 0 2.75; 80 7.145 0 2.75; 81 8.574 0 2.75; 82 10 0 2.75;
83 1.429 4.75 5.5; 84 1.429 4.75 0; 85 2.858 4.75 5.5; 86 2.858 4.75 0;
87 4.287 4.75 5.5; 88 4.287 4.75 0; 89 5.716 4.75 5.5; 90 5.716 4.75 0;
91 7.145 4.75 5.5; 92 7.145 4.75 0; 93 8.574 4.75 5.5; 94 8.574 4.75 0;
95 10 4.75 2.75; 96 0 4.75 2.75; 97 1.429 4.75 2.75; 98 2.858 4.75 2.75;
99 4.287 4.75 2.75; 100 5.716 4.75 2.75; 101 7.145 4.75 2.75;
102 8.574 4.75 2.75; 128 0 0 -0.5; 129 10 0 -0.5; 130 0 9.5 -0.5;
131 10 9.5 -0.5; 132 3 9.5 0; 133 3 9.5 5.5; 134 7 9.5 0; 135 7 9.5 5.5;
136 9 9.5 0; 137 9 9.5 5.5; 138 3 9.5 2.75; 139 5 9.5 2.75; 140 7 9.5 2.75;
141 9 9.5 2.75; 142 1 9.5 0; 143 1 9.5 5.5; 144 1 9.5 2.75; 145 0 7.125 0;
146 10 7.125 0;
MEMBER INCIDENCES
1 1 11; 2 2 142; 4 5 9; 5 6 143; 6 7 10; 7 2 43; 8 3 44; 13 9 6; 14 10 8;
17 12 4; 21 13 24; 23 14 13; 25 15 14; 26 16 23; 28 17 16; 30 18 17; 31 19 132;
32 20 133; 33 19 45; 34 21 16; 35 22 13; 36 21 46; 37 23 134; 38 24 135;
39 23 47; 40 25 136; 41 26 137; 42 25 48; 67 43 6; 68 44 7; 73 43 144;
74 45 138; 75 46 139; 76 47 140; 77 48 141; 116 5 64; 117 15 70; 119 18 69;
120 1 63; 121 63 65; 122 64 66; 124 65 67; 125 66 68; 127 67 18; 128 68 15;
130 69 71; 131 70 72; 133 71 73; 134 72 74; 136 73 4; 138 1 75; 145 4 82;
146 75 5; 153 82 8; 154 75 76; 155 76 77; 156 77 78; 157 78 79; 158 79 80;
159 80 81; 160 81 82; 161 74 8; 162 11 84; 163 17 90; 164 12 95; 165 10 93;
166 14 87; 167 9 96; 168 83 9; 169 84 86; 171 85 83; 172 86 88; 174 87 85;
175 88 17; 177 89 14; 178 90 92; 180 91 89; 181 92 94; 183 93 91; 184 94 12;
186 95 10; 194 96 97; 195 97 98; 196 98 99; 197 99 100; 198 100 101;
199 101 102; 200 102 95; 256 96 11; 269 20 45; 270 22 46; 271 24 47; 272 26 48;
273 128 1; 274 129 4; 275 130 2; 276 131 3; 301 132 21; 302 133 22; 303 134 25;
304 135 26; 305 136 3; 306 137 7; 307 138 46; 308 139 47; 309 140 48;
310 141 44; 311 132 138; 312 16 139; 313 134 140; 314 136 141; 315 133 138;
316 13 139; 317 135 140; 318 137 141; 319 142 19; 320 143 20; 321 144 45;
322 142 144; 323 143 144; 372 97 84; 373 97 83; 374 98 86; 375 98 85;
376 99 88; 377 99 87; 378 100 90; 379 100 89; 380 101 92; 381 101 91;
382 102 94; 383 102 93; 384 76 63; 385 76 64; 386 77 65; 387 77 66; 388 78 67;
389 78 68; 390 79 69; 391 79 70; 392 80 71; 393 80 72; 394 81 73; 395 81 74;
447 14 7; 449 9 2; 454 14 6; 455 15 10; 456 15 9; 458 5 11; 459 3 10; 460 12 8;
461 11 145; 462 12 146; 467 145 2; 468 146 3; 469 145 142; 470 146 136;
471 18 14; 472 17 13;
ELEMENT INCIDENCES SHELL
396 2 142 144 43; 397 142 19 45 144; 398 19 132 138 45; 399 132 21 46 138;
400 21 16 139 46; 401 16 23 47 139; 402 23 134 140 47; 403 134 25 48 140;
```

```
404 25 136 141 48; 405 136 3 44 141; 406 43 144 143 6; 407 144 45 20 143;
408 45 138 133 20; 409 138 46 22 133; 410 46 139 13 22; 411 139 47 24 13;
412 47 140 135 24; 413 140 48 26 135; 414 48 141 137 26; 415 141 44 7 137;
416 11 84 97 96; 417 84 86 98 97; 418 86 88 99 98; 419 88 90 100 99;
420 90 92 101 100; 421 92 94 102 101; 422 94 12 95 102; 423 96 97 83 9;
424 97 98 85 83; 425 98 99 87 85; 426 99 100 89 87; 427 100 101 91 89;
428 101 102 93 91; 429 102 95 10 93; 430 1 63 76 75; 431 63 65 77 76;
432 65 67 78 77; 433 67 69 79 78; 434 69 71 80 79; 435 71 73 81 80;
436 73 4 82 81; 437 75 76 64 5; 438 76 77 66 64; 439 77 78 68 66;
440 78 79 70 68; 441 79 80 72 70; 442 80 81 74 72; 443 81 82 8 74;
*
ELEMENT PROPERTY
396 TO 443 THICKNESS 0.01
DEFINE MATERIAL START
ISOTROPIC STEEL
E 2.1e+008
POISSON 0.3
DENSITY 78.5
ALPHA 1.2e-005
DAMP 0.03
END DEFINE MATERIAL
*
*
MEMBER PROPERTY EUROPEAN
1 17 461 462 467 468 TABLE ST TUB30030016
447 454 TO 456 471 472 TABLE ST TUB1201206
116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 153 161 -
162 TO 169 171 172 174 175 177 178 180 181 183 184 186 256 TABLE ST HE240B
73 TO 77 154 TO 160 194 TO 200 307 TO 310 321 TABLE ST HE140A
372 TO 395 TABLE ST HE220B
275 276 TABLE ST TUB30030016
273 274 TABLE ST TUB1601606
2 5 7 8 21 26 31 TO 42 67 68 269 TO 272 301 TO 306 311 TO 320 322 -
323 TABLE ST TUB25025016
23 25 28 30 469 470 TABLE ST TUB12012010
4 6 13 14 TABLE ST TUB2502508
449 458 TO 460 TABLE ST TUB1401408
CONSTANTS
MATERIAL STEEL ALL
*
SUPPORTS
1 4 5 8 PINNED
**************************************
* SYETEM GENERATED SELF WEIGHT *
**************************************
MEMBER RELEASE
447 START MY
447 END MY
449 START MY
449 END MY
454 START MY
454 END MY
455 START MY
455 END MY
456 START MY
456 END MY
459 START MY
459 END MY
460 START MY
460 END MY
```

```
458 START MY
458 END MY
471 START MX MY
471 END MY
472 START MX MY
472 END MY
LOAD 1 LOADTYPE Dead  TITLE SYSTEM GENERATED SELF WEIGHT - Y
SELFWEIGHT Y -1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
LOAD 11 LOADTYPE Dead  TITLE SYSTEM GENERATED SELFWEIGHT + X
SELFWEIGHT X 1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
LOAD 21 LOADTYPE Dead  TITLE SYSTEM GENERATED SELF WEIGHT + Z
SELFWEIGHT Z 1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
LOAD 2 LOADTYPE Dead  TITLE SECONDRY/OUTFITTING STEEL - Y
SELFWEIGHT Y -0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
LOAD 12 LOADTYPE Dead  TITLE SECONDRY/OUTFITTING STEEL + X
SELFWEIGHT X 0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
LOAD 22 LOADTYPE Dead  TITLE SECONDRY/OUTFITTING STEEL + Z
SELFWEIGHT Z 0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
********************
* EQUIPMENT LOAD *
********************
LOAD 3 LOADTYPE Dead  TITLE DEAD WEIGHT EQUIPMENT - Y
MEMBER LOAD
372 TO 395 UNI GY -8.829 0 1
LOAD 13 LOADTYPE Dead  TITLE DEAD WEIGHT EQUIPMENT + X
MEMBER LOAD
372 TO 395 UNI GX 8.829 0 1
LOAD 23 LOADTYPE Dead  TITLE DEAD WEIGHT EQUIPMENT + Z
MEMBER LOAD
372 TO 395 UNI GZ 8.829 0 1
*****************************
* FUNCTION VARIABLE LOAD *
*****************************
LOAD 4 LOADTYPE Live  TITLE FUNCTIONAL LIVE LOADS - Y
MEMBER LOAD
374 TO 381 386 TO 393 UNI GY -3.4 0 1
372 373 382 TO 385 394 395 UNI GY -6.975 0 1
374 TO 381 386 TO 393 UNI GY -7.15 1 2.75
372 373 382 TO 385 394 395 UNI GY -10.725 1 2.75
LOAD 14 LOADTYPE Live  TITLE FUNCTIONAL LIVE LOADS + X
MEMBER LOAD
374 TO 381 386 TO 393 UNI GX 3.4 0 1
```

```
372 373 382 TO 385 394 395 UNI GX 6.975 0 1
374 TO 381 386 TO 393 UNI GX 7.15 1 2.75
372 373 382 TO 385 394 395 UNI GX 10.725 1 2.75
LOAD 24 LOADTYPE Live  TITLE FUNCTIONAL LIVE LOADS + Z
MEMBER LOAD
374 TO 381 386 TO 393 UNI GZ 3.4 0 1
372 373 382 TO 385 394 395 UNI GZ 6.975 0 1
374 TO 381 386 TO 393 UNI GZ 7.15 1 2.75
372 373 382 TO 385 394 395 UNI GZ 10.725 1 2.75

*******************
* LAY DOWN LOAD *
*******************
LOAD 5 LOADTYPE Live REDUCIBLE TITLE LAYDOWN LOAD - Y
MEMBER LOAD
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GY -13.87
LOAD 15 LOADTYPE Live REDUCIBLE TITLE LAYDOWN LOAD + X
MEMBER LOAD
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GX 13.87
LOAD 25 LOADTYPE Live REDUCIBLE TITLE LAYDOWN LOAD + Z
MEMBER LOAD
33 36 39 42 73 TO 77 269 TO 272 307 TO 318 321 TO 323 UNI GZ 13.87
***************************
* WIND LOAD IN TRANSPORT  *
***************************
LOAD 61 LOADTYPE Live REDUCIBLE TITLE WIND ACTION IN TRANSPORT + X
MEMBER LOAD
1 4 7 13 67 138 146 167 256 449 458 461 467 UNI GX 0.5151
6 8 14 17 68 145 153 164 183 186 459 460 462 468 UNI GX 0.3678
LOAD 62 LOADTYPE Live REDUCIBLE TITLE WIND ACTION IN TRANSPORT - X
MEMBER LOAD
6 8 14 17 68 145 153 164 186 459 460 462 468 UNI GX -0.5151
1 4 7 13 67 138 146 167 256 449 458 461 467 UNI GX -0.3678
LOAD 63 LOADTYPE Live REDUCIBLE TITLE WIND ACTION IN TRANSPORT + Z
MEMBER LOAD
1 2 17 26 28 30 31 34 37 40 119 TO 121 124 127 130 133 136 162 163 169 172 -
175 178 181 184 301 303 305 319 461 462 467 468 UNI GZ 0.5151
4 TO 6 13 14 21 23 25 32 35 38 41 116 117 122 125 128 131 134 161 165 166 -
168 171 174 177 180 183 302 304 306 320 447 454 TO 456 UNI GZ 0.3678
LOAD 64 LOADTYPE Live REDUCIBLE TITLE WIND ACTION IN TRANSPORT - Z
MEMBER LOAD
4 TO 6 13 14 21 23 25 32 35 38 41 116 117 122 125 128 131 134 161 165 166 -
168 171 174 177 180 183 302 304 306 320 447 454 TO 456 UNI GZ -0.5151
1 2 17 26 28 30 31 34 37 40 119 TO 121 124 127 130 133 136 162 163 169 172 -
175 178 181 184 301 303 305 319 461 462 467 468 UNI GZ -0.3678
***********************************
* BARGE ACCELERATION IN TRANSPORT *
***********************************
LOAD 71 LOADTYPE Dead  TITLE BARGE ACCELERATION  + X
SELFWEIGHT X 0.5945 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
SELFWEIGHT X 0.1486 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
MEMBER LOAD
372 TO 395 UNI GX 5.2488 0 1
LOAD 72 LOADTYPE Dead  TITLE BARGE ACCELERATION  - X
```

SELFWEIGHT X -0.5945 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
SELFWEIGHT X -0.1486 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
MEMBER LOAD
372 TO 395 UNI GX -5.2488 0 1
LOAD 73 LOADTYPE Dead TITLE BARGE ACCELERATION + Z
SELFWEIGHT Z 0.8668 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
SELFWEIGHT Z 0.2167 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
MEMBER LOAD
372 TO 395 UNI GZ 7.653 0 1
LOAD 74 LOADTYPE Dead TITLE BARGE ACCELERATION - Z
SELFWEIGHT Z -0.8668 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
SELFWEIGHT Z -0.2167 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
MEMBER LOAD
372 TO 395 UNI GZ -7.653 0 1
LOAD 75 LOADTYPE Dead TITLE BARGE ACCELERATION + Y
SELFWEIGHT Y 0.35 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
SELFWEIGHT Y 0.0875 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
MEMBER LOAD
372 TO 395 UNI GY 3.09 0 1
LOAD 76 LOADTYPE Dead TITLE BARGE ACCELERATION - Y
SELFWEIGHT Y -0.45 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
SELFWEIGHT Y -0.1125 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 462 467 TO 472
MEMBER LOAD
372 TO 395 UNI GY -3.973 0 1
****
* WIND ACTION COMBINATION IN TRANSPORT ULS-A *
****
LOAD COMB 181 TRANSPORT: ULS-A + X + Y
1 1.3 2 1.3 3 1.3 61 0.7 71 0.7 75 0.7
LOAD COMB 182 TRANSPORT:ULS-A + X + Z + Y

1 1.3 2 1.3 3 1.3 61 0.495 63 0.495 71 0.495 73 0.495 75 0.7
LOAD COMB 183 TRANSPORT: ULS-A + Z + Y
1 1.3 2 1.3 3 1.3 63 0.7 73 0.7 75 0.7
LOAD COMB 184 TRANSPORT: ULS-A - X + Z + Y
1 1.3 2 1.3 3 1.3 62 0.495 63 0.495 72 0.495 73 0.495 75 0.7
LOAD COMB 185 TRANSPORT: ULS-A - X + Y
1 1.3 2 1.3 3 1.3 62 0.7 72 0.7 75 0.7
LOAD COMB 186 TRANSPORT: ULS-A - X - Z + Y
1 1.3 2 1.3 3 1.3 62 0.495 64 0.495 72 0.495 74 0.495 75 0.7
LOAD COMB 187 TRANSPORT: ULS- A - Z + Y
1 1.3 2 1.3 3 1.3 64 0.7 74 0.7 75 0.7
LOAD COMB 188 TRANSPORT: ULS-A - Z + X + Y
1 1.3 2 1.3 3 1.3 64 0.495 61 0.495 74 0.495 71 0.495 75 0.7
LOAD COMB 191 TRANSPORT: ULS-A + X - Y
1 1.3 2 1.3 3 1.3 61 0.7 71 0.7 76 0.7
LOAD COMB 192 TRANSPORT:ULS-A + X + Z - Y
1 1.3 2 1.3 3 1.3 61 0.495 63 0.495 71 0.495 73 0.495 76 0.7
LOAD COMB 193 TRANSPORT: ULS-A + Z - Y
1 1.3 2 1.3 3 1.3 63 0.7 73 0.7 76 0.7
LOAD COMB 194 TRANSPORT: ULS-A - X + Z - Y
1 1.3 2 1.3 3 1.3 62 0.495 63 0.495 72 0.495 73 0.495 76 0.7
LOAD COMB 195 TRANSPORT: ULS-A - X - Y
1 1.3 2 1.3 3 1.3 62 0.7 72 0.7 76 0.7
LOAD COMB 196 TRANSPORT: ULS-A - X - Z - Y
1 1.3 2 1.3 3 1.3 62 0.495 64 0.495 72 0.495 74 0.495 76 0.7
LOAD COMB 197 TRANSPORT: ULS- A - Z - Y
1 1.3 2 1.3 3 1.3 64 0.7 74 0.7 76 0.7
LOAD COMB 198 TRANSPORT: ULS-A - Z + X - Y
1 1.3 2 1.3 3 1.3 64 0.495 61 0.495 74 0.495 71 0.495 76 0.7
****
*WIND ACTION COMBINATION IN TRANSPORT ULS-B *
****
LOAD COMB 201 TRANSPORT: ULS-B + X + Y
1 1.0 2 1.0 3 1.0 61 1.3 71 1.3 75 1.3
LOAD COMB 202 TRANSPORT: ULS-B + X + Z + Y
1 1.0 2 1.0 3 1.0 61 0.92 63 0.92 71 0.92 73 0.92 75 1.3
LOAD COMB 203 TRANSPORT: ULS-B + Z + Y
1 1.0 2 1.0 3 1.0 63 1.3 73 1.3 75 1.3
LOAD COMB 204 TRANSPORT: ULS-B - X + Z + Y
1 1.0 2 1.0 3 1.0 62 0.92 63 0.92 72 0.92 73 0.92 75 1.3
LOAD COMB 205 TRANSPORT: ULS-B - X + Y
1 1.0 2 1.0 3 1.0 62 1.3 72 1.3 75 1.3
LOAD COMB 206 TRANSPRT: ULS-B - X - Z + Y
1 1.0 2 1.0 3 1.0 62 0.92 64 0.92 72 0.92 74 0.92 75 1.3
LOAD COMB 207 TRANSPORT: ULS-B - Z + Y
1 1.0 2 1.0 3 1.0 64 1.3 74 1.3 75 1.3
LOAD COMB 208 TRANSPORT: ULS-B - Z + X + Y
1 1.0 2 1.0 3 1.0 64 0.92 61 0.92 74 0.92 71 0.92 75 1.3
LOAD COMB 211 TRANSPORT: ULS-B + X - Y
1 1.0 2 1.0 3 1.0 61 1.3 71 1.3 76 1.3
LOAD COMB 212 TRANSPORT: ULS-B + X + Z - Y
1 1.0 2 1.0 3 1.0 61 0.92 63 0.92 71 0.92 73 0.92 76 1.3
LOAD COMB 213 TRANSPORT: ULS-B + Z - Y
1 1.0 2 1.0 3 1.0 63 1.3 73 1.3 76 1.3
LOAD COMB 214 TRANSPORT: ULS-B - X + Z - Y
1 1.0 2 1.0 3 1.0 62 0.92 63 0.92 72 0.92 73 0.92 76 1.3
LOAD COMB 215 TRANSPORT: ULS-B - X - Y
1 1.0 2 1.0 3 1.0 62 1.3 72 1.3 76 1.3
LOAD COMB 216 TRANSPRT: ULS-B - Z - X - Y
1 1.0 2 1.0 3 1.0 64 0.92 62 0.92 74 0.92 72 0.92 76 1.3

```
LOAD COMB 217 TRANSPORT: ULS-B - Z - Y
1 1.0 2 1.0 3 1.0 64 1.3 74 1.3 76 1.3
LOAD COMB 218 TRANSPORT: ULS-B - Z + X - Y
1 1.0 2 1.0 3 1.0 64 0.92 61 0.92 74 0.92 71 0.92 76 1.3
PERFORM ANALYSIS PRINT STATICS CHECK
***
LOAD LIST 181 TO 188
PARAMETER 1
CODE EC3
BEAM 1 ALL
GM0 1 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
*
LOAD LIST 191 TO 198
PARAMETER 2
CODE EC3
BEAM 1 ALL
GM0 1 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
*
LOAD LIST 201 TO 208
PARAMETER 3
CODE EC3
BEAM 1 ALL
GM0 1 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
*
LOAD LIST 211 TO 218
PARAMETER 4
CODE EC3
BEAM 1 ALL
GM0 1 ALL
TRACK 0 ALL
PY 355000 ALL
CHECK CODE ALL
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
****
FINISH
****
```

A.4 STAAD. Pro INPUT FILE LIFTING DESIGN

STAAD SPACE

START JOB INFORMATION

ENGINEER DATE 5-Jan-15

JOB NAME Master Thesis Spring 2015

JOB CLIENT Universiy of Stavanger

ENGINEER NAME Gholam Sakhi Sakha

END JOB INFORMATION

INPUT WIDTH 79

UNIT METER KN

JOINT COORDINATES

1 0 0 0; 2 0 9.5 0; 3 10 9.5 0; 4 10 0 0; 5 0 0 5.5; 6 0 9.5 5.5; 7 10 9.5 5.5;

8 10 0 5.5; 9 0 4.75 5.5; 10 10 4.75 5.5; 11 0 4.75 0; 12 10 4.75 0;

13 5 9.5 5.5; 14 5 4.75 5.5; 15 5 0 5.5; 16 5 9.5 0; 17 5 4.75 0; 18 5 0 0;

19 2 9.5 0; 20 2 9.5 5.5; 21 4 9.5 0; 22 4 9.5 5.5; 23 6 9.5 0; 24 6 9.5 5.5;

25 8 9.5 0; 26 8 9.5 5.5; 43 0 9.5 2.75; 44 10 9.5 2.75; 45 2 9.5 2.75;

46 4 9.5 2.75; 47 6 9.5 2.75; 48 8 9.5 2.75; 63 1.429 0 0; 64 1.429 0 5.5;

65 2.858 0 0; 66 2.858 0 5.5; 67 4.287 0 0; 68 4.287 0 5.5; 69 5.716 0 0;

70 5.716 0 5.5; 71 7.145 0 0; 72 7.145 0 5.5; 73 8.574 0 0; 74 8.574 0 5.5;

75 0 0 2.75; 76 1.429 0 2.75; 77 2.858 0 2.75; 78 4.287 0 2.75;

79 5.716 0 2.75; 80 7.145 0 2.75; 81 8.574 0 2.75; 82 10 0 2.75;

83 1.429 4.75 5.5; 84 1.429 4.75 0; 85 2.858 4.75 5.5; 86 2.858 4.75 0;

87 4.287 4.75 5.5; 88 4.287 4.75 0; 89 5.716 4.75 5.5; 90 5.716 4.75 0;

91 7.145 4.75 5.5; 92 7.145 4.75 0; 93 8.574 4.75 5.5; 94 8.574 4.75 0;

95 10 4.75 2.75; 96 0 4.75 2.75; 97 1.429 4.75 2.75; 98 2.858 4.75 2.75;

99 4.287 4.75 2.75; 100 5.716 4.75 2.75; 101 7.145 4.75 2.75;

102 8.574 4.75 2.75; 128 0 0 -0.5; 129 10 0 -0.5; 130 0 9.5 -0.5;

131 10 9.5 -0.5; 132 3 9.5 0; 133 3 9.5 5.5; 134 7 9.5 0; 135 7 9.5 5.5;

136 9 9.5 0; 137 9 9.5 5.5; 138 3 9.5 2.75; 139 5 9.5 2.75; 140 7 9.5 2.75;

141 9 9.5 2.75; 142 1 9.5 0; 143 1 9.5 5.5; 144 1 9.5 2.75; 145 5 25 2.81;

146 0 7.125 0; 147 10 7.125 0;

MEMBER INCIDENCES

1 1 11; 2 2 142; 4 5 9; 5 6 143; 6 7 10; 7 2 43; 8 3 44; 13 9 6; 14 10 8;

17 12 4; 21 13 24; 23 14 13; 25 15 14; 26 16 23; 28 17 16; 30 18 17; 31 19 132;

32 20 133; 33 19 45; 34 21 16; 35 22 13; 36 21 46; 37 23 134; 38 24 135;

39 23 47; 40 25 136; 41 26 137; 42 25 48; 67 43 6; 68 44 7; 73 43 144;

74 45 138; 75 46 139; 76 47 140; 77 48 141; 116 5 64; 117 15 70; 119 18 69;

120 1 63; 121 63 65; 122 64 66; 124 65 67; 125 66 68; 127 67 18; 128 68 15;

130 69 71; 131 70 72; 133 71 73; 134 72 74; 136 73 4; 138 1 75; 145 4 82;

146 75 5; 153 82 8; 154 75 76; 155 76 77; 156 77 78; 157 78 79; 158 79 80;

159 80 81; 160 81 82; 161 74 8; 162 11 84; 163 17 90; 164 12 95; 165 10 93;

166 14 87; 167 9 96; 168 83 9; 169 84 86; 171 85 83; 172 86 88; 174 87 85;
175 88 17; 177 89 14; 178 90 92; 180 91 89; 181 92 94; 183 93 91; 184 94 12;
186 95 10; 194 96 97; 195 97 98; 196 98 99; 197 99 100; 198 100 101;
199 101 102; 200 102 95; 256 96 11; 269 20 45; 270 22 46; 271 24 47; 272 26 48;
273 128 1; 274 129 4; 275 130 2; 276 131 3; 301 132 21; 302 133 22; 303 134 25;
304 135 26; 305 136 3; 306 137 7; 307 138 46; 308 139 47; 309 140 48;
310 141 44; 311 132 138; 312 16 139; 313 134 140; 314 136 141; 315 133 138;
316 13 139; 317 135 140; 318 137 141; 319 142 19; 320 143 20; 321 144 45;
322 142 144; 323 143 144; 372 97 84; 373 97 83; 374 98 86; 375 98 85;
376 99 88; 377 99 87; 378 100 90; 379 100 89; 380 101 92; 381 101 91;
382 102 94; 383 102 93; 384 76 63; 385 76 64; 386 77 65; 387 77 66; 388 78 67;
389 78 68; 390 79 69; 391 79 70; 392 80 71; 393 80 72; 394 81 73; 395 81 74;
447 14 7; 449 9 2; 454 14 6; 455 15 10; 456 15 9; 458 5 11; 459 3 10; 460 12 8;
461 11 146; 462 12 147; 463 6 145; 464 2 145; 465 3 145; 466 7 145; 467 146 2;
468 147 3; 469 146 142; 470 147 136; 471 145 139;
ELEMENT INCIDENCES SHELL
396 2 142 144 43; 397 142 19 45 144; 398 19 132 138 45; 399 132 21 46 138;
400 21 16 139 46; 401 16 23 47 139; 402 23 134 140 47; 403 134 25 48 140;
404 25 136 141 48; 405 136 3 44 141; 406 43 144 143 6; 407 144 45 20 143;
408 45 138 133 20; 409 138 46 22 133; 410 46 139 13 22; 411 139 47 24 13;
412 47 140 135 24; 413 140 48 26 135; 414 48 141 137 26; 415 141 44 7 137;
416 11 84 97 96; 417 84 86 98 97; 418 86 88 99 98; 419 88 90 100 99;
420 90 92 101 100; 421 92 94 102 101; 422 94 12 95 102; 423 96 97 83 9;
424 97 98 85 83; 425 98 99 87 85; 426 99 100 89 87; 427 100 101 91 89;
428 101 102 93 91; 429 102 95 10 93; 430 1 63 76 75; 431 63 65 77 76;
432 65 67 78 77; 433 67 69 79 78; 434 69 71 80 79; 435 71 73 81 80;
436 73 4 82 81; 437 75 76 64 5; 438 76 77 66 64; 439 77 78 68 66;
440 78 79 70 68; 441 79 80 72 70; 442 80 81 74 72; 443 81 82 8 74;
***
START GROUP DEFINITION
MEMBER
_1.25 2 5 TO 8 13 67 68 275 276 305 306 461 462 467 TO 470
_1.15 21 23 26 28 31 TO 42 73 TO 77 269 TO 272 301 TO 304 307 TO 323 447 449 -
454 459
_1.00 1 4 14 17 25 30 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 -
138 145 146 153 TO 169 171 172 174 175 177 178 180 181 183 184 186 -
194 TO 200 256 273 274 276 372 TO 395 455 456 458 460
END GROUP DEFINITION
***
ELEMENT PROPERTY

```
396 TO 443 THICKNESS 0.01
***
DEFINE MATERIAL START
ISOTROPIC STEEL
E 2.1e+008
POISSON 0.3
DENSITY 78.5
ALPHA 1.2e-005
DAMP 0.03
END DEFINE MATERIAL
MEMBER PROPERTY EUROPEAN
1 17 461 462 467 468 TABLE ST TUB30030016
447 454 TO 456 TABLE ST TUB1201206
116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 153 161 -
162 TO 169 171 172 174 175 177 178 180 181 183 184 186 256 TABLE ST HE240B
73 TO 77 154 TO 160 194 TO 200 307 TO 310 321 TABLE ST HE140A
372 TO 395 TABLE ST HE220B
275 276 TABLE ST TUB30030016
273 274 TABLE ST TUB1601606
2 5 7 8 21 26 31 TO 42 67 68 269 TO 272 301 TO 306 311 TO 320 322 -
323 TABLE ST TUB25025016
463 TO 466 471 TABLE ST PIPE OD 0.15 ID 0.05
23 25 28 30 469 470 TABLE ST TUB12012010
4 6 13 14 TABLE ST TUB2502508
449 458 TO 460 TABLE ST TUB1401408
CONSTANTS
MATERIAL STEEL ALL
*************************************
* SYETEM GENERATED SELF WEIGHT *
*************************************
MEMBER RELEASE
447 START MY
447 END MY
449 START MY
449 END MY
454 START MY
454 END MY
455 START MY
455 END MY
456 START MY
```

```
456 END MY
458 START MY
458 END MY
459 START MY
459 END MY
460 START MY
460 END MY
463 START MX MY MZ
466 START MX MY MZ
465 START MX MY MZ
464 START MX MY MZ
SUPPORTS
145 FIXED
LOAD 1 LOADTYPE Dead  TITLE SYSTEM GENERATED SELF WEIGHT - Y
SELFWEIGHT Y -1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 471
LOAD 11 LOADTYPE Dead  TITLE SYSTEM GENERATED SELFWEIGHT + X
SELFWEIGHT X 1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 471
LOAD 21 LOADTYPE Dead  TITLE SYSTEM GENERATED SELF WEIGHT + Z
SELFWEIGHT Z 1.1 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 471
LOAD 2 LOADTYPE Dead  TITLE SECONDRY/OUTFITTING STEEL - Y
SELFWEIGHT Y -0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 -
73 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 471
LOAD 12 LOADTYPE Dead  TITLE SECONDRY/OUTFITTING STEEL + X
SELFWEIGHT X 0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 471
LOAD 22 LOADTYPE Dead  TITLE SECONDRY/OUTFITTING STEEL + Z
SELFWEIGHT Z 0.25 LIST 1 2 4 TO 8 13 14 17 21 23 25 26 28 30 TO 42 67 68 73 -
```

```
74 TO 77 116 117 119 TO 122 124 125 127 128 130 131 133 134 136 138 145 146 -
153 TO 169 171 172 174 175 177 178 180 181 183 184 186 194 TO 200 256 269 -
270 TO 276 301 TO 323 372 TO 443 447 449 454 TO 456 458 TO 471
LOAD 3 LOADTYPE Dead  TITLE DEAD WEIGHT EQUIPMENT - Y
MEMBER LOAD
372 TO 395 UNI GY -8.829 0 1
LOAD 13 LOADTYPE Dead  TITLE DEAD WEIGHT EQUIPMENT + X
MEMBER LOAD
372 TO 395 UNI GX 8.829 0 1
LOAD 23 LOADTYPE Dead  TITLE DEAD WEIGHT EQUIPMENT + Z
MEMBER LOAD
372 TO 395 UNI GZ 8.829 0 1


*****************************
*LOAD COMBINATION ULS-A *
*****************************
LOAD COMB 511 LIFT ANALYSIS GAMMAC = 1.25
1 3.5186 2 3.5186 3 3.5186
LOAD COMB 512 LIFT ANALYSIS GAMMAC = 1.10
1 3.1 2 3.1 3 3.1
LOAD COMB 513 LIFT ANALYSIS GAMMAC = 1.00
1 2.8149 2 2.8149 3 2.8149
PERFORM ANALYSIS PRINT STATICS CHECK
***
LOAD LIST 511
PARAMETER 1
CODE EC3
BEAM 1 MEMB _1.25
GM0 1.15 MEMB _1.25
TRACK 0 MEMB _1.25
PY 355000 MEMB _1.25
CHECK CODE MEMB _1.25
PERFORM ANALYSIS
PRINT ANALYSIS RESULTS
***
LOAD LIST 512
PARAMETER 2
CODE EC3
BEAM 1 MEMB _1.15
```

GM0 1.15 MEMB _1.15

TRACK 0 MEMB _1.15

PY 355000 MEMB _1.15

CHECK CODE MEMB _1.15

PERFORM ANALYSIS

PRINT ANALYSIS RESULTS

***

LOAD LIST 513

PARAMETER 3

CODE EC3

BEAM 1 MEMB _1.00

GM0 1.15 MEMB _1.00

TRACK 0 MEMB _1.00

PY 355000 MEMB _1.00

CHECK CODE MEMB _1.00

PERFORM ANALYSIS

PRINT ANALYSIS RESULTS

FINISH

A.5 STAAD. Pro OUTPUT FILE ANALYSIS INPLACE DESIGN
A.5.1 Utilization table, reaction summary and displacement summary
A.5.2 Inplace, ULS-a/b wind, LC101-115

Software licensed to	Job No	Sheet No 1	Rev
	Part		
Job Title	Ref		
	By	Date 5-Jan-15	Chd
Client	File INPLACE MASTER THES	Date/Time 05-May-2015 13:17	

Job Information

	Engineer	Checked	Approved
Name:			
Date:	5-Jan-15		

Structure Type	SPACE FRAME

Number of Nodes	91	Highest Node	146
Number of Elements	158	Highest Beam	451
Number of Plates	48	Highest Plate	443

Number of Basic Load Cases	33
Number of Combination Load Cases	10

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	SYSTEM GENERATED SELF WEIGHT - Y
Primary	11	SYSTEM GENERATED SELFWEIGHT + X
Primary	21	SYSTEM GENERATED SELF WEIGHT + Z
Primary	2	SECONDRY/OUTFITTING STEEL - Y
Primary	12	SECONDRY/OUTFITTING STEEL + X
Primary	22	SECONDRY/OUTFITTING STEEL + Z
Primary	3	DEAD WEIGHT EQUIPMENT - Y
Primary	13	DEAD WEIGHT EQUIPMENT + X
Primary	23	DEAD WEIGHT EQUIPMENT + Z
Primary	4	FUNCTIONAL LIVE LOADS - Y
Primary	14	FUNCTIONAL LIVE LOADS + X
Primary	24	FUNCTIONAL LIVE LOADS + Z
Primary	5	LAYDOWN LOAD - Y
Primary	15	LAYDOWN LOAD + X
Primary	25	LAYDOWN LOAD + Z
Primary	31	WIND + X
Primary	32	WIND - X
Primary	33	WIND + Z
Primary	34	WIND - Z
Primary	41	EQ 100 + X
Primary	42	EQ 100 - X
Primary	43	EQ 100 + Z
Primary	44	EQ 100 - Z
Primary	45	EQ 100 + Y
Primary	46	EQ 100 - Y
Primary	51	EQ 10000 + X
Primary	52	EQ 10000 - X
Primary	53	EQ 10000 + Z
Primary	54	EQ 10000 - Z
Primary	55	EQ 10000 + Y
Primary	56	EQ 10000 - Y
Primary	300	EXPLOSION LOAD

Print Time/Date: 05/05/2015 13:19 STAAD.Pro for Windows 2007.04.12 Print Run 1 of 10

Software licensed to	Job No	Sheet No 2	Rev
Job Title	Part		
	Ref		
	By	Date 5-Jan-15	Chd
Client	File INPLACE MASTER THES	Date/Time 05-May-2015 13:17	

Job Information Cont...

Type	L/C	Name
Primary	301	EXPLOSION LOAD
Combination	101	INPLACE: ULS-A WIND + X
Combination	102	INPLACE: ULS-A WIND + X - Z
Combination	103	INPLACE: ULS-A WIND - X
Combination	104	INPLACE: ULS-A WIND - X - Z
Combination	105	INPLACE: ULS-A WIND - Z
Combination	111	INPLACE: ULS-B WIND + X
Combination	112	INPLACE: ULS-B WIND + X - Z
Combination	113	INPLACE: ULS-B WIND - X
Combination	114	INPLACE: ULS-B WIND - X - Z
Combination	115	INPLACE: ULS-B WIND - Z

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
1	TUB300300	TUB300300	0.389	1.000	0.389	EC-eq(5.36)	103	181.000	24.2E+3	24.2E+3	37.6E+3
2	TUB250250	TUB250250	0.618	1.000	0.618	EC-eq(5.36)	103	149.000	13.5E+3	13.5E+3	21.1E+3
4	TUB250250	TUB250250	0.348	1.000	0.348	EC-5.5.4.LTB	104	77.100	7.51E+3	7.51E+3	11.5E+3
5	TUB250250	TUB250250	0.183	1.000	0.183	EC-5.5.4.LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
6	TUB250250	TUB250250	0.503	1.000	0.503	EC-5.5.4.LTB	104	77.100	7.51E+3	7.51E+3	11.5E+3
7	TUB250250	TUB250250	0.125	1.000	0.125	EC-eq(5.36)	103	149.000	13.5E+3	13.5E+3	21.1E+3
8	TUB250250	TUB250250	0.125	1.000	0.125	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
13	TUB250250	TUB250250	0.503	1.000	0.503	EC-5.5.4.LTB	102	77.100	7.51E+3	7.51E+3	11.5E+3
14	TUB250250	TUB250250	0.348	1.000	0.348	EC-5.5.4.LTB	102	77.100	7.51E+3	7.51E+3	11.5E+3
17	TUB300300	TUB300300	0.389	1.000	0.389	EC-eq(5.36)	101	181.000	24.2E+3	24.2E+3	37.6E+3
21	TUB250250	TUB250250	0.364	1.000	0.364	EC-5.5.4.LTB	105	149.000	13.5E+3	13.5E+3	21.1E+3
23	TUB120120	TUB120120	0.804	1.000	0.804	EC-5.5.4.LTB	102	43.500	870.000	870.000	1.38E+3
25	TUB120120	TUB120120	0.416	1.000	0.416	EC-5.5.4	105	43.500	870.000	870.000	1.38E+3
26	TUB250250	TUB250250	0.489	1.000	0.489	EC-5.5.4	101	149.000	13.5E+3	13.5E+3	21.1E+3
28	TUB120120	TUB120120	0.037	1.000	0.037	EC-eq(5.36)	105	43.500	870.000	870.000	1.38E+3
30	TUB120120	TUB120120	0.044	1.000	0.044	EC-eq(5.36)	105	43.500	870.000	870.000	1.38E+3
31	TUB250250	TUB250250	0.308	1.000	0.308	EC-5.5.4.LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
32	TUB250250	TUB250250	0.272	1.000	0.272	EC-5.5.4.LTB	103	149.000	13.5E+3	13.5E+3	21.1E+3
33	TUB250250	TUB250250	0.200	1.000	0.200	EC-5.5.2 LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
34	TUB250250	TUB250250	0.489	1.000	0.489	EC-5.5.4	103	149.000	13.5E+3	13.5E+3	21.1E+3
35	TUB250250	TUB250250	0.364	1.000	0.364	EC-5.5.4.LTB	105	149.000	13.5E+3	13.5E+3	21.1E+3
36	TUB250250	TUB250250	0.237	1.000	0.237	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
37	TUB250250	TUB250250	0.460	1.000	0.460	EC-5.5.4.LTB	103	149.000	13.5E+3	13.5E+3	21.1E+3
38	TUB250250	TUB250250	0.273	1.000	0.273	EC-5.5.4.LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
39	TUB250250	TUB250250	0.237	1.000	0.237	EC-eq(5.36)	103	149.000	13.5E+3	13.5E+3	21.1E+3
40	TUB250250	TUB250250	0.621	1.000	0.621	EC-5.5.4.LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
41	TUB250250	TUB250250	0.195	1.000	0.195	EC-5.5.4.LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
42	TUB250250	TUB250250	0.200	1.000	0.200	EC-5.5.2 LTB	103	149.000	13.5E+3	13.5E+3	21.1E+3
67	TUB250250	TUB250250	0.133	1.000	0.133	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
68	TUB250250	TUB250250	0.133	1.000	0.133	EC-eq(5.36)	103	149.000	13.5E+3	13.5E+3	21.1E+3
73	HE140A	HE140A	0.382	1.000	0.382	EC-5.5.4.LTB	103	31.400	1.03E+3	389.000	8.100
74	HE140A	HE140A	0.170	1.000	0.170	EC-5.5.4.LTB	102	31.400	1.03E+3	389.000	8.100
75	HE140A	HE140A	0.123	1.000	0.123	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
76	HE 140 A	HE140 A	0.168	1.000	0.168	EC-5.5.4.LTB	103	31.400	1.03E+3	389.000	8.100
77	HE 140 A	HE140 A	0.217	1.000	0.217	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100
103	TUB120120	TUB120120	0.395	1.000	0.395	EC-5.4.3 (T)	103	28.500	610.000	610.000	949.000
106	TUB120120	TUB120120	0.409	1.000	0.409	EC-5.4.3 (T)	103	28.500	610.000	610.000	949.000
107	TUB140140	TUB140140	0.463	1.000	0.463	EC-5.4.3 (T)	103	41.900	1.21E+3	1.21E+3	1.89E+3
108	TUB140140	TUB140140	0.467	1.000	0.467	EC-5.4.3 (T)	104	41.900	1.21E+3	1.21E+3	1.89E+3
109	TUB140140	TUB140140	0.463	1.000	0.463	EC-5.4.3 (T)	101	41.900	1.21E+3	1.21E+3	1.89E+3
110	TUB140140	TUB140140	0.467	1.000	0.467	EC-5.4.3 (T)	102	41.900	1.21E+3	1.21E+3	1.89E+3
116	HE 240 B	HE240 B	0.159	1.000	0.159	EC-eq(5.36)	103	106.000	11.3E+3	3.92E+3	103.000
117	HE 240 B	HE240 B	0.213	1.000	0.213	EC-eq(5.36)	104	106.000	11.3E+3	3.92E+3	103.000
119	HE 240 B	HE240 B	0.387	1.000	0.387	EC-eq(5.36)	105	106.000	11.3E+3	3.92E+3	103.000
120	HE 240 B	HE240 B	0.664	1.000	0.664	EC-eq(5.36)	103	106.000	11.3E+3	3.92E+3	103.000
121	HE 240 B	HE240 B	0.271	1.000	0.271	EC-eq(5.36)	101	106.000	11.3E+3	3.92E+3	103.000
122	HE 240 B	HE240 B	0.165	1.000	0.165	EC-eq(5.36)	101	106.000	11.3E+3	3.92E+3	103.000
124	HE 240 B	HE240 B	0.390	1.000	0.390	EC-eq(5.36)	102	106.000	11.3E+3	3.92E+3	103.000
125	HE 240 B	HE240 B	0.163	1.000	0.163	EC-eq(5.36)	101	106.000	11.3E+3	3.92E+3	103.000
127	HE 240 B	HE240 B	0.387	1.000	0.387	EC-eq(5.36)	105	106.000	11.3E+3	3.92E+3	103.000
128	HE 240 B	HE240 B	0.213	1.000	0.213	EC-eq(5.36)	102	106.000	11.3E+3	3.92E+3	103.000
130	HE 240 B	HE240 B	0.390	1.000	0.390	EC-eq(5.36)	104	106.000	11.3E+3	3.92E+3	103.000
131	HE 240 B	HE240 B	0.163	1.000	0.163	EC-eq(5.36)	103	106.000	11.3E+3	3.92E+3	103.000
133	HE 240 B	HE240 B	0.270	1.000	0.270	EC-eq(5.36)	103	106.000	11.3E+3	3.92E+3	103.000
134	HE 240 B	HE240 B	0.166	1.000	0.166	EC-eq(5.36)	103	106.000	11.3E+3	3.92E+3	103.000
136	HE 240 B	HE240 B	0.664	1.000	0.664	EC-eq(5.36)	101	106.000	11.3E+3	3.92E+3	103.000
138	HE 240 B	HE240 B	0.191	1.000	0.191	EC-5.5.4.LTB	104	106.000	11.3E+3	3.92E+3	103.000
145	HE 240 B	HE240 B	0.191	1.000	0.191	EC-5.5.4.LTB	102	106.000	11.3E+3	3.92E+3	103.000
146	HE 240 B	HE240 B	0.128	1.000	0.128	EC-5.5.4.LTB	104	106.000	11.3E+3	3.92E+3	103.000
153	HE 240 B	HE240 B	0.128	1.000	0.128	EC-5.5.4.LTB	102	106.000	11.3E+3	3.92E+3	103.000
154	HE 140 A	HE140 A	0.266	1.000	0.266	EC-eq(5.36)	102	31.400	1.03E+3	389.000	8.100
155	HE 140 A	HE140 A	0.268	1.000	0.268	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100
156	HE 140 A	HE140 A	0.123	1.000	0.123	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100
157	HE 140 A	HE140 A	0.080	1.000	0.080	EC-5.5.4.LTB	105	31.400	1.03E+3	389.000	8.100
158	HE 140 A	HE140 A	0.124	1.000	0.124	EC-5.5.4.LTB	103	31.400	1.03E+3	389.000	8.100
159	HE 140 A	HE140 A	0.268	1.000	0.268	EC-5.5.4.LTB	102	31.400	1.03E+3	389.000	8.100
160	HE 140 A	HE140 A	0.266	1.000	0.266	EC-eq(5.36)	104	31.400	1.03E+3	389.000	8.100
161	HE 240 B	HE240 B	0.159	1.000	0.159	EC-eq(5.36)	101	106.000	11.3E+3	3.92E+3	103.000
162	HE 240 B	HE240 B	0.941	1.000	0.941	EC-eq(5.36)	103	106.000	11.3E+3	3.92E+3	103.000
163	HE 240 B	HE240 B	0.502	1.000	0.502	EC-eq(5.36)	105	106.000	11.3E+3	3.92E+3	103.000
164	HE 240 B	HE240 B	0.215	1.000	0.215	EC-5.5.4.LTB	101	106.000	11.3E+3	3.92E+3	103.000
165	HE 240 B	HE240 B	0.258	1.000	0.258	EC-5.5.4.LTB	101	106.000	11.3E+3	3.92E+3	103.000
166	HE 240 B	HE240 B	0.172	1.000	0.172	EC-5.5.4.LTB	105	106.000	11.3E+3	3.92E+3	103.000
167	HE 240 B	HE240 B	0.109	1.000	0.109	EC-5.5.4.LTB	103	106.000	11.3E+3	3.92E+3	103.000
168	HE 240 B	HE240 B	0.258	1.000	0.258	EC-5.5.4.LTB	103	106.000	11.3E+3	3.92E+3	103.000
169	HE 240 B	HE240 B	0.270	1.000	0.270	EC-eq(5.36)	103	106.000	11.3E+3	3.92E+3	103.000
171	HE 240 B	HE240 B	0.153	1.000	0.153	EC-5.5.4.LTB	103	106.000	11.3E+3	3.92E+3	103.000
172	HE 240 B	HE240 B	0.474	1.000	0.474	EC-eq(5.36)	104	106.000	11.3E+3	3.92E+3	103.000
174	HE 240 B	HE240 B	0.158	1.000	0.158	EC-5.5.4.LTB	104	106.000	11.3E+3	3.92E+3	103.000
175	HE 240 B	HE240 B	0.502	1.000	0.502	EC-eq(5.36)	105	106.000	11.3E+3	3.92E+3	103.000
177	HE 240 B	HE240 B	0.172	1.000	0.172	EC-5.5.4.LTB	105	106.000	11.3E+3	3.92E+3	103.000
178	HE 240 B	HE240 B	0.474	1.000	0.474	EC-eq(5.36)	102	106.000	11.3E+3	3.92E+3	103.000
180	HE 240 B	HE240 B	0.158	1.000	0.158	EC-5.5.4.LTB	102	106.000	11.3E+3	3.92E+3	103.000

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
181	HE240B	HE240B	0.271	1.000	0.271	EC-eq(5.36)	101	106.000	11.3E+3	3.92E+3	103.000
183	HE240B	HE240B	0.153	1.000	0.153	EC-5.5.4.LTB	101	106.000	11.3E+3	3.92E+3	103.000
184	HE240B	HE240B	0.941	1.000	0.941	EC-eq(5.36)	101	106.000	11.3E+3	3.92E+3	103.000
186	HE240B	HE240B	0.109	1.000	0.109	EC-5.5.4.LTB	101	106.000	11.3E+3	3.92E+3	103.000
194	HE140A	HE140A	0.234	1.000	0.234	EC-eq(5.36)	102	31.400	1.03E+3	389.000	8.100
195	HE140A	HE140A	0.236	1.000	0.236	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100
196	HE140A	HE140A	0.113	1.000	0.113	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100
197	HE140A	HE140A	0.108	1.000	0.108	EC-5.5.4.LTB	102	31.400	1.03E+3	389.000	8.100
198	HE140A	HE140A	0.113	1.000	0.113	EC-5.5.4.LTB	103	31.400	1.03E+3	389.000	8.100
199	HE140A	HE140A	0.236	1.000	0.236	EC-5.5.4.LTB	103	31.400	1.03E+3	389.000	8.100
200	HE140A	HE140A	0.234	1.000	0.234	EC-eq(5.36)	104	31.400	1.03E+3	389.000	8.100
256	HE240B	HE240B	0.215	1.000	0.215	EC-5.5.4.LTB	103	106.000	11.3E+3	3.92E+3	103.000
269	TUB250250	TUB250250	0.211	1.000	0.211	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
270	TUB250250	TUB250250	0.237	1.000	0.237	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
271	TUB250250	TUB250250	0.238	1.000	0.238	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
272	TUB250250	TUB250250	0.211	1.000	0.211	EC-eq(5.36)	103	149.000	13.5E+3	13.5E+3	21.1E+3
273	TUB160160	TUB160160	0.581	1.000	0.581	EC-5.5.4.LTB	103	37.700	1.46E+3	1.46E+3	2.33E+3
274	TUB160160	TUB160160	0.581	1.000	0.581	EC-5.5.4.LTB	101	37.700	1.46E+3	1.46E+3	2.33E+3
275	TUB300300	TUB300300	0.001	1.000	0.001	EC-5.4.6-(Y)	101	181.000	24.2E+3	24.2E+3	37.6E+3
276	TUB300300	TUB300300	0.001	1.000	0.001	EC-5.4.6-(Y)	101	181.000	24.2E+3	24.2E+3	37.6E+3
301	TUB250250	TUB250250	0.460	1.000	0.460	EC-5.5.4.LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
302	TUB250250	TUB250250	0.273	1.000	0.273	EC-5.5.4.LTB	103	149.000	13.5E+3	13.5E+3	21.1E+3
303	TUB250250	TUB250250	0.308	1.000	0.308	EC-5.5.4.LTB	103	149.000	13.5E+3	13.5E+3	21.1E+3
304	TUB250250	TUB250250	0.272	1.000	0.272	EC-5.5.4.LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
305	TUB250250	TUB250250	0.618	1.000	0.618	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
306	TUB250250	TUB250250	0.183	1.000	0.183	EC-5.5.4.LTB	101	149.000	13.5E+3	13.5E+3	21.1E+3
307	HE140A	HE140A	0.168	1.000	0.168	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100
308	HE140A	HE140A	0.123	1.000	0.123	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100
309	HE140A	HE140A	0.170	1.000	0.170	EC-5.5.4.LTB	104	31.400	1.03E+3	389.000	8.100
310	HE140A	HE140A	0.382	1.000	0.382	EC-5.5.4.LTB	101	31.400	1.03E+3	389.000	8.100
311	TUB250250	TUB250250	0.226	1.000	0.226	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
312	TUB250250	TUB250250	0.252	1.000	0.252	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
313	TUB250250	TUB250250	0.226	1.000	0.226	EC-eq(5.36)	103	149.000	13.5E+3	13.5E+3	21.1E+3
314	TUB250250	TUB250250	0.184	1.000	0.184	EC-eq(5.36)	103	149.000	13.5E+3	13.5E+3	21.1E+3
315	TUB250250	TUB250250	0.226	1.000	0.226	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
316	TUB250250	TUB250250	0.253	1.000	0.253	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
317	TUB250250	TUB250250	0.226	1.000	0.226	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
318	TUB250250	TUB250250	0.181	1.000	0.181	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
319	TUB250250	TUB250250	0.621	1.000	0.621	EC-5.5.4.LTB	103	149.000	13.5E+3	13.5E+3	21.1E+3
320	TUB250250	TUB250250	0.195	1.000	0.195	EC-5.5.4.LTB	103	149.000	13.5E+3	13.5E+3	21.1E+3
321	HE140A	HE140A	0.217	1.000	0.217	EC-5.5.4.LTB	103	31.400	1.03E+3	389.000	8.100
322	TUB250250	TUB250250	0.184	1.000	0.184	EC-eq(5.36)	101	149.000	13.5E+3	13.5E+3	21.1E+3
323	TUB250250	TUB250250	0.181	1.000	0.181	EC-eq(5.36)	103	149.000	13.5E+3	13.5E+3	21.1E+3
372	HE220B	HE220B	0.262	1.000	0.262	EC-5.5.4.LTB	103	91.000	8.09E+3	2.84E+3	76.500
373	HE220B	HE220B	0.256	1.000	0.256	EC-5.5.4.LTB	103	91.000	8.09E+3	2.84E+3	76.500
374	HE220B	HE220B	0.277	1.000	0.277	EC-5.5.2 LTB	103	91.000	8.09E+3	2.84E+3	76.500
375	HE220B	HE220B	0.277	1.000	0.277	EC-5.5.2 LTB	103	91.000	8.09E+3	2.84E+3	76.500
376	HE220B	HE220B	0.252	1.000	0.252	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.500
377	HE220B	HE220B	0.252	1.000	0.252	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.500
378	HE220B	HE220B	0.252	1.000	0.252	EC-5.5.2 LTB	103	91.000	8.09E+3	2.84E+3	76.500

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
379	HE220B	HE220B	0.252	1.000	0.252	EC-5.5.2 LTB	103	91.000	8.09E+3	2.84E+3	76.600
380	HE220B	HE220B	0.278	1.000	0.278	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.600
381	HE220B	HE220B	0.278	1.000	0.278	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.600
382	HE220B	HE220B	0.262	1.000	0.262	EC-5.5.4.LTB	101	91.000	8.09E+3	2.84E+3	76.600
383	HE220B	HE220B	0.256	1.000	0.256	EC-5.5.4.LTB	101	91.000	8.09E+3	2.84E+3	76.600
384	HE220B	HE220B	0.253	1.000	0.253	EC-5.5.4.LTB	103	91.000	8.09E+3	2.84E+3	76.600
385	HE220B	HE220B	0.250	1.000	0.250	EC-5.5.4.LTB	104	91.000	8.09E+3	2.84E+3	76.600
386	HE220B	HE220B	0.274	1.000	0.274	EC-5.5.2 LTB	103	91.000	8.09E+3	2.84E+3	76.600
387	HE220B	HE220B	0.274	1.000	0.274	EC-5.5.2 LTB	103	91.000	8.09E+3	2.84E+3	76.600
388	HE220B	HE220B	0.261	1.000	0.261	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.600
389	HE220B	HE220B	0.261	1.000	0.261	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.600
390	HE220B	HE220B	0.261	1.000	0.261	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.600
391	HE220B	HE220B	0.261	1.000	0.261	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.600
392	HE220B	HE220B	0.274	1.000	0.274	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.600
393	HE220B	HE220B	0.274	1.000	0.274	EC-5.5.2 LTB	101	91.000	8.09E+3	2.84E+3	76.600
394	HE220B	HE220B	0.252	1.000	0.252	EC-5.5.4.LTB	101	91.000	8.09E+3	2.84E+3	76.600
395	HE220B	HE220B	0.250	1.000	0.250	EC-5.5.4.LTB	102	91.000	8.09E+3	2.84E+3	76.600
444	TUB120120	TUB120120	0.409	1.000	0.409	EC-5.4.3 (T)	101	28.500	610.000	610.000	949.000
445	TUB120120	TUB120120	0.395	1.000	0.395	EC-5.4.3 (T)	101	28.500	610.000	610.000	949.000
446	TUB300300	TUB300300	0.516	1.000	0.516	EC-eq(5.36)	103	181.000	24.2E+3	24.2E+3	37.6E+3
447	TUB300300	TUB300300	0.516	1.000	0.516	EC-eq(5.36)	101	181.000	24.2E+3	24.2E+3	37.6E+3
448	TUB300300	TUB300300	0.578	1.000	0.578	EC-eq(5.36)	103	181.000	24.2E+3	24.2E+3	37.6E+3
449	TUB120120	TUB120120	0.855	1.000	0.855	EC-5.5.4	103	43.500	870.000	870.000	1.38E+3
450	TUB300300	TUB300300	0.578	1.000	0.578	EC-eq(5.36)	101	181.000	24.2E+3	24.2E+3	37.6E+3
451	TUB120120	TUB120120	0.855	1.000	0.855	EC-5.5.4	101	43.500	870.000	870.000	1.38E+3

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	21	15:LAYDOWN I	39.896	-1.932	-0.012	39.942	-0.001	-0.000	0.002
Min X	21	52:EQ 10000 -	-13.886	0.524	0.003	13.944	0.000	0.000	-0.000
Max Y	101	301:EXPLOSIC	-0.007	38.878	0.147	38.878	-0.000	-0.000	0.000
Min Y	18	101:INPLACE:	0.246	-42.322	-0.525	42.326	0.000	0.000	0.000
Max Z	145	300:EXPLOSIC	3.474	0.006	1.698	3.865	0.000	-0.000	0.000
Min Z	146	105:INPLACE:	5.456	-0.755	-2.209	5.935	-0.000	-0.000	-0.001
Max rX	67	301:EXPLOSIC	-0.001	-4.953	-0.002	4.953	0.018	0.000	0.003
Min rX	87	300:EXPLOSIC	-0.000	-2.241	0.098	2.243	-0.019	0.000	0.004
Max rY	4	15:LAYDOWN I	2.858	-0.558	-0.548	2.963	0.000	0.001	-0.003
Min rY	4	52:EQ 10000 -	-1.511	0.173	0.213	1.536	-0.000	-0.000	0.001
Max rZ	82	301:EXPLOSIC	0.002	-3.338	0.001	3.338	0.000	0.000	0.024
Min rZ	75	301:EXPLOSIC	-0.002	-3.336	0.001	3.336	0.000	-0.000	-0.024
Max Rst	18	101:INPLACE:	0.246	-42.322	-0.525	42.328	0.000	0.000	0.000

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Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (m)	X (mm)	Y (mm)	Z (mm)	Resultant (mm)
Max X	314	15:LAY DOWN I	1.375	39.949	0.900	0.061	39.959
Min X	109	113:INPLACE: I	3.634	-23.081	-4.305	-1.990	23.563
Max Y	198	301:EXPLOSIC	1.429	-0.007	38.877	0.147	38.878
Min Y	312	105:INPLACE:	1.100	0.001	-43.366	-0.031	43.366
Max Z	106	33:WIND + Z	3.448	-0.004	0.058	17.900	17.901
Min Z	444	34:WIND - Z	3.448	-0.005	-0.071	-25.332	25.332
Max Rst	312	101:INPLACE:	1.100	1.712	-43.355	-0.017	43.389

Reactions

		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
2	1:SYSTEM GE	0.000	212.016	-60.598	0.000	0.000	0.000
	11:SYSTEM GE	0.000	-222.003	177.969	0.000	0.000	0.000
	21:SYSTEM GE	0.000	0.000	-117.146	0.000	0.000	0.000
	2:SECONDRY	0.000	48.185	-13.772	0.000	0.000	0.000
	12:SECONDRY	0.000	-50.455	40.447	0.000	0.000	0.000
	22:SECONDRY	0.000	0.000	-26.624	0.000	0.000	0.000
	3:DEAD WEIG	0.000	105.916	-30.636	0.000	0.000	0.000
	13:DEAD WEIC	0.000	-50.062	40.360	0.000	0.000	0.000
	23:DEAD WEIC	0.000	0.000	-26.428	0.000	0.000	0.000
	4:FUNCTIONA	0.000	230.206	-66.584	0.000	0.000	0.000
	14:FUNCTION	0.000	-108.807	87.688	0.000	0.000	0.000
	24:FUNCTION	0.000	0.000	-57.440	0.000	0.000	0.000
	5:LAYDOWN L	0.000	412.633	-119.370	0.000	0.000	0.000
	15:LAY DOWN I	0.000	-782.107	621.689	0.000	0.000	0.000
	25:LAY DOWN I	0.000	0.000	-412.632	0.000	0.000	0.000
	31:WIND + X	0.000	-44.409	37.420	0.000	0.000	0.000
	32:WIND - X	0.000	44.409	-37.420	0.000	0.000	0.000
	33:WIND + Z	0.000	-0.000	-30.815	0.000	0.000	0.000
	34:WIND - Z	0.000	0.000	34.990	0.000	0.000	0.000
	41:EQ 100 + X	0.000	-52.646	42.000	0.000	0.000	0.000
	42:EQ 100 - X	0.000	52.646	-42.000	0.000	0.000	0.000
	43:EQ 100 + Z	0.000	0.000	-8.371	0.000	0.000	0.000
	44:EQ 100 - Z	0.000	-0.000	8.371	0.000	0.000	0.000
	45:EQ 100 + Y	0.000	-38.563	11.123	0.000	0.000	0.000
	46:EQ 100 - Y	0.000	38.563	-11.123	0.000	0.000	0.000
	51:EQ 10000 +	0.000	-260.875	208.132	0.000	0.000	0.000
	52:EQ 10000 -	0.000	260.875	-208.132	0.000	0.000	0.000
	53:EQ 10000 +	0.000	0.000	-37.895	0.000	0.000	0.000
	54:EQ 10000 -	0.000	-0.000	37.895	0.000	0.000	0.000
	55:EQ 10000 +	0.000	-395.093	114.159	0.000	0.000	0.000
	56:EQ 10000 -	0.000	397.756	-114.724	0.000	0.000	0.000
	300:EXPLOSIC	0.000	-0.149	-0.152	0.000	0.000	0.000
	301:EXPLOSIC	0.000	-0.001	0.522	0.000	0.000	0.000
	101:INPLACE:	0.000	1.28E+3	-352.054	0.000	0.000	0.000
	102:INPLACE:	0.000	1.29E+3	-342.405	0.000	0.000	0.000
	103:INPLACE:	0.000	1.34E+3	-404.442	0.000	0.000	0.000

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		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
	104:INPLACE:	0.000	1.33E+3	-379.451	0.000	0.000	0.000
	105:INPLACE:	0.000	1.31E+3	-353.755	0.000	0.000	0.000
	111:INPLACE:I	0.000	951.224	-242.314	0.000	0.000	0.000
	112:INPLACE:I	0.000	968.144	-224.415	0.000	0.000	0.000
	113:INPLACE:I	0.000	1.07E+3	-339.606	0.000	0.000	0.000
	114:INPLACE:I	0.000	1.05E+3	-293.193	0.000	0.000	0.000
	115:INPLACE:I	0.000	1.01E+3	-258.804	0.000	0.000	0.000
3	1:SYSTEM GE	0.000	212.032	-60.600	0.000	0.000	0.000
	11:SYSTEM GE	0.000	222.003	-177.969	0.000	0.000	0.000
	21:SYSTEM GI	0.000	-0.000	-117.150	0.000	0.000	0.000
	2:SECONDRY	0.000	48.189	-13.773	0.000	0.000	0.000
	12:SECONDRY	0.000	50.455	-40.447	0.000	0.000	0.000
	22:SECONDRY	0.000	-0.000	-26.625	0.000	0.000	0.000
	3:DEAD WEIG	0.000	105.980	-30.650	0.000	0.000	0.000
	13:DEAD WEIC	0.000	50.062	-40.360	0.000	0.000	0.000
	23:DEAD WEIC	0.000	-0.000	-26.444	0.000	0.000	0.000
	4:FUNCTIONAL	0.000	230.344	-66.617	0.000	0.000	0.000
	14:FUNCTIONA	0.000	108.807	-87.688	0.000	0.000	0.000
	24:FUNCTIONA	0.000	-0.000	-57.476	0.000	0.000	0.000
	5:LAYDOWN L	0.000	412.633	-119.370	0.000	0.000	0.000
	15:LAYDOWN L	0.000	782.107	-621.689	0.000	0.000	0.000
	25:LAYDOWN L	0.000	-0.000	-412.632	0.000	0.000	0.000
	31:WIND + X	0.000	44.409	-37.420	0.000	0.000	0.000
	32:WIND - X	0.000	-44.409	37.420	0.000	0.000	0.000
	33:WIND + Z	0.000	0.000	-30.815	0.000	0.000	0.000
	34:WIND - Z	0.000	-0.000	34.990	0.000	0.000	0.000
	41:EQ 100 + X	0.000	52.646	-42.000	0.000	0.000	0.000
	42:EQ 100 - X	0.000	-52.646	42.000	0.000	0.000	0.000
	43:EQ 100 + Z	0.000	-0.000	-8.372	0.000	0.000	0.000
	44:EQ 100 - Z	0.000	0.000	8.372	0.000	0.000	0.000
	45:EQ 100 + Y	0.000	-38.571	11.125	0.000	0.000	0.000
	46:EQ 100 - Y	0.000	38.571	-11.125	0.000	0.000	0.000
	51:EQ 10000 +	0.000	260.875	-208.132	0.000	0.000	0.000
	52:EQ 10000 -	0.000	-260.875	208.132	0.000	0.000	0.000
	53:EQ 10000 +	0.000	-0.000	-37.898	0.000	0.000	0.000
	54:EQ 10000 -	0.000	0.000	37.898	0.000	0.000	0.000
	55:EQ 10000 +	0.000	-394.795	113.964	0.000	0.000	0.000
	56:EQ 10000 -	0.000	397.844	-114.744	0.000	0.000	0.000
	300:EXPLOSIC	0.000	0.155	-0.214	0.000	0.000	0.000
	301:EXPLOSIC	0.000	0.001	0.516	0.000	0.000	0.000
	101:INPLACE:	0.000	1.34E+3	-404.508	0.000	0.000	0.000
	102:INPLACE:	0.000	1.33E+3	-379.517	0.000	0.000	0.000
	103:INPLACE:	0.000	1.28E+3	-352.120	0.000	0.000	0.000
	104:INPLACE:	0.000	1.29E+3	-342.471	0.000	0.000	0.000
	105:INPLACE:	0.000	1.31E+3	-353.821	0.000	0.000	0.000
	111:INPLACE:I	0.000	1.07E+3	-339.657	0.000	0.000	0.000
	112:INPLACE:I	0.000	1.05E+3	-293.244	0.000	0.000	0.000
	113:INPLACE:I	0.000	951.445	-242.365	0.000	0.000	0.000
	114:INPLACE:I	0.000	968.365	-224.466	0.000	0.000	0.000

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		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
	104:INPLACE:	0.000	1.33E+3	-379.451	0.000	0.000	0.000
	105:INPLACE:	0.000	1.31E+3	-353.755	0.000	0.000	0.000
	111:INPLACE:I	0.000	951.224	-242.314	0.000	0.000	0.000
	112:INPLACE:I	0.000	968.144	-224.415	0.000	0.000	0.000
	113:INPLACE:I	0.000	1.07E+3	-339.606	0.000	0.000	0.000
	114:INPLACE:I	0.000	1.05E+3	-293.193	0.000	0.000	0.000
	115:INPLACE:I	0.000	1.01E+3	-258.804	0.000	0.000	0.000
3	1:SYSTEM GE	0.000	212.032	-60.600	0.000	0.000	0.000
	11:SYSTEM GE	0.000	222.003	-177.969	0.000	0.000	0.000
	21:SYSTEM GE	0.000	-0.000	-117.150	0.000	0.000	0.000
	2:SECONDRY	0.000	48.189	-13.773	0.000	0.000	0.000
	12:SECONDRY	0.000	50.455	-40.447	0.000	0.000	0.000
	22:SECONDRY	0.000	-0.000	-26.625	0.000	0.000	0.000
	3:DEAD WEIG	0.000	105.980	-30.650	0.000	0.000	0.000
	13:DEAD WEIG	0.000	50.062	-40.360	0.000	0.000	0.000
	23:DEAD WEIG	0.000	-0.000	-26.444	0.000	0.000	0.000
	4:FUNCTIONA	0.000	230.344	-66.617	0.000	0.000	0.000
	14:FUNCTIONA	0.000	108.807	-87.688	0.000	0.000	0.000
	24:FUNCTIONA	0.000	-0.000	-57.476	0.000	0.000	0.000
	5:LAYDOWN L	0.000	412.633	-119.370	0.000	0.000	0.000
	15:LAYDOWN L	0.000	782.107	-621.689	0.000	0.000	0.000
	25:LAYDOWN L	0.000	-0.000	-412.632	0.000	0.000	0.000
	31:WIND + X	0.000	44.409	-37.420	0.000	0.000	0.000
	32:WIND - X	0.000	-44.409	37.420	0.000	0.000	0.000
	33:WIND + Z	0.000	0.000	-30.815	0.000	0.000	0.000
	34:WIND - Z	0.000	-0.000	34.990	0.000	0.000	0.000
	41:EQ 100 + X	0.000	52.646	-42.000	0.000	0.000	0.000
	42:EQ 100 - X	0.000	-52.646	42.000	0.000	0.000	0.000
	43:EQ 100 + Z	0.000	-0.000	-8.372	0.000	0.000	0.000
	44:EQ 100 - Z	0.000	0.000	8.372	0.000	0.000	0.000
	45:EQ 100 + Y	0.000	-38.571	11.125	0.000	0.000	0.000
	46:EQ 100 - Y	0.000	38.571	-11.125	0.000	0.000	0.000
	51:EQ 10000 +	0.000	260.875	-208.132	0.000	0.000	0.000
	52:EQ 10000 -	0.000	-260.875	208.132	0.000	0.000	0.000
	53:EQ 10000 +	0.000	-0.000	-37.898	0.000	0.000	0.000
	54:EQ 10000 -	0.000	0.000	37.898	0.000	0.000	0.000
	55:EQ 10000 +	0.000	-394.795	113.964	0.000	0.000	0.000
	56:EQ 10000 -	0.000	397.844	-114.744	0.000	0.000	0.000
	300:EXPLOSIC	0.000	0.155	-0.214	0.000	0.000	0.000
	301:EXPLOSIC	0.000	0.001	0.516	0.000	0.000	0.000
	101:INPLACE:	0.000	1.34E+3	-404.508	0.000	0.000	0.000
	102:INPLACE:	0.000	1.33E+3	-379.517	0.000	0.000	0.000
	103:INPLACE:	0.000	1.28E+3	-352.120	0.000	0.000	0.000
	104:INPLACE:	0.000	1.29E+3	-342.471	0.000	0.000	0.000
	105:INPLACE:	0.000	1.31E+3	-353.821	0.000	0.000	0.000
	111:INPLACE:I	0.000	1.07E+3	-339.657	0.000	0.000	0.000
	112:INPLACE:I	0.000	1.05E+3	-293.244	0.000	0.000	0.000
	113:INPLACE:I	0.000	951.445	-242.365	0.000	0.000	0.000
	114:INPLACE:I	0.000	968.365	-224.466	0.000	0.000	0.000

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Reactions Cont...

		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
	115:INPLACE:I	0.000	1.01E+3	-258.855	0.000	0.000	0.000
128	1:SYSTEM GE	3.777	0.000	60.598	-0.647	0.778	2.298
	11:SYSTEM GE	-212.030	0.000	-303.333	0.728	-55.530	3.822
	21:SYSTEM G	-5.651	0.000	-94.870	-0.932	-1.199	0.002
	2:SECONDRY	0.858	0.000	13.772	-0.147	0.177	0.522
	12:SECONDRY	-48.189	0.000	-68.939	0.166	-12.620	0.869
	22:SECONDRY	-1.284	0.000	-21.561	-0.212	-0.272	0.000
	3:DEAD WEIG	2.441	0.000	30.636	-0.244	0.519	1.827
	13:DEAD WEIC	-105.951	0.000	-103.658	0.310	-27.845	1.319
	23:DEAD WEIC	-5.700	0.000	-79.488	-0.484	-1.242	0.001
	4:FUNCTIONA	5.245	0.000	66.584	-0.550	1.114	3.820
	14:FUNCTIONA	-230.280	0.000	-225.267	0.677	-60.497	2.870
	24:FUNCTIONA	-11.895	0.000	-172.766	-1.051	-2.573	0.001
	5:LAYDOWN L	6.768	0.000	119.370	-0.726	1.363	4.576
	15:LAYDOWN L	-412.647	0.000	-868.342	1.548	-107.788	9.475
	25:LAYDOWN L	0.018	0.000	-0.001	-0.008	0.007	-0.011
	31:WIND + X	-47.001	0.000	-65.474	0.178	-12.313	0.959
	32:WIND - X	46.891	0.000	65.474	-0.178	12.286	-0.922
	33:WIND + Z	-1.833	0.000	-30.900	-0.404	-0.383	0.009
	34:WIND - Z	2.102	0.000	35.070	0.382	0.439	-0.010
	41:EQ 100 + X	-43.671	0.000	-68.031	0.148	-11.437	0.794
	42:EQ 100 - X	43.671	0.000	68.031	-0.148	11.437	-0.794
	43:EQ 100 + Z	-0.319	0.000	-4.787	-0.035	-0.069	-0.000
	44:EQ 100 - Z	0.319	0.000	4.787	0.035	0.069	0.000
	45:EQ 100 + Y	-0.731	0.000	-11.123	0.088	-0.151	-0.500
	46:EQ 100 - Y	0.731	0.000	11.123	-0.088	0.151	0.500
	51:EQ 10000 +	-217.358	0.000	-337.692	0.738	-56.927	3.945
	52:EQ 10000 -	217.358	0.000	337.692	-0.738	56.927	-3.945
	53:EQ 10000 +	-1.468	0.000	-21.957	-0.158	-0.316	-0.000
	54:EQ 10000 -	1.468	0.000	21.957	0.158	0.316	0.000
	55:EQ 10000 +	-7.506	0.000	-114.159	0.905	-1.554	-5.157
	56:EQ 10000 -	7.534	0.000	114.724	-0.906	1.560	5.158
	300:EXPLOSIC	3.309	0.000	0.152	1.727	0.795	-1.799
	301:EXPLOSIC	1.735	0.000	-0.522	-4.930	0.423	11.179
	101:INPLACE:	-8.084	0.000	332.416	-2.883	-3.482	17.627
	102:INPLACE:	2.592	0.000	363.198	-2.731	-0.740	17.426
	103:INPLACE:	57.641	0.000	424.080	-3.132	13.737	16.310
	104:INPLACE:	49.068	0.000	428.018	-2.906	11.436	16.494
	105:INPLACE:	26.288	0.000	402.797	-2.740	5.445	16.949
	111:INPLACE:I	-42.012	0.000	205.843	-2.082	-12.055	14.290
	112:INPLACE:I	-22.173	0.000	263.019	-1.799	-6.960	13.916
	113:INPLACE:I	80.048	0.000	376.077	-2.544	19.923	11.844
	114:INPLACE:I	64.114	0.000	383.361	-2.126	15.646	12.186
	115:INPLACE:I	21.022	0.000	323.190	-1.963	4.355	13.034
129	1:SYSTEM GE	-3.777	0.000	60.600	-0.646	-0.778	-2.299
	11:SYSTEM GE	-212.018	0.000	303.333	-0.728	-55.529	3.822
	21:SYSTEM G	5.651	0.000	-94.882	-0.932	1.199	-0.002
	2:SECONDRY	-0.858	0.000	13.773	-0.147	-0.177	-0.522
	12:SECONDRY	-48.186	0.000	68.939	-0.166	-12.620	0.869

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Reactions Cont...

		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
	22:SECONDRY	1.284	0.000	-21.564	-0.212	0.273	-0.000
	3:DEAD WEIG	-2.441	0.000	30.650	-0.245	-0.519	-1.827
	13:DEADWEIC	-105.945	0.000	103.658	-0.310	-27.844	1.319
	23:DEADWEIC	5.700	0.000	-79.536	-0.484	1.243	-0.000
	4:FUNCTIONAI	-5.245	0.000	66.617	-0.551	-1.114	-3.820
	14:FUNCTION/	-230.270	0.000	225.267	-0.677	-60.496	2.870
	24:FUNCTION/	11.895	0.000	-172.868	-1.052	2.573	-0.000
	5:LAYDOWN L	-6.768	0.000	119.370	-0.726	-1.364	-4.576
	15:LAYDOWN	-412.618	0.000	868.342	-1.547	-107.785	9.475
	25:LAYDOWN	-0.018	0.000	-0.001	-0.008	-0.007	0.011
	31:WIND + X	-46.888	0.000	65.474	-0.178	-12.285	0.922
	32:WIND - X	46.999	0.000	-65.474	0.178	12.313	-0.959
	33:WIND + Z	1.833	0.000	-30.900	-0.404	0.383	-0.009
	34:WIND - Z	-2.102	0.000	35.070	0.382	-0.439	0.010
	41:EQ 100 + X	-43.669	0.000	68.031	-0.148	-11.437	0.794
	42:EQ 100 - X	43.669	0.000	-68.031	0.148	11.437	-0.794
	43:EQ 100 + Z	0.319	0.000	-4.789	-0.035	0.069	0.000
	44:EQ 100 - Z	-0.319	0.000	4.789	0.035	-0.069	-0.000
	45:EQ 100 + Y	0.731	0.000	-11.125	0.088	0.151	0.500
	46:EQ 100 - Y	-0.731	0.000	11.125	-0.088	-0.151	-0.500
	51:EQ 10000 +	-217.345	0.000	337.692	-0.738	-56.926	3.945
	52:EQ 10000 -	217.345	0.000	-337.692	0.738	56.926	-3.945
	53:EQ 10000 +	1.468	0.000	-21.967	-0.158	0.316	0.000
	54:EQ 10000 -	-1.468	0.000	21.967	0.158	-0.316	-0.000
	55:EQ 10000 +	7.506	0.000	-113.964	0.905	1.555	5.159
	56:EQ 10000 -	-7.534	0.000	114.744	-0.907	-1.560	-5.159
	300:EXPLOSIC	-3.309	0.000	0.214	1.727	-0.795	1.801
	301:EXPLOSIC	-1.735	0.000	-0.516	-4.932	-0.423	-11.188
	101:INPLACE:	-57.639	0.000	424.146	-3.134	-13.737	-16.311
	102:INPLACE:	-49.067	0.000	428.084	-2.908	-11.436	-16.496
	103:INPLACE:	8.082	0.000	332.482	-2.885	3.481	-17.628
	104:INPLACE:	-2.593	0.000	363.264	-2.732	0.740	-17.427
	105:INPLACE:	-26.288	0.000	402.863	-2.742	-5.445	-16.950
	111:INPLACE:	-80.045	0.000	376.128	-2.546	-19.923	-11.845
	112:INPLACE:	-64.112	0.000	383.411	-2.127	-15.646	-12.187
	113:INPLACE:	42.008	0.000	205.894	-2.084	12.054	-14.291
	114:INPLACE:	22.170	0.000	263.069	-1.800	6.969	-13.917
	115:INPLACE:	-21.022	0.000	323.240	-1.964	-4.396	-13.035

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Client	File INPLACE MASTER THES	Date/Time 05-May-2015 13:17	

Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	128	52:EQ 10000 - :	217.358	0.000	337.692	-0.738	56.927	-3.945
Min FX	128	15:LAYDOWN I	-412.647	0.000	-888.342	1.548	-107.788	9.475
Max FY	3	101:INPLACE:	0.000	1.34E+3	-404.508	0.000	0.000	0.000
Min FY	2	15:LAYDOWN I	0.000	-782.107	621.689	0.000	0.000	0.000
Max FZ	129	15:LAYDOWN I	-412.618	0.000	888.342	-1.547	-107.785	9.475
Min FZ	128	15:LAYDOWN I	-412.647	0.000	-888.342	1.548	-107.788	9.475
Max MX	129	300:EXPLOSIC	-3.309	0.000	0.214	1.727	-0.795	1.801
Min MX	129	301:EXPLOSIC	-1.735	0.000	-0.516	-4.882	-0.423	-11.188
Max MY	128	52:EQ 10000 - :	217.358	0.000	337.692	-0.738	58.927	-3.945
Min MY	128	15:LAYDOWN I	-412.647	0.000	-888.342	1.548	-107.788	9.475
Max MZ	128	101:INPLACE:	-8.084	0.000	332.416	-2.883	-3.482	17.827
Min MZ	129	103:INPLACE:	8.082	0.000	332.482	-2.885	3.481	-17.828

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A.5.1.2 Inplace, earthquake ULS-a/b, LC121-158

Software licensed to	Job No	Sheet No 1	Rev
	Part		
Job Title Master thesis spring 2015	Ref		
	By	Date 5-Jan-15	Chd
Client UIS	File INPLACE MASTER THES	Date/Time 05-May-2015 14:00	

Job Information

	Engineer	Checked	Approved
Name:			
Date:	5-Jan-15		

Structure Type	SPACE FRAME

Number of Nodes	91	Highest Node	146
Number of Elements	158	Highest Beam	451
Number of Plates	48	Highest Plate	443

Number of Basic Load Cases	33
Number of Combination Load Cases	32

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Combination	121	INPLACE: ULS-A EQ 100 + X - Y
Combination	122	INPLACE: ULS-A EQ 100 + X - Z - Y
Combination	123	INPLACE: ULS-A EQ 100 - X - Y
Combination	124	INPLACE: ULS-A EQ 100 - X + Z - Y
Combination	125	INPLACE: ULS- A EQ 100 + Z - Y
Combination	126	INPLACE: ULS-A EQ 100 + Z + X - Y
Combination	127	INPLACE: ULS-A EQ 100 - Z- Y
Combination	128	INPLACE: ULS-A EQ 100 - Z - X - Y
Combination	131	INPLACE: ULS-A EQ 100 + X +Y
Combination	132	INPLACE: ULS-A EQ 100 +X - Z + Y
Combination	133	INPLACE: ULS-A EQ 100 - X + Y
Combination	134	INPLACE: ULS-A EQ 100 - X + Z + Y
Combination	135	INPLACE: ULS-A EQ 100 + Z + Y
Combination	136	INPLACE: ULS-A EQ 100 +Z + X + Y
Combination	137	INPLACE: ULS-A EQ 100 - Z + Y
Combination	138	INPLACE: ULS-A EQ 100 - Z - X + Y
Combination	141	INPLACE: ULS-B EQ 100 + X - Y
Combination	142	INPLACE: ULS-B EQ 100 + X - Z - Y
Combination	143	INPLACE: ULS-B EQ 100 - X - Y
Combination	144	INPLACE: ULS-B EQ 100 - X + Z - Y
Combination	145	INPLACE: ULS-B EQ 100 + Z - Y
Combination	146	INPLACE: ULS-B EQ 100 + Z + X - Y
Combination	147	INPLACE: ULS-B EQ 100 - Z - Y
Combination	148	INPLACE: ULS-B EQ 100 - Z - X - Y
Combination	151	INPLACE: ULS-B EQ 100 + X + Y
Combination	152	INPLACE: ULS-B EQ 100 + X - Z + Y
Combination	153	INPLACE: ULS- B EQ 100 - X + Y
Combination	154	INPLACE: ULS-B EQ 100 - X + Z + Y
Combination	155	INPLACE: ULS-B EQ 100 + Z + Y
Combination	156	INPLACE: ULS-B EQ 100 + Z + X + Y
Combination	157	INPLACE: ULS-B EQ 100 - Z + Y
Combination	158	INPLACE: ULS-B EQ 100 - Z - X + Y

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Client UIS	File INPLACE MASTER THES	Date/Time 05-May-2015 14:00	

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
1	TUB300300	TUB300300	0.371	1.000	0.371	EC-eq(5.36)	123	181.000	24.2E+3	24.2E+3	37.6E+3
2	TUB250250	TUB250250	0.540	1.000	0.540	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
4	TUB250250	TUB250250	0.317	1.000	0.317	EC-5.5.4.LTB	123	77.100	7.51E+3	7.51E+3	11.5E+3
5	TUB250250	TUB250250	0.153	1.000	0.153	EC-5.5.4.LTB	123	149.000	13.5E+3	13.5E+3	21.1E+3
6	TUB250250	TUB250250	0.416	1.000	0.416	EC-5.5.4.LTB	121	77.100	7.51E+3	7.51E+3	11.5E+3
7	TUB250250	TUB250250	0.102	1.000	0.102	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
8	TUB250250	TUB250250	0.102	1.000	0.102	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
13	TUB250250	TUB250250	0.412	1.000	0.412	EC-5.5.4.LTB	123	77.100	7.51E+3	7.51E+3	11.5E+3
14	TUB250250	TUB250250	0.299	1.000	0.299	EC-5.5.4.LTB	121	77.100	7.51E+3	7.51E+3	11.5E+3
17	TUB300300	TUB300300	0.360	1.000	0.360	EC-eq(5.36)	121	181.000	24.2E+3	24.2E+3	37.6E+3
21	TUB250250	TUB250250	0.295	1.000	0.295	EC-5.5.4.LTB	121	149.000	13.5E+3	13.5E+3	21.1E+3
23	TUB120120	TUB120120	0.758	1.000	0.758	EC-5.5.4	127	43.500	870.000	870.000	1.38E+3
25	TUB120120	TUB120120	0.329	1.000	0.329	EC-5.5.4.LTB	121	43.500	870.000	870.000	1.38E+3
26	TUB250250	TUB250250	0.432	1.000	0.432	EC-5.5.4	121	149.000	13.5E+3	13.5E+3	21.1E+3
28	TUB120120	TUB120120	0.061	1.000	0.061	EC-eq(5.36)	123	43.500	870.000	870.000	1.38E+3
30	TUB120120	TUB120120	0.046	1.000	0.046	EC-eq(5.36)	123	43.500	870.000	870.000	1.38E+3
31	TUB250250	TUB250250	0.255	1.000	0.255	EC-5.5.4.LTB	121	149.000	13.5E+3	13.5E+3	21.1E+3
32	TUB250250	TUB250250	0.221	1.000	0.221	EC-5.5.4.LTB	127	149.000	13.5E+3	13.5E+3	21.1E+3
33	TUB250250	TUB250250	0.162	1.000	0.162	EC-5.5.2 LTB	121	149.000	13.5E+3	13.5E+3	21.1E+3
34	TUB250250	TUB250250	0.435	1.000	0.435	EC-5.5.4	123	149.000	13.5E+3	13.5E+3	21.1E+3
35	TUB250250	TUB250250	0.296	1.000	0.296	EC-5.5.4.LTB	128	149.000	13.5E+3	13.5E+3	21.1E+3
36	TUB250250	TUB250250	0.191	1.000	0.191	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
37	TUB250250	TUB250250	0.395	1.000	0.395	EC-5.5.4.LTB	123	149.000	13.5E+3	13.5E+3	21.1E+3
38	TUB250250	TUB250250	0.226	1.000	0.226	EC-5.5.4.LTB	122	149.000	13.5E+3	13.5E+3	21.1E+3
39	TUB250250	TUB250250	0.191	1.000	0.191	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
40	TUB250250	TUB250250	0.525	1.000	0.525	EC-5.5.4.LTB	121	149.000	13.5E+3	13.5E+3	21.1E+3
41	TUB250250	TUB250250	0.159	1.000	0.159	EC-5.5.4.LTB	123	149.000	13.5E+3	13.5E+3	21.1E+3
42	TUB250250	TUB250250	0.161	1.000	0.161	EC-5.5.2 LTB	123	149.000	13.5E+3	13.5E+3	21.1E+3
67	TUB250250	TUB250250	0.108	1.000	0.108	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
68	TUB250250	TUB250250	0.108	1.000	0.108	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
73	HE140A	HE140A	0.308	1.000	0.308	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
74	HE140A	HE140A	0.139	1.000	0.139	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
75	HE140A	HE140A	0.108	1.000	0.108	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
76	HE140A	HE140A	0.142	1.000	0.142	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
77	HE140A	HE140A	0.179	1.000	0.179	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
103	TUB120120	TUB120120	0.346	1.000	0.346	EC-5.4.3 (T)	123	28.500	610.000	610.000	949.000
106	TUB120120	TUB120120	0.358	1.000	0.358	EC-5.4.3 (T)	123	28.500	610.000	610.000	949.000
107	TUB140140	TUB140140	0.408	1.000	0.408	EC-5.4.3 (T)	123	41.900	1.21E+3	1.21E+3	1.89E+3
108	TUB120120	TUB120120	0.578	1.000	0.578	EC-5.4.3 (T)	123	28.500	610.000	610.000	949.000
109	TUB140140	TUB140140	0.404	1.000	0.404	EC-5.4.3 (T)	121	41.900	1.21E+3	1.21E+3	1.89E+3
110	TUB140140	TUB140140	0.409	1.000	0.409	EC-5.4.3 (T)	121	41.900	1.21E+3	1.21E+3	1.89E+3
116	HE240B	HE240B	0.139	1.000	0.139	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
117	HE240B	HE240B	0.190	1.000	0.190	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
119	HE240B	HE240B	0.329	1.000	0.329	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
120	HE240B	HE240B	0.568	1.000	0.568	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
121	HE240B	HE240B	0.243	1.000	0.243	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
122	HE240B	HE240B	0.147	1.000	0.147	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
124	HE240B	HE240B	0.333	1.000	0.333	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
125	HE240B	HE240B	0.142	1.000	0.142	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
127	HE240B	HE240B	0.329	1.000	0.329	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000

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Client UIS	File INPLACE MASTER THES	Date/Time 05-May-2015 14:00

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
128	HE240B	HE240B	0.189	1.000	0.189	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
130	HE240B	HE240B	0.333	1.000	0.333	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
131	HE240B	HE240B	0.143	1.000	0.143	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
133	HE240B	HE240B	0.243	1.000	0.243	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
134	HE240B	HE240B	0.148	1.000	0.148	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
136	HE240B	HE240B	0.571	1.000	0.571	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
138	HE240B	HE240B	0.184	1.000	0.184	EC-5.5.4.LTB	123	106.000	11.3E+3	3.92E+3	103.000
145	HE240B	HE240B	0.163	1.000	0.163	EC-5.5.4.LTB	121	106.000	11.3E+3	3.92E+3	103.000
146	HE240B	HE240B	0.119	1.000	0.119	EC-5.5.4.LTB	123	106.000	11.3E+3	3.92E+3	103.000
153	HE240B	HE240B	0.118	1.000	0.118	EC-5.5.4.LTB	121	106.000	11.3E+3	3.92E+3	103.000
154	HE140A	HE140A	0.236	1.000	0.236	EC-eq(5.36)	121	31.400	1.03E+3	389.000	8.100
155	HE140A	HE140A	0.236	1.000	0.236	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
156	HE140A	HE140A	0.112	1.000	0.112	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
157	HE140A	HE140A	0.067	1.000	0.067	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
158	HE140A	HE140A	0.112	1.000	0.112	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
159	HE140A	HE140A	0.234	1.000	0.234	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
160	HE140A	HE140A	0.236	1.000	0.236	EC-eq(5.36)	123	31.400	1.03E+3	389.000	8.100
161	HE240B	HE240B	0.139	1.000	0.139	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
162	HE240B	HE240B	0.821	1.000	0.821	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
163	HE240B	HE240B	0.420	1.000	0.420	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
164	HE240B	HE240B	0.189	1.000	0.189	EC-5.5.4.LTB	121	106.000	11.3E+3	3.92E+3	103.000
165	HE240B	HE240B	0.225	1.000	0.225	EC-5.5.4.LTB	121	106.000	11.3E+3	3.92E+3	103.000
166	HE240B	HE240B	0.156	1.000	0.156	EC-5.5.4.LTB	123	106.000	11.3E+3	3.92E+3	103.000
167	HE240B	HE240B	0.108	1.000	0.108	EC-5.5.4.LTB	123	106.000	11.3E+3	3.92E+3	103.000
168	HE240B	HE240B	0.226	1.000	0.226	EC-5.5.4.LTB	123	106.000	11.3E+3	3.92E+3	103.000
169	HE240B	HE240B	0.236	1.000	0.236	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
171	HE240B	HE240B	0.136	1.000	0.136	EC-5.5.4.LTB	123	106.000	11.3E+3	3.92E+3	103.000
172	HE240B	HE240B	0.406	1.000	0.406	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
174	HE240B	HE240B	0.140	1.000	0.140	EC-5.5.4.LTB	123	106.000	11.3E+3	3.92E+3	103.000
175	HE240B	HE240B	0.422	1.000	0.422	EC-eq(5.36)	123	106.000	11.3E+3	3.92E+3	103.000
177	HE240B	HE240B	0.157	1.000	0.157	EC-5.5.4.LTB	121	106.000	11.3E+3	3.92E+3	103.000
178	HE240B	HE240B	0.405	1.000	0.405	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
180	HE240B	HE240B	0.140	1.000	0.140	EC-5.5.4.LTB	121	106.000	11.3E+3	3.92E+3	103.000
181	HE240B	HE240B	0.229	1.000	0.229	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
183	HE240B	HE240B	0.136	1.000	0.136	EC-5.5.4.LTB	121	106.000	11.3E+3	3.92E+3	103.000
184	HE240B	HE240B	0.812	1.000	0.812	EC-eq(5.36)	121	106.000	11.3E+3	3.92E+3	103.000
186	HE240B	HE240B	0.093	1.000	0.093	EC-5.5.4.LTB	121	106.000	11.3E+3	3.92E+3	103.000
194	HE140A	HE140A	0.203	1.000	0.203	EC-eq(5.36)	121	31.400	1.03E+3	389.000	8.100
195	HE140A	HE140A	0.205	1.000	0.205	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
196	HE140A	HE140A	0.102	1.000	0.102	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
197	HE140A	HE140A	0.093	1.000	0.093	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
198	HE140A	HE140A	0.104	1.000	0.104	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
199	HE140A	HE140A	0.206	1.000	0.206	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
200	HE140A	HE140A	0.204	1.000	0.204	EC-eq(5.36)	123	31.400	1.03E+3	389.000	8.100
256	HE240B	HE240B	0.203	1.000	0.203	EC-5.5.4.LTB	123	106.000	11.3E+3	3.92E+3	103.000
269	TUB250250	TUB250250	0.162	1.000	0.162	EC-5.5.2 LTB	121	149.000	13.5E+3	13.5E+3	21.1E+3
270	TUB250250	TUB250250	0.191	1.000	0.191	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
271	TUB250250	TUB250250	0.191	1.000	0.191	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
272	TUB250250	TUB250250	0.171	1.000	0.171	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
273	TUB160160	TUB160160	0.585	1.000	0.585	EC-5.5.4	123	37.700	1.46E+3	1.46E+3	2.33E+3

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
274	TUB160160	TUB160160	0.589	1.000	0.589	EC-5.5.4	121	37.700	1.46E+3	1.46E+3	2.33E+3
275	TUB300300	TUB300300	0.001	1.000	0.001	EC-5.4.6-(Y)	121	181.000	24.2E+3	24.2E+3	37.6E+3
276	TUB300300	TUB300300	0.001	1.000	0.001	EC-5.4.6-(Y)	121	181.000	24.2E+3	24.2E+3	37.6E+3
301	TUB250250	TUB250250	0.394	1.000	0.394	EC-5.5.4.LTB	121	149.000	13.5E+3	13.5E+3	21.1E+3
302	TUB250250	TUB250250	0.224	1.000	0.224	EC-5.5.4.LTB	127	149.000	13.5E+3	13.5E+3	21.1E+3
303	TUB250250	TUB250250	0.261	1.000	0.261	EC-5.5.4.LTB	123	149.000	13.5E+3	13.5E+3	21.1E+3
304	TUB250250	TUB250250	0.223	1.000	0.223	EC-5.5.4.LTB	121	149.000	13.5E+3	13.5E+3	21.1E+3
305	TUB250250	TUB250250	0.519	1.000	0.519	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
306	TUB250250	TUB250250	0.156	1.000	0.156	EC-5.5.4.LTB	121	149.000	13.5E+3	13.5E+3	21.1E+3
307	HE140A	HE140A	0.140	1.000	0.140	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
308	HE140A	HE140A	0.109	1.000	0.109	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
309	HE140A	HE140A	0.142	1.000	0.142	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
310	HE140A	HE140A	0.307	1.000	0.307	EC-5.5.4.LTB	121	31.400	1.03E+3	389.000	8.100
311	TUB250250	TUB250250	0.182	1.000	0.182	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
312	TUB250250	TUB250250	0.202	1.000	0.202	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
313	TUB250250	TUB250250	0.182	1.000	0.182	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
314	TUB250250	TUB250250	0.150	1.000	0.150	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
315	TUB250250	TUB250250	0.182	1.000	0.182	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
316	TUB250250	TUB250250	0.203	1.000	0.203	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
317	TUB250250	TUB250250	0.182	1.000	0.182	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
318	TUB250250	TUB250250	0.147	1.000	0.147	EC-eq(5.36)	123	149.000	13.5E+3	13.5E+3	21.1E+3
319	TUB250250	TUB250250	0.546	1.000	0.546	EC-5.5.4.LTB	123	149.000	13.5E+3	13.5E+3	21.1E+3
320	TUB250250	TUB250250	0.155	1.000	0.155	EC-5.5.4	121	149.000	13.5E+3	13.5E+3	21.1E+3
321	HE140A	HE140A	0.184	1.000	0.184	EC-5.5.4.LTB	123	31.400	1.03E+3	389.000	8.100
322	TUB250250	TUB250250	0.151	1.000	0.151	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
323	TUB250250	TUB250250	0.148	1.000	0.148	EC-eq(5.36)	121	149.000	13.5E+3	13.5E+3	21.1E+3
372	HE220B	HE220B	0.236	1.000	0.236	EC-5.5.4.LTB	123	91.000	8.09E+3	2.84E+3	76.800
373	HE220B	HE220B	0.231	1.000	0.231	EC-5.5.4.LTB	123	91.000	8.09E+3	2.84E+3	76.800
374	HE220B	HE220B	0.253	1.000	0.253	EC-5.5.2 LTB	123	91.000	8.09E+3	2.84E+3	76.800
375	HE220B	HE220B	0.253	1.000	0.253	EC-5.5.2 LTB	123	91.000	8.09E+3	2.84E+3	76.800
376	HE220B	HE220B	0.234	1.000	0.234	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
377	HE220B	HE220B	0.234	1.000	0.234	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
378	HE220B	HE220B	0.234	1.000	0.234	EC-5.5.2 LTB	123	91.000	8.09E+3	2.84E+3	76.800
379	HE220B	HE220B	0.234	1.000	0.234	EC-5.5.2 LTB	123	91.000	8.09E+3	2.84E+3	76.800
380	HE220B	HE220B	0.253	1.000	0.253	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
381	HE220B	HE220B	0.253	1.000	0.253	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
382	HE220B	HE220B	0.237	1.000	0.237	EC-5.5.4.LTB	121	91.000	8.09E+3	2.84E+3	76.800
383	HE220B	HE220B	0.231	1.000	0.231	EC-5.5.4.LTB	121	91.000	8.09E+3	2.84E+3	76.800
384	HE220B	HE220B	0.228	1.000	0.228	EC-5.5.4.LTB	123	91.000	8.09E+3	2.84E+3	76.800
385	HE220B	HE220B	0.223	1.000	0.223	EC-5.5.4.LTB	123	91.000	8.09E+3	2.84E+3	76.800
386	HE220B	HE220B	0.250	1.000	0.250	EC-5.5.2 LTB	123	91.000	8.09E+3	2.84E+3	76.800
387	HE220B	HE220B	0.250	1.000	0.250	EC-5.5.2 LTB	123	91.000	8.09E+3	2.84E+3	76.800
388	HE220B	HE220B	0.242	1.000	0.242	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
389	HE220B	HE220B	0.242	1.000	0.242	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
390	HE220B	HE220B	0.242	1.000	0.242	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
391	HE220B	HE220B	0.242	1.000	0.242	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
392	HE220B	HE220B	0.250	1.000	0.250	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
393	HE220B	HE220B	0.250	1.000	0.250	EC-5.5.2 LTB	121	91.000	8.09E+3	2.84E+3	76.800
394	HE220B	HE220B	0.229	1.000	0.229	EC-5.5.4.LTB	121	91.000	8.09E+3	2.84E+3	76.800
395	HE220B	HE220B	0.224	1.000	0.224	EC-5.5.4.LTB	121	91.000	8.09E+3	2.84E+3	76.800

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
444	TUB120120	TUB120120	0.355	1.000	0.355	EC-5.4.3 (T)	121	28.500	610.000	610.000	949.000
445	TUB120120	TUB120120	0.355	1.000	0.355	EC-5.4.3 (T)	121	28.500	610.000	610.000	949.000
446	TUB300300	TUB300300	0.435	1.000	0.435	EC-eq(5.36)	123	181.000	24.2E+3	24.2E+3	37.6E+3
447	TUB300300	TUB300300	0.431	1.000	0.431	EC-eq(5.36)	121	181.000	24.2E+3	24.2E+3	37.6E+3
448	TUB300300	TUB300300	0.496	1.000	0.496	EC-eq(5.36)	123	181.000	24.2E+3	24.2E+3	37.6E+3
449	TUB300300	TUB300300	0.489	1.000	0.489	EC-eq(5.36)	121	181.000	24.2E+3	24.2E+3	37.6E+3
450	TUB120120	TUB120120	0.728	1.000	0.728	EC-5.5.4	123	43.500	870.000	870.000	1.38E+3
451	TUB120120	TUB120120	0.712	1.000	0.712	EC-5.5.4	121	43.500	870.000	870.000	1.38E+3

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	146	156:INPLACE:	8.818	-0.460	-1.217	8.414	-0.000	-0.000	-0.001
Min X	145	143:INPLACE:	-7.790	-0.536	-1.974	8.054	0.000	0.000	0.001
Max Y	130	123:INPLACE:	-3.310	1.148	0.000	3.502	0.002	-0.000	-0.003
Min Y	18	127:INPLACE:	-0.005	-36.460	-0.465	36.453	-0.000	0.000	0.000
Max Z	7	156:INPLACE:	5.687	-6.109	0.048	8.346	-0.000	-0.000	0.002
Min Z	145	123:INPLACE:	-7.108	-0.657	-2.886	7.530	0.000	0.000	0.001
Max rX	84	123:INPLACE:	-1.705	-9.536	-1.995	9.890	0.008	-0.000	-0.009
Min rX	70	123:INPLACE:	-0.672	-11.866	-0.438	11.893	-0.010	-0.000	-0.001
Max rY	129	156:INPLACE:	0.000	-0.643	-0.000	0.643	0.000	0.004	0.002
Min rY	128	143:INPLACE:	-0.000	-0.815	-0.000	0.815	0.000	-0.008	-0.003
Max rZ	82	123:INPLACE:	-0.633	-4.482	-0.392	4.543	0.001	-0.000	0.018
Min rZ	75	121:INPLACE:	0.628	-4.892	-0.382	4.947	0.001	0.000	-0.018
Max Rst	18	123:INPLACE:	-0.592	-36.449	-0.459	36.467	-0.000	-0.000	-0.000

Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (m)	X (mm)	Y (mm)	Z (mm)	Resultant (mm)
Max X	451	156:INPLACE:	0.773	8.718	-0.607	-1.416	8.854
Min X	450	143:INPLACE:	1.031	-8.408	-0.786	-2.020	8.679
Max Y	275	123:INPLACE:	0.000	-3.310	1.148	0.000	3.502
Min Y	388	121:INPLACE:	1.375	0.608	-37.160	-0.447	37.167
Max Z	23	128:INPLACE:	3.325	0.674	-13.397	6.664	14.518
Min Z	25	128:INPLACE:	2.850	-1.217	-11.804	-3.370	12.335
Max Rst	388	121:INPLACE:	1.375	0.608	-37.160	-0.447	37.167

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Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	128	143:INPLACE:	88.075	0.000	348.383	0.000	0.000	0.000
Min FX	129	156:INPLACE:	-86.878	0.000	349.332	0.000	0.000	0.000
Max FY	3	121:INPLACE:	0.000	1.17E+3	-357.458	0.000	0.000	0.000
Min FY	128	121:INPLACE:	-18.816	0.000	274.146	0.000	0.000	0.000
Max FZ	129	121:INPLACE:	-42.293	0.000	377.271	0.000	0.000	0.000
Min FZ	3	121:INPLACE:	0.000	1.17E+3	-357.458	0.000	0.000	0.000
Max MX	2	121:INPLACE:	0.000	1.09E+3	-293.959	0.000	0.000	0.000
Min MX	2	121:INPLACE:	0.000	1.09E+3	-293.959	0.000	0.000	0.000
Max MY	2	121:INPLACE:	0.000	1.09E+3	-293.959	0.000	0.000	0.000
Min MY	2	121:INPLACE:	0.000	1.09E+3	-293.959	0.000	0.000	0.000
Max MZ	2	121:INPLACE:	0.000	1.09E+3	-293.959	0.000	0.000	0.000
Min MZ	2	121:INPLACE:	0.000	1.09E+3	-293.959	0.000	0.000	0.000

A.5.1.3 Inplace, earthquake,(ALS), LC161-178

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Job Information

	Engineer	Checked	Approved
Name:	Gholam Sakhi Sakha		
Date:	5-Jan-15		

Structure Type	SPACE FRAME

Number of Nodes	91	Highest Node	146
Number of Elements	158	Highest Beam	451
Number of Plates	48	Highest Plate	443

Number of Basic Load Cases	33
Number of Combination Load Cases	16

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Combination	161	INPLACE: ALS EQ 10000 + X - Y
Combination	162	INPLACE: ALS EQ 10000 + X - Z - Y
Combination	163	INPLACE: ALS EQ 10000 - X - Y
Combination	164	INPLACE: ALS EQ 10000 - X + Z - Y
Combination	165	INPLACE: ALS EQ 10000 + Z - Y
Combination	166	INPLACE: ALS EQ 10000 + Z + X - Y
Combination	167	INPLACE: ALS EQ 10000 - Z - Y
Combination	168	INPLACE: ALS EQ 10000 - Z - X - Y
Combination	171	INPLACE: ALS EQ 10000 + X +Y
Combination	172	INPLACE: ALS EQ 10000 + X - Z + Y
Combination	173	INPLACE: ALS EQ 10000 - X + Y
Combination	174	INPLACE: ALS EQ 10000 - X + Z + Y
Combination	175	INPLACE: ALS EQ 10000 + Z + Y
Combination	176	INPLACE: ALS EQ 10000 + Z + X + Y
Combination	177	INPLACE: ALS EQ 10000 - Z + Y
Combination	178	INPLACE: ALS EQ 10000 - Z - X + Y

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Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
1	TUB300300	TUB3003000	0.371	1.000	0.371	EC-eq(5.36)	163	181.000	24.2E+3	24.2E+3	37.6E+3
2	TUB250250	TUB2502500	0.569	1.000	0.569	EC-5.5.3	163	149.000	13.5E+3	13.5E+3	21.1E+3
4	TUB250250	TUB2502500	0.409	1.000	0.409	EC-5.5.4.LTB	163	77.100	7.51E+3	7.51E+3	11.5E+3
5	TUB250250	TUB2502500	0.195	1.000	0.195	EC-5.5.4.LTB	163	149.000	13.5E+3	13.5E+3	21.1E+3
6	TUB250250	TUB2502500	0.485	1.000	0.485	EC-5.5.4.LTB	161	77.100	7.51E+3	7.51E+3	11.5E+3
7	TUB250250	TUB2502500	0.114	1.000	0.114	EC-eq(5.36)	163	149.000	13.5E+3	13.5E+3	21.1E+3
8	TUB250250	TUB2502500	0.114	1.000	0.114	EC-eq(5.36)	161	149.000	13.5E+3	13.5E+3	21.1E+3
13	TUB250250	TUB2502500	0.485	1.000	0.485	EC-5.5.4.LTB	163	77.100	7.51E+3	7.51E+3	11.5E+3
14	TUB250250	TUB2502500	0.409	1.000	0.409	EC-5.5.4.LTB	161	77.100	7.51E+3	7.51E+3	11.5E+3
17	TUB300300	TUB3003000	0.371	1.000	0.371	EC-eq(5.36)	161	181.000	24.2E+3	24.2E+3	37.6E+3
21	TUB250250	TUB2502500	0.340	1.000	0.340	EC-5.5.4.LTB	162	149.000	13.5E+3	13.5E+3	21.1E+3
23	TUB120120	TUB1201200	0.762	1.000	0.762	EC-5.5.4.LTB	161	43.500	870.000	870.000	1.38E+3
25	TUB120120	TUB1201200	0.398	1.000	0.398	EC-5.5.4.LTB	161	43.500	870.000	870.000	1.38E+3
26	TUB250250	TUB2502500	0.481	1.000	0.481	EC-5.5.4	161	149.000	13.5E+3	13.5E+3	21.1E+3
28	TUB120120	TUB1201200	0.109	1.000	0.109	EC-5.5.4.LTB	162	43.500	870.000	870.000	1.38E+3
30	TUB120120	TUB1201200	0.095	1.000	0.095	EC-eq(5.36)	161	43.500	870.000	870.000	1.38E+3
31	TUB250250	TUB2502500	0.298	1.000	0.298	EC-5.5.4.LTB	161	149.000	13.5E+3	13.5E+3	21.1E+3
32	TUB250250	TUB2502500	0.251	1.000	0.251	EC-5.5.4.LTB	168	149.000	13.5E+3	13.5E+3	21.1E+3
33	TUB250250	TUB2502500	0.183	1.000	0.183	EC-5.5.2 LTB	161	149.000	13.5E+3	13.5E+3	21.1E+3
34	TUB250250	TUB2502500	0.481	1.000	0.481	EC-5.5.4	163	149.000	13.5E+3	13.5E+3	21.1E+3
35	TUB250250	TUB2502500	0.336	1.000	0.336	EC-5.5.4.LTB	163	149.000	13.5E+3	13.5E+3	21.1E+3
36	TUB250250	TUB2502500	0.206	1.000	0.206	EC-5.5.3	162	149.000	13.5E+3	13.5E+3	21.1E+3
37	TUB250250	TUB2502500	0.439	1.000	0.439	EC-5.5.4.LTB	164	149.000	13.5E+3	13.5E+3	21.1E+3
38	TUB250250	TUB2502500	0.253	1.000	0.253	EC-5.5.4.LTB	167	149.000	13.5E+3	13.5E+3	21.1E+3
39	TUB250250	TUB2502500	0.205	1.000	0.205	EC-5.5.3	162	149.000	13.5E+3	13.5E+3	21.1E+3
40	TUB250250	TUB2502500	0.634	1.000	0.634	EC-5.5.4.LTB	161	149.000	13.5E+3	13.5E+3	21.1E+3
41	TUB250250	TUB2502500	0.182	1.000	0.182	EC-5.5.4.LTB	162	149.000	13.5E+3	13.5E+3	21.1E+3
42	TUB250250	TUB2502500	0.183	1.000	0.183	EC-5.5.2 LTB	163	149.000	13.5E+3	13.5E+3	21.1E+3
67	TUB250250	TUB2502500	0.109	1.000	0.109	EC-eq(5.36)	163	149.000	13.5E+3	13.5E+3	21.1E+3
68	TUB250250	TUB2502500	0.109	1.000	0.109	EC-eq(5.36)	161	149.000	13.5E+3	13.5E+3	21.1E+3
73	HE140A	HE140A	0.360	1.000	0.360	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
74	HE140A	HE140A	0.167	1.000	0.167	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
75	HE140A	HE140A	0.122	1.000	0.122	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
76	HE140A	HE140A	0.163	1.000	0.163	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
77	HE140A	HE140A	0.218	1.000	0.218	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
103	TUB120120	TUB1201200	0.547	1.000	0.547	EC-5.4.3 (T)	163	28.500	610.000	610.000	949.000
106	TUB120120	TUB1201200	0.638	1.000	0.638	EC-5.4.3 (T)	163	28.500	610.000	610.000	949.000
107	TUB140140	TUB1401400	0.602	1.000	0.602	EC-5.4.3 (T)	163	41.900	1.21E+3	1.21E+3	1.89E+3
108	TUB140140	TUB1401400	0.573	1.000	0.573	EC-5.4.3 (T)	163	41.900	1.21E+3	1.21E+3	1.89E+3
109	TUB140140	TUB1401400	0.602	1.000	0.602	EC-5.4.3 (T)	161	41.900	1.21E+3	1.21E+3	1.89E+3
110	TUB140140	TUB1401400	0.573	1.000	0.573	EC-5.4.3 (T)	161	41.900	1.21E+3	1.21E+3	1.89E+3
116	HE240B	HE240B	0.170	1.000	0.170	EC-eq(5.36)	163	106.000	11.3E+3	3.92E+3	103.000
117	HE240B	HE240B	0.219	1.000	0.219	EC-5.5.4.LTB	161	106.000	11.3E+3	3.92E+3	103.000
119	HE240B	HE240B	0.339	1.000	0.339	EC-5.5.2 LTB	163	106.000	11.3E+3	3.92E+3	103.000
120	HE240B	HE240B	0.770	1.000	0.770	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
121	HE240B	HE240B	0.270	1.000	0.270	EC-eq(5.36)	161	106.000	11.3E+3	3.92E+3	103.000
122	HE240B	HE240B	0.160	1.000	0.160	EC-eq(5.36)	161	106.000	11.3E+3	3.92E+3	103.000
124	HE240B	HE240B	0.344	1.000	0.344	EC-5.5.2 LTB	161	106.000	11.3E+3	3.92E+3	103.000
125	HE240B	HE240B	0.164	1.000	0.164	EC-eq(5.36)	161	106.000	11.3E+3	3.92E+3	103.000
127	HE240B	HE240B	0.339	1.000	0.339	EC-5.5.2 LTB	161	106.000	11.3E+3	3.92E+3	103.000

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
128	HE240B	HE240B	0.219	1.000	0.219	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
130	HE240B	HE240B	0.344	1.000	0.344	EC-5.5.2 LTB	163	106.000	11.3E+3	3.92E+3	103.000
131	HE240B	HE240B	0.164	1.000	0.164	EC-eq(5.36)	163	106.000	11.3E+3	3.92E+3	103.000
133	HE240B	HE240B	0.270	1.000	0.270	EC-eq(5.36)	163	106.000	11.3E+3	3.92E+3	103.000
134	HE240B	HE240B	0.160	1.000	0.160	EC-eq(5.36)	163	106.000	11.3E+3	3.92E+3	103.000
136	HE240B	HE240B	0.770	1.000	0.770	EC-5.5.4.LTB	161	106.000	11.3E+3	3.92E+3	103.000
138	HE240B	HE240B	0.276	1.000	0.276	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
145	HE240B	HE240B	0.283	1.000	0.283	EC-5.5.4.LTB	162	106.000	11.3E+3	3.92E+3	103.000
146	HE240B	HE240B	0.148	1.000	0.148	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
153	HE240B	HE240B	0.149	1.000	0.149	EC-5.5.4.LTB	162	106.000	11.3E+3	3.92E+3	103.000
154	HE140A	HE140A	0.267	1.000	0.267	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
155	HE140A	HE140A	0.277	1.000	0.277	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
156	HE140A	HE140A	0.134	1.000	0.134	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
157	HE140A	HE140A	0.084	1.000	0.084	EC-5.5.4.LTB	162	31.400	1.03E+3	389.000	8.100
158	HE140A	HE140A	0.134	1.000	0.134	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
159	HE140A	HE140A	0.277	1.000	0.277	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
160	HE140A	HE140A	0.267	1.000	0.267	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
161	HE240B	HE240B	0.170	1.000	0.170	EC-eq(5.36)	161	106.000	11.3E+3	3.92E+3	103.000
162	HE240B	HE240B	0.879	1.000	0.879	EC-5.5.2 LTB	163	106.000	11.3E+3	3.92E+3	103.000
163	HE240B	HE240B	0.436	1.000	0.436	EC-5.5.2 LTB	161	106.000	11.3E+3	3.92E+3	103.000
164	HE240B	HE240B	0.250	1.000	0.250	EC-5.5.4.LTB	161	106.000	11.3E+3	3.92E+3	103.000
165	HE240B	HE240B	0.296	1.000	0.296	EC-5.5.4.LTB	161	106.000	11.3E+3	3.92E+3	103.000
166	HE240B	HE240B	0.189	1.000	0.189	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
167	HE240B	HE240B	0.153	1.000	0.153	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
168	HE240B	HE240B	0.296	1.000	0.296	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
169	HE240B	HE240B	0.255	1.000	0.255	EC-eq(5.36)	163	106.000	11.3E+3	3.92E+3	103.000
171	HE240B	HE240B	0.159	1.000	0.159	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
172	HE240B	HE240B	0.413	1.000	0.413	EC-5.5.2 LTB	163	106.000	11.3E+3	3.92E+3	103.000
174	HE240B	HE240B	0.166	1.000	0.166	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
175	HE240B	HE240B	0.436	1.000	0.436	EC-5.5.2 LTB	163	106.000	11.3E+3	3.92E+3	103.000
177	HE240B	HE240B	0.189	1.000	0.189	EC-5.5.4.LTB	161	106.000	11.3E+3	3.92E+3	103.000
178	HE240B	HE240B	0.413	1.000	0.413	EC-5.5.2 LTB	161	106.000	11.3E+3	3.92E+3	103.000
180	HE240B	HE240B	0.166	1.000	0.166	EC-5.5.4.LTB	161	106.000	11.3E+3	3.92E+3	103.000
181	HE240B	HE240B	0.256	1.000	0.256	EC-eq(5.36)	161	106.000	11.3E+3	3.92E+3	103.000
183	HE240B	HE240B	0.159	1.000	0.159	EC-5.5.4.LTB	161	106.000	11.3E+3	3.92E+3	103.000
184	HE240B	HE240B	0.879	1.000	0.879	EC-5.5.2 LTB	161	106.000	11.3E+3	3.92E+3	103.000
186	HE240B	HE240B	0.153	1.000	0.153	EC-5.5.4.LTB	161	106.000	11.3E+3	3.92E+3	103.000
194	HE140A	HE140A	0.216	1.000	0.216	EC-5.5.2 LTB	161	31.400	1.03E+3	389.000	8.100
195	HE140A	HE140A	0.232	1.000	0.232	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
196	HE140A	HE140A	0.118	1.000	0.118	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
197	HE140A	HE140A	0.103	1.000	0.103	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
198	HE140A	HE140A	0.118	1.000	0.118	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
199	HE140A	HE140A	0.232	1.000	0.232	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
200	HE140A	HE140A	0.216	1.000	0.216	EC-5.5.2 LTB	163	31.400	1.03E+3	389.000	8.100
256	HE240B	HE240B	0.250	1.000	0.250	EC-5.5.4.LTB	163	106.000	11.3E+3	3.92E+3	103.000
269	TUB2502500	TUB2502500	0.183	1.000	0.183	EC-5.5.3	161	149.000	13.5E+3	13.5E+3	21.1E+3
270	TUB2502500	TUB2502500	0.205	1.000	0.205	EC-5.5.3	162	149.000	13.5E+3	13.5E+3	21.1E+3
271	TUB2502500	TUB2502500	0.205	1.000	0.205	EC-5.5.3	162	149.000	13.5E+3	13.5E+3	21.1E+3
272	TUB2502500	TUB2502500	0.183	1.000	0.183	EC-5.5.3	163	149.000	13.5E+3	13.5E+3	21.1E+3
273	TUB2002000	TUB2002000	0.962	1.000	0.962	EC-5.5.4	163	75.600	4.53E+3	4.53E+3	7.02E+3

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
274	TUB200200	TUB2002000	1.265	1.000	1.265	EC-5.5.4	162	75.500	4.53E+3	4.53E+3	7.02E+3
275	TUB300300	TUB3003000	0.001	1.000	0.001	EC-5.4.6-(Y)	161	181.000	24.2E+3	24.2E+3	37.6E+3
276	TUB300300	TUB3003000	0.001	1.000	0.001	EC-5.4.6-(Y)	161	181.000	24.2E+3	24.2E+3	37.6E+3
301	TUB250250	TUB2502500	0.439	1.000	0.439	EC-5.5.4.LTB	166	149.000	13.5E+3	13.5E+3	21.1E+3
302	TUB250250	TUB2502500	0.254	1.000	0.254	EC-5.5.4.LTB	168	149.000	13.5E+3	13.5E+3	21.1E+3
303	TUB250250	TUB2502500	0.298	1.000	0.298	EC-5.5.4.LTB	163	149.000	13.5E+3	13.5E+3	21.1E+3
304	TUB250250	TUB2502500	0.251	1.000	0.251	EC-5.5.4.LTB	161	149.000	13.5E+3	13.5E+3	21.1E+3
305	TUB250250	TUB2502500	0.569	1.000	0.569	EC-5.5.3	161	149.000	13.5E+3	13.5E+3	21.1E+3
306	TUB250250	TUB2502500	0.195	1.000	0.195	EC-5.5.4.LTB	161	149.000	13.5E+3	13.5E+3	21.1E+3
307	HE140A	HE140A	0.163	1.000	0.163	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
308	HE140A	HE140A	0.122	1.000	0.122	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
309	HE140A	HE140A	0.167	1.000	0.167	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
310	HE140A	HE140A	0.360	1.000	0.360	EC-5.5.4.LTB	161	31.400	1.03E+3	389.000	8.100
311	TUB250250	TUB2502500	0.195	1.000	0.195	EC-5.5.3	162	149.000	13.5E+3	13.5E+3	21.1E+3
312	TUB250250	TUB2502500	0.219	1.000	0.219	EC-5.5.3	162	149.000	13.5E+3	13.5E+3	21.1E+3
313	TUB250250	TUB2502500	0.195	1.000	0.195	EC-5.5.3	163	149.000	13.5E+3	13.5E+3	21.1E+3
314	TUB250250	TUB2502500	0.158	1.000	0.158	EC-5.5.2 LTB	163	149.000	13.5E+3	13.5E+3	21.1E+3
315	TUB250250	TUB2502500	0.195	1.000	0.195	EC-5.5.3	162	149.000	13.5E+3	13.5E+3	21.1E+3
316	TUB250250	TUB2502500	0.220	1.000	0.220	EC-5.5.3	162	149.000	13.5E+3	13.5E+3	21.1E+3
317	TUB250250	TUB2502500	0.195	1.000	0.195	EC-5.5.3	163	149.000	13.5E+3	13.5E+3	21.1E+3
318	TUB250250	TUB2502500	0.158	1.000	0.158	EC-5.5.2 LTB	163	149.000	13.5E+3	13.5E+3	21.1E+3
319	TUB250250	TUB2502500	0.634	1.000	0.634	EC-5.5.4.LTB	163	149.000	13.5E+3	13.5E+3	21.1E+3
320	TUB250250	TUB2502500	0.183	1.000	0.183	EC-5.5.4	162	149.000	13.5E+3	13.5E+3	21.1E+3
321	HE140A	HE140A	0.218	1.000	0.218	EC-5.5.4.LTB	163	31.400	1.03E+3	389.000	8.100
322	TUB250250	TUB2502500	0.158	1.000	0.158	EC-5.5.2 LTB	161	149.000	13.5E+3	13.5E+3	21.1E+3
323	TUB250250	TUB2502500	0.158	1.000	0.158	EC-5.5.2 LTB	161	149.000	13.5E+3	13.5E+3	21.1E+3
372	HE220B	HE220B	0.272	1.000	0.272	EC-5.5.4.LTB	163	91.000	8.09E+3	2.84E+3	76.800
373	HE220B	HE220B	0.262	1.000	0.262	EC-5.5.4.LTB	163	91.000	8.09E+3	2.84E+3	76.800
374	HE220B	HE220B	0.276	1.000	0.276	EC-5.5.2 LTB	163	91.000	8.09E+3	2.84E+3	76.800
375	HE220B	HE220B	0.276	1.000	0.276	EC-5.5.2 LTB	163	91.000	8.09E+3	2.84E+3	76.800
376	HE220B	HE220B	0.253	1.000	0.253	EC-5.5.2 LTB	161	91.000	8.09E+3	2.84E+3	76.800
377	HE220B	HE220B	0.254	1.000	0.254	EC-5.5.2 LTB	161	91.000	8.09E+3	2.84E+3	76.800
378	HE220B	HE220B	0.253	1.000	0.253	EC-5.5.2 LTB	163	91.000	8.09E+3	2.84E+3	76.800
379	HE220B	HE220B	0.254	1.000	0.254	EC-5.5.2 LTB	163	91.000	8.09E+3	2.84E+3	76.800
380	HE220B	HE220B	0.276	1.000	0.276	EC-5.5.2 LTB	161	91.000	8.09E+3	2.84E+3	76.800
381	HE220B	HE220B	0.276	1.000	0.276	EC-5.5.2 LTB	161	91.000	8.09E+3	2.84E+3	76.800
382	HE220B	HE220B	0.272	1.000	0.272	EC-5.5.4.LTB	161	91.000	8.09E+3	2.84E+3	76.800
383	HE220B	HE220B	0.261	1.000	0.261	EC-5.5.4.LTB	161	91.000	8.09E+3	2.84E+3	76.800
384	HE220B	HE220B	0.275	1.000	0.275	EC-5.5.4.LTB	163	91.000	8.09E+3	2.84E+3	76.800
385	HE220B	HE220B	0.252	1.000	0.252	EC-5.5.4.LTB	163	91.000	8.09E+3	2.84E+3	76.800
386	HE220B	HE220B	0.272	1.000	0.272	EC-5.5.2 LTB	163	91.000	8.09E+3	2.84E+3	76.800
387	HE220B	HE220B	0.272	1.000	0.272	EC-5.5.2 LTB	163	91.000	8.09E+3	2.84E+3	76.800
388	HE220B	HE220B	0.262	1.000	0.262	EC-5.5.2 LTB	161	91.000	8.09E+3	2.84E+3	76.800
389	HE220B	HE220B	0.262	1.000	0.262	EC-5.5.2 LTB	161	91.000	8.09E+3	2.84E+3	76.800
390	HE220B	HE220B	0.262	1.000	0.262	EC-5.5.2 LTB	163	91.000	8.09E+3	2.84E+3	76.800
391	HE220B	HE220B	0.262	1.000	0.262	EC-5.5.2 LTB	163	91.000	8.09E+3	2.84E+3	76.800
392	HE220B	HE220B	0.272	1.000	0.272	EC-5.5.2 LTB	161	91.000	8.09E+3	2.84E+3	76.800
393	HE220B	HE220B	0.272	1.000	0.272	EC-5.5.2 LTB	161	91.000	8.09E+3	2.84E+3	76.800
394	HE220B	HE220B	0.275	1.000	0.275	EC-5.5.4.LTB	161	91.000	8.09E+3	2.84E+3	76.800
395	HE220B	HE220B	0.251	1.000	0.251	EC-5.5.4.LTB	161	91.000	8.09E+3	2.84E+3	76.800

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
444	TUB120120	TUB120120	0.649	1.000	0.649	EC-5.4.3 (T)	162	28.500	610.000	610.000	949.000
445	TUB120120	TUB120120	0.547	1.000	0.547	EC-5.4.3 (T)	161	28.500	610.000	610.000	949.000
446	TUB300300	TUB300300	0.455	1.000	0.455	EC-eq(5.36)	163	181.000	24.2E+3	24.2E+3	37.6E+3
447	TUB300300	TUB300300	0.455	1.000	0.455	EC-eq(5.36)	161	181.000	24.2E+3	24.2E+3	37.6E+3
448	TUB300300	TUB300300	0.509	1.000	0.509	EC-eq(5.36)	163	181.000	24.2E+3	24.2E+3	37.6E+3
449	TUB300300	TUB300300	0.509	1.000	0.509	EC-eq(5.36)	161	181.000	24.2E+3	24.2E+3	37.6E+3
450	TUB120120	TUB120120	0.846	1.000	0.846	EC-5.5.4	163	43.500	870.000	870.000	1.38E+3
451	TUB120120	TUB120120	0.846	1.000	0.846	EC-5.5.4	161	43.500	870.000	870.000	1.38E+3

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	146	162:INPLACE:	**18.078**	-0.697	-1.921	18.191	-0.000	-0.000	-0.002
Min X	145	163:INPLACE:	**-16.680**	-0.802	-2.075	16.808	-0.000	0.000	0.002
Max Y	131	161:INPLACE:	13.840	**1.280**	0.000	13.894	0.002	0.000	0.003
Min Y	18	167:INPLACE:	0.000	**-40.302**	-0.411	40.304	-0.000	0.000	0.000
Max Z	5	171:INPLACE:	2.276	0.117	**0.124**	2.282	-0.000	0.000	-0.002
Min Z	145	168:INPLACE:	-13.288	-0.778	**-2.077**	13.472	-0.000	0.000	0.002
Max rX	94	161:INPLACE:	8.549	-9.852	-1.309	13.109	**0.007**	-0.000	0.010
Min rX	68	161:INPLACE:	2.342	-12.217	-0.331	12.444	**-0.011**	0.000	0.001
Max rY	129	162:INPLACE:	0.000	-0.938	-0.000	0.938	0.001	**0.006**	0.002
Min rY	128	163:INPLACE:	-0.000	-1.127	-0.000	1.127	0.001	**-0.004**	-0.003
Max rZ	82	163:INPLACE:	-2.010	-3.852	-0.113	4.347	0.001	-0.000	**0.016**
Min rZ	75	161:INPLACE:	2.010	-3.850	-0.113	4.345	0.001	0.000	**-0.016**
Max Rst	16	161:INPLACE:	13.919	-39.989	-0.018	**42.348**	0.001	-0.000	0.000

Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (m)	X (mm)	Y (mm)	Z (mm)	Resultant (mm)
Max X	451	162:INPLACE:	1.031	**18.987**	-0.952	-2.395	19.171
Min X	450	163:INPLACE:	1.031	**-17.882**	-0.989	-2.497	18.132
Max Y	276	161:INPLACE:	0.000	13.839	**1.280**	0.000	13.894
Min Y	312	167:INPLACE:	1.100	0.001	**-40.889**	-0.057	40.889
Max Z	23	165:INPLACE:	2.850	0.001	-13.912	**6.646**	15.374
Min Z	25	167:INPLACE:	2.375	0.000	-12.242	**-3.394**	12.704
Max Rst	312	161:INPLACE:	1.100	13.930	-40.877	-0.017	**43.186**

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Reaction Summary

	Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kNm)	Moment MY (kNm)	Moment MZ (kNm)
Max FX	128	163:INPLACE:	245.008	0.000	709.419	0.000	0.000	0.000
Min FX	129	162:INPLACE:	-350.612	0.000	750.893	0.000	0.000	0.000
Max FY	3	161:INPLACE:	0.000	1.51E+3	-568.535	0.000	0.000	0.000
Min FY	128	161:INPLACE:	-189.819	0.000	9.568	0.000	0.000	0.000
Max FZ	129	162:INPLACE:	-350.612	0.000	750.893	0.000	0.000	0.000
Min FZ	3	161:INPLACE:	0.000	1.51E+3	-568.535	0.000	0.000	0.000
Max MX	2	161:INPLACE:	0.000	984.613	-150.515	0.000	0.000	0.000
Min MX	2	161:INPLACE:	0.000	984.613	-150.515	0.000	0.000	0.000
Max MY	2	161:INPLACE:	0.000	984.613	-150.515	0.000	0.000	0.000
Min MY	2	161:INPLACE:	0.000	984.613	-150.515	0.000	0.000	0.000
Max MZ	2	161:INPLACE:	0.000	984.613	-150.515	0.000	0.000	0.000
Min MZ	2	161:INPLACE:	0.000	984.613	-150.515	0.000	0.000	0.000

A.5.1.4 Explosion loads inplace LC 311-312

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Job Information

	Engineer	Checked	Approved
Name:			
Date:	5-Jan-15		

Structure Type	SPACE FRAME

Number of Nodes	91	Highest Node	146
Number of Elements	158	Highest Beam	451
Number of Plates	48	Highest Plate	443

Number of Basic Load Cases	33
Number of Combination Load Cases	2

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Combination	311	ALS EXPLOSION LOAD
Combination	312	ALS EXPLOSION LOAD

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
1	TUB300300	TUB300300	0.460	1.000	0.460	EC-eq(5.36)	312	181.000	24.2E+3	24.2E+3	37.6E+3
2	TUB250250	TUB250250	0.406	1.000	0.406	EC-5.5.3	311	149.000	13.5E+3	13.5E+3	21.1E+3
4	TUB250250	TUB250250	0.405	1.000	0.405	EC-5.5.4.LTB	311	77.100	7.51E+3	7.51E+3	11.5E+3
5	TUB250250	TUB250250	0.128	1.000	0.128	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
6	TUB250250	TUB250250	0.301	1.000	0.301	EC-5.5.4.LTB	311	77.100	7.51E+3	7.51E+3	11.5E+3
7	TUB250250	TUB250250	0.089	1.000	0.089	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
8	TUB250250	TUB250250	0.089	1.000	0.089	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
13	TUB250250	TUB250250	0.301	1.000	0.301	EC-5.5.4.LTB	311	77.100	7.51E+3	7.51E+3	11.5E+3
14	TUB250250	TUB250250	0.405	1.000	0.405	EC-5.5.4.LTB	311	77.100	7.51E+3	7.51E+3	11.5E+3
17	TUB300300	TUB300300	0.460	1.000	0.460	EC-eq(5.36)	312	181.000	24.2E+3	24.2E+3	37.6E+3
21	TUB250250	TUB250250	0.302	1.000	0.302	EC-5.5.4.LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
23	TUB120120	TUB120120	0.611	1.000	0.611	EC-5.5.4	312	43.500	870.000	870.000	1.38E+3
25	TUB120120	TUB120120	0.289	1.000	0.289	EC-5.5.4	311	43.500	870.000	870.000	1.38E+3
26	TUB250250	TUB250250	0.731	1.000	0.731	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
28	TUB120120	TUB120120	0.353	1.000	0.353	EC-eq(5.36)	311	43.500	870.000	870.000	1.38E+3
30	TUB120120	TUB120120	0.377	1.000	0.377	EC-5.4.3 (T)	312	43.500	870.000	870.000	1.38E+3
31	TUB250250	TUB250250	0.260	1.000	0.260	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
32	TUB250250	TUB250250	0.220	1.000	0.220	EC-5.5.4.LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
33	TUB250250	TUB250250	0.156	1.000	0.156	EC-5.5.2 LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
34	TUB250250	TUB250250	0.731	1.000	0.731	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
35	TUB250250	TUB250250	0.302	1.000	0.302	EC-5.5.4.LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
36	TUB250250	TUB250250	0.175	1.000	0.175	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
37	TUB250250	TUB250250	0.367	1.000	0.367	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
38	TUB250250	TUB250250	0.209	1.000	0.209	EC-5.5.4.LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
39	TUB250250	TUB250250	0.175	1.000	0.175	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
40	TUB250250	TUB250250	0.485	1.000	0.485	EC-5.5.4 LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
41	TUB250250	TUB250250	0.157	1.000	0.157	EC-5.5.4	312	149.000	13.5E+3	13.5E+3	21.1E+3
42	TUB250250	TUB250250	0.156	1.000	0.156	EC-5.5.2 LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
67	TUB250250	TUB250250	0.090	1.000	0.090	EC-eq(5.36)	312	149.000	13.5E+3	13.5E+3	21.1E+3
68	TUB250250	TUB250250	0.090	1.000	0.090	EC-eq(5.36)	312	149.000	13.5E+3	13.5E+3	21.1E+3
73	HE140A	HE140A	0.270	1.000	0.270	EC-5.5.2 LTB	312	31.400	1.03E+3	389.000	8.100
74	HE140A	HE140A	0.131	1.000	0.131	EC-5.5.4 LTB	312	31.400	1.03E+3	389.000	8.100
75	HE140A	HE140A	0.231	1.000	0.231	EC-5.5.4 LTB	311	31.400	1.03E+3	389.000	8.100
76	HE140A	HE140A	0.126	1.000	0.126	EC-5.5.4 LTB	312	31.400	1.03E+3	389.000	8.100
77	HE140A	HE140A	0.150	1.000	0.150	EC-5.5.4 LTB	312	31.400	1.03E+3	389.000	8.100
103	TUB120120	TUB120120	0.305	1.000	0.305	EC-5.4.3 (T)	311	28.500	610.000	610.000	949.000
106	TUB120120	TUB120120	0.361	1.000	0.361	EC-5.4.3 (T)	312	28.500	610.000	610.000	949.000
107	TUB140140	TUB140140	0.350	1.000	0.350	EC-5.4.3 (T)	311	41.900	1.21E+3	1.21E+3	1.89E+3
108	TUB140140	TUB140140	0.342	1.000	0.342	EC-5.4.3 (T)	312	41.900	1.21E+3	1.21E+3	1.89E+3
109	TUB140140	TUB140140	0.351	1.000	0.351	EC-5.4.3 (T)	311	41.900	1.21E+3	1.21E+3	1.89E+3
110	TUB140140	TUB140140	0.342	1.000	0.342	EC-5.4.3 (T)	312	41.900	1.21E+3	1.21E+3	1.89E+3
116	HE240B	HE240B	0.363	1.000	0.363	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
117	HE240B	HE240B	0.733	1.000	0.733	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
119	HE240B	HE240B	0.342	1.000	0.342	EC-5.4.6-(Y)	312	106.000	11.3E+3	3.92E+3	103.000
120	HE240B	HE240B	0.719	1.000	0.719	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
121	HE240B	HE240B	0.471	1.000	0.471	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
122	HE240B	HE240B	0.406	1.000	0.406	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
124	HE240B	HE240B	0.471	1.000	0.471	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
125	HE240B	HE240B	0.406	1.000	0.406	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
127	HE240B	HE240B	0.342	1.000	0.342	EC-5.4.6-(Y)	312	106.000	11.3E+3	3.92E+3	103.000
128	HE240B	HE240B	0.733	1.000	0.733	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
130	HE240B	HE240B	0.471	1.000	0.471	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
131	HE240B	HE240B	0.407	1.000	0.407	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
133	HE240B	HE240B	0.471	1.000	0.471	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
134	HE240B	HE240B	0.406	1.000	0.406	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
136	HE240B	HE240B	0.720	1.000	0.720	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
138	HE240B	HE240B	0.212	1.000	0.212	EC-5.5.4 LTB	312	106.000	11.3E+3	3.92E+3	103.000
145	HE240B	HE240B	0.212	1.000	0.212	EC-5.5.4 LTB	312	106.000	11.3E+3	3.92E+3	103.000
146	HE240B	HE240B	0.214	1.000	0.214	EC-5.5.4 LTB	312	106.000	11.3E+3	3.92E+3	103.000
153	HE240B	HE240B	0.214	1.000	0.214	EC-5.5.4 LTB	312	106.000	11.3E+3	3.92E+3	103.000
154	HE140A	HE140A	0.630	1.000	0.630	EC-5.5.2 LTB	312	31.400	1.03E+3	389.000	8.100
155	HE140A	HE140A	0.659	1.000	0.659	EC-5.5.4 LTB	312	31.400	1.03E+3	389.000	8.100
156	HE140A	HE140A	0.239	1.000	0.239	EC-5.5.4 LTB	312	31.400	1.03E+3	389.000	8.100
157	HE140A	HE140A	0.157	1.000	0.157	EC-5.5.4 LTB	312	31.400	1.03E+3	389.000	8.100
158	HE140A	HE140A	0.240	1.000	0.240	EC-5.5.4 LTB	312	31.400	1.03E+3	389.000	8.100
159	HE140A	HE140A	0.660	1.000	0.660	EC-5.5.4 LTB	312	31.400	1.03E+3	389.000	8.100
160	HE140A	HE140A	0.630	1.000	0.630	EC-5.5.2 LTB	312	31.400	1.03E+3	389.000	8.100
161	HE240B	HE240B	0.362	1.000	0.362	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
162	HE240B	HE240B	0.984	1.000	0.984	EC-5.5.2 LTB	311	106.000	11.3E+3	3.92E+3	103.000
163	HE240B	HE240B	0.885	1.000	0.885	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
164	HE240B	HE240B	0.230	1.000	0.230	EC-5.5.4 LTB	311	106.000	11.3E+3	3.92E+3	103.000
165	HE240B	HE240B	0.389	1.000	0.389	EC-5.5.4 LTB	311	106.000	11.3E+3	3.92E+3	103.000
166	HE240B	HE240B	0.691	1.000	0.691	EC-5.5.4 LTB	311	106.000	11.3E+3	3.92E+3	103.000
167	HE240B	HE240B	0.188	1.000	0.188	EC-5.5.4 LTB	311	106.000	11.3E+3	3.92E+3	103.000
168	HE240B	HE240B	0.388	1.000	0.388	EC-5.5.4 LTB	311	106.000	11.3E+3	3.92E+3	103.000

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
169	HE 240 B	HE240 B	0.433	1.000	0.433	EC-5.5.2 LTB	311	106.000	11.3E+3	3.92E+3	103.000
171	HE 240 B	HE240 B	0.397	1.000	0.397	EC-5.5.4.LTB	311	106.000	11.3E+3	3.92E+3	103.000
172	HE 240 B	HE240 B	0.449	1.000	0.449	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
174	HE 240 B	HE240 B	0.400	1.000	0.400	EC-5.5.4.LTB	311	106.000	11.3E+3	3.92E+3	103.000
175	HE 240 B	HE240 B	0.885	1.000	0.885	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
177	HE 240 B	HE240 B	0.691	1.000	0.691	EC-5.5.4.LTB	311	106.000	11.3E+3	3.92E+3	103.000
178	HE 240 B	HE240 B	0.448	1.000	0.448	EC-5.5.2 LTB	312	106.000	11.3E+3	3.92E+3	103.000
180	HE 240 B	HE240 B	0.401	1.000	0.401	EC-5.5.4.LTB	311	106.000	11.3E+3	3.92E+3	103.000
181	HE 240 B	HE240 B	0.432	1.000	0.432	EC-5.5.2 LTB	311	106.000	11.3E+3	3.92E+3	103.000
183	HE 240 B	HE240 B	0.397	1.000	0.397	EC-5.5.4.LTB	311	106.000	11.3E+3	3.92E+3	103.000
184	HE 240 B	HE240 B	0.984	1.000	0.984	EC-5.5.2 LTB	311	106.000	11.3E+3	3.92E+3	103.000
186	HE 240 B	HE240 B	0.188	1.000	0.188	EC-5.5.4.LTB	311	106.000	11.3E+3	3.92E+3	103.000
194	HE 140 A	HE140 A	0.588	1.000	0.588	EC-5.5.2 LTB	311	31.400	1.03E+3	389.000	8.100
195	HE 140 A	HE140 A	0.625	1.000	0.625	EC-5.5.4.LTB	311	31.400	1.03E+3	389.000	8.100
196	HE 140 A	HE140 A	0.294	1.000	0.294	EC-5.5.4.LTB	312	31.400	1.03E+3	389.000	8.100
197	HE 140 A	HE140 A	0.294	1.000	0.294	EC-5.5.4.LTB	312	31.400	1.03E+3	389.000	8.100
198	HE 140 A	HE140 A	0.293	1.000	0.293	EC-5.5.4.LTB	312	31.400	1.03E+3	389.000	8.100
199	HE 140 A	HE140 A	0.626	1.000	0.626	EC-5.5.4.LTB	311	31.400	1.03E+3	389.000	8.100
200	HE 140 A	HE140 A	0.589	1.000	0.589	EC-5.5.2 LTB	311	31.400	1.03E+3	389.000	8.100
256	HE 240 B	HE240 B	0.230	1.000	0.230	EC-5.5.4.LTB	311	106.000	11.3E+3	3.92E+3	103.000
269	TUB250250	TUB2502500	0.156	1.000	0.156	EC-5.5.2 LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
270	TUB250250	TUB2502500	0.175	1.000	0.175	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
271	TUB250250	TUB2502500	0.175	1.000	0.175	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
272	TUB250250	TUB2502500	0.156	1.000	0.156	EC-5.5.2 LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
273	TUB160160	TUB1601600	0.320	1.000	0.320	EC-5.5.4	311	37.700	1.46E+3	1.46E+3	2.33E+3
274	TUB160160	TUB1601600	0.320	1.000	0.320	EC-5.5.4	311	37.700	1.46E+3	1.46E+3	2.33E+3
275	TUB300300	TUB3003000	0.001	1.000	0.001	EC-5.4.6-(Y)	311	181.000	24.2E+3	24.2E+3	37.6E+3
276	TUB300300	TUB3003000	0.001	1.000	0.001	EC-5.4.6-(Y)	311	181.000	24.2E+3	24.2E+3	37.6E+3
301	TUB250250	TUB2502500	0.367	1.000	0.367	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
302	TUB250250	TUB2502500	0.209	1.000	0.209	EC-5.5.4.LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
303	TUB250250	TUB2502500	0.260	1.000	0.260	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
304	TUB250250	TUB2502500	0.220	1.000	0.220	EC-5.5.4.LTB	312	149.000	13.5E+3	13.5E+3	21.1E+3
305	TUB250250	TUB2502500	0.406	1.000	0.406	EC-5.5.3	311	149.000	13.5E+3	13.5E+3	21.1E+3
306	TUB250250	TUB2502500	0.128	1.000	0.128	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
307	HE 140 A	HE140 A	0.126	1.000	0.126	EC-5.5.4.LTB	312	31.400	1.03E+3	389.000	8.100
308	HE 140 A	HE140 A	0.231	1.000	0.231	EC-5.5.4.LTB	311	31.400	1.03E+3	389.000	8.100
309	HE 140 A	HE140 A	0.131	1.000	0.131	EC-5.5.4.LTB	312	31.400	1.03E+3	389.000	8.100
310	HE 140 A	HE140 A	0.270	1.000	0.270	EC-5.5.2 LTB	312	31.400	1.03E+3	389.000	8.100
311	TUB250250	TUB2502500	0.167	1.000	0.167	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
312	TUB250250	TUB2502500	0.186	1.000	0.186	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
313	TUB250250	TUB2502500	0.167	1.000	0.167	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
314	TUB250250	TUB2502500	0.134	1.000	0.134	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
315	TUB250250	TUB2502500	0.166	1.000	0.166	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
316	TUB250250	TUB2502500	0.187	1.000	0.187	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
317	TUB250250	TUB2502500	0.166	1.000	0.166	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
318	TUB250250	TUB2502500	0.134	1.000	0.134	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
319	TUB250250	TUB2502500	0.485	1.000	0.485	EC-5.5.4.LTB	311	149.000	13.5E+3	13.5E+3	21.1E+3
320	TUB250250	TUB2502500	0.157	1.000	0.157	EC-5.5.4	312	149.000	13.5E+3	13.5E+3	21.1E+3
321	HE 140 A	HE140 A	0.150	1.000	0.150	EC-5.5.4.LTB	312	31.400	1.03E+3	389.000	8.100
322	TUB250250	TUB2502500	0.134	1.000	0.134	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
323	TUB250250	TUB2502500	0.134	1.000	0.134	EC-5.5.3	312	149.000	13.5E+3	13.5E+3	21.1E+3
372	HE220B	HE220B	0.747	1.000	0.747	EC-5.5.4.LTB	311	91.000	8.09E+3	2.84E+3	76.600
373	HE220B	HE220B	0.743	1.000	0.743	EC-5.5.4.LTB	311	91.000	8.09E+3	2.84E+3	76.600
374	HE220B	HE220B	0.922	1.000	0.922	EC-5.5.2 LTB	311	91.000	8.09E+3	2.84E+3	76.600
375	HE220B	HE220B	0.922	1.000	0.922	EC-5.5.2 LTB	311	91.000	8.09E+3	2.84E+3	76.600
376	HE220B	HE220B	0.964	1.000	0.964	EC-5.5.2 LTB	311	91.000	8.09E+3	2.84E+3	76.600
377	HE220B	HE220B	0.964	1.000	0.964	EC-5.5.2 LTB	311	91.000	8.09E+3	2.84E+3	76.600
378	HE220B	HE220B	0.964	1.000	0.964	EC-5.5.2 LTB	311	91.000	8.09E+3	2.84E+3	76.600
379	HE220B	HE220B	0.964	1.000	0.964	EC-5.5.2 LTB	311	91.000	8.09E+3	2.84E+3	76.600
380	HE220B	HE220B	0.922	1.000	0.922	EC-5.5.2 LTB	311	91.000	8.09E+3	2.84E+3	76.600
381	HE220B	HE220B	0.922	1.000	0.922	EC-5.5.2 LTB	311	91.000	8.09E+3	2.84E+3	76.600
382	HE220B	HE220B	0.746	1.000	0.746	EC-5.5.4.LTB	311	91.000	8.09E+3	2.84E+3	76.600
383	HE220B	HE220B	0.742	1.000	0.742	EC-5.5.4.LTB	311	91.000	8.09E+3	2.84E+3	76.600
384	HE220B	HE220B	0.734	1.000	0.734	EC-5.5.4.LTB	312	91.000	8.09E+3	2.84E+3	76.600
385	HE220B	HE220B	0.731	1.000	0.731	EC-5.5.4.LTB	312	91.000	8.09E+3	2.84E+3	76.600
386	HE220B	HE220B	0.918	1.000	0.918	EC-5.5.2 LTB	312	91.000	8.09E+3	2.84E+3	76.600
387	HE220B	HE220B	0.918	1.000	0.918	EC-5.5.2 LTB	312	91.000	8.09E+3	2.84E+3	76.600
388	HE220B	HE220B	0.974	1.000	0.974	EC-5.5.2 LTB	312	91.000	8.09E+3	2.84E+3	76.600
389	HE220B	HE220B	0.974	1.000	0.974	EC-5.5.2 LTB	312	91.000	8.09E+3	2.84E+3	76.600
390	HE220B	HE220B	0.974	1.000	0.974	EC-5.5.2 LTB	312	91.000	8.09E+3	2.84E+3	76.600
391	HE220B	HE220B	0.974	1.000	0.974	EC-5.5.2 LTB	312	91.000	8.09E+3	2.84E+3	76.600
392	HE220B	HE220B	0.918	1.000	0.918	EC-5.5.2 LTB	312	91.000	8.09E+3	2.84E+3	76.600
393	HE220B	HE220B	0.918	1.000	0.918	EC-5.5.2 LTB	312	91.000	8.09E+3	2.84E+3	76.600
394	HE220B	HE220B	0.733	1.000	0.733	EC-5.5.4.LTB	312	91.000	8.09E+3	2.84E+3	76.600
395	HE220B	HE220B	0.731	1.000	0.731	EC-5.5.4.LTB	312	91.000	8.09E+3	2.84E+3	76.600
444	TUB120120	TUB120120	0.361	1.000	0.361	EC-5.4.3 (T)	312	28.500	610.000	610.000	949.000
445	TUB120120	TUB120120	0.305	1.000	0.305	EC-5.4.3 (T)	311	28.500	610.000	610.000	949.000
446	TUB300300	TUB3003000	0.383	1.000	0.383	EC-eq(5.36)	311	181.000	24.2E+3	24.2E+3	37.6E+3
447	TUB300300	TUB3003000	0.383	1.000	0.383	EC-eq(5.36)	311	181.000	24.2E+3	24.2E+3	37.6E+3
448	TUB300300	TUB3003000	0.431	1.000	0.431	EC-eq(5.36)	312	181.000	24.2E+3	24.2E+3	37.6E+3
449	TUB300300	TUB3003000	0.431	1.000	0.431	EC-eq(5.36)	312	181.000	24.2E+3	24.2E+3	37.6E+3
450	TUB120120	TUB1201200	0.631	1.000	0.631	EC-5.5.4	312	43.500	870.000	870.000	1.38E+3
451	TUB120120	TUB1201200	0.631	1.000	0.631	EC-5.5.4	312	43.500	870.000	870.000	1.38E+3

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Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	146	312:ALS EXPL	5.828	-0.573	-1.907	6.159	-0.000	-0.000	-0.000
Min X	145	312:ALS EXPL	-5.828	-0.573	-1.907	6.157	-0.000	0.000	0.000
Max Y	97	312:ALS EXPL	0.058	13.252	-0.870	13.281	-0.000	0.000	0.005
Min Y	79	312:ALS EXPL	-0.004	-67.856	-0.409	67.857	-0.004	0.000	-0.001
Max Z	145	311:ALS EXPL	-0.759	-0.571	0.098	0.954	0.000	0.000	0.001
Min Z	146	312:ALS EXPL	5.828	-0.573	-1.907	6.159	-0.000	-0.000	-0.000
Max rX	92	311:ALS EXPL	0.043	-31.207	-0.983	31.223	0.020	-0.000	0.008
Min rX	68	312:ALS EXPL	-0.005	-13.411	-0.402	13.417	-0.028	-0.000	0.005
Max rY	129	311:ALS EXPL	0.000	-1.072	-0.000	1.072	0.000	0.000	0.003
Min rY	128	311:ALS EXPL	-0.000	-1.072	-0.000	1.072	0.000	-0.000	-0.003
Max rZ	82	312:ALS EXPL	-0.009	-7.497	-0.393	7.508	0.001	0.000	0.036
Min rZ	75	312:ALS EXPL	0.009	-7.494	-0.393	7.504	0.001	-0.000	-0.036
Max Rst	79	312:ALS EXPL	-0.004	-67.856	-0.409	67.857	-0.004	0.000	-0.001

Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (m)	X (mm)	Y (mm)	Z (mm)	Resultant (mm)
Max X	4	312:ALS EXPL	1.900	6.809	-5.640	-2.267	8.761
Min X	14	312:ALS EXPL	2.850	-6.814	-5.641	-2.268	8.766
Max Y	199	312:ALS EXPL	0.857	-0.048	14.726	-0.888	14.752
Min Y	158	312:ALS EXPL	0.857	-0.012	-68.757	-0.407	68.758
Max Z	23	312:ALS EXPL	2.850	0.000	-10.519	6.698	12.414
Min Z	25	312:ALS EXPL	2.375	0.001	-9.924	-5.861	11.420
Max Rst	158	312:ALS EXPL	0.857	-0.012	-68.757	-0.407	68.758

Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	128	311:ALS EXPL	12.030	0.000	291.173	0.000	0.000	0.000
Min FX	129	311:ALS EXPL	-12.030	0.000	291.286	0.000	0.000	0.000
Max FY	3	311:ALS EXPL	0.000	1.01E+3	-291.286	0.000	0.000	0.000
Min FY	128	311:ALS EXPL	12.030	0.000	291.173	0.000	0.000	0.000
Max FZ	129	311:ALS EXPL	-12.030	0.000	291.286	0.000	0.000	0.000
Min FZ	3	311:ALS EXPL	0.000	1.01E+3	-291.286	0.000	0.000	0.000
Max MX	2	311:ALS EXPL	0.000	1.01E+3	-291.173	0.000	0.000	0.000
Min MX	2	311:ALS EXPL	0.000	1.01E+3	-291.173	0.000	0.000	0.000
Max MY	2	311:ALS EXPL	0.000	1.01E+3	-291.173	0.000	0.000	0.000
Min MY	2	311:ALS EXPL	0.000	1.01E+3	-291.173	0.000	0.000	0.000
Max MZ	2	311:ALS EXPL	0.000	1.01E+3	-291.173	0.000	0.000	0.000
Min MZ	2	311:ALS EXPL	0.000	1.01E+3	-291.173	0.000	0.000	0.000

A.5.1.5 Fire action inplace (ALS) LC 411

Software licensed to	Job No	Sheet No 1	Rev
	Part		
Job Title	Ref		
	By	Date 5-Jan-15	Chd
Client	File INPLACE MASTER THES	Date/Time 23-Apr-2015 13:07	

Job Information

	Engineer	Checked	Approved
Name:			
Date:	5-Jan-15		

Structure Type	SPACE FRAME

Number of Nodes	91	Highest Node	146
Number of Elements	158	Highest Beam	451
Number of Plates	48	Highest Plate	443

Number of Basic Load Cases	31
Number of Combination Load Cases	1

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Combination	411	ALS FIRE LOAD

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
1	TUB300300	TUB3003000	0.272	1.000	0.272	EC-eq(5.36)	411	181.000	24.2E+3	24.2E+3	37.6E+3
2	TUB250250	TUB2502500	0.430	1.000	0.430	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
4	TUB250250	TUB2502500	0.254	1.000	0.254	EC-5.5.4.LTB	411	77.100	7.51E+3	7.51E+3	11.5E+3
5	TUB250250	TUB2502500	0.140	1.000	0.140	EC-5.5.4.LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
6	TUB250250	TUB2502500	0.381	1.000	0.381	EC-5.5.4.LTB	411	77.100	7.51E+3	7.51E+3	11.5E+3
7	TUB250250	TUB2502500	0.085	1.000	0.085	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
8	TUB250250	TUB2502500	0.085	1.000	0.085	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
13	TUB250250	TUB2502500	0.381	1.000	0.381	EC-5.5.4.LTB	411	77.100	7.51E+3	7.51E+3	11.5E+3
14	TUB250250	TUB2502500	0.254	1.000	0.254	EC-5.5.4.LTB	411	77.100	7.51E+3	7.51E+3	11.5E+3
17	TUB300300	TUB3003000	0.272	1.000	0.272	EC-eq(5.36)	411	181.000	24.2E+3	24.2E+3	37.6E+3
21	TUB250250	TUB2502500	0.280	1.000	0.280	EC-5.5.4.LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
23	TUB120120	TUB1201200	0.668	1.000	0.668	EC-5.5.4	411	43.500	870.000	870.000	1.38E+3
25	TUB120120	TUB1201200	0.296	1.000	0.296	EC-5.5.4	411	43.500	870.000	870.000	1.38E+3
26	TUB250250	TUB2502500	0.378	1.000	0.378	EC-5.5.4	411	149.000	13.5E+3	13.5E+3	21.1E+3
28	TUB120120	TUB1201200	0.011	1.000	0.011	EC-eq(5.36)	411	43.500	870.000	870.000	1.38E+3
30	TUB120120	TUB1201200	0.024	1.000	0.024	EC-5.4.3 (T)	411	43.500	870.000	870.000	1.38E+3
31	TUB250250	TUB2502500	0.236	1.000	0.236	EC-5.5.4.LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
32	TUB250250	TUB2502500	0.209	1.000	0.209	EC-5.5.4.LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
33	TUB250250	TUB2502500	0.154	1.000	0.154	EC-5.5.2 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
34	TUB250250	TUB2502500	0.378	1.000	0.378	EC-5.5.4	411	149.000	13.5E+3	13.5E+3	21.1E+3
35	TUB250250	TUB2502500	0.280	1.000	0.280	EC-5.5.4.LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
36	TUB250250	TUB2502500	0.174	1.000	0.174	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
37	TUB250250	TUB2502500	0.355	1.000	0.355	EC-5.5.4.LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
38	TUB250250	TUB2502500	0.210	1.000	0.210	EC-5.5.4.LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
39	TUB250250	TUB2502500	0.174	1.000	0.174	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
40	TUB250250	TUB2502500	0.476	1.000	0.476	EC-5.5.4.LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
41	TUB250250	TUB250250	0.150	1.000	0.150	EC-5.5.4	411	149.000	13.5E+3	13.5E+3	21.1E+3
42	TUB250250	TUB250250	0.154	1.000	0.154	EC-5.5.2 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
67	TUB250250	TUB250250	0.088	1.000	0.088	EC-eq(5.36)	411	149.000	13.5E+3	13.5E+3	21.1E+3
68	TUB250250	TUB250250	0.088	1.000	0.088	EC-eq(5.36)	411	149.000	13.5E+3	13.5E+3	21.1E+3
73	HE140A	HE140A	0.293	1.000	0.293	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
74	HE140A	HE140A	0.131	1.000	0.131	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
75	HE140A	HE140A	0.095	1.000	0.095	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
76	HE140A	HE140A	0.129	1.000	0.129	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
77	HE140A	HE140A	0.166	1.000	0.166	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
103	TUB120120	TUB120120	0.292	1.000	0.292	EC-5.4.3 (T)	411	28.500	610.000	610.000	949.000
106	TUB120120	TUB120120	0.283	1.000	0.283	EC-5.4.3 (T)	411	28.500	610.000	610.000	949.000
107	TUB140140	TUB140140	0.338	1.000	0.338	EC-5.4.3 (T)	411	41.900	1.21E+3	1.21E+3	1.89E+3
108	TUB140140	TUB140140	0.343	1.000	0.343	EC-5.4.3 (T)	411	41.900	1.21E+3	1.21E+3	1.89E+3
109	TUB140140	TUB140140	0.338	1.000	0.338	EC-5.4.3 (T)	411	41.900	1.21E+3	1.21E+3	1.89E+3
110	TUB140140	TUB140140	0.344	1.000	0.344	EC-5.4.3 (T)	411	41.900	1.21E+3	1.21E+3	1.89E+3
116	HE240B	HE240B	0.101	1.000	0.101	EC-eq(5.36)	411	106.000	11.3E+3	3.92E+3	103.000
117	HE240B	HE240B	0.144	1.000	0.144	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
119	HE240B	HE240B	0.275	1.000	0.275	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
120	HE240B	HE240B	0.451	1.000	0.451	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
121	HE240B	HE240B	0.187	1.000	0.187	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
122	HE240B	HE240B	0.111	1.000	0.111	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
124	HE240B	HE240B	0.279	1.000	0.279	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
125	HE240B	HE240B	0.111	1.000	0.111	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
127	HE240B	HE240B	0.275	1.000	0.275	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
128	HE240B	HE240B	0.144	1.000	0.144	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
130	HE240B	HE240B	0.279	1.000	0.279	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
131	HE240B	HE240B	0.111	1.000	0.111	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
133	HE240B	HE240B	0.187	1.000	0.187	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
134	HE240B	HE240B	0.111	1.000	0.111	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
136	HE240B	HE240B	0.451	1.000	0.451	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
138	HE240B	HE240B	0.138	1.000	0.138	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
145	HE240B	HE240B	0.138	1.000	0.138	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
146	HE240B	HE240B	0.097	1.000	0.097	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
153	HE240B	HE240B	0.097	1.000	0.097	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
154	HE140A	HE140A	0.192	1.000	0.192	EC-5.5.2 LTB	411	31.400	1.03E+3	389.000	8.100
155	HE140A	HE140A	0.206	1.000	0.206	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
156	HE140A	HE140A	0.094	1.000	0.094	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
157	HE140A	HE140A	0.060	1.000	0.060	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
158	HE140A	HE140A	0.094	1.000	0.094	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
159	HE140A	HE140A	0.206	1.000	0.206	EC-5.5.4.LTB	411	31.400	1.03E+3	389.000	8.100
160	HE140A	HE140A	0.192	1.000	0.192	EC-5.5.2 LTB	411	31.400	1.03E+3	389.000	8.100
161	HE240B	HE240B	0.101	1.000	0.101	EC-eq(5.36)	411	106.000	11.3E+3	3.92E+3	103.000
162	HE240B	HE240B	0.666	1.000	0.666	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
163	HE240B	HE240B	0.350	1.000	0.350	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
164	HE240B	HE240B	0.160	1.000	0.160	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
165	HE240B	HE240B	0.194	1.000	0.194	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
166	HE240B	HE240B	0.129	1.000	0.129	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
167	HE240B	HE240B	0.078	1.000	0.078	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
168	HE240B	HE240B	0.194	1.000	0.194	EC-5.5.4.LTB	411	106.000	11.3E+3	3.92E+3	103.000
169	HE240B	HE240B	0.178	1.000	0.178	EC-eq(5.36)	411	106.000	11.3E+3	3.92E+3	103.000

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
171	HE240B	HE240B	0.117	1.000	0.117	EC-5.5.4 LTB	411	106.000	11.3E+3	3.92E+3	103.000
172	HE240B	HE240B	0.335	1.000	0.335	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
174	HE240B	HE240B	0.120	1.000	0.120	EC-5.5.4 LTB	411	106.000	11.3E+3	3.92E+3	103.000
175	HE240B	HE240B	0.350	1.000	0.350	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
177	HE240B	HE240B	0.129	1.000	0.129	EC-5.5.4 LTB	411	106.000	11.3E+3	3.92E+3	103.000
178	HE240B	HE240B	0.335	1.000	0.335	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
180	HE240B	HE240B	0.120	1.000	0.120	EC-5.5.4 LTB	411	106.000	11.3E+3	3.92E+3	103.000
181	HE240B	HE240B	0.179	1.000	0.179	EC-eq(5.36)	411	106.000	11.3E+3	3.92E+3	103.000
183	HE240B	HE240B	0.117	1.000	0.117	EC-5.5.4 LTB	411	106.000	11.3E+3	3.92E+3	103.000
184	HE240B	HE240B	0.666	1.000	0.666	EC-5.5.2 LTB	411	106.000	11.3E+3	3.92E+3	103.000
186	HE240B	HE240B	0.078	1.000	0.078	EC-5.5.4 LTB	411	106.000	11.3E+3	3.92E+3	103.000
194	HE140A	HE140A	0.164	1.000	0.164	EC-5.5.2 LTB	411	31.400	1.03E+3	389.000	8.100
195	HE140A	HE140A	0.181	1.000	0.181	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
196	HE140A	HE140A	0.087	1.000	0.087	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
197	HE140A	HE140A	0.083	1.000	0.083	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
198	HE140A	HE140A	0.087	1.000	0.087	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
199	HE140A	HE140A	0.181	1.000	0.181	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
200	HE140A	HE140A	0.164	1.000	0.164	EC-5.5.2 LTB	411	31.400	1.03E+3	389.000	8.100
256	HE240B	HE240B	0.160	1.000	0.160	EC-5.5.4 LTB	411	106.000	11.3E+3	3.92E+3	103.000
269	TUB250250	TUB2502500	0.154	1.000	0.154	EC-5.5.2 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
270	TUB250250	TUB2502500	0.173	1.000	0.173	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
271	TUB250250	TUB2502500	0.173	1.000	0.173	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
272	TUB250250	TUB2502500	0.154	1.000	0.154	EC-5.5.2 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
273	TUB160160	TUB160160	0.310	1.000	0.310	EC-5.5.4	411	37.700	1.46E+3	1.46E+3	2.33E+3
274	TUB160160	TUB160160	0.310	1.000	0.310	EC-5.5.4	411	37.700	1.46E+3	1.46E+3	2.33E+3
275	TUB300300	TUB3003000	0.001	1.000	0.001	EC-5.4.6-(Y)	411	181.000	24.2E+3	24.2E+3	37.6E+3
276	TUB300300	TUB3003000	0.001	1.000	0.001	EC-5.4.6-(Y)	411	181.000	24.2E+3	24.2E+3	37.6E+3
301	TUB250250	TUB2502500	0.355	1.000	0.355	EC-5.5.4 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
302	TUB250250	TUB2502500	0.210	1.000	0.210	EC-5.5.4 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
303	TUB250250	TUB2502500	0.236	1.000	0.236	EC-5.5.4 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
304	TUB250250	TUB2502500	0.209	1.000	0.209	EC-5.5.4 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
305	TUB250250	TUB2502500	0.430	1.000	0.430	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
306	TUB250250	TUB2502500	0.140	1.000	0.140	EC-5.5.4 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
307	HE140A	HE140A	0.129	1.000	0.129	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
308	HE140A	HE140A	0.095	1.000	0.095	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
309	HE140A	HE140A	0.131	1.000	0.131	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
310	HE140A	HE140A	0.293	1.000	0.293	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
311	TUB250250	TUB2502500	0.165	1.000	0.165	EC-5.5.2 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
312	TUB250250	TUB2502500	0.185	1.000	0.185	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
313	TUB250250	TUB2502500	0.165	1.000	0.165	EC-5.5.2 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
314	TUB250250	TUB2502500	0.132	1.000	0.132	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
315	TUB250250	TUB2502500	0.165	1.000	0.165	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
316	TUB250250	TUB2502500	0.185	1.000	0.185	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
317	TUB250250	TUB2502500	0.165	1.000	0.165	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
318	TUB250250	TUB2502500	0.132	1.000	0.132	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
319	TUB250250	TUB2502500	0.476	1.000	0.476	EC-5.5.4 LTB	411	149.000	13.5E+3	13.5E+3	21.1E+3
320	TUB250250	TUB2502500	0.150	1.000	0.150	EC-5.5.4	411	149.000	13.5E+3	13.5E+3	21.1E+3
321	HE140A	HE140A	0.166	1.000	0.166	EC-5.5.4 LTB	411	31.400	1.03E+3	389.000	8.100
322	TUB250250	TUB2502500	0.132	1.000	0.132	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3
323	TUB250250	TUB2502500	0.132	1.000	0.132	EC-5.5.3	411	149.000	13.5E+3	13.5E+3	21.1E+3

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
372	HE220B	HE220B	0.201	1.000	0.201	EC-5.5.4.LTB	411	91.000	8.09E+3	2.84E+3	76.500
373	HE220B	HE220B	0.197	1.000	0.197	EC-5.5.4.LTB	411	91.000	8.09E+3	2.84E+3	76.500
374	HE220B	HE220B	0.213	1.000	0.213	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
375	HE220B	HE220B	0.213	1.000	0.213	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
376	HE220B	HE220B	0.194	1.000	0.194	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
377	HE220B	HE220B	0.194	1.000	0.194	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
378	HE220B	HE220B	0.194	1.000	0.194	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
379	HE220B	HE220B	0.194	1.000	0.194	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
380	HE220B	HE220B	0.213	1.000	0.213	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
381	HE220B	HE220B	0.213	1.000	0.213	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
382	HE220B	HE220B	0.201	1.000	0.201	EC-5.5.4.LTB	411	91.000	8.09E+3	2.84E+3	76.500
383	HE220B	HE220B	0.197	1.000	0.197	EC-5.5.4.LTB	411	91.000	8.09E+3	2.84E+3	76.500
384	HE220B	HE220B	0.193	1.000	0.193	EC-5.5.4.LTB	411	91.000	8.09E+3	2.84E+3	76.500
385	HE220B	HE220B	0.191	1.000	0.191	EC-5.5.4.LTB	411	91.000	8.09E+3	2.84E+3	76.500
386	HE220B	HE220B	0.211	1.000	0.211	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
387	HE220B	HE220B	0.211	1.000	0.211	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
388	HE220B	HE220B	0.201	1.000	0.201	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
389	HE220B	HE220B	0.201	1.000	0.201	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
390	HE220B	HE220B	0.201	1.000	0.201	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
391	HE220B	HE220B	0.201	1.000	0.201	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
392	HE220B	HE220B	0.211	1.000	0.211	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
393	HE220B	HE220B	0.211	1.000	0.211	EC-5.5.2 LTB	411	91.000	8.09E+3	2.84E+3	76.500
394	HE220B	HE220B	0.193	1.000	0.193	EC-5.5.4.LTB	411	91.000	8.09E+3	2.84E+3	76.500
395	HE220B	HE220B	0.191	1.000	0.191	EC-5.5.4.LTB	411	91.000	8.09E+3	2.84E+3	76.500
444	TUB120120	TUB120120	0.283	1.000	0.283	EC-5.4.3 (T)	411	28.500	610.000	610.000	949.000
445	TUB120120	TUB120120	0.292	1.000	0.292	EC-5.4.3 (T)	411	28.500	610.000	610.000	949.000
446	TUB300300	TUB300300	0.339	1.000	0.339	EC-eq(5.36)	411	181.000	24.2E+3	24.2E+3	37.6E+3
447	TUB300300	TUB300300	0.339	1.000	0.339	EC-eq(5.36)	411	181.000	24.2E+3	24.2E+3	37.6E+3
448	TUB300300	TUB300300	0.383	1.000	0.383	EC-eq(5.36)	411	181.000	24.2E+3	24.2E+3	37.6E+3
449	TUB300300	TUB300300	0.384	1.000	0.384	EC-eq(5.36)	411	181.000	24.2E+3	24.2E+3	37.6E+3
450	TUB120120	TUB120120	0.654	1.000	0.654	EC-5.5.4	411	43.500	870.000	870.000	1.38E+3
451	TUB120120	TUB120120	0.654	1.000	0.654	EC-5.5.4	411	43.500	870.000	870.000	1.38E+3

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	146	411:ALS FIRE I	**4.240**	-0.577	-1.604	4.570	-0.000	-0.000	-0.001
Min X	145	411:ALS FIRE I	**-4.238**	-0.577	-1.604	4.569	-0.000	0.000	0.001
Max Y	131	411:ALS FIRE I	-0.054	**0.922**	0.000	0.924	0.002	0.000	0.003
Min Y	18	411:ALS FIRE I	0.000	**-32.709**	-0.411	32.712	0.000	0.000	0.000
Max Z	6	411:ALS FIRE I	0.148	-6.618	**0.036**	6.620	-0.001	0.000	-0.003
Min Z	146	411:ALS FIRE I	4.240	-0.577	**-1.604**	4.570	-0.000	-0.000	-0.001
Max rX	94	411:ALS FIRE I	0.114	-8.653	-1.010	8.712	**0.006**	-0.000	0.008
Min rX	68	411:ALS FIRE I	-0.005	-10.153	-0.398	10.161	**-0.009**	-0.000	0.001
Max rY	129	411:ALS FIRE I	0.000	-0.818	-0.000	0.818	0.000	**0.000**	0.004
Min rY	128	411:ALS FIRE I	-0.000	-0.818	-0.000	0.818	0.000	**-0.000**	-0.004
Max rZ	82	411:ALS FIRE I	-0.012	-4.075	-0.393	4.094	0.001	0.000	**0.012**
Min rZ	75	411:ALS FIRE I	0.012	-4.073	-0.393	4.092	0.001	-0.000	**-0.012**

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	By	Date 5-Jan-15	Chd
Client	File INPLACE MASTER THES	Date/Time 23-Apr-2015 13:07	

Node Displacement Summary Cont...

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max Rst	18	411:ALS FIRE I	0.000	-32.709	-0.411	32.712	0.000	0.000	0.000

Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (m)	X (mm)	Y (mm)	Z (mm)	Resultant (mm)
Max X	451	411:ALS FIRE I	0.515	4.478	-0.759	-1.775	4.877
Min X	450	411:ALS FIRE I	0.515	-4.478	-0.759	-1.775	4.876
Max Y	276	411:ALS FIRE I	0.000	-0.054	0.922	0.000	0.924
Min Y	312	411:ALS FIRE I	1.100	0.001	-33.463	-0.014	33.463
Max Z	23	411:ALS FIRE I	2.850	0.001	-11.423	5.872	12.623
Min Z	25	411:ALS FIRE I	2.375	0.000	-9.965	-2.742	10.336
Max Rst	312	411:ALS FIRE I	1.100	0.001	-33.463	-0.014	33.463

Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	128	411:ALS FIRE I	10.508	0.000	291.204	0.000	0.000	0.000
Min FX	129	411:ALS FIRE I	-10.508	0.000	291.255	0.000	0.000	0.000
Max FY	3	411:ALS FIRE I	0.000	1.01E+3	-291.255	0.000	0.000	0.000
Min FY	128	411:ALS FIRE I	10.508	0.000	291.204	0.000	0.000	0.000
Max FZ	129	411:ALS FIRE I	-10.508	0.000	291.255	0.000	0.000	0.000
Min FZ	3	411:ALS FIRE I	0.000	1.01E+3	-291.255	0.000	0.000	0.000
Max MX	2	411:ALS FIRE I	0.000	1.01E+3	-291.204	0.000	0.000	0.000
Min MX	2	411:ALS FIRE I	0.000	1.01E+3	-291.204	0.000	0.000	0.000
Max MY	2	411:ALS FIRE I	0.000	1.01E+3	-291.204	0.000	0.000	0.000
Min MY	2	411:ALS FIRE I	0.000	1.01E+3	-291.204	0.000	0.000	0.000
Max MZ	2	411:ALS FIRE I	0.000	1.01E+3	-291.204	0.000	0.000	0.000
Min MZ	2	411:ALS FIRE I	0.000	1.01E+3	-291.204	0.000	0.000	0.000

A.5.1.6 Transport, ULS-a/b, LC181-198

Software licensed to		Job No	Sheet No 1	Rev
		Part		
Job Title	Master Thesis Spring 2015	Ref		
		By Gholam Sakhi Sakh 5-Jan-15	Chd	
Client	University of Stavanger	File MASTER THESIS TRANS	Date/Time 06-May-2015 09:45	

Job Information

	Engineer	Checked	Approved
Name:	Gholam Sakhi Sakha		
Date:	5-Jan-15		

Structure Type	SPACE FRAME

Number of Nodes	91	Highest Node	146
Number of Elements	160	Highest Beam	472
Number of Plates	48	Highest Plate	443

Number of Basic Load Cases	25
Number of Combination Load Cases	16

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Combination	181	TRANSPORT: ULS-A + X + Y
Combination	182	TRANSPORT:ULS-A+ X + Z + Y
Combination	183	TRANSPORT: ULS-A + Z + Y
Combination	184	TRANSPORT: ULS-A - X + Z + Y
Combination	185	TRANSPORT: ULS-A - X + Y
Combination	186	TRANSPORT: ULS-A - X - Z + Y
Combination	187	TRANSPORT: ULS- A - Z + Y
Combination	188	TRANSPORT: ULS-A - Z + X + Y
Combination	191	TRANSPORT: ULS-A + X - Y
Combination	192	TRANSPORT:ULS-A+ X + Z - Y
Combination	193	TRANSPORT: ULS-A + Z - Y
Combination	194	TRANSPORT: ULS-A - X + Z - Y
Combination	195	TRANSPORT: ULS-A - X - Y
Combination	196	TRANSPORT: ULS-A - X - Z - Y
Combination	197	TRANSPORT: ULS- A - Z - Y
Combination	198	TRANSPORT: ULS-A - Z + X - Y

Print Time/Date: 06/05/2015 09:59 STAAD.Pro for Windows 2007.04.12 Print Run 1 of 6

Software licensed to	Job No	Sheet No 2	Rev
Job Title Master Thesis Spring 2015	Part		
	Ref		
	By Gholam Sakhi Sakhi 5-Jan-15	Chd	
Client University of Stavanger	File MASTER THESIS TRANS	Date/Time 06-May-2015 09:45	

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
1	TUB300300	TUB3003001	0.214	1.000	0.214	EC-5.5.4.LTB	197	181.000	24.2E+3	24.2E+3	37.6E+3
2	TUB250250	TUB2502501	0.140	1.000	0.140	EC-eq(5.36)	196	149.000	13.5E+3	13.5E+3	21.1E+3
4	TUB250250	TUB2502500	0.376	1.000	0.376	EC-5.5.4.LTB	194	77.100	7.51E+3	7.51E+3	11.5E+3
5	TUB250250	TUB2502501	0.085	1.000	0.085	EC-5.5.4.LTB	195	149.000	13.5E+3	13.5E+3	21.1E+3
6	TUB250250	TUB2502500	0.207	1.000	0.207	EC-5.5.4.LTB	192	77.100	7.51E+3	7.51E+3	11.5E+3
7	TUB250250	TUB2502501	0.046	1.000	0.046	EC-5.5.4.LTB	197	149.000	13.5E+3	13.5E+3	21.1E+3
8	TUB250250	TUB2502501	0.040	1.000	0.040	EC-5.5.4.LTB	196	149.000	13.5E+3	13.5E+3	21.1E+3
13	TUB250250	TUB2502500	0.208	1.000	0.208	EC-5.5.4.LTB	194	77.100	7.51E+3	7.51E+3	11.5E+3
14	TUB250250	TUB2502500	0.377	1.000	0.377	EC-5.5.4.LTB	192	77.100	7.51E+3	7.51E+3	11.5E+3
17	TUB300300	TUB3003001	0.215	1.000	0.215	EC-5.5.4.LTB	197	181.000	24.2E+3	24.2E+3	37.6E+3
21	TUB250250	TUB2502501	0.069	1.000	0.069	EC-5.5.4.LTB	197	149.000	13.5E+3	13.5E+3	21.1E+3
23	TUB120120	TUB1201201	0.328	1.000	0.328	EC-5.5.4	194	43.500	870.000	870.000	1.38E+3
25	TUB120120	TUB1201201	0.245	1.000	0.245	EC-5.5.4.LTB	194	43.500	870.000	870.000	1.38E+3
26	TUB250250	TUB2502501	0.107	1.000	0.107	EC-eq(5.36)	197	149.000	13.5E+3	13.5E+3	21.1E+3
28	TUB120120	TUB1201201	0.072	1.000	0.072	EC-5.5.4	193	43.500	870.000	870.000	1.38E+3
30	TUB120120	TUB1201201	0.075	1.000	0.075	EC-5.5.4.LTB	192	43.500	870.000	870.000	1.38E+3
31	TUB250250	TUB2502501	0.061	1.000	0.061	EC-eq(5.36)	198	149.000	13.5E+3	13.5E+3	21.1E+3
32	TUB250250	TUB2502501	0.065	1.000	0.065	EC-5.5.4	196	149.000	13.5E+3	13.5E+3	21.1E+3
33	TUB250250	TUB2502501	0.033	1.000	0.033	EC-5.5.2 LTB	194	149.000	13.5E+3	13.5E+3	21.1E+3
34	TUB250250	TUB2502501	0.106	1.000	0.106	EC-eq(5.36)	197	149.000	13.5E+3	13.5E+3	21.1E+3
35	TUB250250	TUB2502501	0.068	1.000	0.068	EC-5.5.4.LTB	197	149.000	13.5E+3	13.5E+3	21.1E+3
36	TUB250250	TUB2502501	0.038	1.000	0.038	EC-5.5.4	192	149.000	13.5E+3	13.5E+3	21.1E+3
37	TUB250250	TUB2502501	0.094	1.000	0.094	EC-eq(5.36)	197	149.000	13.5E+3	13.5E+3	21.1E+3
38	TUB250250	TUB2502501	0.075	1.000	0.075	EC-5.5.4	197	149.000	13.5E+3	13.5E+3	21.1E+3
39	TUB250250	TUB2502501	0.038	1.000	0.038	EC-5.5.4	194	149.000	13.5E+3	13.5E+3	21.1E+3
40	TUB250250	TUB2502501	0.149	1.000	0.149	EC-5.5.3	198	149.000	13.5E+3	13.5E+3	21.1E+3
41	TUB250250	TUB2502501	0.056	1.000	0.056	EC-5.5.4	192	149.000	13.5E+3	13.5E+3	21.1E+3
42	TUB250250	TUB2502501	0.033	1.000	0.033	EC-5.5.2 LTB	191	149.000	13.5E+3	13.5E+3	21.1E+3
67	TUB250250	TUB2502501	0.030	1.000	0.030	EC-eq(5.36)	194	149.000	13.5E+3	13.5E+3	21.1E+3
68	TUB250250	TUB2502501	0.030	1.000	0.030	EC-eq(5.36)	192	149.000	13.5E+3	13.5E+3	21.1E+3
73	HE140A	HE140A	0.052	1.000	0.052	EC-5.5.4.LTB	195	31.400	1.03E+3	389.000	8.100
74	HE140A	HE140A	0.044	1.000	0.044	EC-5.5.4.LTB	198	31.400	1.03E+3	389.000	8.100
75	HE140A	HE140A	0.036	1.000	0.036	EC-5.5.4.LTB	197	31.400	1.03E+3	389.000	8.100
76	HE140A	HE140A	0.043	1.000	0.043	EC-5.5.4.LTB	196	31.400	1.03E+3	389.000	8.100
77	HE140A	HE140A	0.045	1.000	0.045	EC-5.5.4.LTB	197	31.400	1.03E+3	389.000	8.100
116	HE240B	HE240B	0.124	1.000	0.124	EC-5.5.4.LTB	195	106.000	11.3E+3	3.92E+3	103.000
117	HE240B	HE240B	0.132	1.000	0.132	EC-5.5.4.LTB	191	106.000	11.3E+3	3.92E+3	103.000
119	HE240B	HE240B	0.190	1.000	0.190	EC-5.5.4	193	106.000	11.3E+3	3.92E+3	103.000
120	HE240B	HE240B	0.211	1.000	0.211	EC-5.5.4.LTB	196	106.000	11.3E+3	3.92E+3	103.000
121	HE240B	HE240B	0.105	1.000	0.105	EC-5.5.2 LTB	198	106.000	11.3E+3	3.92E+3	103.000
122	HE240B	HE240B	0.098	1.000	0.098	EC-5.5.4.LTB	195	106.000	11.3E+3	3.92E+3	103.000
124	HE240B	HE240B	0.105	1.000	0.105	EC-5.5.2 LTB	198	106.000	11.3E+3	3.92E+3	103.000
125	HE240B	HE240B	0.100	1.000	0.100	EC-5.5.4.LTB	195	106.000	11.3E+3	3.92E+3	103.000
127	HE240B	HE240B	0.190	1.000	0.190	EC-5.5.4	193	106.000	11.3E+3	3.92E+3	103.000
128	HE240B	HE240B	0.132	1.000	0.132	EC-5.5.4.LTB	195	106.000	11.3E+3	3.92E+3	103.000
130	HE240B	HE240B	0.105	1.000	0.105	EC-5.5.2 LTB	196	106.000	11.3E+3	3.92E+3	103.000
131	HE240B	HE240B	0.100	1.000	0.100	EC-5.5.4.LTB	191	106.000	11.3E+3	3.92E+3	103.000
133	HE240B	HE240B	0.105	1.000	0.105	EC-5.5.2 LTB	196	106.000	11.3E+3	3.92E+3	103.000
134	HE240B	HE240B	0.099	1.000	0.099	EC-5.5.4.LTB	191	106.000	11.3E+3	3.92E+3	103.000
136	HE240B	HE240B	0.211	1.000	0.211	EC-5.5.4.LTB	198	106.000	11.3E+3	3.92E+3	103.000

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	By Gholam Sakhi Sakhi/5-Jan-15	Chd	
Client University of Stavanger	File MASTER THESIS TRANS	Date/Time 06-May-2015 09:45	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
138	HE240B	HE240B	0.070	1.000	0.070	EC-5.5.4.LTB	197	106.000	11.3E+3	3.92E+3	103.000
145	HE240B	HE240B	0.071	1.000	0.071	EC-5.5.4.LTB	197	106.000	11.3E+3	3.92E+3	103.000
146	HE240B	HE240B	0.048	1.000	0.048	EC-5.5.4.LTB	192	106.000	11.3E+3	3.92E+3	103.000
153	HE240B	HE240B	0.048	1.000	0.048	EC-5.5.4.LTB	194	106.000	11.3E+3	3.92E+3	103.000
154	HE140A	HE140A	0.133	1.000	0.133	EC-5.5.2 LTB	191	31.400	1.03E+3	389.000	8.100
155	HE140A	HE140A	0.134	1.000	0.134	EC-5.5.2 LTB	191	31.400	1.03E+3	389.000	8.100
156	HE140A	HE140A	0.072	1.000	0.072	EC-5.5.2 LTB	191	31.400	1.03E+3	389.000	8.100
157	HE140A	HE140A	0.013	1.000	0.013	EC-5.5.4.LTB	197	31.400	1.03E+3	389.000	8.100
158	HE140A	HE140A	0.072	1.000	0.072	EC-5.5.2 LTB	195	31.400	1.03E+3	389.000	8.100
159	HE140A	HE140A	0.134	1.000	0.134	EC-5.5.2 LTB	195	31.400	1.03E+3	389.000	8.100
160	HE140A	HE140A	0.133	1.000	0.133	EC-5.5.2 LTB	195	31.400	1.03E+3	389.000	8.100
161	HE240B	HE240B	0.124	1.000	0.124	EC-5.5.4.LTB	191	106.000	11.3E+3	3.92E+3	103.000
162	HE240B	HE240B	0.262	1.000	0.262	EC-5.5.2 LTB	196	106.000	11.3E+3	3.92E+3	103.000
163	HE240B	HE240B	0.167	1.000	0.167	EC-eq(5.36)	197	106.000	11.3E+3	3.92E+3	103.000
164	HE240B	HE240B	0.106	1.000	0.106	EC-5.5.4.LTB	197	106.000	11.3E+3	3.92E+3	103.000
165	HE240B	HE240B	0.182	1.000	0.182	EC-5.5.4.LTB	191	106.000	11.3E+3	3.92E+3	103.000
166	HE240B	HE240B	0.227	1.000	0.227	EC-5.5.4.LTB	194	106.000	11.3E+3	3.92E+3	103.000
167	HE240B	HE240B	0.052	1.000	0.052	EC-5.5.4.LTB	198	106.000	11.3E+3	3.92E+3	103.000
168	HE240B	HE240B	0.182	1.000	0.182	EC-5.5.4.LTB	195	106.000	11.3E+3	3.92E+3	103.000
169	HE240B	HE240B	0.095	1.000	0.095	EC-eq(5.36)	198	106.000	11.3E+3	3.92E+3	103.000
171	HE240B	HE240B	0.107	1.000	0.107	EC-5.5.4.LTB	195	106.000	11.3E+3	3.92E+3	103.000
172	HE240B	HE240B	0.096	1.000	0.096	EC-eq(5.36)	198	106.000	11.3E+3	3.92E+3	103.000
174	HE240B	HE240B	0.101	1.000	0.101	EC-5.5.4.LTB	195	106.000	11.3E+3	3.92E+3	103.000
175	HE240B	HE240B	0.167	1.000	0.167	EC-eq(5.36)	197	106.000	11.3E+3	3.92E+3	103.000
177	HE240B	HE240B	0.228	1.000	0.228	EC-5.5.4.LTB	192	106.000	11.3E+3	3.92E+3	103.000
178	HE240B	HE240B	0.095	1.000	0.095	EC-eq(5.36)	196	106.000	11.3E+3	3.92E+3	103.000
180	HE240B	HE240B	0.102	1.000	0.102	EC-5.5.4.LTB	191	106.000	11.3E+3	3.92E+3	103.000
181	HE240B	HE240B	0.094	1.000	0.094	EC-eq(5.36)	196	106.000	11.3E+3	3.92E+3	103.000
183	HE240B	HE240B	0.107	1.000	0.107	EC-5.5.4.LTB	191	106.000	11.3E+3	3.92E+3	103.000
184	HE240B	HE240B	0.266	1.000	0.266	EC-5.5.2 LTB	198	106.000	11.3E+3	3.92E+3	103.000
186	HE240B	HE240B	0.055	1.000	0.055	EC-5.5.4.LTB	196	106.000	11.3E+3	3.92E+3	103.000
194	HE140A	HE140A	0.125	1.000	0.125	EC-5.5.4.LTB	193	31.400	1.03E+3	389.000	8.100
195	HE140A	HE140A	0.133	1.000	0.133	EC-5.5.4.LTB	198	31.400	1.03E+3	389.000	8.100
196	HE140A	HE140A	0.067	1.000	0.067	EC-5.5.2 LTB	191	31.400	1.03E+3	389.000	8.100
197	HE140A	HE140A	0.029	1.000	0.029	EC-5.5.4.LTB	197	31.400	1.03E+3	389.000	8.100
198	HE140A	HE140A	0.067	1.000	0.067	EC-5.5.2 LTB	195	31.400	1.03E+3	389.000	8.100
199	HE140A	HE140A	0.132	1.000	0.132	EC-5.5.4.LTB	196	31.400	1.03E+3	389.000	8.100
200	HE140A	HE140A	0.125	1.000	0.125	EC-5.5.4.LTB	193	31.400	1.03E+3	389.000	8.100
256	HE240B	HE240B	0.109	1.000	0.109	EC-5.5.4.LTB	197	106.000	11.3E+3	3.92E+3	103.000
269	TUB250250	TUB2502500	0.033	1.000	0.033	EC-5.5.3	194	149.000	13.5E+3	13.5E+3	21.1E+3
270	TUB250250	TUB2502500	0.036	1.000	0.036	EC-5.5.2 LTB	193	149.000	13.5E+3	13.5E+3	21.1E+3
271	TUB250250	TUB2502500	0.036	1.000	0.036	EC-5.5.2 LTB	192	149.000	13.5E+3	13.5E+3	21.1E+3
272	TUB250250	TUB2502500	0.033	1.000	0.033	EC-5.5.3	191	149.000	13.5E+3	13.5E+3	21.1E+3
273	TUB160160	TUB1601600	0.001	1.000	0.001	EC-eq(5.36)	196	37.700	1.46E+3	1.46E+3	2.33E+3
274	TUB160160	TUB1601600	0.001	1.000	0.001	EC-eq(5.36)	196	37.700	1.46E+3	1.46E+3	2.33E+3
275	TUB300300	TUB3003000	0.001	1.000	0.001	EC-5.4.6-(Y)	191	181.000	24.2E+3	24.2E+3	37.6E+3
276	TUB300300	TUB3003000	0.001	1.000	0.001	EC-5.4.6-(Y)	191	181.000	24.2E+3	24.2E+3	37.6E+3
301	TUB250250	TUB2502500	0.095	1.000	0.095	EC-eq(5.36)	197	149.000	13.5E+3	13.5E+3	21.1E+3
302	TUB250250	TUB2502500	0.075	1.000	0.075	EC-5.5.4	197	149.000	13.5E+3	13.5E+3	21.1E+3
303	TUB250250	TUB2502500	0.059	1.000	0.059	EC-eq(5.36)	196	149.000	13.5E+3	13.5E+3	21.1E+3

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Client University of Stavanger	File MASTER THESIS TRANS	Date/Time 06-May-2015 09:45	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
304	TUB250250	TUB250250	0.064	1.000	0.064	EC-5.5.4	198	149.000	13.5E+3	13.5E+3	21.1E+3
305	TUB250250	TUB250250	0.145	1.000	0.145	EC-eq(5.36)	198	149.000	13.5E+3	13.5E+3	21.1E+3
306	TUB250250	TUB250250	0.085	1.000	0.085	EC-5.5.4.LTB	191	149.000	13.5E+3	13.5E+3	21.1E+3
307	HE140A	HE140A	0.044	1.000	0.044	EC-5.5.4.LTB	198	31.400	1.03E+3	389.000	8.100
308	HE140A	HE140A	0.035	1.000	0.035	EC-5.5.4.LTB	197	31.400	1.03E+3	389.000	8.100
309	HE140A	HE140A	0.043	1.000	0.043	EC-5.5.4.LTB	195	31.400	1.03E+3	389.000	8.100
310	HE140A	HE140A	0.052	1.000	0.052	EC-5.5.4.LTB	191	31.400	1.03E+3	389.000	8.100
311	TUB250250	TUB250250	0.034	1.000	0.034	EC-5.5.2 LTB	193	149.000	13.5E+3	13.5E+3	21.1E+3
312	TUB250250	TUB250250	0.040	1.000	0.040	EC-5.5.4	192	149.000	13.5E+3	13.5E+3	21.1E+3
313	TUB250250	TUB250250	0.034	1.000	0.034	EC-5.5.2 LTB	191	149.000	13.5E+3	13.5E+3	21.1E+3
314	TUB250250	TUB250250	0.035	1.000	0.035	EC-5.5.4	196	149.000	13.5E+3	13.5E+3	21.1E+3
315	TUB250250	TUB250250	0.034	1.000	0.034	EC-5.5.3	193	149.000	13.5E+3	13.5E+3	21.1E+3
316	TUB250250	TUB250250	0.045	1.000	0.045	EC-5.5.4	194	149.000	13.5E+3	13.5E+3	21.1E+3
317	TUB250250	TUB250250	0.034	1.000	0.034	EC-5.5.3	191	149.000	13.5E+3	13.5E+3	21.1E+3
318	TUB250250	TUB250250	0.034	1.000	0.034	EC-5.5.4	197	149.000	13.5E+3	13.5E+3	21.1E+3
319	TUB250250	TUB250250	0.143	1.000	0.143	EC-5.5.3	196	149.000	13.5E+3	13.5E+3	21.1E+3
320	TUB250250	TUB250250	0.056	1.000	0.056	EC-5.5.4	194	149.000	13.5E+3	13.5E+3	21.1E+3
321	HE140A	HE140A	0.044	1.000	0.044	EC-5.5.4.LTB	197	31.400	1.03E+3	389.000	8.100
322	TUB250250	TUB250250	0.034	1.000	0.034	EC-5.5.4	198	149.000	13.5E+3	13.5E+3	21.1E+3
323	TUB250250	TUB250250	0.033	1.000	0.033	EC-5.5.4	197	149.000	13.5E+3	13.5E+3	21.1E+3
372	HE220B	HE220B	0.168	1.000	0.168	EC-5.5.4.LTB	196	91.000	8.09E+3	2.84E+3	76.600
373	HE220B	HE220B	0.165	1.000	0.165	EC-5.5.4.LTB	198	91.000	8.09E+3	2.84E+3	76.600
374	HE220B	HE220B	0.207	1.000	0.207	EC-5.5.4.LTB	195	91.000	8.09E+3	2.84E+3	76.600
375	HE220B	HE220B	0.194	1.000	0.194	EC-5.5.2 LTB	195	91.000	8.09E+3	2.84E+3	76.600
376	HE220B	HE220B	0.222	1.000	0.222	EC-5.5.4.LTB	195	91.000	8.09E+3	2.84E+3	76.600
377	HE220B	HE220B	0.220	1.000	0.220	EC-5.5.4.LTB	194	91.000	8.09E+3	2.84E+3	76.600
378	HE220B	HE220B	0.222	1.000	0.222	EC-5.5.4.LTB	191	91.000	8.09E+3	2.84E+3	76.600
379	HE220B	HE220B	0.220	1.000	0.220	EC-5.5.4.LTB	192	91.000	8.09E+3	2.84E+3	76.600
380	HE220B	HE220B	0.207	1.000	0.207	EC-5.5.4.LTB	191	91.000	8.09E+3	2.84E+3	76.600
381	HE220B	HE220B	0.194	1.000	0.194	EC-5.5.2 LTB	191	91.000	8.09E+3	2.84E+3	76.600
382	HE220B	HE220B	0.168	1.000	0.168	EC-5.5.4.LTB	198	91.000	8.09E+3	2.84E+3	76.600
383	HE220B	HE220B	0.165	1.000	0.165	EC-5.5.4.LTB	196	91.000	8.09E+3	2.84E+3	76.600
384	HE220B	HE220B	0.164	1.000	0.164	EC-5.5.4.LTB	194	91.000	8.09E+3	2.84E+3	76.600
385	HE220B	HE220B	0.163	1.000	0.163	EC-5.5.4.LTB	196	91.000	8.09E+3	2.84E+3	76.600
386	HE220B	HE220B	0.203	1.000	0.203	EC-5.5.4.LTB	194	91.000	8.09E+3	2.84E+3	76.600
387	HE220B	HE220B	0.203	1.000	0.203	EC-5.5.4.LTB	192	91.000	8.09E+3	2.84E+3	76.600
388	HE220B	HE220B	0.223	1.000	0.223	EC-5.5.4.LTB	194	91.000	8.09E+3	2.84E+3	76.600
389	HE220B	HE220B	0.220	1.000	0.220	EC-5.5.4.LTB	191	91.000	8.09E+3	2.84E+3	76.600
390	HE220B	HE220B	0.223	1.000	0.223	EC-5.5.4.LTB	192	91.000	8.09E+3	2.84E+3	76.600
391	HE220B	HE220B	0.220	1.000	0.220	EC-5.5.4.LTB	195	91.000	8.09E+3	2.84E+3	76.600
392	HE220B	HE220B	0.203	1.000	0.203	EC-5.5.4.LTB	192	91.000	8.09E+3	2.84E+3	76.600
393	HE220B	HE220B	0.202	1.000	0.202	EC-5.5.4.LTB	194	91.000	8.09E+3	2.84E+3	76.600
394	HE220B	HE220B	0.164	1.000	0.164	EC-5.5.4.LTB	192	91.000	8.09E+3	2.84E+3	76.600
395	HE220B	HE220B	0.163	1.000	0.163	EC-5.5.4.LTB	198	91.000	8.09E+3	2.84E+3	76.600
447	TUB120120	TUB120120	0.301	1.000	0.301	EC-5.4.3 (T)	191	28.500	610.000	610.000	949.000
449	TUB120120	TUB120120	0.185	1.000	0.185	EC-5.4.3 (T)	197	28.500	610.000	610.000	949.000
454	TUB120120	TUB120120	0.302	1.000	0.302	EC-5.4.3 (T)	195	28.500	610.000	610.000	949.000
455	TUB120120	TUB120120	0.403	1.000	0.403	EC-5.4.3 (T)	191	28.500	610.000	610.000	949.000
456	TUB120120	TUB120120	0.403	1.000	0.403	EC-5.4.3 (T)	195	28.500	610.000	610.000	949.000
458	TUB140140	TUB140140	0.389	1.000	0.389	EC-5.5.4	193	41.900	1.21E+3	1.21E+3	1.89E+3

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
459	TUB140140	TUB140140	0.134	1.000	0.134	EC-eq(5.36)	197	41.900	1.21E+3	1.21E+3	1.89E+3
460	TUB140140	TUB140140	0.390	1.000	0.390	EC-5.5.4	193	41.900	1.21E+3	1.21E+3	1.89E+3
461	TUB300300	TUB300300	0.136	1.000	0.136	EC-5.5.4.LTB	197	181.000	24.2E+3	24.2E+3	37.6E+3
462	TUB300300	TUB300300	0.137	1.000	0.137	EC-5.5.4.LTB	197	181.000	24.2E+3	24.2E+3	37.6E+3
467	TUB300300	TUB300300	0.087	1.000	0.087	EC-5.5.4	197	181.000	24.2E+3	24.2E+3	37.6E+3
468	TUB300300	TUB300300	0.088	1.000	0.088	EC-5.5.4	197	181.000	24.2E+3	24.2E+3	37.6E+3
469	TUB120120	TUB120120	0.197	1.000	0.197	EC-5.5.4	196	43.500	870.000	870.000	1.38E+3
470	TUB120120	TUB120120	0.200	1.000	0.200	EC-5.5.4	198	43.500	870.000	870.000	1.38E+3
471	TUB120120	TUB120120	0.206	1.000	0.206	EC-eq(5.36)	193	28.500	610.000	610.000	949.000
472	TUB120120	TUB120120	0.170	1.000	0.170	EC-5.4.3 (T)	194	28.500	610.000	610.000	949.000

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	131	191:TRANSPO	6.726	0.002	0.604	6.753	0.001	-0.000	0.000
Min X	130	185:TRANSPO	-6.469	0.059	0.937	6.537	0.000	0.000	-0.000
Max Y	130	184:TRANSPO	-4.671	0.290	3.284	5.717	0.001	0.000	-0.000
Min Y	99	197:TRANSPO	0.015	-15.545	-3.325	15.897	-0.001	0.000	-0.000
Max Z	6	184:TRANSPO	-2.978	-1.405	3.319	4.675	-0.000	0.000	-0.001
Min Z	43	198:TRANSPO	3.940	-1.525	-5.661	7.066	0.000	-0.000	-0.001
Max rX	86	194:TRANSPO	-2.741	-5.573	0.998	6.291	0.004	0.000	-0.002
Min rX	70	197:TRANSPO	-0.001	-3.755	-0.024	3.755	-0.006	-0.000	-0.001
Max rY	6	195:TRANSPO	-4.211	-1.841	0.490	4.622	-0.000	0.000	-0.001
Min rY	7	191:TRANSPO	4.203	-1.840	0.619	4.630	-0.000	-0.000	0.001
Max rZ	82	196:TRANSPO	-0.033	-0.938	0.004	0.938	0.000	-0.000	0.007
Min rZ	75	198:TRANSPO	0.033	-0.949	0.004	0.950	0.000	0.000	-0.007
Max Rst	99	197:TRANSPO	0.015	-15.545	-3.325	15.897	-0.001	0.000	-0.000

Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (m)	X (mm)	Y (mm)	Z (mm)	Resultant (mm)
Max X	449	191:TRANSPO	3.634	18.148	-2.336	-4.188	18.771
Min X	449	185:TRANSPO	3.634	-15.088	-1.870	-0.475	15.161
Max Y	275	184:TRANSPO	0.000	-4.671	0.290	3.284	5.717
Min Y	376	197:TRANSPO	0.275	0.014	-15.661	-3.323	16.010
Max Z	454	183:TRANSPO	3.448	-1.184	-3.385	12.112	12.631
Min Z	454	197:TRANSPO	3.448	-1.729	-4.327	-16.686	17.305
Max Rst	449	191:TRANSPO	3.634	18.148	-2.336	-4.188	18.771

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Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	5	195:TRANSPO	131.498	496.584	-46.820	0.000	0.000	0.000
Min FX	8	191:TRANSPO	-132.037	496.655	-46.870	0.000	0.000	0.000
Max FY	8	192:TRANSPO	-123.069	572.858	-161.154	0.000	0.000	0.000
Min FY	8	186:TRANSPO	73.323	-87.808	189.318	0.000	0.000	0.000
Max FZ	5	197:TRANSPO	0.121	99.836	205.889	0.000	0.000	0.000
Min FZ	8	183:TRANSPO	-49.598	387.483	-178.881	0.000	0.000	0.000
Max MX	1	181:TRANSPO	-61.297	263.331	-50.180	0.000	0.000	0.000
Min MX	1	181:TRANSPO	-61.297	263.331	-50.180	0.000	0.000	0.000
Max MY	1	181:TRANSPO	-61.297	263.331	-50.180	0.000	0.000	0.000
Min MY	1	181:TRANSPO	-61.297	263.331	-50.180	0.000	0.000	0.000
Max MZ	1	181:TRANSPO	-61.297	263.331	-50.180	0.000	0.000	0.000
Min MZ	1	181:TRANSPO	-61.297	263.331	-50.180	0.000	0.000	0.000

A.5.1.7 Transport, ULS-b, LC 201-218

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Job Information

	Engineer	Checked	Approved
Name:	Gholam Sakhi Sakha		
Date:	5-Jan-15		

Structure Type	SPACE FRAME

Number of Nodes	91	Highest Node	146
Number of Elements	160	Highest Beam	472
Number of Plates	48	Highest Plate	443

Number of Basic Load Cases	25
Number of Combination Load Cases	16

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Combination	201	TRANSPORT: ULS-B + X + Y
Combination	202	TRANSPORT: ULS-B + X + Z + Y
Combination	203	TRANSPORT: ULS-B + Z + Y
Combination	204	TRANSPORT: ULS-B - X + Z + Y
Combination	205	TRANSPORT: ULS-B - X + Y
Combination	206	TRANSPRT: ULS-B - X - Z + Y
Combination	207	TRANSPORT: ULS-B - Z + Y
Combination	208	TRANSPORT: ULS-B - Z + X + Y
Combination	211	TRANSPORT: ULS-B + X - Y
Combination	212	TRANSPORT: ULS-B + X + Z - Y
Combination	213	TRANSPORT: ULS-B + Z - Y
Combination	214	TRANSPORT: ULS-B - X + Z - Y
Combination	215	TRANSPORT: ULS-B - X - Y
Combination	216	TRANSPRT: ULS-B - Z - X - Y
Combination	217	TRANSPORT: ULS-B - Z - Y
Combination	218	TRANSPORT: ULS-B - Z + X - Y

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Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
1	TUB300300	TUB300300	0.259	1.000	0.259	EC-5.5.4.LTB	217	181.000	24.2E+3	24.2E+3	37.6E+3
2	TUB250250	TUB250250	0.160	1.000	0.160	EC-eq(5.36)	216	149.000	13.5E+3	13.5E+3	21.1E+3
4	TUB250250	TUB250250	0.468	1.000	0.468	EC-5.5.4.LTB	214	77.100	7.51E+3	7.51E+3	11.5E+3
5	TUB250250	TUB250250	0.091	1.000	0.091	EC-5.5.4.LTB	215	149.000	13.5E+3	13.5E+3	21.1E+3
6	TUB250250	TUB250250	0.220	1.000	0.220	EC-5.5.4.LTB	212	77.100	7.51E+3	7.51E+3	11.5E+3
7	TUB250250	TUB250250	0.051	1.000	0.051	EC-5.5.4.LTB	218	149.000	13.5E+3	13.5E+3	21.1E+3
8	TUB250250	TUB250250	0.051	1.000	0.051	EC-5.5.4.LTB	216	149.000	13.5E+3	13.5E+3	21.1E+3
13	TUB250250	TUB250250	0.220	1.000	0.220	EC-5.5.4.LTB	214	77.100	7.51E+3	7.51E+3	11.5E+3
14	TUB250250	TUB250250	0.468	1.000	0.468	EC-5.5.4.LTB	212	77.100	7.51E+3	7.51E+3	11.5E+3
17	TUB300300	TUB300300	0.259	1.000	0.259	EC-5.5.4.LTB	217	181.000	24.2E+3	24.2E+3	37.6E+3
21	TUB250250	TUB250250	0.071	1.000	0.071	EC-5.5.4.LTB	217	149.000	13.5E+3	13.5E+3	21.1E+3
23	TUB120120	TUB120120	0.349	1.000	0.349	EC-5.5.4	212	43.500	870.000	870.000	1.38E+3
25	TUB120120	TUB120120	0.270	1.000	0.270	EC-5.5.4.LTB	212	43.500	870.000	870.000	1.38E+3
26	TUB250250	TUB250250	0.122	1.000	0.122	EC-eq(5.36)	217	149.000	13.5E+3	13.5E+3	21.1E+3
28	TUB120120	TUB120120	0.093	1.000	0.093	EC-5.5.4.LTB	211	43.500	870.000	870.000	1.38E+3
30	TUB120120	TUB120120	0.122	1.000	0.122	EC-5.5.4	213	43.500	870.000	870.000	1.38E+3
31	TUB250250	TUB250250	0.066	1.000	0.066	EC-eq(5.36)	218	149.000	13.5E+3	13.5E+3	21.1E+3
32	TUB250250	TUB250250	0.064	1.000	0.064	EC-5.5.4	217	149.000	13.5E+3	13.5E+3	21.1E+3
33	TUB250250	TUB250250	0.032	1.000	0.032	EC-5.5.2 LTB	214	149.000	13.5E+3	13.5E+3	21.1E+3
34	TUB250250	TUB250250	0.122	1.000	0.122	EC-eq(5.36)	217	149.000	13.5E+3	13.5E+3	21.1E+3
35	TUB250250	TUB250250	0.071	1.000	0.071	EC-5.5.4.LTB	217	149.000	13.5E+3	13.5E+3	21.1E+3
36	TUB250250	TUB250250	0.037	1.000	0.037	EC-5.5.4	212	149.000	13.5E+3	13.5E+3	21.1E+3
37	TUB250250	TUB250250	0.103	1.000	0.103	EC-eq(5.36)	217	149.000	13.5E+3	13.5E+3	21.1E+3
38	TUB250250	TUB250250	0.076	1.000	0.076	EC-5.5.4	217	149.000	13.5E+3	13.5E+3	21.1E+3
39	TUB250250	TUB250250	0.037	1.000	0.037	EC-5.5.4	214	149.000	13.5E+3	13.5E+3	21.1E+3
40	TUB250250	TUB250250	0.161	1.000	0.161	EC-5.5.3	218	149.000	13.5E+3	13.5E+3	21.1E+3
41	TUB250250	TUB250250	0.057	1.000	0.057	EC-5.5.4	212	149.000	13.5E+3	13.5E+3	21.1E+3
42	TUB250250	TUB250250	0.032	1.000	0.032	EC-5.5.2 LTB	211	149.000	13.5E+3	13.5E+3	21.1E+3
67	TUB250250	TUB250250	0.032	1.000	0.032	EC-eq(5.36)	214	149.000	13.5E+3	13.5E+3	21.1E+3
68	TUB250250	TUB250250	0.032	1.000	0.032	EC-eq(5.36)	212	149.000	13.5E+3	13.5E+3	21.1E+3
73	HE140A	HE140A	0.053	1.000	0.053	EC-5.5.4.LTB	215	31.400	1.03E+3	389.000	8.100
74	HE140A	HE140A	0.046	1.000	0.046	EC-5.5.4.LTB	218	31.400	1.03E+3	389.000	8.100
75	HE140A	HE140A	0.039	1.000	0.039	EC-5.5.4.LTB	218	31.400	1.03E+3	389.000	8.100
76	HE140A	HE140A	0.046	1.000	0.046	EC-5.5.4.LTB	216	31.400	1.03E+3	389.000	8.100
77	HE140A	HE140A	0.049	1.000	0.049	EC-5.5.4.LTB	217	31.400	1.03E+3	389.000	8.100
116	HE240B	HE240B	0.159	1.000	0.159	EC-5.5.4.LTB	215	106.000	11.3E+3	3.92E+3	103.000
117	HE240B	HE240B	0.155	1.000	0.155	EC-eq(5.36)	215	106.000	11.3E+3	3.92E+3	103.000
119	HE240B	HE240B	0.235	1.000	0.235	EC-5.5.4	213	106.000	11.3E+3	3.92E+3	103.000
120	HE240B	HE240B	0.247	1.000	0.247	EC-5.5.4.LTB	216	106.000	11.3E+3	3.92E+3	103.000
121	HE240B	HE240B	0.112	1.000	0.112	EC-5.5.2 LTB	218	106.000	11.3E+3	3.92E+3	103.000
122	HE240B	HE240B	0.109	1.000	0.109	EC-eq(5.36)	211	106.000	11.3E+3	3.92E+3	103.000
124	HE240B	HE240B	0.112	1.000	0.112	EC-5.5.2 LTB	218	106.000	11.3E+3	3.92E+3	103.000
125	HE240B	HE240B	0.114	1.000	0.114	EC-eq(5.36)	211	106.000	11.3E+3	3.92E+3	103.000
127	HE240B	HE240B	0.235	1.000	0.235	EC-5.5.4	213	106.000	11.3E+3	3.92E+3	103.000
128	HE240B	HE240B	0.155	1.000	0.155	EC-eq(5.36)	211	106.000	11.3E+3	3.92E+3	103.000
130	HE240B	HE240B	0.112	1.000	0.112	EC-5.5.2 LTB	216	106.000	11.3E+3	3.92E+3	103.000
131	HE240B	HE240B	0.114	1.000	0.114	EC-eq(5.36)	215	106.000	11.3E+3	3.92E+3	103.000
133	HE240B	HE240B	0.112	1.000	0.112	EC-5.5.2 LTB	216	106.000	11.3E+3	3.92E+3	103.000
134	HE240B	HE240B	0.109	1.000	0.109	EC-eq(5.36)	215	106.000	11.3E+3	3.92E+3	103.000
136	HE240B	HE240B	0.247	1.000	0.247	EC-5.5.4.LTB	218	106.000	11.3E+3	3.92E+3	103.000

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
138	HE240B	HE240B	0.097	1.000	0.097	EC-5.5.4.LTB	217	106.000	11.3E+3	3.92E+3	103.000
145	HE240B	HE240B	0.097	1.000	0.097	EC-5.5.4.LTB	217	106.000	11.3E+3	3.92E+3	103.000
146	HE240B	HE240B	0.062	1.000	0.062	EC-5.5.4.LTB	213	106.000	11.3E+3	3.92E+3	103.000
153	HE240B	HE240B	0.062	1.000	0.062	EC-5.5.4.LTB	213	106.000	11.3E+3	3.92E+3	103.000
154	HE140A	HE140A	0.137	1.000	0.137	EC-5.5.2 LTB	211	31.400	1.03E+3	389.000	8.100
155	HE140A	HE140A	0.138	1.000	0.138	EC-5.5.2 LTB	211	31.400	1.03E+3	389.000	8.100
156	HE140A	HE140A	0.075	1.000	0.075	EC-5.5.2 LTB	211	31.400	1.03E+3	389.000	8.100
157	HE140A	HE140A	0.016	1.000	0.016	EC-5.5.4.LTB	217	31.400	1.03E+3	389.000	8.100
158	HE140A	HE140A	0.075	1.000	0.075	EC-5.5.2 LTB	215	31.400	1.03E+3	389.000	8.100
159	HE140A	HE140A	0.138	1.000	0.138	EC-5.5.2 LTB	215	31.400	1.03E+3	389.000	8.100
160	HE140A	HE140A	0.137	1.000	0.137	EC-5.5.2 LTB	215	31.400	1.03E+3	389.000	8.100
161	HE240B	HE240B	0.159	1.000	0.159	EC-5.5.4.LTB	211	106.000	11.3E+3	3.92E+3	103.000
162	HE240B	HE240B	0.287	1.000	0.287	EC-5.5.2 LTB	216	106.000	11.3E+3	3.92E+3	103.000
163	HE240B	HE240B	0.180	1.000	0.180	EC-eq(5.36)	217	106.000	11.3E+3	3.92E+3	103.000
164	HE240B	HE240B	0.147	1.000	0.147	EC-5.5.4.LTB	217	106.000	11.3E+3	3.92E+3	103.000
165	HE240B	HE240B	0.212	1.000	0.212	EC-5.5.4.LTB	211	106.000	11.3E+3	3.92E+3	103.000
166	HE240B	HE240B	0.237	1.000	0.237	EC-5.5.4.LTB	213	106.000	11.3E+3	3.92E+3	103.000
167	HE240B	HE240B	0.072	1.000	0.072	EC-5.5.4.LTB	218	106.000	11.3E+3	3.92E+3	103.000
168	HE240B	HE240B	0.212	1.000	0.212	EC-5.5.4.LTB	215	106.000	11.3E+3	3.92E+3	103.000
169	HE240B	HE240B	0.103	1.000	0.103	EC-eq(5.36)	218	106.000	11.3E+3	3.92E+3	103.000
171	HE240B	HE240B	0.114	1.000	0.114	EC-5.5.4.LTB	215	106.000	11.3E+3	3.92E+3	103.000
172	HE240B	HE240B	0.103	1.000	0.103	EC-eq(5.36)	218	106.000	11.3E+3	3.92E+3	103.000
174	HE240B	HE240B	0.106	1.000	0.106	EC-5.5.4.LTB	215	106.000	11.3E+3	3.92E+3	103.000
175	HE240B	HE240B	0.180	1.000	0.180	EC-eq(5.36)	217	106.000	11.3E+3	3.92E+3	103.000
177	HE240B	HE240B	0.237	1.000	0.237	EC-5.5.4.LTB	212	106.000	11.3E+3	3.92E+3	103.000
178	HE240B	HE240B	0.103	1.000	0.103	EC-eq(5.36)	216	106.000	11.3E+3	3.92E+3	103.000
180	HE240B	HE240B	0.106	1.000	0.106	EC-5.5.4.LTB	211	106.000	11.3E+3	3.92E+3	103.000
181	HE240B	HE240B	0.103	1.000	0.103	EC-eq(5.36)	216	106.000	11.3E+3	3.92E+3	103.000
183	HE240B	HE240B	0.114	1.000	0.114	EC-5.5.4.LTB	211	106.000	11.3E+3	3.92E+3	103.000
184	HE240B	HE240B	0.287	1.000	0.287	EC-5.5.2 LTB	218	106.000	11.3E+3	3.92E+3	103.000
186	HE240B	HE240B	0.072	1.000	0.072	EC-5.5.4.LTB	216	106.000	11.3E+3	3.92E+3	103.000
194	HE140A	HE140A	0.128	1.000	0.128	EC-5.5.4.LTB	213	31.400	1.03E+3	389.000	8.100
195	HE140A	HE140A	0.139	1.000	0.139	EC-5.5.4.LTB	218	31.400	1.03E+3	389.000	8.100
196	HE140A	HE140A	0.076	1.000	0.076	EC-5.5.4.LTB	218	31.400	1.03E+3	389.000	8.100
197	HE140A	HE140A	0.033	1.000	0.033	EC-5.5.4.LTB	217	31.400	1.03E+3	389.000	8.100
198	HE140A	HE140A	0.076	1.000	0.076	EC-5.5.4.LTB	216	31.400	1.03E+3	389.000	8.100
199	HE140A	HE140A	0.139	1.000	0.139	EC-5.5.4.LTB	216	31.400	1.03E+3	389.000	8.100
200	HE140A	HE140A	0.128	1.000	0.128	EC-5.5.4.LTB	213	31.400	1.03E+3	389.000	8.100
256	HE240B	HE240B	0.147	1.000	0.147	EC-5.5.4.LTB	217	106.000	11.3E+3	3.92E+3	103.000
269	TUB250250	TUB250250	0.032	1.000	0.032	EC-5.5.3	215	149.000	13.5E+3	13.5E+3	21.1E+3
270	TUB250250	TUB250250	0.035	1.000	0.035	EC-5.5.2 LTB	213	149.000	13.5E+3	13.5E+3	21.1E+3
271	TUB250250	TUB250250	0.035	1.000	0.035	EC-5.5.2 LTB	212	149.000	13.5E+3	13.5E+3	21.1E+3
272	TUB250250	TUB250250	0.032	1.000	0.032	EC-5.5.3	211	149.000	13.5E+3	13.5E+3	21.1E+3
273	TUB160160	TUB160160	0.001	1.000	0.001	EC-eq(5.36)	216	37.700	1.46E+3	1.46E+3	2.33E+3
274	TUB160160	TUB160160	0.001	1.000	0.001	EC-eq(5.36)	216	37.700	1.46E+3	1.46E+3	2.33E+3
275	TUB300300	TUB300300	0.001	1.000	0.001	EC-5.4.6-(Y)	211	181.000	24.2E+3	24.2E+3	37.6E+3
276	TUB300300	TUB300300	0.001	1.000	0.001	EC-5.4.6-(Y)	211	181.000	24.2E+3	24.2E+3	37.6E+3
301	TUB250250	TUB250250	0.103	1.000	0.103	EC-eq(5.36)	217	149.000	13.5E+3	13.5E+3	21.1E+3
302	TUB250250	TUB250250	0.076	1.000	0.076	EC-5.5.4	217	149.000	13.5E+3	13.5E+3	21.1E+3
303	TUB250250	TUB250250	0.066	1.000	0.066	EC-eq(5.36)	216	149.000	13.5E+3	13.5E+3	21.1E+3

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
304	TUB250250	TUB250250	0.064	1.000	0.064	EC-5.5.4	217	149.000	13.5E+3	13.5E+3	21.1E+3
305	TUB250250	TUB250250	0.160	1.000	0.160	EC-eq(5.36)	218	149.000	13.5E+3	13.5E+3	21.1E+3
306	TUB250250	TUB250250	0.091	1.000	0.091	EC-5.5.4.LTB	211	149.000	13.5E+3	13.5E+3	21.1E+3
307	HE140A	HE140A	0.046	1.000	0.046	EC-5.5.4.LTB	218	31.400	1.03E+3	389.000	8.100
308	HE140A	HE140A	0.039	1.000	0.039	EC-5.5.4.LTB	216	31.400	1.03E+3	389.000	8.100
309	HE140A	HE140A	0.046	1.000	0.046	EC-5.5.4.LTB	216	31.400	1.03E+3	389.000	8.100
310	HE140A	HE140A	0.053	1.000	0.053	EC-5.5.4.LTB	211	31.400	1.03E+3	389.000	8.100
311	TUB250250	TUB250250	0.035	1.000	0.035	EC-5.5.4	213	149.000	13.5E+3	13.5E+3	21.1E+3
312	TUB250250	TUB250250	0.040	1.000	0.040	EC-5.5.4	212	149.000	13.5E+3	13.5E+3	21.1E+3
313	TUB250250	TUB250250	0.035	1.000	0.035	EC-5.5.4	212	149.000	13.5E+3	13.5E+3	21.1E+3
314	TUB250250	TUB250250	0.035	1.000	0.035	EC-5.5.4	216	149.000	13.5E+3	13.5E+3	21.1E+3
315	TUB250250	TUB250250	0.033	1.000	0.033	EC-5.5.3	214	149.000	13.5E+3	13.5E+3	21.1E+3
316	TUB250250	TUB250250	0.044	1.000	0.044	EC-5.5.4	212	149.000	13.5E+3	13.5E+3	21.1E+3
317	TUB250250	TUB250250	0.033	1.000	0.033	EC-5.5.3	211	149.000	13.5E+3	13.5E+3	21.1E+3
318	TUB250250	TUB250250	0.033	1.000	0.033	EC-5.5.4	217	149.000	13.5E+3	13.5E+3	21.1E+3
319	TUB250250	TUB250250	0.161	1.000	0.161	EC-5.5.3	216	149.000	13.5E+3	13.5E+3	21.1E+3
320	TUB250250	TUB250250	0.057	1.000	0.057	EC-5.5.4	214	149.000	13.5E+3	13.5E+3	21.1E+3
321	HE140A	HE140A	0.049	1.000	0.049	EC-5.5.4.LTB	217	31.400	1.03E+3	389.000	8.100
322	TUB250250	TUB250250	0.035	1.000	0.035	EC-5.5.4	218	149.000	13.5E+3	13.5E+3	21.1E+3
323	TUB250250	TUB250250	0.033	1.000	0.033	EC-5.5.4	216	149.000	13.5E+3	13.5E+3	21.1E+3
372	HE220B	HE220B	0.174	1.000	0.174	EC-5.5.4.LTB	216	91.000	8.09E+3	2.84E+3	76.600
373	HE220B	HE220B	0.170	1.000	0.170	EC-5.5.4.LTB	216	91.000	8.09E+3	2.84E+3	76.600
374	HE220B	HE220B	0.212	1.000	0.212	EC-5.5.4.LTB	215	91.000	8.09E+3	2.84E+3	76.600
375	HE220B	HE220B	0.193	1.000	0.193	EC-5.5.4.LTB	213	91.000	8.09E+3	2.84E+3	76.600
376	HE220B	HE220B	0.226	1.000	0.226	EC-5.5.4.LTB	215	91.000	8.09E+3	2.84E+3	76.600
377	HE220B	HE220B	0.224	1.000	0.224	EC-5.5.4.LTB	214	91.000	8.09E+3	2.84E+3	76.600
378	HE220B	HE220B	0.226	1.000	0.226	EC-5.5.4.LTB	211	91.000	8.09E+3	2.84E+3	76.600
379	HE220B	HE220B	0.224	1.000	0.224	EC-5.5.4.LTB	212	91.000	8.09E+3	2.84E+3	76.600
380	HE220B	HE220B	0.212	1.000	0.212	EC-5.5.4.LTB	211	91.000	8.09E+3	2.84E+3	76.600
381	HE220B	HE220B	0.193	1.000	0.193	EC-5.5.4.LTB	213	91.000	8.09E+3	2.84E+3	76.600
382	HE220B	HE220B	0.174	1.000	0.174	EC-5.5.4.LTB	218	91.000	8.09E+3	2.84E+3	76.600
383	HE220B	HE220B	0.170	1.000	0.170	EC-5.5.4.LTB	218	91.000	8.09E+3	2.84E+3	76.600
384	HE220B	HE220B	0.173	1.000	0.173	EC-5.5.4.LTB	215	91.000	8.09E+3	2.84E+3	76.600
385	HE220B	HE220B	0.169	1.000	0.169	EC-5.5.4.LTB	216	91.000	8.09E+3	2.84E+3	76.600
386	HE220B	HE220B	0.209	1.000	0.209	EC-5.5.4.LTB	215	91.000	8.09E+3	2.84E+3	76.600
387	HE220B	HE220B	0.206	1.000	0.206	EC-5.5.4.LTB	216	91.000	8.09E+3	2.84E+3	76.600
388	HE220B	HE220B	0.227	1.000	0.227	EC-5.5.4.LTB	214	91.000	8.09E+3	2.84E+3	76.600
389	HE220B	HE220B	0.222	1.000	0.222	EC-5.5.4.LTB	212	91.000	8.09E+3	2.84E+3	76.600
390	HE220B	HE220B	0.227	1.000	0.227	EC-5.5.4.LTB	212	91.000	8.09E+3	2.84E+3	76.600
391	HE220B	HE220B	0.222	1.000	0.222	EC-5.5.4.LTB	211	91.000	8.09E+3	2.84E+3	76.600
392	HE220B	HE220B	0.209	1.000	0.209	EC-5.5.4.LTB	211	91.000	8.09E+3	2.84E+3	76.600
393	HE220B	HE220B	0.206	1.000	0.206	EC-5.5.4.LTB	218	91.000	8.09E+3	2.84E+3	76.600
394	HE220B	HE220B	0.173	1.000	0.173	EC-5.5.4.LTB	211	91.000	8.09E+3	2.84E+3	76.600
395	HE220B	HE220B	0.169	1.000	0.169	EC-5.5.4.LTB	218	91.000	8.09E+3	2.84E+3	76.600
447	TUB120120	TUB120120	0.362	1.000	0.362	EC-5.4.3 (T)	211	28.500	610.000	610.000	949.000
449	TUB140140	TUB140140	0.309	1.000	0.309	EC-5.5.4	213	41.900	1.21E+3	1.21E+3	1.89E+3
454	TUB120120	TUB120120	0.362	1.000	0.362	EC-5.4.3 (T)	215	28.500	610.000	610.000	949.000
455	TUB120120	TUB120120	0.560	1.000	0.560	EC-5.4.3 (T)	211	28.500	610.000	610.000	949.000
456	TUB120120	TUB120120	0.559	1.000	0.559	EC-5.4.3 (T)	215	28.500	610.000	610.000	949.000
458	TUB140140	TUB140140	0.793	1.000	0.793	EC-5.5.4	213	41.900	1.21E+3	1.21E+3	1.89E+3

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
459	TUB140140	TUB140140	0.309	1.000	0.309	EC-5.5.4	213	41.900	1.21E+3	1.21E+3	1.89E+3
460	TUB140140	TUB140140	0.793	1.000	0.793	EC-5.5.4	213	41.900	1.21E+3	1.21E+3	1.89E+3
461	TUB300300	TUB300300	0.150	1.000	0.150	EC-5.5.4.LTB	217	181.000	24.2E+3	24.2E+3	37.6E+3
462	TUB300300	TUB300300	0.150	1.000	0.150	EC-5.5.4.LTB	217	181.000	24.2E+3	24.2E+3	37.6E+3
467	TUB300300	TUB300300	0.103	1.000	0.103	EC-5.5.4.LTB	217	181.000	24.2E+3	24.2E+3	37.6E+3
468	TUB300300	TUB300300	0.103	1.000	0.103	EC-5.5.4.LTB	217	181.000	24.2E+3	24.2E+3	37.6E+3
469	TUB120120	TUB120120	0.209	1.000	0.209	EC-5.5.4	216	43.500	870.000	870.000	1.38E+3
470	TUB120120	TUB120120	0.209	1.000	0.209	EC-5.5.4	218	43.500	870.000	870.000	1.38E+3
471	TUB120120	TUB120120	0.242	1.000	0.242	EC-eq(5.36)	213	28.500	610.000	610.000	949.000
472	TUB120120	TUB120120	0.175	1.000	0.175	EC-5.4.3 (T)	217	28.500	610.000	610.000	949.000

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	131	211:TRANSPOI	12.088	0.164	2.124	12.275	0.001	-0.001	-0.000
Min X	130	215:TRANSPO	-12.078	0.164	2.124	12.265	0.001	0.001	0.000
Max Y	131	202:TRANSPO	8.495	0.884	6.784	10.893	0.001	-0.000	-0.000
Min Y	78	217:TRANSPO	0.002	-15.668	-0.085	15.560	-0.001	-0.000	-0.000
Max Z	7	202:TRANSPO	5.688	-1.495	8.864	9.032	0.000	-0.001	0.000
Min Z	7	216:TRANSPR	-5.859	-0.193	-8.398	10.240	-0.001	0.000	0.001
Max rX	92	212:TRANSPO	5.099	-4.518	2.671	7.317	0.004	-0.000	0.002
Min rX	68	217:TRANSPO	0.004	-3.410	-0.087	3.411	-0.008	0.000	0.001
Max rY	6	215:TRANSPO	-7.950	-2.299	2.155	8.551	-0.000	0.001	-0.001
Min rY	7	211:TRANSPOI	7.959	-2.300	2.155	8.560	-0.000	-0.001	0.001
Max rZ	82	216:TRANSPR	-0.064	-0.835	-0.000	0.838	0.000	-0.000	0.007
Min rZ	75	218:TRANSPO	0.064	-0.835	-0.000	0.837	0.000	0.000	-0.007
Max Rst	99	218:TRANSPO	4.467	-15.404	-4.178	16.674	-0.001	-0.000	-0.000

Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (m)	X (mm)	Y (mm)	Z (mm)	Resultant (mm)
Max X	449	211:TRANSPOI	3.634	22.660	-1.764	-4.763	23.115
Min X	459	215:TRANSPO	3.634	-22.641	-1.765	-4.763	23.107
Max Y	276	202:TRANSPO	0.000	8.495	0.884	6.784	10.893
Min Y	388	217:TRANSPO	0.550	0.001	-15.778	-0.083	15.780
Max Z	447	203:TRANSPO	3.448	0.663	-2.194	28.342	23.454
Min Z	447	217:TRANSPO	3.448	1.652	-3.949	-29.316	29.627
Max Rst	447	217:TRANSPO	3.448	1.652	-3.949	-29.316	29.627

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Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	5	215:TRANSPO	217.888	665.774	-101.917	0.000	0.000	0.000
Min FX	8	211:TRANSPOI	-218.128	666.128	-101.890	0.000	0.000	0.000
Max FY	8	212:TRANSPO	-202.311	808.780	-314.005	0.000	0.000	0.000
Min FY	5	208:TRANSPO	-163.934	-420.610	337.290	0.000	0.000	0.000
Max FZ	8	217:TRANSPO	27.038	-74.955	388.688	0.000	0.000	0.000
Min FZ	8	203:TRANSPO	-66.275	460.558	-842.810	0.000	0.000	0.000
Max MX	1	201:TRANSPO	-113.521	220.703	-77.986	0.000	0.000	0.000
Min MX	1	201:TRANSPO	-113.521	220.703	-77.986	0.000	0.000	0.000
Max MY	1	201:TRANSPO	-113.521	220.703	-77.986	0.000	0.000	0.000
Min MY	1	201:TRANSPO	-113.521	220.703	-77.986	0.000	0.000	0.000
Max MZ	1	201:TRANSPO	-113.521	220.703	-77.986	0.000	0.000	0.000
Min MZ	1	201:TRANSPO	-113.521	220.703	-77.986	0.000	0.000	0.000

A.5.1.8 Lift, ULS-a, LC511, LC 512, LC 513

Software licensed to	Job No	Sheet No 1	Rev
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Job Title Master Thesis Spring 2015	Ref		
	By Gholam Sakhi Sakh 5-Jan-15	Chd	
Client University of Stavanger	File MASTER THESIS LIFT(fir	Date/Time 06-May-2015 10:26	

Job Information

	Engineer	Checked	Approved
Name:	Gholam Sakhi Sakha		
Date:	5-Jan-15		

Structure Type	SPACE FRAME

Number of Nodes	92	Highest Node	147
Number of Elements	163	Highest Beam	471
Number of Plates	48	Highest Plate	443

Number of Basic Load Cases	9
Number of Combination Load Cases	3

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Combination	511	LIFT ANALYSIS GAMMAC = 1.25
Combination	512	LIFT ANALYSIS GAMMAC = 1.10
Combination	513	LIFT ANALYSIS GAMMAC = 1.00

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm^2)	Iz (cm^4)	Iy (cm^4)	Ix (cm^4)
1	TUB300300	TUB300300	0.257	1.000	0.257	EC-eq(5.36)	513	181.000	24.2E+3	24.2E+3	37.6E+3
2	TUB250250	TUB250250	0.340	1.000	0.340	EC-5.5.4.LTB	511	149.000	13.5E+3	13.5E+3	21.1E+3
4	TUB250250	TUB250250	0.254	1.000	0.254	EC-eq(5.36)	513	77.100	7.51E+3	7.51E+3	11.5E+3
5	TUB250250	TUB250250	0.138	1.000	0.138	EC-5.5.4.LTB	511	149.000	13.5E+3	13.5E+3	21.1E+3
6	TUB250250	TUB250250	0.357	1.000	0.357	EC-eq(5.36)	511	77.100	7.51E+3	7.51E+3	11.5E+3
7	TUB250250	TUB250250	0.049	1.000	0.049	EC-5.5.4	511	149.000	13.5E+3	13.5E+3	21.1E+3
8	TUB250250	TUB250250	0.049	1.000	0.049	EC-5.5.4	511	149.000	13.5E+3	13.5E+3	21.1E+3
13	TUB250250	TUB250250	0.356	1.000	0.356	EC-eq(5.36)	511	77.100	7.51E+3	7.51E+3	11.5E+3
14	TUB250250	TUB250250	0.254	1.000	0.254	EC-eq(5.36)	513	77.100	7.51E+3	7.51E+3	11.5E+3
17	TUB300300	TUB300300	0.257	1.000	0.257	EC-eq(5.36)	513	181.000	24.2E+3	24.2E+3	37.6E+3
21	TUB250250	TUB250250	0.104	1.000	0.104	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
23	TUB120120	TUB120120	0.061	1.000	0.061	EC-eq(5.36)	512	43.500	870.000	870.000	1.38E+3
25	TUB120120	TUB120120	0.069	1.000	0.069	EC-eq(5.36)	513	43.500	870.000	870.000	1.38E+3
26	TUB250250	TUB250250	0.354	1.000	0.354	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
28	TUB120120	TUB120120	0.360	1.000	0.360	EC-eq(5.36)	512	43.500	870.000	870.000	1.38E+3
30	TUB120120	TUB120120	0.112	1.000	0.112	EC-eq(5.36)	513	43.500	870.000	870.000	1.38E+3
31	TUB250250	TUB250250	0.154	1.000	0.154	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
32	TUB250250	TUB250250	0.117	1.000	0.117	EC-5.5.4	512	149.000	13.5E+3	13.5E+3	21.1E+3
33	TUB250250	TUB250250	0.037	1.000	0.037	EC-5.5.2 LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
34	TUB250250	TUB250250	0.353	1.000	0.353	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
35	TUB250250	TUB250250	0.104	1.000	0.104	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
36	TUB250250	TUB250250	0.161	1.000	0.161	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
37	TUB250250	TUB250250	0.250	1.000	0.250	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
38	TUB250250	TUB250250	0.104	1.000	0.104	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3

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Client University of Stavanger	File MASTER THESIS LIFT(fir	Date/Time 06-May-2015 10:26	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
39	TUB250250	TUB250250	0.161	1.000	0.161	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
40	TUB250250	TUB250250	0.333	1.000	0.333	EC-5.5.4 LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
41	TUB250250	TUB250250	0.098	1.000	0.098	EC-5.5.4	512	149.000	13.5E+3	13.5E+3	21.1E+3
42	TUB250250	TUB250250	0.037	1.000	0.037	EC-5.5.2 LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
67	TUB250250	TUB250250	0.051	1.000	0.051	EC-5.5.4	511	149.000	13.5E+3	13.5E+3	21.1E+3
68	TUB250250	TUB250250	0.051	1.000	0.051	EC-5.5.4	511	149.000	13.5E+3	13.5E+3	21.1E+3
73	HE140A	HE140A	0.048	1.000	0.048	EC-5.5.4 LTB	512	31.400	1.03E+3	389.000	8.100
74	HE140A	HE140A	0.156	1.000	0.156	EC-5.5.4 LTB	512	31.400	1.03E+3	389.000	8.100
75	HE140A	HE140A	0.996	1.000	0.996	EC-5.5.4 LTB	512	31.400	1.03E+3	389.000	8.100
76	HE140A	HE140A	0.400	1.000	0.400	EC-5.5.4 LTB	512	31.400	1.03E+3	389.000	8.100
77	HE140A	HE140A	0.025	1.000	0.025	EC-5.5.4 LTB	512	31.400	1.03E+3	389.000	8.100
116	HE240B	HE240B	0.114	1.000	0.114	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
117	HE240B	HE240B	0.252	1.000	0.252	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
119	HE240B	HE240B	0.166	1.000	0.166	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
120	HE240B	HE240B	0.381	1.000	0.381	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
121	HE240B	HE240B	0.195	1.000	0.195	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
122	HE240B	HE240B	0.141	1.000	0.141	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
124	HE240B	HE240B	0.194	1.000	0.194	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
125	HE240B	HE240B	0.141	1.000	0.141	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
127	HE240B	HE240B	0.166	1.000	0.166	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
128	HE240B	HE240B	0.252	1.000	0.252	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
130	HE240B	HE240B	0.194	1.000	0.194	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
131	HE240B	HE240B	0.141	1.000	0.141	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
133	HE240B	HE240B	0.195	1.000	0.195	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
134	HE240B	HE240B	0.142	1.000	0.142	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
136	HE240B	HE240B	0.382	1.000	0.382	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
138	HE240B	HE240B	0.061	1.000	0.061	EC-5.5.2 LTB	513	106.000	11.3E+3	3.92E+3	103.000
145	HE240B	HE240B	0.061	1.000	0.061	EC-5.5.2 LTB	513	106.000	11.3E+3	3.92E+3	103.000
146	HE240B	HE240B	0.061	1.000	0.061	EC-5.5.2 LTB	513	106.000	11.3E+3	3.92E+3	103.000
153	HE240B	HE240B	0.061	1.000	0.061	EC-5.5.2 LTB	513	106.000	11.3E+3	3.92E+3	103.000
154	HE140A	HE140A	0.214	1.000	0.214	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
155	HE140A	HE140A	0.216	1.000	0.216	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
156	HE140A	HE140A	0.117	1.000	0.117	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
157	HE140A	HE140A	0.018	1.000	0.018	EC-eq(5.36)	513	31.400	1.03E+3	389.000	8.100
158	HE140A	HE140A	0.117	1.000	0.117	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
159	HE140A	HE140A	0.216	1.000	0.216	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
160	HE140A	HE140A	0.214	1.000	0.214	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
161	HE240B	HE240B	0.114	1.000	0.114	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
162	HE240B	HE240B	0.514	1.000	0.514	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
163	HE240B	HE240B	0.203	1.000	0.203	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
164	HE240B	HE240B	0.055	1.000	0.055	EC-5.5.2 LTB	513	106.000	11.3E+3	3.92E+3	103.000
165	HE240B	HE240B	0.174	1.000	0.174	EC-5.5.4 LTB	513	106.000	11.3E+3	3.92E+3	103.000
166	HE240B	HE240B	0.230	1.000	0.230	EC-5.5.4 LTB	513	106.000	11.3E+3	3.92E+3	103.000
167	HE240B	HE240B	0.055	1.000	0.055	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
168	HE240B	HE240B	0.174	1.000	0.174	EC-5.5.4 LTB	513	106.000	11.3E+3	3.92E+3	103.000
169	HE240B	HE240B	0.175	1.000	0.175	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
171	HE240B	HE240B	0.143	1.000	0.143	EC-5.5.4 LTB	513	106.000	11.3E+3	3.92E+3	103.000
172	HE240B	HE240B	0.199	1.000	0.199	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
174	HE240B	HE240B	0.142	1.000	0.142	EC-5.5.4 LTB	513	106.000	11.3E+3	3.92E+3	103.000
175	HE240B	HE240B	0.202	1.000	0.202	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000

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	By Gholam Sakhi Sakhi 15-Jan-15	Chd	
Client University of Stavanger	File MASTER THESIS UFT(fir	Date/Time 06-May-2015 10:26	

Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
177	HE240B	HE240B	0.230	1.000	0.230	EC-5.5.4.LTB	513	106.000	11.3E+3	3.92E+3	103.000
178	HE240B	HE240B	0.200	1.000	0.200	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
180	HE240B	HE240B	0.142	1.000	0.142	EC-5.5.4.LTB	513	106.000	11.3E+3	3.92E+3	103.000
181	HE240B	HE240B	0.175	1.000	0.175	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
183	HE240B	HE240B	0.143	1.000	0.143	EC-5.5.4.LTB	513	106.000	11.3E+3	3.92E+3	103.000
184	HE240B	HE240B	0.514	1.000	0.514	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
186	HE240B	HE240B	0.055	1.000	0.055	EC-eq(5.36)	513	106.000	11.3E+3	3.92E+3	103.000
194	HE140A	HE140A	0.197	1.000	0.197	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
195	HE140A	HE140A	0.199	1.000	0.199	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
196	HE140A	HE140A	0.109	1.000	0.109	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
197	HE140A	HE140A	0.031	1.000	0.031	EC-5.5.4.LTB	513	31.400	1.03E+3	389.000	8.100
198	HE140A	HE140A	0.109	1.000	0.109	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
199	HE140A	HE140A	0.199	1.000	0.199	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
200	HE140A	HE140A	0.197	1.000	0.197	EC-5.5.2 LTB	513	31.400	1.03E+3	389.000	8.100
256	HE240B	HE240B	0.055	1.000	0.055	EC-5.5.2 LTB	513	106.000	11.3E+3	3.92E+3	103.000
269	TUB250250'	TUB250250'	0.025	1.000	0.025	EC-5.5.2 LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
270	TUB250250'	TUB250250'	0.162	1.000	0.162	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
271	TUB250250'	TUB250250'	0.162	1.000	0.162	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
272	TUB250250'	TUB250250'	0.025	1.000	0.025	EC-5.5.2 LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
273	TUB160160i	TUB16016C	0.002	1.000	0.002	EC-5.4.5.1	513	37.700	1.46E+3	1.46E+3	2.33E+3
274	TUB160160i	TUB16016C	0.002	1.000	0.002	EC-5.4.5.1	513	37.700	1.46E+3	1.46E+3	2.33E+3
275	TUB300300'	TUB300300'	0.002	1.000	0.002	EC-5.4.6-(Y)	511	181.000	24.2E+3	24.2E+3	37.6E+3
276	TUB300300'	TUB300300'	0.002	1.000	0.002	EC-5.4.6-(Y)	513	181.000	24.2E+3	24.2E+3	37.6E+3
301	TUB250250'	TUB250250'	0.250	1.000	0.250	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
302	TUB250250'	TUB250250'	0.104	1.000	0.104	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
303	TUB250250'	TUB250250'	0.154	1.000	0.154	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
304	TUB250250'	TUB250250'	0.118	1.000	0.118	EC-5.5.4	512	149.000	13.5E+3	13.5E+3	21.1E+3
305	TUB250250'	TUB250250'	0.340	1.000	0.340	EC-5.5.4.LTB	511	149.000	13.5E+3	13.5E+3	21.1E+3
306	TUB250250'	TUB250250'	0.138	1.000	0.138	EC-5.5.4.LTB	511	149.000	13.5E+3	13.5E+3	21.1E+3
307	HE140A	HE140A	0.400	1.000	0.400	EC-5.5.4.LTB	512	31.400	1.03E+3	389.000	8.100
308	HE140A	HE140A	0.994	1.000	0.994	EC-5.5.4.LTB	512	31.400	1.03E+3	389.000	8.100
309	HE140A	HE140A	0.156	1.000	0.156	EC-5.5.4.LTB	512	31.400	1.03E+3	389.000	8.100
310	HE140A	HE140A	0.048	1.000	0.048	EC-5.5.4.LTB	512	31.400	1.03E+3	389.000	8.100
311	TUB250250'	TUB250250'	0.034	1.000	0.034	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
312	TUB250250'	TUB250250'	0.407	1.000	0.407	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
313	TUB250250'	TUB250250'	0.034	1.000	0.034	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
314	TUB250250'	TUB250250'	0.050	1.000	0.050	EC-5.5.4	512	149.000	13.5E+3	13.5E+3	21.1E+3
315	TUB250250'	TUB250250'	0.044	1.000	0.044	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
316	TUB250250'	TUB250250'	0.496	1.000	0.496	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
317	TUB250250'	TUB250250'	0.044	1.000	0.044	EC-eq(5.36)	512	149.000	13.5E+3	13.5E+3	21.1E+3
318	TUB250250'	TUB250250'	0.050	1.000	0.050	EC-5.5.4	512	149.000	13.5E+3	13.5E+3	21.1E+3
319	TUB250250'	TUB250250'	0.333	1.000	0.333	EC-5.5.4.LTB	512	149.000	13.5E+3	13.5E+3	21.1E+3
320	TUB250250'	TUB250250'	0.098	1.000	0.098	EC-5.5.4	512	149.000	13.5E+3	13.5E+3	21.1E+3
321	HE140A	HE140A	0.025	1.000	0.025	EC-5.5.4.LTB	512	31.400	1.03E+3	389.000	8.100
322	TUB250250'	TUB250250'	0.050	1.000	0.050	EC-5.5.4	512	149.000	13.5E+3	13.5E+3	21.1E+3
323	TUB250250'	TUB250250'	0.050	1.000	0.050	EC-5.5.4	512	149.000	13.5E+3	13.5E+3	21.1E+3
372	HE220B	HE220B	0.274	1.000	0.274	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
373	HE220B	HE220B	0.274	1.000	0.274	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
374	HE220B	HE220B	0.339	1.000	0.339	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
375	HE220B	HE220B	0.339	1.000	0.339	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600

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Utilization Ratio Cont...

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (cm²)	Iz (cm⁴)	Iy (cm⁴)	Ix (cm⁴)
376	HE220B	HE220B	0.354	1.000	0.354	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
377	HE220B	HE220B	0.354	1.000	0.354	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
378	HE220B	HE220B	0.354	1.000	0.354	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
379	HE220B	HE220B	0.354	1.000	0.354	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
380	HE220B	HE220B	0.339	1.000	0.339	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
381	HE220B	HE220B	0.339	1.000	0.339	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
382	HE220B	HE220B	0.274	1.000	0.274	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
383	HE220B	HE220B	0.274	1.000	0.274	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
384	HE220B	HE220B	0.269	1.000	0.269	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
385	HE220B	HE220B	0.269	1.000	0.269	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
386	HE220B	HE220B	0.337	1.000	0.337	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
387	HE220B	HE220B	0.337	1.000	0.337	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
388	HE220B	HE220B	0.358	1.000	0.358	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
389	HE220B	HE220B	0.358	1.000	0.358	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
390	HE220B	HE220B	0.358	1.000	0.358	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
391	HE220B	HE220B	0.358	1.000	0.358	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
392	HE220B	HE220B	0.337	1.000	0.337	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
393	HE220B	HE220B	0.337	1.000	0.337	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
394	HE220B	HE220B	0.269	1.000	0.269	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
395	HE220B	HE220B	0.269	1.000	0.269	EC-5.5.2 LTB	513	91.000	8.09E+3	2.84E+3	76.600
447	TUB120120	TUB1201208	0.263	1.000	0.263	EC-eq(5.36)	512	28.500	610.000	610.000	949.000
449	TUB140140	TUB1401408	0.071	1.000	0.071	EC-eq(5.36)	512	41.900	1.21E+3	1.21E+3	1.89E+3
454	TUB120120	TUB1201208	0.263	1.000	0.263	EC-eq(5.36)	512	28.500	610.000	610.000	949.000
455	TUB120120	TUB1201208	0.207	1.000	0.207	EC-eq(5.36)	513	28.500	610.000	610.000	949.000
456	TUB120120	TUB1201208	0.207	1.000	0.207	EC-eq(5.36)	513	28.500	610.000	610.000	949.000
458	TUB140140	TUB1401408	0.083	1.000	0.083	EC-5.5.4	513	41.900	1.21E+3	1.21E+3	1.89E+3
459	TUB140140	TUB1401408	0.071	1.000	0.071	EC-eq(5.36)	512	41.900	1.21E+3	1.21E+3	1.89E+3
460	TUB140140	TUB1401408	0.083	1.000	0.083	EC-5.5.4	513	41.900	1.21E+3	1.21E+3	1.89E+3
461	TUB300300	TUB3003000	0.286	1.000	0.286	EC-eq(5.36)	511	181.000	24.2E+3	24.2E+3	37.6E+3
462	TUB300300	TUB3003000	0.286	1.000	0.286	EC-eq(5.36)	511	181.000	24.2E+3	24.2E+3	37.6E+3
463	PIPE	N/A						157.080	2.45E+3	2.45E+3	4.91E+3
464	PIPE	N/A						157.080	2.45E+3	2.45E+3	4.91E+3
465	PIPE	N/A						157.080	2.45E+3	2.45E+3	4.91E+3
466	PIPE	N/A						157.080	2.45E+3	2.45E+3	4.91E+3
467	TUB300300	TUB3003000	0.272	1.000	0.272	EC-eq(5.36)	511	181.000	24.2E+3	24.2E+3	37.6E+3
468	TUB300300	TUB3003000	0.272	1.000	0.272	EC-eq(5.36)	511	181.000	24.2E+3	24.2E+3	37.6E+3
469	TUB120120	TUB1201200	0.402	1.000	0.402	EC-5.5.4	511	43.500	870.000	870.000	1.38E+3
470	TUB120120	TUB1201200	0.402	1.000	0.402	EC-5.5.4	511	43.500	870.000	870.000	1.38E+3
471	PIPE	N/A						157.080	2.45E+3	2.45E+3	4.91E+3

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Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	145	511:LIFT ANAL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Min X	146	511:LIFT ANAL	-7.862	-204.735	1.29E+3	1.3E+3	-0.072	-0.000	0.000
Max Y	6	511:LIFT ANAL	-4.318	191.834	1.12E+3	1.13E+3	-0.073	0.000	-0.002
Min Y	129	511:LIFT ANAL	-7.256	-243.798	1.8E+3	1.82E+3	-0.071	-0.000	0.003
Max Z	4	511:LIFT ANAL	-7.276	-208.073	1.8E+3	1.81E+3	-0.071	-0.000	0.003
Min Z	145	511:LIFT ANAL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Max rX	145	511:LIFT ANAL	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Min rX	68	511:LIFT ANAL	-7.366	185.797	1.8E+3	1.81E+3	-0.088	-0.000	0.002
Max rY	6	511:LIFT ANAL	-4.318	191.834	1.12E+3	1.13E+3	-0.073	0.000	-0.002
Min rY	7	511:LIFT ANAL	-4.829	188.894	1.12E+3	1.13E+3	-0.073	-0.000	0.001
Max rZ	82	511:LIFT ANAL	-7.338	-12.526	1.8E+3	1.8E+3	-0.072	-0.000	0.016
Min rZ	75	511:LIFT ANAL	-7.355	-9.585	1.8E+3	1.8E+3	-0.072	-0.000	-0.016
Max Rst	129	511:LIFT ANAL	-7.256	-243.798	1.8E+3	1.82E+3	-0.071	-0.000	0.003

Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (m)	X (mm)	Y (mm)	Z (mm)	Resultant (mm)
Max X	464	511:LIFT ANAL	6.611	126.288	-142.953	554.254	585.938
Min X	465	511:LIFT ANAL	6.611	-128.189	-144.224	554.282	587.128
Max Y	5	511:LIFT ANAL	0.000	-4.318	191.834	1.12E+3	1.13E+3
Min Y	274	511:LIFT ANAL	0.000	-7.256	-243.798	1.8E+3	1.82E+3
Max Z	17	511:LIFT ANAL	4.750	-7.276	-208.073	1.8E+3	1.81E+3
Min Z	463	511:LIFT ANAL	16.507	0.000	0.000	0.000	0.000
Max Rst	274	511:LIFT ANAL	0.000	-7.256	-243.798	1.8E+3	1.82E+3

Reaction Summary

			Horizontal	Vertical	Horizontal	Moment		
	Node	L/C	FX (kN)	FY (kN)	FZ (kN)	MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	145	513:LIFT ANAL	-0.000	2.48E+3	-0.000	272.761	0.000	1.163
Min FX	145	511:LIFT ANAL	-0.000	3.09E+3	-0.000	340.949	0.000	1.454
Max FY	145	511:LIFT ANAL	-0.000	3.09E+3	-0.000	340.949	0.000	1.454
Min FY	145	513:LIFT ANAL	-0.000	2.48E+3	-0.000	272.761	0.000	1.163
Max FZ	145	513:LIFT ANAL	-0.000	2.48E+3	-0.000	272.761	0.000	1.163
Min FZ	145	511:LIFT ANAL	-0.000	3.09E+3	-0.000	340.949	0.000	1.454
Max MX	145	511:LIFT ANAL	-0.000	3.09E+3	-0.000	340.949	0.000	1.454
Min MX	145	513:LIFT ANAL	-0.000	2.48E+3	-0.000	272.761	0.000	1.163
Max MY	145	511:LIFT ANAL	-0.000	3.09E+3	-0.000	340.949	0.000	1.454
Min MY	145	513:LIFT ANAL	-0.000	2.48E+3	-0.000	272.761	0.000	1.163
Max MZ	145	511:LIFT ANAL	-0.000	3.09E+3	-0.000	340.949	0.000	1.454
Min MZ	145	513:LIFT ANAL	-0.000	2.48E+3	-0.000	272.761	0.000	1.163

APENDIX B

LAYDOWN LOADS CALCULATION

STATIC WIND LOAD CALCULATION

EARTHQUAKE ACCELERATION CALCULATION

BARGE ACCELERATION CALCULATION

VARIABLE FUNCTIONAL LOADS CALCULATION

COMBINATION ACTIONS TABLE

B.1 LAYDOWN LOAD CALCULATION

Master Thesis UiS **Laydown Load**

The structure unit measures 10000 mm, 5500 mm and 9500 mm (L-W-H). According to NORSOK, laydown areas are not normally to be designed for less than 15.0kN/m^2.

Laydown area: [ref/3/, NORSOK N-003, 5.3/ Table 1] $q := 15.0\frac{kN}{m^2}$

Calculations:

Width of module $d_{module} := 5500mm$

Length of module $L_{module} := 10000mm$

Area of module $A_{module} := d_{module} \cdot L_{module} = 55.0 \cdot m^2$

Total point load: $F_{total} := q \cdot A_{module} = 825.0 \cdot kN$

Length of members on the top of the DOP: $L_m := L_{module} + 9 \cdot d_{module} = 59.5\,m$

Laydown load $F_{laydown} := \frac{F_{total}}{L_m} = 13.9 \cdot \frac{kN}{m}$

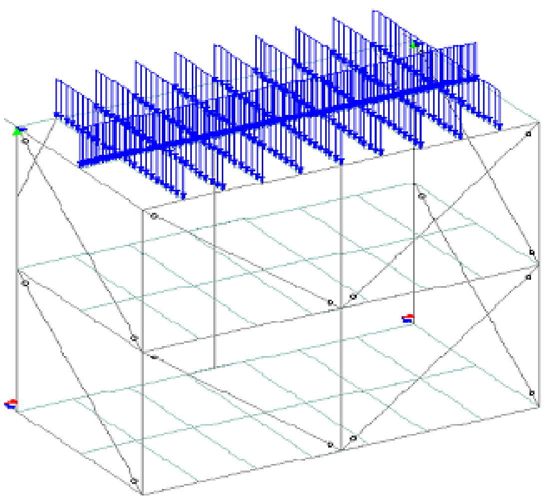

Figure from Staad.Pro

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B.2 STATIC WIND CALCULATION

Master Thesis UiS **Design Wind Load**

2/3 of the height of the module structure is applied for design and calculation of wind load according to design brief. Level at top of steel weather deck, Black Gold field is 57950mm. [ref/1/, Structural Design Brief/ Environmental load.].

Level at top of steel celler deck: $d_{top.c.d} := 33800mm$

Height of module $h_{module} := 9500mm$

Width of module $d_{module} := 5500mm$

Length of module $L_{module} := 10000mm$

Module height above sea level: $Z_{module} := d_{top.c.d} + \frac{2}{3} \cdot h_{module} = 40133 \cdot mm$

Mean wind action: [ref/3/, NORSOK N-003/6.3.2-6.3.3.]

3 second gust wind will be used for local design when structure have a vertical or horizontal extent less than 50.0 meter. Reference wind 1 hour mean wind velocity at z-direction equal 10.0m is 34.0m/s. [ref/1/, Metocean data, Black Gold field.].

Reference wind 1 hour mean wind velocity at z := 10 m: $U_0 := 34.0 \frac{m}{s}$

average time period: $t_0 := 3600s$

Gust wind period: $t := 3.0s$

$$C_1 := 5.73 \cdot 10^{-2} \cdot \left(1 + 0.15 \cdot U_0 \cdot \frac{s}{m}\right)^{0.5} = 0.14$$

$$U_z := U_0 \cdot \left(1 + C_1 \cdot \ln\left(\frac{Z_{module}}{10m}\right)\right) = 40.7 \cdot \frac{m}{s}$$

Turbulence intensity factor: $I_u := 0.06 \cdot \left(1 + 0.043 \cdot U_0 \cdot \frac{s}{m}\right) \cdot \left(\frac{Z_{module}}{10m}\right)^{-0.22} = 0.11$

Characteristic wind velocity: $U_{zt} := U_z \cdot \left(1 - 0.41 \cdot I_u \cdot \ln\left(\frac{t}{t_0}\right)\right) = 53.6 \frac{m}{s}$

Mass density of air: $\rho := 1.225 \frac{kg}{m^3}$

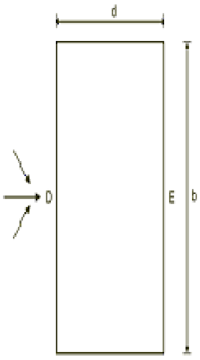
Shape coefficients: [ref/3/, NORSOK N-003.6.3.3.] $C_s := 1.2$

$\alpha := 90deg$

Master Thesis UiS **Design Wind Load**

External pressure coefficient:

$$\frac{h_{module}}{d_{module}} = 1.7$$



$c_{pe.d} := 0.7$

$c_{pe.e} := -0.5$

Mean wind pressure:

$$q_{wind} := \frac{1}{2} \cdot C_s \cdot \rho \cdot (U_{z.t})^2 \cdot \sin(\alpha) = 2.1 \cdot \frac{kN}{m^2}$$

Area of north part of module

$A_{north} := 5500mm \cdot 9500mm$

$A_{north} = 52.25m^2$

lenght of load area fro the north direction.

$L_{west} := 2 \cdot 9500mm + 3 \cdot 5500mm$

$L_{west} = 35.5m$

Wind force acting on module from north direction

$F_{wind} := q_{wind} \cdot A_{north}$

$F_{wind} = 1.102 \times 10^5 N$

The new model can be assumed to be 50% solid.

$F_{wind.design} := 0.50 \cdot F_{wind}$

$F_{wind.design} = 5.508 \times 10^4 N$

Wind pressure in transport: [ref/6/, DNV/2.2.3.1]

$$q_{wind.t} := 1.0 \frac{kN}{m^2}$$

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B.3 EARTHQUAKE ACCELERATION CALCULATION

EERTHQUAKE ACCELERATION CALCULATION

Earthquake accelerations are given in the design brief must be used to calculate the correct acceleration for the module. The accelerations given in design brief are for top and bottom of the main structure but for module we need to find it.

the module lower support points are in line with ceøller deck center line (33.0 m), and top of module are in line with mezz deck (center line 42.5 m).
To be conservative and same time have the most closest value of acceleration for the module the 2/3 height of the module used for calculation of acceleration.

Refrence accelerations have been taken from design brief:

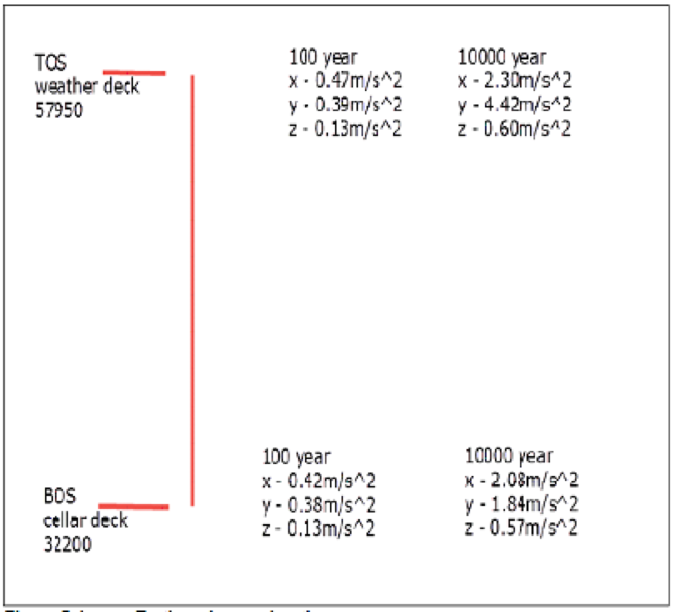

Figure 5-1 Earthquake accelerations

Eartthquake acceleration 100 year

Distance between top and bottom of main structure

$TOS := 57950mm$ $BOS := 32200mm$

$\Delta := TOS - BOS$ $\Delta = 25.75m$

Master Thesis Uis **Eartquake acceleration**

X_direction

$Accx_{top} := 0.47 \cdot \frac{m}{s^2}$ $Accx_{bottom} := 0.42 \cdot \frac{m}{s^2}$

$\Delta_x := Accx_{top} - Accx_{bottom}$ $h_{module} := 9.5m$

$\Delta_x = 0.05 \frac{m}{s^2}$

Assume 2/3 height of module: $\Delta h := \frac{2}{3} \cdot h_{module}$

$Accx := \Delta_x \cdot \frac{\Delta h}{\Delta} + Accx_{bottom}$ $Accx = 0.4323 \frac{m}{s^2}$

$X_{100} := \frac{Accx}{g}$ $X_{100} = 0.0441$

Y_direction

$Accy_{top} := 0.39 \cdot \frac{m}{s^2}$ $Accy_{bottom} := 0.38 \cdot \frac{m}{s^2}$

$\Delta_y := Accy_{top} - Accy_{bottom}$ $\Delta_y = 0.01 \frac{m}{s^2}$

$Accy := \Delta_y \cdot \frac{\Delta h}{\Delta} + Accy_{bottom}$ $Accy = 0.3825 \frac{m}{s^2}$

$Y_{100} := \frac{Accy}{g}$ $Y_{100} = 0.039$

Z_direction

$Accz_{top} := 0.13 \cdot \frac{m}{s^2}$ $Accz_{bottom} := 0.13 \cdot \frac{m}{s^2}$

$\Delta_z := Accz_{top} - Accz_{bottom}$ $\Delta_z = 0 \frac{m}{s^2}$

$Accz := \Delta_z \cdot \frac{\Delta h}{\Delta} + 0.13 \cdot \frac{m}{s^2}$ $Accz = 0.13 \frac{m}{s^2}$

$Z_{100} := \frac{Accz}{g}$ $Z_{100} = 0.0133$

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Master Thesis Uis **Eartquake acceleration**

Earthquake acceleartion 10000 year

X_direction

$Acx_{top} := 2.30 \cdot \frac{m}{s^2}$ $Acx_{bottom} := 2.08 \cdot \frac{m}{s^2}$

$\Delta X := Acx_{top} - Acx_{bottom}$ $\Delta X = 0.22 \frac{m}{s^2}$

$Acx := \Delta X \cdot \frac{\Delta h}{\Delta} + Acx_{bottom}$ $Acx = 2.1341 \frac{m}{s^2}$

$X_{10000} := \frac{Acx}{g}$ $X_{10000} = 0.2176$

Y – direction

$Acy_{top} := 4.42 \cdot \frac{m}{s^2}$ $Acy_{bottom} := 1.84 \cdot \frac{m}{s^2}$

$\Delta Y := Acy_{top} - Acy_{bottom}$ $\Delta Y = 2.58 \frac{m}{s^2}$

$Acy := \Delta Y \cdot \frac{\Delta h}{\Delta} + Acy_{bottom}$ $Acy = 2.4746 \frac{m}{s^2}$

$Y_{10000} := \frac{Acy}{g}$ $Y_{10000} = 0.2523$

Z – direction

$Acz_{top} := 0.60 \cdot \frac{m}{s^2}$ $Acz_{bottom} := 0.57 \cdot \frac{m}{s^2}$

$\Delta Z := Acz_{top} - Acz_{bottom}$ $\Delta Z = 0.03 \frac{m}{s^2}$

$Acz := \Delta Z \cdot \frac{\Delta h}{\Delta} + Acz_{bottom}$ $Acz = 0.5774 \frac{m}{s^2}$

$Z_{10000} := \frac{Acz}{g}$ $Z_{10000} = 0.0589$

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B.4 BARGE ACCELERATION CALCULATION

Master Thesis UiS **Barge acceleration**

The offshore module structure shall be fabricated onshore, and transported to the Black gold field on a barge. Wind load and barge accelerations shall be calculated according to DNV Rules for planning and execution of marine operations.[ref/6/, 2.2.3.]. Barge dimensions are provided by Aker Solutions in Stavanger. 2/3 height of the module structure shall be used in calculation according to Design brief, 5.2.

Distance between bottom of the module and barge deck: $d_{module.b} := 500mm$

Height of module: $h_{module} := 9500mm$

Width of module: $d_{module} := 5500mm$

Length of module: $L_{module} := 10000mm$

Depth of barge: $d_{barge} := 7620mm$

Calculations:

From DNV 1996 rules for planning and excution of marine operaion Part.2

Longitudinal accelartion due to pitch and surge: $X_{acc} := 0.45g$ at waterline

Incresing 0.01g each meter above the bottom of object.

Transvers acceleation due to roll and sway : $Z_{acc} := 0.65g$ at waterline

Increasing 0.015g each meter above the bottom of object.

Barge acceleration in +X:

$$a_X := 0.45g + \left(d_{barge} + \frac{2}{3} \cdot h_{module} + d_{module.b}\right) \cdot 0.01 \frac{g}{m} = 0.5945 \cdot g$$

Barge acceleration in +Z:

$$a_Z := 0.65g + \left(d_{barge} + \frac{2}{3} \cdot h_{module} + d_{module.b}\right) \cdot 0.015 \frac{g}{m} = 0.8668 \cdot g$$

Barge accelerations in -X and -Z have the same value with opposite direction.

Maximum Barge acceleration in +Y: $a_{Ymax} := 0.35g$

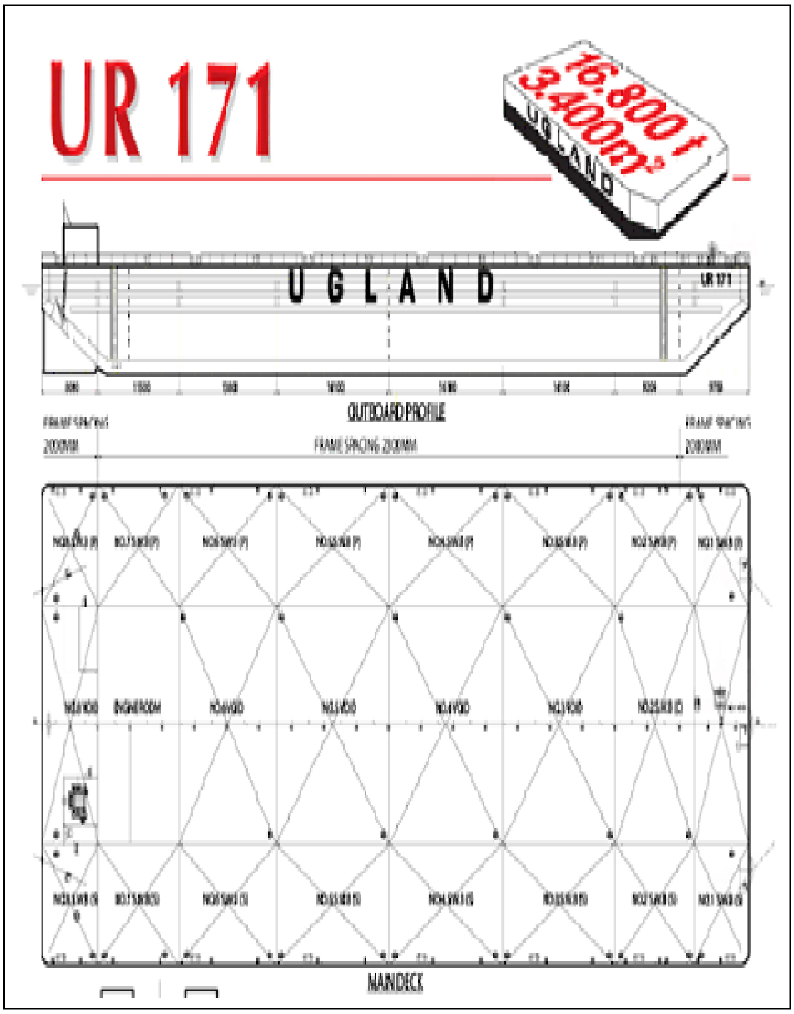
Minimum Barge acceleration in -Y: $a_{Ymin} := 0.45g$

Barge acceleration in + x : $a_x := 0.5945g$

Barge acceleartion in + z: $a_z := 0.8668g$

Master Thesis UiS Barge acceleration

Barge data



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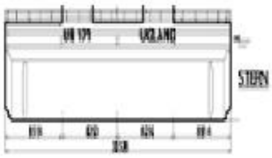
Master Thesis UiS **Barge acceleration**



POINT LOADS	
Crossing points of bulkheads	433 tonnes
Crossing points of long. bulkheads and transverse webs.	264 tonnes
Midspan transverse webs	164 tonnes

Built:	2011 by Nantong Tongde Shipbuilding & Repairing CO.	
Class:	American Bureau of Shipping (ABS)	
Signal letter:	LG6457	
Register Tonnage:	Gross: 6969 tons / Net: 2090 tons	

DIMENSIONS:

Length overall:	330'	100,584 m
Length b.p.p:		96,599 m
Breadth:	110'	33,528 m
Depth:	25'	7,620 m
Draft Loaded:		6,086 m
Draft Light:		1,163 m

CAPASITIES:

Deadweight:	16.214 tonnes
Lightship weight:	3.316 tonnes
Deck area:	3239 m^2
Deck unit load:	25 t / sqm

ARRANGEMENTS & FORM:

Bulkheads:	3 longitudinal, 7 transverse
Ballast tanks:	17
Void tanks:	6
Bow:	Raked
Stern:	Raked with twin skegs

EQUIPMENT:

Engines for ballast pumps:	2 off water cooled diesel engines, Volvo Penta D7C TA - 169 kW at 1900 rpm, driving 2 ballast pumps.
Ballast Pumps:	Bombas Itur 300-350, ballast capacity 1000 m^3/hr/each
Generator:	Hyundai HMG550 32 kW, 400v/3phases/50Hz
Engine for Hydraulic pump for capstan and anchor winch:	Perkins Diesel 70 kw, 4.4TWGM
Engine for retriever winch:	Perkins Diesel 29,6 kw, 404D-22G
Lightning:	El. lightening in pump room/ shore connection and battery charger. Solar powered navigation lights.
Bilge Pump:	Desmi S100 80 m^3/hr at 25 meter
Fuel Oil Transfer pump:	Itur RC 1-1/2 5 m^3/hr at 45 meter
Anchor winch:	Hydraulic mooring winch, Maker: Jianghai, China, 25ton.
Capstans:	2 hydraulic operated, 10 tonnes.

MOORING/TOWING:

Anchor:	Stockless bower, 5500 kg.
Anchor chain/wire:	10m 58 mm stud link chain/ 120m, 44 mm dia.wire
Towing arrangement:	3 recessed smit brackets, two for main towing and one for emergency. Chain/wire with triangle plate, SWL 120t.
Bollard:	7 bollards on each side, capacity 20 tons.
Fenders:	20 rubber tyres installed by chain from deck each side.

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B.5 VARIABLE FUNCTIONAL LOADS

Calculation of variable functional loads on deck area

The variable functional loads have been selected from following table.

Table 2-3 Variable functional loads on deck areas

	Local design		*Primary design*	*Global design*
	Distributed load p (kN/m^2)	*Point load P (kN)*	*Apply factor to distributed load*	*Apply factor to primary design load*
Storage areas	q	1.5 q	1.0	1.0
Lay down areas	q	1.5 q	f	f
Lifeboat platforms	9.0	9.0	1.0	may be ignored
Area between equipment	5.0	5.0	f	may be ignored
Walkways, staircases and platforms, crew spaces	4.0	4.0	f	may be ignored
Walkways and staircases for inspection only	3.0	3.0	f	may be ignored
Areas not exposed to other functional loads	2.5	2.5	1.0	-

Notes:

- Wheel loads to be added to distributed loads where relevant. (Wheel loads can be considered acting on an area of 300 x 300 mm.)
- Point loads to be applied on an area 100 x 100 mm, and at the most severe position, but not added to wheel loads or distributed loads.
- q to be evaluated for each case. Lay down areas should not be designed for less than 15 kN/m^2.
- $f = \min\{1.0 ; (0.5 + 3/\sqrt{A})\}$, where A is the loaded area in m^2.
- Global load cases shall be established based upon "worst case", characteristic load combinations, complying with the limiting global criteria to the structure. For buoyant structures these criteria are established by requirements for the floating position in still water, and intact and damage stability requirements, as documented in the operational manual, considering variable load on the deck and in tanks.

Source DNV-OS-C101 Offshore standard

According to the above table the variable functional loads between equipment area must be choosen.

Variable functional loads: $q_{variable} := \frac{5.0kN}{m^2}$

Total deck ara: $10 \cdot 55 = 55\text{m}^2$

Area under pums: $0.75 \cdot 2 \cdot 6 = 9\text{m}^2$

Total available area: $55\text{m}^2 - 9\text{m}^2 = 46\text{m}^2$

Uniformly distributed variable functional loads varying on deck area:

For beams 1 and 6 under pumps:

$$F_{Und} := q_{variable} \cdot \left(1.43\text{m} + \frac{1.43\text{m}}{2} - 0.75\text{m}\right)$$

$$F_{Und} = 6.975 \frac{\text{kN}}{\text{m}}$$

At both ends: $F_{End} := q_{variable} \cdot \left(1.43\text{m} + \frac{1.43\text{m}}{2}\right)$

$$F_{End} = 10.725 \frac{\text{kN}}{\text{m}}$$

For beams 2-5 under pumps: $F_{und} := q_{variable} \cdot 1.43\text{m} \cdot 1.75$

$$F_{und} = 3.4 \frac{\text{kN}}{\text{m}}$$

At both end of beams 2-5: $F_{end} := q_{variable} \cdot 1.43\text{m}$

$$F_{end} = 7.15 \frac{\text{kN}}{\text{m}}$$

B.6 COMBINATION ACTIONS TABLE

Wind load combination ULS-a/b

Table B.4.1 wind load combination

Basic load cases			Uls-a load combination							ULS-b load combination				
No	Description of load	WCF	combination		load combination numbers						load combination numbers			
			uls-a	uls-b	101	102	103	104	105	111	112	113	114	115
1	selfweight	1.10	1.30	1.00	1.43	1.43	1.43	1.43	1.43	1.10	1.10	1.10	1.10	1.10
2	secondry steel	1.10	1.30	1.00	1.43	1.43	1.43	1.43	1.43	1.10	1.10	1.10	1.10	1.10
3	equipment load	1.10	1.30	1.00	1.43	1.43	1.43	1.43	1.43	1.10	1.10	1.10	1.10	1.10
4	variable load		0.70	1.30	0.70	0.70	0.70	0.70	0.70	1.00	1.00	1.00	1.00	1.00
5	laydown load		0.70	1.30	0.70	0.70	0.70	0.70	0.70	1.00	1.00	1.00	1.00	1.00
31	wind +x		0.70	1.30	0.70	0.49				1.30	0.92			
32	wind -x		0.70	1.30			0.70	0.49				1.30	0.92	
33	wind +z		0.70	1.30							0			
34	wind -z		0.70	1.30		0.49		0.49	0.70		0.92		0.92	1.30

Earthquake action 100 year

Table B.4.2 earthquake action combination ULS-a

	Basic load cases		ULS-a Earthquake 100 years load combination																
No	Description of loa	WCF																	
			uls-a	121	122	123	124	125	126	127	128	131	132	133	134	135	136	137	138
1	selfweight	1.10	1.30	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
2	secondry steel	1.10	1.30	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
3	equipment load	1.10	1.30	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
4	variable liad		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	laydown load		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	EQ 100yr +x		0.70	0.70	0.49				0.49			0.70	0.49				0.49		
42	EQ 100yr -x		0.70			0.70	0.49				0.49			0.70	0.49				0.49
43	Eq 100yr +z		0.70					0.70	0.49							0.70	0.49		
44	EQ 100yr -z		0.70		0.49		0.49			0.70	0.49		0.49		0.49			0.70	0.49
45	EQ 100yr +y		0.70									-0.70	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70
46	EQ 100yr -y		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70								

Table.B.4.3 earthquake action combination ULS-b

	Basic load cases		ULS-b Earthquake 100 years load combination																
No	Description of loa	WCF	EQ 100yr -Y									EQ 100yr + Y							
			uls-b	141	142	143	144	145	146	147	148	151	152	153	154	155	156	157	158
1	selfweight	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
2	secondry steel	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
3	equipment load	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
4	variable liad		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
5	laydown load		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
41	EQ 100yr + x		1.30	1.30	0.92				0.92			1.30	0.92				0.92		
42	EQ 100yr -x		1.30			1.30	0.92				0.92			1.30	0.92				0.92
43	Eq 100yr + z		1.30					1.30	0.92							1.30	0.92		
44	EQ 100yr - z		1.30		0.92		0.92			1.30	0.92		0.92		0.92			1.30	0.92
45	EQ 100yr + y		1.30									-1.30	-1.30	-1.30	-1.30	-1.30	-1.30	-1.30	-1.30
46	EQ 100yr - y		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30								

Earthquake action 10000 year ALS

Table B.4.4 earthquake action combination

	Basic load cases		ALS earthquake 10 000 year +y -y																
No	Description of load	WCF	EQ 10 000 - y									EQ 10 000 + y							
			ALS	161	162	163	164	165	166	167	168	171	172	173	174	175	176	177	178
1	selfweight	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
2	secondry steel	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
3	equipment load	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
4	variable liad		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
5	laydown load		0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
51	EQ 10 000 yr +x		1.00	1.00	0.71				0.71			1.00	0.71				0.71		
52	EQ 10 000 yr -x		1.00			1.00	0.71				0.71			1.00	0.71				0.71
53	EQ 10 000 yr + z		1.00					1.00	0.71							1.00	0.71		
54	EQ 10 000 yr - z		1.00		0.71		0.71			1.00	0.71		0.71		0.71			1.00	0.71
55	EQ 10 000 yr + y		1.00									-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00	-1.00
56	EQ 10 000yr - y		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00								

Barge acceleration action

Table.B.4.5 barge acceleration action ULS-a

	Basic load cases			Barge acceleration action ULS-a															
No	Description of load	WCF				ULS-a + y								ULS-a – y					
			uls-b	181	182	183	184	185	186	187	188	191	192	193	194	195	196	197	198
1	selfweight	1.10	1.00	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
2	secondry steel	1.10	1.30	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
3	equipment load	1.10	1.30	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43
61	Wind transport + x		0.70	0.70	0.49						0.49	0.70	0.49						0.49
62	Wind transport - x		0.70				0.49	0.70	0.49						0.49	0.70	0.49		
63	Wind transport + z		0.70		0.49	0.70	0.49						0.49	0.70	0.49				
64	Wind transport - z		0.70						0.49	0.70	0.49						0.49	0.70	0.49
71	Barge acceleration + x		0.70	0.70	0.49						0.49	0.70	0.49						0.49
72	Bargeacceleration - x		0.70				0.49	0.70	0.49						0.49	0.70	0.49		
73	Barge acceleration + z		0.70		0.49	0.70	0.49						0.49	0.70	0.49				
74	Barge acceleration - z		0.70						0.49	0.70	0.49						0.49	0.70	0.49
75	Barge acceleration + y		0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70								
76	Barge acceleration - y		0.70									-0.70	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70	-0.70

Table B.4.6 barge acceleration action ULS-b

	Basic load cases			Barge acceleration action ULS-b															
No	Description of load	WCF				ULS-b + y								Uls-b - y					
			uls-b	201	202	203	204	205	206	207	208	211	212	213	214	215	216	217	218
1	selfweight	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
2	secondry steel	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
3	equipment load	1.10	1.00	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10	1.10
61	Wind transport + x		1.30	1.30	0.92						0.92	1.30	0.92						0.92
62	Wind transport - x		1.30				0.92	1.30	0.92						0.92	1.30	0.92		
63	Wind transport + z		1.30		0.92	1.30	0.92						0.92	1.30	0.92				
64	Wind transport - z		1.30						0.92	1.30	0.92						0.92	1.30	0.92
71	Barge acceleration + x		1.30	1.30	0.92						0.92	1.30	0.92						0.92
72	Bargeacceleration - x		1.30				0.92	1.30	0.92						0.92	1.30	0.92		
73	Barge acceleration + z		1.30		0.92	1.30	0.92						0.92	1.30	0.92				
74	Barge acceleration - z		1.30						0.92	1.30	0.92						0.92	1.30	0.92
75	Barge acceleration + y		1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30	1.30								
76	Barge acceleration - y		1.30									-1.30	-1.30	-1.30	-1.30	-1.30	-1.30	-1.30	-1.30

APENDIX.C

DROPPED OBJECT IMPACT LOAD CALCULATION

EXPLOSION LOADS CALCULATION

FIRE LOADS CALCULATION

C.1 DROPPED OBJECT IMPACT LOAD CALCULATION

Master Thesis UiS **DOP impact load, ALS**

Calculation of dropped object impact load

According to Design brief the accidental load to be considered is a dropped object load on the module structure. The accidental load shall be combined with the other loads on the module structure, with appropriate factors. Dropped object load to be considered is a 7tonne container falling 3 m. The module structure shall absorb all the energy created without damaging the instrument. An impact energy of 210kJ with a contact area of 0.8m^2 shall be used for the design. This analysis is for ALS condition, hence the load and material factors are set to 1.00
The beam is considered pinned at both end(conservative).

Factors:

Design Load Factor: $\gamma_{ALS} := 1.00$

Material Factor: $\gamma_{m1} := 1.00$ (ALS)

Material Strength:

Steel grade: S355 $f_y := 355MPa$

$f_u := 510MPa$

$f_{yd} := \frac{f_y}{\gamma_{m1}} = 355.0MPa$

Youngs modulus: $E := 210000MPa$

Design Load:

Mass of falling object: $m_0 := 7tonne$

Traveled distance from drop point: $s_1 := 3000mm$

Velocity of dropped object: [ref, NORSOK N-004, A.4.2.]

$$v_0 := \sqrt{2g \cdot s_1} = 7.7\frac{m}{s}$$

Impact energy: $E_{imp} := \left(\frac{1}{2}\right) \cdot m_0 \cdot v_0^2 = 205.9kN \cdot m$

The calculations are based on following practice and philosophy:

1. First the plastic zone x for each plastic hinge is found.
2. From the allowable strain the maximum permissible rotation is calculated for each hinge.
3. The average rotation angle is taken as 70% of the maximum allowable rotation. For an ideal stress-strain diagram the average rotation angle will be 50% of the maximum allowable rotation angle. But because of the fastening/hardening deformation effect of stress-strain in the rotation area, the maximum rotation will not decrease linearly but decrease more parabolic. Hence 70% of the maximum allowable rotation angle is used to calculate the maximum absorbable plastic energy.

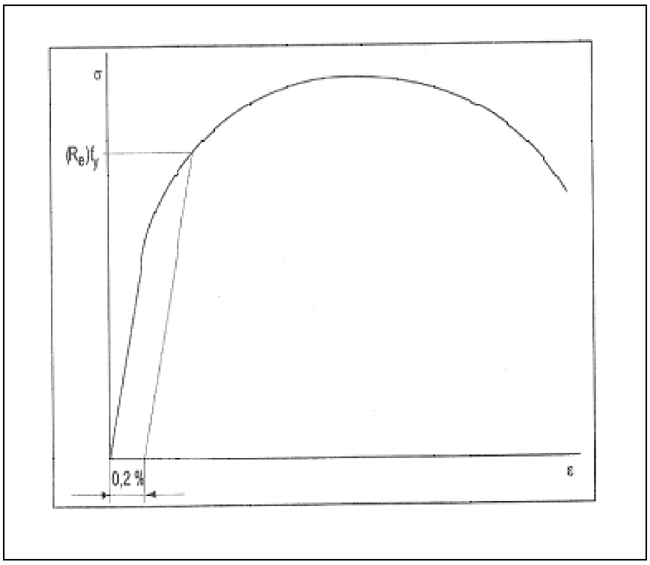
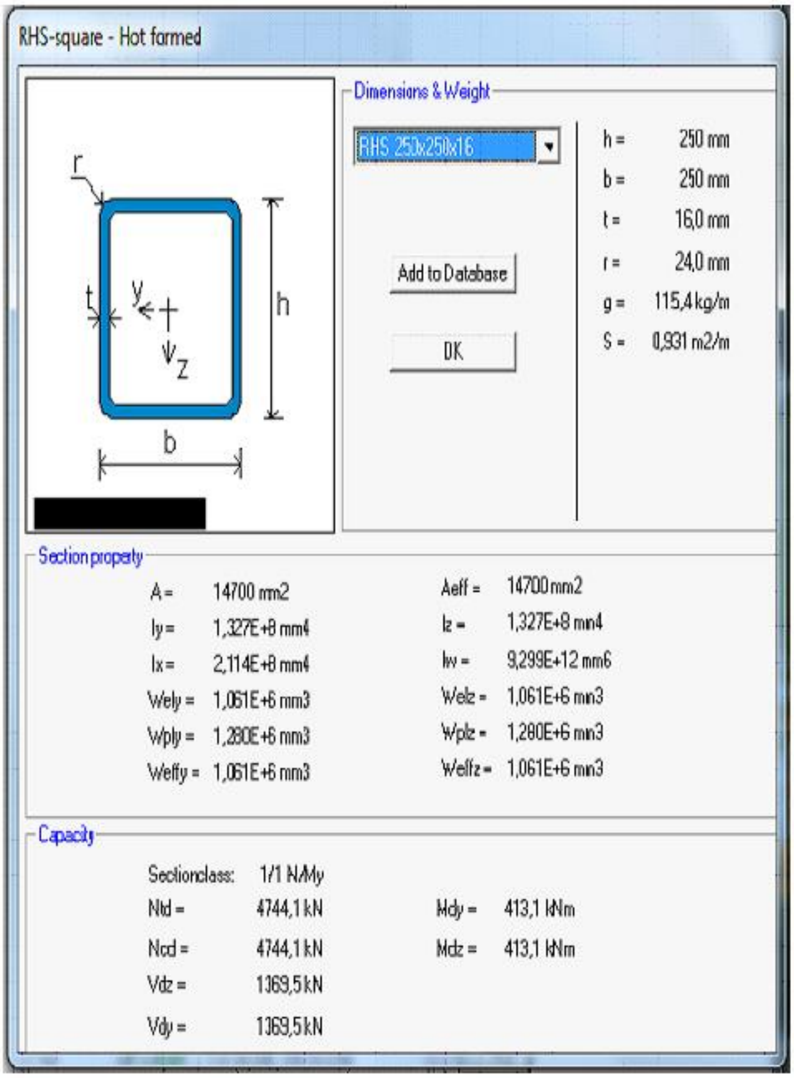


Figure 2.12 [ref, stålhåndbok del 3:2010]

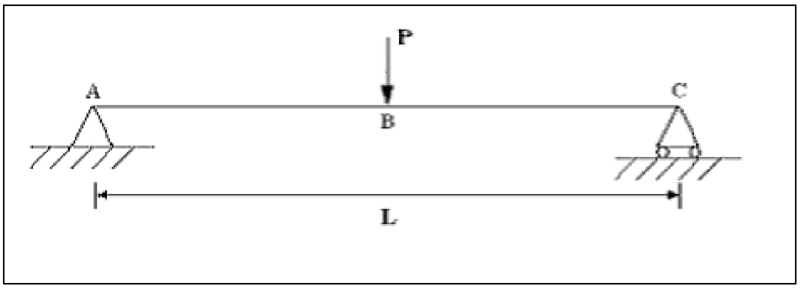
Master Thesis UiS DOP impact load, ALS

Data is from COLBEAM- NS3472



Energy absorption for a simple supported beam:

HE 140 B



Length of member: $L_{member} := 5500mm$

Height of profile: $h_{prof} := 250mm$

width of profile: $w_{prof} := 250mm$

Thickness of profile: $t_{prof} := 16mm$

Section property:

Section modulus, elastic: $W_e := 1061000mm^3$

Section modulus, plastic: $W_p := 1280000mm^3$

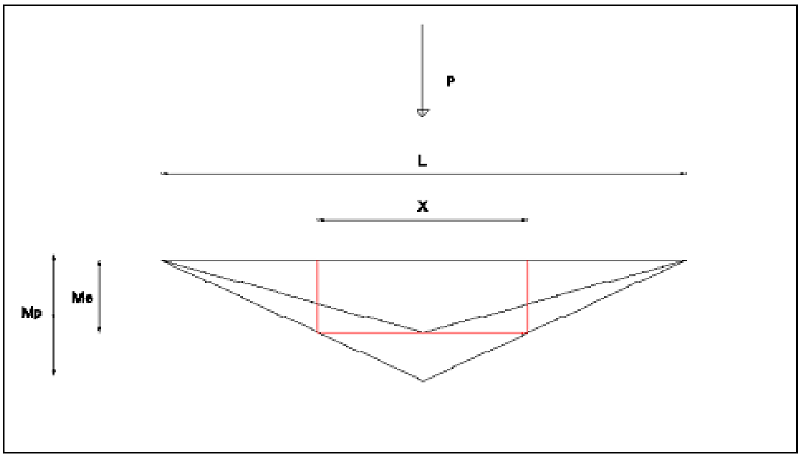
Moment of inertia: $I_y := 132700000mm^4$

Capacities :

Elastic moment capacity: $M_e := f_y \cdot W_e = 376.7\, kN \cdot m$

Plastic moment capacity: $M_p := f_y \cdot W_p = 454.4\, kN \cdot m$

plastic zone:



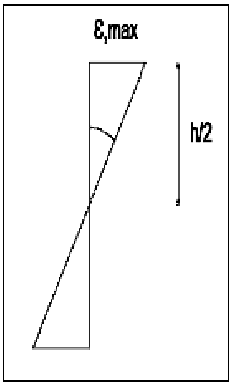
$$X1 := L_{member} \cdot \frac{M_p - M_e}{M_p} = 941.0 \cdot mm$$

$$X2 := L_{member} \cdot \left(1 - \frac{M_e}{M_p}\right) = 941.0 \cdot mm$$

$$X3 := L_{member} \cdot \left(1 - \frac{W_e}{W_p}\right) = 941.0 \cdot mm$$

$X := X1$ $\quad\quad X = 0.941 m$

Maximum rotation angle(note unit is rad pr.mm):



Maximum strain: $\varepsilon_{max} := 0.22$

Maximum rotation angle: $\theta_{max} := \frac{\varepsilon_{max}}{\frac{h_{prof}}{2}} = 0.002 \cdot \frac{rad}{mm}$

Average rotation angle: $\theta_{avg} := 0.7 \cdot \theta_{max} = 0.001 \cdot \frac{rad}{mm}$

The average rotation angle is acting on the length of plastic zone.

Plastic rotation angle in plastic zone: $\theta := X \cdot \theta_{avg} = 1.16 \cdot rad$

$$\theta_{required} := \frac{E_{imp}}{M_p} = 0.45 \cdot rad$$

Plastic absorbable energy is: $E_p := \theta \cdot M_p = 526.8 \cdot kN \cdot m$

Utilization: $UF := \frac{E_{imp}}{E_p} = 0.39$

Reaction force: $R_{reaction} := \frac{M_p}{\frac{1}{4} \cdot L_{member}} = 330.5 \cdot kN$

$$V_{R.shear} := t_{prof} \cdot h_{prof} \cdot \frac{f_y}{\sqrt{3}} = 819.8 \cdot kN$$

The shear through capacity must be higher than Impact energy.

$$E_{shear.through} := 2 \cdot \frac{1}{2} \cdot t_{prof} \cdot h_{prof}^{2} \cdot \frac{f_y}{\sqrt{3}} = 205.0 \cdot kN \cdot m$$

Utilization: $UF_{st} := \frac{E_{imp}}{E_{shear.through}} = 1.00$

Stiffness in hollow sections: [ref, NORSOK N-004, Table A.6-2]

$$k := \frac{48 \cdot E \cdot I_y}{L_{member}^{3}} = 8039.8 \cdot \frac{kN}{m}$$

Critical strain, recommended value for S355 steel: $\varepsilon_{cr} := 0.7 \cdot \varepsilon_{max} = 0.15$

Load and stress analysis

Impact force: $F_{imp} := m_0 \cdot g + \sqrt{(m_0 \cdot g)^2 + k \cdot m_0 \cdot v_0^{\ 2}} = 1890 \cdot kN$

Deflection on impact beam member: $\theta_{act} := \frac{E_{imp}}{M_p} = 0.5$ $\theta_{act} = 0.453 \cdot rad$

Actual displacement $d_{act} := \frac{L_{member}}{2} \cdot \frac{\theta_{act}}{2} = 0.623 m$

$d_{act} = 623 mm$

Maximum deflection, restrained by critical strain and plasticity zone:

$$\Delta := \frac{\varepsilon_{cr} \cdot X \cdot L_{member}}{2 \cdot h_{prof}} = 1594.1 \cdot mm$$

$$Check := \begin{cases} \text{"OK"} & \text{if } d_{act} \le \Delta \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

Check = "OK"

C.2 EXPLOSION LOADS CALCULATION

Master thesis UIS Explosion loads

Explosion loads calculation:

Internal pressure given in design brief

$bar = 1 \times 10^5 Pa$

$P_{int} := 0.6bar$

$F_{exp} := 0.60 \cdot bar$

$A_{module} := 55.0m^2$

$F_{exp} = 6 \times 10^4 Pa$

$F_{design} := 0.40 \cdot F_{exp}$

$F_{design} = 2.4 \times 10^4 Pa$

$F_{tot} := F_{design} \cdot A_{module}$

$F_{tot} = 1.32 \times 10^6 N$

Lenght of member carrying loads on the deck of module.

$L_{memb} := 9 \cdot 5.5m + 10m$

$L_{memb} = 59.5m$

unifromly distributed load on the deck of module

$$F_{uniform} := \frac{F_{tot}}{L_{memb}} \qquad F_{uniform1} := 295798 \cdot \frac{N}{m}$$

lenght of the member carrying loads on the first and second floor.

$L_{member} := 6 \cdot 5.50m + 10m$

$L_{member} = 43m$

$$F_{uniformly} := \frac{F_{tot}}{L_{member}} \qquad F_{uniform2} := 40930 \cdot \frac{N}{m}$$

Spring semester 2015 page 1 of 1

C.3 FIRE LOADS DESIGN CALCULATION CHE CK

Fire action calculation based on (EC3) EN 1993-1-2:2005 section 4.2.3.

Structure has suffiecient capacity (R=30 minutes) during fire if the critical temperature in member of structure full fil following criteria:

Temperature domain: $\theta_{at} \leq \theta_{a.cr}$

Fire duration design:

$R_{tim} = 30min$

Member 448 with highest bending moment during fire action

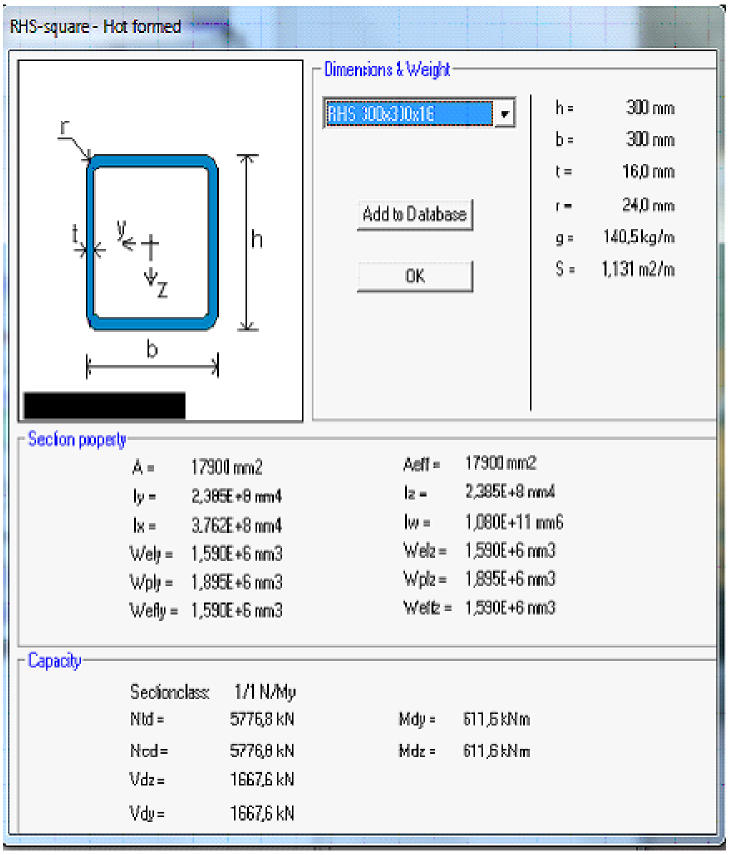


Figure from Colbeam NS 3472

TUB – 300·300·16

Yield strength: $f_y := 355MPa$

Plastic section modulus $W_{pl} := 1.895 \cdot 10^6 mm^3$

Material factor (ALS) $\gamma_{m1} := 1.00$

Bending moment capacity $M_{R.d} := 611.6 kN \cdot m$

Highest bending moment during fire action $M_{Ed} := 156.778 kN \cdot m$

$E_{fi.d} := M_{Ed}$ highest moment during fire action

$R_{fi.d.o} := M_{R.d}$ resistant moment capacity of member

$\mu_o := \frac{E_{fi.d}}{R_{fi.d.o}}$ $\mu_o = 0.256$ degree of utilzation

Critical temperature:

$$\theta_{a.cr} := 39.19 \cdot \ln\left(\frac{1}{0.9674 \mu_o^{3.833}} - 1\right) + 482 \qquad \theta_{a.cr} = 687.5 \, °C$$

All sides of column effected by fire **If t << b** :

Area of cross section $A_{cs} := 17900 mm^2$

Hight of cross section $h := 300mm$

Width of cross section $b := 300mm$

Thickness of cross section $t := 16.0mm$

surface area of the member per uint length $A_m := 2\cdot(h + b)\cdot 1\cdot\frac{m^2}{m}$ $A_m = 1.2\,m^2$

volum of the member per unit length $V_{cs} := A_{cs}\cdot 1\cdot\frac{m^3}{m}$ $V_{cs} = 0.018\,m^4$

Section factor for unprotected steel members $SF := \frac{A_m}{V_{cs}}$ $SF = 67.039\,\frac{1}{m^2}$

Simple Calculation models- Temperature domain

- Increase of temperature after fire time *Δt* for unprotected internal steelwork.

Tabell 13.7 Ståltemperatur i uisolert komponent under ISO brann [13.6]

A_m/V (m^{-1})	400	200	100	60	40	25
Tid (min)	Ståltemperatur °C					
0	20	20	20	20	20	20
5	430	291	177	121	90	65
10	640	552	392	276	204	142
11	661	587	432	308	228	159
12	678	616	409	340	253	177
13	693	642	303	371	278	194
14	705	663	335	402	303	212
15	716	682	365	432	328	230
16	725	698	391	460	353	249
18	736	721	438	513	401	286
20	754	734	676	561	447	323
22	780	744	706	604	491	360
24	799	767	726	641	532	396
26	813	792	735	674	570	431
28	826	813	746	701	604	466
30	837	828	767	721	636	498

Fra Larsen [3]

Design temperature:

$$\theta_{at} := 721 + \left(\frac{67.04 - 60}{100 - 60}\right)\cdot(766 - 721)$$ $\theta_{at} = 728\ °C$

$$\text{Check} := \begin{cases} \text{"OK"} & \text{if } \theta_{at} \le \theta_{a.cr} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

Check = "FAIL"

Fire insulation is required

Member 40 with highest momen during fire action:

TUB – 250·250·16

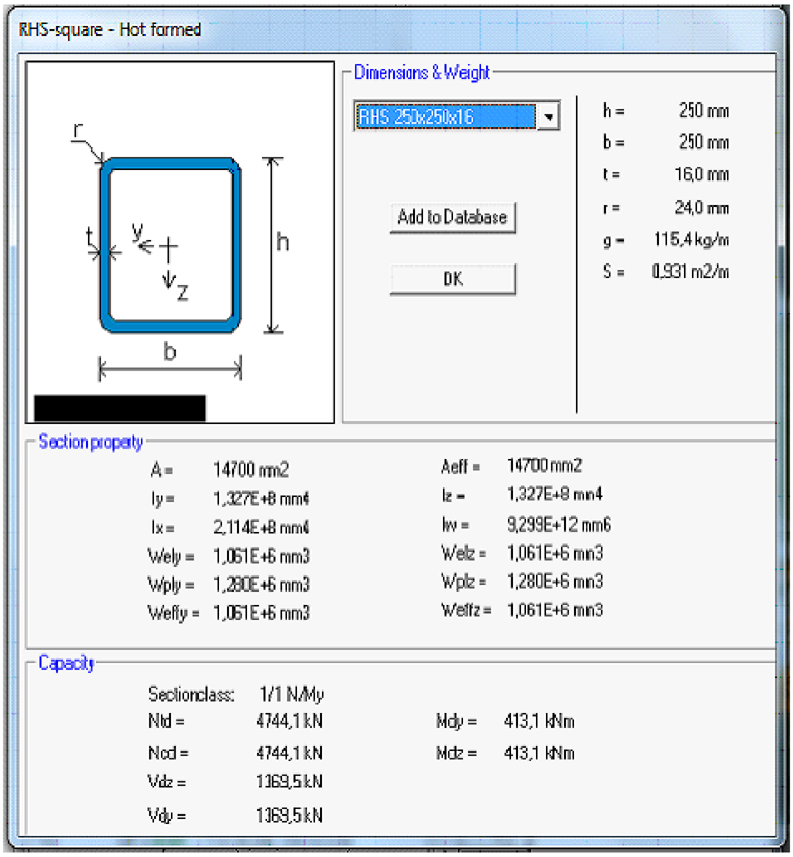


Figure Colbeam NS3472

Plastic section modulus $W_{pl.1} := 1.28 \cdot 10^6 mm^3$

Bending moment capacity of cross section $M_{R.d.1} := 413.1 \cdot kN \cdot m$

Highest bending moment on member during fire action $M_{Ed.1} := 193.817 \cdot kN \cdot m$

Area of cross section $A_{cs1} := 14700mm^2$

Hight of cross section $h_1 := 250mm$

Width of cross section $b_1 := 250mm$

Thickness of cross section $t_1 := 16mm$

Degree of utilization:

$$\mu_{o.1} := \frac{M_{Ed.1}}{M_{R.d.1}} \qquad \mu_{o.1} = 0.469$$

$$\theta_{a.cr.1} := 39.19 \cdot \ln\left(\frac{1}{0.9674 \cdot \mu_{o.1}^{3.833}} - 1\right) + 482 \qquad \theta_{a.cr.1} = 594.836\,°C$$

All 3 sides of beam effected by fire

If t << b :

surface area of the member per unit lenght $A_{m1} := 2(h_1 + b_1) \cdot 1 \cdot \frac{m^2}{m} = 1\,m^2$

volume of the member per unit length $V_{cs1} := A_{cs1} \cdot 1 \cdot \frac{m^3}{m} = 0.015m^4$

section factor for unprotected steel members $SF_1 := \frac{A_{m1}}{V_{cs1}} = 68.027 \frac{1}{m^2}$

Design temperature:

$$\theta_{at.1} := 721 + \left(\frac{68.027 - 60}{100 - 60}\right) \cdot (766 - 721) \qquad \theta_{at.1} = 730\,°C$$

$$Check_1 := \begin{cases} \text{"OK"} & \text{if } \theta_{at.1} \le \theta_{a.cr.1} \\ \text{"FAIL"} & \text{otherwise} \end{cases} \qquad Check_1 = \text{"FAIL"}$$

Fire insulation is required

Member 184 with highest moment during fire action:

HE – 240 – B

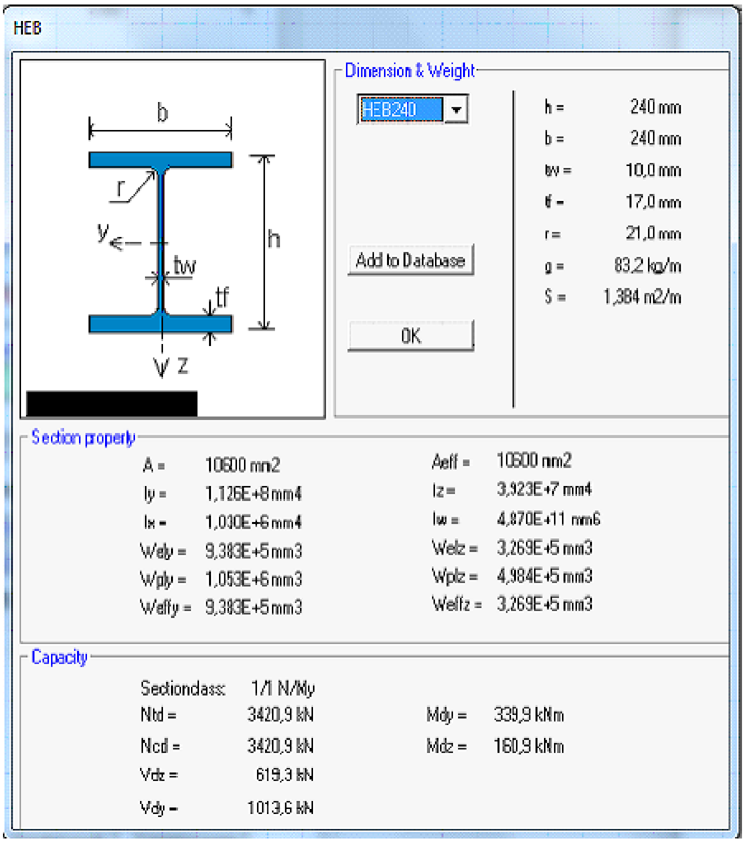


Figure from NS 3472

Plastic section modulus $W_{pl.2} := 1.053 \cdot 10^{6} mm^{3}$

Bending moment capacity of cross section $M_{Rd.z.2} := 339.9 \cdot kN \cdot m$

Highest bending moment on member during fire action $M_{Ed.2} := 223.108 \cdot kN \cdot m$

Cross section area of member $A_{cs2} := 11840mm^2$

Hight of cross section $h_2 := 240mm$

Width of cross section $b_2 := 240mm$

Thickness of cross section $t_f := 17.0mm$

Degree of utilization: $\mu_{o.2} := \frac{M_{Ed.2}}{M_{Rd.z.2}}$ $\mu_{o.2} = 0.656$

Critical temperature:

$$\theta_{a.cr.2} := 39.19 \cdot \ln\left(\frac{1}{0.9674 \mu_{o.2}^{3.833}} - 1\right) + 482 \qquad \theta_{a.cr.2} = 538.152 \, °C$$

All 3 sides of beam effected by fire **If t << b**:

Surface area of the member per unit lenght $A_{m2} := (b_2 + 2 \cdot t_f) \cdot 1 \cdot \frac{m^2}{m} = 0.274m^2$

Volume of the member per unit length $V_{cs.2} := (b_2 \cdot t_f) \cdot 1 \cdot \frac{m^3}{m} = 4.08 \times 10^{-3} m^4$

Section factor for unprotected steel members $SF_2 := \frac{A_{m2}}{V_{cs.2}} = 67.157 \frac{1}{m^2}$

Design temperature:

$$\theta_{at.2} := 721 + \left(\frac{67.157 - 60}{100 - 60}\right) \cdot (767 - 721) \qquad \theta_{at.2} = 729.231 \quad °C$$

$$Check_2 := \begin{cases} \text{"OK"} & \text{if } \theta_{at.2} \le \theta_{a.cr.2} \\ \text{"FAIL"} & \text{otherwise} \end{cases} \qquad Check_2 = \text{"FAIL"}$$

Fire insulation is required

Member 393 with highest bending moment during fire action

HE_220 – B

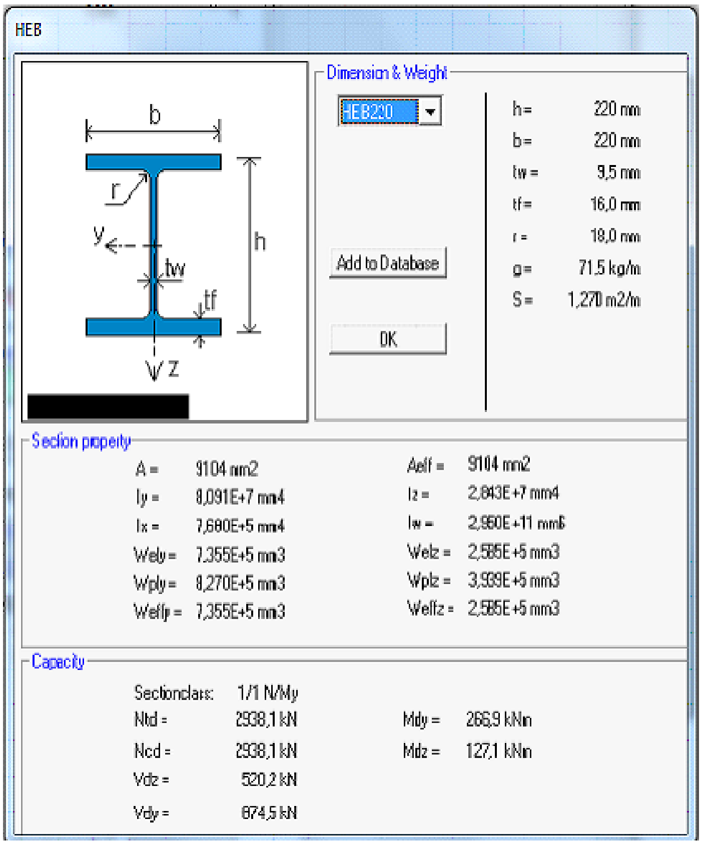


Figure from Colbeam NS 3472

Plastic section modulus $W_{pl.3} := 8.270 \cdot 10^{5} mm^{3}$

Bending moment capacity of cross section $M_{Rd.3} := 266.9 \cdot kN \cdot m$

Highest bending moment on member during fire action $M_{Ed.3} := 52.03 kN \cdot m$

Area of cross section $A_{cs3} := 9104mm^2$

Hight of cross section $h_3 := 220mm$

Width of cross section $b_3 := 220mm$

Thickness of cross section $t_{fl} := 16.0mm$

Degree of utilization: $\mu_{o.3} := \frac{M_{Ed.3}}{M_{Rd.3}}$ $\mu_{o.3} = 0.195$

Critical temperature:

$$\theta_{a.cr3} := 39.19 \cdot \ln\left(\frac{1}{0.9674\mu_o^{3.833}} - 1\right) + 482 \qquad \theta_{a.cr.3} = 687.\text{:}°C$$

All 3 sides of beam exposed to fire **If t << b** :

Surface area of the member per uint length $A_{m.3} := (b_3 + 2 \cdot t_{fl}) \cdot 1 \cdot \frac{m^2}{m} = 0.252m^2$

Volum of the member per unit length $V_{cs.3} := (b_3 \cdot t_{fl}) \cdot 1 \cdot \frac{m^3}{m} = 3.52 \times 10^{-3} m^4$

Section factor for unprotected steel members $SF_3 := \frac{A_{m.3}}{V_{cs.3}} = 71.591 \frac{1}{m^2}$

Design temperature:

$$\theta_{at.3} := 721 + \left(\frac{71.591 - 60}{100 - 60}\right) \cdot (767 - 721) \qquad \theta_{at.3} = 734.33\,°C$$

$$Check_3 := \begin{cases} \text{"OK"} & \text{if } \theta_{at} \le \theta_{a.cr} \\ \text{"FAIL"} & \text{otherwise} \end{cases} \qquad Check_3 = \text{"FAIL"}$$

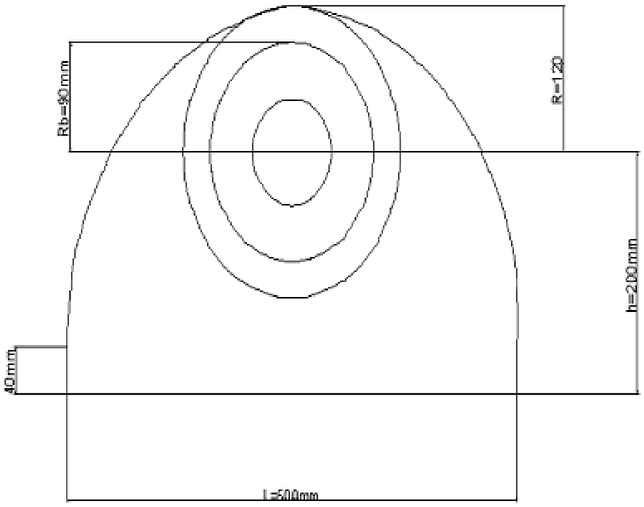
Fire insulation is required

APENDIX D

CALCULATION AND DESIGN CHECK OF PAD EYES

D.1 CALCULATION AND DESIGN CHECK OF PAD EYES

Lifting Padeyes Type 2 WWL< 55T



Padeye type 2 (WLL <50 T): [ref/7/, Norsok R-002 lifting equipment.]

The Padeye should be made of a 55 mm steel plate. 2x 30 mm cheek plate. A standard shackle bolt which can carry 85 tonnes WLL has a diameter of 83 mm, making the pinhole diameter 87 mm.

Shackle bolt diameter: $d := 83mm$

Padeye minimum hole diameter: $d_h := 1.03d + 2mm = 87 \cdot mm$

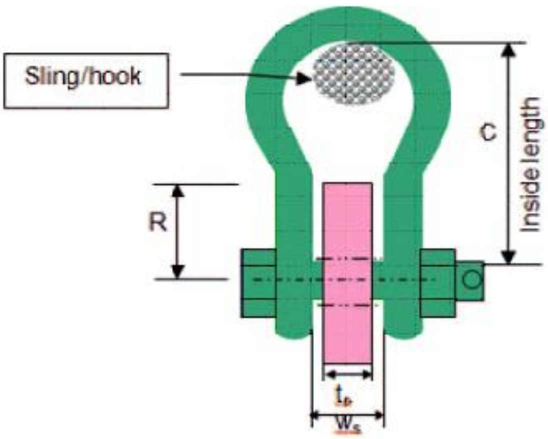
Total Padeye plate thickness T shall fulfil the following criteria:

$$0.4 \cdot w_s < Tp < 0.6 \cdot w_s$$

Cheeck radius: according to Norsok R-002 lifting equipment

$1.0 \cdot d_h < R_b < 1.5 \cdot d_h$ $1.0 \cdot d_h = 87.5 \cdot mm$ $1.5 d_h = 131.2 \cdot mm$

Choose cheeck radius as: $R_b := 90mm$



[ref/7/, Norsok R-002 lifting equipment].

Padeye height, length and radius:

Type 2- load - $90° \le \alpha_1 \le 90°$

Inside width of shackle at bolt section $w_s := 127mm$

Padeye plate thickness:

$0.4 \cdot w_s < t_p < 0.6 w_s$ $0.4 \cdot w_s = 50.80mm$ $0.6 \cdot w_s = 76.20mm$

Choose : $t_{p.choice} := 55mm$

Cheek plate thickness: $t_c := 0.85 \cdot \frac{w_s}{4} = 27.0 \cdot mm$

$t_{c.choice} := 30mm$

Pad eye radius:

$R_p := R_b + t_c = 117.0 \cdot mm$

Height of padeye:

$R_{choice} := 120.0mm$

$2.2 \cdot d_h \leq h \leq 2.4 \cdot d_h$ $\quad 2.4 \cdot d_h = 208.8mm$ $\quad 2.2 \cdot d_h = 191.4mm$

$h := 200.0mm$

Minimum length of padeye:

$2.4 \cdot h \leq L \leq 2.7 \cdot h$ $\quad 2.4 \cdot h = 480mm$ $\quad 2.7 \cdot h = 540mm$

Padeye length should be as long as plate is wide. $\quad L_{choice} := 500mm$

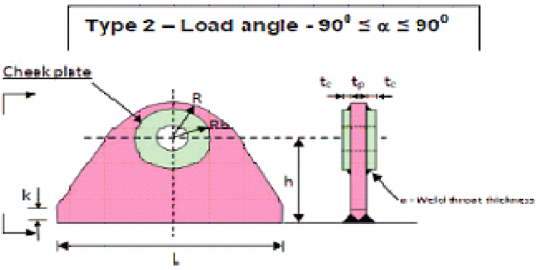


Figure J.6 - Lifting lug Type 2 geometry – Cheek plates each side

Figure . [ref/7/, Norsok R-002 lifting equipment.]

Steel grade S420: [ref, stålkosntruksjoner Table 6.2] $\quad f_y := 420MPa$

$f_u := 520MPa$

<u>Factor:</u> [ref/4/, NORSOK N-004 Table 6.1.]

General material factor: $\quad \gamma_{m1} := 1.15$

Resistance of net section at bolt holes: $\quad \gamma_{m2} := 1.30$

Resistance of fillet and partial penetration weld: $\gamma_{mw} := 1.30$

Correlation factor (S420): $\beta_w := 1.00$

Lifting Design Load Factors: [ref/7/, Norsok R-002 lifting equipment.]

Factors relevant for lifting design:

Weight contingency factor: $\gamma_{WCF} := 1.10$

Minimum CoG factor (xy-plane): $\gamma_{CoG} := 1.10$

Dynamic amplification factor: $\gamma_{DAF} := 1.4316$

Skew load factor: $\gamma_{SKL} := 1.25$

Ultimate limit state factor(ULS-a): $\gamma_{ULS} := 1.30$

Consequence factor: $\gamma_c := 1.30$

Load factor: $\gamma_F := 1.30$

Design factor: $\gamma_{DF} := 1.68$

Total factor: $\gamma_{tot} := \gamma_{WCF} \cdot \gamma_{CoG} \cdot \gamma_{DAF} \cdot \gamma_{SKL} \cdot \gamma_{ULS} \cdot \gamma_c = 3.66$

According to design brief. Minimum sling angle is 70 degrees to horizontal plane. [ref/1/, 7.2.]

Length of the offshore module structure: $L_{A\_B} := 10000mm$

Width of the offshore module structure: $L_{B\_C} := 5500mm$

Master Thesis UiS	Pad Eye Design

Data is from Staad.Pro analysis:

Center gravity of the offshore module was found by Staad. Pro analysis.

$x = 5000mm$ $y = 5736mm$ $z = 2680mm$

Structure:

Total lifting weight: $W_{lifting} := 742.27kN$

Location of COG :

$a_1 := 5000mm$ $a_2 := 5000mm$

$b_1 := 2680mm$ $b_2 := 2820mm$

Maximum sling force for 4 point

$$P_{LP} := \frac{W_{lifting} \cdot a_1 \cdot b_1 \cdot \gamma_{WCF} \cdot \gamma_{CoG} \cdot \gamma_{SKL} \cdot \gamma_{DAF}}{L_{A\_B} \cdot L_{B\_C}} = 391.6 kN \qquad (F-4)$$

Load components:

Design load for lifting pad eyes and supporting strucure: $P_p = \frac{(P_{LP} \cdot DF)}{\cos(\alpha)}$ (F – 11)

Sling angle to the horizontal plane $\alpha := 70deg$

Sling force: $P_p := \frac{(P_{LP} \cdot \gamma_{DF})}{\cos(\alpha)} = 1923.4 kN$

Vertical force: $P_{pv} := P_p \cdot \cos(\alpha) = 657.9 kN$

Horizontal force: $P_{ph} := P_p \cdot \sin(\alpha) = 1807.4 kN$

The padeyes are assumed to be welded onto the top of the RHS250X250X16 beam.

$$P_{pv} = P_p * \cos\alpha \quad (J.1)$$

$$P_{ph} = P_p * \sin\alpha \quad (J.2)$$

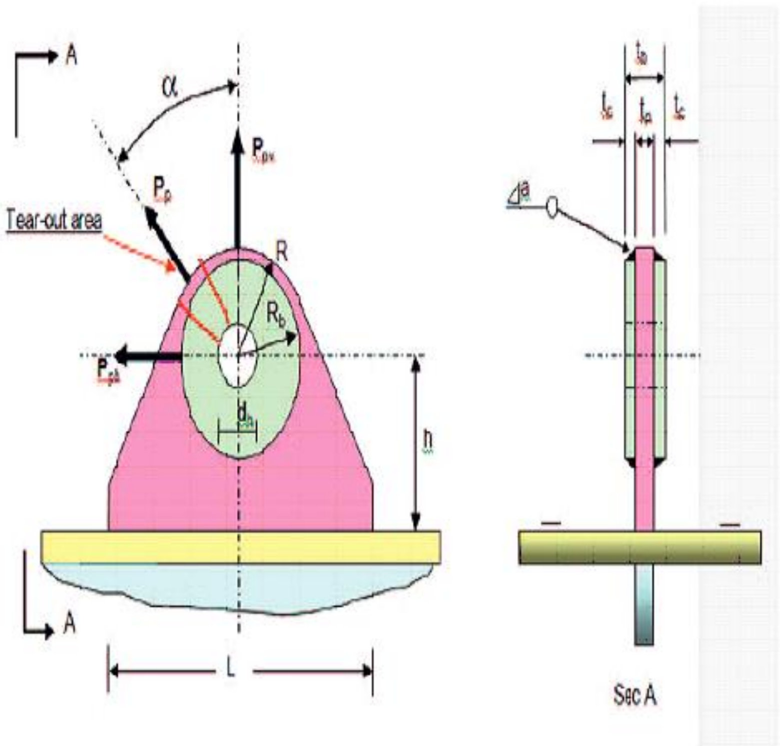


Figure J.8 - Design load components

(Source, Norsok R-002 Lifting equipment)

Calculations:

Check load bearing limit design stress at pinhole edge:

According to the Norsok R-002 Annex J this criteria must satisfy:

$\sigma_{d.b} \geq \sigma_b$

Design bearing capacity: $\sigma_{d.b} := 1.5 \cdot \frac{f_u}{\gamma_{m2}} = 600.0 \cdot \frac{N}{mm^2}$ (J – 6)

Pin hole bearing stress: $t_{eff} := t_{p.choice} + 2 \cdot t_{c.choice} = 115.0\,mm$

Actual stress: $\sigma_b := \frac{P_p}{t_{eff} \cdot d} = 201.5 \cdot \frac{N}{mm^2}$ (J – 7)

Bearing hole interaction ratio: $IR := \frac{\sigma_b}{\sigma_{d.b}} = 0.34$

Check shear design strength:

Shear design strength: $\tau_{R.d} := \frac{f_y}{\gamma_{m1} \cdot \sqrt{3}} = 210.9 \cdot \frac{N}{mm^2}$

Check tear-out limit design stress:

Tear-out area (Pad eye type 2): $\tau_{R.d} \geq \tau_{E.d}$

$$A_{sh} := \left(R_p - \frac{d_h}{2}\right) \cdot t_{p.choice} + 2 \cdot \left(R_{choice} - \frac{d_h}{2}\right) \cdot t_{c.choice} = 8603.6\,mm^2$$

Actual stress: $\tau_{Ed} := \frac{P_p}{2 \cdot A_{sh}} = 111.8 \cdot \frac{N}{mm^2}$

Utilization: $UF_{\tau Ed} := \frac{\tau_{Ed}}{\tau_{R.d}} = 0.53$

Check cheek plate fillet weld:

Nominal throat size of fillet weld between cheek and plate.
[ref/7/, Norsok R-002 Lifting equipment]

Nominal throat size of fillet weld: $a_{weld} := 7.0mm$

Effective weld length: $L_{eff} := \frac{2}{3} \cdot 2 \cdot \pi \cdot R_b = 377 \cdot mm$ (J – 9)

Load through weld: $P_{cp} := \frac{P_p \cdot t_c}{t_{p.choice} + 2 \cdot t_{c.choice}} = 451.4kN$ (J – 10)

Actual stress in weld:

$$\tau_{Ed.w} := \frac{P_p \cdot t_c}{\left(t_{p.choice} + 2 \cdot t_{c.choice}\right) \cdot \frac{4}{3} \cdot \pi \cdot R_{choice} \cdot a_{weld}} = 128.3 \cdot \frac{N}{mm^2} \quad (J-11)$$

$$\tau_{max} := \frac{f_y}{\left(\gamma_{m1} \cdot \sqrt{3}\right)} = 210.9 \cdot \frac{N}{mm^2}$$

Utilization: $UF_{cw} := \frac{\tau_{Ed.w}}{\tau_{max}} = 0.61$

Lateral load:

According to Aker Solution work instruction Padeye shall be designed for a lateral load of +/-3% of the maximum sling force, in addition to any nominal lateral load on the Padeye. The load shall be applied at the point of action, e.g. at the shackle bow or at the trunnion stopper plate.

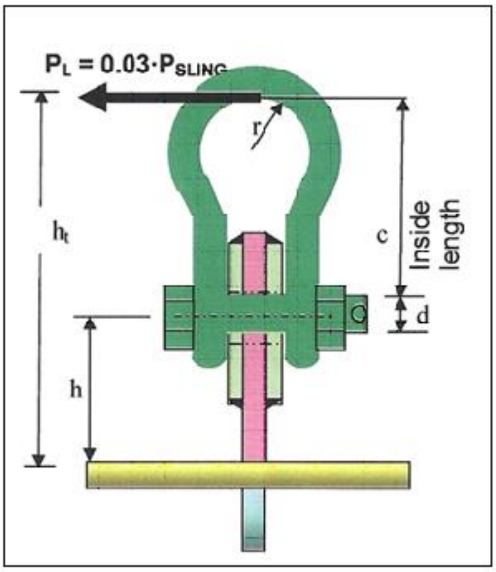


Figure 2-3. [ref/8/, Aker Solutions work instruction.]

Check lateral load:

Length from top of shackle to eye pin: [ref/9/, Green pin.]

$$L_1 := 329mm$$

Length from middle of pin to edge top of Padeye: $L_2 := 63mm$

Height of Padeye: $L_3 := h + R_p = 317 \cdot mm$

Lateral load, 3% of sling load: $F_{lat} := P_{pv} \cdot 3\% = 19.7 \cdot kN$

Distance from of shackle eye to Padeye bottom:

$$L_d := L_1 - L_2 + L_3 = 583.0 \cdot mm$$

Moment at bottom of Padeye: $M := F_{lat} \cdot L_d = 11.5 \cdot kN \cdot m$

Section modulus, Padeye: $W_{lat} := \frac{1}{6} \cdot L_{choice} \cdot t_{p.choice}^{\ 2} = 252083.3\,mm^3$

Actual stress:

Lateral load: $\sigma_{lat} := \frac{M}{W_{lat}} = 45.6 \cdot MPa$

Sling load: $\sigma_{sling} := \frac{P_{pv}}{L_{choice} \cdot t_{p.choice}} = 23.9 \cdot MPa$

Shear: $\tau_{lat} := \frac{P_{ph}}{L_{choice} \cdot t_{p.choice}} = 65.7 \cdot MPa$

Von Mises: $\sigma_j := \sqrt{(\sigma_{lat} + \sigma_{sling})^2 + 3 \cdot \tau_{lat}^{\ 2}} = 133.4 \cdot MPa$

Utilization: $UF_{mom} := \frac{\sigma_j}{f_y} \cdot \gamma_{m1} = 0.365$

Check vertical welds on module:

Effective length of weld: $l_w := 500mm$

Number of welds: $n := 4$

The weld are along RHS250X250X16.

Root dimension: $a_{rot.d} := 5.0mm$

Shear stress: $\tau_v := \frac{P_{pv}}{l_w \cdot a_{rot.d} \cdot n} = 65.8 \cdot MPa$

Utilization: $UF_w := \frac{\tau_v}{f_y} \cdot \sqrt{3} \cdot \gamma_{m1} = 0.31$

APENDIX E

DESIGN CHECK OF BOLTS AND WELDED CONNECTION

E.1 DESING CHECK OF BOLTS AND WELDS CONNECTION

Calculation of bolts connection for inplace condition at bottom suuport

The new offshore module shall be fasted by bolts at two lower support to the main column (RHS) of the existing platform and therfore boltes capacity must be checked.

Bolts properties:

Number of bolts: $n := 6$

Bolt class: M30, grade 8.8

Bolts diameter: $d_b := 27mm$

Hole diameter: $d_0 := d_b + 3mm = 30 \cdot mm$

Bolt yield strength: $f_{yb} := 640MPa$

Bolt ultimate strength: $f_{ub} := 800MPa$

Bolt gross area: $A1 := 573mm^2$

Bolt shear area: $A_s := 459mm^2$

Factors for class 8.8 bolt: [Ref/5/, Eurocode 3, part 1-8, Table 3.4.]

$\alpha_v := 0.6$

$k_2 := 0.9$

Plate steel grade: S420

Yield strength: $f_y := 420MPa$

Ultimate tensile strength: $f_u := 520MPa$

Material factor: [ref/4/, NORSOK N-004, Table 6.1.] $\gamma_{M2} := 1.30$

Maximum reaction force: [ref, Staad.Pro analysis.]

Reaction Summary

	Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kNm)	MY (kNm)	MZ (kNm)
Max FX	128	163:NPLACE:	245.003	0.000	709.419	0.000	0.000	0.000
Min FX	129	162:NPLACE:	-350.612	0.000	750.893	0.000	0.000	0.000
Max FY	128	161:NPLACE:	-189.819	0.004	9.568	0.000	0.000	0.000
Min FY	128	161:NPLACE:	-189.819	0.000	9.568	0.000	0.000	0.000
Max FZ	129	162:NPLACE:	-350.612	0.000	750.893	0.000	0.000	0.000
Min FZ	128	171:NPLACE:	-207.394	0.000	-219.501	0.000	0.000	0.000
Max MX	128	161:NPLACE:	-189.819	0.000	9.568	0.000	0.000	0.000
Min MX	128	161:NPLACE:	-189.819	0.000	9.568	0.000	0.000	0.000
Max MY	128	161:NPLACE:	-189.819	0.000	9.568	0.000	0.000	0.000
Min MY	128	161:NPLACE:	-189.819	0.000	9.568	0.000	0.000	0.000
Max MZ	128	161:NPLACE:	-189.819	0.000	9.568	0.000	0.000	0.000
Min MZ	128	161:NPLACE:	-189.819	0.000	9.568	0.000	0.000	0.000

Horizontal reaction force in x direction: $F_x := 350.612kN$

Horizontal reaction forcein z direction: $F_z := 750.89kN$

Calculations: [ref/5/, Eurocode 3, part 1-8, Table 3.4.]

Tension capacity: $F_{t.Rd} := \frac{k_2 \cdot f_{ub} \cdot A_s}{\gamma_{M2}} = 254.2\cdot kN$

Design shear load: $F_{v.Ed} := \frac{\sqrt{F_x^2 + F_z^2}}{n} = 138.1\cdot kN$

Shear resistance per bolt: $F_{v.Rd} := \frac{\alpha_v \cdot f_{ub} \cdot A_s}{\gamma_{M2}} = 169.5\cdot kN$

Utilization: $UF := \frac{F_{v.Ed}}{F_{v.Rd}} = 0.81$

End and edge distances and spacing: [ref/3/, Eurocode3,part 1-8, Table3.3.]

End distance: $e_1 := 35mm$

Edge distance: $e_2 := 35mm$

Spacing distance: $p_1 := 140mm$

Spacing distance: $p_2 := 280mm$

Sketch of bolts and plate to connect bottom support to the existing RHS

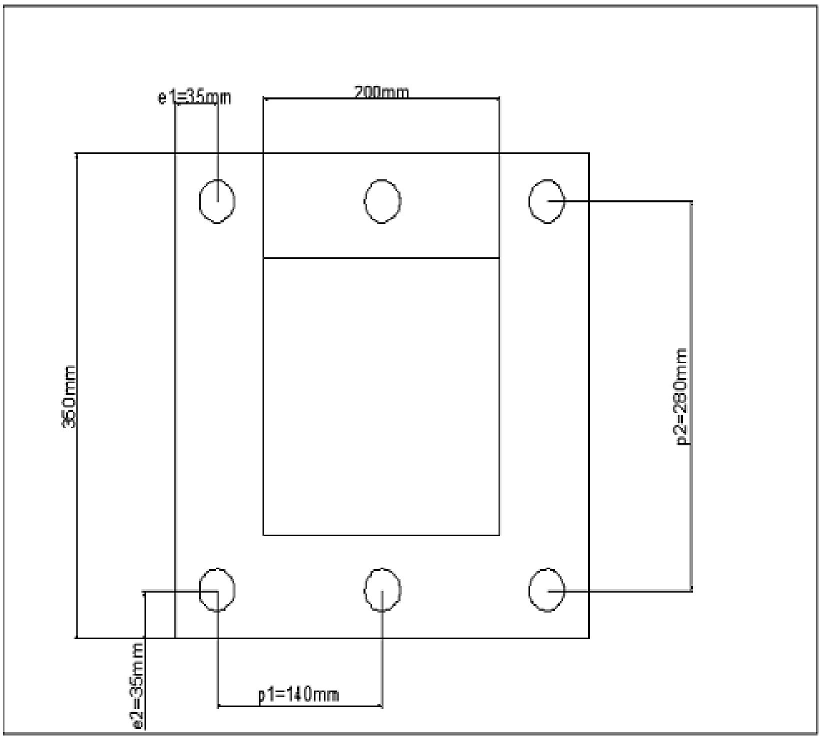


Plate drawing (Source Autocad)

Check bearing resistance:

Plate size: 350X350X25

Calculation is according to, Eurocode 3, part 1-8, Table 3.4.

Thickness of plate: $t_p := 25mm$

Factors: [ref, Eurocode 3, part 1-8, Table 3.4.]

$$k_1 = \min\left(2.8 \cdot \frac{e_2}{d_0} - 1.7, 2.5\right) \qquad \alpha_b = \min\left(\frac{f_{ub}}{f_u}, 1.0, \frac{e_1}{3 \cdot d_0}\right)$$

$$k_1 := 2.8 \cdot \frac{e_2}{d_0} - 1.7 = 1.567 \qquad \alpha_b := 0.4$$

$$\frac{f_{ub}}{f_u} = 1.5 \qquad \frac{e_1}{3 \cdot d_0} = 0.4$$

Bearing resistance:

$$F_{b.Rd} := \frac{k_1 \cdot \alpha_b \cdot f_u \cdot d_b \cdot t_p}{\gamma_{M2}} = 169.2kN$$

$$\text{Check} := \begin{cases} \text{"OK"} & \text{if } F_{v.Ed} \le F_{b.Rd} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

Check = "OK"

Welded connection:

Calculations are according to Stålkonstruksjoner. Table 6.2.

Material factor for welded connections: [ref/5/, Eurocode 3 part 1-8, Table 2.1.]

Correlation factor(S420): $\beta_w := 1.00$

Thickness of profile: $t_w := 16mm$

Length of weld: $l_w := 200mm$

Number of welds: $n_w := 2$

Throat dimension: $a \geq 0.5 \cdot t_w$ $a := 0.5 \cdot t_w = 8.0 \cdot mm$

Normal and shear stress component in welded section:

$\sigma_{normal} = \tau_{normal} = 0.0$

shear stress component in welded section:

$$\tau_{parallel} := \frac{2 \cdot F_x}{n_w \cdot l_w \cdot a} = 219.132 \cdot MPa$$

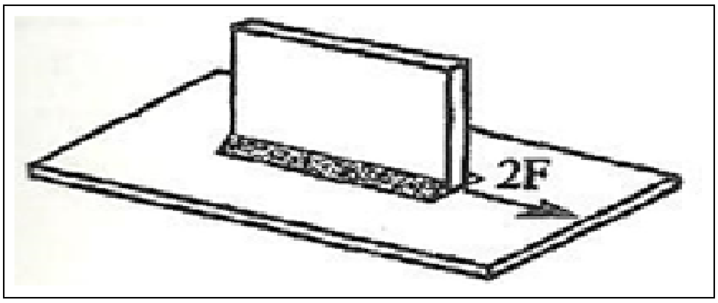
Von Mises criteria: [ref, Stålkonstruksjoner Table 6.2.]:

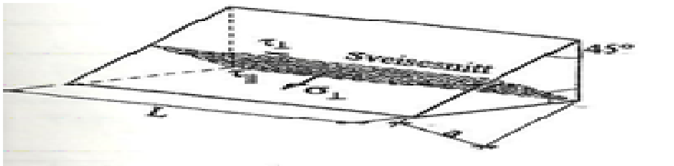
$$\sigma = \sqrt{\sigma_{normal}^2 + 3\cdot\left(\tau_{normal}^2 + \tau_{parallel}^2\right)} \le \frac{f_u}{\gamma_{M2}\cdot\beta_w}$$

$$\sigma := \sqrt{3\cdot\tau_{parallel}^2} = 379.5\,MPa$$

$$Check1 := \begin{cases} \text{"OK"} & \text{if } \sigma \le \dfrac{f_u}{\gamma_{M2}\cdot\beta_w} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

Check1 = "OK"





Figures are from Stålkonstruksjoner. Table 6.2

Calculation of plates connection for inplace condition at topp suuport

Plate thickness $t_{PL} := 20mm$

Number of plates $n_{PL} := 2$

Doameter of support $d_{supp} := 220mm$

Vertical length of support plate $L_v := 500mm$

Material factor $\gamma_m := 1.15$

$\gamma_{m.2} := 1.30$

Load factor ULS-a $\gamma_{ULS} := 1.30$

Maximum reaction force at topp support (Source Stad Pro analysis)

Reaction Summary

	Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kNm)	Moment MY (kNm)	Moment MZ (kNm)
Max FX	2	161:INPLACE:,	0.000	984.613	-150.515	0.000	0.000	0.000
Min FX	2	161:INPLACE:,	0.000	984.613	-150.515	0.000	0.000	0.000
Max FY	3	161:INPLACE:,	0.000	1.51E+3	-568.535	0.000	0.000	0.000
Min FY	2	171:INPLACE:,	0.000	191.615	78.554	0.000	0.000	0.000
Max FZ	2	171:INPLACE:,	0.000	191.615	78.554	0.000	0.000	0.000
Min FZ	3	161:INPLACE:,	0.000	1.51E+3	-568.535	0.000	0.000	0.000
Max MX	2	161:INPLACE:,	0.000	984.613	-150.515	0.000	0.000	0.000
Min MX	2	161:INPLACE:,	0.000	984.613	-150.515	0.000	0.000	0.000
Max MY	2	161:INPLACE:,	0.000	984.613	-150.515	0.000	0.000	0.000
Min MY	2	161:INPLACE:,	0.000	984.613	-150.515	0.000	0.000	0.000
Max MZ	2	161:INPLACE:,	0.000	984.613	-150.515	0.000	0.000	0.000
Min MZ	2	161:INPLACE:,	0.000	984.613	-150.515	0.000	0.000	0.000

Maximum vertical force $F_v := 1510kN$

Load impact area on support $A_{supp} := t_{PL} \cdot d_{supp} \cdot \frac{2}{3} \cdot n_{PL}$

$A_{supp} = 5867mm^2$

Direct stress on support $\sigma_v := \frac{F_v}{A_{supp}}$

$\sigma_v = 255.7MPa$

Utilization factor $UF_{pl} := \frac{\sigma_v}{f_y} \cdot \gamma_{ULS} \cdot \gamma_m = 0.916$

Welds capacity between plate and column of existing platform

Length of weld $L_w := L_v = 500mm$

Throat dimension $a_w := 5mm$

Number of welds $n_{wpl} := n_{PL} \cdot 2 = 4$

Stress in weld $\tau_{II} := \frac{F_v}{a_w \cdot L_w \cdot n_{PL}}$ $\tau_{II} = 150MPa$

Utilization facor $UF_w := \frac{\tau_{II}}{f_y} \cdot \gamma_{ULS} \cdot \gamma_m = 0.537m$

Von Mises criteria :

$$\sigma_w = \sqrt{\sigma_{normal}^2 + 3 \cdot \left(\tau_{normal}^2 + \tau_{parallel}^2\right)}$$

$\tau_{parallel.w} := \tau_{II}$ $\sigma_w := \sqrt{3 \cdot \tau_{II}^2}$ $\sigma_w = 150MPa$

$$Check_2 := \begin{cases} \text{"OK"} & \text{if } \sigma \le \frac{f_u}{\gamma_{M2} \cdot \beta_w} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$Check_2 = \text{"OK"}$

Welds capacity of joints with highest tensile force

According to Staad Pro analysis the most highest tensile force will be resulted in case of (ALS) earthquake action 10 000 year for inplace on member 107 at node (9)

Maximum tension force $F_{xtensile} := 650.961\text{kN}$

Throat thickness $a_{wjoint} := 5.0\text{mm}$

Length of weld $L_{wj} := 340\text{mm}$

Shear stress at welded connection $\tau_{II.joint} := \dfrac{\frac{F_{xtensile}}{2}}{a_{wjoint} \cdot L_{wj}}$

$\tau_{II.joint} = 239.3\text{MPa}$

Utilization $UF_{jointweld} := \dfrac{\tau_{II.joint}}{f_y} = 0.456$

Von Mises criteria:

$$\sigma = \sqrt{\sigma_{normal}^2 + 3 \cdot \left(\tau_{normal}^2 + \tau_{parallel}^2\right)}$$

Parallel shear stress $\tau_{parallel.joint} = \tau_{II.joint}$

$\sigma_{joint} := \sqrt{3 \cdot \tau_{II.joint}^2} = 3.316 \times 10^8 \text{Pa}$

$\sigma_{joint} = 414.5\text{MPa}$

$$Check_3 := \begin{cases} \text{"OK"} & \text{if } \sigma_{joint} \le \dfrac{f_u}{\gamma_{M2} \cdot \beta_w} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$Check_3 = \text{"OK"}$

Maximum tensile force on member 13 at node (9)

Maximum tensile force $F_{x13} := 370.649kN$

Length of weld $L_{w13} := 500mm$

Throat dimension $a_{w13} := 5.0mm$

shear stress at weld $\tau_{II13} := \frac{F_{x13}}{L_{w13} \cdot a_{w13}} = 1.483 \times 10^{8} Pa$

$\tau_{II13} = 148.256MPa$

Utilization $UF_{13} := \frac{\tau_{II13}}{f_y} = 0.353$

Von Mises criteria:

$$\sigma = \sqrt{\sigma_{normal}^2 + 3 \cdot \left(\tau_{normal}^2 + \tau_{parallel}^2\right)}$$

$\tau_{parallel.13} := \tau_{II13}$

$\sigma_{13} := \sqrt{3 \cdot \tau_{II13}^2} = 2.568 \times 10^{8} Pa$

$\sigma_{joint} = 256.8MPa$

$$Check_4 := \begin{cases} \text{"OK"} & \text{if } \sigma_{joint} \le \frac{f_u}{\gamma_{M2} \cdot \beta_w} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$Check_4 = \text{"OK"}$

Maximum tensile force on member 167 at node (9)

Maximum tensile force $F_{x167} := 236.982kN$

Length of weld $L_{w167} := 500mm$

Throat dimension $a_{w167} := 5.0mm$

shear stress at weld $\tau_{II167} := \frac{F_{x167}}{L_{w167} \cdot a_{w167}} = 9.479 \times 10^{7} Pa$

$\tau_{II167} = 94.793MPa$

Utilization $UF_{167} := \frac{\tau_{II167}}{f_y} = 0.226$

Von Mises criteria:

$$\sigma = \sqrt{\sigma_{normal}^2 + 3 \cdot \left(\tau_{normal}^2 + \tau_{parallel}^2\right)}$$

$\tau_{parallel.167} := \tau_{II167}$

$\sigma_{167} := \sqrt{3 \cdot \tau_{II167}^2} = 1.642 \times 10^{8} Pa$

$\sigma_{joint} = 164.186MPa$

$$Check_5 := \begin{cases} \text{"OK"} & \text{if } \sigma_{joint} \le \frac{f_u}{\gamma_{M2} \cdot \beta_w} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$Check_5 = \text{"OK"}$