



NJDOT HIGH FRICTION SURFACE TREATMENT SPECIFICATION

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NJDOT HIGH FRICTION SURFACE TREATMENT (HFST) SPECIFICATION

- DESCRIPTION
- MATERIALS & EQUIPMENT
- CONSTRUCTION
- MEASUREMENT & PAYMENT

- FOCUS ON HIGHLIGHTS
- LESSONS LEARNED



MATERIALS & EQUIPMENT



HFST MATERIALS

- HFST POLYMERIC BINDER RESIN (GLUE)
- HFST AGGREGATE (GRIT)



HFST POLYMERIC BINDER RESIN – Polymer modified binder resin system designed for HFST on NJ highways – THE GLUE!

Table 912.05-1 Physical Requirements of the Binder Resin System

Property	Test Method¹	Requirement
Ultimate Tensile Strength ⁵ (psi)	ASTM D 638	2,500 minimum
Elongation at break point ⁵	ASTM D 638	30% minimum
Compressive Strength ⁵ (psi)	ASTM C 579	1,000 psi at 3 hours 5,000 psi at 7 days
Water Absorption	ASTM D 570	1.0% maximum
Durometer Hardness ⁵ (shore D)	ASTM D2240	60 - 80
Viscosity ² (Poises)	ASTM D 2556	7 - 30
Gel Time ³ (minutes)	ASTM C 881	10 minimum
Cure Rate ⁴ (hours)	ASTM D 1640	3 maximum

1. Prepare all samples per manufacturer's recommendation
2. Viscosity – prepare one pint sample and mix for 2 to 3 minutes before testing. Use X1.1 for spindle selection and test at a temperature of $73 \pm 2^{\circ}\text{F}$.
3. Gel Time – Prepare a 60 g sample per manufacturer's recommendation. Perform testing at a temperature of $73 \pm 2^{\circ}\text{F}$.
4. Cure Rate – Prepare specimens of 50-55 wet mil thickness.
5. Cure the following test specimens for 7 days at $73 \pm 2^{\circ}\text{F}$, and test immediately without delay:
 - a. Durometer Hardness – Use the type 1 precision type D method.
 - b. Compressive Strength – Prepare specimen according to Method “B”, 2” x 2” cube, using 2.75 parts of sand to one part mix polymer resin by volume. Sand must conform to ASTM C778, 20-30 sand.
 - c. Ultimate Tensile Strength Prepare Type 1 specimens in accordance to ASTM D638.
 - d. Elongation at break point – Prepare Type 1 specimens in accordance to ASTM D638.

HFST AGGREGATE – Clean and dry fine aggregate of manufactured calcined bauxite – THE GRIT!

Table 912.05-2 Requirements for HFST Aggregate

Property	Test Method	Requirement
Polish Stone Value	AASHTO T 279	38.0 minimum
Resistance to Degradation ¹	AASHTO T 96	20.0% maximum
Moisture Content	AASHTO T 255	0.2% maximum
Aluminum Oxide ²	ASTM C 25	87% minimum

1. For Resistance to Aggregate Degradation test, use grading “D” in AASHTO T 96.
2. For Aluminum Oxide content use section 15 of ASTM C 25.

Table 912.05-3 Gradation Requirements for Fine Aggregate used for HFST

Sieve Size	Percent Passing
No. 4	100
No. 6	95 - 100
No. 16	0 - 5

EQUIPMENT

- PORTABLE SHOT BLAST EQUIPMENT
- TRUCK MOUNTED HFST APPLICATION EQUIPMENT

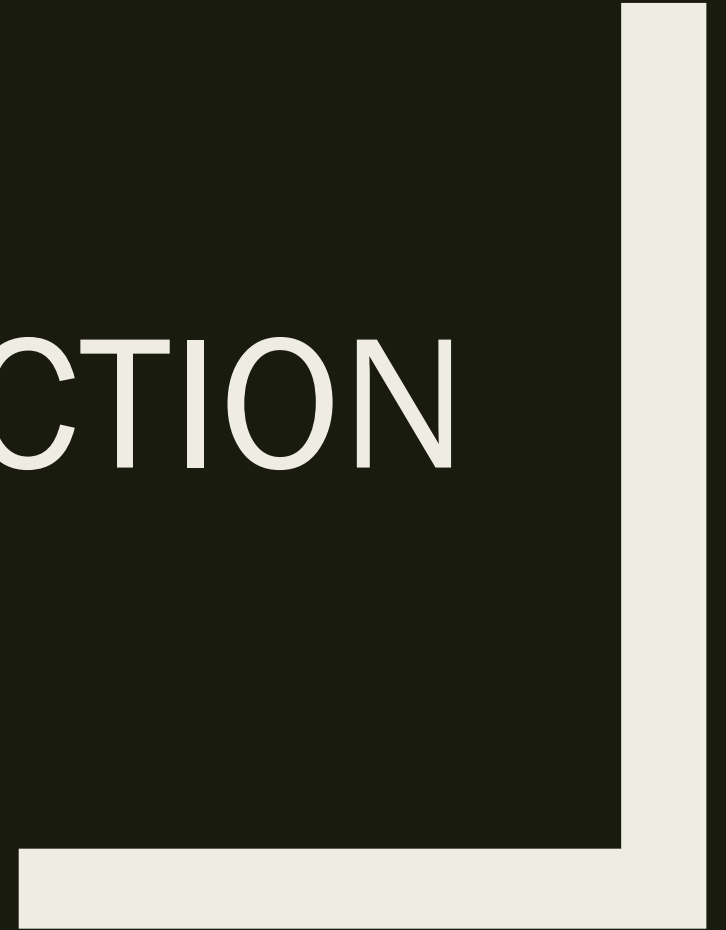
PORTABLE SHOT BLAST EQUIPMENT



TRUCK MOUNTED HFST APPLICATION EQUIPMENT VS. MANUAL APPLICATION



CONSTRUCTION



CONSTRUCTION

- WEATHER
- TEST STRIP
- SURFACE PREPARATION
- HFST APPLICATION
- SURFACE QUALITY REQUIREMENTS
- SKID RESISTANCE REQUIREMENTS
- MAINTENANCE BOND

WEATHER

- Minimum 55 °F and rising
- Surface is dry with no precipitation in the NWS forecast



TEST STRIP

- DO IT!!
- Make contractor prove they can provide HFST as specified by the contract
- If test strip fails, then contractor should provide a corrective action plan
- Avoid costly mistakes that could end up in claims or litigation
- Do as many test strips as necessary until HFST meets requirements

SURFACE PREPARATION

- Repairs complete and cured 30 days minimum
- Remove or protect traffic markings and striping
- Protect all inlets, RPM's, utilities
- Shot blasted for removal of deleterious material
- Clean surface
- RE approval of surface prior to HFST



HFST APPLICATION

- TEST STRIP completed and approved by RE. Tested under traffic.
- Equipment checks
- Material checks
- Apply binder resin (GLUE)
- Apply aggregate immediately after binder resin (GRIT)
- Curing and sweeping before opening to traffic



Surface Quality Skid Resistance

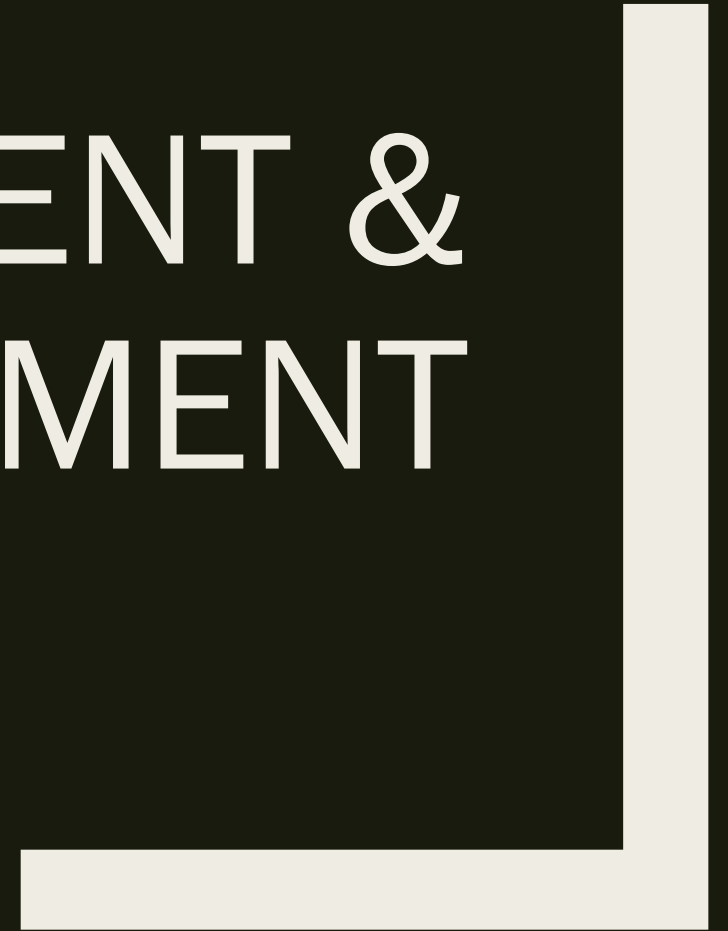
- RE performs visual inspection of HFST
- RE can reject HFST based on visual assessment
- If RE visually approves HFST, then NJDOT Pavement Management performs Skid Resistance Testing using ASTM Test Method E 274 for Initial Acceptance
 - *Average SN ≥ 65 for multiple tests*
 - *Minimum SN ≥ 60 for single test*



MAINTENANCE BOND

- Bond required for 100% of the value of HFST
- 3 years maintenance bond period
- NJDOT will monitor visual and skid resistance each year
- Remedial action required for deficient HFST
- If more than 30 % of original HFST requires remediation, then NJDOT may require full removal and replacement
- Conflict resolution (5 members) team will make final recommendations

MEASUREMENT & PAYMENT



MEASUREMENT & PAYMENT

- HIGH FRICTION SURFACE TREATMENT (SQUARE YARD)
- HIGH FRICTION SURFACE TREATMENT MAINTENANCE BOND (LUMP SUM)

LESSONS LEARNED



LESSONS LEARNED

- Be sure pavement condition is GOOD!
- Do not construct over microsurfacing, slurry seal or other thin treatments
- Not all products advertised as HFST meet NJDOT specification or AASHTO Provisional Specification (PP-79)
- We are currently in the pilot phase with HFST

Route 17 Southbound Approximate MP 19



Lane 1						
Pass 1		Pass 2		Pass 3		Average
MP	SN40	MP	SN40	MP	SN40	SN40
No Test	No Test	19.158	70.4	19.157	72.1	71.2
19.132	74.8	19.120	69.8	19.111	69.3	71.3
19.082	80.0	19.075	79.6	19.070	76.4	78.6
19.025	76.2	19.035	74.8	19.028	71.0	74.0
18.964	75.8	18.995	73.4	18.987	76.3	75.2

Lane 2						
Pass 1		Pass 2		Pass 3		Average
MP	SN40	MP	SN40	MP	SN40	SN40
19.157	69.7	19.157	74.9	19.157	74.5	73.0
19.117	70.2	19.113	75.6	19.117	73.6	73.1
19.076	68.1	19.069	70.4	19.077	71.0	69.8
19.035	68.7	19.026	68.7	19.037	69.6	69.0
18.994	66.3	18.988	67.7	18.999	71.6	68.5
18.955	64.3	18.950	58.4	18.960	67.5	63.4

Lane 3						
Pass 1		Pass 2		Pass 3		Average
MP	SN40	MP	SN40	MP	SN40	SN40
19.158	73.2	19.162	71.1	19.159	70.6	71.7
19.115	70.4	19.123	68.9	19.12	71.0	70.1
19.071	69.8	19.085	72.1	19.081	70.0	70.6
19.025	64.5	19.048	65.8	19.042	68.4	66.2
18.986	69.0	19.009	66.4	19.003	70.6	68.7
18.947	71.7	18.972	70.4	18.966	73.8	72.0

Route 130 Southbound MP 78.8 – 80.3

Rte	Dir	MP	SN40 Lane 2		
			Run #1	Run #2	Run #3
130	S	80.3	74	72.6	71.5
130	S	80.1	74.3	71	74.5
130	S	79.9	74.3	74.2	76.7
130	S	79.7	72.8	73.8	76.5
130	S	79.5	68.8	68.7	68
130	S	79.3	73.5	74.5	71.5
130	S	79.1	74.9	71.7	73.6
130	S	78.9	Note 1	71.8	68.6



Route 29 Southbound Ramp to Lalor Street



Route 29 Southbound to Lalor St. Ramp						
Pass 1		Pass 2		Pass 3		Average
MP	SN40	MP	SN40	MP	SN40	SN40
0.000	40.5	0.000	37.4	0.000	36.7	38.2
0.036	37.2	0.024	32.9	0.035	36.4	35.5
0.071	34.1	0.054	31.4	0.073	32.7	32.7
0.109	52.2	0.085	50.0	0.111	46.5	49.6
0.144	51.4	0.119	50.1	0.141	50.4	50.6
0.174	48.2	0.142	49.7	0.163	48.4	48.8
0.203	49.5	0.168	45.4	0.186	51.8	48.9
0.229	54.4	0.200	54.2	0.206	50.7	53.1

Route 80 Interchange Ramps @ Interchanges 12 & 53

- Currently in Construction
- To be completed soon (2017)

QUESTIONS

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- Thank you!

