Overdriven Nails in Structural Sheathings

Design Guide

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SBCA

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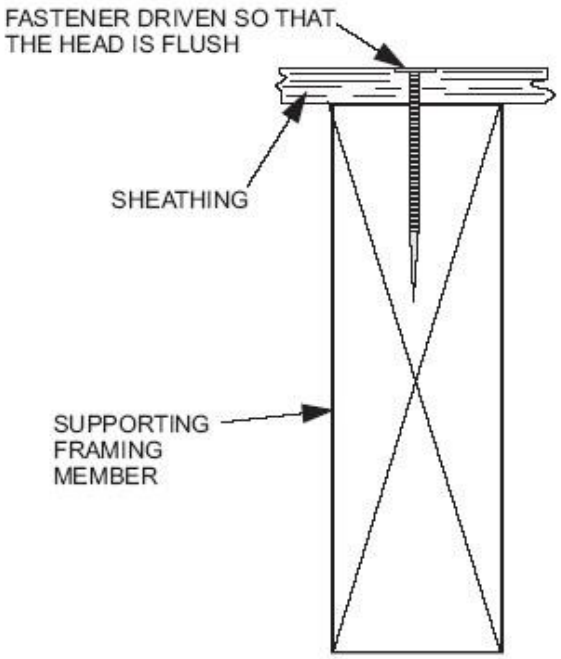
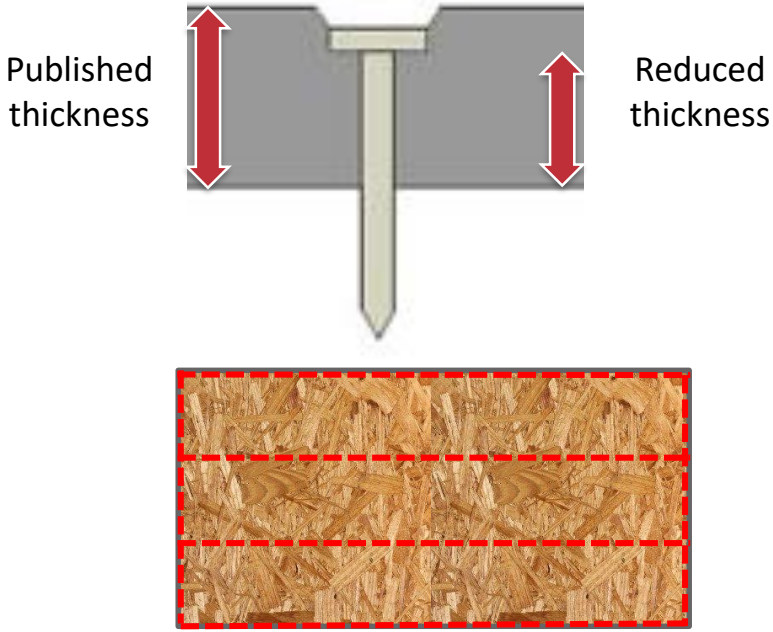
Introduction

- Design values, whether provided by building codes and standards or proprietary sources, typically assume that the head of a fastener is flush with the surface of the sheathing.



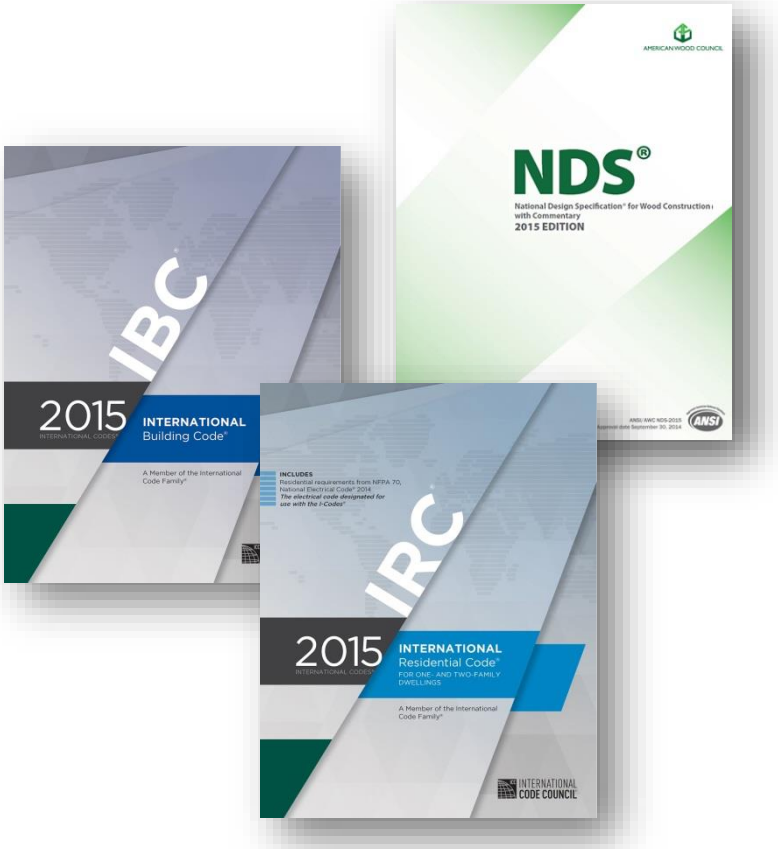
Introduction

- When fasteners are overdriven, the effective thickness of the panel is reduced, causing the shear strength of the panel to be reduced.
- At panel edges, overdriven fasteners allow for easier pull-through or tear-out due to the reduced thickness of the panel at the fastener head.
- At intermediate framing members, overdriven fasteners provide reduced resistance to panel buckling.



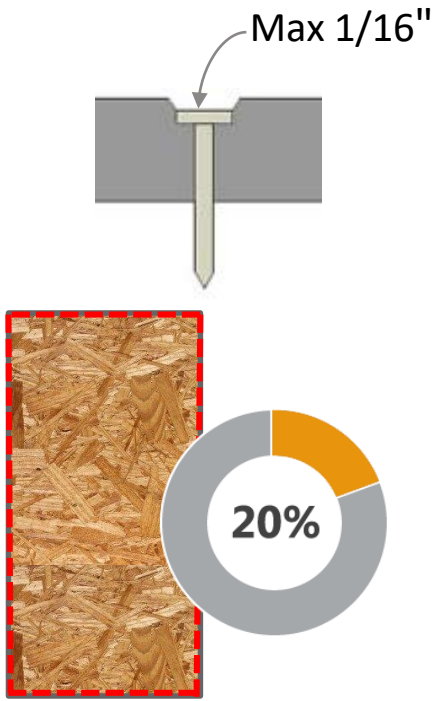
Introduction

- There is no guidance in the International Building Code®, International Residential Code®, or National Design Specification® for Wood Construction as to what the capacity reduction is for overdriven fasteners nor what corrective action could be taken.
- This design guide will go through various steps to account for overdriven fasteners in a structural sheathing panel.



Step 1 – Determine if Capacity Reduction is Required

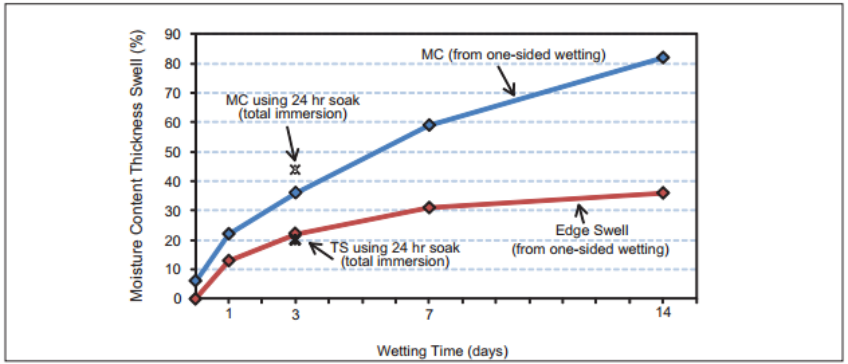
- According to the Engineered Wood Association (APA), if any of the following four conditions are met, NO shear capacity reduction is required:
  1. All nails are overdriven into panels by no greater than $^{1}/_{16}$" under dry conditions (moisture content less than 16%)
  2. No more than 20% of the perimeter fasteners are overdriven by no greater than ⅛"



Step 1 – Determine if Capacity Reduction is Required

3. If all perimeter fasteners are overdriven by the same amount and it appears that wetting occurred during construction, fastener embedment may be due to panel swelling in thickness.
   - This can be verified by measuring the thickness of panels where fasteners appear to be over-driven, and comparing the measurements where panels have been protected from the weather, or the original nominal panel thickness.

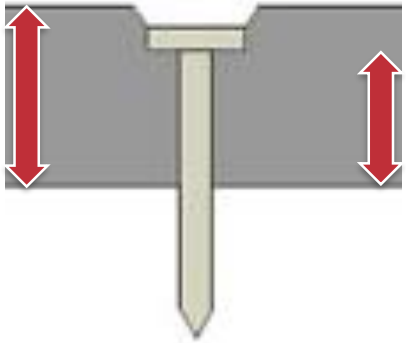
Figure 3. OSB Sheathing Response to One-Sided Wetting



Step 1 – Determine if Capacity Reduction is Required

4. If actual panels used in construction are thicker than the required minimum nominal panel thickness upon which the design shear capacity is based, and the overdriving is less than or equal to the difference between the two panel thicknesses.

If panel is thicker than necessary

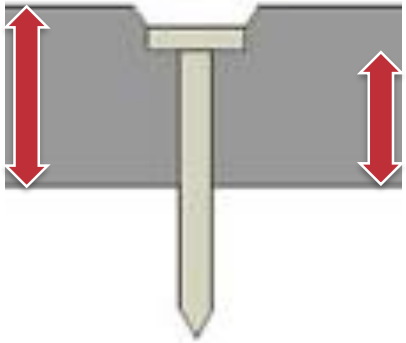


Reduced thickness is OK

Step 2 – Calculate Reduced Shear Capacity

- Re-analyze capacity based on average thickness of panel measured from bottom of fastener head.
- For example, a ⅝" panel with fasteners overdriven by ⅛" would have the capacity of a ½" panel.
- Adjust nailing schedule accordingly

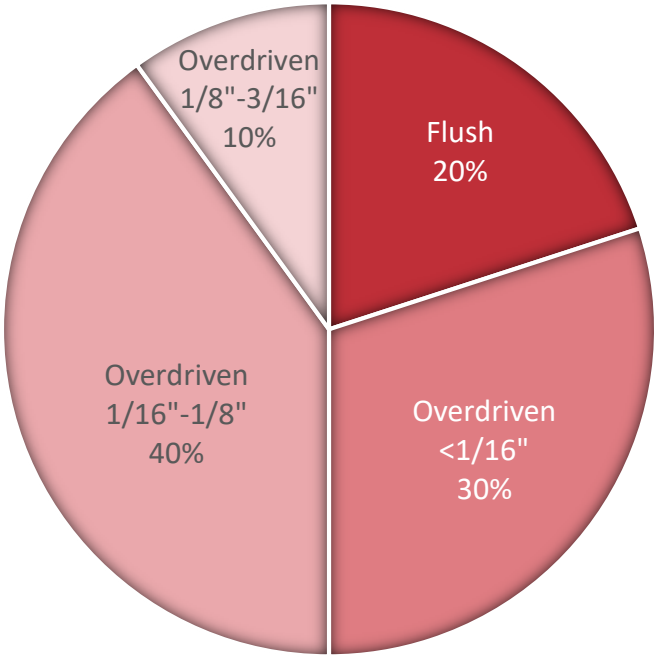
5/8" OSB - 1/8" Overdriven



Capacity is same as ½" OSB

Step 2 – Re-analyze Shear Capacity

- TECO provides the following example:
  - Assume that 20% of the nails in a shear wall are driven flush with the sheathing and the remaining nails are overdriven as follows:
    - 30% between flush up to $^{1}/_{16}$"
    - 40% between $^{1}/_{16}$" up to ⅛" and
    - 10% between ⅛" up to $^{3}/_{16}$".

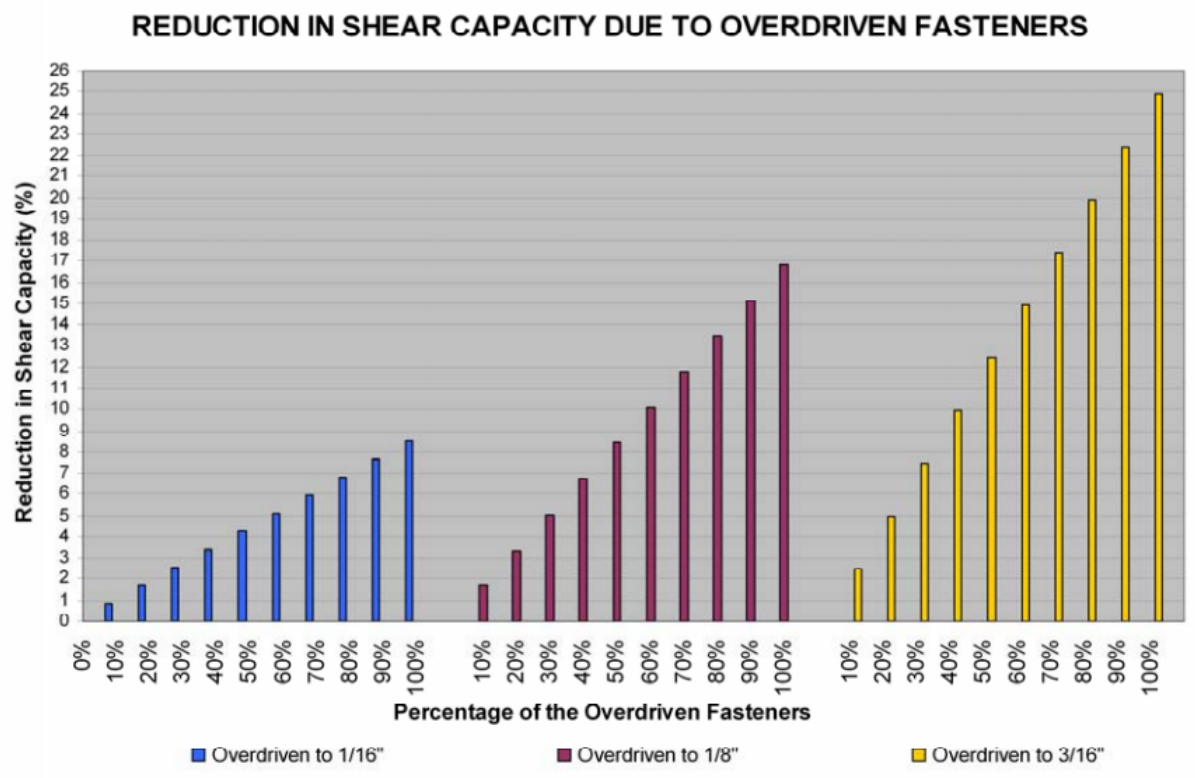


Step 2 – Re-analyze Shear Capacity

- Using the chart (on the following slide) an estimate of the reduction in shear capacity based on the number and magnitude of overdriven nails would be:
  - 20% flush = 0% reduction
  - 30% up to $^{1}/_{16}$" ≈ 2.6% reduction
  - 40% between $^{1}/_{16}$" up to ⅛" ≈ 6.7% reduction
  - 10% between ⅛" up to $^{3}/_{16}$" ≈ 2.5% reduction

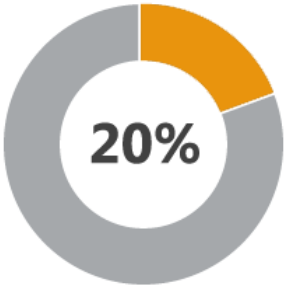
Total Reduction ≈ 11.8%

Step 2 – Re-analyze Shear Capacity



Step 3 – Add Additional Fasteners

- If the following conditions are met, additional fasteners must be added to maintain shear capacity (if a capacity reduction is not taken):
  - More than 20% of the fasteners around the perimeter are overdriven by over $^{1}/_{16}$"
  - Any fasteners are overdriven by more than ⅛"



Step 3 – Add Additional Fasteners

- Procedure to add additional fasteners:
  - Add 1 additional fastener for every 2 that are overdriven.
  - If the additional nails violate the minimum spacing requirements (3" o.c. for 2x_ lumber for splitting), use staples for the additional fasteners to reduce the potential for splitting.