NORDIC STRUCTURES

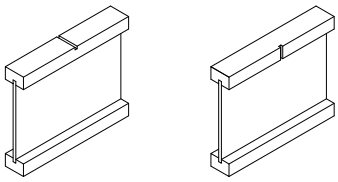
# Damaged Flanges in Nordic Joist

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

**Minor Damages**

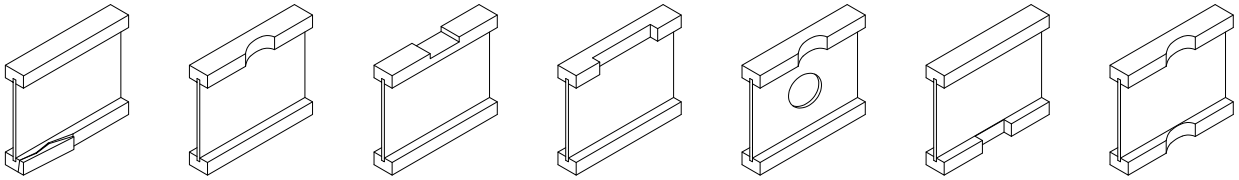
Crushing from strapping and minor cuts are common, unintentional occurrences in I-joist flanges. Generally, these slight damages do not affect performance. However, an engineering analysis might be required when the following limits are exceeded:

- 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 resistance 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 resistance of the damaged I-joist and provide a flange reinforcement where applicable. The maximum factored bending moment exerted at the damage location must be compared to the factored bending moment resistance, $M_r$, of the unreinforced or reinforced I-joist, calculated as follows:

$$M_r = M_{r,residual} + n \cdot M_{r,increase}$$

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 factored bending moment resistance at damage location suffices - see the following table.

NORDIC STRUCTURES

**Design Properties**

| Joist depth | Joist series | $M_{r,residual}$[a] (lbf-ft) | | | $M_{r,increase}$[c] (lbf-ft) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Residual flange cross-section[b] | | | Reinforcement length (ft) | | | | | |
| | | 80% | 60% | 40% | 2 | 4 | 6 | 8 | 10 | 12 |
| 9-1/2" | NI-20 | 1,210 | 870 | 560 | 170 | 510 | 860 | 1,200 | 1,540 | 1,880 |
| | NI-40x | 2,070 | 1,490 | 960 | 170 | 510 | 860 | 1,200 | 1,540 | 1,880 |
| | NI-60 | 2,070 | 1,490 | 960 | 170 | 510 | 860 | 1,200 | 1,540 | 1,880 |
| | NI-80 | 2,900 | 2,090 | 1,340 | 220 | 670 | 1,110 | 1,560 | 2,000 | 2,450 |
| 11-7/8" | NI-20 | 1,580 | 1,150 | 740 | 220 | 670 | 1,110 | 1,550 | 2,000 | 2,440 |
| | NI-40x | 2,710 | 1,970 | 1,280 | 220 | 670 | 1,110 | 1,550 | 2,000 | 2,440 |
| | NI-60 | 2,710 | 1,970 | 1,280 | 220 | 670 | 1,110 | 1,550 | 2,000 | 2,440 |
| | NI-80 | 3,800 | 2,760 | 1,790 | 290 | 870 | 1,440 | 2,020 | 2,600 | 3,180 |
| | NI-90 | 3,800 | 2,760 | 1,790 | 290 | 870 | 1,440 | 2,020 | 2,600 | 3,180 |
| 14" | NI-40x | 3,280 | 2,400 | 1,560 | 270 | 800 | 1,340 | 1,870 | 2,410 | 2,940 |
| | NI-60 | 3,280 | 2,400 | 1,560 | 270 | 800 | 1,340 | 1,870 | 2,410 | 2,940 |
| | NI-80 | 4,600 | 3,360 | 2,190 | 350 | 1,040 | 1,740 | 2,440 | 3,130 | 3,830 |
| | NI-90 | 4,600 | 3,360 | 2,190 | 350 | 1,040 | 1,740 | 2,440 | 3,130 | 3,830 |
| 16" | NI-60 | 3,820 | 2,810 | 1,830 | 310 | 930 | 1,550 | 2,170 | 2,790 | 3,410 |
| | NI-80 | 5,350 | 3,930 | 2,560 | 400 | 1,210 | 2,020 | 2,830 | 3,630 | 4,440 |
| | NI-90 | 5,350 | 3,930 | 2,560 | 400 | 1,210 | 2,020 | 2,830 | 3,630 | 4,440 |

a) Residual factored bending moment resistance, $M_{r,residual}$, 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 resistance shall be considered at damage location for cross-sections falling below 40% of the original.

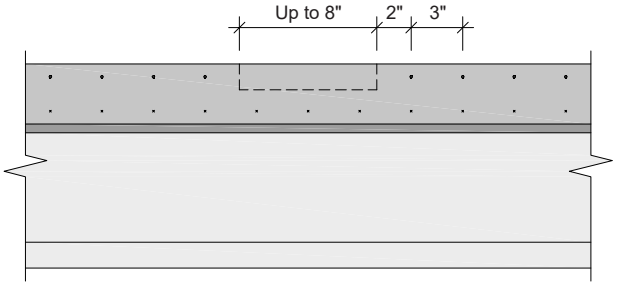
c) Factored bending moment resistance increase, $M_{r,increase}$, at damage location due to flange reinforcement on one side.

Note:

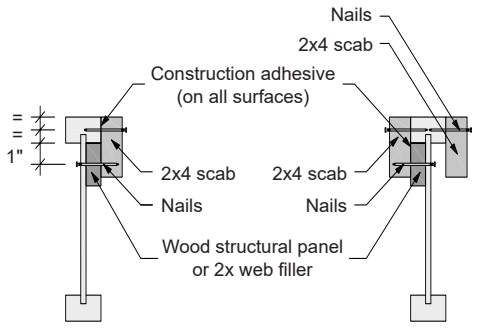
1. The tabulated design values are for standard-term duration of load ($K_D$ = 1.0) and assume the affected flange is fully laterally supported ($K_L$ = 1.0).

**Repair Details**

- Reinforcement:
  - Reinforcement shall be applied to one or both sides of the affected flange, centred 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 centred on the damaged flange (through scab), and another placed at 1 inch from flange inner edge (through web and filler).
  - Use 2-1/2-inch common nails (2x3 flanges) or 3-inch 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).