

NTPEP PROJECT WORK PLAN FOR FIELD AND LABORATORY EVALUATION OF HOT MIX ASPHALT CRACK SEALING MATERIALS

PURPOSE

The purpose of this work plan is to define the laboratory and field procedures used to evaluate crack sealing materials in rout and seal and clean and seal applications. The current evaluation procedures are for hot poured crack sealants. Additional types of crack sealant materials may be included in this evaluation process at a later date.

The laboratory procedures consist primarily of ASTM test procedures and the field evaluation procedures are based on procedures detailed in the Strategic Highway Research Program (SHRP): Materials and Procedures for Sealing and Filling Cracks in Asphalt-Surfaced Pavements- Manual of Practice.

The evaluation procedures are divided into the following sections:

- a) Laboratory Evaluation Procedures
 - Standard Laboratory Conditions
 - Hot Poured Sealants

- b) Field Evaluation Procedures
 - Site Selection and Required Quantities
 - Sealer Installation
 - Evaluation
 - Water Infiltration
 - Debris Retention
 - Spall
 - Tracking
 - Crack Movement
 - Photolog

- c) Reporting of Results

REFERENCED DOCUMENTS

AASHTO T316-04: Viscosity Determination of Asphalt Binder Using Rotational Viscometer

ASTM D36 Test Method for Softening Point of Bitumen (Ring and Ball Apparatus)

ASTM D5167-03: Standard Practice for Melting of Hot-Applied Joint and Crack Sealant and Filler for Evaluation

ASTM D5329-04: Standard Test Methods for Sealants and Fillers, Hot Applied, for Joints and Cracks in Asphaltic and Portland Cement Concrete Pavements
ASTM D1985-03: Standard Practice for

Preparing Concrete Blocks for Testing Sealants, for Joints and Cracks

ASTM D 6690-06a: Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements

ASTM E-171-94: Standard Specification for Standard Atmospheres for Conditioning and Testing Flexible Barrier Materials

FHWA-RD-99-147: Materials and Procedures for Sealing and Filling Cracks in Asphalt-Surfaced Pavements- Manual of Practice

LABORATORY EVALUATION PROCEDURES

STANDARD LABORATORY CONDITIONS

Standard laboratory conditions are defined as a temperature of $23 \pm 2^{\circ}\text{C}$ ($73.4^{\circ} \pm 3.6^{\circ}\text{F}$) and a relative humidity of $50 \pm 5\%$.

HOT POUR SEALANTS

The manufacturer shall supply two 11.4 kg (25 pound) blocks of sealant material from the same lot or batch of material used for the field evaluation. One of the 11.4 kg (25 pound) blocks will be used to conduct the laboratory evaluation and the second 11.4 kg (25 pound) block of material will be retained for 1 month after the manufacturer has been notified of the laboratory evaluation results for potential verification testing. No product name changes are allowed during the course of the evaluation. The laboratory evaluation will consist of testing two samples using the following procedures. The laboratory results that are reported will be the average of the individual tests at each heating condition. The report forms for the hot pour sealants are provided in Table 1 of the Report section.

1. Sample Preparation

The crack sealant samples shall be prepared in accordance with ASTM D 5167-03 using a sample size of approximately 2,200 grams (4.9 pounds). If the capacity of the sealant melter will not accommodate a 2,200 g sample, the sample will be split into two 1,100-gram samples and will be melted on both sides of the melter at the same time. The test specimens will be prepared by heating sealant to the manufacturer's maximum heating temperature after which the initial set of test specimens for bond to concrete, softening point, resilience, asphalt compatibility, fingerprinting and penetration will be prepared. The sealant material remaining in the melter will be kept at the manufacturer's maximum heating temperature for 6 hours ± 15 minutes, after which a second set of test specimens for bond to concrete, softening point, resilience, asphalt compatibility, fingerprinting and penetration will be prepared.

2. Sealant Laboratory Testing

The sealant shall be evaluated in accordance with ASTM D 6690-06a and the methods described in the following paragraphs.

A. Bond to Concrete

Three non-immersed bond specimens will be prepared and tested in accordance with ASTM D5329-04, Section 9 and ASTM D 6690-06a Table 1. The blocks will be prepared in accordance with ASTM D 1985. Only Type III sealant as defined by D6690-06a shall be tested for water –immersed bond. Three additional bond specimens will be conditioned and tested per ASTM 6690-06a Section 7.5 for the water-immersed bond testing. The result of each extension cycle for each specimen will be reported as the amount of adhesion and/or cohesion failure in square centimeters (square inches).

B. Resilience - The resilience specimens will be prepared and in accordance with ASTM D5329-04, Section 12 and tested at 25°C (77°F). The resilience results will be reported as the percent recovery.

C. Cone Penetration - Two penetration specimens will be prepared in accordance with ASTM D5329-04, Section 6. One penetration specimen will be tested in accordance with ASTM D5329-04, Section 6. The second specimen will be tested in accordance with ASTM D5329-04, Section 6 with the following exceptions; the specimen will be allowed to cool to standard laboratory conditions for 17 ± 2 hours, the specimen will then be placed in a freezer at $-18^{\circ}\text{C} \pm 1^{\circ}\text{C}$ ($0^{\circ}\text{F} \pm 2^{\circ}\text{F}$) for 4 hours ± 15 minutes prior to testing. One hour before testing, the penetrometer cone attachment will also be placed in the freezer at $-18^{\circ}\text{C} \pm 1^{\circ}\text{C}$ ($0^{\circ}\text{F} \pm 2^{\circ}\text{F}$). At the end of the 4-hour specimen-conditioning period, remove the test specimen and cone from the freezer, place the cone in the penetrometer and immediately conduct the test. After making the measurement, clean the cone attachment and place the specimen and cone back in the freezer for 10 ± 2 minutes before making two successive measurements for a total of three measurements. The penetration results will be averaged and the average value reported.

D. Asphalt Compatibility- The HMA and crack sealer specimens shall be prepared in accordance with ASTM 5329-04 Section 14.

E. Rotational Viscosity- Crack sealer specimens shall be prepared in accordance with AASHTO T-316-04. The viscosity shall be measured at the manufacturer's maximum heating temperature and reading shall be taken at 30 seconds and at 60RPM.

F. Fingerprinting- Infrared Spectra shall be obtained from a representative sample using an Attenuated Total Reflectance (ATR) attachment.

FIELD EVALUATION PROCEDURES

SITE SELECTION AND QUANTITIES

The member department will select a field evaluation site consisting of at least 500 feet of pavement for each sealant material evaluated. All transverse and longitudinal sealed cracks or joints will be evaluated. The application may be rout and seal or clean and seal. Site selection criteria should include pavement age, roadway history and crack spacing. Efforts will be made to host test sites in various climatic regions of the United States.

SEALANT INSTALLATION

The manufacturer will supply all materials for the evaluation of their product. The manufacturer and the test state will mutually agree upon the equipment and labor required to prepare the cracks and install the crack sealant material. The manufacturers will either supply all labor and equipment required or the test state will provide a single contractor for all manufacturers at the manufacturers' expense. Traffic control, installation scheduling, and installation location will be provided by the test state. The manufacturer should have a technical representative present at the installation of the sealant to certify that the material is installed in accordance with their recommended procedures. If the representative believes that the installation is not in accordance with the recommended procedures, they will inform the designated representative of the member department of this fact in writing within one week of the installation of the material. If this occurs, the member department may eliminate that manufacturer's installation from further evaluation without a refund of fees. If no letter is received within this first week, the installation will be accepted and included in the field evaluation.

Before installation, GPS or Reference Point stationing of test sections shall be documented. For ease of conducting the field installation, the 500' test section may be separated into smaller subsections. A pavement condition survey and detailed sketching of the cracks including crack spacing shall be done. Three transverse cracks and three longitudinal cracks will be pinned with PK nails on each side of the cracks. These pins shall be used to monitor crack movement during the course of the evaluation.

During the installation, a drawing will be prepared to show the location of each sealant, provide the slope of the pavement, the crack spacing and the crack width. The average daily traffic and the closest Strategic Highway Research Program (SHRP) weather data station will also be reported. The manufacturer will supply with the application for evaluation the recommended shape factor if routing is done and performance characteristics such as the amount of crack movement the sealant is capable of withstanding or the sealant working range, the maximum and minimum crack width for satisfactory performance of the sealant, the recommended crack preparation and sealant installation procedures, and when the area can be reopened to traffic. These conditions will apply if they do not conflict with the agency's construction practices.

The crack preparation and sealant installation techniques used during the installation will be

recorded. Any deviation from the manufacturer's recommendations will be noted. Additionally, the manufacturer's representative will be allowed to provide comments on the crack preparation and sealant installation. If the manufacturer's representative does provide such comments, they will be included with the installation report. The weather conditions during the installation will also be recorded.

FIELD EVALUATION OBSERVATIONS

Water Infiltration

Water infiltration will be measured as the percentage of the overall crack length where water can bypass the sealant and enter the crack either through complete adhesion or cohesion failure. Adhesion and cohesion failures will be determined through the visual inspection method. All cracks in the driving lane shall be inspected to determine the percent allowing water infiltration. Any visual cracks, splits or openings in the sealant or between the sealant and asphalt shall be examined to determine the depth of the opening. Instruments such as a dull knife or a thin blade spatula may be used to assist in the evaluation.

The percentage of cracks that allow water infiltration will be determined by the equation:

$$\%L = (L_f / L_{tot}) * 100$$

where:

- $\%L$ = Percent length of the crack allowing water infiltration
- L_f = Total length of the crack sealant field evaluation section allowing the Infiltration of water (inches)
- L_{tot} = Total length of the crack sealant field evaluation section (inches)

Debris or Stone Retention

Stone or debris retention will be rated as follows:

No Debris Retention: No stones or debris are stuck to the top of the sealant or embedded on the surface of the sealant/ HMA interface.

Low Severity: Occasional stones and/or debris are stuck to the top of the sealant, or debris embedded on the surface of the sealant/HMA interface.

Medium Severity: Stones or debris are stuck to the sealant and some debris is deeply embedded in the sealant or material embedded between the sealant and the crack face but not entering the crack below the sealant.

High Severity: A large amount of stones and debris are stuck to and deeply embedded in the sealant or filling the crack, or a considerable amount of debris is embedded between the

sealant and the crack face and entering the crack below the sealant.

Spalling

Spalling is the length of any cracking, breaking, chipping or fraying of crack edges. The length and severity of spalling shall be measured along each crack.

Crack Movement

Longitudinal and transverse crack movements shall be measured by installing pins or PK nails on both sides of three transverse and longitudinal cracks. A drill should be used to make a pilot hole for the installation of the pins. Pins shall be placed far enough away from the cracks so as not to cause further deterioration in the pin installation process. At each evaluation, crack movement shall be measured as the distance between the pins measured by a caliper minus the spacing between the pins at installation.

Photo Log

Photographs of the cracks shall be taken and included in the report.

Tracking

Tracking of sealant by traffic will be measured for information only. The distance of tracking and photographs will be used to determine levels of severity for future field evaluations.

Additional information such as the pavement condition, environmental conditions, and traffic conditions will also be recorded. Specific items that are to be recorded are provided in Table 2 in the Report section.

REPORTING OF THE RESULTS

The results of the sealant evaluations will consist of the appropriate laboratory evaluation form and the field evaluation form.

Table 1. Hot Pour Sealant Laboratory Evaluation.

Joint Sealant Test	Test Cycle	Results from Initial Heating	Results from 2nd Heating
Bond To Concrete, -29°C (-20°F), 3 cycles, 200% Extension, non-immersed	1		
	2		
	3		
Bond To Concrete, -29°C (-20°F), 3 cycles, 50% Extension, non-immersed	1		
	2		
	3		
Bond To Concrete, -29°C (-20°F), 3 cycles, 50% Extension, water-immersed	1		
	2		
	3		
Bond To Concrete, -18°C (0°F), 5 cycles, 50% Extension, non-immersed	1		
	2		
	3		
	4		
	5		
Softening Point, °C (°F)			
Resilience, % Recovery			
Penetration @ 25°C (77°F)			
Penetration @ -18°C (0°F)			
Asphalt Compatibility			
Rotational Viscosity , Pa.S			

Table 2: Field Evaluation Form

Test Section ID	NTPEP #	Company	Product Trade Name	Crack Preparation/ Rout Configuration
Installation Date	Technical Contact	Product Lot #	Contractor	Equipment

Application Conditions

Comments

Transverse Crack Sealant Failure				Spalling (inch)	Tracking (inch)
Date of Test	% Adhesion Failure	% Cohesion Failure	Total Seal Failure		

Longitudinal Crack Seal Failure				Debris Retention (Severity)	Crack Movement (inches)
Date of Test	% Adhesion Failure	% Cohesion Failure	Total Seal Failure		

Quality Assurance

The Mn/DOT Lab is AASHTO Accredited and participates in ASTM and DOT-sponsored Round Robin Testing Programs. Ratings between two raters for the field evaluation are measured and have a standard deviation of 2.5 % Adhesion Failure based on the average Adhesion Failure of 22.8%.

Table 3: Crack Sealant Field Evaluation Worksheet - 0-100' Test Sub-Section

NTPEP #: _____

Test Section: _____

Crack ID: _____

Longitudinal ID-L

Transverse ID-T

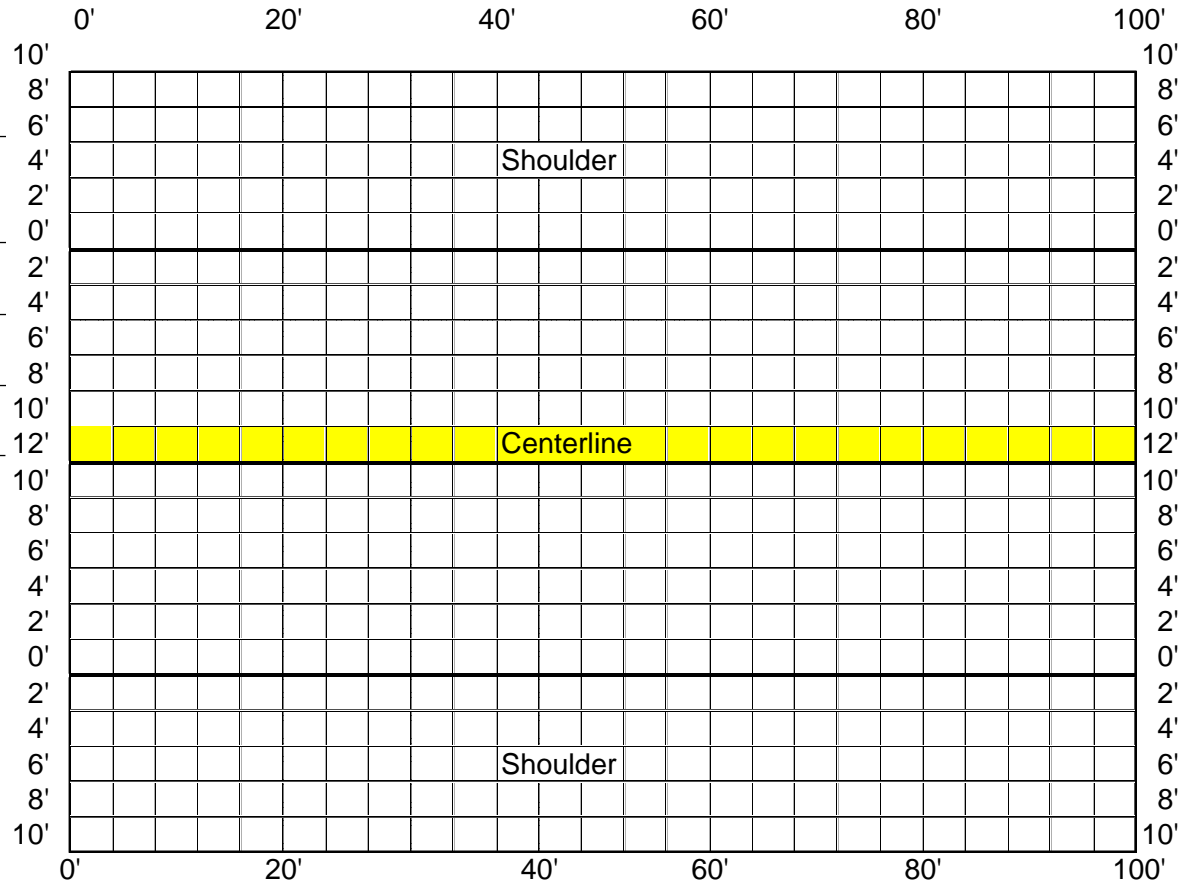
Location: _____

Ref. Point: _____

Date: _____

Evaluator: _____

Notes:



Comments: _____

Table 4: Crack Sealant Field Evaluation Worksheet - 100'-200' Test Sub-Section

Revised 10/08

NTPEP #: _____

Test Section: _____

Crack ID: _____

Longitudinal ID-L

Transverse ID-T

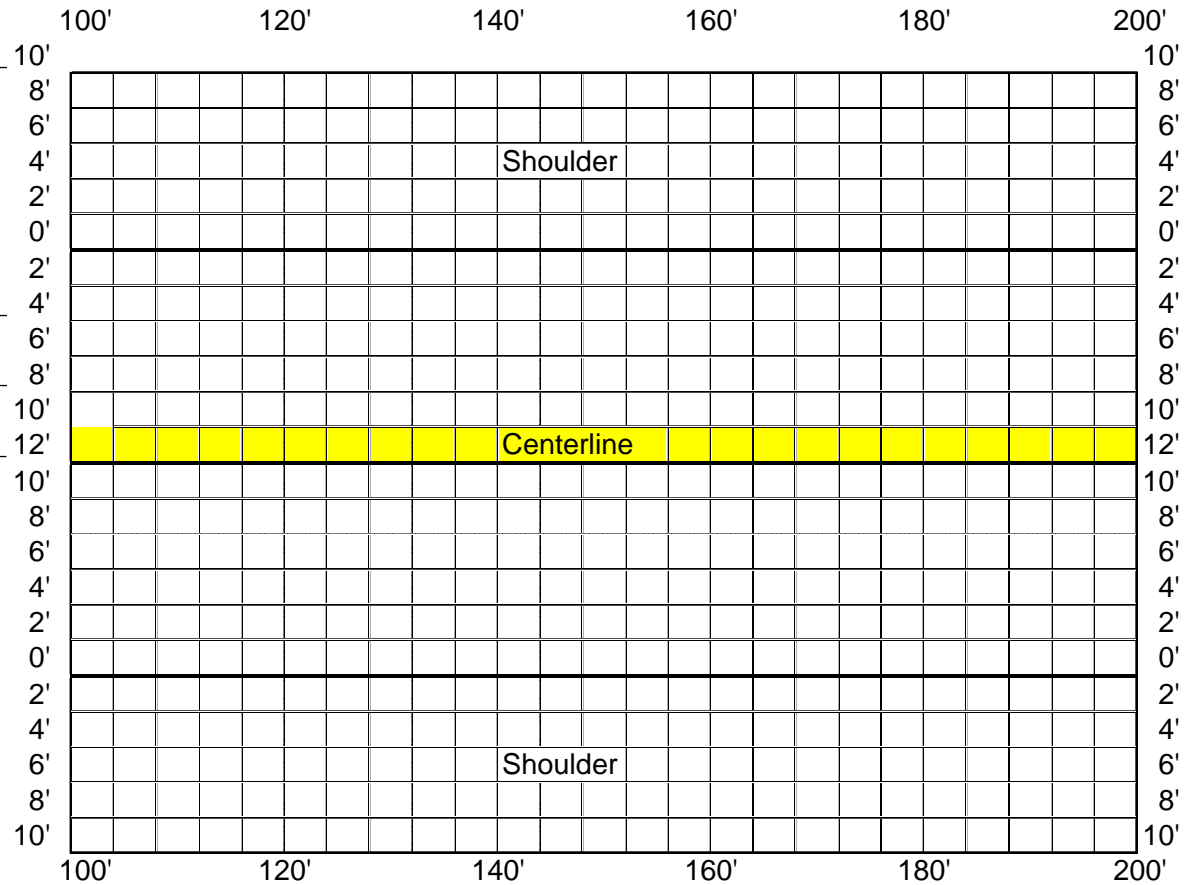
Location: _____

Ref. Point: _____

Date: _____

Evaluator: _____

Notes:



Comments: _____

Table 5: Crack Sealant Field Evaluation Worksheet - 200'-300' Test Sub-Section

NTPEP #: _____

Test Section: _____

Crack ID: _____

Longitudinal ID-L

Transverse ID-T

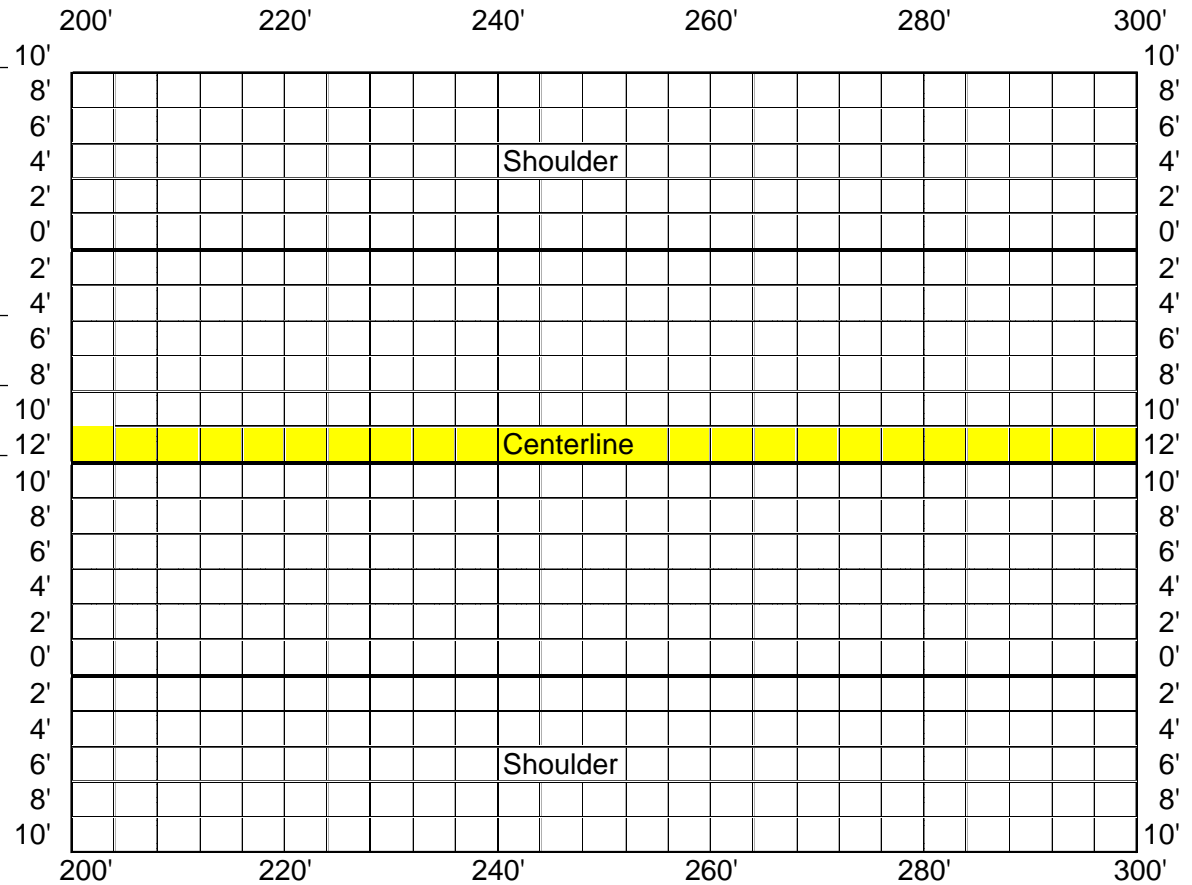
Location: _____

Ref. Point: _____

Date: _____

Evaluator: _____

Notes:



Comments: _____

Table 6: Crack Sealant Field Evaluation Worksheet - 300'-400' Test Sub-Section

NTPEP #: _____

Test Section: _____

Crack ID: _____

Longitudinal ID-L

Transverse ID-T

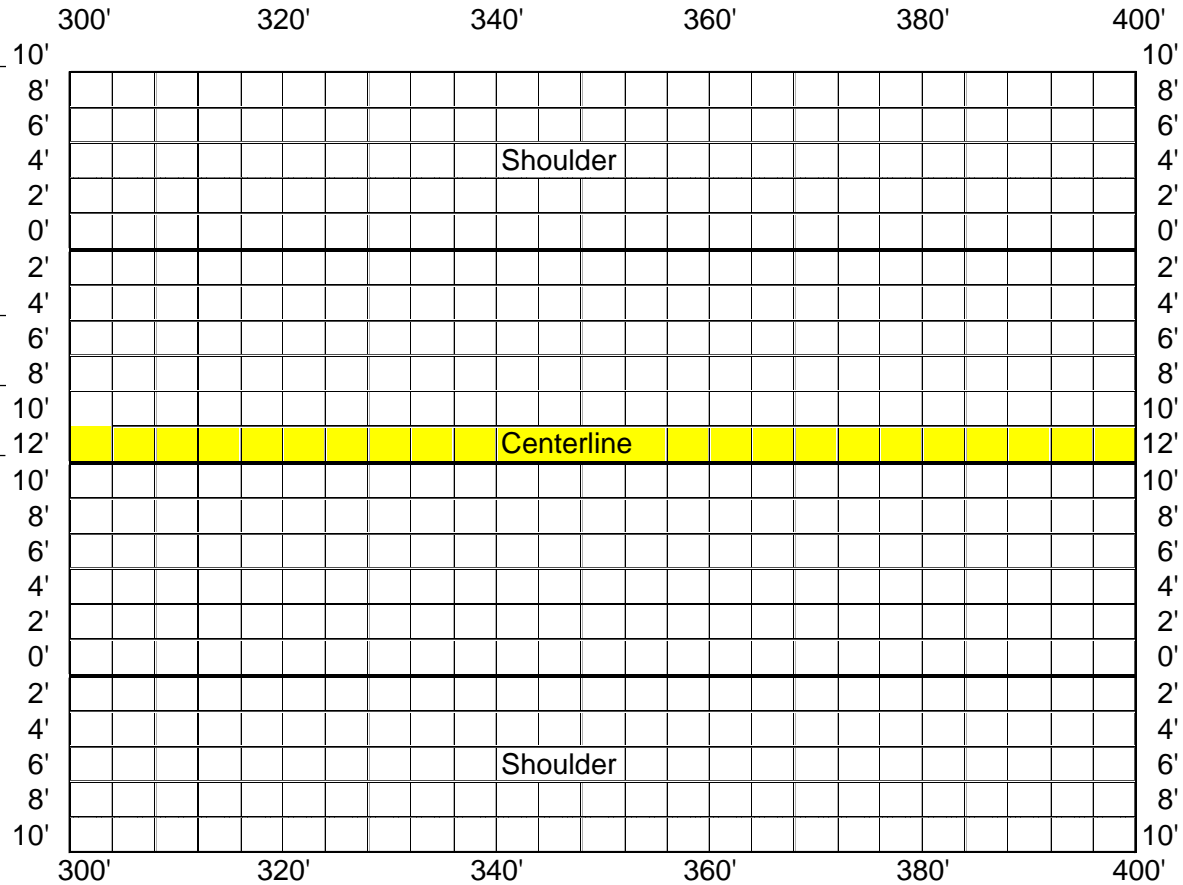
Location: _____

Ref. Point: _____

Date: _____

Evaluator: _____

Notes:



Comments: _____

Table 7: Crack Sealant Field Evaluation Worksheet - 400'-500' Test Sub-Section

NTPEP #: _____

Test Section: _____

Crack ID: _____

Longitudinal ID-L

Transverse ID-T

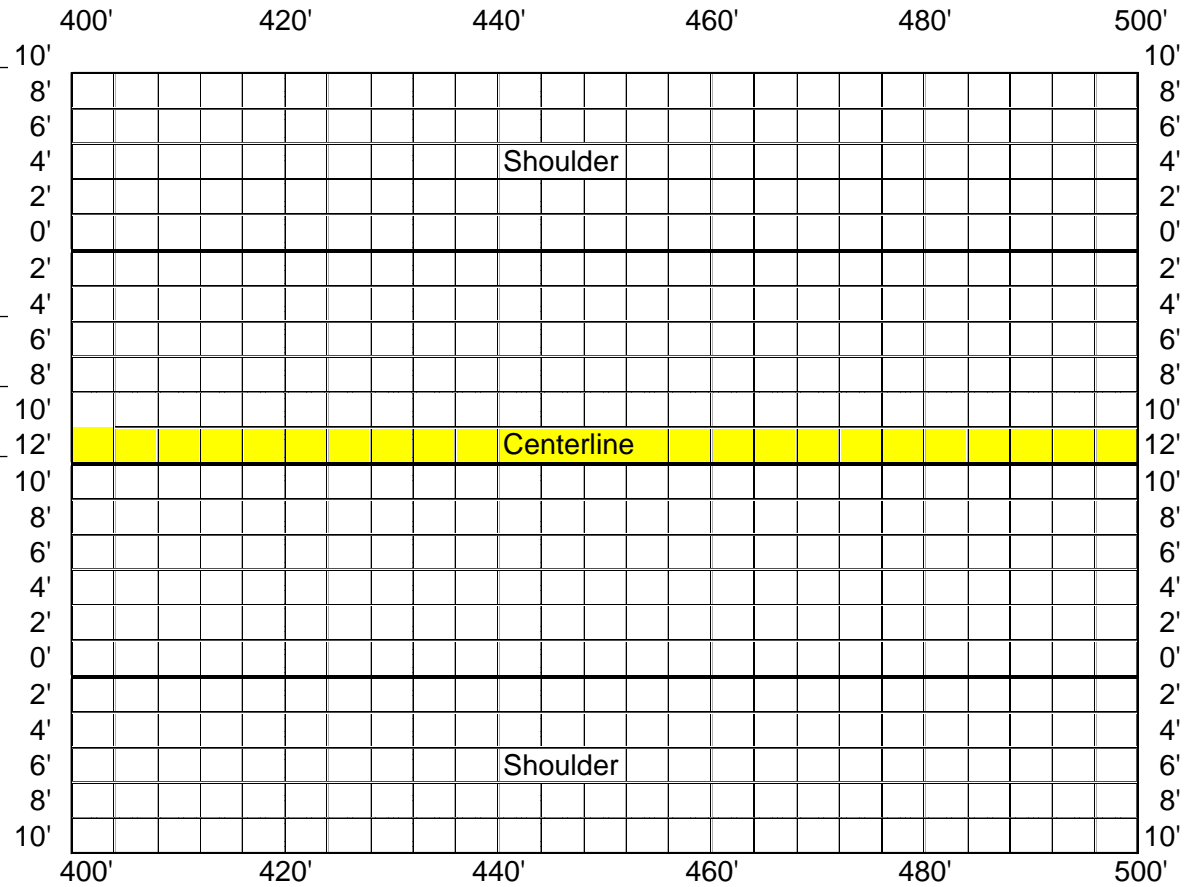
Location: _____

Ref. Point: _____

Date: _____

Evaluator: _____

Notes:



Comments: _____