Re: D-85, Replace Radio Tower, Ebbegunbaeg, $179,000

Q. Please provide a copy of the recommendation included in the 2007 report by the structural engineer that indicates that the radio tower should be replaced.

A. The referenced report is attached. The recommendation is contained in Section 3.0 of the report.

NEWFOUNDLAND AND LABRADOR HYDRO

STRUCTURAL ASSESSMENT

EXISTING 30m KNOCK-DOWN SELF-SUPPORT TOWER

Ebbegunbaeg, NL

To Confirm the Existing Tower is in Conformance with CSA S37-01

Prepared by:

TILLER
Tiller Engineering Inc.

Prepared for:

Newfoundland and Labrador Hydro
St. John's, NL., Canada

Issue Date:	Status:	Project #:	Issued By:	Checked By:	Approved By:
April 8, 2008	R1-Issued To Client	2008-52	JW	RT	JW

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1.0 Tower Information

CLIENT: Newfoundland and Labrador Hydro
CLIENTS CONTACT: Don Richards, P. Eng.

TYPE: Self-Support Tower (See Tower Profile)
DESCRIPTION: Triangular cross section
HEIGHT: 30.5m
MANUFACTURER: Trylon

PURPOSE: To verify the existing tower structural capacity, condition and conformance to CSA S37-01 under existing loadings as indicated in the loading schedule.

PROPOSED LOADING SCHEDULE				
Item	**Elevation m(ft)**	**Type**	**Azimuth (degrees)**	**Tx-Lines**
1	11.5 (38)	Radial YA6900W		RG8
2	17.5 (58)	SRL 360		EW64

Note: The related information contained in the above schedule is the main contributor to the proposed structural loading only. They are not intended to be a complete and exact inventory of all tower appurtenances.

REFERENCES:

The following references were used in our analysis:

1) Tiller Engineering Inc. "Maintenance Inspection Report" dated December 21, 2006.
2) Tiller Engineering Inc. structural mapping and tower inventory field notes dated June 18, 2007.

2.0 Analysis Results

The following strength results for the existing tower were obtained based on a Class I static analysis in accordance with **CSA S37-01 *Antennas, Towers, and Antenna-Supporting Structures*.** The results are based on the assumption that the tower is in good, undamaged and non-corroded structural condition.

Class I Strength Results: (Existing)

- TOWER LEGS: **OVERLOADS 338% Utilization**
- TOWER DIAGONALS: **OVERLOADS 105% Utilization**
- TOWER HORIZONTALS: **NO OVERLOADS 3% Utilization**

Serviceability Results:

The maximum deflection is less than 1ft which is acceptable.
The maximum twist/tilt is less than +/- 0.5 degrees which is acceptable.

The following table outlines all maintenance items required as per Tiller Engineering 2006 Maintenance inspection report.

Item	*Description*	*Priority*
1	Install anti-climb system.	High
2	Post warning signs for falling ice.	High
3	Repair all leg foundations.	High
4	Perform a Structural Analysis to verify tower conformance with CSA S37-01	High
5	Straighten the transmission lines and install the proper hangers and adapters.	Moderate
6	Clean and cold galvanize corrosion	Moderate
7	Remove all garbage/debris from tower site	Moderate
8	Install proper transmission line grounding as recommended by the manufacturer.	Moderate
9	Repair bent members	Moderate

3.0 Conclusions and Recommendations

A class I analysis in accordance with the Canadian Tower Code, ***CSA S37-01 Antennas, Towers and Antenna-Supporting Structures*** was performed on the existing Newfoundland and Labrador Hydro EBB tower, NL.

The analysis considered all existing loading for the Ebbegunbaeg tower. The EBB tower exhibits tower leg overloads over 300% and minor diagonal overloads. In addition to leg overloads the existing condition of the tower foundation is deteriorated and requires structural repairs (See Appendix C, Photos #3 &#4). As a result of the extensive leg overloads and deteriorated tower foundations we recommend a full replacement of this tower. As a temporary cautionary measure we recommend installing signage indicating that the tower does not meet CSA-S37-01 requirement and should not be climbed during icing or high wind conditions.

Jonathan E. Walsh, P. Eng.
Structural Engineer
Tiller Engineering Inc.

4.0 Analysis Notes, Assumptions and Limitations

1. Analysis was performed to **Class I Reliability** based on extreme wind and ice loading.
2. Site Specific Wind Data of Qe = 550 Pa used in analysis.
3. 50 mm radial ice considered in analysis as per original design drawings.
4. Steel grade assumed to be 300 MPa for all members.
5. Member capacities as per CSA S16.1 and CSA S37-01
6. Dimensions and member sizes determined from fielding mapping preformed by Tiller Engineering on June 18, 2007.
7. All antenna information obtained from Tiller Engineering fielding mapping preformed by Tiller Engineering on June 18, 2007.
8. This tower analysis report is intended to verify the adequacy of the main tower structural components. Legs, diagonals and horizontals were checked and are an indication of the adequacy of the complete tower system. Not all tower components (including foundations) are checked. Tiller can check all components for the client for a fee if requested.
9. This report represents an engineering opinion based on the terms of reference and assumptions outlined. The analysis was performed using commercially available analysis software used as a tool to evaluate an existing structural system designed and fabricated by others. It is agreed that the maximum liability associated with this report is the total fee received.
10. This report assumes that the existing tower was fabricated, installed and maintained as per CSA standards**.** It is recommended that as per CSA S37-01 the current physical structural condition of the tower be verified by inspection. We are available to perform this service for a fee if required by the client.
11. This report was prepared by Tiller Engineering Inc. for the account of Newfoundland and Labrador Hydro. The report is confidential and may not be copied or distributed without the permission. The material in it reflects Tiller Engineering Inc.'s best judgement in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or reliance on, or decisions to be made based on it are the responsibility of such third parties. Tiller Engineering Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.
12. Costing is an estimate only. Actual cost for upgrade work depends on tendering and market conditions.
13. The client is to review the reports purpose, assumptions, and limitations and to report back to the consultant if there are any questions, clarifications or adjustments required.

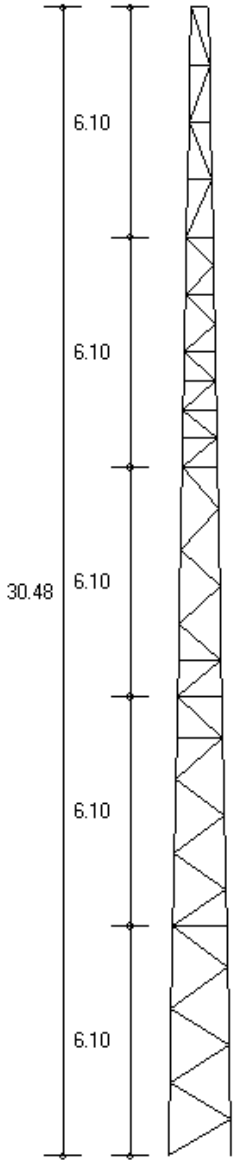
APPENDIX A

TOWER PROFILE

DESIGN SPECIFICATION

Design Standard: CSA - S37 - 01
Wind pressure = 550.00 (Pa)
Ice thickness = 50.00 (mm)

Sct.	Length (m)	Top Width (mm)	Bot Width (mm)
1	6.10	1422.40	1666.88
2	6.10	1177.93	1422.40
3	6.10	933.45	1177.93
4	6.10	688.98	933.45
5	6.10	444.50	688.98



MAXIMUM BASE REACTIONS

	Bare	Iced
Download (kN)	321.7	338.4
Uplift (kN)	315.5	298.8
Shear (kN)	19.0	17.5

APPENDIX B

ANALYSIS RESULTS GRAPHICAL SUMMARY

PROJECT DATA

Project Title:	*EBB Analysis*
Customer Name:	*Newfoundland and Labrador Hydro*
Site:	*Ebb*
Contract No.:	*2008-52*
Revision:	*1*
Engineer:	*Jonathan E. Walsh P. Eng.*
Date:	*September 16, 2007*
Time:	*02:25:40 PM*
Design Standard:	CSA-S37-01

GENERAL DESIGN CONDITIONS

Start wind direction:	0.00 (Deg)
End wind direction:	330.00 (Deg)
Increment wind direction:	30.00 (Deg)
Elevation above ground:	0.00 (m)
Importance Factor:	1.00
Serviceability Factor:	1.00
Gust Factor Cg:	2.5
Material Density:	7850.0(kg/m^3)
Young's Modulus:	199947.6 (MPa)
Poisson Ratio:	0.30
Weight Multiplier:	1.00

WIND ONLY CONDITIONS:

Wind pressure:	550.00 (Pa)
Wind Load Factor:	1.50
Dead Load Factor:	1.25
Dead Load Factor for Uplift:	0.85
Dead Load Factor for Guys:	1.00

WIND AND ICE CONDITIONS:

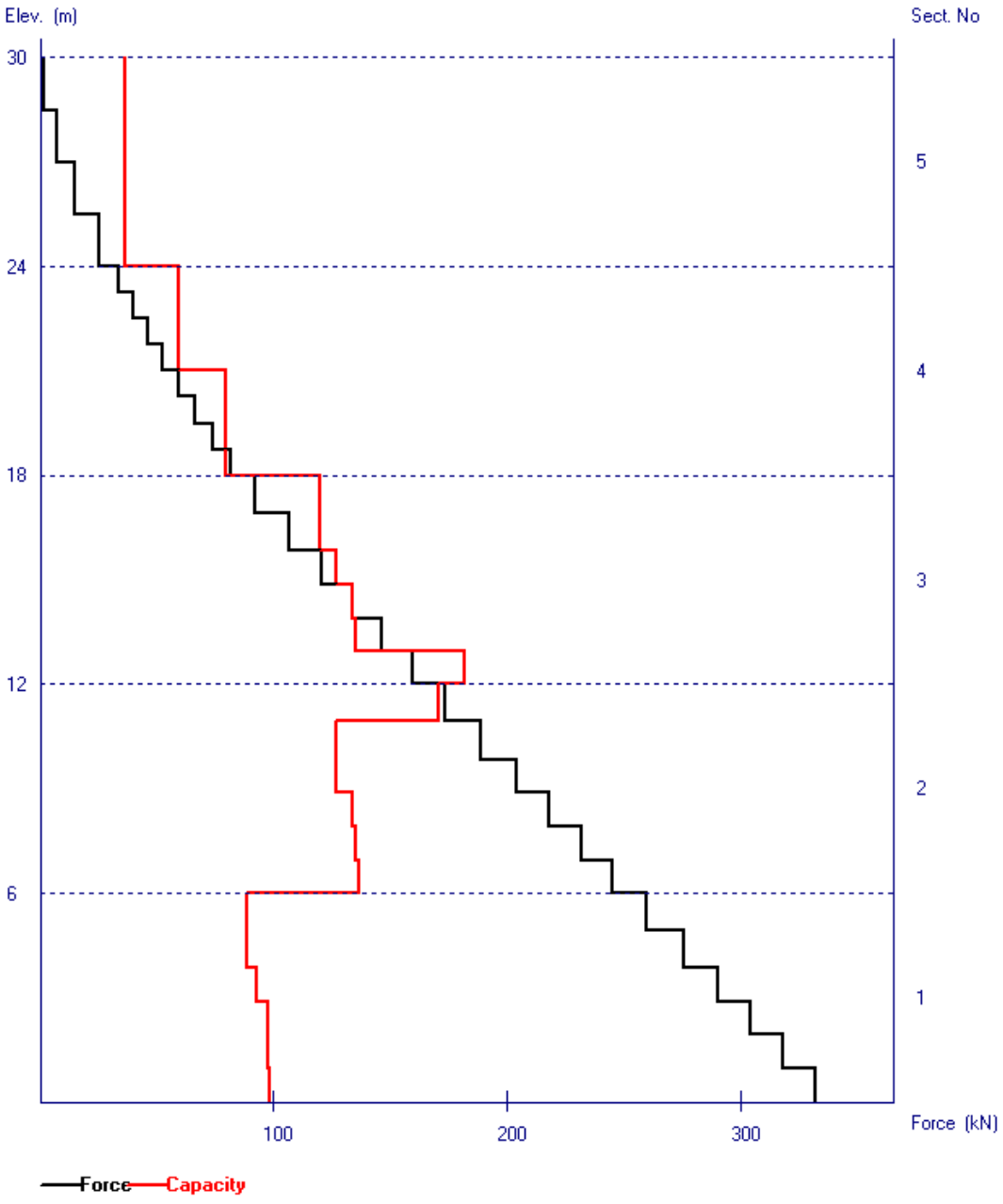
Wind pressure:	550.00 (Pa)
Ice thickness:	50.00 (mm)
Wind Load Factor:	1.50
Wind reduction factor:	0.50
Dead Load Factor:	1.25
Ice Load Factor:	1.50
Dead Load Factor for Guys:	1.00

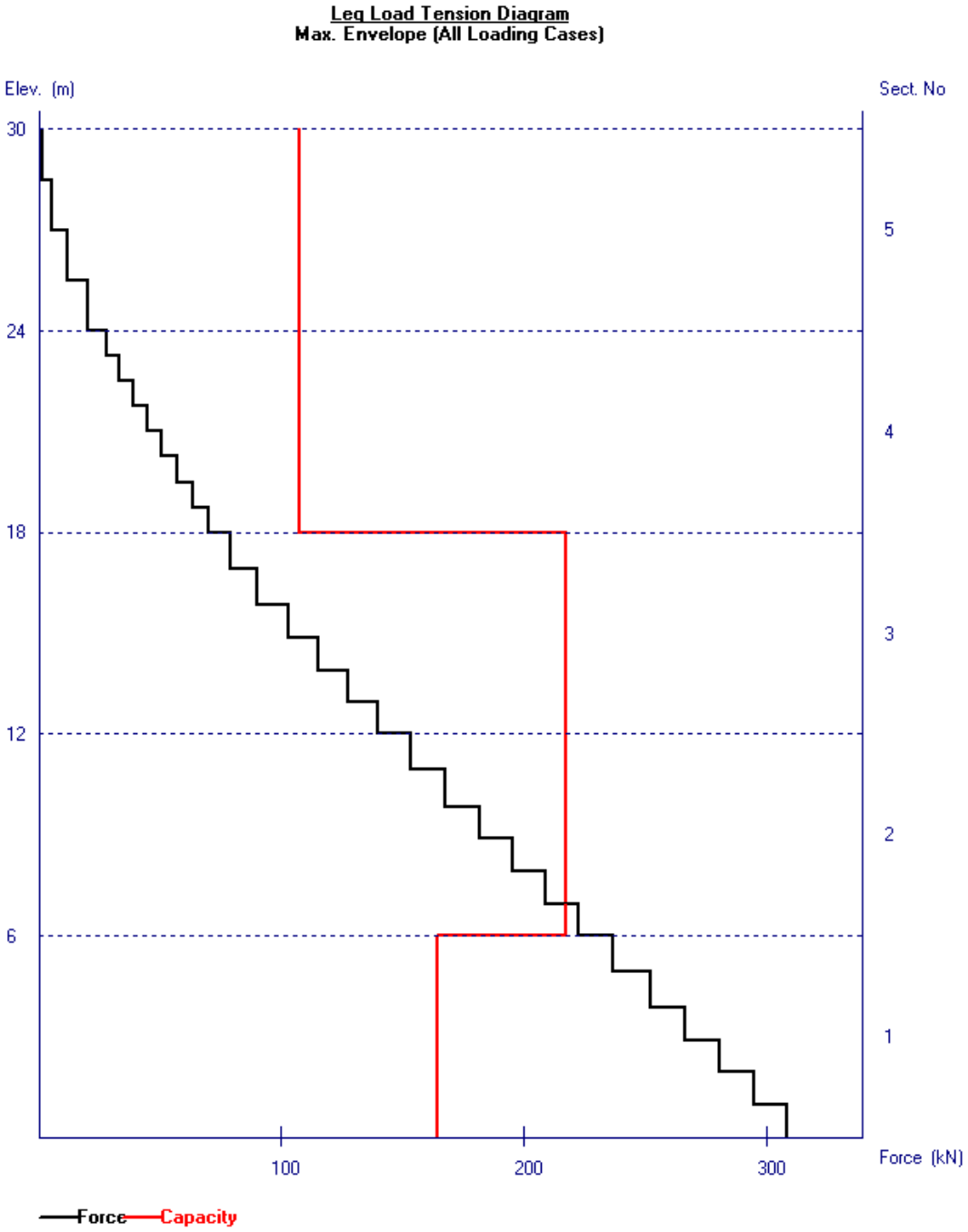
Temperature Reduction with Ice: 10.0 (Deg. Celsius)

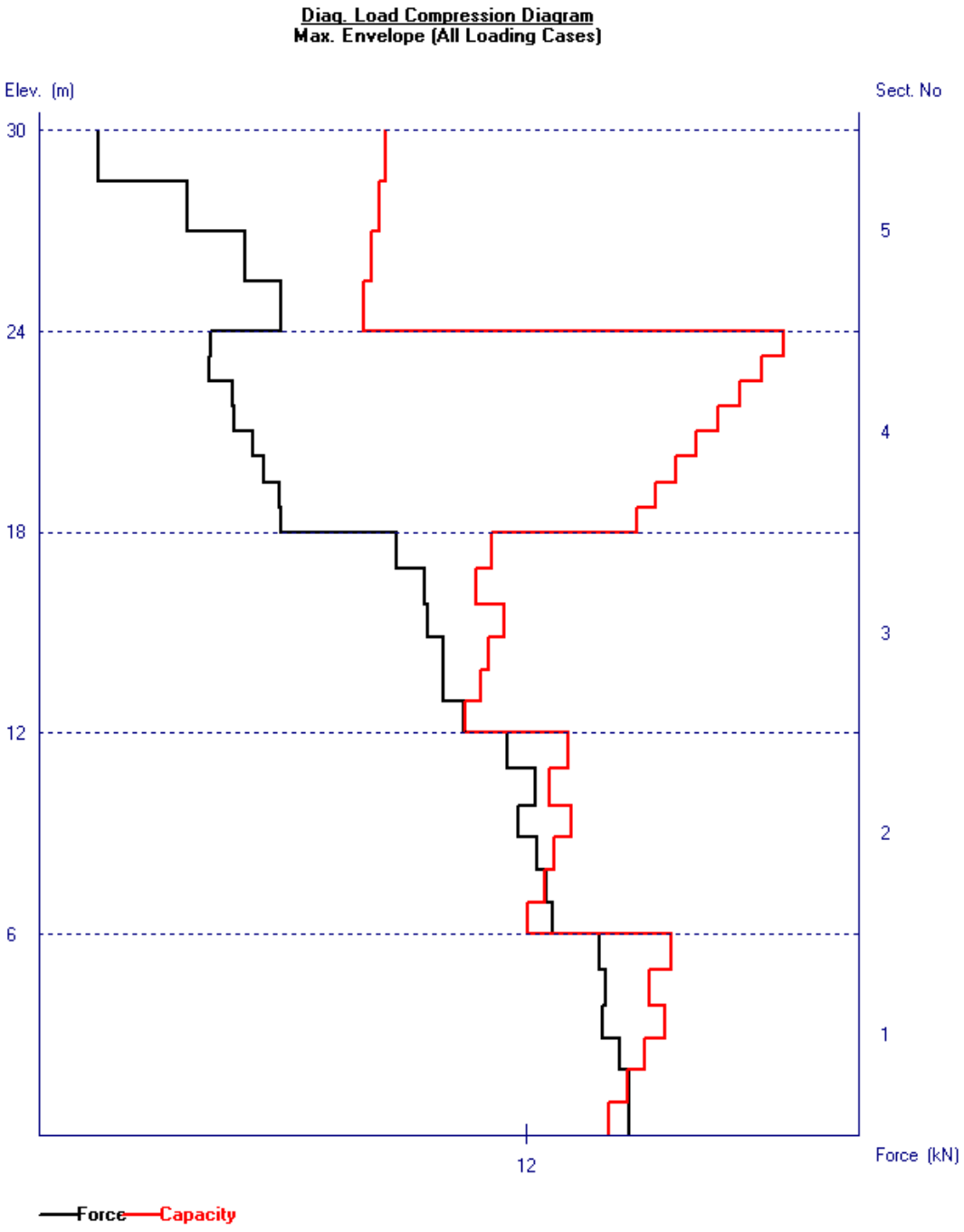
WIND ONLY SERVICEABILITY CONDITIONS:

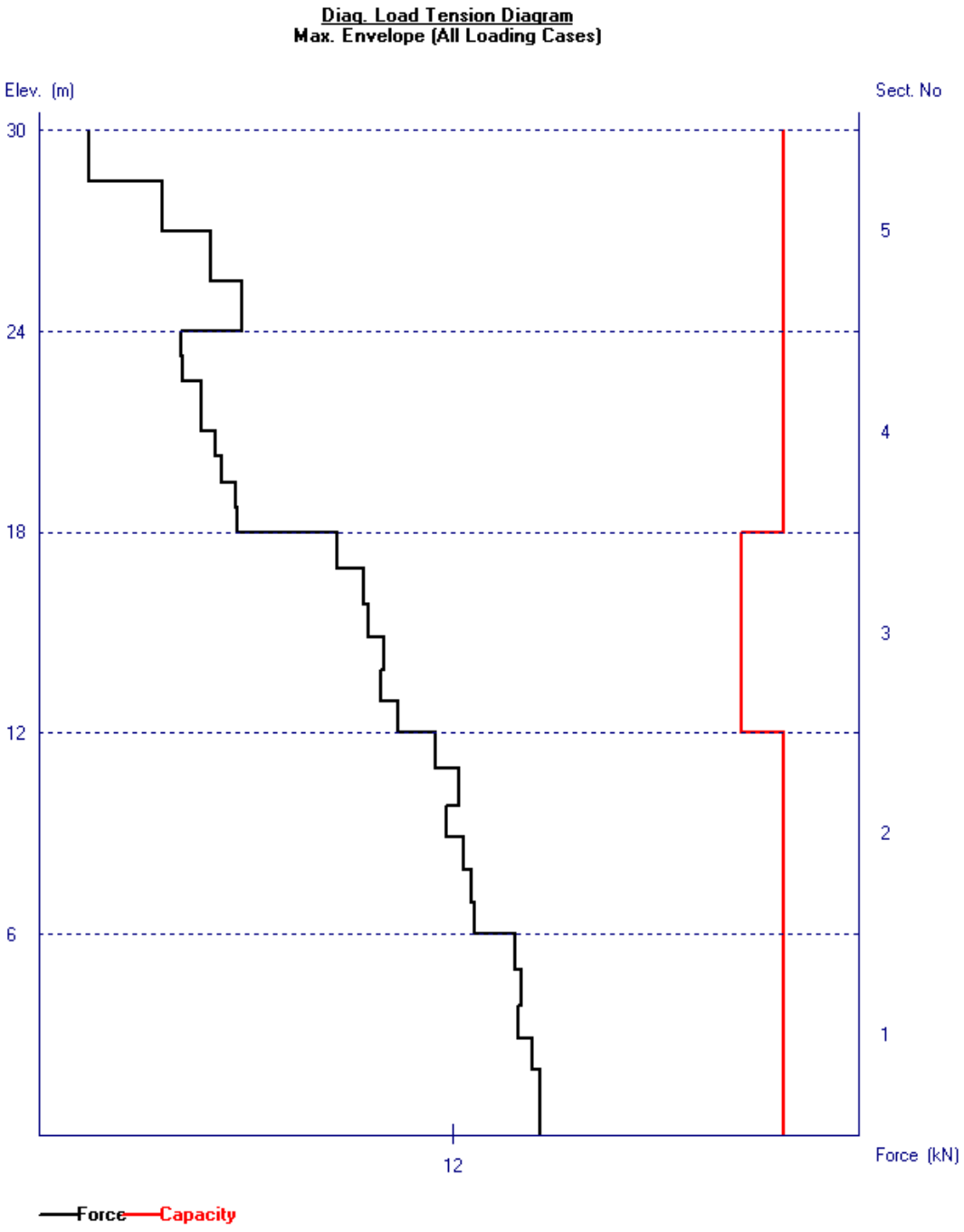
Wind pressure:	550.00 (Pa)
Wind Load Factor:	1.00
Dead Load Factor:	1.00
Dead Load Factor for Guys:	1.00

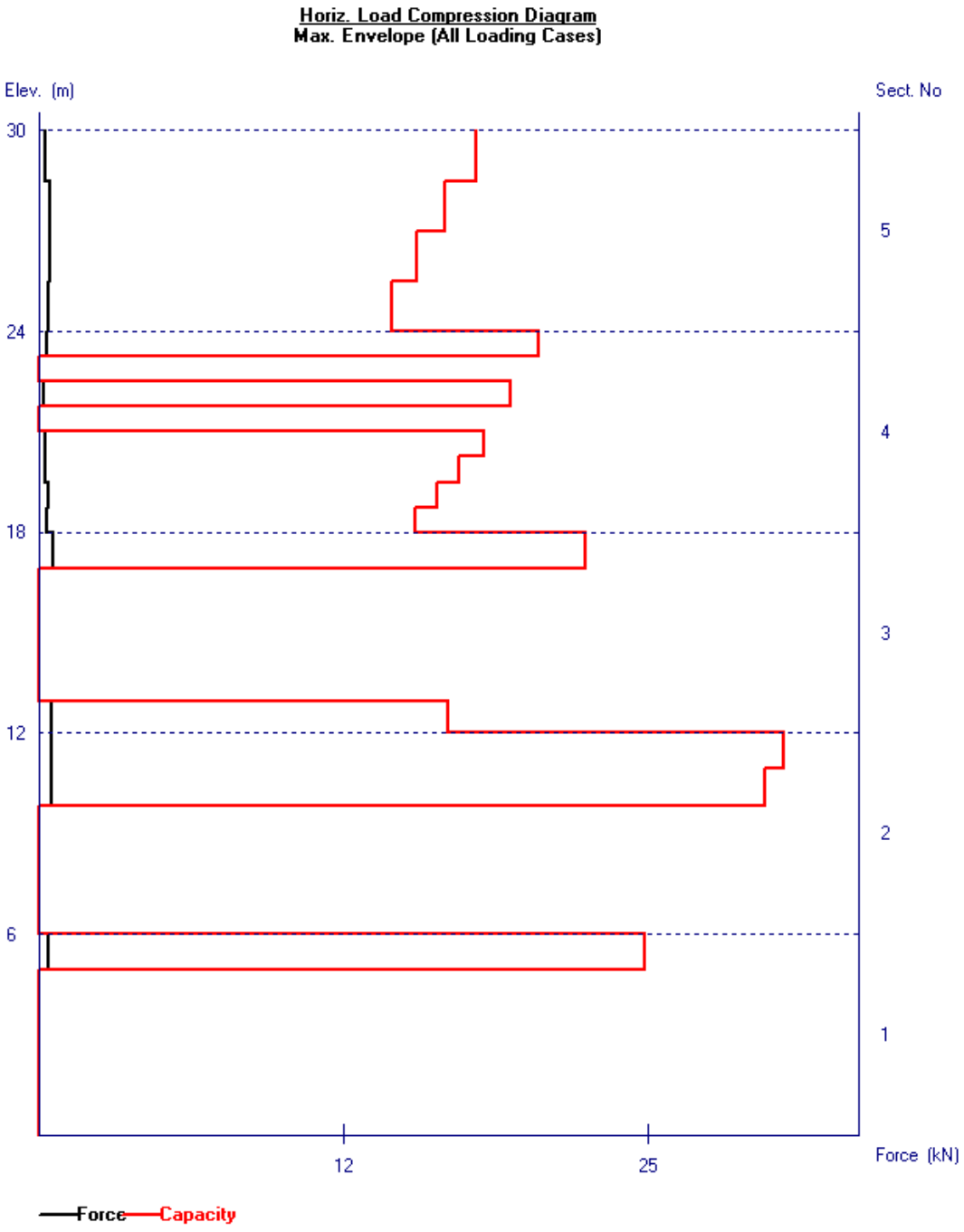
Leg Load Compression Diagram
Max. Envelope (All Loading Cases)

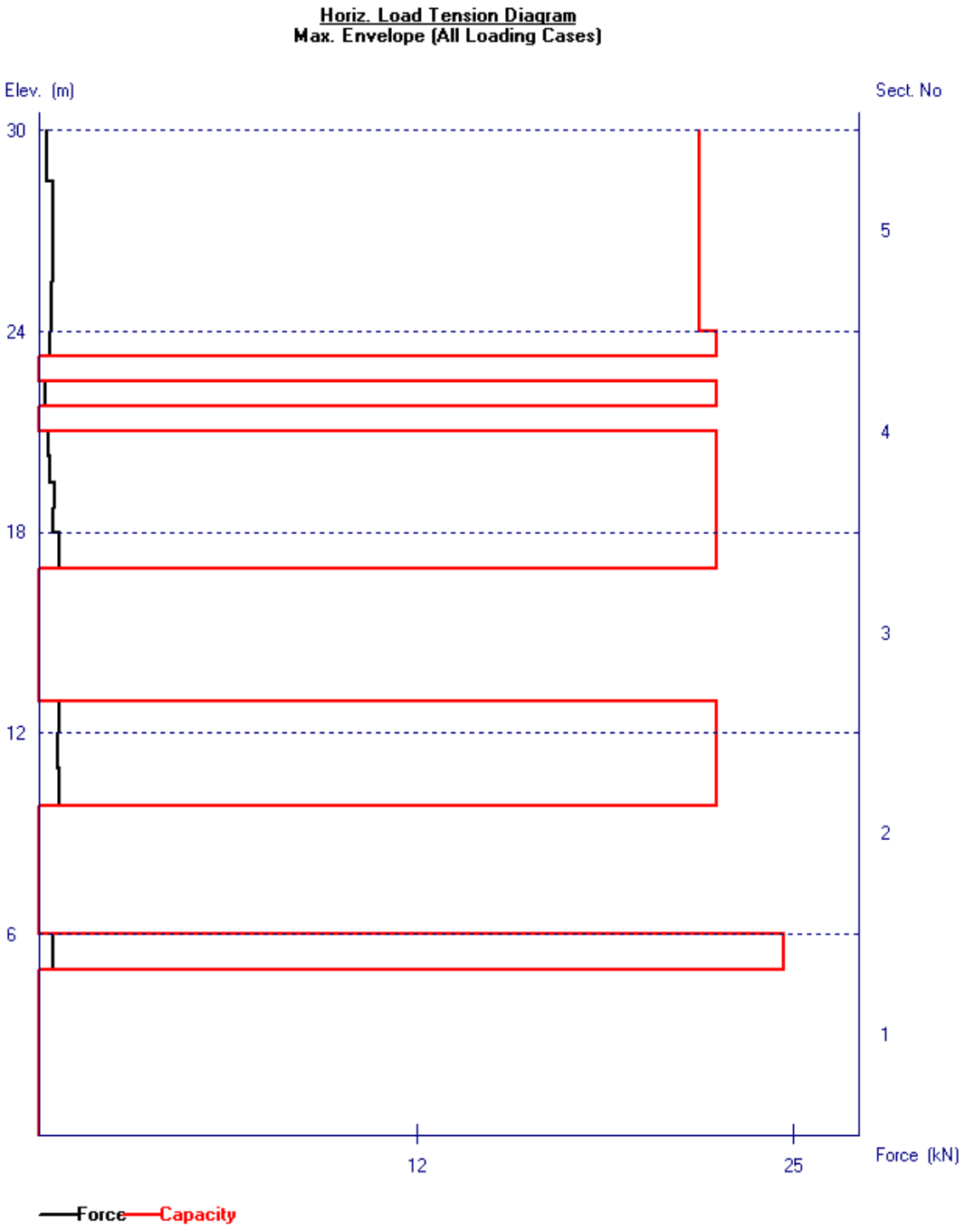



Leg Load Tension Diagram
Max. Envelope (All Loading Cases)
Elev. (m)
Sect. No
30
24
18
12
6
5
4
3
2
1
100
200
300
Force (kN)
Force
Capacity


Diag. Load Compression Diagram
Max. Envelope (All Loading Cases)
Elev. (m)
Sect. No
30
24
18
12
6
5
4
3
2
1
12
Force (kN)
Force
Capacity


Diag. Load Tension Diagram
Max. Envelope (All Loading Cases)
Elev. (m)
Sect. No
30
24
18
12
6
5
4
3
2
1
12
Force (kN)
Force
Capacity


Horiz. Load Compression Diagram
Max. Envelope (All Loading Cases)
Elev. (m)
Sect. No
30
24
18
12
6
5
4
3
2
1
12
25
Force (kN)
Force
Capacity


Horiz. Load Tension Diagram
Max. Envelope (All Loading Cases)
Elev. (m)
Sect. No
30
24
18
12
6
5
4
3
2
1
12
25
Force (kN)
Force
Capacity

APPENDIX C

Photos

Photo #1: Tower Profile

Photo #2: Tower Section

Photo #3: Deteriorated Foundation

Photo #4: Deteriorated Foundation