**NOTICE TO USERS**

Although payment for *Slab Jacking* is in square feet of slabs or pavements raised, it is also necessary to enter estimated grout and foam quantities in the Measurement and Payment section of this provision. For assistance with determining these quantities, contact Mike Holmes, Grouting Supervisor with the NCDOT Geotechnical Engineering Unit at (919) 906-9900 or by email at mrholmes@ncdot.gov.

**SLAB JACKING: (1-16-18)**

**Description**

Slab jacking consists of lifting concrete slabs by pumping cementitious grout or injecting polyurethane foam in between a slab and subgrade through holes drilled in the slab. Slab jacking is required to raise settling concrete slabs and restore pavements and bridge approaches to their original grade as required or directed. Use a prequalified Subsurface Grouting Contractor to perform slab jacking. Define “grout” as cementitious grout pumped under slabs and “foam” as polyurethane foam injected below slabs.

**Materials**

Refer to Division 10 of the *Standard Specifications*.

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| **Item** | **Section** |
| Grout | 1003 |

Use Type 4 grout for cementitious grout and Type 3 grout for patching holes in pavements. Use Type 1 polyurethane in accordance with the *Polyurethanes* provision for polyurethane foam.

**Prejacking Requirements**

Submit a PDF copy of a slab jacking plan at least 14 days before mobilizing to the site. Do not begin slab jacking until a jacking plan submittal is accepted. Provide detailed project information in the slab jacking plan including sequence and schedule of work and traffic control operations, grout or foam type, drill hole pattern and limits and proposed slab jacking equipment and methods. The Engineer may require a prejacking meeting to discuss the slab jacking, movement monitoring, profile measuring and other aspects of the work. If required, schedule this meeting onsite and during daylight hours before mobilizing to the site. The District or Bridge Maintenance Engineer, Geotechnical Operations Engineer or Grouting Supervisor and Grouting Contractor Superintendent will attend prejacking meetings.

1. **Equipment**

Provide a grout plant or truck mounted mobile equipment as necessary to transport, proportion, mix and batch materials and pump grout or inject foam for slab jacking. For grout, use colloidal mixers and positive displacement pumps that can attain continuous grout pressures up to 300 psi. Monitor grout pressures with an in-line calibrated pressure gauge that is protected from grout contamination and mounted near the nozzle end of the grout line. For foam, use polyurethane equipment recommended by the Foam Manufacturer and proportioners with integrated digital stroke counters to determine quantity of foam injected.

Unless otherwise approved, use pneumatic or hydraulic drills weighing no more than 60 lb capable of drilling round and plumb holes of the required diameter through concrete slabs without damaging slabs. At least 2 monitoring methods are required when raising slabs. Measure profiles of slabs less than 50 ft long with tight string lines and profiles of longer slabs with laser levels. Also, continuously monitor slab lift with digital electronic devices that can measure to the nearest 0.01". For jointed pavements, use devices with the ability to simultaneously detect the movement of two adjacent slabs. Provide calibration certificates for devices dated within 1 year of beginning work.

1. **Preprofile Survey**

A field survey is required before raising any pavement with more than 3/4" of differential settlement or any bridge approach slab. Use a string line or laser level to record and plot the slab profile at maximum 5 ft intervals along each wheel path. For sections with curb and gutter or paved shoulders 5 ft or wider, record and plot the curb or shoulder profile using a string line or laser level at maximum 5 ft intervals along each gutter line or shoulder centerline. Also, take digital pictures of existing cracks in slabs and mark their locations on slabs. Provide an electronic and/or hard copy of this survey and photographic information to the Engineer before pumping grout or injecting foam.

**Slab Jacking Methods**

Use equipment and methods accepted in the slab jacking plan or approved by the Engineer. Do not drill more holes than can be utilized and patched during a single shift and do not drill holes in a lane for which work cannot be completed before the shift ends. Avoid drilling with excessive downward force so underside of concrete slabs do not spall or break. Unless otherwise approved, do not drill holes more than 1" below slabs. Drill holes on approved patterns and within approved limits that meet the following requirements:

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| **DRILL HOLE REQUIREMENTS** |
| **Material** | **Hole Diameter** | **Maximum Hole Spacing** |
| **Between Holes** | **From Closest****Joint or Slab Edge** |
| Grout | 1-1/2" to 2-1/2" | 6 ft | 2 ft |
| Foam | 5/8" ±1/8" | 4 ft |

For grout, flush holes with water to clear drill cuttings from holes. Grout flow is required between drill holes during pumping. Depending on conditions, it may be necessary to use tighter hole spacing so grout readily flows between holes.

Remove oil, rust inhibitors, residual fluids and similar foreign materials from holding tanks/hoppers, proportioners, mixers, pumps, hoses and all other equipment in contact with grout or foam before use. For grout, retain empty grout bags onsite until number of bags used at each slab jacking location is recorded and provided to the Engineer. For foam, record the pounds of foam injected at each slab jacking location based on the volume per stroke of the proportioner and the specific gravity of the liquid foam components provided by the Proportioner and Foam Manufacturers, respectively.

Secure discharge lines in drill holes so seal is sufficient to maintain the required pressure underneath slabs and grout or foam does not flow out of sealed holes. Do not extend nozzle end of hoses below underside of concrete slabs. For grout, insert tapered wooden plugs in drill holes to prevent grout leakage through previously grouted holes.

Allow water displaced by grout or foam to flow from under slabs freely. Prevent excessive loss of grout or foam through cracks and joints or from underneath shoulders. Control any uncontained grout or foam for cleanup and prevent grout or foam from encroaching onto adjacent open traffic lanes. If large voids are encountered below slabs, inject foam with methods that do not cause the foam to overheat or self-ignite.

Start lifting slabs by pumping grout or injecting foam into holes where slabs need to be raised the most. It is crucial to monitor slab lift closely when pumping grout or injecting foam to prevent raising slabs too fast or too much during slab jacking. Make certain to pump grout or inject foam in drill holes as often as necessary to support slabs and take precautions to avoid breaking or cracking concrete slabs. Slabs will be considered damaged if damage is due to slab jacking methods as determined by the Engineer based on crack patterns and locations.

If concrete slabs are damaged, submit a proposed remediation or repair plan for review. Ensure remediation submittals are designed, detailed and sealed by an engineer licensed in the state of North Carolina. Do not begin remediation or repair work until plans are approved. No extension of completion date or time will be allowed for repair of damaged slabs.

1. **Postprofile Survey**

A field survey is required after raising any concrete slab that required a preprofile survey. Record the new slab profile along the same survey lines and with the same methods that were used for the preprofile survey. For each survey line, plot the preprofile and postprofile survey data together on the same graph to show the improvement. Slab jacking acceptance is based in part on profile elevations ±1/4" of planned. Slabs with profile elevations more than 1/4" above planned may be considered damaged as determined by the Engineer. Take digital pictures of any new or enlarged cracks in slabs and mark their locations on slabs. Provide an electronic and/or hard copy of this survey and photographic information to the Engineer with the quantity of grout or foam used for each slab jacking location.

1. **Cleanup**

Remove all wooden plugs, tubing, access ports and any other objects from drill holes. Remove excess grout or foam from holes and fill holes with Type 3 grout. Collect and dispose of any debris, waste and excess grout or foam before leaving the site and opening lanes to traffic.

**Measurement and Payment**

*Slab Jacking* will be measured and paid in square feet. Slab jacking will be measured as the square feet of slabs or pavements raised including shoulders. When slab jacking does not extend to joints or slab edges, measurement will be made to 2 ft beyond the last line of drill holes.

The contract unit price for *Slab Jacking* will be full compensation for submittals, surveys, monitoring, labor, tools, equipment, cleanup, patching holes and any incidentals necessary to complete the work. The contract unit price for *Slab Jacking* will also be full compensation for grout or foam up to the estimated quantities listed below. Grout or foam in excess of these quantities will be paid as extra work in accordance with Article 104-7 of the *Standard Specifications*.

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| **ESTIMATED QUANTITIES** |
| Grout | \_\_\_\_\_\_\_ cy |
| Foam | \_\_\_\_\_\_\_ lb |

No payment will be made for excessive grout or foam loss through cracks and joints or from underneath shoulders. No payment will be made for remediation or repair of damaged slabs.

Payment will be made under:

|  |  |  |
| --- | --- | --- |
| **Pay Item** |  | **Pay Unit** |
| Slab Jacking at \_\_\_\_\_\_\_\_\_\_\_\_ | Square Foot |

**PE SEAL NAME**

**PE #**