PREFERRED JOIST PACKAGE

The Canam Steel Corporation Preferred Joist Package (PJP) is a set of value-added design features that can be specified on steel joist projects. These features go above and beyond the Steel Joist Institute specifications and typical industry practice, to provide additional capabilities. The PJP provides the Engineer of Record (EOR) with convenience and peace of mind, and can bring value to the project as a whole by reducing field labor or retrofit costs. This document will explain and discuss the features of the PJP.

The PJP can be specified by the EOR on a given project simply by inserting the PJP block of notes on the structural contract drawings. For convenience, the notes are provided in both a PDF and an AutoCAD format. By bundling these features together, they are easier to specify, and the standardization of these features makes them more economical.

The PJP notes are labeled U.N.O. (Unless Noted Otherwise), because the EOR still has the option of specifying additional design requirements, for the entire project or individual joists that supersede the PJP requirements. But for simplicity, the format of the standard PJP notes should not be disturbed. While Canam Steel is proud to have introduced the PJP, it is not exclusive to Canam and any joist manufacturer should have the design capabilities to competitively bid projects with the PJP.
**PJP-1: Field Added Struts**

**PJP-1**: FOR CONCENTRATED LOADS WITH KNOWN MAGNITUDES AND LOCATIONS, THE JOISTS SHALL BE DESIGNED SUCH THAT FIELD ADDED STRUT ANGLES WILL NOT BE REQUIRED.

The field added strut detail, as shown in **Figure 1**, is widely considered an industry standard. Whenever a concentrated load is not placed at a joist panel point, this detail requires the erector to add an angle or other member, to transfer the concentrated load from the point of application on one chord, to a joint or panel point on the opposite chord. For a joist not specifically designed to take a concentrated load between the panel points, this added strut is vital to the integrity and performance of the joist. But why should the erector be expected to essentially “complete the fabrication” of the joist? And does the joist manufacturer and EOR know that this step was actually completed in the field? For known magnitudes and locations of concentrated loads the PJP requires that the joist manufacturer provide a joist capable of carrying the concentrated loads, at the given locations, without the need for field added struts.

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**FIGURE 1**
PJP-1: Field Added Struts

This can be accomplished in one of thee ways, at the joist manufacturer's discretion: adjust the joist geometry to provide a panel point or joint at the load location, design the chord with sufficient additional bending capability to transfer the concentrated load to adjacent panel points, or add an additional strut member during shop fabrication. While this design feature will add slightly to the cost of the joists, it will typically be more economical than the cost of adding struts in the field, with the joist already in the air.

It can be argued that the field added strut detail is necessary because the exact locations of concentrated loads cannot be accurately predicted. However, there are three solutions to this problem. First, where the EOR knows that the exact location of a load may vary, the load can be specified as a traveling load, either within a certain range, or along the entire joist length, and the chord and other joist elements can be designed both for the worst effect of the moving location of the load within the range, and for the local bending to transfer the load to adjacent panel points. Secondly, the joist framing plan will clearly show the extent of the known concentrated loads and their locations. The field added strut detail will still be present on Canam's field use prints, but with an explanatory note to say that the struts are only required where there are concentrated loads, as allowed by the EOR, that are not specifically shown on the framing plan. And thirdly, with PJP design feature number two, a provision is made to allow a certain amount of additional, miscellaneous load.
PJP-2: Concentrated Loads

PJP-2: ALL JOISTS SHALL BE DESIGNED FOR AN ADDITIONAL 400 POUND TRAVELING PROVISIONAL LOAD, OF WHICH ONE SINGLE CONCENTRATED LOAD OF UP TO 300 LBS MAY BE PLACED BETWEEN ANY TWO TOP CHORD PANEL POINTS AND A SINGLE CONCENTRATED LOAD OF UP TO 100 LBS MAY BE PLACED BETWEEN ANY TWO BOTTOM CHORD PANEL POINTS.

All PJP joists will be designed for an additional 400 (nominal, un-factored) pounds of capacity in addition to the design load of the Load Tables or as specified by the designations, notes, or load diagrams. As described in the PJP note and as depicted in Figure 2, the additional load can be applied as up to a single concentrated load of 300 pounds between any two adjacent top chord panel points, and as a single load of up to 100 pounds between any two bottom chord panel points, or any combination of smaller loads that does not exceed these criteria and the overall limit of 400 pounds. The joist design will consider the most unfavorable position of the additional loads in the design of each individual component of the joist.

**FIGURE 2**
PJP-3: Shear Reversal

PJP-3: FOR THE POSSIBILITY OF SHEAR REVERSAL DUE TO UNBALANCED LOADING, THE JOIST DIAGONAL WEB MEMBERS LOCATED IN THE MIDDLE ¼ OF THE SPAN SHALL BE DESIGNED FOR A MINIMUM SHEAR, IN COMPRESSION, OF 15% OF THE END REACTION.

The Steel Joist Institute Specifications require that joists be designed for a minimum shear of equal to 25 percent of the end reaction, rather than the theoretical shear that approaches zero at the center of a uniformly loaded truss. However, there is no provision for the possibility of a shear reversal, due to unbalanced loading, that would cause compressive forces in tension web members near the center of a joist. The purpose of this provision is to provide some capacity for this condition, nominally equal to a “half-span” live load equal to 60 percent of the total load capacity of the joist. The resulting shear diagram is shown in Figure 3.
PJP-4: Rollover

PJP-4: ALL JOIST SEATS AT THE POTENTIAL DIAPHRAGM BOUNDARIES SHALL HAVE THE CAPACITY TO RESIST A LATERAL LOAD APPLIED AT THE TOP OF THE TOP CHORD, PERPENDICULAR TO THE SPAN, (ROLLOVER) AS FOLLOWS:

- FOR JOIST SEATS UP TO 3½" DEEP, THE SEAT SHALL BE CAPABLE OF RESISTING A 2,000 LB FORCE. NOTE THAT FOR K-SERIES JOISTS A MINIMUM ANCHORAGE WELD LENGTH OF 1½" SHALL BE USED.
- FOR JOIST SEATS GREATER THAN 3½" DEEP, THE SEAT SHALL BE CAPABLE OF RESISTING A 1,200 LB FORCE.

The PJP joists will provide a known and defined capacity for transfer of boundary diaphragm shear from the deck elevation down to the joist bearing elevation, through the joist seat. The design force is applied perpendicular to the joist top chord, at the top of the top chord, as shown in Figure 4.

FIGURE 4
PJP-4: Rollover

Because the overturning moment increases with the depth of the seat, two different values are provided, depending on the seat height: 2,000 (nominal, unfactored) pounds for seat depths of up to and including 3-1/2 inches, and 1,200 (nominal, un-factored) pounds for seat depths greater than 3-1/2 inches. While every joist seat has some degree of capacity and resistance to "rollover", no published minimum values have been provided and the EOR must either specify exact values every time, or this element of the lateral load resisting system is possibly overlooked on some projects.

With the PJP, all joist ends at the building perimeter, as well as other obvious shear diaphragm boundaries, such as expansion joints, will be designed for the minimum capacities noted above. Canam's framing plan submittal will clearly indicate the diaphragm boundaries, for review by the EOR.

The SJI specifications require that the EOR provide the joist end anchorage weld requirements on the contract drawings, considering uplift forces, and shear diaphragm forces, etc. SJI does provide a minimum size and length for the anchorage welds, depending on the joist series. With the 2,000 pound rollover force for seats of up to 3-1/2" inches high, a minimum weld anchorage length of 1-1/2 inches should be specified, in order to properly engage a sufficient length of the bearing seat assembly in resisting the rollover force.

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