Wind Pressures on Buildings with Appurtenances

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ABSTRACT

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Wind pressures on buildings are affected by various appurtenances such as balconies, mullions or vertical ribs, as well as by the general roughness of the building envelope. The determination of the influence of the configuration of the building envelope to the wind loads on cladding and structural elements of a building is important for two reasons: first, to identify any modifications necessary for wind codes of practice and design standards; and second, to investigate the possibility of simplification of wind tunnel building models in the event that the simulation of architectural details appears to be insignificant to the measured wind pressures.

This thesis describes the results of an experimental study carried out in the boundary layer wind tunnel of the Centre for Building Studies under simulated wind conditions over an open country and an urban terrain. The basic model of the study simulated a 60.8 m by 60.8 m square building at two different heights (120 m and 15 m). Appurtenances attached on one wall of the building included: 2 m and 4 m wide balconies, 4 m wide balconies with vertical walls; 1 m

and 2 m vertical ribs or mullions; and two different kinds of uniform roughness of maximum size equal to 0.15 and 0.30 m respectively.

The experimental data indicate that for wind blowing perpendicular to the wall with the appurtenances, the wind pressures are only slightly affected by the roughness of the wall with the exception of the upper zone on which local pressures decrease with increasing roughness and the edge region on which local suctions increase drastically in the case of vertical ribs or mullions. When the appurtenances are on a side or leeward wall, the wind suctions are also only slightly affected by the roughness of the wall with the exception of the lower zone on which local pressures decrease with increasing roughness and the edge region on which local suctions also increase drastically for particular rib or mullion configurations. Trends are similar for both mean and fluctuating wind loads and they occur for both terrain exposures tested. The thesis quantifies these effects and makes appropriate recommendations.

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CHAPTER 1. INTRODUCTION

A knowledge of the wind-induced local pressures expected to act on the building envelope during its lifetime is required for rational design of glass and cladding on buildings. The importance of this requirement has been increased in recent years by the popularity of tall buildings with large areas of glass and lightweight cladding. Fluctuations of pressure on wall surfaces are caused by the turbulence in the wind flow approaching the building and by flow disturbances generated by the surface elements, such as mullions or vertical ribs, balconies, as well as the texture of the building materials, which can be characterized as uniform - roughness. The prediction of wind load on buildings is generally difficult because of the random nature of the approaching flow; however, it is even more difficult when appurtenances such as various architechtural elements are present. Figures 1.1 to 1.4 illustrate buildings with different appurtenances in the downtown area of Montreal. Figure 1.5 illustrates failures of cladding and glass caused by wind.

Wind standards and building codes of practice provide stipulations for building cladding design. These stipulations mainly originate from tests on buildings with smooth surfaces. However, in most cases buildings have different kinds of appurtenances (roughness) and the application of the same provisions becomes doubtful.

FIG. 1.1 BALCONIES-COMMON STRUCTURES ON APARTMENT BUILDINGS

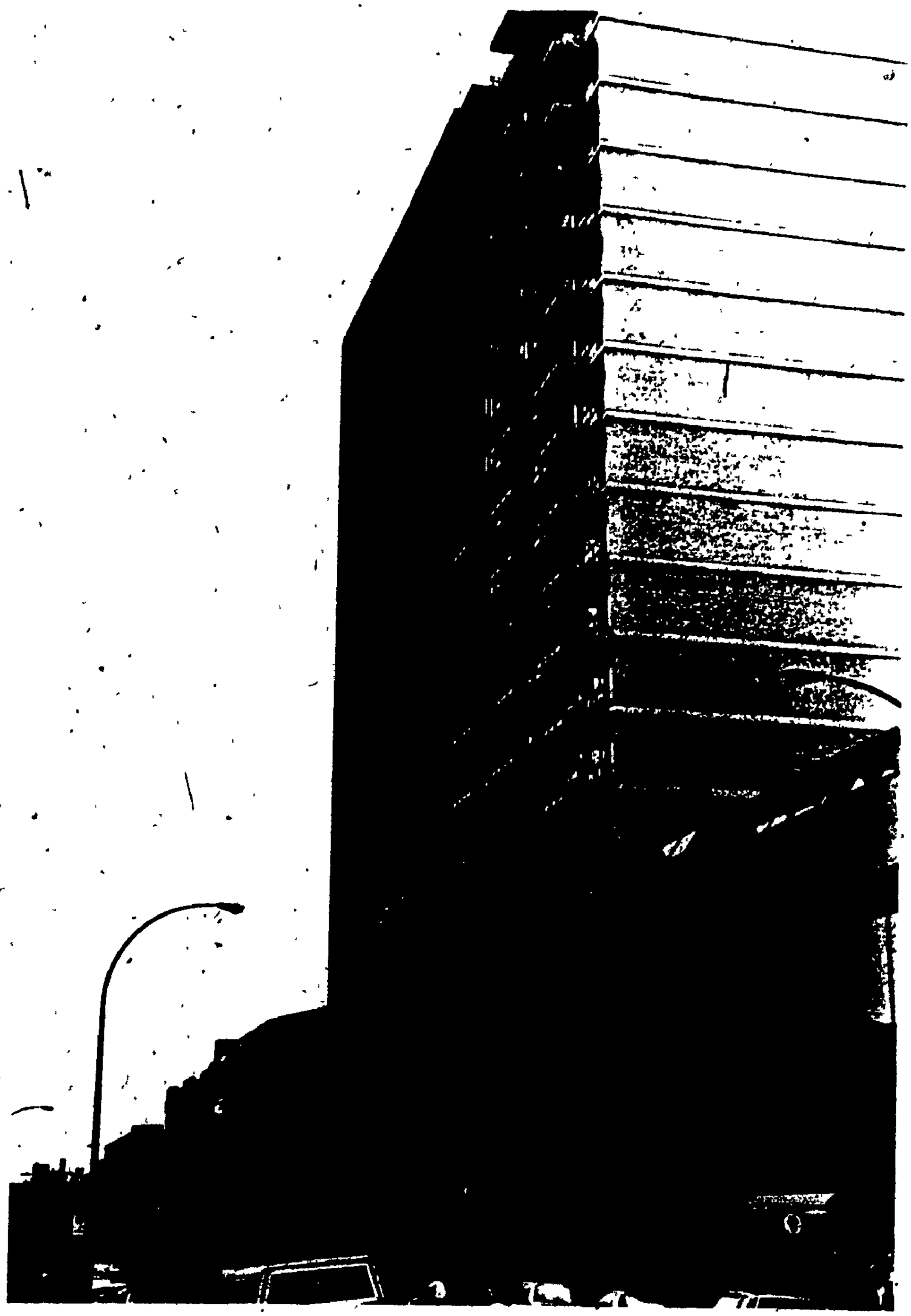


FIG. 1.2 BALCONIES WITH AND WITHOUT WALLS

FIG. 1.3 BUILDING WITH VERTICAL RIBS

FIG. 1-4 BUILDING WITH MULLIONS

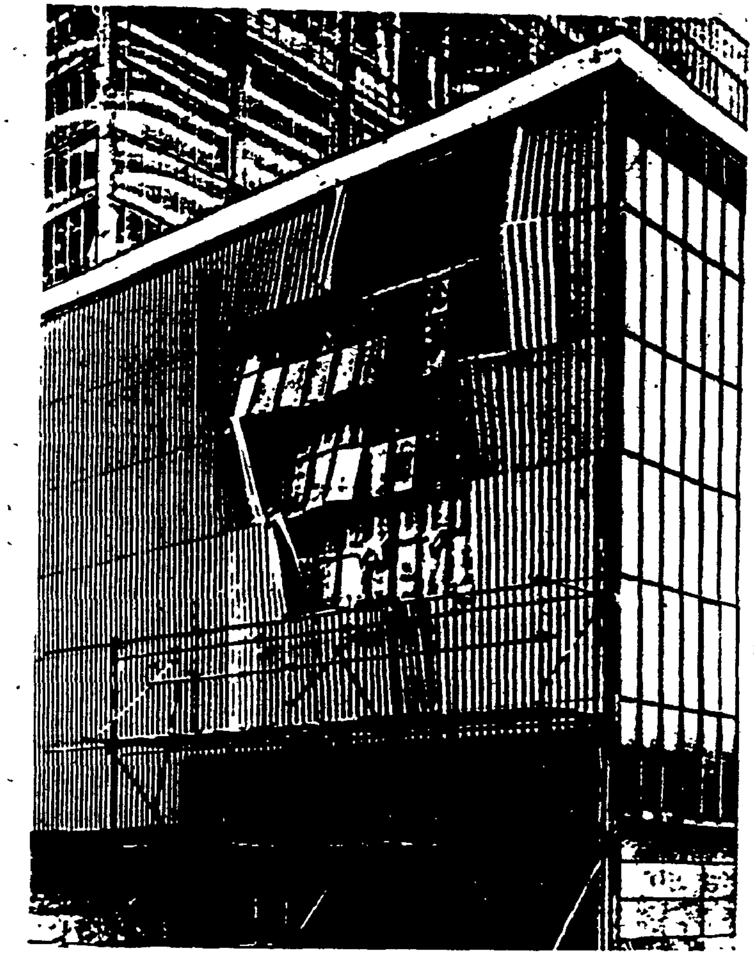
Therefore, it is of interest to examine the suitability of these wind code/standard provisions for buildings with roughness. In addition, wind tunnel modelling commonly assumes that the surfaces of the buildings to be simulated are smooth. Hence, the question exists whether the wind pressures measured on the smooth building surface can also represent those acting on a model with rough surface and what is the difference, if any.

Very few studies related to this topic have been carried out previously. Furthermore, the information obtained from these previous studies is far from adequate to answer the questions of either wind tunnel modelling or building cladding design. Therefore, a systematic experimental study of the effects of these building appurtenances on locally-induced wind pressures appears necessary.

The objective of this study is to understand the effects of surface roughness and appurtenances of different kinds on the local wind pressures on building cladding and to provide answers to the questions of wind code and standard specifications for cladding design and requirements for wind tunnel modelling.

This thesis consists of 6 chapters. Historical background is presented in Chapter 2, in which research literature related to this work is discussed. Chapter 3 describes basic theoretical knowledge on boundary layer flow

(A) Lightweight metal and glass clad, reinforced concrete frame office block, damaged by high suction near the upwind edges



(B) Cladding panels damaged by suction near windward corner

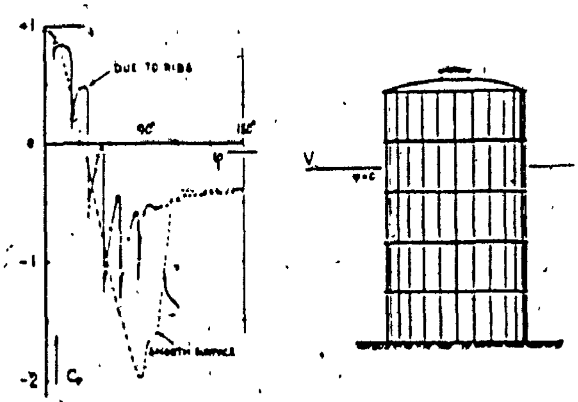
FIG. 1.5 WIND-INDUCED CLADDING FAILURE AFTER COOK (1985), EATON (1974) simulation requirements for wind tunnel modelling. Experimental equipment, i.e, wind tunnel and data acquisition system are also presented. Experimental procedures and data handling are discussed in Chapter 4, in which the basic test model, the details of the appurtenances and the configurations tested are described. Pressure measurements and the experimental errors involved are also discussed in this chapter. Results and discussion of the experimental study are given in Chapter 5, in which the effects of different appurtenances are discussed in turn for different building heights and terrain exposures. Results of spectral analysis attempted to understand the mechanism of the various effects of appurtenances are also presented. The most critical values observed during the tests for each case are organized in Chapter 6 and recommendations for wind standards and wind tunnel modelling are made. Finally, Chapter 7 presents conclusions and recommendations for further studies.

CHAPTER 2. HISTORICAL BACKGROUND

Over the last 30 years there have been a limited number of experimental studies related to the wind-induced pressures on buildings with appurtenances. Although most of these studies referred only to some particular cases and the experimental work was mainly carried out in aeronautical wind tunnels, they are valuable references to a systematic study of wind effects of appurtenances on building surfaces.

Hoerner (1957) discussed the effects of vertical ribs on a circular cylindrical storage tank in his famous book of Fluid-Dynamic Drag. The test was performed in an aeronautical wind tunnel. Hoerner reported that the negative pressures at the sides of circular cylinders can have high values. However, the suction peaks are eliminated by ribs in the outside structure of the storage tank, although the drag is higher in this condition than with smooth surface. See Figure 2.1.

Anatol Roshko (1970) compared the wind pressure data from wind tunnel tests on circular and prismatic cylinders and discussed the effects of shape, Reynolds number and surface roughness. He carried out his tests in an aeronautical wind tunnel and attempted to model many of the parameters previously simulated in boundary layer wind tunnels such as those at the University of Western Ontario and at Colorado State University.



Pressure distribution on the circumference of a gas storage tank with smooth surface and with steel ribs on the surface, respectively.

	b = depth of ribs
d = 15b	d = diameter of the tank
h = 26b	h = height of the tank

FIG. 2.1 PRESSURE DISTRIBUTION ON THE CIRCUMFERENCE OF A GAS STORAGE TANK WITH SMOOTH SURFACE AND WITH STEEL RIBS AFTER HOERNER (1957)

Roshko reports a dependence of the pressure distribution on Reynolds number not only for round but also for sections with sharp edges. He describes an experiment, in which a square prism was tested with and without shallow grooves cut along the length of the two upstream faces. The model was oriented so that one of the corners was pointed directly upstream, i.e. the wind was at a 45^{o} angle to both front faces. Pressures on the leeward sides were measured with and without the grooves on the upstream faces. Although there was almost no difference in the mean pressures between the cases with and without grooves, there was a variation with Reynolds number that was more apparent with grooves on the front face than without the grooves. The variation in the mean pressure coefficients was 5 percent over a range of Reynolds number from $4.3*10^{5}$ to $7.8*10^{5}$. The results of Roshko's test with smooth and rough windward surface are shown in Figure 2.2.

Roshko concludes that exact scaling of details from full-scale to model may not give accurate results automatically.

This problem was also recognized by Standen, Dalgliesh and Templin (1971), who attempted to make appropriate corrections for it. They made measurements on a full-scale building with mullions as well as on a wind tunnel model of this building. Their idea was that the effect of surface roughness, such as that caused by mullions, was to influence

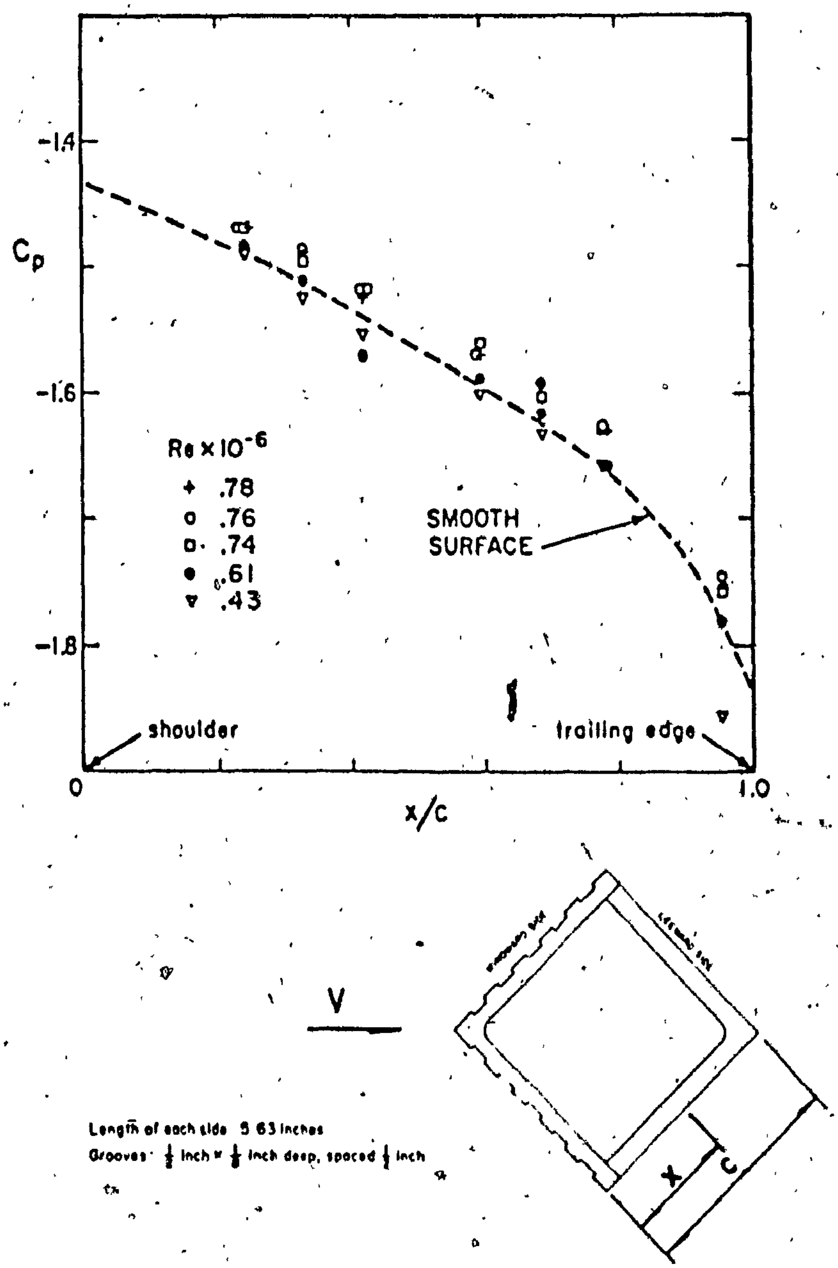


FIG. 2.2 PRESSURE DISTRIBUTION ON LEEWARD SIDE OF A SQUARE CYLINDER AFTER ROSHKO (1970)

the growth of the local boundary layer on the surface of the building. Using flat plate boundary layer theory from Schlichting (1968) they deduced that the scale of mullions should be proportional to the local boundary-layer thickness. The boundary layer thickness increases as the 4/5 power of the Reynolds number based on the distance over which the boundary layer has developed, i.e. the length of the building side. Since the incident velocity in full-scale and model are approximately the same, the scaling of mullions should be the 4/5 power of the overall geometric scale. For a scale of 1:400, this suggests a mullion scale of 1:120 or an exaggeration of 3.3:1 for the mullions.

Leutheusser (1970) performed a series of wind-tunnel studies on building models with various architectural details such as roof parapets and mullions. In mullion experiments, his main purpose was to study the local effects of mullions spaced at various intervals on a two-dimensional uniform flow. Only mean pressures were measured in his study.

Other than very local effects of wind-induced pressures on the surface of the mullions and between them, the overall trends showed no difference between the cases with and without mullions in most regions. However, there were differences on side faces when the wind was normal to the front face. These differences showed a decrease in pressure (larger negative values) towards the leading edge of the face when mullions were added. The differences increased as the spacing between mullions was decreased.

Newberry and Eaton (1974) reported in the Wind Loading Handbook that the presence of ribs on the face of a rectangular clad building has relatively little effect on the overall wind load unless the d/b (d is the depth of building in the wind direction, b is the breadth of structure across the wind direction) ratio for the building is more than about 3 and the ribs are on the side faces. Under such conditions the re-attached flow along the side faces will tend to exert forces on the ribs which will increase the force coefficient of the building; even so, for all normal configurations the increase will be unlikely to exceed about 5 to 10 percent.

Newberry and Eaton (1974) also found that the effect of very rough facades, such as those formed by the presence of numerous balconies, is to produce a series of pockets of pressure across the windward facade with the result that pressure tends to fall off rather less than it otherwise would towards the edges of the facade. Windward face Cp values for rectangular clad buildings should therefore be increased slightly in the presence of balconies.

Templin and Cermak (1976) also carried out wind tunnel studies concerning the effect of mullions on wind-induced loads on buildings. Two building models were tested. One model represented a building with a special cross-section called the Independent Square Building, which was under construction in Jacksonville, Florida. This building was instrumented in full-scale to measure pressures. Its dimensions were 52.30 m by 31.00 m by 160.00 m high. They expected to compare the results from the wind tunnel with those from the full-scale measurements. The second building was a rectangular building, 32 m by 65 m by 130 m high. The mullions tested were 0.8 mm (20.5 cm in full-scale) and 2.4 mm (61.4 cm in full scale).

Templin and Cermak reported that there were no measurable differences between the pressures recorded on the Independent Square building model without mullions and those with the short (0.8 mm) mullions. When the size of mullions, however, was increased to 2.4 mm to give a three-fold exaggeration relative to the true-scale, some differences were detected. Not all regions on the building showed a change for each wind direction. The primary regions that were affected by the presence of mullions were those sides where the main flow reattached after separating from the upwind corner. At most taps, the effect of the 2.4 mm mullions was to reduce the magnitude of the mean and rms pressures. The reduction never exceeded about 40 percent. For a few taps, there were slight increases in the magnitude of pressure. These occurred in separated regions of flow, but the largest increases were only about 20 percent for the mean and expected peak pressures.

With regard to the rectangular building, Templin and Cermak reported that examination of a rectangular shaped building with square corners revealed more effects of mullions than on the Independent Square building. There were both positive and negative changes in the magnitude of mean, rms and peak pressure coefficients due to mullions. These changes occurred on all faces of the building for all wind directions including stagnation faces, faces in the wake and reattachment faces. Most changes consisted of decreases in the magnitude of mean and rms pressure coefficients. The mullions therefore added protection to the building. However, on sides where reattachment occurred, there were large negative peaks due to increased rms values at points near the leading edges of the sides.

Templin and Cermak noticed that some of the taps which showed increases in pressure magnitudes on the rectangular building were located between the first and second mullions on the side. This indicated that the location of the first mullion relative to the corner may have a great effect on the pressures measured. It was recommended that a study should be carried out on the effect of corner geometry on the flow patterns around buildings.

Although some work has been carried out in determining the effects of appurtenances and the correct way to model them, it seems that much more work needs to be done. So far no systematic study about effects of appurtenances on buildings has been performed in a three-dimensional turbulent flow. This appears necessary for the purposes of wind tunnel modelling and building code development.

CHAPTER 3. BOUNDARY LAYER SIMULATION AND EXPERIMENTAL EQUIPMENT

3.1 The Wind Tunnel

The first wind tunnel was built by Stanton at the National Physical Laboratory in the UK in 1903, for aircraft design (Lawson, 1980).

Over the years, although the wind tunnel design was improved and wind tunnels became more sophisticated, the use of them was limited to aeronautical problems rather than to the problems of wind loads on buildings. When the results of investigations conducted in aeronautical tunnels were found to be far from the results of full-scale measurements available, the use of wind tunnel for loads on buildings fell into disrepute.

The first special purpose wind tunnel, a Boundary Layer Wind Tunnel (BLWT) was designed by Cermak in 1958. This together with the Model Law formulated by Jensen (1958) (ensured that similarity of flow conditions could be maintained if the ratio of building height to upstream roughness length was kept the same in the wind tunnel and in nature) indicated the beginning of modern wind-engineering.

3.1.1 Basic Requirements for Wind Tunnel Modeling

The scale factors of length, mass and time are important parameters in wind tunnel modelling. These factors are defined as follows:

Length scale factor $\mathcal{L}$ = model length / prototype length
Mass scale factor $\mathcal{M}$ = model mass / prototype mass
Time scale factor $\mathcal{T}$ = model time / prototype time

Once these three primary scale factors are set, all other subsidiary scale factors (e.g. the velocity scale factor $\mathcal{V} = \mathcal{L} / \mathcal{T}$) and all non-dimensional parameters are set in the model.

The range of choice of the scale factors when reproducing a physical, rather than a mathematical model is set by the characteristics of the available test conditions, the size and speed range of the wind tunnel when in the laboratory, or the size of the substitute structure and its test wind speed when in the real wind. The time scale factor $\mathcal{T}$ can be set indirectly by the choice of the velocity scale factor $\mathcal{V}$. In the wind tunnel the choice of $\mathcal{V}$ is made to suit within the available range. In the atmosphere there is no real choice, $\mathcal{V}$ being set as the ratio of the wind speed of the test to the design wind speed.

The Strouhal number, Reynolds number and Froude number are three non-dimensional parameters associated with scale factors, namely:

$nD/\overline{V}$ Strouhal Number (non-dimensional frequency)

$\rho_a \overline{V} D/\mu$ Reynolds Number (inertia force/viscous force)

$gD/\overline{V}^2$ Froude Number (gravity forces of structure/inertia force of air)

Where: n is the frequency relevant to the flow, ρ_a and μ are air density and dynamic viscosity respectively.

For the three non-dimensional parameters, the reference length, D, and the flow velocity, V, are the only remaining variables, giving three mutually incompatible requirements for complete dynamic similarity between prototype and model:

D proportional to $\overline{V}$ from Strouhal Number

D proportional to $1/\overline{V}$ from Reynolds Number

D proportional to $\overline{V}^2$ from the Froude Number

Clearly the only scale factors at which complete dynamic similarity is obtained are at $\mathcal{M} = \mathcal{L} = \mathcal{T} = 1$, that is at full scale, and no 'model' can be completely accurate. The accuracy of a given model depends on which non-dimensional parameters have been matched, and on the significance of those excluded from matching.

3.1.2 Non-dimensional Parameters

A powerful tool in describing the characteristics of wind flow around buildings and structures is 'dimensional analysis'. The key to dimensional analysis is Buckingham's "π" theorem which states that the relationship between N independent variables is described by N-m independent non-dimensional parameters (numerics), where m is the number of dimensions contained in the N variables. Suppose, for simplicity, that the flow around a body depends on only six parameters: pressure p, velocity V, frequency n, dynamic viscosity μ, air density ρ_a and size D. This leads to three non-dimensional parameters:

Pressure Coefficient	$Cp = p/(0.5* \rho_a \overline{V}^2)$
Reynolds Number	$Re = \rho_a \overline{V} D/\mu$
Strouhal Number	$St = nD/\overline{V}$

since the three dimensions, mass, length and time, are contained in these variables. Other numerics could be formed from the variables, but these would be combinations of the three listed. The particular three were selected because they represent ratios of physical significance.

3.1.3 The Model - Law

The Reynolds Number Simulation has always been considered the model-law in connection with velocities that are below the velocity of sound. Thus, it has been attempted as far as possible to obtain the same value for the Reynolds' Number in nature and in model.

This model law requires that the product of the velocity and the size of the object must be alike in model tests and in nature.

This requirement, however, can almost never be fulfilled in reality. For example, assuming a 20 meter high building exposed to a wind velocity of 40 m/s, a model test demands a product of the height of the model and the velocity in the wind tunnel of 20*40 = 800 m^2/s. If a 4m high model is used, a wind velocity of 200 m/s should be achieved in order to fulfill the requirement of Reynolds number. Clearly, it is impossible either to build 4m high model in wind tunnel or to obtain a 200 m/s wind velocity, which is high enough to bring in undesirable Mach Number effects involving compressibility of the fluid.

Fortunately, the Reynolds number restriction can be relaxed if a model has sharp edges, since the sharp edges fix the flow separations, which cannot possibly be located elsewhere. The part of the vortex layer that is nearest to the slipping point, therefore, will be fairly independent of Reynolds Number, and thereby all essential relations in the flow must also be independent of Re. On the contrary, some other problems cannot be considered independent of Re. For example, the flow around spheres and cylinders may change its character altogether when Reynolds Number is altered, because the point of separation may move a substantial length over the curved surface.

Martin Jensen (1958) discussed the model law. He realized that Reynolds Number may not be the most essential parameter in the aerodynamics of the natural wind. He suggested that the model law may be based upon the turbulence properties of the flow.

From Nikuradse's investigations on the flow of water through pipes with rough walls, it is known that the water moves independently of Reynolds Number when a fully rough flow is involved. Such a flow is only dependent on the roughness of the surface.

The wind in the layers near the earth is nearly always turbulent regardless of height from the ground surface. Therefore, it is thus a fully rough flow, and this implies, as in the case of rough pipes, that Reynolds number is of no significance. The flow is determined by roughness, or perhaps rather by turbulence, because the turbulence alone depends on the roughness when the atmosphere is in a neutral equilibrium i.e. when there are no thermal exchanges with the turbulence.

Jensen recognized that the flow in the wind tunnel must be turbulent in a way similar to that of natural wind. He stated that for model tests, the velocity profile in the wind tunnel must be similar to that in nature, or, expressed more simply, that the roughness parameter for the tunnel floor must be to scale to the roughness parameter in nature, i.e.

$$Z_o/z_o = D/d$$

where Z_o is the roughness parameter in nature, z_o is the roughness parameter in the tunnel, and D and d are a measure in the object in nature and in the tunnel respectively. The model must of course be entirely immersed in the turbulent boundary layer of the tunnel.

Figure 3.1 illustrates Jensen's characteristic results for the model law. Jensen measured the mean pressures on a low-rise building in full scale and compared the results with a series of wind-tunnel model tests. The wind tunnel used was unique at that time since it was sufficiently long to allow the growth of a deep boundary layer above the floor. Jensen varied the roughness of the floor from smoother to rougher than the full-scale case. When smooth, the results were identical to those obtained from smooth uniform flow tests in wind tunnels appropriate for testing of aircrafts; these compare badly with the full-scale data. Full-scale and model data compare very well only when the roughness number in the model matched that in full scale, i.e. $H/Z_o = h/z_o = 170$; $Z_o/z_o = H/h = 20$.

Figure 3.2 shows the ve[illegible]ity profiles for both Jensen's wind tunnel and the nature, where $Z_o = 0.95$cm, $z_o = 0.047$cm.

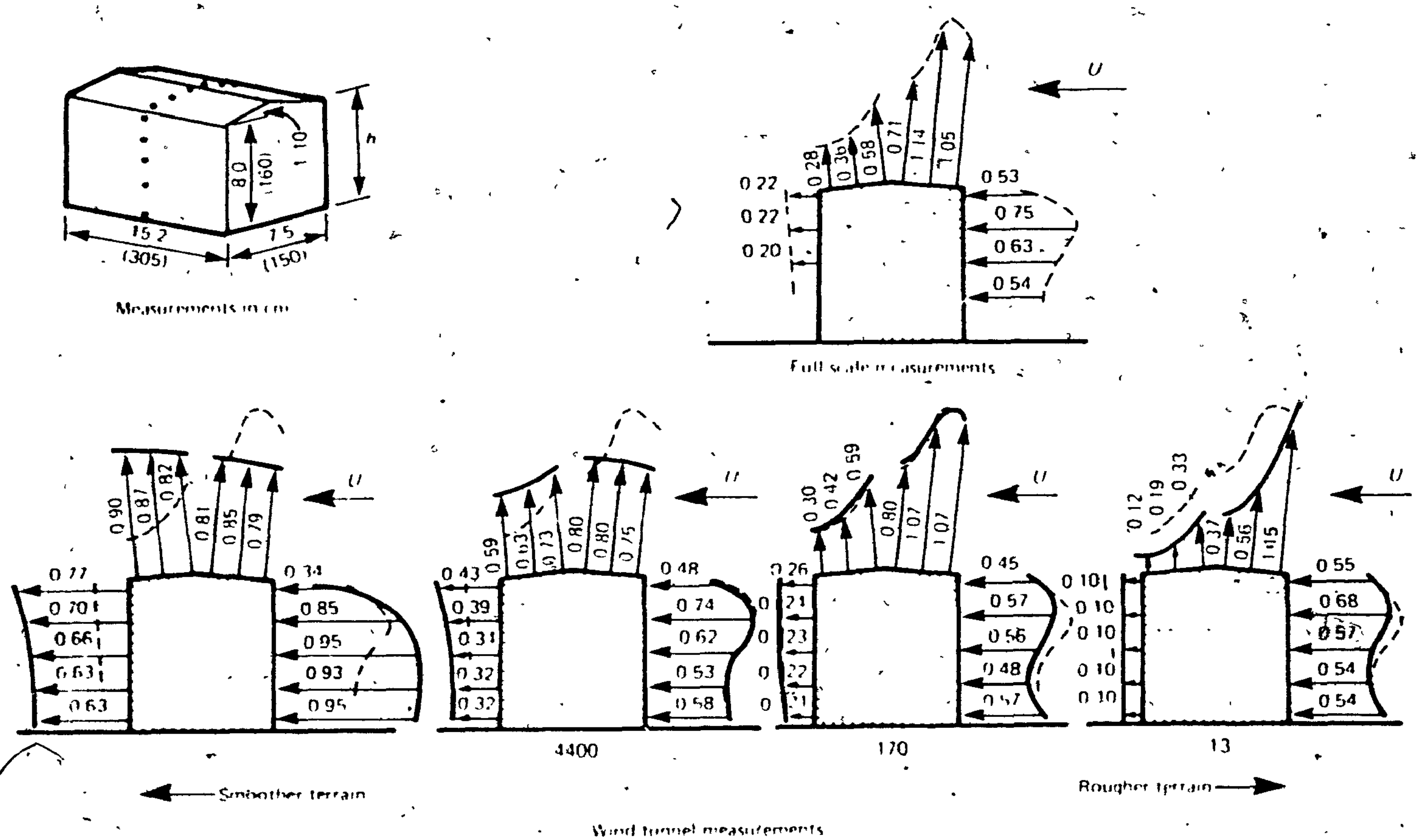


FIG. 3.1 PRESSURE COEFFICIENTS DEMONSTRATING THE EFFECT OF GROUND ROUGHNESS AFTER JENSEN (1958)

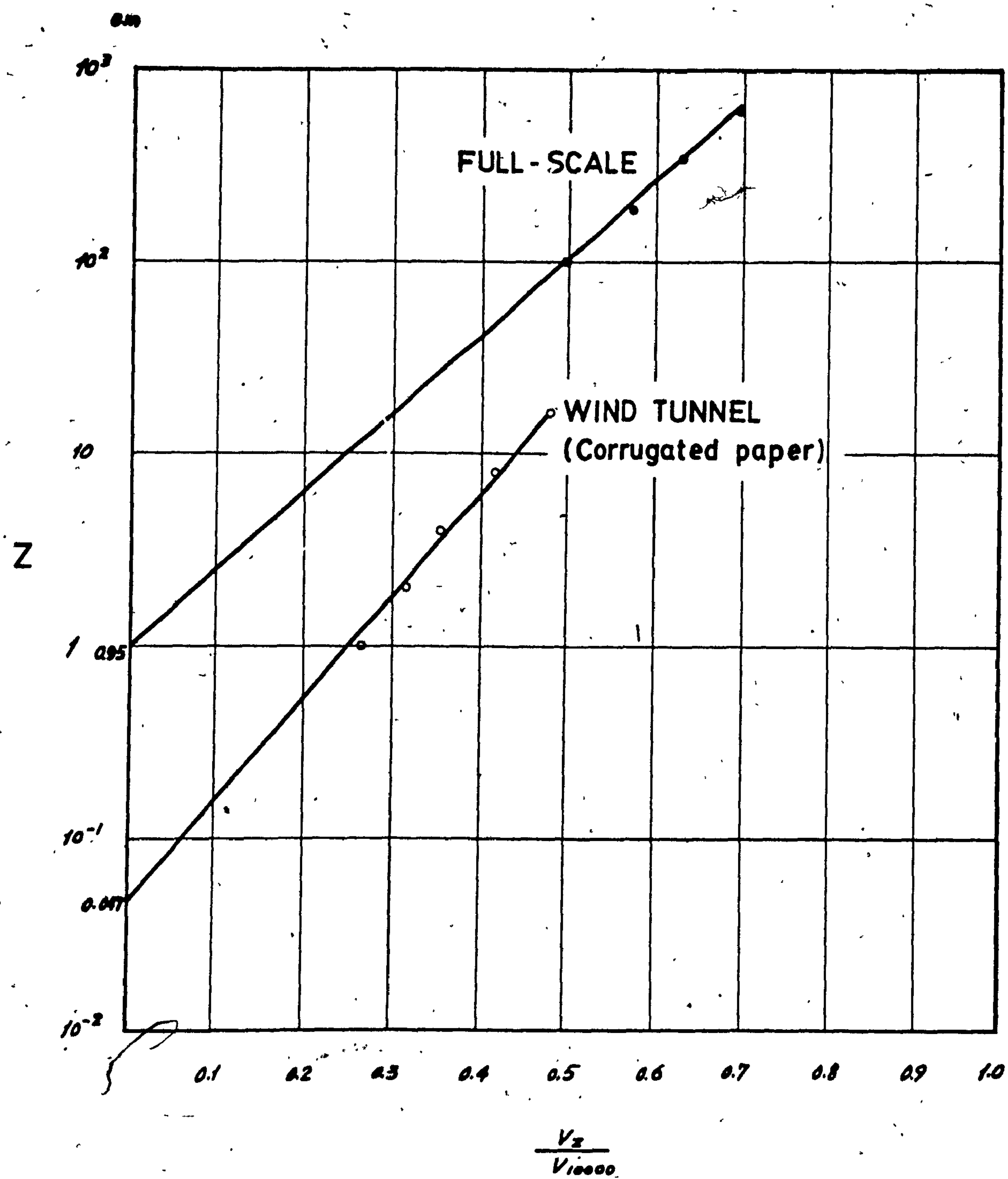


FIG. 3.2 VELOCITY PROFILES IN JENSEN'S EXPERIMENTS AFTER JENSEN (1958)

3.1.4 The Wind Tunnel of the Centre for Building Studies

All measurements in this study were made in the boundary layer wind tunnel located in the Building Aerodynamics Laboratory of the Centre for Building Studies, Concordia University. A schematic of the wind tunnel is shown in Figure 3.3 and photographs of the interior and exterior of the tunnel are shown in Figures 3.4A and 3.4B respectively. It is an open loop tunnel powered by a 50 hp single-speed induction motor. The cross-section of the tunnel is 1.8 m * 1.8 m and the length of the test section is 12.2 m. The roof is of adjustable height from 1.4 m to 1.8 m to allow for zero longitudinal pressure gradient for various floor roughness characteristics simulating different terrain exposures. The turbulent shear flow is developed naturally over the tunnel floor by using different floor roughnesses. A turntable with a diameter of 1.21 m is located in the most downstream section of the tunnel so that the influence of wind direction can be investigated. The turntable can be operated either manually or electrically. The maximum wind speed at the test section is 14 m/s (46 ft/s).

3.1.5 The Blockage Effect

In an empty wind tunnel, flow conditions along the

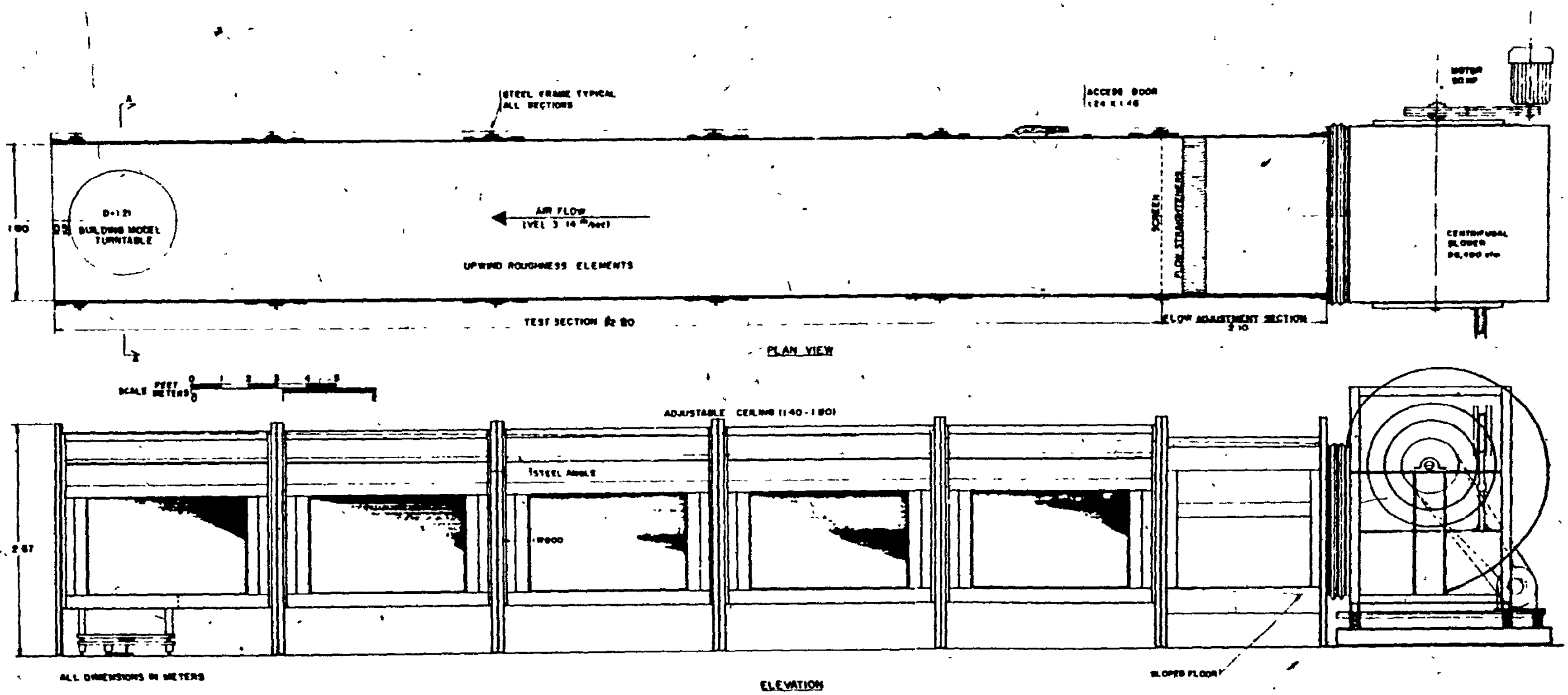


FIG. 3.3 A SCHEMATIC OF THE WIND TUNNEL OF THE CENTRE FOR BUILDING STUDIES AFTER STATHOPOULOS (1984)

FIG. 3.4A: THE INTERIOR VIEW OF THE WIND TUNNEL OF THE CENTRE FOR BUILDING STUDIES

FIG. 3.4B: THE EXTERIOR VIEW OF THE WIND TUNNEL OF THE CENTRE FOR BUILDING STUDIES

working section will be identical and the streamlines will be parallel to the walls. When a model, however, is placed on the floor of the tunnel, the air must pass over or around the model, and this distortion of the flow will spread away from the model.

If the air at the height of the wind tunnel roof is inclined to move vertically due to the model, the pressure of the roof applies a constraint upon the flow which will be transmitted back through the fluid to the model. Measurements, either of pressures or velocities, around the model will be changed by the pressure of the roof of the wind tunnel so that the results from a wind tunnel investigation will differ from others obtained in the atmosphere which has no equivalent upper constraint. This is the so-called blockage effect.

There are two ways to overcome this problem. One is to make the wind tunnel roof height changeable, so that the static pressure gradient along the roof is constant. Another method is to increase the wind tunnel cross-section area. Experiments carried out by Kirrane and Steward (1978) conclude that a 10% area ratio between the model cross-section and the wind tunnel cross-section is an acceptable upper limit without correction.

The cross-section of the wind tunnel of the Centre for Building Studies is 1.8m*1.8m and 10% of the area of the tunnel cross-section is $1.8^2 * 0.1 = 0.324\ m^2$. Therefore, a model with a cross-section area 0.324 m^2 (57*57 cm^2) can be tested in the tunnel without any correction. The maximum model cross-section used in the experimental studies was 0.3*0.15 = 0.045 m^2 which is far less than 1/10 of the cross-section area of 0.324 m^2. Thus no correction is necessary for blockage effect.

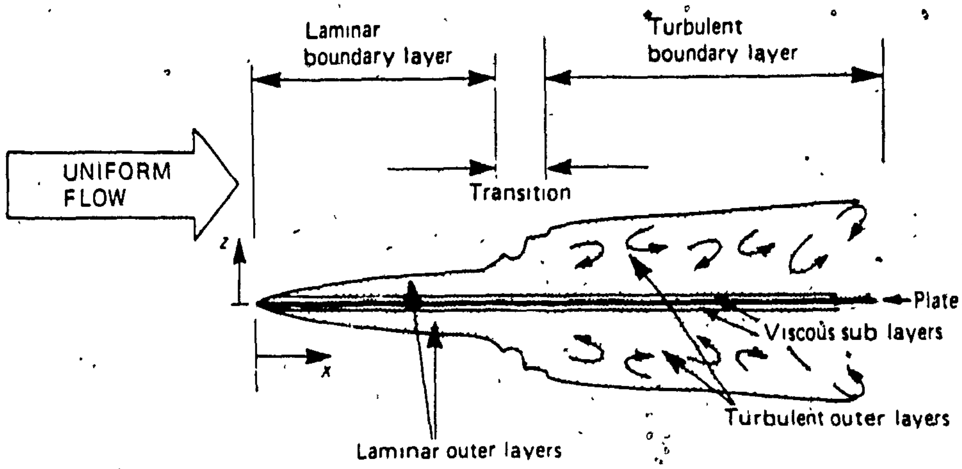
3.1.6 Boundary Layer Simulation

The boundary layer is the region of flow near the surface of a body which is affected by the action of shear stresses on the body.

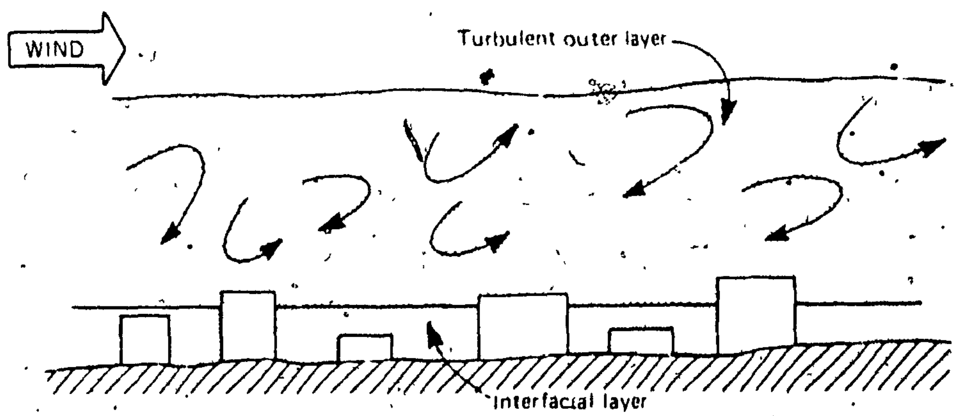
The boundary layer formed on either side of a thin smooth plate held tangential to smooth uniform flow is shown in Figure 3.5 (a). Next to the surface, the flow is brought to rest by friction, where far away from the plate the flow is unaffected. Many of the flow characteristics can be deduced merely by consideration of the relevant Reynolds number, Re. When Re is very small, viscous forces dominate. Conversely, when Re is very large, inertia forces dominate.

For the integral effect from the start of the plate to the downstream location:

$$Re_X = \frac{\rho a V X}{\mu}$$



(a) Boundary layers on a flat plate



(b) Boundary layer on Earth's surface

FIG. 3.5 FORMATION OF BOUNDARY LAYERS

where: ρ_a = the air density

V = the uniform flow velocity

X = the distance from the start point of the plate

μ = the viscosity

Near the upstream edge of the plate, where X is small so that Re_X is also small, the whole boundary layer is viscous-dominated and laminar. As X increases further down the plate, viscosity becomes relatively less important. When inertia becomes more important than viscosity at the critical Re_X ($= 10^5$), the flow in the outer boundary layer becomes unstable and any disturbance in the flow will trigger transition to turbulence. The flow remains fully turbulent downstream of transition as Re_X increases further, with the Reynolds stresses replacing viscosity as the agent for transmitting shear stress through the flow outside of the viscous sub-layer. Increasing the external uniform velocity increases Re_X, making the viscous sub-layer thinner and moving the turbulence transition point closer to the upstream edge of the plate.

A surface is aerodynamically smooth as long as any roughness is buried in the viscous sub-layer. The atmospheric boundary layer (ABL) is the region of wind which is affected by the surface of the earth. At almost any wind speed, the Reynolds numbers associated with the ABL are so large that the flow is always expected to be turbulent. The surface of the earth is always fully aerodynamically rough owing to the large size of roughness elements, such as fences, hedges, trees, buildings, e.t.c. see Figure 3.5 (b). In this case, the viscous sub-layer of the boundary layer on smooth surface is replaced by a layer within the depth of the roughness elements, the 'interfacial layer', through which the turbulent Reynolds stress of the outer boundary layer is transmitted as normal pressure force on the roughness elements.

In order to obtain reasonable results in the wind tunnel, the wind velocity profile, the turbulence intensity and spectra must be reproduced at an approprate scale factor. Kinematic similarity, with regard to a non-dimensional characteristic time (e.g. Strouhal number associated with flow patterns such as vortex shedding), and dynamic similarity, with regard to a characteristic force (e.g. Reynolds number associated with flow separation and reattachment), should also be fulfilled.

3.1.7 Logarithmic Law Model and Power Law Model

In a boundary layer, the relationship between the velocity and the height can be described by either the Logarithmic Law Model or the Power Law Model.

The Logarithmic Law Model, which fits measured wind speed data best near the ground, is derived from the boundary layer theory and can be stated as follows:

$$\frac{\overline{V}(Z)}{\overline{V}g} = \frac{1}{K} Cg * \ln\left[\frac{Z}{Z_O}\right]$$

where: $\overline{V}(Z)$ = the mean velocity at the height Z

$\overline{V}g$ = the gradient velocity

K = the Von Karman's constant, K = 0.4

Cg = the geostrophic drag coefficient

Z = the height within the boundary layer

Z_O = the roughness length

The Power-Law has been universally employed as an empirical model for mean and gust wind speed profiles for many years.

$$\frac{\overline{V}(Z)}{\overline{V}g} = \left(\frac{Z}{Zg}\right)^{\alpha}$$

where: Zg = the gradient height

α = an experimentally-determined exponent dependent on the roughness of the exposure

The shortcomings of the Power-Law model are that it has no theoretical justification and the fit is best in the upper region of the boundary layer but is not so good near the surface.

The results of mean velocity and longitudinal turbulence intensity profiles taken at the centre of the turntable for the two simulated exposures tested in the present study are shown in Figure 3.6. It can be seen that the Power-Law Model with exponent 0.15 for the open country exposure and 0.38 for the urban exposure fits most of the measured values very well.

Typical values of the parameters for different full-scale terrains taken from Davenport (1971), are compared with those obtained from the measured wind tunnel data in Table 3.1. The data indicate that a 1:400-length scale may be the most appropriate for the simulation of the natural wind characteristics in the wind tunnel.

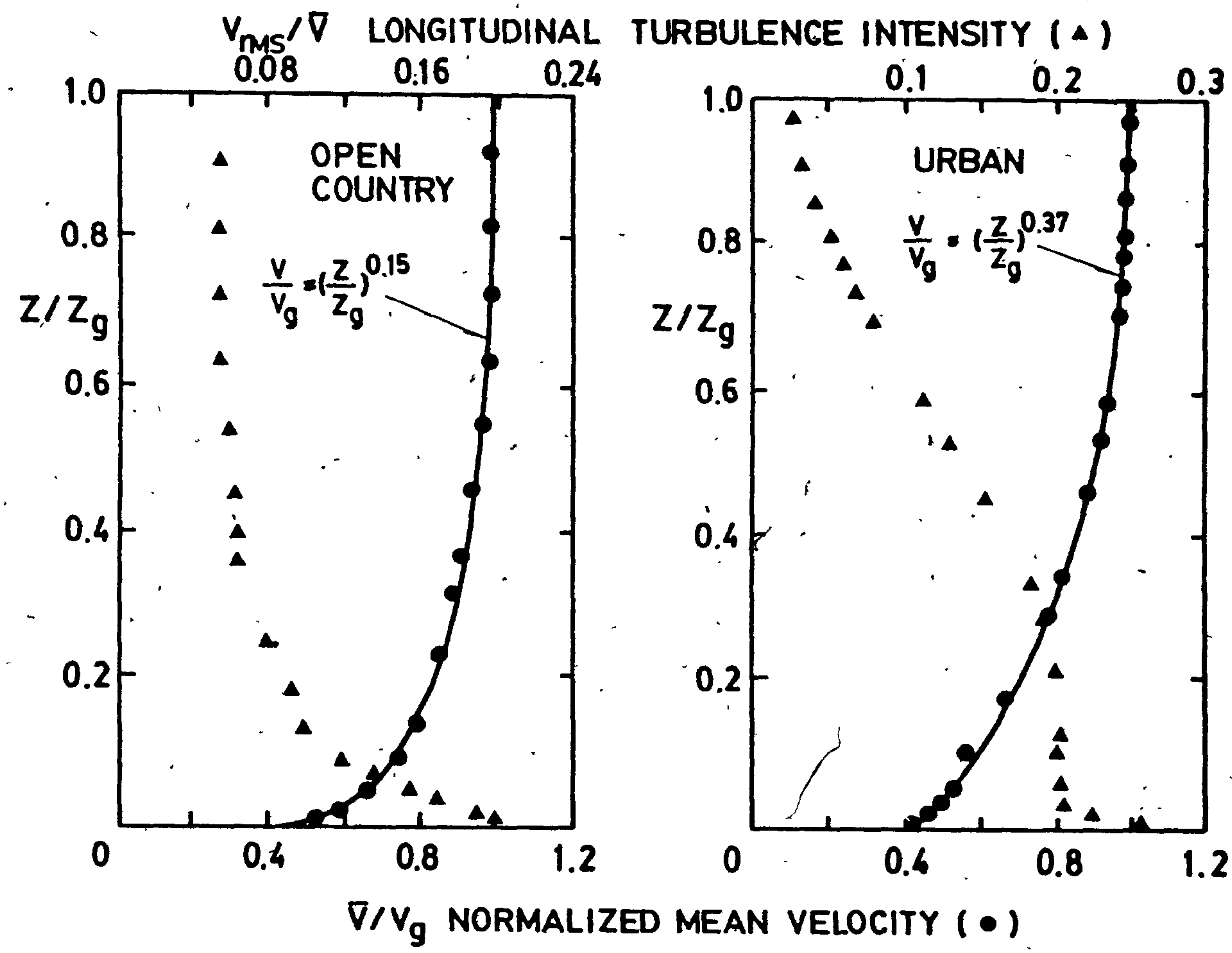


FIG. 3.6 MEAN SPEED AND TURBULENCE INTENSITY PROFILES FOR OPEN COUNTRY AND URBAN SIMULATED TERRAIN EXPOSURES

	FULL SCALE		WIND TUNNEL	
	OPEN COUNTRY	URBAN	OPEN COUNTRY	URBAN
Zg(cm)	27000	51500	60	82
Z_0 (cm)	1-10	100-500	0.01	1.20
α	0.16	0.40	0.15	0.37
Cg	0.042	0.046	0.042	0.046

TABLE 3.1 PARAMETERS FOR FULL-SCALE AND SIMULATED TERRAIN EXPOSURES

3.1.8 The Spectra of Longitudinal Turbulence Component

The characteristics of the wind at the surface of the earth are influenced by two main factors. One factor is the large scale pressure differences which are responsible for the mass movement of air in the atmosphere and which give rise to the gradient wind. The second factor is the small scale phenomena such as ground roughness and local topography which modify the gradient wind into the surface wind. These two mechanisms cause velocity fluctuations which have quite different time scales. Figure 3.7 shows a typical wind velocity spectrum which clearly indicates two significant peaks corresponding to the ranges of passage of weather systems and local turbulence. In wind tunnel simulation, only the micrometeorological range (turbulence peak) is simulated.

The well-known Von Karman's equation (1975) forms an analytical expression for the spectra of longitudinal turbulence component.

$$\frac{nS(n)}{\sigma^2} = \frac{4n'}{(1+70.8n'^2)^{5/6}}$$

$$n' = \frac{nLx}{\overline{V}z}$$

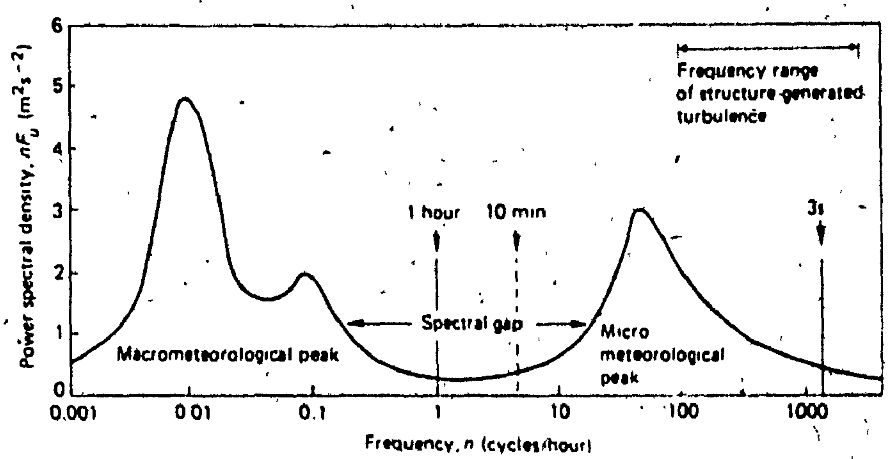


FIG. 3.7 SPECTRUM OF HORIZONTAL WIND SPEED AFTER VAN DER HOVEN (1957)

$$L_x = \frac{25(Z-d)^{0.35}}{Z_o^{0.063}} \quad (m)$$

where: n = the frequency

$S(n)$ = the power spectral density of the longitudinal turbulence component

σ^2 = the variance of the longitudinal wind speed

$\bar{V}z$ = the mean wind speed at height Z

Lx = the length scale of turbulence in the longitudinal direction

d = the displacement length

Z_o = the roughness length

Davenport's empirical expression (1961) for the power spectral density has the following form:

$$\frac{nS(n)}{\sigma^2} = \frac{2}{3} \frac{n'^2}{(1 + n'^2)^{4/3}}$$

$$n' = \frac{n}{\bar{V}_{10}} 1200 = \frac{n}{\bar{V}z} \frac{\bar{V}z}{\bar{V}_{10}} 1200$$

Figure 3.8 shows the comparison between typical spectra of the longitudinal turbulence component measured in the wind

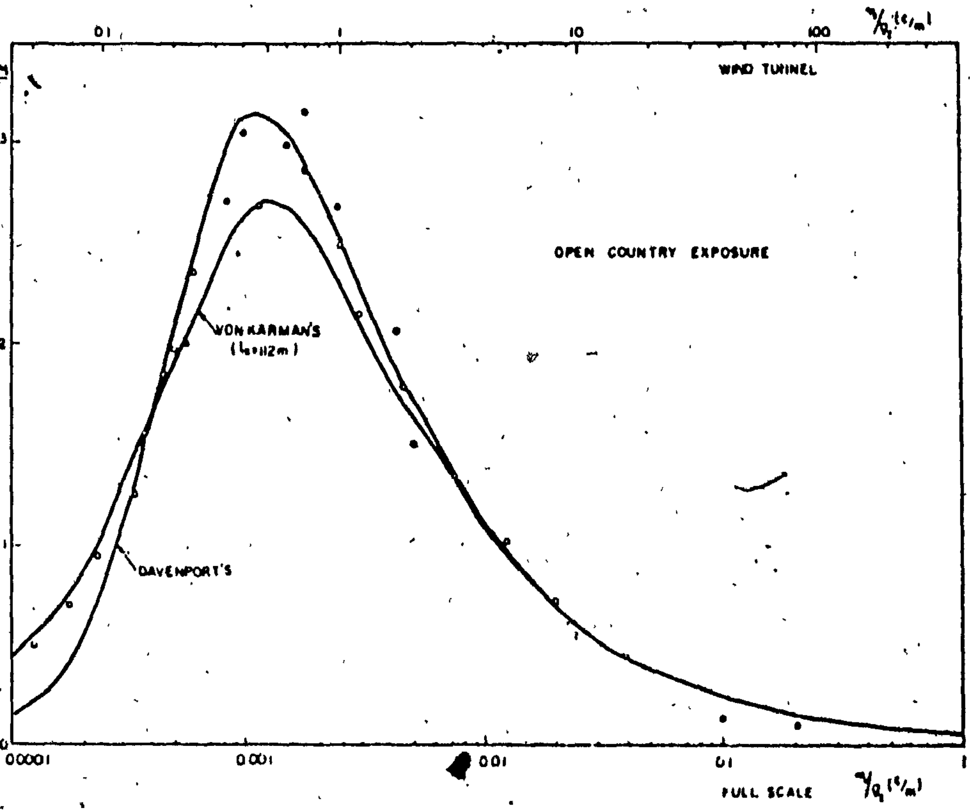


FIG. 3.8 SPECTRA OF LONGITUDINAL TURBULENCE COMPONENT AT $Z/Z_G = 1/6$ AFTER STATHOPOULOS (1984)

tunnel at a height equal to one sixth of the boundary layer depth by Stathopoulos (1984) and the curves of Von Karman's equation (1975) as well as the Davenport's empirical equation (1961). Generally the agreement between the experimental and analytical-empirical models may be considered as satisfactory for the 1:400 scale suggested.

3.2 The Data Acquisition System

All pressures were measured in the wind tunnel by a high-speed data-acquisition system, the MACSYM-2.

The pressure signal was carried from the tap on the model's surface via a plastic tube to a pressure selector valve to a SETRA 237 dynamic pressure transducer. The valve was designed to minimize losses in frequency response of the signal being monitored. The fluctuating signal from the transducer was amplified and transmitted to a multi-channel analog-to-digital converter. The tubing system used in the present measurements responds adequately to pressure fluctuations on the model up to a frequency of 100 Hz with negligible distortion. Data were collected at a sampling rate of 50 samples per second for a period of 30 seconds. The sampling time of 30 seconds is required by the time scale of the test system, which is about 1:140. In other words, 30 seconds in wind tunnel test is equivalent to about one hour full-scale; this covers the turbulence part (micrometeorological range) of the spectrum of horizontal wind speed. Finally, pressure coefficients, Cp mean, Cp max, Cp min, Cp rms (definitions of the pressure coefficients are given in Chapter 4.4) are calculated by the MACSYM-2.

Figure 3.9 illustrates the experimental set-up for the test system. A pitot tube located at gradient height is connected to a pressure transducer reading the difference between the total and static pressure and also to an inclined manometer allowing a visual readout. Finally, the MACSYM-2 data acquisition system is connected to the Perkin Elmer computer system for further analysis of the data.

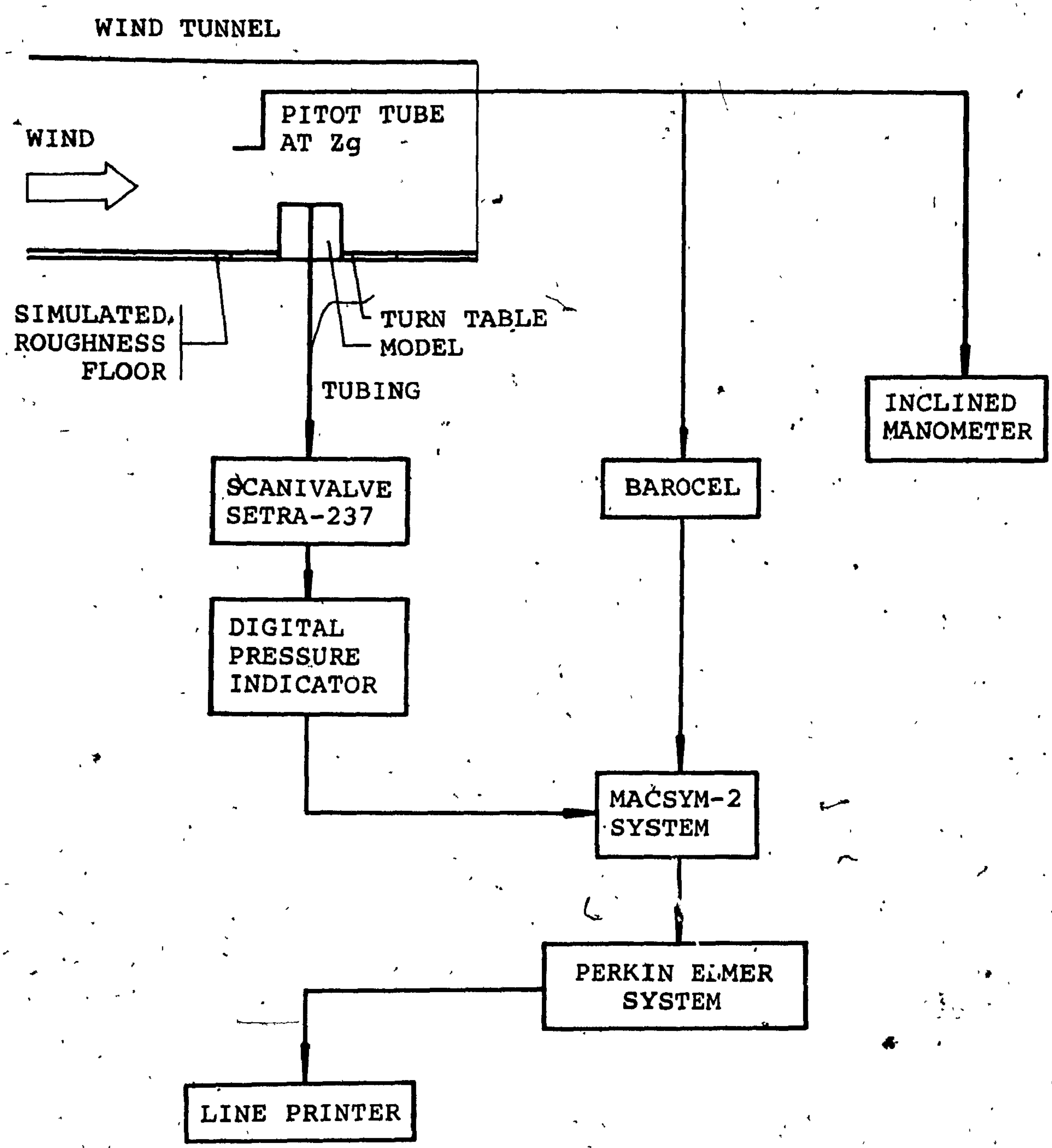


FIG. 3.9 EXPERIMENTAL SET-UP

CHAPTER 4. EXPERIMENTAL PROCEDURE AND DATA HANDLING

4.1 The Model

All the tests were carried out on a 'lucite' plastic square model. The model was built to the scale of 1:400, with dimensions 15.20cm*15.20cm*30cm high, representing a tall building in full scale with dimensions of 60.80m*60.80m*120m high.

There were 47 taps located on the front surface of the model, as shown in Figure 4.1. There are 12 taps located near the two edges of the building at a distance of 60 cm for each corner of the building in full scale. These taps can be used to investigate the effects of appurtenances on the wind loads of edge areas. The front surface was divided into 8 zones as indicated in Figure 4.2, in order to analyze the results. The pressure distribution for each zone was represented by monitoring the pressure on the taps located within that zone.

In order to investigate the influence of building height, a low rise building was represented by the same model with a height of 3.75 cm (15 m high in full scale). The front surface of the model has only 11 taps (level 1,2 and of 3 of Figure 4.2).

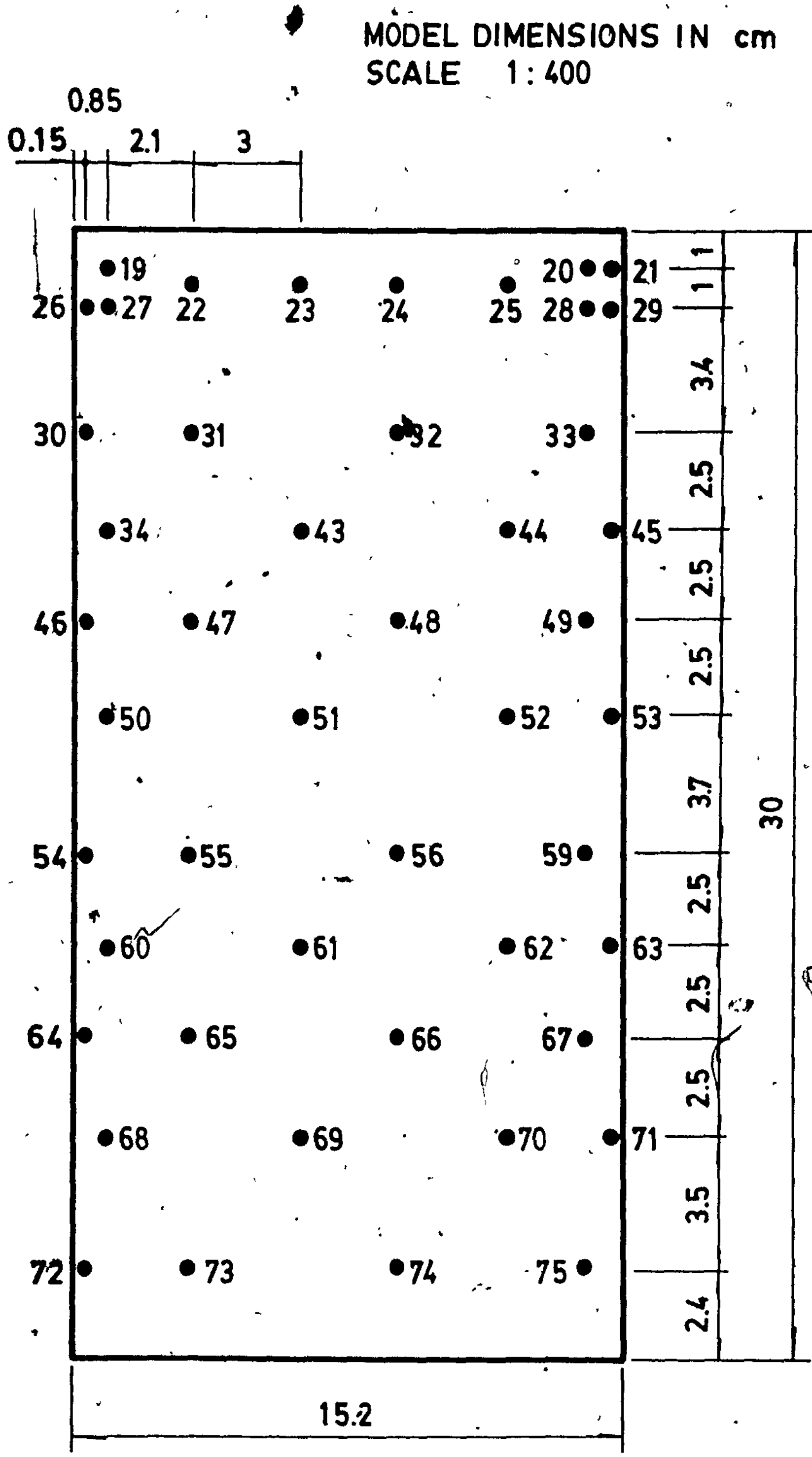


FIG. 4.1 PRESSURE TAP LOCATIONS FOR THE MODEL

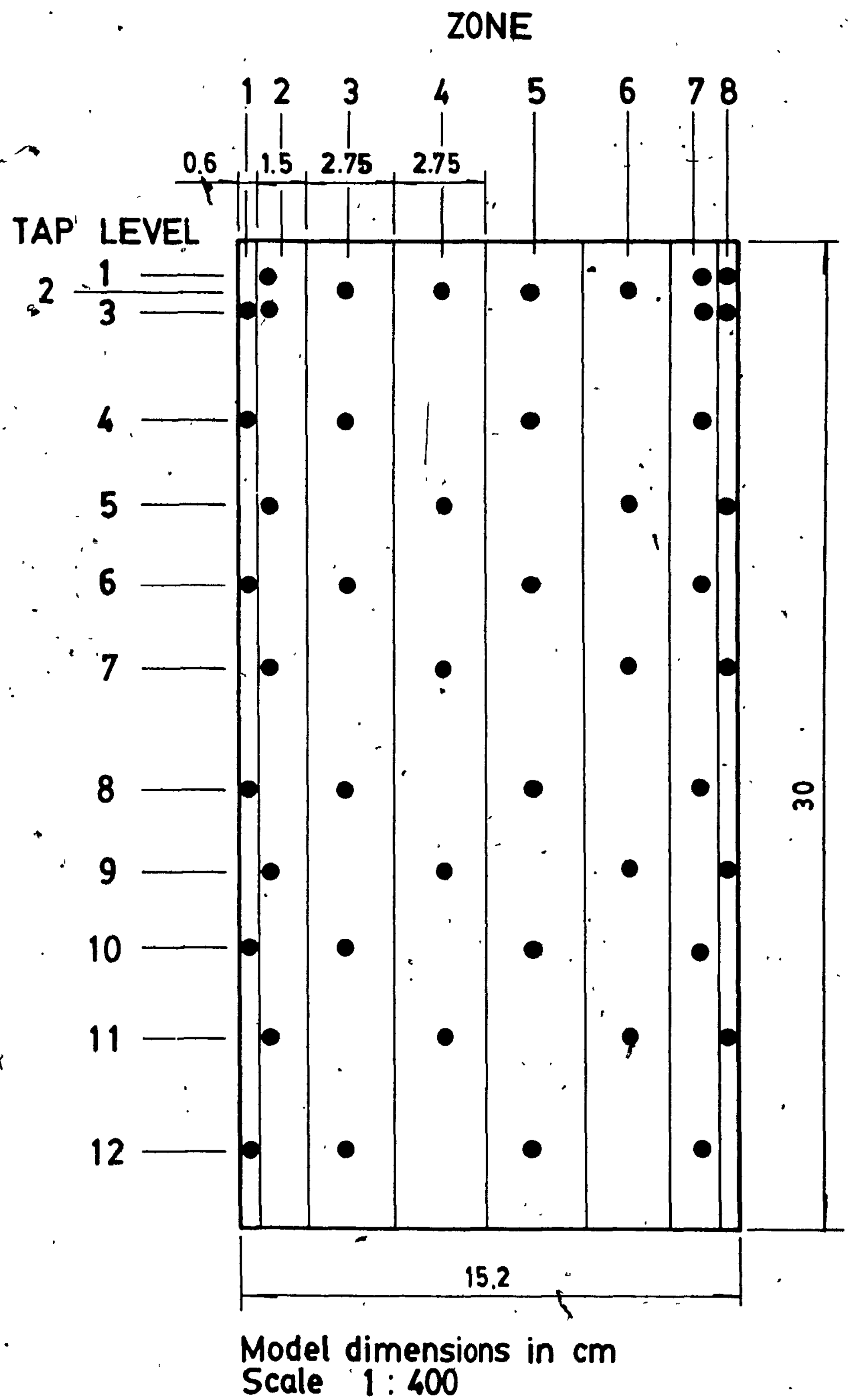


FIG. 4.2 ZONE DIVISION OF THE BUILDING WALL

4.2 The Configuration of the Appurtenances

Figure 4.3 illustrates the testing configurations in terms of terrain exposure, building height, details of appurtenances, and azimuth.

Four different configurations of appurtenances were considered in the experiments in an attempt to include all common surface roughnesses of buildings. The appurtenances are uniform roughness balconies, balconies with walls, and mullions or vertical ribs.

Sometimes the building surface has certain texture, and it is interesting to know whether the roughness of the surface causes any differences on the cladding pressures. This uniform roughness case was simulated by sandpaper. See Figure 4.4.

Two different kinds of sandpapers, namely 80 GAR and 40 ALO were used in the test. The maximum heights of the sand layers correspond to 0.15 m and 0.30 m in full scale respectively. The sandpaper was attached on the building surface by using double sided tape and holes of 6 mm in diameter were made at each tap location to let the wind approach the pressure taps. Figures 4.5A and 4.5B show the uniform roughness arrangement for the tall and low building model respectively.

Balconies are common structures frequently used for low rise and intermediate buildings up to 50 m high. Their

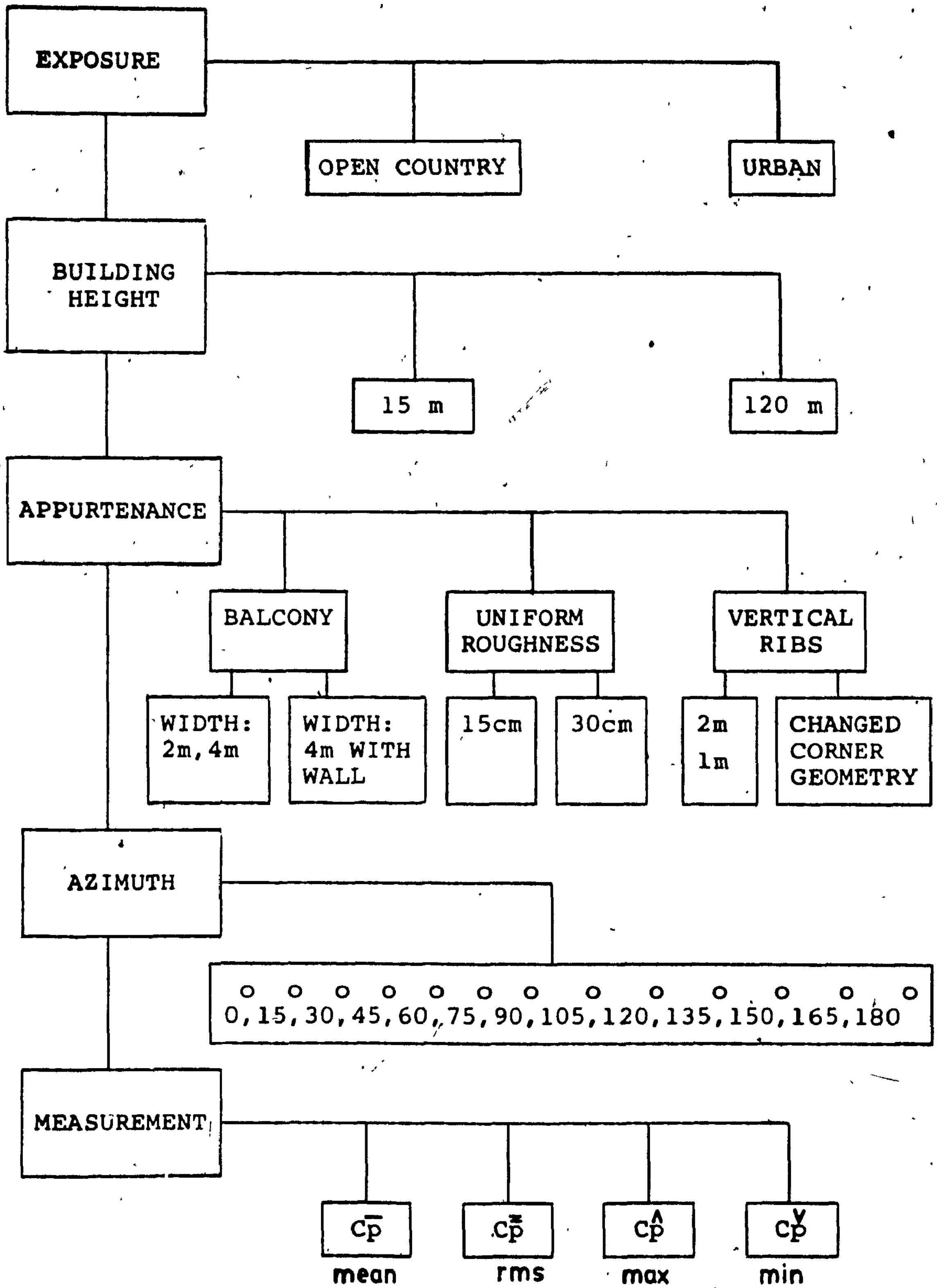


FIG. 4.3 TESTING CONFIGURATIONS

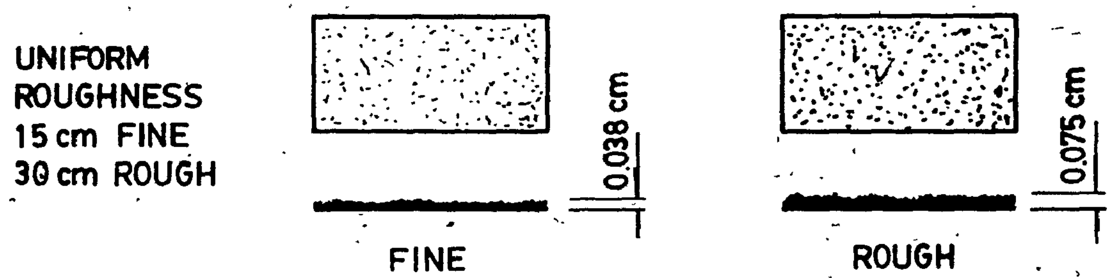


FIG. 4.4 UNIFORM ROUGHNESS TESTED

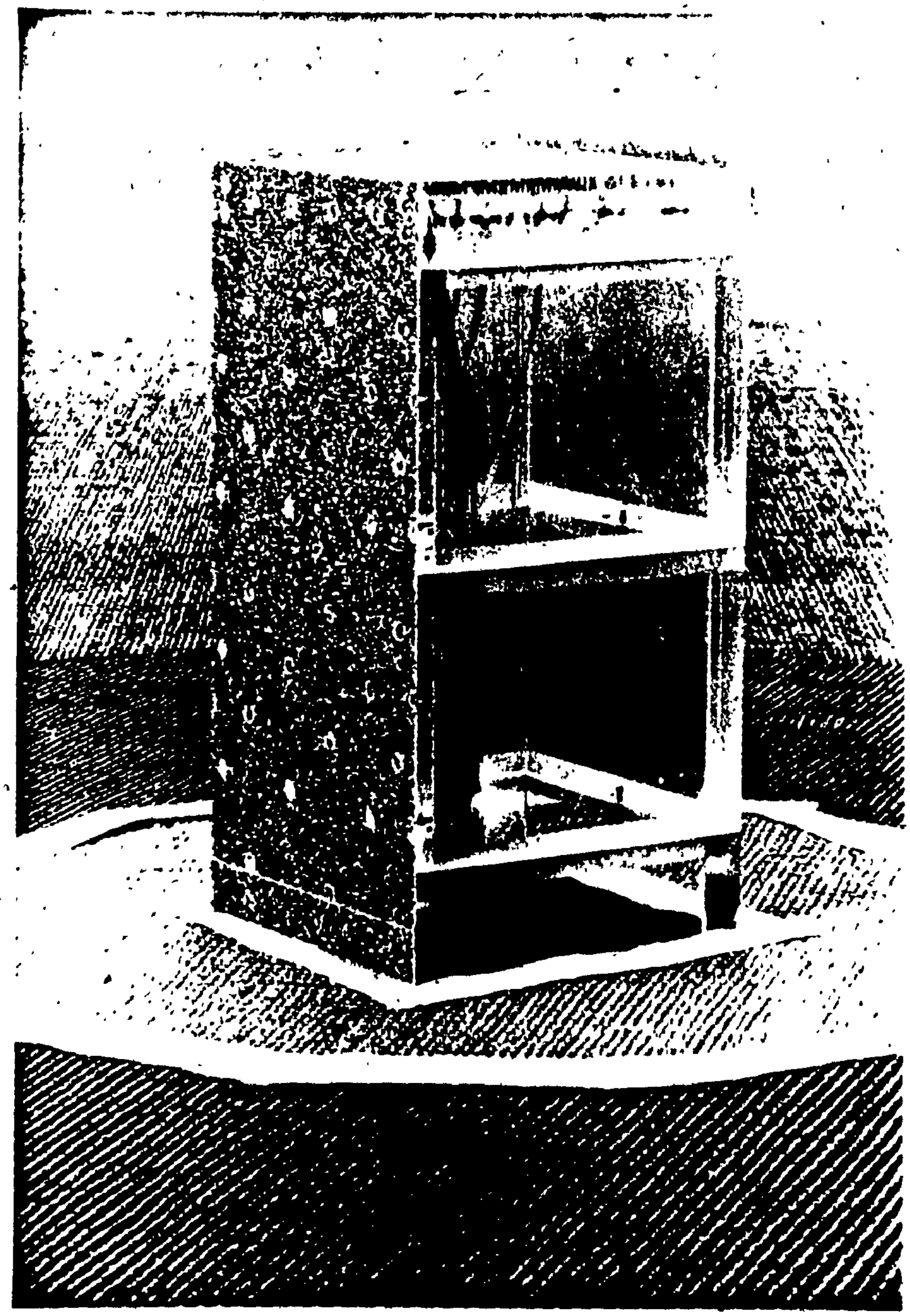


FIG. 4.5 A: TALL BUILDING WITH 15 cm UNIFORM ROUGHNESS

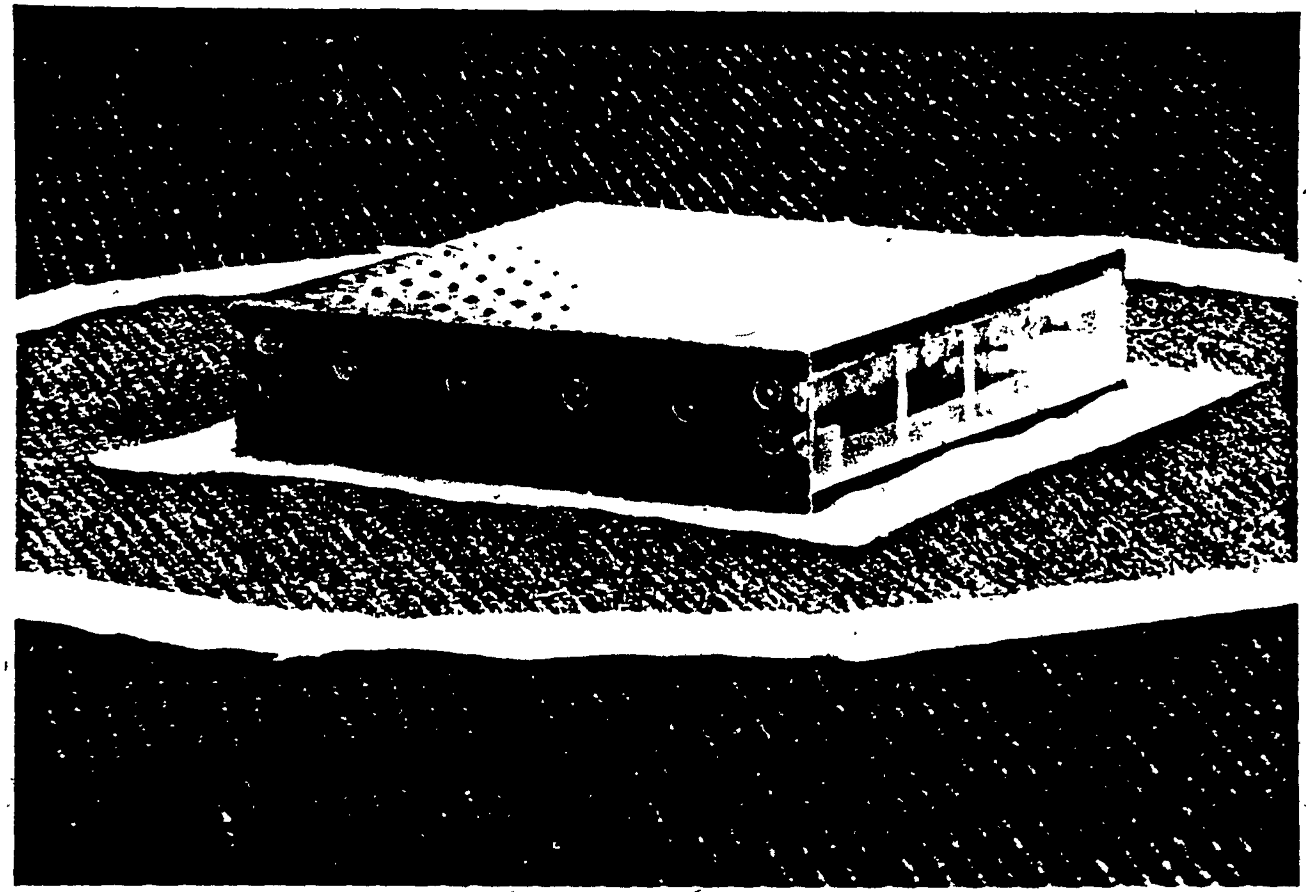


FIG. 4.5 B: LOW BUILDING WITH 30 cm UNIFORM ROUGHNESS

width usually ranges between 1m and 3m.

Some balconies are built in the way that projected from the building surface while others are inserted in the building surface (Figure 1.2). Some of these balconies have walls up to 1.5 m high surrounding their free edges, while others have only fences. In this study balconies are simulated by zinc plates with a thickness of 0.6 mm (24 cm in full scale according to the scale 1:400). Balconies were tested at two different widths, (2m and 4m) in order to determine the influence of the balcony width on the pressures on the surface of the buildings, as indicated in Figures 4.6A to 4.6c. For the balconies with walls, only one width (4m) was used but with two different wall heights, 1m and 2m. These balconies were attached on the model front surface by scotch tape and a constant interval of 4m was chosen. A total of 29 balconies were used for each balcony configuration for the 120m-high building as Figure 4.7 shows. For the 15m-high building only 3 balconies were used as shown in Figure 4.8. It should be noted that for all balcony configurations, no attempt was made to measure variation of pressure across the gaps between adjacent balconies.

Mullions or vertical ribs on the external wall of a building are common appurtenances because of cladding requirements or simply for decoration. The vertical ribs were simulated by using 0.6 mm thick zinc plates, 0.5 cm and 0.25 cm in depth for 120 m and 15 m high buildings respectively. Full scale dimensions are 0.24m*2.00m deep

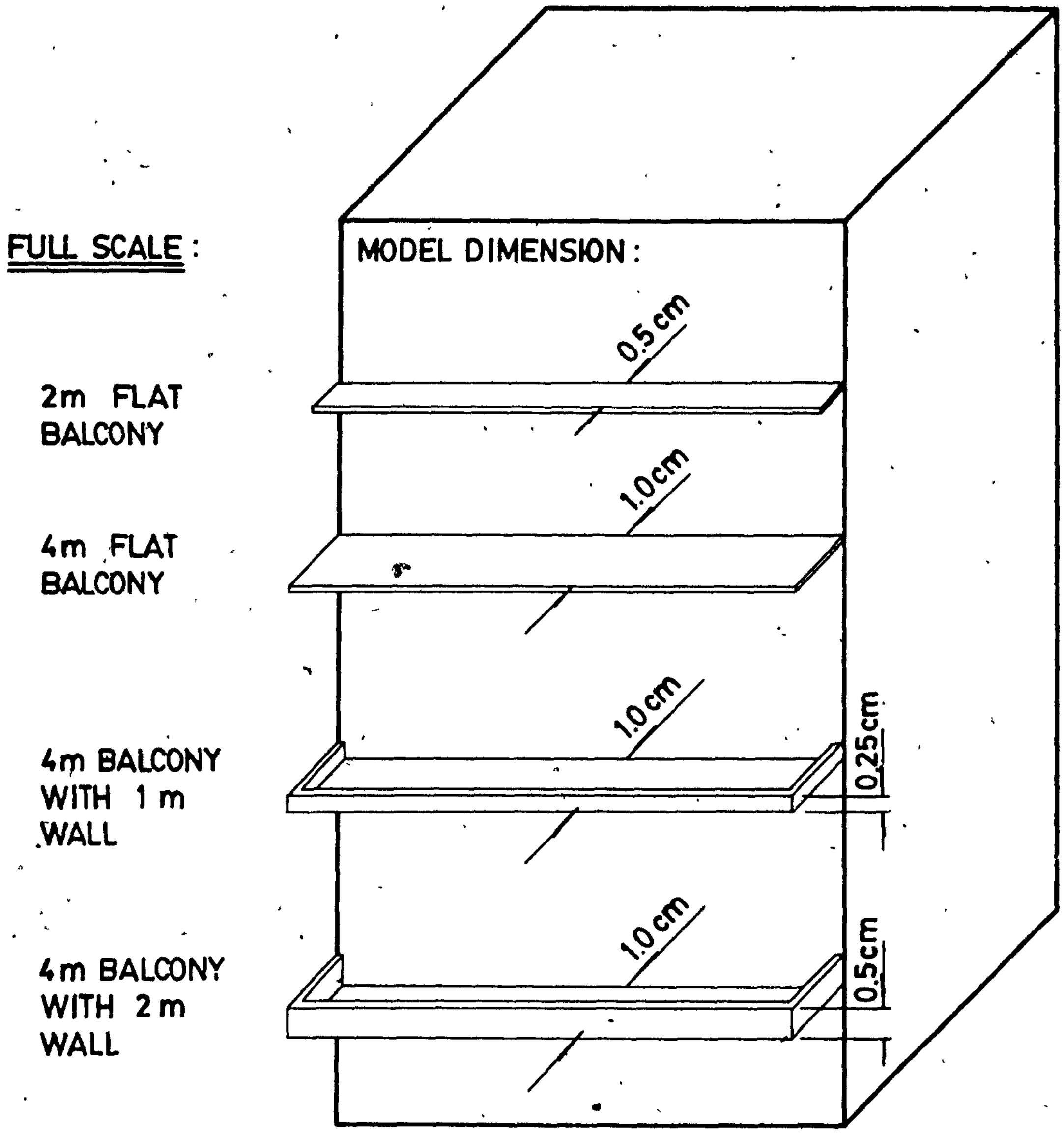


FIG. 4.6 A: TYPES OF BALCONIES TESTED

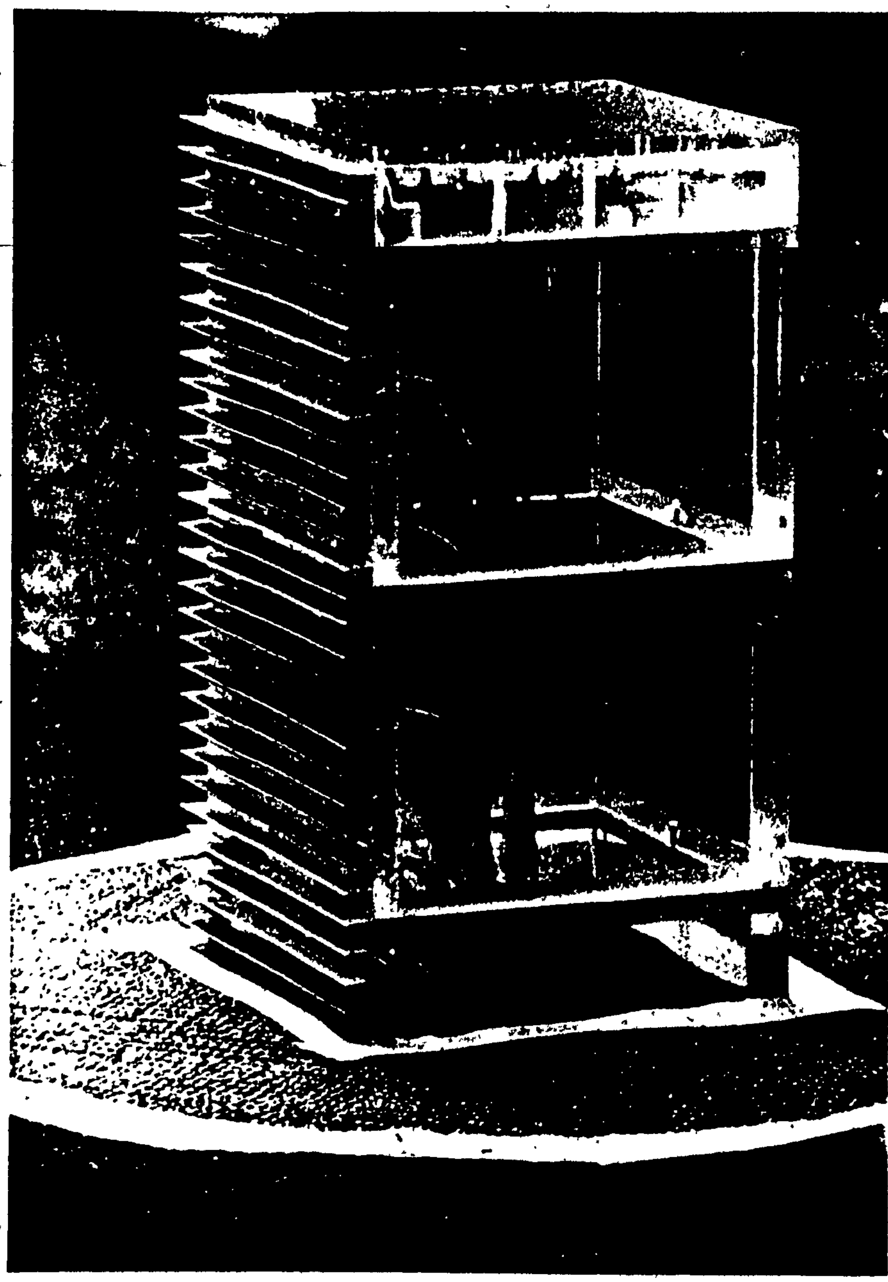


FIG. 4.6 B: TALL BUILDING MODEL WITH 4 m BALCONIES

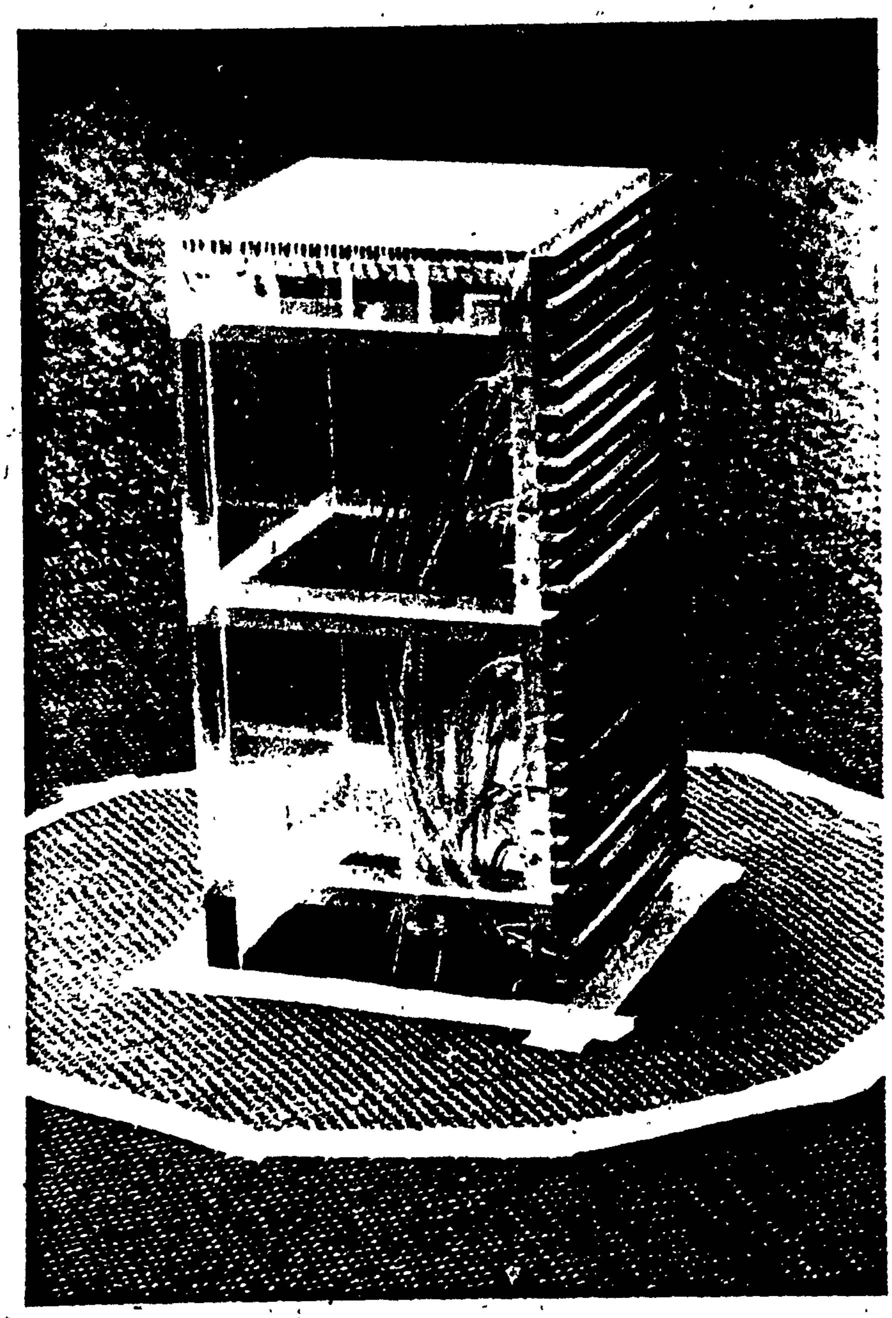


FIG. 4.6 C: TALL BUILDING MODEL WITH 4 m BALCONIES HAVING 2 m WALLS

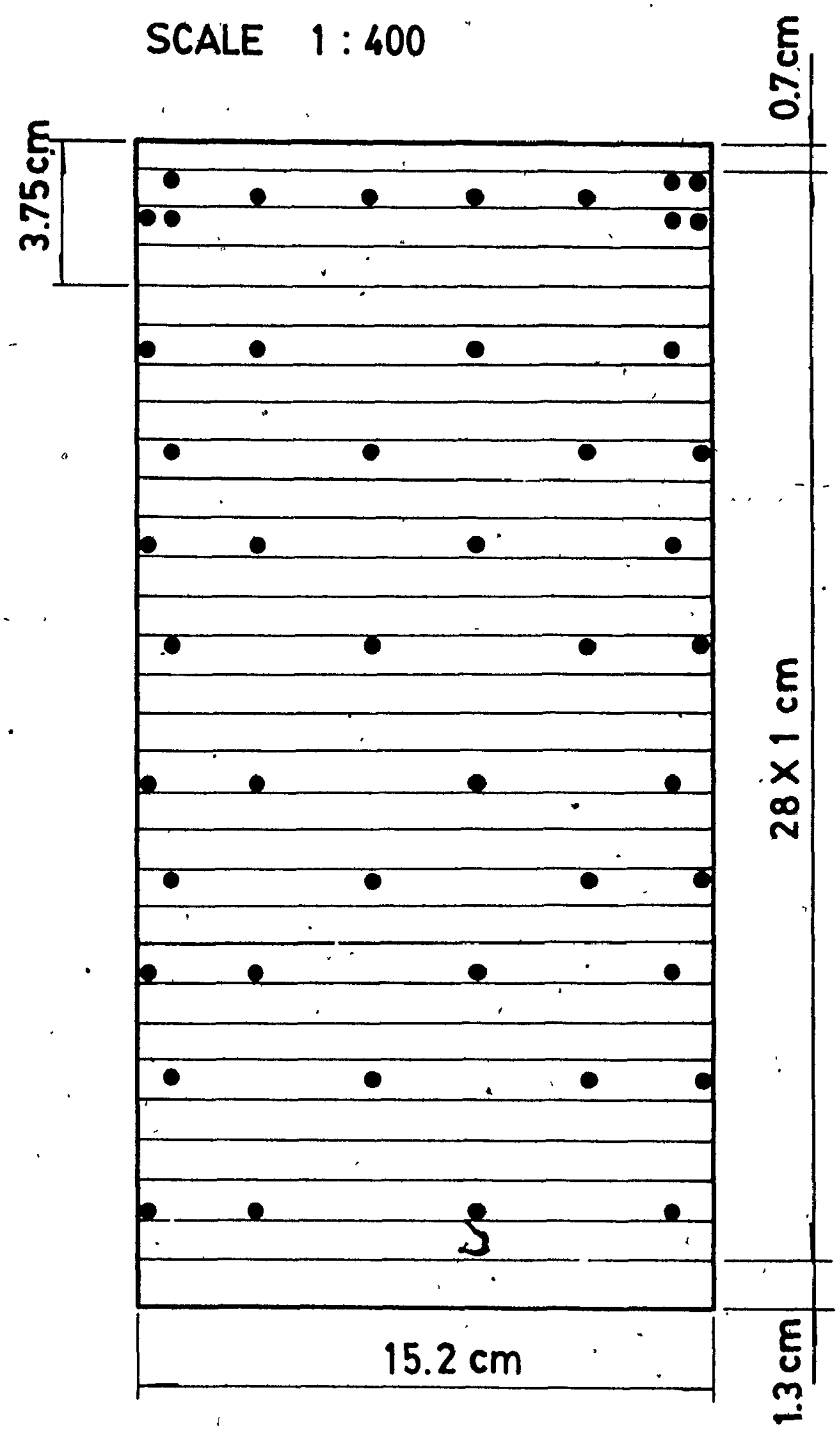


FIG. 4.7 POSITION OF BALCONIES

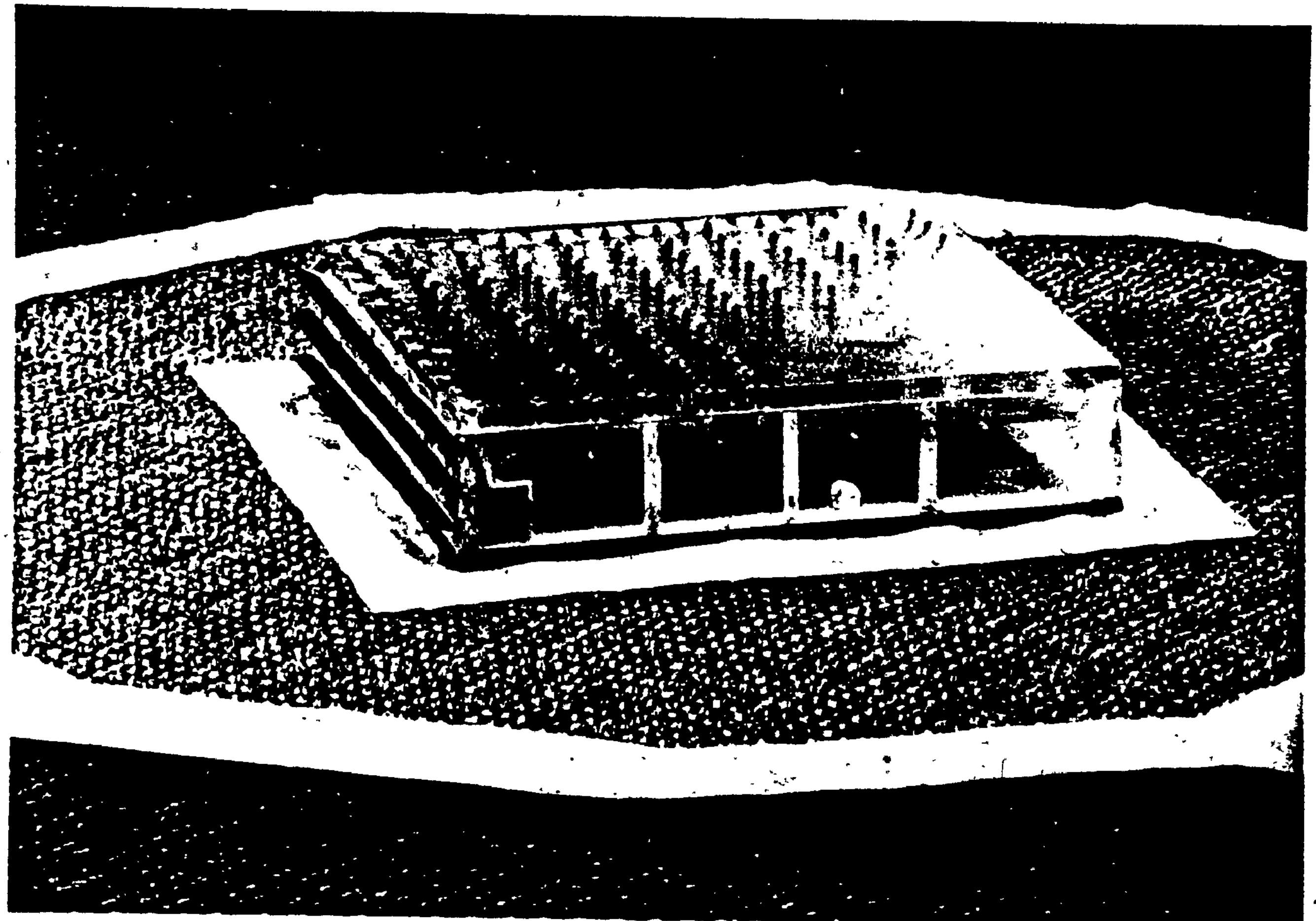


FIG. 4.8 LOW BUILDING (15 m). WITH 4 m BALCONIES

and they extend all over the height of the building, as indicated in Figures 4.9A to 4.9C. Because the mullions at the wall edge area have large influence on pressures, only 4 mullion are simulated in edge are, for the 15 m high building. The mullions are attached on one surface of the model with an interval of 0.5 cm (2m in full scale). The most left and the most right mullion are located 1.4m from each edge. Since interesting effects were found near the edge of the building, different dimensions and geometry as well as different locations for the corner mullions were examined. These different corner mullion arrangements are shown in Figure 4.10.

Firstly, a two times exaggeration in depth for the most left and the most right mullions were considered in order to study the effect of depth of the corner mullion. Secondly, a strip of zinc plate 0.5 cm width was used to cover the first and second mullions at the edge of the building to examine the effect of very wide mullions on pressures. Thirdly, an extra mullion was attached at the corner in order to investigate how the pressures may change.

The dimensions for balconies and especially for mullions employed in this study seem too large to be realistic based on the general geometric scale of 1:400 (2 m and 4 m wide balconies, 1 m and 2 m deep mullions). However, based on the suggestion made by Standen, Dalgliesh and Templin (1971), a different scale for appurtenances (1:120) may be more appropriate under specific conditions

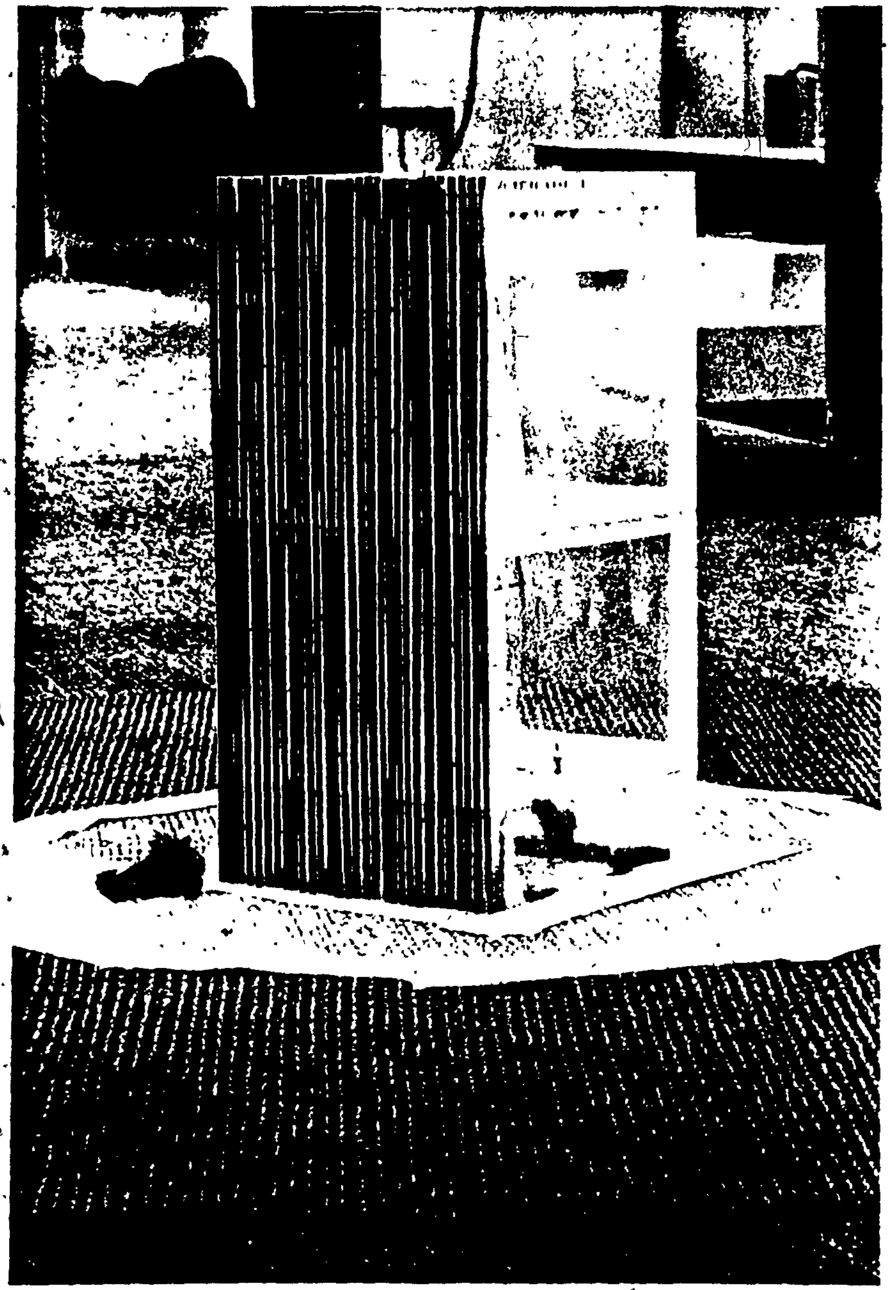


FIG. 4.9 A: TALL BUILDING MODEL WITH 2 m MULLIONS

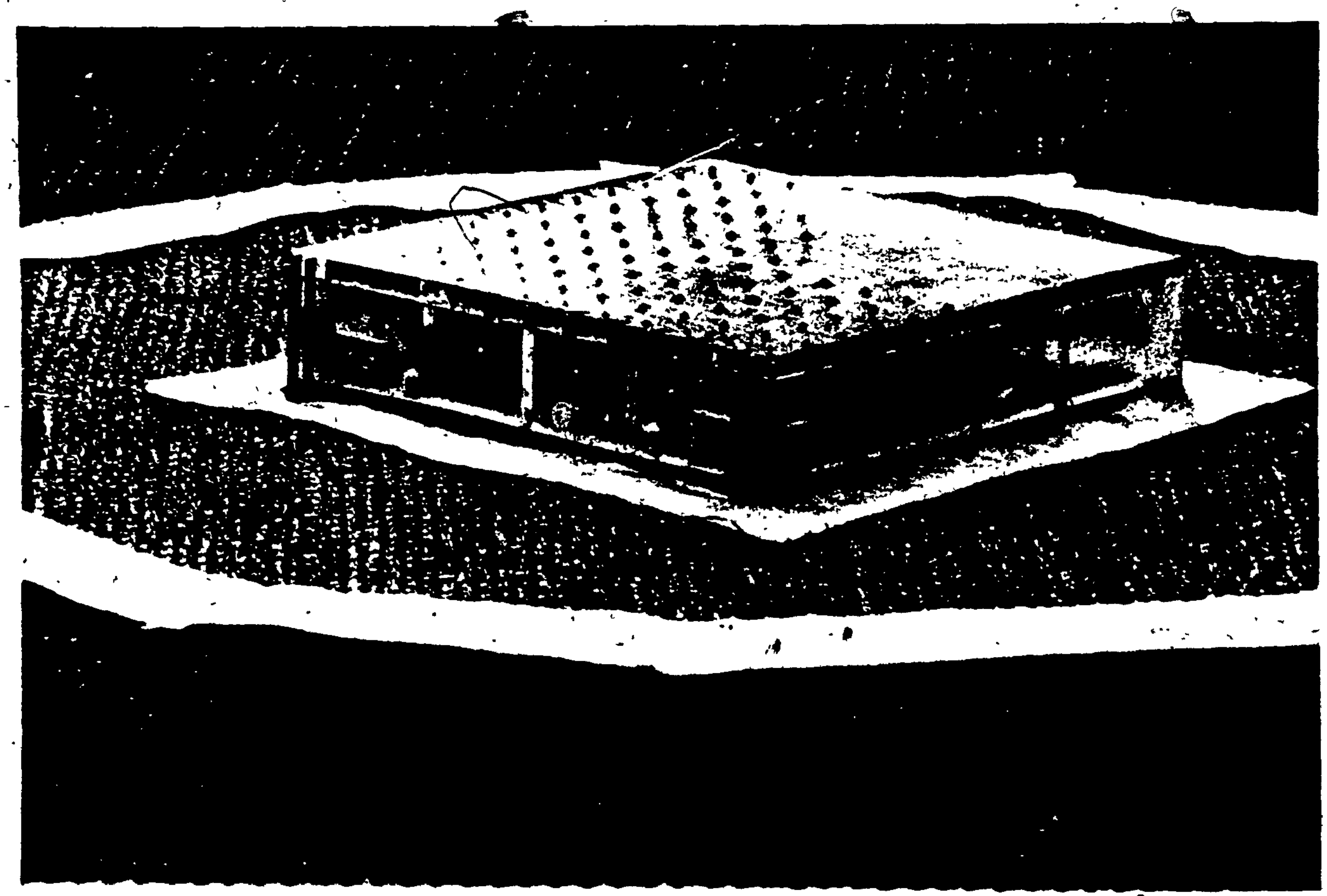


FIG. 4.9 B: THE 15 m MODEL WITH FOUR 1 m MULLIONS

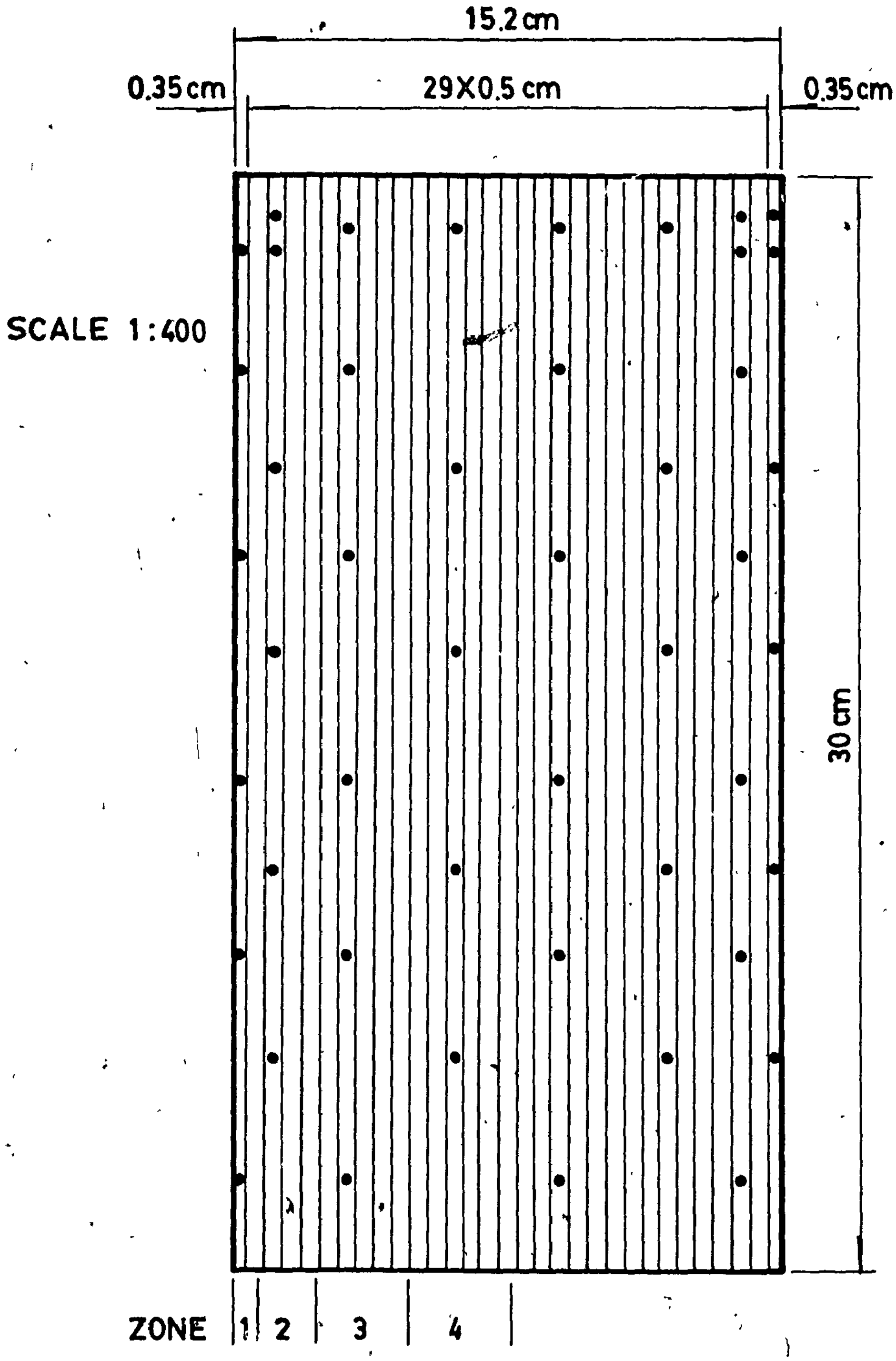


FIG. 4.9 C: POSITION OF MULLIONS

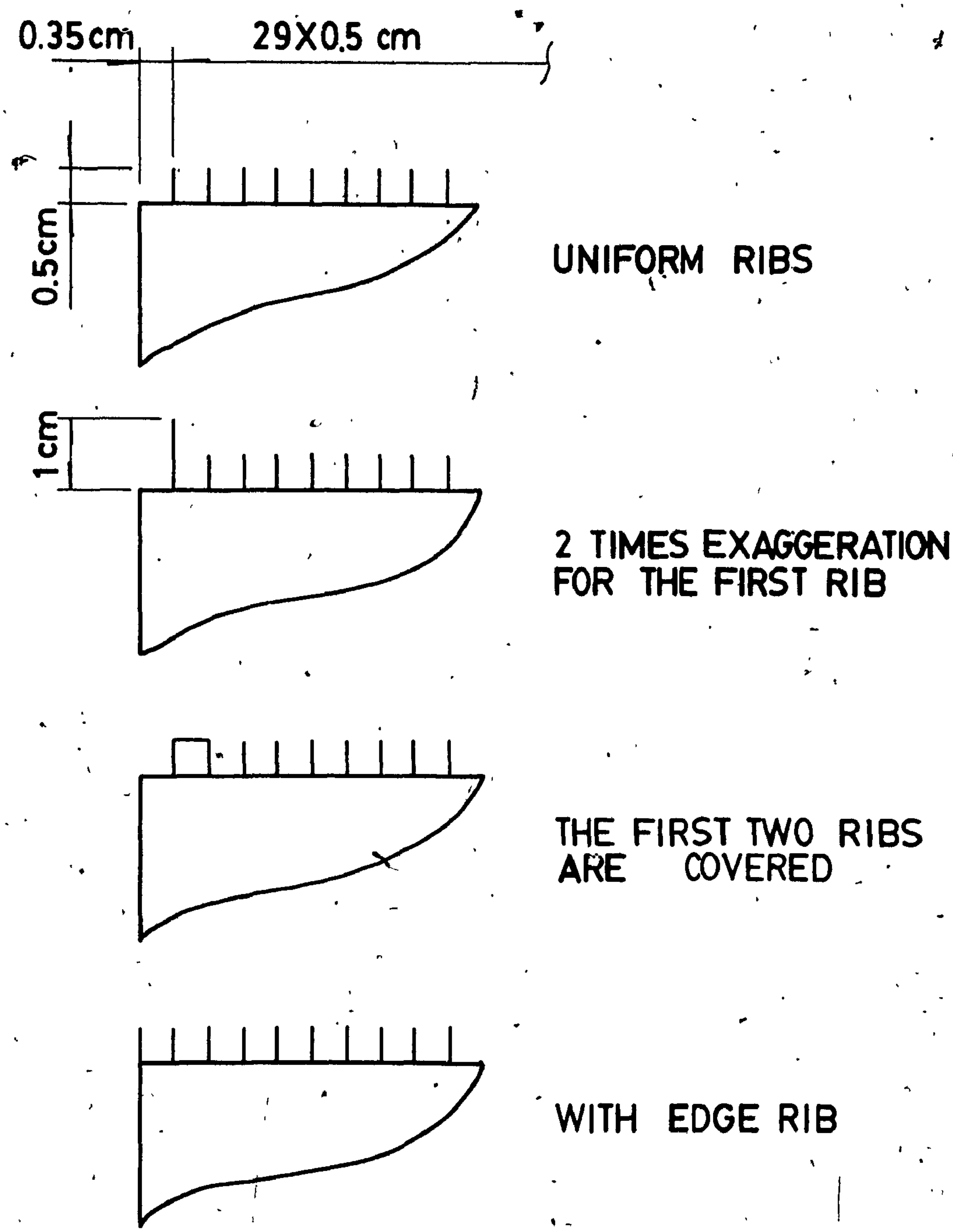


FIG. 4.10 DIFFERENT CORNER MULLION ARRANGEMENTS

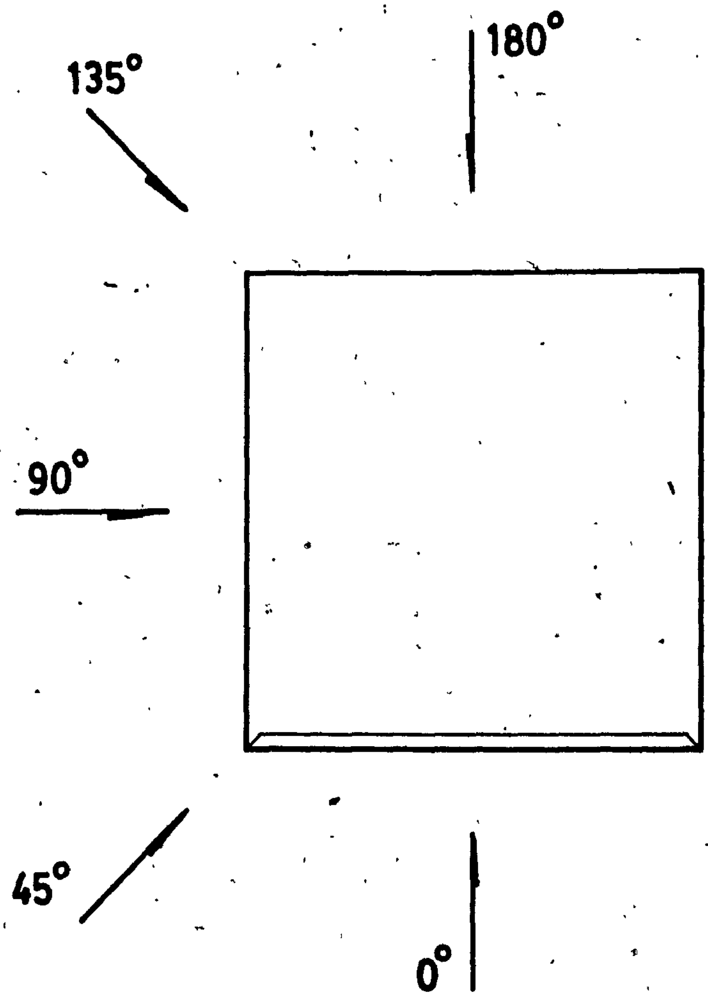


FIG. 4.11 AZIMUTH DEFINITION

BLDG. HEIGHT	EXPOSURE	APPURTENANCE	AZIMUTH												
			0	15	30	45	60	75	90	105	120	135	150	165	180
15M	OPEN COUNTRY	SMOOTH	V	V		V			V	V					V
		2M BALCONY	V	V		V			V	V					V
		30CM ROUGH	V	V		V			V	V					V
		1M RIBS	V	V		V			V	V					V
	URBAN	SMOOTH	V	V		V			V	V					V
		2M BALCONY	V	V		V			V	V					V
		30CM ROUGH	V	V		V			V	V					V
120M	OPEN COUNTRY	SMOOTH	V	V	V	V	V	V	V	V	V	V	V	V	V
		2M BALCONY	V	V	V	V	V	V	V	V	V	V	V	V	V
		4M BALCONY	V	V	V	V	V	V	V	V	V	V	V	V	V
		B.+1M WALL	V	V	V	V	V	V	V	V	V	V	V	V	V
		B.+2M WALL	V	V	V	V	V	V	V	V	V	V	V	V	V
		15CM ROUGH	V	V	V	V	V	V	V	V	V	V	V	V	V
		30CM ROUGH	V	V		V			V	V					V
		2M RIBS	V	V	V	V	V	V	V	V	V	V	V	V	V
		CORNER RIBS	V	V	V	V	V	V	V	V	V	V	V	V	V
	URBAN	SMOOTH	V	V	V	V	V	V	V	V	V	V	V	V	V
		30CM ROUGH	V	V	V	V	V	V	V	V	V	V	V	V	V
		2M RIBS	V	V	V	V	V	V	V	V	V	V	V	V	V

B.+1M WALL = BALCONIES WITH 1M WALLS

TABLE 4.1 AZIMUTHS TESTED FOR DIFFERENT APPURTENANCES (see Chapter 2). By using this scale, 0.50 cm and 1.00 cm wide balconies in model dimension imply 0.60 m and 1.20 m wide balconies respectively in full scale. Also, 0.25 cm and 0.50 cm deep mullions imply 0.30 m and 0.60 m deep mullions respectively in full scale. This should be borne in mind when the results of various configurations are reviewed and discussed in Chapter 5.

4.3 The Azimuths and the Exposures

For the purpose of investigating the pressure changes under different wind directions, azimuth is defined as the angle between the normal to the front surface of the model and the upstream wind direction in the wind tunnel, as indicated in Figure 4.11. Because of symmetry, only azimuths ranging from 0° to 180° have been examined in this study. The azimuths tested for different appurtenances are shown in Table 4.1.

Tests were carried out for two different terrain exposures: the open country exposure, simulated by a rough carpet and the urban exposure, simulated by a staggered arrangement of eggboxes stapled on panels placed on the floor of the wind tunnel. Figures 4.12A and 4.12B illustrate the two exposures used in the wind tunnel. The mean wind speed and turbulence intensity profiles are shown in Figure 3.4.

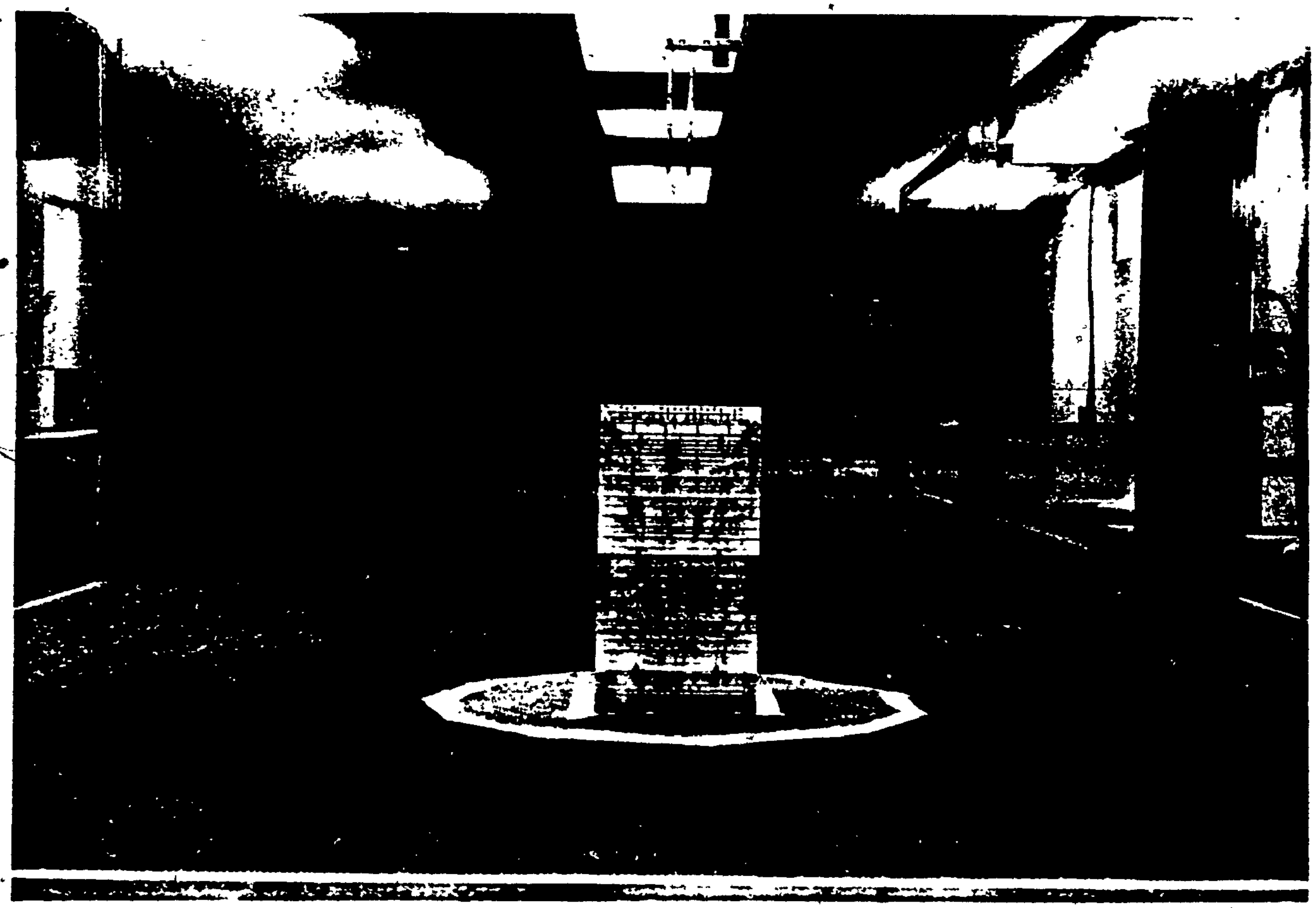


FIG. 4.12 A: THE OPEN COUNTRY SIMULATED TERRAIN EXPOSURE

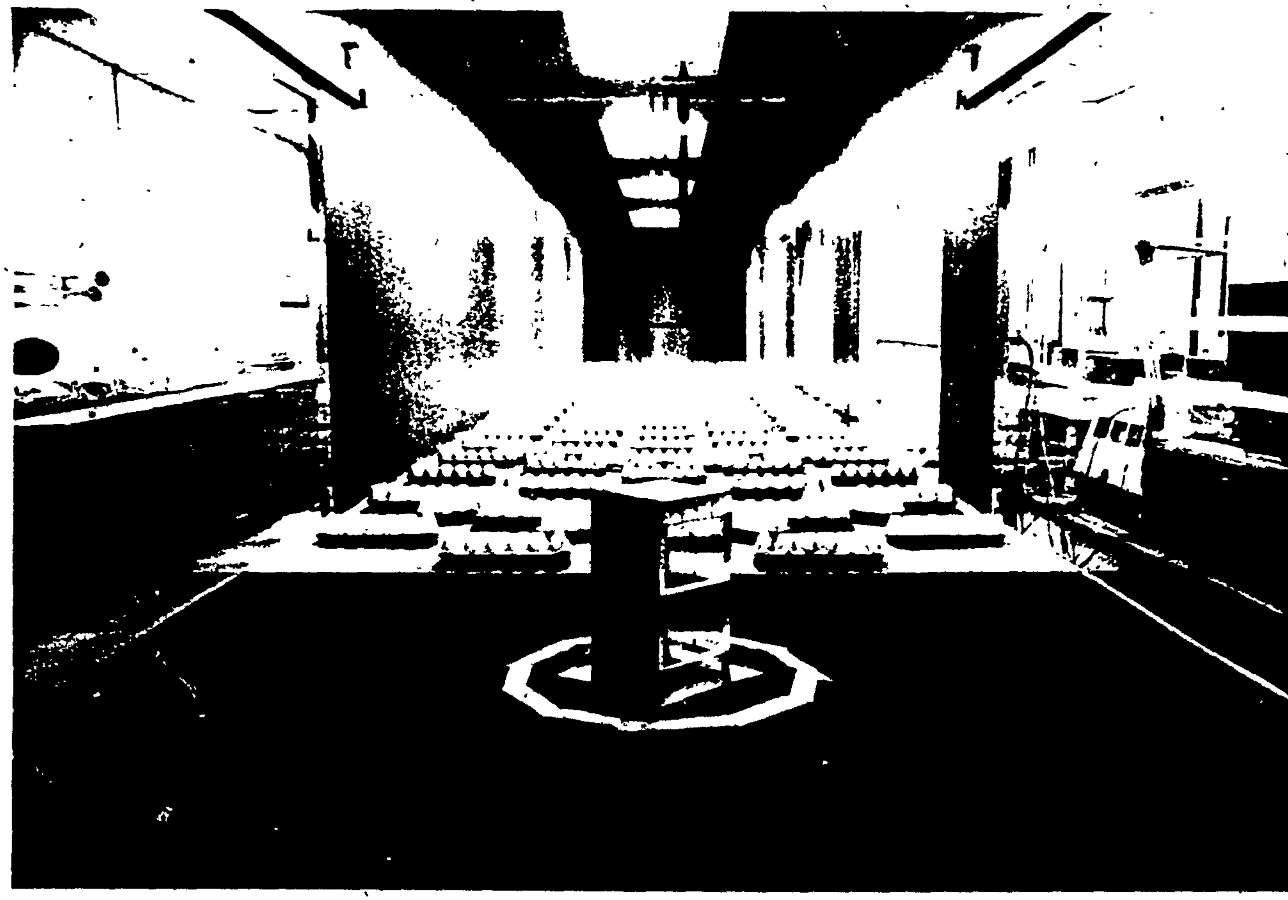


FIG. 4.12 B: THE URBAN SIMULATED TERRAIN EXPOSURE

The parameters of the two different exposures are shown in Table 3.1.

4.4 Pressure Measurements

Measurements of the surface pressures on the model were reduced to non-dimensional pressure coefficients, by referencing them to the mean dynamic velocity pressure at either gradient or roof height. The data records were collected from the pressure taps at a sample rate of 50 samples/sec for a sampling period of 30 seconds, i.e. a total of 1500 individual values. Then, the peak instantaneous maximum, and peak instantaneous minimum values measured were recorded and the mean and rms values were computed. These statistics were converted into pressure coefficients defined as follows:

$$Cp\ mean = \overline{P} / q$$

$$Cp\ rms = \sqrt{\frac{1}{n} \sum_{i=1}^{n} (Pi - \overline{P})^2} / q$$

$$Cp\ max = Pmax / q$$

$$Cp\ min = Pmin / q$$

where: $q = 0.5 * \rho_a * \overline{V}^2$ = the dynamic velocity pressure at reference height

n = the number of samples

P_i = each individual sampled pressure

$\overline{V}$ = the reference mean velocity

The reference mean velocity was measured at the gradient height of the boundary layer. In order to obtain pressure coefficients based on the dynamic velocity pressure at roof height, appropriate height factors should be utilized. These are indicated in Table 4.2 for the two different building heights and exposures tested in the present study. The following equation was used for the derivation of the height factors:

$$P = Cp_H * 0.5 * \rho_a * \overline{V}_H^2 = Cp_G * 0.5 * \rho_a * \overline{V}_G^2$$

$$Cp_H = (q_G / q_H) * Cp_G$$

EXPOSURE	BUILDING HEIGHT m	HEIGHT FACTOR q_G / q_H
OPEN COUNTRY	15	2.24
	120	1.20
URBAN	15	9.81
	120	2.11

TABLE 4.2 HEIGHT FACTORS FOR CHANGING REFERENCE VELOCITY

4.5 Repeatability of Test Results

Due to small measurement errors of the test system (temperature effects etc.) and the random nature of the measured data, two tests for the same model and the same nominal exposure configuration may produce somewhat different results. Estimating the magnitude of the errors involved is of significance to researcher.

Figure 4.13 shows results of Cp mean and Cp rms measured on the same nominal building configuration during two sets of tests conducted 7 months apart and 3 days apart respectively. The maximum error on Cp mean and Cp rms is less than 15% and 10% for the tests conducted 7 months apart, and is less than 5% respectively for those conducted 3 days apart.

However, it should be mentioned that since most tests of this study were done within a period of a few days or consecutive weeks, it is reasonable to believe that repeatability errors indicated by the tests conducted 3 days apart are more likely to be involved in this study.

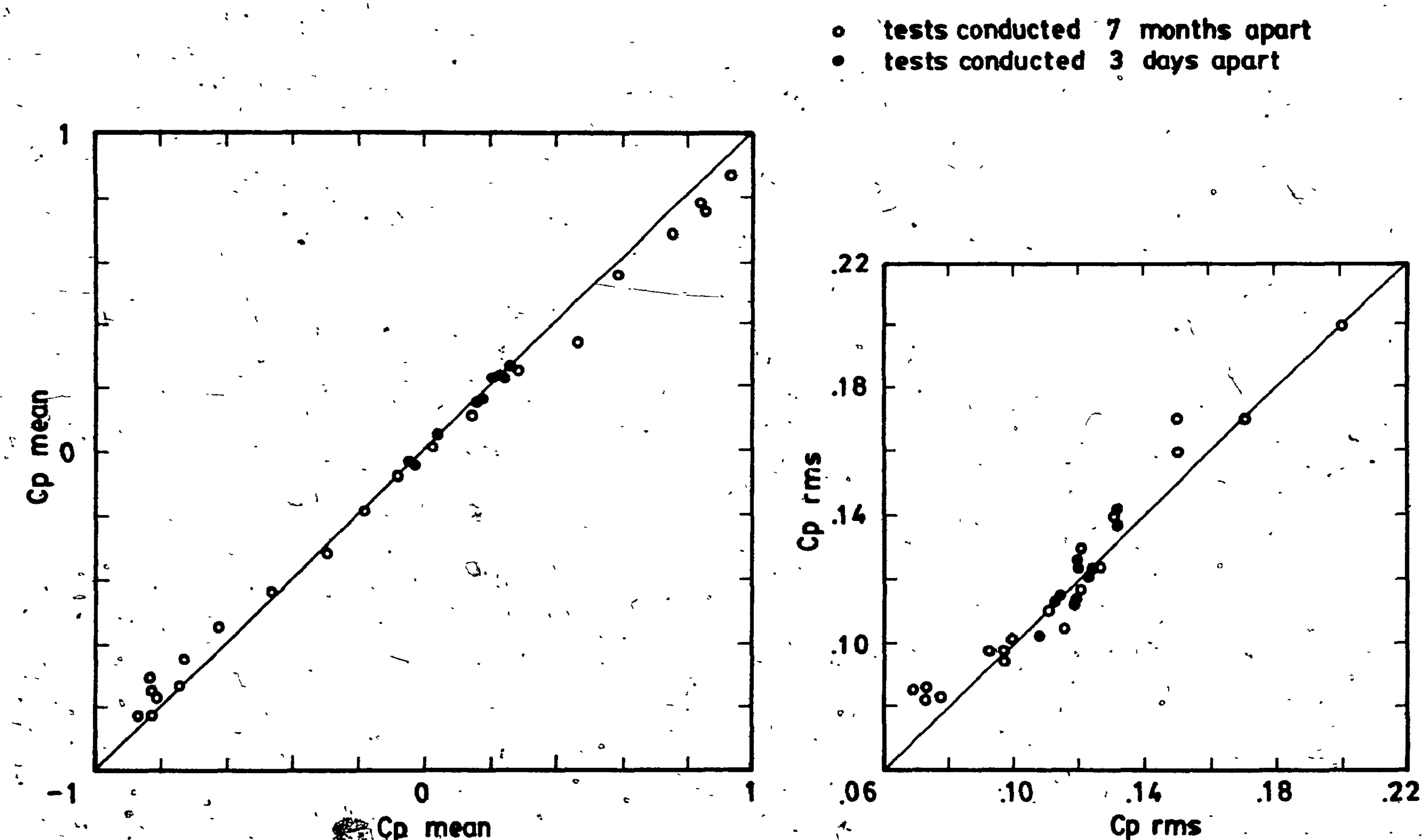


FIG. 4.13 REPEATABILITY TESTS

CHAPTER 5. RESULTS AND DISCUSSION

In this chapter, the results of the experimental study comparing the wind pressures on smooth and rough wall surface cases are presented according to the type of the appurtenances. First wind pressures on smooth wall surfaces are presented and discussed, whereas, the effects of uniform roughness are discussed in section 5.2, including the fine and rough sandpaper simulations. The effects of balconies of different geometries are discussed in section 5.3, including 2 m and 4 m width balconies and 4 m width balconies with 1 m and 2 m walls. The effects of mullions are discussed in section 5.4, including 2 m uniformly distributed mullions and mullions with different geometries at the edges of the building. The effects of appurtenances on a low rise building including 4 m balconies and rough sandpaper simulation as well as the effects of 1 m mullions are described in section 5.5. Finally, the effects of appurtenances on buildings in urban exposure and the calculation of drag forces on buildings with appurtenances are included in sections 5.6 and 5.7 respectively.

The knowledge of frequency content of surface pressure fluctuations is of great help in determining their origin. Power spectral density plots [fS(f)] have been made for some taps on which significant pressure differences between smooth and rough surfaces were observed for open country flow conditions. In addition, traces of pressure fluctuations for those significant taps corresponding to each spectrum curve are presented following each spectrum. The character of pressure fluctuations can be easily seen from those traces.

Although data were obtained for 13 wind azimuths for most cases tested, only significant or typical cases have been presented in this chapter, in order to illustrate the phenomena involved. All of the data for the tall building (120 m high) except the cases of mullions with different corner geometries are presented as azimuthal plots of average and discrete values based on appropriate zone divisions in the Appendix.

5.1 Wind Pressures on Buildings with Smooth Walls

Before making any tests with appurtenances, the building model was tested with a smooth surface.

Figures 5.1 to 5.3 show the contour plots of Cp mean, Cp rms, Cp peak respectively for the 120 m-high building at 0^o, 45^o, 90^o, 135^o and 180^o azimuths for both smooth and uniform roughness surfaces. For the case of smooth surface at 0^o azimuth in Figure 5.1 the facade of the building faces the oncoming wind and, therefore, the pressures are distributed symmetrically. The stagnation point, at which

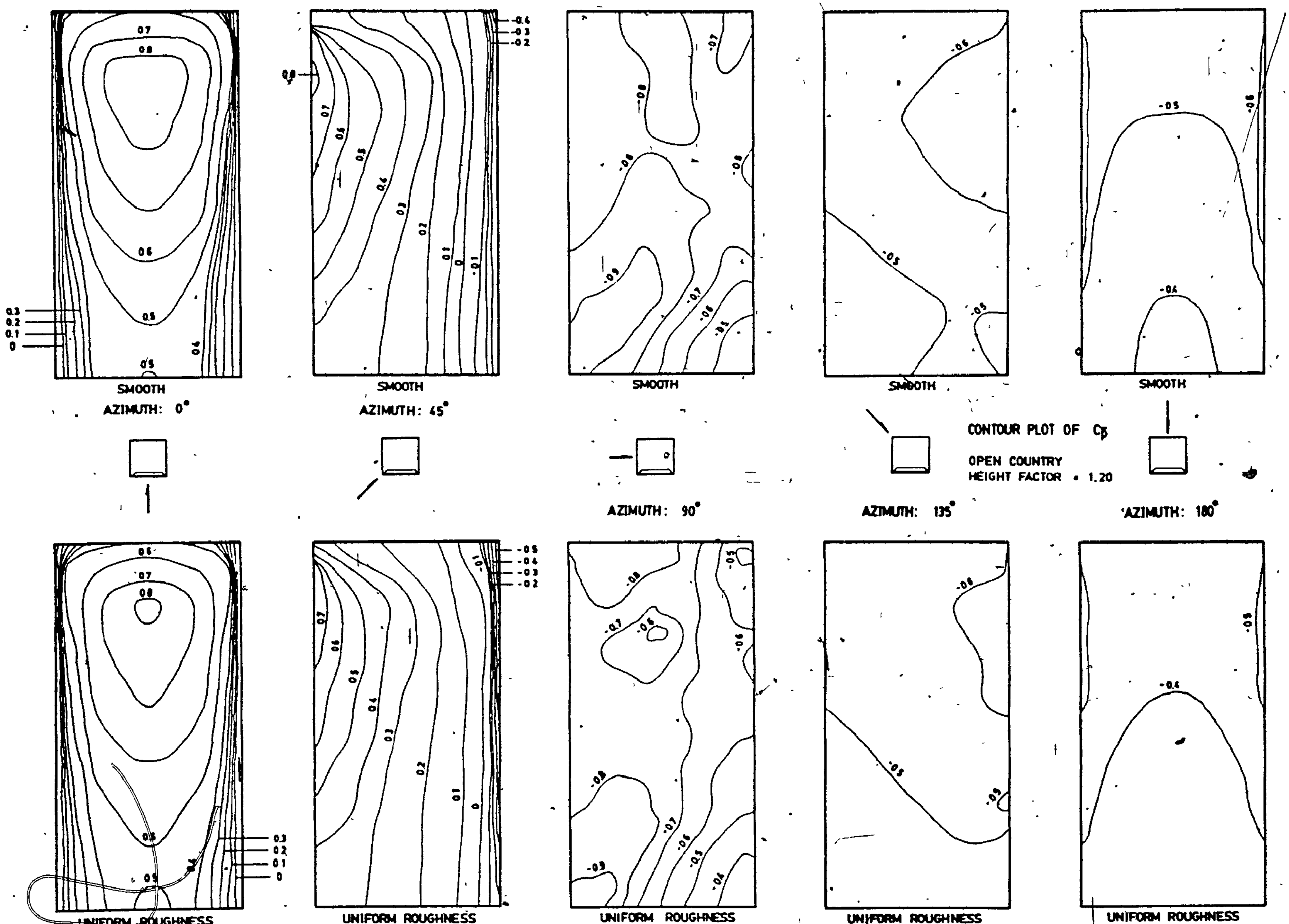


FIG. 5.1 CONTOURS OF Cp MEAN FOR BUILDINGS WITH SMOOTH AND ROUGH WALLS (15 cm ROUGHNESS)-H=120 m, OPEN COUNTRY EXPOSURE

the mean pressure obtains its maximum value, is located at approximately the top 1/5 of the building height and has a Cp mean of +0.8. The coefficients shown are pressures normalized by the reference dynamic pressure at gradient height. If the velocity pressure at the roof height is chosen as reference pressure, a height factor of 1.2 should be used, yielding a Cp mean of +0.96 for the stagnation point. Table 4.1 provides information about height factors for different building heights. At the 90° azimuth all Cp mean values become negative and a Cp mean of -0.9 was observed near the edge at the bottom part of the wall right after separation. This is due to eddies developed after the flow separation line. At the 135° azimuth the Cp mean distribution is quite uniform with a value of -0.5 observed in most of the wall area. At 180° the Cp mean is distributed symmetrically and with values showing suction of a small magnitude. In 0° and 45° azimuths the wall surface is facing the coming wind, thus positive Cp mean values are observed and the greatest value, +0.8, occurred at the top 1/5 of the building height. At 135° and 180° azimuths the surface was placed within the wake of the flow, thus negative Cp mean values were observed, however their magnitude was less than 0.6. The 90° azimuth is a critical azimuth at which the highest suction -0.9 occurred in bottom part of the building near the edge. This is due to the eddies developed after the separation of the flow.

Figure 5.2 shows the contours of Cp rms for buildings

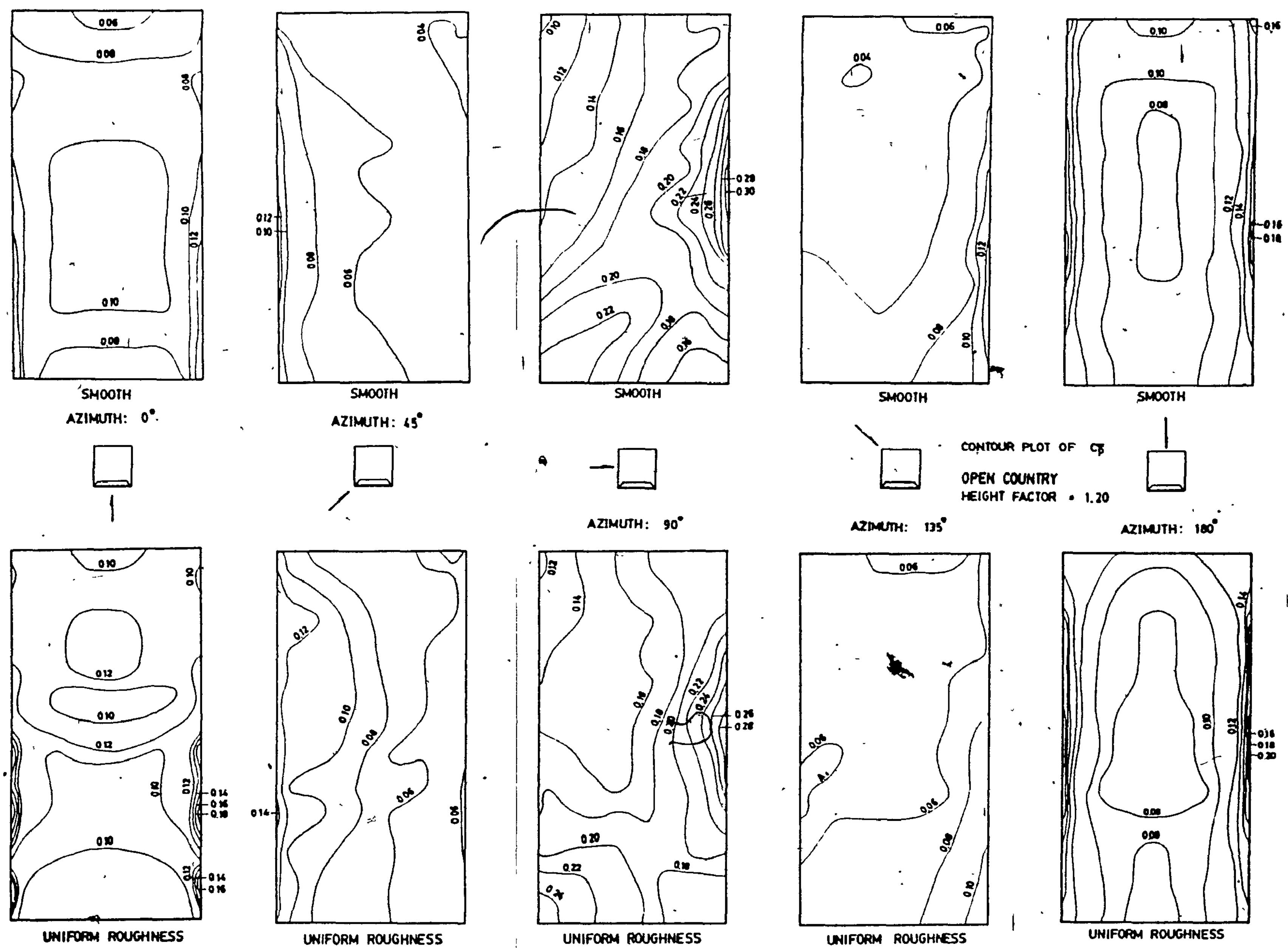


FIG. 5.2 CONTOURS OF Cp RMS FOR BUILDINGS WITH SMOOTH AND ROUGH WALLS (15 cm ROUGHNESS)-H=120 m, OPEN COUNTRY EXPOSURE

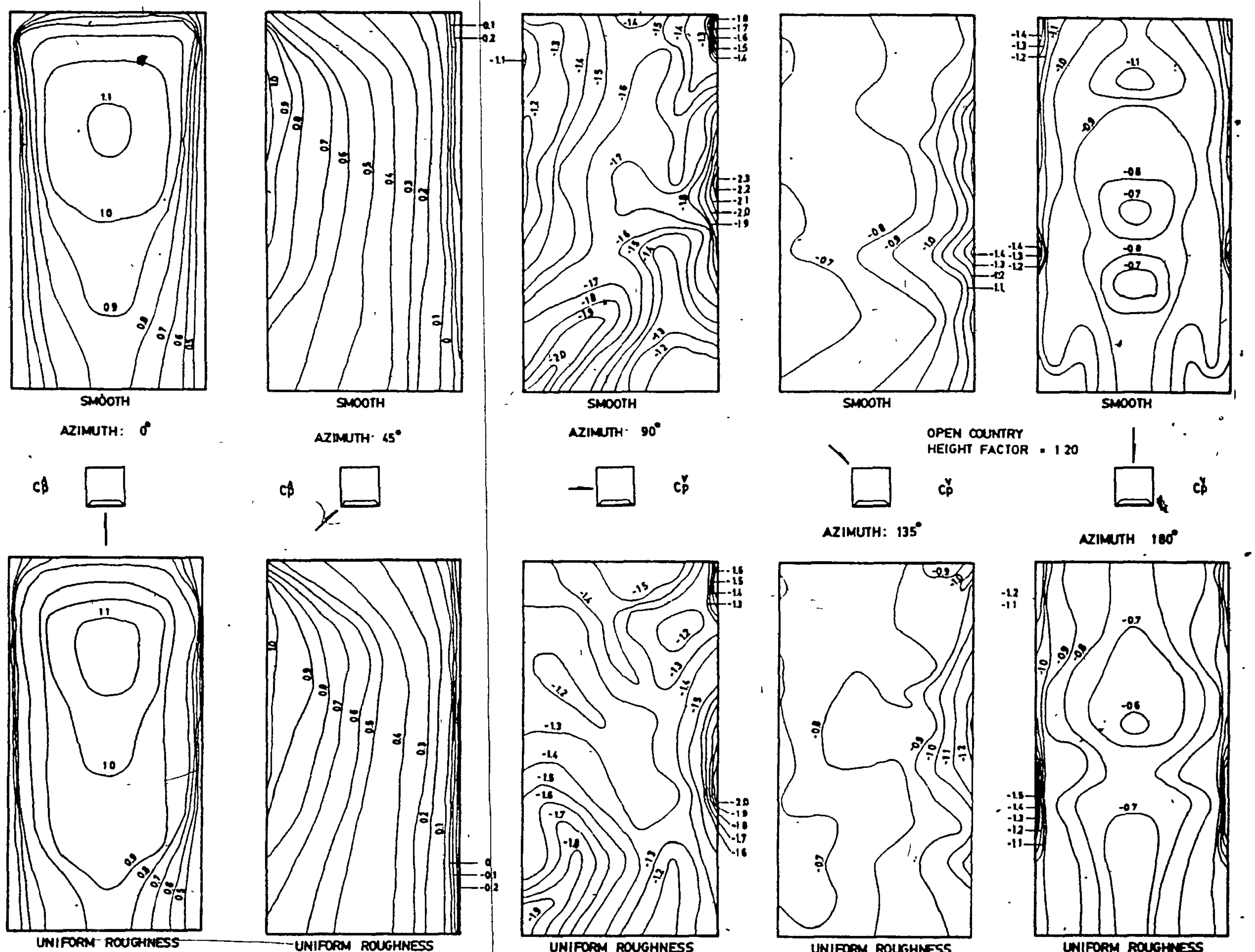


FIG. 5.3 CONTOURS OF Cp MIN FOR BUILDINGS WITH SMOOTH AND ROUGH WALLS (15 cm ROUGHNESS)-H=120 m, OPEN COUNTRY EXPOSURE

with smooth walls. It can be seen that high Cp rms value, up to 0.30, occur at 90^{o} azimuth. This is because the side wall is located after the flow separation and eddies in the flow make the pressure fluctuate in an intensive manner. Figure 5.3 shows the contours of Cp peaks for buildings with smooth walls. At 0^{o} azimuth, the Cp man value at the stagnation point is 1.1, indicating a gust factor of about 1.4. For 90^{o} azimuth, at the lower part of the building near the windward edge area, Cp min is -2.0, yielding a gust factor of about 2.3. This indicates that the distribution of pressure fluctuations may be different from place to place and from one azimuth to another.

In order to verify the experimental results of this study, comparison of mean pressure coefficients along the central vertical line of the wall was made between the values of this study and those of Corke and Nagib (1979), as indicated in Figure 5.4. The model used by Corke and Nagib represented a square section building with dimensions of 50*50*100 m high. It can be seen that the results from this study generally agree with those from the test by Corke and Nagib and the difference existed is due to the different wind profile exponents used in this study (0.15) and those used by Corke and Nagib (0.11 and 0.23), as indicated in the figure.

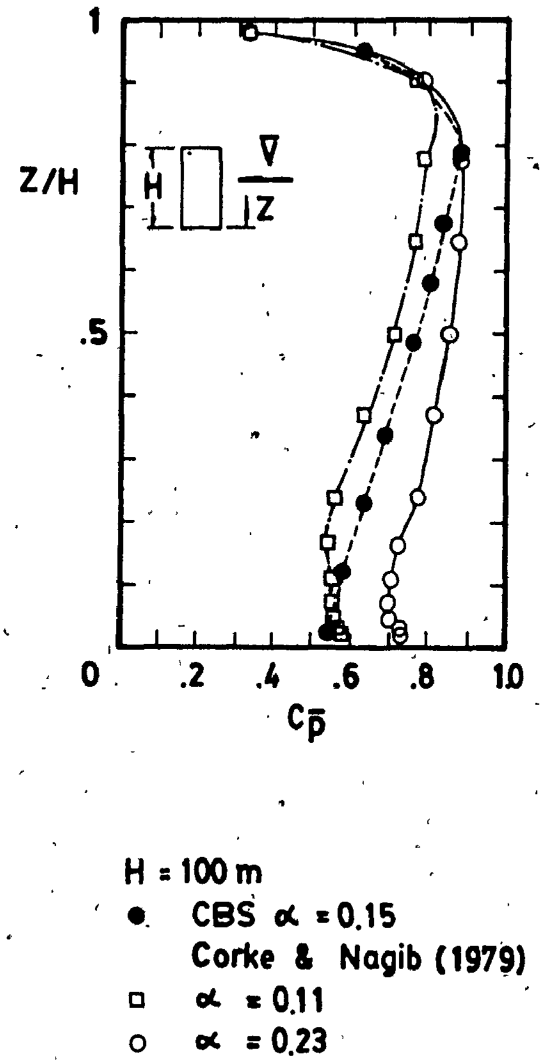


FIG. 5.4 COMPARISON OF Cp MEAN OBTAINED IN THE PRESENT STUDY AND THOSE OF CORKE AND NAGIB (1979)

5.2 The Effect of Uniform Roughness

Uniform roughness with maximum thickness of 15 cm and 30 cm were simulated by '80 GAR' (fine) and '40 ALO' (rough) two kinds of sandpapers with model thickness of 0.038 cm and 0.075 cm respectively.

In the case of fine sandpaper simulation, pressures of the whole front surface of the model (47 taps) were measured for 13 wind azimuths, i.e. from 0° to 180° with an interval of 15°, in order to investigate the effect of uniform roughness under different wind directions.

In the case of rough sandpaper simulation, pressures on some taps which have been mostly affected in the case of fine uniform roughness, were measured in order to determine the effect of the roughness size on the wind-induced loading.

5.2.1 The Effect of 15 cm Uniform Roughness

The small uniform roughness (15 cm) has shown a small decrease in Cp mean and Cp min (suction decreases) for azimuths 90° to 180° (roughness on side or leeward wall). For 0° and 45° azimuths, a small decrease was also shown in Cp mean, however, there was almost no difference for Cp max. One exception is the edge, in which small suctions slightly increase at 0^{o} azimuths.

Two different kinds of diagrams have been plotted comparing the pressure coefficients measured on building surfaces with and without uniform roughness. Contour plots show the general pressure changes for the entire building surface and pressure coefficient comparison curves show the variation of Cp mean, Cp rms and Cp peak for a particular vertical zone of the building wall for specific azimuth.

Figure 5.1 illustrates the comparison of Cp mean between the cases of 15 cm uniform roughness and smooth wall surface. As it can be seen, Cp mean values slightly decrease in most areas of the rough wall for all wind directions. At the stagnation area the pressure decreases for 0^{o} azimuth by 13% (from 0.8 to 0.7) when the uniform roughness panel is attached on the building surface. A similar trend (decrease in positive and negative pressures) can be seen for the other azimuths except at the edges of the building, where mean suctions somewhat increase.

The uniform roughness also shows a small increase in Cp rms values and this effect is more pronounced for 0^{o} and 45^{o} azimuth, as Figure 5.2 indicates. This might be due to the fact that the roughness affects the flow along the surface after the oncoming wind flow is split and during its movement along the surface.

Figure 5.3 shows the contour plots of Cp peak, namely Cp max for 0^{o} and 45^{o} and Cp min for the other azimuths.

For 0^{o} and 45^{o} azimuth, Cp max slightly increases with the roughness of the surface. However, a general decrease in Cp min can be observed at 90^{o}, 135^{o} and 180^{o} azimuths and this agrees with the behavior of Cp mean. This phenomenon might be explained as the existence of the uniform roughness increases the flow turbulence in the shear layer and the original flow pattern is modified. As a result, the magnitude of peak suction is reduced.

Figures 5.5 and 5.6 illustrate the comparison of Cp mean, Cp rms and Cp peak for the cases of uniform roughness and the smooth surface for a central vertical zone and an edge zone respectively. For the central zone, it is interesting to note that for 0^{o} azimuth, the uniform roughness slightly decreases Cp mean whereas for 90^{o} azimuth, this happens at the lower part of the building.

Figure 5.6 shows the effect of uniform roughness in zone 1 (edge). As can be seen, both mean and peak instantaneous suctions increase for 0^{o} azimuth. There is no major effect on zone 1 for other azimuths.

From the previous discussion, it can be concluded that uniform roughness makes both positive (windward azimuth) and negative (leeward azimuth) pressures decrease in most areas of the building surface except the edge region of the windward wall which experiences higher suction for higher roughness. Therefore, uniform roughness provides most areas of building cladding with a kind of protection from

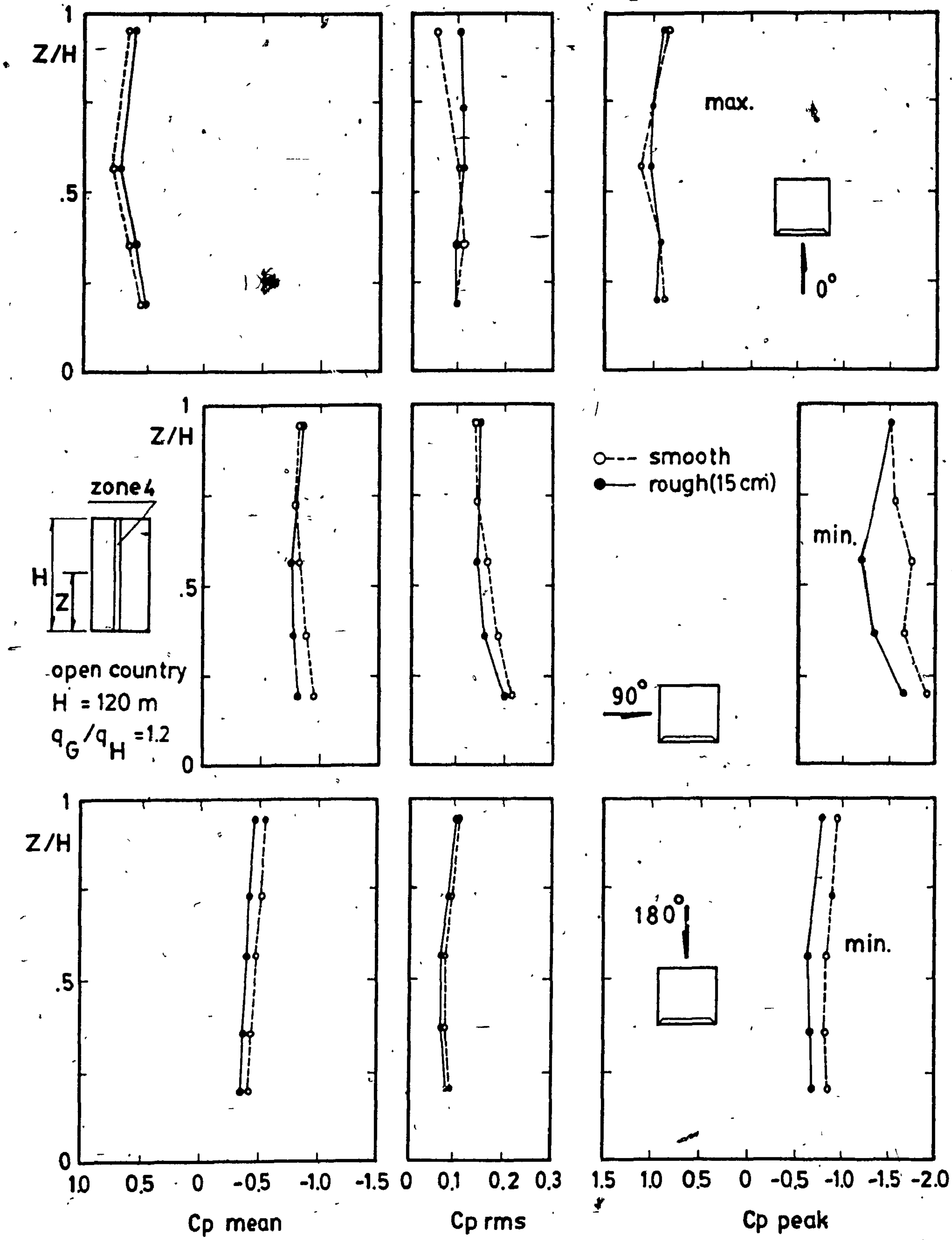


FIG. 5.5 EFFECTS OF 15 cm UNIFORM ROUGHNESS ON PRESSURE COEFFICIENTS MEASURED ON ZONE 4

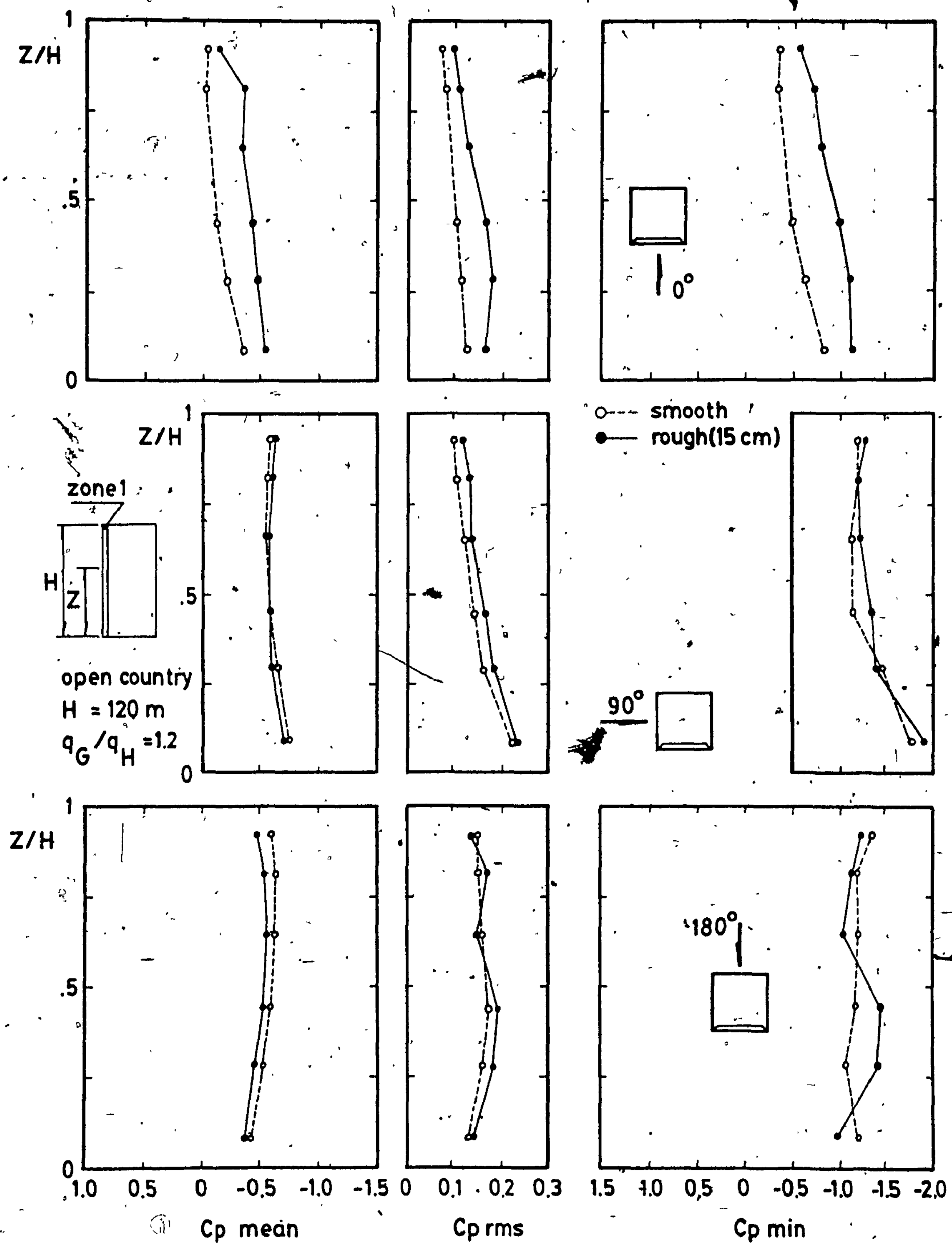


FIG. 5.6 EFFECTS OF 15 cm UNIFORM ROUGHNESS ON PRESSURE COEFFICIENTS MEASURED ON ZONE 1

wind.

5.2.2 The Effect of 30 cm Uniform Roughness

As discussed in section 5.2.1, the 15 cm uniform roughness simulated by fine sandpaper had a very small effect on wind pressures. It is interesting to investigate the effect of the thickness of the uniform roughness on the wind-induced pressures/suctions on the cladding elements of the building envelope. Therefore, a panel simulating uniform roughness of 30 cm full scale was placed on the wall of the building model to investigate its effect on wind-induced pressures.

Figure 5.7 shows the comparison of Cp mean, Cp rms and Cp min for smooth surface and different sandpaper simulations on 4 taps at level 4 (H=98 m). Figure 5.8 shows the comparison of Cp mean, Cp rms and Cp min versus azimuth between fine and rough sandpaper simulation on tap 32, which is located at the upper part of the building wall surface. As can be seen, a small effect is caused by the rough sandpaper simulation in all cases.

Therefore, uniform roughness does not appear to be a very important factor affecting the wind pressures on building cladding. It generally reduces Cp mean and Cp min by a small amount.

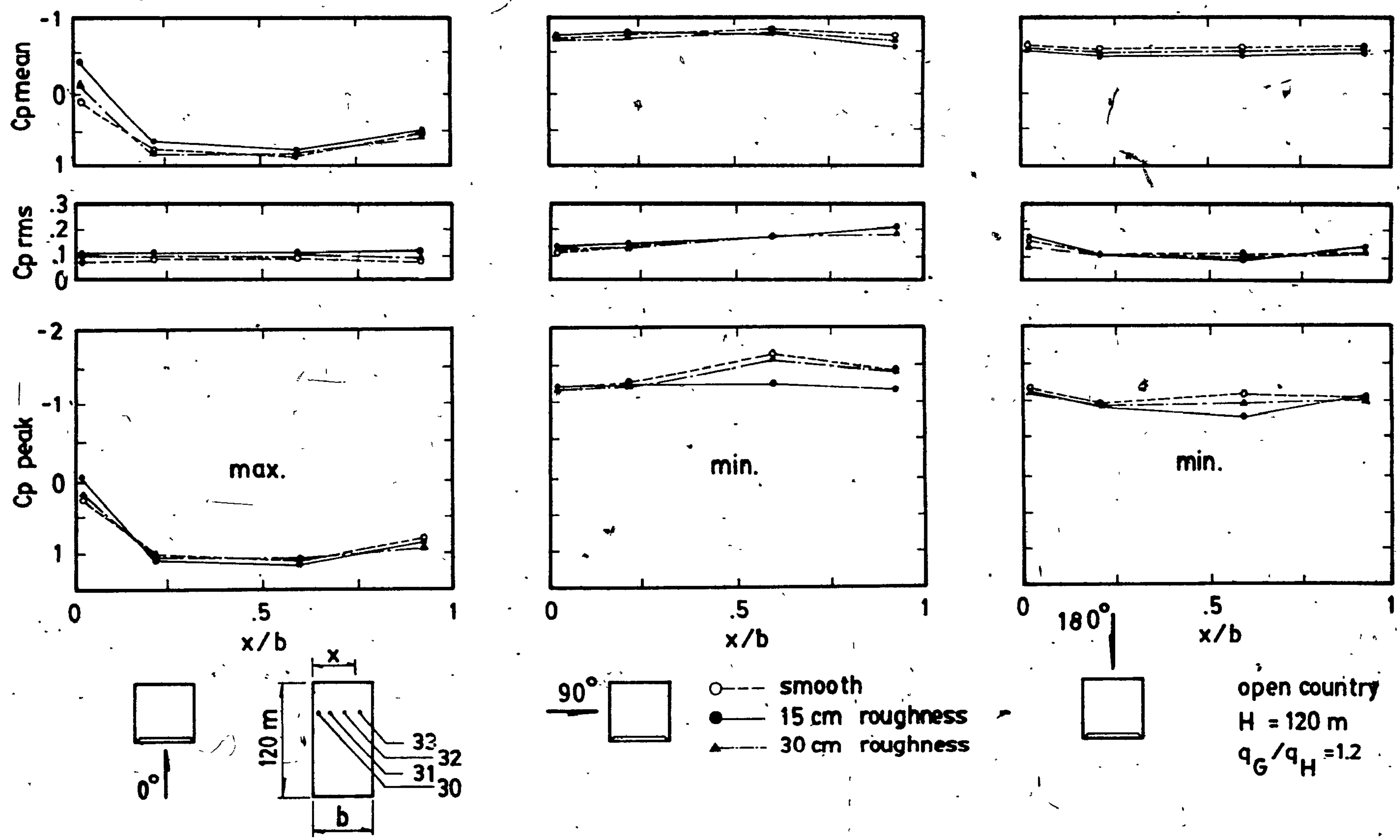


FIG. 5.7 PRESSURE COEFFICIENTS ON SMOOTH AND ROUGH WALL SURFACES

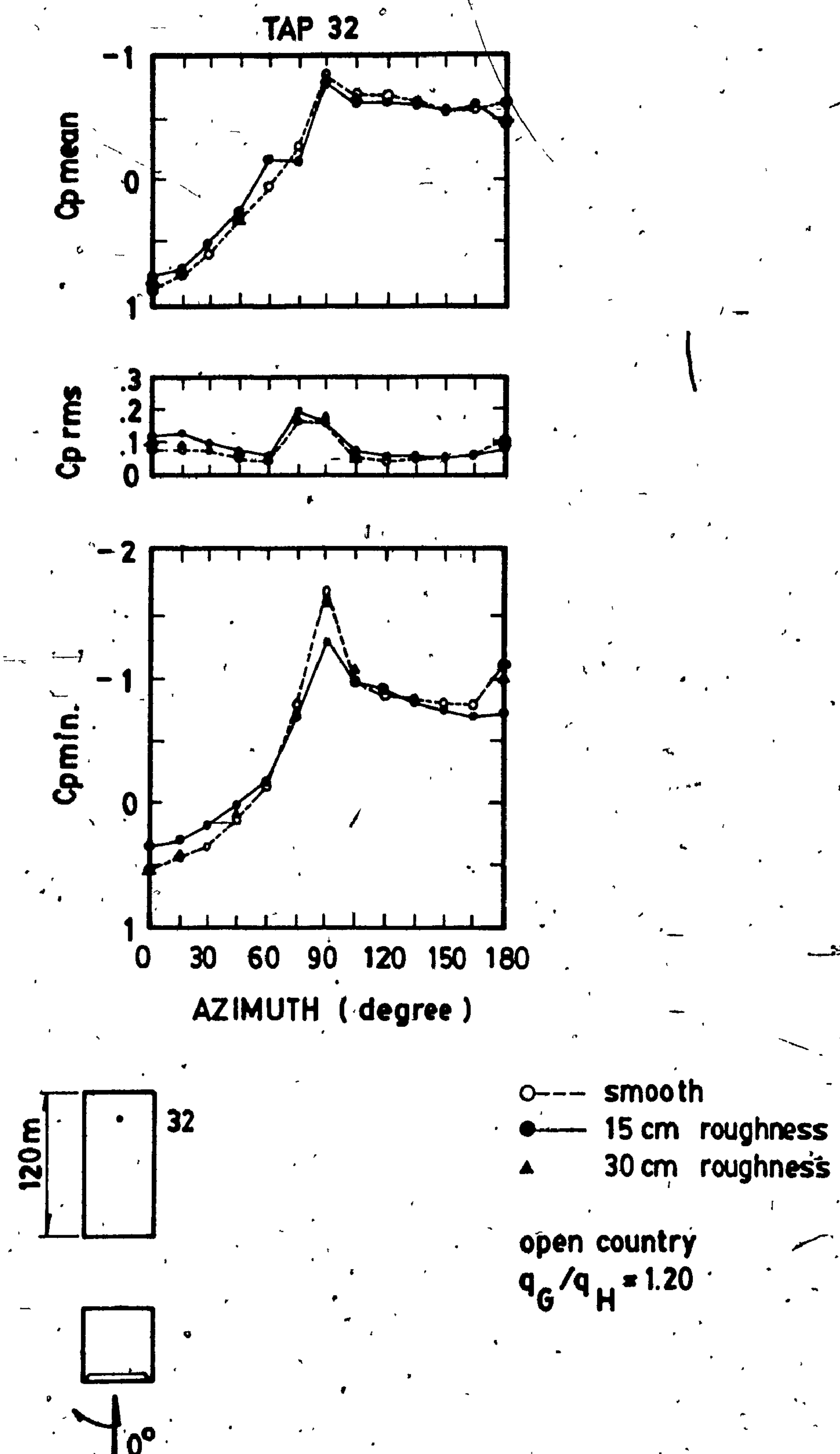


FIG. 5.8 EFFECTS OF UNIFORM ROUGHNESS ON PRESSURE COEFFICIENTS MEASURED ON TAP 32

5.3 The Effect of Balconies

For each consideration of balconies, pressures of 47 taps of the whole front surface of the model were measured for 13 wind directions (0° to 180° azimuths with an interval of 15°). However, only the typical results which show significant differences are presented in this section.

5.3.1 The Effect of Balconies without walls

Balconies with two different widths, full scale equivalent to 2 m and 4 m, were tested. Both types of balconies show a general decrease in pressure (suction and pressure decrease) for all azimuths.

Figure 5.9 illustrates the comparison between the cases with and without balconies in central zone 4 for azimuths 0°, 90° and 180°. It can be seen from the figure that when balconies are present, both Cp peak and Cp rms values generally decrease in magnitude, as compared with those of smooth building. Although at 90° azimuth, a more pronounced effect of Cp min was found for the case of 4 m-width balconies, in most cases the effects of 2 m and 4 m-width balconies were almost the same. Similar to the trend

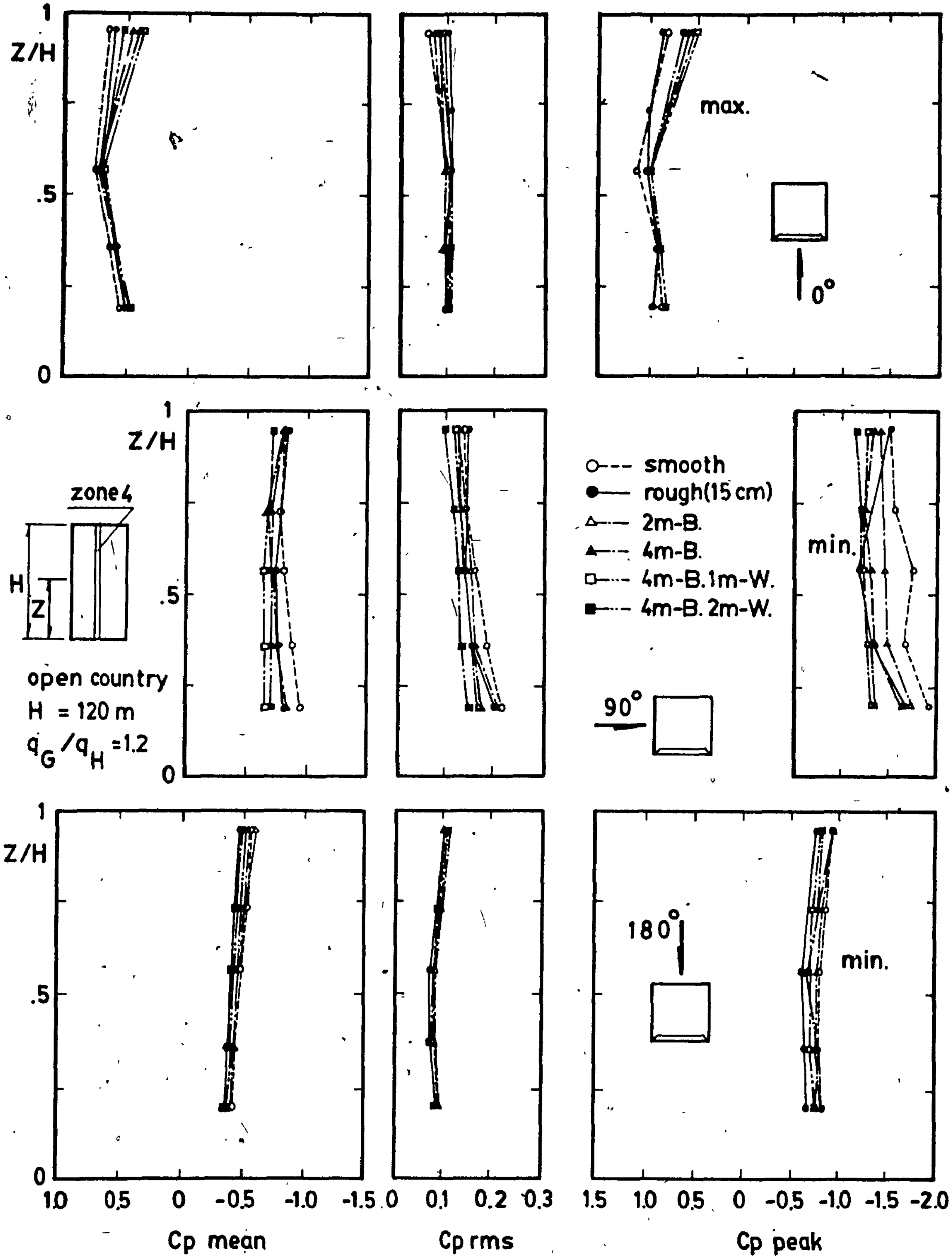


FIG. 5.9 EFFECTS OF BALCONIES ON PRESSURE COEFFICIENTS MEASURED ON ZONE 4

mentioned in the previous section, a more pronounced effect was found at the top part of the zone at 0° azimuth while at the bottom part of the zone at 90° azimuth.

Figure 5.10 shows the effects of balconies in the edge area. It can be seen that almost no measurable difference was found.

It can therefore be concluded that balconies reduce Cp peak and Cp mean pressures in the intermediate part of the wall surface by a small magnitude while the existence of balconies does not affect pressures at the wall edges. There was no pronounced difference between the effects of 2 m and 4 m-width balconies.

5.3.2 The Effect of Balconies With Walls

4 m-width balconies with 1 m and 2 m walls were tested in order to determine the effect of balconies with walls and the effect of different wall heights on the wind pressures on the wall of a building.

Balconies with walls show a general decrease in Cp mean and Cp min values in most areas of the surface. At the edge, Cp min and Cp mean change from negative to positive.

Figure 5.9 shows the effects of balconies with walls on zone 4. It can be seen very clearly that balconies with walls have more pronounced effect than balconies without

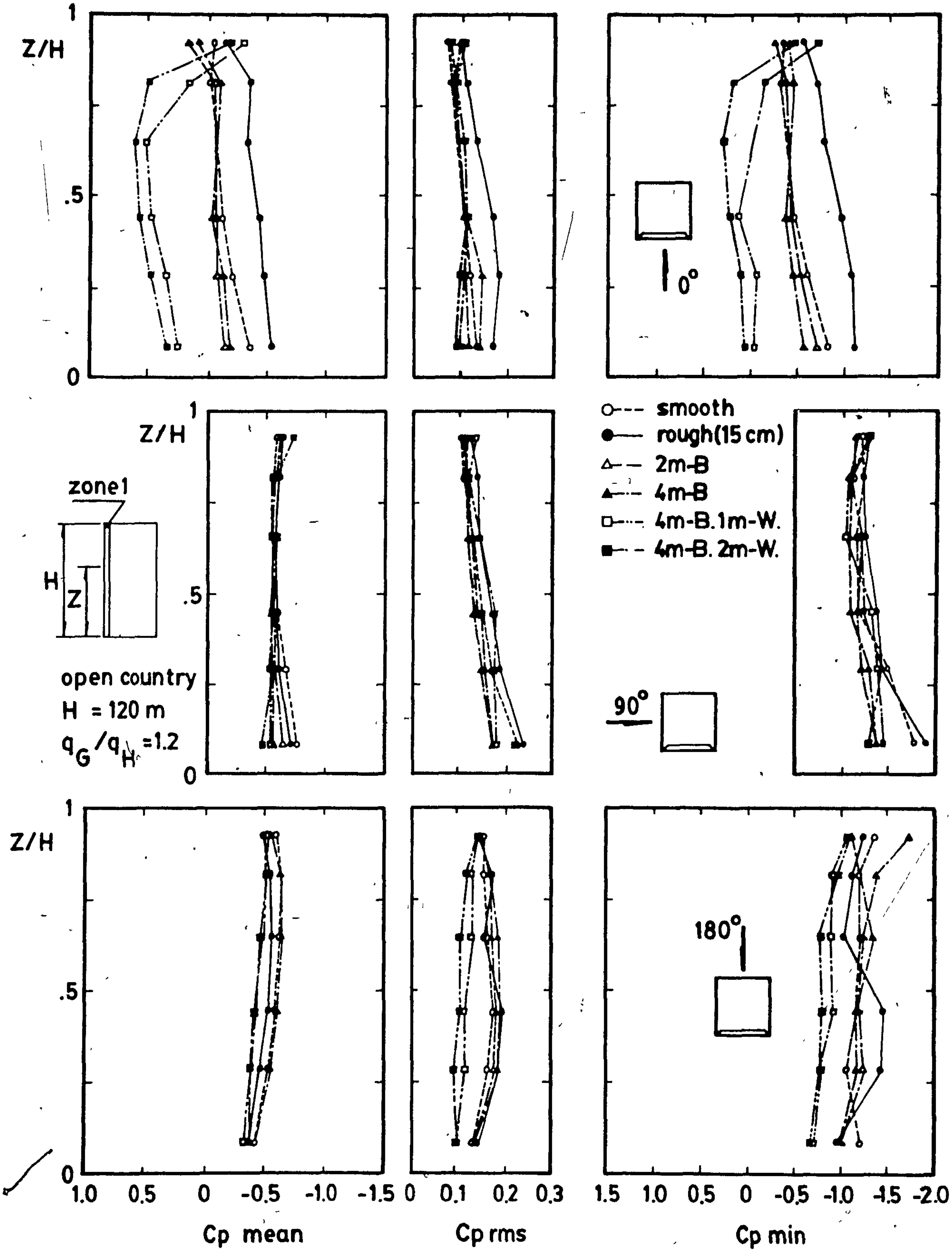


FIG. 5.10 EFFECTS OF BALCONIES ON PRESSURE COEFFICIENTS MEASURED ON ZONE 1

walls do. This is because the walls form a sort of small barrier to the flow and stop part of it from hitting the building surface at the windward surfaces or reduce the effect of vortices in leeward surfaces. Thus, both positive and negative peaks are reduced.

Figure 5.10 illustrates the effects of balconies with walls at the edge zone of the building wall. Both Cp mean and Cp min change from negative to positive values in 0^{o} azimuth. This may be explained by considering that the wall of the building falls into the wake of the walls of the balconies. For Cp min, the maximum difference was 0.88, from -0.83 to 0.05. For Cp mean the maximum difference was 0.70, from -0.36 to 0.34.

As can be seen from Figure 5.10 all pressure coefficients decrease in the presence of balconies with walls and the effects are more pronounced at the lower part of the zone for all azimuths. The influence of the balconies increases with increasing the height of the balcony walls.

It can be concluded from the above discussion that balconies with walls make both Cp mean and Cp min decreased in the intermediate area of the building surface. At the edge, the suction was changed to positive pressure at 0^{o} azimuth and the case of balconies with 2 m walls have more pronounced effects. However, the differences for both Cp min and Cp mean were less than 0.9.

5.4 The Effect of Mullions

As illustrated in Figure 4.9, two different mullion configurations were tested. One is 2 m (5 mm in model) deep mullions, attached on the entire wall surface with an interval of 2 m (5 mm in model) among each other. The second configuration is mullions with different geometries at the corner of the building.

In this section the effect of uniform mullion configuration will be discussed first in order to get a general picture of the effects of mullions on the wind-induced pressures. Mullions with different geometries near the corners will be discussed later in order to understand how the corner geometry affects the flow and the wind pressures on the wall surface.

5.4.1 The Effect of 2 m Uniformly-Distributed Mullions

Uniformly-distributed mullions show a great increase in both Cp mean and Cp min at the edge and in the area near the edge (zones 1 and 2) for 0^{o} to 30^{o}, 90^{o} to 105^{o} and 150^{o} to 180^{o} azimuths. In the intermediate part of the building surface, however, the pressure was only slighly affected.

Figures 5.11 and 5.12 illustrate the effects of mullions on wind pressure on 8 taps, 4 of them located at the bottom part of the building (level 12), and another 4 located at the upper part of the building (level 4). As can be seen, Cp min and Cp mean on taps 72 and 30, which were located at the wall edge area, are significantly increased in the presence of mullions for 0^o azimuth. For tap 72, Cp mean was increased from -0.37 to -1.03 (+178%) and Cp min was increased from -0.83 to -2.03 (+145%). Cp rms of tap 72 was increased by 83%, from 0.12 to 0.22. This can be explained as the existence of the vertical mullions especially those close to edge makes the flow separation point change; instead of occurring at the corner of the building it occurs at the edge of the first mullion. The edge area thus falls into the shear layer of the flow and intensive vortices in the shear layer increase the suction greatly. However, there was no significant difference observed on the other 3 taps, which were located in the intermediate part of the wall of the building. A similar trend can be seen from Figure 5.12 regarding the 4 taps at the top part of the building. However, the effects are not as pronounced as those of level 12.

High pressure fluctuations were also observed near the edge for 105^o azimuth, in which Cp min of tap 72 increased from -1.10 to -2.97 (+170%) and Cp rms increased from 0.11 to 0.37 (+236%). Since the side wall edge is located within the flow shear layer the existence of the edge mullions

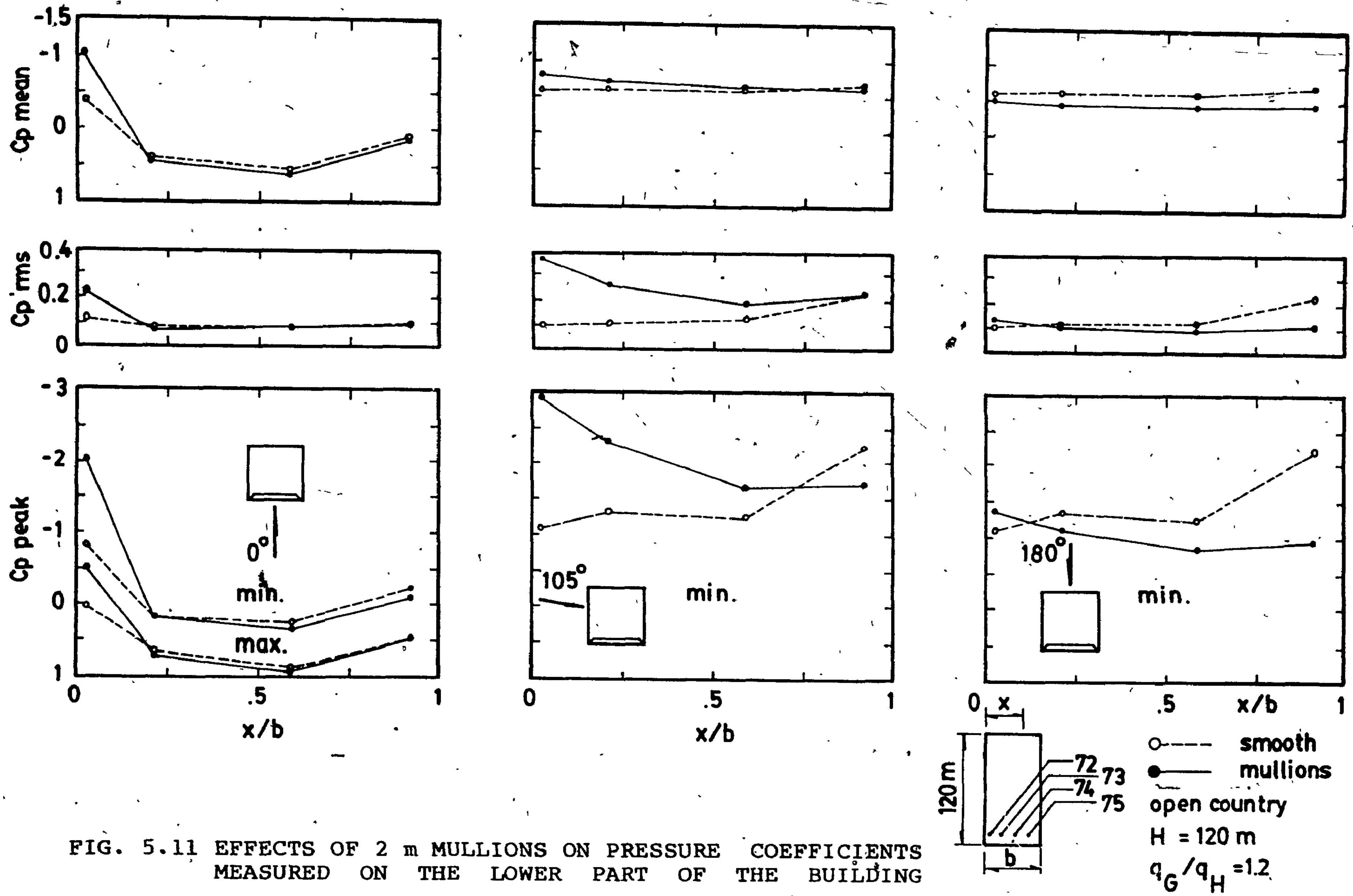


FIG. 5.11 EFFECTS OF 2 m MULLIONS ON PRESSURE COEFFICIENTS MEASURED ON THE LOWER PART OF THE BUILDING

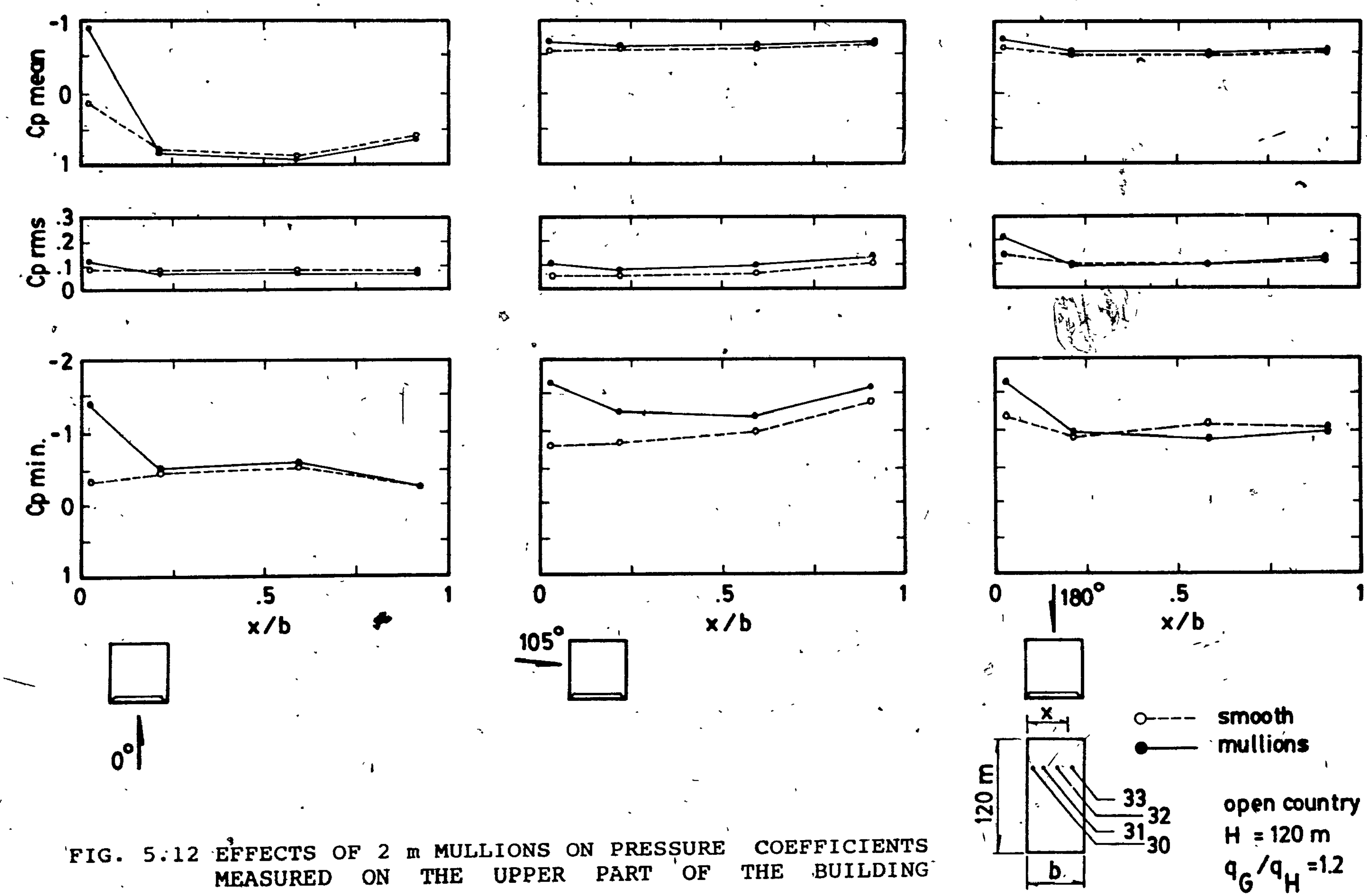


FIG. 5.12 EFFECTS OF 2 m MULLIONS ON PRESSURE COEFFICIENTS MEASURED ON THE UPPER PART OF THE BUILDING

blocks the flow passing around the corner as it does in the smooth case, and thus strong vortices are developed as the flow changes direction. The effects were less pronounced at the top part of the building (compared to the lower part). At 180° azimuth, decreased Cp min and Cp mean were observed in the intermediate part of the building with mullions, but some increase of Cp min and Cp mean still occurred at the edge. However, the increase compared to those at 105° azimuth was not critical.

Figure 5.13 shows the comparison of Cp mean for edge taps between the values of this study (2 m mullions) and those measured by Templin and Cermak (1976) for a 33 m by 65 m rectangular building with 0.6 m mullions. The coefficients for both cases are referenced to the gradient dynamic velocity pressure. It can be seen from the figure that the trends are similar between the two tests. Some pressure differences in smooth cases between these studies are probably due to the different building geometries. Regarding the effect of mullions on the first tap from the edge, 58% increase (tap 30) was observed in this study and 41% increase was observed by Templin and Cermak. It should be noted that tap 30 in this study is located between the edge of the side wall and the first mullion, while the tap used in Templin and Cermak's test is located between first and second mullions. Tap 34 in this study is located between second and third mullions and a 40% increase was observed in this tap, and this is almost the same as that

Cp mean

	CBS		Templin & Cermak(1976)
	Tap 30	Tap 34	
smooth	-0.72	-0.72	-0.64
mullions	(2.0 m)		(0.6 m)
	-1.13	-1.01	-0.90
increase by (%)	58	40	41

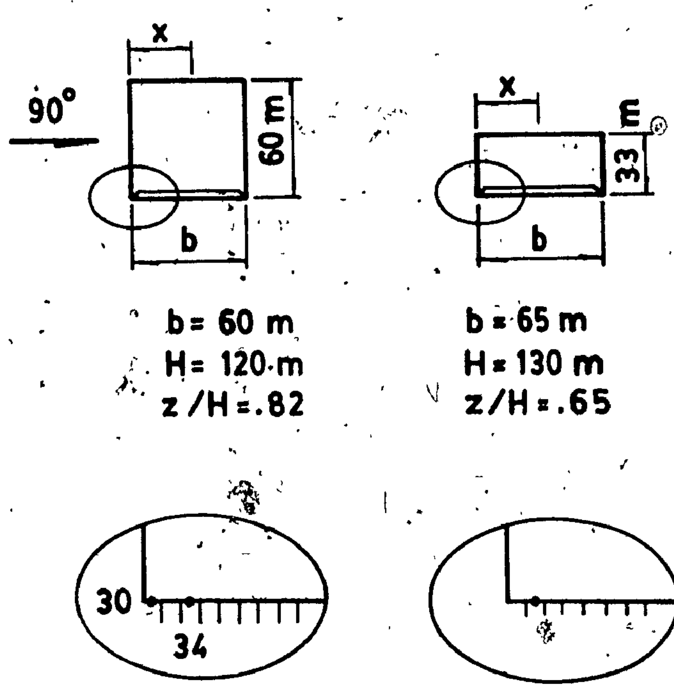


FIG. 5.13 COMPARISON OF Cp MEAN VALUES BETWEEN CBS AND TEMPLIN & CERMAK (1976), WITH MULLIONS

from Templin and Cermak's test. Two important conclusions, therefore, can be reasoned out:

(1) more pronounced effect of mullions on pressures may be expected in the area between the edge of a side wall and the first mullion;

(2) short mullions (0.6 m mullions were used in Templin and Cermak's test) may have the same effect on wind-induced pressure in the edge area as large mullions (2 m mullions were used in this study based on the scale 1:400).

Figure 5.14 illustrates the effect of mullions on zone 1 (i.e. edge). Great effect of mullions on all the pressure coefficient Cp mean, Cp min., Cp rms were observed in the edge area. The effect became more severe in the lower part of the building at 105° azimuth, i.e. when mullions were placed on the side walls. This is due to the horseshoe vortex, which develops at the bottom of the windward face by downflow and whose transmission to the lower part of the side wall is disturbed by the mullions. This is indicated schematically in Figure 5.15, which shows the development of the horseshoe vortex around a rectangular building. 105° azimuth is a critical wind direction and tap 72, as discussed earlier in this section, is a critical tap at which the worst Cp min of -2.97 and Cp rms of 0.37 was observed.

Spectra of pressure fluctuations of tap 26 at 15° azimuth and of tap 72 at 0° and 105° azimuths are presented

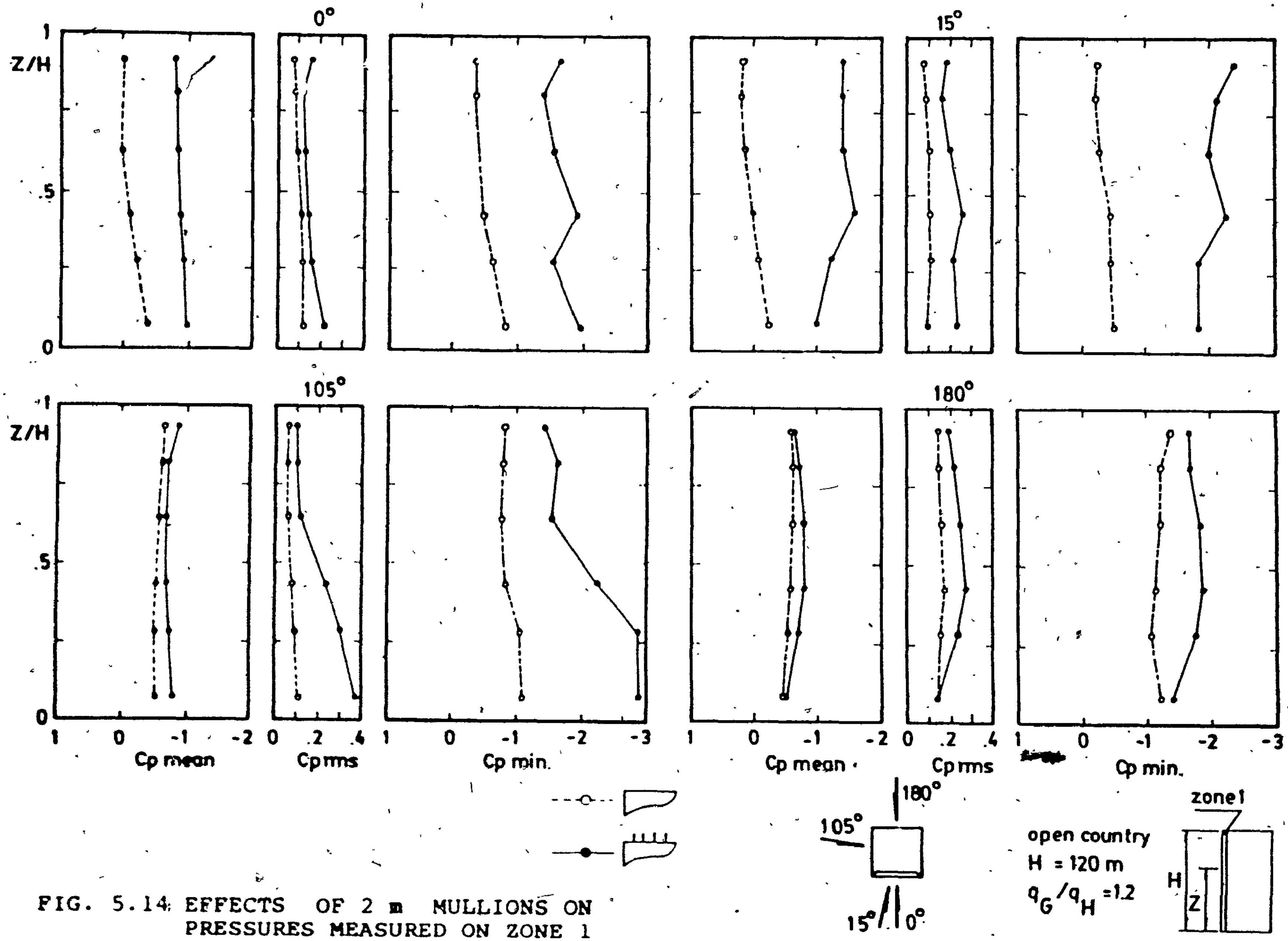


FIG. 5.14 EFFECTS OF 2 m MULLIONS ON PRESSURES MEASURED ON ZONE 1

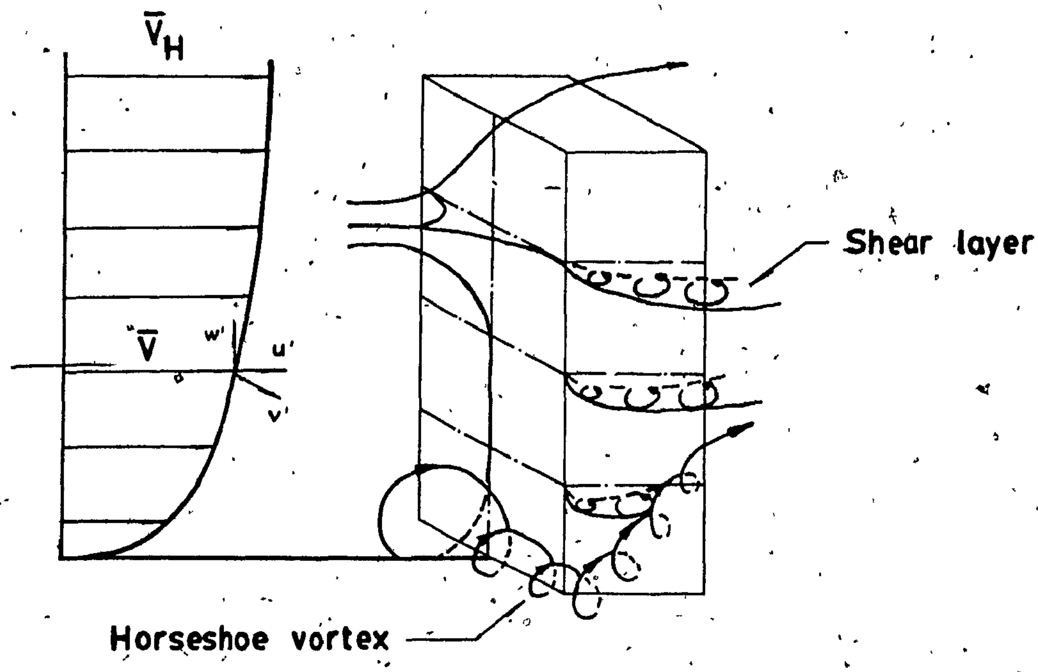


FIG. 5.15 FLOW PATTERN AROUND A RECTANGULAR BUILDING

in Figure 5.16. For tap 26 (at the edge) at 15° azimuth, the spectra reflect the characteristics of fluctuations of the incident wind whose energy is broadly distributed in the middle frequency region. Comparing the two spectra with and without mullions on tap 26, it can be seen that the spectrum in the case of mullions is somewhat skewed towards the lower frequency, i.e. more energy is distributed in the low frequency range. This is because the presence of mullions changes the size and the period of the eddies by creating a more stable region or pockets in the separated flow. At the frequency about 120 Hz, there is a high narrow energy peak, which together with the small adjacent energy peaks are associated with instrumentation noise. It can be seen that the high noise peak was reduced greatly in the case of mullions. This is due to the fact that the intensity of the noise is dominated by that of fluctuations caused by mullions. These high pressure fluctuations are also apparent in Figure 5.17 which shows pressure traces recorded on tap 26 with and without mullions.

For tap 72 at 0° azimuth, a well-defined energy peak occurred at a frequency about 9 Hz and the peak is more pronounced in the smooth case. This energy peak might be associated with the horseshoe vortex developed at the bottom of the building driven by downflow, since tap 72 is located at the lower part of the building at 0° azimuth. For the case of mullions, the energy distribution is broader than that of the smooth case. Consequently, the energy peak

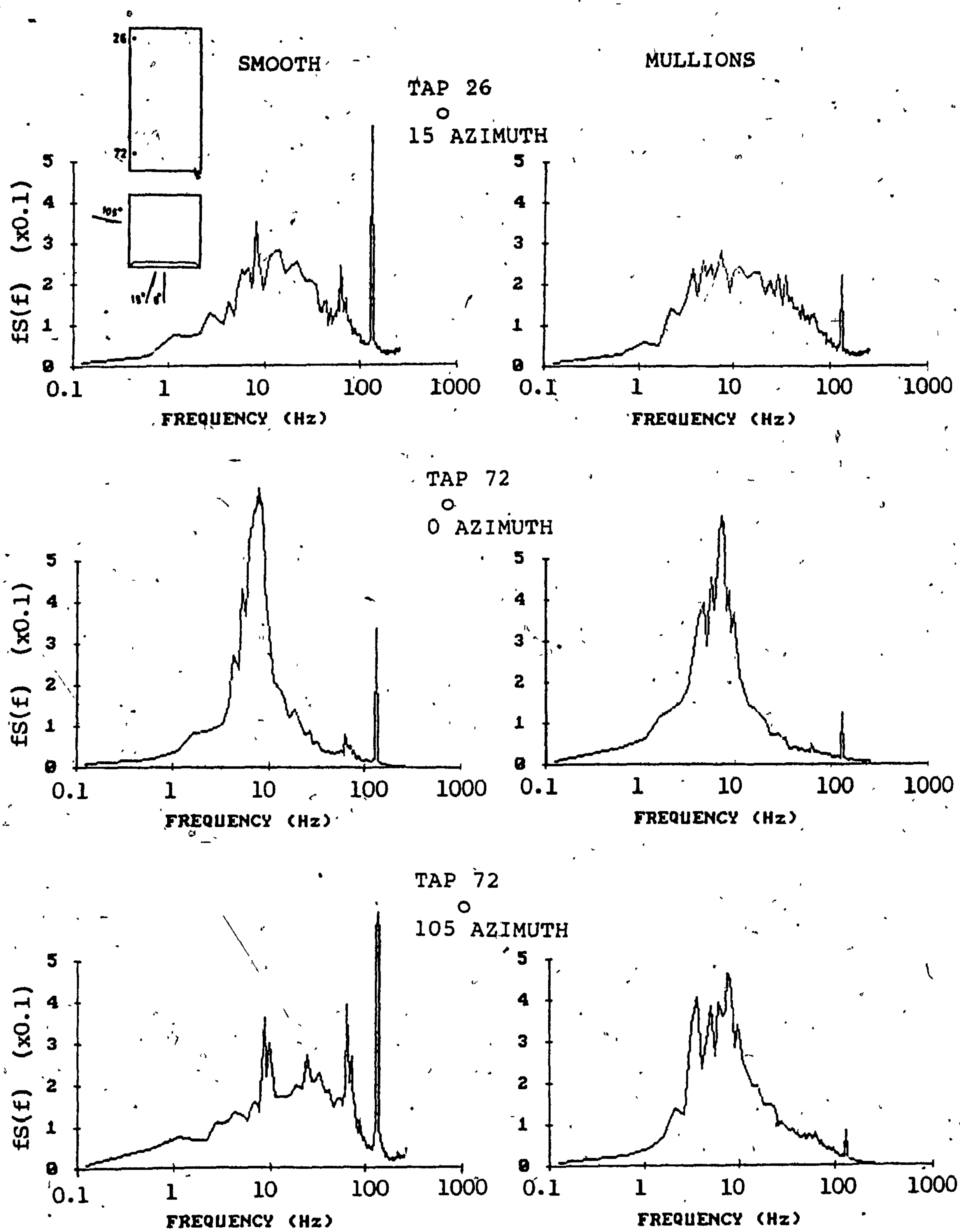


FIG. 5.16 POWER SPECTRAL DENSITIES OF PRESSURE FLUCTUATIONS ON TAPS 26 AND 72, WITH AND WITHOUT MULLIONS (H=120 m) OPEN COUNTRY EXPOSURE

associated with the horseshoe vortex is smaller than that of the smooth wall surface case.

At 105° azimuth, which is a critical azimuth for tap 72, the spectrum of mullion case has more energy in the low frequency range and in fact there is a considerable amount of energy at frequencies lower than 9 Hz. The energy at the lower frequencies may be associated with the motion of the separation vortex. Again, since the intensity of the noise is dominated by that of pressure fluctuations caused by mullions, the high energy peak of noise disappears in the mullion case.

Figures 5.17 and 5.18 illustrate the pressure traces on taps 26 and 72. It can be seen from Figure 5.17 that Cp mean greatly increases and the fluctuation of the pressure is not very severe. These phenomena agree with the data shown in Figure 5.14. Figure 5.18 illustrates the traces on tap 72 at 0° and 105° azimuths. It can be seen that for 0° azimuth, the fluctuations of the pressure are similar for the cases with and without mullions but Cp mean was increased for the mullion case, which caused the increase in Cp min. For 105° azimuth, the Cp mean values are almost the same for smooth and mullion cases, but the pressure of the mullion case has strong fluctuations, which cause the increase of Cp min. These phenomena agree with those indicated by pressure coefficient curves (Figure 5.14).

Figure 5.19 illustrates the effect of uniformly

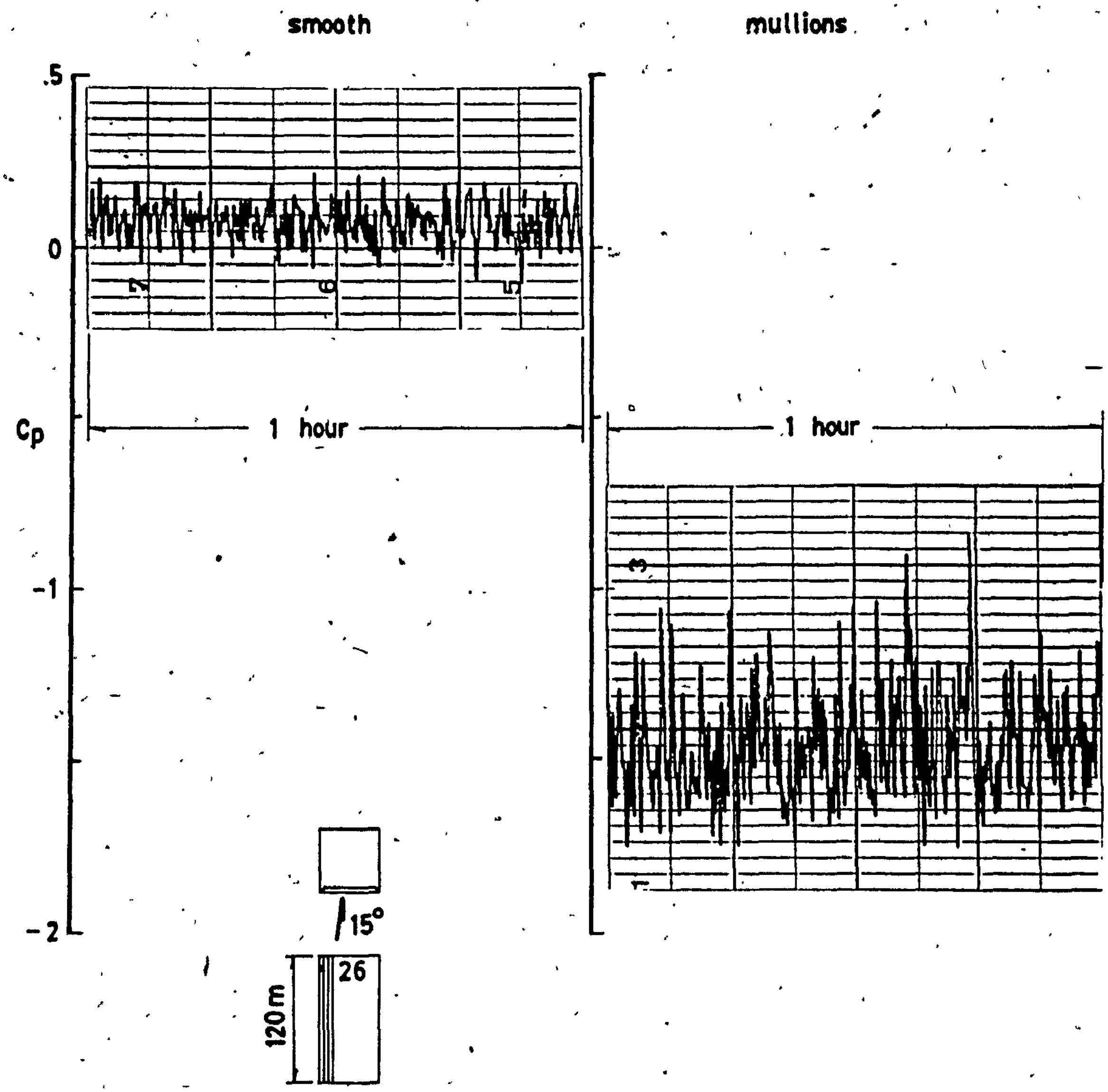


FIG. 5.17 PRESSURE TRACES ON TAP 26 WITH AND WITHOUT MULLIONS
OPEN COUNTRY EXPOSURE

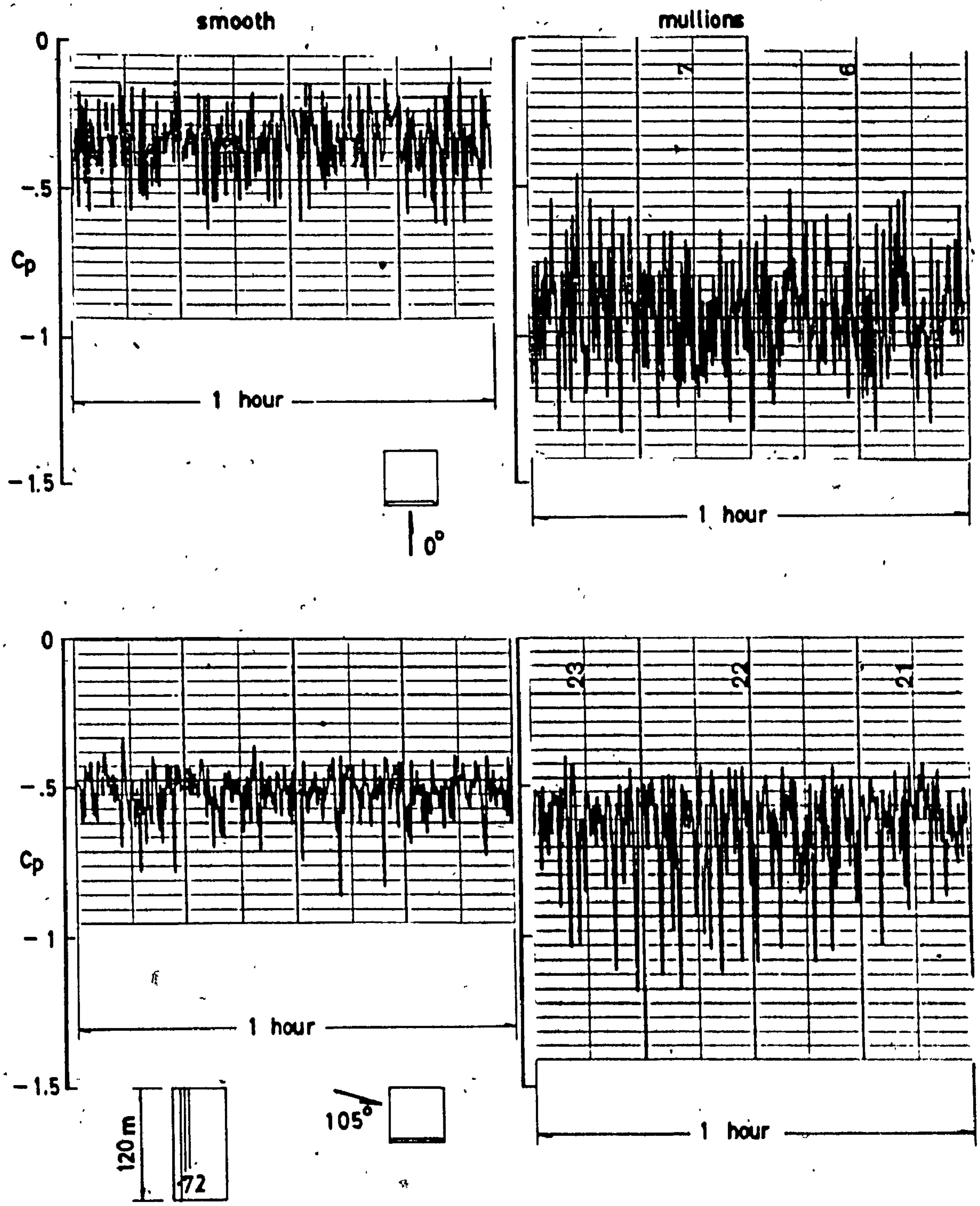


FIG. 5.18 PRESSURE TRACES ON TAP 72 WITH AND WITHOUT MULLIONS
OPEN COUNTRY EXPOSURE

distributed mullions on zone 2. As indicated in the figure, small increases of Cp min and Cp mean in zone 2 appear for 0° and 180° azimuths. At 90° azimuth, however, significant increases of Cp mean, Cp min. and Cp rms are still observed. These increase are not as great as those of zone 1.

Figure 5.20 shows the effect of mullions on pressures measured on zone 4. Except for some small increase observed at 90° azimuth, there was almost no measurable difference between the cases with and without mullions.

Figure 5.21 shows the effects of 2 m mullions for zones 1 to 4 at 105° azimuth, which appears to be the most critical azimuth. Although Cp mean increases in a small magnitude, there is no significant change from zones 1 to 4. However, Cp min increases drastically due to the significant increment of Cp rms. More pronounced effect can be found out at the lower part of the building and the effect of mullions gets smaller as the distance from the tap to the edge increases as previously discussed.

Based on the observation that edge is a critical place with high fluctuating pressures, the comparison of pressure coefficients on 3 taps (26, 72, 71), chosen from those near the edges, were plotted versus azimuth. Figure 5.22 shows pressure coefficients on taps 26 and 72 versus azimuth. It can be seen that from 0° to 30° and 90° to 105° azimuths, significant effects occur on tap 72 and the worst value

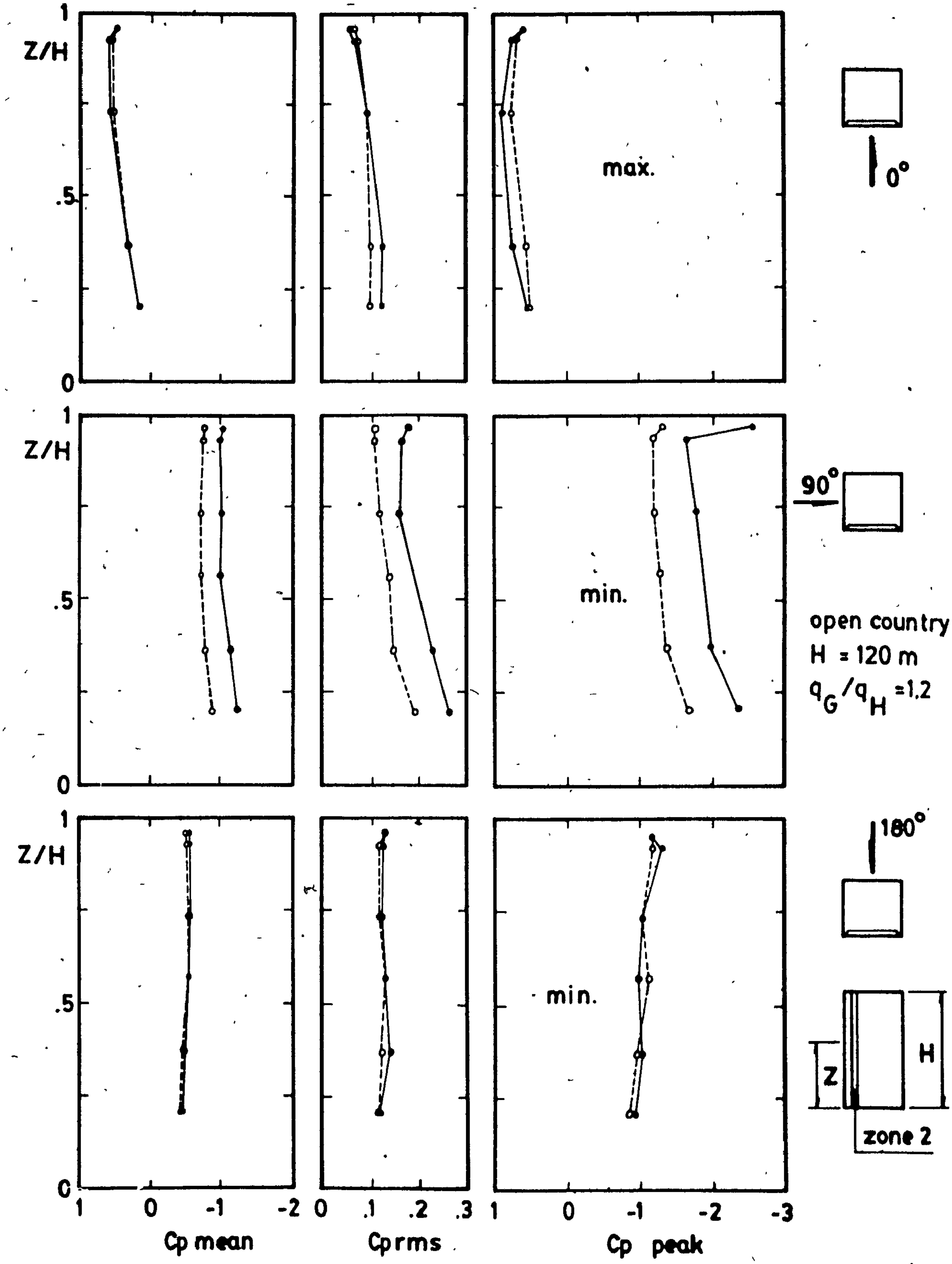


FIG. 5.19 EFFECTS OF 2 m MULLIONS ON PRESSURE COEFFICIENTS MEASURED ON ZONE 2

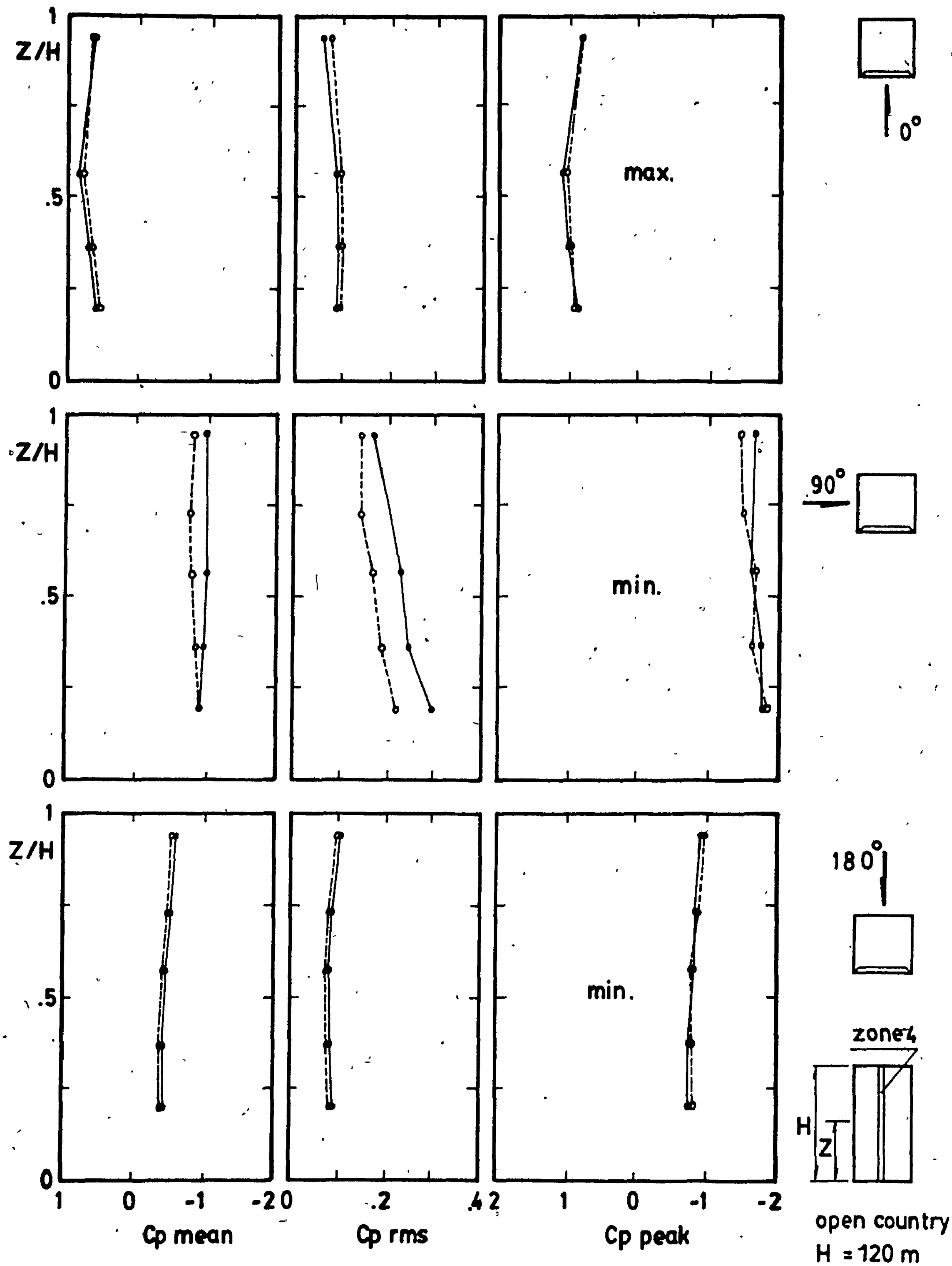


FIG. 5.20 EFFECTS OF 2 m MULLIONS ON PRESSURE COEFFICIENTS MEASURED ON ZONE 4

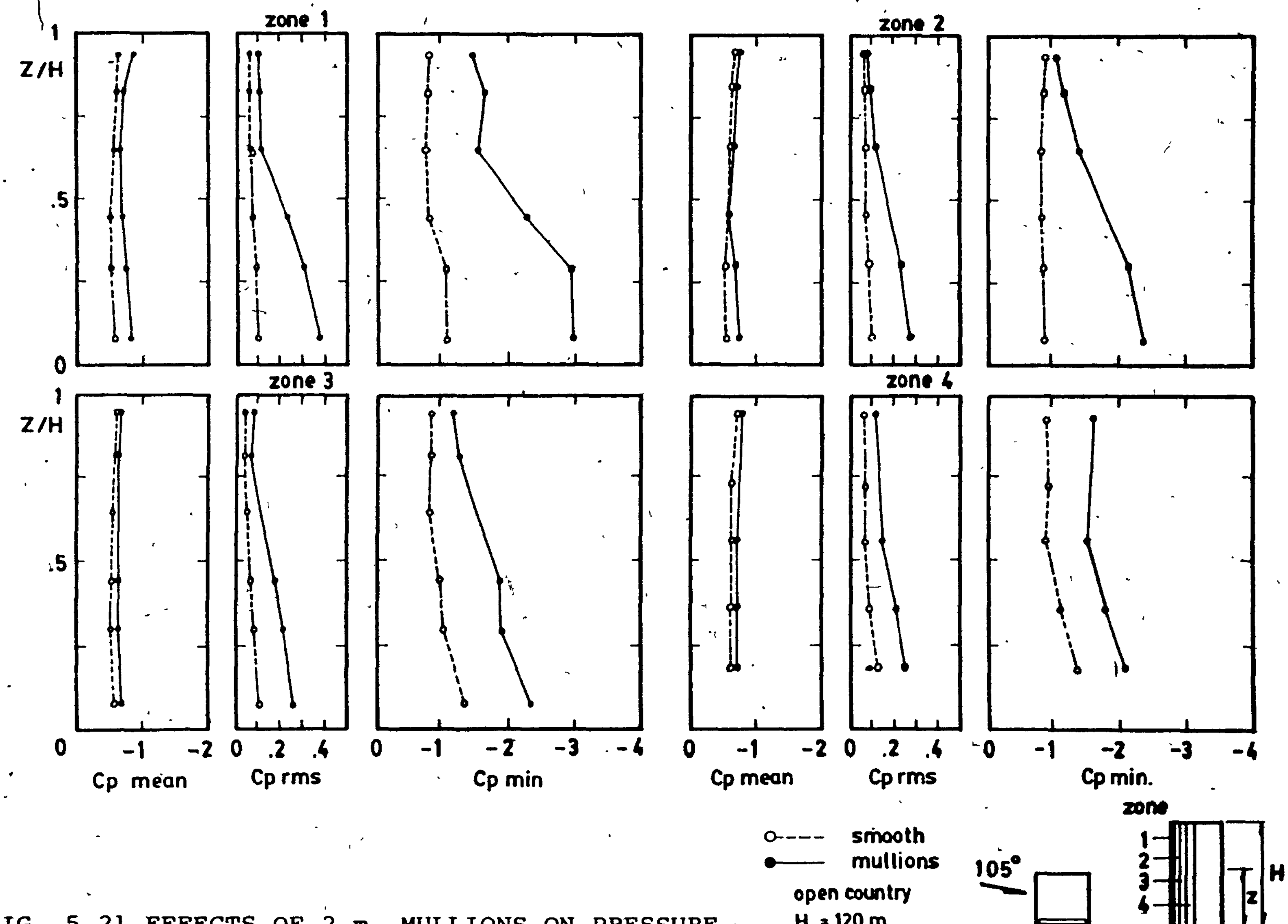


FIG. 5.21 EFFECTS OF 2 m MULLIONS ON PRESSURE COEFFICIENTS MEASURED ON ZONE 1 TO 4

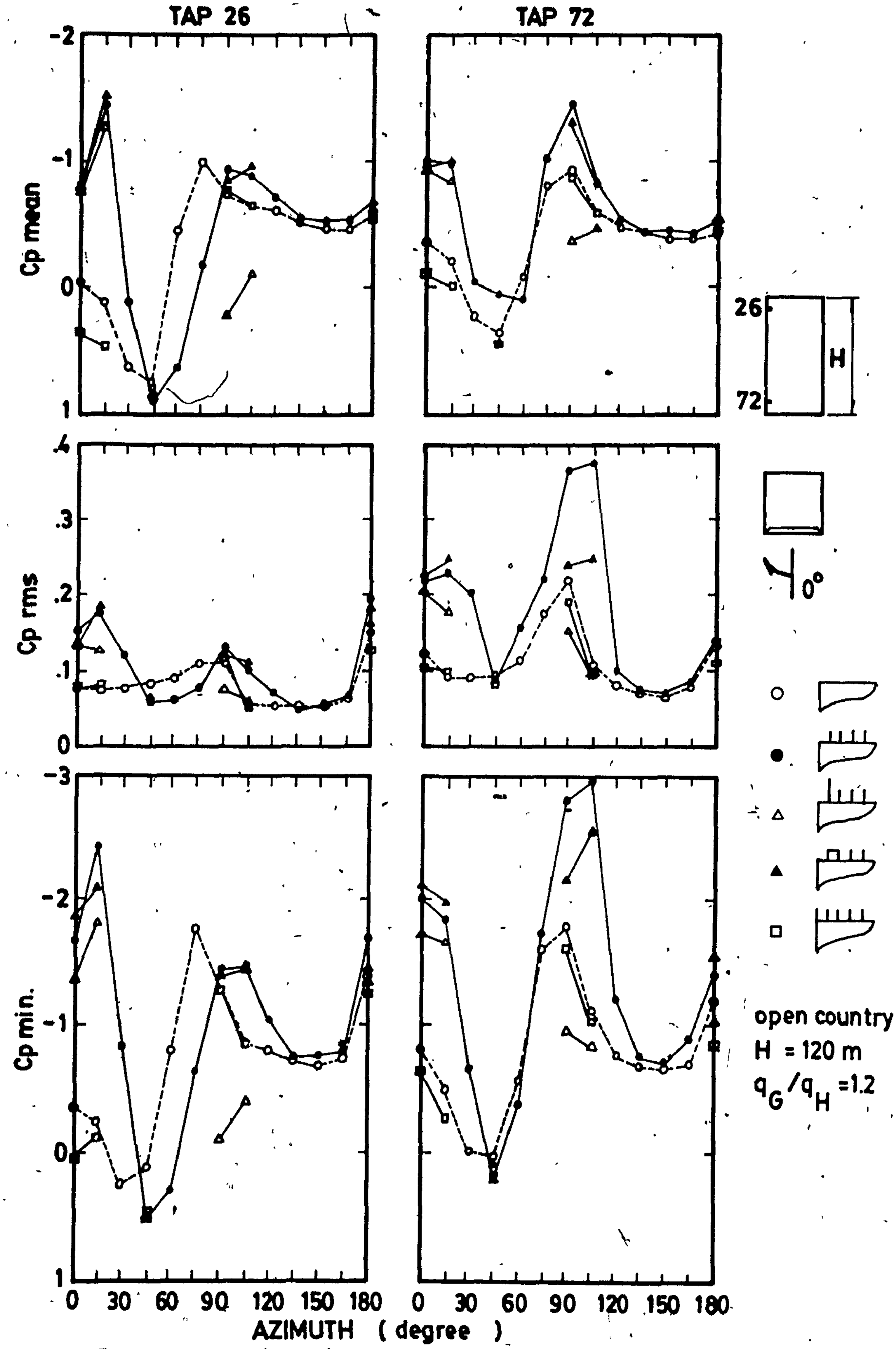


FIG. 5.22 EFFECTS OF 2 m MULLIONS ON PRESSURE COEFFICIENTS MEASURED ON TAPS 26 AND 72

occurs at 105° azimuth, where Cp min of -2.97 was measured with a high Cp rms of 0.37. For tap 26, 15° is a critical azimuth at which high values of Cp mean, Cp rms and Cp min were observed. The Cp mean was -1.45, the Cp min. was -2.40 and the Cp rms was 0.19 in the presence of uniformly distributed mullions. Figure 5.23 shows pressures on tap 71, which is located at the other edge of the wall surface, versus azimuth. High Cp min was found at tap 71 at 165° azimuth; however, compared to the taps on the other edge, this tap is not critical.

Pressures in the intermediate part of the building were not much affected when mullions were attached on the building surface. Figure 5.23 also shows the pressure coefficients versus azimuth on tap 51, which is located in zone 4 in the middle part of the building wall. Only small differences were observed for azimuths around 105°.

From the above discussion, it can be concluded that mullions may cause adverse wind effects near the edges of the building wall. The worst azimuth is around 105° and highly fluctuating pressures were measured for this wind direction. In the intermediate part of the wall surface, however, mullions cause no pronounced effect.

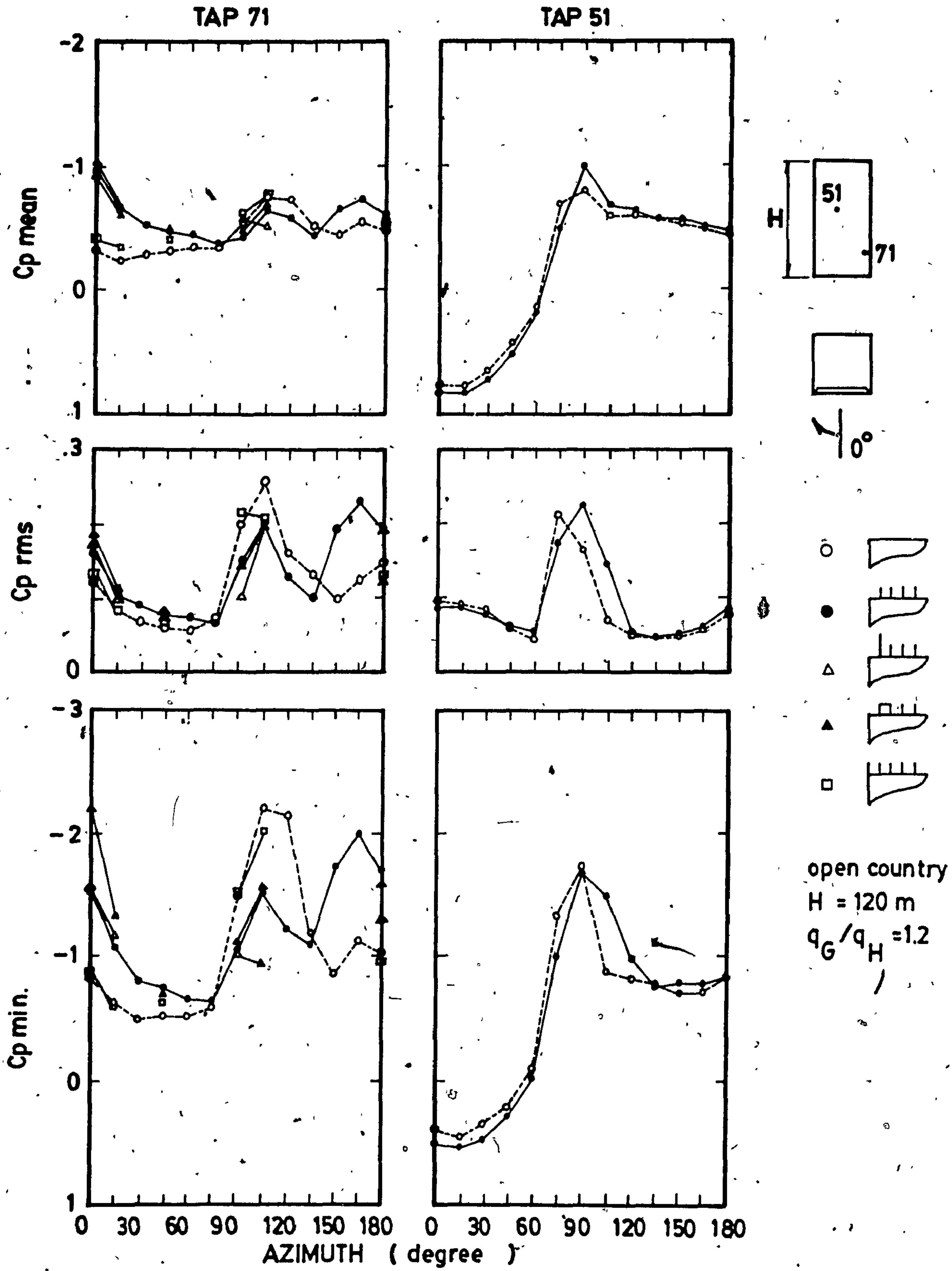


FIG. 5.23 EFFECTS OF 2 m MULLIONS ON PRESSURE COEFFICIENTS MEASURED ON TAPS 51 AND 71

5.4.2 The Effect of Mullions with Various Geometries at the Wall Edges

Mullions with three different geometries at the edge were tested. Case 1 is the 2 times exaggeration for the first mullion. Case 2 is the one that the first two mullions were covered. Case 3 is the one with a mullion at each edge. See Figure 4.10.

Case 1 and Case 2 show an increase in Cp min and Cp mean similar to that of uniformly distributed mullions. However, Case 3 shows a very small difference.

Figure 5.24 illustrates the effects of the three cases of different mullion geometry at wall edges. For windward azimuths, i.e. 0° and 15° azimuths, both Cp min and Cp mean increase in Case 1 and Case 2 with a magnitude similar to that of the general mullions, and the effect of Case 1 was generally less pronounced than that of the Case 2. In Case 3, however, Cp mean and Cp min were decreased slightly. This indicates that the edge mullion in case 3 protects the edge area from high suctions, but that the mullion geometries in Case 1 and Case 2 did not change the adverse flow pattern caused by mullions in general.

At 105° azimuth only Case 2 had a pronounced effect on Cp min, Cp mean as well as Cp rms, while Case 1 and Case 3 had almost no effects, as shown in Figure 5.24. At 180° azimuth, both Case 1 and Case 2 indicated some small effects.

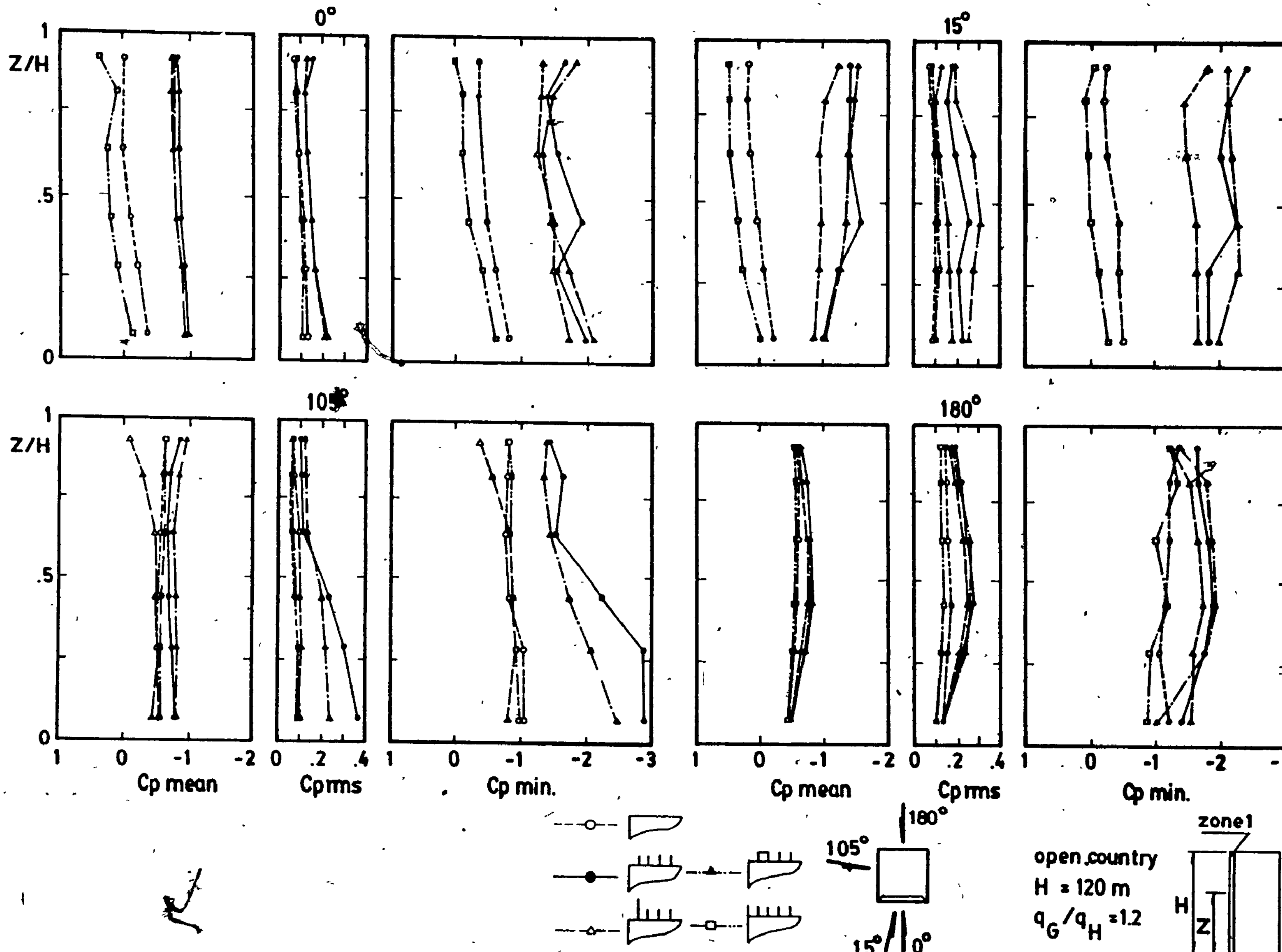


FIG. 5.24 EFFECTS OF MULLIONS WITH DIFFERENT CORNER GEOMETRIES ON PRESSURES MEASURED ON ZONE 1

The effects of mullions with different corner geometries versus azimuth are illustrated in Figures 5.22 and 5.23.

Through the above discussion it can be concluded that mullion configurations of Case 1 and Case 2 make the flow pattern as adverse as the case of uniform mullions does, however the configuration of Case 3 provide a method of releasing the high suctions caused by the existence of general mullions. On the other hand, the edge mullion itself in Case 3 may sustain high wind loads, although, this has not been examined in the present study.

5.5 The Effect of Appurtenances on Low Buildings

To investigate the effects of appurtenances on buildings of different height, a 15 m low building was modeled in the wind tunnel and tests were carried out with simulated 30 cm uniform roughness, 4 m balconies, and 1 m mullions. Pressure coefficients presented in this section are referenced to the dynamic velocity pressure measured at roof height.

5.5.1 The Effects of 4 m Balconies and 30 cm Uniform Roughness

On the 15 m high building, 4 m balconies and uniform roughness simulation (by using rough sandpaper) did not show any pronounced effect on the wind pressures on the walls except at the edge area for 90° azimuth, where some high suctions were observed.

Figure 5.25 shows the pressure coefficients for the cases of smooth surface, 30 cm uniform roughness and 4 m balconies at 90° azimuth. The small effect of appurtenances on the wind pressures is apparent. Only in the edge area near separation, balconies cause some reduction of suctions, whereas uniform roughness impose a small increase on both mean and rms values of suction coefficients. Some increase of instantaneous peak values of pressure coefficients noticed at one point is probably accidental without any major significance.

Figure 5.26 illustrates the spectra of pressure fluctuations on the smooth surface wall and that with 4 m balconies with walls for the low building (15 m high). Two pressure taps, namely 19 and 26, were monitored. For tap 19, the energy distribution skews towards the high frequency in the presence of appurtenances. A considerable amount of energy is concentrated at the frequency about 70 Hz, which is associated with vortex shedding. (The vortex shedding frequency can be determined by Strouhal number which is about

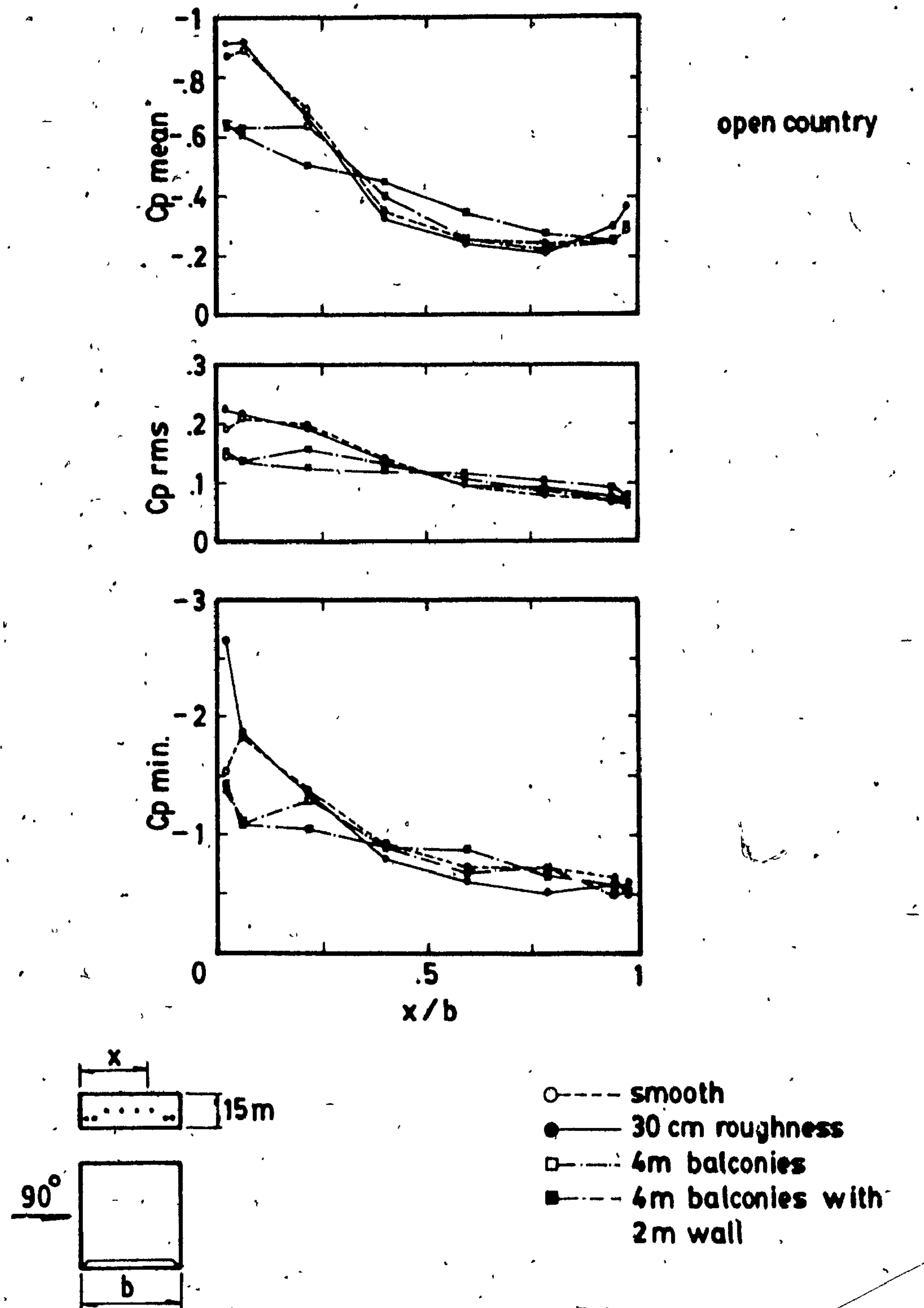


FIG. 5.25 EFFECTS OF APPURTENANCES ON WIND PRESSURE COEFFICIENTS MEASURED ON A LOW BUILDING MODEL (Cp REFERENCED TO ROOF HEIGHT)

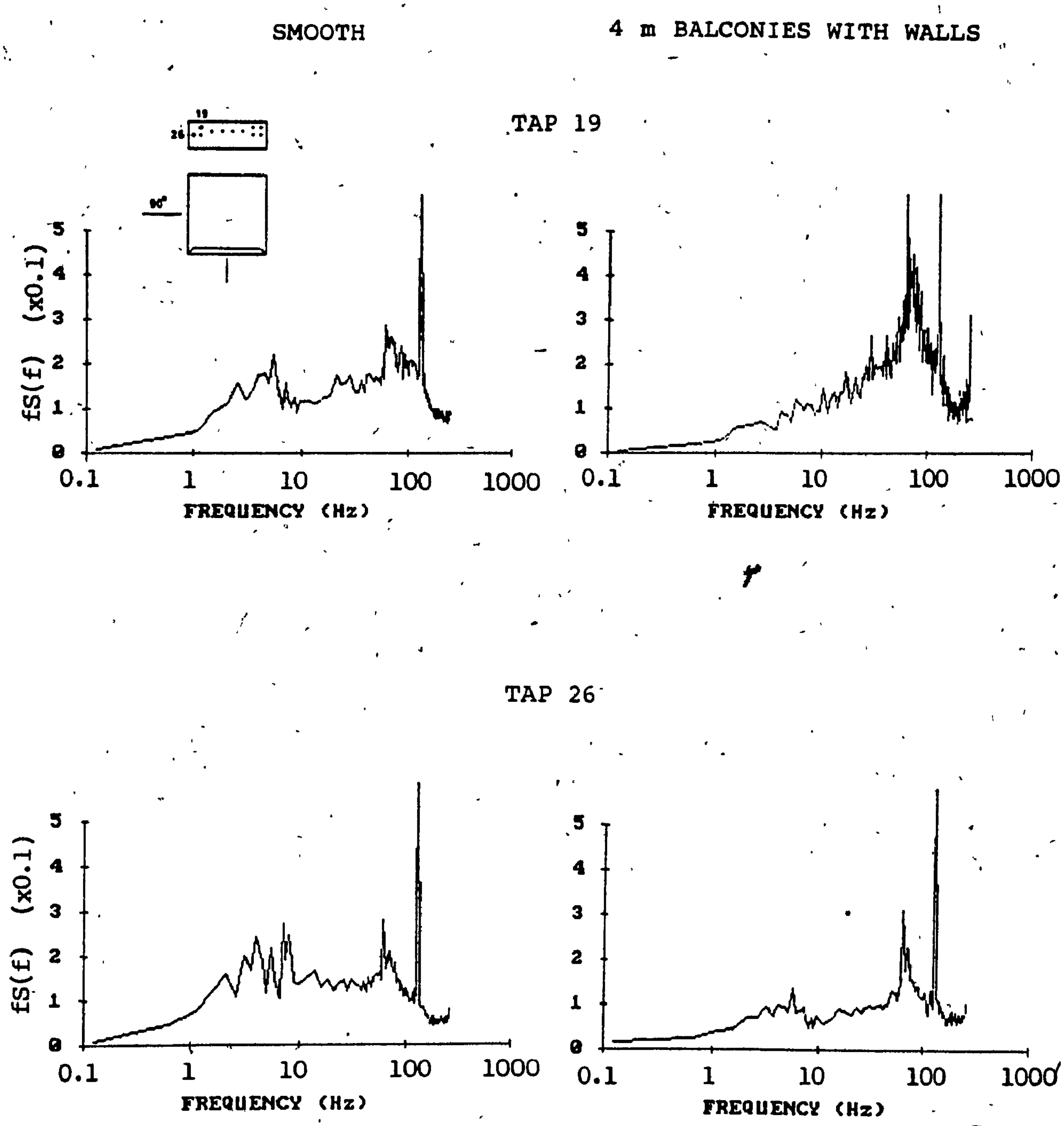


FIG. 5.26 POWER SPECTRAL DENSITIES OF PRESSURE FLUCTUATIONS ON TAPS 19 AND 26, WITH AND WITHOUT BALCONIES (H=15 m) OPEN COUNTRY EXPOSURE

0.21. i.e. n=V*St/L, where: n=Strouhal frequency, St=Strouhal number, L=the characteristic length of the model) However, the energy peak associated with vortex shedding in the smooth case is not so apparent. A similar trend can be seen from the spectra measured from tap 26, but the difference between the cases with and without balconies is relatively small. This may be due to the fact that tap 19 is located above all three balconies in the 15 m building, while tap 26 is located between two balconies. Thus, different flow patterns develop around the two taps. Figure 5.27 illustrates the pressure traces on taps 19 and 26 at 90° azimuth. It can be seen that for both taps Cp mean decreases and the amplitudes of fluctuation are also reduced in the presence of balconies on the wall of the low building.

Generally, it appears that there is no significant effect for the cases of 4 m balconies and rough uniform roughness on the low rise building.

5.5.2 The Effect of 1 m Mullions

In order to investigate the effects of mullions on low rise buildings, four 1 m mullions were attached on the low rise building model (see Fig. 4.8B). The results of the tests compared to those obtained from the case of smooth surface are shown in Figure 5.28.

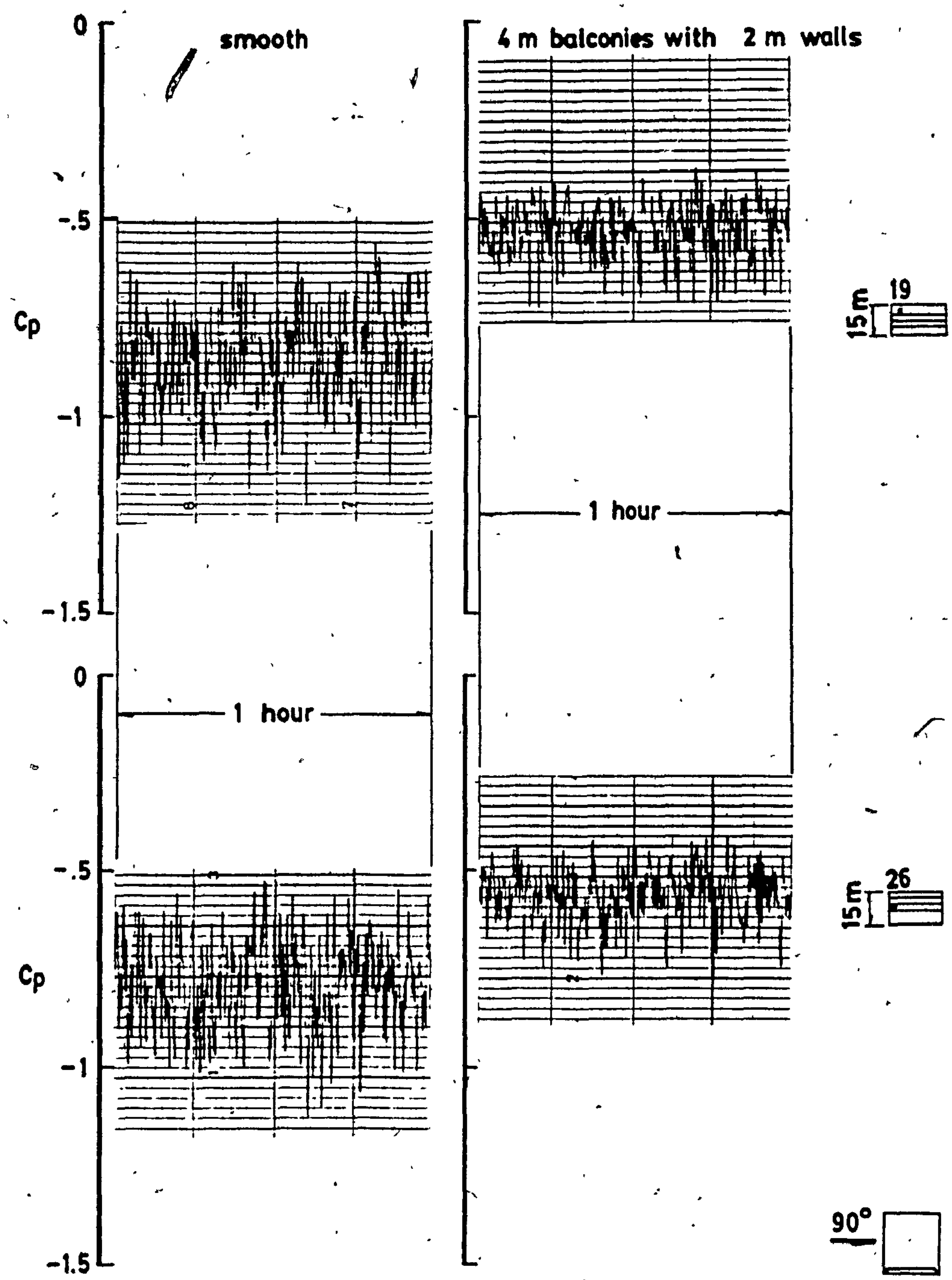


FIG. 5.27 PRESSURE TRACES ON TAPS 19 AND 26
WITH AND WITHOUT BALCONIES
OPEN COUNTRY EXPOSURE

The 1 m mullions show a general increase in Cp mean, Cp rms and Cp min at the edge area. The effect was more pronounced at 0^{o} azimuth. The mechanism of the phenomenon is similar to that of the 120 m-high building.

Figure 5.28 shows the pressure coefficients versus azimuth for edge taps 21, 29 and 26. Trends for taps 21 and 29 were very similar but tap 21, which was higher up on the wall, had more pronounced effects. The worst value of Cp min was -3.46 (from -0.78 for smooth wall). The worst value of Cp mean was -1.40 (from -0.09 for smooth wall). The Cp rms at 0^{o} azimuth increased from 0.28 to 0.57. The results of tap 26 can be treated as the results of tap 29 from 180^{o} to 360^{o} azimuth, because of symmetry.

Figure 5.29 shows the spectra of pressure fluctuations measured on the low rise (15 m high) building wall with and without mullions. It can be seen that in smooth surface cases more energy is concentrated at the Strouhal frequency (70 Hz). This phenomenon indicates that the existence of mullions reduces vortex intensity. Again, the energy peaks associated with noise are reduced or disappeared in the case of mullions, except for tap 23 in 0^{o} azimuth, which is located in the middle part of the building surface for which no significant difference observed between the smooth and mullion cases.

Figures 5.30 and 5.31 illustrate the traces of pressure fluctuation for taps 21, 23 and 29. As indicated in Figure

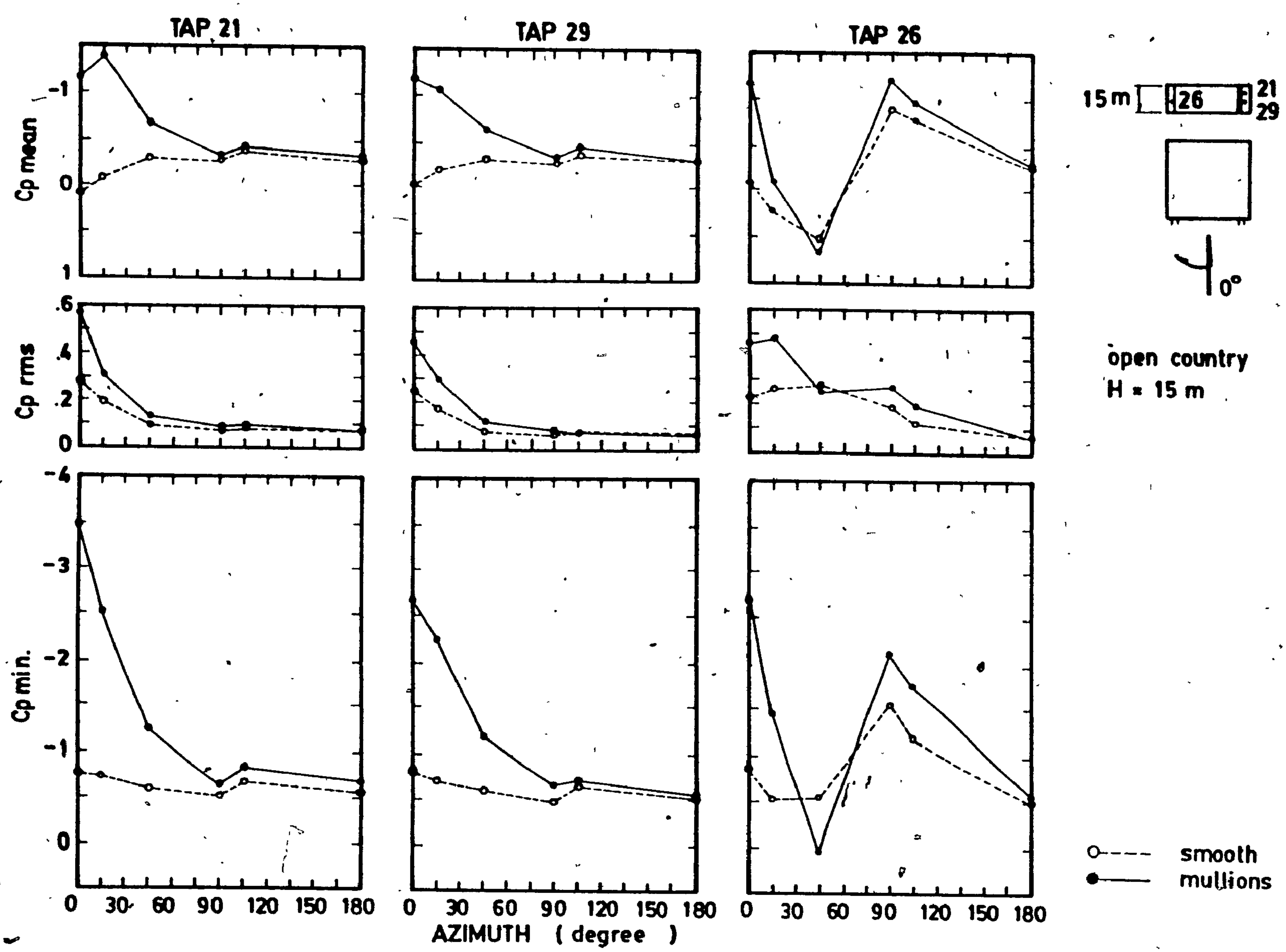


FIG. 5.28 EFFECTS OF 1 m MULLIONS ON PRESSURES MEASURED ON LOW BUILDINGS (Cp REFERENCED TO ROOF HEIGHT)

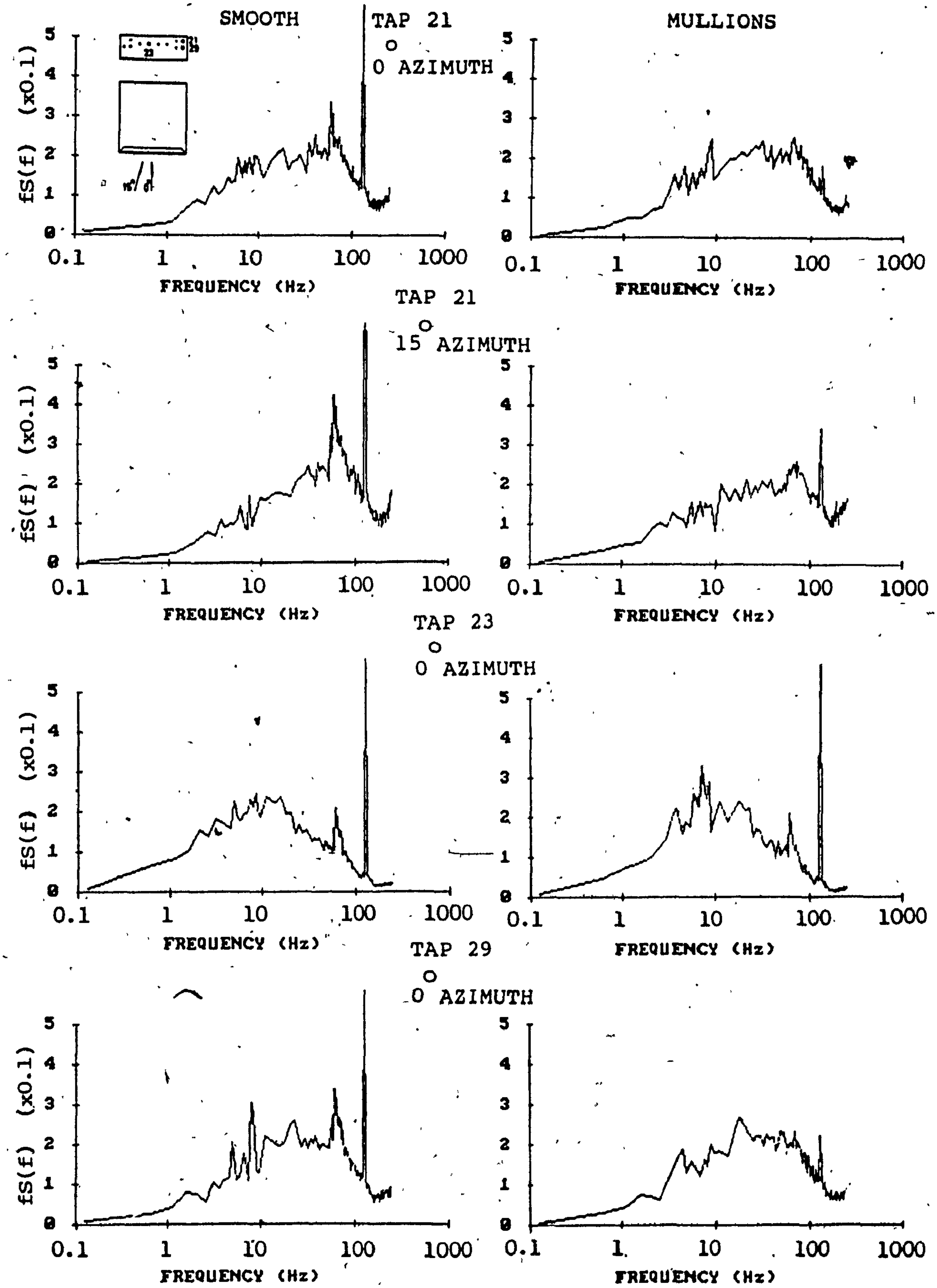


FIG. 5.29 POWER SPECTRAL DENSITIES OF PRESSURE FLUCTUATIONS ON TAPS 21, 23 AND 29, WITH & WITHOUT MULLIONS (H=15m) OPEN COUNTRY EXPOSURE

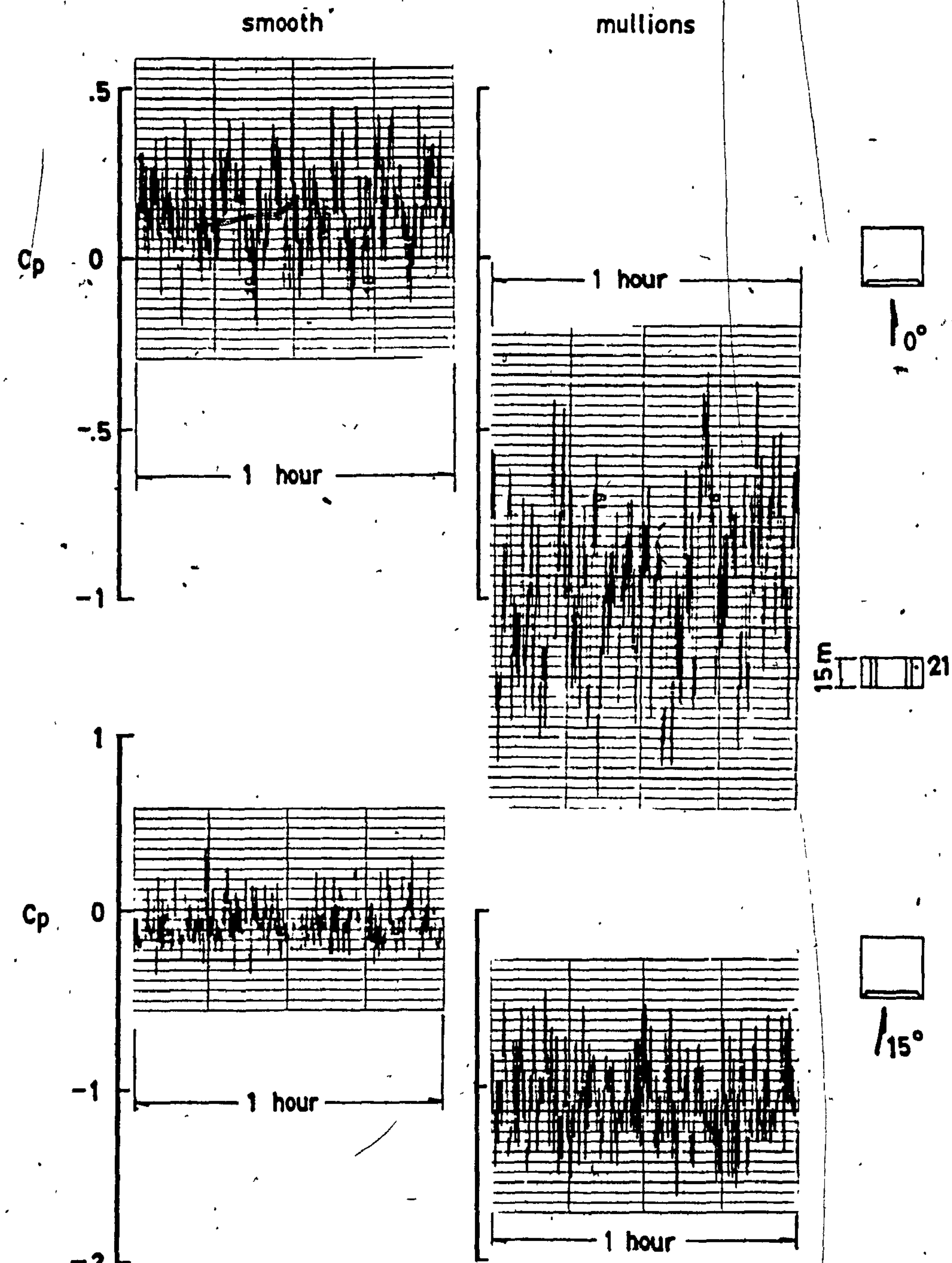


FIG. 5.30 PRESSURE TRACES ON TAP 21 WITH AND WITHOUT MULLIONS
OPEN COUNTRY EXPOSURE

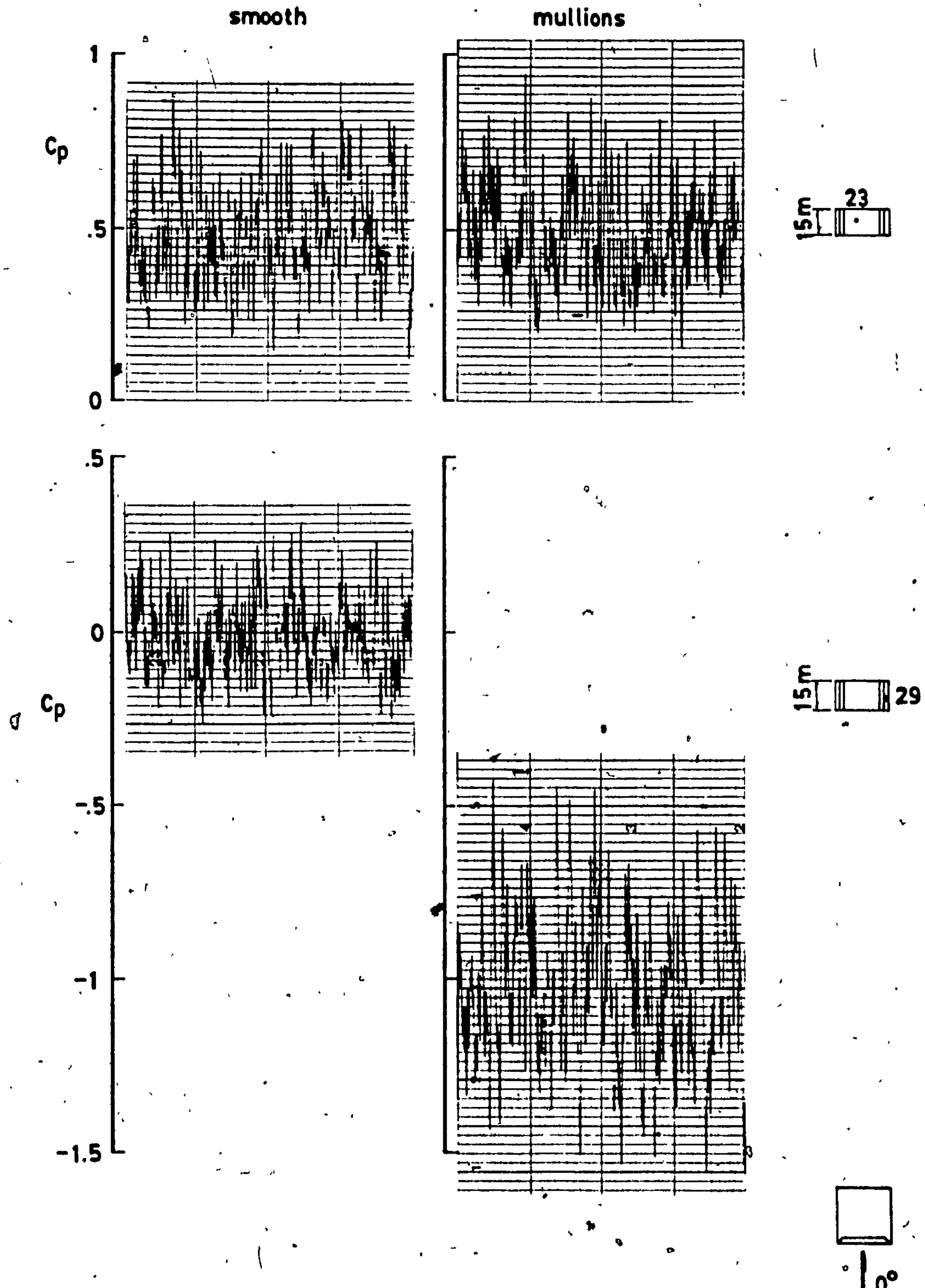


FIG. 5.31 PRESSURE TRACES ON TAPS 23 AND 29 WITH AND WITHOUT MULLIONS, OPEN COUNTRY EXPOSURE

5.30, pressure fluctuations on tap 21 for 0° azimuth are stronger than that of 15° azimuth. Figure 5.31 shows pressure traces for central tap 23 and edge tap 29 for 0° azimuth. For tap 29, more significant fluctuations are caused by the mullions near the edge, whereas for tap 23 there is no significant difference observed between the cases of smooth wall surface and that with mullions.

From the discussion it can be concluded that for the low building, even though the mullion depth was reduced to 1 m, a drastic increase in both Cp mean and Cp min was observed near the edges of the wall. In the case of uniform mullions on the 120 m high building, the worst Cp min was -2.97 or -3.56 if using the roof reference pressure (-2.97X1.20=-3.56). This is almost equivalent to that obtained from the low rise building, i.e. -3.46. Therefore, building height and the depth of the mullions do not appear to be significant factors for the adverse flow conditions caused by the existence of the mullions near the edge.

5.6 The Effect of Appurtenances in Urban Exposure

For the 120 m high building, mullions cause a great increase in Cp mean, Cp min and Cp rms, while uniform roughness shows a very small effect in urban exposure. For the 15 m-high building, there was no pronounced effect, except for 90° azimuth, at which the cases with uniform roughness and 4 m balconies show a decrease in Cp min.

From Figure 5.32 it can be seen that, in the urban exposure at the lower part of the wall edge, Cp min in the mullion case was increased by 108%, from -2.83 to -5.90, Cp mean was increased by 65%, from -1.03 to -1.70 and Cp rms was increased by as high as 128%, from 0.29 to 0.66. The urban exposure made the flow more turbulent and, as a result, high pressure occurred at the edge area when mullions were present. Figure 5.33 shows the effects of 30 cm roughness and 4 m balconies for the 15 m high building in urban exposure. Some differences are observed but they are not as large as those in the mullion case.

It can thus be concluded that urban exposure conditions make the flow pattern at the edge of the wall with mullions more adverse than in the open country exposure. However, the urban exposure does not affect the wind-induced pressures at the edge of the wall very much when the roughness is in the form of balconies or uniform roughness.

5.7 The Effect of Appurtenances on Drag Forces

Figure 5.34 illustrates the effects of appurtenances on the mean drag force on a building. The drag force, F, is calculated by the following equations:

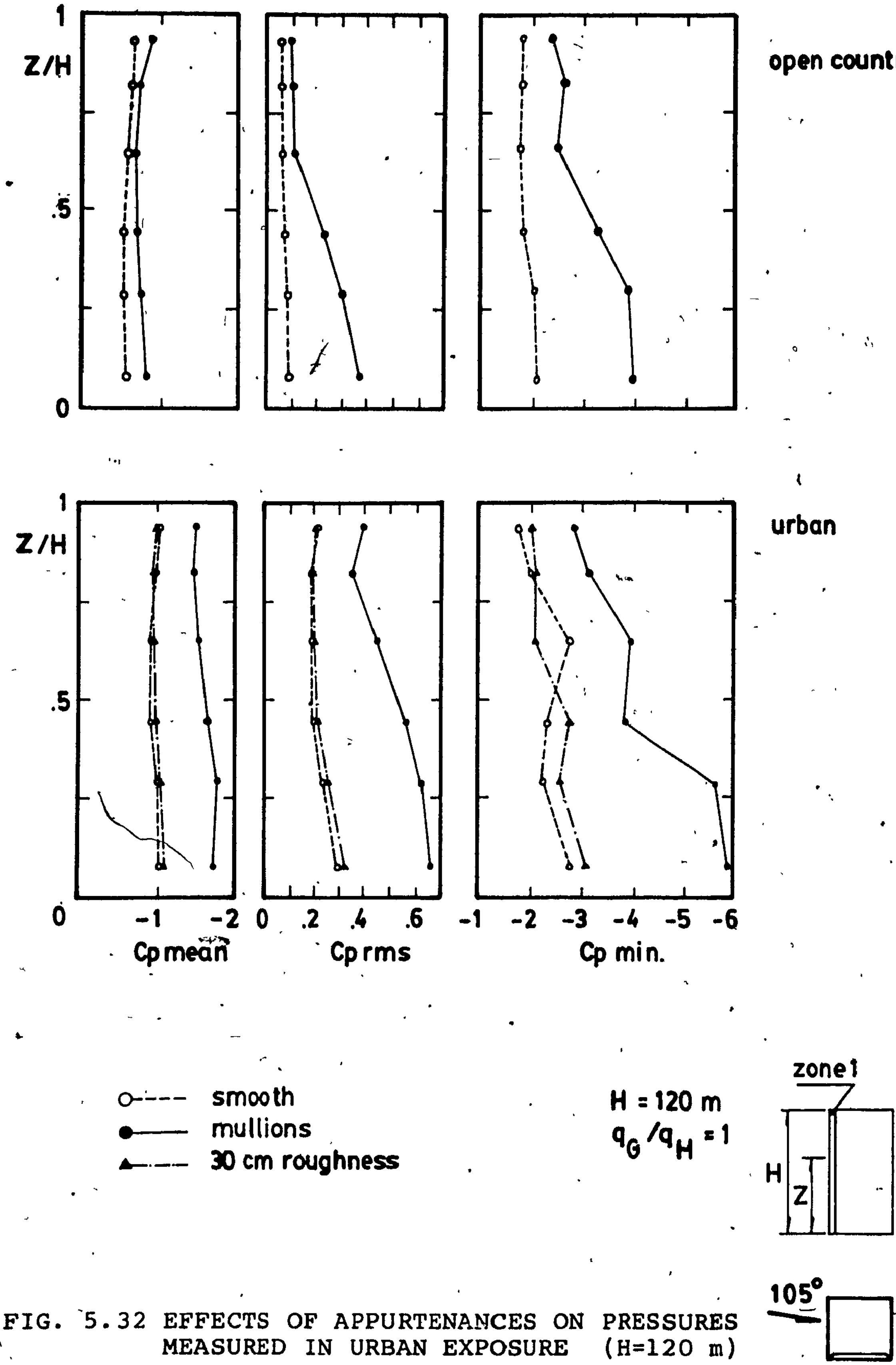


FIG. 5.32 EFFECTS OF APPURTENANCES ON PRESSURES MEASURED IN URBAN EXPOSURE (H=120 m)

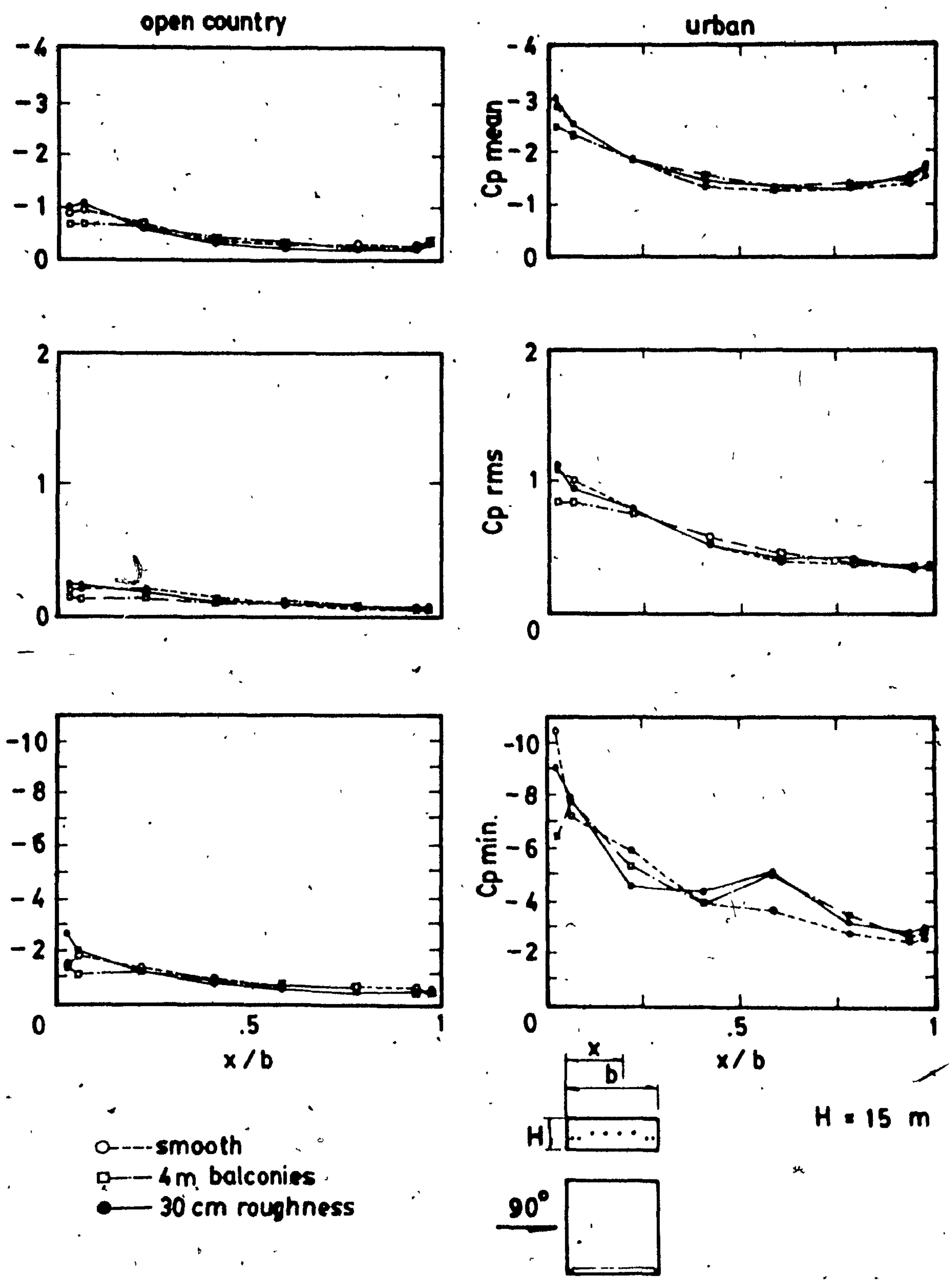


FIG. 5.33 EFFECTS OF APPURTENANCES ON PRESSURES MEASURED IN URBAN EXPOSURE (H=15 m)

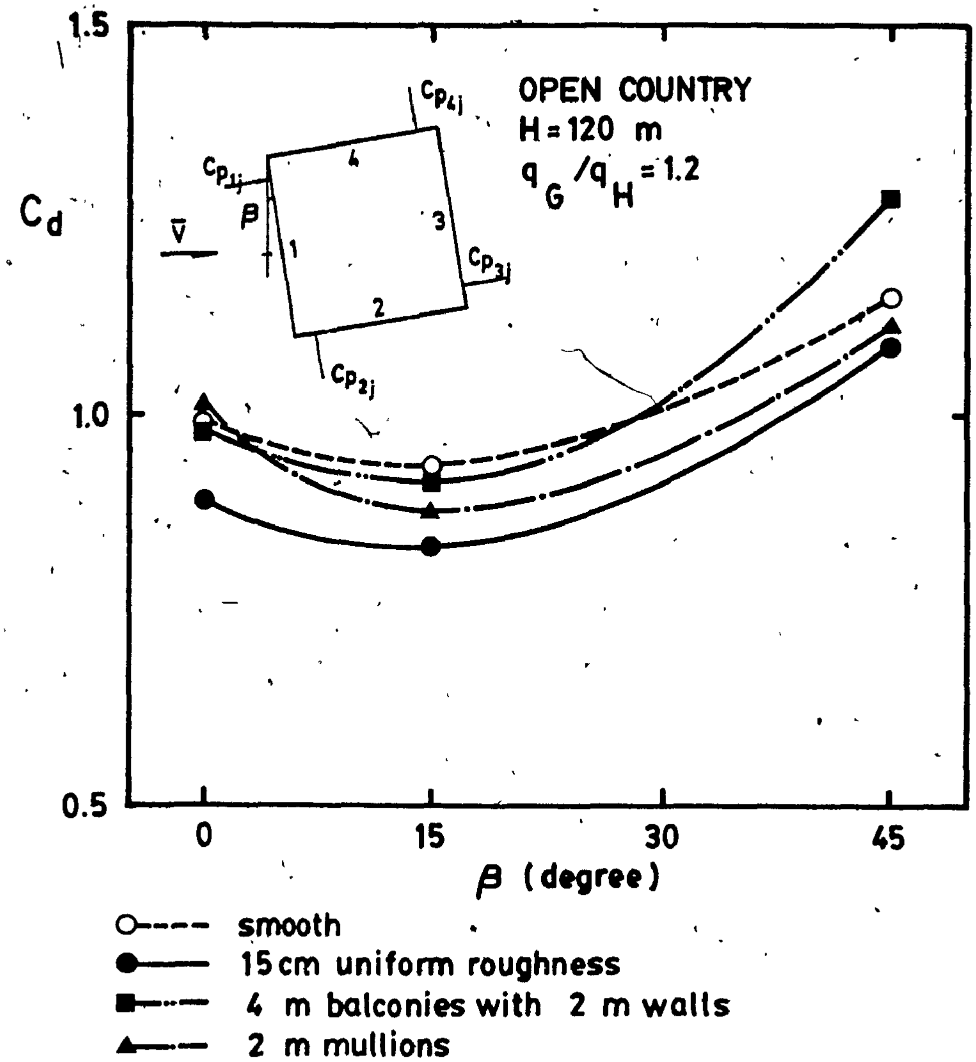


FIG. 5.34 EFFECTS OF APPURTENANCES ON THE MEAN DRAG FORCE

$$F = Cd * q * A$$

where: Cd = drag coefficient

q = dynamic velocity pressure

A = frontal wall surface

The drag coefficient, Cd, has been calculated as follows:

$$Cd = \sum_{j=1}^{8} \left[(Cp_{1j} - Cp_{3j}) * \cos\beta + (Cp_{4j} - Cp_{2j}) * \sin\beta \right] * \frac{A_j}{A}$$

where: A_j = the area of zone j, (see Fig. 4.2)

Cp_{ij} = the average Cp mean of zone j at side i

It can be seen from the figure that from 0^o to 45^o azimuth, the total drag force generally decreases slightly for the various types of appurtenances. A small increase is noticed for the case of balconies with walls at the 45^o azimuth. The case of 15 cm uniform roughness shows the most pronounced decrease especially at 0^o azimuth. It should be noted, however, that drag force coefficients are necessary only for the design of main structural systems and not of cladding elements.

CHAPTER 6 RECOMMENDATIONS FOR WIND STANDARDS AND WIND TUNNEL MODELLING

For the purpose of cladding and glass design, the most critical (worst) values obtained from the tests are presented in this section and a comparison is made between these values and those stipulated in the National Building Code of Canada (NBCC 1985).

6.1 Building Code Approach

Section 4.1.8.1.(1) of the NBCC (1985) gives the formula for calculating the specified external pressure or suction due to wind on part or all of the surface of a building:

$$p = q*Ce*Cg*Cp$$

where: p = the specified external pressure acting statically and in a direction normal to the surface either as a pressure directed towards the surface or as a suction directed away from the surface;

q = the reference velocity pressure;

Ce = the exposure factor;

Cg = the gust effect factor;

Cp = the external pressure coefficient averaged over the area of the surface considered.

Cg:

For Cladding or Windows: Cg = 2.5

Cp: as illustrated in Figures 6.1 and 6.2 for tall buildings and Figure 6.3 for low building.

It should be noted that for low buildings, since the highest wind and the worst wind azimuth as well as the worst building location are unlikely to occur at the same time, the values stipulated in NBCC are only 80% of the original values.

Therefore, when comparison is made, a factor of 1.25 should be multiplied to the NBCC values.

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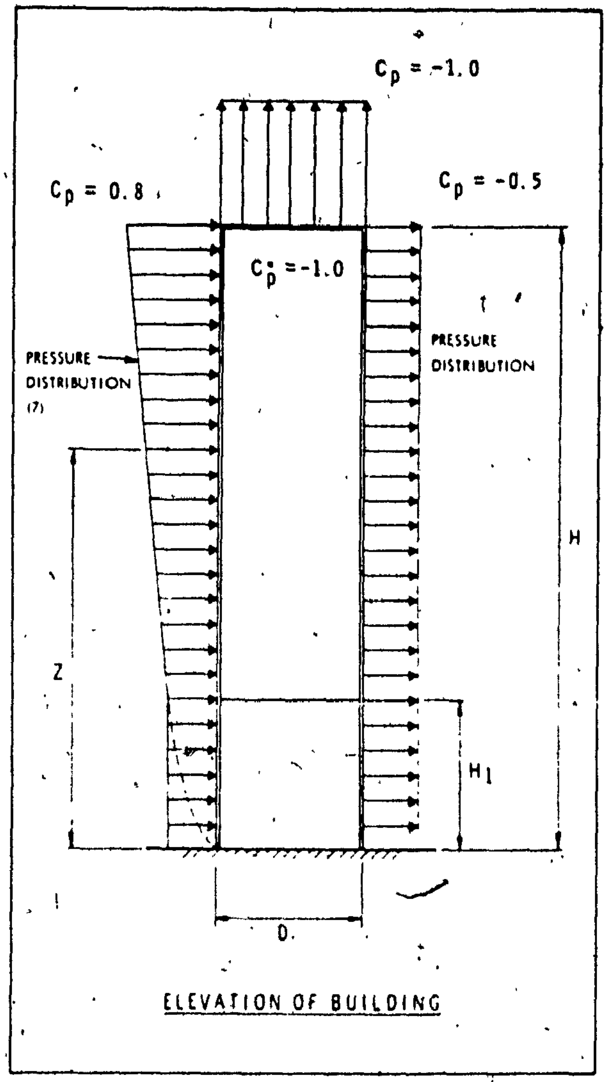


BR 4314-4

Flat roof buildings greater in height than in width

Notes to Figure

(1) Wind perpendicular to one wall for width use the dimension perpendicular to the wind direction

(2) Wind at an angle to the wall this condition produces high local suctions on the wall which is at a slight angle to the wind The coefficient C_p^* may occur anywhere over the wall area but need not be considered in conjunction with the C_p for over all loading The coefficients C_p^* for the roof are given in Figure B 11

(3) End walls pressure coefficients for end walls (parallel to wind direction) are given in Figure B 11

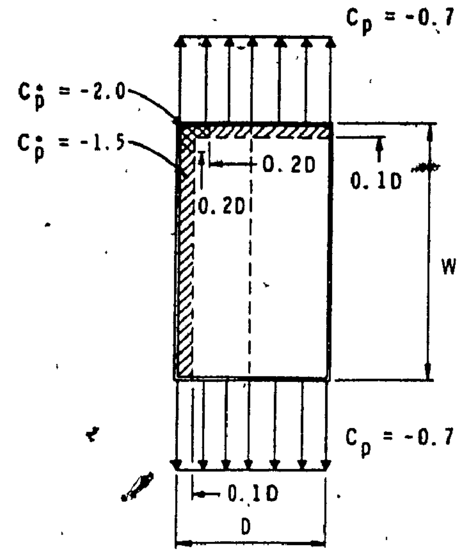
(4) Interior pressure coefficients C_{pi} for interior pressures are given in Figure B 11

(5) Reference height for exposure factor for the calculation of both spatially averaged and local pressures, use ½ H for the leeward walls H for the roof and side walls and the actual height Z to the level under consideration for the windward wall

(6) Height H_1 the height to which C_e is constant is 10 m for the simplified method and exposure A 12 7 m for exposure B and 30 m for exposure C

(7) Windward Wall C_p the pressure coefficient is 0 8 for the entire height The variation shown in the pressure distribution shown is due to variation in exposure factor C_e

FIG. 6.1 PRESSURE COEFFICIENTS ON WINDWARD AND LEEWARD WALLS OF TALL BUILDINGS AFTER NBCC (1985)



PLAN VIEW OF BUILDING

INTERIOR PRESSURES	C_{pi}
1. Openings mainly in windward wall.	+0.7
2. Openings mainly in leeward wall.	-0.5
3. Openings mainly in walls parallel to wind direction.	-0.7
4. Openings uniformly distributed in all 4 walls.	-0.3

BR 4314-6

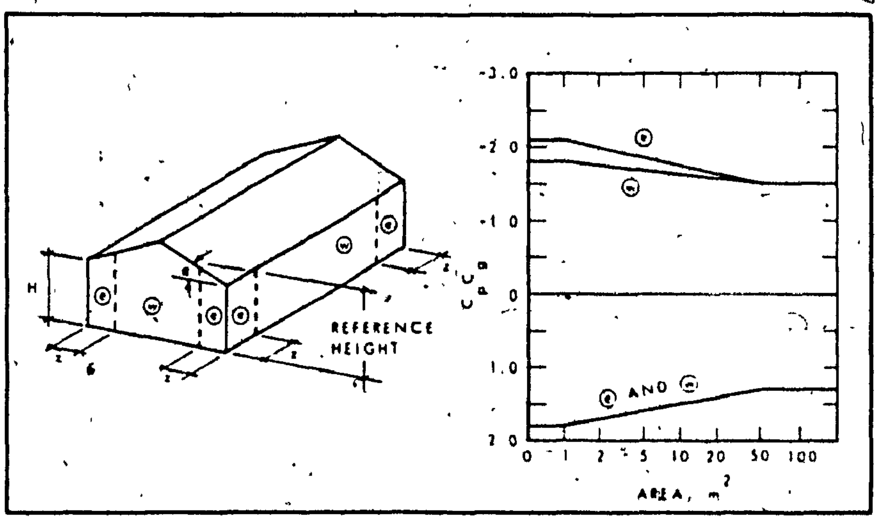
Notes to Figure

(1) Local maximum suctions: the coefficients C_p^* for the roof surface occur for wind at an angle to one corner, and are used in the design of the roofing itself and its anchorage to the structure. C_p^* are not to be added to the C_p for determining total uplift on the roof

(2) End walls: the end walls are the ones parallel to the wind direction and have a uniform pressure distribution over the whole building height, except for local maximum suction as indicated in Figure B-10

(3) Reference height for exposure factor for the calculation of external pressures on end walls use H, the total height of the building. For the calculation of internal pressures, use ½ H unless there are dominant openings in the windward wall, in which case use Z, the height to the highest such opening

FIG. 6.2 PRESSURE COEFFICIENTS ON SIDE WALLS OF TALL BUILDINGS AFTER NBCC (1985)



BR 5911-19

External peak pressure coefficients, C_pC_g, on individual walls and for the design of cladding and secondary structural members

Notes to Figure

(1) These coefficients apply for any roof slope α

(2) The abscissa area in the graph is the design tributary area within the specified zone

(3) z = 10 per cent of least horizontal dimension or 40 per cent of height, H, whichever is less. Also z ≥ 1 m, z ≥ 4 per cent of least horizontal dimension

(4) Interior pressure coefficients C_{pi} are given in Figure B 11

(5) The eave height may be substituted for the reference height (mean height) if the angle of the roof is less than 10°

FIG. 6.3 PRESSURE COEFFICIENTS ON WALLS OF LOW RISE BUILDINGS AFTER NBCC (1985)

BUILDING		Cg	PRESSURES		SUCTIONS	
			Cp	Cg*Cp	Cp	Cg*Cp
TALL BUILDING		2.5	+0.8	+2.0	-1.0	-2.5
LOW BUILDING	EDGE AREA			+1.8		-2.1
	WALL AREA			+1.8		-1.8

TABLE 6.1 THE MOST CRITICAL NBCC VALUES FOR BUILDING WALL

6.2 The Most Critical Values for the Cases with and without Appurtenances

Figures 6.4 to 6.12 illustrate the most critical values of mean and instantaneous peak pressure coefficients registered for all azimuths. The results for the cases of uniform roughness and balconies for 120 m high buildings are presented in Figures 6.4, 6.5 and 6.6. The results for the cases of uniformly distributed mullions and mullions with changed corner geometries for 120 m high buildings are shown in Figures 6.7, 6.8 and 6.9. The results for the cases of appurtenances for 15 cm high building are illustrated in Figures 6.10, 6.11 and 6.12. The worst values were selected from all the coefficients recorded from 0^{o} to 180^{o} azimuth for each zone. All the values shown in these figures are referenced to the dynamic pressures at roof height.

It can be seen that for Cp max, all critical values observed from the 120 m high buildings are less than the value stipulated in NBCC and in most zones the values from cases of appurtenances are higher than those from smooth case, as indicated in Figures 6.4 and 6.7. For Cp min, the worst value of the cases of the 120 m high building with uniform roughness and balconies is only 18% higher than that stipulated in NBCC for edge zone and in most zones, the values for the cases of appurtenances are smaller than those for smooth case, as indicated in Figure 6.5. However, the

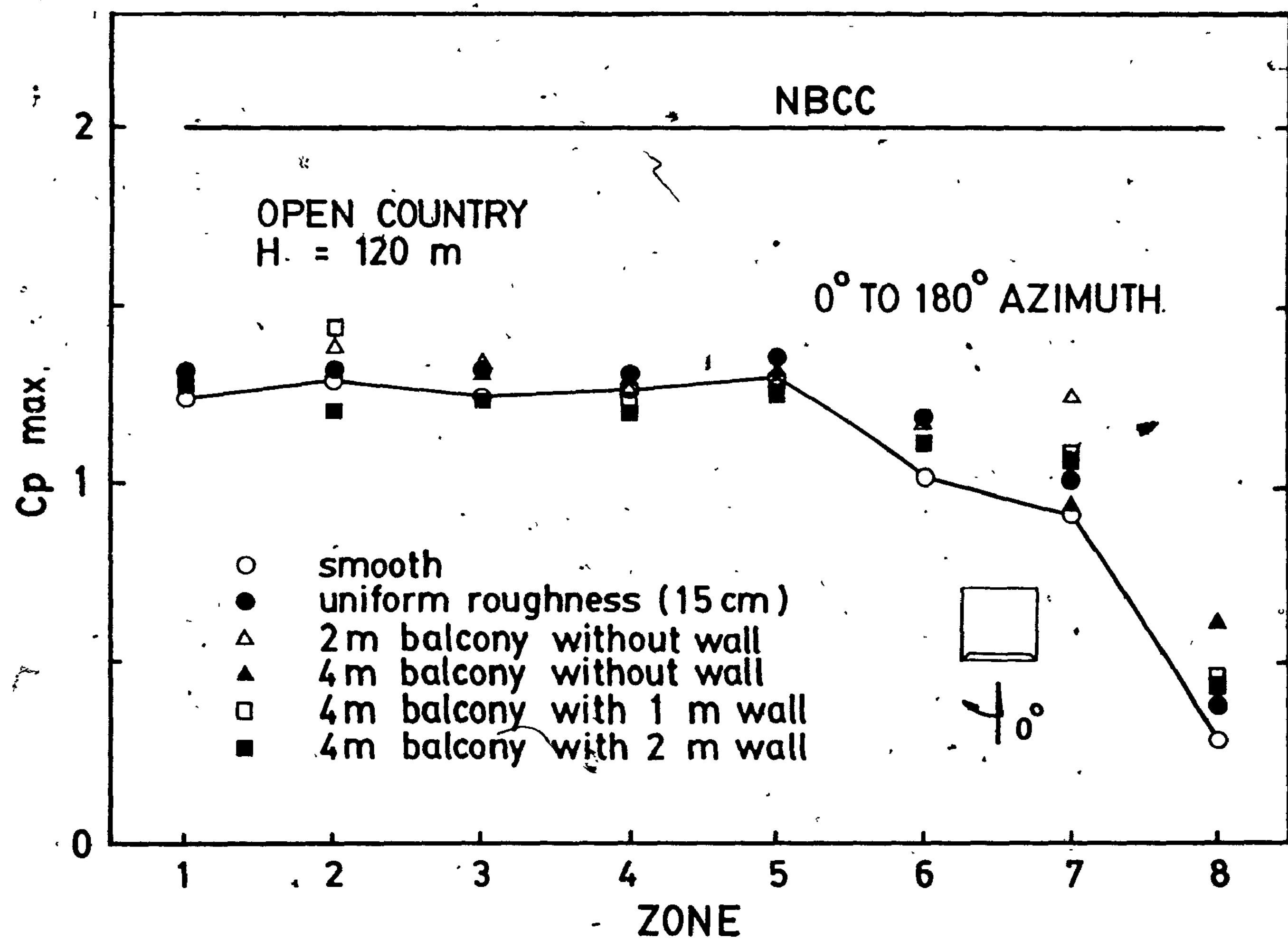


FIG. 6.4 THE WORST VALUES FOR THE CASES OF BALCONIES AND UNIFORM ROUGHNESS, Cp MAX

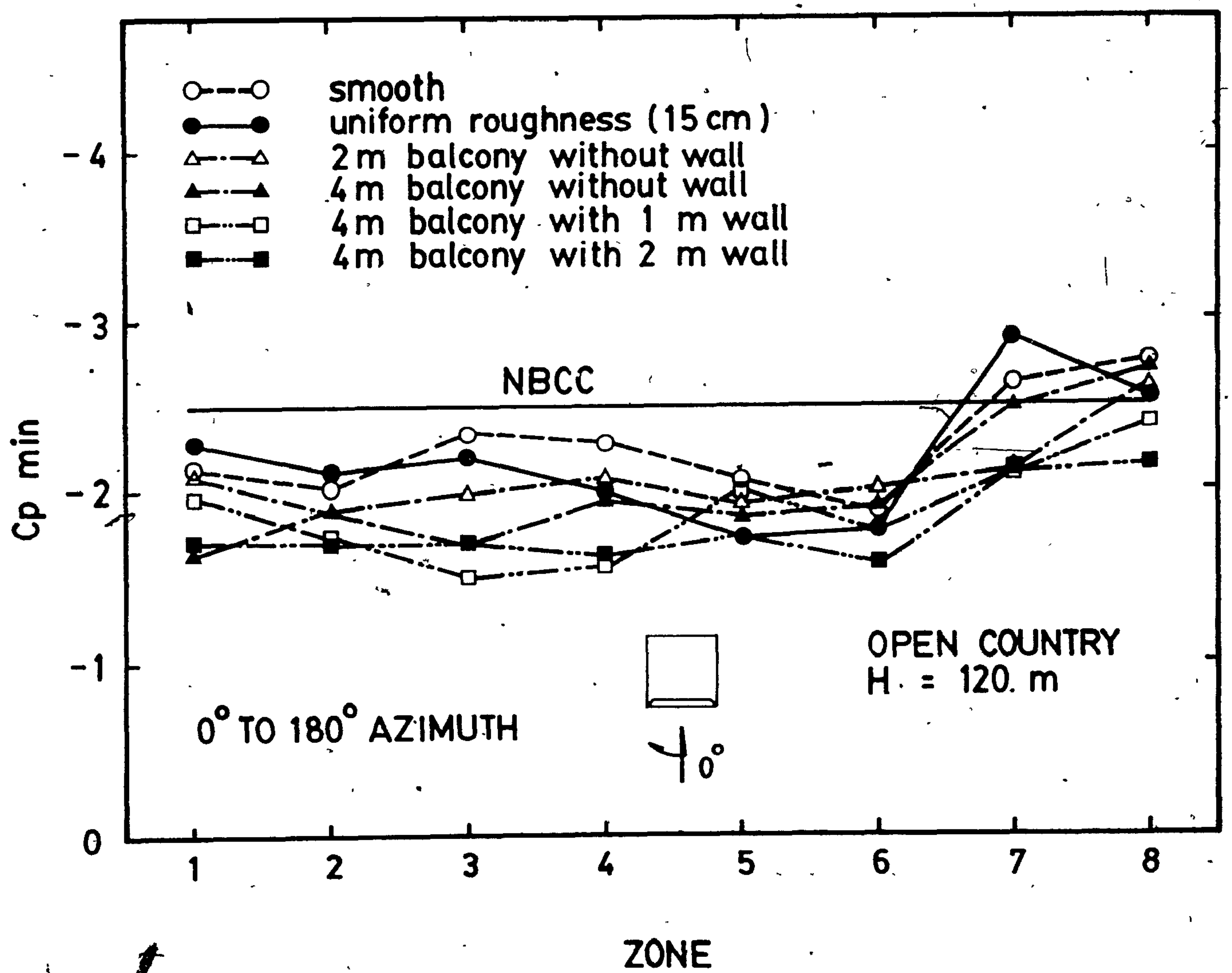


FIG. 6.5 THE WORST VALUES FOR THE CASES OF BALCONIES AND UNIFORM ROUGHNESS, Cp MIN

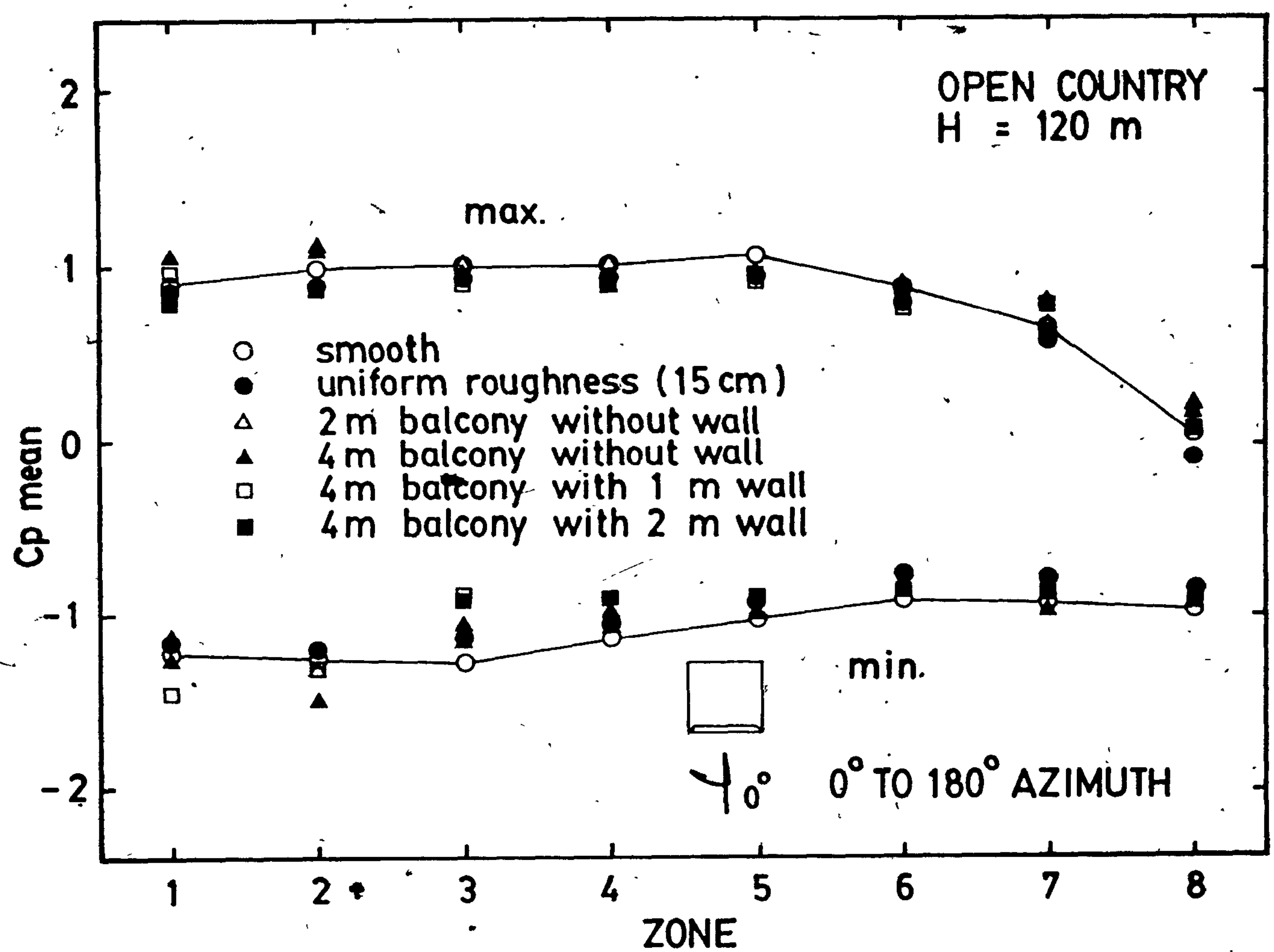


FIG. 6.6 THE WORST VALUES FOR THE CASES OF BALCONIES AND UNIFORM ROUGHNESS, Cp MEAN

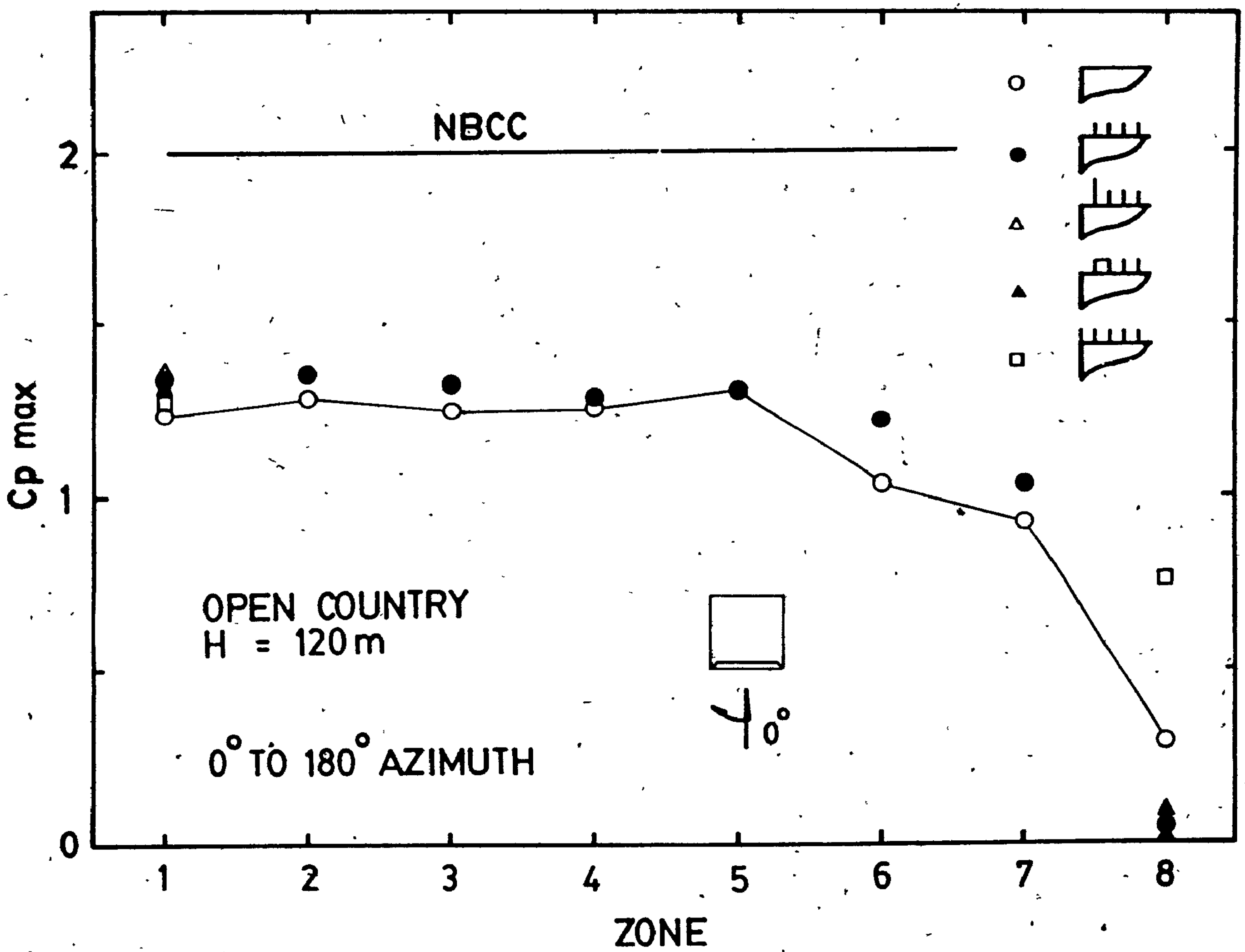


FIG. 6.7 THE WORST VALUES FOR THE CASE OF MULLIONS, Cp MAX

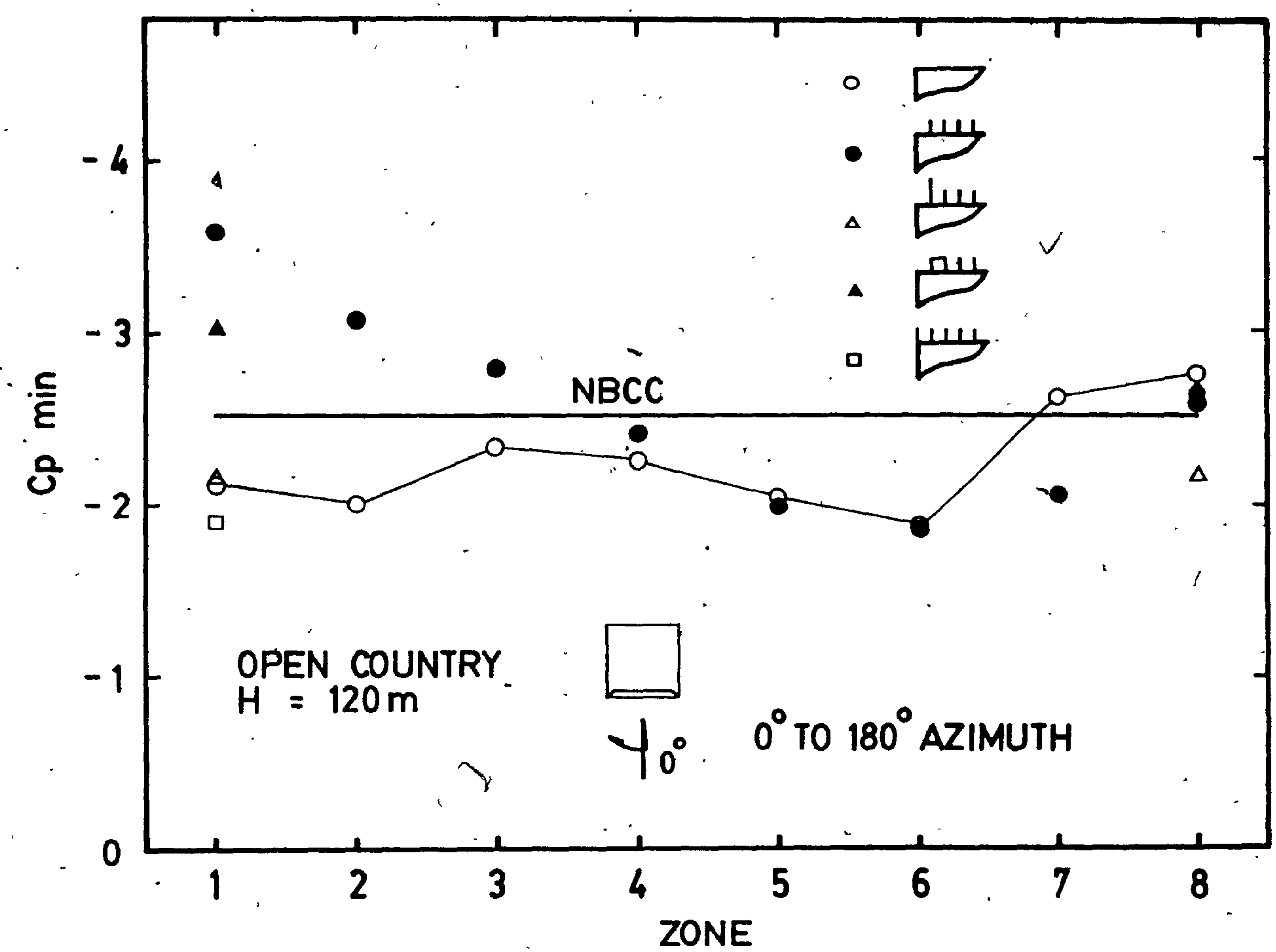


FIG. 6.8 THE WORST VALUES FOR THE CASE OF MULLIONS, Cp MIN

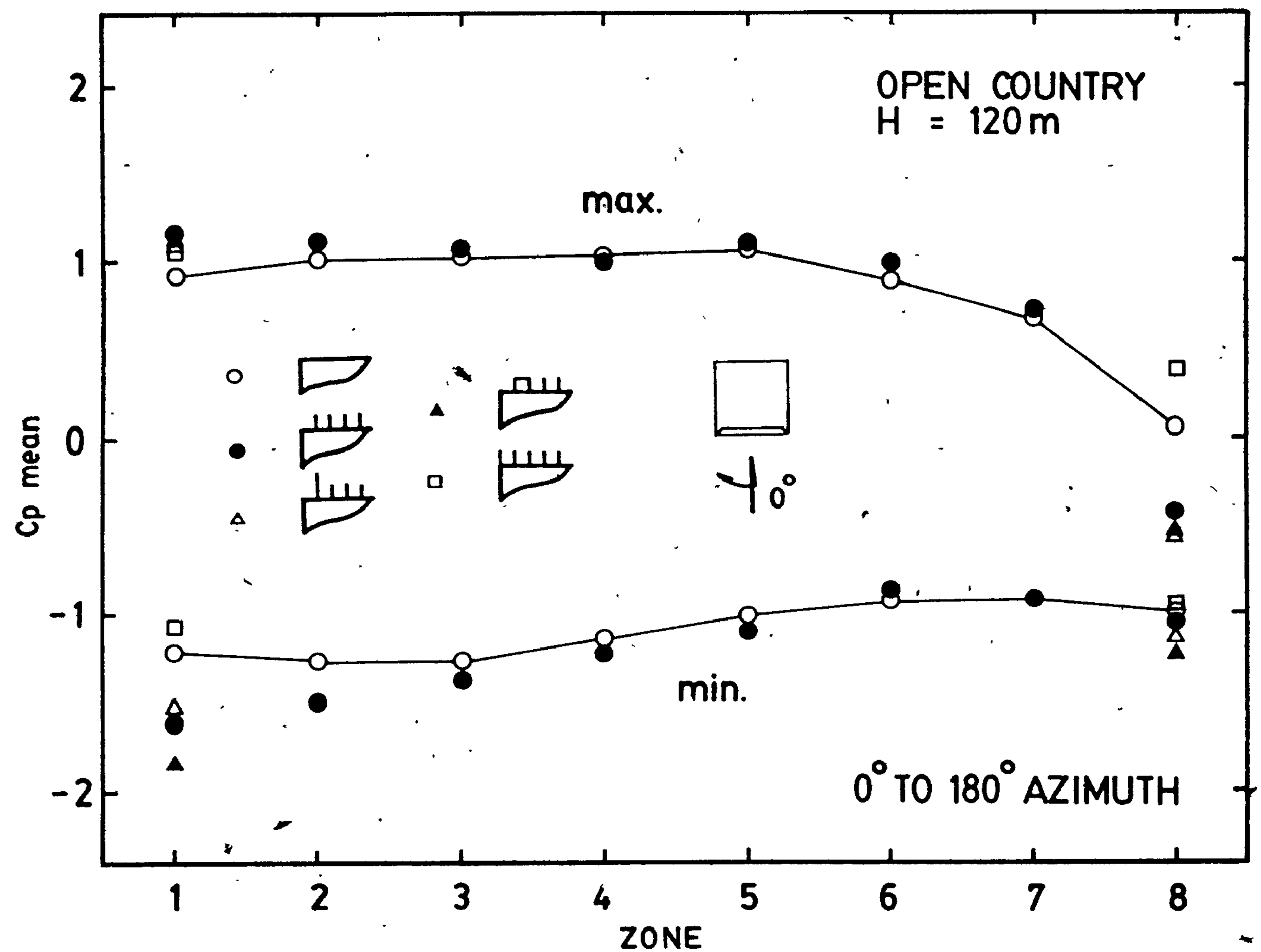


FIG. 6.9 THE WORST VALUES FOR THE CASE OF MULLIONS, Cp MEAN

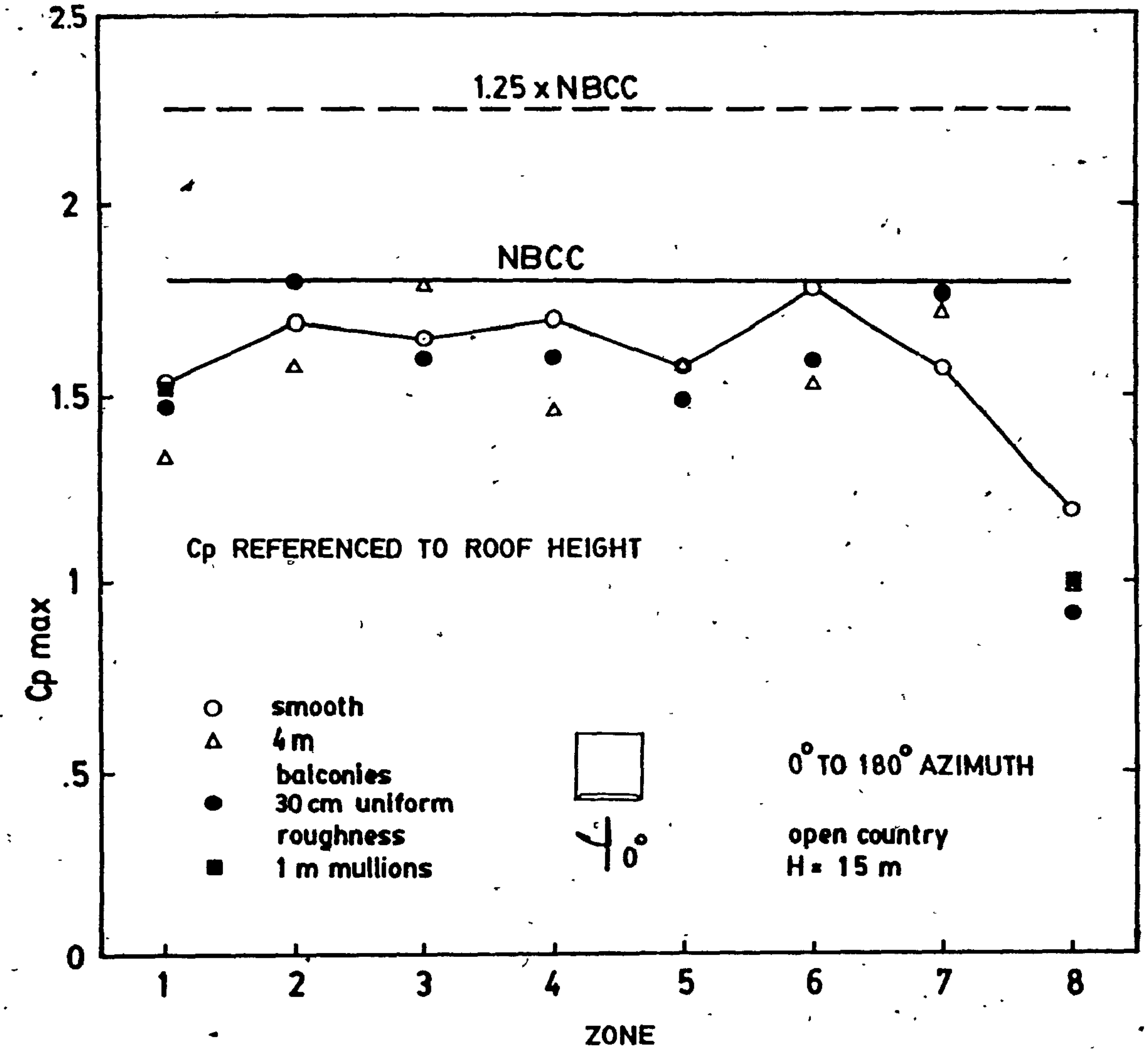


FIG. 6.10 THE WORST VALUES FOR THE LOW BUILDING WITH AND WITHOUT APPURTENANCES, Cp MAX

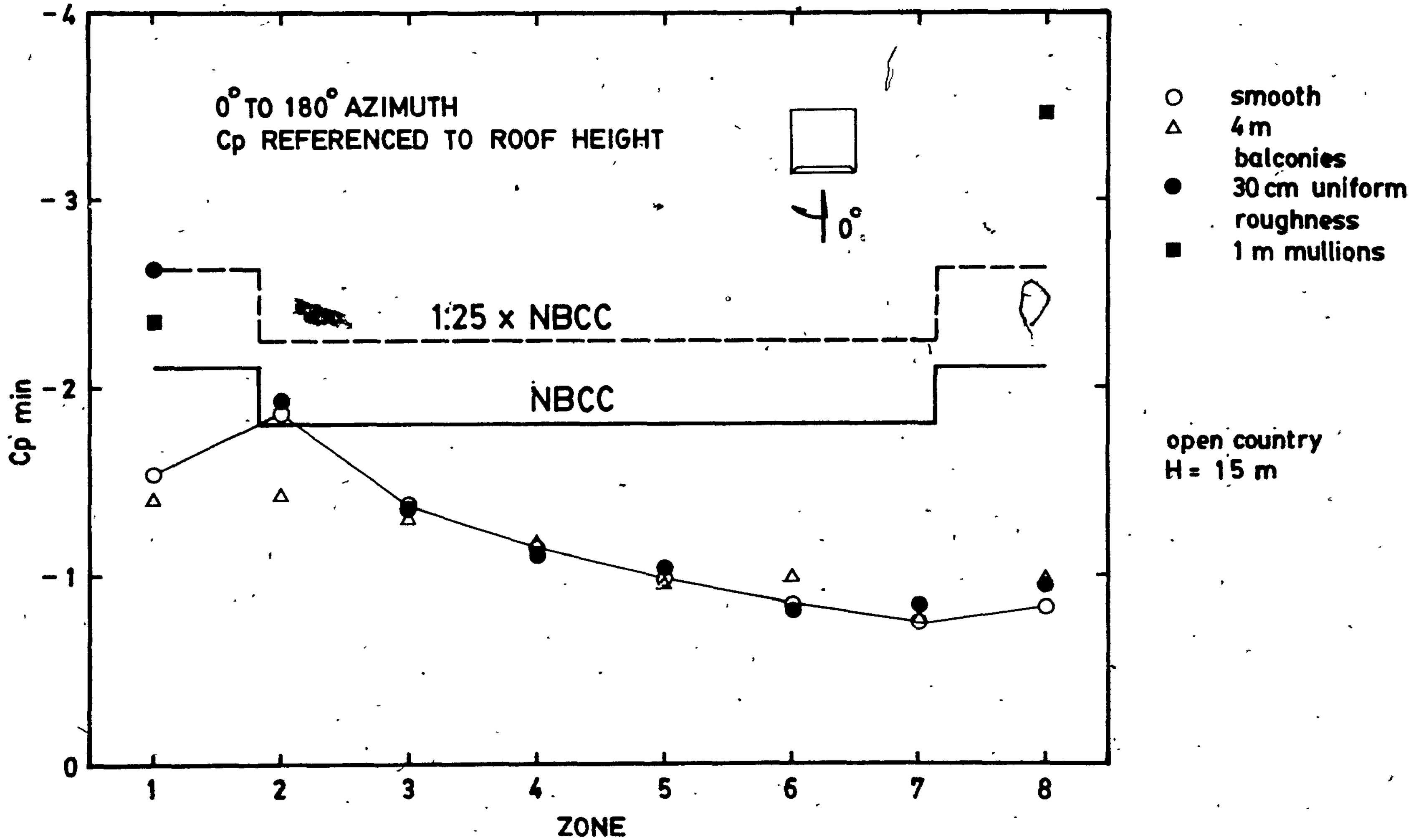


FIG. 6.11 THE WORST VALUES FOR THE LOW BUILDING WITH AND WITHOUT APPURTENANCES, Cp MIN

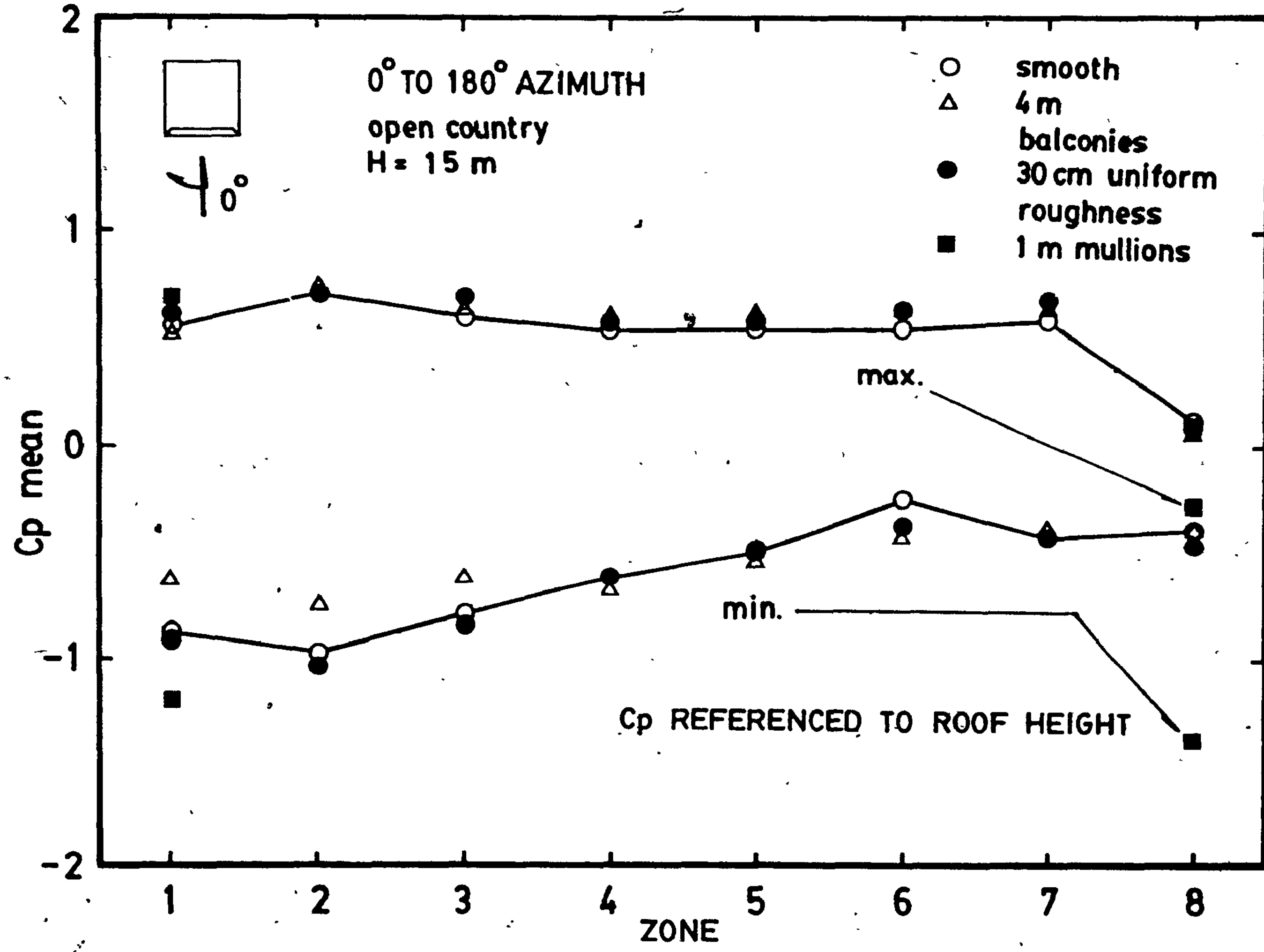


FIG. 6.12 THE WORST VALUES FOR THE LOW BUILDING WITH AND WITHOUT APPURTENANCES, Cp MEAN

worst Cp min value for the tall building with mullions is 45% Cigher than that stipulated by NBCC and in most zones the values for mullion cases are higher than those for smooth case, as shown in Figure 6.8.

For the case of the low building, the worst Cp max value is equal to that stipulated in NBCC as indicated in Figure 6.10, and the worst Cp min value is 30% higher than that stipulated in NBCC (considering the reduction factor of 0.8, the value of 1.25*NBCC is used for comparison), as indicated in Figure 6.11.

The most critical values of Cp mean (both maximum and minimum) are presented in Figures 6.6, 6.9 and 6.12. For high rise buildings, the difference of Cp mean values between the smooth surface case on one hand and for the cases of balconies and uniform roughness on the other is less than 20%, as indicated in Figure 6.6. The difference of Cp mean values for the case of mullions is up to 50%, as indicated in Figure 6.9. The difference of Cp mean values for low buildings is much higher, as indicated in Figure 6.12.

The most critical Cp min values for each case are presented in Table 6.2 and Table 6.3 respectively.

ALL VALUES REFERENCED TO ROOF HEIGHT

CASE	Cp min 15 m	Cp min 120 m
SMOOTH	-1.85	-2.78
UNIFORM ROUGHNESS, 15 cm		-2.94
UNIFORM ROUGHNESS, 30 cm	-2.65	
2 m MULLIONS (ALL CASES)		-3.56
1 m MULLIONS	-3.45	
2 m BALCONIES		-2.68
4 m BALCONIES	-1.40	-2.76
4 m BALCONIES WITH 1 m WALLS		-2.40
4 m BALCONIES WITH 2 m WALLS		-2.14

Table 6.2 The Most Critical Cp min Values for Different Cases of Appurtenances

ALL VALUES REFERENCED TO ROOF HEIGHT

CASE	Cp max 15 m	Cp max 120 m
SMOOTH	1.78	1.30
UNIFORM ROUGHNESS, 15 cm		1.36
UNIFORM ROUGHNESS, 30 cm	1.80	
2 m MULLIONS (ALL CASES)		1.35
1 m MULLIONS	1.52	
2 m BALCONIES		1.38
4 m BALCONIES	1.78	1.31
4 m BALCONIES WITH 1 m WALLS		1.43
4 m BALCONIES WITH 2 m WALLS		1.28

Table 6.3 The Most Critical Cp max Values for Different Cases of Appurtenances

6.3 Recommendations.

Based on the results of the study, recommendations can be made for building glass and cladding design and for requirements of wind tunnel modelling.

For Building Glass and Cladding Design:

1. For both tall and low buildings, the maximum positive Cp*Cg values for all of appurtenances obtained from this study are somewhat larger than those for the smooth cases. They are, however, significantly smaller than the values stipulated by NBCC. Therefore, the current NBCC maximum Cp*Cg values may be applicable for buildings with appurtenances.

2. If balconies or uniform roughness are present, a Cp*Cg of -3.00 is recommended for high buildings for cladding and glass design for the edge area (b/5 from the corner of the building). This value (-3.00) is 20% higher than the value (-2.50) stipulated by NBCC (1985).

3. If mullions are present, a Cp*Cg of -3.50 is recommended for the edge area (b/5 from the corner of the building) for tall buildings, for cladding and glass design. This value (-3.50) for 120 m building is 40% higher than the value (-2.50) stipulated by NBCC (1985). A Cp*Cg of -2.80 is recommended for edge

area (b/5 from the corner of the building) for low buildings, if mullions are present. This value (-3.5*0.8=-2.80) for 15 m high building is 35% higher than the value (-2.10) stipulated by NBCC (1985). The recommended value may be relaxed for the intermediate part of the building surface and for the case that the depth of the mullion is less than 20 cm (Templin and Cermak, 1976). Wind tunnel tests, however, are highly recommended for buildings with mullions in order to determine more reliable wind loading for their surfaces.

4. For the building with mullions or vertical ribs, edge mullions or vertical ribs (Case 3, as defined in section 5.4.2) are highly recommended to be structured because the effective protection they provide to the edge area of buildings.

For Wind Tunnel Modelling:

1. In wind tunnel test modeling, surface uniform roughness up to about 30 cm may be omitted if the purpose of test is concerning to cladding or glass load rather than to others. By omitting the simulation of these small details, the errors involved are not expected to exceed 20% for the worst values of pressure coefficients measured;

2. In wind tunnel test modeling, balconies with width up to 4 m with or without walls may be omitted if the purpose of the test is concerning to cladding or glass load rather than to others. The errors involved are less than 30% for the worst values;

3. In wind tunnel test modeling, mullions or vertical ribs should not be omitted since the existence of these vertical structures have large effects on wind loads at wall edge area, even in the case that the depth of the mullion is small (less than 60 cm). Therefore mullions on test models should be present when the building to be modeled has mullions.

CHAPTER 7 CONCLUSIONS AND RECOMMENDATIONS FOR FURTHER WORK

7.1 Conclusions

The experimental findings of this study allow several conclusions to be made concerning the wind pressures on buildings with appurtenances:

1. Uniform roughness with a thickness up to 30 cm makes both positive and negative pressures decrease (less than 0.5 for Cp min, and less than 0.3 for Cp mean) in most areas of the building surface. Exception is the wall edge area, where the negative pressure appears to increase at 0° azimuth. Therefore, uniform roughness generally provides building cladding with some protection.

2. Balconies with a width up to 4 m without walls reduce slightly Cp peak and Cp mean in the intermediate part of a building surface while the existence of balconies does not affect the pressures at wall edges. The variation of width of balcony does not cause a pronounced difference on pressures in the range examined. For low buildings, the effect of balconies on the wind loads on the wall is small.

3. Balconies with walls up to 2 m reduce Cp mean and Cp

min in the intermediate area of the building surface, whereas for 0° azimuth positive pressures are expected in the edge. High walls have more pronounced effects in edge.

4. Mullions make flow adverse at the edges, and for tall buildings significant suction increases (more than 150%) have been registered for critical wind directions (105° azimuth). Different geometries of mullions in the corner area cannot release these high suctions on the wall edges, unless a mullion is attached at the edge as extension to the wall. For low buildings with 1 m mullions, significant suction increases have been registered for critical wind directions (0° azimuth). Therefore, care must be taken in building cladding or glass design when mullions or vertical ribs of any size are used.

5. In urban exposure, the same trends as those of open country are observed. Higher Cp values, however, are registered especially at the wall edge area.

6. It seems that no general law for scaling appurtenances can be formulated since there are too many parameters such as building geometry and wind direction which affect the formulation. It can be concluded from this study, however, that within an amplification factor of about 3 for appurtenances, no significant pressure difference is observed. In other words, the testing

results are not very sensitive to the change of appurtenances scaling factor within certain range.

7.2 Recommendations for Further Studies

Although the findings from the present study are of importance for both wind tunnel modeling and wind load specifications for building design, the work done in this project cannot answer all relevant questions.

Further work should be done for the case of smaller mullions, i.e. from 0.20 m to 1.00 m in depth and the emphasis should be on the wall edge area. The effect of appurtenances on roofs could help to answer the questions on wind tunnel modeling for the measurement of roof wind pressures. Statistical study on peak pressure distribution should also be carried out in order to answer the questions about the properties of pressure fluctuations measured on buildings with different appurtenances.

The additional work suggested indicates the next step needed to achieve a better understanding of the effects of appurtenances on the wind pressure distribution on buildings. Then better wind tunnel modeling can be achieved and in turn more reliable and economical measurements can be made to serve the purpose of building cladding and structural element design.

APPENDIX

This appendix consists of two parts, A and B. All the results provided in this appendix are measured in open country exposure for the 120 m high building.

Part A provides comparison of pressure coefficient curves measured on 120 m high buildings with smooth walls and with different appurtenances on walls for 0° to 180° azimuths (see Figs. A.1 to A.42). The appurtenances include 15 cm uniform roughness, 2 m and 4 m wide balconies, 4 m wide balconies with 1 m and 2 m high walls and 2 [illegible] uniformly distributed mullions. These curves are plotted for local (point) or averaged values for each zone of the building wall.

Part B consists of figures of comparison of mean and rms pressure coefficients measured at smooth walls and walls with appurtenances (15 cm uniform roughness or balconies-all configurations) in different format, as indicated in Figures B.1 to B.10. The pressure difference between smooth and rough case is represented by the sign (plus or minus) of difference. The number of differences as well as the location of the signs reflect the general trend of the pressure change. A threshold value with an absolute value of 0.04 is chosen for Cp mean and 0.01 for Cp rms. The meanings of these signs are shown as follows:

$$\Delta Cp = Cp\ (rough) - Cp\ (smooth)$$

For Cp mean:

"+": $\Delta Cp > +0.04$

"-": $\Delta Cp < -0.04$

"0": $|\Delta Cp| \leqslant 0.04$

For Cp rms:

"+": $\Delta Cp > +0.01$

"-": $\Delta Cp < -0.01$

"0": $|\Delta Cp| \leqslant 0.01$

Figure B.11 shows the distribution of the pressure differences. Tables B.1, B.2 and Figure B.12 illustrate the number of differences versus azimuth.

PART A

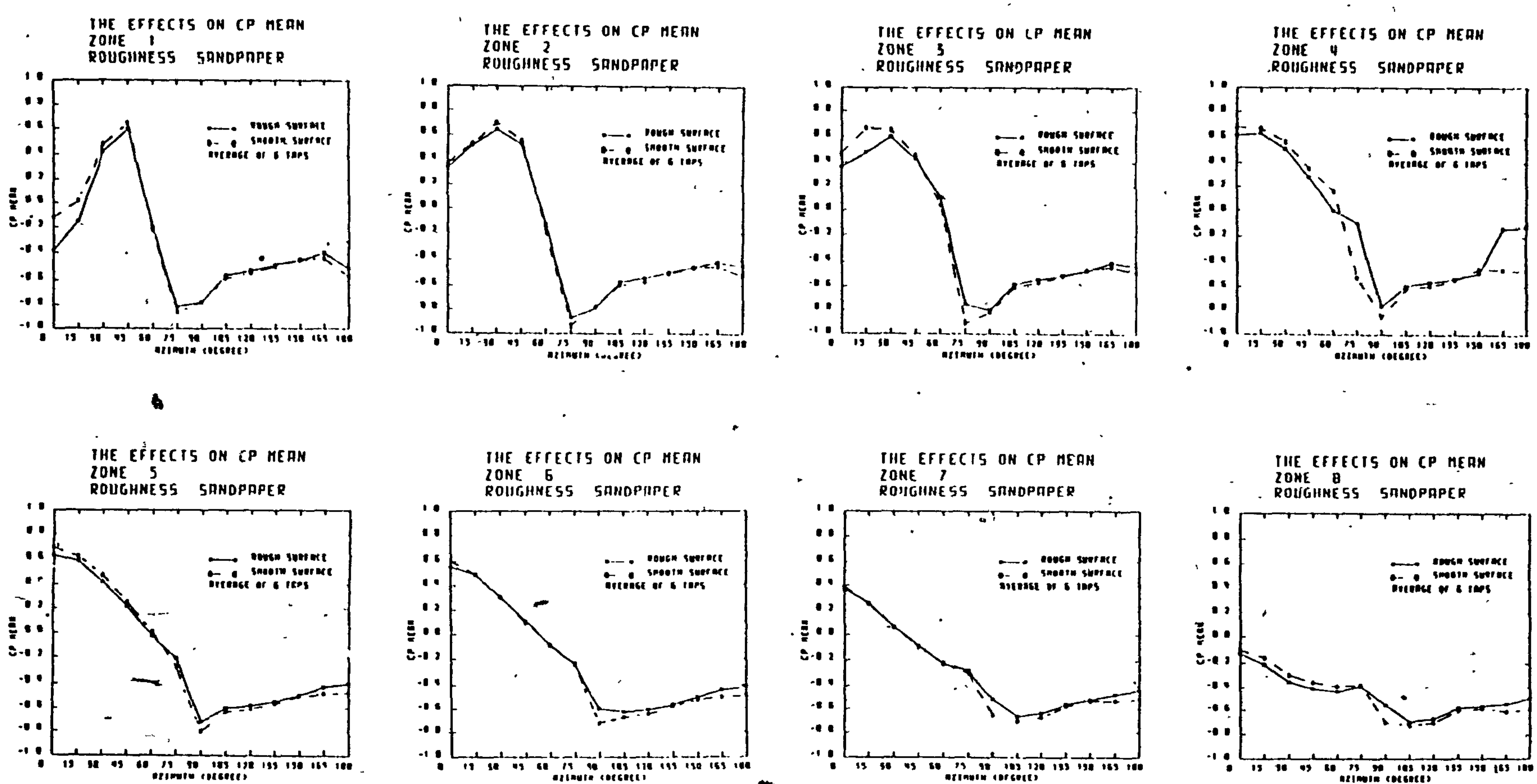


FIG. A.1 EFFECT OF 15 cm ROUGHNESS ON Cp MEAN (ZONE-AVERAGED VALUES)

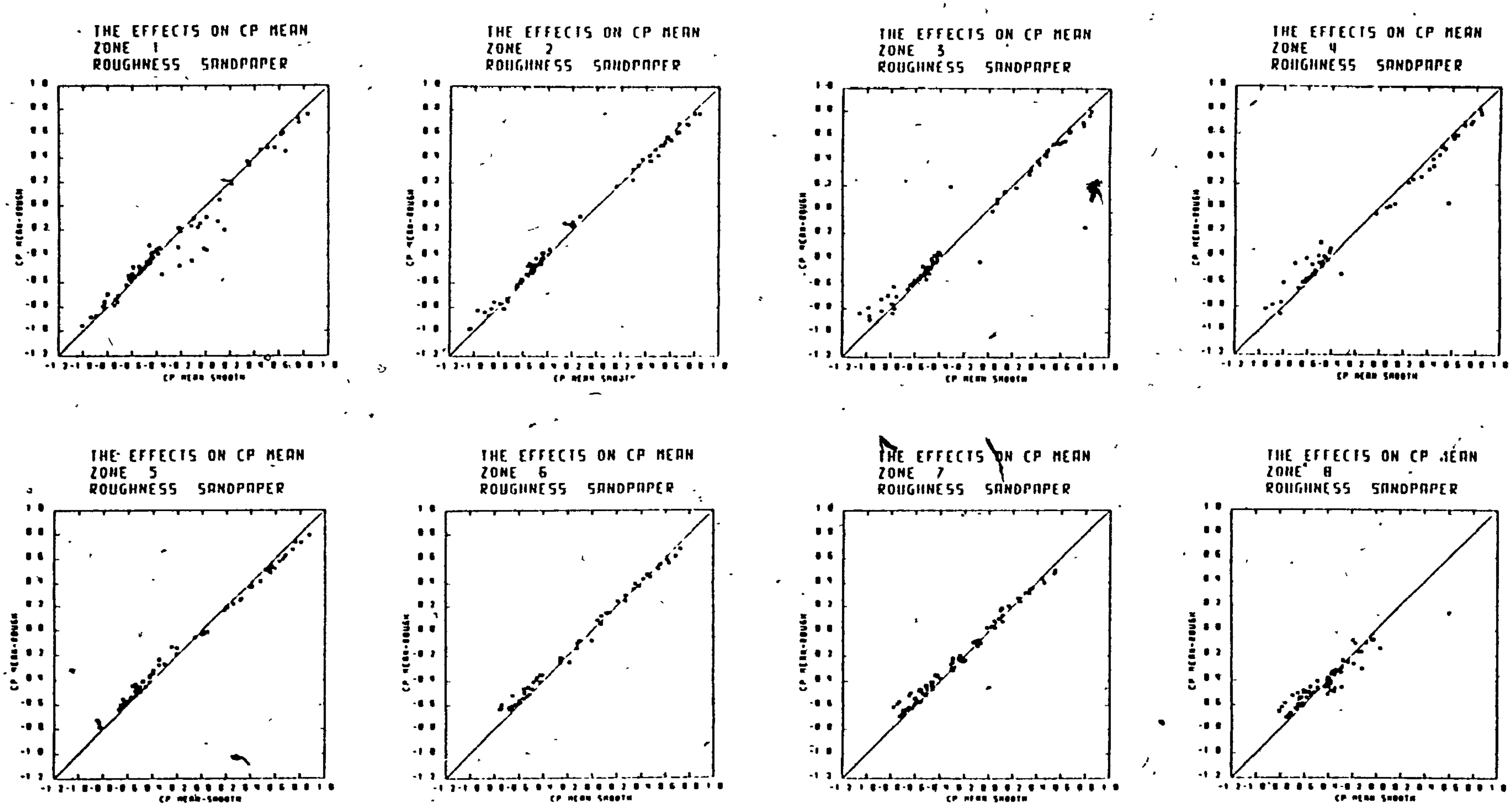


FIG. A.2 COMPARISON OF Cp MEAN ON BUILDINGS WITH SMOOTH AND WITH 15 cm UNIFORM ROUGHNESS

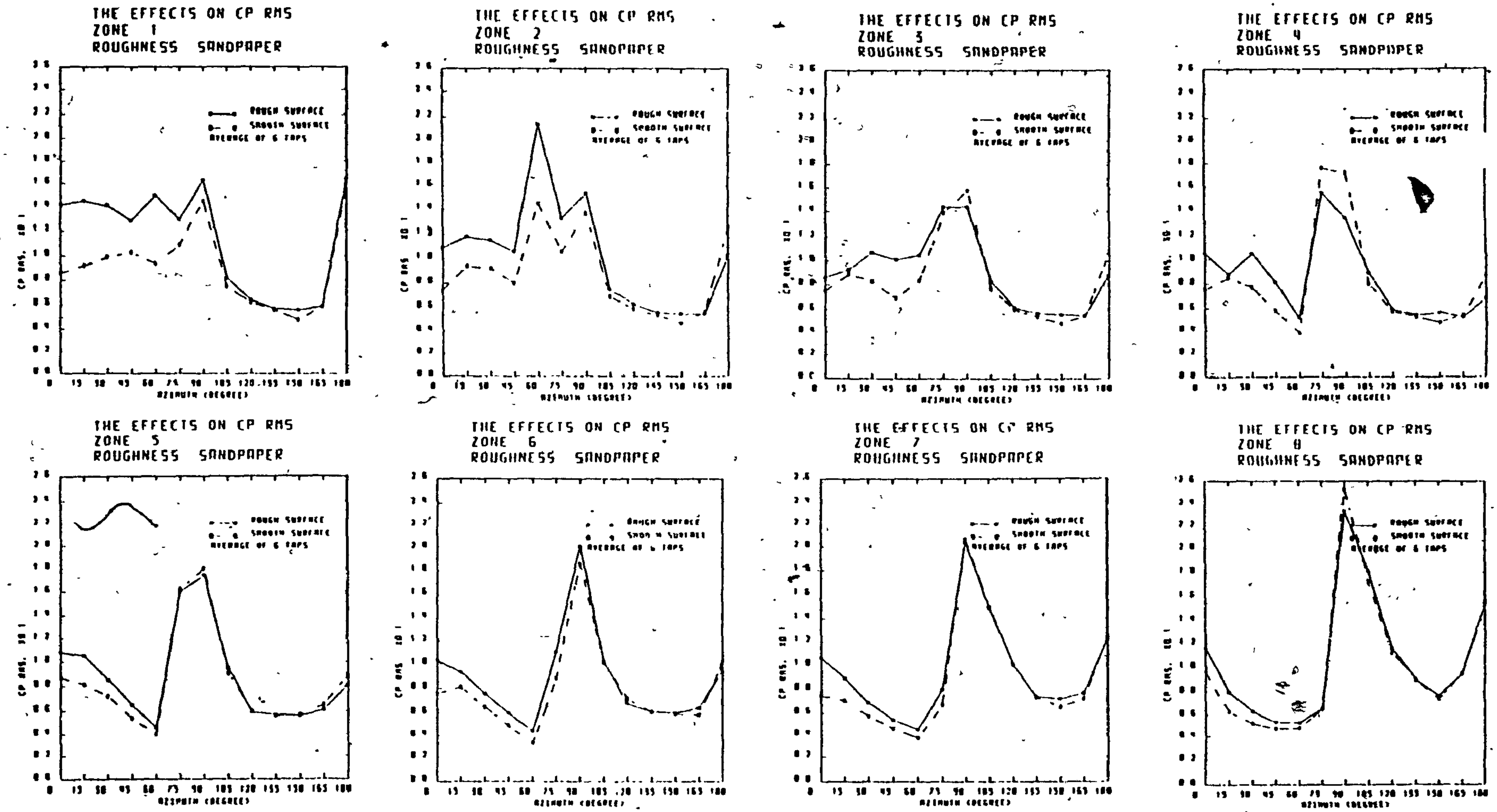


FIG. A.3 EFFECT OF 15 cm UNIFORM ROUGHNESS ON Cp RMS
(ZONE-AVERAGED VALUES)

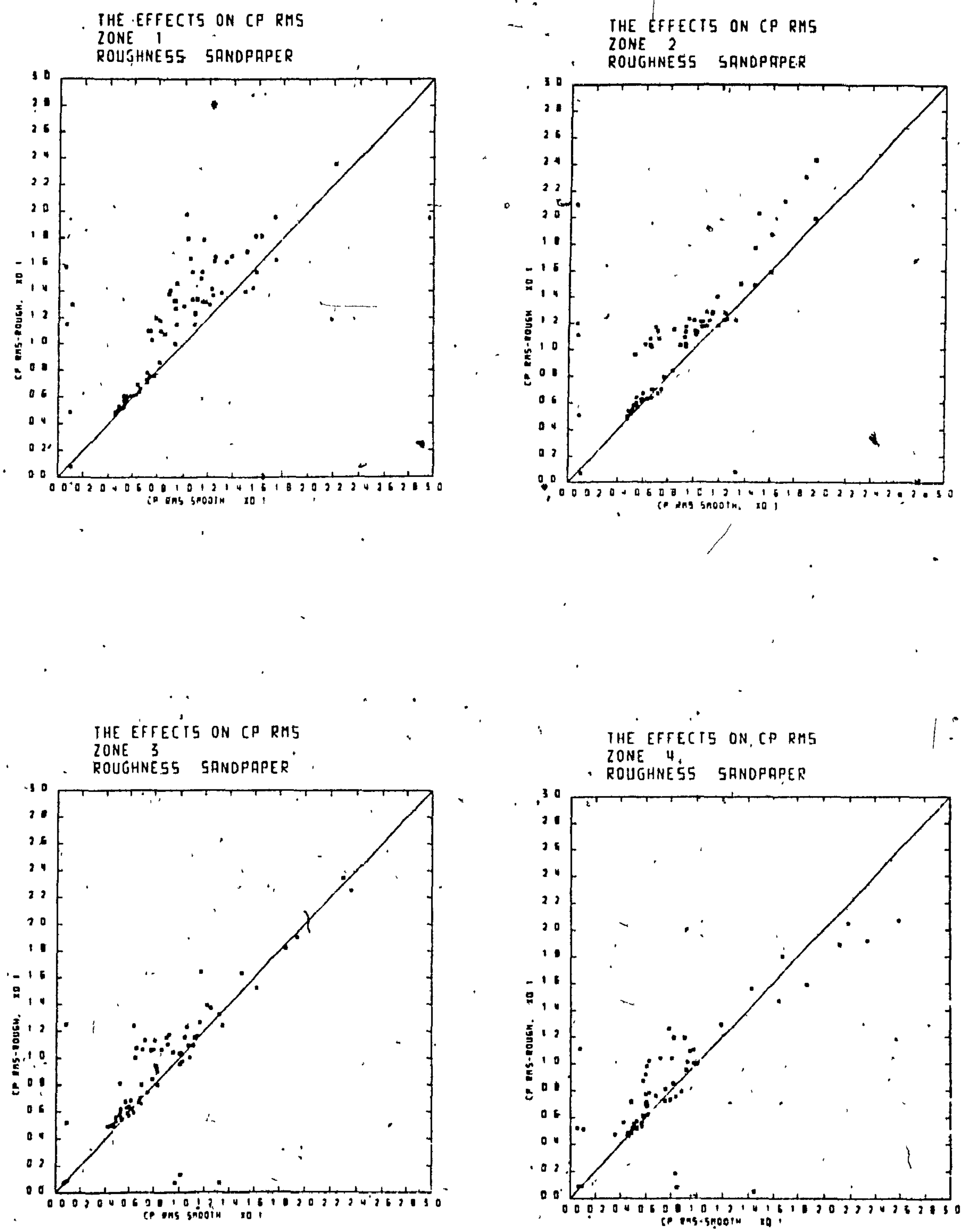


FIG. A.4 COMPARISON OF Cp RMS ON BUILDINGS WITH SMOOTH AND WITH 15 cm UNIFORM ROUGHNESS

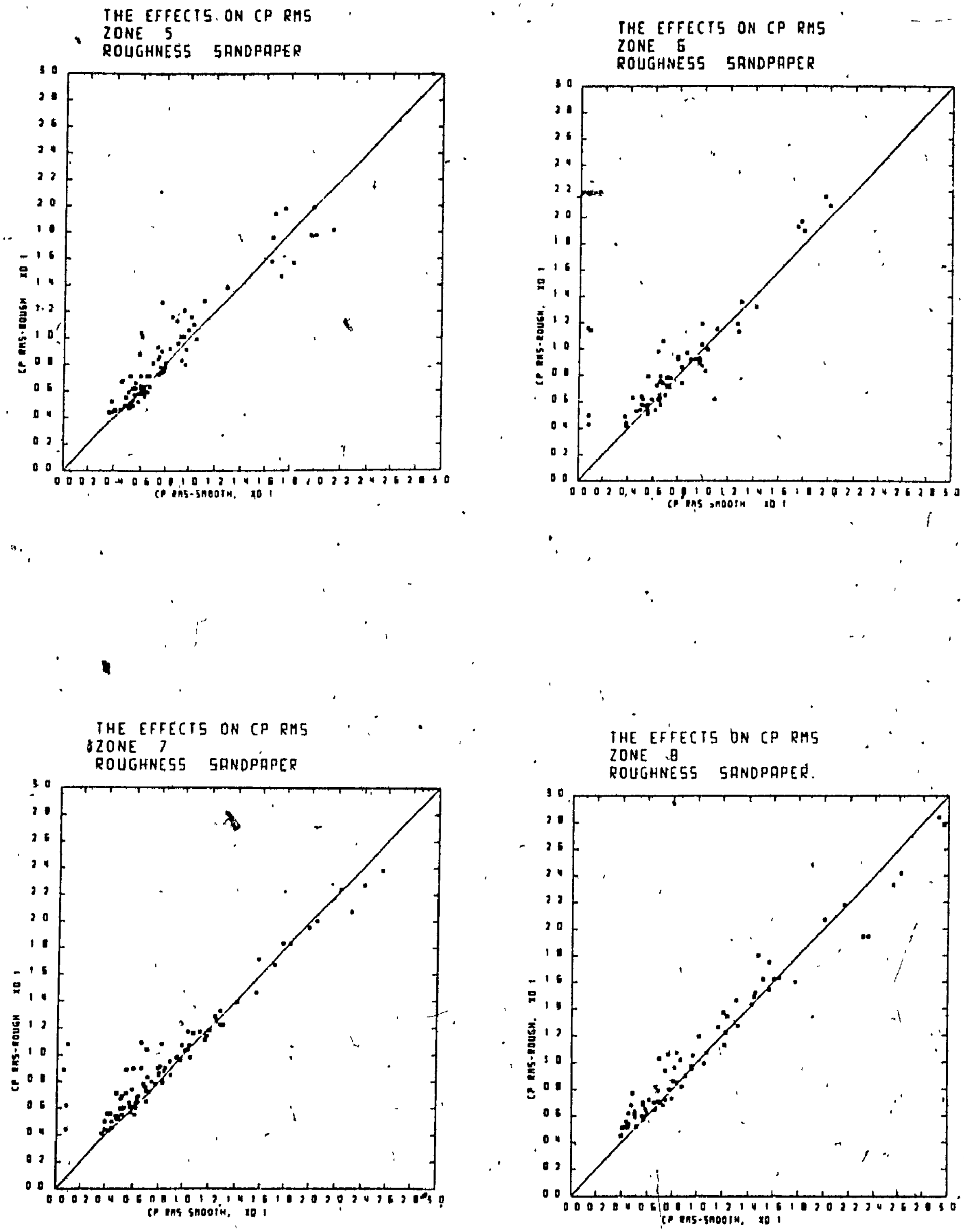


FIG. A.4 CONTINUED

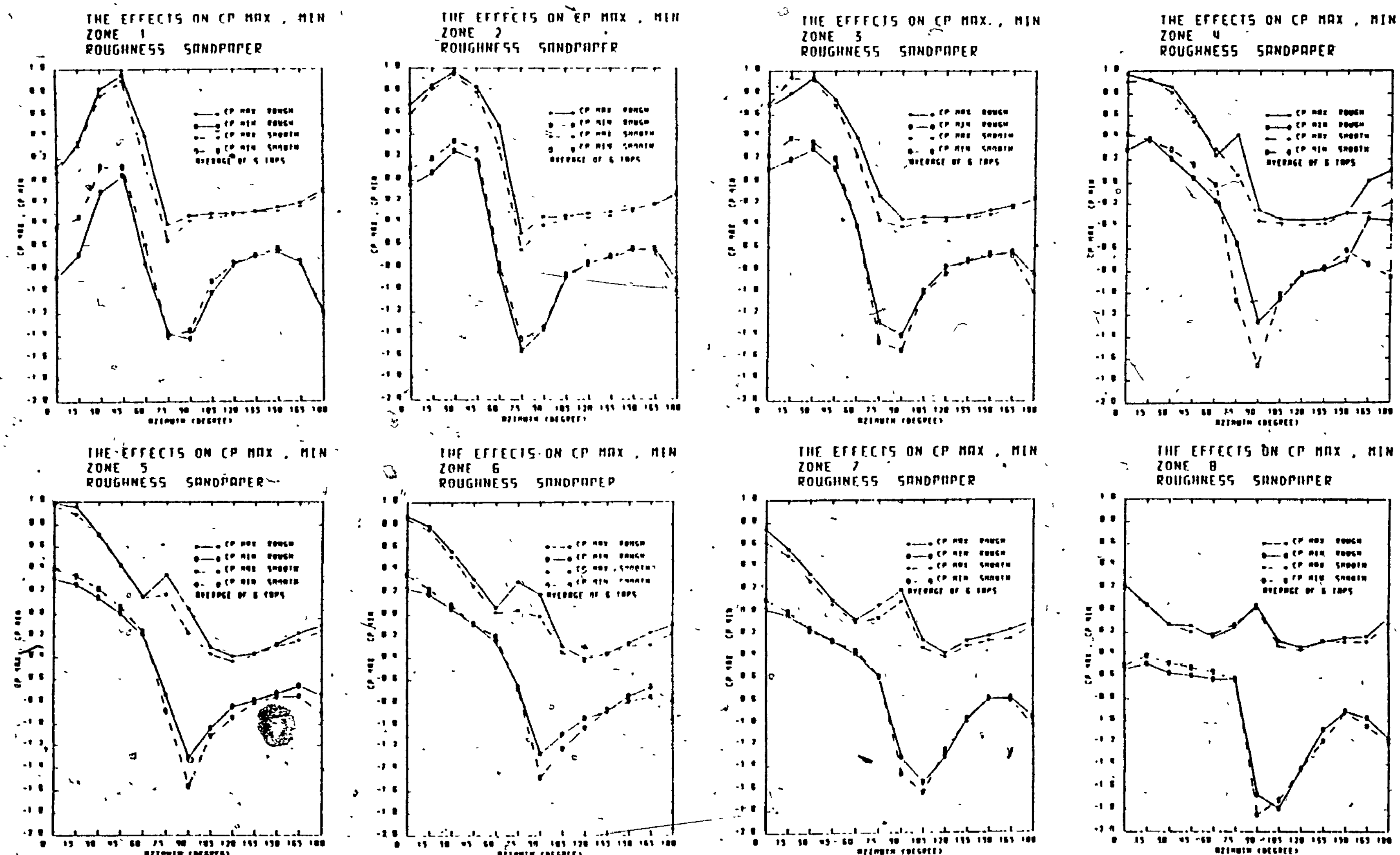


FIG. A.5 EFFECT OF 15 cm ROUGHNESS ON Cp PEAK
(ZONE-AVERAGED VALUES)

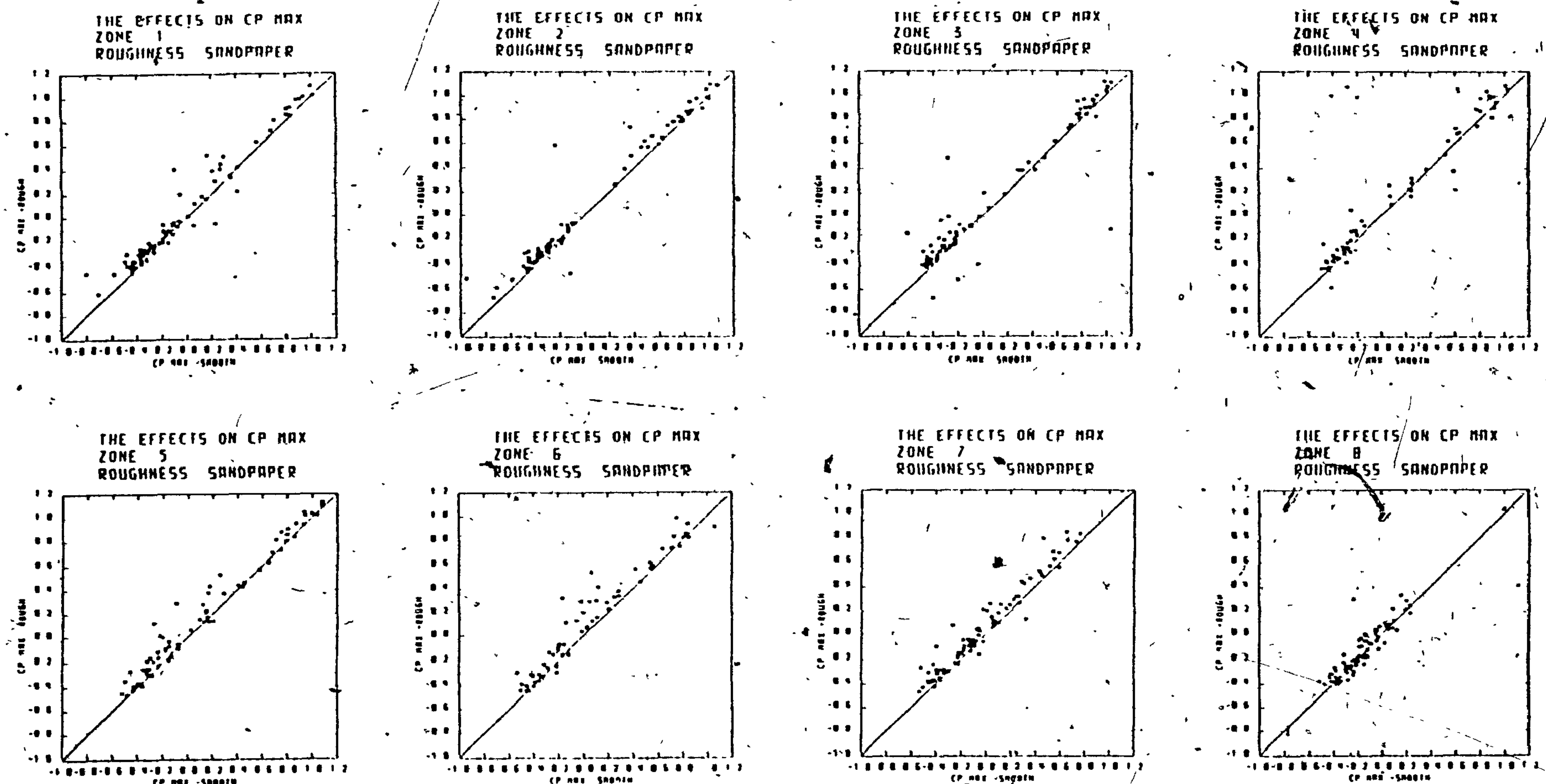


FIG. A.6 COMPARISON OF Cp MAX ON BUILDINGS WITH SMOOTH AND WITH 15 cm UNIFORM ROUGHNESS

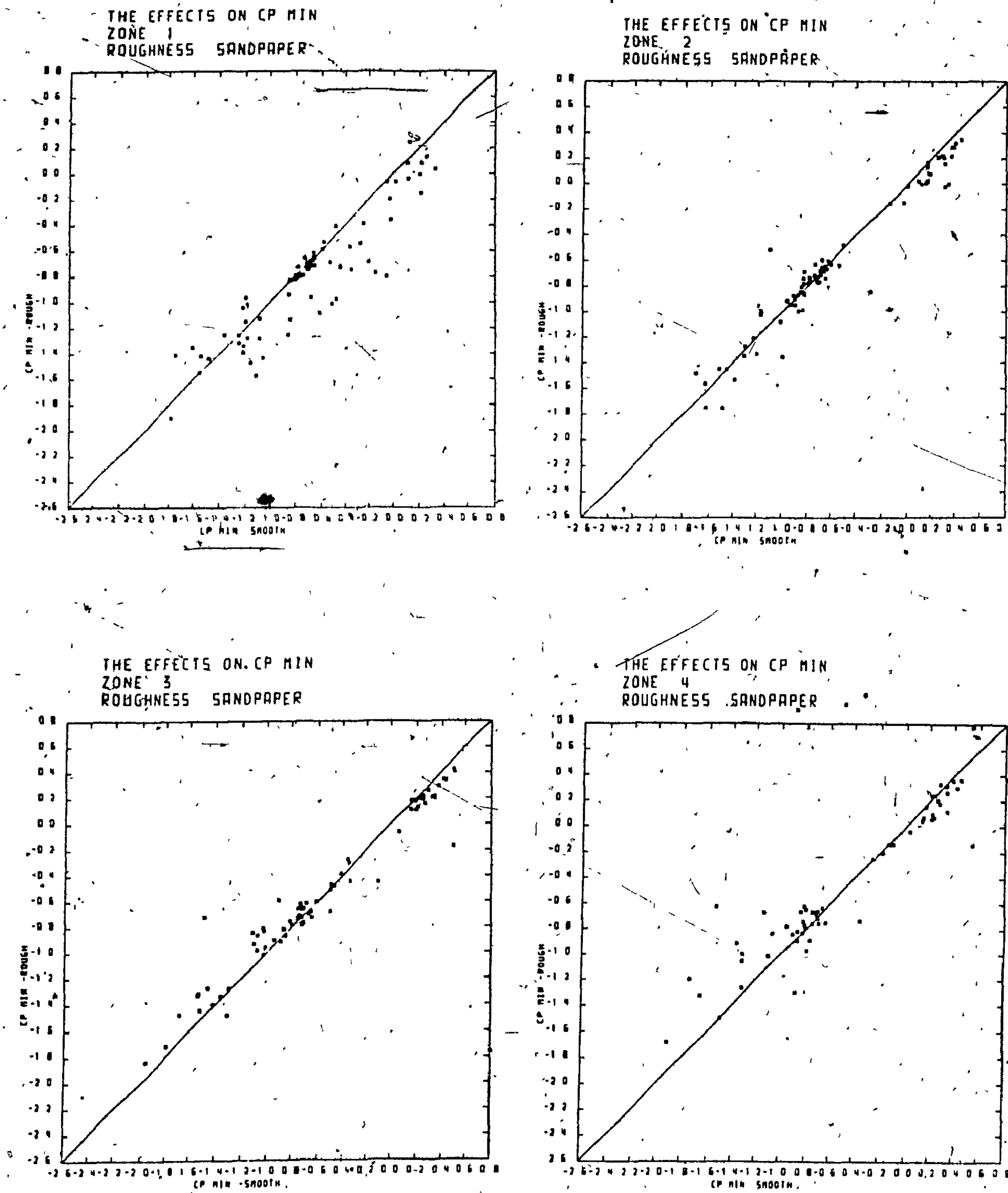


FIG. A.7 COMPARISON OF Cp MIN ON BUILDINGS WITH SMOOTH AND WITH 15 cm UNIFORM ROUGHNESS

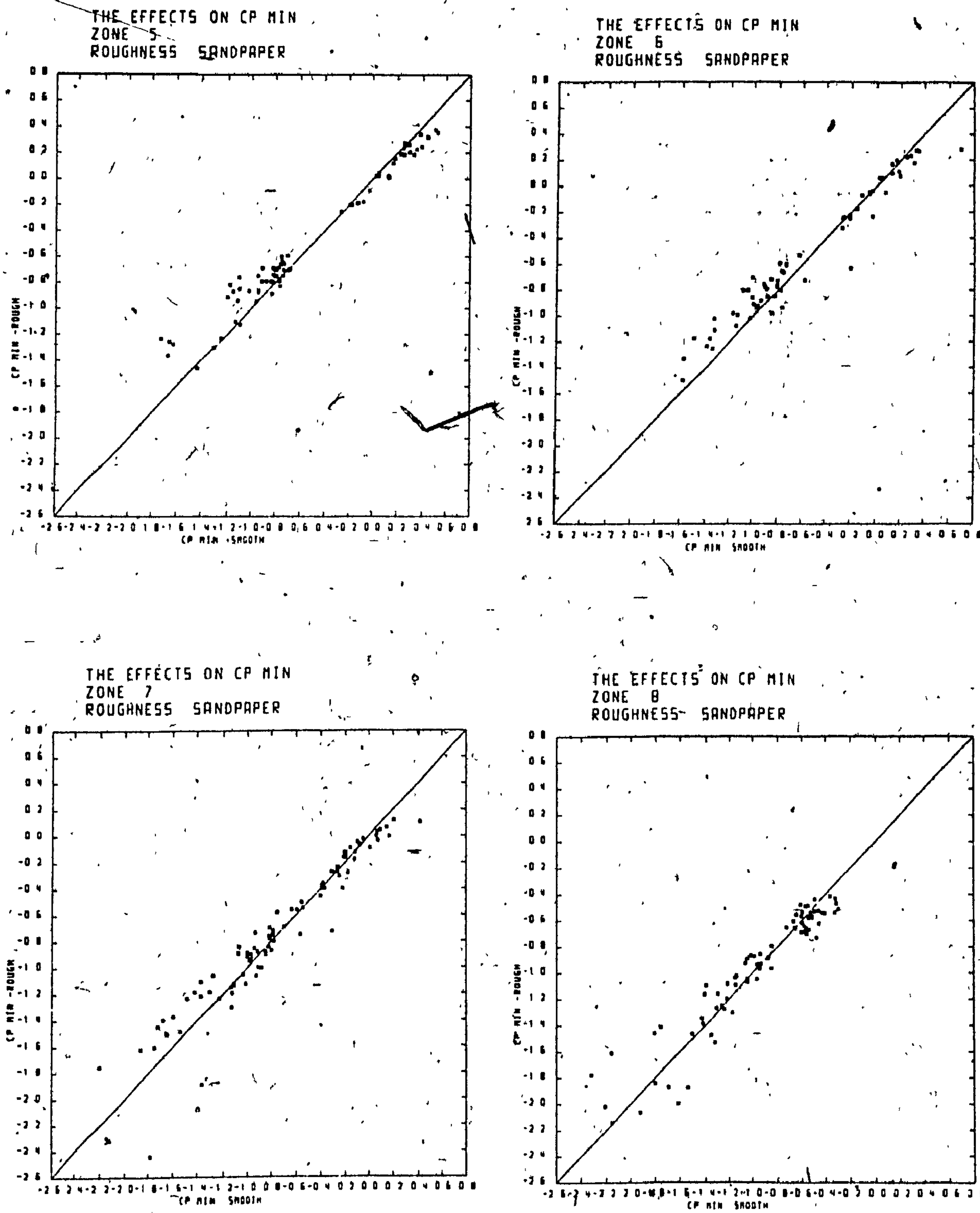


FIG. A.7 CONTINUED

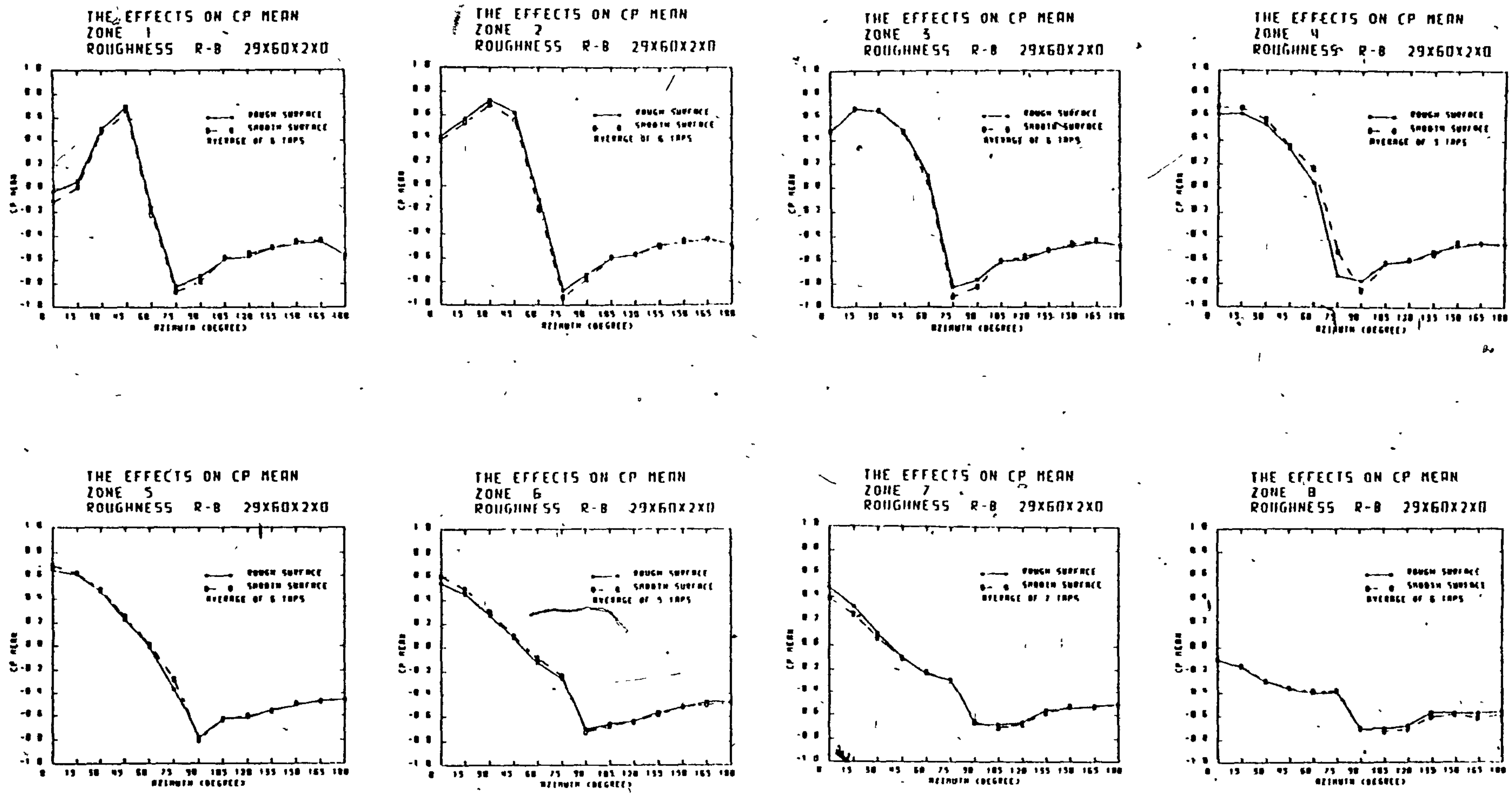


FIG. A.8 EFFECT OF 2 m BALCONIES ON Cp MEAN (ZONE-AVERAGED VALUES)

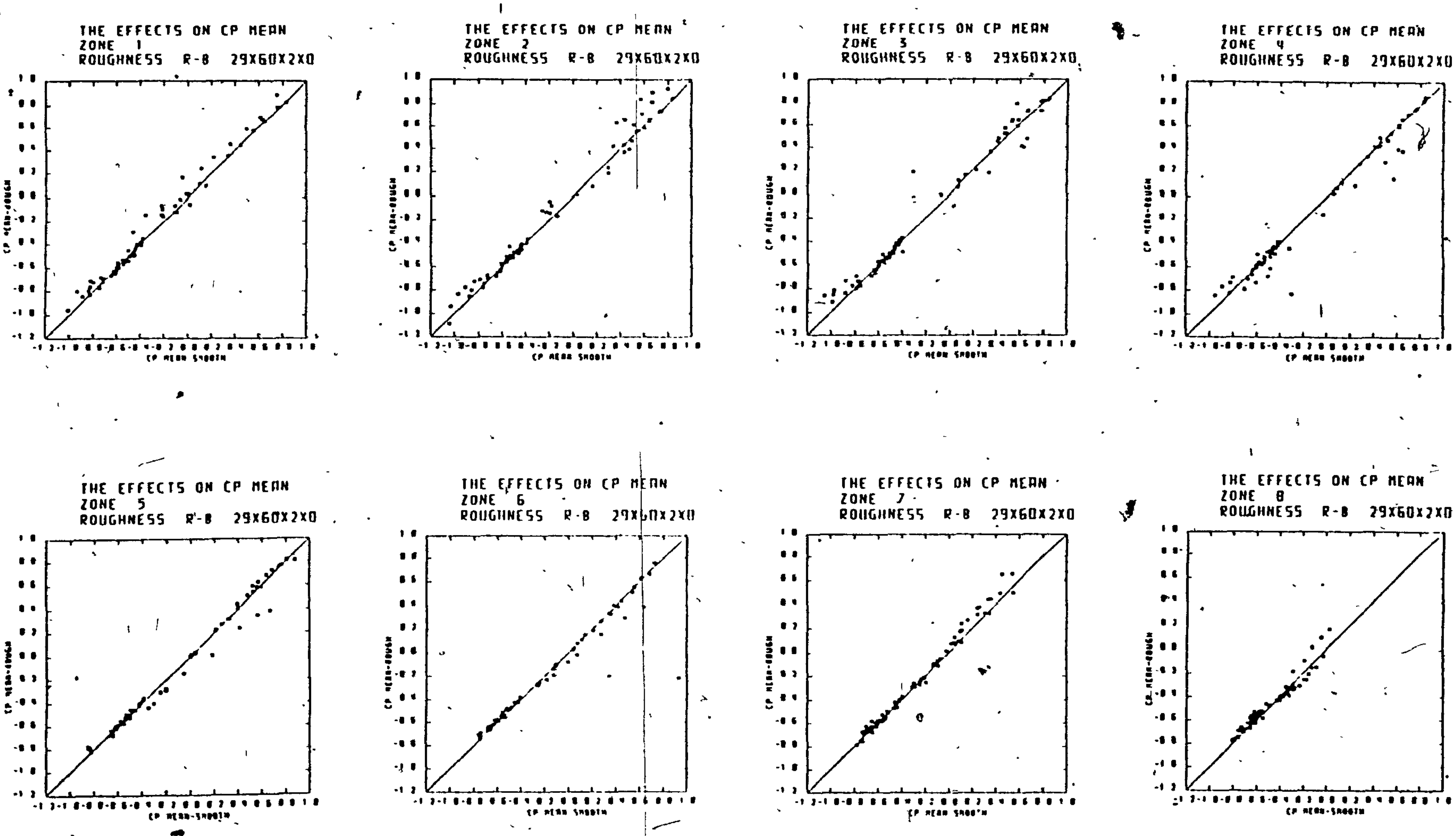


FIG. A.9 COMPARISON OF Cp MEAN ON BUILDINGS WITH SMOOTH AND WITH 2 m BALCONIES

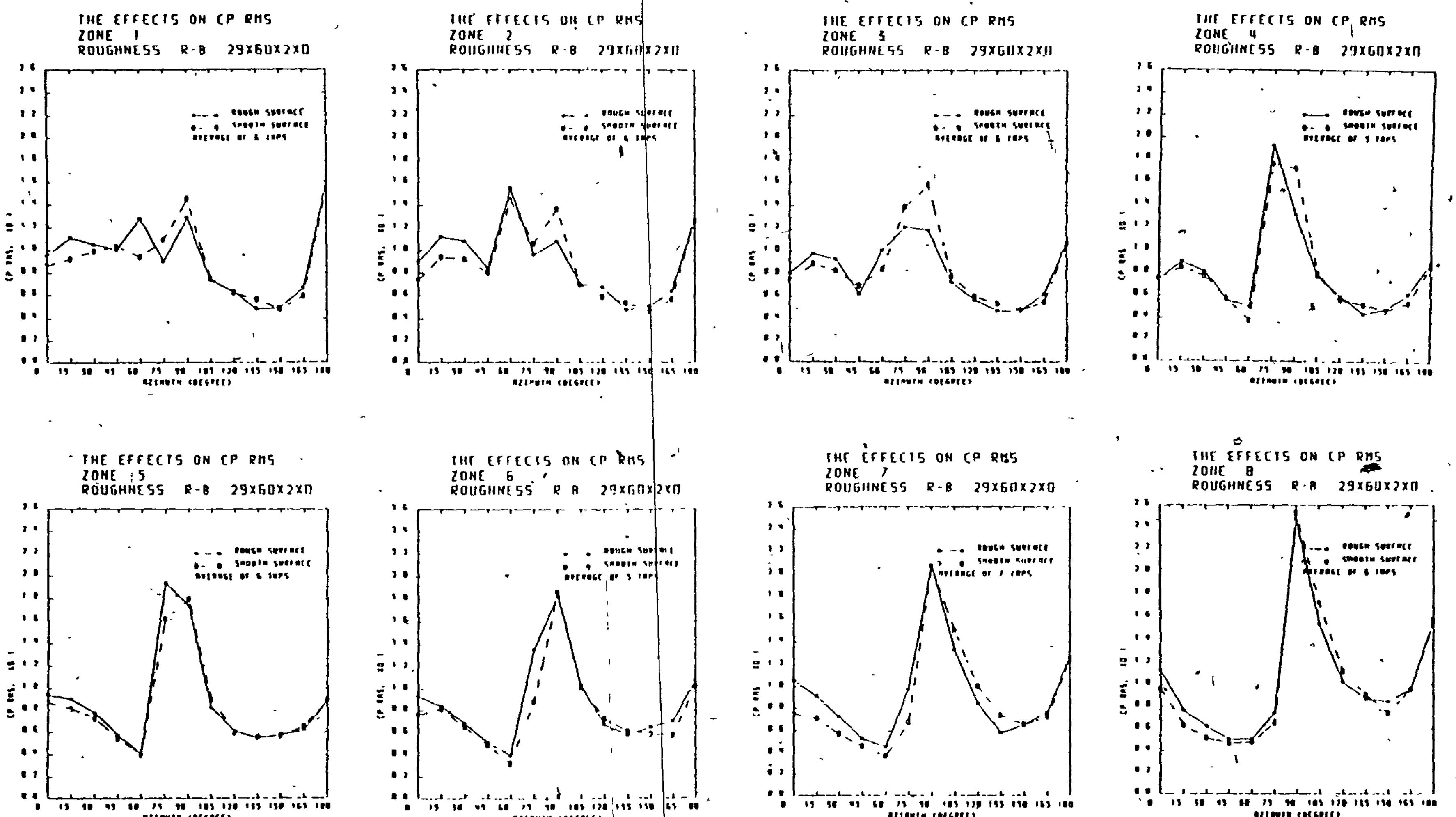


FIG. A.10 EFFECT OF 2 m BALCONIES ON Cp RMS (ZONE-AVERAGED VALUES)

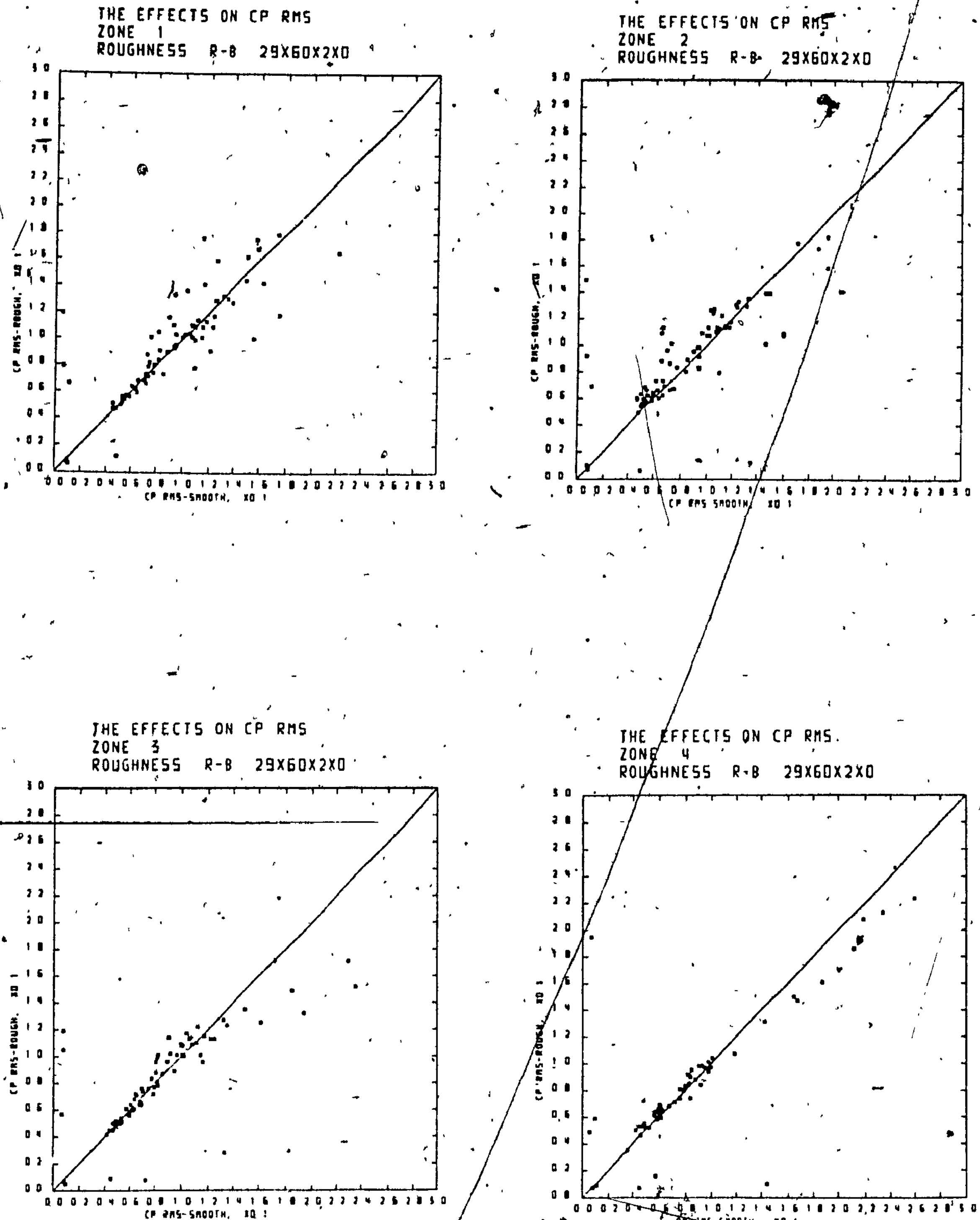


FIG. A.11 COMPARISON OF Cp RMS ON BUILDINGS WITH SMOOTH AND WITH 2 m BALCONIES

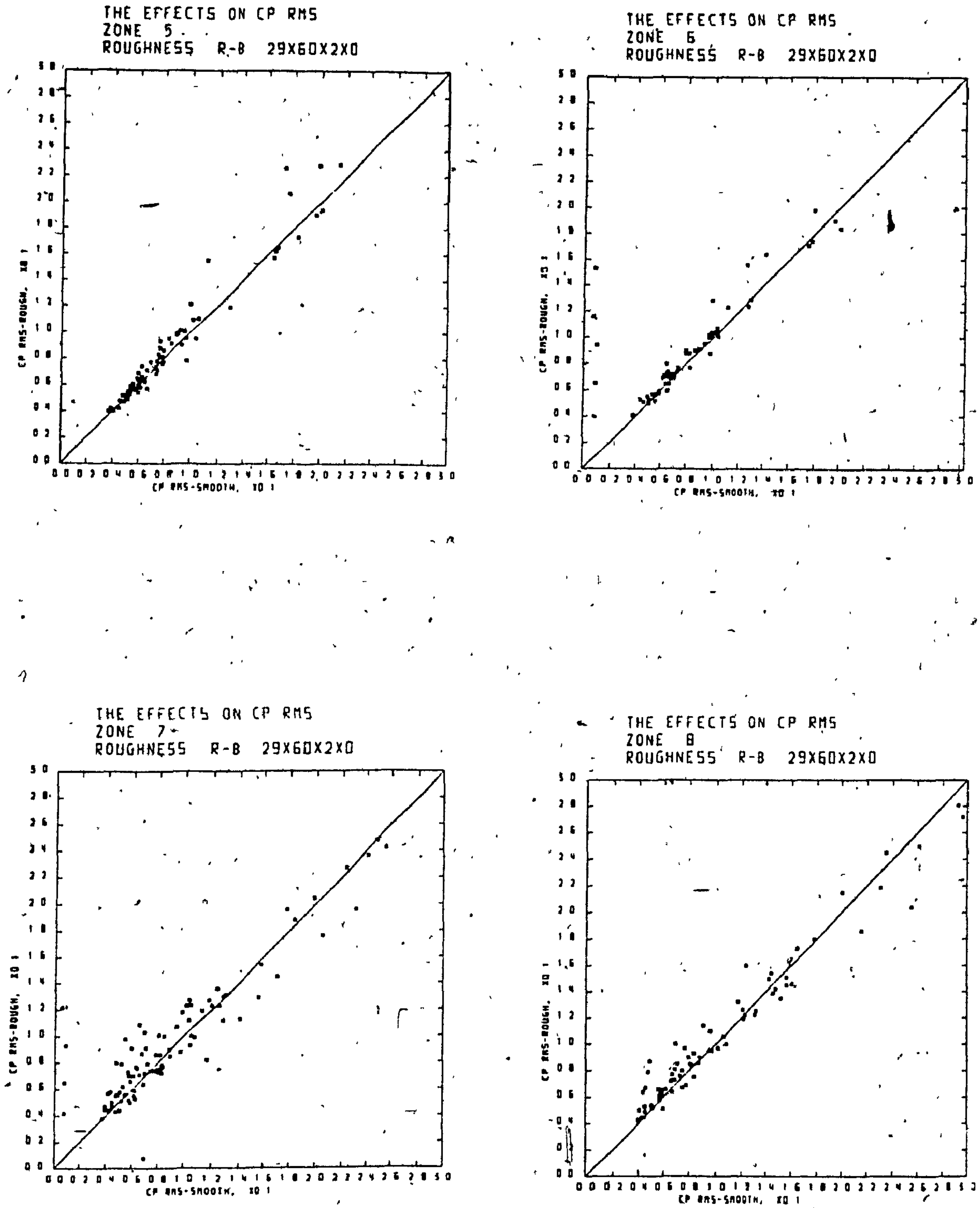


FIG. A.11 CONTINUED

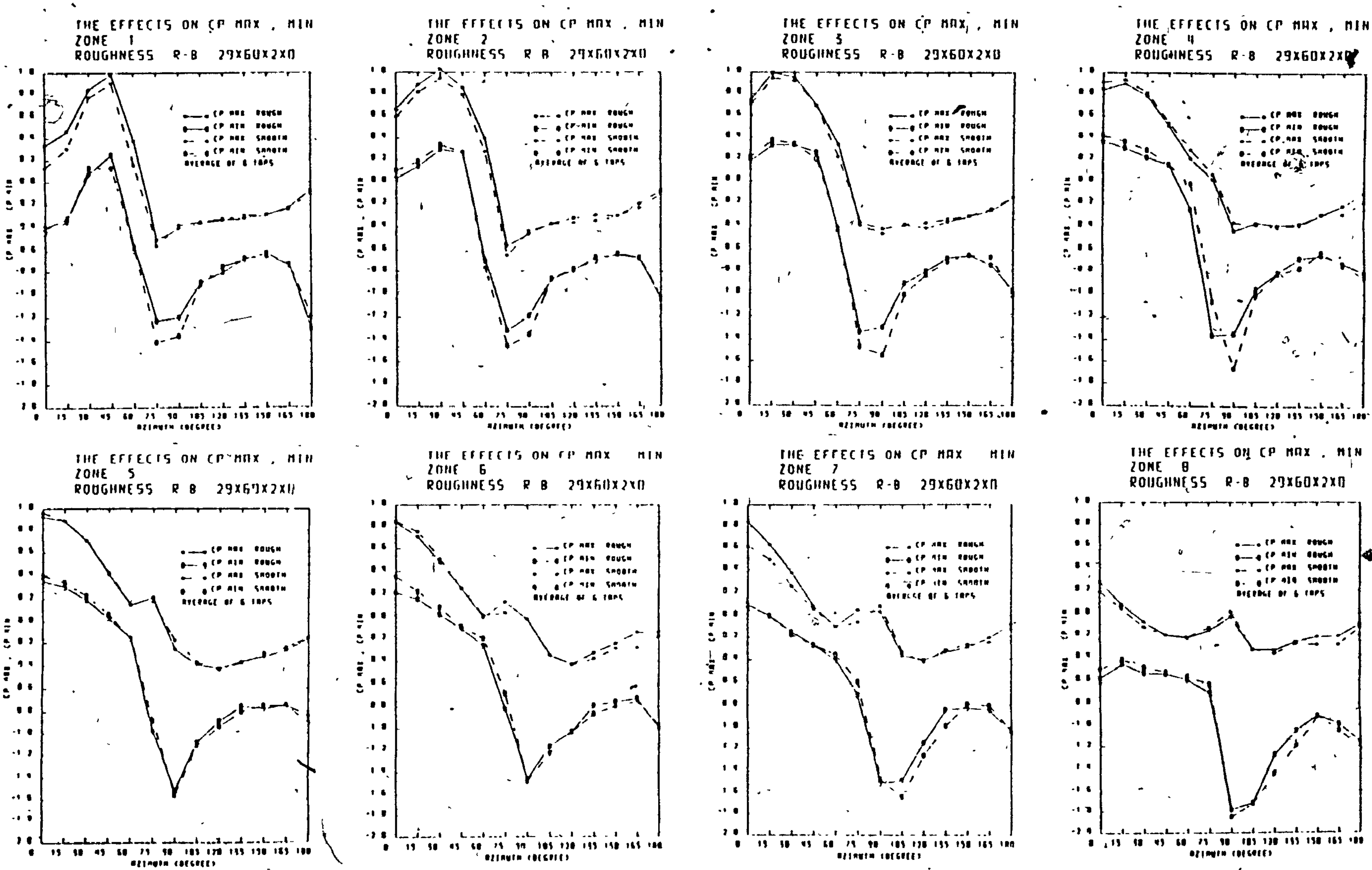


FIG. A.12 EFFECT OF 2 m BALCONIES ON Cp PEAK (ZONE-AVERAGED VALUES)

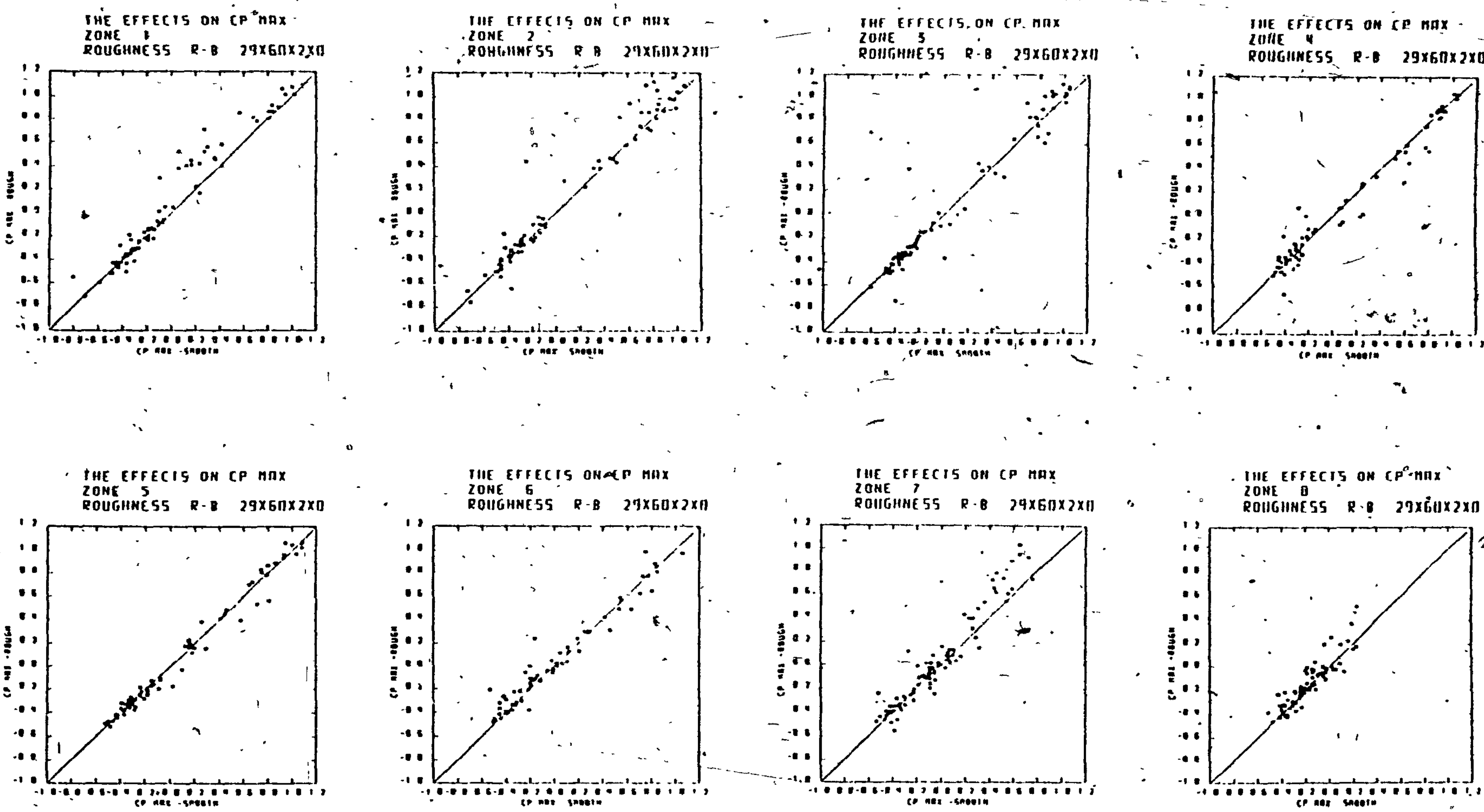


FIG. A.13 COMPARISON OF Cp MAX ON BUILDINGS WITH SMOOTH AND WITH 2 m BALCONIES

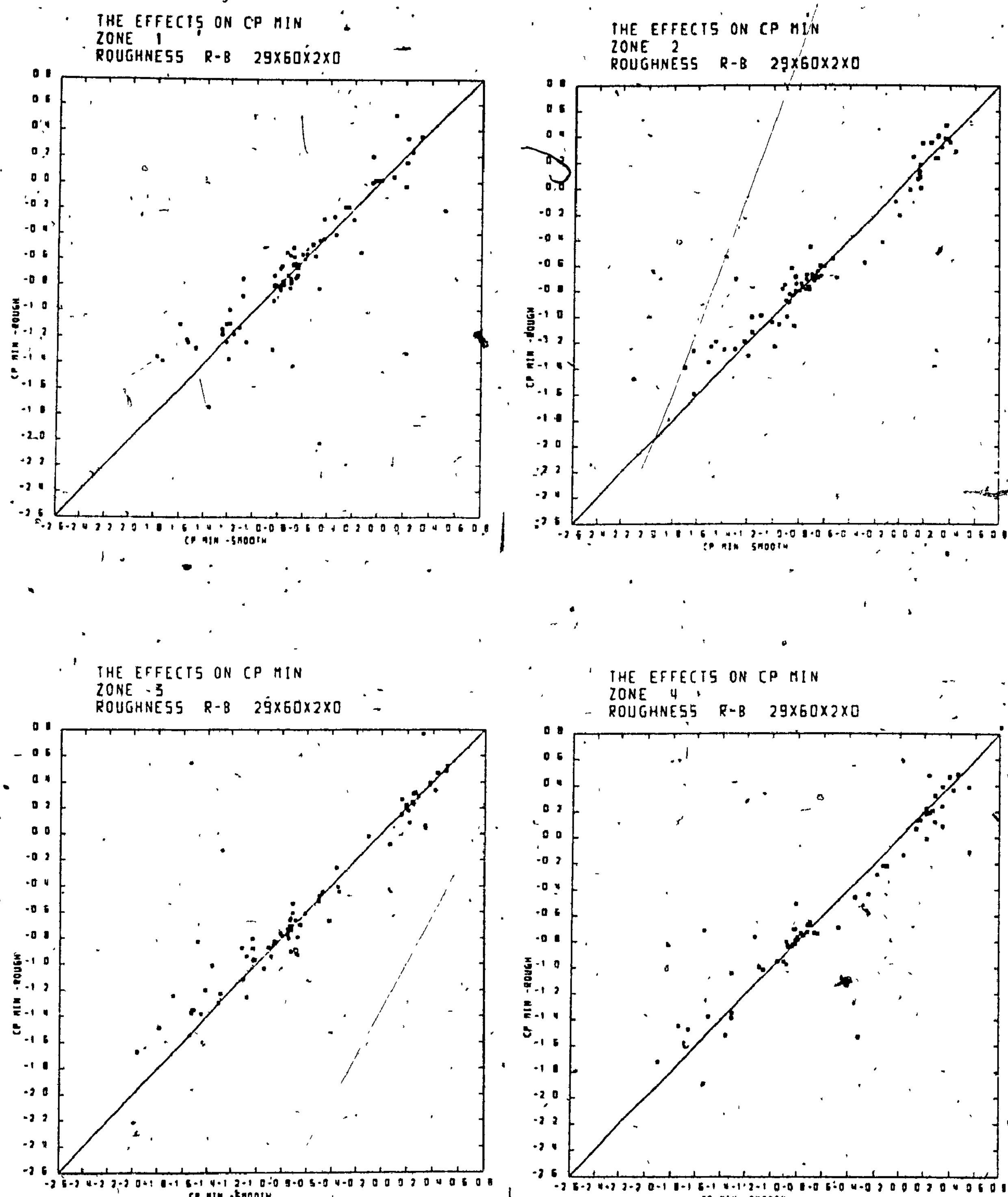
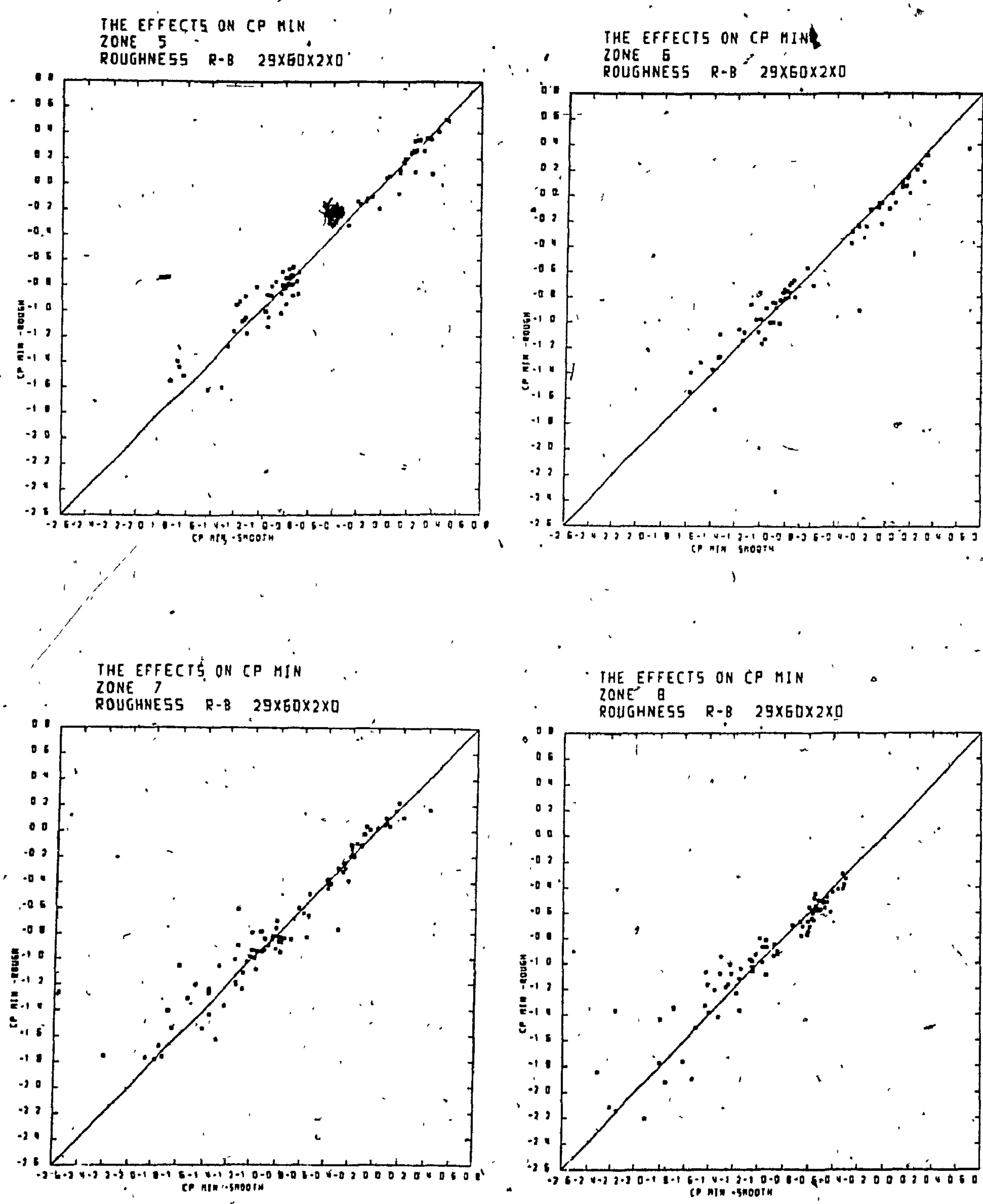


FIG. A.14 COMPARISON OF Cp MIN ON BUILDINGS WITH SMOOTH AND WITH 2 m BALCONIES



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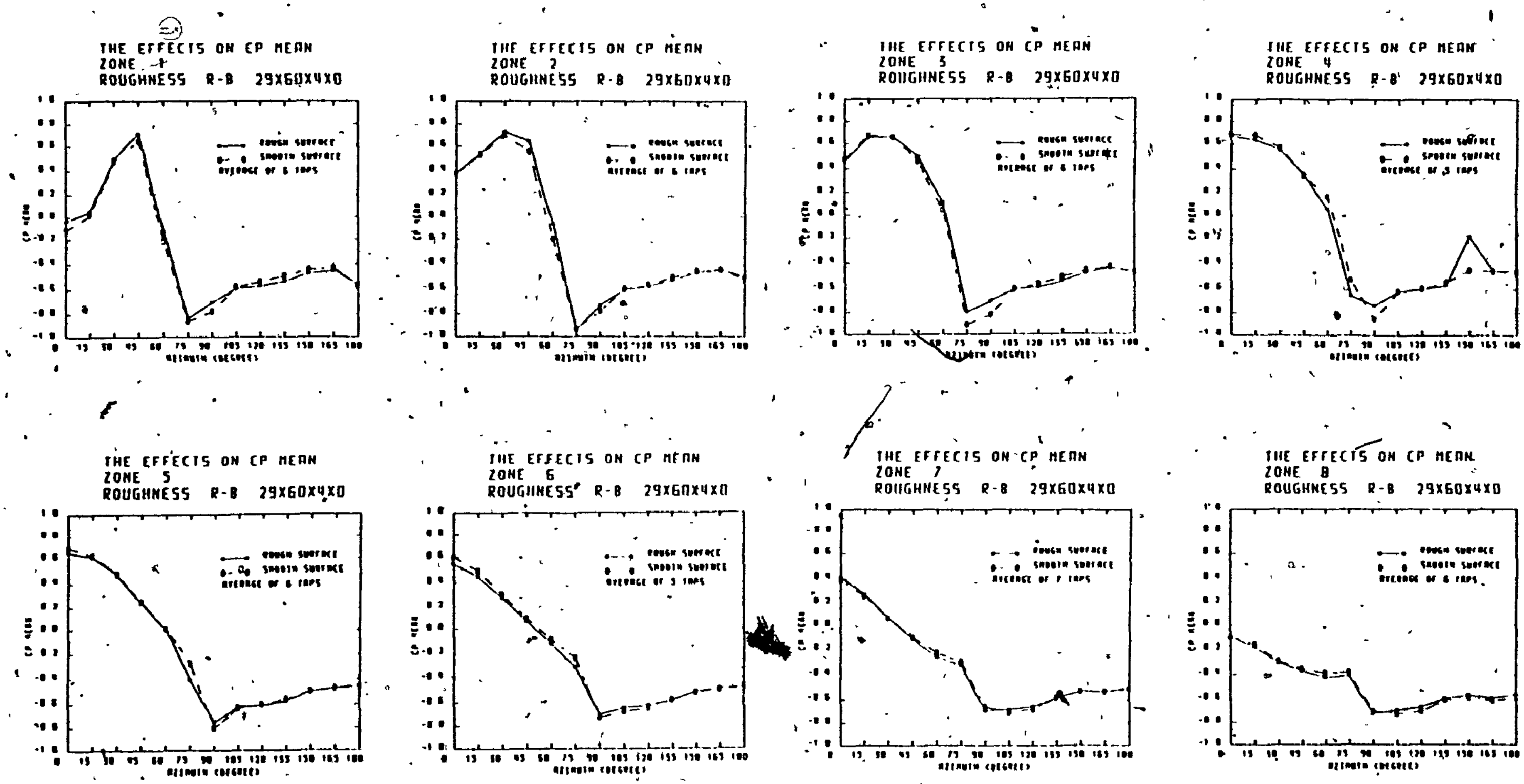


FIG. A.15 EFFECT OF 4 m BALCONIES ON Cp MEAN (ZONE-AVERAGED VALUES)

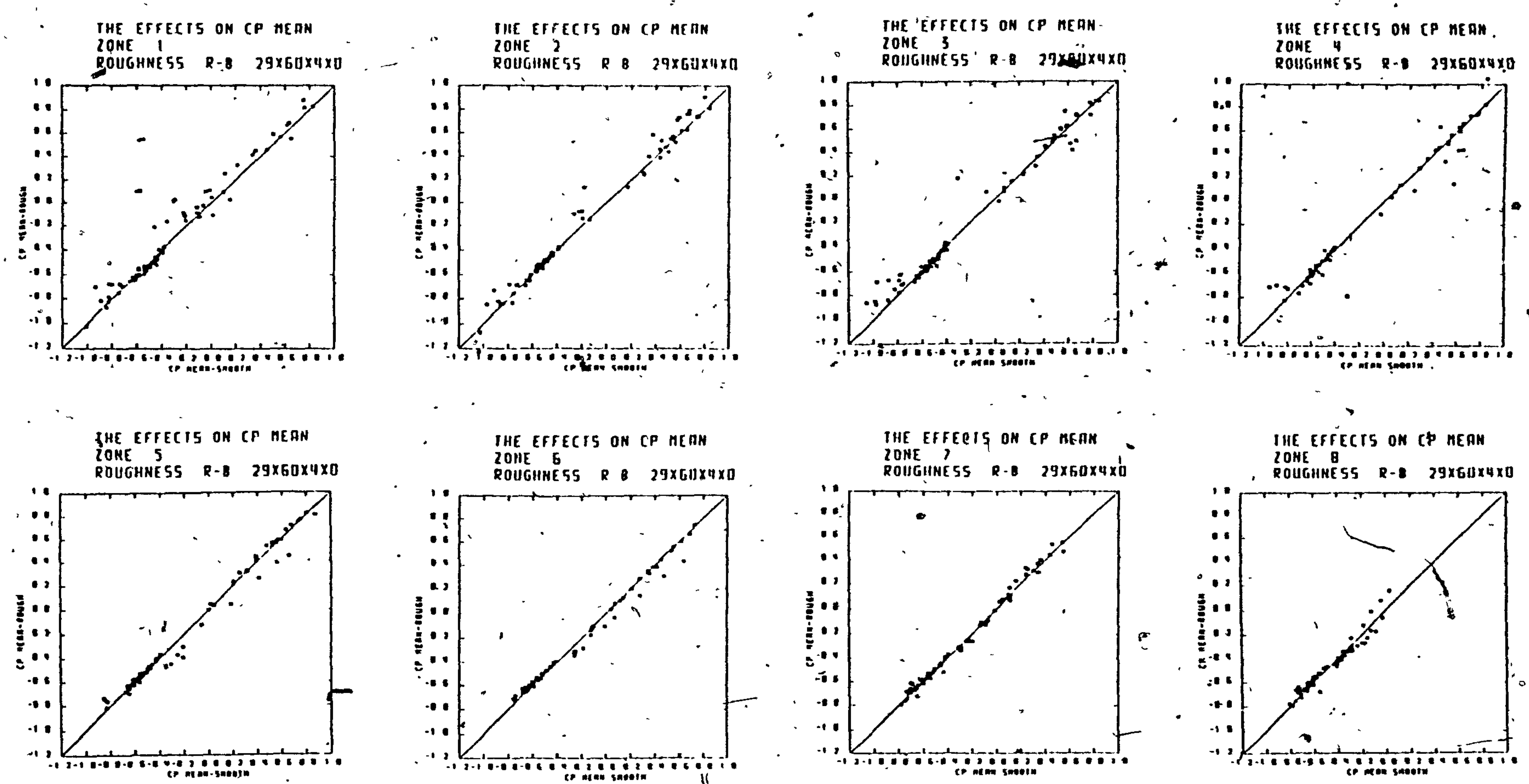


FIG. A.16 COMPARISON OF Cp MEAN ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES

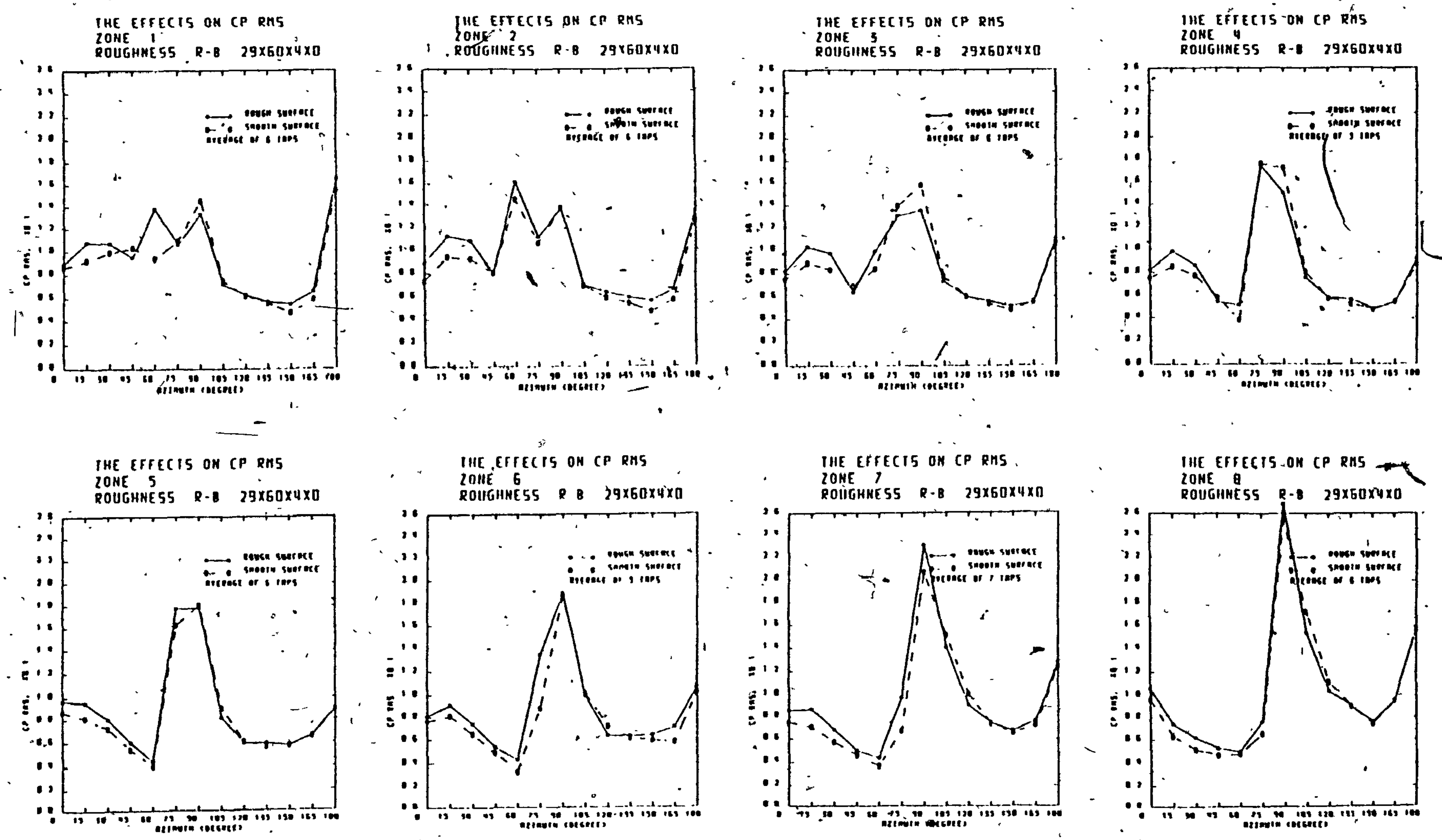


FIG. A.17 EFFECT OF 4 m BALCONIES ON Cp RMS (ZONE-AVERAGED VALUES)

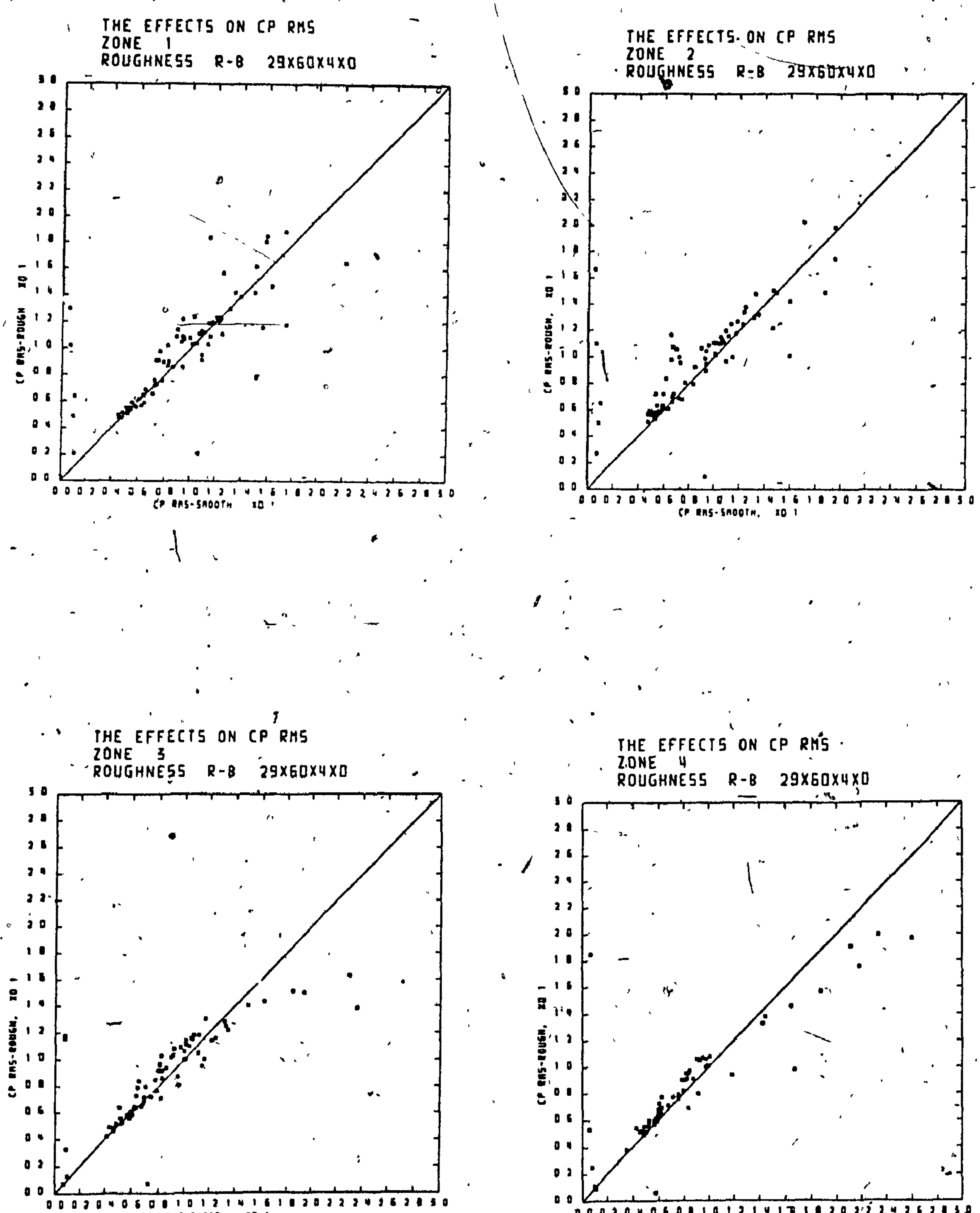
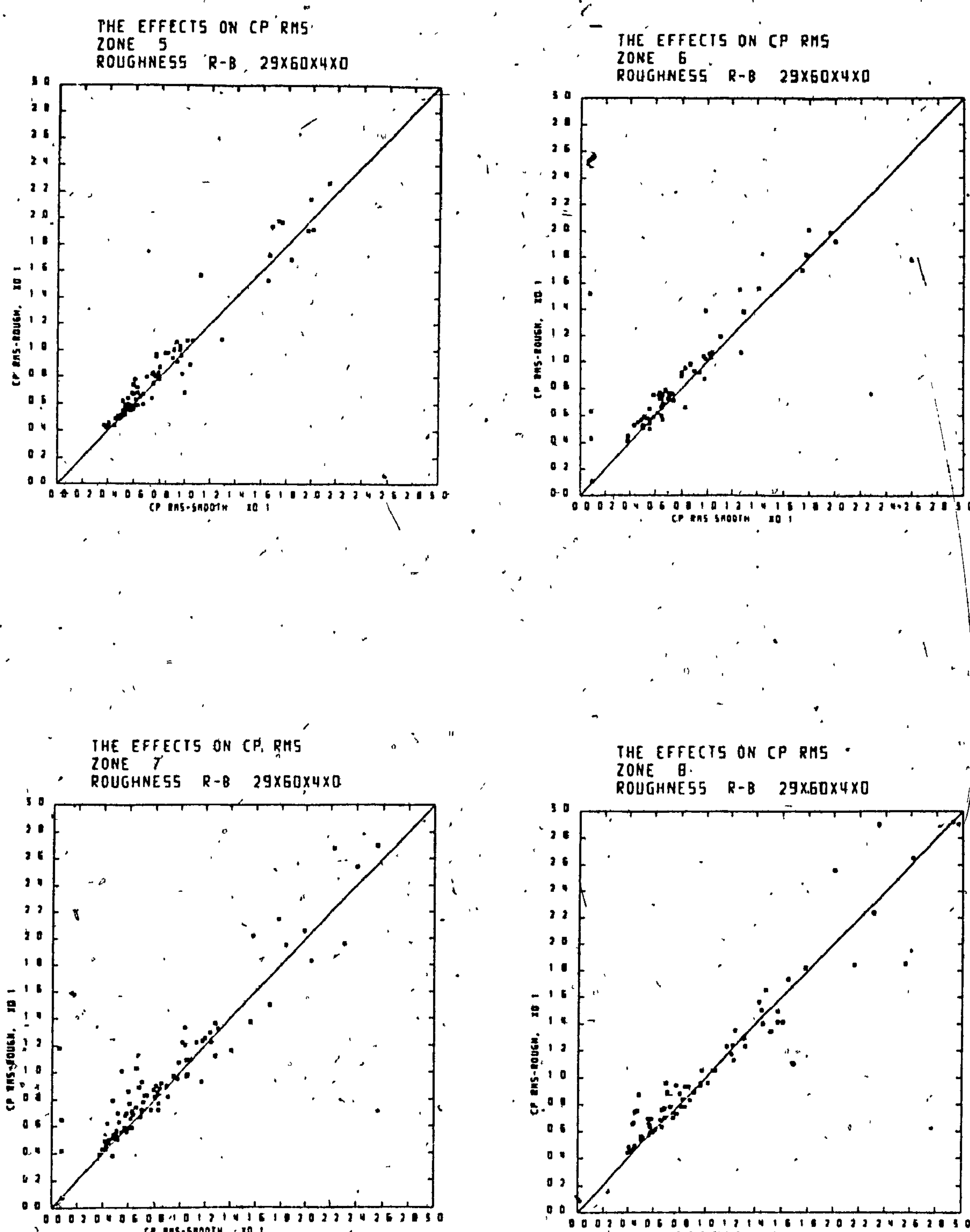


FIG. A.18 COMPARISON OF Cp RMS ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES



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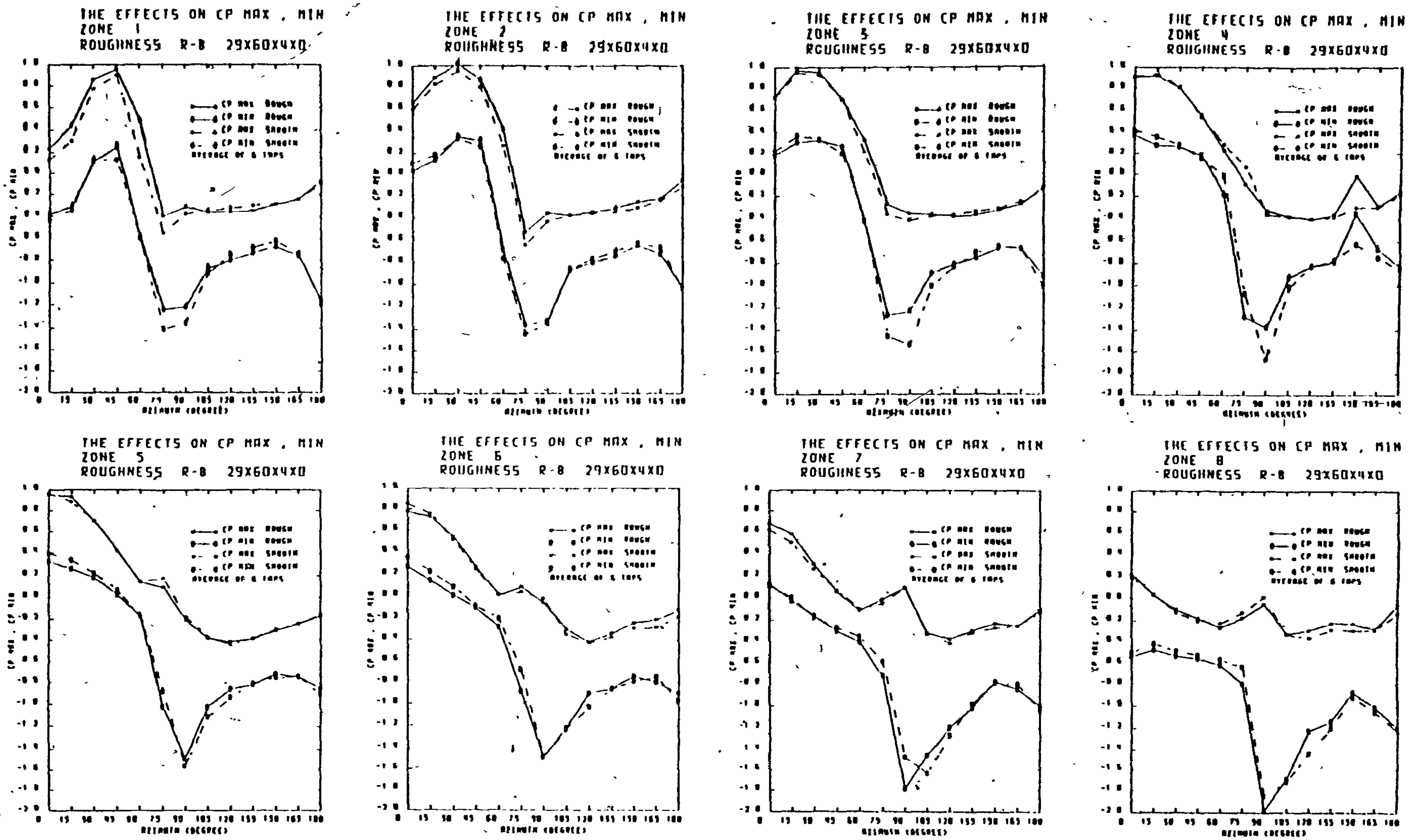


FIG. A.19 EFFECT OF 4 m BALCONIES ON Cp PEAK (ZONE-AVERAGED VALUES)

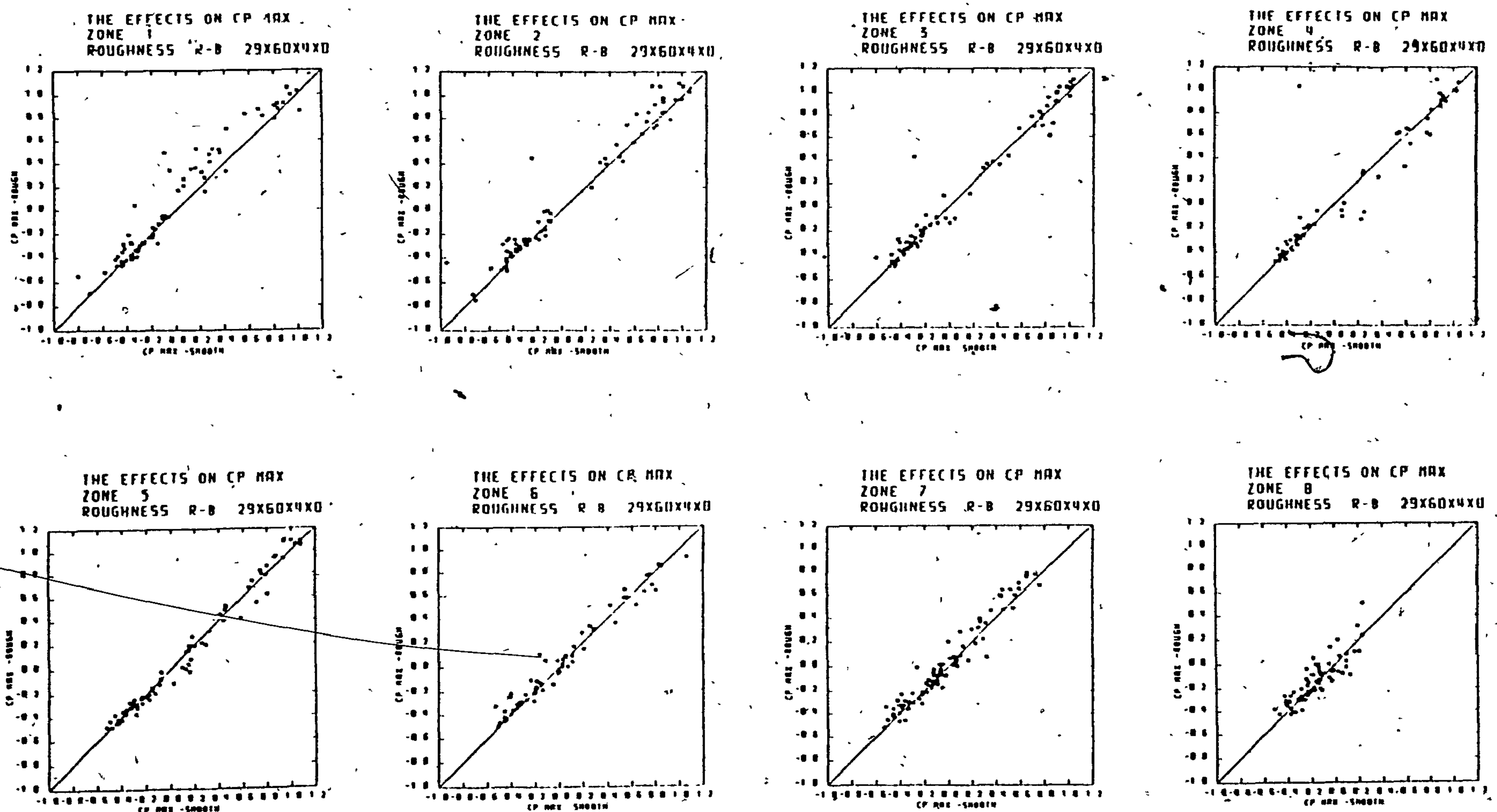


FIG. A.20 COMPARISON OF Cp MAX ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES

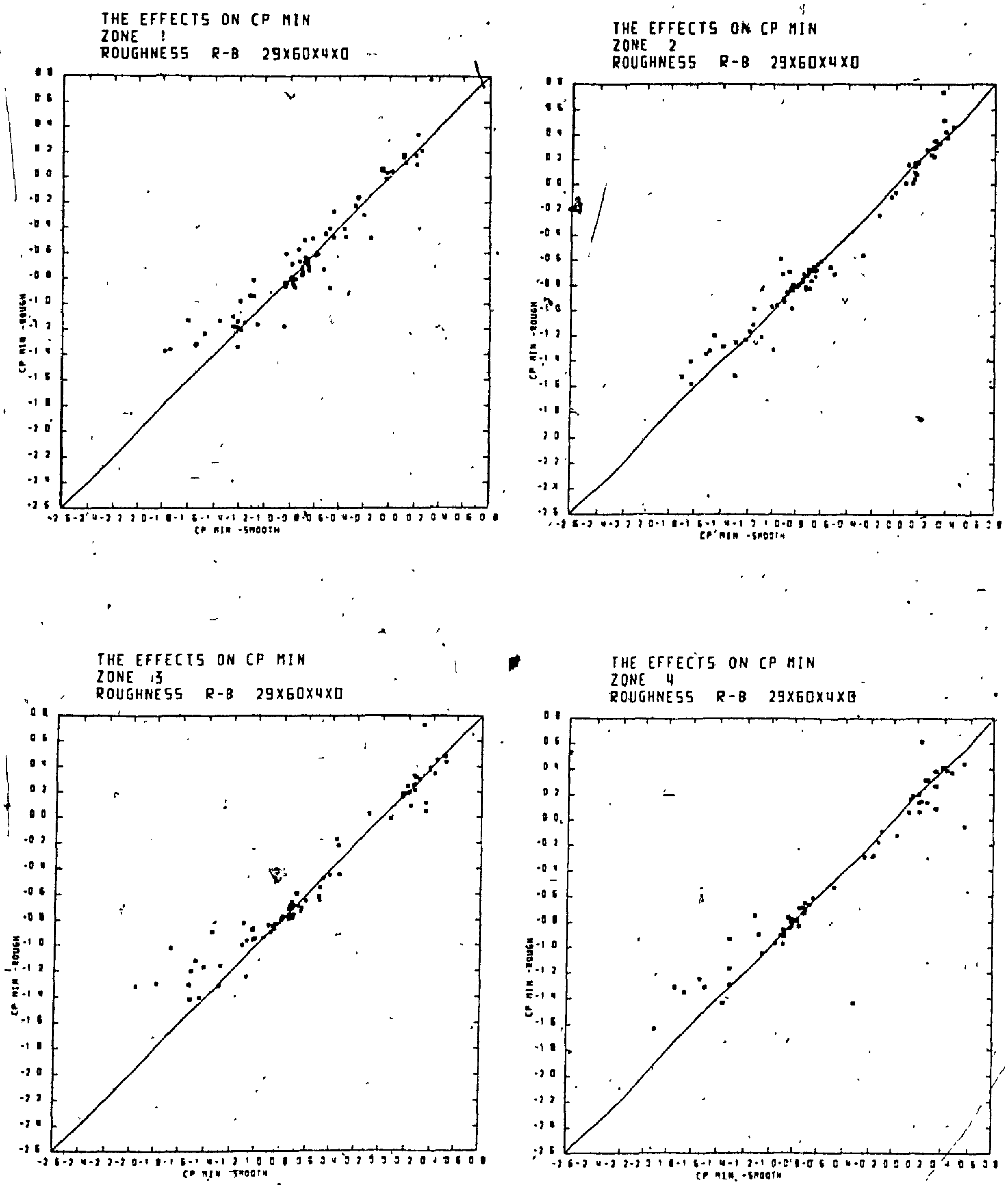
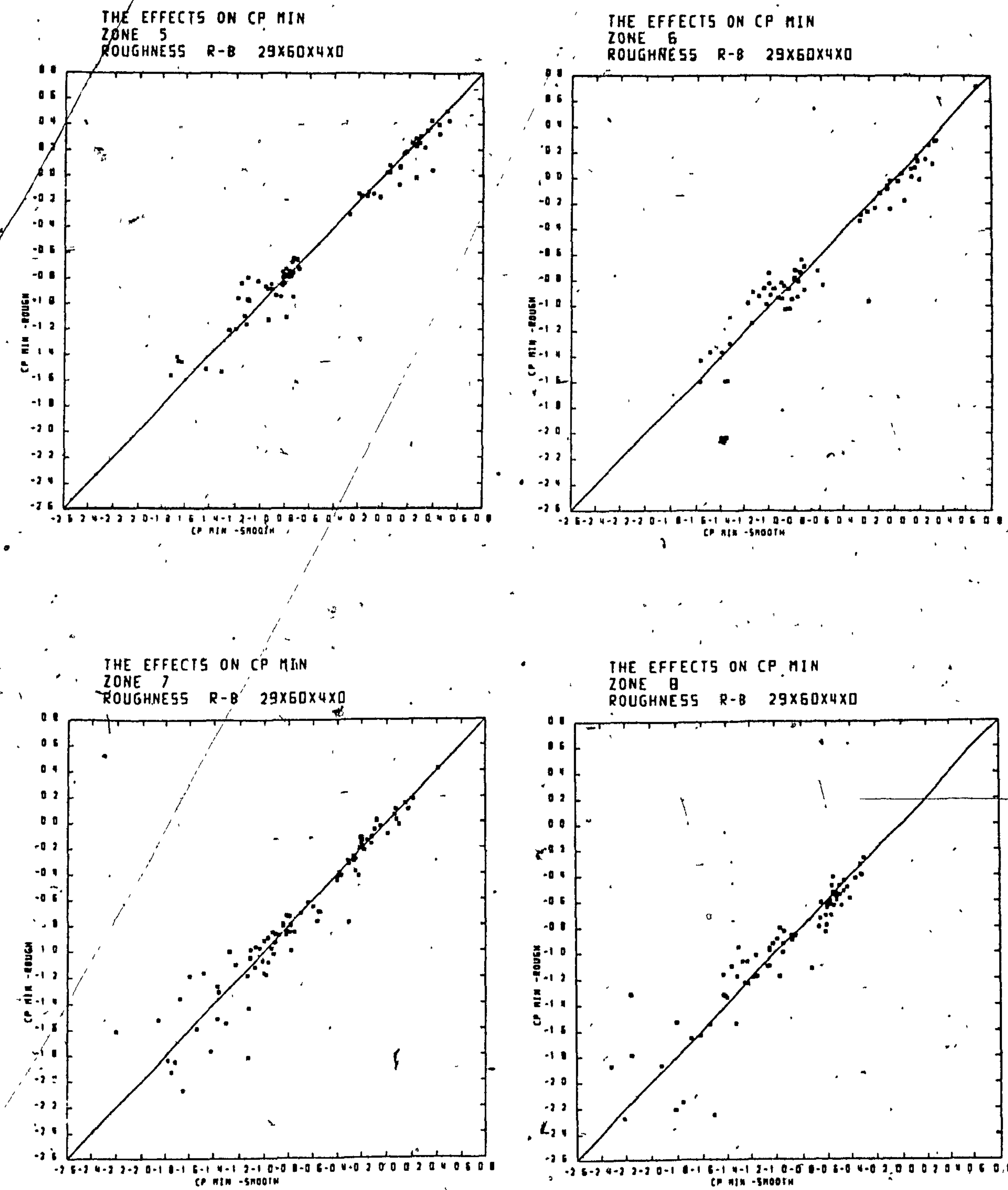


FIG. A.21 COMPARISON OF Cp MIN ON BUILDINGS WITH SMOOTH AND WITH .4 m BALCONIES.



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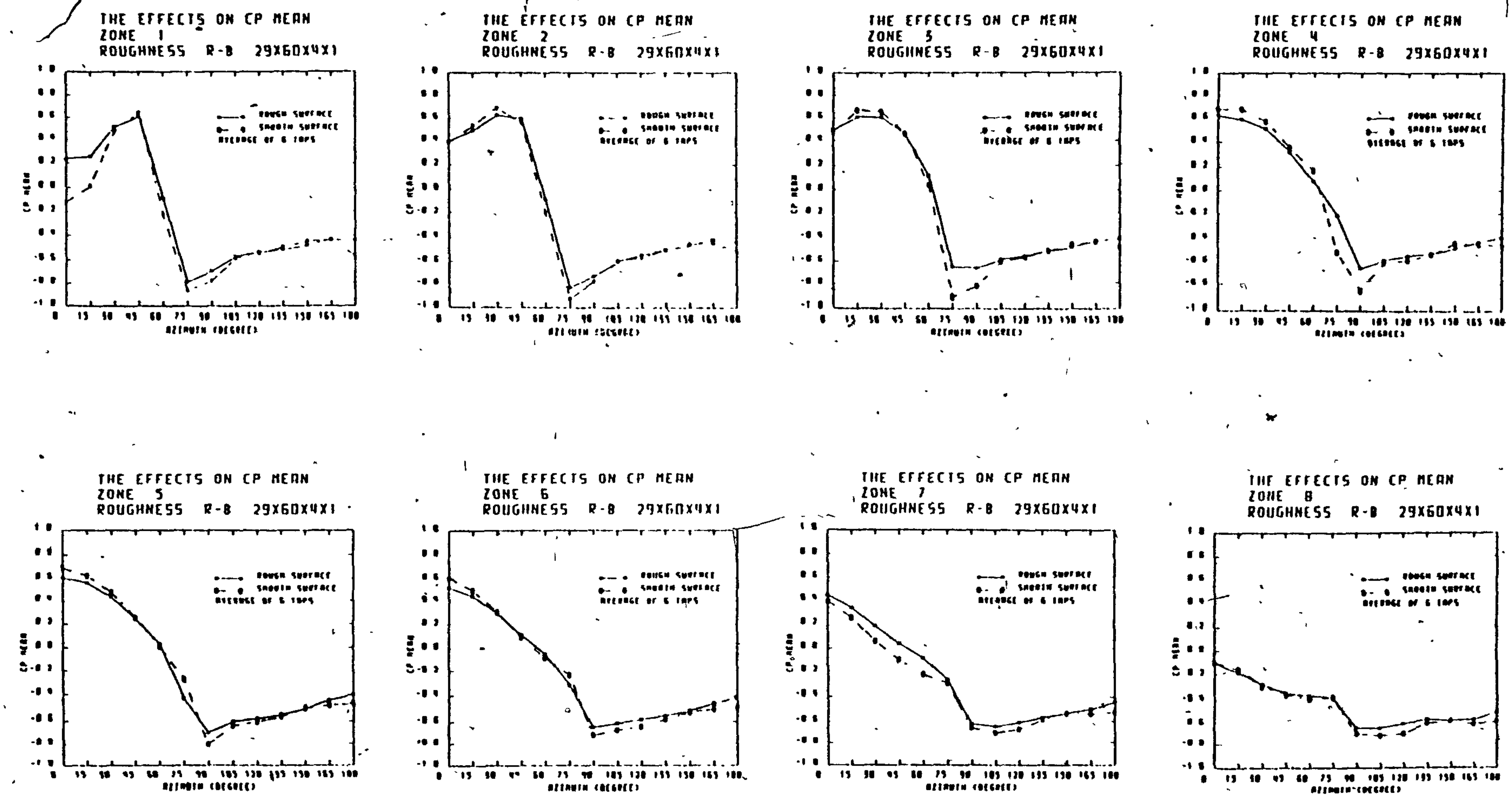


FIG. A.22 EFFECT OF 4 m BALCONIES WITH 1 m WALLS ON Cp MEAN (ZONE-AVERAGED VALUES)

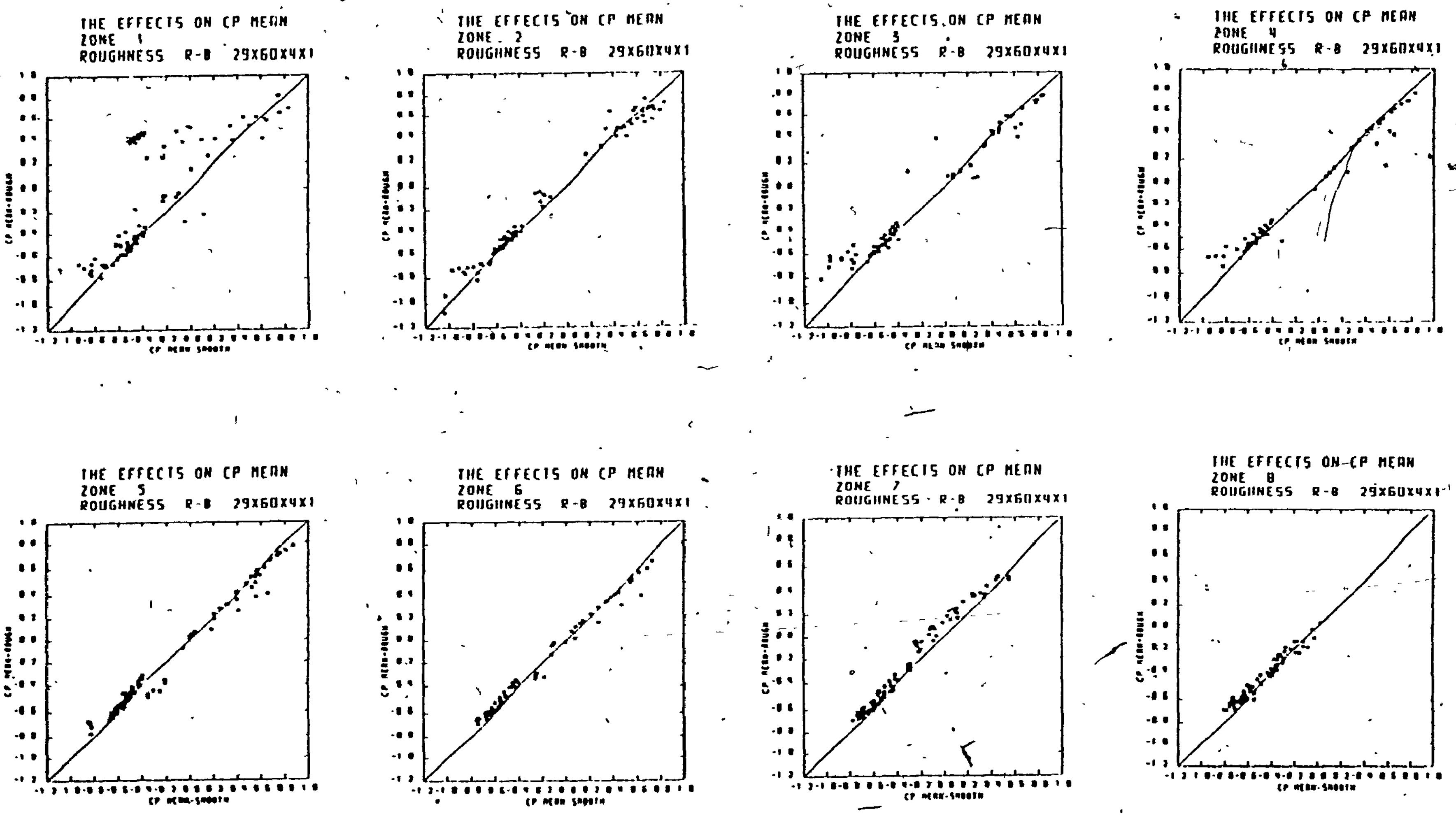


FIG. A.23 COMPARISON OF Cp MEAN ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES WITH 1 m WALLS

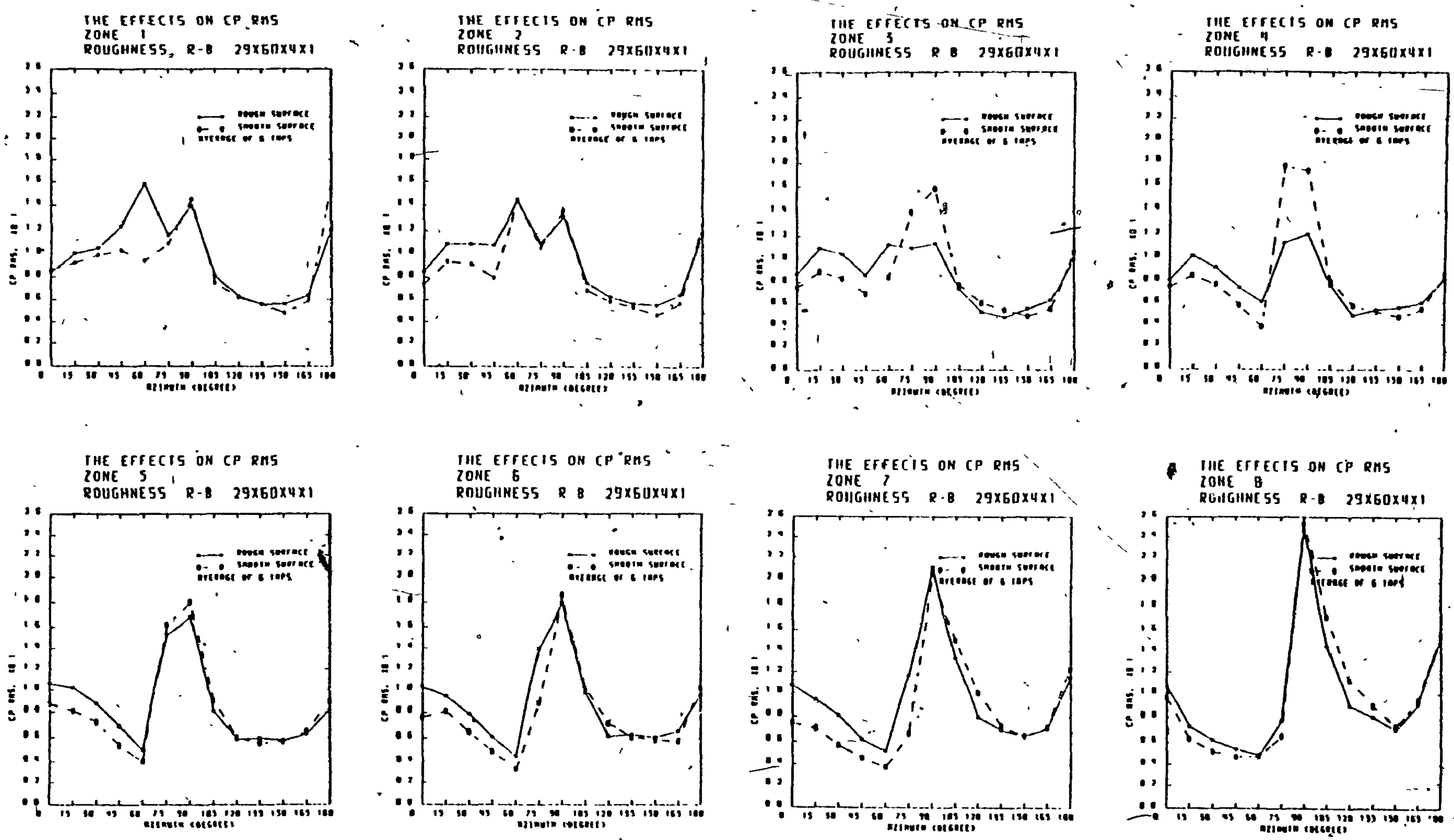


FIG. A.24 EFFECT OF 4 m BALCONIES WITH 1 m WALLS ON Cp RMS (ZONE-AVERAGED VALUES)

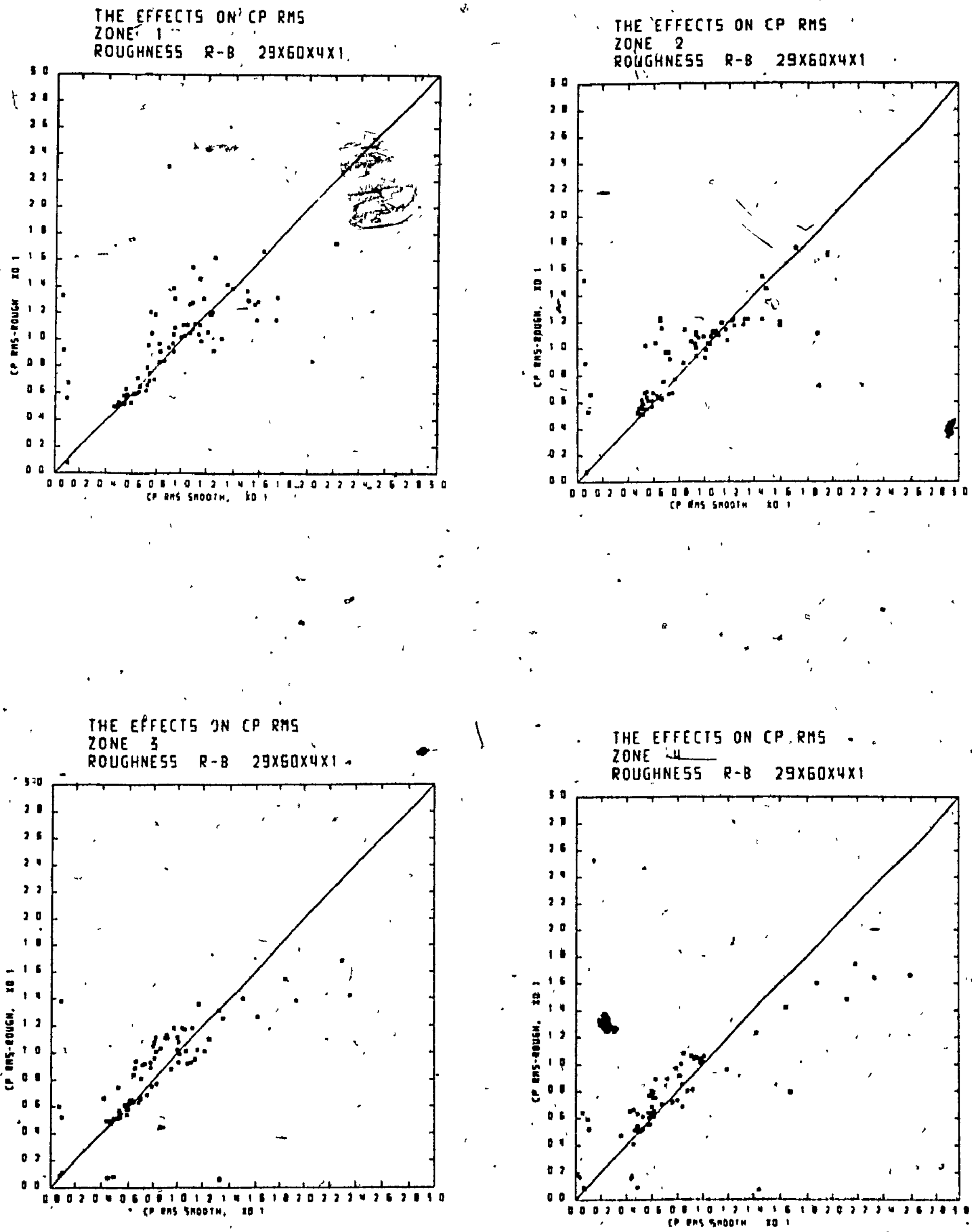
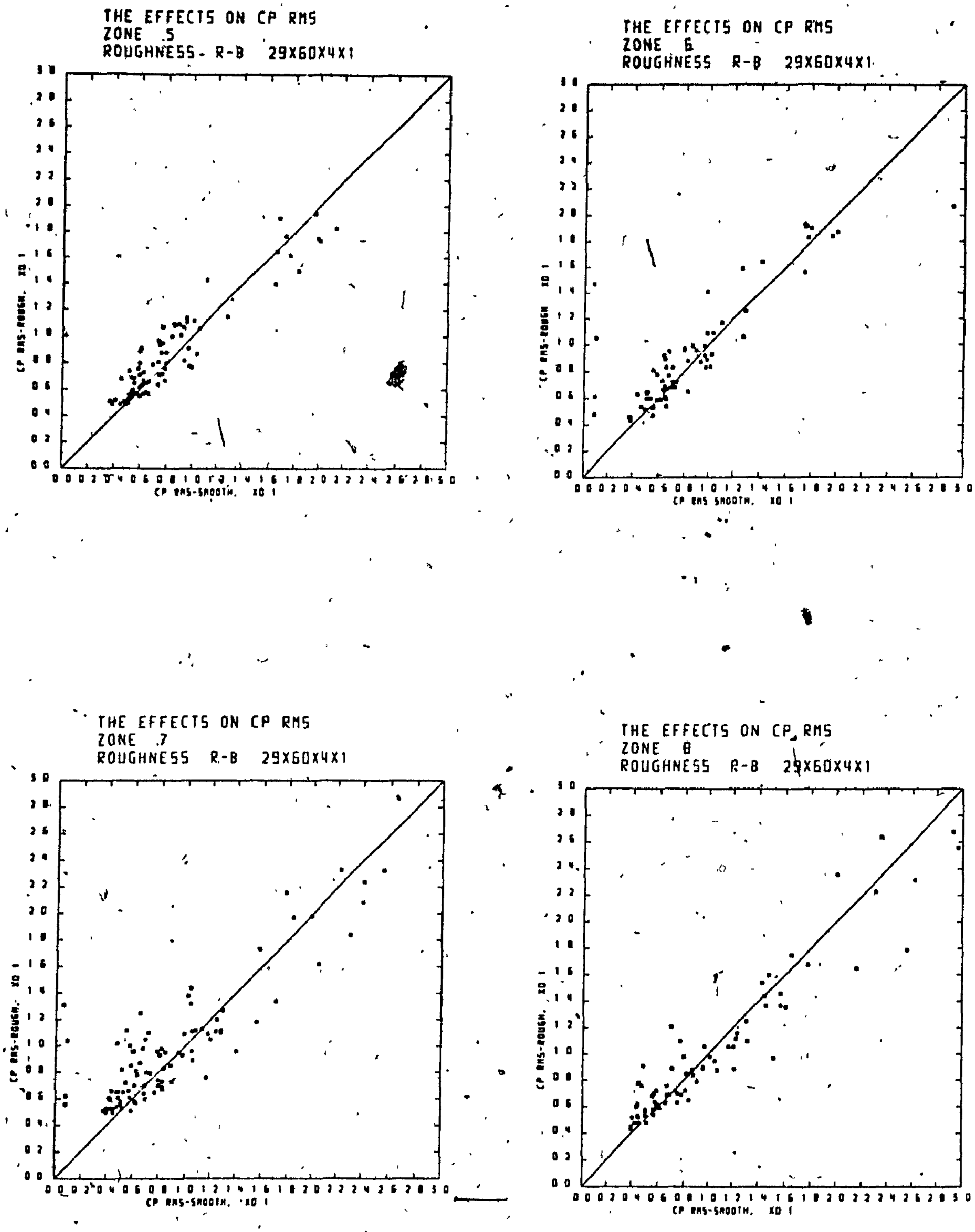


FIG. A.25 COMPARISON OF Cp RMS ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES WITH 1 m WALLS



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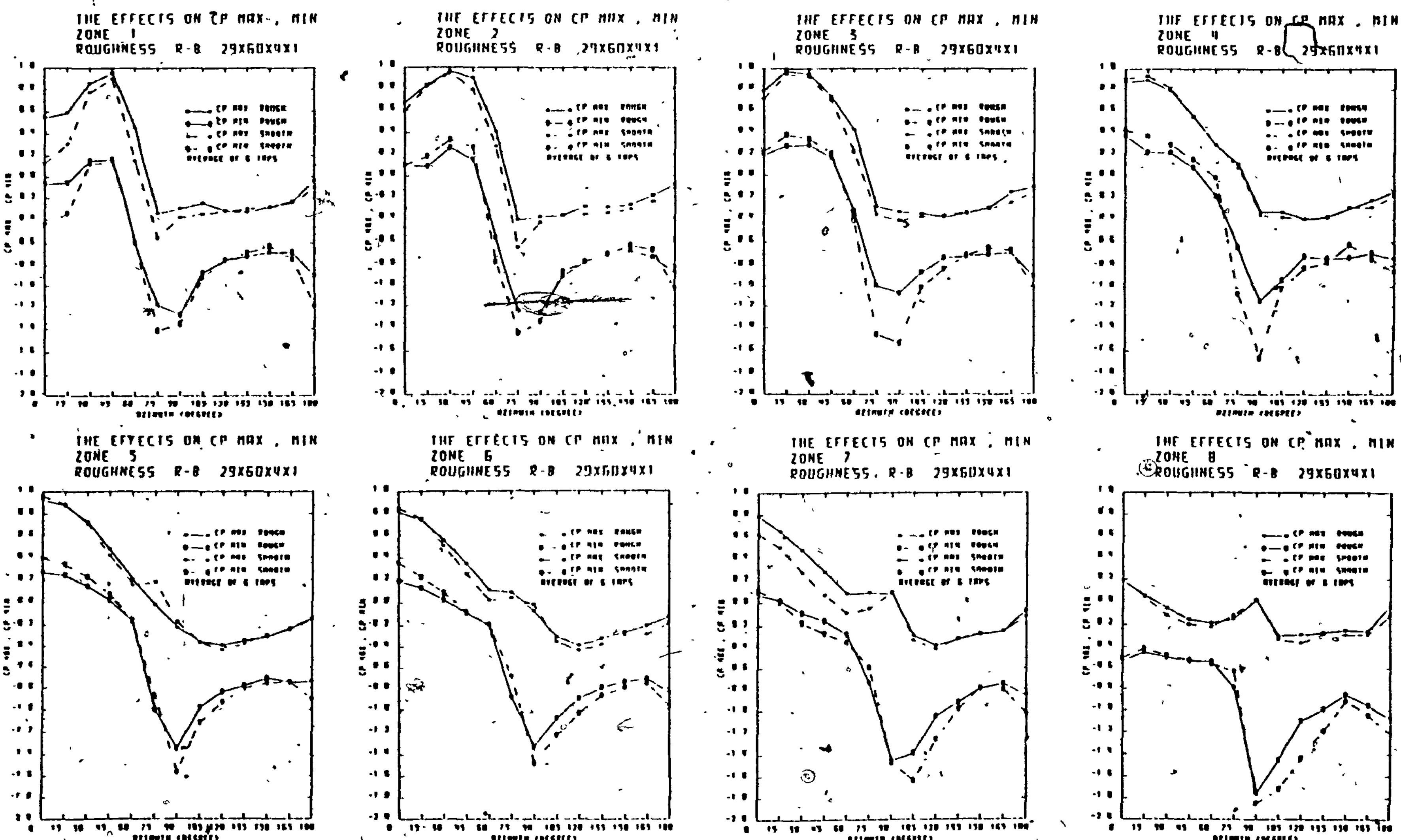


FIG. A.26 EFFECT OF 4 m BALCONIES WITH 1 m WALLS ON Cp PEAK (ZONE-AVERAGED VALUES)

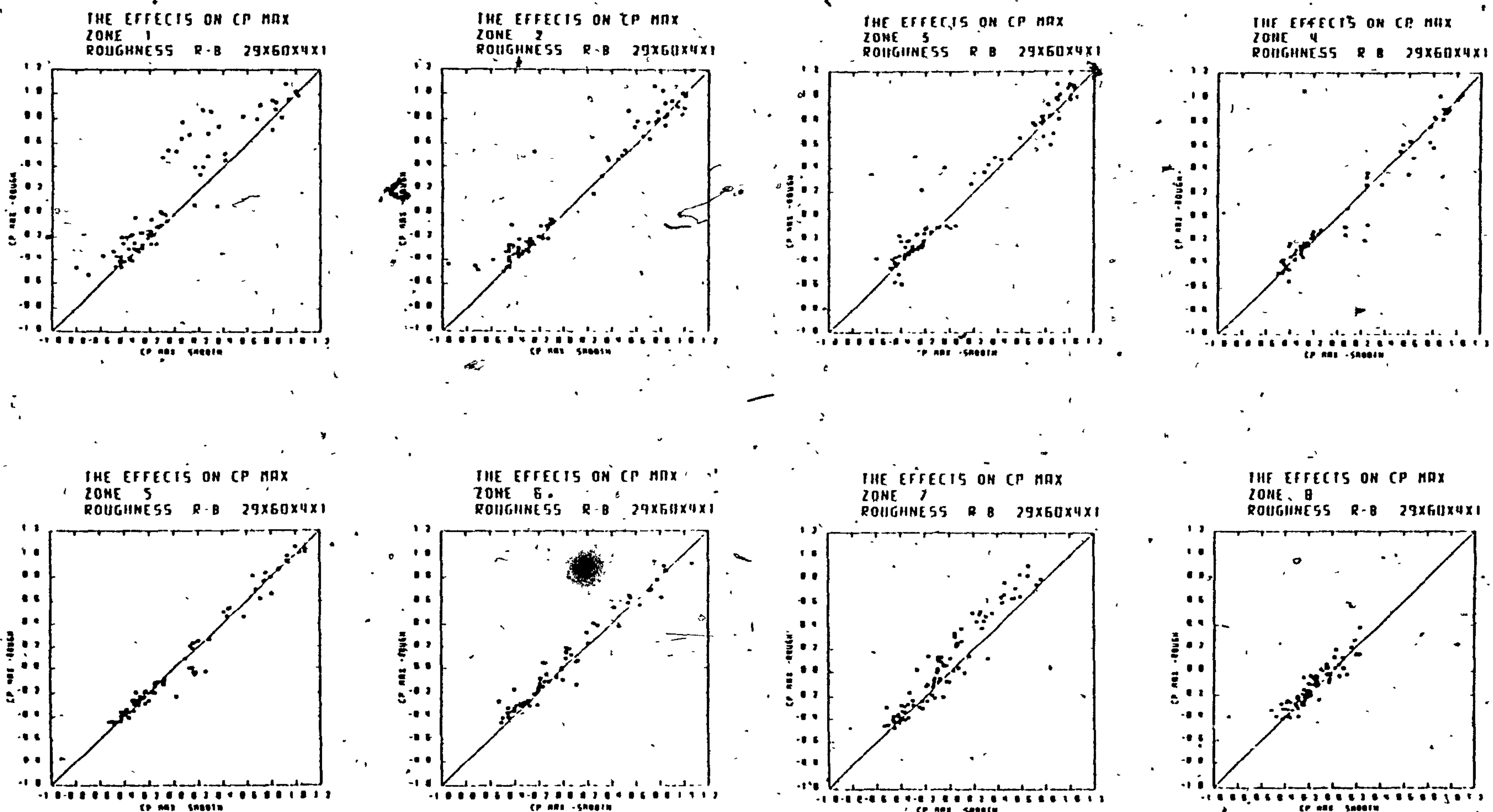


FIG. A.27 COMPARISON OF Cp MAX ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES WITH 1 m WALLS

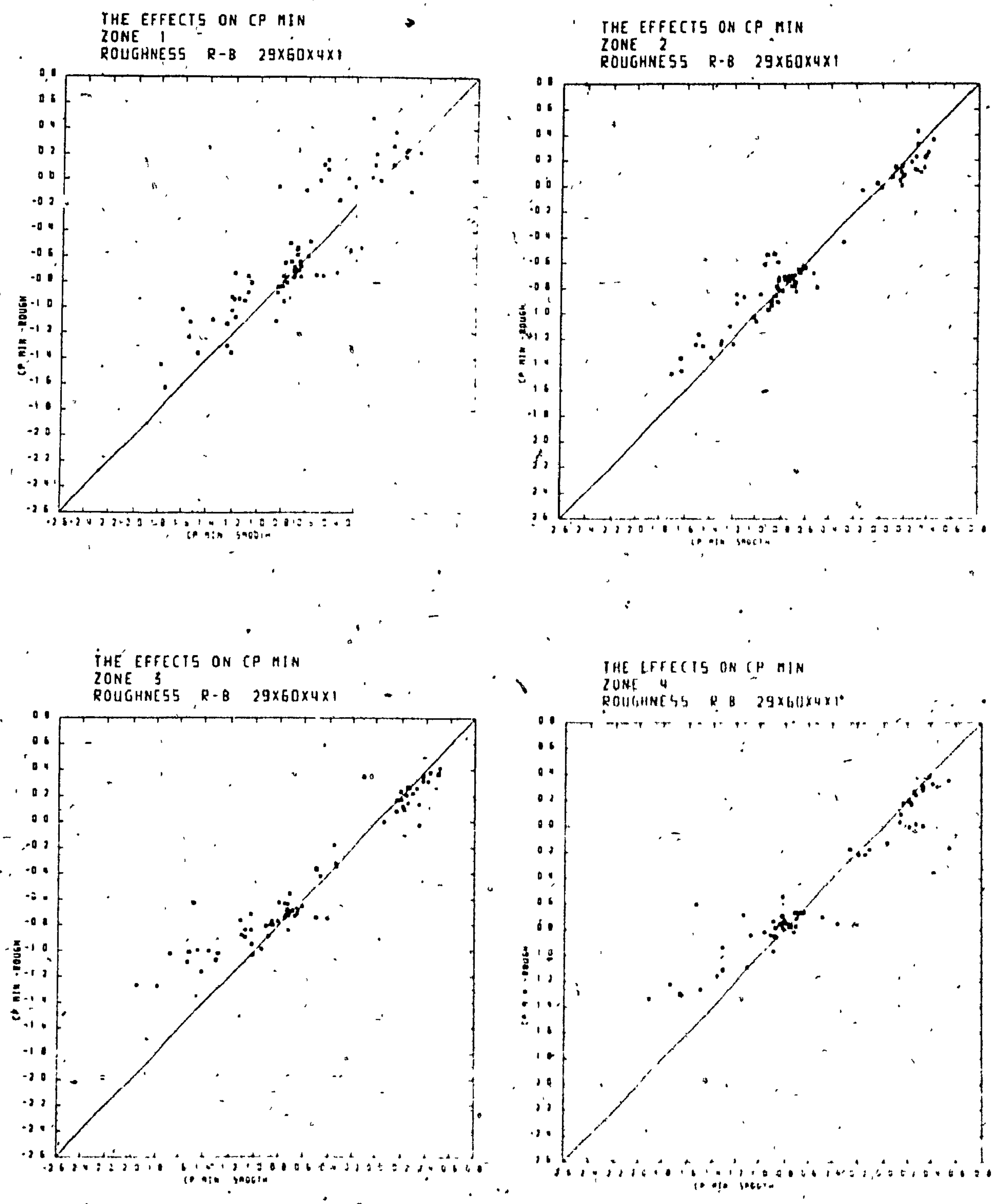
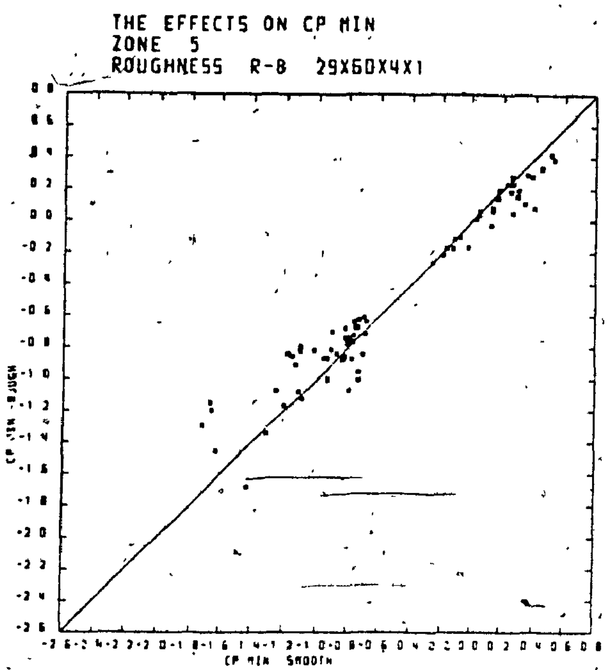
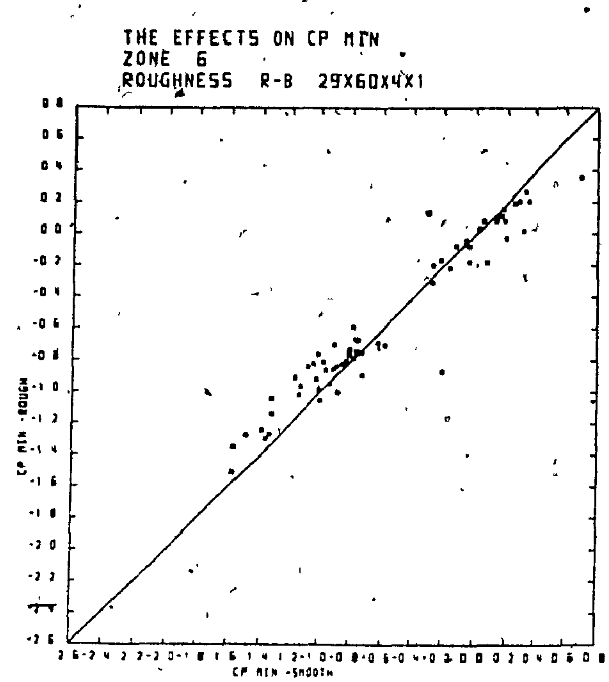
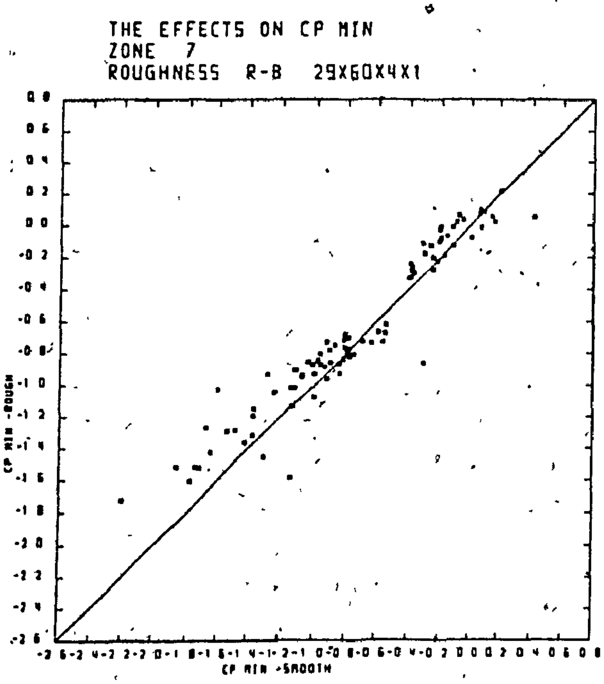
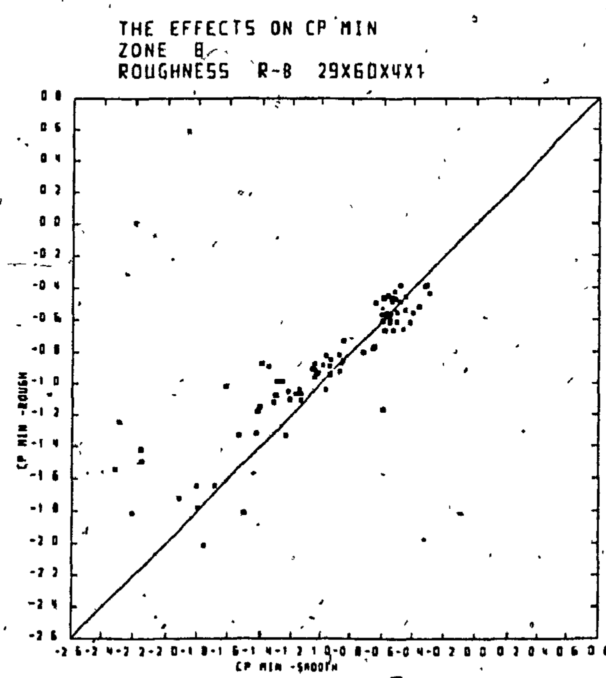


FIG. A.28 COMPARISON OF Cp MIN ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES WITH 1 m WALLS









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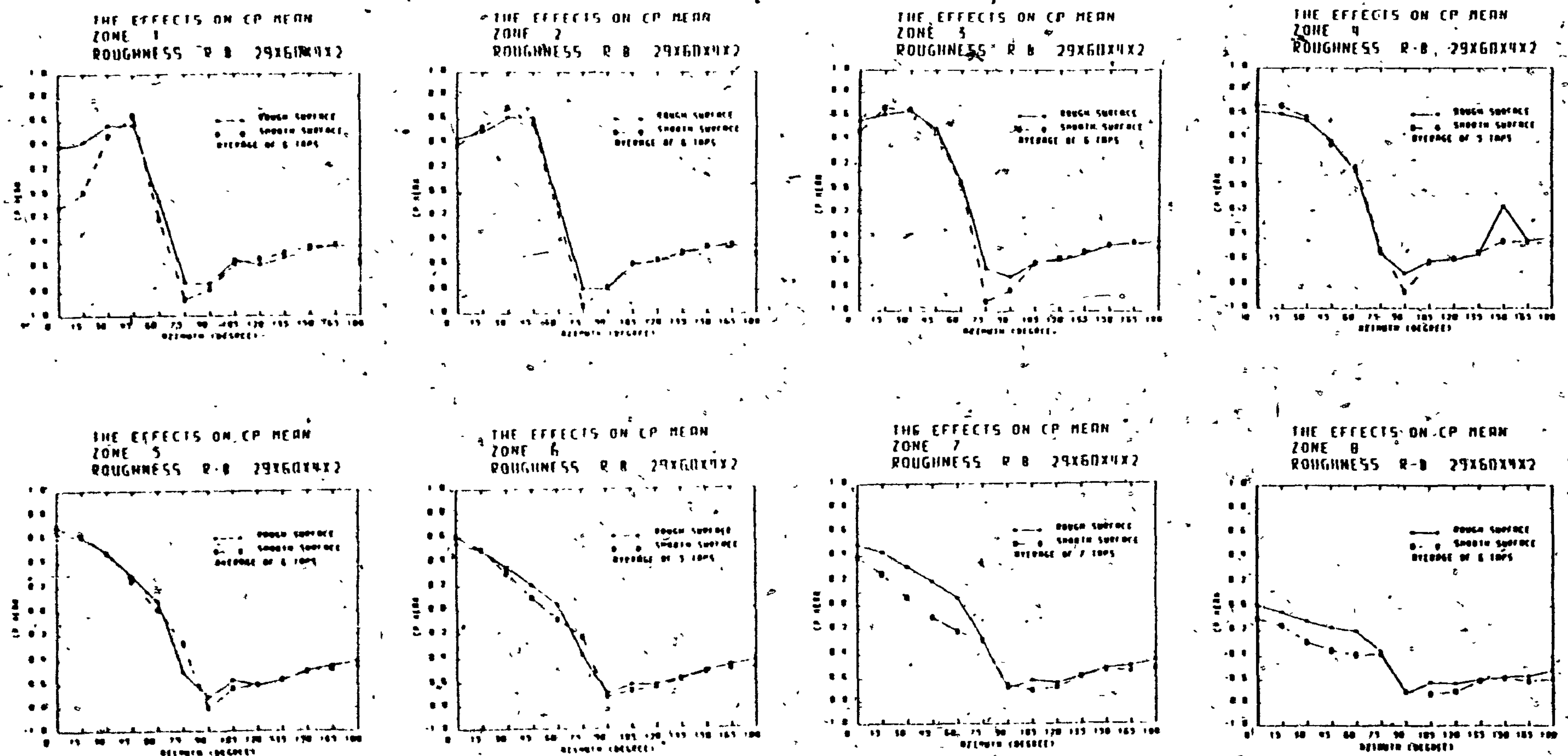


FIG. A.29 EFFECT OF 4 m BALCONIES WITH 2 m WALLS ON Cp MEAN (ZONE-AVERAGED VALUES)

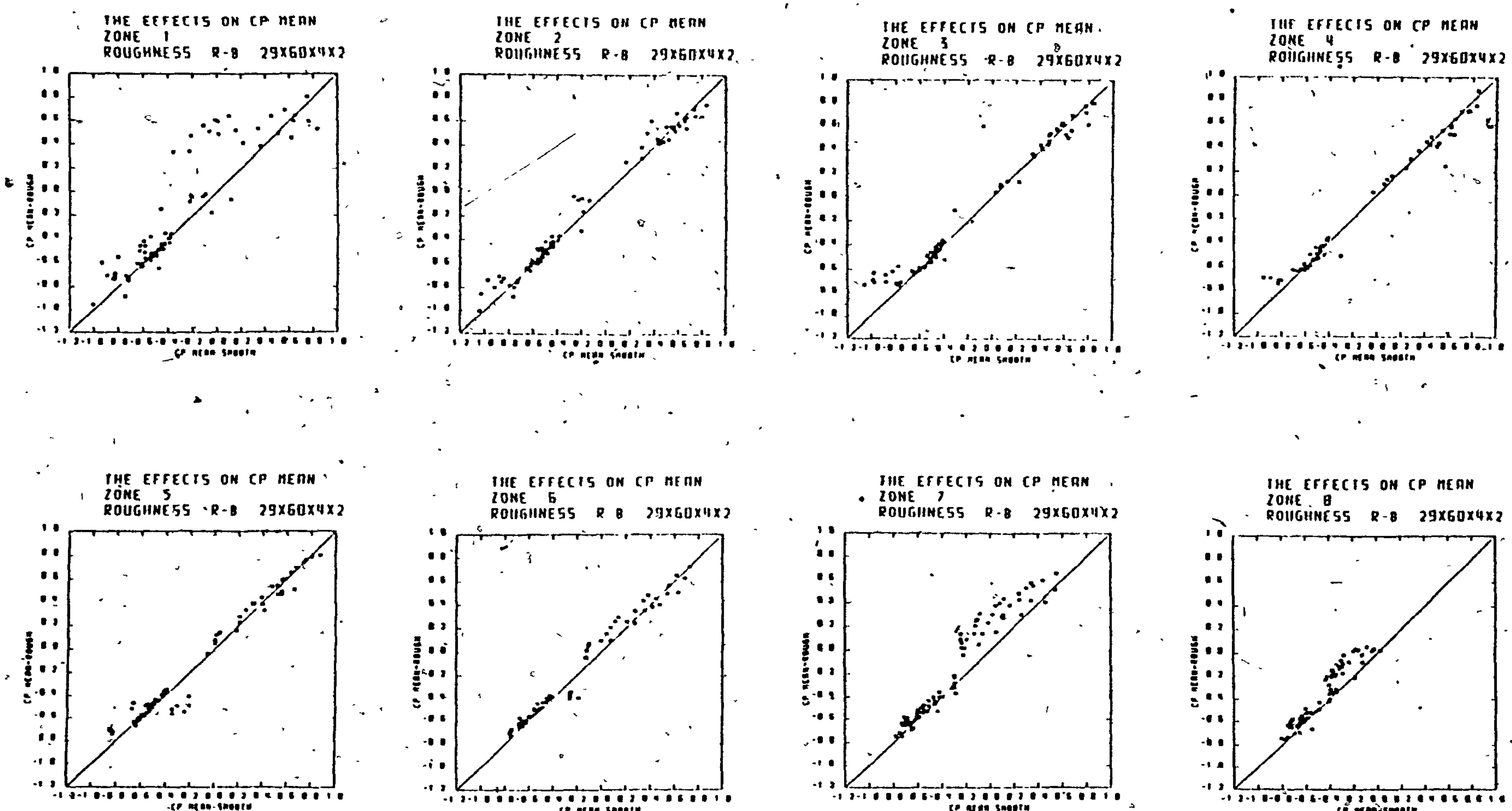


FIG. A.30 COMPARISON OF Cp MEAN ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES WITH 2 m WALLS

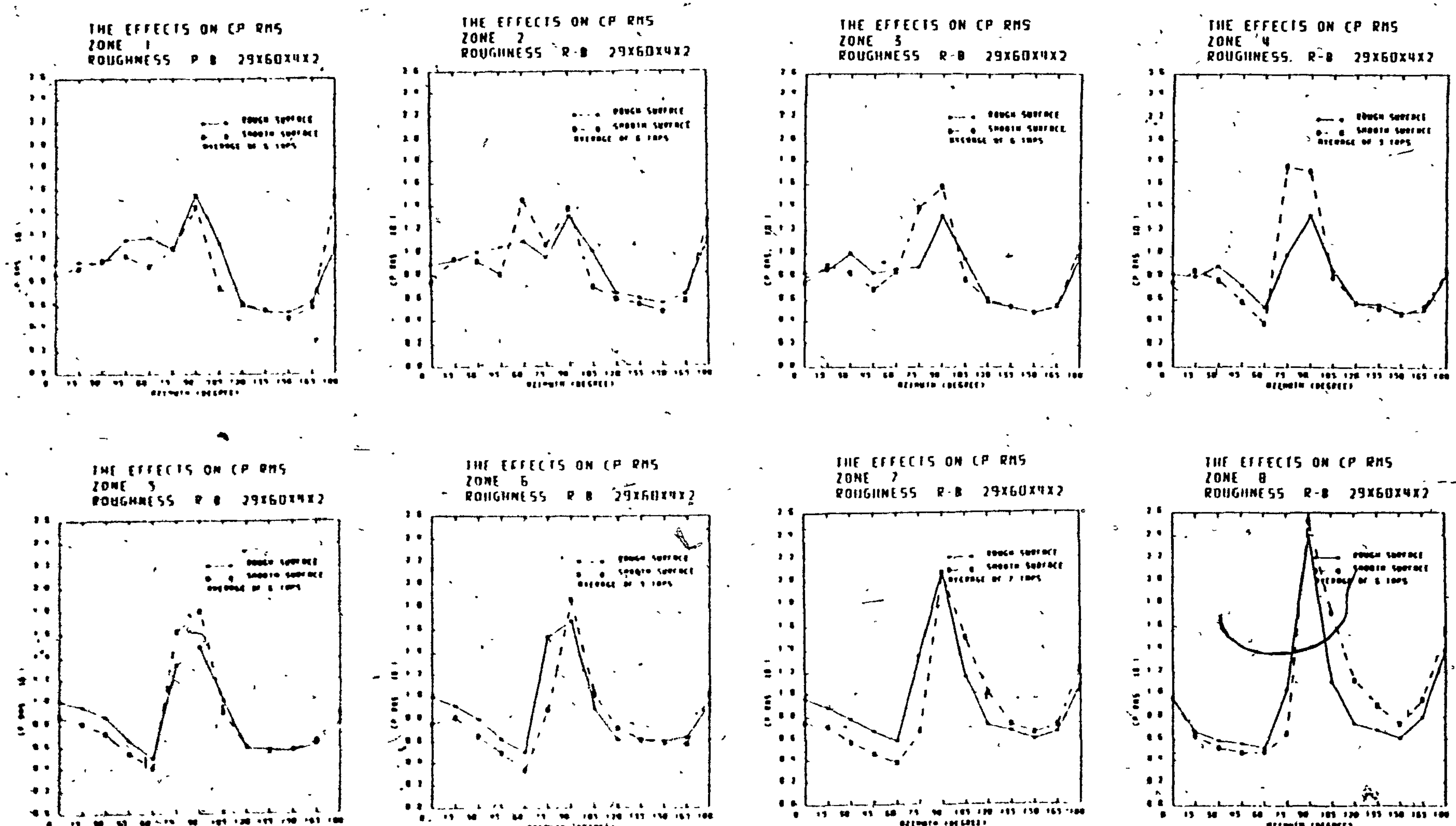


FIG. A.31 EFFECT OF 4 m BALCONIES WITH 2 m WALLS ON Cp RMS (ZONE-AVERAGED VALUES)

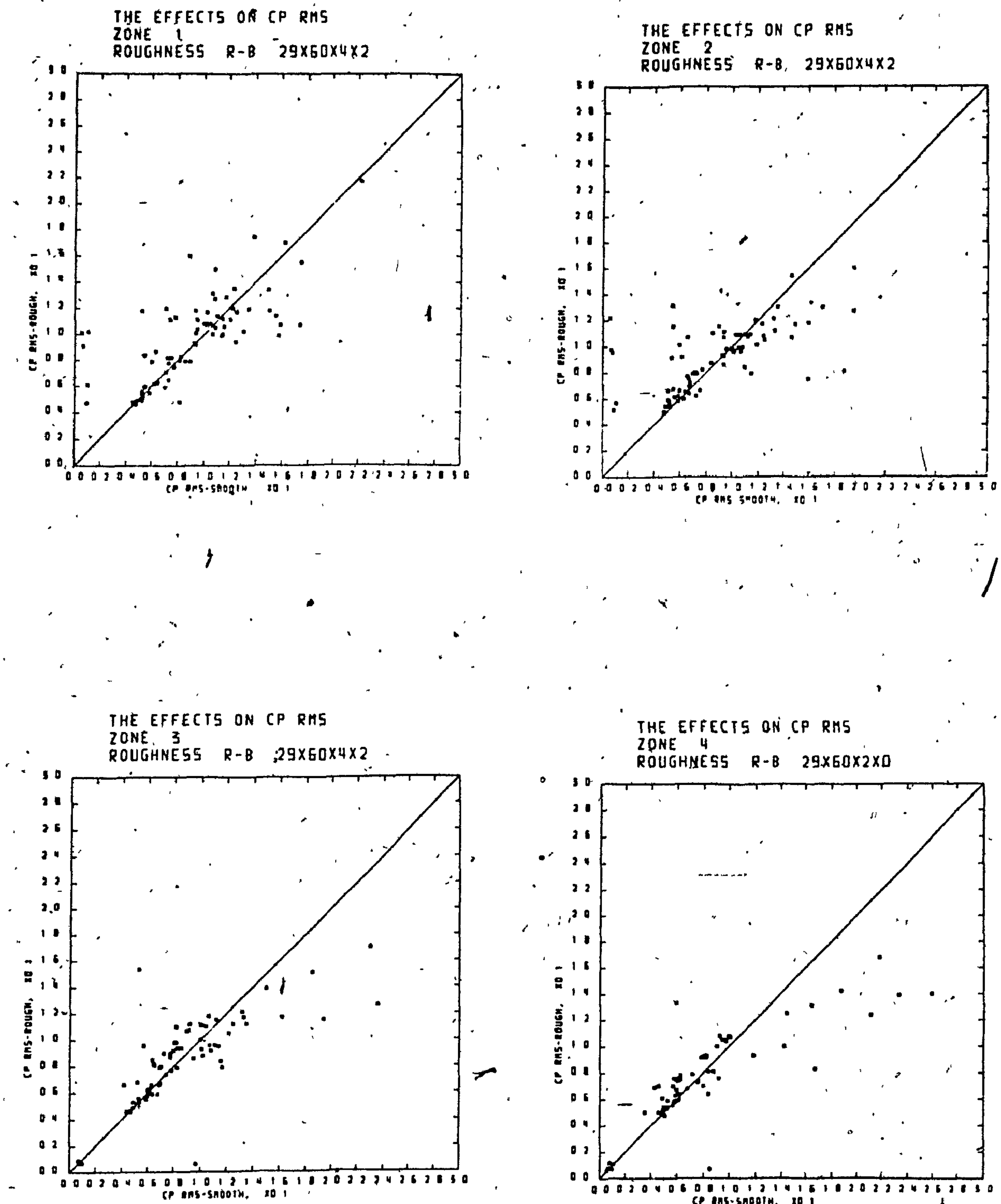
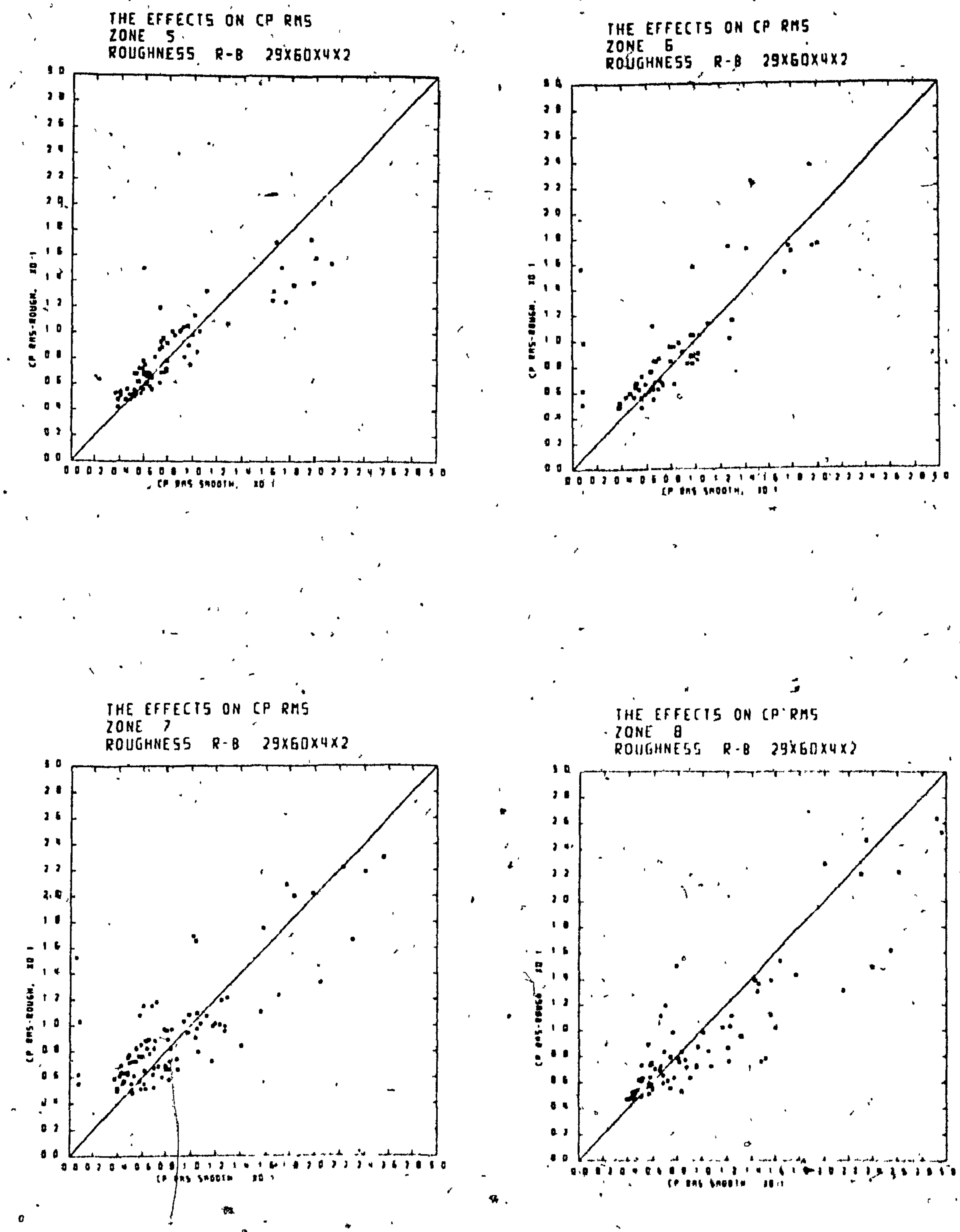


FIG. A.32 COMPARISON OF Cp RMS ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES WITH 2 m WALLS



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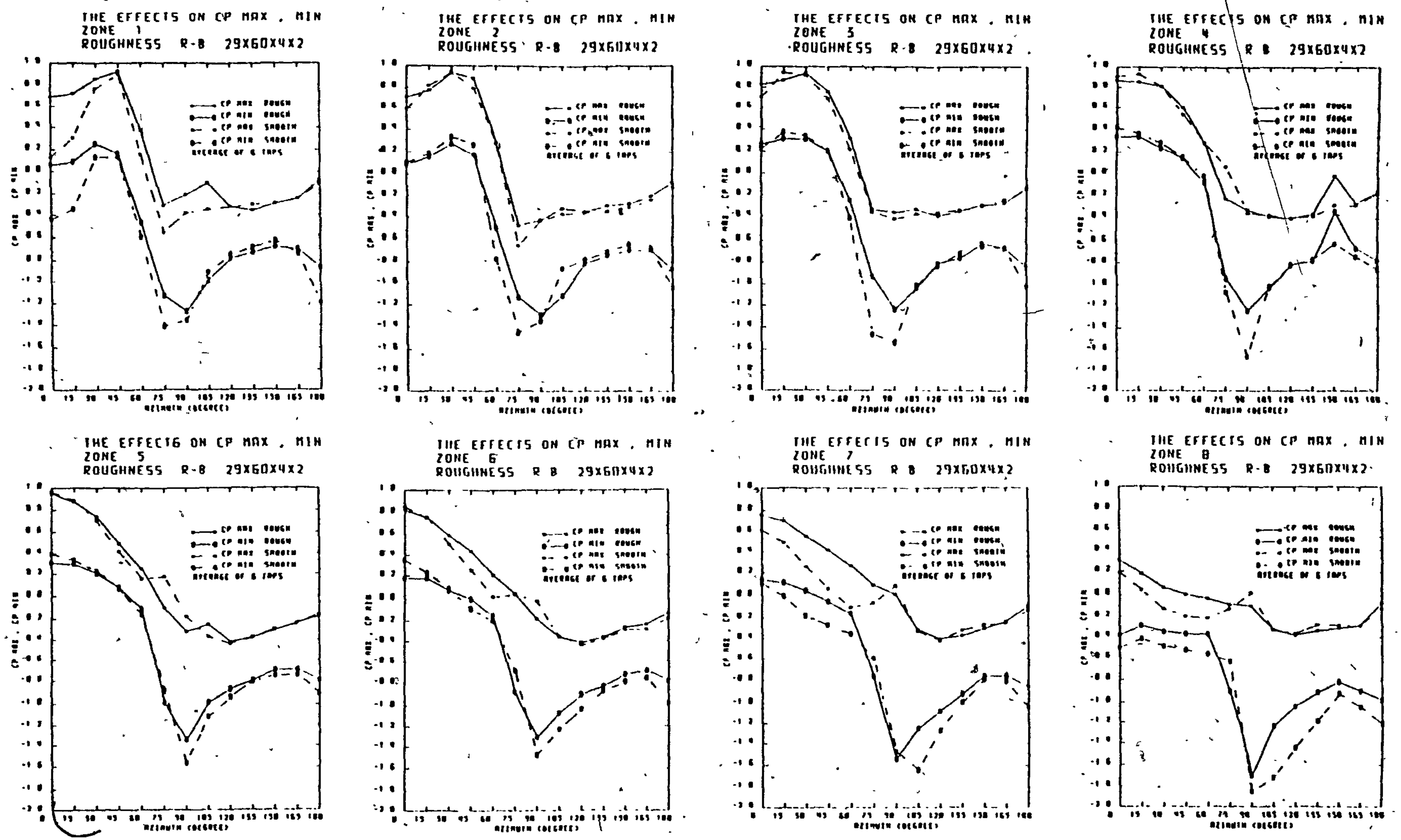


FIG. A.33 EFFECT OF 4 m BALCONIES WITH 2 m WALLS ON Cp PEAK (ZONE-AVERAGED VALUES)

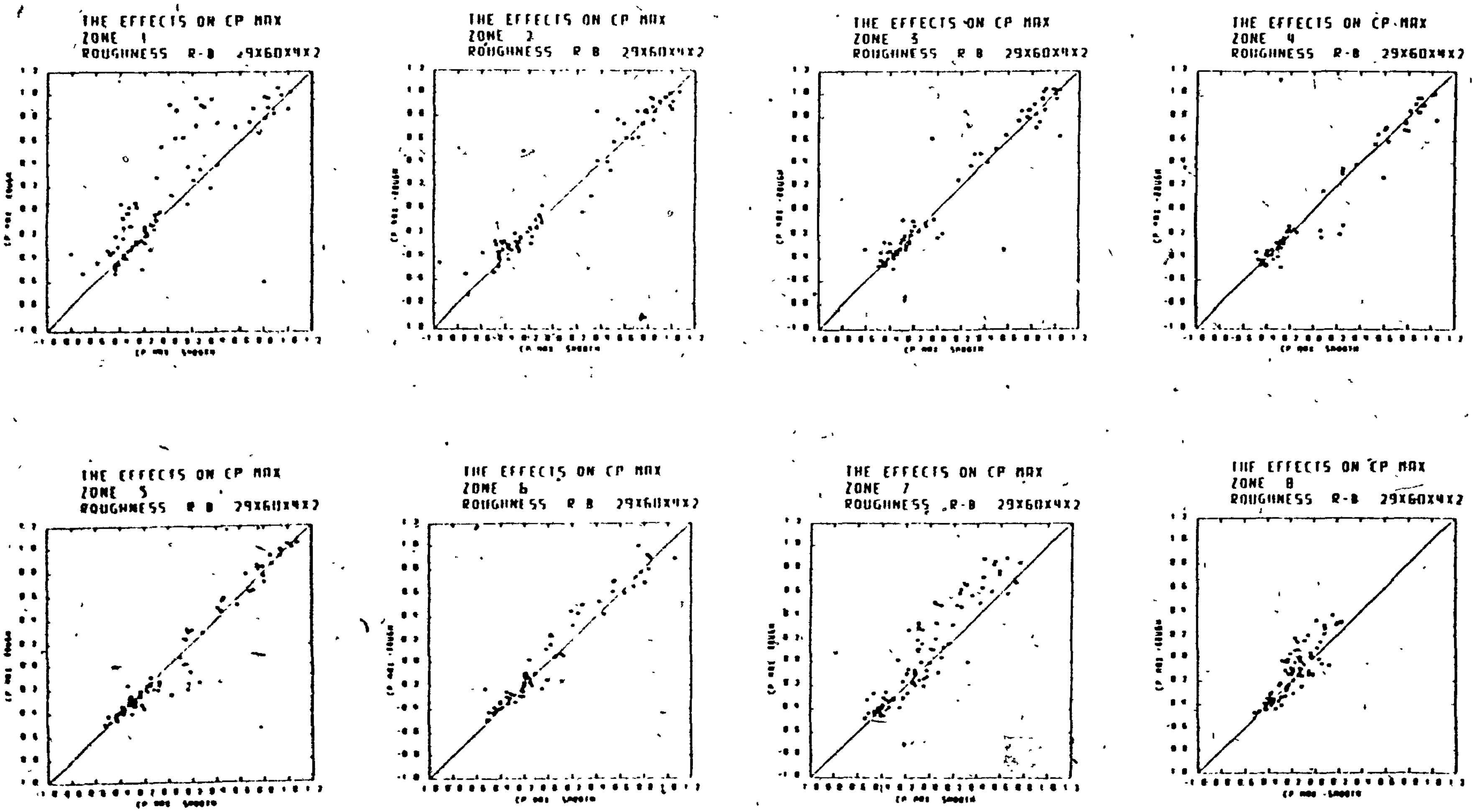


FIG. A.34 COMPARISON OF Cp MAX ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES WITH 2 m WALLS

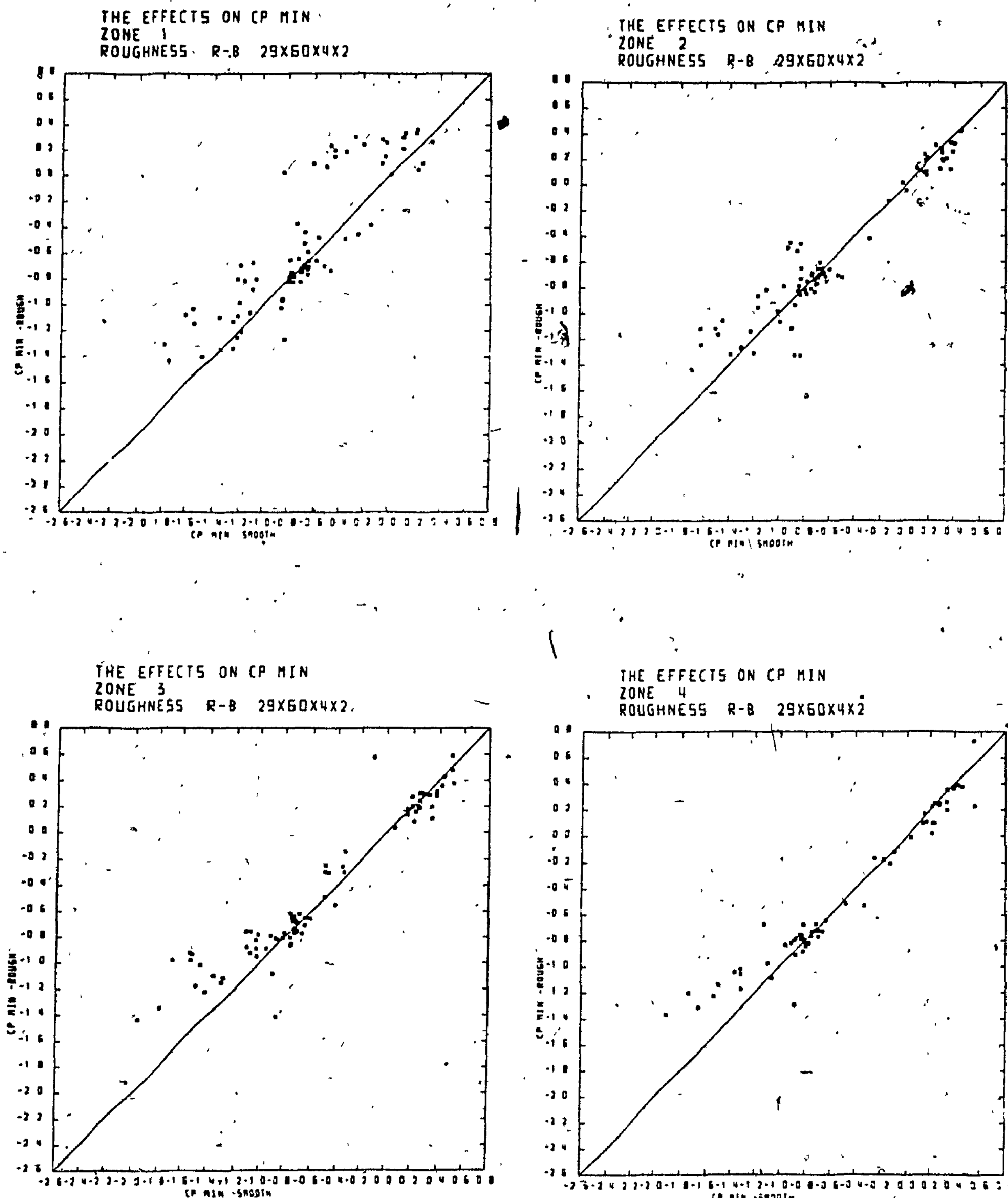


FIG. A.35 COMPARISON OF Cp MIN ON BUILDINGS WITH SMOOTH AND WITH 4 m BALCONIES WITH 2 m WALLS

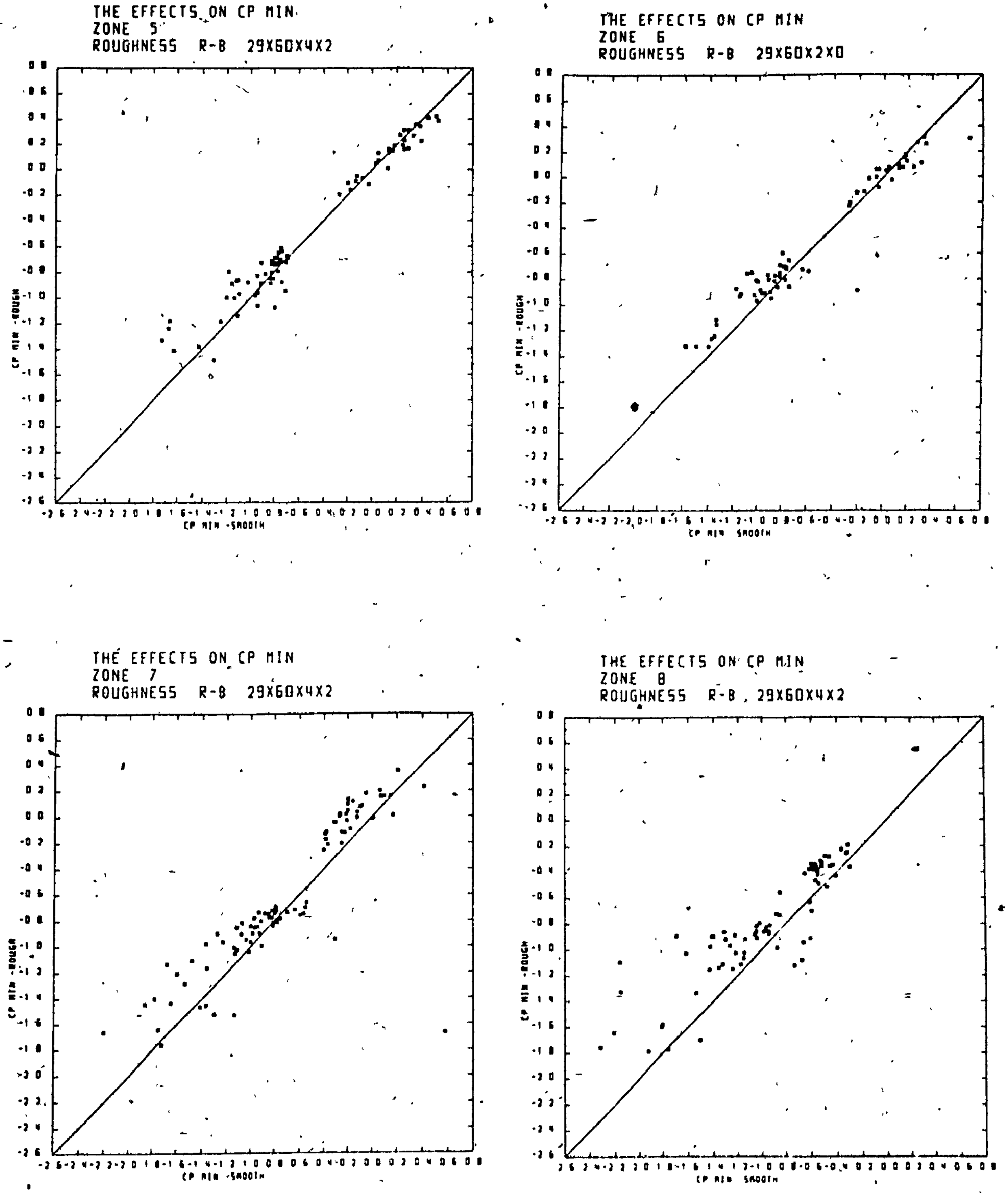


FIG. A.35 CONTINUED

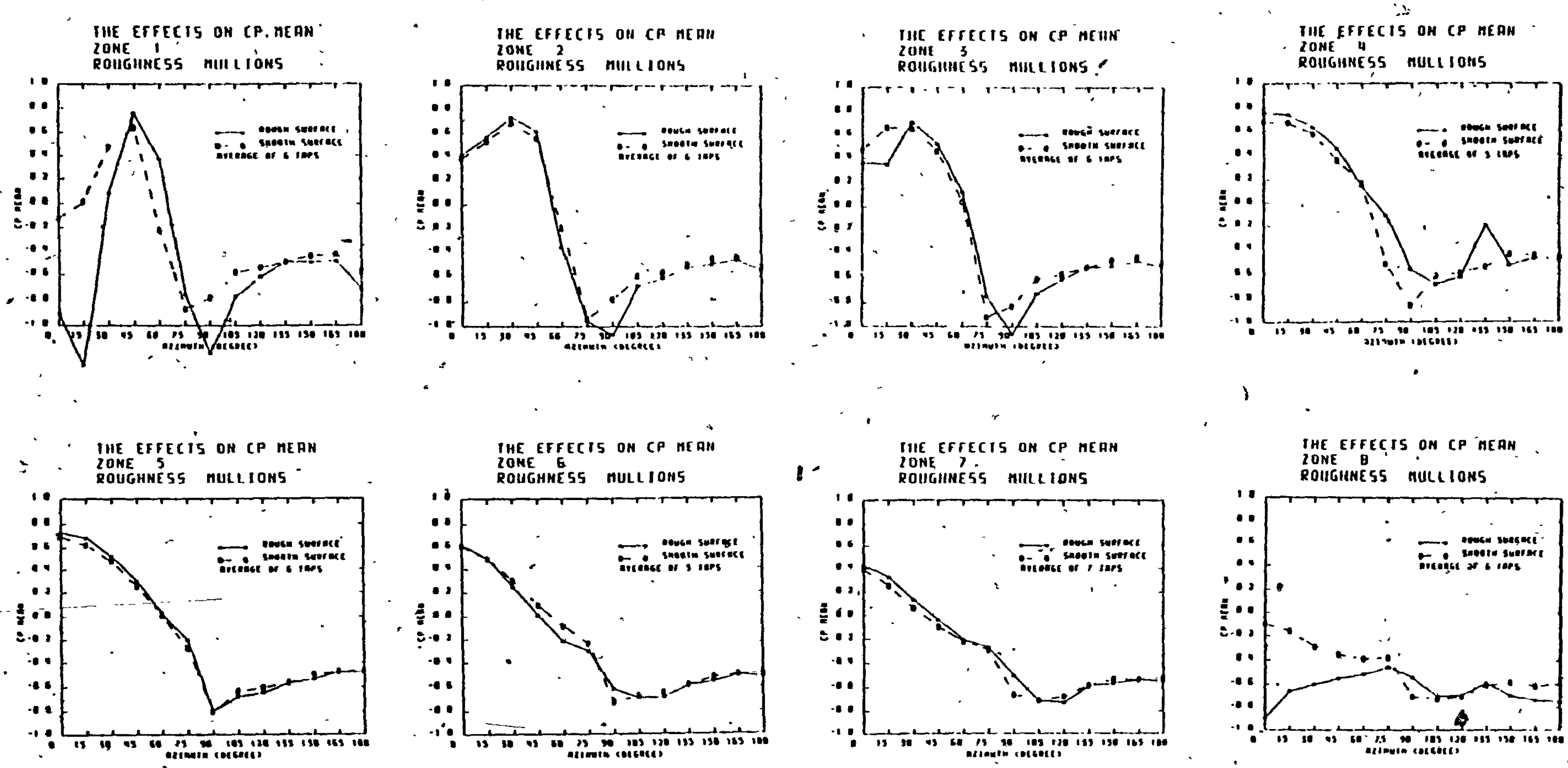


FIG. A.36 EFFECT OF MULLIONS ON Cp MEAN (ZONE-AVERAGED VALUES)

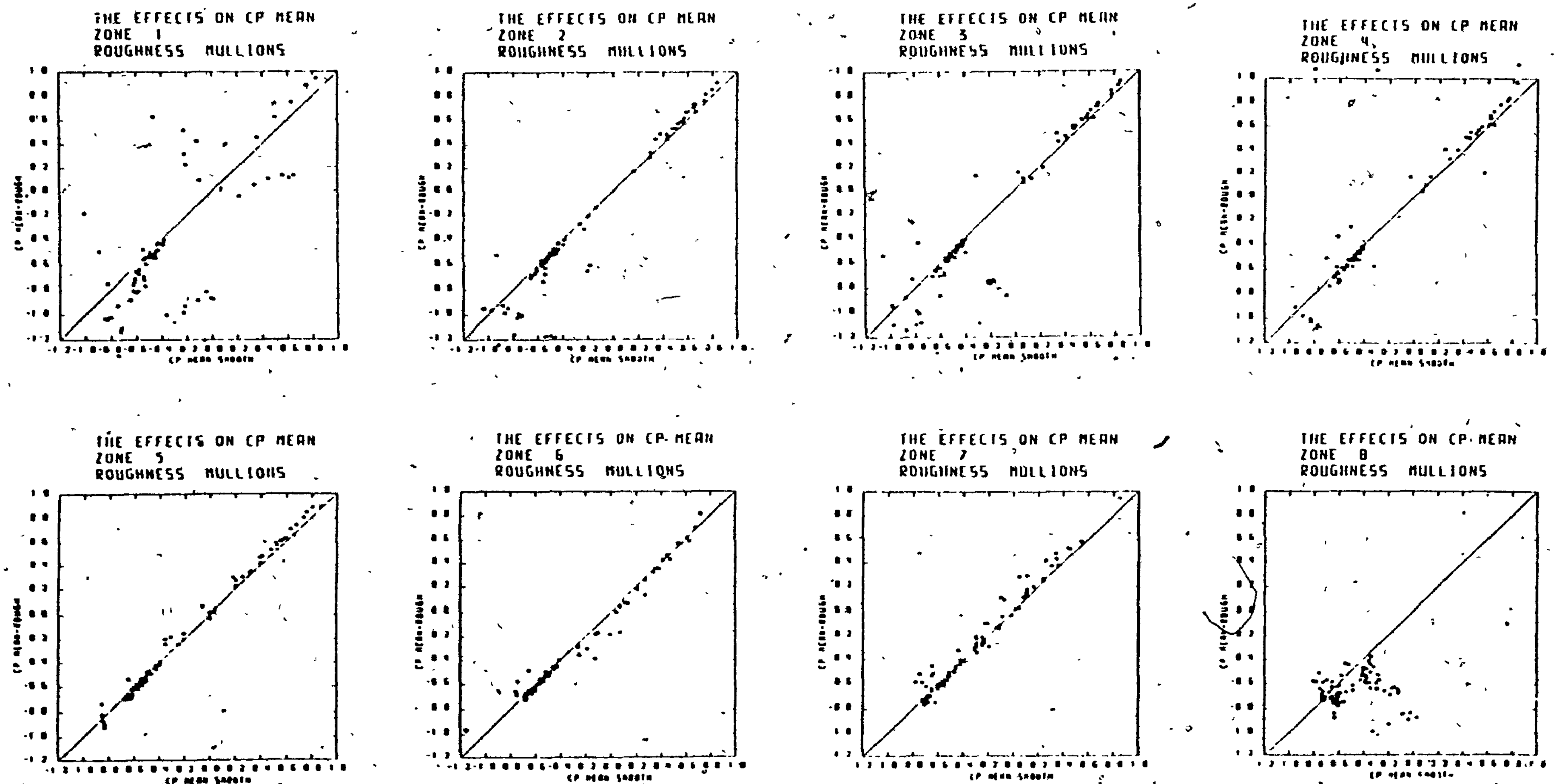


FIG. A.37 COMPARISON OF Cp MEAN ON BUILDINGS WITH SMOOTH AND WITH MULLIONS

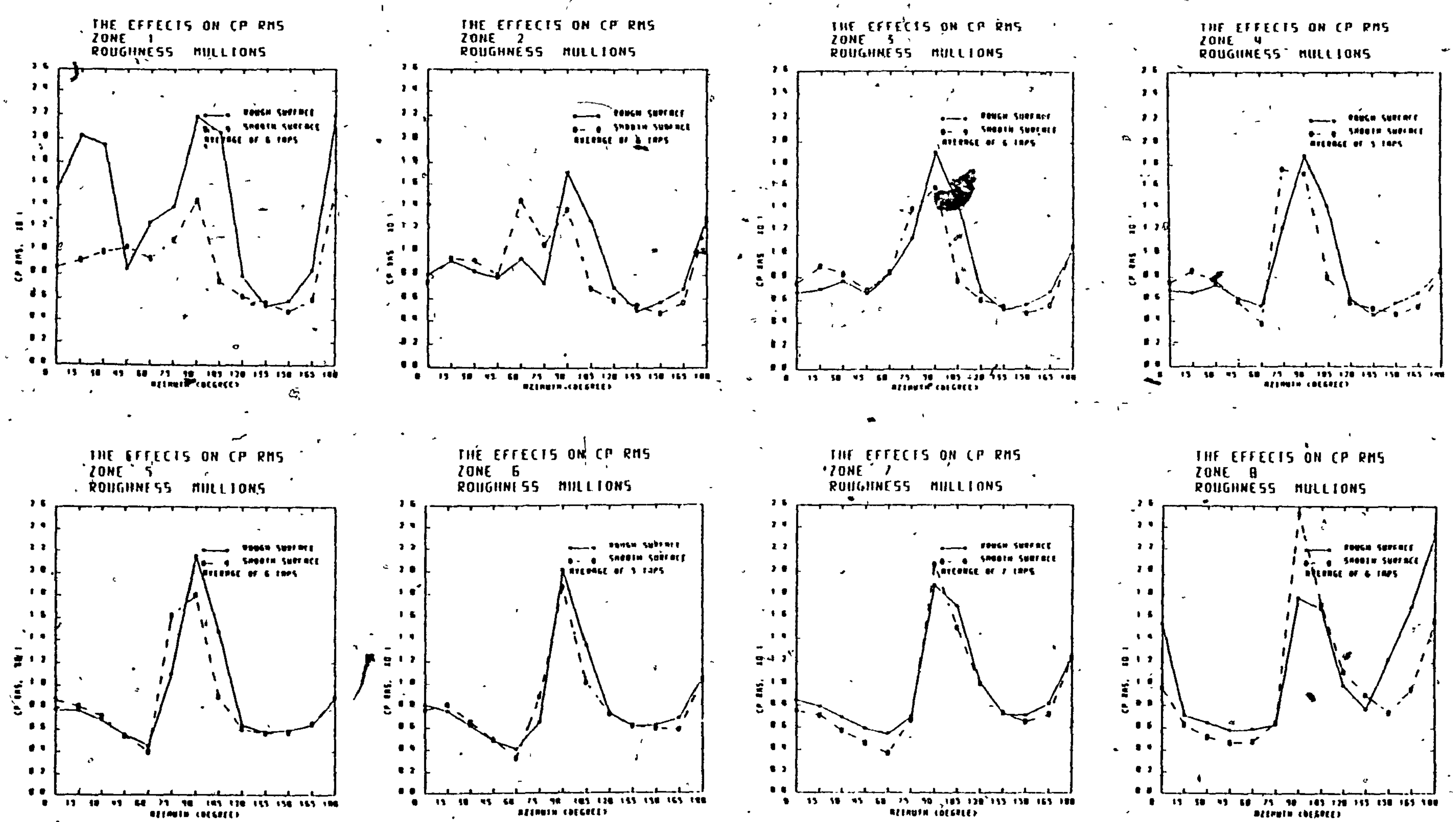


FIG. A.38 EFFECT OF MULLIONS ON Cp RMS (ZONE-AVERAGED VALUES)

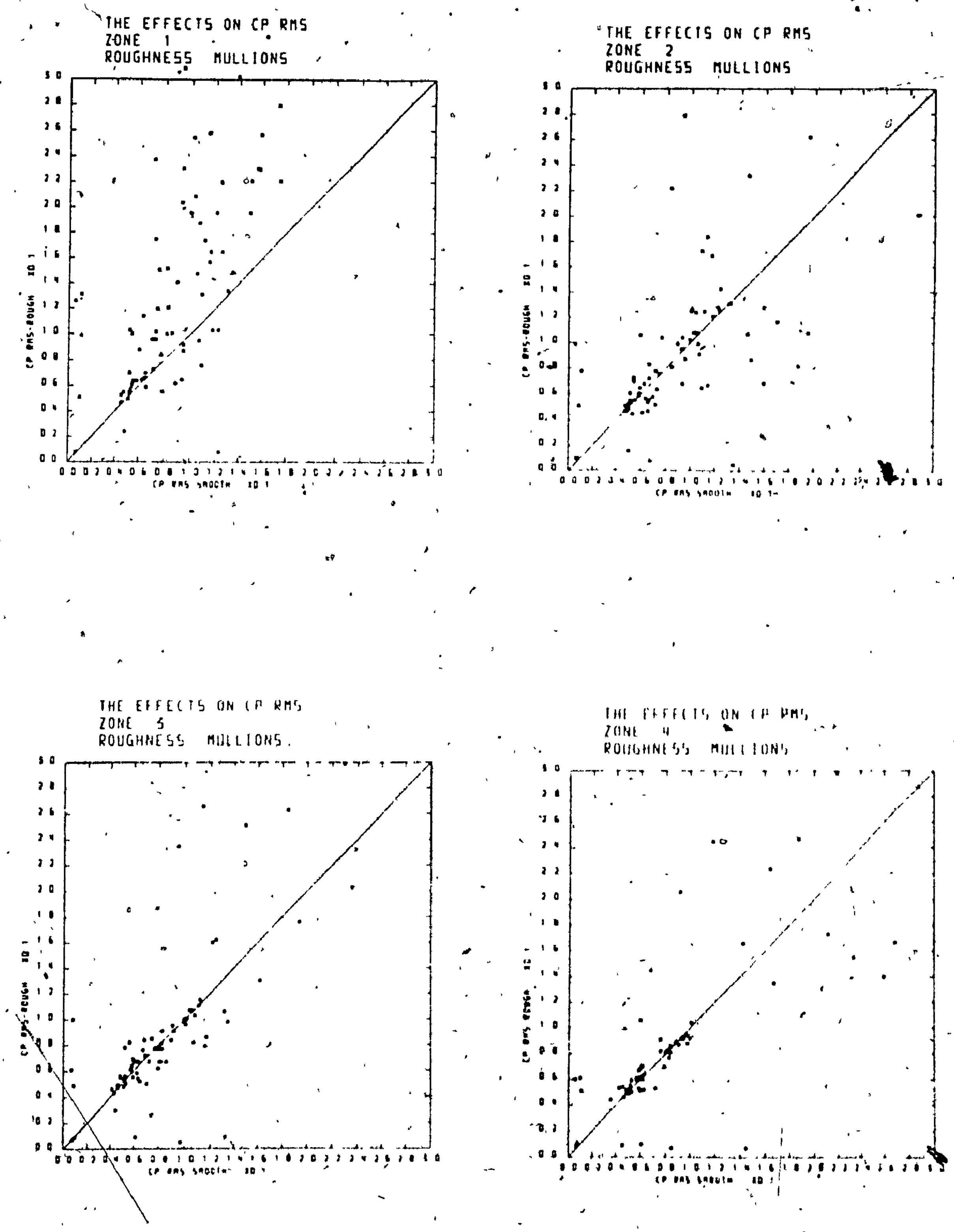


FIG. A.39 COMPARISON OF Cp RMS ON BUILDINGS WITH SMOOTH AND WITH MULLIONS

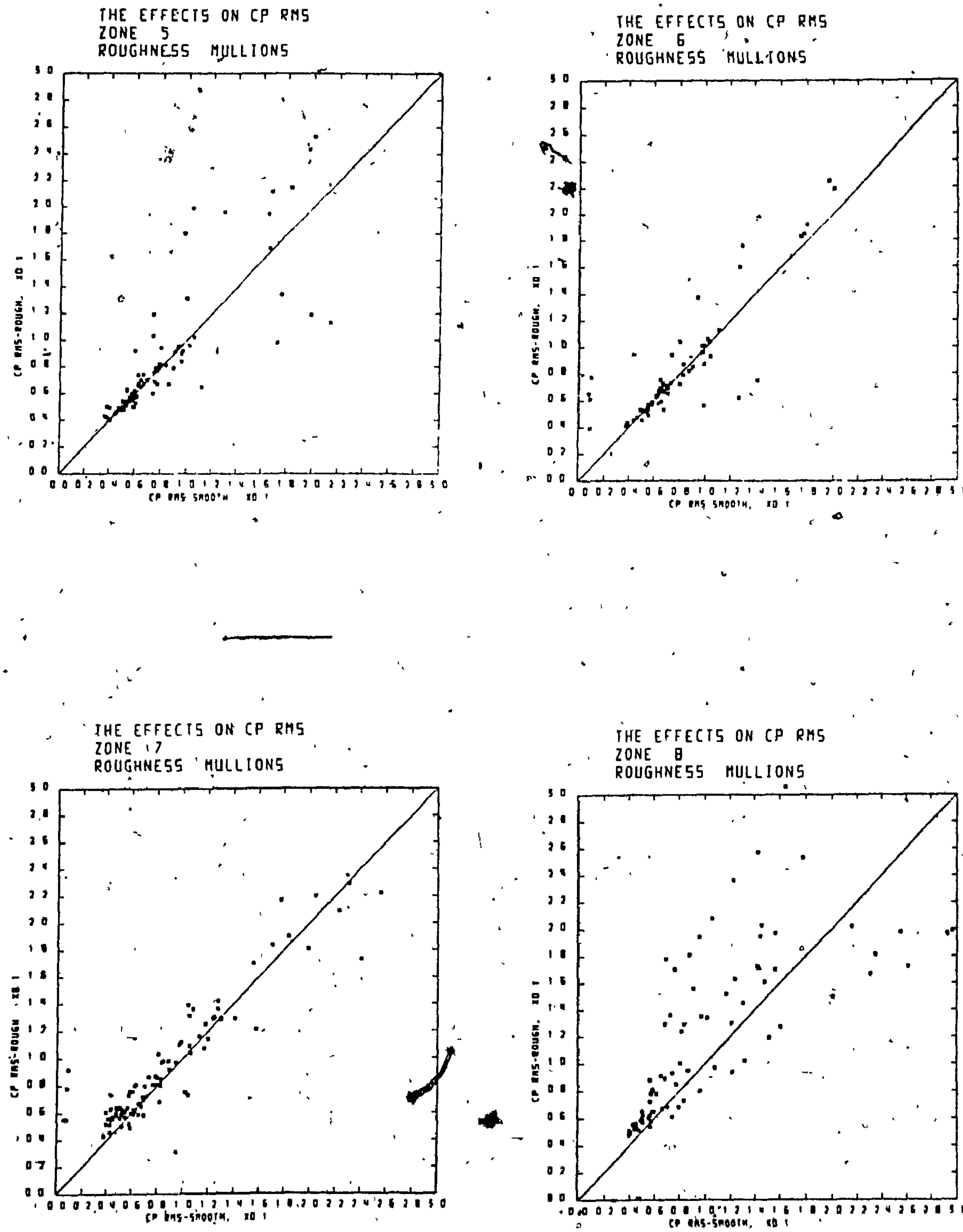


FIG. A.39 CONTINUED

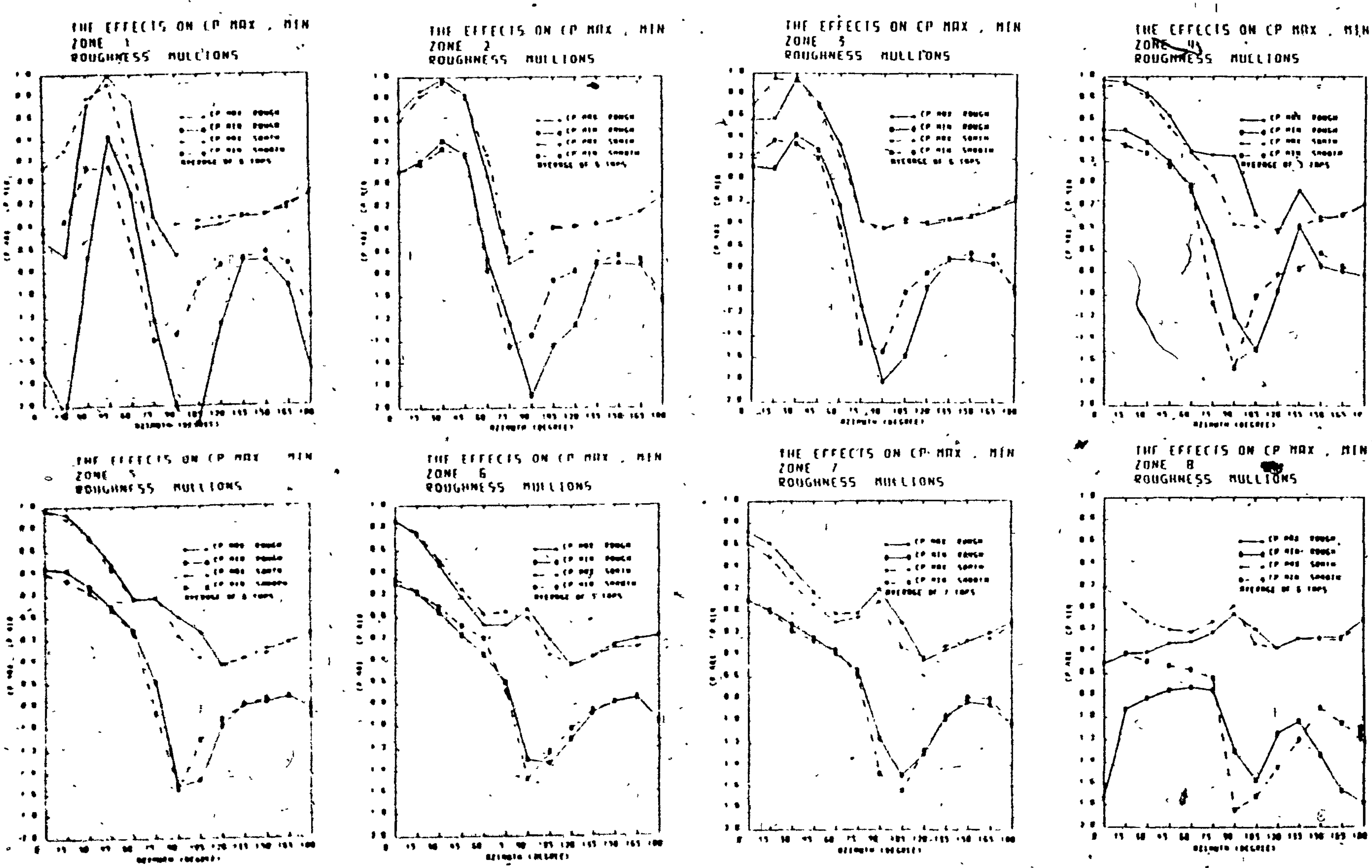


FIG. A.40 EFFECT OF MULLIONS ON Cp PEAK (ZONE-AVERAGED VALUES)

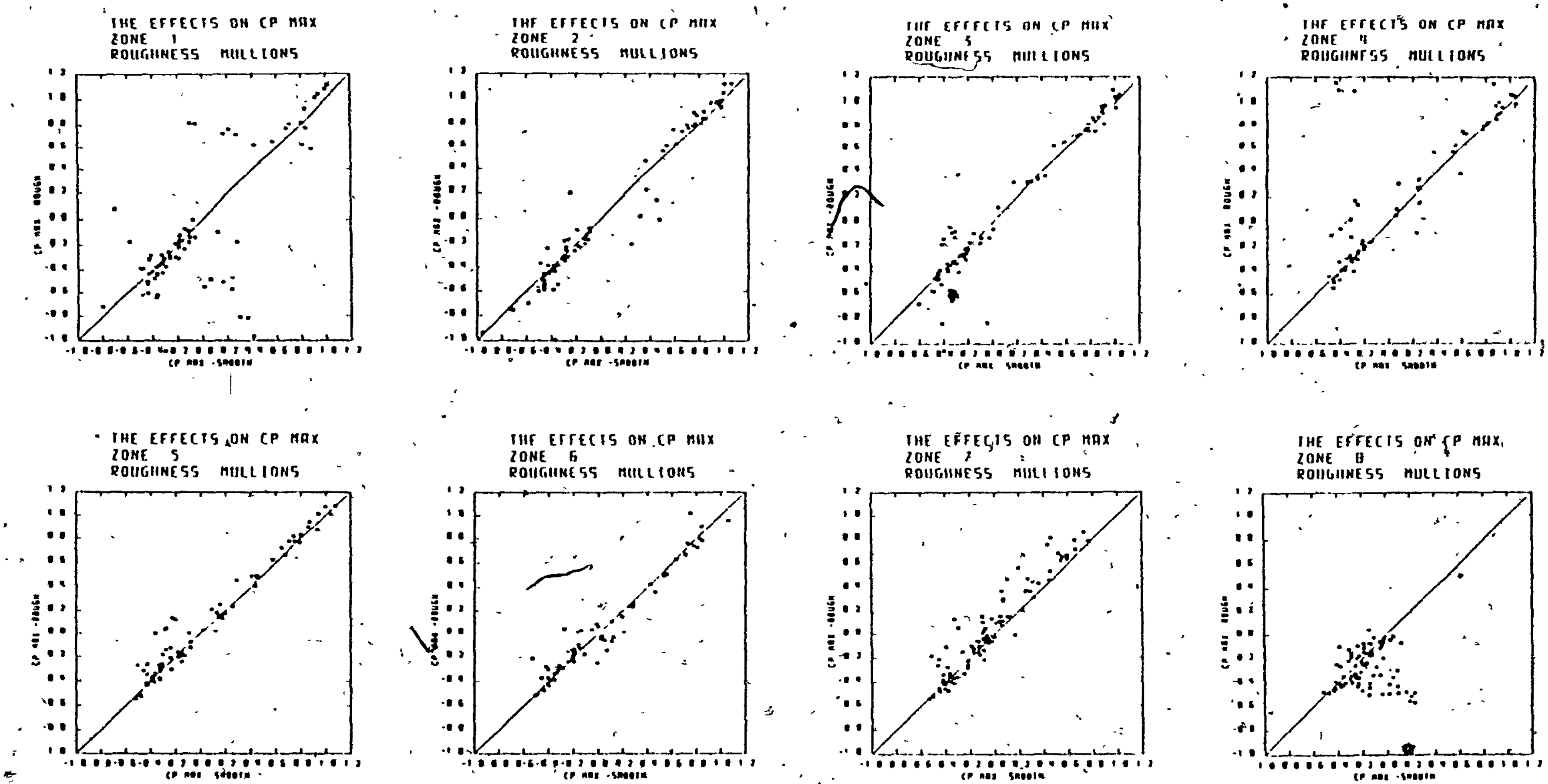


FIG. A.41 COMPARISON OF Cp MAX ON BUILDINGS WITH SMOOTH AND WITH MULLIONS

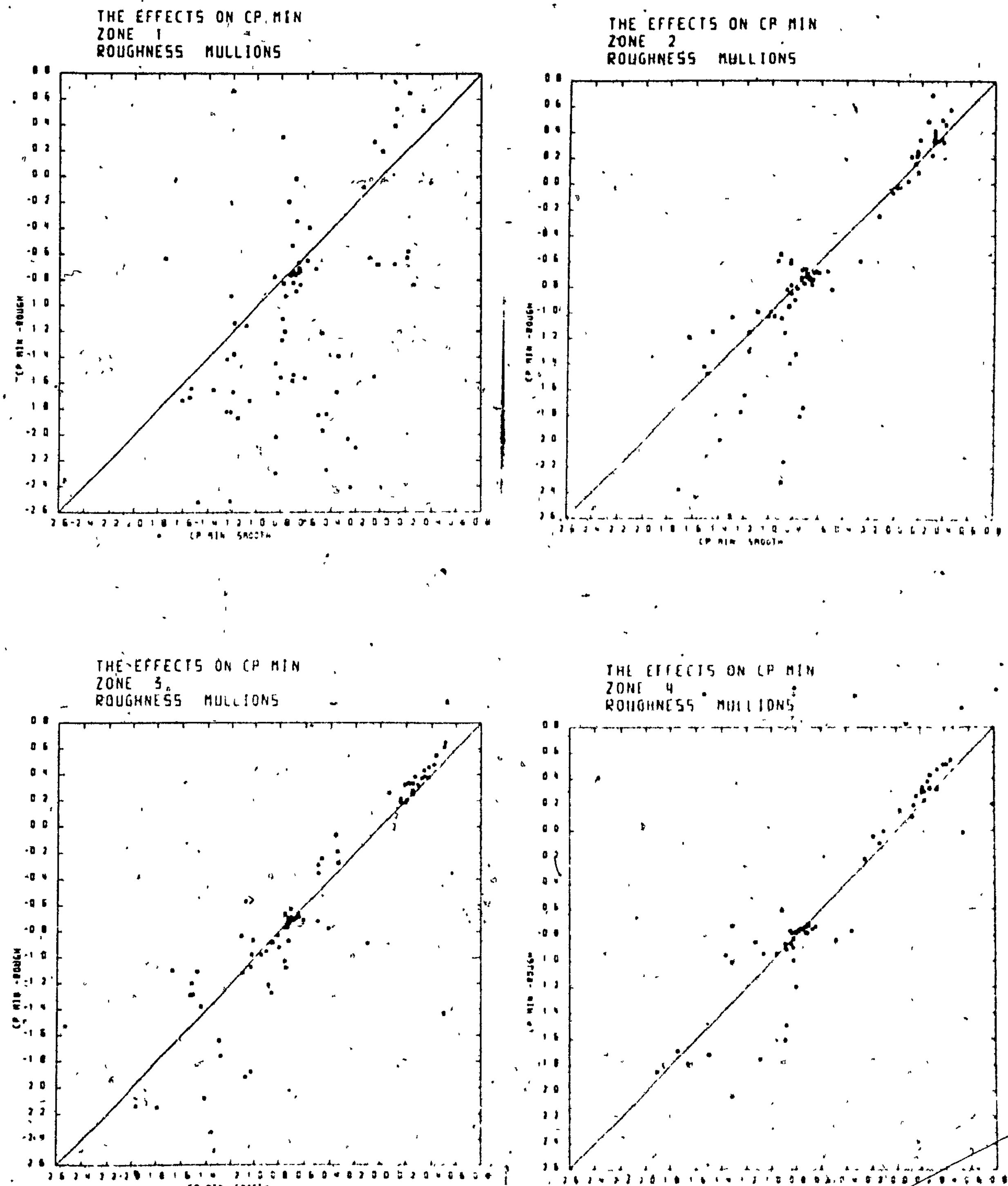
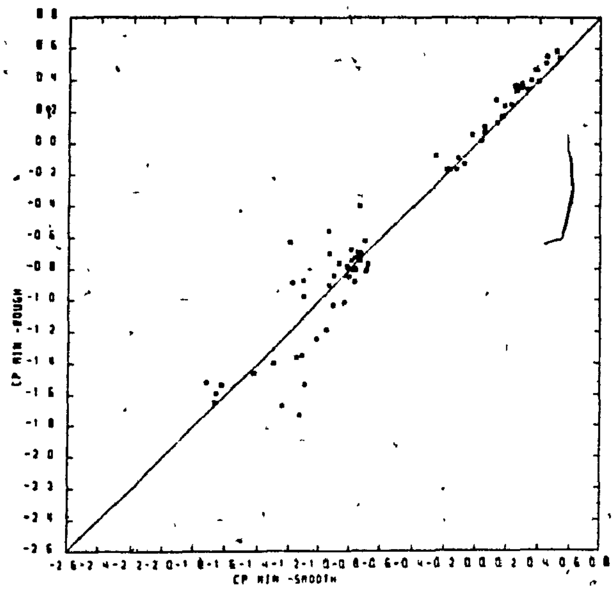
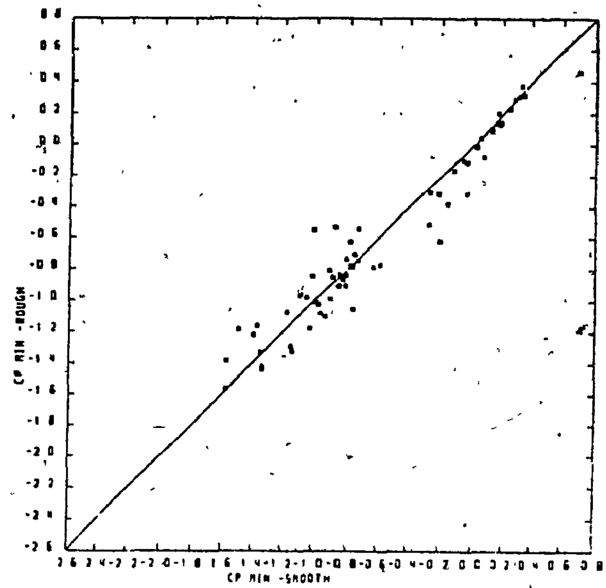


FIG. A.42 COMPARISON OF Cp MIN ON BUILDINGS WITH SMOOTH AND WITH MULLIONS

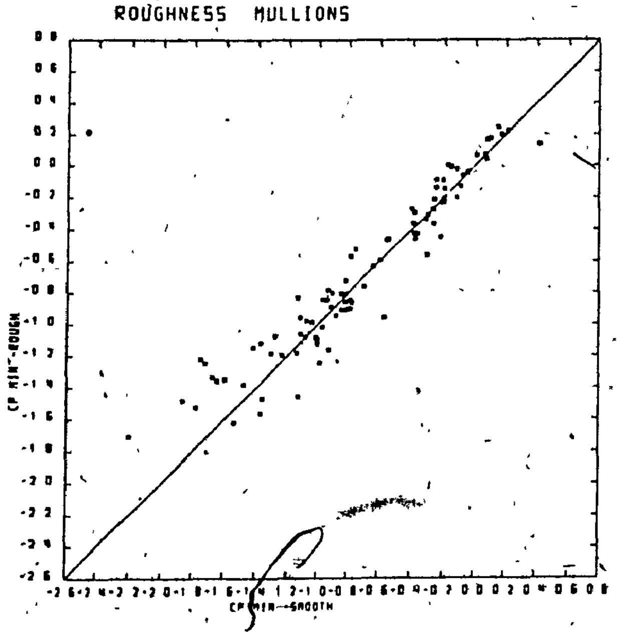
THE EFFECTS ON CP MIN
ZONE 5,
ROUGHNESS MULLIONS



THE EFFECTS ON CP MIN
ZONE 6
ROUGHNESS MULLIONS



THE EFFECTS ON CP MIN
ZONE 7
ROUGHNESS MULLIONS



THE EFFECTS ON CP MIN
ZONE 8
ROUGHNESS MULLIONS

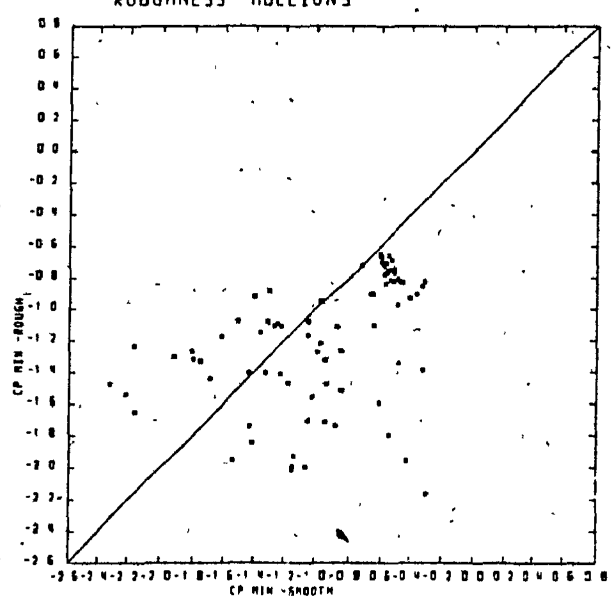


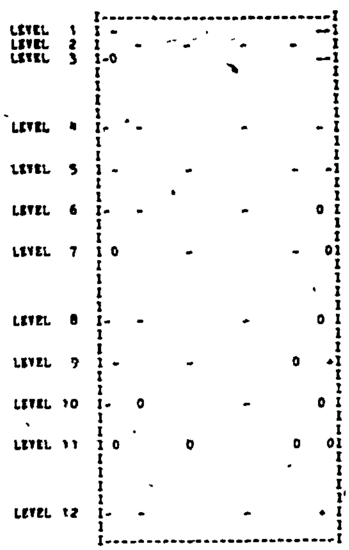
FIG. A.42 CONTINUED

PART B

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 0
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
+ GREATER THAN 0.040
- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



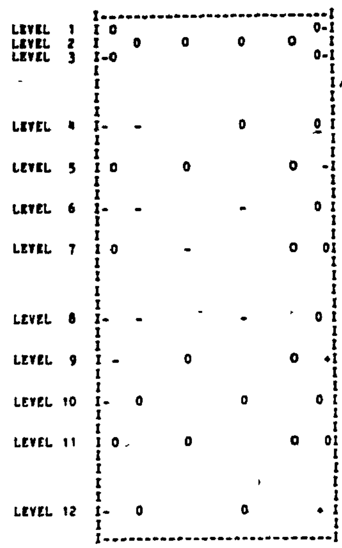
TAP	ROUGH	SMOOTH	DIFF
19	.38	.45	-.06
20	.40	.46	-.06
21	-.08	-.04	-.04
22	.56	.64	-.08
23	.59	.65	-.06
24	.60	.66	-.07
25	.56	.64	-.08
26	-.15	-.05	-.10
27	.50	.52	-.02
28	.47	.55	-.08
29	-.14	.04	-.18
30	-.36	.01	-.37*
31	.68	.79	-.10
32	.79*	.88*	-.09
33	.50	.56	-.06
34	.42	.50	-.08
43	.77	.85	-.08
44	.67	.73	-.05
45	-.07	-.02	-.05
46	-.35	-.01	-.34
47	-.42	-.07	-.35
48	.73	.81	-.08
49	.43	.44	-.01
50	.35	.34	.00
51	.69	.76	-.08
52	.62	.69	-.07
53	-.10	-.08	-.02
54	-.44	-.11	-.33
55	.54	.60	-.06
56	.63	.68	-.06
59	.35	.37	-.02
60	.23	.30	-.07
61	.57	.62	-.06
62	.51	.54	-.03
63	-.08	-.19	.11
64	-.47	-.21	-.26
65	.45	.48	-.03
66	.53	.57	-.04
67	.27	.25	.02
68	.18	.17	.01
69	.50	.52	-.03
70	.43	.42	.01
71	-.31	-.32	.00
72	-.54	-.36	-.18
73	.38	.43	-.05
74	.52	.56	-.04
75	.18	.11	.07

NO. OF + = 2 NO. OF - = 33 NO. OF 0 = 12
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 15
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
+ GREATER THAN 0.040
- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



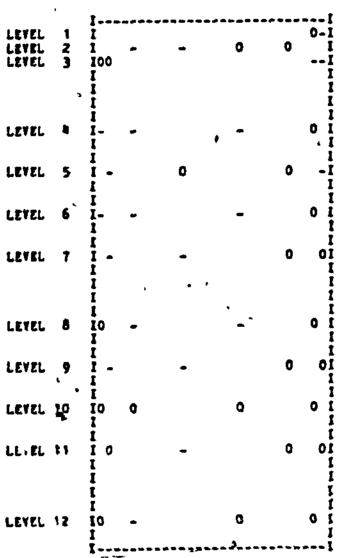
TAP	ROUGH	SMOOTH	DIFF
19	.57	.57	.00
20	.24	.26	-.03
21	-.27	-.18	-.09
22	.63	.67	-.03
23	.58	.61	-.03
24	.54	.56	-.02
25	.44	.48	-.03
26	.05	.11	-.06
27	.69	.67	.01
28	.31	.34	-.03
29	-.30	-.12	-.19
30	-.20	.16	-.36
31	.80*	.85*	-.05
32	.73	.76	-.03
33	.34	.35	.00
34	.62	.65	-.04
43	.80	.84	-.04
44	.58	.62	-.04
45	-.17	-.12	-.05
46	-.13	.10	-.23
47	-.15	.80	-.95*
48	.67	.74	-.07
49	.32	.31	.00
50	.53	.56	-.03
51	.71	.77	-.07
52	.55	.56	-.01
53	-.17	-.15	-.02
54	-.10	.00	-.11
55	.63	.68	-.04
56	.58	.64	-.06
59	.27	.25	.02
60	.38	.44	-.05
61	.59	.62	-.03
62	.47	.45	.02
63	-.10	-.17	.07
64	-.18	-.06	-.12
65	.53	.55	-.02
66	.51	.52	-.01
67	.20	.17	.04
68	.32	.30	.02
69	.51	.52	-.02
70	.40	.36	.04
71	-.26	-.23	-.03
72	-.34	-.22	-.12
73	.44	.47	-.03
74	.50	.53	-.03
75	.17	.10	.07

NO. OF + = 2 NO. OF - = 16 NO. OF 0 = 29
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 30
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
+ GREATER THAN 0.040
- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



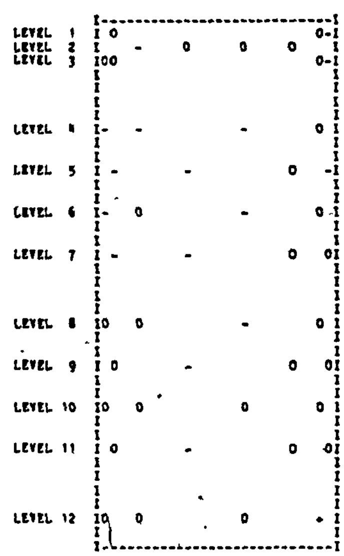
TAP	ROUGH	SMOOTH	DIFF
19	.61	.67	-.06
20	.02	.05	-.03
21	-.46	-.34	-.12
22	.55	.62	-.07
23	.44	.50	-.07
24	.37	.41	-.04
25	.25	.28	-.03
26	.58	.62	-.04
27	.77	.80	-.03
28	.07	.12	-.04
29	-.46	-.28	-.17
30	.45	.65	-.20*
31	.77	.83	-.07
32	.52	.60	-.08
33	.12	.12	.01
34	.77*	.84*	-.07
43	.67	.71	-.04
44	.37	.39	-.01
45	-.34	-.29	-.04
46	.48	.57	-.08
47	.71	.78	-.07
48	.48	.56	-.08
49	.10	.08	.02
50	.67	.75	-.08
51	.59	.65	-.06
52	.35	.34	.01
53	-.33	-.29	-.03
54	.47	.45	.01
55	.62	.67	-.05
56	.42	.48	-.06
59	.08	.05	.03
60	.54	.61	-.07
61	.49	.55	-.06
62	.30	.28	.02
63	-.24	-.27	.03
64	.37	.34	.02
65	.53	.54	-.01
66	.37	.40	-.02
67	.04	.02	.02
68	.47	.48	-.01
69	.40	.45	-.05
70	.24	.22	.03
71	-.30	-.28	-.02
72	.18	.22	-.03
73	.44	.48	-.04
74	.36	.40	-.04
75	.03	-.01	.04

NO. OF + = 0 NO. OF - = 22 NO. OF 0 = 25
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 45
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
+ GREATER THAN 0.040
- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



TAP	ROUGH	SMOOTH	DIFF
19	.40	.38	.02
20	-.12	-.09	-.03
21	-.49	-.39	-.10
22	.29	.34	-.05
23	.21	.25	-.04
24	.17	.18	-.02
25	.05	.08	-.03
26	.72	.75	-.03
27	.56	.59	-.03
28	-.10	-.06	-.03
29	-.49	-.35	-.14*
30	.75*	.83*	-.08
31	.53	.59	-.05
32	.26	.33	-.06
33	-.07	-.08	.01
34	.68	.74	-.05
43	.35	.46	-.11
44	.15	.14	.01
45	-.43	-.38	-.05
46	.69	.76	-.08
47	.55	.58	-.03
48	.25	.31	-.07
49	-.08	-.10	.03
50	.60	.65	-.05
51	.32	.42	-.10
52	.15	.12	.03
53	-.41	-.37	-.03
54	.60	.64	-.04
55	.48	.49	-.02
56	.22	.26	-.04
59	-.08	-.11	.03
60	.50	.54	-.04
61	.26	.35	-.09
62	.12	.08	.04
63	-.32	-.34	.01
64	.48	.51	-.03
65	.40	.41	-.01
66	.19	.21	-.02
67	-.09	-.12	.03
68	.43	.43	-.01
69	.24	.29	-.05
70	.09	.05	.04
71	-.33	-.31	-.02
72	.34	.36	-.02
73	.33	.36	-.03
74	.19	.21	-.02
75	-.09	-.13	.04

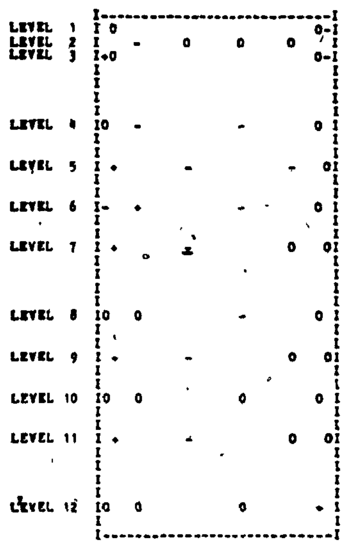
NO. OF + = 1 NO. OF - = 16 NO. OF 0 = 30
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.1 EFFECT OF UNIFORM ROUGHNESS ON Cp MEAN

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 60
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
+ GREATER THAN 0.040
- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



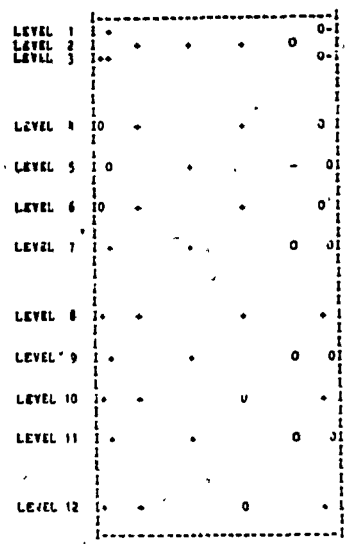
NO. OF + = 7 NO. OF - = 13 NO. OF 0 = 27
* -- THE MAXIMU OR MINIMUM VALUES

TAP	ROUGH	SMOOTH	DIFF
19	-.17	-.20	.03
20	-.24	-.22	-.02
21	-.51*	-.40	-.11
22	-.02	.03	-.05
23	-.05	-.03	-.03
24	-.06	-.06	.00
25	-.14	-.12	-.02
26	-.33	-.46	.13
27	-.16	-.18	.02
28	-.24	-.21	-.03
29	-.48	-.38	-.10
30	-.18	-.22	.04
31	.18	.23	-.05
32	-.01	.05	-.06
33	-.23	-.24	.02
34	-.15	-.23	.08
43	.04	.58*	-.54*
44	-.08	.00	-.08
45	-.46	-.43	-.03
46	-.17	-.12	-.06
47	.19	-.31	.49
48	-.02	.04	-.06
49	-.23	-.19	-.04
50	-.14	-.26	.12
51	.03	.13	-.10
52	-.08	-.09	.02
53	-.44	-.42	-.03
54	-.19	-.22	.02
55	.15	.14	.01
56	-.03	.01	-.04
59	-.22	-.25	.03
60	-.13	-.19	.07
61	.01	.09	-.08
62	-.08	-.10	.02
63	-.35	-.37	.02
64	-.22	-.21	-.01
65	.09	.08	.01
66	-.03	.00	-.03
67	-.21	-.23	.02
68	-.08	-.13	.05
69	.00	.06	-.07
70	-.10	-.12	.02
71	-.36	-.34	-.02
72	-.11	-.10	-.02
73	.05	.08	-.02
74	-.02	.00	-.03
75	-.19	-.23	.04

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 75
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
+ GREATER THAN 0.040
- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



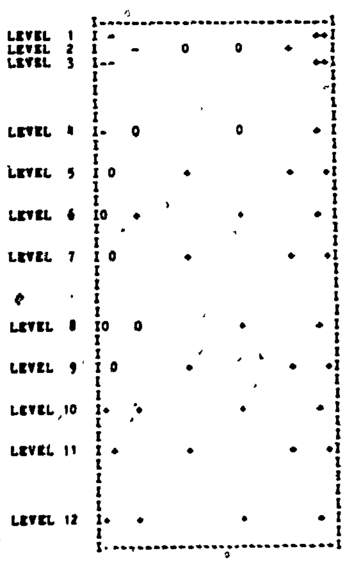
NO. OF + = 27 NO. OF - = 3 NO. OF 0 = 17
* -- THE MAXIMU OR MINIMUM VALUES

TAP	ROUGH	SMOOTH	DIFF
19	-.98	-1.04	.05
20	-.30	-.30	.00
21	-.45	-.40	-.06
22	-.87	-.98	.11
23	-.29	-.49	.19
24	-.14	-.20	.06
25	-.23	-.24	.01
26	-.96	-1.01	.05
27	-.98	-1.03	.05
28	-.31	-.29	-.02
29	-.44	-.39	-.05
30	-.88	-.89	.01
31	-.79	-.97	.19
32	-.14	-.25	.11
33	-.30	-.31	.01
34	-.87	-.88	.01
43	1.04*	-.30	1.34*
44	-.25	-.18	-.07
45	-.41	-.41	.00
46	-.82	-.82	.00
47	-.84	-1.05*	.21
48	-.24	-.35	.11
49	-.29	-.28	-.01
50	-.83	-.97	.14
51	-.45	-.70	.25
52	-.25	-.26	.00
53	-.38	-.40	.02
54	-.80	-.84	.04
55	-.72	-.88	.16
56	-.28	-.35	.07
59	-.26	-.31	.05
60	-.81	-.86	.05
61	-.41	-.61	.19
62	-.25	-.25	.00
63	-.33	-.35	.03
64	-.75	-.82	.07
65	-.69	-.82	.13
66	-.27	-.30	.03
67	-.25	-.29	.05
68	-.76	-.84	.08
69	-.39	-.50	.11
70	-.22	-.25	.04
71	-.32	-.34	.01
72	-.70	-.80	.13
73	-.62	-.77	.15
74	-.19	-.20	.01
75	-.22	-.29	.07

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 90
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
+ GREATER THAN 0.040
- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



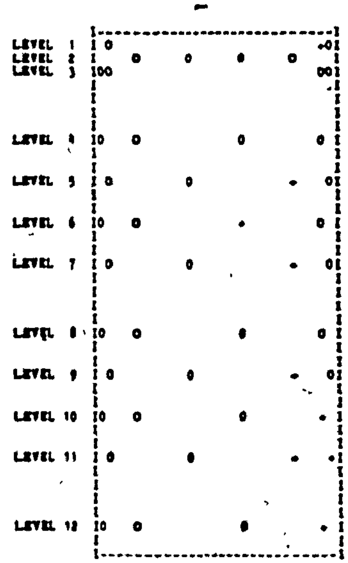
NO. OF + = 32 NO. OF - = 5 NO. OF 0 = 10
* -- THE MAXIMU OR MINIMUM VALUES

TAP	ROUGH	SMOOTH	DIFF
19	-.81	-.76	-.05
20	-.50	-.63	.14
21	-.50	-.65	.15
22	-.84	-.78	-.06
23	-.86	-.82	-.04
24	-.79	-.83	.04
25	-.62	-.74	.12
26	-.79	-.74	-.04
27	-.81	-.75	-.06
28	-.51	-.64	.14
29	-.52	-.69	.17
30	-.76	-.72	-.04
31	-.80	-.77	-.03
32	-.78	-.82	.04
33	-.57	-.73	.16
34	-.75	-.72	-.03
43	-.60	-.80	.19*
44	-.64	-.75	.11
45	-.62	-.78	.16
46	-.71	-.71	.00
47	-.70	-.75	.05
48	-.75	-.83	.09
49	-.61	-.78	.16
50	-.73	-.73	.00
51	-.76	-.82	.06
52	-.64	-.76	.12
53	-.65	-.81	.15
54	-.74	-.74	.00
55	-.76	-.79	.03
56	-.73	-.85	.12
59	-.59	-.75	.16
60	-.77	-.79	.02
61	-.79	-.89	.10
62	-.60	-.74	.14
63	-.59	-.75	.17
64	-.78	-.82	.05
65	-.82	-.88	.05
66	-.73	-.85	.12
67	-.52	-.64	.13
68	-.84	-.91	.07
69	-.82	-.95	.13
70	-.52	-.65	.13
71	-.46	-.54	.09
72	-.89	-.93	.04
73	-.90*	-.97*	.07
74	-.56	-.64	.08
75	-.35	-.44	.09

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 105
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
+ GREATER THAN 0.040
- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



NO. OF + = 9 NO. OF - = 0 NO. OF 0 = 38
* -- THE MAXIMU OR MINIMUM VALUES

TAP	ROUGH	SMOOTH	DIFF
19	-.64	-.65	.02
20	-.65	-.69	.04
21	-.68	-.70	.02
22	-.64	-.66	.02
23	-.65	-.67	.02
24	-.64	-.67	.03
25	-.64	-.67	.03
26	-.62	-.65	.03
27	-.61	-.64	.03
28	-.66	-.69	.03
29	-.68	-.71	.03
30	-.59	-.61	.03
31	-.60	-.64	.03
32	-.62	-.66	.04
33	-.67	-.71	.04
34	-.57	-.60	.03
43	-.59	-.62	.03
44	-.63	-.67	.04
45	-.69	-.72	.03
46	-.55	-.58	.03
47	-.56	-.60	.04
48	-.60	-.65	.05
49	-.68	-.71	.03
50	-.54	-.57	.04
51	-.57	-.60	.03
52	-.63	-.68	.05
53	-.70	-.73	.03
54	-.52	-.54	.02
55	-.54	-.57	.03
56	-.59	-.62	.04
59	-.69	-.72	.03
60	-.52	-.54	.02
61	-.56	-.59	.02
62	-.62	-.68	.06
63	-.71*	-.74	.03
64	-.52	-.53	.01
65	-.55	-.56	.01
66	-.58	-.61	.03
67	-.68	-.73	.04
68	-.54	-.56	.01
69	-.58	-.61	.02
70	-.60	-.65	.05
71	-.71	-.75*	.05
72	-.56	-.58	.02
73	-.57	-.60	.03
74	-.58	-.59	.02
75	-.63	-.70	.06*

FIG. B.1 CONTINUED

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       120
ROUGHNESS:               SANDPAPER
BUILDING HEIGHT:              120M
+  GREATER THAN              0.040
-  LESS THAN                -0.040
0  BETWEEN         -0.040 & 0.040

           I----------------------------I
LEVEL  1   I 0                        00I
LEVEL  2   I     0     0     +     0    I
LEVEL  3   I00                        00I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   I0    0           0        0 I
           I                            I
           I                            I
LEVEL  5   I +         0           +   +I
           I                            I
           I                            I
LEVEL  6   I0    0           0        + I
           I                            I
           I                            I
LEVEL  7   I 0         0           +   +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   I0    0           0        + I
           I                            I
           I                            I
LEVEL  9   I 0         0           0   0I
           I                            I
           I                            I
LEVEL 10   I0    0           0        + I
           I                            I
           I                            I
LEVEL 11   I 0         0           0   +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   I0    0           0        0 I
           I                            I
           I----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.59	-.62	.03
20	-.63	-.66	.04
21	-.64	-.66	.02
22	-.60	-.63	.03
23	-.60	-.64	.04
24	-.60	-.64	.04
25	-.62	-.66	.04
26	-.59	-.61	.02
27	-.59	-.62	.03
28	-.63	-.67	.03
29	-.64	-.67	.03
30	-.57	-.60	.03
31	-.58	-.62	.03
32	-.62	-.65	.03
33	-.65	-.69	.04
34	-.57	-.61	.04
43	-.59	-.63	.04
44	-.62	-.68	.05*
45	-.67	-.71	.05
46	-.55	-.58	.02
47	-.56	-.60	.03
48	-.60	-.64	.04
49	-.66	-.70	.04
50	-.53	-.57	.04
51	-.57	-.60	.04
52	-.62	-.67	.05
53	-.69	-.73*	.04
54	-.50	-.52	.02
55	-.52	-.55	.03
56	-.57	-.61	.03
59	-.64	-.70	.05
60	-.48	-.52	.04
61	-.53	-.56	.03
62	-.59	-.62	.03
63	-.71*	-.72	.02
64	-.45	-.46	.01
65	-.48	-.50	.02
66	-.55	-.57	.02
67	-.64	-.68	.04
68	-.46	-.47	.01
69	-.51	-.53	.02
70	-.58	-.60	.01
71	-.68	-.73	.04
72	-.47	-.47	.00
73	-.49	-.50	.01
74	-.52	-.53	.01
75	-.62	-.62	.00

NO. OF + = 10   NO. OF - = 0   NO. OF 0 = 37
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       135
ROUGHNESS:               SANDPAPER
BUILDING HEIGHT:              120M
+  GREATER THAN              0.040
-  LESS THAN                -0.040
0  BETWEEN         -0.040 & 0.040

           I----------------------------I
LEVEL  1   I 0                        00I
LEVEL  2   I     0     0     0     0    I
LEVEL  3   I00                        00I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   I0    0           0        0 I
           I                            I
           I                            I
LEVEL  5   I 0         0           0   +I
           I                            I
           I                            I
LEVEL  6   I0    0           0        0 I
           I                            I
           I                            I
LEVEL  7   I 0         0           0   0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   I0    0           0        0 I
           I                            I
           I                            I
LEVEL  9   I 0         0           0   0I
           I                            I
           I                            I
LEVEL 10   I0    0           0        0 I
           I                            I
           I                            I
LEVEL 11   I 0         0           0   0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   I0    0           0        0 I
           I                            I
           I----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.51	-.51	.00
20	-.58	-.60	.01
21	-.60	-.60	.00
22	-.52	-.52	.00
23	-.54	-.54	.00
24	-.55	-.56	.01
25	-.58	-.58	.01
26	-.52	-.52	.01
27	-.52	-.52	-.01
28	-.59	-.60	.01
29	-.60	-.61	.01
30	-.53	-.54	.01
31	-.55	-.56	.00
32	-.59	-.60	.01
33	-.62	-.65	.03
34	-.54	-.56	.01
43	-.57	-.59	.02
44	-.60	-.63	.03
45	-.63*	-.67*	.05*
46	-.53	-.54	.02
47	-.55	-.56	.01
48	-.58	-.62	.04
49	-.61	-.65	.04
50	-.51	-.54	.03
51	-.55	-.58	.02
52	-.59	-.62	.03
53	-.62	-.65	.04
54	-.47	-.49	.01
55	-.50	-.52	.03
56	-.54	-.58	.03
59	-.56	-.59	.03
60	-.45	-.47	.03
61	-.51	-.53	.02
62	-.54	-.55	.01
63	-.54	-.58	.03
64	-.42	-.43	.01
65	-.46	-.46	.00
66	-.51	-.53	.01
67	-.50	-.52	.02
68	-.41	-.43	.02
69	-.48	-.48	.00
70	-.51	-.51	.00
71	-.50	-.51	.02
72	-.41	-.43	.01
73	-.44	-.45	.01
74	-.48	-.50	.01
75	-.46	-.46	.00

NO. OF + = 1   NO. OF - = 0   NO. OF 0 = 46
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       150
ROUGHNESS:               SANDPAPER
BUILDING HEIGHT:              120M
+  GREATER THAN              0.040
-  LESS THAN                -0.040
0  BETWEEN         -0.040 & 0.040

           I----------------------------I
LEVEL  1   I 0                        00I
LEVEL  2   I     0     0     0     0    I
LEVEL  3   I00                        00I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   I0    0           0        0 I
           I                            I
           I                            I
LEVEL  5   I 0         -           0   0I
           I                            I
           I                            I
LEVEL  6   I0    0           0        0 I
           I                            I
           I                            I
LEVEL  7   I 0         0           0   0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   I0    0           0        0 I
           I                            I
           I                            I
LEVEL  9   I 0         0           0   0I
           I                            I
           I                            I
LEVEL 10   I0    0           0        0 I
           I                            I
           I                            I
LEVEL 11   I 0         0           0   0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   I0    0           0        0 I
           I                            I
           I----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.46	-.45	-.01
20	-.56	-.55	-.01
21	-.61	-.61	.00
22	-.47	-.47	.00
23	-.48	-.48	.00
24	-.50	-.50	.00
25	-.52	-.53	.00
26	-.46	-.46	.00
27	-.46	-.46	.00
28	-.57	-.57	-.01
29	-.61*	-.61	.00
30	-.49	-.49	.00
31	-.50	-.51	.00
32	-.54	-.55	.01
33	-.59	-.61	.02
34	-.51	-.51	.00
43	-.53	-.32	-.21*
44	-.56	-.60	.04
45	-.60	-.64*	.04
46	-.50	-.50	.00
47	-.51	-.48	-.03
48	-.53	-.56	.03
49	-.58	-.60	.02
50	-.48	-.50	.02
51	-.51	-.53	.02
52	-.54	-.56	.03
53	-.58	-.61	.03
54	-.45	-.45	.00
55	-.47	-.47	.00
56	-.50	-.51	.01
59	-.50	-.53	.03
60	-.41	-.43	.02
61	-.46	-.47	.01
62	-.47	-.49	.02
63	-.52	-.54	.02
64	-.39	-.39	.00
65	-.43	-.42	.00
66	-.45	-.46	.00
67	-.44	-.46	.03
68	-.39	-.39	.00
69	-.42	-.43	.00
70	-.41	-.42	.01
71	-.47	-.49	.02
72	-.39	-.38	.00
73	-.41	-.41	.00
74	-.42	-.42	.01
75	-.38	-.39	.01

NO. OF + = 0   NO. OF - = 1   NO. OF 0 = 46
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       165
ROUGHNESS:               SANDPAPER
BUILDING HEIGHT:              120M
+  GREATER THAN              0.040
-  LESS THAN                -0.040
0  BETWEEN         -0.040 & 0.040

           I----------------------------I
LEVEL  1   I 0                        ++I
LEVEL  2   I     0     0     +     +    I
LEVEL  3   I00                        ++I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   I0    0           +        + I
           I                            I
           I                            I
LEVEL  5   I +         +           +   +I
           I                            I
           I                            I
LEVEL  6   I+    0           +        + I
           I                            I
           I                            I
LEVEL  7   I 0         +           +   +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   I+    +           +        + I
           I                            I
           I                            I
LEVEL  9   I +         0           +   +I
           I                            I
           I                            I
LEVEL 10   I+    0           +        + I
           I                            I
           I                            I
LEVEL 11   I 0         +           +   +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   I0    0           +        + I
           I                            I
           I----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.42	-.45	.03
20	-.53	-.60	.06
21	-.59	-.65*	.05
22	-.43	-.45	.03
23	-.44	-.47	.03
24	-.46	-.50	.04
25	-.50	-.55	.05
26	-.43	-.45	.03
27	-.43	-.45	.02
28	-.54	-.60	.06
29	-.60	-.64	.05
30	-.45	-.48	.03
31	-.46	-.49	.03
32	-.49	-.54	.05
33	-.54	-.60	.06
34	-.46	-.50	.04
43	.97*	-.44	1.41*
44	-.48	-.55	.07
45	-.56	-.64	.08
46	-.38	-.44	.06
47	-.36	-.39	.03
48	-.46	-.53	.07
49	-.50	-.54	.04
50	-.45	-.47	.02
51	-.45	-.50	.06
52	-.46	-.51	.06
53	-.54	-.62	.08
54	-.40	-.44	.04
55	-.41	-.46	.05
56	-.41	-.47	.06
59	-.44	-.51	.07
60	-.37	-.43	.05
61	-.40	-.44	.04
62	-.39	-.45	.06
63	-.50	-.58	.08
64	-.35	-.40	.04
65	-.38	-.42	.04
66	-.38	-.42	.04
67	-.41	-.46	.05
68	-.35	-.38	.03
69	-.37	-.41	.05
70	-.35	-.40	.05
71	-.49	-.56	.06
72	-.34	-.38	.03
73	-.36	-.40	.04
74	-.34	-.39	.04
75	-.37	-.42	.05

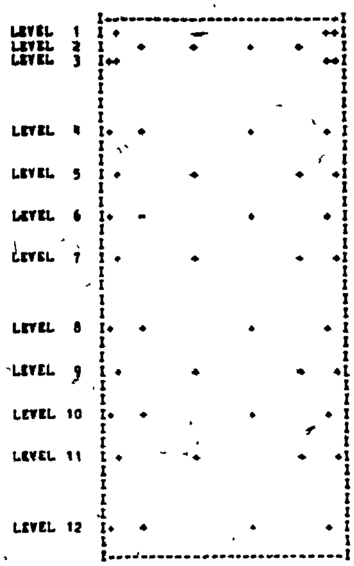
NO. OF + = 33   NO. OF - = 0   NO. OF 0 = 14
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.1 CONTINUED

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 180
ROUGHNESS: SANDPAPER
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



TAP	ROUGH	SMOOTH	DIFF
19	-.46	-.53	.08
20	-.46	-.56	.10
21	-.49	-.58	.09
22	-.45	-.53	.08
23	-.46	-.56	.10
24	-.45	-.56	.11
25	-.46	-.56	.10
26	-.49	-.59	.10
27	-.45	-.55	.10
28	-.47	-.56	.09
29	-.50	-.60	.10
30	-.55	-.63	.08
31	-.46	-.54	.08
32	-.44	-.54	.10
33	-.48	-.57	.09
34	-.47	-.56	.09
43	.94*	-.51	1.45*
44	-.45	-.52	.07
45	-.55	-.63*	.08
46	-.58	-.62	.05
47	-.56	-.50	-.05
48	-.42	-.48	.06
49	-.47	-.55	.08
50	-.44	-.53	.09
51	-.40	-.46	.06
52	-.41	-.48	.07
53	-.54	-.63	.09
54	-.54	-.60	.06
55	-.40	-.46	.06
56	-.37	-.43	.06
59	-.43	-.51	.07
60	-.41	-.49	.08
61	-.36	-.41	.05
62	-.37	-.45	.07
63	-.48	-.60	.13
64	-.48	-.54	.06
65	-.37	-.44	.07
66	-.35	-.41	.05
67	-.41	-.47	.06
68	-.38	-.45	.07
69	-.34	-.40	.07
70	-.35	-.42	.07
71	-.41	-.48	.08
72	-.37	-.42	.05
73	-.35	-.41	.06
74	-.32	-.39	.07
75	-.35	-.42	.07

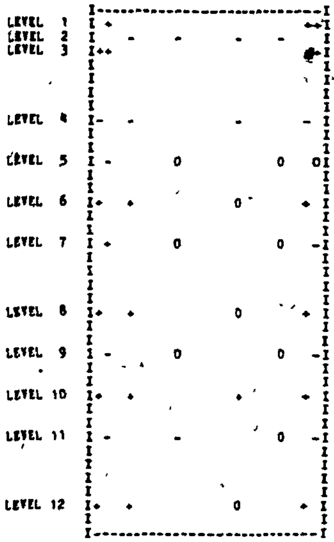
NO. OF + = 46   NO. OF - = 1   NO. OF 0 = 0
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.1 CONTINUED

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 0
BALCONY NO.: 29
BALCONY GEOMETRY: 61*2*0.16M
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



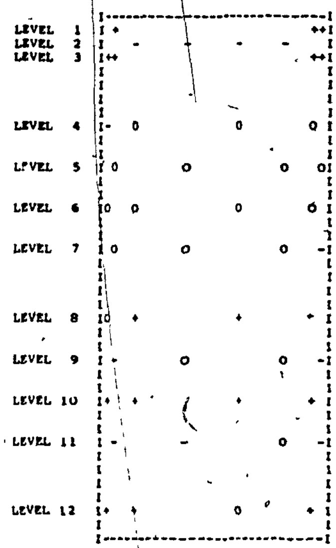
TAP	ROUGH	SMOOTH	DIFF
19	.66	.45	.21
20	.65	.46	.19
21	.10	-.04	.13
22	.39	.64	-.24
23	.39	.65	-.26
24	.38	.66	-.28*
25	.39	.64	-.24
26	.16	-.05	.21
27	.61	.52	.09
28	.65	.55	.10
29	.17	.04	.13
30	-.06	.01	-.07
31	.73	.79	-.06
32	.81	.88*	-.07
33	.50	.56	-.06
34	.46	.50	-.04
43	.87*	.85	.03
44	.75	.73	.03
45	-.05	-.02	-.04
46	.03	-.01	.04
47	.00	-.07	.07
48	.81	.81	.00
49	.89	.84	.05
50	.42	.34	.08
51	.75	.76	-.01
52	.66	.69	-.03
53	-.15	-.08	-.07
54	-.07	-.11	.04
55	.64	.60	.04
56	.72	.68	.03
59	.45	.37	.08
60	.24	.30	-.06
61	.60	.62	-.03
62	.51	.54	-.03
63	-.26	-.19	-.07
64	-.10	-.21	.12
65	.56	.48	.08
66	.62	.57	.05
67	.37	.25	.13
68	.08	.17	-.09
69	.48	.52	-.04
70	.39	.42	-.03
71	-.39	-.32	-.07
72	-.15	-.36	.21
73	.47	.43	.04
74	.57	.56	.01
75	.24	.11	.13

NO. OF + = 21 NO. OF - = 15 NO. OF 0 = 11
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 15
BALCONY NO.: 29
BALCONY GEOMETRY: 61*2*0.16M
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



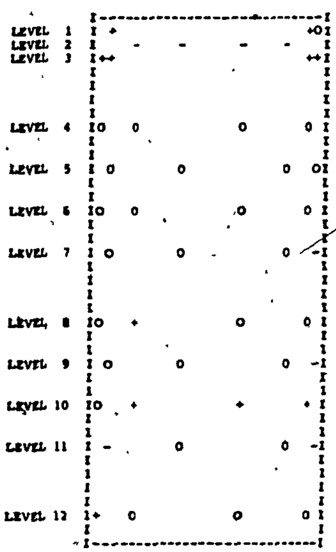
TAP	ROUGH	SMOOTH	DIFF
19	.84*	.57	.26*
20	.38	.26	.12
21	-.09	-.18	.09
22	.47	.67	-.20
23	.40	.61	-.21
24	.35	.56	-.22
25	.29	.48	-.18
26	.24	.11	.13
27	.82	.67	.15
28	.44	.34	.10
29	.02	-.12	.14
30	.09	.16	-.07
31	.84	.85*	-.01
32	.76	.76	.00
33	.32	.35	-.03
34	.64	.65	-.01
43	.84	.84	.00
44	.63	.62	.01
45	-.16	-.12	-.03
46	.11	.10	.01
47	.82	.80	.02
48	.75	.74	.01
49	.33	.31	.02
50	.56	.56	.00
51	.77	.77	.00
52	.55	.56	-.01
53	-.21	-.15	-.06
54	.03	.00	.02
55	.73	.68	.05
56	.68	.64	.04
59	.31	.25	.07
60	.37	.44	-.06
61	.62	.62	.00
62	.44	.45	-.02
63	-.26	-.17	-.09
64	-.02	-.06	.05
65	.64	.55	.09
66	.59	.52	.06
67	.27	.17	.10
68	.19	.30	-.12
69	.48	.52	-.05
70	.33	.36	-.03
71	-.31	-.23	-.08
72	-.07	-.22	.15
73	.52	.47	.05
74	.54	.53	.01
75	.17	.10	.07

NO. OF + = 17 NO. OF - = 11 NO. OF 0 = 16
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 30
BALCONY NO.: 39
BALCONY GEOMETRY: 61*2*0.16M
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



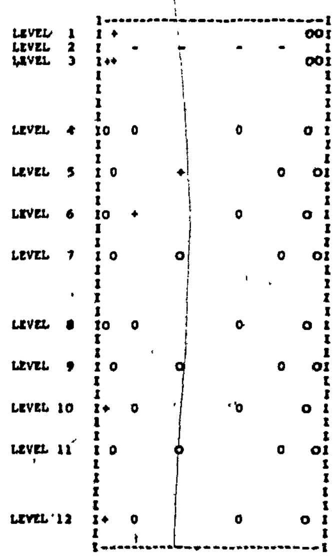
TAP	ROUGH	SMOOTH	DIFF
19	.90	.67	.23*
20	.13	.05	.08
21	-.32	-.34	.02
22	.41	.62	-.21
23	.23	.50	-.21
24	.24	.41	-.18
25	.16	.28	-.12
26	.69	.62	.07
27	.93*	.80	.13
28	.18	.12	.07
29	-.19	-.28	.10
30	.66	.65	.00
31	.82	.83	-.02
32	.58	.60	-.02
33	.08	.12	-.03
34	.85	.84*	.00
43	.71	.71	.01
44	.41	.39	.02
45	-.30	-.29	-.01
46	.57	.57	.00
47	.81	.78	.03
48	.58	.56	.02
49	.10	.08	.01
50	.74	.75	-.01
51	.67	.65	.02
52	.34	.34	.00
53	-.34	-.29	-.04
54	.44	.45	-.01
55	.72	.67	.05
56	.51	.48	.03
59	.09	.05	.04
60	.58	.61	-.03
61	.54	.55	-.01
62	.27	.28	-.01
63	-.33	-.27	-.05
64	.35	.34	.01
65	.63	.54	.09
66	.44	.40	.04
67	.08	.02	.05
68	.40	.48	-.08
69	.43	.45	-.02
70	.19	.22	-.03
71	-.34	-.28	-.06
72	.34	.22	.12
73	.51	.48	.03
74	.41	.40	.00
75	.02	-.01	.03

NO. OF + = 11 NO. OF - = 8 NO. OF 0 = 22
* -- THE MAXIMU OR MINIMUM VALUES

COMPARIS ON OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 45
BALCONY NO.: 29
BALCONY GEOMETRY: 61*2*0.16M
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



TAP	ROUGH	SMOOTH	DIFF
19	.63	.38	.25*
20	-.07	-.09	.02
21	-.40	-.39	-.01
22	.17	.34	-.17
23	.10	.25	-.15
24	.01	.18	-.18
25	-.02	.08	-.09
26	.88*	.75	.13
27	.71	.59	.12
28	-.05	-.06	.02
29	-.32	-.35	.03
30	.83	.83*	-.01
31	.58	.59	.00
32	.31	.33	-.01
33	-.11	-.08	-.03
34	.74	.74	.00
43	.50	.46	.05
44	.15	.14	.01
45	-.39	-.38	-.02
46	.78	.76	.02
47	.79	.58	.21
48	.31	.31	.00
49	-.10	-.10	.00
50	.66	.65	.01
51	.42	.42	.00
52	.11	.12	.00
53	-.39	-.37	-.02
54	.67	.64	.03
55	.52	.49	.02
56	.27	.26	.01
59	-.10	-.11	.01
60	.55	.54	.01
61	.34	.35	-.01
62	.08	.08	.00
63	-.36	-.34	-.02
64	.58	.51	.08
65	.44	.41	.03
66	.22	.21	.02
67	-.09	-.12	.03
68	.43	.43	.00
69	.28	.29	-.01
70	.03	.05	-.02
71	-.34	-.31	-.03
72	.45	.36	.09
73	.36	.36	.00
74	.21	.21	.00
75	-.11	-.13	.02

NO. OF + = 7 NO. OF - = 4 NO. OF 0 = 27
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.2 EFFECT OF 2m BALCONIES ON Cp MEAN

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      60
BALCONY NO.:                  29
BALCONY GEOMETRY: 61*2*0.16M
BUILDING HEIGHT:             120M
+  GREATER THAN             0.040
-  LESS THAN               -0.040
O  BETWEEN      -0.040 & 0.040

         I------------------------------I
LEVEL  1 I +                         00I
LEVEL  2 I    -      -      -      -   I
LEVEL  3 I++                         00I
LEVEL  4 I+  0          0           0 I
LEVEL  5 I +                     -   0I
LEVEL  6 I0  +          0           - I
LEVEL  7 I+ +    0            0      0I
LEVEL  8 I+  0          0           0 I
LEVEL  9 I +     0            0      0I
LEVEL 10 I+  0          0           0 I
LEVEL 11 I 0     0            0      0I
LEVEL 12 I0  0          0           0 I
         I------------------------------I

NO OF + = 10     NO. OF - = 7     NO OF 0 = 23
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.05	-.20	.15
20	-.22	-.22	.00
21	-.42	-.40	-.02
22	-.10	-.03	-.13
23	-.15	-.03	-.12
24	-.15	-.06	-.09
25	-.20	-.12	-.08
26	-.30	-.46	.16
27	-.08	-.18	.10
28	-.22	-.21	-.01
29	-.39	-.38	-.01
30	-.15	-.22	.08
31	.20	.23	-.04
32	.03	.05	-.02
33	-.28	-.24	-.03
34	-.14	-.23	.09
43	.15	.58*	-.43
44	-.08	.00	-.08
45	-.43	-.43	.00
46	-.12	-.12	-.01
47	.18	-.31	.49*
48	.04	.04	.00
49	-.26	-.19	-.06
50	-.12	-.26	.14
51	.12	.13	-.01
52	-.10	-.09	-.01
53	-.43*	-.42	-.01
54	-.15	-.22	.06
55	.15	.14	.01
56	.02	.01	.00
59	-.25	-.25	-.01
60	-.14	-.19	.05
61	.08	.09	-.02
62	-.12	-.10	-.01
63	-.39	-.37	-.02
64	-.16	-.21	.04
65	.11	.08	.03
66	.00	.00	.00
67	-.23	-.23	.00
68	-.17	-.13	-.04
69	.03	.06	-.03
70	-.14	-.12	-.02
71	-.37	-.34	-.03
72	-.12	-.10	-.03
73	.06	.08	-.02
74	.00	.00	-.01
75	-.24	-.23	.00

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      75
BALCONY NO.:                  29
BALCONY GEOMETRY: 61*2*0.16M
BUILDING HEIGHT:             120M
+  GREATER THAN             0.040
-  LESS THAN               -0.040
O  BETWEEN      -0.040 & 0.040

         I------------------------------I
LEVEL  1 I -                         00I
LEVEL  2 I    +      -      -      0   I
LEVEL  3 I++                         00I
LEVEL  4 I+  +          -           0 I
LEVEL  5 I 0     -            -      0I
LEVEL  6 I0  +          -           0 I
LEVEL  7 I +     -            0      0I
LEVEL  8 I+  0          -           0 I
LEVEL  9 I +     -            0      0I
LEVEL 10 I+  +          -           0 I
LEVEL 11 I +     -            0      0I
LEVEL 12 I+  0          -           0 I
         I------------------------------I

NO OF + = 13     NO OF - = [illegible]     NO OF 0 = 21
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-1.09*	-1.04	-.05
20	-.27	-.30	.03
21	-.40	-.40	.00
22	-.85	-.98	.12
23	-.61	-.49	-.12
24	-.28	-.20	-.08
25	-.26	-.24	-.02
26	-.96	-1.01	.05
27	-.94	-1.03	.09
28	-.28	-.29	.01
29	-.40	-.39	-.02
30	-.85	-.89	.04
31	-.91	-.99	.07
32	-.31	-.35	-.03
33	-.30	-.31	.01
34	-.35	-.44	.02
43	-.83	-.30	-.53*
44	-.23	-.18	-.05
45	-.43	-.41	-.02
46	-.83	-.82	-.01
47	-.86	-1.05*	.19
48	-.44	-.35	[illegible]
49	-.29	-.28	-.01
50	-.44	-.47	.13
51	-.79	-.70	-.09
52	[illegible]	-.76	-.01
53	-.43	-.40	-.03
54	-.80	-.84	.04
55	-.44	[illegible]	.04
56	-.45	-.35	-.10
59	-.30	-.31	.01
60	-.80	-.86	.06
61	-.74	-.61	-.13
62	-.28	-.25	-.03
63	-.38	-.35	-.02
64	-.77	-.77	.00
65	-.78	-.82	.04
66	-.41	-.30	-.10
67	-.28	-.27	-.01
68	-.72	-.84	.11
69	-.48	-.30	-.18
70	-.27	-.25	-.02
71	-.35	-.33	-.02
72	-.73	-.83	-.10
73	-.74	-.77	.03
74	-.30	-.20	-.10
75	-.29	-.29	.00

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      90
BALCONY NO :                  29
BALCONY GEOMETRY: 61*2*0.16M
BUILDING HEIGHT:             120M
+  GREATER THAN             0 040
-  LESS THAN               -0.040
O  BETWEEN      -0 040 & 0.040

         I------------------------------I
LEVEL  1 I 0                         00I
LEVEL  2 I    0      0      0      0   I
LEVEL  3 I00                         00I
LEVEL  4 I0  0          0           0 I
LEVEL  5 I 0     +            0      0I
LEVEL  6 I0  0          +           0 I
LEVEL  7 I +     +            +      0I
LEVEL  8 I+  +          +           0 I
LEVEL  9 I +     +            +      0I
LEVEL 10 I+  +          +           - I
LEVEL 11 I +     +            0      -I
LEVEL 12 I+  +          -           0 I
         I------------------------------I

NO OF + = 18     NO. OF - = 3     NO OF 0 = 10
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.78	-.76	-.02
20	-.63	-.63	.00
21	-.67	-.65	-.02
22	-.80	-.78	-.01
23	-.82	-.82	.00
24	-.83	-.83	.00
25	-.74	-.74	.00
26	-.77	-.74	-.03
27	-.75	-.75	00
28	-.66	-.64	-.01
29	-.68	-.69	.01
30	-.72	-.72	-.01
31	-.75	-.77	02
32	-.82	-.82	00
33	-.75	-.73	-.02
34	-.71	-.72	.01
43	-.69	-.80	.11
44	-.71	-.75	.03
45	-.77	-.78	.01
46	-.69	-.71	02
47	-.78	-.75	-.03
48	-.79	-.83	.04
49	-.79	-.78	-.01
50	-.68	-.73	.05
51	-.74	-.82	.08
52	-.71	-.76	.05
53	-.78	-.81	.03
54	-.69	-.74	.05
55	-.70	-.79	.09
56	-.78	-.85	.07
59	-.76	-.75	-.01
60	-.71	-.79	08
61	-.77	-.89	.12
62	-.69	-.74	.05
63	-.75	-.75	.01
64	-.72	-.82	.11
65	-.74	-.88	.13
66	-.80	-.85	.05
67	-.68	-.64	-.04
68	-.78	-.91	.13
69	-.84*	-.95	.11
70	-.65	-.65	.00
71	-.58	-.54	-.04
72	-.80	-.93	.13
73	-.82	-.97*	.15*
74	-.69	-.64	-.05
75	-.47	-.44	-.03

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                     105
BALCONY NO.:                  29
BALCONY GEOMETRY: 61*2*0.16M
BUILDING HEIGHT:             120M
+  GREATER THAN             0 040
-  LESS THAN               -0.040
O  BETWEEN      -0 040 & 0.040

         I------------------------------I
LEVEL  1 I 0                         00I
LEVEL  2 I    -      0      0      0   I
LEVEL  3 I00                         00I
LEVEL  4 I0  0          0           0 I
LEVEL  5 I 0     0            0      0I
LEVEL  6 I0  0          0           0 I
LEVEL  7 I 0     0            0      0I
LEVEL  8 I0  0          0           0 I
LEVEL  9 I 0     0            0      0I
LEVEL 10 I0  0          0           + I
LEVEL 11 I 0     0            0      +I
LEVEL 12 I0  0          0           + I
         I------------------------------I

NO. OF + = 3     NO. OF - = 1     NO. OF 0 = 28
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.69	-.65	-.03
20	-.68	-.69	.01
21	-.70	-.70	00
22	-.70	-.66	-.04
23	-.71*	-.67	-.04
24	-.69	-.67	-.01
25	-.68	-.67	00
26	-.67	-.65	-.02
27	-.65	-.64	-.01
28	-.69	-.69	.01
29	-.70	-.71	.01
30	-.63	-.61	-.02
31	-.64	-.64	.00
32	-.65	-.66	.01
33	-.69	-.71	.02
34	-.59	-.60	.01
43	-.61	-.62	.00
44	-.66	-.67	.01
45	-.70	-.72	.02
46	-.58	-.58	.00
47	-.60	-.60	.00
48	-.64	-.65	.01
49	-.70	-.71	.01
50	-.56	-.57	.01
51	-.60	-.60	.00
52	-.66	-.68	.02
53	-.70	-.73	.03
54	-.54	-.54	-.01
55	-.56	-.57	.00
56	-.62	-.62	.00
59	-.68	-.72	.04
60	-.54	-.54	.00
61	-.57	-.59	.02
62	-.66	-.68	.02
63	-.70	-.74	04
64	-.55	-.53	-.02
65	-.56	-.56	.00
66	-.60	-.61	.01
67	-.68	-.73	.05
68	-.56	-.56	-.01
69	-.59	-.61	.02
70	-.63	-.65	.02
71	-.69	-.75*	.06
72	-.56	-.58	.02
73	-.57	-.60	.03
74	-.59	-.59	.01
75	-.63	-.70	.07*

FIG. B.2 CONTINUED

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       120
BALCONY NO.:                    29
BALCONY GEOMETRY:  61*2*0.16M
BUILDING HEIGHT:              120M
+   GREATER THAN             0.040
-   LESS THAN               -0.040
O   BETWEEN      -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I    -    0     0     0      I
LEVEL  3  I-0                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0   0          0         0 I
          I                            I
          I                            I
LEVEL  5  I 0       0           0    0I
          I                            I
          I                            I
LEVEL  6  I0   0          0         0 I
          I                            I
          I                            I
LEVEL  7  I 0       0           0    +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0   0          0         0 I
          I                            I
          I                            I
LEVEL  9  I 0       0           0    0I
          I                            I
          I                            I
LEVEL 10  I0   0          0         0 I
          I                            I
          I                            I
LEVEL 11  I 0       0           0    +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0   0          0         0 I
          I                            I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.64	-.62	-.02
20	-.67	-.66	-.01
21	-.67	-.66	-.01
22	-.67	-.63	-.05
23	-.67	-.64	-.03
24	-.66	-.64	-.02
25	-.66	-.66	-.01
26	-.65	-.61	-.04
27	-.63	-.62	-.01
28	-.66	-.67	.00
29	-.67	-.67	.00
30	-.63	-.60	- 03
31	-.64	-.62	-.02
32	-.66	-.65	-.01
33	-.68	-.69	.02
34	-.57	-.61	.04
43	-.63	-.63	.01
44	-.66	-.68	.02
45	-.68	-.71	.03
46	-.60	-.58	- 02
47	-.61	-.60	-.02
48	-.66	-.64	-.02
49	-.69	-.70	.01
50	-.55	-.57	.02
51	-.61	-.60	.00
52	-.64	-.67	03
53	-.68	-.73*	.06
54	-.55	-.52	-.02
55	-.58	-.55	- 03
56	- 63	-.61	-.02
59	-.67	-.70	.03
60	-.52	-.52	.00
61	-.58	-.56	-.02
62	-.62	- 62	.01
63	- 69*	-.72	.03
64	-.48	- 46	-.02
65	-.53	-.50	-.03
66	-.57	-.57	-.01
67	-.65	-.68	03
68	-.49	-.47	-.01
69	-.53	- 53	.00
70	-.59	-.60	.01
71	-.66	-.73	.06*
72	-.49	-.47	- 02
73	-.51	-.50	- 01
74	-.54	-.53	-.01
75	-.60	-.62	.02

NO OF + = 2 NO. OF - = 2 NO OF 0 = 29

* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       135
BALCONY NO.:                    29
BALCONY GEOMETRY:  61*2*0.16M
BUILDING HEIGHT:              120M
+   GREATER THAN             0.040
-   LESS THAN               -0.040
O   BETWEEN      -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I    0    0     0     0      I
LEVEL  3  I00                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0   0          0         0 I
          I                            I
          I                            I
LEVEL  5  I 0       +           0    +I
          I                            I
          I                            I
LEVEL  6  I0   +          0         + I
          I                            I
          I                            I
LEVEL  7  I +       0           0    +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0   0          0         0 I
          I                            I
          I                            I
LEVEL  9  I 0       0           0    +I
          I                            I
          I                            I
LEVEL 10  I0   0          0         0 I
          I                            I
          I                            I
LEVEL 11  I 0       0           0    +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0   0          0         0 I
          I                            I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.53	-.51	-.02
20	-.59	-.60	.00
21	-.60	-.60	.00
22	-.55	-.52	-.02
23	-.56	-.54	-.02
24	-.58	-.56	-.02
25	-.59	-.58	-.01
26	-.54	-.52	-.01
27	-.53	-.52	-.01
28	-.60	-.60	.00
29	-.61	-.61	.00
30	-.57	-.54	-.03
31	-.57	-.56	-.02
32	-.60	-.60	.00
33	-.63*	-.65	.02
34	-.52	-.56	.03
43	-.49	-.59	.10
44	-.62	-.63	.01
45	-.63	-.67*	.05
46	-.54	-.54	.01
47	-.51	-.56	.05
48	-.60	-.62	.01
49	-.59	-.65	.06
50	-.43	-.54	.11*
51	-.56	-.58	.02
52	-.58	-.62	.04
53	-.58	-.65	.07
54	- 50	-.49	-.01
55	-.54	-.52	-.01
56	-.56	-.58	.02
59	-.58	-.59	00
60	-.48	-.47	00
61	-.51	-.53	.02
62	-.53	-.55	.02
63	- 53	-.58	05
64	- 43	-.43	00
65	-.47	-.46	-.01
66	- 50	-.53	.03
67	-.50	-.52	.02
68	-.42	-.43	02
69	- 46	-.48	.02
70	- 48	-.51	03
71	- 46	-.51	.05
72	-.40	-.43	.03
73	- 42	-.45	.02
74	-.46	-.50	.04
75	- 42	-.46	.03

NO. OF + = 8 NO. OF - = 0 NO. OF 0 = 23

* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       165
BALCONY NO.:                    29
BALCONY GEOMETRY:  61*2*0.16M
BUILDING HEIGHT:              120M
+   GREATER THAN             0.040
-   LESS THAN               -0.040
O   BETWEEN      -0 040 & 0 040

          I-----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I    0    0     0     0      I
LEVEL  3  I00                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0   0          0         0 I
          I                            I
          I                            I
LEVEL  5  I 0       -           0    +I
          I                            I
          I                            I
LEVEL  6  I-   -          0         0 I
          I                            I
          I                            I
LEVEL  7  I 0       0           0    +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0   0          0         0 I
          I                            I
          I                            I
LEVEL  9  I 0       0           0    0I
          I                            I
          I                            I
LEVEL 10  I0   0          0         0 I
          I                            I
          I                            I
LEVEL 11  I 0       0           0    0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0   0          0         0 I
          I                            I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.45	-.45	.00
20	-.58	-.60	.02
21	-.64	-.65*	.01
22	-.46	-.45	-.01
23	-.48	-.47	-.01
24	-.50	-.50	-.01
25	-.55	-.55	.00
26	-.47	-.45	-.02
27	- 46	-.45	- 01
28	-.58	-.60	.02
29	-.64*	-.64	.00
30	-.50	-.48	-.02
31	-.51	.49	- 02
32	- 54	-.54	00
33	-.61	-.60	- 01
34	-.48	-.50	.02
43	-.48	-.44	-.04
44	- 51	-.55	.04
45	-.56	-.64	.07
46	-.50	- 44	-.05
47	-.49	-.39	-.10*
48	-.52	-.53	.01
49	-.56	-.54	-.03
50	- 46	-.47	.01
51	-.47	- 50	.03
52	-.48	-.51	.04
53	- 53	-.62	.08
54	-.44	-.44	.00
55	-.45	-.46	.01
56	-.46	-.47	.01
59	-.50	-.51	.00
60	-.41	-.43	.02
61	-.42	-.44	.02
62	-.42	-.45	.03
63	-.55	-.58	.03
64	-.39	-.40	.01
65	-.40	-.42	.02
66	-.41	-.42	01
67	-.45	-.46	.00
68	-.37	-.38	.01
69	-.38	-.41	.03
70	-.38	-.40	.02
71	-.52	-.56	.03
72	- 36	- 38	.02
73	-.37	- 40	.02
74	-.36	-.39	.03
75	-.40	-.42	.02

NO. OF + = 2 NO. OF - = 3 NO OF 0 = 26

* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       150
BALCONY NO.:                    29
BALCONY GEOMETRY:  61*2*0.16M
BUILDING HEIGHT:              120M
+   GREATER THAN             0.040
-   LESS THAN               -0.040
O   BETWEEN      -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I    0    0     0     0      I
LEVEL  3  I-0                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I-   0          0         0 I
          I                            I
          I                            I
LEVEL  5  I 0       -           0    0I
          I                            I
          I                            I
LEVEL  6  I+   0          0         0 I
          I                            I
          I                            I
LEVEL  7  I 0       0           0    +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0   0          0         0 I
          I                            I
          I                            I
LEVEL  9  I 0       0           0    0I
          I                            I
          I                            I
LEVEL 10  I0   0          0         0 I
          I                            I
          I                            I
LEVEL 11  I 0       0           0    0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0   0          0         0 I
          I                            I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.48	-.45	-.03
20	-.58	-.55	-.03
21	-.63	-.61	-.02
22	-.50	-.47	-.04
23	-.51	-.48	- 03
24	-.53	-.50	-.03
25	-.56	-.53	-.03
26	-.50	-.46	-.04
27	-.49	-.46	-.03
28	-.58	-.57	-.02
29	-.63	-.61	-.02
30	-.54	-.49	- 05
31	-.54	-.51	-.04
32	- 58	-.55	- 03
33	-.63*	-.61	- 02
34	-.51	-.51	.00
43	-.44	-.32	-.12*
44	-.57	- 60	02
45	-.61	-.64*	.04
46	-.45	-.50	.05
47	-.49	-.48	-.01
48	-.56	-.56	.00
49	-.61	-.60	-.01
50	- 52	-.50	-.02
51	-.52	-.53	.01
52	-.54	-.56	02
53	-.56	-.61	05
54	-.48	-.45	-.03
55	-.50	-.47	-.03
56	-.53	-.51	-.02
59	-.55	-.53	-.08
60	-.46	-.43	-.03
61	-.47	-.47	.00
62	-.49	-.49	.00
63	- 54	-.54	.00
64	-.41	-.39	-.03
65	-.43	-.42	-.01
66	-.46	-.46	.00
67	-.47	-.46	-.01
68	-.40	-.39	-.01
69	-.43	-.43	.00
70	-.42	-.42	.00
71	-.48	-.49	01
72	-.39	-.38	.00
73	-.41	-.41	.00
74	-.41	- 42	.01
75	-.38	-.39	.01

NO. OF + = 2 NO OF - = 3 NO. OF 0 = 28

* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.2 CONTINUED

```
COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *             TAP ROUGH  SMOOTH  DIFF

    AZIMUTH:                     180            19  -.52   -.53    .02
    BALCONY NO.:                  29            20  -.53   -.56    .03
    BALCONY GEOMETRY: 61*2*0.16M                21  -.57   -.58    .01
    BUILDING HEIGHT:             120M           22  -.55   -.53   -.02
    +  GREATER THAN             0.040           23  -.57   -.56   -.01
    -  LESS THAN               -0.040           24  -.56   -.56    .00
    0  BETWEEN     -0.040 & 0.040               25  -.56   -.56    .00
                                                26  -.56   -.59    .03
            I---------------------------I       27  -.52   -.55    .03
LEVEL  1    I 0                       00I       28  -.53   -.56    .03
LEVEL  2    I     0     0     0     0   I       29  -.56   -.60    .04
LEVEL  3    I00                       00I       30  -.63   -.63    .00
            I                           I       31  -.54   -.54    .00
            I                           I       32  -.52   -.54    .01
            I                           I       33  -.57   -.57    .00
            I                           I       34  -.51   -.56    .05*
LEVEL  4    I0    0           0        0I       43  -.47   -.51    .04
            I                           I       44  -.49   -.52    .03
            I                           I       45  -.60   -.63*   .03
LEVEL  5    I +         0           0  0I       46  -.64*  -.62   -.02
            I                           I       47  -.50   -.50    .00
            I                           I       48  -.47   -.48    .01
LEVEL  6    I0    0           0        0I       49  -.55   -.55    .00
            I                           I       50  -.51   -.53    .02
            I                           I       51  -.43   -.46    .02
LEVEL  7    I 0         0           0  0I       52  -.47   -.48    .01
            I                           I       53  -.59   -.63    .04
            I                           I       54  -.60   -.60    .00
            I                           I       55  -.45   -.46    .01
            I                           I       56  -.43   -.43    .00
LEVEL  8    I0    0           0        0I       59  -.51   -.51    .00
            I                           I       60  -.48   -.49    .02
            I                           I       61  -.41   -.41    .00
LEVEL  9    I 0         0           0  0I       62  -.44   -.45    .01
            I                           I       63  -.57   -.60    .03
            I                           I       64  -.54   -.54    .00
LEVEL 10    I0    0           0        0I       65  -.42   -.44    .02
            I                           I       66  -.39   -.41    .02
            I                           I       67  -.47   -.47    .00
LEVEL 11    I 0         0           0  0I       68  -.43   -.44    .01
            I                           I       69  -.39   -.40    .01
            I                           I       70  -.41   -.42    .01
            I                           I       71  -.47   -.48    .01
            I                           I       72  -.41   -.42    .01
LEVEL 12    I0    0           0        0I       73  -.39   -.41    .02
            I                           I       74  -.38   -.39    .01
            I---------------------------I       75  -.41   -.42    .01

            NO. OF + = 1      NO OF - = 0      NO OF 0 = 31
            * -- THE MAXIMU OR MINIMUM VALUES
```

FIG. B.2 CONTINUED

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 0
BALCONY NO.: 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
         I---------------------------I
LEVEL  1 I +                       ++I
LEVEL  2 I    -     -     -     -    I
LEVEL  3 I+0                       0+I
LEVEL  4 I-   -           -        - I
LEVEL  5 I -        +           0  -I
LEVEL  6 I+   +           0        0 I
LEVEL  7 I +        0           0  -I
LEVEL  8 I+   0           0        0 I
LEVEL  9 I -        0           0  -I
LEVEL 10 I+   0           0        + I
LEVEL 11 I 0        0           0  0I
LEVEL 12 I+   0           0        + I
         I---------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.53	.45	.09
20	.53	.46	.07
21	.08	-.04	.11
22	.42	.64	-.22*
23	.44	.65	-.21
24	.45	.66	-.22
25	.43	.64	-.20
26	.10	-.05	.14
27	.55	.52	.03
28	.55	.55	.00
29	.16	.04	.12
30	-.11	.01	-.13
31	.71	.79	-.07
32	.80	.88*	-.08
33	.47	.56	-.08
34	.44	.50	-.07
43	1.05*	.85	.20
44	.75	.73	.02
45	-.06	-.02	-.04
46	.11	-.01	.12
47	.06	-.07	.13
48	.81	.81	.00
49	.44	.44	.00
50	.40	.34	.06
51	.74	.76	-.02
52	.66	.69	-.03
53	-.17	-.08	-.09
54	-.04	-.11	.07
55	.62	.60	.02
56	.71	.68	.03
59	.40	.37	.03
60	.26	.30	-.04
61	.60	.62	-.02
62	.52	.54	-.02
63	-.26	-.19	-.07
64	-.12	-.21	.10
65	.50	.48	.02
66	.59	.57	.01
67	.33	.25	.09
68	.13	.17	-.04
69	.49	.52	-.03
70	.38	.42	-.04
71	-.34	-.32	-.02
72	-.17	-.36	.19
73	.43	.43	.00
74	.55	.56	-.01
75	.17	.11	.06

NO. OF + = 14   NO. OF - = 13   NO. OF 0 = 20
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 15
BALCONY NO.: 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
         I---------------------------I
LEVEL  1 I +                       ++I
LEVEL  2 I    -     -     -     -    I
LEVEL  3 I++                       0+I
LEVEL  4 I-   0           0        - I
LEVEL  5 I 0        0           0  -I
LEVEL  6 I0   0           0        0 I
LEVEL  7 I -        0           0  -I
LEVEL  8 I+   0           0        0 I
LEVEL  9 I -        0           0  -I
LEVEL 10 I0   +           0        + I
LEVEL 11 I -        0           0  -I
LEVEL 12 I+   0           0        0 I
         I---------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.71	.57	.14
20	.32	.26	.06
21	-.12	-.18	.06
22	.49	.67	-.17
23	.44	.61	-.17
24	.39	.56	-.18*
25	.30	.48	-.17
26	.25	.11	.14
27	.76	.67	.09
28	.37	.34	.03
29	-.01	-.12	.10
30	.03	.16	-.13
31	.83*	.85*	-.02
32	.77	.76	.00
33	.29	.35	-.05
34	.63	.65	-.02
43	.83	.84	-.01
44	.60	.62	-.02
45	-.17	-.12	-.05
46	.09	.10	-.01
47	.80	.80	.00
48	.75	.74	.00
49	.31	.31	.00
50	.52	.56	-.04
51	.75	.77	-.02
52	.55	.56	-.01
53	-.23	-.15	-.08
54	.05	.00	.04
55	.71	.68	.04
56	.67	.64	.04
59	.28	.25	.03
60	.39	.44	-.05
61	.63	.62	.02
62	.44	.45	-.01
63	-.27	-.17	-.10
64	-.03	-.06	.04
65	.59	.55	.04
66	.56	.52	.04
67	.22	.17	.06
68	.24	.30	-.06
69	.51	.52	-.02
70	.33	.36	-.03
71	-.29	-.23	-.06
72	-.09	-.22	.13
73	.48	.47	.01
74	.53	.53	.00
75	.12	.10	.02

NO. OF + = 10   NO. OF - = 13   NO. OF 0 = 24
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 30
BALCONY NO.: 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
         I---------------------------I
LEVEL  1 I +                       0OI
LEVEL  2 I    -     -     -     -    I
LEVEL  3 I++                       0+I
LEVEL  4 I-   0           0        - I
LEVEL  5 I 0        0           0  0I
LEVEL  6 I0   0           0        0 I
LEVEL  7 I 0        0           0  -I
LEVEL  8 I0   +           +        0 I
LEVEL  9 I 0        0           0  -I
LEVEL 10 I+   +           +        0 I
LEVEL 11 I 0        0           0  0I
LEVEL 12 I+   0           0        0 I
         I---------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.79	.67	.12
20	.07	.05	.02
21	-.34	-.34	.01
22	.47	.62	-.15
23	.34	.50	-.16*
24	.26	.41	-.16
25	.15	.28	-.13
26	.67	.62	.05
27	.90*	.80	.10
28	.11	.12	-.01
29	-.22	-.28	.06
30	.55	.65	-.10
31	.83	.83	.00
32	.58	.60	-.01
33	.07	.12	-.05
34	.81	.84*	-.03
43	.73	.71	.02
44	.39	.39	.00
45	-.31	-.29	-.01
46	.56	.57	.00
47	[illegible]	.78	.04
48	.57*	.56	.01
49	.09	.08	.00
50	.74	.75	-.01
51	.67	.65	.01
52	.35	.34	.01
53	-.34	-.29	-.04
54	.46	.45	.00
55	.72	.67	.05
56	.54	.48	.05
59	.08	.05	.03
60	.62	.61	.01
61	.57	.55	.02
62	.29	.28	.01
63	-.33	-.27	-.06
64	.41	.34	.07
65	.60	.54	.06
66	.44	.40	.04
67	.06	.02	.04
68	.48	.48	.00
69	.46	.45	.01
70	.20	.22	-.02
71	-.31	-.28	-.02
72	.32	.22	.11
73	.50	.48	.02
74	.41	.40	.01
75	-.01	-.01	.00

NO. OF + = 10   NO. OF - = 8   NO. OF 0 = 29
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 45
BALCONY NO.: 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
         I---------------------------I
LEVEL  1 I +                       -0I
LEVEL  2 I    -     -     -     -    I
LEVEL  3 I++                       0OI
LEVEL  4 I0   0           0        0 I
LEVEL  5 I 0        +           0  0I
LEVEL  6 I+   +           0        0 I
LEVEL  7 I +        0           0  0I
LEVEL  8 I+   +           +        0 I
LEVEL  9 I 0        0           0  0I
LEVEL 10 I+   0           0        0 I
LEVEL 11 I 0        0           0  0I
LEVEL 12 I+   0           0        0 I
         I---------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.59	.38	.21*
20	-.13	-.09	-.04
21	-.39	-.39	.00
22	.28	.34	-.06
23	.09	.25	-.16
24	.05	.18	-.14
25	-.03	.08	-.11
26	.88*	.75	.13
27	.73	.59	.14
28	-.09	-.06	-.03
29	-.34	-.35	.01
30	.83	.83*	.00
31	.61	.59	.02
32	.32	.33	.00
33	-.11	-.08	-.03
34	.74	.74	.01
43	.64	.46	.18
44	.13	.14	-.01
45	-.40	-.38	-.02
46	.82	.76	.05
47	.75	.58	.17
48	.31	.31	.00
49	-.12	-.10	-.01
50	.76	.65	.11
51	.44	.42	.01
52	.11	.12	-.01
53	-.41	-.37	-.03
54	.69	.64	.05
55	.54	.49	.04
56	.30	.26	.04
59	-.12	-.11	.00
60	.57	.54	.03
61	.37	.35	.02
62	.08	.08	.00
63	-.37	-.34	-.04
64	.59	.51	.03
65	.45	.41	.04
66	.23	.21	.03
67	-.11	-.12	.01
68	.46	.43	.03
69	.29	.29	.00
70	.04	.05	-.01
71	-.33	-.31	-.02
72	.45	.38	.08
73	.36	.36	.00
74	.21	.21	.01
75	-.14	-.13	-.01

NO. OF + = 12   NO. OF - = 5   NO. OF 0 = 30
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.3 EFFECT OF 4m BALCONIES ON Cp MEAN

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                     60
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN      -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I +                         --I
LEVEL  2  I     -     -     -    - -    I
LEVEL  3  I++                         -0I
LEVEL  4  I+   0          0       +  0  I
LEVEL  5  I +                     -  0I
LEVEL  6  I0   +           0         -  I
LEVEL  7  I +        0           0   0I
LEVEL  8  I+   0          0          0  I
LEVEL  9  I +        0           0   0I
LEVEL 10  I+   0          0          0  I
LEVEL 11  I 0        0           0   0I
LEVEL 12  I0   0          0.         0  I
          I-----------------------------I

NO. OF + = 10     NO. OF - = 10     NO. OF 0 = 27
* -- THE MAXIMUM OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.08	-.20	.12
20	-.26	-.22	-.04
21	-.47*	-.40	-.06
22	-.02	.03	-.06
23	-.11	-.03	-.08
24	-.12	-.06	-.07
25	-.17	-.12	-.05
26	-.21	-.46	.25
27	.13	-.18	.31
28	-.26	-.21	-.05
29	-.41	-.38	-.03
30	-.09	-.22	.13
31	.21	.23	-.03
32	.04	.05	-.01
33	-.26	-.24	-.02
34	-.08	-.22	.15
43	.15	.58*	-.43
44	-.10	.00	-.10
45	-.45	-.43	-.02
46	-.09	-.12	.03
47	.18	-.31	.48*
48	.03	.04	-.01
49	-.26	-.19	-.07
50	-.10	-.26	.16
51	.14	.13	.01
52	-.10	-.09	-.01
53	-.44	-.42	-.03
54	-.12	-.22	.10
55	.15	.14	.01
56	.05	.01	.03
59	-.26	-.25	-.02
60	-.14	-.19	.06
61	.09	.09	-.01
62	-.13	-.10	-.01
63	-.41	-.37	-.04
64	-.16	-.21	.15
65	.10	.08	.02
66	.00	.03	.00
67	-.25	-.23	-.02
68	-.15	-.13	-.02
69	.04	.06	-.03
70	-.14	-.12	-.02
71	-.36	-.34	-.02
72	-.13	-.10	-.03
73	.06	.00	-.01
74	.03	.00	.00
75	-.25	-.23	-.02

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                     75
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN      -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I -                         -0I
LEVEL  2  I    +     +     -     -      I
LEVEL  3  I0+                         +0I
LEVEL  4  I+   +           -         0  I
LEVEL  5  I +               -        - 0I
LEVEL  6  I0   +            -        -  I
LEVEL  7  I +         -          -   0I
LEVEL  8  I0   0           -         0  I
LEVEL  9  I 0           -          -  0I
LEVEL 10  I0   +            -        0  I
LEVEL 11  I 0           -          -  0I
LEVEL 12  I+   +            -        +  I
          I-----------------------------I

NO. OF + = [illegible]     NO. OF - = [illegible]     NO. OF 0 = 17
* -- THE MAXIMUM OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-1.23*	-1.04	-.19
20	-.34	-.30	-.04
21	-.41	-.40	-.01
22	-.08	-.98	.10
23	-.41	-.49	.08
24	-.31	-.20	-.10
25	-.21	-.24	.03
26	-1.02	-1.01	-.02
27	-1.07	-1.03	-.04
28	-.34	-.29	-.05
29	-.41	-.39	-.03
30	-.82	-.89	.07
31	-.85	-.98	.13
32	-.37	-.25	-.12
33	-.31	-.31	.00
34	-.82	-.88	.05
43	-.78	-.30	-.48*
44	-.24	-.14	-.10
45	-.44	-.41	-.04
46	-.83	-.82	-.01
47	-.86	-1.05*	.19
48	-.47	-.35	-.12
49	-.33	-.28	-.04
50	-.85	-.97	.12
51	-.77	-.70	-.07
52	-.31	-.26	-.05
53	-.43	-.40	-.03
54	-.48	-.44	-.04
55	-.44	[illegible]	.04
56	-.46	-.55	.11
59	-.32	-.31	-.01
60	-.65	[illegible]	[illegible]
61	[illegible]	[illegible]	[illegible]
62	-.33	-.35	-.03
63	-.38	-.35	-.03
64	[illegible]	[illegible]	[illegible]
65	-.75	[illegible]	[illegible]
66	-.45	-.30	[illegible]
67	-.31	[illegible]	[illegible]
68	[illegible]	[illegible]	[illegible]
69	-.41	-.50	.11
70	[illegible]	[illegible]	[illegible]
71	-.36	-.34	[illegible]
72	[illegible]	[illegible]	[illegible]
73	[illegible]	[illegible]	.15
74	[illegible]	[illegible]	[illegible]
75	-.32	[illegible]	[illegible]

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                     90
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN      -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I -                        00I
LEVEL  2  I    0     0     0     0      I
LEVEL  3  I00                        00I
LEVEL  4  I0   +           +         0  I
LEVEL  5  I 0         +          0   0I
LEVEL  6  I0   +           +         0  I
LEVEL  7  I +         +          +   0I
LEVEL  8  I+   +           +         0  I
LEVEL  9  I +         +          +   0I
LEVEL 10  I+   +           +         -  I
LEVEL 11  I +         +          0      I
LEVEL 12  I+   +           +            I
          I-----------------------------I

NO. OF + = 21     NO. OF - = 5     NO. OF 0 = 21
* -- THE MAXIMUM OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.83*	-.76	-.07
20	-.63	-.63	.00
21	-.68	-.65	-.03
22	-.78	-.78	.01
23	-.82	-.82	.00
24	-.82	-.83	.01
25	-.72	-.74	.02
26	-.75	-.74	-.01
27	-.75	-.75	.00
28	-.65	-.64	-.01
29	-.66	-.69	.03
30	-.70	-.72	.02
31	-.71	-.77	.06
32	-.76	-.82	.06
33	-.75	-.73	-.02
34	-.69	-.73	.04
43	-.73	-.80	.07
44	-.72	-.75	.02
45	-.80	-.78	-.02
46	-.70	-.71	.01
47	-.70	-.75	.05
48	-.76	[illegible]	[illegible]
49	-.79	-.78	-.02
50	-.69	[illegible]	.03
51	-.71	-.82	.11
52	-.71	-.76	.04
53	-.78	-.85	.07
54	-.80	-.74	-.06
55	-.68	-.79	.11
56	-.75	-.85	.10
59	-.76	-.75	-.02
60	-.68	-.79	.11
61	-.70	-.89	.19
62	-.69	-.74	.05
63	-.76	-.75	.00
64	-.80	-.82	.14
65	-.68	-.88	.20
66	-.74	-.85	.11
67	-.73	-.64	-.08
68	-.73	-.81	.16
69	-.72	-.95	.23
70	-.65	-.65	.00
71	-.80	-.56	-.14
72	-.71	[illegible]	[illegible]
73	-.69	-.91*	.49*
74	-.70	-.64	-.06
75	-.53	-.64	[illegible]

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    105
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN      -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I    0     0     0     0      I
LEVEL  3  I00                        00I
LEVEL  4  I0   0           0         0  I
LEVEL  5  I 0                    0   0I
LEVEL  6  I0   0           0         0  I
LEVEL  7  I 0         0          0    I
LEVEL  8  I0   0           0        0  I
LEVEL  9  I 0         0          +    I
LEVEL 10  I    0           0         +  I
LEVEL 11  I 0         +          0    I
LEVEL 12  I0               0         +  I
          I-----------------------------I

NO. OF + = [illegible]     NO. OF - = [illegible]     NO. OF 0 = [illegible]
* -- THE MAXIMUM OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.69	-.65	-.03
20	-.70	-.69	-.01
21	-.74*	-.70	-.04
22	-.69	-.66	-.03
23	-.70	-.67	-.03
24	-.69	-.67	-.01
25	-.66	-.67	.01
26	-.66	-.65	-.01
27	-.65	-.64	.00
28	-.69	-.69	.00
29	-.69	-.71	.02
30	-.62	-.62	-.01
31	-.64	-.64	.00
32	-.64	-.64	.02
33	-.70	-.73	.03
34	-.60	-.60	.00
43	-.62	-.62	-.01
44	-.65	-.67	.02
45	-.69	-.72	.02
46	-.60	-.58	.02
47	-.60	-.60	.00
48	[illegible]	[illegible]	.03
49	-.70	-.71	.01
50	-.57	-.57	.00
51	-.60	-.60	.00
52	-.65	-.60	.03
53	-.69	-.71	.04
54	-.57	.56	[illegible]
55	-.57	-.57	.00
56	-.62	[illegible]	.01
59	-.60	-.72	.04
60	[illegible]	[illegible]	[illegible]
61	[illegible]	[illegible]	.01
62	[illegible]	[illegible]	[illegible]
63	-.69	-.76	.05
64	[illegible]	[illegible]	[illegible]
65	-.55	-.56	.01
66	[illegible]	[illegible]	[illegible]
67	[illegible]	-.71	[illegible]
68	[illegible]	[illegible]	[illegible]
69	-.51	-.61	[illegible]
70	[illegible]	[illegible]	[illegible]
71	-.61	[illegible]	[illegible]
72	[illegible]	[illegible]	[illegible]
73	[illegible]	[illegible]	[illegible]
74	[illegible]	[illegible]	[illegible]
75	[illegible]	[illegible]	[illegible]

FIG. B.3 CONTINUED

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    120
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN     -0.040 & 0.040

          I----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I     0     0     0     0    I
LEVEL  3  I00                        00I
LEVEL  4  I0    0           0        0 I
LEVEL  5  I 0       0            0   0I
LEVEL  6  I0    0           0        0 I
LEVEL  7  I 0       0            0   +I
LEVEL  8  I0    0           0        0 I
LEVEL  9  I 0       0            0   +I
LEVEL 10  I-    0           0        + I
LEVEL 11  I 0       0            0   +I
LEVEL 12  I0    0           0        0 I
          I----------------------------I

NO. OF + =  4     NO. OF - =  1     NO. OF 0 = 42
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.65	-.62	-.03
20	-.68	-.66	-.01
21	-.67	-.66	-.01
22	-.66	-.63	-.03
23	-.66	-.64	-.03
24	-.66	-.64	-.01
25	-.66	-.66	.00
26	-.65	-.61	-.04
27	-.62	-.62	-.01
28	-.66	-.67	.00
29	-.67	-.67	.00
30	-.63	-.60	-.03
31	-.63	-.62	-.01
32	-.66	-.65	-.01
33	-.68	-.69	.01
34	-.60	-.61	.01
43	-.64	-.63	-.01
44	-.66	-.66	.01
45	-.68	-.71	.03
46	-.61	-.58	-.04
47	-.61	-.60	-.02
48	-.65	-.64	-.01
49	-.69*	-.70	.01
50	-.57	-.57	.00
51	-.61	-.60	- 01
52	-.64	-.67	.03
53	-.66	-.73*	.07
54	-.55	-.52	-.02
55	-.58	-.55	-.04
56	-.61	-.61	00
59	-.66	-.70	.04
60	-.51	-.52	.00
61	-.56	-.56	-.01
62	-.60	-.62	.03
63	-.67	-.72	.06
64	-.50	-.46	-.04
65	-.53	-.50	- 03
66	-.56	-.57	.01
67	-.63	-.68	.06
68	-.50	-.47	-.02
69	-.52	-.53	.01
70	-.57	-.60	.03
71	-.64	-.73	.08*
72	-.50	-.47	- 03
73	-.51	-.50	- 01
74	- 54	- 53	-.01
75	-.59	- 62	.03

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    135
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN     -0.040 & 0.040

          I----------------------------I
LEVEL  1  I -                        00I
LEVEL  2  I     0     -     -     0    I
LEVEL  3  I-0                        00I
LEVEL  4  I-    0           0        0 I
LEVEL  5  I 0       0            0   0I
LEVEL  6  I-    -           0        0 I
LEVEL  7  I 0       0            0   0I
LEVEL  8  I-    -           0        0 I
LEVEL  9  I 0       0            0   0I
LEVEL 10  I-    0           0        0 I
LEVEL 11  I 0       0            0   0I
LEVEL 12  I0    0           0        0 I
          I----------------------------I

NO. OF + =  0     NO. OF - = 10     NO. OF 0 = 37
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.55	-.51	-.04
20	-.62	-.60	-.02
21	-.62	-.60	-.03
22	-.56	-.52	-.04
23	-.59	-.54	-.05
24	-.60	-.56	-.04
25	-.62	-.56	-.03
26	-.57	-.52	-.05
27	-.54	-.52	-.02
28	-.62	-.60	-.02
29	-.63	-.61	-.02
30	-.60	-.54	-.06*
31	-.59	-.56	-.04
32	-.63	-.60	-.03
33	-.65	-.65	.00
34	-.58	-.56	-.02
43	-.62	-.59	-.03
44	-.64	-.63	-.01
45	-.65	-.67*	.02
46	-.60	-.54	-.05
47	-.60	-.56	-.04
48	-.63	-.62	-.02
49	-.66*	-.65	-.01
50	-.55	-.54	-.01
51	-.59	-.58	-.01
52	-.62	-.62	.00
53	-.62	-.65	.04
54	-.54	-.49	-.05
55	-.56	-.52	-.04
56	-.59	-.58	-.02
59	-.58	-.59	.00
60	-.49	-.47	-.02
61	-.53	-.53	.00
62	-.55	- 55	.01
63	-.56	-.58	.01
64	-.48	-.43	-.05
65	-.50	-.46	-.04
66	-.52	-.53	.01
67	-.52	-.52	.00
68	-.45	-.43	-.02
69	-.48	-.48	.01
70	-.49	-.51	.02
71	-.48	-.51	.03
72	-.44	-.43	-.01
73	-.44	-.45	.00
74	-.49	-.50	.01
75	-.44	-.46	.02*

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    150
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN     -0.040 & 0.040

          I----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I     0     0     0     0    I
LEVEL  3  I00                        00I
LEVEL  4  I0    0           0        0 I
LEVEL  5  I 0       +            0   0I
LEVEL  6  I-    -           0        0 I
LEVEL  7  I 0       0            0   0I
LEVEL  8  I0    0           0        0 I
LEVEL  9  I 0       0            0   0I
LEVEL 10  I0    0           0        0 I
LEVEL 11  I 0       0            0   0I
LEVEL 12  I0    0           0        0 I
          I----------------------------I

NO. OF + =  1     NO. OF - =  2     NO. OF 0 = 44
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.45	-.45	.00
20	-.56	-.55	-.01
21	-.60	-.61	.01
22	-.48	-.47	-.01
23	-.48	-.48	- 01
24	-.50	-.50	.00
25	-.54	-.53	-.01
26	-.47	-.46	-.02
27	-.46	-.46	.00
28	-.57	-.57	-.01
29	-.60	-.61	.02
30	-.53	-.49	- 04
31	-.52	-.51	-.01
32	-.56	-.55	-.01
33	-.61	-.61	.00
34	-.51	-.51	.00
43	1.00*	-.32	1.32*
44	-.59	-.60	.01
45	-.62	-.64*	.03
46	-.54	-.50	-.04
47	-.56	-.48	- 08
48	-.56	- 56	.00
49	- 60	-.60	.00
50	-.49	-.50	.01
51	-.52	-.53	.01
52	-.55	-.56	.02
53	-.59	-.61	.02
54	-.48	-.45	-.03
55	-.50	-.47	-.03
56	-.52	-.51	- 01
59	-.53	-.53	.00
60	-.44	-.43	-.02
61	-.47	-.47	.00
62	-.47	-.49	.02
63	-.52	-.54	.02
64	-.43	-.39	-.04
65	-.44	-.42	-.01
66	-.45	-.46	.01
67	-.46	-.46	.00
68	-.40	-.39	-.01
69	-.41	-.43	.02
70	-.41	-.42	.01
71	-.47	-.49	.02
72	-.38	-.38	.00
73	-.40	-.41	.01
74	-.40	-.42	.02
75	-.37	-.39	.02

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    165
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*4*0.16M
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN     -0.040 & 0.040

          I----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I     0     0     0     0    I
LEVEL  3  I00                        00I
LEVEL  4  I0    0           0        0 I
LEVEL  5  I 0       -            0   0I
LEVEL  6  I-    0           0        0 I
LEVEL  7  I 0       0            0   0I
LEVEL  8  I0    0           0        0 I
LEVEL  9  I 0       0            0   0I
LEVEL 10  I0    0           0        0 I
LEVEL 11  I 0       0            0   0I
LEVEL 12  I0    0           0        0 I
          I----------------------------I

NO. OF + =  0     NO. OF - =  2     NO. OF 0 = 45
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.45	-.45	.00
20	-.58	-.60	.01
21	-.65*	-.65*	.00
22	-.46	-.45	.00
23	-.47	-.47	.00
24	-.49	-.50	.01
25	-.55	-.55	.01
26	-.46	-.45	.00
27	-.45	-.45	.00
28	-.58	-.60	.01
29	-.64	-.64	.01
30	-.50	-.48	-.02
31	-.51	-.49	-.02
32	-.55	-.54	-.01
33	-.61	-.60	00
34	-.50	-.50	.00
43	-.49	-.44	-.05
44	-.56	-.55	- 01
45	-.60	- 64	.04
46	-.52	-.44	-.08*
47	-.43	-.39	-.04
48	-.53	-.53	.00
49	-.57	-.54	-.04
50	-.47	-.47	.00
51	-.49	-.50	.01
52	-.51	-.51	.00
53	-.60	-.62	.02
54	-.47	-.44	-.03
55	-.47	-.46	-.01
56	-.48	-.47	-.01
59	-.50	-.51	.01
60	-.43	-.43	.00
61	-.44	-.44	.01
62	-.44	- 45	.01
63	-.55	-.58	.03
64	-.41	-.40	-.01
65	-.41	-.42	.01
66	-.41	-.42	.01
67	-.46	-.46	.00
68	-.38	-.38	.01
69	-.39	-.41	.03
70	-.40	-.40	.01
71	-.52	-.56	.03
72	-.37	-.36	.00
73	-.38	-.40	.01
74	-.37	-.39	.02
75	-.41	-.42	.01

FIG. B.3 CONTINUED

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

```
* BALCONY DATA MINUS SMOOTH DATA *              TAP  ROUGH   SMOOTH   DIFF

   AZIMUTH:                     180              19  -.52    -.53     .02
   BALCONY NO.:                  29              20  -.53    -.56     .03
   BALCONY GEOMETRY: 61*4*0.16M                  21  -.56    -.58     .02
   BUILDING HEIGHT:            120M              22  -.52    -.53     .00
   +  GREATER THAN            0.040              23  -.53    -.56     .03
   -  LESS THAN              -0.040              24  -.53    -.56     .03
   0  BETWEEN      -0.040 & 0.040                25  -.53    -.56     .03
                                                 26  -.55    -.58     .04
           I-----------------------------I       27  -.52    -.55     .03
LEVEL  1   I 0                         00I       28  -.53    -.56     .03
LEVEL  2   I    0     0      0     0     I       29  -.56    -.60     .04*
LEVEL  3   I00                         0+I       30  -.62    -.63     .00
           I                             I       31  -.51    -.54     .02
           I                             I       32  -.52    -.54     .01
           I                             I       33  -.56    -.57     .01
           I                             I       34  -.53    -.56     .03
LEVEL  4   I0   0            0         0 I       43  -.49    -.51     .02
           I                             I       44  -.50    -.52     .02
           I                             I       45  -.61    -.63*   -.02
LEVEL  5   I 0        0            0   0I        46  -.64*   -.62    -.02
           I                             I       47  -.50    -.50     .01
           I                             I       48  -.47    -.48     .01
LEVEL  6   I0   0            0         0 I       49  -.54    -.55     .01
           I                             I       50  -.51    -.53     .01
           I                             I       51  -.44    -.46     .02
LEVEL  7   I 0        0            0   0I        52  -.47    -.48     .01
           I                             I       53  -.61    -.63     .02
           I                             I       54  -.60    -.60     .00
           I                             I       55  -.46    -.46     .00
           I                             I       56  -.42    -.43     .00
LEVEL  8   I0   0            0         0 I       59  -.49    -.51     .01
           I                             I       60  -.48    -.49     .02
           I                             I       61  -.40    -.41     .01
LEVEL  9   I 0        0            0   0I        62  -.43    -.45     .01
           I                             I       63  -.57    -.60     .04
           I                             I       64  -.53    -.54     .01
LEVEL 10   I0   0            0         0 I       65  -.43    -.44     .01
           I                             I       66  -.40    -.41     .01
           I                             I       67  -.46    -.47     .00
LEVEL 11   I 0        0            0   0I        68  -.42    -.44     .02
           I                             I       69  -.38    -.40     .02
           I                             I       70  -.40    -.42     .02
           I                             I       71  -.47    -.48     .01
           I                             I       72  -.40    -.42     .01
LEVEL 12   I0   0            0         0 I       73  -.38    -.41     .03
           I                             I       74  -.37    -.39     .01
           I-----------------------------I       75  -.37    -.42     .0[illegible]

     NO. OF + = 1      NO. OF - = 0      NO. OF 0 = 46
     * -- THE MAXIMU OR MINIMUM VALUES
```

FIG. B.3 CONTINUED

```
COMPARISION OF Cp MEAN  BETWEEN  THE CASES WITH & WITHOUT ROUGHNE

* ROUGH    DATA MINUS SMOOTH DATA *

     AZIMUTH:                        0
     BALCONY NO: 29(REAL,WALL 1M)
     BALCONY GEOMETRY:  61*4*0.16
     BUILDING HEIGHT:             120M
     + GREATER THAN              0.040
     - LESS THAN                -0.040
     0 BETWEEN     -0.040 & 0.040

           I----------------------------I
LEVEL  1   I 0                        +0I
LEVEL  2   I     -     -     -     -    I
LEVEL  3   I--                        -0I
LEVEL  4   I+    -           -        - I
LEVEL  5   I 0         +           -  -I
LEVEL  6   I+    +           -        + I
LEVEL  7   I +         -           -  -I
LEVEL  8   I+    0           0        + I
LEVEL  9   I 0         -           0  +I
LEVEL 10   I+    0           0        + I
LEVEL 11   I +         +           0  +I
LEVEL 12   I+    0           -        + I
           I----------------------------I

      NO. OF + = 16      NO. OF - = 19      NO. OF 0 = 12
      * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.47	.45	.02
20	.52	.46	.05
21	-.02	-.04	.01
22	.39	.64	-.25
23	.38	.65	-.26
24	.41	.66	-.26
25	.40	.64	-.23
26	-.29	-.05	-.25
27	.39	.52	-.13
28	.50	.55	-.05
29	.04	.04	.01
30	.16	.01	.15
31	.70	.79	-.08
32	.77	.88*	-.10
33	.51	.56	-.04
34	.47	.50	-.03
43	.99*	.85	.15
44	.67	.73	-.06
45	-.10	-.02	-.08
46	.51	-.01	.53
47	.38	-.07	.45
48	.74	.81	-.07
49	.50	.44	.05
50	.46	.34	.12
51	.69	.76	-.07
52	.61	.69	-.08
53	-.19	-.08	-.11
54	.47	-.11	.58
55	.58	.60	-.02
56	.66	.68	-.03
59	.45	.37	.08
60	.31	.30	.01
61	.58	.62	-.04
62	.51	.54	-.03
63	-.13	-.19	.06
64	.34	-.21	.55
65	.51	.48	.03
66	.58	.57	.01
67	.38	.25	.13
68	.25	.17	.08
69	.48	.52	-.04
70	.41	.42	-.01
71	-.25	-.32	.07
72	.24	-.36	.60*
73	.41	.43	-.01
74	.49	.56	-.07
75	.25	.11	.13

```
COMPARISION OF Cp MEAN  BETWEEN  THE CASES WITH & WITHOUT ROUGHNE

* ROUGH    DATA MINUS SMOOTH DATA *

     AZIMUTH:                       15
     BALCONY NO: 29(REAL,WALL 1M)
     BALCONY GEOMETRY:  61*4*0.16
     BUILDING HEIGHT:             120M
     + GREATER THAN              0.040
     - LESS THAN                -0.040
     0 BETWEEN     -0.040 & 0.040

           I----------------------------I
LEVEL  1   I +                        +-I
LEVEL  2   I     -     -     -     -    I
LEVEL  3   I--                        00I
LEVEL  4   I+    -           -        0 I
LEVEL  5   I -         -           -  -I
LEVEL  6   I+    -           -        + I
LEVEL  7   I -         -           0  -I
LEVEL  8   I+    0           0        + I
LEVEL  9   I -         0           0  0I
LEVEL 10   I+    0           0        + I
LEVEL 11   I 0         0           0  0I
LEVEL 12   I+    -           -        + I
           I----------------------------I

      NO. OF + = 11      NO. OF - = 21      NO. OF 0 = 15
      * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.63	.57	.06
20	.37	.26	.10
21	-.23	-.18	-.05
22	.49	.67	-.17
23	.41	.61	-.20
24	.38	.56	-.18
25	.32	.48	-.16
26	-.23	.11	-.34*
27	.52	.67	-.15
28	.34	.34	.00
29	-.13	-.12	-.02
30	.25	.16	.10
31	.78*	.85*	-.07
32	.71	.76	-.06
33	.38	.35	.03
34	.58	.65	-.08
43	.76	.84	-.07
44	.58	.62	-.04
45	-.18	-.12	-.06
46	.39	.10	.29
47	.73	.80	-.07
48	.69	.74	-.05
49	.39	.31	.08
50	.50	.56	-.06
51	.69	.77	-.08
52	.52	.56	-.04
53	-.28	-.15	-.13
54	.50	.00	.50*
55	.64	.68	-.03
56	.61	.64	-.03
59	.36	.25	.11
60	.39	.44	-.04
61	.58	.62	-.04
62	.43	.45	-.02
63	-.13	-.17	.04
64	.37	-.06	.44
65	.57	.55	.03
66	.54	.52	.01
67	.31	.17	.14
68	.30	.30	.00
69	.49	.52	-.03
70	.36	.36	.00
71	-.20	-.23	.03
72	.25	-.22	.47
73	.43	.47	-.05
74	.45	.53	-.08
75	.21	.10	.11

```
COMPARISION OF Cp MEAN  BETWEEN  THE CASES WITH & WITHOUT ROUGHNE

* ROUGH    DATA MINUS SMOOTH DATA *

     AZIMUTH:                       30
     BALCONY NO: 29(REAL,WALL 1M)
     BALCONY GEOMETRY:  61*4*0.16
     BUILDING HEIGHT:             120M
     + GREATER THAN              0.040
     - LESS THAN                -0.040
     0 BETWEEN     -0.040 & 0.040

           I----------------------------I
LEVEL  1   I +                        +-I
LEVEL  2   I     -     -     -     -    I
LEVEL  3   I--                        +0I
LEVEL  4   I-    -           -        + I
LEVEL  5   I -         -           0  0I
LEVEL  6   I0    -           0        + I
LEVEL  7   I -         0           0  0I
LEVEL  8   I+    0           0        + I
LEVEL  9   I -         0           0  +I
LEVEL 10   I+    0           0        + I
LEVEL 11   I 0         0           0  +I
LEVEL 12   I+    0           -        + I
           I----------------------------I

      NO. OF + = 13      NO. OF - = 16      NO. OF 0 = 18
      * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.75	.67	.08
20	.15	.05	.10
21	-.38	-.34	-.04
22	.46	.62	-.16
23	.32	.50	-.18
24	.26	.41	-.15
25	.17	.28	-.11
26	.40	.62	-.22*
27	.64	.80	-.16
28	.17	.12	.05
29	-.28	-.28	.00
30	.57	.65	-.08
31	.77*	.83	-.06
32	.55	.60	-.05
33	.21	.12	.09
34	.72	.84*	-.13
43	.66	.71	-.05
44	.39	.39	.00
45	-.30	-.29	-.01
46	.60	.57	.04
47	.73	.78	-.05
48	.54	.56	-.02
49	.24	.08	.16
50	.65	.75	-.10
51	.61	.65	-.04
52	.35	.34	.00
53	-.32	-.29	-.03
54	.60	.45	.15
55	.66	.67	-.01
56	.48	.48	.00
59	.23	.05	.18
60	.55	.61	-.06
61	.52	.55	-.03
62	.30	.28	.02
63	-.18	-.27	.03
64	.52	.34	.18
65	.57	.54	.04
66	.42	.40	.02
67	.18	.02	.16
68	.46	.48	-.02
69	.44	.45	-.01
70	.23	.22	.02
71	-.22	-.28	.06
72	.40	.22	.18
73	.45	.48	-.03
74	.36	.40	-.05
75	.12	-.01	.14

```
COMPARISION OF Cp MEAN  BETWEEN  THE CASES WITH & WITHOUT ROUGHNE

* ROUGH    DATA MINUS SMOOTH DATA *

     AZIMUTH:                       45
     BALCONY NO: 29(REAL,WALL 1M)
     BALCONY GEOMETRY:  61*4*0.16
     BUILDING HEIGHT:             120M
     + GREATER THAN              0.040
     - LESS THAN                -0.040
     0 BETWEEN     -0.040 & 0.040

           I----------------------------I
LEVEL  1   I +                        +0I
LEVEL  2   I     0     -     -     -    I
LEVEL  3   I++                        +0I
LEVEL  4   I-    0           0        + I
LEVEL  5   I -         0           0  0I
LEVEL  6   I-    0           0        + I
LEVEL  7   I 0         0           0  0I
LEVEL  8   I-    0           0        + I
LEVEL  9   I 0         0           +  +I
LEVEL 10   I0    0           0        + I
LEVEL 11   I 0         0           0  +I
LEVEL 12   I0    0           0        + I
           I----------------------------I

      NO. OF + = 13      NO. OF - =  7      NO. OF 0 = 27
      * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.63	.38	.25*
20	-.04	-.09	.05
21	-.42	-.39	-.03
22	.31	.34	-.03
23	.10	.25	-.15
24	.09	.18	-.09
25	.02	.08	-.06
26	.82*	.75	.06
27	.66	.59	.07
28	.00	-.06	.07
29	-.36	-.35	-.01
30	.69	.83*	-.14
31	.58	.59	-.01
32	.32	.33	-.01
33	.06	-.08	.15
34	.68	.74	-.06
43	.43	.46	-.02
44	.18	.14	.03
45	-.38	-.38	.00
46	.64	.76	-.12
47	.56	.58	-.02
48	.32	.31	.00
49	.09	-.10	.19
50	.63	.65	-.03
51	.41	.42	-.01
52	.15	.12	.04
53	-.40	-.37	-.02
54	.59	.64	-.05
55	.50	.49	.01
56	.28	.26	.02
59	.08	-.11	.19
60	.52	.54	-.02
61	.34	.35	-.01
62	.12	.08	.04
63	-.25	-.34	.08
64	.52	.51	.01
65	.43	.41	.02
66	.23	.21	.02
67	.06	-.12	.18
68	.44	.43	.00
69	.29	.29	.00
70	.08	.05	.04
71	-.26	-.31	.05
72	.39	.36	.03
73	.33	.36	-.03
74	.19	.21	-.02
75	.01	-.13	.14

FIG. B.4 EFFECT OF 4m BALCONIES WITH 1m WALLS ON Cp MEAN

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 60
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61**0.16
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
          I-----------------------------I
LEVEL  1  I 0                         +0I
LEVEL  2  I    +    0     0     0       I
LEVEL  3  I++                         +0I
LEVEL  4  I+   -          0           + I
LEVEL  5  I +      -            0     0I
LEVEL  6  I+   +     ,    0           + I
LEVEL  7  I +       0                 0I
LEVEL  8  I+  0           0           + I
LEVEL  9  I +       0                 +I
LEVEL 10  I+  0           0           + I
LEVEL 11  I+        0                 +I
LEVEL 12  I+  0           0           + I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.18	-.20	.02
20	-.14	-.22	.07
21	-.42*	-.40	-.02
22	.09	.03	.06
23	-.05	-.03	-.02
24	-.08	-.06	-.02
25	-.13	-.12	-.01
26	-.18	-.46	.28
27	-.08	-.18	.10
28	-.12	-.21	.08
29	-.38	-.38	.00
30	-.10	-.22	.12
31	.18	.23	-.06
32	.07	.05	.03
33	-.06	-.24	.18
34	-.04	-.23	.18
43	.15	.58*	-.43
44	-.02	.00	-.02
45	-.40	-.43	.03
46	-.07	-.12	.05
47	.14	-.31	.44*
48	.08	.04	.04
49	-.05	-.19	.14
50	-.05	-.26	.21
51	.14	.13	.00
52	-.02	-.09	.07
53	-.42	-.42	.00
54	-.06	-.22	.16
55	.13	.14	-.01
56	.05	.01	.04
59	-.05	-.25	.20
60	-.07	-.19	.13
61	.10	.09	.00
62	-.04	-.10	.06
63	-.29	-.37	.08
64	-.06	-.21	.15
65	.11	.08	.03
66	.03	.00	.04
67	-.06	-.23	.17
68	-.09	-.13	.04
69	.07	.06	.00
70	-.05	-.12	.06
71	-.29	-.34	.05
72	-.04	-.10	.06
73	.08	.08	.00
74	.02	.00	.01
75	-.09	-.23	.14

NO. OF + = 25 NO. OF - = 2 NO OF 0 = 20
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 75
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61**0.16
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
          I-----------------------------I
LEVEL  1  I -                         +0I
LEVEL  2  I    +     +     -     -      I
LEVEL  3  I+-                         +0I
LEVEL  4  I+   +           +          + I
LEVEL  5  I +        +            -   0I
LEVEL  6  I+   +           +          0 I
LEVEL  7  I +        +            -   0I
LEVEL  8  I+   +           +          0 I
LEVEL  9  I +        +            -   0I
LEVEL 10  I+   +                      0 I
LEVEL 11  I +        0            -   0I
LEVEL 12  I+   +                      0 I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-1.08	-1.04	-.04
20	-.25	-.30	.04
21	-.37	-.40	.03
22	-.62	-.98	.36
23	-.43	-.49	.05
24	-.35	-.20	-.15
25	-.29	-.24	-.05
26	-1.19*	-1.01	-.19
27	-.94	-1.03	.09
28	-.25	-.29	.04
29	-.37	-.39	.01
30	-.70	-.89	.19
31	-.71	-.99	.27
32	-.45	-.25	-.20
33	-.25	-.31	.05
34	-.75	-.88	.13
43	1.33	-.80	1.33*
44	-.33	-.18	-.15
45	-.83	-.81	-.02
46	-.76	-.82	.06
47	-.81	-1.05*	.24
48	-.49	-.35	-.15
49	-.30	-.28	-.02
50	-.74	-.97	.23
51	-.60	-.70	.10
52	-.34	-.26	-.08
53	-.42	-.40	-.02
54	-.74	-.84	.10
55	-.63	-.88	.24
56	-.47	-.35	-.12
59	-.29	-.31	.02
60	-.77	-.86	.09
61	-.55	-.61	.05
62	-.33	-.25	-.07
63	-.34	-.35	.01
64	-.72	-.83	.11
65	-.59	-.82	.21
66	-.44	-.30	-.14
67	-.28	-.29	.02
68	-.72	-.84	.12
69	-.50	-.50	.00
70	-.31	-.25	-.06
71	-.33	-.34	.03
72	-.62	-.80	.18
73	-.53	-.77	.24
74	-.38	-.20	-.18
75	-.26	-.29	.01

NO. OF + = 23 NO. OF - = 13 NO OF 0 = 11
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 90
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61**0.16
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
          I-----------------------------I
LEVEL  1  I -                        -00I
LEVEL  2  I    +     +     +     +    + I
LEVEL  3  I00                         0+I
LEVEL  4  I0   +           +          + I
LEVEL  5  I 0        +            +   +I
LEVEL  6  I0   +           +          + I
LEVEL  7  I +        +            +   +I
LEVEL  8  I+   +           +          + I
LEVEL  9  I +        +            +   +I
LEVEL 10  I+   +           +          0 I
LEVEL 11  I +        +            +   +I
LEVEL 12  I+   +           0          0 I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.82*	-.76	-.06
20	-.61	-.63	.03
21	-.62	-.65	.03
22	-.73	-.78	.06
23	-.75	-.82	.08
24	-.77	-.83	.06
25	-.69	-.74	.05
26	-.78	-.74	-.04
27	-.76	-.75	-.01
28	-.62	-.64	.03
29	-.62	-.69	.07
30	-.69	-.72	.03
31	-.68	-.77	.09
32	-.72	-.82	.10
33	-.68	-.73	.05
34	-.69	-.72	.03
43	-.58	-.80	.22
44	-.65	-.75	.09
45	-.69	-.78	.09
46	-.67	-.71	.04
47	-.61	-.75	.14
48	-.69	-.83	.15
49	-.69	-.78	.08
50	-.69	-.73	.04
51	-.67	-.82	.15
52	-.66	-.76	.10
53	-.69	-.81	.12
54	-.68	-.74	.06
55	-.65	-.77	.14
56	-.68	-.85	.17
59	-.65	-.75	.09
60	-.71	-.79	.08
61	-.66	-.89	.23
62	-.64	-.74	.09
63	-.66	-.75	.09
64	-.67	-.82	.16
65	-.65	-.88	.23
66	-.64	-.85	.18
67	-.63	-.64	.01
68	-.72	-.91	.19
69	-.67	-.95	.28
70	-.60	-.65	.05
71	-.60	-.59	-.01
72	-.67	-.93	.26
73	-.66	-.97*	.31*
74	-.64	-.64	-.01
75	-.65	-.66	-.01

NO. OF + = 34 NO. OF - = 2 NO OF 0 = 11
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 105
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61**0.16
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
          I-----------------------------I
LEVEL  1  I 0                         00I
LEVEL  2  I    0     0     0     0      I
LEVEL  3  I00                         0+I
LEVEL  4  I0   0           0          + I
LEVEL  5  I 0        0            +   +I
LEVEL  6  I0   0           +          + I
LEVEL  7  I 0        0            +   +I
LEVEL  8  I0   0           +          + I
LEVEL  9  I 0        0            +   +I
LEVEL 10  I+   0           +          + I
LEVEL 11  I 0        +            +   +I
LEVEL 12  I+   +           0          + I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.69*	-.65	-.04
20	-.67	-.69	.02
21	-.69	-.70	.02
22	-.67	-.66	-.01
23	-.68	-.67	.00
24	-.66	-.67	.01
25	-.65	-.67	.02
26	-.67	-.65	-.03
27	-.66	-.64	-.02
28	-.66	-.69	.03
29	-.67	-.71	.04
30	-.63	-.61	-.01
31	-.62	-.64	.02
32	-.63	-.64	.01
33	-.67	-.71	.04
34	-.58	-.60	.02
43	-.59	-.67	.07
44	-.67	-.67	.05
45	-.63	-.72	.08
46	-.58	-.58	.00
47	-.58	-.60	.02
48	-.61	-.65	.04
49	-.66	-.71	.05
50	-.56	-.57	.01
51	-.58	-.60	.02
52	-.61	-.68	.07
53	-.64	-.73	.09
54	-.53	-.54	.00
55	-.55	-.57	.02
56	-.58	-.62	.04
59	-.64	-.72	.08
60	-.55	-.54	-.01
61	-.56	-.59	.03
62	-.60	-.68	.08
63	-.66	-.76	.09
64	-.61	-.73	.12
65	-.54	-.56	.02
66	-.51	-.61	.09
67	-.63	-.73	.10
68	-.55	-.56	.00
69	-.55	-.61	.06
70	-.59	-.65	.06
71	-.63	-.75*	.12*
72	-.51	-.54	.03
73	-.54	-.60	.06
74	-.55	-.59	.04
75	-.60	-.70	.10

NO. OF + = 21 NO. OF - = 5 NO OF 0 = 21
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.4 CONTINUED

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    120
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY:  61*4*0.16
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN    -0.040 & 0.040

          I---------------------------I
LEVEL  1  I 0                       00I
LEVEL  2  I    0     0     0     +    I
LEVEL  3  I00                       ++I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  4  I0   0           0       +  I
          I                           I
          I                           I
LEVEL  5  I +      +    +          +  +I
          I                           I
          I                           I
LEVEL  6  I0   0           0       +  I
          I                           I
          I                           I
LEVEL  7  I 0        0             +  +I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  8  I0   0           0       +  I
          I                           I
          I                           I
LEVEL  9  I 0        0             +  +I
          I                           I
          I                           I
LEVEL 10  I0   0           0       +  I
          I                           I
          I                           I
LEVEL 11  I 0        0             +  +I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL 12  I0   0           0       +  I
          I                           I
          I---------------------------I

NO. OF + = 18      NO. OF - = 0      NO. OF 0 = 29
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.60	-.62	.02
20	-.63	-.66	.04
21	-.63	-.66	.03
22	-.62	-.63	.01
23	-.62	-.64	.02
24	-.62	-.64	.03
25	-.61	-.66	.04
26	-.63	-.61	-.02
27	-.60	-.62	.02
28	-.62	-.67	.05
29	-.62	-.67	.05
30	-.61	-.60	.00
31	-.60	-.62	.02
32	-.62	-.65	.03
33	-.63	-.69	.06
34	-.56	-.61	.05
43	-.51	-.63	.12
44	-.61	-.68	.07
45	-.62	-.71	.10
46	-.59	-.58	-.01
47	-.60	-.60	.00
48	-.61	-.64	.03
49	-.64*	-.70	.06
50	-.53	-.57	.04
51	-.57	-.60	.03
52	-.60	-.67	.08
53	-.60	-.73*	.14*
54	-.50	-.52	.02
55	-.53	-.55	.01
56	-.57	-.61	.04
59	-.62	-.70	.08
60	-.51	-.52	.01
81	-.55	-.56	.01
62	-.56	-.62	.06
63	-.60	-.72	.12
64	-.43	-.46	.04
65	-.50	-.50	.00
66	-.54	-.57	.03
67	-.58	-.68	.10
68	-.47	-.47	.00
69	-.50	-.53	.03
70	-.52	-.60	.07
71	-.59	-.73	.14
72	-.45	-.47	.02
73	-.48	-.50	.02
74	-.51	-.53	02
75	-.55	-.62	.08

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    135
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY:  61*4*0.16
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN    -0.040 & 0.040

          I---------------------------I
LEVEL  1  I 0                       00I
LEVEL  2  I    0     0     0     0    I
LEVEL  3  I00                       00I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  4  I-   0           0        0 I
          I                           I
          I                           I
LEVEL  5  I 0        0           0   +I
          I                           I
          I                           I
LEVEL  6  I-   0           0        0 I
          I                           I
          I                           I
LEVEL  7  I 0        0           0   +I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  8  I0   0           0        0 I
          I                           I
          I                           I
LEVEL  9  I 0        0           0   0I
          I                           I
          I                           I
LEVEL 10  I0   0           0        0 I
          I                           I
          I                           I
LEVEL 11  I 0        0           0   +I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL 12  I0   0           0        0 I
          I                           I
          I---------------------------I

NO. OF + = 3      NO. OF - = 2      NO. OF 0 = 42
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.49	-.51	.02
20	-.59	-.60	.01
21	-.60	-.60	.00
22	-.53	-.52	-.01
23	-.55	-.54	-.02
24	-.57	-.56	-.01
25	-.57	-.58	.01
26	-.56	-.52	-.04
27	-.53	-.52	-.01
28	-.60	-.60	.00
29	-.61	-.61	.00
30	-.59	-.54	-.05
31	-.59	-.56	-.03
32	-.61	-.60	-.01
33	-.63*	-.65	.02
34	-.54	-.56	.02
43	-.57	-.59	.02
44	-.60	-.63	.03
45	-.61	-.67*	.06
46	-.58	-.54	-.04
47	-.54	-.56	.02
48	-.60	-.62	.01
49	-.62	-.65	.03
50	-.52	-.54	.02
51	-.57	-.58	.01
52	-.58	-.62	.04
53	-.58	-.65	.07*
54	-.51	-.49	-.02
55	-.52	-.52	.00
56	-.55	-.58	.03
59	-.57	-.59	.02
60	-.49	-.47	-.02
61	-.51	-.53	.01
62	-.52	-.55	.03
63	-.54	-.58	.04
64	-.44	-.43	-.01
65	-.47	-.46	-.01
66	-.50	-.53	.03
67	-.51	-.52	.01
68	-.43	-.43	.00
69	-.46	-.48	.02
70	-.47	-.51	.04
71	-.46	-.51	.06
72	-.41	-.43	.02
73	-.43	-.45	.02
74	-.46	-.50	.04
75	-.43	-.46	.03

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    150
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY:  61*4*0.16
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN    -0.040 & 0.040

          I---------------------------I
LEVEL  1  I 0                       00I
LEVEL  2  I    0     0     0     0    I
LEVEL  3  I00                       00I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  4  I0   0           0        0 I
          I                           I
          I                           I
LEVEL  5  I 0        -           0   0I
          I                           I
          I                           I
LEVEL  6  I-   -           0        0 I
          I                           I
          I                           I
LEVEL  7  I 0        0           0   0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  8  I0   0           0        0 I
          I                           I
          I                           I
LEVEL  9  I 0        0           0   0I
          I                           I
          I                           I
LEVEL 10  I0   0           0        0 I
          I                           I
          I                           I
LEVEL 11  I 0        0           0   0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL 12  I0   0           0        0 I
          I                           I
          I---------------------------I

NO. OF + = 0      NO. OF - = 3      NO. OF 0 = 44
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.44	-.45	.01
20	-.55	-.55	.00
21	-.59	-.61	.01
22	-.47	-.47	-.01
23	-.48	-.48	-.01
24	-.50	-.50	.00
25	-.52	-.53	.01
26	-.49	-.46	-.03
27	-.47	-.46	-.01
28	-.56	-.57	.00
29	-.61	-.61	.01
30	-.53	-.49	-.04
31	-.53	-.51	-.02
32	-.56	-.55	-.02
33	-.61	-.61	.00
34	-.50	-.51	.01
43	-.53	-.32	-.22*
44	-.58	-.60	.02
45	-.63*	-.64*	.01
46	-.55	-.50	-.05
47	-.55	-.48	-.07
48	-.57	-.56	-.01
49	-.60	-.60	.00
50	-.50	-.50	.00
51	-.53	-.53	.01
52	-.55	-.56	.01
53	-.61	-.61	.00
54	-.48	-.45	-.03
55	-.49	-.47	-.02
56	-.51	-.51	-.01
59	-.53	-.53	.00
60	-.45	-.43	-.02
61	-.47	-.47	.00
62	-.48	-.49	.01
63	-.55	-.54	-.01
64	-.42	-.39	-.03
65	-.44	-.42	-.02
66	-.46	-.46	.00
67	-.47	-.46	.00
68	-.41	-.39	-.02
69	-.43	-.43	.00
70	-.41	-.42	.01
71	-.49	-.49	.00
72	-.39	-.38	-.01
73	-.40	-.41	.01
74	-.41	-.42	.02
75	-.38	-.39	.01

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    165
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY:  61*4*0.16
BUILDING HEIGHT:           120M
+  GREATER THAN           0.040
-  LESS THAN             -0.040
0  BETWEEN    -0.040 & 0.040

          I---------------------------I
LEVEL  1  I 0                       +0I
LEVEL  2  I    0     0     0     +    I
LEVEL  3  I00                       +0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  4  I0   0           0        0 I
          I                           I
          I                           I
LEVEL  5  I 0        0           +   +I
          I                           I
          I                           I
LEVEL  6  I-   -           0        0 I
          I                           I
          I                           I
LEVEL  7  I 0        +           +   0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  8  I0   0           +        0 I
          I                           I
          I                           I
LEVEL  9  I 0        0           +   +I
          I                           I
          I                           I
LEVEL 10  I0   0           0        0 I
          I                           I
          I                           I
LEVEL 11  I 0        +           0   +I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL 12  I0   0           0        + I
          I                           I
          I---------------------------I

NO. OF + = 13      NO. OF - = 2      NO. OF 0 = 32
* -- THE MAXIMU OR MINIMUM VALUES
```

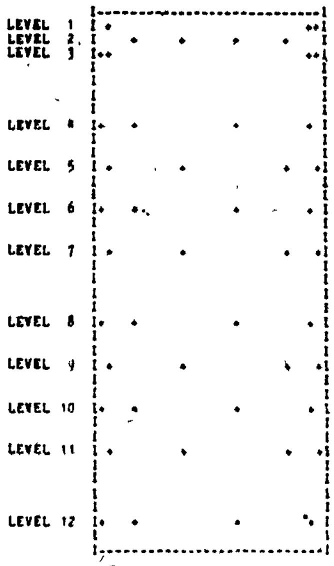
TAP	ROUGH	SMOOTH	DIFF
19	-.41	-.45	.03
20	-.53	-.60	.06
21	-.61*	-.65*	.04
22	-.43	-.45	.02
23	-.45	-.47	.02
24	-.46	-.50	.04
25	-.50	-.55	.05
26	-.45	-.45	.00
27	-.44	-.45	.01
28	-.55	-.60	.05
29	-.61	-.64	.03
30	-.49	-.48	-.01
31	-.49	-.49	.00
32	-.52	-.54	.02
33	-.56	-.60	.04
34	-.47	-.50	.03
43	-.48	-.44	-.03
44	-.50	-.55	.05
45	-.58	-.64	.06
46	-.49	-.44	-.04
47	-.48	-.39	-.09*
48	-.49	-.53	.04
49	-.52	-.54	.02
50	-.43	-.47	.04
51	-.46	-.50	.04
52	-.47	-.51	.04
53	-.58	-.62	.04
54	-.43	-.44	.01
55	-.43	-.46	.03
56	-.43	-.47	.04
59	-.47	-.51	.03
60	-.40	-.43	.03
61	-.41	-.44	.04
62	-.41	-.45	.05
63	-.54	-.58	.04
64	-.39	-.40	.01
65	-.38	-.42	.03
66	-.39	-.42	.03
67	-.43	-.46	.03
68	-.36	-.38	.03
69	-.37	-.41	.04
70	-.37	-.40	.03
71	-.51	-.56	.04
72	-.34	-.38	.03
73	-.36	-.40	.04
74	-.35	-.39	04
75	-.38	-.42	.04

FIG. B.4 CONTINUED

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 180
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 6*4*0.16
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040



TAP	ROUGH	SMOOTH	DIFF
19	-.46	-.53	.07
20	-.47	-.56	.09
21	-.51	-.58	.07
22	-.47	-.53	.06
23	-.47	-.56	.08
24	-.47	-.56	.09
25	-.48	-.56	.07
26	-.50	-.59	.09
27	-.48	-.55	.07
28	-.47	-.56	.09
29	-.50	-.60	.10
30	-.51	-.63	.12
31	-.47	-.54	.06
32	-.46	-.54	.07
33	-.49	-.57	.08
34	-.47	-.56	.09
43	-.42	-.51	.08
44	-.44	-.52	.08
45	-.54	-.63*	.09
46	-.49	-.62	.14
47	-.44	-.50	.06
48	-.42	-.48	.06
49	-.47	-.55	.08
50	-.45	-.53	.08
51	-.39	-.46	.07
52	-.41	-.48	.06
53	-.56*	-.63	.07
54	-.42	-.60	.18*
55	-.39	-.46	.07
56	-.37	-.43	.05
59	-.43	-.51	.07
60	-.41	-.49	.08
61	-.36	-.41	.05
62	-.38	-.45	.07
63	-.50	-.60	.11
64	-.38	-.54	.16
65	-.36	-.44	.08
66	-.35	-.41	.06
67	-.39	-.47	.08
68	-.36	-.44	.08
69	-.34	-.40	.06
70	-.35	-.42	.07
71	-.42	-.48	.06
72	-.33	-.42	.09
73	-.33	-.41	.08
74	-.32	-.39	.07
75	-.34	-.42	.08

NO. OF + = 41 NO. OF - = 0 NO OF 0 = 0
* -- THE MAXIMUM OR MINIMUM VALUES

FIG. B.4 CONTINUED

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                          0
BALCONY NO.:               29(REAL)
BALCONY GEOMETRY: 61*4*0.16H
BUILDING HEIGHT:               120H
+  GREATER THAN               0.040
-  LESS THAN                 -0.040
0  BETWEEN        -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I 0                         -+I
LEVEL  2  I     -     -     -     -   - I
LEVEL  3  I--                         00I
LEVEL  4  I+    -           -        + I
LEVEL  5  I +         0          0   +I
LEVEL  6  I+    +           0        + I
LEVEL  7  I +                    -   +I
LEVEL  8  I+    0           0        + I
LEVEL  9  I                      -   +I
LEVEL 10  I+    +           0        + I
LEVEL 11  I +         -          0   +I
LEVEL 12  I+    0           -        + I
          I-----------------------------I
NO. OF + = 21     NO. OF - = 15     NO. OF 0 = 14
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.42	.45	-.02
20	.41	.46	-.05
21	.02	-.04	.06
22	.51	.64	-.13
23	.52	.65	-.13
24	.51	.66	-.15
25	.50	.64	-.13
26	-.18	-.05	-.13
27	.45	.52	-.07
28	.51	.55	-.04
29	.03	.04	-.01
30	.49	.01	.47
31	.72	.79	-.07
32	.80	.88*	-.08
33	.66	.56	.10
34	.56	.50	.05
43	.89*	.85	.04
44	.73	.73	.00
45	.04	-.02	.06
46	.60	-.01	.62
47	.60	-.07	.67
48	.79	.81	-.02
49	.60	.44	.15
50	.51	.34	.16
51	.71	.76	-.06
52	.63	.69	-.06
53	.05	-.08	.13
54	.56	-.11	.67
55	.62	.60	.02
56	.69	.68	.01
59	.55	.37	.18
60	.39	.30	.09
61	.58	.62	-.04
62	.49	.54	-.05
63	.03	-.19	.22
64	.47	-.21	.69
65	.53	.48	.05
66	.58	.57	.01
67	.43	.25	.18
68	.27	.17	.10
69	.45	.52	-.08
70	.38	.42	-.04
71	-.11	-.32	.21
72	.34	-.36	.70*
73	.42	.43	-.01
74	.49	.56	-.07
75	.30	.11	.19

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                         15
BALCONY NO.:               29(REAL)
BALCONY GEOMETRY: 61*4*0.16H*
BUILDING HEIGHT:               120H
+  GREATER THAN               0.040
-  LESS THAN                 -0.040
0  BETWEEN        -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I -                         +0I
LEVEL  2  I     -     -     -     -   - I
LEVEL  3  I--                         ++I
LEVEL  4  I+    -           0        + I
LEVEL  5  I -         -          0   +I
LEVEL  6  I+    -           0        + I
LEVEL  7  I 0         -          0   +I
LEVEL  8  I+    0           0        + I
LEVEL  9  I 0         0          0   +I
LEVEL 10  I+    0           0        + I
LEVEL 11  I 0         -          0   +I
LEVEL 12  I+    0           -        + I
          I-----------------------------I
NO. OF + = 17     NO. OF - = 14     NO. OF 0 = 16
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.52	.57	-.06
20	.31	.26	.04
21	-.21	-.18	-.02
22	.57	.67	-.10
23	.53	.61	-.09
24	.47	.56	-.09
25	.40	.48	-.07
26	-.07	.11	-.18
27	.55	.67	-.13
28	.42	.34	.08
29	-.07	-.12	.04
30	.52	.16	.36
31	.80*	.85*	-.05
32	.76	.76	.00
33	.57	.35	.22
34	.61	.65	-.04
43	.76	.84	-.08
44	.65	.62	.03
45	-.01	-.12	.11
46	.64	.10	.54
47	.62	.80	-.18
48	.74	.74	.00
49	.53	.31	.22
50	.54	.56	-.02
51	.72	.77	-.06
52	.56	.56	.00
53	.03	-.15	.18
54	.59	.00	.59*
55	.69	.68	.01
56	.65	.64	.02
59	.48	.25	.24
60	.44	.44	.00
61	.59	.62	-.03
62	.45	.45	.00
63	.04	-.17	.21
64	.51	-.06	.57
65	.57	.55	.02
66	.55	.52	.02
67	.38	.17	.22
68	.30	.30	.00
69	.44	.52	-.08
70	.35	.36	-.01
71	-.07	-.23	.16
72	.34	-.22	.57
73	.45	.47	-.02
74	.47	.53	-.06
75	.29	.10	.19

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                         30
BALCONY NO.:               29(REAL)
BALCONY GEOMETRY: 61*4*0.16H*
BUILDING HEIGHT:               120H
+  GREATER THAN               0.040
-  LESS THAN                 -0.040
0  BETWEEN        -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I                           +0I
LEVEL  2  I     -     -     -     -   - I
LEVEL  3  I--                         ++I
LEVEL  4  I0    0           0        + I
LEVEL  5  I -         0          +   +I
LEVEL  6  I+    0           0        + I
LEVEL  7  I -         0          +    I
LEVEL  8  I+    0           +        + I
LEVEL  9  I -         0          +   +I
LEVEL 10  I+    +           +        + I
LEVEL 11  I -         0          +   +I
LEVEL 12  I+    0           0        + I
          I-----------------------------I
NO. OF + = 23     NO. OF - = 10     NO. OF 0 = 14
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.64	.67	-.03
20	.16	.05	.11
21	[illegible]	-.34	.03
22	.54	.62	-.08
23	.42	.50	-.08
24	.33	.41	-.08
25	.24	.28	-.04
26	.45	.62	-.17
27	.64	.80	-.16
28	.28	.12	.16
29	-.17	-.28	.11
30	.65	.65	.00
31	.80*	.83	-.03
32	.60	.60	.00
33	.44	.12	.32
34	.74	.84*	-.10
43	.71	.71	.00
44	.48	.39	.09
45	-.11	-.29	.18
46	.69	.57	.13
47	.77	.78	.00
48	.59	.56	.03
49	.40	.08	.32
50	.65	.75	-.10
51	.64	.65	-.01
52	.43	.34	.09
53	-.06	-.29	.24
54	.64	.45	.19
55	.70	.67	.03
56	.54	.48	.06
59	[illegible]	.05	.33*
60	.57	.61	-.04
61	.55	.55	.00
62	.35	.28	.07
63	-.01	-.27	.26
64	.53	.34	.19
65	.58	.54	.04
66	.44	.40	.04
67	.31	.02	.28
68	.43	.48	-.05
69	.43	.45	-.02
70	.26	.22	.04
71	-.08	-.28	.20
72	.41	.22	.20
73	.48	.48	.00
74	.38	.40	-.02
75	.23	-.01	.25

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                         45
BALCONY NO.:               29(REAL)
BALCONY GEOMETRY: 61*4*0.16H*
BUILDING HEIGHT:               120H
+  GREATER THAN               0.040
-  LESS THAN                 -0.040
0  BETWEEN        -0.040 & 0.040

          I-----------------------------I
LEVEL  1  I +                         ++I
LEVEL  2  I     0     0     0     0     I
LEVEL  3  I++                         ++I
LEVEL  4  I-    +           +        + I
LEVEL  5  I 0         0          +   +I
LEVEL  6  I-    0           +        + I
LEVEL  7  I 0         0          +   +I
LEVEL  8  I-    +           +        + I
LEVEL  9  I 0         0          +   +I
LEVEL 10  I0    0           +        + I
LEVEL 11  I 0         0          +   +I
LEVEL 12  I0    0           0        + I
          I-----------------------------I
NO. OF + = 26     NO. OF - = [illegible]     NO. OF 0 = 18
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.61	.38	.23
20	.05	-.09	.14
21	-.31	-.39	.07
22	.38	.34	.03
23	.23	.25	-.02
24	.16	.18	-.03
25	.10	.08	.02
26	.81*	.75	.06
27	.67	.59	.08
28	.14	-.06	.21
29	-.20	-.35	.15
30	.52	.83*	-.31
31	.63	.59	.04
32	.39	.33	.06
33	.31	-.08	.39*
34	.71	.74	-.02
43	.49	.46	.04
44	.29	.14	.15
45	-.19	-.38	.19
46	.59	.76	-.17
47	.61	.58	.03
48	.38	.31	.07
49	.26	-.10	.36
50	.63	.65	-.02
51	.46	.42	.04
52	.26	.12	.14
53	-.14	-.37	.23
54	.60	.64	-.04
55	.54	.49	.05
56	.33	.26	.07
59	.25	-.11	.37
60	.56	.54	.02
61	.38	.35	.03
62	.21	.08	.13
63	-.09	-.34	.25
64	.49	.51	-.02
65	.45	.41	.04
66	.27	.21	.07
67	.21	-.12	.33
68	.46	.43	.02
69	.31	.29	.03
70	.15	.05	.11
71	-.13	-.31	.18
72	.39	.36	.02
73	.36	.36	.00
74	.22	.21	.02
75	.14	-.13	.27

FIG. B.5 EFFECT OF 4m BALCONIES WITH 2m WALLS ON Cp MEAN

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 60
BALCONY NO.: 39(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
         I-----------------------------I
LEVEL 1  I -                         ++I
LEVEL 2  I    0      +      0     +   I
LEVEL 3  I+0                         ++I
LEVEL 4  I+    -          +          + I
LEVEL 5  I +          -          +   +I
LEVEL 6  I+    +          +          + I
LEVEL 7  I +          0          +.  +I
LEVEL 8  I+    0          +          + I
LEVEL 9  I +          +          +   +I
LEVEL 10 I+   0           +          + I
LEVEL 11 I +          0          +   +I
LEVEL 12 I+    0          +          + I
         I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.32*	-.20	-.12
20	-.04	-.22	.18
21	-.27	-.40	.13
22	.05	.03	.01
23	.02	-.03	.05
24	-.04	-.06	.02
25	-.05	-.12	.08
26	-.15	-.46	.31
27	-.16	-.18	.02
28	.02	-.21	.23
29	-.21	-.38	.17
30	-.08	-.22	.14
31	.14	.23	-.10
32	.14	.05	.09
33	.14	-.24	.38*
34	-.06	-.23	.17
43	.25	.58*	-.33
44	.09	.00	.09
45	-.22	-.43	.20
46	-.04	-.12	.08
47	-.11	-.31	.20
48	.13	.04	.09
49	.09	-.19	.29
50	-.03	-.26	.23
51	.17	.13	.03
52	.07	-.09	.16
53	-.20	-.42	.22
54	-.03	-.22	.18
55	.14	.14	.00
56	.12	.01	.10
59	.09	-.25	.34
60	-.05	-.19	.15
61	.14	.09	.04
62	.05	-.10	.16
63	-.15	-.37	.22
64	-.05	-.21	.16
65	.11	.08	.03
66	.08	.00	.08
67	.06	-.23	.30
68	-.06	-.13	.07
69	.10	.06	.03
70	.02	-.12	.13
71	-.18	-.34	.15
72	-.02	-.10	.08
73	.09	.08	.02
74	.05	.00	.05
75	.02	-.23	.26

NO. OF + = 36   NO. OF - = 3   NO. OF 0 = 8
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 75
BALCONY NO.: 39(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
         I-----------------------------I
LEVEL 1  I 0                         ++I
LEVEL 2  I    +    0      -       -   I
LEVEL 3  I++                         +0I
LEVEL 4  I+    +          -          0 I
LEVEL 5  I + -        -          -   0I
LEVEL 6  I+    +          -          - I
LEVEL 7  I +          +          -   0I
LEVEL 8  I+    +          -          0 I
LEVEL 9  I +          0          -   0I
LEVEL 10 I+    +        - -          0 I
LEVEL 11 I +          0          -   0I
LEVEL 12 I+    +          -          0 I
         I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-1.00*	-1.04	.03
20	-.22	-.30	.08
21	-.35	-.40	.04
22	-.63	-.98	.34*
23	-.52	-.49	-.03
24	-.49	-.30	-.18
25	-.34	-.24	-.10
26	-.96	-1.01	.05
27	-.86	-1.03	.17
28	-.23	-.29	.06
29	-.35	-.39	.04
30	-.71	-.89	.18
31	-.69	-.99	[illegible]
32	-.54	-.33	[illegible]
33	-.31	-.31	-.01
34	-.70	-.88	.17
43	-.51	-.30	-.21
44	-.40	-.18	-.21
45	-.42	-.41	-.02
46	-.74	-.82	.09
47	-.73	-1.05*	.32
48	-.56	-.33	-.22
49	-.37	-.28	-.08
50	-.74	-.97	.23
51	-.63	-.70	.07
52	-.40	-.26	-.15
53	-.41	-.40	.00
54	-.74	-.84	.10
55	-.65	-.88	.23
56	-.52	-.35	-.17
59	-.32	-.31	-.01
60	-.75	-.86	.11
61	-.57	-.61	.04
62	-.38	-.25	-.13
63	-.34	-.35	.01
64	-.69	-.82	.13
65	-.62	-.82	.20
66	-.49	-.30	-.18
67	-.31	-.29	-.02
68	-.72	-.84	.12
69	-.53	-.50	-.03
70	-.35	-.25	-.10
71	-.34	-.34	.00
72	-.56	-.80	.24
73	-.57	-.77	.20
74	-.41	-.20	-.20
75	-.28	-.29	.01

NO. OF + = 21   NO. OF - = 13   NO. OF 0 = 13
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 90
BALCONY NO.: 39(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
         I-----------------------------I
LEVEL 1  I - .                       --I
LEVEL 2  I    +      +      +     0   I
LEVEL 3  I--                         -0I
LEVEL 4  I0    0          +          0 I
LEVEL 5  I 0          +          +   0I
LEVEL 6  I0    +          +          0 I
LEVEL 7  I 0          +          +   +I
LEVEL 8  I0    +          +          0 I
LEVEL 9  I 0          +          +   0I
LEVEL 10 I+    +          +          0 I
LEVEL 11 I +          +          0   -I
LEVEL 12 I+    +          0          - I
         I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.88	-.76	-.11
20	-.68	-.63	-.05
21	-.70	-.65	-.05
22	-.73	-.78	.05
23	-.74	-.82	08
24	-.75	-.83	.08
25	-.73	-.74	.01
26	-.88*	-.74	-.14
27	-.80	-.75	-.05
28	-.69	-.64	-.05
29	-.70	-.69	-.01
30	-.75	-.72	-.03
31	-.73	-.77	.04
32	-.73	-.82	.09
33	-.75	-.73	-.02
34	-.73	-.72	-.01
43	-.71	-.80	.08
44	-.69	-.75	.05
45	-.75	-.78	.03
46	-.74	-.71	-.03
47	-.71	-.75	.04
48	-.71	-.83	.12
49	-.74	-.78	.03
50	-.75	-.73	-.02
51	-.71	-.82	.11
52	-.71	-.76	.05
53	-.74	-.81	.06
54	-.71	-.74	.03
55	-.72	-.79	.07
56	-.72	-.85	.13
59	-.72	-.75	.03
60	-.78	-.79	.01
61	-.69	-.89	.19
62	-.68	-.74	.06
63	-.73	-.75	.02
64	-.71	-.82	.11
65	-.71	-.88	.17
66	-.70	-.85	.15
67	-.68	-.64	-.04
68	-.80	-.91	.11
69	-.69	-.95	.25
70	-.65	-.65	.00
71	-.67	-.54	-.12
72	-.60	-.93	.33*
73	-.71	-.97*	.26
74	-.63	-.66	.04
75	-.53	-.66	.09

NO. OF + = 22   NO. OF - = 8   NO. OF 0 = 17
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 105
BALCONY NO.: 39(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT: 120M
\+ GREATER THAN 0.040
\- LESS THAN -0.040
0 BETWEEN -0.040 & 0.040

```
         I-----------------------------I
LEVEL 1  I 0                         ++I
LEVEL 2  I    +      0      +     +   I
LEVEL 3  I+0                         ++I
LEVEL 4  I0    0          +          + I
LEVEL 5  I 0          0          0   +I
LEVEL 6  I0    0          0          + I
LEVEL 7  I 0          0          0   +I
LEVEL 8  I0    0          0          + I
LEVEL 9  I 0          0          +   +I
LEVEL 10 I0    0          0          + I
LEVEL 11 I 0          0          +   +I
LEVEL 12 I+    0          0          + I
         I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	-.64	-.65	.01
20	-.59	-.69	.10
21	-.59	-.70	.11
22	-.62	-.66	.04
23	-.63	-.67	.04
24	-.52	-.67	.15
25	-.58	-.67	.09
26	-.60	-.65	.04
27	-.63	-.66	.02
28	-.60	-.69	.09
29	-.58	-.71	.13
30	-.61	-.61	.00
31	-.63	-.64	.00
32	-.47	-.66	.19*
33	-.58	-.71	.13
34	-.57	-.60	.03
43	-.62	-.62	.00
44	-.64	-.67	.03
45	-.65	-.72	.07
46	-.56	-.58	.03
47	-.60	-.60	.00
48	-.64	-.65	.01
49	-.65*	-.71	.06
50	-.60	-.57	-.03
51	-.62	-.60	-.01
52	-.64	-.68	.04
53	-.64	-.73	.09
54	-.53	-.54	.01
55	-.58	-.57	-.02
56	-.61	-.63	.01
59	-.65	-.72	.07
60	-.58	-.54	-.04
61	-.59	-.59	.00
62	-.63	-.68	.06
63	-.63	-.74	.11
64	-.52	-.53	.01
65	-.58	-.56	-.01
66	-.60	-.61	.01
67	-.63	-.72	.08
68	-.59	-.56	-.04
69	-.58	-.61	.03
70	-.60	-.65	.05
71	-.63	-.75*	.12
72	-.46	-.58	.12
73	-.58	-.60	.02
74	-.57	-.59	.01
75	-.61	-.70	.09

NO. OF + = 21   NO. OF - = [illegible]   NO. OF 0 = [illegible]
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.5 CONTINUED

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                        120
BALCONY NO.:              29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT:              120M
+  GREATER THAN              0.040
-  LESS THAN                -0.040
0  BETWEEN         -0.040 & 0.040

            I-----------------------------I
LEVEL  1    I 0                        001
LEVEL  2    I    0     0     0     0     I
LEVEL  3    100                         001
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  4    10   0           0          0 I
            I                             I
            I                             I
LEVEL  5    I 0        0           0     +I
            I                             I
            I                             I
LEVEL  6    10   0           0          + I
            I                             I
            I                             I
LEVEL  7    I 0        0           0     +I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  8    10   0           0          + I
            I                             I
            I                             I
LEVEL  9    I 0        0           0     +I
            I                             I
            I                             I
LEVEL 10    10   0           0          + I
            I                             I
            I                             I
LEVEL 11    I 0        0           0     +I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL 12    I-   0           0          0 I
            I                             I
            I-----------------------------I

NO. OF + = 7     NO. OF - = 1     NO. OF 0 = 39
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.66	-.62	-.03
20	-.65	-.66	.02
21	-.64	-.66	.03
22	-.63	-.63	.00
23	-.63	-.64	.01
24	-.63	-.64	.01
25	-.64	-.66	.02
26	-.64	-.61	-.03
27	-.61	-.62	.01
28	-.64	-.63	.03
29	-.63	-.67	.03
30	-.63	-.60	-.02
31	-.62	-.62	.00
32	-.64	-.65	.01
33	-.65	-.69	.04
34	-.59	-.61	.02
43	-.61	-.63	.02
44	-.66*	-.68	.02
45	-.65	-.71	.06
46	-.59	-.58	-.01
47	[illegible]	-.60	-.01
48	-.65	-.64	-.01
49	-.65	-.70	.05
50	-.58	-.57	-.01
51	-.63	-.60	-.02
52	-.64	-.67	.03
53	-.65	-.73*	.08
54	-.55	-.52	-.03
55	-.57	-.55	-.02
56	-.61	-.61	.00
59	-.64	-.70	.06
60	-.54	-.52	-.02
61	-.58	-.56	-.03
62	-.60	-.62	.02
63	-.61	-.72	.11
64	-.50	-.46	-.03
65	-.54	-.50	-.04
66	-.59	-.57	-.02
67	-.61	-.68	.07
68	-.50	-.47	-.03
69	-.54	-.53	-.01
70	-.57	-.60	.03
71	-.60	-.73	.12
72	-.65	-.47	-.16*
73	-.53	-.50	-.03
74	-.54	-.53	-.01
75	-.61	-.62	.01

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                        135
BALCONY NO.:              29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT:              120M
+  GREATER THAN              0.040
-  LESS THAN                -0.040
0  BETWEEN         -0.040 & 0.040

            I-----------------------------I
LEVEL  1    I 0                        001
LEVEL  2    I    0     0     0     0     I
LEVEL  3    100                         001
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  4    I-   0           0          0 I
            I                             I
            I                             I
LEVEL  5    I 0        0           0     0I
            I                             I
            I                             I
LEVEL  6    10   0           0          0 I
            I                             I
            I                             I
LEVEL  7    I 0        0           0     0I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  8    I-   0           0          0 I
            I                             I
            I                             I
LEVEL  9    I -        0           0     0I
            I                             I
            I                             I
LEVEL 10    I-   0           0          0 I
            I                             I
            I                             I
LEVEL 11    I 0        0           0     0I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL 12    10   0           0          0 I
            I                             I
            I-----------------------------I

NO. OF + = 0     NO. OF - = 4     NO. OF 0 = 43
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.52	-.51	-.01
20	-.58	-.60	.01
21	-.59	-.60	.00
22	-.53	-.52	-.01
23	-.54	-.54	.00
24	-.56	-.56	.00
25	-.57	-.58	.01
26	-.56	-.52	-.03
27	-.53	-.52	-.01
28	-.60	-.60	.01
29	-.60	-.61	.01
30	-.58	-.54	-.04
31	-.58	-.56	-.03
32	-.61	-.60	-.01
33	-.63	-.65	.02
34	-.56	-.56	.00
43	-.60	-.59	-.01
44	-.62	-.63	.01
45	-.64*	-.67*	.03
46	-.57	-.54	-.03
47	-.57	-.56	-.01
48	-.63	-.62	-.01
49	-.63	-.65	.02
50	-.57	-.54	-.03
51	-.61	-.58	-.03
52	-.62	-.62	.00
53	-.63	-.65	.03
54	-.54	-.49	-.06*
55	-.54	-.52	-.01
56	-.57	-.58	.00
59	-.59	-.59	.00
60	-.51	-.47	-.04
61	-.53	-.53	.00
62	-.55	-.55	.01
63	-.57	-.58	.00
64	-.49	-.43	-.06
65	-.50	-.46	-.04
66	-.52	-.53	.01
67	-.53	-.52	-.01
68	-.46	-.43	-.02
69	-.48	-.48	.00
70	-.49	-.51	.02
71	-.51	-.51	.00
72	-.45	-.43	-.02
73	-.45	-.45	-.01
74	-.47	-.50	.02
75	-.46	-.46	.00

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                        150
BALCONY NO.:              29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT:              120M
+  GREATER THAN              0.040
-  LESS THAN                -0.040
0  BETWEEN         -0.040 & 0.040

            I-----------------------------I
LEVEL  1    I 0                        001
LEVEL  2    I    0     0     0     0     I
LEVEL  3    100                         001
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  4    10   0           0          0 I
            I                             I
            I                             I
LEVEL  5    I 0        +           0     0I
            I                             I
            I                             I
LEVEL  6    10   0           0          0 I
            I                             I
            I                             I
LEVEL  7    I 0        0           0     0I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  8    I-   0           0          0 I
            I                             I
            I                             I
LEVEL  9    I 0        0           0     0I
            I                             I
            I                             I
LEVEL 10    I-   0           0          0 I
            I                             I
            I                             I
LEVEL 11    I 0        0           0     0I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL 12    10   0           0          0 I
            I                             I
            I-----------------------------I

NO. OF + = 1     NO. OF - = 2     NO. OF 0 = 44
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.44	-.45	.00
20	-.52	-.55	.03
21	-.58	-.61	.02
22	-.45	-.47	.02
23	-.46	-.48	.01
24	-.48	-.50	.02
25	-.52	-.53	.01
26	-.47	-.46	-.01
27	-.46	-.46	.00
28	-.54	-.57	.02
29	-.58	-.61	.03
30	-.52	-.49	-.02
31	-.51	-.51	-.01
32	-.55	-.55	.00
33	-.58	-.61	.03
34	-.51	-.51	.00
43	1.10*	-.32	1.41*
44	-.56	-.60	.03
45	-.62	-.64*	.02
46	-.52	-.50	-.02
47	-.46	-.48	.01
48	-.56	-.56	.00
49	-.58	-.60	.02
50	-.50	-.50	.00
51	-.54	-.53	.00
52	-.56	-.56	.01
53	-.61	-.61	.00
54	-.49	-.45	-.04
55	-.49	-.47	-.02
56	-.51	-.51	.00
59	-.52	-.53	.01
60	-.45	-.43	-.02
61	-.47	-.47	.00
62	-.48	-.49	.01
63	-.53	-.54	.01
64	-.43	-.39	-.04
65	-.44	-.42	-.01
66	-.44	-.46	.01
67	-.46	-.46	.00
68	-.40	-.39	-.01
69	-.42	-.43	.01
70	-.41	-.42	.01
71	-.49	-.49	-.01
72	-.39	-.38	.00
73	-.40	-.41	.01
74	-.40	-.42	.03
75	-.40	-.39	.00

COMPARISION OF Cp MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                        165
BALCONY NO.:              29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT:              120M
+  GREATER THAN              0.040
-  LESS THAN                -0.040
0  BETWEEN         -0.040 & 0.040

            I-----------------------------I
LEVEL  1    I 0                        ++I
LEVEL  2    I    0     0     0     +     I
LEVEL  3    100                         ++I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  4    10   0           0          + I
            I                             I
            I                             I
LEVEL  5    I 0        -           +     +I
            I                             I
            I                             I
LEVEL  6    I-   -           0          0 I
            I                             I
            I                             I
LEVEL  7    I 0        0           0     0I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  8    10   0           0          0 I
            I                             I
            I                             I
LEVEL  9    I 0        0           0     +I
            I                             I
            I                             I
LEVEL 10    10   0           0          0 I
            I                             I
            I                             I
LEVEL 11    I 0        0           0     0I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL 12    10   0           0          0 I
            I                             I
            I-----------------------------I

NO. OF + = 9     NO. OF - = 3     NO. OF 0 = 35
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	-.42	-.45	.03
20	-.51	-.60	.08
21	-.58	-.65*	.07
22	-.42	-.45	.03
23	-.44	-.47	.03
24	-.46	-.50	.04
25	-.50	-.55	.05
26	-.45	-.45	.01
27	-.44	-.45	.02
28	-.53	-.60	.07
29	-.59	-.64	.05
30	-.49	-.48	-.01
31	-.49	-.49	.00
32	-.51	-.54	.03
33	-.55	-.60	.05
34	-.47	[illegible]	.02
43	-.50	[illegible]	-.05
44	-.50	-.55	.05
45	-.59*	-.64	.05
46	-.49	-.44	-.04
47	-.52	-.39	-.12*
48	-.50	-.53	.03
49	-.54	-.54	.00
50	-.47	-.47	.00
51	-.49	-.50	.02
52	-.50	-.51	.01
53	-.59	-.62	.02
54	-.44	-.44	.00
55	-.44	-.46	.02
56	-.45	-.47	.03
59	-.48	-.51	.03
60	-.41	-.43	.02
61	-.42	-.44	.02
62	-.43	-.45	.03
63	-.52	-.58	.05
64	-.40	-.40	.00
65	-.39	-.42	.03
66	-.40	-.42	.02
67	-.44	-.46	.02
68	-.37	-.38	.02
69	-.38	-.41	.03
70	-.38	-.40	.02
71	-.52	-.56	.03
72	-.36	-.38	.01
73	-.38	-.40	.02
74	-.36	-.39	.03
75	-.40	-.42	.02

FIG. B.5 CONTINUED

COMPARISION OF C_P MEAN BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      180
BALCONY NO.:            29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BUILDING HEIGHT:             120M
+  GREATER THAN             0.040
-  LESS THAN               -0.040
0  BETWEEN     -0.040 & 0.040

           I------------------------------I
LEVEL  1   I +                          ++I
LEVEL  2   I     +      +      +     +    I
LEVEL  3   I++                          ++I
           I                              I
           I                              I
           I                              I
           I                              I
LEVEL  4   I+    +             +        + I
           I                              I
           I                              I
LEVEL  5   I +          +           +   +I
           I                              I
           I                              I
LEVEL  6   I+    +             +        + I
           I                              I
           I                              I
LEVEL  7   I +          0           0   +I
           I                              I
           I                              I
           I                              I
           I                              I
LEVEL  8   I+    +             0        + I
           I                              I
           I                              I
LEVEL  9   I +          0           +   +I
           I                              I
           I                              I
LEVEL 10   I+    +             +        + I
           I                              I
           I                              I
LEVEL 11   I +          +           +   +I
           I                              I
           I                              I
           I                              I
           I                              I
LEVEL 12   I+    +             +        + I
           I                              I
           I------------------------------I

NO. OF + = 43      NO. OF - = 0      NO. OF 0 = 4
* -- THE MAXIMU OR MINIMUM VALUES
```

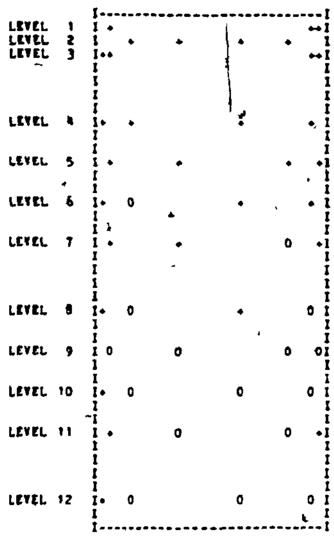
TAP	ROUGH	SMOOTH	DIFF
19	-.49	-.53	.05
20	-.49	-.56	.07
21	-.52	-.58	.06
22	-.48	-.53	.05
23	-.49	-.56	.07
24	-.49	-.56	.07
25	-.49	-.56	.07
26	-.52	-.59	.07
27	-.49	-.55	.06
28	-.49	-.56	.07
29	-.53	-.60	.07
30	-.50	-.63	.13
31	-.49	-.54	.05
32	-.48	-.54	.06
33	-.49	-.57	.07
34	-.47	-.56	.09
43	-.44	-.51	.07
44	-.45	-.52	.08
45	-.55	-.63*	.08
46	-.46	-.62	.16
47	-.46	-.50	.05
48	-.44	-.48	.04
49	-.47	-.55	.07
50	-.47	-.53	.06
51	-.42	-.46	.04
52	-.44	-.48	.04
53	-.57*	-.63	.06
54	-.43	-.60	.17*
55	-.41	-.46	.05
56	-.39	-.43	.04
59	-.43	-.51	.07
60	-.41	-.49	.08
61	-.37	-.41	.04
62	-.40	-.45	.05
63	-.49	-.60	.11
64	-.39	-.54	.15
65	-.38	-.44	.05
66	-.36	-.41	.05
67	-.40	-.47	.07
68	-.37	-.44	.07
69	-.36	-.40	.04
70	-.38	-.42	.05
71	-.43	-.48	.05
72	-.36	-.42	.07
73	-.36	-.41	.05
74	-.35	-.39	.04
75	-.36	-.42	.06

FIG. B.5 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 0
ROUGHNESS: SANDPAPER
BULDING HEIGHT: 120M
\+ GREATER THAN 0.010
\- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010



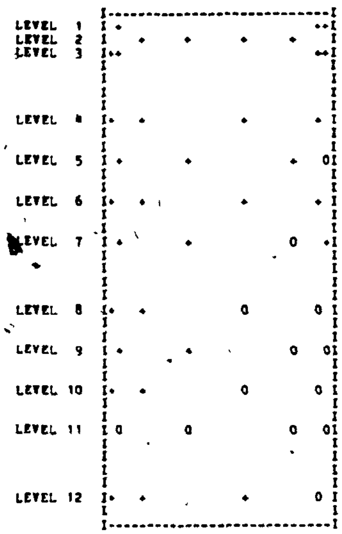
TAP	ROUGH	SMOOTH	DIFF
19	.10	.07	.03
20	.11	.07	.04
21	.11	.08	.03
22	.11	.07	.03
23	.10	.07	.03
24	.10	.06	.04
25	.11	.07	.04
26	.10	.08	.03
27	.11	.07	.04
28	.11	.07	.03
29	.10	.07	.03
30	.11	.08	.03
31	.11	.09	.02
32	.12	.09	.03
33	.11	.08	.03
34	.11	.09	.02
43	.11	.01	.10
44	.11	.01	.10
45	.11	.08	.02
46	.13	.01	.12*
47	.01	.01	.00
48	.12	.10	.02
49	.11	.01	.10
50	.11	.01	.10
51	.11	.10	.01
52	.10	.10	.00
53	.12	.10	.02
54	.17	.10	.06
55	.10	.10	.00
56	.12	.10	.01
59	.11	.10	.01
60	.11	.10	.01
61	.10	.10	.00
62	.10	.10	-.01
63	.13	.12	.01
64	.18*	.12	.06
65	.10	.10	.00
66	.10	.10	.01
67	.11	.10	.00
68	.11	.10	.01
69	.10	.10	.00
70	.09	10	.00
71	.13	.12	.01
72	.16	.13*	.04
73	09	08	.01
74	.09	.08	.01
75	.10	.09	.00

NO. OF + = 31 NO. OF - = 0 NO OF 0 = 16
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 30
ROUGHNESS: SANDPAPER
BULDING HEIGHT: 120M
\+ GREATER THAN 0.010
\- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010



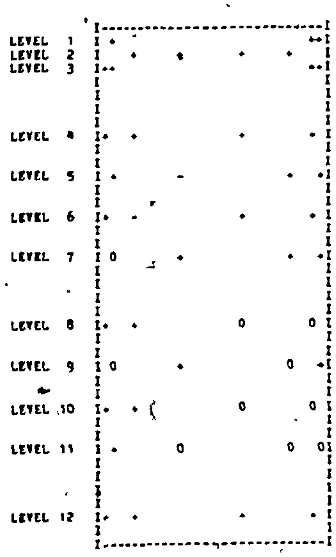
TAP	ROUGH	SMOOTH	DIFF
19	.10	.07	.04
20	.07	.05	.02
21	.06	.05	.02
22	.10	.06	.04
23	.09	.06	.03
24	.09	.06	.03
25	.08	.06	.02
26	.11	.08	.03
27	.11	.07	.04
28	.07	.05	.02
29	.06	.04	.01
30	.14	.09	.05*
31	.11	.08	.03
32	.09	.07	.02
33	.07	.05	.02
34	.12	.10	.03
43	.13	.08	.05
44	.08	.07	.01
45	.05	.05	.01
46	.16*	.11	.05
47	.12	.09	.02
48	.09	.08	.01
49	.07	.06	.02
50	.12	.11	.01
51	.12	.08	.04
52	.08	.07	.01
53	.06	.05	.01
54	.15	.11	.04
55	.12	.09	.02
56	.08	.08	.00
59	.07	.06	.01
60	.12	.11	.01
61	.10	.08	.02
62	.07	.07	.01
63	.07	.06	.01
64	.16	.12*	.04
65	.11	.09	.02
66	.08	.08	.00
67	.07	.06	.00
68	.11	.10	.01
69	.09	.08	.00
70	.07	.06	.01
71	.07	.07	.00
72	.13	.09	.04
73	.09	.08	.01
74	.08	.07	.01
75	.06	.06	.01

NO. OF + = 34 NO. OF - = 0 NO. OF 0 = 13
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 15
ROUGHNESS: SANDPAPER
BULDING HEIGHT: 120M
\+ GREATER THAN 0.010
\- LESS THAN -0.010
0 BETWEEN -0 010 & 0.010



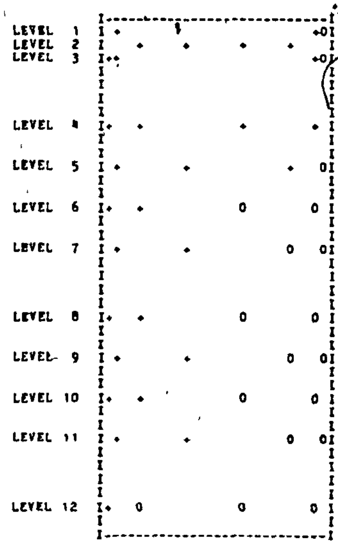
TAP	ROUGH	SMOOTH	DIFF
19	.11	.07	.04
20	.09	.05	.03
21	.08	.05	.03
22	.11	.07	.04
23	.10	.06	.04
24	.10	.06	.04
25	.10	.06	.03
26	.11	.07	.04
27	.12	.07	.05
28	.09	.06	.03
29	.07	.05	.02
30	.12	.08	04
31	.11	.08	.03
32	.13	.08	.05
33	.09	.07	.02
34	.12	.10	.02
43	01	.09	-.08
44	.09	.08	.01
45	.07	.06	.01
46	.13	.10	.03
47	.01	.10	-.09
48	.11	.09	.02
49	.09	.08	.01
50	.12	.11	.01
51	.12	.09	.03
52	.10	.09	.01
53	.08	.07	.02
54	.20*	.10	.10*
55	.12	.11	.02
56	.10	.09	.01
59	.09	.09	.01
60	.12	.11*	.01
61	.11	.09	.01
62	.09	.09	.00
63	.09	.08	.02
64	.18	.10	.08
65	.12	.10	.01
66	.10	.09	.01
67	.09	.08	.01
68	.12	.10	.02
69	.10	09	.01
70	.09	.08	.00
71	.09	.08	01
72	.13	.09	.04
73	.09	.08	01
74	.09	.08	.01
75	.08	.07	.01

NO. OF + = 35 NO OF - = 2 NO. OF 0 = 10
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 45
ROUGHNESS: SANDPAPER
BULDING HEIGHT: 120M
\+ GREATER THAN 0.010
\- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010



TAP	ROUGH	SMOOTH	DIFF
19	.10	.05	.04
20	.06	.04	.01
21	.05	.05	.01
22	.08	.05	.03
23	.07	.05	.02
24	.07	.05	.02
25	.06	.04	.02
26	.12	.08	.04
27	.10	.06	.04
28	.06	.04	.01
29	.05	.04	.01
30	.13	.09	.03
31	.12	.06	.06*
32	.07	.05	.02
33	.05	.04	.01
34	.12	.09	.03
43	.09	.06	.03
44	.06	.05	.01
45	.05	.04	.01
46	.13	.11	.03
47	.11	.07	.04
48	.07	.06	01
49	.05	.05	[illegible]
50	.11	.09	.02
51	.10	.06	.04
52	.06	.05	.01
53	.05	.05	.01
54	.13	.12	.01
55	.10	.08	.03
56	.06	.06	.00
59	.05	.05	.00
60	.10	.09	.01
61	.08	.06	.02
62	.06	.05	.01
63	.06	.05	.01
64	.14*	.12*	.02
65	.11	.08	.03
66	.06	.05	.01
67	.05	.05	.00
68	.10	.09	.01
69	.07	.06	.01
70	.05	.05	.01
71	.06	.06	.00
72	.12	.09	.02
73	.08	.07	.01
74	.06	.06	.01
75	.05	.05	.00

NO. OF + = 29 NO. OF - = 0 NO OF 0 = 18
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.6 EFFECT OF UNIFORM ROUGHNESS ON Cp RMS

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 60
ROUGHNESS: SANDPAPER
BULDING HEIGHT: 120M
\+ GREATER THAN 0.010
\- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I-----------------------------I
LEVEL  1  I +                         +0I
LEVEL  2  I    0     +      +       +  I
LEVEL  3  I++                         00I
LEVEL  4  I+   0            0        0 I
LEVEL  5  I +        +              + 0I
LEVEL  6  I+   +            0        + I
LEVEL  7  I +        +            0   0I
LEVEL  8  I+   0            0        0 I
LEVEL  9  I +        0            0   0I
LEVEL 10  I+   -            0        0 I
LEVEL 11  I +        0            0   0I
LEVEL 12  I+   0            0        0 I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.19	.16	.03
20	.05	.04	.01
21	.06	.05	.01
22	.05	.04	.01
23	.05	.04	.01
24	.05	.04	.01
25	.05	.04	.01
26	.14	.09	.05
27	.23	.19	.04
28	.04	.04	.00
29	.05	.05	.01
30	.15	.09	.05
31	.09	.08	.01
32	.05	.04	.00
33	.04	.04	.00
34	.20	.15	.05
43	.05	.01	.05
44	.04	.01	.03
45	.05	.04	.01
46	.16	.01	.15
47	.13	.01	.12
48	.04	.04	.01
49	.04	.01	.04
50	.21	.01	.20*
51	.06	.04	.01
52	.04	.04	.00
53	.05	.04	.01
54	.16	.14	.03
55	.13	.13	.00
56	.05	.04	.00
59	.04	.04	.00
60	.24*	.20*	.05
61	.05	.05	.00
62	.04	.04	.00
63	.05	.05	.00
64	.17	.13	.04
65	.12	.14	-.01
66	.04	.04	.00
67	.05	.05	.00
68	.21	.17	.04
69	.06	.06	.00
70	.04	.04	.00
71	.06	.06	.00
72	.13	.12	.02
73	.11	.11	.00
74	.05	.05	.00
75	.05	.05	.00

NO. OF + = 21 NO OF - = 1 NO. OF 0 = 25
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 75
ROUGHNESS: SANDPAPER
BULDING HEIGHT: 120M
\+ GREATER THAN 0.010
\- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I-----------------------------I
LEVEL  1  I +                         00I
LEVEL  2  I    +      +      0     0   I
LEVEL  3  I00                         00I
LEVEL  4  I+   +            -        0 I
LEVEL  5  I +        0             + 0I
LEVEL  6  I+   0            0        + I
LEVEL  7  I +        -             - 0I
LEVEL  8  I0   -            -        0 I
LEVEL  9  I 0        -            0   0I
LEVEL 10  I-   0            -        0 I
LEVEL 11  I 0        -             +  0I
LEVEL 12  I+   -            +        0 I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.13	.12	.01
20	.06	.06	.00
21	.06	.06	.01
22	.16	.12	.05
23	.19	.17	.01
24	.11	.10	.01
25	.06	[illegible]	[illegible]
26	.12	.11	.01
27	.12	.11	.01
28	.05	.06	-.01
29	.06	.06	.00
30	.11	.09	.02
31	.13	.12	.01
32	.20	.19	.02
33	.07	.07	.00
34	.12	[illegible]	[illegible]
43	[illegible]	.01	[illegible]
44	.12	.01	.11
45	[illegible]	[illegible]	[illegible]
46	.12	.01	.11
47	.01	.01	.00
48	.20	[illegible]	.00
49	.09	.01	.08
50	.12	.01	.11*
51	.13	.21	-.02
52	.13	.14	-.01
53	.06	.07	.00
54	.13	.12	.01
55	.15	[illegible]	-.01
56	.13	.21	[illegible]
59	.10	.10	.00
60	.15	.15	.00
61	.19	.23	-.04
62	.12	.13	-.01
63	.07	.08	-.01
64	.14	.15	-.01
65	.11	.11	.00
66	.15	.17	[illegible]
67	.10	.10	.00
68	.16	[illegible]	[illegible]
69	.21	.26*	-.05
70	.12	.10	[illegible]
71	.07	.07	[illegible]
72	.16	[illegible]	-.01
73	.22*	[illegible]	[illegible]
74	[illegible]	.11	[illegible]
75	.06	.07	.01

NO. OF + = [illegible] NO. OF - = [illegible] NO. OF 0 = [illegible]
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 90
ROUGHNESS: SANDPAPER
BULDING HEIGHT: 120M
\+ GREATER THAN 0.010
\- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I-----------------------------I
LEVEL  1  I +                         0-I
LEVEL  2  I    +     +      +      0   I
LEVEL  3  I++                         0-I
LEVEL  4  I+   +            0        0 I
LEVEL  5  I +        -              + -I
LEVEL  6  I+   -            -        - I
LEVEL  7  I +        -              + -I
LEVEL  8  I+   +            -        - I
LEVEL  9  I +        -            0   0I
LEVEL 10  I+   0            -        0 I
LEVEL 11  I 0        +              + 0I
LEVEL 12  I+   0            +        + I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.13	.11	.01
20	.18	.18	.00
21	.19	.23	-.04
22	.14	.12	.02
23	.16	.14	.01
24	.18	.17	.01
25	.19	.18	.01
26	.12	.11	.02
27	.13	.11	.02
28	.18	.18	.00
29	.19	.23	-.04
30	.13	.11	.02
31	.14	.13	.01
32	.16	.17	-.01
33	.19	.20	.00
34	.14	.12	.02
43	.00	.14	-.14*
44	.19	.17	.02
45	.24	.26	-.02
46	.14	.12	.01
47	.01	.13	-.13
48	.16	.18	-.03
49	.23	.24	-.01
50	.15	.14	.01
51	.15	.17	-.02
52	.22	.20	.02
53	.28	.30*	-.02
54	.17	.14	.03
55	.16	.15	.01
56	.18	.20	-.02
59	.24	.26	-.02
60	.18	.15	.03
61	.16	.19	-.03
62	.21	.20	.01
63	.28*	.29	-.01
64	.18	.16	.02
65	.18	.19	.00
66	.18	.20	-.02
67	.22	.22	.00
68	.20	.20	.00
69	.20	.22	-.01
70	.20	.18	.02
71	.21	.20	.01
72	.24	.22	.01
73	.23	.23	.00
74	.19	.17	.03
75	.17	.16	.01

NO. OF + = 21 NO. OF - = 14 NO OF 0 = 12
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 105
ROUGHNESS: SANDPAPER
BULDING HEIGHT: 120M
\+ GREATER THAN 0.010
\- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I-----------------------------I
LEVEL  1  I 0                         ++I
LEVEL  2  I    +      +      0     +   I
LEVEL  3  I00                         0+I
LEVEL  4  I0   0            +        0 I
LEVEL  5  I 0        0            0   +I
LEVEL  6  I0   0            0        0 I
LEVEL  7  I 0        0            0   +I
LEVEL  8  I0   0            0        0 I
LEVEL  9  I 0        0            -   0I
LEVEL 10  I0   0            0        0 I
LEVEL 11  I +        0            0   -I
LEVEL 12  I+   0            0        - I
          I-----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.05	.01
20	.12	.10	.01
21	.18	.15	.03*
22	.07	.06	.01
23	.08	.06	.02
24	.08	.07	.01
25	.09	.08	.01
26	.06	.05	.01
27	.06	.05	.00
28	.12	.11	.01
29	.15	.13	.02
30	.06	.05	.01
31	.06	.05	.01
32	.07	.06	.01
33	.11	.10	.00
34	.07	.06	.01
43	.07	.06	.01
44	.08	.07	.00
45	.14	.12	.02
46	.07	.06	.00
47	.07	.06	.01
48	.07	.07	.00
49	.13	.13	.00
50	.07	.07	.00
51	.08	.07	.01
52	.09	.09	.00
53	.17	.16	.02
54	.08	.07	.01
55	.08	.08	.00
56	.09	.10	-.01
59	.17	.17	.00
60	.08	.08	.00
61	.09	.09	.00
62	.11	.13	-.02
63	.22	.22	.00
64	.10	.09	.01
65	.10	.09	.01
66	.11	.10	.01
67	.20	.20	.00
68	.10	.09	.01
69	.13	.12	.01
70	.14	.13	.01
71	.23*	.26*	-.02
72	.12	.11	.01
73	.12	.11	.00
74	.14	.13	.01
75	.21	.23	-.02

NO. OF + = 10 NO. OF - = 3 NO OF 0 = 34
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.6 CONTINUED

```
COMPARISION OF  Cp RMS BETWEEN  THE CASES WITH & WITHOUT  ROUGHNE

* ROUGH   DATA MINUS SMOOTH DATA *

     AZIMUTH:                  120
     ROUGHNESS:           SANDPAPER
     BULDING HEIGHT:           120M
     +  GREATER THAN          0.010
     -  LESS THAN            -0.010
     0  BETWEEN     -0.010 & 0.010

          I----------------------------I
LEVEL  1  I 0                        0+I
LEVEL  2  I     0     0     0     0    I
LEVEL  3  I00                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  5  I 0        0           0   0I
          I                            I
          I                            I
LEVEL  6  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  7  I 0        0           0   0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  9  I 0        0           0    +I
          I                            I
          I                            I
LEVEL 10  I0    0           0        0 I
          I                            I
          I                            I
LEVEL 11  I 0        0           0   0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0    0           0        - I
          I                            I
          I----------------------------I

          NO. OF + = 2       NO. OF - = 1       NO. OF 0 = 44
          * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.05	.00
20	.08	.07	.01
21	.10	.09	.02*
22	.06	.05	.00
23	.05	.05	.00
24	.06	.05	.01
25	.06	.06	.00
26	.06	.05	.00
27	.05	.05	.00
28	.08	.07	.01
29	.08	.08	.00
30	.05	.05	.00
31	.05	.05	.00
32	.05	.05	.01
33	.07	.06	.00
34	.05	.05	.00
43	.05	.05	.00
44	.05	.06	.00
45	.09	.08	.00
46	.06	.05	.00
47	.05	.05	.00
48	.05	.05	.00
49	.08	.08	.00
50	.06	.05	.00
51	.05	.05	.00
52	.06	.07	-.01
53	.11	.11	.00
54	.06	.06	.00
55	.06	.06	.00
56	.06	.06	-.01
59	.11	.12	-.01
60	.07	.07	.00
61	.06	.06	.00
62	.07	.08	- 01
63	.16*	.15	.01
64	.08	.07	.00
65	.07	.07	.00
66	.06	.06	.00
67	.14	.14	.00
68	.08	.08	.00
69	.08	.08	.01
70	.09	.10	-.01
71	.16	.16*	.00
72	.09	.08	.00
73	.08	.08	.00
74	.08	.08	.00
75	.15	.16	- 01

```
COMPARISION OF  Cp RMS BETWEEN  THE CASES WITH & WITHOUT  ROUGHNE

* ROUGH   DATA MINUS SMOOTH DATA *

     AZIMUTH:                  135
     ROUGHNESS:           SANDPAPER
     BULDING HEIGHT:           120M
     +  GREATER THAN          0.010
     -  LESS THAN            -0.010
     0  BETWEEN     -0.010 & 0.010

          I----------------------------I
LEVEL  1  I 0                        0+I
LEVEL  2  I     0     0     0     0    I
LEVEL  3  I00                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  5  I 0        0           0   0I
          I                            I
          I                            I
LEVEL  6  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  7  I 0        0           0   0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  9  I 0        0           0   0I
          I                            I
          I                            I
LEVEL 10  I0    0           0        0 I
          I                            I
          I                            I
LEVEL 11  I 0        +           0   0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0    0           0        0 I
          I                            I
          I----------------------------I

          NO. OF + = 2       NO. OF - = 0       NO. OF 0 = 45
          * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.05	.05	.00
20	.06	.06	.00
21	.07	.06	.01*
22	.05	.05	.00
23	.06	.05	.00
24	.06	.06	.00
25	.06	.06	.00
26	.05	.05	.00
27	.05	.05	.01
28	.06	.06	.00
29	.06	.06	.00
30	.05	.05	.00
31	.05	.04	.00
32	.05	.05	.00
33	.06	.06	.00
34	.05	.05	.00
43	.05	.05	.00
44	.05	.06	-.01
45	.07	.08	00
46	.05	.05	.00
47	.05	.05	.00
48	.05	.05	.00
49	.06	.07	-.01
50	.05	.05	.00
51	.05	.05	.00
52	.06	.06	.00
53	.09	.10	.00
54	.05	.05	.00
55	.06	.05	.01
56	.05	.05	.00
59	.09	.08	.01
60	.06	.06	.00
61	.05	.05	.00
62	.06	.06	.00
63	.11	.12	-.01
64	.06	.06	.00
65	.06	.06	.01
66	.06	.06	.00
67	.09	.08	.00
68	.06	.07	.00
69	.07	.06	.01
70	.08	.07	.01
71	.13*	.13*	.00
72	.07	.07	.00
73	.07	.07	.00
74	.07	.06	.01
75	.10	.10	.00

```
COMPARISION OF  Cp RMS BETWEEN  THE CASES WITH & WITHOUT  ROUGHNE

* ROUGH   DATA MINUS SMOOTH DATA *

     AZIMUTH:                  150
     ROUGHNESS:           SANDPAPER
     BULDING HEIGHT:           120M
     +  GREATER THAN          0.010
     -  LESS THAN            -0.010
     0  BETWEEN     -0.010 & 0.010

          I----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I     0     0     0     0    I
LEVEL  3  I00                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  5  I 0        +           0   0I
          I                            I
          I                            I
LEVEL  6  I+    +           0        + I
          I                            I
          I                            I
LEVEL  7  I +        0           0    +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  9  I 0        0-          0   0I
          I                            I
          I                            I
LEVEL 10  I0    0           0        0 I
          I                            I
          I                            I
LEVEL 11  I 0        0           +   0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0    0           0        0 I
          I                            I
          I----------------------------I

          NO. OF + = 7       NO. OF - = 0       NO. OF 0 = 40
          * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.06	.00
20	.06	.05	.01
21	.07	.07	.00
22	.06	.06	.00
23	.06	.06	.00
24	.06	.05	.00
25	.06	.05	.00
26	.06	.05	.00
27	.05	.05	.00
28	.06	.05	.01
29	.06	.06	.01
30	.05	.05	.00
31	.05	.05	.00
32	.05	.05	-.01
33	.05	.05	.00
34	.05	.05	.00
43	.05	.01	.04
44	.05	.05	.00
45	.06	.06	.00
46	.05	.01	.04
47	.05	.01	.04*
48	.05	.05	.00
49	.07	.05	.02
50	.05	.01	.04
51	.05	.05	.00
52	.05	.06	- 01
53	.08	.07	.01
54	.05	.05	.00
55	.06	.05	.01
56	.05	.05	.00
59	.08	.08	.00
60	.05	.05	.00
61	.05	.05	.00
62	.06	.06	.00
63	.09	.09	.00
64	.06	.06	.00
65	.06	.06	.00
66	.06	.06	.00
67	.09	.08	.01
68	.06	.06	.00
69	.07	.06	.01
70	.08	.06	.01
71	.10*	.10*	.00
72	.07	.07	.00
73	.06	.06	.00
74	.07	.07	.00
75	.09	.09	.01

```
COMPARISION OF  Cp RMS BETWEEN  THE CASES WITH & WITHOUT  ROUGHNE

* ROUGH   DATA MINUS SMOOTH DATA *

     AZIMUTH:                  165
     ROUGHNESS:           SANDPAPER
     BULDING HEIGHT:           120M
     +  GREATER THAN          0.010
     -  LESS THAN            -0.010
     0  BETWEEN     -0.010 & 0.010

          I----------------------------I
LEVEL  1  I 0                        00I
LEVEL  2  I     0     0     0     0    I
LEVEL  3  I00                        0+I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  5  I 0        0           +   0I
          I                            I
          I                            I
LEVEL  6  I0    0           0        + I
          I                            I
          I                            I
LEVEL  7  I 0        0           0   0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0    0           0        0 I
          I                            I
          I                            I
LEVEL  9  I 0        0           0   0I
          I                            I
          I                            I
LEVEL 10  I0    0           0        0 I
          I                            I
          I                            I
LEVEL 11  I 0        0           0   0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0    0           0        0 I
          I                            I
          I----------------------------I

          NO. OF + = 3       NO. OF - = 0       NO. OF 0 = 44
          * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.06	.00
20	.08	.08	.00
21	.10	.10	.01
22	.06	.06	.00
23	.06	.06	.00
24	.06	.06	.00
25	.07	.07	.00
26	.06	.06	.00
27	.06	.06	.00
28	.07	.07	.00
29	.10	.08	.01
30	.06	.06	.00
31	.06	.05	.01
32	.06	.06	.00
33	.06	.06	.00
34	.06	.06	.00
43	.01	.01	.00
44	.05	.01	.04
45	.07	.07	.00
46	.01	.01	.00
47	.01	.01	.00
48	.05	.06	-.01
49	.06	.01	.05*
50	.01	.01	.00
51	.05	.06	.00
52	.06	.07	.00
53	.08	.09	-.01
54	.07	.07	.00
55	.06	.06	-.01
56	.06	.06	-.01
59	.08	.08	.00
60	.07	.07	.00
61	.06	.06	.00
62	.06	.07	-.01
63	.10	.11	-.01
64	.08	.07	.00
65	.07	.07	.00
66	.06	.07	.00
67	.09	.09	-.01
68	.07	.08	-.01
69	.08	.08	-.01
70	.07	.07	.00
71	.12*	.12*	.00
72	.08	.08	.00
73	.07	.08	.00
74	.07	.08	.00
75	.10	.11	-.01

FIG. B.6 CONTINUED

COMPARISION OF Cp' RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

```
* ROUGH   DATA MINUS SMOOTH DATA *

     AZIMUTH:                    180
     ROUGHNESS:             SANDPAPER
     BULDING HEIGHT:            120M
     +  GREATER THAN           0.010
     -  LESS THAN             -0.010
     0  BETWEEN     -0.010 & 0.010

            I-----------------------------I
LEVEL  1    I 0                         00I
LEVEL  2    I     0     0     0     0     I
LEVEL  3    I-0                         00I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  4    I+    0           -         0 I
            I                             I
            I                             I
LEVEL  5    I 0         +           0   0I
            I                             I
            I                             I
LEVEL  6    I0    -           0         0 I
            I                             I
            I                             I
LEVEL  7    I -         0           -   0I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL  8    I+    0           0         0 I
            I                             I
            I                             I
LEVEL  9    I 0         0           -   -I
            I                             I
            I                             I
LEVEL 10    I+    0           0         0 I
            I                             I
            I                             I
LEVEL 11    I 0         0           0   0I
            I                             I
            I                             I
            I                             I
            I                             I
LEVEL 12    I0    0           -         0 I
            I                             I
            I-----------------------------I

            NO. OF + : 3     NO. OF - : 9     NO. OF 0 : 35
            * -- THE MAXIMU OF MINIMUM VALUES
```

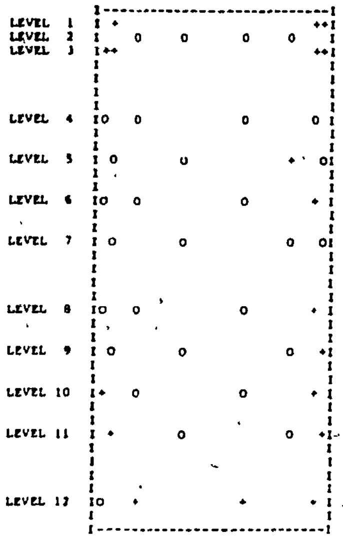
TAP	ROUGH	SMOOTH	DIFF
19	.12	.13	-.01
20	.12	.13	-.01
21	.15	.16	.00
22	.12	.11	.00
23	.10	.10	.00
24	.10	.11	-.01
25	.12	.11	.00
26	.14	.15	-.01
27	.12	.12	.00
28	.13	.13	.00
29	.15	.15	.01
30	.17	.15	.02
31	.09	.10	-.01
32	.08	.10	-.02
33	.12	.11	.00
34	.13	.12	.00
43	.02	.08	-.07
44	.09	.10	-.01
45	.14	.14	.00
46	.16	.16	.00
47	.01	.10	-.09
48	.08	.08	.00
49	.11	.12	.00
50	.01	.13	-.13*
51	.07	.08	.00
52	.07	.10	-.01
53	.16	.17	.00
54	.20*	.17	.02
55	.10	.10	.00
56	.07	.08	.00
59	.12	.13	-.01
60	.12	.13	.00
61	.07	.08	-.01
62	.08	.10	-.02
63	.16	.18*	-.02
64	.18	.16	.02
65	.10	.11	-.01
66	.08	.08	.00
67	.13	.12	.00
68	.12	.12	.00
69	.08	.09	-.01
70	.10	.10	.00
71	.15	.14	.00
72	.14	.13	.01
73	.11	.11	.00
74	.08	.09	-.01
75	.12	.12	.00

FIG. B.6 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 0
BALCONY NO.: 29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010



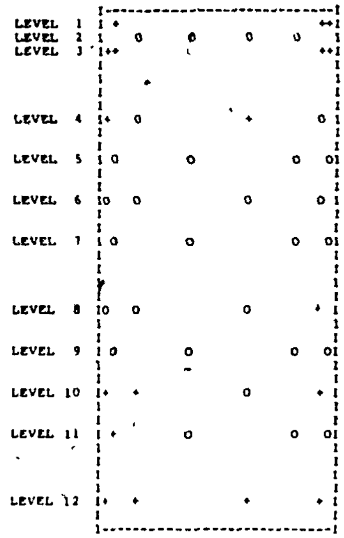
TAP	ROUGH	SMOOTH	DIFF
19	.11	.07	.05
20	.11	.07	.04
21	.10	.08	.02
22	.07	.07	.00
23	.07	.07	.00
24	.07	.06	.01
25	.07	.07	.00
26	.10	.08	.03
27	.10	.07	.03
28	.10	.07	.03
29	.10	.07	.03
30	.09	.08	.01
31	.09	.09	.00
32	.09	.09	.00
33	.09	.08	.00
34	.10	.09	.00
43	.01	01	.00
44	09	.01	08
45	.09	.08	01
46	01	.01	.00
47	.00	.01	.00
48	.10	.10	00
49	.09	.01	.08*
50	01	.01	00
51	.09	.10	.00
52	.10	.10	.00
53	10	.10	.00
54	10	.10	.00
55	.11	.10	.01
56	11	.10	.01
59	.12	.10	.02
60	.11	10	.01
61	.10	.10	.00
62	.10	.10	00
63	.13	12	.02
64	.14	12	03
65	.11	.10	.01
66	.10	.10	.00
67	12	.10	.02
68	11	.10	.01
69	10	.10	.00
70	.10	.10	.00
71	16*	12	.04
72	13	.13*	.00
73	10	.08	02
74	.09	08	.01
75	11	.09	01

NO OF + = * NO OF - = 0 NO OF 0 = [illegible]
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 15
BALCONY NO: 29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010



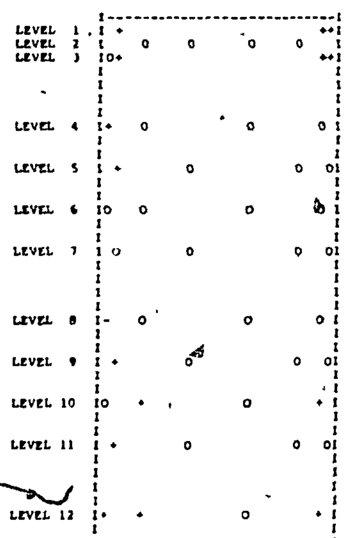
TAP	ROUGH	SMOOTH	DIFF
19	.11	.07	.04*
20	.10	.05	.04
21	.09	.05	.04
22	.07	.07	.01
23	.06	.06	.00
24	.06	.06	.00
25	.06	.06	.00
26	.09	.07	.02
27	.10	.07	.03
28	.09	.06	.03
29	.08	.05	.03
30	.10	.08	.02
31	.09	.08	.01
32	.09	08	.01
33	.07	.07	.01
34	.11	.10	.01
43	.09	.09	.01
44	.09	.08	.01
45	.06	.06	.00
46	.10	.10	.00
47	.10	.10	.00
48	.10	.09	.01
49	.09	.08	.01
50	.11	.11	.00
51	.10	.09	.01
52	.09	09	.00
53	06	.07	.00
54	.10	.10	.00
55	.11	.11	.01
56	.10	.09	.01
59	.10	.09	.02
60	.12	.11*	.01
61	.10	.09	.00
62	.09	.09	.00
63	.08	.08	.00
64	.14*	.10	.03
65	.12	.10	.01
66	.10	.09	.01
67	.10	.08	.02
68	.12	.10	02
69	.10	.09	.00
70	.09	.08	.01
71	.09	08	.00
72	.13	09	.04
73	.10	.08	.02
74	09	.08	.02
75	09	07	.02

NO OF + = - NO OF - = 0 NO OF 0 = [illegible]
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 30
BALCONY NO: 29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT: 120M
+ GREATER THAN 0 010
- LESS THAN -0.010
0 BETWEEN -0 010 & 0.010



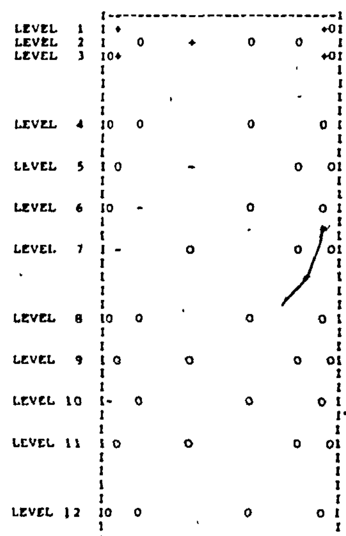
TAP	ROUGH	SMOOTH	DIFF
19	.09	.07	.02
20	.08	.05	.03*
21	.07	.05	.02
22	.07	.06	.01
23	.06	.06	00
24	.06	.06	.01
25	.06	.06	.00
26	.08	.08	.01
27	.09	.07	.01
28	.08	.05	.03
29	.06	.04	.02
30	12	.09	.03
31	.08	.08	.00
32	.07	07	.00
33	.06	.05	.00
34	.11	10	01
43	.08	.08	.00
44	07	07	.00
45	.05	.05	.00
46	11	.11	.00
47	.10	09	.01
48	.08	08	.00
49	.07	.06	.01
50	.11	.11	.00
51	.09	.08	.00
52	07	.07	00
53	.05	.05	.00
54	.10	.11	-.01
55	.10	.09	.01
56	.09	08	.01
59	.08	.06	.01
60	.13*	.11	.02
61	.08	.08	.00
62	.07	.07	.00
63	.07	.06	.00
64	.11	.12*	- 01
65	.11	.09	.02
66	.08	.08	.01
67	.08	.06	.01
68	.13	.10	.02
69	.09	.08	.01
70	.07	.06	01
71	.07	.07	.01
72	.11	.09	02
73	.10	.08	.02
74	.08	.07	.01
75	.07	.06	.02

NO OF + = 15 NO OF - = 1 NO OF 0 = 31
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

AZIMUTH: 45
BALCONY NO.: 29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWELN -0 010 & 0 010



TAP	ROUGH	SMOOTH	DIFF
19	.07	.05	.01
20	06	.04	.01
21	.05	.05	.01
22	.05	.05	.00
23	.07	.05	.02
24	.05	.05	.00
25	.05	.04	01
26	.08	.08	.00
27	.07	.06	.01
28	.06	.04	02
29	.05	.04	.01
30	.09	.09	00
31	.07	.06	.00
32	.05	.05	.00
33	.04	.04	.00
34	.09	.09	.00
43	.02	.06	-.04
44	.05	.05	.00
45	.04	.04	.00
46	.10	.11	-.01
47	.01	.07	-.06*
48	.06	.06	.00
49	.04	.05	.00
50	.08	.09	-.01
51	.06	.06	.00
52	.05	.05	.00
53	.05	.05	.00
54	.11*	.12	- 01
55	.08	.08	.01
56	.06	.06	.00
59	.06	.05	.01
60	.10	.09	00
61	.06	.06	.00
62	.05	.05	.00
63	.05	.05	.00
64	.11	.12*	-.01
65	.08	.08	.00
66	.06	.05	.00
67	.06	.05	.01
68	.09	.09	.00
69	.07	.06	.01
70	.05	.05	.00
71	.06	.06	.01
72	.10	09	01
73	.08	.07	.01
74	.06	.06	.00
75	.05	.05	.01

NO OF + = 5 NO. OF - = 4 NO OF 0 = 38
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.7 EFFECT OF 2m BALCONIES ON Cp RMS

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                          60
BALCONY NO.:                      29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT:                 120M
+  GREATER THAN                0.010
-  LESS THAN                  -0.010
0  BETWEEN        -0.010 & 0.010

          I---------------------------I
LEVEL  1  I -                      00I
LEVEL  2  I    0     0     0     0   I
LEVEL  3  I0-                      00I
LEVEL  4  I0   0         0         0 I
LEVEL  5  I -       +          +   0I
LEVEL  6  I+   +         0         + I
LEVEL  7  I +       0          0   0I
LEVEL  8  I0   0         0         0 I
LEVEL  9  I -       0          0   0I
LEVEL 10  I+   -         0         0 I
LEVEL 11  I 0       0          0   0I
LEVEL 12  I+   0         0         0 I
          I---------------------------I

NO. OF + = 8     NO. OF - = 5     NO OF 0 = 24
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.11	.16	-.05
20	.05	.04	.01
21	.05	.05	.00
22	.04	.04	.00
23	.04	.04	.00
24	.04	.04	.00
25	.04	.04	.00
26	.09	.09	.00
27	.17	.19	-.02
28	.05	.04	.01
29	.05	.05	.01
30	.09	.09	.00
31	.08	.08	.00
32	.04	.04	.00
33	.04	.04	.00
34	.14	.15	-.01
43	.05	.01	.04
44	.04	.01	.03
45	.04	.04	.00
46	.12	.01	.11
47	.12	.01	.11
48	.04	.04	.00
49	.04	.01	.03
50	.15	.01	.14*
51	.05	.04	.01
52	.04	.04	.00
53	.05	.04	.00
54	.13	.14	-.01
55	.13	.13	.00
56	.04	.04	.00
59	.04	.04	.00
60	.18*	.20*	-.01
61	.05	.05	.01
62	.04	.04	.00
63	.05	.05	.00
64	.16	.13	.03
65	.12	.14	-.01
66	.04	.04	.00
67	.05	.05	.00
68	.18	.17	.01
69	.06	.06	.01
70	.04	.04	.00
71	.06	.06	.00
72	.18	.12	.06
73	.11	.11	.01
74	.04	.05	.00
75	.05	.05	.00

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                          75
BALCONY NO.:                      29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT:                 120M
+  GREATER THAN                0.010
-  LESS THAN                  -0.010
0  BETWEEN        -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                      +0I
LEVEL  2  I    0     -     +     +   I
LEVEL  3  I--                      00I
LEVEL  4  I-   -         +         0 I
LEVEL  5  I -       +          +   0I
LEVEL  6  I+   +         +         + I
LEVEL  7  I +       -          +   0I
LEVEL  8  I-   -         +         + I
LEVEL  9  I - -     -          +   +I
LEVEL 10  I-   -         +         + I
LEVEL 11  I -       -          +   +I
LEVEL 12  I-   -         +         + I
          I---------------------------I

NO. OF + = [illegible]     NO. OF - = [illegible]     NO. OF 0 = 9
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.11	.12	.00
20	.07	.06	.01
21	.06	.06	.01
22	.12	.12	.00
23	.15	.17	-.02
24	.12	.10	.02
25	.08	.06	.02
26	.08	.11	-.03
27	.08	.11	-.03
28	.07	.06	.01
29	.06	.06	.00
30	.07	.08	-.01
31	.10	.12	-.02
32	.21	.18	.03
33	.08	.07	.01
34	[illegible]	.07	-.01
43	.19	.01	.19*
44	.15	.01	.14
45	.07	.06	.01
46	.08	.01	.07
47	.10	.01	.10
48	.23	.20	.03
49	.12	.01	.12
50	.09	.01	.08
51	.19	.21	-.02
52	.16	.14	.02
53	.08	.07	.01
54	.09	.12	-.03
55	.13	.16	-.04
56	.23*	.21	.02
59	.13	.10	.02
60	.10	.15	-.05
61	.21	.23	-.02
62	.16	.13	.03
63	.09	.08	.01
64	.10	.16	-.06
65	.13	.19	-.06
66	.23	.17	.05
67	.12	.10	.02
68	.11	.16	-.05
69	.22	.26*	-.04
70	.13	.10	.03
71	.09	.07	.01
72	.12	.17	-.06
73	.15	.24	-.08
74	.16	.11	.04
75	.09	.07	.02

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                          90
BALCONY NO :                      29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT:                 120M
+  GREATER THAN                0 010
-  LESS THAN                  -0.010
0  BETWEEN        -0.010 & 0 010

          I---------------------------I
LEVEL  1  I 0                      ++I
LEVEL  2  I    0     -     0     +   I
LEVEL  3  I00                      0-I
LEVEL  4  I0   -         0         0 I
LEVEL  5  I 0       -          0   -I
LEVEL  6  I0   -         -         0 I
LEVEL  7  I -       -          0   -I
LEVEL  8  I-   -         0         0 I
LEVEL  9  I 0       -          -   -I
LEVEL 10  I-   -         0         0 I
LEVEL 11  I -       -          0   +I
LEVEL 12  I-   -         0         0 I
          I---------------------------I

NO OF + = 4     NO OF - = 21     NO. OF 0 = 22
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.11	.11	.00
20	.20	.18	.02
21	.25	.23	01
22	.11	.12	- 01
23	.13	.14	- 01
24	.16	.17	00
25	.20	.18	02
26	.11	.11	00
27	.11	11	00
28	.19	18	.00
29	.22	.23	- [illegible]
30	11	11	00
31	.11	.13	- 01
32	.16	.17	- 01
33	20	.20	00
34	11	.12	- 01
43	.01	.14	-.13*
44	.17	.17	00
45	25	.26	- 01
46	12	12	- 01
47	.03	13	- 11
48	17	.18	- 01
49	.24	.24	00
50	01	14	- 12
51	.15	.17	- 02
52	.19	20	- 01
53	27	.30*	-.02
54	13	.14	- 01
55	14	.15	- 02
56	19	20	- 01
59	.24	26	- 01
60	.14	.15	- 01
61	.16	.19	- 03
62	18	.20	- 02
63	.28*	.29	- 01
64	.14	.16	- 02
65	15	19	- 04
66	19	20	-.01
67	.23	.22	00
68	16	20	- 04
69	.21	.22	-.01
70	17	.18	.00
71	.22	.20	.01
72	.17	.22	- 06
73	.17	23	- 06
74	17	.17	.00
75	.15	.16	.00

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                         105
BALCONY NO.:                      29
BALCONY GEOMETRY: 61*2*0 16M
BULDING HEIGHT:                 120M
+  GREATER THAN                0 010
-  LESS THAN                  -0 010
0  BETWEEN        -0 010 & 0 010

          I---------------------------I
LEVEL  1  I 0                      00I
LEVEL  2  I    0     0     0     +   I
LEVEL  3  I00                      00I
LEVEL  4  I0   0         0         - I
LEVEL  5  I 0       0          0   0I
LEVEL  6  I0   0         0         - I
LEVEL  7  I 0       0          0   -I
LEVEL  8  I0   0         -           I
LEVEL  9  I 0       0          0   -I
LEVEL 10  I0   0         0         - I
LEVEL 11  I 0       -          0   -I
LEVEL 12  I0   -         0         - I
          I---------------------------I

NO OF + = 1     NO OF - = .4     NO. OF 0 = 22
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	05	00
20	.11	.10	.01
21	.14	.15	-.01
22	.06	06	.00
23	.07	06	.01
24	.07	.07	.00
25	.09	.08	01
26	.06	.05	.00
27	.06	.05	00
28	.10	.11	- 01
29	.12	.13	-.01
30	.05	.05	.00
31	05	.05	.00
32	.06	.06	.00
33	.09	.10	- 01
34	06	.06	00
43	06	.06	.00
44	08	.07	00
45	13	.12	.01
46	.06	06	.00
47	.06	.06	.00
48	.07	.07	- 01
49	.11	.13	- 02
50	.07	.07	00
51	.07	.07	.00
52	.09	.09	00
53	.14	.16	-.01
54	.07	.07	.00
55	.07	.08	-.01
56	.08	.10	-.02
59	.14	.17	-.03
60	.08	.08	.00
61	.08	.09	-.01
62	.12	.13	.00
63	.19	.22	-.03
64	09	.09	00
65	.09	.09	-.01
66	.09	10	-.01
67	.18	.20	- 03
68	.09	.09	.00
69	.11	.12	-.01
70	.13	.13	00
71	20*	.26*	-.05*
72	.10	.11	-.01
73	.10	.11	- 01
74	.12	.13	-.01
75	.20	.23	- 04

FIG. B.7 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    120
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT:            120M
+  GREATER THAN           0 010
-  LESS THAN             -0.010
0  BETWEEN    --0 010 & 0.010

           I-----------------------------I
LEVEL  1   I O                        00I
LEVEL  2   I     O     O     O     O    I
LEVEL  3   I00                        00I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   IO    O           O         -I
           I                            I
           I                            I
LEVEL  5   I +       O           O    0I
           I                            I
           I                            I
LEVEL  6   IO    O           O         -I
           I                            I
           I                            I
LEVEL  7   I +       O           O    0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   IO    O           O          I
           I                            I
           I                            I
LEVEL  9   I O       O           O     -I
           I                            I
           I                            I
LEVEL 10   IO    O           +         -I
           I                            I
           I                            I
LEVEL 11   I O       O           O     -I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   IO    O           O         -I
           I                            I
           I-----------------------------I

NO  OF + = 3      NO  OF - = 7      NO  OF 0 = 37
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.05	.01
20	.07	.07	.00
21	.09	.09	.00
22	.05	.05	.00
23	.05	.05	.00
24	.05	.05	.00
25	.06	.06	.00
26	.05	05	.00
27	.05	.05	.00
28	.06	.07	.00
29	.07	.08	-.01
30	.05	.05	00
31	.05	.05	.00
32	.05	.05	.00
33	.05	.06	- 01
34	.06	05	01
43	.05	.05	.00
44	.05	.06	.00
45	08	.08	-.01
46	.05	.05	00
47	.05	.05	.00
48	.05	.05	.00
49	.07	.08	- 01
50	07	.05	.01
51	.05	.05	00
52	06	.07	- 01
53	.10	.11	- 01
54	06	.06	00
55	.06	.06	.00
56	.06	.06	00
59	08	.12	- 03*
60	07	.07	.01
61	.06	.06	01
62	.08	.08	- 01
63	.14	.15	- 02
64	.08	.07	01
65	.07	.07	00
66	07	.06	.01
67	.11	.14	- 03
68	.08	.08	.01
69	.07	.08	00
70	.09	.10	- 01
71	.15*	.16*	- 02
72	.08	.08	.00
73	.08	.08	.00
74	08	08	00
75	.13	16	- 03

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    135
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT:            120M
+  GREATER THAN           0 010
-  LESS THAN             -0.010
0  BETWEEN     -0.010 & 0.010

           I-----------------------------I
LEVEL  1   I O                        00I
LEVEL  2   I     O     O     O     O    I
LEVEL  3   I00                        00I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   IO    O           O        O I
           I                            I
           I                            I
LEVEL  5   I +       -           O    0I
           I                            I
           I                            I
LEVEL  6   I-    -           O         -I
           I                            I
           I                            I
LEVEL  7   I -       O           O    0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   IO    O           O        O I
           I                            I
           I                            I
LEVEL  9   I O       O           O    0I
           I                            I
           I                            I
LEVEL 10   IO    O           O        O I
           I                            I
           I                            I
LEVEL 11   I O       O           O    0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   IO    O           O        O I
           I                            I
           I-----------------------------I

NO  OF + = 1      NO. OF - = 5      NO  OF 0 = 41
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.05	.05	.00
20	.05	.06	-.01
21	.06	.06	.00
22	.05	.05	.00
23	.05	.05	.00
24	.06	.06	.00
25	.06	.06	.00
26	.05	.05	.00
27	.05	.05	.00
28	.05	.06	- 01
29	.05	.06	-.01
30	.05	.05	.00
31	.05	.04	.00
32	05	.05	.00
33	.05	.06	-.01
34	.06	.05	01
43	.01	.05	- 04
44	.05	.06	.00
45	.07	.08	-.01
46	01	.05	-.04
47	.01	.05	- 04
48	.05	.05	.00
49	.01	.07	-.06*
50	.01	.05	- 04
51	.05	.05	.00
52	.06	.06	00
53	.09	.10	.00
54	.05	.05	00
55	.05	.05	.00
56	.05	.05	.00
59	.07	.08	-.01
60	.06	.06	.00
61	.05	.05	.00
62	.06	.06	-.01
63	.12	12	.00
64	.06	.06	- 01
65	.06	.06	.00
66	.05	.06	- 01
67	.08	.08	-.01
68	.06	.07	-.01
69	.06	.06	.00
70	.06	07	.00
71	.13*	.13*	-.01
72	.07	.07	-.01
73	.06	.07	-.01
74	.06	.06	00
75	09	.10	-.01

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    150
BALCONY NO.:                 29
BALCONY GEOMETRY: 61*2*0 16M
BULDING HEIGHT:            120M
+  GREATER THAN           0 010
-  LESS THAN             -0.010
0  BETWEEN     -0.010 & 0 010

           I-----------------------------I
LEVEL  1   I O                        00I
LEVEL  2   I     O     O     O     O    I
LEVEL  3   I00                        00I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   IO    O           O        00I
           I                            I
           I                            I
LEVEL  5   I +       O           O    0I
           I                            I
           I                            I
LEVEL  6   IO    O           O        0 I
           I                            I
           I                            I
LEVEL  7   I O       O           O    +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   IO    O           O        0 I
           I                            I
           I                            I
LEVEL  9   I O       O           O    +I
           I                            I
           I                            I
LEVEL 10   IO    O           O        0 I
           I                            I
           I                            I
LEVEL 11   I O       O           O    +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   IO    O           O        0 I
           I                            I
           I-----------------------------I

NO. OF + = 4      NO. OF - = 0      NO  OF 0 = 17
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	06	.01
20	06	.05	.01
21	.07	07	00
22	.06	06	.00
23	06	.06	00
24	.06	.05	00
25	06	.05	00
26	06	.05	0C
27	.06	.05	.00
28	.06	.05	.01
29	.06	.06	.00
30	.05	05	00
31	.05	.05	.00
32	.05	05	.00
33	05	.05	.00
34	06	.05	01
43	.01	01	.00
44	05	.05	00
45	.07	06	.01
46	01	01	00
47	.01	01	.00
48	.05	05	00
49	.04	.05	-.01
50	.01	.01	00
51	.05	.05	.00
52	.07	.06	01
53	.08	.07	.01
54	.05	05	.00
55	05	.05	00
56	06	.05	00
59	.07	.08	00
60	.06	05	.00
61	.05	05	00
62	.07	.06	.01
63	.11*	.09	.02*
64	.06	06	.00
65	.06	06	.00
66	.06	.06	.00
67	.08	.09	.00
68	.07	.06	.00
69	.07	.06	.01
70	.07	.06	.01
71	.11	.10*	01
72	.07	07	00
73	.06	06	.00
74	.07	.07	00
75	.09	09	00

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    165
BALCONY NO :                 29
BALCONY GEOMETRY: 61*2*0.16M
BULDING HEIGHT:            120M
+  GREATER THAN           0 010
-  LESS THAN             -0 010
0  BETWEEN     -0.01) & 0 010

           I-----------------------------I
LEVEL  1   I O                        00I
LEVEL  2   I     O     O     O     O    I
LEVEL  3   I00                        00I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   IO    O           O        O I
           I                            I
           I                            I
LEVEL  5   I O       +           +    0I
           I                            I
           I                            I
LEVEL  6   I+    +           O        + I
           I                            I
           I                            I
LEVEL  7   I +       O           O    0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   IO    O           O        O I
           I                            I
           I                            I
LEVEL  9   I O       O           O    0I
           I                            I
           I                            I
LEVEL 10   IO    O           -        O I
           I                            I
           I                            I
LEVEL 11   I O       O           O    0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   IO    O           O        O I
           I                            I
           I-----------------------------I

NO  OF + = 6      NO  OF - = 1      NO. OF 0 = 40
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	06	.00
20	08	.08	- 01
21	.09	.10	.00
22	.06	06	.00
23	06	.06	00
24	07	.06	.00
25	07	07	00
26	.06	.06	.00
27	.06	.06	.00
28	07	.07	00
29	.08	.08	.00
30	06	06	.00
31	.05	.05	00
32	.06	.06	.00
33	06	06	00
34	06	.06	00
43	.06	.01	05
44	.06	.01	.06
45	08	.07	.00
46	.07	.01	05
47	06	01	.05
48	06	06	00
49	.06	01	06
50	.07	.01	.06*
51	.06	.06	00
52	07	.07	.01
53	09	.09	00
54	07	.07	00
55	.06	.06	00
56	.06	.06	00
59	08	.08	.00
60	.07	.07	-.01
61	.06	.06	.00
62	.07	.07	.00
63	11	.11	.00
64	.07	.07	.00
65	.06	.07	.00
66	.06	07	- 01
67	09	.09	- 01
68	.07	08	-.01
69	07	.08	- 01
70	.07	07	.00
71	12*	.12*	.00
72	.07	.08	.00
73	.08	.08	.00
74	07	.08	.00
75	.10	.11	- 01

FIG. B.7 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
      AZIMUTH:                        180
      BALCONY NO.:                     29
      BALCONY GEOMETRY: 61*2*0.16M
      BULDING HEIGHT:               120M
      +  GREATER THAN              0,010
      -  LESS THAN                -0.010
      0  BETWEEN      -0.010 & 0.010

            I-----------------------------I
LEVEL  1    I 0                          00I
LEVEL  2    I     0      0      0      +   I
LEVEL  3    I00                          00I
            I                              I
            I                              I
            I                              I
            I                              I
LEVEL  4    I+    0             0        0 I
            I                              I
            I                              I
LEVEL  5    I 0          0           0   0I
            I                              I
            I                              I
LEVEL  6    I0    0             0        0 I
            I                              I
            I                              I
LEVEL  7    I 0          0           0   0I
            I                              I
            I                              I
            I                              I
            I                              I
LEVEL  8    I0    0             0        0 I
            I                              I
            I                              I
LEVEL  9    I 0          0           0   0I
            I                              I
            I                              I
LEVEL 10    I+    0             0        + I
            I                              I
            I                              I
LEVEL 11    I 0          0      0    0   0I
            I                              I
            I                              I
            I                              I
            I                              I
LEVEL 12    I0    0             0        0 I
            I                              I
            I-----------------------------I

            NO OF + = 4      NO. OF - = 0
            * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.13	.13	.00
20	.13	.13	.00
21	.15	.16	-.01
22	.12	.11	.01
23	.10	.10	.00
24	.11	.11	.00
25	.12	.11	.01
26	.14	.15	-.01
27	.13	.12	.01
28	.12	.13	.00
29	.14	.15	-.01
30	.16	.15	.01
31	.11	.10	.01
32	.09	.10	.00
33	.12	.11	.01
34	.13	.12	.00
43	.09	.08	.01
44	10	.10	.00
45	.15	.14	.01
46	.17	.16	.01
47	.10	.10	.00
48	.08	.08	.00
49	.13	.12	.01
50	.14	.13	.00
51	.08	.08	.01
52	.10	.10	.01
53	.17	.17	.01
54	.18	.17	.01
55	.10	.10	.00
56	.08	.08	.00
59	.13	.13	.00
60	.13	.13	.01
61	.08	.08	.00
62	.10	.10	.00
63	.18*	.18*	.00
64	.17	.16	.02*
65	.11	.11	.00
66	.08	.08	.00
67	.14	.12	.01
68	.12	.12	.00
69	.09	.09	.00
70	.11	.10	.00
71	.15	.14	.01
72	.13	.13	.00
73	.11	.11	.00
74	.09	.09	.00
75	.12	.12	.00

NO. OF 0 = ..

FIG. B.7 CONTINUED

```
COMPARISION OF Cp RMS BETWEEN  THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *            TAP ROUGH  SMOOTH  DIFF

      AZIMUTH:                    0           19   .11    .07    .04*
      BALCONY NO.:               29           20   .10    .07    .04
      BALCONY GEOMETRY: 61*4*0.16M            21   .09    .08    .02
      BULDING HEIGHT:          120M           22   .08    .07    .01
      +  GREATER THAN         0.010           23   .08    .07    .01
      -  LESS THAN           -0.010           24   .07    .06    .01
      0  BETWEEN    -0.010 & 0.010            25   .08    .07    .01
                                              26   .10    .08    .02
          I--------------------------I        27   .10    .07    .02
LEVEL  1  I +                      ++I        28   .09    .07    .02
LEVEL  2  I    0    0     +    +     I        29   .10    .07    .03
LEVEL  3  I++                      ++I        30   .09    .08    .01
          I                          I        31   .09    .09    .01
          I                          I        32   .10    .09    .01
          I                          I        33   .09    .08    .00
          I                          I        34   .10    .09    .01
LEVEL  4  I0   0          +        0 I        43   .03    .01    .02
          I                          I        44   .01    .01    .00
          I                          I        45   .09    .08    .01
LEVEL  5  I 0       +          0    0I        46   .02    .01    .01
          I                          I        47   .01    .01    .00
          I                          I        48   .10    .10    .00
LEVEL  6  I0   0          0        0 I        49   .01    .01    .00
          I                          I        50   .03    .01    .02
          I                          I        51   .10    .10    .00
LEVEL  7  I +       0          0    0I        52   .10    .10    .00
          I                          I        53   .10    .10   -.01
          I                          I        54   .10    .10    .00
          I                          I        55   .11    .10    .01
          I                          I        56   .11    .10    .01
LEVEL  8  I0   0          0        0 I        59   .11    .10    .01
          I                          I        60   .10    .10    .00
          I                          I        61   .10    .10    .00
LEVEL  9  I 0       0          0    0I        62   .11    .10    .00
          I                          I        63   .12    .12    .01
          I                          I        64   .11    .12   -.01
LEVEL 10  I0   0          0        0 I        65   .10    .10    .00
          I                          I        66   .10    .10    .01
          I                          I        67   .11    .10    .00
LEVEL 11  I 0       0          0    +I        68   .10    .10    00
          I                          I        69   .11    .10    .01
          I                          I        70   .10    .10    .01
          I                          I        71   .14*   .12    .01
          I                          I        72   .11    13*   -.01
LEVEL 12  I-   0          +        0 I        73   .09    .08    .01
          I                          I        74   .10    .08    .01
          I--------------------------I        75   .10    .09    .00

          NO. OF + = 14     NO. OF - = 1      NO. OF U = 32
          * -- THE MAXIMU OR MINIMUM VALUES
```

```
COMPARISION OF Cp RMS BETWEEN  THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *            TAP ROUGH  SMOOTH  DIFF

      AZIMUTH:                   15           19   .12    .07    .05*
      BALCONY NO.:               29           20   .10    .05    .05
      BALCONY GEOMETRY: 61*4*0.16M            21   .09    .05    .04
      BULDING HEIGHT:          120M           22   .08    .07    .02
      +  GREATER THAN         0.010           23   .08    .06    .01
      -  LESS THAN           -0.010           24   .08    .06    .02
      0  BETWEEN    -0.010 & 0.010            25   .08    .06    .01
                                              26   .09    .07    .02
          I--------------------------I        27   .11    .07    .04
LEVEL  1  I +                      ++I        28   .09    .06    .03
LEVEL  2  I    +    +     +    +     I        29   .08    .05    .03
LEVEL  3  I++                      ++I        30   .10    .08    .02
          I                          I        31   .10    .08    .02
          I                          I        32   .09    .08    .02
          I                          I        33   .07    .07    .01
          I                          I        34   .11    .10    .01
LEVEL  4  I+   +          +        0 I        43   .10    .09    .01
          I                          I        44   .09    .08    .01
          I                          I        45   .06    .06    .01
LEVEL  5  I +       +          +    0I        46   .11    .10    .01
          I                          I        47   .11    .10    .01
          I                          I        48   .09    .09    .00
LEVEL  6  I0   +          0        0 I        49   .09    .08    .01
          I                          I        50   .11    .11    .00
          I                          I        51   .11    .09    .02
LEVEL  7  I 0       +          +    0I        52   .10    .09    .01
          I                          I        53   .06    .07    .00
          I                          I        54   .10    .10    .00
          I                          I        55   .12    .11    .01
          I                          I        56   .11    .09    .01
LEVEL  8  I0   0          +        0 I        59   .09    .09    .01
          I                          I        60   .12    .11*   .00
          I                          I        61   .11    .09    .01
LEVEL  9  I 0       +          0    0I        62   .09    .09    .00
          I                          I        63   .07    .08    .00
          I                          I        64   .12*   .10    .02
LEVEL 10  I+   0          0        0 I        65   .11    .10    .01
          I                          I        66   .10    .09    .01
          I                          I        67   .09    .08    .01
LEVEL 11  I 0       +          +    0I        68   .11    .10    .01
          I                          I        69   .10    .09    .01
          I                          I        70   .09    .08    .01
          I                          I        71   .08    .08    .00
          I                          I        72   .12    .09    .03
LEVEL 12  I+   +          +        0 I        73   .10    .08    .02
          I                          I        74   .10    .08    .02
          I--------------------------I        75   .08    .07    .01

          NO. OF + = 28     NO. OF - = 0      NO. OF 0 = 19
          * -- THE MAXIMU OR MINIMUM VALUES
```

```
COMPARISION OF Cp RMS BETWEEN  THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *            TAP ROUGH  SMOOTH  DIFF

      AZIMUTH:                   30           19   .10    .07    .03*
      BALCONY NO.:               29           20   .08    .05    .03
      BALCONY GEOMETRY: 61*4*0.16M            21   .07    .05    .03
      BULDING HEIGHT:          120M           22   .08    .06    .01
      +  GREATER THAN         0.010           23   .06    .06    .00
      -  LESS THAN           -0.010           24   .07    .06    .01
      0  BETWEEN    -0.010 & 0.010            25   .06    .06    .01
                                              26   .09    .08    .02
          I--------------------------I        27   .10    .07    .03
LEVEL  1  I +                      ++I        28   .07    .05    .02
LEVEL  2  I    +    0     0    0     I        29   .06    .04    .02
LEVEL  3  I++                      ++I        30   .11    .09    .02
          I                          I        31   .09    .08    .01
          I                          I        32   .08    .07    .01
          I                          I        33   .06    .05    .00
          I                          I        34   .11    .10    .01
LEVEL  4  I+   +          0        0 I        43   .09    .08    .01
          I                          I        44   .08    .07    .01
          I                          I        45   .05    .05    .00
LEVEL  5  I +       +          0    0I        46   .11    .11    .00
          I                          I        47   .10    .09    .01
          I                          I        48   .08    .08    .01
LEVEL  6  I0   +          0        + I        49   .07    .06    .01
          I                          I        50   .11    .11    .01
          I                          I        51   .09    08     .01
LEVEL  7  I 0       0          0    0I        52   .08    .07    .01
          I                          I        53   .05    .05    00
          I                          I        54   .10    .11   -.01
          I                          I        55   .11    .09    .02
          I                          I        56   .09    .08    01
LEVEL  8  I-   +          0        0 I        59   .07    .06    .01
          I                          I        60   .12    .11    .01
          I                          I        61   .09    .08    .01
LEVEL  9  I 0       0          0    0I        62   .08    .07    .01
          I                          I        63   .06    .06    .00
          I                          I        64   .12*   .12*   .00
LEVEL 10  I0   +          0        0 I        65   .10    .09    .01
          I                          I        66   .08    .08    .01
          I                          I        67   .07    .06    .00
LEVEL 11  I 0       +          +    0I        68   .11    .10    .01
          I                          I        69   .09    .08    .01
          I                          I        70   .08    .06    .01
          I                          I        71   .07    .07    .00
          I                          I        72   .10    .09    .01
LEVEL 12  I+   +          0        0 I        73   .10    .08    .02
          I                          I        74   .08    .07    .01
          I--------------------------I        75   .06    .06    .00

          NO OF + = 20      NO. OF - = 1      NO. OF 0 = 26
          * -- THE MAXIMU OR MINIMUM VALUES
```

```
COMPARISION OF Cp RMS BETWEEN  THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *            TAP ROUGH  SMOOTH  DIFF

      AZIMUTH:                   45           19   .07    .05    .02
      BALCONY NO.:               29           20   .06    .04    .02
      BALCONY GEOMETRY: 61*4*0.16M            21   .07    .05    .02
      BULDING HEIGHT:          120M           22   .06    .05    .01
      +  GREATER THAN         0.010           23   .05    .05    .01
      -  LESS THAN           -0.010           24   .05    .05    .00
      0  BETWEEN    -0.010 & 0.010            25   .05    .04    .01
                                              26   .09    .08    .01
          I--------------------------I        27   .08    .06    .02
LEVEL  1  I +                      ++I        28   .05    .04    .01
LEVEL  2  I    +    0     0    0     I        29   .05    .04    .01
LEVEL  3  I++                      00I        30   .11    .09    .02
          I                          I        31   .07    .06    .01
          I                          I        32   .06    .05    .01
          I                          I        33   .04    .04    .00
          I                          I        34   .09    .09    .01
LEVEL  4  I+   0          0        0 I        43   .01    .06   -.05
          I                          I        44   .05    .05    .00
          I                          I        45   .04    .04    .00
LEVEL  5  I 0       -          0    0I        46   .02    .11   -.09*
          I                          I        47   .01    .07   -.07
          I                          I        48   .06    .06    .01
LEVEL  6  I-   -          0        - I        49   .04    .05   -.01
          I                          I        50   .01    .09   -.08
          I                          I        51   .07    .06    .01
LEVEL  7  I -       0          0    0I        52   .06    .05    .01
          I                          I        53   .05    .05    .00
          I                          I        54   .12    .12    .00
          I                          I        55   .09    .08    .01
          I                          I        56   .07    06     .01
LEVEL  8  I0   0          0        0 I        59   .05    .05    .01
          I                          I        60   .10    .09    .01
          I                          I        61   .07    .06    .01
LEVEL  9  I +       0          0    0I        62   .05    .05    .00
          I                          I        63   .06    .05    .01
          I                          I        64   .12*   .12*   .00
LEVEL 10  I0   0          0        0 I        65   .09    .08    .01
          I                          I        66   .06    .05    .00
          I                          I        67   .05    .05    .00
LEVEL 11  I +       +          0    0I        68   .11    .09    .02
          I                          I        69   .07    .06    .01
          I                          I        70   .05    .05    .01
          I                          I        71   .06    .06    .00
          I                          I        72   .11    .09    .01
LEVEL 12  I+   0          0        0 I        73   .07    .07    .00
          I                          I        74   .06    .06    .00
          I--------------------------I        75   .05    .05    .00

          NO. OF + = 11     NO. OF - = 5      NO. OF 0 = 11
          * -- THE MAXIMU OR MINIMUM VALUES
```

FIG. B.8 EFFECT OF 4m BALCONIES ON Cp RMS

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       60
BALCONY NO.:                   29
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:              120M
+  GREATER THAN             0.010
-  LESS THAN               -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I -                         00I
LEVEL  2  I     0     0     0     0     I
LEVEL  3  I+-                         00I
LEVEL  4  I+   -           0         0 I
LEVEL  5  I 0        +           +    0I
LEVEL  6  I+   +           0         + I
LEVEL  7  I +        +           0    0I
LEVEL  8  I0   0           0         0 I
LEVEL  9  I 0        0           0    0I
LEVEL 10  I+   -           0         0 I
LEVEL 11  I +        0           0    0I
LEVEL 12  I+   0           0         0 I
          I-----------------------------I

NO. OF + = 12      NO. OF - =  4      NO. OF 0 = 31
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.10	.16	-.06
20	.04	.04	.00
21	.05	.05	.00
22	.04	.04	.00
23	.04	.04	.00
24	.04	.04	.00
25	.04	.04	.00
26	.11	.09	.02
27	.15	.19	-.04
28	.04	.C1	.00
29	.05	.05	.00
30	.11	.09	.01
31	.07	.08	-.01
32	.04	.04	.00
33	.04	.04	.00
34	.15	.15	.00
43	.05	.01	.05
44	.04	.01	.03
45	.04	.04	.00
46	.13	.01	.12
47	.12	.01	.11
48	.04	.04	.01
49	.04	.01	.03
50	.17	.01	.16*
51	.05	.04	.01
52	.05	.04	.01
53	.05	.04	.00
54	.14	.14	.01
55	.13	.13	.00
56	.05	.04	.00
59	.05	.04	.00
60	.20	.20*	.00
61	.05	.05	.00
62	.04	.04	.00
63	.05	.05	.00
64	.16	.13	.03
65	.12	.14	-.01
66	.04	.04	.00
67	.05	.05	.00
68	.20*	.17	.03
69	.06	.06	.00
70	.04	.04	.00
71	.06	.06	.00
72	.18	.12	.07
73	.12	.11	.01
74	.04	.05	.00
75	.05	.05	.00

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       75
BALCONY NO.:                   29
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:              120M
+  GREATER THAN             0.010
-  LESS THAN               -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I -                         +0I
LEVEL  2  I     +     -     -     0     I
LEVEL  3  I--                         +0I
LEVEL  4  I0   -           +         + I
LEVEL  5  I 0        +           +    +I
LEVEL  6  I+   +           +         + I
LEVEL  7  I +        -           +    0I
LEVEL  8  I0   -     -     +         + I
LEVEL  9  I -        -           +    0I
LEVEL 10  I-   -           +         + I
LEVEL 11  I +        -           +    +I
LEVEL 12  I-   -           +         + I
          I-----------------------------I

NO. OF + = 23      NO OF - = 16      NO OF 0 = 8
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.10	.12	-.02
20	.07	.06	.01
21	.07	.06	.01
22	.13	.12	.01
23	.10	.17	-.07
24	.07	.10	-.03
25	.07	.06	.00
26	.09	.11	-.02
27	.10	.11	-.01
28	.08	.06	.02
29	.06	.06	.01
30	.09	.09	.00
31	.10	.12	-.02
32	.20	.18	.02
33	.08	.07	.01
34	.09	.09	.00
43	.19	.01	.18*
44	.15	.01	.14
45	.07	.06	.01
46	.10	.01	.09
47	.12	.01	.11
48	.22	.20	.02
49	.12	.01	.11
50	.11	.01	.10
51	.19	.21	-.02
52	.16	.14	.01
53	.08	.07	.01
54	.12	.12	.00
55	.14	.16	-.02
56	.23*	.21	.01
59	.12	.10	.03
60	.12	.15	-.02
61	.20	.23	-.03
62	.16	.13	.03
63	.09	.08	.01
64	.12	.16	-.04
65	.15	.19	-.04
66	.20	.17	.03
67	.12	.10	.02
68	.14	.16	-.02
69	.20	.26*	-.06
70	.14	.10	.04
71	.09	.07	.02
72	.12	.17	-.06
73	.14	.24	-.10
74	.16	.11	.05
75	.09	.07	.02

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                       90
BALCONY NO.:                   29
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:              120M
+  GREATER THAN             0.010
-  LESS THAN               -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I +                         ++I
LEVEL  2  I     0     -     0     +     I
LEVEL  3  I00                         +0I
LEVEL  4  I0   0           -         0 I
LEVEL  5  I 0        0           0    0I
LEVEL  6  I0   0           -         + I
LEVEL  7  I 0        -           0    0I
LEVEL  8  I0   -           0         0 I
LEVEL  9  I 0        -           0    0I
LEVEL 10  I-   -           0         + I
LEVEL 11  I -        -           0    +I
LEVEL 12  I-   -           +         + I
          I-----------------------------I

NO. OF + = 10      NO. OF - = 12      NO. OF 0 = 25
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.13	.11	.01
20	.22	.18	.04
21	.29	.23	.05
22	.11	.12	-.01
23	.13	.14	-.01
24	.17	.17	.01
25	.20	.18	.02
26	.11	.11	.00
27	.12	.11	.01
28	.19	.18	.01
29	.22	.23	-.01
30	.11	.11	.00
31	.12	.13	-.01
32	.15	.17	-.01
33	.21	.20	101
34	.12	.12	.00
43	.14	.14	-.01
44	.17	.17	-.00
45	.26	.26	.00
46	.12	.12	.00
47	.13	.13	-.01
48	.17	.18	-.01
49	.25	.24	.01
50	.13	.14	.00
51	.15	.17	-.02
52	.20	.20	.00
53	.29	.30*	- 01
54	.14	.14	.00
55	.14	.15	-.01
56	.19	.20	-.01
59	.27	.26	01
60	.15	.15	.00
61	.16	.19	- 03
62	.19	.20	-.01
63	.29*	.29	.00
64	.15	.16	-.02
65	.15	.19	- 03
66	.19	.20	-.01
67	.27	.22	.05
68	.17	.20	-.02
69	.18	.22	-.04
70	.18	.18	.00
71	.26	.20	.06
72	17	.22	-.06
73	.16	.23	-.07*
74	.19	.17	.03
75	.20	.16	.04

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      105
BALCONY NO.:                   29
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:              120M
+  GREATER THAN             0.010
-  LESS THAN               -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I 0                         ++I
LEVEL  2  I     0     0     0     0     I
LEVEL  3  I00                         00I
LEVEL  4  I0   0           0         0 I
LEVEL  5  I 0        0           0    0I
LEVEL  6  I0   0           0         - I
LEVEL  7  I 0        0           0    -I
LEVEL  8  I0   0           -         - I
LEVEL  9  I 0        -           -    -I
LEVEL 10  I0   0           -         - I
LEVEL 11  I 0        -           0    -I
LEVEL 12  I-   -           -         - I
          I-----------------------------I

NO. OF + =  2      NO. OF - = 15      NO. OF 0 = 30
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.05	.00
20	.13	.10	.03
21	.17	.15	.02
22	.06	.06	.00
23	.07	.06	.01
24	.08	.07	.01
25	.09	.08	.01
26	.05	.05	.00
27	.06	.05	.00
28	.11	.11	.00
29	.13	.13	.00
30	.05	.05	.00
31	.06	.05	.00
32	.06	.06	.00
33	.10	.10	-.01
34	.06	.06	.00
43	.06	.06	.00
44	.07	.07	.00
45	.12	.12	.00
46	.06	.06	.00
47	.06	.06	.00
48	.06	.07	-.01
49	.11	.13	-.02
50	.07	.07	.00
51	.07	.07	.00
52	.09	.09	.00
53	.14	.16	-.02
54	.08	.07	.00
55	.08	.08	.00
56	.08	.10	-.02
59	.15	.17	-.02
60	.08	.08	.00
61	.08	.09	-.01
62	.11	.13	-.02
63	.18	.22	-.03
64	.09	.09	-.01
65	.09	.09	-.01
66	.09	.10	-.02
67	.18	.20	-.02
68	.09	.09	.00
69	.09	.12	-.03
70	.14	.13	.01
71	.19	.26*	-.07*
72	.09	.11	-.01
73	.09	.11	-.02
74	.11	.13	-.02
75	.20*	.23	-.04

FIG. B.8 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                        120
BALCONY NO.:                     29
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:                120M
+  GREATER THAN               0.010
-  LESS THAN                 -0.010
0  BETWEEN         -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                       00I
LEVEL  2  I    0     0     0     0    I
LEVEL  3  I00                       00I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  4  I0   0          0         0 I
          I                           I
          I                           I
LEVEL  5  I 0      0           0    0I
          I                           I
          I                           I
LEVEL  6  I0   0          0         - I
          I                           I
          I                           I
LEVEL  7  I 0      0           0    0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  8  I0   0          0         - I
          I                           I
          I                           I
LEVEL  9  I 0      0           -    -I
          I                           I
          I                           I
LEVEL 10  I0   0          0         - I
          I                           I
          I                           I
LEVEL 11  I 0      0           -    -I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL 12  I0   0          0         - I
          I                           I
          I---------------------------I

NO. OF + = 0      NO. OF - = 8      NO. OF 0 = 39
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.05	.05	.00
20	.08	.07	.01
21	.09	.09	.01
22	.05	.05	.00
23	.05	.05	.00
24	.05	.05	.00
25	.06	.06	.00
26	.05	.05	.00
27	.06	.05	.00
28	.07	.07	.00
29	.07	.08	-.01
30	.05	.05	.00
31	.05	.05	.00
32	.05	.05	.00
33	.06	.06	.00
34	.06	.05	.01
43	.05	.05	.00
44	.05	.06	-.01
45	.08	.08	-.01
46	.05	.05	.00
47	.05	.05	.00
48	.05	.05	.00
49	.07	.08	-.01
50	.06	.05	.01
51	.05	.05	.00
52	.06	.07	-.01
53	.10	.11	.00
54	.06	.06	.00
55	.06	.06	.00
56	.06	.06	.00
59	.09	.12	-,02
60	.07	.07	.00
61	.06	.06	.00
62	.07	.08	-.02
63	.13	.15	-.02
64	.07	.07	.00
65	.07	.07	.00
66	.07	.06	.01
67	.12	.14	-.03*
68	.08	.08	.00
69	.08	.08	.00
70	.09	.10	-.01
71	.14*	.16*	-.02
72	.09	.08	.00
73	.09	.08	.00
74	.06	.08	.00
75	.14	.16	-.02

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                        135
BALCONY NO.:                     29
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:                120M
+  GREATER THAN               0.010
-  LESS THAN                 -0.010
0  BETWEEN         -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                       0+I
LEVEL  2  I    0     0     +     +    I
LEVEL  3  I0+                       00I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  4  I0   0          0         0 I
          I                           I
          I                           I
LEVEL  5  I 0      0           0    0I
          I                           I
          I                           I
LEVEL  6  I0   0          0         0 I
          I                           I
          I                           I
LEVEL  7  I 0      0           0    0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  8  I0   0          0         0 I
          I                           I
          I                           I
LEVEL  9  I 0      0           0    0I
          I                           I
          I                           I
LEVEL 10  I0   0          0         0 I
          I                           I
          I                           I
LEVEL 11  I 0      0           0    0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL 12  I0   0          0         0 I
          I                           I
          I---------------------------I

NO. OF + = 4      NO. OF - = 0      NO. OF 0 = 4J
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.05	.01
20	.07	.06	.00
21	.07	.06	.01
22	.05	.05	.00
23	.06	.05	.01
24	.07	.06	.01
25	.08	.06	.02*
26	.05	.05	.00
27	.06	.05	.01
28	.06	.06	.00
29	.06	.06	.00
30	.05	.05	.00
31	.05	.04	.00
32	.05	.05	.00
33	.06	.06	.00
34	.04	.05	.01
43	.05	.05	.00
44	.05	.06	.00
45	.07	.08	-.01
46	.05	.05	.00
47	.05	.05	.00
48	.05	.05	.00
49	.07	.07	.00
50	.06	.05	.01
51	.05	.05	.01
52	.06	.06	.00
53	.09	.10	-.00
54	.05	.05	.00
55	.06	.05	.00
56	.05	.05	.00
59	.08	.08	.00
60	.06	.06	.00
61	.05	.05	.00
62	.06	.06	.00
63	.12*	.12	.00
64	.06	.06	-.01
65	.06	.06	.00
66	.06	.06	.00
67	.09	.08	.00
68	.07	.07	.00
69	.06	.06	.00
70	.07	.07	.00
71	.12	.13*	-.01
72	.07	.07	.00
73	.07	.07	.00
74	.06	.06	00
75	.09	.10	.00

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                        150
BALCONY NO.:                     29
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:                120M
+  GREATER THAN               0.010
-  LESS THAN                 -0.010
0  BETWEEN         -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                       +0I
LEVEL  2  I    0     0     0     0    I
LEVEL  3  I00                       00I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  4  I0   0          0         0 I
          I                           I
          I                           I
LEVEL  5  I 0      0           0    0I
          I                           I
          I                           I
LEVEL  6  I+   +          0         0 I
          I                           I
          I                           I
LEVEL  7  I +      0           0    0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  8  I0   0          0         0 I
          I                           I
          I                           I
LEVEL  9  I 0      0           0    0I
          I                           I
          I                           I
LEVEL 10  I0   0          0         0 I
          I                           I
          I                           I
LEVEL 11  I 0      0           0    0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL 12  I0   0          0         0 I
          I                           I
          I---------------------------I

NO. OF + = 4      NO. OF - = 0      NO. OF 0 = 43
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.06	.00
20	.06	.05	.01
21	.07	.07	.00
22	.06	.06	.00
23	.06	.06	.00
24	.06	.05	.00
25	.06	.05	.00
26	.05	.05	.00
27	.06	.05	.01
28	.05	.05	.00
29	.06	.06	.00
30	.05	.05	.00
31	.05	.05	.00
32	.05	.05	.00
33	.05	.05	.00
34	.05	.05	.00
43	.01	.01	.00
44	.06	.05	.01
45	.06	.06	.01
46	.05	.01	.04
47	.03	.01	.02
48	.05	.05	.00
49	.06	.05	.01
50	.05	.01	.04*
51	.05	.05	.00
52	.06	.06	.00
53	.08	.07	.01
54	.05	.05	.00
55	.05	.05	.00
56	.06	.05	.00
59	.07	.08	-.01
60	.06	.05	.00
61	.06	.05	.00
62	.07	.06	.01
63	.09	.09	.00
64	.06	.06	.00
65	.06	.06	.00
66	.05	.06	.00
67	.08	.08	.00
68	.06	.06	.00
69	.06	.06	.00
70	.07	.06	.01
71	.10*	.10*	.00
72	.07	.07	.00
73	.06	.06	.00
74	.07	.07	.00
75	.09	.09	.00

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                        165
BALCONY NO.:                     29
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:                120M
+  GREATER THAN               0.010
-  LESS THAN                 -0.010
0  BETWEEN         -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                       00I
LEVEL  2  I    0     0     0     0    I
LEVEL  3  I00                       00I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  4  I0   0          0         0 I
          I                           I
          I                           I
LEVEL  5  I +      0           +    0I
          I                           I
          I                           I
LEVEL  6  I+   0          0         + I
          I                           I
          I                           I
LEVEL  7  I +      0           0    0I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL  8  I0   0          0         0 I
          I                           I
          I                           I
LEVEL  9  I 0      0           0    0I
          I                           I
          I                           I
LEVEL 10  I0   0          0         0 I
          I                           I
          I                           I
LEVEL 11  I 0      -           0    -I
          I                           I
          I                           I
          I                           I
          I                           I
LEVEL 12  I0   0          0         0 I
          I                           I
          I---------------------------I

NO. OF + = 5      NO. OF - = 2      NO. OF U = 40
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.06	.00
20	.08	.08	-.01
21	.10	.10	.01
22	.06	.06	.00
23	.06	.06	.00
24	.07	.06	.01
25	.08	.07	.00
26	.06	.06	-.01
27	.06	.06	.00
28	.07	.07	.00
29	.08	.08	.00
30	.06	.06	.00
31	.06	.05	.00
32	.06	.06	.00
33	.06	.06	.00
34	.07	.06	.01
43	.01	.01	.00
44	.06	.01	.05
45	.08	.07	[illegible]
46	.06	.01	[illegible]
47	.01	.01	.00
48	.06	.06	.00
49	.06	.01	.06*
50	.06	.01	.05
51	.06	.06	.00
52	.07	.07	.00
53	.08	.09	-.01
54	.07	.07	-.01
55	.06	.06	.00
56	.06	.06	.00
59	.08	.08	-.01
60	.07	.07	.00
61	.06	.06	.00
62	.07	.07	.00
63	.10	.11	.00
64	.07	.07	.00
65	.06	.07	.00
66	.0u	.07	-.01
67	.08	.09	-.01
68	.07	.08	-.01
69	.07	.08	-.02
70	.08	.07	.00
71	.11*	.12*	-.01
72	.08	.08	.00
73	.07	.08	.00
74	.08	.08	.00
75	.10	.11	-.01

FIG. B.8 CONTINUED

```
COMPARISION OF Cp RMS BETWEEN  THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *              TAP ROUGH  SMOOTH  DIFF

    AZIMUTH:                  180               19   .13    .13    .00
    BALCONY NO.:               29               20   .13    .13    .00
    BALCONY GEOMETRY: 61*4*0.16M                21   .15    .16   -.01
    BULDING HEIGHT:           120M              22   .12    .11    .01
    +  GREATER THAN          0.010              23   .11    .10    .01
    -  LESS THAN            -0.010              24   .11    .11    .00
    0  BETWEEN     -0.010 & 0.010               25   .12    .11    .01
                                                26   .14    .15   -.01
           I--------------------------I         27   .13    .12    .00
LEVEL  1   I 0                      00I         28   .12    .13    .00
LEVEL  2   I    0    0    0    0      I         29   .14    .15   -.01
LEVEL  3   I00                      00I         30   .16    .15    .01
           I                          I         31   .11    .10    .01
           I                          I         32   .10    .10    .00
           I                          I         33   .12    .11    .01
           I                          I         34   .13    .12    .01
LEVEL  4   I+   0         0         0 I         43   .09    .08    .01
           I                          I         44   .10    .10    .01
           I                          I         45   .16    .14    .01
LEVEL  5   I +       +         0     +I         46   .19    .16    .03*
           I                          I         47   .10    .10    .00
           I                          I         48   .08    .08    .00
LEVEL  6   I+   0         0         0 I         49   .12    .12    .01
           I                          I         50   .15    .13    .02
           I                          I         51   .08    .08    .00
LEVEL  7   I +       0         0    0I          52   .10    .10    .00
           I                          I         53   .17    .17    .01
           I                          I         54   .19*   .17    .02
           I                          I         55   .11    .10    .01
           I                          I         56   .08    .08    .00
LEVEL  8   I+   +         0         0 I         59   .14    .13    .01
           I                          I         60   .14    .13    .01
           I                          I         61   .08    .03    .00
LEVEL  9   I +       0         0    0I          62   .11    .10    .00
           I                          I         63   .18    .18*   .00
           I                          I         64   .18    .16    .02
LEVEL 10   I+   0         0         0 I         65   .12    .11    .01
           I                          I         66   .08    .08    .00
           I                          I         67   .13    .12    .00
LEVEL 11   I 0       0         0    0I          68   .13    .12    .01
           I                          I         69   .09    .09    .00
           I                          I         70   .10    .10    .00
           I                          I         71   .15    .14    .01
           I                          I         72   .13    .13    .00
LEVEL 12   I0   0         0         0 I         73   .10    .11   -.01
           I                          I         74   .09    .09    .00
           I--------------------------I         75   .13    .12    .01

           NO. OF + = 10      NO. OF - =  0      NO. OF 0 = 37
           * -- THE MAXIMU OR MINIMUM VALUES
```

FIG. B.8 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    0
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 6*4*0.16
BULDING HEIGHT:          120M
+  GREATER THAN         0.010
-  LESS THAN           -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I +                         ++I
LEVEL  2  I     +      +      +      +  I
LEVEL  3  I++                         ++I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL  4  I0    +             +        +I
          I                             I
          I                             I
LEVEL  5  I 0          0             + 0I
          I                             I
          I                             I
LEVEL  6  I0    0             +        +I
          I                             I
          I                             I
LEVEL  7  I 0          0             0 0I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL  8  I0    0             +       0 I
          I                             I
          I                             I
LEVEL  9  I 0          0             0 -I
          I                             I
          I                             I
LEVEL 10  I-    +             +       0 I
          I                             I
          I                             I
LEVEL 11  I 0          0             0 0I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL 12  I-    +             +       0 I
          I                             I
          I-----------------------------I

NO. OF + : 22      NO OF - : 3      NO. OF 0 : 22
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.12	.07	.05
20	.13*	.07	.06
21	.11	.08	.03
22	.09	.07	.02
23	.09	.07	.02
24	.09	.06	.03
25	.09	.07	.03
26	.10	.08	.03
27	.09	.07	.02
28	.10	.07	.03
29	.12	.07	.05
30	.09	.08	.01
31	.10	.09	.02
32	.11	.09	.02
33	.10	.08	.02
34	.10	.09	.01
43	.01	.01	.00
44	.10	.01	.09*
45	.09	.08	.00
46	.01	.01	.00
47	.01	.01	.00
48	.11	.10	.02
49	.10	.01	.09
50	.01	.01	.00
51	.10	.10	.01
52	.11	.10	.01
53	.10	.10	.00
54	.11	.10	.01
55	.11	.10	.01
56	.11	.10	.01
59	.11	.10	.01
60	.10	.10	.00
61	.10	.10	.00
62	.11	.10	.00
63	.11	.12	-.01
64	.10	.12	-.02
65	.11	.10	.01
66	.11	.10	.02
67	.11	.10	.01
68	.09	.10	-.01
69	.10	.10	.00
70	.10	.10	.00
71	.12	.12	-.01
72	.09	.13*	-.03
73	.10	.08	.02
74	.10	.08	.02
75	.09	.09	.00

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                   15
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 6*4*0.16
BULDING HEIGHT:          120M
+  GREATER THAN         0.010
-  LESS THAN           -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I +                         ++I
LEVEL  2  I     +      +      +      +  I
LEVEL  3  I++                         ++I
          I                             I
          I                             I
          I                   +         I
          I                             I
LEVEL  4  I+    +             +        +I
          I                             I
          I                             I
LEVEL  5  I 0          +             + 0I
          I                             I
          I                             I
LEVEL  6  I0    +             +        +I
          I                             I
          I                             I
LEVEL  7  I 0          +             + 0I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL  8  I0    +             +       0 I
          I                             I
          I                             I
LEVEL  9  I 0          0             0 0I
          I                             I
          I                             I
LEVEL 10  I0    +             +        +I
          I                             I
          I            +                I
LEVEL 11  I 0          +             0 0I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL 12  I0    +             +       0 I
          I                             I
          I-----------------------------I

NO. OF + : 30      NO. OF - : 0      NO. OF 0 : 17
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.12*	.07	.06*
20	.11	.05	.06
21	.09	.05	.04
22	.09	.07	.03
23	.09	.06	.03
24	.09	.06	.03
25	.09	.06	.03
26	.10	.07	.02
27	.10	.07	.03
28	.10	.06	.04
29	.08	.05	.03
30	.10	.08	.02
31	.11	.08	.03
32	.11	.08	.03
33	.09	.07	.02
34	.11	.10	.01
43	.11	.09	.02
44	.10	.08	.02
45	.06	.06	.00
46	.10	.10	.00
47	.12	.10	.02
48	.11	.09	.02
49	.10	.08	.02
50	.11	.11	.00
51	.11	.09	.02
52	.10	.09	.01
53	.07	.07	.00
54	.11	.10	.01
55	.12	.11	.01
56	.11	.09	.01
59	.09	.09	.01
60	.11	.11*	.00
61	.10	.09	.01
62	.10	.09	.01
63	.07	.08	-.01
64	.10	.10	.00
65	.12	.10	.01
66	.10	.09	.01
67	.09	.08	.01
68	.10	.10	.00
69	.10	.09	.01
70	.09	.08	.01
71	.07	.08	-.01
72	.09	.09	.00
73	.10	.08	.02
74	.09	.08	.02
75	.08	.07	.01

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                   30
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 6*4*0.16
BULDING HEIGHT:          120M
+  GREATER THAN         0.010
-  LESS THAN           -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I +                         ++I
LEVEL  2  I     +      +      +      +  I
LEVEL  3  I++                         ++I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL  4  I0    +             +        +I
          I                             I
          I                             I
LEVEL  5  I +          +             + 0I
          I                             I
          I                             I
LEVEL  6  I0    +             +        +I
          I                             I
          I                             I
LEVEL  7  I 0          +             + 0I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL  8  I0    +             0        +I
          I                             I
          I                             I
LEVEL  9  I 0          0             0 0I
          I                             I
          I                             I
LEVEL 10  I0    +             +        +I
          I                             I
          I                             I
LEVEL 11  I 0          0             0 0I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL 12  I0    +             0       0 I
          I                             I
          I-----------------------------I

NO. OF + : 28      NO. OF - : 0      NO. OF 0 : 19
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.12*	.07	.05*
20	.10	.05	.05
21	.08	.05	.03
22	.09	.06	.02
23	.08	.06	.02
24	.08	.06	.02
25	.08	.06	.02
26	.12	.08	.05
27	.10	.07	.03
28	.08	.05	.03
29	.06	.04	.02
30	.09	.09	.00
31	.10	.08	.02
32	.10	.07	.02
33	.07	.05	.02
34	.11	.10	.01
43	.10	.08	.02
44	.08	.07	.02
45	.05	.05	.01
46	.10	.11	.00
47	.11	.09	.02
48	.09	.08	.02
49	[illegible]	.06	.03
50	.11	.11	.01
51	.10	.08	.02
52	.08	.07	.01
53	.06	.05	.01
54	.10	.11	-.01
55	.11	.09	.02
56	.09	.08	.01
59	.08	.06	.02
60	.11	.11	.00
61	.09	.08	.01
62	.08	.07	.01
63	.06	.06	.00
64	.11	.12*	.00
65	.11	.09	.02
66	.09	.08	.01
67	.08	.06	.01
68	.10	.10	.00
69	.09	.08	.01
70	.07	.06	.01
71	.06	.07	.00
72	.10	.09	.00
73	.10	.08	.02
74	.08	.07	.01
75	.07	.06	.01

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

```
AZIMUTH:                   45
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 6*4*0.16
BULDING HEIGHT:          120M
+  GREATER THAN         0.010
-  LESS THAN           -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I +                         ++I
LEVEL  2  I     +      +      +      +  I
LEVEL  3  I++                         ++I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL  4  I+    +             +        +I
          I                             I
          I                             I
LEVEL  5  I +          +             + 0I
          I                             I
          I                             I
LEVEL  6  I+    +             +        +I
          I                             I
          I                             I
LEVEL  7  I +          +             + 0I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL  8  I+    +             +        +I
          I                             I
          I                             I
LEVEL  9  I +          +             0 0I
          I                             I
          I                             I
LEVEL 10  I0    +             +        +I
          I                             I
          I                             I
LEVEL 11  I +          +             0 0I
          I                             I
          I                             I
          I                             I
          I                             I
LEVEL 12  I+    +             0       0 I
          I                             I
          I-----------------------------I

NO. OF + : 38      NO. OF - : 0      NO. OF 0 : 9
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.10	.05	.05*
20	.07	.04	.02
21	.06	.05	.02
22	.07	.05	.02
23	.06	.05	.01
24	.07	.05	.02
25	.06	.04	.02
26	.12	.08	.04
27	.10	.06	.04
28	.06	.04	.02
29	.05	.04	.01
30	.14*	.09	.05
31	.08	.06	.02
32	.07	.05	.02
33	.06	.04	.02
34	.11	.09	.03
43	.08	.06	.02
44	.06	.05	.01
45	.05	.04	.01
46	.13	.11	.02
47	.09	.07	.02
48	.07	.06	.01
49	.06	.05	.02
50	.11	.09	.02
51	.08	.06	.02
52	.06	.05	.01
53	.05	.05	.01
54	.13	.12	.01
55	.09	.08	.02
56	.07	.06	.01
59	.06	.05	.02
60	.11	.09	.02
61	.08	.06	.01
62	.06	.05	.01
63	.05	.05	.00
64	.12	.12*	.00
65	.09	.08	.01
66	.07	.05	.01
67	.06	.05	.01
68	.10	.09	.01
69	.08	.06	.01
70	.05	.05	.01
71	.06	.06	.00
72	.11	.09	.01
73	.08	.07	.01
74	.06	.06	.01
75	.05	.05	.01

FIG. B.9 EFFECT OF 4m BALCONIES WITH 1m WALLS ON Cp RMS

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH. DATA MINUS SMOOTH DATA *

AZIMUTH: 60
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61*4*0.16
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I----------------------------I
LEVEL  1  I -                        +0I
LEVEL  2  I    +     +      0     0    I
LEVEL  3  I+-                        +0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I+   +            +        + I
          I                            I
          I                            I
LEVEL  5  I 0        +            +  0I
          I                            I
          I                            I
LEVEL  6  I+   +            +        + I
          I                            I
          I                            I
LEVEL  7  I +        +            0  0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0   0            +        0 I
          I                            I
          I                            I
LEVEL  9  I -        +            0  0I
          I                            I
          I                            I
LEVEL 10  I+   -            0        0 I
          I                            I
          I                            I
LEVEL 11  I 0        0            0  0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I+   0            0        0 I
          I                            I
          I----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.12	.16	-.04
20	.05	.04	.01
21	.05	.05	.00
22	.07	.04	.02
23	.05	.04	.01
24	.05	.04	.01
25	.05	.04	.01
26	.23*	.09	.14
27	.11	.19	-.08
28	.05	.04	.01
29	.05	.05	.00
30	.13	.09	.04
31	.11	.08	.03
32	.05	.04	.01
33	.05	.04	.01
34	.14	.15	-.01
43	.06	.01	.06
44	.05	.01	.04
45	.04	.04	.00
46	.13	.01	.13
47	.14	.01	.13
48	.05	.04	.01
49	.06	.01	.05
50	.15	.01	.15*
51	.06	.04	.02
52	.05	.04	.01
53	.05	.04	.00
54	.14	.14	.01
55	.13	.13	.00
56	.05	.04	.01
59	.05	.04	.01
60	.17	.20*	-.03
61	.07	.05	.02
62	.04	.04	.00
63	.05	.05	.00
64	.16	.13	.04
65	.13	.14	-.01
66	.05	.04	.01
67	.05	.05	.01
68	.18	.17	.00
69	.06	.06	.01
70	.04	.04	.00
71	.05	.06	.00
72	.15	.12	.03
73	.10	.11	-.01
74	.05	.05	.00
75	.05	.05	.00

NO. OF + = 21 NO. OF - = 4 NO. OF 0 = 22
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 75
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61*4*0.16
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I----------------------------I
LEVEL  1  I 0                        ++I
LEVEL  2  I    +     -      -     +    I
LEVEL  3  I+0                        +0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0   -            -        + I
          I                            I
          I                            I
LEVEL  5  I 0        0            +  +I
          I                            I
          I                            I
LEVEL  6  I+   0            -        + I
          I                            I
          I                            I
LEVEL  7  I +        -            +  0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I+   -            -        + I
          I                            I
          I                            I
LEVEL  9  I -        -            +  +I
          I                            I
          I                            I
LEVEL 10  I-   -            0        + I
          I                            I
          I                            I
LEVEL 11  I -        -            +  +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I-   -            +        + I
          I                            I
          I----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.12	.12	.00
20	.10	.06	.04
21	.07	.06	.01
22	.14	.12	.02
23	.08	.17	-.09
24	.08	.10	-.02
25	.09	.06	.02
26	.16	.11	.05
27	.11	.11	.00
28	.10	.06	.04
29	.06	.06	.01
30	.08	.09	.00
31	.10	.12	-.01
32	.16	.18	-.01
33	.11	.07	.04
34	.10	.09	.01
43	.01	.01	.00
44	.15	.01	.14*
45	.07	.06	.01
46	.09	.01	.09
47	.01	.01	.00
48	.17	.20	-.02
49	.13	.01	.13
50	.09	.01	.08
51	.15	.21	-.06
52	.16	.14	.02
53	.08	.07	.01
54	.11	.12	-.02
55	.13	.16	-.04
56	.18*	.21	-.03
59	.14	.10	.04
60	.12	.15	-.02
61	.16	.23	-.07
62	.16	.13	.03
63	.10	.08	.02
64	.13	.16	-.03
65	.14	.19	-.06
66	.18	.17	.00
67	.14	.10	.04
68	.12	.16	-.04
69	.17	.26*	-.09
70	.14	.10	.04
71	.09	.07	.02
72	.13	.17	-.04
73	.14	.24	-.09
74	.14	.11	.03
75	.10	.07	.03

NO. OF + = 21 NO. OF - = 17 NO. OF 0 = 9
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 90
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61*4*0.16
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I----------------------------I
LEVEL  1  I 0                        ++I
LEVEL  2  I    -     -      0     0    I
LEVEL  3  I+0                        +0I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0   -            -        0 I
          I                            I
          I                            I
LEVEL  5  I 0        -            +  - I
          I                            I
          I                            I
LEVEL  6  I0   -            -        - I
          I                            I
          I                            I
LEVEL  7  I -        -            -  -I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0   -            -        - I
          I                            I
          I                            I
LEVEL  9  I 0        -            -  -I
          I                            I
          I                            I
LEVEL 10  I0   -            0        0 I
          I                            I
          I                            I
LEVEL 11  I -        -            0  +I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I-   -            +        + I
          I                            I
          I----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.12	.11	.01
20	.22	.18	.04
21	.26	.23	.03
22	.10	.12	-.02
23	.12	.14	-.02
24	.17	.17	.00
25	.19	.18	.01
26	.13	.11	.02
27	.11	.11	.00
28	.20	.18	.01
29	.22	.23	-.01
30	.11	.11	.00
31	.11	.13	-.02
32	.14	.17	-.03
33	.20	.20	.00
34	.11	.12	.00
43	.01	.14	-.14*
44	.16	.17	-.02
45	.23	.26	-.03
46	.12	.12	.00
47	.01	.13	-.13
48	.15	.18	-.03
49	.22	.24	-.02
50	.12	.14	-.01
51	.14	.17	-.02
52	.18	.20	-.01
53	.26	.30*	-.04
54	.14	.14	.00
55	.14	.15	-.01
56	.17	.20	-.03
59	.23	.26	-.02
60	.15	.15	.01
61	.16	.19	-.03
62	.19	.20	-.01
63	.27*	.29	-.03
64	.17	.16	.00
65	.15	.19	-.03
66	.19	.20	.00
67	.23	.22	.01
68	.17	.20	-.02
69	.17	.22	-.05
70	.18	.18	.00
71	.24	.20	.03
72	.17	.22	-.05
73	.17	.23	-.06
74	.19	.17	.02
75	.17	.16	.01

NO. OF + = 7 NO. OF - = 25 NO. OF 0 = 15
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 105
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61*4*0.16
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I----------------------------I
LEVEL  1  I +                        ++I
LEVEL  2  I    0     0      0     +    I
LEVEL  3  I00                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I0   0            0        0 I
          I                            I
          I                            I
LEVEL  5  I 0        0            0  -I
          I                            I
          I                            I
LEVEL  6  I0   0            0        - I
          I                            I
          I                            I
LEVEL  7  I 0        0            0  -I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I0   0            -        - I
          I                            I
          I                            I
LEVEL  9  I 0        -            -  -I
          I                            I
          I                            I
LEVEL 10  I+   0            -        - I
          I                            I
          I                            I
LEVEL 11  I 0        -            0  -I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I0   -            -        - I
          I                            I
          I----------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.07	.05	.01
20	.13	.10	.03
21	.16	.15	.01
22	.06	.06	.00
23	.07	.06	.01
24	.08	.07	.01
25	.10	.08	.02
26	.06	.05	.01
27	.06	.05	.01
28	.11	.11	.00
29	.13	.13	-.01
30	.06	.05	.00
31	.05	.05	.00
32	.06	.06	.00
33	.10	.10	-.01
34	.07	.06	.01
43	.06	.06	.00
44	.07	.07	.00
45	.11	.12	-.02
46	.07	.06	.01
47	.06	.06	.00
48	.06	.07	-.01
49	.11	.13	-.02
50	.08	.07	.01
51	.07	.07	.00
52	.09	.09	-.01
53	.14	.16	-.02
54	.08	.07	.01
55	.08	.08	.00
56	.08	.10	-.02
59	.13	.17	-.04
60	.09	.08	.01
61	.08	.09	-.01
62	.11	.13	-.02
63	.17	.22	-.05
64	.10	.09	.01
65	.09	.09	-.01
66	.09	.10	-.02
67	.16	.20	-.04
68	.09	.09	.00
69	.10	.12	-.02
70	.13	.13	.00
71	.18	.26*	-.08*
72	.11	.11	.00
73	.09	.11	-.02
74	.12	.13	-.01
75	.18*	.23	-.05

NO. OF + = 5 NO. OF - = 15 NO. OF 0 = 27
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.9 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 120
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61*4*0.16
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I------------------------------I
LEVEL  1  I +                          00I
LEVEL  2  I    0     0      0      0     I
LEVEL  3  I00                          00I
LEVEL  4  I0   0            0         0 I
LEVEL  5  I 0        -             0   -I
LEVEL  6  I0   -            0         - I
LEVEL  7  I 0        0             -   -I
LEVEL  8  I0   0            0         - I
LEVEL  9  I 0        0             -   -I
LEVEL 10  I0   0            0         - I
LEVEL 11  I 0        0             -   -I
LEVEL 12  I0   0            0         - I
          I------------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.07	.05	.01
20	.08	.07	.01
21	.09	.09	.00
22	.05	.05	.00
23	.05	.05	.00
24	.05	.05	.00
25	.06	.06	.00
26	.05	.05	.00
27	.06	.05	.01
28	.06	.07	.00
29	.07	.08	-.01
30	.05	.05	.00
31	.05	.05	.00
32	.05	.05	.00
33	.06	.06	-.01
34	.06	.05	.01
43	.01	.05	-.04
44	.05	.06	-.01
45	.06	.08	-.02
46	.06	.05	.00
47	.01	.05	-.04
48	.05	.05	.00
49	.07	.08	-.02
50	.05	.05	.00
51	.05	.05	.00
52	.05	.07	-.01
53	.09	.11	-.02
54	.06	.06	.00
55	.06	.06	.00
56	.06	.06	-.01
59	.08	.12	-.04
60	.06	.07	.00
61	.06	.06	.00
62	.06	.08	-.02
63	.10	.15	-.05*
64	.08	.07	.00
65	.07	.07	.00
66	.07	.06	.00
67	.10	.14	-.05
68	.08	.08	.00
69	.07	.08	.00
70	.08	.10	-.02
71	.14*	.16*	-.02
72	.08	.08	.00
73	.08	.08	-.01
74	.08	.08	.00
75	.12	.16	-.04

NO. OF + = 1 NO OF - = 13 NO. OF 0 = 33
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 135
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61*4*0.16
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I------------------------------I
LEVEL  1  I +                          0+I
LEVEL  2  I    0     0      +      +     I
LEVEL  3  I00                          00I
LEVEL  4  I0   0            0         0 I
LEVEL  5  I 0        0             0   -I
LEVEL  6  I0   -            0         - I
LEVEL  7  I 0        0             0   0I
LEVEL  8  I0   0            0         0 I
LEVEL  9  I 0        0             0   -I
LEVEL 10  I0   0            0         0 I
LEVEL 11  I 0        0             0   -I
LEVEL 12  I0   0            0         0 I
          I------------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.05	.01
20	.07	.06	.01
21	.07	.06	.01
22	.05	.05	.00
23	.06	.05	.01
24	.08	.06	.02
25	.08	.06	.02
26	.05	.05	.00
27	.06	.05	.01
28	.06	.06	.00
29	.06	.06	.00
30	.05	.05	.00
31	.05	.04	.00
32	.05	.05	.00
33	.05	.06	-.01
34	.05	.05	.00
43	.04	.05	.00
44	.05	.06	.00
45	.06	.08	-.01
46	.05	.05	.00
47	.01	.05	-.04*
48	.05	.05	.00
49	.06	.07	-.01
50	.05	.05	.00
51	.05	.05	.00
52	.05	.06	.00
53	.09	.10	-.01
54	.05	.05	.00
55	.05	.05	.00
56	.06	.05	.00
59	.07	.08	-.01
60	.06	.06	.00
61	.05	.05	.00
62	.06	.06	.00
63	.09	.12	-.03
64	.06	.06	.00
65	.06	.06	.00
66	.05	.06	.00
67	.08	.08	.00
68	.06	.07	-.01
69	.06	.06	.00
70	.07	.07	.00
71	.11*	.13*	-.02
72	.07	.07	-.01
73	.07	.07	.00
74	.06	.06	.00
75	.09	.10	.00

NO. OF + = 4 NO OF - = 5 NO. OF 0 = 38
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 150
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61*4*0.16
BULDING HEIGHT: 120M
+ GREATER THAN 0.010
- LESS THAN -0.010
0 BETWEEN -0.010 & 0.010

```
          I------------------------------I
LEVEL  1  I 0                           0I
LEVEL  2  I    0     0                   I
LEVEL  3  I00                            I
LEVEL  4  I0   0            0         0 I
LEVEL  5  I 0        +             0   0I
LEVEL  6  I+   +            0         0 I
LEVEL  7  I +        0             0   0I
LEVEL  8  I0   0            0         - I
LEVEL  9  I 0        0             0   -I
LEVEL 10  I0   0            0         0 I
LEVEL 11  I 0        0             0   0I
LEVEL 12  I0   0            0         0 I
          I------------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.06	.00
20	.06	.05	.01
21	.07	.07	.00
22	.06	.06	.00
23	.06	.06	.00
24	.06	.05	.00
25	.06	.05	.01
26	.06	.05	.00
27	.05	.05	.00
28	.06	.05	.01
29	.06	.06	.00
30	.05	.05	.00
31	.05	.05	.00
32	.05	.05	.00
33	.05	.05	.00
34	.05	.05	.00
43	.05	.01	.04
44	.05	.05	.00
45	.06	.06	.00
46	.06	.01	.05*
47	.05	.01	.04
48	.05	.05	.00
49	.06	.05	.01
50	.05	.01	.04
51	.05	.05	.01
52	.06	.06	.00
53	.07	.07	.00
54	.05	.05	.00
55	.05	.05	.00
56	.06	.05	.00
59	.06	.08	-.01
60	.05	.05	.00
61	.05	.05	.00
62	.07	.06	.00
63	.08	.09	-.01
64	.05	.06	-.01
65	.05	.06	.00
66	.06	.06	.00
67	.07	.08	-.01
68	.06	.06	.00
69	.06	.06	.00
70	.07	.06	.00
71	.09*	.10*	-.01
72	.06	.07	.00
73	.06	.06	.00
74	.07	.07	.00
75	.09	.09	.00

NO. OF + = 5 NO. OF - = 2 NO. OF 0 = 40
* -- THE MAXIMU OR MINIMUM VALUES

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT ROUGHNE

* ROUGH DATA MINUS SMOOTH DATA *

AZIMUTH: 165
BALCONY NO: 29(REAL,WALL 1M)
BALCONY GEOMETRY: 61*4*0.16
BULDING HEIGHT: 120M
GREATER THAN 0.010
SS THAN -0.010
WEEN -0.010 & 0.010

```
          I------------------------------I
LEVEL  1  I 0                          00I
LEVEL  2  I .  0     0      0      0     I
LEVEL  3  I00                          00I
LEVEL  4  I0   0            0         0 I
LEVEL  5  I 0        +             +   0I
LEVEL  6  I+ + +            0         + I
LEVEL  7  I +        0             0   0I
LEVEL  8  I0   0            0         - I
LEVEL  9  I 0        0             0   -I
LEVEL 10  I0   0            -         - I
LEVEL 11  I 0        -             0   -I
LEVEL 12  I0   0            0         - I
          I------------------------------I
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.06	.00
20	.07	.08	-.01
21	.11	.10	.01
22	.06	.06	.00
23	.06	.06	.00
24	.07	.06	.01
25	.07	.07	.00
26	.06	.06	.00
27	.06	.06	.00
28	.07	.07	.00
29	.09	.08	.00
30	.06	.06	.00
31	.06	.05	.00
32	.06	.06	.00
33	.06	.06	.00
34	.07	.06	.01
43	.06	.01	.05
44	.06	.01	.05
45	.07	.07	.00
46	.07	.01	.06*
47	.06	.01	.05
48	.06	.06	.00
49	.06	.01	.05
50	.07	.01	.05
51	.05	.06	.00
52	.06	.07	-.01
53	.08	.09	.00
54	.06	.07	-.01
55	.06	.06	.00
56	.06	.06	-.01
59	.07	.08	-.01
60	.07	.07	-.01
61	.05	.06	.00
62	.07	.07	.00
63	.09	.11	-.01
64	.07	.07	-.01
65	.06	.07	-.01
66	.06	.07	-.01
67	.07	.09	-.02
68	.07	.08	-.01
69	.07	.08	-.02
70	.07	.07	.00
71	.11*	.12*	-.01
72	.07	.08	-.01
73	.07	.08	-.01
74	.07	.08	.00
75	.09	.11	-.02

NO. OF + = 6 NO. OF - = 7 NO. OF 0 = 34
* -- THE MAXIMU OR MINIMUM VALUES

FIG. B.9 CONTINUED

```
COMPARISION OF  Cp RMS BETWEEN  THE CASES WITH & WITHOUT  ROUGHNE

* ROUGH  DATA MINUS SMOOTH DATA *          TAP ROUGH  SMOOTH  DIFF

     AZIMUTH:                  180          19   .12    .13   -.01
     BALCONY NO: 29(REAL,WALL 1M)           20   .13    .13    .00
     BALCONY GEOMETRY:  &1**0.16            21   .15    .16   -.01
     BULDING HEIGHT:          120M          22   .12    .11    .01
     + GREATER THAN          0.010          23   .11    .10    .00
     - LESS THAN            -0.010          24   .11    .11    .00
     0 BETWEEN      -0.010 & 0.010          25   .12    .11    .01
                                            26   .14    .15   -.01
           I---------------------------I    27   .12    .12    .00
LEVEL  1   I -                       0-I    28   .12    .13   -.01
LEVEL  2   I    0     0     0     0    I    29   .14    .15   -.01
LEVEL  3   I-0                       00I    30   .13    .15   -.02
           I                           I    31   .10    .10    .00
           I                           I    32   .09    .10   -.01
           I                           I    33   .11    .11    .00
           I                           I    34   .12    .12    .00
LEVEL  4   I-   0           0        0 I    43   .09    .08    .00
           I                           I    44   .09    .10   -.01
           I                           I    45   .15    .14    .01
LEVEL  5   I 0      0             0   +I    46   .13    .16   -.03
           I                           I    47   .09    .10   -.01
           I                           I    48   .08    .08    .00
LEVEL  6   I-   0           0        0 I    49   .11    .12   -.01
           I                           I    50   .12    .13   -.01
           I                           I    51   .07    .08    .00
LEVEL  7   I -      0             0   0I    52   .09    .10   -.01
           I                           I    53   .17*   .17    .01
           I                           I    54   .12    .17   -.06*
           I                           I    55   .10    .10    .00
           I                           I    56   .07    .08   -.01
LEVEL  8   I-   0           0        - I    59   .11    .13   -.02
           I                           I    60   .12    .13   -.01
           I                           I    61   .07    .08   -.01
LEVEL  9   I 0      0             -   -I    62   .08    .10   -.02
           I                           I    63   .17    .18*  -.01
           I                           I    64   .12    .16   -.04
LEVEL 10   I-   -           -        - I    65   .09    .11   -.02
           I                           I    66   .07    .08   -.01
           I                           I    67   .11    .12   -.01
LEVEL 11   I -      0             0   0I    68   .11    .12   -.01
           I                           I    69   .08    .09   -.01
           I                           I    70   .09    .10   -.01
           I                           I    71   .14    .14    .00
           I                           I    72   .10    .13   -.03
LEVEL 12   I-   -           -        - I    73   .09    .11   -.02
           I                           I    74   .08    .09   -.01
           I---------------------------I    75   .10    .12   -.02

           NO. OF + = 1      NO. OF - = 19       NO. OF 0 = 27
           * -- THE MAXIMU OR MINIMUM VALUES
```

FIG. B.9 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                     0
BALCONY NO.:          29(REAL)
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:           120M
+  GREATER THAN          0.010
-  LESS THAN            -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I 0                         ++I
LEVEL  2  I     0      0      +     +   I
LEVEL  3  I00                         ++I
LEVEL  4  I0    0             +       0 I
LEVEL  5  I 0          0            + 0I
LEVEL  6  I+    0             0       + I
LEVEL  7  I +          0           0  0I
LEVEL  8  I0    0             +       0 I
LEVEL  9  I 0          0           0  -I
LEVEL 10  I0    +             0       0 I
LEVEL 11  I 0          0           0  -I
LEVEL 12  I-    +             +       0 I
          I-----------------------------I

NO. OF + = 15      NO. OF - = 3      NO. OF 0 = 29
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.08	.07	.01
20	.08	.07	.01
21	.10	.08	.02
22	.08	.07	.01
23	.08	.07	.01
24	.08	.06	.02
25	.08	.07	.01
26	.08	.08	.01
27	.08	.07	.01
28	.08	.07	.01
29	.08	.07	.01
30	.08	.08	.00
31	.09	.09	.01
32	.10	.09	.01
33	.09	.08	.01
34	.09	.09	.00
43	.01	.01	.00
44	.10	.01	.09
45	.08	.08	.00
46	.10	.01	.09
47	.01	.01	.00
48	.10	.10	.01
49	.10	.01	.09*
50	.10	.01	[illegible]
51	.10	.10	[illegible]
52	.10	.10	.01
53	.10	.10	.00
54	.11	.10	.00
55	.11	.10	.01
56	.11*	.10	01
59	.11	.10	.01
60	.10	.10	00
61	.11	.10	.01
62	.10	.10	.00
63	.10	.12	-.02
64	.11	.12	-.01
65	.11	.10	.01
66	.10	.10	.01
67	.11	.10	.00
68	.10	.10	-.01
69	.10	.10	.01
70	.10	.10	.01
71	.11	.12	-.01
72	.09	.13*	-.03
73	.09	.08	01
74	.10	.08	02
75	.10	.09	.01

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    15
BALCONY NO.:          29(REAL,
BALCONY GEOMETRY: 61*4*0.16M
BULDING HEIGHT:           120M
+  GREATER THAN          0.010
-  LESS THAN            -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I +                         ++I
LEVEL  2  I     +      +      +     +   I
LEVEL  3  I00                         +0I
LEVEL  4  I0    +             +       + I
LEVEL  5  I 0          -            + 0I
LEVEL  6  I0    -             +       + I
LEVEL  7  I 0          0            + 0I
LEVEL  8  I0    +             +       0 I
LEVEL  9  I 0          0           0  0I
LEVEL 10  I+    0             +       + I
LEVEL 11  I 0          +            + 0I
LEVEL 12  I0    +             +       + I
          I-----------------------------I

NO. OF + = 25      NO. OF - = 2      NO. OF 0 = 20
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.07	.01
20	.07	.05	.02
21	.06	.05	.01
22	.08	.07	.02
23	08	.06	.02
24	.08	.06	.01
25	.08	.06	.01
26	.08	.07	.01
27	.08	.07	.01
28	.08	.06	.02
29	.05	.05	.01
30	.08	.08	.00
31	.10	.08	.02
32	.10	.08	.02
33	.09	.07	.02
34	.10	.10	.00
43	.01	.09	-.08
44	.09	08	.02
45	.06	.06	.00
46	.11	.10	.01
47	.01	.10	-.09*
48	.10	.09	.01
49	.10	.08	.02
50	.10	.11	-.01
51	.10	.09	.01
52	.10	09	.01
53	.07	.07	.00
54	.11	.10	.01
55	.12*	.11	.01
56	.10	.09	.01
59	.10	.09	.01
60	.11	.11*	-.01
61	.10	.09	.01
62	.09	.09	.00
63	.08	.08	.00
64	.12	.10	.01
65	.11	.10	.01
66	.10	09	.01
67	.10	.08	.02
68	10	.10	-.01
69	.11	.09	.02
70	.09	.08	.01
71	.08	.08	.00
72	.09	09	.00
73	.10	.08	.02
74	.09	.08	.02
75	09	.07	.02

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    30
BALCONY NO.:          29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BULDING HEIGHT:           120M
+  GREATER THAN          0.010
-  LESS THAN            -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I +                         +0I
LEVEL  2  I     +      +      +     +   I
LEVEL  3  I+0                         +0I
LEVEL  4  I-    +             +       + I
LEVEL  5  I 0          +            + 0I
LEVEL  6  I0    +             +       + I
LEVEL  7  I -          +            + +I
LEVEL  8  I-    +             +       + I
LEVEL  9  I 0          +            + 0I
LEVEL 10  I-    +             +       + I
LEVEL 11  I 0          0            + 0I
LEVEL 12  I0    +             +       + I
          I-----------------------------I

NO. OF + = 31      NO. OF - = 4      NO. OF 0 = 12
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.11	.07	.04*
20	.06	.05	.01
21	.05	.05	.01
22	.08	.06	.02
23	.08	.06	.02
24	.07	.06	.01
25	.07	.06	.02
26	.11	.08	.04
27	.08	.07	.01
28	.07	.05	.02
29	.05	.04	.01
30	.08	.09	-.01
31	.09	.08	.01
32	.09	.07	.01
33	.08	.05	.03
34	.10	.10	.00
43	.09	.08	.01
44	.08	.07	.02
45	.05	.05	.00
46	.10	.11	-.01
47	.11	.09	.02
48	.09	08	.02
49	.09	.06	.03
50	.10	.11	-.01
51	.09	.08	.01
52	.09	.07	.02
53	.06	.05	.01
54	.10	.11	-.02
55	.11*	.09	.02
56	.09	.08	.01
59	.09	.06	.02
60	.11	.11	.00
61	.09	.08	.01
62	.08	.07	.02
63	.07	.06	.01
64	.10	.12*	-.02
65	.11	.09	.02
66	.09	.08	.01
67	.08	.06	.02
68	.11	.10	.01
69	.09	.08	.01
70	.08	.06	.01
71	.07	.07	.00
72	.09	.09	.00
73	.10	.08	.02
74	.08	.07	.01
75	.08	.06	.02

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    45
BALCONY NO.:          29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BULDING HEIGHT:           120M
+  GREATER THAN          0.010
   LESS THAN            -0.010
0  BETWEEN     -0.010 & 0.010

          I-----------------------------I
LEVEL  1  I +                         +0I
LEVEL  2  I     +      +      +     +   I
LEVEL  3  I++                         +0I
LEVEL  4  I0    +             +       + I
LEVEL  5  I +          +            + 0I
LEVEL  6  I+    +             +       + I
LEVEL  7  I +          +            + 0I
LEVEL  8  I+    +             0       + I
LEVEL  9  I +          +            + +I
LEVEL 10  I0    0             +       + I
LEVEL 11  I +          +            + 0I
LEVEL 12  I+    0             0       + I
          I-----------------------------I

NO. OF + = 3[illegible]      NO. OF - = 0      NO. OF 0 = [illegible]
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.09	.05	.04*
20	.05	.04	.01
21	.05	.05	.01
22	.07	.05	.02
23	.06	.05	.01
24	.06	.05	.01
25	.06	.04	.01
26	.11	.08	.03
27	.09	.06	.03
28	.06	.04	.02
29	.05	.04	.01
30	.10	.09	.01
31	.09	.06	.02
32	.07	.05	.02
33	.07	.04	.03
34	.11	.09	.02
43	.08	.06	.02
44	.07	.05	.02
45	.05	.04	.01
46	.13*	.11	.02
47	.09	.07	.02
48	.07	.06	.02
49	.08	.05	.03
50	.11	.09	.01
51	.08	.06	.01
52	.07	.05	.02
53	.05	.05	.01
54	.11	.12	.01
55	.09	.08	.01
56	.07	.06	.01
59	.08	.05	.03
60	.11	.09	.02
61	.08	.06	.01
62	.06	.05	.01
63	.07	.05	.02
64	.12	.12*	.00
65	09	[illegible]	.01
66	.07	.05	.01
67	.07	.05	.02
68	.12	.09	.02
69	.07	.06	.01
70	.06	.05	.01
71	.06	.06	.01
72	.11	.09	.02
73	.08	.07	.01
74	.06	.06	.01
75	.06	.05	.02

FIG. B.10 EFFECT OF 4m BALCONIES WITH 2m WALLS ON Cp RMS

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
     AZIMUTH:                       75
     BALCONY NO.:             29(REAL)
     BALCONY GEOMETRY: 61*4*0.16M*
     BULDING HEIGHT:              120M
     +  GREATER THAN             0.010
     -  LESS THAN               -0.010
     0  BETWEEN       -0.010 & 0.010

           I----------------------------I
LEVEL  1   I -                        ++I
LEVEL  2   I     -      -     0    +    I
LEVEL  3   I0-                        ++I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   I0   -             -       + I
           I                            I
           I                            I
LEVEL  5   I 0        0            +   +I
           I                            I
           I                            I
LEVEL  6   I+    0            -       + I
           I                            I
           I                            I
LEVEL  7   I +                -    +   +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   I0    -            -       + I
           I                            I
           I                            I
LEVEL  9   I                  -    +   +I
           I                            I
           I                            I
LEVEL 10   I-    -            -       + I
           I                            I
           I                            I
LEVEL 11   I -                -    +   +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   I-    -            +       + I
           I                            I
           I----------------------------I

     NO. OF + = 21     NO. OF - = 19     NO. OF 0 = 7
     * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.08	.12	-.04
20	.11	.06	.05
21	.08	.06	.02
22	.08	.12	-.04
23	.08	.17	-.09
24	.10	.10	.00
25	.11	.06	.05
26	.10	.11	.00
27	.08	.11	-.03
28	.12	.06	.05
29	.07	.06	.02
30	.08	.09	-.01
31	.08	.12	-.03
32	.12	.18	-.05
33	.12	.07	.05
34	.09	.09	-.01
43	.01	.01	.00
44	.16	.01	.15*
45	.09	.06	.03
46	.09	.01	.08
47	.01	.01	.00
48	.14	.20	-.06
49	.15	.01	.15
50	.10	.01	.09
51	.12	.21	-.09
52	.17	.14	.03
53	.11	.07	.04
54	.11	.12	-.01
55	.12	.16	-.05
56	.15	.21	-.06
59	.17	.10	.06
60	.11	.15	-.04
61	.14	.23	-.09
62	.17*	.13	.05
63	.15	.08	.07
64	.11	.16	-.04
65	.12	.19	-.08
66	.15	.17	-.02
67	.17	.10	.07
68	.12	.16	-.04
69	.14	.26*	-.12
70	.16	.10	.06
71	.12	.07	.05
72	.16	.17	-.02
73	.13	.24	-.11
74	.13	.11	.02
75	.12	.07	.05

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
     AZIMUTH:                       60
     BALCONY NO.:             29(REAL)
     BALCONY GEOMETRY: 61*4*0.16M*
     BULDING HEIGHT:              120M
     +  GREATER THAN             0.010
     -  LESS THAN               -0.010
     0  BETWEEN       -0.010 & 0.010

           I----------------------------I
LEVEL  1   I -                       +0I
LEVEL  2   I     +      +     0    +    I
LEVEL  3   I+-                       +0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   I0    +            0       + I
           I                            I
           I                            I
LEVEL  5   I -        0            +   0I
           I                            I
           I                            I
LEVEL  6   I+    0            +       + I
           I                            I
           I                            I
LEVEL  7   I +          +          +   0I
           I +                          I
           I                            I
           I                            I
           I                            I
LEVEL  8   I-    -            +       + I
           I                            I
           I                            I
LEVEL  9   I -          +          +   +I
           I                            I
           I                            I
LEVEL 10   I0    -            0       + I
           I                            I
           I                            I
LEVEL 11   I -          +          0   0I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   I0    -            0       + I
           I                            I
           I----------------------------I

     NO. OF + = 23     NO. OF - = 9     NO. OF 0 = 15
     * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.08	.16	-.08
20	.05	.04	.01
21	.05	.05	.00
22	.07	.04	.02
23	.05	.04	.01
24	.04	.04	.00
25	.05	.04	.01
26	.16*	.09	.07
27	.08	.19	-.11
28	.05	.04	.01
29	.05	.05	.00
30	.10	.09	.01
31	.11	.08	.03
32	.05	.04	.01
33	.06	.04	.02
34	.12	.15	-.03
43	.01	.01	.00
44	.05	.01	.04
45	.05	.04	.01
46	.10	.01	.10
47	.01	.01	.00
48	.05	.04	.02
49	.06	.01	.05
50	.12	.01	.12*
51	.07	.04	.03
52	.05	.04	.01
53	.05	.04	.00
54	.13	.14	-.02
55	.12	.13	-.01
56	.05	.04	.01
59	.06	.04	.02
60	.13	.20*	-.07
61	.07	.05	.02
62	.05	.04	.01
63	.06	.05	.01
64	.12	.13	-.01
65	.11	.14	-.02
6	.05	.04	.01
67	.06	.05	.02
68	.13	.17	-.04
69	.07	.06	.01
70	.05	.04	.01
71	.06	.06	.00
72	.11	.12	.00
73	.10	.11	-.01
74	.05	.05	.00
75	.06	.05	.01

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
     AZIMUTH:                       90
     BALCONY NO.:             29(REAL)
     BALCONY GEOMETRY: 61*4*0.16M*
     BULDING HEIGHT:              120M
     +  GREATER THAN             0.010
     -  LESS THAN               -0.010
     0  BETWEEN       -0.010 & 0.010

           I----------------------------I
LEVEL  1   I 0                        ++I
LEVEL  2   I     -      -     -    -    I
LEVEL  3   I+0                        +-I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   I0    -            -       0 I
           I                            I
           I                            I
LEVEL  5   I 0        +            -   -I
           I                            I
           I                            I
LEVEL  6   I+    -            -       - I
           I                            I
           I                            I
LEVEL  7   I 0        -            -   -I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   I+    -            -       - I
           I                            I
           I                            I
LEVEL  9   I 0        -            -   -I
           I                            I
           I                            I
LEVEL 10   I0    -            -       0 I
           I                            I
           I                            I
LEVEL 11   I -        -            0   +I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   I0    -            0       + I
           I                            I
           I----------------------------I

     NO. OF + = 8     NO. OF - = 27     NO. OF 0 = 12
     * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.11	.11	-.01
20	.21	.18	.03
21	.25	.23	.01
22	.10	.12	-.02
23	.10	.14	-.04
24	.13	.17	-.03
25	.17	.18	-.01
26	.13	.11	.02
27	.11	.11	.00
28	.20	.18	.02
29	.22	.23	-.01
30	.11	.11	.00
31	.11	.13	-.01
32	.13	.17	-.04
33	.20	.20	.00
34	.12	.12	.00
43	.13	.14	-.02
44	.15	.17	-.02
45	.22	.26	-.04
46	.14	.12	.01
47	.12	.13	-.02
48	.14	.18	-.05
49	.22	.24	-.02
50	.13	.14	-.01
51	.13	.17	-.03
52	.17	.20	-.02
53	.25	.30*	-.04
54	.17	.14	.03
55	.14	.15	-.01
56	.16	.20	-.04
59	.23	.26	-.03
60	.15	.15	.01
61	.14	.19	-.05
62	.17	.20	-.03
63	.26*	.29	-.03
64	.17	.16	.01
65	.15	.19	-.03
66	.17	.20	-.02
67	.22	.22	.00
68	.16	.20	-.04
69	.17	.22	-.05
70	.17	.18	-.01
71	.23	.20	.03
72	.22	.22	.00
73	.17	.23	-.06*
74	.17	.17	.00
75	.17	.16	.02

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
     AZIMUTH:                      105
     BALCONY NO.:             29(REAL)
     BALCONY GEOMETRY: 61*4*0.16M*
     BULDING HEIGHT:              120M
     +  GREATER THAN             0.010
     -  LESS THAN               -0.010
     0  BETWEEN       -0.010 & 0.010

           I----------------------------I
LEVEL  1   I +                        --I
LEVEL  2   I     +      +     +    0    I
LEVEL  3   I++                        0-I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  4   I+    +            +       0 I
           I                            I
           I                            I
LEVEL  5   I +        0            0   -I
           I                            I
           I                            I
LEVEL  6   I+    0            -       - I
           I                            I
           I                            I
LEVEL  7   I 0        0            -   -I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL  8   I+    0            -       - I
           I                            I
           I                            I
LEVEL  9   I 0        -            -   -I
           I                            I
           I                            I
LEVEL 10   I+    0            -       - I
           I                            I
           I                            I
LEVEL 11   I 0        -            -   -I
           I                            I
           I                            I
           I                            I
           I                            I
LEVEL 12   I+    -            -       - I
           I                            I
           I----------------------------I

     NO. OF + = 14     NO. OF - = 21     NO. OF 0 = 12
     * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.12	.05	.06
20	.09	.10	-.01
21	.08	.15	-.07
22	.10	.06	.04
23	.13	.06	.07
24	.12	.07	.05
25	.08	.08	.00
26	.08	.05	.03
27	.13	.05	.08
28	.10	.11	-.01
29	.09	.13	-.04
30	.12	.05	.06
31	.15	.05	.10*
32	.15	.06	.09
33	.10	.10	-.01
34	.10	.06	.04
43	.06	.06	.00
44	.06	.07	-.01
45	.09	.12	-.03
46	.09	.06	.02
47	.06	.06	.00
48	.06	.07	-.01
49	.09	.13	-.03
50	.07	.07	.00
51	.07	.07	.00
52	.08	.09	-.01
53	.11	.16	-.05
54	.12	.07	.05
55	.08	.08	.00
56	.08	.10	-.02
59	.12	.17	-.05
60	.09	.08	.00
61	.08	.09	-.02
62	.10	.13	-.03
63	.13	.22	-.09
64	.12	.09	.02
65	.09	.09	-.01
66	.09	.10	-.02
67	.13	.20	-.07
68	.09	.09	.00
69	.09	.12	-.03
70	.12	.13	-.01
71	.16	.26*	-.09
72	.15	.11	.04
73	.09	.11	-.02
74	.11	.13	-.02
75	.17*	.23	-.07

FIG. B.10 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      120
BALCONY NO.:            29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BULDING HEIGHT:              120M
+  GREATER THAN             0.010
-  LESS THAN               -0.010
0  BETWEEN      -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                      00I
LEVEL  2  I    0     0     0     0   I
LEVEL  3  I00                      0-I
LEVEL  4  I0   0           0       - I
LEVEL  5  I 0        0         0   -I
LEVEL  6  I0   0           0       - I
LEVEL  7  I +        0         -   -I
LEVEL  8  I+   0           0       - I
LEVEL  9  I 0        0         -   -I
LEVEL 10  I0   0           0       - I
LEVEL 11  I 0        0         -   -I
LEVEL 12  I-   0           0       - I
          I---------------------------I

NO. OF + = 2     NO. OF - = 14     NO. OF 0 = 31
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.05	.05	.00
20	.07	.07	-.01
21	.08	.09	-.01
22	.05	.05	.00
23	.05	.05	.00
24	.05	.05	.00
25	.06	.06	.00
26	.05	.05	.00
27	.06	.05	.01
28	.06	.07	-.01
29	.06	.08	-.02
30	.05	.05	.00
31	.05	.05	.00
32	.05	.05	.00
33	.05	.06	-.01
34	.05	.05	.00
43	.05	.05	.00
44	.05	.06	-.01
45	.05	.08	-.03
46	.06	.05	.00
47	.05	.05	.00
48	.05	.05	.00
49	.06	.08	-.02
50	.07	.05	.01
51	.05	.05	.00
52	.05	.07	-.01
53	.07	.11	-.04
54	.08	.06	.02
55	.06	.06	.00
56	.06	.06	.00
59	.07	.12	-.05
60	.07	.07	.00
61	.06	.06	.00
62	.07	.08	-.02
63	.08	.15	-.07*
64	.08	.07	.00
65	.07	.07	.00
66	.07	.06	.00
67	.08	.14	-.06
68	.08	.08	.01
69	.07	.08	.00
70	.08	.10	-.02
71	.10	.16*	-.06
72	.05	.08	-.03
73	.08	.08	.00
74	.08	.08	.00
75	.11*	.16	-.05

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      135
BALCONY NO.:            29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BULDING HEIGHT:              120M
+  GREATER THAN             0.010
-  LESS THAN               -0.010
0  BETWEEN      -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                      00I
LEVEL  2  I    0     0     0     0   I
LEVEL  3  I00                      00I
LEVEL  4  I0   0           0       0 I
LEVEL  5  I 0        0         0   -I
LEVEL  6  I0   0           0       - I
LEVEL  7  I +        0         0   -I
LEVEL  8  I0 . 0           0       0 I
LEVEL  9  I 0        0         0   -I
LEVEL 10  I0   0           0       0 I
LEVEL 11  I 0        0         0   -I
LEVEL 12  I0 . 0           0       0 I
          I---------------------------I

NO. OF + = 1     NO. OF - = 5     NO. OF 0 = 41
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.05	.01
20	.06	.06	.00
21	.06	.06	.00
22	.05	.05	.00
23	.06	.05	.01
24	.07	.06	.01
25	.07	.06	.01
26	.05	.05	.00
27	.05	.05	.01
28	.06	.06	.00
29	.05	.06	-.01
30	.05	.05	.00
31	.05	.04	.00
32	.05	.05	.00
33	.05	.06	-.01
34	.05	.05	.00
43	.05	.05	.00
44	.05	.06	.00
45	.05	.08	-.03
46	.05	.05	.00
47	.05	.05	.00
48	.05	.05	.00
49	.05	.07	-.02
50	.07	.05	.02
51	.05	.05	.00
52	.06	.06	.00
53	.07	.10	-.03
54	.05	.05	.00
55	.05	.05	.00
56	.05	.05	.00
59	.07	.08	-.01
60	.06	.06	.00
61	.05	.05	.00
62	.06	.06	.00
63	.08	.12	-.05*
64	.06	.06	.00
65	.06	.06	.00
66	.06	.06	.00
67	.06	.06	.00
68	.06	.07	.00
69	.07	.06	.01
70	.07	.07	.00
71	.09*	.13*	-.04
72	.07	.07	.00
73	.07	.07	.00
74	.07	.06	.00
75	.09	.10	.00

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      150
BALCONY NO.:            29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BULDING HEIGHT:              120M
+  GREATER THAN             0.010
-  LESS THAN               -0.010
0  BETWEEN      -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                      00I
LEVEL  2  I    0     0     0     0   I
LEVEL  3  I00                      00I
LEVEL  4  I0   0           0       0 I
LEVEL  5  I 0        0         0   0I
LEVEL  6  I+   0           0       0 I
LEVEL  7  I +        0         0   0I
LEVEL  8  I0   0           0       - I
LEVEL  9  I 0        0         0   -I
LEVEL 10  I0   0           0       - I
LEVEL 11  I 0        0         0   -I
LEVEL 12  I0   0           0       - I
          I---------------------------I

NO. OF + = 2     NO. OF - = 5     NO. OF 0 = 40
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.06	.00
20	.06	.05	.01
21	.06	.07	.00
22	.06	.06	.00
23	.06	.06	.00
24	.06	.05	.01
25	.06	.05	.01
26	.06	.05	.00
27	.05	.05	.00
28	.05	.05	.00
29	.06	.06	.00
30	.05	.05	.00
31	.05	.05	.00
32	.05	.05	.00
33	.05	.05	.00
34	.05	.05	.00
43	.01	.01	.00
44	.06	.05	.01
45	.05	.06	-.01
46	.05	.01	.04
47	.01	.01	.00
48	.05	.05	.00
49	.05	.05	.00
50	.05	.01	.04*
51	.05	.05	.00
52	.06	.06	.00
53	.06	.07	-.01
54	.05	.05	.00
55	.05	.05	.00
56	.05	.05	.00
59	.06	.08	-.02
60	.05	.05	.00
61	.05	.05	.00
62	.06	.06	.00
63	.06	.09	-.03
64	.05	.06	.00
65	.05	.06	.00
66	.05	.06	.00
67	.07	.08	-.01
68	.06	.06	.00
69	.06	.06	.00
70	.06	.06	.00
71	.07	.10*	-.02
72	.06	.07	.00
73	.06	.06	.00
74	.06	.07	.00
75	.07*	.09	-.02

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                      165
BALCONY NO.:            29(REAL)
BALCONY GEOMETRY: 61*4*0.16M*
BULDING HEIGHT:              120M
+  GREATER THAN             0.010
-  LESS THAN               -0.010
0  BETWEEN      -0.010 & 0.010

          I---------------------------I
LEVEL  1  I 0                      --I
LEVEL  2  I    0     0     0     0   I
LEVEL  3  I00                      00I
LEVEL  4  I0   0           0       0 I
LEVEL  5  I 0        0         +   -I
LEVEL  6  I+   0           0       + I
LEVEL  7  I +        0         0   -I
LEVEL  8  I-   0           0       - I
LEVEL  9  I 0        0         0   -I
LEVEL 10  I0   0           -       - I
LEVEL 11  I 0        -         0   -I
LEVEL 12  I0   0           0       - I
          I---------------------------I

NO. OF + = 4     NO. OF - = 12     NO. OF 0 = 31
* -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.06	.06	.00
20	.07	.08	-.01
21	.09	.10	-.01
22	.07	.06	.00
23	[illegible]	.06	.00
24	.07	.06	.01
25	.07	.07	.00
26	.06	.06	.00
27	.06	.06	.00
28	.07	.07	.00
29	.08	.08	-.01
30	.06	.06	.00
31	.06	.05	.00
32	.06	.06	.00
33	.05	.06	-.01
34	.07	.06	.01
43	.01	.01	.00
44	.06	.01	.05*
45	.06	.07	-.01
46	.06	.01	.05
47	.01	.01	.00
48	.06	.06	.00
49	.05	.01	.05
50	.06	.01	.05
51	.06	.06	.00
52	.06	.07	.00
53	.07	.09	-.02
54	.06	.07	-.01
55	.06	.06	-.01
56	.06	.06	-.01
59	.07	.08	-.02
60	.06	.07	-.01
61	.06	.06	.00
62	.06	.07	-.01
63	.08	.11	-.02
64	.06	.07	-.01
65	.06	.07	-.01
66	.06	.07	-.01
67	.07	.09	-.02
68	.07	.08	-.01
69	.06	.08	-.02
70	.07	.07	-.01
71	.10*	.12*	-.02
72	.08	.08	.00
73	.07	.08	.00
74	.07	.08	-.01
75	.08	.11	-.03

FIG. B.10 CONTINUED

COMPARISION OF Cp RMS BETWEEN THE CASES WITH & WITHOUT BALCONIES

* BALCONY DATA MINUS SMOOTH DATA *

```
AZIMUTH:                    180
BALCONY NO.:          29(REAL)
BALCONY GEOMETRY: 1*4*0.10M*
BUILDING HEIGHT:           120M
+  GREATER THAN           0.010
-  LESS THAN             -0.010
0  BETWEEN    -0.010 & 0.010

          I----------------------------I
LEVEL  1  I -                        0-I
LEVEL  2  I    0      0      0    0    I
LEVEL  3  I-0                        00I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  4  I    0             0       0 I
          I                            I
          I                            I
LEVEL  5  I -         0            0  0I
          I                            I
          I                            I
LEVEL  6  I-   0             0       - I
          I                            I
          I                            I
LEVEL  7  I -         0            -  -I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL  8  I-   -             0       - I
          I                            I
          I                            I
LEVEL  9  I -         0            -  -I
          I                            I
          I                            I
LEVEL 10  I-   -             0       - I
          I                            I
          I                            I
LEVEL 11  I -         0            -  -I
          I                            I
          I                            I
          I                            I
          I                            I
LEVEL 12  I-   -       -     -       - I
          I                            I
          I----------------------------I

          NO. OF + = 0      NO. OF - = 26      NO. OF 0 = 21
          * -- THE MAXIMU OR MINIMUM VALUES
```

TAP	ROUGH	SMOOTH	DIFF
19	.12	.13	-.01
20	.12	.13	-.01
21	.14	.16	-.02
22	.12	.11	.00
23	.11	.10	.01
24	.10	.11	.00
25	.11	.11	.00
26	.13	.15	-.02
27	.12	.12	-.01
28	.12	.13	-.01
29	.14	.15	-.01
30	.12	.15	-.03
31	.10	.10	.00
32	.09	.10	-.01
33	.11	.11	-.01
34	.11	.12	-.02
43	.08	.08	.00
44	.09	.10	-.01
45	.14	.14	.00
46	.11	.16	-.05
47	.09	.10	-.01
48	.07	.08	-.01
49	.10	.12	-.02
50	.11	.13	-.02
51	.07	.08	.00
52	.09	.10	-.01
53	.15*	.17	-.01
54	.11	.17	-.07*
55	.09	.10	-.01
56	.07	.08	-.01
59	.10	.13	-.03
60	.10	.13	-.02
61	.07	.08	-.01
62	.09	.10	-.02
63	.14	.18*	-.03
64	.10	.16	-.06
65	.09	.11	-.02
66	.07	.08	-.01
67	.10	.12	-.02
68	.10	.12	-.02
69	.08	.09	-.01
70	.09	.10	-.01
71	.12	.14	-.02
72	.10	.13	-.03
73	.10	.11	-.02
74	.08	.09	-.01
75	.10	.12	-.02

FIG. B.10 CONTINUED

AZIMUTH	NO. OF DIFFERENCE + : $\Delta C_{\bar{p}} > 0.04$ - : $\Delta C_{\bar{p}} < -0.04$									
	2mB. NO W.		4mB. NO W.		4mB. 1m W.		4mB. 2m W.		SANDPAPER	
	+	-	+	-	+	-	+	-	+	-
0	21	15	14	13	16	19	21	15	2	33
15	17	11	10	13	11	21	17	14	2	16
30	11	8	10	8	13	16	23	10	0	22
45	7	4	12	5	13	7	26	3	1	16
60	10	7	10	10	25	2	36	3	7	13
75	13	13	10	20	23	13	21	13	27	3
90	18	3	21	5	34	2	22	8	32	5
105	3	1	7	0	21	0	21	0	9	0
120	2	2	4	1	18	0	7	1	10	0
135	8	0	0	10	3	2	0	4	1	0
150	2	3	1	2	0	3	1	2	0	1
165	2	3	0	2	13	2	9	3	33	0
180	1	0	1	0	47	0	43	0	46	1

TOTAL TAPS: 47 THRESHOLD VALUE = 0.04

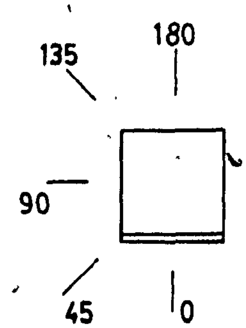


TABLE B.1 NUMBER OF TAPS WITH DIFFERENCE IN Cp MEAN BETWEEN SMOOTH AND ROUGH SURFACES

AZIMUTH	NO. OF DIFFERENCE $+ : \Delta C_{\tilde{p}} > 0.01$ $- : \Delta C_{\tilde{p}} < -0.01$									
	2mB. NO W.		4mB. NO W		4mB. 1mW.		4mB. 2mW.		SANDPAPER	
	+	-	+	-	+	-	+	-	+	-
0	18	0	14	1	22	3	15	3	31	0
15	18	0	28	0	30	0	25	2	35	2
30	15	1	20	1	28	0	31	4	34	0
45	5	4	11	5	38	0	36	0	29	0
60	8	5	12	4	21	4	23	9	21	1
75	22	17	23	16	21	17	21	19	13	10
90	4	21	10	12	7	25	8	27	21	14
105	1	11	2	15	5	15	14	21	10	3
120	3	7	0	8	1	13	2	14	2	1
135	1	5	4	0	4	5	1	5	2	0
150	4	0	4	0	5	2	2	5	7	0
165	6	1	5	2	6	7	4	12	3	0
180	4	0	10	0	1	19	0	26	3	9

TOTAL TAPS: 47 THRESHOLD VALUE = 0.01

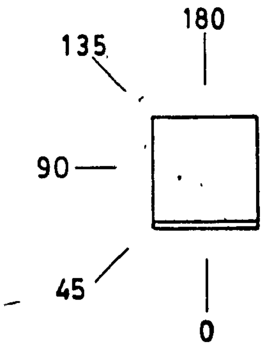


TABLE B.2 NUMBER OF TAPS WITH DIFFERENCE IN Cp RMS BETWEEN SMOOTH AND ROUGH SURFACES

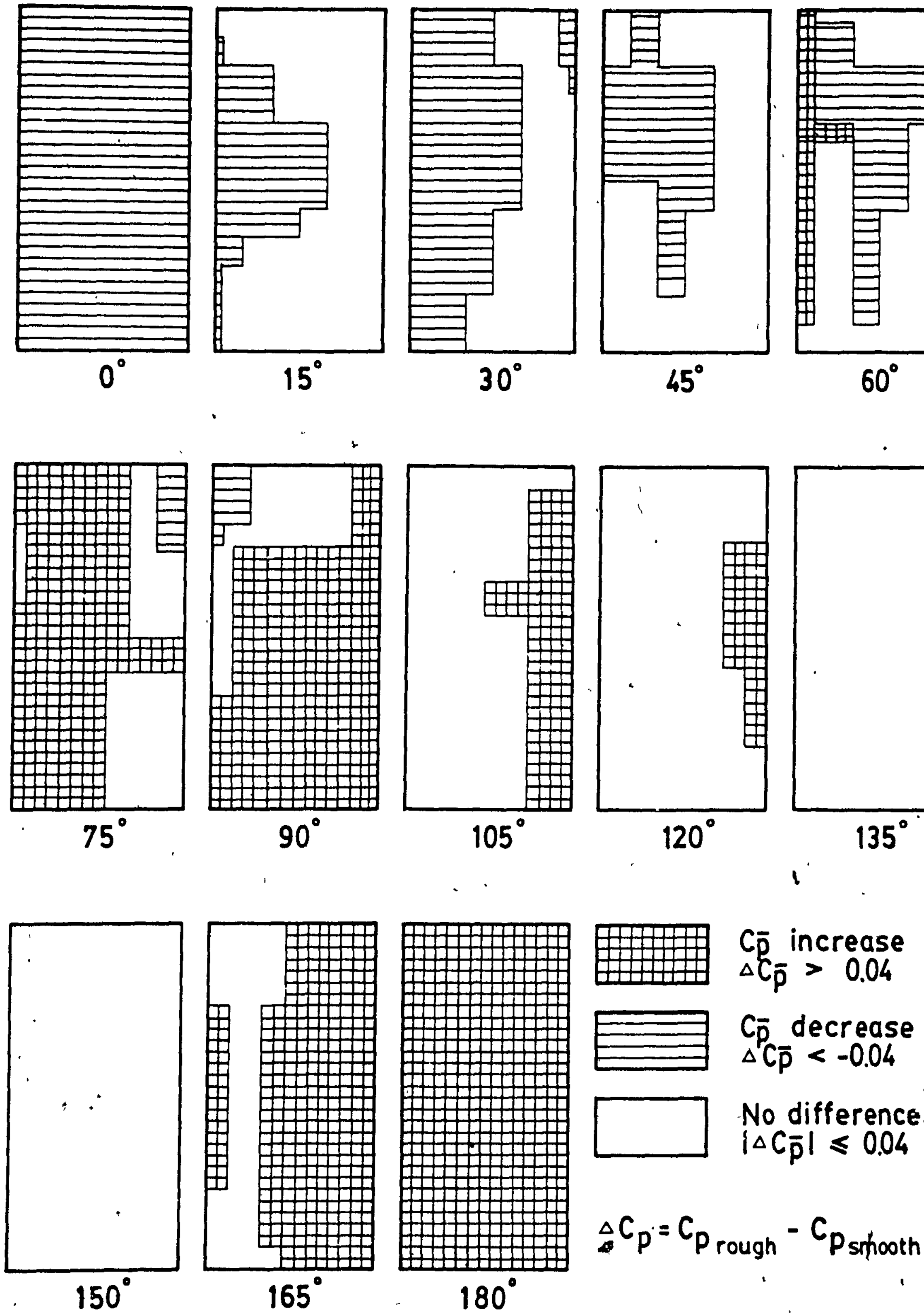


FIG. B.11 EFFECT OF 15 cm UNIFORM ROUGHNESS ON Cp MEAN

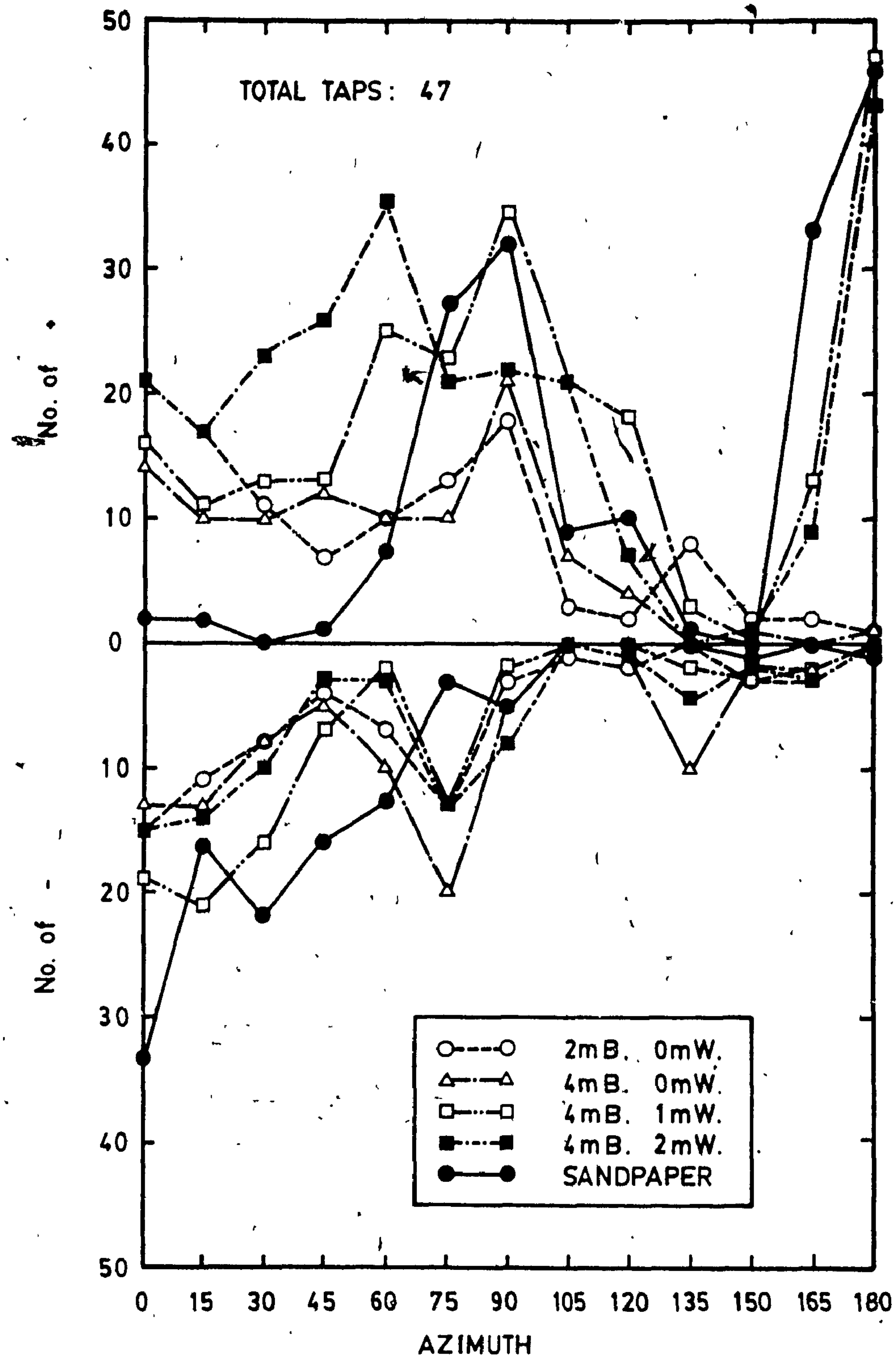


FIG. B.12 EFFECT OF APPURTENANCES ON Cp MEAN - NUMBER OF TAPS AFFECTED VERSUS AZIMUTHS

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