Deflection Limits for Floor Trusses

Design Guide

Revised 3/24/2017

SBCA

SBCA has been the voice of the structural building components industry since 1983, providing educational programs and technical information, disseminating industry news, and facilitating networking opportunities for manufacturers of roof trusses, wall panels and floor trusses. **SBCA** endeavors to expand component manufacturers' market share and enhance the professionalism of the component manufacturing industry.

Introduction

- Current building codes provide minimum design requirements for floor deflection
- Manufacturers or trade associations often recommend more stringent deflection requirements to address serviceability or appearance for a variety of products
- This presentation gives a step by step approach to ensure the proper application of floor structural member deflection limits when using certain types of floor toppings

Step 1 – Check Applicable Building Codes

- Deflection of structural members is covered by the building codes.
- IBC Table 1604.3 contains deflection limits for floor structural members, including creep
- The IRC also provides deflection limits in Table R301.7, although creep is not addressed

TABLE 1604.3 DEFLECTION LIMITS[a, b, c, h, i]

CONSTRUCTION	*L*	*S* or *W*[f]	*D* + *L*[d, g]
Roof members:[e]			
Supporting plaster or stucco ceiling	//360	//360	//240
Supporting nonplaster ceiling	//240	//240	//180
Not supporting ceiling	//180	//180	//120
Floor members	//360	—	//240
Exterior walls:			
With plaster or stucco finishes	—	//360	—
With other brittle finishes	—	//240	—
With flexible finishes	—	//120	—
Interior partitions:[b]			
With plaster or stucco finishes	//360	—	—
With other brittle finishes	//240	—	—
With flexible finishes	//120	—	—
Farm buildings	—	—	//180
Greenhouses	—	—	//120

Step 2 – Identify Minimum Deflection Limits

- *ANSI/TPI 1* (referenced by the IBC and IRC) includes:
  - Additional information required on the construction documents in order to effectively design trusses for serviceability
  - Detailed information regarding deflection and creep in floor trusses

Table 7.6-1 Deflection Limits for Non-Cantilevered Portions of Trusses.[3, 5]

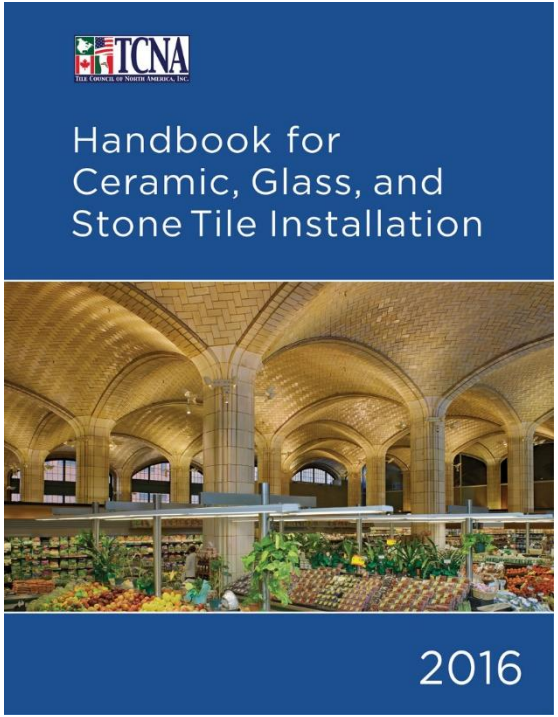
Values given in the table are divisors that are applied to the clear span length, L_s, to establish a deflection limit (limit = L_s / specified value).

Member	Deflection due to Live Load Only (Δ_{LL})	Deflection due to Live Load Plus Creep Component of Deflection due to Dead Load (Δ_{CR})	Deflection due to Total Load (Δ_{TL}), when specified[7]
Roof Truss supporting plaster[1]	360	240	240
Roof Truss supporting drywall[1]	240	180	180
Roof Truss not supporting ceilings[1]	180	120	120
Floor Trusses[2] (see footnotes for Trusses supporting ceramic tile)	360	240	240
Top Chord panel[4]	180	120	120
Habitable spaces in Trusses[6]	360		

1. Roofs not having sufficient slope or camber to assure adequate drainage shall be investigated for ponding.
2. Certain floor coverings require more restrictive deflection criteria. For ceramic tile, Truss spacing and appropriate dead load for the installation method, and other aspects of design per *ANSI A108/A118/A136* shall be such that the system passes the requirements of the Building Designer per Chapter 2 of this Standard.
3. Cantilevered and overhang portions of Trusses are subject to deflection limits using the values shown above applied to twice the length of the cantilever, L_s.
4. Span length for Top Chord panel limits shall be the panel length.
5. Where required by *ACI 530/TMS 402* for Trusses used as a beam or lintel providing support of vertical masonry veneer, a minimum of 1/600 deflection limit shall apply.
6. Limit is for panel deflection of the loaded panel when loaded with 30 psf (14.4 KPa) or greater of live load.
7. The limits for Δ_{LL} and Δ_{CR} correspond to limits established by typical building codes and shall be applied to all trusses. The limit for Δ_{TL} is provided for application when building designers specify such a check due to total load be performed.

Step 3 – Check Trade Association Guidelines

- Trade associations or other groups often recommend more stringent deflection limits than code minimum requirements.
- Additional recommendations may apply, including:
  - Reduced on-center spacing of structural members
  - Specific subfloor & underlayment requirements
  - Maximum dimensions of topping or variation in thickness
  - Other detailing requirements



Step 4 – Creep

Total Load Deflection = Live Load Deflection + Dead Load Deflection

$\Delta_{TL} = \Delta_{LL} + \Delta_{DL}$

Time dependent deformation under long term loading (Creep)

$\Delta_{LongTerm} = K_{CR} \times \Delta_{LT} + \Delta_{ST}$

K_{CR} = Creep factor

$\geq$ 2.0 for trusses using seasoned lumber used in dry service conditions

$\geq$ 3.0 for trusses using green lumber or for wet service conditions

$\Delta_{LongTerm}$ = Total long term deflection due to immediate deflection of both short term and long term loads and creep deflection of long term loads

Δ_{LT} = Immediate deflection due to the long term component of the design load (immediate deflection due to the portion of load considered to be present over a sustained time period, typically dead load or a portion of the dead load

Δ_{ST} = Deflection due to short term or normal component of the design load (deflection due to transient loads, typically live loads)

Step 4 – Creep

- For purposes of deflection limitations in accordance with the IBC, trusses using only seasoned lumber used in dry service conditions shall determine the deflection for the total load check as follows:

Δ_{CR} = Deflection due to live load plus creep component of deflection due to dead load

$= \Delta_{LL} + (K_{CR} - 1) \times \Delta_{DL}$

K_{CR} = Creep factor

$\geq$ 2.0 for trusses using seasoned lumber used in dry service conditions

$\geq$ 3.0 for trusses using green lumber or for wet service conditions

Step 5 – Verify in Design Software

- Truss design software typically addresses code deflection requirements by default but the designer needs to verify the settings are correct for their design.
- The building designer may specify more stringent criteria.
- Given complete and accurate loading and serviceability information, truss designs will account for all the considerations and include pertinent information on the Truss Design Drawing.