ERDA /Y-76-S-06-2438/76/1
Distribution Category UC-60

SITES FOR WIND POWER INSTALLATIONS: Wind Tunnel Simulation of the Influence of Two-Dimensional Ridges on Wind Speed and Turbulence -Tabulated Experimental Data-

Progress Report for the
Period June - November 1976

R. N. Meroney
V. A. Sandborn
R. J. B. Bouwmeester
M. A. Rider

Fluid Mechanics & Wind Engineering Program
Civil Engineering Department
Colorado State University
Fort Collins, Colorado 80523

December 1976

Prepared for the United States
Energy Research and Development Administration
Division of Solar Energy
Federal Wind Energy Program
Interagency Agreement No. E(11-1)2000

CER76-77RNM-VAS-RB-MAR29

TABLE OF CONTENTS

SUMMARY

In the second part of the report on the wind field developed over two dimensional model hills experimental data are presented in tabular form. For the initial interpretation of the large quantity of data the first annual report (ERDA/NSF-00702/75/T1) should be consulted.

The objective of this research was to increase technical capacity to locate favorable wind system sites, reduce uncertainty in the prediction or validation of the characteristics of sites, and thus assist in the sizing and performance prediction of wind systems. The research included evaluation of low speed aerodynamics over terrain and boundary flow conditions over ridges by means of wind tunnel modeling.

Measurements reported herein have been completed over triangular and sinusoidal shape hills of wind speed, static pressure variation, and turbulence intensity. Hill aspect ratios studied range from 1/2 to 1/6 with some data available at 1/20.

LIST OF TABLES

LIST OF FIGURES

NOMENCLATURE

e	rms of fluctuating voltage output of wire
E	mean voltage output of the wires
h	model height
L	1/4 times length of hill models
p	pressure
Re_h	Reynolds number based on hill height
U,V,W *)	longitudinal, lateral and vertical mean velocities
U^* *)	surface shear velocity
u,v,w	rms of turbulent velocities
$\overline{uw}$	time average of the product of the longitudinal and vertical turbulent velocities
x,y,z	coordinates in upwind longitudinal, lateral and vertical direction
z_o	roughness height
z_s	terrain height
α	exponent in power law
δ	boundary layer thickness

*) subscript o indicates the value in the approach flow

SITES FOR WIND POWER INSTALLATIONS:
Wind Tunnel Simulation of the Influence of Two-Dimensional Ridges on Wind Speed and Turbulence

1.0 INTRODUCTION

A problem encountered in the siting of Wind Energy Conversion Systems is the accurate estimation of topographical influence on power available from the wind. Recognition of site selection importance has led to a series of monographs and papers on the subject (Meroney, 1976). Laboratory simulation permits the systematic evaluation of the influence of simple combinations of approach flow wind characteristics and topographical features on variations of available wind energy. In this second part of the report on the wind field developed over two-dimensional model hills experimental data are presented in tabular form. By providing the elemental data in organized tabular form it is expected that analysts and numerical modelers may proceed to use the information to construct better physical models or to validate existing algorithms. For the initial interpretation of the data the first annual report (ERDA/NSF-00702/75-T1) by Meroney, et al. (1976a) should be consulted.

In the following sections of this progress report one finds a review of the experimental program, a summary of data reduction procedures, and the tabulated data for flow over two-dimensional ridges.

2.0 TEST PROCEDURES

A wide range of natural wind characteristics can be simulated by means of the unique Meteorological Wind Tunnel of the Fluid Dynamics and Diffusion Laboratory which has been used for this research. Characteristics of major concern are magnitudes and spatial distribution of mean velocity, turbulence scales and turbulence spectra of winds approaching the wind power sites. Verification that natural wind characteristics are simulated to a high degree of approximation by the long-test-section type wind tunnel has been been reported by Cermak (1975).

Measurements in wakes require considerable care, both in their acquisition and in their interpretation. In this chapter the methods used to make measurements and the techniques used in converting directly measured quantities to meaningful physical quantities are discussed. Attention is drawn to the limitations in the techniques in an attempt to prevent misinterpretation or misunderstanding of the results to be presented in the fourth chapter.

2.1 The Wind Tunnel Facility

The experiments were performed in the Meteorological Wind Tunnel located in the Fluid Dynamics and Diffusion Laboratory at Colorado State University. A plan view of the wind tunnel is shown in Figure 1. The tunnel is a closed circuit facility driven by a 250 hp variable-pitch, variable-speed propeller. The test section is nominally 2 m square and 27 m long fed through a 9:1 contraction ratio. The test section walls diverge 0.01 m/m and the roof is adjustable to maintain a zero pressure gradient along the test section. The mean velocity can be adjusted continuously from 0.3 to 37 m/sec. The wind speed in the test

section does not deviate from that set by the speed controller by more than 1/2 percent. The tunnel is equipped with a refrigeration system to maintain the air temperature at a constant level ($\pm$ 1/2^{o}C). Though the wind tunnel is capable of simulating thermally stratified planetary boundary layers all tests reported in this report used a neutral boundary-layer stratification.

At the entrance to the wind tunnel test section a 0.038 m high sawtooth boundary-layer trip is installed to insure prompt formation and growth of a turbulent boundary layer. A similarity profile is attained in the boundary layer within 6.1 m of the test section entrance. All the measurements reported in this report were made with the models at or beyond 11.0 m from the start of the test section. Thus the approach-flow boundary layer has a similarity velocity profile and changed very slowly along the test section.

The boundary layer continues to thicken at successive locations along the test section. Over the smooth flat plate the thickness of the boundary layer increases in proportion to $x^{.48}$. However, in the region in which all measurements were made, the boundary-layer growth was linear within the ability to measure the boundary-layer thickness.

2.2 Design and Construction of Hill Models

A total of 17 hill models have been designed and constructed for the meteorological wind tunnel:

triangular-shaped hill models (width 1.83 m)
- -with a height of 5.08 cm and slopes of 1/2, 1/3, 1/4, 1/6
- -with a height of 15.29 cm and slopes of 1/2, 1/3, 1/4, 1/6
- -with a height of 5.08 cm and a slope of 1/20

sine-shaped hill models
- -with a height of 5.08 cm
- -with a height-length ratio of 1/2, 1/3, 1/4, 1/6
- -with a height of 15.24 cm and a height-length ratio of 1/2, 1/3, 1/4, 1/6

For each of the hills mentioned above, three types of surface instrumentations were installed. The instrumentations were static pressure holes, preston tubes, and surface hot wires. The locations of the static holes are tabulated in Figure 3.

In one series of tests the hills were mounted in the wind tunnel with a false floor upstream. The false floor was placed 5.60 m directly downwind of the initial boundary layer trip and was 10.75 m in length, Figure 2. The false floor consisted of three sections--an approach ramp, a plywood testing base, and a trailing ramp behind the hill.

The approach ramp was that section of false floor furthest upstream. Masonite, .32 cm thick, was used to construct the ramp at an angle of $.84^{o}$ with the horizontal. The horizontal length of approach ramp was 1.3 m. The plywood testing base was that section of false floor positioned adjacent and flush to the approach ramp. Plywood, 1.91 cm thick, was used to maintain a horizontal surface in which designed models could be placed. The testing base covered 8.55 m in length. The trailing ramp was the final section of false floor located furthest downstream. Positioning of the ramp was flush and sloping downward from the testing base. The ramp was constructed of masonite, .32 cm thick, forming an angle of 1.21^{o} with the horizontal. This final section of false floor was .90 m in length.

For the tests where turbulence intensity data are reported the models were mounted directly on the wind tunnel aluminum base plate 21 meters from the initial boundary layer trip. This change was made in preparation for a series of measurements in stably stratified flow where heat transfer requirements demand a clear floor. Approach velocity profiles were unchanged however δ = 70 cm versus δ = 53 cm at 14 m from the entrance.

A uniform approach roughness was obtained for the run where $z_o/h = 2 \times 10^{-3}$ by gluing graded rock particles with average diameter k ~ 0.25 cm to plywood support boards spaced approximately ~1.0 cm on center. Roughness was also applied to the hill utilizing double-sided sticky tape. The roughness extended 7.2 m upwind at the hillcrest and 2.4 m downwind of the crest. The resulting power law coefficient was n = 0.21 as designed by the method of Gartshore and deCroos (1976).

2.3 Instrumentation

The research program has been directed toward the evaluation of the shear flow above the hill models. Detailed measurements of the static pressure distribution and the mean velocity above the hills have been completed for a number of flow conditions. Provision for evaluation of the surface shear stress are also included on the models. Limited measures of the turbulent distributions above the hills have also been made.

2.3.1 Pressure Measurements

The hill models each contain a set of static pressure taps, as indicated in Table 3. The static holes were sharp edged, .064 cm diameter holes drilled perpendicular to the hill surface. Based on the results of previous investigators these small diameter static

pressure holes will measure the static pressure with a minimum of error. The error in static pressure (divide by the local surface shear stress) is a function of the "Shear Reynolds Number" ($\equiv U^*d/\nu$); where $U^*(\equiv \sqrt{\tau_w/\rho})$ is the shear velocity, d is the static hole diameter and ν is the kinematic viscosity of air. The Shear Reynolds Number approaching the hill models is approximately 15 for a flow velocity of 15.2 m per second. For this Reynolds number the ratio of the static pressure error divided by the surface shear stress is less than 0.05. The error may be somewhat larger over the upstream portion of the hills where the Shear Reynolds Number will increase.

The static pressure distribution in the boundary layers above the hills were measured with conventional, forward facing (axis aligns with the flow), cylindrical pressure probes, and also a disk probe. The cylindrical probe was a commercial type employed for pitot static design. The cylindrical probe is subject to errors due to the "pitch" angle between the air flow and the axis of the cylinder. Near the surface of the hills the air flow will vary rapidly, and thus, produce systematic errors in the static pressure measurements of a cylindrical probe. To reduce the flow direction error in static pressure measurements a disk type probe was employed. The disk probe employs the static pressure reading from a static tap drilled through the center of a small diameter thin disk. The measured static pressure at the disk center will be somewhat lower than the actual stream pressure, but it was found to be insensitive to pitch angles of ± 30 degrees.

The cylindrical probe had a diameter of .18 cm, with an eliptical nose. The static taps were located .67 cm from the nose and 1.59 cm from the support stem. The cylindrical static probe was employed mainly for measurements well above the hill surface, where the flow direction was not influenced by the hill. The disk probe was used for measurements near the hill surface. The disk has a diameter of .62 cm which restricts the measurements near the surface.

All pressure measurements, both static and total, were made with commercial, capacitance, pressure transducers. The pressure transducers were calibrated against a laboratory standard, water manometer. For all measurements the calibration accuracy was maintained to three significant figures (differential pressure). The accuracy of individual measurements was limited due to large time dependent fluctuations of the pressure. The output of the transducers were read with special digital voltmeters with averaging circuits of 15 to 30 seconds. Even with these long averaging times, it was not possible to maintain an accuracy of three significant figures for many of the static pressure readings--particularly near the crest of the hills.

2.3.2 Velocity and Flow Direction Measurements

Mean velocity measurements above the hills were made with commercial pitot- and Kiehl-total pressure probes. A pitot probe .18 cm in diameter with an eliptical nose was employed in regions where flow direction angles were small. In the region near the hill surface, where large flow angles were encountered, a small Kiehl probe, .16 cm in diameter, was employed to measure the total pressure. The Kiehl probe is insensitive to flow angles over a range of at least

$\pm$40 degrees. For the range of velocities measured in the present study both probes agreed with the total pressure measured by the laboratory standard pitot probe. No corrections were made to the probe reading in computing the mean velocity.

A preliminary set of mean velocity profiles were taken employing .064 cm diameter flat nosed, total pressure tubes mounted on a fixed rake. The tubes were adjusted to be approximately aligned with the flow direction at all heights. For the more detailed studies a movable carriage was employed for the surveys. The carriage spans the tunnel and contains a vertical traverse. The pressure probes were mounted on an arm 1.32 m ahead of the carriage. Both direct x-y recordings of the output of the probes traversing through the boundary layer, and direct time averaged readings of the pressures were obtained during the course of the experiments.

A limited amount of information was obtained on the flow angle over the hills with a 35 degree, cantilevered wedge probe. The wedge probe contains a static tap on the face of each side of the wedge. When the wedge is directly aligned with the flow the pressure at the two static taps are equal. The wedge probe was set at different heights above the hills and manually rotated to determine the null point between the two static pressure readings.

Preston tubes .07 cm in diameter were mounted on the surface of the hills to aid in the evaluation of the surface shear stress. Adequate calibrations for the tubes have not at present been completed.

2.3.3 Turbulence Measurements

Hot wire anemometers were employed to measure the turbulent velocities over the hills. Commercial, constant temperature, anemometer circuits were used to operate platinum alloy hot wires. The heat transfer from a hot wire is employed to measure both the mean and turbulent velocity components in flows. The present measurements employed hot wire sensing elements approximately .15 cm long and .001 cm in diameter to evaluate the turbulence. Single wires placed normal to the mean flow were used to measure the longitudinal component of the turbulent velocity, u. The turbulent velocity component, w, normal to the mean flow and perpendicular to the surface was obtained from hot wires yawed with respect to the mean flow.

The hot wire sensors were calibrated by placing them in the free stream of the wind tunnel. The electrical power required to maintain the wires at a fixed temperature (or resistance) was measured as a function of flow velocity. The flow velocity was measured directly with a pitot-static probe. The wind tunnel temperature was held constant, so only the velocity varied. Slight deviation of the air temperature produced some uncertainty in the hot wire calibrations. Since the wire resistance is held electronically constant, the hot wire power can be related to the voltage drop versus the flow velocity. The turbulent velocities were determined from the following relations

(Wire Normal to Flow) $$u = \frac{dU}{dE} \quad e \tag{1}$$

(Yawed Wire) $$\left(\frac{dE}{dU}\right)^2 u^2 + 2\left(\frac{dE}{dU}\right)\left(\frac{1}{U}\frac{dE}{d\psi}\right)\overline{uw} + \left(\frac{1}{U}\frac{dE}{d\psi}\right)^2 w^2 = e^2 \tag{2}$$

where $\frac{dE}{dU}$ is the local sensitivity of the hot wire output voltage drop to velocity change, and $dE/d\psi$ is the local sensitivity of the hot wire output voltage drop to a change in flow direction. The yawed wire is sensitive to two turbulent velocity components plus the correlation between the components. The correlation, $\overline{uw}$, is the Reynolds stress term and of major interest in boundary layer theory. In order to determine $\overline{uw}$ and w^2 it was necessary to operate hot wires with different sensitivities to the components. An X-probe consisting of two wires was employed for the present study. One wire was set approximately normal to the mean flow in the vertical direction, and the second wire was yawed at an angle of approximately 40 degrees to the flow. The wire normal to the flow measured directly u^2, while the product of the voltage output of the normal, e_n, and the yawed, e_y, wires give,

$$\overline{e_n e_y} = \left(\frac{dE}{dU}\right)_n \left(\frac{dE}{dU}\right)_y u^2 + \left(\frac{dE}{dU}\right)_n \left(\frac{1}{U}\frac{dE}{d\psi}\right)_y \overline{uw} \qquad (3)$$

thus, the value u^2 computed directly from the normal wire output according to equation (1). The value $\overline{uw}$ was computed from the product according to equation (3), and w^2 was then determined from equation (2). Only turbulence intensity values are tabulated herein.

Preliminary evaluations of the longitudinal component u^2 were made with a set of hot wires mounted normal to the flow and parallel to the surface. A single X-probe was employed with the transversing carriage in later tests. Evaluation of the X-probe data is still being carried out.

Hot wires were also mounted on the surface of the hills to measure the fluctuations in the surface shear stress. Data from these wires have not been analyzed at the present time.

2.4 Test Conditions

The flow fields above the hills were surveyed at two free stream velocities, 9.1 meters per second and 15.2 meters per second. The wind tunnel ceiling was adjusted to produce a near zero pressure gradient along the wind tunnel test section without the hills installed. The approach turbulence level in the free stream was of the order of 0.2 percent of the mean velocity. After the initial boundary layer trip the approach flow develops over a smooth (aerodynamically) wood surface. The equivalent flat plate Reynolds numbers for the boundary layer approaching the hills for the smooth surface case are 4×10^7 and 7×10^7. The freestream velocity was monitored throughout the tests with a pitot-static probe affixed to the ceiling upstream of the hill locations.

3.0 DATA REDUCTION

This report contains data of several measuring periods attained in the Meteorological Wind Tunnel located in the Fluid Dynamics and Diffusion Laboratory of Colorado State University, Fort Collins, Colorado, during the second half of 1976 and 1977. The general measuring procedure has been described extensively in the first annual report as well as reviewed in the previous section. For each measuring period the procedure was somewhat different. Therefore, a list with information about the instrumentation and the procedures applied in the acquisition of the data which is reported in the tables is given in the appendix.

During the last year a set of computer programs have been developed in order to represent the data in a way that usage becomes relatively easy. Contour lines can be generated of the pressures, velocities and turbulence in the flow field over the two-dimensional hill models. Also the stream line pattern can be visualized. In the process of the generation of countour lines a number of steps are built in order to get rid of inconsistencies in the data. A flow chart of the procedure was given in the annual report.

Some of the features of the data reduction procedure are given below: Incorporating such features into their own data reduction programs may facilitate the utilization of this data by other investigators.

- The measurements obtained from a verticle traverse are smoothed and interpolated using cubic spline functions.
- A microfilm plot is generated of each verticle profile to see if the data points look consistent with its neighboring points.

- Subsequent verticle profiles are checked on its consistency. If there is an indication of erroneous data then that particular data can easily be ignored.
- Any region in the flow field where measurements have been made can be specified separately while all data is taken into consideration.

Other features have been added for the generation of smoothed velocity profiles. The magnitude of the velocity changes drastically close to the surface and in the wake-main flow interface. Those regions require special attention during the measurements (more measurements) as well as during the reduction procedure.

Surface region: The part of the data in a vertical profile which represents the elevation can be transformed to a logarithmic scale. In this way the data to be smoothed is more or less equally "spaced," which results in satisfactory smoothing in the surface region.

Wake interface region: Smoothing of a verticle profile through a wake using the procedure described in the first annual report results in an oscillating interpolating function. A rotation of the coordinates (velocity and elevation) prevent this undesired phenomena.

The consistency between successive velocity profiles may be improved by incorporating the assumption that at a height of 10 times the hill height above the hill the streamline stays horizontal. A justification for the assumption is the fact that the variation in velocities generated at that height agrees to a high degree with measurements attained from a horizontal traverse at that elevation.

Besides the visual presentation of the data described above, values for each flow case and flow characteristic are generated in an equally spaced grid and are stored on tape. Two different grid spacings are used:

$$\begin{cases} \Delta x = .16 \times L \\ \Delta z = .20 \times h \end{cases} \quad \text{and} \quad \begin{cases} \Delta x = .04 \times L \\ \Delta z = .04 \times h \end{cases}$$

While the grids have the dimensions horizontally 2 resp. .5 times the hill length, and vertically 10 resp. 2 times the hill height. Both grids are centered around the crest with its lowest grid points coinciding with the upstream surface.

4.0 TABULATED DATA

The evaluated static pressure, mean velocity, and longitudinal turbulence intensity data are listed herein in tabular form. The tables include location information for each point in centimeters with respect to the longitudinal crest of the hill but above base height. Hill configuration, roughness, stratification, and reference approach velocity are indicated on each table.

Table 1 performs as a locator table for specific information. Table numbers specify the static pressure, mean velocity, or turbulence intensity table pertinent to a specific set of model conditions. In addition Reynolds number, Re_h, roughness/boundary layer thickness ratio, z_o/δ, and friction velocity $U_o*/U_o(10h)$ are specified.

In Table 2 static pressures are given in newton per centimeter squared. Table 3 and Table 4 give mean velocities and turbulence intensities in meter per second.

REFERENCES

Cermak, J. E. (1975), "Applications of Fluid Mechanics to Wind Engineering," 1974 Freeman Scholar Lecture, ASME J. of Fluid Engineering, Vol. 97, Series No. 1, March, pp. 1-30.

Gartshore, I. S. and de Croos, K. A. (1976), "Roughness Element Geometry Required for Wind Tunnel Simulations of the Atmospheric Wind," ASME Technical Paper 76-WA/FE-18, 7 p.

Meroney, R. N., Sandborn, V. A., Bouwmeester, R. J. B., and Rider, M. A. (1976a), "Sites for Wind Power Installations: Wind Tunnel Simulation of the Influence of Two-Dimensional Ridges on Wind Speed and Turbulence," Annual Report, Prepared under NSF/RANN GAER-75-00702, ERDA/NSF Report 00702/75/T1, July 1976, 80 p.

Meroney, R. N. (1976b), "Wind Tunnel Simulation of the Influence of Two-Dimensional Ridges on Wind Speed and Turbulence," Proceedings.

Meroney, R. N. (1976c), "History of Wind Characteristics Research," Appendix A, Proceedings of the Wind Characteristics Workshop, AMS Headquarters, Boston, Massachusetts, June 2-4, 1976, Battelle, Pacific Northwest Laboratories.

TABLES

Table 1.0 Locator Table

The following table depicts the test conditions for data tabulated:

SHAPE	SLOPE*	$\frac{h}{L}$	h (cm)	$U_o(10h)$ (m/sec)	Re_h	$\frac{z_o}{h}$	$\frac{\delta}{h}$	$U_o^*/U_o(10h)$	NUMBERS FOR TABLE IDENTIFICATION PRESSURE	VELOCITY	TURBULENCE
Triangular	1:2	1.0	5.08	9.14	30,000	1.5×10^{-4}	14.0	.032	1.1a	1.2a	1.3a
Triangular	1:2	1.0	5.08	15.24	50,000	9.0×10^{-5}	10.5	.032	1.1b	1.2b	
Triangular	1:3	.67	5.08	9.14	30,000	1.5×10^{-4}	10.5	.032	1.1c	1.2c	
Triangular	1:3	.67	5.08	15.24	50,000	9.0×10^{-5}	10.5	.032	1.1d	1.2d	
Triangular	1:4	.50	5.08	9.14	30,000	1.5×10^{-4}	14.0	.032	1.1e	1.2e	1.3b
Triangular	1:4	.50	5.08	15.24	50,000	9.0×10^{-5}	10.5	.032	1.1f	1.2f	
Triangular	1:6	.33	5.08	9.14	30,000	1.5×10^{-4}	14.0	.032	1.1g	1.2g	1.3c
Triangular	1:6	.33	5.08	15.24	50,000	9.0×10^{-5}	10.5	.032	1.1h	1.2h	
Triangular	1:20	.10	5.08	9.14	30,000	1.5×10^{-4}	14.0	.032	1.1i	1.2i	1.3d
Sinusoidal	1:3	.67	5.08	9.14	30,000	1.5×10^{-4}	10.5	.032	1.1j	1.2j	
Sinusoidal	1:3	.67	5.08	15.24	50,000	9.0×10^{-5}	10.5	.032	1.1k	1.2k	
Sinusoidal	1:4	.50	5.08	9.14	30,000	1.5×10^{-4}	10.5	.032	1.1l	1.2l	
Sinusoidal	1:4	.50	5.08	15.24	50,000	9.0×10^{-5}	10.5	.032	1.1m	1.2m	
Triangular	1:4	.50	5.08	9.14	30,000	2.0×10^{-3}	14.0	.040	1.1n	1.2n	1.3e

*For sinusoidal hill slope equals hill height to half width ratio.

Table 1.1a Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 2, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -30.48		X= -15.24		X= -10.16		X= -7.62		X= -2.54	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.040	0.00	.080	0.00	.100	1.27	.084	3.81	.005
.33	.043	.33	.079	.31	.103	1.60	.085	4.12	.010
.46	.039	.46	.073	.44	.100	1.73	.082	4.25	.010
1.10	.039	.70	.074	.68	.096	2.14	.084	4.69	.004
2.11	.040	1.63	.077	1.27	.095	3.32	.073	5.42	-.005
3.70	.037	3.43	.069	5.01	.067	5.05	.058	6.91	-.005
5.36	.038	5.21	.061	6.92	.053	6.82	.025	8.72	-.012
7.12	.034	6.99	.054	11.00	.033	10.39	.029	12.19	-.014
10.71	.035	10.58	.041	15.71	.019	14.11	.014	15.77	-.015
14.30	.027	15.82	.033	21.12	.005	19.30	.005	21.17	-.016
19.68	.022	21.31	.013	28.28	-.000	24.65	.000	26.87	-.018
26.06	.017	28.44	.005	36.84	-.004	31.83	-.003	31.87	-.018
32.12	.011	37.76	.002	44.87	-.001	42.54	-.008	42.59	-.014
42.87	.005	45.45	-.006	54.11	-.006	53.95	-.004	54.12	-.014
54.33	-.017	54.23	-.005						

X= -0.00		X= 2.54		X= 7.62		X= 15.24		X= 30.48	
Z	P	Z	P	Z	P	Z	P	Z	P
5.08	-.090	3.81	-.100	1.27	-.105	0.00	-.100	0.00	-.082
5.37	-.067	4.10	-.100	1.59	-.106	.33	-.104	.31	-.082
5.50	-.065	4.21	-.100	1.70	-.106	.50	-.106	.46	-.083
6.23	-.056	4.45	-.105	1.85	-.104	.72	-.107	.93	-.086
7.61	-.045	4.64	-.106	2.00	-.101	1.07	-.106	1.63	-.087
9.82	-.038	4.80	-.106	2.13	-.107	1.88	-.110	3.12	-.093
12.19	-.031	5.53	-.086	3.86	-.107	3.19	-.110	4.90	-.098
14.06	-.029	5.73	-.088	5.47	-.111	4.95	-.113	6.63	-.096
17.57	-.028	6.70	-.081	6.65	-.103	6.79	-.114	10.20	-.083
21.22	-.025	8.39	-.065	10.13	-.084	10.36	-.093	13.82	-.073
26.48	-.026	11.99	-.049	13.71	-.073	13.99	-.077	19.54	-.064
31.93	-.022	17.33	-.043	19.13	-.051	17.55	-.068	24.53	-.059
40.89	-.018	22.66	-.034	24.55	-.043	23.46	-.052	31.68	-.050
46.14	-.019	28.01	-.028	31.58	-.034	28.63	-.044	38.77	-.037
54.02	-.017	35.33	-.023	41.39	-.026	37.16	-.034	46.42	-.027
		44.12	-.023	53.72	-.022	44.60	-.026	53.90	-.022
		53.77	-.020			54.01	-.022		

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1b Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 2, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -50.80		X= -30.48		X= -20.32		X= -12.70		X= -7.47	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.067	0.00	.103	0.00	.156	0.00	.235	1.35	.205
.09	.051	.09	.098	.09	.142	.09	.222	1.98	.207
.28	.049	.24	.097	.30	.143	.27	.228	2.68	.192
.64	.051	.66	.096	.56	.137	.57	.224	2.97	.174
.77	.051	.81	.093	.81	.138	.80	.220	3.40	.165
1.07	.052	1.03	.092	1.01	.143	1.06	.223	4.83	.126
1.54	.051	1.51	.096	1.54	.143	1.52	.217	7.67	.074
2.95	.049	3.02	.096	2.91	.138	2.94	.197	12.68	.010
5.76	.047	5.89	.091	5.76	.123	5.81	.141	19.82	-.020
10.87	.045	10.82	.075	10.97	.082	10.80	.071	27.00	-.031
18.08	.038	18.00	.045	18.14	.033	17.95	.021	37.67	-.037
25.20	.029	25.25	.019	25.24	.001	25.09	-.001	51.93	-.030
35.88	.015	35.81	-.003	35.87	-.022	35.82	-.017		
50.21	.003	50.27	-.015	50.17	-.033	50.09	-.020		

X= -5.23		X= -2.92		X= -1.78		X= -.70		X= -0.00	
Z	P	Z	P	Z	P	Z	P	Z	P
2.46	.118	3.62	-.006	4.19	-.074	4.73	-.227	5.08	-.339
3.10	.119	4.25	-.024	4.83	-.113	5.15	-.253	5.17	-.368
3.81	.094	4.98	-.056	5.53	-.137	5.85	-.240	5.37	-.337
4.05	.089	5.23	-.057	5.77	-.141	6.12	-.231	5.65	-.294
4.54	.078	5.68	-.064	6.26	-.146	6.59	-.214	5.93	-.270
5.95	.047	7.12	-.076	7.67	-.139	8.00	-.180	6.14	-.259
8.81	.006	9.97	-.076	10.51	-.118	10.86	-.137	6.56	-.238
13.83	-.033	14.96	-.074	16.96	-.096	15.86	-.106	8.01	-.189
20.96	-.046	22.10	-.072	24.10	-.085	23.00	-.082	10.86	-.148
28.13	-.046	29.25	-.060	31.23	-.072	30.17	-.049	15.94	-.115
38.82	-.046	39.98	-.048	40.54	-.065	40.89	-.051	23.12	-.096
50.88	-.041	49.92	-.040	52.48	-.054	53.65	-.040	30.31	-.081
								41.04	-.072
								54.70	-.057

X= 1.12		X= 4.52		X= 6.81		X= 12.70		X= 30.48	
Z	P	Z	P	Z	P	Z	P	Z	P
4.52	-.377	2.82	-.386	1.68	-.372	0.00	-.338	0.00	-.217
4.93	-.351	3.23	-.363	2.08	-.376	.09	-.335	.09	-.209
5.63	-.360	3.93	-.362	2.78	-.377	.26	-.341	.28	-.233
5.89	-.336	4.18	-.363	3.03	-.380	.59	-.335	.57	-.240
6.38	-.311	4.65	-.363	3.51	-.380	.80	-.335	.79	-.248
7.76	-.254	6.03	-.343	4.94	-.369	1.05	-.342	1.07	-.253
10.63	-.186	8.93	-.288	7.78	-.325	1.52	-.346	1.54	-.258
15.64	-.135	13.94	-.205	12.78	-.192	2.95	-.350	2.93	-.278
22.79	-.102	21.08	-.145	19.94	-.164	5.78	-.363	5.80	-.294
29.96	-.083	28.20	-.121	27.10	-.129	10.80	-.286	10.82	-.247
40.63	-.067	38.93	-.084	37.82	-.085	17.96	-.208	17.93	-.204
53.55	-.048	53.21	-.059	52.07	-.052	25.08	-.134	25.09	-.164
						35.80	-.103	35.82	-.125
						50.07	-.068	50.07	-.076

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1c Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 3, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -76.20		X= -45.72		X= -30.48		X= -17.78		X= -10.01	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.014	0.00	.026	0.00	.035	0.00	.063	1.74	.021
.09	.002	.09	.015	.09	.031	.09	.059	2.02	-.022
.26	.005	.27	.018	.27	.031	.26	.064	2.74	-.026
.59	.006	.58	.020	.60	.030	.60	.059	2.99	-.026
.80	.004	.80	.018	.80	.030	.81	.059	3.45	-.030
1.06	.004	1.06	.019	1.07	.027	1.05	.052	4.88	-.034
1.52	.005	1.52	.018	1.53	.028	1.52	.053	7.74	-.045
2.96	.002	2.94	.016	2.94	.030	2.95	.048	12.73	-.060
5.79	.004	5.81	.015	5.82	.032	5.80	.034	19.88	-.066
10.80	.000	10.80	.012	10.82	.019	10.80	.014	27.02	-.071
17.94	.002	17.94	.006	17.98	.008	17.95	-.004	37.74	-.067
25.08	-.002	25.09	.003	25.10	.000	25.10	-.010	52.03	-.066
35.80	-.001	35.80	-.001	35.80	-.004	35.80	-.019		
50.10	-.004	50.10	-.006	50.10	-.009	50.10	.007		

X= -6.50		X= -4.14		X= -3.02		X= -1.75		X= -.64	
Z	P	Z	P	Z	P	Z	P	Z	P
2.91	.008	3.70	-.024	4.07	-.042	4.50	-.070	4.87	-.042
3.19	-.011	3.98	-.051	4.35	-.070	4.78	-.091	5.15	-.126
3.91	-.015	4.69	-.052	5.07	-.070	5.48	-.095	5.33	-.121
4.16	-.023	4.94	-.053	5.31	-.073	5.75	-.091	5.65	-.117
4.61	-.018	5.40	-.055	5.79	-.072	6.20	-.086	5.85	-.110
6.04	-.024	6.84	-.053	7.22	-.066	7.63	-.078	6.10	-.103
8.90	-.028	9.70	-.048	10.07	-.057	10.50	-.063	6.59	-.098
13.90	-.030	14.69	-.041	15.07	-.045	15.49	-.051	8.00	-.083
21.06	-.030	21.84	-.036	22.22	-.036	22.63	-.045	10.88	-.068
28.18	-.028	28.98	-.029	29.36	-.031	29.78	-.035	15.86	-.052
38.90	-.025	39.70	-.029	40.07	-.026	40.49	-.029	23.04	-.031
53.18	-.021	53.99	-.021	54.35	-.022	54.77	-.026	30.15	-.033
								40.86	-.026
								55.08	-.021

X= -0.00		X= 2.39		X= 7.14		X= 11.91		X= 17.78	
Z	P	Z	P	Z	P	Z	P	Z	P
5.08	-.128	4.28	-.125	2.70	-.129	1.11	-.131	0.00	-.124
5.17	-.132	4.67	-.124	3.08	-.128	1.49	-.133	.38	-.125
5.35	-.127	4.86	-.131	3.78	-.128	2.18	-.134	.56	-.126
5.67	-.129	5.18	-.135	4.06	-.133	2.38	-.134	.85	-.128
5.86	-.123	5.36	-.136	4.51	-.132	2.93	-.134	1.07	-.129
6.11	-.120	5.62	-.130	5.96	-.134	4.38	-.137	1.35	-.128
6.58	-.107	6.09	-.118	8.75	-.111	7.22	-.129	1.80	-.129
8.04	-.093	7.53	-.107	13.82	-.088	12.18	-.102	3.24	-.136
10.88	-.073	10.35	-.088	20.97	-.068	19.32	-.078	4.14	-.135
15.87	-.059	15.39	-.066	28.09	-.051	26.50	-.062	11.13	-.104
23.06	-.047	22.52	-.051	38.78	-.041	37.18	-.046	18.22	-.076
30.18	-.039	29.64	-.041	53.05	-.033	51.50	-.037	25.38	-.059
40.91	-.031	40.35	-.032					36.11	-.044
55.19	-.027	54.66	-.028					50.39	-.033

X= 76.20	
Z	P
0.00	-.006
.09	-.006
.27	-.012
.58	-.012
.80	-.016
1.04	-.017
1.51	-.022
2.99	-.027
5.87	-.029
10.79	-.024
17.95	-.026
25.16	-.028
35.80	-.026
50.08	-.023

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1d Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 3, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -76.20		X= -45.72		X= -30.48		X= -17.78		X= -10.01	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.039	0.00	.071	0.00	.097	0.00	.182	1.74	.112
.09	.013	.09	.048	.09	.078	.09	.173	2.02	.082
.27	.011	.25	.050	.29	.073	.27	.168	2.22	.080
.58	.013	.59	.047	.62	.078	.61	.163	2.51	.071
.80	.013	.81	.048	.82	.079	.78	.166	2.75	.065
1.05	.014	1.05	.047	1.07	.077	1.07	.165	2.99	.067
1.52	.015	1.52	.048	1.56	.076	1.52	.158	3.44	.059
2.94	.014	2.94	.042	2.97	.074	2.95	.146	4.86	.043
5.80	.013	5.82	.040	5.85	.067	5.85	.102	7.72	.007
10.80	.008	10.80	.029	10.79	.050	10.85	.052	12.82	-.025
17.95	.002	17.95	.020	17.99	.021	17.96	.002	23.47	-.062
25.10	.002	25.10	.006	25.07	.001	25.10	-.023	27.04	-.063
35.79	-.001	35.82	-.003	35.82	-.017	35.79	-.034	37.69	-.061
50.09	-.005	50.10	-.015	50.07	-.027	50.09	-.034	51.89	-.054

X= -6.50		X= -4.14		X= -3.02		X= -1.75		X= -.64	
Z	P	Z	P	Z	P	Z	P	Z	P
2.91	.016	3.70	-.074	4.07	-.126	4.50	-.196	4.87	-.305
3.19	-.026	3.98	-.125	4.35	-.179	4.78	-.249	5.15	-.331
3.92	-.044	4.78	-.133	5.09	-.187	5.49	-.243	5.87	-.296
4.16	-.043	5.04	-.133	5.69	-.183	5.74	-.233	6.12	-.290
4.58	-.048	5.41	-.130	5.81	-.182	6.20	-.230	6.58	-.272
6.00	-.058	6.88	-.136	7.22	-.172	7.62	-.204	8.00	-.235
8.94	-.075	9.69	-.131	10.07	-.151	10.48	-.168	10.85	-.192
13.91	-.080	14.71	-.121	15.07	-.124	15.49	-.138	15.85	-.153
21.06	-.080	21.84	-.102	22.26	-.106	22.65	-.112	23.00	-.126
28.20	-.080	29.01	-.089	29.39	-.087	29.82	-.092	30.16	-.107
38.89	-.071	39.69	-.072	40.07	-.071	40.53	-.075	40.88	-.089
51.83	-.056	51.87	-.062	52.02	-.058	52.08	-.062	52.68	-.073

X= -0.00		X= 2.39		X= 7.14		X= 11.91		X= 17.78	
Z	P	Z	P	Z	P	Z	P	Z	P
5.08	-.359	4.28	-.360	2.70	-.355	1.11	-.363	0.00	-.345
5.17	-.371	4.67	-.369	3.08	-.359	1.49	-.367	.38	-.342
5.37	-.371	4.84	-.367	3.25	-.352	1.68	-.368	.57	-.342
5.67	-.370	5.17	-.373	3.57	-.361	2.03	-.369	1.17	-.355
5.89	-.349	5.37	-.371	3.80	-.364	2.23	-.371	1.38	-.365
6.13	-.334	5.62	-.365	4.05	-.363	2.47	-.375	1.62	-.360
6.60	-.305	6.10	-.345	4.52	-.368	2.93	-.375	1.84	-.366
8.03	-.270	7.52	-.313	5.94	-.372	4.36	-.381	3.28	-.375
10.88	-.212	10.38	-.259	8.82	-.307	7.23	-.368	6.11	-.388
15.91	-.167	15.35	-.198	13.81	-.243	12.20	-.287	11.12	-.282
23.03	-.135	22.53	-.153	20.94	-.181	19.33	-.211	18.22	-.210
30.16	-.118	29.67	-.132	28.08	-.142	26.53	-.167	25.37	-.159
40.87	-.098	40.37	-.103	38.78	-.108	37.21	-.128	36.11	-.112
52.73	-.080	52.49	-.092	52.52	-.087	51.46	-.090	50.44	-.079

X= 76.20	
Z	P
0.00	-.027
.09	-.037
.27	-.040
.59	-.046
.80	-.052
1.13	-.056
1.51	-.066
2.95	-.081
5.80	-.090
10.80	-.072
17.92	-.075
25.07	-.080
35.79	-.080
50.07	-.071

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1e Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -81.28		X= -40.64		X= -25.40		X= -20.32		X= -15.24	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	0.000	0.00	0.000	0.00	.050	0.00	.055	1.27	.020
.34	-.007	.35	.006	.39	.029	.40	.054	1.62	.025
.60	-.006	.62	.008	.64	.032	.67	.049	1.91	.021
1.11	-.004	1.09	.007	.94	.030	1.16	.047	2.42	.019
1.87	-.007	1.89	.008	1.12	.026	1.96	.041	2.94	.019
2.59	-.004	3.10	.009	1.43	.027	3.14	.034	3.95	.015
3.94	-.004	7.28	.006	2.37	.026	5.94	.020	5.25	.008
6.23	-.004	11.78	.003	3.78	.023	9.34	.009	7.60	-.001
10.36	-.004	16.32	-.002	7.12	.017	14.47	-.004	10.37	-.009
14.54	-.009	21.78	-.005	14.25	.001	21.74	-.013	14.51	-.016
21.69	-.010	29.20	-.009	21.78	-.013	28.97	-.017	21.72	-.021
28.78	-.008	36.65	-.011	28.84	-.013	36.44	-.016	28.75	-.021
35.99	-.008	44.18	-.008	36.35	-.013	43.64	-.012	36.16	-.020
43.16	-.006	53.29	-.006	45.13	-.013	52.87	-.014	44.49	-.016
53.14	-.009			53.05	-.011			53.10	-.014

X= -10.16		X= -2.54		X= -0.00		X= 2.54		X= 10.16	
Z	P	Z	P	Z	P	Z	P	Z	P
2.54	-.010	4.45	-.115	5.08	-.380	4.44	-.200	2.54	-.090
2.93	-.020	4.84	-.121	5.44	-.253	4.92	-.184	2.97	-.059
3.20	-.018	5.37	-.118	5.67	-.237	5.23	-.186	3.27	-.056
3.71	-.022	6.12	-.112	5.95	-.224	5.77	-.176	3.66	-.061
4.18	-.022	7.12	-.111	6.40	-.187	6.65	-.158	3.96	-.064
4.95	-.021	8.45	-.102	7.19	-.160	7.97	-.139	5.18	-.068
5.95	-.025	10.54	-.083	8.01	-.136	10.78	-.100	7.09	-.068
8.01	-.030	13.02	-.067	9.27	-.115	14.52	-.072	10.72	-.067
11.16	-.030	16.81	-.053	10.52	-.103	21.65	-.051	14.71	-.061
14.68	-.034	22.24	-.044	13.30	-.080	29.01	-.038	21.72	-.050
21.58	-.030	29.51	-.036	17.72	-.059	37.65	-.028	28.44	-.039
28.70	-.027	37.47	-.027	22.11	-.048	44.34	-.027	36.54	-.032
36.28	-.024	45.61	-.021	29.95	-.037	52.95	-.024	44.51	-.026
44.55	-.019	53.11	-.024	37.50	-.027			53.05	-.019
53.03	-.014			45.50	-.020				
				53.24	-.020				

X= 17.78		X= 20.32		X= 25.40		X= 81.28	
Z	P	Z	P	Z	P	Z	P
.64	-.040	0.00	-.020	0.00	0.000	0.00	0.000
1.04	-.019	.38	-.003	.38	-.001	.60	-.012
1.29	-.016	.62	-.004	.68	-.001	.92	-.012
1.77	-.023	.93	-.004	1.39	-.002	1.64	-.014
2.07	-.023	1.23	-.010	1.87	-.004	3.61	-.013
2.52	-.024	1.78	-.011	2.58	-.010	6.83	-.014
3.70	-.026	2.50	-.013	4.43	-.018	10.92	-.016
5.96	-.035	3.96	-.020	6.91	-.017	13.82	-.015
9.09	-.036	7.01	-.027	14.24	-.024	21.20	-.016
14.39	-.041	10.58	-.030	21.22	-.028	28.69	-.014
21.29	-.038	14.35	-.036	28.66	-.029	36.54	-.013
28.56	-.037	21.24	-.038	36.74	-.026	44.01	-.015
36.33	-.032	28.53	-.033	44.84	-.026	52.52	-.015
44.52	-.028	36.51	-.030	52.61	-.021		
52.69	-.023	44.22	-.024				
		52.78	-.022				

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1f Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X=-101.60		X= -60.96		X= -40.64		X= -22.86		X= -14.83	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.032	0.00	.066	0.00	.078	0.00	.166	1.37	.040
.09	.001	.09	.020	.09	.052	.09	.139	1.59	.015
.27	.007	.26	.025	.26	.050	.27	.141	2.30	.001
.60	.006	.59	.027	.58	.053	.59	.143	2.56	.002
.80	.008	.81	.029	.80	.046	.81	.139	3.02	-.004
1.05	.009	1.05	.027	1.05	.049	1.05	.141	4.44	-.018
1.52	.007	1.54	.025	1.52	.046	1.52	.131	7.30	-.044
2.94	.007	2.95	.023	2.95	.049	2.95	.109	12.30	-.070
5.81	.004	5.81	.026	5.80	.044	5.82	.062	19.44	-.074
10.82	.004	10.80	.021	10.79	.036	10.82	.002	26.58	-.065
17.96	.004	17.95	.018	17.96	.018	17.94	-.019	37.30	-.052
25.11	.004	25.08	.014	25.10	.005	25.10	-.026	51.59	-.032
35.80	.003	35.80	.009	35.80	.001	35.80	-.027		
50.07	.005	50.07	.001	50.08	-.005	50.09	-.027		

X= -9.88		X= -4.95		X= -2.54		X= -1.27		X= -0.00	
Z	P	Z	P	Z	P	Z	P	Z	P
2.61	-.117	3.84	-.321	4.44	-.487	4.76	-.649	5.08	-.629
2.83	-.151	4.06	-.350	4.66	-.513	4.98	-.671	5.17	-1.247
3.55	-.157	4.78	-.346	5.38	-.511	5.69	-.634	5.35	-1.088
3.79	-.156	5.01	-.342	5.63	-.505	5.94	-.611	5.68	-.899
4.25	-.160	5.49	-.336	6.09	-.490	6.40	-.566	5.88	-.827
5.68	-.162	6.91	-.317	7.51	-.428	7.84	-.453	6.13	-.737
8.53	-.166	9.76	-.314	10.38	-.319	10.69	-.325	6.59	-.634
13.53	-.146	14.78	-.178	15.38	-.228	15.69	-.204	8.03	-.472
20.68	-.114	21.91	-.125	22.51	-.154	22.83	-.128	10.88	-.316
27.83	-.096	29.06	-.098	29.66	-.117	29.98	-.128	15.88	-.184
38.55	-.073	39.76	-.082	40.38	-.080	40.70	-.067	23.03	-.108
52.83	-.052	54.06	-.053	54.67	-.055	54.99	-.046	30.17	-.087
								40.88	-.054
								55.18	-.050

X= 2.54		X= 7.37		X= 14.73		X= 22.86		X= 81.28	
Z	P	Z	P	Z	P	Z	P	Z	P
4.44	-.512	3.24	-.230	1.40	-.029	0.00	.001	0.00	.030
4.74	-.549	3.53	-.282	1.69	-.032	.09	.002	.09	-.007
4.91	-.555	4.02	-.277	2.20	-.036	.27	-.004	.26	-.006
5.23	-.550	4.25	-.279	2.41	-.039	.60	-.013	.59	-.005
5.45	-.542	4.49	-.281	2.65	-.041	.81	-.015	.81	-.005
5.69	-.538	4.96	-.285	3.11	-.049	1.05	-.018	1.05	-.005
6.16	-.515	6.38	-.290	4.55	-.067	1.52	-.027	1.52	-.003
7.60	-.435	9.24	-.267	7.41	-.090	2.95	-.044	2.95	-.010
10.46	-.317	14.25	-.211	12.41	-.111	5.80	-.077	5.80	-.011
15.45	-.205	21.39	-.154	19.55	-.105	10.80	-.116	10.80	-.009
22.59	-.128	28.54	-.119	26.68	-.090	17.95	-.129	17.94	-.010
29.74	-.086	39.25	-.073	37.40	-.065	25.09	-.138	25.09	-.011
40.44	-.068	53.54	-.052	51.68	-.054	35.80	-.096	35.80	-.014
54.74	-.045					50.10	-.078	50.08	-.014

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1g Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 6, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -50.80		X= -35.56		X= -20.32		X= -12.70		X= -7.62	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.010	0.00	.020	1.69	-.012	2.96	-.037	3.81	-.085
.31	.011	.35	.027	2.01	-.001	3.29	-.021	4.12	-.058
.43	.011	.46	.028	2.15	-.001	3.42	-.022	4.24	-.058
.78	.006	.73	.023	2.52	.000	3.70	-.024	4.66	-.057
1.37	.007	1.66	.023	3.29	-.002	4.43	-.024	5.29	-.058
2.06	.010	3.52	.020	4.69	-.000	5.93	-.030	7.27	-.057
3.49	.006	5.90	.018	6.76	-.003	7.49	-.028	10.83	-.050
5.33	.004	8.29	.017	10.74	-.006	9.46	-.032	15.32	-.043
7.06	.006	10.89	.011	14.32	-.012	13.13	-.035	19.74	-.034
10.63	.004	14.39	.008	17.99	-.012	16.18	-.031	25.16	-.029
14.23	.001	17.93	.003	23.27	-.016	21.56	-.027	32.32	-.021
19.62	.001	23.29	-.001	28.79	-.013	28.76	-.018	39.42	-.022
24.93	-.000	28.67	.000	35.75	-.007	38.76	-.015	46.66	-.017
32.07	-.001	35.86	-.001	42.93	-.006	45.43	-.012	54.50	-.017
40.50	-.001	43.12	.003	54.33	-.005	54.43	-.011		
47.18	-.001	54.34	.005						
54.36	-.005								

X= -0.00		X= 7.62		X= 12.70		X= 30.48	
Z	P	Z	P	Z	P	Z	P
5.08	-.325	3.81	-.850	2.96	-.060	0.00	.020
5.39	-.194	4.12	-.095	3.28	-.043	.36	.030
5.51	-.186	4.23	-.072	3.41	-.043	.48	.033
5.83	-.171	4.64	-.071	3.73	-.041	.81	.028
6.21	-.167	5.55	-.074	4.31	-.042	1.81	.027
6.86	-.143	7.13	-.068	5.31	-.042	6.93	.008
8.71	-.103	8.87	-.066	8.52	-.043	10.48	.001
10.85	-.084	11.32	-.057	10.67	-.043	15.75	-.006
14.44	-.062	15.89	-.048	14.38	-.038	21.13	-.008
19.89	-.042	21.63	-.032	19.58	-.036	28.30	-.049
25.29	-.033	28.55	-.028	25.08	-.030	35.46	-.013
33.31	-.022	35.70	-.018	32.17	-.023	44.43	-.013
40.31	-.015	44.87	-.016	39.44	-.023	53.98	-.014
47.19	-.016	54.24	-.011	46.38	-.018		
54.50	-.014			54.36	-.015		

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1h Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 6, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X=-152.40		X= -76.20		X= -45.72		X= -30.48		X= -22.86	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	0.000	0.00	0.000	0.00	.073	0.00	.127	1.27	-.023
.15	0.000	.15	-.014	.15	.059	.15	.141	1.78	-.023
1.18	-.007	.84	-.014	.50	.051	.50	.120	2.81	-.023
2.21	-.010	1.52	-.014	2.21	.047	1.18	.106	4.52	-.031
3.92	-.013	4.95	-.014	3.92	.047	2.90	.084	6.58	-.036
5.64	-.014	8.38	-.014	7.35	.044	4.61	.063	10.01	-.044
9.07	-.021	11.81	-.014	10.78	.040	8.04	.027	13.44	-.058
12.50	-.021	15.24	-.014	14.21	.034	11.47	.013	16.87	-.065
15.93	-.021	18.67	-.014	17.64	.030	16.61	-.009	23.73	-.065
19.36	-.021	25.53	-.014	21.07	.023	20.04	-.023	30.58	-.061
22.79	-.021	32.39	-.014	24.50	.017	25.19	-.030	34.01	-.061
29.64	-.021	39.25	-.014	27.93	.016	32.05	-.037	40.87	-.065
36.50	-.021	46.11	-.014	31.36	.013	38.90	-.037	47.73	-.051
43.36	-.021	52.96	-.014	34.79	.009	45.76	-.037	54.59	-.051
46.79	-.021	58.11	-.014	45.08	0.000			59.73	-.044
				55.37	0.000				

X= -17.78		X= -12.70		X= -7.62		X= -5.08		X= -2.54	
Z	P	Z	P	Z	P	Z	P	Z	P
2.12	-.037	2.96	-.125	3.81	-.241	4.23	-.305	4.66	-.431
2.62	-.052	3.47	-.140	4.32	-.256	4.74	-.313	5.16	-.431
4.34	-.073	4.50	-.147	6.03	-.248	5.43	-.316	7.91	-.374
6.05	-.080	6.90	-.154	7.75	-.241	6.11	-.316	14.77	-.231
7.77	-.087	10.33	-.154	11.18	-.220	11.26	-.277	21.63	-.167
9.48	-.087	13.76	-.147	18.04	-.180	14.69	-.209	28.48	-.131
11.20	-.087	20.62	-.125	24.89	-.130	21.55	-.163	31.91	-.117
16.34	-.094	27.48	-.111	31.75	-.099	28.40	-.127	35.34	-.102
19.77	-.092	30.91	-.093	38.61	-.081	35.26	-.098	38.77	-.088
23.20	-.087	37.76	-.083	45.47	-.069	38.69	-.088	45.63	-.074
26.63	-.087	41.19	-.074	52.33	-.056	45.55	-.074	49.06	-.067
33.49	-.069	48.05	-.065	58.50	-.054	52.07	-.064	52.49	-.064
36.92	-.066	54.91	-.058						
43.78	-.063								
52.35	-.052								
57.49	-.052								

X= -1.27		X= -0.00		X= 2.54		X= 5.08		X= 10.16	
Z	P	Z	P	Z	P	Z	P	Z	P
4.87	-.567	5.08	-1.000	4.66	-.424	4.23	-.324	3.39	-.207
5.38	-.567	5.23	-1.000	4.91	-.438	4.74	-.338	4.15	-.214
7.09	-.439	5.58	-.774	8.34	-.345	5.77	-.324	7.24	-.214
10.52	-.317	6.26	-.549	15.20	-.217	8.17	-.303	10.66	-.207
15.66	-.232	7.29	-.430	18.63	-.188	15.03	-.217	14.09	-.185
22.52	-.161	9.00	-.346	22.06	-.160	18.46	-.188	20.95	-.150
29.38	-.125	12.43	-.278	25.49	-.141	25.32	-.146	24.38	-.128
36.24	-.096	19.29	-.188	28.92	-.124	28.75	-.129	27.81	-.114
39.67	-.082	22.72	-.165	32.35	-.111	39.03	-.090	34.67	-.100
46.53	-.075	29.58	-.143	35.77	-.096	45.89	-.074	41.53	-.078
53.39	-.068	36.44	-.126	40.92	-.081	52.07	-.067	50.10	-.057
		39.87	-.106	54.64	-.063			55.25	-.057
		46.73	-.099						
		53.59	-.075						

X= 15.24		X= 20.32		X= 30.48		X= 45.72		X= 76.20	
Z	P	Z	P	Z	P	Z	P	Z	P
2.54	-.115	1.69	-.071	0.00	.114	0.00	0.000	0.00	0.000
3.30	-.115	2.46	-.056	.15	.086	.15	-.010	.15	-.009
3.99	-.136	3.14	-.064	1.18	.064	1.52	-.010	2.55	-.009
4.67	-.150	3.48	-.071	3.58	.029	2.55	-.011	4.61	-.011
6.39	-.157	5.88	-.071	7.01	0.000	5.30	-.014	8.04	-.020
9.82	-.157	9.31	-.085	10.44	-.016	7.01	-.014	11.47	-.023
13.25	-.157	12.74	-.085	13.87	-.021	10.44	-.016	14.90	-.024
16.68	-.150	16.17	-.085	19.01	-.036	13.87	-.019	20.04	-.026
20.11	-.143	19.60	-.081	25.87	-.043	19.01	-.021	25.19	-.026
23.54	-.136	26.46	-.078	31.02	-.050	24.16	-.024	32.05	-.026
26.96	-.129	31.60	-.071	34.45	-.050	31.02	-.024	38.90	-.029
33.82	-.108	40.18	-.064	41.30	-.050	36.16	-.024	45.76	-.029
40.68	-.093	51.50	-.049	47.82	-.050	41.30	-.026	49.19	-.029
44.11	-.086					52.96	-.029		
54.40	-.079								

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1i Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 20, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X=-203.20		X=-152.40		X=-127.00		X=-101.60		X= -76.20	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	-.003	0.00	-.002	0.00	.002	0.00	.016	1.27	-.009
.25	-.003	.25	-.002	.25	.002	.25	.016	1.52	-.009
1.40	-.005	1.40	-.002	1.63	.002	1.63	.015	3.17	-.010
4.18	-.005	4.68	-.002	4.41	.000	4.41	.011	5.32	-.009
8.25	-.005	8.75	-.002	9.77	-.000	7.41	.007	9.89	-.009
15.18	-.006	16.33	-.004	16.63	-.001	11.55	.003	14.82	-.010
22.47	-.005	23.90	-.003	24.05	-.001	16.84	-.000	20.60	-.010
29.83	-.005	30.75	-.002	31.20	-.001	24.05	-.003	26.96	-.011
36.68	-.004	37.90	-.002	38.48	-.004	30.91	-.003	35.75	-.011
44.04	-.004	44.83	-.002	45.20	-.003	38.55	-.004	43.89	-.010
51.54	-.002	52.47	-.003	52.70	-.003	45.55	-.005	52.53	-.010
43.97	-.004					52.77	-.006		
46.97	-.003								
52.54	-.002								

X= -50.80		X= -25.40		X= -0.00		X= 25.40		X= 50.80	
Z	P	Z	P	Z	P	Z	P	Z	P
2.54	-.019	3.81	-.035	5.08	-.116	3.81	-.041	2.54	-.025
2.79	-.019	4.06	-.035	5.33	-.116	4.06	-.041	2.79	-.025
4.37	-.021	5.28	-.037	6.27	-.092	5.21	-.042	4.01	-.025
7.30	-.022	7.93	-.038	8.56	-.074	7.64	-.042	6.87	-.026
12.51	-.022	12.71	-.037	13.06	-.061	12.56	-.041	11.16	-.026
20.58	-.022	19.93	-.035	20.70	-.050	20.28	-.039	18.87	-.025
28.58	-.021	27.78	-.033	28.63	-.043	27.28	-.036	26.94	-.025
36.23	-.021	35.78	-.032	36.70	-.037	34.99	-.034	35.30	-.024
44.08	-.019	44.21	-.027	44.49	-.033	43.42	-.030	44.08	-.023
52.30	-.018	52.21	-.024	52.42	-.030	52.21	-.027	52.01	-.020

X= 76.20		X= 101.60		X= 127.00	
Z	P	Z	P	Z	P
1.27	-.013	0.00	.010	0.00	.002
1.52	-.013	.25	.010	.25	.002
2.95	-.014	1.24	.008	2.34	-.001
6.30	-.014	3.67	.007	6.77	-.001
10.66	-.016	7.74	.002	14.48	-.002
17.66	-.015	15.24	-.004	22.27	-.004
25.80	-.016	22.46	-.006	30.12	-.004
34.16	-.016	30.17	-.007	38.34	-.005
43.09	-.015	37.24	-.008	45.27	-.005
51.95	-.014	44.82	-.009	52.48	-.004
		52.39	-.009		

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1j Sinusoidal Hill Model, Height 5.08 cm, Halflength Height Ratio 3, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -60.96		X= -45.72		X= -30.48		X= -17.78		X= -12.83	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.016	0.00	.029	0.00	.041	0.00	.081	1.25	.057
.09	.005	.09	.020	.09	.029	.09	.069	1.81	.051
.28	.005	.27	.021	.25	.030	.27	.074	1.99	.048
.59	.006	.58	.020	.59	.030	.58	.077	2.30	.040
.81	.006	.78	.020	.81	.034	.80	.075	2.55	.037
1.12	.005	1.05	.019	1.05	.032	1.07	.074	2.78	.029
1.52	.006	1.51	.021	1.52	.035	1.51	.070	3.24	.025
2.93	.005	2.97	.018	2.96	.033	2.94	.063	4.67	.012
5.81	.004	5.81	.021	5.80	.031	5.81	.039	7.55	-.007
10.81	.004	10.80	.014	10.79	.024	10.80	.009	12.54	-.028
17.95	.003	17.95	.016	17.95	.013	17.95	-.003	19.66	-.015
25.09	.003	25.10	.016	25.07	.009	25.10	-.006	26.85	-.014
35.81	.001	35.80	.014	35.80	-.001	35.80	-.003	37.55	-.007
50.09	.002	50.08	.014	50.12	.004	50.17	-.000	51.80	-.002

X= -7.85		X= -5.46		X= -3.02		X= -1.22		X= -0.00	
Z	P	Z	P	Z	P	Z	P	Z	P
3.51	-.119	4.30	-.193	4.84	-.252	5.04	-.270	5.08	-.252
3.98	-.112	4.66	-.182	5.03	-.233	5.15	-.251	5.17	-.260
4.13	-.112	4.84	-.181	5.20	-.235	5.33	-.250	5.34	-.244
4.48	-.117	5.17	-.175	5.52	-.235	5.65	-.253	5.68	-.240
4.69	-.115	5.39	-.171	5.74	-.224	5.87	-.246	5.89	-.236
4.93	-.116	5.62	-.169	6.00	-.216	6.13	-.237	6.15	-.227
5.41	-.112	6.09	-.160	6.46	-.201	6.57	-.222	6.61	-.210
6.83	-.106	7.51	-.139	7.88	-.162	8.01	-.182	8.04	-.169
9.68	-.096	10.38	-.109	10.04	-.126	10.85	-.135	10.89	-.118
14.71	-.077	15.37	-.076	15.74	-.067	15.87	-.078	15.89	-.065
21.84	-.060	22.52	-.047	22.87	-.040	23.01	-.049	23.02	-.036
28.96	-.047	29.69	-.034	30.04	-.027	30.15	-.033	30.15	-.024
39.68	-.037	40.37	-.024	40.73	-.018	40.85	-.026	40.86	-.013
53.96	-.031	54.66	-.017	55.08	-.009	55.18	-.019	55.17	-.007

X= 4.86		X= 12.19		X= 17.78		X= 60.96	
Z	P	Z	P	Z	P	Z	P
4.45	-.191	1.57	-.023	0.00	-.003	0.00	.004
4.68	-.235	1.93	-.013	.09	.007	.09	-.003
4.86	-.235	2.10	-.014	.27	.006	.27	-.003
5.17	-.233	2.43	-.015	.58	.001	.58	-.002
5.40	-.227	2.65	-.015	.80	.001	.80	-.002
5.66	-.222	2.89	.007	1.05	-.007	1.13	-.004
6.12	-.216	3.35	-.042	1.52	-.008	1.51	-.004
7.53	-.121	4.79	-.045	2.95	-.008	2.95	-.004
10.38	-.088	7.64	-.048	5.79	-.011	5.81	-.005
15.41	-.053	12.65	-.048	10.81	-.014	10.82	-.005
22.54	-.031	19.79	-.044	17.98	-.018	17.95	-.005
29.70	-.017	26.95	-.042	25.14	-.022	25.08	-.005
40.38	-.007	37.65	-.038	35.31	-.020	35.82	-.006
54.64	.001	51.95	-.036	50.11	-.016	50.08	-.005

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1k Sinusoidal Hill Model, Height 5.08 cm, Halflength Height Ratio 3, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -60.96		X= -45.72		X= -30.48		X= -17.78		X= -12.83	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	-.016	0.00	-.008	0.00	.023	0.00	.124	1.25	.061
.09	-.044	.09	.029	.09	.059	.09	.175	1.81	.101
.27	-.041	.25	.039	.26	.062	.27	.176	2.52	.070
.60	-.039	.58	.036	.59	.067	.58	.175	2.78	.058
.80	-.037	.80	.037	.80	.066	.80	.170	3.24	.046
1.05	.032	1.05	.037	1.06	.064	1.06	.175	4.67	.003
1.51	.027	1.51	.035	1.52	.064	1.51	.173	7.52	-.049
2.95	.024	2.95	.039	2.95	.061	2.95	.146	12.52	-.078
5.80	.026	5.81	.035	5.80	.058	5.80	.082	19.67	-.076
10.80	.022	10.81	.035	10.80	.038	10.80	.007	26.81	-.072
17.95	.021	17.94	.029	17.95	.013	17.94	-.038	37.52	-.045
25.10	.014	25.08	.019	25.09	-.004	25.08	-.045	51.81	-.025
35.80	.004	35.82	.004	35.80	-.016	35.80	-.033		
50.08	.004	50.08	.000	50.09	-.014	50.09	-.024		

X= -7.85		X= -5.46		X= -3.02		X= -1.22		X= -0.00	
Z	P	Z	P	Z	P	Z	P	Z	P
3.51	-.352	4.30	-.507	4.84	-.687	5.04	-.725	5.08	-.722
3.98	-.290	4.66	-.506	5.03	-.714	5.15	-.723	5.17	-.767
4.70	-.286	5.38	-.480	5.75	-.607	5.85	-.675	5.35	-.721
4.94	-.283	5.61	-.463	6.14	-.571	6.12	-.646	5.68	-.686
5.40	-.276	6.09	-.438	6.46	-.544	6.57	-.604	5.89	-.668
6.83	-.253	7.51	-.381	7.89	-.456	8.02	-.500	6.21	-.633
9.69	-.218	10.39	-.292	10.73	-.333	10.89	-.352	6.60	-.602
14.69	-.166	15.36	-.211	15.73	-.214	15.85	-.246	8.20	-.647
21.83	-.128	22.51	-.145	22.88	-.146	23.03	-.149	10.87	-.352
28.97	-.095	29.66	-.110	30.03	-.108	30.15	-.114	15.87	-.229
39.68	-.071	40.38	-.074	38.19	-.078	40.89	-.074	23.02	-.153
54.01	-.048	54.67	-.056	52.50	-.060	52.30	-.060	30.18	-.119
								41.06	-.083
								52.13	-.063

X= 4.86		X= 12.19		X= 17.78		X= 60.96	
Z	P	Z	P	Z	P	Z	P
4.45	-.449	1.57	-.100	0.00	-.046	0.00	.022
4.68	-.505	1.93	-.107	.09	-.030	.09	.005
4.85	-.479	2.10	-.107	.27	-.034	.27	.010
5.18	-.466	2.43	-.110	.59	-.045	.60	.011
5.41	-.457	2.65	-.114	.80	-.049	.80	.008
5.65	-.448	2.89	-.119	1.07	-.051	1.07	.005
6.11	-.421	3.35	-.130	1.52	-.057	1.51	.008
7.54	-.377	4.79	-.151	2.95	-.060	2.95	.003
10.38	-.300	7.63	-.177	5.81	-.062	5.79	-.002
15.39	-.221	12.63	-.174	10.82	-.081	10.79	.007
22.54	-.151	19.78	-.151	17.95	-.100	17.95	.001
29.70	-.111	26.94	-.123	25.09	-.086	25.10	-.004
40.40	-.077	37.67	-.088	35.80	-.065	35.82	-.004
52.33	-.057	51.95	-.068	50.09	-.051	50.11	-.007

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.11 Sinusoidal Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X=-101.60		X= -60.96		X= -40.64		X= -22.86		X= -14.83	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.004	0.00	.016	0.00	.021	0.00	.058	2.09	-.002
.09	-.003	.09	.004	.09	.016	.09	.053	2.56	-.033
.25	-.003	.27	.004	.27	.017	.27	.054	3.28	-.037
.58	-.001	.60	.003	.60	.015	.58	.052	3.53	-.036
.81	-.003	.80	.002	.80	.015	.81	.053	3.99	-.039
1.04	-.003	1.05	-.000	1.05	.015	1.05	.051	5.41	-.039
1.52	-.002	1.52	-.001	1.51	.016	1.52	.051	8.28	-.040
2.94	-.002	2.94	.003	2.95	.014	2.94	.039	13.27	-.048
5.80	-.002	5.82	.003	5.80	.014	5.80	.026	20.43	-.038
10.80	-.004	10.80	.003	10.81	.010	10.81	.001	27.55	-.031
17.92	-.002	17.95	.001	17.95	.002	17.92	-.013	38.28	-.024
25.12	-.005	25.10	-.002	25.09	-.004	25.10	-.017	49.81	-.016
35.80	-.005	35.82	-.004	35.80	-.007	35.80	-.019		
50.07	-.005	49.88	-.008	50.10	-.009	50.11	-.016		

X= -9.88		X= -4.95		X= -2.54		X= -0.00		X= 2.54	
Z	P	Z	P	Z	P	Z	P	Z	P
3.67	-.130	4.71	-.155	4.98	-.167	5.08	-.196	4.98	-.207
4.08	-.124	4.97	-.156	5.11	-.188	5.17	-.216	5.12	-.212
4.79	-.121	5.47	-.156	5.60	-.184	5.35	-.206	5.30	-.205
5.05	-.119	5.69	-.154	5.85	-.181	5.67	-.232	5.63	-.195
5.50	-.112	5.92	-.153	6.07	-.176	5.89	-.196	5.85	-.189
6.94	-.101	6.39	-.150	6.54	-.165	6.13	-.187	6.03	-.186
9.78	-.085	7.82	-.134	7.96	-.151	6.59	-.179	6.55	-.178
14.79	-.067	10.68	-.114	10.81	-.126	8.03	-.157	7.98	-.149
21.93	-.049	15.68	.598	15.81	-.086	10.88	-.118	10.84	-.117
29.08	-.039	22.83	-.056	22.97	-.063	15.88	-.079	15.84	-.084
39.79	-.029	29.97	-.042	30.12	-.046	23.03	-.049	22.97	-.051
50.11	-.021	40.69	-.029	40.82	-.030	30.17	-.036	30.14	-.039
		50.17	-.024	52.49	-.026	40.88	-.024	40.82	-.027
						49.61	-.017	52.34	-.021

X= 7.37		X= 14.73		X= 22.86		X= 81.28	
Z	P	Z	P	Z	P	Z	P
4.28	-.153	2.13	-.012	0.00	.030	0.00	.003
4.49	-.148	2.44	-.021	.09	.031	.09	-.004
4.67	-.143	2.62	-.024	.28	.031	.27	-.005
5.02	-.146	2.96	-.025	.59	.025	.58	-.002
5.22	-.146	3.16	-.030	.81	.025	.80	-.006
5.48	-.146	3.40	-.032	1.06	.023	1.02	-.005
5.92	-.140	3.87	-.033	1.53	.018	1.52	-.004
7.35	-.124	5.31	-.037	2.96	.015	2.94	-.005
10.23	-.103	8.16	-.042	5.80	-.001	5.81	-.003
15.20	-.077	13.17	-.045	10.80	-.015	10.82	-.006
22.35	-.055	20.30	-.039	17.96	-.027	17.95	-.007
29.51	-.042	27.46	-.033	25.09	-.027	25.11	-.010
40.19	-.032	38.17	-.024	35.80	-.029	35.80	-.006
52.42	-.030	52.37	-.018	50.09	-.023	50.09	-.007

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1m Sinusoidal Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X=-101.60		X= -60.96		X= -40.64		X= -22.86		X= -14.83	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.020	0.00	.049	0.00	.064	0.00	.175	2.09	-.008
.09	-.007	.09	.010	.09	.041	.09	.161	2.56	-.087
.29	-.009	.27	.015	.27	.042	.27	.167	2.74	-.091
.60	-.008	.58	.016	.60	.043	.58	.158	3.06	-.096
.80	-.009	.80	.015	.80	.042	.80	.154	3.28	-.094
1.05	-.006	1.05	.015	1.05	.038	1.07	.155	3.45	-.096
1.51	-.005	1.52	.014	1.52	.038	1.52	.153	4.00	-.102
2.97	-.008	2.95	.014	2.94	.039	2.93	.124	5.41	-.104
5.82	-.007	5.80	.013	5.80	.036	5.81	.075	8.26	-.114
10.79	-.009	10.81	.008	10.81	.023	10.81	-.005	13.28	-.121
17.94	-.009	17.95	-.000	17.96	.008	17.97	-.045	20.41	-.109
25.11	-.010	25.10	-.004	25.12	-.008	25.12	-.056	27.58	-.085
35.80	-.009	35.80	-.010	35.79	-.028	35.83	-.053	38.27	-.066
50.09	-.012	50.12	-.013	50.11	-.027	50.10	-.047	52.56	-.045

X= -9.88		X= -4.95		X= -2.54		X= -0.00		X= 2.54	
Z	P	Z	P	Z	P	Z	P	Z	P
3.67	-.357	4.71	-.417	4.98	-.474	5.08	-.515	4.98	-.517
4.08	-.349	4.97	-.428	5.11	-.544	5.17	-.673	5.12	-.727
4.25	-.347	5.14	-.430	5.29	-.540	5.35	-.659	5.29	-.703
4.58	-.342	5.47	-.427	5.60	-.526	5.66	-.639	5.62	-.680
4.78	-.334	5.67	-.425	5.83	-.517	5.87	-.628	5.84	-.665
5.05	-.327	5.92	-.421	6.07	-.507	6.13	-.621	6.08	-.654
5.50	-.314	6.40	-.410	6.55	-.485	6.58	-.601	6.56	-.614
6.94	-.282	7.84	-.374	7.99	-.433	8.04	-.484	7.99	-.492
9.76	-.236	10.69	-.304	10.81	-.348	10.87	-.375	10.84	-.376
14.80	-.175	15.67	-.224	15.82	-.252	15.85	-.269	15.81	-.268
21.92	-.139	22.82	-.156	22.98	-.169	23.01	-.182	22.96	-.179
29.07	-.108	29.96	-.113	30.10	-.127	30.15	-.129	30.21	-.127
39.80	-.082	40.69	-.081	40.85	-.086	40.92	-.087	40.81	-.087
53.43	-.059	53.45	-.056	53.46	-.063	53.20	-.064	55.16	-.057

X= 7.37		X= 14.73		X= 22.86		X= 81.28	
Z	P	Z	P	Z	P	Z	P
4.28	-.511	2.13	-.503	0.00	.112	0.00	.013
4.49	-.537	2.44	-.115	.09	.105	.09	-.015
4.65	-.543	2.63	-.114	.27	.102	.27	-.016
4.98	-.486	2.96	-.130	.58	.090	.58	-.015
5.19	-.483	3.17	-.149	.80	.087	.81	-.015
6.18	-.449	3.42	-.144	1.05	.084	1.07	-.016
6.63	-.435	3.88	-.148	1.54	.079	1.52	-.014
8.05	-.387	5.31	-.157	2.94	.052	2.96	-.018
10.92	-.317	8.17	-.166	5.80	.011	5.82	-.017
15.17	-.252	13.14	-.161	10.84	-.027	10.80	-.018
22.32	-.168	20.28	-.137	17.95	-.065	17.97	-.017
29.57	-.124	27.47	-.105	25.08	-.067	25.10	-.019
40.22	-.081	38.15	-.075	35.81	-.063	35.81	-.018
54.51	-.059	52.47	-.055	50.09	-.052	50.08	-.017

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.1n Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Gravel, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** STATIC PRESSURES **********

X= -40.64		X= -30.48		X= -20.32		X= -15.24		X= -10.16	
Z	P	Z	P	Z	P	Z	P	Z	P
0.00	.011	0.00	.015	0.00	.042	1.27	.017	2.54	-.011
.34	.015	.34	.019	.34	.043	1.61	.023	2.88	-.003
.47	.013	.60	.022	.60	.041	1.87	.022	3.14	-.004
.60	.015	.88	.021	.83	.043	2.15	.021	3.39	-.009
.71	.012	1.38	.022	1.33	.036	2.64	.020	3.89	-.011
2.53	.015	2.35	.021	2.33	.032	3.59	.017	4.87	-.016
4.80	.010	4.55	.017	4.44	.023	4.91	.013	7.93	-.020
8.40	.003	8.38	.012	8.01	.010	8.24	.003	11.44	-.022
12.01	.004	12.02	.008	11.60	.005	11.82	-.006	18.77	-.021
19.07	.001	18.85	-.002	18.74	-.003	19.10	-.015	25.89	-.019
26.28	-.002	26.05	-.005	25.95	-.008	26.03	-.013	32.98	-.015
33.46	-.003	33.13	-.007	33.15	-.010	33.12	-.012	41.69	-.014
42.04	-.007	41.68	-.004	41.60	-.012	41.78	-.010	51.70	-.010
52.09	-.010	51.61	-.008	51.51	-.005	51.43	-.008		

X= -5.08		X= -0.00		X= 5.08		X= 10.16		X= 20.32	
Z	P	Z	P	Z	P	Z	P	Z	P
3.81	-.062	5.08	-.168	3.81	-.101	2.54	-.076	0.00	-.036
4.15	-.053	5.42	-.143	4.15	-.099	2.88	-.075	.34	-.036
4.41	-.048	5.68	-.144	4.41	-.097	3.14	-.071	.60	-.037
4.69	-.051	5.93	-.139	4.69	-.098	3.37	-.073	.85	-.037
5.18	-.051	6.42	-.125	5.16	-.103	3.84	-.070	1.09	-.039
6.14	-.050	7.40	-.113	6.14	-.105	4.87	-.074	1.33	-.041
7.96	-.047	9.18	-.091	8.36	-.093	7.38	-.074	1.58	-.045
11.62	-.040	12.00	-.071	11.22	-.076	10.68	-.068	1.83	-.043
15.11	-.033	15.59	-.057	14.88	-.061	14.44	-.060	2.08	-.041
22.22	-.020	22.56	-.038	22.19	-.044	22.13	-.044	2.58	-.043
29.40	-.018	29.61	-.032	29.15	-.035	29.25	-.036	3.33	-.045
36.86	-.013	36.68	-.027	36.46	-.027	36.39	-.030	4.82	-.046
43.73	-.009	43.81	-.022	43.68	-.027	43.65	-.022	7.73	-.045
50.94	-.008	51.63	-.018	51.36	-.019	51.45	-.019	14.91	-.044
								21.94	-.036
								29.10	-.034
								36.37	-.033
								43.21	-.024
								50.65	-.021

X= 40.64	
Z	P
0.00	-.000
.34	.003
.60	-.000
1.12	-.003
1.83	-.006
3.08	-.008
3.95	-.013
6.15	-.011
10.82	-.012
15.50	-.020
22.57	-.019
29.68	-.019
36.83	-.019
43.98	-.018
51.40	-.017

P STATIC PRESSURES IN NT/CM2
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2a Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 2, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -30.48		X= -15.24		X= -10.16		X= -7.62		X= -2.54	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	3.81	0.00
.05	3.83	.05	2.92	.05	1.37	1.32	2.92	3.86	5.12
.18	4.01	.18	3.05	.18	1.58	1.45	3.10	3.99	5.28
.33	4.26	.33	3.10	.31	1.83	1.60	3.31	4.12	5.33
.46	4.29	.46	3.30	.44	2.15	1.73	3.34	4.25	5.44
1.10	4.89	.70	3.61	.68	2.55	2.14	3.83	4.69	5.73
2.11	5.34	1.63	4.22	1.27	3.34	3.32	4.60	5.42	6.10
3.70	6.10	3.43	4.93	5.01	5.47	5.05	5.42	6.91	6.73
5.36	6.21	5.21	5.51	6.92	5.93	6.82	5.96	8.72	6.99
7.12	6.32	6.99	5.95	11.00	6.68	10.39	6.68	12.19	7.35
10.71	6.75	10.58	6.51	15.71	7.39	14.11	7.22	15.77	7.66
14.30	7.13	15.82	7.20	21.12	7.99	19.30	7.75	21.17	8.11
19.68	7.49	21.31	7.79	28.28	8.48	24.65	8.18	26.87	8.47
26.06	8.06	28.44	8.40	36.84	9.21	31.83	8.80	31.87	8.87
32.12	8.58	37.76	9.02	44.87	9.34	42.54	9.35	42.59	9.23
42.87	9.17	45.45	9.42	54.11	9.51	53.95	9.50	54.12	9.52
54.33	9.54	54.23	9.43						

X= -0.00		X= 2.54		X= 7.62		X= 15.24		X= 30.48	
Z	U	Z	U	Z	U	Z	U	Z	U
5.08	0.00	3.81	0.00	1.27	0.00	0.00	0.00	0.00	0.00
5.13	6.63	3.86	0.00	1.32	0.00	.05	0.00	.05	0.00
5.26	6.71	3.99	0.00	1.45	0.00	.18	0.00	.18	0.00
5.37	6.85	4.10	0.00	1.59	0.00	.33	0.00	.31	0.00
5.50	6.85	4.21	0.00	1.70	0.00	.50	0.00	.46	0.00
6.23	7.07	4.45	0.00	1.85	0.00	.72	0.00	.93	0.00
7.61	7.17	4.64	0.00	2.00	0.00	1.07	0.00	1.63	0.00
9.82	7.40	4.80	0.00	2.13	0.00	1.88	0.00	3.12	1.71
12.19	7.55	5.53	6.67	3.86	0.00	3.19	0.00	4.90	3.28
14.06	7.70	5.73	7.18	5.47	3.03	4.95	1.85	6.63	4.95
17.57	7.89	6.70	7.32	6.65	6.79	6.79	5.08	10.20	7.64
21.22	8.17	8.39	7.44	10.13	7.46	10.36	7.87	13.82	8.07
26.48	8.57	11.99	7.75	13.71	7.59	13.99	8.08	19.54	8.46
31.93	8.89	17.33	8.27	19.13	8.27	17.55	8.27	24.53	8.89
40.89	9.36	22.66	8.46	24.55	8.65	23.46	8.55	31.68	8.89
46.14	9.51	28.01	8.69	31.58	8.98	28.63	8.84	38.77	9.37
54.02	9.59	35.33	9.15	41.39	9.45	37.16	9.16	46.42	9.38
		44.12	9.51	53.72	9.63	44.60	9.35	53.90	9.45
		53.77	9.60			54.01	9.59		

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2b Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 2, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -50.80		X= -30.48		X= -20.32		X= -12.70		X= -7.47	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.35	0.00
.09	7.33	.09	7.30	.09	5.95	.09	3.94	1.98	6.91
.28	8.16	.24	7.71	.30	6.52	.27	4.49	2.68	7.78
.64	8.72	.66	8.53	.56	7.14	.57	5.22	2.97	8.01
.77	8.97	.81	8.85	.81	7.91	.80	5.73	3.40	8.54
1.07	9.20	1.03	9.04	1.01	8.05	1.06	5.99	4.83	9.70
1.54	9.53	1.51	9.39	1.54	8.62	1.52	6.71	7.67	10.83
2.95	10.35	3.02	10.26	2.91	9.54	2.94	7.87	12.68	12.21
5.76	11.26	5.89	11.01	5.76	10.53	5.81	9.50	19.82	13.56
10.87	12.22	10.82	12.29	10.97	11.89	10.80	10.68	27.00	14.38
18.08	13.31	18.00	13.61	18.14	13.75	17.95	12.74	37.67	15.13
25.20	14.07	25.25	14.59	25.24	14.74	25.09	13.76	51.93	15.27
35.88	15.00	35.81	15.62	35.87	15.63	35.82	14.65		
50.21	15.31	50.27	15.96	50.17	15.99	50.09	14.96		

X= -5.23		X= -2.92		X= -1.78		X= -.70		X= -0.00	
Z	U	Z	U	Z	U	Z	U	Z	U
2.46	0.00	3.62	0.00	4.19	0.00	4.73	0.00	5.08	0.00
3.10	8.29	4.25	9.93	4.83	10.30	5.15	11.66	5.17	12.85
3.81	8.93	4.98	10.43	5.53	10.90	5.85	11.92	5.37	12.94
4.05	9.31	5.23	10.66	5.77	11.03	6.12	12.03	5.65	12.79
4.54	9.53	5.68	10.98	6.26	11.23	6.59	12.14	5.93	12.75
5.95	10.26	7.12	11.53	7.67	11.65	8.00	12.35	6.14	12.60
8.81	11.49	9.97	12.23	10.51	12.24	10.86	12.77	6.56	12.73
13.83	12.59	14.96	13.63	16.96	13.11	15.86	13.35	8.01	12.93
20.96	13.72	22.10	13.99	24.10	13.88	23.00	14.07	10.86	13.34
28.13	14.51	29.25	14.68	31.23	14.45	30.17	14.64	15.94	13.86
38.82	15.21	39.98	15.22	40.54	14.91	40.89	15.23	23.12	14.56
50.88	15.31	49.92	15.29	52.48	15.00	53.65	15.31	30.31	15.24
								41.04	15.74
								54.70	15.80

X= 1.12		X= 4.52		X= 6.81		X= 12.70		X= 30.48	
Z	U	Z	U	Z	U	Z	U	Z	U
4.52	0.00	2.82	0.00	1.68	0.00	0.00	0.00	0.00	0.00
4.93	.26	3.23	.26	2.08	.26	.09	.26	.09	.26
5.63	12.87	3.93	.26	2.78	.26	.26	.26	.28	.26
5.89	12.86	4.18	.26	3.03	.26	.59	.26	.57	.26
6.38	12.86	4.65	.26	3.51	.26	.80	.26	.79	.26
7.76	12.95	6.03	2.79	4.94	.26	1.05	.26	1.07	.26
10.63	13.21	8.93	13.33	7.78	13.09	1.52	.26	1.54	.26
15.64	13.79	13.94	13.88	12.78	13.80	2.95	.26	2.93	2.67
22.79	14.47	21.08	14.44	19.94	14.34	5.78	3.74	5.80	6.08
29.96	15.01	28.20	15.11	27.10	14.81	10.80	13.65	10.82	12.71
40.63	15.58	38.93	15.57	37.82	15.38	17.96	14.16	17.93	14.09
53.55	15.59	53.21	15.60	52.07	15.48	25.08	14.93	25.09	14.77
						35.80	15.46	35.82	15.46
						50.07	15.55	50.07	15.64

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2c Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 3, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -76.20		X= -45.72		X= -30.48		X= -17.78		X= -10.01	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.74	0.00
.09	4.00	.09	4.01	.09	3.48	.09	2.56	2.02	4.72
.26	4.60	.27	4.51	.27	3.94	.26	2.95	2.74	5.23
.59	4.98	.58	4.95	.60	4.56	.60	3.48	2.99	5.33
.80	5.28	.80	5.19	.80	4.76	.81	3.73	3.45	5.58
1.06	5.57	1.06	5.32	1.07	4.98	1.05	4.09	4.88	5.99
1.52	5.77	1.52	5.54	1.53	5.19	1.52	4.45	7.74	6.63
2.96	6.16	2.94	6.01	2.94	5.79	2.95	5.23	12.73	7.44
5.79	6.74	5.81	6.60	5.82	6.31	5.80	6.06	19.88	8.22
10.80	7.31	10.80	7.14	10.82	7.02	10.80	6.91	27.02	8.88
17.94	7.96	17.94	7.85	17.98	7.81	17.95	7.86	37.74	9.26
25.08	8.41	25.09	8.43	25.10	8.43	25.10	8.51	52.03	9.31
35.80	8.83	35.80	9.00	35.80	9.02	35.80	9.21		
50.10	8.90	50.10	9.22	50.10	9.21	50.10	9.29		

X= -6.50		X= -4.14		X= -3.02		X= -1.75		X= -.64	
Z	U	Z	U	Z	U	Z	U	Z	U
2.91	0.00	3.70	0.00	4.07	0.00	4.50	0.00	4.87	0.00
3.19	5.64	3.98	6.25	4.35	6.63	4.78	6.84	5.15	7.17
3.91	6.02	4.69	6.52	5.07	6.82	5.48	7.10	5.33	7.21
4.16	6.09	4.94	6.60	5.31	6.91	5.75	7.19	5.65	7.25
4.61	6.28	5.40	6.83	5.79	7.10	6.20	7.28	5.85	7.25
6.04	6.69	6.84	7.07	7.22	7.37	7.63	7.51	6.10	7.31
8.90	7.19	9.70	7.52	10.07	7.66	10.50	7.71	6.59	7.30
13.90	7.87	14.69	8.02	15.07	8.04	15.49	8.06	8.00	7.54
21.06	8.50	21.84	8.61	22.22	8.52	22.63	8.52	10.88	7.80
28.18	9.01	28.98	9.03	29.36	8.83	29.78	8.89	15.86	8.15
38.90	9.33	39.70	9.36	40.07	9.11	40.49	9.14	23.04	8.61
53.18	9.33	53.99	9.18	54.35	9.11	54.77	9.12	30.15	8.97
								40.86	9.28
								55.08	9.23

X= -0.00		X= 2.39		X= 7.14		X= 11.91		X= 17.78	
Z	U	Z	U	Z	U	Z	U	Z	U
5.08	0.00	4.28	0.00	2.70	0.00	1.11	0.00	0.00	0.00
5.17	6.91	4.67	.46	3.08	.26	1.49	.26	.38	.26
5.35	6.96	4.86	.46	3.78	.26	2.18	.26	.56	.26
5.67	7.44	5.18	1.55	4.06	.26	2.38	.26	.85	.26
5.86	7.39	5.36	3.95	4.51	.26	2.93	.26	1.07	.26
6.11	7.44	5.62	6.62	5.96	5.99	4.38	.26	1.35	.26
6.58	7.54	6.09	7.54	8.75	8.05	7.22	7.39	1.80	.26
8.04	7.69	7.53	7.81	13.82	8.42	12.18	8.39	3.24	.26
10.88	7.92	10.35	8.05	20.97	8.76	19.32	8.80	4.14	2.15
15.87	8.30	15.39	8.42	28.09	9.18	26.50	9.11	11.13	8.28
23.06	8.77	22.52	8.79	38.78	9.35	37.18	9.31	18.22	8.69
30.18	9.14	29.64	9.16	53.05	9.25	51.50	9.29	25.38	8.89
40.91	9.32	40.35	9.26					36.11	9.31
55.19	9.25	54.66	9.21					50.39	9.32

X= 76.20	
Z	U
0.00	0.00
.09	2.51
.27	2.84
.58	3.11
.80	3.30
1.04	3.35
1.51	3.62
2.99	4.27
5.87	5.51
10.79	7.03
17.95	8.02
25.16	8.64
35.80	9.09
50.08	9.21

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2d Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 3, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -76.20		X= -45.72		X= -30.48		X= -17.78		X= -10.01	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.74	0.00
.09	7.28	.09	6.57	.09	6.25	.09	4.82	2.02	7.80
.27	7.71	.25	7.63	.29	6.45	.27	5.43	2.22	8.12
.58	8.68	.59	8.44	.62	7.53	.61	6.37	2.51	8.38
.80	9.04	.81	8.82	.82	7.96	.78	6.69	2.75	8.71
1.05	9.39	1.05	9.06	1.07	8.33	1.07	7.06	2.99	9.06
1.52	9.95	1.52	9.59	1.56	8.89	1.52	7.65	3.44	9.31
2.94	10.68	2.94	10.37	2.97	9.69	2.95	8.89	4.86	10.25
5.80	11.48	5.82	11.24	5.85	10.71	5.85	10.24	7.72	11.35
10.80	12.25	10.80	12.25	10.79	11.80	10.85	11.65	12.82	12.54
17.95	13.32	17.95	13.32	17.99	12.94	17.96	13.13	23.47	13.67
25.10	14.20	25.10	14.12	25.07	13.89	25.10	14.02	27.04	14.50
35.79	14.83	35.82	14.82	35.82	14.81	35.79	14.88	37.69	15.15
50.09	15.03	50.10	15.08	50.07	15.09	50.09	15.07	51.89	15.20

X= -6.50		X= -4.14		X= -3.02		X= -1.75		X= -.64	
Z	U	Z	U	Z	U	Z	U	Z	U
2.91	0.00	3.70	0.00	4.07	0.00	4.50	0.00	4.87	0.00
3.19	9.33	3.98	10.48	4.35	11.12	4.78	11.81	5.15	12.45
3.92	9.99	4.78	11.10	5.09	11.65	5.49	12.16	5.87	12.61
4.16	10.34	5.04	11.43	5.69	11.68	5.74	12.27	6.12	12.82
4.58	10.61	5.41	11.48	5.81	12.00	6.20	12.49	6.58	12.80
6.00	11.32	6.88	12.05	7.22	12.45	7.62	12.82	8.00	13.08
8.94	12.20	9.69	12.75	10.07	12.92	10.48	13.21	10.85	13.31
13.91	13.03	14.71	13.44	15.07	13.56	15.49	13.62	15.85	13.69
21.06	14.00	21.84	14.27	22.26	14.38	22.65	14.45	23.00	14.36
28.20	14.69	29.01	14.90	29.39	15.00	29.82	15.00	30.16	14.93
38.89	15.26	39.69	15.33	40.07	15.37	40.53	15.35	40.88	15.30
51.83	15.29	51.87	15.34	52.02	15.35	52.08	15.38	52.68	15.30

X= -0.00		X= 2.39		X= 7.14		X= 11.91		X= 17.78	
Z	U	Z	U	Z	U	Z	U	Z	U
5.08	0.00	4.28	0.00	2.70	0.00	1.11	0.00	0.00	0.00
5.17	12.20	4.67	.26	3.08	.26	1.49	.26	.38	.26
5.37	12.22	4.84	.26	3.25	.26	1.68	.26	.57	.26
5.67	12.68	5.17	.26	3.57	.26	2.03	.26	1.17	.26
5.89	12.82	5.37	5.48	3.80	.26	2.23	.26	1.38	.26
6.13	12.78	5.62	11.02	4.05	.26	2.47	.26	1.62	.26
6.60	12.82	6.10	12.80	4.52	3.41	2.93	.26	1.84	.26
8.03	13.06	7.52	13.23	5.94	8.96	4.36	3.13	3.28	.26
10.88	13.41	10.38	13.62	8.82	13.77	7.23	12.00	6.11	7.68
15.91	13.89	15.35	14.06	13.81	14.18	12.20	13.90	11.12	13.94
23.03	14.42	22.53	14.51	20.94	14.68	19.33	14.63	18.22	14.50
30.16	15.01	29.67	15.11	28.08	15.11	26.53	15.16	25.37	15.00
40.87	15.39	40.37	15.43	38.78	15.53	37.21	15.60	36.11	15.54
52.73	15.43	52.49	15.48	52.52	15.58	51.46	15.65	50.44	15.62

X= 76.20	
Z	U
0.00	0.00
.09	4.19
.27	5.01
.59	5.45
.80	5.57
1.13	6.02
1.51	5.91
2.95	7.01
5.80	9.11
10.80	12.21
17.92	13.32
25.07	14.34
35.79	15.18
50.07	15.42

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2e Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -81.28		X= -40.64		X= -25.40		X= -20.32		X= -15.24	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00
.09	4.51	.09	4.21	.09	3.74	.09	2.88	1.36	4.42
.23	5.05	.23	4.60	.22	4.04	.24	3.20	1.50	4.47
.34	5.18	.35	4.88	.39	4.22	.40	3.62	1.62	4.56
.60	5.41	.62	5.11	.64	4.52	.67	4.02	1.91	4.91
1.11	5.74	1.09	5.54	.94	4.74	1.16	4.59	2.42	5.28
1.87	6.16	1.89	5.82	1.12	5.07	1.96	5.12	2.94	5.53
2.59	6.35	3.10	6.19	1.43	5.30	3.14	5.69	3.95	5.87
3.94	6.57	7.28	6.84	2.37	5.74	5.94	6.35	5.25	6.34
6.23	6.87	11.78	7.21	3.78	6.05	9.34	6.87	7.60	7.02
10.36	7.21	16.32	7.60	7.12	6.65	14.47	7.44	10.37	7.33
14.54	7.59	21.78	7.94	14.25	7.39	21.74	7.98	14.51	7.72
21.69	8.20	29.20	8.48	21.78	8.08	28.97	8.66	21.72	8.15
28.78	8.54	36.65	9.08	28.84	8.51	36.44	9.05	28.75	8.66
35.99	8.88	44.18	9.27	36.35	8.94	43.64	9.31	36.16	8.98
43.16	9.22	53.29	9.37	45.13	9.21	52.87	9.39	44.49	9.27
53.14	9.39			53.05	9.29			53.10	9.45

X= -10.16		X= -2.54		X= -0.00		X= 2.54		X= 10.16	
Z	U	Z	U	Z	U	Z	U	Z	U
2.54	0.00	4.44	0.00	5.08	0.00	4.44	0.00	2.54	0.00
2.63	5.35	4.53	6.73	5.17	8.62	4.53	5.54	2.63	3.38
2.76	5.67	4.67	7.20	5.29	9.32	4.68	7.33	2.77	3.92
2.93	5.81	4.84	7.60	5.44	9.31	4.92	8.39	2.97	4.15
3.20	5.92	5.37	7.82	5.67	9.18	5.23	8.52	3.27	5.26
3.71	6.28	6.12	7.89	5.95	9.13	5.77	8.63	3.66	5.96
4.18	6.46	7.12	8.12	6.40	8.82	6.65	8.59	3.96	6.57
4.95	6.61	8.45	8.21	7.19	8.69	7.97	8.76	5.18	7.28
5.95	6.86	10.54	8.15	8.01	8.52	10.78	8.50	7.09	7.63
8.01	7.27	13.02	8.15	9.27	8.39	14.52	8.28	10.72	8.07
11.16	7.58	16.81	8.16	10.52	8.52	21.65	8.46	14.71	8.27
14.68	7.84	22.24	8.41	13.30	8.42	29.01	8.76	21.72	8.56
21.58	8.23	29.51	8.71	17.72	8.44	37.65	9.14	28.44	8.82
28.70	8.78	37.47	9.08	22.11	8.52	44.34	9.47	36.54	9.15
36.28	9.21	45.61	9.37	29.95	8.82	52.95	9.59	44.51	9.36
44.55	9.40	53.11	9.56	37.50	9.16			53.05	9.52
53.03	9.49			45.50	9.36				
				53.24	9.52				

X= 17.78		X= 20.32		X= 25.40		X= 81.28	
Z	U	Z	U	Z	U	Z	U
.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.72	2.23	.09	1.14	.09	2.66	.09	4.47
.87	2.43	.23	1.89	.23	2.81	.22	4.78
1.04	2.76	.38	2.21	.38	3.11	.60	5.07
1.29	3.24	.62	2.45	.68	3.44	.92	5.33
1.77	4.02	.93	2.96	1.39	4.21	1.64	5.80
2.07	4.57	1.23	3.53	1.87	4.75	3.61	6.10
2.52	5.30	1.78	4.27	2.58	5.53	6.83	6.65
3.70	6.35	2.50	5.33	4.43	6.52	10.92	7.32
5.96	7.08	3.96	6.47	6.91	7.12	13.82	7.61
9.09	7.40	7.01	7.09	14.24	7.78	21.20	8.04
14.39	7.96	10.58	7.51	21.22	8.28	28.69	8.44
21.29	8.53	14.35	7.87	28.66	8.69	36.54	8.86
28.56	8.95	21.24	8.28	36.74	9.06	44.01	9.22
36.33	9.23	28.53	8.77	44.84	9.45	52.52	9.43
44.52	9.48	36.51	9.21	52.61	9.53		
52.69	9.56	44.22	9.40				
		52.78	9.56				

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2f Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X=-101.60		X= -60.96		X= -40.64		X= -22.86		X= -14.83	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.37	0.00
.09	7.15	.09	7.55	.09	7.43	.09	5.79	1.59	8.75
.27	7.77	.26	7.99	.26	8.04	.27	6.14	2.30	9.72
.60	8.84	.59	8.93	.58	8.66	.59	7.18	2.56	10.06
.80	9.21	.81	9.07	.80	9.07	.81	7.62	3.02	10.43
1.05	9.72	1.05	9.49	1.05	9.34	1.05	8.08	4.44	11.20
1.52	10.18	1.54	10.02	1.52	9.92	1.52	8.63	7.30	12.15
2.94	10.87	2.95	10.86	2.95	10.62	2.95	9.72	12.30	13.16
5.81	11.84	5.81	11.63	5.80	11.45	5.82	10.93	19.44	14.19
10.82	12.63	10.80	12.61	10.79	12.47	10.82	12.47	26.58	14.83
17.96	13.64	17.95	13.46	17.96	13.41	17.94	13.66	37.30	15.38
25.11	14.33	25.08	14.30	25.10	14.30	25.10	14.48	51.59	15.37
35.80	14.92	35.80	14.92	35.80	15.07	35.80	15.21		
50.07	15.06	50.07	15.07	50.08	15.24	50.09	15.32		

X= -9.88		X= -4.95		X= -2.54		X= -1.27		X= -0.00	
Z	U	Z	U	Z	U	Z	U	Z	U
2.61	0.00	3.84	0.00	4.44	0.00	4.76	0.00	5.08	0.00
2.83	10.67	4.06	11.58	4.66	13.78	4.98	14.94	5.17	17.83
3.55	11.41	4.78	13.19	5.38	14.25	5.69	15.28	5.35	17.52
3.79	11.62	5.01	13.29	5.63	14.30	5.94	15.36	5.68	16.88
4.25	11.86	5.49	13.54	6.09	14.52	6.40	15.28	5.88	16.57
5.68	12.41	6.91	13.84	7.51	14.62	7.84	14.91	6.13	16.24
8.53	13.19	9.76	14.16	10.38	14.54	10.69	14.67	6.59	15.77
13.53	13.78	14.78	14.34	15.38	14.55	15.69	14.62	8.03	15.39
20.68	14.60	21.91	14.82	22.51	14.93	22.83	14.95	10.88	14.84
27.83	15.10	29.06	15.20	29.66	15.37	29.98	15.36	15.88	14.73
38.55	15.49	39.76	15.57	40.38	15.65	40.70	15.64	23.03	14.98
52.83	15.48	54.06	15.54	54.67	15.56	54.99	15.51	30.17	15.29
								40.88	15.64
								55.18	15.56

X= 2.54		X= 7.37		X= 14.73		X= 22.86		X= 81.28	
Z	U	Z	U	Z	U	Z	U	Z	U
4.44	0.00	3.24	0.00	1.40	0.00	0.00	0.00	0.00	0.00
4.74	13.06	3.53	7.45	1.69	3.66	.09	2.78	.09	7.60
4.91	14.33	4.02	11.28	2.20	6.22	.27	3.00	.26	8.23
5.23	14.65	4.25	12.04	2.41	7.18	.60	4.09	.59	9.17
5.45	14.76	4.49	12.36	2.65	8.37	.81	5.08	.81	9.24
5.69	14.93	4.96	12.68	3.11	9.85	1.05	5.66	1.05	9.31
6.16	14.98	6.38	13.35	4.55	11.11	1.52	7.43	1.52	9.72
7.60	14.87	9.24	13.83	7.41	12.01	2.95	10.04	2.95	10.43
10.46	14.70	14.25	14.21	12.41	13.14	5.80	11.41	5.80	11.35
15.45	14.73	21.39	14.76	19.55	14.00	10.80	12.67	10.80	12.53
22.59	14.98	28.54	15.21	26.68	14.74	17.95	13.85	17.94	13.44
29.74	15.34	39.25	15.51	37.40	15.24	25.09	14.55	25.09	14.21
40.44	15.56	53.54	15.45	51.68	15.25	35.80	15.24	35.80	14.91
54.74	15.50					50.10	15.34	50.08	15.09

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2g Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 6, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -50.80		X= -35.56		X= -20.32		X= -12.70		X= -7.62	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	1.69	0.00	2.96	0.00	3.81	0.00
.05	4.26	.05	3.80	1.74	5.04	3.01	5.42	3.86	6.15
.18	4.51	.18	4.15	1.87	5.16	3.14	5.63	3.99	6.36
.31	4.66	.35	4.37	2.01	5.33	3.29	5.77	4.12	6.53
.43	4.82	.46	4.54	2.15	5.44	3.42	5.94	4.24	6.64
.78	5.20	.73	4.85	2.52	5.69	3.70	6.10	4.66	6.85
1.37	5.54	1.66	5.64	3.29	6.06	4.43	6.37	5.29	7.05
2.06	5.82	3.52	6.17	4.69	6.44	5.93	6.85	7.27	7.42
3.49	6.19	5.90	6.55	6.76	6.80	7.49	7.06	10.83	7.76
5.33	6.76	8.29	6.80	10.74	7.23	9.46	7.44	15.32	8.05
7.06	6.83	10.89	7.08	14.32	7.65	13.13	7.98	19.74	8.25
10.63	7.17	14.39	7.41	17.99	7.97	16.18	8.04	25.16	8.57
14.23	7.46	17.93	7.79	23.27	8.63	21.56	8.38	32.32	9.01
19.62	7.89	23.29	8.17	28.79	8.90	28.76	8.76	39.42	9.46
24.93	8.28	28.67	8.49	35.75	9.23	38.76	9.28	46.66	9.45
32.07	8.74	35.86	8.99	42.93	9.40	45.43	9.37	54.50	9.41
40.50	9.16	43.12	9.25	54.33	9.50	54.43	9.52		
47.18	9.26	54.34	9.28						
54.36	9.37								

X= -0.00		X= 7.62		X= 12.70		X= 30.48	
Z	U	Z	U	Z	U	Z	U
5.08	0.00	3.81	0.00	2.96	0.00	0.00	0.00
5.13	8.12	3.86	5.08	3.01	4.65	.05	2.45
5.26	8.46	3.99	5.78	3.14	4.92	.18	2.65
5.39	8.56	4.12	6.18	3.28	5.13	.36	3.02
5.51	8.53	4.23	6.48	3.41	5.34	.48	3.05
5.83	8.48	4.64	7.19	3.73	5.97	.81	3.72
6.21	8.72	5.55	7.41	4.31	6.64	1.81	4.90
6.86	8.47	7.13	7.65	5.31	6.94	6.93	6.54
8.71	8.24	8.87	7.84	8.52	7.39	10.48	6.96
10.85	8.21	11.32	7.92	10.67	7.57	15.75	7.47
14.44	8.25	15.89	8.17	14.38	7.82	21.13	8.01
19.89	8.41	21.63	8.38	19.58	8.18	28.30	7.64
25.29	8.65	28.55	8.77	25.08	8.46	35.46	8.96
33.31	9.10	35.70	9.19	32.17	9.06	44.43	9.29
40.31	9.31	44.87	9.44	39.44	9.33	53.98	9.51
47.19	9.47	54.24	9.48	46.38	9.42		
54.50	9.51			54.36	9.43		

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2h Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 6, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X=-152.40		X= -76.20		X= -45.72		X= -30.48		X= -22.86	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00
.15	7.60	.15	7.74	.15	7.65	.15	6.14	1.78	9.16
1.18	9.42	.84	8.91	.50	8.69	.50	7.74	2.81	10.26
2.21	10.53	1.52	10.17	2.21	10.30	1.18	9.18	4.52	10.97
3.92	11.31	4.95	11.54	3.92	11.37	2.90	10.13	6.58	11.67
5.64	11.96	8.38	12.09	7.35	12.01	4.61	10.97	10.01	12.32
9.07	12.38	11.81	12.55	10.78	12.59	8.04	11.92	13.44	12.90
12.50	12.65	15.24	13.07	14.21	12.99	11.47	12.55	16.87	13.44
15.93	13.33	18.67	13.54	17.64	13.36	16.61	13.33	23.73	14.13
19.36	13.94	25.53	14.13	21.07	13.82	20.04	13.74	30.58	14.75
22.79	14.34	32.39	14.70	24.50	14.13	25.19	14.29	34.01	15.08
29.64	14.82	39.25	15.09	27.93	14.44	32.05	14.90	40.87	15.34
36.50	15.27	46.11	15.19	31.36	14.78	38.90	15.24	47.73	15.34
43.36	15.34	52.96	15.19	34.79	15.12	49.76	15.34	54.59	15.34
49.79	15.34	58.11	15.19	45.08	15.34			59.73	15.34
				55.37	15.34				

X= -17.78		X= -12.70		X= -7.62		X= -5.08		X= -2.54	
Z	U	Z	U	Z	U	Z	U	Z	U
2.12	0.00	2.96	0.00	3.81	0.00	4.23	0.00	4.66	0.00
2.62	9.99	3.47	11.15	4.32	12.01	4.74	12.23	5.16	13.69
4.34	11.33	4.50	11.92	6.03	12.73	5.43	12.85	7.91	13.98
6.05	11.88	6.90	12.46	7.75	13.07	6.11	13.38	14.77	14.18
7.77	12.30	10.33	13.07	11.18	13.70	11.26	13.85	21.63	14.60
9.48	12.68	13.76	13.62	18.04	14.24	14.69	14.12	28.48	14.96
11.20	13.02	20.62	14.21	24.89	14.67	21.55	14.48	31.91	15.12
16.34	13.57	27.48	14.75	31.75	15.05	28.40	14.87	35.34	15.27
19.77	13.96	30.91	15.03	38.61	15.44	35.26	15.21	38.77	15.40
23.20	14.29	37.76	15.27	45.47	15.37	38.69	15.43	45.63	15.35
26.63	14.60	41.19	15.38	52.33	15.44	45.55	15.35	49.06	15.37
33.49	15.08	48.05	15.37	58.50	15.34	52.07	15.34	52.49	15.37
36.92	15.34	54.91	15.37						
43.78	15.45								
52.35	15.34								
57.49	15.34								

X= -1.27		X= -0.00		X= 2.54		X= 5.08		X= 10.16	
Z	U	Z	U	Z	U	Z	U	Z	U
4.87	0.00	5.08	0.00	4.66	0.00	4.23	0.00	3.39	0.00
5.38	13.99	5.23	15.12	4.91	13.64	4.74	12.68	4.15	11.77
7.09	14.43	7.29	14.52	8.34	13.96	5.77	13.16	7.24	12.80
10.52	13.98	8.32	14.21	15.20	14.06	8.17	13.74	10.66	13.33
15.66	14.29	12.43	14.21	18.63	14.21	15.03	14.06	14.09	13.74
22.52	14.63	19.29	14.31	22.06	14.43	18.46	14.13	20.95	14.24
29.38	14.97	22.72	14.37	25.49	14.60	25.32	14.60	24.38	14.58
36.24	15.32	29.58	14.73	28.92	14.76	28.75	14.90	27.81	14.88
39.67	15.47	36.44	15.03	32.35	15.00	39.03	15.21	34.67	15.12
46.53	15.41	39.87	15.19	35.77	15.19	45.89	15.32	41.53	15.34
53.39	15.37	46.73	15.19	40.92	15.27	52.07	15.27	50.10	15.27
		53.59	15.19	54.64	15.27			55.25	15.27

X= 15.24		X= 20.32		X= 30.48		X= 45.72		X= 76.20	
Z	U	Z	U	Z	U	Z	U	Z	U
2.54	0.00	1.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3.30	8.16	2.46	6.66	.15	7.46	.15	7.57	.15	8.81
3.99	9.99	3.14	9.06	1.18	9.42	1.52	9.42	2.55	10.53
4.67	11.64	3.48	10.53	3.58	10.91	2.55	10.53	4.61	11.48
6.39	12.29	5.88	11.71	7.01	11.94	5.30	11.19	8.04	12.23
9.82	12.73	9.31	12.46	10.44	12.48	7.01	11.64	11.47	12.66
13.25	13.36	12.74	12.99	13.87	12.97	10.44	12.27	14.90	13.14
16.68	13.74	16.17	13.33	19.01	13.77	13.87	12.90	20.04	13.64
20.11	14.06	19.60	13.74	25.87	14.40	19.01	13.41	25.19	14.18
23.54	14.29	26.46	14.48	31.02	14.82	24.16	13.98	32.05	14.64
26.96	14.60	31.60	14.76	34.45	15.12	31.02	14.60	38.90	15.08
33.82	15.06	40.18	15.30	41.30	15.37	36.16	14.90	45.76	15.35
40.68	15.27	51.50	15.30	49.82	15.41	41.30	15.24	49.19	15.35
44.11	15.34					52.96	15.35		
54.40	15.27								

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2i Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 20, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X=-127.00		X=-101.60		X= -76.20		X= -50.80		X= -25.40	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	1.27	0.00	2.54	0.00	3.81	0.00
.05	4.28	.05	4.04	1.32	4.80	2.59	4.92	3.86	5.15
.18	4.65	.18	4.29	1.45	5.15	2.72	5.19	3.99	5.43
.33	4.91	.33	4.56	1.60	5.31	2.87	5.47	4.11	5.67
.59	5.19	.60	4.83	1.84	5.54	3.37	5.98	4.33	5.97
1.11	5.56	1.37	5.42	2.30	5.84	4.12	6.49	4.84	6.31
1.88	6.10	2.54	5.80	3.33	6.19	5.70	6.71	5.84	6.75
3.43	6.53	5.01	6.32	4.93	6.58	9.00	7.17	8.82	7.27
6.01	6.84	8.63	6.87	8.53	7.03	12.68	7.50	12.82	7.65
9.98	7.12	12.87	7.27	13.95	7.53	19.67	7.98	16.90	7.94
14.56	7.56	17.41	7.51	21.38	8.02	28.00	8.51	24.81	8.50
21.56	8.00	23.98	7.92	28.57	8.45	35.44	8.92	33.16	8.91
29.58	8.57	31.00	8.57	35.78	8.88	43.27	9.29	42.44	9.28
36.68	8.89	38.31	8.80	44.45	9.18	52.59	9.36	52.47	9.39
44.61	9.07	45.34	9.04	52.72	9.40				
52.95	9.33	53.07	9.34						

X= -5.08		X= -0.00		X= 5.08		X= 50.80		X= 101.60	
Z	U	Z	U	Z	U	Z	U	Z	U
4.83	0.00	5.08	0.00	4.83	0.00	2.54	0.00	0.00	0.00
4.88	5.51	5.13	6.12	4.88	4.82	2.59	4.39	.05	0.00
5.00	5.83	5.26	6.45	5.00	5.21	2.72	4.96	.18	0.00
5.13	6.11	5.37	6.77	5.16	5.64	2.85	5.07	.67	4.16
5.40	6.68	5.61	6.97	5.39	6.24	3.12	5.35	1.30	4.91
5.88	6.93	6.11	7.17	5.88	6.75	3.60	5.84	2.78	5.76
6.86	7.14	6.84	7.31	6.85	7.12	4.56	6.42	5.14	6.52
8.97	7.50	8.09	7.40	8.58	7.42	6.37	6.96	8.61	7.02
12.41	7.81	11.41	7.76	12.30	8.04	10.20	7.34	12.40	7.27
15.95	7.95	15.20	8.06	17.28	8.21	15.75	7.69	16.88	7.63
19.83	8.23	19.50	8.24	22.63	8.43	22.90	8.16	23.34	8.09
26.44	8.55	21.21	8.62	29.67	8.78	30.10	8.63	30.90	8.53
33.78	8.90	33.59	8.96	37.12	9.12	37.34	9.00	37.90	8.84
42.35	9.37	42.39	9.22	44.68	9.37	44.57	9.23	45.31	9.24
52.18	9.45	52.28	9.39	52.59	9.43	52.19	9.45	52.13	9.32

X= 152.40	
Z	U
0.00	0.00
.05	4.49
.30	4.96
.56	5.31
1.19	5.66
2.59	6.22
5.60	6.80
8.98	7.21
12.77	7.45
16.12	7.62
23.49	8.12
30.60	8.54
38.05	8.90
44.78	9.07
52.62	9.26

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2j Sinusoidal Hill Model, Height 5.08 cm, Halflength Height Ratio 3, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -60.96		X= -45.72		X= -30.48		X= -17.78		X= -12.83	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00
.09	4.19	.09	4.13	.09	3.90	.09	2.78	1.81	4.63
.28	4.37	.27	4.40	.25	3.97	.27	3.00	1.99	4.76
.59	5.03	.58	4.92	.59	4.68	.58	3.56	2.30	5.08
.81	5.28	.78	5.20	.81	5.00	.80	3.83	2.55	5.30
1.12	5.47	1.05	5.42	1.05	5.20	1.07	4.28	2.78	5.47
1.52	5.75	1.51	5.72	1.52	5.35	1.51	4.63	3.24	5.81
2.93	6.26	2.97	6.28	2.96	5.99	2.94	5.45	4.67	6.46
5.81	6.80	5.81	6.78	5.80	6.62	5.81	6.40	7.55	7.22
10.81	7.41	10.80	7.36	10.79	7.29	10.80	7.36	12.54	7.95
17.95	7.97	17.95	7.94	17.95	7.94	17.95	8.16	19.66	8.48
25.09	8.46	25.10	8.46	25.07	8.54	25.10	8.72	26.85	8.94
35.81	8.93	35.80	8.94	35.80	9.01	35.80	9.10	37.55	9.17
50.09	9.03	50.08	9.04	50.12	9.10	50.17	9.14	51.80	9.14

X= -7.85		X= -5.46		X= -3.02		X= -1.22		X= -0.00	
Z	U	Z	U	Z	U	Z	U	Z	U
3.51	0.00	4.30	0.00	4.84	0.00	5.04	0.00	5.08	0.00
3.98	7.24	4.66	7.87	5.03	8.78	5.15	8.75	5.17	8.18
4.13	7.25	4.84	8.13	5.20	8.91	5.33	8.73	5.34	9.01
4.48	7.33	5.17	8.20	5.52	8.97	5.65	9.11	5.68	9.21
4.69	7.43	5.39	8.24	5.74	8.94	5.87	9.18	5.89	9.17
4.93	7.50	5.62	8.31	6.00	9.00	6.13	9.14	6.15	9.10
5.41	7.59	6.09	8.35	6.46	9.01	6.57	9.17	6.61	9.01
6.83	7.84	7.51	8.37	7.88	8.81	9.01	9.03	8.04	8.97
9.68	8.05	10.38	8.42	10.04	8.66	10.85	8.75	10.89	8.79
14.71	8.37	15.37	8.49	15.74	8.75	15.87	8.72	15.89	8.75
21.84	8.81	22.52	8.84	22.87	9.03	23.01	8.94	23.02	8.95
28.96	9.08	29.69	9.08	30.04	9.20	30.15	9.25	30.15	9.18
39.68	9.23	40.37	9.31	40.73	9.35	40.85	9.31	40.86	9.30
53.96	9.20	54.66	9.21	55.08	9.27	55.18	9.23	55.17	9.21

X= 4.86		X= 12.19		X= 17.78		X= 60.96	
Z	U	Z	U	Z	U	Z	U
4.45	0.00	1.57	0.00	0.00	0.00	0.00	0.00
4.68	6.81	1.93	2.54	.09	1.45	.09	4.43
4.86	7.74	2.10	2.69	.27	1.45	.27	4.43
5.17	8.38	2.43	4.19	.58	1.45	.58	5.15
5.40	8.43	2.65	5.20	.80	2.01	.80	5.42
5.66	8.46	2.89	5.84	1.05	2.78	1.13	5.59
6.12	8.48	3.35	6.46	1.52	3.52	1.51	5.70
7.53	8.55	4.79	6.95	2.95	5.70	2.95	5.94
10.38	8.48	7.64	7.52	5.79	6.66	5.81	6.54
15.41	8.60	12.65	8.12	10.81	7.45	10.82	7.31
22.54	8.84	19.79	8.52	17.98	8.24	17.95	7.95
29.70	9.01	26.95	8.88	25.14	8.69	25.08	8.38
40.38	9.18	37.65	9.17	35.31	9.08	35.82	8.87
54.64	9.10	51.95	9.14	50.11	9.10	50.08	8.97

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2k Sinusoidal Hill Model, Height 5.08 cm, Halflength Height Ratio 3, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -60.96		X= -45.72		X= -30.48		X= -17.78		X= -12.83	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.25	0.00
.09	7.36	.09	7.15	.09	6.78	.09	4.82	1.81	8.20
.27	7.47	.25	7.82	.26	6.76	.27	5.52	2.52	9.17
.60	8.55	.58	8.64	.59	8.04	.58	6.32	2.78	9.52
.80	9.03	.80	9.08	.80	8.57	.80	6.91	3.24	9.98
1.05	9.38	1.05	9.42	1.06	8.85	1.06	7.27	4.67	11.05
1.51	9.72	1.51	9.77	1.52	9.31	1.51	7.79	7.52	12.26
2.95	10.60	2.95	10.56	2.95	10.18	2.95	9.17	12.52	13.39
5.80	11.55	5.81	11.38	5.80	11.09	5.80	10.80	19.67	14.22
10.80	12.29	10.81	12.31	10.80	12.21	10.80	12.34	26.81	14.90
17.95	13.32	17.94	13.34	17.95	13.36	17.94	13.73	37.52	15.45
25.10	14.16	25.08	14.19	25.09	14.23	25.08	14.57	51.81	15.42
35.80	14.92	35.82	14.91	35.80	15.04	35.80	15.24		
50.08	15.05	50.08	15.09	50.09	15.24	50.09	15.33		

X= -7.85		X= -5.46		X= -3.02		X= -1.22		X= -0.00	
Z	U	Z	U	Z	U	Z	U	Z	U
3.51	0.00	4.30	0.00	4.84	0.00	5.04	0.00	5.08	0.00
3.98	12.26	4.66	13.79	5.03	15.19	5.15	14.84	5.17	14.81
4.70	12.74	5.38	14.04	5.75	15.01	5.85	15.30	5.35	15.37
4.94	12.91	5.61	14.05	6.14	15.09	6.12	15.31	5.68	15.62
5.40	13.04	6.09	14.07	6.46	15.00	6.57	15.35	5.89	15.48
6.83	13.41	7.51	14.07	7.89	14.89	8.02	15.06	6.21	15.31
9.69	13.70	10.39	14.00	10.73	14.53	10.89	14.75	6.60	15.30
14.69	14.11	15.36	14.20	15.73	14.42	15.85	14.53	8.20	14.92
21.83	14.60	22.51	14.54	22.88	14.66	23.03	14.74	10.87	14.77
28.97	15.09	29.66	14.98	30.03	15.09	30.15	15.09	15.87	14.58
39.68	15.48	40.38	15.25	38.19	15.30	40.89	15.36	23.02	14.80
54.01	15.45	54.67	15.21	52.50	15.24	52.30	15.33	30.18	15.19
								41.06	15.38
								52.13	15.33

X= 4.86		X= 12.19		X= 17.78		X= 60.96	
Z	U	Z	U	Z	U	Z	U
4.45	0.00	1.57	0.00	0.00	0.00	0.00	0.00
4.68	12.74	1.93	2.74	.09	.26	.09	7.71
4.85	13.78	2.10	3.09	.27	.26	.27	8.72
5.18	14.06	2.43	6.12	.59	.27	.60	9.41
5.41	14.16	2.65	7.67	.80	2.92	.80	9.61
5.65	14.16	2.89	9.59	1.07	4.09	1.07	9.93
6.11	14.16	3.35	10.69	1.52	5.00	1.51	10.09
7.54	14.23	4.79	11.71	2.95	9.65	2.95	10.60
10.38	14.30	7.63	12.59	5.81	11.41	5.79	11.34
15.39	14.39	12.63	13.58	10.82	12.79	10.79	12.54
22.54	14.76	19.78	14.33	17.95	13.75	17.95	13.50
29.70	15.07	26.94	14.91	25.09	14.62	25.10	14.32
40.40	15.36	37.67	15.33	35.60	15.28	35.82	15.09
52.33	15.33	51.95	15.34	50.09	15.37	50.11	15.32

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.21 Sinusoidal Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X=-101.60		X= -60.96		X= -40.64		X= -22.86		X= -14.83	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.09	0.00
.09	4.27	.09	4.19	.09	4.15	.09	2.72	2.56	5.98
.25	4.95	.27	4.76	.27	4.41	.27	3.24	3.28	6.45
.58	5.30	.60	5.25	.60	5.11	.58	3.76	3.53	6.56
.81	5.62	.80	5.40	.80	5.29	.81	4.12	3.99	6.77
1.04	5.70	1.05	5.56	1.05	5.44	1.05	4.38	5.41	7.07
1.52	5.97	1.52	5.75	1.51	5.70	1.52	4.79	8.28	7.50
2.94	6.47	2.94	6.38	2.95	6.13	2.94	5.49	13.27	8.15
5.80	6.98	5.82	6.85	5.80	6.68	5.80	6.30	20.43	8.72
10.80	7.48	10.80	7.40	10.81	7.18	10.81	7.12	27.55	9.13
17.92	8.02	17.95	7.99	17.95	8.04	17.92	8.13	38.28	9.30
25.12	8.49	25.10	8.46	25.09	8.59	25.10	8.71	49.81	9.21
35.80	8.87	35.82	8.84	35.80	9.10	35.80	9.20		
50.07	8.95	49.88	8.94	50.10	9.22	50.11	9.28		

X= -9.88		X= -4.95		X= -2.54		X= -0.00		X= 2.54	
Z	U	Z	U	Z	U	Z	U	Z	U
3.67	0.00	4.71	0.00	4.98	0.00	5.08	0.00	4.98	0.00
4.08	7.52	4.97	7.77	5.11	7.87	5.17	7.79	5.12	7.85
4.79	7.62	5.47	8.12	5.60	8.55	5.35	8.69	5.30	8.55
5.05	7.76	5.69	8.16	5.85	8.55	5.67	8.79	5.63	8.71
5.50	7.81	5.92	8.20	6.07	8.55	5.89	8.87	5.85	8.79
6.94	7.99	6.39	8.38	6.54	8.66	6.13	8.76	6.03	8.71
9.78	8.20	7.82	8.55	7.96	8.71	6.59	8.81	6.55	8.76
14.79	8.51	10.68	8.63	10.81	8.76	8.03	8.88	7.98	8.76
21.93	8.82	15.68	8.76	15.81	8.86	10.88	8.93	10.84	8.76
29.08	9.13	22.83	8.98	22.97	9.04	15.88	8.97	15.84	8.83
39.79	9.30	29.97	9.21	30.12	9.27	23.03	9.08	22.97	9.02
50.11	9.30	40.69	9.39	40.82	9.39	30.17	9.30	30.14	9.23
		50.17	9.34	52.49	9.25	40.88	9.43	40.82	9.28
						49.61	9.41	52.34	9.20

X= 7.37		X= 14.73		X= 22.86		X= 81.28	
Z	U	Z	U	Z	U	Z	U
4.28	0.00	2.13	0.00	0.00	0.00	0.00	0.00
4.49	6.69	2.44	3.67	.09	.26	.09	5.08
4.67	7.40	2.62	4.17	.28	1.51	.27	5.36
5.02	7.94	2.96	5.40	.59	2.11	.58	5.67
5.22	8.09	3.16	5.90	.81	2.59	.80	5.80
5.48	8.21	3.40	6.27	1.06	3.24	1.02	5.94
5.92	8.27	3.87	6.60	1.53	4.30	1.52	6.15
7.35	8.38	5.31	6.79	2.96	5.80	2.94	6.33
10.23	8.55	8.16	7.40	5.80	6.57	5.81	6.82
15.20	8.63	13.17	8.03	10.80	7.34	10.82	7.31
22.35	8.92	20.30	8.66	17.96	8.21	17.95	8.10
29.51	9.20	27.46	9.02	25.09	8.87	25.11	8.68
40.19	9.21	38.17	9.35	35.80	9.37	35.80	9.15
52.42	9.17	52.37	9.35	50.09	9.38	50.09	9.25

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2m Sinusoidal Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 15.24 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X=-101.60		X= -60.96		X= -40.64		X= -22.86		X= -14.83	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.09	0.00
.09	7.65	.09	7.47	.09	7.04	.09	5.20	2.56	10.11
.29	8.54	.27	8.29	.27	7.84	.27	5.77	2.74	10.32
.60	9.35	.58	9.04	.60	8.57	.58	6.72	3.06	10.53
.80	9.75	.80	9.49	.80	8.76	.80	7.18	3.28	10.85
1.05	9.85	1.05	9.77	1.05	9.20	1.07	7.54	3.45	10.97
1.51	10.51	1.52	10.18	1.52	9.71	1.52	8.18	4.00	11.21
2.97	11.29	2.95	11.05	2.94	10.61	2.93	9.31	5.41	11.87
5.82	11.93	5.80	11.70	5.80	11.46	5.81	10.81	8.26	12.63
10.79	12.93	10.81	12.47	10.81	12.31	10.81	12.26	13.28	13.46
17.94	13.88	17.95	13.51	17.96	13.37	17.97	13.59	20.41	14.34
25.11	14.63	25.10	14.21	25.12	14.16	25.12	14.48	27.58	14.90
35.80	15.28	35.80	14.95	35.79	14.95	35.83	15.17	38.27	15.32
50.09	15.41	50.12	15.06	50.11	15.17	50.10	15.28	52.56	15.28

X= -9.88		X= -4.95		X= -2.54		X= -0.00		X= 2.54	
Z	U	Z	U	Z	U	Z	U	Z	U
3.67	0.00	4.71	0.00	4.98	0.00	5.08	0.00	4.98	0.00
4.08	12.55	4.97	13.12	5.11	13.43	5.17	13.54	5.12	14.05
4.25	12.66	5.14	13.41	5.29	14.04	5.35	14.80	5.29	14.91
4.58	12.81	5.47	13.54	5.60	14.18	5.66	14.86	5.62	15.09
4.78	13.02	5.67	13.67	5.83	14.25	5.87	14.97	5.84	15.17
5.05	12.93	5.92	13.68	6.07	14.34	6.13	14.96	6.08	15.10
5.50	13.12	6.40	13.85	6.55	14.25	6.58	15.00	6.56	15.15
6.94	13.37	7.84	14.18	7.99	14.53	8.04	14.98	7.99	15.14
9.76	13.71	10.69	14.25	10.81	14.57	10.87	14.91	10.84	14.95
14.80	14.18	15.67	14.44	15.82	14.59	15.85	14.88	15.81	14.96
21.92	14.62	22.82	14.76	22.98	14.88	23.01	15.17	22.96	15.21
29.07	15.09	29.96	15.14	30.10	15.19	30.15	15.54	30.21	15.67
39.80	15.37	40.69	15.33	40.85	15.42	40.92	15.71	40.81	15.78
53.43	15.33	53.45	15.19	53.46	15.31	53.20	15.61	55.16	15.65

X= 7.37		X= 14.73		X= 22.86		X= 81.28	
Z	U	Z	U	Z	U	Z	U
4.28	0.00	2.13	0.00	0.00	0.00	0.00	0.00
4.49	12.12	2.44	6.07	.09	3.17	.09	8.42
4.65	12.91	2.63	7.64	.27	3.48	.27	9.31
4.98	13.89	2.96	10.06	.58	4.40	.58	9.69
5.19	13.94	3.17	10.80	.80	5.63	.81	10.06
6.18	14.15	3.42	11.25	1.05	6.52	1.07	10.27
6.63	14.20	3.88	11.64	1.54	7.95	1.52	10.43
8.05	14.40	5.31	12.26	2.94	10.06	2.96	11.01
10.92	14.54	8.17	12.91	5.80	11.35	5.82	11.68
15.17	14.68	13.14	13.77	10.84	12.70	10.80	12.58
22.32	15.09	20.28	14.63	17.95	13.90	17.97	13.58
29.57	15.49	27.47	15.17	25.08	14.67	25.10	14.32
40.22	15.76	38.15	15.64	35.81	15.41	35.81	15.04
54.51	15.69	52.47	15.62	50.09	15.52	50.08	15.22

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.2n Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Gravel, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** LONGITUDINAL VELOCITIES **********

X= -40.64		X= -30.48		X= -20.32		X= -15.24		X= -10.16	
Z	U	Z	U	Z	U	Z	U	Z	U
0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	2.54	0.00
.34	2.73	.34	2.80	.34	1.14	1.61	3.09	2.88	3.75
.47	3.01	.60	3.11	.60	2.11	1.87	3.75	3.14	4.31
.60	3.12	.88	3.47	.83	2.53	2.15	3.82	3.39	4.80
.71	3.52	1.38	3.89	1.33	3.29	2.64	4.07	3.89	4.96
2.53	4.85	2.35	4.56	2.33	3.94	3.59	4.82	4.87	5.52
4.80	5.48	4.55	5.24	4.44	4.96	4.91	5.35	7.93	6.40
8.40	6.43	8.38	6.06	8.01	6.00	8.24	6.43	11.44	6.82
12.01	6.77	12.02	6.52	11.60	6.55	11.82	6.96	18.77	7.78
19.07	7.64	18.85	7.65	18.74	7.50	19.10	7.82	25.89	8.38
26.28	8.35	26.05	8.17	25.95	8.16	26.03	8.33	32.98	8.89
33.46	8.59	33.13	8.61	33.15	8.81	33.12	8.95	41.69	9.25
42.04	8.97	41.68	8.92	41.60	9.13	41.78	9.22	51.70	9.43
52.09	9.34	51.61	9.39	51.51	9.26	51.43	9.43		

X= -5.08		X= -0.00		X= 5.08		X= 10.16		X= 20.32	
Z	U	Z	U	Z	U	Z	U	Z	U
3.81	0.00	5.08	0.00	3.81	0.00	2.54	0.00	0.00	0.00
4.15	3.93	5.42	6.53	4.15	2.01	2.88	1.42	.34	.31
4.41	5.48	5.68	7.08	4.41	3.62	3.14	2.13	.60	.80
4.69	5.83	5.93	7.25	4.69	4.99	3.37	2.09	.85	1.00
5.18	6.11	6.42	7.25	5.16	6.79	3.84	4.33	1.09	1.55
6.14	6.44	7.40	7.48	6.14	7.22	4.87	6.34	1.33	1.93
7.96	6.84	9.18	7.46	8.36	7.39	7.38	7.01	1.58	2.46
11.62	7.27	12.00	7.57	11.22	7.64	10.68	7.31	1.83	2.74
15.11	7.54	15.59	7.75	14.88	7.79	14.44	7.66	2.08	3.59
22.22	8.32	22.56	8.11	22.19	8.27	22.13	8.25	2.58	3.95
29.40	8.68	29.61	8.70	29.15	8.69	29.25	8.77	3.33	5.11
36.86	9.05	36.68	9.14	36.46	9.04	36.39	9.22	4.82	6.26
43.73	9.26	43.81	9.32	43.68	9.11	43.65	9.35	7.73	6.67
50.94	9.42	51.63	9.42	51.36	9.44	51.45	9.42	14.91	7.55
								21.94	8.13
								29.10	8.69
								36.37	9.33
								43.21	9.45
								50.65	9.51

X= 40.64	
Z	U
0.00	0.00
.34	2.31
.60	2.77
1.12	3.16
1.83	3.69
3.08	4.54
3.95	5.36
6.15	6.06
10.82	6.75
15.50	7.34
22.57	7.98
29.68	8.59
36.83	8.94
43.98	9.28
51.40	9.40

U LONGITUDINAL VELOCITIES IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.3a Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 2, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** RMS OF LONGITUDINAL VELOCITYFLUCTUATIONS **********

X= -30.48		X= -15.24		X= -10.16		X= -7.62		X= -2.54	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	3.81	0.00
.05	.66	.05	.61	.05	.19	1.32	.51	3.86	.56
.18	.71	.18	.74	.18	.42	1.45	.49	3.99	.50
.33	.70	.33	.75	.31	.51	1.60	.51	4.12	.48
.46	.67	.46	.74	.44	.59	1.73	.55	4.25	.49
1.10	.71	.70	.75	.68	.66	2.14	.60	4.69	.53
2.11	.73	1.63	.80	1.27	.72	3.32	.69	5.42	.58
3.70	.73	3.43	.75	5.01	.56	5.05	.70	6.91	.60
5.36	.69	5.21	.72	6.92	.63	6.82	.65	8.72	.60
7.12	.66	6.99	.66	11.00	.58	10.39	.60	12.19	.58
10.71	.63	10.58	.63	15.71	.37	14.11	.57	15.77	.56
14.30	.60	15.82	.61	21.12	.15	19.30	.56	21.17	.55
19.68	.57	21.31	.57	28.28	.54	24.65	.54	26.87	.53
26.06	.54	28.44	.52	36.84	.37	31.83	.47	31.87	.48
32.12	.48	37.76	.40	44.87	.21	42.54	.26	42.59	.29
42.87	.26	45.45	.19	54.11	.08	53.95	.08	54.12	.10
54.33	.09	54.23	.07						

X= 0.00		X= 2.54		X= 7.62		X= 15.24		X= 30.48	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
5.08	0.00	3.81	0.00	1.27	0.00	0.00	0.00	0.00	0.00
5.13	.55	3.86	.24	1.32	.28	.05	.25	.05	.51
5.26	.48	3.99	.26	1.45	.32	.18	.40	.18	.49
5.37	.45	4.10	.28	1.59	.33	.33	.43	.31	.51
5.50	.48	4.21	.29	1.70	.33	.50	.46	.46	.53
6.23	.54	4.45	.32	1.85	.33	.72	.51	.93	.58
7.61	.58	4.64	.35	2.00	.31	1.07	.48	1.63	.67
9.82	.58	4.80	.39	2.13	.33	1.88	.47	3.12	1.00
12.19	.56	5.53	1.24	3.86	.34	3.19	.51	4.90	1.53
14.06	.56	5.73	.73	5.47	1.10	4.95	.95	6.63	1.76
17.57	.55	6.70	.58	6.65	1.27	6.79	1.19	10.20	.82
21.22	.55	8.39	.59	10.13	.67	10.36	.60	13.82	.61
26.48	.52	11.99	.56	13.71	.58	13.99	.57	19.54	.57
31.93	.48	17.33	.57	19.13	.55	17.55	.55	24.53	.53
40.89	.33	22.66	.55	24.55	.53	23.46	.54	31.68	.48
46.14	.22	28.01	.51	31.58	.48	28.63	.51	38.77	.36
54.02	.09	35.33	.42	41.39	.33	37.16	.42	46.42	.23
		44.12	.26	53.72	.10	44.60	.26	53.90	.09
		53.77	.07			54.01	.10		

URMS RMS OF LONG. VELOCITYFLUCT. IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.3b Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** RMS OF LONGITUDINAL VELOCITYFLUCTUATIONS **********

X= -81.28		X= -40.64		X= -25.40		X= -20.32		X= -15.24	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00
.09	.71	.09	.72	.09	.71	.09	.64	1.36	.65
.23	.71	.23	.74	.22	.75	.24	.70	1.50	.60
.34	.74	.35	.71	.39	.72	.40	.73	1.62	.58
.60	.71	.62	.68	.64	.74	.67	.78	1.91	.64
1.11	.70	1.09	.75	.94	.77	1.16	.77	2.42	.69
1.87	.69	1.89	.74	1.12	.78	1.96	.75	2.94	.67
2.59	.69	3.10	.72	1.43	.78	3.14	.75	3.95	.67
3.94	.68	7.28	.64	2.37	.79	5.94	.65	5.25	.66
6.23	.65	11.78	.61	3.78	.72	9.34	.59	7.60	.60
10.36	.61	16.32	.58	7.12	.65	14.47	.58	10.37	.60
14.54	.57	21.78	.58	14.25	.62	21.74	.57	14.51	.58
21.69	.57	29.20	.51	21.78	.57	28.97	.48	21.72	.56
28.78	.52	36.65	.34	28.84	.56	36.44	.35	28.75	.50
35.99	.39	44.18	.26	36.35	.45	43.64	.26	36.16	.41
43.16	.27	53.29	.11	45.13	.28	52.87	.11	44.49	.27
53.14	.13			53.05	.13			53.10	.08

X= -10.16		X= -2.54		X= 0.00		X= 2.54		X= 10.16	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
2.54	0.00	4.44	0.00	5.08	0.00	4.44	0.00	2.54	0.00
2.63	.67	4.53	.73	5.17	.68	4.53	1.23	2.63	.95
2.76	.58	4.67	.60	5.29	.62	4.68	1.24	2.77	.99
2.93	.55	4.84	.53	5.44	.62	4.92	.69	2.97	1.03
3.20	.57	5.37	.57	5.67	.63	5.23	.62	3.27	1.06
3.71	.63	6.12	.59	5.95	.61	5.77	.66	3.66	1.08
4.18	.63	7.12	.57	6.40	.65	6.65	.67	3.96	.90
4.95	.58	8.45	.57	7.19	.65	7.97	.64	5.18	.71
5.95	.61	10.54	.55	8.01	.59	10.78	.60	7.09	.65
8.01	.60	13.02	.54	9.27	.57	14.52	.56	10.72	.60
11.16	.56	16.81	.55	10.52	.56	21.65	.58	14.71	.57
14.68	.55	22.24	.54	13.30	.58	29.01	.54	21.72	.58
21.58	.57	29.51	.51	17.72	.59	37.65	.42	28.44	.53
28.70	.49	37.47	.40	22.11	.55	44.34	.22	36.54	.45
36.28	.35	45.61	.21	29.95	.49	52.95	.12	44.51	.29
44.55	.21	53.11	.10	37.50	.41			53.05	.15
53.03	.10			45.50	.26				
				53.24	.14				

X= 17.78		X= 20.32		X= 25.40		X= 81.28	
Z	URMS	Z	URMS	Z	URMS	Z	URMS
.64	0.00	0.00	0.00	0.00	0.00	0.00	0.00
.72	.83	.09	.55	.09	.83	.09	.80
.87	.96	.23	.82	.23	.98	.22	.84
1.04	1.15	.38	.95	.38	1.01	.60	.81
1.29	1.24	.62	1.06	.68	1.14	.92	.89
1.77	1.45	.93	1.23	1.39	1.33	1.64	.97
2.07	1.43	1.23	1.33	1.87	1.40	3.61	1.04
2.52	1.42	1.78	1.51	2.58	1.33	6.83	1.02
3.70	.93	2.50	1.30	4.43	.99	10.92	.81
5.96	.71	3.96	.87	6.91	.74	13.82	.70
9.09	.65	7.01	.71	14.24	.64	21.20	.59
14.39	.57	10.58	.62	21.22	.59	28.69	.54
21.29	.57	14.35	.59	28.66	.54	36.54	.43
28.56	.52	21.24	.60	36.74	.44	44.01	.33
36.33	.41	28.53	.51	44.84	.29	52.52	.19
44.52	.26	36.51	.40	52.61	.17		
52.69	.15	44.22	.29				
		52.78	.15				

URMS RMS OF LONG. VELOCITYFLUCT. IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.3c Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 6, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** RMS OF LONGITUDINAL VELOCITYFLUCTUATIONS **********

X= -50.80		X= -35.56		X= -20.32		X= -12.70		X= -7.62	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
0.00	0.00	0.00	0.00	1.69	0.00	2.96	0.00	3.81	0.00
.05	.67	.05	.66	1.74	.62	3.01	.65	3.86	.63
.18	.67	.18	.69	1.87	.62	3.14	.62	3.99	.59
.31	.68	.35	.69	2.01	.58	3.29	.56	4.12	.53
.43	.66	.46	.69	2.15	.58	3.42	.54	4.24	.50
.78	.69	.73	.70	2.52	.61	3.70	.54	4.66	.52
1.37	.70	1.66	.73	3.29	.64	4.43	.58	5.29	.54
2.06	.70	3.52	.71	4.69	.64	5.93	.58	7.27	.55
3.49	.68	5.90	.67	6.76	.62	7.49	.57	10.83	.52
5.33	.65	8.29	.63	10.74	.59	9.46	.55	15.32	.51
7.06	.64	10.89	.61	14.32	.57	13.13	.55	19.74	.51
10.63	.61	14.39	.59	17.99	.56	16.18	.54	25.16	.48
14.23	.60	17.93	.57	23.27	.54	21.56	.52	32.32	.42
19.62	.57	23.29	.56	28.79	.49	28.76	.46	39.42	.30
24.93	.54	28.67	.51	35.75	.39	38.76	.31	46.66	.17
32.07	.47	35.86	.35	42.93	.26	45.43	.21	54.50	.07
40.50	.32	43.12	.24	54.33	.06	54.43	.08		
47.18	.12	54.34	.09						
54.36	.06								

X= 0.00		X= 7.62		X= 12.70		X= 30.48	
Z	URMS	Z	URMS	Z	URMS	Z	URMS
5.08	0.00	3.81	0.00	2.96	0.00	0.00	0.00
5.13	.59	3.86	.67	3.01	.64	.05	.60
5.26	.54	3.99	.72	3.14	.66	.18	.63
5.39	.48	4.12	.75	3.28	.67	.36	.67
5.51	.48	4.23	.75	3.41	.69	.48	.73
5.83	.47	4.64	.63	3.73	.66	.81	.79
6.21	.50	5.55	.55	4.31	.53	1.81	.84
6.86	.52	7.13	.53	5.31	.54	6.93	.58
8.71	.51	8.87	.51	8.52	.53	10.48	.50
10.85	.50	11.32	.49	10.67	.51	15.75	.50
14.44	.49	15.89	.49	14.38	.49	21.13	.48
19.89	.48	21.63	.47	19.58	.48	28.30	.42
25.29	.45	28.55	.42	25.08	.46	35.46	.36
33.31	.37	35.70	.36	32.17	.38	44.43	.20
40.31	.29	44.87	.22	39.44	.23	53.98	.08
47.19	.19	54.24	.07	46.38	.11		
54.50	.09			54.36	.06		

URMS RMS OF LONG. VELOCITYFLUCT. IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.3d Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 20, Surface Roughness Smooth, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** RMS OF LONGITUDINAL VELOCITYFLUCTUATIONS **********

X=-127.00		X=-101.60		X= -76.20		X= -50.80		X= -25.40	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
0.00	0.00	0.00	0.00	1.27	0.00	2.54	0.00	3.81	0.00
.05	.71	.05	.71	1.32	.72	2.59	.74	3.86	.73
.18	.73	.18	.73	1.45	.72	2.72	.73	3.99	.72
.33	.71	.33	.71	1.60	.67	2.87	.68	4.11	.67
.59	.71	.60	.71	1.84	.70	3.37	.65	4.33	.68
1.11	.72	1.37	.73	2.30	.69	4.12	.68	4.84	.68
1.88	.75	2.54	.73	3.33	.71	5.70	.68	5.84	.66
3.43	.74	5.01	.69	4.93	.69	9.00	.63	8.82	.64
6.01	.70	8.63	.62	8.53	.65	12.68	.60	12.82	.60
9.98	.64	12.87	.60	13.95	.60	19.67	.59	16.90	.58
14.56	.59	17.41	.59	21.38	.57	28.00	.51	24.81	.54
21.56	.56	23.98	.54	28.57	.51	35.44	.43	33.16	.46
29.58	.50	31.00	.49	35.78	.41	43.27	.30	42.44	.31
36.68	.41	38.31	.37	44.45	.28	52.59	.14	52.47	.16
44.61	.24	45.34	.27	52.72	.13				
52.95	.14	53.07	.13						

X= -5.08		X= 0.00		X= 5.08		X= 50.80		X= 101.60	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
4.83	0.00	5.08	0.00	4.83	0.00	2.54	0.00	0.00	0.00
4.88	.75	5.13	.76	4.88	.77	2.59	.77	.05	.63
5.00	.71	5.26	.67	5.00	.82	2.72	.75	.18	.82
5.13	.66	5.37	.64	5.16	.84	2.85	.74	.67	.76
5.40	.67	5.61	.69	5.39	.77	3.12	.78	1.30	.79
5.88	.62	6.11	.64	5.88	.70	3.60	.80	2.78	.79
6.86	.66	6.84	.63	6.85	.63	4.56	.79	5.14	.70
8.97	.59	8.09	.64	8.58	.65	6.37	.64	8.61	.66
12.41	.60	11.41	.60	12.30	.62	10.20	.60	12.40	.65
15.95	.59	15.20	.57	17.28	.60	15.75	.61	16.88	.61
19.83	.56	19.50	.56	22.63	.58	22.90	.58	23.34	.59
26.44	.54	26.93	.51	29.67	.52	30.10	.52	30.90	.52
33.78	.47	33.59	.45	37.12	.41	37.34	.45	37.90	.42
42.35	.31	42.39	.36	44.68	.32	44.57	.30	45.31	.26
52.18	.16	52.28	.19	52.59	.17	52.19	.14	52.13	.14

X= 152.40	
Z	URMS
0.00	0.00
.05	.71
.30	.69
.56	.73
1.19	.73
2.59	.77
5.60	.71
8.98	.65
12.77	.60
16.12	.60
23.49	.59
30.60	.48
38.05	.39
44.78	.28
52.62	.18

URMS RMS OF LONG. VELOCITYFLUCT. IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

Table 1.3e Triangular Hill Model, Height 5.08 cm, Halflength Height Ratio 4, Surface Roughness Gravel, Freestream Velocity 9.14 m/sec, Neutral Thermal Stratification

********** RMS OF LONGITUDINAL VELOCITYFLUCTUATIONS **********

X= -40.64		X= -30.48		X= -20.32		X= -15.24		X= -10.16	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	2.54	0.00
.34	.76	.34	.79	.34	.70	1.61	.72	2.88	.77
.47	.83	.60	.86	.60	.79	1.87	.76	3.14	.78
.60	.85	.88	.89	.83	.86	2.15	.78	3.39	.78
.71	.87	1.38	.93	1.33	.94	2.64	.84	3.89	.75
2.53	.94	2.35	.94	2.33	.93	3.59	.91	4.87	.82
4.80	.89	4.55	.88	4.44	.93	4.91	.93	7.93	.82
8.40	.83	8.38	.83	8.01	.87	8.24	.82	11.44	.77
12.01	.81	12.02	.79	11.60	.79	11.82	.80	18.77	.70
19.07	.70	18.85	.70	18.74	.68	19.10	.69	25.89	.61
26.28	.60	26.05	.59	25.95	.59	26.03	.56	32.98	.50
33.46	.44	33.13	.46	33.15	.45	33.12	.47	41.69	.30
42.04	.27	41.68	.28	41.60	.23	41.78	.28	51.70	.11
52.09	.10	51.61	.11	51.51	.11	51.43	.12		

X= -5.08		X= 0.00		X= 5.08		X= 10.16		X= 20.32	
Z	URMS	Z	URMS	Z	URMS	Z	URMS	Z	URMS
3.81	0.00	5.08	0.00	3.81	0.00	2.54	0.00	0.00	0.00
4.15	.84	5.42	.84	4.15	.85	2.88	.54	.34	.36
4.41	.79	5.68	.74	4.41	1.32	3.14	.85	.60	.53
4.69	.78	5.93	.71	4.69	1.37	3.37	1.08	.85	.65
5.18	.75	6.42	.72	5.16	.91	3.84	1.35	1.09	.82
6.14	.77	7.40	.77	6.14	.79	4.87	1.14	1.33	.93
7.96	.77	9.18	.81	8.36	.81	7.38	.79	1.58	1.12
11.62	.75	12.00	.79	11.22	.74	10.68	.78	1.83	1.19
15.11	.74	15.59	.71	14.88	.69	14.44	.72	2.08	1.33
22.22	.67	22.56	.62	22.19	.65	22.13	.65	2.58	1.39
29.40	.56	29.61	.56	29.15	.53	29.25	.54	3.33	1.33
36.86	.44	36.68	.41	36.46	.42	36.39	.37	4.82	1.06
43.73	.22	43.81	.27	43.68	.27	43.65	.22	7.73	.85
50.94	.11	51.63	.12	51.36	.12	51.45	.10	14.91	.77
								21.94	.66
								29.10	.55
								36.37	.37
								43.21	.25
								50.65	.12

X= 40.64	
Z	URMS
0.00	0.00
.34	.82
.60	.87
1.12	1.02
1.83	1.16
3.08	1.31
3.95	1.29
6.15	1.05
10.82	.84
15.50	.75
22.57	.65
29.68	.53
36.83	.42
43.98	.27
51.40	.15

URMS RMS OF LONG. VELOCITYFLUCT. IN M/SEC
X DOWNSTREAM DISTANCE FROM CREST IN CM
Z HEIGHT ABOVE UPSTREAM SURFACE-LEVEL IN CM

FIGURES

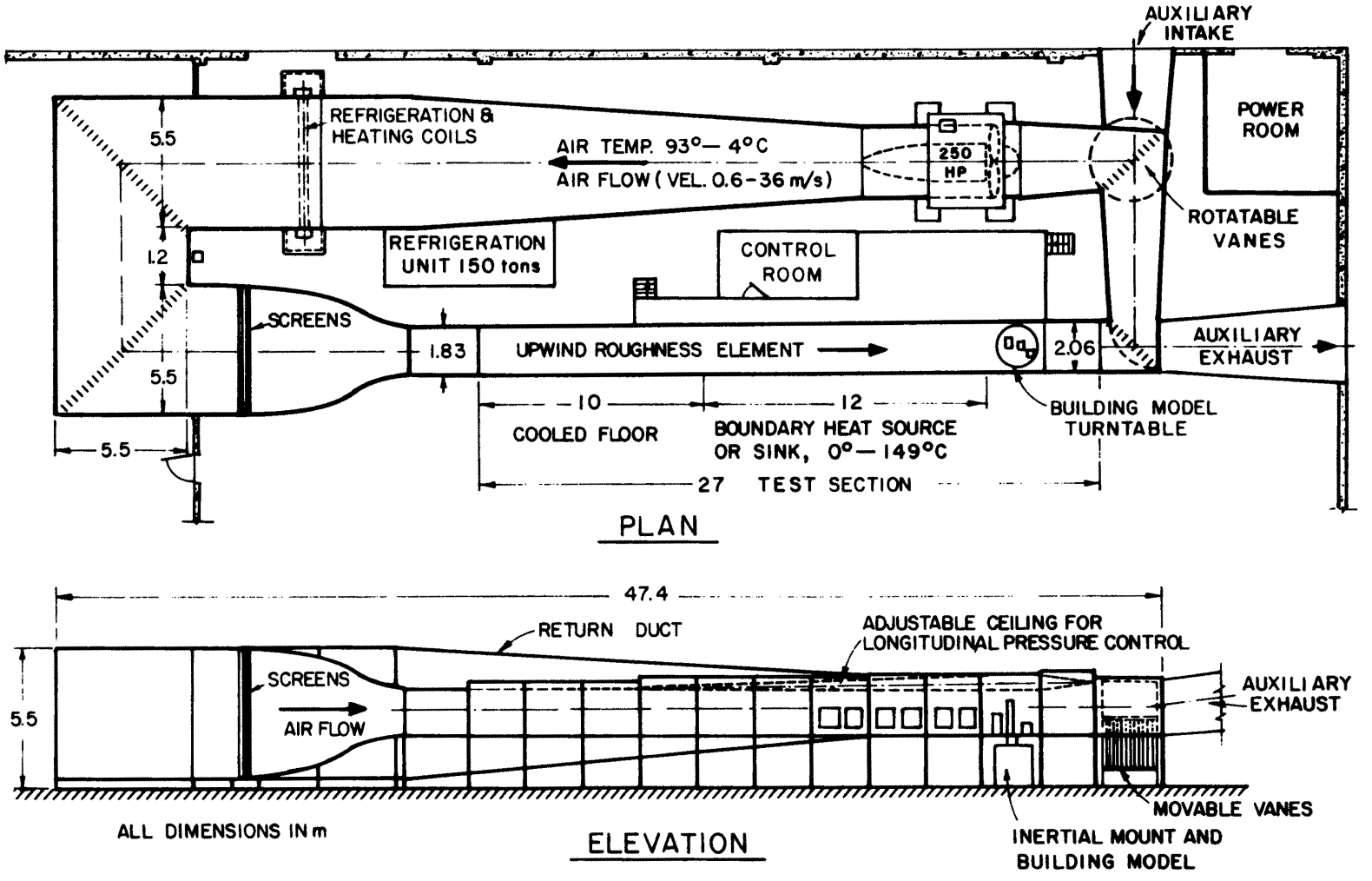

Figure 1. METEOROLOGICAL WIND TUNNEL (Completed in 1963)
FLUID DYNAMICS & DIFFUSION LABORATORY
COLORADO STATE UNIVERSITY

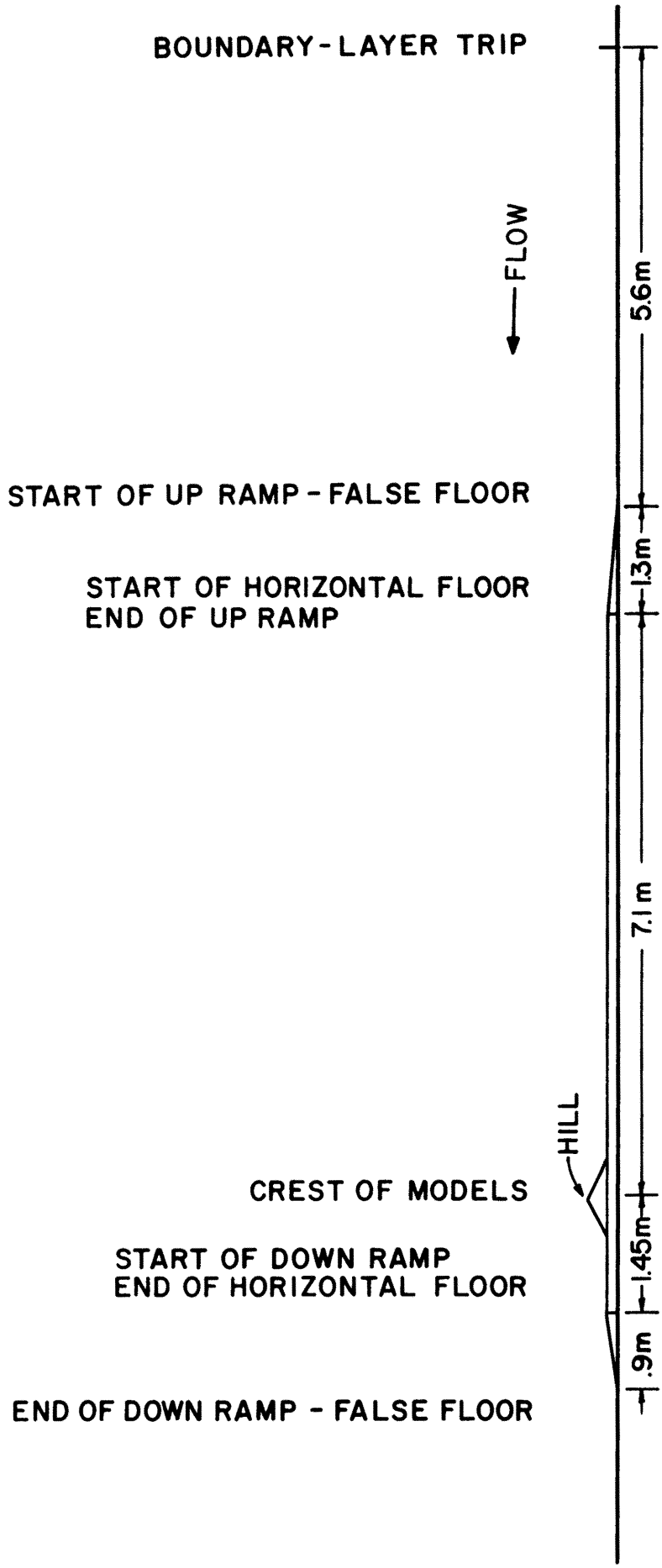

Figure 2. Model Installation in the Wind Tunnel

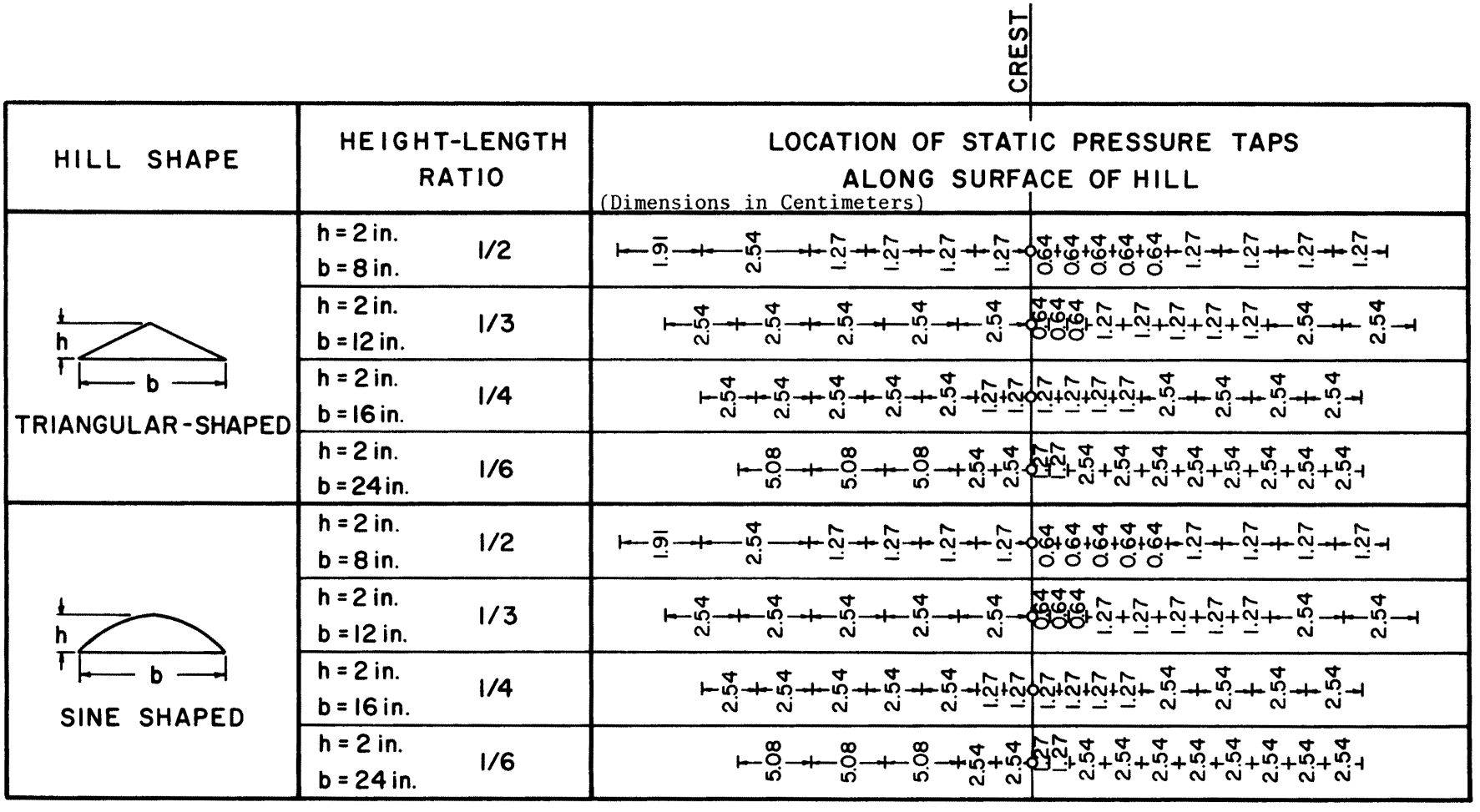

Figure 3. Location of Static Pressure Instrumentation on the Hill Models

APPENDIXES

APPENDIX A: INSTRUMENTATION

Data tabulated in tables,

2-2, 2-3, 2-4, 2-6, 2-8, 2-10, 2-11, 2-12, 2-13

3-2, 3-3, 3-4, 3-6, 3-8, 3-10, 3-11, 3-12, and 3-13 was attained with the following instruments: static and dynamic pressures were measured using the static holes of a pitot-static tube. The tubes were connected to MKS Baratron Pressure Meters (Type 77). The pressure meter outputs were connected to digital voltmeters, TSI, model 1076, with an averaging circuit of 10 seconds.

Data tabulated in tables

2-1, 2-5, 2-7, 2-9, 2-14

3-1, 3-5, 3-7, 3-9, 3-14

4-1, 4-2, 4-3, 4-4, and 4-5,

was attained with the following instruments. The hill model was placed directly on the aluminum floor of the wind tunnel, 21 m downstream of the boundary layer trip. Static and dynamic pressures were measured using a disk-static pressure probe and a Kiehl-total pressure probe. The tubes were connected to MKS Baratron Pressure Meters (type 77). The output of both meters were connected to Integrating Digital Voltmeters DYMEC model 2401C. Both signals were integrated over 60 seconds.

At the same location and at the same time turbulence velocities were measured. A constant temperature anemometer, TSI model 1051-2 was employed to operate platinum alloy hot wires. The anemometer output was connected to two digital voltmeters, TSI, model 1076 to read the d.c. resp. the rms voltages with an averaging circuit of 10 seconds.

APPENDIX B: EXAMPLE TRANSFORMATION OF DATA TO PROTOTYPE SITUATIONS

Since every effort was made to maintain geometric, kinematic, and dynamic similarity the laboratory results should scale directly to a similar prototype situation. One must look for equivalence in hill shape, average aspect ratio, roughness to hill height ratio, thermal stratification and hill height to gradient windheight ratio. In the following example crest values of velocity, pressure, and rms longitudinal turbulence are prepared for flow of an adiabatic atmosphere over a triangular shaped hill where

$h_m = 5.08$ cm

$U_o\ (10h)_m = 9.14$ m/sec

$(h/L)_m = 0.67$

$(z_o/h)_m = 1.5 \times 10^{-4}$

$(\delta/h)_m = 10.5$

The prototype situation considered will be for an adiabatic atmosphere over a half sine wave shaped hill where

$h_p = 100$ m

$U_o(30m)_p = 5$ m/sec

$(h/L)_p = 1.0$

$(z_o/h)_p = 1.5 \times 10^{-4}$

$(\delta/h)_p \sim 10.5.$

This implies a field situation where $z_o \simeq 1.5$ cm which is generally considered to be for flat or gently rolling, open country with very few obstructions. Gradient wind height would be approximately 1000 m which is appropriate for the given roughness and wind speeds for latitudes near 33^o. Length scale ratio, LR, will be 1/1969.

Velocity Profile: To calculate the prototype velocities at a given x, z location with respect to the hill crest the following relation is appropriate.

$$U_p\ (x,z) = U_o\ (30\ m)\ \frac{U_m(x \cdot LR,\ z \cdot LR)}{U_{o_m}\ (30 \times LR)}$$

$$U_p\ (x,z) = 5.0\ \frac{U_m(x_m,\ z_m)}{U_{o_m}\ (1.52\ cm)}$$

where $x_m\ (cm) = x/19.69$

$z_m\ (cm) = z/19.69$

Static Pressure Profile: To calculate the prototype static pressure variation at a given x,z location with respect to the hill crest the following relation is appropriate.

$$C_p(x,z) = \frac{p(x,z) - p_o}{1/2\rho U_o^{\ 2}(30m)} = \frac{p_m(x \cdot LR,\ z \cdot LR)}{1/2\rho U_{o_m}^{\ 2}(30 \cdot LR)}$$

$$Cp(x,z) = \frac{p_m(x_m,\ z_m)}{1/2\rho U_{o_m}^{\ 2}(1.52cm)}$$

Longitudinal Turbulence Intensity Profile: To calculate the prototype longitudinal turbulent intensity variation at a given x, z location with respect to the hill crest the following relation is appropriate

$$\left[\frac{U_{rms}(x,z)}{U_o\ (30_m)}\right]_p = \left[\frac{U_{rms}\ (x \cdot LR,\ z \cdot LR)}{U_o(30 \cdot LR)}\right]_m$$

$$\left[\frac{U_{rms}(x,z)}{U_o(30\ m)}\right]_p = \left[\frac{U_{rms}(x_m,\ z_m)}{U_o\ (1.52\ cm)}\right]_m$$

Typical values of velocity, static pressure coefficient, and turbulent intensity are plotted as compared to their upstream values as shown in Figure B-1.

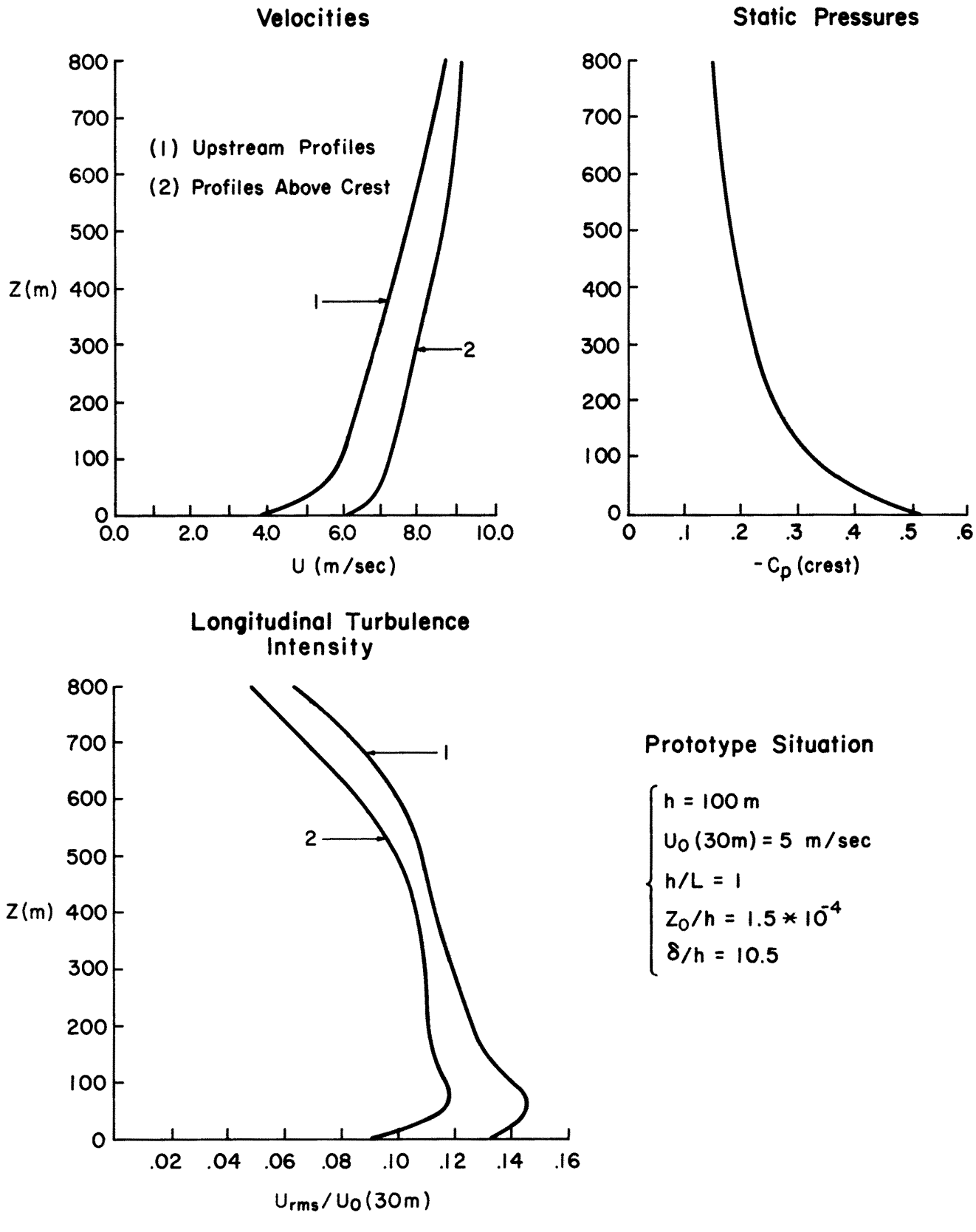
Velocities
(1) Upstream Profiles
(2) Profiles Above Crest
Z(m)
U (m/sec)
Static Pressures
$-C_p$ (crest)
Longitudinal Turbulence Intensity
$U_{rms}/U_0(30m)$
Prototype Situation
h = 100 m
U_0 (30m) = 5 m/sec
h/L = 1
$Z_0/h = 1.5 * 10^{-4}$
δ/h = 10.5

Figure B-1