

## SHOULDERS

### 06.01 GENERAL

This manual is intended for internal guidance only and is not intended to create a legal or moral duty. Supervisors have discretion, based upon their expertise and the particular circumstances, to deviate from this manual and to conduct additional research or receive input from experts in other areas, as needed.

#### 06.01.01. IMPORTANCE

The term "shoulder" refers to the graded or surfaced area of the roadway, on the side of and adjacent to the pavement, which gives lateral support to the road surface and can be used by traffic in an emergency. The shoulder must be capable of sustaining the weight of the average vehicle using the highway, and its surface must be kept properly maintained for safe deceleration of traffic. Shoulders that are properly sloped and maintained at all times aid in the quick removal of surface water from the roadway into the drainage system.

Shoulder maintenance is a year-round job and requires continual attention. This phase of highway maintenance is of the utmost importance, because the failure of a pavement often starts at the inside edge of a shoulder. Shoulder maintenance includes the maintenance of the following areas just outside a normal shoulder:

- approaches to the roadway at side roads on the State System
- turnouts for school bus stops
- graded surfaces adjacent to rural mailboxes.

At private and commercial driveway entrances, County forces will perform maintenance work only within the normal shoulder width. The shoulder at such a place must be stabilized to prevent unsafe driving conditions and costly maintenance which can result from rutting and tracking of mud onto the pavement.

#### 06.01.02 REQUIREMENTS

The color of the material used in the construction or stabilization of a shoulder should be considered where practical. The color of the shoulder surface should contrast with the color of the adjacent roadway surface, so motor vehicle operators can easily distinguish between the roadway and the shoulder. A difference in color is especially important for night traffic. Currently, all two-lane paved roads are edge-stripped with white reflectorized paint. The type of surface on the shoulder will sometimes be different from that used on the adjacent traveled way, to help drivers distinguish between the areas by the handling of the vehicle or the sound of the tires.

The depths of the surface courses of shoulders may vary from 4" to 8", and shoulder widths may range from 2' to 10'. The rate of fall, or the slope across the shoulder, will depend on the type of shoulder surface and will be between ½" to 1" per foot of width.

## **06.02 SHOULDER MAINTENANCE SCHEDULE**

### **06.02.01 PURPOSE**

The County Maintenance Superintendent will plan the routine maintenance of shoulders in accordance with a detailed seasonal schedule. The following listing of the items to be completed during each season of the year will be used as a basis or a guide in the development of seasonal plans.

### **06.02.02 SPRING**

- 1) **Field inspection of shoulders to determine the amount and type of maintenance required and the priority of the work.**
- 2) **Blading of all stabilized shoulders to smooth the surface to improve drainage, promote safety for the traveling public, replace lost material, and give pavement edge support.**
- 3) **Reshaping of all stabilized shoulders to attain the proper grade and slope and to remove false or secondary ditches and gutters.**
- 4) **Paring down high turf shoulders, repairing the effects of erosion, and refilling ruts.**
- 5) **Patching paved shoulders.**
- 6) **Begin routine mowing.**

### **06.02.03 SUMMER**

- 1) **Continued routine blading of all stabilized shoulders and replacing of lost shoulder material.**
- 2) **Rebuilding and stabilizing shoulders.**
- 3) **Repairing extensively damaged sections, as scheduled.**
- 4) **Removing all false ditches along shoulders.**
- 5) **Making improvements as scheduled.**
- 6) **Mowing turf shoulders.**
- 7) **Raising low spots on paved shoulders.**
- 8) **Making permanent repairs to the surface and base on paved shoulders.**
- 9) **Resurfacing paved shoulders.**

- 10) Continued routine inspection of all shoulders.
- 11) Routine mowing.

#### **06.02.04 FALL**

- 1) Routine blading and dressing of stabilized shoulders.
- 2) Reshaping and replacing shoulder material to assure proper drainage.
- 3) Stabilizing spots that show erosion and instability.
- 4) Completion of improvements and major repairs.
- 5) Routine mowing until after heavy frost.
- 6) Completing repairs to paved shoulders.
- 7) Sealing all cracks and joints in paved shoulders.
- 8) Continued routine shoulder inspection.

#### **06.02.05 WINTER**

- 1) Occasional blading of stabilized shoulders that have become excessively rutted, but only when weather and soil conditions permit.
- 2) Stabilizing soft spots by the addition of coarse graded aggregate.
- 3) Patching potholes in paved shoulders when conditions permit.
- 4) Repairing ruts and effects of erosion in turf shoulders.
- 5) Continued routine inspection of all shoulders.

### **06.03 MATERIALS FOR SHOULDERS**

#### **06.03.01 TYPES**

The several types of shoulder surfaces may be broadly grouped into the following four general classifications:

- 1) Turf or grass shoulders
- 2) Stabilized shoulders
- 3) Paved shoulders
- 4) Combination shoulders

The proper maintenance procedures are different for the various types of shoulder surface. A brief description of each type will be given first.

#### **06.03.02 TURF SHOULDERS**

The existing earth will normally be capable of supporting vegetation. The grass covering will be established naturally by volunteer growth without artificial seeding or sodding. Granular material may have been, or may be added to native soil to give increased stability to the surface; however, the amount must not be enough to interfere with normal growth of the grass. A turf shoulder will have a slope of 1" minimum per foot of width.

#### **06.03.03 STABILIZED SHOULDERS**

A stabilized shoulder usually consists of coarse graded aggregate spread on or incorporated in the existing natural soil. If the aggregate is spread in a separate layer it is usually laid in a prepared subgrade. Aggregates used in stabilizing shoulders are gravel, crushed stone, crushed slag, hard shale, chert or red dog. Bituminous materials are used frequently in conjunction with the coarse aggregate to improve its performance.

In some cases, stabilization may be obtained simply by the progressive addition of local granular material. In other cases it may be necessary to add graded aggregate and binder and use mechanical mixing equipment. A stabilized shoulder will generally have a slope of  $\frac{3}{4}$ " per foot of width.

#### **06.03.04 PAVED SHOULDERS**

As the term implies, a paved shoulder is one having a special wearing course. This course may be composed of portland cement concrete, bituminous concrete, penetration macadam, or bituminous surface treatment. The slope of a shoulder of portland cement or bituminous concrete will be  $\frac{1}{2}$ " per foot of width. For penetration macadam or bituminous surface treatment, the slope will be  $\frac{3}{4}$ " per foot. Maintenance of a paved shoulder is similar in many respects to that of a roadway surface of the same type, although the degree of importance is different.

There are often certain conditions where the shoulder and ditch both should be paved in order to cut down on erosion and give the roadway pavement edge support. This type of shoulder should be constructed where the existing shoulder width is less than 3' to edge of ditch, and where a steep grade contributes to severe erosion. Refer to Figure 06-1 for details.

#### **06.03.05 COMBINATION SHOULDERS**

In a combination shoulder, the surface for a width of 1  $\frac{1}{2}$  to 3 feet adjacent to the pavement is of higher type than for the remainder of the shoulder. Such a shoulder is usually provided where the width of the paved portion of the road surface is not great enough for the amount and type of traffic using it, or on a steep grade where severe erosion occurs. Without the better surfacing next to the pavement there

would be continual rutting of the shoulder along the edges of the pavement. A combination shoulder may be constructed by placing a stabilized or paved strip along the inside edge of a turf shoulder, or by placing a paved strip along the inside of a stabilized shoulder.

#### **06.04 TURF SHOULDERS MAINTENANCE**

##### **06.04.01 LIMITATIONS**

Turf shoulders are not practical on a heavily traveled road or on a lightly traveled road at locations where the shoulders are subjected to frequent use. On Local Service Roads and some low traffic Trunkline and Feeder roads in rural sections, a turf shoulder provides a relatively stable surface and will resist erosion. Where turf shoulders are used on a road, they must be replaced by graded aggregate or paved sections in such critical locations as turnouts for bus stops or mailboxes, in urban locations, at entrances to driveways, or on the inside of some curves and at intersections.

##### **06.04.02 TYPES OF MAINTENANCE OPERATIONS**

A turf shoulder must be maintained with a cross slope of at least 1" per foot. A flatter slope will not assure rapid runoff of surface water.

Maintenance of turf shoulders consists of the following operations:

- 1) Mowing and cleaning
- 2) Repairing ruts, filling holes and raising low spots.
- 3) Rolling, blading or paring down.
- 4) Providing stabilized areas for school bus and mailbox turnouts and at other critical sites.

##### **06.04.03 MOWING AND CLEANING**

Shoulders will be mowed as required, to keep the vegetation sufficiently low for safety. In the spring and early summer, the grass must be kept at least 3" high. In the late summer and fall, the height must be at least 4". The heat of the sun and lack of water in dry weather will damage sod that is cut too short. The maximum allowable height of grass on turf shoulders is between 7 and 8".

The Maintenance Crew Supervisor responsible for the maintenance of turf shoulders must coordinate the operation of picking up trash along the roadside with mowing operations. This will reduce the chance of the mower hitting an object such as a bottle, can, or large rock. It is important to eliminate the danger of an object being thrown into the path of an oncoming vehicle or onto adjacent private property.

#### **06.04.04 RUTS, HOLES AND OTHER LOW SPOTS REPAIR**

Damage to a turf shoulder in the form of ruts caused by traffic or erosion will be promptly repaired by filling the ruts with select material, compacted and dressed to conform to the surface contour. When available, sod that is being pulled or cut back is ideal for use in making such repairs. Holes and other low spots in a shoulder will be repaired in a similar manner.

If ruts continually recur in an area on the inside of a curve, it may necessary to pave the affected area. This type of paving is referred to as "mooning." The use of mooning, or simply widening the inside of a curve, is one of the most effective means of reducing maintenance of the shoulder and the edge of the pavement. A sketch indicating the use of mooning is shown in Figure 06-2. There will sometimes be locations where it will be advantageous to use a combination of mooning as shown in Figure 06-2, and paving of the shoulder and ditch as shown in Figure 06-1 if the width of the remaining shoulder after mooning is 3' or less.

#### **06.04.05 ROLLING, BLADING OR PARING HIGH SHOULDERS**

##### **06.04.05.01 ROLLING**

The surface of a turf shoulder has a tendency to become too high as the result of the growth of vegetation, the collection of foreign matter, and frost action. It is often necessary to remove the effects of frost heave in the spring to obtain the proper grade. This can be accomplished by rolling the turf shoulder with a suitable rubber-tired or steel-wheel roller.

##### **06.04.05.02 BLADING OR PARING**

Where rolling will not depress a high shoulder sufficiently, it will be necessary to blade or pare the shoulder. If proper precautions are taken, this work can be done by graders without serious or permanent damage to the turf. A high shoulder will be bladed or pared in the early spring as soon as weather conditions permit. If the grass is more than 3 inches high, it must be mowed before the shoulder is pared.

##### **06.04.05.03 EXCESS SOD DISPOSAL**

Any waste shoulder material that cannot be economically used by maintenance forces in their work may be made available to the public at no charge. Such material will be given upon request and on first-come first-serve basis. The Maintenance Supervisor in charge of the job is responsible for determining if it is to the Division's advantage to fulfill a request for the excess material. The Supervisor must insure that the location where the material is to be dumped is not too far away and is readily accessible. Waste material will only be *dumped* on private property and *will never be spread* by Division employees or equipment. Every request for waste shoulder material must be made to the Maintenance Supervisor in charge of the crew removing the material from the shoulder, and the Supervisor will take necessary steps in insure Division rules and regulations are adhered to with respect to disposal of waste sod material.

Whenever a property owner requests waste material, he/she must sign a release form agreeing not to hold the Division or its employees responsible for any damage to private property that may occur as a result of the material being placed.

#### **06.04.06 TURNOUTS FOR SCHOOL BUSES AND MAILBOXES**

A turf shoulder is not suitable at a turnout for school buses or mailboxes. Graded aggregate or similar stabilizing material must be placed at each turnout to prevent rutting at certain times of the year.

During the winter and extended periods of bad weather, these locations must be given special attention by all supervisory maintenance employees. When such an employee sees a place that is beginning to show excessive rutting, he/she should report the condition to the County Maintenance Superintendent in whose County the condition is located, or to the District Maintenance Engineer.

#### **06.05 STABILIZED SHOULDERS MAINTENANCE**

##### **06.05.01 GRADATION OF AGGREGATES**

The degree of stability of the shoulder depends on the soil aggregate mixture used. The addition of a well graded granular surfacing material, with ample fines, to a natural earth shoulder will provide stability and produce a good all-weather shoulder. As a result, maintenance costs will be reduced. Typical gradations of aggregates that are suitable for stabilizing shoulders are:

##### **Limestone, Slag or Gravel Aggregates**

2 ¾", 1 ½ or ¾ inch top size crusher run containing all dust of fracture. The size to use will depend upon the condition of shoulders, type of traffic, and volume of traffic.

##### **Sandstone Aggregates**

2 ½ or 1 ½ inch top size crusher run containing all dust of fracture.

After the first application of aggregate, it will be necessary to make spot replacement of this material from time to time.

##### **06.05.02 TYPES OF MAINTENANCE OPERATIONS**

Every stabilized shoulder will be constructed and maintained with a slope of ¾" per foot width. The rate of fall of each shoulder will be checked from time to time during routine maintenance operations to assure proper runoff of surface water. A shoulder with too little fall will tend to hold water so that it will soak into the shoulder material and develop soft spots. If, during an inspection after a rain, it is noted that a section of shoulder is holding water, that section will be marked. The proper slope will then be restored as soon as conditions permit. A shoulder with a slope too steep is a

hazard to the traveling public. Also, during a heavy rainfall, surface water will run across a steep shoulder with enough velocity to cause erosion.

Routine dressing of a stabilized shoulder, by blading, is required to keep the inside of the shoulder at the same level as the edge of the pavement, and to move and redistribute loose material to fill ruts and minor holes. In addition, it is necessary to replace, from time to time, the shoulder material that becomes worn or lost.

Even though stabilized shoulders are kept smooth and approximately at the correct section by routine blading and periodic replacement of worn or lost material, the shoulders must be reshaped at least once a year. Since the terrain throughout West Virginia is generally hilly or mountainous, another important maintenance consideration throughout the State is to control erosion of stabilized shoulders. Maintenance of stabilized shoulders includes the following:

- 1) Scarifying as required.
- 2) Blading
- 3) Replacement of material.
- 4) Reshaping
- 5) Rolling
- 6) Control of erosion

#### **06.05.03. BLADING**

##### **06.05.03.01 GENERAL EXPLANATIONS**

One of the most important purposes of routine blading is to prevent the formation of a rut at the edge of the pavement. When such a rut is allowed to form and remain, the edge of the pavement is easily damaged because of the loss of lateral support and there is great danger of a serious accident. During periods of wet weather, a rut will hold or pond surface water, and the subgrade and base under the roadway could become saturated resulting in failure of the surfacing course. The concern that is second in importance is to prevent low shoulders which also cause a reduction in the amount of lateral support provided at the edge of the pavement.

The low area at the edge of pavement shall first be lightly scarified or shaped in order to prepare the area before blading or placing additional material.

More frequent blading of a stabilized shoulder will be required where the shoulder material has poor binding quality, traffic is relatively heavy, and where a roadway less than 20 feet wide carries a large volume of truck traffic.

On the inside of a sharp curve, it may not be possible to prevent the formation of a rut by routine blading of a stabilized shoulder. It is then necessary to widen the



pavement, as shown in Figure 06-2 and as explained in Section 06.04.04. In other places where the pavement width and traffic conditions are such that frequent blading of a stabilized shoulder will not eliminate the rut at the edge of the roadway, satisfactory results may be obtained by constructing a combination shoulder and ditch (see Figure 6-1).

#### **06.05.03.02 PROCEDURE**

A stabilized shoulder will be bladed only when there is enough moisture in the shoulder material to make it workable and easily re-compacted. If a stabilized shoulder is bladed when the material is too dry, the material will become drier and much of the loose fine surface material will be lost quickly as a result of the action of vehicle wheels and the wind.

A light grader should be used for routine blading. The grader will usually travel in the direction of traffic. However, it is necessary to reverse the direction of blading occasionally to maintain a uniform cross section of the shoulder on each side of a paved entrance to a driveway or an intersection. If the grader always moves in the same direction, a high spot will occur at the near side of a paved section as a result of the accumulation of material left when the blade is raised. There will be a low spot, or hole, on the far side of the paved section where the blade is first lowered. The frequency with which the direction of blading is to be reversed will be determined by judgment based on observation. A good rule of thumb is to have the grader travel against traffic every fifth pass.

When a stabilized shoulder is being bladed, the operator of the grader must start at the outside edge of the shoulder and carry the loosened material to the edge of the pavement. Whether one or two passes will be required to cover the entire shoulder will depend on the width of the shoulder and the length of the blade. When the loosened surface material is at the edge of the pavement, the grader operator will set the blade just above the level of the shoulder. Care must be taken to ensure that all material is wasted before any of it reaches the end or heel of the blade.

If the operator follows the recommended procedure, travel on the roadway will not be hazardous during blading operations. There will not be a large windrow of loose material on the pavement and as a result there will be less dust. Also, painted edge lines will not be damaged by the action of the blade scraping over them.

Enough loose material will usually be available to fill a rut of reasonable size at the edge of the pavement. By following the recommended procedure, the operator will be less likely to form a false or secondary ditch or gutter, which would interfere with proper drainage, near the outside edge of the shoulder.

Despite efforts to the contrary, a certain amount of shoulder material is usually temporarily deposited on the edge of the pavement. At the end of each day's work this material must be completely removed and the pavement swept by available equipment to prevent hazardous driving conditions. This procedure should be followed periodically throughout the workday.

### **06.05.03.03 TRAFFIC CONTROL**

The Crew Leader in charge of shoulder maintenance will be responsible for taking proper precautions for the control of traffic through the area where the maintenance operation is being performed. The procedures to be followed are described in the Signs and Markings Chapter of this Manual. The required temporary signs must be erected. When a grader is traveling in the opposite direction of traffic, a flagger and proper traffic control devices must be stationed at each end of the section to guide motorists. Maintenance work on shoulders will normally be confined to one side of a highway at a time to minimize disruption of traffic flow.

### **06.05.04 REPLACING SHOULDER MATERIAL**

Worn-out and lost shoulder material must be replaced periodically to restore the shoulder cross-section. The shoulder must be built up when the adjacent pavement is raised by resurfacing. To improve an existing stabilized shoulder in this way, well-graded granular material must be hauled to the site, spread, and compacted. Whether the work will be performed by hand or with specialized equipment will depend on the quantity of material needed to return the shoulder to the correct grade and slope. When a stabilized shoulder is to be built, it is usually desirable to improve the shoulder at the same time by adding good graded material. For performing an operation of this type, the procedures described in the Unpaved Surfaces Chapter of this Manual will be followed.

If granular material is added to a shoulder during a period of dry weather and a water truck is not available for supplying the required binding moisture, it will be helpful to add water prior to delivering the material to the job site.

### **06.05.05 RESHAPING STABILIZED SHOULDERS**

Even though ruts and holes in shoulders are removed by routine blading throughout the winter as weather and soil conditions permit, reshaping after the frost leaves the ground is necessary and must be done in the spring. The procedure to be followed in reshaping a shoulder is described in this Chapter. If reshaping is performed properly, smooth surfaces with the correct slope and grade will be produced and edge support will be provided for the existing pavement.

In some locations, a shoulder may be unnecessarily wide, as shown in Figure 06-3. Such a shoulder should be reshaped to make the width uniform. The maximum width will be 10' along an Expressway, Trunkline and Feeder road and 6' on the Local Service system. Along a length of roadway on a wide fill or in a wide cut, the shoulders will be graded to the prescribed slope for the specified maximum width. The remainder of the fill or cut section will be initially graded with a fall of 2" per foot of width and will be allowed to sod. Following this procedure will give the section a uniform neat appearance, avoid excessive shoulder maintenance, and will reduce the amount of work required to properly maintain the roadside ditch.

## **06.05.06 FALSE DITCH OR GUTTER**

### **06.05.06.01 FORMATION**

Another major problem in shoulder maintenance is the prevention or removal of a false or secondary ditch or gutter near the outside edge of a shoulder. This ditch is often formed when so much shoulder material has been lost that the grader operator must rob material from the outside of the shoulder to bring the shoulder flush with the pavement edge. Also, when the unit of equipment being used for blading has a blade that is too short to extend over the full width of the shoulder, and only one pass is made, a ridge is developed at the outer edge of the shoulder. When a grader is being used for blading a stabilized shoulder on a fill that is bordered by guard rail, the operator must take special care not to dig the heel of the blade into the shoulder so far that a false gutter is formed near the guard rail, as shown in Figure 06-4. The slope of the surface of the shoulder must be continued to the top of the fill slope so the surface water will run off uniformly for the entire length of the fill.

### **06.05.06.02 REMOVAL**

Once a false ditch is formed along the outside of a stabilized shoulder, it must be eliminated. A grader can be used for this work on an unobstructed shoulder. When the shoulder is bordered by a guardrail, the work must be done with hand tools or by use of specialized equipment. The removal of the ridge or false ditch permits proper lateral drainage across the shoulder. The removal operation will also help to bring additional fines into the shoulder aggregate, since the material is first carried inward toward the roadway and then floated back to the outer edge. The excess material will usually be wasted over the edge of the fill. However, if it contains an excess of grass and weeds and other objectionable material, it must be loaded into a truck and hauled away.

If a false ditch is formed on a shoulder in a cut, where there is no guard rail, two passes of the grader will usually be sufficient to remove the ridge or windrow of material forming the false ditch and to reshape the shoulder. A 4:1 or flatter slope is preferable and should be continuous from the edge of the roadway to the top of the front edge of the regular drainage ditch.

When the grading is completed, the finished shoulder will have the normal shoulder slope. The entire area will then be rolled with a rubber tired roller.

## **06.05.07 EROSION CONTROL**

The tendency of surface water to wash away shoulder material is most severe on a steep grade where the water flows along the shoulder rapidly and at the low point on a long concave vertical curve where a large amount of water must flow across the shoulder. In order to prevent excessive erosion of a stabilized shoulder on a steep grade, a uniform cross slope of the proper amount must be maintained for the entire width of the shoulder. The surface water will then be able to run off the shoulder along the entire length of the shoulder. If a false ditch or gutter is allowed to form along the outer edge of a shoulder (as described in Section 06.05.06.01) or if a rut is

allowed to develop between the pavement and the shoulder, a large amount of water will be concentrated on a small portion of the width of the shoulder until it exerts enough force to break through a weak spot. Such action has been known to wash away a long portion of a shoulder during a single storm.

## **06.06 PAVED SHOULDER MAINTENANCE**

### **06.06.01 TYPES OF OPERATIONS**

Paved shoulders have been provided in many rural areas where the volume of traffic is heavy and through urban areas where shoulders are needed to permit vehicles to park and to enter or leave driveways. Along such high-speed highways as those of the Interstate System, shoulders are paved for improved safety and ease of day-to-day routine maintenance.

The methods of maintaining paved shoulders correspond to those set forth in this Manual for surfaces of similar types. However, a brief outline of the maintenance necessary for paved shoulders will be indicated in this chapter of the Manual, and references will be made to specific portions of the Paved Surfaces Chapter for certain details.

The maintenance of paved shoulders includes the following operations:

- 1) Patching
- 2) Surface treatment
- 3) Repair of base failures
- 4) Sealing cracks and joints

### **06.06.02 PATCHING**

When a paved shoulder is patched, care will be taken to see that the surface of the patch is flush with the existing adjacent surface, as required in all patching of paved surfaces. The material used for each permanent patch in a paved shoulder will be the same as the material in the existing shoulder surfacing.

The correct procedure to be used in patching a paved surface of a certain type is described in detail in the Paved Surfaces Chapter of this Manual and the same procedure will be used for patching a paved shoulder of that type.

### **06.06.03 SURFACE TREATMENT**

#### **06.06.03.01 NATURE OF TREATMENT**

When the bituminous surface on a paved shoulder becomes lean, dry, cracked, or loses life due to oxidation, the surface will be retreated with a suitable liquid bituminous material. This binding material will be covered with sharp sand, or

crushed aggregate. The treatment is similar to that described in the Paved Surfaces Chapter of this Manual. This same treatment may be necessary to raise a paved shoulder that has settled.

#### **06.06.03.02 PROCEDURE**

When a shoulder is repaired by a surface treatment, the finished surface must be flush with the roadway pavement. The following precautions must be taken to prevent asphalt from being shot on the surface of the traveled way along the edge:

- 1) Only experienced distributor operators will be assigned to this type of work.
- 2) When material is being sprayed next to the road pavement, the inside nozzle will be turned parallel to the pavement edge to eliminate a fanning pattern and to produce a sharp, clean line. Also a shield should be attached to the distributor to ride on the edge of the adjacent pavement. These precautions will prevent asphalt being splattered onto the existing pavement.
- 3) If the pavement edge is not straight, the bituminous material will be applied in a strip 8 to 12” wide along the inside edge of the shoulder with a hand hose, and the remainder of the shoulder with the distributor.

If asphalt gets on the road surface accidentally, it must be removed immediately. Remaining spots will be covered with sand or other suitable material to eliminate a slick spot or tracked asphalt.

When settlement of the shoulder is so great that all of the material required to raise it cannot be applied by the method just described in a single layer, two layers may have to be used. When a suitable patch material is available, it can be applied in one layer, but a proper tack coat must be applied to the old surface and the edge of the pavement. When the material needed to bring a low shoulder up to grade must be applied in two layers, the correct procedure is to stop the second layer 6 to 12” short of the outside edge of the first layer, so a feather-edging effect can be provided.

In the Paved Surfaces Chapter of this Manual, additional information is given in regard to the preparation, type and grade of the bituminous materials, aggregates used in surface treatment and the procedure for placing the materials. Details of the procedures to be used when working with bituminous concrete are described in the same Chapter of this Manual.

#### **06.06.04 BASE FAILURE REPAIR**

When the failure of a paved shoulder is due to the failure of its base, you should follow the procedure outlined in the Paved Surfaces Chapter of this Manual relative to base failure repair. In general, repairs for this type of failure include the following operations:

- scarifying
- either removing and replacing unsuitable material or adding material to stabilize the unstable area
- reshaping the surface and recompacting the material to the correct grade and slope

When the failure is caused by water trapped in the subgrade, the use of french drains or underdrains will be required. The use of subsurface drainage is discussed in detail in the Drainage Chapter of this Manual.

#### **06.06.05 SEALING CRACKS AND JOINTS**

Cracks and joints which appear in portland cement concrete or bituminous concrete will be treated as prescribed for each in the Paved Surfaces Chapter of this Manual. The weakest point in a paved shoulder, and the place where most failures start in the traveled way and the shoulder, is the joint between the roadway pavement and the paved shoulder. "Pumping" often develops when this longitudinal joint is not kept sealed, and special attention must be paid to conditions at this joint. Frequently, the roadway pavement and the paved shoulder are constructed of different materials. For instance, there may be a portland cement concrete pavement and a bituminous surface on the shoulder. Each material expands and contracts at a different rate with the variations in temperature. Since there is continued expansion and contraction, it is extremely difficult to maintain a watertight seal in the joint between the pavement and shoulder.

#### **06.07 COMBINATION SHOULDER MAINTENANCE**

##### **06.07.01 CONSTRUCTION**

##### **06.07.01.01 GENERAL EXPLANATION**

As explained in Sections 06.04.04 and 06.05.03.01, a combination shoulder is required where frequent blading will not prevent the formation of a rut between the roadway and a turf or stabilized shoulder. The portion of a turf shoulder next to the roadway must be replaced by a strip of stabilized material or the portion of a stabilized shoulder must be replaced by a strip of surface treatment or bituminous concrete. Types of combination shoulders are shown in Figure 06-5.

The various steps or stages in the construction of a combination shoulder are described here with suggested procedures for repairing a combination shoulder if a failure should occur.

##### **06.07.01.02 TURF SHOULDER STABILIZATION**

If ruts continue to recur on the inside of a turf shoulder, the original soil must be trenched adjacent to the roadway to a depth of 6 to 8" and for a width great enough

to include the entire rut. This width will usually be between 2 and 3'. A grader, with a half-section of the cutting edge from a snow plow attached to the lower edge of the regular grader blade, should be used for the trenching operation. Only a half-section of cutting edge is used on the grader moldboard because some material removed from the trench is to be left on the roadway near its outer edge. This excess material must then be picked up and disposed of immediately. The trench will then be backfilled with a graded mixture of crushed aggregate, or other suitable base material. It is highly desirable that from 6 to 12 pounds of sodium chloride per cubic yard of aggregate be incorporated into this mixture. A combination shoulder of this type is shown in Figure 06-5, Method No. 1.

If an admixture of sodium chloride is used, sufficient water must be added to the mixture to cause the salt to go into solution and be thoroughly dispersed throughout the aggregate layer. The mixture will be placed in the trench in at least two layers and each layer will be thoroughly compacted. Upon completion of the compaction, the new portion of the shoulder should be flush with both the adjacent roadway and the remaining turf portion of the shoulder.

#### **06.07.02 MAINTENANCE**

Maintenance of a combination shoulder will combine the procedures for the surface described in the preceding sections of this Chapter which are applicable. The correct sections for reference are:

**TURF SHOULDER:** Section 06.04.03 to 06.04.06

**STABILIZED SHOULDER:** Sections of 06.05.03 to 06.05.07

**PAVED SHOULDER:** Section 06.06.02 to 06.06.05.

Thus, if the combination shoulder is composed of a paved portion and a turf portion, Sections 06.04 and 06.06 will be used.

#### **06.08 APPROACHES, ENTRANCES AND TURNOUTS**

##### **06.08.01 GENERAL**

The nature of the maintenance of a portion of a shoulder used for an approach to a side road, an entrance to a driveway, or a turnout for a school bus stop or mailboxes does not differ greatly from normal shoulder maintenance. However, the extent of the repair and maintenance operations may be quite different. The major problem at the special locations just mentioned is the establishment and maintenance of the proper slope from the edge of the roadway to the outside of the shoulder. The need for adequate stabilization or paving at these locations is generally understood, and the necessary stability is usually provided. Sections 05 and 06 of this Chapter discuss, in detail, the construction and maintenance of stabilized and paved shoulders.

## **06.08.02 SIDE-ROAD APPROACHES**

When a side road on the State System intersects a paved highway, the approach to the side road will be stabilized or paved for a distance of approximately 200' back from the edge of the pavement of the through highway. Private driveways and approaches to places of business must be stabilized or paved and maintained by the owners in accordance with their approved encroachment permit and as described in the Permits Chapter of this Manual. County forces do maintenance work within the normal shoulder width, if necessary, for the safety of the traffic on the State road. Whether stabilization or paving will be required will depend on the amount of traffic using the side road. Stabilization or paving is necessary for two reasons. First, it would be difficult to maintain an unstabilized shoulder at the intersection. Second, in wet weather, vehicles coming from an unstabilized-unpaved road onto a paved road will carry mud onto the pavement and create a potential hazard to motorists using the roadway.

The grade of the approach must be consistent with the slope of the existing shoulder of the through road. Proper shoulder drainage must be maintained and the shoulder must have a uniform plane or surface for use of errant vehicles. The correct details are shown in the sketch in Figure 06-6. The normal slope of the shoulder must be continued for its entire width, and the road approach must be flush with the shoulder at their junction.

If the existing approach to a side road does not meet these standards, it must be reconstructed to the proper grade and elevation, and must be maintained in that condition. All necessary stabilization or paving will be provided in accordance with the current Standard Specifications.

## **06.08.03 ENTRANCES**

### **06.08.03.01 IMPROPER ENTRANCES ELIMINATION**

When a property owner or other party in control of property desires to construct an entrance, either private or commercial, an encroachment permit is necessary before any work commences. Details of the permit procedure are discussed in the Permits Chapter of this Manual. The responsibilities of County and District maintenance personnel in regard to proper enforcement of encroachment permits are described in detail in the Permits Chapter.

The presence of even one improperly constructed entrance along a road or highway makes it difficult to provide proper maintenance of the shoulder. Moreover, poor or improper drainage at an entrance often is a direct cause of failure of the road surface at the location, and an improperly constructed entrance sometimes creates a hazard to the traveling public by directing surface water onto the highway. This water forms icy spots during cold weather and creates a hazard by being splashed at other times. Improperly constructed entrances are a statewide problem on all road systems from Local Service Roads to Expressways.



Certain steps must be taken by Division personnel to eliminate existing improperly constructed entrances and to correct the dangerous conditions caused by them along many of our highways. If an existing entrance does not conform to the standards set forth by the West Virginia Division of Highways, it is the responsibility of the County Maintenance Superintendent to contact the owner personally and notify him/her that County maintenance forces will have to reshape the surface at the entrance so the shoulder of the highway will have the proper slope for its entire width.

It is the duty and responsibility of every Division employee to notice and report the location of each newly constructed entrance which appears to have been improperly constructed. Employees in the District and County maintenance organization should be on alert during the early stages of construction of any building or other roadside improvement requiring a driveway. The District Maintenance Engineer or the County Maintenance Superintendent in whose territory the construction is located should be alerted if a problem is suspected.

#### **06.08.03.02 MAINTENANCE OF SHOULDER AT ENTRANCES**

At each entrance, the normal shoulder width will be maintained by the County maintenance forces in the performance of the regular routine shoulder maintenance operations.

#### **06.08.04 SCHOOL BUS STOPS AND MAIL BOX TURNOUTS**

##### **06.08.04.01 SCHOOL BUS TURNOUTS**

The continued consolidation of schools throughout the State has increased the number of school bus routes and has made necessary the establishment of numerous school bus stops (with and without shelters) and the provision of turn-arounds at frequent intervals along the highways. It is the policy of the Division to stabilize all shoulders at such locations with suitable material and to provide regular maintenance for them.

As shown in the sketch in Figure 06-7, the maximum width of the shoulder at a turnout for school buses will be approximately 12'. The proper shoulder slope must be maintained for the full width at the turnout. As stated earlier in this chapter, the proper slope is  $\frac{3}{4}$ " per foot of width for an unpaved shoulder and  $\frac{3}{4}$ " or  $\frac{1}{2}$ " per foot of width for a paved shoulder.

##### **06.08.04.02 MAIL BOX TURNOUTS**

At a turnout for mail boxes, the same shoulder stabilization plan will be used as is described for a school bus turnout.

A person desiring the benefits of a service on a rural mail delivery route is required by the Post Office Division to furnish, erect, and properly maintain a mail box for receiving mail. The West Virginia Division of Highways wishes to cooperate with the Postal Service by permitting a mail box to be placed where it will be

convenient to mail carriers, but it must not interfere with highway maintenance operations. A sketch of a typical mail box turnout is shown in Figure 06-7.

Two or more owners of mail boxes will be encouraged to place them in a group so they can be serviced by the carrier at one stop. When a group installation is already in place, the owner of a new box will be requested to install his box in the same location. A new installation will preferably be located on the far side of the intersection. Maintenance forces will provide suitable surfacing between the pavement edge and a group of mail boxes or a single box.

Whenever a mail box is so positioned that it will hide a highway sign or interfere with maintenance operations, the County Maintenance Superintendent will request the owner to select a more suitable location. In the event of a disagreement, the District Office will send a written request to the local postmaster to request assistance in settling the issue.

#### **06.09 PROCEDURE FOR USING STRING LINE TO CHECK SLOPE**

To compute the required total difference in elevation between two points on a shoulder, it is only necessary to multiply the required fall per foot of width by the horizontal distance between the two points. For example, the required slope for an unpaved shoulder is  $\frac{3}{4}$ " per foot of width. So the total fall, or difference in elevation, between the edge of the roadway and the outside edge of an unpaved shoulder 9' wide will be  $\frac{3}{4}" \times 9' = 27/4$  or  $6 \frac{3}{4}"$ .

The fall from the edge of the roadway at any point on the shoulder can be computed in a similar way.

There are several ways in which a string line can be used for checking the slope of a shoulder. Maintenance personnel should experiment with and test a procedure which they feel comfortable with, and then use that method often to verify slopes when maintenance work is contemplated or being performed.

#### **FOOTNOTE**

*As more fully set forth in Section 01.01.01, nothing in this manual is intended to create a legal or moral duty and has been created for internal guidance only.*