Appendix C. RESEARCH & TECHNICAL DOCUMENTS
ii. Pavement Management

Many jurisdictions respond to funding shortages by deferring preventative maintenance, which allows roadway systems to deteriorate at high rates. As cities and counties concentrate their limited resources on the most obvious needs, such as filling the worst potholes or reconstructing streets with the worst pavement conditions, the critical area of preventive maintenance is neglected. Research has shown that a typical pavement deteriorates 40 percent in quality in the first 75 percent of its life, and then deteriorates another 40 percent in the next 12 percent of its life.

A pavement management system (PMS) allows jurisdictions to identify needs and allocate a sufficient amount of funds to preventative maintenance, which, in turn, lowers the overall cost of maintaining the street network. The cost of preventive maintenance is generally one-fifth to one-tenth the cost of repairing pavement that is 80 percent deteriorated. Studies of pavement failure and rehabilitation strategies have found that if streets are properly maintained while still in a "good" to "excellent" condition, the total sum of preventative maintenance investment is significantly less than if the pavement is allowed to deteriorate to the "poor" and "failed" conditions and is then reconstructed. The goal of PMS is to raise the condition of the street network so that preventive maintenance is the primary strategy being applied, which will minimize long-term budget needs.

The Pavement Management System is composed of five different processes. They include (1) entering street inventory data, (2) calculating pavement conditions, (3) specifying maintenance treatments, (4) determining budget and maintenance needs, and (5) formulating budget scenarios. The following discusses these processes and identifies the information that is required in order to complete them.

Street Network Inventory

The first step in establishing a street network inventory is to divide the streets into numbered sections, usually based on City blocks. Each section consists of a street segment that is uniform in its condition, surface type, and width. These sections are the basic management units of the PMS.

Geometric and historical information is entered into the PMS database for each maintenance section. This data includes the section number, beginning point, end point, length, width, surface type, number of lanes, year of construction, and functional class of each section.

A typical inspection unit, usually 100 feet in length for most City streets, is selected from each street section for more careful examination. The inspection unit chosen is typically representative of the condition of the street section as a whole. Generally, an inspection unit includes at least 10 percent of the area of the street section.

Each inspection unit is surveyed for pavement distress for each of the following categories:

- Alligator cracking
- Block cracking
- Distortions
- Longitudinal and transverse cracking
- Patching
- Rutting
- Weathering

The guidelines that are followed for inspecting pavement can be found in the Manual for Pavement Condition Index Distress Identification as published by MTC. Once the information is collected, the distress information is entered into the PMS program with the respective quantities and levels of severity.

Pavement Condition Calculation

When the street section information is entered into the program, the PMS program determines pavement conditions based on a rating scheme developed by MTC. The condition of each of the street sections is described by a Pavement Condition Index (PCI) number, based on the distress observed when the section was inspected. The Pavement Condition Index values range from "Very Good" (PCI = 70 to 100) to "Failed" (PCI = 0 to 25). PCI value calculations are based on accumulated data and pavement testing done by the U.S. Army Construction Engineering Research Laboratory and used within MTC's program. The program initially assumes each section to be in perfect condition, and lowers its PCI for every distress recorded when it was inspected.

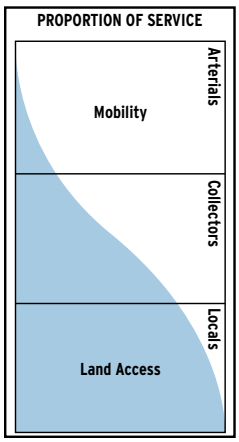
The PCI is separated into five categories that describe the extent of pavement deterioration. Deterioration may be caused by load-related distresses, the environment, or both.

Preventative Maintenance and Rehabilitation Treatment Specification

The PMS program requires a jurisdiction to specify the preventative maintenance or rehabilitation treatment, along with its unit cost, for each PCI category. PMS software then matches each street section with an appropriate treatment based on its PCI. PCI Category II is considered "Preventive Maintenance," and usually requires crack sealing, slurry seals, or thin overlays. PCI Categories III, IV and V are considered "Rehabilitation". Rehabilitation treatments range from thin overlays (Category III), to thick overlays (Category IV), to full pavement reconstruction (Category V).

The PMS program also allows the user to specify different treatment strategies for streets, corresponding to their functional classes (residential, collector, or arterial) and their different surface types, including asphalt concrete (AC), asphalt concrete over asphalt concrete (AC over AC), portland cement concrete (PCC), and asphalt concrete over Portland cement concrete (AC over PCC). The MTC Pavement Management System User's Guide can be referenced for a more complete description of the process and criteria for matching the pavement condition with the maintenance type.

RELATIONSHIP OF FUNCTIONALLY CLASSIFIED SYSTEMS IN SERVING TRAFFIC MOBILITY AND LAND ACCESS



THE CONCEPT OF FUNCTIONAL CLASSIFICATION

Functional classification is the process by which streets and highways are grouped into classes, or systems, according to the character of service they are intended to provide. Most travel involves movement through a network of roads. It becomes necessary then to determine how this travel can be channelized within the network in a logical and efficient manner.

Functional classification defines the nature of this channelization process by defining the part that any particular road or street should play in serving the flow of trips through a highway network.

Functional classification can be applied in planning highway system development, determining the jurisdictional responsibility for particular systems and in fiscal planning.

Freeways

Freeways are designed to carry large volumes of interurban, regional and interstate traffic, although they may carry local traffic in urbanized areas. They are designed to separate two or more travel lanes with a median, to prohibit access from abutting property and to limit access from cross streets by providing grade separations.

Access to a restricted number of cross streets may be provided at grade-separated interchanges. Acceleration and deceleration lanes are provided at interchanges. The desired minimum spacing between interchanges is one mile in urban areas, and two miles in rural areas. Auxiliary lanes may be provided from one interchange to the next in densely developed urban areas with closely spaced interchanges, or where

a considerable amount of traffic travels only between two interchanges.

Primary Arterials

Arterials are major through highways that carry large volumes of traffic over long distances. Although they are principally intended to serve intercity travel, they may also provide routes of regional significance in less heavily traveled corridors and some local traffic in larger urban areas. Arterials are intended to serve a through-traffic function and not to provide access to property. The number of lanes of traffic may vary from two to four or more. Continuous or intersection-turn lanes may be provided.

Secondary Arterials

Secondary arterials serve the same function as primary arterials but either carry a lesser volume of traffic or carry a higher proportion of local traffic over shorter distances. Within urban areas, these arterials may connect locations with large-scale traffic generators. Although access to abutting land is permitted, it is secondary to the traffic function of the arterial.

Major Collectors

This class of highways primarily serves internal traffic within a sub-county local area and carries this traffic to the arterial system. Major collector highways do not ordinarily carry a high proportion of long through trips and are not, of necessity, continuous for great lengths. In urban areas, collectors may carry traffic volumes in excess of 10,000 vehicles per day, although in rural areas volumes are considerably less.

Minor Collectors

This class of highways serves the same function as major collectors, but occurs primarily in rural areas where traffic volumes are lower but the length of trips and the roadway are usually longer.

Local Roads

The sole function of these roadways is primarily to provide access to adjacent land. These highways make up a large percentage of the roadway network but carry a small proportion of the total vehicle miles of travel.

TRAFFIC LEVEL OF SERVICE CONCEPT

The concept of levels of service uses qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists and passengers. The descriptions of individual levels of service characterize these conditions in terms of such factors as travel speed (and thus travel time), freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of service are defined for each type of facility for which analysis procedures are available. The analysis is usually done for peak period driving conditions. "A" represents the best possible service; "F" represents the worst. The characteristics of traffic flow for these

LEVEL OF SERVICE THRESHOLDS

LEVEL OF SERVICE	FREEWAY	ARTERIAL CLASS I	ARTERIAL CLASS II	ARTERIAL CLASS III	ARTERIAL CLASS IV
Range of Free Flow Speed (mph)	55-70	55 to 45	45 to 35	35 to 30	35 to 25
Typical Free Flow Speed (mph)	65 mph*	50 mph	40 mph	35 mph	30 mph
A	-	> 42	> 35	> 30	> 25
B	≥ 50	> 34-42	> 28-35	> 24-30	> 19-25
C	≥ 47	> 27-34	> 22-28	> 18-24	> 13-19
D	≥ 42	> 21-27	> 17-22	> 14-18	> 9-13
E	≥ 30	> 16-21	> 13-17	> 10-14	> 7-9
F	< 30	≤ 16	≤ 13	≤ 10	< 7

* Freeway design speed
Source: Highway Capacity Manual 2000, Exhibit 15-2. Transportation Research Board.

various levels of service are summarized in the table on page 137. Level of service "D" is defined as the stage approaching unstable traffic flow, where speeds and maneuverability are restricted.