

**ROBB ENGINEERING OWSJ's
UPDATED INFORMATION**

PREPARED BY: THE OWSJ TASK REVIEW BOARD

**PREPARED FOR: PROFESSIONAL ENGINEERS & GEOSCIENTISTS OF
NEWFOUNDLAND AND LABRADOR (PEG-NL)**

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Summary

The adequacy of Robb Engineering open web steel joists has been questioned since the partial collapse of two local structures in 1987 and 1995. To date most of the information available was summarized in a report titled "Open Web Steel Joist Load Testing Program", issued in 1997. Additional information is now publicly available that describes major quality gaps and poor shop practices at Robb Engineering that support the structural concerns expressed to date and which support the case for remediation of open web steel joists. This may require that professional engineers, who have investigated Robb OWSJ problems in the past, revisit previous opinions or decisions and discuss same with the client.

When the initial advisory was published by the Government, it was understood that the period in question included joists fabricated between 1963 and 1985. Presently no conclusive proof is available confirming a date when the shop practices were improved, therefore joists fabricated up to the close of the Robb Engineering Plant, Amherst, NS, in the early 90's should be addressed.

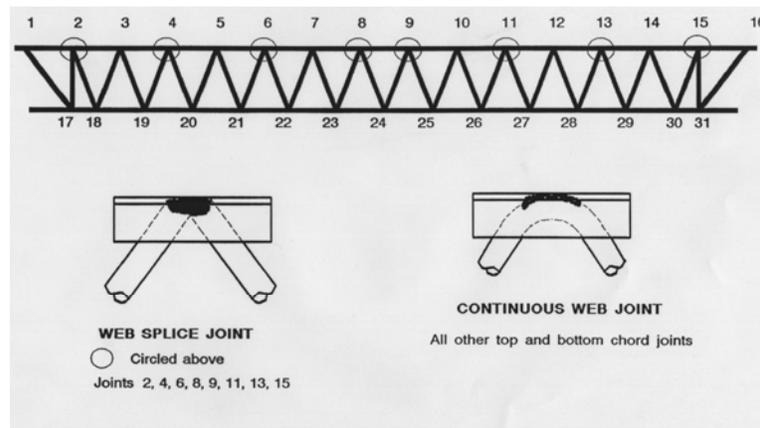
It is recommended that all Robb joists fabricated from 1963 onward, be subjected to a detailed inspection. Guidelines for remediating Robb OWSJ's may be found in Volume 2 Appendix VI of Open Web Steel Joist Task Review Board's, Final Report, which is published on PEG-NL's website, www.pegnl.ca.

Robb Open Web Steel Joists: The Case for Remediation

In the spring of 1997 there was an advisory from the Minister of Works Services and Transportation and the Minister of Government Services and Lands regarding a problem with the welded connections of Open Web Steel Joists (OWSJ) fabricated by Robb Engineering Division, Dominion Bridge Company Limited (Robb) of Amherst, NS. This was in part precipitated by information the Professional Engineers and Geoscientists of Newfoundland and Labrador (PEG-NL) uncovered following the partial collapse of a shopping mall and a warehouse in the St. John's area, in winters of 1987 and 1995 respectively. This advisory was followed by a widespread initiative to contact owners of buildings containing Robb Joists to suggest they engage a structural engineer to review/inspect the OWSJ's in their building to determine if remediation is necessary. During the same period (96/97) a task force was set up by the Province, to develop and promote a consistent remediation approach, and to provide advice and technical assistance to those requiring same. This task force became known as "The OWSJ Task Review Board".

Through a consultant team, the Task Force embarked upon an identification program, a testing program, an inspection program, and finally an OWSJ remediation program, for Province and School Board owned buildings. A report was subsequently published in September of 1997 titled "Open Web Steel Joist Load Testing and Inspection Program".

One of the more startling statistics that was reported in the above referred publication was that 8.3% of all joists inspected had one or more broken welds, which was based upon almost 7000 inspected joists. These weld cracks appeared quite randomly in both their location relative to the joist and their location relative to the building, although in some buildings, the cracks occurred in groups of consecutive joists. In addition to the weld cracks, there were numerous other weld flaws such as porosity, under cut, lack of fusion, etc. Virtually every joist inspected contained welds which were grossly deficient in comparison to the requirements of CSA W59 Welded Steel Construction. Then there was the "Puddle Weld", a pool of weld metal that was deposited on the ends of web members where they joined in the top chord. This non standard weld detail occurred at least at every second top chord panel point, and is depicted in the sketch below as a "Web Splice Joint".



The remainder of the panel point welds were flare bevel welds. There were also splices in the chord angles which were butt welds that were carried out using resistance welding. Another deficiency that was common through out the joist is that there was no attempt to remove the slag covering in many cases.

These flaws, defects and weld profile issues pointed to a problematic quality program breakdown in the Robb plant. However, without hard evidence to support the obvious, the Task Force elected to report the information, and leave the engineer to draw his/her own conclusions about Robb's weld quality problems.

During a recent court case involving Robb joists, new information has become publicly available about substandard shop practices and inadequate quality control. It was agreed that it was important to get this information out to the structural engineering community, to adequately arm them to make an informed decision as to whether or not Robb joists require remediation.

In 1963, Robb started fabricating the type of joist in question, i.e. double angle chords and round rod web members. They fabricated this type of joist until they closed their joist line, sometime in the early '90's. During that time, they were certified to the requirements of CSA W47.1. Although Robb fabricated numerous buildings, bridges, and other structures without any known welding problems, during the period in question the same is not true for their open web steel joists. Their joist line was separate from their regular fabrication and did not receive the same level of attention to certification requirements, code requirements or quality.

Up to 1986 and possibly later, no procedures were ever successfully qualified for the flare bevel welds used through out the joists. The puddle weld, which was not covered by the welding codes/standards was not qualified, nor was there any rationale developed to determine its capacity. For most of the period the welders did not have the appropriate welder certificate of qualification (ticket). In 1980 there was an attempt to qualify a group of OWSJ welders, twelve (12) were tested, eleven (11) failed. Furthermore, the welders were on a quota system that meant once they finished their allotted number of joints for the day, they could stop working. For long periods, one or more of the following conditions applied:

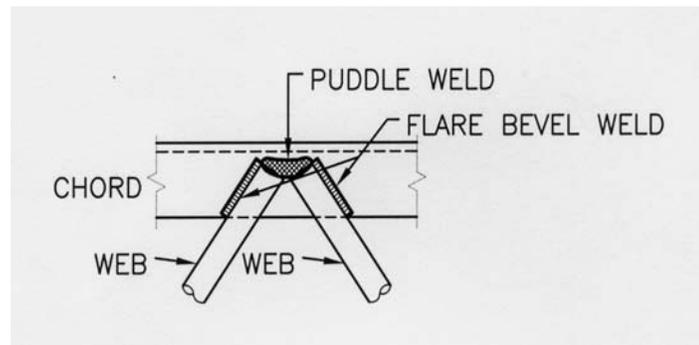
1. the welding electrodes were not certified as required,
2. electrodes were used in a position for which they were not designed,
3. electrodes were used for welding a material for which they were not approved.

The engineering manager was not a professional engineer and the CSA W47.1 welding engineer was based in head office and not resident in the Atlantic Region.

In light of the above it is recommended that any Robb Joists fabricated from 1963 onward using double angle chords and round rod web member, be inspected and where deemed necessary, remediated.

As early as 1973 Dominion Bridge (parent company) personnel recognized that there was a problem with the Robb joist quality. Tests were carried out that indicated there was a cracking and ductility problem especially with the larger diameter web rods which are normally located in the areas of higher stress. In 1979 their welding engineer revisited the cracking issue and pointed to poor fit up as a major contributing factor.

Tests carried out by Dominion Bridge Ltd. on puddle welds, indicated those welded in production were significantly lower in capacity when compared against similar welds prepared in the laboratory. It was also stated by Dominion Bridge personnel that the puddle welds were meant to be used in conjunction with flare bevel welds as indicated below. This method, however, was not normally used.



Robb Engineering knew they had a serious problem with their joist line as early as 1973. Despite attempts by their own in house Dominion Bridge personnel to rectify the problems, they were not rectified as late as 1986 and possibly not even after that date.

Given the fact that Canadian standards and structural design theory assume that members will yield before connections fail, in order to assist in the safe evacuation, or to allow a structure to be temporarily supported for repair, and given the lack of attention to quality issues the additional information included herein may require the engineer to review previous decisions and recommendations pertaining to buildings containing Robb OWSJ.

For further information refer to:

*The OWSJ Remediation Program for the Province of Newfoundland and Labrador
Dated May 2005 (Available at www.pegnl.ca)*

*Open Web Steel Joist Load Testing and Inspection Program
Dated September 1997 (Available by hard copy only)*

Centrac Building Court Transcripts (Available by hard copy only)

or contact

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