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Experimental Investigation of Wind Loads on Multi Span Pitched Roof Buildings

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Abstract

Structures of various types like bridges, towers, chimneys etc. are designed for primary loads such as self weight, superimposed loads, wind loads, earthquake forces. Some structures are also designed for secondary loads/stresses such as snow loads, creep and shrinkage effects, temperature effects, soil and fluid pressures, and impact/erection loads etc (IS: 456, IS:875 and IS: 1893).The evaluation of design wind loads on various surfaces of a building requires information about pressure coefficients and design wind speed. The values of pressure coefficients on surfaces of canopies, roofs and walls are normally determined by model studies performed in wind tunnels or from the measurement on prototype. Roof is the essential part of the building which provides protection to the users from sunrays, wind, snow, dust and rain. Parameters like wind velocity, wind direction, shape of building, its height, slope of roof and permeability affect wind loads on roofs. In this study, single, double and three span pitched roof building models are taken and kept in open boundary layer wind tunnel and the pressure coefficients on the surface of the pitched roofs are calculated and compared with the corresponding values prescribed in IS 875(Part 3).

INTRODUCTION

Evaluation of Wind Loads

The basic wind speed(V_b) for any locality is obtained from Fig.1 of IS:875(Part 3) and shall be modified to include the following effects to get design wind velocity at any height (V_z) for the chosen structure:

a) Risk Level
b) Terrain roughness, height and size of structure; and
c) Local topography

It can be mathematically expressed as follows:

$$V_z=V_b\, k_1\, k_2\, k_3$$

where

V_z=design wind speed at any height z in m/s;

k_1=probability factor (risk coefficient)

k_2=terrain, height and structure size factor

k_3=topography factor

The design wind pressure at any particular altitude above mean ground level is calculated by the following relationship between wind pressure and wind velocity:

$$p_d=0.6\, V_z^2$$

The wind load, F, acting in a direction normal to the individual structural element or cladding unit is:

$$F=(C_{pe}-C_{pi})\, A\, p_d$$

where

C_{pe}=external pressure coefficient,

C_{pi}=internal pressure coefficient,

A=surface area of structural element or cladding unit,

p_d=design wind pressure.

In the above formula, positive wind load signifies the force acting towards the strucutral element and negative away from it.

Internal pressure coefficients (C_{pi}) for a building or part of it depends upon the degree of permeability of cladding to the flow of air. The internal air pressure can be positive or negative which depends on the direction of flow of air in relation to openings in the buildings.

For openings upto 5% , $C_{pi} = \pm 0.2$

For openings upto 20% , $C_{pi} =\pm 0.5$

For openings above 20% , $C_{pi} =\pm 0.7$

Parameters Affecting Wind Loads

Various parameters affecting wind loads on structures can be broadly classified into two groups:

(i) Flow parameters
(ii) Structural parameters
(iii) <u>Flow parameters</u>

Flow parameters that affect wind loads on structures are as follows:

(a) Wind Velocity

The design wind pressure or design wind loads on any structure is directly proportional to the square of the design wind velocity which in turn is determined from the basic wind velocity after applying suitable modification factors as already discussed.

(b) Direction of wind

The angle at which wind attacks a structure also affects the wind pressure distribution on surfaces of the structure.

(c) Ground roughness or Turbulence

Ground roughness causes turbulence in the flow which in turn affects the wind pressure values on surfaces of the structures.

(ii) Structural parameters

Various structural parameters which affect the wind loads on structures are as follows:

(a) Shape of building

Shape of the building is influenced by the ratio of its dimensions in plan, its height and roofing system.Various types of roofs that are generally adopted are pitched roofs, monoslope roofs, canopy roofs and curved roofs. Greater is the height of the building, greater will be the wind load acting on it.

(b) Slope of the roof

For a given span, if the slope of the roof is increased, surface area of roof also increases and hence wind load on roof member increases.

(c) Flexibility of building

If a building or structure or any part of it is flexible, it will show large deformations under wind. It will inturn change the shape of the building or structure resulting in change in wind loads on it.

(d) Permeability

Internal air pressure in the building depends upon the degree of permeability of the cladding to the flow of air. The internal air pressure may be positive or negative depending upon the direction of flow of air in relation to % of openings in the buildings.

(e) Solidity ratio

It is equal to the effective area (projected area of all individual elements) of a frame normal to the wind direction divided by the area enclosed by the boundary of the frame normal to the wind direction.Higher is the solidity ratio, greater will be the wind load acting on it.

(f) Breadth and depth of the building

Greater is the breadth and depth of building, greater will be the wind load acting on the structure.

(g) Shielding effect

High rise buildings are frequently constructed in groups with the result that downstream building may be shielded by an upstream one. The steady shear force and overturning moment are usually reduced by the presence of a building on windward side. Due to shielding, local wind velocities may be increased.

(h) Effect of parapets

The addition of parapets reduces the magnitude of roof peak suction coefficients but lower suction values remain unaffected or increased only slightly. On the other hand, parapets tend to increase the mean suction locally close to roof corners.

PROPOSED RESEARCH WORK

In the present study, rigid models of multi span pitched roof buildings are made and tested in wind tunnel to find wind pressure distribution on such roofs. Models are tested as single building block, two building blocks and up to three building blocks placed adjacently. Rise to span ratio and height to span ratio are kept constant and only the wind incidence angle is varied. Results of the experimental program are given in the form of tables, contours of wind pressure coefficients in chapter three.

Recent Research Work

Many researchers all over the world are carrying out research in the area of wind effects on low-rise and high-rise building including those in India. However, no research publication is available in the area of wind effects/loads on multi-span pitched roof buildings.

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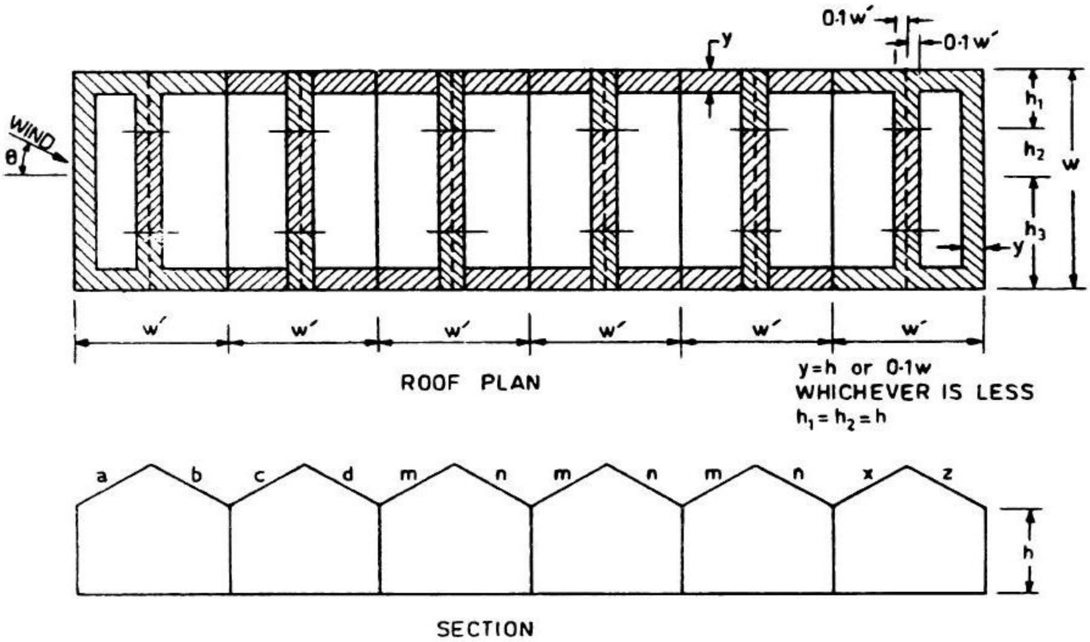

Roof Angle	Wind Angle	First Span		First Intermediate Span		Other Intermediate Span		End Span		Local Coefficient	
α	θ	a	b	c	d	m	n	x	z	(hatched)	(hatched)
degrees	degrees										
5	0	−0·9	−0·6	−0·4	−0·3	−0·3	−0·3	−0·3	−0·3	−2·0	−1·5
10		−1·1	−0·6	−0·4	−0·3	−0·3	−0·3	−0·3	−0·4		
20		−0·7	−0·6	−0·4	−0·3	−0·3	−0·3	−0·3	−0·5		
30		−0·2	−0·6	−0·4	−0·3	−0·2	−0·3	−0·2	−0·5		
45		+0·3	−0·6	−0·6	−0·4	−0·2	−0·4	−0·2	−0·5		

Roof Angle α degrees	Wind Angle θ degrees	Distance h_1	h_2	h_3
Up to 45	90	−0·8	−0·6	−0·2

Frictional drag: When wind angle θ = 0°, horizontal forces due to frictional drag are allowed for in the above values; and

when wind angle θ = 90°, allow for frictional drag in accordance with **6.3.1.**

NOTE — Evidence on these buildings is fragmentary and any departure from the cases given should be investigated separately.

Figure 1.1 Wind pressure coefficients on multi span pitched roof as per IS875(Part-3)

EXPERIMENTAL PROGRAMME

General

Experimental measurements of wind loads on structures can be made either by testing full scale models or prototype in the field or reduced scale models in the wind tunnels. Measurement of the wind loads on structures in the field is difficult but the wind tunnel technique is comparatively easier. The present study involves testing of rigid scale models of multi-span pitched roof building in the open circuit boundary layer wind tunnel at Indian Institute of Technology Roorkee.

Details of Wind Tunnel

The wind tunnel used for the present study is an open circuit type boundary layer wind tunnel with no thermal stratification. It has a test section of 2mx2m cross section with 15 m length. Near the downstream edge of the test section, a natural boundary layer of approximate depth 50 cm develops due to the long length of the wind tunnel without any floor roughening device. However, presence of barrier wall, vortex generators and blocks help in obtaining the flow fields of different velocity profiles and turbulence.

Details of Models

Models are made of Perspex sheet of thickness 5 mm. 45 pressure tapping points are there in each face A and B. Stainless steel tube is inserted in the pressure tapping hole and is covered by long PVC tube whose other end is connected to the U-tube manometer. First a single model is tested followed by two models and finally three models case. Models were of length 300 mm, breadth 150 mm and height 100 mm. Roof angle of the model is kept as 20.

Instrumentation

Pitot tube used in the present study is known as Prandtl-Pitot tube. It is a combination of a total head tube and a static tube, the latter measuring the piezometric head at the given point. The head of the tube is well rounded to avoid separation of flow and holes are provided on its shaft at such a place that static pressure endures there. The two tubes are enclosed in the same tube and are then connected to a differential manometer which measures velocity head.

Manometers are devices used for measuring the fluid pressures by balancing the pressure against a column of liquid in static equilibrium. In the present study single U tube manometer is used to measure the velocity and pressure respectively. It is used to measure the velocity head by connecting it to pitot tube or to measure the pressures on the surfaces of model. Accuracy of pressure measurement can be increased by inclining the measuring limb of the manometer.

Evaluation of wind Velocity and Pressure Coefficient

The wind velocity in the tunnel using the pitot tube and inclined U-tube manometer is determined by the following expression

$$V = \sqrt{2g.\Delta h_{air}}$$

$$= \sqrt{2g.\Delta h_{spirit}}\sqrt{\frac{\rho_{spirit}}{\rho_{air}}}\sqrt{\sin\varphi}$$

$$V_{m/sec} = 5.76\sqrt{\Delta h_{spirit}}$$

where,

V=wind velocity in tunnel (m/sec)

Δh_{air}=air head in U-tube manometer(cm)

Δh_{spirit}=spirit head in U-tube manometer(cm)

Φ=inclination of manometer (15°)

ρ_{spirit}=density of spirit (789 kg/m^3)

ρ_{air}=density of air (1.208 kg/m^3)

$$C_p = \frac{33.16\,\Delta h_{spirit}}{{V_{ref}}^2}$$

where V_{ref}=reference wind velocity (m/sec)

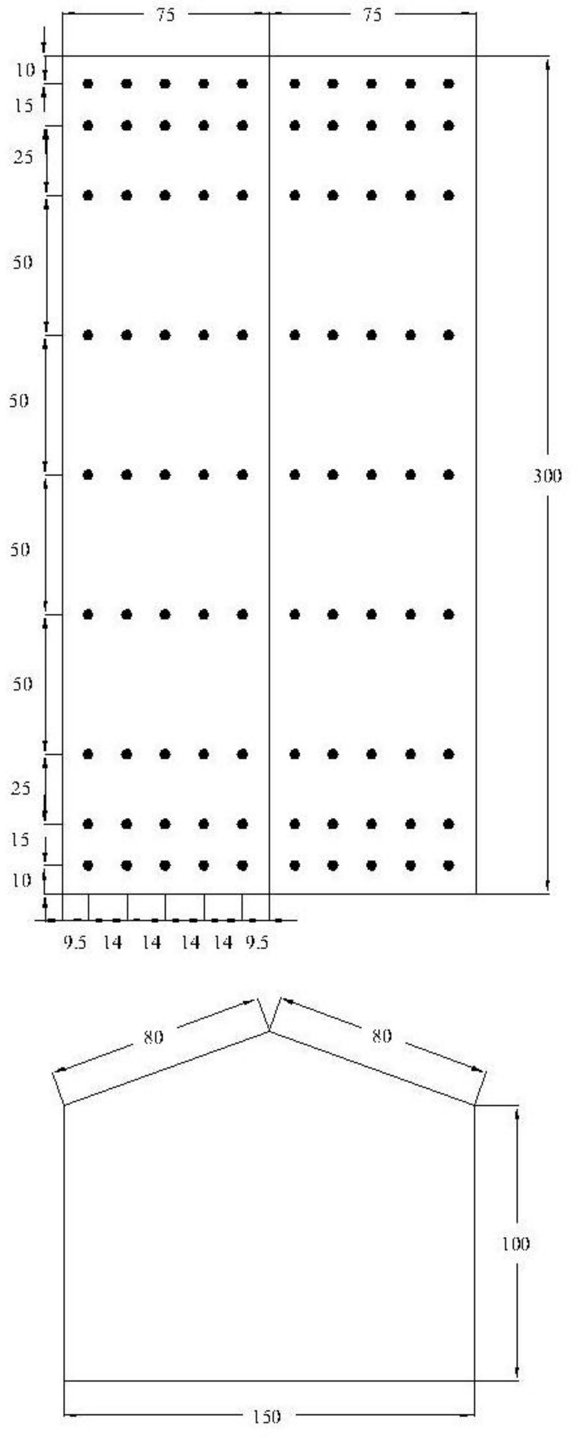

Figure 2.1 Plan and Side Elevation of model

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Figure 2.2 Flow Roughening Devices

Figure 2.4 Turbine

Figure 2.3 Model of three span pitched roof building

Figure 2.5 Prandtl-Pitot tube

RESULTS AND DISCUSSIONS

General

This chapter deals with the results of wind tunnel tests on rigid models of multi span pitched roof buildings. These models have been tested in the boundary layer wind tunnel. Mean value of the wind pressures on the roof surface of the models have been calculated and presented in the form of tables and contours.

Single Span Building

Results for single span building are given in Tables 3.1 and 3.2

Table 3.1: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on single span building (Face A)

Pressure point No	0°	15°	30°	45°	60°	75°	90°
A1	0.495	0.561	0.231	0.0495	0.0825	0.033	0.3465
A2	0.495	0.825	0.693	0.165	0.0495	0.0165	0.165
A3	0.495	0.693	0.6765	0.363	0.099	0.033	0.132
A4	0.528	0.627	0.6705	0.462	0.198	0.033	0.132
A5	0.495	0.577	0.5445	0.495	0.297	0.0825	0.132
A6	0.429	0.33	0.165	0.297	0.4455	0.363	0.363
A7	0.4785	0.429	0.1155	0.0825	0.0825	0.0495	0.1155
A8	0.4785	0.528	0.198	0.099	0.0825	0.033	0.0825
A9	0.5115	0.577	0.363	0.165	0.1815	0.066	0.1155
A10	0.4785	0.577	0.4455	0.3135	0.297	0.099	0.1155

Pressure point No	**0°**	**15°**	**30°**	**45°**	**60°**	**75°**	**90°**
A11	0.33	0.215	0.198	0.363	0.429	0.3465	0.3465
A12	0.3465	0.149	0.0825	0.1155	0.165	0.132	0.1155
A13	0.363	0.182	0.0825	0.132	0.1155	0.0495	0.066
A14	0.363	0.215	0.132	0.1815	0.165	0.06	0.0825
A15	0.363	0.33	0.231	0.2805	0.297	0.132	0.132
A16	0.1485	0.116	0.2145	0.396	0.429	0.3465	0.3465
A17	0.165	0.083	0.132	0.2475	0.2475	0.132	0.132
A18	0.1485	0.083	0.132	0.1815	0.165	0.0825	0.066
A19	0.132	0.132	0.165	0.2145	0.1815	0.1155	0.0825
A20	0.1485	0.116	0.2475	0.363	0.297	0.1815	0.165
A21	0.0825	0.099	0.231	0.3795	0.429	0.33	0.33
A22	0.0825	0.066	0.165	0.2805	0.2145	0.132	0.132
A23	0.0495	0.083	0.132	0.2145	0.165	0.099	0.066
A24	0.0495	0.083	0.1485	0.2145	0.198	0.1155	0.0825
A25	0.0495	0.116	0.231	0.33	0.264	0.1815	0.1485
A26	0.066	0.116	0.2145	0.363	0.3795	0.3465	0.33
A27	0.066	0.165	0.231	0.33	0.2805	0.2145	0.165
A28	0.033	0.066	0.132	0.198	0.165	0.099	0.099
A29	0.0495	0.066	0.132	0.2145	0.165	0.099	0.1155
A30	0.066	0.132	0.2145	0.2805	0.231	0.165	0.165
A31	0	0.099	0.198	0.297	0.33	0.297	0.297
A32	0.0495	0.083	0.132	0.198	0.1815	0.165	0.1485
A33	0.0165	0.049	0.1155	0.1815	0.165	0.099	0.0825
A34	0.033	0.083	0.1155	0.2145	0.165	0.1155	0.1155
A35	0.0495	0.066	0.165	0.231	0.231	0.165	0.1485
A36	0.0165	0.066	0.1485	0.2145	0.231	0.2805	0.33
A37	0.0165	0.033	0.099	0.1485	0.1485	0.099	0.1155
A38	0.0495	0.016	0.066	0.132	0.1155	0.099	0.066
A39	0.033	0.049	0.1155	0.165	0.165	0.132	0.099
A40	0.033	0.066	0.099	0.2145	0.2145	0.165	0.165
A41	-0.033	0.033	0.132	0.1815	0.1815	0.231	0.264
A42	0	0.016	0.066	0.099	0.099	0.132	0.132
A43	0	0.016	0.066	0.099	0.099	0.1485	0.1155
A44	0.033	0.033	0.099	0.1485	0.165	0.1815	0.132
A45	0.033	0.049	0.1155	0.165	0.198	0.1815	0.1485
Max. Cp	0.528	0.825	0.693	0.495	0.4455	0.363	0.363
Min. Cp	-0.033	0.0165	0.066	0.0495	0.0495	0.0165	0.066

Table 3.2: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on single span building (Face B)

Pressure point No	**0°**	**15°**	**30°**	**45°**	**60°**	**75°**	**90°**
B1	0.495	0.462	0.462	0.4455	0.4455	0.2805	0.264
B2	0.528	0.462	0.495	0.5115	0.594	0.2805	0.264
B3	0.5115	0.4785	0.4785	0.528	0.726	0.297	0.285
B4	0.528	0.561	0.594	0.6435	0.66	0.3135	0.264
B5	0.5115	0.561	0.594	0.726	0.792	0.3135	0.297
B6	0.495	0.462	0.4455	0.4455	0.363	0.2805	0.2805
B7	0.5115	0.495	0.462	0.495	0.396	0.2805	0.2805
B8	0.528	0.5115	0.561	0.5445	0.429	0.297	0.264
B9	0.5115	0.5445	0.528	0.495	0.5115	0.3465	0.264
B10	0.528	0.561	0.594	0.759	0.9095	0.363	0.297
B11	0.429	0.429	0.4125	0.3795	0.2475	0.2805	0.264
B12	0.3795	0.4455	0.429	0.33	0.297	0.297	0.264
B13	0.3795	0.4455	0.429	0.363	0.363	0.297	0.264
B14	0.396	0.462	0.4125	0.4785	0.6105	0.3135	0.264
B15	0.129	0.495	0.5775	0.759	0.693	0.297	0.264
B16	0.132	0.264	0.264	0.297	0.297	0.297	0.2805
B17	0.165	0.264	0.264	0.3135	0.396	0.2805	0.264
B18	0.132	0.2475	0.264	0.396	0.462	0.2805	0.264
B19	0.165	0.198	0.33	0.6105	0.528	0.2805	0.2475
B20	0.165	0.264	0.5115	0.7095	0.594	0.297	0.264
B21	0.066	0.1485	0.2145	0.264	0.33	0.2805	0.264
B22	0.0495	0.1155	0.2145	0.33	0.3465	0.264	0.264
B23	0.0825	0.1155	0.2475	0.4125	0.396	0.2805	0.264
B24	0.0495	0.132	0.33	0.495	0.4455	0.297	0.264
B25	0.066	0.1815	0.462	0.561	0.4785	0.264	0.2475
B26							
B27	0.0495	0.099	0.231	0.297	0.363	0.264	0.2805
B28	0.066	0.1155	0.2805	0.396	0.3795	0.297	0.264
B29	0.0495	0.132	0.3465	0.429	0.396	0.264	0.264
B30	0.066	0.1815	0.396	0.4785	0.396	0.231	0.264
B31	0.0495	0.099	0.1815	0.264	0.33	0.297	0.2805
B32	0.0495	0.099	0.1815	0.297	0.297	0.231	0.264
B33	0.033	0.099	0.2145	0.297	0.3795	0.2805	0.264
B34	0.033	0.1155	0.2475	0.363	0.4125	0.285	0.264
B35	0.066	0.1485	0.3135	0.3795	0.363	0.2475	0.264
B36	0.0495	0.132	0.165	0.2475	0.297	0.297	0.264
B37	0.066	0.1155	0.165	0.2805	0.297	0.297	0.2805
B38	0.0495	0.099	0.198	0.2805	0.297	0.297	0.2805
B39	0.0495	0.132	0.198	0.3135	0.363	0.3135	0.264
B40	0.0495	0.132	0.264	0.363	0.3465	0.3135	0.264
B41	0.066	0.132	0.1815	0.264	0.264	0.2805	0.264
B42	0.066	0.132	0.2145	0.264	0.3135	0.2805	0.264
B43	0.066	0.132	0.2145	0.2805	0.297	0.2805	0.264
B44	0.0495	0.132	0.231	0.2805	0.2805	0.264	0.264
B45	0.033	0.1155	0.231	0.3465	0.33	0.297	0.297
Max. Cp	0.528	0.561	0.594	0.759	0.9075	0.363	0.297
Min. Cp	0.033	0.099	0.165	0.2475	0.2475	0.231	0.2475

Two Span Building

Results for two span building are given in Tables 3.3 to 3.6

Table 3.3: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on two spans building (Span1-FaceA)

Pressure point No	0°	15°	30°	45°	60°	75°	90°
1-A1	0.5445	0.561	0.462	0.3795	0.231	0.0825	0.1815
1-A2	0.594	0.726	0.561	0.33	0.198	0.0165	0.0825
1-A3	0.5775	0.7755	0.66	0.4125	0.198	0.0165	0.066
1-A4	0.561	0.6435	0.6105	0.396	0.264	0.066	0.066
1-A5	0.561	0.5775	0.495	0.363	0.33	0.132	0.066
1-A6	0.5445	0.5115	0.462	0.3465	0.2475	0.0165	0.1198
1-A7	0.5115	0.462	0.4125	0.297	0.198	0	0.132
1-A8	0.528	0.4785	0.363	0.231	0.198	0.033	0.066
1-A9	0.528	0.528	0.396	0.231	0.2145	0.066	0.0495
1-A10	0.5115	0.5445	0.429	0.264	0.297	0.165	0.0825
1-A11	0.4785	0.4785	0.4455	0.2145	-0.0495	-0.165	0.2475
1-A12	0.396	0.4125	0.3465	0.231	0.099	-0.1155	0.165
1-A13	0.396	0.363	0.2805	0.231	0.1815	-0.066	0.099
1-A14	0.396	0.3465	0.2805	0.231	0.2475	0	0.0495
1-A15	0.4125	0.396	0.3135	0.264	0.3465	0.115	0.0825
1-A16	0.2805	0.33	0.132	-0.0495	0	0.099	0.264
1-A17	0.2475	0.264	0.198	0.033	-0.0165	-0.0495	0.264
1-A18	0.231	0.2475	0.2475	0.099	0.0165	-0.066	0.2145
1-A19	0.198	0.2475	0.2805	0.1485	0.115	-0.0165	0.165
1-A20	0.231	0.264	0.3135	-0.033	0.264	0.099	0.165
1-A21	0.1815	0.198	0.0165	0	0.1485	0.2475	0.2475
1-A22	0.132	0.1485	0.033	-0.033	0.0165	0.165	0.2475
1-A23	0.132	0.1815	0.1155	0.033	0.0495	0.066	0.231
1-A24	0.132	0.1815	0.165	0.099	0.1155	0.0495	0.198
1-A25	0.1485	0.2145	0.2805	0.231	0.264	0.099	0.1815
1-A26	0.1155	0.0825	0.033	0.0495	0.2475	0.297	0.2805
1-A27	0.132	0.1485	0.1155	0.099	0.2805	0.33	0.264
1-A28	0.099	0.1155	0.0825	0.033	0.099	0.198	0.198
1-A29	0.099	0.1155	0.1155	0.099	0.1155	0.1485	0.1485
1-A30	0.099	0.1815	0.2145	0.231	0.231	0.1815	0.1815
1-A31	0.0825	0.0495	0.033	0.099	0.297	0.2805	0.198
1-A32	0.0825	0.0825	0.0495	0.099	0.2475	0.264	0.1155
1-A33	0.0825	0.0825	0.0495	0.033	0.1815	0.2145	0.099
1-A34	0.0825	0.1155	0.099	0.066	0.165	0.198	0.0495
1-A35	0.0825	0.132	0.1485	0.1485	0.2145	0.198	0.1155
1-A36	0.066	0.0495	0.0495	0.132	0.2475	0.2475	0.1485
1-A37	0.0825	0.0495	0.0495	0.099	0.2475	0.231	0.0825
1-A38	0.0825	0.0825	0.066	0.066	0.198	0.198	0.0495
1-A39	0.0825	0.0825	0.0825	0.099	0.1815	0.165	0.0495
1-A40	0.0825	0.1155	0.132	0.132	0.2145	0.198	0.1155
1-A41	0.066	0.066	0.0825	0.165	0.2475	0.264	0.1485
1-A42	0.0825	0.0825	0.0825	0.099	0.231	0.2475	0.0825
1-A43	0.0825	0.0825	0.066	0.099	0.1815	0.198	0.033
1-A44	0.0825	0.0825	0.1155	0.099	0.1815	0.1815	0.033
1-A45	0.0825	0.1155	0.1155	0.132	0.1815	0.165	0.099
Max. Cp	0.594	0.7755	0.66	0.4125	0.3465	0.33	0.2805
Min. Cp	0.066	0.0495	0.0165	-0.0495	-0.0495	-0.165	0.033

Table 3.4: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on two spans building (Span1-FaceB)

Pressure point No	0°	15°	30°	45°	60°	75°	90°
1-B1	0.5445	0.5115	0.4455	0.4125	0.363	0.198	0.132
1-B2	0.495	0.5115	0.4455	0.3795	0.3795	0.2475	0.1485
1-B3	0.5115	0.495	0.4455	0.396	0.528	0.33	0.2145
1-B4	0.5115	0.495	0.4455	0.396	0.5445	0.3135	0.2475
1-B5	0.5115	0.528	0.4455	0.4455	0.627	0.5445	0.396
1-B6	0.495	0.4785	0.4125	0.3795	0.3465	0.1485	0.0825
1-B7	0.528	0.5115	0.4455	0.3465	0.3795	0.1815	0.132
1-B8	0.5445	0.528	0.4455	0.4125	0.4125	0.231	0.1815
1-B9	0.5115	0.528	0.3465	0.396	0.495	0.363	0.2805
1-B10	0.5115	0.5115	0.264	0.528	0.7425	0.528	0.363
1-B11	0.4125	0.4125	0.396	0.3465	0.297	0.1485	0.099
1-B12	0.4125	0.429	0.396	0.33	0.3135	0.198	0.1155
1-B13	0.462	0.4455	0.4125	0.3465	0.363	0.3135	0.1815
1-B14	0.4455	0.4455	0.4125	0.396	0.528	0.396	0.2475
1-B15	0.495	0.528	0.462	0.4455	0.7095	0.396	0.33
1-B16	0.2145	0.3465	0.3135	0.2805	0.2805	0.1815	0.099
1-B17	0.2145	0.33	0.3465	0.2970	0.3135	0.2475	0.1155
1-B18	0.198	0.3135	0.3135	0.3135	0.4125	0.3135	0.1155
1-B19	0.2145	0.3135	0.3465	0.396	0.5445	0.3135	0.1815
1-B20	0.2475	0.33	0.4125	0.5115	0.726	0.3465	0.231
1-B21	0.1155	0.2475	0.2475	0.5115	0.264	0.165	0.0825
1-B22	0.1155	0.2145	0.264	0.264	0.33	0.2145	0.099
1-B23	0.1155	0.2277	0.2805	0.297	0.4125	0.264	0.1155
1-B24	0.1155	0.231	0.3135	0.3795	0.5115	0.264	0.165
1-B25	0.132	0.2475	0.4455	0.5775	0.6105	0.33	0.1815
1-B26							
1-B27	0.099	0.1815	0.2145	0.231	0.3135	0.1815	0.1155
1-B28	0.099	0.1815	0.2475	0.297	0.3795	0.198	0.1155
1-B29	0.099	0.198	0.3135	0.396	0.462	0.2475	0.165
1-B30	0.099	0.2475	0.429	0.561	0.5445	0.2805	0.2145
1-B31	0.099	0.1485	0.1485	0.1815	0.2475	0.1485	0.0825
1-B32	0.0825	0.1485	0.1815	0.2145	0.264	0.1485	0.1155
1-B33	0.066	0.1485	0.1815	0.264	0.3135	0.1815	0.165
1-B34	0.099	0.1485	0.2475	0.33	0.3465	0.2145	0.2145
1-B35	0.0825	0.2145	0.3465	0.3795	0.4125	0.264	0.33
1-B36	0.0825	0.1485	0.1485	0.1815	0.2145	0.1485	0.099
1-B37	0.0825	0.1485	0.1485	0.1815	0.2475	0.1485	0.099
1-B38	0.066	0.1485	0.165	0.2145	0.2475	0.1815	0.1485
1-B39	0.066	0.1485	0.2145	0.2475	0.297	0.198	0.2475
1-B40	0.0825	0.1815	0.2805	0.297	0.363	0.264	0.363
1-B41	0.0825	0.1485	0.165	0.1815	0.231	0.1485	0.1155
1-B42	0.099	0.132	0.165	0.198	0.264	0.165	0.132
1-B43	0.099	0.132	0.165	0.198	0.264	0.1815	0.1815
1-B44	0.099	0.1485	0.165	0.231	0.2805	0.2145	0.2145
1-B45	0.099	0.1485	0.231	0.297	0.3135	0.231	0.3465
Max. Cp	0.5445	0.528	0.462	0.5775	0.7425	0.5445	0.396
Min. Cp	0.066	0.132	0.1485	0.1815	0.2145	0.1485	0.0825

Table 3.5: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on two spans building (Span2-FaceA)

Pressure point No	0°	15°	30°	45°	60°	75°	90°
2-A1	0.5445	0.66	0.33	0.0825	0.1155	0.264	0.363
2-A2	0.5445	0.7755	0.7425	0.2805	0.0825	0.099	0.1485
2-A3	0.5445	0.6435	0.7425	0.528	0.165	0.099	0.1155
2-A4	0.5445	0.561	0.66	0.5115	0.2475	0.132	0.1485
2-A5	0.528	0.561	0.627	0.627	0.4125	0.297	0.2145
2-A6	0.495	0.4455	0.1815	0.1815	0.3465	0.495	0.396
2-A7	0.528	0.462	0.165	0.066	0.0825	0.132	0.1485
2-A8	0.528	0.561	0.264	0.066	0.1155	0.132	0.099
2-A9	0.528	0.627	0.429	0.1815	0.198	0.198	0.132
2-A10	0.528	0.5775	0.528	0.3465	0.33	0.33	0.2145
2-A11	0.396	0.2475	0.1815	0.33	0.4455	0.495	0.3795
2-A12	0.429	0.2145	0.099	0.099	0.198	0.2475	0.198
2-A13	0.429	0.3135	0.1155	0.099	0.1485	0.1815	0.099
2-A14	0.429	0.363	0.165	0.165	0.231	0.2145	0.1485
2-A15	0.4125	0.4125	0.264	0.297	0.363	0.3465	0.198
2-A16	0.198	0.1485	0.198	0.363	0.462	0.4785	0.363
2-A17	0.2145	0.1155	0.132	0.231	0.297	0.3135	0.1815
2-A18	0.198	0.1155	0.099	0.132	0.198	0.198	0.099
2-A19	0.198	0.132	0.132	0.165	0.2145	0.231	0.1155
2-A20	0.231	0.1485	0.198	0.2145	0.33	0.264	0.165
2-A21	0.132	0.1155	0.198	0.363	0.4455	0.462	0.363
2-A22	0.099	0.099	0.132	0.2475	0.231	0.2805	0.165
2-A23	0.1155	0.099	0.132	0.1815	0.2145	0.198	0.099
2-A24	0.132	0.099	0.132	0.1815	0.264	0.198	0.099
2-A25	0.1485	0.132	0.1815	0.2475	0.4455	0.231	0.165
2-A26	0.099	0.132	0.198	0.3135	0.33	0.429	0.4125
2-A27	0.099	0.099	0.165	0.2475	0.264	0.231	0.165
2-A28	0.099	0.0825	0.132	0.1815	0.2145	0.1815	0.099
2-A29	0.099	0.099	0.132	0.1815	0.231	0.1815	0.099
2-A30	0.099	0.1155	0.1815	0.231	0.264	0.231	0.165
2-A31	0.066	0.099	0.198	0.2805	0.396	0.429	0.363
2-A32	0.066	0.099	0.132	0.2145	0.264	0.2475	0.165
2-A33	0.066	0.0825	0.132	0.1815	0.2145	0.198	0.1155
2-A34	0.066	0.066	0.1485	0.165	0.198	0.1815	0.1485
2-A35	0.066	0.099	0.165	0.1815	0.231	0.2475	0.198
2-A36	0.066	0.099	0.1815	0.264	0.363	0.4125	0.363
2-A37	0.066	0.099	0.132	0.198	0.2475	0.2475	0.165
2-A38	0.066	0.066	0.1155	0.1485	0.198	0.2145	0.1155
2-A39	0.066	0.066	0.1155	0.1485	0.198	0.198	0.1485
2-A40	0.0825	0.0825	0.132	0.165	0.2145	0.2475	0.231
2-A41	0.0825	0.099	0.1485	0.2475	0.33	0.396	0.363
2-A42	0.066	0.0825	0.1155	0.1815	0.231	0.2475	0.165
2-A43	0.066	0.0825	0.1155	0.1815	0.2145	0.231	0.132
2-A44	0.0495	0.0825	0.1155	0.1485	0.198	0.2145	0.165
2-A45	0.066	0.0825	0.1155	0.1815	0.2475	0.264	0.231
Max. Cp	0.5445	0.7755	0.7425	0.627	0.462	0.495	0.4125
Min. Cp	0.0495	0.066	0.099	0.066	0.0825	0.099	0.099

Table 3.6: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on two spans building (Span2-FaceB)

Pressure point No	0°	15°	30°	45°	60°	75°	90°
2-B1	0.5445	0.495	0.4785	0.4125	0.2805	0.1485	0.2145
2-B2	0.594	0.4785	0.5775	0.4785	0.33	0.2145	0.231
2-B3	0.594	0.5115	0.561	0.5775	0.4125	0.297	0.2805
2-B4	0.528	0.528	0.5775	0.6105	0.5115	0.33	0.3135
2-B5	0.528	0.5775	0.6105	0.7095	0.5115	0.495	0.363
2-B6	0.528	0.528	0.4785	0.3795	0.231	0.0825	0.2145
2-B7	0.528	0.528	0.5115	0.4455	0.297	0.1485	0.2475
2-B8	0.528	0.528	0.528	0.5115	0.297	0.198	0.3135
2-B9	0.5445	0.5445	0.5775	0.5115	0.3135	0.3465	0.363
2-B10	0.528	0.5445	0.66	0.561	0.561	0.759	0.3465
2-B11	0.462	0.4785	0.429	0.2475	-0.0165	-0.0165	0.2805
2-B12	0.429	0.4455	0.4785	0.2805	0.1155	0.099	0.297
2-B13	0.396	0.4455	0.462	0.297	0.165	0.264	0.3135
2-B14	0.396	0.4455	0.429	0.297	0.3465	0.528	0.3465
2-B15	0.4125	0.5115	0.4785	0.5775	0.693	0.627	0.297
2-B16	0.297	0.2805	0.1155	-0.0495	-0.033	0.231	0.297
2-B17	0.231	0.2805	0.1815	0.033	0.099	0.3465	0.264
2-B18	0.231	0.2805	0.198	0.1485	0.297	0.4785	0.2805
2-B19	0.2145	0.2475	0.2475	0.363	0.495	0.4455	0.2805
2-B20	0.2145	0.297	0.4455	0.528	0.4785	0.462	0.264
2-B21	0.1815	0.1155	0	-0.0165	0.165	0.396	0.297
2-B22	0.1485	0.132	0.0495	0.099	0.2805	0.429	0.2475
2-B23	0.1485	0.132	0.1155	0.2475	0.363	0.363	0.264
2-B24	0.1485	0.165	0.264	0.396	0.363	0.363	0.2475
2-B25	0.1485	0.2145	0.33	0.396	0.33	0.3465	0.264
2-B26	0.1155	0.066	0.0165	0.099	0.2805	0.363	0.3135
2-B27	0.1155	0.0825	0.0825	0.165	0.297	0.33	0.264
2-B28	0.099	0.1155	0.165	0.3135	0.297	0.33	0.264
2-B29	0.099	0.132	0.2475	0.33	0.264	0.33	0.264
2-B30	0.099	0.165	0.2805	0.3135	0.264	0.297	0.264
2-B31	0.099	0.0495	0.0495	0.1485	0.264	0.297	0.231
2-B32	0.066	0.0825	0.1155	0.2475	0.264	0.3135	0.297
2-B33	0.066	0.099	0.1815	0.2805	0.264	0.297	0.297
2-B34	0.066	0.1155	0.198	0.2475	0.2475	0.3135	0.297
2-B35	0.0825	0.132	0.198	0.2475	0.231	0.33	0.297
2-B36	0.0825	0.066	0.099	0.198	0.231	0.33	0.2145
2-B37	0.0825	0.0825	0.1485	0.264	0.2475	0.297	0.264
2-B38	0.0825	0.0825	0.1815	0.2475	0.231	0.33	0.297
2-B39	0.0825	0.099	0.1815	0.2145	0.198	0.33	0.3465
2-B40	0.0825	0.1155	0.1815	0.2145	0.231	0.3135	0.363
2-B41	0.0825	0.0825	0.1155	0.231	0.264	0.33	0.2145
2-B42	0.0825	0.099	0.1485	0.264	0.2475	0.3135	0.264
2-B43	0.0825	0.099	0.165	0.231	0.231	0.3135	0.297
2-B44	0.0825	0.099	0.1485	0.2145	0.231	0.3135	0.33
2-B45	0.0825	0.099	0.1485	0.1815	0.198	0.297	0.396
Max. Cp	0.594	0.5775	0.66	0.7095	0.693	0.759	0.396
Min. Cp	0.066	0.0495	0	-0.0495	-0.033	-0.0165	0.2145

Three Span Building

Results for three span building are given in Tables 3.7 to 3.12

Table 3.7: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on three spans building (Span1-FaceA)

Pressure point No	0°	45°	90°
1-A1	0.561	0.297	0
1-A2	0.693	0.297	0
1-A3	0.7095	0.33	-0.033
1-A4	0.627	0.3465	0
1-A5	0.627	0.3135	0.033
1-A6	0.561	0.2805	-0.0495
1-A7	0.5445	0.2475	-0.066
1-A8	0.1485	0.198	0.066
1-A9	0.594	0.198	-0.0165
1-A10	0.627	0.231	0.0495
1-A11	0.5115	0.198	-0.0495
1-A12	0.4785	0.231	-0.066
1-A13	0.4455	0.198	-0.0495
1-A14	0.462	0.2145	-0.0165
1-A15	0.4785	0.198	0.066
1-A16	0.33	0.0825	0
1-A17	0.3135	0.1155	0
1-A18	0.3135	0.132	0
1-A19	0.297	0.165	0.033
1-A20	0.2805	0.2145	0.0825
1-A21	0.2145	0.0495	0.033
1-A22	0.2145	0.0495	0
1-A23	0.198	0.0825	0
1-A24	0.198	0.132	0.033
1-A25	0.198	0.198	0.099
1-A26	0.1485	0	0
1-A27	0.165	0.066	0
1-A28	0.132	0.066	0
1-A29	0.132	0.099	0.033
1-A30	0.1485	0.165	0.099
1-A31	0.099	0	-0.033
1-A32	0.099	0	-0.033
1-A33	0.1155	0.033	-0.033
1-A34	0.099	0.066	0
1-A35	0.099	0.1485	0.066
1-A36	0.099	0	-0.0495
1-A37	0.099	0	-0.0495
1-A38	0.099	0.033	-0.033
1-A39	0.099	0.066	0
1-A40	0.099	0.1155	0.0825
1-A41	0.099	0.033	-0.033
1-A42	0.1155	0.033	-0.0165
1-A43	0.1155	0.066	-0.0165
1-A44	0.099	0.066	0
1-A45	0.099	0.1155	0.0495
Max. Cp	0.7095	0.3465	0.099
Min. Cp	0.099	0	-0.066

Table 3.8: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on three spans building (Span1-FaceB)

Pressure point No	0°	45°	90°
1-B1	0.5775	0.297	0.099
1-B2	0.5775	0.2805	0.1155
1-B3	0.561	0.2805	0.1485
1-B4	0.5445	0.2805	0.1815
1-B5	0.5445	0.2805	0.33
1-B6	0.528	0.2475	0.066
1-B7	0.561	0.264	0.099
1-B8	0.561	0.2805	0.165
1-B9	0.5445	0.2805	0.2475
1-B10	0.561	0.297	0.3135
1-B11	0.4455	0.264	0.0825
1-B12	0.4455	0.231	0.1155
1-B13	0.4785	0.264	0.1815
1-B14	0.4785	0.2805	0.231
1-B15	0.495	0.297	0.264
1-B16	0.2805	0.231	0.0825
1-B17	0.2805	0.231	0.099
1-B18	0.2475	0.231	0.1485
1-B19	0.2805	0.264	0.198
1-B20	0.2475	0.297	0.297
1-B21	0.1815	0.198	0.066
1-B22	0.165	0.231	0.099
1-B23	0.1485	0.231	0.1155
1-B24	0.1485	0.264	0.165
1-B25	0.1815	0.3135	0.297
1-B26			
1-B27	0.1155	0.198	0.099
1-B28	0.1155	0.2475	0.1485
1-B29	0.1155	0.264	0.198
1-B30	0.1155	0.3465	0.3135
1-B31	0.1155	0.165	0.066
1-B32	0.1155	0.1815	0.099
1-B33	0.099	0.2145	0.165
1-B34	0.1155	0.2475	0.2475
1-B35	0.1155	0.3135	0.3135
1-B36	0.1155	0.165	0.066
1-B37	0.099	0.1485	0.099
1-B38	0.1155	0.198	0.132
1-B39	0.0825	0.2145	0.264
1-B40	0.1155	0.2805	0.33
1-B41	0.1155	0.165	0.099
1-B42	0.099	0.165	0.1155
1-B43	0.1155	0.165	0.165
1-B44	0.0825	0.198	0.198
1-B45	0.099	0.2475	0.3465
Max. Cp	0.5775	0.3465	0.3465
Min. Cp	0.0825	0.1485	0.066

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Table 3.9: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on three spans building (Span2-FaceA)

Pressure point No	0°	45°	90°
2-A1	0.528	0.3465	0.1815
2-A2	0.528	0.33	0.0825
2-A3	0.5115	0.363	0.033
2-A4	0.528	0.3795	0
2-A5	0.5445	0.429	0.033
2-A6	0.528	0.33	0.165
2-A7	0.561	0.33	0.0825
2-A8	0.528	0.2805	0.033
2-A9	0.528	0.264	0.033
2-A10	0.5775	0.33	0.066
2-A11	0.528	0.198	0.198
2-A12	0.495	0.2805	0.132
2-A13	0.495	0.264	0.066
2-A14	0.495	0.264	0.033
2-A15	0.495	0.297	0.066
2-A16	0.3135	-0.0825	0.2145
2-A17			
2-A18	0.3135	0.0495	0.165
2-A19	0.33	0.165	0.132
2-A20	0.33	0.2145	0.099
2-A21	0.2145	-0.066	0.2145
2-A22	0.1815	-0.066	0.231
2-A23	0.2145	0	0.165
2-A24	0.1815	0.033	0.132
2-A25	0.2145	0.132	0.099
2-A26	0.1155	0	0.2145
2-A27	0.132	-0.0165	0.198
2-A28	0.132	0	0.1485
2-A29	0.132	0.033	0.099
2-A30	0.132	0.1155	0.099
2-A31	0.099	0.099	0.165
2-A32	0.099	0	0.099
2-A33	0.099	0	0.033
2-A34	0.0825	0.033	0.033
2-A35	0.099	0.0825	0.033
2-A36	0.0825	0.099	0.132
2-A37	0.099	0.066	0.066
2-A38	0.099	0.0495	0
2-A39	0.0825	0.066	-0.033
2-A40	0.0825	0.099	0.033
2-A41	0.0825	0.1815	0.132
2-A42	0.0825	0.099	0.0495
2-A43	0.0825	0.099	0
2-A44	0.0825	0.099	0
2-A45	0.0825	0.099	0.033
Max. Cp	0.5775	0.429	0.231
Min. Cp	0.0825	-0.0825	-0.033

Table 3.10: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on three spans building (Span2-FaceB)

Pressure point No	0°	45°	90°
2-B1	0.5445	0.33	0.033
2-B2	0.594	0.3465	0.033
2-B3	0.5445	0.396	0.099
2-B4	0.5445	0.4455	0.099
2-B5	0.5445	0.5115	0.231
2-B6	0.561	0.2805	0
2-B7	0.5445	0.33	0.033
2-B8	0.561	0.3795	0.066
2-B9	0.5445	0.396	0.132
2-B10	0.5445	0.462	0.2145
2-B11	0.495	0.2145	0
2-B12	0.462	0.264	0.033
2-B13	0.495	0.2805	0.066
2-B14	0.4785	0.33	0.099
2-B15	0.462	0.396	0.198
2-B16	0.3135	0.099	0.033
2-B17	0.3135	0.165	0.0495
2-B18	0.3135	0.198	0.066
2-B19	0.33	0.264	0.099
2-B20	0.297	0.3795	0.132
2-B21	0.198	0.033	0.033
2-B22	0.198	0.099	0.066
2-B23	0.198	0.1485	0.066
2-B24	0.1815	0.2475	0.099
2-B25	0.165	0.396	0.132
2-B26	0.132	0	0.033
2-B27	0.132	0.099	0.0495
2-B28	0.132	0.1485	0.066
2-B29	0.132	0.264	0.099
2-B30	0.132	0.3465	0.1485
2-B31	0.0825	0.0495	0.033
2-B32	0.0825	0.1155	0.033
2-B33	0.0825	0.198	0.099
2-B34	0.099	0.2805	0.1485
2-B35	0.099	0.2805	0.2145
2-B36	0.0825	0.0825	0
2-B37	0.0825	0.132	0.0495
2-B38	0.0825	0.231	0.099
2-B39	0.0825	0.231	0.132
2-B40	0.0825	0.231	0.2145
2-B41	0.0825	0.1155	0.033
2-B42	0.0825	0.1485	0.0495
2-B43	0.0825	0.1815	0.099
2-B44	0.0825	0.198	0.1485
2-B45	0.0825	0.198	0.2145
Max. Cp	0.594	0.5115	0.231
Min. Cp	0.0825	0	0

Table 3.11: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on three spans building (Span3-FaceA)

Pressure point No	0°	45°	90°
3-A1	0.5775	0.0825	0.33
3-A2	0.5775	0.297	0.1485
3-A3	0.5115	0.297	0.099
3-A4	0.5775	0.4785	0.132
3-A5	0.5775	0.561	0.1815
3-A6	0.5445	0.1485	0.363
3-A7	0.5445	0.0495	0.1155
3-A8	0.594	0.0825	0.099
3-A9	0.561	0.1815	0.099
3-A10	0.5775	0.33	0.1485
3-A11	0.4455	0.297	0.3795
3-A12	0.462	0.0825	0.1485
3-A13	0.462	0.0825	0.0825
3-A14	0.495	0.1485	0.1155
3-A15	0.4785	0.2475	0.1485
3-A16	0.2475	0.3135	0.3795
3-A17	0.264	0.1815	0.165
3-A18	0.2475	0.132	0.099
3-A19	0.264	0.165	0.099
3-A20	0.2805	0.231	0.1155
3-A21	0.165	0.33	0.363
3-A22	0.1485	0.2145	0.1815
3-A23	0.1485	0.165	0.099
3-A24	0.1485	0.165	0.099
3-A25	0.165	0.2145	0.1485
3-A26	0.1155	0.33	0.3795
3-A27	0.1155	0.231	0.165
3-A28	0.1155	0.1815	0.099
3-A29	0.1155	0.1815	0.099
3-A30	0.1155	0.2145	0.165
3-A31	0.0825	0.3135	0.363
3-A32	0.0825	0.2145	0.1485
3-A33	0.0825	0.198	0.1155
3-A34	0.0825	0.1815	0.1155
3-A35	0.1155	0.198	0.1815
3-A36	0.0825	0.3135	0.33
3-A37	0.0825	0.231	0.132
3-A38	0.0825	0.198	0.099
3-A39	0.0825	0.1815	0.132
3-A40	0.0825	0.198	0.1815
3-A41	0.0825	0.3135	0.3465
3-A42	0.0825	0.231	0.1485
3-A43	0.0825	0.2145	0.1155
3-A44	0.0825	0.198	0.132
3-A45	0.0825	0.231	0.198
Max. Cp	0.594	0.561	0.3795
Min. Cp	0.0825	0.0495	0.0825

Table 3.12: Variation of mean pressure coefficient (C_p) (suction) with wind incidence angle (θ) on three spans building (Span3-FaceB)

Pressure point No	0°	45°	90°
3-B1	0.5115	0.3795	0.2145
3-B2	0.561	0.429	0.231
3-B3	0.528	0.495	0.2475
3-B4	0.5445	0.594	0.264
3-B5	0.5445	0.6435	0.2805
3-B6	0.5115	0.3795	0.198
3-B7	0.561	0.4455	0.2475
3-B8	0.528	0.4785	0.264
3-B9	0.5445	0.4785	0.2805
3-B10	0.528	0.528	0.2805
3-B11	0.495	0.231	0.2475
3-B12	0.495	0.3135	0.2475
3-B13	0.462	0.2805	0.264
3-B14	0.462	0.2805	0.264
3-B15	0.462	0.5115	0.264
3-B16	0.3135	-0.0495	0.2475
3-B17	0.3135	0.0165	0.2145
3-B18	0.396	0.1155	0.2145
3-B19	0.33	0.2805	0.198
3-B20	0.33	0.4785	0.2145
3-B21	0.2145	-0.033	0.264
3-B22	0.198	0.0495	0.2145
3-B23	0.198	0.1815	0.198
3-B24	0.198	0.363	0.2145
3-B25	0.1815	0.363	0.198
3-B26	0.132	0.0495	0.2475
3-B27	0.132	0.1485	0.2805
3-B28	0.132	0.2805	0.2475
3-B29	0.132	0.2805	0.2145
3-B30	0.132	0.297	0.2145
3-B31	0.099	0.1485	0.2145
3-B32	0.099	0.2475	0.264
3-B33	0.099	0.3135	0.2805
3-B34	0.099	0.2805	0.2805
3-B35	0.099	0.264	0.2805
3-B36	0.099	0.2145	0.2145
3-B37	0.099	0.264	0.2475
3-B38	0.099	0.2805	0.2805
3-B39	0.099	0.2475	0.3135
3-B40	0.099	0.2475	0.3135
3-B41	0.099	0.2805	0.198
3-B42	0.1155	0.3135	0.2145
3-B43	0.099	0.2805	0.2475
3-B44	0.099	0.2475	0.264
3-B45	0.099	0.231	0.33
Max. Cp	0.561	0.6435	0.33
Min. Cp	0.099	-0.0495	0.198

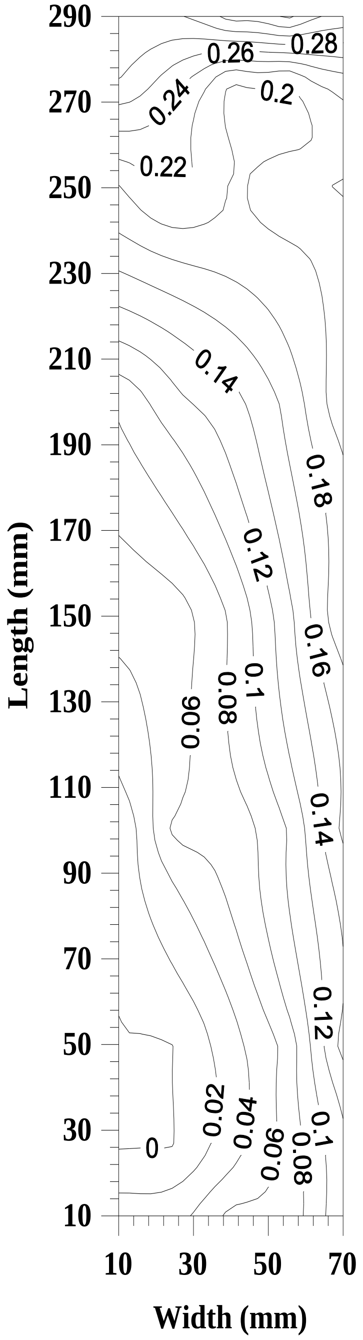

Figure 3.1 A sample of contour diagram of mean pressure coefficients (suction) on Face A of first span of three spans building for wind angle 45°

OBSERVATIONS

1. In the case of single building (Face A) max Cp value is observed of value 0.825 for wind incidence angle 15°.
2. In the case of single building (Face B) max Cp value is observed of value 0.9095 for wind incidence angle 60°.
3. In the case of two building block (Block1-FaceA) max Cp value is observed of value 0.7755 for wind incidence angle 15°.
4. In the case of two building block (Block1-FaceB) max Cp value is observed of value 0.7425 for wind incidence angle 60°.
5. In the case of two building block (Block2-FaceA) max Cp value is observed of value 0.7755 for wind incidence angle 15°.
6. In the case of two building block (Block2-FaceB) max Cp value is observed of value 0.759 for wind incidence angle 75°.
7. In the case of three building block (Block1-FaceA) max Cp value is observed of value 0.7095 for wind incidence angle 0°.
8. In the case of three building block (Block1-FaceB) max Cp value is observed of value 0.5775 for wind incidence angle 0°.
9. In the case of three building block (Block2-FaceA) max Cp value is observed of value 0.5775 for wind incidence angle 0°.
10. In the case of three building block (Block2-FaceB) max Cp value is observed of value 0.594 for wind incidence angle 0°.
11. In the case of three building block (Block3-FaceA) max Cp value is observed of value 0.594 for wind incidence angle 0°.
12. In the case of three building block (Block3-FaceB) max Cp value is observed of value 0.6435 for wind incidence angle 45°.
13. Overall min C_p is observed of value -0.165 for wind incidence angle 75° on two building block (Block1-FaceA)
14. Codal value 0.7 is given for wind incidence angle 0° on Block1-FaceA which is nearly the same as calculated in the experiment.
15. Contours are of parallel horizontal lines for wind incidence angle 0°.
16. Contours are of parallel vertical lines along the wind direction and circles placed adjacently in the other direction for wind incidence angle 90°.
17. All the points on the multi span pitched roofs are subjected to suction for all wind incidence angles except very few spots subjected to pressure of very small magnitude.

CONCLUSIONS

It is observed from the results presented in Chapter-4 that wind pressure coefficients on upper surface of pitched roofs are highly influenced by wind incidence angles. Further, wind pressure is not uniform on a surface. It varies from point to point.

The data generated as a result of present study will be of great help for structural designers while designing multi-span pitched roof buildings.

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