



MORTAR-SET OVERLAYS FOR BELGARD PAVERS AND SLABS USED IN PEDESTRIAN & LIGHT VEHICULAR APPLICATIONS

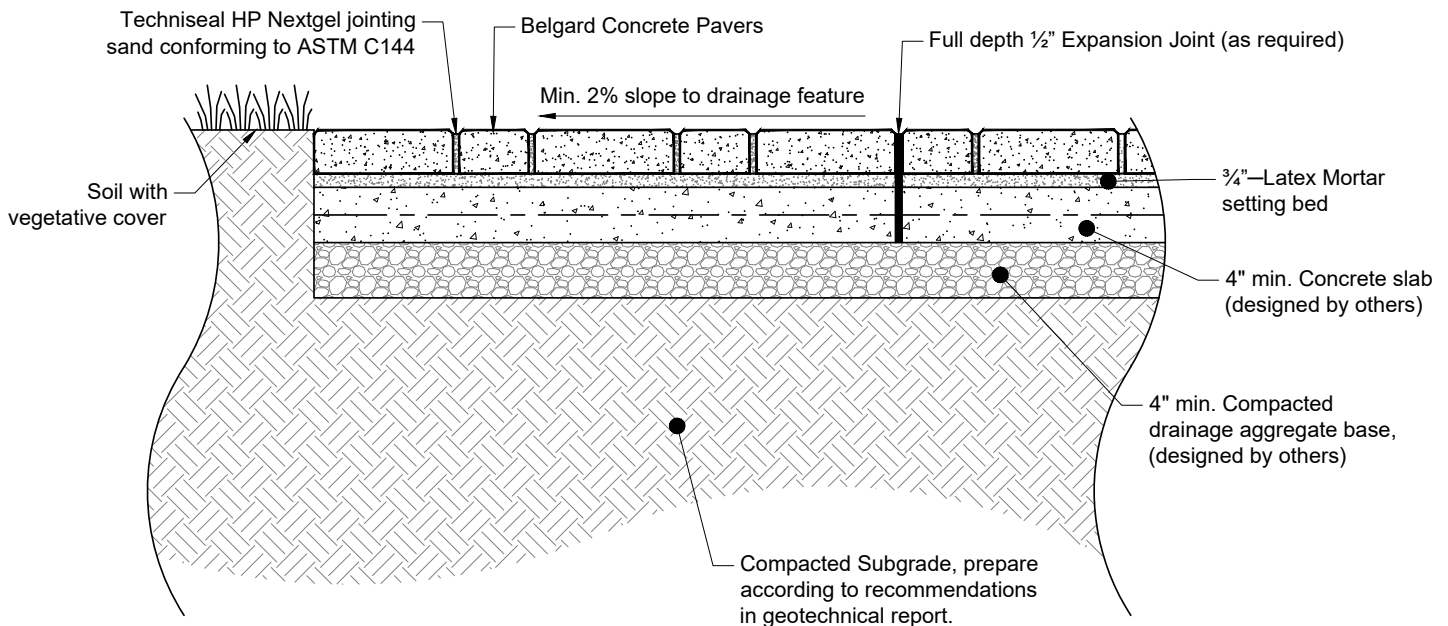
Belgard pavers and slabs can be assembled using a variety of construction details based on application and site-specific conditions and can be classified into two categories: sand-set and adhered solutions. Sand-set pavers are most commonly placed over dense-graded base, but for some commercial applications a concrete base can be utilized. Adhered solutions generally included bituminous-sand set and mortar set overlays on concrete base. Bituminous-sand set overlays provides a high-performance bond for heavy traffic loading applications. However, bituminous overlays require complex installation techniques, and few contractors have the required experience, increasing costs and limiting availability. Furthermore, concrete pavers used for bitumen-sand set application must be manufactured to more stringent height tolerances, +/- 1/16 inch (1.5 mm), which may require gauging, a secondary process that increases the cost and can limit availability.

Another alternative assembly to sand-set concrete pavers or slabs is to bond the products to a concrete base using a mortar-set approach. This adhered design solution is becoming more popular due to advancements in polymer-modified products.

This Technical Note provides design and installation considerations when specifying or installing mortar-set concrete pavers or slabs on a concrete base.

TYPICAL DETAILS

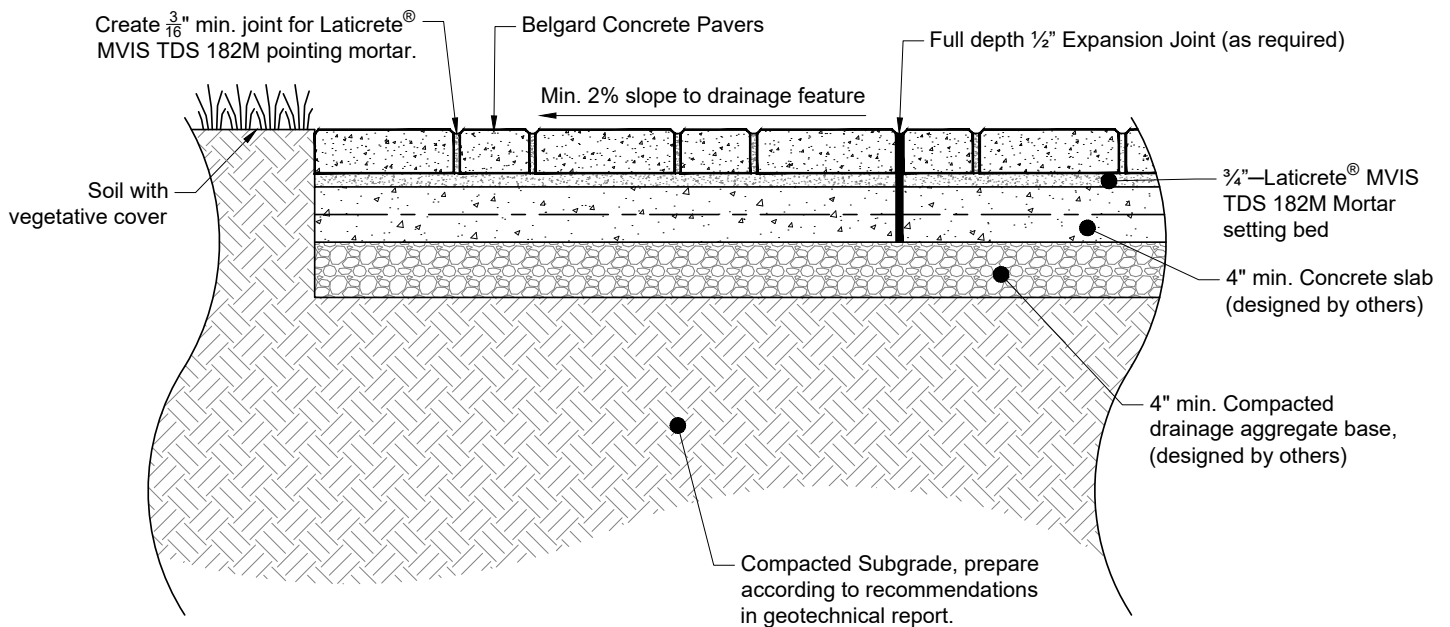
Site-specific conditions dictate the appropriate shape, unit thickness, and overall assembly including concrete base thickness design. However, a commonly used typical Belgard mortar set overlay detail is shown below.



The generic detail illustrates a latex mortar setting bed (typically includes cement, fine sand, polymer ingredients to strengthen and improve adhesion, and admixtures to address flexibility, cold-weather conditions, and set times- which is often a masonry veneer mortar or lightweight mortar), that can be applied using a trowel to the back of the paver and/or slab. Both paver and slab will need to be troweled and back buttered to achieve 100% coverage.

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A more robust solution to consider is to fill the surface joints with a pointing mortar as shown in the detail below. This requires the contractor to create a minimum $\frac{3}{16}$ " joint space and extra care is required to keep the pavers clean and free from mortar staining. Belgard recommends using Laticrete's Pointing Mortar along with their MVIS Veneer Mortar as the setting bed. The installer should follow Laticrete's installation guidelines to meet their warranty requirements.



In general, pavers or slabs set on any mortar bed overlying a concrete base become monolithic with the concrete substrate, creating a rigid pavement system. This bonded approach, adhering the units directly to the concrete base, provides significant support for pedestrian applications and an edge restraint system is usually not required.

MORTAR VS. GROUT

The main difference between mortar and grout is the amount of water in the mix. Grout mixes may or may not include sand and tend to have enough water to make the mix flow and enter narrow paver joints. Grout is a binder sometimes used for filling joints but does not act as an adhesive. Mortar, on the other hand, contains sand and uses minimal amounts of water to activate cementitious material and produce a smooth consistency that sticks to a trowel and spreads easily on the bottom of a paver or slab. Mortar can be used as a bedding layer to adhere pavers to a substrate, and it can also be used to fill joint openings $\geq \frac{3}{16}$ ", however, using larger joint spacing will limit laying patterns because most products are installed with $\frac{1}{8}$ " joints. It is important to remember that "adhesive" mortars cannot be used for grouting joints.

For commercial applications, Belgard recommends a mortar approach for paver or slab applications with joints filled with pointing or veneer mortar. Polymeric sand can be used in some applications based on

site-specific conditions. In non-vehicular applications with positive surface drainage and in non-freeze climates, polymeric sand may be a suitable alternative. **IMPORTANT:** Using grout bags to fill narrow joints may cause excess grout to flow onto concrete paver/slabs, permanently staining the paving units. A test area is recommended to check for staining and color of pointing mortar. In some cases, a grout release or sealer may be needed.

Thick set, mud-set, and thick bed or medium bed mortar systems are synonymous terms, used to describe solutions to level out unevenness in a concrete base or to create slope. More descriptively, thick beds are usually > 20 mm ($\frac{3}{4}$ " and provide a working platform once cured. A medium bed mortar can be applied on a cured thick bed mortar layer. If wet setting over a fresh mortar system, then a slurry coat of thin set is needed under the mortar bed and on the back of the paver. Paving units shall be tamped into fresh mortar till flat to height and full coverage is achieved.

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CONCRETE BASE CONDITIONS

Concrete must be structurally sound and stable to support the project design loads. The surface must be clean and smooth to provide a flat finish. A fortified mortar bed (leveling bed) is often required to repair cracked concrete. The leveling bed is often referred to as the mortar bed. Preparation of the concrete substrate is an important part of the installation process.

If crack prevention is required, it shall be installed prior to applying the mortar to the concrete. Laticrete's MVIS WCI is a thin, load-bearing crack isolation membrane that dries quickly and does not require use of fabrics.

COLD WEATHER APPLICATIONS

Mortars and grouts that are solely portland cement-based can be easily damaged (weakened) due to below-freezing temperatures and should be limited to areas not subject to freeze-thaw conditions (Zone 1 Climatic Zone Map as shown below in ASTM C936, Standard Specification for Solid Concrete Interlocking Paving Units, Figure X1.1). These types of materials also take significantly longer to cure in cold weather conditions. Belgard recommends that designers utilize polymer-modified mortar and grout materials when working outside Zone 1. Follow guidelines provided by the mortar/grout supplier for suitability for project-specific conditions. Follow manufacturer recommendations for cold weather installations when using modified mortars and grouts.



FIG. X1.1 Climate Zone Map

MORTAR-SET OVERLAYS FOR BELGARD PAVERS AND SLABS USED IN PEDESTRIAN & LIGHT VEHICULAR APPLICATIONS**DESIGN & INSTALLATION CONSIDERATIONS**

Factors to consider when designing an adhered solution include climate, product application, subbase and base materials, subgrade conditions, and slope. Product considerations include dimensions, joint opening size, type of joint infill, and pattern. Thin paving units < 2" (50 mm) are ideally suited for adhered overlay designs.

Mortars or grouts used for paving applications should be fast setting, stain resistant, designed for exterior applications, and meet ANSI A 118.4 (Modified Dry Set Cement Mortar) or ANSI A118.7 (Polymer Modified Cement Grouts) requirements.

Installation temperature impacts curing time and performance, so ambient temperatures must be between 40 °F (4 °C) and 90 °F (32 °C) when using most mortar set overlay solutions.

Dry-mix sand with Portland Cement, or products that rely on hydration activation after installation of the paving units, require careful consideration. These solutions rely on contractor-applied watering which is often not uniform or easy to control. Furthermore, large-format paving slabs greater than 15" x 15" (381 mm x 381 mm) will be difficult to activate by watering, and full bonding is unlikely in the center areas of large slabs.

It is important to identify expansion joints and crack control joints on the concrete substrate. Protect full-depth expansion joint openings with backer rod and caulking before installation. Full-depth expansion joints must extend to the pavement surface by aligning with the paving unit joints. Never span an expansion joint with a paving unit. Crack control joints can be filled and spanned with mortar such as Laticrete's Latasil, a movement and expansion joint fill material, which should be installed over all movement and expansion joints in accordance with the manufacturer's instructions and industry standards.



Proper drainage is required for any adhered paving solution. Maintaining a minimum 2% (1/4" per foot) slope to promote drainage and prevent deicing salt accumulation in surface openings is critical. In addition, not all latex/polymer modified portland cement mortars are suitable for wet areas. Consult the mortar supplier for appropriate material selection for intermittent and submerged applications.

Mortar-set pavers or slabs can be used for walkways or plazas on suspended concrete slab decks. The thickness of the structural slab is based on the span and design load. In these applications, the mortar setting bed should not be bonded to the structural concrete substrate to allow the pavement to move independently. Unbonded systems isolate the mortar bed from the underlying concrete base by a cleavage or crack isolation membrane. Reinforcement such as a welded wire fabric is often added to the mortar setting bed, which is often thicker than 3/4" to provide additional strength. Structural design of paving units on suspended slabs over inhabited or uninhabited space requires project-specific engineering design review.

ADDITIONAL RESOURCES

Laticrete's Masonry Veneer Installation System (MVIS) For Horizontal Installations over Concrete Slabs, TDS 182M, and other related Technical Data Sheets provides details, specifications, and product information for this solution. Contact a Belgard representative for a copy. Additional information, including product data sheets, can be found at: www.Laticrete.com.

In addition, the Tile Council of North America (www.tcnatile.com) has excellent resources explaining polymer-modified mortar, including references to test methods and standards applicable to porcelain tile products.



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