



# Bonding Ceramic Tile, Stone or Brick Over Wood Floors

## TDS 152

### I. STRUCTURAL FRAMING

A. Floor systems over which tile or stone will be installed shall be in conformance with the International Residential Code (IRC) for residential applications, the International Building Code (IBC) for commercial applications, or applicable building codes.

B. The deflection of engineered wood structural framing, including I-joists, open-web truss joists, composite laminated veneer lumber/ LVL, glue laminated timber/glulam and other engineered wood beams or joists, that supports wood sub-floors under all distributed or concentrated live and dead loads shall not exceed 1/480 of the span where a ceramic tile or brick finish is adhered to an underlayment installed over a structural sub-floor.

C. The deflection of engineered wood structural framing, including I-joists, open-web truss joists, composite laminated veneer lumber/ LVL, glue laminated timber/glulam and other engineered wood beams or joists, that supports wood sub-floors under all distributed or concentrated live and dead loads shall be determined by a qualified structural design professional where a stone finish is adhered to an underlayment installed over a structural sub-floor.

D. Joist spacing in conventional sawn lumber and engineered wood structural framing systems shall not exceed 16" (400mm) o.c. However, the actual requirements for the spacing of joists are governed by the thickness and type of the sub-floor panel relative to the joist or beam spacing (see II.B.). The Tile Council of North America (TCNA) and LATICRETE International do provide options for wider joist spacing if necessary. Please refer to the TCNA Handbook for Ceramic, Glass, and Stone Tile Installation and LATICRETE® Architectural Guidebook (available at [www.laticrete.com/ag](http://www.laticrete.com/ag)) for more information.

E. The actual weight of materials and construction assemblies, including concentrated dead loads of fixed service and other equipment, shall be utilized as prescribed by state and local building codes to estimate dead loads for the purpose of structural design.

F. The minimum uniformly distributed live load and minimum concentrated live loads, wherever such loads shall occur, shall be provided for as prescribed by state and local building codes.

G. Lateral and other bracing must be constructed as prescribed by code and/or engineered wood manufacturers' literature to achieve specified design deflection values.

### II. SUB-FLOOR

A. Floor systems over which tile or stone will be installed shall be in conformance with the International Residential Code (IRC) for residential applications, the International Building Code (IBC) for commercial applications, or applicable building codes. Historically, the deflection of the structural sub-floor panels spanning between structural framing components (beams and joists) is not to exceed:

1. 1/360 of the span where a ceramic tile or brick finish is directly adhered to the underlayment and sub-floor;
2. 1/480 of the span for spans up to 14 ft. (4.3m) and no greater than 7/32" (6mm) for spans over 14 ft. (4.3m), where a stone finish is directly adhered to an underlayment and a structural sub-floor.

B. Thickness of plywood, oriented strand board/OSB or composite/COM-PLY sub-floor panels:

1. 5/8" (16mm) or 19/32" (15mm) thick for 16" (400mm) o.c. joist spacing;
2. 3/4" (19mm) or 23/32" (18mm) thick for up to 24" (600mm) o.c. joist spacing;
3. for all other structural sub-floor materials, such as wood planks, minimum thickness must be as prescribed by building code and deflection must be verified by a qualified professional to comply with requirements in sections II.A.1. and II.A.2.;

4. sub-floor panels of other thickness with APA-Engineered Wood Association trademark grade span ratings that are commensurate with joist spacing are acceptable.

C. All sub-floor panels must be APA Exterior or Interior Exposure 1 exposure durability with any APA grade designation. Single layer sub-floor panels are not acceptable for direct adhesion of ceramic tile, stone or brick without a suitable, properly installed underlayment.

D. Installation:

1. Sub-floor panels must be installed with the face grain or strength axis perpendicular to the support members to ensure proper strength and maximum stiffness;
2. Panel continuous over two or more spans;
3. End joints must occur over framing members;
4. Must be tongue and groove, or if not available, all edges must be blocked;
5. Sub-floor panels must be glued/adhered to the support members with construction adhesive to increase stiffness and fastened with specified mechanical fasteners;
6. A 1/8" (3mm) space must be provided at time of panel installation between the panel edges and any hard abutment (e.g. perimeter walls, pipes, etc...);
7. Fasten 6" (150mm) o.c. along all edges and 8" (200mm) o.c. in panel field with 8d ring-shank, coated or hot-dip galvanized nails for 5/8" (15mm) and 3/4" (19mm) thick panels, or, screw the panels in place.

E. For thin-bed ceramic tile installations when a cementitious bonding material will be used, including medium bed mortar: maximum allowable variation in the tile substrate – for tiles with edges shorter than 15" (375mm), maximum allowable variation is 1/4" in 10' (6mm in 3m) from the required plane, with no more than 1/16" variation in 12" (1.5mm variation in 300mm) when measured from the high points in the surface. For tiles with at least one edge 15" (375mm) in length, maximum allowable variation is 1/8" in 10' (3mm in 3m) from the required plane, with no more than 1/16" variation in 24" (1.5mm variation in 600mm) when measured from the high points in the surface. For modular substrate units, such as exterior glue plywood panels or adjacent concrete masonry units, adjacent edges cannot exceed 1/32" (0.8mm) difference in height. Should the architect/designer require a more stringent finish tolerance (e.g. 1/8" in 10' [3mm in 3m]), the subsurface specification must reflect that tolerance, or the tile specification must include a specific and separate requirement to bring the subsurface tolerance into compliance with the desired tolerance.

In addition to deflection considerations, above-ground installations are inherently more susceptible to vibration. Consult grout, mortar, and membrane manufacturer to determine appropriate installation materials for above-ground installations. A crack isolation and higher quality setting materials can increase the performance capabilities of above-ground applications. However, the upgraded materials cannot mitigate structural deficiencies including floors not meeting code requirements and/or over loading or other abuse of the installation in excess of design parameters.

### III. UNDERLAYMENT

A. The underlayment may not be used in whole or part as a structural panel to achieve minimum deflection requirements of the sub-floor as specified in section II.A.1., but may be used as a structural panel to provide increased stiffness to meet deflection requirements specified in II.A.2.

B. Use APA Exterior structural-use sub-floor panel grade designations A-A, A-B, A-C, B-B, B-C, C-C & C-C Plugged and all Structural I panel grades; Note: interior plywood with exterior glue exposure durability is not acceptable. A 3/8" (10mm) thick, 7-ply birch plywood underlayment is also an acceptable underlayment over 16" (400mm) o.c. floor joists only.

C. The minimum recommended thickness for plywood underlayment panels is 5/8" (16mm) or 19/32" (15mm).

D. Mortar beds, cementitious backer units and fiber cement underlayment, which are approved for direct adhesion of ceramic tile, stone and brick, are acceptable as exterior glue plywood underlayment substitutes - consult manufacturer for guidelines on installation and recommended adhesives (see LATICRETE TDS 126 and 208 for additional information on cementitious backer units).

E. Installation:

1. Protect underlayment from damage or contamination by other trades;

2. Stagger end joints of underlayment panels by at least one joist spacing from the ends of the sub-floor panels;
3. Offset from the floor joist below by 2" (50mm) so that underlayment end fasteners do not penetrate the joist;
4. Allow minimum 1/8" (3mm) between sub-floor panels and 1/4" (6mm) between panel and wall for expansion;
5. Glue underlayment to sub-floor with construction adhesive or below mentioned adhesive to increase stiffness;
6. Fasten 6" (150mm) o.c. along all edges and 8" (200mm) o.c. in both directions in panel field with 8d ring-shank, coated or hot-dip galvanized nails for 5/8" (15mm) and 3/4" (19mm) thick panels or screw the panels in place.

#### **IV. INSTALLATION OF CERAMIC TILE, STONE & BRICK**

##### **A. Recommended Installation Materials:**

1. 254 Platinum
2. 257 TITANIUM™
3. 254R Platinum Rapid
4. 125 Sound & Crack Adhesive
5. TRI-LITE™
6. SURE SET™
7. 4-XLT
8. 4-XLT Rapid
9. 317 Mortar; or, 272 Mortar and 333 Flexible Additive;
10. LHT™ and 333 Flexible Additive
11. 253 Gold
12. 252 Silver
13. 220 Marble & Granite Mortar and 333 Flexible Additive
14. 317 Mortar; or, 272 Mortar and 101 Rapid Latex Admix
15. LATAPOXY® 300 Adhesive
16. LATAPOXY BIOGREEN™ 300
17. LATAPOXY 210 Adhesive
18. STRATA\_MAT™
19. STRATA\_MAT XT

#### **V. LIMITATIONS**

A. Engineered wood structural framing may be subject to increased in-service deflection due to moisture exposure and long span conditions.

B. Plywood is not a suitable subsurface for the installation of ceramic tile brick or stone in interior locations where plywood is exposed to excessive moisture or humidity, such as steam rooms, showers, pools, fountains, over damp basements, or for exterior installations.

C. Fire-retardant, marine grade or preservative treated plywood, Masonite®, hardwood floors, strip wood floors, "yellow pitch pine" plywood, wood laminates, composite panels (e.g. Advantech), luan, wafer board, particleboard, oriented strand board/OSB, or similar engineered or reconstructed wood panels are not suitable substrates for the direct adhesive installation of ceramic tile, stone or brick. However, some of these materials, such as oriented strand board/OSB or fire retardant plywood, may be used as a structural sub-floor when 1) the material meets sub-floor deflection criteria listed in II.A.1. & II.A.2. of this specification, 2) are identified with an APA trademark as a performance rated structural-use panel, and 3) an underlayment suitable for direct adhesion of ceramic tile, stone or brick is provided over the sub-floor.

D. For interior installations of ceramic tile, stone and brick in wet areas above occupied space, install HYDRO BAN®, HYDRO BAN Sheet Membrane or 9235 Waterproofing Membrane to prevent moisture penetration through floor construction to ceiling or occupied spaces below. Please note that this treatment is not designed for exterior roof decks.

NOTE: Given the numerous advances in technology and underlayment material types, please refer to the LATICRETE Architectural Guidebook (available at [www.laticrete.com/ag](http://www.laticrete.com/ag)) for complete installation instructions for applications over wood floors.



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