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THE EFFECT OF MASS, WIND ANGLE AND ERECTION TECHNIQUE ON THE AEROELASTIC BEHAVIOUR OF A CABLE-STAYED BRIDGE MODEL

by

S. J. Zan

National Aeronautical Establishment

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THE EFFECT OF MASS, WIND ANGLE, AND ERECTION TECHNIQUE ON THE AEROELASTIC BEHAVIOUR OF A CABLE-STAYED BRIDGE MODEL

EFFET DE LA MASSE, DE L'ANGLE DU VENT ET DE LA TECHNIQUE D'ÉRECTION SUR LE COMPORTEMENT AÉROÉLASTIQUE D'UNE MAQUETTE DE PONT À HAUBANS

by/par

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SUMMARY

This report presents the results of an aeroelastic investigation into the dynamic response of a cable-stayed bridge to wind loading. The investigation is a continuation of an earlier study in which the deck response was investigated for nine deck sections in three different flows, (Ref. 1). The present investigation used a plate girder section only and was concerned with the effects of mass, yawed winds and erection phases on the response of the bridge to buffeting and a torsional instability. The model, built at a geometric scale of 1:75, was tested in the NAE 9 m × 9 m low speed wind tunnel.

RÉSUMÉ

Le présent rapport contient les résultats d'une étude aéroélastique sur la réponse dynamique d'un pont à haubans aux efforts exercés par le vent. Cette étude est un prolongement d'une étude antérieure sur la réponse de neuf sections de tablier à troix écoulements différents (référence 1). La présente étude portait sur une section composée de poutres à âme pleine seulement et visant à déterminer les effets de la masse, des vents obliques et des phases d'érection sur la réponse du pont au tremblement et à une instabilité de torsion. La maquette, construite à une échelle géométrique de 1/75, a été mise à l'essai dans la soufflerie à basse vitesse de 9 m × 9 m de l'É.A.N.

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LIST OF SYMBOLS

f	frequency (Hz)
f_{iv}	frequency of i^{th} vertical mode
f_T	frequency of torsional mode
m	mass per unit length
u'	root-mean-square value of fluctuating component of streamwise velocity
w'	root-mean-square value of fluctuating component of vertical velocity
A	aspect ratio (span/chord)
A_2^*	motion coefficient (after Scanlan)
B	bridge chord
C_z	lift coefficient for a two-dimensional body
C_z'	lift coefficient for a body with a finite aspect ratio
C_{z_α}	lift curve slope for a two-dimensional body
C_{z_α}'	lift curve slope for a body with a finite aspect ratio
V	wind speed
$\overline{V}$	mean wind speed
V_N	component of V normal to bridge deck
V_{crit}	mean wind speed at onset of torsional instability
α	angle of attack (radians)
ε	constant in Equation 1
ρ	air density
ζ	structural damping (percent of critical)
ζ_a	aerodynamic damping (percent of critical)

1.0 Introduction

This series of experiments evolved as a result of several recent investigations into dynamic wind effects on long span cable-stayed bridges. One of these investigations was a direct precursor of this experiment, and is described in detail in Reference 1. That investigation studied the effects of deck section geometry and wind turbulence on the aeroelastic behaviour of a dynamically scaled model of a cable-stayed bridge. The basic structure of the model was determined from the properties of the Quincy Bridge, Quincy, Illinois. Nine deck cross sections were each tested in three scaled turbulent flows. Several of these cross sections were modelled after existing cable-stayed bridges. Measurements were made of vortex shedding response, buffeting response and torsional instability response as a function of wind speed. The geometric scale of the model was 1:75, and the velocity scale was 1:5.

The important conclusions drawn from that experiment were that plate girder sections were susceptible to vortex shedding induced motions, whereas box girder sections were not. In addition, a turbulence intensity of 5% at deck level was sufficient to impede the formation and shedding of coherent vortices, and thus eliminate the motion. The same turbulence intensity was ineffective in altering the velocity at which a torsional instability was observed. A higher turbulence intensity, 12%, induced a substantial buffeting response, to the extent that the critical velocity for torsional instability could not be reached for fear of model damage. Thus it was not possible to determine if this level of turbulence was sufficient to delay or perhaps preclude the onset of a torsional instability. One of the goals of the present experiment was to test at higher reduced velocities to observe the effect of this level of turbulence on the torsional instability phenomenon.

An important problem that has recently surfaced, particularly in North America, is the large, perhaps catastrophic, buffeting response that can occur during erection of a cable-stayed bridge if the balanced cantilever technique is used. Analytical predictions of buffeting response during the erection phase have demonstrated the need to carefully plan the erection scheme to avoid these large deflections. The most convenient method to date is to use temporary tie-downs, which stiffen the structure so that the resonant frequencies of the bridge are above those frequencies in which the wind stores a considerable portion of its energy. This problem has been studied analytically by Zan (References 2 and 3); and experimentally by Gamble and Irwin (Reference 4), who optimized the tie-down scheme for the Annacis Island Bridge. For the present set of experiments, half of the model could be removed from the wind tunnel, allowing simulation of a half completed bridge. It was possible to test this half bridge with and without anchoring at the end pier. The largest buffeting response, and hence the critical design case, occurs just before the side span is anchored to the end pier.

A mechanism for the reduction of the large buffeting response may be inherent in the geometry of the partially completed structure. A completed bridge acts as a two-dimensional lift device; (although in practice the flow field is three-dimensional) however, a partially completed bridge will have an 'end effect' that may reduce the lift coefficient and hence lift-curve slope. This phenomenon is well documented for finite span aeroplane wings. It is the intention of this investigation to determine if the same effect occurs for bridge road decks.

Another phase of this experiment investigated the response of the model to a yawed wind, specifically 30° (Figure 1). Measurements were made of the buffeting response and torsional instability response for both the full bridge and for the erection phase condition. Previous aeroelastic investigations that have included yawed wind studies include work by Davenport et al (Reference 5) and Irwin and Schuyler (Reference 6).

2.0 Experimental Procedure

The experimental set-up for these investigations was similar to that described in Reference 1. For the case of wind normal to the bridge, the model was mounted on two pedestals which are dynamically isolated from the tunnel shell. It was not possible to mount the bridge model on the pedestals for the case of a yawed wind, so the model was mounted on the floor. In both cases the mounting surface was levelled in both directions to ensure a mean angle of attack of zero degrees.

The model displacements were sensed using Kaman displacement transducers. These were installed at four locations under the deck in pairs, which allowed computation of vertical and torsional deflections (Figure 2). The lateral bending stiffness of this bridge is much greater than the vertical bending stiffness. As a result, the blowback was assumed to be negligible, and the vertical and torsional deflections could then be calculated by taking the sum and difference of the signals from a pair of transducers.

For the case of the half-bridge and all tests for which the model was yawed, the south centre pair of transducers was moved to the location shown in Figure 2.

The wind simulations used for the present study were as described in detail in Reference 1. There were two correctly scaled simulations of the earth's turbulent boundary layer and a third case with smooth flow. Reference 1 shows that the spectra of turbulence were consistent with the model scaling. Turbulence intensities at deck level were as follows:

Simulation	$u'/\overline{V}$	$w'/\overline{V}$
Highly Turbulent	0.120	0.062
Moderately Turbulent	0.050	0.026
Smooth	0.005	--

Only one deck section was used for this investigation. The section chosen was a plate girder construction as shown in Figure 3. This was one of the nine sections used in the experiments described in Reference 1.

As mentioned, there was interest in obtaining higher reduced velocities in the present series of experiments so that the torsional instability behaviour in a highly turbulent flow could be investigated. The most practical method to raise the reduced velocities at a given dimensional wind speed was to lower the model frequencies. To this end, brass weights were attached inboard of the main girders. These were located close to the existing radius of gyration to preserve the frequency ratio between the bending and torsional modes. The added mass (Figure 3) was about 50% of the existing deck mass, which lowered the torsional frequency from 12.0 Hz to 8.74 Hz. The first two vertical mode frequencies were lowered to 4.1 Hz and 5.6 Hz from 5.0 Hz and 6.7 Hz respectively.

The drawbacks to achieving higher reduced velocities with this method are that the vertical buffeting response may increase and that the increased polar mass moment of inertia may raise the critical velocity in much the same way that structural damping does. With respect to the first point, it is difficult to assess the effect of the additional mass on vertical buffeting response. The response is inversely proportional to the mass; however the added mass also lowers the model frequencies which will tend to increase the response. An estimate of the buffeting response for the two cases is presented in Figure 4, using the theory of Irwin (Reference 7).

Data acquisition was similar to the previous experiment. The nine channels of data (eight displacement transducers and dynamic pressure) were each sampled at 40 Hz. Data reduction involved computing the mean, root-mean-square (rms) and peak response of bridge deck vertical and torsional motion, and the mean wind speed. Time histories were 1500 data points in length for each channel which corresponds to about 10 minutes of full scale data. A software filter was used to remove displacement response peaks that exceeded the limit over which the transducer response could be considered linear. As a result, there are a few cases in the table of results for which the peak response shown was not the actual peak. Examination of the actual time history revealed that the deleted peaks were roughly 1 mm greater than those that were accepted. The maximum allowable response at model scale was 13 mm at the centre span and north centre stations and 6.5 mm at the side span and south centre stations. For displacements that were 13 mm (or 6.5 mm) or less, the accuracy was better than 2% of full scale deflection, whereas for displacements of the order of 14 mm (or 7.5 mm) the accuracy was about 10% of full scale deflections.

The test sequence is presented in Table I. Measurements of frequencies and damping for the various modes are presented in Table II. The damping values were obtained using the log decrement method by exciting the bridge in one mode and observing the decay of the response. Classical theory would predict a decrease in damping (ζ) as mass increases. This is not always the case for the present experiment as is evident in Table II. It was thought that there was some frictional contact between the cables and the added brass which tended to increase the damping.

TABLE I

Test Sequence

Run	Full/Half Bridge	Added Mass (Y/N)	Yaw Angle	Flow
1	F	N	0	Highly Turbulent
2	F	N	0	Smooth
3	F	Y	0	Smooth
4	F	Y	0	Moderately Turbulent
5	F	Y	0	Highly Turbulent
6	H	Y	0	Highly Turbulent
7	H	Y	0	Smooth
8	H	Y	0	Moderately Turbulent
9	H	N	0	Moderately Turbulent
10	H	N	0	Smooth
11	H	N	0	Highly Turbulent
12	H*	N	0	Highly Turbulent
13	H	N	30	Highly Turbulent
14	H	N	30	Smooth
15	H	N	30	Moderately Turbulent
16	F	N	30	Moderately Turbulent
17	F	N	30	Smooth
18	F	N	30	Highly Turbulent

* For this case only, the half bridge was not anchored to the side span pier

TABLE II

Frequency and Damping Measurements

(damping expressed as percent of critical)

MODEL	MODE 1V	MODE 2V	MODE 1T
Full bridge	5.0 Hz (1.1%)	6.7 Hz (0.80%)	11.9 Hz (1.0%)
Full bridge with added mass	4.06 Hz (0.84%)	5.6 Hz (0.90%)	8.74 Hz (1.3%)
Half bridge with added mass	3.58 Hz (0.95%)	6.66 Hz (0.55%)	8.25 Hz (1%)
Half bridge	4.31 Hz (0.45%)	8.0 Hz (0.45%)	10.6 Hz (0.54%)
Half bridge not anchored at side span pier	2.2 Hz (0.16%)	7 Hz (--)	9.5 Hz (--)

3.0 Results

Computer listings of the results are presented in Appendix A. The results are in terms of model scale values. The bridge deflections are listed for each of the four stations shown in Figure 2. The wind speeds have been converted to deck level values.

The data presented for both vertical and torsional deflections are the mean, root-mean-square (rms) and peak deflections. The peak deflections are defined as the magnitude of the largest excursion from the mean value. The fourth column, Ratio, is defined as the absolute value of peak divided by the value of rms. For response due to buffeting, the ratio will have a value of about 3.5. For response due to a torsional instability, the ratio would be 1.4 if the response was sinusoidal, but is usually slightly greater.

Figures 5 and 8 through 12 are plots of the results to be discussed. The plots are in terms of non-dimensional variables for response to torsional instability and in terms of dimensional variables for response to buffeting. The reason for the dimensional plots of buffeting response is that the response does not collapse on reduced velocity, since the response depends on many variables including mass, frequency, span length, and dimensional wind spectrum. The values plotted in all cases are the rms response at the centre of the main span.

4.0 Discussion

4.1 Torsional Instability

Figure 5(a) shows the torsional response in smooth flow at high wind speeds for the unmodified plate girder and the plate girder with added mass. The two response curves for the unmodified plate girder represent the response at two different levels of structural damping. The influence of structural damping on the onset of a torsional instabiity is unique to each bridge deck. The effect can be explained by considering Scanlan's A_2^* motion coefficient (Reference 8) as a function of velocity (Figure 6). A bridge deck for which the derivative of A_2^* with respect to reduced velocity is large will not possess a critical velocity sensitive to changes in structural damping. If the derivative of A_2^* with respect to reduced velocity is small, the critical velocity will be greatly affected by the structural damping level. Figure 7 is a plot of the critical windspeed as a function of structural damping for three plate girder sections. The data are taken from various full and sectional model tests performed at the NAE (Reference 1 and 9). The critical windspeed is defined as that for which an rms response of one degree occurs. It is seen that the critical velocity increase resulting from the increased structural damping for the plate girder section is similar to that shown for data from the Quincy deck sections. The two sections are similar and thus likely have similar A_2^* curves.

Because the damping of the bridge in torsion is roughly one percent of critical for most of this experiment (Table II), the response curve shown for one percent damping will be taken as a reference curve throughout this discussion. Figure 5(a) shows that the effect of increased inertia is to raise the critical velocity, suggesting a square root dependence. (33% increase in $(\frac{V}{fB})$ for an 85% increase in polar mass moment of inertia).

Figure 5(b) shows the response of the full and half bridge for a wind angle of 30°. As expected the critical velocity is increased with the yawed wind. This figure also indicates that the half-bridge geometry has some effect on the instability behaviour as its response is very similar to the full bridge response, but at a much lower damping level. The effect of damping shown in Figure 7 would suggest that the reduced critical velocity for the half-bridge would be about 10.4 if the structural damping were 1%. If the curves are plotted using the component of velocity normal to the bridge deck, (Figure 5c), agreement is obtained with the full bridge at 0°, suggesting that the instability is dependent on the normal component of velocity, in agreement with Reference 7.

Figure 5(d) shows the effect of increased inertia on the half-bridge. The data here are not in complete agreement with the results of Figures 5(a) and 5(b). At first glance, it appears that the additional inertia raises the critical velocity in agreement with Figure 5(a), however the damping is considerably lower for the half-bridge without added mass. (Table II) As stated in the last paragraph, it can be estimated that the reduced critical velocity for the half-bridge without added mass would be about 10.4 for a damping level of about one percent of critical, in which case there would be little difference when compared to the result with the added mass.

In this series of experiments, the unmodified plate girder was not tested in moderately turbulent flow. An estimated response curve based on the data of Figure 7 and the results in Reference 1, is shown in Figure 8(a) for the model with a structural damping level of one percent. For the full bridge, the increased inertia raises the critical velocity by about 31% in agreement with the smooth flow results.

At a wind angle of 30°, the normal component of critical velocity again provides a reasonable collapse parameter for the full bridge data when structural damping is taken into account. Again there is a difference in critical velocities for the full and half-bridge studies.

Figures 8(c) shows that the half bridge critical velocity is increased as the inertia increases. The critical velocities from Figures 8(a, b, c) are in good agreement with Figures 5(a, b, c) which confirms the results of Reference 1, that a moderately turbulent flow has little effect on the critical speed for the onset of the torsional instability.

In the highly turbulent flow, the buffeting response dominated the bridge behaviour and unfortunately it was still not possible to attain sufficient wind velocities to determine whether or not a highly turbulent flow would affect the onset of a torsional instability.

4.2.1 Torsional Buffeting

Figure 9a, 9b, 9c are plots of the torsional buffeting response of the bridge deck as a function of dimensional model wind speed for the tests in the highly turbulent flow. The prototype wind speeds are five times greater than the model wind speeds. The most noteworthy aspect of Figure 9(a) is that the response at a given dimensional wind speed is not affected by the added mass or structural damping level.

The addition of inertia to the deck would tend to lower the response according to classical vibration theory, however the added inertia also lowers frequencies, and at lower frequencies the amount of energy in the wind that is available to excite the bridge in a resonant condition increases.

At a wind angle of 30°, the response of the full bridge is decreased (Figure 9b) and again the normal component of velocity seems to govern the response. This observation may not be valid for a bridge with appreciable camber along the span as a yawed wind will change the mean angle of attack of the wind. The response of the half-bridge is much larger than the full bridge at a given wind speed because of the decreased frequencies.

This same characteristic is shown in Figure 9(c), where it is also evident that the effect of added inertia is negligible in terms of the response at a given dimensional windspeed. One curve on Figure 9(c) shows the response of the deck with a double cantilever. This simulates the erection state just prior to anchoring at the side pier and shows that the response can be very large if the deck is not tied down.

4.2.2 Vertical Buffeting

The effect of added mass on the vertical buffeting response is the same as that for the torsional buffeting response. Figure 10(a) shows the response of the full bridge in a highly turbulent flow with and without the added mass. A similar result is found for the half-bridge, Figure 10(b), where it can also be seen that the buffeting response increases dramatically during the erection stages. For the case of the half-bridge not anchored to the side span pier, an rms response of 240 mm at prototype scale occurs at the prototype wind speed of 31.3 m/s. The peak response for a ten minute period is about 650 mm (see Appendix). This compares to a peak response of about 170 mm for the completed structure at the same mean wind speed and for the same time period. The scaling factors on vertical response, wind speed and time are 75, 5 and 15 respectively.

Figure 10(c) is a plot of the buffeting response of the full and half-bridge at 30°. Trends similar to those already discussed are evident.

As mentioned, it was thought that the buffeting response of the half-bridge may be reduced by the end effect. Since the buffeting response can be estimated accurately using analytical techniques, a comparison was made between calculated and measured responses to determine if the end effect significantly reduces the response.

Figure 11a is a plot of the measured and calculated buffeting response of the full bridge at 0°. The calculated response is based on Reference 7, with the exception that the aerodynamic damping term was modified as outlined in Reference 2. Basically this modification is in the form of a constant in the equation. The aerodynamic damping (percent critical), according to quasi-steady theory, is given by

$$\zeta_a = \left(\frac{100\varepsilon}{8\pi}\right) \left(\frac{\rho B^2}{m}\right) \left(\frac{V}{f_{iv} B}\right) \left(C_{z_\alpha}\right) \tag{1}$$

with $\varepsilon = 1$. However, several sectional model studies have shown that ε can be less than 1. Investigations at the NAE have shown ε to vary from 0.31 (Reference 3) to 1.0 (Reference 7) with ε decreasing as C_{z_α} increases (Figure 11b). An explicit value of ε was not obtained from section model tests of this deck section shape, thus a trial and error procedure was used to determine that for this section, ε is equal to about 0.6. This value of ε permitted the best agreement with the experimental data. (Figure 11a).

Since the various parameters used in the analytical technique were predicting a response that agreed well with experimental data, predictions were then made of the response of the half-bridge anchored at the side span, using the measured values of frequencies and damping for the model in this configuration. These results were then compared to the experimental values. Figure 12 shows the measured response is less than estimated by theory, suggesting that the end effects are important in the buffeting response.

A brief literature survey was undertaken to determine several corrections to the lift on a finite aspect ratio wing. Two such corrections were found, a simple one of the form (Reference 10)

$$\frac{C'_{z_\alpha}}{C_{z_\alpha}} = \left[1 + \frac{C_{z_\alpha}}{\pi A}\right]^{-1} \tag{2}$$

where C'_{z_α} is the value of the lift curve slope for finite aspect ratio, C_{z_α} is the value of the lift curve slope for infinite (2D) aspect ratio, and A is the aspect ratio. (span/chord for a bridge). Equation 2, which is valid for flat plates (Reference 14), assumes on elliptical spanwise lift distribution. A correction for an arbitrary circulation distribution is more complex and is presented in Reference 11.

Figure 13 shows the two corrections to the lift curve slope as a function of aspect ratio. C_{Z_α} was taken to be 5.3 which was determined from sectional model tests on the original configuration of the Quincy Bridge (Reference 9). The original deck configuration of the Quincy Bridge did not differ significantly from the plate girder section tested here. The correction for the arbitrary circulation distribution was worked out assuming an untwisted rectangular "wing" planform and a symmetrical circulation distribution about the midpoint of the span.

Also shown in Figure 12 are estimated response curves for the half bridge incorporating the effects of a finite aspect ratio. The aspect ratio was taken to be twice the half span divided by the chord since there is likely only a "bridge-tip" vortex at the free end of the main span. If the deck were not anchored at the side span, the aspect ratio would be more correctly taken as the half span to chord ratio because vortices can develop at both ends of the deck. It is seen in the figure that the correction is not sufficient to fully account for the three-dimensional effects for the half-bridge. More research is needed in this area, considering the number of cable-stayed bridges that are currently using the balanced cantilever technique for erection.

The buffeting response in the moderately turbulent flow followed the same trends as in the highly turbulent flow and will not be elaborated on here.

5.0 Conclusions

A 1:75 geometric scale aeroelastic model of a cable-stayed bridge was tested in the NAE 9 m x 9 m low speed wind tunnel, to determine the effects of mass, yawed winds and erection configuration on the response to a torsional instability and buffeting. The conclusions reached are:

(i) With respect to a torsional instability, it was found that increasing the polar mass moment of inertia of the deck raised the critical velocity for the onset of a torsional instability. This occurred in both smooth flow and moderately turbulent flow.

(ii) A confirmation was made of the previous result (Reference 1) that the onset of a torsional instability for a plate girder section is not affected by the presence of a moderate amount of turbulence. It was not possible to fully examine the effects of highly turbulent flow on the instability behaviour due to the excessive vertical buffeting response with this model.

(iii) From the results presented here, prediction of critical wind speeds for the onset of a torsional instability for the erection phase will be conservative if one uses either sectional model results or aeroelastic model results from the complete bridge as a basis for the prediction.

(iv) With respect to a yawed wind, it was found that the component of wind normal to the deck governs the torsional instability and buffeting behaviour.

(v) The buffeting response increases dramatically during erection, due to the decreased frequencies, which emphasizes the need for temporary tie downs. The response to buffeting for a partially erected span is not as large as buffeting theory would predict.

(vi) The effect of adding mass to the deck had little effect on the response of the deck at a given dimensional wind speed and thus it can be concluded that the bridge stiffness is the dominant parameter as far as the buffeting response is concerned. The response of a linear system decreases with added mass, however the mass also lowers the bridge frequencies allowing a greater input of wind energy into the deck, and it seems that these two effects effectively cancel each other.

(vii) It is also evident that the level of structural damping plays only a minor role in the vertical buffeting response at high wind speeds since the aerodynamic damping dominates. Evaluation of Equation 1 for a given condition clearly indicates this point.

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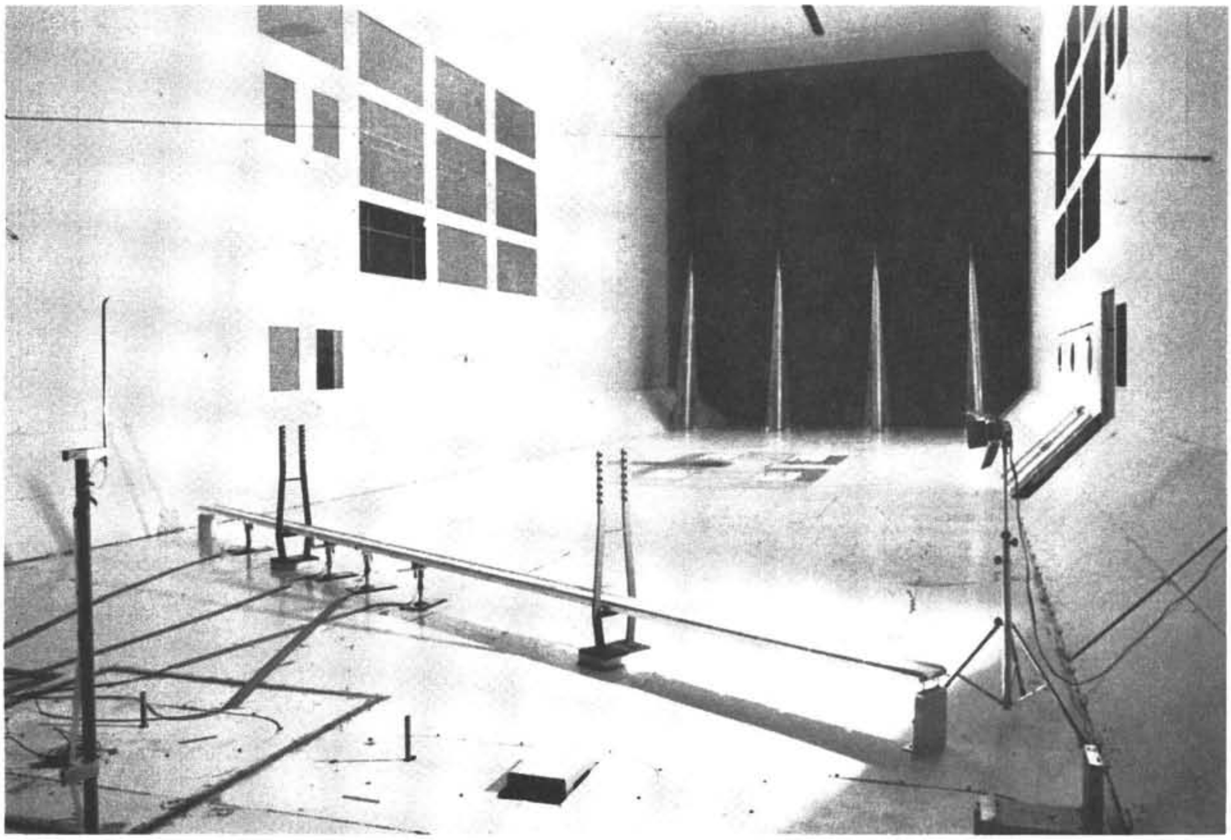


FIG. 1: MODEL INSTALLATION FOR A WIND ANGLE OF 30°

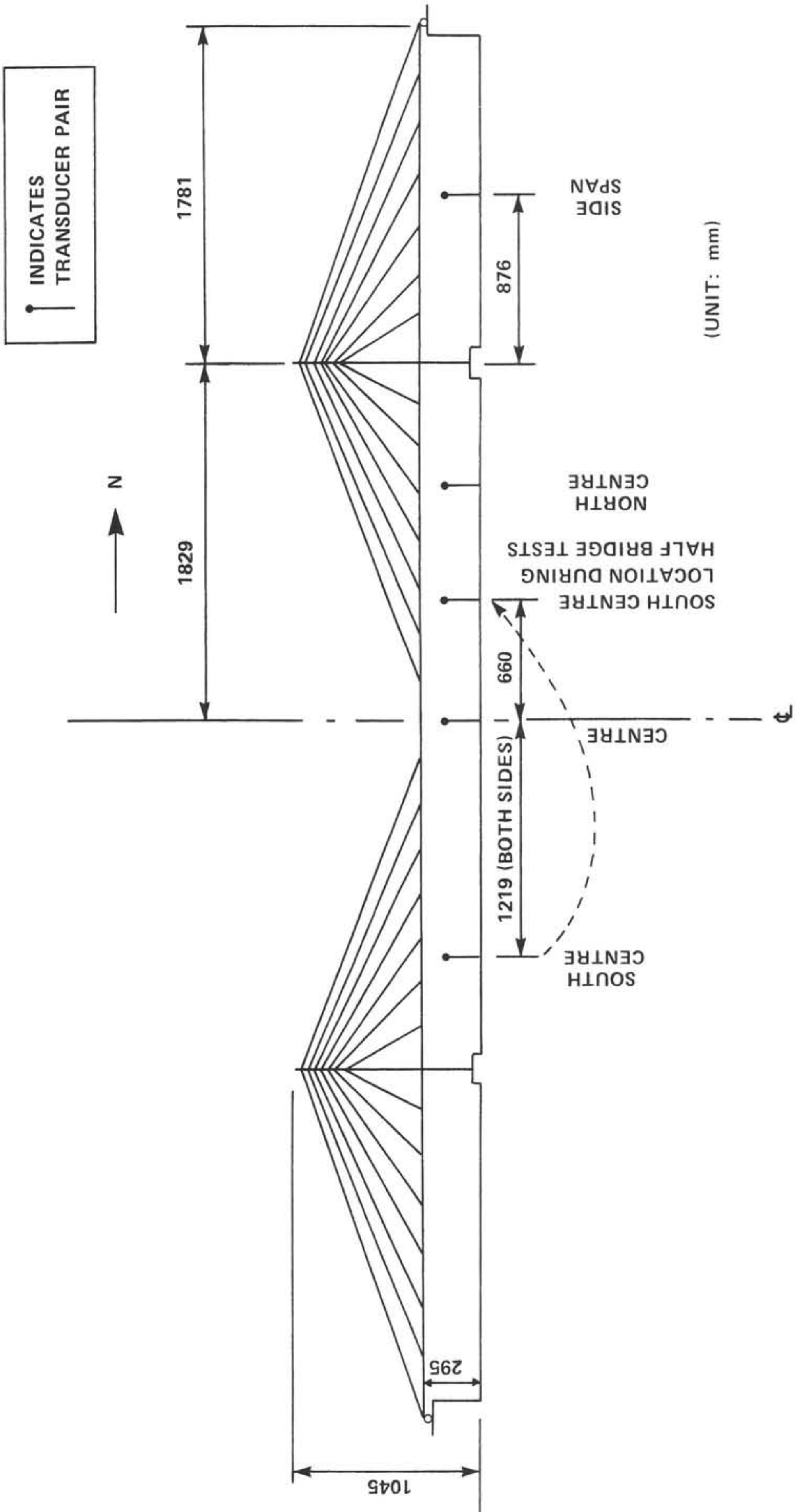


FIG. 2: ELEVATION OF MODEL

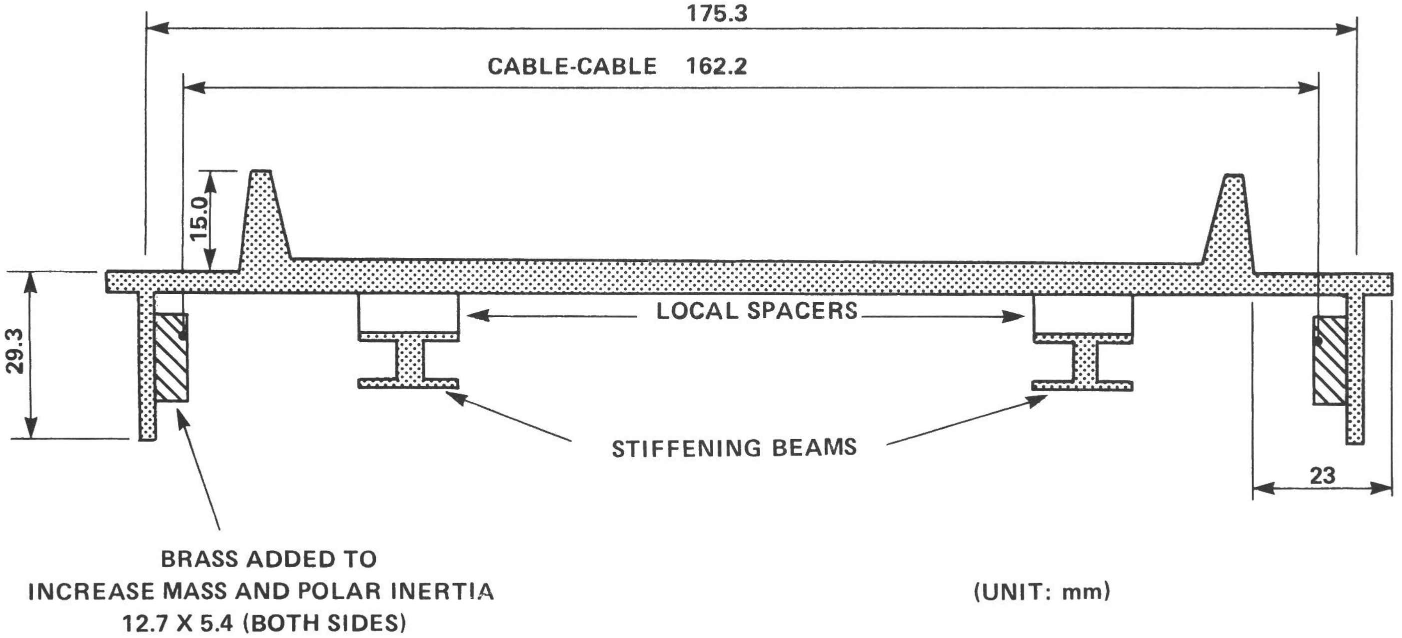


FIG. 3: PLATE GIRDER SECTION

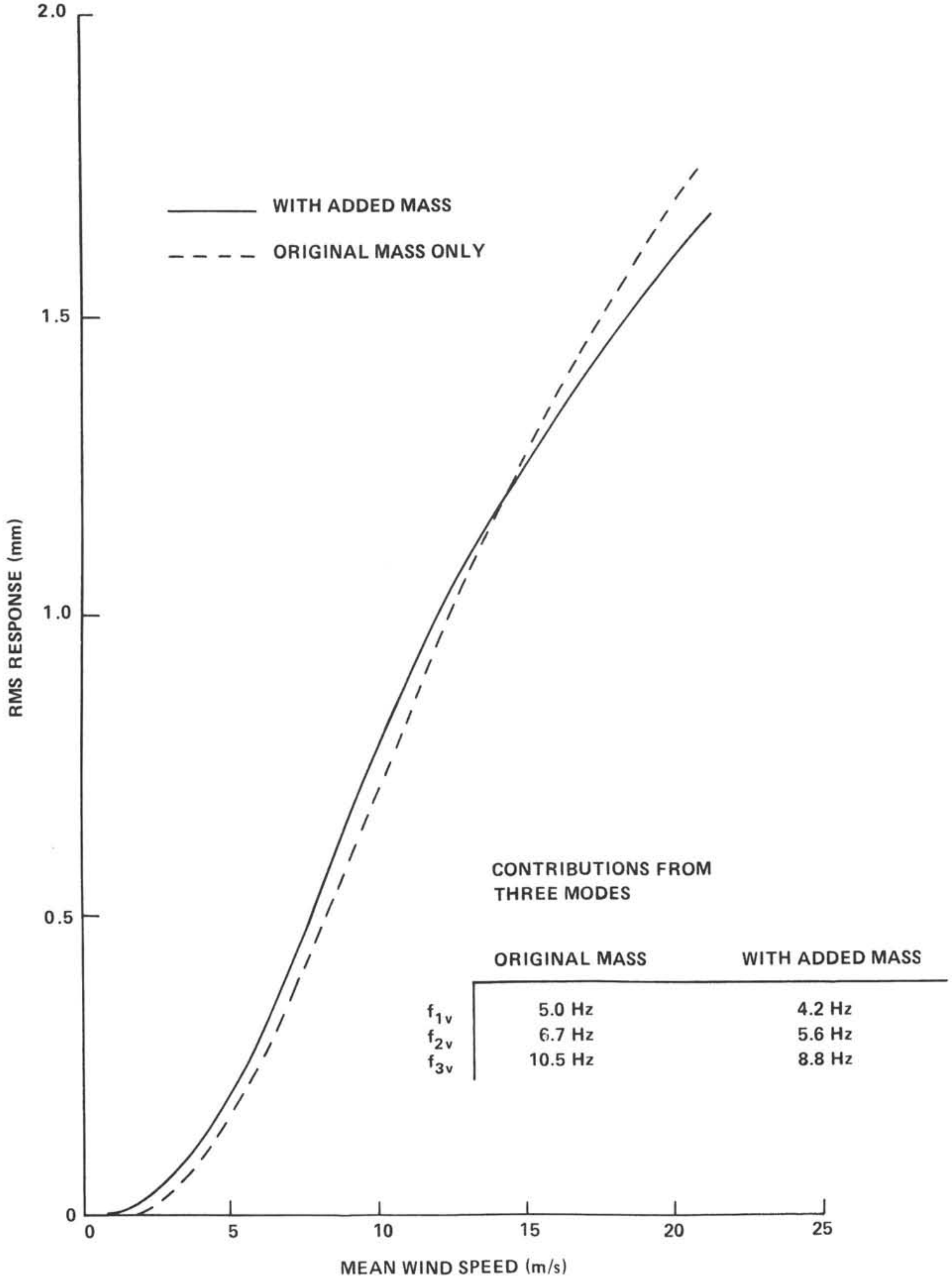


FIG. 4: ESTIMATED BUFFETING RESPONSE OF A GENERALIZED CO-ORDINATE FOR THE FULL BRIDGE IN HIGHLY TURBULENT FLOW

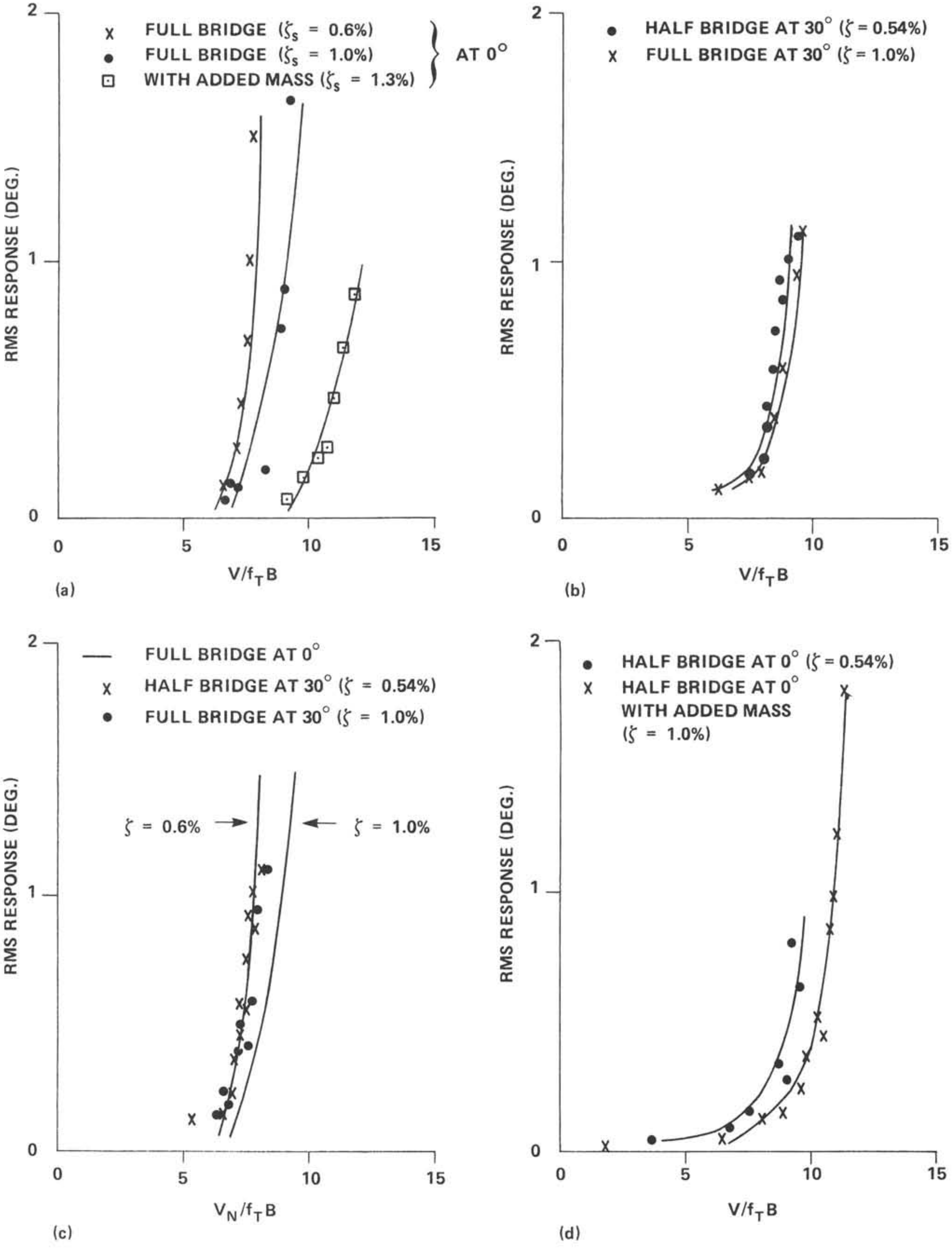


FIG. 5: TORSIONAL INSTABILITY RESPONSE IN SMOOTH FLOW

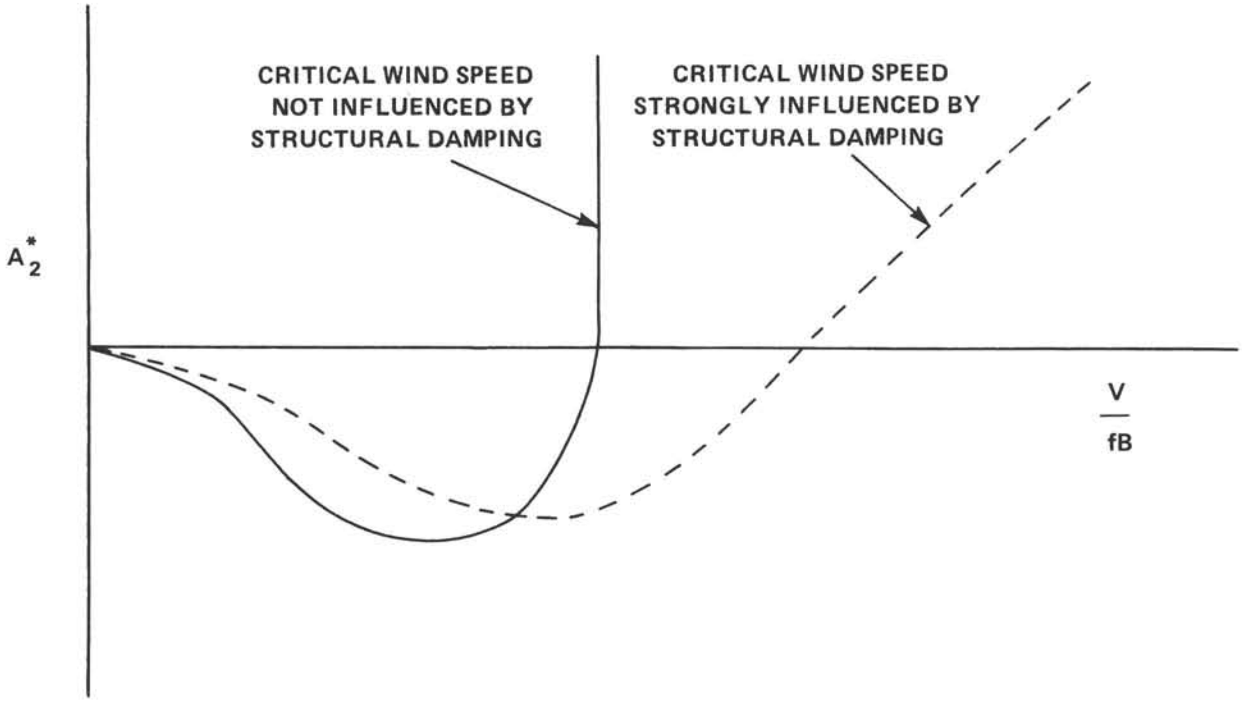


FIG. 6: EFFECT OF A_2^* CURVE ON CRITICAL WIND SPEED

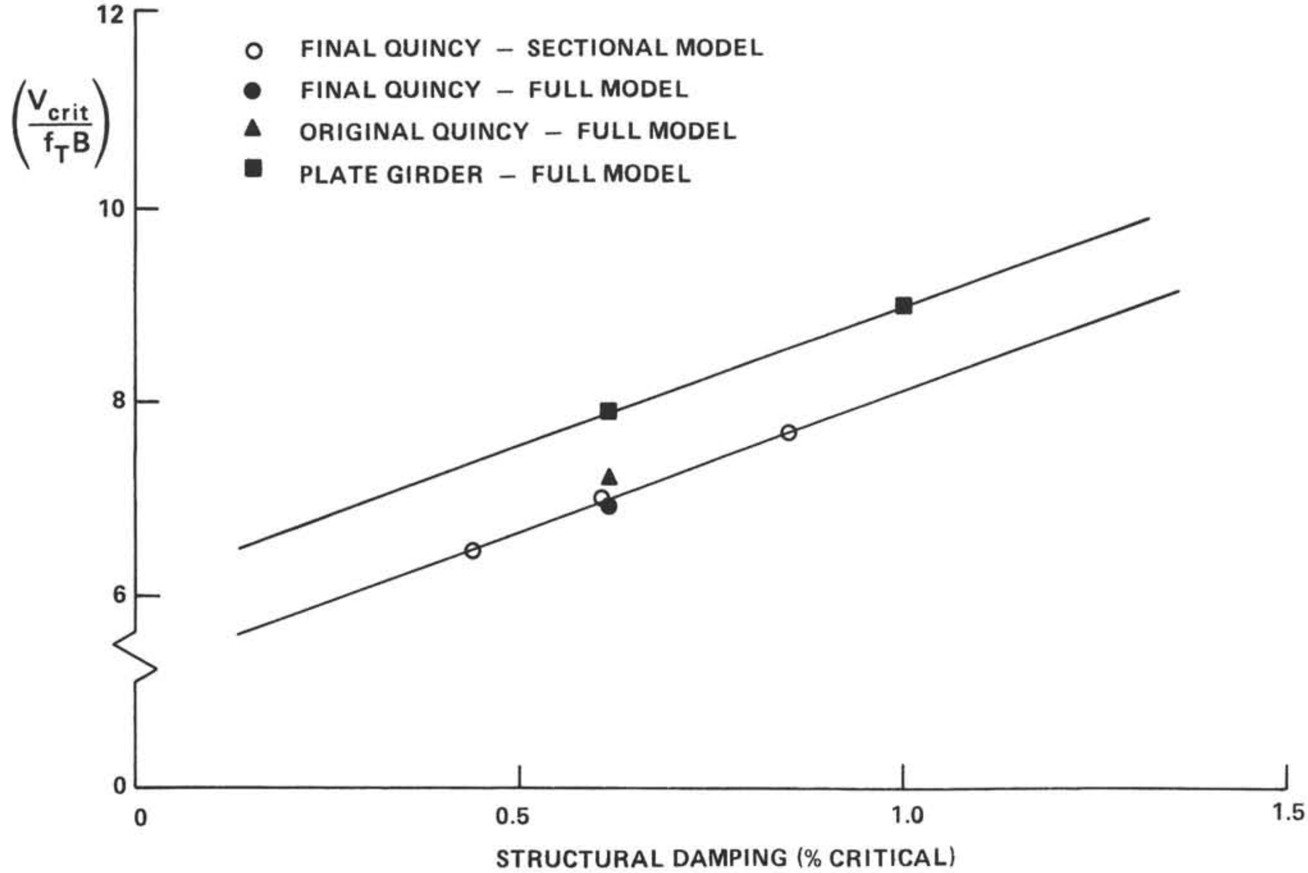


FIG. 7: EFFECT OF STRUCTURAL DAMPING ON CRITICAL WIND SPEED

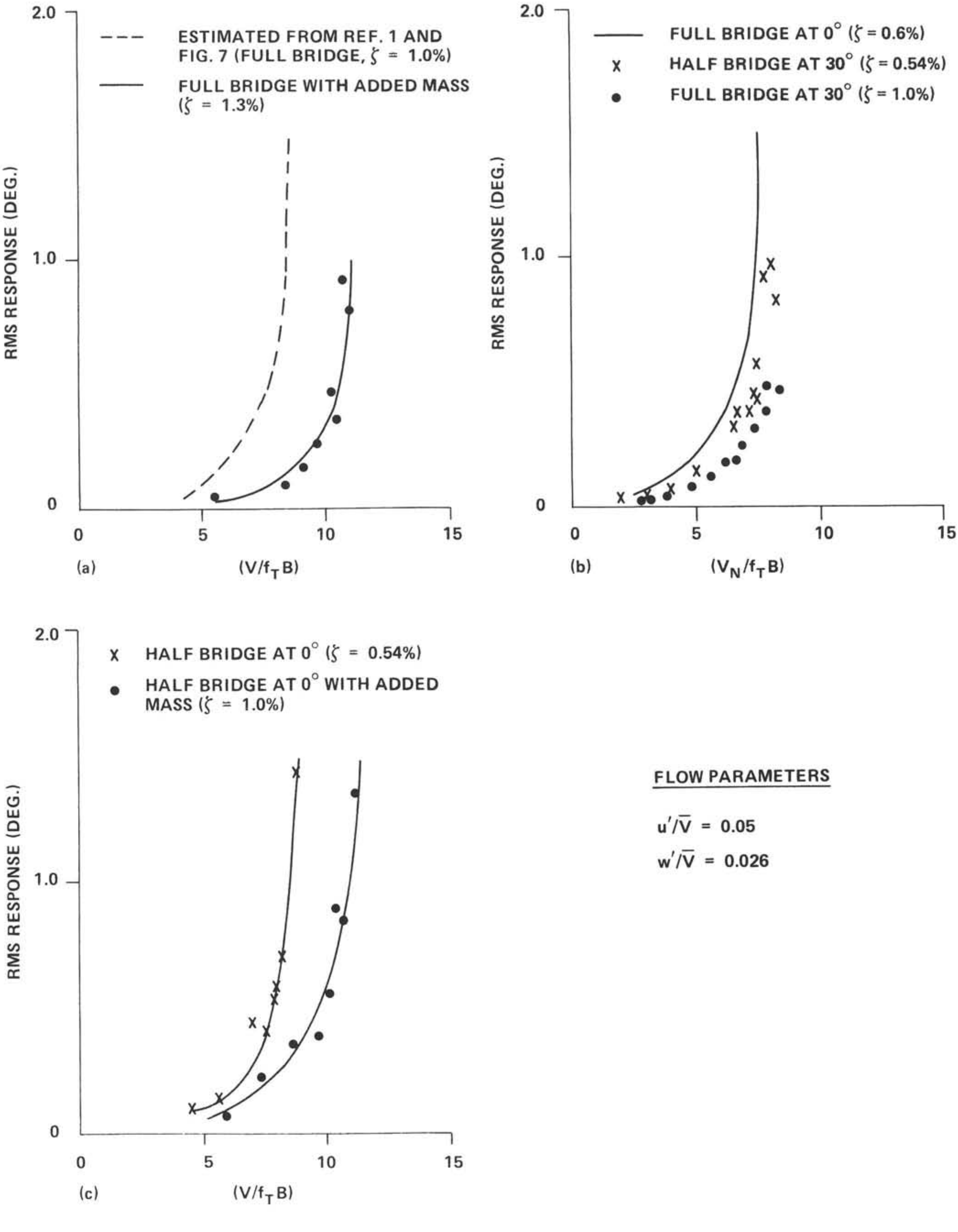
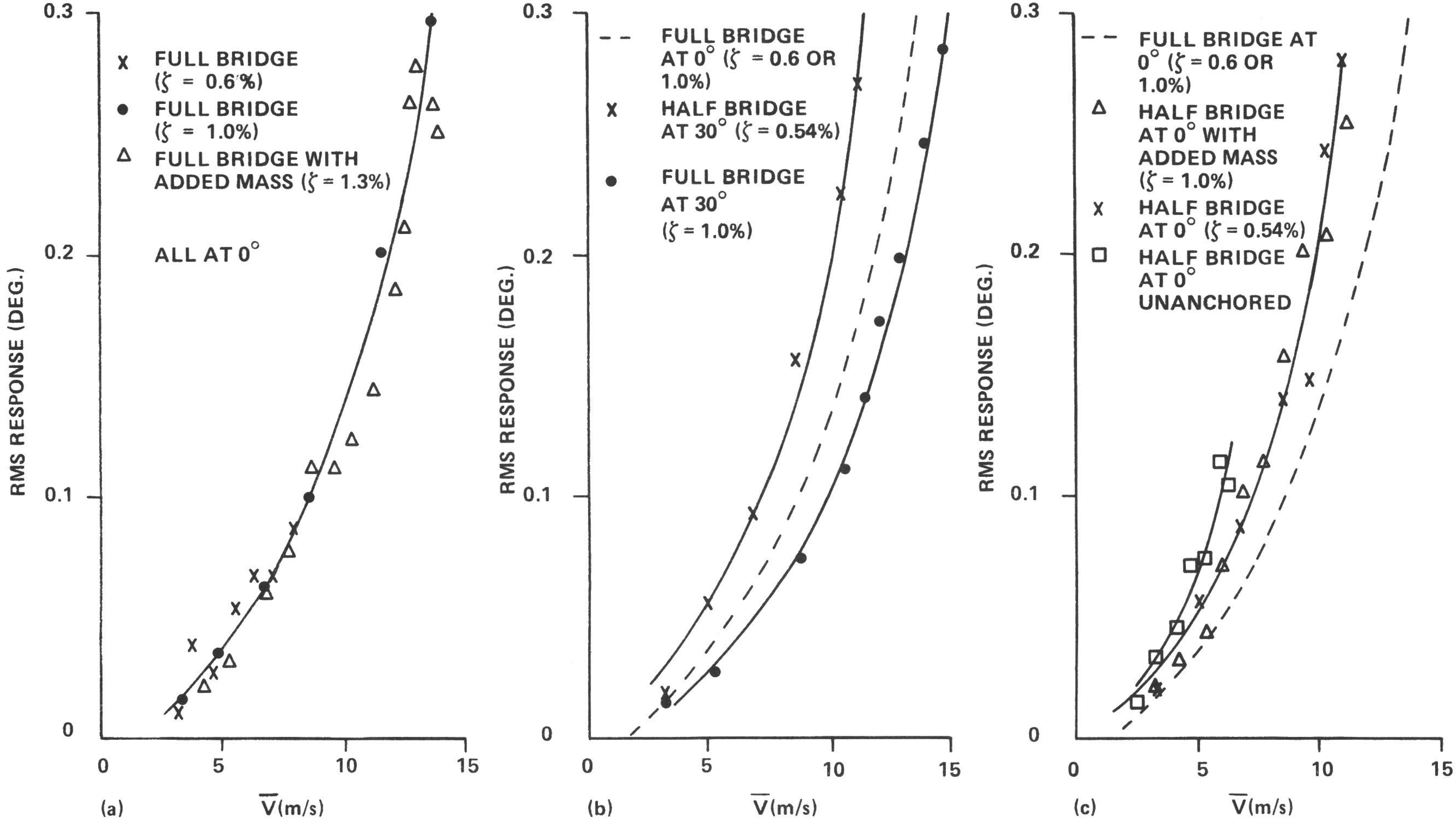
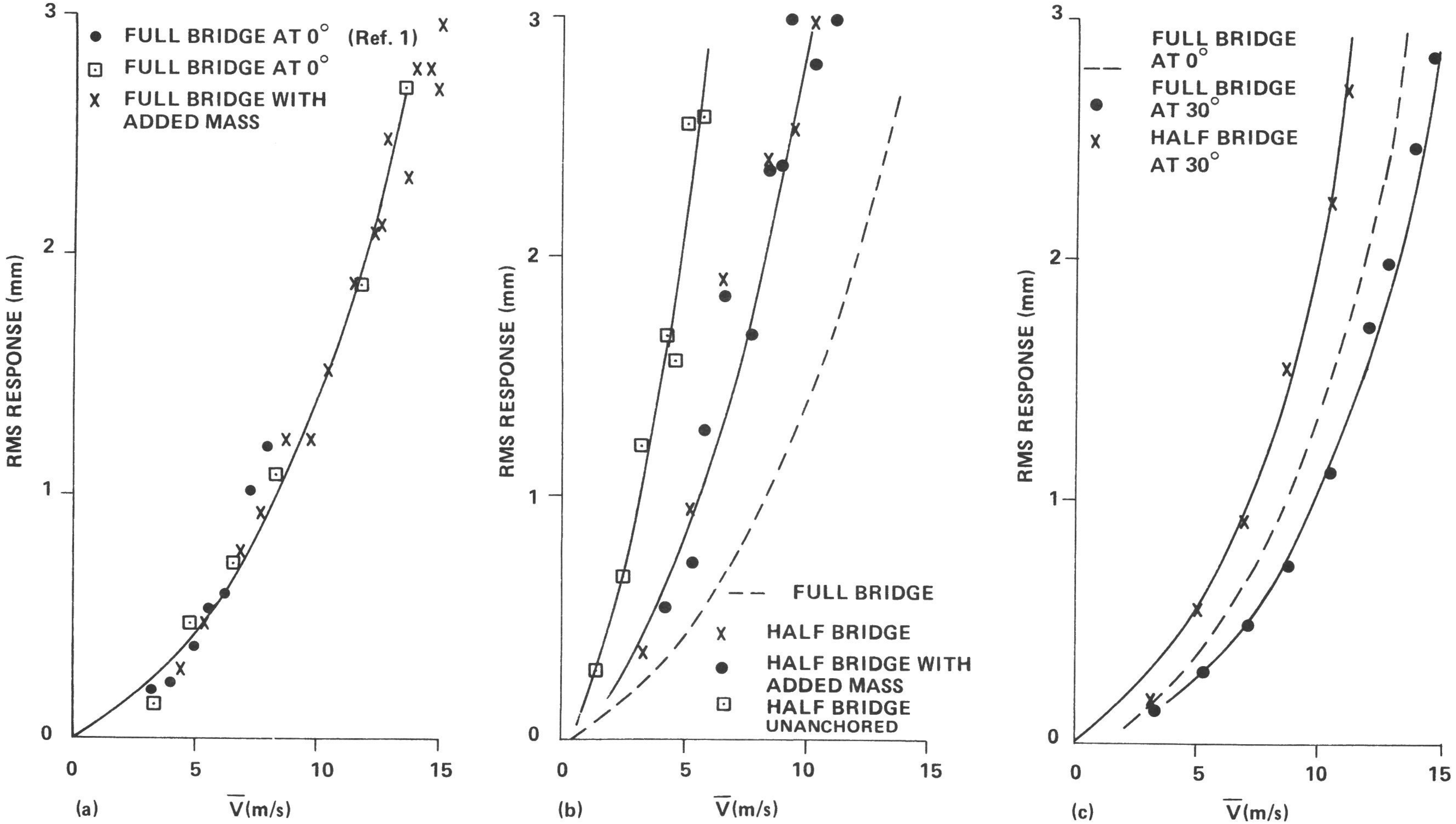


FIG. 8: TORSIONAL INSTABILITY RESPONSE IN MODERATELY TURBULENT FLOW



$u'/\overline{V} = 0.12 \qquad w'/\overline{V} = 0.062$

FIG. 9: TORSIONAL BUFFETING RESPONSE IN HIGHLY TURBULENT FLOW



$u'/\overline{V} = 0.12$ $w'/\overline{V} = 0.062$

FIG. 10: VERTICAL BUFFETING RESPONSE IN HIGHLY TURBULENT FLOW

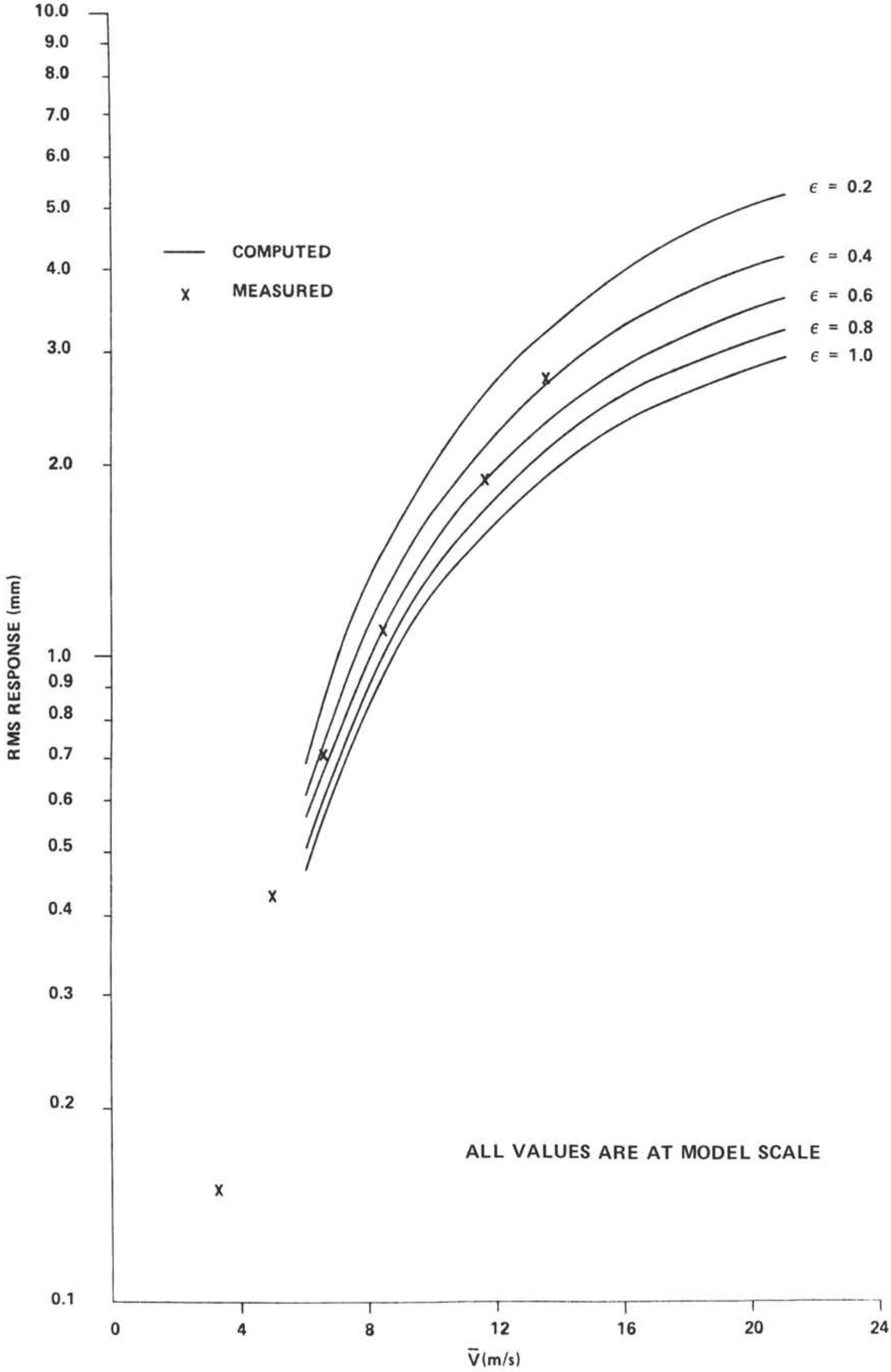


FIG. 11(a): COMPUTED AND MEASURED RESPONSE OF THE FULL BRIDGE

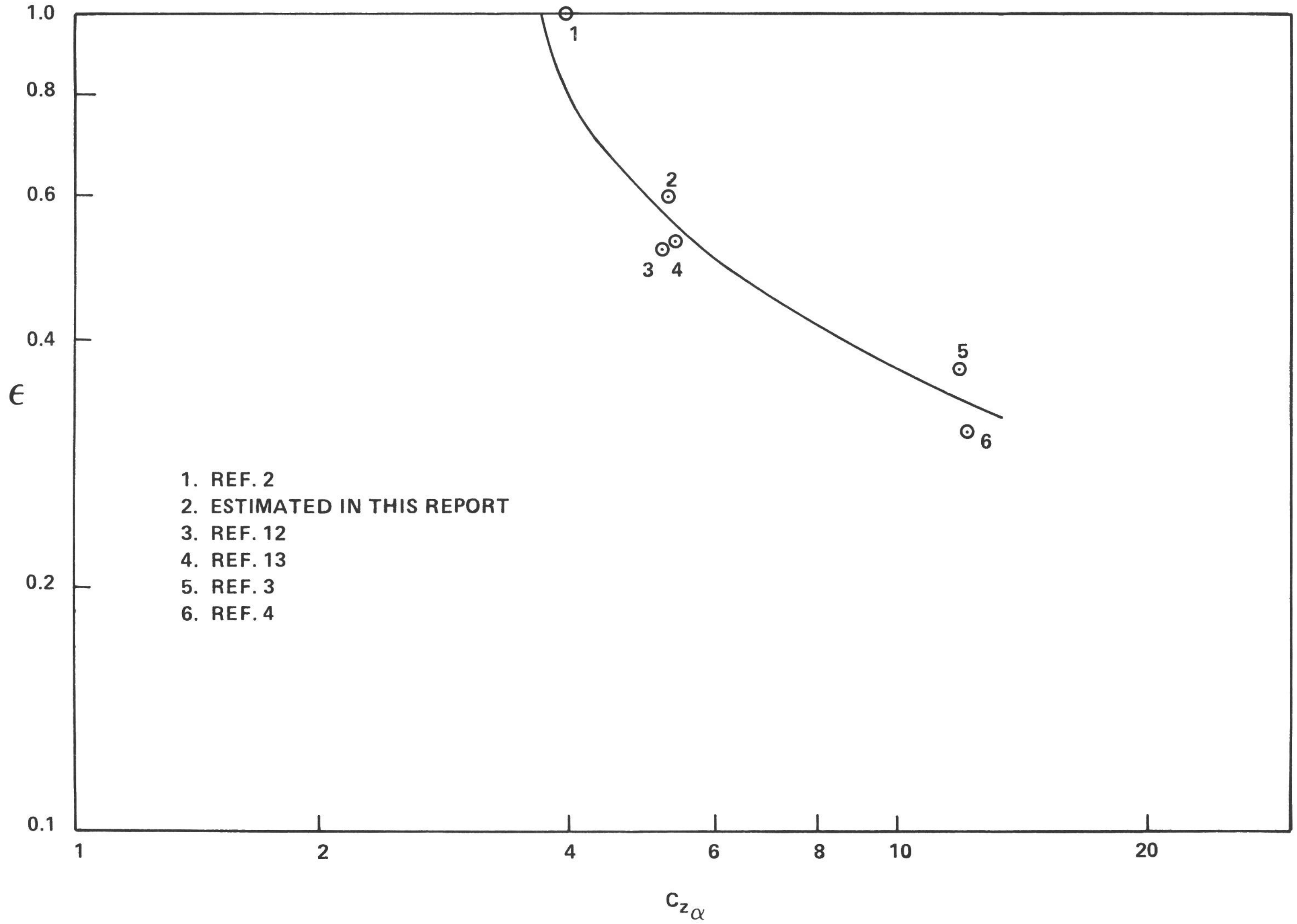


FIG. 11(b): VARIATION OF ϵ WITH C_{z_α}

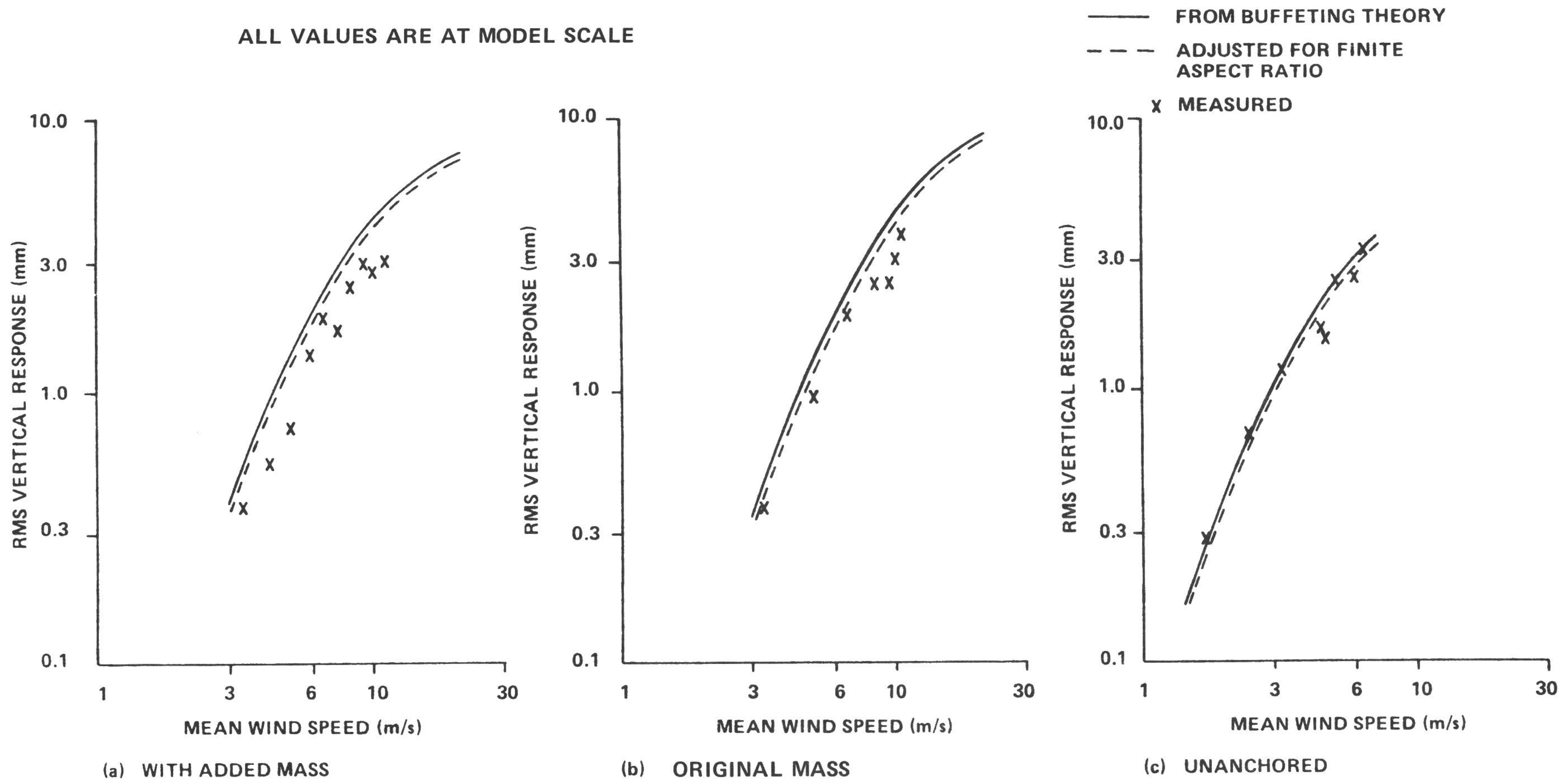


FIG. 12: COMPUTED AND MEASURED RESPONSE OF HALF BRIDGE

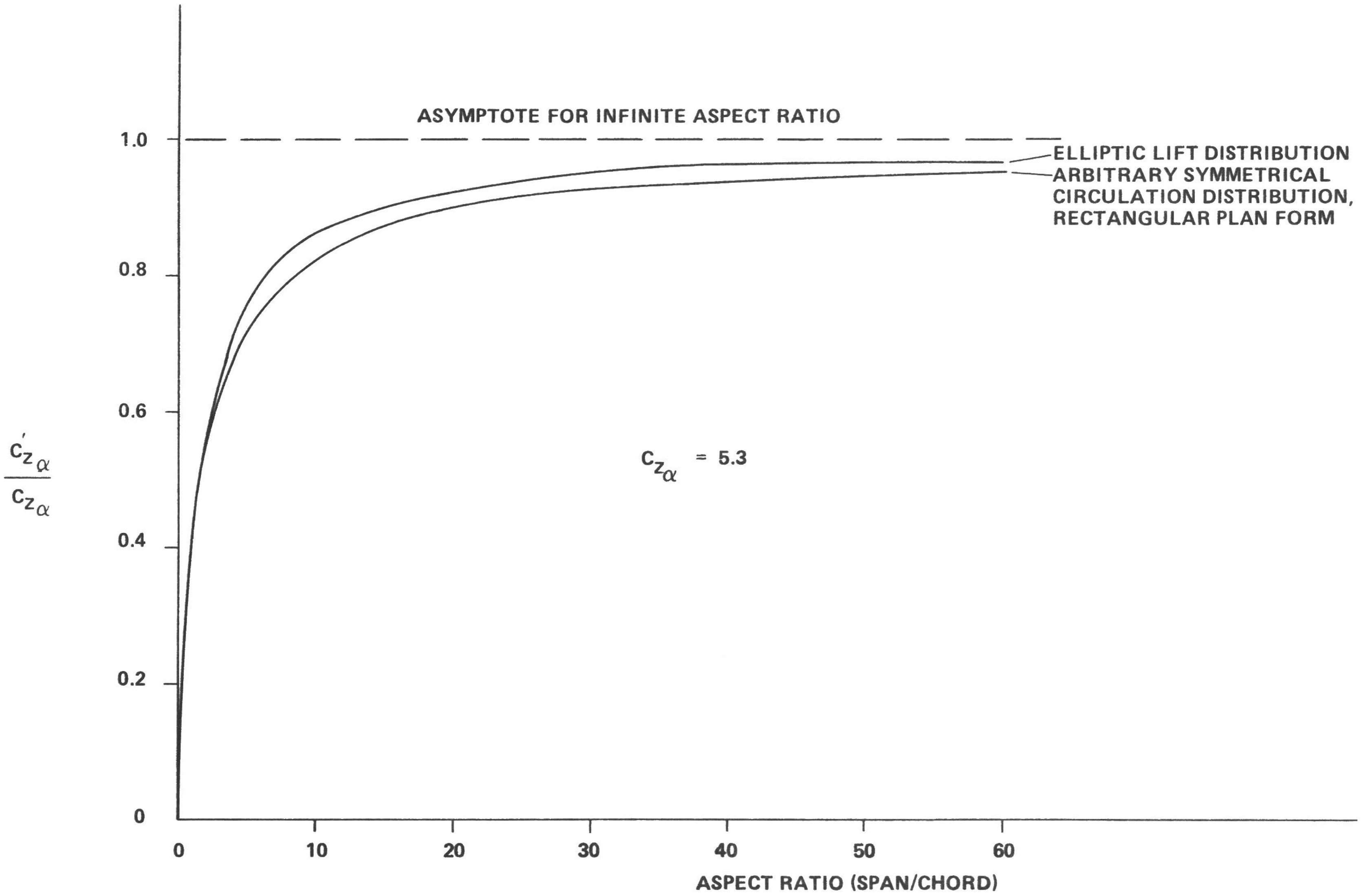


FIG. 13: EFFECT OF FINITE ASPECT RATIO ON LIFT CURVE SLOPE

APPENDIX A

FULL BRIDGE AT 0 DEG
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 3.35 M/S								
SIDE SPAN	0.006	0.077	0.335	4.33	-0.004	0.021	0.087	4.07
NORTH CENTRE	***TRANSDUCER MALFUNCTION***							
CENTRE SPAN	0.054	0.149	0.548	3.68	0.028	0.015	0.057	3.84
SOUTH CENTRE	0.032	0.054	-0.187	3.49	-0.002	0.010	-0.028	2.65
MEAN WIND SPEED 4.96 M/S								
SIDE SPAN	0.002	0.248	-1.026	4.14	-0.004	0.065	0.274	4.19
NORTH CENTRE	***TRANSDUCER MALFUNCTION***							
CENTRE SPAN	0.122	0.453	1.847	4.08	0.028	0.036	0.146	4.09
SOUTH CENTRE	0.057	0.173	0.717	4.15	0.002	0.016	-0.055	3.40
MEAN WIND SPEED 6.62 M/S								
SIDE SPAN	0.005	0.405	-1.360	3.36	-0.002	0.112	0.420	3.76
NORTH CENTRE	***TRANSDUCER MALFUNCTION***							
CENTRE SPAN	0.214	0.702	-2.308	3.29	0.016	0.065	0.212	3.25
SOUTH CENTRE	0.097	0.282	-0.959	3.40	0.001	0.026	-0.090	3.47
MEAN WIND SPEED 8.39 M/S								
SIDE SPAN	0.002	0.611	2.268	3.71	0.007	0.175	-0.597	3.40
NORTH CENTRE	***TRANSDUCER MALFUNCTION***							
CENTRE SPAN	0.361	1.077	-4.485	4.17	-0.009	0.100	0.325	3.25
SOUTH CENTRE	0.157	0.424	1.622	3.82	-0.008	0.041	0.150	3.65
MEAN WIND SPEED 11.62 M/S								
SIDE SPAN	-0.087	1.190	-4.179	3.51	0.036	0.361	-1.138	3.15
NORTH CENTRE	***TRANSDUCER MALFUNCTION***							
CENTRE SPAN	0.908	1.886	7.460	3.96	-0.104	0.202	-0.801	3.95
SOUTH CENTRE	0.332	0.822	3.140	3.82	-0.056	0.081	-0.358	4.42
MEAN WIND SPEED 13.46 M/S								
SIDE SPAN	-0.054	1.581	-6.174	3.91	0.054	0.462	1.724	3.74
NORTH CENTRE	***TRANSDUCER MALFUNCTION***							
CENTRE SPAN	1.212	2.710	10.261	3.79	-0.153	0.299	-1.060	3.55
SOUTH CENTRE	0.460	1.077	3.728	3.46	-0.087	0.119	-0.814	6.85

FULL BRIDGE AT 0 DEG
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 2.32 M/S								
SIDE SPAN	0.007	0.421	0.753	1.79	-0.002	0.009	-0.022	2.31
NORTH CENTRE	0.021	0.271	0.493	1.82	0.014	0.008	-0.030	3.80
CENTRE SPAN	0.047	0.040	-0.113	2.87	0.011	0.006	-0.020	3.18
SOUTH CENTRE	0.032	0.265	0.491	1.85	0.003	0.010	0.022	2.23
MEAN WIND SPEED 13.75 M/S								
SIDE SPAN	-0.043	0.312	-1.003	3.21	0.035	0.032	0.105	3.34
NORTH CENTRE	0.343	0.213	0.766	3.60	0.051	0.030	0.105	3.53
CENTRE SPAN	0.973	0.455	-1.651	3.63	-0.047	0.085	-0.290	3.41
SOUTH CENTRE	0.321	0.218	-0.769	3.53	-0.026	0.034	0.118	3.48
MEAN WIND SPEED 14.21 M/S								
SIDE SPAN	-0.090	0.354	-1.335	3.77	0.057	0.041	-0.154	3.77
NORTH CENTRE	0.396	0.238	0.757	3.18	0.062	0.042	0.133	3.19
CENTRE SPAN	0.675	0.576	1.882	3.27	-0.137	0.140	0.387	2.76
SOUTH CENTRE	0.304	0.244	-0.756	3.09	-0.041	0.048	-0.189	3.91
MEAN WIND SPEED 14.66 M/S								
SIDE SPAN	-0.087	0.368	-1.645	4.48	0.061	0.039	0.118	3.02
NORTH CENTRE	0.422	0.245	1.120	4.58	0.064	0.038	0.153	4.05
CENTRE SPAN	0.733	0.616	2.640	4.29	-0.140	0.119	0.332	2.78
SOUTH CENTRE	0.317	0.260	-0.920	3.54	-0.045	0.043	-0.159	3.71
MEAN WIND SPEED 17.35 M/S								
SIDE SPAN	-0.117	0.431	1.690	3.93	0.085	0.057	-0.199	3.47
NORTH CENTRE	0.582	0.303	-1.038	3.43	0.083	0.058	-0.161	2.80
CENTRE SPAN	1.147	0.653	2.171	3.33	-0.176	0.188	0.534	2.84
SOUTH CENTRE	0.448	0.309	1.006	3.25	-0.061	0.064	-0.184	2.88
MEAN WIND SPEED 18.26 M/S								
SIDE SPAN	-0.117	0.500	-1.735	3.47	0.101	0.163	-0.604	3.70
NORTH CENTRE	0.648	0.329	-1.158	3.52	0.093	0.202	-0.608	3.00
CENTRE SPAN	1.340	0.850	2.947	3.47	-0.194	0.758	2.195	2.90
SOUTH CENTRE	0.503	0.356	-1.334	3.75	-0.069	0.226	0.705	3.12
MEAN WIND SPEED 18.75 M/S								
SIDE SPAN	-0.121	0.533	-1.629	3.06	0.107	0.191	-0.501	2.62
NORTH CENTRE	0.685	0.350	-1.302	3.72	0.092	0.241	-0.648	2.68
CENTRE SPAN	1.428	0.845	2.791	3.30	-0.208	0.902	2.082	2.31
SOUTH CENTRE	0.536	0.375	1.524	4.06	-0.069	0.270	0.681	2.53
MEAN WIND SPEED 18.99 M/S								
SIDE SPAN	-0.177	0.624	-2.032	3.26	0.117	0.326	-0.996	3.06
NORTH CENTRE	0.797	0.390	1.797	4.61	0.094	0.448	-1.547	3.45
CENTRE SPAN	1.766	1.208	5.187	4.29	-0.258	1.638	-4.294	2.62
SOUTH CENTRE	0.641	0.477	1.938	4.06	-0.065	0.508	1.658	3.26

FULL BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 13.84 M/S								
SIDE SPAN	-0.030	0.313	-1.281	4.10	0.034	0.031	0.101	3.24
NORTH CENTRE	0.376	0.208	-0.675	3.25	0.008	0.030	0.106	3.59
CENTRE SPAN	0.780	0.478	-1.547	3.23	-0.053	0.077	0.244	3.16
SOUTH CENTRE	0.333	0.231	-0.821	3.56	-0.076	0.039	0.132	3.40
MEAN WIND SPEED 14.97 M/S								
SIDE SPAN	-0.040	0.349	-1.290	3.70	0.046	0.050	-0.162	3.28
NORTH CENTRE	0.460	0.230	0.732	3.18	0.009	0.050	0.126	2.53
CENTRE SPAN	0.945	0.495	1.664	3.36	-0.055	0.171	0.419	2.44
SOUTH CENTRE	0.375	0.251	-0.913	3.64	-0.090	0.063	-0.194	3.06
MEAN WIND SPEED 15.80 M/S								
SIDE SPAN	-0.038	0.373	-1.591	4.27	0.051	0.059	-0.176	2.98
NORTH CENTRE	0.581	0.243	0.803	3.31	0.025	0.061	-0.172	2.83
CENTRE SPAN	1.053	0.583	-1.955	3.36	-0.057	0.219	0.468	2.14
SOUTH CENTRE	0.412	0.264	-0.893	3.38	-0.102	0.078	0.214	2.76
MEAN WIND SPEED 16.04 M/S								
SIDE SPAN	-0.053	0.414	-1.322	3.19	0.056	0.072	-0.233	3.26
NORTH CENTRE	0.703	0.259	1.084	4.19	0.037	0.076	0.207	2.73
CENTRE SPAN	1.119	0.653	1.986	3.04	-0.056	0.286	-0.665	2.32
SOUTH CENTRE	0.427	0.281	1.064	3.79	-0.108	0.096	-0.271	2.83
MEAN WIND SPEED 16.04 M/S								
SIDE SPAN	-0.035	0.412	1.527	3.70	0.056	0.061	0.222	3.66
NORTH CENTRE	0.813	0.272	-0.937	3.44	0.043	0.060	-0.186	3.09
CENTRE SPAN	1.094	0.669	3.039	4.54	-0.047	0.216	0.553	2.56
SOUTH CENTRE	0.418	0.299	-0.999	3.35	-0.111	0.079	-0.256	3.26
MEAN WIND SPEED 16.75 M/S								
SIDE SPAN	-0.045	0.485	-1.610	3.32	0.064	0.113	0.285	2.52
NORTH CENTRE	1.141	0.281	-0.952	3.39	0.057	0.120	-0.277	2.31
CENTRE SPAN	1.211	0.816	2.434	2.98	-0.065	0.474	-0.981	2.07
SOUTH CENTRE	0.460	0.307	-1.059	3.45	-0.120	0.155	-0.340	2.20
MEAN WIND SPEED 17.21 M/S								
SIDE SPAN	-0.058	0.638	1.983	3.11	0.070	0.162	-0.473	2.92
NORTH CENTRE	1.405	0.335	1.140	3.40	0.063	0.170	0.377	2.22
CENTRE SPAN	1.289	1.123	3.408	3.03	-0.068	0.689	1.438	2.08
SOUTH CENTRE	0.490	0.358	-1.359	3.80	-0.129	0.220	-0.539	2.45
MEAN WIND SPEED 17.97 M/S								
SIDE SPAN	-0.061	0.763	2.044	2.68	0.080	0.208	0.454	2.19
NORTH CENTRE	1.757	0.360	1.063	2.96	0.057	0.216	0.442	2.05
CENTRE SPAN	1.400	1.390	3.357	2.42	-0.072	0.883	1.628	1.84
SOUTH CENTRE	0.538	0.396	1.275	3.22	-0.136	0.281	-0.583	2.08

FULL BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 4.27 M/S								
SIDE SPAN	0.003	0.092	0.345	3.76	0.003	0.010	0.039	3.82
NORTH CENTRE	0.062	0.064	0.206	3.23	0.009	0.009	-0.036	3.84
CENTRE SPAN	0.176	0.174	0.507	2.92	-0.011	0.013	-0.046	3.49
SOUTH CENTRE	0.049	0.068	-0.228	3.35	-0.010	0.012	0.038	3.11
MEAN WIND SPEED 5.34 M/S								
SIDE SPAN	-0.007	0.146	-0.507	3.46	0.003	0.014	-0.043	3.19
NORTH CENTRE	0.101	0.097	0.300	3.11	0.011	0.011	-0.035	3.26
CENTRE SPAN	0.254	0.255	0.825	3.24	-0.013	0.022	-0.078	3.47
SOUTH CENTRE	0.067	0.100	0.320	3.19	-0.012	0.014	0.045	3.22
MEAN WIND SPEED 6.43 M/S								
SIDE SPAN	-0.010	0.194	0.685	3.53	0.003	0.018	-0.054	3.09
NORTH CENTRE	0.138	0.123	0.400	3.24	0.009	0.017	-0.059	3.56
CENTRE SPAN	0.329	0.328	1.041	3.17	-0.024	0.039	0.117	3.04
SOUTH CENTRE	0.092	0.127	-0.421	3.32	-0.012	0.021	0.071	3.44
MEAN WIND SPEED 8.52 M/S								
SIDE SPAN	-0.033	0.343	1.412	4.12	0.013	0.027	0.101	3.72
NORTH CENTRE	0.227	0.222	-0.697	3.14	0.009	0.021	0.069	3.25
CENTRE SPAN	0.536	0.604	2.082	3.45	-0.039	0.049	0.160	3.25
SOUTH CENTRE	0.150	0.219	-0.724	3.30	-0.014	0.026	-0.078	2.94
MEAN WIND SPEED 9.58 M/S								
SIDE SPAN	-0.038	0.346	-1.259	3.64	0.020	0.031	-0.145	4.72
NORTH CENTRE	0.275	0.221	0.717	3.24	0.012	0.027	0.114	4.22
CENTRE SPAN	0.645	0.529	-2.085	3.94	-0.048	0.071	0.327	4.60
SOUTH CENTRE	0.181	0.228	0.876	3.84	-0.019	0.032	0.127	3.91
MEAN WIND SPEED 10.72 M/S								
SIDE SPAN	-0.042	0.484	1.519	3.14	0.033	0.034	0.134	3.93
NORTH CENTRE	0.334	0.317	-1.047	3.30	0.012	0.029	-0.109	3.75
CENTRE SPAN	0.777	0.790	-2.682	3.39	-0.055	0.069	-0.254	3.67
SOUTH CENTRE	0.217	0.324	-1.254	3.87	-0.023	0.035	0.123	3.50
MEAN WIND SPEED 11.74 M/S								
SIDE SPAN	-0.061	0.503	-2.201	4.38	0.042	0.041	0.156	3.76
NORTH CENTRE	0.400	0.327	-1.226	3.75	0.014	0.037	-0.146	3.95
CENTRE SPAN	0.944	0.806	-2.958	3.67	-0.065	0.096	0.338	3.54
SOUTH CENTRE	0.264	0.332	-1.289	3.89	-0.027	0.044	-0.144	3.27
MEAN WIND SPEED 12.78 M/S								
SIDE SPAN	-0.059	0.569	1.932	3.40	0.054	0.048	0.191	4.00
NORTH CENTRE	0.465	0.383	1.233	3.22	0.016	0.042	-0.153	3.63
CENTRE SPAN	1.088	0.895	2.929	3.27	-0.078	0.102	0.320	3.13
SOUTH CENTRE	0.314	0.396	-1.465	3.70	-0.034	0.050	-0.200	3.96

FULL BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 13.84 M/S								
SIDE SPAN	-0.081	0.656	-2.195	3.35	0.065	0.064	0.214	3.34
NORTH CENTRE	0.541	0.431	-1.484	3.44	0.017	0.056	0.218	3.90
CENTRE SPAN	1.249	0.947	-3.239	3.42	-0.091	0.172	0.545	3.16
SOUTH CENTRE	0.358	0.431	-1.525	3.53	-0.037	0.067	-0.236	3.49
MEAN WIND SPEED 14.84 M/S								
SIDE SPAN	-0.084	0.709	2.098	2.96	0.074	0.081	-0.267	3.28
NORTH CENTRE	0.618	0.492	1.518	3.09	0.016	0.076	0.310	4.09
CENTRE SPAN	1.415	1.140	3.282	2.88	-0.108	0.244	-0.837	3.43
SOUTH CENTRE	0.405	0.495	1.681	3.40	-0.039	0.089	0.324	3.66
MEAN WIND SPEED 15.49 M/S								
SIDE SPAN	-0.077	0.748	2.244	3.00	0.081	0.123	-0.437	3.55
NORTH CENTRE	0.656	0.485	1.459	3.01	0.015	0.127	-0.382	3.01
CENTRE SPAN	1.502	1.181	4.037	3.42	-0.120	0.476	1.339	2.81
SOUTH CENTRE	0.428	0.494	1.948	3.95	-0.036	0.148	0.450	3.03
MEAN WIND SPEED 15.91 M/S								
SIDE SPAN	-0.087	0.786	-2.568	3.27	0.085	0.099	0.355	3.58
NORTH CENTRE	0.695	0.517	1.994	3.86	0.014	0.096	0.326	3.39
CENTRE SPAN	1.574	1.135	4.025	3.55	-0.123	0.326	-1.004	3.08
SOUTH CENTRE	0.447	0.530	-1.669	3.15	-0.033	0.111	0.386	3.48
MEAN WIND SPEED 16.36 M/S								
SIDE SPAN	-0.090	0.916	2.918	3.18	0.095	0.214	-0.626	2.93
NORTH CENTRE	0.739	0.544	1.929	3.55	0.015	0.233	-0.649	2.79
CENTRE SPAN	1.682	1.505	6.163	4.09	-0.129	0.913	-2.255	2.47
SOUTH CENTRE	0.473	0.558	1.996	3.58	-0.032	0.268	-0.722	2.69
MEAN WIND SPEED 16.59 M/S								
SIDE SPAN	-0.105	0.895	-3.006	3.36	0.095	0.174	-0.613	3.53
NORTH CENTRE	0.763	0.566	2.013	3.55	0.017	0.186	-0.639	3.44
CENTRE SPAN	1.736	1.409	-4.199	2.98	-0.132	0.707	-1.892	2.68
SOUTH CENTRE	0.476	0.589	2.061	3.50	-0.029	0.214	0.583	2.72

FULL BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 4.25 M/S								
SIDE SPAN	-0.002	0.163	-0.487	3.00	0.005	0.011	-0.052	4.60
NORTH CENTRE	0.036	0.107	0.351	3.28	0.026	0.010	-0.043	4.27
CENTRE SPAN	0.132	0.278	-0.834	3.00	-0.010	0.022	-0.064	2.99
SOUTH CENTRE	0.050	0.107	-0.357	3.33	-0.004	0.013	-0.046	3.56
MEAN WIND SPEED 5.19 M/S								
SIDE SPAN	0.002	0.245	0.871	3.55	0.006	0.019	0.079	4.13
NORTH CENTRE	0.056	0.158	-0.551	3.49	0.025	0.014	-0.043	3.15
CENTRE SPAN	0.161	0.476	1.484	3.12	-0.021	0.033	0.120	3.65
SOUTH CENTRE	0.059	0.164	0.603	3.68	-0.005	0.017	0.063	3.72
MEAN WIND SPEED 6.83 M/S								
SIDE SPAN	-0.003	0.407	-1.413	3.47	0.011	0.029	0.101	3.45
NORTH CENTRE	0.114	0.266	0.919	3.46	0.027	0.024	-0.091	3.82
CENTRE SPAN	0.291	0.746	-2.283	3.06	-0.039	0.060	0.200	3.34
SOUTH CENTRE	0.089	0.270	-0.876	3.25	-0.009	0.028	0.107	3.78
MEAN WIND SPEED 7.65 M/S								
SIDE SPAN	-0.007	0.563	-1.833	3.26	0.015	0.038	0.142	3.76
NORTH CENTRE	0.143	0.365	-1.482	4.06	0.027	0.030	0.110	3.66
CENTRE SPAN	0.367	0.901	3.133	3.48	-0.068	0.079	0.284	3.61
SOUTH CENTRE	0.099	0.356	1.335	3.75	-0.008	0.035	-0.124	3.52
MEAN WIND SPEED 8.64 M/S								
SIDE SPAN	-0.018	0.703	-2.542	3.62	0.018	0.050	-0.172	3.41
NORTH CENTRE	0.187	0.460	-1.737	3.78	0.027	0.039	0.123	3.13
CENTRE SPAN	0.461	1.219	4.295	3.52	-0.101	0.113	-0.350	3.10
SOUTH CENTRE	0.114	0.456	-1.463	3.21	-0.011	0.046	-0.163	3.58
MEAN WIND SPEED 9.48 M/S								
SIDE SPAN	0.021	0.727	-2.780	3.82	0.019	0.054	-0.159	2.97
NORTH CENTRE	0.191	0.492	1.690	3.43	0.034	0.042	0.162	3.82
CENTRE SPAN	0.519	1.233	-3.870	3.14	-0.109	0.115	0.373	3.26
SOUTH CENTRE	0.132	0.488	1.606	3.29	-0.013	0.050	-0.165	3.30
MEAN WIND SPEED 10.30 M/S								
SIDE SPAN	0.002	0.945	-3.656	3.87	0.022	0.063	0.230	3.63
NORTH CENTRE	0.246	0.621	2.127	3.43	0.032	0.049	0.198	4.07
CENTRE SPAN	0.659	1.501	5.791	3.86	-0.118	0.125	0.494	3.94
SOUTH CENTRE	0.179	0.644	-2.152	3.34	-0.018	0.056	0.192	3.43
MEAN WIND SPEED 11.15 M/S								
SIDE SPAN	-0.011	1.066	-3.367	3.16	0.024	0.069	0.229	3.31
NORTH CENTRE	0.298	0.692	-2.336	3.38	0.033	0.054	0.202	3.72
CENTRE SPAN	0.735	1.896	-6.504	3.43	-0.123	0.144	0.616	4.26
SOUTH CENTRE	0.182	0.737	2.633	3.57	-0.018	0.064	-0.215	3.34

FULL BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 12.00 M/S								
SIDE SPAN	-0.048	1.317	5.362	4.07	0.031	0.084	-0.348	4.16
NORTH CENTRE	0.374	0.858	3.856	4.49	0.033	0.068	0.249	3.69
CENTRE SPAN	0.847	2.086	-7.858	3.77	-0.135	0.186	-0.581	3.13
SOUTH CENTRE	0.204	0.876	2.665	3.04	-0.022	0.079	-0.260	3.30
MEAN WIND SPEED 12.39 M/S								
SIDE SPAN	-0.026	1.351	4.770	3.53	0.034	0.094	0.332	3.54
NORTH CENTRE	0.385	0.887	3.443	3.88	0.036	0.076	-0.282	3.70
CENTRE SPAN	0.926	2.105	-7.332	3.48	-0.140	0.212	-0.700	3.30
SOUTH CENTRE	0.229	0.862	3.630	4.21	-0.019	0.089	-0.307	3.46
MEAN WIND SPEED 12.72 M/S								
SIDE SPAN	-0.061	1.468	5.135	3.50	0.037	0.103	-0.344	3.35
NORTH CENTRE	0.427	0.970	3.015	3.11	0.037	0.089	-0.290	3.27
CENTRE SPAN	1.027	2.484	-8.419	3.39	-0.138	0.265	0.848	3.19
SOUTH CENTRE	0.254	0.980	-2.894	2.95	-0.015	0.106	0.384	3.63
MEAN WIND SPEED 12.98 M/S								
SIDE SPAN	-0.095	1.754	5.567	3.17	0.044	0.111	-0.425	3.84
NORTH CENTRE	0.482	1.150	3.686	3.20	0.040	0.093	0.342	3.66
CENTRE SPAN	1.164	3.240	-10.568	3.26	-0.143	0.278	1.110	3.99
SOUTH CENTRE	0.274	1.196	-3.900	3.26	-0.011	0.113	-0.417	3.69
MEAN WIND SPEED 13.53 M/S								
SIDE SPAN	-0.004	1.411	-5.132	3.64	0.044	0.112	0.375	3.34
NORTH CENTRE	0.456	0.958	-3.350	3.50	0.043	0.093	0.339	3.64
CENTRE SPAN	1.072	2.324	9.630	4.14	-0.149	0.261	0.837	3.20
SOUTH CENTRE	0.250	0.986	-3.654	3.71	-0.007	0.113	-0.412	3.64
MEAN WIND SPEED 13.92 M/S								
SIDE SPAN	-0.086	1.622	-5.873	3.62	0.047	0.120	0.442	3.69
NORTH CENTRE	0.529	1.087	4.088	3.76	0.042	0.096	0.362	3.76
CENTRE SPAN	1.297	2.767	-9.339	3.38	-0.156	0.250	-0.878	3.51
SOUTH CENTRE	0.286	1.093	-4.511	4.13	-0.007	0.116	-0.481	4.14
MEAN WIND SPEED 14.15 M/S								
SIDE SPAN	-0.078	1.689	-5.811	3.44	0.047	0.141	-0.690	4.90
NORTH CENTRE	0.552	1.139	4.102	3.60	0.043	0.121	0.429	3.53
CENTRE SPAN	1.377	2.778	10.396	3.74	-0.158	0.367	1.063	2.90
SOUTH CENTRE	0.304	1.163	4.888	4.20	-0.003	0.149	0.613	4.13
MEAN WIND SPEED 14.59 M/S								
SIDE SPAN	-0.047	1.623	6.020	3.71	0.051	0.149	0.550	3.69
NORTH CENTRE	0.563	1.089	4.270	3.92	0.046	0.124	0.487	3.94
CENTRE SPAN	1.365	2.693	9.794	3.64	-0.162	0.358	1.035	2.89
SOUTH CENTRE	0.277	1.131	-4.748	4.20	-0.001	0.145	0.513	3.54

FULL BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 15.01 M/S								
SIDE SPAN	-0.032	1.783	5.930	3.33	0.054	0.170	0.569	3.34
NORTH CENTRE	0.578	1.198	4.473	3.73	0.048	0.139	0.560	4.03
CENTRE SPAN	1.442	2.903	-10.800	3.72	-0.170	0.437	1.263	2.89
SOUTH CENTRE	0.314	1.251	4.359	3.48	0.002	0.170	-0.668	3.93
MEAN WIND SPEED 15.24 M/S								
SIDE SPAN	-0.049	1.847	-5.860	3.17	0.054	0.166	-0.626	3.77
NORTH CENTRE	0.618	1.264	4.581	3.62	0.050	0.136	-0.478	3.51
CENTRE SPAN	1.521	3.119	9.670	3.10	-0.173	0.387	-1.316	3.40
SOUTH CENTRE	0.349	1.355	-4.138	3.05	0.004	0.168	-0.759	4.52
MEAN WIND SPEED 15.67 M/S								
SIDE SPAN	-0.072	2.127	6.088	2.86	0.054	0.178	-0.670	3.77
NORTH CENTRE	0.661	1.438	6.430	4.47	0.050	0.138	0.614	4.43
CENTRE SPAN	1.581	3.639	11.266	3.10	-0.156	0.342	1.095	3.20
SOUTH CENTRE	0.362	1.477	5.524	3.74	0.014	0.168	-0.747	4.44
MEAN WIND SPEED 16.00 M/S								
SIDE SPAN	-0.075	2.094	6.152	2.94	0.061	0.235	0.787	3.35
NORTH CENTRE	0.703	1.370	4.684	3.42	0.050	0.205	0.812	3.95
CENTRE SPAN	1.667	3.810	-11.824	3.10	-0.082	0.713	2.242	3.14
SOUTH CENTRE	0.388	1.521	5.199	3.42	0.048	0.268	-1.052	3.93

HALF BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 3.35 M/S								
SIDE SPAN	0.002	0.105	-0.344	3.27	0.003	0.010	0.030	3.09
NORTH CENTRE	0.029	0.066	-0.200	3.03	0.009	0.008	-0.030	3.54
CENTRE SPAN	0.099	0.377	1.009	2.68	-0.001	0.023	-0.082	3.63
SOUTH CENTRE	0.057	0.149	-0.466	3.14	0.002	0.015	0.048	3.15
MEAN WIND SPEED 4.27 M/S								
SIDE SPAN	-0.010	0.154	-0.486	3.15	0.003	0.014	-0.053	3.79
NORTH CENTRE	0.050	0.099	0.300	3.04	0.010	0.010	-0.044	4.33
CENTRE SPAN	0.157	0.547	1.710	3.12	-0.008	0.033	0.115	3.44
SOUTH CENTRE	0.091	0.215	0.658	3.05	0.005	0.021	-0.072	3.49
MEAN WIND SPEED 5.11 M/S								
SIDE SPAN	-0.015	0.216	-0.661	3.07	0.003	0.019	-0.074	3.80
NORTH CENTRE	0.078	0.140	-0.438	3.13	0.006	0.013	0.048	3.61
CENTRE SPAN	0.245	0.735	2.462	3.35	-0.013	0.043	0.158	3.63
SOUTH CENTRE	0.132	0.294	-0.923	3.15	0.003	0.027	-0.100	3.74
MEAN WIND SPEED 5.92 M/S								
SIDE SPAN	-0.027	0.363	-1.082	2.98	0.007	0.027	-0.086	3.26
NORTH CENTRE	0.114	0.229	-0.713	3.12	0.004	0.019	0.084	4.35
CENTRE SPAN	0.318	1.292	3.587	2.78	-0.014	0.071	-0.273	3.87
SOUTH CENTRE	0.173	0.500	1.420	2.84	-0.003	0.042	0.183	4.36
MEAN WIND SPEED 6.72 M/S								
SIDE SPAN	-0.014	0.522	-1.579	3.02	0.009	0.037	-0.122	3.30
NORTH CENTRE	0.136	0.327	-1.086	3.32	0.003	0.026	0.079	3.08
CENTRE SPAN	0.360	1.856	5.684	3.06	-0.020	0.103	0.354	3.44
SOUTH CENTRE	0.194	0.709	-2.212	3.12	0.002	0.060	0.244	4.04
MEAN WIND SPEED 7.55 M/S								
SIDE SPAN	-0.045	0.511	-1.681	3.29	0.016	0.042	-0.156	3.71
NORTH CENTRE	0.190	0.326	1.022	3.14	0.001	0.030	-0.119	3.96
CENTRE SPAN	0.474	1.692	4.679	2.77	-0.025	0.115	-0.397	3.44
SOUTH CENTRE	0.268	0.682	-2.090	3.07	0.004	0.069	-0.253	3.64
MEAN WIND SPEED 8.44 M/S								
SIDE SPAN	-0.029	0.716	-2.307	3.22	0.020	0.051	0.193	3.78
NORTH CENTRE	0.228	0.460	-1.628	3.54	0.000	0.040	-0.133	3.36
CENTRE SPAN	0.521	2.384	7.228	3.03	-0.038	0.159	0.506	3.18
SOUTH CENTRE	0.296	0.952	-3.654	3.84	0.013	0.094	-0.296	3.14
MEAN WIND SPEED 9.39 M/S								
SIDE SPAN	-0.032	0.890	3.082	3.46	0.023	0.060	-0.192	3.21
NORTH CENTRE	0.262	0.571	-1.876	3.29	-0.001	0.049	0.187	3.80
CENTRE SPAN	0.620	2.995	8.423	2.81	-0.046	0.202	0.637	3.16
SOUTH CENTRE	0.340	1.205	-3.600	2.99	0.019	0.119	0.423	3.55

HALF BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 10.27 M/S								
SIDE SPAN	-0.037	0.877	-2.699	3.08	0.032	0.065	0.239	3.70
NORTH CENTRE	0.316	0.565	1.713	3.03	-0.002	0.055	-0.198	3.63
CENTRE SPAN	0.868	2.801	-8.163	2.91	0.003	0.209	-0.761	3.65
SOUTH CENTRE	0.407	1.150	-3.769	3.28	0.023	0.127	0.486	3.82
MEAN WIND SPEED 11.13 M/S								
SIDE SPAN	-0.042	0.932	3.764	4.04	0.039	0.073	0.264	3.59
NORTH CENTRE	0.370	0.620	-2.102	3.39	-0.005	0.063	-0.212	3.36
CENTRE SPAN	0.960	3.019	9.354	3.10	-0.005	0.254	-1.013	3.99
SOUTH CENTRE	0.485	1.246	-4.147	3.33	0.031	0.155	-0.547	3.54

HALF BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 2.29 M/S								
SIDE SPAN	-0.005	0.021	-0.071	3.33	-0.002	0.002	-0.008	3.84
NORTH CENTRE	0.003	0.015	0.047	3.21	0.000	0.006	-0.023	3.56
CENTRE SPAN	0.052	0.063	-0.193	3.07	-0.006	0.004	-0.014	3.06
SOUTH CENTRE	0.034	0.029	0.089	3.10	-0.008	0.010	-0.024	2.31
MEAN WIND SPEED 2.77 M/S								
SIDE SPAN	-0.016	0.037	-0.126	3.42	-0.001	0.003	-0.013	4.55
NORTH CENTRE	0.005	0.023	0.090	3.97	-0.001	0.007	-0.026	3.87
CENTRE SPAN	0.065	0.140	-0.475	3.39	-0.010	0.011	-0.042	3.74
SOUTH CENTRE	0.042	0.055	0.202	3.68	-0.005	0.012	-0.038	3.20
MEAN WIND SPEED 3.24 M/S								
SIDE SPAN	-0.025	0.173	0.350	2.03	-0.001	0.004	0.014	3.17
NORTH CENTRE	0.012	0.071	-0.154	2.18	-0.003	0.008	-0.028	3.51
CENTRE SPAN	0.085	0.159	0.513	3.23	-0.016	0.014	0.041	3.06
SOUTH CENTRE	0.054	0.250	-0.510	2.04	-0.001	0.016	-0.046	2.86
MEAN WIND SPEED 4.64 M/S								
SIDE SPAN	-0.024	0.087	-0.265	3.06	-0.002	0.008	-0.030	3.62
NORTH CENTRE	0.030	0.061	-0.190	3.12	-0.004	0.008	-0.030	3.54
CENTRE SPAN	0.175	0.306	0.865	2.83	-0.027	0.025	-0.073	2.95
SOUTH CENTRE	0.089	0.122	-0.342	2.81	0.007	0.018	0.050	2.74
MEAN WIND SPEED 6.97 M/S								
SIDE SPAN	-0.052	0.122	0.366	3.01	0.004	0.012	0.041	3.36
NORTH CENTRE	0.129	0.082	0.253	3.10	-0.009	0.011	-0.044	3.84
CENTRE SPAN	0.373	0.377	1.193	3.16	-0.037	0.037	-0.124	3.35
SOUTH CENTRE	0.222	0.166	-0.525	3.15	0.002	0.026	0.080	3.12
MEAN WIND SPEED 9.22 M/S								
SIDE SPAN	-0.078	0.203	-0.721	3.55	0.015	0.022	0.094	4.28
NORTH CENTRE	0.215	0.131	-0.470	3.59	-0.016	0.015	-0.056	3.77
CENTRE SPAN	0.601	0.657	2.201	3.35	-0.055	0.046	-0.153	3.35
SOUTH CENTRE	0.317	0.279	-0.964	3.45	0.023	0.029	-0.105	3.63
MEAN WIND SPEED 11.57 M/S								
SIDE SPAN	-0.096	0.221	-0.795	3.59	0.027	0.034	-0.132	3.86
NORTH CENTRE	0.344	0.150	-0.684	4.57	-0.015	0.026	-0.093	3.55
CENTRE SPAN	0.936	0.638	-2.146	3.36	-0.133	0.118	0.370	3.12
SOUTH CENTRE	0.477	0.294	-1.037	3.52	0.053	0.070	-0.234	3.36
MEAN WIND SPEED 12.69 M/S								
SIDE SPAN	-0.107	0.230	-0.837	3.63	0.034	0.038	-0.129	3.44
NORTH CENTRE	0.413	0.164	-0.566	3.45	-0.012	0.031	-0.100	3.27
CENTRE SPAN	1.107	0.558	-1.736	3.11	-0.196	0.144	0.480	3.34
SOUTH CENTRE	0.567	0.300	-0.983	3.28	0.072	0.083	-0.256	3.10

HALF BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 13.67 M/S								
SIDE SPAN	-0.118	0.288	1.158	4.02	0.039	0.049	0.166	3.36
NORTH CENTRE	0.474	0.196	-0.629	3.21	-0.005	0.048	0.159	3.33
CENTRE SPAN	1.256	0.722	2.844	3.94	-0.244	0.239	-0.695	2.91
SOUTH CENTRE	0.654	0.383	1.534	4.00	0.087	0.140	0.389	2.77
MEAN WIND SPEED 14.24 M/S								
SIDE SPAN	-0.124	0.283	-0.876	3.09	0.045	0.063	-0.187	2.96
NORTH CENTRE	0.519	0.203	0.635	3.13	0.000	0.072	0.173	2.39
CENTRE SPAN	1.353	0.748	-2.526	3.38	-0.270	0.367	-0.815	2.22
SOUTH CENTRE	0.712	0.363	1.219	3.36	0.095	0.219	0.448	2.05
MEAN WIND SPEED 14.68 M/S								
SIDE SPAN	-0.128	0.337	-1.204	3.57	0.049	0.080	0.207	2.59
NORTH CENTRE	0.549	0.238	0.819	3.44	0.004	0.099	-0.226	2.29
CENTRE SPAN	1.422	0.931	-4.176	4.48	-0.303	0.506	0.990	1.96
SOUTH CENTRE	0.752	0.432	-2.002	4.63	0.101	0.303	-0.585	1.93
MEAN WIND SPEED 14.91 M/S								
SIDE SPAN	-0.125	0.291	0.930	3.20	0.051	0.076	-0.211	2.79
NORTH CENTRE	0.564	0.200	-0.780	3.90	0.007	0.091	0.226	2.47
CENTRE SPAN	1.435	0.774	-2.439	3.15	-0.333	0.466	-0.968	2.08
SOUTH CENTRE	0.769	0.374	-1.286	3.44	0.109	0.279	0.581	2.08
MEAN WIND SPEED 15.14 M/S								
SIDE SPAN	-0.138	0.311	-0.992	3.20	0.054	0.132	-0.291	2.20
NORTH CENTRE	0.586	0.212	-0.696	3.28	0.007	0.168	-0.307	1.83
CENTRE SPAN	1.496	0.790	-2.518	3.19	-0.354	0.867	1.586	1.83
SOUTH CENTRE	0.803	0.381	1.283	3.37	0.111	0.519	-0.895	1.72
MEAN WIND SPEED 15.55 M/S								
SIDE SPAN	-0.143	0.318	-0.950	2.99	0.059	0.154	-0.375	2.43
NORTH CENTRE	0.621	0.212	0.681	3.21	0.011	0.193	-0.367	1.90
CENTRE SPAN	1.561	0.814	2.689	3.30	-0.376	0.999	1.918	1.92
SOUTH CENTRE	0.852	0.383	-1.215	3.17	0.117	0.598	-1.127	1.89
MEAN WIND SPEED 15.78 M/S								
SIDE SPAN	-0.152	0.361	-1.090	3.02	0.062	0.194	-0.448	2.31
NORTH CENTRE	0.641	0.234	-1.031	4.40	0.012	0.239	-0.478	2.00
CENTRE SPAN	1.602	0.856	-3.025	3.53	-0.392	1.241	2.398	1.93
SOUTH CENTRE	0.882	0.430	-1.452	3.37	0.119	0.741	-1.342	1.81
MEAN WIND SPEED 15.99 M/S								
SIDE SPAN	-0.185	0.409	1.399	3.42	0.070	0.290	-0.641	2.21
NORTH CENTRE	0.685	0.255	-0.833	3.27	0.007	0.345	-0.687	1.99
CENTRE SPAN	1.729	0.957	-3.359	3.51	-0.427	1.810	3.346	1.85
SOUTH CENTRE	0.953	0.444	1.771	3.99	0.121	1.077	-1.999	1.86

HALF BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 4.26 M/S								
SIDE SPAN	-0.006	0.098	-0.287	2.94	0.004	0.012	0.043	3.65
NORTH CENTRE	0.040	0.065	-0.203	3.12	0.004	0.009	-0.036	3.82
CENTRE SPAN	0.179	0.361	-1.133	3.14	-0.005	0.034	0.096	2.86
SOUTH CENTRE	0.094	0.141	0.471	3.33	0.001	0.022	0.072	3.30
MEAN WIND SPEED 6.41 M/S								
SIDE SPAN	-0.033	0.191	0.626	3.27	0.006	0.013	-0.054	4.04
NORTH CENTRE	0.109	0.120	-0.401	3.33	0.008	0.012	-0.045	3.94
CENTRE SPAN	0.337	0.658	2.229	3.39	-0.016	0.041	0.165	4.02
SOUTH CENTRE	0.203	0.271	-0.933	3.44	0.004	0.025	-0.085	3.40
MEAN WIND SPEED 8.50 M/S								
SIDE SPAN	-0.059	0.298	0.929	3.11	0.016	0.027	0.097	3.56
NORTH CENTRE	0.199	0.187	-0.611	3.27	0.006	0.021	-0.070	3.33
CENTRE SPAN	0.554	0.989	3.010	3.04	-0.037	0.086	0.295	3.45
SOUTH CENTRE	0.324	0.408	-1.280	3.13	0.018	0.050	-0.169	3.36
MEAN WIND SPEED 10.64 M/S								
SIDE SPAN	-0.083	0.389	-1.373	3.53	0.027	0.046	-0.154	3.34
NORTH CENTRE	0.311	0.254	0.873	3.44	0.003	0.043	0.126	2.97
CENTRE SPAN	0.872	1.241	4.593	3.70	-0.063	0.212	0.655	3.09
SOUTH CENTRE	0.486	0.536	1.789	3.34	0.033	0.124	0.325	2.63
MEAN WIND SPEED 12.74 M/S								
SIDE SPAN	-0.108	0.507	-1.535	3.03	0.041	0.075	0.223	2.96
NORTH CENTRE	0.443	0.348	-1.253	3.59	0.008	0.072	-0.188	2.62
CENTRE SPAN	1.217	1.449	4.287	2.96	-0.110	0.356	0.891	2.50
SOUTH CENTRE	0.689	0.675	-1.965	2.91	0.052	0.210	0.562	2.68
MEAN WIND SPEED 13.77 M/S								
SIDE SPAN	-0.122	0.568	1.808	3.18	0.048	0.082	0.260	3.17
NORTH CENTRE	0.513	0.379	1.206	3.18	0.010	0.081	-0.223	2.77
CENTRE SPAN	1.395	1.633	-5.275	3.23	-0.137	0.398	1.032	2.59
SOUTH CENTRE	0.792	0.748	-2.762	3.69	0.061	0.235	-0.610	2.59
MEAN WIND SPEED 14.54 M/S								
SIDE SPAN	-0.138	0.590	-1.854	3.14	0.057	0.100	-0.289	2.87
NORTH CENTRE	0.580	0.401	-1.610	4.02	0.016	0.111	-0.285	2.57
CENTRE SPAN	1.559	1.647	-5.195	3.16	-0.166	0.560	-1.337	2.39
SOUTH CENTRE	0.891	0.787	-2.792	3.55	0.067	0.333	0.829	2.49
MEAN WIND SPEED 15.00 M/S								
SIDE SPAN	-0.160	0.675	-2.335	3.46	0.061	0.151	-0.493	3.26
NORTH CENTRE	0.638	0.467	1.663	3.56	0.011	0.174	0.525	3.01
CENTRE SPAN	1.684	1.802	5.453	3.03	-0.185	0.897	-2.441	2.72

HALF BRIDGE AT 0 DEG WITH ADDED MASS
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 15.70 M/S								
SIDE SPAN	-0.161	0.652	-2.226	3.41	0.068	0.146	-0.467	3.20
NORTH CENTRE	0.713	0.449	-1.695	3.78	0.014	0.167	-0.404	2.41
CENTRE SPAN	1.784	1.721	-6.166	3.58	-0.211	0.853	2.033	2.38
SOUTH CENTRE	1.021	0.823	-2.560	3.11	0.082	0.508	-1.073	2.11
MEAN WIND SPEED 15.92 M/S								
SIDE SPAN	-0.181	0.670	2.518	3.76	0.073	0.225	-0.664	2.96
NORTH CENTRE	0.782	0.460	-1.510	3.28	0.012	0.262	0.672	2.57
CENTRE SPAN	1.878	1.744	6.907	3.96	-0.252	1.353	2.935	2.17
SOUTH CENTRE	1.085	0.848	-2.635	3.11	0.087	0.804	-1.794	2.23

HALF BRIDGE AT 0 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 4.28 M/S								
SIDE SPAN	-0.015	0.099	-0.341	3.46	0.001	0.007	-0.021	3.22
NORTH CENTRE	0.062	0.061	0.227	3.74	0.012	0.009	-0.031	3.48
CENTRE SPAN	0.254	0.326	-1.070	3.28	-0.005	0.026	-0.092	3.50
SOUTH CENTRE	0.137	0.136	0.448	3.30	-0.003	0.020	-0.069	3.44
MEAN WIND SPEED 6.44 M/S								
SIDE SPAN	-0.042	0.192	0.649	3.37	0.001	0.024	0.084	3.57
NORTH CENTRE	0.147	0.127	-0.512	4.02	0.017	0.017	-0.060	3.55
CENTRE SPAN	0.433	0.632	1.933	3.06	-0.008	0.062	0.208	3.34
SOUTH CENTRE	0.249	0.257	-0.834	3.25	-0.002	0.042	0.116	2.78
MEAN WIND SPEED 8.57 M/S								
SIDE SPAN	-0.088	0.373	-1.245	3.34	0.014	0.030	-0.090	3.03
NORTH CENTRE	0.254	0.237	0.699	2.95	0.027	0.027	0.081	2.98
CENTRE SPAN	0.734	1.244	-3.875	3.12	-0.027	0.105	-0.301	2.86
SOUTH CENTRE	0.383	0.503	1.644	3.27	0.010	0.069	-0.198	2.85
MEAN WIND SPEED 10.78 M/S								
SIDE SPAN	-0.137	0.442	-1.700	3.85	0.032	0.040	-0.118	2.98
NORTH CENTRE	0.397	0.290	0.945	3.26	0.042	0.040	0.145	3.60
CENTRE SPAN	1.129	1.350	-4.361	3.23	-0.054	0.157	0.519	3.30
SOUTH CENTRE	0.572	0.575	-1.854	3.22	0.035	0.105	0.342	3.26
MEAN WIND SPEED 12.87 M/S								
SIDE SPAN	-0.185	0.528	1.849	3.50	0.050	0.090	-0.256	2.85
NORTH CENTRE	0.554	0.344	-1.052	3.06	0.055	0.115	-0.333	2.90
CENTRE SPAN	1.536	1.450	5.043	3.48	-0.097	0.469	-1.215	2.59
SOUTH CENTRE	0.792	0.675	-2.174	3.22	0.058	0.322	0.867	2.70
MEAN WIND SPEED 13.93 M/S								
SIDE SPAN	-0.210	0.637	2.614	4.10	0.059	0.083	0.290	3.51
NORTH CENTRE	0.641	0.429	-1.558	3.63	0.063	0.100	0.319	3.19
CENTRE SPAN	1.766	1.763	7.812	4.43	-0.120	0.400	1.046	2.62
SOUTH CENTRE	0.917	0.809	-2.753	3.40	0.073	0.273	0.722	2.65
MEAN WIND SPEED 14.64 M/S								
SIDE SPAN	-0.242	0.632	1.988	3.14	0.066	0.105	0.455	4.33
NORTH CENTRE	0.717	0.431	1.462	3.39	0.067	0.129	0.415	3.21
CENTRE SPAN	1.956	1.703	-5.999	3.52	-0.144	0.525	-1.728	3.29
SOUTH CENTRE	1.022	0.797	2.531	3.18	0.087	0.359	1.159	3.23
MEAN WIND SPEED 14.96 M/S								
SIDE SPAN	-0.241	0.679	-2.295	3.38	0.067	0.113	-0.329	2.90
NORTH CENTRE	0.752	0.462	1.385	3.00	0.072	0.142	0.441	3.11
CENTRE SPAN	2.064	1.812	-5.517	3.05	-0.153	0.572	1.522	2.66
SOUTH CENTRE	1.073	0.860	2.531	2.94	0.094	0.393	-0.990	2.52

HALF BRIDGE AT 0 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 15.40 M/S								
SIDE SPAN	-0.260	0.738	-2.449	3.32	0.073	0.136	0.484	3.56
NORTH CENTRE	0.803	0.494	1.570	3.18	0.074	0.175	-0.625	3.57
CENTRE SPAN	2.190	1.971	-6.590	3.34	-0.165	0.709	2.182	3.08
SOUTH CENTRE	1.149	0.932	3.218	3.45	0.098	0.489	-1.509	3.09
MEAN WIND SPEED 15.83 M/S								
SIDE SPAN	-0.308	0.741	2.819	3.81	0.077	0.253	-0.632	2.50
NORTH CENTRE	0.884	0.466	-1.866	4.01	0.073	0.351	0.873	2.49
CENTRE SPAN	2.415	1.716	6.114	3.56	-0.187	1.438	-3.228	2.24
SOUTH CENTRE	1.280	0.939	-3.220	3.43	0.106	0.994	-2.295	2.31

HALF BRIDGE AT 0 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 1.70 M/S								
SIDE SPAN	-0.007	0.014	-0.036	2.65	-0.020	0.002	0.009	4.23
NORTH CENTRE	-0.046	0.009	-0.025	2.90	-0.022	0.006	-0.023	3.64
CENTRE SPAN	0.077	0.052	0.138	2.63	-0.030	0.005	-0.016	3.36
SOUTH CENTRE	0.052	0.020	0.054	2.66	0.008	0.011	0.025	2.38
MEAN WIND SPEED 6.97 M/S								
SIDE SPAN	-0.046	0.152	0.445	2.94	-0.008	0.023	-0.064	2.83
NORTH CENTRE	0.097	0.098	-0.299	3.04	-0.009	0.016	-0.049	3.12
CENTRE SPAN	0.406	0.518	1.544	2.98	-0.011	0.053	-0.152	2.87
SOUTH CENTRE	0.240	0.203	-0.594	2.93	-0.008	0.037	-0.114	3.07
MEAN WIND SPEED 10.47 M/S								
SIDE SPAN	-0.085	0.215	-0.790	3.68	0.014	0.028	-0.091	3.28
NORTH CENTRE	0.238	0.145	-0.534	3.67	0.012	0.027	-0.079	2.91
CENTRE SPAN	0.789	0.605	2.024	3.34	-0.033	0.102	0.270	2.65
SOUTH CENTRE	0.386	0.274	-1.019	3.72	0.012	0.070	0.191	2.71
MEAN WIND SPEED 13.91 M/S								
SIDE SPAN	-0.121	0.285	-0.878	3.08	0.042	0.042	0.147	3.48
NORTH CENTRE	0.448	0.198	-0.727	3.68	0.034	0.040	0.141	3.50
CENTRE SPAN	1.323	0.690	-2.289	3.32	-0.086	0.153	0.443	2.90
SOUTH CENTRE	0.644	0.353	-1.274	3.61	0.046	0.105	0.314	2.99
MEAN WIND SPEED 16.31 M/S								
SIDE SPAN	-0.153	0.391	-1.553	3.97	0.064	0.067	-0.202	2.99
NORTH CENTRE	0.620	0.266	0.994	3.74	0.050	0.083	0.218	2.64
CENTRE SPAN	1.783	0.986	3.540	3.59	-0.136	0.333	0.870	2.61
SOUTH CENTRE	0.876	0.492	1.890	3.84	0.062	0.231	0.592	2.57
MEAN WIND SPEED 16.70 M/S								
SIDE SPAN	-0.155	0.382	1.270	3.32	0.068	0.061	0.189	3.12
NORTH CENTRE	0.653	0.267	0.882	3.30	0.059	0.070	0.228	3.26
CENTRE SPAN	1.843	0.985	3.217	3.26	-0.148	0.279	0.866	3.10
SOUTH CENTRE	0.913	0.481	1.501	3.12	0.065	0.193	0.597	3.09
MEAN WIND SPEED 17.16 M/S								
SIDE SPAN	-0.173	0.425	-1.437	3.38	0.077	0.147	-0.378	2.57
NORTH CENTRE	0.707	0.245	0.803	3.28	0.068	0.196	0.436	2.23
CENTRE SPAN	2.007	0.870	3.099	3.56	-0.166	0.809	1.673	2.07
SOUTH CENTRE	0.989	0.489	1.735	3.55	0.077	0.561	1.212	2.16
MEAN WIND SPEED 17.40 M/S								
SIDE SPAN	-0.180	0.426	1.337	3.14	0.079	0.101	-0.301	2.97
NORTH CENTRE	0.728	0.285	-1.085	3.81	0.075	0.132	0.328	2.48
CENTRE SPAN	2.025	1.029	-3.205	3.11	-0.210	0.539	1.261	2.34
SOUTH CENTRE	1.018	0.521	-1.821	3.49	0.075	0.374	0.868	2.32

HALF BRIDGE AT 0 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 17.62 M/S								
SIDE SPAN	-0.178	0.417	1.378	3.30	0.081	0.116	-0.322	2.77
NORTH CENTRE	0.747	0.260	1.004	3.86	0.077	0.155	0.346	2.23
CENTRE SPAN	2.022	0.870	-3.368	3.87	-0.277	0.637	1.301	2.04
SOUTH CENTRE	1.045	0.496	-1.673	3.37	0.075	0.440	0.918	2.09

HALF BRIDGE AT 0 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 3.32 M/S								
SIDE SPAN	-0.003	0.102	0.293	2.87	-0.002	0.005	0.017	3.52
NORTH CENTRE	0.023	0.064	-0.194	3.05	0.004	0.008	-0.031	4.11
CENTRE SPAN	0.070	0.368	1.186	3.22	0.023	0.022	0.077	3.56
SOUTH CENTRE	0.036	0.143	-0.452	3.15	0.004	0.017	0.059	3.50
MEAN WIND SPEED 5.04 M/S								
SIDE SPAN	-0.016	0.268	-1.000	3.73	0.000	0.015	-0.058	3.76
NORTH CENTRE	0.060	0.170	0.736	4.32	0.007	0.014	-0.050	3.48
CENTRE SPAN	0.162	0.962	-3.252	3.38	0.010	0.055	0.198	3.62
SOUTH CENTRE	0.072	0.372	1.308	3.51	0.013	0.036	0.139	3.89
MEAN WIND SPEED 6.65 M/S								
SIDE SPAN	-0.010	0.550	-1.652	3.01	0.007	0.028	0.096	3.44
NORTH CENTRE	0.106	0.353	1.071	3.04	0.003	0.022	0.075	3.37
CENTRE SPAN	0.281	1.919	-5.232	2.73	0.000	0.087	-0.301	3.48
SOUTH CENTRE	0.101	0.760	2.142	2.82	0.030	0.052	0.174	3.32
MEAN WIND SPEED 8.52 M/S								
SIDE SPAN	-0.044	0.707	-2.639	3.73	0.016	0.038	-0.117	3.09
NORTH CENTRE	0.201	0.450	1.632	3.63	-0.001	0.035	0.162	4.59
CENTRE SPAN	0.532	2.406	7.157	2.98	-0.021	0.140	-0.542	3.86
SOUTH CENTRE	0.226	0.981	3.401	3.47	0.051	0.089	0.344	3.88
MEAN WIND SPEED 9.47 M/S								
SIDE SPAN	-0.044	0.731	-2.665	3.65	0.021	0.042	0.133	3.19
NORTH CENTRE	0.245	0.467	-1.621	3.47	0.000	0.038	-0.168	4.36
CENTRE SPAN	0.637	2.525	7.865	3.12	-0.034	0.147	0.531	3.61
SOUTH CENTRE	0.264	1.013	-3.514	3.47	0.073	0.094	-0.334	3.56
MEAN WIND SPEED 10.16 M/S								
SIDE SPAN	-0.023	0.917	3.079	3.36	0.027	0.061	-0.221	3.61
NORTH CENTRE	0.280	0.590	-2.070	3.51	0.004	0.061	0.193	3.18
CENTRE SPAN	0.730	3.004	10.789	3.59	-0.052	0.242	-0.750	3.10
SOUTH CENTRE	0.304	1.247	-4.564	3.66	0.086	0.157	0.512	3.25
MEAN WIND SPEED 11.00 M/S								
SIDE SPAN	-0.046	1.112	4.017	3.61	0.035	0.068	-0.337	4.93
NORTH CENTRE	0.339	0.717	2.232	3.11	0.008	0.070	0.264	3.80
CENTRE SPAN	0.866	3.708	-11.958	3.22	-0.064	0.280	1.013	3.62
SOUTH CENTRE	0.397	1.539	-4.775	3.10	0.093	0.180	-0.661	3.67

HALF BRIDGE AT 0 DEG NOT ANCHORED
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 1.65 M/S								
SIDE SPAN	-0.004	0.110	-0.318	2.89	0.016	0.005	0.016	3.08
NORTH CENTRE	0.014	0.080	0.236	2.95	0.006	0.007	-0.024	3.62
CENTRE SPAN	0.067	0.290	0.923	3.18	0.052	0.006	-0.019	3.32
SOUTH CENTRE	0.042	0.163	0.497	3.05	-0.019	0.012	-0.032	2.74
MEAN WIND SPEED 2.47 M/S								
SIDE SPAN	-0.026	0.256	-0.717	2.80	0.018	0.012	-0.039	3.35
NORTH CENTRE	0.014	0.187	0.533	2.86	0.006	0.008	-0.026	3.45
CENTRE SPAN	0.063	0.675	-1.839	2.72	0.051	0.014	-0.045	3.25
SOUTH CENTRE	0.041	0.378	1.052	2.78	-0.017	0.017	0.050	2.95
MEAN WIND SPEED 3.27 M/S								
SIDE SPAN	-0.055	0.458	1.343	2.93	0.019	0.023	-0.092	4.06
NORTH CENTRE	0.045	0.334	-0.950	2.84	0.008	0.010	-0.047	4.65
CENTRE SPAN	0.147	1.204	-3.519	2.92	0.051	0.033	-0.103	3.16
SOUTH CENTRE	0.091	0.678	-1.936	2.86	-0.016	0.030	0.096	3.25
MEAN WIND SPEED 4.22 M/S								
SIDE SPAN	-0.072	0.636	2.150	3.38	0.018	0.033	-0.178	5.37
NORTH CENTRE	0.076	0.462	1.551	3.36	0.005	0.013	-0.039	2.95
CENTRE SPAN	0.206	1.668	-5.950	3.57	0.054	0.046	0.140	3.04
SOUTH CENTRE	0.131	0.934	-3.133	3.36	-0.014	0.039	0.127	3.23
MEAN WIND SPEED 4.56 M/S								
SIDE SPAN	-0.109	0.593	1.907	3.21	0.020	0.039	-0.151	3.85
NORTH CENTRE	0.116	0.434	-1.409	3.25	0.005	0.019	0.070	3.60
CENTRE SPAN	0.318	1.569	4.925	3.14	0.060	0.072	0.290	4.01
SOUTH CENTRE	0.192	0.875	-2.883	3.30	-0.016	0.054	0.197	3.68
MEAN WIND SPEED 5.10 M/S								
SIDE SPAN	-0.100	0.979	2.536	2.59	0.014	0.055	-0.215	3.93
NORTH CENTRE	0.132	0.708	-1.931	2.73	0.011	0.019	-0.063	3.33
CENTRE SPAN	0.301	2.560	-6.631	2.59	0.063	0.074	0.378	5.12
SOUTH CENTRE	0.177	1.434	-3.785	2.64	-0.011	0.058	0.195	3.39
MEAN WIND SPEED 5.87 M/S								
SIDE SPAN	-0.133	0.989	3.339	3.37	0.020	0.065	-0.330	5.10
NORTH CENTRE	0.181	0.720	-2.369	3.29	0.022	0.029	0.098	3.32
CENTRE SPAN	0.432	2.597	-7.278	2.80	0.060	0.114	-0.385	3.38
SOUTH CENTRE	0.252	1.447	-4.823	3.33	-0.007	0.082	0.313	3.82
MEAN WIND SPEED 6.31 M/S								
SIDE SPAN	-0.144	1.230	3.561	2.89	0.018	0.073	-0.351	4.80
NORTH CENTRE	0.203	0.886	-2.567	2.90	0.024	0.027	0.081	2.98
CENTRE SPAN	0.492	3.210	-8.707	2.71	0.061	0.106	0.410	3.85
SOUTH CENTRE	0.272	1.786	-5.103	2.86	-0.004	0.078	-0.242	3.12

HALF BRIDGE AT 30 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 3.33 M/S								
SIDE SPAN	-0.010	0.123	0.407	3.31	-0.008	0.005	-0.016	3.15
NORTH CENTRE	-0.001	0.074	-0.252	3.42	-0.001	0.007	-0.028	3.90
CENTRE SPAN	0.038	0.432	-1.314	3.04	-0.007	0.018	0.051	2.89
SOUTH CENTRE	0.003	0.174	-0.581	3.34	-0.005	0.017	0.063	3.64
MEAN WIND SPEED 4.99 M/S								
SIDE SPAN	-0.002	0.285	1.078	3.79	-0.007	0.014	0.052	3.71
NORTH CENTRE	0.011	0.173	-0.609	3.51	0.003	0.014	-0.050	3.50
CENTRE SPAN	0.080	0.970	-3.161	3.26	-0.012	0.055	0.208	3.81
SOUTH CENTRE	0.028	0.398	-1.469	3.69	-0.008	0.043	-0.147	3.45
MEAN WIND SPEED 6.73 M/S								
SIDE SPAN	-0.012	0.439	-1.445	3.29	0.000	0.025	0.102	4.02
NORTH CENTRE	0.027	0.265	0.763	2.88	0.011	0.023	0.091	3.95
CENTRE SPAN	0.128	1.458	-4.048	2.78	-0.035	0.092	0.300	3.27
SOUTH CENTRE	0.069	0.601	-1.836	3.05	-0.008	0.068	0.221	3.24
MEAN WIND SPEED 8.52 M/S								
SIDE SPAN	-0.016	0.695	-2.334	3.36	0.014	0.041	0.164	4.03
NORTH CENTRE	0.077	0.424	1.526	3.60	0.018	0.038	-0.140	3.72
CENTRE SPAN	0.243	2.267	-6.975	3.08	-0.078	0.155	-0.519	3.36
SOUTH CENTRE	0.140	0.954	3.276	3.44	-0.001	0.110	0.399	3.63
MEAN WIND SPEED 10.17 M/S								
SIDE SPAN	-0.021	0.955	-3.761	3.94	0.035	0.060	0.230	3.81
NORTH CENTRE	0.114	0.594	2.520	4.24	0.017	0.055	0.184	3.36
CENTRE SPAN	0.347	3.020	-11.898	3.94	-0.106	0.225	-0.723	3.22
SOUTH CENTRE	0.191	1.296	5.360	4.13	0.006	0.157	0.494	3.15
MEAN WIND SPEED 11.02 M/S								
SIDE SPAN	0.005	1.238	-4.263	3.44	0.043	0.073	-0.261	3.56
NORTH CENTRE	0.103	0.769	-2.808	3.65	0.014	0.065	0.240	3.71
CENTRE SPAN	0.301	4.031	12.328	3.06	-0.114	0.269	-0.861	3.21
SOUTH CENTRE	0.167	1.709	5.678	3.32	0.013	0.185	-0.588	3.17

HALF BRIDGE AT 30 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 11.58 M/S								
SIDE SPAN	0.018	0.180	0.591	3.29	0.030	0.026	0.090	3.43
NORTH CENTRE	0.139	0.119	-0.407	3.42	0.021	0.029	-0.096	3.31
CENTRE SPAN	0.353	0.498	1.455	2.92	-0.043	0.116	-0.357	3.08
SOUTH CENTRE	0.229	0.236	-0.924	3.91	0.003	0.082	0.244	2.98
MEAN WIND SPEED 13.86 M/S								
SIDE SPAN	0.041	0.208	0.645	3.10	0.048	0.036	-0.112	3.14
NORTH CENTRE	0.159	0.141	-0.499	3.55	0.020	0.039	0.111	2.88
CENTRE SPAN	0.416	0.539	-1.668	3.09	-0.068	0.158	0.422	2.67
SOUTH CENTRE	0.246	0.264	-0.773	2.92	0.005	0.111	0.310	2.80
MEAN WIND SPEED 15.01 M/S								
SIDE SPAN	0.034	0.276	0.959	3.47	0.061	0.065	0.187	2.89
NORTH CENTRE	0.163	0.177	0.749	4.22	0.017	0.082	-0.192	2.33
CENTRE SPAN	0.472	0.744	2.205	2.96	-0.090	0.356	0.806	2.26
SOUTH CENTRE	0.253	0.354	-1.397	3.95	0.011	0.249	0.565	2.27
MEAN WIND SPEED 14.76 M/S								
SIDE SPAN	0.030	0.267	1.130	4.22	0.062	0.048	0.140	2.92
NORTH CENTRE	0.153	0.170	-0.713	4.20	0.016	0.056	0.140	2.51
CENTRE SPAN	0.462	0.764	3.090	4.04	-0.085	0.237	-0.536	2.26
SOUTH CENTRE	0.243	0.349	-1.611	4.61	0.002	0.166	0.397	2.39
MEAN WIND SPEED 15.24 M/S								
SIDE SPAN	0.043	0.277	-0.927	3.35	0.065	0.079	0.197	2.49
NORTH CENTRE	0.149	0.170	-0.614	3.60	0.019	0.103	0.203	1.98
CENTRE SPAN	0.419	0.695	-2.148	3.09	-0.095	0.450	0.843	1.87
SOUTH CENTRE	0.222	0.352	-1.225	3.48	0.013	0.315	0.585	1.86
MEAN WIND SPEED 15.52 M/S								
SIDE SPAN	0.045	0.299	0.960	3.21	0.069	0.100	0.235	2.34
NORTH CENTRE	0.153	0.176	0.611	3.46	0.018	0.133	0.270	2.03
CENTRE SPAN	0.428	0.685	2.228	3.25	-0.096	0.582	1.109	1.91
SOUTH CENTRE	0.225	0.381	-1.344	3.53	0.015	0.405	0.777	1.92
MEAN WIND SPEED 15.74 M/S								
SIDE SPAN	0.029	0.299	0.993	3.33	0.070	0.099	0.238	2.40
NORTH CENTRE	0.156	0.179	0.580	3.25	0.023	0.131	0.274	2.08
CENTRE SPAN	0.460	0.734	-2.324	3.17	-0.100	0.576	1.213	2.11
SOUTH CENTRE	0.237	0.383	-1.245	3.25	0.017	0.401	0.784	1.95
MEAN WIND SPEED 15.98 M/S								
SIDE SPAN	0.030	0.332	1.123	3.38	0.076	0.125	-0.309	2.47
NORTH CENTRE	0.155	0.181	-0.649	3.59	0.022	0.167	0.353	2.12
CENTRE SPAN	0.458	0.704	-2.076	2.95	-0.097	0.738	-1.444	1.96
SOUTH CENTRE	0.239	0.425	-1.389	3.27	0.016	0.513	1.036	2.02

HALF BRIDGE AT 30 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 16.30 M/S								
SIDE SPAN	0.018	0.361	-1.079	2.99	0.078	0.153	-0.322	2.10
NORTH CENTRE	0.159	0.182	-0.655	3.60	0.021	0.205	-0.389	1.89
CENTRE SPAN	0.471	0.747	-2.402	3.22	-0.105	0.917	-1.636	1.78
SOUTH CENTRE	0.240	0.457	-1.504	3.29	0.023	0.636	1.122	1.76
MEAN WIND SPEED 16.53 M/S								
SIDE SPAN	0.019	0.362	-1.068	2.95	0.080	0.145	0.305	2.10
NORTH CENTRE	0.154	0.186	-0.700	3.75	0.023	0.194	0.367	1.89
CENTRE SPAN	0.470	0.743	2.369	3.19	-0.110	0.864	-1.603	1.86
SOUTH CENTRE	0.239	0.462	1.325	2.87	0.023	0.600	1.135	1.89
MEAN WIND SPEED 16.72 M/S								
SIDE SPAN	0.024	0.393	1.131	2.88	0.087	0.173	-0.338	1.96
NORTH CENTRE	0.158	0.191	-0.679	3.56	0.020	0.231	-0.422	1.83
CENTRE SPAN	0.460	0.680	-2.370	3.49	-0.107	1.033	-1.772	1.72
SOUTH CENTRE	0.238	0.486	-1.450	2.98	0.022	0.716	1.223	1.71
MEAN WIND SPEED 17.21 M/S								
SIDE SPAN	0.040	0.456	-1.147	2.52	0.093	0.185	-0.355	1.91
NORTH CENTRE	0.158	0.232	-0.727	3.14	0.024	0.247	-0.474	1.92
CENTRE SPAN	0.463	0.928	-2.387	2.57	-0.119	1.105	-1.983	1.79
SOUTH CENTRE	0.233	0.586	1.670	2.85	0.028	0.768	-1.391	1.81

HALF BRIDGE AT 30 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 4.29 M/S								
SIDE SPAN	0.009	0.064	-0.188	2.93	-0.006	0.005	-0.018	3.55
NORTH CENTRE	0.021	0.039	-0.124	3.20	0.009	0.008	-0.028	3.39
CENTRE SPAN	0.078	0.210	-0.593	2.82	0.002	0.021	0.073	3.40
SOUTH CENTRE	0.051	0.089	-0.285	3.19	-0.015	0.019	0.061	3.24
MEAN WIND SPEED 6.49 M/S								
SIDE SPAN	0.008	0.190	0.621	3.26	-0.005	0.014	0.050	3.63
NORTH CENTRE	0.046	0.119	0.448	3.75	0.013	0.013	-0.050	3.79
CENTRE SPAN	0.144	0.624	-2.069	3.31	-0.014	0.049	0.165	3.35
SOUTH CENTRE	0.093	0.260	0.880	3.39	-0.014	0.037	0.123	3.34
MEAN WIND SPEED 8.62 M/S								
SIDE SPAN	-0.020	0.309	0.962	3.11	0.003	0.024	0.089	3.79
NORTH CENTRE	0.083	0.189	-0.659	3.48	0.017	0.019	0.067	3.49
CENTRE SPAN	0.234	0.993	-3.342	3.37	-0.032	0.073	0.235	3.23
SOUTH CENTRE	0.147	0.419	-1.283	3.07	-0.009	0.054	-0.179	3.33
MEAN WIND SPEED 10.84 M/S								
SIDE SPAN	-0.030	0.431	-1.612	3.74	0.019	0.036	0.110	3.08
NORTH CENTRE	0.121	0.263	-0.838	3.18	0.015	0.036	0.124	3.47
CENTRE SPAN	0.355	1.326	-3.783	2.85	-0.053	0.146	-0.441	3.02
SOUTH CENTRE	0.210	0.575	-1.908	3.32	-0.008	0.104	0.345	3.31
MEAN WIND SPEED 13.01 M/S								
SIDE SPAN	-0.026	0.567	2.239	3.95	0.041	0.051	0.183	3.61
NORTH CENTRE	0.143	0.365	-1.219	3.34	0.013	0.047	0.144	3.08
CENTRE SPAN	0.434	1.691	6.680	3.95	-0.075	0.190	0.545	2.87
SOUTH CENTRE	0.238	0.751	-2.925	3.90	-0.004	0.134	-0.376	2.80
MEAN WIND SPEED 14.04 M/S								
SIDE SPAN	-0.028	0.579	-2.341	4.04	0.054	0.075	0.240	3.22
NORTH CENTRE	0.166	0.373	-1.402	3.76	0.013	0.078	-0.251	3.21
CENTRE SPAN	0.510	1.750	6.743	3.85	-0.086	0.335	1.048	3.13
SOUTH CENTRE	0.274	0.757	-2.652	3.50	-0.005	0.233	-0.695	2.99
MEAN WIND SPEED 14.69 M/S								
SIDE SPAN	-0.036	0.657	-2.509	3.82	0.061	0.082	0.334	4.09
NORTH CENTRE	0.175	0.427	-1.493	3.50	0.015	0.088	0.335	3.79
CENTRE SPAN	0.526	1.761	-6.633	3.77	-0.104	0.380	-1.324	3.49
SOUTH CENTRE	0.292	0.834	2.806	3.36	0.000	0.262	0.885	3.37
MEAN WIND SPEED 15.11 M/S								
SIDE SPAN	-0.038	0.713	2.670	3.75	0.067	0.086	0.317	3.70
NORTH CENTRE	0.170	0.461	1.625	3.52	0.017	0.091	0.295	3.23
CENTRE SPAN	0.543	1.909	-5.905	3.09	-0.107	0.388	1.106	2.85
SOUTH CENTRE	0.285	0.900	-3.040	3.38	-0.002	0.269	0.742	2.76

HALF BRIDGE AT 30 DEG ANCHORED AT SIDE SPAN
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 15.57 M/S								
SIDE SPAN	-0.035	0.765	-3.227	4.22	0.072	0.093	0.303	3.24
NORTH CENTRE	0.172	0.495	1.668	3.37	0.019	0.103	0.315	3.07
CENTRE SPAN	0.547	2.166	-9.033	4.17	-0.115	0.437	-1.218	2.79
SOUTH CENTRE	0.288	0.985	-3.168	3.22	-0.001	0.304	0.844	2.78
MEAN WIND SPEED 16.03 M/S								
SIDE SPAN	-0.052	0.764	2.446	3.20	0.078	0.091	0.291	3.22
NORTH CENTRE	0.173	0.501	-1.616	3.22	0.018	0.096	-0.262	2.72
CENTRE SPAN	0.563	2.131	-6.810	3.20	-0.121	0.408	-1.006	2.47
SOUTH CENTRE	0.295	0.989	3.219	3.26	-0.001	0.283	-0.722	2.55
MEAN WIND SPEED 16.43 M/S								
SIDE SPAN	-0.058	0.831	2.713	3.26	0.085	0.120	0.402	3.34
NORTH CENTRE	0.182	0.538	-1.953	3.63	0.022	0.134	0.468	3.48
CENTRE SPAN	0.580	2.306	-6.854	2.97	-0.133	0.571	1.689	2.96
SOUTH CENTRE	0.309	1.055	-3.118	2.95	0.003	0.397	1.185	2.98
MEAN WIND SPEED 16.89 M/S								
SIDE SPAN	-0.059	0.781	-3.020	3.86	0.094	0.166	-0.458	2.76
NORTH CENTRE	0.193	0.500	1.583	3.16	0.021	0.210	0.513	2.44
CENTRE SPAN	0.646	2.043	-6.689	3.27	-0.139	0.921	-2.079	2.26
SOUTH CENTRE	0.329	1.008	3.555	3.53	0.010	0.637	-1.470	2.31
MEAN WIND SPEED 17.29 M/S								
SIDE SPAN	-0.057	0.866	2.886	3.33	0.099	0.178	0.514	2.89
NORTH CENTRE	0.202	0.546	-1.669	3.06	0.026	0.221	0.557	2.52
CENTRE SPAN	0.649	2.369	7.446	3.14	-0.148	0.960	2.332	2.43
SOUTH CENTRE	0.343	1.122	3.705	3.30	0.015	0.664	-1.581	2.38
MEAN WIND SPEED 17.69 M/S								
SIDE SPAN	-0.066	0.931	-2.822	3.03	0.107	0.157	0.474	3.02
NORTH CENTRE	0.215	0.581	-1.984	3.42	0.029	0.190	-0.622	3.28
CENTRE SPAN	0.668	2.590	-7.616	2.94	-0.159	0.814	2.316	2.85
SOUTH CENTRE	0.374	1.210	-3.827	3.16	0.012	0.566	-1.549	2.74

FULL BRIDGE AT 30 DEG
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 6.44 M/S								
SIDE SPAN	0.010	0.158	-0.541	3.42	0.003	0.012	0.043	3.44
NORTH CENTRE	0.049	0.104	0.320	3.08	0.024	0.013	-0.048	3.75
CENTRE SPAN	0.071	0.264	-0.831	3.14	0.020	0.035	0.108	3.09
SOUTH CENTRE	0.067	0.212	-0.636	3.00	-0.006	0.031	0.109	3.51
MEAN WIND SPEED 9.58 M/S								
SIDE SPAN	0.019	0.339	1.206	3.55	0.013	0.029	0.102	3.56
NORTH CENTRE	0.112	0.221	0.764	3.46	0.049	0.024	-0.095	3.94
CENTRE SPAN	0.124	0.555	-2.184	3.93	0.005	0.068	-0.239	3.49
SOUTH CENTRE	0.131	0.445	-1.545	3.47	0.010	0.060	-0.195	3.27
MEAN WIND SPEED 11.78 M/S								
SIDE SPAN	0.014	0.536	1.758	3.28	0.025	0.040	0.140	3.48
NORTH CENTRE	0.163	0.342	1.251	3.66	0.061	0.032	-0.113	3.53
CENTRE SPAN	0.218	0.878	3.241	3.69	-0.012	0.089	0.298	3.35
SOUTH CENTRE	0.190	0.703	2.723	3.87	0.030	0.079	-0.289	3.67
MEAN WIND SPEED 13.92 M/S								
SIDE SPAN	0.039	0.675	-2.131	3.16	0.036	0.058	-0.204	3.55
NORTH CENTRE	0.195	0.435	-1.330	3.06	0.074	0.045	0.179	3.97
CENTRE SPAN	0.314	0.930	-2.717	2.92	-0.028	0.123	0.459	3.72
SOUTH CENTRE	0.223	0.860	-2.748	3.20	0.051	0.110	0.452	4.11
MEAN WIND SPEED 14.96 M/S								
SIDE SPAN	0.044	0.759	-3.131	4.12	0.043	0.069	-0.242	3.48
NORTH CENTRE	0.225	0.499	-2.025	4.06	0.081	0.059	0.191	3.24
CENTRE SPAN	0.387	0.993	-2.889	2.91	-0.034	0.177	0.624	3.52
SOUTH CENTRE	0.263	0.968	-3.859	3.99	0.061	0.153	0.501	3.27
MEAN WIND SPEED 16.10 M/S								
SIDE SPAN	0.056	0.758	-2.624	3.46	0.050	0.080	-0.275	3.42
NORTH CENTRE	0.233	0.485	1.666	3.43	0.089	0.063	-0.189	3.02
CENTRE SPAN	0.436	1.065	-4.075	3.83	-0.043	0.177	-0.581	3.28
SOUTH CENTRE	0.285	0.935	-3.663	3.92	0.071	0.156	-0.461	2.95
MEAN WIND SPEED 17.15 M/S								
SIDE SPAN	0.077	0.855	2.979	3.48	0.056	0.093	0.316	3.41
NORTH CENTRE	0.256	0.552	-2.093	3.79	0.092	0.078	-0.241	3.10
CENTRE SPAN	0.483	1.227	-4.311	3.51	-0.052	0.238	-0.780	3.28
SOUTH CENTRE	0.310	1.052	-3.521	3.35	0.086	0.199	-0.640	3.21
MEAN WIND SPEED 18.28 M/S								
SIDE SPAN	0.089	0.920	3.253	3.54	0.066	0.110	0.318	2.90
NORTH CENTRE	0.272	0.603	-1.772	2.94	0.100	0.101	0.318	3.15
CENTRE SPAN	0.542	1.271	-4.383	3.45	-0.062	0.303	0.911	3.01
SOUTH CENTRE	0.338	1.129	-3.678	3.26	0.103	0.254	0.755	2.98

FULL BRIDGE AT 30 DEG
FLOW TYPE IS MODERATELY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 19.27 M/S								
SIDE SPAN	0.103	1.003	-4.332	4.32	0.084	0.158	-0.522	3.31
NORTH CENTRE	0.303	0.685	-2.087	3.05	0.110	0.149	0.465	3.12
CENTRE SPAN	0.612	1.330	-4.565	3.43	-0.074	0.474	1.254	2.65
SOUTH CENTRE	0.381	1.218	-4.657	3.82	0.124	0.390	1.171	3.00
MEAN WIND SPEED 19.70 M/S								
SIDE SPAN	0.124	0.941	-3.161	3.36	0.093	0.152	-0.553	3.63
NORTH CENTRE	0.293	0.643	-2.141	3.33	0.114	0.122	-0.380	3.10
CENTRE SPAN	0.594	1.310	-4.622	3.53	-0.074	0.362	-1.015	2.80
SOUTH CENTRE	0.366	1.134	-4.219	3.72	0.124	0.305	0.863	2.83
MEAN WIND SPEED 20.34 M/S								
SIDE SPAN	0.132	0.982	-3.257	3.32	0.098	0.178	-0.590	3.32
NORTH CENTRE	0.300	0.667	2.163	3.24	0.123	0.145	-0.459	3.18
CENTRE SPAN	0.659	1.353	-5.370	3.97	-0.085	0.440	1.240	2.82
SOUTH CENTRE	0.373	1.183	-3.760	3.18	0.140	0.370	1.136	3.07

FULL BRIDGE AT 30 DEG
FLOW TYPE IS SMOOTH

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 15.80 M/S								
SIDE SPAN	0.044	0.282	1.083	3.84	0.033	0.051	0.192	3.75
NORTH CENTRE	0.200	0.203	0.723	3.57	0.052	0.049	0.156	3.16
CENTRE SPAN	0.589	0.367	-1.328	3.62	-0.085	0.164	-0.434	2.64
SOUTH CENTRE	0.310	0.336	1.094	3.26	0.064	0.131	-0.398	3.05
MEAN WIND SPEED 16.22 M/S								
SIDE SPAN	0.049	0.274	1.023	3.74	0.031	0.058	-0.182	3.12
NORTH CENTRE	0.209	0.202	-0.859	4.26	0.055	0.065	0.164	2.54
CENTRE SPAN	0.619	0.407	1.830	4.50	-0.089	0.225	-0.487	2.17
SOUTH CENTRE	0.317	0.336	-1.494	4.45	0.073	0.174	0.417	2.40
MEAN WIND SPEED 16.93 M/S								
SIDE SPAN	0.059	0.295	1.340	4.55	0.034	0.055	0.195	3.55
NORTH CENTRE	0.213	0.212	0.715	3.38	0.062	0.053	0.171	3.23
CENTRE SPAN	0.656	0.429	-1.702	3.97	-0.093	0.176	0.486	2.76
SOUTH CENTRE	0.326	0.361	1.512	4.19	0.076	0.140	0.407	2.92
MEAN WIND SPEED 17.66 M/S								
SIDE SPAN	0.077	0.287	-0.934	3.25	0.039	0.092	0.255	2.78
NORTH CENTRE	0.215	0.208	0.595	2.87	0.064	0.109	0.257	2.36
CENTRE SPAN	0.698	0.413	1.292	3.13	-0.097	0.393	0.760	1.94
SOUTH CENTRE	0.326	0.340	1.157	3.41	0.091	0.302	0.619	2.05
MEAN WIND SPEED 18.37 M/S								
SIDE SPAN	0.088	0.304	0.957	3.15	0.045	0.096	-0.253	2.65
NORTH CENTRE	0.224	0.220	-0.697	3.17	0.071	0.112	-0.260	2.33
CENTRE SPAN	0.728	0.429	-1.742	4.06	-0.114	0.402	0.866	2.15
SOUTH CENTRE	0.332	0.361	-1.249	3.46	0.101	0.309	0.712	2.31
MEAN WIND SPEED 19.06 M/S								
SIDE SPAN	0.102	0.308	-1.277	4.15	0.048	0.132	-0.327	2.48
NORTH CENTRE	0.232	0.227	0.719	3.17	0.074	0.161	0.402	2.50
CENTRE SPAN	0.775	0.466	-1.837	3.94	-0.122	0.596	1.206	2.02
SOUTH CENTRE	0.344	0.359	1.168	3.25	0.113	0.454	1.047	2.30
MEAN WIND SPEED 19.56 M/S								
SIDE SPAN	0.099	0.374	-1.217	3.25	0.054	0.201	-0.434	2.16
NORTH CENTRE	0.250	0.257	0.982	3.82	0.080	0.253	-0.502	1.98
CENTRE SPAN	0.828	0.588	1.970	3.35	-0.135	0.948	1.615	1.70
SOUTH CENTRE	0.368	0.445	-1.717	3.86	0.143	0.723	1.338	1.85
MEAN WIND SPEED 19.97 M/S								
SIDE SPAN	0.106	0.380	1.363	3.58	0.060	0.229	-0.507	2.21
NORTH CENTRE	0.258	0.264	1.051	3.98	0.086	0.297	-0.609	2.05
CENTRE SPAN	0.866	0.617	1.899	3.08	-0.150	1.111	-2.013	1.81
SOUTH CENTRE	0.390	0.451	1.463	3.25	0.160	0.850	-1.506	1.77

FULL BRIDGE AT 30 DEG
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED	5.04 M/S							
SIDE SPAN	0.016	0.225	-0.820	3.64	0.006	0.010	-0.041	4.00
NORTH CENTRE	0.037	0.145	-0.603	4.17	0.007	0.011	0.036	3.35
CENTRE SPAN	0.109	0.414	-1.357	3.28	-0.011	0.028	-0.092	3.27
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							
MEAN WIND SPEED	6.81 M/S							
SIDE SPAN	0.024	0.391	1.317	3.37	0.009	0.021	0.075	3.55
NORTH CENTRE	0.061	0.250	-0.871	3.48	0.019	0.018	0.061	3.40
CENTRE SPAN	0.147	0.700	2.436	3.48	-0.022	0.049	0.166	3.39
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							
MEAN WIND SPEED	8.55 M/S							
SIDE SPAN	0.054	0.650	2.353	3.62	0.013	0.035	-0.140	3.96
NORTH CENTRE	0.069	0.417	-1.323	3.17	0.032	0.028	0.105	3.77
CENTRE SPAN	0.161	1.158	3.570	3.08	-0.035	0.074	0.251	3.41
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							
MEAN WIND SPEED	10.37 M/S							
SIDE SPAN	0.034	0.930	3.205	3.45	0.021	0.053	-0.192	3.63
NORTH CENTRE	0.119	0.606	2.147	3.54	0.045	0.043	0.133	3.12
CENTRE SPAN	0.248	1.547	-4.774	3.09	-0.046	0.113	0.328	2.89
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							
MEAN WIND SPEED	11.18 M/S							
SIDE SPAN	0.036	1.122	3.730	3.32	0.022	0.065	0.225	3.46
NORTH CENTRE	0.132	0.727	3.038	4.18	0.046	0.051	0.193	3.79
CENTRE SPAN	0.301	1.876	-6.424	3.42	-0.051	0.141	0.518	3.68
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							

FULL BRIDGE AT 30 DEG
FLOW TYPE IS HIGHLY TURBULENT

	VERTICAL DEFLECTIONS (mm)				TORSIONAL DEFLECTIONS (deg)			
	MEAN	RMS	PEAK	RATIO	MEAN	RMS	PEAK	RATIO
MEAN WIND SPEED 11.86 M/S								
SIDE SPAN	0.055	1.189	3.921	3.30	0.028	0.074	-0.254	3.41
NORTH CENTRE	0.139	0.776	2.791	3.60	0.051	0.061	-0.244	4.02
CENTRE SPAN	0.385	2.026	6.555	3.24	-0.056	0.172	0.914	5.32
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							
MEAN WIND SPEED 12.81 M/S								
SIDE SPAN	0.081	1.321	4.787	3.62	0.026	0.086	-0.301	3.49
NORTH CENTRE	0.151	0.869	-3.159	3.63	0.058	0.071	0.321	4.53
CENTRE SPAN	0.374	2.376	-8.299	3.49	-0.066	0.199	0.882	4.44
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							
MEAN WIND SPEED 13.73 M/S								
SIDE SPAN	-0.004	1.515	4.763	3.14	0.030	0.111	-0.567	5.09
NORTH CENTRE	0.239	0.987	3.043	3.08	0.055	0.088	0.307	3.51
CENTRE SPAN	0.442	2.538	-8.041	3.17	-0.067	0.245	0.778	3.18
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							
MEAN WIND SPEED 14.58 M/S								
SIDE SPAN	0.085	1.604	4.710	2.94	0.029	0.133	-0.591	4.44
NORTH CENTRE	0.200	1.068	-3.601	3.37	0.070	0.107	0.474	4.41
CENTRE SPAN	0.496	2.824	-10.585	3.75	-0.056	0.284	0.964	3.39
SOUTH CENTRE	***TRANSDUCER MALFUNCTION***							