DOWNTOWN MARQUEE
PORT ORCHARD, WASHINGTON

STRUCTURAL EVALUATION REPORT

CTS PROJECT NO. WA05.055.S01

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A. EXECUTIVE SUMMARY

A.1 Marquee Description

Port Orchard Downtown Marquee was constructed in the early 1970's as a means of providing protection for pedestrians using the sidewalks on each side of Bay Street, from Frederick Street at the west end towards the east, where Bay Street takes a moderate turn to the north.

Sections A and B in Appendix A show a general configuration of the marquee. A corrugated metal deck serves as the roof of the marquee, and is supported by steel channels at the face of the buildings and at the edge of the sidewalks. One exception to this is at the southeast corner of Bay Street and Sidney Street intersection, where the roof of the marquee is made of wood decking supported by wood beams projecting from the building.

The steel channels at the face of the buildings are sometimes bolted to the building, but sometimes they are supported by metal posts. Most of the metal posts have steel base-plates bolted to the sidewalk, although some are embedded in the sidewalk with no visible base-plates. At the edge of the sidewalk, the steel channels are supported by round poles or build-up wood posts.

The knee braces that are located at each of the columns consist of 6x10 lumber giving the marquee its characteristic look. See Elevation C in Appendix A.

For the purposes of documenting structural conditions of the marquee, we have divided this structure into four segments named Marquee #1, #2, #3, and #4. This division can be seen in Plan 1 in Appendix A.

A.2 Structural System

The structural system to carry gravity loads, such as the weight of the materials, or snow load, consists of a corrugated metal deck, steel channels, and wood columns. The built-up wood posts are supported by small concrete pedestals, while round poles are embedded in the ground.

The lateral forces, such as wind and earthquake in the direction parallel to Bay Street, are resisted by the frame system consisting of round poles with knee braces. In the direction perpendicular to Bay Street, the corrugated metal deck acts as a diaphragm between the round poles which then resist the lateral force as cantilevers.
In our analysis we have subjected the marquee to the following loads:

**Dead load:** weight of the various materials

**Basic snow load:** 25 psf per ICBO 2003

**Snow load with drift:** 48 psf Marquee #1 and #2
53 psf Marquee #3 and #4

**Live load:** 75 psf per ICBO 2003

**Wind load:** 85 mph wind

**Seismic load:** per ASCE/SEI 31-03

### A.3 Deficiencies of Structural Members

The deficiencies of the structural members can be divided into two groups: a) deficiencies due to their inadequate size, and b) deficiencies due to damage.

#### a. Deficiencies due to Inadequate Size:

1. The maximum vertical load that can be supported by the metal deck of Marquee #1 and #2 is 39 psf. This load is more than snow load with snow drift, and less than live load of 75 psf.
2. The maximum vertical load that can be supported by the metal deck of Marquee #3 and #4 is 84 psf.
   For our calculations, we assumed the deck is 22 gage, this being the lightest deck produced by steel mills for some time. The reason why ICBO requires such a high load for canopies must be due to the fact that they extend over areas occupied by the public. Since this not the case in Port Orchard, we are mentioning this deficiency here only for completeness.
3. Steel channel spanning between wood columns has a capacity of 40 psf at Marquee #1 and #2, and 68 psf at Marquee #3 and #4. This capacity is more than snow load with snow drift, but less than live load of 75 psf.
4. Steel Channel supported by the steel posts next to the buildings has a capacity of 27 psf at Marquee #1 and #2, and 32 psf at Marquee #3 and #4. Both capacities are less than snow load with snow drift.
5. The round poles resist lateral forces by being embedded into the ground with support of the sidewalk at the grade level. These poles need to be embedded 8'-0" into the ground to resist wind load if the railing were to remain, and 5'-0" into the ground if the railing is removed. For seismic forces, the embdenment needs to be 5'-0". During our investigation, we could not find out how deep these poles are embedded at this time.
6. The metal deck does not meet the flexible diaphragm maximum length to width ratio in order to act as a lateral load carrying element between the round poles. Again, this deficiency is only mentioned here for completeness since it will cause large deflections of the deck, but not a structural collapse. In addition, the metal deck panels are not connected at the seams, that diminishes the ability of the metal deck to act as a diaphragm even more.
7. The steel channels are connected to the round poles with two 5/8”
diameter lag bolts. The capacity of this connection is 18 psf at Marquee
#1 and #2, and 26 psf at Marquee #3 and #4. Neither capacity meets the
snow load with snow drift or live load requirements.

8. The steel channels are connected to the buildings with one 5/8” diameter
lag bolt at about 2'-9” spacing. The capacity of this connection is 49 psf
at Marquee #1 and #2, and 67 psf at Marquee #3 and #4. Neither capacity
meets the 75 psf requirement.

9. The knee brace connections at each end do not have the capacity to
transfer lateral loads into the round pole.

b. Deficiencies due to Damage:

1. The wood members of the built-up posts suffer from dry-rot. The
condition is worse in Marquee #1 and #2 than in Marquee #3 and #4,
because of greater exposure to rain, sun and wind. We discounted the
capacity of these columns by 50%, and even at this level, they have a
capacity of 180 psf at Marquee #1 and #2, and 260 psf at Marquee #3 and
#4.

2. Several of the knee braces also suffer from dry-rot, due to the same
exposure conditions as stated for the posts.

3. Several 4x6 and 4x12 wood members forming the gutter, together with the
steel beam, have dry-rot due to water penetration.

4. Several 4x12 wood members have severe splits.

5. Several lag bolts are loose due shrinkage of the wood members they are
connecting.

A.4 Cost of Repairs

a. Immediate remedies $ 41,000
b. Near-term repairs $ 26,000
c. Long-term repairs $ 10,000
d. Renovation options $ 8,000

All costs include materials, labor, contingency, and contractor’s overhead and profit, but
do not include WSST. See Section D for details of the proposed remedies and repairs.

B. MARQUEE CONDITIONS

B.1 Marquee #1 – See Plan 2 in Appendix B and photos in Appendix C
B.2 Marquee #2 – See Plan 3 in Appendix B and photos in Appendix C
B.3 Marquee #3 – See Plan 4 in Appendix B and photos in Appendix C
B.4 Marquee #4 - See Plan 5 in Appendix B and photos in Appendix C

C. STRUCTURAL MODELING

The marquee configuration, shown in Elevation C in Appendix A, depicts the marquee as it is viewed from the street. The round poles, also serving as lamp posts, are spaced at regular intervals of approximately 60 feet. This distance is further divided into three equal spaces by the build-up columns supporting gravity loads. The structural model of a complete marquee 60-foot bay is shown in Elevation D of Appendix A as Diagram #1.

Diagram #2 in Elevation D shows our model for resisting the lateral loads - in this case seismic load, acting in a direction parallel to Bay Street. In comparison with Diagram #1, we have removed the knee braces at the build-up posts, because if the build-up posts do not have a positive connection to the concrete base, the knee braces have a minimum role in resisting any lateral force. In the model shown in Diagram #2, the knee braces act in tension and compression.

Diagram #3 is similar to Diagram #2, except in this case only one knee brace in compression participates in the system resisting the lateral load. We have included this configuration to demonstrate that the present system has sufficient redundancy, even when some of the knee braces are incapacitated due to dry-rot, and to consider that the knee brace in tension may have insufficient connection at the top since it subjects the lag bolt to withdrawal force.

Diagram #4 shows the round pole resisting the lateral force in the direction perpendicular to the building as a cantilever.

The conclusion of our structural modeling is that the round poles have sufficient capacity to resist wind and seismic forces without knee braces provided that they have adequate embedment into the soil, and provided that the lag bolts connecting the steel channels to the these poles are increased to 1" diameter.

We have included several details in Appendix A worthy of mention. Detail E shows the build-up column configuration. The individual wood members are connected together with a few spikes and bolts. The connection is not sufficient to make these members act as one column; especially considering that the spikes have split the wood at the bottom of these posts, as demonstrated in one of the photos.

Detail F shows how the steel channel and 4x6 and 4x12 wood members, that are connected together, act as a horizontal link between the round poles. Also, all three members form a gutter that is interrupted at each round pole and slopes toward the build-up posts, because they have a downspout inside each one of them.

Detail G shows the only lag bolt serving as a connection between the horizontal link of the structural system and the knee brace.
Detail H shows condition at the joints between the metal deck panels, and a need for a shear connector at round pole locations.

D. RECOMMENDED REPAIRS

D.1 Immediate Remedies
As immediate measures to improve safety, we recommend removal of the picket fence; repairs to the gutter, replacement of the knee braces and 4x12s damaged by dry-rot; replacement of all wood members identified as having splits; and replacement of the lag bolts with larger size to account for the wood shrinkage or for size deficiency.
Cost: $41,000

D.2 Near-term Repairs
In cooperation with the building owners, replace existing flashing between the building wall and the marquee roof. Provide button punch connections between the metal deck panels. Provide shear connectors at each round pole.
Cost: $26,000

D.3 Long-term Repairs
Replace all built-up wood posts with pressure-treated lumber.
Cost: $10,000

D.4 Renovation Options
Remove knee braces at the built-up posts, where they serve only an aesthetic purpose.
Cost: $8,000

D.5 Miscellaneous Items
Maintenance Checklist:
- Leaking
- Gutter cleaning
- Minor repairs
Annual maintenance budget: $3,000 to $4,000

Business Signs
Once the picket fence is removed, the individual businesses would have the opportunity to attach their signs to the outside 4x12 fascia using the steel bolts already in place, and in case of larger signs, brace these back to the metal deck as is done at the present time.
FACE OF BUILDING

1\(\frac{1}{2}\)" CORRUGATED METAL DECK

FLASHING

LAC BOLT OR EXP. ANCHOR AS APPLICABLE WHERE OCCURS

3" ± DIA. STEEL POST

1" ± 10' - 0"

4' - 0"

4" GUTTER

2x4 BOTTOM & TOP RAIL

1x6 PICKETS

2x4

4x4 POST @ 2' - 0" TO 5' - 0"

SPACING

4x12

4x6

3x8 @ EA. FACE

© BUILT-UP POSTS

8' - 6" ± NORTH SIDE

5' - 10" ± SOUTH SIDE

OF BAY STREET

SIDEWALK

2x6 @ EA. SIDE

© BUILT-UP POSTS

RAIN LEADER

CURB

DOWNTOWN MARQUEE

PORT ORCHARD, WASHINGTON 98366

STRUCTURAL INVESTIGATION

PROJECT: DOWNTOWN MARQUEE

JOB NO. WA05.055.S01

DATE 10.10.05

SHEET NO. SECTION A
PORT ORCHARD, WASHINGTON 98366

DOWNTOWN MARQUEE

1x6 PICKETS

2x4 BOTTOM AND TOP RAILING

4x12 WOOD FACIA

4x4 RAILING POST, @ 2'-0"
TO 5'-0"

6x10 KNEE BRACE, EA. POST
20'-0" O.C.

2x8 EA. FACE @ INTERMEDIATE POSTS

6x10 KNEE BRACE, EA. POST

2x6 EA. SIDE @ INTERMEDIATE POSTS

POLE ENDS UP BELOW SIDEWALK

12"± DIA. POLE EVERY THIRD POST

4" CONCRETE CURB

CONCRETE PEDESTAL @ INTERMEDIATE POST

RAIN LEADER

APPROXIMATELY 10'-0"

5'-0"
PUDDLE WELDS

METAL DECK

STEEL CHANNEL

X

FLASHING

2x4

CONTINUOUS 4x4 FILLER

8" DIA. M.B.

5/8" DIA. LAG BOLT

6" 4"

NOMINAL NOMINAL

NOTE: RAILING POSTS NOT SHOWN NOT SHOWN
Metal deck panels are not connected at joints. Recommend adding button punch connection @ 24".

Add puddle welds @ 12".

Add shear connector L 2x2x\(\frac{3}{16}\) at each round pole.