Chapter 2: Evaluation of Existing Pavements

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CHAPTER 2
EVALUATION OF EXISTING PAVEMENTS

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Chapter 2 - Appendix

Appendix 2A - Pavement Rehabilitation Manual: Volume 1 - Pavement Evaluation

6/30/00
EVALUATION OF EXISTING PAVEMENTS

2-1

2.1 INTRODUCTION

The appropriate time to perform a pavement evaluation is when a project is initiated. The advantage of having the information at this time is:

1. Alternate rehabilitation treatments can be evaluated to analyze estimated cost versus the length of expected service.

2. Adequate funds can be programmed for the project.

Candidate projects for rehabilitation are usually identified either by the Transportation Maintenance Resident Engineer or by a network condition survey rating. The actual condition of the pavements may range from pavements that are in poor condition and require significant work to pavements that are in good condition and need only preventive maintenance.

Many different maintenance or repair techniques can be applied to pavements to extend their service lives. Use of these techniques is often a cost-effective strategy (in the framework of life-cycle cost), and delays the placement of a costly overlay, recycling, or even reconstruction, for several years.

When evaluating the feasibility and effectiveness of applying maintenance or rehabilitation methods, the three main factors, which are discussed in this chapter should be considered: (1) surface distress condition, (2) structural condition, and (3) functional condition of the existing pavement. The current NYSDOT pavement evaluation process as discussed in this chapter consists of surface distress condition for every project, and limited structural condition depending on the project site. The evaluation report is included in the Pavement Evaluation and Treatment Selection Report (PETS) as discussed in Section 3.4 of Chapter 3.

This chapter also describes additional special distress, structural, and functional condition surveys that are not required by the PETS but are included here for informational purposes only.

2.2 PAVEMENT CONDITION SURVEYS REQUIRED BY THE PETS

Pavement condition surveys required by the PETS include the following:

- Distress condition survey.
- Transportation Maintenance Engineers Information.
- Field investigations, if required.
- Condition report.
The uniform procedures for evaluating the condition of pavements is outlined in the Pavement Rehabilitation Manual, Volume 1, *Pavement Evaluation*. This manual is included in this chapter as Appendix 2A. The procedure includes the following steps:

1. Acquire project information from records which provide history, features, and related data on the pavement.
2. Perform a field distress survey on the pavement and shoulders if required by Section 3.3 of Chapter 3.
3. Obtain information from the Transportation Maintenance Resident Engineer on the pavement, shoulder, foundation, and drainage performance.
4. Perform a field investigation of the pavement, shoulders, foundation, and drainage as necessary.

The project information shall be collected using a standard format developed for the pavement evaluation procedure. This information will identify the proposed project, provide the history of the performance, list roadway features, and provide related pavement data. The information should be available from records in the Region Office. The information shall be collected before making the field survey and should be checked during the field survey. The form for collecting project information is included in Appendix A to the Pavement Rehabilitation Manual, Volume 1, *Pavement Evaluation*. This manual is included as Appendix 2A in this chapter.

### 2.2.1 Pavement Distress Condition Survey

When a pavement evaluation is conducted, the following information needs to be collected if the engineer is to make knowledgeable decisions regarding rehabilitation needs and strategies:

1. **Distress Type** - Identify each type of distress. The distress types should be placed in categories.
2. **Distress Severity** - Note the level of severity for each distress type present to assess degree of deterioration.
3. **Distress Amount** - Note the relative area (percentage of the project) affected by each combination of distress type and severity.

A technically sound engineering condition survey must address each one of these needs. To meet these needs, NYSDOT developed a pavement evaluation manual for use in performing pavement
distress surveys. The Pavement Rehabilitation Manual, Volume 1, *Pavement Evaluation* (Appendix 2A of this chapter), contains uniform procedures for evaluating the condition of pavements and shoulders and includes standard forms developed for collecting project information and pavement and shoulder distress data. This manual should be used to evaluate pavement condition prior to any pavement design activities being performed.

As part of the procedure for evaluating the condition of pavements, a field distress survey is completed on the pavement and shoulders. Section 3.3 of this manual discusses the type of project that requires a pavement distress survey.

The field survey should be completed by a team of two people; one to drive and collect data, the other to collect and record data.

The field survey shall be performed when the entire pavement and shoulder surfaces are visible. If the survey is performed when frost is in the ground, this condition should be noted, since the frost can magnify the distress.

The location of the information collected from the pavement in the field survey shall be identified by the reference marker system. If reference markers do not exist, other readily discernable permanent features such as structures, crossroads, interchanges, etc., should be used to identify locations.

For further detail on the distress data collection procedure, refer to Appendix 2A of this chapter.

### 2.2.2 Transportation Maintenance Engineers Information

The Transportation Maintenance Resident Engineer shall be consulted to obtain information concerning the influence of the seasons, which may not be apparent at the time of the pavement evaluation survey. The consultation should include the level of maintenance required on the pavement and shoulders, and locations (identified by reference markers) of drainage problems, frost heaves, settlements, or other foundation problems. The information should be documented and become part of the PETSR.

### 2.2.3 Field Investigations

At times in-depth field investigations will be warranted to determine the cause of some types of distress. These would usually include coring the pavement and/or shoulders, or investigating foundation or drainage problems. The Regional Materials Engineer (RME) is available for investigating pavement problems and the Regional Geotechnical Engineer (RGE) is available for investigating the shoulders, roadway foundation, drainage, and suitability of pavement rubblizing. The information and data (in summary form) and conclusions obtained from the investigation shall be part of the PETSR.
Full-depth pavement cores provide information on the condition and makeup of underlying pavement layers. Usually only a few cores are necessary to provide the information to make a treatment decision. If conditions are uniform, coring in a typical area will be representative of the entire project. Where conditions are extremely diverse, a core in each area is desirable. Cores may have an impact on the repair method chosen.

2.2.4 Condition Report

The information obtained from the pavement survey, consultation with the Transportation Maintenance Resident Engineer and any field investigation shall be condensed into the PETSR. The report shall state the severity and extent of each type of distress appearing in the pavement, shoulders, and foundation. Drainage deficiencies should also be included. This report will become part of the PETSR (if required) and summarized in the Design Approval Document (DAD).

2.3 PAVEMENT CONDITION SURVEYS NOT REQUIRED BY THE PETSR

*These are special tests and are not required as part of Pavement Evaluation and Treatment Selection Report (PETSR). These tests are performed only by request and as determined by the Regional Materials Engineer or Regional Geotechnical Engineer.*

2.3.1 Automated Distress Survey

In recent years, tremendous advances have been made in the development of automated equipment that can be used to collect, store, and process distress data. This equipment is capable of measuring most pavement distress types at higher speeds. Other advantages of automated distress survey equipment include:

1. More consistent measurements.
2. Increase in safety.
3. No disruption to traffic flow.
4. Predictable productivity.
5. Highly objective output.
6. Increase in sample size.

As a part of the pavement performance monitoring program, NYSDOT uses outside qualified vendors to perform automated distress surveys on about 50 test sites every two years.
The majority of this automated information is collected on segments of the National Highway System (NHS) within NYS and is used currently to evaluate performance of different pavement treatment types as a part of the pavement performance monitoring program. This type of distress survey is not used to evaluate pavement condition on individual projects but on a network level.

2.3.2 **Structural Condition Using Nondestructive Deflection Survey**

The structural capacity refers to a pavement’s ability to support current or future traffic loadings and is measured by the pavement structural condition evaluation. Knowledge of the pavement structural condition provides valuable information in the selection and design of feasible alternatives to rehabilitate that pavement.

To determine the structural capacity of a pavement, a structural condition evaluation must be performed. This evaluation can be performed using a nondestructive (NDT) deflection testing and analysis.

Deflection-based NDT devices produce deflections on the pavement surface under dynamic loadings. These deflections are measured by a set of sensors located at specific distances from the load center. NYSDOT currently uses a Falling Weight Deflectometer (FWD) to perform deflection testing for pavement structural evaluation. FWD testing is used in conjunction with the pavement distress survey, materials sampling, and layer thickness information, to determine the pavement layer moduli, and other parameters of both rigid and flexible pavements.

FWD testing in NYSDOT is currently limited to the following activities:

- Deflection survey of 50 statewide sites as a part of pavement performance monitoring program.
- Deflection survey of 48 statewide sites as part of a SUPERPAVE performance monitoring program.
- Determination of load transfer efficiencies at joints and cracks of PCC pavements.
- Determination of the appropriateness and effectiveness of cracking and seating, and rubblizing operations.

The Pavement Design Services Group of Geotechnical Engineering Bureau maintains and operates the FWD. This type of deflection survey is not used to evaluate pavement structural condition on individual projects.

2.3.3 **Roughness Survey**

Roughness survey is an important part of the pavement construction acceptance process.
Roughness is a measure of a pavement’s functional performance, that is, how well the pavement is providing a smooth, safe ride to the traveling public. Roughness can develop from surface irregularities that are built into a pavement during construction, and surface irregularities that develop after construction (due to traffic loading, climatic effects, and other factors). The primary purpose of performing roughness surveys for a given project is to obtain a roughness profile so that locations of severe roughness can be identified.

The standard unit for roughness measurement is the Profile Index (PI). The PI is a numeric scale that ranges from 0 to 200 mm/km (0 to 13 in/mi), with larger values indicating greater roughness. These roughness surveys are performed using profilographs by the contractor as part of construction QC/QA program. This type of survey is not used to evaluate pavement condition on individual projects.

2.3.4 Pavement Friction

Pavement friction is a measure of the forces at the tire-pavement interface that resist the sliding of a braking tire and also allow a rolling tire to make directional changes to the vehicle. Sufficient pavement friction normally exists on dry pavements for all reasonable vehicle maneuvers (Note: dry pavements contaminated with petroleum products, organic residue, or covered with hard particles such as fine gravel may not provide adequate friction in some instances). During heavy rain, or when a condition of heavy runoff or ponding occurs on the pavement, vehicles can travel at sufficient speed to ride up on the film of water, resulting in the tire losing contact with the pavement surface, causing a loss of steering control and severely diminished braking action. This condition is called hydroplaning.

Pavement friction is influenced by three factors: microtexture, macrotexture, and cross slope.

- Microtexture is the surface “roughness” of the individual coarse aggregate particles in the case of flexible pavements, or the surface roughness of the hardened concrete paste in the case of rigid pavements. It contributes to the total frictional force through the molecular adhesion that is developed when the pavement contacts a vehicle’s tires.

- Macrotecture refers to the coarse texture of the pavement which is controlled by the coarse aggregate size in flexible pavements, and by surface texture in rigid pavements. It contributes to the total frictional force through hysteresis by deformation of the rubber tire surface, and improves pavement-tire contact by providing escape channels for the surface water at the pavement-tire interface.

- Cross slope reduces water film thickness by providing surface drainage. This assists pavement-tire contact and thereby reduces the likelihood of hydroplaning.

The Department uses a locked-wheel test trailer system conforming to the requirements of ASTM E 274 to measure pavement friction. The system measures the friction developed by a fully locked, ribbed test tire dragged at a constant speed on an applied film of water of specified thickness. This
test is designed to be very sensitive to the frictional forces developed through adhesion and hysteresis, while deemphasizing a pavement’s ability or inability to drain water.

NYSDOT ensures adequate pavement friction by controlling the type of aggregates used in pavement surface courses and surface texturing techniques. Specification requirements vary, depending on use factors such as traffic volume, vehicle characteristics, speed, and project location. While there is no established “safe” friction number (FN) for highways, it is intuitive that higher friction equates to shorter stopping distances and possibly better directional control during extreme maneuvers. As part of its pavement management program, the Department established a Programmatic Design Target Friction Number measured at 64 km/h of 32, or FN(64) = 32. (Expressed in English units, the parentheses are dropped: FN40 = 32 refers to a friction number of 32 tested at 40 mph.) This friction level ensures the assumed friction values in the AASHTO Minimum Stopping Sight Distance Design Criteria for wet pavements are exceeded. Pavements with severe geometries or heavy braking and/or turning patterns should be given priority consideration when their friction numbers fall significantly below this level.

The Materials Bureau performs pavement friction tests on all aggregate mixes and all texture treatments specified by the Department. Due to seasonal limitations, pavement friction testing is performed between May and December each year. Pavement friction test results for project scoping can usually be provided in the same construction season requested, depending on the testing work load. Additionally, FN data which were obtained in response to a special study or Priority Investigation Location (PIL) study is available upon request from the Materials Bureau.