Network-Level Pavement Condition Rating: Balancing Quality, Quantity, and Timeliness

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ABSTRACT

In New York, network-level condition data are used for project selection, system status assessment, and fund allocations. To meet these needs, the New York State Department of Transportation must conduct an annual inventory of the condition of the more-than-16,400-mi State Touring Route System, and summarize and report the results by October of each year. Reviewed in this paper is the status of network-level pavement condition rating in New York. Reviewed also is the New York Department of Transportation's rating method and its use from 1981 to 1985. It shows how the competing demands for data quality, quantity, and timeliness can be balanced by decentralizing the rating process, and using photograph-based rating scales, to rate roads rapidly from moving vehicles. New York's methods have resulted in a full inventory of the State Touring Route System, completed and surveyed within 3 months, with high accuracy. This means that this information will be used for project planning and budgeting next year's construction.

It is generally recognized that effective and efficient pavement management extends beyond the mere collection and analysis of data on individual highway sections (1). State highway agencies and many local governments are typically responsible for many thousands of miles of road. They must be able to monitor the overall condition of their systems, evaluate the implications of alternative financing strategies on individual sections and on overall system performance, and plan for necessary financial resources to make intended improvements. Network-level pavement management also involves processes by which data on individual highway sections are pulled together to provide a complete picture of the system, and are used to help select projects for repair.

A large number of methods have been developed for obtaining overall network condition data. The FHWA's Highway Performance Monitoring System (HPMS) (2), which is used by all states, collects data from a sample of roads using the AASHO Road Test's Present Serviceability Rating. This process is beginning to provide consistent nationwide data on road condition (3). However, most states need data on all road sections in order to select projects, and they therefore also conduct periodic condition surveys of all sections. Hudson et al. (4) recently reviewed these methods and found a wide variety of techniques in operation. Highly detailed distress surveys have been developed by Ontario (5); many states are also implementing detailed systems as well (6). All of these methods produce usable results, but, in each case, a conscious trade-off has been made between network or project data, timeliness of information (how rapidly it can be made available), and detail of information. New York's method also balances these trade-offs even though specific items are sampled within each section; its full accounting of all sections means that network data can be used as an aid in the process of project selection.

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Network-level pavement management is no easy task, as numerous states and local municipalities are discovering. Most agencies need high-quality current statistics on the system as a whole, not just on portions or on a sample. One of the critical problems in network-level pavement management is that data on the system must be collected, summarized, processed, and interpreted in rapid enough fashion to affect policy. These issues involve the quantity, quality, and timeliness of the information. Many agencies have found that the process of collecting detailed distress information on short sections of highway becomes so bogged down, when applied to the network level, that the overall summary results may be unavailable for a year or so. Alternatively, the data collection effort must be decentralized: quality control is then difficult, or equipment may be unavailable for effective decentralization and parallel surveys. These problems are worsened by difficulties with equipment, calibration, staff turnover, computer processing, and so forth. Highway information managers often find themselves frustrated in their efforts to maintain quality and ensure timeliness of information, while handling extremely large volumes of data in a consistent manner. As the focus of highway repair shifts from a small number of large major projects to a larger number of smaller jobs, the importance of current and timely information on all highway sections will increase. Therefore, the prevailing difficulties of network-level pavement management techniques must be reduced if pavement management is to be effective in the future.

The purpose of this paper is to describe how these issues have been approached, and to some extent solved, by the New York State Department of Transportation (NYSDOT). Described in some detail in this paper are the efforts undertaken by the NYSDOT to improve the quality and timeliness of its system condition information while increasing the quantity and level of detail obtained in the field. Discussed in the paper are procedures undertaken by the NYSDOT to develop an effective pavement network condition

survey, which produces high-quality information for a large network in a rapid fashion.

BACKGROUND

There are over 109,000 mi of road in New York. Of these, the New York State Touring Route System (containing state highways and selected nonstate sections signed for continuity) totals approximately 16,400 mi. This system forms the focus of most of the NYSDOT's responsibilities, and carries over 50 percent of the state's traffic.

In New York, highway condition rating procedures evolved from the traditional sufficiency surveys in the 1960s. In the 1970s, full inventories of condition and road characteristics were conducted every 2 years (Figure 1). The condition rating system, termed the Sufficiency System, was based on a survey of all touring routes by the staff of the NYSDOT's 11 regional offices. Once every 2 years, for approximately 2 months in the summer, crews from each regional office would drive their respective highway systems, averaging about 1,500 mi each, and report condition and other data on road-rating sheets. Typical highway sections were about 3/4 of a mile in length. The rating procedures used involved a 10-point verbal scale for rating both surface and underlying structural integrity (base). On completion, these data were submitted to the main office in Albany where they were processed and summarized. Because of lags in submitting the information, constant changes in milepoint and other recordkeeping systems, and rekeypunching of entire records, reports of data were sometimes not available for at least a year. Quality control checks of ratings and training were nonexistent. Furthermore, data from verbal scales were found to drift over time, so results by different crews tended to diverge as well. As a result of these problems, the survey was not useful in assessing the current condition of the system or identifying specific highway sections needing attention, so its use declined.

In the mid-1970s, the NYSDOT instituted annual network rideability surveys; however, because the system relied on only 2 vehicles, this survey experienced numerous equipment problems. In addition, numerous data processing-related problems delayed production of network data. Because highway sections had to be traversed in series, full network data were also typically not available for several years. Serious problems in the resulting trends led to loss of credibility. Rideability data were last published for 1980.

IMPROVEMENTS

Recognizing these problems, and confronted with the need for better, more timely data, the NYSDOT set out in 1981 to make improvements. The specific goals that the revised system was intended to achieve are as follows:

1. Quantity: Collect, process, and report information on 16,000+ mi of highway (approximately 18,000 highway sections) in a consistent fashion.
2. Quality: Ensure that condition data on each highway section are accurate, precise, and comparable with data on other sections. Identify the error level in the data.
3. Timeliness: Collect a full inventory of the network in spring-summer months, and provide results in early fall rapidly enough to be used in the selection of highway projects for the following construction season.

As it turned out, the last criterion is the most difficult to achieve. Given infinite time, of course, one individual in one vehicle could conduct a network survey of a large system. However, not only will the field survey itself take time, but so will processing of the field data and distribution of results. The constraints on New York's network survey (that is, collecting data in a rapid-enough fashion to use in the development of next year's program) limited the schedule to that shown in Figure 2. Experience has shown that current condition information must be available by approximately the first of October if the Department is to use it as a pointer to assist in identifying specific highway sections for maintenance-type or light overlay work.

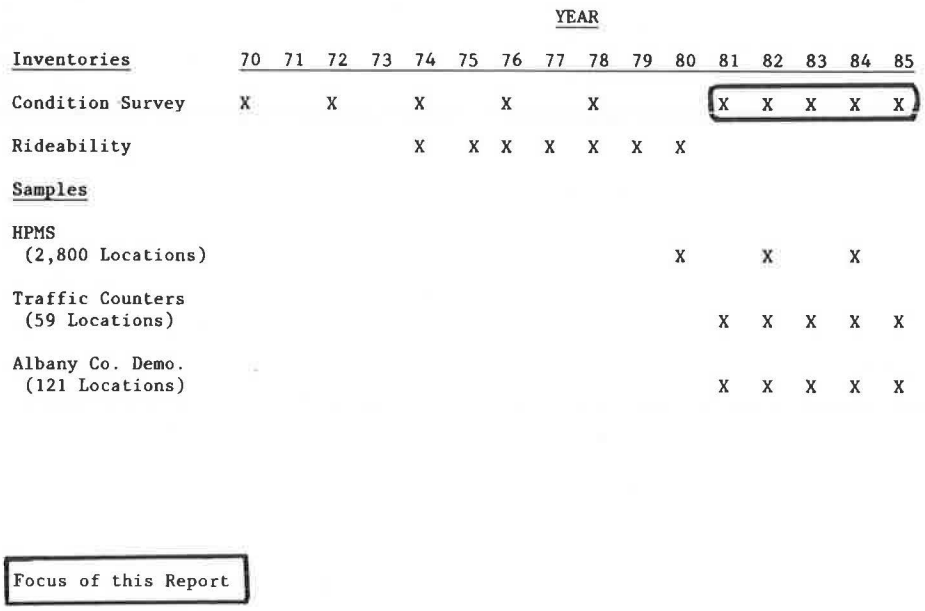

FIGURE 1 NYSDOT highway condition data surveys.

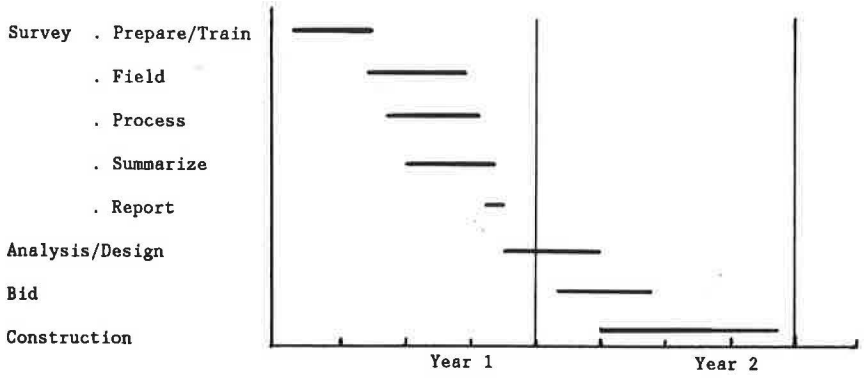

FIGURE 2 Schedule for condition data.

Therefore, the cycle of project development requires that the entire pavement condition survey and summarization effort be accomplished in approximately 3 months. This requirement produced deadline dates for collection and processing of the information as follows:

Deadline Dates	Activity
June-July	Collect information
August	Process and summarize
September	Prepare summary report and provide information to regional offices

SURVEY SCHEDULE

To meet this schedule, the following key steps were taken to develop a smoothly flowing system.

Lock-In Section Lengths

In years past, numerous small changes to the lengths of individual highway sections significantly increased processing time, and prevented section matching with the preceding year's information. Because the highway system actually changes only when repairs occur, such section length changes are generally unnecessary. The NYSDOT, therefore, instituted rules restricting the changing of section length.

Basically, highway sections were frozen in length, except in cases where reconstruction or realignment occurred or where obvious significant errors (greater than 0.1 mi) warranted revisions. This directive had the effect of increasing the speed of data encoding in the field, and allowing the field rating effort to focus on highway condition. During the first year of the new procedures, physical characteristics were checked carefully, but, once recorded, they were subsequently rechecked only if reconstruction occurred.

Photograph Scale of Pavement Condition

In 1981, a method of accurately estimating the condition of highway pavements from a rapidly moving vehicle was developed. This was accomplished by devising a 10-point photograph scale of pavement condition, in which photographs rather than verbal points were used to estimate the condition of roads. This procedure is based on a technique in psychology known as Q-sort, and produces an accurate estimate of the overall condition of the pavement. The method is described in a number of earlier NYSDOT publications (7,8).

For use in the field, the photograph scales are presented in a small hand-held Pavement Rating Manual (9). This manual (Figure 3) is designed to be held up against the windshield of the moving vehicle by the rater, who occupies the passenger seat. As the vehicle traverses the section, the rater turns the pages of the manual to find the photograph that most closely approximates the highway condition, and then estimates the section's condition. Condition is measured for surface and structural integrity (base). Experience has shown that an accurate judgment can be made in 10-15 sec. This allows sections as short as 1/4 mi to be rated at normal driving speed.

Decentralized Collection

No matter how rapidly data can be encoded in vehicles, large networks cannot be covered rapidly if only one crew is used. In the New York method, one crew can cover a maximum of 100 miles per day; a network the size of New York's would therefore take more than 160 days of effort, or 2/3 of a work year, to cover. Rapid rating of the system therefore requires methods that allow for the simultaneous rating of roads in different portions of the state, using different crews in the field at the same time. The NYSDOT's condition rating system, based on the Sufficiency System, already used a decentralized rating process in which 11 regional crews from each of the NYSDOT's regions were responsible for its sufficiency ratings each year. These crews were used for application of the new methodology.

Intensive Training

To ensure that the method produces consistent results from different crews, the regional crews are brought to NYSDOT's Albany office for two days of intensive training each spring. Non-NYSDOT staff with virtually no prior experience in pavement condition scoring also participated in the 1984 and 1985 training sessions, with 14 such teams attending the 1985 session. Crews are instructed in how to rate roads using the hand-held rater, beginning with still frames of road sections, then with slow-moving films, and finally with actual field tests. Experienced raters work with less-experienced individuals to reinforce the rating procedures, and group discussions are held to clarify issues in the rating process. The NYSDOT has found that this procedure works well, and quickly produces a consensus among teams concerning the rating to be assigned to a given section of pavement. The procedure also allows for the identification of particular team(s) that

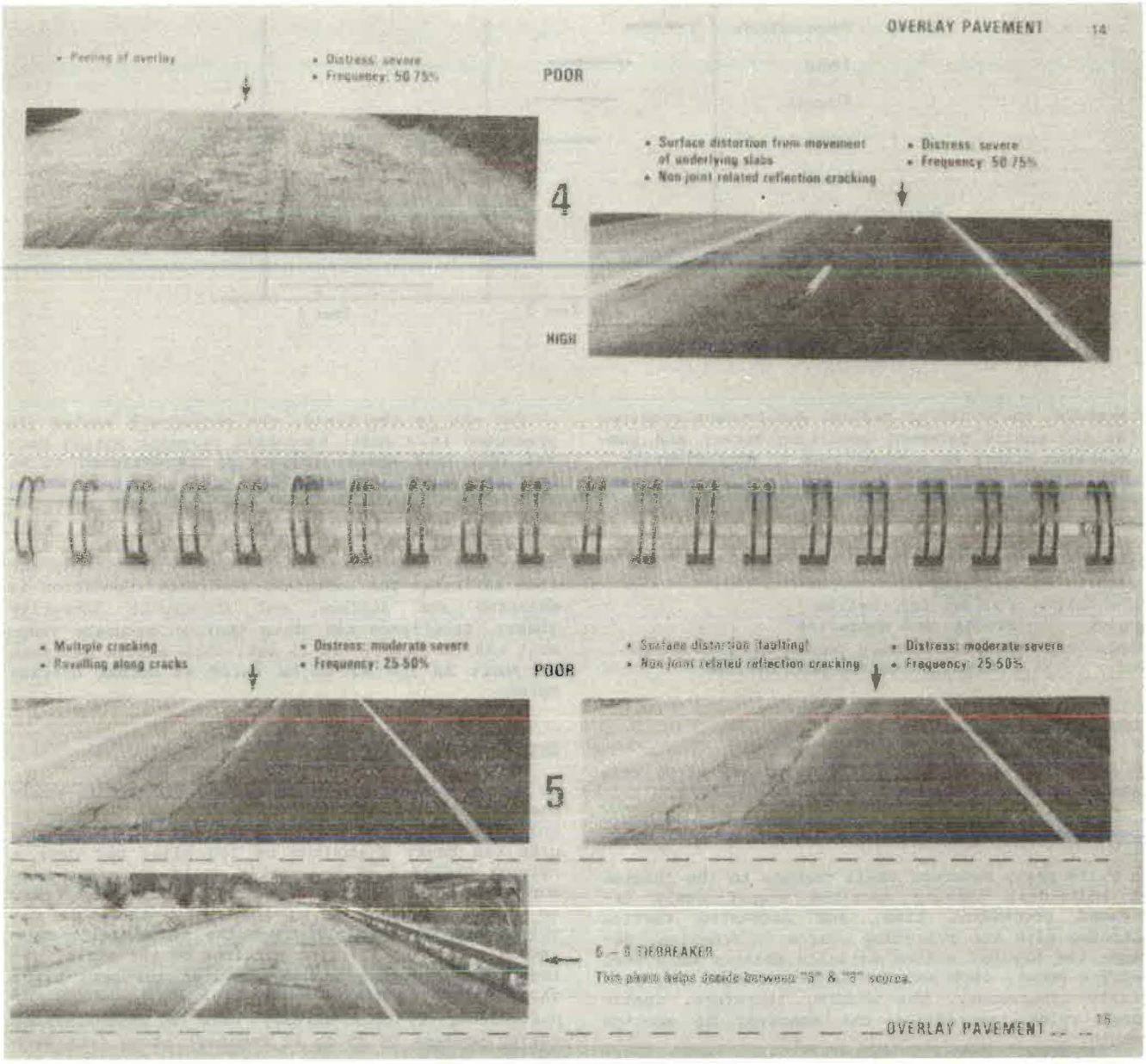

FIGURE 3 Sample page from NYSDOT Pavement Condition Rating Manual.

may be having problems with certain kinds of highway sections. Specific remedial training can then be provided to the team(s).

As an example of the accuracy that can be obtained, Table 1 gives the results of the 500 training-session judgments on the condition of 10 highway sections (10 highway section's surface and base rating each, multiplied by 25 rating teams). The data show an extremely high degree of consistency among the rating teams for each pavement section: of all 500 judgments, 67 percent were rated on the mode, an additional 30 percent were 1 point on either side; and only 3 percent (15 judgments) were 2 or more points from the mode. Thus, 97 percent of highway sections were rated within 10 percent of the modal estimates for each section. These distributions are much tighter than any that the authors have seen concerning crew data from other environments.

Checks on the Actual Field Work

Checks during training can go a long way toward ensuring accurate ratings, but unless section ratings are actually checked in the field, there is no guarantee that the actual field ratings are accurately done. To ensure accurate field work, the NYSDOT undertakes double-rating of about 5 percent of highway sections. These are accomplished by (a) a team from the Albany office traversing randomly selected highway routes in each region, and (b) regional teams double-rating sections in adjacent regions. This

TABLE 1 1985 Training Session Judgments

	Road Section																			
	1		2		3		4		5		6		7		8		9		10	
Region	S[a]	B[b]	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B	S	B
Region DOT																				
1	6	6	5	5	4	4	6	6	8	8	6	6	6	6	8	8	6	5	4	4
2	6	6	6	5	5	5	6	6	7	6	5	5	6	5	7	8	6	5	4	4
3	6	7	5	5	5	5	6	6	7	7	6	6	6	6	7	7	6	5	4	4
4	6	6	6	5	5	5	6	6	8	8	6	6	6	6	8	8	7	6	4	4
5	6	6	6	6	6	5	6	6	7	7	6	6	6	6	7	7	6	6	4	4
6	6	6	5	5	5	5	6	6	7	7	6	6	6	5	7	7	6	5	4	4
7	6	5	5	5	5	4	6	6	7	7	6	5	6	5	7	7	6	5	4	5
8	6	6	5	5	4	4	6	6	8	8	6	6	6	6	8	8	6	5	4	4
9	6	7	7	6	5	5	5	6	7	7	7	6	6	6	7	7	6	5	3	2
10	7	7	5	5	6	5	5	6	8	8	6	6	6	5	8	8	6	6	4	4
11	7	7	5	7	4	4	7	6	8	8	7	6	6	5	8	8	7	6	3	2
Others																				
Region 6, No. 2	7	7	6	7	5	6	6	6	7	7	6	6	6	5	7	8	6	6	4	4
Utica MPO	6	6	5	5	5	5	5	5	6	5	6	5	6	5	7	7	5	5	4	4
Buffalo MPO	6	6	6	6	6	5	6	7	7	7	6	6	6	6	7	7	6	6	4	4
Region 8, No. 2	5	6	5	5	5	4	6	5	6	7	6	5	5	4	7	8	7	5	3	4
FHWA	6	6	5	5	5	4	5	5	8	7	6	6	5	6	7	7	5	4	2	3
Orange County	6	6	5	5	5	4	6	6	7	8	6	7	6	6	8	8	6	5	3	3
Throughway No. 1	6	7	5	5	4	4	6	6	7	7	6	6	6	5	7	7	6	6	5	4
Throughway No. 2	7	8	5	5	4	5	6	6	7	7	7	6	6	6	7	7	6	6	5	4
No. 1, Erie County	6	7	5	5	6	5	6	6	7	8	5	5	6	5	8	8	6	5	4	4
No. 2, Erie County	7	7	6	6	5	5	5	5	7	8	6	6	6	6	8	9	6	6	4	4
Cortland County	6	7	5	5	5	5	6	6	7	7	6	6	6	6	7	8	6	5	4	3
Region 11, No. 2	6	7	5	6	5	5	6	6	8	7	6	8	7	8	5	7	8	8	4	4
Albany No. 1	7	6	7	6	5	5	5	6	8	8	6	7	6	6	7	6	6	6	4	4
Albany No. 2	6	6	6	6	5	4	6	6	8	8	7	6	6	6	8	8	6	6	4	4
Modal Score	6	6	5	5	5	5	6	6	7	7	6	6	6	6	7	8	6	5	4	4
Judgments																				
No. of Judgments at Mode	18	13	16	16	16	15	18	20	15	13	19	17	22	14	15	12	19	13	18	18
No. of Judgments ± 1 from Modal Score	7	11	7	7	9	10	7	5	10	11	6	8	3	12	10	1	5	11	6	5
No. of Judgments ± 2 from Modal Score	0	1	2	2	0	0	0	0	0	1	0	1	0	2	1	0	1	1	1	2

[a] S = surface rating.
[b] B = base rating.

process yields about 1,100 highway sections that are double-rated in the field, from which average differences in ratings can be calculated. These data can be used for improving the next year's training effort.

Data Processed as Received

Individual rating crews are urged to send data to the Albany office for processing as soon as it is completed, rather than holding it for submission in larger batches. In this way, data are not retained in regional offices waiting for late-arriving items, but are submitted directly for processing. This effort substantially smooths out the processing workload and results in the Albany office being able to handle the 18,000+ highway records that are submitted within the schedules established. As records are received in small batches, they move through a standard edit check, keypunching and computerization, and a summarization and matching process. As they are completed, they are added to a growing holding file containing all data concerning the highway system.

Results Summarized as Received

As the Albany office receives completed data from each of its 11 regions, or other groups, these data are processed and condition profiles for each region are prepared. These are transmitted back to each regional office, together with a specialized listing of poor sections; data on the distribution of sections by condition, pavement type, and federal-aid class; and other statistics including trends over time. In addition, the Albany office comments on the quality of the regional survey.

Table 2 indicates that this information can be handled rapidly. The average time from receipt of a set of regional data to a return transmittal of summary results is approximately 24 days. For 1985, the last regional submittal was received in the Albany office on September 4, and all results were transmitted back to the regions by October 17.

RESULTS

These efforts have yielded a substantial improvement in the NYSDOT's ability to summarize its information (10). Tables 3 and 4 give results from the past 5 years. Figure 4 shows that the overall condition of New York's highway system has improved steadily during this time period. The NYSDOT's "Rebuild New York" highway improvement program has improved overall system average condition, and is substantially reducing the backlog of poor highways (condition $\leq$ 5).

Not only are the data summarized completely, but they are also considerably more accurate. Table 5

TABLE 2 Sufficiency Process Documentation, 1981-1985

Year	Training Date	Field Rating Period	Processing	Last Date Sent to Regions	Draft Summary Report
1981	4/29	5/1 - 9/1	6/10 - 10/9	10/9	12/1
1982	5/11	5/15 - 8/15	6/20 - 9/1	10/28	12/10
1983	5/24-25	5/29 - 8/15	6/20 - 9/20	10/4	12/10
1984	5/1-2	5/15 - 8/10	6/25 - 9/21	10/25	12/1
1985	5/1-8	5/15 - 8/20	6/13 - 10/1	10/17	–
Average elapsed days from start of field rating		0-93	127	151	200

gives the overall consistency in field readings for 1982-1985. These results show excellent agreement between ratings by separate field crews, and a tightened overall distribution of error. In the 1985 data, fully 94 percent of all highway surface judgments, and 93 percent of all highway base judgments by two teams were within ± 1 point, and the overall average error was extremely small.

An additional analysis concerning changes in condition of individual sections can be undertaken because data are available for several points in time for each highway section. Figure 5 shows the distribution of highway sections according to changes in condition between 1984 and 1985. Of 15,497 highway sections matched out of a possible 18,300, approximately 336 show a decline of 2 or more points and 3,846 show a deterioration of 1 point. On the other side of the scale, 825 sections were improved. This

TABLE 3 Surface Condition, New York State Touring Route System, 1981-1985

		Lane Miles									
		1981		1982		1983		1984		1985	
Condition Level		Actual	Percent	Actual	Percent	Actual	Percent	Actual	Percent	Actual	Percent
Excellent	10	1,188	3.0	1,021	2.6	1,487	3.7	1,176	3.0	1,471	3.7
	9	1,439	3.6	2,904	7.3	3,435	8.6	3,226	8.1	3,360	8.5
Total		2,627	6.6	3,925	9.9	4,922	12.3	4,402	11.1	4,831	12.3
Good-to-fair	8	8,381	21.1	7,656	19.3	7,761	19.4	7,925	19.9	7,960	20.2
	7	13,487	34.0	11,858	29.8	11,638	29.1	12,227	30.8	11,870	30.2
	6	10,012	25.2	10,745	27.0	10,593	26.5	10,315	26.0	10,509	26.7
Total		31,880	80.4	30,259	76.2	29,992	75.0	30,467	76.7	30,339	77.1
Poor	5	3,828	9.7	4,249	10.7	4,214	10.5	3,966	10.0	3,378	8.6
	4	1,152	2.9	1,041	2.6	699	1.7	734	1.8	657	1.7
	3	154	0.4	234	0.6	168	0.4	152	0.4	133	0.3
	2	17	.0	19	.0	10	.0	14	.0	0	.0
	1	2	.0	2	.0	0	.0	0	.0	0	.0
Total		5,153	13.0	5,545	14.0	5,091	12.7	4,866	12.2	4,168	10.6
Grand total		39,660	100	39,729	100	40,005	100	39,735	100	39,338	100
Average		6.82		6.83		6.93		6.92		6.98	

TABLE 4 Base Condition, New York State Touring Route System, 1981-1985

		Lane Miles									
		1981		1982		1983		1984		1985	
Condition Level		Actual	Percent	Actual	Percent	Actual	Percent	Actual	Percent	Actual	Percent
Excellent	10	1,115	2.8	1,044	2.6	1,275	3.2	1,144	2.9	1,355	3.4
	9	1,442	3.6	2,747	6.9	3,859	9.6	3,370	8.5	3,260	8.3
Total		2,557	6.4	3,791	9.5	5,134	12.8	4,514	11.4	4,615	11.7
Good-to-fair	8	6,473	16.3	6,461	16.3	6,298	15.7	7,133	18.0	8,198	20.8
	7	10,610	26.8	11,039	27.8	10,795	27.0	10,201	25.7	10,340	26.3
	6	11,711	29.5	10,439	26.3	10,982	27.5	11,775	29.6	10,187	25.9
Total		28,794	72.6	27,939	70.3	28,075	70.2	29,109	73.3	28,725	73.0
Poor	5	5,641	14.2	5,763	14.5	5,130	12.8	4,630	11.7	4,870	12.4
	4	2,217	5.6	1,753	4.4	1,352	3.4	1,237	3.1	875	2.2
	3	409	1.0	403	1.0	257	0.6	197	0.5	230	0.6
	2	39	0.1	77	0.2	57	0.1	48	0.1	23	0.1
	1	3	.0	3	.0	0	0.0	0	0.0	0	0.0
Total		8,309	21.0	7,999	20.1	6,796	17.0	6,112	15.4	5,998	15.2
Grand total		39,660	100	39,729	100	40,005	100	39,735	100	39,338	100
Average		6.53		6.64		6.78		6.79		6.88	

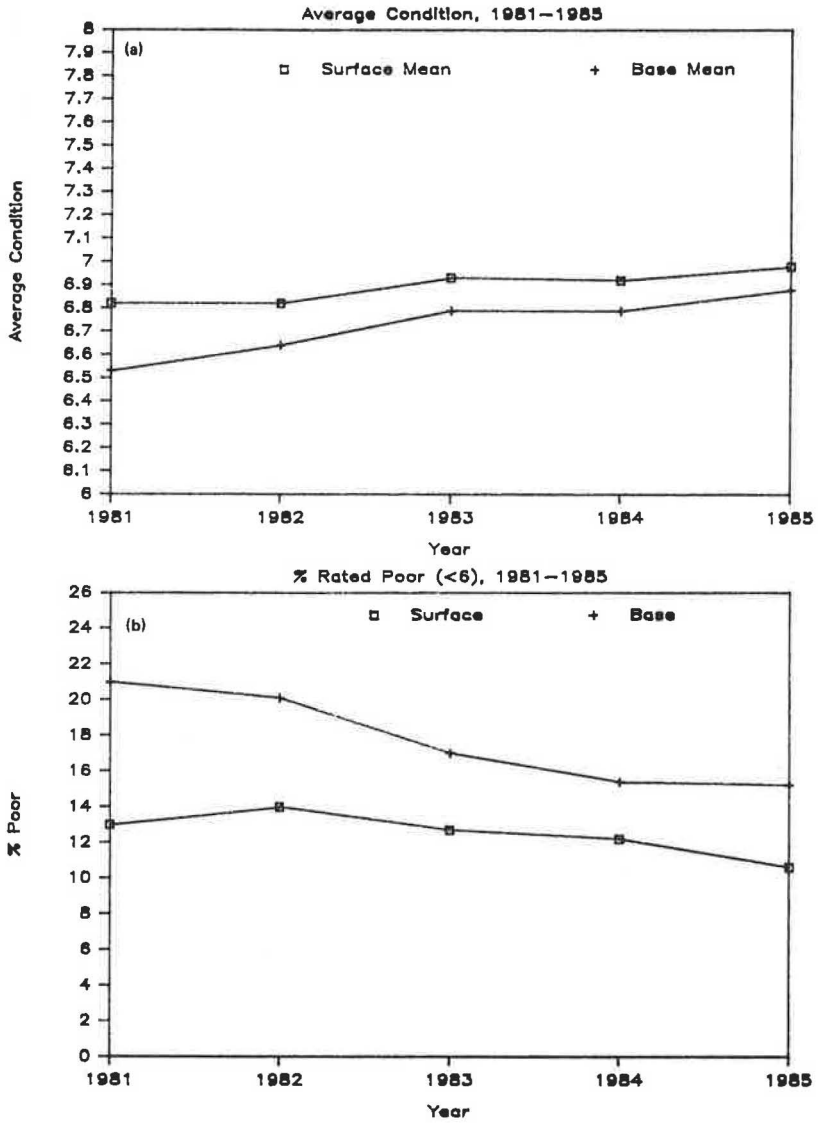

FIGURE 4 Overall condition of the New York highway system.

is in line with the NYSDOT's repair program, which amounted to approximately 1,000 mi last year.

PLANS FOR THE FUTURE

Although the NYSDOT is generally satisfied with the overall delivery and administrative aspects of this system, improvements are still being made. The primary ones now under development follow.

TABLE 5 Accuracy of Condition Data, 1982-1985

Condition Data	1982	1983	1984	1985
Surface				
Average differences (points)	−.11	+.05	+.001	−.002
Probable range	.52	.53	.38	.53
Percent within ± 1 point	96.6	95.5	96.9	93.8
Base				
Average difference (points)	−.39	+.05	−.06	−.01
Probable range	.55	.57	.46	.56
Percent within ± 1 point	91.2	92.0	95.3	93.3
Total sections checked	1,130	1,173	1,159	1,069

Corporate Data Base

The highway condition data system is largely separate from the NYSDOT's other record systems on traffic, bridge data, accidents, and other features. The NYSDOT is working to develop a corporate data base, which will combine all of this information into one highway record. This will allow regional offices to easily summarize and compare information for highway sections rather than search for information in disparate sources.

Condition Data for Local Roads

The Department is extending its information recording systems to include an additional 10,000 mi of federal-aid roads that are off the state highway system. Condition data for other highway sections are being developed in some metropolitan areas, cooperatively with the MPOs, and by counties and cities. These groups are using the NYSDOT's highway condition rating system to rate the condition of their highways. The New York State Thruway Authority and local agencies within New York are also using

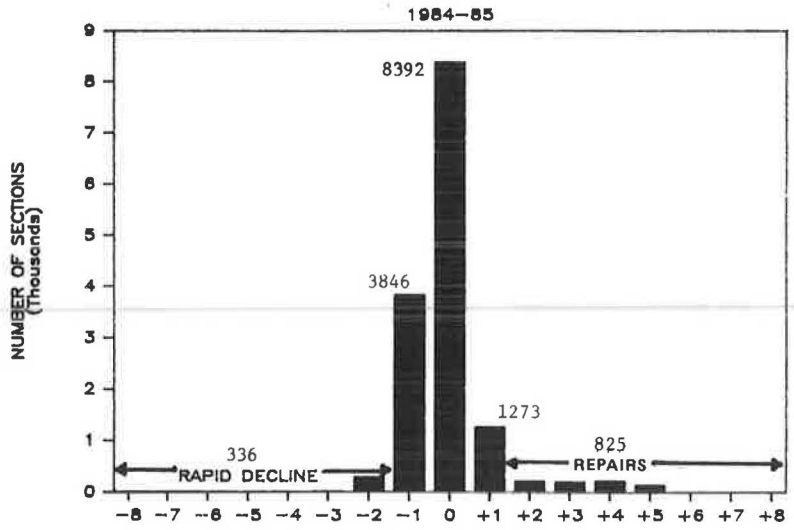

FIGURE 5 Change in surface scores.

these data to help identify project priorities. To date, 20 such crews have been trained by the NYSDOT's staff at the 1984 and 1985 annual training sessions. Table 6 gives the areas where field scoring has been or is planned to be conducted.

The information procured from the highway condition surveys conducted by these groups is used by the MPO and their members in the evaluation and determination of priorities of proposed projects as part of their Transportation Improvement Program (TIP) development process. In addition, the Thruway Authority and local municipalities use their highway condition data in the development of their annual improvement.

In some areas of New York, efforts have been initiated to field score all federal-aid roadways to determine county and regional needs. As an example, countywide scoring by consultant teams has been accomplished in Long Island as part of the determination of short- and long-range regional highway needs. New York City is currently planning to undertake a program to survey the condition of their 6,000 mi of streets. They expect to initiate their survey in early 1986, using an extension of the method.

TABLE 6 Local Government's Participation in New York State Road Rating

Agency	1984	1985
NYSDOT Thruway Authority	Touring Routes Thruway	Touring Routes Thruway
Albany MPO	FA Nonstate (1983) FA Nonstate (1984)	FA Nonstate
Buffalo MPO		FA Nonstate Erie and Niagara
Erie County	1983 Erie County	
Niagara County	1984 Niagara County	
Saratoga County	County Roads	
City of Troy	City Streets	
Putnam County	County Roads	
Warren County		County Roads
Washington County		County Roads
Westchester County	County Roads	
Utica MPO	FA Nonstate	
Binghamton MPO	1984 FA Nonstate	
Chemung County		County Roads
Dutchess County		County Roads
Orange County		County Roads
City of Syracuse		City Streets
New York City		Planning City Streets
Nassau County	FA System	
Suffolk County	FA System	

Note: MPO = metropolitan planning organization and FA = federal aid.

Infrastructure Needs Model

The NYSDOT previously developed a highway condition projection model that uses the condition data to estimate future needs. This tool is a flexible technique for handling pavement needs, but does not deal with related issues such as capacity, service, and safety. To address these concerns, the NYSDOT is developing an expanded tool that will allow estimation of a full range of highway and bridge needs, blending ideas of the HPMS analytical packages as well as other needs estimation techniques. Both mainframe and micro versions of this tool are being constructed.

Pavement Distress Survey

Although the NYSDOT understands that network-level highway condition rating procedures are important for overall pavement management, it also recognizes that more detail on pavement distress is needed to determine what particular actions to take on a given highway section once it has been identified for repairs. The NYSDOT is now testing a variety of methods of obtaining various kinds of distress information from moving vehicles, and plans to undertake a pilot survey during 1986. The pavement distress survey will provide additional detailed information, and will be helpful in project selection and determining improvements for various identified distresses.

Deterioration Trends

As the NYSDOT accumulates information on highway condition for each highway section, it is able to more thoroughly understand and predict the remaining pavement life of each highway section. Because this is a long-range goal that requires a considerable history of pavement information for each section, the NYSDOT is now building the data base and tools necessary to handle and process that information.

SUMMARY

Overall, the NYSDOT has made considerable progress in developing a network-level pavement condition system that obtains, processes, and summarizes network-level condition data in an accurate and timely fashion. The system is used as one input to the NYSDOT's cycle for identifying highway sections for repairs, and thus is constrained to a 2-month delivery period between collection and report. This constraint has generated a decentralized, highly automated, tightly controlled field review and office processing system that has been shown to be capable of achieving high-quality results for large highway systems within a tight time limit.

REFERENCES

1. Guidelines on Pavement Management. AASHTO, Washington, D.C., 1985.
2. Highway Performance Monitoring System, Field Manual (as revised). FHWA, U.S. Department of Transportation, 1978.
3. The Status of the Nation's Highways. U.S. Department of Transportation, June 1985.
4. W.R. Hudson et al. Pavement Rating Procedures: State of the Art. FHWA, U.S. Department of Transportation, May 1984.
5. Pavement Maintenance Guidelines. Ontario Ministry of Transportation and Communications, Downsville, Ontario, Canada, Sept. 1980.
6. Pavement Condition Survey Rating Manual. Pennsylvania Department of Transportation, Harrisburg, Sept. 1983.
7. D.T. Hartgen, J.J. Shufon, F. Parella, and K.W.P. Koeppel. Visual Scales of Pavement Condition. In Transportation Research Record 893, TRB, National Research Council, Washington, D.C., 1982, pp. 1-7.
8. D.T. Hartgen and J.J. Shufon. Windshield Surveys of Highway Condition. In Transportation Research Record 938, TRB, National Research Council, Washington, D.C., 1983, pp. 73-81.
9. Pavement Condition Rating Manual. New York State Department of Transportation, Albany, May 1985.
10. D.T. Hartgen. Status of Highway Condition Rating in NYS. In Transportation Research Record 997, TRB, National Research Council, Washington, D.C., 1984, pp. 85-90.

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