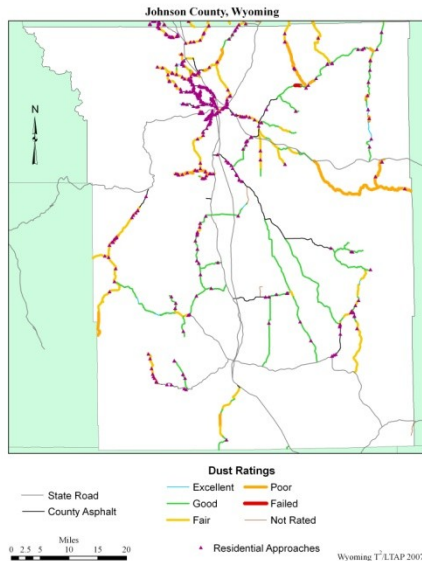


Gravel Roads Management: Programming Guide



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Introduction

This *Programming Guide* is intended to assist programmers and database managers with some of the programming and other information that will be needed to implement a gravel roads management system (GRMS) as described in the '*Gravel Roads Management: Implementation Guide*' prepared as part of an effort to assist local government agencies with the implementation of a GRMS. For more details, see the final report titled *Gravel Roads Management*.

While many decisions will have to be made by the programmer or data manager, this guide should answer many of the questions that will arise when developing code and software structures to manage and analyze data from a GRMS. It is assumed that programmers and database managers will be working with road and bridge personnel, particularly the supervisor, and that the road and bridge personnel will be working with the *Implementation Guide*. This Guide goes into enough detail so that programmers and data managers understand the process, though in many instances, additional detail will need to be drawn from the final report or the *Implementation Guide*.

Various flowcharts show processes that will take place, both within and outside of any software that is written. Verbal descriptions accompany each flowchart explaining its purpose and application.

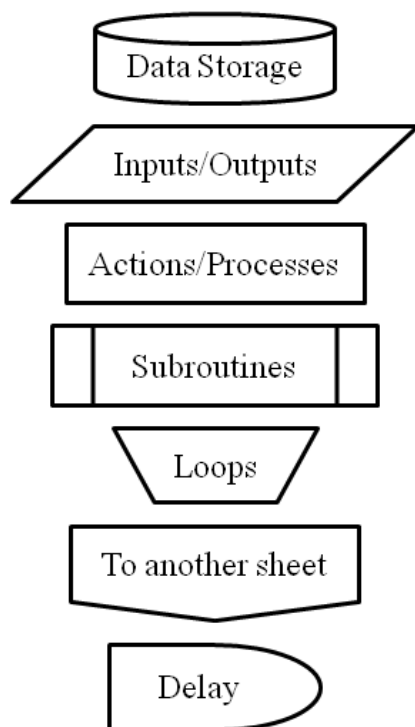


Figure 1: Shapes key

Figures 1 and 2 indicate what the various symbols in the flowcharts mean.

Figure 3 illustrates the various tables and their relationships. The inventory table is the master. All data in the Location, Maintenance, Maintenance Schedule, and Condition tables will have information referenced to the section ID for each record. The external and peripheral data tables refer to tables external to a GRMS that may provide useful information, particularly costs, but are not linked to a particular section of road.

Nine tables are suggested that may hold information relevant to unsealed roads management, particularly cost data.

Many of these may already be present in an existing cost tracking system, though they may use function, object and activity codes

and line items assigned by accountants. If this is the case, provisions should be made to adjust them so that they provide information that is easily put to use for engineering as well as accounting purposes. These nine tables, also shown in Figure 3, are:



Figure 2: Colors key

- Labor
- Equipment
- Materials
- Gravel
- Supplies
- Traffic Control
- Water
- Haul
- Travel

Another nine tables are described that hold information directly relevant to unsealed roads management, and a tenth table is described that holds data relevant to cyclic maintenance scheduling. They are:

- Inventory
- Location
- Legal and Right-of-Way
- Traffic
- Condition
- Utilities
- Safety
- Drainage
- Maintenance
- Cyclic Maintenance

Individual programmers may elect to store their data in different ways, but this schema provides a reasonable way to organize the various tables that will comprise a GRMS.

Tables 1 through 27 in the Tables of Data Fields section below and an accompanying spreadsheet contain recommended fields and information about them that provides some of the metadata needed for a valid database. The following information is provided for the fields:

- Title
 - Verbal name of the field
- Heading_8
 - An eight or fewer character heading, all in uppercase, without spaces, and with only underbars as punctuation
- Units
 - When applicable, the units of the field are defined
- Data Type
 - A data type for programming purposes is suggested, such as integer, double, or string
- Default Value
 - The value to be displayed in forms if nothing else is entered
- Input Format
 - An entry method within a form is suggested
- Description and Commentary
 - Additional information about the field
- Error Limits
 - Eligible values for error checking
- Options
 - List of entries to appear in dropdown lists, radio buttons, and so on

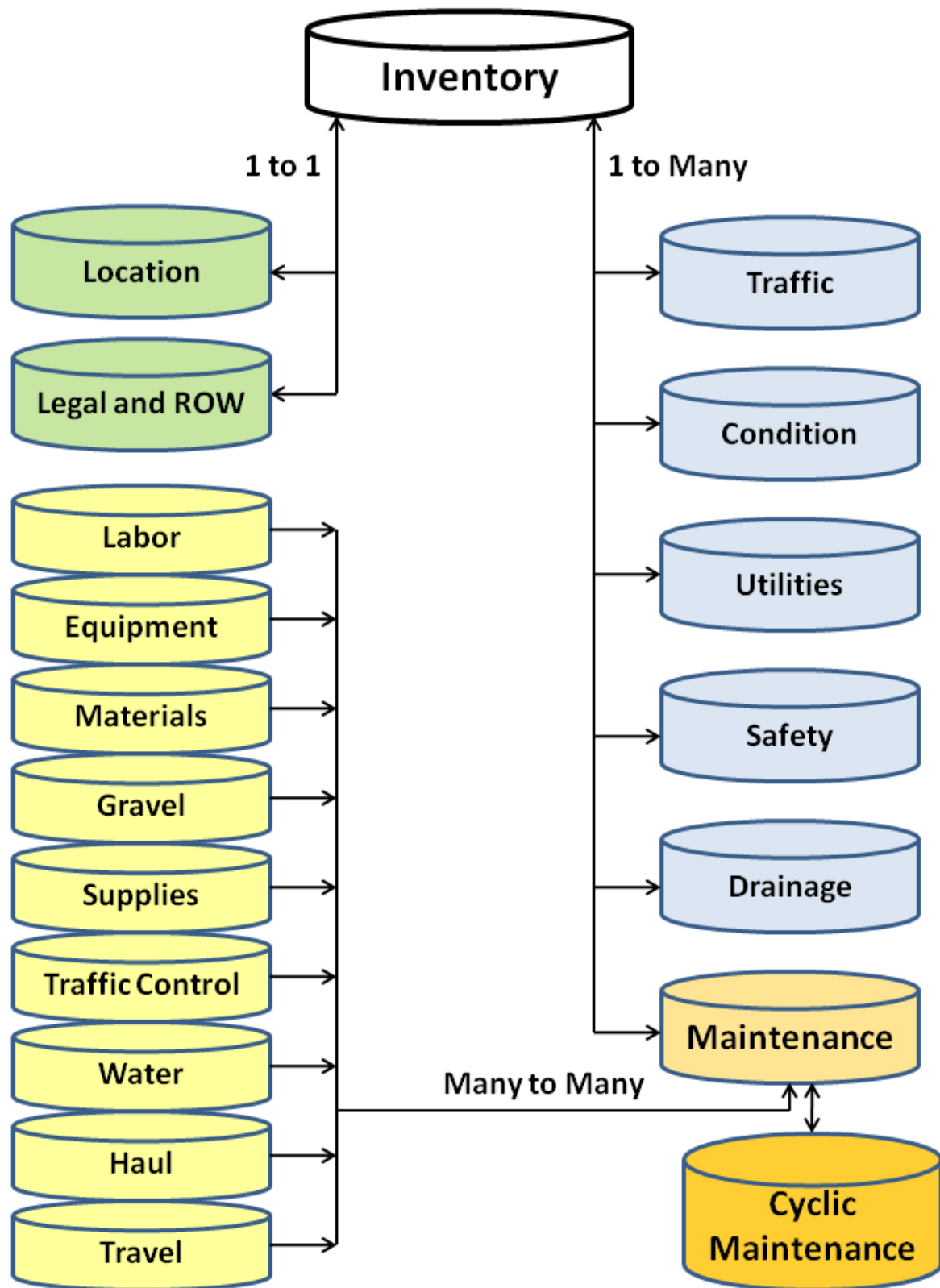


Figure 3: Data tables and relationships

Inventory

The inventory table contains basic, static information about each road section. There will be one record for each section, and each section will have a unique section ID.

Section ID Assignment

Each programmer and agency will need to develop a scheme to uniquely identify each road section within the network. The important criteria are, first, that a section can be further divided if the need arises, and, second, that it is relatively easy to recognize which section one is discussing simply from the section's unique ID.

Many agencies will already have an established system. One consideration for programmers is that in some cases an established section or road may need to be subdivided into several discrete sections, perhaps with the simple addition of an 'A' or a '1' and '2' to identify different sections. If a new scheme is developed, a good option would be to have a road number, the beginning milepost, and the ending milepost. For example, county road 22A from mile marker 0.00 to 12.90 might be called: 022A_00000_01290, allowing the use of a 16-digit string variable. In this system, four digits would identify the road, five would identify the beginning mileage, and five would identify the ending mileage. This would allow sections to easily be split. For example, it might be decided that most of the work done on road 22A has been performed on the first 2.68 miles where traffic from a subdivision enters, so the section should be split there. All entries in all tables for section 022A_00000_01290 would be changed to 022A_00000_00268, and a new section, 022A_00268_01290 would be created and inventory data for this section would be collected for the 10.22 miles beyond the subdivision entrance at milepost 2.68.

The process of establishing sections, also referred to as 'maintenance management sections,' is to be performed by supervisors and maintainers. Once they have established the limits of the sections, the data manager will need to input the limits of the section into the database. Figure 4 shows some of the information that will be needed to establish the sections. Data managers should be prepared to provide other personnel with this information so they may make good decisions as to where to split roads into sections.

Fields

There are many fields one might program into an unsealed roads inventory. For most agencies, it would make sense to have a single inventory for all their roads, regardless of surface type. With this consideration, four pieces of information, five fields, are considered critical to any roadway inventory:

- Unique Section ID
- Location
 - At a minimum, the beginning and ending points should be defined
 - Ideally, a GIS would be used and shape files would be referenced in the inventory
- Length
- Surface Type

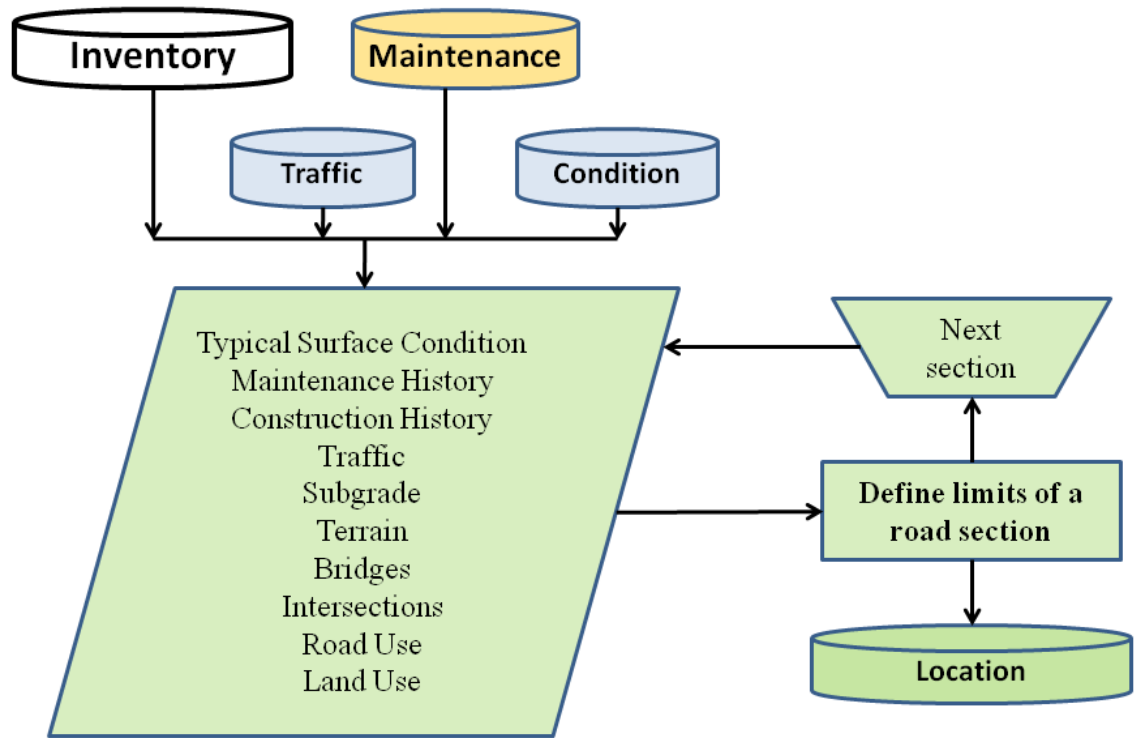


Figure 4 Establishing limits of maintenance management sections

A number of other fields are desirable, listed here in approximate order of importance:

- Road Name
- Road Number
- Top Width
- Inventory Date
- Inventory Data Collector
- Owner
- Right-of-Way or Easement Width
- Functional Class
- Maintenance Intervention Level
- Maintenance Strategy
- Maintenance District
- Traffic Volumes
 - Measured
 - ADT
 - % Trucks >10,000 lbs
 - Estimated
 - ADT
 - % Trucks >10,000 lbs

- Traffic Speeds
 - Posted
 - Statutory
 - Measured
 - Mean
 - 85th Percentile
 - Design
 - Typical safe driving speed
 - Surface condition limited
 - Sight distance limited
 - Alignment limited
- Utilities
 - Type
 - Location
 - Contact Information
 - Legal agreements
- Legal Documentation
- Survey Information
- Subgrade Type(s)
- Roadway Prism Height
- Road Use
- Land Use
- Terrain
- Other Roadway Features

Maintenance and Cost Tracking

There are a number of commercial software programs for tracking maintenance and costs. Unfortunately many of these are more tailored to accounting purposes rather than to engineering or road management purposes. A comprehensive discussion of maintenance and cost tracking is beyond the scope of this project. However, there are some fundamental principles relating to tracking maintenance and costs.

Maintenance histories for each road section should be easily accessible through a GRMS. The histories should be in terms of these eight maintenance tasks:

- Blading
- Reshaping
- Regraveling
- Dust control
- Stabilization
- Drainage maintenance

- Isolated repairs
- Major improvements

Often this will necessitate changes in the line items to which costs are assigned, in how data analysis is performed, and in reports generated. In the simplest terms, this means that all maintenance performed directly on unsealed roads must be assigned to one of the eight tasks. Then, when data are retrieved for a given section, all work done to the section should appear in chronological order, ideally with the cost of performing each task also retrieved.

Maintenance histories should be easily retrieved, since they are fundamental information needed when the common complaint is received, “You haven’t bladed my road in months and it needs it now!” Whoever answers the phone should be able to pull up any road section and immediately view the road’s recent maintenance history. Ideally they would also have a maintenance schedule so they could tell the caller when the road is scheduled for its next maintenance and which roads will be maintained before the caller’s road.

The main reason for accurately tracking maintenance is so that future maintenance activities can be scheduled in a rational manner, rather than on a complaint basis.

Cyclic Maintenance Scheduling

Cyclic maintenance scheduling is a process where maintenance frequencies and practices are assumed

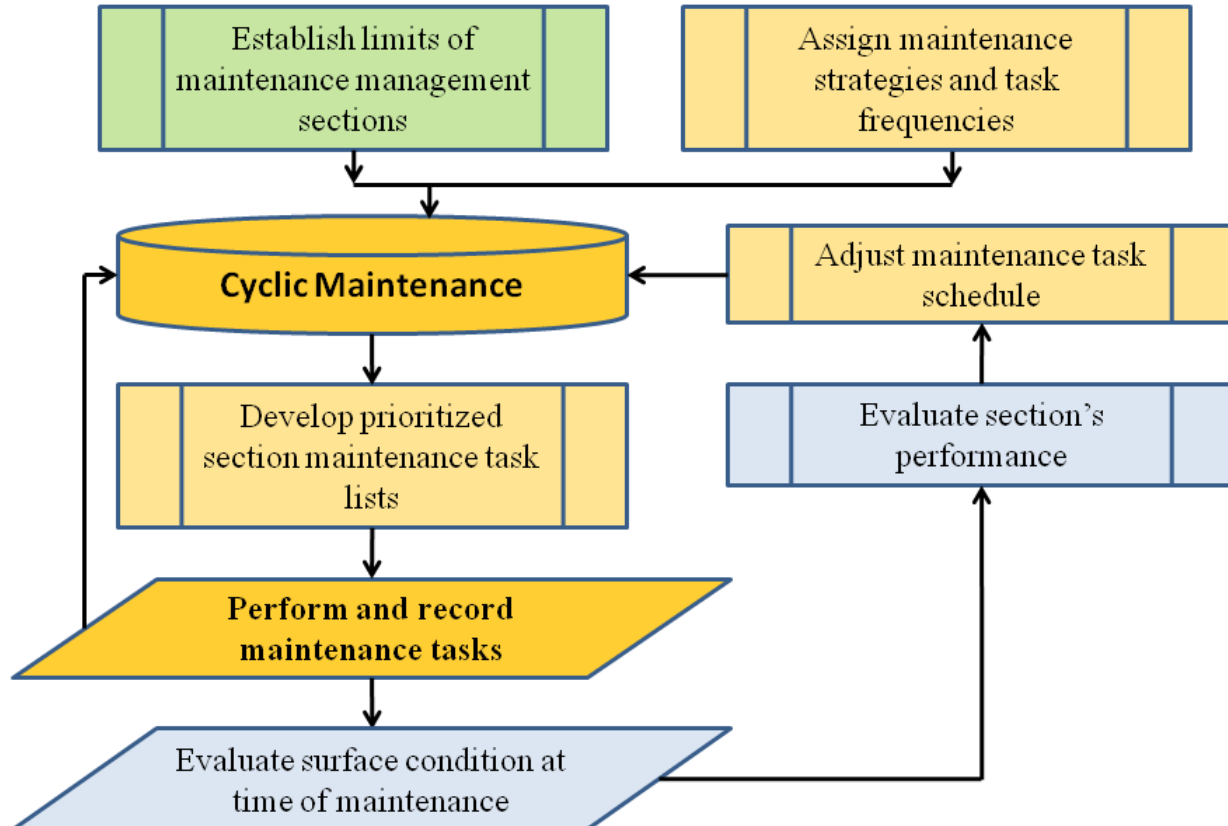


Figure 5 Cyclic maintenance scheduling

and schedules are generated for maintainers and supervisors that let them perform maintenance on a scheduled basis. Collecting condition data will allow these maintenance schedules to be adjusted based on the performance and durability of the road section being maintained. Figure 5 presents the overall cyclic maintenance scheme.

The first two steps, the upper rectangles in Figure 5, are the division of the road network into 'maintenance management sections' and the assignment of maintenance strategies, task frequencies, and maintenance intervention levels to each section.

Next, the maintenance cycle is entered. Prioritized task lists are generated. Work is performed and recorded. Surface conditions at the time of maintenance are evaluated. Timing of maintenance on individual sections is adjusted based on the observed surface conditions. The cycle is modified and the process continues.

Defining Maintenance Strategies

The process of defining maintenance strategies will be performed by supervisors and maintainers; they must provide these definitions in a format that allows programmers and database managers to generate prioritized maintenance task lists. Figure 6 demonstrates the input sources that supervisors and

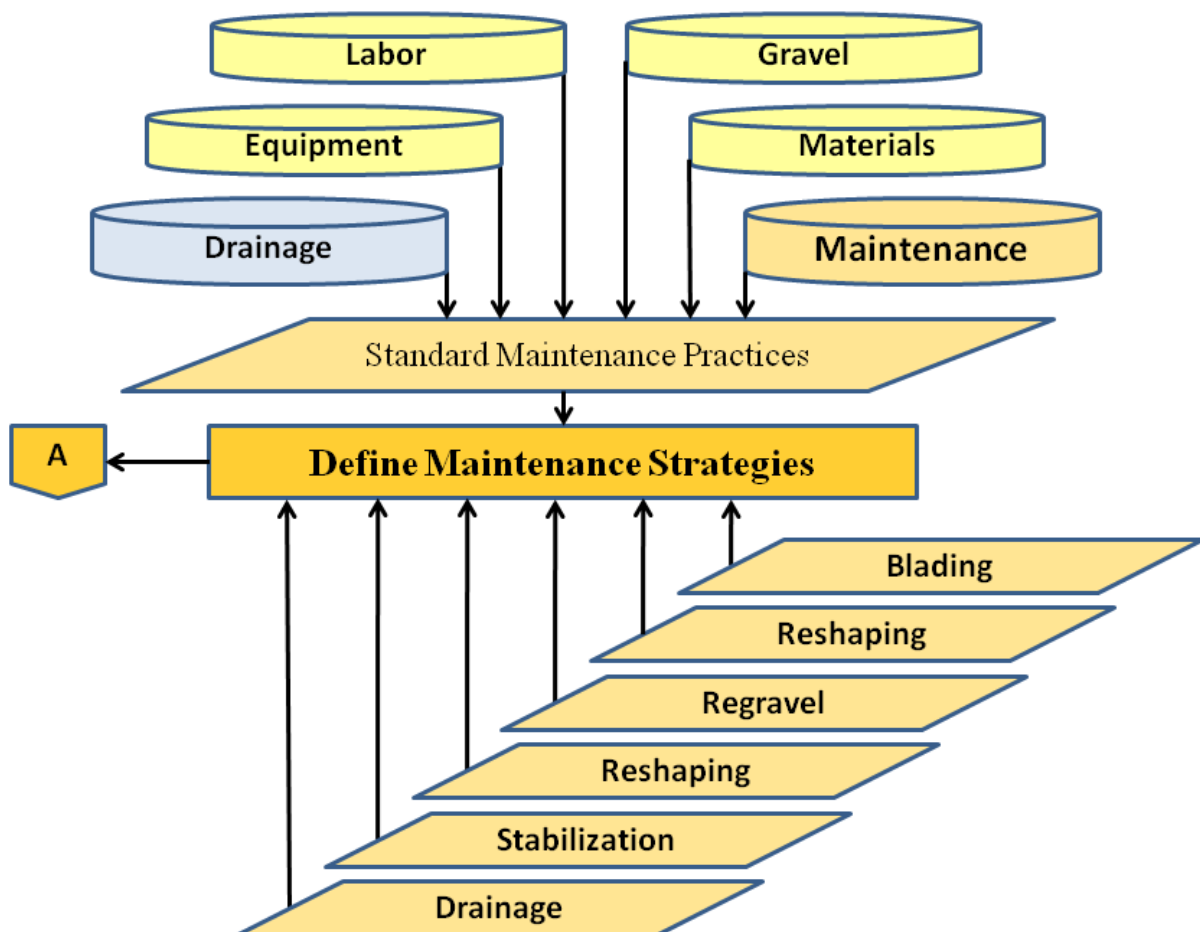


Figure 6 Defining maintenance strategies

maintainers will use to establish a maintenance strategy and task frequency for each road section. Strategies will be those currently used by the agency. If maintenance data are currently available, this information could simply be taken from existing records. However, supervisors should be aware of any influences, such as a frequent complainer that may have influenced the decision of when to maintain individual roads in the past.

Assign Maintenance Intervention Levels

In order to decide when a road needs to be maintained, an agency must establish the worst acceptable condition, a maintenance intervention level, for each road section. These values will be used to assess whether maintenance periods should be extended or shortened when combined with observations of current surface conditions when maintenance is performed.

Assign Task Frequencies

Once the maintenance strategies are assigned, each task will be assigned a frequency. **Table 3 Tasks Include with Each Primary Task** in the *IMPLEMENTATION GUIDE* shows which tasks are assumed to be completed when a primary task is performed. This will guide the resetting of the maintenance period for some of the maintenance tasks. Individual agencies should modify these assumptions based on their maintenance practices.

Figure 7 illustrates how inputs are combined to initiate the maintenance cycle. Once maintenance task

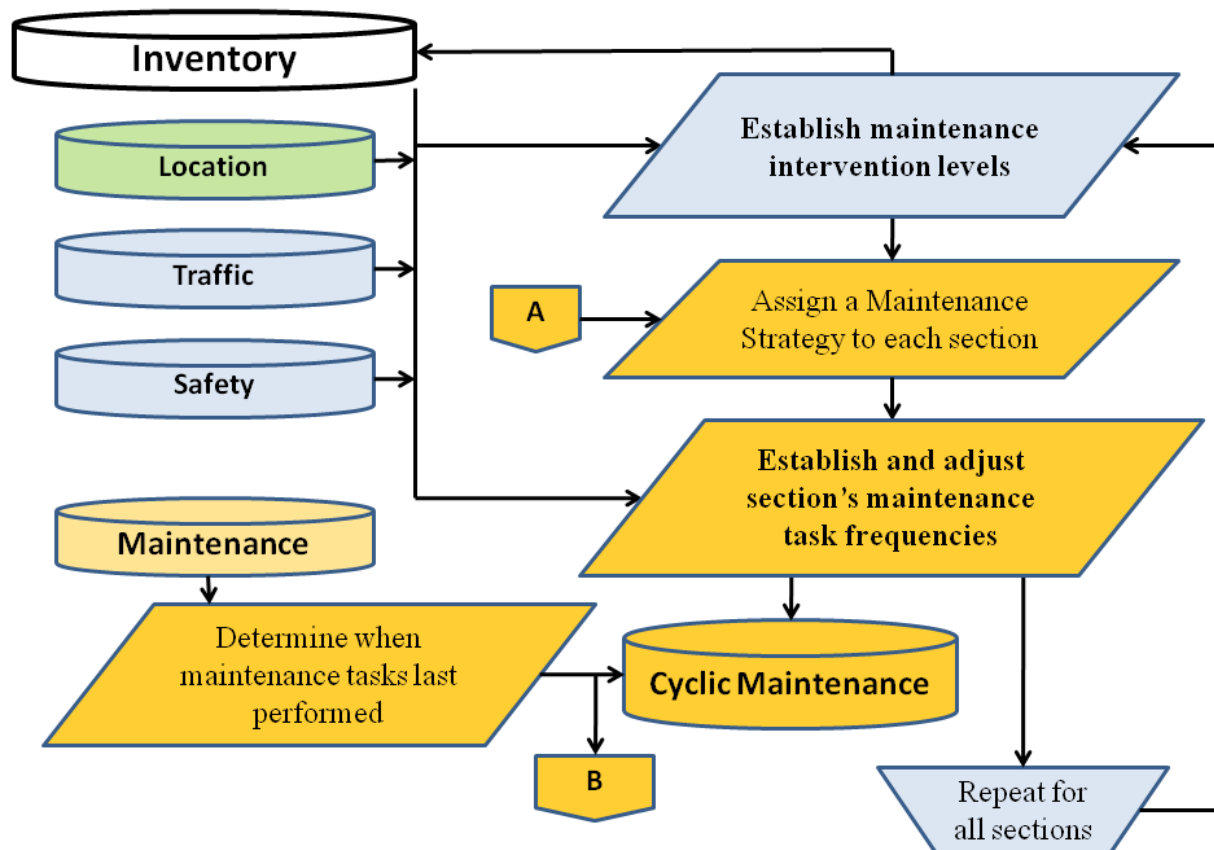


Figure 7 Assign maintenance strategies and task frequencies

frequencies are established and the time when each maintenance task was last performed, the maintenance cycle begins.

Figure 8 illustrates how the prioritized maintenance task lists are generated. The time since every task was performed on every section is calculated and compared to the assigned period for that task and road section. Those tasks at the highest percentage of their assigned periods are placed at the top of the prioritized lists. A list is generated for each maintainer and for the supervisor. One of the supervisor's reports will contain all maintenance tasks for the entire unsealed road network, while the other will contain only the regreveling, dust control, stabilization and drainage maintenance functions since these are generally performed by a crew. The maintainer will get only a list of blading and reshaping tasks on the individual maintainer's road sections.

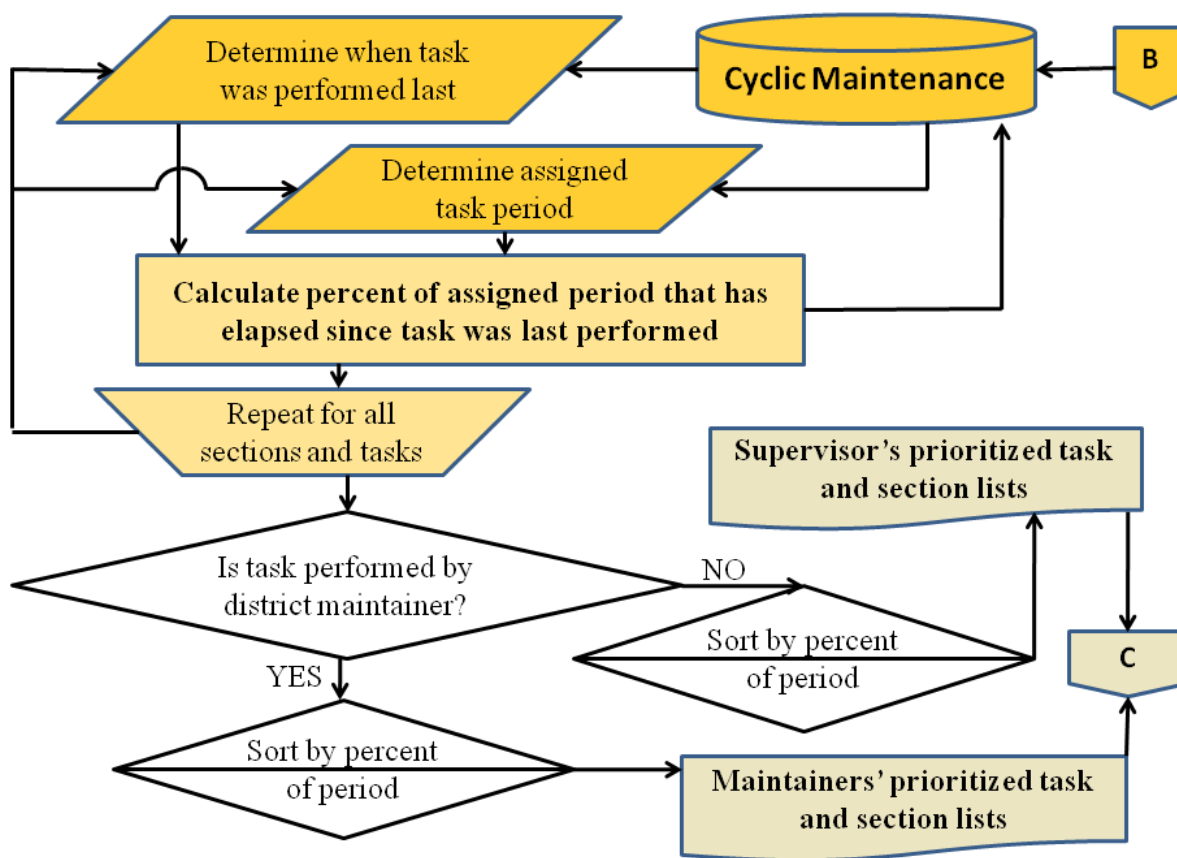


Figure 8 Develop prioritized section maintenance task lists

Figure 9 shows the procedures to be used when adjusting the maintenance period for each task on each section. As noted, the algorithms for this have not been firmly established. Experience will be the best guide for establishing exactly how these adjustments are made. The theory is simple. If the task periods are correctly set, the section's condition when it is at 100% of its maintenance task period will be its maintenance intervention level. Data from all roads when they are maintained should be compared. Roads may be maintained at times widely varying from the theoretically correct 100% of the maintenance task period. Initial data might indicate, for example, that when roads are bladed at 150%

of their assigned time, they are about 1½ rating points on a ten-scale worse than their maintenance intervention levels (MIL). Then those sections that are bladed at 150% of their assigned period that are ½ point less than their MIL or better could have their period lengthened by, perhaps, 30%. Those that are 2 points worse than their MIL could have their assigned times shortened by 15%. The details of this process will need to be worked out. This is one primary function of performing a pilot project to flesh out the details of a cyclic maintenance process.

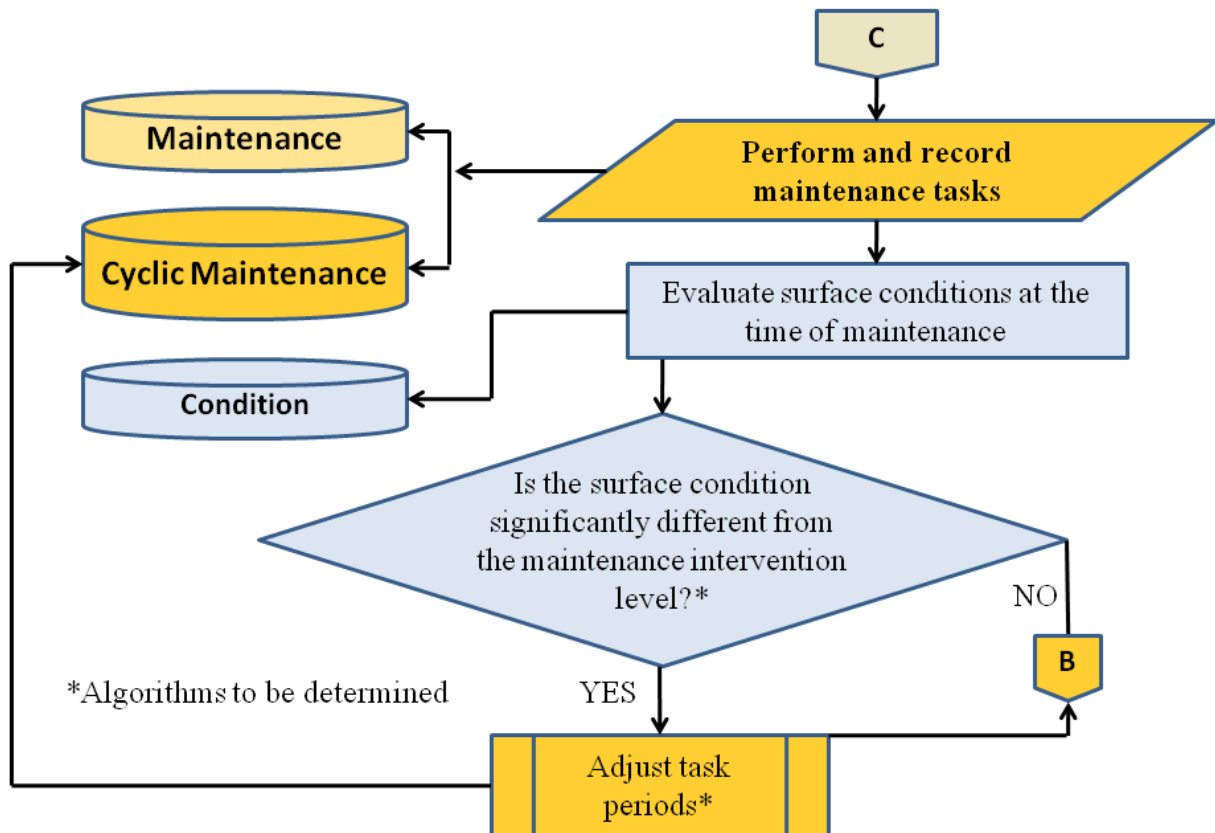


Figure 9 Perform and record tasks; evaluate surface conditions; adjust task periods

Triggered Maintenance Scheduling

The principle of triggered maintenance scheduling is very simple, though its execution can be difficult, primarily due to the data inputs needed to make the system work. The basic idea is that whenever a certain condition falls below an acceptable level, maintenance is performed. Normally the condition that triggers maintenance is some performance characteristic, though other triggers such as maintenance frequency might also be used. Figure 10 demonstrates the typical process of triggered maintenance scheduling.

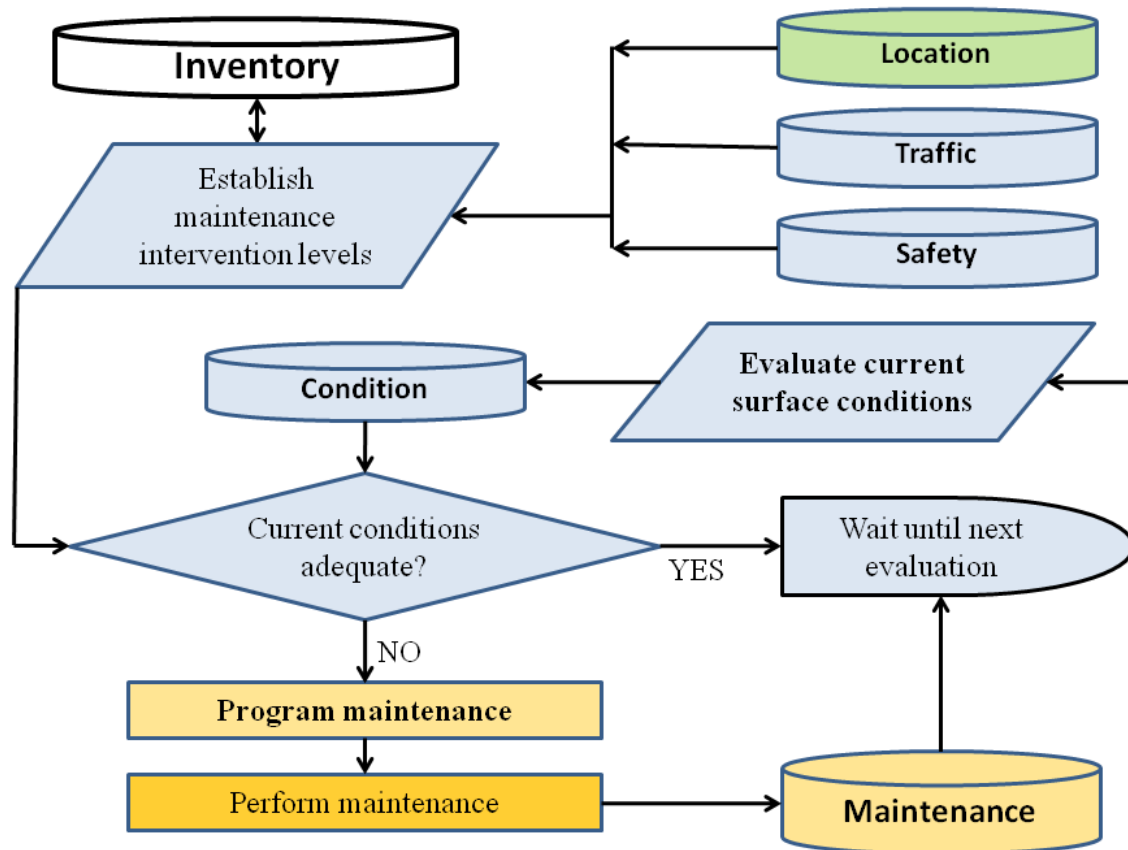


Figure 10 Triggered maintenance scheduling

Tables of Data Fields

Inventory

Main

Table 1 Inventory: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
INV_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
INV_DATE	Inventory Date	Date	Date	Today	Text Box
INV_PERS	Inventory Data Collector	--	String	Blank/ Previous	Combo Box
ROADNAME	Road Name	--	String	Blank/ Previous	List Box
ROADNUMB	Road Number	--	String	Blank/ Previous	List Box
LENGTH	Section Length	miles	Double	Blank	from GPS or Text Box
TOP_WDTH	Top Width	feet	Double	Blank	Text Box
SURF_TYP	Surface Type	--	Integer	3 - Gravel/ Previous	Radio Button
FUNCT_CL	Functional Class	--	Integer	0 - Not assigned	Radio Button
MIL	Maintenance Intervention Level	--	Integer	0 - Not Rated	Radio Button
MAINT_ST	Maintenance Strategy	--	Integer	5 - BDGS	List Box
MAINT_DT	Maintenance District	--	Integer	Blank/ Previous	List Box
SG_ASHTO	Subgrade Type - AASHTO	--	Integer	Blank	List Box
SG_GI	Subgrade Type - AASHTO Group Index	--	Integer	Blank	Text Box
SG_USCS	Subgrade Type - USCS	--	Integer	Blank	List Box
SG_QUAL	Subgrade Quality	--	Integer	Blank	List Box
ROAD_HT	Roadway Prism Height	--	Integer	Blank	List Box
ROAD_USE	Primary Road Use	--	Integer	Blank	Check Box
LAND_USE	Primary Land Use	--	Integer	Blank	List Box
TERRAIN	Terrain	--	Integer	Blank	List Box
INV_COMM	Section Inventory Comments	--	String	Blank	Text Box

Comments

Table 2 Inventory: Comments

Heading_8	Description and Commentary
INV_KEY	A number unique for each entry
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps four digits for the road number _ begin MP _ end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
INV_PERS	Agency generated list of data collectors
ROADNAME	List of all road names generated by and unique to the agency
ROADNUMB	List of all road numbers generated by and unique to the agency
LENGTH	Input methods to be generated by GIS programmer
SURF_TYP	May also include other surfacing types, as indicated in blue below
FUNCT_CL	May also include other functional classes, as indicated in blue below
MAINT_ST	See list, or as designated by the agency
MAINT_DT	Agency list of maintenance districts
SG_ASHTO	See list
SG_GI	Group Index determined by laboratory testing
SG_USCS	See list
SG_QUAL	See list
ROAD_HT	See list
ROAD_USE	See list
LAND_USE	See list
TERRAIN	See list
INV_COMM	A number unique for each entry

List Options

Table 3a Inventory: List Options

SURF_TYP	FUNCT_CL	MIL	MAINT_ST	SG_ASHTO	SG_USCS	SG_QUAL
1 - Dirt/Earth - Unimproved	0 - Not assigned	0 - Not Rated	1 - N	1 - A-1	1 - GW	1 - Failed
2 - Dirt/Earth - Improved	1 - Rural minor access	1 - Failed	2 - D	2 - A-1-a	2 - GP	2 - Very Poor
3 - Gravel	2 - Rural major access	2 - Very Poor	3 - BD	3 - A-1-b	3 - GM	3 - Poor
4 - Gravel with Isolated Dust Control	3 - Rural minor collector	3 - Poor	4 - BDS	4 - A-3	4 - GM-GC	4 - Poor
5 - Gravel with Dust Control	4 - Rural major collector	4 - Poor	5 - BDSG	5 - A-2	5 - GC	5 - Fair
6 - Stabilized Gravel	5 - Rural minor arterial	5 - Fair	6 - BDSGI	6 - A-2-4	6 - SW	6 - Fair
7 - Stabilized Gravel with Dust Control	6 - Rural principal arterial	6 - Fair	7 - BDSGU	7 - A-2-5	7 - SP	7 - Good
8 - Sealed/Oiled Road	7 - Industrial/ Commercial	7 - Good	8 - BDSGT	8 - A-2-6	8 - SM	8 - Good
9 - Asphalt Pavement	8 - Recreational/ Scenic	8 - Good	9 - BDSGTU	9 - A-2-7	9 - SM-SC	9 - Very Good
10 - Concrete Pavement	9 - Resource recovery	9 - Very Good		10 - A-4	10 - SC	10 - Excellent
	10 - Urban residential	10 - Excellent		11 - A-5	11 - OL	
	11 - Urban major access			12 - A-6	12 - ML	
	12 - Urban collector			13 - A-7	13 - ML-CL	
	13 - Urban minor arterial			14 - A-7-5	14 - CL	
	14 - Urban principal arterial			15 - A-7-6	15 - MH	
					16 - OH	
					17 - CH	

Table 3b Inventory: List Options

ROAD_HT	ROAD_USE	LAND_USE	TERRAIN
1 - Below Natural Grade	1 - Residential	1 - Urban	1 - Flat
2 - At Natural Grade	2 - School Bus Route	2 - Rural (With residences)	2 - Rolling
3 - <1½' Above Natural Grade	3 - Postal Route	3 - Remote (No residences)	3 - Hilly
4 - 1½' to 3' Above Natural Grade	4 - Public Transit Route		4 - Mountainous
5 - 3' to 5' Above Natural Grade	5 - Emergency Access		
6 - >5' Above Natural Grade	6 - Industrial		
	7 - Agricultural		
	8 - Recreational		
	9 - Resource Recovery		
	10 - Mining		
	11 - Logging		
	12 - Oil and Gas Drilling		
	13 - Wind Farm		
	14 - Through Traffic		
	15 - Mixed/Other/Unknown		

Location

Main

Table 4 Location: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
LOC_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
BEG_LAT	Beginning Latitude	Degrees, decimal minutes	Double	Blank	from GPS
BEG_LONG	Beginning Longitude				
END_LAT	Ending Latitude				
END_LONG	Ending Longitude				
SHAPE_FL	Shape File	As determined by GIS programmer	String	Blank	from GIS
BEG_MARK	Beginning Landmark	--	String	Blank	Combo Box
END_MARK	Ending Landmark	--	String	Blank	Combo Box
LOC_COMM	Section Location Comments	--	String	Blank	Text Box

Comments

Table 5 Location: Comments

Heading_8	Description and Commentary
LOC_KEY	List of all sections generated by and unique to the agency. Section identifier as uniquely assigned in the Inventory
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps four digits for the road number _begin MP _end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
BEG_LAT	Input methods to be generated by GIS programmer
BEG_LONG	Input methods to be generated by GIS programmer
END_LAT	Input methods to be generated by GIS programmer
END_LONG	Input methods to be generated by GIS programmer
SHAPE_FL	Input methods to be generated by GIS programmer
BEG_MARK	List of intersecting roads and other landmarks, with option of user entry
END_MARK	List of intersecting roads and other landmarks, with option of user entry

Legal and Right-of-Way

Main

Table 6 Legal and Right-of-Way: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
LEG_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
LEG_DATE	Legal and ROW Date	Date	String	Today	Text Box
LEG_PERS	Legal and ROW Data Collector	--	String	Blank/ Previous	Combo Box
OWNER	Owner	--	Integer	7 - Unknown	Combo Box
ROW_WIDTH	Right-of-Way or Easement Width	feet	Double	Blank	Text Box
LEG_STAT	Legal Status	--	Integer	2 - Unknown	Combo Box
LEG_FILE	Legal and ROW File location	--	String	Blank	Text Box
SVY_DATE	Survey Date	Date	Date	Blank	Text Box
SURVEYOR	Surveyor	--	String	Blank	Combo Box
SVY_FILE	Survey File location	--	String	Blank	Text Box
INV_COMM	Survey, Legal and ROW Comments	--	String	Blank	Text Box

Comments

Table 7 Legal and Right-of-Way: Comments

Heading_8	Description and Commentary
LEG_KEY	A number unique for each entry
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps three (or more) digits for the road number _begin MP _end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
LEG_DATE	Concatenate dates when the survey, legal and ROW information was updated
LEG_PERS	Agency generated list of data collectors. Concatenate people who have updated the survey, legal and ROW information with the date they updated
OWNER	Agency list of possible owners/ lessees/ easement holder of the road
LEG_STAT	Agency list of possible legal statuses
LEG_FILE	File and extension containing legal documents. System for retrieving scanned legal documents set up by programmer
SVY_DATE	Most recent survey date
SURVEYOR	Agency generated list of surveyors
SVY_FILE	Survey data files, maps, and so on. File and extension containing survey documents. System for retrieving survey documents set up by programmer
INV_COMM	A number unique for each entry

List Options

Table 8 Legal and Right-of-Way: List Options

OWNER	LEG_STAT
1 - County	1 - Undocumented
2 - Other County	2 - Unknown
3 - Municipality A	3 - Documented ROW
4 - Munciipality B	4 - Documented easement
5 - Other public	
6 - Other Private	
7 - Unknown	

Traffic

Main

Table 9 Traffic: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
TRAF_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
TRF_DATE	Traffic Information Date	Date	Date	Today	Text Box
TRF_PERS	Traffic Data Collector	--	String	Blank/ Previous	Combo Box
MES_AADT	Measured AADT	Vehicles per Day	Double	Blank	Text Box
EST_AADT	Estimated AADT				
MES_TRUX	Measured Percent Trucks	Percent Trucks			
EST_TRUX	Estimated Percent Trucks				
SPD_POST	Posted Speed	mph		Agency statutory speed limit	
SPD_STAT	Statutory Speed			Blank	
SPD_MEAN	Measured Mean Speed				
SPD_85TH	Measured 85th Percentile Speed				
SPD_DSGN	Design Speed				
SPD_TYP	Typical Safe Driving Speed				
INV_COMM	Section Inventory Comments	--	String		

Comments

Table 10 Traffic: Comments

Heading_8	Description and Commentary
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps four digits for the road number _begin MP _end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
TRF_PERS	Agency generated list of data collectors
INV_COMM	A number unique for each entry

Condition

Main

Table 11 Condition: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
CND_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
CND_DATE	Condition Date	Date	Date	Today	Text Box
CND_PERS	Condition Data Collector	--	String	Blank/ Previous	Combo Box
GRVL_TKN	Gravel Thickness	inches	Double		
OVERALL	Overall Condition	--			
RIDE_QUL	Overall Ride Quality	--			
POTHOLES	Potholes	--			
RUTS	Ruts	--			
WASHBRDS	Washboards/ Corrugations	--	Integer	Blank	List Box
DUST	Dust	--			
LOOSEAGR	Loose Aggregate	--			
STONES	Fixed Stones	--			
EROSION	Erosion	--			
SLIPPERY	Slipperiness	--			
MEAS_RUF	Measurd Roughness	eg, IRI	Double		Text Box
CND_COMM	Section Condition Comments	--	String		

Comments

Table 12 Condition: Comments

Heading_8	Description and Commentary
CND_KEY	A number unique for each entry
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps four digits for the road number _begin MP _end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
CND_PERS	Agency generated list of data collectors
GRVL_TKN	Measured gravel thickness
OVERALL	Overall condition rated on a ten-scale; refers to total road condition, including drainage, safety, and surfacing, generally reflecting typical conditions
RIDE_QUL	Overall ride quality rated on a ten-scale; evaluating current ride quality based mostly on current surface roughness
POTHOLES	Potholes rated on a ten-scale
RUTS	Rutting rated on a ten-scale
WASHBRDS	Rhythmic corrugation rated on a ten-scale
DUST	Dust rated on a ten-scale
LOOSEAGR	Loose aggregate rated on a ten-scale
STONES	Fixed stones and associated roughness rated on a ten-scale
EROSION	Erosion of driving surface after significant moisture events
SLIPPERY	Slipperiness rated on a ten-scale
MEAS_RUF	Measured roughness

Utilities

Main

Table 13 Utilities: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
UT_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
UT_INSP	Utility Inspection Date	Date	Date	Today	Text Box
UTL_PERS	Utility Data Collector	--	String	Blank/ Previous	Combo Box
UTILITY	Utility Company	--	Integer	Blank	List Box
UT_LINE	Utility Line Type	--	Integer		List Box
UT_YEAR	Utility year and date of installation	Date	Date		Text Box
UT_EM_PE	Utility emergency contact person	--	String		Combo Box
UT_EM_PH	Utility emergency contact number	--			Combo Box
UT_LOCAT	Utility location	--			Text Box
UT_COMEN	Utility Comment	--			
UT_LOG	Utility comment log	--			

Comments

Table 14 Utilities: Comments

Heading_8	Description and Commentary
UT_KEY	A number unique for each entry
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps four digits for the road number _begin MP _end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
UTL_PERS	Agency generated list of data collectors
UTILITY	List of all utility companies generated by the agency. Each agency should compile a list of all utilities on its ROW
UT_LINE	List of all utility line types generated by the agency. Each agency should compile a list of all utilities on its ROW. There might be different sizes, for example water might either be small for local lines or 42" for a major line intersecting the road.
UT_EM_PE	List of emergency contacts
UT_EM_PH	List of emergency contacts
UT_LOCAT	Verbal description of where the utility is, for example, parallel to the road on the west side, or crosses north of the river bridge
UT_COMEN	Brief verbal description of actions pertaining to the utility
UT_LOG	File name and location of log pertaining to the utility

List Options

Table 15 Utilities: List Options

UTILITY	UT_LINE
1 - Water	1 - Water
2 - Telephone	2 - Telephone
3 - Communication	3 - Fiber Optic
4 - Electric	4 - Electric
5 - Gas	5 - Gas
6 - Oil	6 - Oil
7 - Municipality	7 - Sanitary Sewer
8 - Other	8 - Storm Drain
9 - Unknown	9 - Other
	10 - Unknown

Safety

Main

Table 16a Safety: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
SFTY_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
SFT_DATE	Safety Evaluation Date	Date	Date	Today	Text Box
SFT_PERS	Safety Data Collector	--	String	Blank/ Previous	Combo Box
OTFS_S31	Extent of Foreslope steeper than 3:1	--			
OTFS3141	Extent of Foreslope 3:1 to 4:1	--			
OTFS4151	Extent of Foreslope 4:1 to 5:1	--			
OTFS_F51	Extent of Foreslope flatter than 5:1	--			
OTHCZ_H	Extent of High severity isolated overturning hazards within the Clear Zone	--			
OTHCZ_M	Extent of Medium severity isolated overturning hazards within the Clear Zone	--			
OTHCZ_L	Extent of Low severity isolated overturning hazards within the Clear Zone	--			
IMOBCZ_H	Extent of High severity immovable objects within the Clear Zone	--	Integer	Blank	Radio Button
IMOBCZ_M	Extent of Medium severity immovable objects within the Clear Zone	--			
IMOBCZ_L	Extent of Low severity immovable objects within the Clear Zone	--			
CZ_LT2	Extent of Clear Zone Width less than 2'	--			
CZ_2_5	Extent of Clear Zone Width 2' to 5'	--			
CZ_5_8	Extent of Clear Zone Width 5' to 8'	--			
CZ_8_12	Extent of Clear Zone Width 8' to 12'	--			
CZ_12_16	Extent of Clear Zone Width 12' to 16'	--			
CZ_GT16	Extent of Clear Zone Width greater than 16'	--			

Table 16b Safety: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
HZ_CURVE	Safety Comments on Horizontal Curves	--			
V_CURVE	Safety Comments on Vertical Curves	--			
BLIND_DR	Safety Comments on Blind Driveways and Approaches	--			
LIM_SD_X	Safety Comments on Limited Sight Distance Intersections	--			
SURPRISE	Safety Comments on Inconsistent design - surprise curves, dips, and so on	--			
SUPERS_C	Safety Comments on Superelevations and curves	--			
POTH_RUT	Safety Comments on Potholes and ruts	--			
WSBD_COR	Safety Comments on washboards/ corrugations	--			
LOOSE_ML	Safety Comments on Loose Material	--	String	Blank	Text Box
DUST	Safety Comments on Dust	--			
DROP_OFF	Safety Comments on Edge Drop-off	--			
BRDG_APR	Safety Comments on Bridge Approaches	--			
SOFT_SHD	Safety Comments on Soft Shoulders	--			
SIGN_DEL	Safety Comments on Signage and Delineation	--			
VEGETATN	Safety Comments on Vegetation	--			
ANIMALS	Safety Comments on Animals	--			
SFT_COMM	General Safety Comments	--			

Comments

Table 17 Safety: Comments

Heading_8	Description and Commentary
SFTY_KEY	A number unique for each entry
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps three (or more) digits for the road number _begin MP _end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
SFT_PERS	Agency generated list of data collectors
OTFS_S31	OverTurning ForeSlope
OTFS3141	
OTFS4151	
OTFS_F51	
DUST	Dust rated on a ten-scale

List Options

Table 18a Safety: List Options

OTFS_S31	OTFS3141	OTFS4151	OTFS_F51	OTHCZ_H	OTHCZ_M	OTHCZ_L	IMOBCZ_H
1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >10/mile	1 - >10/mile	1 - >10/mile	1 - >10/mile
2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 5 to 10/mile	2 - 5 to 10/mile	2 - 5 to 10/mile	2 - 5 to 10/mile
3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 2 to 5/mile	3 - 2 to 5/mile	3 - 2 to 5/mile	3 - 2 to 5/mile
4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - <2/mile	4 - <2/mile	4 - <2/mile	4 - <2/mile
5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - None	5 - None	5 - None	5 - None
6 - None	6 - None	6 - None	6 - None				

Table 18b Safety: List Options

IMOBCZ_M	IMOBCZ_L	CZ_LT2	CZ_2_5	CZ_5_8	CZ_8_12	CZ_12_16	CZ_GT16
1 - >10/mile	1 - >10/mile	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%
2 - 5 to 10/mile	2 - 5 to 10/mile	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%
3 - 2 to 5/mile	3 - 2 to 5/mile	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%
4 - <2/mile	4 - <2/mile	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%
5 - None	5 - None	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%
		6 - None	6 - None	6 - None	6 - None	6 - None	6 - None

Drainage

Main

Table 19 Drainage: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
DRN_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
DRN_DATE	Condition Date	Date	Date	Today	Text Box
DRN_PERS	Condition Data Collector	--	String	Blank/ Previous	Combo Box
DRAINAGE	Overall Drainage Rating	--			
CROWN	Surface Drainage Rating	--			
SUBSURFC	Subsurface Drainage Rating	--			
CROWN_VG	Extent of Very Good crown surface drainage	--			
CROWN_GD	Extent of Good crown surface drainage	--			
CROWN_FR	Extent of Fair crown surface drainage	--			
CROWN_PR	Extent of Poor crown surface drainage	--			
CROWN_VP	Extent of Very Poor crown surface drainage	--			
CROWN_FL	Extent of Failed crown surface drainage	--			
SHLDR_GD	Extent of Good shoulder surface drainage	--			
SHLDR_FR	Extent of Fair shoulder surface drainage	--			
SHLDR_PR	Extent of Poor shoulder surface drainage	--			
SHLDR_VP	Extent of Very Poor shoulder surface drainage	--	Integer	0 - Not Rated	Radio Button
DITCH_VG	Extent of Very Good ditches	--			
DITCH_GD	Extent of Good ditches	--			
DITCH_FR	Extent of Fair ditches	--			
DITCH_PR	Extent of Poor ditches	--			
DITCH_VP	Extent of Very Poor ditches	--			
DITCH_FL	Extent of Failed ditches	--			
CULV_VG	Extent of Very Good culverts	--			
CULV_GD	Extent of Good culverts	--			
CULV_FR	Extent of Fair culverts	--			
CULV_PR	Extent of Poor culverts	--			
CULV_VP	Extent of Very Poor culverts	--			
CULV_FL	Extent of Failed culverts	--			
DRN_COMM	General Drainage Comments	--	String	Blank	Text Box

Comments

Table 20a Drainage: Comments

Heading_8	Description and Commentary
DRN_KEY	A number unique for each entry
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps three (or more) digits for the road number _ begin MP _ end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
DRN_PERS	Agency generated list of data collectors
DRAINAGE	As per Wisconsin PASER-series manual
CROWN	Subjective evaluation of the surface drainage, particularly crown
SUBSURFC	Subjective evaluation of the subsurface drainage, particularly shoulders and ditches
CROWN_VG	4% to 5% cross slope; well defined 'rooftop' shape; very good superelevations
CROWN_GD	3% to 6% cross slope; good 'rooftop' shape, minor flattening at the centerline; good superelevations
CROWN_FR	1½% to 3% or >6% cross slope; generally has reasonable crown shape with limited flat spots at the centerline; minor superelevation deficiencies
CROWN_PR	0% to 1½% cross slope; significant and extensive areas with deficient crown; significant superelevation problems
CROWN_VP	0% to inverted cross slope; generally lacks crown; poor or no superelevations
CROWN_FL	inverted cross slope; primary drainage is within the traveled way
SHLDR_GD	Shoulders adequately carry water to the foreslope without obstruction
SHLDR_FR	Occasional diversion of water away from the ditches by high shoulders, leading to limited erosion
SHLDR_PR	Significant channeling of water above the ditches due to high shoulders, leading to extensive erosion
SHLDR_VP	Extensive channeling of water in secondary caused by high shoulders, leading to extensive and dangerous erosion

Table 20b Drainage: Comments

Heading_8	Description and Commentary
DITCH_VG	No or negligible ponding or obstructions within the ditches; depth of ditches at least 3' below the edge of the shoulder
DITCH_GD	Only minor obstructions and ponding less than 6" deep within ditches; depth of ditches and standing water at least 2' below the edge of the shoulder
DITCH_FR	Some ponding less than 1' deep within the ditches; depth of ditch and any standing water at least 1' below the edge of the shoulder
DITCH_PR	Extensive ponding or blockages within the ditches; intermittent areas without ditching and extensive areas with ditches less than 1' deep
DITCH_VP	Water frequently standing by much of the roadway; ditches often not present or very shallow
DITCH_FL	Ditches generally not present; water is channeled onto the road surface
CULV_VG	Culvert ends clean and resistant to scour; barrel has less than 10% of its depth blocked
CULV_GD	Culvert ends in adequate condition with only minor susceptibility to scouring; only minor barrel blockage for less than 25% of the culverts' depth
CULV_FR	Some damage to culvert ends; significant scour potential; significant barrel blockage up to 50% of the culverts' depth
CULV_PR	Significant damage to culvert ends; significant risk of scour and piping; barrel blocked up to two-thirds of the culverts' depth
CULV_VP	Culverts' capacity a small fraction of its original capacity due to blockage or damage; high risk of scour, piping or overtopping
CULV_FL	No flow through culverts

List Options

Table 21a Drainage: List Options

DRAINAGE	CROWN	SUBSURFC	CROWN_VG	CROWN_GD	CROWN_FR	CROWN_PR	CROWN_VP	CROWN_FL
0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated
1 - Failed	1 - Failed	1 - Failed	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%
2 - Very Poor	2 - Very Poor	2 - Very Poor	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%
3 - Poor	3 - Poor	3 - Poor	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%
4 - Poor	4 - Poor	4 - Poor	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%
5 - Fair	5 - Fair	5 - Fair	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%
6 - Fair	6 - Fair	6 - Fair	6 - None	6 - None	6 - None	6 - None	6 - None	6 - None
7 - Good	7 - Good	7 - Good						
8 - Good	8 - Good	8 - Good						
9 - Very Good	9 - Very Good	9 - Very Good						
10 - Excellent	10 - Excellent	10 - Excellent						

Table 21b Drainage: List Options

SHLDR_GD	SHLDR_FR	SHLDR_PR	SHLDR_VP	DITCH_VG	DITCH_GD	DITCH_FR	DITCH_PR
0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated
1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%
2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%
3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%
4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%
5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%
6 - None	6 - None	6 - None	6 - None	6 - None	6 - None	6 - None	6 - None

Table 21c Drainage: List Options

DITCH_VP	DITCH_FL	CULV_VG	CULV_GD	CULV_FR	CULV_PR	CULV_VP	CULV_FL
0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated	0 - Not Rated
1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%	1 - >50%
2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%	2 - 20% - 50%
3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%	3 - 5% - 20%
4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%	4 - 2% - 5%
5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%	5 - <2%
6 - None	6 - None	6 - None	6 - None	6 - None	6 - None	6 - None	6 - None

Maintenance

Main

Table 22 Maintenance: Main

Heading_8	Title	Units	Data Type	Default Value	Input Format
MNT_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
MNT_DATE	Maintenance Date	Date	Date	Today	Text Box
MNT_PERS	Maintenance Data Collector	--	String	Blank/ Previous	Combo Box
MNT_TYPE	Maintenance Task	--	Integer		List Box
MNT_COST	Total Cost				
MNT_LABR	Labor Cost				
MNT_TRVL	Travel Cost	\$. \$\$	Double	Blank	Text Box
MNT_EQPT	Equipment Cost				
MNT_MATL	Materials Cost				
GRVL_SRC	Gravel Source	--	Integer		List Box
GRVL_TYP	Gravel Type	--	Integer		List Box
HAUL_T_M	Haul Cost per ton-mile	\$/ton-mile			
HAUL_Y_M	Haul Cost per yard-mile	\$/yard-mile		Blank/ Previous	
HAULDIST	Average Haul Distance	miles			
MNT_HAUL	Haul Cost	\$. \$\$			
GRVL_TON	Gravel Cost per Ton	\$/ton			
GRVL_QNT	Gravel Quantity	ton	Double		Text Box
GRVL_CY	Gravel Cost per Cubic Yard	\$/cy			
GRVL_QNY	Gravel Quantity	cubic yard			
MNT_SUPL	Supplies Cost	\$. \$\$			
MNT_TRFC	Traffic Control Cost	\$. \$\$		Blank	
MNT_WATR	Water Cost	\$. \$\$			
TRTM_PRD	Treatment Product	--	Integer		List Box
TRTM_RAT	Treatment Rate	--	Double		Text Box
TRTM_MTD	Treatment Method	--	Integer		List Box
MNT_CNTR	Contractor Cost	\$. \$\$	Double		Text Box
MNT_COMM	Maintenance Comments	--	String		Text Box

Comments

Table 23 Maintenance: Comments

Heading_8	Description and Commentary
MNT_KEY	A number unique for each entry
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps four digits for the road number _begin MP _end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.
MNT_PERS	Agency generated list of those entering maintenance data
MNT_TYPE	List of maintenance tasks
MNT_COST	Methods for generating this have yet to be determined
MNT_LABR	
MNT_TRVL	
MNT_EQPT	
MNT_MATL	
GRVL_SRC	Agency generated list of gravel sources
GRVL_TYP	Agency list of gravel types
HAUL_T_M	Methods for generating this have yet to be determined
HAUL_Y_M	
HAULDIST	
MNT_HAUL	
GRVL_TON	
GRVL_QNT	
GRVL_CY	
GRVL_QNY	
MNT_SUPL	
MNT_TRFC	
MNT_WATR	
TRTM_PRD	
TRTM_RAT	
TRTM_MTD	
MNT_CNTR	

List Options

Table 24 Maintenance: List Options

MNT_TYPE	GRVL_SRC	GRVL_TYP	TRTM_PRD	TRTM_MTD
1 - Blading	0 - Unknown/ Other	0 - Other/ Unknown	1 - CaCl flakes	1 - Topical spray
2 - Reshaping	1 - This Pit	1 - Base	2 - MgCl brine	2 - Motor grader blended
3 - Regravel	2 - That Quarry	2 - Surfacing		3 - Reclaimer blended
4 - Dust Control		3 - Subbase		
5 - Stabilization		4 - Chips		
6 - Isolated Repairs				
7 - Major Work				
8 - Drainage Maintenance				
9 - Other*				

* May want to include lists for maintenance of, for example, signs, culverts, asphalt roads and so on

Cyclic Maintenance

Main

Table 25 Cyclic Maintenance - Main

Heading_8	Title	Units	Data Type	Default	
				Value	Input Format
CYC_KEY	Key	--	Integer	1 + previous	Software assigned
SECT_ID	Unique Section ID	--	String	Blank	List Box
MAINT_PF	Maintenance to be performed	--	Integer	None	Check Box
BLADE_YR	Blading Period			0.5	
RESHP_YR	Reshaping Period			5	
REGRV_YR	Regravel Period	years		10	
DUST_YR	Dust Control Period	(often	Double	-1	Text Box
STAB_YR	Stabilization Period	fractions)		-1	
DRAIN_YR	Drainage Maintenance Period			5	
BLADE_LA	Blading last performed date				
RESHP_LA	Reshaping last performed date				
REGRV_LA	Regravel last performed date	days	Date	Blank	Retrieved from
DUST_LA	Dust Control last performed date				Maintenance Table
STAB_LA	Stabilization last performed date				
DRAIN_LA	Drainage Maintenance last performed date				
BLADE_PC	Blading Percent of Scheduled Time				
RESHP_PC	Reshaping Percent of Scheduled Time				
REGRV_PC	Regravel Percent of Scheduled Time				
DUST_PC	Dust Control Percent of Scheduled Time	percent	Double	Blank	Calculated
STAB_PC	Stabilization Percent of Scheduled Time				
DRAIN_PC	Drainage Maintenance Percent of Scheduled Time				

Comments and Error Limits

Table 26 Cyclic Maintenance – Comments and Error Limits

Heading_8	Description and Commentary	Error Limits
CYC_KEY	A number unique for each entry	
SECT_ID	List of all sections generated by and unique to the agency. A unique section identifier that should be descriptive, perhaps three (or more) digits for the road number _begin MP _end MP. Programmers should be prepared to split sections up later as the agency realizes they need to further divide some sections.	
MAINT_PF	Select all maintenance activities to be performed on this section. Based on subjective planning and decision making by the supervisor and maintainer	
BLADE_YR RESHP_YR REGRV_YR DUST_YR STAB_YR DRAIN_YR	Automatically assign -1 for never done, ie not checked on MAINT_PF box. If this maintenance is selected on MAINT_PF, then enter the time in years between performing this task	From 0.0027 to 100, or -1
BLADE_LA RESHP_LA REGRV_LA DUST_LA STAB_LA DRAIN_LA		Between 01/01/1900 and Today
BLADE_PC RESHP_PC REGRV_PC DUST_PC STAB_PC DRAIN_PC	(Current Date - Last Performed Date)/ (Period*365)	

List Options

Table 27 Cyclic Maintenance – List Options

MAINT_PF
0 - None
1 - Blading
2 -Reshaping
3 - Regravel
4 - Dust Control
5 - Stabilization
6 - Drainage
7 - Other