

MONOPOLE TOWER REPORT

Structural Analysis Report

Proposed Antennae Configuration
Existing 100 ft. Monopole Tower
Hwy 20 / 67 SITE # TX0068A
Dallas, Texas

MEI PROJECT # 99-047 *Site # 135*

For

NEXTEL OF TEXAS
Dallas, Texas



Prepared By:
[Signature]

E. Mark Malouf, PE
Registered Professional Engineer
Texas # 64167

January 29, 1999



received
1-29-99

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TOWER HISTORY / DATA

A stress analysis is performed by MEI as requested and authorized by Mr. Kenneth Self, Nextel, to determine whether the existing tower will be in compliance with TIA/EIA 222-F Standard at the code required wind speed when supporting the provided proposed antenna configuration.

The following tower information has been made available or is known :

| | Type of Information |
|--|--|
| Tower Height & Type / Owner | 100 ft Monopole Tower / AT&T Wireless, Dallas, Texas – Site #135 |
| Original Designer Fabricator | VALMONT, VALLEY, NE |
| Origination Date | 1992 |
| Tower Model & Configuration | 12 Sided - made of uniformly tapered slip-joint sections. Base Diameter across flats varying from 32.89 inches Width Across Flats at the base to 16.48 inches Width Across Flats at the top with a uniform taper and is fabricated of two (2) 12-sided tubular sections. |
| Original Wind load Requirements | TIA /EIA-222 – Unknown |

INFORMATION SUPPLIED FOR ANALYSIS:

All tower information used in the analysis was obtained as follows:

| | Supplied By | Type of Information |
|-------------------|--------------------------|--|
| Tower Mast | MEI SITE SURVEY | Tower pole information as per MEI limited Site Mapping performed on 1/28/99 (MTSI climbing subcontractor). |
| Antennas | MEI SITE SURVEY / NEXTEL | Existing antennas information as per MEI limited Site Mapping. Proposed antenna information as per Kenneth Self, Nextel, via fax on 01/21/99. |
| Foundation | AT&T WIRELESS | Foundation data as per drawing by Valmont Order # 10888-92, dated 6/24/92, was made available by David Draper, ATTWS on 1/22/99. No Soil data available. |

Tower data and antenna location and type used in analysis is based on and is as accurate as the data furnished. Please review tower and antenna loading and if any discrepancies are noted, please notify MEI.

MATERIALS INFORMATION USED IN ANALYSIS:

Data on steel strength was *Not* available from the data furnished, the following values were *assumed* and used for this structural analysis, which is common for poles of this type:

| | |
|-------------------------|---|
| Tower Mast | Shaft : ASTM S-22 - 65 Ksi Yield Strength |
| Splice Type | Slip-Joint connections |
| Anchor Bolt Type | Unknown |

ANALYSIS

The purpose of this independent stress analysis review is to determine that the existing tower design is in conformance to the ANSI/TIA/EIA 222-F Standard requirements for the proposed antennae loads installation by NEXTEL.

The proprietary Monopole Tower Computer Program provides a complete and rigorous analysis based on a three-dimensional, cantilevered pole type structure with a fixed base. The computer program analyzes Round, 12-sided, 16-sided or 18-sided monopole towers. The wind is applied to all members with the appropriate shape factors according to code. This existing tower is assumed, for the purpose of this analysis, to have been properly maintained and to be in good condition with no structural defects and with no deterioration to its member capacities. All welds and connections are assumed to develop at least the member capacity. This analysis is based on data supplied and on the limited site inspection performed by MEI.

The subject tower is analyzed for conformance with the following:

| | |
|----------------------------------|---|
| Minimum Code Requirements | Dallas County Area, Texas ANSI/TIA/EIA 222-F Standard 70 Mph basic wind speed |
| Present Analysis | ANSI/TIA/EIA 222-F Standard – June 1996 |
| Basic wind speed Used | 75 Mph with 0" ice – controls over 65 Mph + 1/2" ice condition (Increased wind speed 5 Mph for Site Location Importance). The EIA Standard recommends, when installing new antennas to an existing structure, the structural analysis should be performed in accordance to the new version of the Standard. |

ANTENNA LOADS

The following antenna loading configuration was considered:

| NO | ELEVATION | APPURTENANCES DESCRIPTION | TRANSMISSION LINES |
|----|------------|--|--|
| | FT | PROPOSED | |
| 1. | 80.0 c.l. | (9) DB874H105 Panel Antennas on 14 ft Low Profile Cellular Platform – Nextel | (9) 7/8" Dia. – internal up to 75' then external |
| | | EXISTING | |
| 1. | 105.0 base | 2' Omni Whip Antenna – ATTWS | (1) 1/2" Dia. – internal |
| 2. | 103.0 c.l. | (9) DB834H85RF-F Panel Antennas – ATTWS | (3) 7/8" Dia. / (6) 1/2" Dia. – internal |
| 3. | 100.0 base | (1) 13' Cellular Platform | |

Notes:

- All existing Transmission Lines are considered properly tied and supported and internal. All lines and antennas not listed above are assumed to be removed.
- All New Transmission Lines are considered to be properly supported & tied and installed external to pole. Install Accordingly.

RESULTS

The existing monopole tower was analyzed with the proposed antennae loading per ANSI/TIA/EIA 222-F Standard requirements.

The results of the computer structural analysis indicated the following:

| MEMBERS | RESULTS |
|------------------|---|
| TOWER MAST/SHAFT | All sections of the tower mast/shaft are Acceptable <i>Max Stress Ratio = 103.8 %</i> |
| FOUNDATION | Base on Data Supplied – Satisfactory . |
| DEFLECTION | Max Deflection at 75 Mph is 81.83 inches |

Notes:

1. The percent of *Overstress* (OS) is the percentage that the maximum load in the member is above the allowable load as determined by Code requirements (which already includes the allowed 1/3 increase).
2. Refer to the Maximum Loads Summary for more details on the tower member loads.
3. NG = Not Good / Not Satisfactory ; OK = Satisfactory ; SF = Safety Factor
4. *Basic Wind Speed* is the Fastest-mile wind speed (a sustained type of wind) and is not a Gusting wind speed (short duration gust wind of 3-second duration in general).

FINDINGS

- Based on the computer structural analysis results, *the existing 100 ft monopole tower does meet the requirements of ANSI/TIA/EIA 222-F Standard for a basic wind speed of 75 Mph with 0" ice / 65 Mph with 1/2" Ice for the proposed antenna configuration without structural modification.*
- Based on the analysis results and data available, *the pole main shaft stress is at the allowable capacity (see pg. 5) at the previously noted elevations for the proposed antenna loading at the wind loading considered. Some part of the shaft are slightly overstressed; however, the overstress percentage is small enough (~4%) to be considered acceptable. Refer to the Graphical Results Diagrams in Appendix 2 for visual depictions of the analysis results.*
- Based on the data available, and assumed soil parameters, *the existing foundation is satisfactory for the new base reactions.*
- This analysis considered the existing transmission lines to be located on the inside of the pole shaft and the proposed transmission lines are to be located on the inside of the pole shaft up to elev. 75 ft where there are (2) existing port holes of 6" x 9" size. The lines will be external from elev. 75 ft to 80 ft. and strapped to the pole shaft.
- All antenna data is based on information supplied by NEXTEL , AT&T WIRELESS, and MEI LIMITED SITE SURVEY.
- *The tower is at its maximum support capacity (104 % stress ratio) at this wind loading; therefore, no additional loads besides the proposed antennas should be installed without further structural evaluation.*
- *The tower site survey was performed to obtain data required for the tower structural analysis and to determine the overall tower condition. The limited site survey indicated that the tower is in good overall condition with no visual sign of damaged members.*

RECOMMENDATIONS

- *The existing tower member stresses are in conformance with the TIA/EIA 222-F Standard for the wind loading considered while supporting the previously stated proposed antenna configuration loads.*
- *Install the new panel antennas at 80 ft elevation using 14 ft low profile clamp-on platform and the new transmission lines are to be internal to the shaft exiting at the existing handholes at Elev. 75 ft then external to elev. 80 ft and all lines to be properly supported. Install accordingly.*

Installation procedures and loading are not within the scope of this report and should be performed and evaluated by a competent tower erection contractor.

REPORT SCOPE & LIMITATIONS

The engineering services rendered by MALOUF ENGINEERING INTERNATIONAL, INC. ('MEI') in connection with this Structural Analysis are limited to a computer analysis of the tower structure, size and capacity of its members. MEI does not analyze the fabrication, including welding and connection capacities, except as included in this Report.

Furthermore, the information and conclusions contained in this report were determined by application of the current "state-of-the-art" engineering and analysis procedures and formulae, and MEI assumes no obligation to revise any of the information or conclusions contained in this report in the event such engineering and analysis procedures and formulae are hereafter modified or revised.

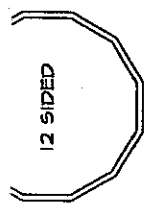
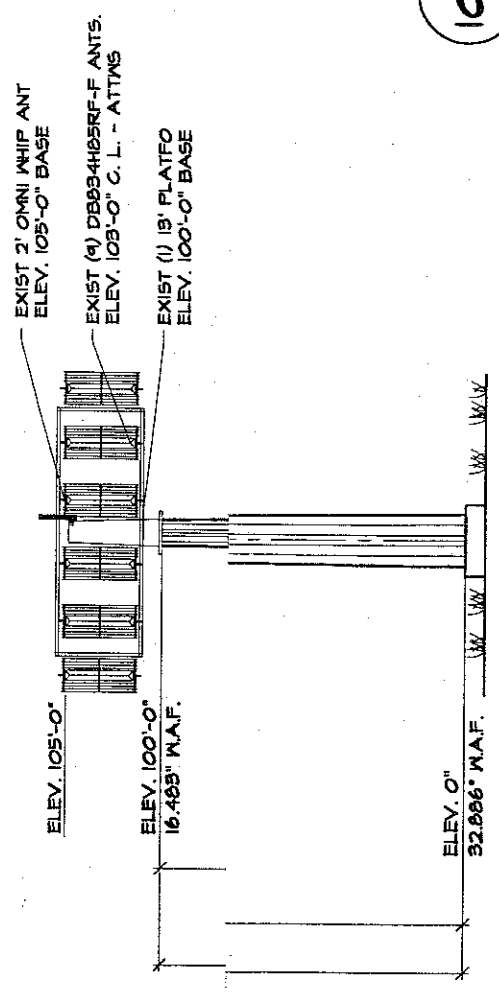
MEI makes no warranties, expressed or implied in connection with this Report and disclaims any liability arising from original design, material, fabrication, and erection deficiencies or the "As-Built" condition of this tower. MEI will not be responsible whatsoever for or on account of consequential or incidental damages sustained by any person, firm, or organization as a result of any data or conclusions contained in this Report. The maximum liability of MALOUF ENGINEERING INTERNATIONAL, INC. pursuant to this Report shall be limited to the total fee received for the preparation of this Report.

Installation procedures and loading are not within the scope of this report and should be performed and evaluated by a competent tower erection contractor. Modification Design is Not within the scope of this report. The tower reinforcement design and detailing can be performed by MEI under a new consulting agreement.

APPENDIX - 1

TOWER ELEVATION DRAWING

| | |
|-------------------|--------------------------------|
| TWR. HT. & TYPE: | 100 FT 12-SIDED MONOPOLE |
| SITE NAME: | Hwy 20/67 SITE #TX0068A |
| LOCATION: | DALLAS, TX |
| MANUF. / MODEL: | VALMONT - 12 SIDED |
| YEAR BUILT: | 1992 |
| ORIG. DESIGN: | TIA/EIA 222 UNKNOWN |
| PRESENT ANALYSIS: | TIA/EIA-222-F - 75MPH + 0' ICE |



102

SECTION: THRU TOWER
SCALE: N.T.S.

101

ELEVATION: 100' MONOPOLE TOWER
SCALE: 1"=10'

ALL RIGHTS RESERVED. THIS DRAWING SHALL REMAIN THE PROPERTY OF THE ENGINEER. NO PART THEREOF SHALL BE REPRODUCED, COPIED, ADAPTED, DISCLOSED OR DISTRIBUTED TO OTHERS WITHOUT WRITTEN PERMISSION OF MEI INC.

| | |
|-----------|----------|
| SHEET NO | 1 |
| DATE | 01/29/99 |
| JOB NO | 99-047 |
| REVISIONS | |

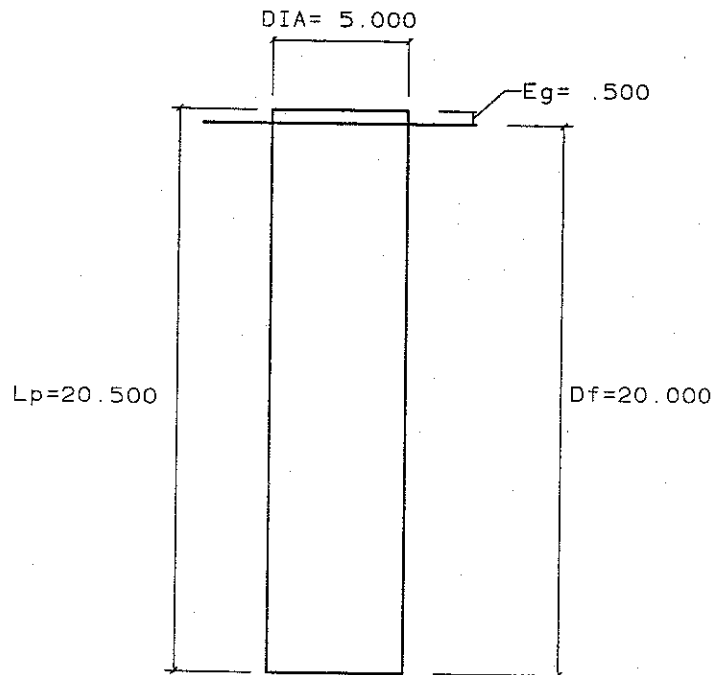
| |
|----------------|
| DRAWN BY: JMG |
| ENG'D. BY: JMG |
| APP'D. BY: MM |

ELEVATION & SECTION
100 FT 12-SIDED MONOPOLE
NEXTEL OF TEXAS TX
DALLAS

MEI
MALOUF ENGINEERING INT'L, INC.
STRUCTURAL CONSULTANTS

275 W. CAMPBELL RD. SUITE 611
RICHARDSON, TEXAS 75080-3549
Tel: 972-763-2578 Fax: 972-763-2583

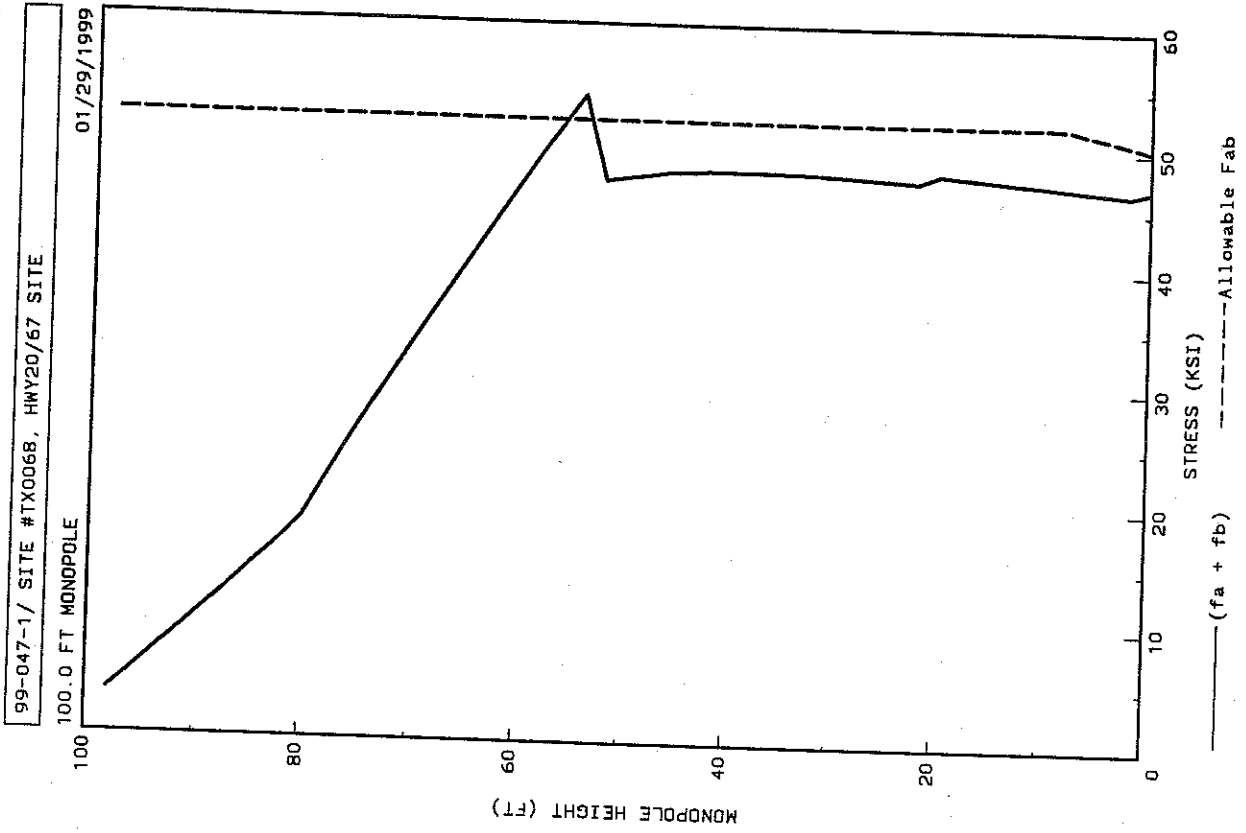
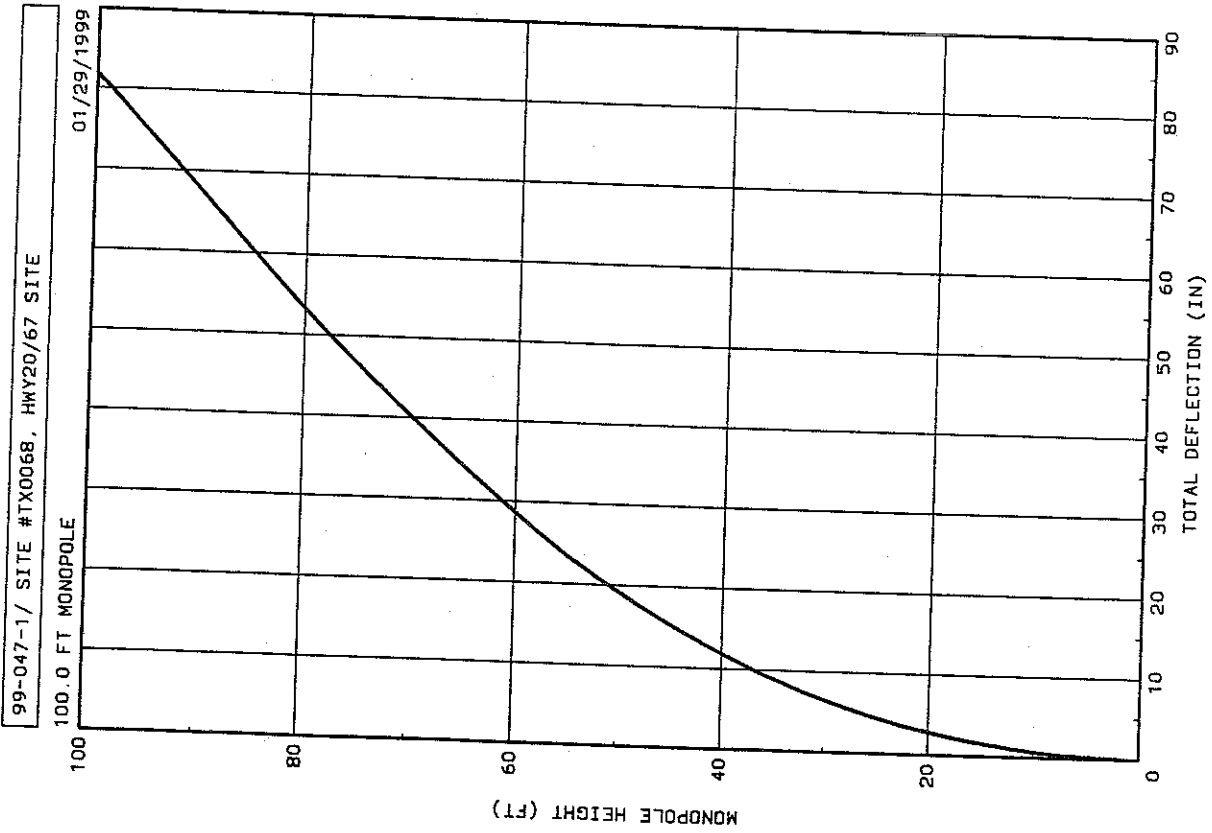
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TITLE = 105 FT MONOPOLE
SITE NAME = TX068, DALLAS, TX
CLIENT NAME= AT&T WIRELESS

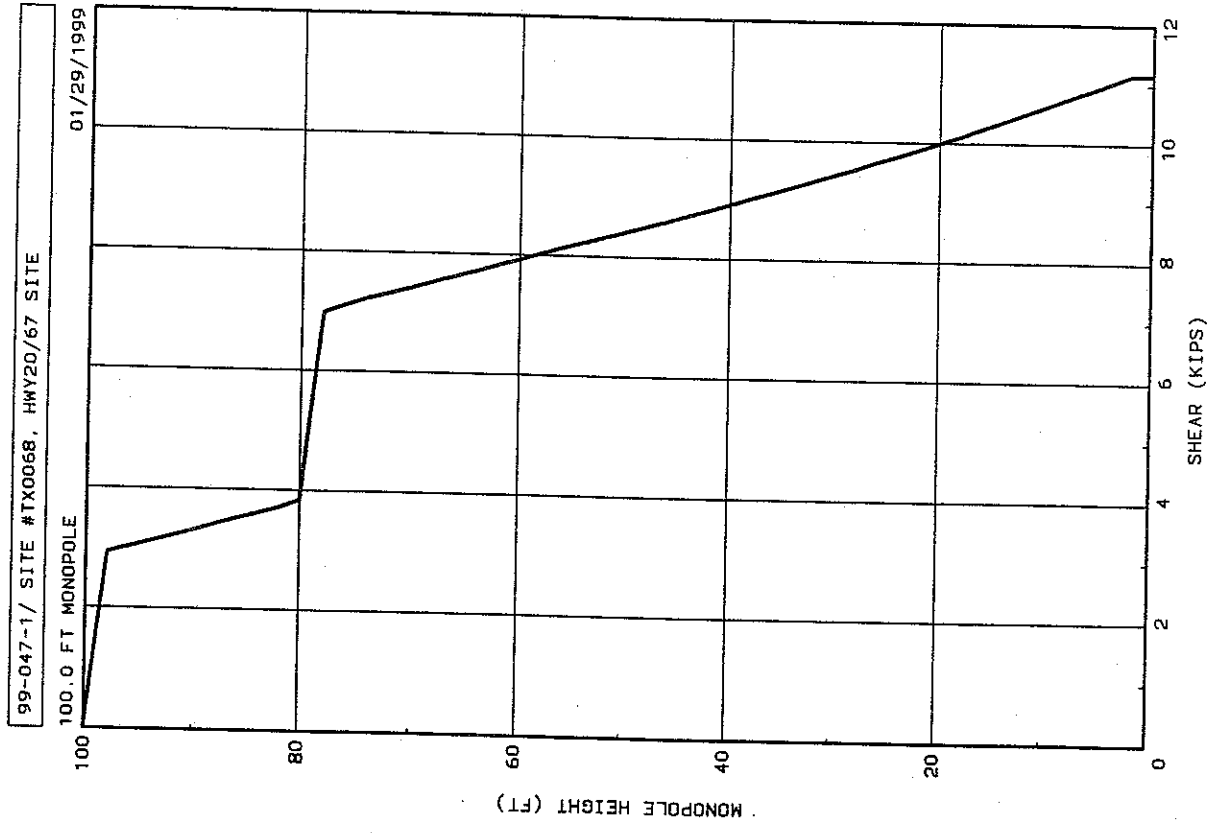
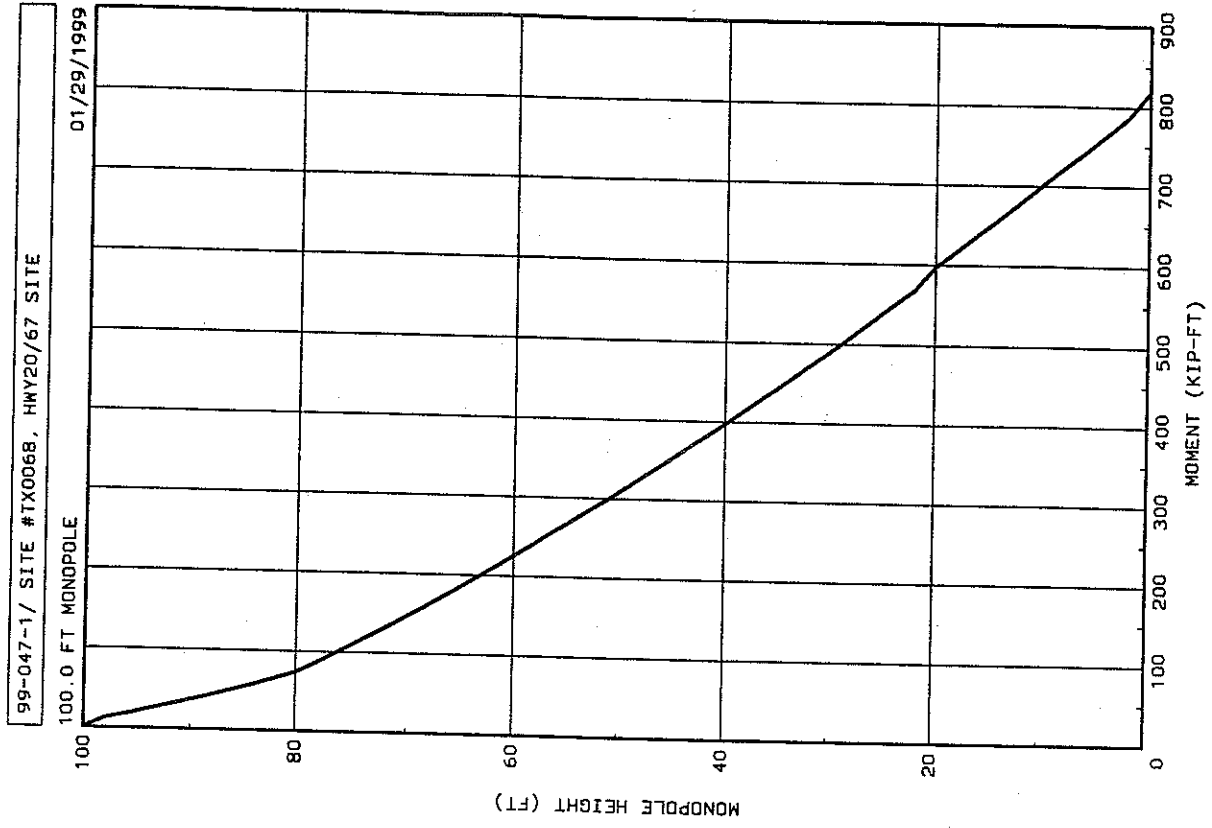


PIER FOUNDATION DETAILS AND DIMENSIONS (UNITS=FT)

APPENDIX - 2

GRAPHICAL RESULTS DIAGRAMS





APPENDIX - 3

Run 1: Proposed Antenna Loading

STRUCTURAL ANALYSIS COMPUTER PRINTOUT

ANALYSIS SUMMARY PRINTOUT

MALOUF ENGINEERING INTERNATIONAL, Inc.
 Richardson, Texas - (972)783-2578
 VERSION: MONE2T04 012899

01/29/1999 - Page : 1
 Run at: 10:15:23.
 INPUT FILENAME: 99-047-1.mmp

MONOPOLE CHARACTERISTICS

| Actual | Sec Elev.bot (ft) | Elev.top (ft) | Dia.bot (in) | Dia.top (in) | Thick (in) | Taper (in/ft) | Weight (kips) | Splice @bot(in) |
|--------|-------------------|---------------|--------------|--------------|------------|---------------|---------------|-----------------|
| 1 | .000 | 55.500 | 32.886 | 19.063 | .2500 | .24906 | 3.905 | .0 |
| 2 | 51.500 | 100.000 | 20.604 | 16.483 | .1875 | .08497 | 1.826 | 48.0 |

Analytical Model

| Sec Elev.bot (ft) | Elev.top (ft) | Dia.bot (in) | Dia.top (in) | Thick (in) | Taper (in/ft) | Weight (kips) | Splice Wt(kips) |
|-------------------|---------------|--------------|--------------|------------|---------------|---------------|-----------------|
| 1 | .000 | 54.000 | 32.886 | 19.437 | .2500 | .24906 | 3.827 |
| 2 | 54.000 | 100.000 | 20.392 | 16.483 | .1875 | .08497 | 1.722 |

Monopole Height : 100.00 ft
 Monopole Weight : 5.73 Kips (excluding antennae and lines)
 Base Diameter : 32.89 Inch
 Top Diameter : 16.48 Inch
 Yield Strength : 65.00 Ksi
 Modulus of Elas : 29000 Ksi
 Pole Shape : 12 Sided Section

** ANALYSIS SUMMARY **

Moment @ base = 818.71 ft-Kips
 Shear @ base = 11.15 Kips
 Vert_Load @ base = 10.83 Kips
 Max. Stress Ratio = 1.038 ** Acceptable (< 5%)
 (33% Increase in Allowable Stress Already Included)
 Max.Total Deflect.= 81.83 in

 * MONOPOLE STRUCTURAL ANALYSIS *
 * (c) 1999, Malouf Engineering Intl., Inc. *

Monopole Description : 100 FT 12-SIDED MONOPOLE
 Site location : SITE #TX0068, HWY20/67 SITE
 Client Name : NEXTEL
 MEI Job Number : 99-047-1

COMMENTS
 PROPOSED NEXTEL(9) DB874H105 ANTS AT 80.0' CL
 TOWER DATA AS PER MEI SURVEY OF 1/28/99.
 Stone View Dr. Site(Hwy 20/67)

J. GEORGE, EIT / E.MARK MALOUF, PE

PROGRAM DESCRIPTION

The monopole is modeled for the computer analysis as a uniform cantilevered beam with a fixed support. The monopole is divided into element members, and antennae are applied as concentrated loads. The structural analysis is performed in conformance with the ANSI/TIA EIA222-F standard and includes the primary and first order P-Delta moments. The horizontal wind shear is calculated as per EIA Sect 2.3.2 and the allowable stresses are per EIA Table 5.

DESIGN/ANALYSIS REQUIREMENTS
 Basic Wind Velocity : 75.00 Mph
 Ice Thickness : .00 Inch

ANTENNA LOADING CONSIDERED

| # | Elev (ft) | Antenna Description | TX-Line | NUM | EXP | DIA (in) | WGT (plf) |
|---|-----------|----------------------------|-----------------|-----|------|----------|-----------|
| 1 | 100.0 | EXIST 2' WHIP ANT | 1/2" Dia. | 1 | .00 | .63 | .14 |
| 2 | 100.0 | EXIST (9)DB834HB5RF-F ANTS | 7/8" Dia. | 3 | .00 | 1.11 | .54 |
| 3 | 100.0 | EXIST (1) 13' PLATFORM | 1/2" Dia. | 6 | .00 | .63 | .14 |
| 4 | 100.0 | EXIST STEP BOLTS | STEP BOLTS LOAD | 1 | 1.00 | .30 | .06 |
| 5 | 80.0 | PROP. (9) DB 874H105 ANTS | 7/8" Dia. | 9 | .30 | 1.11 | .54 |
| 6 | 80.0 | PROP. LP PLATFORM | 7/8" Dia. | 9 | .00 | 1.11 | .54 |

| # | Elev (ft) | CaAa/Dia | Wght | V arm | Ice Factor | Hor Fl | TX Wid | Hor F2 | TX Elev (feet) |
|---|-----------|----------|------|-------|------------|--------|--------|--------|----------------|
| 1 | 100.0 | MISC | 1.0 | .025 | 3.0 | 1.00 | .033 | .00 | .0 100.0 |
| 2 | 100.0 | MISC | 48.5 | .250 | 6.0 | 1.00 | 1.620 | .00 | .0 100.0 |
| 3 | 100.0 | MISC | 35.0 | 2.000 | 1.0 | 1.00 | 1.169 | .00 | .0 100.0 |
| 4 | 100.0 | MISC | .0 | .000 | .0 | 1.00 | 1.000 | .36 | .083 .0 100.0 |
| 5 | 80.0 | MISC | 52.0 | .150 | .0 | 1.00 | 1.630 | 3.60 | .075 75.0 80.0 |
| 6 | 80.0 | MISC | 45.0 | 2.000 | .0 | 1.00 | 1.410 | .00 | .0 75.0 |

Total Antenna Horizontal Load = 5.863 Kips
 Total Antenna Weight = 4.425 Kips
 Total Appurtenance Horiz. Load = .158 Kips

ANALYSIS SUMMARY PRINTOUT

MALOUF ENGINEERING INTERNATIONAL, Inc. 01/29/1999 - Page : 2

Monopole Description : 100 FT 12-SIDED MONOPILE
 Site Location : SITE #TX0068, HWY20/67 SITE
 Client Name : NEXTEL
 MEI Job Number : 99-047-1

WIND LOADING ANALYSIS RESULTS

| Memb. | Elev. (ft.) | O.D. (inch) | Thick (inch) | OD ice (inch) | Kz | C | Cf | Shear (kips) | Moment (kip-ft) |
|---|-------------|-------------|--------------|---------------|-------|---------|-------|--------------|-----------------|
| SECTION 2 (ELEV 54.00-100.00 FT): LENGTH= 46.00 FT / STEEL WT= 1.826 KIPS | | | | | | | | | |
| 50 | 100.0 | 16.483 | .188 | 16.483 | 1.369 | 120.525 | .000 | .00 | .00 |
| 49 | 98.0 | 16.653 | .188 | 16.653 | 1.361 | 121.413 | 1.030 | 2.92 | 11.91 |
| 48 | 96.0 | 16.823 | .188 | 16.823 | 1.353 | 122.287 | 1.030 | 3.02 | 17.74 |
| 47 | 94.0 | 16.993 | .188 | 16.993 | 1.345 | 123.148 | 1.030 | 3.11 | 23.82 |
| 46 | 92.0 | 17.163 | .188 | 17.163 | 1.336 | 123.994 | 1.030 | 3.21 | 30.15 |
| 45 | 90.0 | 17.333 | .188 | 17.333 | 1.328 | 124.824 | 1.030 | 3.31 | 36.73 |
| 44 | 88.0 | 17.503 | .188 | 17.503 | 1.319 | 125.640 | 1.030 | 3.41 | 43.56 |
| 43 | 86.0 | 17.673 | .188 | 17.673 | 1.310 | 126.439 | 1.030 | 3.51 | 50.62 |
| 42 | 84.0 | 17.842 | .188 | 17.842 | 1.302 | 127.221 | 1.030 | 3.61 | 57.94 |
| 40 | 80.0 | 18.182 | .188 | 18.182 | 1.292 | 127.986 | 1.030 | 3.70 | 65.49 |
| 39 | 78.0 | 18.352 | .188 | 18.352 | 1.283 | 128.733 | 1.030 | 3.82 | 73.28 |
| 38 | 76.0 | 18.522 | .188 | 18.522 | 1.274 | 129.461 | 1.030 | 6.98 | 87.40 |
| 37 | 74.0 | 18.692 | .188 | 18.692 | 1.264 | 130.169 | 1.030 | 7.10 | 101.74 |
| 36 | 72.0 | 18.862 | .188 | 18.862 | 1.255 | 130.857 | 1.030 | 7.22 | 116.32 |
| 35 | 70.0 | 19.032 | .188 | 19.032 | 1.245 | 131.524 | 1.030 | 7.32 | 131.13 |
| 34 | 68.0 | 19.202 | .188 | 19.202 | 1.235 | 132.169 | 1.030 | 7.42 | 146.16 |
| 33 | 66.0 | 19.372 | .188 | 19.372 | 1.224 | 132.790 | 1.030 | 7.52 | 161.42 |
| 32 | 64.0 | 19.542 | .188 | 19.542 | 1.214 | 133.386 | 1.030 | 7.62 | 176.90 |
| 31 | 62.0 | 19.712 | .188 | 19.712 | 1.203 | 133.957 | 1.030 | 7.72 | 192.59 |
| 30 | 60.0 | 19.882 | .188 | 19.882 | 1.192 | 134.500 | 1.030 | 7.82 | 208.50 |
| 29 | 58.0 | 20.052 | .188 | 20.052 | 1.181 | 135.015 | 1.030 | 7.92 | 224.61 |
| 28 | 56.0 | 20.222 | .188 | 20.222 | 1.169 | 135.500 | 1.030 | 8.02 | 240.93 |
| | | | | | 1.157 | 135.953 | 1.030 | 8.12 | 257.45 |

| SECTION | 1 (ELEV | .00- | 54.00 FT) | LENGTH= | 54.00 FT / | STEEL WT= | 3.905 KIPS |
|---------|---------|--------|-----------|---------|------------|-----------|------------|
| 27 | 54.0 | 19.437 | .250 | 19.437 | 1.145 | 129.985 | 1.030 |
| 26 | 52.0 | 19.935 | .250 | 19.935 | 1.132 | 132.586 | 1.030 |
| 25 | 50.0 | 20.433 | .250 | 20.433 | 1.120 | 135.125 | 1.030 |
| 24 | 48.0 | 20.931 | .250 | 20.931 | 1.106 | 137.597 | 1.030 |
| 23 | 46.0 | 21.429 | .250 | 21.429 | 1.093 | 139.999 | 1.030 |
| 22 | 44.0 | 21.927 | .250 | 21.927 | 1.079 | 142.326 | 1.030 |
| 21 | 42.0 | 22.425 | .250 | 22.425 | 1.064 | 144.573 | 1.030 |
| 20 | 40.0 | 22.923 | .250 | 22.923 | 1.049 | 146.732 | 1.030 |
| 19 | 38.0 | 23.422 | .250 | 23.422 | 1.033 | 148.797 | 1.030 |
| 18 | 36.0 | 23.920 | .250 | 23.920 | 1.017 | 150.760 | 1.030 |
| 17 | 34.0 | 24.418 | .250 | 24.418 | 1.000 | 152.612 | 1.030 |
| 16 | 32.0 | 24.916 | .250 | 24.916 | 1.000 | 155.725 | 1.030 |
| 15 | 30.0 | 25.414 | .250 | 25.414 | 1.000 | 158.838 | 1.030 |
| 14 | 28.0 | 25.912 | .250 | 25.912 | 1.000 | 161.951 | 1.030 |
| 13 | 26.0 | 26.410 | .250 | 26.410 | 1.000 | 165.065 | 1.030 |
| 12 | 24.0 | 26.908 | .250 | 26.908 | 1.000 | 168.178 | 1.030 |
| 11 | 22.0 | 27.407 | .250 | 27.407 | 1.000 | 171.291 | 1.030 |
| 10 | 20.0 | 27.905 | .250 | 27.905 | 1.000 | 174.405 | 1.030 |
| 9 | 18.0 | 28.403 | .250 | 28.403 | 1.000 | 177.518 | 1.030 |
| 8 | 16.0 | 28.901 | .250 | 28.901 | 1.000 | 180.631 | 1.030 |
| 7 | 14.0 | 29.399 | .250 | 29.399 | 1.000 | 183.744 | 1.030 |
| 6 | 12.0 | 29.897 | .250 | 29.897 | 1.000 | 186.858 | 1.030 |
| 5 | 10.0 | 30.395 | .250 | 30.395 | 1.000 | 189.971 | 1.030 |
| 4 | 8.0 | 30.893 | .250 | 30.893 | 1.000 | 193.084 | 1.030 |
| 3 | 6.0 | 31.392 | .250 | 31.392 | 1.000 | 196.198 | 1.030 |
| 2 | 4.0 | 31.890 | .250 | 31.890 | 1.000 | 199.311 | 1.030 |
| 1 | 2.0 | 32.388 | .250 | 32.388 | 1.000 | 202.424 | 1.030 |
| 0 | .0 | 32.886 | .250 | 32.886 | 1.000 | 205.538 | 1.030 |

ANALYSIS SUMMARY PRINTOUT

MALOUF ENGINEERING INTERNATIONAL, Inc. 01/29/1999 - Page : 3

Monopole Description : 100 FT 12-SIDED MONOPOLE
 Site Location : SITE #TX0068, HWY20/67 SITE
 Client Name : NEXTEL
 MEI Job Number : 99-047-1

MAXIMUM STRESS ANALYSIS RESULTS

| Memb | <--Elev--> | (ft) | (in3) | Sec Mod | Prim Mom | P-D Mom | Tot Mom | fa | fb | Fab | C.S.R |
|---------|------------|--------|--------|---------|----------|----------|----------|-------|-------|-------|-------|
| SECTION | 2 (ELEV | 54.00- | 100.00 | FT): | LENGTH= | (Kip-ft) | (Kip-ft) | (Ksi) | (Ksi) | (Ksi) | |
| 50 | 98.0 | 100.0 | 40.5 | 5.65 | .03 | 11.91 | .01 | 3.53 | 39.00 | 1.826 | KIPS |
| 49 | 96.0 | 98.0 | 41.3 | 11.39 | .12 | 17.74 | .01 | 5.15 | 39.00 | .068 | |
| 48 | 94.0 | 96.0 | 42.2 | 17.32 | .28 | 23.82 | .02 | 6.78 | 39.00 | .099 | |
| 47 | 92.0 | 94.0 | 43.0 | 23.44 | .49 | 30.15 | .03 | 8.41 | 39.00 | .131 | |
| 46 | 90.0 | 92.0 | 43.9 | 29.75 | .75 | 36.73 | .04 | 10.03 | 39.00 | .162 | |
| 45 | 88.0 | 90.0 | 44.8 | 36.25 | 1.07 | 43.56 | .04 | 11.66 | 39.00 | .194 | |
| 44 | 86.0 | 88.0 | 45.7 | 42.95 | 1.45 | 50.62 | .05 | 13.29 | 39.00 | .225 | |
| 43 | 84.0 | 86.0 | 46.6 | 49.84 | 1.87 | 57.94 | .06 | 14.91 | 39.00 | .288 | |
| 42 | 82.0 | 84.0 | 47.5 | 56.92 | 2.34 | 65.49 | .06 | 16.53 | 39.00 | .319 | |
| 41 | 80.0 | 82.0 | 48.5 | 64.20 | 2.86 | 73.28 | .07 | 18.15 | 39.00 | .354 | |
| 40 | 78.0 | 80.0 | 49.4 | 77.75 | 3.42 | 87.40 | .08 | 21.23 | 39.00 | .414 | |
| 39 | 76.0 | 78.0 | 50.3 | 91.50 | 4.01 | 101.74 | .09 | 24.26 | 39.00 | .472 | |
| 38 | 74.0 | 76.0 | 51.3 | 105.44 | 4.65 | 116.32 | .10 | 27.22 | 39.00 | .529 | |
| 37 | 72.0 | 74.0 | 52.2 | 119.58 | 5.32 | 131.13 | .11 | 30.12 | 39.00 | .585 | |
| 36 | 70.0 | 72.0 | 53.2 | 133.91 | 6.02 | 146.16 | .12 | 32.96 | 39.00 | .640 | |
| 35 | 68.0 | 70.0 | 54.2 | 148.44 | 6.75 | 161.42 | .13 | 35.74 | 39.00 | .693 | |
| 34 | 66.0 | 68.0 | 55.2 | 163.17 | 7.50 | 176.90 | .14 | 38.47 | 39.00 | .746 | |
| 33 | 64.0 | 66.0 | 56.2 | 178.10 | 8.26 | 192.59 | .15 | 41.14 | 39.00 | .797 | |
| 32 | 62.0 | 64.0 | 57.2 | 193.22 | 9.05 | 208.50 | .16 | 43.76 | 39.00 | .848 | |
| 31 | 60.0 | 62.0 | 58.2 | 208.53 | 9.85 | 224.61 | .17 | 46.32 | 39.00 | .897 | |
| 30 | 58.0 | 60.0 | 59.2 | 224.05 | 10.66 | 240.93 | .18 | 48.82 | 39.00 | .945 | |
| 29 | 56.0 | 58.0 | 60.2 | 239.75 | 11.47 | 257.45 | .19 | 51.28 | 39.00 | .993 | |
| 28 | 54.0 | 56.0 | 61.3 | 255.66 | 12.28 | 274.17 | .20 | 53.68 | 39.00 | 1.038 | |

| SECTION | 1 (ELEV | .00- | 54.00 | FT): | LENGTH= | 54.00 | FT / | STEEL WT= | 3.905 | KIPS |
|---------|---------|------|-------|--------|---------|--------|------|-----------|-------|------|
| 27 | 52.0 | 54.0 | 74.7 | 271.75 | 13.09 | 291.08 | .28 | 46.77 | 39.00 | .905 |
| 26 | 50.0 | 52.0 | 78.6 | 288.04 | 13.90 | 308.17 | .28 | 47.03 | 39.00 | .910 |
| 25 | 48.0 | 50.0 | 82.7 | 304.51 | 14.71 | 325.45 | .29 | 47.23 | 39.00 | .914 |
| 24 | 46.0 | 48.0 | 86.8 | 321.17 | 16.17 | 343.58 | .29 | 47.48 | 39.00 | .920 |
| 23 | 44.0 | 46.0 | 91.1 | 338.03 | 16.94 | 361.20 | .29 | 47.58 | 39.00 | .919 |
| 22 | 42.0 | 44.0 | 95.5 | 355.09 | 17.66 | 378.98 | .29 | 47.64 | 39.00 | .922 |
| 21 | 40.0 | 42.0 | 99.9 | 372.34 | 18.37 | 396.94 | .29 | 47.67 | 39.00 | .922 |
| 20 | 38.0 | 40.0 | 104.5 | 389.80 | 19.07 | 415.10 | .29 | 47.67 | 39.00 | .922 |
| 19 | 36.0 | 38.0 | 109.2 | 407.45 | 19.76 | 433.44 | .29 | 47.65 | 39.00 | .922 |
| 18 | 34.0 | 36.0 | 113.9 | 425.31 | 20.44 | 451.98 | .30 | 47.61 | 39.00 | .921 |
| 17 | 32.0 | 34.0 | 118.8 | 443.37 | 21.11 | 470.71 | .30 | 47.55 | 39.00 | .920 |
| 16 | 30.0 | 32.0 | 123.8 | 461.64 | 21.76 | 489.63 | .30 | 47.47 | 39.00 | .919 |
| 15 | 28.0 | 30.0 | 128.8 | 480.12 | 22.40 | 508.75 | .30 | 47.38 | 39.00 | .917 |
| 14 | 26.0 | 28.0 | 134.0 | 498.81 | 23.03 | 528.07 | .30 | 47.28 | 39.00 | .915 |
| 13 | 24.0 | 26.0 | 139.3 | 517.72 | 23.64 | 547.59 | .30 | 47.17 | 39.00 | .913 |
| 12 | 22.0 | 24.0 | 144.7 | 536.86 | 24.24 | 567.32 | .31 | 47.05 | 39.00 | .911 |
| 11 | 20.0 | 22.0 | 150.2 | 556.22 | 24.86 | 587.26 | .31 | 47.53 | 39.00 | .923 |
| 10 | 18.0 | 20.0 | 155.8 | 575.81 | 25.49 | 607.41 | .31 | 47.68 | 39.00 | .920 |
| 9 | 16.0 | 18.0 | 161.4 | 595.64 | 26.13 | 627.77 | .31 | 47.37 | 39.00 | .917 |
| 8 | 14.0 | 16.0 | 167.2 | 615.70 | 26.78 | 648.34 | .31 | 47.21 | 39.00 | .914 |
| 7 | 12.0 | 14.0 | 173.1 | 636.01 | 27.44 | 669.12 | .32 | 47.04 | 39.00 | .911 |
| 6 | 10.0 | 12.0 | 179.1 | 656.57 | 28.11 | 690.12 | .32 | 46.88 | 39.00 | .908 |
| 5 | 8.0 | 10.0 | 185.2 | 677.38 | 28.79 | 711.34 | .32 | 46.71 | 38.96 | .905 |
| 4 | 6.0 | 8.0 | 191.4 | 698.45 | 29.48 | 732.78 | .32 | 46.55 | 38.65 | .910 |
| 3 | 4.0 | 6.0 | 197.7 | 719.77 | 30.18 | 754.44 | .33 | 46.38 | 38.33 | .914 |
| 2 | 2.0 | 4.0 | 204.1 | 741.36 | 30.87 | 776.32 | .33 | 46.22 | 38.02 | .918 |
| 1 | .0 | 2.0 | 210.6 | 763.22 | 31.58 | 798.44 | .32 | 46.65 | 37.71 | .934 |

ANALYSIS SUMMARY PRINTOUT

MALOUF ENGINEERING INTERNATIONAL, Inc. 01/29/1999 - Page : 4

 Monopole Description : 100 FT 12-SIDED MONOPOLE
 Site Location : SITE #TX0068, HWY20/67 SITE
 Client Name : NEXTEL
 MEI Job Number : 99-047-1

DEFLECTION ANALYSIS RESULTS

| Memb | Elev. (ft.) | Mom (in4) | Inert (inch) | Pres.S.S (inch) | Prev.S.S Pt.Ld (inch) | Total Deflc (inch) |
|---|-------------|-----------|--------------|-----------------|-----------------------|--------------------|
| SECTION 2 (ELEV 54.00- 100.00 FT) : LENGTH= 46.00 FT / STEEL WT= 1.826 KIPS | | | | | | |
| 50 | 100.0 | 333.5 | .000 | .000 | .000 | 81.829 |
| 49 | 98.0 | 344.0 | .000 | .001 | .001 | 78.913 |
| 48 | 96.0 | 354.8 | .000 | .004 | .000 | 76.000 |
| 47 | 94.0 | 365.7 | .000 | .006 | .000 | 73.097 |
| 46 | 92.0 | 377.0 | .000 | .007 | .000 | 70.204 |
| 45 | 90.0 | 388.4 | .000 | .009 | .000 | 67.328 |
| 44 | 88.0 | 400.1 | .000 | .011 | .000 | 64.469 |
| 43 | 86.0 | 411.9 | .000 | .012 | .000 | 61.633 |
| 42 | 84.0 | 424.1 | .000 | .014 | .000 | 58.822 |
| 41 | 82.0 | 436.4 | .000 | .016 | .000 | 56.039 |
| 40 | 80.0 | 449.0 | .000 | .017 | .000 | 53.288 |
| 39 | 78.0 | 461.9 | .000 | .020 | .001 | 50.572 |
| 38 | 76.0 | 475.0 | .000 | .023 | .002 | 47.895 |
| 37 | 74.0 | 488.3 | .000 | .026 | .002 | 45.267 |
| 36 | 72.0 | 501.9 | .000 | .028 | .002 | 42.690 |
| 35 | 70.0 | 515.7 | .000 | .031 | .002 | 40.172 |
| 34 | 68.0 | 529.8 | .000 | .033 | .002 | 37.716 |
| 33 | 66.0 | 544.1 | .000 | .036 | .002 | 35.328 |
| 32 | 64.0 | 558.7 | .000 | .038 | .002 | 33.012 |
| 31 | 62.0 | 573.5 | .000 | .040 | .002 | 30.774 |
| 30 | 60.0 | 588.7 | .000 | .042 | .002 | 28.617 |
| 29 | 58.0 | 604.0 | .000 | .044 | .002 | 26.545 |
| 28 | 56.0 | 619.7 | .000 | .046 | .002 | 24.563 |

| SECTION | 1 (ELEV | .00- | 54.00 FT): | LENGTH= | 54.00 FT / | STEEL WT= | 3.905 KIPS |
|---------|---------|--------|------------|---------|------------|-----------|------------|
| 27 | 54.0 | 725.7 | .000 | .042 | .002 | .000 | 22.675 |
| 26 | 52.0 | 783.7 | .000 | .041 | .002 | .000 | 20.878 |
| 25 | 50.0 | 844.7 | .000 | .041 | .002 | .000 | 19.167 |
| 24 | 48.0 | 908.9 | .000 | .040 | .000 | .000 | 17.540 |
| 23 | 46.0 | 976.1 | .000 | .039 | .000 | .000 | 15.936 |
| 22 | 44.0 | 1046.6 | .000 | .038 | .000 | .000 | 14.533 |
| 21 | 42.0 | 1120.4 | .000 | .038 | .000 | .000 | 13.150 |
| 20 | 40.0 | 1197.7 | .000 | .037 | .000 | .000 | 11.845 |
| 19 | 38.0 | 1278.3 | .000 | .036 | .000 | .000 | 10.617 |
| 18 | 36.0 | 1362.6 | .000 | .036 | .000 | .000 | 9.465 |
| 17 | 34.0 | 1450.4 | .000 | .035 | .000 | .000 | 8.385 |
| 16 | 32.0 | 1542.0 | .000 | .034 | .000 | .000 | 7.378 |
| 15 | 30.0 | 1637.3 | .000 | .034 | .000 | .000 | 6.442 |
| 14 | 28.0 | 1736.5 | .000 | .033 | .000 | .000 | 5.575 |
| 13 | 26.0 | 1839.6 | .000 | .032 | .000 | .000 | 4.776 |
| 12 | 24.0 | 1946.7 | .000 | .032 | .000 | .000 | 4.043 |
| 11 | 22.0 | 2057.8 | .000 | .031 | .000 | .000 | 3.376 |
| 10 | 20.0 | 2173.2 | .000 | .031 | .000 | .000 | 2.772 |
| 9 | 18.0 | 2292.7 | .000 | .030 | .000 | .000 | 2.231 |
| 8 | 16.0 | 2416.6 | .000 | .029 | .000 | .000 | 1.752 |
| 7 | 14.0 | 2544.8 | .000 | .029 | .000 | .000 | 1.333 |
| 6 | 12.0 | 2677.5 | .000 | .028 | .000 | .000 | .974 |
| 5 | 10.0 | 2814.8 | .000 | .028 | .000 | .000 | .672 |
| 4 | 8.0 | 2956.6 | .000 | .027 | .000 | .000 | .428 |
| 3 | 6.0 | 3103.2 | .000 | .027 | .000 | .000 | .239 |
| 2 | 4.0 | 3254.5 | .000 | .026 | .000 | .000 | .106 |
| 1 | 2.0 | 3410.6 | .000 | .026 | .000 | .000 | .026 |

ANALYSIS SUMMARY PRINTOUT

MALOUF ENGINEERING INTERNATIONAL, Inc. 01/29/1999 - Page : 5

Monopole Description : 100 FT 12-SIDED MONOPOLE
 Site Location : SITE #TX0068, HWY20/67 SITE
 Client Name : NEXTEL
 MEI Job Number : 99-047-1

SWAY ANALYSIS RESULTS

| Memb | Elev. (ft.) | Mom Inert (in4) | sway due to | | Prev.S.S Pt.Id (degree) | Total Sway (degree) | SECTION | 1 (ELEV) | .00- | 54.00 FT): LENGTH= | 54.00 FT / STEEL WT= | 3.905 KIPS |
|------|-------------|-----------------|--------------------------|-----------|---------------------------------|---------------------|---------|----------|--------|--------------------|----------------------|------------|
| | | | Pres.S.S Moment (degree) | STEEL WT= | | | | | | | | |
| 50 | 100.0 | 333.5 | .0000 | .0000 | 46.00 FT / STEEL WT= 1.826 KIPS | | 27 | 54.0 | 725.7 | .0000 | .0064 | .0000 |
| 49 | 98.0 | 344.0 | .0001 | .0048 | .0000 | 6.9614 | 26 | 52.0 | 783.7 | .0000 | .0060 | .0000 |
| 48 | 96.0 | 354.8 | .0001 | .0183 | .0000 | 6.9425 | 25 | 50.0 | 844.7 | .0000 | .0057 | .0000 |
| 47 | 94.0 | 365.7 | .0000 | .0269 | .0000 | 6.9194 | 24 | 48.0 | 908.9 | .0000 | .0053 | .0000 |
| 46 | 92.0 | 377.0 | .0000 | .0354 | .0000 | 6.8875 | 23 | 46.0 | 976.1 | .0000 | .0050 | .0000 |
| 45 | 90.0 | 388.4 | .0000 | .0436 | .0000 | 6.8472 | 22 | 44.0 | 1046.6 | .0000 | .0047 | .0000 |
| 44 | 88.0 | 400.1 | .0000 | .0516 | .0000 | 6.7988 | 21 | 42.0 | 1120.4 | .0000 | .0045 | .0000 |
| 43 | 86.0 | 411.9 | .0000 | .0593 | .0000 | 6.7423 | 20 | 40.0 | 1197.7 | .0000 | .0042 | .0000 |
| 42 | 84.0 | 424.1 | .0000 | .0669 | .0000 | 6.6781 | 19 | 38.0 | 1278.3 | .0000 | .0040 | .0000 |
| 41 | 82.0 | 436.4 | .0000 | .0742 | .0000 | 6.6064 | 18 | 36.0 | 1362.6 | .0000 | .0038 | .0000 |
| 40 | 80.0 | 449.0 | .0000 | .0813 | .0000 | 6.5273 | 17 | 34.0 | 1450.4 | .0000 | .0036 | .0000 |
| 39 | 78.0 | 461.9 | .0000 | .0958 | .0000 | 6.4410 | 16 | 32.0 | 1542.0 | .0000 | .0034 | .0000 |
| 38 | 76.0 | 475.0 | .0000 | .1096 | .0000 | 6.3329 | 15 | 30.0 | 1637.3 | .0000 | .0033 | .0000 |
| 37 | 74.0 | 488.3 | .0000 | .1229 | .0000 | 6.2147 | 14 | 28.0 | 1736.5 | .0000 | .0031 | .0000 |
| 36 | 72.0 | 501.9 | .0000 | .1356 | .0000 | 6.0834 | 13 | 26.0 | 1839.6 | .0000 | .0030 | .0000 |
| 35 | 70.0 | 515.7 | .0000 | .1478 | .0000 | 5.9395 | 12 | 24.0 | 1946.7 | .0000 | .0029 | .0000 |
| 34 | 68.0 | 529.8 | .0000 | .1594 | .0000 | 5.7835 | 11 | 22.0 | 2057.8 | .0000 | .0027 | .0000 |
| 33 | 66.0 | 544.1 | .0000 | .1706 | .0000 | 5.6160 | 10 | 20.0 | 2173.2 | .0000 | .0026 | .0000 |
| 32 | 64.0 | 558.7 | .0000 | .1814 | .0000 | 5.4373 | 9 | 18.0 | 2292.7 | .0000 | .0025 | .0000 |
| 31 | 62.0 | 573.5 | .0000 | .1917 | .0000 | 5.2481 | 8 | 16.0 | 2416.6 | .0000 | .0024 | .0000 |
| 30 | 60.0 | 588.7 | .0000 | .2016 | .0000 | 5.0486 | 7 | 14.0 | 2544.8 | .0000 | .0023 | .0000 |
| 29 | 58.0 | 604.0 | .0000 | .2111 | .0000 | 4.8393 | 6 | 12.0 | 2677.5 | .0000 | .0022 | .0000 |
| 28 | 56.0 | 619.7 | .0000 | .2202 | .0000 | 4.6207 | 5 | 10.0 | 2814.8 | .0000 | .0021 | .0000 |
| | | | | | | | 4 | 8.0 | 2956.6 | .0000 | .0021 | .0000 |
| | | | | | | | 3 | 6.0 | 3103.2 | .0000 | .0021 | .0000 |
| | | | | | | | 2 | 4.0 | 3254.5 | .0000 | .0020 | .0000 |
| | | | | | | | 1 | 2.0 | 3410.6 | .0000 | .0019 | .0000 |

ANALYSIS SUMMARY PRINTOUT

Version: FDN2-D0/AF

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*****
* FOUNDATION ANALYSIS PROGRAM
* Pier Analysis
* (c) 1997, Malouf Engineering Intl., Inc.
*****

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MEI JOB NUMBER = 99-047
DESCRIPTION = 105 FT MONOPOLE
SITE NAME = TX068, DALLAS, TX
CLIENT NAME = AT&T WIRELESS
TIME/DATE/FILE = 10:15:59 / 01-29-1999 / 99-047-1.mmp

```

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--- MAXIMUM DESIGN LOADS ---
COMPRESSION UPLIFT SHEAR MOMENT
(KIPS) (KIPS) (KIPS) (KIP-FT)
10.830 .000 11.150 818.710

```

```

--- PIER DIMENSIONS ---
PIER PIER EXTENSION SHAFT BELL BELL
DEPTH DIAMETER ABOVE GRADE LENGTH DIAMETER DIAMETER THICKNESS
(FT) (FT) (FT) (FT) (FT) (FT)
20.000 5.000 .500 .000 5.000 5.000 .000

```

```

--- MATERIAL PROPERTIES ---
CONCRETE ULT. BEARING SOIL SOIL
DENSITY CAPACITY DENSITY FRICTION NEGLECT ALPHA
(KCF) (KSF) (KCF) (DEG) (FT)
.150 6.000 .100 24.000 7.500 .350

```

```

--- FACTOR OF SAFETY VALUES ---
SKIN FRICTION PASSIVE CONCRETE SOIL
PRESSURE (UPLIFT) (COMPR.) PRESSURE WEIGHT WEIGHT
2.00 2.00 2.00 2.00 1.25 1.50

```

```

--- LAYER DATA ---
SOIL SOIL ULT. PASS. ULT. SKIN SOIL
THICK DEPTH FRICTION COHESION PRESSURE FRICTION DENSITY
(FT) (FT) (DEG) (KSF) (KCF) (KSF) (KCF) (KCF)
1 7.50 7.50 .0 .000 .110* .000+ .110 .150
2 1.50 9.00 6.0 1.500 3.035* .598+ .110 .150
3 11.00 20.00 6.0 6.000 1.458* 2.262+ .110 .150
* PASSIVE PRESSURE COMPUTED BASED ON SOIL FRICTION AND COHESION
+ SKIN FRICTION COMPUTED BASED ON SOIL FRICTION AND COHESION

```

*** COMMENTS ***
 ESTIMATED SOIL PARAMETERS BASED ON ORIGINAL CALCULATIONS BY
 LEEDCO ENGINEERS REF JOB # 1928 DATED 6/25/92.

RESULTS

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WT./VOL. OF SOIL ABOVE = .0 KIPS / .000 FT3
WT./VOL. OF CONCRETE PIER = 60.4 KIPS / 402.517 FT3

SKIN RESISTANCE = 202.5 KIPS (ALLOWABLE)
TIP BEARING CAPACITY = 58.9 KIPS (ALLOWABLE)

UPLIFT CAPACITY OF PIER = 250.8 KIPS > .0 KIPS (OK) R= .000
TOTAL DOWNLOAD CAPACITY = 261.4 KIPS > 10.8 KIPS (OK) R= .041

BROM'S METHOD FOR COHESIVE SOILS:
AVERAGE COHESION VALUE = 3.412 KSF
REQUIRED PIER LENGTH = 14.952 FT ( .073 FT DEPTH TO ZERO SHEAR)
AVAILABLE PIER LENGTH = 20.000 FT > 14.952 FT (OK) R= .748
MAXIMUM MOMENT = 908.31 KIP-FT

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REINFORCEMENT CHECK (PIER FOUNDATION) L= 20.50' DIA= 60.0" FC= 3000 PSI

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FACTORED COMPRESSION LOAD = 18.77 KIPS
FACTORED UPLIFT LOAD = .00 KIPS
FACTORED MOMENT LOAD = 1312.01 KIP-FT

REQUIRED STEEL AREA = 18.93 IN2 (COMPRESSION AND MOMENT)
REQUIRED STEEL AREA = 14.14 IN2 (ACI MIN.= 0.005A)

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TOTAL BAR AREA PROVIDED = 23.98 IN2 (24 x NO. 9 BARS) /FY= 60. KSI,C= 3.0"
THE TOTAL BAR AREA PROVIDED IS SUFFICIENT.
VERT. BAR CLEAR SPACING = 5.94 IN

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DESIGN PARAMETERS

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TIE BAR SIZE = 4
TIE SPACING @ UPPER REGION (IN) = 9.00 (AVG.= 8.250 IN)
TIE SPACING OVERALL (IN) = 18.00 (AVG.= 16.200 IN)
TIE SPACING AT TOP/BOT (IN) = 3.00

NUMBER OF ANCHOR BOLTS = 10
ANCHOR BOLT DIAMETER (IN) = 1.25
ANCHOR BOLT LENGTH (IN) = 72.00
ANCHOR BOLT PROJ. LENGTH (IN) = 6.00
ANCHOR BOLT TEMPLATE DIA. (IN) = 40.00
ANCHOR PATTERN (0=CIRC,1=SQR) = 0

VOLUME OF CONCRETE (YD3) = 14.91
TOWER FACE WIDTH (FT) = .000
TOWER CODE (1=SINGLE,3/4=SST) = 1

```