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Re: OEG Big Apple I-Joist

The OEG Big Apple I-Joist is a structural member composed of two Big Apple Joist 1600BA350-118 profiles welded back-to-back forming an I-shaped profile. The joist end connection of the joist to its supporting member utilizes a hot-rolled L4x4x1/4 welded to the I-Joist.

Joist Design

The cold-formed steel I-joist design is governed by the design provisions of the AISI *North American Specification for the Design of Cold-Formed Steel Structural Members*, AISI S100. AISI S100 was employed to determine both the strength and deflection performance. Strength performance for bending, shear as well as the deflection moment inertia were evaluated using AISI S100.

However, the I-joist end connection design is not addressed by AISI S100 therefore the end connection design capacity was determined by tests as outlined by the *Test Standard for Joist Connectors Attached to Cold-Formed Steel Structural Framing*, AISI S914.

Joist End Connection Performance

Tests as prescribed by AISI S914 were performed at Farabaugh Engineering and Testing Laboratory, McKeesport, PA, an independent test laboratory. A description and summary of those tests are contained in Farabaugh test report T315-22 dated November 18, 2022.

AISI S914 defines two performance requirements: (1) connection strength evaluated in accordance with AISI S100 Chapter J and (2) serviceability/deflection limited to not more than 1/8".

Using AISI S100 Chapter K, the available connection strength, R_a , was determined to be 12,840 lbs (Table 1). Test No. 3 exhibited the most flexibility and achieved a 1/8" deflection at an applied load of 25,000 lbs., or 12,500 lbs. end reaction. Therefore, the connection performance is governed by the available capacity of 12,500 lbs.

Table 1 Test Results

Test No.	Failure Load (lbs)	Failure Reaction (lbs)
1	50300	25150
2	54400	27200
3	40900	20450
	Average	24267
	Std Dev	3461
	COV	0.1426
	Omega	2
	Ra	12840

Design Methodology

The design of the 1600BA350-118 Big Apple I-Joist must consider the following limit states:

- Moment capacity of the I-Joist, 631 in-kips
- Shear capacity of the I-Joist, 22 kips
- Live load deflection limit of L/360
- End connection force limited to 12,500 lbs.

Limiting Span-to-Uniform Load

Applying the above four design limit states to the 1600BA350-118 Big Apple I-Joist resulted in limiting span-to-uniform load relationships as summarized by Table 2.

Table 2 Limiting Span-to-Uniform Load

Span (ft)	Strength Capacity (lb/ft)	L/360 Deflection (lb/ft)
18	1298	1559
19	1165	1325
20	1052	1136
21	954	982
22	869	854
23	795	747
24	730	658
25	673	582
26	622	517
27	577	462

28	537	414
29	500	373
30	467	337
31	438	305
32	411	277
33	386	253
34	364	231
35	343	212
36	325	195
37	307	179
38	291	166
39	277	153
40	263	142