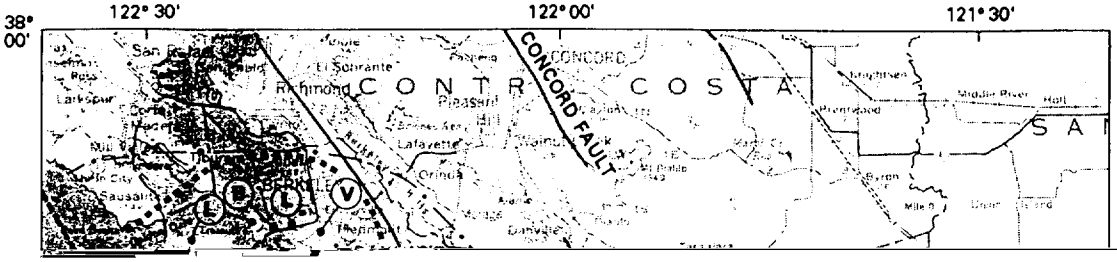
SANTA
WT.
OBSERVATORY
MT
HAMILTON
Lookout tower


38°
00'
122° 30'
122° 00'
121° 30'
CONCORD FAULT
CONCORD
Richmond
CONTRA COSTA
Pleasant Hill
Lafayette
Orinda
Walnut Creek
Martinez
Pittsburg
Antioch
Brentwood
Byron
Mt. Diablo
Danville
San Ramon
Sausalito
Larkspur
Mill Valley
Tiburon
Novato
Petaluma
Sonoma
El Sobrante
Middle River
Holt
Oakley
Discovery Bay
Clayton
Concord
Pittsburg
Bay Point
Clyde
Port Chicago
Rodeo
Hercules
Pinole
Crockett
Tormey
Martinez
Pacheco
Vine Hill
Rio Vista
Bethel Island
Knightsen
Oakley
Discovery Bay
Byron
Bethel Island
Brentwood
Oakley
Knightsen
Rio Vista
Bethel Island
Byron
Discovery Bay
Oakley
Brentwood

EXPLANATION

D
U 70

Fault rupture of Loma Prieta earthquake--Arrows show relative horizontal movement; small arrow and numeral show direction and amount of dip; U, upthrown side; D, downthrown side

Fault--Dashed where approximately located

★ Main shock epicenter

Area of aftershocks and abundant landslides

Area of ground cracks possibly related to faulting

Approximate limit of major structural damage

Approximate limit of landslides

(L) Prominent area of liquefaction

(B) Damaged bridge

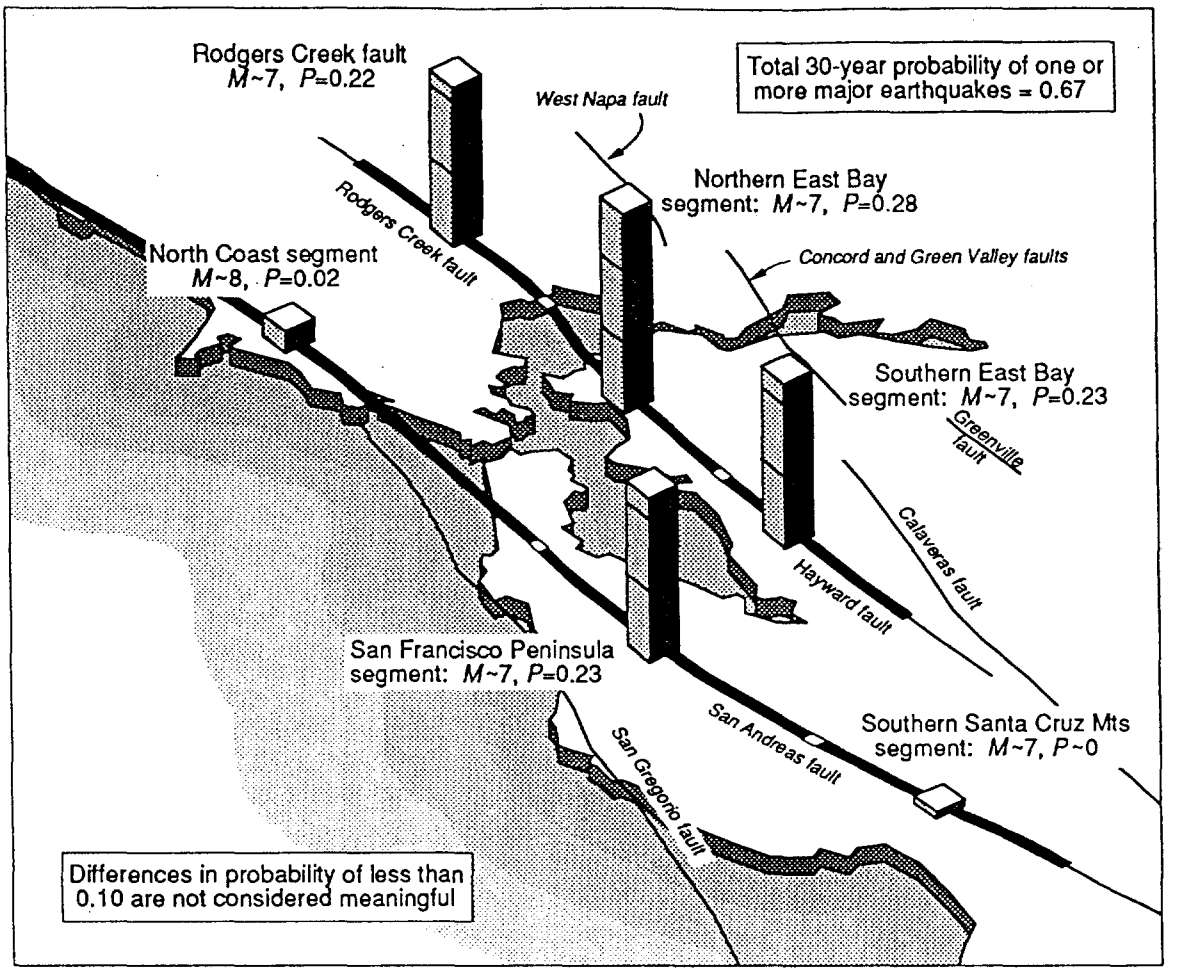
(D) Damaged dam

(V) Damaged two-story viaduct

Figure 1. Continued

ATTACHMENT E

(PAGE 2/2) SOURCE: REF. 4

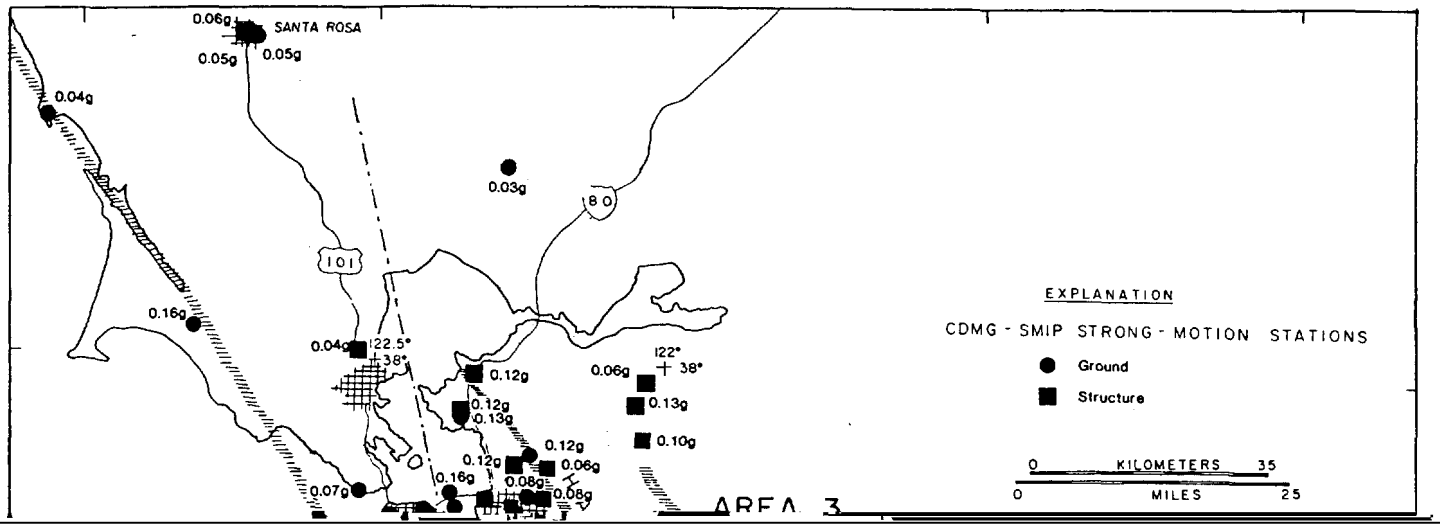


30-YEAR PROBABILITIES (P) OF LARGE EARTHQUAKES ($M \geq 7$) IN THE SAN FRANCISCO BAY REGION

Column heights are proportional to 30-year probability of earthquake rupture

ATTACHMENT F

SOURCE: REF. 6


0.06g
SANTA ROSA
0.05g
0.05g
0.04g
0.03g
80
101
0.16g
0.04g
122.5°
38°
0.12g
0.06g
122°
38°
0.12g
0.13g
0.13g
0.12g
0.10g
0.12g
0.06g
0.16g
0.08g
0.08g
0.07g
AREA 3
EXPLANATION
CDMG - SMIP STRONG - MOTION STATIONS
Ground
Structure
0 KILOMETERS 35
0 MILES 25

ATTACHMENT H

SOURCE: REF. 8

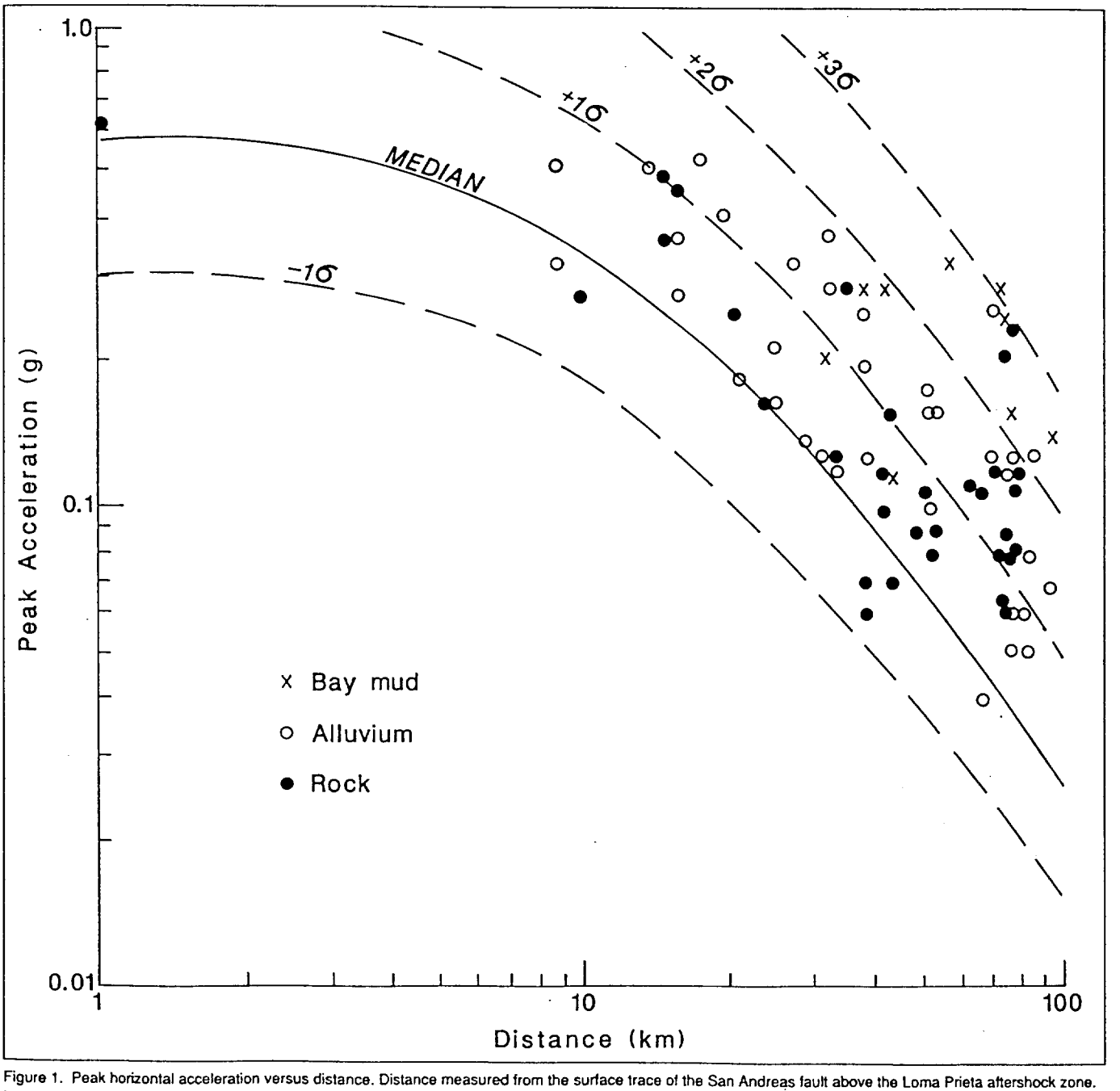


Figure 1. Peak horizontal acceleration versus distance. Distance measured from the surface trace of the San Andreas fault above the Loma Prieta aftershock zone. Largest of the two horizontal components is plotted. Solid line is the median curve of Joyner and Boore (1981) for a moment magnitude 6.9 earthquake. Dashed lines indicate median -1, +1, +2 and +3 standard deviations. Solid dots indicate stations located on (or near) rock; open circles, on alluvium; x's, on bay mud.

STATEMENT OF MADISON J. BATT, CONSULTING ENGINEER

I, Madison J. Batt, declare the following:

1. I am an Associate in the Structural Engineering division of TRA Architecture Engineering Planning Interiors, Ltd. (TRA), a multi-disciplined architectural/engineering firm headquartered in Seattle, Washington. I have been employed with the firm since February, 1988. Prior to joining TRA, I was employed as a structural engineer from 1978-1988 by Skilling Ward Magnusson Barkshire, Inc., a structural engineering firm headquartered in Seattle, Washington. I have had over 19 years of extensive practical experience as a Professional Civil/Structural Engineer concentrating on the design and analysis of structures. I have been responsible for the seismic analysis of many structures and have recently designed the seismic frames on several large building projects. In the past nine years I have specialized in tower engineering with emphasis on design, inspection, and analysis of communications towers.

2. I am currently serving as the Project Director for the US Coast Guard West Coast Tower Inspection Project. Working with the Civil Engineering Unit in Oakland, California we are inspecting 110 towers for this project. I am also serving as the Project Director on the FY92 High Antenna Tower Inspection Project for the Department of the Navy, Pacific Division, as well as Project Director of the City of Seattle, West Seattle Radio Tower Replacement Project. I have also designed several guyed and microwave communication towers ranging from 100' - 300' in the Northwest.

3. I was the structural project engineer responsible for the design of the seismic moment frames, braced frames and shear walls on the Snohomish County PUD expansion Project in Everett, Washington. Prior to that I was part of the team that provided a seismic analysis of the the VA hospital in Spokane, Washington. In addition, [redacted]

7. I am a registered Structural Engineer in the states of California, Washington and

15. The UBC defines the seismic design load with the goal of preventing major structural collapse while accepting some structural damage during the life of the structure. Additionally, the UBC recognizes the inherent ductility (ability to absorb energy) of different structural systems and adjusts the design load accordingly. The acceptance of some structural damage is related to the economics of managing the seismic risk along with the other risks. The UBC accounts for the ductility of the structural system by reducing the anticipated dynamic limit state base shear force to a working stress or design base shear. This reduction from limit state (actual maximum anticipated) to design force is approximately a factor of 1.5 for tower structures. The UBC design base shear at this site would be 0.20g (0.2 times the weight of the structure) or a limit state of approximately 0.30g. The actual ground acceleration experienced at the site in the 1989 Loma Prieta earthquake (as described in Dr. C. B. Crouse's statement) was approximately 0.5g. The UBC anticipated limited state base shear is approximately 9,000 pounds while the probable experienced base shear at the site was approximately 15,000 pounds. Therefore, the experienced seismic base shear is 2/3 of the design wind load. Further, the design wind load is a working stress load while the experienced seismic load is a limit state load. If the wind load was also increased to limit state, it would be approximately three (3) times the actual experienced seismic force at the site.

16. The damage sustained to the tower and to the top-mounted antenna demonstrates that the wind design criteria for the design of the antenna may have been less than what is recommended today. Wind loading on older antennas used 30psf to 50psf as prescribed in the earlier editions of the EIA Standard (Ref 3). Based on the current standards the loading on antennas can often be at least twice as high as the previous design criteria.

17. The magnitude of seismic activity described in the statement of C. B. Crouse would, in my opinion, result in a low risk of damage to the tower over the next 30 years. The expected life for guyed towers is between 30 to 50 years. With the changes expected in the next 20 years in the television industry, many guyed and free-standing towers will be modified or replaced to support the additional equipment needed for High Definition Television (HDTV). This tower appears to be in good structural condition and should last at least 30 more years assuming that the tower was designed for the proper wind loading.

18. If the proper wind loading was used in the design of the replacement antenna it should be capable of withstanding anticpated future earthquake loads.

19. Given that the tower experienced strong ground acceleration as noted above and that the damage was limited to the top of the tower and antenna, I do not believe that the tower needs any additional strengthening in order to withstand anticipated future earthquakes.

20. However, there is one element that may require modification. Guyed towers [illegible]

REFERENCES

1. Uniform Building Code (UBC), 1991 Edition, International Conference of Building Officials. Part V, Chapter 23, Section 2330, Earthquake Design.

2. ASCE STANDARD, Minimum Design Loads for Buildings and Other Structures, ASCE 7-88 (Formerly ANSI A58.1), 6. Wind Loads

3. EIA/TIA Standard, EIA/TIA-222-E, Structural Standards for Steel Antenna Towers and Antenna Supporting Structures, 1991.

4. Lemelin, D. R.; Surry, D.; and Davenport, A. G.; Boundary Layer Wind Tunnel Laboratory, The University of Western Ontario, London, Ontario, Canada; (1988); "SIMPLE APPROXIMATIONS FOR WIND SPEED-UP OVER HILLS"; Journal of Wind Engineering and Industrial Aerodynamics, 28 (1988) pgs. 117-127

EXHIBIT 1

MADISON J. BATT, P.E. **TRA**

Associate
Project Structural Engineer

Summary

Mr. Batt has over 19 years of extensive experience serving as a Civil/Structural Engineer. He has been responsible for the seismic analysis of many structures and has recently analyzed and/or designed seismic frames on several large projects. For the past nine years he has specialized in tower engineering and has been responsible for the design, inspection, and analysis of communication towers located throughout the West Coast. Currently, Mr. Batt is serving as the Project Director for the US Coast Guard West Coast Tower Inspection Project, Civil Engineering Unit, Oakland, Ca. He also is serving as the Project Director on the FY92 High Antenna Tower Inspection Project for the Department of the Navy, Pacific Division. In addition, he is the Project Director for the City of Seattle, West Seattle Tower Project which includes responsibility for the design of a 140 foot self-supporting microwave communication tower. Recently, he was responsible for the design of a 100 foot replacement tower for the Washington State Patrol at Boistfort Peak, Washington. He also designed two 310 foot guyed replacement towers for KBSN AM and KDRM FM in Moses Lake, Washington. Mr. Batt also recently evaluated and designed guy replacements for a 400 foot tower, located on Mt. Constitution, Orcas Island, Washington.

Education

University of New Hampshire, Durham, New Hampshire,
Bachelor of Science, Civil Engineering, 1974

University of Washington, Seattle, Washington,
Post Graduate Studies, Structures, 1977

Wind Engineering Seminars, 1989 & 1992

Registration

Registered Civil Engineer, Washington, 1979
Registered Structural Engineer, Washington, 1981
Registered Civil Engineer, California, 1991
Registered Structural Engineer, California, 1991
Registered Structural Engineer, Wyoming, 1992

Selected Experience

TRA Architecture Engineering Planning Interiors, Ltd.
Associate and Structural Engineer, since 1988

Skilling Ward Magnusson Barkshire Inc., Seattle, Washington,
Associate, 1978-88

MADISON J. BATT, P.E.
Associate
Project Structural Engineer

Relevant Structural Project Experience

Tower Projects

US Coast Guard, Civil Engineering Unit, Oakland, California, Inspection of 110 Towers in Washington, Montana, Oregon, Nevada, and California, Project Director, 1993

Department of the Navy, Pacific Division, FY92 High Antenna Tower Inspection Project, Inspection of 36 Towers in Hawaii, Washington, Japan and Okinawa, Project Director, 1992-1993

Eastside Public Safety Tower Analysis, Bellevue, Washington, Analysis of two towers for new 800 mhz communication system and recommendations, Project Director, 1993

City of Seattle, West Seattle Tower Project, Seattle, Washington, design of a 140 foot self-supporting microwave communication tower, Project Director, 1991-93

KXLY Radio Tower Inspection, Spokane, Washington, Inspection of 454 foot AM Freestanding Tower, Project Director, 1992

KOMO TV Tower Inspection, Seattle, Washington, Inspection of 400 foot TV Tower and Ultra Sound of antenna mast for wall thickness, Project Director, 1992

KOMO AM Radio Tower Inspection, Seattle, Washington, Inspection of three 500 foot guyed towers, Project Director, 1992

KVEW TV Tower Inspection, Pasco, Washington, Inspection, Analysis and repair project of 200 Guyed Tower, Project Director, 1992

KCWC TV Tower, Limestone Mountain, Wyoming, 200 ft Guyed Tower Analysis and Upgrade Project, Project Director, 1992

Washington State Patrol, Baw Faw Replacement Tower, Boistfort Peak, Washington, design specifications for a new 100' communications tower, Project Director, 1992

State of Washington, Department of Natural Resources, Various locations in Washington, Communication tower inspection and grounding design project at 10 sites, Project Director, 1992

KPUG AM guy replacement project, Bellingham, Washington, inspection and guy replacement for two 210 foot AM radio towers, Project Director, 1991

Medford Municipal Airport FAA ASR 9 Tower, Medford, Oregon, Foundation design for new tower, Project Director, 1991

Mt. Constitution Tower, Orcas Island, Washington, guy replacement for a 400 foot tower, Project Director, 1991

KBSN AM and KDRM FM towers, Moses Lake, Washington, designed two 310 foot guyed replacement towers, Project Director, 1991

Washington State Patrol, Beezley Hill Communication Tower, Ephrata, Washington, Tower Inspection, Project Director, 1991

Mt. Constitution, Orcas Island, Washington, evaluation and recommendation report for 400 ft. communication tower, Project Director, 1990-91

KAPP Tower Inspection, Yakima, Washington, Project Director, 1991

KXXO Radio Tower, Rooster Rock, Washington, Structural Inspection, Project Director, 1990

KCPQ Channel 13, Tacoma, Washington, Tower Evaluations, Project Director, 1990

State of Washington, Department of Natural Resources, Various locations in Washington, Multiple communication tower retrofit documents and construction inspection, Project Director, 1990

Federal Center South Communication Tower, Seattle, Washington, Inspection and recommendation report, Project Director, 1990

Army Corps of Engineers, Adams Ridge HF/SSB, Eastern Washington, Antenna Towers Inspection and report, Project Director, 1989

KCTS-TV, Seattle, Washington, Tower inspection, Project Director, 1988-89

State of Washington, Department of Natural Resources, Various locations in Washington, Communication tower inspection report and grounding designs at 7 tower sites, Project Director, 1988

MADISON J. BATT, P.E.
Associate
Project Structural Engineer

Relevant Seismic Project Experience

Seismic Projects

Snohomish County PUD Headquarters Expansion, Everett, Washington, Design of Seismic Frame system for 5 story office building, Project structural manager for office building, Training Center, and Post Tensioned Parking Garage, 1991 - 1993

Veterans Administrations Hospital Seismic Analysis, Spokane, Washington, seismic analysis of existing hospital structure using ETABS, Project Engineer, 1992

H-Wing Health Sciences Addition, University of Washington, Seattle, Washington, Seismic frame analysis and design, Project Structural Engineer, 1991

Seattle School District #1, Capitol Improvement Program, Muir Elementary School, Seattle, Washington, Structural compliance review, 1990

Existing G & H Wings, Health Sciences Facility, University of Washington, Seattle, Washington, Seismic capacity study, 1990

Security Pacific Bank Building Renovation, Seattle, Washington, Seismic analysis and upgrade, 1989

Dexter Horton Building, Seattle, Washington, Seismic study and evaluation reports, 1989

Seattle School District #1, Capitol Improvement Program, Lawton Elementary School, Seattle, Washington, Structural compliance review, 1990

Camlin Hotel, Seattle, Washington, Seismic study, 1989

Aerospace Engineering Research Building, University of

MADISON J. BATT, P.E.
Associate
Project Structural Engineer

Seattle School District #1, Capitol Improvement Program, Olympic View Elementary School, Seattle, Washington, Structural compliance review, 1989

United Airlines Maintenance Facility, Sea-Tac International Airport, Seattle, Washington, Seismic analysis and design of framing, 1988

Loma Linda UMC, Phase Two, Lateral frame design, Loma Linda, California, 1987

St. Agnes Medical Center, Fresno, California, Seismic analysis, 1986

Washington State Convention and Trade Center, Seattle, Washington, Preliminary lateral design, Field surveillance, 1984

Swedish Hospital Medical Center, Southwest Addition, Seattle, Washington, Seismic evaluation and six-story addition to existing building, Project Structural Manager, 1983

Existing Veterans Hospital, Seattle, Washington, Seismic analysis, 1981

Publications

"Concrete Tower Upgrade", Television Technology, Madison Batt, August 1988

"A Fresh Look at Guyed Towers" Television Technology, Tony Tschanz and Madison Batt, February 1988

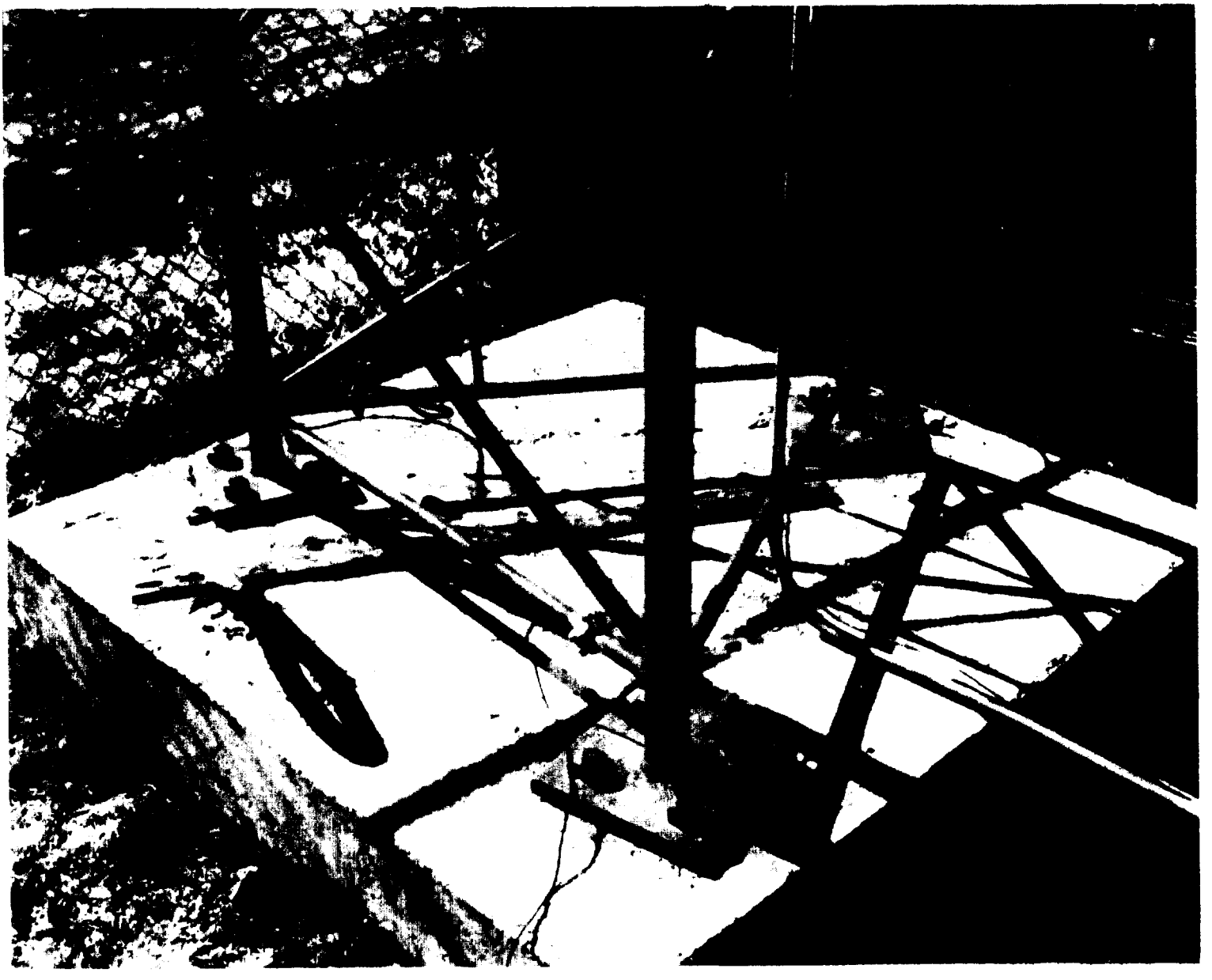
"Have a Pro Inspect Your Tower", Television Technology, Tony Tschanz and Madison Batt, January 1988

"Examining Tower Structures", Television Technology, Tony Tschanz and Madison Batt, December 1987

Service and Affiliations

Associate Member: Society of Broadcast Engineers
Member: Structural Engineers Association of WA
Member: American Institute of Steel Construction
Member: American Society of Civil Engineers
Member: Society of Military Engineers

ATTACHMENT A



This is a photo of the base of a tower with a condition similar to the KNTV base. The tower legs are bolted directly to the concrete foundation.

215 Columbia
Seattle, Washington 98104-1551
(206) 682-1133 FAX (206) 343-9537

TRA
Tower Engineering & Inspection

ATTACHMENT B

CERTIFICATE OF SERVICE

This will certify that a complete copy of the foregoing "Comments of KTVU, Inc." was sent this 19th day of July, 1993, via first class United States mail, postage prepaid, to the following:

Tom W. Davidson, Esq.
Paul S. Pien, Esq.
Akin, Gump, Strauss, Hauer & Feld,
L.L.P.
1333 New Hampshire Avenue, N.W.
Suite 400
Washington, D.C. 20036

Joel Rosenbloom, Esq.
William R. Richardson, Jr.