MAJOR PROJECT

ON

ANALYTICAL STUDY OF A RAFT FOUNDATION BY DIFFERENT MODELS

Submitted in partial fulfillment
of the requirement for award of the degree of

MASTER OF ENGINEERING
IN
CIVIL ENGINEERING
(Structural Engineering)

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DECLARATION

I here by declare that the work which is embodied in this major project entitled "ANALYTICAL STUDY OF A RAFT FOUNDATION BY DIFFERENT MODELS" is an authentic record of my own work carried out for partial fulfillment of the requirements for the award of Master of Civil Engineering (Structural Engineering) under the guidance at Delhi College of Engineering, New Delhi. The matter embodied in this dissertation has not been submitted for the award of any other degree.

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This is certified that above statement made by the student is correct to the best of our knowledge.

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ABSTRACT

In case of transmission towers it is often seen that allowable pressure on soil are significantly low for individual footings to distribute the structural load through the foundation area. Alternatively when soil contains compressible lenses or the soil profile is erratic, it is difficult to define and assess the extent of each of the weak pockets or cavities, in these situations raft foundation is required to incorporate effect of overall settlement. In the present study the raft foundation is analyzed by different approaches using Staad pro and simplified models.

The relative stiffness of the foundation is directly proportional to the thickness of the raft; hence in the present work thickness of raft is modified as per the relative stiffness. A number of combinations of relative stiffness and baring capacity are considered to obtain shear force and bending moment. It is observe that Staad pro gives higher bending moment and shear force under the explained set of conditions considered in the problem. Further at certain locations the values so obtained are lower than the values obtained by simplified Model. One of the reason associated with the set of comparison is because of limited load conditions and moments considered from equivalent center of gravity of the raft in simplified model.

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Chapter 1
INTRODUCTION

1.1 GENERAL

Foundation engineering has been practiced as an art, without the help of science, ever since the beginning of human settlement. It was in first half of 20th century that concerted effort have made to study and understand the physical laws governing the behavior of sub surface materials, i.e. soil from which foundations derived their support and on whose behavior on structures.

Study of soil mechanics has provided us with new techniques for selecting appropriate type of foundation and predicting the behavior of complete structures. Amount of uncertainty and degree of variation in the properties of soil and number of parameters on which performance of a foundation depends, give approximate solution.

1.2 REQUIREMENTS OF RAFT FOUNDATION

Raft or Mat foundation is a combined footing that covers the entire area beneath a structure and supports all walls and columns. This raft or mat normally rests directly on soil or rock, but can also be supported on Piles as well.

Raft foundation is generally suggested in the following situations:

(a) Whenever building loads are so heavy or the allowable pressure on soil so small that individual footing would cover more than floor area.

(b) Whenever soil contains compressible lenses or the soil is sufficiently erratic and it is difficult to define and assess the extent of each of the weak pockets or cavities and thus, estimate the overall and differential settlement.

(c) When structures and equipment to be supported are very sensitive to differential settlement.

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(d) Where structures naturally lend themselves for the use of raft foundation such as silos, chimneys, water towers, etc.

(e) Floating foundation cases where in soil is having very poor bearing capacity and the weight of the super-structure is proposed to be balanced by the weight of the soil removed.

(f) Buildings where basements are to be provided or pits located below ground water table.

(g) Buildings where individual foundation, if provided, will be subjected to large widely varying bending moments which may result in differential rotation and differential settlement of individual footings causing distress in the building.

1.3 CLASSIFICATION OF RAFT FOUNDATION

Raft can be classified into the following ways:

(i)Based on the method of their support, raft can be divided into three categories

(a) Raft supported on soil,
(b) Raft supported on piles, and
(c) Buoyancy raft.

(ii)Based on the structural system adopted for the structure of the raft:

(a) Plain slab rafts which flat concrete slabs are having a uniform thickness throughout. This can be with pedestals or without pedestals.
(b) Beam and slab raft which can be designed with down stand beam or up stand beam systems.
(c) Cellular raft or framed raft with foundation slab, walls, columns and one of the floor slabs acting together to give a very rigid structure.

- Raft of uniform depth is most popular due to its simplicity of design and construction.
- Pedestals are used to distribute the load on a bigger area in case of heavy column loads.
- Slab and beam raft is used as a foundation for heavy buildings where stiffness is the principal requirement to avoid excessive distortion of the super structure as a result of variation in the load distribution over the raft compressibility of the supporting soil.
- If the beams are deep, ribs placed below the basement floor or raft. the bottom of the excavation becomes badly cut up with aches, impairing the bearing value of the soil because of its disturbance.
- Buoyancy raft are necessarily to be provided with a basement so that the weight of the soil removed. Cellular raft consisting of foundation slabs. Walls, columns and ground floor slab can be designed. But it creates considerable amount of uncertainties. Raft is designed as a slab of uniform thickness.

Raft, as a slab of uniform thickness, has an additional advantage of providing better water-proofing treatment ease of reinforcement fabrication and lying of concrete. This type of raft is most commonly used.

Raft supported on pile

Raft supported on soil

Flate plate with pedestal

Flat plate raft

Beam and Slab raft

Framed raft

Figure 1.1 Various types of rafts are shown (Satish Chandra,1997)

Chapter 2

LITERATURE REVIEW

2.1 INTRODUCTION

Analysis proposed to be adopted while determining moments, shear forces for the design of raft. Once the bending moments and shear forces are known, structural design does not present any difficulty and there exists no difference of opinion in this respect for different authors except very minor difference relating to desired thickness of slab and the effectiveness of the shear reinforcement.

Methods suggested by IS Codes and ACI committees are summarized below.

IS Code 2950 (1965)

There are two approaches for design the first one is conventional method and second is the elastic method. In the conventional method, the foundation is considered infinitely rigid and pressure distribution independent of the deflection of the raft. Soil pressures are also assumed to be planner so that the centroid of the soil pressure coincides with the line of action of the resulting forces of all the loads acting on the foundation. The method is normally used in design because of its simplicity. A generous amount of reinforcement is provided to safeguard uncertainties caused by differential settlement. The raft is analyzed as a whole in each of the two perpendicular directions. Thus, total shear forces and total bending moments acting on any section cutting across the entire raft is equal to the arithmetic sum of all forces and reactions/moments to the left or right of the section. The actual reinforcement provided shall be more than that worked out theoretically.

Elastic method has two approaches. In one, the soil is replaced by an infinite number of isolated springs. In the other, the soil is assumed as a continuous elastic medium obeying Hook's Law. These methods are applicable in case the foundation is comparatively flexible and the loads tend to concentrate over small areas. The actual reinforcement can be one-and-a-halftimes that required theoretically. The famous soil line method falls in this category.

As limitations to applicability of the methods, code mentions that the codal provisions:

(1) do not apply to large and heavy industrial construction where special considerations of the base pressure distribution will be required.
(2) apply only to fairly uniform soil conditions and for fairly horizontal planes of separation of layer below.
(3) foundations in seismic area and/or to vibrating load shall be given special considerations.

IS Code 2950 (Part-I) (1973)

In the revised version of the code, following methods of analysis have been proposed:

(a) Assumption of linearly varying contact pressure
(b) Perfectly rigid structures
(c) Perfectly flexible structures
(d) Structures stiffened along one axis
(e) Structures stiffened along both the axis

General methods:

(i) Based on modulus of sub grade reaction, and
(ii) Based on modulus of compressibility (half space theory).

Method (a) corresponds to the conventional method in the earlier version of the code and has similar limitations. In method (b) contact pressure distribution is to be calculated based on Boussineq's Equation for Elastic Isotropic half space and is applicable when deformations of raft under loads are small as compared to the mean settlement of the structure. Method (c) is applicable for structures which have relatively less stiffening members specially resting on very stiff foundation soil. In this case, the deflections of the raft are same as the settlements of the foundation soil under external load. Method (d) is something in between methods (b) and (c). Here in the direction of the stiffened axis the contact pressure distribution is determined by Boussineq's Equation as in method (b). In perpendicular direction distribution is determined as given (f). Method (c) is same as method (h). The two methods under (f) are elastic methods and are used when simplified methods from (a) to (e) are not applicable. Details given in the code do not provide enough guidance to enable the analysis and design to be completed. Apart from the limitations applicable in earlier version of the code it is slated that:

(i) Allowable settlement both total and differential shall satisfy the requirement of the supper-structure
(ii) The approximate values of permissible settlements as given in earlier code have been deleted.

IS 2950 (Part I) (1981)

In the second revision of the code, two methods of analysis have been suggested depending upon the assumption involved. Conventional method assuming planner distribution of contact pressure is applicable to foundations which are rigid relative to supporting soil and the compressible soil layer is relatively shallow. The rigidity of the foundation is determined with a relative stiffness factor ($K > 0.5$) or columns spacing less than $1.75/\lambda$. Methods of determining value of K and λ are given in the code. Conventional method is applicable when either of the two conditions is satisfied. The value of K depends upon the flexural rigidity of the super-structure, modulus of the compressibility of the foundation soil, thickness of the raft, length of the section in the bending axis and length perpendicular to the section. Value of A, depends upon modulus of sub-grade reaction for the footing of the width of the raft, modulus of elasticity of concrete and moment of inertia of the raft. In this method, the raft is analyzed as a whole in each of the two perpendicular directions on the basis of statics.

In case of flexible footings, simplified methods are applicable when variation in adjacent column load is not more than 20% of the higher value and the structure (combined action of the super-structure and raft) may be considered as flexible i.e., relative stiffness factor K is greater than 0.5. This method is more or less same as the famous soil line method.

When conditions, as mentioned above, for flexible foundations are not satisfied, a method based on closed form of solution of elastic plate theory has been suggested. The distribution of deflection and contact pressure on the raft due to a column load is determined by the plate theory. Since the effect of a column load on the elastic foundation is damped out rapidly. It is possible to determine the total effect at a point of all column loads with in the zone of influence by the method of super-imposition. The computation of the effect at any point is restricted to columns of two adjoining bays in all directions.

The code also lays down that:

(a) Size and shape of the foundation adopted affects the magnitude of sub-grade modulus which should be taken into consideration.
(b) Consideration must be given to the increased contact pressure developed along the edges of the raft on cohesive soils and the opposite effect on granular soils.
(c) Expansion joint should be provided when the structure supported by the raft consists of several parts with varying heights and loads or there is a change in the direction of the raft.
(d) This method does not explicitly provide any guidance as to how factors emphasized in (a) and (b) above should be allowed for.

ACI Committee 336, Design of Combined Footings and Mats (1988)

There is no authentic method has been given that can evaluate all the factors involved in the problem and allow carrying out determination of contact pressures under combined footings and mats. Simplifying assumption must, therefore, be made based on the knowledge of the interaction of the various elements of the system. The following factors should be considered while examining any problem:

(1) Soil type immediately below the footing
(2) Soil type at the greater depth
(3) Size of footing
(4) Shape of footing
(5) Eccentricity of loading
(6) Rigidity of footing
(7) Rigidity of the super-structure

(8) Modulus of sub-grade reaction

The committee suggests procedure to be followed for design of footings under two columns: (i) grid foundations and (ii) strip footings supporting more than two columns and mat foundation. Linear soil pressure distribution is suggested for footings which can be considered rigid to the extent that only very small relative deformations result from the loading. The rigidity may result from the spacing of the columns on the footing from the rigidity of the footing it self for rigidity of the super-structure. Limitations which must be fulfilled to make this assumption valid have been discussed in the report.

Distribution of soil pressure by means of sub-grade reaction has been suggested where sub-soils are of such character that the deformations are localized in the general vicinity of loads and when the maximum contact pressure is smaller than about one and a half times the ultimate bearing capacity. In case of rigid footings, it is suggested that uniform or linear distribution of oil pressure can be assumed and the design based on static. Flexible footing procedure is divided into 2 parts i.e. uniform condition and general condition. Uniform conditions are considered to be those where the variation in adjacent column loads and spans is not greater than 20%. For cases where supporting columns are at random location with varying intensities of loads a detailed design procedure based on plate theories has been recommended.

ACI committee 336 2R -88 Published in ACI Manual (1993)

(a) Maximum unfactored design contact pressure should not exceed the available soil pressure determined by engineer. Where wind or earthquake forces form a part of the load combination, the allowable soil pressure may be increased as allowed by the local code and in consultation with geo-technical engineer.

(b) Combined footings and mats are sensitive to time dependent sub surface response. Many structural engineers analyze and design mat foundations by computer using the finite element method. Soil response can be estimated by modeling with coupled or uncoupled "Soil springs". The spring properties are usually calculated using a modulus of sub grade reaction, adjusted for footing size, tributary area to the node, effective depth, and change of modulus with depth. The use of uncoupled springs in the model is a simplified approximation. The time dependent characteristics of the soil response, consolidation settlement or partial consolidation settlement, often can significantly influence the sub grade reaction values. Thus, the use of a single constant modulus of sub grade reaction can lead to misleading results.

(c) Caution should be exercised when using finite element analysis for soils. Without good empirical results, soil springs derived from values of sub grade reaction may only be a rough approximation of the actual response of soils.

(d) The response of a footing is a complex interaction of the footing itself, the superstructure above, and the soil. That interaction may continue for a long time until final equilibrium is established between the superimposed loads and the supporting soil reactions. Moments, shears, and deflections can only be computed if these soil reactions can be determined.

(e) No analytical method has been devised that can evaluate all of the various factors involved in the problem of soil-structure interaction and allow the accurate determination of the contact pressures and associated sub grade response.

(f) For mat foundations modulus of sub grade reaction cannot be reliably estimated on the basis of field plate load tests because the scale effects are too severe. .

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Soil Structure Inter-action -The Real Behavior of Structures (1989)

The above institutions constituted a joint committee under Dr. Sam Thornborn which prepared this report. Pointing out that,

(i) Real behavior of structures in contact with ground involves an inter-active process beginning with the construction phase and ending with a state of balance after a period of adjustment of stresses and strains within the structure and within the ground influenced by the structure.

(ii) Actual behavior of the structure relates to the inherent spatial variations in the ground and it should be appreciated that these variations are not always readily identifiable by occasional and local boring, sampling and testing.

The report deals with the question of soil structure interaction in 2 parts. Part I relates to structures supported by ground and Part II for ground supported by structures.

(a) Under structures supported by ground, the report points out that engineers could estimate the settlements for a perfectly flexible load or they could estimate the average settlement of a rigid load but in between these limits. The paper could say nothing.

(b) If used sensibly and with discernment, analytical methods can be of considerable assistance enabling a designer to gain a feel for the behavior of soil structure system. However, if used blindly: such methods cause menace and can be extremely misleading.

(c) For a framed building founded on a raft, during excavation some heave of the soil will occur. The raft will then be constructed and will be influenced by the differential settlement there after. As the structural load is applied short term settlements take place, the part of the structure in existence distorts and the overall stiffness gradually increases. The cladding is then added and may substantially increase the stiffness of the building. Finally, the imposed load is applied. Not all the components of the buildings are subject to the same relative deflection. The relative deflections experienced by the raft will be the largest. Those experienced by the structural members will vary with location and elevation in the building. The likelihood of damage will diminish, the larger the proportion of medium and long-term settlements, the smaller the ratio of imposed/dead loads and later the stage at which the finishes are applied.

(d) The report has an appendix which has reviewed currently available techniques for the analysis of the total soil structure system.

(e) The manner in which and the limitations with which super-structure can be modeled have been singled out. For soil model, it is pointed out that commonly known approach of treating the soil as a set of liner unconnected springs cannot be recommended for the analysis of rafts and continuous footings although this model has the advantage of being easily included in standard computer programmes for structural analysis. It is a poor physical model. The results of analysis based on use of this model may be excessively sensitive to the pattern of applied load.

Chapter 3

DESIGN APPROACH

3.1 INTRODUCTION

Two approaches have been generally used for analyzing the behavior of raft foundation:

A. Rigid foundation approach
B. Flexible foundation approach

3.1.1 Rigid Approach

In rigid foundation approach, it is presumed that raft is rigid enough to support over non-uniformities of soil structure. Pressure distribution is considered to be either uniform or varying linearly. Designs of rigid raft follows conventional methods where again following two approaches have been used:

(a) Inverted floor system
(b) Combined footing approach

In rigid rafts, differential settlements are comparatively low but bending moment and shear forces to which raft is subjected are considerably high.

3.1.2 Flexible Approach

In flexible foundation approach. Raft is considered to distribute load in the area immediately surrounding the column depending upon the soil characteristics. In this approach differential settlements are comparatively larger but bending moments and shear forces to which the raft is subjected are comparatively low. Analysis is suggested basically on two theories

(a) Flexible plate supported on elastic foundation, i.e. Hetenyi's Theory

(b) Foundation supported on bed of uniformly distributed elastic springs with a spring constant determined using coefficient of sub-grade reaction. Each spring is presumed to behave independently, i.e. Winkler’s foundation

Based on these two basic approaches, simplified methods subject to certain limitations which can be carried out by manual computation or by computer based methods like finite element and finite differences methods. Finite differences method is based on the second approach. If uniformly distributed elastic springs and can consider one value of sub-grade modulus for the entire area.

Finite element method transforms the problem of plates on elastic foundation into a computer oriented method of matrix structural analysis. In this method, plate is idealized as a mesh of finite elements inter-connected only at the nodes (corners), and the soil may be modeled as a set of isolated springs or as an elastic isotropic half space. The matrix structural analysis can be extended to include the influence of the super-structure as well. Thus the interaction between the super-structure, the foundation and the soil can be accounted for. It is possible to consider different values of sub-grade modulus in different areas of the raft foundation.

As a simplification of treating the entire raft as a plate, concept of beam on elastic foundation is also being used. For this purpose raft is considered to consist of beams in both the directions. Each of these beams is treated as supported on springs having spring constant calculated using modulus of sub grade reaction and carrying column loads. The beam is then analyzed as a beam on elastic foundation.

3.2 **Parameters for Raft Design**

Three basic parameters, i.e. rigidity of the raft, pressure distribution under the raft and value of sub-grade modulus become important in addition to whatever other information is received from soil investigation report.

3.3 **Pressure Distribution Under the Raft**

A problem which has to be solved while designing a raft foundation is to evaluate the actual contact pressure of the soil against the raft. Contact pressure, settlement of foundation, soil characteristics and its behavior are so much inter-related and their relationship so complex, that soil foundation structure interaction is not clear.

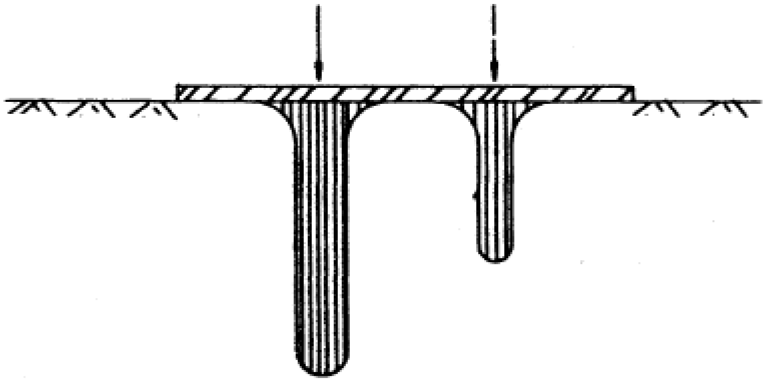
Considering all these aspects it can be said that the contact pressure distribution under the raft depends upon:

The nature of the soil below the raft, i.e., a single homogenous mass or a layered formation, thicknesses of various layers and their relative locations, Properties of the soil, the nature of the foundation, i.e., whether rigid, flexible or soft, Rigidity of the super-structure, the quantum of loads and their relative magnitude, Presence of adjoining foundation, Size of raft, time at which pressure measurements are taken

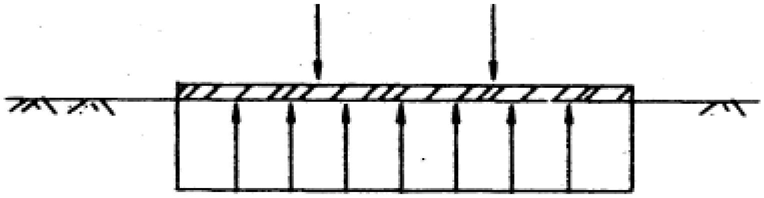
The total settlement under the raft foundation can be considered to be made up of three components, i.e., S = Sd + Sc + Si .

Where S_d is the immediate or distortion settlement, Sc the consolidation settlement and Si is the secondary compression settlement. The immediate component is that portion of the settlement which occurs simultaneously with the load application, primarily as a result of distortion within the foundation soils. The settlement is generally not elastic although it is calculated using elastic theory. The remaining components result from the gradual expulsion of water from the void and corresponding compression of the soil skeleton. The Distinction between the consolidation and secondary compression settlement is made on the basis of physical processes which control the time rate of settlement. Consolidation settlements are largely due to primary consolidation in which the time rate of settlement is controlled by the rate at which water can be expelled from the void spaces in the soil. Effect of groundwater table is appreciable on the load carrying capacity of the soil and consequently settlements. It is, therefore, necessary to consider the expected ground water table in life time of the structure including the temporary rises as during floods. Even in areas where sub-soil water table is not present, it is necessary to consider long term built up water for design of basement and raft foundation. If coefficient of permeability k is below 0.1mm per second). Soil is cohesive and probability of surface water accumulated against basement walls exist. In such situations, it may be necessary to design raft foundations of basement for water uplift also.

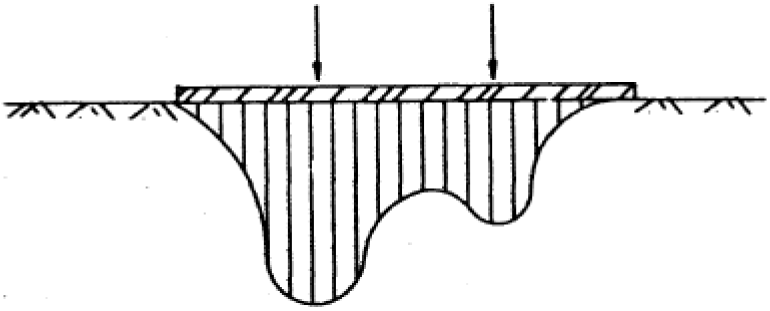
The consolidation pressure involves expulsion of water from the soil being compressed. This takes time and at any time between the application of the load producing consolidation and the time at which essentially ultimate or 100 per cent consolidation has occurred, the measured settlements and consequently contact pressure distribution would be different. Many times it may take several years to achieve final settlement. There are situations in engineering practice where footings are placed so close to each other that their zones of influence overlap. Studies have shown that effect of adjacent footings may vary considerably with angle of shearing resistance. For low values they are negligible. For higher values they appear to be significant particularly if footing is surrounded by others on all sides. There are practically no effects in case of punching shear failure. It is generally recommended that interference effect may be neglected. In view of various factors affecting the pressure distribution under a raft foundation and difficulties in determining affect of each. it is generally believed that contact pressure distribution under a raft could be of the following type as shown in Fig. 3.1.



(a) Rock



(b) Soft soil



(c) Stiff soil

Figure 3.1 Contact pressure distributions under a Raft (Satish Chandra, 1997)

Fig.3 .1 (a) is applicable when the mat is supported on hard rock and column loads are transmitted to the rock on areas of relatively small size directly under the columns.

If the raft rests on a stiff dense soil then loads are distributed to the sub-soil in relatively large areas, as shown in Fig. 3.1 (b).

It is only on very soft soils that the contact pressure against the mat foundation approaches linear distribution as shown in Fig. 3.1 (c).

Therefore, it is commonly justified to design a mat on mud, soft clay, peat or organic soil by the conventional rigid method using uniform pressure. In fact assumption of rigid footings with uniform soil pressure results in designing the raft for assumed bending moments which are larger than the actual bending moments. The resulting design is conservative generally but may not be economical.

3.4 Rigidity Criteria

Whether a structure behaves as rigid or flexible, it depends on the relative stiffness of the structure and the foundation soil. The behavior of the foundation as rigid or flexible will also depend upon the rigidity of the super-structure above and properties of soil below. In physical terms, a rigid foundation would mean a foundation which is capable of bridging over pockets of soil with different properties and thus try to even out the settlements at various points. A rigid foundation would, therefore, have comparatively lower values of differential settlement but higher values of stresses. A rigid foundation with a rigid super-structure on a comparatively compressible soil will result in uniform settlements of structure.

A flexible foundation with a flexible super-structures and a comparatively rigid soil below will behave as a flexible foundation and would result in large differential settlements and low stresses. Thus:

(i) A rigid member is characterized by high bending moments and relatively small, uniform deflections. Over all differential settlements are small.

(ii) An intermediate member, as the term implies, has intermediate bending and deflection values.

(iii) The flexible member has comparatively smaller bending moments and deflection is maximum in vicinity of the loads and small values else where. Overall differential settlement would be of higher orders.

Rigidity criteria proposed by various Codes are discussed below:

3.4.1 Proposed by IS : 2950 (Part 1) (1981)

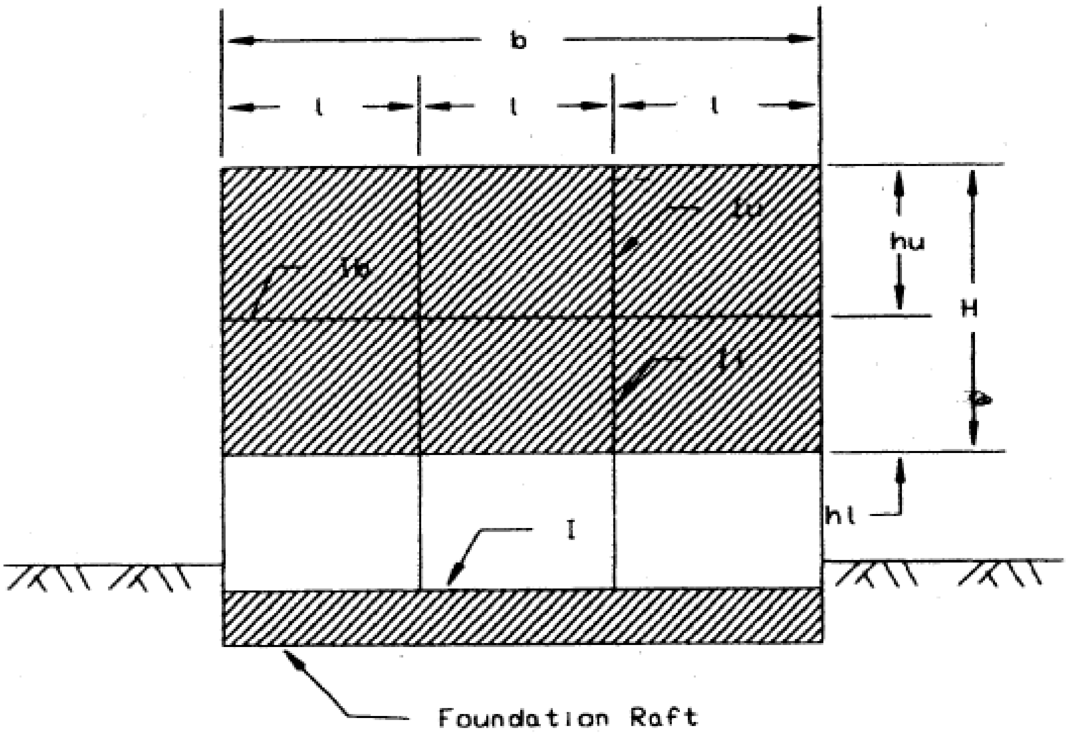
Appendix C of this standard gives the method of deciding rigidity of super-structure and foundation. This is given below:

Rigidity of Superstructure and Foundation

C-1 Determination of the Rigidity of the Structure.

C-1.1 The flexural rigidity EI of the structure of any section may be estimated according to the relation given below (see also Fig. 3.2):

$$EI = \frac{E_l I_l b^2}{2H^2} + \sum E_2 I_b \left[1 + \frac{(I'_u + I'_l)\, b^2}{(I'_b + I'_u + I'_l)\, l^2} \right]$$



3.4.2 Figure 3.2 Determination of rigidity of a structure(IS : 2950 (Part 1) 1981)

Where,

El = modulus of elasticity of the infilling material (wall material) in kg/cm^2.

Ii = Moment of inertia of the infilling in cm^2,

b = length or breadth of the structure in the direction of bending.

H = total height of the filling in cm.

E2 = modulus of elasticity of frame material in kg/cm^2

I_b =moment of inertia of the beam in cm4

$$I'_u = \frac{I_u}{H_u}$$

$$I'_l = \frac{I_l}{h_l}$$

$$I_b = \frac{I_b}{l}$$

where

I = Spacing of columns in cm,
hu = Length of upper column in cm,
hi =Length of lower column in cm,

$$I'_f = \frac{I_f}{l}$$

I_u =Moment of inertia of upper column in cm^4,
I_l = Moment of inertia of lower column in cm^4
I_f =Moment of inertia of foundation beam or raft in cm^4

Note : The summation is to be done over all the storeys, including the foundation beam of raft. In the case of the foundation I_f' replaces I_u' and I'_l becomes zero, whereas for the top most beam I'u become zero.

C-2 Relative Stiffness Factor k

C-2.1 Whether a structure behave as rigid or flexible depends on the relative stiffness of the structure and the foundation soil. This relation is expressed by the relative stiffness factor K given below:

(a) For the whole structure

$$K = \frac{EI}{E_s b^3 a}$$

(b) For rectangular rafts or beams

$$K = \frac{E}{12 E_s}\left(\frac{d}{b}\right)^3$$

(c) For circular rafts

$$K = \frac{E}{12\,E_s}\left(\frac{d}{2R}\right)^3$$

where

EI = Flexible rigidity of the structure over the length (a) in kg/cm^2.
Es == Modulus of compressibility of the foundation soil in kg/cm^2
b = Length of the section in the bending axis in cm,
a = Length perpendicular to the section under investigation in cm,
d = Thickness of the raft or beam in cm.
R =Radius of the raft in cm

C-2.1.1 For K > 0.5, the foundation may be considered as rigid

C-3 Determination of Critical Column Spacing

C-3.1 Evaluation of the characteristics λ is made as follows:

$$\lambda = \sqrt[4]{\frac{kB}{4\,E_c\,I}}$$

where

k =Modulus of sub-grade reaction in kg/cm^3 for footing of width B in cm

B =Width of raft in cm,

Ec =Modulus of elasticity of concrete in kgf/cm^2

I =Moment of inertia of the raft in cm^4

Modulus of compressibility of the soil is the additional property required in this particular case.

3.4.3 ACI Committee, 436 (1966)

Suggested design procedure for combined footings and mats -American Concrete Institute Journal, October, 1966

Footings supporting field structures

Continuous strip footings supporting structures which because of their rigidity will not allow the individual columns to settle differentially should be designed as rigid footings with a linear distribution of soil pressure. This distribution can be determined on the basis of simple statics. To determine the approximate rigidity of the structure, an analysis must be made comparing the combined stiffness of the footings, super-structure framing members, and shear walls with the stiffness of the soil. The relative stiffness will determine whether the footing should be considered rigid or flexible.

The following formulas may be used in this analysis

$$K_r = \frac{E'I_B}{E's \, . \, b^3}$$

where

E' = Modulus of elasticity of the materials used in the structure, kips per sq.ft (metric tons per sq.m)

IB = Moment of inertia of the structure Per unit length, $ft.^3$ (m^3)

IF = Moment of inertia of the footing per unit length, ft^3 (m^3)

E's= Modulus of elasticity of the soil, kips per sq.ft (metric tons per sq.m)

b = Width of footings, ft (m)

An approximate value of $E'I_s$ per unit length of building can be determined by summing the flexural rigidity of the footing ($E'L_F$) the flexural rigidity of the each framed member ($E'I_B$) and the flexural rigidity of any shear walls (E'3/12) where a and h are the thickness and height of the wall, respectively.

Computations indicates that as the relative stiffness Kr increases, the differential settlement decreases rapidly.

For Kr= 0, the ratio of differential to total settlement is 0.5 for long footing and 0.35 for a square one.

For Kr = 0.5 the ratio of differential to total settlement is about 0.1.

If the analysis of the relative stiffness of the footing yields a value above 0.5, the footing can be considered rigid and the variation of soil pressure determined on the basis of simple statistics.

If the relative stiffness factor is found to be less than 0.5, the footing shall be designed as a flexible member using the foundation modulus approach as described under section 6.4 of the report.

Columns Spacing

The column spacing on continuous footings is important in determining the variation in soil pressure distribution. If the average of two adjacent spans in a continuous strip having adjacent loads and column spacings that vary by not more than 20 per cent of the greater value or is less than 1.75/λ, the footing can be considered rigid and the variation of soil pressure determined on the basis of simple statics.

If the average of two adjacent span, as limited above, is greater than 1.75/λ the design of the footing shall be governed by subgrade modulus theories.

For general cases falling outside the limitation stated above, the critical spacing at which the subgrade modulus theory becomes effective has to be determined individually.

Evaluation of the factor can be made on the basis of the following formulae:

$$\lambda = \sqrt[4]{\frac{K_s b}{4 E_c I}}$$

$$K_s = SK'_s$$

Ks =Coefficient of vertical subgrade reaction, Kips per cu ft (metric tons per cu m)
K's= basic value of coefficient of vertical subgrade reaction for a square area with width b = 1 ft (0.3 m). Kips per cu ft (metric tons per cu m)
b = Width of footings, ft (m)
S = Size or shape factor for a footing on a particular type of soil
Ec' = Modulus of elasticity of concrete., Kips per sq ft (metric tons per sq m)
I =Moment of inertia of footings ft^3 (m^3)

For sandy soils the size factor S can be determined from the following formula:

$$S = \frac{(b+1)^2}{(2b)}$$

with a limiting value of 0.25 for large footings.

As for clay soils, the shape factor S can be determined from the following formula:

$$S = \frac{(n + 0.5)}{1.5\,n}$$

When n is the ratio of the longer side to the shorter side of the footing. As for extremely long footings, where n approaches infinity, S can be assumed as 0.67.
Values for K' can be determined from the results of field tests performed on the subgrade of the proposed structure or can be estimated on the basis of empirical values in "Evaluation of coefficients of Subgrade Reaction" by Terzaghi.

3.5 Modulus of Sub-Grade Reaction

One of the important terms required in analyzing foundation on the basis of flexible footings is value of modulus of sub-grade reaction also called coefficient of sub-grade reaction for the particular soil in the foundation of the buildings. Mathematically, this can be axpressed as intensity of soil pressure required to create a unit deflection. Theoretically, it can be determined by performing a plate load test and plotting a curve of soil pressure versus deflection. In actual practice, however, many other factors enter and actual value in field is different from what can be determined by a simple plate load "test. Major problems associated are:

(a) Soil is not perfectly elastic and results are effected by the magnitudes of soil pressure and deflection
(b) Footing size affects the value
(c) Footing shape also affects
(d) Depth at which footing is located also affects
(e) Soil stratification and other changes with depth which may not show when testing with a small plate
(f) In methods where soil modulus is determined in laboratory, site condition can not be exactly duplicated in field laboratory
(g) Various authors have suggested different factors to take these problems into account

On the other hand, certain refrecnces have suggested very simple values for modulus of sub-grade reaction which can be determined from bearing capacity factors used in Terzaghi bearing capacity equation.

3.5.1 Modulus of Subgrade Reaction (Bowles 1988)

Has related value of modulus of sub-grade reaction with safe bearing capacity by the elation Ks = 36 qa where qa is the allowable bearing capacity in Kips per sq ft. A slightly improved values are also suggested by the equation.

$Ks = 12 (c.Nc.Sc) + 12 (y.Nq.Sq) Z$

where c is cohesion, Nc and Nq are bearing capacity factors, Sc and Sq are shape factors for particular soil in foot units .

Moreover:

$$Sc = 1 + \frac{Nc \times B}{Nc \times L}$$

$$Sq = 1 + \left(\frac{B}{L}\right) \times \tan \theta$$

General values suggested by Bowles are given below:

Soil	**Range of ks(kN/m3)**
Loose sand	4800-16000
Medium Sand	9600-80000
Dense Sand	64000-128000
Clayey Sand (Medium)	32000-80000
Silty Sand (Medium)	24000-48000
Clayey Soil	
qu≤200kpa	12000-24000
200<qu≤400ksf	24000-48000
qu>800	>48000

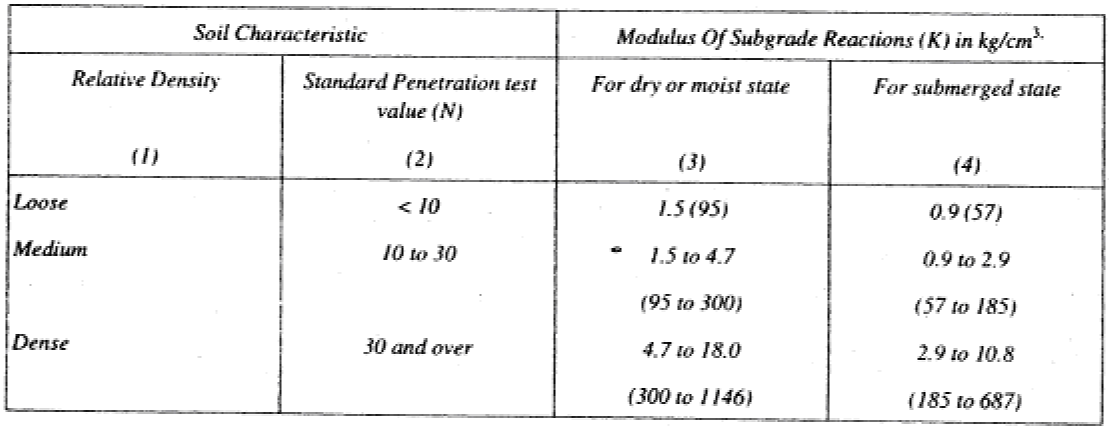
3.5.2 Modulus of Subgrade Reaction (IS: 2950 (Part I) 1981)

Provision relating to determination of modulus of sub-grade reaction are included in Appendix B. This is reproduced below Figures given in bracket in Tables I and II are in Kipslc ft. units.

B-1 General

B-1.1 The modulus of subgrade reaction (k) as applicable to the case of load through a plate of size 30 x 30 cm or between 30 cm wide on the soil is given in Table 1 for cohesionless soils and in Table 2 for cohesive soils. Unless more specific determination of K is done (see B-2 and B-3) these values may be used/or design of raft foundation in cases where the depth of the soil affected by the width of the footing may be considered isotropic and the extrapolation of plate load test results is valid.

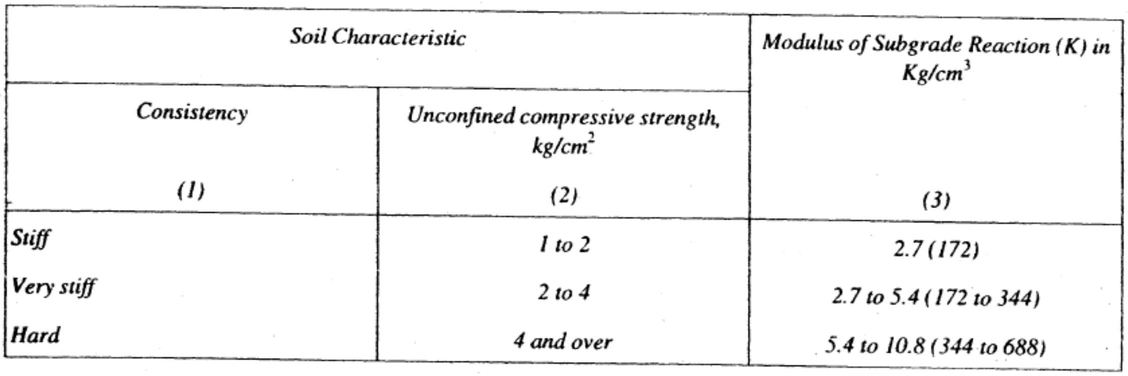
Table3.1 Modulus of Sub-grade Reaction (K) for Cohesionless Soils



Soil Characteristic		Modulus Of Subgrade Reactions (K) in kg/cm³	
Relative Density (1)	Standard Penetration test value (N) (2)	For dry or moist state (3)	For submerged state (4)
Loose	< 10	1.5 (95)	0.9 (57)
Medium	10 to 30	1.5 to 4.7 (95 to 300)	0.9 to 2.9 (57 to 185)
Dense	30 and over	4.7 to 18.0 (300 to 1146)	2.9 to 10.8 (185 to 687)

The above values apply to a square plate 30 X 30 cm or beams 30 cm wide

Table 3.2 Modulus of Sub-grade Reaction (K) for Cohesive Soils.



Soil Characteristic		Modulus of Subgrade Reaction (K) in Kg/cm³
Consistency (1)	Unconfined compressive strength, kg/cm² (2)	(3)
Stiff	1 to 2	2.7 (172)
Very stiff	2 to 4	2.7 to 5.4 (172 to 344)
Hard	4 and over	5.4 to 10.8 (344 to 688)

The values apply to a square plate 30 x 30 cm. The above values are based on the assumption that the average loading intensity does not exceed half the ultimate bearing capacity.

B-2 Field Determination

In cases where the depth of the soil affected by the width of the footing may be considered as isotropic the value of K may be determined in accordance with IS: 9214 – (1997). The test shall be carried out with a plate of size not less than 30 cm.

B-2.1 The average value of K shall be based on a number of plate load tests carried out over the area, the number and location of the tests depending upon the extent and importance of the structure.

NOTE IS:9214 –(1979) lays down that Ks can be determined as slope of the secant drawn between the points corresponding to zero settlement and point corresponding to 1.25 mm settlement of a load settlement curve obtained from a plate load test on the soil using a 75 cm dia plate or smaller dia with corrections for size of the plate used.

B-3 Laboratory Determination

B-3.1 For stratified deposits or deposits with lenses of different materials, evaluation of K from plate load will be unrealistic and its determination shall be based on laboratory tests (IS: 2720 (Part XI)-1972 and IS: 2720 (Part XII)-1981)

B-3.2 In carrying out the test, the continuing cell pressure may be so selected as to be-representative of the depth of average stress influence zone (about 0.5 B to B)

B-3.3 The value of K shall be determined from the following relationship

$$K = 0.65 \sqrt[12]{\frac{E_s B^4}{EI}} \cdot \frac{E_s}{1-\mu^2} \cdot \frac{1}{B}$$

where
Es =Modulus of elasticity of soil (Appendix A)
E =Young's modulus of foundation material
μ =Poisson's ratio of soil (Appendix A of IS Code) and
I =Moment of inertia of structure if determined or of the foundation

B-3.4 In the absence of laboratory test data, appropriate values of E, and μ may be determined in accordance with Appendix A and used in B-3.3 for evaluation of K.

B-4 Calculations

B-4.1 When the structure is rigid (see Appendix C) the average modulus of sub grade reaction may also be determined as follows.

$$K_s = \frac{\text{Average contact pressure}}{\text{Average settlement of the raft}}$$

Appendix C lays down the method of determining the rigidity of superstructure and foundation.

Appendix A lays down method of determination of modulus of elasticity of soil by field tests or laboratory tests.
Equation in B-3.3 above is based on work carried out by *Vesic*. *Bowles* has observed that the 12th root of any value will be close to 1 and equation can be considered to be equivalent to

$$K_s = \frac{E_s}{1-\mu^2}$$

and suggested that value of K can be calculated by the equation K = 36 q_a where q_a is allowable bearing capacity in kips per sq. ft.

3.5.3 K- Value of Soils in Field.(IS 9214-1979)

Modulus of sub-grade reaction is defined as a ratio of load per unit area (applied through a centrally loaded rigid body) of a horizontal surface of a mass of soil to corresponding settlement of the surface. It is determined as the slope of secant drawn between the point corresponding to zero settlement and the points of 1.25 mm settlement, of a load settlement curve obtained on a soil using 75 cm dia or smaller loading plates with corrections for size of the plate.

The value of modulus of sub grade reaction so determined is required to be corrected for

(a) when using plates smaller than 75 cm in dia.
(b) correction for bending of the plate.
(c) correction for saturation.

Average value of k is to be based on a number of plate load tests carried out over the area, the number and location depending upon the extent and importance of the structure. Final correction is required to be applied for the size of actual raft being different from plate.

3.5.4 K- Value of Soils in Field. (IS-8009 (Part I) 1978) & (IS 6403-1981).

Another method of arriving at the value of modulus of sub-grade reactions would be to determine the bearing capacity of soil for the contemplated raft foundation and the settlement for the same raft foundation in accordance with the two codes referred above and utilizes the same. This value should be more realistic as it is usual in case of all foundations to fix their dimensions in plan for full bearing capacity.

However, determination of bearing capacity of soils is not an exact mathematical exercise leading to accurate results. Large number of approximations and engineering judgments are involved. Two types of failure, i.e. general sheer failure and local sheer failures have been recognized.

Settlement calculations in the present state of knowledge are considered to be at best estimate of the most probable magnitude of settlement. Calculations in this code are based on the assumption that the loads transmitted to the foundation are static and vertical. The soil mass below is considered to consist of horizontal soil layers having known properties determined on the basis of base log data from several bores. In practice, However, no two base log data is similar, soil layers are not horizontal and it is quite difficult to idealize the soil below foundation in the manner contemplated in the code.

Different methods of calculating settlement are applicable for cohesionless and cohesive soils. Because of difficulty in sampling of cohesionless soil and consequent inability for determining their compressibility characteristics. Settlement calculations are based on semi-empirical methods utilizing results of static cone penetration tests, standard penetration test or plate load test. Plate load tests being getting out of fashion, it will normally be worked on the basis of 'N' values from standard penetration test.

In case of cohesive soils, settlement is considered to be built up to two components: immediate settlement plus primary consolidation settlement. Procedure for estimation of immediate and consolidation settlement differ for different types of soil profile, i.e nature and location of various soil layers below the foundation. These also depend even on the fact whether the cohesive soil layer is pre-consolidated or normally loaded clay.

Settlements as calculated are required to be corrected for the effect of depth of the foundation and effect of rigidity of raft. Correction due to depth of foundation is applied as a depth factor. For rigidity it is assumed that the deflection at the centre of rigid foundation is equal to 0.8 times that for a flexible foundation. To apply this factor one has to decide whether the foundation is rigid or flexible. As already discussed in para 5.5 this itself is full of uncertainties and approximations.

Further settlements of an actual structure would depend upon the time rate of loading. Methods have been suggested to take this into account, but these methods again are based on number of assumptions and neglecting the effect of loading and unloading cycles high undergo during the construction process. .

3.5.5 Modulus of Subgrade Reaction based on SPT (1970)

Alpan correlated the values of reciprocal of the modulus of sub grade reaction with SPT blows which were also available for the tests (using settlement curves of plate load test). Alam Singh has also developed a correction chart for overburden pressure. S.P.T. value determined in field is corrected for overburden pressure from these charts. He has further suggested that the value so determined should not be more than 3 times the original value of N. When N is greater than 15, it should be further corrected as per relationship.

$N = 15 + 0.5\,(WT-15)$

This corrected value of N is used in the curve to find out reciprocal of modulus of sub-grade reactions. These values are for plates and have to be corrected for size of the raft foundation. In this plot curve 1 and 2 represent the extreme boundaries. Average curve is suggested for N values between 10 to 20, curve 2 for N value >50, curve I for N < 10 and Terzaghi, Peck curve for N values between 30 and 50.

3.6 JOINTS IN RAFTS

Joints are required in Raft against two factors

1) Thermal and
2) Seismic effects.

In buildings where there are no basements, whether these joints should be extended to foundation raft in the affirmative as there is not much of difficulty in extending the joints in the raft.. However, where the buildings have basements, provision of joints requires a deeper thought as joints are always a source of leakage in the building.

If the buildings have basements, foundations are generally more than 3 m below ground level and are very little affected by thermal variations. Thermal effects are, therefore, not of much consequence at this depth. Seismic effects, however, are still important as they are independent of the depth of foundation.

In multi-block buildings having basements unless technology to ensure water tight construction is available, joints need not be provided in the basement rafts. Wherever computer facilities of adequate size are available, raft should be analyzed as a whole. On the other hand, where it cannot be done, a separate analysis can be carried out for portion of the raft taking 2 or 3 bays on either side of the joint and neglecting the other portions. The common portion can then be designed for these values or the individual block values whichever is higher. While detailing, reinforcement should be provided liberally at the joint.

3.7 PARAMETER CONSIDERED IN METHODS OF ANALYSIS

The following factors affect the choice of the structural designer to select a particular method of analysis of raft foundation:

(a) Importance of the building;
(b) Time available for carrying out the design;
(c)Permitted cost of analysis in design;
(d)Nature of soil, its bearing capacity and extent of soil investigation carried out;
(e)Cost of the building;
(f)Type of the building and loads imposed by the buildings;
(g)Infrastructure facilities available with the structural designer, and
(h)Limitations in reinforcement detailing and fabrication.

Chapter 4

DESIGN AND ANALYSIS OF RAFT

4.1 INTRODUCTION

In this chapter, we are designing a raft foundation loaded with four columns, of a transmission tower in which we are analyzing it on change in two major criteria's.

1) Bearing capacity
2) Relative stiffness

1) With variation of Bearing capacity following three type of cases are considered

a) B.C.=26.5 KN/m^2
b) B.C.=80 KN/m^2
c) B.C.=300 KN/m^2

2) In Relative stiffness also two thickness of raft is considered.

We know that relative stiffness is directly proportional to thickness hence in the current work change thickness result in change in stiffness.

PROBLEM FORMATION:-

A Raft for transmission tower was designed using Stadd pro model and was compared with a simplified model

Table 4.1 Assumed Dimensions of Foundation

1	Footing Width at the Bottom of Slab	B	m	6.000
2	Width of Footing Top of Slab	B1	m	6.000
3	C/C of pedestal at top of slab	B2	m	3.340
4	C/C of pedestal at plinth level	B2	m	3.190
5	Width of Chimney	Bc	m	0.450
6	Depth of PCC Pad	Dpad	m	0.100
7	Depth of Slab at middle From top of PCC Pad	D1	m	0.80/0.50
8	Depth of Slab from at end	D2	m	0.80/0.50
9	Height of Chimney Upto G.L From Top of Slab	Dc	m	1.100

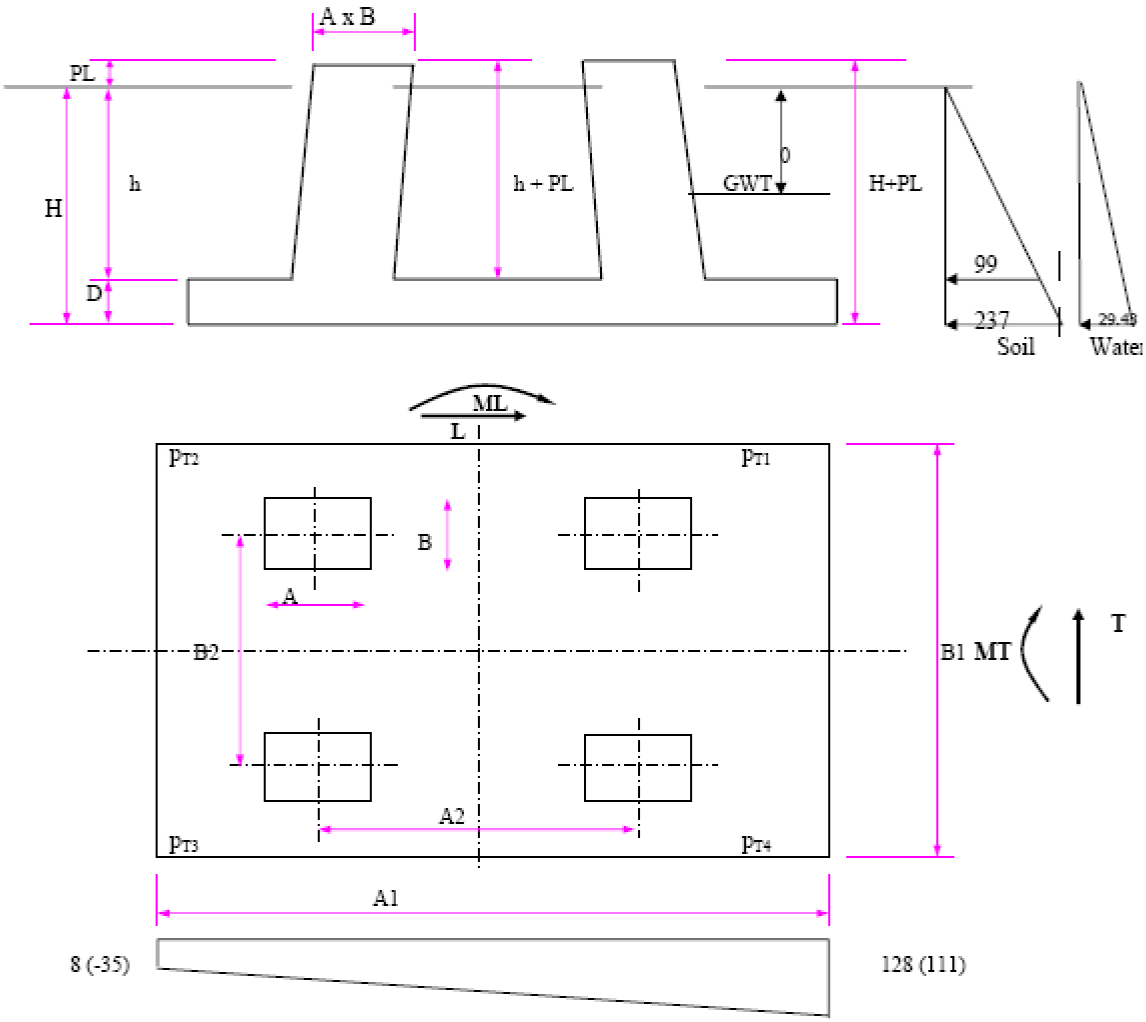


Table 4.2 Ultimate Foundation Loads

Sr. No	Type of Load	
1	Vertical Load (kg)	14964
2	Side Thrust (Transverse) (kg)	1289
3	Side Thrust (Longitudinal) (kg)	15040
4	Moment (Transverse) (kg-m)	222760
5	Moment (Longitudinal) (kg-m)	17959

Table 4.3 Input Parameters

Sl.No	Description	Variable	Unit	Value
1	Slope of Tower Leg	Φ	Deg	3.310
2	Depth of Soil Below G.L	Dl	m	1.100
3	Depth of water table below G.L.	h1	m	1.50
4	Unit Weight of Soil Below G.L (dry)	W_s	Kg/m^3	1440
5	Unit Weight of Soil Below G.L (wet)	W_s	Kg/m^3	940
6	Angle of Repose(dry soil)	α	Deg	30
7	Angle of Repose(wet soil)	α	Deg	15
8	Allowable Bearing Capacity of Soil(NC)(Dry Soil)	Sbcs	KN/m^2	26.500
9	Allowable Bearing Capacity of Soil(BWC) (Dry Soil)	Sbcsb	KN/m^2	26.5
10	Allowable Bearing Capacity of Soil(NC)(Rock Soil)	Sbcs	KN/m^2	300
11	Allowable Bearing Capacity of Soil(BWC) (Rock Soil)	Sbcsb	KN/m^2	300
12	Allowable Bearing Capacity of Soil(NC)(Wet Soil)	Sbcs	KN/m^2	80
13	Allowable Bearing Capacity of Soil(BWC) (Wet Soil)	Sbcsb	KN/m^2	80
14	Total Depth of Foundation Below G.L (Including Pcc Pad)	D	m	2.000
15	Plinth Height	Dp	m	0.225
16	Unit Weight of Concrete below G.L(dry)	Wc	Kg/m^3	2400
17	Unit Weight of Concrete below G.L (sub)	Wc	Kg/m^3	1400
18	Characteristic Strength of Concrete	Fck	N/mm^2	20
19	Characteristic Strength of Steel	Fy	N/mm^2	415
20	Clear Cover To Chimney Reinforcement	Ccc	mm	50
21	Clear Cover To Footing Slab Reinforcement	Ccs	mm	50
22	Coeff. Of Sliding Between Soil & Conc.			0.25

4.3 Solution

Calculation sheets are Appended

Chapter 5

RESULT, DISCUSSION & CONCLUSION

5.1 RESULTS & DISCUSSION

The usual practice of design being followed is to work out preliminary sizes of the raft and thickness of the slab. If raft is uniformly thick then it should be analysed on the basis of shear forces and moments. As an improvement where computer facilities and greater expertise are available, raft is analysed as flexible raft selecting one out of the three particular values i.e. modulus of subgrade reaction, relative stiffness and assumed size of the raft. Values of bending moments and shear force obtained are used in design of raft. In both of these designs, the preliminary size of raft selected are found to be structurally unsafe in resisting moments and shear and thus design is completed and finalised after addition of permissible reinforcement.

Table 5.1 Comparision of Staad & Simplified Model

Thickness 0.5m							
Bearing capacity kN/m^2		**26.5**		**80**		**300**	
Model		**Simplified**	**Staad**	**Simplified**	**Staad**	**Simplified**	**Staad**
Shear N/mm^2	**SQx**	128.9	227.6	128.9	147.5	128.9	288.9
	SQy	1504	225.3	1504	1412	1504	2174
	Mx	22276	9940	22276	10114.61	22276	8444.94
Moments kNm/m	**My**		1570		1651.54		2107.67
	Mxy	1795.9	1316	1795.9	1348.346	1795.9	2485.71

Table 5.2 Comparision of Staad & Simplified Model

Thickness 0.8m							
Bearing capacity kN/m^2		**26.5**		**80**		**300**	
Model		**Simplified**	**Staad**	**Simplified**	**Staad**	**Simplified**	**Staad**
Shear N/mm^2	**SQx**	128.9	151.3	128.9	151.2	128.9	1.558
	SQy	1504	1169	1504	1672	1504	1.301
	Mx	22276	10845.4	22276	10863.9	22276	1020.7
Moments kNm/m	**My**		1685.8		1725.8		1517.01
	Mxy	1795.9	4159.6	1795.9	3766.8	1795.9	3452.1

5.3 CONCLUSION

Two approaches for the analysis of raft foundations are presented. The rafts analyzed by Staad Pro and Simplified model are considered. In this thesis we considered all the loads on the transmission tower and analyzed by the Staad Pro. Moments and shear forces are generated by the analysis of superstructure. These shear forces and moments are used for design of raft foundation. Critical cases of moments and shear forces are considered for design of raft foundation.

In simplified model we take the critical load condition to design the raft foundation. In simplified model we considered critical vertical load on the four columns of transmission tower. These forces give the various thrust on the raft which we consider in the design of raft foundation. They give the uplift and downward thrust, which is considered for the design. From thrust we determine the shear force in various directions. Now assuming a size of raft 6m x 6m, centre of gravity is marked. Also by marking the centre of gravity we determine the moment in longitudinal and transverse directions on the raft. Now for this moment the thickness of raft is calculated. we apply all checks namely over turning, sliding & punching shear. We provide the reinforcement in this raft according to moment and shear force for different thickness and different bearing capacity.

In Staad model we make the model and applied load case with factor of safety then we analyze this model for each node. In this model we also consider for different thickness and different bearing capacity. Which give different values of shear forces and moment on the raft at each nodes. This is very different to the following manner given in tables.

In first table we take the thickness of raft as 0.5m and for all bearing capacity namely 26.5, 80,300 N/mm^2 are used and in the second table we take the thickness of raft as 0.8m with same bearing capacity respectively. Now the value of shear force and moment is considered for comparing with the Staad model and the simplified model.. Both the models considered case 1)DL 2)DL+LL 3)DL+LL+WL/EQ. In simplified model we consider moment and shear force only on the column position while in Staad model we consider moment and shear force on all the nodes of raft.

.

Rigidity of raft gives effect on the stresses actually developing in the raft. Soil pressure distribution under the raft is neither uniform non linearly varying. This depends upon the relative rigidity of foundation and soil. For a known value of soil rigidity, there is a value of raft rigidity which would make the soil pressure more or less uniform.

Modulus of sub-grade reaction, which is a measure of soil rigidity, is a function of the nature and properties of the soil below and behaviour of structure above. Variation in the bending moments for same value of rigidity of raft with varying values of modulus of subgrade reaction is considerable.

If the thickness and value of subgrade reaction can be changed, then some extent of variations that can be expected on the values of bending moments would be much high. In seismic areas or in high wind areas, there are horizontal loads which act upon the super-structure and, therefore, also on the foundation. Their effect is to vary the column base moments and also increase in vertical load in some columns and decrease in others This increase and decrease is a cyclic process which depends upon the direction in which the horizontal forces are acting.

Simplified Model is more appropriate to comprehend physically the effect of shear forces and bending moments, compare to Staad Model which is more versatile for the designers.

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Appendix I

Thickness: 0.5 meter			
Shear Force SQX (N/mm2)			
Bearing Capacity	26.5 (kN/m2)	80 (kN/m2)	300 (kN/m2)
1	0.347	0.356	0.218
2	0.831	0.929	0.423
3	0.664	0.85	0.163
4	-0.033	0.212	-0.44
5	-0.253	-0.019	-0.451
6	-0.288	-0.071	-0.329
7	-0.261	-0.066	-0.214
8	-0.206	-0.033	-0.136
9	-0.136	0.015	-0.095
10	-0.059	0.07	-0.077
11	0.032	0.136	-0.052
12	0.103	0.139	0.019
13	0.092	0.081	0.04
14	0.027	0.003	0.021
15	-0.31	-0.266	-0.542
16	0.771	0.705	0.769
17	-0.515	-0.326	-1.021
18	-0.687	-0.618	-0.845
19	-0.576	-0.533	-0.568
20	-0.455	-0.433	-0.338
21	-0.346	-0.341	-0.18
22	-0.25	-0.256	-0.085
23	-0.163	-0.177	-0.036
24	-0.08	-0.094	-0.012
25	-0.014	-0.016	-0.014
26	0.155	0.214	0.017
27	0.067	-0.023	0.128
28	-0.095	-0.06	-0.145
29	-0.839	-0.738	-1.197
30	0	0	0
31	-2.776	-2.791	-2.889
32	-1.101	-1.047	-1.214
33	-0.651	-0.602	-0.639
34	-0.459	-0.424	-0.353

35	-0.336	-0.317	-0.185
36	-0.238	-0.232	-0.089
37	-0.149	-0.152	-0.036
38	-0.065	-0.074	-0.006
39	0.019	0.009	0.027
40	-0.062	-0.061	-0.047
41	0	0	0
42	-0.172	-0.197	-0.248
43	-1.004	-1.103	-0.941
44	1.347	1.475	0.988
45	-1.226	-1.242	-1.336
46	-0.805	-0.773	-0.882
47	-0.548	-0.507	-0.534
48	-0.402	-0.373	-0.305
49	-0.3	-0.285	-0.163
50	-0.213	-0.21	-0.077
51	-0.13	-0.138	-0.027
52	-0.04	-0.057	0.017
53	0.06	0.027	0.084
54	0.345	0.238	0.394
55	0.287	0.372	0.156
56	-0.593	-0.697	-0.484
57	0.415	0.444	0.279
58	0.88	0.959	0.559
59	0.654	0.753	0.331
60	-0.225	-0.172	-0.345
61	-0.325	-0.285	-0.326
62	-0.297	-0.271	-0.219
63	-0.242	-0.23	-0.125
64	-0.178	-0.18	-0.06
65	-0.109	-0.121	-0.017
66	-0.03	-0.05	0.022
67	0.087	0.057	0.096
68	0.213	0.207	0.156
69	0.157	0.164	0.099
70	0.052	0.065	0.028
71	0.178	0.194	0.079
72	0.261	0.311	0.059
73	0.145	0.206	-0.05
74	-0.023	0.031	-0.138
75	-0.167	-0.129	-0.181

76	-0.2	-0.178	-0.141
77	-0.183	-0.175	-0.085
78	-0.143	-0.149	-0.041
79	-0.093	-0.109	-0.01
80	-0.034	-0.056	0.016
81	0.029	0.006	0.041
82	0.067	0.05	0.051
83	0.046	0.035	0.025
84	0.001	-0.008	-0.003
85	0.127	0.141	0.051
86	0.15	0.189	0.004
87	0.072	0.122	-0.067
88	-0.032	0.012	-0.113
89	-0.107	-0.074	-0.117
90	-0.137	-0.12	-0.089
91	-0.136	-0.134	-0.055
92	-0.114	-0.125	-0.024
93	-0.082	-0.103	-0.003
94	-0.045	-0.071	0.012
95	-0.01	-0.037	0.021
96	0.012	-0.011	0.021
97	0.014	-0.001	0.012
98	0.004	-0.001	0.003
99	0.092	0.104	0.032
100	0.087	0.118	-0.018
101	0.028	0.066	-0.068
102	-0.029	0.006	-0.085
103	-0.076	-0.051	-0.079
104	-0.1	-0.09	-0.059
105	-0.103	-0.107	-0.033
106	-0.093	-0.109	-0.011
107	-0.074	-0.101	0.005
108	-0.054	-0.085	0.014
109	-0.034	-0.066	0.018
110	-0.018	-0.046	0.016
111	-0.008	-0.026	0.008
112	-0.001	-0.006	0
113	0.068	0.08	0.021
114	0.06	0.086	-0.017
115	0.015	0.045	-0.053
116	-0.025	0.001	-0.062

117	-0.058	-0.041	-0.055
118	-0.076	-0.073	-0.038
119	-0.081	-0.091	-0.018
120	-0.076	-0.099	0
121	-0.069	-0.101	0.012
122	-0.062	-0.1	0.017
123	-0.057	-0.095	0.017
124	-0.046	-0.08	0.014
125	-0.027	-0.048	0.007
126	-0.007	-0.011	-0.003
127	0.053	0.064	0.016
128	0.051	0.072	-0.007
129	0.019	0.042	-0.031
130	-0.015	0.004	-0.04
131	-0.044	-0.035	-0.037
132	-0.061	-0.064	-0.025
133	-0.064	-0.08	-0.008
134	-0.062	-0.09	0.008
135	-0.063	-0.1	0.017
136	-0.073	-0.116	0.017
137	-0.089	-0.133	0.006
138	-0.091	-0.13	-0.002
139	-0.06	-0.084	-0.005
140	-0.014	-0.017	-0.007
141	0.048	0.061	0.014
142	0.057	0.072	0.011
143	0.038	0.055	-0.001
144	0.002	0.017	-0.017
145	-0.038	-0.033	-0.028
146	-0.054	-0.062	-0.02
147	-0.052	-0.073	-0.002
148	-0.046	-0.077	0.015
149	-0.05	-0.09	0.024
150	-0.081	-0.127	0.012
151	-0.145	-0.195	-0.031
152	-0.177	-0.223	-0.062
153	-0.116	-0.145	-0.038
154	-0.018	-0.022	-0.003
155	0.014	0.002	0.024
156	0.114	0.11	0.097
157	0.134	0.142	0.104

158	0.024	0.048	-0.006
159	-0.057	-0.054	-0.043
160	-0.062	-0.074	-0.028
161	-0.044	-0.068	-0.002
162	-0.022	-0.056	0.024
163	-0.013	-0.054	0.042
164	-0.045	-0.088	0.032
165	-0.221	-0.268	-0.095
166	-0.468	-0.538	-0.3
167	-0.326	-0.371	-0.223
168	-0.055	-0.065	-0.05
169	-0.119	-0.011	-0.271
170	-0.014	-0.103	0.103
171	0.234	0.348	0.057
172	-0.125	-0.103	-0.135
173	-0.134	-0.136	-0.105
174	-0.089	-0.106	-0.05
175	-0.04	-0.067	-0.006
176	0.01	-0.025	0.036
177	0.055	0.016	0.081
178	0.084	0.046	0.126
179	0.038	0.018	0.096
180	-0.648	-0.638	-0.497
181	-0.374	-0.454	-0.292
182	0.917	1	0.876
183	0.069	0.112	-0.043
184	0	0	0
185	-1.019	-1.04	-0.937
186	-0.432	-0.438	-0.388
187	-0.233	-0.247	-0.18
188	-0.123	-0.145	-0.077
189	-0.037	-0.067	-0.011
190	0.042	0.006	0.048
191	0.131	0.092	0.126
192	0.257	0.219	0.255
193	0.504	0.476	0.517
194	1.48	1.539	1.343
195	0	0	0
196	0.019	-0.076	0.29
197	0.212	0.171	0.279
198	0.356	0.451	0.222

199	-1.089	-1.151	-0.999
200	-0.489	-0.502	-0.424
201	-0.253	-0.261	-0.2
202	-0.122	-0.134	-0.084
203	-0.027	-0.044	-0.016
204	0.059	0.038	0.044
205	0.163	0.138	0.132
206	0.316	0.286	0.291
207	0.623	0.587	0.62
208	1.267	1.14	1.432
209	-0.469	-0.417	-0.426
210	-0.254	-0.259	-0.285
211	0.119	0.147	0.072
212	0.077	0.091	0.047
213	-0.207	-0.244	-0.155
214	-0.505	-0.622	-0.337
215	-0.399	-0.546	-0.214
216	-0.245	-0.412	-0.094
217	-0.077	-0.254	0.015
218	0.099	-0.084	0.126
219	0.274	0.093	0.256
220	0.438	0.264	0.414
221	0.537	0.37	0.567
222	0.144	0.027	0.242
223	-0.181	-0.234	-0.08
224	-0.165	-0.164	-0.116

Thickness: 0.5 meter			
Shear Force SQY (N/mm2)			
Bearing Capacity	**26.5 (kN/m2)**	**80 (kN/m2)**	**300 (kN/m2)**
1	-0.396	-0.397	-0.382
2	-0.085	-0.13	-0.007
3	0.162	0.117	0.22
4	0.243	0.22	0.232
5	0.073	0.062	0.054
6	0.044	0.034	0.028
7	0.024	0.016	0.011
8	0.013	0.007	0.004
9	0.009	0.005	0.001
10	0.009	0.007	0
11	0.01	0.02	-0.013
12	0.048	0.062	0.002
13	0.092	0.099	0.045
14	0.099	0.073	0.086
15	-1.061	-0.958	-1.333
16	-0.816	-0.921	-0.55
17	1.55	1.412	1.745
18	0.408	0.417	0.34
19	0.1	0.076	0.101
20	0.025	0	0.029
21	0.01	-0.015	0.015
22	0.009	-0.017	0.01
23	0.012	-0.014	0.008
24	0.024	-0.002	0.014
25	-0.003	-0.037	0.003
26	0.071	0.151	-0.064
27	0.357	0.321	0.276
28	0.253	0.142	0.336
29	0.021	-0.009	0.034
30	0	0	0
31	0.211	0.29	0.069
32	-0.022	-0.032	-0.016
33	-0.07	-0.1	-0.025
34	-0.056	-0.093	-0.01
35	-0.035	-0.075	0.003
36	-0.015	-0.057	0.011
37	0.002	-0.043	0.018

38	0.017	-0.032	0.027
39	0.062	-0.007	0.083
40	0.01	-0.098	0.092
41	0	0	0
42	0.126	0.099	0.122
43	2.553	2.706	2.205
44	0.679	0.71	0.516
45	-2.478	-2.621	-2.174
46	-0.548	-0.589	-0.437
47	-0.287	-0.328	-0.185
48	-0.147	-0.193	-0.057
49	-0.084	-0.132	-0.011
50	-0.045	-0.097	0.011
51	-0.018	-0.074	0.023
52	-0.004	-0.063	0.03
53	0.06	-0.018	0.095
54	-0.057	-0.027	-0.132
55	-0.864	-0.889	-0.804
56	-0.922	-1.206	-0.636
57	1.795	1.984	1.319
58	-0.087	-0.108	-0.076
59	-0.624	-0.666	-0.524
60	-0.692	-0.747	-0.526
61	-0.336	-0.382	-0.198
62	-0.199	-0.247	-0.078
63	-0.116	-0.168	-0.016
64	-0.07	-0.125	0.011
65	-0.043	-0.102	0.024
66	-0.03	-0.093	0.03
67	-0.045	-0.101	0.007
68	-0.192	-0.238	-0.127
69	-0.353	-0.405	-0.267
70	-0.861	-1.137	-0.474
71	1.191	1.402	0.714
72	-0.176	-0.196	-0.14
73	-0.3	-0.319	-0.223
74	-0.366	-0.399	-0.235
75	-0.284	-0.322	-0.142
76	-0.192	-0.235	-0.061
77	-0.126	-0.174	-0.012
78	-0.084	-0.136	0.013

79	-0.061	-0.118	0.025
80	-0.059	-0.119	0.026
81	-0.087	-0.148	0.006
82	-0.162	-0.229	-0.046
83	-0.191	-0.246	-0.074
84	-0.747	-1.03	-0.292
85	0.852	1.085	0.398
86	-0.191	-0.202	-0.141
87	-0.201	-0.205	-0.134
88	-0.239	-0.256	-0.128
89	-0.213	-0.238	-0.085
90	-0.163	-0.195	-0.039
91	-0.119	-0.157	-0.007
92	-0.087	-0.13	0.013
93	-0.069	-0.118	0.024
94	-0.069	-0.123	0.028
95	-0.089	-0.148	0.022
96	-0.129	-0.194	0.008
97	-0.122	-0.173	0.011
98	-0.682	-0.963	-0.192
99	0.611	0.863	0.195
100	-0.18	-0.18	-0.124
101	-0.158	-0.147	-0.1
102	-0.174	-0.175	-0.084
103	-0.161	-0.17	-0.056
104	-0.133	-0.15	-0.028
105	-0.103	-0.127	-0.006
106	-0.08	-0.109	0.009
107	-0.067	-0.102	0.019
108	-0.068	-0.108	0.024
109	-0.083	-0.13	0.025
110	-0.112	-0.166	0.023
111	-0.094	-0.135	0.036
112	-0.654	-0.919	-0.168
113	0.435	0.701	0.055
114	-0.163	-0.151	-0.111
115	-0.131	-0.106	-0.087
116	-0.133	-0.118	-0.067
117	-0.121	-0.113	-0.045
118	-0.103	-0.102	-0.026
119	-0.083	-0.089	-0.011

120	-0.066	-0.077	-0.001
121	-0.055	-0.072	0.007
122	-0.057	-0.079	0.012
123	-0.075	-0.103	0.01
124	-0.109	-0.145	0.003
125	-0.097	-0.121	0.014
126	-0.659	-0.894	-0.215
127	0.305	0.579	-0.053
128	-0.144	-0.12	-0.108
129	-0.106	-0.069	-0.083
130	-0.094	-0.065	-0.058
131	-0.082	-0.058	-0.04
132	-0.072	-0.053	-0.029
133	-0.059	-0.046	-0.021
134	-0.044	-0.036	-0.013
135	-0.031	-0.028	-0.006
136	-0.031	-0.031	-0.004
137	-0.056	-0.062	-0.016
138	-0.115	-0.127	-0.047
139	-0.129	-0.133	-0.057
140	-0.695	-0.891	-0.336
141	0.208	0.486	-0.147
142	-0.13	-0.096	-0.119
143	-0.071	-0.025	-0.075
144	-0.042	-0.001	-0.039
145	-0.032	0.007	-0.03
146	-0.036	-0.001	-0.031
147	-0.03	0	-0.03
148	-0.015	0.011	-0.024
149	0.006	0.031	-0.015
150	0.025	0.048	-0.005
151	-0.004	0.018	-0.028
152	-0.12	-0.106	-0.119
153	-0.207	-0.189	-0.192
154	-0.765	-0.915	-0.536
155	0.134	0.415	-0.246
156	-0.133	-0.095	-0.153
157	-0.022	0.012	-0.037
158	0.073	0.119	0.036
159	0.036	0.089	-0.003
160	0.003	0.05	-0.029

161	-0.003	0.041	-0.037
162	0.015	0.056	-0.032
163	0.053	0.094	-0.014
164	0.124	0.168	0.029
165	0.178	0.231	0.063
166	-0.09	-0.044	-0.167
167	-0.406	-0.372	-0.457
168	-0.889	-0.993	-0.832
169	0.229	0.535	-0.24
170	-0.437	-0.425	-0.418
171	0.21	0.177	0.252
172	0.292	0.376	0.169
173	0.089	0.148	0.02
174	0.031	0.085	-0.027
175	0.017	0.068	-0.041
176	0.035	0.085	-0.038
177	0.089	0.139	-0.012
178	0.194	0.246	0.061
179	0.549	0.612	0.336
180	0.41	0.541	0.202
181	-1.371	-1.372	-1.37
182	-0.76	-0.807	-0.962
183	0.329	0.365	0.249
184	0	0	0
185	0.424	0.539	0.256
186	0.269	0.348	0.147
187	0.075	0.131	-0.001
188	0.036	0.087	-0.03
189	0.025	0.074	-0.042
190	0.041	0.089	-0.041
191	0.086	0.135	-0.021
192	0.166	0.215	0.028
193	0.487	0.53	0.303
194	0.567	0.533	0.47
195	0	0	0
196	0.652	0.705	0.491
197	0.205	0.332	-0.006
198	-0.63	-0.569	-0.782
199	-1.045	-1.119	-0.957
200	0.046	0.088	-0.013
201	0.019	0.054	-0.037

202	0.029	0.064	-0.026
203	0.033	0.069	-0.028
204	0.042	0.08	-0.029
205	0.058	0.097	-0.029
206	0.071	0.114	-0.038
207	0.082	0.099	-0.003
208	-1.243	-1.119	-1.414
209	-0.544	-0.425	-0.906
210	0.433	0.399	0.285
211	-0.011	0.025	-0.08
212	-0.231	-0.231	-0.247
213	-0.22	-0.229	-0.219
214	-0.108	-0.113	-0.107
215	0.004	0.013	-0.018
216	0.021	0.033	-0.007
217	0.034	0.049	0
218	0.037	0.054	-0.001
219	0.03	0.049	-0.012
220	0.017	0.038	-0.028
221	-0.119	-0.089	-0.165
222	-0.232	-0.185	-0.315
223	-0.216	-0.168	-0.322
224	0.061	0.079	-0.047

Thickness: 0.5 meter			
Bending Moment Mx (kNm/m)			
Bearing Capacity	**26.5 (kN/m2)**	**80 (kN/m2)**	**300 (kN/m2)**
1	40.118	36.252	34.388
2	243.108	231.423	208.712
3	431.454	426.809	333.995
4	470.079	485.779	303.09
5	355.191	389.027	163.549
6	231.49	277.234	55.012
7	128.73	181.334	-10.056
8	49.559	104.811	-44.195
9	-7.318	47.425	-60.66
10	-42.886	9.393	-68.277
11	-55.647	-6.507	-69.643
12	-39.83	0.933	-54.197
13	-13.094	11.169	-24.952
14	0.76	5.882	-2.465
15	-39.67	-33.313	-70.812
16	113.474	103.414	102.601
17	685.447	677.08	587.25
18	498.282	517.836	326.982
19	341.902	376.384	154.166
20	218.851	263.99	47.414
21	121.346	172.531	-13.462
22	46.183	99.38	-45.34
23	-8.448	43.618	-61.113
24	-43.338	5.453	-68.802
25	-59.992	-15.272	-72.874
26	-51.739	-3.844	-74.109
27	3.624	16.323	-6.092
28	14.164	12.01	20.467
29	-156.271	-152.122	-187.094
30	0.061	0.063	0.047
31	994.341	1011.461	844.494
32	504.623	528.13	334.312
33	320.01	355.266	140.294
34	201.753	245.784	39.18
35	111.899	160.811	-16.195
36	42.641	92.64	-45.141
37	-8.571	39.418	-60.058

38	-42.884	0.782	-68.377
39	-60.691	-22.882	-72.625
40	-82.076	-48.662	-87.461
41	-0.002	0.001	0
42	44.503	50.563	45.823
43	-110.855	-118.514	-110.881
44	93.029	88.767	77.506
45	731.031	758.789	583.569
46	453.668	480.666	290.748
47	295.491	330.893	127.171
48	187.843	230.522	35.719
49	105.965	152.401	-14.531
50	42.386	89.036	-41.207
51	-5.265	38.571	-55.336
52	-37.597	0.988	-63.083
53	-55.352	-24.689	-65.803
54	-48.981	-37.458	-43.251
55	41.355	46.039	33.919
56	49.033	60.429	39.581
57	31.436	32.318	21.14
58	195.139	199.421	147.783
59	349.429	366.386	244.677
60	361.662	389.403	215.13
61	263.139	298.451	109.401
62	174.58	215.722	34.849
63	102.511	146.359	-9.391
64	45.444	88.643	-33.55
65	2.422	42.009	-46.13
66	-26.534	6.893	-51.842
67	-38.35	-14.031	-48.596
68	-18.378	-5.618	-22.049
69	15.032	22.365	9.845
70	5.749	6.776	5.822
71	29.917	30.923	19.601
72	143.736	148.934	99.775
73	245.229	260.946	153.22
74	267.142	293.686	140.745
75	220.888	255.224	84.67
76	157.598	196.972	31.826
77	98.783	140.006	-3.737
78	50.158	89.974	-23.988

79	13.157	48.656	-33.95
80	-11.117	17.655	-36.72
81	-19.388	0.622	-30.725
82	-10.743	1.032	-16.017
83	1.024	6.473	-2.727
84	4.297	5.845	3.694
85	25.962	27.443	16.319
86	108.883	114.725	68.62
87	172.783	187.763	94.537
88	195.135	220.034	88.157
89	177.008	209.772	59.276
90	136.698	174.109	25.626
91	93.07	131.76	0.283
92	54.558	91.272	-14.717
93	24.605	56.526	-21.341
94	4.787	29.765	-21.652
95	-4.048	12.983	-16.829
96	-3.824	5.738	-9.021
97	-0.203	3.845	-2.247
98	0.937	1.954	0.753
99	20.143	21.84	11.525
100	82.152	88.629	46.607
101	128.446	143.352	61.803
102	147.298	171.283	56.957
103	140.019	171.328	39.496
104	115.815	151.421	18.865
105	85.692	122.166	2.357
106	57.571	91.668	-7.07
107	35.126	64.139	-9.995
108	19.227	41.27	-8.411
109	9.258	23.555	-4.535
110	3.85	11.044	-0.559
111	1.287	3.528	1.426
112	0.436	1.126	0.509
113	15.792	17.71	8.081
114	63.5	70.691	32.539
115	99.094	114.338	42.42
116	115.233	138.916	38.76
117	112.883	143.38	26.988
118	97.658	132.016	13.237
119	77.549	112.367	2.847

120	58.878	90.975	-1.564
121	44.356	71.163	-0.339
122	33.168	52.951	3.919
123	22.865	34.945	7.721
124	12.48	17.538	8.72
125	4.103	4.676	6.37
126	0.174	0.509	0.488
127	12.497	14.576	5.622
128	50.618	58.566	23.899
129	80.33	96.126	32.046
130	94.955	118.947	29.552
131	93.819	124.319	19.711
132	82.332	116.27	8.419
133	68.396	102.275	1.323
134	57.831	88.576	1.155
135	52.296	77.543	7.567
136	48.435	66.68	16.699
137	39.45	50.021	21.838
138	22.884	26.387	18.863
139	6.437	5.64	10.315
140	-0.312	-0.294	0.084
141	9.899	12.345	3.382
142	40.971	49.22	18.706
143	71.045	87.374	29.692
144	85.152	109.987	28.106
145	81.245	112.939	15.722
146	67.833	102.3	2.501
147	56.597	90.278	-3.655
148	52.676	82.647	-0.412
149	57.211	81.364	12.224
150	66.188	83.404	30.803
151	63.82	73.882	41.587
152	37.856	40.696	31.725
153	6.02	4.177	11.072
154	-4.13	-4.549	-3.889
155	5.918	7.566	1.472
156	36.445	45.669	16.666
157	69.733	85.54	35.416
158	88.699	116.234	35.387
159	70.87	105.024	11.057
160	51.185	87.059	-7.063

161	40.312	74.433	-13.557
162	41.278	70.954	-8.046
163	55.227	78.559	10.211
164	80.715	96.916	41.25
165	102.967	112.768	73.371
166	60.733	63.934	50.765
167	-4.38	-6.961	-0.337
168	-6.908	-7.379	-6.946
169	7.076	19.767	-13.362
170	-2.563	1.923	-8.497
171	122.468	136.484	92.804
172	98.456	131.297	43.682
173	57.246	94.761	1.199
174	30.811	68.659	-21.285
175	19.517	54.561	-28.205
176	23.453	53.244	-21.847
177	43.806	66.61	-0.813
178	82.604	97.587	39.479
179	142.511	151.269	103.692
180	177.671	188.368	150.593
181	-69.917	-78.263	-52.93
182	-56.654	-62.609	-59.627
183	1.956	9.565	-12.862
184	0.024	0.027	0.018
185	258.771	296.552	194.48
186	101.073	140.286	43.041
187	40.435	81.661	-13.041
188	9.212	49.358	-37.524
189	-2.988	33.314	-44.963
190	2.399	32.653	-38.907
191	26.315	48.92	-17.69
192	72.623	86.806	25.651
193	156.515	162.582	110.676
194	391.135	397.068	336.909
195	0.034	0.036	0.024
196	-46.347	-43.409	-62.267
197	7.798	5.678	10.178
198	91.875	104.72	74.908
199	248.733	300.052	172.642
200	96.229	141.971	34.185
201	27.583	72.902	-24.304

202	-9.705	33.007	-51.846
203	-24.186	13.533	-60.718
204	-18.157	12.659	-55.405
205	9.267	31.775	-33.969
206	62.134	75.375	11.888
207	153.673	157.498	100.344
208	342.707	330.126	301.523
209	110.209	99.753	112.243
210	0.113	2.692	-3.811
211	32.387	37.743	24.753
212	127.672	153.674	89.525
213	150.177	193.378	89.076
214	94.546	144.425	30.516
215	22.155	70.463	-29.393
216	-20.189	24.357	-59.741
217	-36.908	1.843	-70.172
218	-30.578	0.684	-65.361
219	-0.293	22.202	-43.134
220	58.394	71.154	5.622
221	149.907	151.361	94.052
222	208.367	198.642	168.576
223	165.006	153.442	147.837
224	38.688	34.8	37.552

Thickness: 0.5 meter			
Bending Moment My (kNm/m)			
Bearing Capacity	**26.5 (kN/m2)**	**80 (kN/m2)**	**300 (kN/m2)**
1	-17.033	-22.72	-8.74
2	-16.181	-21.942	-8.541
3	-11.341	-16.866	-4.769
4	5.918	1.482	9.506
5	15.028	12.175	15.392
6	12.177	10.493	10.344
7	7.975	6.904	5.675
8	5.084	4.568	2.693
9	3.599	3.651	1.149
10	3.655	4.598	0.505
11	5.583	7.426	1.173
12	8.086	10.097	2.598
13	9.844	11.903	3.732
14	10.726	12.558	4.659
15	-148.57	-161.553	-128.859
16	-112.137	-144.878	-60.067
17	61.361	28.423	99.813
18	83.566	70.041	82.285
19	64.941	55.78	55.264
20	40.802	34.761	29.379
21	23.679	19.704	14.247
22	13.027	10.785	6.356
23	8.152	7.684	3.219
24	8.535	10.488	2.839
25	11.68	17.35	2.104
26	32.781	48.898	5.359
27	60.937	67.967	33.272
28	54.748	52.633	41.817
29	-208.965	-229.288	-180.555
30	-0.035	-0.042	-0.023
31	221.628	210.946	210.767
32	164.888	143.816	159.777
33	94.7	78.125	81.533
34	54.587	40.749	41.817
35	29.364	18.152	19.538
36	15.445	6.491	9.141
37	10.47	3.681	6.165

38	12.742	8.353	7.921
39	28.397	26.759	19.219
40	12.341	14.98	5.82
41	0.027	0.027	0.022
42	94.587	102.624	74.371
43	-313.09	-391.65	-192.101
44	-166.978	-235.785	-73.948
45	128.223	93.863	141.675
46	98.329	68.93	99.301
47	67.168	39.775	64
48	37.229	12.933	33.575
49	17.565	-4.074	16.306
50	6.669	-12.685	8.213
51	4.286	-13.099	7.182
52	11.995	-3.789	13.654
53	29.317	14.696	27.831
54	96.677	77.04	90.272
55	219.05	217.798	176.998
56	216.894	235.03	157.238
57	-77.006	-152.332	21.14
58	-66.604	-134.006	9.379
59	-49.664	-105.907	-0.313
60	-17.676	-64.217	10.491
61	1.187	-38.953	18.578
62	-2.508	-38.956	12.226
63	-9.27	-42.955	6.192
64	-13.636	-45.243	3.405
65	-12.7	-42.657	4.749
66	-4.235	-32.854	11.181
67	14.543	-11.851	23.536
68	40.209	17.934	37.951
69	66.688	50.868	50.018
70	82.169	70.63	55.421
71	-10.667	-85.177	71.644
72	-35.704	-105.842	37.126
73	-60.221	-123.787	-0.449
74	-62.884	-120.088	-14.251
75	-52.688	-104.531	-11.729
76	-43.999	-91.985	-6.479
77	-42.088	-87.635	-4.658
78	-41.442	-85.391	-3.048

79	-39.204	-82.031	-0.509
80	-33.775	-75.38	3.105
81	-26.231	-66.064	6.185
82	-18.684	-56.154	7.13
83	-11.704	-46.887	6.52
84	-6.498	-40.227	6.481
85	-4.854	-77.973	70.032
86	-30.709	-101.215	41.049
87	-62.356	-128.95	5.355
88	-77.511	-140.271	-13.768
89	-79.408	-138.808	-18.435
90	-75.96	-132.897	-15.928
91	-72.857	-128.321	-12.053
92	-71.363	-126.164	-8.85
93	-70.362	-124.971	-6.281
94	-69.197	-123.726	-4.517
95	-68.082	-122.421	-4.102
96	-67.288	-121.407	-5.005
97	-66.252	-120.259	-6.234
98	-65.358	-119.404	-6.964
99	-18.341	-87.42	54.297
100	-40.872	-108.639	32.473
101	-70.166	-136.07	4.591
102	-88.5	-152.702	-12.631
103	-96.65	-159.528	-19.396
104	-98.395	-160.537	-19.161
105	-98.376	-160.488	-16.309
106	-99.175	-161.931	-13.488
107	-101.303	-165.225	-11.57
108	-104.207	-169.604	-10.454
109	-107.087	-174.108	-9.663
110	-109.295	-178.006	-8.645
111	-110.531	-181.023	-6.973
112	-110.925	-182.624	-5.569
113	-40.175	-101.937	32.966
114	-58.675	-120.222	17.155
115	-83.493	-144.935	-3.246
116	-100.666	-162.305	-16.175
117	-110.282	-172.477	-21.52
118	-114.705	-177.866	-21.509
119	-117.672	-182.298	-19.47

120	-122.054	-188.729	-17.884
121	-128.783	-198.095	-17.575
122	-136.86	-209.289	-17.781
123	-144.242	-220.078	-16.905
124	-149.415	-228.739	-13.863
125	-152.338	-235.17	-8.696
126	-153.601	-238.733	-4.707
127	-65.47	-116.462	7.417
128	-80.09	-131.862	-3.752
129	-99.821	-153.153	-17.666
130	-113.357	-168.638	-25.251
131	-120.827	-178.338	-26.754
132	-124.807	-184.701	-24.776
133	-129.234	-191.814	-22.633
134	-137.126	-202.921	-22.597
135	-149.693	-219.384	-25.407
136	-165.542	-239.81	-29.729
137	-180.73	-260.068	-32.197
138	-191.771	-276.295	-30.117
139	-198.647	-288.323	-23.739
140	-202.022	-295.042	-18.349
141	-91.856	-128.645	-24.234
142	-102.859	-141.663	-31.256
143	-116.336	-158.49	-38.176
144	-123.625	-169.557	-38.357
145	-125.096	-174.521	-33.244
146	-125.797	-178.457	-27.585
147	-130.206	-186.221	-24.907
148	-140.469	-200.372	-26.364
149	-158.498	-222.974	-33.188
150	-185.213	-255.237	-45.797
151	-215.26	-291.734	-59.363
152	-240.017	-323.381	-66.573
153	-257.505	-347.755	-65.834
154	-267.046	-361.761	-63.287
155	-119.367	-137.937	-67.185
156	-126.472	-149.712	-67.856
157	-131.989	-162.469	-63.05
158	-123.802	-159.272	-47.925
159	-114.735	-153.687	-33.418
160	-113.227	-155.209	-26.352

161	-118.17	-163.732	-24.434
162	-128.68	-178.249	-26.697
163	-147.104	-201.143	-34.823
164	-179.59	-238.631	-53.934
165	-234.078	-300.085	-89.899
166	-297.228	-372.387	-130.353
167	-344.502	-429.246	-155.835
168	-368.174	-459.239	-164.957
169	-126.251	-114.877	-116.469
170	-191.448	-202.765	-143.381
171	-141.497	-170.782	-73.731
172	-80.363	-103.663	-24.566
173	-80.381	-106.248	-18.986
174	-86.639	-115.609	-19.404
175	-94.322	-126.883	-20.741
176	-102.664	-138.983	-22.622
177	-113.24	-153.319	-26.229
178	-131.836	-175.641	-36.081
179	-165.28	-210.937	-61.774
180	-335.39	-388.665	-199.049
181	-570.556	-651.539	-387.029
182	-495.947	-578.576	-330.069
183	-13.415	-7.406	-14.844
184	-0.002	-0.003	0.003
185	44.339	44.464	50.997
186	0.844	-7.203	29.184
187	-34.917	-46.849	1.003
188	-53.897	-69.659	-10.488
189	-64.601	-83.777	-15.691
190	-69.386	-91.767	-16.443
191	-68.807	-94.222	-12.779
192	-59.861	-87.593	-2.166
193	-38.861	-69.747	23.793
194	35.995	20.207	64.176
195	-0.033	-0.04	-0.016
196	-136.152	-157.544	-93.054
197	60.687	54.852	77.881
198	136.654	138.773	147.355
199	136.459	149.371	128.673
200	31.739	34.298	37.189
201	-4.673	-6.901	10.063

202	-25.691	-31.259	-4.771
203	-34.858	-42.963	-10.18
204	-36.607	-46.876	-10.159
205	-30.619	-42.861	-3.942
206	-11.3	-25.769	15.029
207	27.9	11.112	53.184
208	138.855	106.976	183.2
209	119.808	85.839	188.27
210	30.178	13.144	78.126
211	24.506	25.394	25.535
212	20.965	21.994	22.064
213	15.42	16.351	16.808
214	11.215	11.998	12.674
215	3.225	3.028	6.029
216	-3.768	-5	0.543
217	-6.518	-8.408	-1.345
218	-6.785	-9.232	-1.081
219	-4.372	-7.315	1.615
220	2.729	-1.021	9.294
221	9.819	4.821	18.091
222	11.95	5.92	22.927
223	17.06	10.751	29.4
224	21.004	14.837	33.526

Thickness: 0.5 meter			
Bending Moment Mxy (kNm/m)			
Bearing Capacity	**26.5 (kN/m2)**	**80 (kN/m2)**	**300 (kN/m2)**
1	-21.618	-13.418	-39.343
2	-24.198	-6.988	-57.028
3	7.234	29.228	-27.487
4	43.051	69.409	8.713
5	42.691	72.405	10.062
6	26.681	57.173	-0.006
7	15.534	45.494	-5.682
8	9.658	38.276	-8.14
9	7.27	33.837	-9.17
10	6.465	30.05	-9.73
11	4.138	23.683	-11.216
12	0.083	15.797	-14.342
13	-0.661	11.098	-13.234
14	-0.597	4.826	-6.724
15	-51.847	-37.463	-85.57
16	-122.597	-100.104	-159.787
17	-48.685	-9.564	-102.988
18	78.133	115.914	27.713
19	63.609	105.54	15.128
20	40.662	83.482	-0.052
21	25.422	67.782	-8.307
22	17.58	58.417	-11.455
23	14.322	52.721	-12.492
24	13.112	48.076	-13.159
25	9.268	39.217	-15.76
26	3.896	35.045	-26.432
27	-7.298	11.61	-26.147
28	-4.313	7.797	-16.272
29	65.7	81.719	33.607
30	0.012	0.015	0.005
31	78.012	108.278	26.724
32	69.682	109.029	13.205
33	49.525	91.752	-1.384
34	32.454	75.466	-10.426
35	22.833	65.595	-13.459
36	19.091	60.739	-13.053
37	19.115	58.916	-11.359

38	20.455	57.838	-10.171
39	21.609	55.162	-9.042
40	8.092	35.006	-18.667
41	0.004	0.007	0
42	35.367	49.889	18.649
43	238.91	268.542	182.31
44	316.377	348.364	248.751
45	254.778	294.178	174.445
46	55.369	95.795	-6.364
47	31.814	75.243	-21.757
48	21.997	66.622	-23.35
49	18.95	63.532	-19.956
50	20.528	64.238	-14.838
51	25.622	67.774	-8.93
52	32.621	72.592	-2.805
53	43.175	79.379	7.079
54	51.695	87.949	12.025
55	73.381	102.662	37.283
56	81.903	110.713	45.737
57	213.364	243.505	149.683
58	268.161	311.289	179.917
59	179.31	222.251	98.681
60	80.268	123.969	10.992
61	34.078	79.595	-23.664
62	21.254	67.736	-27.173
63	19.619	66.069	-22.273
64	24.455	70.114	-14.395
65	33.937	78.167	-4.986
66	47.443	89.565	6.535
67	66.178	105.53	22.667
68	86.691	125.264	39.013
69	95.358	136.343	41.838
70	69.867	100.598	29.103
71	188.036	223.185	115.203
72	244.253	294.012	144.413
73	180.302	229.283	89.798
74	105.447	154.141	28.152
75	52.306	100.8	-10.773
76	30.891	79.477	-21.315
77	26.004	74.237	-19.22
78	30.851	78.235	-11.573

79	42.3	88.393	-0.973
80	59.041	103.471	12.44
81	79.343	122.599	27.698
82	96.428	139.675	39.374
83	108.567	154.269	44.962
84	80.756	114.638	32.371
85	149.521	187.159	76.111
86	195.473	248.251	95.124
87	154.31	206.061	62.957
88	106.91	158.416	27.033
89	66.106	117.01	-0.375
90	42.313	92.584	-12.838
91	34.391	83.928	-13.517
92	37.487	86.066	-7.676
93	48.479	95.907	2.044
94	64.824	111.114	14.215
95	82.991	128.531	26.795
96	98.1	143.471	36.582
97	110.612	157.783	42.628
98	82.94	117.625	31.223
99	116.582	155.404	46.564
100	155.006	209.117	58.992
101	128.206	180.976	40.325
102	97.618	150.064	19.587
103	68.93	120.662	2.643
104	49.305	100.188	-6.538
105	40.569	90.501	-8.202
106	41.754	90.629	-4.193
107	51.057	98.836	3.887
108	66.018	112.806	14.649
109	82.981	129.055	26.08
110	97.581	143.226	35.618
111	110.684	157.66	42.562
112	83.171	117.417	31.496
113	90.101	129.077	25.205
114	121.543	175.483	32.509
115	104.533	156.75	22.881
116	85.524	137.271	12.266
117	66.415	117.443	3.168
118	51.353	101.541	-2.616
119	42.748	91.938	-4.459

120	41.845	89.89	-2.204
121	48.98	95.844	4.26
122	63.006	108.81	14.541
123	80.485	125.469	26.805
124	96.226	140.551	37.823
125	110.118	155.284	46.223
126	82.979	115.586	34.723
127	69.178	107.389	9.78
128	94.709	147.124	13.59
129	84.742	134.965	10.659
130	74.391	123.919	7.654
131	62.718	111.654	4.432
132	50.88	99.195	0.791
133	41.232	88.624	-2.156
134	36.889	83.024	-2.528
135	40.598	85.308	1.658
136	53.834	97.227	12.05
137	73.973	116.351	27.442
138	93.224	134.755	42.359
139	108.473	150.342	53.157
140	82.099	111.968	40.684
141	53.3	89.918	-1.115
142	73.543	123.199	0.196
143	69.184	115.858	3.455
144	67.407	113.238	8.181
145	61.893	107.641	9.469
146	50.524	96.212	5.311
147	37.236	82.12	-0.844
148	27.106	70.589	-5.646
149	24.216	65.88	-6.178
150	33.82	73.527	2.247
151	58.491	96.818	22.792
152	85.769	123.167	45.973
153	103.696	140.94	61.155
154	77.946	104.011	46.966
155	41.765	74.782	-6.634
156	58.657	102.684	-4.993
157	61.599	102.575	5.354
158	70.497	111.446	18.93
159	67.117	109.613	19.822
160	50.994	93.823	10.743

161	31.945	74.059	-0.376
162	14.576	55.191	-10.839
163	1.944	40.408	-18.924
164	-0.733	34.987	-20.113
165	19.932	52.597	-1.211
166	61.071	92.101	36.482
167	82.726	113.181	56.496
168	62.571	83.427	44.684
169	20.675	51.177	-22.954
170	24.587	55.769	-19.775
171	75.843	114.415	22.276
172	84.711	121.843	38.808
173	72.053	111.737	29.079
174	49.527	89.562	14.028
175	26.012	65.456	-0.99
176	3.246	41.272	-15.779
177	-17.751	18.158	-30.732
178	-36.108	-3.154	-45.358
179	-39.075	-9.945	-48.376
180	-16.863	8.257	-21.728
181	77.268	98.619	65.167
182	95.402	116.346	81.118
183	0.345	15.811	-21.983
184	0.008	0.011	0.003
185	102.22	130.256	64.518
186	79.07	112.929	38.703
187	65.036	101.564	27.381
188	42.922	80.163	12.106
189	19.935	56.969	-2.748
190	-3.451	32.503	-18.158
191	-26.075	8.091	-34.494
192	-48.657	-16.86	-53.402
193	-62.719	-34.229	-67.186
194	-112.553	-92.116	-113.463
195	-0.003	-0.001	-0.004
196	55.331	65.828	52.378
197	32.751	45.933	13.009
198	81.68	101.451	54.266
199	114.089	145.69	74.006
200	51.785	81.571	18.261
201	49.021	82.81	16.424

202	34.768	70.497	7.14
203	15.292	51.51	-5.034
204	-5.878	29.727	-18.655
205	-25.275	8.831	-32.081
206	-39.233	-7.317	-43.247
207	-43.203	-15.298	-46.312
208	-125.542	-96.385	-132.827
209	-100.664	-85.377	-100.926
210	-37.578	-29.913	-32.561
211	24.195	29.831	16.564
212	39.403	51.491	23.356
213	31.547	47.522	11.565
214	27.826	47.269	6.28
215	29.04	51.936	7.33
216	22.296	47.219	3.41
217	9.503	35.122	-4.323
218	-4.878	20.522	-13.27
219	-17.478	6.978	-21.641
220	-23.28	-0.536	-25.577
221	-22.094	-2.631	-23.573
222	-30.759	-15.279	-31.99
223	-44.272	-32.718	-46.525
224	-28.911	-23.689	-30.116

Thickness: 0.8 meter			
Shear Force SQX (N/mm2)			
Bearing Capacity	**26.5 (kN/m2)**	**80 (kN/m2)**	**300 (kN/m2)**
1	0.246	0.247	0.208
2	0.546	0.572	0.389
3	0.474	0.53	0.222
4	0.116	0.194	-0.169
5	-0.031	0.05	-0.279
6	-0.06	0.021	-0.267
7	-0.052	0.026	-0.223
8	-0.029	0.044	-0.172
9	0.002	0.067	-0.121
10	0.036	0.093	-0.073
11	0.075	0.121	-0.018
12	0.084	0.106	0.04
13	0.053	0.055	0.052
14	0.008	0.002	0.024
15	-0.147	-0.136	-0.219
16	0.276	0.267	0.275
17	-0.317	-0.272	-0.522
18	-0.39	-0.366	-0.497
19	-0.306	-0.285	-0.375
20	-0.246	-0.227	-0.28
21	-0.193	-0.177	-0.201
22	-0.145	-0.133	-0.136
23	-0.098	-0.09	-0.083
24	-0.051	-0.045	-0.036
25	-0.007	-0.001	-0.003
26	0.092	0.109	0.057
27	0.002	-0.015	0.048
28	-0.038	-0.03	-0.067
29	-0.585	-0.569	-0.69
30	0.001	0.001	0.001
31	-1.513	-1.512	-1.558
32	-0.622	-0.608	-0.695
33	-0.37	-0.355	-0.42
34	-0.263	-0.249	-0.285
35	-0.198	-0.187	-0.196
36	-0.146	-0.138	-0.129
37	-0.098	-0.093	-0.074
38	-0.049	-0.047	-0.025

39	0.004	0.003	0.024
40	0.027	0.025	0.042
41	0	0	0
42	-0.192	-0.2	-0.175
43	-0.479	-0.5	-0.44
44	0.468	0.49	0.369
45	-0.682	-0.688	-0.712
46	-0.467	-0.458	-0.522
47	-0.31	-0.296	-0.354
48	-0.23	-0.218	-0.25
49	-0.177	-0.167	-0.174
50	-0.132	-0.126	-0.114
51	-0.088	-0.085	-0.062
52	-0.038	-0.039	-0.009
53	0.018	0.011	0.053
54	0.136	0.112	0.211
55	0.113	0.127	0.075
56	-0.32	-0.348	-0.246
57	0.222	0.228	0.183
58	0.454	0.471	0.35
59	0.32	0.341	0.2
60	-0.121	-0.108	-0.192
61	-0.18	-0.168	-0.224
62	-0.169	-0.158	-0.187
63	-0.143	-0.136	-0.14
64	-0.113	-0.108	-0.094
65	-0.077	-0.076	-0.05
66	-0.034	-0.037	-0.003
67	0.029	0.022	0.064
68	0.103	0.102	0.117
69	0.072	0.074	0.072
70	0.019	0.021	0.012
71	0.135	0.139	0.101
72	0.208	0.219	0.131
73	0.14	0.155	0.052
74	0.025	0.04	-0.047
75	-0.08	-0.069	-0.124
76	-0.11	-0.101	-0.127
77	-0.109	-0.104	-0.104
78	-0.094	-0.091	-0.073
79	-0.07	-0.07	-0.039
80	-0.037	-0.041	-0.004
81	0.001	-0.003	0.031

82	0.026	0.022	0.046
83	0.021	0.019	0.033
84	0.004	0.003	0.01
85	0.08	0.083	0.055
86	0.122	0.131	0.062
87	0.081	0.092	0.011
88	0.015	0.027	-0.043
89	-0.04	-0.03	-0.076
90	-0.073	-0.066	-0.085
91	-0.083	-0.08	-0.074
92	-0.079	-0.079	-0.054
93	-0.065	-0.069	-0.031
94	-0.046	-0.051	-0.009
95	-0.026	-0.032	0.009
96	-0.01	-0.015	0.018
97	-0.003	-0.006	0.015
98	-0.001	-0.003	0.006
99	0.057	0.059	0.035
100	0.077	0.084	0.031
101	0.049	0.058	-0.005
102	0.01	0.018	-0.035
103	-0.028	-0.021	-0.055
104	-0.053	-0.05	-0.059
105	-0.066	-0.066	-0.053
106	-0.069	-0.071	-0.04
107	-0.064	-0.07	-0.025
108	-0.056	-0.063	-0.012
109	-0.044	-0.052	-0.002
110	-0.032	-0.039	0.003
111	-0.019	-0.023	0.004
112	-0.005	-0.007	0.002
113	0.043	0.045	0.024
114	0.057	0.062	0.019
115	0.034	0.041	-0.007
116	0.006	0.012	-0.028
117	-0.022	-0.018	-0.04
118	-0.043	-0.042	-0.042
119	-0.056	-0.058	-0.037
120	-0.062	-0.068	-0.028
121	-0.065	-0.073	-0.02
122	-0.065	-0.075	-0.014
123	-0.062	-0.072	-0.012
124	-0.053	-0.061	-0.01

125	-0.034	-0.039	-0.007
126	-0.01	-0.011	-0.003
127	0.036	0.038	0.02
128	0.049	0.053	0.018
129	0.032	0.036	-0.001
130	0.007	0.011	-0.018
131	-0.018	-0.017	-0.029
132	-0.038	-0.039	-0.031
133	-0.049	-0.055	-0.026
134	-0.057	-0.065	-0.019
135	-0.064	-0.075	-0.015
136	-0.075	-0.087	-0.019
137	-0.086	-0.098	-0.027
138	-0.083	-0.094	-0.032
139	-0.058	-0.064	-0.026
140	-0.017	-0.018	-0.009
141	0.037	0.039	0.022
142	0.051	0.054	0.027
143	0.039	0.042	0.014
144	0.015	0.017	-0.005
145	-0.018	-0.018	-0.023
146	-0.038	-0.041	-0.026
147	-0.045	-0.052	-0.018
148	-0.049	-0.059	-0.009
149	-0.057	-0.069	-0.006
150	-0.082	-0.095	-0.022
151	-0.126	-0.139	-0.06
152	-0.138	-0.15	-0.078
153	-0.099	-0.106	-0.06
154	-0.034	-0.036	-0.023
155	0.005	0.003	0.009
156	0.064	0.063	0.053
157	0.086	0.087	0.063
158	0.021	0.025	-0.006
159	-0.036	-0.038	-0.038
160	-0.047	-0.052	-0.031
161	-0.043	-0.052	-0.014
162	-0.035	-0.047	0.005
163	-0.033	-0.046	0.015
164	-0.051	-0.064	0.003
165	-0.149	-0.161	-0.087
166	-0.295	-0.311	-0.216
167	-0.184	-0.195	-0.136

168	-0.018	-0.02	-0.012
169	-0.008	0.02	-0.095
170	-0.015	-0.029	0.022
171	0.069	0.093	-0.017
172	-0.085	-0.081	-0.104
173	-0.086	-0.089	-0.082
174	-0.065	-0.073	-0.046
175	-0.041	-0.052	-0.012
176	-0.017	-0.029	0.021
177	0.009	-0.005	0.052
178	0.03	0.017	0.076
179	0.03	0.024	0.066
180	-0.211	-0.202	-0.193
181	-0.157	-0.173	-0.109
182	0.438	0.457	0.404
183	0.046	0.055	0
184	0	0	0
185	-0.574	-0.575	-0.57
186	-0.253	-0.256	-0.25
187	-0.144	-0.15	-0.13
188	-0.085	-0.094	-0.062
189	-0.04	-0.052	-0.01
190	0.003	-0.011	0.037
191	0.052	0.038	0.09
192	0.126	0.113	0.165
193	0.272	0.263	0.306
194	0.774	0.783	0.752
195	0	0	0
196	0.081	0.066	0.161
197	0.1	0.091	0.131
198	0.13	0.147	0.076
199	-0.589	-0.607	-0.552
200	-0.303	-0.312	-0.281
201	-0.172	-0.182	-0.147
202	-0.099	-0.112	-0.068
203	-0.042	-0.058	-0.007
204	0.012	-0.005	0.05
205	0.076	0.058	0.115
206	0.164	0.147	0.208
207	0.337	0.321	0.384
208	0.609	0.576	0.721
209	-0.133	-0.123	-0.14
210	-0.14	-0.145	-0.133

211	0.082	0.089	0.057
212	0.025	0.023	0.016
213	-0.196	-0.22	-0.149
214	-0.385	-0.433	-0.265
215	-0.341	-0.401	-0.191
216	-0.256	-0.324	-0.092
217	-0.16	-0.232	0.008
218	-0.056	-0.13	0.109
219	0.054	-0.019	0.214
220	0.165	0.096	0.32
221	0.232	0.169	0.387
222	0.061	0.019	0.186
223	-0.12	-0.138	-0.054
224	-0.106	-0.105	-0.094

Thickness: 0.8 meter			
Shear Force SQY (N/mm2)			
Bearing	**26.5**	**80**	**300**
Capacity	**N/mm2**	**N/mm2**	**N/mm2**
1	-0.265	-0.264	-0.265
2	-0.057	-0.07	-0.011
3	0.08	0.067	0.124
4	0.14	0.131	0.161
5	0.043	0.039	0.05
6	0.014	0.01	0.023
7	0.005	0.002	0.012
8	0.001	-0.002	0.007
9	0.001	-0.001	0.006
10	0.001	-0.001	0.005
11	0.01	0.013	0.002
12	0.033	0.037	0.02
13	0.054	0.057	0.047
14	0.046	0.036	0.072
15	-0.593	-0.569	-0.688
16	-0.322	-0.347	-0.22
17	0.646	0.609	0.77
18	0.249	0.246	0.254
19	0.04	0.032	0.065
20	-0.004	-0.013	0.022
21	-0.014	-0.023	0.013
22	-0.014	-0.023	0.012
23	-0.011	-0.02	0.015
24	-0.004	-0.013	0.021
25	-0.013	-0.022	0.011
26	0.079	0.096	0.034
27	0.17	0.162	0.196
28	0.101	0.065	0.2
29	0.098	0.102	0.084
30	0	0	0
31	0.059	0.07	0.026
32	-0.051	-0.057	-0.026
33	-0.07	-0.08	-0.03
34	-0.063	-0.075	-0.018
35	-0.051	-0.064	-0.005
36	-0.039	-0.053	0.007
37	-0.03	-0.045	0.017
38	-0.021	-0.037	0.028
39	-0.008	-0.029	0.05

40	-0.034	-0.058	0.029
41	0	0	0
42	-0.02	-0.041	0.038
43	1.46	1.51	1.301
44	0.249	0.253	0.221
45	-1.169	-1.202	-1.052
46	-0.412	-0.424	-0.35
47	-0.202	-0.213	-0.145
48	-0.126	-0.139	-0.067
49	-0.087	-0.102	-0.027
50	-0.064	-0.081	-0.004
51	-0.05	-0.068	0.012
52	-0.042	-0.063	0.022
53	-0.021	-0.044	0.05
54	-0.102	-0.1	-0.104
55	-0.544	-0.564	-0.487
56	-0.701	-0.792	-0.434
57	1.149	1.213	0.929
58	-0.013	-0.014	-0.009
59	-0.381	-0.392	-0.33
60	-0.448	-0.462	-0.376
61	-0.248	-0.26	-0.183
62	-0.158	-0.171	-0.092
63	-0.109	-0.124	-0.043
64	-0.082	-0.099	-0.014
65	-0.068	-0.087	0.002
66	-0.062	-0.082	0.01
67	-0.074	-0.092	-0.009
68	-0.163	-0.18	-0.101
69	-0.287	-0.313	-0.201
70	-0.689	-0.786	-0.394
71	0.814	0.887	0.571
72	-0.034	-0.03	-0.037
73	-0.203	-0.207	-0.172
74	-0.246	-0.253	-0.197
75	-0.211	-0.22	-0.152
76	-0.152	-0.163	-0.09
77	-0.113	-0.126	-0.048
78	-0.089	-0.104	-0.021
79	-0.077	-0.095	-0.007
80	-0.078	-0.097	-0.005
81	-0.099	-0.119	-0.023
82	-0.144	-0.165	-0.062

83	-0.209	-0.236	-0.108
84	-0.623	-0.721	-0.309
85	0.619	0.7	0.357
86	-0.037	-0.029	-0.052
87	-0.131	-0.13	-0.116
88	-0.16	-0.161	-0.128
89	-0.151	-0.155	-0.107
90	-0.126	-0.132	-0.075
91	-0.101	-0.11	-0.046
92	-0.084	-0.096	-0.025
93	-0.077	-0.091	-0.013
94	-0.08	-0.097	-0.011
95	-0.096	-0.115	-0.021
96	-0.122	-0.143	-0.039
97	-0.169	-0.195	-0.068
98	-0.578	-0.676	-0.262
99	0.49	0.578	0.214
100	-0.034	-0.021	-0.061
101	-0.093	-0.086	-0.093
102	-0.108	-0.104	-0.094
103	-0.106	-0.105	-0.082
104	-0.095	-0.096	-0.062
105	-0.08	-0.085	-0.042
106	-0.07	-0.077	-0.026
107	-0.065	-0.075	-0.017
108	-0.07	-0.082	-0.015
109	-0.083	-0.098	-0.021
110	-0.104	-0.121	-0.033
111	-0.145	-0.167	-0.056
112	-0.55	-0.643	-0.25
113	0.398	0.492	0.113
114	-0.027	-0.009	-0.067
115	-0.064	-0.053	-0.081
116	-0.071	-0.062	-0.076
117	-0.069	-0.063	-0.065
118	-0.063	-0.06	-0.051
119	-0.055	-0.054	-0.038
120	-0.048	-0.05	-0.026
121	-0.045	-0.049	-0.018
122	-0.05	-0.057	-0.017
123	-0.065	-0.074	-0.025
124	-0.089	-0.101	-0.04
125	-0.134	-0.151	-0.067

126	-0.535	-0.62	-0.27
127	0.329	0.425	0.037
128	-0.017	0.004	-0.07
129	-0.038	-0.023	-0.071
130	-0.036	-0.023	-0.06
131	-0.033	-0.022	-0.05
132	-0.03	-0.022	-0.042
133	-0.026	-0.02	-0.033
134	-0.02	-0.017	-0.023
135	-0.015	-0.014	-0.015
136	-0.019	-0.019	-0.014
137	-0.038	-0.04	-0.028
138	-0.076	-0.08	-0.056
139	-0.135	-0.145	-0.098
140	-0.536	-0.609	-0.321
141	0.272	0.37	-0.022
142	-0.007	0.016	-0.071
143	-0.009	0.008	-0.054
144	0.004	0.019	-0.036
145	0.008	0.023	-0.029
146	0.004	0.017	-0.029
147	0.004	0.014	-0.026
148	0.011	0.019	-0.017
149	0.023	0.031	-0.004
150	0.033	0.04	0.006
151	0.009	0.015	-0.015
152	-0.06	-0.056	-0.076
153	-0.155	-0.157	-0.154
154	-0.56	-0.62	-0.406
155	0.227	0.323	-0.07
156	-0.007	0.015	-0.075
157	0.02	0.034	-0.023
158	0.074	0.09	0.024
159	0.061	0.079	0.004
160	0.036	0.052	-0.015
161	0.03	0.044	-0.019
162	0.039	0.052	-0.01
163	0.063	0.075	0.012
164	0.11	0.122	0.053
165	0.133	0.147	0.066
166	-0.034	-0.021	-0.087
167	-0.233	-0.228	-0.265
168	-0.613	-0.659	-0.527

169	0.264	0.357	-0.04
170	-0.127	-0.109	-0.176
171	0.114	0.11	0.115
172	0.197	0.219	0.115
173	0.094	0.113	0.027
174	0.056	0.073	-0.006
175	0.047	0.063	-0.013
176	0.057	0.072	-0.004
177	0.089	0.104	0.024
178	0.156	0.17	0.084
179	0.33	0.346	0.238
180	0.21	0.243	0.091
181	-0.676	-0.672	-0.702
182	-0.501	-0.532	-0.502
183	0.215	0.237	0.135
184	0	0	0
185	0.175	0.199	0.098
186	0.164	0.186	0.084
187	0.082	0.099	0.018
188	0.057	0.072	-0.003
189	0.051	0.066	-0.008
190	0.061	0.075	-0.001
191	0.088	0.102	0.021
192	0.139	0.152	0.066
193	0.265	0.275	0.189
194	0.189	0.183	0.174
195	0	0	0
196	0.284	0.287	0.239
197	0.146	0.185	0.012
198	-0.403	-0.391	-0.472
199	-0.53	-0.545	-0.503
200	0.009	0.019	-0.03
201	0.039	0.05	-0.004
202	0.043	0.054	-0.001
203	0.048	0.058	0.001
204	0.056	0.067	0.005
205	0.067	0.078	0.012
206	0.079	0.091	0.02
207	0.026	0.033	-0.021
208	-0.53	-0.495	-0.657
209	-0.353	-0.327	-0.498
210	0.209	0.196	0.188
211	0.013	0.025	-0.032

212	-0.135	-0.136	-0.143
213	-0.137	-0.14	-0.136
214	-0.068	-0.07	-0.068
215	0.011	0.014	-0.003
216	0.022	0.025	0.004
217	0.029	0.033	0.009
218	0.032	0.037	0.01
219	0.033	0.039	0.007
220	0.026	0.032	-0.001
221	-0.054	-0.045	-0.091
222	-0.117	-0.103	-0.171
223	-0.101	-0.088	-0.159
224	0.048	0.049	0.013

Thickness: 0.8 meter			
Bending Moment Mx (kNm/m)			
Bearing Capacity	26.5 (kN/m2)	80 (kN/m2)	300 (kN/m2)
1	-0.265	-0.264	-0.265
2	-0.057	-0.07	-0.011
3	0.08	0.067	0.124
4	0.14	0.131	0.161
5	0.043	0.039	0.05
6	0.014	0.01	0.023
7	0.005	0.002	0.012
8	0.001	-0.002	0.007
9	0.001	-0.001	0.006
10	0.001	-0.001	0.005
11	0.01	0.013	0.002
12	0.033	0.037	0.02
13	0.054	0.057	0.047
14	0.046	0.036	0.072
15	-0.593	-0.569	-0.688
16	-0.322	-0.347	-0.22
17	0.646	0.609	0.77
18	0.249	0.246	0.254
19	0.04	0.032	0.065
20	-0.004	-0.013	0.022
21	-0.014	-0.023	0.013
22	-0.014	-0.023	0.012
23	-0.011	-0.02	0.015
24	-0.004	-0.013	0.021
25	-0.013	-0.022	0.011
26	0.079	0.096	0.034
27	0.17	0.162	0.196
28	0.101	0.065	0.2
29	0.098	0.102	0.084
30	0	0	0
31	0.059	0.07	0.026
32	-0.051	-0.057	-0.026
33	-0.07	-0.08	-0.03
34	-0.063	-0.075	-0.018
35	-0.051	-0.064	-0.005
36	-0.039	-0.053	0.007
37	-0.03	-0.045	0.017
38	-0.021	-0.037	0.028
39	-0.008	-0.029	0.05

40	-0.034	-0.058	0.029
41	0	0	0
42	-0.02	-0.041	0.038
43	1.46	1.51	1.301
44	0.249	0.253	0.221
45	-1.169	-1.202	-1.052
46	-0.412	-0.424	-0.35
47	-0.202	-0.213	-0.145
48	-0.126	-0.139	-0.067
49	-0.087	-0.102	-0.027
50	-0.064	-0.081	-0.004
51	-0.05	-0.068	0.012
52	-0.042	-0.063	0.022
53	-0.021	-0.044	0.05
54	-0.102	-0.1	-0.104
55	-0.544	-0.564	-0.487
56	-0.701	-0.792	-0.434
57	1.149	1.213	0.929
58	-0.013	-0.014	-0.009
59	-0.381	-0.392	-0.33
60	-0.448	-0.462	-0.376
61	-0.248	-0.26	-0.183
62	-0.158	-0.171	-0.092
63	-0.109	-0.124	-0.043
64	-0.082	-0.099	-0.014
65	-0.068	-0.087	0.002
66	-0.062	-0.082	0.01
67	-0.074	-0.092	-0.009
68	-0.163	-0.18	-0.101
69	-0.287	-0.313	-0.201
70	-0.689	-0.786	-0.394
71	0.814	0.887	0.571
72	-0.034	-0.03	-0.037
73	-0.203	-0.207	-0.172
74	-0.246	-0.253	-0.197
75	-0.211	-0.22	-0.152
76	-0.152	-0.163	-0.09
77	-0.113	-0.126	-0.048
78	-0.089	-0.104	-0.021
79	-0.077	-0.095	-0.007
80	-0.078	-0.097	-0.005
81	-0.099	-0.119	-0.023
82	-0.144	-0.165	-0.062

83	-0.209	-0.236	-0.108
84	-0.623	-0.721	-0.309
85	0.619	0.7	0.357
86	-0.037	-0.029	-0.052
87	-0.131	-0.13	-0.116
88	-0.16	-0.161	-0.128
89	-0.151	-0.155	-0.107
90	-0.126	-0.132	-0.075
91	-0.101	-0.11	-0.046
92	-0.084	-0.096	-0.025
93	-0.077	-0.091	-0.013
94	-0.08	-0.097	-0.011
95	-0.096	-0.115	-0.021
96	-0.122	-0.143	-0.039
97	-0.169	-0.195	-0.068
98	-0.578	-0.676	-0.262
99	0.49	0.578	0.214
100	-0.034	-0.021	-0.061
101	-0.093	-0.086	-0.093
102	-0.108	-0.104	-0.094
103	-0.106	-0.105	-0.082
104	-0.095	-0.096	-0.062
105	-0.08	-0.085	-0.042
106	-0.07	-0.077	-0.026
107	-0.065	-0.075	-0.017
108	-0.07	-0.082	-0.015
109	-0.083	-0.098	-0.021
110	-0.104	-0.121	-0.033
111	-0.145	-0.167	-0.056
112	-0.55	-0.643	-0.25
113	0.398	0.492	0.113
114	-0.027	-0.009	-0.067
115	-0.064	-0.053	-0.081
116	-0.071	-0.062	-0.076
117	-0.069	-0.063	-0.065
118	-0.063	-0.06	-0.051
119	-0.055	-0.054	-0.038
120	-0.048	-0.05	-0.026
121	-0.045	-0.049	-0.018
122	-0.05	-0.057	-0.017
123	-0.065	-0.074	-0.025
124	-0.089	-0.101	-0.04
125	-0.134	-0.151	-0.067

126	-0.535	-0.62	-0.27
127	0.329	0.425	0.037
128	-0.017	0.004	-0.07
129	-0.038	-0.023	-0.071
130	-0.036	-0.023	-0.06
131	-0.033	-0.022	-0.05
132	-0.03	-0.022	-0.042
133	-0.026	-0.02	-0.033
134	-0.02	-0.017	-0.023
135	-0.015	-0.014	-0.015
136	-0.019	-0.019	-0.014
137	-0.038	-0.04	-0.028
138	-0.076	-0.08	-0.056
139	-0.135	-0.145	-0.098
140	-0.536	-0.609	-0.321
141	0.272	0.37	-0.022
142	-0.007	0.016	-0.071
143	-0.009	0.008	-0.054
144	0.004	0.019	-0.036
145	0.008	0.023	-0.029
146	0.004	0.017	-0.029
147	0.004	0.014	-0.026
148	0.011	0.019	-0.017
149	0.023	0.031	-0.004
150	0.033	0.04	0.006
151	0.009	0.015	-0.015
152	-0.06	-0.056	-0.076
153	-0.155	-0.157	-0.154
154	-0.56	-0.62	-0.406
155	0.227	0.323	-0.07
156	-0.007	0.015	-0.075
157	0.02	0.034	-0.023
158	0.074	0.09	0.024
159	0.061	0.079	0.004
160	0.036	0.052	-0.015
161	0.03	0.044	-0.019
162	0.039	0.052	-0.01
163	0.063	0.075	0.012
164	0.11	0.122	0.053
165	0.133	0.147	0.066
166	-0.034	-0.021	-0.087
167	-0.233	-0.228	-0.265
168	-0.613	-0.659	-0.527

169	0.264	0.357	-0.04
170	-0.127	-0.109	-0.176
171	0.114	0.11	0.115
172	0.197	0.219	0.115
173	0.094	0.113	0.027
174	0.056	0.073	-0.006
175	0.047	0.063	-0.013
176	0.057	0.072	-0.004
177	0.089	0.104	0.024
178	0.156	0.17	0.084
179	0.33	0.346	0.238
180	0.21	0.243	0.091
181	-0.676	-0.672	-0.702
182	-0.501	-0.532	-0.502
183	0.215	0.237	0.135
184	0	0	0
185	0.175	0.199	0.098
186	0.164	0.186	0.084
187	0.082	0.099	0.018
188	0.057	0.072	-0.003
189	0.051	0.066	-0.008
190	0.061	0.075	-0.001
191	0.088	0.102	0.021
192	0.139	0.152	0.066
193	0.265	0.275	0.189
194	0.189	0.183	0.174
195	0	0	0
196	0.284	0.287	0.239
197	0.146	0.185	0.012
198	-0.403	-0.391	-0.472
199	-0.53	-0.545	-0.503
200	0.009	0.019	-0.03
201	0.039	0.05	-0.004
202	0.043	0.054	-0.001
203	0.048	0.058	0.001
204	0.056	0.067	0.005
205	0.067	0.078	0.012
206	0.079	0.091	0.02
207	0.026	0.033	-0.021
208	-0.53	-0.495	-0.657
209	-0.353	-0.327	-0.498
210	0.209	0.196	0.188
211	0.013	0.025	-0.032

212	-0.135	-0.136	-0.143
213	-0.137	-0.14	-0.136
214	-0.068	-0.07	-0.068
215	0.011	0.014	-0.003
216	0.022	0.025	0.004
217	0.029	0.033	0.009
218	0.032	0.037	0.01
219	0.033	0.039	0.007
220	0.026	0.032	-0.001
221	-0.054	-0.045	-0.091
222	-0.117	-0.103	-0.171
223	-0.101	-0.088	-0.159
224	0.048	0.049	0.013

Thickness: 0.8 meter

Bending Moment My (kNm/m)

Bearing	**26.5**	**80**	**300**
Capacity	**(kN/m2)**	**(kN/m2)**	**(kN/m2)**
1	-25.459	-27.771	54.277
2	-26.219	-29.455	262.507
3	-7.798	-10.871	401.124
4	8.697	6.549	418.454
5	9.767	8.4	295.68
6	8.209	7.148	168.181
7	5.278	4.514	68.15
8	3.496	2.991	-3.832
9	3.106	2.894	-52.03
10	3.912	3.982	-79.762
11	6.242	7.052	-85.395
12	8.937	10.276	-62.708
13	11.623	12.845	-29.091
14	11.632	12.307	-3.841
15	-140.038	-147.315	-49.709
16	-133.723	-150.887	136.076
17	25.873	8.731	689.141
18	67	60.083	467.49
19	45.603	39.887	290.975
20	27.544	23.382	160.564
21	14.622	11.605	64.057
22	7.591	5.661	-5.012
23	5.795	4.95	-51.71
24	10.17	10.66	-79.588
25	15.661	17.617	-92.575
26	44.171	53.218	-82.548
27	61.733	67.198	-6.758
28	53.012	52.976	19.417
29	-195.439	-207.607	-190.097
30	-0.152	-0.165	0.221
31	180.524	172.83	1020.736
32	96.06	82.488	487.933
33	62.03	51.358	275.138
34	30.526	21.543	147.255
35	11.667	4.419	57.868
36	2.158	-3.492	-5.651
37	1.202	-2.88	-49.178
38	7.747	5.32	-76.484
39	32.775	32.136	-91.587

40	20.143	21.706	-109.362
41	0.103	0.104	-0.007
42	101.012	105.352	47.41
43	-333.126	-372.924	-94.219
44	-229.462	-266.446	110.963
45	64.267	44.04	692.252
46	46.713	28.304	420.743
47	24.422	7.654	247.506
48	3.446	-11.222	134.207
49	-10.988	-23.781	54.013
50	-17.804	-28.852	-3.326
51	-16.824	-26.243	-42.84
52	-5.664	-13.596	-67.136
53	14.111	7.971	-76.889
54	80.865	72.104	-59.086
55	219.22	220.757	29.696
56	211.283	221.366	35.318
57	-176.033	-216.387	46.99
58	-143.588	-180.558	198.932
59	-93.719	-124.545	290.168
60	-54.864	-80.771	305.975
61	-45.43	-68.365	209.109
62	-45.879	-66.575	120.604
63	-49.526	-68.326	52.262
64	-51.076	-68.245	2.171
65	-47.829	-63.542	-32.153
66	-37.889	-52.195	-51.912
67	-18.98	-31.797	-52.689
68	12.057	1.553	-25.911
69	48.411	41.866	-0.748
70	65.646	61.812	-0.499
71	-106.932	-146.854	26.199
72	-112.829	-150.758	126.087
73	-124.193	-158.674	206.882
74	-119.125	-150.192	212.42
75	-106.706	-134.925	166.583
76	-97.662	-123.704	104.805
77	-93.956	-118.36	50.661
78	-91.837	-114.944	9.31
79	-88.501	-110.504	-18.862
80	-82.355	-103.235	-33.626
81	-73.448	-93.013	-33.059
82	-62.535	-80.491	-20.177

83	-52.205	-68.553	-5.981
84	-45.893	-61.299	1.936
85	-95.316	-133.862	18.992
86	-109.062	-146.465	87.628
87	-133.016	-168.321	138.637
88	-143.673	-176.866	150.473
89	-143.316	-174.643	127.111
90	-138.647	-168.501	87.314
91	-134.847	-163.646	47.789
92	-133.09	-161.178	16.167
93	-132.249	-159.83	-5.293
94	-131.458	-158.601	-16.158
95	-130.436	-157.123	-17.121
96	-129.239	-155.48	-11.34
97	-127.89	-153.751	-4.175
98	-127.047	-152.739	-0.054
99	-102.615	-138.091	13.783
100	-116.647	-151.555	61.755
101	-141.748	-175.65	97.806
102	-158.04	-190.978	107.717
103	-165.04	-197.192	95.339
104	-166.641	-198.268	70.472
105	-167.136	-198.543	43.572
106	-169.024	-200.504	21.545
107	-172.795	-204.582	6.942
108	-177.752	-210.006	-0.467
109	-182.891	-215.71	-2.456
110	-187.348	-220.796	-1.569
111	-190.701	-224.818	-0.333
112	-192.226	-226.697	-0.12
113	-115.778	-146.274	10.181
114	-128.292	-158.726	45.392
115	-151.132	-181.542	71.752
116	-168.068	-198.591	79.848
117	-178.073	-208.866	72.341
118	-183.7	-214.943	55.956
119	-188.57	-220.476	38.333
120	-195.466	-228.285	24.904
121	-205.318	-239.313	17.43
122	-217.213	-252.62	14.282
123	-229.165	-266.155	12.289
124	-239.303	-277.958	9.188
125	-246.743	-287.023	4.619

126	-250.241	-291.357	0.103
127	-129.575	-153.28	7.778
128	-140.058	-164.2	35.566
129	-159.305	-184.407	56.282
130	-173.695	-199.935	62.717
131	-182.899	-210.383	56.28
132	-189.491	-218.28	43.439
133	-197.123	-227.335	31.561
134	-208.691	-240.536	25.481
135	-225.487	-259.262	26.017
136	-246.45	-282.477	29.402
137	-268.335	-306.889	29.117
138	-287.552	-328.766	21.582
139	-301.784	-345.565	10.213
140	-308.673	-353.774	0.227
141	-142.016	-157.304	7.368
142	-150.535	-166.983	30.398
143	-164.314	-182.825	50.78
144	-172.545	-193.24	54.38
145	-176.635	-199.319	44.868
146	-181.47	-206.038	30.846
147	-190.172	-216.65	21.734
148	-204.816	-233.395	21.721
149	-227.295	-258.246	31.205
150	-258.81	-292.549	45.411
151	-296.952	-333.98	50.748
152	-334.548	-375.254	38.902
153	-363.681	-407.984	15.584
154	-378.276	-424.536	0.034
155	-151.424	-156.487	7.566
156	-163.416	-171.406	37.657
157	-167.357	-179.618	51.687
158	-156.27	-171.209	55.322
159	-152.062	-169.008	34.692
160	-156.693	-175.681	15.735
161	-166.486	-187.598	7.374
162	-181.6	-204.985	11.979
163	-204.358	-230.187	30.04
164	-238.879	-267.329	59.156
165	-296.215	-327.899	82.738
166	-381.359	-417.912	57.321
167	-453.808	-495.989	27.809
168	-475.536	-520.501	5.857

169	-127.595	-119.117	0.474
170	-219.873	-220.735	2.903
171	-170.162	-181.256	115.373
172	-94.947	-103.312	64.579
173	-105.863	-116.533	22.457
174	-116.837	-129.498	-2.783
175	-129.003	-143.815	-11.367
176	-141.889	-158.901	-3.78
177	-156.893	-176.095	20.822
178	-179.986	-201.411	64.248
179	-207.432	-230.244	126.468
180	-403.312	-428.65	183.954
181	-685.684	-725.824	-40.092
182	-563.242	-604.163	-40.225
183	-9.236	-5.61	-11.85
184	-0.007	-0.007	0.082
185	35.542	36.289	234.064
186	-19.186	-21.683	71.672
187	-50.87	-55.442	7.828
188	-71.716	-78.357	-22.717
189	-85.121	-93.694	-32.25
190	-93.836	-104.274	-23.101
191	-98.882	-111.151	5.716
192	-96.696	-110.489	59.019
193	-97.7	-113.871	155.891
194	-0.075	-9.067	398.256
195	-0.153	-0.166	0.115
196	-160.817	-173.167	-64.973
197	61.722	60.736	4.646
198	154.635	158.82	79.679
199	139.224	147.328	197.294
200	17.705	18.72	64.69
201	-13.178	-13.909	-5.463
202	-32.523	-34.814	-40.851
203	-42.329	-45.899	-52.188
204	-46.663	-51.427	-42.382
205	-45.383	-51.261	-10.378
206	-35.544	-42.729	48.91
207	-7.752	-15.667	152.256
208	100.446	83.893	327.705
209	111.627	94.683	113.203
210	16.404	8.36	-12.062
211	20.78	21.203	27.625

212	23.053	23.976	95.982
213	20.061	21.104	101.338
214	10.623	11.142	53.351
215	-0.229	-0.479	-11.817
216	-4.96	-5.517	-49.614
217	-7.787	-8.649	-62.067
218	-8.633	-9.749	-52.039
219	-7.585	-8.965	-18.536
220	-4.462	-6.082	43.24
221	4.31	2.015	133.006
222	11.32	8.188	182.611
223	12.155	8.854	151.41
224	11.095	8.597	40.184

<table>
<tr><th colspan="4">Thickness: 0.8 meter</th></tr>
<tr><th colspan="4">Bending Moment Mxy (kNm/m)</th></tr>
<tr><th>Bearing</th><th>26.5</th><th>80</th><th>300</th></tr>
<tr><th>Capacity</th><th>(kN/m2)</th><th>(kN/m2)</th><th>(kN/m2)</th></tr>
<tr><td>1</td><td>-20.974</td><td>-17.466</td><td>-18.366</td></tr>
<tr><td>2</td><td>1.504</td><td>9.978</td><td>-15.579</td></tr>
<tr><td>3</td><td>37.378</td><td>49.532</td><td>1.824</td></tr>
<tr><td>4</td><td>59.023</td><td>73.759</td><td>14.868</td></tr>
<tr><td>5</td><td>62.332</td><td>78.522</td><td>13.505</td></tr>
<tr><td>6</td><td>51.015</td><td>68.002</td><td>10.743</td></tr>
<tr><td>7</td><td>41.416</td><td>58.501</td><td>6.866</td></tr>
<tr><td>8</td><td>35.495</td><td>52.164</td><td>4.365</td></tr>
<tr><td>9</td><td>31.763</td><td>47.528</td><td>3.221</td></tr>
<tr><td>10</td><td>27.982</td><td>42.306</td><td>3.324</td></tr>
<tr><td>11</td><td>22.608</td><td>35.189</td><td>3.689</td></tr>
<tr><td>12</td><td>15.884</td><td>25.801</td><td>4.935</td></tr>
<tr><td>13</td><td>10.576</td><td>17.409</td><td>7.919</td></tr>
<tr><td>14</td><td>3.451</td><td>6.495</td><td>9.516</td></tr>
<tr><td>15</td><td>-64.323</td><td>-55.683</td><td>-115.406</td></tr>
<tr><td>16</td><td>-144.803</td><td>-130.564</td><td>-75.173</td></tr>
<tr><td>17</td><td>-29.36</td><td>-4.298</td><td>78.783</td></tr>
<tr><td>18</td><td>97.053</td><td>120.408</td><td>83.379</td></tr>
<tr><td>19</td><td>104.111</td><td>130.309</td><td>57.524</td></tr>
<tr><td>20</td><td>85.868</td><td>113.285</td><td>34.932</td></tr>
<tr><td>21</td><td>71.402</td><td>99.081</td><td>19.678</td></tr>
<tr><td>22</td><td>62.444</td><td>89.583</td><td>10.871</td></tr>
<tr><td>23</td><td>56.831</td><td>82.688</td><td>7.303</td></tr>
<tr><td>24</td><td>51.736</td><td>75.502</td><td>8.953</td></tr>
<tr><td>25</td><td>39.909</td><td>60.886</td><td>10.836</td></tr>
<tr><td>26</td><td>34.583</td><td>56.846</td><td>20.454</td></tr>
<tr><td>27</td><td>9.628</td><td>23.034</td><td>47.518</td></tr>
<tr><td>28</td><td>9.588</td><td>17.963</td><td>52.923</td></tr>
<tr><td>29</td><td>73.434</td><td>82.255</td><td>-156.022</td></tr>
<tr><td>30</td><td>0.049</td><td>0.056</td><td>-0.103</td></tr>
<tr><td>31</td><td>118.809</td><td>138.484</td><td>197.925</td></tr>
<tr><td>32</td><td>117.398</td><td>142.269</td><td>131.914</td></tr>
<tr><td>33</td><td>101.437</td><td>128.858</td><td>86.671</td></tr>
<tr><td>34</td><td>85.111</td><td>113.703</td><td>50.633</td></tr>
<tr><td>35</td><td>74.449</td><td>103.384</td><td>28.184</td></tr>
<tr><td>36</td><td>68.966</td><td>97.505</td><td>16.047</td></tr>
<tr><td>37</td><td>66.777</td><td>94.235</td><td>12.501</td></tr>
<tr><td>38</td><td>65.574</td><td>91.313</td><td>15.725</td></tr>
<tr><td>39</td><td>62.433</td><td>85.325</td><td>36.619</td></tr>
</table>

40	36.47	55.657	16.979
41	0.024	0.031	0.101
42	51.431	59.626	89.394
43	293.629	311.21	-199.058
44	415.964	436.368	-105.299
45	350.704	376.686	125.305
46	141.115	167.881	98.249
47	95.268	123.736	69.657
48	80.811	110.467	42.586
49	74.896	104.932	24.108
50	74.311	104.061	14.208
51	77.437	106.288	12.403
52	82.882	110.241	20.682
53	93.54	118.723	35.895
54	101.749	127.872	110.001
55	116.98	137.109	219.405
56	114.925	132.318	186.624
57	230.546	247.071	-39.038
58	302.367	328.087	-20.819
59	231.744	258.725	4.974
60	156.328	184.988	24.677
61	101.819	131.789	23.687
62	83.522	114.431	16.526
63	78.844	110.102	8.467
64	81.373	112.386	3.918
65	88.883	119.114	4.721
66	100.923	129.878	11.929
67	117.411	145.099	27.191
68	131.934	158.727	51.619
69	138.671	164.735	76.254
70	95.062	112.028	85.507
71	191.529	209.696	28.658
72	288.336	317.895	14.611
73	235.686	266.15	-9.912
74	167.055	198.048	-17.327
75	117.801	149.455	-14.637
76	94.074	126.301	-12.027
77	87.054	119.473	-12.112
78	89.836	121.992	-12.167
79	99.378	130.845	-10.291
80	114.194	144.681	-5.904
81	132.047	161.683	0.235
82	148.078	177.346	7.027

83	157.251	186.36	12.794
84	101.648	120.067	16.398
85	160.791	180.273	38.085
86	246.296	277.782	19.965
87	216.124	248.526	-11.173
88	170.255	203.001	-28.933
89	130.185	163.241	-34.376
90	105.652	138.934	-33.601
91	96.147	129.436	-31.727
92	97.483	130.457	-30.351
93	106.69	139.051	-29.06
94	121.343	152.953	-27.669
95	138.181	169.149	-26.351
96	153.299	183.942	-25.187
97	161.21	191.385	-24.057
98	104.063	123.08	-23.271
99	133.595	153.768	25.143
100	208.574	241.054	9.2
101	191.33	224.608	-18.695
102	161.43	194.943	-37.614
103	132.815	166.506	-46.432
104	112.296	146.059	-48.616
105	102.12	135.761	-48.274
106	101.651	134.922	-47.999
107	109.249	141.929	-48.602
108	122.652	154.64	-49.818
109	138.565	169.925	-51.006
110	153.19	184.112	-51.522
111	161.062	191.322	-51.127
112	103.676	122.627	-50.698
113	111.316	131.663	1.393
114	176.046	208.645	-11.181
115	167.038	200.266	-33.388
116	148.513	181.872	-49.24
117	129.067	162.55	-57.5
118	113.042	146.56	-60.518
119	103.039	136.391	-61.705
120	100.468	133.396	-63.698
121	105.799	138.082	-67.461
122	118.04	149.574	-72.313
123	134.161	164.989	-76.638
124	149.772	180.038	-78.975
125	158.425	187.851	-78.943

126	102.123	120.436	-78.591
127	92.875	112.891	-28.842
128	148.589	180.462	-37.853
129	145.538	177.831	-53.556
130	135.428	167.746	-63.782
131	123.092	155.568	-68.308
132	110.182	142.77	-69.726
133	99.212	131.664	-71.379
134	93.191	125.162	-75.797
135	94.866	126.058	-84.023
136	105.648	135.928	-95.04
137	123.363	152.785	-105.937
138	141.9	170.624	-113.697
139	152.932	180.674	-116.881
140	99.376	116.529	-118.042
141	77.396	96.519	-64.246
142	125.65	155.95	-69.299
143	127.973	158.341	-76.669
144	126.101	156.538	-77.986
145	118.776	149.592	-75.492
146	106.34	137.507	-73.653
147	92.078	123.187	-75.107
148	80.494	111.069	-81.355
149	75.629	105.242	-93.974
150	81.896	110.259	-113.783
151	100.679	127.846	-138.253
152	125.22	151.503	-160.887
153	142.113	167.385	-175.385
154	93.442	108.909	-182.151
155	59.095	76.554	-104.773
156	105.549	132.436	-107.845
157	121.297	148.814	-99.618
158	124.947	153.035	-81.307
159	117.952	146.827	-70.829
160	102.368	131.893	-68.499
161	83.149	112.709	-70.746
162	64.971	93.982	-77.419
163	51.062	78.965	-90.622
164	47.047	73.37	-114.394
165	58.728	83.179	-158.01
166	82.441	104.994	-223.411
167	113.378	134.777	-275.464
168	91.317	105.035	-288.319

169	34.914	52.662	-127.132
170	52.883	73.522	-185.355
171	130.923	157.653	-110.416
172	124.954	150.214	-46.723
173	116.012	143.016	-49.34
174	96.415	124.282	-53.723
175	73.635	101.663	-58.637
176	50.617	78.156	-64.041
177	29.285	55.717	-71.361
178	12.101	36.762	-85.89
179	11.882	34.453	-108.116
180	11.44	32.124	-284.527
181	123.526	139.981	-517.011
182	141.709	156.329	-405.137
183	-0.915	7.455	-11.787
184	0.037	0.044	0.005
185	152.821	172.253	40.772
186	114.124	136.922	4.766
187	105.913	131.124	-20.821
188	87.064	113.393	-34.64
189	64.728	91.428	-41.933
190	40.733	67.087	-44.954
191	17.163	42.5	-44.475
192	-5.051	18.625	-37.919
193	-20.097	0.941	-30.091
194	-115.153	-99.15	35.158
195	-0.002	0.003	-0.095
196	89.772	96.99	-112.409
197	49.017	57.676	73.044
198	119.665	133.289	155.333
199	172.637	194.962	125.094
200	96.236	117.078	22.057
201	89.099	112.304	-2.543
202	76.626	101.379	-16.96
203	57.258	82.625	-22.885
204	35.078	60.276	-23.924
205	13.329	37.631	-19.84
206	-4.194	18.491	-6.67
207	-27.091	-7.241	22.143
208	-125.079	-103.829	156.191
209	-106.76	-95.116	178.2
210	-28.139	-21.648	55.108
211	25.443	28.563	21.549

212	45.384	52.298	22.752
213	50.771	60.715	19.212
214	54.001	66.503	11.005
215	51.668	65.698	2.418
216	45.667	60.816	-1.385
217	34.21	49.85	-3.299
218	20.594	36.196	-3.388
219	7.516	22.602	-1.556
220	-2.197	11.83	2.344
221	-11.383	1.144	12.964
222	-19.351	-9.252	22.967
223	-27.034	-20.212	25.104
224	-20.708	-17.997	21.694

DESIGN OF RAFT FOUNDATION

SUPPORT NO	LOAD CASE	FORCE " GFx "	FORCE " GFy "	FORCE " GFz "	FORCE " LFx "	FORCE " LFy "	FORCE " LFz "
235	10	-3058.14	35673.16	-2787.32	5078.81	-35787.62	766.65
	11	-2881.74	32455.75	-2617.48	4720.17	-32559.89	779.06
*	***12***	***-2281.33***	***37707.13***	***-3754.46***	***4417.21***	***-37828.12***	***1618.58***
	13	-2104.94	34489.72	-3584.62	4058.58	-34600.38	1630.98
237	10	-412.4	11177.76	-1384.36	-220.75	-11213.63	751.21
	11	-587.81	7970.47	-1216.34	136.33	-7996.04	764.86
	12	***1699.17***	***32579.43***	***-3456.51***	***-3544.6***	***-32683.96***	***1611.08***
	13	1523.76	29372.14	-3288.49	-3187.52	-29466.38	1624.73
239	10	-2678.11	-28862.4	-2419.13	4312.99	28955.01	784.25
	11	-2854.49	-32079.39	-2589.01	4671.6	32182.32	771.9
	12	***-1906.01***	***-30895.61***	***-3381.38***	***3656.06***	***30994.74***	***1631.33***
**	***13***	***-2082.39***	***-34112.59***	***-3551.26***	***4014.67***	***34222.04***	***1618.99***
241	10	-790.61	-4384.74	-1019.33	542.24	4398.81	770.96
	11	-615.21	-7591.91	-1187.4	185.17	7616.27	757.36
	12	***1316.25***	***-25787.12***	***-3096.36***	***-2776.94***	***25869.86***	***1635.67***
	13	1491.65	-28994.29	-3264.43	-3134	29087.32	1622.08

NOTES:

1) All the above reaction are Working reactions in "KG"

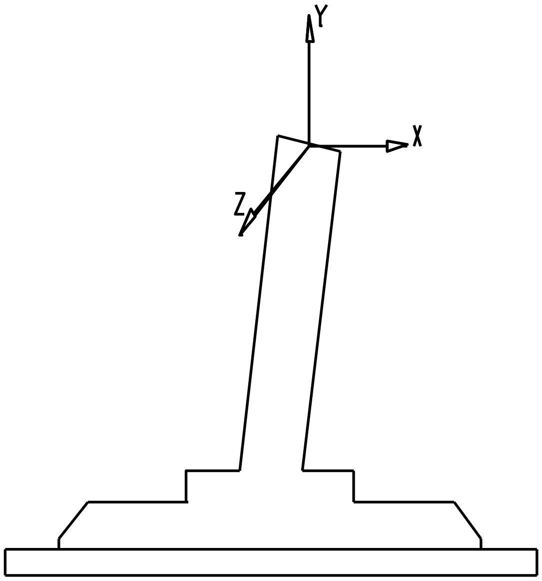
2) The Loads with suffix **'G'** indicates that the loads are in Global direction and with suffix **'L'** indicates the loads are in Local direction.

3) F.O.S of 1.1 is to be applied to get the ultimate loads for foundation design

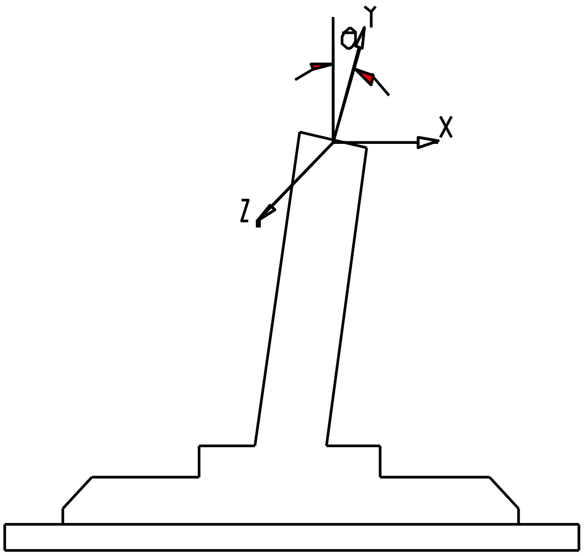
(*) Governing Load Case for maximum Downthrust in Normal condition

(* *)   Governing Load Case for maximum Uplift in Normal condition

Load Case Description	**Load Combination No**	**F.O.S applied to get Ultimate loads**	**Leg Slope In Deg**
Normal Condition	**10, 11, 12 & 13**	**1.1**	**3.31**



GLOBAL AXIS



LOCAL AXIS

Support Reactions for Foundation

Reactions for tower

Load case-12

Node No.	Down Thrust (kg)	Uplift (kg)	Side thrust (Transverse)(kg)	Side thrust (Longitudinal) (kg)
13	37707.13		-2281.33	-3754.46
14	32579.43		1699.17	-3456.51
15		-30895.61	-1906.01	-3381.38
16		-25787.12	1316.25	-3096.36

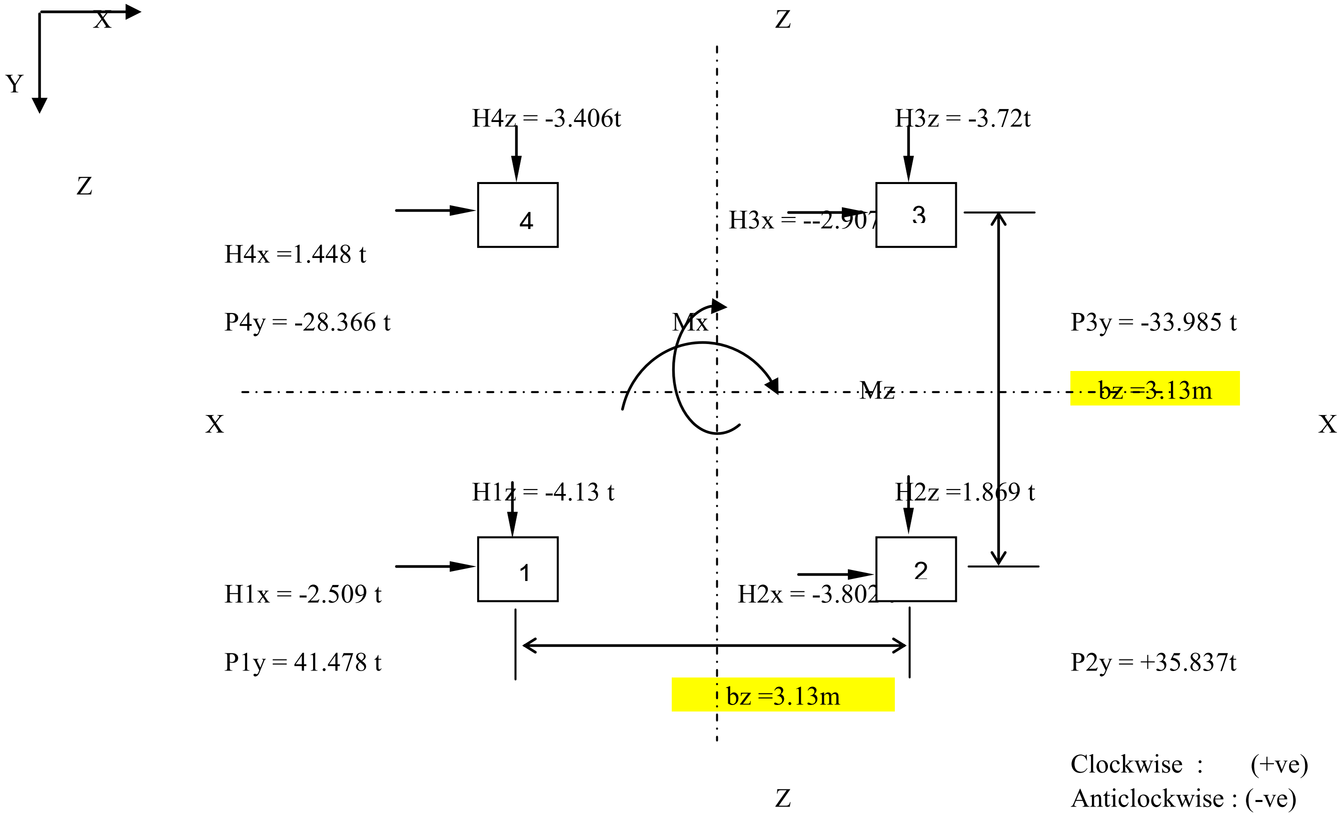
Ultimate Reactions for Foundation

FOS : 1.1

Node No.	Down Thrust (kg)	Uplift (kg)	Side thrust (Transverse)(kg)	Side thrust (Longitudinal) (kg)
13	41478	0	-2509	-4130
14	35837	0	1869	-3802
15	0	-33985	-2097	-3720
16	0	-28366	1448	-3406

Support Reactions for Foundation

1st Slope of tower leg = 3.31deg



Total Vertical Load (Py) = P1y + P2y + P3y + P4y
= (41.478) + (35.837) + (-33.985) + (-28.366)
= **14.964t**

Total Horizontal Shear in X direction (Hx)
= H1x + H2x + H3x + H4x
= (-2.509) + (-1.869) + (-2.907) + (1.148)
= **1.289t**

Total Horizontal Shear in Z direction (Hz)
= H1z + H2z + H3z + H4z
= -(+4.13) + (3.82) + (+-3.72) + (-3.46)
= **15.04t**

Total Moment about XX axis at top of pad (Mx) for +6m Extn.
= (P1y x bz/2) + (P2y x bz/2) + (P3y x bz/2) + (P4y x bz/2)
= -(41.478 x 3.19/2)-(35.837 x 3.19/2)
-(33.985 x3.19/2) - (28.366 x3.19/2)
= **222.760t - m**

Total Moment about ZZ axis at top of pad (Mz) for +6m Extn.
= (P1y x bx/2) + (P2y x bx/2) + (P3y x bx/2) + (P4y x bx/2)

= -(41.478 x3.19/2)+(28.366 x3.19/2)
+(35.837 x3.19/2)- (33.985 x3.19/2)
= **17.959t - m**

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(1) --- CHECK FOR OVER TURNING

Description	Expression
Volume of Footing Concrete below water table in M^3	7.5^2*(0.4)
Volume of Footing Concrete above water table in M3	7.5^2*(0.1))
Volume of pedestal above water in M^3	0.45^2*(1.4+0.225)*4
Weight of Conctete footing in kg	(22.5*1400+2400*5.63)
Weight of Pedestal in Kg	(1.32*2400)
Wt of soil in Kg	(7.5^2*1.4-4*0.45^2*1.4)*1440
Total Vertical load in kg	45012+3168+111767+14964
B.M. (Mu) Mz (kg-m)	222760+(1.4+0.5+0.225)*1289
B.M. (Mu) Mx (kg-m)	17959+(1.4+0.5+0.225)*15040
I) F.O.S in Longitudinal :-	(174911.04*7.5* 0.5) / 225499.125
	HENCE, SAFE IN OVER TURNING
II) F.O.S in Transverse :-	(174911.04*7.5* 0.5) / 49919

(2) --- CHECK FOR SLIDING

Description	Expression
I) F.O.S in Longitudinal :-	174911.04*0.25 / 1289
	HENCE, SAFE IN SLIDING
II) F.O.S in Transverse :-	174911.04*0.25 / 15040
	HENCE, SAFE IN SLIDING

(3) --- STRUCTURAL DESIGN OF FOUNDATION

Description	Expression
Eccentricity (ex) in m	225499.125 / 174911.04
ex / L	1.289 / 7.5
Eccentricity (ey) in m	49919 / 174911.04
ey / B	0.285 / 7.5
From Teng's chart	Co-efficient, K
Maximum Soil Pressure in kg/m^2	174911.04*2.5/7.5^2
Net pressure in kg/m^2	7773.82 - (2-0.1)*940

Description	Expression	
Maximum design presssure in kg/m^2	5988	
Length of Cantilever portion in m	(7.5-3.38-0.45)/2	
Moment @ Bottom (Kg-m)	5988*1.835^2/2	
Moment @ Top (Kg-m)	1.5*(0.4*1400+0.1*2400+1.4*1440)	
Effective depth in m	0.5 - 0.05-0.012-0.006	
Reinforcement at bottom of slab		
Mub/bd^2	10081*9.8*1000/(1000*0.432^2*1000^2)	
Percentage of steel at bottom	From Table-1 of SP-16 design aids for IS: 456	
Area of steel at bottom in mm^2	0.152*0.432*1000*7.5*1000/100	
Dia of Bar	**12**	**Number of bars**44
Spacing of bars	170.000	
	Provide 12mm dia bars at 170mm C/C on both ways at bottom of slab	

Description	Expression	
Reinforcement at top of slab		
Mub/bd^2	4224*9.8*1000/(1000*0.432^2*1000^2)	
Percentage of steel at bottom	From Table-1 of SP-16 design aids for IS: 456	
Area of steel at bottom in mm^2	0.12*0.432*1000*7.5*1000/100	
Dia of Bar	**12**	**Number of bars**35
Spacing of bars	215.000	
	Provide 12mm dia bars at 215mm C/C on both ways at bottom of slab	

(4) --- CHECK FOR SHEAR

Description	Expression
Total Shear force kg	5988*(1.835-0.432)
Net shear force kg	8401
Shear stress in N/mm^2	8401*9.8/(1000*0.432*1000)
Percentage of Reinforcement Provided	
Allowable shear stress	Table 61 SP16 design aids for IS: 456
	Shear stress is Less than Allowable Shear stress Hence, O.K.

Appendix-II

STAAD FILE :-

```
    1. STAAD FLOOR
INPUT FILE: Structure2A2.STD
    2. START JOB INFORMATION
   3. DATE  01/12/06
    4. END JOB INFORMATION
    5. INPUT WIDTH 79
    6. UNIT METER KN
    7. JOINT COORDINATES
    8. 1 0 0 0; 2 8 0 0; 3 0 0 7; 4 8 0 7; 5 0 0 6.5; 6 0.5 0 6.5; 7 0.5 0 7; 8 0 0 6
    9. 9 0.5 0 6; 10 0 0 5.5; 11 0.5 0 5.5; 12 0 0 5; 13 0.5 0 5; 14 0 0 4.5
   10. 15 0.5 0 4.5; 16 0 0 4; 17 0.5 0 4; 18 0 0 3.5; 19 0.5 0 3.5; 20 0 0 3
   11. 21 0.5 0 3; 22 0 0 2.5; 23 0.5 0 2.5; 24 0 0 2; 25 0.5 0 2; 26 0 0 1.5
   12. 27 0.5 0 1.5; 28 0 0 1; 29 0.5 0 1; 30 0 0 0.5; 31 0.5 0 0.5; 32 0.5 0 0
   13. 33 1 0 6.5; 34 1 0 7; 35 1 0 6; 36 1 0 5.5; 37 1 0 5; 38 1 0 4.5; 39 1 0 4
   14. 40 1 0 3.5; 41 1 0 3; 42 1 0 2.5; 43 1 0 2; 44 1 0 1.5; 45 1 0 1; 46 1 0 0.5
   15. 47 1 0 0; 48 1.5 0 6.5; 49 1.5 0 7; 50 1.5 0 6; 51 1.5 0 5.5; 52 1.5 0 5
   16. 53 1.5 0 4.5; 54 1.5 0 4; 55 1.5 0 3.5; 56 1.5 0 3; 57 1.5 0 2.5; 58 1.5 0 2
   17. 59 1.5 0 1.5; 60 1.5 0 1; 61 1.5 0 0.5; 62 1.5 0 0; 63 2 0 6.5; 64 2 0 7
   18. 65 2 0 6; 66 2 0 5.5; 67 2 0 5; 68 2 0 4.5; 69 2 0 4; 70 2 0 3.5; 71 2 0 3
   19. 72 2 0 2.5; 73 2 0 2; 74 2 0 1.5; 75 2 0 1; 76 2 0 0.5; 77 2 0 0; 78 2.5 0 6.5
   20. 79 2.5 0 7; 80 2.5 0 6; 81 2.5 0 5.5; 82 2.5 0 5; 83 2.5 0 4.5; 84 2.5 0 4
   21. 85 2.5 0 3.5; 86 2.5 0 3; 87 2.5 0 2.5; 88 2.5 0 2; 89 2.5 0 1.5; 90 2.5 0 1
   22. 91 2.5 0 0.5; 92 2.5 0 0; 93 3 0 6.5; 94 3 0 7; 95 3 0 6; 96 3 0 5.5; 97 3 0 5
   23. 98 3 0 4.5; 99 3 0 4; 100 3 0 3.5; 101 3 0 3; 102 3 0 2.5; 103 3 0 2
   24. 104 3 0 1.5; 105 3 0 1; 106 3 0 0.5; 107 3 0 0; 108 3.5 0 6.5; 109 3.5 0 7
   25. 110 3.5 0 6; 111 3.5 0 5.5; 112 3.5 0 5; 113 3.5 0 4.5; 114 3.5 0 4
   26. 115 3.5 0 3.5; 116 3.5 0 3; 117 3.5 0 2.5; 118 3.5 0 2; 119 3.5 0 1.5
   27. 120 3.5 0 1; 121 3.5 0 0.5; 122 3.5 0 0; 123 4 0 6.5; 124 4 0 7; 125 4 0 6
   28. 126 4 0 5.5; 127 4 0 5; 128 4 0 4.5; 129 4 0 4; 130 4 0 3.5; 131 4 0 3
   29. 132 4 0 2.5; 133 4 0 2; 134 4 0 1.5; 135 4 0 1; 136 4 0 0.5; 137 4 0 0
   30. 138 4.5 0 6.5; 139 4.5 0 7; 140 4.5 0 6; 141 4.5 0 5.5; 142 4.5 0 5
   31. 143 4.5 0 4.5; 144 4.5 0 4; 145 4.5 0 3.5; 146 4.5 0 3; 147 4.5 0 2.5
   32. 148 4.5 0 2; 149 4.5 0 1.5; 150 4.5 0 1; 151 4.5 0 0.5; 152 4.5 0 0
   33. 153 5 0 6.5; 154 5 0 7; 155 5 0 6; 156 5 0 5.5; 157 5 0 5; 158 5 0 4.5
   34. 159 5 0 4; 160 5 0 3.5; 161 5 0 3; 162 5 0 2.5; 163 5 0 2; 164 5 0 1.5
   35. 165 5 0 1; 166 5 0 0.5; 167 5 0 0; 168 5.5 0 6.5; 169 5.5 0 7; 170 5.5 0 6
   36. 171 5.5 0 5.5; 172 5.5 0 5; 173 5.5 0 4.5; 174 5.5 0 4; 175 5.5 0 3.5
   37. 176 5.5 0 3; 177 5.5 0 2.5; 178 5.5 0 2; 179 5.5 0 1.5; 180 5.5 0 1
   38. 181 5.5 0 0.5; 182 5.5 0 0; 183 6 0 6.5; 184 6 0 7; 185 6 0 6; 186 6 0 5.5
   39. 187 6 0 5; 188 6 0 4.5; 189 6 0 4; 190 6 0 3.5; 191 6 0 3; 192 6 0 2.5
   40. 193 6 0 2; 194 6 0 1.5; 195 6 0 1; 196 6 0 0.5; 197 6 0 0; 198 6.5 0 6.5
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   42. 204 6.5 0 4; 205 6.5 0 3.5; 206 6.5 0 3; 207 6.5 0 2.5; 208 6.5 0 2
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209 6.5 0 1.5; 210 6.5 0 1; 211 6.5 0 0.5; 212 6.5 0 0; 213 7 0 6.5; 214 7 0 7
215 7 0 6; 216 7 0 5.5; 217 7 0 5; 218 7 0 4.5; 219 7 0 4; 220 7 0 3.5
221 7 0 3; 222 7 0 2.5; 223 7 0 2; 224 7 0 1.5; 225 7 0 1; 226 7 0 0.5
227 7 0 0; 228 7.5 0 6.5; 229 7.5 0 7; 230 7.5 0 6; 231 7.5 0 5.5; 232 7.5 0 5
233 7.5 0 4.5; 234 7.5 0 4; 235 7.5 0 3.5; 236 7.5 0 3; 237 7.5 0 2.5
238 7.5 0 2; 239 7.5 0 1.5; 240 7.5 0 1; 241 7.5 0 0.5; 242 7.5 0 0
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249 8 0 3.5; 250 8 0 3; 251 8 0 2.5; 252 8 0 2; 253 8 0 1.5; 254 8 0 1
255 8 0 0.5; 256 1.256 0 0.756; 257 1.256 0 6.244; 258 6.744 0 0.756
259 6.744 0 6.244
MEMBER INCIDENCES
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119. 220 237 238 252 251; 221 238 239 253 252; 222 239 240 254 253
120. 223 240 241 255 254; 224 241 242 2 255
121. ELEMENT PROPERTY
122. 1 TO 224 THICKNESS 0.8
123. DEFINE MATERIAL START
124. ISOTROPIC MATERIAL1
125. E 2.17185E+007
126. POISSON 0.17
127. DENSITY 23.5616
128. ALPHA 1E-005
129. DAMP 0.05
130. ISOTROPIC MATERIAL2
131. E 2.17185E+007
132. POISSON 0.17
133. DENSITY 0
134. ALPHA 1E-005
135. DAMP 0.05
136. END DEFINE MATERIAL
137. MEMBER PROPERTY AMERICAN
138. 225 TO 240 PRIS AX 0.01 IX 100 IY 100 IZ 100
139. CONSTANTS
140. MATERIAL MATERIAL1 MEMB 1 TO 224
141. MATERIAL MATERIAL2 MEMB 225 TO 240
142. SUPPORTS
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310. 167 FIXED BUT FX FZ MX MY MZ KFY 1000.01
311. 168 FIXED BUT FX FZ MX MY MZ KFY 1999.99
312. 169 FIXED BUT FX FZ MX MY MZ KFY 1000.01
313. 170 FIXED BUT FX FZ MX MY MZ KFY 2000
314. 171 FIXED BUT FX FZ MX MY MZ KFY 2000
315. 172 FIXED BUT FX FZ MX MY MZ KFY 2000
316. 173 FIXED BUT FX FZ MX MY MZ KFY 2000
317. 174 FIXED BUT FX FZ MX MY MZ KFY 2000
318. 175 FIXED BUT FX FZ MX MY MZ KFY 2000
319. 176 FIXED BUT FX FZ MX MY MZ KFY 2000
320. 177 FIXED BUT FX FZ MX MY MZ KFY 2000
321. 178 FIXED BUT FX FZ MX MY MZ KFY 2000
322. 179 FIXED BUT FX FZ MX MY MZ KFY 2000
323. 180 FIXED BUT FX FZ MX MY MZ KFY 2000
324. 181 FIXED BUT FX FZ MX MY MZ KFY 1999.99
325. 182 FIXED BUT FX FZ MX MY MZ KFY 1000.01
326. 183 FIXED BUT FX FZ MX MY MZ KFY 1999.99
327. 184 FIXED BUT FX FZ MX MY MZ KFY 1000.01
328. 185 FIXED BUT FX FZ MX MY MZ KFY 2000
329. 186 FIXED BUT FX FZ MX MY MZ KFY 2000
330. 187 FIXED BUT FX FZ MX MY MZ KFY 2000
331. 188 FIXED BUT FX FZ MX MY MZ KFY 2000
332. 189 FIXED BUT FX FZ MX MY MZ KFY 2000
333. 190 FIXED BUT FX FZ MX MY MZ KFY 2000
334. 191 FIXED BUT FX FZ MX MY MZ KFY 2000
335. 192 FIXED BUT FX FZ MX MY MZ KFY 2000
336. 193 FIXED BUT FX FZ MX MY MZ KFY 2000
337. 194 FIXED BUT FX FZ MX MY MZ KFY 2000
338. 195 FIXED BUT FX FZ MX MY MZ KFY 2000
339. 196 FIXED BUT FX FZ MX MY MZ KFY 1999.99
340. 197 FIXED BUT FX FZ MX MY MZ KFY 1000.01
341. 198 FIXED BUT FX FZ MX MY MZ KFY 1999.98
342. 199 FIXED BUT FX FZ MX MY MZ KFY 1000.01
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343. 200 FIXED BUT FX FZ MX MY MZ KFY 2000.02
344. 201 FIXED BUT FX FZ MX MY MZ KFY 2000
345. 202 FIXED BUT FX FZ MX MY MZ KFY 2000
346. 203 FIXED BUT FX FZ MX MY MZ KFY 2000
347. 204 FIXED BUT FX FZ MX MY MZ KFY 2000
348. 205 FIXED BUT FX FZ MX MY MZ KFY 2000
349. 206 FIXED BUT FX FZ MX MY MZ KFY 2000
350. 207 FIXED BUT FX FZ MX MY MZ KFY 2000
351. 208 FIXED BUT FX FZ MX MY MZ KFY 2000
352. 209 FIXED BUT FX FZ MX MY MZ KFY 2000
353. 210 FIXED BUT FX FZ MX MY MZ KFY 2000.02
354. 211 FIXED BUT FX FZ MX MY MZ KFY 1999.98
355. 212 FIXED BUT FX FZ MX MY MZ KFY 1000.01
356. 213 FIXED BUT FX FZ MX MY MZ KFY 1999.98
357. 214 FIXED BUT FX FZ MX MY MZ KFY 1000.01
358. 215 FIXED BUT FX FZ MX MY MZ KFY 2000
359. 216 FIXED BUT FX FZ MX MY MZ KFY 2000
360. 217 FIXED BUT FX FZ MX MY MZ KFY 2000
361. 218 FIXED BUT FX FZ MX MY MZ KFY 2000
362. 219 FIXED BUT FX FZ MX MY MZ KFY 2000
363. 220 FIXED BUT FX FZ MX MY MZ KFY 2000
364. 221 FIXED BUT FX FZ MX MY MZ KFY 2000
365. 222 FIXED BUT FX FZ MX MY MZ KFY 2000
366. 223 FIXED BUT FX FZ MX MY MZ KFY 2000
367. 224 FIXED BUT FX FZ MX MY MZ KFY 2000
368. 225 FIXED BUT FX FZ MX MY MZ KFY 2000
369. 226 FIXED BUT FX FZ MX MY MZ KFY 1999.98
370. 227 FIXED BUT FX FZ MX MY MZ KFY 1000.01
371. 228 FIXED BUT FX FZ MX MY MZ KFY 1999.98
372. 229 FIXED BUT FX FZ MX MY MZ KFY 1000
373. 230 FIXED BUT FX FZ MX MY MZ KFY 1999.99
374. 231 FIXED BUT FX FZ MX MY MZ KFY 1999.99
375. 232 FIXED BUT FX FZ MX MY MZ KFY 1999.99
376. 233 FIXED BUT FX FZ MX MY MZ KFY 1999.99
377. 234 FIXED BUT FX FZ MX MY MZ KFY 1999.99
378. 235 FIXED BUT FX FZ MX MY MZ KFY 1999.99
379. 236 FIXED BUT FX FZ MX MY MZ KFY 1999.99
380. 237 FIXED BUT FX FZ MX MY MZ KFY 1999.99
381. 238 FIXED BUT FX FZ MX MY MZ KFY 1999.99
382. 239 FIXED BUT FX FZ MX MY MZ KFY 1999.99
383. 240 FIXED BUT FX FZ MX MY MZ KFY 1999.99
384. 241 FIXED BUT FX FZ MX MY MZ KFY 1999.98
385. 242 FIXED BUT FX FZ MX MY MZ KFY 1000
386. 243 FIXED BUT FX FZ MX MY MZ KFY 1000
387. 244 FIXED BUT FX FZ MX MY MZ KFY 1000.01
388. 245 FIXED BUT FX FZ MX MY MZ KFY 1000.01
389. 246 FIXED BUT FX FZ MX MY MZ KFY 1000.01
390. 247 FIXED BUT FX FZ MX MY MZ KFY 1000.01
391. 248 FIXED BUT FX FZ MX MY MZ KFY 1000.01
392. 249 FIXED BUT FX FZ MX MY MZ KFY 1000.01
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393. 250 FIXED BUT FX FZ MX MY MZ KFY 1000.01
394. 251 FIXED BUT FX FZ MX MY MZ KFY 1000.01
395. 252 FIXED BUT FX FZ MX MY MZ KFY 1000.01
396. 253 FIXED BUT FX FZ MX MY MZ KFY 1000.01
397. 254 FIXED BUT FX FZ MX MY MZ KFY 1000.01
398. 255 FIXED BUT FX FZ MX MY MZ KFY 1000
399. LOAD 1 LOADTYPE NONE  TITLE LOAD CASE 1
400. *ELEMENT LOAD
401. *1 TO 224 PR GY -8000
402. JOINT LOAD
403. 258 FX -55.46 FY -267.72 FZ -0.89 MX 1025 MY 12 MZ -1326
404. 256 FX -110.14 FY -817.48 FZ -105.88 MX -308 MY 132 MZ -311
405. 257 FX -48.59 FY -187.96 FZ -8.75 MX -2611 MY -563 MZ -192 MZ 45
406. 259 FX -102.72 FY -738.04 FZ -98.7 MX -536 MY -445 MZ -688
408. SELFWEIGHT Y -1
409. PERFORM ANALYSIS


     P R O B L E M   S T A T I S T I C S
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  NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =   259/   240/   255
  ORIGINAL/FINAL BAND-WIDTH=   253/    25/     78 DOF
  TOTAL PRIMARY LOAD CASES =    1, TOTAL DEGREES OF FREEDOM =
777
  SIZE OF STIFFNESS MATRIX =       61 DOUBLE  KILO-WORDS
  REQRD/AVAIL. DISK SPACE  =     13.8/  24770.8 MB
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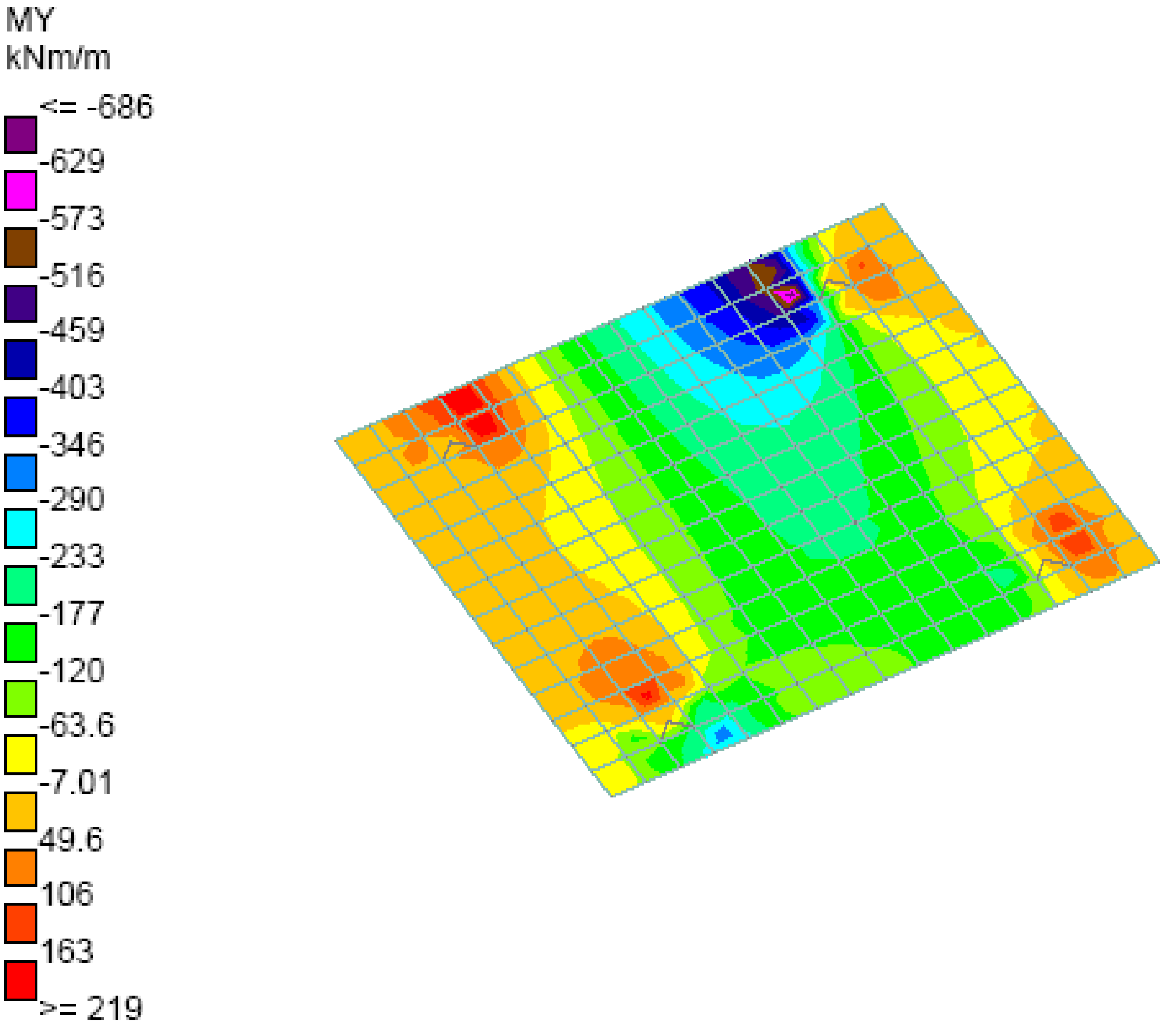
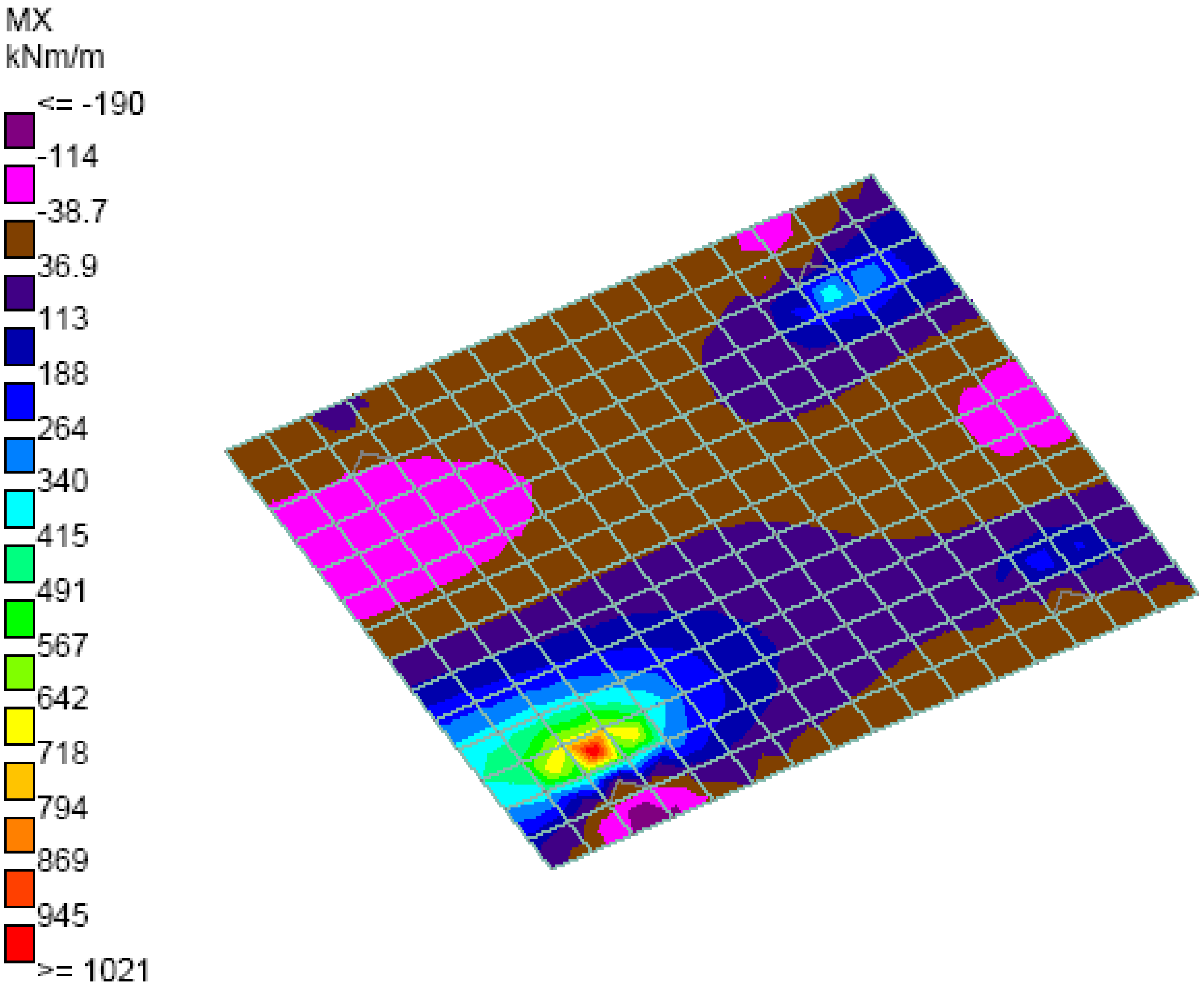
STAAD PRO MODEL :

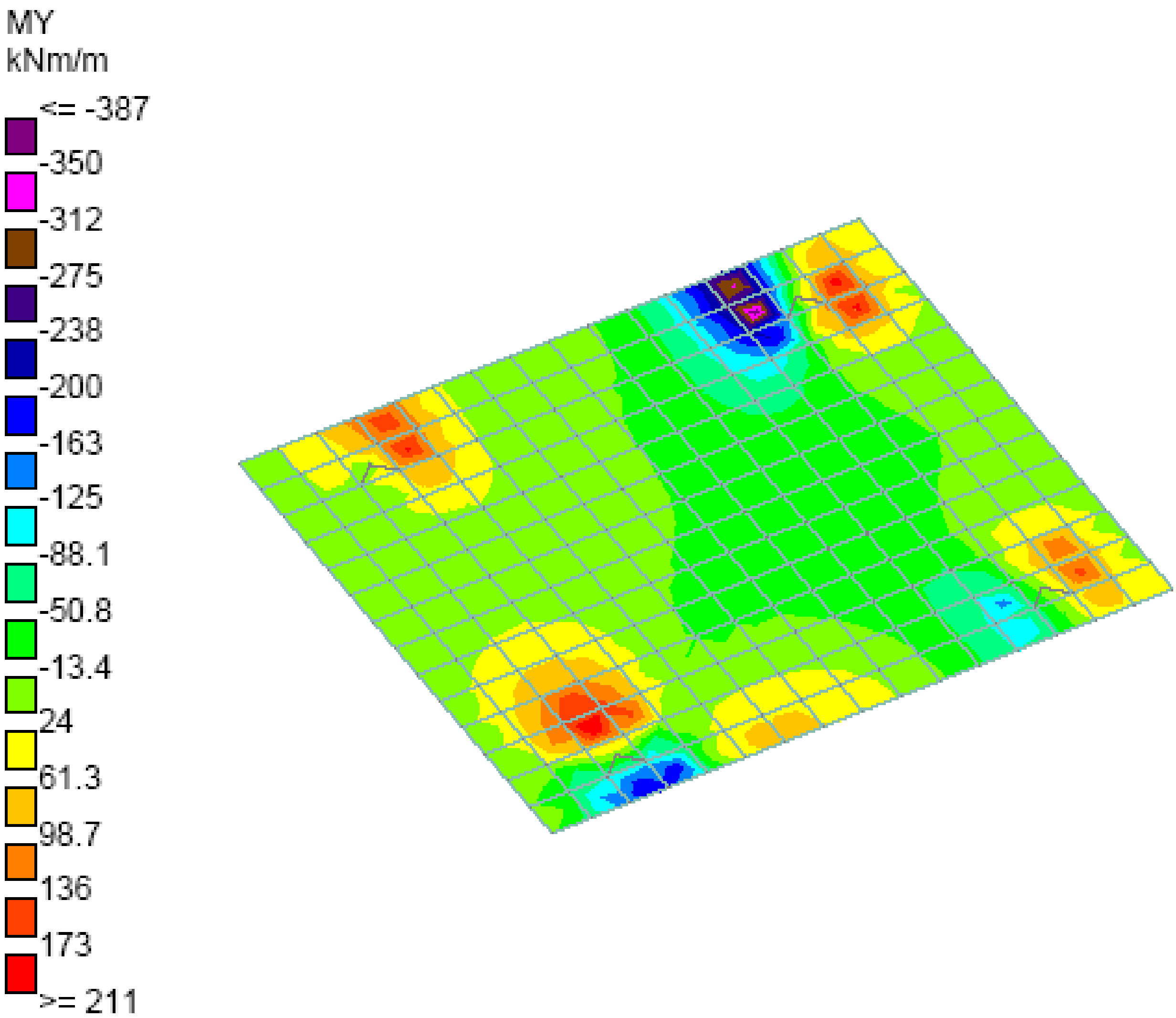
My,0.5m thick,80kN/m^2



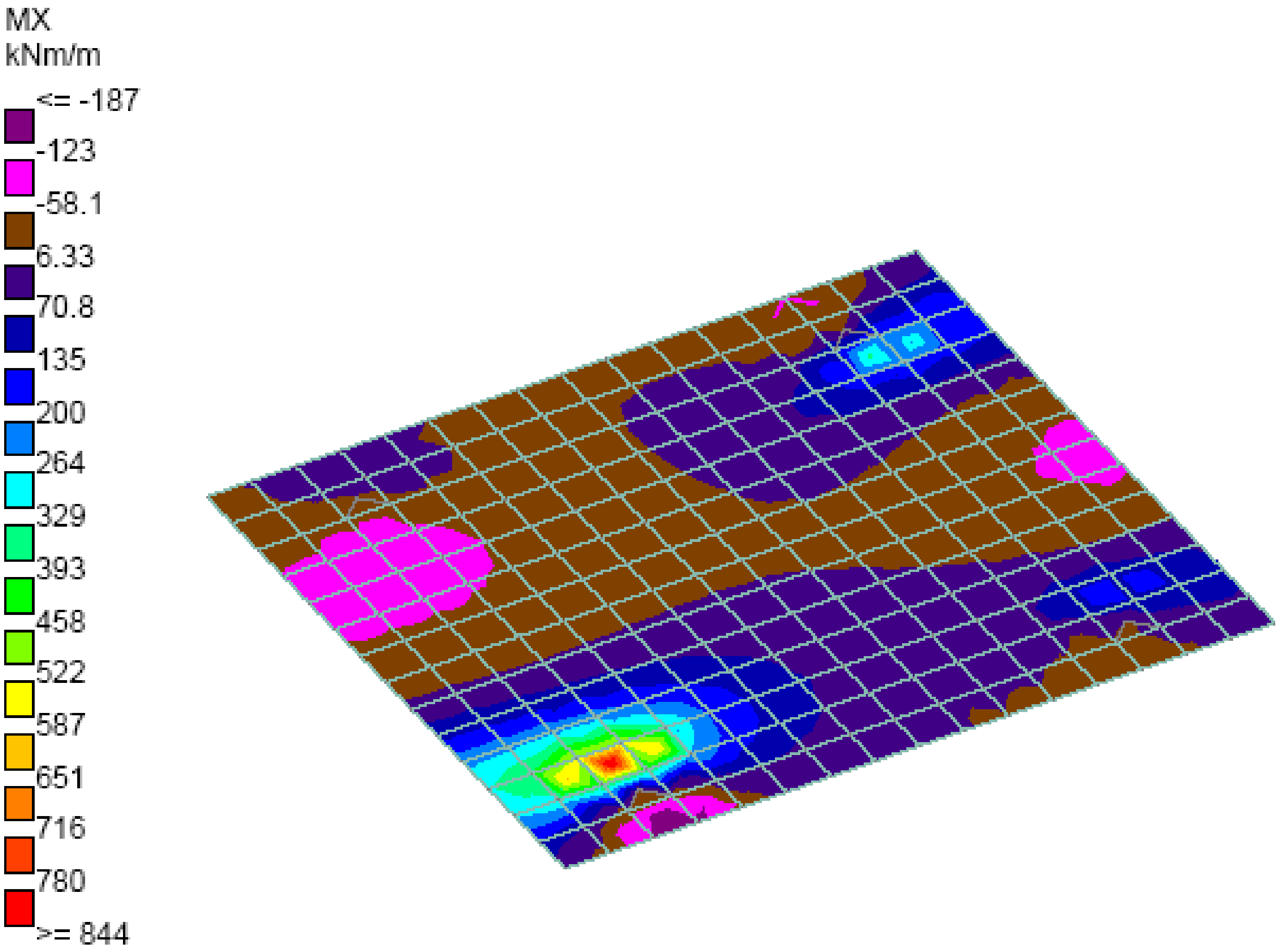
Mx,0.8m thick,80kN/m^2



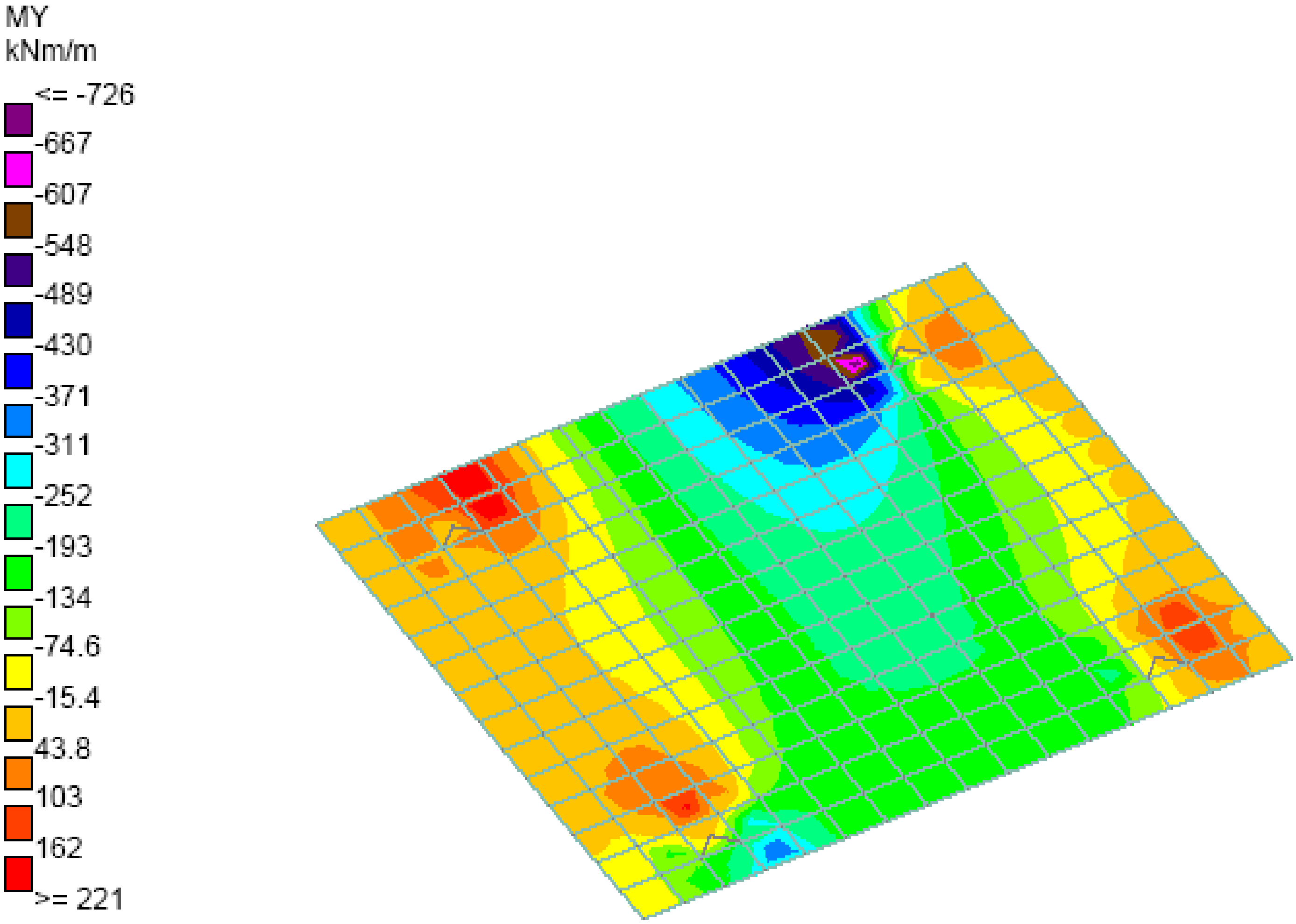
My,0.8m thick,80kN/m^2



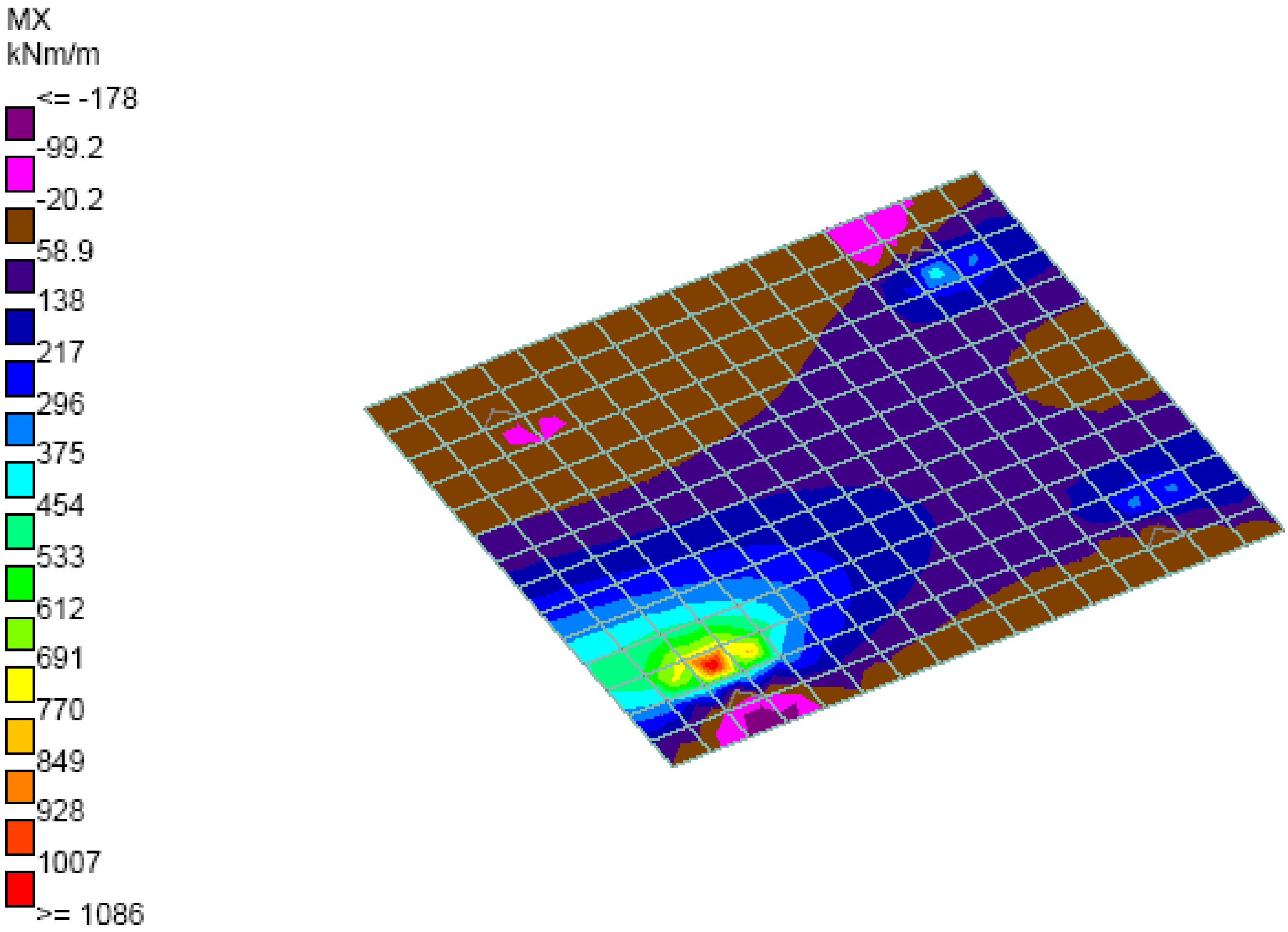
Mx,0.5m thick,300kN/m^2



My,0.5m thick,300kN/m^2



Mx,0.8m thick,300kN/m^2



My,0.8m thick,300kN/m^2