# ANALYSIS AND ECONOMICAL DESIGN OF 400 KV MULTI CIRCUITT TRANSMISSION LINE TOWER

A Dissertation Submitted in Partial Fulfillment
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With specialization in

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Submitted by
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2004-2006

# CERTIFICATE

This is to certify that the project entitled **"ANALYSIS AND ECONOMICAL DESIGN OF 400 KV MULTI CIRCUIT TRANSMISSION LINE TOWER"** is being submitted by Reyaz Ahmad**,** is a bonafide record of student's own work carried by him under our guidance and supervision in partial fulfillment of requirement for the award of the Degree of **Master of Structural Engineering(Civill Engineering) Department of Civil and Environmental Engineering, Delhi College of Engineering, Delhi, University of Delhi.**

The matter embodied in this project has not been submitted for the award of any other degree.

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**REYAZ AHMAD**

**Roll No: 8813**

## SYNOPSIS

The Wheelng of Power from Thermal / Hydro / Nuclear Power stations, and interconnection of state grids have given rise to the need for Extra-High Tension {E.H.T.} transmission lines.

Analysis and desgn of transmission line towers is a most challenging Job and requres several engineering man-days and prototype testing.

In this project efforts have been made to do 3D Analysis of tower considring all the members of the space truss as primary member. STAAD Pro program has been used to analyse and design the members of 400 Kv multi circuit tension tpwer haave deviation angle 2-15 degree.

Fixing of geometry of the tower is done by taking into aaccount , Slope of leg member, Slope of cross arms, Electrical clearance, Mid span clearance, Peak clearance, Phase phase to clearance and slenderness of member.

An Excel program has been to do Sag tension calculation s. Steel section Design has done in Exel program, Member section adopted as Starred angle and equal angle section.

An attempt has been made to make the transmission line most cost effective by changing the bracing pattern of transmission line self supporting structure having Squre base.

For Optimizing any member section , the entire load computations are repeated , simultaneneously the analysis and again the design. Thus is done some succesive itteration have been carried out before arriving at the economical design of towers. Then all these towers are compound and analyzed.

After analysing various towers for different initial dead weights, it has been noticed that final weight of tower is almost less from initial weight assumed

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# INTRODUCTION

## 1.1 PRESENT STATUS

The purpose of transmision line tension tower (multi circuit) is to support conductors carrying electric power and two groundwires at suitable distances above the ground level and at suitable distances from each other[1]. The transmission line towers cost about 28-42 percent of the total cost of transmission line and development of an optimum design can, therefore, result in substantial economies[15]. The construction of E.H.V. lines, design of towers and testing of towers consume 20% of time as a most moderate estimate. The design, testing and fabrication of towers taken together would take about 35% of total. project time. These considerations naturally call for accurate and efficient methods of design and analysis for the transmission line towers.

From the electrical point of view, the most important requirment is insulation and sag clearance to surface obstruction.These, together with the cross section of conductors, the spacing between conductors, and the relative location of ground wires with respect to the conductors, influence the design of tower and foundation.

The selection of an optimum outline together with right type of bracing system contributes to a large extent in developing an economical design of transmission line tower. [Ref. 12]

The height of tower is fixed on the basis of electrical clearance requirments and the structural designer has the task of designing the general configuration, members and joint details. [Ref. 21 ]

The Self supporting tension tower behaves as a single cantilever fixed at its base. [Ref. 20]

As a goal of every designer is to design the best (optimum) systems. But, because of the practical restrictions this has been achieved through intuition, experience and repeated trials, a process that has worked well.

Power Grid Corporation of India Limited has prescribed the following steps to optimized the Design of Power transmission lines

1. Review of existing system and practices.
2. Selection of clearances.
3. Insulator and insulator design.
4. Bundle conductor studies.
5. Line cost analysis and span optimization.
6. Economic evolution of life.
7. Tower configuration analysis.
8. Tower weight estimation.
9. Foundation volumes estimation.

In Civil Engineering structures, most of the time, it is economical to design oversafe structure rather than spending much more time on accurate analysis. But, this is not the case with transmission line towers. A little bit of saving of weight of steel per tower, ultimately results in enormous saving for any transmission line. The cost of transmission line tower is influenced by its weight. The weight in turn is influenced by the designer's diligence and his efficient application of the governing specifications, Hence the aim of designer should be to conserve every bit of steel possible, within the limitation of the specifications consistent with reliability. Reliability of a transmission sturcture depends not only upon its design, but also an the development of structural arrangement, detailing of connections, uniformity of quality of structural sections, accurate fabrication, erection in the field and ultimaely maintenance. An economical foundation design and proper erection techniques are also very vital for the safety of the tower.

Input data required for analysis and design of the tower is given below :

(1) Wind span, weight span and normal span.

(2) Angle and type of tower.

(3) Environmental temperature- conditions.

(4) Wind load intensity for structure, wire and insulator assembly.

(5) Outline of tower, that is, co-ordinates of joints.(Geometry of tower)

(6) Properties of rolled.angle sections:

(7) Limiting slenderness ratio and minimum length of different types of members.

(8) Effective length factor for each member of the truss; and other data, such as Density, young's modulus of elasticity of tower material, ultimate tensile strength of ground wire and power conductors, member group and sub group for each member.

IS 802 ( Part 1 / sec 1) : 1995 define the load / forces to be taaken of conductor and ground wire for normal, broken wire and safty conditions. Wind loads and self-weights are calculated for each member and are applied at respective tower nodes. While performing 3-D analysis, it is assumed that structure is pin jointed. Analysis of structure is done for different load combinations, that is, normal ,broken wire and safety conditions and design forces far each member are found.

In the tranmission line towers those members which are to be formed from same angle section, form a member group. In a member group, those of equal lengths are forming a member sub-group. While estimating the cross-sectional area of members or during design, only one member of a sub-group with maximum force is designed and rest of the members of that sub-group are directly assigned the same cross-section.

Besically optimization is done by changing the bracing pattern of tension towers.

## 1.2 OBJECTIVES

For weight optimization of tension tower basic parameters considered are as follows:

1. Base Width
2. Height of the tower.
3. Shape of the tower.

**Tower outline** It is defined in the terms of following parameters:

**A. Tower Height**

•Minimum ground clearance.

•Maximum sag including creep coefficient of conductor.

•Length of suspension insulator string assembly.

•Vertical spacing between power conductors.

•Location of ground wire.

•Angle of shield.

•Minimum mid span clearance.

•Tension Insulatar drop.

**B. Tower Width:**

•At Base or Ground level

•At Waist level Or Top Hamper level.

•At Cross arm/Boom level.

Normally, the base width varies from 1/4 to 1/6 of the overall heights of the tower above concrete level i.e. 1/6 for suspension towers, 1/5 for medium angle towers and 1 /4 for heavy angle tower. The economical base width (cm) of tower is given by:

$$B=K\sqrt{M}$$

Where, M is the over turning moment in Kg-m,

K is a constant having range from 1.35 to 2.5 i.e. average value is 1.93.

width at waist level is cross arm is 1/1.5 to 1/2.5 times the base width.

Rigid horizontal diaphragms are used at top and at intermediate sections, preferably at an intervals of 25 to 30 m to increase the torsional stiffness of the cross arms.

The length of cross arms varies from 4 to 18 m and number depends on the number of circuits and the earth wire used at the apex of tower.

**Cross Arm Spread:**

•Type of insulator string assembly i.e. suspension, I string or V string / tension / pilot.

•Swing angle i.e. suspension string assembly and conductor jumper.

- Phase to phase horizontal spacing.

D.**The slope of the leg member** below the cross arm varies from1/5 to 1/12 i.e. optimal is 1 in 8. Fatter slope gives low cost footings and lighter main corner members, at the expense of heavier and longer bracing members.

Spacing between two towers depends on transmission voltage i.e. 200m to 400m is used for up to 300 KV and 400m to 600m for above.

### 1.2.1 FIXATION OF OUTLINE OF TOWER

Keeping in mind the above restrictions, an attempt has been made to make the transmission line more cost effective by optimizing the geometry (shape) and behavior (type) of transmission line structure.

This has been carried out as per the guidelines of Power Grid Corporation of india limited by following the IS Codes and CBIP Manuals with the latest ongoing world wide research.

following research has been carried out for meeting these objectives:

1. Terminology of transmission line and its components have been understood.
2. Literature survey and the on going research work have been studied.
3. Methodology for analysis and design of transmission line towers is studied
4. Finally, worked is done in the direction to find out the most economical configuration or geometry.

To meet these objectives, the following work has been done:

1. The sag tension calculation for conductor and ground wire is calculated using parabolic equation.
2. Towers are configured with keeping in mind all the electrical and structural constrains on Microsoft Excel and Auto CAD.
3. Loading format including reliability, security and safety conditions is evaluated. Now all the towers are modeled using STAAD Pro.
4. The wind loading is calculated on the longitudinal face of the towers.
5. Then, the towers are analyzed as a three dimensional structure using STAAD.
6. Finally, tower members are designed as an angle sections.

To get the optimum member sections, total of three iterations are carried out. The member sections are required in the wind load calculations, so with every successive design iteration, wind loading on towers is changing, followed by there analysis and design.

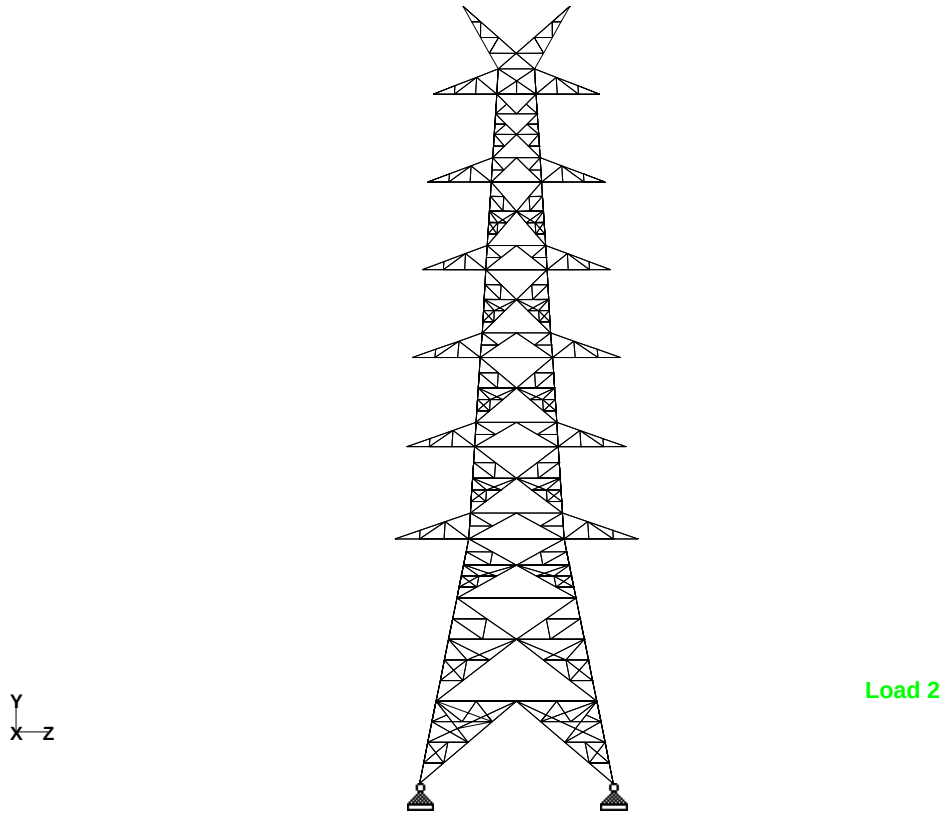
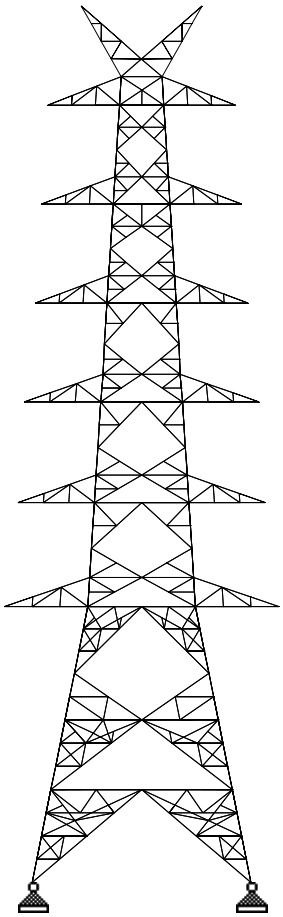



**Fig No-1**

**KBRACING UPTO UPPER CROSS ARM**

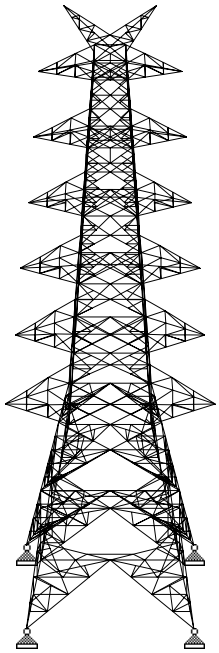


Y
X—Z

Load 2

**Fig No-2**

**K BRACING UPTO LOWER CROSS ARM**



Load 2

**ISOMETRIC VIEW**

**Fig No-3**

**K BRACING UPTO LOWER CROSS ARM**

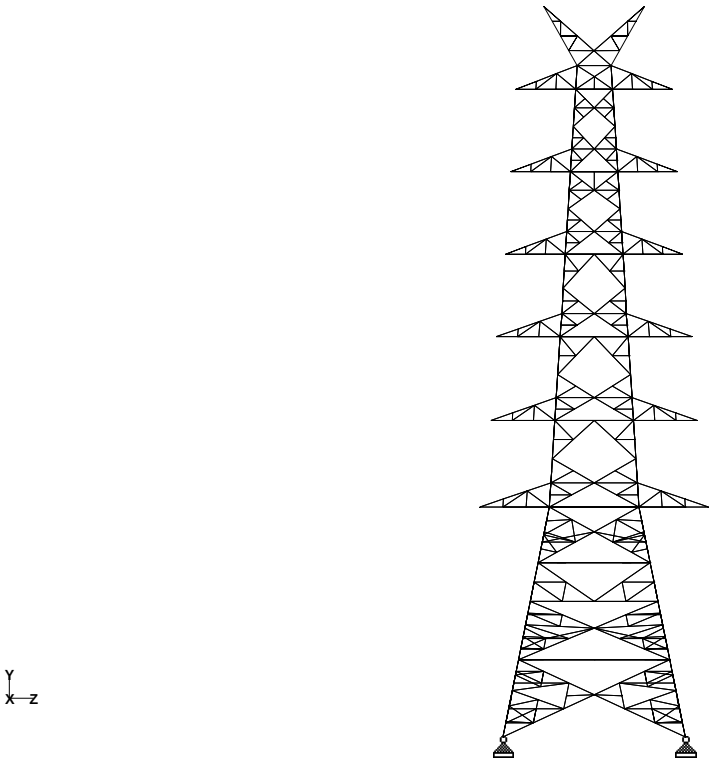



**Fig NO-4**

**X BRACING UPTO LOWER CROSS ARM**

**CHAPTER-2**

# LITERATURE REVIEW

Overhead transmission line plays an important role in the operation of a reliable electrical power system.

A high voltage transmission line structure is a complex structure in that its design is characterized by the special requirements to be met from both electrical and structural points of view, the former decides the general shape of the tower in respect of its height and the length of its cross arms that carry electrical conductors. [Ref. 40]

The increase in the demand for electrical energy can be met more economically by increasing the power transmission capacity of the transmission lines. Alternatively, utilizing saving in the cost of transmission lines. In this connection minimizing the cost of transmission line structures is an obvious need. [Ref. 36 , Ref. 40]

Transmission line towers are a vital component and there reliability and the safety should be checked to minimize the risk of disruption to power supply that may result from in-service tower failure. Lattice transmission towers are constructed using angle section members which are eccentrically connected. [Ref. 34]

Many older transmission towers are designed based on tension only bracing systems with slender diagonal members. The increased demand in the power supply and changing global weather patterns mean that these towers require upgrading to carry the resultant heavier loading. The failure of single tower can rapidly propagate along the line and result in severe damage that can costs in millions. [Ref. 32]

In India, single standardized sizes and designs are being used because of valid requirements of a fast developing country i.e. speeding up construction activities and early completion of transmission projects, even at a higher cost due to use of non optimized sizes. [Ref. 36]

The main structural components of transmission line are the conductors, the shield wires, the insulator strings and hardware and the suspension and dead end structures. The response of a line section to cable rupture depends on the interaction between all these components. The conductors are the stranded cables composed of aluminum, galvanized steel or a combination of the two. Shield wires are grounded steel wires placed above the conductors for lightning protection. Conductors are attached to suspension structures via insulators strings that are vertical under the normal operation conditions and are free to swing along the line whenever there is longitudinal inbalanced load. [Ref. 37]

Static analysis forms the basis of calculations in structural design of overhead tower lines. The environmental loads considered in design can be assumed static (icing) or quasi-static (idealized steady wind). They provide a good estimate of the extreme forces that a transmission line is subjected to during its service life. [Ref. 37]

Optimization of transmission structures in weight and shape through mathematical programming methods has attracted wide attention in the past. Member sectional areas are usually treated as design variables for weight optimization. The joint coordinates are included as decision variables in the case of shape optimization. In combined shape and weight optimization problems, the main objective function, viz. the weight of the structure, is a highly nonlinear function of the design, variables because at every stage of iteration, the nodal coordinates and the member lengths get changed. [Ref. 40]

In spite, being the restriction of fixed base width, still there is a scope for the weight minimization and optimum geometry shaping of a transmission line tower. This is apart from the optimum sizing of the members. [Ref. 40]

# CHAPTER - 3

## LOAD AND LOADING COMBINATION FOR TENSION TOWER

### 3.1 Tower configuration

In the design of transmission line structures, the selection of an optimum outline and system of bracing patterns contribute to a great extent in developing an economical design of a transmission line tower and thereby reducing its overall cost. The selection of an outline diagram is flexible in nature. Various configurations have been tried fron considerations of (i) voltage (ii) number of circuits (iii) type of material used for structure (iv) transmission efficiency (v) overall economy and also to some extent (vi) aesthetic values. For a particular tower configuration selected, the outline decided shall satisfy both, electrical and structural requirements in consistent with economy.

The steel structures used in the H.V./E.H.V. transmission lines can be broadly classified as (1) Guyed structures and (2) self-supported structures. In India the self supported structures only have been used, as these are more robust, need lesser right of way, and especially more reliable, compared to guyed structures. In this thesis the analysis and design of self-supported steel transmision line towers has been dealt with.

The configuration of a self-supported steel latticed tower is dependent on various electrical and structural requirements such as-

(1) Conductor arrangement

(2) Minimum ground clearance.

(3) Length of insulator assembly.

(4) Mid-span clearances between conductor and groundwire.

(5) Nature of shielding provided that is, the number and height of groundwires

(6) The system of bracing patterns.

All the above factors are considered from transmission efficiency, structural soundness and personnel safety point of view.

The first five requirements are electrical in nature. These in most cases will decide the configuration of the tower. The required clearances must be ensured in the worst position of conductors eg.in mountaineous areas, conductor may slope as much as 40° below horizontal. A large number of configurations can be laid down which will satisfy the above clearance requirements. The usual arrangement of conductor an a single circuit.line is side by side in a horizontal plane. This gives the lowest profile. Other configurations are also common. On double circuit towers the conductors are hung one above another in a more or less vertical plane from three horizontal cross-arms. Another arrangement uses two cross arms, the upper of which supports two conductors, while the lower supports four conductors, in which case each of the two circuits is placed in a triangular configuration.

## 3.2 Types of Towers.

Towers may support single, double or multiple circuits. The first two types are generally used for transmission line work. Economy dictates that a variety of tower types can be used. These will vary is weight and complexity from light suspension towers used on level terrain to heavy dead end towers. Much discussion has centred about the number of tower types required on a typical transmission line. Fabricators and erectors prefer a smaller number of types, whereas the designer will like to reduce the total weight of steel by using a large variety of towers depending on the various loading conditions and the terrain in the typical line.

A. Suspension Tower or Type A:

These are used for Straight run of line or $\alpha = 2°$.

When particularly $\alpha = 0°$, then termed as Tangent Tower.

B. Tension or Angle Tower:

These are used at locations where the angle of deviation exceeds 2 °

Further classified as:

B.1. Small Angle Tower or Type B: $\alpha = 2° \text{ to } 15°$

B.2. Medium Angle Tower or Type C: $\alpha = 15° \text{ to } 30°$

B.3. Large Angle Tower or Type D: $\alpha = 30° \text{ to } 60°$

On a tangent or suspension tower, th conductor is supported by one or more strings of insulators hanging vertically from the tower cross-arm. These towers are designed mainly for supporting the tensioned wire. These are spaced, depending on the relief of terrain from 200 to 400 meters apart for lines with a voltage 220 - 330 kV and from 400 to 600 metres apart for lines with higher voltages.

Angle towers are placed at angles in the line and are designed to resist the angular components of the cable pulls. These are usually so placed that the axis of the cross arms bisects the angle in the line. An angle suspension tower can be used for normal spans with a small angle turn in the line or with longer span on tangents.

## 3.3 Tower Loads

The following types of loads are accounted for in the design of transmision line towers.

(1) **Transverse loads** on a tower are due to wind load on supporting structure, conductors and groundwires and transverse components of cable tension on angle towers due to line deviation. This load acts along the longitudinal axis of cross-arms.

(2) **Longitudinal Loads** On a tower are due to unbalanced pull due to broken conductor or groundwire and pull of all conductors and ground wire in case of dead end towers. This load acts horizontally along the direction of line.

**(3) Vertical Loads** On a tower are due to weight of structure, conductor and groundwire, insulator and fittings, ice coating (if any);line man with tools. These loads are applied at point of conductor supports.

**(4) Eccentric vertical loads** arise in a tower under unequal loads in the case of arrangement of conductors on a single circuit tower and also due to unbalanced vertical loads under broken wire conditions.

**(5) Earthquake forces** : are generally **neglected** because transmission line towers are comparatively light stuctures and also because/it is the maximu wind pressure criteria which governs the design.

**(7) Temperature stresses** due to variation of temperature. These are not considered for structure of normal height.

## 3.4 Calculation of Design Loads :

### 3.4.1. Wind Pressure Loads

On the basis of measured maximum velocities for different parts of the country, including winds of short duration, the country has been divided into six zones of wind speed, wind pressure for the structures is different from that of conductors and earthwires. Force due to wind on various elements of transmission line is obtained by multiplying pressure with the projected area of that element.

### 3.4.2. Dead weights

These are all vertical leads which are calculated separately for the structures, the conductors and groundwires and the insulators etc.

**(a) Conductors and Groundwires**

The conductor weight on any tower is equal to the weight of conductor and ice, if any, between the adjacent law points of the catenary or weight span. Under brokenwire condition the weight of conductors,/ groundwire is taken as 60% of that under normal condition.

**(b) Weight of insulator and weight of line-man with tools**

For each point of conductor attachment the weight of insulator is calculated depending upon the number of discs per string and the number of strings.

**(3.5) Load due to condutor and ground wire tensions**

Sag tension calculation and determination of maximum working tension.

The size and type of condutor , wind and climatic condition of region and span length determine the conductor sag and tension.

(i) the minimum f.o.s.for conductor shall be 2. based on their tensile strength.

(ii) The conductor tension at 32°C (90°F) without external load shall not exceed the following percentages of the ultimate tensile strength of the conductor.

Initial unloaded tension - 35 percent

Final unloaded tension - 25 percent

Hence, sag-tension computations made for final stringing of the conductors must ensure that factor of safety of 2 and 4 are obtainable under maximum loading condition and every day loading condition, respectively.

Standard sag--tension parabolic equation considering th combined effect of elasticity and temperature is given as -

$$f_2^2(f_2 -( K- \alpha\ t.E)) = L^2\delta^2.q_2^2.E / 24 \qquad (2.1)$$

where, f = working tensile stress of conductor in kg/cm$^2$

K = constant computed from initial temperature and wind pressure condition assumed.

E = final modulus of elasticity in kg/cm$^2$

$\alpha$ = coefficient of linear expansion of conductor per degree centigrade.

t = change in temperature = final temperature minus initial temperature in degree centrigrade.

L = span length in meters, $\delta$ = weight of conductor/m/cm$^2$ - W/A, kg/m/cmz

where, A = cross-sectional area of conductor in $cm^2$

q = loading factor = $\sqrt{\{\frac{W^2 + p^2}{W2}\}}$ (2.2)

Where W = weight of conductor in kg/m length of conductor

P = wind load on conductor in kg/m length of conductor.

While calculating the maximum working tension of groundwire, the governing criterion is the requisite minimum mid--span clearance between the conductor and groundwire.

## 3.6 **Loading Combination**

The most safe tower would be that, which is designed to withstand simultaneous application of worst loading. But, for economy combined with reliability, we must consider the probable combination of load that are likely to occur. This will depend upon the importance of the line, type of tower, climatic conditions, terrain through which the line passes, alternative arrangement of supply to the receiving station and continuity of supply.

Loading Combinations given by the IS 802: Part 1: Sec: 1:1995 are as follo

1. Reliability Condition (Normal Condition):

- Transverse loads
- Vertical loads
- Longitudinal loads

2. Security Condition (Broken Wire Condition)
   - Transverse loads
   - Vertical loads
   - Longitudinal loads
3. Safety Condition (Construction and Maintenance):

- Transverse loads
- Vertical loads
- Longitudinal loads

Note ;- In case of Broken Wire Condition: (any two phases broken in the same side and same span or any one phase and one ground wire broken ).

# CHAPTER-4

## ANALYSIS AND DESIGN APPROACH OF TENSION TOWER:

CBIP in "Transmission Line Manual" has elaborated that the wind plays a vital role in the load calculation on tower. In order to determine the wind load on tower, this is divided into different panels having a height "h". These panels should normally be taken between the intersections of the legs and bracings. For lattice tower, wind is considered normal to the face of tower acting at the center of gravity of the panel.

Most latticed towers are particularly susceptible to mean wind effects in the degin of lattice towers normally a quasi static approach is adopted with gust response factor included to take into account the dynamic nature of the wind for evaluating the peak stresses in members. It has been recognized that gusts do not envelope the entire span between transmission structures. [Ref. 54]

Gust response factor is the multiplier used for the wind loading to obtain the peak load effect and accounts for the additional loading effects due to wind turbulence and dynmic amplification of flexible structures and cables. [Ref. 9]

Gust response factor for conductor and ground wire depends on the terrain catogries, height above the ground and the span. Gust response factor for tower depends upon the terrain categories and the height above the ground . Gust responce factor for insulator depends on the ground roughness and height of insulator attachment above ground. [Ref. 12]

Drag coefficients under the wind effect are considered for the conductor, ground wire and the insulator. [Ref. 12]

## 4.1 ANALYSIS OF TOWER:

The space truss is one type of frame struture. The joint of the frame structure are the points of intersection of member as well as points of support and free end of member.

Earlier, transmission towers were designed by performing manual calculations based on two dimensional stress analysis / stress diagram method which was time consuming and laborious. The designer has the limitations to try out several permutation and combinations of tower geometry. [Ref. 16 & Ref. 14]

Latter on, the highly sophisticated software have been developed to automate calculation of member forces based on three dimensional finite element analysis / stiffness matrix analysis. Such software finds out critical member force for a number of loading conditions and a variety of possible tower combinations, giving very accurate results. Availability of such software have done great help to designers to understand force distribution and afford to them ample time to concentrate on fine tuning design aspects and at the same time undertake the repetitive calculation and optimization. [Ref. 16]

STAAD Pro 2004 is the next generation of the structural analysis and design software from research engineers. The STAAD provides general purpose structural analysis and integrates steel/ concrete/ timber. STAAD Pro 2004 is simple to use and user friendly. The entire input data may be generated either graphically or by typing simple English language based commands. STAAD uses analysis command as perform Analysis.

To ascertain the margin of safety available on the towers, towers are analyzed with the powerful computer software. For this, the towers are idealized as a 3 dimensional pin jointed space truss consisting of nodes and members. Towers are statically indeterminate structure, thus appropriate powerful computer software is essential. [Ref. 16 & Ref. 14]

## 4.2 WIND LOAD ON TOWER

$\mathbf{F_{wt} = P_d \, X C_{dt} \, X \, A_e X \, G_T}$

Where $\mathbf{P_d}$ = Design wind pressure, in N / $m^2$

$\mathbf{C_{dt}}$ = Drag cofficient for panel. ( Values of $C_{dt}$ find from Table 5 IS 802 (Part 1/ Sec 1) : 1995 )

$\mathbf{A_e}$ = Total Net surface Area Of the Legs, Bracings, Cross Arms and Secondry members of the Panel Projeected normal to the face in $m^2$.

$\mathbf{G_T}$ = Gust responce factor (Values of $G_T$ find from Table 6 IS 802 (Part 1/ Sec 1) : 1995 )

$\mathbf{P_d} = 0.6 \, V_d^2$

$V_d$ = Design wind Speed in m/ s

$V_d = V_R \times K_1 \times K_2$

Where $V_R$ = Metrological reference wind speed = $V_b / k_0$

$V_b$ = Basic wind speed ( According to 6 Wind zone)

$\mathbf{k_0}$ = 1.375

$K_1$ = Risk cofficient (Values of $K_1$ find from Table 2 IS 802 (Part 1/ Sec 1) : 1995 )

$K_2$ = Terrain Roughness Cofficient.( find from Table 3 IS 802 (Part 1/ Sec 1) : 1995)

**Wind load on conductor and ground Wire:**

$\mathbf{F_{wc} = P_d \, X \, C_{dc} \, X \, L \, X \, d \, x \, G_c}$

Where $\mathbf{F_{wc}}$ = Wind load on condutor in Newtons

$\mathbf{C_{dc}}$ = Drag cofficient Taken as **1.0** for conductor and **1.2** for ground wire

**L = Wind span.**

**d = Diameter of cable.**

$\mathbf{G_c}$ **= Gust Responce Factor (**find from Table 7 IS 802 (Part 1/ Sec 1) : 1995)

**Wind load on Insulator Strings.**

$\mathbf{F_{wi} = P_d \, X \, C_{di} \, X \, A_i \, X \, G_T}$

Where, $\mathbf{F_{wi}}$ = Wind load on Insulator Strings.

$\mathbf{P_d}$ = Design wind pressure, in N / $m^2$

$\mathbf{C_{di}}$ = Drag cofficient, to be taken as 1.2;

$\mathbf{A_i}$ = 50% Of the area of Insultor String Projected on a Plane which is parallel to longitudnal Axis of the String.

$\mathbf{G_T}$ = Gust responce factor (find from Table 6 IS 802 (Part 1/ Sec 1) : 1995 )

4.3 **CLASSIFICATION OF LOAD**

(a) Climatic Load – Related to Reliability Requirment.(Under Normal Condition)

(b) Failure Containment load - Related to Security Requirment.( Under Broken Wire Condition)

(c) Construction and maintenance load- Related to Safety Requirment.

**4.4 NATURE OF LOADS.**

**4.4.**1 Transverse Loads(T)

4.4.2 Vertical loads (V)

4.4.3 Longitudnal loads(L)

**4.5 LOADING CRITERIA**

Load imposed on tower due to action of wind area calculated under tthe following climatic criteria:

Criterian I Every day temp. And design wind pressure.

Criterian II Minimum temp. With 36% of design wind pressure.

4.6 **TRANSVERSE LOADS(TR)**

4.6.1 **Reliability Requirment.**

Total Transverse Loads = $\mathbf{F_{wt}} + \mathbf{F_{wi}} + \mathbf{F_{wc}} + \mathbf{F_{wd}}$

$\mathbf{F_{wd}}$ = Transverse Load from mechanicaltension of conductor and ground wire due to wind ( Deviation load )

$\mathbf{F_{wd}} = 2 \times T \sin \Phi / 2$

4.6**.2 Security Requirment.**

Total Transverse Loads (TS) = $\mathbf{F_{wt}} + \mathbf{F_{wi}} + \mathbf{F_{wc}} + \mathbf{F_{wd}}$

(a) 60% Wind span shall be considered for a broken-wire and 100% for intact wire.

(b) Transverse Load due to line deviation shall be component of 100% mechanical tension of conductor and ground wire.

4.6.3 **Safety Requirment. (TM)**

Transverse Load due to wind action on tower structure, conductors, ground wires and insulators shall be taken as nil.

Transverse Load due to mechanical tension of conductor and ground wire at every day temp. And nil wind condition on account of line deviation shall be taken as followos:-

$TM = 2 \times T_1 \sin \Phi / 2$

4.7 **Vertical loads (VR) –**

4.7**.1 Reliability Condition.**

Loads due to weight of each conductor and ground wire based on appropriate weight span, weight of insulator string and accesories.

4.7.2 **Security Condition.**

Loads due to weight of each conductor and ground wire based on appropriate weight span, weight of insulator string and accesories.In broken condition shall be considered as 60% of weight span.

4.7.3 **Safety Condition.**

Same as .6.2 multtiplied by overload factor of 2.

4.8 **Longitudnal loads(LR)**

4.8.1 **Reliability Condition.**

Longitudnal load taken as nil

4.8.2 **Security Condition.**

As 3.4 for broken wire condition . for intact wire these loads should be nil.

4.8.3 **Safety Condition.**

In Broken wire condition loads equql to ttwicee the sagging tension (sagging tension is 50% of the tensionat every day temp. And no wind) for one eearthwire or one complete phase sub-conductor which is in process of stringing. At other earthwiree or condutor attachment points for which stringing has been completed, loads equal to 1.5 times the sagging tension will be considered

## 4.9 DESIGN OF TOWER:

Transmission line towers are designed according to the provisions of Indian national standard codes. Tower designed according to these codes have proved reliable. Adoption of these probabilistic methods of design has not only made us at par with the latest techniques developed in the world but have also lead to optimum and reliable economic designs.

The design criteria of transmission lines shall be such that it should facilitate the transmission lines to fulfill the function to an accepted level of performance. The stringent design criterion leads to the obvious increased level of performance. However, the optimum level is a matter of economics, which could be decided by considering minimum level of safety of people and conformance to the national regulations. [Ref. 13]

Since axial force is the only force for a truss element, the member has to be designed for either compression or tension. But reversal of loads may also induce alternate nature of forces; hence these members are to be designed for both compression and tension. The total force acting on any individual member under the normal condition and also under the broken wire condition is multiplied by the corrosponding factor of safety and it is ensured that the values are within the permissible ultimate strength of the particular steel used.[Ref. 19] .

IS 802: Part 1: Sec: 1:1995 (CBIP) has restricted the Slenderness Ratio as following:

| | |
|---|---|
| Leg members, G.W. Peak, X arm lower member | <120 |
| Bracings | <200 |
| Redundant / Nominal stress carrying members | <250 |
| Tension members | <400 |

# CHAPTER-5

# ANALYSIS AND DESIGN OF TENSION TOWER

# (NUMERICAL STUDY)

## 5.1 ANALYSIS OF TOWER

Steps involveed are as follows:

A. Transmission line data fixation.
B. Sag tension calculation for conductor and ground wire.
C. Configuration of towers.(Fixing the dimension of tower components).
D. Loading tree.
E. Wind loading on tower.
F. STADD PRO Analysis Results.
   (i) Forces
   (ii) Deflection.

A. TRANSMISSION LINE DATA:

As per the guidelinces of PGCIL, the folloeing parameters for the transmission line and its components are assumed from I.S. 802: Part 1 Sec:1:1995, IS 5613: Part 2:Sec:1:1989 and CBIP Manual No. "268"

| | | |
|---|---|---|
| 1. | Transmission line voltage | 400 kV |
| 2. | Right of way | 52 m |
| 3. | Angle of line deviation (β) | 2°- 15° |
| 4. | Terrain type considered | plain |
| 5. | Terrain category | 2 |
| 6. | Return period | 50 years |
| 7. | Wind zone | 3 |
| 8. | Basic wind speed | 44 m/s |
| 9. | Basic wind pressure | 62.58 kg/sqm |
| 10. | Tower type | Type B |
| 11. | Tower geometry | Sq.base tower |
| 12. | No. of circuit | Multi circuit (Four circuit) |
| 13. | Tower configuration | Vertical conductor configuration |
| 14. | Tower shape | Barrel shaped |
| 15. | Bracing pattern | Warren type |
| 16. | Cross arm | Pointed |
| 17. | Body extension | Not considered |
| 18. | Steel used | Mild steel / High tensile Steel |

| | | | |
|---|---|---|---|
| 19. | Slope of tower leg | | 10°-17° Permissible |
| 20. | Conductor material | | ACSR(Aluminum conductor steel Rein.) |
| 21. | Conductor configuration | | Moose |
| 22. | Max.temp. | | 85°c |
| 23. | No. of ground wire | | Two |
| 24. | Peak type | | Horn |
| 25. | G.W. type | | Earth wire 7/3.66 |
| 26. | Shielding angle | | 20° |
| 27. | Max. temp. | | 53° |
| 28. | Insulator type | | Tension string |
| 29. | No. of insulator disc | | 23x2 |
| 30. | Size of insulator disc | | 280x170 |
| 31. | Length of insulator string | | 3850 mm |
| 32. | Minimum ground clearance | | 8840 mm |
| 33. | Sag error considered | | 150 mm |
| 34. | Creep effect | | 000 |
| 35. | Mid span clearance | | 9000 mm |
| 36. | Width of hamper level | | 2000 mm |
| 37. | Phase to phase clearance | | |
| | *Vertical spacing b/w conductor | | 8000(min) |
| | * Horizontal spacing b/w conductor | | 12640 mm |
| 38. | Phase to ground metal clearance:- | | |
| | Swing angle | | |
| | 22° | | 3050mm |
| | 44° | | 1860mm |
| 39. | Base width/ Length above ground level | | 1:4 |
| 40. | Minimum thickness of member | | |
| | Leg member, GW peak and lower member of | | |
| | CA | | 5mm |
| | Others | | 4mm |
| 41. | Permissible Wt span | | |
| | * Normal condition | max | 600m |
| | | Min | 0 |
| | * BWC | max | 360m |
| | | Min | -200m |
| 42. | Normal span | | 400m |
| 43. | Design span | | 400m |
| 44. | Wind span | | 400m |
| 45. | Weight span | | 600m |
| 46. | Concrete level to ground level | | 225mm |
| 47. | Tower weight (Minimum) | | 47524 kg |

B; **Sag Tension Calculation for conductor**

Sag tensions are calculated by using parabolic equations as discussed in the IS. 5613: Part 2 Sec:1:1989 by developing intigrated program on microsoft Exel For both the conductorr and ground wire.

**Parabolic Formula** $F_2^2(F_2 -( K- \alpha t.E)) = L^z\delta^2.q_2^2.E / 24$

As $K= F,- (L^2.\delta^2.q_2^2.E / 24.F_1^2)$

**Sag Tension Calculation(Lower circuit)**

| s. no. | Environmental temp. ($^oC$) | Wind factor | Ice thickness cm | Vertical sag M | Tension kg | F.o.S. |
|---|---|---|---|---|---|---|
| 1 | 32.0 | 0 | 0 | 11.089 | 3614.52 | 4.545(22%) |
| 2 | 32.0 | 1.0 | 0 | 5.58 | 7183.36 | 2.287 |
| 3 | 85.0 | 0.00 | 0 | 13.262 | 3022.27 | 5.436 |
| 4 | 0. | 0.00 | 0 | 9.669 | 4145.31 | 3.963 |
| 5 | 32.0 | 0.75 | 0 | 6.635 | 6040.73 | 2.72 |
| 6 | 1.00 | 0.36 | 0 | 8.143 | 4921.86 | 3.338 |

**(2) Sag Tension Calculation (upper circuit)**

| s. no. | Environmental temp. ($^oC$) | Wind factor | Icethickness | Vertical sag m | Tension kg | F.o.S. |
|---|---|---|---|---|---|---|
| 1 | 32.0 | 0 | 0 | 11.089 | 3614.52 | 4.545(22%) |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2 | 32.0 | 1.0 | 0 | 5.324 | 7527.75 | 2.182 |
| 3 | 85.0 | 0.00 | 0 | 13.262 | 3022.27 | 5.436 |
| 4 | 0. | 0.00 | 0 | 9.669 | 4145.31 | 3.963 |
| 5 | 32.0 | 0.75 | 0 | 6.361 | 6300.47 | 2.607 |
| 6 | 1.00 | 0.36 | 0 | 7.971 | 5028.25 | 3.267 |

**Sag Tension Calculation for Ground wire**

| s. no. | Environmental temp. ($^{o}$C) | Wind factor | Ice thickness cm | Vertical sag m | Tension kg | F.o.S. |
|---|---|---|---|---|---|---|
| 1 | 32.0 | 0 | 0 | 9.615 | 1212.69 | 5.75(22%) |
| 2 | 32.0 | 1.0 | 0 | 3.773 | 3089.99 | 2.256 |
| 3 | 53.0 | 0.00 | 0 | 10.199 | 1143.26 | 6.098 |
| 4 | 0. | 0.00 | 0 | 8.702 | 1339.94 | 5.203 |
| 5 | 32.0 | 0.75 | 0 | 4.55 | 2562.74 | 2.721 |
| 6 | 0.00 | 0.36 | 0 | 6.317 | 1815.75 | 3.777 |

## C. CONFIGURING TOWER:

A. **Height Till Waist Level** (From G.L.):

| | |
|---|---|
| Minimum Ground Clearance: | 8840 mm |
| Sag Error Considered: | 150 mm |
| Max. Sag of Conductor | 13262 mm |
| Height Till Lower Cross Arm: | 22252m |
| Provided | 22310mm |

B. Vertical Spacing Between Cross Arms.

| | |
|---|---|
| Minim. Vertical Spacing Between Conductor: | 8000 mm |
| Provided Vertical Spacing Between Cross Arm: | 8000mm |

C. Height Till Upper Cross Ann: 62860mm

D. Vertical Clearance Between Ground Wire And Top Conductor:

### 1. MID SPAN CLEARANCE CHECK

SAG OF GROUND WIRE ($0^{\circ}$+0.0) = 8700 mm

SAG OF CONDUCTOR ($0^{\circ}$+0.0) = 9669 mm

SAG DIFFERENCE: 240 mm

MINIMUM MIDSPAN CLEARENCE ALLOWED: 9000 mm

HEIGHT BETWEEN TOWER TOP AND U.C.A (BOTTOM) : 8033 mm

TOTAL TOWER HEIGHT: 62860 + 8033 **70893** mm

2- **PEAK CLEARANCE CHECK**:

TOWER TYPE SQUARE BASE

HEIGHT FROM G.L.

LOWER CROSS ARM 22310

BETWEEN UPPER AND LOWER CROSS ARM 40550

AS PER SHIELDING ANGLE REQUIREMENT: 8033

TOWER TOTAL HEIGH- 70893

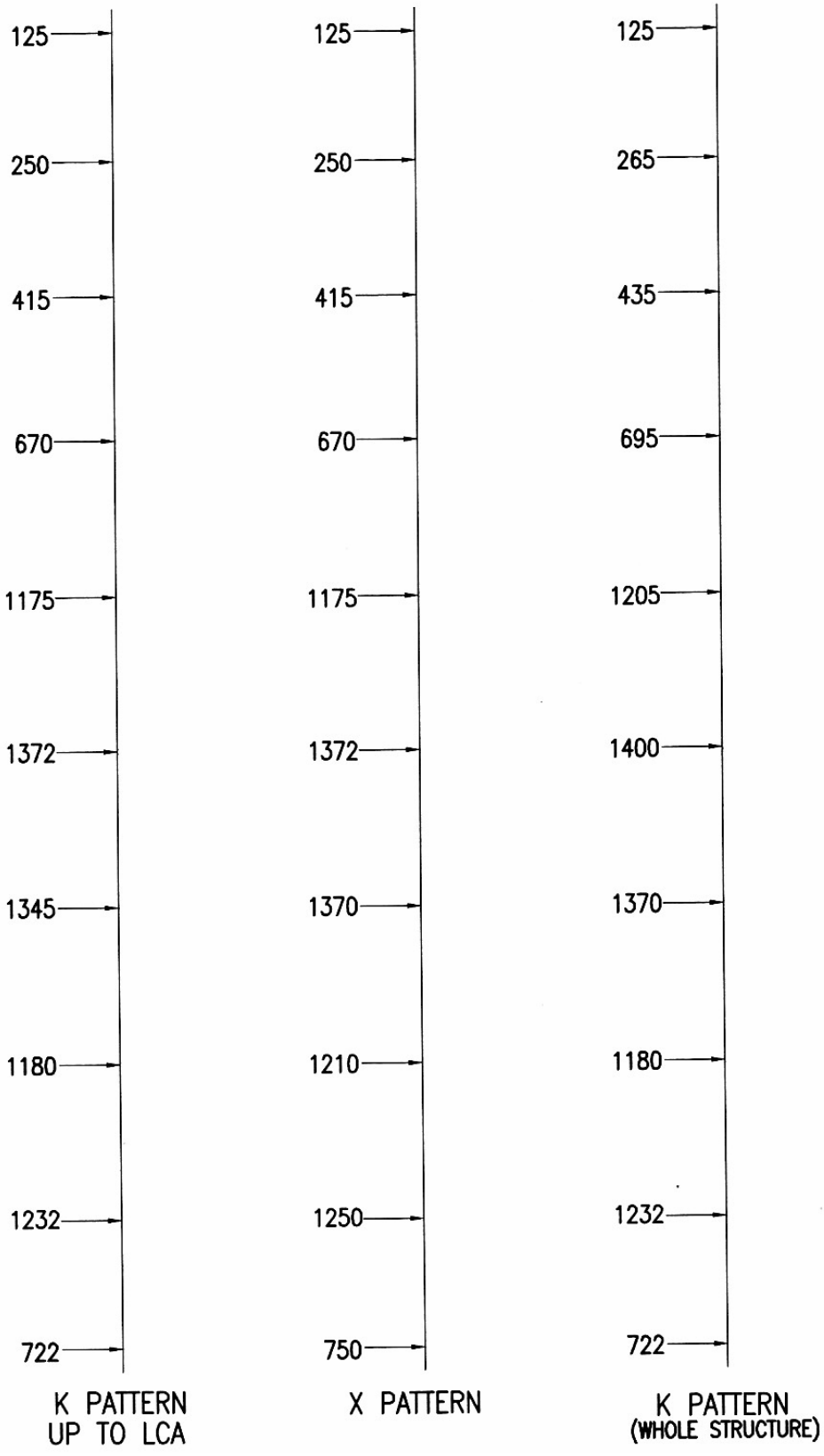
E. Horizontal Spacing Beween Cross Ann Tip **:**

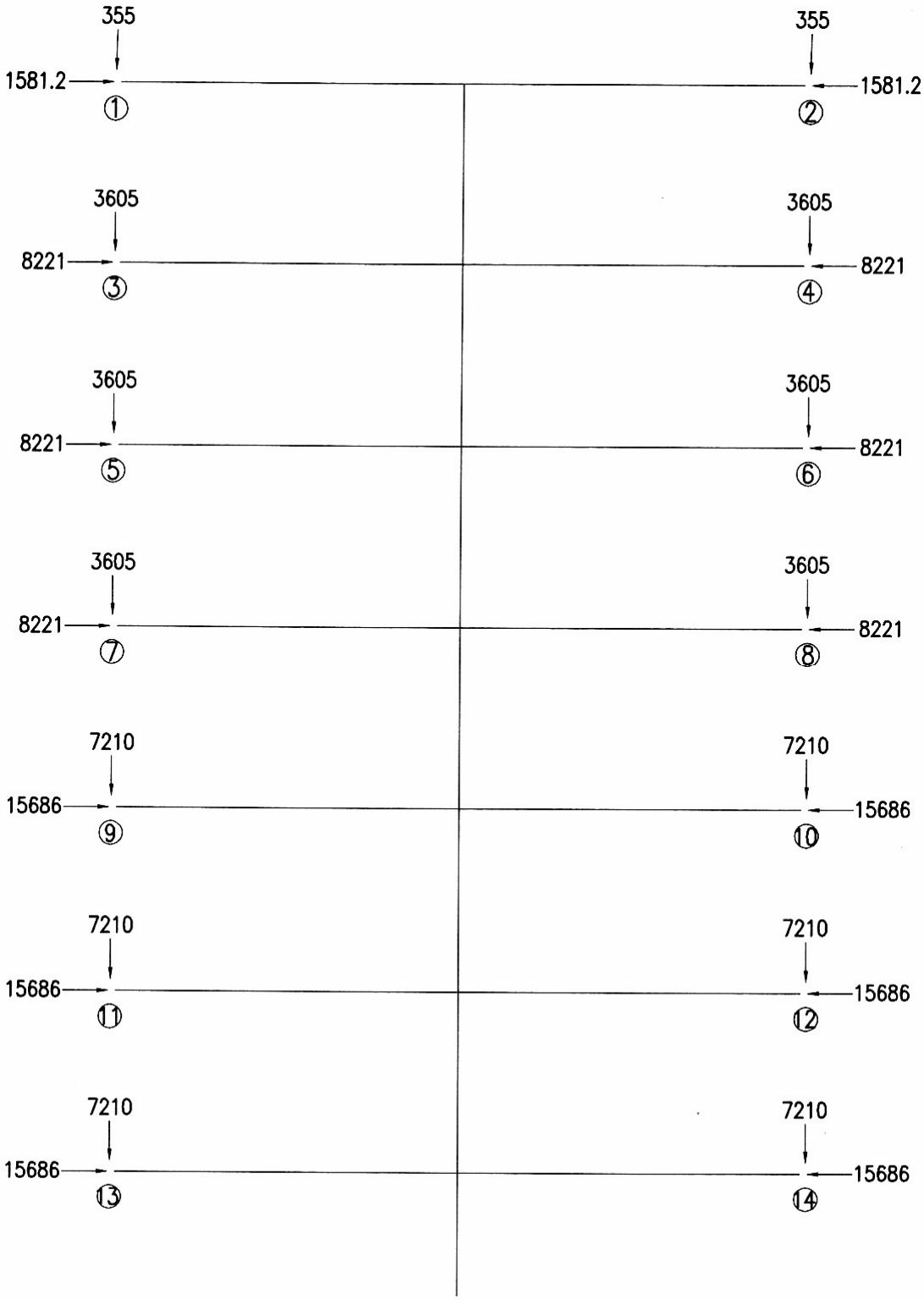
**Minim. Horizontal Spacing Between Conductor: 9000 mm**

**ELECTRICAL CLEARANCE CHECK** :

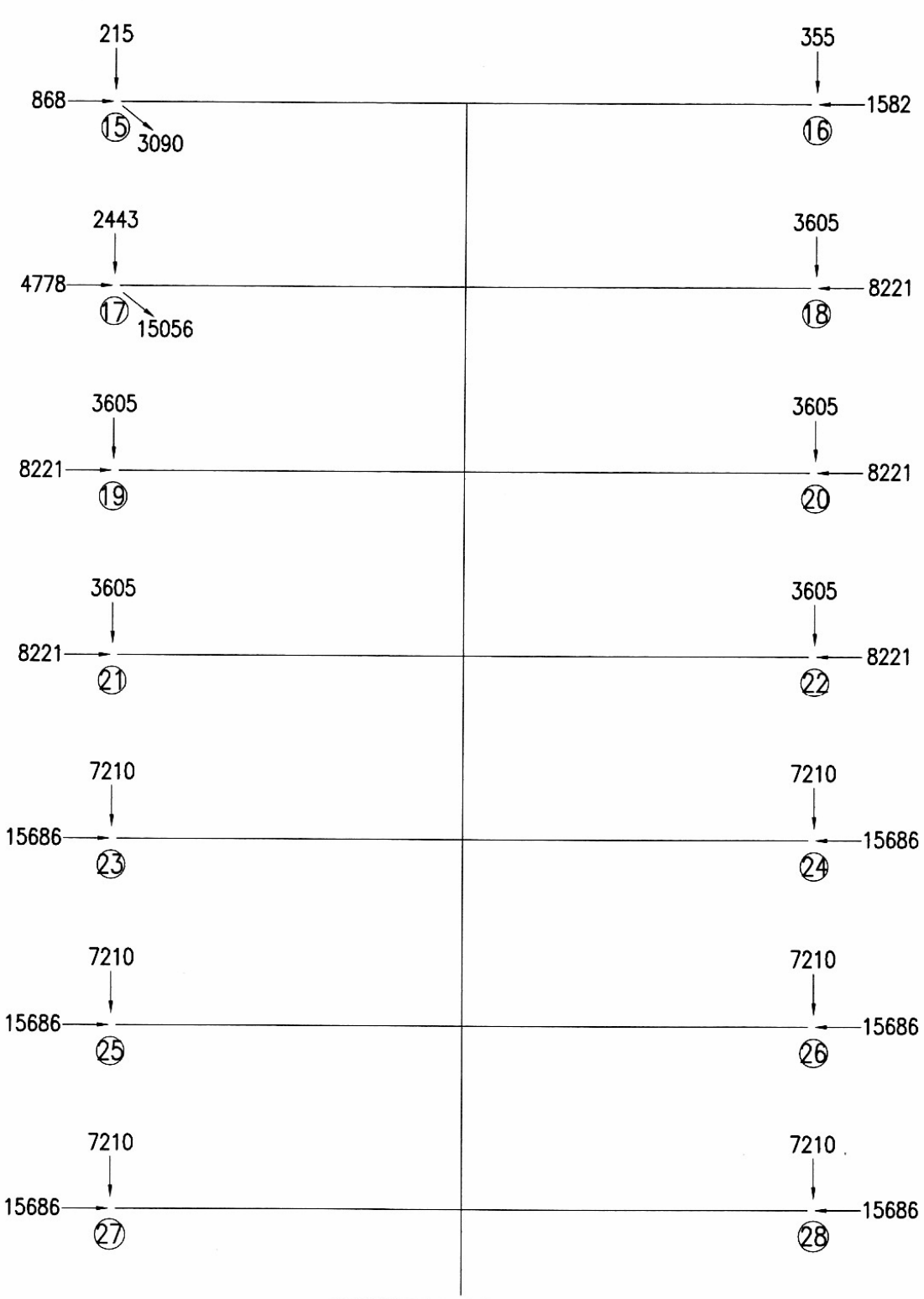
| | | |
|---|---|---|
| Width At Waist Level: | 8700 (Bottom) | 5080 (Top) |
| Eletrical Clearance: | 495 0 | 4950 |
| Horz. Spacing (Required) | 18600 | 14980 |
| **Total Horz. Spacing(provided)** | **22200** | **15180** |

## WIND LOAD TREE

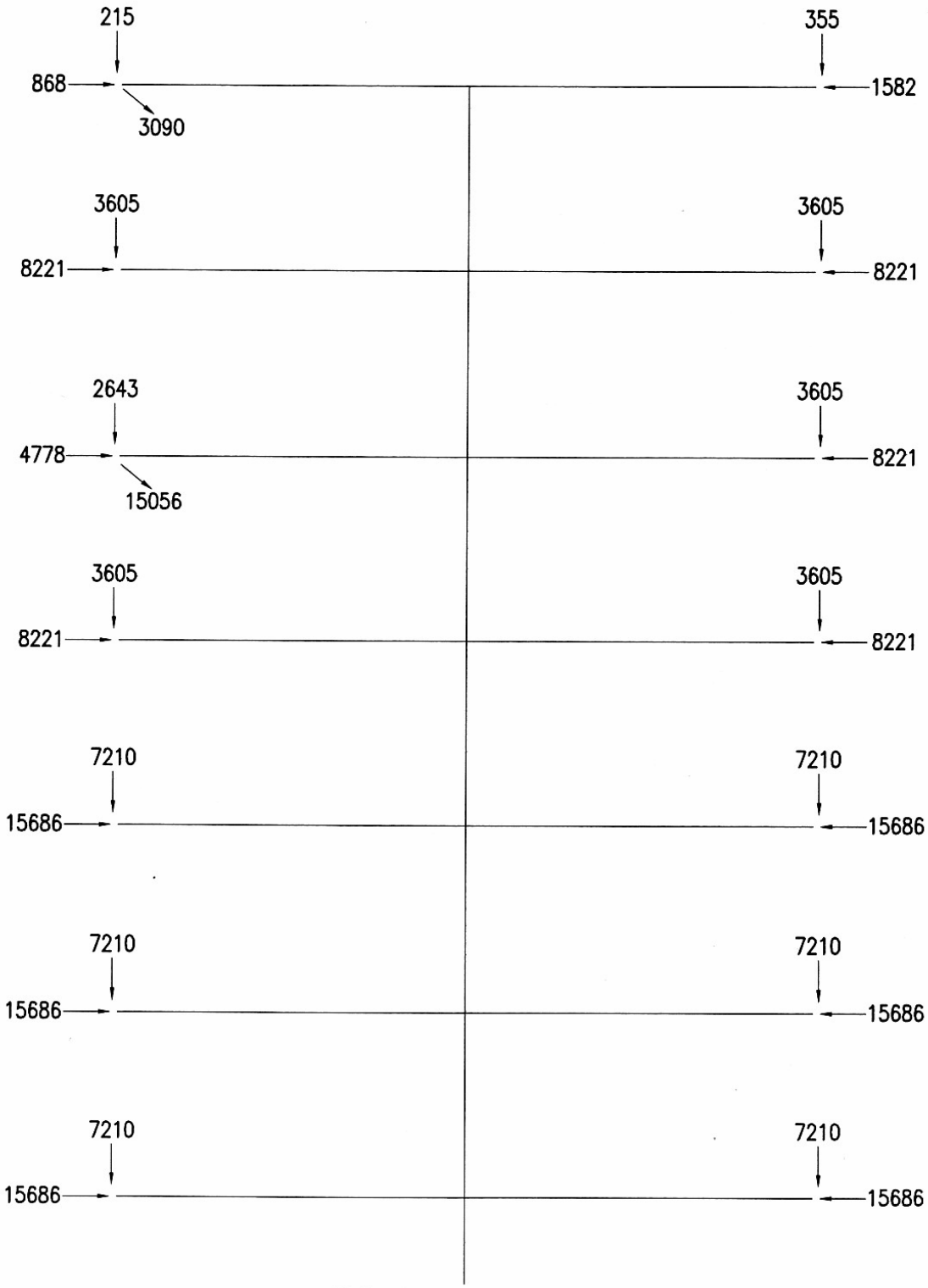





RELIABILITY CONDITION

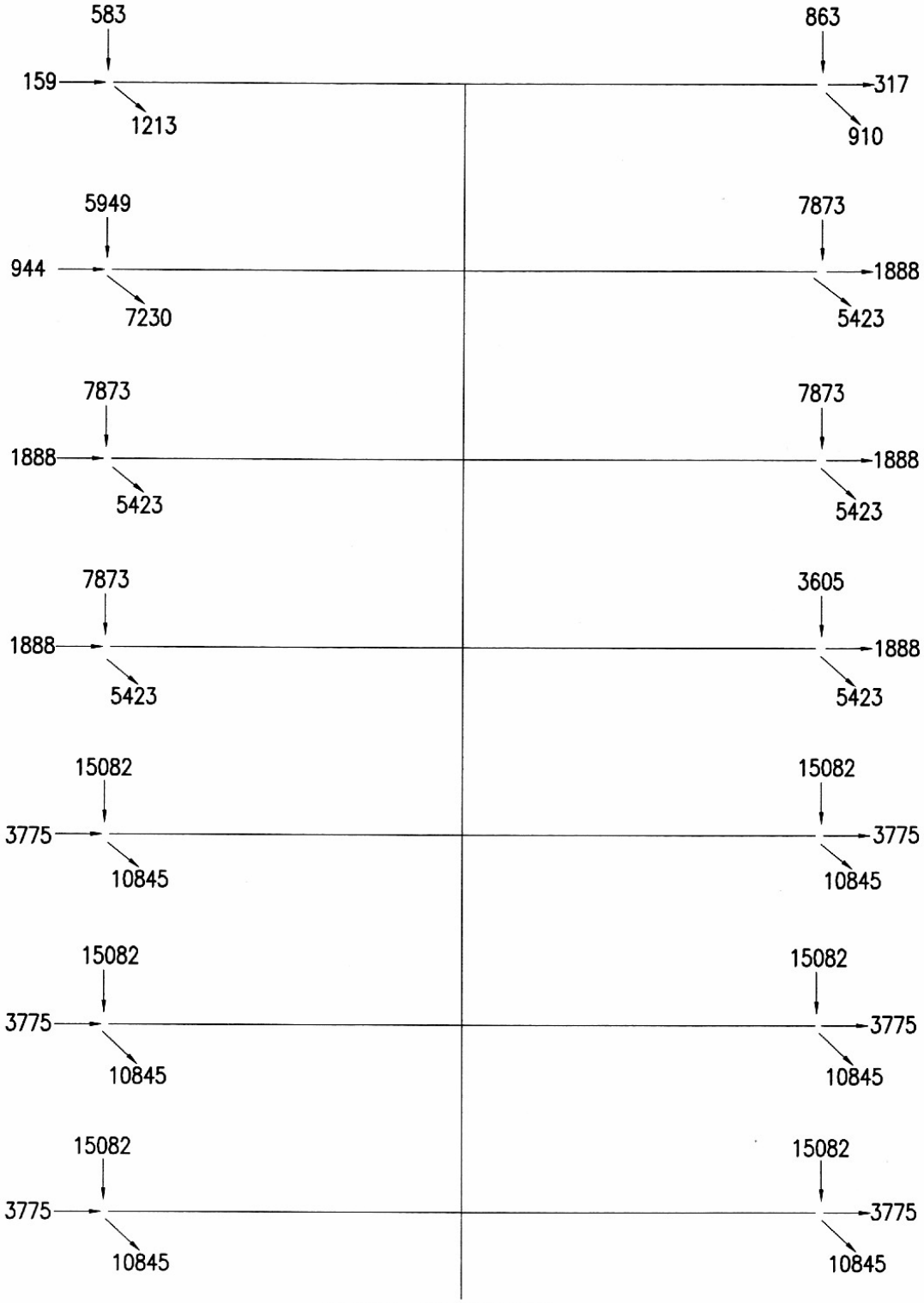



SECURITY CONDITION
GW AND TOP LEFT CONDUCTION BROKEN




SECURITY CONDITION

GW AND TOP SECOND LEFT CONDUCTOR BROKEN




SAFTY CONDITION

GW AND TOP SECOND LEFT CONDUCTOR BROKEN

**E. Wind loading on towers.**

| **Wind loading on towers (Kg) Square tower** | | | |
|---|---|---|---|
| Height (m) | K bracing upto lower cross arm | **X** bracing upto lower cross arm | K bracing upto Upper cross arm |
| **0** | **722** | **750** | **722** |
| **7.5** | **1232** | **1250** | **1232** |
| **13.15** | **1180** | **1210** | **1180** |
| **22.3** | **1345** | **1370** | **1370** |
| **30.7** | **1372** | **1372** | **1400** |
| **38.856** | **1175** | **1175** | **1205** |
| **46.856** | **670** | **670** | **695** |
| **54.856** | **415** | **415** | **435** |
| **62.856** | **250** | **250** | **265** |
| **70.893** | **125** | **125** | **125** |
| **TOTAL** | **35378** | **35800** | **36150** |

F. **ANALYSIS RESULTS**

All the three towers are analyzed in STAAD Pro 2004 and the following results are obtained.

**Maximum Force in the Leg Member (KG)**

| | K bracing upto LCA | | **X** bracing upto LCA | | **K** bracing upto UCA | |
|---|---|---|---|---|---|---|
| Panel No. | Com.load | Tensile.load | Com.load | Tensile.load | Com.load | Tensile.load |
| 1 | 264830 | 207502 | 219312 | 209284 | 244621 | 232066 |
| 2 | 206780 | 201934 | 261621 | 206907 | 231093 | 222399 |
| 3 | 207746 | 204597 | 239763 | 191681 | 219715 | 218187 |
| 4 | 220679 | 201546 | 172685 | 173956 | 202263 | 197678 |
| 5 | 216796 | 178134 | 217369 | 139051 | 175745 | 172601 |
| 6 | 162902 | 128718 | 163243 | 128300 | 150687 | 143536 |
| 7 | 159440 | 131572 | 121533 | 131184 | 122440 | 121191 |
| 8 | 116370 | 90761 | 116382 | 58988 | 103955 | 101144 |
| 9 | 111864 | 68104 | 111881 | 93281 | 71130 | 79789 |
| 10 | 68538 | 52335 | 78678 | 52939 | 54245 | 62277 |
| 11 | 67080 | 55043 | 67015 | 54911 | 62434 | 49876 |
| 12 | 50879 | 47066 | 50608 | 41032 | 39335 | 41148 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 13 | 34085 | 24039 | 33809 | 23752 | 33899 | 35678 |
| 14 | 32729 | 26889 | 32431 | 16740 | 34053 | 28806 |
| 15 | 24297 | 16866 | 12646 | 26929 | 24297 | 20237 |
| 16 | 11309 | 4208 | 6914 | 3957 | 11148 | 6858 |

| **Maximum Force in the Cross Arm (KG)** | | | | | | |
|---|---|---|---|---|---|---|
| Panel | K bracing upto LCA | | **X** bracing upto LCA | | **K** bracing upto UCA | |
| | LOWER MEMBER | | | | | |
| | Com.load | Tensile.load | Com.load | Tensile.load | Com.load | Tensile.load |
| Lower | 38652 | 29952 | 38573 | 20053 | 38196 | 21188 |
| Upper | 767 | 22000 | 756 | 21618 | 876 | 22275 |
| | UPPER MEMBER | | | | | |
| Lower | 28641 | 21755 | 29128 | 21668 | 28266 | 21104 |
| Upper | 678 | 13992 | 455 | 13885 | 434 | 14016 |

| **Deflection of tower(mm)** | | | |
|---|---|---|---|
| Height (M) | K bracing upto UCA | **X** bracing upto LCA | **K** bracing upto LCA |
| 0 | 000 | 000 | 000 |
| 7.5 | 10 | 11 | 17 |
| 13.15 | 26 | 23 | 30 |
| 22.3 | 53 | 53 | 60 |
| 30.7 | 101 | 98 | 125 |
| 38.856 | 159 | 155 | 175 |
| 46.856 | 216 | 212 | 230 |
| 54.856 | 289 | 283 | 315 |
| 62.856 | 372 | 361 | 415 |
| 70.893 | 772 | 755 | 850 |

5.2 **DESIGN OF TOWERS:**

| **Design of leg member** | | | | | | |
|---|---|---|---|---|---|---|
| | K bracing upto LCA | | **X** bracing upto LCA | | **K** bracing upto UCA | |
| Panel no. | Angle section | **F.O.S** | Angle section | **F.O.S** | Angle section | **F.O.S** |
| **1** | 150x150x15(S) | **1.09** | 150x150x15(S) | **1.1** | 150x150x15(S) | **1.18** |
| **2** | 150x150x15(S) | **1.2** | 150x150x15(S) | **1.3** | 150x150x15(S) | **1.2** |
| **3** | 150x150x15(S) | **1.39** | 150x150x15(S) | **1.45** | 150x150x15(S) | **1.5** |
| **4** | 150x150x15(S) | **1.35** | 150x150x15(S) | **1.34** | 150x150x15(S) | **1.41** |
| **5** | 150x150x15(S) | **1.3** | 150x150x15(S) | **1.43** | 150x150x15(S) | **1.44** |
| **6** | 150x150x15(S) | **1.33** | 150x150x15(S) | **1.42** | 150x150x15(S) | **1.48** |
| **7** | 150x150x12(S) | **1.4** | 150x150x12(S) | **1.34** | 150x150x12(S) | **1.35** |
| **8** | 150x150x12(S) | **1.43** | 150x150x12(S) | **1.47** | 150x150x12(S) | **1.5** |
| **9** | 150x150x18 | **1.18** | 150x150x18 | **1.19** | 150x150x18 | **1.24** |
| 10 | 150x150x15 | **1.19** | 150x150x15 | **1.25** | 150x150x15 | **1.3** |
| **11** | 150x150x12 | **1.25** | 150x150x12 | **1.4** | 150x150x12 | **1.3** |

| | | | | | | |
|---|---|---|---|---|---|---|
| **12** | 150x150x12 | **1.24** | 150x150x12 | **1.36** | 150x150x12 | **1.4** |
| **13** | 130x130x12 | **1.23** | 130x130x12 | **1.23** | 130x130x12 | **1.24** |
| **14** | 110x110x8 | **1.25** | 110x110x8 | **1.34** | 110x110x8 | **1.4** |
| **15** | 110x110x8 | **1.3** | 110x110x8 | **1.35** | 110x110x8 | **1.4** |
| **16** | 100x10x8 | **1.4** | 100x10x8 | **1.9** | 100x10x8 | **1.5** |
| **17** | 100x10x8 | **1.4** | 100x10x8 | **2** | 100x10x8 | **1.5** |

| **Design of cross arm** | | | | | | |
|---|---|---|---|---|---|---|
| | K bracing upto LCA | | **X** bracing upto LCA | | **K** bracing upto UCA | |
| Panel no. | Angle section | **F.O.S** | Angle section | **F.O.S** | Angle section | **F.O.S** |
| **LOWER MEMBER** | | | | | | |
| LOWER | MS130x130x10 | **1.225** | MS130x130x10 | **1.23** | MS130x130x10 | **1.3** |
| UPPER | MS 90x90x6 | **1.27** | MS 90x90x6 | **1.275** | MS 90x90x6 | **1.21** |
| **UPPER MEMBER** | | | | | | |
| LOWER | MS130x130x10 | **1.226** | MS130x130x10 | **1.25** | MS130x130x10 | **1.22** |
| UPPER | MS 90x90x6 | **1.27** | MS 90x90x6 | **1.28** | MS 90x90x6 | 1.21 |

CHAPTER-6

# CONCLUSION

Design of tension tower has been done for Reliability, security and safety conditions As per IS 802 (Part 1/ sec 1)1995

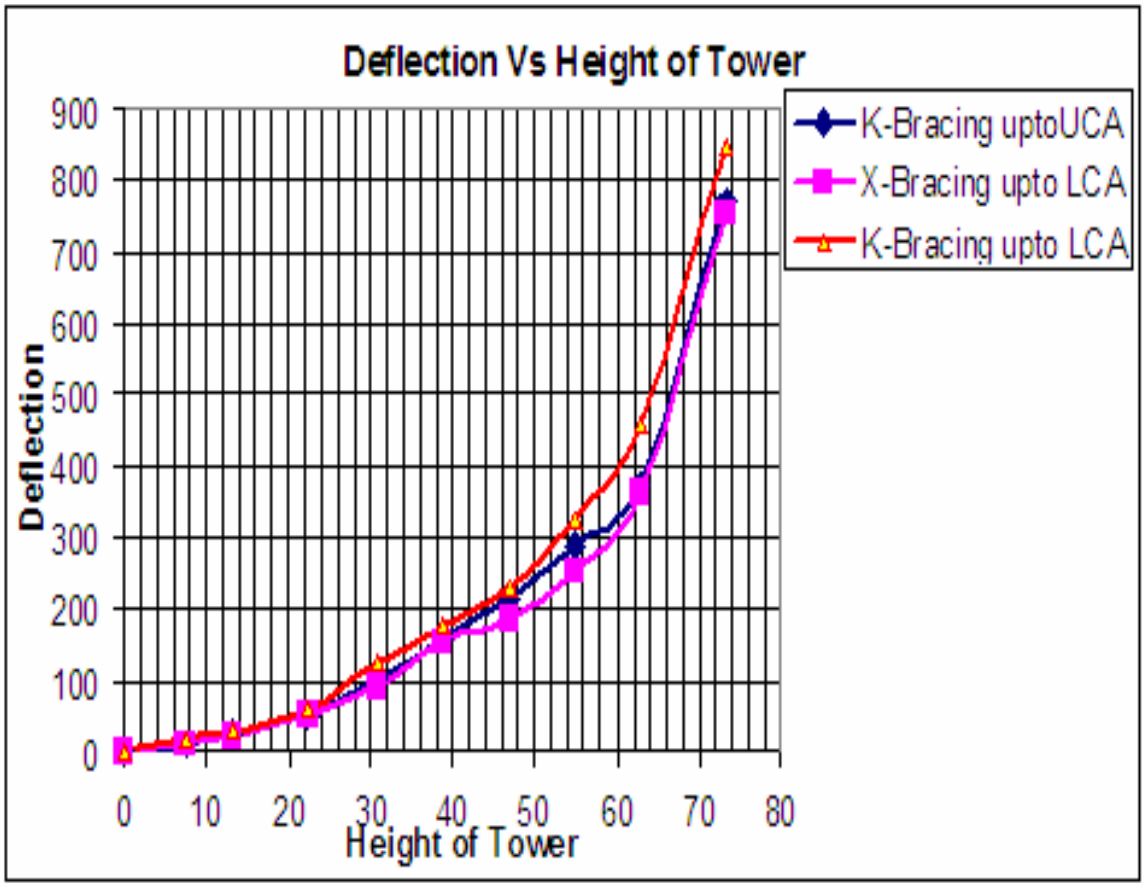
1. Tension Tower having same width and height has been designed for different bracing patterns.
2. Wind loading is calculated for each tower and has led to following results.

| TOWER TYPE | TOTAL WIND LOAD |
|---|---|
| K bracing upto lower cross arm | **35378 kg** |
| **X** bracing upto lower cross arm | **35800 kg** |
| K bracing upto upper cross arm | **36150 kg** |

3. Maximum Axial compressive force in one of the leg member of the bottom panel, observed is as follows:

| TOWER TYPE | MAXIMUM AXIAL FORCE (KG) |
|---|---|
| K bracing upto lower cross arm | 264830 |
| **X** bracing upto lower cross arm | 219312 |
| K bracing upto upper cross arm | 244621 |

4. **Deflection of tower (Fz direction)**

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The tower having **X** bracing upto LCA is found to have lesser amount of node deflection throughout the height of the tower as compare with the other two tower. This implies that the tower having **X** bracing upto LCA is behaving more rigidity than other two towers

5. Total weight of steel in tower is as follows:

| **TOWER TYPE** | **TOWER SELF WEIGHT(KG)** | **% Reduction in weight** |
|---|---|---|
| K bracing upto **LCA** | 47524 | 6.86 % |
| **X** bracing upto **LCA** | 50732 | 12.75% |
| K bracing upto **UCA** | 54469 | 0 |

# CHAPTER-7

## SCOPE OF FUTURE STUDY

The need for electrical power is increasing every second and simultaneously the available right of way is becoming more critical. As much of the transmission line structural optimization is already worked out that is by reconsidering the behavior of tower and geometry of tower. Still the following are the ways of improvement.

1. Effective static loading on transmission line structure, conductor and ground wire can be replaced with the actual dynamic loading and the results can be compared for the towers.

2. Instead of considering wind as the prominent force seismic force can be considered and the snow load can be checked with different combinations.

3. The tower leg members can be changed from angle section to to pipe / rod section and there detailed behavior can be analyzed.

4. Also, an effort of trying different structural material like aluminium should go on till some wonderful results would be achiveed.

5. Attempt in changing the shape of cross arm / angle of cross arm can wonderful results.

6. Developing pole type structures in an eloborative way can bring a tremendous change in the market. Even the genrel advantage of lightweight, erection ease, pre assebly, and simple foundation design of tower can be extended to pole type structures.

7. Looking into indiå's theft condition efforts can bee make to develop pole structure.

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## SAG TENSION CALCULATION

**Sag tension calculation (Lower circuit)**

Using parabolic equation

| | | |
|---|---|---|
| Basic Span (L): | 400 | (m) |
| Wind Pressure (P ): | 62.58 | (kg / sqm) |

**CONDUCTOR DETAILS:**

| | | |
|---|---|---|
| Type: | MOOSE | |
| Overall Diameter (D): | 0.03177 | (m) |
| Cross Sectional Area (A): | 5.97 | (sq.cm) |
| Unit weight of Conductor (w): | 2.004 | (kg / m) |
| Ultimate Tensile Strength (UTS) : | 16428 | (kgs) |
| Coeff. of Linear Expansion (a) : | $0.1930e^{-4}$ | (/ deg $C^{o}$) |
| Modulus of Elasticity (E): | 703400 | (kg/sqcm) |
| Shape Factor : | 1 | |
| Gust Factor : | 2.268 | |
| Drag Factor : | 1 | |
| Creep : | 0 | (%) |

BASIC CONDITIONS:

| | | |
|---|---|---|
| Temperature: | 32.00 | deg C |
| Wind Factor: | 0.0 | |
| Ice Thickness: | 0.0 | |
| Factor of Safety: | 4.545 | |

Initial Sag-Tension and FOS Calculations:

Initial

Tension: T = 22% OF UTS
Stress: $F_1 = T / A$

Initial Sag: $S = w.L^2 / 8T$

Parameters:
$\delta$ = Weight of Conductor in kg / m / sqcm

$\delta$ = W / A

p = Wind Load on Conductor in kg /m length of conductor

p = P*D

q = Loading Factor

$q_{0.00} = (\sqrt{((P*0.0)^2 + w^2)} / w$

$q_{o.36} = (\sqrt{((P*0.36)^2 + w^2)} / w$

$q_{o.75} = (\sqrt{((P*0.75)^2 + w^2)} / w$

$q_{1.0} = (\sqrt{((P*1.0)^2 + w^2)} / w$

F = Working Tensil~ Strength of Conductor in kg/ sqcm

K = Constant (computed from initial temperature & wind pressure conditions)

t = Change in temperature

**Parabolic Formula:**

$F_2^2(F_2 -( K- \alpha\ t.E)) = L^z\delta^2.q_2^2.E / 24$

As $K= F,- (L^2.\delta^2.q_2^2.E / 24.F_1^2)$ keep $L^2.\delta^2.q_2^2.E / 24 = z$

Initial Sag-Tension and FOS Calculations:

| s. no. | Environmental temp. ($^oC$) | Wind factor | Ice thickness cm | Vertical sag M | Tension kg | F.o.S. |
|---|---|---|---|---|---|---|
| 1 | 32.0 | 0 | 0 | 11.089 | 3614.52 | 4.545(22%) |
| 2 | 32.0 | 1.0 | 0 | 5.58 | 7183.36 | 2.287 |
| 3 | 85.0 | 0.00 | 0 | 13.262 | 3022.27 | 5.436 |
| 4 | 0. | 0.00 | 0 | 9.669 | 4145.31 | 3.963 |
| 5 | 32.0 | 0.75 | 0 | 6.635 | 6040.73 | 2.72 |
| 6 | 1.00 | 0.36 | 0 | 8.143 | 4921.86 | 3.338 |

**Max vertical sag (m) = 13.262**

**Max tension (kgs) = 7183.36**

## (2) Sag Tension Calculation (upper circuit)

'Using Parabolic Equation

| | | Units |
|---|---|---|
| DATA: | | |
| Basic Span (L): | 400 | (m) |
| Wind Pressure (P ): | 62.58 | (kg / sqm) |

**CONDUCTOR DETAILS:**

| | | |
|---|---|---|
| Type: | MOOSE | |
| Overall Diameter (D): | 0.03177 | (m) |
| Cross Sectional Area (A): | 5.97 | (sq.cm) |
| Unit weight of Conductor (w): | 2.004 | (kg / m) |
| Ultimate Tensile Strength (UTS) : | 16428 | (kgs) |
| Coeff. of Linear Expansion (a) : | $0.1930e^{-4}$ | (/ deg $C^{o}$) |
| Modulus of Elasticity (E): | 703400 | (kg/sqcm) |
| Shape Factor : | 1 | |
| Gust Factor : | 2.44 | |
| Drag Factor : | 1 | |
| Creep : | 0 | (%) |

BASIC CONDITIONS:

Temperature: 32.00deg C

Wind Factor: 0.0

Ice Thickness: 0.0

Factor of Safety: 4.545

Initial Sag-Tension and FOS Calculations:

| s. no. | Environmental temp. ($^{o}$C) | Wind factor | Ice thickness cm | Vertical sag m | Tension kg | F.o.S. |
|---|---|---|---|---|---|---|
| 1 | 32.0 | 0 | 0 | 11.089 | 3614.52 | 4.545(22%) |
| 2 | 32.0 | 1.0 | 0 | 5.324 | 7527.75 | 2.182 |
| 3 | 85.0 | 0.00 | 0 | 13.262 | 3022.27 | 5.436 |
| 4 | 0. | 0.00 | 0 | 9.669 | 4145.31 | 3.963 |
| 5 | 32.0 | 0.75 | 0 | 6.361 | 6300.47 | 2.607 |
| 6 | 1.00 | 0.36 | 0 | 7.971 | 5028.25 | 3.267 |

**Max vertical sag (m) = 13.262**

**Max tension (kgs) = 7527.75**

## B. Sag Tension Calculation for Ground wire

'Using Parabolic Equation

| | | Units |
|---|---|---|
| DATA: | | |
| Basic Span (L): | 400 | (m) |
| Wind Pressure (P ): | 62.58 | (kg / sqm) |

**SHIELDWIRE DETAILS:-**

| | | |
|---|---|---|
| Type: | EWIRE | |
| Overall Diameter (D): | 0.01098 | (m) |
| Cross Sectional Area (A): | 0.7365 | (sq.cm) |
| Unit weight of Conductor (w): | 0.583 | (kg / m) |
| Ultimate Tensile Strength (UTS) : | 6972 | (kgs) |
| Coeff. of Linear Expansion (a) : | $0.115e^{-4}$ | (/ deg $C^{o}$) |
| Modulus of Elasticity (E): | 1936100 | (kg/sqcm) |
| Shape Factor : | 1 | |
| Gust Factor : | 2.468 | |
| Drag Factor : | 1.2 | |
| Creep : | 0 | (%) |

**BASIC CONDITIONS:**

Temperature: 0.00 deg C

Wind Factor: 0.0

Ice Thickness: 0.0

Factor of Safety: 5.2032

Initial Sag-Tension and FOS Calculations:

| s. no. | Environmental temp. ($^{o}$C) | Wind factor | Ice thickness cm | Vertical sag m | Tension kg | F.o.S. |
|---|---|---|---|---|---|---|
| 1 | 32.0 | 0 | 0 | 9.615 | 1212.69 | 5.75(22%) |
| 2 | 32.0 | 1.0 | 0 | 3.773 | 3089.99 | 2.256 |
| 3 | 53.0 | 0.00 | 0 | 10.199 | 1143.26 | 6.098 |
| 4 | 0. | 0.00 | 0 | 8.702 | 1339.94 | 5.203 |
| 5 | 32.0 | 0.75 | 0 | 4.55 | 2562.74 | 2.721 |
| 6 | 0.00 | 0.36 | 0 | 6.317 | 1815.75 | 3.777 |

**Max vertical sag (m) = 10.2**

**Max tension (kgs) = 3090**

## LOADING CALCULATION

| | | | |
|---|---|---|---|
| $\mathbf{P}_d$ | (kg/sqm) | DesignWind pressure | 62.58 |
| L | (m) | Normal span | 400 m |

Diameter

| d (m) | GW | Conductor | Insulator |
|---|---|---|---|
| | 0.01098 | 0.03177 | 0.252 |

| | | | |
|---|---|---|---|
| Gust res. Fect. | 2.468 | Lower = 2.268<br>Upper = 2.44 | 2.68 |
| Drag factor | 1.2 | 1.0 | 1.2 |

Tension :-

| | | |
|---|---|---|
| T(Kg) | 3090 | Lower = 7183.36<br>Upper = 7527.75 |
| $T_{1\,(0.00)}$ (Kg) | 1212.69 | Lower = 7183.3<br>Upper = 7527.75 |
| $T_{1\,(0.75)}$ (Kg) | 2562.74 | Lower = 7183.36<br>Upper = 7527.75 |
| Weight | 0.583 | 2.004 |

M = 2

Length of insulator =5.6 m  Wind Span = 400 m  Weight span = 600 m

**TOWER LOADING CALCULATION: Quad-twin (Bot circuit,44m/s)**

Reliability and security conditions

| Span | Normal condition | Broken wire condition |
|---|---|---|
| Wind span | 400 | 240 |
| Weight span | | |
| | max.600 | 360 |
| | min.0 | -200 |
| Deviation | min 0 | |
| | max $15^0$ | |

| | CONDUCTOR | EARTHWIRE DETAILS |
|---|---|---|
| Wind pressure | 62.58 | |
| Number | 4 | 1 |
| Diameter | 3.177 | 1.098 |
| Unit wt. | 2.004 | 0.583 |
| Tension | 7184 | 3090 |
| Gust factor | 2.268 | 2.468 |

INSULATOR DETAILS

| | |
|---|---|
| Number | = 8 |
| Dia | = 0.28 |
| Length | = 6.55 |
| Weight | = 300 |
| Gust on insulator | = 2.51 |

## Conductor

| | Description no. dia span pressure | N.C load | Factor | BWC load |
|---|---|---|---|---|
| A | Transverse load | | | |
| | Wind on wire 4x 0.03177x 400x | 6867.645 | 0.6 | 4120.587 |
| | 135.1048 | 1316.261 | 1 | 1316.261 |
| | Wind on insulator 8x 0.28x 6.55x | 7501.601 | 0.5 | 3750.8 |
| | 89.712 | 15685.51 | | 9187.648 |
| B. | Deviation L 8x 7184x sin( 7.5) | | | |
| | Vertical load | 4809.6 | 0.6 | 2885.76 |
| | Weight of wire 4x 2.004x 600 | 2400 | 1 | 2400 |
| C. | Wight of insulator 8x 300 | 7209.6 | | 5285.76 |
| | Longitudinal load 4x 7184 x cos ( 7.5 ) | 0 | | 28736 |
| 2. | EARTHWIRE | | | |
| A. | Transverse load | | | |
| | Wind on wire 1 x 0.01098 x 400 x | 774.847 | 0.6 | 464.91 |
| | 176.4225 | 806.6519 | 0.5 | 403.33 |
| B. | Deviation L 2 x 3090 x sin ( 7.5) | | | |
| | Vertical load | 1581.5 | 0.6 | 868.23 |
| | Weight of wire 1 x0.583 x 600 | 349.8 | | 209.88 |
| | Weight of clamp | 5 | | 5 |
| C. | | 354.8 | | 214.88 |
| | Longitudinal load 1 x 3090 x cos x(7.5) | 0 | | 3090 |

**TOWER LOADING CALCULATION**: Quad-twin (Bot circuit,44m/s)

Safety conditions

| Span | Normal condition | Broken wire condition |
|---|---|---|
| Wind span | 400 | 240 |
| Weight span | | |
| | max.600 | 360 |
| | min.0 | -200 |
| Deviation | min 0 | |
| | max $15^0$ | |

| | CONDUCTOR | EARTHWIRE DETAILS |
|---|---|---|
| Wind pressure | 62.58 (kg/sqm) | |
| Number | 4 | 1 |
| Diameter | 3.177 | 1.098 |
| Unit wt. | 2.004 | 0.583 |
| Tension | 3615 | 1213 |
| Gust factor | 2.268 | 2.468 |

INSULATOR DETAILS

| | |
|---|---|
| Number | = 8 |
| Dia | = 0.28 |
| Length | = 6.55 |
| Weight | = 300 |
| Gust on insulator | = 2.51 |

conductor

| | Description no. dia span pressure | N.C load | Factor | BWC load |
|---|---|---|---|---|
| A | Transverse load | | | |
| | Deviation L 8x 3615x sin( 7.5) | 3774.817 | 0.5 | 1887.409 |
| | | 3774.817 | | 1887.409 |
| B. | Vertical load | | | |
| | Weight of wire 4x 2.004x 600 x 2 | 9619.2 | 0.6 | 5771.52 |
| | Wight of insulator 8x 300 x2 | 4800 | 1 | 4800 |
| | Wight of man | 153 | | 153 |
| | Additional vertical load | 510 | | 510 |
| C. | Longitudinal load 8 x 3615 x0.5cos ( 7.5) | | | |
| | (NC) 1.5 x 3615 x0.5cos (7.5 ) | 15082.2 | | 11234.52 |
| | | 10845 | | 14460 |
| 2. | EARTHWIRE | | | |
| A. | Transverse load | | | |
| | Deviation L 2 x 1213 x sin ( 7.5) | 316.6565 | 0.5 | 158.33 |
| B. | Vertical load | | | |
| | Weight of wire 1 x0.583 x 600 x 2 | 699.6 | | 419.76 |
| | Weight of clamp | 10 | 0.6 | 5 |
| | Weight of man | 153 | | 153 |
| | | 862.6 | | 582.76 |
| C. | Longitudinal load2 x 123 x .05cos x(7. 5) | | | 1213 |
| | 1. 5x 123 x .5cos x(7. 5 ) | 910 | | |

**TOWER LOADING CALCULATION**: Quad-twin (Top circuit,44m/s)

Reliability and security conditions

| Span | Normal condition | Broken wire condition |
|---|---|---|
| Wind span | 400 | 240 |
| Weight span | | |
| | max.600 | 360 |
| | min.0 | -200 |
| Deviation | min 0 | |
| | max $15^0$ | |

| | CONDUCTOR | EARTHWIRE DETAILS |
|---|---|---|
| Wind pressure | 62.58 | |
| Number | 2 | 1 |
| Diameter | 3.177 | 1.098 |
| Unit wt. | 2.004 | 0.583 |
| Tension | 7528 | 3090 |
| Gust factor | 2.44 | 2.468 |

INSULATOR DETAILS

| | |
|---|---|
| Number | = 4 |
| Dia | = 0.28 |
| Length | = 5.6 |
| Weight | = 300 |
| Gust on insulator | = 2.66 |

Conductor

| | Description no. dia span pressure | N.C load | Factor | BWC load |
|---|---|---|---|---|
| A | Transverse load | | | |
| | Wind on wire 2x 0.03177x 400x 145.3508 | 3694.6 596.302 | 0.6 1 | 2216.52 596.302 |
| | Wind on insulator 4x 0.28x 5.6x 95.073 | 3930.4 | 0.5 | 1965.20 |
| | Deviation L 4x 7528x sin( 7.5) | 8220.9 | | 4778.0 |
| B. | Vertical load | 404.8 1200 | 0.6 1 | 1442.88 1200 |
| | Weight of wire 2x 2.004x 600 | | | |
| C. | Wight of insulator 4x 300 | 3604.8 0 | | 2642.88 15056 |
| | Longitudinal load 2x 7528 x cos ( 7. 5 ) | | | |
| 2. | EARTHWIRE | | | |
| A. | Transverse load | | | |
| | Wind on wire 1 x 0.01098 x 400 x 176.4225 | 774.847 806.651 | 0.6 0.5 | 464.91 403.33 |
| B. | Deviation L 2 x 3090 x sin ( 7.5) | | | |
| | Vertical load | 1581.5 | 0.6 | 868.23 |
| | Weight of wire 1 x0.583 x 600 | 349.8 5 | | 209.88 5 |
| | Weight of clamp | | | |
| C. | Longitudinal load 1 x 3090 x cos x(7. 5) | 354.8 0 | | 214.88 3090 |

**TOWER LOADING CALCULATION**: Quad-twin (Top circuit,44m/s)

Safety conditions

| Span | Normal condition | Broken wire condition |
|---|---|---|
| Wind span | 400 | 240 |
| Weight span | | |
| | max.600 | 360 |
| | min.0 | -200 |
| Deviation | min 0 | |
| | max $15^0$ | |

| | CONDUCTOR | EARTHWIRE DETAILS |
|---|---|---|
| Wind pressure | 62.58 | |
| Number | 2 | 1 |
| Diameter | 3.177 | 1.098 |
| Unit wt. | 2.004 | 0.583 |
| Tension | 3615 | 1213 |
| Gust factor | 2.44 | 2.468 |

INSULATOR DETAILS

| | |
|---|---|
| Number | = 8 |
| Dia | = 0.28 |
| Length | = 5.6 |
| Weight | = 300 |
| Gust on insulator | = 2.56 |

**Conductor**

| | Description no. dia span pressure | N.C load | Factor | BWC load |
|---|---|---|---|---|
| A | Transverse load | | | |
| | Deviation L 4x 3615x sin( 7.5) | 3774.817 | 0.5 | 1887.409 |
| | | 3774.817 | | 1887.409 |
| B. | Vertical load | | | |
| | Weight of wire 2x 2.004x 600 x 2 | 9619.2 | 0.6 | 5771.52 |
| | Wight of insulator 4x 300 x2 | 4800 | 1 | 4800 |
| | Wight of man | 153 | | 153 |
| | Additional vertical load | 510 | | 510 |
| | | 15082.2 | | 11234.52 |
| C. | Longitudinal load 4 x 3615 x0.5cos ( ) | 0 | | 14460 |
| 2. | EARTHWIRE | | | |
| A. | Transverse load | | | |
| | Deviation L 2 x 1213 x sin ( 7.5) | 316.6565 | 0.5 | 158.33 |
| B. | Vertical load | 699.6 | | 419.76 |
| | Weight of wire 1 x0.583 x 600 x 2 | 10 | | 5 |
| | Weight of clamp | 153 | 0.6 | 153 |
| | Weight of man | 862.6 | | 582.76 |
| C. | Longitudinal load 2 x 123 x .05cos x( 7. 5 ) | | | 1213 |
| | 1.5 x 123 x .5cos x( 7. 5 ) | 910 | | |

## Wind area calculations

| Panel no. | Panel bound | Section | No. | Length m | Breadth m | Area m x m |
|---|---|---|---|---|---|---|
| 1. | 1 (0 to 7.5) | Main legs $S^{L}150x150x20$ | 2 | 7.8 | 0.2 | 6.24 |
| | 2 | Lattice $HT^{DL}110x110x8$ | 2 | 11.7 | 0.11 | 1.872 |
| | 3 | Horizontal $M^{DL}90x90x6$ | 1 | 14.67 | 0.09 | 2.64 |
| | 4 | Redundant | 2 | 1.83 | 0.09 | 0.3294 |
| | 5 | $MS^{L}90x90x6$ | 2 | 7.9 | 0.08 | 1.343 |
| | 6 | $MS^{L}80x80x6$ | 2 | 3.67 | 0.06 | 0.44 |
| | 7 | $MS^{L}60x60x5$ | 2 | 3.05 | 0.075 | 0.4575 |
| | 8 | $MS^{L}75x75x5$ | 2 | 2.31 | 0.06 | 0.277 |
| | 9 | $MS^{L}60x60x4$ $MS^{L}55x55x5$ | 2 | 2.4 | 0.055 | 0.264 |
| | | | | | | 14.4459 |
| 2 | (7.5-13.15) | Main legs | | | | |
| | 10 | $SH^{TL}150x150x20$ | 2x2 | 5.87 | 0.2 | 4.696 |
| | 11 | Lattice $MS^{DL}90x90x6$ | 2 | 9.33 | 0.09 | 1.6794 |
| | 12 | Horizontal $MS^{DL}90x90x6$ | 1 | 12.4 | 0.09 | 1.116 |
| | 13 | Redundant | 2 | 4.13 | 0.08 | 0.6608 |
| | 14 | $MS^{L}80x80x6$ | 2 | 4.22 | 0.075 | 0.633 |
| | 15 | $MS^{L}75x75x6$ | 2 | 2.56 | 0.075 | 0.384 |
| | 16 | $MS^{L}75x75x4$ $MS^{L}60x60x5$ | 2 | 2.07 | 0.06 | 0.2484 |
| | | | | | | 9.4176 |
| 3 | (13.15-16.91) | Main legs | | | | |
| | 17 | $SH^{TL}150x150x20$ | 2x2 | 3.91 | 0.2 | 3.128 |
| | 18 | Lattice $MS^{DL}90x90x6$ | 2 | 6.66 | 0.09 | 1.1988 |
| | 19 | Redundant | 2 | 3.33 | 0.075 | 0.4993 |
| | 20 | $MS^{L}75x75x6$ | 2 | 3.1 | 0.06 | 0.372 |
| | 21 | $MS^{L}60x60x5$ | 2 | 1.96 | 0.06 | 0.233 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | $MS^{L}$60x60x5 | | | | 5.434 |
| 4 | (16.15-22.31) | Main legs | | | | |
| | 22 | $SH^{TL}$150x150x20 | 2x2 | 5.62 | 0.15 | 3.372 |
| | 23 | Lattice | 2 | 7.74 | 0.10 | 1.548 |
| | 24 | $MS^{DL}$100x100x6 | 2 | 2.9 | 0.075 | 0.435 |
| | 25 | Redundant | 2 | 2.13 | 0.075 | 0.3195 |
| | 26 | $MS^{L}$75x75x6 | 2 | 2.9 | 0.06 | 0.348 |
| | 27 | $MS^{L}$75x75x5 | 2 | 3.13 | 0.06 | 0.3756 |
| | 28 | $MS^{L}$60x60x6 | 2 | 1.8 | 0.05 | 0.18 |
| | | $MS^{L}$60x60x5 | | | | 6.586 |
| | | $MS^{L}$50x50x5 | | | | |
| 5 | (22.31-27.01) | Main legs | | | | |
| | 29 | $SH^{TL}$150x150x20 | 2x2 | 4.72 | 0.15 | 2.832 |
| | 30 | Lattice | 2 | 9.64 | 0.1 | 1.928 |
| | 31 | $MS^{DL}$100x100x7 | 2 | 8.4 | 0.1 | 1.68 |
| | 32 | Horizontal | 2 | 8.7 | 0.11 | 1.914 |
| | 33 | $MS^{DL}$100x100x6 | 2 | 2.34 | 0.75 | 0.351 |
| | 34 | $MS^{DL}$110x110x6 | 2 | 2.25 | 0.75 | 0.3375 |
| | | Redundant | | | | 9.0425 |
| | | $MS^{L}$75x75x6 | | | | |
| | | $MS^{L}$75x75x5 | | | | |
| 6 | (27.01-30.71) | Main legs | | | | |
| | 35 | $SH^{TL}$150x150x15 | 2x2 | 3.71 | 0.15 | 2.226 |
| | 36 | Lattice | 2 | 5.49 | 0.11 | 1.21 |
| | 37 | $HT^{DL}$110x110x8 | 2 | 2.58 | 0.75 | 0.387 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | 38 | Redundant<br>$MS^{L}$75x75x6<br>$MS^{L}$75x75x5 | 2 | 1.91 | 0.75 | 0.2865 |
| | | | | | | 4.113 |
| 7 | (30.71-35.16) | Main legs | | | | |
| | 39 | $SH^{TL}$150x150x15 | 2x2 | 7.42 | 0.25 | 4.452 |
| | 40 | Lattice<br>$HT^{DL}$80x80x6 | 2 | 9.38 | 0.08 | 2.814 |
| | 41 | Horizontal | 2 | 7.64 | 0.12 | 1.8336 |
| | 42 | $MS^{DL}$120x120x10 | 2 | 7.36 | 0.12 | 1.472 |
| | 43 | $MS^{DL}$100x100x8 | 2 | 2.4 | 0.08 | 0.384 |
| | 44 | | 2 | 2.25 | 0.075 | 0.3375 |
| | | Redundant<br>$MS^{L}$80x80x6<br>$MS^{L}$75x75x6 | | | | 11.293 |
| 8 | (35.16-38.86) | Main legs | | | | |
| | 45 | $H^{TL}$200x200x10 | 2 | 4.94 | 0.2 | 1.976 |
| | 46 | Lattice<br>$HT^{DL}$100x100x7 | 2 | 4.69 | 0.1 | 0.938 |
| | 47 | Redundant | 2 | 2.3 | 0.08 | 0.368 |
| | 48 | $MS^{L}$80x80x6 | 2 | 2.45 | 0.075 | 0.368 |
| | | $MS^{L}$75x75x6 | | | | 3.66 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 9 | (38.86-43.56) | Main legs | | | | |
| | 49 | $H^{TL}$150x150x6 | 2 | 4.72 | 0.15 | 1.484 |
| | | Lattice | | | | |
| | 50 | $HT^{DL}$75x75x6 | 2 | 4.96 | 0.075 | 1.194 |
| | | Horizontal | | | | |
| | 51 | $HT^{DL}$110x110x | 2 | 6.62 | 0.11 | 1.456 |
| | 52 | 8 | 2 | 6.32 | 0.09 | 1.1376 |
| | | $HT^{DL}$90x90x6 | | | | |
| | 53 | Redundant | 2 | 2.74 | 0.075 | 0.411 |
| | 54 | $MS^{L}$75x75x6 | 2 | 1.56 | 0.075 | 0.234 |
| | 55 | $MS^{L}$75x75x5 | 2 | 1.79 | 0.06 | 0.2148 |
| | 56 | $MS^{L}$60x60x6 | 2 | 1.60 | 0.06 | 0.198 |
| | | $MS^{L}$60x60x5 | | | | 6.33 |
| 10 | (43.56-46.86) | Main legs | | | | |
| | 57 | $H^{TL}$150x150x15 | 2 | 3.31 | 0.15 | 0.993 |
| | | Lattice | | | | |
| | 58 | $HT^{DL}$90x90x7 | 2 | 4.47 | 0.09 | 0.8046 |
| | | Redundant | | | | |
| | 59 | $MS^{L}$75x75x6 | 2 | 2.4 | 0.075 | 0.36 |
| | 60 | $MS^{L}$75x75x5 | 2 | 1.4 | 0.075 | 0.21 |
| | | | | | | 2.3625 |
| 11 | (46.86-51.26) | Main legs | | | | |
| | 61 | $H^{TL}$150x150x12 | 2 | 4.42 | 0.15 | 1.326 |
| | | Lattice | | | | |
| | 62 | $HT^{DL}$75x75x6 | 2 | 6.91 | 0.075 | 2.073 |
| | | Horizontal | | | | |
| | 63 | $HT^{DL}$100x100x | 2 | 5.59 | 0.1 | 0.559 |
| | | 7 | | | | |
| | 64 | Redundant | 2 | 1.68 | 0.075 | 0.256 |
| | 65 | $MS^{L}$75x75x6 | 2 | 1.33 | 0.06 | 0.1596 |
| | | $MS^{L}$60x60x6 | | | | |
| | | | | | | 4.3736 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 12 | (51.26-54.86) | Main legs | | | | |
| | 66 | $H^{TL}$130x130x12 | 2 | 3.61 | 0.13 | 0.9386 |
| | | Lattice | | | | |
| | 67 | $HT^{DL}$80x80x6 | 2 | 3.1 | 0.08 | 0.496 |
| | | Redundant | | | | |
| | 68 | $MS^{L}$75x75x6 | 2 | 2.41 | 0.075 | 0.3615 |
| | 69 | $MS^{L}$60x60x6 | 2 | 1.55 | 0.06 | 0.186 |
| | 70 | $MS^{L}$60x60x5 | 2 | 1.46 | 0.06 | 0.1752 |
| | | | | | | 2.1573 |
| 13 | (54.86-59.26) | Main legs | | | | |
| | 71 | $H^{TL}$110x110x8 | 2 | 4.42 | 0.11 | 0.9724 |
| | | Lattice | | | | |
| | 72 | $HT^{DL}$60x60x5 | 2 | 6.38 | 0.06 | 0.7656 |
| | | Horizontal | | | | |
| | 73 | $HT^{DL}$90x90x6 | 2 | 4.60 | 0.09 | 0.414 |
| | 74 | $HT^{DL}$65x65x6 | 2 | 4.32 | 0.065 | 0.587 |
| | | Redundant | | | | |
| | 75 | $MS^{L}$60x60x6 | 2 | 1.59 | 0.06 | 0.1908 |
| | 76 | $MS^{L}$50x50x5 | 2 | 1.50 | 0.05 | 0.15 |
| | 77 | $MS^{L}$50x50x4 | 2 | 1.30 | 0.05 | 0.113 |
| | 78 | $MS^{L}$45x45x4 | 2 | 1.08 | 0.045 | 0.097 |
| | | | | | | 3.307 |
| 14 | (59.26-62.86) | Main legs | | | | |
| | 79 | $H^{TL}$100x100x7 | 2 | 3.61 | 0.1 | 0.722 |
| | | Lattice | | | | |
| | 80 | $HT^{DL}$60x60x5 | 2 | 5.34 | 0.06 | 0.6168 |
| | | Redundant | | | | |
| | 81 | $MS^{L}$50x50x6 | 2 | 1.35 | 0.05 | 0.135 |
| | 82 | $MS^{L}$45x45x5 | 2 | 1.27 | 0.045 | 0.1143 |
| | | | | | | 1.4738 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 15 | (62.86-65.16) | Main legs | | | | |
| | 83 | $H^{TL}$100x100x7 | 2 | 2.31 | 0.1 | 0.462 |
| | | Lattice | | | | |
| | 84 | $HT^{DL}$90x90x6 | 2 | 4.15 | 0.09 | 0.747 |
| | | Horizontal | | | | |
| | 85 | $HT^{DL}$100x100x5 | 2 | 6.95 | 0.1 | 1.39 |
| | | Redundant | | | | |
| | 86 | $MS^{L}$50x50x6 | 2 | 1.15 | 0.05 | 0.575 |
| | | | | | | 2.6565 |

## Wind load calculation on tower

| Panel no. | Area of member | Area of panel | Solidity ratio | Cg of panel At base | Height from base of tower | Drag coefficient | Gust response factor | Design wind pressure | Wind load on tower |
|---|---|---|---|---|---|---|---|---|---|
| | Ae mxm | Ap mxm | Φ Ae/Ap | m | m +10m | Cd αxΦ | Gt | Pd Kg/mxm | Wt= pd*Gt*Cd*Ae kg |
| 1 | 14.4459 | 123.82 | 0.1167 | 3.7 | 13.7 | 3.3165 | 2.023 | 59.57 | 5773.62 |
| 2 | 9.4176 | 77.96 | 0.12 | 2.8 | 20.45 | 3.30 | 2.205 | 59.57 | 4082.16 |
| 3 | 5.434 | 44.7 | 0.1215 | 1.88 | 27.25 | 3.28 | 2.272 | 59.57 | 2412.29 |
| 4 | 6.586 | 53.72 | 0.122 | 2.65 | 29.9 | 3.27 | 2.29 | 59.57 | 2937.86 |
| 5 | 9.0425 | 39.58 | 0.228 | 2.32 | 35.08 | 2.788 | 2.35 | 59.57 | 3529.2 |
| 6 | 4.113 | 29.22 | 0.14 | 1.836 | 39.31 | 3.20 | 2.39 | 59.57 | 1873.85 |
| 7 | 11.293 | 32.825 | 0.344 | 2.2 | 43.38 | 2.368 | 2.428 | 59.57 | 3867.83 |
| 8 | 3.66 | 25.41 | 0.144 | 1.834 | 47.47 | 3.18 | 2.459 | 59.57 | 1702.8 |
| 9 | 6.33 | 29.8 | 0.424 | 2.31 | 51.66 | 2.85 | 2.49 | 59.57 | 2675.93 |
| 10 | 2.3625 | 19.22 | 0.122 | 1.63 | 54.69 | 3.27 | 2.51 | 59.57 | 1155.64 |
| 11 | 4.3736 | 23.46 | 0.186 | 2.167 | 58.54 | 2.97 | 2.54 | 59.57 | 1965.42 |
| 12 | 2.1573 | 17.42 | 0.123 | 1.78 | 61.46 | 3.27 | 2.56 | 59.57 | 1075.78 |
| 13 | 3.307 | 19.05 | 0.1734 | 2.157 | 66.25 | 3.033 | 2.59 | 59.57 | 1547.51 |
| 14 | 1.4738 | 13.772 | 0.11 | 1.72 | 69.47 | 3.35 | 2.615 | 59.57 | 769.09 |
| 15 | 2.6565 | 7.9325 | 0.335 | 1.133 | 76.85 | 2.395 | 2.66 | 59.57 | 1008.15 |
| | | | | | | | | | 35378 |

```
            *************************************************
            *                                               *
            *           STAAD.Pro                           *
            *           Version  2003    Bld 1001.US        *
            *           Proprietary Program of             *
            *           Research Engineers,  Intl.         *
            *           Date=    JUL 26, 2006              *
            *           Time=     9:14:19                  *
            *                                               *
            *      USER ID:                                 *
            *************************************************
```

```
     1. STAAD SPACE
     2. START JOB INFORMATION
     3. ENGINEER DATE 22-MAR-06
     4. END JOB INFORMATION
     5. INPUT WIDTH 79
     6. UNIT METER KG
     7. JOINT COORDINATES
     8. 1 0 0 13.52; 2 17.7 0 13.52; 3 1.51277 7.49996 15.0328
     9. 4 16.1872 7.49996 15.0328; 5 3.41069 16.9095 16.9307; 6 14.289
         16.9095             16.9307
    10. 7 4.5 22.31 18.02; 8 13.2 22.31 18.02; 9 4.79599 27.01 18.316
    11. 10 12.904 27.01 18.316; 11 5.029 30.71 18.549; 12 12.671 30.71 18.549
    12. 13 5.30938 35.16 18.8294; 14 12.3906 35.16 18.8293; 15 5.5425 38.86
         19.0625
    13. 16 12.1575 38.86 19.0625; 17 5.836 43.56 19.356; 18 11.8614 43.56
19.356
    14. 19 6.0465 46.86 19.567; 20 6.3237 51.26 19.8437; 21 11.3763 51.26
        19.8437
    15. 22 6.5505 54.86 20.07; 23 11.1495 54.86 20.0705; 24 6.82765 59.2593
        20.3476
    16. 25 10.8723 59.2593 20.348; 26 7.0545 62.86 20.575; 27 10.6455 62.86
        20.5745
    17. 28 7.1994 65.16 20.7194; 29 10.5006 65.16 20.719; 32 11.635 46.86
        19.5665
    18. 33 8.84999 7.49996 15.0328; 34 8.85 22.31 18.02; 35 8.85 30.71 18.549
    19. 36 8.85 38.86 19.0625; 37 8.84075 46.86 19.5667; 38 8.85 54.86
20.0702
    20. 39 8.85 62.86 20.5747; 40 0.378193 1.87499 13.8982
    21. 41 0.756385 3.74998 14.2764; 42 1.13458 5.62497 14.6546
    22. 43 17.3218 1.87499 13.8982; 44 16.9436 3.74998 14.2764
    23. 45 16.5654 5.62497 14.6546; 46 12.5186 7.49996 15.0328
    24. 47 5.18138 7.49996 15.0328; 48 6.63749 5.62497 14.6546
    25. 49 4.42499 3.74998 14.2764; 50 2.2125 1.87499 13.8982
    26. 51 11.0625 5.62497 14.6546; 52 13.275 3.74998 14.2764
    27. 53 15.4875 1.87499 13.8982; 54 3.88603 5.62497 14.6546
    28. 55 13.8139 5.62497 14.6546; 56 1.89235 9.38187 15.4123
    29. 57 2.27194 11.2638 15.7919; 58 2.65152 13.1457 16.1715
    30. 59 3.03111 15.0276 16.5511; 60 15.8076 9.38187 15.4123
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31. 61 15.4279 11.2638 15.7919; 62 15.0483 13.1457 16.1715
32. 63 14.6686 15.0276 16.5511; 64 5.75071 13.1457 16.1715
33. 65 8.8499 13.1457 16.1715; 66 11.9491 13.1457 16.1715
34. 67 6.40419 11.2638 15.7919; 68 3.95848 9.38187 15.4123
35. 69 11.2957 11.2638 15.7919; 70 13.7414 9.38187 15.4123
36. 71 11.5695 15.0276 16.5511; 72 6.1303 15.0276 16.5511
37. 73 7.0369 20.5098 17.6569; 74 5.22379 18.7097 17.2938
38. 75 10.663 20.5098 17.6569; 76 12.476 18.7097 17.2938
39. 77 3.77379 18.7097 17.2938; 78 4.1369 20.5098 17.6569
40. 79 13.926 18.7097 17.2938; 80 13.563 20.5098 17.6569
41. 81 13.3618 11.2638 15.7919; 83 12.7558 12.0711 15.9548; 84 6.675 22.31 18.02



42. 85 11.025 22.31 18.02; 86 4.64799 24.66 18.168; 87 13.052 24.66 18.168
43. 88 4.91249 28.86 18.4325; 89 12.7875 28.86 18.4325; 90 8.85 24.66 18.168
44. 91 6.675 23.485 18.094; 92 11.025 23.485 18.094; 93 6.823 28.86 18.4325
45. 94 10.877 28.86 18.4325; 95 5.16919 32.935 18.6892; 96 12.5308 32.935 18.6891
46. 97 5.42594 37.01 18.9459; 98 12.274 37.01 18.9459; 99 8.84999 32.935 18.6892
47. 100 6.9395 31.8225 18.6191; 101 10.7605 31.8225 18.6191
48. 102 7.07969 37.01 18.9459; 103 10.6203 37.01 18.9459
49. 104 7.07969 34.0475 18.7593; 105 10.6203 34.0475 18.7592
50. 107 5.73817 41.083 19.2582; 109 11.9601 41.083 19.2582
51. 110 5.94125 45.21 19.4615; 111 11.7482 45.21 19.4612
52. 112 8.84913 41.083 19.2582; 115 7.34257 42.322 19.3071
53. 116 10.3553 42.322 19.3071; 117 7.33838 45.21 19.4614
54. 118 10.3511 45.21 19.4614; 119 6.1158 47.96 19.6362; 120 6.1851 49.06 19.7053
55. 121 6.2544 50.16 19.7745; 122 11.5703 47.96 19.6358; 123 11.5056 Z49.06 19.7051
56. 124 11.441 50.16 19.7744; 125 6.4371 53.06 19.9568; 126 11.2629 53.06 19.9571
57. 127 8.85 53.06 19.957; 128 8.84538 49.06 19.7052; 129 7.58685 52.16 19.9003
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59. 132 10.1108 50.16 19.7745; 133 7.44594 47.96 19.6361
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62. 138 6.68907 57.0597 20.2088; 139 6.75836 58.1595 20.2782
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66. 146 8.84999 57.0597 20.209; 147 7.95224 61.9598 20.5181
67. 148 9.74774 61.9598 20.5179; 149 7.83882 60.1595 20.4045
68. 150 9.86114 60.1595 20.4046; 151 7.83882 58.1595 20.2783
69. 152 9.86114 58.1595 20.2785; 153 7.70024 55.9598 20.1395
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71. 228 17.7 0 31.22; 229 1.51277 7.49996 29.7072; 230 16.1872 7.49996 29.7072

72. 231 3.41069 16.9095 27.8094; 232 14.289 16.9095 27.8094; 233 4.5
22.31 26.72
73. 234 13.2 22.31 26.72; 235 4.79599 27.01 26.424; 236 12.904 27.01
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74. 237 5.029 30.71 26.191; 238 12.671 30.71 26.191; 239 5.30938 35.16
25.9106
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38.86 25.6775
76. 243 5.836 43.56 25.384; 244 11.8614 43.56 25.384; 245 6.0465 46.86
25.173
77. 246 6.3237 51.26 24.8963; 247 11.3763 51.26 24.8963; 248 6.5505 54.86
24.67
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83. 265 8.85 62.86 24.1653; 266 0.378193 1.87499 30.8418
84. 267 0.756385 3.74998 30.4636; 268 1.13458 5.62497 30.0854
85. 269 17.3218 1.87499 30.8418; 270 16.9436 3.74998 30.4636
86. 271 16.5654 5.62497 30.0854; 272 12.5186 7.49996 29.7072
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91. 281 13.8139 5.62497 30.0854; 282 1.89235 9.38187 29.3277
92. 283 2.27194 11.2638 28.9481; 284 2.65152 13.1457 28.5685
93. 285 3.03111 15.0276 28.1889; 286 15.8076 9.38187 29.3277
94. 287 15.4279 11.2638 28.9481; 288 15.0483 13.1457 28.5685
95. 289 14.6686 15.0276 28.1889; 290 5.75071 13.1457 28.5685
96. 291 8.8499 13.1457 28.5685; 292 11.9491 13.1457 28.5685
97. 293 6.40419 11.2638 28.9481; 294 3.95848 9.38187 29.3277
STAAD SPACE -- PAGE NO.
3

98. 295 11.2957 11.2638 28.9481; 296 13.7414 9.38187 29.3277
99. 297 11.5695 15.0276 28.1889; 298 6.1303 15.0276 28.1889
100. 299 7.0369 20.5098 27.0831; 300 5.22379 18.7097 27.4462
101. 301 10.663 20.5098 27.0831; 302 12.476 18.7097 27.4462
102. 303 3.77379 18.7097 27.4462; 304 4.1369 20.5098 27.0831
103. 305 13.926 18.7097 27.4462; 306 13.563 20.5098 27.0831
104. 307 13.3618 11.2638 28.9481; 308 12.7558 12.0711 28.7853
105. 309 6.675 22.31 26.72; 310 11.025 22.31 26.72; 311 4.64799 24.66
26.572
106. 312 13.052 24.66 26.572; 313 4.91249 28.86 26.3075; 314 12.7875 28.86
26.3075
107. 315 8.85 24.66 26.572; 316 6.675 23.485 26.646; 317 11.025 23.485
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301. MEMBER INCIDENCES
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601. 2196 889 499; 2197 15 890; 2198 890 107; 2199 889 890; 2200 889 107


602. 2201 241 891; 2202 241 892; 2203 891 499; 2204 892 332; 2205 891 892
603. 2206 891 332; 2207 16 893; 2208 109 894; 2209 242 895; 2210 334 896
604. 2211 893 578; 2212 894 16; 2213 895 578; 2215 894 893; 2216 893 109
605. 2217 895 896; 2218 895 334; 2219 112 897; 2220 897 16; 2223 893 897
606. 2224 15 899; 2225 899 112; 2226 899 890; 2227 107 899; 2228 897 109
607. 2229 241 900; 2230 337 901; 2231 900 337; 2232 901 242; 2233 896 901
608. 2234 901 334; 2235 892 900; 2236 900 332; 2237 242 896; 2238 902 244
609. 2239 903 243; 2240 904 18; 2241 905 17; 2242 341 902; 2243 902 581
610. 2244 903 340; 2245 903 778; 2246 904 116; 2247 904 583; 2248 115 905
611. 2249 905 504; 2250 906 487; 2251 907 487; 2252 908 566; 2253 909 566
612. 2254 86 906; 2255 311 907; 2256 910 315; 2257 911 315; 2258 912 90
613. 2259 913 90; 2260 311 910; 2261 312 911; 2262 312 909; 2263 87 908
614. 2264 87 913; 2265 86 912; 2380 254 961; 2381 255 962; 2382 255 963
615. 2383 29 964; 2384 961 28; 2385 962 29; 2386 965 966; 2387 965 967
616. 2388 967 968; 2389 968 969; 2390 969 28; 2391 966 970; 2392 970 971
617. 2393 971 29; 2394 972 973; 2395 972 974; 2396 963 254; 2397 963 975
618. 2398 975 976; 2399 976 977; 2400 977 965; 2401 977 967; 2402 977 966
619. 2403 966 976; 2404 967 976; 2405 976 970; 2406 976 968; 2407 970 975
620. 2408 975 968; 2409 964 28; 2410 964 978; 2411 978 979; 2412 979 980
621. 2413 980 972; 2414 974 981; 2415 981 971; 2416 971 255; 2417 973 982
622. 2418 982 969; 2419 969 254; 2420 973 980; 2421 980 974; 2422 974 979
623. 2423 979 973; 2424 979 981; 2425 979 982; 2426 982 978; 2427 978 981
624. 2428 975 971; 2429 971 978; 2430 975 969; 2431 969 978; 2432 345 353
625. 2433 120 128; 2434 95 99; 2435 320 324; 2436 290 983; 2437 476 984
626. 2438 66 985; 2439 553 986; 2440 291 983; 2441 475 984; 2442 65 985
627. 2443 554 986; 2444 983 475; 2445 984 65; 2446 985 554; 2447 986 291
628. 2448 983 474; 2449 984 64; 2450 985 555; 2451 986 292
629. DEFINE MATERIAL START
630. ISOTROPIC STEEL
631. E 2.09042E+010
632. POISSON 0.3
633. DENSITY 7850
634. ALPHA 1.2E-005
635. DAMP 0.03
636. END DEFINE MATERIAL
637. START USER TABLE
638. TABLE 1

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639. UNIT CM MTON
640. ANGLE
641. STR50X6
642. 10 10 0.6 1.9 11.36 11.36
643. STR65X6
644. 13 13 0.6 2.5 14.88 14.88
645. STR65X8
646. 13 13 0.8 2.47 19.52 19.52
647. STR75X6
648. 15 15 0.6 2.91 17.32 17.32
649. STR75X8
650. 15 15 0.8 2.88 22.76 22.76
651. STR90X6
652. 18 18 0.6 3.5 20.94 20.94
653. STR90X8
654. 18 18 0.8 3.47 27.58 27.58
655. STR100X6
656. 20 20 0.6 3.9 23.34 23.34
657. STR100X8
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658. 20 20 0.8 3.98 30.78 30.78
659. STR110X8
660. 22 22 0.8 4.28 34.04 34.04
661. STR110X10
662. 22 22 1 4.25 42.12 42.12
663. STR110X12
664. 22 22 1.2 4.22 50.04 50.04
665. STR130X10
666. 26 26 1 5.57 50.12 50.12
667. STR150X12
668. 30 30 1.2 5.83 69.18 69.18
669. STR150X15
670. 30 30 1.5 5.78 85.56 85.56
671. STR200X15
672. 40 40 1.5 7.79 115.6 115.6
673. STR200X18
674. 40 40 1.8 7.75 137.62 137.62
675. STR200X20
676. 40 40 2 7.63 187.6 187.6
677. END
678. UNIT METER MTON
679. MEMBER PROPERTY INDIAN
680. ***MAIN LEG MEMBERS
681. 1 19 53 TO 58 457 474 507 TO 512 UPTABLE 1 STR150X15
682. 2 20 85 TO 92 458 475 539 TO 546 UPTABLE 1 STR150X15
683. 3 4 21 22 124 TO 127 149 150 459 460 476 477 578 TO 581 601 -
684. 602 UPTABLE 1 STR150X15
685. 5 6 23 24 151 152 171 172 461 462 478 479 603 604 623 624 UPTABLE 1
     STR150X12
686. 7 25 173 174 463 480 625 626 TABLE ST ISA200X200X15
687. 2197 2198 2202 2204 2208 2210 2212 2237 TABLE ST ISA150X150X18
688. 198 200 650 652 2238 TO 2241 TABLE ST ISA150X150X18
689. 9 27 201 202 465 482 653 654 TABLE ST ISA150X150X15
690. 10 28 227 TO 232 466 483 679 TO 684 TABLE ST ISA150X150X12
691. 11 29 233 234 467 484 685 686 TABLE ST ISA130X130X12
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   692. 12 30 268 TO 273 468 485 720 TO 725 TABLE ST ISA110X110X8
   693. 13 14 31 32 274 275 469 470 486 487 726 727 TABLE ST ISA100X100X8
   694. **SEC. MEMBER
   695. 49 50 61 TO 66 503 504 515 TO 520 924 925 930 TO 935 958 TO 967 1171
1172 -
   696. 1177 TO 1182 1205 TO 1214 TABLE LD ISA90X90X6
   697. 1544 1546 1547 1555 TO 1557 1565 1566 1568 1569 1578 1579 1584 1587
TO 1589 -
   698. 1594 1595 1712 1714 1715 1722 1724 1725 1732 1734 1735 1743 1745 1746
1757 -
   699. 1759 1760 1767 1769 1770 TABLE ST ISA90X90X6
   700. 926 927 968 TO 971 1173 1174 1215 TO 1218 TABLE LD ISA100X100X6
   701. 1007 1008 1010 TO 1013 1254 1255 1257 TO 1260 2250 TO 2252 -
   702. 2253 TABLE LD ISA100X100X8
   703. 1006 1009 1016 1017 1253 1256 1263 1264 TABLE LD ISA110X110X8
   704. 1026 TO 1031 1036 1037 1273 TO 1278 1283 1284 TABLE LD ISA80X80X6
   705. 51 52 107 TO 110 155 158 165 166 505 506 561 TO 564 607 610 617 618
        1023 1024 -
   706. 1032 1033 1270 1271 1279 1280 TABLE LD ISA100X100X8
   707. 1050 1055 1295 1297 1301 1302 1754 1755 2195 2196 2201 2203 2207 2209
2211 -
   708. 2213 TABLE LD ISA75X75X6
   709. 1045 1046 1056 1057 1292 1293 1303 1304 TABLE LD ISA90X90X8
   710. 179 TO 184 189 190 313 631 TO 636 641 642 764 1077 TO 1080 1083 TO
1086 1324 -
   711. 1325 TO 1327 1330 TO 1333 TABLE LD ISA75X75X6
   712. 1071 TO 1074 1081 1082 1097 1098 1318 TO 1321 1328 1329 1344 -
   713. 1345 TABLE LD ISA80X80X6
     STAAD SPACE                                              -- PAGE NO.
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   714. 280 TO 295 732 TO 747 1107 1108 1111 1112 1117 TO 1120 1354 1355 1358
1359 -
   715. 1364 TO 1367 TABLE LD ISA60X60X6
   716. 1105 1106 1109 1110 1113 TO 1116 1352 1353 1356 1357 1360 TO 1362 -
   717. 1363 TABLE LD ISA70X70X6
   718. 1133 TO 1136 1380 TO 1383 TABLE ST ISA90X90X6
   719. 207 209 213 214 238 TO 241 248 249 264 265 659 661 665 666 690 TO 693
700 -
   720. 701 716 717 1137 1384 2219 2220 2224 2225 2229 TO 2232 TABLE LD
ISA75X75X6
   721. 99 TO 104 553 TO 558 TABLE LD ISA100X100X6
   722. 97 98 105 106 156 157 159 TO 162 176 177 185 186 551 552 559 560 608
609 611 -
   723. 612 TO 614 628 629 637 638 2256 TO 2259 TABLE LD ISA90X90X6
   724. 204 205 215 216 656 657 667 668 TABLE LD ISA80X80X6
   725. 244 TO 247 251 TO 253 696 TO 699 702 TO 705 TABLE LD ISA70X70X6
   726. 309 TO 312 760 TO 763 TABLE ST ISA80X80X6
   727. 2397 TO 2400 2410 TO 2413 TABLE ST ISA100X100X6
   728. 2386 TO 2395 2401 TO 2408 2414 TO 2431 TABLE ST ISA75X75X6
   729. 33 42 59 60 488 496 513 514 909 917 928 929 1156 1164 1175 -
   730. 1176 TABLE LD ISA90X90X6
   731. 911 918 998 999 1158 1165 1245 1246 TABLE LD ISA110X110X10
   732. 2019 TO 2021 2034 TO 2036 2049 TO 2051 2064 TO 2066 TABLE ST
ISA45X45X5
   733. 75 84 529 538 944 953 1191 1200 2022 2023 2037 2038 2052 2053 2067 -
   734. 2068 TABLE ST ISA50X50X4
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   735. 76 TO 83 530 TO 537 945 TO 952 1192 TO 1199 2024 TO 2033 2039 TO 2048
2054 -
   736. 2055 TO 2063 2069 TO 2078 TABLE ST ISA60X60X5
   737. 67 TO 74 521 TO 528 936 TO 943 1183 TO 1190 TABLE ST ISA45X45X5
   738. 1665 TO 1667 1670 TO 1679 1681 TO 1707 TABLE ST ISA65X65X5
   739. 111 TO 114 128 137 TO 140 565 TO 568 582 589 TO 592 972 TO 975 985 -
   740. 992 TO 995 1219 TO 1222 1232 1239 TO 1242 2079 2080 2091 2102 -
   741. 2103 TABLE ST ISA65X65X5
   742. 93 TO 96 547 TO 550 954 TO 957 1201 TO 1204 TABLE LD ISA75X75X6
   743. 115 TO 123 130 131 133 TO 136 569 TO 577 583 TO 588 976 TO 984 986 TO
991 -
   744. 1223 TO 1231 1233 TO 1238 2081 TO 2090 2092 TO 2101 2104 TO 2125 -
   745. 2126 TABLE ST ISA70X70X5
   746. 141 142 145 TO 148 593 594 597 TO 600 996 997 1000 TO 1003 1243 1244
1247 -
   747. 1248 TO 1250 2130 TO 2137 2141 TO 2148 2155 TO 2170 TABLE ST
ISA50X50X4
   748. *CROSSARM.
   749. *LOWERMENBER
   750. 1545 1548 1549 1554 1558 1559 1564 1567 1570 1571 1576 1577 1585 1586
1590 -
   751. 1591 TO 1593 1713 1716 1717 1723 1726 1727 1733 1736 1737 1744 -
   752. 1747 1748 1758 1761 1762 1768 1771 1772  TABLE ST ISA130X130X10
   753. 1812 1815 1816 1625 1626 1630 1631 1634 1635 1802 -
   754. 1805 1806 1822 1825 1826 1833 1836 1837 1645 1646 1650 1651 1654 1655
-
   755. 1791 1607 1610 1611 1780 1783 1784  1794 1795 1605 -
   756. 1614 1615 TABLE ST ISA110X110X10
   757. *UPPER MEMBER
   758. 1604 1606 1608 1609 1612 1613 1624 1627 TO 1629 1632 1633 1644 1647
TO 1649 -
   759. 1652 1653 1779 1781 1782 1790 1792 1793 1801 1803 1804 1811 1813 1814
1821 -
   760. 1823 1824 1832 1834 1835 1859 TO 1874 TABLE ST ISA90X90X6
   761. *REDUNDANT
   762. 1550 1551 1560 1561 1572 1573 1580 1581 1596 1597 1600 1601 1719 1721
1730 -
   763. 1731 1740 1741 1751 1752 1765 1766 1775 1776 1845 TO 1858 1875 TO
1888 1905 -
   764. 1906 TO 1918 2171 TO 2176 TABLE ST ISA60X60X6
   765. 1552 1553 1562 1563 1574 1575 1582 1583 1598 1599 1602 1603 1718 1720
1728 -
   766. 1729 1738 1739 1749 1750 1763 1764 1773 1774 TABLE ST ISA45X45X5
   767. 1616 1617 1620 1621 1636 1637 1640 1641 1656 1657 1660 1661 1785 1786
1796 -
   768. 1797 1807 1808 1817 1818 1827 1828 1838 1839 TABLE ST ISA45X45X5
   769. 1936 1937 1939 1940 1944 1945 1947 1948 1966 1967 1969 1970 1972 1974
1994 -
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   770. 1995 1997 1999 2000 2002 2127 TO 2129 2138 TO 2140 2149 TO 2153 -
   771. 2154 TABLE ST ISA65X65X5
   772. 1618 1619 1622 1623 1638 1639 1642 1643 1658 1659 1662 1663 1787 1788
1798 -
   773. 1799 1809 1810 1819 1820 1829 1830 1840 1841 1935 1938 1941 TO 1943
1946 -
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774. 1965 1968 1971 1973 1993 1996 1998 2001 2177 TO 2182 TABLE ST ISA65X65X6
775. 163 164 615 1014 1015 1261 1262 2254 2255 2260 TO 2265 TABLE ST ISA50X50X4
776. 616 2183 2185 2186 2188 TABLE ST ISA50X50X4
777. 167 169 619 621 1018 1020 1265 1267 2189 2191 2192 2194 TABLE ST ISA60X60X5
778. 168 170 187 188 191 192 620 622 639 640 643 644 1019 1021 1034 1035 1038 1039 -
779. 1266 1268 1281 1282 1285 1286 1919 TO 1934 TABLE ST ISA65X65X5
780. 194 196 646 648 1041 1043 1288 1290 TABLE ST ISA75X75X6
781. 193 195 645 647 1040 1042 1287 1289 TABLE ST ISA60X60X5
782. 219 222 671 674 1063 1307 1310 1756 2199 2200 2205 2206 2215 TO 2218 2223 -
783. 2226 TO 2228 2233 TO 2236 2242 TO 2249 TABLE ST ISA50X50X4
784. 675 1949 TO 1964 TABLE ST ISA60X60X5
785. 223 TO 226 676 TO 678 1064 TO 1067 1311 TO 1314 TABLE ST ISA60X60X5
786. 243 695 1075 1076 1322 1323 2432 2433 TABLE ST ISA75X75X6
787. 250 254 TO 261 296 TO 307 706 TO 713 748 TO 759 1087 TO 1094 1121 TO 1132 -
788. 1334 TO 1341 1368 TO 1379 TABLE ST ISA50X50X4
789. 235 236 687 688 1068 1069 1315 1316 TABLE ST ISA75X75X6
790. 237 262 263 266 267 689 714 715 718 719 1070 1095 1096 1099 1100 1317 1342 -
791. 1343 1346 1347 1977 TO 1992 2003 TO 2018 TABLE ST ISA50X50X4
792. 278 279 730 731 1103 1104 1350 1351 1496 1502 2380 TO 2385 2396 -
793. 2409 TABLE ST ISA65X65X5
794. 276 277 728 729 1101 1102 1348 1349 TABLE ST ISA65X65X5
795. 48 502 915 923 1162 1170 1831 1842 TABLE ST ISA100X100X10
796. 2436 TO 2451 TABLE LD ISA75X75X6
797. * CROSS ARM BASE
798. 153 154 606 1004 1005 1251 1252 1402 TABLE ST ISA100X100X6
799. 43 143 144 497 595 596 1843 1844 TABLE ST ISA100X100X6
800. 44 498 910 919 1157 1166 1742 1753 1889 TO 1904 TABLE ST ISA130X130X8
801. 178 630 1022 1025 1269 1272 2434 2435 TABLE ST ISA100X100X8
802. 45 499 912 920 1159 1167 1777 1778 TABLE LD ISA110X110X8
803. 46 500 913 921 1160 1168 1789 1800 TABLE LD ISA100X100X6
804. 203 206 655 658 1044 1047 1291 1294 TABLE ST ISA90X90X6
805. 47 501 914 922 1161 1169 1975 1976 TABLE ST ISA100X100X8
806. CONSTANTS
807. MATERIAL STEEL MEMB 1 TO 7 9 TO 14 19 TO 25 27 TO 33 42 TO 128 130 131 133 -
808. 134 TO 174 176 TO 196 198 200 TO 207 209 213 TO 216 219 222 TO 241 -
809. 243 TO 307 309 TO 313 457 TO 463 465 TO 470 474 TO 480 482 TO 488 -
810. 496 TO 604 606 TO 626 628 TO 648 650 652 TO 659 661 665 TO 668 671 -
811. 674 TO 693 695 TO 764 909 TO 915 917 TO 1047 1050 1055 TO 1057 1063 TO 1137
812. 1156 TO 1162 1164 TO 1295 1297 1301 TO 1304 1307 1310 TO 1384 1402 1496 1502 813. 1544 TO 1663 1665 TO 1667 1670 TO 1679 1681 TO 1707 1712 TO 2183 2185 2186 -
814. 2188 2189 2191 2192 2194 TO 2213 2215 TO 2220 2223 TO 2265 2380 TO 2451
815. SUPPORTS
816. 1 2 227 228 PINNED
817. UNIT METER KG
818. LOAD 2 RELIABILITY CONDITION
819. SELFWEIGHT Y -1

820. JOINT LOAD
821. 972 FY -355 FZ 1582
822. 965 FY -355 FZ 1582
823. 746 FY -3605 FZ 8221
824. 733 FY -3605 FZ 8221
825. 723 FY -3605 FZ 8221


826. 650 FY -7210 FZ 15686
827. 636 FY -7210 FZ 15686
828. 615 FY -7210 FZ 15686
829. 743 FY -3606 FZ 8221
830. 736 FY -3606 FZ 8221
831. 726 FY -3606 FZ 8221
832. 647 FY -7210 FZ 15686
833. 633 FY -7210 FZ 15686
834. 622 FY -7210 FZ 15686
835. *WIND LOAD
836. 1 2 227 228 FZ 722
837. 3 4 229 230 FZ 1232
838. 58 62 284 288 FZ 1180
839. 7 8 233 234 FZ 1345
840. 11 12 237 238 FZ 1372
841. 15 16 241 242 FZ 1175
842. 19 32 245 258 FZ 670
843. 22 23 248 249 FZ 416
844. 26 27 252 253 FZ 250
845. 965 972 FZ 125
846. LOAD 3 SECCURITY - GROUND WIRE AND TOP LEFT CONDUCTOR BROKEN CONDITION
847. SELFWEIGHT Y -1
848. JOINT LOAD
849. 972 FX 3090 FY -215 FZ 868
850. 965 FY -355 FZ 1582
851. 746 FX 15056 FY -2643 FZ 4778
852. 733 FY -3605 FZ 8221
853. 723 FY -3605 FZ 8221
854. 650 FY -7210 FZ 15686
855. 636 FY -7210 FZ 15686
856. 615 FY -7210 FZ 15686
857. 743 FY -3606 FZ 8221
858. 736 FY -3606 FZ 8221
859. 726 FY -3606 FZ 8221
860. 647 FY -7210 FZ 15686
861. 633 FY -7210 FZ 15686
862. 622 FY -7210 FZ 15686
863. *WIND LOAD
864. 1 2 227 228 FZ 722
865. 3 4 229 230 FZ 1232
866. 58 62 284 288 FZ 1180
867. 7 8 233 234 FZ 1345
868. 11 12 237 238 FZ 1372
869. 15 16 241 242 FZ 1175
870. 19 32 245 258 FZ 670
871. 22 23 248 249 FZ 416
872. 26 27 252 253 FZ 250

873. 965 972 FZ 125
874. LOAD 4 SECCURITY - GROUND WIRE AND SECOND TOP LEFT CONDUCTOR BROKEN CONDITION
875. SELFWEIGHT Y -1
876. JOINT LOAD
877. 972 FX 3090 FY -215 FZ 868
878. 965 FY -355 FZ 1582
879. 746 FY -3605 FZ 8221
880. 733 FX 15056 FY -2643 FZ 4778
881. 723 FY -3605 FZ 8221



882. 650 FY -7210 FZ 15686
883. 636 FY -7210 FZ 15686
884. 615 FY -7210 FZ 15686
885. 743 FY -3606 FZ 8221
886. 736 FY -3606 FZ 8221
887. 726 FY -3606 FZ 8221
888. 647 FY -7210 FZ 15686
889. 633 FY -7210 FZ 15686
890. 622 FY -7210 FZ 15686
891. *WIND LOAD
892. 1 2 227 228 FZ 722
893. 3 4 229 230 FZ 1232
894. 58 62 284 288 FZ 1180
895. 7 8 233 234 FZ 1345
896. 11 12 237 238 FZ 1372
897. 15 16 241 242 FZ 1175
898. 19 32 245 258 FZ 670
899. 22 23 248 249 FZ 416
900. 26 27 252 253 FZ 250
901. 965 972 FZ 125
902. LOAD 5 SECCURITY - GROUND WIRE AND THIRD LEFT CONDUCTOR BROKEN CONDITION
903. SELFWEIGHT Y -1
904. JOINT LOAD
905. 972 FX 3090 FY -215 FZ 868
906. 965 FY -355 FZ 1582
907. 746 FY -3605 FZ 8221
908. 733 FY -3605 FZ 8221
909. 723 FX 15056 FY -2643 FZ 4778
910. 650 FY -7210 FZ 15686
911. 636 FY -7210 FZ 15686
912. 615 FY -7210 FZ 15686
913. 743 FY -3606 FZ 8221
914. 736 FY -3606 FZ 8221
915. 726 FY -3606 FZ 8221
916. 647 FY -7210 FZ 15686
917. 633 FY -7210 FZ 15686
918. 622 FY -7210 FZ 15686
919. *WIND LOAD
920. 1 2 227 228 FZ 722
921. 3 4 229 230 FZ 1232
922. 58 62 284 288 FZ 1180
923. 7 8 233 234 FZ 1345
924. 11 12 237 238 FZ 1372

925. 15 16 241 242 FZ 1175
926. 19 32 245 258 FZ 670
927. 22 23 248 249 FZ 416
928. 26 27 252 253 FZ 250
929. 965 972 FZ 125
930. LOAD 6 SECCURITY - GROUND WIRE AND FOURTH LEFT CONDUCTOR BROKEN CONDITION
931. SELFWEIGHT Y -1
932. JOINT LOAD
933. 972 FX 3090 FY -215 FZ 868
934. 965 FY -355 FZ 1582
935. 746 FY -3605 FZ 8221
936. 733 FY -3605 FZ 8221
937. 723 FY -3605 FZ 8221



938. 650 FX 28736 FY -5286 FZ 9186
939. 636 FY -7210 FZ 15686
940. 615 FY -7210 FZ 15686
941. 743 FY -3606 FZ 8221
942. 736 FY -3606 FZ 8221
943. 726 FY -3606 FZ 8221
944. 647 FY -7210 FZ 15686
945. 633 FY -7210 FZ 15686
946. 622 FY -7210 FZ 15686
947. *WIND LOAD
948. 1 2 227 228 FZ 722
949. 3 4 229 230 FZ 1232
950. 58 62 284 288 FZ 1180
951. 7 8 233 234 FZ 1345
952. 11 12 237 238 FZ 1372
953. 15 16 241 242 FZ 1175
954. 19 32 245 258 FZ 670
955. 22 23 248 249 FZ 416
956. 26 27 252 253 FZ 250
957. 965 972 FZ 125
958. LOAD 7 SECCURITY - GROUND WIRE AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
959. SELFWEIGHT Y -1
960. JOINT LOAD
961. 972 FX 3090 FY -215 FZ 868
962. 965 FY -355 FZ 1582
963. 746 FY -3605 FZ 8221
964. 733 FY -3605 FZ 8221
965. 723 FY -3605 FZ 8221
966. 650 FY -7210 FZ 15686
967. 636 FX 28736 FY -5286 FZ 9186
968. 615 FY -7210 FZ 15686
969. 743 FY -3606 FZ 8221
970. 736 FY -3606 FZ 8221
971. 726 FY -3606 FZ 8221
972. 647 FY -7210 FZ 15686
973. 633 FY -7210 FZ 15686
974. 622 FY -7210 FZ 15686
975. *WIND LOAD
976. 1 2 227 228 FZ 722

977. 3 4 229 230 FZ 1232
978. 58 62 284 288 FZ 1180
979. 7 8 233 234 FZ 1345
980. 11 12 237 238 FZ 1372
981. 15 16 241 242 FZ 1175
982. 19 32 245 258 FZ 670
983. 22 23 248 249 FZ 416
984. 26 27 252 253 FZ 250
985. 965 972 FZ 125
986. LOAD 8 SECCURITY - GROUND WIRE AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
987. SELFWEIGHT Y -1
988. JOINT LOAD
989. 972 FX 3090 FY -215 FZ 868
990. 965 FY -355 FZ 1582
991. 746 FY -3605 FZ 8221
992. 733 FY -3605 FZ 8221
993. 723 FY -3605 FZ 8221



994. 650 FY -7210 FZ 15686
995. 636 FY -7210 FZ 15686
996. 615 FX 28736 FY -5286 FZ 9186
997. 743 FY -3606 FZ 8221
998. 736 FY -3606 FZ 8221
999. 726 FY -3606 FZ 8221
1000. 647 FY -7210 FZ 15686
1001. 633 FY -7210 FZ 15686
1002. 622 FY -7210 FZ 15686
1003. *WIND LOAD
1004. 1 2 227 228 FZ 722
1005. 3 4 229 230 FZ 1232
1006. 58 62 284 288 FZ 1180
1007. 7 8 233 234 FZ 1345
1008. 11 12 237 238 FZ 1372
1009. 15 16 241 242 FZ 1175
1010. 19 32 245 258 FZ 670
1011. 22 23 248 249 FZ 416
1012. 26 27 252 253 FZ 250
1013. 965 972 FZ 125
1014. LOAD 9 SECCURITY - FIRST AND SECOND LEFT CONDUCTOR BROKEN CONDITION
1015. SELFWEIGHT Y -1
1016. JOINT LOAD
1017. 972 FY -355 FZ 1582
1018. 965 FY -355 FZ 1582
1019. 746 FX 15056 FY -2643 FZ 4778
1020. 733 FX 15056 FY -2643 FZ 4778
1021. 723 FY -3605 FZ 8221
1022. 650 FY -7210 FZ 15686
1023. 636 FY -7210 FZ 15686
1024. 615 FY -7210 FZ 15686
1025. 743 FY -3606 FZ 8221
1026. 736 FY -3606 FZ 8221
1027. 726 FY -3606 FZ 8221
1028. 647 FY -7210 FZ 15686
1029. 633 FY -7210 FZ 15686

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1030. 622 FY -7210 FZ 15686
1031. *WIND LOAD
1032. 1 2 227 228 FZ 722
1033. 3 4 229 230 FZ 1232
1034. 58 62 284 288 FZ 1180
1035. 7 8 233 234 FZ 1345
1036. 11 12 237 238 FZ 1372
1037. 15 16 241 242 FZ 1175
1038. 19 32 245 258 FZ 670
1039. 22 23 248 249 FZ 416
1040. 26 27 252 253 FZ 250
1041. 965 972 FZ 125
1042. LOAD 10 SECCURITY - FIRST AND THIRD LEFT CONDUCTOR BROKEN CONDITION
1043. SELFWEIGHT Y -1
1044. JOINT LOAD
1045. 972 FY -355 FZ 1582
1046. 965 FY -355 FZ 1582
1047. 746 FX 15056 FY -2643 FZ 4778
1048. 733 FY -3605 FZ 8221
1049. 723 FX 15056 FY -2643 FZ 4778
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1050. 650 FY -7210 FZ 15686
1051. 636 FY -7210 FZ 15686
1052. 615 FY -7210 FZ 15686
1053. 743 FY -3606 FZ 8221
1054. 736 FY -3606 FZ 8221
1055. 726 FY -3606 FZ 8221
1056. 647 FY -7210 FZ 15686
1057. 633 FY -7210 FZ 15686
1058. 622 FY -7210 FZ 15686
1059. *WIND LOAD
1060. 1 2 227 228 FZ 722
1061. 3 4 229 230 FZ 1232
1062. 58 62 284 288 FZ 1180
1063. 7 8 233 234 FZ 1345
1064. 11 12 237 238 FZ 1372
1065. 15 16 241 242 FZ 1175
1066. 19 32 245 258 FZ 670
1067. 22 23 248 249 FZ 416
1068. 26 27 252 253 FZ 250
1069. 965 972 FZ 125
1070. LOAD 11 SECCURITY - FIRST AND FOURTH LEFT CONDUCTOR BROKEN CONDITION
1071. SELFWEIGHT Y -1
1072. JOINT LOAD
1073. 972 FY -355 FZ 1582
1074. 965 FY -355 FZ 1582
1075. 746 FX 15056 FY -2643 FZ 4778
1076. 733 FY -3605 FZ 8221
1077. 723 FY -3605 FZ 8221
1078. 650 FX 28736 FY -5286 FZ 9186
1079. 636 FY -7210 FZ 15686
1080. 615 FY -7210 FZ 15686
1081. 743 FY -3606 FZ 8221
1082. 736 FY -3606 FZ 8221
1083. 726 FY -3606 FZ 8221
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1084. 647 FY -7210 FZ 15686
1085. 633 FY -7210 FZ 15686
1086. 622 FY -7210 FZ 15686
1087. *WIND LOAD
1088. 1 2 227 228 FZ 722
1089. 3 4 229 230 FZ 1232
1090. 58 62 284 288 FZ 1180
1091. 7 8 233 234 FZ 1345
1092. 11 12 237 238 FZ 1372
1093. 15 16 241 242 FZ 1175
1094. 19 32 245 258 FZ 670
1095. 22 23 248 249 FZ 416
1096. 26 27 252 253 FZ 250
1097. 965 972 FZ 125
1098. LOAD 12 SECCURITY - FIRST AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
1099. SELFWEIGHT Y -1
1100. JOINT LOAD
1101. 972 FY -355 FZ 1582
1102. 965 FY -355 FZ 1582
1103. 746 FX 15056 FY -2643 FZ 4778
1104. 733 FY -3605 FZ 8221
1105. 723 FY -3605 FZ 8221
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1106. 650 FY -7210 FZ 15686
1107. 636 FX 28736 FY -5286 FZ 9186
1108. 615 FY -7210 FZ 15686
1109. 743 FY -3606 FZ 8221
1110. 736 FY -3606 FZ 8221
1111. 726 FY -3606 FZ 8221
1112. 647 FY -7210 FZ 15686
1113. 633 FY -7210 FZ 15686
1114. 622 FY -7210 FZ 15686
1115. *WIND LOAD
1116. 1 2 227 228 FZ 722
1117. 3 4 229 230 FZ 1232
1118. 58 62 284 288 FZ 1180
1119. 7 8 233 234 FZ 1345
1120. 11 12 237 238 FZ 1372
1121. 15 16 241 242 FZ 1175
1122. 19 32 245 258 FZ 670
1123. 22 23 248 249 FZ 416
1124. 26 27 252 253 FZ 250
1125. 965 972 FZ 125
1126. LOAD 13 SECCURITY - FIRST AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
1127. SELFWEIGHT Y -1
1128. JOINT LOAD
1129. 972 FY -355 FZ 1582
1130. 965 FY -355 FZ 1582
1131. 746 FX 15056 FY -2643 FZ 4778
1132. 733 FY -3605 FZ 8221
1133. 723 FY -3605 FZ 8221
1134. 650 FY -7210 FZ 15686
1135. 636 FY -7210 FZ 15686
1136. 615 FX 28736 FY -5286 FZ 9186
1137. 743 FY -3606 FZ 8221
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  1138. 736 FY -3606 FZ 8221
  1139. 726 FY -3606 FZ 8221
  1140. 647 FY -7210 FZ 15686
  1141. 633 FY -7210 FZ 15686
  1142. 622 FY -7210 FZ 15686
  1143. *WIND LOAD
  1144. 1 2 227 228 FZ 722
  1145. 3 4 229 230 FZ 1232
  1146. 58 62 284 288 FZ 1180
  1147. 7 8 233 234 FZ 1345
  1148. 11 12 237 238 FZ 1372
  1149. 15 16 241 242 FZ 1175
  1150. 19 32 245 258 FZ 670
  1151. 22 23 248 249 FZ 416
  1152. 26 27 252 253 FZ 250
  1153. 965 972 FZ 125
  1154. LOAD 14 SECCURITY - SECOND AND THIRD LEFT CONDUCTOR BROKEN CONDITION
  1155. SELFWEIGHT Y -1
  1156. JOINT LOAD
  1157. 972 FY -355 FZ 1582
  1158. 965 FY -355 FZ 1582
  1159. 746 FY -3605 FZ 8221
  1160. 733 FX 15056 FY -2643 FZ 4778
  1161. 723 FX 15056 FY -2643 FZ 4778
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  1162. 650 FY -7210 FZ 15686
  1163. 636 FY -7210 FZ 15686
  1164. 615 FY -7210 FZ 15686

  1165. 743 FY -3606 FZ 8221
  1166. 736 FY -3606 FZ 8221
  1167. 726 FY -3606 FZ 8221
  1168. 647 FY -7210 FZ 15686
  1169. 633 FY -7210 FZ 15686
  1170. 622 FY -7210 FZ 15686
  1171. *WIND LOAD
  1172. 1 2 227 228 FZ 722
  1173. 3 4 229 230 FZ 1232
  1174. 58 62 284 288 FZ 1180
  1175. 7 8 233 234 FZ 1345
  1176. 11 12 237 238 FZ 1372
  1177. 15 16 241 242 FZ 1175
  1178. 19 32 245 258 FZ 670
  1179. 22 23 248 249 FZ 416
  1180. 26 27 252 253 FZ 250
  1181. 965 972 FZ 125
  1182. LOAD 15 SECCURITY - SECOND AND FOURTH LEFT CONDUCTOR BROKEN CONDITION
  1183. SELFWEIGHT Y -1
  1184. JOINT LOAD
  1185. 972 FY -355 FZ 1582
  1186. 965 FY -355 FZ 1582
  1187. 746 FY -3605 FZ 8221
  1188. 733 FX 15056 FY -2643 FZ 4778
  1189. 723 FY -3605 FZ 8221
  1190. 650 FX 28736 FY -5286 FZ 9186
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1191. 636 FY -7210 FZ 15686
1192. 615 FY -7210 FZ 15686
1193. 743 FY -3606 FZ 8221
1194. 736 FY -3606 FZ 8221
1195. 726 FY -3606 FZ 8221
1196. 647 FY -7210 FZ 15686
1197. 633 FY -7210 FZ 15686
1198. 622 FY -7210 FZ 15686
1199. *WIND LOAD
1200. 1 2 227 228 FZ 722
1201. 3 4 229 230 FZ 1232
1202. 58 62 284 288 FZ 1180
1203. 7 8 233 234 FZ 1345
1204. 11 12 237 238 FZ 1372
1205. 15 16 241 242 FZ 1175
1206. 19 32 245 258 FZ 670
1207. 22 23 248 249 FZ 416
1208. 26 27 252 253 FZ 250
1209. 965 972 FZ 125
1210. LOAD 16 SECCURITY - SECOND AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
1211. SELFWEIGHT Y -1
1212. JOINT LOAD
1213. 972 FY -355 FZ 1582
1214. 965 FY -355 FZ 1582
1215. 746 FY -3605 FZ 8221
1216. 733 FX 15056 FY -2643 FZ 4778
1217. 723 FY -3605 FZ 8221
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1218. 650 FY -7210 FZ 15686
1219. 636 FX 28736 FY -5286 FZ 9186
1220. 615 FY -7210 FZ 15686
1221. 743 FY -3606 FZ 8221
1222. 736 FY -3606 FZ 8221
1223. 726 FY -3606 FZ 8221
1224. 647 FY -7210 FZ 15686
1225. 633 FY -7210 FZ 15686
1226. 622 FY -7210 FZ 15686
1227. *WIND LOAD
1228. 1 2 227 228 FZ 722
1229. 3 4 229 230 FZ 1232
1230. 58 62 284 288 FZ 1180
1231. 7 8 233 234 FZ 1345
1232. 11 12 237 238 FZ 1372
1233. 15 16 241 242 FZ 1175
1234. 19 32 245 258 FZ 670
1235. 22 23 248 249 FZ 416
1236. 26 27 252 253 FZ 250
1237. 965 972 FZ 125
1238. LOAD 17 SECCURITY - SECOND AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
1239. SELFWEIGHT Y -1
1240. JOINT LOAD
1241. 972 FY -355 FZ 1582
1242. 965 FY -355 FZ 1582
1243. 746 FY -3605 FZ 8221
1244. 733 FX 15056 FY -2643 FZ 4778
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1245. 723 FY -3605 FZ 8221
1246. 650 FY -7210 FZ 15686
1247. 636 FY -7210 FZ 15686
1248. 615 FX 28736 FY -5286 FZ 9186
1249. 743 FY -3606 FZ 8221
1250. 736 FY -3606 FZ 8221
1251. 726 FY -3606 FZ 8221
1252. 647 FY -7210 FZ 15686
1253. 633 FY -7210 FZ 15686
1254. 622 FY -7210 FZ 15686
1255. *WIND LOAD
1256. 1 2 227 228 FZ 722
1257. 3 4 229 230 FZ 1232
1258. 58 62 284 288 FZ 1180
1259. 7 8 233 234 FZ 1345
1260. 11 12 237 238 FZ 1372
1261. 15 16 241 242 FZ 1175
1262. 19 32 245 258 FZ 670
1263. 22 23 248 249 FZ 416
1264. 26 27 252 253 FZ 250
1265. 965 972 FZ 125
1266. LOAD 18 SECCURITY - THIRD AND FOURTH LEFT CONDUCTOR BROKEN CONDITION
1267. SELFWEIGHT Y -1
1268. JOINT LOAD
1269. 972 FY -355 FZ 1582
1270. 965 FY -355 FZ 1582
1271. 746 FY -3605 FZ 8221
1272. 733 FY -3605 FZ 8221
1273. 723 FX 15056 FY -2643 FZ 4778
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1274. 650 FX 28736 FY -5286 FZ 9186
1275. 636 FY -7210 FZ 15686
1276. 615 FY -7210 FZ 15686
1277. 743 FY -3606 FZ 8221
1278. 736 FY -3606 FZ 8221
1279. 726 FY -3606 FZ 8221
1280. 647 FY -7210 FZ 15686
1281. 633 FY -7210 FZ 15686
1282. 622 FY -7210 FZ 15686
1283. *WIND LOAD
1284. 1 2 227 228 FZ 722
1285. 3 4 229 230 FZ 1232
1286. 58 62 284 288 FZ 1180
1287. 7 8 233 234 FZ 1345
1288. 11 12 237 238 FZ 1372
1289. 15 16 241 242 FZ 1175
1290. 19 32 245 258 FZ 670
1291. 22 23 248 249 FZ 416
1292. 26 27 252 253 FZ 250
1293. 965 972 FZ 125
1294. LOAD 19 SECCURITY - THIRD AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
1295. SELFWEIGHT Y -1
1296. JOINT LOAD
1297. 972 FY -355 FZ 1582
1298. 965 FY -355 FZ 1582
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1299. 746 FY -3605 FZ 8221
1300. 733 FY -3605 FZ 8221
1301. 723 FX 15056 FY -2643 FZ 4778
1302. 650 FY -7210 FZ 15686
1303. 636 FX 28736 FY -5286 FZ 9186
1304. 615 FY -7210 FZ 15686
1305. 743 FY -3606 FZ 8221
1306. 736 FY -3606 FZ 8221
1307. 726 FY -3606 FZ 8221
1308. 647 FY -7210 FZ 15686
1309. 633 FY -7210 FZ 15686
1310. 622 FY -7210 FZ 15686
1311. *WIND LOAD
1312. 1 2 227 228 FZ 722
1313. 3 4 229 230 FZ 1232
1314. 58 62 284 288 FZ 1180
1315. 7 8 233 234 FZ 1345
1316. 11 12 237 238 FZ 1372
1317. 15 16 241 242 FZ 1175
1318. 19 32 245 258 FZ 670
1319. 22 23 248 249 FZ 416
1320. 26 27 252 253 FZ 250
1321. 965 972 FZ 125
1322. LOAD 20 SECCURITY - THIRD AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
1323. SELFWEIGHT Y -1
1324. JOINT LOAD
1325. 972 FY -355 FZ 1582
1326. 965 FY -355 FZ 1582
1327. 746 FY -3605 FZ 8221
1328. 733 FY -3605 FZ 8221
1329. 723 FX 15056 FY -2643 FZ 4778
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1330. 650 FY -7210 FZ 15686
1331. 636 FY -7210 FZ 15686
1332. 615 FX 28736 FY -5286 FZ 9186
1333. 743 FY -3606 FZ 8221
1334. 736 FY -3606 FZ 8221
1335. 726 FY -3606 FZ 8221
1336. 647 FY -7210 FZ 15686
1337. 633 FY -7210 FZ 15686
1338. 622 FY -7210 FZ 15686
1339. *WIND LOAD
1340. 1 2 227 228 FZ 722
1341. 3 4 229 230 FZ 1232
1342. 58 62 284 288 FZ 1180
1343. 7 8 233 234 FZ 1345
1344. 11 12 237 238 FZ 1372
1345. 15 16 241 242 FZ 1175
1346. 19 32 245 258 FZ 670
1347. 22 23 248 249 FZ 416
1348. 26 27 252 253 FZ 250
1349. 965 972 FZ 125
1350. LOAD 21 SECCURITY - FOURTH AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
1351. SELFWEIGHT Y -1
1352. JOINT LOAD
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1353. 972 FY -355 FZ 1582
1354. 965 FY -355 FZ 1582
1355. 746 FY -3605 FZ 8221
1356. 733 FY -3605 FZ 8221
1357. 723 FY -3605 FZ 8221
1358. 650 FX 28736 FY -5286 FZ 9186
1359. 636 FX 28736 FY -5286 FZ 9186
1360. 615 FY -7210 FZ 15686
1361. 743 FY -3606 FZ 8221
1362. 736 FY -3606 FZ 8221
1363. 726 FY -3606 FZ 8221
1364. 647 FY -7210 FZ 15686
1365. 633 FY -7210 FZ 15686
1366. 622 FY -7210 FZ 15686
1367. *WIND LOAD
1368. 1 2 227 228 FZ 722
1369. 3 4 229 230 FZ 1232
1370. 58 62 284 288 FZ 1180
1371. 7 8 233 234 FZ 1345
1372. 11 12 237 238 FZ 1372
1373. 15 16 241 242 FZ 1175
1374. 19 32 245 258 FZ 670
1375. 22 23 248 249 FZ 416
1376. 26 27 252 253 FZ 250
1377. 965 972 FZ 125
1378. LOAD 22 SECCURITY - FOURTH AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
1379. SELFWEIGHT Y -1
1380. JOINT LOAD
1381. 972 FY -355 FZ 1582
1382. 965 FY -355 FZ 1582
1383. 746 FY -3605 FZ 8221
1384. 733 FY -3605 FZ 8221
1385. 723 FY -3605 FZ 8221
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1386. 650 FX 28736 FY -5286 FZ 9186
1387. 636 FY -7210 FZ 15686
1388. 615 FX 28736 FY -5286 FZ 9186
1389. 743 FY -3606 FZ 8221
1390. 736 FY -3606 FZ 8221
1391. 726 FY -3606 FZ 8221
1392. 647 FY -7210 FZ 15686
1393. 633 FY -7210 FZ 15686
1394. 622 FY -7210 FZ 15686
1395. *WIND LOAD
1396. 1 2 227 228 FZ 722
1397. 3 4 229 230 FZ 1232
1398. 58 62 284 288 FZ 1180
1399. 7 8 233 234 FZ 1345
1400. 11 12 237 238 FZ 1372
1401. 15 16 241 242 FZ 1175
1402. 19 32 245 258 FZ 670
1403. 22 23 248 249 FZ 416
1404. 26 27 252 253 FZ 250
1405. 965 972 FZ 125
1406. LOAD 23 SECCURITY - FIFTH AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
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  1407. SELFWEIGHT Y -1
  1408. JOINT LOAD
  1409. 972 FY -355 FZ 1582
  1410. 965 FY -355 FZ 1582
  1411. 746 FY -3605 FZ 8221
  1412. 733 FY -3605 FZ 8221
  1413. 723 FY -3605 FZ 8221
  1414. 650 FY -7210 FZ 15686
  1415. 636 FX 28736 FY -5286 FZ 9186
  1416. 615 FX 28736 FY -5286 FZ 9186
  1417. 743 FY -3606 FZ 8221
  1418. 736 FY -3606 FZ 8221
  1419. 726 FY -3606 FZ 8221
  1420. 647 FY -7210 FZ 15686
  1421. 633 FY -7210 FZ 15686
  1422. 622 FY -7210 FZ 15686
  1423. *WIND LOAD
  1424. 1 2 227 228 FZ 722
  1425. 3 4 229 230 FZ 1232
  1426. 58 62 284 288 FZ 1180
  1427. 7 8 233 234 FZ 1345
  1428. 11 12 237 238 FZ 1372
  1429. 15 16 241 242 FZ 1175
  1430. 19 32 245 258 FZ 670
  1431. 22 23 248 249 FZ 416
  1432. 26 27 252 253 FZ 250
  1433. 965 972 FZ 125
  1434. LOAD 24 SECCURITY - GROUND WIRE AND TOP RIGHT CONDUCTOR BROKEN
CONDITION
  1435. SELFWEIGHT Y -1
  1436. JOINT LOAD
  1437. 972 FY -355 FZ 1582
  1438. 965 FX 3090 FY -215 FZ 868
  1439. 746 FY -3605 FZ 8221
  1440. 733 FY -3605 FZ 8221
  1441. 723 FY -3605 FZ 8221
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  1442. 650 FY -7210 FZ 15686
  1443. 636 FY -7210 FZ 15686
  1444. 615 FY -7210 FZ 15686
  1445. 743 FX 15056 FY -2643 FZ 4778
  1446. 736 FY -3606 FZ 8221
  1447. 726 FY -3606 FZ 8221
  1448. 647 FY -7210 FZ 15686
  1449. 633 FY -7210 FZ 15686
  1450. 622 FY -7210 FZ 15686
  1451. *WIND LOAD
  1452. 1 2 227 228 FZ 722
  1453. 3 4 229 230 FZ 1232
  1454. 58 62 284 288 FZ 1180
  1455. 7 8 233 234 FZ 1345
  1456. 11 12 237 238 FZ 1372
  1457. 15 16 241 242 FZ 1175
  1458. 19 32 245 258 FZ 670
  1459. 22 23 248 249 FZ 416
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  1460. 26 27 252 253 FZ 250
  1461. 965 972 FZ 125
  1462. LOAD 25 SECCURITY - GROUND WIRE AND SECOND RIGHT CONDUCTOR BROKEN
CONDITION
  1463. SELFWEIGHT Y -1
  1464. JOINT LOAD
  1465. 972 FY -355 FZ 1582
  1466. 965 FX 3090 FY -215 FZ 868
  1467. 746 FY -3605 FZ 8221
  1468. 733 FY -3605 FZ 8221
  1469. 723 FY -3605 FZ 8221
  1470. 650 FY -7210 FZ 15686
  1471. 636 FY -7210 FZ 15686
  1472. 615 FY -7210 FZ 15686
  1473. 743 FY -3606 FZ 8221
  1474. 736 FX 15056 FY -2643 FZ 4778
  1475. 726 FY -3606 FZ 8221
  1476. 647 FY -7210 FZ 15686
  1477. 633 FY -7210 FZ 15686
  1478. 622 FY -7210 FZ 15686
  1479. *WIND LOAD
  1480. 1 2 227 228 FZ 722
  1481. 3 4 229 230 FZ 1232
  1482. 58 62 284 288 FZ 1180
  1483. 7 8 233 234 FZ 1345
  1484. 11 12 237 238 FZ 1372
  1485. 15 16 241 242 FZ 1175
  1486. 19 32 245 258 FZ 670
  1487. 22 23 248 249 FZ 416
  1488. 26 27 252 253 FZ 250
  1489. 965 972 FZ 125
  1490. LOAD 26 SECCURITY - GROUND WIRE AND THIRD RIGHT CONDUCTOR BROKEN
CONDITION
  1491. SELFWEIGHT Y -1
  1492. JOINT LOAD
  1493. 972 FY -355 FZ 1582
  1494. 965 FX 3090 FY -215 FZ 868
  1495. 746 FY -3605 FZ 8221
  1496. 733 FY -3605 FZ 8221
  1497. 723 FY -3605 FZ 8221
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  1498. 650 FY -7210 FZ 15686
  1499. 636 FY -7210 FZ 15686
  1500. 615 FY -7210 FZ 15686
  1501. 743 FY -3606 FZ 8221
  1502. 736 FY -3606 FZ 8221
  1503. 726 FX 15056 FY -2643 FZ 4778
  1504. 647 FY -7210 FZ 15686
  1505. 633 FY -7210 FZ 15686
  1506. 622 FY -7210 FZ 15686
  1507. *WIND LOAD
  1508. 1 2 227 228 FZ 722
  1509. 3 4 229 230 FZ 1232
  1510. 58 62 284 288 FZ 1180
  1511. 7 8 233 234 FZ 1345
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  1512. 11 12 237 238 FZ 1372
  1513. 15 16 241 242 FZ 1175
  1514. 19 32 245 258 FZ 670
  1515. 22 23 248 249 FZ 416
  1516. 26 27 252 253 FZ 250
  1517. 965 972 FZ 125
  1518. LOAD 27 SECCURITY - GROUND WIRE AND FOURTH RIGHT CONDUCTOR BROKEN
CONDITION
  1519. SELFWEIGHT Y -1
  1520. JOINT LOAD
  1521. 972 FY -355 FZ 1582
  1522. 965 FX 3090 FY -215 FZ 868
  1523. 746 FY -3605 FZ 8221
  1524. 733 FY -3605 FZ 8221
  1525. 723 FY -3605 FZ 8221
  1526. 650 FY -7210 FZ 15686
  1527. 636 FY -7210 FZ 15686
  1528. 615 FY -7210 FZ 15686
  1529. 743 FY -3606 FZ 8221
  1530. 736 FY -3606 FZ 8221
  1531. 726 FY -3606 FZ 8221
  1532. 647 FX 28736 FY -5286 FZ 9186
  1533. 633 FY -7210 FZ 15686
  1534. 622 FY -7210 FZ 15686
  1535. *WIND LOAD
  1536. 1 2 227 228 FZ 722
  1537. 3 4 229 230 FZ 1232
  1538. 58 62 284 288 FZ 1180
  1539. 7 8 233 234 FZ 1345
  1540. 11 12 237 238 FZ 1372
  1541. 15 16 241 242 FZ 1175
  1542. 19 32 245 258 FZ 670
  1543. 22 23 248 249 FZ 416
  1544. 26 27 252 253 FZ 250
  1545. 965 972 FZ 125
  1546. LOAD 28 SECCURITY - GROUND WIRE AND FIFTH RIGHT CONDUCTOR BROKEN
CONDITION
  1547. SELFWEIGHT Y -1
  1548. JOINT LOAD
  1549. 972 FY -355 FZ 1582
  1550. 965 FX 3090 FY -215 FZ 868
  1551. 746 FY -3605 FZ 8221
  1552. 733 FY -3605 FZ 8221
  1553. 723 FY -3605 FZ 8221
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  1554. 650 FY -7210 FZ 15686
  1555. 636 FY -7210 FZ 15686
  1556. 615 FY -7210 FZ 15686
  1557. 743 FY -3606 FZ 8221
  1558. 736 FY -3606 FZ 8221
  1559. 726 FY -3606 FZ 8221
  1560. 647 FY -7210 FZ 15686
  1561. 633 FX 28736 FY -5286 FZ 9186
  1562. 622 FY -7210 FZ 15686
  1563. *WIND LOAD
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  1564. 1 2 227 228 FZ 722
  1565. 3 4 229 230 FZ 1232
  1566. 58 62 284 288 FZ 1180
  1567. 7 8 233 234 FZ 1345
  1568. 11 12 237 238 FZ 1372
  1569. 15 16 241 242 FZ 1175
  1570. 19 32 245 258 FZ 670
  1571. 22 23 248 249 FZ 416
  1572. 26 27 252 253 FZ 250
  1573. 965 972 FZ 125
  1574. LOAD 29 SECCURITY - GROUND WIRE AND BOTTOM RIGHT CONDUCTOR BROKEN
CONDITION
  1575. SELFWEIGHT Y -1
  1576. JOINT LOAD
  1577. 972 FY -355 FZ 1582
  1578. 965 FX 3090 FY -215 FZ 868
  1579. 746 FY -3605 FZ 8221
  1580. 733 FY -3605 FZ 8221
  1581. 723 FY -3605 FZ 8221
  1582. 650 FY -7210 FZ 15686
  1583. 636 FY -7210 FZ 15686
  1584. 615 FY -7210 FZ 15686
  1585. 743 FY -3606 FZ 8221
  1586. 736 FY -3606 FZ 8221
  1587. 726 FY -3606 FZ 8221
  1588. 647 FY -7210 FZ 15686
  1589. 633 FY -7210 FZ 15686
  1590. 622 FX 28736 FY -5286 FZ 9186
  1591. *WIND LOAD
  1592. 1 2 227 228 FZ 722
  1593. 3 4 229 230 FZ 1232
  1594. 58 62 284 288 FZ 1180
  1595. 7 8 233 234 FZ 1345
  1596. 11 12 237 238 FZ 1372
  1597. 15 16 241 242 FZ 1175
  1598. 19 32 245 258 FZ 670
  1599. 22 23 248 249 FZ 416
  1600. 26 27 252 253 FZ 250
  1601. 965 972 FZ 125
  1602. LOAD 30 SECCURITY - FIRST AND SECOND RIGHT CONDUCTOR BROKEN CONDITION
  1603. SELFWEIGHT Y -1
  1604. JOINT LOAD
  1605. 972 FY -355 FZ 1582
  1606. 965 FY -355 FZ 1582
  1607. 746 FY -3605 FZ 8221
  1608. 733 FY -3605 FZ 8221
  1609. 723 FY -3605 FZ 8221
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  1610. 650 FY -7210 FZ 15686
  1611. 636 FY -7210 FZ 15686
  1612. 615 FY -7210 FZ 15686
  1613. 743 FX 15056 FY -2643 FZ 4778
  1614. 736 FX 15056 FY -2643 FZ 4778
  1615. 726 FY -3606 FZ 8221
  1616. 647 FY -7210 FZ 15686
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1617. 633 FY -7210 FZ 15686
1618. 622 FY -7210 FZ 15686
1619. **WIND LOAD
1620. 1 2 227 228 FZ 722
1621. 3 4 229 230 FZ 1232
1622. 58 62 284 288 FZ 1180
1623. 7 8 233 234 FZ 1345
1624. 11 12 237 238 FZ 1372
1625. 15 16 241 242 FZ 1175
1626. 19 32 245 258 FZ 670
1627. 22 23 248 249 FZ 416
1628. 26 27 252 253 FZ 250
1629. 965 972 FZ 125
1630. LOAD 31 SECCURITY - FIRST AND THIRD RIGHT CONDUCTOR BROKEN CONDITION
1631. SELFWEIGHT Y -1
1632. JOINT LOAD
1633. 972 FY -355 FZ 1582
1634. 965 FY -355 FZ 1582
1635. 746 FY -3605 FZ 8221
1636. 733 FY -3605 FZ 8221
1637. 723 FY -3605 FZ 8221
1638. 650 FY -7210 FZ 15686
1639. 636 FY -7210 FZ 15686
1640. 615 FY -7210 FZ 15686
1641. 743 FX 15056 FY -2643 FZ 4778
1642. 736 FY -3605 FZ 8221
1643. 726 FX 15056 FY -2643 FZ 4778
1644. 647 FY -7210 FZ 15686
1645. 633 FY -7210 FZ 15686
1646. 622 FY -7210 FZ 15686
1647. **WIND LOAD

1648. 1 2 227 228 FZ 722
1649. 3 4 229 230 FZ 1232
1650. 58 62 284 288 FZ 1180
1651. 7 8 233 234 FZ 1345
1652. 11 12 237 238 FZ 1372
1653. 15 16 241 242 FZ 1175
1654. 19 32 245 258 FZ 670
1655. 22 23 248 249 FZ 416
1656. 26 27 252 253 FZ 250
1657. 965 972 FZ 125
1658. LOAD 32 SECCURITY - FIRST AND FOURTH RIGHT CONDUCTOR BROKEN CONDITION
1659. SELFWEIGHT Y -1
1660. JOINT LOAD
1661. 972 FY -355 FZ 1582
1662. 965 FY -355 FZ 1582
1663. 746 FY -3605 FZ 8221
1664. 733 FY -3605 FZ 8221
1665. 723 FY -3605 FZ 8221
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1666. 650 FY -7210 FZ 15686
1667. 636 FY -7210 FZ 15686
1668. 615 FY -7210 FZ 15686
1669. 743 FX 15056 FY -2643 FZ 4778
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1670. 736 FY -3605 FZ 8221
1671. 726 FY -3605 FZ 8221
1672. 647 FX 28736 FY -5286 FZ 9186
1673. 633 FY -7210 FZ 15686
1674. 622 FY -7210 FZ 15686
1675. *WIND LOAD
1676. 1 2 227 228 FZ 722
1677. 3 4 229 230 FZ 1232
1678. 58 62 284 288 FZ 1180
1679. 7 8 233 234 FZ 1345
1680. 11 12 237 238 FZ 1372
1681. 15 16 241 242 FZ 1175
1682. 19 32 245 258 FZ 670
1683. 22 23 248 249 FZ 416
1684. 26 27 252 253 FZ 250
1685. 965 972 FZ 125
1686. LOAD 33 SECCURITY - FIRST AND FIFTH RIGHT CONDUCTOR BROKEN CONDITION
1687. SELFWEIGHT Y -1
1688. JOINT LOAD
1689. 972 FY -355 FZ 1582
1690. 965 FY -355 FZ 1582
1691. 746 FY -3605 FZ 8221
1692. 733 FY -3605 FZ 8221
1693. 723 FY -3605 FZ 8221
1694. 650 FY -7210 FZ 15686
1695. 636 FY -7210 FZ 15686
1696. 615 FY -7210 FZ 15686
1697. 743 FX 15056 FY -2643 FZ 4778
1698. 736 FY -3605 FZ 8221
1699. 726 FY -3605 FZ 8221
1700. 647 FY -7210 FZ 15686
1701. 633 FX 28736 FY -5286 FZ 9186
1702. 622 FY -7210 FZ 15686
1703. *WIND LOAD
1704. 1 2 227 228 FZ 722
1705. 3 4 229 230 FZ 1232
1706. 58 62 284 288 FZ 1180
1707. 7 8 233 234 FZ 1345
1708. 11 12 237 238 FZ 1372
1709. 15 16 241 242 FZ 1175
1710. 19 32 245 258 FZ 670
1711. 22 23 248 249 FZ 416
1712. 26 27 252 253 FZ 250
1713. 965 972 FZ 125
1714. LOAD 34 SECCURITY - FIRST AND BOTTOM RIGHT CONDUCTOR BROKEN CONDITION
1715. SELFWEIGHT Y -1
1716. JOINT LOAD
1717. 972 FY -355 FZ 1582
1718. 965 FY -355 FZ 1582
1719. 746 FY -3605 FZ 8221
1720. 733 FY -3605 FZ 8221
1721. 723 FY -3605 FZ 8221
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1722. 650 FY -7210 FZ 15686
1723. 636 FY -7210 FZ 15686
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  1724. 615 FY -7210 FZ 15686
  1725. 743 FX 15056 FY -2643 FZ 4778
  1726. 736 FY -3605 FZ 8221
  1727. 726 FY -3605 FZ 8221
  1728. 647 FY -7210 FZ 15686
  1729. 633 FY -7210 FZ 15686
  1730. 622 FX 28736 FY -5286 FZ 9186
  1731. *WIND LOAD
  1732. 1 2 227 228 FZ 722
  1733. 3 4 229 230 FZ 1232
  1734. 58 62 284 288 FZ 1180
  1735. 7 8 233 234 FZ 1345
  1736. 11 12 237 238 FZ 1372
  1737. 15 16 241 242 FZ 1175
  1738. 19 32 245 258 FZ 670
  1739. 22 23 248 249 FZ 416
  1740. 26 27 252 253 FZ 250
  1741. 965 972 FZ 125
  1742. LOAD 35 SECCURITY - SECOND AND THIRD RIGHT CONDUCTOR BROKEN CONDITION
  1743. SELFWEIGHT Y -1
  1744. JOINT LOAD
  1745. 972 FY -355 FZ 1582
  1746. 965 FY -355 FZ 1582
  1747. 746 FY -3605 FZ 8221
  1748. 733 FY -3605 FZ 8221
  1749. 723 FY -3605 FZ 8221
  1750. 650 FY -7210 FZ 15686
  1751. 636 FY -7210 FZ 15686
  1752. 615 FY -7210 FZ 15686
  1753. 743 FY -3605 FZ 8221
  1754. 736 FX 15056 FY -2643 FZ 4778
  1755. 726 FX 15056 FY -2643 FZ 4778
  1756. 647 FY -7210 FZ 15686
  1757. 633 FY -7210 FZ 15686
  1758. 622 FY -7210 FZ 15686
  1759. *WIND LOAD
  1760. 1 2 227 228 FZ 722
  1761. 3 4 229 230 FZ 1232
  1762. 58 62 284 288 FZ 1180
  1763. 7 8 233 234 FZ 1345
  1764. 11 12 237 238 FZ 1372
  1765. 15 16 241 242 FZ 1175
  1766. 19 32 245 258 FZ 670
  1767. 22 23 248 249 FZ 416
  1768. 26 27 252 253 FZ 250
  1769. 965 972 FZ 125
  1770. LOAD 36 SECCURITY - SECOND AND FOURTH RIGHT CONDUCTOR BROKEN
CONDITION
  1771. SELFWEIGHT Y -1
  1772. JOINT LOAD
  1773. 972 FY -355 FZ 1582
  1774. 965 FY -355 FZ 1582
  1775. 746 FY -3605 FZ 8221
  1776. 733 FY -3605 FZ 8221
  1777. 723 FY -3605 FZ 8221
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  1778. 650 FY -7210 FZ 15686
  1779. 636 FY -7210 FZ 15686
  1780. 615 FY -7210 FZ 15686
  1781. 743 FY -3605 FZ 8221
  1782. 736 FX 15056 FY -2643 FZ 4778
  1783. 726 FY -3605 FZ 8221
  1784. 647 FX 28736 FY -5286 FZ 9186
  1785. 633 FY -7210 FZ 15686
  1786. 622 FY -7210 FZ 15686
  1787. *WIND LOAD
  1788. 1 2 227 228 FZ 722
  1789. 3 4 229 230 FZ 1232
  1790. 58 62 284 288 FZ 1180
  1791. 7 8 233 234 FZ 1345
  1792. 11 12 237 238 FZ 1372
  1793. 15 16 241 242 FZ 1175
  1794. 19 32 245 258 FZ 670
  1795. 22 23 248 249 FZ 416
  1796. 26 27 252 253 FZ 250
  1797. 965 972 FZ 125
  1798. LOAD 37 SECCURITY - SECOND AND FIFTH RIGHT CONDUCTOR BROKEN CONDITION
  1799. SELFWEIGHT Y -1
  1800. JOINT LOAD
  1801. 972 FY -355 FZ 1582
  1802. 965 FY -355 FZ 1582
  1803. 746 FY -3605 FZ 8221
  1804. 733 FY -3605 FZ 8221
  1805. 723 FY -3605 FZ 8221
  1806. 650 FY -7210 FZ 15686
  1807. 636 FY -7210 FZ 15686
  1808. 615 FY -7210 FZ 15686
  1809. 743 FY -3605 FZ 8221
  1810. 736 FX 15056 FY -2643 FZ 4778
  1811. 726 FY -3605 FZ 8221
  1812. 647 FY -7210 FZ 15686
  1813. 633 FX 28736 FY -5286 FZ 9186
  1814. 622 FY -7210 FZ 15686
  1815. *WIND LOAD
  1816. 1 2 227 228 FZ 722
  1817. 3 4 229 230 FZ 1232
  1818. 58 62 284 288 FZ 1180
  1819. 7 8 233 234 FZ 1345
  1820. 11 12 237 238 FZ 1372
  1821. 15 16 241 242 FZ 1175
  1822. 19 32 245 258 FZ 670
  1823. 22 23 248 249 FZ 416
  1824. 26 27 252 253 FZ 250
  1825. 965 972 FZ 125
  1826. LOAD 38 SECCURITY - SECOND AND BOTTOM RIGHT CONDUCTOR BROKEN
CONDITION
  1827. SELFWEIGHT Y -1
  1828. JOINT LOAD
  1829. 972 FY -355 FZ 1582
  1830. 965 FY -355 FZ 1582
  1831. 746 FY -3605 FZ 8221
  1832. 733 FY -3605 FZ 8221
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  1833. 723 FY -3605 FZ 8221
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  1834. 650 FY -7210 FZ 15686
  1835. 636 FY -7210 FZ 15686
  1836. 615 FY -7210 FZ 15686
  1837. 743 FY -3605 FZ 8221
  1838. 736 FX 15056 FY -2643 FZ 4778
  1839. 726 FY -3605 FZ 8221
  1840. 647 FY -7210 FZ 15686
  1841. 633 FY -7210 FZ 15686
  1842. 622 FX 28736 FY -5286 FZ 9186
  1843. *WIND LOAD
  1844. 1 2 227 228 FZ 722
  1845. 3 4 229 230 FZ 1232
  1846. 58 62 284 288 FZ 1180
  1847. 7 8 233 234 FZ 1345
  1848. 11 12 237 238 FZ 1372
  1849. 15 16 241 242 FZ 1175
  1850. 19 32 245 258 FZ 670
  1851. 22 23 248 249 FZ 416
  1852. 26 27 252 253 FZ 250
  1853. 965 972 FZ 125
  1854. LOAD 39 SECCURITY - THIRD AND FOURTH RIGHT CONDUCTOR BROKEN CONDITION
  1855. SELFWEIGHT Y -1
  1856. JOINT LOAD
  1857. 972 FY -355 FZ 1582
  1858. 965 FY -355 FZ 1582
  1859. 746 FY -3605 FZ 8221
  1860. 733 FY -3605 FZ 8221
  1861. 723 FY -3605 FZ 8221
  1862. 650 FY -7210 FZ 15686
  1863. 636 FY -7210 FZ 15686
  1864. 615 FY -7210 FZ 15686
  1865. 743 FY -3605 FZ 8221
  1866. 736 FY -3605 FZ 8221
  1867. 726 FX 15056 FY -2643 FZ 4778
  1868. 647 FX 28736 FY -5286 FZ 9186
  1869. 633 FY -7210 FZ 15686
  1870. 622 FY -7210 FZ 15686
  1871. *WIND LOAD
  1872. 1 2 227 228 FZ 722
  1873. 3 4 229 230 FZ 1232
  1874. 58 62 284 288 FZ 1180
  1875. 7 8 233 234 FZ 1345
  1876. 11 12 237 238 FZ 1372
  1877. 15 16 241 242 FZ 1175
  1878. 19 32 245 258 FZ 670
  1879. 22 23 248 249 FZ 416
  1880. 26 27 252 253 FZ 250
  1881. 965 972 FZ 125
  1882. LOAD 40 SECCURITY - THIRD AND FIFTH RIGHT CONDUCTOR BROKEN CONDITION
  1883. SELFWEIGHT Y -1
  1884. JOINT LOAD
  1885. 972 FY -355 FZ 1582
  1886. 965 FY -355 FZ 1582
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  1887. 746 FY -3605 FZ 8221
  1888. 733 FY -3605 FZ 8221
  1889. 723 FY -3605 FZ 8221
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  1890. 650 FY -7210 FZ 15686
  1891. 636 FY -7210 FZ 15686
  1892. 615 FY -7210 FZ 15686
  1893. 743 FY -3605 FZ 8221
  1894. 736 FY -3605 FZ 8221
  1895. 726 FX 15056 FY -2643 FZ 4778
  1896. 647 FY -7210 FZ 15686
  1897. 633 FX 28736 FY -5286 FZ 9186
  1898. 622 FY -7210 FZ 15686
  1899. *WIND LOAD
  1900. 1 2 227 228 FZ 722
  1901. 3 4 229 230 FZ 1232
  1902. 58 62 284 288 FZ 1180
  1903. 7 8 233 234 FZ 1345
  1904. 11 12 237 238 FZ 1372
  1905. 15 16 241 242 FZ 1175
  1906. 19 32 245 258 FZ 670
  1907. 22 23 248 249 FZ 416
  1908. 26 27 252 253 FZ 250
  1909. 965 972 FZ 125
  1910. LOAD 41 SECCURITY - THIRD AND BOTTOM RIGHT CONDUCTOR BROKEN CONDITION
  1911. SELFWEIGHT Y -1
  1912. JOINT LOAD
  1913. 972 FY -355 FZ 1582
  1914. 965 FY -355 FZ 1582
  1915. 746 FY -3605 FZ 8221
  1916. 733 FY -3605 FZ 8221
  1917. 723 FY -3605 FZ 8221
  1918. 650 FY -7210 FZ 15686
  1919. 636 FY -7210 FZ 15686
  1920. 615 FY -7210 FZ 15686
  1921. 743 FY -3605 FZ 8221
  1922. 736 FY -3605 FZ 8221
  1923. 726 FX 15056 FY -2643 FZ 4778
  1924. 647 FY -7210 FZ 15686
  1925. 633 FY -7210 FZ 15686
  1926. 622 FX 28736 FY -5286 FZ 9186

  1927. *WIND LOAD
  1928. 1 2 227 228 FZ 722
  1929. 3 4 229 230 FZ 1232
  1930. 58 62 284 288 FZ 1180
  1931. 7 8 233 234 FZ 1345
  1932. 11 12 237 238 FZ 1372
  1933. 15 16 241 242 FZ 1175
  1934. 19 32 245 258 FZ 670
  1935. 22 23 248 249 FZ 416
  1936. 26 27 252 253 FZ 250
  1937. 965 972 FZ 125
  1938. LOAD 42 SECCURITY - FOURTH AND FIFTH RIGHT CONDUCTOR BROKEN CONDITION
  1939. SELFWEIGHT Y -1
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  1940. JOINT LOAD
  1941. 972 FY -355 FZ 1582
  1942. 965 FY -355 FZ 1582
  1943. 746 FY -3605 FZ 8221
  1944. 733 FY -3605 FZ 8221
  1945. 723 FY -3605 FZ 8221
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  1946. 650 FY -7210 FZ 15686
  1947. 636 FY -7210 FZ 15686
  1948. 615 FY -7210 FZ 15686
  1949. 743 FY -3605 FZ 8221
  1950. 736 FY -3605 FZ 8221
  1951. 726 FY -3605 FZ 8221
  1952. 647 FX 28736 FY -5286 FZ 9186
  1953. 633 FX 28736 FY -5286 FZ 9186
  1954. 622 FY -7210 FZ 15686
  1955. *WIND LOAD
  1956. 1 2 227 228 FZ 722
  1957. 3 4 229 230 FZ 1232
  1958. 58 62 284 288 FZ 1180
  1959. 7 8 233 234 FZ 1345
  1960. 11 12 237 238 FZ 1372
  1961. 15 16 241 242 FZ 1175
  1962. 19 32 245 258 FZ 670
  1963. 22 23 248 249 FZ 416
  1964. 26 27 252 253 FZ 250
  1965. 965 972 FZ 125
  1966. LOAD 43 SECCURITY - FOURTH AND BOTTOM RIGHT CONDUCTOR BROKEN
CONDITION
  1967. SELFWEIGHT Y -1
  1968. JOINT LOAD
  1969. 972 FY -355 FZ 1582
  1970. 965 FY -355 FZ 1582
  1971. 746 FY -3605 FZ 8221
  1972. 733 FY -3605 FZ 8221
  1973. 723 FY -3605 FZ 8221
  1974. 650 FY -7210 FZ 15686
  1975. 636 FY -7210 FZ 15686
  1976. 615 FY -7210 FZ 15686
  1977. 743 FY -3605 FZ 8221
  1978. 736 FY -3605 FZ 8221
  1979. 726 FY -3605 FZ 8221
  1980. 647 FX 28736 FY -5286 FZ 9186
  1981. 633 FY -7210 FZ 15686
  1982. 622 FX 28736 FY -5286 FZ 9186
  1983. **WIND LOAD
  1984. 1 2 227 228 FZ 722
  1985. 3 4 229 230 FZ 1232
  1986. 58 62 284 288 FZ 1180
  1987. 7 8 233 234 FZ 1345
  1988. 11 12 237 238 FZ 1372
  1989. 15 16 241 242 FZ 1175
  1990. 19 32 245 258 FZ 670
  1991. 22 23 248 249 FZ 416
  1992. 26 27 252 253 FZ 250
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1993. 965 972 FZ 125
1994. LOAD 44 SECCURITY - FIFTH AND BOTTOM RIGHT CONDUCTOR BROKEN CONDITION
1995. SELFWEIGHT Y -1
1996. JOINT LOAD
1997. 972 FY -355 FZ 1582
1998. 965 FY -355 FZ 1582
1999. 746 FY -3605 FZ 8221
2000. 733 FY -3605 FZ 8221
2001. 723 FY -3605 FZ 8221


2002. 650 FY -7210 FZ 15686
2003. 636 FY -7210 FZ 15686
2004. 615 FY -7210 FZ 15686
2005. 743 FY -3605 FZ 8221
2006. 736 FY -3605 FZ 8221
2007. 726 FY -3605 FZ 8221
2008. 647 FY -7210 FZ 15686
2009. 633 FX 28736 FY -5286 FZ 9186
2010. 622 FX 28736 FY -5286 FZ 9186
2011. **WIND LOAD
2012. 1 2 227 228 FZ 722
2013. 3 4 229 230 FZ 1232
2014. 58 62 284 288 FZ 1180
2015. 7 8 233 234 FZ 1345
2016. 11 12 237 238 FZ 1372
2017. 15 16 241 242 FZ 1175
2018. 19 32 245 258 FZ 670
2019. 22 23 248 249 FZ 416
2020. 26 27 252 253 FZ 250
2021. 965 972 FZ 125
2022. LOAD 101 SAFETY - GROUND WIRE AND TOP LEFT CONDUCTOR BROKEN CONDITION
2023. SELFWEIGHT Y -1
2024. JOINT LOAD
2025. 972 FX 910 FY -863 FZ 317
2026. 965 FX 1213 FY -583 FZ 159
2027. 746 FX 7230 FY -5949 FZ 944
2028. 733 FX 5423 FY -7873 FZ 1888
2029. 723 FX 5423 FY -7873 FZ 1888
2030. 650 FX 10845 FY -15082 FZ 3775
2031. 636 FX 10845 FY -15082 FZ 3775
2032. 615 FX 10845 FY -15082 FZ 3775
2033. 743 FX 5423 FY -7873 FZ 1888
2034. 736 FX 5423 FY -7873 FZ 1888
2035. 726 FX 5423 FY -7873 FZ 1888
2036. 647 FX 10845 FY -15082 FZ 3775
2037. 633 FX 10845 FY -15082 FZ 3775
2038. 622 FX 10845 FY -15082 FZ 3775
2039. LOAD 102 SAFETY - GROUND WIRE AND SECOND LEFT CONDUCTOR BROKEN CONDITION
2040. SELFWEIGHT Y -1
2041. JOINT LOAD
2042. 972 FX 910 FY -863 FZ 317
2043. 965 FX 1213 FY -583 FZ 159
2044. 746 FX 5423 FY -7873 FZ 1888
2045. 733 FX 7230 FY -5949 FZ 944

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  2046. 723 FX 5423 FY -7873 FZ 1888
  2047. 650 FX 10845 FY -15082 FZ 3775
  2048. 636 FX 10845 FY -15082 FZ 3775
  2049. 615 FX 10845 FY -15082 FZ 3775
  2050. 743 FX 5423 FY -7873 FZ 1888
  2051. 736 FX 5423 FY -7873 FZ 1888
  2052. 726 FX 5423 FY -7873 FZ 1888
  2053. 647 FX 10845 FY -15082 FZ 3775
  2054. 633 FX 10845 FY -15082 FZ 3775
  2055. 622 FX 10845 FY -15082 FZ 3775
  2056. LOAD 103 SAFETY - GROUND WIRE AND THIRD LEFT CONDUCTOR BROKEN
CONDITION
  2057. SELFWEIGHT Y -1
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  2058. JOINT LOAD
  2059. 972 FX 910 FY -863 FZ 317
  2060. 965 FX 1213 FY -583 FZ 159
  2061. 746 FX 5423 FY -7873 FZ 1888
  2062. 733 FX 5423 FY -7873 FZ 1888
  2063. 723 FX 7230 FY -5949 FZ 944
  2064. 650 FX 10845 FY -15082 FZ 3775
  2065. 636 FX 10845 FY -15082 FZ 3775
  2066. 615 FX 10845 FY -15082 FZ 3775
  2067. 743 FX 5423 FY -7873 FZ 1888
  2068. 736 FX 5423 FY -7873 FZ 1888
  2069. 726 FX 5423 FY -7873 FZ 1888
  2070. 647 FX 10845 FY -15082 FZ 3775
  2071. 633 FX 10845 FY -15082 FZ 3775
  2072. 622 FX 10845 FY -15082 FZ 3775
  2073. LOAD 104 SAFETY - GROUND WIRE AND FOURTH LEFT CONDUCTOR BROKEN
CONDITION
  2074. SELFWEIGHT Y -1
  2075. JOINT LOAD
  2076. 972 FX 910 FY -863 FZ 317
  2077. 965 FX 1213 FY -583 FZ 159
  2078. 746 FX 5423 FY -7873 FZ 1888
  2079. 733 FX 5423 FY -7873 FZ 1888
  2080. 723 FX 5423 FY -7873 FZ 1888
  2081. 650 FX 14460 FY -11235 FZ 1888
  2082. 636 FX 10845 FY -15082 FZ 3775
  2083. 615 FX 10845 FY -15082 FZ 3775
  2084. 743 FX 5423 FY -7873 FZ 1888
  2085. 736 FX 5423 FY -7873 FZ 1888
  2086. 726 FX 5423 FY -7873 FZ 1888
  2087. 647 FX 10845 FY -15082 FZ 3775
  2088. 633 FX 10845 FY -15082 FZ 3775
  2089. 622 FX 10845 FY -15082 FZ 3775
  2090. LOAD 105 SAFETY - GROUND WIRE AND FIFTH LEFT CONDUCTOR BROKEN
CONDITION
  2091. SELFWEIGHT Y -1
  2092. JOINT LOAD
  2093. 972 FX 910 FY -863 FZ 317
  2094. 965 FX 1213 FY -583 FZ 159
  2095. 746 FX 5423 FY -7873 FZ 1888
  2096. 733 FX 5423 FY -7873 FZ 1888
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  2097. 723 FX 5423 FY -7873 FZ 1888
  2098. 650 FX 10845 FY -15082 FZ 3775
  2099. 636 FX 14460 FY -11235 FZ 1888
  2100. 615 FX 10845 FY -15082 FZ 3775
  2101. 743 FX 5423 FY -7873 FZ 1888
  2102. 736 FX 5423 FY -7873 FZ 1888
  2103. 726 FX 5423 FY -7873 FZ 1888
  2104. 647 FX 10845 FY -15082 FZ 3775
  2105. 633 FX 10845 FY -15082 FZ 3775
  2106. 622 FX 10845 FY -15082 FZ 3775
  2107. LOAD 106 SAFETY - GROUND WIRE AND BOTTOM LEFT CONDUCTOR BROKEN
CONDITION
  2108. SELFWEIGHT Y -1
  2109. JOINT LOAD
  2110. 972 FX 910 FY -863 FZ 317
  2111. 965 FX 1213 FY -583 FZ 159
  2112. 746 FX 5423 FY -7873 FZ 1888
  2113. 733 FX 5423 FY -7873 FZ 1888
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  2114. 723 FX 5423 FY -7873 FZ 1888
  2115. 650 FX 10845 FY -15082 FZ 3775
  2116. 636 FX 10845 FY -15082 FZ 3775
  2117. 615 FX 14460 FY -11235 FZ 1888
  2118. 743 FX 5423 FY -7873 FZ 1888
  2119. 736 FX 5423 FY -7873 FZ 1888
  2120. 726 FX 5423 FY -7873 FZ 1888
  2121. 647 FX 10845 FY -15082 FZ 3775
  2122. 633 FX 10845 FY -15082 FZ 3775
  2123. 622 FX 10845 FY -15082 FZ 3775
  2124. LOAD 107 SAFETY - FIRSTE AND SECOND LEFT CONDUCTOR BROKEN CONDITION
  2125. SELFWEIGHT Y -1
  2126. JOINT LOAD
  2127. 972 FX 910 FY -863 FZ 317
  2128. 965 FX 910 FY -863 FZ 317
  2129. 746 FX 7230 FY -5949 FZ 944
  2130. 733 FX 7230 FY -5949 FZ 944
  2131. 723 FX 5423 FY -7873 FZ 1888
  2132. 650 FX 10845 FY -15082 FZ 3775
  2133. 636 FX 10845 FY -15082 FZ 3775
  2134. 615 FX 10845 FY -15082 FZ 3775
  2135. 743 FX 5423 FY -7873 FZ 1888
  2136. 736 FX 5423 FY -7873 FZ 1888
  2137. 726 FX 5423 FY -7873 FZ 1888
  2138. 647 FX 10845 FY -15082 FZ 3775
  2139. 633 FX 10845 FY -15082 FZ 3775
  2140. 622 FX 10845 FY -15082 FZ 3775
  2141. LOAD 108 SAFETY - FIRSTE AND THIRD LEFT CONDUCTOR BROKEN CONDITION
  2142. SELFWEIGHT Y -1
  2143. JOINT LOAD
  2144. 972 FX 910 FY -863 FZ 317
  2145. 965 FX 910 FY -863 FZ 317
  2146. 746 FX 7230 FY -5949 FZ 944
  2147. 733 FX 5423 FY -7873 FZ 1888
  2148. 723 FX 7230 FY -5949 FZ 944
  2149. 650 FX 10845 FY -15082 FZ 3775
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2150. 636 FX 10845 FY -15082 FZ 3775
2151. 615 FX 10845 FY -15082 FZ 3775
2152. 743 FX 5423 FY -7873 FZ 1888
2153. 736 FX 5423 FY -7873 FZ 1888
2154. 726 FX 5423 FY -7873 FZ 1888
2155. 647 FX 10845 FY -15082 FZ 3775
2156. 633 FX 10845 FY -15082 FZ 3775
2157. 622 FX 10845 FY -15082 FZ 3775
2158. LOAD 109 SAFETY - FIRSTE AND FOURTH LEFT CONDUCTOR BROKEN CONDITION
2159. SELFWEIGHT Y -1
2160. JOINT LOAD
2161. 972 FX 910 FY -863 FZ 317
2162. 965 FX 910 FY -863 FZ 317
2163. 746 FX 7230 FY -5949 FZ 944
2164. 733 FX 5423 FY -7873 FZ 1888
2165. 723 FX 5423 FY -7873 FZ 1888
2166. 650 FX 14460 FY -11235 FZ 1888
2167. 636 FX 10845 FY -15082 FZ 3775
2168. 615 FX 10845 FY -15082 FZ 3775
2169. 743 FX 5423 FY -7873 FZ 1888



2170. 736 FX 5423 FY -7873 FZ 1888
2171. 726 FX 5423 FY -7873 FZ 1888
2172. 647 FX 10845 FY -15082 FZ 3775
2173. 633 FX 10845 FY -15082 FZ 3775
2174. 622 FX 10845 FY -15082 FZ 3775
2175. LOAD 110 SAFETY - FIRSTE AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
2176. SELFWEIGHT Y -1
2177. JOINT LOAD
2178. 972 FX 910 FY -863 FZ 317
2179. 965 FX 910 FY -863 FZ 317
2180. 746 FX 7230 FY -5949 FZ 944
2181. 733 FX 5423 FY -7873 FZ 1888
2182. 723 FX 5423 FY -7873 FZ 1888
2183. 650 FX 10845 FY -15082 FZ 3775
2184. 636 FX 14460 FY -11235 FZ 1888
2185. 615 FX 10845 FY -15082 FZ 3775
2186. 743 FX 5423 FY -7873 FZ 1888
2187. 736 FX 5423 FY -7873 FZ 1888
2188. 726 FX 5423 FY -7873 FZ 1888
2189. 647 FX 10845 FY -15082 FZ 3775
2190. 633 FX 10845 FY -15082 FZ 3775
2191. 622 FX 10845 FY -15082 FZ 3775
2192. LOAD 111 SAFETY - FIRSTE AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
2193. SELFWEIGHT Y -1
2194. JOINT LOAD
2195. 972 FX 910 FY -863 FZ 317
2196. 965 FX 910 FY -863 FZ 317
2197. 746 FX 7230 FY -5949 FZ 944
2198. 733 FX 5423 FY -7873 FZ 1888
2199. 723 FX 5423 FY -7873 FZ 1888
2200. 650 FX 10845 FY -15082 FZ 3775
2201. 636 FX 10845 FY -15082 FZ 3775

2202. 615 FX 14460 FY -11235 FZ 1888
2203. 743 FX 5423 FY -7873 FZ 1888
2204. 736 FX 5423 FY -7873 FZ 1888
2205. 726 FX 5423 FY -7873 FZ 1888
2206. 647 FX 10845 FY -15082 FZ 3775
2207. 633 FX 10845 FY -15082 FZ 3775
2208. 622 FX 10845 FY -15082 FZ 3775
2209. LOAD 112 SAFETY - SECOND AND THIRD LEFT CONDUCTOR BROKEN CONDITION
2210. SELFWEIGHT Y -1
2211. JOINT LOAD
2212. 972 FX 910 FY -863 FZ 317
2213. 965 FX 910 FY -863 FZ 317
2214. 746 FX 5423 FY -7873 FZ 1888
2215. 733 FX 7230 FY -5949 FZ 944
2216. 723 FX 7230 FY -5949 FZ 944
2217. 650 FX 10845 FY -15082 FZ 3775
2218. 636 FX 10845 FY -15082 FZ 3775
2219. 615 FX 10845 FY -15082 FZ 3775
2220. 743 FX 5423 FY -7873 FZ 1888
2221. 736 FX 5423 FY -7873 FZ 1888
2222. 726 FX 5423 FY -7873 FZ 1888
2223. 647 FX 10845 FY -15082 FZ 3775
2224. 633 FX 10845 FY -15082 FZ 3775
2225. 622 FX 10845 FY -15082 FZ 3775


2226. LOAD 113 SAFETY - SECOND AND FOURTH LEFT CONDUCTOR BROKEN CONDITION
2227. SELFWEIGHT Y -1
2228. JOINT LOAD
2229. 972 FX 910 FY -863 FZ 317
2230. 965 FX 910 FY -863 FZ 317
2231. 746 FX 5423 FY -7873 FZ 1888
2232. 733 FX 7230 FY -5949 FZ 944
2233. 723 FX 5423 FY -7873 FZ 1888
2234. 650 FX 14460 FY -11235 FZ 1888
2235. 636 FX 10845 FY -15082 FZ 3775
2236. 615 FX 10845 FY -15082 FZ 3775
2237. 743 FX 5423 FY -7873 FZ 1888
2238. 736 FX 5423 FY -7873 FZ 1888
2239. 726 FX 5423 FY -7873 FZ 1888
2240. 647 FX 10845 FY -15082 FZ 3775
2241. 633 FX 10845 FY -15082 FZ 3775
2242. 622 FX 10845 FY -15082 FZ 3775
2243. LOAD 114 SAFETY - SECOND AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
2244. SELFWEIGHT Y -1
2245. JOINT LOAD
2246. 972 FX 910 FY -863 FZ 317
2247. 965 FX 910 FY -863 FZ 317
2248. 746 FX 5423 FY -7873 FZ 1888
2249. 733 FX 7230 FY -5949 FZ 944
2250. 723 FX 5423 FY -7873 FZ 1888
2251. 650 FX 10845 FY -15082 FZ 3775
2252. 636 FX 14460 FY -11235 FZ 1888
2253. 615 FX 10845 FY -15082 FZ 3775
2254. 743 FX 5423 FY -7873 FZ 1888
2255. 736 FX 5423 FY -7873 FZ 1888

2256. 726 FX 5423 FY -7873 FZ 1888
2257. 647 FX 10845 FY -15082 FZ 3775
2258. 633 FX 10845 FY -15082 FZ 3775
2259. 622 FX 10845 FY -15082 FZ 3775
2260. LOAD 115 SAFETY - SECOND AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
2261. SELFWEIGHT Y -1
2262. JOINT LOAD
2263. 972 FX 910 FY -863 FZ 317
2264. 965 FX 910 FY -863 FZ 317
2265. 746 FX 5423 FY -7873 FZ 1888
2266. 733 FX 7230 FY -5949 FZ 944
2267. 723 FX 5423 FY -7873 FZ 1888
2268. 650 FX 10845 FY -15082 FZ 3775
2269. 636 FX 10845 FY -15082 FZ 3775
2270. 615 FX 14460 FY -11235 FZ 1888
2271. 743 FX 5423 FY -7873 FZ 1888
2272. 736 FX 5423 FY -7873 FZ 1888
2273. 726 FX 5423 FY -7873 FZ 1888
2274. 647 FX 10845 FY -15082 FZ 3775
2275. 633 FX 10845 FY -15082 FZ 3775
2276. 622 FX 10845 FY -15082 FZ 3775
2277. LOAD 116 SAFETY - THIRD AND FOURTH LEFT CONDUCTOR BROKEN CONDITION
2278. SELFWEIGHT Y -1
2279. JOINT LOAD
2280. 972 FX 910 FY -863 FZ 317
2281. 965 FX 910 FY -863 FZ 317


2282. 746 FX 5423 FY -7873 FZ 1888
2283. 733 FX 5423 FY -7873 FZ 1888
2284. 723 FX 7230 FY -5949 FZ 944
2285. 650 FX 14460 FY -11235 FZ 1888
2286. 636 FX 10845 FY -15082 FZ 3775
2287. 615 FX 10845 FY -15082 FZ 3775
2288. 743 FX 5423 FY -7873 FZ 1888
2289. 736 FX 5423 FY -7873 FZ 1888
2290. 726 FX 5423 FY -7873 FZ 1888
2291. 647 FX 10845 FY -15082 FZ 3775
2292. 633 FX 10845 FY -15082 FZ 3775
2293. 622 FX 10845 FY -15082 FZ 3775
2294. LOAD 117 SAFETY - THIRD AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
2295. SELFWEIGHT Y -1
2296. JOINT LOAD
2297. 972 FX 910 FY -863 FZ 317
2298. 965 FX 910 FY -863 FZ 317
2299. 746 FX 5423 FY -7873 FZ 1888
2300. 733 FX 5423 FY -7873 FZ 1888
2301. 723 FX 7230 FY -5949 FZ 944
2302. 650 FX 10845 FY -15082 FZ 3775
2303. 636 FX 14460 FY -11235 FZ 1888
2304. 615 FX 10845 FY -15082 FZ 3775
2305. 743 FX 5423 FY -7873 FZ 1888
2306. 736 FX 5423 FY -7873 FZ 1888
2307. 726 FX 5423 FY -7873 FZ 1888
2308. 647 FX 10845 FY -15082 FZ 3775
2309. 633 FX 10845 FY -15082 FZ 3775

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  2310. 622 FX 10845 FY -15082 FZ 3775
  2311. LOAD 118 SAFETY - THIRD AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
  2312. SELFWEIGHT Y -1
  2313. JOINT LOAD
  2314. 972 FX 910 FY -863 FZ 317
  2315. 965 FX 910 FY -863 FZ 317
  2316. 746 FX 5423 FY -7873 FZ 1888
  2317. 733 FX 5423 FY -7873 FZ 1888
  2318. 723 FX 7230 FY -5949 FZ 944
  2319. 650 FX 10845 FY -15082 FZ 3775
  2320. 636 FX 10845 FY -15082 FZ 3775
  2321. 615 FX 14460 FY -11235 FZ 1888
  2322. 743 FX 5423 FY -7873 FZ 1888
  2323. 736 FX 5423 FY -7873 FZ 1888
  2324. 726 FX 5423 FY -7873 FZ 1888
  2325. 647 FX 10845 FY -15082 FZ 3775
  2326. 633 FX 10845 FY -15082 FZ 3775
  2327. 622 FX 10845 FY -15082 FZ 3775
  2328. LOAD 119 SAFETY - FOURTH AND FIFTH LEFT CONDUCTOR BROKEN CONDITION
  2329. SELFWEIGHT Y -1
  2330. JOINT LOAD
  2331. 972 FX 910 FY -863 FZ 317
  2332. 965 FX 910 FY -863 FZ 317
  2333. 746 FX 5423 FY -7873 FZ 1888
  2334. 733 FX 5423 FY -7873 FZ 1888
  2335. 723 FX 5423 FY -7873 FZ 1888
  2336. 650 FX 14460 FY -11235 FZ 1888
  2337. 636 FX 14460 FY -11235 FZ 1888
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  2338. 615 FX 10845 FY -15082 FZ 3775
  2339. 743 FX 5423 FY -7873 FZ 1888
  2340. 736 FX 5423 FY -7873 FZ 1888
  2341. 726 FX 5423 FY -7873 FZ 1888
  2342. 647 FX 10845 FY -15082 FZ 3775
  2343. 633 FX 10845 FY -15082 FZ 3775
  2344. 622 FX 10845 FY -15082 FZ 3775
  2345. LOAD 120 SAFETY - FOURTH AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
  2346. SELFWEIGHT Y -1
  2347. JOINT LOAD
  2348. 972 FX 910 FY -863 FZ 317
  2349. 965 FX 910 FY -863 FZ 317
  2350. 746 FX 5423 FY -7873 FZ 1888
  2351. 733 FX 5423 FY -7873 FZ 1888
  2352. 723 FX 5423 FY -7873 FZ 1888
  2353. 650 FX 14460 FY -11235 FZ 1888
  2354. 636 FX 10845 FY -15082 FZ 3775
  2355. 615 FX 14460 FY -11235 FZ 1888
  2356. 743 FX 5423 FY -7873 FZ 1888
  2357. 736 FX 5423 FY -7873 FZ 1888
  2358. 726 FX 5423 FY -7873 FZ 1888
  2359. 647 FX 10845 FY -15082 FZ 3775
  2360. 633 FX 10845 FY -15082 FZ 3775
  2361. 622 FX 10845 FY -15082 FZ 3775
  2362. LOAD 121 SAFETY - FIFTH AND BOTTOM LEFT CONDUCTOR BROKEN CONDITION
  2363. SELFWEIGHT Y -1
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  2364. JOINT LOAD
  2365. 972 FX 910 FY -863 FZ 317
  2366. 965 FX 910 FY -863 FZ 317
  2367. 746 FX 5423 FY -7873 FZ 1888
  2368. 733 FX 5423 FY -7873 FZ 1888
  2369. 723 FX 5423 FY -7873 FZ 1888
  2370. 650 FX 10845 FY -15082 FZ 3775
  2371. 636 FX 14460 FY -11235 FZ 1888
  2372. 615 FX 14460 FY -11235 FZ 1888
  2373. 743 FX 5423 FY -7873 FZ 1888
  2374. 736 FX 5423 FY -7873 FZ 1888
  2375. 726 FX 5423 FY -7873 FZ 1888
  2376. 647 FX 10845 FY -15082 FZ 3775
  2377. 633 FX 10845 FY -15082 FZ 3775
  2378. 622 FX 10845 FY -15082 FZ 3775
  2379. LOAD 122 SAFETY - GROUND WIRE AND TOP RIGHT CONDUCTOR BROKEN
CONDITION
  2380. SELFWEIGHT Y -1
  2381. JOINT LOAD
  2382. 972 FX 1213 FY -583 FZ 159
  2383. 965 FX 910 FY -863 FZ 317
  2384. 746 FX 5423 FY -7873 FZ 1888
  2385. 733 FX 5423 FY -7873 FZ 1888
  2386. 723 FX 5423 FY -7873 FZ 1888
  2387. 650 FX 10845 FY -15082 FZ 3775
  2388. 636 FX 10845 FY -15082 FZ 3775
  2389. 615 FX 10845 FY -15082 FZ 3775
  2390. 743 FX 7230 FY -5949 FZ 944
  2391. 736 FX 5423 FY -7873 FZ 1888
  2392. 726 FX 5423 FY -7873 FZ 1888
  2393. 647 FX 10845 FY -15082 FZ 3775
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  2394. 633 FX 10845 FY -15082 FZ 3775
  2395. 622 FX 10845 FY -15082 FZ 3775
  2396. LOAD 123 SAFETY - GROUND WIRE AND SECOND RIGHT CONDUCTOR BROKEN
CONDITION
  2397. SELFWEIGHT Y -1
  2398. JOINT LOAD
  2399. 972 FX 1213 FY -583 FZ 159
  2400. 965 FX 910 FY -863 FZ 317
  2401. 746 FX 5423 FY -7873 FZ 1888
  2402. 733 FX 5423 FY -7873 FZ 1888
  2403. 723 FX 5423 FY -7873 FZ 1888
  2404. 650 FX 10845 FY -15082 FZ 3775
  2405. 636 FX 10845 FY -15082 FZ 3775
  2406. 615 FX 10845 FY -15082 FZ 3775
  2407. 743 FX 5423 FY -7873 FZ 1888
  2408. 736 FX 7230 FY -5949 FZ 944
  2409. 726 FX 5423 FY -7873 FZ 1888
  2410. 647 FX 10845 FY -15082 FZ 3775
  2411. 633 FX 10845 FY -15082 FZ 3775
  2412. 622 FX 10845 FY -15082 FZ 3775
  2413. LOAD 124 SAFETY - GROUND WIRE AND THIRD RIGHT CONDUCTOR BROKEN
CONDITION
  2414. SELFWEIGHT Y -1
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  2415. JOINT LOAD
  2416. 972 FX 1213 FY -583 FZ 159
  2417. 965 FX 910 FY -863 FZ 317
  2418. 746 FX 5423 FY -7873 FZ 1888
  2419. 733 FX 5423 FY -7873 FZ 1888
  2420. 723 FX 5423 FY -7873 FZ 1888
  2421. 650 FX 10845 FY -15082 FZ 3775
  2422. 636 FX 10845 FY -15082 FZ 3775
  2423. 615 FX 10845 FY -15082 FZ 3775
  2424. 743 FX 5423 FY -7873 FZ 1888
  2425. 736 FX 7230 FY -5949 FZ 944
  2426. 726 FX 5423 FY -7873 FZ 1888
  2427. 647 FX 10845 FY -15082 FZ 3775
  2428. 633 FX 10845 FY -15082 FZ 3775
  2429. 622 FX 10845 FY -15082 FZ 3775
  2430. LOAD 125 SAFETY - GROUND WIRE AND FOURTH RIGHT CONDUCTOR BROKEN
CONDITION
  2431. SELFWEIGHT Y -1
  2432. JOINT LOAD
  2433. 972 FX 1213 FY -583 FZ 159
  2434. 965 FX 910 FY -863 FZ 317
  2435. 746 FX 5423 FY -7873 FZ 1888
  2436. 733 FX 5423 FY -7873 FZ 1888
  2437. 723 FX 5423 FY -7873 FZ 1888
  2438. 650 FX 10845 FY -15082 FZ 3775
  2439. 636 FX 10845 FY -15082 FZ 3775
  2440. 615 FX 10845 FY -15082 FZ 3775
  2441. 743 FX 5423 FY -7873 FZ 1888
  2442. 736 FX 5423 FY -7873 FZ 1888
  2443. 726 FX 5423 FY -7873 FZ 1888
  2444. 647 FX 14460 FY -11235 FZ 1888
  2445. 633 FX 10845 FY -15082 FZ 3775
  2446. 622 FX 10845 FY -15082 FZ 3775
  2447. LOAD 126 SAFETY - GROUND WIRE AND FIFTH RIGHT CONDUCTOR BROKEN
CONDITION
  2448. SELFWEIGHT Y -1
  2449. JOINT LOAD
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  2450. 972 FX 1213 FY -583 FZ 159
  2451. 965 FX 910 FY -863 FZ 317
  2452. 746 FX 5423 FY -7873 FZ 1888
  2453. 733 FX 5423 FY -7873 FZ 1888
  2454. 723 FX 5423 FY -7873 FZ 1888
  2455. 650 FX 10845 FY -15082 FZ 3775
  2456. 636 FX 10845 FY -15082 FZ 3775
  2457. 615 FX 10845 FY -15082 FZ 3775
  2458. 743 FX 5423 FY -7873 FZ 1888
  2459. 736 FX 5423 FY -7873 FZ 1888
  2460. 726 FX 5423 FY -7873 FZ 1888
  2461. 647 FX 10845 FY -15082 FZ 3775
  2462. 633 FX 14460 FY -11235 FZ 1888
  2463. 622 FX 10845 FY -15082 FZ 3775
  2464. LOAD 127 SAFETY - GROUND WIRE AND FIFTH RIGHT CONDUCTOR BROKEN
CONDITION
  2465. SELFWEIGHT Y -1
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2466. JOINT LOAD
2467. 972 FX 1213 FY -583 FZ 159
2468. 965 FX 910 FY -863 FZ 317
2469. 746 FX 5423 FY -7873 FZ 1888
2470. 733 FX 5423 FY -7873 FZ 1888
2471. 723 FX 5423 FY -7873 FZ 1888
2472. 650 FX 10845 FY -15082 FZ 3775
2473. 636 FX 10845 FY -15082 FZ 3775
2474. 615 FX 10845 FY -15082 FZ 3775
2475. 743 FX 5423 FY -7873 FZ 1888
2476. 736 FX 5423 FY -7873 FZ 1888
2477. 726 FX 5423 FY -7873 FZ 1888
2478. 647 FX 10845 FY -15082 FZ 3775
2479. 633 FX 10845 FY -15082 FZ 3775
2480. 622 FX 14460 FY -11235 FZ 1888
2481. LOAD 128 SAFETY - FIRST AND SECOND RIGHT CONDUCTOR BROKEN CONDITION
2482. SELFWEIGHT Y -1
2483. JOINT LOAD
2484. 972 FX 910 FY -863 FZ 317
2485. 965 FX 910 FY -863 FZ 317
2486. 746 FX 5423 FY -7873 FZ 1888
2487. 733 FX 5423 FY -7873 FZ 1888
2488. 723 FX 5423 FY -7873 FZ 1888
2489. 650 FX 10845 FY -15082 FZ 3775
2490. 636 FX 10845 FY -15082 FZ 3775
2491. 615 FX 10845 FY -15082 FZ 3775
2492. 743 FX 7230 FY -5949 FZ 944
2493. 736 FX 7230 FY -5949 FZ 944
2494. 726 FX 5423 FY -7873 FZ 1888
2495. 647 FX 10845 FY -15082 FZ 3775
2496. 633 FX 10845 FY -15082 FZ 3775
2497. 622 FX 10845 FY -15082 FZ 3775
2498. LOAD 129 SAFETY - FIRST AND THIRD RIGHT CONDUCTOR BROKEN CONDITION
2499. SELFWEIGHT Y -1
2500. JOINT LOAD
2501. 972 FX 910 FY -863 FZ 317
2502. 965 FX 910 FY -863 FZ 317
2503. 746 FX 5423 FY -7873 FZ 1888
2504. 733 FX 5423 FY -7873 FZ 1888
2505. 723 FX 5423 FY -7873 FZ 1888


2506. 650 FX 10845 FY -15082 FZ 3775
2507. 636 FX 10845 FY -15082 FZ 3775
2508. 615 FX 10845 FY -15082 FZ 3775
2509. 743 FX 7230 FY -5949 FZ 944
2510. 736 FX 5423 FY -7873 FZ 1888
2511. 726 FX 7230 FY -5949 FZ 944
2512. 647 FX 10845 FY -15082 FZ 3775
2513. 633 FX 10845 FY -15082 FZ 3775
2514. 622 FX 10845 FY -15082 FZ 3775
2515. LOAD 130 SAFETY - FIRST AND FOURTH RIGHT CONDUCTOR BROKEN CONDITION
2516. SELFWEIGHT Y -1
2517. JOINT LOAD
2518. 972 FX 910 FY -863 FZ 317
2519. 965 FX 910 FY -863 FZ 317

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2520. 746 FX 5423 FY -7873 FZ 1888
2521. 733 FX 5423 FY -7873 FZ 1888
2522. 723 FX 5423 FY -7873 FZ 1888
2523. 650 FX 10845 FY -15082 FZ 3775
2524. 636 FX 10845 FY -15082 FZ 3775
2525. 615 FX 10845 FY -15082 FZ 3775
2526. 743 FX 7230 FY -5949 FZ 944
2527. 736 FX 5423 FY -7873 FZ 1888
2528. 726 FX 5423 FY -7873 FZ 1888
2529. 647 FX 14460 FY -11235 FZ 1888
2530. 633 FX 10845 FY -15082 FZ 3775
2531. 622 FX 10845 FY -15082 FZ 3775
2532. LOAD 131 SAFETY - FIRST AND FIFTH RIGHT CONDUCTOR BROKEN CONDITION
2533. SELFWEIGHT Y -1
2534. JOINT LOAD
2535. 972 FX 910 FY -863 FZ 317
2536. 965 FX 910 FY -863 FZ 317
2537. 746 FX 5423 FY -7873 FZ 1888
2538. 733 FX 5423 FY -7873 FZ 1888
2539. 723 FX 5423 FY -7873 FZ 1888
2540. 650 FX 10845 FY -15082 FZ 3775
2541. 636 FX 10845 FY -15082 FZ 3775
2542. 615 FX 10845 FY -15082 FZ 3775
2543. 743 FX 7230 FY -5949 FZ 944
2544. 736 FX 5423 FY -7873 FZ 1888
2545. 726 FX 5423 FY -7873 FZ 1888
2546. 647 FX 10845 FY -15082 FZ 3775
2547. 633 FX 14460 FY -11235 FZ 1888
2548. 622 FX 10845 FY -15082 FZ 3775
2549. LOAD 132 SAFETY - FIRST AND BOTTOM RIGHT CONDUCTOR BROKEN CONDITION
2550. SELFWEIGHT Y -1
2551. JOINT LOAD
2552. 972 FX 910 FY -863 FZ 317
2553. 965 FX 910 FY -863 FZ 317
2554. 746 FX 5423 FY -7873 FZ 1888
2555. 733 FX 5423 FY -7873 FZ 1888
2556. 723 FX 5423 FY -7873 FZ 1888
2557. 650 FX 10845 FY -15082 FZ 3775
2558. 636 FX 10845 FY -15082 FZ 3775
2559. 615 FX 10845 FY -15082 FZ 3775
2560. 743 FX 7230 FY -5949 FZ 944
2561. 736 FX 5423 FY -7873 FZ 1888
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2562. 726 FX 5423 FY -7873 FZ 1888
2563. 647 FX 10845 FY -15082 FZ 3775
2564. 633 FX 10845 FY -15082 FZ 3775
2565. 622 FX 14460 FY -11235 FZ 1888
2566. LOAD 133 SAFETY - SECOND AND THIRD RIGHT CONDUCTOR BROKEN CONDITION
2567. SELFWEIGHT Y -1
2568. JOINT LOAD
2569. 972 FX 910 FY -863 FZ 317
2570. 965 FX 910 FY -863 FZ 317
2571. 746 FX 5423 FY -7873 FZ 1888
2572. 733 FX 5423 FY -7873 FZ 1888
2573. 723 FX 5423 FY -7873 FZ 1888
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  2574. 650 FX 10845 FY -15082 FZ 3775
  2575. 636 FX 10845 FY -15082 FZ 3775
  2576. 615 FX 10845 FY -15082 FZ 3775
  2577. 743 FX 5423 FY -7873 FZ 1888
  2578. 736 FX 7230 FY -5949 FZ 944
  2579. 726 FX 7230 FY -5949 FZ 944
  2580. 647 FX 10845 FY -15082 FZ 3775
  2581. 633 FX 10845 FY -15082 FZ 3775
  2582. 622 FX 10845 FY -15082 FZ 3775
  2583. LOAD 134 SAFETY - SECOND AND FOURTH RIGHT CONDUCTOR BROKEN CONDITION
  2584. SELFWEIGHT Y -1
  2585. JOINT LOAD
  2586. 972 FX 910 FY -863 FZ 317
  2587. 965 FX 910 FY -863 FZ 317
  2588. 746 FX 5423 FY -7873 FZ 1888
  2589. 733 FX 5423 FY -7873 FZ 1888
  2590. 723 FX 5423 FY -7873 FZ 1888
  2591. 650 FX 10845 FY -15082 FZ 3775
  2592. 636 FX 10845 FY -15082 FZ 3775
  2593. 615 FX 10845 FY -15082 FZ 3775
  2594. 743 FX 5423 FY -7873 FZ 1888
  2595. 736 FX 7230 FY -5949 FZ 944
  2596. 726 FX 5423 FY -7873 FZ 1888
  2597. 647 FX 14460 FY -11235 FZ 1888
  2598. 633 FX 10845 FY -15082 FZ 3775
  2599. 622 FX 10845 FY -15082 FZ 3775
  2600. LOAD 135 SAFETY - SECOND AND FIFTH RIGHT CONDUCTOR BROKEN CONDITION
  2601. SELFWEIGHT Y -1
  2602. JOINT LOAD
  2603. 972 FX 910 FY -863 FZ 317
  2604. 965 FX 910 FY -863 FZ 317
  2605. 746 FX 5423 FY -7873 FZ 1888
  2606. 733 FX 5423 FY -7873 FZ 1888
  2607. 723 FX 5423 FY -7873 FZ 1888
  2608. 650 FX 10845 FY -15082 FZ 3775
  2609. 636 FX 10845 FY -15082 FZ 3775
  2610. 615 FX 10845 FY -15082 FZ 3775
  2611. 743 FX 5423 FY -7873 FZ 1888
  2612. 736 FX 7230 FY -5949 FZ 944
  2613. 726 FX 5423 FY -7873 FZ 1888
  2614. 647 FX 10845 FY -15082 FZ 3775
  2615. 633 FX 14460 FY -11235 FZ 1888
  2616. 622 FX 10845 FY -15082 FZ 3775
  2617. LOAD 136 SAFETY - SECOND AND BOTTOM RIGHT CONDUCTOR BROKEN CONDITION
     STAAD SPACE                                                -- PAGE NO.
48

  2618. SELFWEIGHT Y -1
  2619. JOINT LOAD
  2620. 972 FX 910 FY -863 FZ 317
  2621. 965 FX 910 FY -863 FZ 317
  2622. 746 FX 5423 FY -7873 FZ 1888
  2623. 733 FX 5423 FY -7873 FZ 1888
  2624. 723 FX 5423 FY -7873 FZ 1888
  2625. 650 FX 10845 FY -15082 FZ 3775
  2626. 636 FX 10845 FY -15082 FZ 3775
  2627. 615 FX 10845 FY -15082 FZ 3775
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2628. 743 FX 5423 FY -7873 FZ 1888
2629. 736 FX 7230 FY -5949 FZ 944
2630. 726 FX 5423 FY -7873 FZ 1888
2631. 647 FX 10845 FY -15082 FZ 3775
2632. 633 FX 10845 FY -15082 FZ 3775
2633. 622 FX 14460 FY -11235 FZ 1888
2634. LOAD 137 SAFETY - THIRD AND FOURTH RIGHT CONDUCTOR BROKEN CONDITION
2635. SELFWEIGHT Y -1
2636. JOINT LOAD
2637. 972 FX 910 FY -863 FZ 317
2638. 965 FX 910 FY -863 FZ 317
2639. 746 FX 5423 FY -7873 FZ 1888
2640. 733 FX 5423 FY -7873 FZ 1888
2641. 723 FX 5423 FY -7873 FZ 1888
2642. 650 FX 10845 FY -15082 FZ 3775
2643. 636 FX 10845 FY -15082 FZ 3775
2644. 615 FX 10845 FY -15082 FZ 3775
2645. 743 FX 5423 FY -7873 FZ 1888
2646. 736 FX 5423 FY -7873 FZ 1888

2647. 726 FX 7230 FY -5949 FZ 944
2648. 647 FX 14460 FY -11235 FZ 1888
2649. 633 FX 10845 FY -15082 FZ 3775
2650. 622 FX 10845 FY -15082 FZ 3775
2651. LOAD 138 SAFETY - THIRD AND FIFTH RIGHT CONDUCTOR BROKEN CONDITION
2652. SELFWEIGHT Y -1
2653. JOINT LOAD
2654. 972 FX 910 FY -863 FZ 317
2655. 965 FX 910 FY -863 FZ 317
2656. 746 FX 5423 FY -7873 FZ 1888
2657. 733 FX 5423 FY -7873 FZ 1888
2658. 723 FX 5423 FY -7873 FZ 1888
2659. 650 FX 10845 FY -15082 FZ 3775
2660. 636 FX 10845 FY -15082 FZ 3775
2661. 615 FX 10845 FY -15082 FZ 3775
2662. 743 FX 5423 FY -7873 FZ 1888
2663. 736 FX 5423 FY -7873 FZ 1888
2664. 726 FX 7230 FY -5949 FZ 944
2665. 647 FX 10845 FY -15082 FZ 3775
2666. 633 FX 14460 FY -11235 FZ 1888
2667. 622 FX 10845 FY -15082 FZ 3775
2668. LOAD 139 SAFETY - THIRD AND BOTTOM RIGHT CONDUCTOR BROKEN CONDITION
2669. SELFWEIGHT Y -1
2670. JOINT LOAD
2671. 972 FX 910 FY -863 FZ 317
2672. 965 FX 910 FY -863 FZ 317
2673. 746 FX 5423 FY -7873 FZ 1888


2674. 733 FX 5423 FY -7873 FZ 1888
2675. 723 FX 5423 FY -7873 FZ 1888
2676. 650 FX 10845 FY -15082 FZ 3775
2677. 636 FX 10845 FY -15082 FZ 3775
2678. 615 FX 10845 FY -15082 FZ 3775
2679. 743 FX 5423 FY -7873 FZ 1888
2680. 736 FX 5423 FY -7873 FZ 1888

2681. 726 FX 7230 FY -5949 FZ 944
2682. 647 FX 10845 FY -15082 FZ 3775
2683. 633 FX 10845 FY -15082 FZ 3775
2684. 622 FX 14460 FY -11235 FZ 1888
2685. LOAD 140 SAFETY - FOURTH AND FIFTH RIGHT CONDUCTOR BROKEN CONDITION
2686. SELFWEIGHT Y -1
2687. JOINT LOAD
2688. 972 FX 910 FY -863 FZ 317
2689. 965 FX 910 FY -863 FZ 317
2690. 746 FX 5423 FY -7873 FZ 1888
2691. 733 FX 5423 FY -7873 FZ 1888
2692. 723 FX 5423 FY -7873 FZ 1888
2693. 650 FX 10845 FY -15082 FZ 3775
2694. 636 FX 10845 FY -15082 FZ 3775
2695. 615 FX 10845 FY -15082 FZ 3775
2696. 743 FX 5423 FY -7873 FZ 1888
2697. 736 FX 5423 FY -7873 FZ 1888
2698. 726 FX 5423 FY -7873 FZ 1888
2699. 647 FX 14460 FY -11235 FZ 1888
2700. 633 FX 14460 FY -11235 FZ 1888
2701. 622 FX 10845 FY -15082 FZ 3775
2702. LOAD 141 SAFETY - FOURTH AND BOTTOM RIGHT CONDUCTOR BROKEN CONDITION
2703. SELFWEIGHT Y -1
2704. JOINT LOAD
2705. 972 FX 910 FY -863 FZ 317
2706. 965 FX 910 FY -863 FZ 317
2707. 746 FX 5423 FY -7873 FZ 1888
2708. 733 FX 5423 FY -7873 FZ 1888
2709. 723 FX 5423 FY -7873 FZ 1888
2710. 650 FX 10845 FY -15082 FZ 3775
2711. 636 FX 10845 FY -15082 FZ 3775
2712. 615 FX 10845 FY -15082 FZ 3775
2713. 743 FX 5423 FY -7873 FZ 1888
2714. 736 FX 5423 FY -7873 FZ 1888
2715. 726 FX 5423 FY -7873 FZ 1888
2716. 647 FX 14460 FY -11235 FZ 1888
2717. 633 FX 10845 FY -15082 FZ 3775
2718. 622 FX 14460 FY -11235 FZ 1888
2719. LOAD 142 SAFETY - FIFTH AND BOTTOM RIGHT CONDUCTOR BROKEN CONDITION
2720. SELFWEIGHT Y -1
2721. JOINT LOAD
2722. 972 FX 910 FY -863 FZ 317
2723. 965 FX 910 FY -863 FZ 317
2724. 746 FX 5423 FY -7873 FZ 1888
2725. 733 FX 5423 FY -7873 FZ 1888
2726. 723 FX 5423 FY -7873 FZ 1888
2727. 650 FX 10845 FY -15082 FZ 3775
2728. 636 FX 10845 FY -15082 FZ 3775
2729. 615 FX 10845 FY -15082 FZ 3775


2730. 743 FX 5423 FY -7873 FZ 1888
2731. 736 FX 5423 FY -7873 FZ 1888
2732. 726 FX 5423 FY -7873 FZ 1888
2733. 647 FX 10845 FY -15082 FZ 3775
2734. 633 FX 14460 FY -11235 FZ 1888

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2735. 622 FX 14460 FY -11235 FZ 1888
2736. PERFORM ANALYSIS


          P R O B L E M   S T A T I S T I C S
          -----------------------------------

   NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   691/  1786/     4

   ORIGINAL/FINAL BAND-WIDTH=   655/    35/    216 DOF
   TOTAL PRIMARY LOAD CASES =   85, TOTAL DEGREES OF FREEDOM =   4134
   SIZE OF STIFFNESS MATRIX =     893 DOUBLE  KILO-WORDS
   REQRD/AVAIL. DISK SPACE  =    35.3/   674.1 MB,  EXMEM =   45.7 MB



2737. PRINT MAXFORCE ENVELOPE
MAXFORCE ENVELOPE


        MEMBER FORCE ENVELOPE
        ---------------------

        ALL UNITS ARE KG   METE


  MAX AND MIN FORCE VALUES AMONGST ALL SECTION LOCATIONS

 MEMB          FY/    DIST  LD        MZ/    DIST  LD
               FZ     DIST  LD        MY     DIST  LD        FX     DIST  LD

     1 MAX   -284.34   0.00  142    1225.84   1.95   32
              672.62   0.00   23    1297.08   1.95   23 103006.73 T   0.00
127
       MIN   -650.54   1.95   32      -9.47   0.00  107
             -683.16   1.95   42   -1318.06   1.95   42 207633.55 T   1.95
11

     2 MAX   -567.28   0.00  142    1317.06   1.96    9
             1160.36   0.00   23    1866.11   0.00   43  99584.59 T   0.00
127
       MIN  -1398.37   1.96    9   -1389.94   0.00   11
             -1640.31   1.96   42   -1358.59   1.96   42 201994.11 T   1.96
32

     3 MAX   -877.95   0.00  142    1960.96   1.87    9
              918.68   0.00  121    3889.32   0.00   44  88052.59 T   0.00
142
       MIN  -2384.86   1.87    9   -2475.64   0.00   11
             -2920.80   1.87   43   -1719.43   1.87   42 191850.02 T   1.87
32
```

```
    19 MAX    431.25   0.00  130     897.14   1.95    2
             1004.71   0.00   23    1938.62   1.95   23 132031.33 C   0.00
130
       MIN   -481.41   1.95    2    -820.03   1.95  130
             -272.13   1.95   42    -524.31   1.95   42 159603.53 T   1.95
2

    20 MAX    998.38   0.00  130    1040.52   0.00  130
             2581.56   0.00   23    1974.93   1.96   23 127417.72 C   0.00
130

       MIN  -1003.89   1.96    2    -993.26   0.00    2
                        -134.43   1.96   43   -3077.09   0.00   23 153801.84
      T   1.96    2

   457 MAX    649.11   0.00    2     236.14   1.95  130
              288.36   0.00   21     555.58   1.95   21 216827.56 C   0.00
2
       MIN   -145.64   1.95  130   -1250.95   1.95    2
            -1022.28   1.95   44   -1972.49   1.95   44  39961.38 T   1.95
140

   458 MAX   1425.94   0.00    2    1464.00   0.00    2
              126.56   0.00   22    2968.76   0.00   44 206720.62 C   0.00
2
       MIN   -246.32   1.96  130   -1290.32   1.96    2
            -2580.31   1.96   44   -2080.79   1.96   44  39610.61 T   1.96
130

    512 MAX   -961.00   0.00  142    1994.38   1.95    9
               352.09   0.00  142     679.07   1.95  142 265402.47 C   0.00
11

        MIN  -1324.88   1.95    9    -557.49   0.00   11
             -1031.97   1.95   21   -2005.44   1.95   22 195443.55 C
    543 MAX   -608.82   0.00  142      79.90   1.96   44
              374.96   0.00   44    1376.90   0.00   21 256183.95 C   0.00
11
       MIN   -866.23   1.96   30   -1669.66   0.00    9
             -353.14   1.96   21   -1534.89   0.00   44 186658.75 C   1.96
142
```

# DIAGONAL(BRACING)

```
9 MAX   -131.22   0.00  120     247.37   1.66   30
              335.48   0.00  107     476.90   0.00   44  20275.58 T   0.00
133
       MIN   -427.77   1.66   30    -457.18   0.00   30
             -392.81   1.66   40    -325.68   0.00   130  63210.99 T   1.66
9
24 MAX     50.11   0.00  110     508.34   2.23   44
             -2085.39   0.00   23    5915.23   0.00  140  83444.68 C   0.00
128
       MIN   -326.28   2.23   44    -291.98   0.00  120
```

```
             -4537.64   2.23  126   -4222.86   2.23  126  88282.04 T   2.23
44
930 MAX     21.96   0.00   42      22.41   0.00   42
               -1.52   0.00  140      28.96   0.00   44  22209.45 C   2.92
43
       MIN    -29.64   2.92   23     -17.72   0.49   23
               -9.19   2.92    2     -10.65   2.92    9   5619.41 T   0.00
23

   931 MAX     33.42   0.00    2      20.01   2.92  140
               19.52   0.00    2      59.77   2.92   44  21953.74 C   2.92
43
       MIN    -24.54   2.92  140     -34.28   2.68    2
                0.05   2.92  119     -16.00   0.00    9   5551.31 T   0.00
23

   932 MAX     22.06   0.00  130      23.02   2.92   42
                1.89   0.00  119      58.96   0.00   44  21753.14 C   2.92
43
       MIN    -36.80   2.92    2     -37.06   0.00    2
              -18.21   2.92   44      -4.86   0.00  119   4662.33 T   0.00
23

   933 MAX     24.40   0.00   23      24.51   0.00   23
               -0.21   0.00  130       9.93   0.00   32   6411.41 C   2.92
23
       MIN    -26.64   2.92   44     -16.06   0.73   44
               -5.80   2.92   23     -19.94   2.92   23  21532.39 T   0.00
43

   934 MAX      8.58   0.00  142      55.00   2.92   21
               14.98   0.00   42      50.22   2.92   32   5923.23 C   2.92
23

   960 MAX     20.22   0.00    2      20.84   3.11   42
               34.30   0.00   32      47.00   3.11   42  22937.80 C   3.11
43
       MIN    -27.15   3.11  119     -10.03   1.04  119
                5.57   3.11   23     -62.61   0.00   30   8019.05 T   0.00
23

   961 MAX     18.69   0.00    2      24.88   3.11   22
               26.46   0.00   44      48.50   3.11   44   9973.59 C   3.11
23
       MIN    -29.56   3.11  119     -13.97   1.04   42
               -2.13   3.11  119     -33.77   0.00   44  21437.77 T   0.00
43

   962 MAX     33.53   0.00   23      19.08   3.11  130
               13.92   0.00   23      62.47   3.11   44  22520.88 C   3.11
43
       MIN    -23.83   3.11  130     -33.09   2.59   23
               -0.26   3.11   30     -10.97   0.00   23   7728.52 T   0.00
23

   963 MAX     28.28   0.00  130      57.25   3.11    2
```

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | -2.70 | 0.00 | 109 | 68.52 | 0.00 | 44 | 22255.48 | C | 3.11 |
| 43 | | | | | | | | | | |
| | MIN | -49.69 | 3.11 | 2 | -37.32 | 0.00 | 23 | | | |
| | | -51.28 | 3.11 | 44 | -90.92 | 3.11 | 44 | 6408.05 | T | 0.00 |
| 23 | | | | | | | | | | |
| | 964 MAX | 17.15 | 0.00 | 142 | 47.77 | 3.11 | 11 | | | |
| | | 11.30 | 0.00 | 9 | 47.02 | 3.11 | 30 | 8350.37 | C | 3.11 |
| 23 | | | | | | | | | | |
| | MIN | -30.06 | 3.11 | 11 | 4.20 | 1.30 | 142 | | | |
| | | 1.29 | 3.11 | 44 | -8.31 | 0.00 | 21 | 22108.93 | T | 0.00 |
| 43 | | | | | | | | | | |

# HORIZONTAL

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 33 MAX | 44.98 | 0.00 | 21 | 66.59 | 0.00 | 32 | | | |
| | | 18.17 | 0.00 | 32 | 31.39 | 3.67 | 32 | 17803.65 | C | 0.00 |
| 23 | | | | | | | | | | |
| | MIN | -24.67 | 3.67 | 142 | -11.76 | 2.75 | 23 | | | |
| | | -9.47 | 3.67 | 23 | -35.43 | 0.00 | 30 | 7703.60 | T | 3.67 |
| 32 | | | | | | | | | | |
| | 42 MAX | 30.27 | 0.00 | 140 | 36.13 | 3.67 | 23 | | | |
| | | 12.45 | 0.00 | 23 | 37.93 | 3.67 | 23 | 8324.10 | C | 0.00 |
| 32 | | | | | | | | | | |
| | MIN | -39.58 | 3.67 | 23 | -28.88 | 1.53 | 32 | | | |
| | | -2.08 | 3.67 | 43 | -13.51 | 0.00 | 119 | 16554.11 | T | 3.67 |
| 23 | | | | | | | | | | |
| | 488 MAX | 31.83 | 0.00 | 140 | 32.13 | 3.67 | 11 | | | |
| | | 23.60 | 0.00 | 44 | 40.80 | 3.67 | 44 | **17999.73** | **C** | 0.00 |
| 44 | | | | | | | | | | |
| | MIN | -46.54 | 3.67 | 2 | -47.19 | 1.22 | 44 | | | |
| | | -0.96 | 3.67 | 21 | -45.77 | 0.00 | 44 | 7964.61 | T | 3.67 |
| 11 | | | | | | | | | | |
| | 496 MAX | 42.56 | 0.00 | 11 | 60.24 | 0.00 | 44 | | | |
| | | 6.37 | 0.00 | 11 | 26.42 | 3.67 | 11 | 7859.87 | C | 0.00 |
| 11 | | | | | | | | | | |
| | MIN | -27.86 | 3.67 | 142 | -4.08 | 2.45 | 11 | | | |
| | | -8.94 | 3.67 | 44 | -25.74 | 3.67 | 44 | **17076.32** | **T** | 3.67 |
| 44 | | | | | | | | | | |
| | 954 MAX | 30.68 | 0.00 | 23 | 23.44 | 0.00 | 23 | | | |
| | | 8.62 | 0.00 | 121 | 23.46 | 0.00 | 30 | 545.76 | C | 0.00 |
| 142 | | | | | | | | | | |
| | MIN | -23.55 | 3.10 | 141 | -11.14 | 2.32 | 23 | | | |
| | | -17.80 | 3.10 | 30 | -31.69 | 3.10 | 30 | 919.48 | T | 3.10 |
| 22 | | | | | | | | | | |
| | 955 MAX | 29.95 | 0.00 | 140 | 23.18 | 3.10 | 2 | | | |
| | | 4.48 | 0.00 | 9 | 12.54 | 0.00 | 44 | 852.70 | C | 0.00 |
| 141 | | | | | | | | | | |
| | MIN | -29.36 | 3.10 | 23 | -10.61 | 2.32 | 140 | | | |
| | | -15.70 | 3.10 | 44 | -36.12 | 3.10 | 44 | 1190.56 | T | 3.10 |
| 23 | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 956 | MAX | 21.00 | 0.00 | 44 | 34.72 | 3.10 | 23 | | | |
| | | 11.74 | 0.00 | 23 | 24.16 | 0.00 | 30 | 140.90 T | 0.00 | 119 |
| | MIN | -33.87 | 3.10 | 23 | -10.01 | 0.77 | 119 | | | |
| | | -8.71 | 3.10 | 30 | -19.13 | 0.00 | 23 | 605.42 T | 3.10 | 42 |
| 957 | MAX | 20.17 | 0.00 | 23 | 16.12 | 3.10 | 44 | | | |
| | | -4.75 | 0.00 | 109 | 34.96 | 0.00 | 23 | 439.73 C | 0.00 | 23 |
| | MIN | -25.11 | 3.10 | 44 | -7.06 | 1.29 | 44 | | | |
| | | -18.42 | 3.10 | 23 | -22.12 | 3.10 | 23 | 257.79 T | 3.10 | 130 |
| 1164 | MAX | 44.30 | 0.00 | 22 | 48.74 | 0.00 | 141 | | | |
| | | 21.18 | 0.00 | 23 | 49.48 | 3.67 | 23 | 15967.98 C | 0.00 | 23 |
| | MIN | -21.62 | 3.67 | 44 | -26.26 | 2.75 | 23 | | | |
| | | 3.96 | 3.67 | 140 | -28.20 | 0.00 | 23 | 4090.74 T | 3.67 | 44 |
| 1167 | MAX | 63.81 | 0.00 | 9 | 102.45 | 3.31 | 137 | | | |
| | | -11.54 | 0.00 | 21 | 49.20 | 0.00 | 18 | 50389.62 C | 0.00 | 18 |
| | MIN | -86.94 | 3.31 | 137 | -60.17 | 2.21 | 11 | | | |
| | | -40.10 | 3.31 | 14 | -96.53 | 3.31 | 112 | 16440.54 C | 3.31 | 35 |

## CROSS ARM (LOWER)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1548 | MAX | 17.56 | 0.00 | 8 | 186.47 | 2.68 | 119 | | | |
| | | 38.67 | 0.00 | 130 | 270.01 | 0.00 | 23 | **38651.95 C** | 0.00 | 23 |
| | MIN | -105.91 | 2.68 | 119 | -26.83 | 0.00 | 119 | | | |
| | | -87.74 | 2.68 | 23 | -30.52 | 0.00 | 30 | 19755.38 C | 2.68 | 42 |
| 1554 | MAX | 85.88 | 0.00 | 140 | 151.68 | 0.00 | 140 | | | |
| | | 234.10 | 0.00 | 9 | 242.65 | 2.67 | 11 | 34801.69 C | 0.00 | 140 |
| | MIN | -17.47 | 2.67 | 29 | -17.61 | 2.67 | 42 | | | |
| | | 23.59 | 2.67 | 44 | -424.99 | 0.00 | 109 | 3763.82 C | 2.67 | 21 |
| 1558 | MAX | 12.88 | 0.00 | 29 | 194.32 | 2.68 | 140 | | | |
| | | 10.64 | 0.00 | 44 | 209.81 | 0.00 | 11 | 34116.85 C | 0.00 | 140 |
| | MIN | -111.97 | 2.68 | 140 | -36.72 | 0.00 | 42 | | | |
| | | -99.62 | 2.68 | 9 | -98.85 | 2.68 | 111 | 1766.85 C | 2.68 | 21 |
| 1713 | MAX | 3.90 | 0.00 | 44 | 244.28 | 2.68 | 119 | | | |
| | | 81.43 | 0.00 | 109 | 94.97 | 2.68 | 107 | 14893.42 C | 0.00 | 119 |
| | MIN | -100.79 | 2.68 | 119 | 7.47 | 0.00 | 42 | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2.81 | 2.68 | 42 | -123.68 | 0.00 | 119 | 20313.05 T | 2.68 | 44 |
| 1716 | MAX | 115.48 | 0.00 | 119 | 187.00 | 0.00 | 119 | | | |
| | | 139.58 | 0.00 | 44 | 355.05 | 2.67 | 44 | 15630.20 C | 0.00 | 119 |
| | MIN | -1.70 | 2.67 | 42 | -51.28 | 2.67 | 119 | | | |
| | | 34.44 | 2.67 | 9 | -62.24 | 0.00 | 42 | 19965.70 T | 2.67 | 44 |
| 1717 | MAX | 10.62 | 0.00 | 42 | 120.93 | 2.68 | 119 | | | |
| | | -164.27 | 0.00 | 9 | 406.45 | 0.00 | 44 | 16365.20 C | 0.00 | 119 |
| | MIN | -79.72 | 2.68 | 119 | -30.51 | 0.00 | 29 | | | |
| | | -367.46 | 2.68 | 140 | -743.79 | 2.68 | 119 | 18120.76 T | 2.68 | 44 |
| 1733 | MAX | -2.14 | 0.00 | 42 | 255.18 | 2.43 | 119 | | | |
| | | 89.48 | 0.00 | 44 | 140.54 | 2.43 | 44 | 14132.03 C | 0.00 | 119 |
| | MIN | -117.06 | 2.43 | 109 | -1.20 | 0.00 | 39 | | | |
| | | 25.71 | 2.43 | 39 | -104.16 | 0.00 | 109 | **29950.00 T** | 2.43 | 42 |

## CROSS ARM (TOP)

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1759 | MAX | 40.73 | 0.00 | 109 | 49.44 | 0.00 | 109 | | | |
| | | -331.62 | 0.00 | 35 | 826.71 | 0.00 | 112 | 9726.22 T | 0.00 | 35 |
| | MIN | 0.09 | 2.51 | 35 | -28.05 | 2.51 | 109 | | | |
| | | -793.69 | 2.51 | 107 | -1165.66 | 2.51 | 107 | 20625.61 T | 2.51 | 107 |
| 1767 | MAX | 4.54 | 0.00 | 18 | 56.75 | 2.51 | 128 | | | |
| | | -140.93 | 0.00 | 22 | 267.89 | 0.00 | 112 | 9522.17 T | 0.00 | 14 |
| | MIN | -27.52 | 2.51 | 130 | 3.35 | 0.00 | 14 | | | |
| | | -377.78 | 2.51 | 117 | -683.64 | 2.51 | 133 | 21577.90 T | 2.51 | 128 |
| 1769 | MAX | 40.03 | 0.00 | 130 | 48.64 | 0.00 | 130 | | | |
| | | 774.94 | 0.00 | 129 | 1134.59 | 2.51 | 128 | 9191.46 T | 0.00 | 14 |
| | MIN | 1.31 | 2.51 | 14 | -27.11 | 2.51 | 130 | | | |
| | | 320.65 | 2.51 | 14 | -810.82 | 0.00 | 133 | 21869.26 T | 2.51 | 128 |
| 1770 | MAX | -11.42 | 0.00 | 20 | 65.84 | 2.43 | 130 | | | |
| | | -306.13 | 0.00 | 14 | 1334.19 | 0.00 | 128 | 9867.23 T | 0.00 | 14 |
| | MIN | -58.62 | 2.43 | 130 | -53.51 | 0.00 | 130 | | | |
| | | -944.89 | 2.43 | 130 | -965.68 | 2.43 | 130 | **22000.98 T** | 2.43 | 128 |
| 1792 | MAX | 23.07 | 0.00 | 128 | 24.36 | 0.00 | 128 | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 312.58 | 0.00 | 128 | 415.51 | 2.31 | 128 | 2355.29 | T | 0.00 |
| 9 | | | | | | | | | | |
| | MIN | -5.20 | 2.31 | 9 | -8.87 | 2.31 | 5 | | | |
| | | 99.62 | 2.31 | 9 | -305.38 | 0.00 | 128 | 13721.50 | T | 2.31 |
| 128 | | | | | | | | | | |
| 1793 | MAX | -0.24 | 0.00 | 44 | 26.18 | 2.25 | 107 | | | |
| | | -41.29 | 0.00 | 9 | 499.90 | 0.00 | 128 | 2781.84 | T | 0.00 |
| 9 | | | | | | | | | | |
| | MIN | -27.32 | 2.25 | 107 | -15.65 | 0.00 | 107 | | | |

**PEAK MEMBER**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2387 | MAX | 3.12 | 0.00 | 102 | 11.83 | 2.21 | 3 | | | |
| | | 24.38 | 0.00 | 132 | 48.04 | 2.21 | 24 | 2539.79 | T | 2.21 |
| 3 | | | | | | | | | | |
| | MIN | -11.58 | 2.21 | 3 | -1.14 | 0.00 | 4 | | | |
| | | 19.71 | 2.21 | 106 | -9.69 | 0.00 | 4 | 9546.58 | T | 0.00 |
| 24 | | | | | | | | | | |
| 2388 | MAX | 40.43 | 0.00 | 3 | 21.61 | 0.00 | 3 | | | |
| | | -32.82 | 0.00 | 24 | 85.99 | 0.00 | 4 | 2617.64 | T | 2.21 |
| 34 | | | | | | | | | | |
| | MIN | 12.76 | 2.21 | 24 | -55.17 | 2.21 | 3 | | | |
| | | -66.53 | 2.21 | 8 | -62.59 | 2.21 | 3 | **9825.66** | **T** | 0.00 |
| 25 | | | | | | | | | | |
| 2389 | MAX | -105.36 | 0.00 | 27 | 426.52 | 2.21 | 3 | | | |
| | | -13.56 | 0.00 | 24 | -37.21 | 0.00 | 101 | 2305.35 | T | 2.21 |
| 3 | | | | | | | | | | |
| | MIN | -261.81 | 2.21 | 6 | -140.08 | 0.00 | 5 | | | |
| | | -84.07 | 2.21 | 111 | -270.78 | 2.21 | 3 | 9763.92 | T | 0.00 |
| 24 | | | | | | | | | | |
| 2390 | MAX | 261.89 | 0.00 | 30 | 411.76 | 0.00 | 30 | | | |
| | | 185.42 | 0.00 | 13 | 213.46 | 2.21 | 3 | 2508.47 | T | 2.21 |
| 34 | | | | | | | | | | |
| | MIN | 20.25 | 2.21 | 102 | -154.90 | 2.21 | 30 | | | |
| | | 4.53 | 2.21 | 101 | -203.15 | 0.00 | 13 | 9824.94 | T | 0.00 |
| 25 | | | | | | | | | | |
| 2391 | MAX | 38.69 | 0.00 | 4 | 20.09 | 0.00 | 4 | | | |
| | | 67.16 | 0.00 | 4 | 59.22 | 2.21 | 34 | 6666.65 | C | 2.21 |
| 25 | | | | | | | | | | |
| | MIN | 10.59 | 2.21 | 25 | -52.83 | 2.21 | 4 | | | |
| | | 35.16 | 2.21 | 25 | -91.86 | 0.00 | 3 | 2649.98 | T | 0.00 |
| 34 | | | | | | | | | | |
| 2392 | MAX | -110.12 | 0.00 | 24 | 418.86 | 2.21 | 3 | | | |
| | | 82.71 | 0.00 | 132 | 247.86 | 2.21 | 132 | 6962.07 | C | 2.21 |
| 24 | | | | | | | | | | |
| | MIN | -258.33 | 2.21 | 3 | -140.01 | 0.00 | 3 | | | |
| | | 25.72 | 2.21 | 25 | 45.47 | 0.00 | 101 | 2556.99 | T | 0.00 |
| 3 | | | | | | | | | | |

```
  2393 MAX    263.96   0.00    9     412.43   0.00    9
               22.21   0.00  101     232.57   0.00   24   6423.68 C   2.21
25
       MIN     16.59   2.21  104    -158.87   2.21    9
             -177.51   2.21   24    -173.10   2.21   34   2778.23 T   0.00
34

  2394 MAX      7.76   0.00   25       5.62   2.21  132
                6.86   0.00   24      12.31   2.21   24   2013.83 C   2.21
24
       MIN     -8.12   2.21  107      -4.23   1.48   13
              -20.88   2.21  111     -41.21   2.21    3   6893.02 T   0.00
3

  2395 MAX      7.86   0.00   24       5.13   2.21  111
               12.55   0.00  107      21.08   2.21  107   9181.83 C   2.21
3
       MIN     -8.67   2.21  111      -4.65   1.11    4
              -10.32   2.21    3     -25.23   2.21    3   1979.64 C   0.00
24

  2396 MAX   -571.60   0.00  102    1207.17   1.65   13
             1194.79   0.00   14     911.33   1.65   14   2183.95 C   0.00
125
       MIN  -1497.11   1.65   13   -1257.28   0.00   13
              444.63   1.65  101   -1070.56   0.00   13    486.30 C   1.65
24

  2397 MAX   -230.06   0.00  101    1063.97   1.67   34
              156.54   0.00   24     177.35   1.67   24   3741.49 C   0.00
14
       MIN   -640.52   1.67   34       0.84   0.00   24
             -230.54   1.67    3    -297.74   1.67    3   1430.47 C   1.67
101

  2398 MAX    358.27   0.00   30     401.58   0.00   30
              190.47   0.00    3     154.23   0.00   24   4479.53 C   0.00
3
       MIN    124.11   1.62  101    -174.18   1.62   30
             -145.13   1.62   24    -242.00   0.00    3   1879.00 C   1.62
106

  2399 MAX     -5.22   0.00  101      25.48   1.65   33
                6.88   0.00   34      52.49   0.00    3   4220.72 C   0.00
3
       MIN    -33.98   1.65   31     -24.35   0.00   30
              -39.66   1.65    3     -92.01   1.65   25   1678.05 C   1.65
106

  2410 MAX    384.05   0.00   34     322.41   1.67  101
              199.52   0.00   24     250.77   1.67   24   1169.86 C   0.00
106
       MIN   -196.84   1.67  101    -634.47   1.67   34
             -154.56   1.67    3    -180.00   1.67    3   2140.45 T   1.67
34
```

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 2411 | MAX | 109.60 | 0.00 | 101 | 117.79 | 0.00 | 101 | | | |
| | | 119.56 | 0.00 | 3 | 210.84 | 0.00 | 24 | 1588.56 C | 0.00 | 128 |
| | MIN | -211.24 | 1.62 | 35 | -237.12 | 0.00 | 35 | | | |
| | | -164.24 | 1.62 | 24 | -123.96 | 0.00 | 3 | 2439.89 T | 1.62 | 29 |
| 2412 | MAX | 24.58 | 0.00 | 30 | 20.56 | 0.00 | 30 | | | |
| | | 32.45 | 0.00 | 24 | 92.18 | 1.65 | 4 | 1383.92 C | 0.00 | 128 |
| | MIN | -10.44 | 1.65 | 101 | -13.79 | 1.65 | 34 | | | |
| | | -10.46 | 1.65 | 13 | -42.94 | 0.00 | 24 | 2498.23 T | 1.65 | 29 |
| 2413 | MAX | 5.69 | 0.00 | 101 | 2.15 | 0.00 | 101 | | | |
| | | 1.79 | 0.00 | 13 | 108.12 | 0.00 | 4 | 1383.80 C | 0.00 | 107 |
| | MIN | -7.03 | 1.65 | 35 | -7.80 | 0.14 | 35 | | | |
| | | -67.79 | 1.65 | 4 | -3.44 | 1.65 | 4 | 2538.49 T | 1.65 | 29 |
| 2414 | MAX | 24.61 | 0.00 | 133 | 22.78 | 2.21 | 24 | | | |
| | | 22.24 | 0.00 | 24 | 52.39 | 0.00 | 107 | **9366.27 C** | 2.21 | 4 |
| | MIN | -18.72 | 2.21 | 24 | -30.04 | 2.21 | 111 | | | |
| | | -43.65 | 2.21 | 111 | -44.38 | 2.21 | 133 | 2011.00 C | 0.00 | 13 |

## DESIGN OF LEG MEMBER

**Panel No. 1**

Effective Length: $L_{en}$ 1.95 m

Load in Compression: $P_C$ 265102 kg

Load in Tension: $P_T$ 205121 kg

Steel use: HIGH TENSILE STEEL

Angle: STARRED ANGLE 150x150x15

Rv.v. = 5.78 cm Area = 85.56 $cm^2$

Curve Used = 1

**Design for Compression**:

Slenderness Ratio: 33.73 < 120 OK

Compressive Stress: 3372

Ultimate Compressive Strength: 288500 > 265102 kg OK

Factor of Safety: 1.09

**Check for Tension**:

Net Area: 75.06 $cm^2$ Tensile

Stress: 3600 Kg/cm2

Ultimate Tensile Strength 270216 > 205121 kg OK

Factor of Safety: 1.317

**Panel No. 10**

Effective Length: $L_{eft}$ 1.66 m

Load in Compression: $P_C$ 111864 kg

Load in Tension: $P_T$ 68154 kg

Steel use: HIGH TENSILE STEEL

Angle: SINGLEANGLE 150x150x15

Rv.v. = 2.93 cm Area = 43 $cm^2$

Curve Used = 1

Slenderness Ratio: 56.65 < 120 OK

**Design for Compression**:

Slenderness Ratio: 56.65 < 120 OK

Compressive Stress: 3100

Ultimate Compressive Strength: 133300 > 111864 kg OK

Factor of Safety: **1.19**

**Check for Tension**:

Net Area: 37.53 $cm^2$ Tensile

Stress: 3600 Kg/cm2

Ultimate Tensile Strength 135108 > 68154 kg OK

Factor of Safety: **1.98**

## DESIGN OF BRACING

**Panel No. 1**

| | | | | |
|---|---|---|---|---|
| Effective Length: | $L_{en}$ | 2.92 | m | |
| Load in Compression: | | $P_C$ | 22520 | kg |
| Load in Tension: | $P_T$ | 21000 | kg | |

Steel use: MILD STEEL

Angle: DOUBLE ANGLE 90x90x6

Rv.v. = 2.77 cm Area = 20.94 $cm^2$

Curve Used = 1

**Design for Compression**:

| | | | | |
|---|---|---|---|---|
| Slenderness Ratio: | 105.41 | < | 120 | OK |
| Compressive Stress(Allow) | 1650 | | | |
| Ultimate Compressive Strength: | 34551 | > | 22520 kg | OK |

Factor of Safety: **1.534**

**Check for Tension**:

Net Area: 16.76 $cm^2$ Tensile

Stress: 2500 Kg/cm2

| | | | | |
|---|---|---|---|---|
| Ultimate Tensile Strength | 41900 | > | 21000 kg | OK |

Factor of Safety: **1.995**

## DESIGN OF HORIZONTAL MEMBER

**Panel No. 1**

Effective Length: $L_{en}$ 3.67 m

Load in Compression: $P_C$ 18000 kg

Load in Tension: $P_T$ 17076 kg

Steel use: MILD STEEL

Angle: DOUBLE ANGLE 90x90x6

Rv.v. = 2.77 cm Area = 20.94 $cm^2$

Curve Used = 4

**Design for Compression**:

Slenderness Ratio: 132.5 < 200 OK

Compressive Stress(Allow) 1146.5

Ultimate Compressive Strength: 24000 > 18000 kg OK

Factor of Safety: **1.33**

**Check for Tension**:

Net Area: 16.76 $cm^2$ Tensile

Stress: 2500 Kg/cm2

Ultimate Tensile Strength 41900 > 21000 kg OK

Factor of Safety: **1.995**

## DESIGN OF LOWERCROSS ARM (Main ARM)

Effective Length: $L_{en}$ 2.68 m

Load in Compression: $P_C$ 38650 kg

Load in Tension: $P_T$ 29950 kg

Steel use: MILD STEEL

Angle: SINGLE ANGLE 130x130x12

Rv.v. = 2.54 cm Area = 29.82 $cm^2$

Curve Used = 2

**Design for Compression**:

Slenderness Ratio: 105.5 < 120 OK

Compressive Stress(Allow) 1588

Ultimate Compressive Strength: 47354 > 38650 kg OK

Factor of Safety: **1.225**

**Check for Tension**:

Net Area: 25.62 $cm^2$ Tensile

Stress: 2500 Kg/cm2

Ultimate Tensile Strength 64050 > 29950 kg OK

Factor of Safety: **2.138**

**Panel-10**

| | | | |
|---|---|---|---|
| Effective Length: | $L_{en}$ | 2.02 | m |
| Load in Compression: | $P_C$ | 28641 | kg |
| Load in Tension: | $P_T$ | 21775 | kg |

Steel use: MILD STEEL

Angle: SINGLE ANGLE 110x110x0

Rv.v. = 2.14 cm Area = 21.06 $cm^2$

Curve Used = 2

**Design for Compression**:

Slenderness Ratio: 94.39 < 120 OK

Compressive Stress(Allow) 1722

Ultimate Compressive Strength: 36265 > 28641 kg OK

Factor of Safety: **1.266**

**Check for Tension**:

Net Area: 17.5 $cm^2$ Tensile

Stress: 2500 Kg/cm2

Ultimate Tensile Strength 43750 > 21750 kg OK

Factor of Safety: **2.011**

## DESIGN OF UPPERCROSS ARM

Effective Length: $L_{en}$ 2.76 m

Load in Compression: $P_C$ 767 kg

Load in Tension: $P_T$ 22000 kg

Steel use: HIGH TENSILE STEEL

Angle: SINGLE ANGLE 90x90x6

Rv.v. = 1.75 cm Area = 10.47 $cm^2$

Curve Used = 6

**Design for Compression**:

Slenderness Ratio: 157.7 < 200 OK

Compressive Stress(Allow) 980

Ultimate Compressive Strength: 10260 > 766 kg OK

Factor of Safety: **13.39**

**Check for Tension**:

Net Area: 7.85 $cm^2$ Tensile

Stress: 3600 Kg/cm2

Ultimate Tensile Strength 28260 > 22000 kg OK

Factor of Safety: **1.28**

## DESIGN OF PEAK MEMBER

Effective Length: $L_{en}$ 2.35 m

Load in Compression: $P_C$ 9367 kg

Load in Tension: $P_T$ 9825 kg

Steel use: MILD STEEL

Angle: SINGLE ANGLE 100x100x6

Rv.v. = 1.75 cm Area = 11.67 $cm^2$

Curve Used = 6

**Design for Compression**:

Slenderness Ratio: 121 < 200 OK

Compressive Stress(Allow) 1384

Ultimate Compressive Strength: 16151 > 9367 kg OK

Factor of Safety: **1.72**

**Check for Tension**:

Net Area: 9.12 $cm^2$ Tensile

Stress: 2500 Kg/cm2

Ultimate Tensile Strength 22800 > 9825 kg OK

Factor of Safety: **2.32**