Field Performance Evaluation of Pile Points

Glenn Roberts, P.E.
Chief of Research, NHDOT

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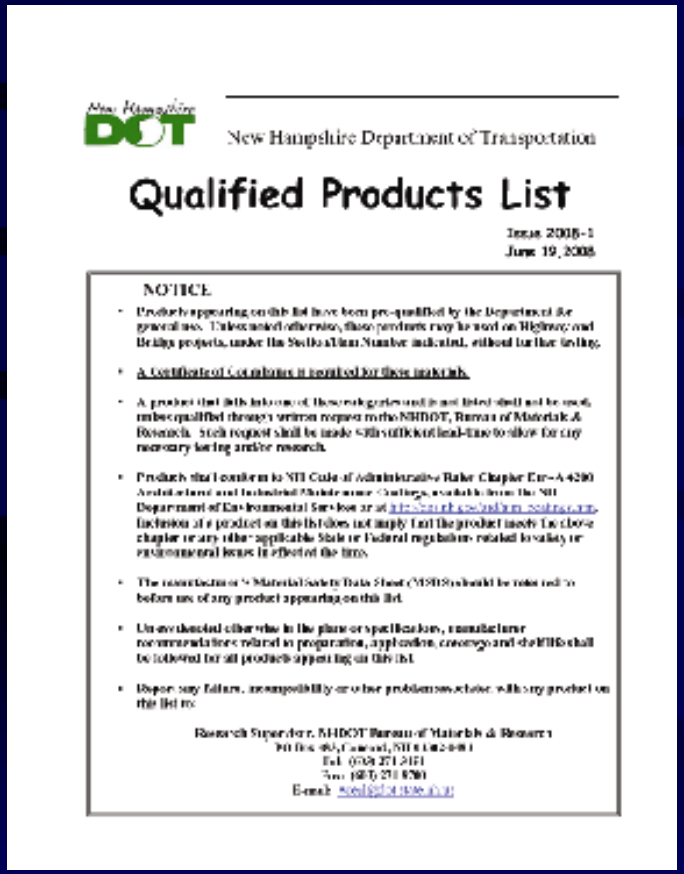
Overview

- New Hampshire DOT Qualified Products List (QPL)
- Qualification Criteria – Pile Points
- Field Evaluation
- Findings & Preliminary Conclusions

Qualified Products List (QPL)



New Hampshire Department of Transportation

Qualified Products List

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NOTICE

- Products appearing on this list have been pre-qualified by the Department for general use. Unless noted otherwise, these products may be used on Highway and Bridge projects, under the Section/Item Number indicated, without further testing.
- A Certificate of Compliance is required for these materials.
- A product that falls into one of these categories and is not listed shall not be used, unless qualified through a written request to the NHDOT, Bureau of Materials & Research. Such request shall be made with sufficient lead-time to allow for any necessary testing and/or research.
- Products that conform to NH Code of Administrative Rules Chapter Env-A 4200 Architectural and Industrial Maintenance Coatings, available from the NH Department of Environmental Services or at http://www.gencourt.state.nh.us. Inclusion of a product on this list does not imply that the product meets the above chapter or any other applicable State or Federal regulations related to safety or environmental issues in effect at the time.
- The manufacturer's Material Safety Data Sheet (MSDS) should be reviewed by [illegible] before use of any product appearing on this list.
- Unless noted otherwise in the plans or specifications, manufacturer recommendations related to preparation, application, coverage and shelf life shall be followed for all products appearing on this list.
- Report any failure, incompatibility or other problems associated with any product on this list to:

Research Supervisor, NHDOT Bureau of Materials & Research
PO Box 483, Concord, NH 03302-0483
Tel: (603) 271-3151
Fax: (603) 271-8700
E-mail: [illegible]

- 99 unique product categories
- Updated annually
- Qualification criteria varies:
  - In-house testing
  - NTPEP test results
  - Field trials
  - Other DOTs
  - Independent tests

QPL
Section 510 – Bearing Piles

A. ITEM 510.65 - DRIVING POINTS FOR STEEL BEARING PILES

Conforming to AASHTO M 103 (ASTM A27), Grade 65-35 or ASTM A148, Grade 90-60.

Manufacturer:	**Product:**
Assoc. Pile & Fitting Corp.	Hard-Bite HP 77600-B
Assoc. Pile & Fitting Corp.	Hard-Bite HP 77750-B
Assoc. Pile & Fitting Corp.	Hard-Bite HP 7780-B *
Assoc. Pile & Fitting Corp.	Pruyn Point HP 75750-B
Dougherty Foundation Prod., Inc.	Tuftip Tufloy H-777 *
Mid-America Foundation	Model HPH **
Piling Accessories, Inc.	Super-Bite PAR-T Series
Versabite Piling Accessories	Versa-Bite VB 300-P Series
Versa-Steel Inc.	Versa Steel VS-300N Series

* *Available only in Grade 90-60*

** *Available only in Grade 65-35*

Qualification Criteria – Pile Points

- Steel Grade
- Weight
- Configuration, including web and flange thickness
- But… No hard & fast limits.
  - New products compared to those on the list already.
  - Qualitative evaluation.

c. 2002

- NHDOT received a submittal for a pile point that was significantly lighter than those listed on QPL.
- Need for a more objective, consistent and transparent qualification criteria.
- Minimum weight/thickness requirements?
- Tighten steel grade requirements?

Preliminary Research

- Contacted State DOTs, product manufacturers
- Reviewed specifications
  - Most states specify by steel grade
  - No uniform criteria in place
- No relevant research found
- NHDOT decision to conduct field experiment

Field Experiment Design

- Existing construction project in area of known shallow bedrock – Rochester Spaulding Turnpike
- Selected points representing various combinations of weight, thickness & steel grade
  - Plan was to include the lightweight point that had been submitted; however, when the pile installation occurred the product was no longer being produced. No comparable alternative found.

Pile Point Properties (HP 12x53)

	Manufacturer	Model	Web (in.)	Flange (in.)	Avg. Wt.	Grade	Remarks
ABC	Dougherty Foundation Products	Tuftip Tufloy H-777	0.78125	0.75	22.2 lb	ASTM A148 90/60	Good condition
DEF	Versa-Steel, Inc.	VS 312N	1.0 (Avg.)	0.9 (Avg.)	23.5 lb	ASTM A148 90/60	Bean-size void, rod attached, pinholes, flange teeth missing
GHI	Associated Pile & Fitting Corp	Hard-Bite 77600 B	1.3125	1.0	31.4	ASTM A27 65/35	Good condition
JKL	Versa-Bite Piling Accessories, Inc.	Super Bite PAR-T	0.875	0.875	23.2	ASTM A27 65/35	Good condition
PQR	Control	No Pile Point					

Soil Conditions

- Excavated to pile cap elevation
- 16.5-17.5 ft thick - medium stiff to very soft, silty marine clay
- 2.5-7.5 ft thick - medium dense silty fine sand (stratified)
- Bedrock (at 14-19 ft depth)

Pile Points Installed

Piles Driven & Extracted 4/18/08

- Vibratory Hammer – set piles to bedrock
- Impact Hammer – drove to refusal (200 blows/no penetration vs. 10 blows typical)
  - Rated energy 42,000 ft-lbs (typ. medium size hammer)
  - Energy transferred to top of pile = 15,000 ft-lbs (OK)
- Pile Driving Analyzer used to measure hammer energy and pile stress
- Vibratory hammer extracted driven piles for inspection

Pile Driving Analyzer (PDA)

Impact Hammer

Extracting Piles

Pile Point Samples

Before and After

Sample ABC
Tuftip Tufloy H-777

Sample ABC
Tuftip Tufloy H-777

Sample ABC
Tuftip Tufloy H-777

Sample ABC
Tuftip Tufloy H-777

Sample A
Tuftip Tufloy H-777

Sample B
Tuftip Tufloy H-777

Sample C
Tuftip Tufloy H-777

Sample DEF
VS 312 N

Sample DEF
VS 312 N

Sample DEF
VS 312 N

Sample DEF
VS 312 N

Sample DEF
VS 312 N

Sample DEF
VS 312 N

Sample D
VS 312 N

Sample E
VS 312 N

Sample F
VS 312 N

Sample DEF
VS 312 N

Sample DEF
VS 312 N

Sample GHI
Hard-Bite 77600 B

Sample GHI
Hard-Bite 77600 B

Sample GHI
Hard-Bite 77600 B

Sample GHI
Hard-Bite 77600 B

Sample GHI
Hard-Bite 77600 B

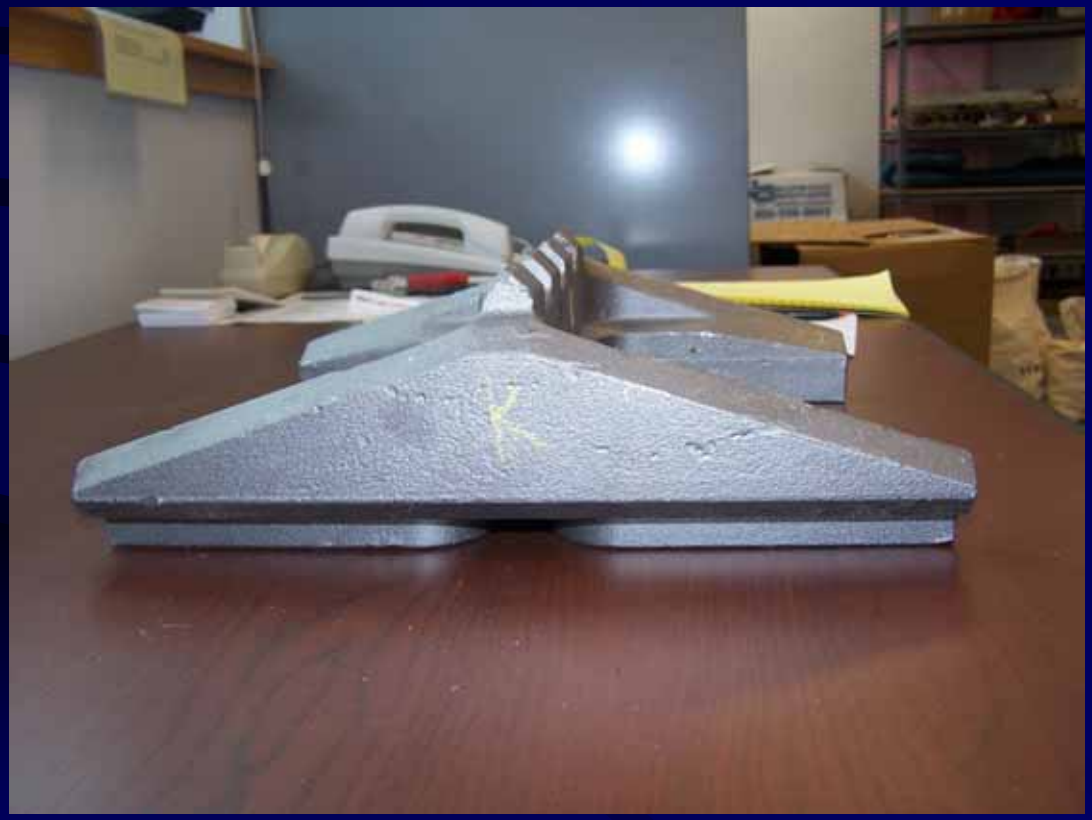
Sample G
Hard-Bite 77600 B

Sample H
Hard-Bite 77600 B

Sample I
Hard-Bite 77600 B

Sample JKL
Super Bite PAR-T

Sample JKL
Super Bite PAR-T



Sample JKL
Super Bite PAR-T

Sample JKL
Super Bite PAR-T

Sample JKL
Super Bite PAR-T

Sample J
Super Bite PAR-T

Sample K
Super Bite PAR-T

Sample L
Super Bite PAR-T

Control Piles (PQR)

Without pile points

Control Pile P

Web curled - Damage detected by PDA

Control Pile Q

Control Pile Q

Web bent but intact. Damage not detected by PDA

Control Pile R

Web bent but intact. Damage not detected by PDA

Findings & Preliminary Conclusions

- Pile points are necessary to minimize damage to end-bearing H-piles.
- The configuration (shape, taper, protrusions) of available pile point models vary significantly and make quantitative comparisons based on dimensional attributes difficult.
- There was no observed correlation between dimensional attributes (i.e. web & flange thickness, thickness ratios, Missouri DOT thickness factor, etc.) and performance of the pile point. Each of the points tested met the Missouri criteria. It is reasonable to require a minimum thickness relative to the H-pile dimensions.

Findings & Preliminary Conclusions (cont'd)

- There was no observed correlation between steel grade and performance of the pile point.
- There was no observed correlation between weight and performance of the pile point. However, it is reasonable to require a minimum weight (e.g. 22#) commensurate with the points evaluated during this field test.
- The lack of prominent protrusions on pile point sample F may have contributed to wander and potential bucking of the pile.
- The PDA was successful in detecting web damage in piles but less successful in detecting flange damage only

Questions?