

## SIDEWALKS AND RIGID PAVEMENTS

**General:** Exterior walks and paved areas constructed in conjunction with new building projects shall conform to the requirements of these guidelines.

This work shall consist of preparatory work and operations, associated with the necessary movement of personnel, equipment, supplies, and incidentals to the project site and for all the work and operations which must be performed or costs that are necessarily incurred prior to commencing the work. The Contractor shall include all expected costs for the movement of all equipment and material necessary to execute the work, including any demobilization. Additional payments will not be made for interruptions in the completion of the Project if the Contractor fails to adequately assess the actual costs of mobilization.

This work shall include the removing of existing pavement, surface and base courses, concrete headers, combination curb and gutter, concrete curb, concrete gutter, concrete driveways, walks, steps, ramps, retaining walls, reinforcement, and miscellaneous masonry, as required; and shall also include salvaging and disposing of the resulting material, together with the necessary excavation and backfilling.

**Snow Removal Considerations:** The requirement for snow removal from all paved surfaces shall be recognized in the layout and construction of walks and paving. Areas that can only be cleaned by hand removal should be kept to an absolute minimum. Ramps should be provided between changes of level in paved areas to allow movement of tractor-mounted plows and/or blowers. Walks and steps with snowmelt systems shall include provisions to intercept and remove melted water so that it will not refreeze on adjacent paved areas which do not have snowmelt systems.

The University's Civil Engineer/Project Manager shall identify all areas of authorized pavement removal. The removal of the existing pavement shall extend to an existing joint or the limits shown on the plans. When called for on the plans or by the University's Civil Engineer/ Project Manager, all pavement to be removed shall be isolated from the pavement to remain by cutting a saw joint, as provided below, or by other methods specifically approved by the University's Project Manager/ Civil Engineer. The pavement to be removed shall be broken into movable sizes and removed from the site. If the pavement to remain is damaged by the Contractor, the University's Project Manager/ Civil Engineer will order further removal at the Contractor's expense. Pavement that is removed without authorization by the University's Civil Engineer/Project Manager shall be replaced at the Contractor's expense.

*The guidelines otherwise specified need to be assumed universal and applicable to all the campus.*

### Walks and Rigid Pavement Construction:

- A. Campus Specific Requirements for sidewalk width and thickness: UND Sidewalks shall be minimum of 7'-0" wide (narrower walks shall be approved by UND Landscape Services and Facilities PDC), 6" thick, with 1/4" per foot transverse slope. Sidewalks with vehicular traffic or mechanical snow removal shall be analyzed for equipment weight and designed accordingly, (generally 6" thickness). A minimum of 4" granular sub-base shall be installed before placing concrete.
- B. Sidewalk shall be constructed on a subgrade that has been sacrificed to a depth of 6" and compacted to a uniform density of not less than ninety-five percent (95%) of the maximum density (as determined by AASHTO standard method T-99) throughout its entire width. The moisture content of the subgrade shall be between two percent below (-2%) and four percent above (+4%) the optimum moisture content as determined by AASHTO standard method T-99. Up to a two inch (2") layer of crushed concrete or sand may be placed on the subgrade as a leveling course. The crushed concrete shall be compacted with a plate compacter and moistened by a light

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- application of water prior to concrete placement. The width of the compacted subgrade shall extend 6" past the width of the sidewalk on both sides.
- C. Walks and Rigid Pavements designated as fire lanes shall be a minimum of 8" thick. Reinforcing steel for fire lanes shall be at a minimum of a single mat of #4 size deformed grade 60 reinforcing steel spaced at 12" on center each way. Additional reinforcing for fire lanes may be required.
- D. The sidewalk shall extend above the adjacent finished grade by 2".
- E. The Fiber Reinforced Concrete (FRC) for the rigid paving shall be City of Grand Forks Standard Specifications) L-3500 mix producing a minimum compressive strength of 3500 psi at the end of the 28-day curing period. The FRC shall meet the following requirements when tested onsite:
1. Concrete hauled in non-agitating trucks shall be placed within 30 minutes after mixing time starts. Concrete hauled in agitating or transit mix trucks shall be placed within 90 minutes after mixing time starts. Concrete exceeding these time limits shall not be incorporated in the pavement or structure.
  2. Concrete temperature shall not exceed 90 deg F nor fall below 40 deg F when measured at the site of the pour. Ice or other cooling measures may be used at the batch plant but must be accounted for in the mix design and water/cement ratio.
  3. The water/Cement ratio shall not exceed 0.50. If water is added to the field, it shall not increase the water/cement ratio to more than 0.50
  4. Air content must be between 6.0% and 8.5%. The contractor shall require the concrete supplier to have measures in place to adjust air content in the field. Add Air-Entraining Admixture confirming to ASTM C260/C260M.
  5. Slump measured at the point of placement shall have a tolerance of +/- 1.5" for specified (from mix design) slump greater than 4" and +/- 1" for the specified slump of 4" or less. Specified slumps shall be permitted to be increased to a maximum of 9" by using mid-range water-reducing agents or high-range water-reducing agents.
  6. For more information on FRC, view point-S, Special Consideration, 2nd point of this document.
- F. Campus Specific requirements for Finishes:  
All rigid paving shall receive a light broom finish unless otherwise noted. Broom lines are to run perpendicular to foot traffic. All exposed concrete edges to have a one-half inch (1/2") radius.
- G. Immediately after the concrete has been finished,  
the concrete surface shall be sealed with a uniform application, no less than 1 gallon per 200 square feet, of white pigmented membrane cure ASTM designation C309, Type 1, Class A.
- H. Campus Specific requirements for Joints:  
Control joints shall be cut in green concrete (less than 24 hours old) using a diamond blade with a crack chaser. The depth shall be one-fourth (1/4) of slab depth. Joint locations shall be approved by UND PM prior to placement. A longitudinal control joint is required if the walk width is greater than 8'-0".
- I. Full-depth expansion joints are to be installed at 50' O/C.  
Pre-formed expansion joint material shall be 1/2" and meet ASTM D1751. The joint shall be sealed with polyurethane sealant. The joint shall be cleaned and inspected prior to sealing. Joint locations shall be approved by the UND PM prior to placement.

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- J. Whenever concrete pavement construction is stopped for a period of over 30 minutes, a transverse construction joint shall be formed by finishing the concrete to a bulkhead made of at least 2" material cut to the exact cross-section of the pavement slab, as shown on the plans.
- K. Sidewalk curves shall be formed true and smooth. Project-specific jointing patterns may be required by the UND PM.
- L. Campus Specific requirements for ADA compliance: All curb ramps shall conform to City of Grand Forks standards as well as the latest ADA accessibility guidelines. Detectable warning panels shall be made of cast iron and approved by UND PM prior to installation. Warning plates must comply with ADA dimensions and shall be installed as per the manufacturer's instructions. All curb ramps shall have a minimum width of seven feet (7') measured at the intersection with the street/gutter line.
- M. Curb and gutter construction shall meet City of Grand Forks standards.
- N. When a new concrete sidewalk is poured against existing concrete pavement or a concrete structure, the new concrete shall have a thickened edge of 7" transitioning back to 5" at the next control joint.
- O. Contractor shall secure the UND PM's approval of subgrade, formwork, and reinforcing prior to placing concrete for each pour. The contractor and the UND PM shall sign off on the pre-pour checklist before concrete shall be discharged into forms.
- P. Contractor shall be required to remove excess and waste material, trash, and debris and legally dispose of it off the University's property. Transit ready-mixed concrete trucks shall not be washed out on the University's property or adjacent property. A contractor should provide a wash-out facility for proper disposal of the residue concrete in the ready-mixed concrete trucks.
- Q. The following product and material submittals must be submitted to the UND PM for approval a minimum of 14 days prior to scheduled use. No unapproved products or materials shall be used.
1. Concrete mix design and compressive strength test results.
  2. Any concrete admixture to be added either at the batch plant or work site.
  3. Cure
  4. Expansion joint material
  5. Joint sealant
  6. Reinforcing steel or mesh
  7. Detectable warning panel
- R. No sheet metal should be placed under concrete.
- S. Special Concrete Considerations:
1. Heated Slab
    - Insulate below the entire floor slab. Although the rate of heat loss through the floor slab is slower at the center of the slab than at the perimeter (of an installation that is not insulated), in cold climates the heat loss through the floor will be continuous will be significantly greater at an uninsulated slab.
    - Insulate the slab perimeter, making sure that the insulation design does not rely on foam placed against the slab perimeter.

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- Place the radiant heat tubing at the industry-recommended depth down from the surface of the slab. Typically the maximum depth that tubing should be placed in a concrete floor slab is 2" down from the finished floor surface.

2. Fiber reinforced Concrete

- The fiber used in concrete for sidewalks construction should be a monofilament macro synthetic fiber developed from polypropylene and polyethylene resins.
- The dosage amount of synthetic fiber added to the concrete should be approximately 4 lb./yd<sup>3</sup> or as recommended by the manufacturer per the application of the concrete. The length of the fiber should be approximately 2 inches. UND PM should be consulted if the dosage is increased or decreased than prescribed above.
- If the dosage is high, and depending on the fiber type, some adjustments to the mixture design becomes necessary. This includes adding or increasing the amount of waterreducing admixture (plasticizer) to maintain workability and slump without changing the water-cement ratio (w/c).
- Fibers should be dispersed uniformly throughout the concrete. Reducing the batch size or increasing the mixing time may become necessary to achieve a uniform dispersion. It is recommended to add the fibers in a continuous manner.
- A mixing speed of 10 to 12 rpm is typically used for the rate of addition in trucks. A minimum of 40 revolutions (4 to 5 minutes) after all the fibers are added is recommended for proper mixing and dispersion of fiber in trucks.
- Fiber should be added, either to the fully mixed concrete, or together with aggregates, but never as the first ingredients.
- When discharging an FRC mixture into a hopper assembly on a pump truck, the chute should be raised 12 to 18 in. (300 to 450 mm) above the grate (if a grate is present) on the pump to allow the fibers to pass through the grate.
- To consolidate fresh FRC and bring sufficient mortar or paste to the surface to enhance the finishing, laser screed, razor back, or vibrating beam machines can be used.

For more details on Form and Placing of the concrete refer to University's design narrative on Concrete Formwork and Placement.

**Sidewalk Demolition:**

- A. The Contractor shall remove the concrete pavement and curbs, if applicable, without damaging the adjacent concrete pavement and curbs. Repair of any damage caused by the operation is at the Contractor's expense.
- B. The Contractor shall remove and dispose of all old pavement, reinforcing steel, and all other materials. The repair section shall be removed with minimum disturbance of the underlying foundation course. Any loosened foundation course material shall be removed and replaced with concrete.
- C. The Contractor shall cut around the perimeter of the repair area as shown in the plans. All repairs shall be cut so the edges are parallel or perpendicular to the traveled way. Saw overcuts shall be kept to a minimum.
- D. The Contractor shall use hand or pneumatic tools to remove the concrete pavement. If the patch is full depth Type C (more than 15 to 45 S.Y.), then a drop hammer may be used to remove the pavement. When tie bars in longitudinal joints are damaged during concrete removal, they shall be replaced by the Contractor at no additional cost to the University with No. 5 reinforcing bars

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that are 12" apart. The new tie bars shall be installed into holes drilled in the existing concrete and secured in place with a non-shrink grout or epoxy.

### **Sidewalk Sawing**

- A. Portland Cement Concrete (PCC) pavement to be removed shall be isolated from the paving to remain by cutting a full depth saw cut, using a diamond blade. If a wheel saw is used, additional sawing shall be required to provide smooth, straight, and true vertical faces.
- B. The Contractor shall immediately and continuously remove the slurry or residue from the saw cut operation. The Contractor shall not permit slurry to flow across shoulders or lanes occupied by traffic. The Contractor shall not permit slurry or residue into gutters, inlets, or other drainage facilities. The Contractor shall leave slabs clean and dry with no residue remaining upon completion of sawing operations, with the exception of residue or slurry into excavations or subgrade that doesn't drain to gutters, inlets, or other drainage facilities.

### **Exterior stairs and ramps:**

- A. Protection: All stairs and ramps associated with a building shall be covered by the building roof or an overhead canopy when feasible
- B. Stair Proportions: Exterior stairs, including those providing direct access to a building entrance, shall have a tread riser proportion of not more than 7.5:10
- C. Exterior Ramps: Exterior ramps shall conform to ADA requirements. Curb cuts shall not be less than 84" wide to allow mechanical snow removal. Smaller curb cuts must be approved by the University's Project Manager/ Civil Engineer.
- D. Project-specific reinforcing details shall be provided in contract documents.
- E. Concrete specifications listed in the previous section (2. Walks) shall be followed for all concrete exterior stairs and ramps as a minimum standard.

### **Stoops and landings:**

- A. Provide structurally supported stoops where exit doors swing outward. Anchor stoops to structure in such a manner so as to prevent heaving from frost.
- B. Provide 1/4" per foot slope on stoops and landings outside exit doors for drainage away from the building.
- C. Project-specific reinforcing details shall be provided in contract documents.
- D. Concrete specifications listed in the previous section (2. Walks) shall be followed for all concrete exterior stairs and ramps as a minimum standard.