NORDIC STRUCTURES

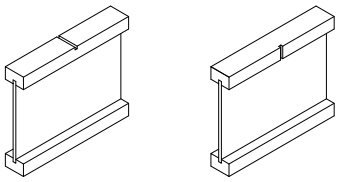
Damaged Flanges in Nordic Joist

This technical note provides guidance on evaluating and repairing damaged flanges in Nordic I-joists.

Minor Damages

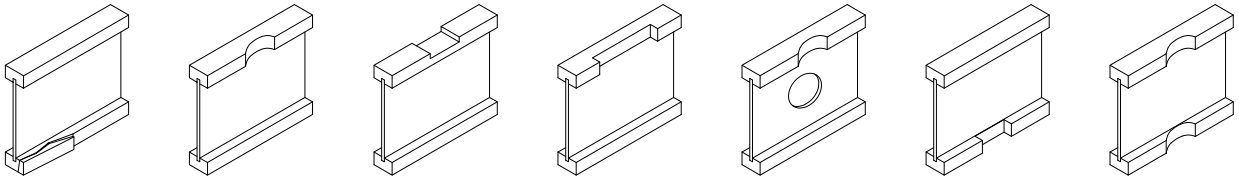
Crushing from strapping and minor cuts are common, unintentional occurrences in I-joist flanges. Generally, these slight damages do not affect performance. However, an engineering analysis might be required when the following limits are exceeded:

- Maximum two slight damages per span.
- Damages no deeper nor wider than 1/4 inch.
- Minimum 36-inch clear distance between damages.



Major Damages

While I-joist flanges must never be intentionally cut, drilled or notched, accidental damages may occur during construction. Under certain circumstances, the residual cross-section or added reinforcement may be sufficient to resist the stresses near the damaged area. In other cases, the affected I-joist must be headered-off, sistered or replaced.



This section is intended for an occasional damaged I-joist in a floor or roof system. Where multiple adjacent I-joists are damaged, suitability of this information must be validated by a professional. Additionally, the guidelines outlined below only apply under these assumptions:

1. The I-joist supports uniform loads only.
2. Maximum one damage per span, no longer than 8 inches parallel to grain.
3. Web openings at the location of the damage meet shear capacity requirements.
4. Where both the top and bottom flanges are damaged at the same location, the residual flange cross-section must be at least 60% of the original.

The following table and repair details may be used to determine the residual capacity of the damaged I-joist and provide a flange reinforcement where applicable. The maximum bending moment exerted at the damage location must be compared to the bending moment capacity, M, of the unreinforced or reinforced I-joist, calculated as follows:

$$M = M_{residual} + n \cdot M_{increase}$$

Where:

n = Number of sides reinforced (1 or 2)

When the following conditions are met, no repair is required:

- The web-to-flange joint is not compromised.
- Damages no longer than 4 inches parallel to grain.
- At least 60% of the original flange cross-section remains.
- Minimum 6-inch horizontal clear distance between damage edges and nearby web openings
- Residual bending moment capacity at damage location suffices - see the following table.

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Design Properties

Joist depth	Joist series	$M_{residual}$ [a] (lbf-ft)			$M_{increase}$ [c] (lbf-ft)					
		Residual flange cross-section [b]			Reinforcement length (ft)					
		80%	60%	40%	2	4	6	8	10	12
9-1/2"	NI-40x	1,300	940	600	80	250	420	580	750	920
	NI-60	1,300	940	600	80	250	420	580	750	920
	NI-80	1,820	1,310	840	130	400	670	930	1,200	1,470
11-7/8"	NI-40x	1,700	1,240	800	110	320	540	760	970	1,190
	NI-60	1,700	1,240	800	110	320	540	760	970	1,190
	NI-80	2,380	1,730	1,120	170	520	860	1,210	1,560	1,900
	NI-90	2,380	1,730	1,120	170	520	860	1,210	1,560	1,900
14"	NI-40x	2,060	1,510	980	130	390	650	910	1,170	1,430
	NI-60	2,060	1,510	980	130	390	650	910	1,170	1,430
	NI-80	2,880	2,110	1,370	210	630	1,040	1,460	1,880	2,290
	NI-90	2,880	2,110	1,370	210	630	1,040	1,460	1,880	2,290
16"	NI-60	2,400	1,760	1,150	150	450	760	1,060	1,360	1,660
	NI-80	3,350	2,460	1,610	240	730	1,210	1,690	2,180	2,660
	NI-90	3,350	2,460	1,610	240	730	1,210	1,690	2,180	2,660

a) Residual bending moment capacity, $M_{residual}$, of the I-joist at damage location.

b) Percentage of original flange cross-section area remaining at damage location. For the purpose of this technical note, no residual capacity shall be considered at damage location for cross-sections falling below 40% of the original.

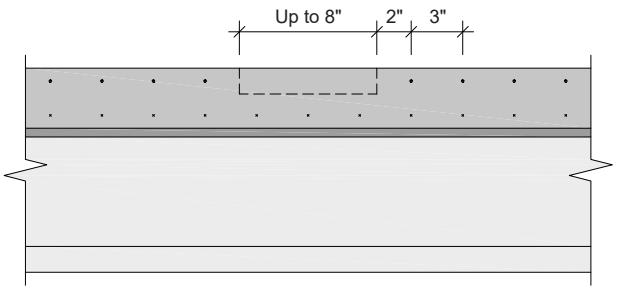
c) Bending moment capacity increase, $M_{increase}$, at damage location due to flange reinforcement on one side.

Note:

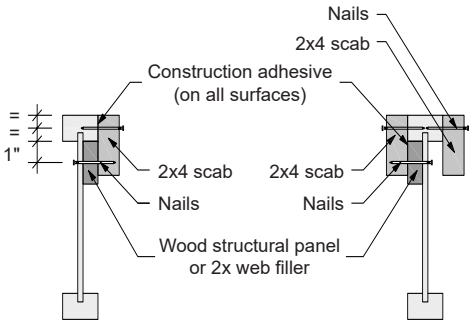
1. The tabulated design values are for normal duration of loading (C_D = 1.0) and assume the affected flange is fully laterally supported (C_L = 1.0).

Repair Details

- Reinforcement:
  - Reinforcement shall be applied to one or both sides of the affected flange, centered on the damaged area.
  - Web filler: wood structural panel or 2x member (where possible) on one side only.
  - Scab: 2x4 S-P-F No. 2 or better.
- Fasteners:
  - Minimum 2-inch end distance parallel to grain.
  - One row of nails centered on the damaged flange (through scab), and another placed at 1 inch from flange inner edge (through web and filler).
  - Use 8d common nails (2x3 flanges) or 10d common nails (2x4 flanges) at 3 inches o.c.
- Construction adhesive must be applied to all surfaces in contact.



Elevation view of a repair to a damaged flange



Section view of a repair to a damaged flange - One or two scabs

For configurations beyond the scope of this technical note, refer to Construction Details (NS-DC3) or contact our technical support (tech@nordic.ca).