INDOOR STADIUM WITH CABLE STAYED ROOF

PROJECT REPORT

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BONAFIDE CERTIFICATE

Certificate that this project report **"INDOOR STADIUM WITH CABLE STAYED ROOF"** is the bonafide work of... who carried out the project work under my supervision.

23/04/05

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SYNOPSIS

SYNOPSIS

Due to fluctuations in the prices of construction materials, it becomes the foremost duty of a civil engineer to design economical and durable structures. This project is an attempt to obtain an efficient roof truss for the indoor stadium

Usually the playing area in the stadium is the central focus point and must be devoid of any kind of obstruction. Hence there is a requirement of a very long span roof truss. Also the self weight must be reduced to be a minimum. Considering all these requirements, the best choice is the cable supported roofing method.

The entire structure is formulated in the **STAAD PRO 2005** software and analyzed in the same, in which the analysis is based on stiffness method.

Apart from design of roof truss special provisions like typical sports flooring for each game, special lighting with optimum intensity has been provided based on international standards in order to enhance a good playing environment for the players.

The space truss consists of tubular truss members, high strength bolts, balls and triangular purlins. The roof trusses are supported by cables consisting of high tensile strength steel wires and cables are supported by masts of 24m height. Loads on the structure are calculated manually based on codes IS: 875 (Part 1 to Part 3), for design specifications - IS: 800-1984, for Steel tubes in general building constructions - IS: 806-1968, Steel tubes for structural purposes - IS: 1161-1998.

The proposed site is located in Chinnavedampatti opposite to Kumaraguru College of Technology. The total area of indoor stadium is 20862.4 sq.m (or) 224561 sq.ft and the playing area is 4115 sq.m (or) 44294 sq.ft. Area of one sector is 3291 sq.m.

ACKNOWLEDGEMENT

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With wings to ideas we have carried out the project with gracious showers of the almighty and our parents. We thank them for their moral and financial support towards the project work.

First we would like to express our sincere gratitude and heartfelt thanks to our beloved guide, **Dr. J. PREMALATHA**, Professor, for having assisted us in all possible ways, in coming out with a successful project.

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We express our sincere thanks to our beloved Vice Principal, **Dr.ANNAMALAI** for all his encouragement and for his kind patronage.

We also thank **Mr.Rajendran** for helping us and providing valuable suggestions in the usage of STAAD software in our project.

Last but not least, we thank all the faculty members of the civil engineering department and to all our dear friends made us endure our difficult times with their unfailing humor and warm wishes for their generous gesture and help which has enabled us to complete our project successfully.

INTRODUCTION

INTRODUCTION

Steel is an invaluable alloy found in nature. It has high strength to weight ratio and many other desirable mechanical properties such as ductility, tensile strength, hardness etc due to which it finds a vital place in structural design.

The most ductile character of steel is exhibited in the direction of rolling. Steel is used a major material for long span structures. The properties of steel mostly do not change with time. This makes steel most suitable material for a structure. Even a small section, which has little self-weight, can resist heavy load.

The consumption of steel has been identified as an indicator of economic well being of a country. The present per capita consumption of steel has been stagnating in the range of 30 kg per annum, whereas other countries like china have surged ahead. Thus, we have to find out ways to use steel in an efficient manner and be ready to face a stiff competition from aluminum in the future.

Steel construction is one of the most efficient sectors in the construction industry. Leading suppliers manufacture the components offsite, using computer controlled equipment that is driven directly by information contained in 3-D computer models that are also used for detailing.

CABLE STRUCTURES

The use of high tensile strength steel wire strands and ropes offers some of the most exciting applications in contemporary architecture. Cables are employed as structural elements in a variety of structures such as roofs, bridges, guyed towers, ropeways and cooling towers. All these forms, except cooling towers using cables, are common place internationally.

In most cases cables are used in roofs and bridges of larger spans, although smaller structures are often seen too mostly to give expression to aesthetic innovativeness in design. Nevertheless the true merit of cables as a structural elements is seen in larger spans. The reason is their efficiency because of the high strength weight ratio of the steel used and the structural form enabling almost 100% utilization of the material involved.

A cable system is thus light weight, but has to combine other structural elements in steel, concrete, or steel concrete composites to form a complete structure.

The other important aspect of cable structures is that related to wind loading and their aerodynamic behaviour. The longer the span more slender the structure, the greater is the wind sensitivity. A cable element is inherently efficient in as far as material usage is concerned.

ANALYSIS AND DESIGN

ANALYSIS AND DESIGN OF TRIANGULAR SPACE FRAME

INTRODUCTION

The space truss is analyzed for combination of dead, live and wind loads based on the stiffness method using the STAAD-PRO Software. The component members are designed manually, based on the principles of working stress method with reference to the appropriate codal provisions.

List of Bureau of Indian Standards Referred

1.	IS : 875-1994(Part-1 to Part-3)	For load calculations
2.	IS : 800-1984	For design specifications
3.	IS : 806-1968	Steel tubes in general building constructions
4.	IS : 1161-1998	Steel tubes for structural purposes

STRUCTURAL GEOMETRY

Span of space truss	35.5
Spacing of space truss c/c	10m
Height of space truss from springing (support)	23.63m

LOAD CALCULATIONS

CALCULATION OF LOADS

LOAD CASE NO:1 (DEAD LOAD)

Self weight of roofing sheet (galvalume)	5.0 kg/m^2
Self weight of triangular purlin	7.0 kg/m^2
Self weight of tubular truss(including ball and other accessories)	7.0 kg/m^2
Total dead load intensity	19.0 kg/m^2
Total dead load transferred to one truss	19.0 x span x truss spacing
Plan x intensity of dead load	18.0 x 35.5 x 10
Total dead load of space truss	63.90 KN

The load is transferred to the space truss through 13 pair of top balls (purlins). Half load is considered for end balls.

Hence,

$13\ w_d = 63.90$ KN

Dead load on each pair of balls at top	63.90/13	4.915
Dead load on individual top ball, w_d	4.915/2	2.4575
Dead load on exterior top ball	2.4575/2	1.229

LOAD CASE NO. : 2 (LIVE LOADS)

As per IS : 875(Part-2),

Live load/m^2 = 0.74 KN/m^2,

(subject to a minimum of 0.40 KN/m^2)

Total live load transferred to one truss = 0.74 x 35.5 x 10

= 180.56 KN

Live load in each pair of top balls = 180.56/13

Load on each pair w_l = 13.89 KN

Live load on individual ball = 13.89/2

= 6.945 KN

Live load on exterior ball = 6.945/2

= 3.473 KN

Note : as per IS : 875 (Part-2), for designing the members of the supporting system (space truss), 2/3rd of the live load is considered in the design. This is incorporated in the form of loading factor in the analysis software.

LOAD CASE NO. : 3

Wind load is calculated as per IS : 875. Wind is considered to act from left to right and vice- versa. Wind load consists of both external wind pressure and internal wind pressure.

Referring to IS : 875, basic wind velocity is taken as 47 m/sec.

The factors k_1, k_2, k_3 are taken as per IS : 875.

Design wind speed,

$V_z = V_b.k_1.k_2.k_3 = 48.175$ m/sec

Therefore, wind pressure, P = 1.392 KN/m^2

Say P = 1.40 KN/m^2

As per IS: 875, the external wind pressure is

On windward quarter of space truss	= -0.77 P
On central half of space truss	= -0.83 P
On leeward quarter of space truss	= -0.4 P

Where,

P=design wind pressure = 1.4 KN/m^2

Also, building is assumed to have medium permeability.

Internal wall pressure = + or – 0.5 P (as per IS:875)

The total wind load acting on the space truss is calculated as given in the tabular form below.

Wind load acting from left to right

Wind load component	Wind ward quarter	Central half	Leeward quarter
External wind pressure	-0.77 P	-0.83 P	-0.4 P
Internal wind pressure(+0.5P) + External wind pressure	-0.27 P	-0.33 P	0.1 P
Internal wind pressure(-0.5P) + External wind pressure	-1.27 P	-1.33 P	-0.9 P
Design wind pressure	-1.27 P = -1.78KN/m^2	-1.33 P = -1.86 KN/m^2	-0.9 P = -1.26 KN/m^2

[-ve indicated forces that act away from truss(uplift)]

[+ve indicated load towards the space truss]

Wind load on top chord members per meter run,

On windward quarter = -1.78 x 10

= -17.8 KN/m (on two lines of top chord)

= -8.9 KN/m (on each top chord member)

On central half = -1.87 x 10

= -18.7 KN/m (on two lines of top chord)

= -9.35 KN/m (on each top chord member)

On leeward quarter = -1.26 x 10

= -12.6 KN/m (on two lines of top chord)

= -6.3 KN/m (on each top chord member)

Wind blowing parallel to ridge

When the wind blows parallel to the ridge, the external pressure is taken as -0.7 P. therefore combined wind pressure along with internal pressure is -1.2 P = -1.68 KN/m^2

Note : As per codal provision, the allowable stress in the members can be increased by 33% when wind load is considered. This is incorporated in the analysis in the form of reduced load factor equal to 0.75.

LOAD COMBINATIOS AND DESIGN METHODOLOGY

LOADING COMBINATIONS

The following **FOUR** loading combinations are considered (As per IS:875)

(i) Dead load + live load

(ii) Dead load + wind load blowing from left (perpendicular to ridge)

(iii) Dead load + wind load blowing from right (perpendicular to ridge)

(iv) Dead load + wind load (parallel to ridge)

DESIGN METHODOLOGY

The design is carried out on the allowable stress principles stated as

Actual stress is less than the allowable stress.

- The allowable stresses in the pipe section are taken from IS:806-1968
- The properties of tubular sections are taken from IS:1161-1998
- Each member is designed for maximum compression and checked for tension resulting from loading combinations.
- The effective length of each member is taken as equal to its actual length as it is clearly discontinuous at the joint.
- In addition, tie runners are provided which connects the space truss bottom chords of each space trusses.
- Typical design of the top and bottom chord members is presented in detail.

DESIGN OF TRUSS MEMBERS

DESIGN OF TYPICAL TUBULAR TRUSS MEMBERS

TOP CHORD MEMBERS (Members Marked as "A")

From analysis results, the maximum compression and tension is extracted from considering various combinations.

Maximum compression = 57.45 KN

Maximum tension = 123.35 KN

Length of each member = 2130 mm

The member is designed for maximum compression and checked for maximum tension.

$$\text{Slenderness ratio} = \frac{\text{Effective length}}{\text{Minimum radius of gyration}}$$

As per IS: 800-1984,

Effective length = 1.0 x 2130

= 2130 mm

From IS: 1161-1998

For a pipe with outer diameter of 60.3 mm,

Properties of this tube section,

Cross sectional area = 650 mm^2

Radius of gyration = 20.1 mm

Wall thickness = 3.65 mm

Class = medium

Slenderness ratio = 2130/20.1 = 105.97

For pipe grade Ys_t 32, from IS: 806-1968

Permissible axial compressive stress = 989 – ((989 – 869) / 10) x 5.97

= 917.36 kgf / cm^2

i.e.. Allowable compressive stress = 89.99 N/mm^2

Allowable axial compression = allowable compressive stress x

Cross sectional area

= 89.99 x 650

= 58.493 KN > 57.45 KN

Hence safe

CHECKING THE MEMBER FOR MAXIMUM TENSION

Maximum tensile force = 123.35 KN

From IS: 806-1968, tube grade of Ys_t 32.

Allowable axial tensile stress = 190 N/mm^2

Allowable tensile force = 190 x 650 = 123.5 KN > 123.35 KN

Hence ok.

CHECK FOR MAXIMUM SLENDERNESS RATIO

As per IS: 800,

Maximum slenderness ratio = 180

Actual slenderness ratio = 105.97 < 180

Hence, the pipe with outer diameter of 60 mm Medium class with wall thickness of 3.65 mm thick is safe.

DESIGN OF PURLINS

DESIGN OF TRIANGULAR PURLIN

Span of purlin = 10.0 m

Spacing of purlin = 2.32 m

Dead loads

Self weight of galvalume roofing

sheet per meter run

(including overlap and fixtures) = 5 kg/m^2 x 2.32

=11.6kg/m

Self weight of purlin @ 7kg/m^2

(assumed) = 7 x 2.32

= 16.24 kg/m

Total dead load = 11.6 + 16.24 = 27.84

W_D = 0.28 KN/m

Live loads

From IS : 875 (Part-2),

Live load intensity (Access to roof is not provided) = $0.75-.52r^2$

Where h= 23.63 and l= 35.5

r = h/l

r =23.63 / 35.5

r =0.666

live load = 0.74 KN/m^2 > 0.4 KN/m^2

Total live load per metre run = 0.74 x 2.32

W_L = 1.717 KN/m

Wind loads

From IS : 875 (Part-3),

Wind pressure = $0.6\ V_z^2$

V_z = $V_b.K_1.K_2.K_3$

V_b = 47 m/sec

K_1 =1.0 (Life of structure = 50 years, General buildings)

K_2 = 1.025 (Category-1, group-C, maximum height = 15m)

K_3 = 1.0 (plain ground)

V_z = 48.175 m/sec

Wind pressure = 1.392 KN/m^2 say 1.4 KN/m^2

External wind pressure

a) Wind perpendicular to the ridge

i) Windward quarter = -0.77 P

ii) Central half = -0.83 P

iii) Leeward quarter = -0.40 P

b) Wind parallel to the ridge

i) Windward side = -0.7 P

ii) Central half = -0.83 P

iii) Leeward side = -0.7 P

Purlin is designed for the maximum external wind pressure of 0.83P (outward).

Internal pressure = 0.2(medium permeability)

Worst effect of external +

internal pressure = -0.83P - 0.2P

= -1.03P = -1.442 KN/m^2

Upward wind load on purlin = -1.442 x 2.32

= -3.35 KN/m

To account for 33% of increased stresses, wind load is reduced by 75%.

75% of wind load = 2.5 KN/m (upward)

Loading combinations

Two loading combinations namely Dead load + live load and dead load + wind load are considered as critical.

a) DL + LL

Total DL + LL = 1.999 KN/m (downward)

Vertical component of DL + LL = 1.758 KN/m

Horizontal component of DL + LL = 0.471 KN/m

For continuous purlin,

B.M in the vertical plane = 5.339 KN-m (sagging)

Provide one sag rod @ half the span in the plane of the purlins.

B.M in the horizontal plane = 0.294 KN-m

b) DL + WL

Total DL + WL (normal to roof) = 0.2414 – 2.51 KN/m

= -2.05 KN/m

Total DL + WL (parallel to roof) = 0.0647 KN/m

B.M in the vertical plane = 5.125 KN-m (hogging)

B.M in the horizontal plane = 0.0404 KN-m

Assuming a triangular purlin of size 200 x 250 mm with angle members

i) DL + LL

Maximum compression in the top angle = 14 + 9.35 = 23.35 KN

Maximum tension in the bottom angle = 28 KN

ii) DL + WL

Maximum tension in the top angle = 21.58 + 1.208 = 22.87 KN

Maximum compression in the bottom angle = 46.16 KN

Design Forces for top angle

Maximum compression = 23.35 KN

Maximum tension = 28 KN

Design is governed by maximum compression. Let the purlin span of 10m is divided into 11 panels.

Top angle design

Panel length = 575 mm

Effective length = 0.85 x 575 = 489 mm

Try ISA 25 x 25 X 5

Slenderness ratio, λ = 489 / 7.2

= 67.92

Allowable compressive load = 114 x 225

= 25.65 kN > 23.35 kN

No need to check for tension. **Hence OK**

Bottom angle design

Try ISA 40 X 40 x 5

Slenderness ratio, λ = 489 / 7.7

= 63.51

Allowable compression	= 118 x 378
	= 44.6kN > 43.16kN

Hence Safe

Diagonal members

Maximum shear force	= 8.32
Cos θ (θ = 21.8)	= 8.32 / 2F
Compression in the diagonal, F	= 4.48 kN
Length of diagonal member	= 381 mm
Effective length	= 323 mm

Try 10mm diameter M.S.rod,

Slenderness ratio	= 323 / 2.5 = 129
Allowable compression	= 57 X 78
	= 4.48kN ≈ 4.8kN

Hence Safe

Design details for purlin

Top pair of angles	= ISA 25 x 25 x 5
Bottom angle	= ISA 40 x 40 x 5
Diagonal member at top and sides	= 10 mm dia M.S.rod
Pitch of diagonals	= 575 mm

Weld connection between diagonal and angle (top/bottom)

Weld size = 3 mm

Strength of weld per unit length = 212 N/mm

Force in the diagonal = 4.48 kN

Weld length required = 21.13 mm ≈ 22 mm

Provide 30 mm length with weld size of 3 mm.

Hence Safe.

Check for deflection

Approximate moment of inertia $= 12.85 \times 10^6 \text{ mm}^4$

Maximum deflection $$= \frac{4}{384} \times \frac{2.63 \times (6310)^4}{(2 \times 10^5) \times (12.85 \times 10^6)}$$

$= 16.89$ mm

Allowable deflection = 6310 / 325 =19.415 mm

Hence safe.

DESIGN OF BOLTS

DESIGN OF HIGH TENSILE STRENGTH BOLTS

FOR TVS HIGH STRENGTH BOLTS

The ultimate tensile stress is taken as follows.

Ultimate tensile strength =1250 N/mm^2 (Grade 12.9)

Ultimate tensile strength =1090 N/mm^2 (Grade 10.9)

Ultimate tensile strength = 880 N/mm^2 (Grade 8.8)

Allowable tensile stress = Ultimate tensile strength / Factor of safety

Factor of safety = 2

Therefore,

Allowable axial tensile stress = 645 N/mm^2 (Grade 12.9)

Allowable axial tensile stress = 545 N/mm^2 (Grade 10.9)

Allowable axial tensile stress = 440 N/mm^2 (Grade 8.8)

The area of the bolt at the root of thread is taken as follows.

12 mm diameter = 78 mm^2

16 mm diameter = 157 mm^2

20 mm diameter = 245 mm^2

24 mm diameter = 353 mm^2

30 mm diameter = 561 mm^2

The capacity of bolt in axial tension = thread area x allowable tensile stress

The following table shows the capacity of bolts in axial tension for different grades.

CAPACITY OF BOLTS IN AXIAL TENSION (in kN)

Grade of	12mm	16mm	20mm	24mm	30mm
8.8	34.3	69.08	107.8	155.3	246.84
10.9	42.5	85.5	133.5	192.3	305.74
12.9	50.3	lul.2	158.1	227.6	361.84

The size and grade of bolt in each pipe is selected in such a way that the tensile strength of bolt is greater than that of pipe so that failure in bolt is avoided.

For instance, for a pipe of 48.3H class,

Tensile strength of pipe section = 556 x 186.39 = 103.63 kN

Hence, either 16mm diameter of grade 12.9 or 20mm diameter of 8.8 grade can be provided.

Also, the threaded length of bolt inside the solid 1v1.S ball should be at-least equal to 1.2 times the diameter of bolt in order to avoid pull-out failure.

DESIGN OF CABLE

DESIGN OF CABLE

Force on cable = 238 KN

Allowable stress of steel bar = 150 N/mm^2

$$\text{Area} = \frac{\text{Cable force}}{\text{Allowable stress}}$$

Area = $238 \times 10^3 / 150$

= 1586.67 mm^2

Dia of entire cable, d $= \left(\frac{4*1586.67}{\pi}\right)^{0.5}$

= 45 mm

Assume diameter of single strand = 5 mm

Therefore no. of strands in one sub-cable = 7

Assuming dia of sub – cable as 15 mm,

No. of sub – cables $= \frac{area\ of\ entire\ cable}{area\ of\ single\ strand}$

$$= \frac{1586.67}{(\pi*15*15)/4}$$

No. of sub – cables = 7

STAAD ANALYSIS

STAAD INPUT FILE

STAAD SPACE

START JOB INFORMATION

ENGINEER DATE 11-Apr-09

END JOB INFORMATION

INPUT WIDTH 79

UNIT METER KN

JOINT COORDINATES

1 32.0468 2.45101 -0.788647; 2 34.277 1.81537 -0.788647;

3 29.7931 2.9977 -0.788647; 4 27.5195 3.4546 -0.788647;

5 25.2296 3.82099 -0.788647; 6 22.927 4.09628 -0.788647;

7 20.6152 4.28005 -0.788647; 8 18.298 4.37201 -0.788647;

9 15.979 4.37201 -0.788647; 10 13.6618 4.28005 -0.788647;

11 11.35 4.09628 -0.788647; 12 9.0474 3.82099 -0.788647;

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19 0.787661 3.28216 -1.97162; 20 3.07541 3.8854 -1.97162;

21 3.07541 3.8854 0.394323; 22 0.787661 3.28216 0.394323;

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POISSON 0.3
DENSITY 76.8195
ALPHA 1.2e-005
DAMP 0.03
END DEFINE MATERIAL
MEMBER PROPERTY INDIAN
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3235 TO 3239 3353 TO 3357 3407 TO 3411 3442 TO 3445 3682 TO 3686 -
3800 TO 3804 3854 TO 3858 3889 TO 3892 4129 TO 4133 4247 TO 4251 -
4301 TO 4305 4336 TO 4339 UNI GY 6.39
```

LOAD 4 LOADTYPE Wind TITLE WLMIDDLE

MEMBER LOAD

109 TO 113 227 TO 231 558 TO 562 676 TO 680 1005 TO 1009 1123 TO 1127 1452 -

1453 TO 1456 1570 TO 1574 1899 TO 1903 2017 TO 2021 2346 TO 2350 2464 TO 2468 -

2793 TO 2797 2911 TO 2915 3240 TO 3244 3358 TO 3362 3687 TO 3691 -

3805 TO 3809 4134 TO 4138 4252 TO 4256 UNI GY 6.67

LOAD 5 LOADTYPE Wind TITLE WLRIGHT

MEMBER LOAD

114 TO 118 232 TO 236 563 TO 567 681 TO 685 1010 TO 1014 1128 TO 1132 1457 -

1458 TO 1461 1575 TO 1579 1904 TO 1908 2022 TO 2026 2351 TO 2355 2469 TO 2473 -

2798 TO 2802 2916 TO 2920 3245 TO 3249 3363 TO 3367 3692 TO 3696 -

3810 TO 3814 4139 TO 4143 4257 TO 4261 UNI GY 4.52

LOAD COMB 6 COMBINATION LOAD CASE 6

1 1.0 2 1.0

LOAD COMB 7 COMBINATION LOAD CASE 7

1 1.0 3 1.0

LOAD COMB 8 COMBINATION LOAD CASE 8

1 1.0 4 1.0

LOAD COMB 9 COMBINATION LOAD CASE 9

1 1.0 5 1.0

PERFORM ANALYSIS

FINISH

STAAD CRITICAL RESULT – AXIAL FORCE

Software licensed to Designtech	Job No	Sheet No 1	Rev
	Part		
le	Ref		
	By	Date 11-Apr-09	Chd
	File kct project.std	Date/Time 22-Apr-2009 15:40	

Advanced Query 2

Member	MAX(FX) (kN)
1	175.35001
2	546.46222
3	539.25598
4	534.93701
5	536.09540
6	549.38062
7	552.73468
8	563.34332
9	567.65887
10	563.09619
11	563.50989
12	564.91589
13	580.66443
14	581.34003
15	603.26392
16	-5.78696
17	2.97863
18	0.91752
19	31.37318
20	7.37688
21	0.34920
22	2.69480
23	2.12252
24	9.93491
25	5.66738
26	-1.48171
27	12.28163
28	8.90394
29	5.44343
30	5.32695
31	11.17372
32	7.44269
33	6.79464
34	9.77357
35	-0.46914
36	14.36581
37	3.18336
38	3.29329
39	7.29956
40	-0.65849
41	3.33642
42	3.48435
43	3.98164
44	8.66772
45	1.28332
46	9.69589

Advanced Query 2 Cont...

Member	MAX(FX) (kN)
49	15.19296
50	7.01988
51	5.78267
52	5.66086
53	8.68768
54	15.02611
55	6.92762
56	10.10826
57	9.42913
58	7.87427
59	4.01901
60	6.89685
61	5.10891
62	-0.02041
63	6.41656
64	-0.64499
65	6.32459
66	6.20058
67	6.35300
68	11.22900
69	8.47267
70	242.14169
71	-22.58161
72	47.74963
73	49.38924
74	-0.00000
75	-0.00000
76	-5.78766
77	-0.24558
78	-1.88725
79	-1.22148
80	-1.36716
81	-0.95934
82	-1.24163
83	-2.03463
84	-0.55026
85	-1.82858
86	-1.71819
87	-0.28787
88	-2.19493
89	-1.53731
90	-3.88927
91	-1.17751
92	-1.28171
93	-0.81178
94	-1.08179
95	-0.01270

Advanced Query 2 Cont...

Member	MAX(FX) (kN)
98	17.13661
99	4.10063
100	0.68879
101	4.66587
102	-2.57329
103	48.03668
104	-0.56928
105	-1.99354
106	-1.31435
107	-0.83686
108	-1.13873
109	-1.16438
110	-0.24699
111	-1.79905
112	-0.81702
113	-1.15097
114	-1.43136
115	0.25193
116	-1.75950
117	-16.00351
118	-9.98381
119	180.41901
120	310.22961
121	310.45300
122	311.19730
123	315.92981
124	310.39850
125	317.55670
126	313.96991
127	322.80090
128	320.41531
129	320.28909
130	313.95969
131	317.72360
132	316.48431
133	315.65051
134	0.03265
135	0.06872
136	1.63017
137	-0.13383
138	0.99386
139	2.49001
140	2.69477
141	2.44845
142	1.66884
143	5.24344

Advanced Query 2 Cont...

Member	MAX(FX) (kN)
147	4.89611
148	0.56618
149	8.59475
150	2.59748
151	12.71429
152	2.51808
153	-0.24010
154	13.36607
155	0.00000
156	-0.28979
157	8.02430
158	-0.28502
159	-0.00000
160	0.00000
161	4.47390
162	8.00271
163	-1.02584
164	7.55697
165	7.25843
166	12.21721
167	8.60017
168	6.77560
169	0.48994
170	0.04795
171	12.15213
172	5.60304
173	1.75196
174	3.49607
175	3.61511
176	3.77594
177	-0.00000
178	0.49402
179	11.07417
180	-0.72340
181	-0.04161
182	0.94697
183	0.87675
184	7.28688
185	7.53505
186	8.01932
187	9.16024
188	59.49012
189	-8.42212
190	15.62232
191	16.61816
192	-0.00000
193	-0.00000

Advanced Query 2 Cont...

Member	MAX(FX) (kN)
196	-0.11196
197	-0.95252
198	-1.20554
199	-0.71048
200	-0.56419
201	-2.91832
202	-0.34470
203	-2.97461
204	-1.46963
205	-1.22320
206	-1.58945
207	-0.95503
208	-3.30401
209	-1.34518
210	-2.02413
211	-0.59881
212	-1.04237
213	-0.52813
214	-1.17255
215	1.11686
216	3.98116
217	1.32549
218	-0.95635
219	0.60360
220	1.64061
221	24.13030
222	-0.08316
223	-0.03472
224	-0.50216
225	-2.16897
226	-0.40182
227	0.44513
228	-0.52491
229	-2.19976
230	0.59462
231	-0.52275
232	-0.13688
233	0.08220
234	-1.53471
235	-5.63622
236	-1.48118
237	801.56451
238	236.44501
239	528.96240
240	146.80550
241	-101.49240
242	-37.07138

FLOORING AND LIGHTING

FLOORING AND LIGHTING

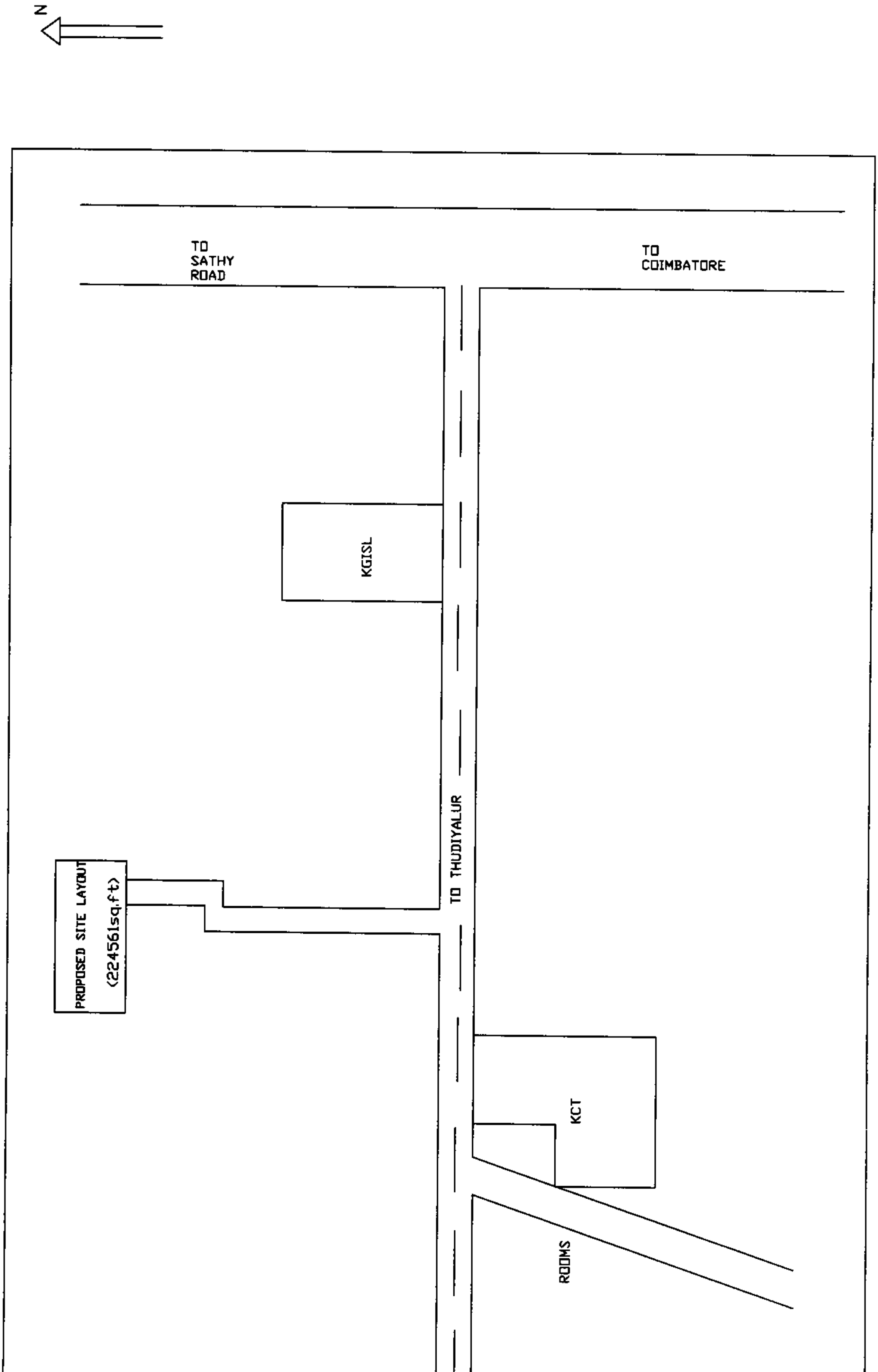
The surface of the flooring is treated with poly urethane and the treatment is called poly urethane surface treatment. It provides a leveled surface so that the players comfortability is increased. When we provide normal flooring, cleaning the floor area is a huge task, so the provision of this type of flooring is a boon to the cleaners. The durability of protecsol is more when compared with other type of flooring.

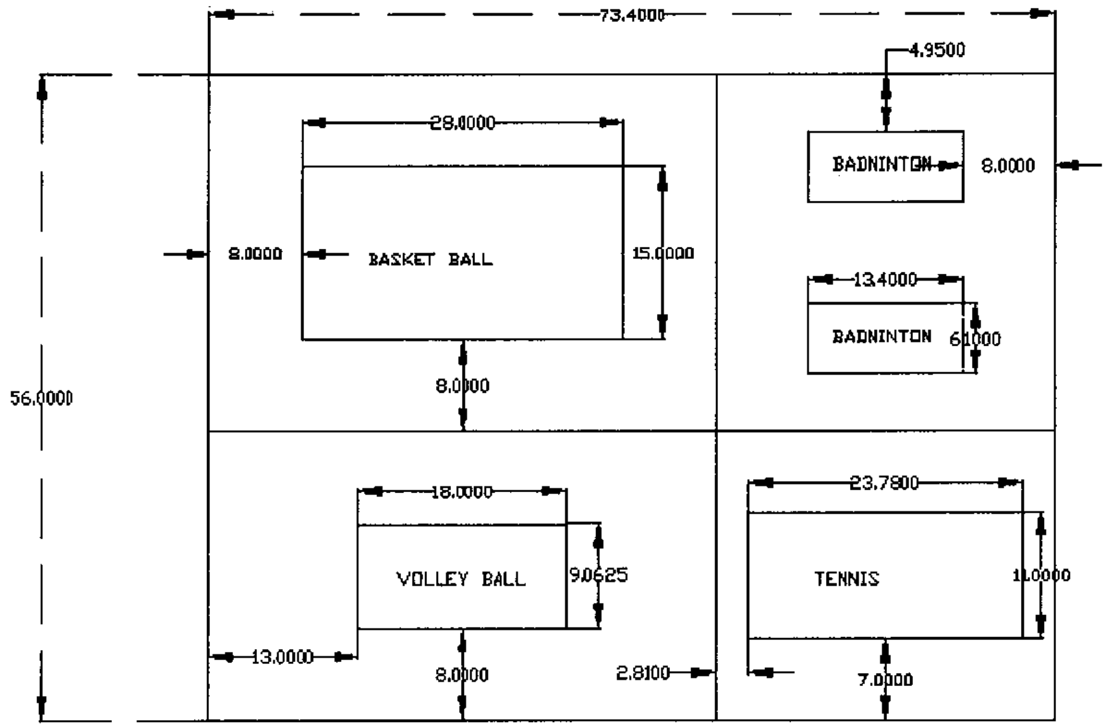
Teraflex flooring is a material provided over the protecsol coating. It provides a good shock absorbance. By using this Teraflex flooring we can increase the frition level. Easy playability for the players. It has the property called Resilience (i,e) springs back to original shape.

- TENNIS – taraflex tennis (london green color)
- BADMINTON – sepak takraw (mint green color)
- BASKET BALL - maple design, oak design(wood)
  - Sweedish technology – ‘bonotech’ wood polish to avoid slippering
- VOLLEY BALL – taraflex action sport 45(grey)

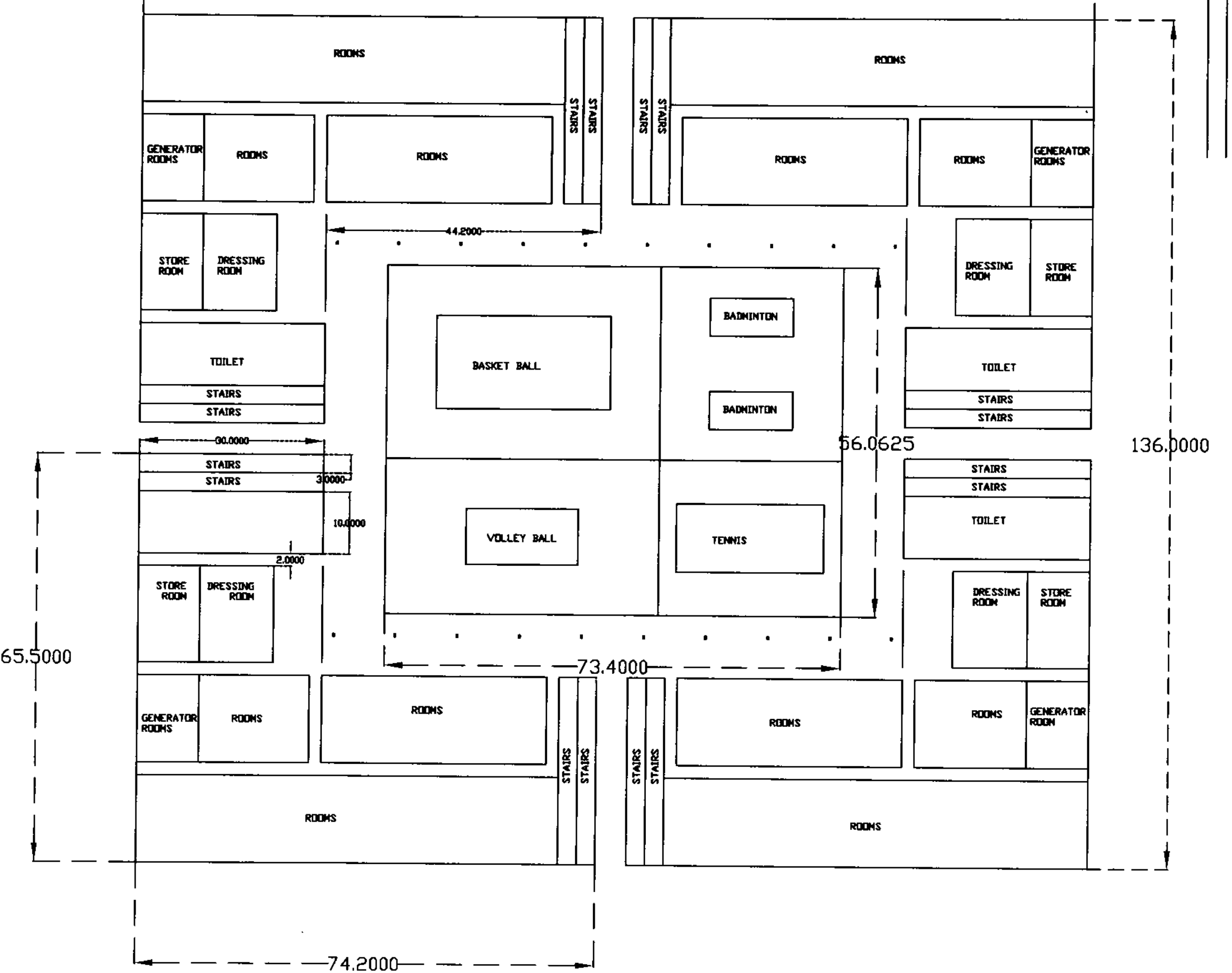
The minimum lighting requirements for all the games is 1000 lux (unit for luminescence) for international standards. Separate light for each sport. Glaring effect is totally eliminated.

DRAWINGS


N
TO SATHY ROAD
TO COIMBATORE
KGISL
TO THUDIYALUR
PROPOSED SITE LAYOUT
(22456sq.ft)
KCT
ROOMS



PLAYING AREA



136.0000
ROOMS
STAIRS
STAIRS
STAIRS
STAIRS
ROOMS
GENERATOR ROOMS
ROOMS
ROOMS
ROOMS
ROOMS
GENERATOR ROOMS
44.2000
STORE ROOM
DRESSING ROOM
DRESSING ROOM
STORE ROOM
TOILET
STAIRS
STAIRS
BASKET BALL
BADMINTON
BADMINTON
TOILET
STAIRS
STAIRS
56.0625
30.0000
STAIRS
STAIRS
3.0000
10.0000
2.0000
VOLLEY BALL
TENNIS
STAIRS
STAIRS
TOILET
STORE ROOM
DRESSING ROOM
DRESSING ROOM
STORE ROOM
65.5000
73.4000
GENERATOR ROOMS
ROOMS
ROOMS
STAIRS
STAIRS
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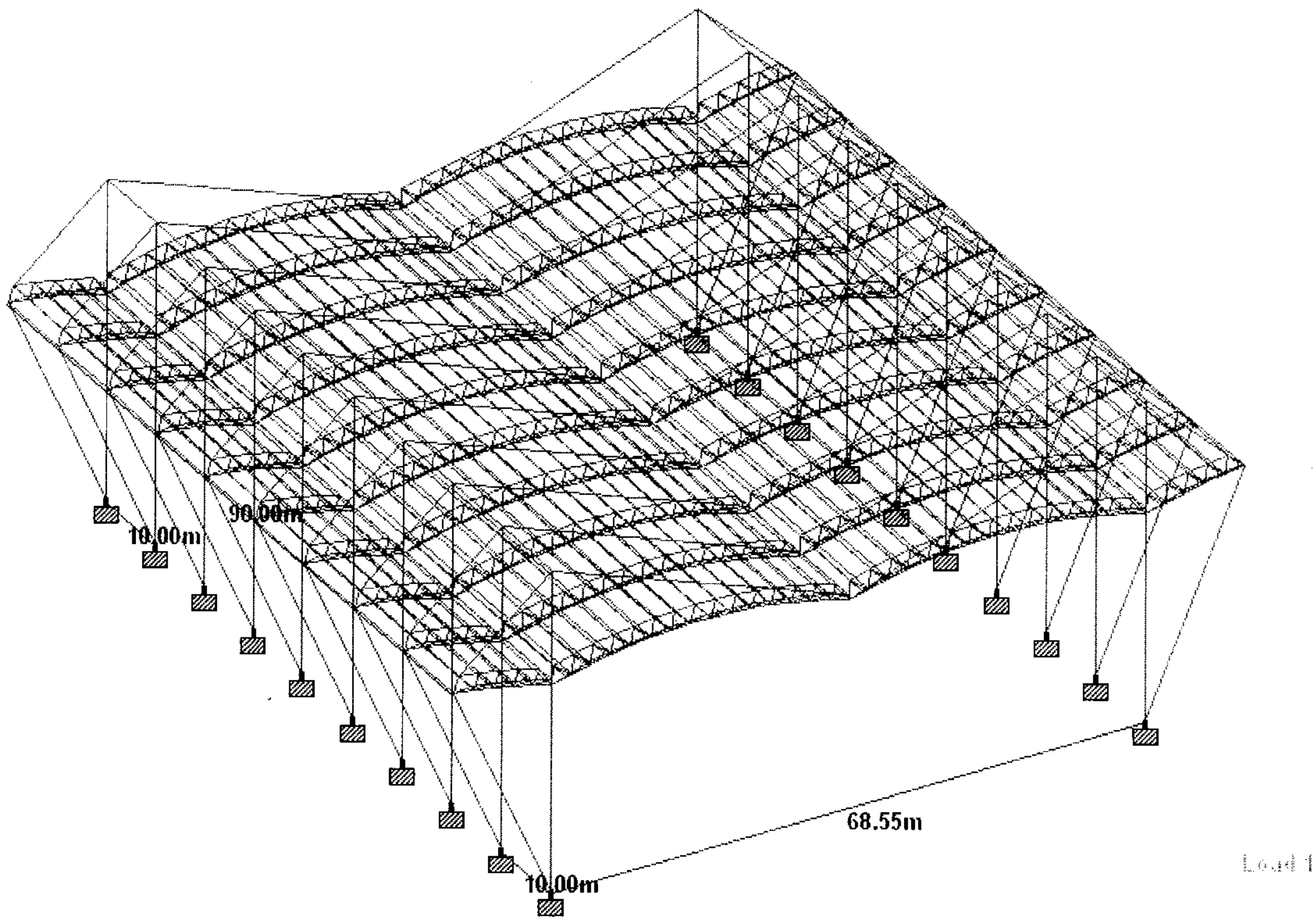
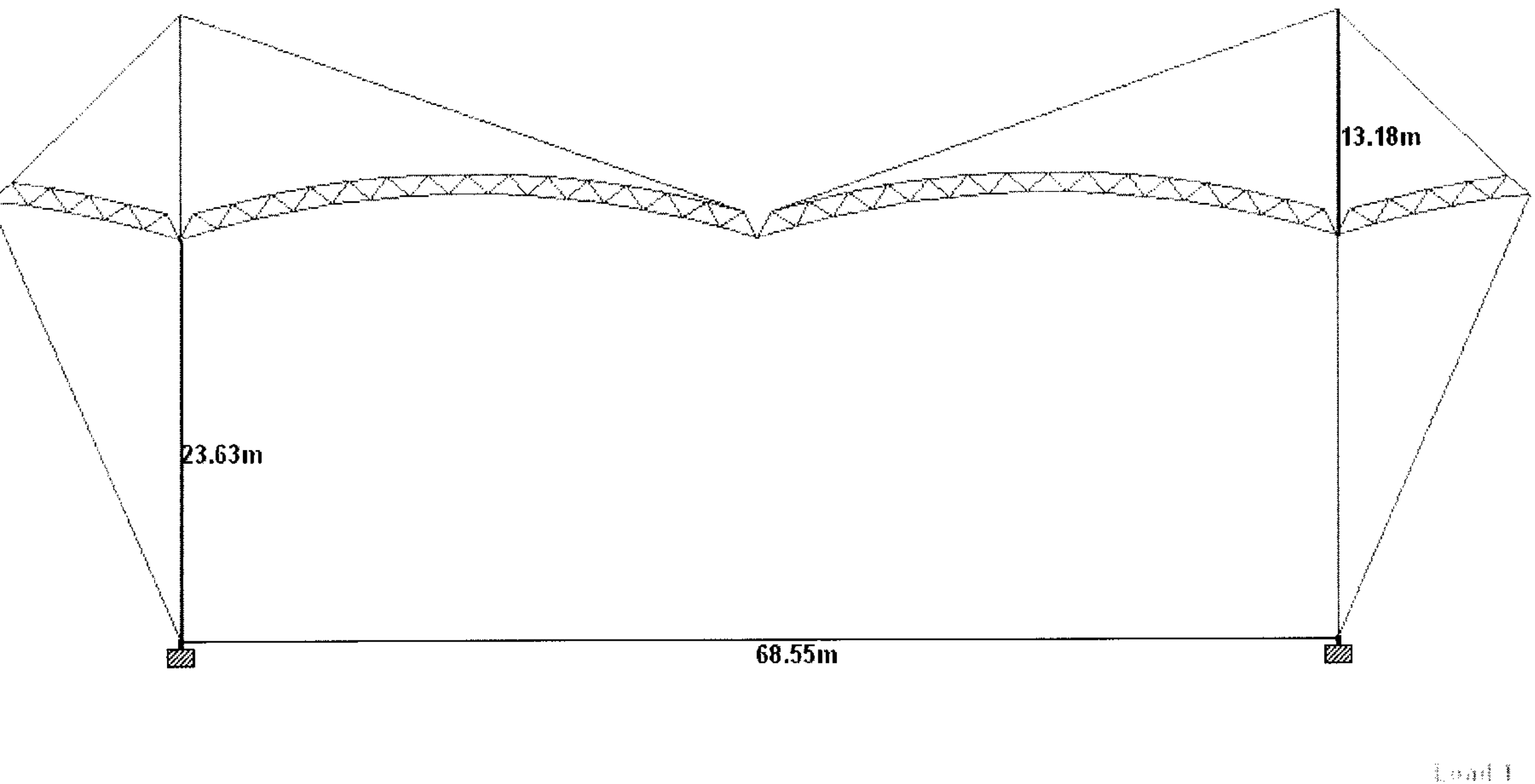
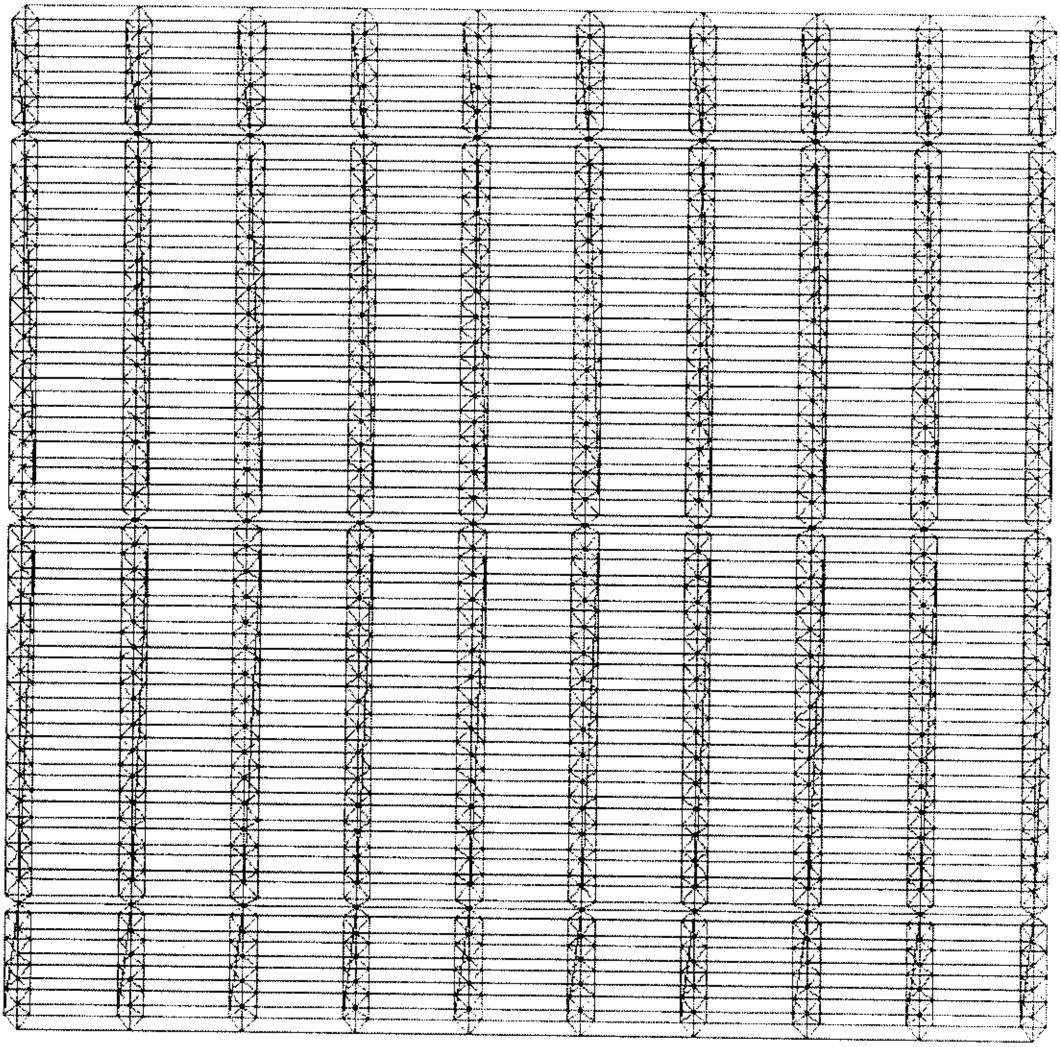
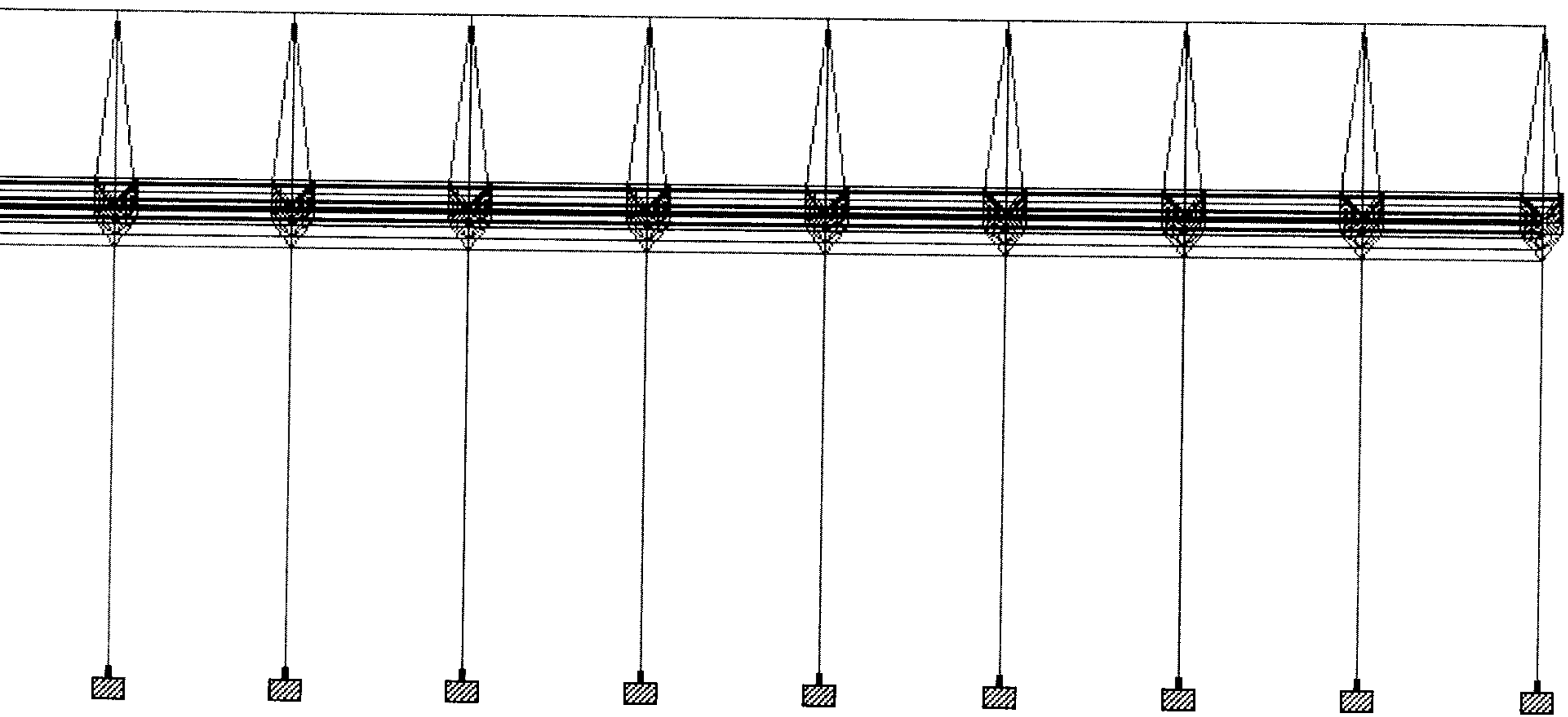
ROOMS
ROOMS
74.2000

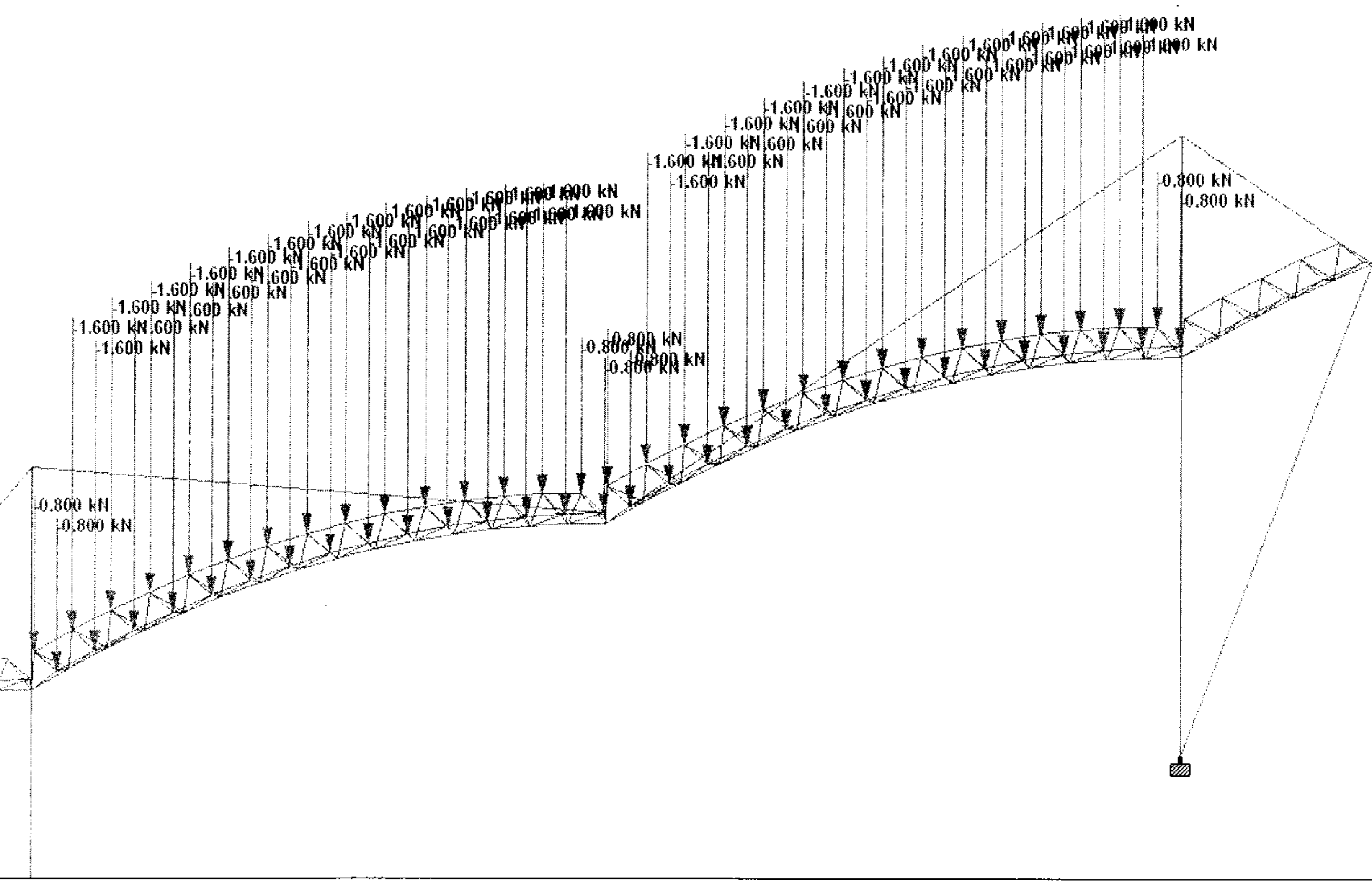

90.00m
10.00m
68.55m
10.00m
Load 1

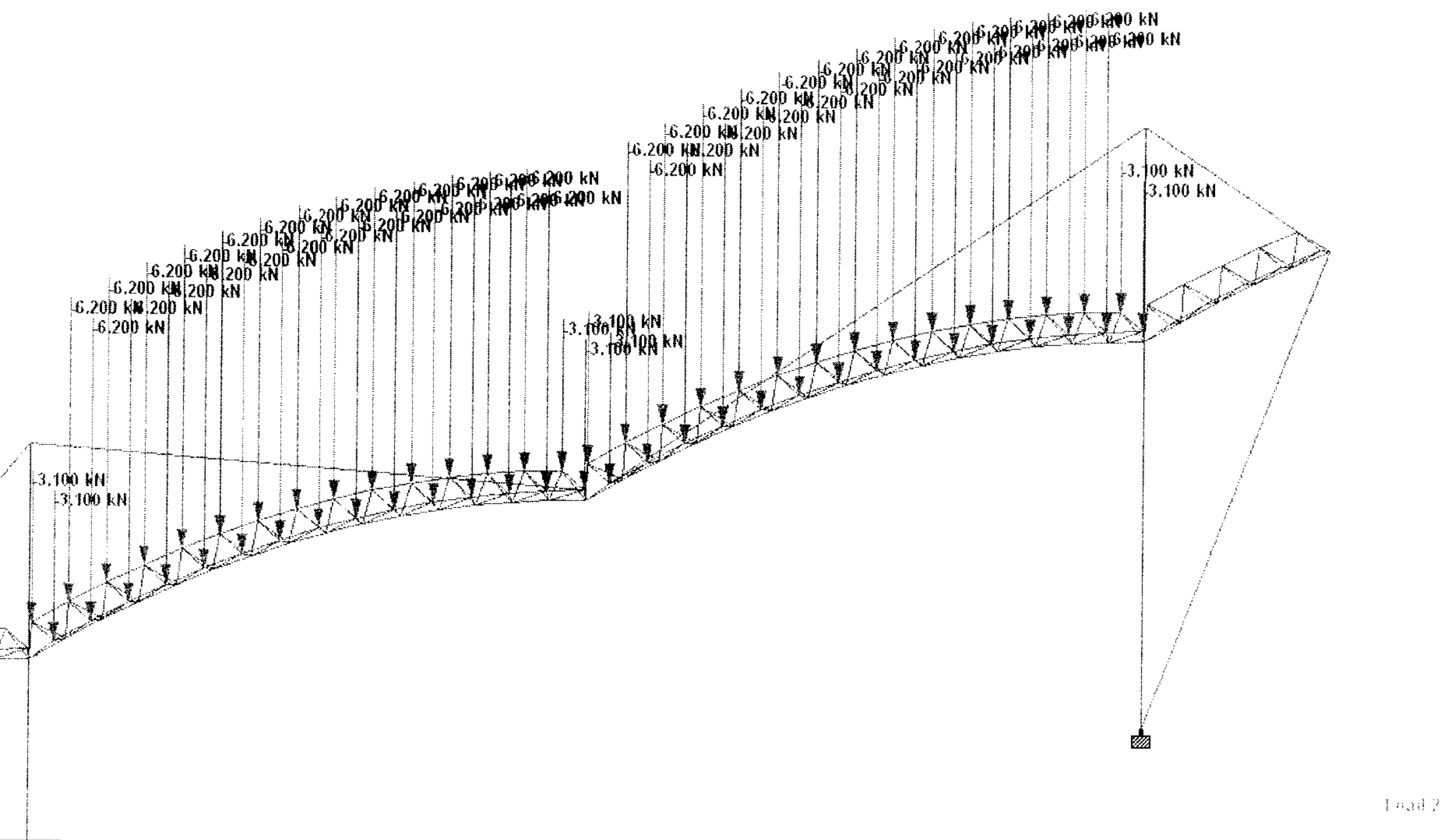

13.18m
23.63m
68.55m
Load 1



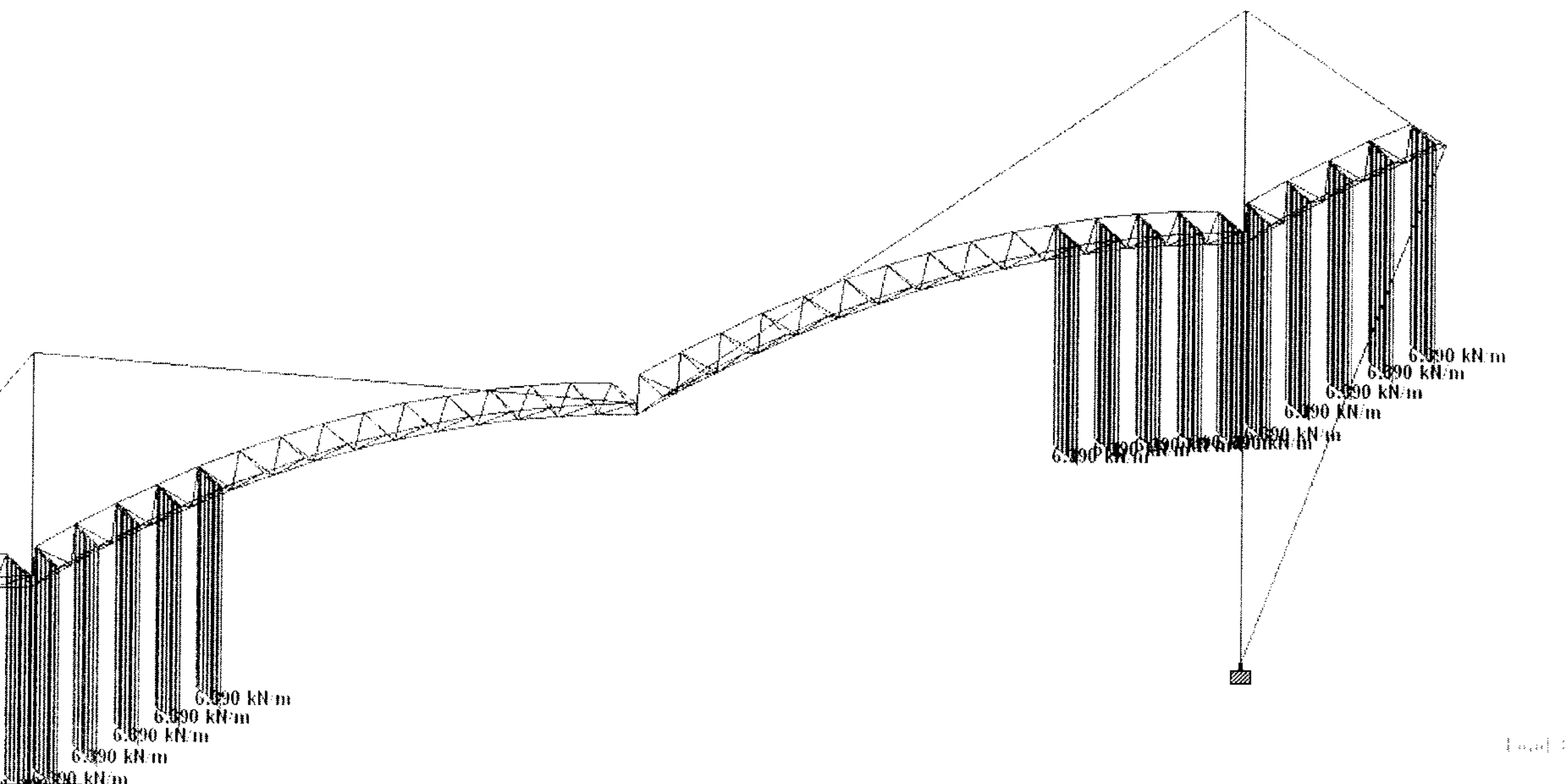


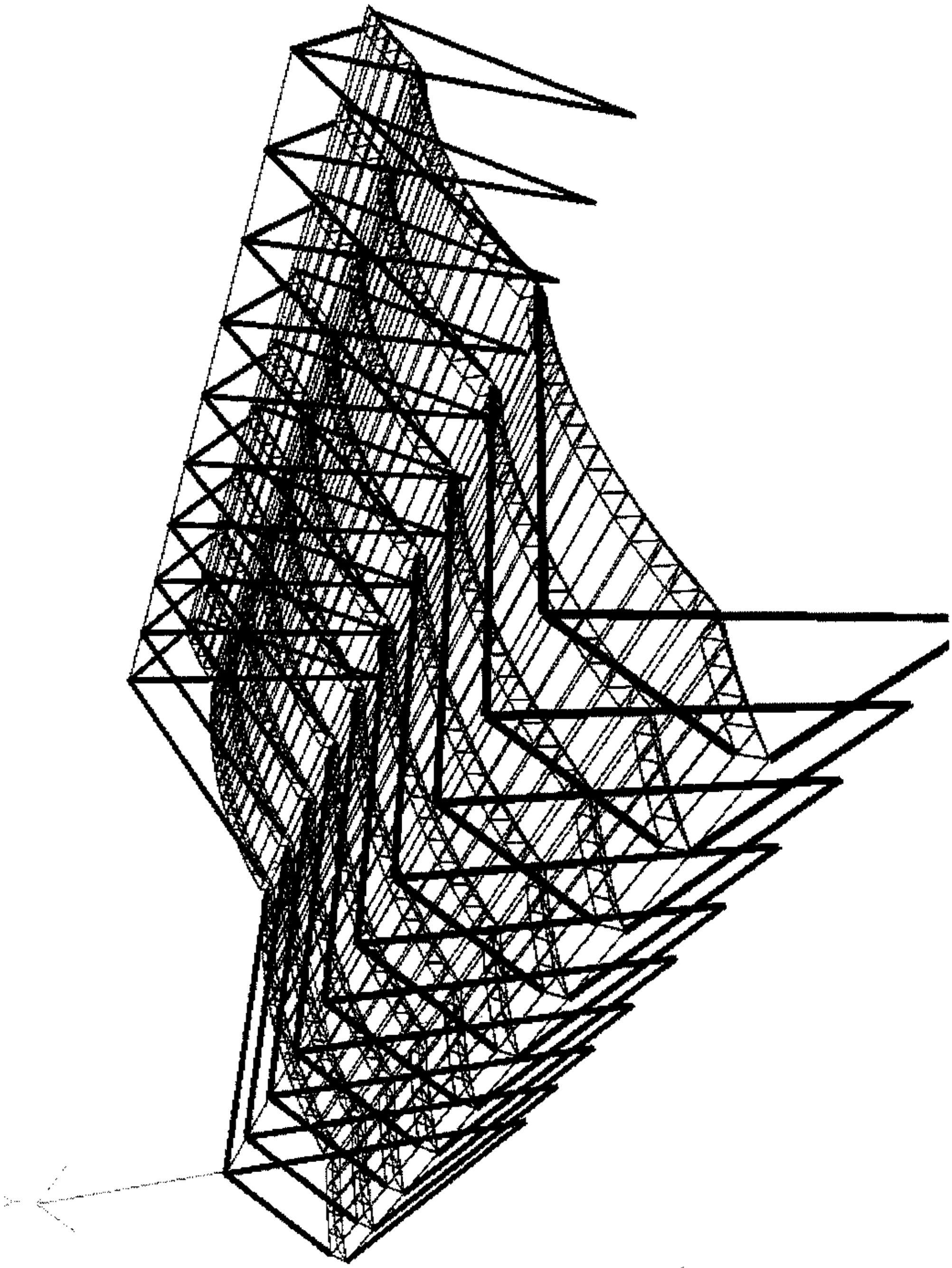
Load 1

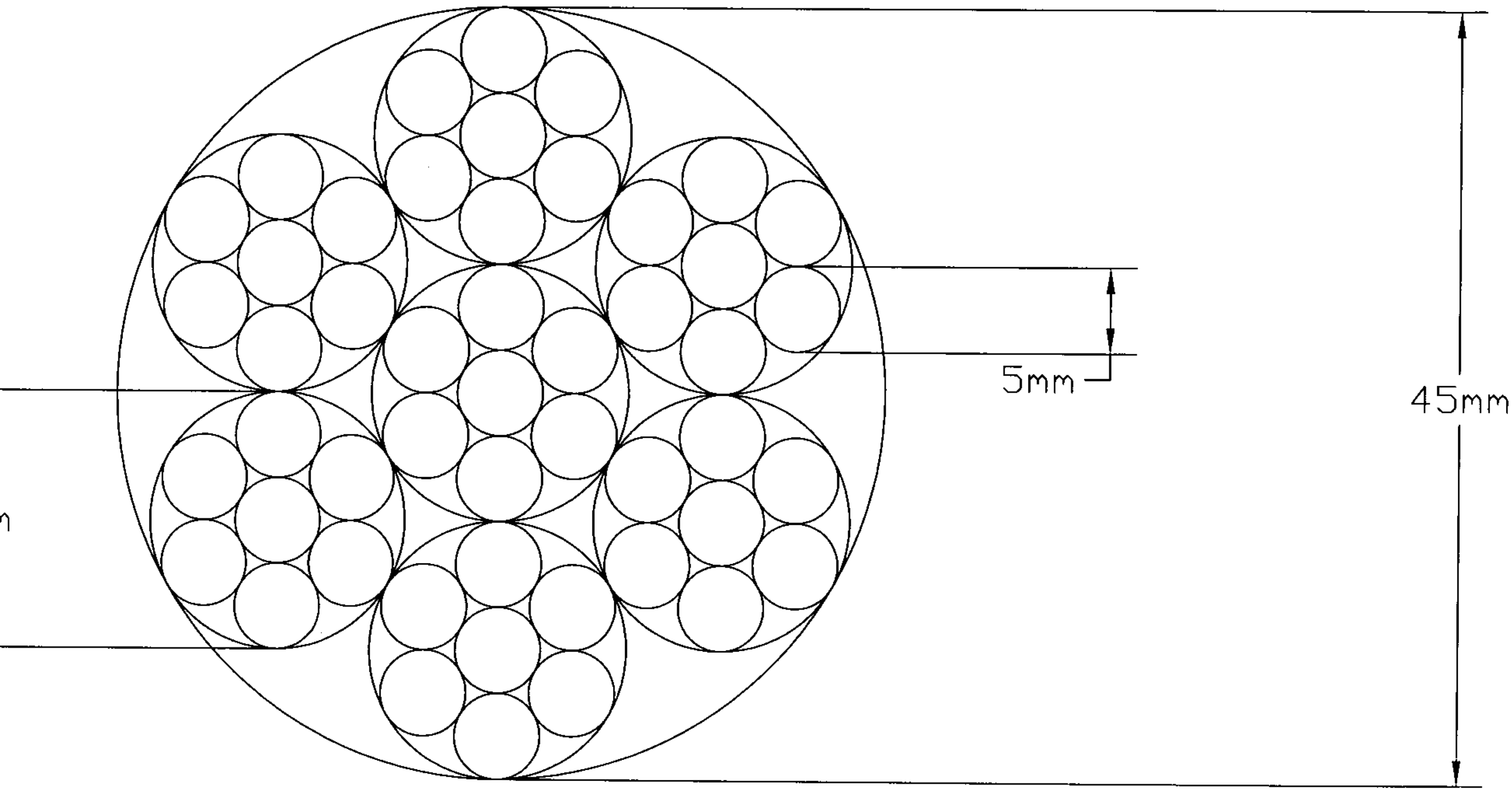

-1.600 kN
-0.800 kN



-6.200 kN
-3.100 kN
Load 2






5mm
45mm

CONCLUSION

CONCLUSION

The cable stayed roofing structure for playing area in the stadium has been modeled using STAAD PRO 2005 software. This structure is analyzed for the different loading combinations of loads like live load, dead load & wind load and the results were obtained successfully with nil errors and warnings.

The maximum forces are obtained from the STAAD PRO software after careful analysis and the supporting cables with high tensile steel strands has been designed. Apart from this, manual design for the purlins, bolts, ball and pipes used in the structure has also been computed abiding the IS codal standards. The comparison between the manual calculations and the STAAD PRO results proved satisfactory.

Moreover special flooring is planned for each game to ease the player's comfortability in the game. Being an indoor stadium, optimum lighting for the different games has also been provided based on international sports standards.

The main objective of this project is fulfilled by obtaining a large span of truss without any obstruction and also reducing the weight of the structure. Using the space frames in combination with cables, resulted in a good space effect and also provided aesthetic beauty to the structure.

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BIBLIOGRAPHY

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   - **July 2006**

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   b. **IS: 875 (PART - 2) – 1987 – CODE OF PRACTICE FOR DESIGN LOADS (OTHER THAN EARTHQUAKE) FOR BUILDING AND STRUCTURES.**