EVALUATION OF SLAB SOD THICKNESS

by

S. M. LAW
ASSISTANT RESEARCH ENGINEER

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Special thanks are offered to Mr. James Simpson of Mid-South Turf for his cooperation in the conduct of this study.

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SYNOPSIS

This research study was undertaken to determine the feasibility of decreasing the thickness of slab sod required on highway construction projects and to provide field data and evaluations to substantiate this. Differing thicknesses of sod were used for both nursery and field grown grasses. A suggested revised set of specifications was to be recommended if the results of this study proved satisfactory.

Slab sod for this research study was supplied by a nearby slab sod farm, Mid South Turf of Abita Springs, Louisiana. Six different species of grasses, Nomow Bermuda, Tiffway Bermuda, Common Bermuda, Centipede, Bahaia and Carpet Grass, were evaluated using slab sod thicknesses of 1/2, 3/4, 1, 1-1/2 and 2 inches. State Project No. 454-04-09, Hammond-Slidell Interstate Highway, was the construction project selected for the location of the study, with two sites on the project being used for the evaluation purposes. One of these sites was on the south slope of the roadway and the other on the opposite side, the north slope of the roadway. Each separate test square, for each species and thickness of grass, was 10 x 20 feet in size.

The south slope was prepared and sod was placed on March 23, 1971, while the north slope was prepared and sod was placed on June 9, 1971. Observations were made on the actual sodding operations, and each plot was also evaluated at various intervals of time thereafter. Watering of the plots during the first month of grass establishment was carefully regulated, while effects of drought conditions on the various species of grasses were noted after any prolonged dry spell.

All of the various species of grasses and thicknesses of sod performed an adequate job of controlling erosion on these slopes. The most efficient thickness of sod was determined from the study and introduced in the suggested set of revised specifications shown in Appendix A, as well as being outlined

in the conclusions and recommendations. Watering was shown to be a very important consideration in any slab sodding operation.

Principal conclusions reached as a result of this study were: (1) the study was limited in purpose and scope, thus the conclusions were only directive in nature, (2) the present specifications calling for slab sod to be a minimum of 2-1/2 inches in thickness is not realistic, a thinner sod could be used, (3) the minimum thickness of sod to effectively do the job is either 1 inch for nursery grown grass or 1-1/2 inches for field grown grasses, (4) care needs to be taken, especially on the nursery grown grasses, to provide sufficient watering of the grass for the first month after installation of the sod and (5) all of the grasses were of adequate quality and capability to be used for the intent of slab sodding operations, with some grasses being better than others depending on the purpose intended for slab sodding.

The following recommendations were made: (1) the specifications should be revised to allow nursery grown grasses to be used for slab sodding operations as well as field grown grasses presently allowed, at the contractors option or as directed by the engineer, (2) specifications should be revised to call for slab sodding to be a minimum of 1-1/2 inches in thickness for field grown grasses and a minimum of 1 inch for nursery grown grasses, (3) the procedures and methods of placing the slab sod as set forth in the present specifications should remain the same and (4) specifications should emphasize the importance and special care to be taken in watering the slab sod on installation and during the first month of growth. A copy of the suggested set of alternate specifications is found in Appendix A.

INTRODUCTION

There is an increasing demand for good slab sod on highway construction projects. Present specifications call for slab sod to be a minimum of 2-1/2 inches thick, and present methods require the contractor to approach private landowners for their source. It has become increasingly difficult to supply slab sod at this thickness, and private landowners are becoming negative to this approach claiming their topsoil is being depleted. Conservation agencies are also complaining about the depletion of topsoil.

Since sod farms cut only a small portion of soil depth, it was necessary for the Department to determine if the thinner depths and different grass species would be successful on construction projects. Experience has shown that for realistic results in research of this type, it is necessary to perform experimental work on projects that are actually under construction.

The advantage of using sod farm grasses over field grasses is the relative ease by which the grasses may be obtained. Various grass species are available, virtually weed-free, and the depth of cut will be considerably less. It is anticipated that with the newer and larger high production machinery, the reduction in weight and handling of the slab sod will result in a cheaper price for slab sod coming from farms. The valuable topsoil will not be depleted at as rapid a rate. Disadvantages include having to ship the grass sod and the possibility of the grass sod drying out.

PURPOSE

It was the specific aim of this study to evaluate various cut depths and different grass species for slab sodding operations. It was hoped that an adaptable grass species and a shallower cut depth could be found which would reduce the costs of slab sodding operations considerably. The purpose of this research effort was to also provide a suggested revised set of specifications for slab sodding operations covering the use of grasses obtained from slab sod farms.

SCOPE

Six species of grasses, Nomow Bermuda, Tiffway Bermuda, Common Bermuda, Centipede, Bahaia and Carpet Grass, were evaluated at thicknesses of 1/2, 3/4, 1, 1-1/2 and 2 inches for the purpose of providing a suggested revised set of specifications as outlined above. The growth of grass (length of grass blades) and the presence of weeds in the plots were not conditions that were directly to be considered in this evaluation.

METHOD OF PROCEDURE

Slab sod for this research study was supplied by a nearby slab sod farm, Mid-South Turf of Abita Springs, Louisiana. The site selected for this evaluation was on State Project No. 454-04-09, F. A. P. No. I-12-1(31)80, Hammond-Slidell Highway, St. Tammany Parish. T. L. James Company was the prime contractor on this construction project.

Slab sod from 1/2 inch in thickness to 2 inches in thickness was evaluated. Six different species of grasses were evaluated at different cut depths to determine which would be most adaptable to slab sodding operations at the shallowest possible cut depth. These evaluated grasses were: Nomow Bermuda, Tiffway Bermuda, Common Bermuda, Centipede, Bahaia and Carpet Grass. Generally, Common Bermuda, Carpet Grass and Bahaia are considered field grown grasses while Tiffway Bermuda, Nomow Bermuda and Centipede are considered nursery grown grasses. However, the prime consideration for separating field from nursery grown grass is the condition under which the grass was grown, either under controlled conditions of a nursery or slab sod farm, or uncontrolled in the field.

Two sites were used in this study, the dimensions of each site being 40 x 120 feet. One plot was located on the south slope of the roadway while the other plot was located on the north slope of the roadway directly opposite the first plot. The slope of each plot was approximately 3:1.

Figure 1 on Page 4 shows the actual geographical location of the plots, while Figure 2 on Page 5 shows the arrangement of the grasses and the depths at which they were evaluated.

Sod for the south slope was cut at the sod farm in Abita Springs, Louisiana on March 22, 1971 and delivered at the site on I-12 on March 23, 1971. The south slope was cultivated and dressed for laying of the sod, and 90 pounds of 8-8-8 fertilizer were applied before the sod was laid. The fertilizer was applied at the rate of 1000 pounds per acre. The sod was placed on the south slope on March 24, 1971, and 10 pounds of 8-8-8 fertilizer were applied on

FIGURE 1

GEOGRAPHICAL LOCATION OF PLOTS

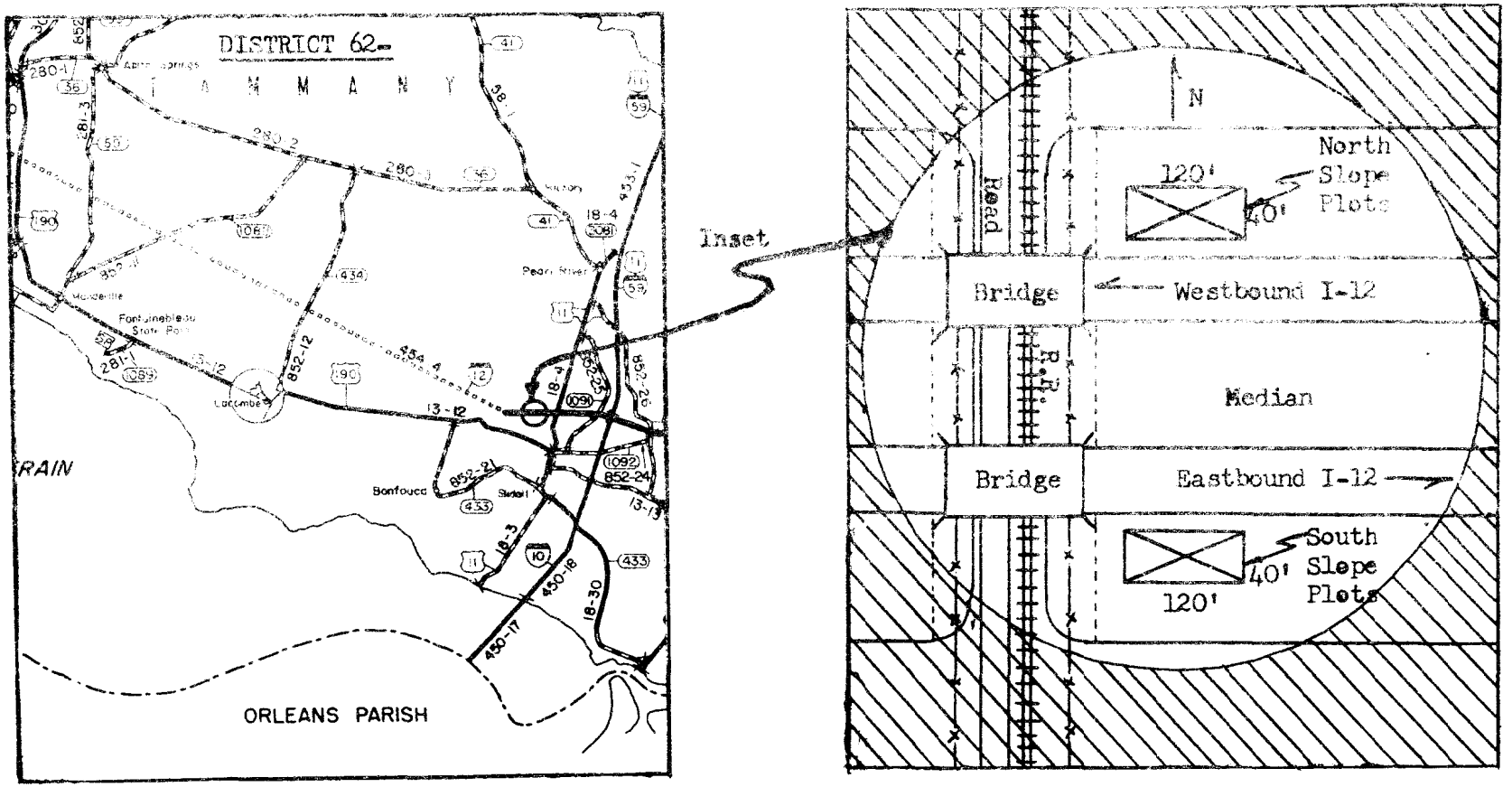

FIGURE 2

ARRANGEMENT OF PLOTS AS TO GRASS

SPECIES AND THICKNESS OF SOD

Nomow Bermuda	Tiffway Bermuda	Common Bermuda	Centipede	Bahaia	Carpet
Top of Slope					
1/2"	1/2"	1/2"	1/2"	2"	2"
3/4"	3/4"	3/4"	3/4"	3/4"	3/4"
1"	1"	1"	1"	1"	1"
1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"	1 1/2"
Bottom of Slope					

4 @ 10' = 40'

6 @ 20' = 120'

top of the sod. The same procedure was used on the north slope, which was laid on June 9, 1971.

Observations were made on the actual sodding operations, and each plot was also evaluated at various intervals, generally once or twice a month. Records were made as to the weight of the various thicknesses of the sod. The plots were watered according to the specifications during the crucial first month and as needed thereafter. A record was kept of the average rainfall in the area for each month. This was obtained from the local Weather Bureau. Mowing was requested on the slab sod plots when the grass or weeds became excessive. This mowing helped the researchers to isolate the various species of grasses and better evaluate each as to growth of grass, weeds and drought characteristics of the grasses. Individual visual observations and conclusions were made on the plots.

DISCUSSION OF RESULTS

Generally speaking, all the various species of grasses and thicknesses of sod fulfilled the purpose of controlling erosion on the slopes. However, an evaluation of each species of grass shows certain grasses are more drought resistant, flourish better, provide better coverage, appear better and seem in some cases to be more weed-free.

Evaluation of Sod Thickness

An evaluation of the sod thicknesses shows advantages and disadvantages in handling and stability for the varying thicknesses and types of grasses. At the end of the study, there was no discernible difference in the appearance of the root system when thickness of sod was compared to another or when one type of grass was compared to another. This may have been due to the short duration of the study. Therefore, prime emphasis on evaluation was made on the initial installation of the sod, because this was where the success or failure of the sod, the efficiency of the operation and any savings of time, money or manpower were determined.

For the Bahaia and Centipede grasses, the 1 inch cut was the easiest to handle, while the shallower cuts (1/2 to 3/4 inch) tended to break apart. The deeper cuts (1-1/2 to 2 inches) were too heavy to handle and tended to break apart due to their own weight. For all the nursery grasses, the 3/4 and 1 inch cuts seemed the easiest to handle, while for the Nomow Bermuda and Tiffway Bermuda, the 1/2 inch cuts tended to slide on the ground when rolled. The 1-1/2 and 2 inch cuts were too heavy to handle, but did not break apart. Table 1 shows comparisons of weights of the various thicknesses of sod.

TABLE 1

COMPARISON OF WEIGHTS OF SOD
(FOR 12 x 24 INCH SLAB)

Depth, inches	Weight, pounds
1/2	11.56
3/4	13.18
1	15.68
1-1/2	19.53
2	26.98

A projection of the weight of sod for 2-1/2 inch thickness will result in an approximate weight of 32 pounds. Use of 1 or 1-1/2 inch thick sod will create a substantial reduction in weight of the sod, affording better handling qualities plus a reduction in cost due to a reduction in shipping weight and the lowering of the unit price of the sod.

Drought Resistance

Table 2 shows the monthly rainfall data for the area. This table shows clearly the drought periods.

TABLE 2

MONTHLY RAINFALL DATA

Month	Rainfall, inches
March (south side installed)	2.47
April	0.68
May	2.02
June (north side installed)	4.45
July	6.20
August	3.25
September	8.29
October	0.08

The south slope plots were affected by the drought which occurred during April and May, even though the plots were watered at various intervals. Most all of the plots began to dry out and turn brown. Generally, the Centipede, Bahaia, Tiffway Bermuda and Nomow Bermuda appeared to be more drought resistant. Common Bermuda and Carpet Grass were affected the most by the drought, with the Carpet Grass in the worst condition.

The north slope plots had the advantage of receiving large amounts of rainfall for a 4 month period at the beginning of the growing period, after the sod was placed. All of the plots thrived; however, weeds took over all of the plots to varying degrees, except for the Bahaia plots. The Bahaia plots were generally weed free on the north slope. The grass underneath the weeds gave good cover and was green and thriving, but the weeds were obscuring the grass.

During the month of October until the middle of November another drought period prevailed, results of which became evident on both the north and south slopes. Bahaia appeared better than any of the grasses at the end of the evaluation period with Centipede and Tiffway Bermuda next in line. Carpet Grass still appeared in the worst shape.

Towards the end of the summer on August 18, most of the area had been receiving good precipitation. Those plots on the north slope especially were green and thriving; however, weeds were present throughout the plots. The plots had just been mowed, and loose grass cuttings were laying on top of the plots. The best single plot on the south slope at this time was the 1 inch Centipede plot, although all of the Bahaia plots generally appeared good.

The evaluation of September 27 showed that on the north slope there was good, green grass coverage on all of the plots, especially on the Bahaia and Centipede grass plots. Varying amounts of weeds dominated the Carpet Grass and Nomow Bermuda Plots. On the south slope there was good coverage on Nomow, Tiffway and Common Bermuda and Carpet Grass plots; however, a large number of weeds were present. There was very good coverage and not as many weeds on the Bahaia plots. Centipede afforded good thick coverage, but weeds especially dominated the 1/2 and 1-1/2 inch plots.

Both the north and south slope plots began to show signs of drying or browning out at the October 12 evaluation, and weeds had overtaken the grasses. Weed growth was evident at an even greater extent at the November 8 evaluation, although the plots had just been mowed. Carpet Grass was browning badly and had some bare spots. The Nomow Bermuda on the north slope was slightly green, but difficult to see because of the weeds. Tiffway Bermuda, Common Bermuda, Centipede and Bahaia on the north slope all were green with good coverage although beginning to dry out somewhat. The south slope plots essentially looked the same as the north slope plots, except they were browning out more rapidly and had more bare spots. The plots appeared to become greener as the thickness increased, with the thinner plots brown and the thicker plots slightly green.

A summary of all the individual monthly evaluations is included in Appendix B. Results of these evaluations showed the importance of initial installation. Handling and placing the sod required careful attention and watering the sod was very important, especially in the first month. Type of grass and thickness of sod, coupled with handling and placing, played a part in efficiency and savings in cost and manpower. Another factor was the amount of water the plots received, either due to the normal manual watering or the rainfall that the plots received. A secondary factor was the weed problem; although it was not supposed to be considered in this study, it tended to play a part in the appearance of the plots, thus we see a mention of weeds throughout the discussion of results. However, only two items need to be considered as prime factors in this study, the first being an evaluation of the six types of grasses, the second an evaluation of the thickness of the cut sod. These factors led to the recommendation of an alternate set of specifications for slab sodding operations.

CONCLUSIONS

The study was limited in purpose and scope, thus the conclusions were only directive in nature. It was learned that all of the grasses and thicknesses of sod did a creditable job of controlling the erosion on this project.

The present specifications calling for slab sod to be a minimum of 2-1/2 inches in thickness is not realistic; a thinner sod should be allowed. The minimum thickness of sod to effectively do the job is either 1 inch for nursery grass or 1-1/2 inches for field sod. Sod less than 1 inch thick tended to break apart, while the deeper thicknesses of sod were too heavy to handle.

Care needs to be taken, especially on the nursery grown grasses, to provide sufficient watering of the grass for the first month after installation of the sod. All of the grasses were of adequate quality and were capable of being used for the intent of slab sodding operations, with some grasses being slightly better than others. The contractor should be allowed to use the grass of his choice, but subject to the approval of the engineer, depending on the purpose intended for the grass.

The most drought resistant grasses shown by the limited duration and evaluation on this study were Centipede, Bahaia and Tiffway Bermuda. The best appearing grass shown on this study was Bahaia, followed in order by Centipede, Tiffway Bermuda, Nomow Bermuda, Common Bermuda and last, Carpet Grass.

The most weed-free plots on the study were the Bahaia plots; however, weeds overtook most of the grass plots, and although an evaluation of the weed resistant qualities of the grasses was not a part of the study, the appearance of the plots was affected by the presence of the weeds. Thus the weeds partly influenced the evaluation of the grasses.

There was no discernible difference in the appearance of the root system of any of the grass species or thicknesses of sod as shown in cut plug samples taken in each plot.

A recommendation should be made for a revised set of specifications for slab sodding operations covering use of grasses obtained from slab sod farms (nursery grown grasses).

RECOMMENDATIONS

Present specifications should be revised accordingly as outlined below and these specifications should be adopted as standard.

The specifications should be revised to allow nursery grown grasses to be used for slab sodding operations as well as field grown grasses presently allowed, at the contractors option or as directed by the engineer. Nursery grown grasses allowed for slab sodding operations should include Centipede, Tiffway Bermuda and Nomow Bermuda. Field grown grasses allowed for slab sodding operations should include Bahaia, Common Bermuda and Carpet Grass.

Specifications should be revised to call for slab sodding to be a minimum of 1-1/2 inches in thickness for field grown grasses and a minimum of 1 inch for nursery grown grasses. The procedures and methods of placing the slab sod as set forth in the present specifications should remain the same.

Specifications should emphasize the importance and special care to be taken in watering the slab sod on installation, especially during the first month of growth and whenever necessary.

A copy of the suggested set of specifications is found in Appendix A.

APPENDIX A

PROPOSED SPECIFICATIONS

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SECTION 714

SLAB SODDING

714. 01 DESCRIPTION. This work shall consist of furnishing, hauling, planting, fertilizing and liming if required, rolling, watering and maintaining live bermuda grass sod, live carpet grass sod, any other approved grass sod which is native to the area or approved nursery grown grass sod at locations shown on the plans or designated by the engineer.

714. 02 MATERIALS. Slab sod from field grown grass shall be composed of bermuda grass, carpet grass or other approved grass which is native to the locality of the work.

Slab sod from nursery grown grass may be used by the contractor at his option. Only the following varieties will be used: centipede, tiffway bermuda, nomow bermuda, common bermuda and bahaia.

Sod furnished shall be free from noxious weeds and other vegetation and shall be planted as provided in these specifications.

Commerical fertilizer and agricultural lime shall meet the requirement of Subsection 915. 08.

Water may be obtained from any available source, except brackish or oily water shall not be used.

CONSTRUCTION REQUIREMENTS

714. 03 GENERAL. Slab sod shall be cut with approved mechanical or manual sod cutters. The designated area shall be mowed when necessary, and the sod shall be cut to a minimum depth of 1-1/2 inches for field grown grass and 1 inch for nursery grown grass, and to a uniform width and in convenient lengths for handling. Care shall be exercised at all times to retain the native soil on the roots of the sod during the process of excavating, hauling and planting.

Sod which has been cut more than 48 hours before placing shall not be used.

Sod taken from bare areas that may produce inferior growth will not be accepted.

Any watering required in connection with cutting, storing or hauling sod will not be paid for.

714. 04 DIGGING AND HANDLING SOD. The contractor may use either a (1) hand method or (2) machine method for digging and handling sod.

(a) Hand Method: When sod is cut in the field, it shall be placed flat, grass side up on boards of convenient lengths and hauled to the planting site with soil still intact. Only one layer of sod shall be placed on each board and such

boards shall be of sufficient thickness to prevent unreasonable bending and of sufficient width so that the slabs of sod shall not hang over the edges. The slabs shall be placed closely without leaving unreasonable spaces between them. In no case shall slab sod be loaded in bulk on vehicles or dumped in bulk on the planting site.

(b) Machine Method: The contractor may use mechanical devices to cut, load, haul and plant sod. Care should be exercised at all times to retain the native soil on the roots of the sod. All sod stacked shall be kept moist and protected from the elements in a manner satisfactory to the engineer. When the machine method is used, final acceptance will not be made until satisfactory growth of sodding has been obtained. Satisfactory growth shall be understood to mean a healthy, living and growing grass turf which has been planted in accordance with the requirements of these specifications.

714.05 PLANTING. All areas to receive slab sod shall be thoroughly scarified and pulverized to a depth of approximately 3 inches and dressed to a reasonable grade. If an item for agricultural lime is included in the contract, the liming shall be done when the area is being pulverized. If an item for fertilizer is included in the contract, approximately 90 percent shall be broadcast over the entire area to receive the slab sodding, the remaining 10 percent shall be broadcast over the sod after placing and rolling. Upon delivery to the planting site, the slab sod shall be transferred onto the surface of the soil. The area to be sodded shall be watered as directed. The slabs of sod shall be placed closely, leaving a minimum amount of space between slabs. Slabs which do not fit closely shall be pulled together with suitable tools.

714.06 ROLLING. All slab sod shall be rolled as soon after planting as practicable with plain rollers or cultipackers. Where rolling is impracticable, the sod shall be tamped by approved hand methods.

714.07 WATERING. All slab sodding shall be watered as necessary. If nursery grown grass sod is used on a project, the contractor will have to pay particular attention to the watering item to provide satisfactory growth for the grass.

714.08 EQUIPMENT. All equipment necessary for the satisfactory performance of this work shall be on the project and approved before work will be permitted to begin.

714.09 METHOD OF MEASUREMENT. Slab sodding will be measured by the square yard, and the area to be included in the measurement shall be the actual area sodded as authorized. Water will be measured by the 1000 gallons in tanks used by contractor. Fertilizer and agricultural lime, when required, will be measured and paid for as provided in Subsection 718.05 and 718.06.

714.10 BASIS OF PAYMENT. Sodding planted and accepted, measured as provided above, shall be paid for at the contract unit price.

Water will be paid for at contract unit price.

Payment will be made under:

ITEM NO.	PAY ITEM	PAY UNIT
714(1)	Slab Sodding	Square Yard
714(2)	Water	M Gallons

APPENDIX B

SUMMARY OF EVALUATION OF

SLAB SOD THICKNESS

SUMMARY OF

EVALUATION OF SLAB SOD THICKNESS

March 22 - Sod cut at Abita Springs Farm.

March 23 - Sod delivered to site on I-12. South slope dressed for laying sod. Ninety (90) pounds of 8-8-8 fertilizer was applied before sod was laid. Fertilizer applied at the rate of 1,000 pounds per acre.

March 24 - Sod was placed on south slope. Ten (10) pounds of 8-8-8 fertilizer was applied on top of the sod.

For the Bahaia and Centipede grasses the 1 inch cut was the easiest to handle. The shallower cuts tended to break apart. The deeper cuts were too heavy to handle and tended to break apart due to their own weight.

For all of the nursery grown grasses the 3/4 and 1 inch cuts seemed the easiest to handle. For the Nomow Bermuda and Tiffway Bermuda the 1/2 inch cuts tended to slide on the ground surface when rolled. The 1-1/2 - 2 inch cuts were too heavy to handle but did not break apart.

March 28 - Heavy rain on plots.

March 30 - Grasses observed. The Common Bermuda plot had been taken over a lush green stand of Ryegrass. The actual coverage by the Common Bermuda was approximately 20-30%. All of the other grasses provided good ground coverage but were still brown.

April 17 - Grasses watered. Grasses are watered every 2 - 3 days.

April 20 - Grasses observed.

Nomow Bermuda - Very slow growing. Good ground coverage at all depths but still very brown.

Tiffway Bermuda - Good coverage at all depths: 1 - 2 inches tall. Coverage seemed thicker at 3/4 - 1 inch cuts.

Common Bermuda - Ryegrass has taken over this plot. Ryegrass stand approximately 6 - 8 inches tall.

Centipede - Brownish in color but providing good coverage. Poorest at 1/2 inch depth. Coverage seemed best at 1 - 1 1/2 inch cuts. Slow growing. Some dirt and gravel washed from roadway above onto 1/2 inch plot probably contributed to its poor appearance.

Bahaia - Good coverage. Thicker at 1 - 1 1/2 inch depths. Sod broken apart at 2 inch depth.

Carpet Grass - Good coverage at all depths. Sod broken apart at 2 inch depth.

Comparative weights of 12 x 24 inch sod pieces

Depth (inches)	Weight (lbs.)
1/2	11.56
3/4	13.18
1	15.68
1-1/2	19.53
2	26.98

May 18 - Grasses observed.

Nomow Bermuda - Short but good coverage. Many weeds.

Tiffway Bermuda - Good, short green coverage. Some weeds but less at 1/2 inch plot.

Common Bermuda - Ryegrass stand approximately 18 inches tall. Ground coverage 20 - 30% Common Bermuda.

Centipede - Poor at 1/2 inch depth. Good coverage at all other depths with some weeds.

Bahaia - Broken sod at 2 inches. Good coverage at all other depths with some weeds.

Carpet Grass - Good coverage but sod appeared to be broken at all depths.

Note: The sod had not been artificially watered since May 11. Some rain occurred on May 12.

Sept. 9	NORTH SLOPE:	Beginning to need mowing. Has been getting adequate precipitation.
	Nomow Bermuda	Good coverage, green but plenty of weeds on all plots.
	Tiffway Bermuda	Good coverage, green but plenty of weeds on the 1/2 and 3/4 inch plots with less weeds on the 1 inch plot. Thin coverage and weeds present on the 1-1/2 inch plot.
	Common Bermuda	Good coverage and excellent growth, with some weeds being present on all plots with less weeds on the 1-1/2 inch plot.
	Centipede	Good coverage and good growth on all the plots. Some weeds present on the 3/4 inch plot and many weeds on the 1 inch plot with fewer weeds on the 1-1/2 inch plot.
	Bahaia	Excellent growth but thin with few weeds on all the plots.
	Carpet Grass	Not as good coverage but green on all plots with heavy stand of weeds.
	SOUTH SLOPE:	Beginning to need mowing. Has been receiving adequate precipitation.
	Nomow Bermuda	Thin coverage on the 1/2 inch plot with plenty of weeds. Fair coverage and heavy weeds on the 3/4, 1 and 1-1/2 inch plots.
	Tiffway Bermuda	Good coverage but thick weeds on all plots.
	Common Bermuda	Good coverage but thick weeds on all plots.
	Centipede	Good thick coverage on all plots with weeds. A brown spot noted on the 1-1/2 inch plot.
	Bahaia	Good coverage but thin on all plots.
	Carpet Grass	Good coverage on all plots. Bare spots noted on the 1 and 2 inch plots. Some weeds were present on the 1-1/2 inch plot and heavy stand of weeds present on the 3/4 and 2 inch plots.

Sept. 27	NORTH SLOPE:	Good, green coverage on all plots, very good on Bahaia and Centipede. Weeds dominate Carpet Grass and Nomow Bermuda plots. Some weeds on all Tiffway Bermuda plots and 3/4 inch Common Bermuda plots, more weeds on 1 and 1-1/2 inch Common Bermuda plots and 3/4 inch Centipede plots, not many weeds on the remainder of the Centipede plots and all the Bahaia plots.
	SOUTH SLOPE:	Good coverage on Nomow, Tiffway Bermuda, Common Bermuda and Carpet Grass with thin weeds. Very good coverage and not as many weeds on the Bahaia plots. Centipede had good thick coverage but heavy weeds in the 1/2 and 1-1/2 inch plots, not as many weeds in the 3/4 and 1 inch plots.
Oct. 12	NORTH SLOPE:	Plots are beginning to dry out. Carpet and Nomow plots are extremely weedy, and it is hard to tell how the grass is doing beneath. Some weeds are present in some of the other plots. Plots are in need of mowing. Bahaia looks good with no weeds present. Tiffway Bermuda looks good with some weeds while Centipede is green and thick, looks good but has some weeds present, and the 1 inch plot is extremely weedy.
	SOUTH SLOPE:	Weeds dominate the plots. Bahaia and Centipede have either no weeds or little weeds. Carpet Grass appears to be in the worst shape. In need of mowing and beginning to become woody.
Nov. 8	NORTH SLOPE:	Grasses are browning and plenty of weeds are present. Plots were just mowed but lots of cut grass laying out on the plots. Carpet Grass is browning badly and has some bare spots with plenty of weeds and the mowing was not too good. Nomow Bermuda is slightly greener but extreme amount of weeds are present and hard to tell grass. Tiffway Bermuda, Common Bermuda, Centipede and Bahaia all have fairly good coverage. 1 inch plots of Common Bermuda have the weeds. Bahaia looks good and Centipede has thick coverage but some weeds present in the 1 and 1-1/2 inch plots. Differences in root depths are not discernible.

June 9	NORTH SLOPE:	The north slope plots were laid and watered on this day.
	SOUTH SLOPE:	Overall, the plots were very dry since they had not received water in a long time. The plots were watered later in the day after the observations were made.
	Nomow Bermuda	Good, short coverage but contains many weeds. Approximately 1/2 of the plot areas were yellow at each depth.
	Tiffway Bermuda	Good short coverage. Gradually choking out the weeds. One half the coverage was yellow at each depth.
	Common Bermuda	The Ryegrass stand has died and dried up. Very few green spots.
	Centipede	Good coverage but dry. Some weeds.
	Bahaia	Good coverage with some bare spots at ground level.
	Carpet Grass	Very dry. Appears to be in the worst shape of all grasses observed.
June 30	NORTH SLOPE:	Evidence showed that this plot was probably watered this day.
	Nomow Bermuda	Good coverage at 1/2 inch depth. All other plots had good coverage with some weeds but were approximately 1/3 brown.
	Tiffway Bermuda	Excellent 2 - 3 inch coverage. At the 1-1/2 inch depth one half of the plot was green while the other half was brown.
	Common Bermuda	At the 1/2 inch depth there was spotted coverage while 1/3 the plot was brown. The 3/4 inch plot was 2/3 brown. The remaining plots provided good coverage approximately 6 inches high but the 1-1/2 inch plot was 1/2 brown.
	Centipede	The 1/2 and 3/4 inch plots provided excellent green coverage but the remaining plots were 1/3 brown.
	Bahaia	Generally, the Bahaia provided good coverage at all depths but was very brown except for the 3/4 inch plot which was green.

	Carpet Grass	Good coverage at all depths but very brown.
	SOUTH SLOPE:	The soil under the sod was moist after a recent rain or watering, but the grasses could use more frequent watering. Some soil was washed from the highway shoulder above into each top plot.
	Nomow Bermuda	Thin coverage with many weeds at all depths.
	Tiffway Bermuda	At the 1/2 inch depth the coverage was thin because of the soil washed from the shoulder. The remaining plots provided good coverage, and the weeds appeared to be thinning out.
	Common Bermuda	Eyebrass appeared to be dead. The Common Bermuda coverage was approximately 10-20%.
	Centipede	Thin coverage at 1/2 inch. Good coverage at all other depths with some weeds.
	Bahaia	Good thick coverage at all depths.
	Carpet Grass	Thin coverage with many weeds at 2 inch depths. Good coverage with many weeds at all other depths.
July 27	NORTH SLOPE:	A highway sign was placed at the top of the Centipede plots with soil scattered over the 1/2 inch and 3/4 inch cuts. This could possibly have a smothering effect on the grasses in these two plots. A recent heavy rain was noted.
	Nomow Bermuda	Good coverage on the 1/2, 3/4 and 1-1/2 inch plots. Some weeds were noted on the 1/2 and 1-1/2 inch plots, while the 3/4 inch plot had many weeds. The 1 inch plot had some brown spots.
	Tiffway Bermuda	Good green coverage was noted on all the plots with the 1-1/2 inch plot having some weeds.
	Common Bermuda	Good green coverage was noted on all plots with some weeds being present in all the plots.
	Centipede	Light coverage was noted on the 1/2 and 3/4 inch plots with good coverage being noted on the 1 and 1-1/2 inch plots, but some weeds were present in all. Plots of 1/2 and 3/4 inch were probably due to recent placement of a sign. Generally Centipede has been looking very good among all the various grasses.

	Bahaia	Good green coverage was noted with some weeds present in all plots.
	Carpet Grass	Good green coverage was also noted on all plots with some weeds being present. The 1-1/2 inch plot has some poor sod.
	SOUTH SLOPE:	The highway shoulder received a heavy application of asphaltic emulsion. Consequently, the entire plot accidently received a light coating due to the airborne particles. It has not yet been determined whether this will have an effect on the progress of the grass plots. The plots had recently received a heavy rain.
	Nomow Bermuda	Thin coverage and many weeds were noted on all plots.
	Tiffway Bermuda	Thin coverage was noted on the 1/2 inch plot with many weeds. Good coverage was noted on the 3/4, 1 and 1-1/2 inch plots, but many weeds were present.
	Common Bermuda	Good coverage was noted on all the plots with some weeds present on the 1/2 inch plot and many weeds noted on the other plots.
	Centipede	Good coverage and many weeds were noted on all the plots.
	Bahaia	Good coverage was noted with some weeds being present on all the plots.
	Carpet Grass	Good coverage was noted with many weeds being present on all the plots.
August 4	NORTH SLOPE:	All plots generally had many weeds and coverage was adequate, but plots were in need of mowing as it was difficult to distinguish between grass and weeds. Bad sod was noted on the 1-1/2 inch plot of the Centipede grass.
	SOUTH SLOPE:	Generally the south slope was in the same condition as the north slope with many weeds being present. Mowing is needed badly.
August 18	NORTH SLOPE:	Most all the area has been getting good precipitation, thus plots are green and thriving, however weeds are present throughout the plots. The plots have just been mowed, and the cut grass is still laying on top of the plots.

Nomow Bermuda	Good coverage, but weeds present.
Tiffway Bermuda	Good coverage and good growth, but many weeds present in the 1 and 1-1/2 inch plots, less in the 3/4 inch plot.
Common Bermuda	Good coverage and growth but hard to tell weeds from grass. Brown spot noted on the 1/2 inch plot.
Centipede	Good coverage, good growth, few weeds, looks good. Some bare spots on the 1-1/2 inch plot.
Bahaia	Few weeds, good coverage, but somewhat thinned.
Carpet Grass	Not as good coverage with weeds being present and hard to tell between grass and weeds on the 1-1/2 inch plot.
SOUTH SLOPE -	Most all the area has been getting good precipitation, thus plots are green and growing, however weeds are present throughout the plots. The plots have just been mowed, and the cut grass is still laying on top of the plots.
Nomow Bermuda	Good coverage on the 3/4, 1 and 1-1/2 inch plots. Thin and less coverage on the 1/2 inch plot. Weeds present in all plots with bare spot noted on the 1-1/2 inch plot.
Tiffway Bermuda	Thin but good coverage on the 1/2 inch plot with less weeds. Good coverage and weeds noted on the other plots. Some brown spots noted on the 1 and 1-1/2 inch plots.
Common Bermuda	Thin but good coverage on all plots. Weeds present on all plots but less on 1/2 inch plot. Brown spots noted on all plots.
Centipede	Good coverage on all plots. Weeds present in all plots but less in the 1 inch plot. Brown spot noted on 1/2 inch plot. The 1 and 1-1/2 inch plots are thick and green. Best single plot on the south slope is the 1 inch plot.
Bahaia	Good coverage and less weeds, tall but thinned.
Carpet Grass	Good coverage but weeds present. Bare spots on the 1 and 1 inch plots with brown spots on the 3/4, 1 and 1-1/2 inch plots.

SOUTH SLOPE: Differences in root depths are not discernible. South slope essentially looks the same as the North slope except is browning out more rapidly and has more bare spots. The thicker plots appear to the slightly greener with the thinner plots brown and getting greener as the thickness increases.