

ISSUE497 **BULLETIN**



Stair construction

February 2008

■ Stairs must be constructed to provide a safe and secure means of circulation.

■ The structure must be durable and remain rigid under normal use

■ Stairs constructed for public access must comply with New Zealand Building Code Clause D1 – *Access routes*.

1.0 SCOPE

1.0.1 The scope of this bulletin is to illustrate common methods of construction for stairways. The details provided illustrate common methods of stair construction but do not attempt to illustrate the many variations that might be encountered.

2.0 BUILDING CODE REQUIREMENTS

2.0.1 Stairs must be constructed to comply with the following Sections of the New Zealand Building Code:

- B1 *Structure* – B1/AS2 provides an Acceptable Solution for a timber barrier and balustrade
- B2 *Durability* – states specific durability requirements for the items covered under B1, D1 and F4 – NZS 3602 is the Acceptable Solution for timber components
- D1 *Access Routes* – has requirements for stair design, slip resistance and handrails
- F4 *Safety from Falling* – Acceptable Solution F4/AS1 provides requirements for barriers in buildings, other than that called up in B1/AS1, and other requirements in relation to falling.

3.0 STAIRS

3.0.1 Stairs are encountered at changes in floor levels within buildings or sudden changes in ground levels where pedestrian access is required. Their correct design is crucial to safe circulation to and within buildings and through the landscape – refer to BRANZ Bulletin 495 *Stair design*.

3.0.2 Steps and stairs are of the following principal types:

- exterior timber steps – used for access to and from decks, principally in private residences or as part of a means of escape from a building
- exterior steel/timber steps – principally used for service access or where larger spans are required
- concrete steps and stairs – regularly used in landscaping or for internal stairways in commercial buildings
- timber stairs – used for private or public access in timber framed buildings.

4.0 HANDRAILS AND BARRIERS

4.0.1 Building Code Acceptable Solution F4/AS1 requires that where it is possible to fall more than one metre or more a barrier must be installed to prevent users from falling. This requirement applies to stairs and where a stair is not enclosed by walls where a barrier must be provided that meets the requirements of F4, *Safety from falling*.

4.0.2 Barriers also need to provide a secure handhold by providing a handrail that meets the requirements of D1, *Access routes*. Where a stair is enclosed by walls and a barrier is not required a handrail should be securely mounted on the wall. Refer to Clause F4 for specific requirements for access routes.

5.0 EXTERIOR TIMBER STEPS

5.0.1 The simplest form of stairs are those constructed to provide access to exterior deck areas, as shown in Figures 1 and 2. These can be constructed in solid timber to match the deck construction. It is important that all timber and fixings used in the construction meet the same durability requirements as the deck construction. Section 4 of NZS 3604 *Timber framed Buildings* may be used as the Acceptable Solution to Building Code Clause B2 *Durability* for timber structures. Exposed bolts and other fastenings will need to be Type 304 stainless steel or epoxy coated galvanised steel.

5.0.2 The timber treads may need to be coated with a non-slip finish or grooved to provide a slip resistant surface, generally gauged or dressed timber will not be suitable for use where the timber may become wet. The grooves to timber treads must be across the stair, at right angles to the direction of travel. Refer to D1/AS1 for suitable tread materials, particularly the mandatory requirements if the steps are to be used by the public.

5.0.3 Balustrades and handrails will need to be constructed to provide the same level of protection from falling as the handrails or barriers to the deck. Balusters are commonly fixed to the exterior face of the stringer with bolts – refer to the Acceptable Solution F4/AS1.

5.0.4 Open treads (as shown in Figures 2 and 3 without solid risers) are not suitable where the stair may be used or accessed by the public, e.g the front steps to a residence.

5.0.5 Stringers may be sized using the joist tables from NZS 3604. Where the stringer is rebated to house the treads (Figure 3) the thickness of the stringer should be increased by the rebate depth.

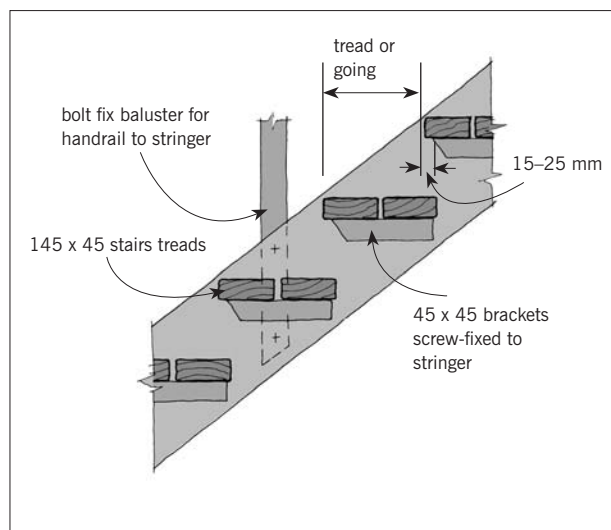


Figure 1. Simple external timber stair.

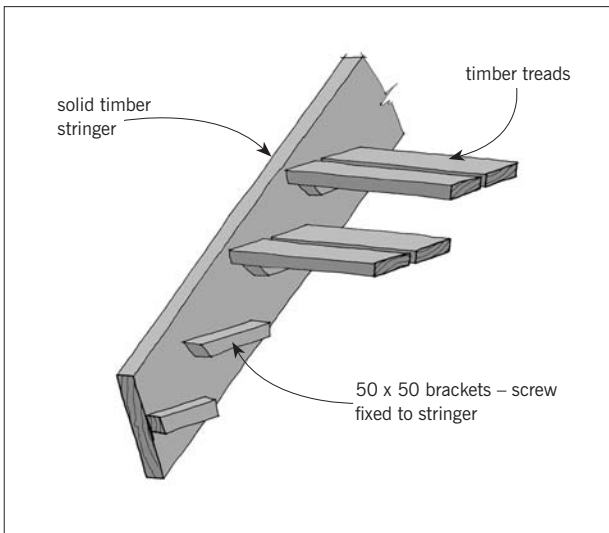


Figure 2. Simple external timber stair.

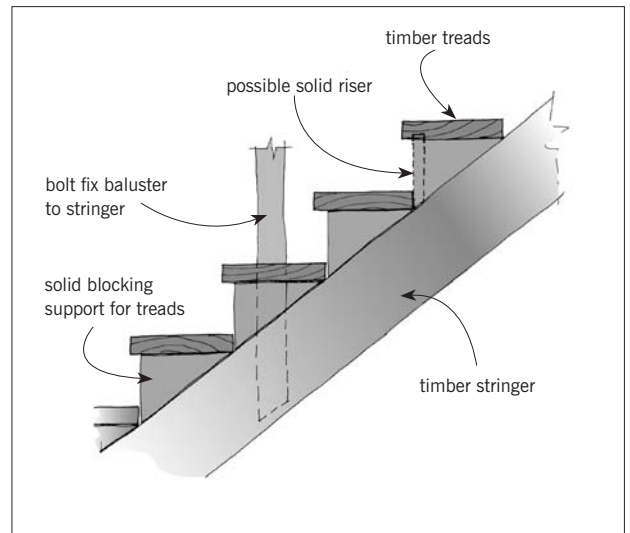


Figure 4. Timber stair using block supports to treads

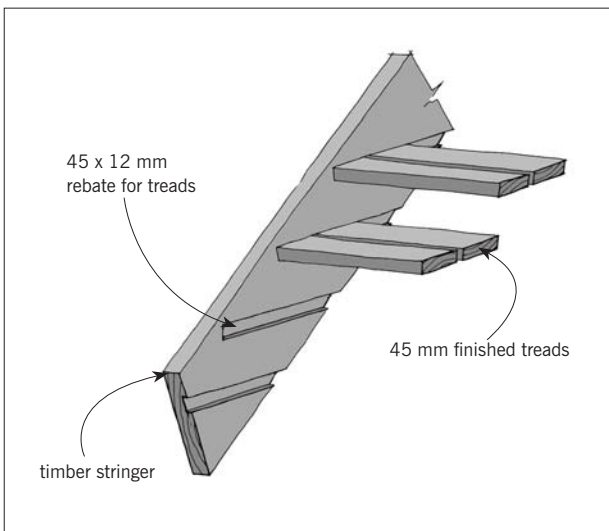


Figure 3. External stair using rebated stringer

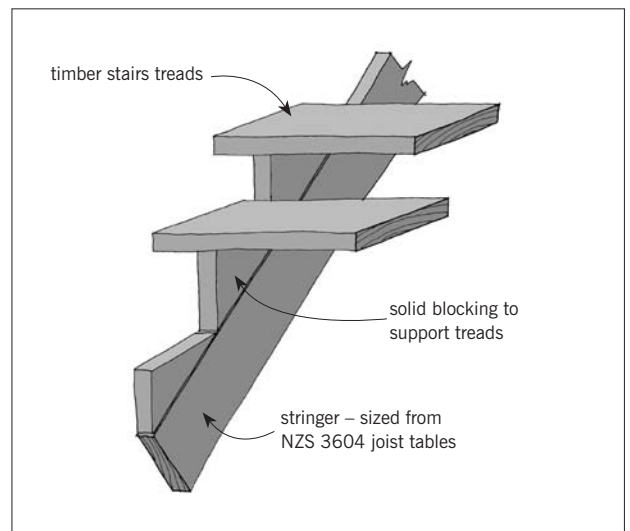


Figure 5. Timber stair using block supports to treads

6.0 TIMBER STAIR – ALTERNATIVE CONSTRUCTION

6.0.1 More secure fixings can be provided for the treads by fixing solid blocking (Figures 4 and 5). One advantage of this construction is that the stringer can be laminated, or be sized by specific engineering design to allow for greater spans. It is important where the stair is exposed to the weather that all timber and fixings used in the construction meet appropriate durability requirements.

6.0.2 The timber treads may need to be coated with a non-slip surface to meet the slip resistance requirements.

6.0.3 Balustrades and handrails will need to be constructed to provide the same level of protection from falling as the handrails or barriers to a deck or balcony.

6.0.4 Open treads are not suitable where the stair may be used or accessed by the public. Solid risers are able to be fitted as shown in Figure 4.

7.0 COMPOSITE STEEL/TIMBER STAIR

7.0.1 For stairs of longer spans it is possible to use a steel stringer, with brackets welded to the stringer (Figures 6 and 7). The steel section can be sized using manufacturer's joist span tables or by specific design.

7.0.2 Treads may be steel or precast concrete in lieu of the timber treads shown. Precast concrete treads will need to be specifically designed and have bolt holes cast in to allow for fixing. Steel treads may generally be sized from manufacturer's literature.

7.0.3 For exterior use the steel stringer and brackets should be hot dip galvanised after fabrication and a protective paint coat applied prior to installation. All fixings, treads and balustrades should meet the durability requirements pertaining to the particular installation.

7.0.4 Balustrades may be fixed by welding steel balusters to the channel or be constructed in timber or steel and bolt fixed to the outer face of the stringer.

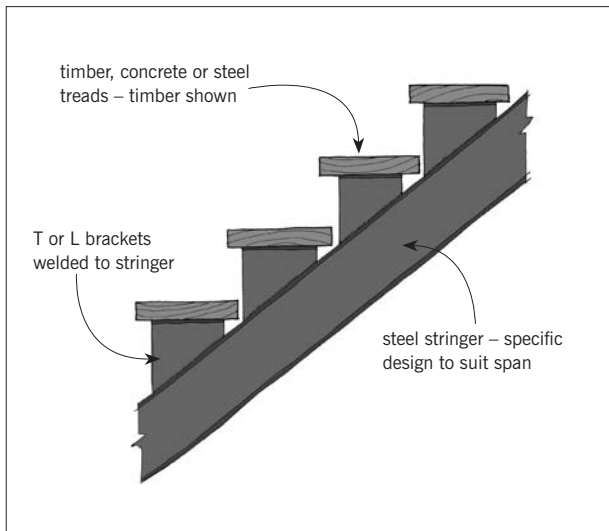


Figure 6. Stair with steel stringer.

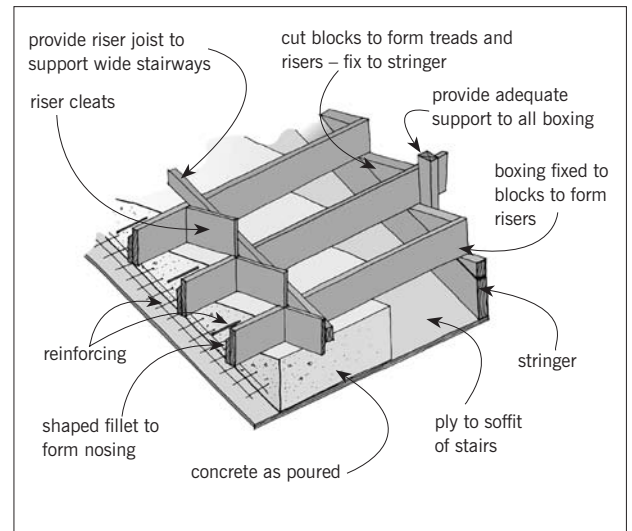


Figure 8 – Boxing up for in-situ concrete steps.

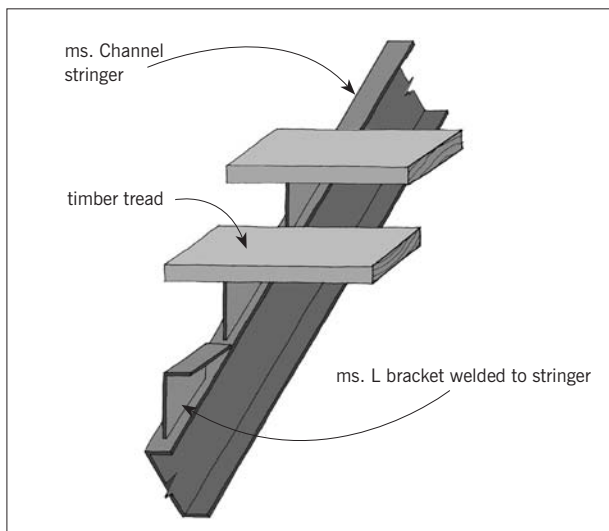


Figure 7. Stair with steel stringer.

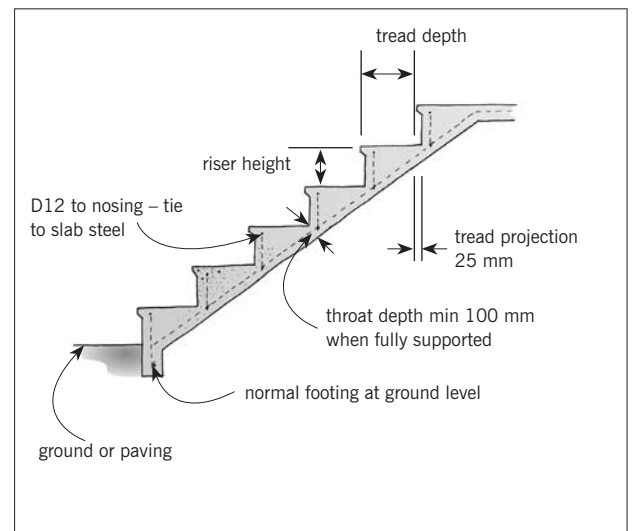


Figure 9. Concrete steps.

8.0 CONCRETE STEPS

8.0.1 A typical method of boxing for in-situ concrete steps is shown in Figure 8. It is important that all boxing is sufficiently rigid and supported to prevent sag or movement due to the weight of the wet concrete.

8.0.2 A free standing stair is shown, but for short run steps on grade may be formed over hardfill rather than the ply formwork shown. For casting on the ground (Figure 9), the minimum depth of the slab at the throat of the steps should be 100 mm. Where the stair is free spanning the reinforcing and thickness at the throat should be specifically designed.

8.0.3 For exterior use, the surface of the treads can be floated off to provide a non-slip surface or may be coated with tiles, plaster or similar surface to form a non-slip finish. For interior stairs vinyl, carpet or other finish may be applied.

8.0.4 Concrete stairways may also be formed as precast units fixed between floor slabs and landings.

8.0.5 Nosings can be formed by incorporating fillets (Figure 9) or be separately incorporated in the applied finish.

9.0 INTERIOR TIMBER STAIRS

9.0.1 Interior timber stairways are constructed as shown in figures 10 and 11. Solid timber or medium density wood fibre sheet (MDF) may be used in the construction. MDF is normally glued and screwed while solid timber may be nailed and glued.

9.0.2 It is important that the wedges hold the treads and risers securely into the rebated stringer. Failure to secure the treads and risers will cause 'creaking' of the stairs.

9.0.3 Fit sufficient glue blocks to tie treads and risers securely together.

9.0.4 Treads should be rebated into the base of the risers to prevent these members separating. The rebate will hold the tread to resist sagging.

9.0.5 Solid timber stairs are not suitable for exterior use.

9.0.6 Balustrades to stairs must comply with the requirements for barriers. Refer Building Code Clause F4 – *Safety from falling* and handrails should comply with Clause D1 *Access routes*.

9.0.7 By selecting the timber used for the construction of the stairs, clear finish may be an option. Alternatively finishes such as vinyl or carpet may be applied.

9.0.8 Solid timber stairs are suitable as public access ways.

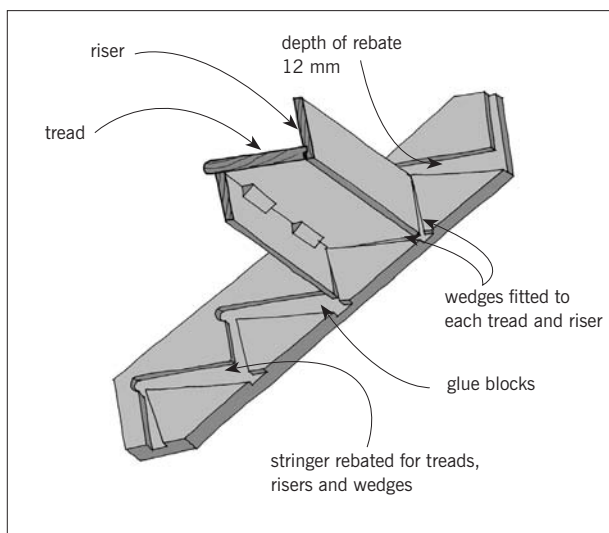


Figure 11. Timber stair construction.

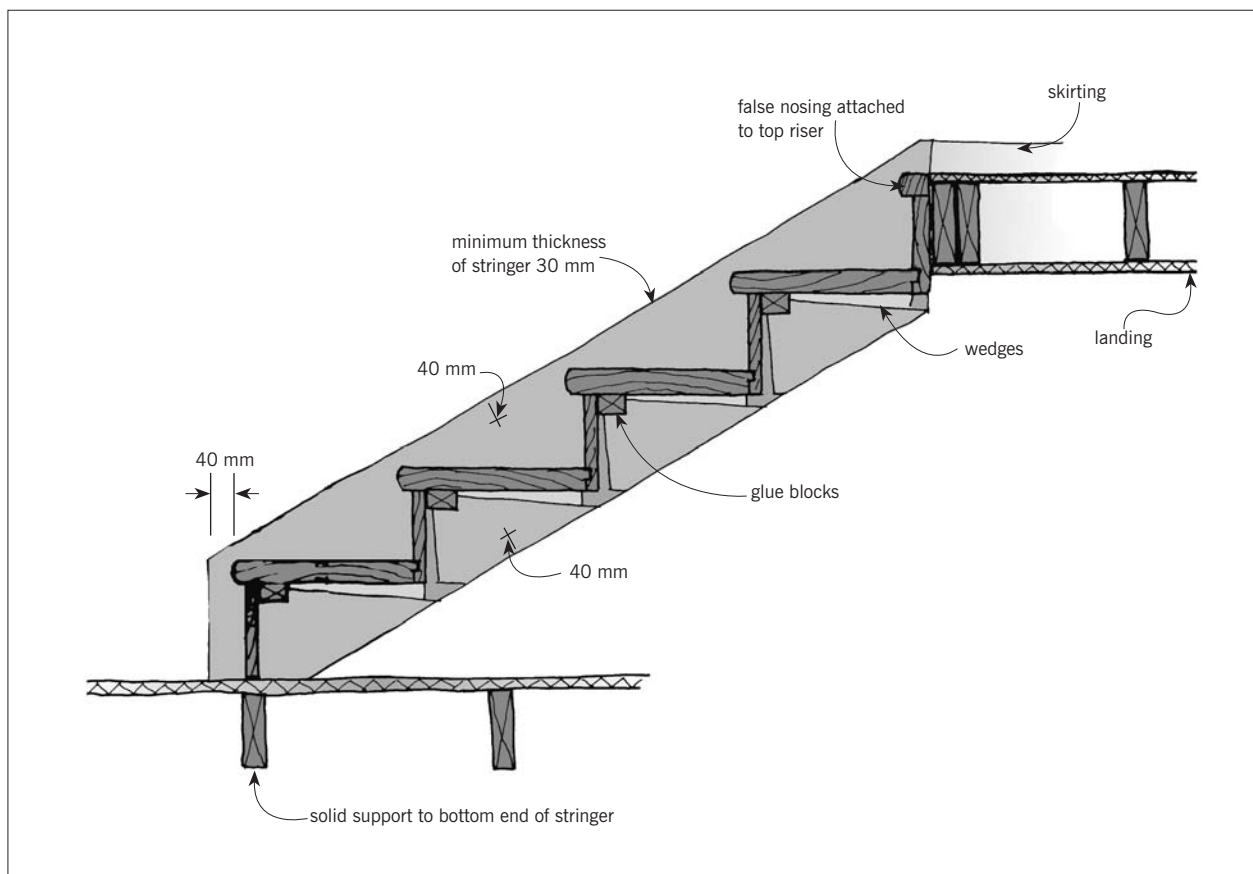


Figure 10. Typical internal timber stairs.

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