

## IDENTIFYING MAINTENANCE NEEDS

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This paper describes an ongoing project initiated for the purpose of improving Virginia's maintenance management system. It is directed at helping maintenance area superintendents (1) identify maintenance needs, (2) prioritize the needs, and (3) plan and perform the work necessary to satisfy the needs. Virginia's present maintenance management system is based on a performance budgeting concept designed by Roy Jorgensen and Associates in the early 1960's. The present project is designed to supplement the performance budgeting concept with detailed planning by the state's 232 area superintendents. In the project, the following activities are being pursued.

1. Each area superintendent is preparing a detailed graphic log of all maintainable items on all of the approximately 250 miles of roadway in his area.
2. Using the graphic logs, six of the area superintendents are identifying all roadway deficiencies to form a list of assessed needs.
3. These six superintendents are developing long-range (1-month) and short-range (1-week) work plans by combining men, equipment, and materials into work crews by activity at specific locations for the purpose of satisfying the assessed needs.

There is high hope of improving the state's system for identifying and prioritizing maintenance needs and in planning and accomplishing the work necessary to meet the needs in an economical and efficient manner.

This paper discusses a project initiated in an attempt to find means of improving Virginia's maintenance management system. It is concerned primarily with improving first line management's ability to identify maintenance needs, prioritize the needs, and plan and perform the work necessary to satisfy the needs.

The Virginia Department of Highways and Transportation's maintenance management system is based upon recommendations resulting from a review of the state's maintenance program by Roy Jorgensen and Associates in the early sixties. The basic ingredient of the system is a performance budgeting concept linked to productivity standards. In essence,

budgeting and planning are based upon performance records. Jorgensen did not intend for planning to be based entirely upon performance but rather that performance records be used as a guide for budgeting. In addition to recommending the use of performance as a budgeting and planning tool, Jorgensen emphasized certain types of planning for every level of management. This paper discusses the planning required of the maintenance area superintendent.

## AREA SUPERINTENDENT'S RESPONSIBILITIES

Germane to the present study are four of the area superintendent's responsibilities set forth by Jorgensen. He noted that the superintendent should —

1. assist the residency maintenance supervisor in the preparation of area maintenance plans;
2. determine the needs for routine maintenance by patrolling roads and observing conditions on all systems;
3. prepare short-term work accomplishment schedules within general plans that show actual crew patterns planned and days of work anticipated to meet performance standards; and
4. inspect roads within his area for maintenance replacement and incidental construction needs, and make recommendations to the residency maintenance supervisor.

It should not be inferred that the area superintendents do not meet these responsibilities; however, it is true that the tasks are performed at different levels of quality.

The Department has 232 area headquarters, each headed by a superintendent and each responsible for about 250 miles of roadway. It was decided that to bring the performance of all these people up to a high level of quality, a program should be initiated to reemphasize and strengthen their role and responsibility in assessing needs, and planning and performing the functions necessary for the efficient and economical maintenance of the state's highway system.

The modified system that has been developed and is being experimented with in ten area headquarters is referred to as the "assessed needs approach". It differs from the performance approach that is based on centerline mileage and on accomplishments reported in terms of the total effort expended on each

type of maintenance activity. Rather, it places emphasis on surveys of the quantities of each activity needed and the physical condition of all the maintenance items within the total roadway mileage. It provides a more structured approach to both budgeting and planning, and facilitates evaluations of how well the maintenance function is being performed. If at the end of the study the assessed needs approach warrants implementation, it will not replace the performance approach; it will supplement the present system by strengthening some of the management features Jorgensen recommended.

The ingredients the research team felt to be essential in any maintenance program are as follows:

1. Capable superintendents.
2. An awareness on the part of superintendents of the importance and responsibility their job carries as well as an awareness of the high regard the Department holds for their position.
3. An organized record of all items that need to be maintained.
4. Standards setting forth the condition in which all items are to be maintained.
5. An assessment of the present and anticipated condition of all of the maintainable items, and a listing of the order in which items should be given attention.
6. An extended plan of the maintenance work effort based on the productivity standards, the quality standards, and the available resources (1-month in this project).
7. A plan of the work effort for each week, based on the 1-month plan and developed each Friday for the ensuing week.
8. A record of each month's accomplishments for comparison with the 1-month work plan.

The remainder of this paper discusses the attempt to improve the maintenance program in terms of these eight items.

#### 1. Capable Superintendents

When Virginia implemented the maintenance management system in the sixties it was not deemed appropriate to replace any of the people in the key position of area superintendent who did not meet the newly written job description for that position. However, through attrition this position has, in most cases, now been filled with highly qualified people. Therefore, at present the people are qualified not only to accept the responsibility of seeing that the needed maintenance is accomplished, but also to assess and plan maintenance needs.

#### 2. Awareness of Importance and Responsibility

There is some question, at least in the mind of the writers, as to whether the superintendents have a total appreciation of the importance of their position. They know that they have a great deal of responsibility, but it appears that more direct communication with management is needed to assure them of the importance of their position. Communication between the superintendents and the residency are good; but those between them and higher management could be improved. This does not imply that management doesn't have an appreciation for the key role of the area superintendent, but it does mean that management should adopt an effective means of letting its appreciation be known. In defense of management, it is the nature of most people to take the obvious for granted and overlook the value of close personal communications. The writers believe that a simple reminder to management will improve this situation.

#### 3. Organized Record of All Maintenance Items

The reader is reminded that the Virginia Department of Highways & Transportation is responsible for not only the interstate and primary road systems, but also for the secondary or county system. The total state highway system comprises more than 52,000

centerline miles of roads of which the interstate, primary, and 7,000 of the 43,000 miles on the secondary system are logged. The graphic logs for these systems by no means show all of the maintainable roadway items. Therefore, the first step in the project discussed here was the development of a graphic method for identifying and locating all of the maintainable items.

The method devised is a modified concept developed by Roy Jorgensen and Associates for the Federal Highway Administration in 1973, and is explained in detail in Appendix A. With this method, all of the needed information for a maintenance area is recorded by highway type as shown in Appendix B. A summary is then prepared for all of the roads in the area for each of the three systems — interstate, primary and secondary — as shown in Appendix C.

When the experimental use of the modified maintenance system was initiated, the superintendents saw little need for the logging of the maintainable items; they thought that they already knew the items in their areas. However, after completing a log, they changed their attitude, and several have commented that they have found multiple uses for this information when it is available at their fingertips. Further, they admit to a better understanding of the magnitudes of the quantities of the various maintainable items. This was especially true for drainage items such as the numbers of pipes under the roadway and at entrances.

In the maintenance areas included in the experimental program this logging has been completed, and top management has found the results helpful to the degree that the procedure will be implemented statewide.

#### 4. Quality Standards

Just prior to the inception of this project, new maintenance quality standards were developed within the Department for the majority of the maintainable items. As an example, one of the standards is shown in Appendix D. The process used in developing the standards, which as yet haven't been completed for all items, was to obtain a consensus of a limited number of all levels of maintenance personnel. These standards have been adopted with the understanding that they might have to be modified as additional knowledge is gained through experience. Experience gained in the present project will be helpful in this respect.

#### 5. Assessment of Condition of Maintainable Items

Step 5 requires the superintendent to again survey all of the roads in his area. In this survey, he records all of the work required to make the maintainable items meet quality standards for the next year, including what needs to be done at the time of the survey as well as what needs to be done during the year. For instance, if a stabilized road is surveyed right after it has been improved by blading or adding stone and it needs no further work at present, the superintendent will still record the number of times he anticipates this particular road will need blading during the next twelve months and the quantity of stone that will be required over the same time period.

The summary resulting from this survey provides the superintendent the quantity of work that needs to be done in each activity during the next year. It is likely that much more work needs to be done than the available resources will permit. At this point the planning task becomes difficult. The superintendent, with the residency supervisor's help, is expected to set priorities for the types of activities to be performed and to justify these priorities to higher management. Of course, if there is a frequent and widespread inability to perform all of the work that should be done with the

available resources, then the Department should consider lower quality standards, at least in some activities. In such cases, consideration should be given to revising the quality standards for selected activities. It should also be remembered that although the available resources appear adequate for accomplishing the required work, it may be difficult to bring them together in the ideal combinations necessary for getting the job done. Six of the ten areas using the modified system are presently working on this phase.

#### 6. Formulation of 1-Month Work Plan

In this step the superintendent forms crews and assigns equipment to accomplish the required maintenance activities in the most effective manner (see Appendix E). The most important unit of time is one day, and emphasis is placed on the importance of planning combined activities on any given day in such a manner that will achieve maximum use of the available equipment and men. Frequently, one or maybe even two men cannot be effectively matched to the equipment available for the planned activity. On other days, a truck may go unassigned. The superintendent should try to avoid these situations, but should not add a man or a truck to a crew if the productivity rate of the crew will be diminished. The crews should be maintained at their ideal size with respect to both men and equipment. Any man not assigned to a crew for a given day should be used where practicable to catch up any backlog of work around the headquarters. On days that the trucks cannot be effectively used, they should be left idle or be scheduled for any needed repairs or preventive maintenance.

In the planning of the units of work to be accomplished in each day of the 1-month work plan, the days are not considered to be in calendar sequence. Rather, the 22 days of work are planned so that they can be performed in any order the superintendent feels will best meet the most pressing needs. When planning the 22 days, the superintendent should take into account the need to plan for some foul weather days. Six of the ten areas are presently working on this phase.

#### 7. Work Plan for Ensuing Week

By Friday afternoon, the superintendent can plan activities for the coming week with (1) a fair idea of what the weather will be, (2) the condition of his equipment, (3) the probable number of men to be available, and (4) the most urgent maintenance needs. Therefore, he selects five of the days from his 1-month work plan and arranges them in the most appropriate sequence. A specially devised four-by-eight foot weekly planning board is used to post this plan by days, crews, and activities as shown in Appendix F. In addition to the space provided for the 1-week plan, room is available for several inclement weather days and for the storage of the remaining work units from the 1-month plan. This backlog of work provides a bar graph of quantities of work that needs to be done to satisfy the 1-month plan. (The areas will begin using this weekly planning board about August 1.)

#### 8. Comparison of Planned to Accomplished Work

It is anticipated that any superintendent will at first plan more work than will be accomplished, because of overestimates, equipment breakdowns, sick leave, bad weather, unanticipated but urgent maintenance needs, and a host of other unforeseeable events. For this reason he is asked to keep a daily record of his crews and the activities to which they are assigned, and at the end of each month to analyze the relationship of the planned work to that accomplished. By doing this, he will be able to document the discrepancies between the two, and with time be able to improve his estimates of what can be

accomplished during a 1-month period.

#### SUMMARY

As previously stated, the purpose of the project reported here is to reemphasize and strengthen the area superintendent's role and responsibility in assessing needs, planning, and performing the functions necessary for the efficient and economical maintenance of the state's highway system. Involved in the project are the area superintendents in 10 of the Department of Highways & Transportation's 232 area headquarters. These ten have completed the logging of all of their maintainable items on all of their roads, and the results have been found to be helpful to the degree that the state is ready to implement the logging procedure statewide. At present 6 of the 10 superintendents are identifying their needs for the next 12 months, and each month are preparing monthly work plans by identifying the activities, locations, crew sizes, and equipment needed daily to accomplish the work needed over this period of time. They are keeping daily records so that work accomplished can be compared to work planned and the reasons for differences can be analyzed. On August 1, the superintendents will begin working with specially designed weekly planning boards.

The experimental maintenance program is designed to allow for changes as knowledge is gained. Periodic meetings are held with the area superintendents, maintenance supervisors, resident and assistant resident engineers, a district maintenance engineer, and an assistant state maintenance engineer to evaluate what is being done and to identify desirable modifications. Thus far the superintendents have been receptive to the experimental program and have been quite helpful, not only in looking after the necessary details but also in providing input for modifications.

At present there is high hope of accomplishing an improvement in the state's system for identifying and prioritizing maintenance needs and in planning and accomplishing the work necessary to meet these needs in an economical and efficient manner.

#### APPENDIX A.

##### HOW TO CONDUCT THE ROADWAY MAINTENANCE LOG INVENTORY

A roadway maintenance log inventory provides a listing of all roadway features maintained by the Department. The inventory performs several functions necessary for an efficient and effective highway maintenance program. First, it provides all levels of the Department accurate information of the gross quantities of maintainable items with which to plan and budget. Second, it makes the area superintendent aware of the location of all items and their condition by requiring him to inspect, in an orderly manner, all items in his area. Third, it aids the area superintendent in formulating schedules for the performance of day-to-day work.

#### Logging Procedures

The inventory is taken by 2-man teams. Each team — a driver and a recorder — covers all of the roads in a maintenance area and records all the features maintained by the Department. The driver calls out the odometer reading while the recorder indicates, on an inventory sheet, the location of each feature. The men share the job of locating — or picking out — the features.

The driving speed used will depend on (1) the

number of features being recorded, (2) how quickly features can be located and recorded, and (3) traffic conditions. The speed should vary from 5 to 30 mph. Frequently, stops will be required to check or measure certain features. Under normal conditions the inventory process should proceed at a rate of one mile of road each 20 to 30 minutes.

**WHAT IS INVENTORIED?**

All roadway features maintained by the Department are logged. These include but are not limited to the following:

1. Box Culverts - size and number
2. Bridges - structure number
3. Concrete Median Barriers - length
4. Cross Drains - number
5. Curb and Gutter - length
6. Ditches - miles of ditchable area
7. Drop Inlets - number
8. Entrances - number with and without pipe
9. Flood Gates - number
10. Guardrail - length
11. Lights - number and type
12. Mowable Swaths - length
13. Outfall Ditches - length
14. Paved Ditches - length
15. Picnic Tables - number
16. Pipes - size and direction of flow
17. Rest Rooms - number
18. Retaining Walls - length
19. Right-of-Way Fence - length
20. Shoulder Type - paved, wedge, gravel, or sod
21. Sidewalk - length
22. Signs - number and type on each post
23. Snow Fence - length
24. Surface Type - bituminous, P.C. concrete, surface treatment, stabilized
25. Under Drains - number

**UNIT OF MEASUREMENT DESIGNATION FOR MAINTAINABLE ITEMS**

Ditches, shoulders, mowable swaths, right-of-way fences, concrete median barriers, and road lengths are measured by estimating the odometer reading to the nearest 0.01 mile. Guardrails, sidewalks, curb and gutters, paved ditches, outfall ditches, snow fences, and retaining walls are measured in feet. Drainage items, signs, entrances, lights, endwalls, flood gates, picnic tables, and rest rooms are totaled as to the number in each category.

**EQUIPMENT REQUIRED FOR LOGGING**

1. Vehicle with an odometer that records in tenths of a mile.
2. Clipboard - long enough to hold legal size paper (14").
3. Straightedge - 6" ruler.
4. Carpenter's ruler and tape measure.
5. Road Inventory - T&S-5 (Rev. 2-71) - establishes roadway termini.
6. Sign inventory.
7. Roadway maintenance inventory sheets and pencils.

**HOW TO COMPLETE ROADWAY MAINTENANCE INVENTORY SHEETS**

All maintainable items are recorded on a Roadway Maintenance Inventory (see Figure 1). The log sheet has three sections: a heading, a roadway section, and a summary. The heading is completed prior to starting the inventory. The roadway section is completed while conducting the inventory and the summary is completed in the office at the end of the day.

Figure 1. Roadway Maintenance Inventory.

ROUTE		START LOCATION	END LOCATION	DATE	PAGE
TRAVEL DIRECTION		PAGE: _____	PAGE: _____		OF _____
DISTRICT		RESIDENCY	COUNTY	MAINTENANCE AREA	INVENTORIED BY
ROUTE: _____		ROUTE: _____			

<p><b>SURFACE TYPE</b></p> <input type="checkbox"/> Bituminous <input type="checkbox"/> P.C. Concrete <input type="checkbox"/> Surface Treatment <input type="checkbox"/> Stabilized <input type="checkbox"/> Other: _____	<p><b>ROAD TYPE</b></p> <input type="checkbox"/> Interstate <input type="checkbox"/> Primary <input type="checkbox"/> Secondary <input type="checkbox"/> Other: _____	<p><b>BASIC CROSS SECTION</b></p> <input type="checkbox"/> 2-Lane <input type="checkbox"/> 4-Lane Divided <input type="checkbox"/> 4-Lane Undivided <input type="checkbox"/> Other: _____	<p>ODOMETER START</p>	<p><b>SUMMARY</b></p> <p>Shoulder Type: Paved _____ miles, Gravel _____ miles, Wedge _____ miles</p> <p>Ditch Miles: Left _____ miles, Right _____ miles, TOTAL _____ miles</p> <p>Slope: _____ number</p> <p>Entrances: With Pipe _____, M/O Pipe _____</p> <p>Drainage Structures: Pipe _____, Box Culvert _____, Other: _____</p> <p>Guardrail: _____ feet</p> <p>Other: _____</p>
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**The Heading**

The heading is located on the top and left side of the Roadway Maintenance Inventory shown in Figure 1. The heading identifies general information as to the location and basic characteristics of the roadway section being inventoried. To complete the heading the following procedure is used:

1. Route - the route is State Route number for the roadway being logged.
2. Travel Direction - the travel direction is the general direction in which the route traverses the maintenance area in the direction the logging is performed (North, South, East, or West).
3. Start Location - the start location for the "page" is any local landmark that will help identify the start of the roadway section. The start location for the "route" is determined from the information supplied in the Road Inventory (T&S-5). This identifies the location at which the route enters the maintenance area or terminates at another roadway.
4. End Location - The end location for the "page" is any local landmark that will help to identify the end of the roadway section. The end location for the "route" identifies the place at which the road exits a maintenance area or terminates.

5. Date — the date of the initial inventory is entered. The dates that any revisions are made are also entered.
6. District, Residency, County, Maintenance Area — enter applicable names for these items.
7. Inventoried By — enter names of inventory team members.
8. Surface Type, Road Type, Basic Cross Section — check the characteristic that describes the roadway being logged.

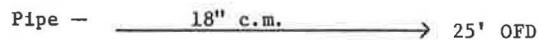
The Roadway

The roadway section of the Roadway Maintenance Inventory is located in the center of the sheet (see Figure 1). The first information to be recorded in the roadway section is the last three digits of the odometer reading in the block labeled "ODOMETER START". It is important that the tenths number be centered on the odometer. Some additional driving may be required to achieve this alignment. Each long mark on the log sheet within the roadway surface represents 0.10 of a mile and should be numbered consecutively from the start reading. (Use 0.05 of a mile in subdivisions and other congested areas.)

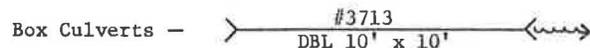
With the start location and odometer reading established, the team is ready to begin logging. The roadway surface is represented in the center of the roadway section. Rows are provided to the left and right of the roadway surface to indicate shoulder type, ditches, mowable swaths and other incidental items such as paved ditch, sidewalk, and curb and gutter.

The logging procedure begins by entering maintainable items present at the start location. Shoulder type is entered on the line provided. Space is provided to enter a second shoulder type if present (i.e. wedge and gravel). Ditchable areas are indicated by a solid straight line drawn in the row provided. Mowable swaths, the number of passes necessary to maintain the Department's mowing standards, are also entered on the line provided. The surface width is indicated on the left in the line provided.

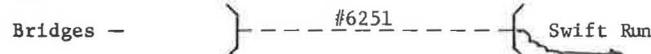
Other maintainable items are entered using the following graphic representations:



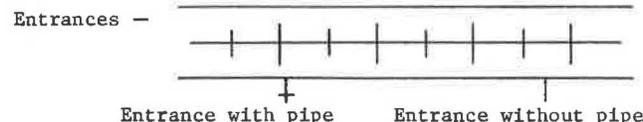
A pipe is represented by a straight line across roadway surface and an arrowhead indicating the direction of flow. The size of the pipe, and material, are entered on this line. An outfall ditch is shown by indicating its length and the letters "OFD".



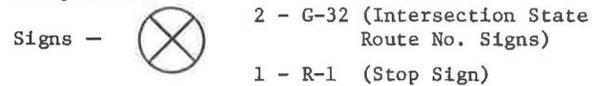
A box culvert is represented by a straight line with wingwalls. The structure number, if present, is noted and the size opening is given. Direction of flow is noted by drawing an arrow on the outlet end.



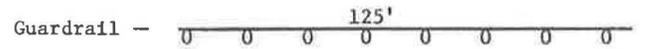
Bridges are represented by straight lines parallel to the roadway surface with wingwalls and structure number. Stream crossing or open ford should also be noted and described as such. Direction of flow is noted by drawing an arrow on the downstream side.



Private driveways, business entrances, etc. are indicated by a short straight line drawn perpendicular to the roadway surface. If a pipe is present, indicate it as shown above. Indication of pipe size is optional.



Signs are shown as a circle with an X in the middle. The Sign Inventory code designation is also shown. Note that more than one sign can be on a pole.



Guardrail is shown as a straight line with posts represented by circles and its length. Guardrail length can be figured by counting the number of guardrail sections and multiplying by 12.5'. EXAMPLE: If there are 10 sections of guardrail, the total length of the guardrail would be 10 x 12.5' or 125'.

Paved Ditches — are indicated by a straight line in "other" row and the letters "PD".

Curb & Gutter — are indicated by a straight line in "other" row and the letters "CG".

Sidewalks — are indicated by a straight line in "other" row and the letters "SW".

Drop Inlets — are indicated by a square box in the roadway surface and the letters "DI".

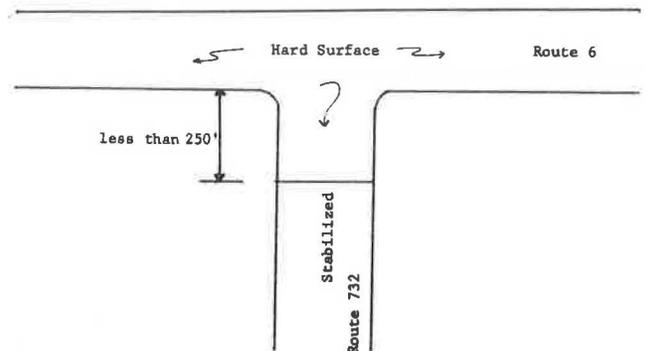
Stop Lights — are indicated by in the center of roadway section and the letters "SPL".

Street Lights — are indicated by in appropriate location and the letters "STL".

Special Situations —

1. If the surface type, road type or basic cross sections change, draw a line across the entire roadway section of the log and terminate all maintainable items at the point corresponding to the odometer reading. Start another inventory sheet at that point.

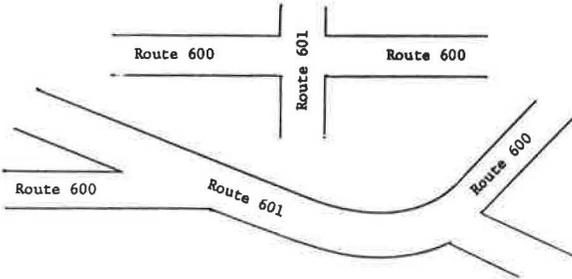
The only exception to this is when a stabilized (gravel) or unimproved road has less than 250 feet of hard surface at the intersection with a hard surface roadway. In this situation the surface type change is noted on the inventory sheet and the logging is continued without starting a new inventory sheet.



Route 732 is inventoried as a stabilized road with the hard surface portion at the intersection with Route 6 being noted on the inventory sheet as being

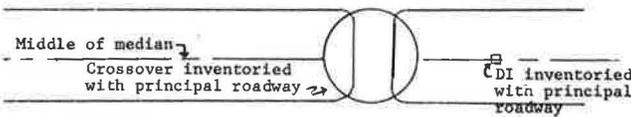
hard surfaced.

2. When the route intersects another route and continues directly across the intersection, do not begin a new inventory sheet. If the route breaks at an intersection, begin a new sheet with a new odometer reading where it picks up again.



3. In logging a route, the length of road will not always coincide with the end of a log sheet. Therefore, when a route terminates somewhere within the mile section as represented by the inventory sheet, draw a line across the entire roadway section and terminate all maintainable items at the point corresponding to the odometer reading.

4. On 4-lane divided highways each roadway is inventoried separately. The middle of the median is the left boundary for each roadway. The principal roadway is the roadway whose traffic direction corresponds to the direction in the T&S-5. All maintainable items located at the middle of the median and all maintainable items associated with cross-overs are inventoried with the principal roadway.

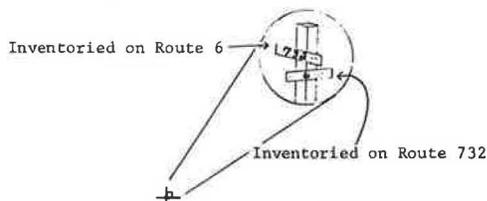


Principal Roadway

Direction in T&S-5 →

On 4-lane divided highway each roadway is inventoried separately.

5. The determination of which signs at an intersection are inventoried on which roadway is based on the location of the driver for whom the sign information is intended. EXAMPLE: At an intersection of a secondary and primary roadway, the primary route number sign located on the other side of the primary roadway is inventoried with the secondary roadway. The secondary route number sign is inventoried with the primary roadway.



Route 6

Route 732

6. The locations of ramps are identified on the mainline inventory sheet. Each ramp is inventoried on a separate sheet and cross-referenced to the mainline inventory sheet.

Example of a Completed Roadway Section -

The maintainable roadway items are as follows with the completed inventory sheet shown in Figure 2.

- 82.50 - Shoulder - sod left and right  
Ditch - left and right  
Mowable swaths - (2) left and (1) right  
Stop sign - R-1  
Surface width - 18'
- 82.58 - Ditch on right stops  
18" c.m. pipe - draining to right - 25' OFD
- 82.62 - Entrance on left with pipe
- 82.70 - Ditch on left stops  
Mowable swaths on left change from (2) to (1)
- 82.75 - Box culvert - DBL 4' x 4' - drainage to right
- 82.84 - Ditch on left and right  
(2) Mowable swaths on each side
- 82.90 - Entrance left with pipe  
Entrance right without pipe
- 83.09 - Sign right - bridge end panel W-54
- 83.10 - Ditches and mowable swaths stop left and right  
Guardrail starts on left and right
- 83.15 - Bridge #6251 over New River
- 83.20 - Ditches begin left and right  
(2) Mowable swaths left and right
- 83.21 - Sign left - bridge end panel W-54
- 83.25 - Connection Route 600
- 83.30 - Ditches, shoulders, and mowable swaths stop left and right  
Sidewalk, and curb and gutter start on left  
Curb and gutter start on right
- 83.40 - Drop inlet on left
- 83.50 - End of one-mile section

Accuracy in recording information is important. When recording the information be careful to enter the item in the row or surface section in which it is observed. For items requiring estimates, care should be taken to make sure that these estimates are as accurate as possible. To ensure that your estimates are fairly accurate, periodically spot-check them by physically measuring an item. For example, an out-fall ditch length should be periodically measured in order to avoid overestimating lengths. Pipes should be measured with a carpenter's rule in order to obtain the proper size.

Section Summary

The maintainable items are totaled for each one-mile section and entered in the summary on the right side of the log sheet shown in Figure 1. A summary is shown below for the one-mile section just completed.

Mowable Swaths -

Total mowable swaths are computed by adding the totals from the left and right sides of the roadway section as either (1), (2), (3) or more mowable swaths. This total will give swath miles or the number of times a tractor mower will be required to pass back and forth over the mile section in order to mow the grass. For example: The total number of miles for the (1) mowable swath is 0.48 whereas the number of miles for the (2) mowable swaths is 0.92. This 0.92 mile must then be multiplied by two to









VIRGINIA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION MAINTENANCE DIVISION STANDARD												
ACTIVITY	DATE					WORK UNIT						
111	February 15, 1980					Tons						
Sheet <u>1</u> of <u>1</u>												
DESCRIPTION — SPOT SEALING OR SKIN PATCHING OF THE ROAD SURFACE												
Putting light application of an emulsified asphalt on the bituminous surface and covering with sharp, clean, uniformly graded stone.												
PURPOSE												
The primary purpose of skin patching is to maintain pavement strength by sealing cracks in the surface layer and thus preventing moisture from weakening the base materials. To prevent serious pavement failure, small cracking should be monitored and should be skin patched when the opening exceeds 1/8".												
The common types of surface cracking and their causes are as follows:												
1. Alligator Cracking — Poor drainage or small cracks allowing water to saturate and weaken base materials.												
2. Edge Cracking — Poor drainage, inadequate base or insufficient lateral support.												
3. Ravelling — Dusty stone or too little asphalt binder.												
4. Longitudinal Cracking — Unstable base; first stage of alligator cracking.												
SCHEDULING FREQUENCY												
MONTH	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
MAJOR EMPHASIS												
MINOR EMPHASIS												
AS REQUIRED												

PROCEDURE		
1. Place traffic control devices in accordance with current Department guidelines, "Typical Traffic Control For Work Area Protection". See Section 14 of the Maintenance Division Policy Manual.		
2. When necessary clean and dry the area to be patched. Broom area if necessary.		
3. Spray a light application of asphalt over the deteriorated area and extend spray one foot beyond on each side. Provide a square patch for a neat appearance and minimal annoyance to the travelling public. Application will vary due to the type asphalt, size, and absorption of underlying pavement. As a guide, the proper application will not flow and the texture of the existing pavement will be visible.		
4. Apply cover stone. The stone should be applied within one minute of spraying the asphalt. The cover stone should be applied in the direction of traffic, one stone thick and touching on all sides.		
5. Begin rolling immediately after the stone is spread and continue until the stone is properly seated or the asphalt shows signs of hardening. On large patches roll from the outside toward the center of the pavement. Care should be taken not to over roll. Stop rolling if crushing of the stone occurs.		
6. Recover traffic control devices.		
PERSONNEL	EQUIPMENT	MATERIALS
1 operator 1 asphalt spray operator 1 person	1 truck w/ asphalt kettle & cover stone 1 front end loader (at stockpile)	<u>Asphalt</u> CMS-2 90°-110° CRS-2 130°-160°
3 operators 1 asphalt spray operator 2 persons	1 truck w/ asphalt kettle or tow distributor 1 truck w/ cover stone & roller 1 front end loader (at stockpile)	<u>Cover Stone</u> #8 stone - 3/8" max. size #78 stone - 1/2" max. size
1 Foreman 7 operators 1 spray bar operator 3 persons on tailgate spreaders	1 distributor 3 trucks (vary to suit haul) w/ tailgate spreaders 1 roller 1 front end loader (at stockpile) 1 tractor broom (if needed)	<u>SMALL TOOLS</u> shovels brooms



APPENDIX F. PLANNING BOARD

WEEKLY PLANNING BOARD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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