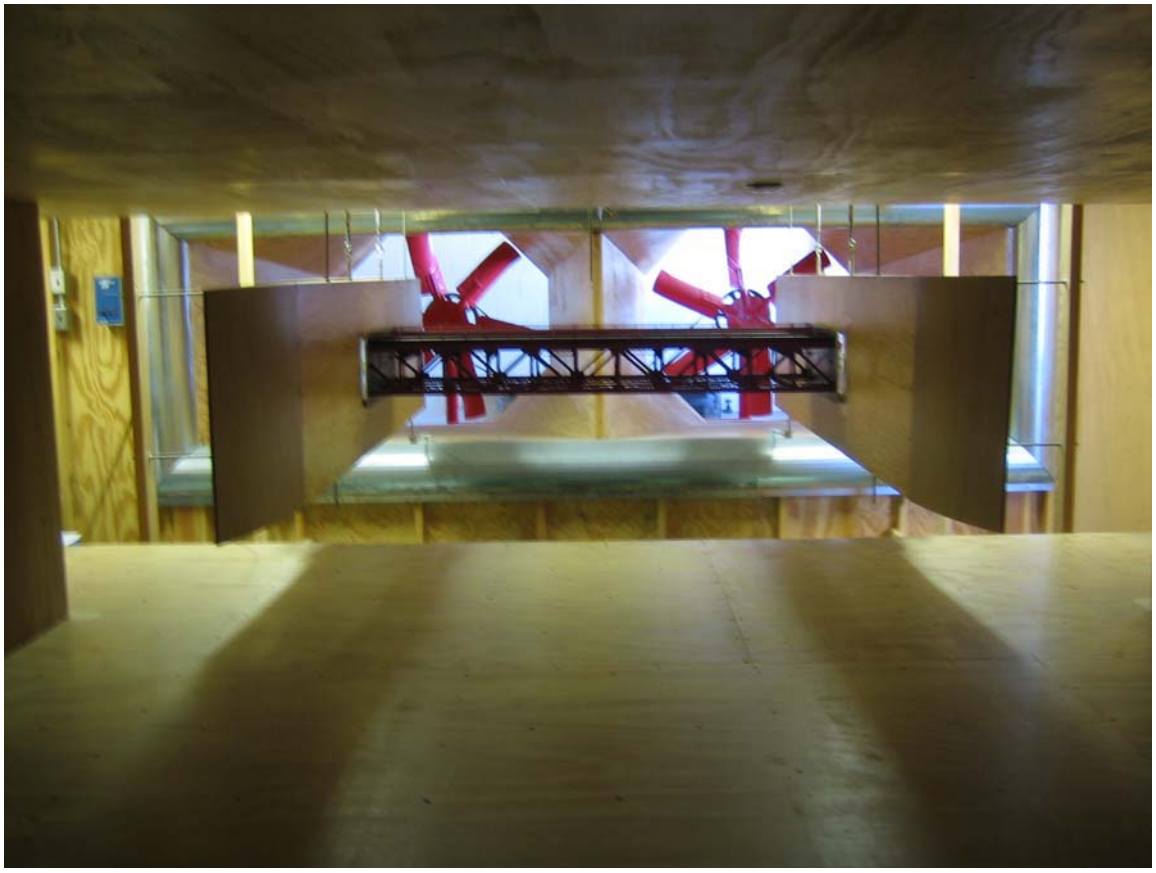
## APPENDIX 5
## MODELS

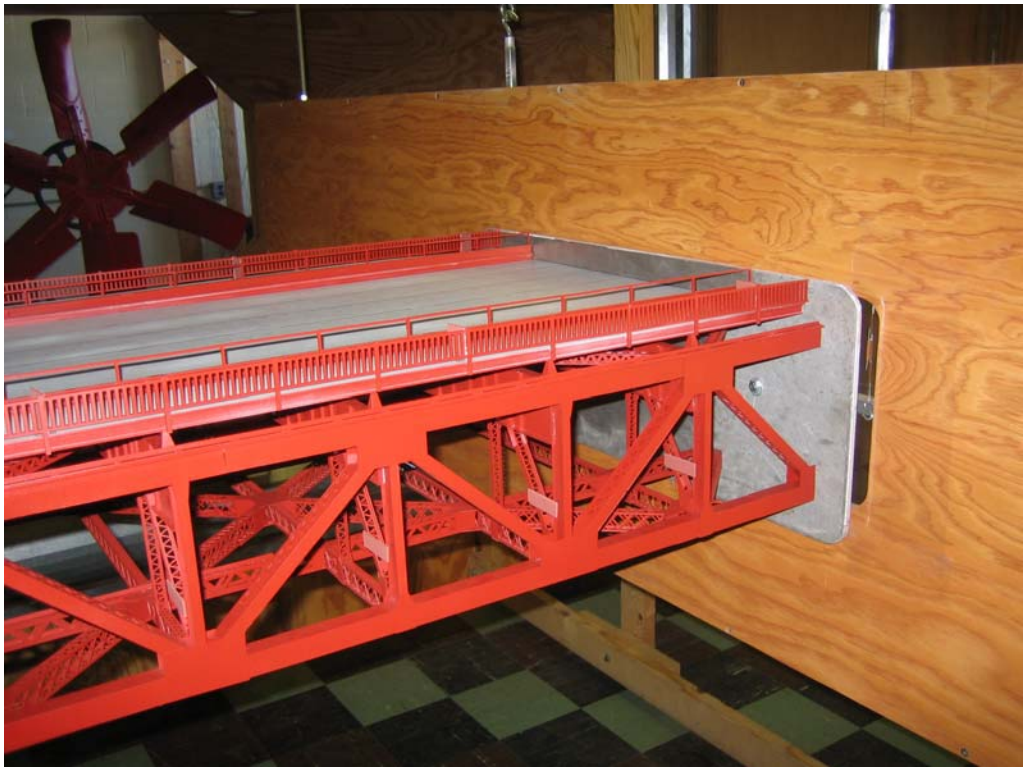
For this study the 1:50 scale model used in the previous study (Ref 2) was used. The model was lengthened to fit the new wind tunnel (see Appendix 2 - Facilities). The model is 1.6256 m long, which models a portion of the full-scale bridge deck 81.28 m (266.67 feet) long.

The model was made of laser cut plastic. As described in Appendices 3 and 4, the model needed to be geometrically correct only. Inertial and elastic scaling was not required.

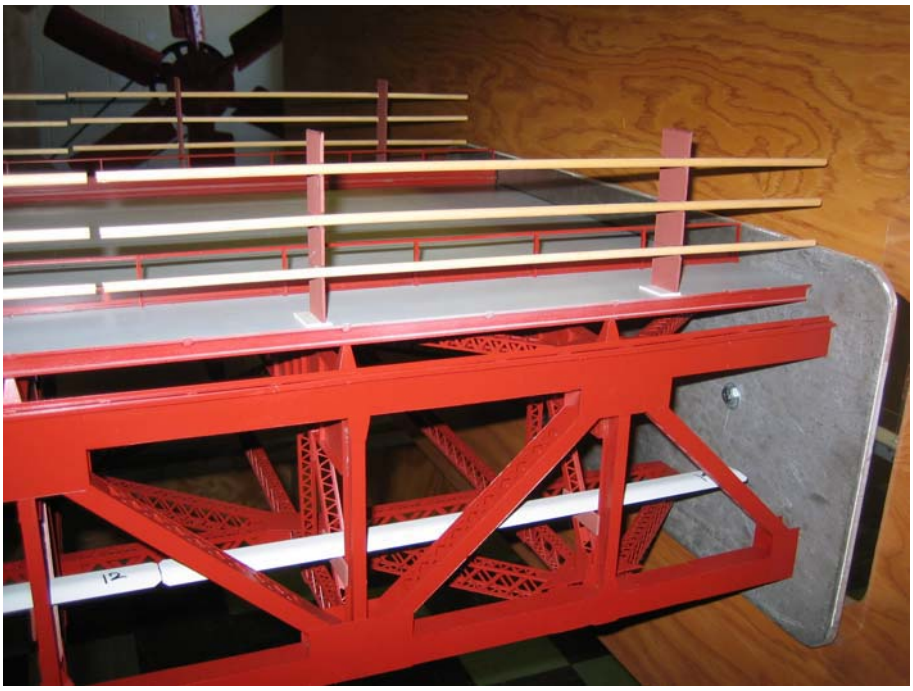
The model is shown in six configurations (the existing configuration and five suicide deterrent system configurations W0, W1, W1 (alternate), W2, W3, and W6) in the following photographs. Those configurations are defined in Section C.



Existing bridge (Test number W0)



Existing bridge (Test number W0)

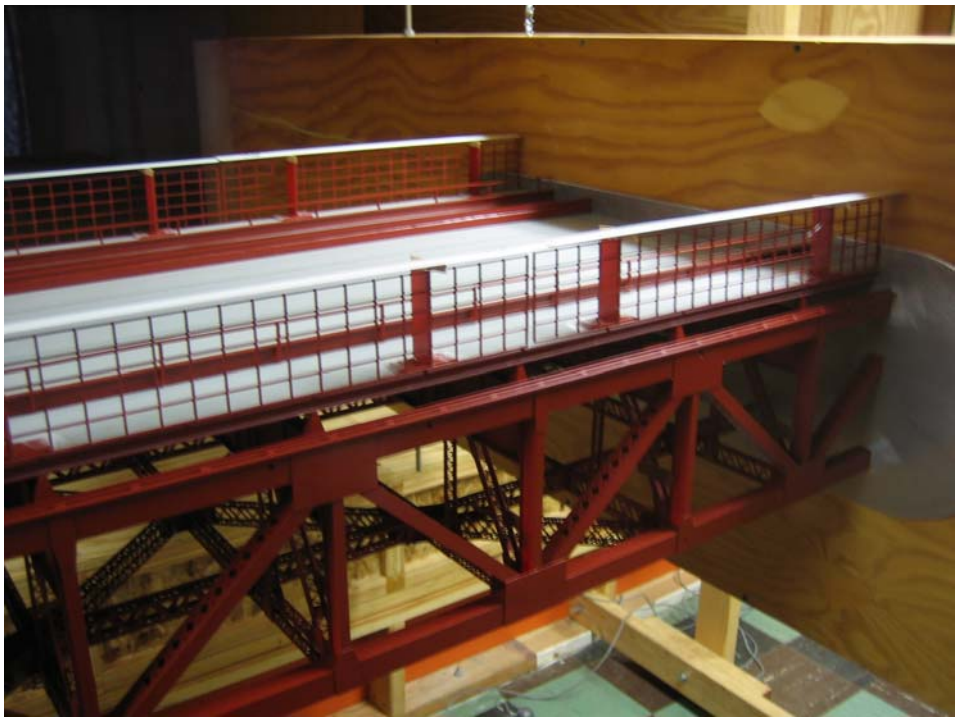


Vertical 12’ barrier with below deck winglets/catwalks (Test number W1)

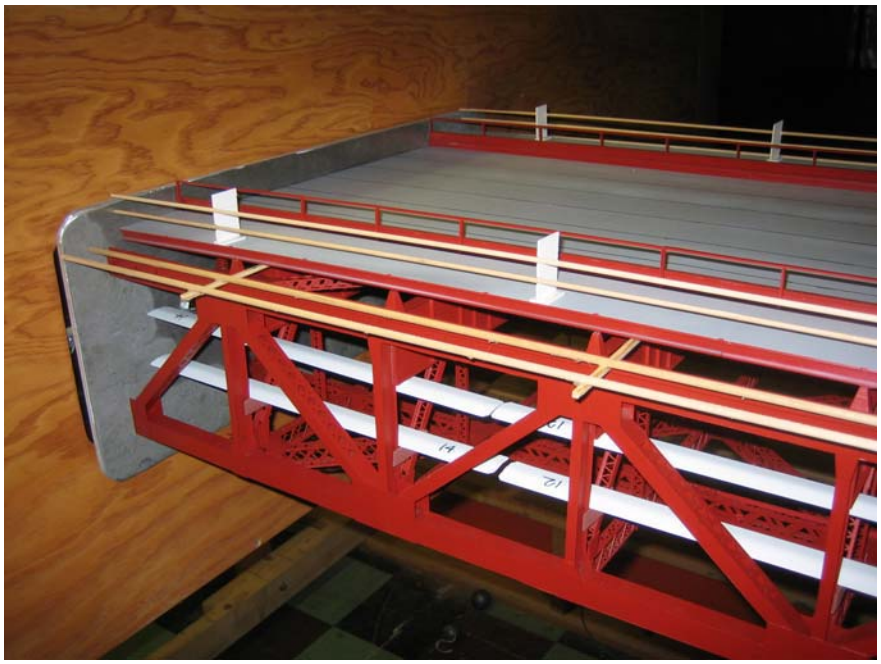
Vertical 12’ barrier with wind fairings (Test number W1 Alt.)

Vertical 12’ barrier with above deck winglets (Test number W2)

Adding to the existing railing and with above deck winglets (Test number W3)



Vertical 10’ barrier with above deck winglets (Test number W5)



Horizontally projecting 10’ barrier with a modified pedestrian railing and with below deck winglets/catwalks (Test number W6)

## APPENDIX 6
## BRIDGE PROPERTIES

Properties of the bridge structure needed for the time domain numerical simulations are nodal coordinates, deck mass per unit length, deck mass moment of inertia about a longitudinal axis (at the center of mass), and the dynamic response characteristics (mode shapes and frequencies). The inertial properties were taken from Ref 5. The dynamic response characteristics were provided by DMJM Harris Inc. and a description of the ADINA modeling is provided below.

In a previous study on the Golden Gate Bridge, damping ratios were deduced from observed bridge motions (Ref 5). A suitable damping ratio of 0.006 was deduced. This is consistent with values of 0.004 for new steel bridges with welded and/or high strength bolted connections, and 0.005 for composite concrete and steel construction (Ref 6). Older, riveted steel truss bridges would be expected to have a higher damping value. The linear viscous damping ratio of 0.006 was therefore considered to be reasonable, and was used for all modes of vibration.

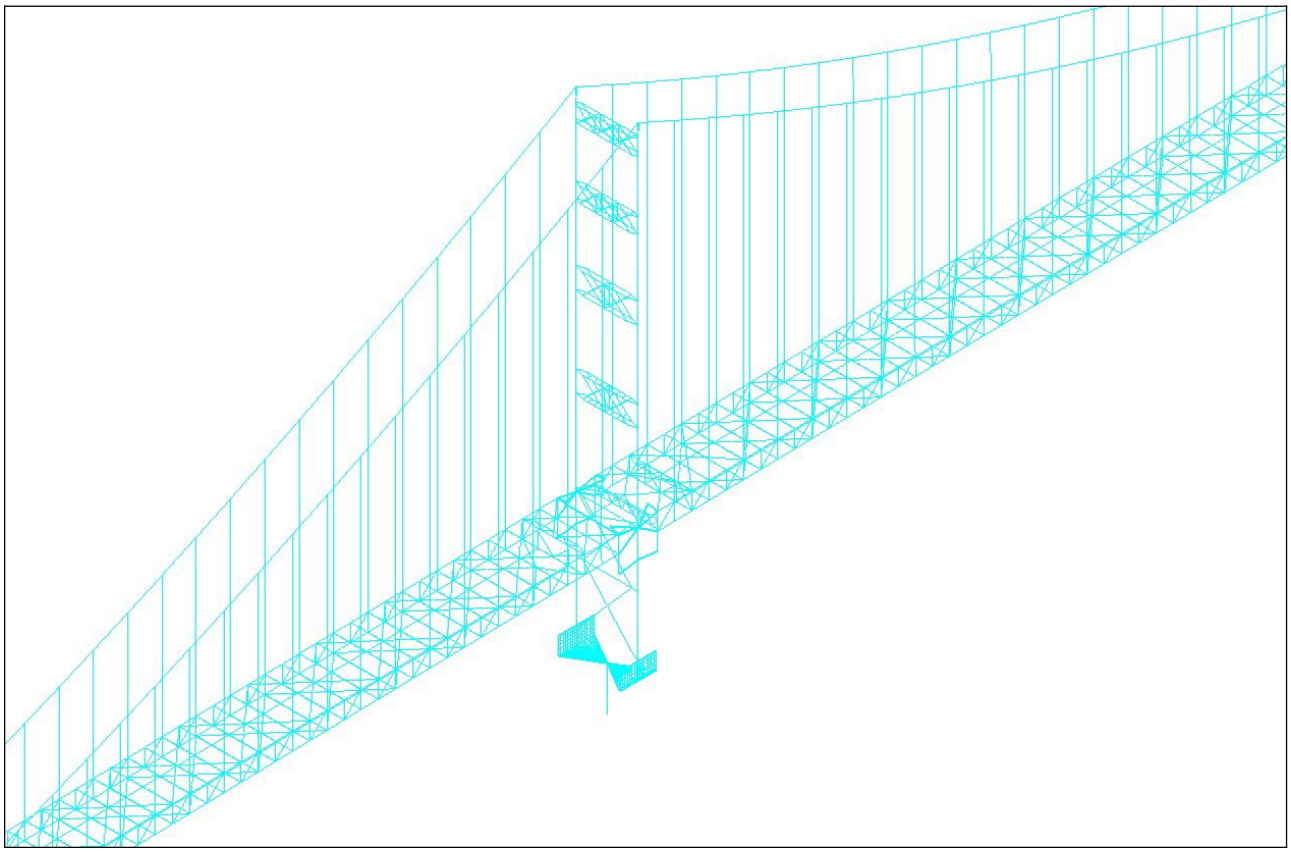
For the numerical simulations, wind speed time histories were generated at 30 locations along the span (approximately 60.96 m (200 feet) apart). Those nodal locations are defined in Table 6.1. The bridge properties used in this analysis are defined in Tables 6.2 through 6.13. The nodal locations are shown schematically in Figure 6.1. Positive coordinate directions (not standard) are shown in Figure 6.2.

### ADINA Modeling

The ADINA model used for the wind stability assessment of the bridge was prepared and converted by International Civil Engineering Consultants, Inc. (ICEC) of Berkeley, California, for the Golden Gate Bridge, Highway and Transportation District (GGBHTD) of San Francisco, California, under a contract agreement by and between GGBHTD and ICEC.

The model includes the suspension bridge, the suspended main and side spans of the bridge from the North to the South anchor block. This model was developed for the modal conversion of the ABAQUS computer model for the suspended structure of the Golden Gate Bridge. It represents the structural configuration of the suspended main and side spans including with the proposed seismic retrofit of the structure.

The modeling of the suspended structure is shown in the following Figure; all major members were explicitly modeled with using linear elastic beam elements for the suspended stiffening trusses (the chords, verticals, diagonals) and the main tower (shafts, struts, verticals and diagonal braces), elastic truss elements for main cables and rocker-links, nonlinear truss elements for the suspenders, tie-downs and wind braces, nonlinear truss and member elements for the plinths (the bottom sections of the main towers), super-element (consisting of an equivalent lumped-mass matrix) for pylon, etc. Nonlinear dampers were also considered in the ADINA model.



## Computation of Frequencies and Mode Shapes

The modal analysis for determining the modal frequencies with the associated mode shapes was performed using the Version of 7.4 of the ADINA computer program.

The first-twenty modal frequencies as obtained from the ADINA modal analysis are summarized in the following table.

***GGB Suicide Barrier Study***
***Frequencies per the Converted ADINA Computer Model***

| MODE NUMBER | FREQUENCY (Hz) | MODE SHAPE |
|---|---|---|
| 1 | 0.048749 | transverse, symmetric mode |
| 2 | 0.086225 | vertical, asymmetric mode |
| 3 | 0.111783 | transverse, asymmetric mode |
| 4 | 0.128540 | vertical, symmetric mode |
| 5 | 0.133075 | vertical, asymmetric mode |
| 6 | 0.163712 | vertical, symmetric mode |
| 7 | 0.183531 | torsional, asymmetric mode |
| 8 | 0.195726 | torsional-transverse, symmetric mode |
| 9 | 0.198024 | vertical, asymmetric mode |
| 10 | 0.203344 | cable transverse, symmetric mode |
| 11 | 0.204704 | torsional, symmetric mode |
| 12 | 0.208492 | cable transverse, asymmetric mode |
| 13 | 0.211595 | vertical, asymmetric mode |
| 14 | 0.216478 | cable transverse, asymmetric mode |
| 15 | 0.224156 | cable transverse, asymmetric mode |
| 16 | 0.258650 | vertical, symmetric mode |
| 17 | 0.264104 | transverse, asymmetric mode |
| 18 | 0.265155 | transverse, asymmetric mode |
| 19 | 0.282724 | vertical, symmetric mode |
| 20 | 0.286409 | torsional, symmetric mode |

**TABLE 6.1**

| WWL NODE | DMJM NODE |
|---|---|
| 1 | 100580 |
| 2 | 101380 |
| 3 | 102180 |
| 4 | 102980 |
| 5 | 103780 |
| 6 | 105330 |
| 7 | 106130 |
| 8 | 106930 |
| 9 | 107730 |
| 10 | 108530 |
| 11 | 109330 |
| 12 | 110130 |
| 13 | 110930 |
| 14 | 111730 |
| 15 | 112530 |
| 16 | 212530 |
| 17 | 211730 |
| 18 | 210930 |
| 19 | 210130 |
| 20 | 209330 |
| 21 | 208530 |
| 22 | 207730 |
| 23 | 206930 |
| 24 | 206130 |
| 25 | 205330 |
| 26 | 203780 |
| 27 | 202980 |
| 28 | 202180 |
| 29 | 201380 |
| 30 | 200580 |

**TABLE 6.2**

**B(M)= 27.432**
**NUMBER OF MODES= 10**
**NUMBER OF NODES= 30**

| NODE | DL(M) | M(KG/M) | MMI(KG*M^2/M) |
|---|---|---|---|
| 1 | 60.96 | 29123 | 4.168E+06 |
| 2 | 60.96 | 29123 | 4.168E+06 |
| 3 | 60.96 | 29123 | 4.168E+06 |
| 4 | 60.96 | 29123 | 4.168E+06 |
| 5 | 60.96 | 29123 | 4.168E+06 |
| 6 | 60.96 | 29123 | 4.168E+06 |
| 7 | 60.96 | 29123 | 4.168E+06 |
| 8 | 60.96 | 29123 | 4.168E+06 |
| 9 | 60.96 | 29123 | 4.168E+06 |
| 10 | 60.96 | 29123 | 4.168E+06 |
| 11 | 60.96 | 29123 | 4.168E+06 |
| 12 | 60.96 | 29123 | 4.168E+06 |
| 13 | 60.96 | 29123 | 4.168E+06 |
| 14 | 60.96 | 29123 | 4.168E+06 |
| 15 | 60.96 | 29123 | 4.168E+06 |
| 16 | 60.96 | 29123 | 4.168E+06 |
| 17 | 60.96 | 29123 | 4.168E+06 |
| 18 | 60.96 | 29123 | 4.168E+06 |
| 19 | 60.96 | 29123 | 4.168E+06 |
| 20 | 60.96 | 29123 | 4.168E+06 |
| 21 | 60.96 | 29123 | 4.168E+06 |
| 22 | 60.96 | 29123 | 4.168E+06 |
| 23 | 60.96 | 29123 | 4.168E+06 |
| 24 | 60.96 | 29123 | 4.168E+06 |
| 25 | 60.96 | 29123 | 4.168E+06 |
| 26 | 60.96 | 29123 | 4.168E+06 |
| 27 | 60.96 | 29123 | 4.168E+06 |
| 28 | 60.96 | 29123 | 4.168E+06 |
| 29 | 60.96 | 29123 | 4.168E+06 |
| 30 | 60.96 | 29123 | 4.168E+06 |

**TABLE 6.3**

| WWL MODE | DMJM MODE | WR(RPS) | DR | MT | MRAT |
|---|---|---|---|---|---|
| 1 | 1 | 0.306 | 0.006 | 1.000 | 0.849 |
| 2 | 2 | 0.542 | 0.006 | 2.000 | 0.501 |
| 3 | 3 | 0.702 | 0.006 | 1.000 | 1.000 |
| 4 | 4 | 0.808 | 0.006 | 2.000 | 0.795 |
| 5 | 5 | 0.836 | 0.006 | 2.000 | 0.271 |
| 6 | 6 | 1.029 | 0.006 | 2.000 | 0.773 |
| 7 | 7 | 1.153 | 0.006 | 3.000 | 0.730 |
| 8 | 8 | 1.230 | 0.006 | 1.000 | 0.813 |
| 9 | 9 | 1.244 | 0.006 | 2.000 | 0.728 |
| 10 | 10 | 1.278 | 0.006 | 1.000 | 0.930 |

**MT=1 FOR SWAY, 2 FOR VERTICAL, 3 FOR TORSION**
**MRAT IS THE RATIO OF GENERALIZED MASS ASSOCIATED WITH DECK MOTION TO THE TOTAL GENERALIZED MASS**

**TABLE 6.4**

**WWL MODE 1**
**DMJM MODE 1**

| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | -0.0004 | 0.0000 | -0.0000 |
| 2 | -0.0009 | 0.0000 | -0.0000 |
| 3 | -0.0013 | 0.0000 | -0.0000 |
| 4 | -0.0015 | 0.0000 | -0.0000 |
| 5 | -0.0016 | 0.0000 | -0.0000 |
| 6 | -0.1461 | 0.0000 | 0.0000 |
| 7 | -0.3033 | 0.0000 | -0.0000 |
| 8 | -0.4506 | -0.0000 | -0.0001 |
| 9 | -0.5844 | 0.0000 | -0.0001 |
| 10 | -0.7023 | 0.0000 | -0.0002 |
| 11 | -0.8022 | 0.0000 | -0.0002 |
| 12 | -0.8827 | 0.0000 | -0.0002 |
| 13 | -0.9424 | -0.0000 | -0.0001 |
| 14 | -0.9813 | -0.0000 | -0.0001 |
| 15 | -1.0000 | -0.0000 | -0.0000 |
| 16 | -1.0000 | 0.0000 | -0.0000 |
| 17 | -0.9814 | 0.0000 | -0.0001 |
| 18 | -0.9426 | 0.0000 | -0.0002 |
| 19 | -0.8830 | -0.0000 | -0.0002 |
| 20 | -0.8025 | -0.0000 | -0.0002 |
| 21 | -0.7025 | -0.0000 | -0.0002 |
| 22 | -0.5843 | -0.0000 | -0.0001 |
| 23 | -0.4503 | -0.0000 | -0.0001 |
| 24 | -0.3031 | -0.0000 | -0.0000 |
| 25 | -0.1459 | -0.0000 | 0.0000 |
| 26 | -0.0015 | -0.0000 | -0.0000 |
| 27 | -0.0014 | -0.0000 | -0.0000 |
| 28 | -0.0012 | -0.0000 | -0.0000 |
| 29 | -0.0008 | -0.0000 | -0.0000 |
| 30 | -0.0003 | -0.0000 | -0.0000 |

**TABLE 6.5**

**WWL MODE 2**
**DMJM MODE 2**

| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | 0.0001 | 0.0254 | 0.0000 |
| 2 | 0.0001 | 0.0535 | -0.0000 |
| 3 | 0.0000 | 0.0642 | -0.0000 |
| 4 | 0.0000 | 0.0573 | -0.0000 |
| 5 | 0.0000 | 0.0334 | -0.0000 |
| 6 | -0.0000 | 0.2809 | 0.0000 |
| 7 | -0.0001 | 0.5575 | -0.0000 |
| 8 | -0.0001 | 0.7770 | 0.0000 |
| 9 | -0.0000 | 0.9262 | 0.0000 |
| 10 | -0.0001 | 0.9951 | 0.0000 |
| 11 | -0.0000 | 0.9772 | 0.0000 |
| 12 | -0.0001 | 0.8732 | 0.0000 |
| 13 | -0.0000 | 0.6896 | 0.0000 |
| 14 | -0.0000 | 0.4406 | 0.0000 |
| 15 | -0.0000 | 0.1487 | 0.0000 |
| 16 | 0.0000 | -0.1579 | 0.0000 |
| 17 | 0.0001 | -0.4495 | 0.0000 |
| 18 | 0.0001 | -0.6978 | -0.0000 |
| 19 | 0.0002 | -0.8806 | -0.0000 |
| 20 | 0.0003 | -0.9834 | -0.0000 |
| 21 | 0.0003 | -1.0000 | -0.0000 |
| 22 | 0.0002 | -0.9299 | 0.0000 |
| 23 | 0.0001 | -0.7794 | -0.0000 |
| 24 | 0.0001 | -0.5588 | -0.0000 |
| 25 | 0.0000 | -0.2813 | -0.0000 |
| 26 | -0.0000 | -0.0329 | -0.0000 |
| 27 | -0.0000 | -0.0564 | -0.0000 |
| 28 | -0.0000 | -0.0633 | 0.0000 |
| 29 | -0.0000 | -0.0526 | -0.0000 |
| 30 | -0.0000 | -0.0250 | -0.0000 |

**TABLE 6.6**

**WWL MODE 3**
**DMJM MODE 3**

| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | -0.0011 | 0.0000 | 0.0001 |
| 2 | -0.0023 | 0.0000 | 0.0001 |
| 3 | -0.0031 | 0.0000 | 0.0001 |
| 4 | -0.0034 | 0.0000 | 0.0001 |
| 5 | -0.0032 | 0.0000 | 0.0000 |
| 6 | -0.2843 | 0.0000 | 0.0007 |
| 7 | -0.5664 | 0.0001 | 0.0007 |
| 8 | -0.7893 | -0.0001 | 0.0007 |
| 9 | -0.9352 | -0.0000 | 0.0005 |
| 10 | -0.9951 | -0.0000 | 0.0004 |
| 11 | -0.9660 | -0.0001 | 0.0003 |
| 12 | -0.8528 | -0.0001 | 0.0001 |
| 13 | -0.6658 | -0.0001 | 0.0000 |
| 14 | -0.4231 | -0.0002 | -0.0001 |
| 15 | -0.1467 | -0.0003 | -0.0003 |
| 16 | 0.1418 | -0.0001 | -0.0004 |
| 17 | 0.4208 | -0.0001 | -0.0004 |
| 18 | 0.6662 | 0.0000 | -0.0003 |
| 19 | 0.8557 | 0.0000 | -0.0002 |
| 20 | 0.9704 | 0.0001 | -0.0001 |
| 21 | 1.0000 | 0.0001 | -0.0002 |
| 22 | 0.9393 | 0.0001 | -0.0004 |
| 23 | 0.7921 | 0.0001 | -0.0005 |
| 24 | 0.5681 | 0.0001 | -0.0007 |
| 25 | 0.2849 | 0.0001 | -0.0006 |
| 26 | 0.0029 | 0.0000 | -0.0000 |
| 27 | 0.0030 | 0.0000 | -0.0001 |
| 28 | 0.0028 | 0.0000 | -0.0001 |
| 29 | 0.0021 | 0.0000 | -0.0001 |
| 30 | 0.0010 | 0.0000 | -0.0000 |

**TABLE 6.7**

**WWL MODE 4**
**DMJM MODE 4**

| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | 0.0003 | 0.1316 | 0.0000 |
| 2 | 0.0003 | 0.2810 | -0.0000 |
| 3 | 0.0003 | 0.3397 | -0.0000 |
| 4 | 0.0002 | 0.3019 | -0.0000 |
| 5 | 0.0001 | 0.1743 | 0.0000 |
| 6 | -0.0000 | 0.1171 | -0.0000 |
| 7 | -0.0000 | 0.1911 | -0.0000 |
| 8 | -0.0000 | 0.1798 | -0.0000 |
| 9 | 0.0001 | 0.0826 | 0.0000 |
| 10 | 0.0001 | -0.0863 | -0.0000 |
| 11 | 0.0001 | -0.3035 | -0.0000 |
| 12 | 0.0001 | -0.5373 | -0.0000 |
| 13 | 0.0000 | -0.7526 | -0.0000 |
| 14 | -0.0001 | -0.9157 | -0.0000 |
| 15 | -0.0001 | -1.0000 | -0.0000 |
| 16 | 0.0004 | -0.9920 | 0.0000 |
| 17 | 0.0003 | -0.8922 | 0.0000 |
| 18 | 0.0001 | -0.7158 | 0.0000 |
| 19 | 0.0000 | -0.4906 | 0.0000 |
| 20 | -0.0001 | -0.2516 | 0.0000 |
| 21 | -0.0003 | -0.0343 | 0.0000 |
| 22 | -0.0003 | 0.1297 | 0.0000 |
| 23 | -0.0001 | 0.2178 | 0.0000 |
| 24 | -0.0001 | 0.2171 | 0.0000 |
| 25 | -0.0000 | 0.1297 | 0.0000 |
| 26 | 0.0001 | 0.1678 | 0.0000 |
| 27 | 0.0001 | 0.2905 | -0.0000 |
| 28 | 0.0001 | 0.3268 | -0.0000 |
| 29 | 0.0002 | 0.2703 | -0.0000 |
| 30 | 0.0001 | 0.1265 | 0.0000 |

**TABLE 6.8**

**WWL MODE 5**
**DMJM MODE 5**

| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | 0.0003 | 0.1121 | 0.0000 |
| 2 | 0.0003 | 0.2396 | -0.0000 |
| 3 | 0.0002 | 0.2899 | -0.0000 |
| 4 | 0.0002 | 0.2575 | -0.0000 |
| 5 | 0.0001 | 0.1484 | 0.0000 |
| 6 | 0.0000 | -0.2509 | -0.0000 |
| 7 | 0.0001 | -0.5174 | -0.0000 |
| 8 | 0.0002 | -0.7477 | -0.0000 |
| 9 | 0.0001 | -0.9115 | -0.0000 |
| 10 | 0.0001 | -0.9845 | -0.0000 |
| 11 | 0.0000 | -0.9537 | -0.0000 |
| 12 | 0.0001 | -0.8220 | -0.0000 |
| 13 | 0.0000 | -0.6054 | -0.0000 |
| 14 | -0.0001 | -0.3310 | -0.0000 |
| 15 | -0.0002 | -0.0287 | -0.0000 |
| 16 | -0.0003 | 0.2734 | 0.0000 |
| 17 | -0.0006 | 0.5499 | 0.0000 |
| 18 | -0.0007 | 0.7769 | 0.0000 |
| 19 | -0.0009 | 0.9327 | 0.0000 |
| 20 | -0.0009 | 1.0000 | 0.0000 |
| 21 | -0.0009 | 0.9733 | 0.0000 |
| 22 | -0.0007 | 0.8585 | 0.0000 |
| 23 | -0.0003 | 0.6747 | 0.0000 |
| 24 | -0.0002 | 0.4493 | 0.0000 |
| 25 | -0.0001 | 0.2117 | 0.0000 |
| 26 | -0.0001 | -0.1914 | -0.0000 |
| 27 | -0.0001 | -0.3320 | 0.0000 |
| 28 | -0.0002 | -0.3736 | 0.0000 |
| 29 | -0.0002 | -0.3088 | 0.0000 |
| 30 | -0.0001 | -0.1443 | -0.0000 |

**TABLE 6.9**

**WWL MODE 6**
**DMJM MODE 6**

| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | 0.0007 | 0.2673 | 0.0000 |
| 2 | 0.0008 | 0.5797 | 0.0000 |
| 3 | 0.0007 | 0.7064 | -0.0000 |
| 4 | 0.0005 | 0.6265 | -0.0000 |
| 5 | 0.0002 | 0.3581 | 0.0000 |
| 6 | -0.0000 | -0.3399 | 0.0000 |
| 7 | 0.0001 | -0.6736 | 0.0000 |
| 8 | 0.0001 | -0.9080 | 0.0000 |
| 9 | -0.0001 | -0.9962 | -0.0000 |
| 10 | -0.0001 | -0.9206 | -0.0000 |
| 11 | -0.0001 | -0.6961 | 0.0000 |
| 12 | -0.0001 | -0.3728 | 0.0000 |
| 13 | -0.0000 | -0.0233 | 0.0000 |
| 14 | 0.0001 | 0.2700 | 0.0000 |
| 15 | 0.0002 | 0.4362 | -0.0000 |
| 16 | -0.0007 | 0.4358 | -0.0000 |
| 17 | -0.0005 | 0.2687 | -0.0000 |
| 18 | -0.0001 | -0.0255 | -0.0000 |
| 19 | 0.0002 | -0.3758 | -0.0000 |
| 20 | 0.0005 | -0.6997 | -0.0000 |
| 21 | 0.0006 | -0.9245 | -0.0000 |
| 22 | 0.0006 | -1.0000 | -0.0000 |
| 23 | 0.0002 | -0.9111 | -0.0000 |
| 24 | 0.0002 | -0.6757 | -0.0000 |
| 25 | 0.0001 | -0.3408 | -0.0000 |
| 26 | 0.0001 | 0.3625 | 0.0000 |
| 27 | 0.0002 | 0.6340 | 0.0000 |
| 28 | 0.0003 | 0.7149 | -0.0000 |
| 29 | 0.0003 | 0.5866 | 0.0000 |
| 30 | 0.0002 | 0.2705 | 0.0000 |

**TABLE 6.10**

**WWL MODE 7**
**DMJM MODE 7**

| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | 0.0027 | -0.0000 | -0.0003 |
| 2 | 0.0049 | -0.0000 | -0.0006 |
| 3 | 0.0059 | -0.0000 | -0.0007 |
| 4 | 0.0058 | -0.0000 | -0.0006 |
| 5 | 0.0045 | -0.0000 | -0.0004 |
| 6 | -0.1171 | 0.0001 | 0.0221 |
| 7 | -0.1827 | 0.0000 | 0.0412 |
| 8 | -0.2264 | 0.0004 | 0.0568 |
| 9 | -0.2438 | 0.0001 | 0.0677 |
| 10 | -0.2375 | -0.0002 | 0.0729 |
| 11 | -0.2111 | -0.0002 | 0.0718 |
| 12 | -0.1692 | -0.0002 | 0.0645 |
| 13 | -0.1160 | -0.0001 | 0.0517 |
| 14 | -0.0571 | 0.0005 | 0.0346 |
| 15 | 0.0030 | 0.0015 | 0.0145 |
| 16 | 0.0507 | 0.0007 | -0.0072 |
| 17 | 0.0865 | 0.0003 | -0.0286 |
| 18 | 0.1138 | 0.0001 | -0.0474 |
| 19 | 0.1335 | 0.0001 | -0.0618 |
| 20 | 0.1467 | 0.0001 | -0.0704 |
| 21 | 0.1549 | 0.0001 | -0.0725 |
| 22 | 0.1570 | 0.0001 | -0.0678 |
| 23 | 0.1486 | 0.0002 | -0.0572 |
| 24 | 0.1243 | -0.0000 | -0.0417 |
| 25 | 0.0875 | -0.0000 | -0.0223 |
| 26 | -0.0008 | -0.0001 | -0.0003 |
| 27 | -0.0008 | -0.0002 | -0.0004 |
| 28 | -0.0006 | -0.0003 | -0.0005 |
| 29 | -0.0002 | -0.0002 | -0.0004 |
| 30 | 0.0003 | -0.0001 | -0.0002 |

**TABLE 6.11**

**WWL MODE 8**
**DMJM MODE 8**

| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | 0.0608 | -0.0000 | -0.0103 |
| 2 | 0.0982 | 0.0001 | -0.0194 |
| 3 | 0.1124 | 0.0004 | -0.0228 |
| 4 | 0.1052 | 0.0005 | -0.0205 |
| 5 | 0.0756 | 0.0006 | -0.0128 |
| 6 | -0.3503 | 0.0001 | -0.0012 |
| 7 | -0.6804 | 0.0002 | -0.0002 |
| 8 | -0.8943 | 0.0001 | 0.0049 |
| 9 | -0.9601 | -0.0004 | 0.0140 |
| 10 | -0.8780 | -0.0009 | 0.0260 |
| 11 | -0.6736 | -0.0012 | 0.0399 |
| 12 | -0.3958 | -0.0012 | 0.0540 |
| 13 | -0.1041 | -0.0008 | 0.0669 |
| 14 | 0.1376 | -0.0006 | 0.0769 |
| 15 | 0.2742 | -0.0003 | 0.0832 |
| 16 | 0.2786 | 0.0001 | 0.0850 |
| 17 | 0.1453 | 0.0005 | 0.0819 |
| 18 | -0.1002 | 0.0007 | 0.0741 |
| 19 | -0.4021 | 0.0008 | 0.0625 |
| 20 | -0.6935 | 0.0006 | 0.0487 |
| 21 | -0.9111 | 0.0003 | 0.0344 |
| 22 | -1.0000 | -0.0002 | 0.0214 |
| 23 | -0.9320 | -0.0005 | 0.0111 |
| 24 | -0.7094 | -0.0005 | 0.0043 |
| 25 | -0.3672 | -0.0003 | 0.0012 |
| 26 | 0.0770 | 0.0002 | -0.0131 |
| 27 | 0.1074 | -0.0002 | -0.0210 |
| 28 | 0.1149 | -0.0004 | -0.0233 |
| 29 | 0.1005 | -0.0005 | -0.0198 |
| 30 | 0.0622 | -0.0003 | -0.0105 |

**TABLE 6.12**

**WWL MODE 9**
**DMJM MODE 9**

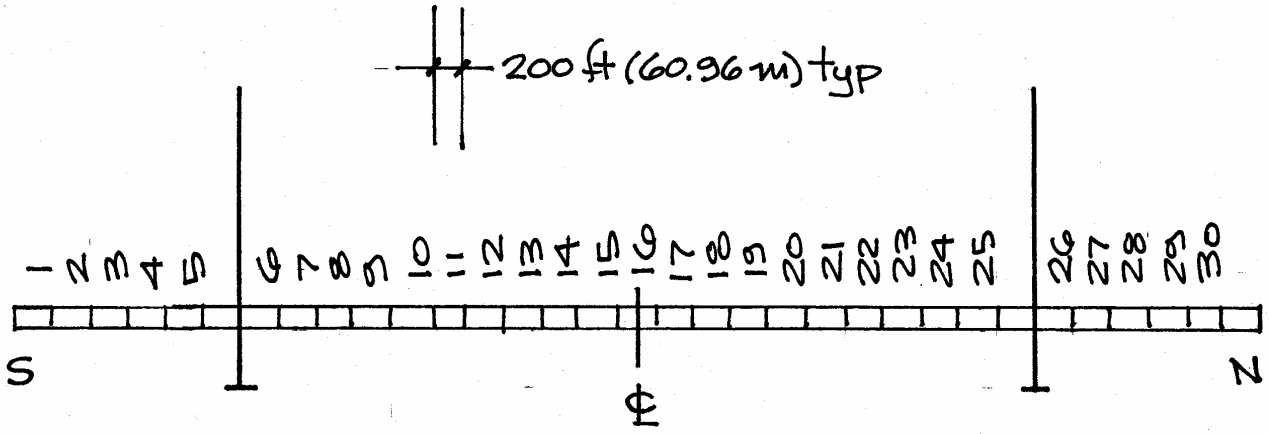
| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | 0.0011 | 0.3666 | 0.0000 |
| 2 | 0.0014 | 0.8117 | -0.0000 |
| 3 | 0.0013 | 1.0000 | -0.0000 |
| 4 | 0.0010 | 0.8854 | -0.0000 |
| 5 | 0.0005 | 0.5005 | 0.0000 |
| 6 | 0.0001 | 0.0469 | -0.0000 |
| 7 | 0.0003 | 0.0835 | -0.0000 |
| 8 | 0.0003 | 0.0915 | -0.0000 |
| 9 | 0.0004 | 0.0704 | -0.0000 |
| 10 | 0.0004 | 0.0289 | -0.0000 |
| 11 | 0.0003 | -0.0190 | -0.0000 |
| 12 | 0.0001 | -0.0572 | -0.0000 |
| 13 | -0.0000 | -0.0724 | -0.0000 |
| 14 | -0.0001 | -0.0591 | -0.0000 |
| 15 | -0.0002 | -0.0227 | -0.0000 |
| 16 | -0.0002 | 0.0226 | -0.0000 |
| 17 | -0.0002 | 0.0590 | 0.0000 |
| 18 | -0.0000 | 0.0721 | 0.0000 |
| 19 | 0.0001 | 0.0568 | 0.0000 |
| 20 | 0.0003 | 0.0185 | 0.0000 |
| 21 | 0.0004 | -0.0295 | 0.0000 |
| 22 | 0.0005 | -0.0710 | 0.0000 |
| 23 | 0.0004 | -0.0919 | 0.0000 |
| 24 | 0.0003 | -0.0838 | 0.0000 |
| 25 | 0.0001 | -0.0470 | 0.0000 |
| 26 | -0.0002 | -0.4968 | -0.0000 |
| 27 | -0.0004 | -0.8790 | 0.0000 |
| 28 | -0.0005 | -0.9928 | 0.0000 |
| 29 | -0.0005 | -0.8061 | 0.0000 |
| 30 | -0.0003 | -0.3642 | -0.0000 |

**TABLE 6.13**

**WWL MODE 10**
**DMJM MODE 10**

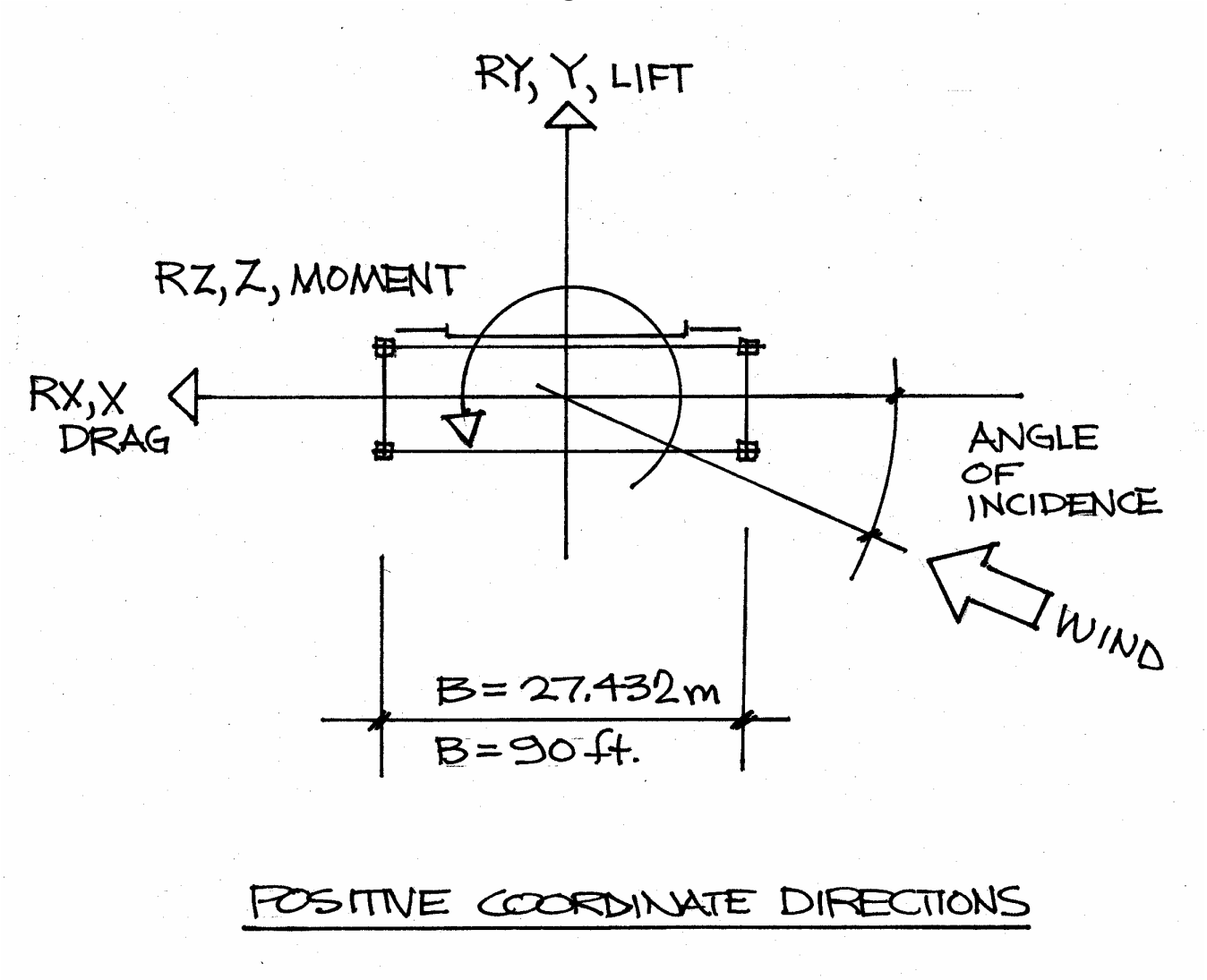
| NODE | RX | RY | RZ |
|---|---|---|---|
| 1 | 0.0585 | -0.0004 | -0.0095 |
| 2 | 0.0960 | -0.0008 | -0.0179 |
| 3 | 0.1106 | -0.0008 | -0.0210 |
| 4 | 0.1035 | -0.0006 | -0.0189 |
| 5 | 0.0740 | -0.0001 | -0.0118 |
| 6 | 0.4239 | 0.0008 | -0.0019 |
| 7 | 0.7931 | 0.0012 | 0.0010 |
| 8 | 0.9919 | 0.0016 | 0.0079 |
| 9 | 0.9917 | 0.0009 | 0.0178 |
| 10 | 0.8015 | -0.0001 | 0.0297 |
| 11 | 0.4594 | -0.0009 | 0.0421 |
| 12 | 0.0320 | -0.0015 | 0.0537 |
| 13 | -0.3981 | -0.0017 | 0.0635 |
| 14 | -0.7451 | -0.0012 | 0.0706 |
| 15 | -0.9370 | -0.0003 | 0.0741 |
| 16 | -0.9374 | 0.0007 | 0.0738 |
| 17 | -0.7448 | 0.0016 | 0.0696 |
| 18 | -0.3954 | 0.0020 | 0.0621 |
| 19 | 0.0383 | 0.0016 | 0.0521 |
| 20 | 0.4688 | 0.0008 | 0.0403 |
| 21 | 0.8116 | -0.0003 | 0.0279 |
| 22 | 1.0000 | -0.0013 | 0.0160 |
| 23 | 0.9976 | -0.0019 | 0.0062 |
| 24 | 0.7972 | -0.0016 | -0.0003 |
| 25 | 0.4264 | -0.0009 | -0.0026 |
| 26 | 0.0738 | 0.0007 | -0.0121 |
| 27 | 0.1037 | 0.0008 | -0.0193 |
| 28 | 0.1110 | 0.0007 | -0.0215 |
| 29 | 0.0967 | 0.0004 | -0.0183 |
| 30 | 0.0591 | 0.0001 | -0.0097 |

**Figure 6.1**




WEST WIND LABORATORY NODE NUMBERS

**Figure 6.2**


RY, Y, LIFT
RZ, Z, MOMENT
RX, X
DRAG
ANGLE
OF
INCIDENCE
WIND
B = 27.432m
B = 90 ft.
POSITIVE COORDINATE DIRECTIONS

## APPENDIX 7
## REFERENCES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