THE INFLUENCE OF CONCRETE STRENGTH ON THE ECONOMY OF REINFORCED CONCRETE COLUMNS

by

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Dedication

This work is dedicated to my father,
my mother and my sweet heart, Samira,
for their love and care throughout my academic life.

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THE INFLUENCE OF CONCRETE STRENGTH ON THE ECONOMY OF REINFORCED CONCRETE COLUMNS

ABSTRACT

The effect of increase in strength of concrete on the economy and performance of reinforced concrete columns is investigated. Two different concrete strengths namely 25 and 45 MPa were used to design columns of 16 different buildings with variation in floor panel size and number of stories carried by the column.

The study indicates that, improvement on the strength of concrete causes a substantial decrease in the size and / or the reinforcement of columns which in turn lowers the cost of reinforced concrete frames. The decrease in cost (savings) is observed to increase with increase in number of stories carried .

The cost benefit in reinforced concrete columns from increasing concrete strength decreases as the floor panels get larger.

BETON DAYANIMIN BETONARME KOLON EKONOMİSİNE ETKİSİ

ÖZET

Bu çalışmada artan beton basınç dayanımının betonarme kolonlar üzerindeki ekonomi ve performans etkileri incelenmiştir. 25 ve 45 Mpa dayanımlı iki beton, kat boyutlarında farklılık gösteren 16 değişik bina dizaynı için kullanılmıştır.

Araştırma neticesinde dayanımdaki artışın kolon boyutlarını ve donatı miktarını azaltarak betonarme yapıların malıyetini düşürdüğü ortaya çıkmaktadır. Artan kat sayısı, maliyette daha büyük azalmalara sebep olmaktadır.

Kolonlarda kullanılan beton dayanımının artması ile elde edilen ekonomik kazançta, döşeme panel açıklıkları arttıkça azalma gözlenmiştir

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1. INTRODUCTION

Today, concrete is commonly used in construction industry, especially in building frames; and it replaces steel in constructing most tall buildings, due to the recent improvement in its strength.; thus by using high – strength concrete.

The term high – strength in the concrete industry simply describes the compressive strength of concrete at 28 days above a certain threshold, which is relative, and depends on the place and time of consideration. For instance, for almost a century, structural concrete has been routinely produced at strengths ranging from 20 to 30 MPa. Four decades ago, in Chicago a 41 MPa was first produced and labeled a high strength, and more recently the threshold rose to 50 – 60 MPa. However, due to high demand in high – rise buildings and bridges, concrete of much higher strength have entered the field of construction: 90, 100, 110 MPa and even higher.

Since both normal and high strength concrete are made up of the same ingredients namely, Portland cement, aggregates and water, what make the difference between the two are the mix proportion, technical know – how, and some differences in the ingredients, in that, high strength concrete invariably contains a high range of superplasticizer while normal concrete does so only sometimes.

High strength concrete with high modulus of elasticity, high density, and low permeability has been used for various reasons including: resistance to freezing and thawing effect, alkali – aggregate reaction, corrosion, leaching, abrasion and chemical attack; all of which decrease as the water cement ratio w/c decreases. But this work is limited to the investigation of cost of reinforced concrete columns as related to concrete strength. Floor panel carrying elements include both columns and walls, only columns are considered here. The same economic advantages apply to high strength in walls as in columns, with the added advantage that a saving in the wall area generally improves the net rentable area.

The aim of this work is to find out how the increase in concrete compressive strength influences the cost of column in reinforced concrete frames. To investigate this, two main variables have been chosen namely the number of column stories and the dimension of floor panels which the columns carry. All other factors are kept constant.

Change in the first variable alters the normal force whereas that of the second alters the moments as well as the normal force in the column.. Sixteen different cases of buildings

were analyzed using 25 and 45 MPa concrete, having two square floor panel sizes and four different stories.

Three dimensional structural analysis of the buildings were performed in both the transverse and longitudinal directions for the lateral load cases combined with the gravitation loads using SAP90; and the result served as the input data for reinforcement design software which in turn gives the total steel used for each column.

Cost analysis is made using the June 1998 Turkish prices for concrete and reinforcing steel, and results compared for different sets of buildings.

2. MATERIALS

2.1 Concrete Production

Concrete is made up of inert aggregate particles bounded by Portland cement-water paste. A number of standard Portland cements exists and are used according to the desired strength of Reinforced Concrete.

The aggregate which consists of both fine and course particles, exerts a major influence on bleeding, ease of finishing, shrinkage and amount of cement and water required to make a given unit of concrete of a given consistency. Importance is also given to the water – cement ratio since that is the major determinant of concrete strength.

In the concrete design practice, proper curing of the concrete is very essential so that water in the mix does not evaporate before the concrete gains the desired strength.

2.2 Strengths of Concrete

Concrete generally has high compressive strength and relatively low tensile strength usually between 10 to 15% of the compressive strength. The shear strength of concrete is however large, approximately 35 to 80% of the compressive strength [1].

2.3 Formation of Reinforced Concrete

The weakness in tension of the plain concrete makes it economical only for footings, concrete slabs laid on the ground and for massive structures such as retaining walls; even then reinforcement is frequently employed.

It is however uneconomical to accept the low tensile strength of plain concrete as a unit on structural strength. The use of reinforcing steel bars in concrete improves markedly upon the economy of construction in that steel, having predominantly high tensile strength carries entirely, the tensile stresses exposed to the structure. [1]

Although steel occupies only a small part of the volume of reinforced concrete (approximately 1 %), it is a major part of the cost. As a very rough guide, the cost of the formwork, the cost the concrete and the cost of the steel are approximately the same, that is one – third of the total cost.

Since reinforcing steel rusts very readily, adequate concrete cover to ensure durability of structure must protect it. The steel is therefore completely surrounded by the concrete; thus, the strain can be transmitted to the steel only via the concrete. The proper adhesion between the steel and the concrete is of greatest importance, and bars should be of sufficiently small diameter to offer an adequate area of contact with the steel.

3. HIGH STRENGTH CONCRETE

3.1 Formation of High Strength Concrete

The compressive strength of concrete is generally governed by the strength of either the cement paste or of the bond between the paste and the aggregate particles.

The strength of cement paste in turn, to a large extent depends on the water – cement ratio and the degree of hydration.

For a given cement and acceptable aggregates, the strength that may be developed by a workable, properly placed mixture of cement, aggregate and water is influenced by the:

- Ratio of mixing water to cement
- Ratio of cement to aggregate
- Grading, surface, texture, shape, strength and stiffness of aggregate particles
- Maximum size of aggregate
- Type and brand of cement
- Amount and type of admixture or Pozzolan
- Mineralogical makeup of the aggregate.

3.2 Development and Technology of High Strength Concrete

In the 1950s, only natural aggregates (sand, gravel), ordinary Portland cements or slag – cements and water were used as constituents for concrete production. Water was necessary for sufficient workability, and the water – cement ratio w/c was normally ranging between 0.6 and 0.7, which limited the compressive strength to about 20 – 40 MPa.

The advent and utilization of water reducing agents and superplasticizers in the concrete industry during the 70s, decreased the w/c – ratio range to about 0.45 – 0.60 without any negative effect on the concrete's workability, and the compressive strength improved to about 60–70 MPa.

In order to obtain yet higher concrete strengths, the w/c ratio was reduced further to 0.25, using some extremely effective super plasticizers, called High Water Reducing Agents (HWRA).

Since the concrete strength is governed not only by the w/c – ratio, but also the cement strength, it was not possible to exceed a concrete strength of 100 MPa by the reduction of the w/c ratio alone; instead, another agent called silica fume was added. [2]

3.3 Mix Proportions of High Strength Concrete

What makes the difference between normal strength and high strength concrete is basically the know – how. The ingredients of both types of concrete are the same, namely, Portland cement, aggregate, water and admixture. There is however a slight difference in the ingredient in that high strength concrete invariably contains a high range of water reducer (superplasticizer), while normal concrete does so only sometimes [3]. In practice, the mix proportions vary, depending on the properties of the individual ingredients and the desired properties of the concrete in service. Details of some actual mixes used in the past are shown in table 3.3 [4].

Usually, Type I cement (in ASTM classification) is used but, if high early strength is required, Type III cement can be used. As shown in the table, other cementitious materials are also included in the mix making the total content cementitious materials to be as high as: 400 to 550 Kg/m^3.

To achieve a high strength, the aggregates should not have too large a maximum size. The coarse aggregate is required to be strong, absolutely clean, that is free from adhering clay or dust; it must not contain reactive silica; and it must be equidimensional in shape, that is neither flanky nor elongated. As for fine aggregate, it is required to be coarsely graded, preferably with a fineness modulus of 2.7 to 3.0. [4]

Inclusion of supplementary cementitious materials, mainly fly ash and slag is very common in the normal strength concrete because of their economic importance in that they are generally cheaper than Portland cement and also, they hydrate or react chemically somewhat later than Portland cement. In the case of the high strength concrete, the reasons for their use are stronger. Given that the high strength is due, in part, to the presence of a dense matrix, replacing a portion of the Portland cement with the supplementary cementitious materials would not unduly depress the early strength of the concrete [3]. Also, the lower chemical reactivity of supplementary cementitious materials means that a

partial replacement of cement is beneficial from the standpoint of controlling the rheological properties of the high strength concrete [3].

Water cement ratio is a very critical issue in the mix since it is the major determinant of the concrete strength in addition to the density of the resulting matrix and the strength of aggregate. The combination of the two major effect namely the w/c and density of the matrix provides a situation in which the w/c influences strength only above a certain minimum value of the ratio. It has been found that the optimum value of w/c is about 0.22. At values higher than 0.22, the influence of w/c is operative; lower values are however harmful because an adequately high density of the matrix cannot be achieved. As seen in Table 3.3, water – cementitious material ratio, w/(c+m),is used rather than the usual water-cement ratio, w/c.

Generally speaking, the cement hydrates more rapidly than supplementary cementitious materials and therefore takes up most of the mixing water. Because of this, it is tempting to conclude that the density of the matrix at the early stage of hardening is governed by w/c, regardless of the other finely divided particles. [3]

However, recent experimental work, as well as field observations show that the finer particles of blast furnace slag, and fly ash all enter into the hydration reactions before some coarser cement particles have done so. It is therefore concluded that it is preferable to quote w/c and w/(c+m) and /or the water content of the mix [3].

Table 3.3 – Mix Proportions of some High Strength Concrete[3]

Ingredient (Kg/m3)	Mix								
	A	B	C	D	E	F	G	H	I
Portland Cement	534	500	315	513	163	228	425	450	460
Silica fume	40	30	36	43	54	46	40	45	–
Fly ash	59	–	–	–	–	–	–	–	–
Slag	–	–	137	–	325	182	–	–	–
Fine aggregate	623	700	745	685	730	800	755	736	780
Coarse aggregate	1069	1100	1130	1080	1100	1110	1045	1118	1080
Total water	139	143	150	139	136	138	175	143	138
w/c ratio	0.22	0.27	0.31	0.25	0.25	0.3	0.38	0.29	0.3
Slump,mm	255	–	–	–	200	220	230	230	110
Cylinder strength (Mpa) at age (days)									
1	–	–	–	–	13	19	–	35	36
2	–	–	–	65	–	–	–	–	–
7	–	–	67	91	72	62	–	68	–
28	–	93	83	119	114	105	95	111	83
56	124	–	–	–	–	–	–	–	–
91	–	107	93	145	126	121	105	–	89
365	–	–	–	–	136	126	–	–	–

3.4 Evolution of High Strength Concrete

To satisfy developer's need for higher strength structures and maintaining column size to attain uniform and larger rentable floors, the concrete construction industry had been striving to improve upon the concrete strength.

In 1962, Material Service Corporation, in Chicago, for the first time, then subsequently developed and delivered to job sites the strengths as shown in Table 3.4. [5]

Table 3.4- High Strength concrete delivered for the first time to Chicago project [5]

1962	Outer Drive East	6000 Psi	41 MPa
1965	Lake Point Tower	7500 Psi	52 MPa
1972	Mid- Continental Plaza	9000 Psi	62 MPa
1976	River Plaza	11000 Psi	76 MPa
1982	Chicago Mercantile E.	14000 Psi	96 MPa
1988	Construction Technology Laboratory	17000 Psi	117 MPa

3.5 Utilization of High Strength Concrete

The first High Strength Concrete structure was a high - rise building in the USA. The highest concrete strength ever used till today was in the construction of a 220m high " Two-Union Square in Seattle, in 1988. Four 3m diameter interior columns and fourteen 1m-diameter columns within the facade both of BS140 strength carried the structure. This concrete was cast in steel pipes, which were used as form work as well as hoop reinforcement. To ensure a complete filling of the pipes without any external compaction, the fresh concrete was pumped from the bottom to the top over two floors in each step. For this purpose, a very weak consistency with a flow value of a=64 to 76 cm was required. Table 3.5.1 gives the mix composition of that. [2]

In 1990, a 186m high - rise building "Trianon" of BS85 strength concrete was constructed for the first time in Frankfurt, Germany.

Table 3.5.1- Concrete mix for High Strength concrete BS140
(Two Union Square, Seattle)

Cement ASTM Type 2	560 Kg/m^3
Silica fume	42 Kg/ m^3
Sand 0/5	650 Kg/ m^3
High Strength Aggregates 5/10	1110 Kg/ m^3
Water	140 Kg/ m^3
Superplasticizers	9 – 14 Kg/ m^3
Retarder	3 l/ m^3
W/C ratio	0.23
Flow	64 – 76 cm
Modulus of elasticity	49,700 N/mm^2

Today in Germany, up to a BS115 strength is applied in various projects on site as well as in prefabricated elements [2]. For flexural and shear - stress members in the high-rise building "Taunustor" in Frankfurt, Germany, a High Strength Concrete of class BS105 was used for the first time [2].

Other prominent structures were the Water Tower Place in Chicago (1975), Joigny Bridge in France (1989), La Laurentienne Building in Montreal (1984) and the Scotia Plaza in Toronto (1987). Table 3.5.2 summarizes the mixtures for these structures.

Table 3.5.2 – Typical High strength concrete mixtures

Mixture number		1	2	3	4	5
Water	Kg/ m^3	195	165	135	145	130
Cement	Kg/ m^3	505	451	500	315	513
Fly Ash	Kg/ m^3	60	---	----	----	-----
Slag	Kg/ m^3	'----	----	-----	137	-----
Silica fume	Kg/ m^3	'----	----	30	36	43
Coarse aggregate	Kg/ m^3	1030	1030	1100	1130	1080
Fine aggregate	Kg/ m^3	630	745	700	745	685
Water reducer	ml/ m^3	975	----	----	900	-----
Retarder	L/ m^3	----	405	1,8	----	-----
Superplasticizers	L/ m^3	----	11,25	14	5,9	15,7
w / (c+m)		0,35	0,37	0,27	0,31	0,25
f'_c at 28 day	(MPa)	65	80	93	83	119
f'_c at 91 day	(MPa)	79	87	107	93	145

1- Water Tower Place, Chicago (1975)

2- Joigny Bridge, France (1989)

3- La Laurentienne Building, Montreal (1984)

4- Scotia Plaza, Toronto (1987)

5- Two Union Square, Seattle (1988)

3.6 Properties of High Strength Concrete

3.6.1 Stress - Strain Relation

The difference between normal strength concrete and high stength concrete are not only in the increased strength but also in different stress – strain relation and consequently, the elastic modulus.

In high strength concrete, the stress – strain curve is nearly linear up ot a stress strength ratio of about 80%. After exceeding the ultimate load, the stress – strain line falls off rapidly, which is typical for a brittle material. Using increased stirrup reinforcement can prevent such a sudden failure of a structure. [2]

Corresponding to the steeper stress-strain line, the modulus of elasticity of high strength concrete is also higher than that of normal concrete. The increase in elastic modulus, however, is less than the increase in compressive strength.[2]

3.6.2 Ductility

Generally, plain concrete is not a ductile material. Plain high – strength concrete is less ductile than that of a lower strength concrete, although the relative ductilities of the two materials when reinforced is less well understood.[6]

The approach used to improve the ductility of concrete columns is substantially the use of additional tie reinforcement. Thus increasing the volume of ties in the column can provide a much more ductile column. If sufficient ties are used, substantial residual strength will remain after the outside shell of the concrete has completely spalled off. Apparently, spalling of the concrete occurs more easily in higher strength concrete because of their lower water content. [6]

3.6.3 Durability

For many years, the incentive for developing high-strength concrete was essentially strength oriented. While the ultimate strength of production of concrete has tripled over the past four decades, the durability of concrete has not improved as much.

Almost all aspects of durability are related to the permeability of concrete, which generally decreases with increase in strength. The use of high-strength concrete could therefore solve many durability problems such as: freezing and thawing, alkali-aggregate reaction, corrosion, leaching, abrasion and resistance to chemical attack which decreases as the w/c decreases. [7]

3.6.4 Fire resistance

Due to its brittleness, high-strength concrete normally has a very low fire resistance. At temperatures between 800-1000 degree C, water in the cement paste which is physically as well as chemically bonded is set free and converted to steam. In normal concrete, the steam can escape or at least the steam pressure can be released due to its adequate capillary pores; whereas in high strength concrete, the dense microstructure of the cement paste prevents such a pressure reduction which would result in a sudden bursting of the concrete cover, so that the reinforcement is subject to direct fire and high temperatures without any protection, resulting in the failure of the structure. [2]

3.7 Regulations on the Use of High Strength Concrete

Although the American code does not have specific upper limits on concrete strength, other parts of the world have strict regulations and limitations on the use of high strength concrete. The current Australian concrete structures code, AS3600, recognizes only the use of concrete up to 50 MPa in strength, although a modification allowing the use of 60 MPa is expected in the near future. [6]

In 1990, high-strength concrete of class BS85 was not regulated in German Standards, so a special permit with extensive investigation was required for the structural

application of BS85 concrete in columns and walls for the 186m high rise building "Trianon" in Frankfurt. Today in Germany, high-strength concrete is applied up to strength of 115 MPa in various projects. [2]

3.8 When to Use High Strength Concrete

The most common requirement for high strength is in compression members. Here, high strength allows the use of smaller columns and therefore, a reduction in weight and hence, a lower load on the foundation. Also a smaller part of the horizontal area is occupied by columns so that there is more of the economically valuable floor space.

Compared with normal reinforced concrete structures, high strength concrete structures have advantages in the smaller dimensions of the members and / or in a reduced reinforcement. For instance, a column 1 x 1m using normal concrete of strength 45 MPa and reinforcement $\mu = 4$ %, can carry a load of 21 MN. This same load can be carried by an 85 MPa high strength concrete column of cross section 1 x 1 m with $\mu = 1.23$ % of reinforcement. Besides the saving in reinforcement, the concrete placement is facilitated.

4 SOME UNDESIRABLE PHENOMENA IN CONCRETE STRUCTURES

4.1 Creep and Shrinkage

Concrete creep is the deformation and flow of matter associated with structure of the cement paste whilst the shrinkage and swelling of concrete is produced by the movement of water in to and out of the gel due to external load and drying.

The creep in concrete is caused by mixture proportions, type of aggregate and age at loading whilst the shrinkage is directly related to water- cement ratio, mixture proportions, type of aggregate and curing condition. [8]

4.2 Influence of Constituent on Creep and Shrinkage

An experimental investigation was conducted on high strength concrete produced in the St. Paul – Minneapolis area which reveals that by lowering the paste content and maximizing the coarse aggregate, a high strength concrete can be produced with a modest improvement in creep and shrinkage deformations. [8]

4.3 Effect of Creep and Shrinkage on the Economy of Structure

The creep increases with the increase in both the cement and water content of the concrete per unit volume. Since concrete required to carry high stresses is frequently as rich as 4:1, it consequently suffers from both large shrinkage and creep movements. The reduction of column length due to these two phenomena can result in the partial transfer of load from the columns to the cladding of the structure, which begins to crush since it is usually not designed to carry load. Overcoming this negative effect is achieved by forming horizontal construction joints at a number of levels with a subsequent increase in building cost. [9]

4.4 Creep and Shrinkage in High –Strength and Normal Strength Concrete

Studies on the creep and shrinkage show advantages of high-strength over normal strength concrete as summarized below:

- Although high- strength concrete generally have greater unit cement paste volume, its drying shrinkage is smaller than that of normal strength. This is because, beside other factors, the drying shrinkage is dependent on the unit cement paste volume and the compressive strength of the concrete.[10]
- For a high- strength concrete of strength higher than 98 MPa, the value of specific creep divided by the unit cement paste is 30.6 ~ 40.8 x 10^{-6} / MPa / m^3 / m^3 both under water and in air which is ¼ ~ 1/5 that of normal strength concrete under air curing. Also the difference in creep between concrete cured in the air and that cured in water diminishes with increase of compressive strength, and does not exist for high – strength concrete with compressive strength over 98 MPa.[10]

5. GENERAL DESIGN CONSIDERATION

5.1 Type and System of structure

The selection of system type highly depends on the function of the building under consideration since this give us the idea about the size of the open space required, mechanical services and the need for flexibility. In this study, residential buildings including apartment, hotels and dormitories which are frame structurally more suitable are considered.

5.2 Slab System

The choice of a slab system for vertical loads depends upon the length of span, loading intensity and the function of the building.

The need for smooth ceiling in residential occupancies resulted in the flat plate being the most prevalent and economical [11]. Therefore, plate floor system is used for frame analysed.

For the flat plate two-way slab system, the minimum thickness, h, as given in codes is:

$$h = \frac{\ln}{36000}\left(800 + \frac{fy}{200}\right) \qquad (5.2.1)$$

Where ln is the length of the clear span in the long direction and fy is the yield stress of the steel in Psi [12,13].

Using the equivalent frame method of design, the flat plate and its supporting columns are considered as a series of elastic frames at right angles to one another [12]. Each of these frames are analysed as if it were a frame consisting of beams and columns.

5.3 Columns

The most common cause of the major damage to buildings is the insufficient ductility in the bearing walls and columns. By suitable reinforcement, ductility is introduced in to the reinforced concrete structures.

Since the cost of reinforcing bars is predominantly high, the amount of reinforcement has a very significant effect on the economy of high rise reinforced concrete buildings. The lowest possible percentage of vertical reinforcement is sometimes attempted for some economic reasons . This can be achieved by increasing the column size (if there is no conflict with the architectural requirement), by increasing the strength of concrete used or by increasing both the strength and the column size.

Quite often, in the upper stories of buildings, columns are much larger than required to carry the load. The oversized columns result either from architectural requirement or from economical considerations to have a few changes in column section.

5.4 Geometric Parameters

The main variables considered are the number of stories and the span lengths in square floor panels shown in fig. 5.4

Two sets of floor spans namely 5m by 5m and 7m by 7m were chosen to be designed each for 5, 10, 15 and 20 stories using 25 MPa and 45 MPa concrete strengths. For a typical representative of concrete frame structures, a 3m-column height was chosen.

After some preliminary calculations, the corresponding slab thickness for various span lengths were obtained as:

5m by 5m ⟶ 16 cm

7m by 7m ⟶ 22 cm

The slab-beam have the same dimensions at all floor levels whilst the columns have varying dimensions. Tables 5.4.1- to 5.4.5 show the preliminary columns and slab-beams cross sections

Table 5.4.1 – Beams cross sections

Bay size	for 25 Mpa Concrete	for 45 Mpa Concrete
5m square	500 by 250 mm	400 by 250 mm
7m square	600 by 350 mm	500 by 300 mm

Table 5.4.2 – Column cross sections for 20 story buildings

fc= 25 Mpa				
Story	5m span		7m span	
level	Int.	Ext.	Int.	Ext.
1	900	700	1100	900
2	900	700	1100	900
3	900	700	1100	900
4	900	700	1100	900
5	900	700	1100	900
6	800	600	1000	800
7	800	600	1000	800
8	800	600	1000	800
9	800	600	1000	800
10	800	600	1000	800
11	700	500	900	700
12	700	500	900	700
13	700	500	900	700
14	500	400	700	600
15	500	400	700	600
16	500	400	700	600
17	400	300	600	500
18	400	300	600	500
19	400	300	600	500
20	400	300	600	500

fc= 45 Mpa				
Story	5m span		7m span	
level	Int.	Ext.	Int.	Ext.
1	700	600	900	800
2	700	600	900	800
3	700	600	900	800
4	700	600	900	800
5	700	600	900	800
6	600	500	800	700
7	600	500	800	700
8	600	500	800	700
9	600	500	800	700
10	600	500	800	700
11	500	400	700	600
12	500	400	700	600
13	500	400	700	600
14	400	300	600	500
15	400	300	600	500
16	400	300	600	500
17	350	300	500	400
18	350	300	500	400
19	350	300	500	400
20	350	300	500	400

Table 5.4.3- column cross sections for 5 story buildings

f_c= 25 MPa				
Story	5m span		7m span	
level	Interior	Exterior	Interior	Exterior
1	500	400	700	600
2	500	400	700	600
3	500	400	700	600
4	500	400	700	600
5	500	400	700	600

f_c= 45 MPa				
Story	5m span		7m span	
level	Int.	Exterior	Int.	Exterior
1	400	300	600	500
2	400	300	600	500
3	400	300	600	500
4	400	300	600	500
5	400	300	600	500

Table 5.4.4 - column cross sections for 15 story buildings

f_c= 25 MPa				
Story	5m span		7m span	
level	Interior	Exterior	Interior	Exterior
1	800	600	1000	800
2	800	600	1000	800
3	800	600	1000	800
4	800	600	1000	800
5	800	600	1000	800
6	700	500	900	700
7	700	500	900	700
8	700	500	900	700
9	700	500	900	700
10	700	500	900	700
11	600	400	800	600
12	600	400	800	600
13	600	400	800	600
14	400	300	600	500
15	400	300	600	500

fc= 45 MPa				
Story	5m span		7m span	
level	Int.	Exterior	Int.	Exterior
1	600	500	800	700
2	600	500	800	700
3	600	500	800	700
4	600	500	800	700
5	600	500	800	700
6	500	400	700	600
7	500	400	700	600
8	500	400	700	600
9	500	400	700	600
10	500	400	700	600
11	400	300	600	500
12	400	300	600	500
13	400	300	600	500
14	350	300	500	400
15	350	300	500	400

Table 5.4.5- column cross sections for 10 story buildings

fc= 25 MPa				
Story	5m span		7m span	
level	Interior	Exterior	Interior	Exterior
1	700	500	900	700
2	700	500	900	700
3	700	500	900	700
4	700	500	900	700
5	700	500	900	700
6	500	400	700	600
7	500	400	700	600
8	500	400	700	600
9	500	400	700	600
10	500	400	700	600

fc= 45 MPa				
Story	5m span		7m span	
level	Int.	Exterior	Int.	Exterior
1	500	400	700	600
2	500	400	700	600
3	500	400	700	600
4	500	400	700	600
5	500	400	700	600
6	400	300	600	500
7	400	300	600	500
8	400	300	600	500
9	400	300	600	500
10	400	300	600	500

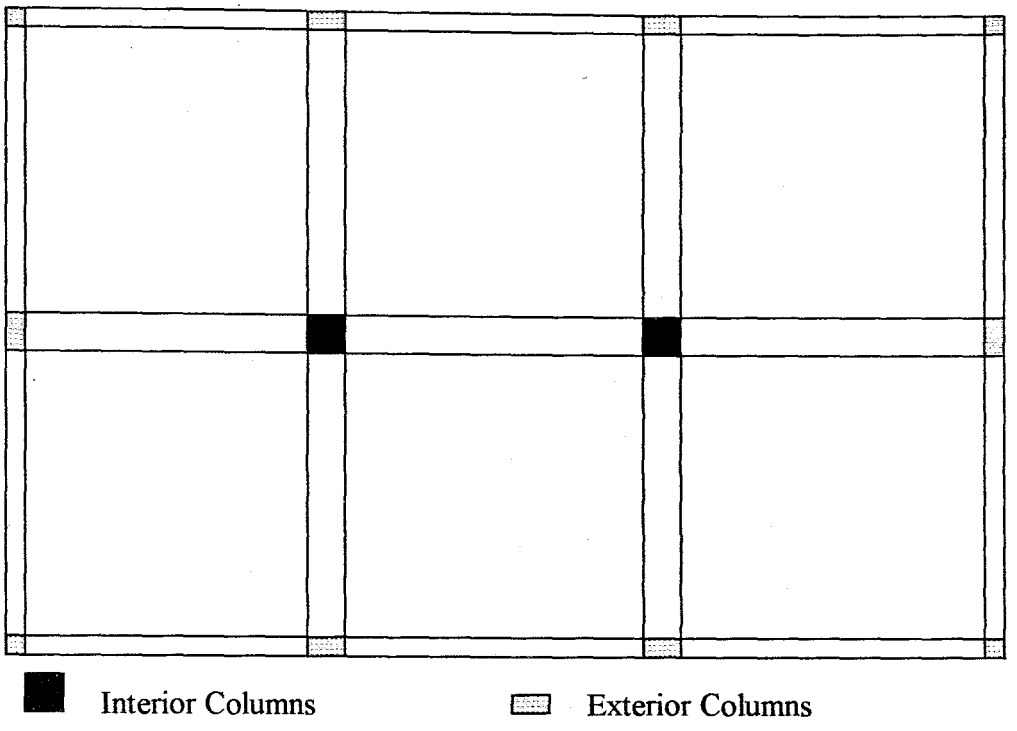


Figure 5.4.1 – Plan View of a Typical Square panel

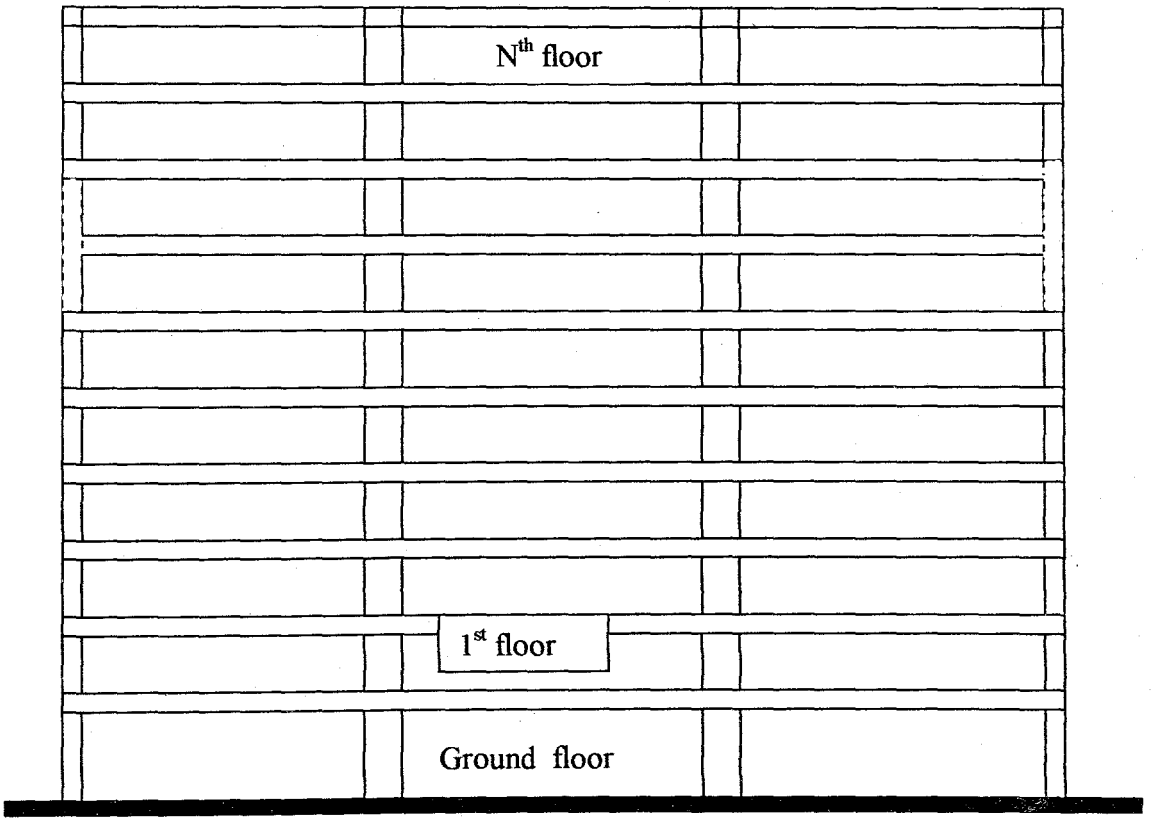


Figure 5.4.2 – Side View in the Long Direction of a typical N story

5. 5 DESIGN OF LOADS

5.5.1 Gravity Loads

The basic aspect of engineering is the design of gravity load even for tall structures in effect on the economy of the project. Proper column layout which leads to economical spans while not impeding the functional requirements of the building is the key to an economical slab system to support the gravity loads.

The gravity loads considered are the service live loads (G) plus the superimposed dead loads (Q) obtained from partitions, ceilings and mechanical.

5.5.2 Horizontal loads

These are the lateral forces exerted on the building by wind (W) and / or earthquake (E). According to the design code, the wind and the earthquake (seismic) loads are not considered simultaneously in the design [12],as explained below:

If winds are considered:

1 1.0G +1.3Q +1.3W

2 1.4G + 1.6Q

3 0.9G + 1.3W

If seismic loads are considered:

4 1.0G +1.0Q + 1.0E

5 1.4G + 1.6Q

6 0.9G +1.0E

The code depicts that the combination with the most severe condition is selected. After some preliminary calculations, combination number 4 was selected.

5.5.3 Design of Seismic Loads

Depending upon the building and the seismic zone or seismic performance category, the seismic forces were applied in the direction that produces the most critical load effect as stipulated in the design code [13] which states that:

The principal steps involved in the earthquake resistance design of a typical concrete structure according to building code provisions are as follows:

1. Determination of design earthquake forces:
   a) calculation of base shear corresponding to computed or estimated fundamental period of vibration of the structure (a preliminary design of the structure is assumed here);
   b) distribution of the base shear over the height of the building.

2 Analysis of the structure under the (static) lateral earthquake forces calculated in step 1, as well as under gravity and wind loads, to obtain member design forces.

3 Designing members and joints for the most unfavourable combination of gravity and lateral (wind or seismic) loads, and detailing them for ductile behaviour.

5.5.4 Design Base Shear

The design base shear represents the total horizontal seismic force that may be assumed to be acting parallel to the axis of the structure considered. The force in the other direction is assumed to act non-concurrently.

The requirement that orthogonal effects be considered in the proportionality of a structural element may be satisfied by designing the element for 100 percent of the prescribed seismic forces in one direction plus 30 percent of the prescribed forces in the perpendicular direction. The combination requiring the greater component strength must be used for design [13].

The total lateral force or base shear, V, is given by:

$$V = Z K C W \qquad (5.5.4.1)$$

Where: Z is seismic zone coefficient

Taken as 1 for zone III [UBC]

K - factor of structural system and type (k=1 from table 12-3 [14])

C - flexibility coefficient

C values were obtained from charts [14]

W is the total dead load, except that in storage and warehouse occupancies.

With k=1 and Z=1 , equation (5.5.4.1) becomes

$$V = C\,W \qquad (5.5.4.2)$$

The lateral seismic design forces, F_x are obtained from the distribution of the base shear, and is given by the relation:

$$F_x = \frac{V\, w_x h_x}{\sum_{i=1}^{n} w_i h_i} \qquad (5.5.4.3)$$

6. CALCULATIONS OF DESIGN LOADS

6.1 Design Data

In this work, design loads are calculated according to the 1994 edition of the Uniform Building Code (UBC)[13]. As shown in section 5 and tables 5.4.1 to 5.4.5, the floor panels have the same dimensions at all floor levels whilst the columns have varying dimensions. Other design data are as follows:

Service loads:

Live loads: 50 psf (UBC –94, Table 16-A)

Additional average value to allow for heavier load on corridors = 25 psf

Thus, total average live load = 75 psf (0.359 ton/m^2)

Superimposed Average for partitioning = 20 psf

dead load : Ceiling and mechanical = 10 psf

Thus total average superimposed dead load = 30 psf (0.1536 ton/m^2)

Material properties:

Concrete: f_{c1} = 25 MPa; f_{c2} = 45 MPa; w_c = 2.323 ton/m^3

Reinforcement: f_y = 460 MPa

6.2 Calculations

Given that: w_c = 2.323 ton/m^3 and

Dead load + Live load = 0.5126 ton/m^3

a) For the 5m by 5mspan of thickness 16 cm, the total weight exerted by the slab is:

$$W = 0.5126 + 2.323 \times 0.16 = 0.88429 \text{ ton/m}^2$$

As shown in figure 6.2.1, each interior beam carries a wholespan area whereas, the exterior beams carry half the area of aspan each. Thus,

Load on the Interior beams = 0.88429 x 5 = 4.421 ton/m

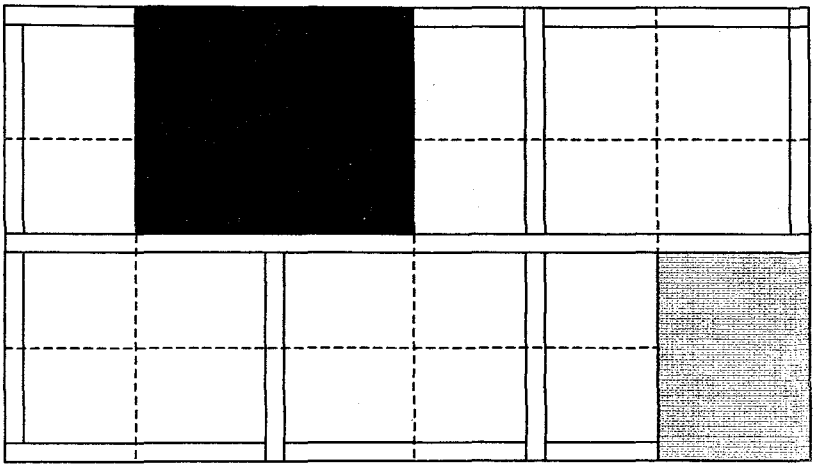
Load on the Exterior beams = 0.88429 x 5 / 2 = 2.211 ton/m

b) For the 7m by 7mspan of thickness 22 cm, the total weight exerted by the slab is:

$$W = 0.5126 + 2.323 \times 0.22 = 1.0237 \text{ ton/m}^2$$

Therefore: Load on the Interior beams = 1.0237 x 7= 7.166 ton/m

Load on the Exterior beams = 1.0237 x 7 / 2 = 3.583 ton/m



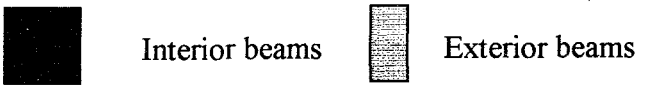


Fig. 6.2.1 - Showing the total slab area carried by the Interior and exterior beams

Considering equation 5.5.4.2, the values for the coefficient, C from design chart [14] are obtained and the weight of each floor, W is computed as the total weight of all elements located between two imaginary parallel planes passing through the midheight of columns above and below the floor considered. Having obtained the C coefficients and W for all sets

of structures, the lateral forces as well as the story and base shears were obtained using the programs in Appendix A and Appendix B for the 25 MPa and 45 MPa concrete respectively. Tables 6.2.1 –6.2.8 show the forces in the transverse and longitudinal directions respectively for 5m by 5m span 20, 15, 10 and 5 story buildings. Those for the other sets are given in the Appendices A and B.

Table 6.2.1 -Lateral forces in Transverse Direction for a 5m span 20 stories

Floor Level From base	*Height h (m)*	*Story weight ton*	*h*w ton-m*	*Lateral force ton*	*Story shear ton*
20	60	141.14	8468.64	17.76	17.76
19	57	141.14	8045.21	16.87	34.63
18	54	141.14	7621.78	15.98	50.61
17	51	141.14	7198.34	15.09	65.70
16	48	147.28	7069.34	14.82	80.52
15	45	147.28	6627.51	13.90	94.42
14	42	147.28	6185.68	12.97	107.39
13	39	156.89	6118.87	12.83	120.22
12	36	156.89	5648.18	11.84	132.06
11	33	156.89	5177.50	10.86	142.92
10	30	166.66	4999.92	10.48	153.40
9	27	166.66	4499.93	9.44	162.83
8	24	166.66	3999.94	8.39	171.22
7	21	166.66	3499.94	7.34	178.56
6	18	166.66	2999.95	6.29	184.85
5	15	178.08	2671.26	5.60	190.45
4	12	178.08	2137.01	4.48	194.93
3	9	178.08	1602.76	3.36	198.29
2	6	178.08	1068.50	2.24	200.53
1	3	178.08	534.25	1.12	201.65

Table 6.2.2 -Lateral forces in Transverse Direction for a 5m span 15 stories

Floor Level From base	*Height h (m)*	*Story weight ton*	*h*w ton-m*	*Lateral force ton*	*Story shear ton*
15	45	141.14	6351.48	19.10	19.10
14	42	141.14	5928.05	17.83	36.93
13	39	147.28	5743.84	17.27	54.20
12	36	147.28	5302.01	15.94	70.15
11	33	147.28	4860.17	14.62	84.76
10	30	156.89	4706.82	14.15	98.92
9	27	156.89	4236.14	12.74	111.66
8	24	156.89	3765.46	11.32	122.98
7	21	156.89	3294.77	9.91	132.89
6	18	156.89	2824.09	8.49	141.38
5	15	166.66	2499.96	7.52	148.90
4	12	166.66	1999.97	6.01	154.91
3	9	166.66	1499.98	4.51	159.42
2	6	166.66	999.98	3.01	162.43
1	3	166.66	499.99	1.50	163.93

Table 6.2.3 -Lateral forces in Transverse Direction for a 5m span 10 stories

10	30	147.28	4418.34	24.18	24.18
9	27	147.28	3976.51	21.76	45.94
8	24	147.28	3534.67	19.34	65.29
7	21	147.28	3092.84	16.93	82.21
6	18	147.28	2651.00	14.51	96.72
5	15	156.89	2353.41	12.88	109.60
4	12	156.89	1882.73	10.30	119.90
3	9	156.89	1412.05	7.73	127.63
2	6	156.89	941.36	5.15	132.78
1	3	156.89	470.68	2.58	135.36

Table 6.2.4 -Lateral forces in Transverse Direction for a 5m span 5 stories

5	15	147.28	2209.17	24.55	24.55
4	12	147.28	1767.34	19.64	44.18
3	9	147.28	1325.50	14.73	58.91
2	6	147.28	883.67	9.82	68.73
1	3	147.28	441.83	4.91	73.64

Table 6.2.5- Lateral forces in the Longitudinal Direction for a 5m span 20 stories

Floor Level From base	*Height h (m)*	*Story weight ton*	*h*w ton-m*	*Lateral force ton*	*Story shear ton*
20	60	141.14	8468.64	9.86	9.86
19	57	141.14	8045.21	9.37	19.24
18	54	141.14	7621.78	8.88	28.11
17	51	141.14	7198.34	8.39	36.50
16	48	147.28	7069.34	8.23	44.73
15	45	147.28	6627.51	7.72	52.45
14	42	147.28	6185.68	7.21	59.66
13	39	156.89	6118.87	7.13	66.79
12	36	156.89	5648.18	6.58	73.37
11	33	156.89	5177.50	6.03	79.40
10	30	166.66	4999.92	5.82	85.22
9	27	166.66	4499.93	5.24	90.46
8	24	166.66	3999.94	4.66	95.12
7	21	166.66	3499.94	4.08	99.20
6	18	166.66	2999.95	3.49	102.69
5	15	178.08	2671.26	3.11	105.81
4	12	178.08	2137.01	2.49	108.30
3	9	178.08	1602.76	1.87	110.16
2	6	178.08	1068.50	1.24	111.41
1	3	178.08	534.25	0.62	112.03

Table 6.2.6- Lateral forces in the Longitudinal Direction for a 5m span 15 stories

15	45	141.14	6351.48	10.91	10.91
14	42	141.14	5928.05	10.19	21.10
13	39	147.28	5743.84	9.87	30.97
12	36	147.28	5302.01	9.11	40.08
11	33	147.28	4860.17	8.35	48.44
10	30	156.89	4706.82	8.09	56.52
9	27	156.89	4236.14	7.28	63.80
8	24	156.89	3765.46	6.47	70.27
7	21	156.89	3294.77	5.66	75.94
6	18	156.89	2824.09	4.85	80.79
5	15	166.66	2499.96	4.30	85.08
4	12	166.66	1999.97	3.44	88.52
3	9	166.66	1499.98	2.58	91.10
2	6	166.66	999.98	1.72	92.82
1	3	166.66	499.99	0.86	93.68

Table 6.2.7- Lateral forces in the Longitudinal Direction for a 5m span 10 stories

10	30	147.28	4418.34	13.58	13.58
9	27	147.28	3976.51	12.23	25.81
8	24	147.28	3534.67	10.87	36.68
7	21	147.28	3092.84	9.51	46.19
6	18	147.28	2651.00	8.15	54.34
5	15	156.89	2353.41	7.24	61.57
4	12	156.89	1882.73	5.79	67.36
3	9	156.89	1412.05	4.34	71.70
2	6	156.89	941.36	2.89	74.60
1	3	156.89	470.68	1.45	76.04

Table 6.2.8- Lateral forces in the Longitudinal Direction for a 5m span 5 stories

5	15	147.28	2209.17	17.43	17.43
4	12	147.28	1767.34	13.94	31.37
3	9	147.28	1325.50	10.46	41.83
2	6	147.28	883.67	6.97	48.80
1	3	147.28	441.83	3.49	52.28

6.3 Structural Analysis of The Buildings

Three – dimensional analysis of the buildings were performed in both the transverse and longitudinal directions for the lateral load cases plus the gravity loads using SAP90 [15]. In the model, rigid diaphragms are assigned at each floor level (using Master Joints), and rigid-end offset were assigned at the ends of each horizontal member so that results were automatically obtained at the faces of each support. Appendix C gives the input and output files for 4 sets of structures. The output files comprehensively show all member forces from which the maximum Axial forces and Moments about both the X and Y-axes were obtained to design for reinforcement.

6.4 Design of Reinforcement

In designing for reinforcement, a program, shown in Appendix D, developed for biaxial bending of short rectangular columns with symmetrical arrangement of reinforcement [16] is used. The relevant input data required, as shown in Appendix D are: the concrete grade, steel strength, column breadth and depth, depths to steel, D1 and D2, axial load and Moments Mx and My. Table 6.4 below shows the output for a typical structure.

Table 6,4 - Design of the Reinforcement Cross Sections
5 story, 5m span and 25 Mpa concrete Strength

Column number	Column cross section (sq. mm)	Reinforcement cross section (sq. mm)
1	160000	640
2	160000	640
3	160000	640
4	160000	640
5	160000	640
6	250000	1000
7	250000	1000
8	160000	640
9	160000	640
10	160000	640
11	160000	640
12	160000	640
13	160000	640
14	160000	640
15	160000	640
16	160000	1036
17	160000	640
18	250000	1405
19	250000	1345
20	160000	1586
21	160000	925
22	160000	1559
23	160000	1566
24	160000	1395
25	160000	1395
26	160000	640
27	160000	640
28	160000	718
29	160000	640
30	250000	1000
31	250000	1000
32	160000	1326
33	160000	660
34	160000	1095
35	160000	1183
36	160000	1224
37	160000	640
38	160000	640
39	160000	640

Table 6.4 (continued)

Column number	Column cross section (sq. mm)	Reinforcement cross section (sq. mm)
40	160000	711
41	160000	640
42	250000	1000
43	250000	1000
44	160000	1232
45	160000	1232
46	160000	1663
47	160000	1163
48	160000	1294
49	160000	1294
50	160000	1294
51	160000	640
52	160000	906
53	160000	972
54	250000	1000
55	250000	1000
56	160000	1633
57	160000	1166
58	160000	1463
59	160000	1606
60	160000	1776

7. COST ANALYSIS

The material prices in the Turkish market for June 1998 is used to analyze the cost of columns used for the buildings under consideration. Prices are converted from Turkish Lira (TL) to more widely used currency, dollar ($) using the immediate exchange rate. These prices are shown as below:

From TBS : 25 MPa ⟶ 12,100,000 TL/m^3 = 47.12 \$/ m^3

45 MPa ⟶ 16,500,000 TL/m^3 = 62.26 \$/ m^3

From IÇDAŞ factory, steel of density $\rho = 7.85$ ton/m^3 , has the following range of prices:

TL/Kg	\$/ Kg
76,000	0.296
75,500	0.294
75,000	0.292
75,300	0.293

From these prices, 0.296 \$/ Kg is chosen and converted to 2323.6 \$/ m^3 using the steel density above. Using the unit prices and the cross sections of concrete and steel obtained in the final design above, the cost of concrete, steel and the entire columns are computed for each set of building and are shown in tables 7.1 –7.4 and figures 7.1-7.8. From these tables savings made and the percentage savings with respect to the 25 MPa concrete for both span cases are computed and shown in tables 7.5 and 7.6 and figure 7.5.

Table 7.1. Cost of columns for the 5m Span Building using 25 Mpa concrete

Number of Stories	Cross Section (m2)		Volume (m3)		Cost of Concrete	Cost of Steel	Total cost of Columns
	Concrete	Steel	Concrete	Steel			
5	10,5	0,074978	31,5	0,224934	1484,28	522,656642	2006,936642
10	27,9	0,174944	83,7	0,524832	3943,944	1219,49964	5163,443635
15	51,2	0,305556	153,6	0,916668	7237,632	2129,96976	9367,601765
20	78,62	0,573768	235,86	1,721304	11113,7232	3999,62197	15113,34517

Table 7.2. Cost of columns for the 7m Span Building using 25 Mpa concrete

Number of Stories	Cross Section (m2)		Volume (m3)		Cost of Concrete	Cost of Steel	Total cost of Columns
	Concrete	Steel	Concrete	Steel			
5	22,9	0,10024	68,7	0,30072	3237,144	698,752992	3935,896992
10	55,5	0,297316	166,5	0,891948	7845,48	2072,53037	9918,010373
15	95,68	0,660244	287,04	1,980732	13525,3248	4602,42888	18127,75368
20	140,78	1,332618	422,34	3,997854	19900,6608	9289,41355	29190,07435

Table 7.3. Cost of columns for the 5m Span Building using 45 Mpa concrete

Number of Stories	Cross Section (m2)		Volume (m3)		Cost of Concrete	Cost of Steel	Total cost of Columns
	Concrete	Steel	Concrete	Steel			
5	6,1	0,101814	18,3	0,305442	1139,358	709,725031	1849,083031
10	16,6	0,211496	49,8	0,634488	3100,548	1474,29632	4574,844317
15	32,55	0,351216	97,65	1,053648	6079,689	2448,25649	8527,945493
20	53,54	0,50385	160,62	1,51155	10000,2012	3512,23758	13512,43878

Table 7.4. Cost of columns for the 7m Span Building using 45 Mpa concrete

Number of Stories	Cross Section (m2)		Volume (m3)		Cost of Concrete	Cost of Steel	Total cost of Columns
	Concrete	Steel	Concrete	Steel			
5	16,1	0,13256	48,3	0,39768	3007,158	924,049248	3931,207248
10	39	0,28223	117	0,84669	7284,42	1967,36888	9251,788884
15	67,66	0,530868	202,98	1,592604	12637,5348	3700,57465	16338,10945
20	102,8	0,952938	308,4	2,858814	19200,984	6642,74021	25843,72421

Table 7.5 Cost of Columns for 5m span for the two strength cases

Stories	fc= 25 Mpa	fc = 45 MPa	Savings	Percentage savings
5	2006,9366	1849,083	157,8536	7,865400432
10	5163,4436	4574,8443	588,5993	11,39935565
15	9367,602	8527,9455	839,6565	8,963409205
20	15113,34517	13512,439	1600,906	10,59266597

Table 7.6 Cost of Columns for 7m span for the two strength cases

Stories	fc= 25 Mpa	fc = 45 MPa	Savings	Percentage savings
5	3935,897	3931,207	4,69	0,119159622
10	9918,01	9251,7889	666,2211	6,717286028
15	18127,754	16338,109	1789,645	9,872403388
20	29190,07	25843,72	3346,35	11,46400129

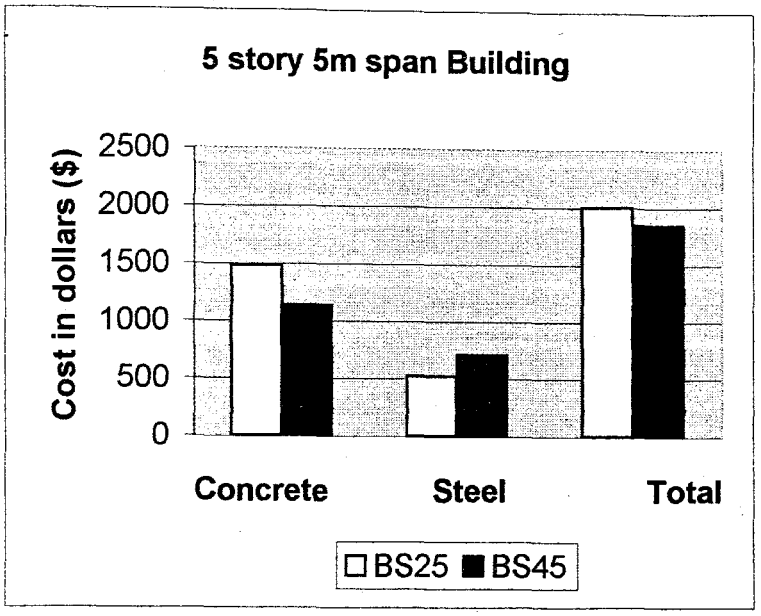


Figure 7.1 Cost for 5 story 5m span Building

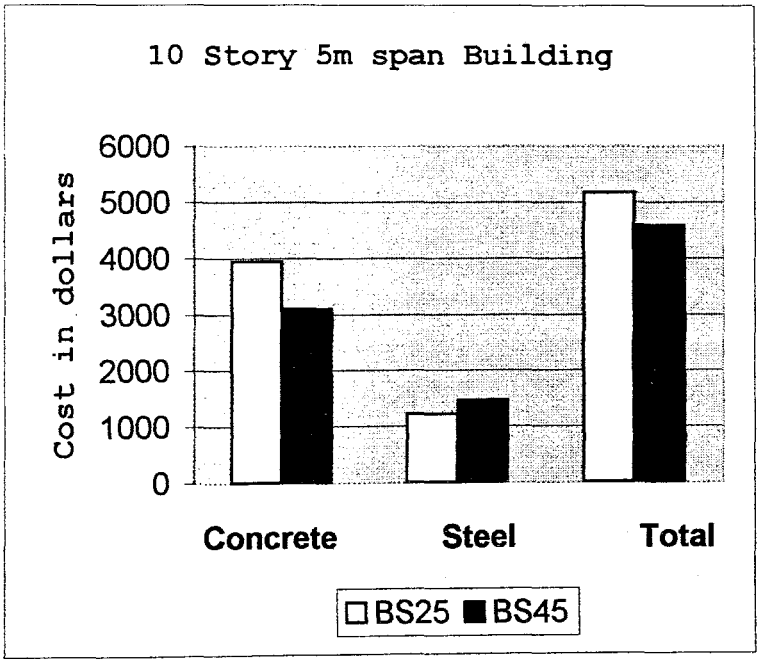


Figure 7.2 Cost for 10 story 5m span Building

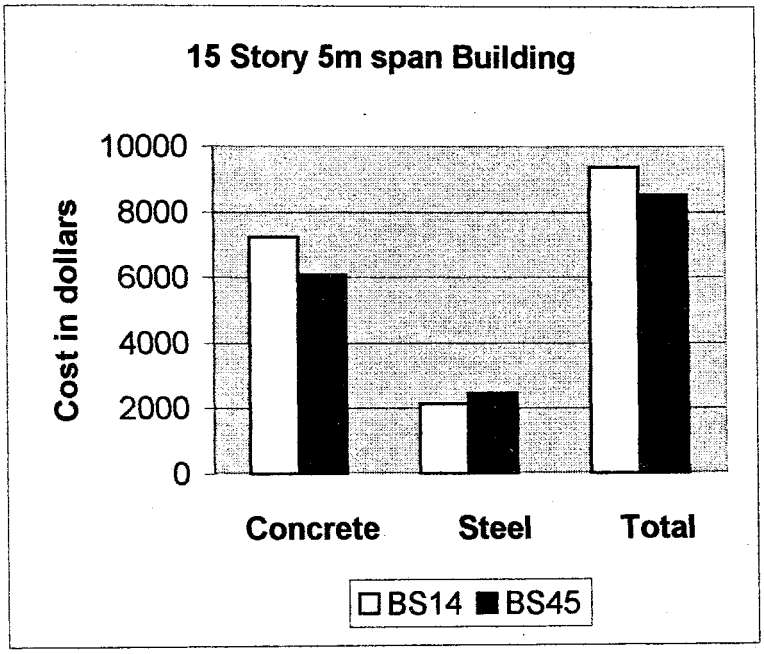


Figure 7.3Cost for 15 story 5m span Building

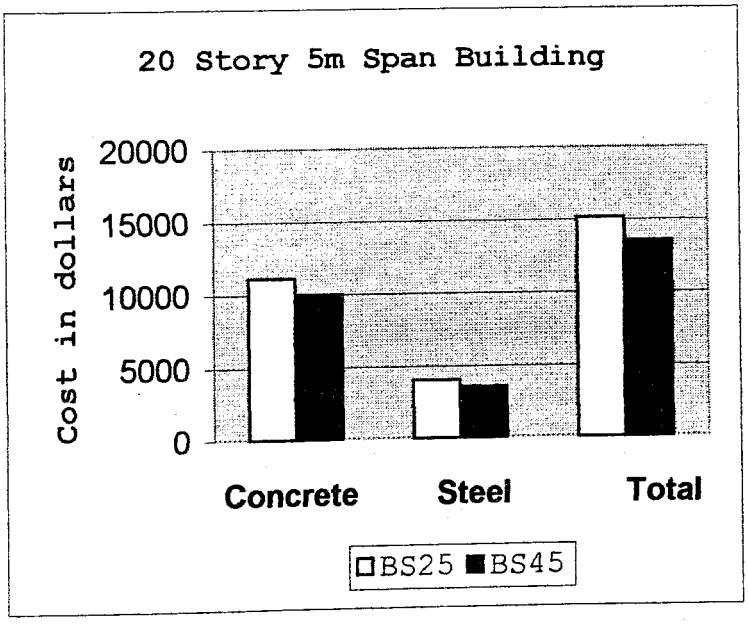


Figure 7.4 Cost for 20 story 5m span Building

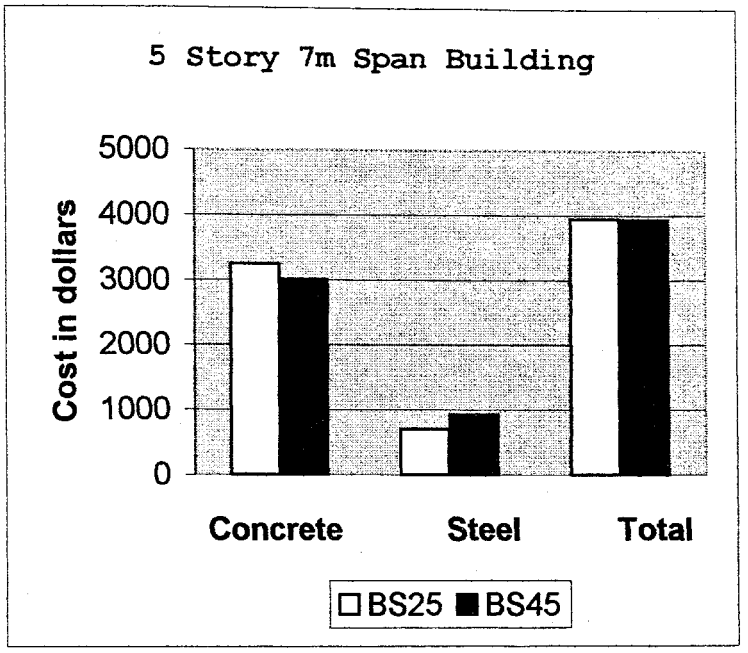


Figure 7.5 Cost for 5 story 7m span Building

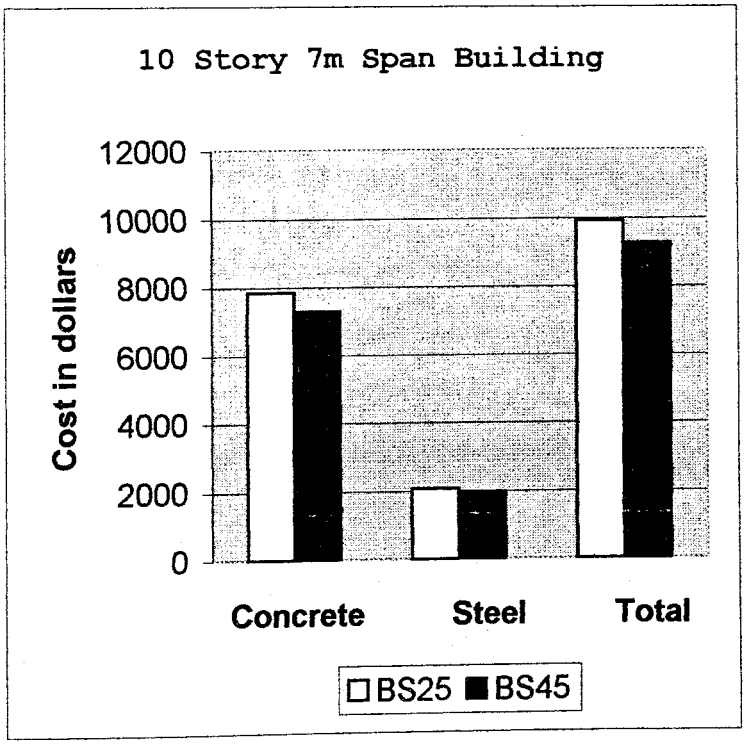


Figure 7.6 Cost for 10 story 7m span Building

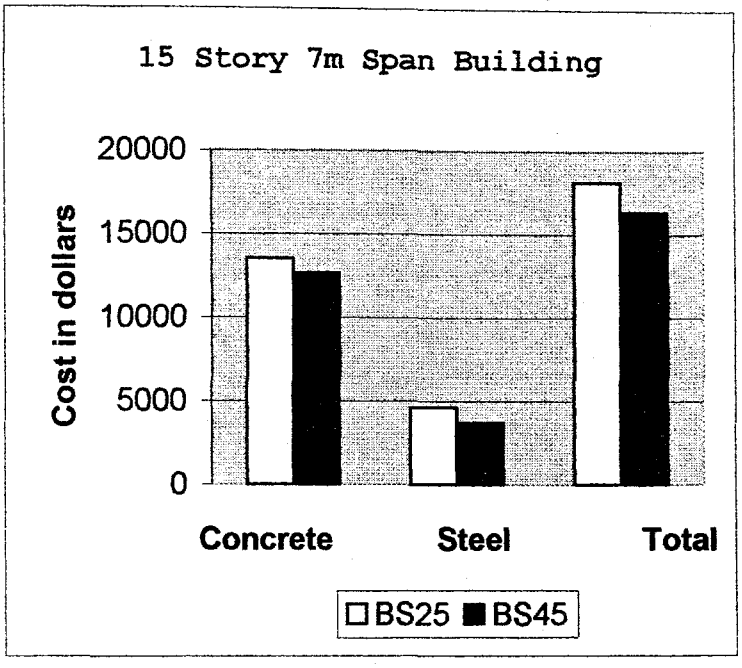


Figure 7.7 Cost for 15 story 7m span Building

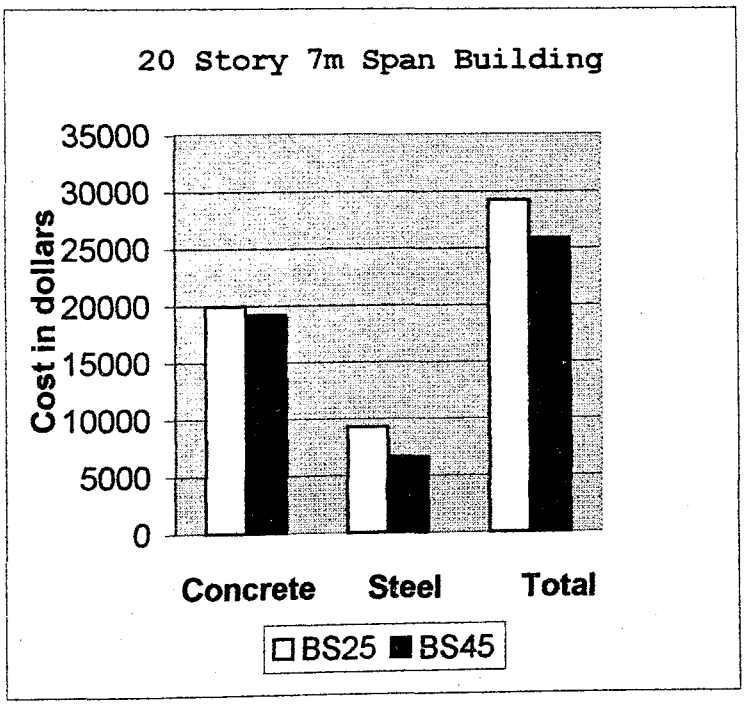


Figure 7.8 Cost for 20 story 7m span Building

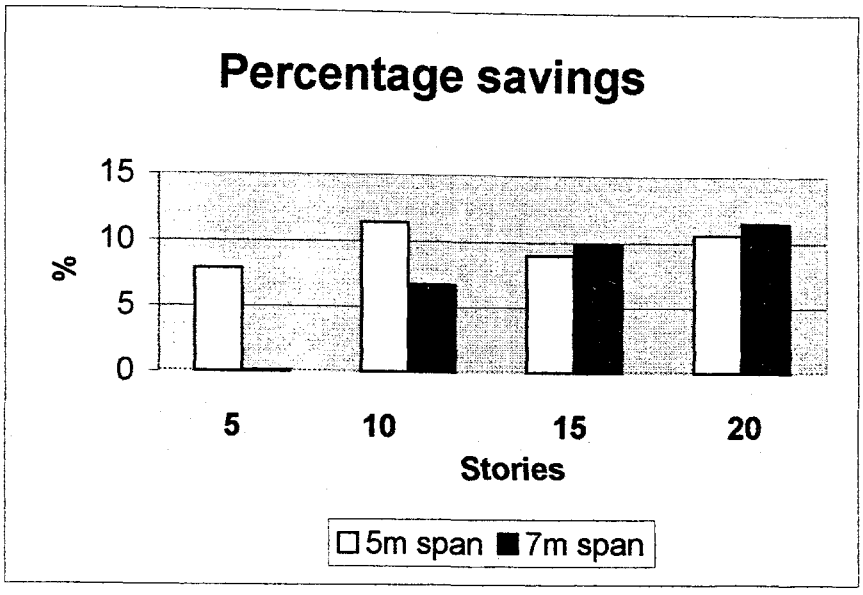


Figure 7.9 Percentage Savings for the 5m and 7m Spans

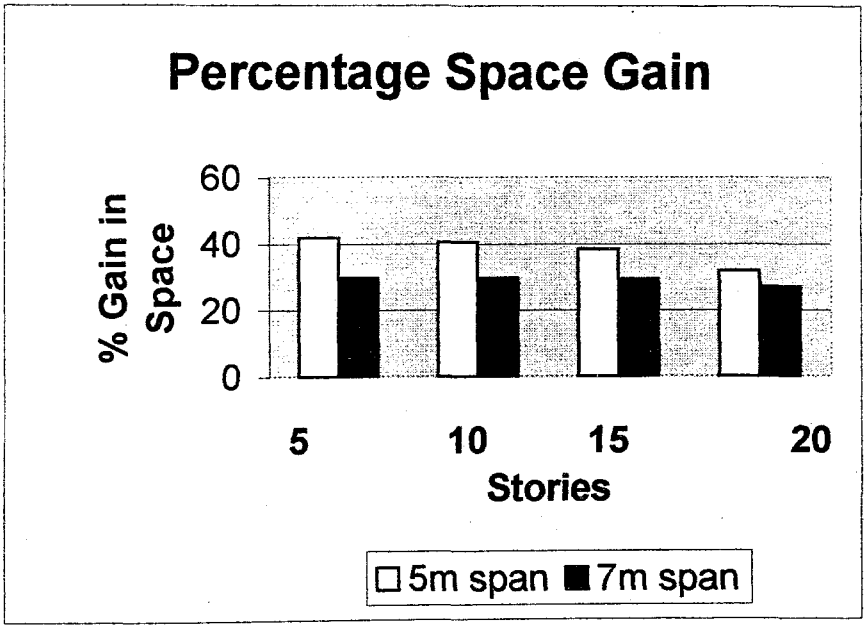


Figure 7.10 Percentage Space Gain for the 5m and 7m Spans

8. DISCUSSION OF THE RESULT

It is observed from figures 7.1 – 7.8, that the total cost of columns in all cases are higher for lower strength concrete than that of the higher strength. These results show significant change when the gross column cross section is changed, even by small amount. Thus with respect to the lower strength, substantial savings are observed when higher strength concrete is used.

Because of the irregular trend in the change in cross section for the BS45 case with respect to BS25, the amounts and costs of reinforcement used for BS45 are observed to be higher than that used for the lower strength, BS25, for some cases (figures: 7.1- 7.8), although the total cost is always higher for the higher strength.

Tables 7.1 through 7.6 and figure 7.9 indicate that the percentage saving observed in using high strength with respect to the lower strength increases with increase in the number of stories for both span cases, although some discrepancy is realized with the 10 story 5 span building which has higher saving than expected. This might have resulted from the column dimensions.

Figure 7.9 reveals that the percentage savings are generally more significant in the lower span, 5m, than in the case of 7m span. This occurrence is caused by the additional moment created by the longer span as compared to that of the shorter span, hence greater reduction in column cross section.

Other advantage in using high strength is the gain in rentable area. BS45 has shown remarkable amount of space gain with respect to lower strength, BS25. The benefit of space gain, unlike the percentage saving is more significant in higher stories (Figure 7.10)

Due to accumulated errors resulting from successive approximations, a few cases have violated the minimum reinforcing ratio, 0.1; these discrepancy, coupled with other factors, contribute to some deviations in the result from expected.

9. CONCLUSION

The information obtained and the result of the design analysis observed from the work provide the following conclusions:

1) With increase in concrete strength, there is a substantial decrease in the cost of column. In other words, saving is realized when a higher strength is used.
2) Keeping other factors constant, the percentage saving is always increasing with increase in stories.
3) Structures with smaller dimensions of floor panels realize more significant decrease in construction cost (savings).The reason is that smaller spans generate less moment and thus greater reduction in column cross section.
4) It is interesting to note that, when a high strength is used instead of a lower one, there is a significant gain in space. This is an important factor because, it increases rentable areas and therefore saves cost.
5) The percentage gain in space is observed to be decreasing with increase in story.

The achievement of the high strength stated above is the team effort of the whole concrete industry; the ready mixed concrete company has to produce it, to be handled by the contractor as specified by the designer and accepted by the code officials. Any reluctance on the part of any member of this team would strongly inhibit the achievement of this strength.

It is interesting to note that, besides its excellent properties, both chemically and mechanically, high strength concrete offers substantial benefits over lower strength concrete and even over steel as an axial load bearing construction material. This work although in a narrow scope, indicates that as well as reducing the cross sectional area of columns, using higher strength concrete provides cheaper columns.

Since actual relative costs for each item in reinforced concrete column construction vary in different localities, general principles for economy of column design are inapplicable.

It is recommended that for further study on the economy of high strength concrete, design is made using the same cross section over an entire floor and for all stories in multi story column; this is expected to save cost of form work which is approximately 30 percent of the entire construction cost, and erection time which consequently have a substantial reduction of the cost.

Appendix A

Lateral forces in Transverse Direction

5m square bay // 20 stories

Floor Level from base	*Height h (m)*	*Story weight tonnes*	*h*w ton-m*	*Lateral force t*	*Story shear t*
20	60	141.14	8468.64	17.76	17.76
19	57	141.14	8045.21	16.87	34.63
18	54	141.14	7621.78	15.98	50.61
17	51	141.14	7198.34	15.09	65.70
16	48	147.28	7069.34	14.82	80.52
15	45	147.28	6627.51	13.90	94.42
14	42	147.28	6185.68	12.97	107.39
13	39	156.89	6118.87	12.83	120.22
12	36	156.89	5648.18	11.84	132.06
11	33	156.89	5177.50	10.86	142.92
10	30	166.66	4999.92	10.48	153.40
9	27	166.66	4499.93	9.44	162.83
8	24	166.66	3999.94	8.39	171.22
7	21	166.66	3499.94	7.34	178.56
6	18	166.66	2999.95	6.29	184.85
5	15	178.08	2671.26	5.60	190.45
4	12	178.08	2137.01	4.48	194.93
3	9	178.08	1602.76	3.36	198.29
2	6	178.08	1068.50	2.24	200.53
1	3	178.08	534.25	1.12	201.65

5m square bay//15 stories

15	45	141.14	6351.48	19.10	19.10
14	42	141.14	5928.05	17.83	36.93
13	39	147.28	5743.84	17.27	54.20
12	36	147.28	5302.01	15.94	70.15
11	33	147.28	4860.17	14.62	84.76
10	30	156.89	4706.82	14.15	98.92
9	27	156.89	4236.14	12.74	111.66
8	24	156.89	3765.46	11.32	122.98
7	21	156.89	3294.77	9.91	132.89
6	18	156.89	2824.09	8.49	141.38
5	15	166.66	2499.96	7.52	148.90
4	12	166.66	1999.97	6.01	154.91
3	9	166.66	1499.98	4.51	159.42
2	6	166.66	999.98	3.01	162.43
1	3	166.66	499.99	1.50	163.93

5m square bay//10 stories

10	30	147.28	4418.34	24.18	24.18
9	27	147.28	3976.51	21.76	45.94
8	24	147.28	3534.67	19.34	65.29
7	21	147.28	3092.84	16.93	82.21
6	18	147.28	2651.00	14.51	96.72
5	15	156.89	2353.41	12.88	109.60
4	12	156.89	1882.73	10.30	119.90
3	9	156.89	1412.05	7.73	127.63
2	6	156.89	941.36	5.15	132.78
1	3	156.89	470.68	2.58	135.36

5m square bay//5 stories

5	15	147.28	2209.17	24.55	24.55
4	12	147.28	1767.34	19.64	44.18
3	9	147.28	1325.50	14.73	58.91
2	6	147.28	883.67	9.82	68.73
1	3	147.28	441.83	4.91	73.64

7m square bay//20 stories

Floor Level from base	*Height h (m)*	*Story weight tonnes*	*h*w ton-m*	*Lateral force t*	*Story shear t*
20	60	323.40	19404.00	42.50	42.50
19	57	323.40	18433.80	40.38	82.88
18	54	323.40	17463.60	38.25	121.13
17	51	323.40	16493.40	36.13	157.26
16	48	332.89	15978.72	35.00	192.26
15	45	332.89	14980.05	32.81	225.07
14	42	332.89	13981.38	30.62	255.69
13	39	346.40	13509.60	29.59	285.28
12	36	346.40	12470.40	27.31	312.60
11	33	346.40	11431.20	25.04	337.64
10	30	359.50	10784.94	23.62	361.26
9	27	359.50	9706.45	21.26	382.52
8	24	359.50	8627.95	18.90	401.42
7	21	359.50	7549.46	16.54	417.96
6	18	359.50	6470.96	14.17	432.13
5	15	374.27	5614.11	12.30	444.43
4	12	374.27	4491.29	9.84	454.27
3	9	374.27	3368.47	7.38	461.64
2	6	374.27	2245.64	4.92	466.56
1	3	374.27	1122.82	2.46	469.02

7m square bay//15 stories

15	45	323.40	14553.00	47.60	47.60
14	42	323.40	13582.80	44.42	92.02
13	39	332.89	12982.71	42.46	134.48
12	36	332.89	11984.04	39.20	173.68
11	33	332.89	10985.37	35.93	209.61
10	30	346.40	10392.00	33.99	243.60
9	27	346.40	9352.80	30.59	274.19
8	24	346.40	8313.60	27.19	301.38
7	21	346.40	7274.40	23.79	325.17
6	18	346.40	6235.20	20.39	345.56
5	15	359.50	5392.47	17.64	363.20
4	12	359.50	4313.98	14.11	377.31
3	9	359.50	3235.48	10.58	387.89
2	6	359.50	2156.99	7.05	394.94
1	3	359.50	1078.49	3.53	398.47

7m square bay//10 stories

10	30	332.89	9986.70	57.41	57.41
9	27	332.89	8988.03	51.67	109.08
8	24	332.89	7989.36	45.93	155.01
7	21	332.89	6990.69	40.19	195.20
6	18	332.89	5992.02	34.45	229.65
5	15	346.40	5196.00	29.87	259.52
4	12	346.40	4156.80	23.90	283.42
3	9	346.40	3117.60	17.92	301.34
2	6	346.40	2078.40	11.95	313.29
1	3	346.40	1039.20	5.97	319.27

7m square bay//5 stories

5	15	332.89	4993.35	55.48	55.48
4	12	332.89	3994.68	44.39	99.87
3	9	332.89	2996.01	33.29	133.16
2	6	332.89	1997.34	22.19	155.35
1	3	332.89	998.67	11.10	166.44

Lateral forces in Longitudinal Direction

5m square bay //20 stories

Floor Level from base	*Height h (m)*	*Story weight tonnes*	*h*w ton-m*	*Lateral force t*	*Story shear t*
20	60	141.14	8468.64	9.86	9.86
19	57	141.14	8045.21	9.37	19.24
18	54	141.14	7621.78	8.88	28.11
17	51	141.14	7198.34	8.39	36.50
16	48	147.28	7069.34	8.23	44.73
15	45	147.28	6627.51	7.72	52.45
14	42	147.28	6185.68	7.21	59.66
13	39	156.89	6118.87	7.13	66.79
12	36	156.89	5648.18	6.58	73.37
11	33	156.89	5177.50	6.03	79.40
10	30	166.66	4999.92	5.82	85.22
9	27	166.66	4499.93	5.24	90.46
8	24	166.66	3999.94	4.66	95.12
7	21	166.66	3499.94	4.08	99.20
6	18	166.66	2999.95	3.49	102.69
5	15	178.08	2671.26	3.11	105.81
4	12	178.08	2137.01	2.49	108.30
3	9	178.08	1602.76	1.87	110.16
2	6	178.08	1068.50	1.24	111.41
1	3	178.08	534.25	0.62	112.03

5m square bay //15 stories

15	45	141.14	6351.48	10.91	10.91
14	42	141.14	5928.05	10.19	21.10
13	39	147.28	5743.84	9.87	30.97
12	36	147.28	5302.01	9.11	40.08
11	33	147.28	4860.17	8.35	48.44
10	30	156.89	4706.82	8.09	56.52
9	27	156.89	4236.14	7.28	63.80
8	24	156.89	3765.46	6.47	70.27
7	21	156.89	3294.77	5.66	75.94
6	18	156.89	2824.09	4.85	80.79
5	15	166.66	2499.96	4.30	85.08
4	12	166.66	1999.97	3.44	88.52
3	9	166.66	1499.98	2.58	91.10
2	6	166.66	999.98	1.72	92.82
1	3	166.66	499.99	0.86	93.68

5m square bay //10 stories

10	30	147.28	4418.34	13.58	13.58
9	27	147.28	3976.51	12.23	25.81
8	24	147.28	3534.67	10.87	36.68
7	21	147.28	3092.84	9.51	46.19
6	18	147.28	2651.00	8.15	54.34
5	15	156.89	2353.41	7.24	61.57
4	12	156.89	1882.73	5.79	67.36
3	9	156.89	1412.05	4.34	71.70
2	6	156.89	941.36	2.89	74.60
1	3	156.89	470.68	1.45	76.04

5m square bay //5 stories

5	15	147.28	2209.17	17.43	17.43
4	12	147.28	1767.34	13.94	31.37
3	9	147.28	1325.50	10.46	41.83
2	6	147.28	883.67	6.97	48.80
1	3	147.28	441.83	3.49	52.28

7m square bay //20 stories

Floor Level from base	*Height h (m)*	*Story weight tonnes*	*h*w ton-m*	*Lateral force t*	*Story shear t*
20	60	323.40	19404.00	22.20	22.20
19	57	323.40	18433.80	21.09	43.30
18	54	323.40	17463.60	19.98	63.28
17	51	323.40	16493.40	18.87	82.15
16	48	332.89	15978.72	18.28	100.43
15	45	332.89	14980.05	17.14	117.57
14	42	332.89	13981.38	16.00	133.57
13	39	346.40	13509.60	15.46	149.03
12	36	346.40	12470.40	14.27	163.30
11	33	346.40	11431.20	13.08	176.38
10	30	359.50	10784.94	12.34	188.72
9	27	359.50	9706.45	11.11	199.83
8	24	359.50	8627.95	9.87	209.70
7	21	359.50	7549.46	8.64	218.34
6	18	359.50	6470.96	7.40	225.74
5	15	374.27	5614.11	6.42	232.16
4	12	374.27	4491.29	5.14	237.30
3	9	374.27	3368.47	3.85	241.16
2	6	374.27	2245.64	2.57	243.73
1	3	374.27	1122.82	1.28	245.01

7m square bay //15 stories

15	45	323.40	14553.00	24.73	24.73
14	42	323.40	13582.80	23.08	47.80
13	39	332.89	12982.71	22.06	69.86
12	36	332.89	11984.04	20.36	90.22
11	33	332.89	10985.37	18.66	108.89
10	30	346.40	10392.00	17.66	126.54
9	27	346.40	9352.80	15.89	142.43
8	24	346.40	8313.60	14.13	156.56
7	21	346.40	7274.40	12.36	168.92
6	18	346.40	6235.20	10.59	179.51
5	15	359.50	5392.47	9.16	188.67
4	12	359.50	4313.98	7.33	196.00
3	9	359.50	3235.48	5.50	201.50
2	6	359.50	2156.99	3.66	205.17
1	3	359.50	1078.49	1.83	207.00

7m square bay //10 stories

10	30	332.89	9986.70	30.54	30.54
9	27	332.89	8988.03	27.48	58.02
8	24	332.89	7989.36	24.43	82.45
7	21	332.89	6990.69	21.38	103.83
6	18	332.89	5992.02	18.32	122.16
5	15	346.40	5196.00	15.89	138.04
4	12	346.40	4156.80	12.71	150.76
3	9	346.40	3117.60	9.53	160.29
2	6	346.40	2078.40	6.36	166.64
1	3	346.40	1039.20	3.18	169.82

7m square bay //5stories

5	15	332.89	4993.35	39.39	39.39
4	12	332.89	3994.68	31.51	70.91
3	9	332.89	2996.01	23.64	94.54
2	6	332.89	1997.34	15.76	110.30
1	3	332.89	998.67	7.88	118.18

Appendix B

Lateral forces in Transverse Direction

5m span length // 20 Stories

Floor Level from base	*Height h (m)*	*Story weight tonnes*	*h*w ton-m*	*Lateral force t*	*Story shear t*
20	60	138.71	8322.72	17.25	17.25
19	57	138.71	7906.58	16.38	33.63
18	54	138.71	7490.45	15.52	49.15
17	51	138.71	7074.31	14.66	63.81
16	48	141.14	6774.91	14.04	77.85
15	45	141.14	6351.48	13.16	91.01
14	42	141.14	5928.05	12.28	103.29
13	39	147.28	5743.84	11.90	115.19
12	36	147.28	5302.01	10.99	126.18
11	33	147.28	4860.17	10.07	136.25
10	30	155.08	4652.52	9.64	145.89
9	27	155.08	4187.27	8.68	154.57
8	24	155.08	3722.02	7.71	162.28
7	21	155.08	3256.76	6.75	169.03
6	18	155.08	2791.51	5.78	174.81
5	15	164.57	2468.61	5.12	179.93
4	12	164.57	1974.89	4.09	184.02
3	9	164.57	1481.17	3.07	187.09
2	6	164.57	987.44	2.05	189.14
1	3	164.57	493.72	1.02	190.16

5m span length // 15 Stories

15	45	138.71	6242.04	18.61	18.61
14	42	138.71	5825.90	17.37	35.97
13	39	141.14	5504.62	16.41	52.38
12	36	141.14	5081.18	15.15	67.52
11	33	141.14	4657.75	13.88	81.41
10	30	147.28	4418.34	13.17	94.58
9	27	147.28	3976.51	11.85	106.43
8	24	147.28	3534.67	10.54	116.96
7	21	147.28	3092.84	9.22	126.18
6	18	147.28	2651.00	7.90	134.09
5	15	155.08	2326.26	6.93	141.02
4	12	155.08	1861.01	5.55	146.57
3	9	155.08	1395.76	4.16	150.73
2	6	155.08	930.50	2.77	153.50
1	3	155.08	465.25	1.39	154.89

5m span length // 10 Stories

10	30	141.14	4234.32	23.06	23.06
9	27	141.14	3810.89	20.76	43.82
8	24	141.14	3387.46	18.45	62.27
7	21	141.14	2964.02	16.14	78.41
6	18	141.14	2540.59	13.84	92.25
5	15	147.28	2209.17	12.03	104.28
4	12	147.28	1767.34	9.63	113.91
3	9	147.28	1325.50	7.22	121.13
2	6	147.28	883.67	4.81	125.94
1	3	147.28	441.83	2.41	128.35

5m span length // 5 Stories

5	15	141.14	2117.16	23.52	23.52
4	12	141.14	1693.73	18.82	42.34
3	9	141.14	1270.30	14.11	56.46
2	6	141.14	846.86	9.41	65.87
1	3	141.14	423.43	4.70	70.57

7m span length // 20 Stories

Floor Level from base	*Height h (m)*	*Story weight w tonnes*	*h*w ton-m*	*Lateral force t*	*Story shear t*
20	60	315.59	18935.64	41.28	41.28
19	57	315.59	17988.86	39.22	80.49
18	54	315.59	17042.08	37.15	117.65
17	51	315.59	16095.29	35.09	152.73
16	48	323.40	15523.20	33.84	186.57
15	45	323.40	14553.00	31.73	218.30
14	42	323.40	13582.80	29.61	247.91
13	39	332.89	12982.71	28.30	276.21
12	36	332.89	11984.04	26.12	302.34
11	33	332.89	10985.37	23.95	326.28
10	30	344.03	10320.90	22.50	348.78
9	27	344.03	9288.81	20.25	369.03
8	24	344.03	8256.72	18.00	387.03
7	21	344.03	7224.63	15.75	402.78
6	18	344.03	6192.54	13.50	416.28
5	15	356.85	5352.75	11.67	427.95
4	12	356.85	4282.20	9.34	437.29
3	9	356.85	3211.65	7.00	444.29
2	6	356.85	2141.10	4.67	448.95
1	3	356.85	1070.55	2.33	451.29

7m span length // 15 Stories

15	45	315.59	14201.73	46.28	46.28
14	42	315.59	13254.95	43.19	89.47
13	39	323.40	12612.60	41.10	130.58
12	36	323.40	11642.40	37.94	168.52
11	33	323.40	10672.20	34.78	203.29
10	30	332.89	9986.70	32.54	235.84
9	27	332.89	8988.03	29.29	265.13
8	24	332.89	7989.36	26.04	291.16
7	21	332.89	6990.69	22.78	313.94
6	18	332.89	5992.02	19.53	333.47
5	15	344.03	5160.45	16.82	350.29
4	12	344.03	4128.36	13.45	363.74
3	9	344.03	3096.27	10.09	373.83
2	6	344.03	2064.18	6.73	380.56
1	3	344.03	1032.09	3.36	383.92

7m span length // 10 Stories

10	30	323.40	9702.00	55.64	55.64
9	27	323.40	8731.80	50.07	105.71
8	24	323.40	7761.60	44.51	150.22
7	21	323.40	6791.40	38.95	189.17
6	18	323.40	5821.20	33.38	222.55
5	15	332.89	4993.35	28.64	251.19
4	12	332.89	3994.68	22.91	274.09
3	9	332.89	2996.01	17.18	291.28
2	6	332.89	1997.34	11.45	302.73
1	3	332.89	998.67	5.73	308.46

7m span length // 5Stories

5	15	323.40	4851.00	53.90	53.90
4	12	323.40	3880.80	43.12	97.02
3	9	323.40	2910.60	32.34	129.36
2	6	323.40	1940.40	21.56	150.92
1	3	323.40	970.20	10.78	161.70

Lateral forces in Longitudinal Direction

5m span length // 20 Stories

Floor Level from base	*Height h (m)*	*Story weight w tonnes*	*h*w ton-m*	*Lateral force t*	*Story shear t*
20	60	138.71	8322.72	9.58	9.58
19	57	138.71	7906.58	9.10	18.68
18	54	138.71	7490.45	8.62	27.31
17	51	138.71	7074.31	8.14	35.45
16	48	141.14	6774.91	7.80	43.25
15	45	141.14	6351.48	7.31	50.56
14	42	141.14	5928.05	6.82	57.38
13	39	147.28	5743.84	6.61	64.00
12	36	147.28	5302.01	6.10	70.10
11	33	147.28	4860.17	5.59	75.70
10	30	155.08	4652.52	5.36	81.05
9	27	155.08	4187.27	4.82	85.87
8	24	155.08	3722.02	4.28	90.16
7	21	155.08	3256.76	3.75	93.91
6	18	155.08	2791.51	3.21	97.12
5	15	164.57	2468.61	2.84	99.96
4	12	164.57	1974.89	2.27	102.23
3	9	164.57	1481.17	1.71	103.94
2	6	164.57	987.44	1.14	105.08
1	3	164.57	493.72	0.57	105.64

5m span length // 15 Stories

15	45	138.71	6242.04	10.63	10.63
14	42	138.71	5825.90	9.92	20.55
13	39	141.14	5504.62	9.38	29.93
12	36	141.14	5081.18	8.65	38.58
11	33	141.14	4657.75	7.93	46.52
10	30	147.28	4418.34	7.53	54.04
9	27	147.28	3976.51	6.77	60.82
8	24	147.28	3534.67	6.02	66.84
7	21	147.28	3092.84	5.27	72.10
6	18	147.28	2651.00	4.52	76.62
5	15	155.08	2326.26	3.96	80.58
4	12	155.08	1861.01	3.17	83.75
3	9	155.08	1395.76	2.38	86.13
2	6	155.08	930.50	1.58	87.71
1	3	155.08	465.25	0.79	88.51

5m span length // 10 Stories

10	30	141.14	4234.32	12.96	12.96
9	27	141.14	3810.89	11.66	24.62
8	24	141.14	3387.46	10.37	34.98
7	21	141.14	2964.02	9.07	44.05
6	18	141.14	2540.59	7.77	51.83
5	15	147.28	2209.17	6.76	58.59
4	12	147.28	1767.34	5.41	63.99
3	9	147.28	1325.50	4.06	68.05
2	6	147.28	883.67	2.70	70.75
1	3	147.28	441.83	1.35	72.11

5m span length // 5 Stories

5	15	141.14	2117.16	16.70	16.70
4	12	141.14	1693.73	13.36	30.06
3	9	141.14	1270.30	10.02	40.08
2	6	141.14	846.86	6.68	46.77
1	3	141.14	423.43	3.34	50.11

7m span length // 20 Stories

Floor Level from base	*Height h (m)*	*Story weight w tonnes*	*h*w ton-m*	*Lateral force t*	*Story shear t*
20	60	315.59	18935.64	21.56	21.56
19	57	315.59	17988.86	20.49	42.05
18	54	315.59	17042.08	19.41	61.46
17	51	315.59	16095.29	18.33	79.79
16	48	323.40	15523.20	17.68	97.46
15	45	323.40	14553.00	16.57	114.04
14	42	323.40	13582.80	15.47	129.50
13	39	332.89	12982.71	14.78	144.29
12	36	332.89	11984.04	13.65	157.94
11	33	332.89	10985.37	12.51	170.45
10	30	344.03	10320.90	11.75	182.20
9	27	344.03	9288.81	10.58	192.78
8	24	344.03	8256.72	9.40	202.18
7	21	344.03	7224.63	8.23	210.41
6	18	344.03	6192.54	7.05	217.46
5	15	356.85	5352.75	6.10	223.56
4	12	356.85	4282.20	4.88	228.43
3	9	356.85	3211.65	3.66	232.09
2	6	356.85	2141.10	2.44	234.53
1	3	356.85	1070.55	1.22	235.75

7m span length // 15 Stories

15	45	315.59	14201.73	24.04	24.04
14	42	315.59	13254.95	22.44	46.48
13	39	323.40	12612.60	21.35	67.83
12	36	323.40	11642.40	19.71	87.54
11	33	323.40	10672.20	18.07	105.61
10	30	332.89	9986.70	16.91	122.51
9	27	332.89	8988.03	15.22	137.73
8	24	332.89	7989.36	13.52	151.25
7	21	332.89	6990.69	11.83	163.09
6	18	332.89	5992.02	10.14	173.23
5	15	344.03	5160.45	8.74	181.97
4	12	344.03	4128.36	6.99	188.96
3	9	344.03	3096.27	5.24	194.20
2	6	344.03	2064.18	3.49	197.69
1	3	344.03	1032.09	1.75	199.44

7m span length // 10 Stories

10	30	323.40	9702.00	29.59	29.59
9	27	323.40	8731.80	26.64	56.23
8	24	323.40	7761.60	23.68	79.91
7	21	323.40	6791.40	20.72	100.62
6	18	323.40	5821.20	17.76	118.38
5	15	332.89	4993.35	15.23	133.61
4	12	332.89	3994.68	12.19	145.79
3	9	332.89	2996.01	9.14	154.93
2	6	332.89	1997.34	6.09	161.03
1	3	332.89	998.67	3.05	164.07

7m span length // 5 Stories

5	15	323.40	4851.00	38.27	38.27
4	12	323.40	3880.80	30.62	68.88
3	9	323.40	2910.60	22.96	91.85
2	6	323.40	1940.40	15.31	107.15
1	3	323.40	970.20	7.65	114.81

Appendix C

```
20 storey building - Span length 5*5// Fc=25MPa
Units :KN-m
SYSTEM
L=2
JOINTS
1       X=0         Y=0         Z=0
4       X=15        Y=0         Z=0
241     X=0         Y=0         Z=60
244     X=15        Y=0         Z=60      Q=1,4,241,244,1,12
5       X=0         Y=5         Z=0
8       X=15        Y=5         Z=0
245     X=0         Y=5         Z=60
248     X=15        Y=5         Z=60      Q=5,8,245,248,1,12
9       X=0         Y=10        Z=0
12      X=15        Y=10        Z=0
249     X=0         Y=10        Z=60
252     X=15        Y=10        Z=60      Q=9,12,249,252,1,12
501     X=7.5       Y=5         Z=3
520     X=7.5       Y=5         Z=60      G=501,520,1

RESTRAINTS
13,252,1        R=1,1,0,0,0,1
1,12,1          R=1,1,1,1,1,1    :FIX BASE
501,520,1       R=0,0,1,1,1,0


FRAME
NM=8    NL=2
C total of 8 member section properties & 2 span loading configurations
1       SH=R          T=0.9,0.9           E=2.4038e7
2       SH=R          T=0.8,0.8
3       SH=R          T=0.7,0.7
4       SH=R          T=0.6,0.6
5       SH=R          T=0.5,0.5
6       SH=R          T=0.4,0.4
7       SH=R          T=0.3,0.3
8       SH=R          T=0.5,0.25
C Below is the span loading(dead +live)data. Values in t/m length of beam
1  WG=0,0,-4.421
2  WG=0,0,-2.221
C  Exterior columns for levels 1-5
1,1,13          G=4,12,12,12,1,1        M=3     LP=3,0     MS=0,501
2,2,14          G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
3,3,15          G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
4,4,16          G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
5,5,17          G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
8,8,20          G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
9,9,21          G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
10,10,22        G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
11,11,23        G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
12,12,24        G=4,12,12,12,1,1         M=3     LP=3,0    MS=0,501
C  Interior columns -levels 1-5
6,6,18          G=4,12,12,12,1,1         M=1     LP=3,0    MS=0,501
7,7,19          G=4,12,12,12,1,1         M=1     LP=3,0    MS=0,501
C  Exterior columns for levels 6-10
61,61,73        G=4,12,12,12,1,1         M=4     LP=3,0    MS=505,506
62,62,74        G=4,12,12,12,1,1         M=4     LP=3,0    MS=505,506
63,63,75        G=4,12,12,12,1,1         M=4     LP=3,0    MS=505,506
64,64,76        G=4,12,12,12,1,1         M=4     LP=3,0    MS=505,506
65,65,77        G=4,12,12,12,1,1         M=4     LP=3,0    MS=505,506
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68,68,80        G=4,12,12,12,1,1        M=4     LP=3,0    MS=505,506
69,69,81        G=4,12,12,12,1,1        M=4     LP=3,0    MS=505,506
70,70,82        G=4,12,12,12,1,1        M=4     LP=3,0    MS=505,506
71,71,83        G=4,12,12,12,1,1        M=4     LP=3,0    MS=505,506
72,72,84        G=4,12,12,12,1,1        M=4     LP=3,0    MS=505,506
C  Interior columns for levels 6-10
66,66,78        G=4,12,12,12,1,1        M=2     LP=3,0    MS=505,506
67,67,79        G=4,12,12,12,1,1        M=2     LP=3,0    MS=505,506
C  Exterior columns for levels  11-13
121,121,133     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
122,122,134     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
123,123,135     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
124,124,136     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
125,125,137     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
128,128,140     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
129,129,141     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
130,130,142     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
131,131,143     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
132,132,144     G=2,12,12,12,1,1        M=5     LP=3,0    MS=510,511
C  Interior columns levels 11-13
126,126,138     G=2,12,12,12,1,1        M=3     LP=3,0    MS=510,511
127,127,139     G=2,12,12,12,1,1        M=3     LP=3,0    MS=510,511
C  Exterior columns levels 14-16
157,157,169     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
158,158,170     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
159,159,171     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
160,160,172     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
161,161,173     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
164,164,176     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
165,165,177     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
166,166,178     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
167,167,179     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
168,168,180     G=2,12,12,12,1,1        M=6     LP=3,0    MS=513,514
C  Interior columns  levels 14-16
162,162,174     G=2,12,12,12,1,1        M=5     LP=3,0    MS=513,514
163,163,175     G=2,12,12,12,1,1        M=5     LP=3,0    MS=513,514
C  Exterior columns  levels 17-20
193,193,205     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
194,194,206     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
195,195,207     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
196,196,208     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
197,197,209     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
200,200,212     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
201,201,213     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
202,202,214     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
203,203,215     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
204,204,216     G=3,12,12,12,1,1        M=7     LP=3,0    MS=516,517
C  Interior columns levels 17-20
198,198,210     G=3,12,12,12,1,1        M=6     LP=3,0    MS=516,517
199,199,211     G=3,12,12,12,1,1        M=6     LP=3,0    MS=516,517
C  BEAMS
C  Exterior beams
241,13,14       G=19,1,12,12,1,1        M=8     LP=2,0    NSL=2  MS=501,501
261,14,15       G=19,1,12,12,1,1        M=8     LP=2,0    NSL=2  MS=501,501
281,15,16       G=19,1,12,12,1,1        M=8     LP=2,0    NSL=2  MS=501,501
361,21,22       G=19,1,12,12,1,1        M=8     LP=2,0    NSL=2  MS=501,501
381,22,23       G=19,1,12,12,1,1        M=8     LP=2,0    NSL=2  MS=501,501
401,23,24       G=19,1,12,12,1,1        M=8     LP=2,0    NSL=2  MS=501,501
421,13,17       G=19,1,12,12,1,1        M=8     LP=3,0    NSL=2  MS=501,501
441,17,21       G=19,1,12,12,1,1        M=8     LP=3,0    NSL=2  MS=501,501
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541,16,20       G=19,1,12,12,1,1        M=8     LP=3,0     NSL=2  MS=501,501
561,20,24       G=19,1,12,12,1,1        M=8     LP=3,0     NSL=2  MS=501,501
C Interior beams
461,14,18       G=19,1,12,12,1,1        M=8     LP=3,0     NSL=1  MS=501,501
481,18,22       G=19,1,12,12,1,1        M=8     LP=3,0     NSL=1  MS=501,501
501,15,19       G=19,1,12,12,1,1        M=8     LP=3,0     NSL=1  MS=501,501
521,19,23       G=19,1,12,12,1,1        M=8     LP=3,0     NSL=1  MS=501,501
301,17,18       G=19,1,12,12,1,1        M=8     LP=2,0     NSL=1  MS=501,501
321,18,19       G=19,1,12,12,1,1        M=8     LP=2,0     NSL=1  MS=501,501
341,19,20       G=19,1,12,12,1,1        M=8     LP=2,0     NSL=1  MS=501,501

LOADS
C Lateral Joint Loads(Earthquake + Wind) in the transverse direction
C ie parallel to the y-axis
501     F=0,1.12,0        L=2
502     F=0,2.24,0
503     F=0,3.36,0
504     F=0,4.48,0
505     F=0,5.60,0
506     F=0,6.29,0
507     F=0,7.34,0
508     F=0,8.39,0
509     F=0,9.44,0
510     F=0,10.48,0
511     F=0,10.86,0
512     F=0,11.84,0
513     F=0,12.83,0
514     F=0,12.97,0
515     F=0,13.90,0
516     F=0,14.82,0
517     F=0,15.09,0
518     F=0,15.98,0
519     F=0,16.87,0
520     F=0,17.76,0
C 30% of Lateral Join Loads in the transverse direction
C ie parallel to the x-axis
501       F=0.62,0,0
502       F=1.24,0,0
503       F=1.87,0,0
504       F=2.49,0,0
505       F=3.11,0,0
506       F=3.49,0,0
507       F=4.08,0,0
508       F=4.66,0,0
509       F=5.24,0,0
510       F=5.82,0,0
511       F=6.03,0,0
512       F=6.58,0,0
513       F=7.13,0,0
514       F=7.21,0,0
515       F=7.72,0,0
516       F=8.23,0,0
517       F=8.39,0,0
518       F=8.88,0,0
519       F=9.37,0,0
520       F=9.86,0,0

COMBO
1 C=9.81,9.81
```

```
SELECT
NT=1 ID=1,252 SW=1
NT=2 ID=1,252 SW=1
NT=5  ID=1,240 SW=1
```

```
15 storey building - Span length 5*5 // Fc=25MPa
Unit  :KN-m
SYSTEM
L=2
JOINTS
1       X=0       Y=0       Z=0
4       X=15      Y=0       Z=0
181     X=0       Y=0       Z=45
184     X=15      Y=0       Z=45     Q=1,4,181,184,1,12
5       X=0       Y=5       Z=0
8       X=15      Y=5       Z=0
185     X=0       Y=5       Z=45
188     X=15      Y=5       Z=45     Q=5,8,185,188,1,12
9       X=0       Y=10      Z=0
12      X=15      Y=10      Z=0
189     X=0       Y=10      Z=45
192     X=15      Y=10      Z=45     Q=9,12,189,192,1,12
501     X=7.5     Y=5       Z=3
515     X=7.5     Y=5       Z=45     G=501,515,1

RESTRAINTS
13,252,1      R=1,1,0,0,0,1
1,12,1        R=1,1,1,1,1,1   :FIX BASE
501,515,1     R=0,0,1,1,1,0

FRAME
NM=7   NL=2
C total of 8 member section properties & 2 span loading configurations
1       SH=R     T=0.8,0.8          E=2.4038e7
2       SH=R         T=0.7,0.7
3       SH=R         T=0.6,0.6
4       SH=R         T=0.5,0.5
5       SH=R         T=0.4,0.4
6       SH=R         T=0.3,0.3
7       SH=R         T=0.5,0.25
C Below is the span loading(dead +live)data. Values in t/m length of beam
1  WG=0,0,-4.421
2  WG=0,0,-2.211
C  Exterior columns for levels 1-5
1,1,13          G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
2,2,14          G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
3,3,15          G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
4,4,16          G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
5,5,17          G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
8,8,20          G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
9,9,21          G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
10,10,22        G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
11,11,23        G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
12,12,24        G=4,12,12,12,1,1       M=3    LP=3,0     MS=0,501
C  Interior columns -levels 1-5
6,6,18          G=4,12,12,12,1,1       M=1    LP=3,0     MS=0,501
7,7,19          G=4,12,12,12,1,1       M=1    LP=3,0     MS=0,501
C  Exterior columns for levels 6-10
61,61,73        G=4,12,12,12,1,1       M=4    LP=3,0     MS=505,506
62,62,74        G=4,12,12,12,1,1       M=4    LP=3,0     MS=505,506
63,63,75        G=4,12,12,12,1,1       M=4    LP=3,0     MS=505,506
64,64,76        G=4,12,12,12,1,1       M=4    LP=3,0     MS=505,506
65,65,77        G=4,12,12,12,1,1       M=4    LP=3,0     MS=505,506
68,68,80        G=4,12,12,12,1,1       M=4    LP=3,0     MS=505,506
```

```
69,69,81        G=4,12,12,12,1,1        M=4     LP=3,0      MS=505,506
70,70,82        G=4,12,12,12,1,1        M=4     LP=3,0      MS=505,506
71,71,83        G=4,12,12,12,1,1        M=4     LP=3,0      MS=505,506
72,72,84        G=4,12,12,12,1,1        M=4     LP=3,0      MS=505,506
C  Interior columns for levels 6-10
66,66,78        G=4,12,12,12,1,1        M=2     LP=3,0      MS=505,506
67,67,79        G=4,12,12,12,1,1        M=2     LP=3,0      MS=505,506
C  Exterior columns for levels  11-13
121,121,133     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
122,122,134     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
123,123,135     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
124,124,136     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
125,125,137     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
128,128,140     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
129,129,141     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
130,130,142     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
131,131,143     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
132,132,144     G=2,12,12,12,1,1        M=5     LP=3,0      MS=510,511
C  Interior columns levels 11-13
126,126,138     G=2,12,12,12,1,1        M=3     LP=3,0      MS=510,511
127,127,139     G=2,12,12,12,1,1        M=3     LP=3,0      MS=510,511
C  Exterior columns levels 14-15
157,157,169     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
158,158,170     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
159,159,171     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
160,160,172     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
161,161,173     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
164,164,176     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
165,165,177     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
166,166,178     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
167,167,179     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
168,168,180     G=1,12,12,12,1,1        M=6     LP=3,0      MS=513,514
C  Interior columns  levels 14-15
162,162,174     G=1,12,12,12,1,1        M=5     LP=3,0      MS=513,514
163,163,175     G=1,12,12,12,1,1        M=5     LP=3,0      MS=513,514
C  BEAMS
C  Exterior beams
181,13,14       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=2   MS=501,501
196,14,15       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=2   MS=501,501
211,15,16       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=2   MS=501,501
271,21,22       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=2   MS=501,501
286,22,23       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=2   MS=501,501
301,23,24       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=2   MS=501,501
316,13,17       G=14,1,12,12,1,1        M=7     LP=3,0    NSL=2   MS=501,501
331,17,21       G=14,1,12,12,1,1        M=7     LP=3,0    NSL=2   MS=501,501
406,16,20       G=14,1,12,12,1,1        M=7     LP=3,0    NSL=2   MS=501,501
421,20,24       G=14,1,12,12,1,1        M=7     LP=3,0    NSL=2   MS=501,501
C Interior beams
346,14,18       G=14,1,12,12,1,1        M=7     LP=3,0    NSL=1   MS=501,501
361,18,22       G=14,1,12,12,1,1        M=7     LP=3,0    NSL=1   MS=501,501
376,15,19       G=14,1,12,12,1,1        M=7     LP=3,0    NSL=1   MS=501,501
391,19,23       G=14,1,12,12,1,1        M=7     LP=3,0    NSL=1   MS=501,501
226,17,18       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=1   MS=501,501
241,18,19       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=1   MS=501,501
256,19,20       G=14,1,12,12,1,1        M=7     LP=2,0    NSL=1   MS=501,501

LOADS
C Lateral Joint Loads(Earthquake + Wind) in the longitudinal direction
C ie parallel to the y-axis
501     F=0,1.5,0       L=2
```

```
502      F=0,3.01,0
503      F=0,4.51,0
504      F=0,6.01,0
505      F=0,7.52,0
506      F=0,8.49,0
507      F=0,9.91,0
508      F=0,11.32,0
509      F=0,12.74,0
510      F=0,14.15,0
511      F=0,14.62,0
512      F=0,15.94,0
513      F=0,17.27,0
514      F=0,17.83,0
515      F=0,19.10,0
C 30% of Lateral Join Loads in the transverse direction
C ie parallel to the x-axis
501        F=0.86,0,0
502        F=1.72,0,0
503        F=2.58,0,0
504        F=3.44,0,0
505        F=4.30,0,0
506        F=4.85,0,0
507        F=5.66,0,0
508        F=6.47,0,0
509        F=7.28,0,0
510        F=8.09,0,0
511        F=8.35,0,0
512        F=9.11,0,0
513        F=9.87,0,0
514        F=10.19,0,0
515        F=10.91,0,0

COMBO
1  C=9.81,9.81

SELECT
NT=1 ID=1,192 SW=1
NT=2 ID=1,192 SW=1
NT=5  ID=1,180 SW=1
```

```
10 storey building - Span length 5*5 // Fc=25MPa
Unit  :KN-m
SYSTEM
L=2
JOINTS
1       X=0       Y=0       Z=0
4       X=15      Y=0       Z=0
121     X=0       Y=0       Z=30
124     X=15      Y=0       Z=30     Q=1,4,121,124,1,12
5       X=0       Y=5       Z=0
8       X=15      Y=5       Z=0
125     X=0       Y=5       Z=30
128     X=15      Y=5       Z=30     Q=5,8,125,128,1,12
9       X=0       Y=10      Z=0
12      X=15      Y=10      Z=0
129     X=0       Y=10      Z=30
132     X=15      Y=10      Z=30     Q=9,12,129,132,1,12
501     X=7.5     Y=5       Z=3
510     X=7.5     Y=5       Z=30     G=501,510,1

RESTRAINTS
13,132,1      R=1,1,0,0,0,1
1,12,1        R=1,1,1,1,1,1   :FIX BASE
501,510,1     R=0,0,1,1,1,0

FRAME
NM=4   NL=2
C total of 5 member section properties & 2 span loading configurations
1       SH=R     T=0.7,0.7          E=2.4038e7
2       SH=R         T=0.5,0.5
3       SH=R         T=0.4,0.4
4       SH=R         T=0.5,0.25
C Below is the span loading(dead +live)data. Values in t/m length of beam
1  WG=0,0,-4.421
2  WG=0,0,-2.211
C  Exterior columns for levels 1-5
1,1,13          G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
2,2,14          G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
3,3,15          G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
4,4,16          G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
5,5,17          G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
8,8,20          G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
9,9,21          G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
10,10,22        G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
11,11,23        G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
12,12,24        G=4,12,12,12,1,1       M=2    LP=3,0          MS=0,501
C  Interior columns -levels 1-5
6,6,18          G=4,12,12,12,1,1       M=1    LP=3,0          MS=0,501
7,7,19          G=4,12,12,12,1,1       M=1    LP=3,0          MS=0,501
C  Exterior columns for levels 6-10
61,61,73        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
62,62,74        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
63,63,75        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
64,64,76        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
65,65,77        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
68,68,80        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
69,69,81        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
70,70,82        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
71,71,83        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
72,72,84        G=4,12,12,12,1,1       M=3    LP=3,0          MS=505,506
```

```
C  Interior columns for levels 6-10
66,66,78        G=4,12,12,12,1,1        M=2     LP=3,0          MS=505,506
67,67,79        G=4,12,12,12,1,1        M=2     LP=3,0          MS=505,506
C  BEAMS
C  Exterior beams
121,13,14       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=2   MS=501,501
131,14,15       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=2   MS=501,501
141,15,16       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=2   MS=501,501
181,21,22       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=2   MS=501,501
191,22,23       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=2   MS=501,501
201,23,24       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=2   MS=501,501
211,13,17       G=9,1,12,12,1,1         M=4     LP=3,0    NSL=2   MS=501,501
221,17,21       G=9,1,12,12,1,1         M=4     LP=3,0    NSL=2   MS=501,501
271,16,20       G=9,1,12,12,1,1         M=4     LP=3,0    NSL=2   MS=501,501
281,20,24       G=9,1,12,12,1,1         M=4     LP=3,0    NSL=2   MS=501,501
C Interior beams
231,14,18       G=9,1,12,12,1,1         M=4     LP=3,0    NSL=1   MS=501,501
241,18,22       G=9,1,12,12,1,1         M=4     LP=3,0    NSL=1   MS=501,501
251,15,19       G=9,1,12,12,1,1         M=4     LP=3,0    NSL=1   MS=501,501
261,19,23       G=9,1,12,12,1,1         M=4     LP=3,0    NSL=1   MS=501,501
151,17,18       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=1   MS=501,501
161,18,19       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=1   MS=501,501
171,19,20       G=9,1,12,12,1,1         M=4     LP=2,0    NSL=1   MS=501,501

LOADS
C Lateral Joint Loads(Earthquake + Wind) in the longitudinal direction
C ie parallel to the y-axis
501     F=0,2.58,0      L=2
502     F=0,5.15,0
503     F=0,7.73,0
504     F=0,10.30,0
505     F=0,12.88,0
506     F=0,14.51,0
507     F=0,16.93,0
508     F=0,19.34,0
509     F=0,21.76,0
510     F=0,24.18,0
C 30% of Lateral Join Loads in the transverse direction
C ie parallel to the x-axis
501       F=1.45,0,0
502       F=2.89,0,0
503       F=4.34,0,0
504       F=5.79,0,0
505       F=7.24,0,0
506       F=8.15,0,0
507       F=9.51,0,0
508       F=10.87,0,0
509       F=12.23,0,0
510       F=13.58,0,0

COMBO
1 C=9.81,9.81

SELECT
NT=1 ID=1,132 SW=1
NT=2 ID=1,132 SW=1
NT=5  ID=1,120 SW=1
```

```
5 storey building-Span length 5*5 //Fc=25MPa
Unit :KN-m
SYSTEM
L=2
JOINTS
1       X=0          Y=0          Z=0
4       X=15         Y=0          Z=0
61      X=0          Y=0          Z=15
64      X=15         Y=0          Z=15        Q=1,4,61,64,1,12
5       X=0          Y=5          Z=0
8       X=15         Y=5          Z=0
65      X=0          Y=5          Z=15
68      X=15         Y=5          Z=15        Q=5,8,65,68,1,12
9       X=0          Y=10         Z=0
12      X=15         Y=10         Z=0
69      X=0          Y=10         Z=15
72      X=15         Y=10         Z=15        Q=9,12,69,72,1,12
501     X=7.5     Y=5        Z=3
505     X=7.5     Y=5        Z=15     G=501,505,1

RESTRAINTS
13,72,1       R=1,1,0,0,0,1
1,12,1         R=1,1,1,1,1,1    :FIX BASE
501,505,1      R=0,0,1,1,1,0

FRAME
NM=3    NL=2
C total of 8 member section properties & 2 span loading configurations
1       SH=R      T=0.5,0.5           E=2.4038e7
2       SH=R      T=0.4,0.4
3       SH=R      T=0.5,0.25
C Below is the span loading(dead +live)data. Values in t/m length of beam
1  WG=0,0,-4.421
2  WG=0,0,-2.211
C  Exterior columns for levels 1-2
1,1,13          G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
2,2,14          G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
3,3,15          G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
4,4,16          G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
5,5,17          G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
8,8,20          G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
9,9,21          G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
10,10,22        G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
11,11,23        G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
12,12,24        G=1,12,12,12,1,1        M=2    LP=3,0          MS=0,501
C  Interior columns -levels 1-2
6,6,18          G=1,12,12,12,1,1        M=1    LP=3,0          MS=0,501
7,7,19          G=1,12,12,12,1,1        M=1    LP=3,0          MS=0,501
C  Exterior columns for levels 3-5
25,25,37        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
26,26,38        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
27,27,39        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
28,28,40        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
29,29,41        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
32,32,44        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
33,33,45        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
34,34,46        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
35,35,47        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
36,36,48        G=2,12,12,12,1,1        M=2    LP=3,0          MS=502,503
```

```
C  Interior columns for levels 3-5
30,30,42        G=2,12,12,12,1,1        M=1     LP=3,0          MS=502,503
31,31,43        G=2,12,12,12,1,1        M=1     LP=3,0          MS=502,503
C  BEAMS
C  Exterior beams
61,13,14        G=4,1,12,12,1,1         M=3     LP=2,0    NSL=2  MS=501,501
66,14,15        G=4,1,12,12,1,1         M=3     LP=2,0    NSL=2  MS=501,501
71,15,16        G=4,1,12,12,1,1         M=3     LP=2,0    NSL=2  MS=501,501
91,21,22        G=4,1,12,12,1,1         M=3     LP=2,0    NSL=2  MS=501,501
96,22,23        G=4,1,12,12,1,1         M=3     LP=2,0    NSL=2  MS=501,501
101,23,24       G=4,1,12,12,1,1         M=3     LP=2,0    NSL=2  MS=501,501
106,13,17       G=4,1,12,12,1,1         M=3     LP=3,0    NSL=2  MS=501,501
111,17,21       G=4,1,12,12,1,1         M=3     LP=3,0    NSL=2  MS=501,501
136,16,20       G=4,1,12,12,1,1         M=3     LP=3,0    NSL=2  MS=501,501
141,20,24       G=4,1,12,12,1,1         M=3     LP=3,0    NSL=2  MS=501,501
C Interior beams
116,14,18       G=4,1,12,12,1,1         M=3     LP=3,0    NSL=1  MS=501,501
121,18,22       G=4,1,12,12,1,1         M=3     LP=3,0    NSL=1  MS=501,501
126,15,19       G=4,1,12,12,1,1         M=3     LP=3,0    NSL=1  MS=501,501
131,19,23       G=4,1,12,12,1,1         M=3     LP=3,0    NSL=1  MS=501,501
76,17,18        G=4,1,12,12,1,1         M=3     LP=2,0    NSL=1  MS=501,501
81,18,19        G=4,1,12,12,1,1         M=3     LP=2,0    NSL=1  MS=501,501
86,19,20        G=4,1,12,12,1,1         M=3     LP=2,0    NSL=1  MS=501,501

LOADS
C Lateral Joint Loads(Earthquake + Wind) in the longitudinal direction
C ie parallel to the y-axis
501     F=0,4.91,0      L=2
502     F=0,9.82,0
503     F=0,14.73,0
504     F=0,19.64,0
505     F=0,24.55,0
C 30% of Lateral Join Loads in the transverse direction
C ie parallel to the x-axis
501       F=3.49,0,0
502       F=6.97,0,0
503       F=10.46,0,0
504       F=13.94,0,0
505       F=17.43,0,0

COMBO
1 C=9.81,9.81

SELECT
NT=1 ID=1,72 SW=1
NT=2 ID=1,72 SW=1
NT=5  ID=1,60 SW=1
```

PROGRAM:SAP90/FILE:\1a.F3F
20 storey building - Bay size 5*5// Fc=25MPa
F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	.000			-666.862			.000
		.000	-9.166	-43.505		9.776	13.510	
		3.000	-9.166	-71.003		9.776	42.838	
		3.000			-666.862			.000
2								
	1	.000			-2714.692			.000
		.000	-17.733	-35.666		-.852	23.236	
		3.000	-17.733	-88.864		-.852	20.679	
		3.000			-2714.692			.000
3								
	1	.000			-2826.277			.000
		.000	-17.750	-35.650		-2.256	24.520	
		3.000	-17.750	-88.900		-2.256	17.753	
		3.000			-2826.277			.000
4								
	1	.000			-1959.248			.000
		.000	-9.204	-43.470		-9.971	31.580	
		3.000	-9.204	-71.083		-9.971	1.667	
		3.000			-1959.248			.000
5								
	1	.000			-3325.917			.000
		.000	3.414	-55.017		18.357	5.658	
		3.000	3.414	-44.774		18.357	60.728	
		3.000			-3325.917			.000
6								
	1	.000			-8280.147			.000
		.000	-.469	-141.399		.704	60.758	
		3.000	-.469	-142.807		.704	62.871	
		3.000			-8280.147			.000
7								
	1	.000			-8511.326			.000
		.000	-.469	-141.399		.043	61.326	
		3.000	-.469	-142.807		.043	61.456	
		3.000			-8511.326			.000
8								
	1	.000			-4681.717			.000
		.000	3.414	-55.017		-18.579	39.457	
		3.000	3.414	-44.774		-18.579	-16.281	
		3.000			-4681.717			.000
9								
	1	.000			-3347.776			.000
		.000	10.432	-61.439		9.862	13.432	
		3.000	10.432	-30.142		9.862	43.017	
		3.000			-3347.776			.000
10								
	1	.000			-5540.653			.000
		.000	19.015	-69.293		-.768	23.159	
		3.000	19.015	-12.247		-.768	20.855	
		3.000			-5540.653			.000
11								
	1	.000			-5652.238			.000
		.000	19.032	-69.308		-2.340	24.598	
		3.000	19.032	-12.211		-2.340	17.576	
		3.000			-5652.238			.000
12								
	1	.000			-4640.163			.000
		.000	10.471	-61.474		-10.057	31.659	
		3.000	10.471	-30.062		-10.057	1.488	
		3.000			-4640.163			.000
13								
	1	.000			-565.228			.000

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          .000     -17.246     -40.559          18.754       1.619
         3.000     -17.246     -92.296          18.754      57.882
         3.000                -565.228                              .000
14 ----------------------------------------------
    1    .000                -2506.541                              .000
          .000     -32.190     -16.862          -2.400      33.410
         3.000     -32.190    -113.433          -2.400      26.210
         3.000                -2506.541                              .000
15 ----------------------------------------------
    1    .000                -2616.817                              .000
          .000     -32.241     -16.795          -6.918      39.186
         3.000     -32.241    -113.519          -6.918      18.432
         3.000                -2616.817                              .000
16 ----------------------------------------------
    1    .000                -1851.288                              .000
          .000     -17.359     -40.410         -18.277      58.606
         3.000     -17.359     -92.489         -18.277       3.776
         3.000                -1851.288                              .000
17 ----------------------------------------------
    1    .000                -3113.999                              .000
          .000      10.440     -80.611          33.769     -22.159
         3.000      10.440     -49.290          33.769      79.149
         3.000                -3113.999                              .000
18 ----------------------------------------------
    1    .000                -7848.426                              .000
          .000      -3.699    -179.477           3.986      78.243
         3.000      -3.699    -190.573           3.986      90.200
         3.000                -7848.426                              .000
19 ----------------------------------------------
    1    .000                -8078.270                              .000
          .000      -3.699    -179.477           1.131      81.543
         3.000      -3.699    -190.573           1.131      84.936
         3.000                -8078.270                              .000
20 ----------------------------------------------
    1    .000                -4463.621                              .000
          .000      10.440     -80.611         -33.369      82.487
         3.000      10.440     -49.290         -33.369     -17.620
         3.000                -4463.621                              .000
21 ----------------------------------------------
    1    .000                -3231.483                              .000
          .000      19.350     -96.974          19.011       1.283
         3.000      19.350     -38.924          19.011      58.316
         3.000                -3231.483                              .000
22 ----------------------------------------------
    1    .000                -5318.087                              .000
          .000      34.332    -120.724          -2.147      33.080
         3.000      34.332     -17.729          -2.147      26.638
         3.000                -5318.087                              .000
23 ----------------------------------------------
    1    .000                -5428.364                              .000
          .000      34.382    -120.791          -7.171      39.517
         3.000      34.382     -17.643          -7.171      18.004
         3.000                -5428.364                              .000
24 ----------------------------------------------
    1    .000                -4517.542                              .000
          .000      19.464     -97.123         -18.533      58.941
         3.000      19.464     -38.731         -18.533       3.342
         3.000                -4517.542                              .000
25 ----------------------------------------------
    1    .000                 -474.282                              .000
          .000     -16.634     -82.383          19.358      23.011
         3.000     -16.634    -132.284          19.358      81.086
         3.000                 -474.282                              .000
26 ----------------------------------------------
    1    .000                -2309.768                              .000
          .000     -29.586     -63.070          -5.682      58.240
         3.000     -29.586    -151.828          -5.682      41.192
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        3.000                       -2309.768                          .000
27 ----------------------------------------------
     1    .000                       -2417.488                          .000
          .000     -29.673     -62.951          -13.402      68.947
         3.000     -29.673    -151.969          -13.402      28.742
         3.000                       -2417.488                          .000
28 ----------------------------------------------
     1    .000                       -1744.803                          .000
          .000     -16.826     -82.119          -17.924      77.347
         3.000     -16.826    -132.597          -17.924      23.576
         3.000                       -1744.803                          .000
29 ----------------------------------------------
     1    .000                       -2908.792                          .000
          .000      21.409    -134.867           32.521       3.440
         3.000      21.409     -70.640           32.521     101.002
         3.000                       -2908.792                          .000
30 ----------------------------------------------
     1    .000                       -7421.953                          .000
          .000     -11.825    -278.243           10.638     126.642
         3.000     -11.825    -313.717           10.638     158.557
         3.000                       -7421.953                          .000
31 ----------------------------------------------
     1    .000                       -7649.128                          .000
          .000     -11.825    -278.243            5.141     134.177
         3.000     -11.825    -313.717            5.141     149.601
         3.000                       -7649.128                          .000
32 ----------------------------------------------
     1    .000                       -4243.112                          .000
          .000      21.409    -134.867          -31.345      97.214
         3.000      21.409     -70.640          -31.345       3.179
         3.000                       -4243.112                          .000
33 ----------------------------------------------
     1    .000                       -3105.611                          .000
          .000      19.925    -135.722           19.792      22.416
         3.000      19.925     -75.946           19.792      81.790
         3.000                       -3105.611                          .000
34 ----------------------------------------------
     1    .000                       -5086.763                          .000
          .000      33.191    -155.346           -5.256      57.652
         3.000      33.191     -55.773           -5.256      41.885
         3.000                       -5086.763                          .000
35 ----------------------------------------------
     1    .000                       -5194.483                          .000
          .000      33.278    -155.465          -13.829      69.534
         3.000      33.278     -55.631          -13.829      28.049
         3.000                       -5194.483                          .000
36 ----------------------------------------------
     1    .000                       -4376.132                          .000
          .000      20.118    -135.986          -18.357      77.943
         3.000      20.118     -75.634          -18.357      22.872
         3.000                       -4376.132                          .000
37 ----------------------------------------------
     1    .000                        -405.337                          .000
          .000     -18.975    -161.422           22.541      62.703
         3.000     -18.975    -218.347           22.541     130.327
         3.000                        -405.337                          .000
38 ----------------------------------------------
     1    .000                       -2131.640                          .000
          .000     -31.435    -142.329          -12.073     111.358
         3.000     -31.435    -236.635          -12.073      75.138
         3.000                       -2131.640                          .000
39 ----------------------------------------------
     1    .000                       -2235.714                          .000
          .000     -31.553    -142.159          -22.240     126.049
         3.000     -31.553    -236.819          -22.240      59.328
         3.000                       -2235.714                          .000
40 ----------------------------------------------
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      1    .000                      -1643.680                          .000
           .000     -19.234    -161.049          -17.060     122.336
          3.000     -19.234    -218.751          -17.060      71.157
          3.000                      -1643.680                          .000
41 ----------------------------------------------
      1    .000                      -2713.912                          .000
           .000      38.510    -240.858           35.303      43.155
          3.000      38.510    -125.328           35.303     149.063
          3.000                      -2713.912                          .000
42 ----------------------------------------------
      1    .000                      -6999.774                          .000
           .000     -18.382    -489.088           17.864     236.112
          3.000     -18.382    -544.233           17.864     289.706
          3.000                      -6999.774                          .000
43 ----------------------------------------------
      1    .000                      -7222.845                          .000
           .000     -18.382    -489.088           10.290     246.853
          3.000     -18.382    -544.233           10.290     277.725
          3.000                      -7222.845                          .000
44 ----------------------------------------------
      1    .000                      -4016.124                          .000
           .000      38.510    -240.858          -30.220     142.494
          3.000      38.510    -125.328          -30.220      51.834
          3.000                      -4016.124                          .000
45 ----------------------------------------------
      1    .000                      -2967.393                          .000
           .000      19.647    -219.648           23.125      61.862
          3.000      19.647    -160.708           23.125     131.237
          3.000                      -2967.393                          .000
46 ----------------------------------------------
      1    .000                      -4839.368                          .000
           .000      32.610    -239.544          -11.498     110.529
          3.000      32.610    -141.715          -11.498      76.036
          3.000                      -4839.368                          .000
47 ----------------------------------------------
      1    .000                      -4943.442                          .000
           .000      32.728    -239.714          -22.816     126.878
          3.000      32.728    -141.531          -22.816      58.430
          3.000                      -4943.442                          .000
48 ----------------------------------------------
      1    .000                      -4205.736                          .000
           .000      19.906    -220.022          -17.644     123.178
          3.000      19.906    -160.304          -17.644      70.247
          3.000                      -4205.736                          .000
49 ----------------------------------------------
      1    .000                       -381.543                          .000
           .000      97.441    -324.194          -37.462     148.914
          3.000      97.441     -31.871          -37.462      36.529
          3.000                       -381.543                          .000
50 ----------------------------------------------
      1    .000                      -1986.852                          .000
           .000      84.384    -305.360          -93.376     223.594
          3.000      84.384     -52.209          -93.376     -56.533
          3.000                      -1986.852                          .000
51 ----------------------------------------------
      1    .000                      -2086.525                          .000
           .000      84.205    -305.120         -107.797     243.297
          3.000      84.205     -52.506         -107.797     -80.093
          3.000                      -2086.525                          .000
52 ----------------------------------------------
      1    .000                      -1554.838                          .000
           .000      97.060    -323.679          -85.122     215.460
          3.000      97.060     -32.499          -85.122     -39.906
          3.000                      -1554.838                          .000
53 ----------------------------------------------
      1    .000                      -2537.330                          .000
           .000     195.532    -454.371          -23.675     129.241
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        3.000     195.532     132.224         -23.675      58.215
        3.000                -2537.330                              .000
54 ----------------------------------------------
     1  .000                -6581.968                              .000
        .000     254.503    -881.793        -127.912     448.624
       3.000     254.503    -118.284        -127.912      64.888
        3.000                -6581.968                              .000
55 ----------------------------------------------
     1  .000                -6799.791                              .000
        .000     254.503    -881.793        -138.691     463.360
       3.000     254.503    -118.284        -138.691      47.286
        3.000                -6799.791                              .000
56 ----------------------------------------------
     1  .000                -3774.322                              .000
        .000     195.532    -454.371        -100.107     236.452
       3.000     195.532     132.224        -100.107     -63.870
        3.000                -3774.322                              .000
57 ----------------------------------------------
     1  .000                -2810.103                              .000
        .000     143.694    -388.816         -36.605     147.754
       3.000     143.694      42.265         -36.605      37.941
        3.000                -2810.103                              .000
58 ----------------------------------------------
     1  .000                -4560.635                              .000
        .000     158.653    -409.637         -92.531     222.450
       3.000     158.653      66.324         -92.531     -55.143
        3.000                -4560.635                              .000
59 ----------------------------------------------
     1  .000                -4660.309                              .000
        .000     158.832    -409.876        -108.641     244.440
       3.000     158.832      66.621        -108.641     -81.483
        3.000                -4660.309                              .000
60 ----------------------------------------------
     1  .000                -3983.398                              .000
        .000     144.075    -389.331         -85.979     216.620
       3.000     144.075      42.892         -85.979     -41.318
        3.000                -3983.398                              .000
61 ----------------------------------------------
     1  .000                 -398.999                              .000
        .000      93.290    -208.069         -37.001      89.899
       3.000      93.290      71.802         -37.001     -21.105
        3.000                 -398.999                              .000
62 ----------------------------------------------
     1  .000                -1873.204                              .000
        .000      84.619    -195.410         -90.179     162.373
       3.000      84.619      58.446         -90.179    -108.163
        3.000                -1873.204                              .000
63 ----------------------------------------------
     1  .000                -1968.531                              .000
        .000      84.443    -195.173        -103.651     180.599
       3.000      84.443      58.156        -103.651    -130.354
        3.000                -1968.531                              .000
64 ----------------------------------------------
     1  .000                -1477.342                              .000
        .000      92.908    -207.559         -77.261     145.364
       3.000      92.908      71.164         -77.261     -86.419
        3.000                -1477.342                              .000
65 ----------------------------------------------
     1  .000                -2378.022                              .000
        .000     189.159    -338.080         -27.073      75.695
       3.000     189.159     229.397         -27.073      -5.525
        3.000                -2378.022                              .000
66 ----------------------------------------------
     1  .000                -6167.537                              .000
        .000     262.642    -610.722        -132.199     303.659
       3.000     262.642     177.203        -132.199     -92.938
        3.000                -6167.537                              .000
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67 ----------------------------------------
     1    .000                    -6378.283                          .000
          .000     262.642    -610.722        -142.594     318.105
         3.000     262.642     177.203        -142.594    -109.676
         3.000                 -6378.283                          .000
68 ----------------------------------------
     1    .000                    -3518.226                          .000
          .000     189.159    -338.080         -89.339     162.222
         3.000     189.159     229.397         -89.339    -105.797
         3.000                 -3518.226                          .000
69 ----------------------------------------
     1    .000                    -2636.274                          .000
          .000     132.261    -261.779         -36.149      88.761
         3.000     132.261     135.004         -36.149     -19.685
         3.000                 -2636.274                          .000
70 ----------------------------------------
     1    .000                    -4251.951                          .000
          .000     144.768    -279.103         -89.347     161.260
         3.000     144.768     155.202         -89.347    -106.780
         3.000                 -4251.951                          .000
71 ----------------------------------------
     1    .000                    -4347.277                          .000
          .000     144.944    -279.340        -104.483     181.712
         3.000     144.944     155.492        -104.483    -131.737
         3.000                 -4347.277                          .000
72 ----------------------------------------
     1    .000                    -3714.617                          .000
          .000     132.643    -262.288         -78.113     146.501
         3.000     132.643     135.642         -78.113     -87.839
         3.000                 -3714.617                          .000
73 ----------------------------------------
     1    .000                     -440.454                          .000
          .000      84.844    -147.931         -28.956      51.734
         3.000      84.844     106.602         -28.956     -35.136
         3.000                  -440.454                          .000
74 ----------------------------------------
     1    .000                    -1780.632                          .000
          .000      75.965    -134.381         -93.745     149.678
         3.000      75.965      93.514         -93.745    -131.557
         3.000                 -1780.632                          .000
75 ----------------------------------------
     1    .000                    -1871.928                          .000
          .000      75.731    -134.036        -111.711     176.083
         3.000      75.731      93.157        -111.711    -159.050
         3.000                 -1871.928                          .000
76 ----------------------------------------
     1    .000                    -1406.169                          .000
          .000      84.317    -147.158         -77.685     124.988
         3.000      84.317     105.794         -77.685    -108.067
         3.000                 -1406.169                          .000
77 ----------------------------------------
     1    .000                    -2230.707                          .000
          .000     203.466    -326.860         -18.376      35.542
         3.000     203.466     283.540         -18.376     -19.585
         3.000                 -2230.707                          .000
78 ----------------------------------------
     1    .000                    -5755.260                          .000
          .000     233.997    -417.371        -113.216     196.702
         3.000     233.997     284.620        -113.216    -142.946
         3.000                 -5755.260                          .000
79 ----------------------------------------
     1    .000                    -5956.920                          .000
          .000     233.997    -417.371        -126.265     215.800
         3.000     233.997     284.620        -126.265    -162.995
         3.000                 -5956.920                          .000
80 ----------------------------------------
     1    .000                    -3254.593                          .000
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          .000     203.466    -326.860          -91.101     145.620
         3.000     203.466     283.540          -91.101    -127.682
         3.000                          -3254.593                      .000
81 ----------------------------------------------
     1    .000                          -2450.283                      .000
          .000     131.832    -218.650          -27.782      50.012
         3.000     131.832     176.847          -27.782     -33.334
         3.000                          -2450.283                      .000
82 ----------------------------------------------
     1    .000                          -3924.335                      .000
          .000     145.781    -240.200          -92.602     148.004
         3.000     145.781     197.143          -92.602    -129.801
         3.000                          -3924.335                      .000
83 ----------------------------------------------
     1    .000                          -4015.631                      .000
          .000     146.015    -240.545         -112.854     177.757
         3.000     146.015     197.500         -112.854    -160.806
         3.000                          -4015.631                      .000
84 ----------------------------------------------
     1    .000                          -3415.999                      .000
          .000     132.360    -219.424          -78.859     126.710
         3.000     132.360     177.655          -78.859    -109.868
         3.000                          -3415.999                      .000
85 ----------------------------------------------
     1    .000                           -485.632                      .000
          .000      79.957    -121.769          -25.628      38.143
         3.000      79.957     118.102          -25.628     -38.741
         3.000                           -485.632                      .000
86 ----------------------------------------------
     1    .000                          -1694.653                      .000
          .000      71.743    -109.305          -89.782     133.969
         3.000      71.743     105.923          -89.782    -135.377
         3.000                          -1694.653                      .000
87 ----------------------------------------------
     1    .000                          -1780.340                      .000
          .000      71.476    -108.917         -110.196     163.758
         3.000      71.476     105.511         -110.196    -166.831
         3.000                          -1780.340                      .000
88 ----------------------------------------------
     1    .000                          -1334.592                      .000
          .000      79.345    -120.881          -76.209     112.811
         3.000      79.345     117.153          -76.209    -115.816
         3.000                          -1334.592                      .000
89 ----------------------------------------------
     1    .000                          -2087.346                      .000
          .000     198.437    -298.573          -15.731      23.233
         3.000     198.437     296.737          -15.731     -23.959
         3.000                          -2087.346                      .000
90 ----------------------------------------------
     1    .000                          -5346.589                      .000
          .000     219.835    -334.448         -105.130     155.124
         3.000     219.835     325.056         -105.130    -160.265
         3.000                          -5346.589                      .000
91 ----------------------------------------------
     1    .000                          -5537.886                      .000
          .000     219.835    -334.448         -119.851     176.659
         3.000     219.835     325.056         -119.851    -182.894
         3.000                          -5537.886                      .000
92 ----------------------------------------------
     1    .000                          -2991.293                      .000
          .000     198.437    -298.573          -88.786     131.640
         3.000     198.437     296.737          -88.786    -134.717
         3.000                          -2991.293                      .000
93 ----------------------------------------------
     1    .000                          -2257.529                      .000
          .000     128.507    -193.479          -24.262      36.162
         3.000     128.507     192.043          -24.262     -36.625
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        3.000                          -2257.529                          .000
94 ----------------------------------------------
     1    .000                          -3593.763                          .000
          .000     141.405    -212.790        -88.452     132.038
         3.000     141.405     211.426        -88.452    -133.317
         3.000                          -3593.763                          .000
95 ----------------------------------------------
     1    .000                          -3679.450                          .000
          .000     141.672    -213.177       -111.526     165.688
         3.000     141.672     211.838       -111.526    -168.891
         3.000                          -3679.450                          .000
96 ----------------------------------------------
     1    .000                          -3106.488                          .000
          .000     129.119    -194.366        -77.574     114.791
         3.000     129.119     192.992        -77.574    -117.932
         3.000                          -3106.488                          .000
97 ----------------------------------------------
     1    .000                           -525.426                          .000
          .000      74.384    -103.475        -22.413      28.069
         3.000      74.384     119.676        -22.413     -39.169
         3.000                           -525.426                          .000
98 ----------------------------------------------
     1    .000                          -1608.618                          .000
          .000      66.520     -91.625        -84.013     122.311
         3.000      66.520     107.935        -84.013    -129.728
         3.000                          -1608.618                          .000
99 ----------------------------------------------
     1    .000                          -1687.531                          .000
          .000      66.229     -91.190       -106.199     155.426
         3.000      66.229     107.497       -106.199    -163.170
         3.000                          -1687.531                          .000
100 ----------------------------------------------
     1    .000                          -1259.747                          .000
          .000      73.710    -102.468        -73.949     106.040
         3.000      73.710     118.660        -73.949    -115.808
         3.000                          -1259.747                          .000
101 ----------------------------------------------
     1    .000                          -1944.633                          .000
          .000     188.637    -278.148        -13.034      13.774
         3.000     188.637     287.764        -13.034     -25.329
         3.000                          -1944.633                          .000
102 ----------------------------------------------
     1    .000                          -4940.753                          .000
          .000     210.199    -286.777        -99.782     131.310
         3.000     210.199     343.821        -99.782    -168.036
         3.000                          -4940.753                          .000
103 ----------------------------------------------
     1    .000                          -5120.579                          .000
          .000     210.199    -286.777       -115.834     155.121
         3.000     210.199     343.821       -115.834    -192.380
         3.000                          -5120.579                          .000
104 ----------------------------------------------
     1    .000                          -2731.083                          .000
          .000     188.637    -278.148        -85.615     124.087
         3.000     188.637     287.764        -85.615    -132.758
         3.000                          -2731.083                          .000
105 ----------------------------------------------
     1    .000                          -2061.996                          .000
          .000     123.646    -178.084        -20.904      25.819
         3.000     123.646     192.855        -20.904     -36.892
         3.000                          -2061.996                          .000
106 ----------------------------------------------
     1    .000                          -3266.307                          .000
          .000     135.344    -196.341        -82.541     120.118
         3.000     135.344     209.690        -82.541    -127.505
         3.000                          -3266.307                          .000
107 ----------------------------------------------
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      1    .000                          -3345.220                              .000
           .000      135.635    -196.776          -107.671     157.619
          3.000      135.635     210.128          -107.671    -165.394
          3.000                          -3345.220                              .000
108 ----------------------------------------------
      1    .000                          -2796.317                              .000
           .000      124.320    -179.091          -75.458     108.290
          3.000      124.320     193.870          -75.458    -118.084
          3.000                          -2796.317                              .000
109 ----------------------------------------------
      1    .000                           -556.432                              .000
           .000       64.875     -88.825          -13.762      18.017
          3.000       64.875     105.799          -13.762     -23.270
          3.000                           -556.432                              .000
110 ----------------------------------------------
      1    .000                          -1519.636                              .000
           .000       56.490     -76.595          -82.610     115.372
          3.000       56.490      92.874          -82.610    -132.458
          3.000                          -1519.636                              .000
111 ----------------------------------------------
      1    .000                          -1590.246                              .000
           .000       56.109     -76.073         -110.512     154.173
          3.000       56.109      92.255         -110.512    -177.362
          3.000                          -1590.246                              .000
112 ----------------------------------------------
      1    .000                          -1180.366                              .000
           .000       64.003     -87.624          -75.645     104.356
          3.000       64.003     104.386          -75.645    -122.579
          3.000                          -1180.366                              .000
113 ----------------------------------------------
      1    .000                          -1801.033                              .000
           .000      192.878    -269.804           -3.446       3.298
          3.000      192.878     308.828           -3.446      -7.041
          3.000                          -1801.033                              .000
114 ----------------------------------------------
      1    .000                          -4538.010                              .000
           .000      177.223    -245.175          -79.577     108.855
          3.000      177.223     286.494          -79.577    -129.875
          3.000                          -4538.010                              .000
115 ----------------------------------------------
      1    .000                          -4705.747                              .000
           .000      177.223    -245.175          -99.064     136.254
          3.000      177.223     286.494          -99.064    -160.939
          3.000                          -4705.747                              .000
116 ----------------------------------------------
      1    .000                          -2475.254                              .000
           .000      192.878    -269.804          -88.863     122.762
          3.000      192.878     308.828          -88.863    -143.826
          3.000                          -2475.254                              .000
117 ----------------------------------------------
      1    .000                          -1864.767                              .000
           .000      123.890    -171.147          -11.813      15.327
          3.000      123.890     200.522          -11.813     -20.112
          3.000                          -1864.767                              .000
118 ----------------------------------------------
      1    .000                          -2945.029                              .000
           .000      137.073    -189.376          -80.712     112.749
          3.000      137.073     221.842          -80.712    -129.387
          3.000                          -2945.029                              .000
119 ----------------------------------------------
      1    .000                          -3015.639                              .000
           .000      137.453    -189.897         -112.410     156.796
          3.000      137.453     222.461         -112.410    -180.433
          3.000                          -3015.639                              .000
120 ----------------------------------------------
      1    .000                          -2488.700                              .000
           .000      124.761    -172.348          -77.594     107.046
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          3.000     124.761     201.935         -77.594    -125.737
          3.000                -2488.700                              .000
121 ----------------------------------------------------------------------
      1    .000                 -576.384                              .000
           .000      61.695     -86.212         -17.663      25.176
          3.000      61.695      98.874         -17.663     -27.814
          3.000                 -576.384                              .000
122 ----------------------------------------------------------------------
      1    .000                -1426.390                              .000
           .000      57.796     -80.040         -66.716      93.629
          3.000      57.796      93.347         -66.716    -106.518
          3.000                -1426.390                              .000
123 ----------------------------------------------------------------------
      1    .000                -1489.239                              .000
           .000      57.478     -79.609         -88.396     123.409
          3.000      57.478      92.825         -88.396    -141.778
          3.000                -1489.239                              .000
124 ----------------------------------------------------------------------
      1    .000                -1096.332                              .000
           .000      60.957     -85.218         -66.025      91.354
          3.000      60.957      97.653         -66.025    -106.722
          3.000                -1096.332                              .000
125 ----------------------------------------------------------------------
      1    .000                -1656.381                              .000
           .000     152.551    -213.164         -11.234      15.863
          3.000     152.551     244.488         -11.234     -17.838
          3.000                -1656.381                              .000
126 ----------------------------------------------------------------------
      1    .000                -4136.183                              .000
           .000     202.125    -281.672         -98.923     137.777
          3.000     202.125     324.703         -98.923    -158.993
          3.000                -4136.183                              .000
127 ----------------------------------------------------------------------
      1    .000                -4290.249                              .000
           .000     202.125    -281.672        -114.886     160.437
          3.000     202.125     324.703        -114.886    -184.220
          3.000                -4290.249                              .000
128 ----------------------------------------------------------------------
      1    .000                -2223.018                              .000
           .000     152.551    -213.164         -76.272     105.426
          3.000     152.551     244.488         -76.272    -123.389
          3.000                -2223.018                              .000
129 ----------------------------------------------------------------------
      1    .000                -1669.438                              .000
           .000     108.015    -149.521         -16.039      22.981
          3.000     108.015     174.525         -16.039     -25.137
          3.000                -1669.438                              .000
130 ----------------------------------------------------------------------
      1    .000                -2628.830                              .000
           .000     118.840    -164.198         -65.169      91.527
          3.000     118.840     192.323         -65.169    -103.980
          3.000                -2628.830                              .000
131 ----------------------------------------------------------------------
      1    .000                -2691.678                              .000
           .000     119.158    -164.628         -89.942     125.511
          3.000     119.158     192.845         -89.942    -144.316
          3.000                -2691.678                              .000
132 ----------------------------------------------------------------------
      1    .000                -2189.386                              .000
           .000     108.754    -150.515         -67.649      93.549
          3.000     108.754     175.746         -67.649    -109.399
          3.000                -2189.386                              .000
133 ----------------------------------------------------------------------
      1    .000                 -580.333                              .000
           .000      53.129     -68.913         -10.442       9.186
          3.000      53.129      90.473         -10.442     -22.142
          3.000                 -580.333                              .000
```

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134 ----------------------------------------
      1    .000                    -1326.421                          .000
           .000      49.402      -63.553        -63.275      91.507
          3.000      49.402       84.655        -63.275     -98.319
          3.000                  -1326.421                          .000
135 ----------------------------------------
      1    .000                    -1382.827                          .000
           .000      49.018      -62.966        -89.668     131.275
          3.000      49.018       84.086        -89.668    -137.728
          3.000                  -1382.827                          .000
136 ----------------------------------------
      1    .000                    -1006.128                          .000
           .000      52.216      -67.526        -66.962      95.898
          3.000      52.216       89.123        -66.962    -104.988
          3.000                  -1006.128                          .000
137 ----------------------------------------
      1    .000                    -1510.050                          .000
           .000     150.995     -221.235         -3.854       -.942
          3.000     150.995      231.750         -3.854     -12.504
          3.000                  -1510.050                          .000
138 ----------------------------------------
      1    .000                    -3732.606                          .000
           .000     168.709     -210.513        -79.873      96.537
          3.000     168.709      295.613        -79.873    -143.081
          3.000                  -3732.606                          .000
139 ----------------------------------------
      1    .000                    -3870.663                          .000
           .000     168.709     -210.513        -97.547     123.331
          3.000     168.709      295.613        -97.547    -169.310
          3.000                  -3870.663                          .000
140 ----------------------------------------
      1    .000                    -1976.240                          .000
           .000     150.995     -221.235        -77.791     113.123
          3.000     150.995      231.750        -77.791    -120.251
          3.000                  -1976.240                          .000
141 ----------------------------------------
      1    .000                    -1478.638                          .000
           .000     107.131     -151.914         -8.432       6.139
          3.000     107.131      169.479         -8.432     -19.156
          3.000                  -1478.638                          .000
142 ----------------------------------------
      1    .000                    -2320.707                          .000
           .000     118.389     -170.126        -61.360      88.616
          3.000     118.389      185.040        -61.360     -95.463
          3.000                  -2320.707                          .000
143 ----------------------------------------
      1    .000                    -2377.113                          .000
           .000     118.774     -170.712        -91.583     134.166
          3.000     118.774      185.608        -91.583    -140.584
          3.000                  -2377.113                          .000
144 ----------------------------------------
      1    .000                    -1904.433                          .000
           .000     108.043     -153.301        -68.973      98.945
          3.000     108.043      170.828        -68.973    -107.974
          3.000                  -1904.433                          .000
145 ----------------------------------------
      1    .000                     -570.357                          .000
           .000      38.952      -54.881           .502       -.097
          3.000      38.952       61.976           .502       1.410
          3.000                   -570.357                          .000
146 ----------------------------------------
      1    .000                    -1220.361                          .000
           .000      35.518      -49.342        -56.983      80.532
          3.000      35.518       57.211        -56.983     -90.418
          3.000                  -1220.361                          .000
147 ----------------------------------------
      1    .000                    -1268.002                          .000
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	.000	35.044	-48.689	-89.450	125.752	
	3.000	35.044	56.443	-89.450	-142.599	
	3.000		-1268.002			.000
148						
1	.000		-909.113			.000
	.000	37.803	-53.305	-66.854	93.117	
	3.000	37.803	60.104	-66.854	-107.444	
	3.000		-909.113			.000
149						
1	.000		-1361.603			.000
	.000	145.397	-204.365	7.229	-9.866	
	3.000	145.397	231.826	7.229	11.820	
	3.000		-1361.603			.000
150						
1	.000		-3331.781			.000
	.000	151.914	-195.616	-68.167	87.163	
	3.000	151.914	260.126	-68.167	-117.338	
	3.000		-3331.781			.000
151						
1	.000		-3453.788			.000
	.000	151.914	-195.616	-90.585	117.733	
	3.000	151.914	260.126	-90.585	-154.022	
	3.000		-3453.788			.000
152						
1	.000		-1736.541			.000
	.000	145.397	-204.365	-78.117	108.796	
	3.000	145.397	231.826	-78.117	-125.557	
	3.000		-1736.541			.000
153						
1	.000		-1286.731			.000
	.000	103.287	-143.772	3.033	-3.580	
	3.000	103.287	166.090	3.033	5.520	
	3.000		-1286.731			.000
154						
1	.000		-2023.702			.000
	.000	114.611	-159.396	-54.583	77.212	
	3.000	114.611	184.436	-54.583	-86.537	
	3.000		-2023.702			.000
155						
1	.000		-2071.342			.000
	.000	115.085	-160.050	-91.850	129.072	
	3.000	115.085	185.205	-91.850	-146.479	
	3.000		-2071.342			.000
156						
1	.000		-1625.487			.000
	.000	104.437	-145.349	-69.384	96.600	
	3.000	104.437	167.962	-69.384	-111.553	
	3.000		-1625.487			.000
157						
1	.000		-548.660			.000
	.000	44.417	-65.629	-10.114	16.642	
	3.000	44.417	67.622	-10.114	-13.701	
	3.000		-548.660			.000
158						
1	.000		-1107.184			.000
	.000	43.199	-63.839	-46.635	67.237	
	3.000	43.199	65.757	-46.635	-72.668	
	3.000		-1107.184			.000
159						
1	.000		-1147.862			.000
	.000	42.828	-63.349	-67.487	96.161	
	3.000	42.828	65.134	-67.487	-106.299	
	3.000		-1147.862			.000
160						
1	.000		-808.108			.000
	.000	43.574	-64.493	-56.713	80.141	
	3.000	43.574	66.229	-56.713	-89.997	

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          3.000                          -808.108                                .000
161 ----------------------------------------------------------------------------------
        1    .000                          -1211.005                               .000
             .000      110.796    -158.028          -5.903      10.920
            3.000      110.796     174.361          -5.903      -6.791
            3.000                          -1211.005                               .000
162 ----------------------------------------------------------------------------------
        1    .000                          -2927.224                               .000
             .000      141.067    -196.565         -69.946      98.773
            3.000      141.067     226.636         -69.946    -111.066
            3.000                          -2927.224                               .000
163 ----------------------------------------------------------------------------------
        1    .000                          -3033.114                               .000
             .000      141.067    -196.565         -82.753     115.234
            3.000      141.067     226.636         -82.753    -133.025
            3.000                          -3033.114                               .000
164 ----------------------------------------------------------------------------------
        1    .000                          -1501.311                               .000
             .000      110.796    -158.028         -64.764      90.975
            3.000      110.796     174.361         -64.764    -103.318
            3.000                          -1501.311                               .000
165 ----------------------------------------------------------------------------------
        1    .000                          -1099.862                               .000
             .000       89.464    -126.863          -8.316      14.202
            3.000       89.464     141.530          -8.316     -10.746
            3.000                          -1099.862                               .000
166 ----------------------------------------------------------------------------------
        1    .000                          -1733.569                               .000
             .000       97.804    -138.049         -45.011      65.008
            3.000       97.804     155.364         -45.011     -70.024
            3.000                          -1733.569                               .000
167 ----------------------------------------------------------------------------------
        1    .000                          -1774.247                               .000
             .000       98.175    -138.539         -69.111      98.389
            3.000       98.175     155.987         -69.111    -108.944
            3.000                          -1774.247                               .000
168 ----------------------------------------------------------------------------------
        1    .000                          -1359.310                               .000
             .000       90.307    -127.999         -58.511      82.581
            3.000       90.307     142.923         -58.511     -92.952
            3.000                          -1359.310                               .000
169 ----------------------------------------------------------------------------------
        1    .000                           -512.542                               .000
             .000       30.112     -38.177            .218      -4.520
            3.000       30.112      52.161            .218      -3.867
            3.000                           -512.542                               .000
170 ----------------------------------------------------------------------------------
        1    .000                           -981.238                               .000
             .000       27.773     -35.222         -39.498      57.554
            3.000       27.773      48.097         -39.498     -60.941
            3.000                           -981.238                               .000
171 ----------------------------------------------------------------------------------
        1    .000                          -1017.950                               .000
             .000       27.283     -34.483         -65.168      95.869
            3.000       27.283      47.367         -65.168     -99.634
            3.000                          -1017.950                               .000
172 ----------------------------------------------------------------------------------
        1    .000                           -703.228                               .000
             .000       29.071     -36.591         -55.345      80.492
            3.000       29.071      50.623         -55.345     -85.544
            3.000                           -703.228                               .000
173 ----------------------------------------------------------------------------------
        1    .000                          -1055.124                               .000
             .000      102.160    -150.427           5.682     -12.649
            3.000      102.160     156.054           5.682       4.397
            3.000                          -1055.124                               .000
174 ----------------------------------------------------------------------------------
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      1    .000                          -2518.062                          .000
           .000      126.336    -174.611          -58.502      80.158
          3.000      126.336     204.398          -58.502     -95.348
          3.000                          -2518.062                          .000
175 ----------------------------------------------------------------------------
      1    .000                          -2609.322                          .000
           .000      126.336    -174.611          -77.496     108.036
          3.000      126.336     204.398          -77.496    -124.452
          3.000                          -2609.322                          .000
176 ----------------------------------------------------------------------------
      1    .000                          -1270.624                          .000
           .000      102.160    -150.427          -64.632      95.014
          3.000      102.160     156.054          -64.632     -98.882
          3.000                          -1270.624                          .000
177 ----------------------------------------------------------------------------
      1    .000                           -922.154                          .000
           .000       83.839    -120.524            2.442      -7.889
          3.000       83.839     130.994            2.442       -.563
          3.000                           -922.154                          .000
178 ----------------------------------------------------------------------------
      1    .000                          -1452.154                          .000
           .000       92.909    -135.067          -37.491      54.537
          3.000       92.909     143.660          -37.491     -57.936
          3.000                          -1452.154                          .000
179 ----------------------------------------------------------------------------
      1    .000                          -1488.866                          .000
           .000       93.399    -135.806          -67.175      98.885
          3.000       93.399     144.390          -67.175    -102.638
          3.000                          -1488.866                          .000
180 ----------------------------------------------------------------------------
      1    .000                          -1112.840                          .000
           .000       84.880    -122.109          -57.570      83.862
          3.000       84.880     132.532          -57.570     -88.848
          3.000                          -1112.840                          .000
181 ----------------------------------------------------------------------------
      1    .000                           -458.453                          .000
           .000       16.217     -23.411           10.765     -14.398
          3.000       16.217      25.240           10.765      17.896
          3.000                           -458.453                          .000
182 ----------------------------------------------------------------------------
      1    .000                           -845.674                          .000
           .000       13.382     -18.865          -31.979      45.620
          3.000       13.382      21.280          -31.979     -50.317
          3.000                           -845.674                          .000
183 ----------------------------------------------------------------------------
      1    .000                           -875.273                          .000
           .000       12.729     -17.976          -62.776      89.298
          3.000       12.729      20.211          -62.776     -99.029
          3.000                           -875.273                          .000
184 ----------------------------------------------------------------------------
      1    .000                           -589.718                          .000
           .000       14.911     -21.615          -56.384      78.543
          3.000       14.911      23.118          -56.384     -90.609
          3.000                           -589.718                          .000
185 ----------------------------------------------------------------------------
      1    .000                           -895.113                          .000
           .000       92.588    -131.507           17.519     -23.916
          3.000       92.588     146.257           17.519      28.640
          3.000                           -895.113                          .000
186 ----------------------------------------------------------------------------
      1    .000                          -2117.230                          .000
           .000       98.872    -140.917          -42.055      60.058
          3.000       98.872     155.699          -42.055     -66.108
          3.000                          -2117.230                          .000
187 ----------------------------------------------------------------------------
      1    .000                          -2194.234                          .000
           .000       98.872    -140.917          -65.693      93.604
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          3.000      98.872     155.699          -65.693    -103.476
          3.000                -2194.234                              .000
188 ------------------------------------------------------------------
      1    .000                -1047.470                              .000
           .000      92.588    -131.507          -67.823      93.974
          3.000      92.588     146.257          -67.823    -109.496
          3.000                -1047.470                              .000
189 ------------------------------------------------------------------
      1    .000                 -743.242                              .000
           .000      81.486    -113.466           13.527     -18.225
          3.000      81.486     130.992           13.527      22.355
          3.000                 -743.242                              .000
190 ------------------------------------------------------------------
      1    .000                -1183.121                              .000
           .000      92.406    -127.931          -29.536      42.191
          3.000      92.406     149.287          -29.536     -46.416
          3.000                -1183.121                              .000
191 ------------------------------------------------------------------
      1    .000                -1212.719                              .000
           .000      93.058    -128.819          -65.219      92.727
          3.000      93.058     150.355          -65.219    -102.930
          3.000                -1212.719                              .000
192 ------------------------------------------------------------------
      1    .000                 -874.506                              .000
           .000      82.792    -115.261          -59.146      82.370
          3.000      82.792     133.115          -59.146     -95.068
          3.000                 -874.506                              .000
193 ------------------------------------------------------------------
      1    .000                 -393.043                              .000
           .000      21.448     -32.494           -2.095       4.568
          3.000      21.448      31.850           -2.095      -1.716
          3.000                 -393.043                              .000
194 ------------------------------------------------------------------
      1    .000                 -700.172                              .000
           .000      21.463     -32.128          -22.901      33.484
          3.000      21.463      32.261          -22.901     -35.220
          3.000                 -700.172                              .000
195 ------------------------------------------------------------------
      1    .000                 -724.950                              .000
           .000      21.100     -31.634          -36.369      52.680
          3.000      21.100      31.667          -36.369     -56.427
          3.000                 -724.950                              .000
196 ------------------------------------------------------------------
      1    .000                 -475.192                              .000
           .000      20.739     -31.526          -37.383      52.981
          3.000      20.739      30.691          -37.383     -59.169
          3.000                 -475.192                              .000
197 ------------------------------------------------------------------
      1    .000                 -729.955                              .000
           .000      56.160     -81.461             .891        .307
          3.000      56.160      87.018             .891       2.980
          3.000                 -729.955                              .000
198 ------------------------------------------------------------------
      1    .000                -1709.554                              .000
           .000     104.024    -152.666          -52.788      77.274
          3.000     104.024     159.406          -52.788     -81.092
          3.000                -1709.554                              .000
199 ------------------------------------------------------------------
      1    .000                -1770.485                              .000
           .000     104.024    -152.666          -64.865      95.058
          3.000     104.024     159.406          -64.865     -99.537
          3.000                -1770.485                              .000
200 ------------------------------------------------------------------
      1    .000                 -826.930                              .000
           .000      56.160     -81.461          -43.805      61.760
          3.000      56.160      87.018          -43.805     -69.657
          3.000                 -826.930                              .000
```

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201 ----------------------------------------
      1    .000                    -575.354                        .000
           .000      56.276      -80.161          -.662        2.596
          3.000      56.276       88.668          -.662         .611
          3.000                    -575.354                        .000
202 ----------------------------------------
      1    .000                    -920.743                        .000
           .000      62.888      -89.099        -21.748       31.866
          3.000      62.888       99.566        -21.748      -33.378
          3.000                    -920.743                        .000
203 ----------------------------------------
      1    .000                    -945.521                        .000
           .000      63.251      -89.593        -37.522       54.298
          3.000      63.251      100.159        -37.522      -58.269
          3.000                    -945.521                        .000
204 ----------------------------------------
      1    .000                    -657.504                        .000
           .000      56.985      -81.128        -38.816       54.953
          3.000      56.985       89.827        -38.816      -61.496
          3.000                    -657.504                        .000
205 ----------------------------------------
      1    .000                    -317.313                        .000
           .000       8.220       -9.949          7.346      -12.312
          3.000       8.220       14.710          7.346        9.726
          3.000                    -317.313                        .000
206 ----------------------------------------
      1    .000                    -542.901                        .000
           .000       8.158      -10.284        -16.343       24.029
          3.000       8.158       14.190        -16.343      -24.999
          3.000                    -542.901                        .000
207 ----------------------------------------
      1    .000                    -565.742                        .000
           .000       7.706       -9.603        -32.317       47.703
          3.000       7.706       13.515        -32.317      -49.247
          3.000                    -565.742                        .000
208 ----------------------------------------
      1    .000                    -362.825                        .000
           .000       7.330       -8.612        -36.647       53.710
          3.000       7.330       13.378        -36.647      -56.231
          3.000                    -362.825                        .000
209 ----------------------------------------
      1    .000                    -557.372                        .000
           .000      46.165      -68.300         11.004      -17.670
          3.000      46.165       70.194         11.004       15.342
          3.000                    -557.372                        .000
210 ----------------------------------------
      1    .000                   -1285.661                        .000
           .000      74.697     -102.830        -36.585       50.374
          3.000      74.697      121.262        -36.585      -59.380
          3.000                   -1285.661                        .000
211 ----------------------------------------
      1    .000                   -1327.779                        .000
           .000      74.697     -102.830        -50.154       70.270
          3.000      74.697      121.262        -50.154      -80.192
          3.000                   -1327.779                        .000
212 ----------------------------------------
      1    .000                    -608.940                        .000
           .000      46.165      -68.300        -44.103       65.215
          3.000      46.165       70.194        -44.103      -67.094
          3.000                    -608.940                        .000
213 ----------------------------------------
      1    .000                    -424.653                        .000
           .000      51.853      -75.435          9.126      -14.980
          3.000      51.853       80.125          9.126       12.396
          3.000                    -424.653                        .000
214 ----------------------------------------
      1    .000                    -667.929                        .000
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          .000      59.149     -87.006          -14.961      21.962
         3.000      59.149      90.442          -14.961     -22.920
         3.000                            -667.929                      .000
215 ----------------------------------------------
       1    .000                            -690.770                      .000
          .000      59.601     -87.687          -33.699      49.770
         3.000      59.601      91.117          -33.699     -51.327
         3.000                            -690.770                      .000
216 ----------------------------------------------
       1    .000                            -470.166                      .000
          .000      52.743     -76.772          -38.427      56.378
         3.000      52.743      81.458          -38.427     -58.902
         3.000                            -470.166                      .000
217 ----------------------------------------------
       1    .000                            -224.067                      .000
          .000       -.710       3.753           11.854     -19.351
         3.000       -.710       1.623           11.854      16.211
         3.000                            -224.067                      .000
218 ----------------------------------------------
       1    .000                            -374.100                      .000
          .000      -2.100       5.581           -8.308      11.903
         3.000      -2.100       -.719           -8.308     -13.022
         3.000                            -374.100                      .000
219 ----------------------------------------------
       1    .000                            -391.681                      .000
          .000      -2.529       6.233          -25.473      37.323
         3.000      -2.529      -1.354          -25.473     -39.097
         3.000                            -391.681                      .000
220 ----------------------------------------------
       1    .000                            -243.335                      .000
          .000      -1.574       5.060          -31.251      45.732
         3.000      -1.574        .339          -31.251     -48.020
         3.000                            -243.335                      .000
221 ----------------------------------------------
       1    .000                            -379.584                      .000
          .000      31.551     -46.136           15.882     -25.331
         3.000      31.551      48.518           15.882      22.315
         3.000                            -379.584                      .000
222 ----------------------------------------------
       1    .000                            -864.359                      .000
          .000      51.611     -68.245          -22.443      29.236
         3.000      51.611      86.589          -22.443     -38.092
         3.000                            -864.359                      .000
223 ----------------------------------------------
       1    .000                            -890.255                      .000
          .000      51.611     -68.245          -38.116      52.094
         3.000      51.611      86.589          -38.116     -62.255
         3.000                            -890.255                      .000
224 ----------------------------------------------
       1    .000                            -399.814                      .000
          .000      31.551     -46.136          -37.613      55.518
         3.000      31.551      48.518          -37.613     -57.321
         3.000                            -399.814                      .000
225 ----------------------------------------------
       1    .000                            -275.012                      .000
          .000      42.117     -60.868           13.605     -21.994
         3.000      42.117      65.482           13.605      18.822
         3.000                            -275.012                      .000
226 ----------------------------------------------
       1    .000                            -430.317                      .000
          .000      47.391     -69.194           -6.912       9.809
         3.000      47.391      72.978           -6.912     -10.927
         3.000                            -430.317                      .000
227 ----------------------------------------------
       1    .000                            -447.898                      .000
          .000      47.820     -69.846          -26.869      39.416
         3.000      47.820      73.614          -26.869     -41.192
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          3.000                          -447.898                                .000
228 ------------------------------------------------------------------------------
        1    .000                          -294.280                                .000
             .000       42.980     -62.174          -33.002      48.375
            3.000       42.980      66.767          -33.002     -50.632
            3.000                          -294.280                                .000
229 ------------------------------------------------------------------------------
        1    .000                          -112.164                                .000
             .000      -16.093      23.554           23.064     -32.616
            3.000      -16.093     -24.723           23.064      36.578
            3.000                          -112.164                                .000
230 ------------------------------------------------------------------------------
        1    .000                          -192.937                                .000
              .000     -19.216      27.603            -.556        .022
            3.000      -19.216     -30.046            -.556      -1.647
            3.000                          -192.937                                .000
231 ------------------------------------------------------------------------------
        1    .000                          -202.115                                .000
             .000      -19.727      28.318          -18.612      26.974
            3.000      -19.727     -30.862          -18.612     -28.862
            3.000                          -202.115                                .000
232 ------------------------------------------------------------------------------
        1    .000                          -116.373                                .000
             .000      -17.151      25.031          -31.114      42.517
            3.000      -17.151     -26.423          -31.114     -50.825
            3.000                          -116.373                                .000
233 ------------------------------------------------------------------------------
        1    .000                          -196.225                                .000
             .000       17.030     -24.188           28.662     -40.265
            3.000       17.030      26.900           28.662      45.721
            3.000                          -196.225                                .000
234 ------------------------------------------------------------------------------
        1    .000                          -446.343                                .000
             .000       25.109     -29.107           -8.863       7.920
            3.000       25.109      46.220           -8.863     -18.669
            3.000                          -446.343                                .000
235 ------------------------------------------------------------------------------
        1    .000                          -457.817                                .000
             .000       25.109     -29.107          -24.066      31.626
            3.000       25.109      46.220          -24.066     -40.572
            3.000                          -457.817                                .000
236 ------------------------------------------------------------------------------
        1    .000                          -199.832                                .000
             .000       17.030     -24.188          -38.025      52.357
            3.000       17.030      26.900          -38.025     -61.717
            3.000                          -199.832                                .000
237 ------------------------------------------------------------------------------
        1    .000                          -126.919                                .000
             .000       37.827     -51.224           25.166     -35.571
            3.000       37.827      62.255           25.166      39.926
            3.000                          -126.919                                .000
238 ------------------------------------------------------------------------------
        1    .000                          -208.160                                .000
             .000       42.457     -58.086             .989      -2.220
            3.000       42.457      69.284             .989        .747
            3.000                          -208.160                                .000
239 ------------------------------------------------------------------------------
        1    .000                          -217.338                                .000
             .000       42.967     -58.802          -20.157      29.215
            3.000       42.967      70.100          -20.157     -31.256
            3.000                          -217.338                                .000
240 ------------------------------------------------------------------------------
        1    .000                          -131.127                                .000
             .000       38.885     -52.701          -33.215      45.472
            3.000       38.885      63.955          -33.215     -54.173
            3.000                          -131.127                                .000
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PROGRAM:SAP90/FILE:\1b.F3F
15 storey building - Bay size 5*5 // Fc=25MPa
F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	.000			-808.879			.000
		.000	-8.702	-9.957		9.338	-.750	
		3.000	-8.702	-36.065		9.338	27.263	
		3.000			-808.879			.000
2								
	1	.000			-2310.630			.000
		.000	-16.896	-2.275		-.643	8.608	
		3.000	-16.896	-52.963		-.643	6.679	
		3.000			-2310.630			.000
3								
	1	.000			-2353.976			.000
		.000	-16.920	-2.253		-1.897	9.783	
		3.000	-16.920	-53.012		-1.897	4.093	
		3.000			-2353.976			.000
4								
	1	.000			-1534.919			.000
		.000	-8.747	-9.915		-10.080	17.456	
		3.000	-8.747	-36.157		-10.080	-12.783	
		3.000			-1534.919			.000
5								
	1	.000			-2614.115			.000
		.000	2.555	-20.513		17.539	-8.440	
		3.000	2.555	-12.847		17.539	44.178	
		3.000			-2614.115			.000
6								
	1	.000			-6419.218			.000
		.000	.966	-58.117		-.585	25.820	
		3.000	.966	-55.219		-.585	24.064	
		3.000			-6419.218			.000
7								
	1	.000			-6549.571			.000
		.000	.966	-58.117		-.513	25.756	
		3.000	.966	-55.219		-.513	24.216	
		3.000			-6549.571			.000
8								
	1	.000			-3396.071			.000
		.000	2.555	-20.513		-18.314	25.176	
		3.000	2.555	-12.847		-18.314	-29.766	
		3.000			-3396.071			.000
9								
	1	.000			-2259.134			.000
		.000	10.613	-28.068		9.431	-.838	
		3.000	10.613	3.772		9.431	27.456	
		3.000			-2259.134			.000
10								
	1	.000			-3880.827			.000
		.000	18.821	-35.764		-.552	8.522	
		3.000	18.821	20.700		-.552	6.867	
		3.000			-3880.827			.000
11								
	1	.000			-3924.173			.000
		.000	18.845	-35.786		-1.988	9.869	
		3.000	18.845	20.749		-1.988	3.905	
		3.000			-3924.173			.000
12								
	1	.000			-2985.174			.000
		.000	10.658	-28.110		-10.173	17.543	
		3.000	10.658	3.864		-10.173	-12.976	
		3.000			-2985.174			.000
13								
	1	.000			-703.949			.000

	.000	-16.199	.795	17.724	-16.077	
	3.000	-16.199	-47.802	17.724	37.094	
	3.000		-703.949			.000
14						
1	.000		-2100.680			.000
	.000	-30.277	23.210	-1.411	13.090	
	3.000	-30.277	-67.620	-1.411	8.856	
	3.000		-2100.680			.000
15						
1	.000		-2142.934			.000
	.000	-30.348	23.304	-5.762	18.579	
	3.000	-30.348	-67.741	-5.762	1.293	
	3.000		-2142.934			.000
16						
1	.000		-1426.180			.000
	.000	-16.332	.970	-18.745	39.956	
	3.000	-16.332	-48.027	-18.745	-16.278	
	3.000		-1426.180			.000
17						
1	.000		-2402.099			.000
	.000	7.462	-34.053	31.879	-38.574	
	3.000	7.462	-11.666	31.879	57.062	
	3.000		-2402.099			.000
18						
1	.000		-5984.405			.000
	.000	-.316	-77.327	1.006	34.723	
	3.000	-.316	-78.275	1.006	37.741	
	3.000		-5984.405			.000
19						
1	.000		-6113.702			.000
	.000	-.316	-77.327	-.377	35.865	
	3.000	-.316	-78.275	-.377	34.734	
	3.000		-6113.702			.000
20						
1	.000		-3180.423			.000
	.000	7.462	-34.053	-32.993	62.577	
	3.000	7.462	-11.666	-32.993	-36.402	
	3.000		-3180.423			.000
21						
1	.000		-2145.374			.000
	.000	19.991	-54.863	18.003	-16.444	
	3.000	19.991	5.109	18.003	37.564	
	3.000		-2145.374			.000
22						
1	.000		-3662.319			.000
	.000	34.103	-77.327	-1.139	12.732	
	3.000	34.103	24.981	-1.139	9.315	
	3.000		-3662.319			.000
23						
1	.000		-3704.573			.000
	.000	34.174	-77.421	-6.034	18.937	
	3.000	34.174	25.102	-6.034	.835	
	3.000		-3704.573			.000
24						
1	.000		-2867.604			.000
	.000	20.124	-55.038	-19.024	40.323	
	3.000	20.124	5.334	-19.024	-16.748	
	3.000		-2867.604			.000
25						
1	.000		-604.189			.000
	.000	-15.093	-22.023	17.804	-4.278	
	3.000	-15.093	-67.301	17.804	49.134	
	3.000		-604.189			.000
26						
1	.000		-1898.697			.000
	.000	-26.868	-4.364	-3.549	26.039	
	3.000	-26.868	-84.968	-3.549	15.393	

	3.000		-1898.697			.000
27						
	1 .000		-1938.837			.000
	.000	-26.990	-4.196	-11.181	36.679	
	3.000	-26.990	-85.167	-11.181	3.135	
	3.000		-1938.837			.000
28						
	1 .000		-1316.593			.000
	.000	-15.319	-21.711	-19.069	49.474	
	3.000	-15.319	-67.668	-19.069	-7.733	
	3.000		-1316.593			.000
29						
	1 .000		-2195.803			.000
	.000	15.594	-64.747	29.844	-22.263	
	3.000	15.594	-17.964	29.844	67.268	
	3.000		-2195.803			.000
30						
	1 .000		-5554.344			.000
	.000	-6.345	-133.770	5.964	61.804	
	3.000	-6.345	-152.804	5.964	79.696	
	3.000		-5554.344			.000
31						
	1 .000		-5681.521			.000
	.000	-6.345	-133.770	2.307	66.833	
	3.000	-6.345	-152.804	2.307	73.753	
	3.000		-5681.521			.000
32						
	1 .000		-2964.567			.000
	.000	15.594	-64.747	-31.434	67.831	
	3.000	15.594	-17.964	-31.434	-26.469	
	3.000		-2964.567			.000
33						
	1 .000		-2023.627			.000
	.000	21.334	-75.157	18.276	-4.929	
	3.000	21.334	-11.155	18.276	49.900	
	3.000		-2023.627			.000
34						
	1 .000		-3438.724			.000
	.000	33.498	-93.203	-3.089	25.405	
	3.000	33.498	7.293	-3.089	16.138	
	3.000		-3438.724			.000
35						
	1 .000		-3478.865			.000
	.000	33.621	-93.371	-11.641	37.314	
	3.000	33.621	7.492	-11.641	2.390	
	3.000		-3478.865			.000
36						
	1 .000		-2736.030			.000
	.000	21.560	-75.468	-19.541	50.125	
	3.000	21.560	-10.788	-19.541	-8.499	
	3.000		-2736.030			.000
37						
	1 .000		-520.344			.000
	.000	-15.929	-70.166	19.849	19.628	
	3.000	-15.929	-117.952	19.849	79.177	
	3.000		-520.344			.000
38						
	1 .000		-1711.499			.000
	.000	-26.844	-53.305	-9.533	60.898	
	3.000	-26.844	-133.838	-9.533	32.300	
	3.000		-1711.499			.000
39						
	1 .000		-1748.721			.000
	.000	-27.009	-53.066	-19.534	75.377	
	3.000	-27.009	-134.095	-19.534	16.774	
	3.000		-1748.721			.000
40						

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      1    .000                          -1210.040                          .000
           .000      -16.231     -69.727          -19.130      78.471
          3.000      -16.231    -118.421          -19.130      21.081
          3.000                          -1210.040                          .000
41 ----------------------------------------------------------------------------
      1    .000                          -1998.498                          .000
           .000       31.028    -134.758           31.172       2.167
          3.000       31.028     -41.674           31.172      95.682
          3.000                          -1998.498                          .000
42 ----------------------------------------------------------------------------
      1    .000                          -5127.523                          .000
           .000      -15.318    -276.159           14.033     136.515
          3.000      -15.318    -322.114           14.033     178.613
          3.000                          -5127.523                          .000
43 ----------------------------------------------------------------------------
      1    .000                          -5251.338                          .000
           .000      -15.318    -276.159            8.761     143.893
          3.000      -15.318    -322.114            8.761     170.176
          3.000                          -5251.338                          .000
44 ----------------------------------------------------------------------------
      1    .000                          -2744.546                          .000
           .000       31.028    -134.758          -31.018      96.760
          3.000       31.028     -41.674          -31.018       3.707
          3.000                          -2744.546                          .000
45 ----------------------------------------------------------------------------
      1    .000                          -1891.728                          .000
           .000       22.436    -128.129           20.482      18.712
          3.000       22.436     -60.821           20.482      80.159
          3.000                          -1891.728                          .000
46 ----------------------------------------------------------------------------
      1    .000                          -3203.234                          .000
           .000       34.106    -146.113           -8.915      60.005
          3.000       34.106     -43.794           -8.915      33.260
          3.000                          -3203.234                          .000
47 ----------------------------------------------------------------------------
      1    .000                          -3240.456                          .000
           .000       34.272    -146.353          -20.152      76.269
          3.000       34.272     -43.538          -20.152      15.814
          3.000                          -3240.456                          .000
48 ----------------------------------------------------------------------------
      1    .000                          -2581.424                          .000
           .000       22.738    -128.567          -19.763      79.386
          3.000       22.738     -60.352          -19.763      20.099
          3.000                          -2581.424                          .000
49 ----------------------------------------------------------------------------
      1    .000                           -477.955                          .000
           .000       68.850    -190.933          -24.197      84.485
          3.000       68.850      15.618          -24.197      11.894
          3.000                           -477.955                          .000
50 ----------------------------------------------------------------------------
      1    .000                          -1555.392                          .000
           .000       58.204    -175.299          -74.055     150.559
          3.000       58.204       -.688          -74.055     -71.605
          3.000                          -1555.392                          .000
51 ----------------------------------------------------------------------------
      1    .000                          -1589.558                          .000
           .000       57.950    -174.959          -88.391     170.149
          3.000       57.950      -1.111          -88.391     -95.023
          3.000                          -1589.558                          .000
52 ----------------------------------------------------------------------------
      1    .000                          -1113.851                          .000
           .000       68.396    -190.321          -72.015     150.867
          3.000       68.396      14.865          -72.015     -65.177
          3.000                          -1113.851                          .000
53 ----------------------------------------------------------------------------
      1    .000                          -1819.305                          .000
           .000      154.145    -303.158          -12.375      67.511
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          3.000     154.145     159.279         -12.375      30.386
          3.000                -1819.305                              .000
54 ----------------------------------------------
      1    .000                -4704.437                              .000
           .000     203.364    -597.316        -105.608     314.485
          3.000     203.364      12.777        -105.608      -2.341
          3.000                -4704.437                              .000
55 ----------------------------------------------
      1    .000                -4823.870                              .000
           .000     203.364    -597.316        -113.384     325.147
          3.000     203.364      12.777        -113.384     -15.003
          3.000                -4823.870                              .000
56 ----------------------------------------------
      1    .000                -2510.775                              .000
           .000     154.145    -303.158         -85.953     170.164
          3.000     154.145     159.279         -85.953     -87.695
          3.000                -2510.775                              .000
57 ----------------------------------------------
      1    .000                -1742.380                              .000
           .000     115.803    -256.116         -23.249      83.207
          3.000     115.803      91.292         -23.249      13.459
          3.000                -1742.380                              .000
58 ----------------------------------------------
      1    .000                -2938.470                              .000
           .000     129.939    -275.455         -73.132     149.313
          3.000     129.939     114.363         -73.132     -70.083
          3.000                -2938.470                              .000
59 ----------------------------------------------
      1    .000                -2972.636                              .000
           .000     130.193    -275.795         -89.314     171.395
          3.000     130.193     114.785         -89.314     -96.545
          3.000                -2972.636                              .000
60 ----------------------------------------------
      1    .000                -2378.275                              .000
           .000     116.257    -256.727         -72.962     152.145
          3.000     116.257      92.044         -72.962     -66.743
          3.000                -2378.275                              .000
61 ----------------------------------------------
      1    .000                 -472.309                              .000
           .000      65.064    -120.024         -24.855      49.890
          3.000      65.064      75.167         -24.855     -24.677
          3.000                 -472.309                              .000
62 ----------------------------------------------
      1    .000                -1427.783                              .000
           .000      59.823    -111.961         -68.118     109.002
          3.000      59.823      67.509         -68.118     -95.353
          3.000                -1427.783                              .000
63 ----------------------------------------------
      1    .000                -1460.112                              .000
           .000      59.586    -111.646         -80.200     125.371
          3.000      59.586      67.114         -80.200    -115.228
          3.000                -1460.112                              .000
64 ----------------------------------------------
      1    .000                -1027.223                              .000
           .000      64.634    -119.455         -62.742     101.681
          3.000      64.634      74.446         -62.742     -86.546
          3.000                -1027.223                              .000
65 ----------------------------------------------
      1    .000                -1656.979                              .000
           .000     141.001    -223.384         -17.640      39.414
          3.000     141.001     199.617         -17.640     -13.505
          3.000                -1656.979                              .000
66 ----------------------------------------------
      1    .000                -4283.265                              .000
           .000     211.186    -407.382        -111.456     212.698
          3.000     211.186     226.176        -111.456    -121.670
          3.000                -4283.265                              .000
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67 ----------------------------------------
     1    .000                    -4396.053                          .000
          .000     211.186     -407.382       -118.012     222.068
         3.000     211.186      226.176       -118.012    -131.969
         3.000                    -4396.053                          .000
68 ----------------------------------------
     1    .000                    -2263.574                          .000
          .000     141.001     -223.384        -73.513     116.542
         3.000     141.001      199.617        -73.513    -103.996
         3.000                    -2263.574                          .000
69 ----------------------------------------
     1    .000                    -1579.280                          .000
          .000     102.333     -170.943        -23.976      48.722
         3.000     102.333      136.057        -23.976     -23.205
         3.000                    -1579.280                          .000
70 ----------------------------------------
     1    .000                    -2645.678                          .000
          .000     114.013     -186.850        -67.279     107.882
         3.000     114.013      155.189        -67.279     -93.955
         3.000                    -2645.678                          .000
71 ----------------------------------------
     1    .000                    -2678.007                          .000
          .000     114.250     -187.166        -81.039     126.490
         3.000     114.250      155.584        -81.039    -116.626
         3.000                    -2678.007                          .000
72 ----------------------------------------
     1    .000                    -2134.193                          .000
          .000     102.763     -171.511        -63.622     102.849
         3.000     102.763      136.778        -63.622     -88.017
         3.000                    -2134.193                          .000
73 ----------------------------------------
     1    .000                     -479.199                          .000
          .000      56.625      -84.984        -17.204      25.036
         3.000      56.625       84.891        -17.204     -26.576
         3.000                     -479.199                          .000
74 ----------------------------------------
     1    .000                    -1314.019                          .000
          .000      51.891      -77.810        -68.925     103.804
         3.000      51.891       77.862        -68.925    -102.971
         3.000                    -1314.019                          .000
75 ----------------------------------------
     1    .000                    -1346.009                          .000
          .000      51.569      -77.334        -85.198     127.689
         3.000      51.569       77.373        -85.198    -127.905
         3.000                    -1346.009                          .000
76 ----------------------------------------
     1    .000                     -943.331                          .000
          .000      56.026      -84.101        -63.911      95.343
         3.000      56.026       83.976        -63.911     -96.390
         3.000                     -943.331                          .000
77 ----------------------------------------
     1    .000                    -1503.706                          .000
          .000     148.599     -224.777         -9.819      13.702
         3.000     148.599      221.021         -9.819     -15.754
         3.000                    -1503.706                          .000
78 ----------------------------------------
     1    .000                    -3861.666                          .000
          .000     176.505     -263.168        -90.308     131.819
         3.000     176.505      266.346        -90.308    -139.106
         3.000                    -3861.666                          .000
79 ----------------------------------------
     1    .000                    -3965.149                          .000
          .000     176.505     -263.168        -98.357     143.483
         3.000     176.505      266.346        -98.357    -151.588
         3.000                    -3965.149                          .000
80 ----------------------------------------
     1    .000                    -2012.329                          .000
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          .000     148.599    -224.777          -75.912     113.971
         3.000     148.599     221.021          -75.912    -113.765
         3.000                -2012.329                              .000
81 ----------------------------------------------
      1    .000                -1409.499                              .000
          .000     102.527    -154.133          -15.980      23.236
         3.000     102.527     153.448          -15.980     -24.705
         3.000                -1409.499                              .000
82 ----------------------------------------------
      1    .000                -2340.741                              .000
          .000     115.629    -174.626          -67.763     102.097
         3.000     115.629     172.262          -67.763    -101.191
         3.000                -2340.741                              .000
83 ----------------------------------------------
      1    .000                -2372.732                              .000
          .000     115.951    -175.102          -86.360     129.396
         3.000     115.951     172.752          -86.360    -129.685
         3.000                -2372.732                              .000
84 ----------------------------------------------
      1    .000                -1873.631                              .000
          .000     103.127    -155.016          -65.135      97.143
         3.000     103.127     154.363          -65.135     -98.261
         3.000                -1873.631                              .000
85 ----------------------------------------------
      1    .000                 -481.229                              .000
          .000      50.268     -68.946          -13.310      16.420
         3.000      50.268      81.859          -13.310     -23.510
         3.000                 -481.229                              .000
86 ----------------------------------------------
      1    .000                -1200.758                              .000
          .000      46.050     -62.410          -62.572      90.463
         3.000      46.050      75.738          -62.572     -97.254
         3.000                -1200.758                              .000
87 ----------------------------------------------
      1    .000                -1230.721                              .000
          .000      45.690     -61.885          -81.011     117.469
         3.000      45.690      75.185          -81.011    -125.564
         3.000                -1230.721                              .000
88 ----------------------------------------------
      1    .000                 -856.057                              .000
          .000      49.586     -67.952          -61.551      87.702
         3.000      49.586      80.806          -61.551     -96.952
         3.000                 -856.057                              .000
89 ----------------------------------------------
      1    .000                -1351.744                              .000
          .000     138.419    -201.418           -6.627       6.270
         3.000     138.419     213.840           -6.627     -13.611
         3.000                -1351.744                              .000
90 ----------------------------------------------
      1    .000                -3442.514                              .000
          .000     161.848    -215.042          -82.185     106.969
         3.000     161.848     270.501          -82.185    -139.586
         3.000                -3442.514                              .000
91 ----------------------------------------------
      1    .000                -3536.166                              .000
          .000     161.848    -215.042          -91.327     120.451
         3.000     161.848     270.501          -91.327    -153.531
         3.000                -3536.166                              .000
92 ----------------------------------------------
      1    .000                -1764.991                              .000
          .000     138.419    -201.418          -72.320     103.898
         3.000     138.419     213.840          -72.320    -113.062
         3.000                -1764.991                              .000
93 ----------------------------------------------
      1    .000                -1235.861                              .000
          .000      97.565    -138.838          -11.913      14.384
         3.000      97.565     153.858          -11.913     -21.355
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        3.000                          -1235.861                          .000
94 ----------------------------------------------
     1    .000                          -2039.437                          .000
           .000     109.018    -156.074          -61.244      88.525
          3.000     109.018     170.980          -61.244     -95.208
          3.000                          -2039.437                          .000
95 ----------------------------------------------
     1    .000                          -2069.400                          .000
           .000     109.377    -156.599          -82.339     119.407
          3.000     109.377     171.533          -82.339    -127.610
          3.000                          -2069.400                          .000
96 ----------------------------------------------
     1    .000                          -1610.689                          .000
           .000      98.248    -139.832          -62.948      89.739
          3.000      98.248     154.911          -62.948     -99.106
          3.000                          -1610.689                          .000
97 ----------------------------------------------
     1    .000                           -471.787                          .000
           .000      43.163     -54.534           -9.361       8.162
          3.000      43.163      74.955           -9.361     -19.923
          3.000                           -471.787                          .000
98 ----------------------------------------------
     1    .000                          -1082.866                          .000
           .000      39.063     -48.526          -55.048      78.484
          3.000      39.063      68.662          -55.048     -86.659
          3.000                          -1082.866                          .000
99 ----------------------------------------------
     1    .000                          -1109.672                          .000
           .000      38.682     -47.953          -75.006     108.249
          3.000      38.682      68.093          -75.006    -116.770
          3.000                          -1109.672                          .000
100 ----------------------------------------------
     1    .000                           -763.663                          .000
           .000      42.431     -53.434          -58.141      82.119
          3.000      42.431      73.860          -58.141     -92.304
          3.000                           -763.663                          .000
101 ----------------------------------------------
     1    .000                          -1198.344                          .000
           .000     125.156    -180.623           -3.146      -1.290
          3.000     125.156     194.845           -3.146     -10.729
          3.000                          -1198.344                          .000
102 ----------------------------------------------
     1    .000                          -3024.695                          .000
           .000     148.786    -179.690          -74.970      88.534
          3.000     148.786     266.668          -74.970    -136.376
          3.000                          -3024.695                          .000
103 ----------------------------------------------
     1    .000                          -3107.929                          .000
           .000     148.786    -179.690          -84.961     103.255
          3.000     148.786     266.668          -84.961    -151.629
          3.000                          -3107.929                          .000
104 ----------------------------------------------
     1    .000                          -1523.347                          .000
           .000     125.156    -180.623          -67.687      97.058
          3.000     125.156     194.845          -67.687    -106.001
          3.000                          -1523.347                          .000
105 ----------------------------------------------
     1    .000                          -1061.955                          .000
           .000      90.846    -126.902           -7.854       5.901
          3.000      90.846     145.635           -7.854     -17.660
          3.000                          -1061.955                          .000
106 ----------------------------------------------
     1    .000                          -1746.113                          .000
           .000     100.630    -142.428          -53.609      76.333
          3.000     100.630     159.462          -53.609     -84.493
          3.000                          -1746.113                          .000
107 ----------------------------------------------
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      1    .000                          -1772.919                          .000
           .000      101.011    -143.001          -76.446     110.401
          3.000      101.011     160.031          -76.446    -118.936
          3.000                          -1772.919                          .000
108 ----------------------------------------------
      1    .000                          -1353.831                          .000
           .000       91.577    -128.002          -59.649      84.379
          3.000       91.577     146.731          -59.649     -94.567
          3.000                          -1353.831                          .000
109 ----------------------------------------------
      1    .000                           -448.927                          .000
           .000       31.774     -40.093            -.084      -1.923
          3.000       31.774      55.230            -.084      -2.175
          3.000                           -448.927                          .000
110 ----------------------------------------------
      1    .000                           -958.432                          .000
           .000       27.857     -33.975          -50.371      69.214
          3.000       27.857      49.596          -50.371     -81.899
          3.000                           -958.432                          .000
111 ----------------------------------------------
      1    .000                           -980.503                          .000
           .000       27.365     -33.300          -75.504     104.275
          3.000       27.365      48.796          -75.504    -122.236
          3.000                           -980.503                          .000
112 ----------------------------------------------
      1    .000                           -665.270                          .000
           .000       30.828     -38.793          -59.696      80.821
          3.000       30.828      53.692          -59.696     -98.266
          3.000                           -665.270                          .000
113 ----------------------------------------------
      1    .000                          -1042.474                          .000
           .000      121.905    -167.768            6.585     -11.551
          3.000      121.905     197.947            6.585       8.203
          3.000                          -1042.474                          .000
114 ----------------------------------------------
      1    .000                          -2608.946                          .000
           .000      112.254    -141.168          -53.534      66.933
          3.000      112.254     195.594          -53.534     -93.669
          3.000                          -2608.946                          .000
115 ----------------------------------------------
      1    .000                          -2681.993                          .000
           .000      112.254    -141.168          -65.600      84.084
          3.000      112.254     195.594          -65.600    -112.716
          3.000                          -2681.993                          .000
116 ----------------------------------------------
      1    .000                          -1288.280                          .000
           .000      121.905    -167.768          -70.603      95.821
          3.000      121.905     197.947          -70.603    -115.989
          3.000                          -1288.280                          .000
117 ----------------------------------------------
      1    .000                           -887.937                          .000
           .000       90.139    -120.992            1.857      -4.601
          3.000       90.139     149.425            1.857        .970
          3.000                           -887.937                          .000
118 ----------------------------------------------
      1    .000                          -1462.780                          .000
           .000      101.225    -136.064          -48.532      66.666
          3.000      101.225     167.610          -48.532     -78.930
          3.000                          -1462.780                          .000
119 ----------------------------------------------
      1    .000                          -1484.851                          .000
           .000      101.716    -136.739          -77.343     106.824
          3.000      101.716     168.409          -77.343    -125.205
          3.000                          -1484.851                          .000
120 ----------------------------------------------
      1    .000                          -1104.280                          .000
           .000       91.085    -122.293          -61.636      83.498
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          3.000      91.085     150.963         -61.636    -101.411
          3.000                -1104.280                              .000
121 ----------------------------------------------------
       1    .000                -412.018                               .000
            .000      27.900     -38.003          -4.305       6.054
          3.000       27.900      45.697          -4.305      -6.863
          3.000                  -412.018                              .000
122 ----------------------------------------------------
       1    .000                -826.713                               .000
            .000      27.754     -37.089         -34.836      48.688
          3.000       27.754      46.174         -34.836     -55.821
          3.000                  -826.713                              .000
123 ----------------------------------------------------
       1    .000                -845.179                               .000
            .000      27.403     -36.612         -50.749      70.833
          3.000       27.403      45.597         -50.749     -81.415
          3.000                  -845.179                              .000
124 ----------------------------------------------------
       1    .000                -562.460                               .000
            .000      27.211     -37.074         -45.275      61.887
          3.000       27.211      44.559         -45.275     -73.937
          3.000                  -562.460                              .000
125 ----------------------------------------------------
       1    .000                -883.820                               .000
            .000      81.203    -112.967          -1.170       1.367
          3.000       81.203     130.643          -1.170      -2.142
          3.000                  -883.820                              .000
126 ----------------------------------------------------
       1    .000                -2191.134                              .000
            .000     133.728    -179.085         -71.696      96.452
          3.000      133.728     222.098         -71.696    -118.637
          3.000                 -2191.134                              .000
127 ----------------------------------------------------
       1    .000                -2252.060                              .000
            .000     133.728    -179.085         -79.030     107.649
          3.000      133.728     222.098         -79.030    -129.440
          3.000                 -2252.060                              .000
128 ----------------------------------------------------
       1    .000                -1057.745                              .000
            .000      81.203    -112.967         -52.871      72.258
          3.000       81.203     130.643         -52.871     -86.356
          3.000                 -1057.745                              .000
129 ----------------------------------------------------
       1    .000                -719.253                               .000
            .000      68.443     -93.134          -2.937       4.196
          3.000       68.443     112.196          -2.937      -4.616
          3.000                  -719.253                              .000
130 ----------------------------------------------------
       1    .000                -1186.843                              .000
            .000      76.719    -104.285         -33.600      46.991
          3.000       76.719     125.873         -33.600     -53.810
          3.000                 -1186.843                              .000
131 ----------------------------------------------------
       1    .000                -1205.309                              .000
            .000      77.071    -104.761         -51.985      72.530
          3.000       77.071     126.450         -51.985     -83.425
          3.000                 -1205.309                              .000
132 ----------------------------------------------------
       1    .000                -869.695                               .000
            .000      69.132     -94.063         -46.643      63.745
          3.000       69.132     113.334         -46.643     -76.184
          3.000                  -869.695                              .000
133 ----------------------------------------------------
       1    .000                -356.883                               .000
            .000      17.345     -18.934           3.504      -9.496
          3.000       17.345      33.102           3.504       1.017
          3.000                  -356.883                              .000
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134 ----------------------------------------
      1    .000                    -684.469                          .000
           .000      17.546      -19.747        -28.803      41.189
          3.000      17.546       32.889        -28.803     -45.219
          3.000                    -684.469                          .000
135 ----------------------------------------
      1    .000                    -700.970                          .000
           .000      17.126      -19.104        -48.374      70.340
          3.000      17.126       32.275        -48.374     -74.782
          3.000                    -700.970                          .000
136 ----------------------------------------
      1    .000                    -455.035                          .000
           .000      16.504      -17.648        -45.074      64.977
          3.000      16.504       31.864        -45.074     -70.246
          3.000                    -455.035                          .000
137 ----------------------------------------
      1    .000                    -720.608                          .000
           .000      73.421     -106.576          6.629     -14.206
          3.000      73.421      113.689          6.629       5.681
          3.000                    -720.608                          .000
138 ----------------------------------------
      1    .000                   -1766.475                          .000
           .000      96.442     -103.602        -50.680      54.557
          3.000      96.442      185.724        -50.680     -97.484
          3.000                   -1766.475                          .000
139 ----------------------------------------
      1    .000                   -1812.215                          .000
           .000      96.442     -103.602        -58.664      65.970
          3.000      96.442      185.724        -58.664    -110.022
          3.000                   -1812.215                          .000
140 ----------------------------------------
      1    .000                    -833.395                          .000
           .000      73.421     -106.576        -52.977      77.693
          3.000      73.421      113.689        -52.977     -81.237
          3.000                    -833.395                          .000
141 ----------------------------------------
      1    .000                    -560.267                          .000
           .000      65.496      -92.830          5.177     -12.039
          3.000      65.496      103.659          5.177       3.493
          3.000                    -560.267                          .000
142 ----------------------------------------
      1    .000                    -922.273                          .000
           .000      73.786     -106.520        -27.293      38.912
          3.000      73.786      114.838        -27.293     -42.966
          3.000                    -922.273                          .000
143 ----------------------------------------
      1    .000                    -938.774                          .000
           .000      74.205     -107.163        -49.884      72.617
          3.000      74.205      115.452        -49.884     -77.035
          3.000                    -938.774                          .000
144 ----------------------------------------
      1    .000                    -658.418                          .000
           .000      66.338      -94.116        -46.747      67.520
          3.000      66.338      104.898        -46.747     -72.722
          3.000                    -658.418                          .000
145 ----------------------------------------
      1    .000                    -284.207                          .000
           .000       2.804       -2.041         13.964     -20.291
          3.000       2.804        6.371         13.964      21.601
          3.000                    -284.207                          .000
146 ----------------------------------------
      1    .000                    -532.389                          .000
           .000       3.010       -1.834        -20.189      27.739
          3.000       3.010        7.195        -20.189     -32.827
          3.000                    -532.389                          .000
147 ----------------------------------------
      1    .000                    -544.426                          .000
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          .000       2.508      -1.140         -43.328       60.772
         3.000       2.508       6.385         -43.328      -69.212
         3.000                            -544.426                        .000
148 ------------------------------------------------------------------
       1    .000                            -339.821                        .000
            .000       1.773       -.619         -44.566       60.647
         3.000         1.773       4.700         -44.566      -73.050
         3.000                            -339.821                        .000
149 ------------------------------------------------------------------
       1    .000                            -553.661                        .000
            .000      60.555     -84.256          17.392      -25.250
         3.000        60.555      97.408          17.392       26.926
         3.000                            -553.661                        .000
150 ------------------------------------------------------------------
       1    .000                           -1343.832                        .000
            .000      69.660     -74.943         -35.932       37.566
         3.000        69.660     134.036         -35.932      -70.231
         3.000                           -1343.832                        .000
151 ------------------------------------------------------------------
       1    .000                           -1376.388                        .000
            .000      69.660     -74.943         -44.542       50.691
         3.000        69.660     134.036         -44.542      -82.935
         3.000                           -1376.388                        .000
152 ------------------------------------------------------------------
       1    .000                            -618.369                        .000
            .000      60.555     -84.256         -52.496       71.666
         3.000        60.555      97.408         -52.496      -85.824
         3.000                            -618.369                        .000
153 ------------------------------------------------------------------
       1    .000                            -401.183                        .000
            .000      61.106     -82.468          15.995      -23.115
         3.000        61.106     100.849          15.995       24.871
         3.000                            -401.183                        .000
154 ------------------------------------------------------------------
       1    .000                            -672.114                        .000
            .000      68.717     -92.987         -18.397       25.212
         3.000        68.717     113.164         -18.397      -29.977
         3.000                            -672.114                        .000
155 ------------------------------------------------------------------
       1    .000                            -684.151                        .000
            .000      69.219     -93.682         -45.120       63.299
         3.000        69.219     113.974         -45.120      -72.061
         3.000                            -684.151                        .000
156 ------------------------------------------------------------------
       1    .000                            -456.797                        .000
            .000      62.137     -83.891         -46.597       63.472
         3.000        62.137     102.520         -46.597      -76.320
         3.000                            -456.797                        .000
157 ------------------------------------------------------------------
       1    .000                            -200.118                        .000
            .000       7.507      -10.417          3.082       -4.243
         3.000         7.507       12.104          3.082        5.003
         3.000                            -200.118                        .000
158 ------------------------------------------------------------------
       1    .000                            -369.673                        .000
            .000       7.740      -10.844         -12.443       17.755
         3.000         7.740       12.377         -12.443      -19.575
         3.000                            -369.673                        .000
159 ------------------------------------------------------------------
       1    .000                            -378.233                        .000
            .000       7.487      -10.493         -22.383       31.934
         3.000         7.487       11.969         -22.383      -35.216
         3.000                            -378.233                        .000
160 ------------------------------------------------------------------
       1    .000                            -223.950                        .000
            .000       6.985       -9.692         -26.358       36.680
         3.000         6.985       11.264         -26.358      -42.393
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          3.000                          -223.950                          .000
161 ----------------------------------------------------------------------------
        1    .000                          -380.410                          .000
             .000       31.963     -45.530            4.821      -6.585
            3.000       31.963      50.360            4.821       7.878
            3.000                          -380.410                          .000
162 ----------------------------------------------------------------------------
        1    .000                          -911.533                          .000
              .000       55.964     -73.908          -31.561      42.108
            3.000       55.964      93.982          -31.561     -52.576
            3.000                          -911.533                          .000
163 ----------------------------------------------------------------------------
        1    .000                          -930.877                          .000
             .000       55.964     -73.908          -33.928      45.324
            3.000       55.964      93.982          -33.928     -56.461
            3.000                          -930.877                          .000
164 ----------------------------------------------------------------------------
        1    .000                          -407.922                          .000
             .000       31.963     -45.530          -30.119      41.984
            3.000       31.963      50.360          -30.119     -48.371
            3.000                          -407.922                          .000
165 ----------------------------------------------------------------------------
        1    .000                          -252.329                          .000
             .000       37.271     -51.675            4.072      -5.627
            3.000       37.271      60.139            4.072       6.589
            3.000                          -252.329                          .000
166 ----------------------------------------------------------------------------
        1    .000                          -432.562                          .000
             .000       40.696     -56.601          -11.632      16.606
            3.000       40.696      65.487          -11.632     -18.289
            3.000                          -432.562                          .000
167 ----------------------------------------------------------------------------
        1    .000                          -441.123                          .000
             .000       40.949     -56.953          -23.195      33.083
            3.000       40.949      65.895          -23.195     -36.501
            3.000                          -441.123                          .000
168 ----------------------------------------------------------------------------
        1    .000                          -276.161                          .000
             .000       37.793     -52.400          -27.347      38.064
            3.000       37.793      60.979          -27.347     -43.978
            3.000                          -276.161                          .000
169 ----------------------------------------------------------------------------
        1    .000                          -102.999                          .000
             .000      -11.305      17.311           17.359     -25.009
            3.000      -11.305     -16.603           17.359      27.069
            3.000                          -102.999                          .000
170 ----------------------------------------------------------------------------
        1    .000                          -191.039                          .000
             .000      -12.219      18.168           -4.527       5.831
            3.000      -12.219     -18.489           -4.527      -7.750
            3.000                          -191.039                          .000
171 ----------------------------------------------------------------------------
        1    .000                          -196.395                          .000
             .000      -12.593      18.695          -15.627      22.614
            3.000      -12.593     -19.085          -15.627     -24.267
            3.000                          -196.395                          .000
172 ----------------------------------------------------------------------------
        1    .000                          -108.836                          .000
             .000      -12.083      18.403          -27.497      37.564
            3.000      -12.083     -17.844          -27.497     -44.928
            3.000                          -108.836                          .000
173 ----------------------------------------------------------------------------
        1    .000                          -196.735                          .000
             .000       18.138     -25.854           20.751     -29.510
            3.000       18.138      28.562           20.751      32.742
            3.000                          -196.735                          .000
174 ----------------------------------------------------------------------------
```

	1	.000		-465.629		.000
		.000	27.356	-31.729	-18.443	21.014
		3.000	27.356	50.339	-18.443	-34.316
		3.000		-465.629		.000
175						
	1	.000		-474.033		.000
		.000	27.356	-31.729	-16.276	20.490
		3.000	27.356	50.339	-16.276	-28.338
		3.000		-474.033		.000
176						
	1	.000		-203.002		.000
		.000	18.138	-25.854	-32.475	44.740
		3.000	18.138	28.562	-32.475	-52.684
		3.000		-203.002		.000
177						
	1	.000		-117.918		.000
		.000	34.112	-46.132	18.780	-27.018
		3.000	34.112	56.204	18.780	29.322
		3.000		-117.918		.000
178						
	1	.000		-208.374		.000
		.000	37.603	-51.545	-3.488	4.322
		3.000	37.603	61.263	-3.488	-6.143
		3.000		-208.374		.000
179						
	1	.000		-213.731		.000
		.000	37.977	-52.073	-16.666	24.123
		3.000	37.977	61.859	-16.666	-25.874
		3.000		-213.731		.000
180						
	1	.000		-123.755		.000
		.000	34.890	-47.225	-28.918	39.573
		3.000	34.890	57.445	-28.918	-47.181
		3.000		-123.755		.000

PROGRAM:SAP90/FILE:\1c.F3F
10 storey building - Bay size 5*5 // Fc=25MPa
F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	.000			-734.353			.000
		.000	-7.682	.127		8.522	-4.776	
		3.000	-7.682	-22.919		8.522	20.789	
		3.000			-734.353			.000
2								
	1	.000			-1749.249			.000
		.000	-14.991	7.119		-1.036	4.368	
		3.000	-14.991	-37.853		-1.036	1.260	
		3.000			-1749.249			.000
3								
	1	.000			-1750.932			.000
		.000	-15.011	7.139		-1.843	5.140	
		3.000	-15.011	-37.894		-1.843	-.389	
		3.000			-1750.932			.000
4								
	1	.000			-1046.932			.000
		.000	-7.714	.158		-10.011	12.954	
		3.000	-7.714	-22.985		-10.011	-17.079	
		3.000			-1046.932			.000
5								
	1	.000			-1866.318			.000
		.000	2.789	-9.890		15.839	-11.776	
		3.000	2.789	-1.523		15.839	35.742	
		3.000			-1866.318			.000
6								
	1	.000			-4365.359			.000
		.000	3.553	-30.995		-2.773	15.509	
		3.000	3.553	-20.336		-2.773	7.189	
		3.000			-4365.359			.000
7								
	1	.000			-4404.751			.000
		.000	3.553	-30.995		-1.158	14.032	
		3.000	3.553	-20.336		-1.158	10.556	
		3.000			-4404.751			.000
8								
	1	.000			-2208.552			.000
		.000	2.789	-9.890		-17.396	20.019	
		3.000	2.789	-1.523		-17.396	-32.169	
		3.000			-2208.552			.000
9								
	1	.000			-1356.751			.000
		.000	10.792	-17.546		8.588	-4.839	
		3.000	10.792	14.830		8.588	20.925	
		3.000			-1356.751			.000
10								
	1	.000			-2435.125			.000
		.000	18.193	-24.627		-.973	4.307	
		3.000	18.193	29.953		-.973	1.389	
		3.000			-2435.125			.000
11								
	1	.000			-2436.808			.000
		.000	18.213	-24.646		-1.906	5.200	
		3.000	18.213	29.994		-1.906	-.518	
		3.000			-2436.808			.000
12								
	1	.000			-1669.330			.000
		.000	10.825	-17.577		-10.077	13.017	
		3.000	10.825	14.896		-10.077	-17.215	
		3.000			-1669.330			.000
13								
	1	.000			-629.405			.000

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          .000     -14.197      14.183          16.063     -21.093
         3.000     -14.197     -28.407          16.063      27.096
         3.000                 -629.405                              .000
14 ----------------------------------------------------------------
     1    .000                 -1539.662                             .000
          .000     -26.415      33.815          -1.820       6.401
         3.000     -26.415     -45.432          -1.820        .941
         3.000                 -1539.662                             .000
15 ----------------------------------------------------------------
     1    .000                 -1540.664                             .000
          .000     -26.475      33.894          -5.350      10.655
         3.000     -26.475     -45.532          -5.350      -5.395
         3.000                 -1540.664                             .000
16 ----------------------------------------------------------------
     1    .000                  -938.922                             .000
          .000     -14.293      14.311         -18.893      32.487
         3.000     -14.293     -28.570         -18.893     -24.191
         3.000                  -938.922                             .000
17 ----------------------------------------------------------------
     1    .000                 -1654.879                             .000
          .000       7.141     -17.608          28.419     -40.865
         3.000       7.141       3.813          28.419      44.392
         3.000                 -1654.879                             .000
18 ----------------------------------------------------------------
     1    .000                 -3924.075                             .000
          .000       4.870     -38.371          -3.542      20.063
         3.000       4.870     -23.762          -3.542       9.438
         3.000                 -3924.075                             .000
19 ----------------------------------------------------------------
     1    .000                 -3962.661                             .000
          .000       4.870     -38.371          -1.760      16.544
         3.000       4.870     -23.762          -1.760      11.264
         3.000                 -3962.661                             .000
20 ----------------------------------------------------------------
     1    .000                 -1994.000                             .000
          .000       7.141     -17.608         -31.468      52.542
         3.000       7.141       3.813         -31.468     -41.862
         3.000                 -1994.000                             .000
21 ----------------------------------------------------------------
     1    .000                 -1245.018                             .000
          .000      20.666     -39.244          16.261     -21.354
         3.000      20.666      22.753          16.261      27.428
         3.000                 -1245.018                             .000
22 ----------------------------------------------------------------
     1    .000                 -2218.595                             .000
          .000      33.197     -59.275          -1.632       6.153
         3.000      33.197      40.316          -1.632       1.257
         3.000                 -2218.595                             .000
23 ----------------------------------------------------------------
     1    .000                 -2219.597                             .000
          .000      33.257     -59.354          -5.538      10.904
         3.000      33.257      40.417          -5.538      -5.711
         3.000                 -2219.597                             .000
24 ----------------------------------------------------------------
     1    .000                 -1554.535                             .000
          .000      20.762     -39.372         -19.091      32.749
         3.000      20.762      22.915         -19.091     -24.523
         3.000                 -1554.535                             .000
25 ----------------------------------------------------------------
     1    .000                  -526.047                             .000
          .000     -12.659       3.758          15.649     -15.685
         3.000     -12.659     -34.218          15.649      31.262
         3.000                  -526.047                             .000
26 ----------------------------------------------------------------
     1    .000                 -1336.097                             .000
          .000     -22.241      18.260          -3.079      11.279
         3.000     -22.241     -48.462          -3.079       2.041
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        3.000                          -1336.097                              .000
27 ----------------------------------------------------------------------------
     1    .000                          -1335.772                              .000
          .000     -22.343      18.401          -9.717      20.588
         3.000     -22.343     -48.628          -9.717      -8.564
         3.000                          -1335.772                              .000
28 ----------------------------------------------------------------------------
     1    .000                           -828.623                              .000
          .000     -12.823       3.985         -19.753      36.029
         3.000     -12.823     -34.483         -19.753     -23.229
         3.000                           -828.623                              .000
29 ----------------------------------------------------------------------------
     1    .000                          -1448.958                              .000
          .000      13.082     -32.675          25.593     -30.672
         3.000      13.082       6.572          25.593      46.105
         3.000                          -1448.958                              .000
30 ----------------------------------------------------------------------------
     1    .000                          -3486.390                              .000
          .000       4.214     -64.678          -2.318      31.758
         3.000       4.214     -52.035          -2.318      24.805
         3.000                          -3486.390                              .000
31 ----------------------------------------------------------------------------
     1    .000                          -3523.330                              .000
          .000       4.214     -64.678          -1.940      31.217
         3.000       4.214     -52.035          -1.940      25.398
         3.000                          -3523.330                              .000
32 ----------------------------------------------------------------------------
     1    .000                          -1780.970                              .000
          .000      13.082     -32.675         -30.111      51.579
         3.000      13.082       6.572         -30.111     -38.755
         3.000                          -1780.970                              .000
33 ----------------------------------------------------------------------------
     1    .000                          -1126.327                              .000
          .000      22.645     -47.824          15.983     -16.147
         3.000      22.645      20.110          15.983      31.801
         3.000                          -1126.327                              .000
34 ----------------------------------------------------------------------------
     1    .000                          -1999.237                              .000
          .000      32.874     -63.185          -2.763      10.840
         3.000      32.874      35.436          -2.763       2.552
         3.000                          -1999.237                              .000
35 ----------------------------------------------------------------------------
     1    .000                          -1998.912                              .000
          .000      32.976     -63.326         -10.034      21.027
         3.000      32.976      35.602         -10.034      -9.074
         3.000                          -1998.912                              .000
36 ----------------------------------------------------------------------------
     1    .000                          -1428.903                              .000
          .000      22.809     -48.051         -20.086      36.491
         3.000      22.809      20.375         -20.086     -23.767
         3.000                          -1428.903                              .000
37 ----------------------------------------------------------------------------
     1    .000                           -432.565                              .000
          .000     -10.808     -20.688          15.736      -4.456
         3.000     -10.808     -53.111          15.736      42.751
         3.000                           -432.565                              .000
38 ----------------------------------------------------------------------------
     1    .000                          -1143.557                              .000
          .000     -18.815      -7.951          -8.422      29.959
         3.000     -18.815     -64.396          -8.422       4.695
         3.000                          -1143.557                              .000
39 ----------------------------------------------------------------------------
     1    .000                          -1141.500                              .000
          .000     -18.953      -7.751         -17.172      42.585
         3.000     -18.953     -64.610         -17.172      -8.931
         3.000                          -1141.500                              .000
40 ----------------------------------------------------------------------------
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      1    .000                          -719.625                          .000
           .000      -11.024     -20.373          -21.331      51.628
          3.000      -11.024     -53.446          -21.331     -12.365
          3.000                          -719.625                          .000
41 ----------------------------------------------------------------------------
      1    .000                         -1250.485                          .000
           .000       26.618     -72.656           24.433     -18.106
          3.000       26.618       7.197           24.433      55.192
          3.000                         -1250.485                          .000
42 ----------------------------------------------------------------------------
      1    .000                         -3049.706                          .000
           .000       -8.426    -140.524            6.304      70.604
          3.000       -8.426    -165.802            6.304      89.517
          3.000                         -3049.706                          .000
43 ----------------------------------------------------------------------------
      1    .000                         -3084.093                          .000
           .000       -8.426    -140.524            5.902      70.726
          3.000       -8.426    -165.802            5.902      88.430
          3.000                         -3084.093                          .000
44 ----------------------------------------------------------------------------
      1    .000                         -1566.384                          .000
           .000       26.618     -72.656          -31.060      66.552
          3.000       26.618       7.197          -31.060     -26.628
          3.000                         -1566.384                          .000
45 ----------------------------------------------------------------------------
      1    .000                          -999.833                          .000
           .000       26.087     -76.539           16.179      -5.099
          3.000       26.087       1.722           16.179      43.437
          3.000                          -999.833                          .000
46 ----------------------------------------------------------------------------
      1    .000                         -1772.268                          .000
           .000       35.866     -91.435           -7.998      29.346
          3.000       35.866      16.164           -7.998       5.352
          3.000                         -1772.268                          .000
47 ----------------------------------------------------------------------------
      1    .000                         -1770.211                          .000
           .000       36.004     -91.635          -17.596      43.198
          3.000       36.004      16.377          -17.596      -9.589
          3.000                         -1770.211                          .000
48 ----------------------------------------------------------------------------
      1    .000                         -1286.894                          .000
           .000       26.303     -76.854          -21.774      52.272
          3.000       26.303       2.056          -21.774     -13.051
          3.000                         -1286.894                          .000
49 ----------------------------------------------------------------------------
      1    .000                          -371.676                          .000
           .000       39.560     -95.711           -8.994      34.290
          3.000       39.560      22.968           -8.994       7.309
          3.000                          -371.676                          .000
50 ----------------------------------------------------------------------------
      1    .000                          -977.628                          .000
           .000       33.287     -86.086          -49.957      88.424
          3.000       33.287      13.775          -49.957     -61.445
          3.000                          -977.628                          .000
51 ----------------------------------------------------------------------------
      1    .000                          -974.546                          .000
           .000       33.074     -85.801          -62.449     105.630
          3.000       33.074      13.422          -62.449     -81.716
          3.000                          -974.546                          .000
52 ----------------------------------------------------------------------------
      1    .000                          -618.520                          .000
           .000       39.229     -95.268          -55.248      98.196
          3.000       39.229      22.420          -55.248     -67.548
          3.000                          -618.520                          .000
53 ----------------------------------------------------------------------------
      1    .000                         -1068.160                          .000
           .000      109.023    -186.669            -.814      22.345
```

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          3.000     109.023     140.400          -.814       19.902
          3.000                           -1068.160                      .000
54 ----------------------------------------------------------------------
       1    .000                           -2615.698                      .000
            .000     172.180    -386.076       -91.315      204.890
          3.000     172.180     130.465       -91.315      -69.056
          3.000                           -2615.698                      .000
55 ----------------------------------------------------------------------
       1    .000                           -2645.811                      .000
            .000     172.180    -386.076       -92.025      206.258
          3.000     172.180     130.465       -92.025      -69.817
          3.000                           -2645.811                      .000
56 ----------------------------------------------------------------------
       1    .000                           -1341.024                      .000
            .000     109.023    -186.669       -66.652      114.061
          3.000     109.023     140.400       -66.652      -85.894
          3.000                           -1341.024                      .000
57 ----------------------------------------------------------------------
       1    .000                            -858.627                      .000
            .000      85.659    -159.351        -8.323       33.386
          3.000      85.659      97.628        -8.323        8.418
          3.000                            -858.627                      .000
58 ----------------------------------------------------------------------
       1    .000                           -1520.299                      .000
            .000      97.879    -176.127       -49.321       87.564
          3.000      97.879     117.509       -49.321      -60.399
          3.000                           -1520.299                      .000
59 ----------------------------------------------------------------------
       1    .000                           -1517.217                      .000
            .000      98.092    -176.413       -63.084      106.490
          3.000      98.092     117.862       -63.084      -82.763
          3.000                           -1517.217                      .000
60 ----------------------------------------------------------------------
       1    .000                           -1105.470                      .000
            .000      85.990    -159.794       -55.919       99.100
          3.000      85.990      98.175       -55.919      -68.657
          3.000                           -1105.470                      .000
61 ----------------------------------------------------------------------
       1    .000                            -339.744                      .000
            .000      43.804     -70.491       -15.294       26.535
          3.000      43.804      60.921       -15.294      -19.346
          3.000                            -339.744                      .000
62 ----------------------------------------------------------------------
       1    .000                            -833.582                      .000
            .000      41.308     -66.757       -45.454       67.970
          3.000      41.308      57.168       -45.454      -68.392
          3.000                            -833.582                      .000
63 ----------------------------------------------------------------------
       1    .000                            -832.416                      .000
            .000      41.128     -66.520       -53.854       79.545
          3.000      41.128      56.863       -53.854      -82.017
          3.000                            -832.416                      .000
64 ----------------------------------------------------------------------
       1    .000                            -525.545                      .000
            .000      43.534     -70.134       -47.638       70.520
          3.000      43.534      60.469       -47.638      -72.395
          3.000                            -525.545                      .000
65 ----------------------------------------------------------------------
       1    .000                            -899.317                      .000
            .000      95.769    -141.895       -10.643       20.060
          3.000      95.769     145.410       -10.643      -11.867
          3.000                            -899.317                      .000
66 ----------------------------------------------------------------------
       1    .000                           -2179.354                      .000
            .000     131.967    -202.194       -71.126      108.662
          3.000     131.967     193.708       -71.126     -104.715
          3.000                           -2179.354                      .000
```

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67 ----------------------------------------
     1    .000                    -2204.535                          .000
          .000     131.967     -202.194        -71.173     108.736
         3.000     131.967      193.708        -71.173    -104.782
         3.000                    -2204.535                          .000
68 ----------------------------------------
     1    .000                    -1105.348                          .000
          .000      95.769     -141.895        -55.654      81.359
         3.000      95.769      145.410        -55.654     -85.603
         3.000                    -1105.348                          .000
69 ----------------------------------------
     1    .000                     -708.074                          .000
          .000      76.232     -114.536        -14.765      25.830
         3.000      76.232      114.161        -14.765     -18.465
         3.000                     -708.074                          .000
70 ----------------------------------------
     1    .000                    -1245.802                          .000
          .000      85.331     -126.738        -44.975      67.325
         3.000      85.331      129.255        -44.975     -67.601
         3.000                    -1245.802                          .000
71 ----------------------------------------
     1    .000                    -1244.636                          .000
          .000      85.512     -126.975        -54.333      80.190
         3.000      85.512      129.560        -54.333     -82.808
         3.000                    -1244.636                          .000
72 ----------------------------------------
     1    .000                     -893.876                          .000
          .000      76.502     -114.893        -48.167      71.225
         3.000      76.502      114.612        -48.167     -73.276
         3.000                     -893.876                          .000
73 ----------------------------------------
     1    .000                     -308.487                          .000
          .000      29.126      -37.419         -5.110       4.168
         3.000      29.126       49.958         -5.110     -11.161
         3.000                     -308.487                          .000
74 ----------------------------------------
     1    .000                     -690.685                          .000
          .000      26.088      -33.139        -39.487      57.315
         3.000      26.088       45.125        -39.487     -61.147
         3.000                     -690.685                          .000
75 ----------------------------------------
     1    .000                     -694.023                          .000
          .000      25.837      -32.766        -50.687      73.662
         3.000      25.837       44.746        -50.687     -78.399
         3.000                     -694.023                          .000
76 ----------------------------------------
     1    .000                     -433.014                          .000
          .000      28.760      -36.874        -45.434      64.976
         3.000      28.760       49.406        -45.434     -71.326
         3.000                     -433.014                          .000
77 ----------------------------------------
     1    .000                     -731.898                          .000
          .000      88.293     -128.911           .563      -4.304
         3.000      88.293      135.968           .563      -2.614
         3.000                     -731.898                          .000
78 ----------------------------------------
     1    .000                    -1740.457                          .000
          .000     109.667     -149.838        -57.773      79.060
         3.000     109.667      179.164        -57.773     -94.260
         3.000                    -1740.457                          .000
79 ----------------------------------------
     1    .000                    -1760.392                          .000
          .000     109.667     -149.838        -59.429      80.666
         3.000     109.667      179.164        -59.429     -97.621
         3.000                    -1760.392                          .000
80 ----------------------------------------
     1    .000                     -869.001                          .000
```

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          .000      88.293    -128.911         -55.048      79.738
         3.000      88.293     135.968         -55.048     -85.406
         3.000                            -869.001                      .000
81 ----------------------------------------------------------------------
     1    .000                            -558.566                      .000
          .000      69.657     -98.536          -4.396       3.107
         3.000      69.657     110.434          -4.396     -10.081
         3.000                            -558.566                      .000
82 ----------------------------------------------------------------------
     1    .000                            -968.415                      .000
          .000      80.409    -115.239         -38.848      56.368
         3.000      80.409     125.989         -38.848     -60.176
         3.000                            -968.415                      .000
83 ----------------------------------------------------------------------
     1    .000                            -971.753                      .000
          .000      80.660    -115.612         -51.326      74.609
         3.000      80.660     126.368         -51.326     -79.370
         3.000                            -971.753                      .000
84 ----------------------------------------------------------------------
     1    .000                            -683.094                      .000
          .000      70.023     -99.082         -46.148      66.037
         3.000      70.023     110.986         -46.148     -72.406
         3.000                            -683.094                      .000
85 ----------------------------------------------------------------------
     1    .000                            -260.604                      .000
          .000      18.722     -20.632            .650      -4.689
         3.000      18.722      35.533            .650      -2.741
         3.000                            -260.604                      .000
86 ----------------------------------------------------------------------
     1    .000                            -538.321                      .000
          .000      14.726     -14.868         -29.552      41.236
         3.000      14.726      29.310         -29.552     -47.420
         3.000                            -538.321                      .000
87 ----------------------------------------------------------------------
     1    .000                            -543.568                      .000
          .000      14.458     -14.472         -42.037      59.739
         3.000      14.458      28.903         -42.037     -66.374
         3.000                            -543.568                      .000
88 ----------------------------------------------------------------------
     1    .000                            -333.692                      .000
          .000      18.331     -20.055         -40.770      56.541
         3.000      18.331      34.937         -40.770     -65.770
         3.000                            -333.692                      .000
89 ----------------------------------------------------------------------
     1    .000                            -560.127                      .000
          .000      69.724     -98.703           6.733     -13.636
         3.000      69.724     110.468           6.733       6.564
         3.000                            -560.127                      .000
90 ----------------------------------------------------------------------
     1    .000                           -1306.338                      .000
          .000      86.876    -110.459         -45.031      57.044
         3.000      86.876     150.169         -45.031     -78.050
         3.000                           -1306.338                      .000
91 ----------------------------------------------------------------------
     1    .000                           -1320.908                      .000
          .000      86.876    -110.459         -48.338      61.984
         3.000      86.876     150.169         -48.338     -83.030
         3.000                           -1320.908                      .000
92 ----------------------------------------------------------------------
     1    .000                            -639.951                      .000
          .000      69.724     -98.703         -49.774      70.027
         3.000      69.724     110.468         -49.774     -79.294
         3.000                            -639.951                      .000
93 ----------------------------------------------------------------------
     1    .000                            -409.890                      .000
          .000      60.332     -82.157           1.415      -5.819
         3.000      60.332      98.839           1.415      -1.575
```

		3.000			-409.890			.000
94								
	1	.000			-702.857			.000
		.000	69.819	-96.482		-28.868	40.222	
		3.000	69.819	112.975		-28.868	-46.381	
		3.000			-702.857			.000
95								
	1	.000			-708.104			.000
		.000	70.087	-96.878		-42.722	60.753	
		3.000	70.087	113.383		-42.722	-67.412	
		3.000			-708.104			.000
96								
	1	.000			-482.978			.000
		.000	60.723	-82.734		-41.536	57.671	
		3.000	60.723	99.435		-41.536	-66.935	
		3.000			-482.978			.000
97								
	1	.000			-192.931			.000
		.000	8.143	-2.050		5.710	-14.419	
		3.000	8.143	22.379		5.710	2.713	
		3.000			-192.931			.000
98								
	1	.000			-373.095			.000
		.000	3.599	4.706		-18.509	24.444	
		3.000	3.599	15.502		-18.509	-31.083	
		3.000			-373.095			.000
99								
	1	.000			-378.340			.000
		.000	3.343	5.101		-32.135	44.508	
		3.000	3.343	15.131		-32.135	-51.898	
		3.000			-378.340			.000
100								
	1	.000			-227.428			.000
		.000	7.768	-1.469		-33.677	46.634	
		3.000	7.768	21.835		-33.677	-54.396	
		3.000			-227.428			.000
101								
	1	.000			-381.707			.000
		.000	49.051	-67.171		11.737	-23.668	
		3.000	49.051	79.981		11.737	11.544	
		3.000			-381.707			.000
102								
	1	.000			-873.857			.000
		.000	61.177	-68.949		-30.150	33.934	
		3.000	61.177	114.583		-30.150	-56.515	
		3.000			-873.857			.000
103								
	1	.000			-883.231			.000
		.000	61.177	-68.949		-35.894	41.246	
		3.000	61.177	114.583		-35.894	-66.437	
		3.000			-883.231			.000
104								
	1	.000			-418.921			.000
		.000	49.051	-67.171		-41.668	59.175	
		3.000	49.051	79.981		-41.668	-65.830	
		3.000			-418.921			.000
105								
	1	.000			-265.545			.000
		.000	47.672	-63.333		6.458	-15.567	
		3.000	47.672	79.684		6.458	3.806	
		3.000			-265.545			.000
106								
	1	.000			-452.275			.000
		.000	55.694	-76.044		-17.822	23.403	
		3.000	55.694	91.037		-17.822	-30.063	
		3.000			-452.275			.000
107								

	1	.000		-457.520		.000
		.000	55.949	-76.440	-32.822	45.548
		3.000	55.949	91.407	-32.822	-52.918
		3.000		-457.520		.000
108						
	1	.000		-300.043		.000
		.000	48.047	-63.913	-34.424	47.782
		3.000	48.047	80.228	-34.424	-55.490
		3.000		-300.043		.000
109						
	1	.000		-101.641		.000
		.000	-15.200	25.011	22.816	-32.373
		3.000	-15.200	-20.590	22.816	36.077
		3.000		-101.641		.000
110						
	1	.000		-193.079		.000
		.000	-22.942	34.997	-6.694	6.567
		3.000	-22.942	-33.830	-6.694	-13.514
		3.000		-193.079		.000
111						
	1	.000		-195.905		.000
		.000	-23.311	35.478	-22.695	29.691
		3.000	-23.311	-34.455	-22.695	-38.393
		3.000		-195.905		.000
112						
	1	.000		-111.928		.000
		.000	-15.754	25.729	-35.703	43.338
		3.000	-15.754	-21.532	-35.703	-63.772
		3.000		-111.928		.000
113						
	1	.000		-196.452		.000
		.000	28.266	-35.079	32.340	-44.604
		3.000	28.266	49.718	32.340	52.417
		3.000		-196.452		.000
114						
	1	.000		-446.480		.000
		.000	30.489	-24.937	-15.514	10.706
		3.000	30.489	66.531	-15.514	-35.836
		3.000		-446.480		.000
115						
	1	.000		-450.934		.000
		.000	30.489	-24.937	-18.720	18.200
		3.000	30.489	66.531	-18.720	-37.960
		3.000		-450.934		.000
116						
	1	.000		-207.596		.000
		.000	28.266	-35.079	-46.776	57.768
		3.000	28.266	49.718	-46.776	-82.560
		3.000		-207.596		.000
117						
	1	.000		-124.401		.000
		.000	43.889	-51.311	23.870	-33.764
		3.000	43.889	80.355	23.870	37.845
		3.000		-124.401		.000
118						
	1	.000		-218.258		.000
		.000	54.102	-64.795	-5.800	5.346
		3.000	54.102	97.511	-5.800	-12.053
		3.000		-218.258		.000
119						
	1	.000		-221.084		.000
		.000	54.470	-65.276	-23.589	30.912
		3.000	54.470	98.135	-23.589	-39.854
		3.000		-221.084		.000
120						
	1	.000		-134.688		.000
		.000	44.442	-52.029	-36.756	44.729

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3.000      44.442      81.297          -36.756      -65.540
3.000                          -134.688                          .000
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PROGRAM:SAP90/FILE:\1d.F3F
5 storey building-Bay size 5*5 //Fc=25MPa
F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	.000			-332.366			.000
		.000	-5.866	-11.680		7.071	4.388	
		3.000	-5.866	-29.279		7.071	25.601	
		3.000			-332.366			.000
2								
	1	.000			-922.231			.000
		.000	-11.660	-6.047		-6.283	17.371	
		3.000	-11.660	-41.027		-6.283	-1.477	
		3.000			-922.231			.000
3								
	1	.000			-906.001			.000
		.000	-11.695	-6.014		-5.979	17.076	
		3.000	-11.695	-41.098		-5.979	-.862	
		3.000			-906.001			.000
4								
	1	.000			-505.139			.000
		.000	-5.902	-11.646		-8.982	19.996	
		3.000	-5.902	-29.351		-8.982	-6.950	
		3.000			-505.139			.000
5								
	1	.000			-961.498			.000
		.000	10.443	-27.537		13.145	-1.518	
		3.000	10.443	3.791		13.145	37.918	
		3.000			-961.498			.000
6								
	1	.000			-2213.771			.000
		.000	3.418	-45.711		-2.763	30.140	
		3.000	3.418	-35.457		-2.763	21.852	
		3.000			-2213.771			.000
7								
	1	.000			-2224.402			.000
		.000	3.418	-45.711		-.158	27.649	
		3.000	3.418	-35.457		-.158	27.174	
		3.000			-2224.402			.000
8								
	1	.000			-1157.265			.000
		.000	10.443	-27.537		-16.116	26.932	
		3.000	10.443	3.791		-16.116	-21.416	
		3.000			-1157.265			.000
9								
	1	.000			-594.311			.000
		.000	10.131	-27.234		7.124	4.336	
		3.000	10.131	3.158		7.124	25.709	
		3.000			-594.311			.000
10								
	1	.000			-1222.197			.000
		.000	17.618	-34.514		-6.235	17.325	
		3.000	17.618	18.342		-6.235	-1.380	
		3.000			-1222.197			.000
11								
	1	.000			-1205.966			.000
		.000	17.653	-34.548		-6.027	17.123	
		3.000	17.653	18.412		-6.027	-.959	
		3.000			-1205.966			.000
12								
	1	.000			-767.084			.000
		.000	10.166	-27.268		-9.035	20.048	
		3.000	10.166	3.231		-9.035	-7.058	
		3.000			-767.084			.000
13								

```
      1    .000                          -265.503                          .000
           .000       27.353      -51.591          -13.536       27.136
          3.000       27.353       30.468          -13.536      -13.473
          3.000                          -265.503                          .000
14 ----------------------------------------------
      1    .000                          -734.223                          .000
           .000       17.893      -36.278          -42.403       69.296
          3.000       17.893       17.400          -42.403      -57.913
          3.000                          -734.223                          .000
15 ----------------------------------------------
      1    .000                          -721.552                          .000
           .000       17.795      -36.146          -43.390       69.935
          3.000       17.795       17.239          -43.390      -60.233
          3.000                          -721.552                          .000
16 ----------------------------------------------
      1    .000                          -407.024                          .000
           .000       27.253      -51.456          -43.831       73.534
          3.000       27.253       30.303          -43.831      -57.959
          3.000                          -407.024                          .000
17 ----------------------------------------------
      1    .000                          -764.475                          .000
           .000       65.377     -105.774           -3.148       10.625
          3.000       65.377       90.357           -3.148        1.180
          3.000                          -764.475                          .000
18 ----------------------------------------------
      1    .000                         -1766.131                          .000
           .000       96.714     -172.380          -67.342      119.766
          3.000       96.714      117.763          -67.342      -82.261
          3.000                         -1766.131                          .000
19 ----------------------------------------------
      1    .000                         -1775.361                          .000
           .000       96.714     -172.380          -64.666      114.376
          3.000       96.714      117.763          -64.666      -79.623
          3.000                         -1775.361                          .000
20 ----------------------------------------------
      1    .000                          -924.770                          .000
           .000       65.377     -105.774          -57.252       94.112
          3.000       65.377       90.357          -57.252      -77.643
          3.000                          -924.770                          .000
21 ----------------------------------------------
      1    .000                          -480.558                          .000
           .000       57.757      -98.036          -13.386       26.934
          3.000       57.757       75.235          -13.386      -13.225
          3.000                          -480.558                          .000
22 ----------------------------------------------
      1    .000                          -980.390                          .000
           .000       72.076     -119.861          -42.268       69.115
          3.000       72.076       96.367          -42.268      -57.690
          3.000                          -980.390                          .000
23 ----------------------------------------------
      1    .000                          -967.719                          .000
           .000       72.173     -119.992          -43.524       70.117
          3.000       72.173       96.528          -43.524      -60.456
          3.000                          -967.719                          .000
24 ----------------------------------------------
      1    .000                          -622.078                          .000
           .000       57.857      -98.170          -43.981       73.736
          3.000       57.857       75.400          -43.981      -58.207
          3.000                          -622.078                          .000
25 ----------------------------------------------
      1    .000                          -220.488                          .000
           .000       20.163      -27.409           -8.185       10.435
          3.000       20.163       33.078           -8.185      -14.120
          3.000                          -220.488                          .000
26 ----------------------------------------------
      1    .000                          -562.493                          .000
           .000       12.200      -15.797          -38.440       56.224
```

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        3.000      12.200      20.802          -38.440      -59.095
        3.000                                -562.493                      .000
27 ---------------------------------------------------------------------------
     1    .000                                -555.969                      .000
          .000      12.057     -15.592          -41.409       60.473
        3.000       12.057      20.578          -41.409      -63.754
        3.000                                -555.969                      .000
28 ---------------------------------------------------------------------------
     1    .000                                -309.938                      .000
          .000      20.014     -27.197          -38.656       55.093
        3.000       20.014      32.844          -38.656      -60.876
        3.000                                -309.938                      .000
29 ---------------------------------------------------------------------------
     1    .000                                -581.640                      .000
          .000      61.938     -90.945             .945       -2.994
        3.000       61.938      94.868             .945        -.160
        3.000                                -581.640                      .000
30 ---------------------------------------------------------------------------
     1    .000                               -1325.611                      .000
          .000      79.312    -110.715          -53.583       74.384
        3.000       79.312     127.223          -53.583      -86.364
        3.000                               -1325.611                      .000
31 ---------------------------------------------------------------------------
     1    .000                               -1332.372                      .000
          .000      79.312    -110.715          -53.062       73.808
        3.000       79.312     127.223          -53.062      -85.378
        3.000                               -1332.372                      .000
32 ---------------------------------------------------------------------------
     1    .000                                -682.648                      .000
          .000      61.938     -90.945          -51.271       73.994
        3.000       61.938      94.868          -51.271      -79.820
        3.000                                -682.648                      .000
33 ---------------------------------------------------------------------------
     1    .000                                -357.666                      .000
          .000      50.941     -72.540           -7.963       10.117
        3.000       50.941      80.283           -7.963      -13.771
        3.000                                -357.666                      .000
34 ---------------------------------------------------------------------------
     1    .000                                -718.960                      .000
          .000      64.450     -92.884          -38.241       55.940
        3.000       64.450     100.464          -38.241      -58.784
        3.000                                -718.960                      .000
35 ---------------------------------------------------------------------------
     1    .000                                -712.436                      .000
          .000      64.593     -93.090          -41.607       60.757
        3.000       64.593     100.689          -41.607      -64.065
        3.000                                -712.436                      .000
36 ---------------------------------------------------------------------------
     1    .000                                -447.116                      .000
          .000      51.090     -72.752          -38.879       55.411
        3.000       51.090      80.516          -38.879      -61.225
        3.000                                -447.116                      .000
37 ---------------------------------------------------------------------------
     1    .000                                -165.395                      .000
          .000      11.841      -9.773           -2.812       -1.433
        3.000       11.841      25.749           -2.812       -9.867
        3.000                                -165.395                      .000
38 ---------------------------------------------------------------------------
     1    .000                                -386.206                      .000
          .000       3.691       2.685          -27.714       38.338
        3.000        3.691      13.758          -27.714      -44.804
        3.000                                -386.206                      .000
39 ---------------------------------------------------------------------------
     1    .000                                -383.877                      .000
          .000       3.538       2.919          -32.246       44.517
        3.000        3.538      13.533          -32.246      -52.220
        3.000                                -383.877                      .000
```

40						
	1	.000		-209.824		.000
		.000	11.681	-9.528	-32.338	44.404
		3.000	11.681	25.515	-32.338	-52.610
		3.000		-209.824		.000
41						
	1	.000		-395.934		.000
		.000	46.395	-64.541	6.133	-15.213
		3.000	46.395	74.642	6.133	3.187
		3.000		-395.934		.000
42						
	1	.000		-886.400		.000
		.000	59.416	-71.044	-39.039	47.235
		3.000	59.416	107.204	-39.039	-69.883
		3.000		-886.400		.000
43						
	1	.000		-890.658		.000
		.000	59.416	-71.044	-40.958	48.583
		3.000	59.416	107.204	-40.958	-74.292
		3.000		-890.658		.000
44						
	1	.000		-446.119		.000
		.000	46.395	-64.541	-43.658	62.089
		3.000	46.395	74.642	-43.658	-68.884
		3.000		-446.119		.000
45						
	1	.000		-234.316		.000
		.000	41.814	-56.194	-2.567	-1.803
		3.000	41.814	69.247	-2.567	-9.505
		3.000		-234.316		.000
46						
	1	.000		-464.874		.000
		.000	53.596	-74.697	-27.489	38.002
		3.000	53.596	86.091	-27.489	-44.466
		3.000		-464.874		.000
47						
	1	.000		-462.545		.000
		.000	53.749	-74.931	-32.470	44.853
		3.000	53.749	86.316	-32.470	-52.558
		3.000		-462.545		.000
48						
	1	.000		-278.745		.000
		.000	41.973	-56.439	-32.582	44.774
		3.000	41.973	69.482	-32.582	-52.971
		3.000		-278.745		.000
49						
	1	.000		-89.566		.000
		.000	-8.297	15.407	13.364	-20.317
		3.000	-8.297	-9.485	13.364	19.775
		3.000		-89.566		.000
50						
	1	.000		-198.323		.000
		.000	-20.809	31.639	-15.650	18.617
		3.000	-20.809	-30.788	-15.650	-28.333
		3.000		-198.323		.000
51						
	1	.000		-197.656		.000
		.000	-21.043	31.943	-20.162	26.014
		3.000	-21.043	-31.187	-20.162	-34.473
		3.000		-197.656		.000
52						
	1	.000		-103.508		.000
		.000	-8.548	15.730	-31.543	37.379
		3.000	-8.548	-9.914	-31.543	-57.250
		3.000		-103.508		.000
53						
	1	.000		-203.398		.000

```
          .000      28.041     -35.221          26.714     -37.655
         3.000      28.041      48.901          26.714      42.488
         3.000                            -203.398                        .000
54 ----------------------------------------------------------------------
      1    .000                            -452.033                        .000
           .000      31.524     -27.843         -22.604      18.863
         3.000      31.524      66.728         -22.604     -48.950
         3.000                            -452.033                        .000
55 ----------------------------------------------------------------------
      1    .000                            -454.071                        .000
           .000      31.524     -27.843         -20.176      19.113
         3.000      31.524      66.728         -20.176     -41.416
         3.000                            -454.071                        .000
56 ----------------------------------------------------------------------
      1    .000                            -219.499                        .000
           .000      28.041     -35.221         -46.940      57.617
         3.000      28.041      48.901         -46.940     -83.202
         3.000                            -219.499                        .000
57 ----------------------------------------------------------------------
      1    .000                            -111.476                        .000
           .000      37.172     -43.157          13.729     -20.797
         3.000      37.172      68.358          13.729      20.391
         3.000                            -111.476                        .000
58 ----------------------------------------------------------------------
      1    .000                            -224.083                        .000
           .000      52.788     -63.728         -15.340      18.196
         3.000      52.788      94.635         -15.340     -27.825
         3.000                            -224.083                        .000
59 ----------------------------------------------------------------------
      1    .000                            -223.416                        .000
           .000      53.022     -64.033         -20.472      26.435
         3.000      53.022      95.034         -20.472     -34.981
         3.000                            -223.416                        .000
60 ----------------------------------------------------------------------
      1    .000                            -125.418                        .000
           .000      37.422     -43.480         -31.908      37.859
         3.000      37.422      68.787         -31.908     -57.866
         3.000                            -125.418                        .000
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PROGRAM:SAP90/FILE:\3d.F3F
5 storey building-Bay size 7*7 //Fc=25MPa

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	.000			-898.294			.000
		.000	-24.106	-81.630		26.846	42.453	
		3.000	-24.106	-153.947		26.846	122.991	
		3.000			-898.294			.000
2								
	1	.000			-2235.927			.000
		.000	-50.113	-57.245		-14.144	80.886	
		3.000	-50.113	-207.584		-14.144	38.452	
		3.000			-2235.927			.000
3								
	1	.000			-2224.664			.000
		.000	-50.123	-57.235		-13.662	80.434	
		3.000	-50.123	-207.606		-13.662	39.447	
		3.000			-2224.664			.000
4								
	1	.000			-1166.618			.000
		.000	-24.116	-81.620		-29.518	95.300	
		3.000	-24.116	-153.969		-29.518	6.746	
		3.000			-1166.618			.000
5								
	1	.000			-2301.727			.000
		.000	23.729	-126.479		52.938	17.990	
		3.000	23.729	-55.293		52.938	176.803	
		3.000			-2301.727			.000
6								
	1	.000			-4947.254			.000
		.000	13.315	-205.285		-7.947	132.554	
		3.000	13.315	-165.340		-7.947	108.714	
		3.000			-4947.254			.000
7								
	1	.000			-4948.915			.000
		.000	13.315	-205.285		-4.969	129.829	
		3.000	13.315	-165.340		-4.969	114.923	
		3.000			-4948.915			.000
8								
	1	.000			-2582.242			.000
		.000	23.729	-126.479		-56.367	120.474	
		3.000	23.729	-55.293		-56.367	-48.628	
		3.000			-2582.242			.000
9								
	1	.000			-1312.032			.000
		.000	32.212	-134.433		26.862	42.438	
		3.000	32.212	-37.797		26.862	123.024	
		3.000			-1312.032			.000
10								
	1	.000			-2669.294			.000
		.000	59.408	-159.933		-14.129	80.871	
		3.000	59.408	18.293		-14.129	38.484	
		3.000			-2669.294			.000
11								
	1	.000			-2658.031			.000
		.000	59.419	-159.942		-13.678	80.448	
		3.000	59.419	18.315		-13.678	39.415	
		3.000			-2658.031			.000
12								
	1	.000			-1580.356			.000
		.000	32.222	-134.443		-29.534	95.315	
		3.000	32.222	-37.776		-29.534	6.713	
		3.000			-1580.356			.000

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13 ----------------------------------------
     1    .000                    -711.067                          .000
          .000      50.667    -138.940        -17.070      65.855
         3.000      50.667      13.061        -17.070      14.645
         3.000                    -711.067                          .000
14 ----------------------------------------
     1    .000                   -1781.407                          .000
          .000       4.971     -66.843       -101.003     190.656
         3.000       4.971     -51.929       -101.003    -112.351
         3.000                   -1781.407                          .000
15 ----------------------------------------
     1    .000                   -1772.199                          .000
          .000       4.942     -66.803       -102.730     191.734
         3.000       4.942     -51.978       -102.730    -116.456
         3.000                   -1772.199                          .000
16 ----------------------------------------
     1    .000                    -934.312                          .000
          .000      50.638    -138.901       -118.816     224.650
         3.000      50.638      13.012       -118.816    -131.798
         3.000                    -934.312                          .000
17 ----------------------------------------
     1    .000                   -1834.762                          .000
          .000     154.591    -290.183         29.036      -6.722
         3.000     154.591     173.589         29.036      80.386
         3.000                   -1834.762                          .000
18 ----------------------------------------
     1    .000                   -3952.077                          .000
          .000     197.894    -416.289       -133.319     279.588
         3.000     197.894     177.393       -133.319    -120.368
         3.000                   -3952.077                          .000
19 ----------------------------------------
     1    .000                   -3953.734                          .000
          .000     197.894    -416.289       -131.528     274.466
         3.000     197.894     177.393       -131.528    -120.118
         3.000                   -3953.734                          .000
20 ----------------------------------------
     1    .000                   -2068.252                          .000
          .000     154.591    -290.183       -166.995     300.023
         3.000     154.591     173.589       -166.995    -200.962
         3.000                   -2068.252                          .000
21 ----------------------------------------
     1    .000                   -1056.164                          .000
          .000     152.468    -297.735        -17.025      65.795
         3.000     152.468     159.669        -17.025      14.720
         3.000                   -1056.164                          .000
22 ----------------------------------------
     1    .000                   -2143.054                          .000
          .000     201.401    -374.205       -100.959     190.598
         3.000     201.401     229.998       -100.959    -112.279
         3.000                   -2143.054                          .000
23 ----------------------------------------
     1    .000                   -2133.846                          .000
          .000     201.430    -374.244       -102.773     191.792
         3.000     201.430     230.047       -102.773    -116.529
         3.000                   -2133.846                          .000
24 ----------------------------------------
     1    .000                   -1279.409                          .000
          .000     152.497    -297.774       -118.861     224.711
         3.000     152.497     159.718       -118.861    -131.873
         3.000                   -1279.409                          .000
25 ----------------------------------------
     1    .000                    -556.490                          .000
          .000      34.243     -43.266         -5.175       2.073
         3.000      34.243      59.462         -5.175     -13.452
         3.000                    -556.490                          .000
26 ----------------------------------------
     1    .000                   -1348.593                          .000
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          .000      -7.810      18.308         -92.414     132.170
        3.000       -7.810      -5.122         -92.414    -145.072
        3.000                             -1348.593                    .000
27 ------------------------------------------------
    1   .000                              -1342.814                    .000
          .000      -7.856      18.372         -97.101     139.050
        3.000       -7.856      -5.195         -97.101    -152.254
        3.000                             -1342.814                    .000
28 ------------------------------------------------
    1   .000                               -705.646                    .000
          .000      34.197     -43.203        -103.339     145.158
        3.000       34.197      59.390        -103.339    -164.860
        3.000                              -705.646                    .000
29 ------------------------------------------------
    1   .000                              -1384.504                    .000
          .000     146.928    -212.009          37.495     -60.446
        3.000      146.928     228.775          37.495      52.038
        3.000                             -1384.504                    .000
30 ------------------------------------------------
    1   .000                              -2964.590                    .000
          .000     168.613    -235.087        -109.393     150.109
        3.000      168.613     270.752        -109.393    -178.070
        3.000                             -2964.590                    .000
31 ------------------------------------------------
    1   .000                              -2966.231                    .000
          .000     168.613    -235.087        -110.929     152.902
        3.000      168.613     270.752        -110.929    -179.883
        3.000                             -2966.231                    .000
32 ------------------------------------------------
    1   .000                              -1540.652                    .000
          .000     146.928    -212.009        -148.551     211.540
        3.000      146.928     228.775        -148.551    -234.114
        3.000                             -1540.652                    .000
33 ------------------------------------------------
    1   .000                               -788.821                    .000
          .000     132.561    -186.609          -5.105       1.974
        3.000      132.561     211.074          -5.105     -13.340
        3.000                              -788.821                    .000
34 ------------------------------------------------
    1   .000                              -1592.336                    .000
          .000     178.615    -254.238         -92.347     132.075
        3.000      178.615     281.606         -92.347    -144.966
        3.000                             -1592.336                    .000
35 ------------------------------------------------
    1   .000                              -1586.557                    .000
          .000     178.661    -254.302         -97.168     139.144
        3.000      178.661     281.679         -97.168    -152.361
        3.000                             -1586.557                    .000
36 ------------------------------------------------
    1   .000                               -937.978                    .000
          .000     132.606    -186.673        -103.409     145.256
        3.000      132.606     211.146        -103.409    -164.972
        3.000                              -937.978                    .000
37 ------------------------------------------------
    1   .000                               -394.280                    .000
          .000      18.222      17.977           3.711     -37.841
        3.000       18.222      72.642           3.711     -26.709
        3.000                              -394.280                    .000
38 ------------------------------------------------
    1   .000                               -912.654                    .000
          .000     -20.077      79.041         -68.096      79.310
        3.000      -20.077      18.809         -68.096    -124.978
        3.000                              -912.654                    .000
39 ------------------------------------------------
    1   .000                               -909.591                    .000
          .000     -20.124      79.115         -75.322      88.873
        3.000      -20.124      18.742         -75.322    -137.094
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	3.000		-909.591			.000
40						
	1 .000		-474.711			.000
	.000	18.175	18.050	-84.860	104.573	
	3.000	18.175	72.576	-84.860	-150.009	
	3.000		-474.711			.000
41						
	1 .000		-932.363			.000
	.000	111.449	-133.092	42.368	-99.569	
	3.000	111.449	201.254	42.368	27.536	
	3.000		-932.363			.000
42						
	1 .000		-1978.675			.000
	.000	125.563	-115.723	-78.846	70.526	
	3.000	125.563	260.967	-78.846	-166.012	
	3.000		-1978.675			.000
43						
	1 .000		-1979.966			.000
	.000	125.563	-115.723	-84.842	76.420	
	3.000	125.563	260.967	-84.842	-178.105	
	3.000		-1979.966			.000
44						
	1 .000		-1016.873			.000
	.000	111.449	-133.092	-125.074	169.139	
	3.000	111.449	201.254	-125.074	-206.081	
	3.000		-1016.873			.000
45						
	1 .000		-520.850			.000
	.000	107.026	-124.715	3.784	-37.956	
	3.000	107.026	196.364	3.784	-26.603	
	3.000		-520.850			.000
46						
	1 .000		-1045.981			.000
	.000	147.680	-190.184	-68.024	79.199	
	3.000	147.680	252.856	-68.024	-124.873	
	3.000		-1045.981			.000
47						
	1 .000		-1042.918			.000
	.000	147.727	-190.258	-75.394	88.984	
	3.000	147.727	252.922	-75.394	-137.199	
	3.000		-1042.918			.000
48						
	1 .000		-601.281			.000
	.000	107.073	-124.789	-84.934	104.688	
	3.000	107.073	196.430	-84.934	-150.114	
	3.000		-601.281			.000
49						
	1 .000		-206.293			.000
	.000	-45.372	86.149	57.422	-90.335	
	3.000	-45.372	-49.967	57.422	81.929	
	3.000		-206.293			.000
50						
	1 .000		-462.327			.000
	.000	-108.815	163.557	-43.205	34.956	
	3.000	-108.815	-162.889	-43.205	-94.660	
	3.000		-462.327			.000
51						
	1 .000		-460.390			.000
	.000	-108.903	163.662	-50.437	47.077	
	3.000	-108.903	-163.048	-50.437	-104.235	
	3.000		-460.390			.000
52						
	1 .000		-236.425			.000
	.000	-45.460	86.254	-94.536	92.395	
	3.000	-45.460	-50.127	-94.536	-191.212	
	3.000		-236.425			.000
53						

	1	.000			-471.490		.000
		.000	76.346	-69.176	121.408	-168.329	
		3.000	76.346	159.862	121.408	195.897	
		3.000			-471.490		.000
54							
	1	.000			-999.719		.000
		.000	68.669	-25.189	-43.056	9.720	
		3.000	68.669	180.818	-43.056	-119.448	
		3.000			-999.719		.000
55							
	1	.000			-1000.319		.000
		.000	68.669	-25.189	-42.259	15.596	
		3.000	68.669	180.818	-42.259	-111.179	
		3.000			-1000.319		.000
56							
	1	.000			-503.842		.000
		.000	76.346	-69.176	-160.997	173.078	
		3.000	76.346	159.862	-160.997	-309.913	
		3.000			-503.842		.000
57							
	1	.000			-254.092		.000
		.000	106.902	-97.082	57.556	-90.498	
		3.000	106.902	223.625	57.556	82.170	
		3.000			-254.092		.000
58							
	1	.000			-513.944		.000
		.000	174.400	-178.742	-43.080	34.801	
		3.000	174.400	344.456	-43.080	-94.439	
		3.000			-513.944		.000
59							
	1	.000			-512.007		.000
		.000	174.488	-178.848	-50.562	47.232	
		3.000	174.488	344.615	-50.562	-104.456	
		3.000			-512.007		.000
60							
	1	.000			-284.223		.000
		.000	106.991	-97.187	-94.670	92.558	
		3.000	106.991	223.785	-94.670	-191.452	
		3.000			-284.223		.000

PROGRAM:SAP90/FILE:\11d.F3F
5 storey building-Bay size 5*5 //Fc=45MPa

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	.000			-328.624			.000
		.000	-4.506	-6.700		5.721	1.652	
		3.000	-4.506	-20.218		5.721	18.815	
		3.000			-328.624			.000
2								
	1	.000			-914.952			.000
		.000	-8.779	-2.493		-6.078	13.267	
		3.000	-8.779	-28.831		-6.078	-4.968	
		3.000			-914.952			.000
3								
	1	.000			-891.142			.000
		.000	-8.822	-2.451		-5.151	12.354	
		3.000	-8.822	-28.917		-5.151	-3.098	
		3.000			-891.142			.000
4								
	1	.000			-492.175			.000
		.000	-4.551	-6.655		-8.505	15.656	
		3.000	-4.551	-20.309		-8.505	-9.860	
		3.000			-492.175			.000
5								
	1	.000			-960.496			.000
		.000	9.459	-20.446		10.373	-2.928	
		3.000	9.459	7.929		10.373	28.192	
		3.000			-960.496			.000
6								
	1	.000			-2263.793			.000
		.000	1.021	-36.187		-2.440	25.392	
		3.000	1.021	-33.122		-2.440	18.073	
		3.000			-2263.793			.000
7								
	1	.000			-2284.909			.000
		.000	1.021	-36.187		1.955	21.120	
		3.000	1.021	-33.122		1.955	26.983	
		3.000			-2284.909			.000
8								
	1	.000			-1159.433			.000
		.000	9.459	-20.446		-14.627	21.682	
		3.000	9.459	7.929		-14.627	-22.198	
		3.000			-1159.433			.000
9								
	1	.000			-571.635			.000
		.000	9.588	-20.574		5.786	1.588	
		3.000	9.588	8.189		5.786	18.947	
		3.000			-571.635			.000
10								
	1	.000			-1216.847			.000
		.000	16.271	-27.153		-6.023	13.212	
		3.000	16.271	21.661		-6.023	-4.856	
		3.000			-1216.847			.000
11								
	1	.000			-1193.037			.000
		.000	16.314	-27.195		-5.207	12.409	
		3.000	16.314	21.747		-5.207	-3.211	
		3.000			-1193.037			.000
12								
	1	.000			-735.185			.000
		.000	9.633	-20.618		-8.571	15.720	
		3.000	9.633	8.280		-8.571	-9.991	
		3.000			-735.185			.000

```
13 ----------------------------------------
     1    .000                    -262.628                          .000
          .000      25.521      -44.731        -13.096      23.802
         3.000      25.521       31.831        -13.096     -15.487
         3.000                    -262.628                          .000
14 ----------------------------------------
     1    .000                    -728.442                          .000
          .000      19.161      -34.064        -38.444      60.922
         3.000      19.161       23.418        -38.444     -54.411
         3.000                    -728.442                          .000
15 ----------------------------------------
     1    .000                    -709.602                          .000
          .000      19.040      -33.900        -37.946      59.475
         3.000      19.040       23.219        -37.946     -54.363
         3.000                    -709.602                          .000
16 ----------------------------------------
     1    .000                    -396.296                          .000
          .000      25.394      -44.560        -40.105      65.060
         3.000      25.394       31.623        -40.105     -55.255
         3.000                    -396.296                          .000
17 ----------------------------------------
     1    .000                    -763.652                          .000
          .000      58.059      -91.162         -5.437      11.465
         3.000      58.059       83.016         -5.437      -4.847
         3.000                    -763.652                          .000
18 ----------------------------------------
     1    .000                   -1808.076                          .000
          .000     101.893     -176.803        -74.206     127.850
         3.000     101.893      128.877        -74.206     -94.769
         3.000                   -1808.076                          .000
19 ----------------------------------------
     1    .000                   -1825.800                          .000
          .000     101.893     -176.803        -67.927     117.106
         3.000     101.893      128.877        -67.927     -86.673
         3.000                   -1825.800                          .000
20 ----------------------------------------
     1    .000                    -926.149                          .000
          .000      58.059      -91.162        -51.962      83.044
         3.000      58.059       83.016        -51.962     -72.842
         3.000                    -926.149                          .000
21 ----------------------------------------
     1    .000                    -461.642                          .000
          .000      52.567      -85.888        -12.913      23.555
         3.000      52.567       71.812        -12.913     -15.186
         3.000                    -461.642                          .000
22 ----------------------------------------
     1    .000                    -975.513                          .000
          .000      65.843     -105.849        -38.288      60.710
         3.000      65.843       91.679        -38.288     -54.152
         3.000                    -975.513                          .000
23 ----------------------------------------
     1    .000                    -956.674                          .000
          .000      65.964     -106.013        -38.103      59.687
         3.000      65.964       91.878        -38.103     -54.621
         3.000                    -956.674                          .000
24 ----------------------------------------
     1    .000                    -595.310                          .000
          .000      52.693      -86.059        -40.288      65.307
         3.000      52.693       72.020        -40.288     -55.557
         3.000                    -595.310                          .000
25 ----------------------------------------
     1    .000                    -217.597                          .000
          .000      19.588      -27.432         -8.766      11.907
         3.000      19.588       31.332         -8.766     -14.393
         3.000                    -217.597                          .000
26 ----------------------------------------
     1    .000                    -558.513                          .000
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          .000      14.840     -20.606        -35.105      51.805
         3.000      14.840      23.913        -35.105     -53.509
         3.000                            -558.513                      .000
27 ------------------------------------------------------------------------
     1    .000                            -548.281                      .000
          .000      14.663     -20.352        -36.225      53.350
         3.000      14.663      23.638        -36.225     -55.324
         3.000                            -548.281                      .000
28 ------------------------------------------------------------------------
     1    .000                            -301.191                      .000
          .000      19.402     -27.165        -35.734      51.634
         3.000      19.402      31.041        -35.734     -55.568
         3.000                            -301.191                      .000
29 ------------------------------------------------------------------------
     1    .000                            -581.840                      .000
          .000      55.110     -81.553         -2.388       2.527
         3.000      55.110      83.776         -2.388      -4.637
         3.000                            -581.840                      .000
30 ------------------------------------------------------------------------
     1    .000                           -1359.315                      .000
          .000      81.014    -113.131        -58.393      81.549
         3.000      81.014     129.910        -58.393     -93.630
         3.000                           -1359.315                      .000
31 ------------------------------------------------------------------------
     1    .000                           -1371.000                      .000
          .000      81.014    -113.131        -53.841      75.133
         3.000      81.014     129.910        -53.841     -86.389
         3.000                           -1371.000                      .000
32 ------------------------------------------------------------------------
     1    .000                            -682.986                      .000
          .000      55.110     -81.553        -46.902      68.543
         3.000      55.110      83.776        -46.902     -72.163
         3.000                            -682.986                      .000
33 ------------------------------------------------------------------------
     1    .000                            -343.148                      .000
          .000      46.878     -67.653         -8.497      11.520
         3.000      46.878      72.982         -8.497     -13.971
         3.000                            -343.148                      .000
34 ------------------------------------------------------------------------
     1    .000                            -713.479                      .000
          .000      59.457     -86.834        -34.875      51.475
         3.000      59.457      91.538        -34.875     -53.151
         3.000                            -713.479                      .000
35 ------------------------------------------------------------------------
     1    .000                            -703.247                      .000
          .000      59.634     -87.088        -36.454      53.681
         3.000      59.634      91.814        -36.454     -55.683
         3.000                            -703.247                      .000
36 ------------------------------------------------------------------------
     1    .000                            -426.742                      .000
          .000      47.064     -67.920        -36.003      52.021
         3.000      47.064      73.273        -36.003     -55.989
         3.000                            -426.742                      .000
37 ------------------------------------------------------------------------
     1    .000                            -162.426                      .000
          .000      11.442     -12.328         -3.364       1.587
         3.000      11.442      22.000         -3.364      -8.505
         3.000                            -162.426                      .000
38 ------------------------------------------------------------------------
     1    .000                            -383.541                      .000
          .000       6.022      -4.248        -25.552      36.618
         3.000       6.022      13.820        -25.552     -40.038
         3.000                            -383.541                      .000
39 ------------------------------------------------------------------------
     1    .000                            -379.472                      .000
          .000       5.828      -3.954        -27.978      39.719
         3.000       5.828      13.529        -27.978     -44.216
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        3.000                          -379.472                          .000
40 ----------------------------------------------------------------------------
     1    .000                          -203.321                          .000
          .000       11.237     -12.018          -29.942      42.379
         3.000       11.237      21.694          -29.942     -47.446
         3.000                          -203.321                          .000
41 ----------------------------------------------------------------------------
     1    .000                          -396.652                          .000
          .000       41.255     -59.152            3.195      -8.346
         3.000       41.255      64.614            3.195       1.240
         3.000                          -396.652                          .000
42 ----------------------------------------------------------------------------
     1    .000                          -910.381                          .000
          .000       61.060     -75.789          -43.411      55.400
         3.000       61.060     107.390          -43.411     -74.832
         3.000                          -910.381                          .000
43 ----------------------------------------------------------------------------
     1    .000                          -916.950                          .000
          .000       61.060     -75.789          -41.150      50.387
         3.000       61.060     107.390          -41.150     -73.064
         3.000                          -916.950                          .000
44 ----------------------------------------------------------------------------
     1    .000                          -446.100                          .000
          .000       41.255     -59.152          -39.851      57.735
         3.000       41.255      64.614          -39.851     -61.817
         3.000                          -446.100                          .000
45 ----------------------------------------------------------------------------
     1    .000                          -224.494                          .000
          .000       38.593     -53.840           -3.062       1.134
         3.000       38.593      61.939           -3.062      -8.052
         3.000                          -224.494                          .000
46 ----------------------------------------------------------------------------
     1    .000                          -460.116                          .000
          .000       49.304     -70.557          -25.287      36.225
         3.000       49.304      77.356          -25.287     -39.637
         3.000                          -460.116                          .000
47 ----------------------------------------------------------------------------
     1    .000                          -456.047                          .000
          .000       49.499     -70.851          -28.243      40.112
         3.000       49.499      77.646          -28.243     -44.617
         3.000                          -456.047                          .000
48 ----------------------------------------------------------------------------
     1    .000                          -265.389                          .000
          .000       38.798     -54.150          -30.244      42.832
         3.000       38.798      62.245          -30.244     -47.899
         3.000                          -265.389                          .000
49 ----------------------------------------------------------------------------
     1    .000                           -87.592                          .000
          .000       -5.300       9.685            9.965     -14.885
         3.000       -5.300      -6.215            9.965      15.009
         3.000                           -87.592                          .000
50 ----------------------------------------------------------------------------
     1    .000                          -197.016                          .000
          .000      -13.741      20.839          -14.929      19.312
         3.000      -13.741     -20.385          -14.929     -25.476
         3.000                          -197.016                          .000
51 ----------------------------------------------------------------------------
     1    .000                          -196.017                          .000
          .000      -14.015      21.207          -16.380      22.529
         3.000      -14.015     -20.838          -16.380     -26.611
         3.000                          -196.017                          .000
52 ----------------------------------------------------------------------------
     1    .000                           -99.813                          .000
          .000       -5.597      10.081          -27.852      35.120
         3.000       -5.597      -6.711          -27.852     -48.437
         3.000                           -99.813                          .000
53 ----------------------------------------------------------------------------
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	1	.000			-204.537			.000
		.000	24.272	-32.693		19.368	-27.429	
		3.000	24.272	40.124		19.368	30.675	
		3.000			-204.537			.000
54								
	1	.000			-464.556			.000
		.000	31.892	-30.982		-27.198	26.613	
		3.000	31.892	64.693		-27.198	-54.981	
		3.000			-464.556			.000
55								
	1	.000			-467.405			.000
		.000	31.892	-30.982		-17.851	17.955	
		3.000	31.892	64.693		-17.851	-35.599	
		3.000			-467.405			.000
56								
	1	.000			-219.646			.000
		.000	24.272	-32.693		-39.752	51.450	
		3.000	24.272	40.124		-39.752	-67.805	
		3.000			-219.646			.000
57								
	1	.000			-106.388			.000
		.000	32.968	-41.199		10.383	-15.452	
		3.000	32.968	57.706		10.383	15.696	
		3.000			-106.388			.000
58								
	1	.000			-220.933			.000
		.000	45.274	-58.185		-14.592	18.839	
		3.000	45.274	77.638		-14.592	-24.937	
		3.000			-220.933			.000
59								
	1	.000			-219.933			.000
		.000	45.548	-58.554		-16.717	23.001	
		3.000	45.548	78.091		-16.717	-27.150	
		3.000			-219.933			.000
60								
	1	.000			-118.608			.000
		.000	33.266	-41.596		-28.271	35.687	
		3.000	33.266	58.202		-28.271	-49.125	
		3.000			-118.608			.000

PROGRAM:SAP90/FILE:\33d.F3F
5 storey building-Bay size 7*7 //Fc=45MPa

F R A M E E L E M E N T F O R C E S

ELT ID	LOAD COMB	DIST ENDI	1-2 PLANE SHEAR	1-2 PLANE MOMENT	AXIAL FORCE	1-3 PLANE SHEAR	1-3 PLANE MOMENT	AXIAL TORQ
1								
	1	.000			-895.250			.000
		.000	-23.497	-64.242		26.256	31.136	
		3.000	-23.497	-134.733		26.256	109.903	
		3.000			-895.250			.000
2								
	1	.000			-2234.524			.000
		.000	-48.773	-40.061		-14.430	70.058	
		3.000	-48.773	-186.380		-14.430	26.770	
		3.000			-2234.524			.000
3								
	1	.000			-2220.649			.000
		.000	-48.784	-40.051		-13.251	68.931	
		3.000	-48.784	-186.403		-13.251	29.177	
		3.000			-2220.649			.000
4								
	1	.000			-1158.440			.000
		.000	-23.508	-64.231		-29.437	84.415	
		3.000	-23.508	-134.756		-29.437	-3.895	
		3.000			-1158.440			.000
5								
	1	.000			-2303.729			.000
		.000	23.601	-109.300		51.607	6.883	
		3.000	23.601	-38.495		51.607	161.705	
		3.000			-2303.729			.000
6								
	1	.000			-4974.873			.000
		.000	10.541	-189.708		-6.779	123.004	
		3.000	10.541	-158.085		-6.779	102.668	
		3.000			-4974.873			.000
7								
	1	.000			-4977.873			.000
		.000	10.541	-189.708		-2.389	118.888	
		3.000	10.541	-158.085		-2.389	111.722	
		3.000			-4977.873			.000
8								
	1	.000			-2582.575			.000
		.000	23.601	-109.300		-55.762	109.599	
		3.000	23.601	-38.495		-55.762	-57.686	
		3.000			-2582.575			.000
9								
	1	.000			-1299.767			.000
		.000	32.117	-117.447		26.273	31.120	
		3.000	32.117	-21.094		26.273	109.938	
		3.000			-1299.767			.000
10								
	1	.000			-2664.295			.000
		.000	58.935	-143.102		-14.413	70.043	
		3.000	58.935	33.703		-14.413	26.803	
		3.000			-2664.295			.000
11								
	1	.000			-2650.420			.000
		.000	58.946	-143.113		-13.268	68.947	
		3.000	58.946	33.726		-13.268	29.144	
		3.000			-2650.420			.000
12								
	1	.000			-1562.958			.000
		.000	32.129	-117.457		-29.454	84.432	
		3.000	32.129	-21.071		-29.454	-3.930	
		3.000			-1562.958			.000

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13 ----------------------------------------
     1    .000                    -709.076                        .000
          .000      46.820    -121.855        -14.798     55.091
         3.000      46.820      18.604        -14.798     10.697
         3.000                  -709.076                        .000
14 ----------------------------------------
     1    .000                   -1780.708                        .000
          .000       2.762     -52.240        -97.811    178.718
         3.000       2.762     -43.954        -97.811   -114.714
         3.000                  -1780.708                        .000
15 ----------------------------------------
     1    .000                   -1769.307                        .000
          .000       2.731     -52.198        -98.099    177.714
         3.000       2.731     -44.006        -98.099   -116.584
         3.000                  -1769.307                        .000
16 ----------------------------------------
     1    .000                    -927.426                        .000
          .000      46.789    -121.813       -114.786    211.266
         3.000      46.789      18.553       -114.786   -133.092
         3.000                   -927.426                        .000
17 ----------------------------------------
     1    .000                   -1836.806                        .000
          .000     148.971    -270.760         29.758    -15.083
         3.000     148.971     176.153         29.758     74.192
         3.000                  -1836.806                        .000
18 ----------------------------------------
     1    .000                   -3975.854                        .000
          .000     199.708    -411.849       -136.240    279.408
         3.000     199.708     187.276       -136.240   -129.313
         3.000                  -3975.854                        .000
19 ----------------------------------------
     1    .000                   -3978.591                        .000
          .000     199.708    -411.849       -131.730    270.241
         3.000     199.708     187.276       -131.730   -124.949
         3.000                  -3978.591                        .000
20 ----------------------------------------
     1    .000                   -2068.259                        .000
          .000     148.971    -270.760       -162.040    285.078
         3.000     148.971     176.153       -162.040   -201.042
         3.000                  -2068.259                        .000
21 ----------------------------------------
     1    .000                   -1045.410                        .000
          .000     146.846    -277.981        -14.750     55.027
         3.000     146.846     162.556        -14.750     10.777
         3.000                  -1045.410                        .000
22 ----------------------------------------
     1    .000                   -2138.243                        .000
          .000     195.156    -353.339        -97.765    178.656
         3.000     195.156     232.128        -97.765   -114.638
         3.000                  -2138.243                        .000
23 ----------------------------------------
     1    .000                   -2126.843                        .000
          .000     195.187    -353.381        -98.145    177.776
         3.000     195.187     232.180        -98.145   -116.660
         3.000                  -2126.843                        .000
24 ----------------------------------------
     1    .000                   -1263.760                        .000
          .000     146.877    -278.023       -114.834    211.330
         3.000     146.877     162.608       -114.834   -133.171
         3.000                  -1263.760                        .000
25 ----------------------------------------
     1    .000                    -555.606                        .000
          .000      32.063     -39.967         -4.229       .847
         3.000      32.063      56.223         -4.229    -11.840
         3.000                   -555.606                        .000
26 ----------------------------------------
     1    .000                   -1348.702                        .000
```

```
          .000      -8.082      18.849        -90.104     128.997
        3.000       -8.082      -5.398        -90.104    -141.315
        3.000                           -1348.702                        .000
27 ------------------------------------------------------------------------
    1   .000                            -1341.476                        .000
          .000      -8.130      18.916        -92.884     133.250
        3.000       -8.130      -5.475        -92.884    -145.403
        3.000                           -1341.476                        .000
28 ------------------------------------------------------------------------
    1   .000                             -700.203                        .000
          .000      32.015     -39.899       -100.096     140.694
        3.000       32.015      56.146       -100.096    -159.595
        3.000                            -700.203                        .000
29 ------------------------------------------------------------------------
    1   .000                            -1386.753                        .000
          .000     142.097    -205.056         36.674     -59.153
        3.000      142.097     221.234         36.674      50.870
        3.000                           -1386.753                        .000
30 ------------------------------------------------------------------------
    1   .000                            -2984.000                        .000
          .000     166.978    -230.159       -110.411     150.000
        3.000      166.978     270.775       -110.411    -181.233
        3.000                           -2984.000                        .000
31 ------------------------------------------------------------------------
    1   .000                            -2986.288                        .000
          .000     166.978    -230.159       -108.421     147.999
        3.000      166.978     270.775       -108.421    -177.264
        3.000                           -2986.288                        .000
32 ------------------------------------------------------------------------
    1   .000                            -1540.159                        .000
          .000     142.097    -205.056       -144.263     205.690
        3.000      142.097     221.234       -144.263    -227.098
        3.000                           -1540.159                        .000
33 ------------------------------------------------------------------------
    1   .000                             -779.919                        .000
          .000     128.064    -180.068         -4.155        .743
        3.000      128.064     204.124         -4.155     -11.723
        3.000                            -779.919                        .000
34 ------------------------------------------------------------------------
    1   .000                            -1587.407                        .000
          .000     173.391    -246.786        -90.034     128.897
        3.000      173.391     273.387        -90.034    -141.204
        3.000                           -1587.407                        .000
35 ------------------------------------------------------------------------
    1   .000                            -1580.182                        .000
          .000     173.439    -246.854        -92.954     133.349
        3.000      173.439     273.463        -92.954    -145.514
        3.000                           -1580.182                        .000
36 ------------------------------------------------------------------------
    1   .000                             -924.517                        .000
          .000     128.112    -180.136       -100.170     140.798
        3.000      128.112     204.201       -100.170    -159.712
        3.000                            -924.517                        .000
37 ------------------------------------------------------------------------
    1   .000                             -393.990                        .000
          .000      16.931      13.858          4.043     -34.076
        3.000       16.931      64.651          4.043     -21.948
        3.000                            -393.990                        .000
38 ------------------------------------------------------------------------
    1   .000                             -913.085                        .000
          .000     -19.896      72.305        -66.396      80.631
        3.000      -19.896      12.615        -66.396    -118.556
        3.000                            -913.085                        .000
39 ------------------------------------------------------------------------
    1   .000                             -909.222                        .000
          .000     -19.946      72.382        -71.829      87.257
        3.000      -19.946      12.545        -71.829    -128.230
```

```
        3.000                          -909.222                          .000
40 ----------------------------------------------
     1    .000                          -470.920                          .000
          .000      16.882      13.935      -82.275      104.543
         3.000      16.882      64.581      -82.275     -142.282
         3.000                          -470.920                          .000
41 ----------------------------------------------
     1    .000                          -934.293                          .000
          .000     107.515    -132.546       41.327      -93.324
         3.000     107.515     189.998       41.327       30.657
         3.000                          -934.293                          .000
42 ----------------------------------------------
     1    .000                         -1992.530                          .000
          .000     124.303    -115.462      -79.871       73.796
         3.000     124.303     257.447      -79.871     -165.818
         3.000                         -1992.530                          .000
43 ----------------------------------------------
     1    .000                         -1994.144                          .000
          .000     124.303    -115.462      -82.770       74.410
         3.000     124.303     257.447      -82.770     -173.899
         3.000                         -1994.144                          .000
44 ----------------------------------------------
     1    .000                         -1016.256                          .000
          .000     107.515    -132.546     -121.583      167.398
         3.000     107.515     189.998     -121.583     -197.350
         3.000                         -1016.256                          .000
45 ----------------------------------------------
     1    .000                          -514.440                          .000
          .000     103.551    -125.068        4.120      -34.197
         3.000     103.551     185.583        4.120      -21.836
         3.000                          -514.440                          .000
46 ----------------------------------------------
     1    .000                         -1041.879                          .000
          .000     143.480    -189.168      -66.320       80.515
         3.000     143.480     241.272      -66.320     -118.444
         3.000                         -1041.879                          .000
47 ----------------------------------------------
     1    .000                         -1038.016                          .000
          .000     143.529    -189.246      -71.905       87.373
         3.000     143.529     241.343      -71.905     -128.341
         3.000                         -1038.016                          .000
48 ----------------------------------------------
     1    .000                          -591.369                          .000
          .000     103.600    -125.146      -82.353      104.664
         3.000     103.600     185.653      -82.353     -142.394
         3.000                          -591.369                          .000
49 ----------------------------------------------
     1    .000                          -206.066                          .000
          .000     -43.051      78.770       54.756      -84.231
         3.000     -43.051     -50.382       54.756       80.035
         3.000                          -206.066                          .000
50 ----------------------------------------------
     1    .000                          -462.529                          .000
          .000    -103.166     153.084      -42.933       38.445
         3.000    -103.166    -156.414      -42.933      -90.353
         3.000                          -462.529                          .000
51 ----------------------------------------------
     1    .000                          -460.293                          .000
          .000    -103.257     153.194      -46.248       46.093
         3.000    -103.257    -156.577      -46.248      -92.651
         3.000                          -460.293                          .000
52 ----------------------------------------------
     1    .000                          -234.154                          .000
          .000     -43.143      78.881      -92.104       94.021
         3.000     -43.143     -50.548      -92.104     -182.291
         3.000                          -234.154                          .000
53 ----------------------------------------------
```

	1	.000		-472.833		.000
		.000	72.458	-70.422	115.368	-159.153
		3.000	72.458	146.952	115.368	186.949
		3.000		-472.833		.000
54						
	1	.000		-1007.841		.000
		.000	65.291	-23.708	-45.167	13.707
		3.000	65.291	172.164	-45.167	-121.795
		3.000		-1007.841		.000
55						
	1	.000		-1008.664		.000
		.000	65.291	-23.708	-36.964	11.378
		3.000	65.291	172.164	-36.964	-99.514
		3.000		-1008.664		.000
56						
	1	.000		-503.536		.000
		.000	72.458	-70.422	-155.607	172.236
		3.000	72.458	146.952	-155.607	-294.585
		3.000		-503.536		.000
57						
	1	.000		-250.341		.000
		.000	103.974	-99.950	54.894	-84.402
		3.000	103.974	211.973	54.894	80.281
		3.000		-250.341		.000
58						
	1	.000		-511.309		.000
		.000	168.873	-179.527	-42.805	38.284
		3.000	168.873	327.093	-42.805	-90.130
		3.000		-511.309		.000
59						
	1	.000		-509.074		.000
		.000	168.964	-179.637	-46.376	46.254
		3.000	168.964	327.256	-46.376	-92.874
		3.000		-509.074		.000
60						
	1	.000		-278.429		.000
		.000	104.066	-100.061	-92.243	94.191
		3.000	104.066	212.138	-92.243	-182.537
		3.000		-278.429		.000

Appendix D

```
        CLS
        K8 = .45: REM ******** Concrete stress factor
        k9 = .9: REM ********Neutral axis depth factor
        PRINT "AXIAL LOAD N, KN"
        INPUT N
        PRINT "MOMENT MX, KN.m"
        INPUT MX
        PRINT "MOMENT MY, KN.m"
        INPUT MY
        FU = 45: FY = 460: D1 = 60: D2 = 60: H = 600: B = 600
        B4 = B1: H4 = H: D4 = D1: D5 = D2
        E1 = FY / 1.15 / 200000:

        GOSUB 5000: REM *** REM Calculation 0f increased reinforcement
        N = N * 10 ^ 3: M = M * 10 ^ 6: EM = H / 20
        IF EM > 20 THEN EM = 20: REM *** Minimum moment
        IF M < N * EM THEN M = N * EM
        D = H - D1

        REM************Check of unreinforced section

        IF N = 0 THEN 360
        REM *****Calculate depth of stress block with no steel

        S = N / B / K8 / FU
        IF S > H THEN 360
        REM ** Check if M < moment of resistance of unreinforced section

        IF N * (H - S) / 2 > M THEN 940

360     REM * Iteration with X decreasing to balance the moment

        X = 2.333 * D: U = 10
380     X = X + H / U
390     X = X - H / U
        IF X < .9 * D THEN 570
        IF X > H / k9 THEN S = H
        IF X < H / k9 THEN S = k9 * X
        IF X = D THEN F3 = 0: GOTO 480
        E = ABS(.0035 * (D - X) / X)
        IF X > D THEN GOSUB 4000: REM *** Steel  compressive stress
subroutine
        IF X < D THEN GOSUB 4030: REM *** Steel tensile  stress
subroutine

        F3 = F7
480     E = .0035 * (X - D1) / X
        GOSUB 4000: REM *** Steel compressive stress subroutine

        F4 = F7
        ST = 2 * (N - K8 * FU * B * S) / (F3 + F4)
        IF ST <= 0 THEN 390
        M3 = K8 * FU * B * S * (H - S) / 2 + ST * (F4 - F3) * (H / 2 -
D1) / 2
        IF M3 < M THEN 390
        IF M * 1.02 > M3 THEN 790
        X = X + H / U: U = 10 * U: GOTO 380

570     REM * Iteration with X increasing to balance the axial load
```

```
        X = D1 + 1: U = 10
590     X = X - H / U
600     X = X + H / U
        IF X > H / k9 THEN S = H
        IF X < H / k9 THEN S = k9 * X
        IF X = D THEN F3 = 0: GOTO 680
        E = ABS(.0035 * (D - X) / X)
        IF X > D THEN GOSUB 4000: REM *** Steel compressive stress
subroutine
        IF X < D THEN GOSUB 4030: REM *** Steel tensile  stress
subroutine

        F3 = F7
680     E = .0035 * (X - D1) / X
        GOSUB 4000: REM *** Steel  compressive stress subroutine

        F4 = F7
        ST = 2 * (M - K8 * FU * B * S * (H - S) / 2) / (F4 - F3) / (H / 2
- D1)
        IF ST < 0 THEN 600
        N2 = K8 * FU * B * S + ST * (F3 + F4) / 2
        IF N2 < N THEN 600
        IF X = D1 + 1 AND N2 > N THEN 790
        IF N * 1.02 > N2 THEN 790
        IF N = 0 AND N2 - N < .1 THEN 790
        X = X - H / U: U = 10 * U: GOTO 590
790     N2 = K8 * FU * B * S + ST * (F3 + F4) / 2
        M3 = K8 * FU * B * S * (H - S) / 2 + ST * (F4 - F3) * (H / 2 -
D1) / 2

        REM** print output

        PRINT "TOTAL STEEL AREA  sq.mm"; INT(ST * 100) / 100
        IF 100 * ST / B / H < .4 THEN 940
        PRINT " AXIAL STRENGTH (KN)"; INT(N2 / 10) / 100
        PRINT " MOMENT STRENGTH (KN.m)"; INT(M3 / 10 ^ 4) / 100
        END
940     PRINT "MINIMUM STEEL AREA REQUIRED= 0.4% OF B*H="; .4 * B * H /
100; "sq.mm"
        END

        REM * Subroutine for steel compressive stress

4000    IF E >= E1 THEN F7 = FY / 1.15: GOTO 4060
        IF E <= E1 THEN F7 = 200000 * E: GOTO 4060

        REM * Subroutine for steel tensile stress

4030    IF E >= E1 THEN F7 = -(FY / 1.15): GOTO 4060
        IF E <= E1 THEN F7 = -(200000 * E)
4060    RETURN

        REM ** Subroutine to calculate incresed moment coefficient

5000    C1 = N / B / H / FU * 1000
        IF C1 > .6 THEN C2 = .3: GOTO 5060
        C2 = .3 + .7 / .6 * (.6 - C1)
5060    H1 = H - D1: B1 = B - D2
        IF MX / H1 < MY / B1 THEN 5100
        M = MX + C2 * (H1 / B1) * MY: AX$ = "X": REM X axis bending
```

```
        GOTO 5120
5100    M = MY + C2 * (B1 / H1) * MX: AX$ = "Y": REM Y axis bending

        H = B1 + D2: B = H1 + D1: D1 = D2
5120    RETURN
```

Bill of quantities for columns of a 15 story structure
fc=25 Mpa fy=460 Mpa span length= 5m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	640000	360000	4880000	2560	1440	19520
2	640000	360000	4880000	2560	1440	19520
3	640000	360000	4880000	2560	1440	19520
4	640000	360000	4880000	2560	1440	19520
5	640000	360000	4880000	2560	1440	19520
6	490000	250000	3480000	2109	2794	32158
7	490000	250000	3480000	1960	2417	28090
8	490000	250000	3480000	1960	1909	23010
9	490000	250000	3480000	1960	1372	17640
10	490000	250000	3480000	1960	1466	18580
11	360000	160000	2320000	1440	2046	23340
12	360000	160000	2320000	1440	1050	13380
13	360000	160000	2320000	1440	1560	18480
14	160000	90000	1220000	809	1486	16478
15	160000	90000	1220000	640	1552	16800
	Total concrete area		**51200000**	**Total steel area**		**305556**

Bill of quantities for columns of a 10 story structure
fc=25 Mpa fy=460 Mpa span length= 5m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	490000	250000	3480000	1960	1000	13920
2	490000	250000	3480000	1960	1000	13920
3	490000	250000	3480000	1960	1000	13920
4	490000	250000	3480000	1960	1000	13920
5	490000	250000	3480000	1960	1287	16790
6	250000	160000	2100000	2226	2310	27552
7	250000	160000	2100000	1236	1976	22232
8	250000	160000	2100000	1000	1658	18580
9	250000	160000	2100000	1000	1346	15460
10	250000	160000	2100000	1000	1665	18650
	Total concrete area		**27900000**	**Total steel area**		**174944**

Bill of quantities for columns of a 20 story structure
fc=25 Mpa fy=460 Mpa span length= 5m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	810000	490000	6520000	3240	1960	26080
2	810000	490000	6520000	3240	1960	26080
3	810000	490000	6520000	3240	1960	26080
4	810000	490000	6520000	3240	1960	26080
5	810000	490000	6520000	3240	2027	26750
6	640000	360000	4880000	3522	3457	41614
7	640000	360000	4880000	2560	3095	36070
8	640000	360000	4880000	2560	1440	19520
9	640000	360000	4880000	2560	1440	19520
10	640000	360000	4880000	2560	1458	19700
11	490000	250000	3480000	1960	3100	34920
12	490000	250000	3480000	1960	2488	28800
13	490000	250000	3480000	1960	2258	26500
14	250000	160000	2100000	3936	3701	44882
15	250000	160000	2100000	2709	2952	34938
16	250000	160000	2100000	1529	2652	29578
17	160000	90000	1220000	3456	3203	38942
18	160000	90000	1220000	2157	2483	29144
19	160000	90000	1220000	640	1836	19640
20	160000	90000	1220000	640	1765	18930
	Total concrete area		**78620000**	**Total steel area**		**573768**

Bill of quantities for columns of a 5 story structure
fc=25 Mpa fy=460 Mpa span length= 5m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	250000	160000	2100000	1000	640	8400
2	250000	160000	2100000	1404	1586	18668
3	250000	160000	2100000	1000	1326	15260
4	250000	160000	2100000	1000	1232	14320
5	250000	160000	2100000	1000	1633	18330
	Total concrete area		**10500000**	**Total steel area**		**74978**

Bill of quantities for columns of a 20 story structure
fc=25 Mpa fy=460 Mpa span length= 7m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	1210000	810000	10520000	15531	4990	80962
2	1210000	810000	10520000	13850	4541	73110
3	1210000	810000	10520000	13141	4402	70302
4	1210000	810000	10520000	13756	5587	83382
5	1210000	810000	10520000	16563	8687	119996
6	1000000	640000	8400000	16457	9761	130524
7	1000000	640000	8400000	11264	7667	99198
8	1000000	640000	8400000	7438	5618	71056
9	1000000	640000	8400000	5138	4572	55996
10	1000000	640000	8400000	4000	4030	48300
11	810000	490000	6520000	6430	6202	74880
12	810000	490000	6520000	4200	5021	58610
13	810000	490000	6520000	3240	4168	48160
14	490000	360000	4580000	7854	5778	73488
15	490000	360000	4580000	5274	4352	54068
16	490000	360000	4580000	2425	3619	41040
17	360000	250000	3220000	3833	4156	49226
18	360000	250000	3220000	1440	3005	32930
19	360000	250000	3220000	1440	2250	25380
20	360000	250000	3220000	1440	3913	42010
	Total concrete area		**140780000**	**Total steel area**		**1332618**

Bill of quantities for columns of a 5 story structure
fc=25 Mpa fy=460 Mpa span length= 7m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	490000	360000	4580000	1960	1440	18320
2	490000	360000	4580000	1960	2175	25670
3	490000	360000	4580000	1960	1440	18320
4	490000	360000	4580000	1960	1569	19610
5	490000	360000	4580000	1960	1440	18320
	Total concrete area		**22900000**	**Total steel area**		**100240**

Bill of quantities for columns of a 15 story structure
fc=25 Mpa fy=460 Mpa span length= 7m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	1000000	640000	8400000	9803	2560	45206
2	1000000	640000	8400000	7874	2560	41348
3	1000000	640000	8400000	6840	2560	39280
4	1000000	640000	8400000	7431	2584	40702
5	1000000	640000	8400000	10184	5877	79138
6	810000	490000	6520000	9544	6422	83308
7	810000	490000	6520000	4526	4757	56622
8	810000	490000	6520000	3240	3735	43830
9	810000	490000	6520000	3240	2832	34800
10	810000	490000	6520000	3240	2456	31040
11	640000	360000	4880000	2560	3441	39530
12	640000	360000	4880000	2560	2408	29200
13	640000	360000	4880000	2560	2509	30210
14	360000	250000	3220000	1400	2248	25280
15	360000	250000	3220000	1440	3787	40750
	Total concrete area		**95680000**	**Total steel area**		**660244**

Bill of quantities for columns of a 10 story structure
fc=25 Mpa fy=460 Mpa span length= 7m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	810000	490000	6520000	3240	1960	26080
2	810000	490000	6520000	3240	1960	26080
3	810000	490000	6520000	3240	1960	26080
4	810000	490000	6520000	3240	1960	26080
5	810000	490000	6520000	3240	2571	32190
6	490000	360000	4580000	3703	3000	37406
7	490000	360000	4580000	1960	2579	29710
8	490000	360000	4580000	1960	2461	28530
9	490000	360000	4580000	1960	2037	24290
10	490000	360000	4580000	1960	3695	40870
	Total concrete area		**55500000**	**Total steel area**		**297316**

Bill of quantities for columns of a 20 story structure
fc=45 Mpa fy=460 Mpa span length= 5m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	490000	360000	4580000	1960	1440	18320
2	490000	360000	4580000	1960	1440	18320
3	490000	360000	4580000	1960	1440	18320
4	490000	360000	4580000	1960	1440	18320
5	490000	360000	4580000	1960	1440	18320
6	360000	250000	3220000	1977	1000	13954
7	360000	250000	3220000	1440	1765	20530
8	360000	250000	3220000	1440	1237	15250
9	360000	250000	3220000	1440	1000	12880
10	360000	250000	3220000	1440	1079	13670
11	250000	160000	2100000	2047	3412	38214
12	250000	160000	2100000	1881	2900	32762
13	250000	160000	2100000	1000	2883	30830
14	160000	90000	1220000	4576	4642	55572
15	160000	90000	1220000	2957	4078	46694
16	160000	90000	1220000	1999	3150	35498
17	122500	90000	1145000	2203	2645	30856
18	122500	90000	1145000	490	2334	24320
19	122500	90000	1145000	490	1764	18620
20	122500	90000	1145000	490	2162	22600
	Total concrete area		**53540000**	**Total steel area**		**503850**

Bill of quantities for columns of a 5 story structure
fc=45 Mpa fy=460 Mpa span length= 5m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	160000	90000	1220000	640	360	4880
2	160000	90000	1220000	2155	2529	29600
3	160000	90000	1220000	803	2220	23806
4	160000	90000	1220000	692	1967	21054
5	160000	90000	1220000	647	2118	22474
	Total concrete area		**6100000**	**Total steel area**		**101814**

Bill of quantities for columns of a 15 story structure
fc=45 Mpa fy=460 Mpa span length= 5m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	360000	250000	3220000	1440	1000	12880
2	360000	250000	3220000	1440	1000	12880
3	360000	250000	3220000	1440	1000	12880
4	360000	250000	3220000	1440	1000	12880
5	360000	250000	3220000	1440	1400	16880
6	250000	160000	2100000	3372	3274	39484
7	250000	160000	2100000	1582	2969	32854
8	250000	160000	2100000	1000	2511	27110
9	250000	160000	2100000	1000	1844	20440
10	250000	160000	2100000	1000	2222	24220
11	160000	90000	1220000	2376	3466	39412
12	160000	90000	1220000	1289	2776	30338
13	160000	90000	1220000	799	2267	24268
14	122500	90000	1145000	490	2024	21220
15	122500	90000	1145000	490	2249	23470
	Total concrete area		**32550000**	**Total steel area**		**351216**

Bill of quantities for columns of a 10 story structure
fc=45 Mpa fy=460 Mpa span length= 5m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	250000	160000	2100000	1000	640	8400
2	250000	160000	2100000	1000	640	8400
3	250000	160000	2100000	1000	640	8400
4	250000	160000	2100000	1000	640	8400
5	250000	160000	2100000	1000	2114	23140
6	160000	90000	1220000	3319	3731	43948
7	160000	90000	1220000	1808	3199	35606
8	160000	90000	1220000	1071	2647	28612
9	160000	90000	1220000	770	2102	22560
10	160000	90000	1220000	770	2249	24030
	Total concrete area		**16600000**	**Total steel area**		**211496**

Bill of quantities for columns of a 20 story structure
fc=45 Mpa fy=460 Mpa span length= 7m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	810000	640000	8020000	8893	2560	43386
2	810000	640000	8020000	7126	2560	39852
3	810000	640000	8020000	6361	2560	38322
4	810000	640000	8020000	7644	2560	40888
5	810000	640000	8020000	11208	4827	70686
6	640000	490000	6180000	13497	6739	94384
7	640000	490000	6180000	8844	4184	59528
8	640000	490000	6180000	4451	1960	28502
9	640000	490000	6180000	2560	1960	24720
10	640000	490000	6180000	2560	1960	24720
11	490000	360000	4580000	5913	4742	59246
12	490000	360000	4580000	3549	3736	44458
13	490000	360000	4580000	863	3371	35436
14	360000	250000	3220000	5444	5890	69788
15	360000	250000	3220000	2734	4370	49168
16	360000	250000	3220000	1440	3999	42870
17	250000	160000	2100000	3322	5096	57604
18	250000	160000	2100000	1000	4061	42610
19	250000	160000	2100000	1000	3184	33840
20	250000	160000	2100000	1000	5093	52930
	Total concrete area		**102800000**	**Total steel area**		**952938**

Bill of quantities for columns of a 5 story structure
fc=45 Mpa fy=460 Mpa span length= 7m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	360000	250000	3220000	1440	1000	12880
2	360000	250000	3220000	1440	2506	27940
3	360000	250000	3220000	1440	1882	21700
4	360000	250000	3220000	1440	2183	24710
5	360000	250000	3220000	1440	4245	45330
	Total concrete area		**16100000**	**Total steel area**		**132560**

Bill of quantities for columns of a 15 story structure
fc=45 Mpa fy=460 Mpa span length= 7m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	640000	490000	6180000	5593	1960	30786
2	640000	490000	6180000	2938	1960	25476
3	640000	490000	6180000	2560	1960	24720
4	640000	490000	6180000	2560	1960	24720
5	640000	490000	6180000	6472	3586	48804
6	490000	360000	4580000	7998	4880	64796
7	490000	360000	4580000	3283	3258	39146
8	490000	360000	4580000	1960	2552	29440
9	490000	360000	4580000	1960	1947	23390
10	490000	360000	4580000	1960	2372	27640
11	360000	250000	3220000	1640	3532	38600
12	360000	250000	3220000	1440	2961	32490
13	360000	250000	3220000	1440	3417	37050
14	250000	160000	2100000	1000	3051	32510
15	250000	160000	2100000	1000	4930	51300
	Total concrete area		**67660000**	**Total steel area**		**530868**

Bill of quantities for columns of a 10 story structure
fc=45 Mpa fy=460 Mpa span length= 7m

Floor level	Column cross section (sq. mm)			Reinforcement cross section (sq. mm)		
	interior	exterior	TOTAL	interior	exterior	TOTAL
1	490000	360000	4580000	1960	1440	18320
2	490000	360000	4580000	1960	1440	18320
3	490000	360000	4580000	1960	1440	18320
4	490000	360000	4580000	1960	1440	18320
5	490000	360000	4580000	1960	2683	30750
6	360000	250000	3220000	1645	2755	30840
7	360000	250000	3220000	1440	3146	34340
8	360000	250000	3220000	1440	3154	34420
9	360000	250000	3220000	1440	2700	29880
10	360000	250000	3220000	1440	4584	48720
	Total concrete area		**39000000**	**Total steel area**		**282230**

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