



FIELD MEASUREMENT FOR EXISTING JOISTS REQUIRING REINFORCEMENT: ANALYSIS OF PROPERTIES FOR COMPLETE FIELD MEASUREMENTS

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TABLE OF CONTENTS

Field measurement for existing joists requiring reinforcement
Geometry
Sections
Welding
Lateral support system
Spacers and ties
Steel grades and shoes
Loading criteria

SUMMARY

Information needed to do a complete joist field measurements when the original design documents are no longer available.

FIELD MEASUREMENT FOR EXISTING JOISTS REQUIRING REINFORCEMENT

The subject of typical joist reinforcement in existing buildings due to changes in loading was discussed in the November 2007 edition of InfoTech, Evaluation of joists and their typical reinforcement in steel-framed buildings.

Before a determination can be made on the type of joist reinforcement needed, it is of the utmost importance to locate the Canam joist tag whenever possible and to record all of the information on that tag. Subsequently, all of the details of the existing Canam joist must be provided to ensure that the building designer's assumptions are based on original design and fabrication data. If Canam no longer has the original joist design records, then technical data must be gathered in the field for the building designer. This article will highlight the importance of being thorough in order to produce detailed field measurements.

Geometry

The evaluation of existing joists starts with the geometry to illustrate the manner in which forces are transmitted through and to the ends of the joists. It is imperative to determine the distance between the two principal axes, the overall depth of the joist and the position of each panel point (where a web member meets the top or bottom chord). As illustrated in Figure 1, the panel point positions can be determined in relation to the reference axis (expressed as 0 on the left-hand side).

For example, the panel point positions at the top chord would be indicated as follows:

- 583 mm
- 1,091 mm
- 1,701 mm
- etc.

The panel point positions can also be located in relation to one another, in which case the panel point positions at the top chord would be indicated as follows:

- 583 mm
- 508 mm
- 610 mm
- etc.

Either of these two methods is acceptable, but note that the panel point positions at the top chord are different from those at the bottom chord. For the various geometrical types, please refer to page 26 of Canam's Joist and Joist Girders Catalogue.

The material utilized in the fabrication of web members differs considerably from that used for the top and bottom chords as follows:

- round or square bars
- U-shaped sections
- cold-formed or hot-rolled angles
- “HSS” sections

In addition, web members may be composed of two types of sections welded together, such as a round bar and an angle. When gathering the field measurements, it is important to list all of the dimensions associated with each section of the web members, including the following:

- diameter
- width
- depth
- thickness
- length

It is possible for the same type of member to be installed along the entire length of a joist, but the thickness may vary from one panel to the next. Particular attention should be paid to the thickness of the paint which varies according to the type of paint used, the number of layers applied, etc.

The use of a micrometre and a caliper square (Figure 3) is strongly recommended to determine the correct member dimensions. The tables on section properties found in Canam’s Joists and Joist Girders Catalogue can also serve as a reference guide. The sections listed there are those used by all of Canam’s Canadian plants.



Figure 3
Micrometre and caliper square

Welding

Determining the diameter and length of the weld may be difficult due to lack of space between the members. The use of a fillet weld gauge (Figure 4) is useful if the weld is accessible. Weld resistance is calculated according to the effective fillet weld, which is determined by the thickness of the welded sections.



Figure 4
Inspection gauge for weld dimensions

Lateral support system

The existing lateral support system is also very important. Therefore, the locations of the bridging rows and the types of bridging (horizontal or diagonal) must be determined. It is essential to verify if a special lateral support system was used as an attachment system other than welded steel deck (see Clause 16.8 of CAN/CSA S16-01 in Canam's Joists and Joist Girders Catalogue). Also, if special connectors were used to connect the top chord, it is important to know what types of connectors were utilized and the spacing between them.

Spacers and ties

Spacers are commonly used in the case of compression members to reduce the slenderness ratio of the attached members. Since they form an integral part of the joist, the number of spacers and ties and their respective locations must be indicated (Figure 5).



Figure 5
Spacers

Steel grades and shoes

Since the grade of a steel section cannot be ascertained through a visual inspection, it is necessary to contact the local Canam office. Canam has kept a record of the steel grades used, based on the types of sections used, since 1961 when joist production first began at its St. Gédéon de Beauce plant.

The shoe length and depth are very useful in determining where the reaction occurs on the bearing member (Figure 6).

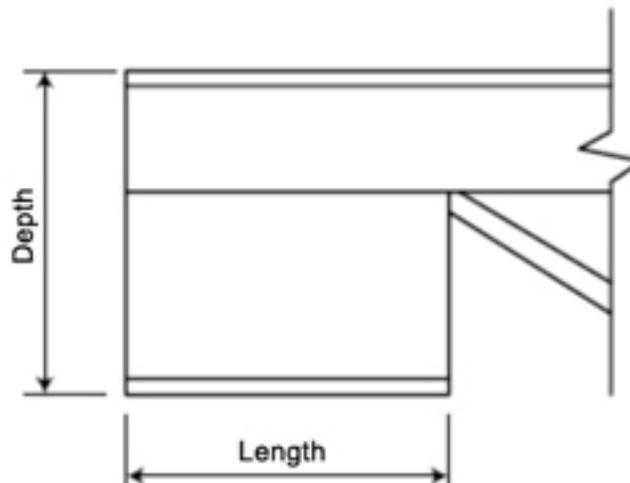


Figure 6

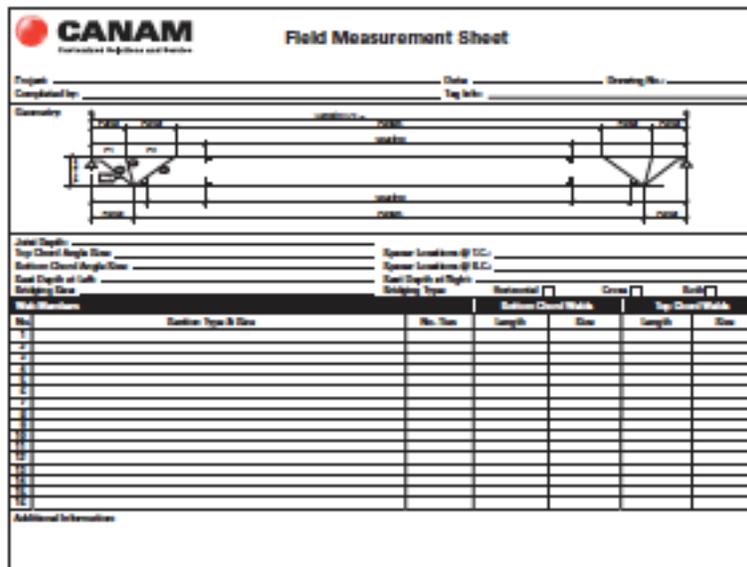
Loading criteria

The building designer must provide all of the loads and related design criteria necessary to perform the joist reinforcement evaluation. All information on existing loads and new loads must be specified. In the case of special loads, every detail is important:

- the specific load
- load position
- load type

The process of gathering all of the field measurements requires a great deal of discipline. The more thorough the information, the more accurate the evaluation for joist reinforcement. If information is missing, Canam will have no choice but to make conservative assumptions.

The elements discussed in this article are based on standard fabrication and installation standards; however, numerous other connections, assembly conditions and fabrication methods may be encountered. To simplify the information gathering, Canam has created a Field Measurement Sheet (Figure 7) that can be downloaded and used in the field to record the measurements of existing joists.



The form includes a header with the CANAM logo and title 'Field Measurement Sheet'. It contains fields for Project, Date, Drawing No., Completed by, and Tag Info. A central diagram shows a joist with various measurement points labeled. Below the diagram are fields for Joint Depth, Top Chord Angle Size, Bottom Chord Angle Size, and Splice Locations. A table for Measurements has columns for No., Position, Type & Size, No., Size, Length, Size, Length, and Size. Checkboxes for Reinforced, Crown, and Bolt are also present.

Figure 7
Field Measurement Sheet



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