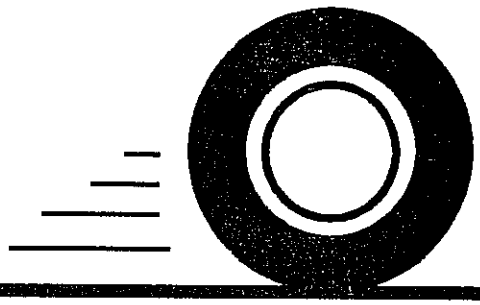
Classifying and Managing Low–Volume Local Roads



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CORNELL LOCAL ROADS PROGRAM

Classifying and Managing Low–Volume Local Roads

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Preface

We prepared this workbook for our training course on *Classifying and Managing Low–Volume Local Roads*. The course is intended for highway superintendents, commissioners of public works, highway managers and supervisors, and others who determine how to manage their roads.

We developed the one–day workshop with the guidance of an Advisory Group, which helped us define the course content, construct a workshop agenda, and determine course material. We appreciate the dedication and commitment of the Advisory Group, consisting of:

Don Geoffroy, P.E., course instructor
Paul Cooney, P.E., Consultant, Community Assistance Engineering
Louis W. Gerard, Superintendent of Highways, Town of Clifton Park
Fred Howard, Consultant, Sear–Brown Group
Edward Kearney, Chief Engineer, Gorman Bros.
Lewis LeMoine, Superintendent of Highways, Town of Colonie
Paul Miller, Superintendent of Highways, Town of Hume
Bill Mobbs, Commissioner of Public Works, Tompkins County
Carl Morrison, Superintendent of Highways, Town of Martinsburg
Dick Murphy, Superintendent of Highways, Village of Montour Falls
Jose Palacios, Superintendent of Highways, Village of Albion
Dave Powers, Superintendent of Highways, Town of Genoa
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Dennis L. Wolfe, Sr., Superintendent of Highways, Town of Southport

Don Geoffroy teaches the workshop and wrote most of the material in this reference manual. He is retired from the New York State Department of Transportation, after 32 years. Don is currently a consulting pavement engineer.

Special thanks to Paul Miller, Superintendent of Highways for the Town of Hume, Allegany County; Richard Pollock, Commissioner of Public Works for the Town of Schodack, Rensselaer County; and Paul Cooney, former County Engineer for Albany County. They spent a day guiding Don Geoffroy through their towns and county, pointed out various situations on their roads, some that they were proud of and some that they were not so proud of. Many of the photographs printed in this report were taken in those locations. Don also spent two days touring town roads in the northeast section of New York State.

References throughout the manual are noted by number in parentheses. The numbers refer to citations listed in Appendix A.

The Cornell University Local Roads Program Technology Transfer Center (T^2) provides training and technical assistance to highway and public works officials in New York State. Support for the T^2 Center is provided by the Federal Highway Administration Local Technical Assistance Program, the New York State Department of Transportation, and Cornell University.

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1 Introduction

1.1 Background

In 1985 the New York State Legislative Commission on Rural Resources conducted a series of rural development symposiums. One of the concerns that was repeatedly expressed in the meetings was that the guidelines for the design of local roads, promulgated by the American Association of State Highway and Transportation Officials (AASHTO), were not appropriate for the actual use on low–volume local roads. Nearly 75,000 miles of local roads in New York State are low–volume roads. The need for appropriate guidelines for the rehabilitation and maintenance was identified by the Commission.

In 1986 the New York State Legislature responded by enacting legislation creating the Local Road Classification Task Force. The Task Force was charged with:

> *" ... developing alternative guidelines for classifying town or county roads in rural areas according to the principle uses and traffic volume; for each class of road, the width of the driving surface and guidelines necessary to construct such roads and bridges; for each class of road the guidelines for maintenance and operation that may be required; and signs that may be needed to designate each class of road along with designated speed limits and other applicable guidelines"(2).*

The Task Force issued its report in December 1988 (6), and a manual to facilitate the use of the local classifications by local officials in December 1989 (13).

Prior to the development of the *Guidelines for Rural Town and County Roads,* there was only one standard for local roads and streets: Chapter 5 of *A Policy on Geometric Design of Highways and Streets* published by AASHTO (3). The *Guidelines for Rural Town and County Roads* provides local officials with an alternative appropriate for the conditions encountered on low–volume local roads.

In 1990 the New York State Local Roads Research and Coordination Council was established by the New York State Legislature (1). The Council was tasked with these four responsibilities:

- Promote the training of municipal officials and employees to encourage the utilization of innovative and cost–cutting procedures as well as more efficient highway maintenance and construction methods
- Encourage the use of the local roads classification *Guidelines* initially presented by the Task Force and updated by the Council
- Explore the potential for encouraging greater efficiency and cost–savings by counties, towns, and villages through coordination of maintenance and construction efforts by entering into joint agreements, including but not limited to (a) purchase of materials and equipment, (b) coordination

of maintenance and storage facilities and (c) contracting with each other for the maintenance of local roads and bridges
- Develop a minimum maintenance road classification addressing repair and service standards for low–volume rural roads, as well as procedures to be followed by local governments for designating minimum maintenance roads within their communities

The Council developed a minimum maintenance road classification as directed by the legislation and published the revised *Manual: Guidelines for Rural Town and County Roads* in 1992 (14). These revised *Guidelines* provide a realistic framework for the rehabilitation and maintenance of low–volume local roads. The Council approved the *Guidelines* for voluntary adoption and use by town and county governments.

1.2 Purpose

1.2.1 Road management plans

There will never be enough money available to make all the improvements that you want to do in a given period of time. It is necessary to establish priorities and take one step at a time. With proper planning and management most, if not all, of the higher priority needs can be addressed over a period of several years. This workbook will describe how to develop road management plans by defining the needs and then establishing an action plan which, using the funds available will address those needs over a period of a few years.

If a road management plan is developed the municipality will be in a better position to respond to citizens complaints and to answer the question, "When is *my* road going to be rebuilt?" The municipality's defense will also be strengthened if and when it is sued either because of an accident or by citizens who allege that local officials are rehabilitating roads based on favoritism rather than prioritized needs.

Proper planning and management saves time and effort. The time and effort spent in the systematic gathering and analysis of information on the condition of a municipality's roads is less than the time and effort required to gather information in a helter skelter fashion to respond to complaints, and it is much more effective in persuading legislative bodies to appropriate adequate funds to address documented needs.

Finally, if road management plans are carried out by adjacent municipalities, the public safety will be enhanced because of the consistent use of road rehabilitation and maintenance practices.

1.2.2 Rehabilitation and maintenance guidelines

As previously mentioned, by default, the current standards to which municipalities are held for the rehabilitation and maintenance of low–volume roads were established by AASHTO in Chapter 5 of *A Policy on Geometric Design of Highways and Streets* (3). The *Manual: Guidelines for Rural Town and County Roads* in 1992 (14) provides a cost–effective alternative which can be adopted by the municipality for the rehabilitation and maintenance of low–volume local roads.

A locality does not have to adopt the *Guidelines*. If it *does not*, it will be held to the standards established by AASHTO. If it *does* adopt the *Guidelines*, the municipality will be in an extremely strong position. Why?

- The *Guidelines* clearly define what needs to be done.
- Appropriate standards for speed, pavement and shoulder width, and the roadside clear zone will be established. These are consistent with the needs and uses of local, low–volume roads in New York State. The municipality cannot be held to standards established for local roads by AASHTO.
- Priorities will be established that define which roads should be rehabilitated first.
- The traveling public will experience consistent standards of construction and maintenance as it moves from one rural jurisdiction to the next.

The first step a municipality should take to enhance the planning and management of its low–volume roads is to adopt the *Manual: Guidelines for Rural Town and County Roads* published by the Local Roads Research and Coordination Council. This can be done by means of a local law.

1.2.3 Material covered

This workbook, and the *Guidelines* from which it is drawn, outlines a process which can be used by local highway officials in classifying and managing low–volume local roads. The process helps local officials determine:

- Classification of each low–volume road segment in the town or county
- Standards of design and maintenance
- Condition of the roads
- Work involved in bringing the roads up to a desirable condition
- Priority of road improvements, given a limited budget

This process is further explained in the next section.

1.3 Process to classify and manage local roads

Adopt the *Guidelines*

Classify local roads

- Conduct inventory
- Obtain traffic data
- Identify collectors
- Identify adjacent land use
- Determine classification

Determine existing conditions

- Pavement surface
- Pavement and shoulder width
- Accident history
- Roadside environment
- Signs
- Drainage
- Alignment

Identify what needs to be done

Compare existing conditions with the:

- Rehabilitation design guidelines
- Maintenance guidelines
- Traffic control guidelines

Determine the differences and needs

Rank needs and prioritize work

Develop action plan

1.3.1 Adopt the *Guidelines*

The first step in the process for the cost–effective management of local roads is to adopt the *Manual: Guidelines for Rural Town and County Roads* (14) published by the Local Roads Research and Coordination Council. A model ordinance for use by either the town board or the county legislature/board of supervisors is available from the Cornell Local Roads Program.

1.3.2 Classify local roads

The second step in the process is to classify roads based on traffic volumes, types of vehicles using the road, and the adjacent land use. Local road classifications and the detailed activities involved in the process are described in Chapter 2.

1.3.3 Determine existing conditions

The third step is to determine the condition of the roads. This requires that the width of the pavement and shoulders be determined, that the accident history be obtained, and that a visual survey be made to determine the condition of the pavement and shoulders, drainage, guiderail, signs, alignment, and clear zone. This step is described in Chapter 3.

1.3.4 Identify what needs to be done

Defining adequate needs is based on comparing existing conditions with pre–defined criteria. Therefore, the fourth step is to compare the existing conditions determined in step three with the desired conditions given in the rehabilitation design, maintenance, and traffic control guidelines. Rehabilitation design guidelines are presented in Chapter 4, maintenance guidelines in Chapter 5, and traffic control guidelines in Chapter 6. The process of comparing the existing conditions to the guidelines is illustrated in Chapter 7. Typically, this comparison will identify one or more of the following deficiencies:

- Low grade line or poor drainage
- Inadequate base or subgrade support
- Inadequate type of surface
- Poor condition of surface
- Narrow surface and/or narrow shoulders
- No clear zone
- Obstacles within the clear zone
- Steep grades
- Restricted sight distance
- Inadequate/improper signing
- High accident experience
- Excessively sharp curves
- Steep slopes adjacent to the pavement
- Pavement/shoulder drop–off

1.3.5 Rank the needs and prioritize the work

Local governments have limited budgets, and they are unable to address all the identified needs in one year. Therefore, it is necessary to rank the needs to determine which is more important and establish priorities on which needs will be addressed first. The process of ranking and prioritizing is discussed in Chapter 8.

1.3.6 Develop an action plan

Chapter 9 discusses the development of an action plan. It can be presented to the town or county board to obtain the funds needed to progress rehabilitation for the deficiencies identified. The action plan is a listing of all the projects, by priority, proposed to be accomplished in each of the next five years. It includes a brief description of proposed work and a cost estimate for each project. The action plan also indicates whether the work will be done by municipal forces, by contract, or by using a combination of contract and local forces.

2 Local road classification

Figure 1 is a schematic illustrating some of the local roads in the Town of Fictitious. There are roads to residential areas, farm operations, industry, mining operations, recreational areas, and roads connecting them with the higher–volume county and state highways.

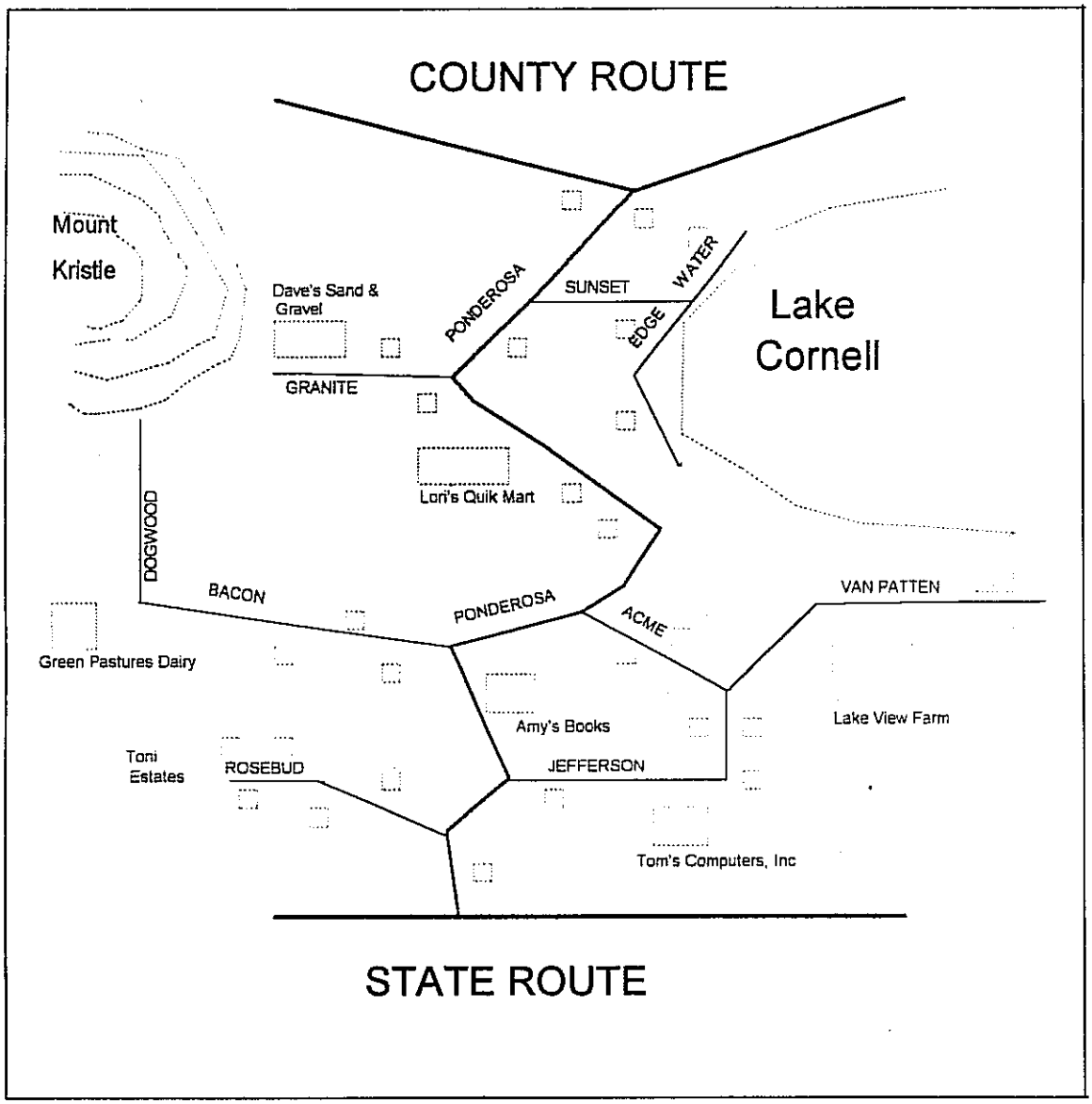

Figure 1

Local roads in the Town of Fictitious

The classification of a local road identifies the significant use characteristics of the road including traffic volumes, vehicle types, adjacent land use, and seasonal variations in the use. The New York State Legislature has noted that, "if a closer relationship can be made between the type of road and bridge use and the type of construction and design of such road including bridges, savings in construction and maintenance costs can be achieved without impairing travel and highway safety" (2). Guidelines for the rehabilitation design, construction, maintenance, and traffic control of low–volume local roads have been developed, which address the needs unique to these roads.

2.1 Local road classifications

The *Guidelines for Rural Town and County Roads* defines low–volume rural roads as roads with fewer than 400 vehicles per day (6). The local roads classifications are:

- **Low–volume collector**
  Collects traffic from any of the other classifications and channels it to higher level roads, such as arterials, Interstates, etc.
- **Residential access**
  Provides access to residences. The traffic volume generated depends on the number of residences. Year around access for fire trucks, ambulances, and school buses must be provided.
- **Farm access**
  Provides access to a farm's center of operation including the residence. Traffic volume is generally low, but may include occasional heavy trucks and farm equipment.
- **Resource/industrial access**
  Provides access to industrial, logging, and mining operations. Traffic volumes can vary and include heavy trucks and significant numbers of employees' cars.
- **Agricultural land access**
  Provides access to farm land. Traffic volumes are low and vary seasonally. These roads should accommodate farm equipment that can be up to 20 feet wide.
- **Recreational land access**
  Provides access to recreational land including seasonal dwellings and parks. Volumes of traffic can vary with the type of recreation facility and season of the year, and may include recreational vehicles.

A **minimum maintenance road** is a low–volume road or road segment primarily providing agricultural or recreational land access, having an average traffic volume of 50 or less vehicles per day, and with no year around residences or businesses. Minimum maintenance is not "no maintenance," and a road or road segment which has been so designated shall be maintained at a level which allows the road to remain passable and functional in accordance with the *Guidelines for Rural Town and County Roads*. The minimum maintenance road concept provides an alternative to abandonment or to designation as a seasonal limited–use road. Abandonment is a difficult process to complete, and a seasonal limited–use road must be upgraded if and when a year around residence is built along the road.

2.2 Applicable rehabilitation design, maintenance, and traffic control guidelines

Table 1 shows the appropriate rehabilitation design, maintenance, and traffic control guidelines for each of the six classifications and the average daily traffic.

Table 1

Low–volume local road classifications from the *Guidelines*

Road classification	Vehicles	Average daily traffic (ADT)	Guidelines		
			Rehabilitation design type	Maintenance	Traffic control
Low–volume collector	all types	50–400	A	Normal	MUTCD
		<50	B	Normal	MUTCD
Residential access	cars, emergency, and service vehicles	50–400	B	Normal	MUTCD
		<50	C	Normal	MUTCD
Farm access	cars, light trucks, some heavy trucks, and farm equipment	250–400	A	Normal	MUTCD
		<250	B	Normal	MUTCD
Resource and industrial access	heavy trucks, and employees cars	50–400	A	Normal	MUTCD
		<50	B	Normal	MUTCD
Agricultural land access	occasional farm equipment seasonal	—	C	Minimum	MUTCD
Recreational Land Access	cars, R.V.s seasonal	50–100	B	Normal	MUTCD
		<50	C	Minimum	MUTCD

The "MUTCD" cited in Table 1 is the *Manual of Uniform Traffic Control Devices* (12), which is supplemented by the *Traffic Sign Handbook for Low–Volume Roads* (22). Both are published by the New York State Department of Transportation, Traffic and Safety Division, Albany.

The guidelines for rehabilitation design, described in Chapter 4, include three rehabilitation design types. Rehabilitation design Type A is for a two–lane, all–purpose road on which two vehicles that are travelling in opposing directions can pass without a reduction in speed. Rehabilitation design Type B is for an area service two–lane road on which vehicles may have to reduce their speed when passing. Rehabilitation design Type C is for an area service one–lane road on which either of two passing vehicles must slow down, stop, or briefly leave the roadway using turnouts provided to allow the other to pass by.

The guidelines for maintenance, described in Chapter 5, include provisions for a minimum maintenance designation that allows a reduced level of maintenance on roads which are used only for agricultural or recreational land access.

The guidelines for traffic control, described in Chapter 6, include recommendations for signs on normally maintained roads and those designated as minimum maintenance roads.

2.3 Process for classifying a local system

The following process can be used by rural town and county governments to classify low–volume roads. You should maintain a permanent written record of this process and keep it to provide documentation for future reference.

2.3.1 Conduct an inventory

Local governments who have received funds from the State's Consolidated Highway Improvement Program (CHIPS) or who have a pavement management system have a list of all their roads. The NYSDOT local highway inventory computer listing (9), Figure 2, includes, but is not limited to the following:

- Road/street name
- Start of section
- End of section
- Length of section
- Functional classification
- Type of pavement
- Width of pavement
- Width of shoulder
- Number of lanes

If your local government does not have a list of its roads, the first step is to conduct an inventory of your road system to identify all the roads or road segments. Each road should be subdivided into sections or segments which exhibit similar characteristics such as traffic volumes, and type and width of pavement. Generally, the endpoints of the segments are associated with an intersecting road or major traffic generator such as a shopping plaza, mining operation, or industry.

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LOCAL HIGHWAY SYSTEM - - TOWN

REGION 1 COUNTY 4 RENSSELAER SCHODACK GEO CODE 0753

HPMS SGIS 7	ROAD OR STREET NAME	OVLPST	TOU RTE NUM	ROAD NUMB 28	START OF SECTION 32	END OF SECTION 46	MILEPOINT START 60	MILEPOINT END 64	SEC LNGTH 68	URBLOC	ONEWAY	RTESIGN 74	RTEQUAL	NO. RDWAY	LANES 77	ACCESS	SPUR	PVTTYP	MEDTYP	PW VI MD NT TH 82	SW HI LD DT RH 84	MW EI DD IT NH 86	PVTCON	PVTDIS	AADT 90	INDC	CONT MOYR 97	STA NUM 101	FC UL NA CS	U A C 120	NHS/FAC
	CRESCENT DR			0380			00.00	00.30	00.30					1	2			3		20	05								09		9
	CROCCO LA			0390			00.00	00.47	00.47					1	1			2		10	02								09		9
	CROSS ST			0400			00.00	00.18	00.18					1	2			3		20	05								09		9
	CYNTHIA LA			0410			00.00	00.30	00.30					1	2			4		20	05								09		9
	DIFILE LA			0420			00.00	00.16	00.16					1	1			2		12	02								09		9
	DOLLNER LA			0430			00.00	00.15	00.15					1	2			4		20	02								190019		
	DORNS MILL SPUR			0440			00.00	00.10	00.10					1	2			4		20	03								09		9
	DOVER LA			0450			00.00	00.26	00.26					1	2			3		18	04								09		9
	DUCK POND RD			0460			00.00	00.04	00.04					1	2			4		20	05								09		9
	DUCK POND RD			0460			00.00	01.91	01.91					1	2			4		20	05								09		9
	EAST DR			0470			00.00	00.20	00.20					1	2			4		20	05								190019		
	EAST HILL RD			0480			00.00	00.20	00.20					1	2			3		16	05								09		9
	ELEANOR DR			0490			00.00	01.00	01.00					1	2			4		20	04								09		9
	FAIRLAWN DR EXT			0500			00.00	00.10	00.10					1	2			3		20	05								09		9
	FAIRLAWN DR			0500			00.00	00.14	00.14					1	2			3		20	05								190019		
	FAWNRIDGE			0505			00.00	00.25	00.25					1	2			3		20	02								09		9
	FERNDALE RD			0510			00.00	00.02	00.02					1	2			3		16	05								09		9
	FERNDALE RD			0510			00.00	00.27	00.27					1	2			4		20	04								09		9
	FIRE LA			0520			00.00	00.14	00.14					1	2			3		18	02								09		9

Figure 2

New York State Department of Transportation local highway system inventory

Figure 3 is a listing of the inventory report from the Road surface management system (RSMS) for the Town of Fictitious. This listing was created using the computer program described in *Road Surface Management System* (7) distributed by the Cornell Local Roads Program. Most of the column headings are self–explanatory.

Surface types:

- Unimproved road
- Graded road
- Gravel road
- Surface treated gravel
- Bituminous concrete (hot or cold mix), mixed bituminous, and bituminous penetration
- Reinforced portland cement concrete
- Brick, block, or miscellaneous

Shoulder types:

- Paved
- Gravel
- Earth
- Curb
- None

Page No. 1 ROAD SURFACE MANAGEMENT SYSTEM Date: 03/08/96

ALL ROADS
INVENTORY INFORMATION

ROAD NAME	MAINT DIV.	INVENTORY NUMBER	START MILES	END MILES	LENGTH MILES	DIRECTION OF TRAVEL (FROM STREET)	(TO STREET)	ROAD WDTH (FT)	SURFACE TYPE	SHLD TYPE	ROAD VOLUME	T M ?	YR INS
		000000-000	0.000	0.000	0.000			20	SURF TR	NONE	LOW	Y	
ACME		367500-000	0.000	0.900	0.900	PONDEROSA	VAN PATTEN	16	SURF TR	NONE	M-HIGH	Y	
BACON		123400-000	0.000	2.500	2.500	PONDEROSA	DOGWOOD	18	SURF TR	NONE	M-LOW	Y	
COUGAR		208000-000	5.000	0.000	5.000	KITTY	LION	20	MISC-ASP	NONE	LOW	Y	
DOGWOOD		450000-000	0.000	1.500	1.500	BACON	DEADEND	14	GRADED	NONE	LOW	Y	
EDGEWATER		550500-000	0.000	1.500	1.500	DEADEND	DEADEND	16	GRAVEL	NONE	LOW	Y	
GRANITE		357500-000	0.000	1.000	1.000	PONDEROSA	DEADEND	18	MISC-ASP	GRAV	LOW	Y	
JEFFERSON		187500-000	0.000	4.000	4.000	PONDEROSA	VAN PATTEN	16	SURF TR	NONE	MOD	Y	
LAKE SHORE DRIVE		082000-000	0.000	0.200	0.200	WASHINGTON AVE	DEAD END	11	MISC-ASP	NONE	LOW	Y	
NORTH SCHODACK		106000-000	0.000	1.660	1.660	BURDEN LAKE RD	CR 50	20	MISC-ASP	NONE	LOW	Y	
NORTHGATE		100000-000	0.000	1.250	1.250	TURNPIKE LANE	ALVINA	20	SURF TR	GRAV	MOD	Y	
PONDEROSA 1		010000-001	0.000	2.000	2.000	STATE ROUTE	ACME	18	MISC-ASP	GRAV	M-HIGH	Y	
PONDEROSA 2		010000-002	0.000	3.000	3.000	ACME	COUNTY ROUTE	18	SURF TR	GRAV	M-HIGH	Y	
POYNEER		126000-000	0.000	2.140	2.140	RT 150	RICE ROAD	20	SURF TR	NONE	LOW	Y	
ROBINHOOD		050500-000	0.000	5.050	5.050	LITTLE JOHN	FRIAR TUCK	18	MISC-ASP	GRAV	LOW	Y	
ROSEBUD		328000-000	0.000	2.330	2.330	PONDEROSA	DEADEND	15	GRAVEL	GRAV	M-LOW	Y	
SAGENDORF		137000-000	0.000	1.100	1.100	RT 150	NORTH SCHODACK RD	20	MISC-ASP	NONE	M-LOW	Y	
SUNSET		001000-000	0.000	1.000	1.000	PONDEROSA	EDGEWATER	16	SURF TR	GRAV	M-LOW	Y	
VAN PATTEN		111100-000	0.000	2.800	2.800	ACME	DEADEND	18	SURF TR	GRAV	MOD	Y	
WASHINGTON AVE		159000-000	0.000	0.210	0.210	CR 7	ALBANY AVE	18	MISC-ASP	NONE	MOD	Y	
	*** Town Maintained Miles ***				39.140								
	*** Non Maintained Miles ***				0.000								
	*** TOTAL MILES ***				39.140								

Figure 3

Road surface management system (RSMS) inventory report for the Town of Fictitious

There are five choices for traffic volume. In RSMS the choices are qualitative. However, numerical values may be assigned to each descriptor. For the purposes of classifying local roads in the Town of Fictitious, the ranges of daily traffic in Table 2 have been assigned to each descriptor.

Table 2

Setting ADT ranges for the traffic volume levels in RSMS

Level	Verbal description	ADT range (vpd)
1	Low	Less than 50
2	Low–moderate	50 to 100
3	Moderate	101 to 250
4	Moderate–high	251 to 400
5	High	Over 400

The Cornell Local Roads Program can provide appropriate forms for setting up a road inventory. They also can instruct you in the use of a low–cost computerized pavement management system for local roads.

2.3.2 Obtain traffic data

Once the roads on the local system have been identified, the next step is to obtain traffic data for each road and road segment. If you have traffic counts, use that data. If not, obtain traffic counts or estimate the traffic volumes using knowledge of traffic patterns and development in the local jurisdiction. All available sources should be used to arrive at a reasonable estimate of the average daily traffic (ADT). A low–volume road is one with fewer than 400 vehicles per day (VPD). Therefore, in some localities, such as towns near cities or some suburban counties, there may be roads with over 400 VPD for which the *Guidelines* are not applicable. The AASHTO standards should be used for roads with more than 400 VPD.

2.3.3 Identify low–volume collectors

The next step is to identify the low–volume collectors. A functional classification map, available at the New York State Department of Transportation regional offices (Appendix B), can be used to identify which of the low–volume roads in the jurisdiction are functionally classified as collectors. These are the low–volume collectors in the town or county. Alternatively, the functional classification column on the NYSDOT local highway inventory computer listing indicates the functional classification of each road on the listing.

The numbers in the functional classification column (FUNC CLAS) in Figure 2, page 11, represent the functional classes shown in Table 3. If the code in Figure 2 is 09 or 19, the road is not a low–volume collector. Otherwise it is at least a collector (9).

Table 3

Functional classification codes from the NYSDOT local highway system inventory

Rural areas		Urban areas	
Code	**Classification**	**Code**	**Classification**
02	Principal arterial	12	Principal arterial–freeway or expressway
06	Minor arterial	14	Other principal arterial
07	Major collector	16	Minor arterial
08	Minor collector	17	Collector
09	Local	19	Local

2.3.4 Identify adjacent land use

Using land use maps, local officials' knowledge and, if necessary, a visual survey, the types of land use on each of the low–volume road segments should be determined. Land use should be identified as one of the following:

- Residential
- Farm (the center of operation of the working farm, including the residence; isolated barns are not included here but are included in agricultural land)
- Mining operations or industrial plants
- Agricultural land, including isolated barns without the farm residence
- Recreational land (state and private recreation land, seasonal camps, and parks)

2.3.5 Determine the classification of each road segment

The classification of each segment will be determined by the classification that generates the highest rehabilitation design requirements shown in Table 1, page 9. For example, a road with both a working farm and residential use and more than 250 vehicles per day, would be classified as a farm road because farm use has a higher rehabilitation design requirement (Type A) than residential (Type B). Using this principle, all of the roads in the local system would be placed in an appropriate classification.

Based on the above information, the roads in the Town of Fictitious shown in Figure 1, page 7, can be classified. Table 4 shows the classification and rehabilitation design type for each road.

Table 4

Classification of Roads in the Town of Fictitious

Road	Traffic volume (vpd)	Adjacent land use and function	Classification
Edgewater	<50	Seasonal camps	Recreational land access Type C
Sunset	50 to 100	Year around residences	Recreational land access Type B
Granite	<50	Sand and gravel operations, year around residences	Resource and industrial access Type B
Acme	250 to 400	Year around residences, carries traffic from Van Patten	Farm access Type A
Van Patten	100 to 250	Center of farm operations	Farm access Type B
Dogwood	<50	Open fields and woodlots, snowmobiles in the winter	Agricultural land access Type C
Bacon	50 to 100	Center of farm operations	Farm access Type B
Jefferson	100 to 250	Light industry, carries traffic from Van Patten	Resource and industrial access Type A
Rosebud	50 to 100	Year around residences	Residential access Type B
Ponderosa	250 to 400	Small businesses and year around residences collect traffic from other roads and carry it to the State Highway and County Road	Low–volume collector Type A

Edgewater Road and Dogwood Road are potential candidates for designation by the town board as minimum maintenance roads. Roads that are currently designated in the seasonal limited–use category are also prime candidates for designation as minimum maintenance roads. Then, in the event that a year around residence or business is established on the road, it will not be necessary to immediately upgrade the road.

3 Determining existing conditions

After the roads have been classified, the second step in managing a local highway system is to determine the condition of the network. This is usually done by making a visual survey of each road segment from a slow moving vehicle (5 mph to 15 mph) and recording the condition of the highway at frequent intervals. Generally, recording the conditions at every tenth of a mile or at each significant change is adequate.

When is a change in the roadway significant? If the road conditions are so different as to cause a change in either the maintenance treatment or the rehabilitation treatment, then the change is significant. If the road conditions do not require a change in treatment, then the change is minor and it need not be recorded.

In recent years, there has been much emphasis placed on pavements and pavement management systems (PMS). Clearly, the condition of the pavement on a road is important. However, there are other features of the roadway which are at least as important and maybe more important for the safety of the motorist and to minimize or reduce the locality's exposure to tort liability. These features should be given as much, if not more consideration, than the condition of the pavement. The purpose of your road survey is to identify one or more of the deficiencies in the following list. Therefore, as you conduct the survey in the field, make notations of the field conditions you observe which will allow you to identify the deficiencies. Figure 4 is a form which you can use to record the existing condition of each road segment, along with space to record needs as you make the survey.

Possible deficiencies:

- **Low grade line**
- **Poor drainage**
- **Poor subbase support**
- **Poor surface**
- **Narrow surface**
- **No clear zone**
- **Obstacles in clear zone**
- **Steep grades**
- **Sharp curves**
- **Poor sight distance**
- **Poor signing**
- **Frequent accidents**
- **Steep slopes**
- **Pavement drop–off**

Existing conditions of local roads

Road name_____ **Road No.**_____ **By**_____ **Date**_____

Segment No._____ **From**_____ **To**_____ **Class**_____

Design rehabilitation type **A** **B** **C**

Desirable: Pavement type Asphalt concrete Surface treated Aggregate Speed _____ Pavement width _____ Shoulder width _____ Clear zone_____	
Existing conditions	**Needs**
Traffic volume (ADT) _____ **Operating speed** _____	
Pavement type: Natural soil____ Gravel____ Cold mix____ Chip seal ____ Hot mix____ Port. cement____ Overlay____	
Pavement width_____ **Pavement condition** _____	
Crown slope Left: OK _____ Too flat _____ Too steep_____ Right: OK _____ Too flat _____ Too steep _____	
Shoulder width Left_____ Right_____ Condition_____	
Pavement/shoulder drop-off Left_____ Right_____	
Ditch Left: Not Needed____ Req'd____ Clean_____ OK____ Right: Not Needed____ Req'd____ Clean_____ OK____	
Culverts Req'd_____ Need replace_____ Clean____ OK____ Req'd_____ Need replace_____ Clean____ OK____	
Clear Zone Left_____ Right_____	
Guiderail Left: Type_____ Condition_____ Right: Type_____ Condition_____	
Horizontal curve Alignment: OK _____ Too sharp _____ Sight distance: OK for speed _____ Inadequate _____	
Vertical alignment OK for speed _____ Inadequate _____	
Intersection sight distances Approach: OK ___ Too short___ Cross road: Left: OK _____ Too short _____ Right: OK _____ Too short _____	
Signs (See road segment sign inventory form)	
Accident history OK __ Property damage __ Injury__ Fatal __	
Other	

Figure 4

Existing condition of local roads form

3.1 Pavement

3.1.1 Width

If the width of the pavement and shoulders is not contained in the NYSDOT local highway system inventory (Figure 2) the width of the pavement and shoulders should be recorded to the nearest foot. For unpaved roads the total width (traveled way plus shoulders) should be measured and recorded.

3.1.2 Type of pavement

If the type of pavement or roadway surface is not listed in the inventory, that information should be recorded when noting existing conditions. A detailed description of each surface is not required. A simple one or two–word description is sufficient. It is suggested that the following pavement types listed in the local highway system inventory (9) be used. These are:

- Natural soils
- Gravel
- Road mix (this includes both chip seal and moto–pave surfaces)
- Plant mix (this includes hot–mix asphalt concrete)
- Portland cement concrete, brick, blocks
- Overlaid pavements

3.1.3 Condition

The condition of the pavement should be recorded. If you have a pavement management system (PMS), that information should be readily available. At this stage in the process, it is unnecessary to record each pavement distress in detail. It is only necessary to gather enough information to be able to decide whether the surface only requires routine maintenance or whether it needs to be rehabilitated.

If you do not have a PMS, it is suggested you use a windshield survey similar to that developed by the New York State Department of Transportation (16). Their rating system rates a pavement on a scale 10 (excellent) to 1 (very poor) depending on the condition of the pavement and relates the rating to a treatment category. Their rating manual has photographs illustrating the condition of the pavement for each rating. The rater simply compares the visual appearance of the pavement with one of the photographs in the manual and records the numerical rating.

Table 5 shows the relationship between rating scores and treatment categories. Additional information regarding the NYSDOT pavement rating system can be obtained from your NYSDOT regional office. A listing of the appropriate DOT personnel and phone numbers is contained in Appendix B.

Table 5

Relationship between NYSDOT pavement rating scores and treatment categories

Scale point	Treatment category
10	Do nothing*
9	Do nothing*
8	Preventive maintenance
7	Preventive maintenance (extensive)
6	Corrective maintenance
5	Rehabilitation
4	Major rehabilitation
1–3	Reconstruction

*Generally you should not need to do anything to the pavement. It is still necessary, however, to mow roadsides, cut brush, clean ditches, and seal cracks, if they develop.

3.2 Accident history

Accidents are categorized depending on whether they involve property damage, personal injury, or fatalities. The accident history of a road is the best indicator of its safety. It provides feedback on causes of accidents. Many factors contribute to accidents including the condition of the vehicle, the condition of the driver, climatic conditions, and the condition of the roadway. If there are frequent accidents occurring at a certain location on a road, you should determine the cause of the accidents.

An accident history is an important analytical tool in conducting such an investigation. Local accident records should be used when available. Contact your local police department, the sheriff's patrol, or the local barracks of the state police and ask them to provide you with a copy of their reports for accidents on your roads. Accident data may also be obtained from the New York State Department of Transportation Centralized Local Accident Surveillance System (CLASS) computer file. Section 5.3 in *Risk Management and Minimizing Tort Liability for Local Highway Departments* (17) contains a description of CLASS. To get the accident data contact:

CLASS Program
Room 314, Building 5
New York State Department of Transportation
Governor Harriman State Office Campus
Albany, New York 12232
(518) 457–2452

3.3 Roadside environment

The roadside environment is the area beyond the shoulder which impacts the vehicle if the driver should veer beyond the shoulder. There are several features included in the roadside environment. These include:

- Guiderail
- Trees
- Utility poles
- Culvert head walls
- Signs
- Boulders
- Rock cuts

Record these on the form (Figure 4) along with the distance from the edge of the shoulder to the feature. Linear features which are parallel to the roadway for some distance, such as a row of trees or a rock cut, should be identified by the beginning and ending odometer readings. Note also the condition of the guiderail.

3.4 Traffic signs

The type, location, and condition of all traffic control signs should be recorded. Figure 5 is a road segment sign inventory form taken directly from *Risk Management and Minimizing Tort Liability for Local Highway Departments* (17). This useful publication can be obtained from the Cornell Local Roads Program.

Road segment sign inventory record form

Sheet _____ of _____

Name _____ # _____ Date _____

Functional classification _____ Segment length _____

starting (0.00) point _____ ending point _____

M.P.	Sign data		Condition		Comments
	left side	right side	left side	right side	

Figure 5

Road segment sign inventory

3.5 Drainage

Note the condition of the drainage along the road. The condition of the ditches would be:

- None required
- Required but non–existent, need new ditch
- Needs cleaning
- Satisfactory

Note the condition of the cross culverts. The conditions would be:

- Required but non–existent, need new culvert
- Collapsed, needs replacement
- Filled in, plugged, needs cleaning
- Satisfactory

3.6 Horizontal and vertical alignment

At this stage in the process it is generally unnecessary to make detailed measurements of the horizontal, vertical, or intersection sight distances. Table 7 in Section 4.3.4 gives an indication of the amount of horizontal, vertical, and intersection sight distance which is required for various speeds. It is usually obvious if the horizontal, vertical, or intersection sight distance is significantly less than those listed in the tables.

If there is any doubt regarding the adequacy of the sight distance, it is suggested that the appropriate speed for the horizontal curves be determined using a ball bank indicator as described in Section 4.3.4, and that the actual horizontal, vertical, and intersection sight distances be measured. Areas where the sight distance is inadequate should be signed and are also candidates for future rehabilitation.

4 Rehabilitation design guidelines

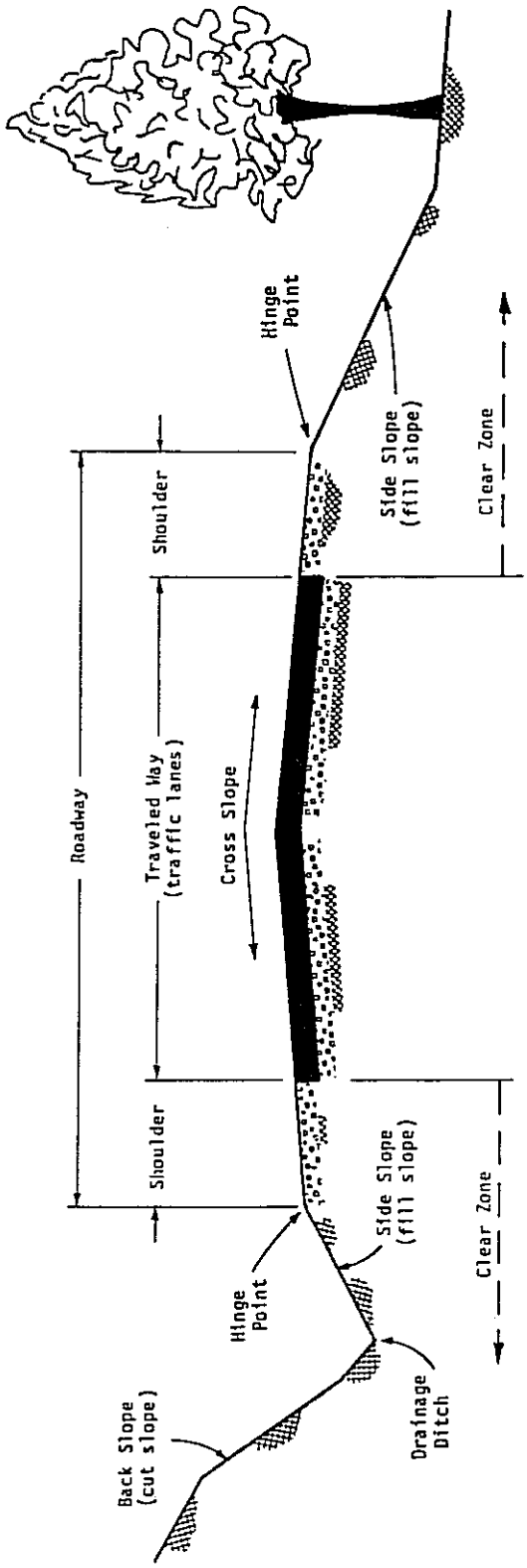
The American Association of State Highway and Transportation Officials (AASHTO) has published guidelines for the geometric design of highways and streets (3). In the foreword of that publication, AASHTO indicates that the publication is not intended as a policy for resurfacing, restoration, or rehabilitation projects. Furthermore, the Policy was developed for use by the states on the Interstates, expressways, major and minor urban and rural arterials. Its treatment of local roads is generally appropriate for more heavily trafficked streets, and is not consistent with the prevailing standards used for low–volume rural roads.

In December 1992 the Local Roads Research and Coordination Council developed and published *Manual: Guidelines for Low–Volume Rural Town and County Roads*, for local roads with fewer than 400 vehicles per day (14). The *Guidelines* were given a minor editorial update and reprinted in March 1996 by the Cornell Local Roads Program. Rehabilitation on low–volume paved roads is defined as resurfacing a continuous road section with greater than 1½ inches of material or reconstruction on essentially the same right–of–way. On unpaved low–volume roads, rehabilitation is defined as resurfacing a continuous segment with new aggregate or other surface material.

The *Guidelines* are based on three typical local road types commonly found in rural New York State that, for the most part, can adequately serve user demands in a safe and cost effective manner.

4.1 Roadway cross sectional elements

Figure 6, from FHWA's pamphlet on *Roadside Improvements for Local Roads and Streets* (19) defines and illustrates the major elements of the roadway cross section. The *Guidelines* established by the Council recommends numerical values for the pavement (traveled way) width, shoulder width, and clear zone which are shown in Table 6, page 28. The width of the pavement and the shoulder need no further definition or explanation. The following is a discussion of the clear zone and the cross–slope.



Traveled Way (traffic lanes) - That portion of the roadway for the movement of vehicles (does not include shoulders or extra turning lanes).

Shoulder ------ That portion of the roadway next to the traveled way for use by stopped vehicles or emergency situations.

Clear Zone ---- That area along the side of the traveled way including the shoulder that is available for recovery of an errant vehicle.

Side Slopes --- Slopes along the side of the roadway identified by their distance from the traveled way, their slope rate, and their height.

Slope Rate ---- The steepness of the slope - usually the ratio of the horizontal distance divided by the vertical change.

Hinge Point --- Point where the slope rate changes.

Figure 6

Roadway cross section *(from Reference 19)*

4.1.1 Clear zone

The "clear zone" is the area from the edge of the traveled way to the nearest roadside hazard. It is available for a vehicle to safely recover from running off the road.

In 1990 there were nearly 45,000 fatalities on the nation's highways. Over 12,000 of those (28 percent) involved a single vehicle which ran off the road and hit a fixed object. These accidents occurred mostly on rural low–volume roads (20). Roadside safety needs to be improved in an effort to reduce the severity of accidents resulting from vehicles "running off the road." This effort to provide a safer roadside requires that particular attention be given to shoulders, slopes, drainage features, signs and light supports, utility poles, mail box supports, guiderail, and other roadside obstacles.

4.1.2 Cross slope

The cross slope of the roadway serves two functions. First, it provides for the runoff of water. If the pavement were flat, with no cross slope, water would pond on the surface causing skidding accidents. It would seep into the pavement base and subbase and accelerate the deterioration of the pavement. Second, the superelevation or banking on the outside of curves, compensates for the centrifugal force which tends to direct the vehicle to the outside of the curve as it goes around the curve.

4.2 Types of local rural roads

The three types of local rural roads for the purposes of selecting rehabilitation guidelines are as follows. The recommended operating characteristics, surfacing materials, and numerical values for critical elements for each type of road are summarized in Table 6.

- **Type A**
  A rehabilitation design Type A road is an all–purpose, two–lane road with an operating speed of 45 miles per hour or greater on which opposing vehicles can pass with no reduction in speed.

- **Type B**
  A rehabilitation design Type B road is an area service, two–lane road with an operating speed of 25 to 45 miles per hour on which trucks cannot pass without reducing speeds and cars cannot pass trucks without reducing speeds, but cars can pass each other with no reduction in speed.

- **Type C**
  A rehabilitation design Type C road is an area service, single–lane, two–way road with an operating speed of 40 miles per hour or less on which all opposing vehicles need to take special precautions when passing.

Table 6

Rehabilitation guidelines *(from reference 14)*

Type of roadway		A	B	C
Functional characteristics		All purpose road	Area service, two–way, two–lane road	Area service, two–way, single lane road
Opposing vehicle interaction		All vehicles pass with no speed reductions	–Trucks cannot pass without reducing speed –Cars cannot pass trucks without reducing speed –Cars can pass at almost normal speed	All vehicles are required to take special precautions
Operating speed (1)		45 mph or greater	25 mph to 45 mph	40 mph or less
Minimum width travelway		18 feet (2)	16 feet (2)	10 feet (3)
Minimum width shoulder		2 feet	2 feet	—
Desirable width of clear zone (including the shoulder width)		10 feet	2 to 5 feet; 10 feet on the outside of sharp curves and on curves at the bottom of long grades	2 feet; wider if possible on outside of curves (4)
Typical surface material	ADT > 150 vpd	Asphalt concrete	Asphalt concrete	Usually unsurfaced
	ADT < 150 vpd	Aggregate	Aggregate	
Effect of surface condition on operating speed		No adverse effect	May cause a reduction	Reducing operating speed

(1) Applicable to normal maintenance roads.
(2) Add two feet to the traveled way if significant truck traffic is present.
(3) If farm vehicles are present, maintain 20–foot horizontal clearance. Widening of the traveled way should be provided at approximately 1000–foot intervals to allow vehicles to pass.
(4) On minimum maintenance roads, a clear zone may not be provided.

4.3 Decision process for rehabilitation projects

After the decision to rehabilitate a section of low-volume road has been made, the following process should be used to select an appropriate design. This process is applied only to those roads scheduled for a rehabilitation project.

The process contains the following steps, which are further described in detail.

- Survey the existing road to determine its type, adjacent land use, traffic volume, condition, geometry, operating speed, and accident history
- Determine the minimum type needed to provide reasonable and safe service to the users of the road
- Decide what design type will be used in the actual rehabilitation design
- Determine the adequacy of each design feature as compared to the guidelines in Table 6.

You should prepare a brief summary report documenting the decisions made and the reasons for your choices. The report should be retained in the municipal files for the lifetime of the road.

4.3.1 Survey the existing road

Verify all of the data that is available for each road segment that is to be rehabilitated. Data sources include your existing conditions form (Figure 4) and the NYSDOT local highway system inventory. The objective of the review is to be sure that the road segment is correctly classified in order to be able to select the appropriate rehabilitation guidelines (Table 6).

At this stage the traffic count (ADT), safe operating speed, and especially the sight distances and clear zone width should be determined accurately. Once obtained, each feature will be given a detailed analysis to verify its adequacy.

4.3.2 Determine the minimum recommended design type

Once the road classification and traffic volume of the segment of the roadway are known, the recommended minimum rehabilitation design type is determined from Table 1.

4.3.3 Determine the design type to be used

Under normal circumstances, the minimum rehabilitation design type determined will provide reasonable and safe service for the roadway. However, before you decide to use the minimum for the rehabilitation design, determine if there are factors or conditions which indicate that a design type other than the recommended minimum be used. Factors to be considered are:

- **Operating speed**
  If the existing operating speed is higher than that provided by the minimum design type in Table 1, consideration should be given to selecting a design type which will provide pavement and shoulder widths to accommodate the existing operating speeds.

- **Accident history**
  Review the accident history. Is there a pattern of accidents which suggest that a higher design type is needed? For example, repeated head–on collisions or run–off–the–road accidents when vehicles pass may indicate that a higher rehabilitation design type be considered.
- **Functional class**
  Does the existing roadway as it is currently functioning meet the recommended minimum design type established in Table 1. If the guidelines in Table 6 are not met, the road should be upgraded to satisfy the design requirements for that classification.

After all of the above have been considered and documented in the summary report, you can identify an overall design type for the rehabilitation of the road.

4.3.4 Detailed analysis of design features

Once you select the overall design type, the next step is to analyze each design feature to identify those that are inconsistent with the rehabilitation guidelines, desired pavement condition, drainage, clear zone, and roadside environment, and which should be either upgraded, rehabilitated, or signed. Additional information on how to design road improvements is given in *Basics of a Good Road* (4) and *Upgrading Your Roads* (23), available from the Cornell Local Roads Program. Another good reference is *Local Low–Volume Roads and Streets* prepared by the American Society of Civil Engineers and printed by the Federal Highway Administration (10).

- **Horizontal alignment**

Is the safe operating speed of each curve compatible with the operating speed guideline given in Table 6 for the design type selected? Does the horizontal alignment reduce the horizontal sight distance?

There are two factors governing the safe operating speed around a curve. The first is the sharpness of the curve and the amount of banking or superelevation. The second is the horizontal sight distance around the curve.

The safe operating speed due to sharpness can be determined with a ***ball bank indicator***. The speed at which the meter gives a reading of 10 is the safe operating speed on the curve (with some exceptions). If the safe operating speed of the curve is less than the operating speed of the road, the curve needs further study. The available options to consider are flattening (straightening) the curve by realigning the road or signing the curve with a lower advisory speed. The preferred option is to flatten the curve. However, the availability of rights–of–way or their cost may prohibit this option. The only option then available to the local highway superintendent may be to install curve warning signs with an appropriate advisory speed.

Figure 7 illustrates the ball bank indicator.

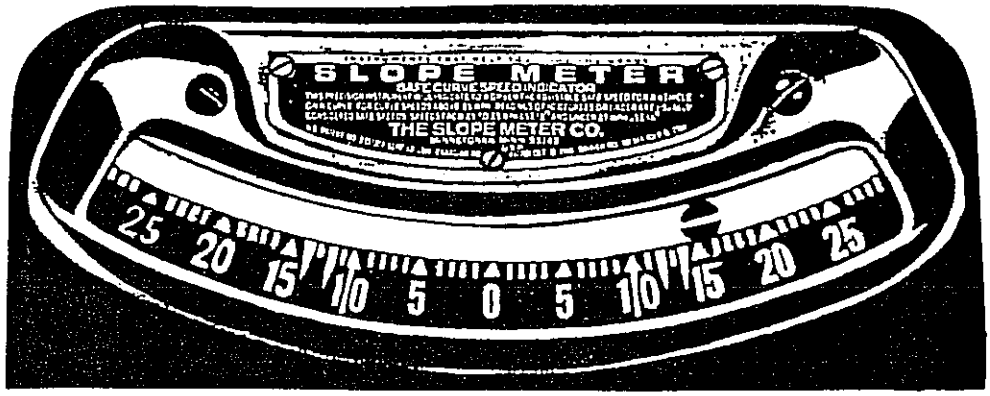


Figure 7

Ball bank indicator

A manual ball bank indicator can be purchased for $95 from:

Slope Meter Company
5947 Xerxes Avenue South
Minneapolis, MN 55410
(800) 521–7719
(612) 535–8025

The ball bank indicator is an inexpensive device, easy to install in a vehicle and use. It is recommended that every municipality either purchase one or have access to one.

Frequently, on rural roads in hilly terrain, the horizontal sight distance around a curve is obstructed by a steep slope close to the pavement. The safe operating speed around the curve is governed by how far ahead a driver can see an object in the road and safely stop before hitting the object. That is known as the **stopping sight distance.** Table 7 lists the stopping sight distance for various vehicle speeds.

Table 7

Stopping sight distance for various vehicle speeds (3)

Vehicle speed (mph)	Stopping sight distance (ft)
20	125
25	150
30	200
35	250
40	325
45	400
50	475
55	550

Figure 8 is a photograph of just such a condition where the town highway department is cutting back and flattening the slope to improve the horizontal sight distance around a curve. Note the location of the original slope around the base of the utility pole and compare that with the location of the final slope. The stopping sight distance around this curve before the improvement was about 200 feet. After the improvement it will be about 450 feet.

Figure 8

Construction project on town road to improve horizontal sight distance

There are other situations where flattening the slope is not possible. Figure 9 shows a building and some trees on the inside of a curve on a town road which reduces the horizontal sight distance. The options available to the town are to acquire the property and flatten the slope, or to sign for the curve with warning signs. Since this property is occupied, the town has signed the curve. The sight distance is approximately 125 feet. The curve is signed for 20 mph.

Figure 9

Horizontal sight distance obstructed by house and trees

- **Vertical alignment**
  The road should be driven to identify crest vertical curves that restrict sight distance. Care should be taken in selecting minimum grades which will provide for adequate surface drainage. Where the sight distance to a potential hazard is severely restricted, consider providing warning devices as recommended by the MUTCD. Potential hazards include turning vehicles, sharp curves, narrow bridges, or other conditions that demand specific driver responses.

  Figure 10 shows the crest of a vertical curve. Immediately beyond the crest the grade descends at a steep slope, and at higher speeds vehicles can become airborne. The sight distance is approximately 125 feet. The road is signed with a LIMITED SIGHT DISTANCE sign and a 20 MPH panel.

Figure 10

Crest vertical curve with limited sight distance

- **Roadway cross–slope**
  There are two reasons for the pavement cross–slope. First, it provides adequate drainage to get the water off the pavement. Second, banked curves permit vehicles to go around the curve safely. Banking, also known as s*uperelevation*, should be introduced gradually at the beginning of the curve by removing the adverse cross–slope and then gradually increasing the banking until reaching the maximum banking. The maximum amount of banking should be 3/4 inch per foot (approximately 6 percent). On straight sections, the high point or crown of the road should be in the center. On curves the high point of the road should be on the outside edge of the curve. Table 8 provides the percent of cross–slope for different types of surfaces to provide adequate drainage on straight sections.

Table 8

Cross–slope drainage criteria for straight roads

Type of surface	Range of cross–slope (percent)	Inches per foot
High (asphalt, portland cement)	1.5 to 2.0	3/16 to 1/4
Intermediate (surface treated)	1.5 to 3.0	3/16 to 3/8
Low (unpaved, gravel)	4.0 to 6.0	1/2 to 3/4

- **Drainage**

  Drainage is of the utmost importance to the safety, performance, and maintainability of the roadway. Once the water runs off the pavement and shoulders it should flow into a ditch in a level or cut section or down the side slope of the embankment in a fill section. This requires ditches along the sides of the roadway, which in turn requires adequate right–of–way.

  Without ditches, water will seep into the pavement base and subbase and accelerate pavement deterioration. If there are no ditches, water will flow onto the adjacent properties, will generate complaints and may result in more serious consequences. Therefore, when rehabilitating a road, local officials should take the opportunity to provide adequate drainage. Drainage ditches along the side of the road should NOT be "tank traps."

  Drainage ditches can be one of three shapes. They can be rounded, "V", or trapezoidal depending on the amount of water that needs to be carried, the amount of right–of–way, and the type of equipment available. Ditches should be lined with vegetation to resist erosion. If this is not possible rip rap or stone bank protection should be used. Figure 11 shows erosion in the ditch line and along the slope of a recently completed construction project. Compare that with Figure 12 which shows a recently completed construction project in the same town where the slopes and ditch were seeded and mulched. In Figure 12 the vegetation is well established and there is no erosion.

Figure 11

Erosion in the ditch line of a construction project

Figure 12

Established vegetation in a seeded and mulched ditch

Culverts need to be provided to carry the water across the road and under driveways and intersecting roads. Special care needs to be given during design to the grade of the intersecting roadways at the intersection to prevent the flow of water onto or across the roadway being designed. Sections 10.5 and 10.6 in *Upgrading Your Roads* (23) provide additional information on designing ditches and culverts.

- **Clear zone**
  The forgiving roadside concept was developed in the late 1960s to save lives. The concept provides a clear zone adjacent to the pavement without any obstructions. This allows a driver to safely recover and steer back to the pavement if the vehicle wanders off the pavement for any reason. The wider the clear zone, the more forgiving the roadside. A 30–foot clear zone is much more forgiving, and therefore more desirable than a 5–foot clear zone. Achieving a clear zone on existing low–volume local roads with tight rights–of–way may be difficult. However, local officials should strive to obtain the desirable widths listed in Table 6.

  Figure 13 shows a well established clear zone on a town road. Figure 14 shows a clear zone that was obtained as part of a construction project. The first phase of the project is to provide drainage and a clear zone. The second phase will upgrade the pavement.

Figure 13

Established clear zone on a town road

Figure 14

Construction project providing clear zone on a town road

Within the right–of–way, local government has the legal right and courts have held the obligation to remove or otherwise mitigate fixed objects. A publication available for the Cornell Local Roads Program, *Managing Your Clear Zones* (11), should be required reading for every local highway official. Two excellent references on clear zones are the *AASHTO Roadside Design Guide* (18) and *Roadside Improvements for Local Roads and Streets* by FHWA (19).

The following principles have been developed as guidelines on how to deal with fixed objects within the right–of–way.

1. Remove the obstacle or redesign it so that it can be traversed
2. Relocate the obstacle to a point where it is less likely to be struck
3. Reduce the severity of the impact by using an appropriate breakaway device
4. Redirect a vehicle by shielding the obstacle with a longitudinal traffic barrier and/or crash cushion
5. Delineate the obstacle if the above alternatives are not appropriate

The following photographs illustrate each of the principles. Figures 15, 16, and 17 illustrate obstacles in the clear zone which should be removed. Figures 15 and 16 both show dangerous mailbox supports. Figure 15 shows a "flight auger" mailbox post on the outside of a curve. It should be replaced (by the owner) with a less rigid metal or wood post. The stand in Figure 16 is constructed by welding a steel channel across two I–beams driven into the ground. Research has shown that when a multiple mailbox structure is hit by an automobile the horizontal member can become airborne and go through the windshield. The rigid structure in Figure 16 should be replaced with a series of separate mailboxes on individual posts.

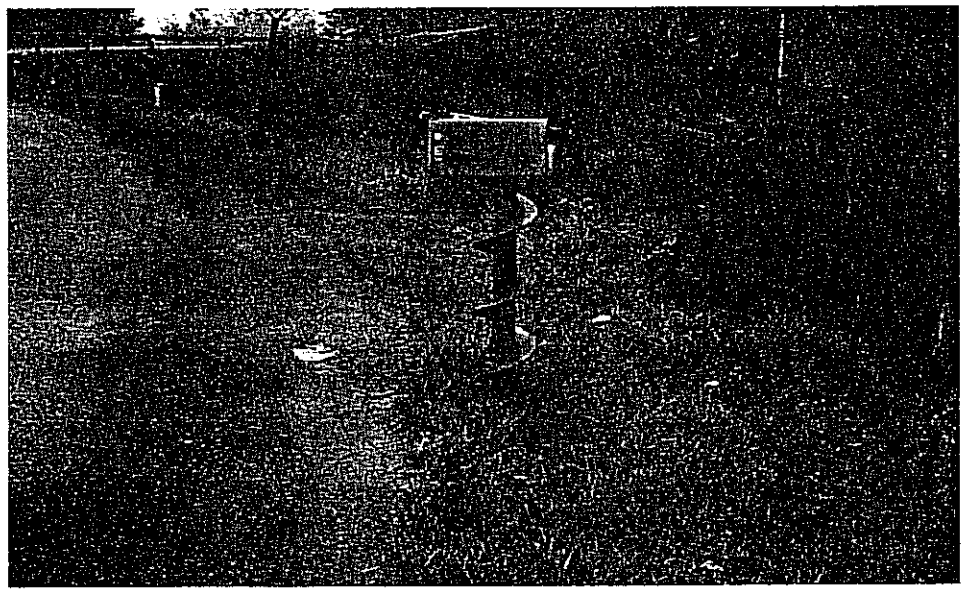


Figure 15

Flight auger mailbox post should be replaced

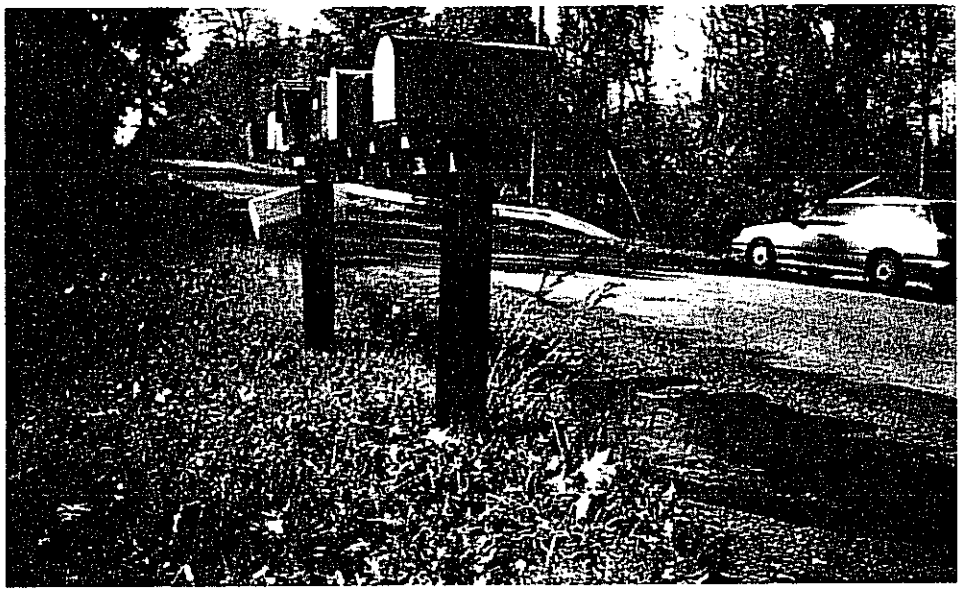


Figure 16

Steel I–beam mailbox stand

Figure 17 shows an abandoned railroad bridge abutment adjacent to the road. It is the only obstacle in an otherwise clear roadside. It should be removed.

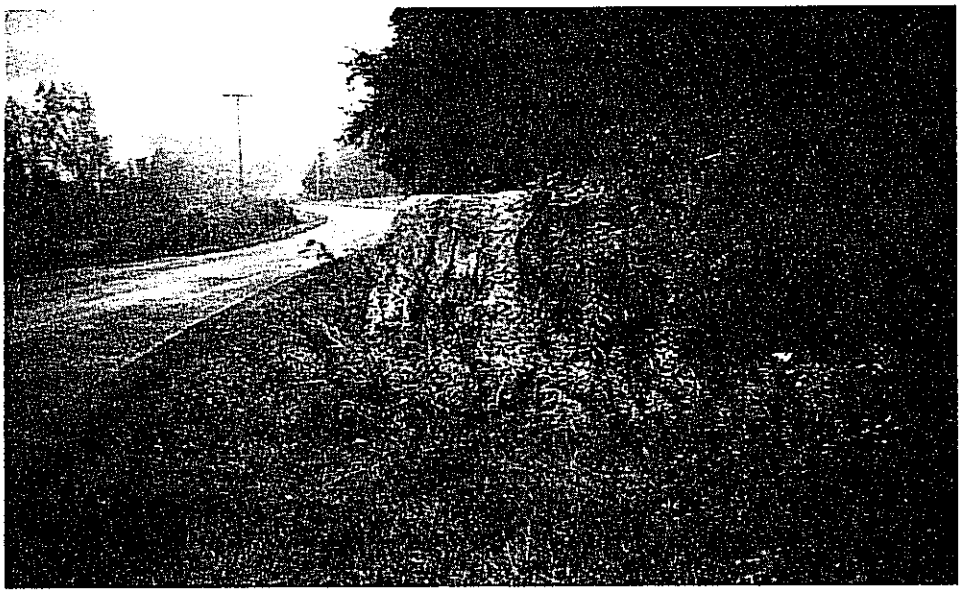


Figure 17

Obstacle in the clear zone which should be removed

Figures 18 and 19 illustrate situations where an obstacle can be relocated. Utility poles are some of the most frequently occurring obstacles in the clear zone. Whenever the utility company updates its facilities, they should be required to relocate the poles further away from the road.

A construction project on a local road also provides the opportunity to relocate poles. Figure 18 shows a utility pole being replaced without relocation. The utility company is updating their facilities, and they have installed a new pole immediately adjacent to an existing pole. Moving the pole back to the brush line would have relocated an obstacle away from an otherwise obstacle–free clear zone. Figure 19 shows the relocation of utility poles as part of a local construction project. Note that the newer pole, without the yardarm, is several feet back from the edge of the pavement.

Figure 18

Utility pole being replaced without relocation

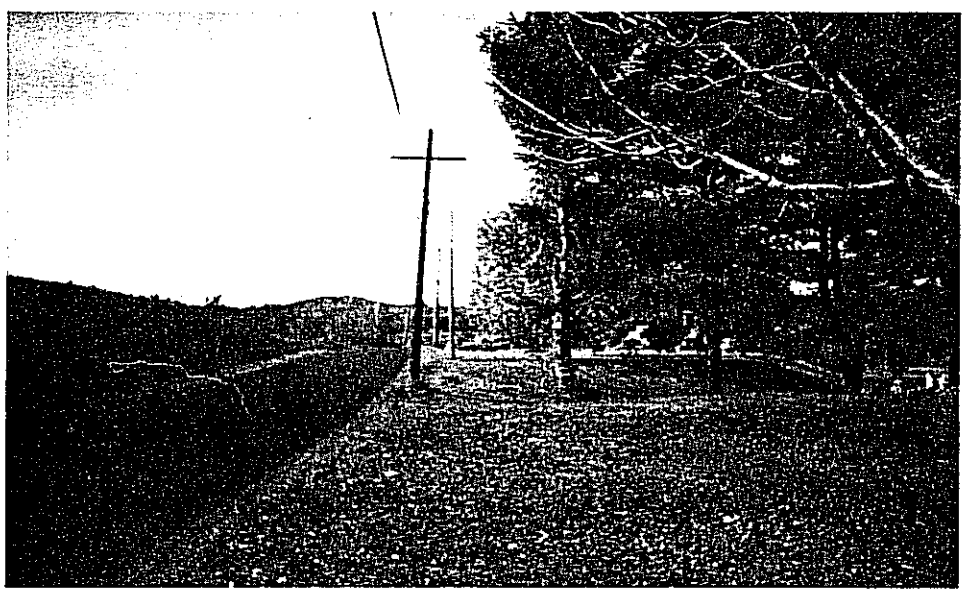


Figure 19

Utility poles being relocated on town construction project

Figure 20 illustrates the use of a breakaway device for signs. It is frequently necessary to place something in the clear zone. However, when that is done, a breakaway device should be used to lessen the impact if it is struck by a vehicle.

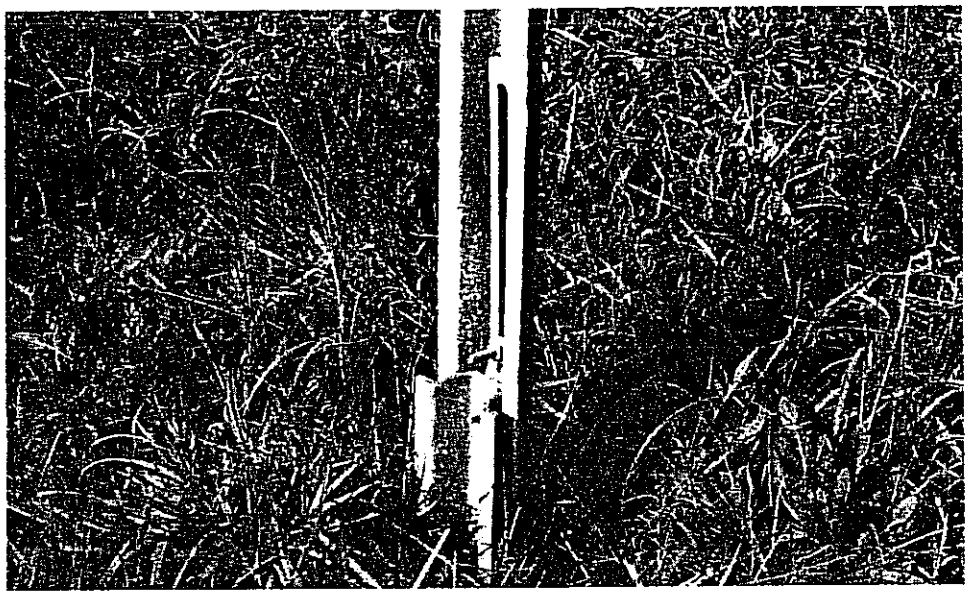


Figure 20

Breakaway sign post mounting

Figure 21 illustrates a guiderail which is being used to shield a row of trees and a steep slope dropping away from the pavement on a town road.

Figure 21

Guiderail used to shield trees and steep slope

If an obstacle cannot be removed, relocated, retrofitted to breakaway, or shielded, then it should be delineated to warn the motorist. Figure 22 shows a barn located very close to the road. The town highway officials have installed two W7–11 reflectorized markers in accordance with the MUTCD on a post to alert drivers of the proximity of the corner of the barn to the road.

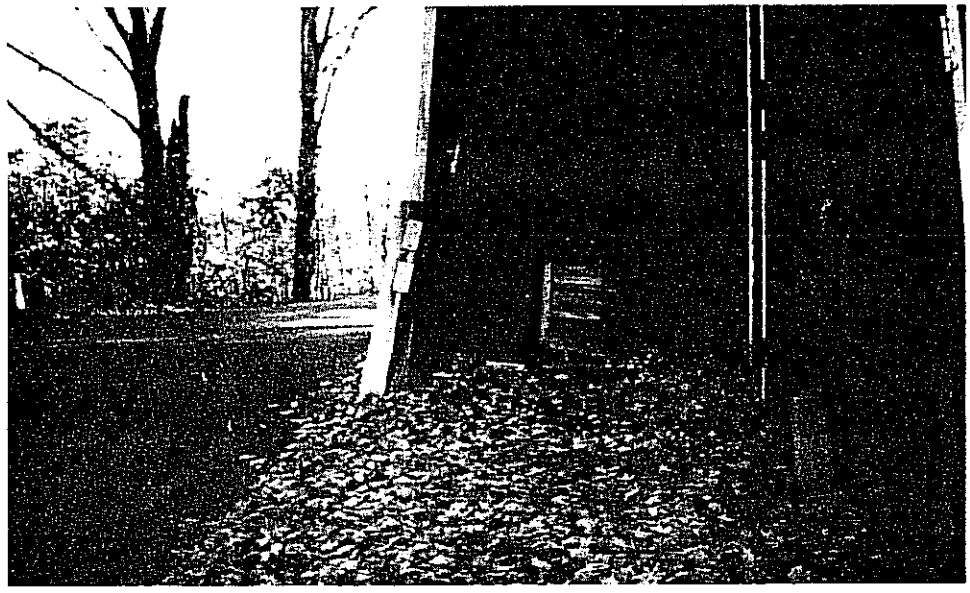


Figure 22

Object markers to delineate the corner of a barn

Figures 23, 24, and 25 illustrate three very common conditions found on local roads. Figure 23 shows a tree on the outside of a curve very close to the road. Note that the tree shows the scars of being hit. The tree should be removed, if possible, or protected with guiderail.

Figure 23

Tree on the outside of a curve which should be removed or shielded

Figure 24 shows a box culvert. It is too short and reduces the width of the clear zone. In this instance, the town will be extending the box culvert so that the flattened side slope can be continued across the box culvert. Too often that is not done, and the roadway takes the shape of a "hour glass" over the box culvert. Culverts need to be extended to provide continuity to the clear zone over the culvert.

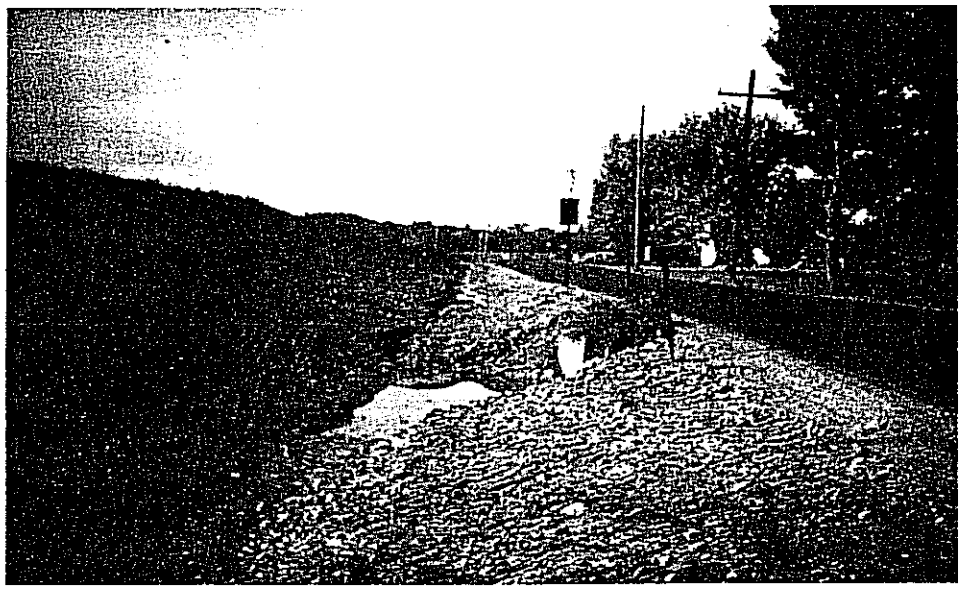


Figure 24

Box culvert which should be lengthened

In Figure 25 additional pavement material was placed causing a hazardous pavement edge drop–off and an over–steepened ditch slope. The front wheel of a vehicle wandering off the pavement may not be able to remount the pavement due to the height of the drop–off. The front wheel of the vehicle will be guided by the drop–off into the blunt end of the culvert under the intersecting side road resulting in a serious accident. The pavement drop–off condition needs to be eliminated, an end section added to the culvert, and the side slope on the intersecting side road flattened.

Figure 25

Pavement drop–off and blunt end of cross culvert

- **Guiderail**

A guiderail is a fixed object. It should only be used when it is needed to shield a hazard worse than hitting the guiderail. The following checklist can be used when deciding to install guiderail.

Is the guiderail needed?

Guiderail should not be used if there is an adequate recovery area with no obstacles should the vehicle leave the roadway. There are many factors that go into deciding where it is appropriate to use guiderail. The factors include traffic volume, operating speed, height of slope, steepness of slope, and probability of a vehicle leaving the road. It is a balance between the cost of installing the guiderail and the benefits to be gained. Charts in the AASHTO Roadside Design Guide (18) suggest that for low–volume roadways with an ADT less than 400 vehicles per day, guiderail is not warranted for slopes as high as 30 to 50 feet and as steep as 1 vertical on 1½ horizontal providing there are no obstacles on the slope. However, if there are hazards such as trees or boulders on the slope, then a guiderail is warranted.

Is there a better way to improve the safety at this location?

Shielding is the fourth priority in establishing a clear zone. If possible the hazards should be removed or eliminated first, or relocated, or retrofitted to breakaway before deciding to install guiderail.

Is the guiderail long enough?

Failure to provide an adequate length of guiderail can result in a vehicle getting behind the guiderail and hitting the hazard.

Is the guiderail designed and constructed to current standards?

To avoid the potential for tort liability, only guiderail systems that have been crash tested and approved should be used. Although there is not a specific catalog with this data available, you can use the New York State Department of Transportation Guiderail and Bridge Rails Systems. Information is available from FHWA on less expensive guiderails that have been tested in other states (21). They have also published a brochure on *Roadside Improvements for Local Roads and Streets* (19).

Is the guiderail located properly?

Is it suitable for the use intended?

Figure 26 shows the use of the wrong type of guiderail to shield a tree. A W–beam guiderail system deflecting seven feet has been installed about three feet in front of the tree. When struck by a vehicle, the guiderail will deflect seven feet and guide the vehicle directly into the tree. A box beam guiderail with two–foot post spacings which would deflect only two feet laterally should have been used to shield the tree.

Figure 26

Wrong guiderail system to shield a tree

4.4 Bridge width considerations

Occasionally, it will be necessary to replace a local bridge as part of a roadway rehabilitation project. In such a case it should be possible to adapt the bridge width to the road. Modern practice would have the bridge deck width equal that of the traveled way plus shoulders, or a minimum of 20 feet.

Often there is shared funding involved in bridge replacement projects. The design standards of the funding agencies will usually dictate the bridge width requirements.

Special consideration should be given if the roadway is to be rehabilitated but not the bridge. If the roadway will be widened this may leave a too narrow bridge. Each bridge along the road should be examined to determine if it will be too narrow after the road rehabilitation.

If a bridge is identified as being too narrow then it should be properly posted with NARROW BRIDGE signs, delineators, and guiderail to channel vehicles safely across the bridge. If the bridge also must be posted with a load limit, **serious consideration** should be given to replacing it.

Further information on the bridge width decision process is given in the *Guidelines* manual (14).

5 Maintenance guidelines

Many rural governments have road systems with miles of poor condition pavements. Their road maintenance budgets are inadequate. Improving the road system from poor to excellent condition may require more than a larger road maintenance budget. It may require a new road system management approach, doing the right thing at the right time, and using new road maintenance technologies.

5.1 Roadway maintenance

What is roadway maintenance? There is no nationally recognized glossary of maintenance terms and activities. Local and regional usages vary. An activity that one highway superintendent may call *routine maintenance*, may be referred to as *corrective maintenance* by another.

One way to categorize maintenance activities is based on the urgency to accomplish the work. The two common categories of tasks based on urgency are *demand maintenance* and *routine maintenance*. A second method of categorizing maintenance activities is based on the effect of the activity. Work is either *preventive* or *corrective*. Opinions differ among the practitioners of both methods. There is no clear line between preventive and corrective maintenance. Some activities can be both. Likewise, between corrective maintenance and minor rehabilitation.

5.1.1 Routine maintenance

Routine maintenance includes day–to–day maintenance activities. The timing is within control of the maintenance personnel. Examples of routine maintenance include mowing and cleaning roadsides, cleaning ditches, sealing cracks in pavement, paving, painting pavement markings, and pruning trees.

5.1.2 Demand maintenance

Demand maintenance activities include those done in response to events beyond control of the local highway superintendent. Some events require a response as soon as possible to avoid serious consequences due to a present or imminent danger. Demand maintenance activities, by definition, cannot be scheduled. They occur without warning and must often be immediately addressed. Demand maintenance activities are performed all hours of the day or night and on an overtime basis. Examples of demand maintenance activities are snow plowing, pothole patching, removing and patching pavement blowups, unplugging drainage facilities, replacing regulatory signs knocked down by traffic, assisting law enforcement officials in cleaning up an accident scene, removing tree limbs and branches fallen on the pavement, and responding to a road closing because of flooding.

5.1.3 Corrective maintenance

Corrective maintenance is planned activities to repair deficiencies, restore elements of a highway to its original condition, or increase the service life of elements of the facility. Repairs can be either

temporary or permanent. Corrective maintenance occurs after part of a road has deteriorated or failed. Examples of corrective maintenance include permanent pavement repairs, repairing a guardrail section, replacing faded signs along a section of highway, and installing new and larger drainage culverts.

5.1.4 Preventive maintenance

- **Definition and timing**
  Preventive maintenance is planned activities performed in advance of critical need or accumulated deterioration to avoid, reduce, or arrest the future deterioration rate. These activities may also *correct* minor defects. Preventive maintenance is intended to stop minor deterioration, retard progressive failures, and reduce routine maintenance and service activity needs. **It is planned maintenance. Timing is crucial. Preventive maintenance should occur before failure occurs.** Examples of preventive maintenance include pavement joint and crack sealing, pavement surface treatments, thin overlays, and cleaning drainage ditches and culverts.

- **Cost–effectiveness**
  Preventive maintenance is the most cost–effective method of maintaining a roadway. On average, for every $1 invested properly in preventive maintenance, $3–$4 in future rehabilitation costs are avoided. Research done for the U.S. Army Corps of Engineers found that the cost to repair a deteriorated pavement was four times that of applying a surface treatment at the proper time.

The results of studies conducted by the Wisconsin Transportation Information Center (Wisconsin's T^2 Center) for a small city with a 68–mile roadway network demonstrates the benefits of preventive maintenance. They found that the most beneficial strategy, resulting in the highest pavement condition rating, was to perform preventive maintenance on pavements, then to resurface, and finally to reconstruct pavements where the condition had deteriorated below the point where preventive maintenance was effective. The least beneficial strategy was to allow a pavement to deteriorate until it needed to be resurfaced or reconstructed.

Other studies have shown that after five years the same pavement condition can be obtained at a 20 percent lower annual cost using preventive maintenance as opposed to working on the worst pavements first.

The key to obtaining these savings is to perform low–cost preventive maintenance treatments at the proper time before significant pavement deterioration occurs. **Applying a preventive maintenance treatment to a severely deteriorated pavement is a waste of money.** Research shows that when a pavement is severely deteriorated, the cost–effective approach is to rehabilitate the pavement, and then maintain it with preventive maintenance treatments. Due to liability issues, total elimination of maintenance on a deteriorated road may not be possible. Local government is responsible to maintain its road system at a safe level for the traveling public. It may be necessary to apply a "band–aid" treatment to a roadway to keep it safe, knowing that it is not cost–effective. The objective is to minimize these situations as much as possible.

5.1.5 Summary of the types of maintenance

The principal differences between preventive and other types of maintenance are illustrated in Table 9. Preventive maintenance is planned and performed before deterioration or failure occurs. It extends the useful performance or service life of the facility.

Table 9

Principal differences in types of maintenance activities

Type of maintenance	Planned	Performed before deterioration has occurred?	Extends the useful life of the facility?
Routine	Yes	Not necessarily	Sometimes
Demand	No	No	Not necessarily
Preventive	Yes	Yes	Yes
Corrective	Generally	No	Yes

5.2 Maintenance activities

Table 10 lists the maintenance activities for roads requiring normal maintenance and for minimum maintenance roads. The listing in the table is followed by a description of each maintenance activity.

Table 10

Maintenance activities on local roads

	Activity	Normal maintenance roads	Minimum maintenance roads
Hard surfaced roads	Sealing cracks	As necessary	May be omitted consistent with decision to keep the road in service
	Patching and filling potholes	On demand	
	Surface treatments	As necessary	
	Thin overlay	As necessary	
Gravel surfaced roads	Blading surface	Frequently	Infrequent
	Regravelling	As necessary	
	Dust palliation	As necessary	
All roads	Shoulder maintenance	As necessary	May be omitted consistent with decision to keep road in service
	Removing snow	Keep roads clear	
Roadsides	Cleaning	As necessary	May be omitted consistent with decision to keep road in service
	Mowing	Frequently	
	Brush control	As necessary to maintain sight distance	
	Guiderail maintenance	As necessary	
	Repair slope failures	As necessary	
Drainage	Clean culverts	As necessary	May be omitted consistent with decision to keep road in service
	Clean ditches	As necessary	
Bridges	Cleaning	As necessary to preserve the bridge	May be omitted consistent with decision to keep road in service
	Lubrication		
	Painting		
	Repair deck		
	Clean drainage elements		
Signs	Maintain	In accordance with MUTCD[1]	In accordance with MUTCD[1]

[1] *Manual on Uniform Traffic Control Devices*

5.2.1 Surface maintenance

- **Sealing cracks**
  Cracks may occur along the centerline at the construction joints, utility cuts, between the pavement and shoulder, or just randomly because of the effects of time, weather, and loads. Crack sealing has been found to be a very cost–effective preventive maintenance measure because it prevents the entry of water into the base course and subgrade. By preventing the entry of water, crack sealing indirectly strengthens the load supporting capability of the road.

  There are several techniques for sealing and filling cracks. The simplest and quickest, which also has the shortest life, is to clean the debris out of the crack with compressed air and spread a hot asphalt sealer over the crack with a squeegee. A better treatment is to rout or countersink the crack to form a reservoir for the sealer and use a polymer–modified, polyester–fiberized asphalt as the sealing material. The Strategic Highway Research Program *Asphalt Pavement Repair Manuals of Practice* contains a section on "Materials and Procedures for Sealing and Filling Cracks in Asphalt–Surfaced Pavements" (15). It is the most current and complete reference on this subject.

- **Patching and filling potholes**
  This treatment consists of the placement and compaction of asphalt concrete into surface defects, such as potholes, which have been cut back to sound material and cleaned of loose debris, water, etc. A certain amount of this work has to be done on an emergency basis using "cold mix," or a "winter mix" during inclement weather, to provide a safe road. Temporary patches should be replaced with permanent patches using the proper materials and procedures when weather conditions improve.

  Patching and filling potholes are *demand maintenance* activities. Extensive patching and frequent potholes are an indication that the pavement has reached the end of its service life, and the road should be scheduled for rehabilitation discussed in Section 4. The Strategic Highway Research Program *Asphalt Pavement Repair Manuals of Practice* contains a section on "Materials and Procedures for the Repair of Potholes in Asphalt-Surfaced Pavements" (15).

- **Surface treatments**
  When the surface of the asphalt pavement has numerous cracks or it has raveled, and it is no longer feasible or practical to treat the individual cracks, a sealing technique which seals the entire surface is used. These are referred to as *surface treatments*, and include slurry seals, microsurfacing, and chip seals. Figure 21, page 41, illustrates two chip seals on a town highway. The lighter material at the top of the photograph is a regular asphalt emulsion. The darker material at the bottom is the proprietary product "Nova Chip."

  Slurry seals
  Slurry seal consists of a mixture of well–graded, fine sand, mineral filler, and diluted asphalt emulsion. The mixture is spread over the entire surface with either a squeegee or spreader box attached behind a truck.

Microsurfacing
This is a mixture of polymer–modified asphalt emulsion, crushed mineral aggregate, mineral filler, water, and additive to control the time to harden. The mixture is spread on the pavement with a spreader box attached behind a truck. Generally, microsurfacing is used to fill ruts and to improve surface texture. However, it has been used to seal surface cracks with mixed results.

Chip seals
Chip seals are constructed by spraying an asphalt emulsion with a liquid asphalt distributor on the pavement and then spreading a layer of small crushed stone with a self–propelled spreader or a spreader box attached behind a truck. A pneumatic, rubber–tired compactor is used to press the stones into the asphalt before the emulsion sets. Some local governments use an additive in the asphalt cement or emulsion to increase stone retention and the performance of the chip seal.

In addition to sealing the surface cracks, a chip seal can be used to increase the surface friction of a smooth pavement. Multiple applications of the asphalt emulsion and stone are also used by some localities depending on the condition of the pavement surface. In addition, some communities use multiple chip seal courses to upgrade a gravel or stabilize road surface to a hard surface, dust free roadway for light–weight traffic. *Chip Seals and Surface Treatments* (5) published by the Cornell Local Roads Program describes in detail the materials and construction techniques for chip seals.

- **Thin overlays**
Thin overlays involve applying a single course of hot mix asphalt concrete having a thickness of 1½ inches or less. The addition of the asphalt concrete to the pavement adds structural strength to the roadway. However, the primary purpose of a thin overlay is not to increase the structural capability of the pavement, but rather to prevent water from entering the pavement in much the same manner as a surface treatment.

  A thin overlay would be used where the traffic volumes are too high for a surface treatment, the pavement surface has minor rutting, or other minor surface deviations. A thin overlay is considered to be primarily a preventive maintenance treatment. However, it does strengthen the pavement and can also be classified as providing corrective maintenance treatment as a secondary benefit. A thin overlay should not be used when there are deep ruts (greater than ½ inch) or the pavement has lost its original shape. *Hot and Cold Mix Paving: Principles and Practices* (7) is an excellent reference. In Chapter 8 "Choosing the right mix for your road," there is a step–by–step process to select the best treatment for a pavement.

- **Blading**
Blading is performed on aggregate and unpaved roads and shoulders. Blading removes potholes, corrugations, and other surface defects, rendering the road smoother and safer to travel on. Blading is usually preceded by scarifying to a depth slightly deeper than the surface defects. Blading should be used to establish a cross–slope of 4 to 6 percent (½ to ¾ inch per foot) for good drainage, and to reduce the development of potholes in the aggregate surface. Blading is

generally most effective if it is done when the gravel surface is damp or wet.

- **Regraveling**
  The process of adding aggregate material to re–establish the crown and grade of the road is regraveling. This activity is commonly done at the same time as blading, but less frequently. The new aggregate is needed to periodically make up for the material that has been lost because of traffic, water erosion, and blading losses.

- **Dust palliation**
  This is the application of water, calcium chloride, sodium chloride (salt), lignin sulfonate, or other non–toxic chemicals to bind the surface and prevent loss of dust. Dust loss leads to the gradual erosion of the road surface, reducing its thickness and load supporting capability. Dust can make summertime travel hazardous when traffic volumes are sufficient to require passing maneuvers. Sometimes the use of dust palliatives will reduce the need for blading and regraveling to a sufficient degree to be highly cost effective.

- **Shoulder maintenance**
  Activities will differ depending on whether the shoulder is paved or unpaved. If paved or stabilized, the shoulder should be maintained similarly to a pavement, (i.e., the cracks should be sealed, or a surface treatment should be applied). If not paved, the shoulder should be periodically graded to keep it smooth. For either type of surface, the shoulder should be kept flush with the pavement. Any pavement/shoulder drop–off that develops should be filled with hot mix asphalt, recycled asphalt pavement (RAP), or a granular material. Any drop–off that develops at the outside edge of the shoulder should be filled in. The berm that forms along the shoulder from the accumulation of winter abrasives should be removed to prevent water from ponding on the shoulder and seeping under the shoulder and pavement.

- **Snow removal**
  Snow and ice control are performed to foster safety to facilitate travel during the winter months. Snow is removed from the surface by a snow plow, grader, or snow blower. Abrasives (sand and salt) are used to enhance trafficability during a storm or immediately afterward when a thin layer of ice or snow remains on the road. Salt is used to lower the melting temperature of ice, and to diminish the bond of the ice on the road surface.

5.2.2 Roadside maintenance

- **Cleaning**
  Picking up litter for aesthetics, sweeping the pavement, and picking up other debris is especially important in the spring on roadways with closed drainage systems (storm drains). Abrasives need to be removed before they wash into, plug, and corrode the catch basins and storm sewers.

- **Mowing**
  Cutting the grass and weeds is particularly important near driveways and intersections to provide a clear line of sight for traffic.

- **Brush control**
  Cutting woody shrubs to prevent encroachment onto the right–of–way is important to provide adequate sight distance, particularly around the inside of curves, and at driveways and intersections. For example, cutting the brush in Figure 9, page 33, would improve the sight distance on that curve.

- **Guiderail maintenance**
  Replacing damaged and ineffective guiderail may also include the use of herbicides to retard the growth of weeds and shrubs in front of and immediately behind the guiderail.

- **Drainage**
  Clean debris from the inlets and outlets of culverts, and clean ditches to maintain the flow. When possible, ditches should be cleaned in the late spring so that vegetation will be quickly re–established to protect against erosion. At other times, reseeding may be necessary for erosion protection. After a major tropical storm or hurricane, remove trees that have been blown down into streams for some distance upstream and downstream of culverts. Otherwise, those upstream will move downstream and block culverts and bridges, and those downstream will cause dams and flooding of the roadways.

- **Slope maintenance**
  Remove landslide debris, cut and remove trees from fill slopes, protect against erosion because of runoff from the road surface or ditches. Seed slopes to retard erosion.

- **Maintain the clear zone**
  When patrolling your roads, observe the building or placement of any objects within the right–of–way which would reduce the clear zone and be a hazard. Be especially watchful for mailboxes, signs, and utility poles.

5.2.3 Bridges

Bridge maintenance consists of:

- Cleaning the drainage scuppers
- Lubricating pins and bearings
- Painting the beam and railings
- Cleaning and patching of deck surface defects
- Removal of winter maintenance abrasives and salt residue
- Protection of bridge abutments against scour and erosion
- Inspection of abutments
- Cleaning of the waterway to maintain flow capacity

5.2.4 Signs

Sign maintenance consists of clearing the brush and trees obstructing the visibility of the sign, replacing damaged signs, and verifying that the signs are installed where they are required. They should conform to the requirements of the *Manual of Uniform Traffic Control Devices (MUTCD)* (12).

5.3 Minimum maintenance road

5.3.1 Background

As discussed in Section 2.1 the minimum maintenance road is an alternative to the seasonal limited–use highway or abandonment. The provisions of the minimum maintenance road differ from the seasonal limited–use highway in two ways:

- On a road designated as a minimum maintenance road all maintenance, not only snow removal can be legally reduced, thereby adopting the already widespread (and financially necessary) practice of reducing maintenance on the least traveled roads
- The decision to provide full service to new residences or businesses established after the designation as a minimum maintenance road is at the discretion of the local government and not a statutory requirement of New York State law.

The detailed process for designating a minimum maintenance road or road segment is contained in the *Guidelines* (14). The following is a brief overview of the process.

5.3.2 Low–volume road classification

If the municipality has not done so, it is necessary to classify its low–volume roads as described in Chapter 2. Only those road segments classified as agricultural or recreational land access with an ADT less than 50 vehicles per day may be designated as minimum maintenance roads.

5.3.3 County and town legislative findings

The legislative body having jurisdiction over the road to be designated must issue a finding that includes, but is not limited to:

- The volume and type of motor vehicle traffic on the road
- A determination that the property owners of the land abutting the road shall have reasonable access to their property
- A determination that the road is not a farm access or year around residential road

5.3.4 Public, school, and planning board review

- At least 60 days before any hearing on the proposed minimum maintenance road designation, a copy of the findings will be made available for public inspection.
- A copy of the findings must also be sent to the local school board and the planning board of the county or town which has jurisdiction over the road.
- The school board and the planning board have 45 days to review the findings and make a recommendation on the proposed road designation. When the school board or the planning board recommends not to designate the road as a minimum maintenance road, they are required to give their reasons why they did not recommend designation.

5.3.5 County and town legislative actions on recommendations

The legislative body may, by resolution, accept, accept in part, or reject the recommendations of either the school board or the planning board prior to any vote upon the proposed local law or resolution.

5.3.6 Public hearing

A public hearing must be held by the legislative body prior to taking action on a proposed minimum maintenance road designation. At least ten days before the public hearing, written notice of the hearing must be sent by certified mail to every owner of real property abutting the road.

5.3.7 Actions

- The legislative body may decide to designate or not to designate a minimum maintenance road.
- If it does, the designation does not take effect until minimum standards are adopted and signs are posted by the highway superintendent advising the public that such road is a minimum maintenance road.
- Minimum maintenance road signs conforming to the *New York State Manual of Uniform Traffic Control Devices* will be posted by the county or town highway superintendent. The details for signing and the minimum maintenance sign are shown in Figure 27, in Section 6.2.
- Once designated a minimum maintenance road, it will not be determined to have been abandoned until at least six years have elapsed.

5.3.8 Discontinuation of local designation

- Anyone owning or occupying real property abutting a road designated as a minimum maintenance road may petition the town board or the county legislature/board of supervisors to discontinue the designation. The town board or county legislature/board of supervisors must hold a public hearing 45 days after receipt of the petition, with at least 10 days notice given prior to the conduct of the public hearing. If the town board or the county legislature/board of supervisors decides that the minimum maintenance road designation should be continued, no further petitions may be submitted for discontinuance for a two–year period. If the board decides to discontinue the minimum maintenance road designation, the discontinuance shall take effect six months after the beginning of the next fiscal year of the town or county.
- As an alternative to the above petition process, the town or county board may adopt a local law or resolution on its own initiative to discontinue the minimum maintenance designation.

6 Traffic control guidelines

This section describes signing and pavement markings of local roads for traffic control which is cost effective, promotes safety, and protects local officials and local government from unwarranted potential liability.

6.1 Normal maintenance roads

Local authorities are authorized in Section 1682 of the Vehicle and Traffic Law to decide conditions to which drivers are to be alerted with traffic control devices. It is mandatory to provide signs indicating weight restrictions, low clearance, dead–end roads, railroad crossings, and road closures. These are specified elsewhere in the Law.

On low–volume local roads subject to normal maintenance activities, the decision regarding the need for other signs should be based on the *principle of positive guidance*. This principle means that hazard warnings be provided whenever a driver cannot anticipate a hazard in time to react safely. When a local official decides that a condition on the local highway system is potentially hazardous, appropriate signing, in conformance with the New York State *Manual of Uniform Traffic Control Devices (MUTCD)* (12) is to be provided.

Features that are inconsistent with the general driving environment should be identified and analyzed for the possible installation of signs. Identification can be made by driving over the highway and noting if a reduction in speed is necessary or if a surprising or unanticipated feature is encountered. Such things as isolated curves or narrow bridges, especially those with limited sight distance, should be evaluated for a "surprise" factor. Signs at every curve generally are unnecessary on low–volume local roads since drivers are aware of conditions. Signs should be restricted to those features that the superintendent determines are inconsistent with the general highway environment and cannot be anticipated early enough for drivers to take appropriate defensive action. You should record all determinations and file them for future reference.

6.2 Minimum maintenance roads

- **Design of sign**
  The New York State Department of Transportation has designed signs for posting minimum maintenance roads. These signs notify and advise motorists that reduced levels of maintenance are in effect. Figure 27 shows the minimum maintenance road sign, W4–16. The warrants for its application and the requirements for its location are listed in Appendix C.

Figure 27

Minimum maintenance road sign

- **Installation of signs**
  Minimum maintenance road signs should be installed at each end of the minimum maintenance road or section of road designated for minimum maintenance and immediately beyond intersections with other public roads. The minimum distance between signs should not exceed two miles. Additional conditions are set forth in the *MUTCD* (12). Posting of minimum maintenance road signs will not relieve rural counties or towns of their responsibility to post other legally required signs such as railroad crossings, dead ends, bridge capacity, low clearances, and road closures.

6.3 Sign management

Each locality should maintain an inventory of the signs on its roads. The inventory should record the type, legend, size, data installed, and location of each sign on its roads. Figure 5, page 22, illustrates a form which can be used to record the inventory. Such an inventory will be an asset in maintaining its signs and in the event of tort liability which involves a sign. A sign maintenance program should include the following considerations.

- **Removal of non-conforming signs**
  The first step after conducting a sign inventory is to remove all signs which do not conform to the *MUTCD* and, where warranted, to replace them with the appropriate signs which do conform to the manual. Signs which are unnecessary or do not conform to the manual tend to confuse drivers. They contribute to the disregard for signs, and they increase the potential for tort claims.

- **Replacement of damaged signs**
  Signs that are damaged, stolen, or destroyed must be replaced without delay. Employees and police should be encouraged to report damaged or missing signs immediately. The sign inventory will be of assistance in identifying missing or destroyed signs. To facilitate the rapid replacement, a supply of STOP, YIELD, and key warning signs should be kept on hand.

Figure 28 shows two W1–11 single arrow signs on a curve. One arrow is partially obstructed by brush, and the other is tilted back and rotated 180 degrees after being hit. The arrow that has been hit should be replaced.

Figure 28

Two W1–11 single arrows on a curve

- **Sign blockage**
  The visibility of signs can be blocked by an initial installation error, growth of vegetation, or changes in roadside development. Every sign should be checked at least annually to determine if blockage has occurred. The brush in front of the arrow in Figure 28 should be removed. Vegetation should be trimmed as necessary. Blockage for other reasons may require that the sign be moved.

- **Reflectorization**
  The initial reflectorization of signs is reduced by weathering and handling. An annual inspection of reflectorization is recommended. As guidance, a sample of a new sign can be placed next to an existing sign and viewed at night from 200 feet away. If the reflectively appears to be less than half of the sample, the sign should be replaced. Figure 29 illustrates a YIELD sign which is barely legible. That sign should be replaced immediately.

Figure 29

Faded YIELD sign on a town road

- **Vandalism**
  The impact of vandalism is severe in terms of safety, confusion for the motorist, public expense of replacement and the risk of tort liability. Perhaps the most effective way to treat vandalism is through countermeasures. Sign vandalism is a crime, and vandals, if caught, should be prosecuted. There are several physical countermeasures that discourage vandalism. Vandal resistant sign face material, tamper–proof fasteners, and tough and impact resistant panels. Other physical countermeasures include raising the height of the panels out of easy reach and painting the back of the panel with a black soft sticky material.

- **Unnecessary signing**
  The driver is sometimes confronted with so many signs that it can be confusing. For this reason, every effort should be made to remove unnecessary and unofficial signs from the public right–of–way. Non–standard signs should be removed. Be alert to signs which convey contradictory messages. The dual display of two regulatory devices is not only undesirable but specifically prohibited by the *MUTCD*. Rather than using two 30–inch **STOP** signs on a post to provide added emphasis, use one larger **STOP** sign.

6.4 Pavement markings

Pavement markings are an effective traffic control device. Where the width of the pavement is 18 feet or more, it is recommended that the centerline of the pavement be marked in accordance with the *MUTCD*. White edge lines on the pavement have been shown to be the most cost–effective traffic control device in reducing run–off–the–road accidents. Therefore, where possible, it is recommended that the edge line be painted on the pavement.

Once the centerline and edge lines have been painted, they must be periodically repainted to maintain their visibility. A municipality's potential for tort claims increases if it doesn't maintain the pavement markings. A municipality can anticipate having to repaint the markings every year if it is using a water–base paint system. Increased life can be obtained by using an epoxy paint system or tape, but these are more expensive.

Figure 30 shows centerline markings on a low–volume town road.

Figure 30

Centerline pavement markings on a low–volume town road

Figure 31 shows both centerline and edge line markings on a low–volume county road. Compare the ease of driving these roads at night with the road shown in Figure 19, page 40.

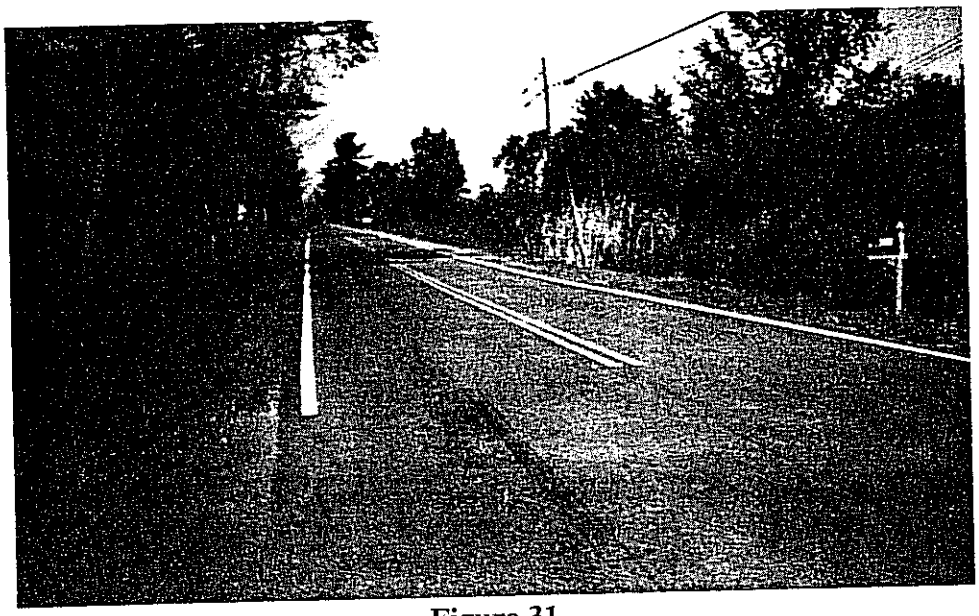


Figure 31

Centerline and edge line pavement markings on a low–volume county road

7 Determining the deficiencies and needs

7.1 Existing conditions

Once the existing conditions have been determined, it is a relatively simple task to compare the existing conditions on a road with the appropriate guidelines and identify the needs and the deficiencies. The condition of local roads form (Figure 4, page 18) facilitates this comparison. All of the information required in the existing conditions box, except for the accident history, can be completed in the field for each road segment. Furthermore, notes can be made in the needs box during the field survey. Back in the office the accident records can be searched, and the accident history for each road segment should be noted on the forms.

7.2 Desirable conditions

The low–volume local road classification and the rehabilitation design type (Table 1, page 9) for the segment are noted on the conditions of local roads form. The desired conditions for the design rehabilitation type are obtained from Table 6, page 28, and entered into the desirable conditions box.

7.3 Identifying the deficiencies

The form shown in Figure 32, summary of deficiencies on local roads, can be used to summarize the information from the conditions of local roads forms. A check mark is made in the appropriate box for each element for each segment. By glancing at the form you can quickly tell what the deficiencies are, if any, on a road. It is also possible to determine if the deficiency is localized or exists throughout the entire length of the road.

Element/ Characteristic	Road name		
	Segment No. _____	Segment No. _____	Segment No. _____
Pavement			
Narrow			
Inadequate surface			
Inadequate base, subbase			
Poor condition			
Shoulders			
Narrow			
Poor condition			
Drainage			
Incorrect grade line			
Inadequate ditching			
Clear zone			
Narrow			
Obstacles			
Steep slopes dropping away			
Alignment			
Steep grades			
Restricted sight distance			
Sharp curves			
Accident experience			
High			

Figure 32

Summary of deficiencies on local roads form

7.4 Listing needs and deficiencies

Based on the information shown on the condition of local roads form and the summary of deficiencies on local roads form, three lists of needs can be developed. These are:

Demand maintenance needs
These are activities which require a response by maintenance personnel as soon as possible to avoid serious consequences because a present or imminent danger exists. Examples include:

- Replacing signs
- Cutting brush which obscures signs
- Unplugging culverts and ditches
- Filling in the pavement/shoulder edge drop–off
- Replacing guiderail that has been damaged
- Filling potholes

Routine maintenance needs
These are activities which are normally scheduled. Timing of when the activity is done is within control of the maintenance personnel. Examples include:

- Sealing cracks in pavement
- Surface treatments
- Grade/cut shoulders
- Clean ditches and culverts
- Widen/deepen/dig new ditches
- Install guiderail
- Mow roadsides and cut brush

Rehabilitation needs
These are activities which are beyond the scope of routine maintenance activities and require the commitment of a large amount of the local highway department's resources whether the work is done by in–house personnel, by contract, or a combination of both. This list is prepared from the summary of deficiencies on local roads form. Examples include:

- Resurfacing with asphalt concrete
- Widening the pavement and shoulders on a section of road
- Constructing new ditches and installing culverts along a section of road
- Pavement rehabilitation including base/subbase reclamation
- Changes in horizontal or vertical alignment

7.5 Surface treatment, resurfacing, or rehabilitation?

A major decision for every local highway official is what to do with the pavement. The pavement shown in Figure 33 is a good example of that problem. The pavement is patched, rutted, and has alligator cracks which indicate inadequate subbase support. There are no ditches, and water ponds on

the surface.

A surface treatment or a thin hot mix overlay would cover the deficiency for a short period of time, but it would not last, and it would probably not be cost effective. On the other hand, a rehabilitation project including drainage and full depth reclamation with an overlay would be expensive.

Therein lies the dilemma of the local highway official. Chapter 8, "Choosing the right mix for your road," in *Hot and Cold Mix Paving: Principles and Practices* (7) provides guidance for the local highway official on diagnosing the road, identifying the alternatives, determining the costs and benefits of the alternatives, and selecting the best alternative.

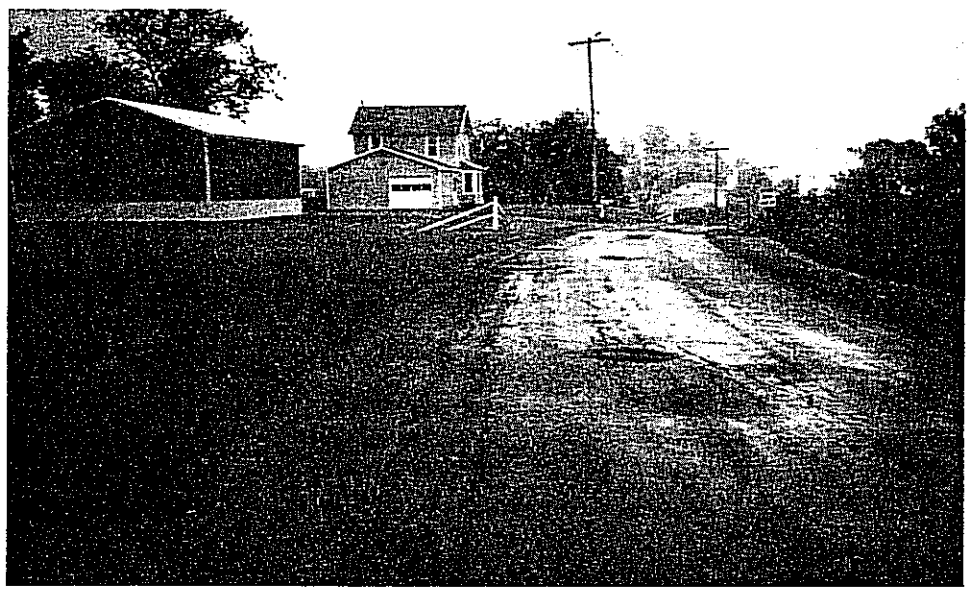


Figure 33

Distressed town road

8 Prioritization and ranking

Chapter 7 lists demand maintenance activities, routine maintenance activities, and rehabilitation projects. Demand maintenance activities should be done first. Because they are the most cost–effective use of public funds, the preventive maintenance activities, (i.e., sealing cracks, surface treatments, cleaning ditches, etc.) should be the next activities. Finally, there is a need to prioritize and rank the rehabilitation projects.

8.1 Determining priority rating

The *Manual: Guidelines for Rural Town and County Roads* (14) recommends a simple priority rating process which considers three factors. These are:

- Road classification
- Average daily traffic
- Pavement condition rating

8.1.1 Road classification

A numerical score is assigned to each road based on its classification. The scores for each classification are shown in Table 11.

Table 11

Road classification score

Road classification	Score (points)
Collector	6
Residential access	5
Farm access	5
Resource/industrial access	4
Agricultural land access	3
Recreational land access	1

8.1.2 Average daily traffic

Numerical scores are assigned to ranges of average daily traffic. These are shown in Table 12.

Table 12

Average daily traffic score

Average daily traffic	Score (points)
More than 400	10
250 to 400	6
50 to 250	3
Less than 50	1

8.1.3 Pavement condition score

The pavement condition score is based on the NYSDOT *Pavement Condition Rating Manual* (16) for paved roads. The pavement scores and the associated distresses are listed in Table 13.

Table 13

Condition rating scores for pavement surfaces (16)

Score	General condition	Unpaved roads Distress frequency*	Paved roads Distress	Distress severity
10	Excellent	None, recently constructed or reconstructed	None, recently constructed or reconstructed	—
9	Excellent	None, recently regraveled or bladed	None, recently resurfaced	—
8	Good	Infrequent (0 to 5%)	Raveling, cracking, wheel track wear	Very slight
7	Good	Infrequent to occasional (5 to 10%)	Raveling, cracking, wheel track wear	Slight
6	Fair	Occasional (10% to 20%)	Raveling, cracking, rutting, patching may exist	Moderate
5	Poor	Occasional to frequent (20% to 50%)	Raveling, cracking, rutting, patching may exist	Moderate to severe
4	Poor	Frequent (50% to 75%)	Raveling, cracking, rutting, patching may exist	Severe
3	Poor	Very frequent (75%+)	Raveling, cracking, rutting, patching may exist	Severe
2	Poor	Extremely deteriorated, motorist discomfort, travel difficulty	Extremely deteriorated, motorist discomfort, travel difficulty	—
1	Poor	Impassible	Impassible	—

* Percent of surface distress in parenthesis

8.1.4 Importance rating

The classification score and the traffic score are multiplied to determine an importance rating for the road. For example, a residential access road (a score of 5, from Table 11) having between 250 and 400 vehicles per day (a score of 6, from Table 12) would have an importance rating of 5 x 6 =30.

8.1.5 Priority rating

The priority rating is established by dividing the importance rating by the condition rating and then multiplying by 10 to avoid having to deal with small numbers. The equation is:

$$Priority\ rating = \frac{Importance\ rating}{Condition\ rating} x\ 10$$

In the example given above, had the pavement condition rating been 5 (in Table 13), the priority rating would be:

$$Priority\ rating = \frac{30}{5} x\ 10 = 60$$

A road that has a high importance rating and a low condition rating would have a high priority rating. It is possible that a collector road with an ADT of 400 and a condition rating of 2 to have a priority rating of 300. However, on low–volume roads, the priority rating will usually fall between 1 and 100.

Projects with the highest priority ratings should be rehabilitated or reconstructed first. For a road system that is badly deteriorated, there will ordinarily be insufficient money to rehabilitate all of the projects in a single year. By using this management technique, the most beneficial rehabilitation and reconstruction projects will be identified so that they can be worked on first. The above method is simple and straightforward and should be sufficient to prioritize local low–volume roads.

For those who prefer a more sophisticated priority setting methodology, Section 6.4 in *Risk Management and Minimizing Tort Liability* (17) describes a process which considers:

- Pavement condition
- Accident history
- Degree of conformity with the design rehabilitation guidelines
- Functional classification

After the priority rating is determined for each road or road segment, the next step is to rank the roads. Figure 34 is a form which has been developed to facilitate this process. Figure 35 shows the form filled out with the roads listed in Figure 3, page 12. The classification, ADT, and pavement condition have been provided. Using the tables provided in this chapter, determine the priority rating and ranking for each road.

Road name	Classification		Daily traffic		Importance rating	Pavement condition	Priority rating	Rank
	Class	Score **A**	ADT	Score **B**	**A X B = C**	Score **D**	**(C/D)X10**	

Figure 34

Prioritizing and ranking rehabilitation projects form

Road name	Classification		Daily traffic		Importance rating	Pavement condition	Priority rating	Rank
	Class	Score A	ADT	Score B	A X B = C	Score D	(C/D)X10	
Acme	Farm access		250–400			7		
Bacon	Farm access		50–100			5		
Cougar	Residential		<50			6		
Dogwood	Agricultural		<50			3		
Edgewater	Recreational		<50			4		
Granite	Resource/Ind		<50			8		
Jefferson	Resource/Ind		100–250			6		
Lake Shore Dr	Residential		50–250			6		
No. Schodack	Collector		250–400			6		
Northgate	Residential		250–400			9		
Ponderosa–1	Collector		250–400			7		
Ponderosa–2	Collector		250–400			4		
Poyneer	Resource/Ind		250–400			3		
Robinhood	Residential		50–250			8		
Rosebud	Residential		50–100			10		
Sagendorf	Collector		250–400			5		
Sunset	Recreational		50–100			4		
Van Patten	Farm access		100–250			7		
Washington	Agricultural		<50			2		

Figure 35

Prioritizing and ranking rehabilitation projects form for the Town of Fictitious

9 Develop an action plan

After the needs have been identified and the priorities have been determined, the last step is to develop an action plan which can be submitted to the town or county board for their approval and to obtain funds to progress the rehabilitation projects which will address the needs. The action plan should list, in rank order, all the projects that need to be done over a few years (five years is recommended), a brief description of the work, who will do the work, and an estimate of the cost.

9.1 Estimating costs

In Chapter 7 the needs and desirable conditions were identified for each road or road segment. The next step is to estimate the cost of a rehabilitation project. Cost information for similar work recently completed in your municipality is the best source of cost information. If you do not have any recent cost information, contact a neighboring municipality that has recently done similar work and ask them to share with you their cost information. Another source of cost information is to contact a vendor or contractor who does that type of work and ask them to give you an estimate. Be aware, however, that you should not let a vendor or contractor provide you with a quote on a proprietary process or product which would limit competition. The table in Appendix D, extracted from Reference 7, provides a range of the cost per square yard for various pavement treatments.

9.2 In-house forces versus contracting

There is a wide variation among local highway departments regarding the amount of rehabilitation and reconstruction done by the municipal forces versus that done by a competitively let contract. Factors which account for this are the size of the municipal work force, the type of equipment that it owns, the skill and experience of its employees, and the local availability of private contractors. In developing the action plan, you need to decide whether the work will be done with your own forces, through a competitively bid contract, or a combination of both where the municipal forces do some of the work, such as grading or ditching, and a contractor is hired to do the paving.

9.3 Workup for sample project

The highest priority project from the exercise in Section 8.3 is the rehabilitation of the segment of Ponderosa Road from Acme Road to the County Road. Figure 36 is the completed existing conditions of local roads form for this segment of Ponderosa Road.

Existing conditions of local roads

Road name Ponderosa **Road No.** 1000-2 **By** C. Brown **Date** 6/15/95

Segment No. 2 **From** Acme **To** County Rd. **Class** Low-volume collector

Design rehabilitation type (A) B C

Desirable: Pavement type (Asphalt concrete) Surface treated Aggregate Speed 45 Pavement width 20' Shoulder width 2' Clear zone 10'	
Existing conditions	**Needs**
Traffic volume (ADT) 300 **Operating speed** ≈ 40	
Pavement type: Natural soil____ Gravel____ Cold mix ✓ Chip seal ____ Hot mix____ Port. cement____ Overlay____	Asphalt concrete pavement
Pavement width 18 **Pavement condition** 4	
Crown slope Left: OK ____ Too flat ✓ Too steep____ Right: OK ____ Too flat ✓ Too steep ____	Reshape
Shoulder width Left 2 Right 2 Condition OK	
Pavement/shoulder drop-off Left 0 Right 0	
Ditch Left: Not Needed____ Req'd ✓ Clean____ OK____ Right: Not Needed____ Req'd____ Clean ✓ OK____	Granite - County Road
Culverts Req'd____ Need replace____ Clean____ OK ✓ Req'd____ Need replace____ Clean____ OK ✓	Lengthen for additional width
Clear Zone Left 6' Right 6'	10' desirable
Guiderail Left: Type____ Condition____ Right: Type box beam Condition OK	Need 500' box beam between Acme and Granite
Horizontal curve Alignment: OK ____ Too sharp ✓ Sight distance: OK for speed ____ Inadequate ____	Flatten curve between Acme and Quik Mart
Vertical alignment OK for speed ✓ Inadequate ____	
Intersection sight distances Approach: OK ___ Too short___ Cross road: Left: OK ____ Too short ✓ Right: OK ____ Too short ____	Improved intersection with Granite
Signs (See road segment sign inventory form)	
Accident history OK ✓ Property damage __ Injury__ Fatal __	
Other	

Figure 36

Existing condition of local roads form for Ponderosa Road, segment 2

The town highway superintendent decided that the town forces would clean the ditches, grade a new ditch between Granite and the County Road, lengthen the culverts to obtain the additional width, remove boulders to increase the clear zone, and work with the utility company to relocate utility poles. Dave's Sand & Gravel agreed to do the grading required to improve the sight distance at the intersection with Granite Road. Their trucks and those of their employees and customers were most affected by the poor existing sight distance. Flattening the curve, paving with hot–mix asphalt, and installing box beam guiderail is beyond the capability of the town forces and will be let out to bid. The town forces will do their work in 1996 and the contract work will be done in 1997.

Estimated costs

For work done by town forces: $10,000
For work done by contract:
Flattening the curve:
Grading 5,000 cubic yards @ $10 = $50,000
Paving:
2–course overlay, area = 3 miles x 5,280 feet/mile x 20 feet wide = 316,800 square feet
316,800 square feet/9 square feet per square yard = 35,200 square yards
35,200 square yards @ $6 square yard = $211,200
Box beam guiderail:
500 feet @ $25/foot = $12,500
TOTAL: $273,700

The same kind of analysis has to be done for each rehabilitation project. The information is then used to complete the action plan form.

9.4 Action plan

Figure 37 shows the rehabilitation project action plan for the Town of Fictitious that would be presented to the town board by the town highway superintendent. The projects are in priority order for the next five years.

- The amount needed in each of the first four years is approximately $400,000. When developing an action plan try to smooth out the peaks and valleys. To accomplish this it may sometimes be necessary to do the projects out of their rank order.
- Funds required in the last year are lower than the first four years. It is advisable not to identify projects for all of the funds you might obtain. Projects slip, and there are always unanticipated needs and changes. Allow some slack in the program to be able to accommodate needed change.
- There is work to be done by contract and by town forces in each year. In 1997 the town work is entirely maintenance. Use stage construction when feasible. Do preparatory work one year, to be followed up by a contract the following year.
- There is no work planned for Northgate and Robinhood. The pavements are in good condition on these residential roads and there are no needs at this time. A surface treatment is planned for Rosebud even though it is a gravel road in good condition because there have been complaints about dust. No rehabilitation work is planned for Dogwood and Washington because these are both candidates for designation as minimum maintenance roads. Any required maintenance will be done by town forces on an *as needed* basis.

Rank	Year	Road	Work to be done	Town forces or contract	Estimated cost
1	1996	Ponderosa–2	Ditching, extend culverts, remove boulders	Town	$10,000
2	1996	Poyneer	Paving	Contract	$80,000
3	1996	Sagendorf	Reclamation with overlay	Contract	$200,000
4	1996	No. Schodack	Mill and fill	Contract	$80,000
6	1996	Acme	Ditching, culverts	Town	$30,000
Total	**1996**				**$400,000**
1	1997	Ponderosa–2	Grading, paving, guiderail	Contract	$275,000
5	1997	Ponderosa–1	Single course overlay	Contract	$65,000
6	1997	Acme	Widening, paving	Contract	$80,000
Total	**1997**				**$420,000**
8	1998	Bacon	Surface treatment	Town	$40,000
9	1998	Lake Shore Dr.	Drainage, widening, paving	Contract	$100,000
10	1998	Van Patten	Reclamation with overlay	Contract	$250,000
Total	**1998**				**$390,000**
11	1999	Jefferson	Widening, 2 course overlay	Contract	$400,000
13	1999	Rosebud	Double surface treatment	Town	$50,000
Total	**1999**				**$450,000**
16	2000	Cougar	Single surface treatment	Town	$50,000
17	2000	Sunset	Single course overlay	Contract	$40,000
18	2000	Granite	Single course overlay	Contract	$40,000
19	2000	Edgewater	Double surface treatment	Town	$30,000
Total	**2000**				**$160,000**

Figure 37

Rehabilitation project action plan for the Town of Fictitious

Appendix A References

1. Article 16-B, Executive Law

2. Senate Bill 7189–B, January 29, 1986

3. *A Policy on Geometric Design of Highways and Streets*, American Association of State Highway and Transportation Officials, Washington, D.C., 1990

4. **Basics of a Good Road*, CLRP Report # 93–3, Cornell Local Roads Program, revised January 1993

5. **Chip Seals and Surface Treatments,* CLRP Report # 91–5, Cornell Local Roads Program, 1991

6. *Guidelines for Rural Town and County Roads*, Local Road Classification Task Force, Report to the Governor and to the Legislature, December 1988

7. **Hot and Cold Mix Paving: Principles and Practices,* CLRP Report # 95–4, Cornell Local Roads Program, March 1995

8. *Improving Guardrail Installations on Local Roads and Streets,* Federal Highway Administration, January 1986

9. *Instructions for Updating the Local Highway Inventory,* New York State Department of Transportation Planning Division, Data Services Bureau, September 1994

10. *Local Low–Volume Roads and Streets,* American Society of Civil Engineers, November 1992, printed by Office of Technology Applications, Federal Highway Administration, Publication No. FHWA–SA–93–006, Washington, DC

11. **Managing Your Clear Zones*, 1989, Cornell Local Roads Program

12. *Manual on Uniform Traffic Control Devices,* Traffic and Safety Division, New York State Department of Transportation, Albany, NY, 1983

13. *Manual: Guidelines for Rural Town and County Roads*, Local Road Classification Task Force, December 1989

14. *Manual: Guidelines for Rural Town and County Roads,* Local Road Research and Coordination Council, December 1992 (revised and reprinted March 1996)

15. *Materials and Procedures for the Repair of Potholes in Asphalt–Surfaced Pavements,* Asphalt Pavement Repair Manuals of Practice, SHRP–H–348, Strategic Highway Research Program, National Research Council, Washington, DC, August 1993

16. *Pavement Condition Rating Manual,* New York State Department of Transportation Planning Division, April 1990

17. **Risk Management and Minimizing Tort Liability for Local Highway Departments,* CLRP #91–10, Cornell Locals Roads Program, September 1991

18. *Roadside Design Guide,* American Association of State Highway and Transportation Officials, Washington, DC, October 1988

19. *Roadside Improvements for Local Roads and Streets,* Federal Highway Administration, October 1986

20. *Safety Opportunities in IVHS,* Standing Committee on Highway Traffic Safety, American Association of State Highway and Transportation Officials, Washington, D.C., July 1993

21. *Summary Report on Selected Guardrails,* Report No. FHWA–SA–91–050, Federal Highway Administration, June 1992

22. *Traffic Sign Handbook for Low-Volume Rural Roads*, Traffic and Safety Division, New York State Department of Transportation, June 1985

23. **Upgrading Your Roads*, CLRP Report # 92–6, Cornell Local Roads Program, 1992

*publications available from the Cornell Local Roads Program
(see front cover for address and telephone number)

Appendix B NYSDOT regional office officials

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Richard Schamlz, *Planning/Programming*
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Long Island City, New York 11101
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Appendix C Warrants for the minimum maintenance road sign

yellow background
black legend

Minimum maintenance road sign, W4–16

				Letter size and series		
Sign No.	**Size**	**Margin**	**Border**	**Line 1**	**Line 2**	**Line 3**
W4–16B	24" x 24"	3/8"	5/8"	3"–C	3"–C	3"–C
W4–16C	30" x 30"	1/2"	3/4"	4"–C	4"–C	4"–C
W4–16D	36" x 36"	5/8"	7/8"	5"–C	5"–C	5"–C
W4–16E	48" x 48"	3/4"	1 1/4"	6"–C	6"–C	6"–C

(a) Application

(1) This sign is for use to warn that a lower than normal level of maintenance is being provided on a highway, or highway section.

(2) The Local Roads Research and Coordination Council's publication, *Guidelines for Rural Town and County Roads*, contains standards for the maintenance of such roads.

(3) The W4–16 sign should be used only where all of the following conditions exist:

(i) The road is in a rural area

(ii) The average traffic volume is 50 vehicles per day or less

(iii) The road's principal or exclusive function is to provide access to farm and/or recreational lands

(iv) The road does not provide the only highway access to any business, residence, or center of farm operation

(4) The W4–16 sign may be supplemented with a W9–2 auxiliary mileage sign where the reduced maintenance road (or road section) is 1,000 feet long or longer.

(b) Location

(1) The W4–16 sign is in posting category IV. It should be placed on the right side of the roadway facing approaching traffic at each end of the minimum maintenance section.

(2) Additional W4–16 signs should be placed on the minimum maintenance road immediately beyond intersecting roads.

(3) Where the minimum maintenance road (or road section) is long, and the distance between successive W4–16 signs is more than two miles, additional signs should be placed so that motorists will encounter a sign at least once every two miles.

(c) Supplemental and related devices

Seasonal limited–use highway sign and W9–2 auxiliary mileage sign.

Appendix D Approximate costs of pavement rehabilitations

Approximate costs of pavement rehabilitation treatments

Treatment	Total cost* (1994 $/square yard)
Surface treatment: single double	 $.75 – $1.75 $1.25 – $2.75
Slurry seal	$.85 – $2
Micropave	$.90 – $3
Single course overlay 1½	$2 – $4.50
Cold mill and replacement 1½	$2.75 – $5.50
Two–course overlay 3"	$4 – $9
Cold recycle 3"	$2 – $4
Multiple course overlay 6"	$6 – $13.50
Reclamation with overlay	$6 – $20
Total reconstruction	$15 – $50

*Costs are contractor costs including labor, materials, equipment, profit, etc.

Source: Reference 7