TEXAS HIGHWAY DEPARTMENT

AUSTIN

June 19, 1941

Refer to File No. DCG

ADMINISTRATIVE CIRCULAR NO. 29-41

SUBJECT: Soils & Sodding

TO ALL DISTRICT ENGINEERS

Gentlemen:

We are transmitting herewith a discussion relative to soils and sodding and based upon a State-wide inventory of the work that has been accomplished and that is now being accomplished throughout the State.

It is possible that not nearly enough thought is being given to this subject. It should be remembered that block sodding was designed to be used only in rare and specific instances, since this is a very expensive procedure. We must realize that our organization combines both construction and maintenance and the maintenance employees are directly responsible to the District Engineer as are the construction employees. By proper maintenance and taking a certain amount of risk, we can often in one season accomplish a sodded effect at appreciably less cost than might originally be accomplished by block sodding.

Occasionally it is noticed that sodding is being performed on a construction project under most unfavorable weather conditions. It is realized that the time at which the planting is to be actually done is very difficult to estimate and to control. It has also been noticed that a considerable amount of sodding is sometimes lost when the paving operations follow immediately behind the grading and sodding operations.

These matters should be given careful thought during the design of the project, as well as during the period of construction.

The Austin office is open to any constructive suggestions that the field employees may offer concerning these important items of our work.

Sincerely yours,

/s/ *D. C. Greer*

State Highway Engineer

I. CLASSIFICATION OF SOILS FOR ROADSIDE VEGETATION

Soils for roadway foundations are selected to minimize movements and failures due to moisture fluctuations whereas soils for the support of roadside vegetation are selected for fertility and texture. Soils for roadside use are topsoils usually obtained at depths not greater than eighteen (18) inches while soils for roadway foundations may be secured from sources, stripped of topsoil, at much greater depths. All soils are composed basically of sand, silt, clay, and humus, of which no single ingredient will make a valuable or fertile soil. The loams are the most valuable soils for the growth of vegetation, and are usually a mixture of the four ingredients described below.

Sand: Sand is a mineral substance composed of small but separate grains of rock, usually quartz. There is practically no food value in sand, however, sand in soil makes the soil mellow, porous, and warm.

Clay: Clay is a plastic earth substance composed of fine particles of rock such as silica, limestone, aluminum, and feldspar. The finer particles are so small that they cannot be seen without the aid of a microscope. In contrast to sand, the clays are rich in plant food, retain moisture well, and are not as subject to erosion; however, an excess of clay in the soil will make it adhesive and unmanageable when wet.

Silt: Silt is composed of soil grains intermediate in size and in character between sand and clay. Such soils are usually rich in plant food and retain moisture well.

Humus: Humus is a black or dark brown substance in soils, formed by decomposed organic matter, chiefly vegetable. It is valuable to soils in that it furnishes plant food, absorbs and retains moisture, and improves soil texture and aeration.

II. TREATMENT OF VARIOUS SOILS FOR ROADSIDE VEGETATION.

Sandy soils: These are the soils containing as much as 80 percent sand and less than 10 percent clay. Such soils are poor in plant food, and being porous, are least resistant to erosion. Such soils may be improved in texture and fertility by the addition of one or more of the following materials, clay, silt, barnyard manure, sawdust, cotton-burrs, leaf mold, grass clippings, or a straw mulch (wheat, oats, or rice). Another method is to plant a cover crop and plow the crop under when in full growth. The following cover crops may be used for this purpose: for east Texas, white Dutch clover planted at the rate of 3 pounds per acre, little hop clover at 2 pounds per acre, or common Lespedeza at 10 pounds per acre; for the Gulf Coast area, common Lespedeza at 10 pounds per acre; for the Blackland Belt, black medic at 5 pounds per acre

or bur-clover at 5 pounds per acre; and for the Plains area, common alfalfa at 20 pounds per acre.

Sandy loams: These soils contain from 60 percent to 80 percent sand, the remainder being clay, silt, and humus. For treatment of these soils, use the same methods as listed under *sandy soils.*

Clay soils: These soils contain 60 percent or more of clay and silt. These soils may be improved by the application of humus or sand to lighten the soils. Cover crops such as wheat, oats, alfalfa, clover, et cetera plowed under also furnish humus to the tight soils. The addition of 1 to 1½ tons of burned or slacked lime to the acre will make a clay soil more friable, thus improving its texture. The addition of lime should not be applied more often than 4 to 6 years. Deep and frequent cultivation is another means of making the soil porous.

Clay loams: These are similar to clay soils, but they contain less clay and silt, and more sand, usually 30 percent to 50 percent clay and 10 percent to 35 percent sand. This is a good soil, which with an occasional application of humus develops fertility thus making a good topsoil. The leaving of grass clippings and an occasional loosening with a tooth harrow will also benefit the soil.

Loam soils: These are the most useful "all around" soils, combining the lightness of sand with the strength and retentiveness of the clays. They contain about 40 percent to 60 percent of sand and from 15 percent to 25 percent clay. They are the most desirable soils for topsoil provided that there is sufficient amount of humus present. The humus content can be determined by visual inspection and by making the following simple test: press a small sample of soil, under normal moisture conditions, into a ball with the hands and then release and tap lightly. If sufficient humus is present the soil will crumble and return to its normal state.

Gravelly and stony loams: These are sandy loams, clay loams, or loams with an admixture of gravel or stones; all pieces of rock from $\frac{1}{25}$ of an inch up to 3 inches are gravel, larger pieces are stones. No special treatment is necessary; however, an application of humus will improve the soil texture.

Muck soils: Muck is the black soil produced when a luxuriant growth of plants decays slowly under water for many years. Such a soil needs only to be drained and frequently loosened by cultivation to become useful as a topsoil.

Topsoils: Clay loams and loam soils, listed above, when secured at shallow depths are usually used for topsoil dressings, and are best suited for the establishment of vegetation on the roadsides. Bacteria and earthworms, which are necessary to the life of any soil, thrive in a topsoil that is loose in texture and contains considerable humus. Earthworms digest organic refuse combined with the mineral components of the soil, and then excrete humus. They also aid soil drainage and aeration by making small holes and passageways

from the ground surface to the subsoils, sometimes to a depth of 7 feet. For agricultural purposes, it has been found that there should be at least six hundred pounds of earthworms to the acre to keep the soil in the proper physical condition.

III. SODDING

Sodding is primarily for the control of erosion, the control of obnoxious weeds, and the insulation of the subsoils. A sandy loam mulch sod placed on sterile soils acts as an insulation, and is an excellent material for the preservation of moisture in the roadbed. Such a granular material will preserve the density obtained during construction thus having a tendency to reduce future swells and loss of stability. In blackland areas or others where a sandy loam mulch sod cannot be obtained it is suggested that a pervious mulch material such as cotton-burrs, leaf mold, or partially decomposed straw be used and planted with grass.

For level areas of the roadside with good topsoil, sodding is not essential as revegetation will become established usually in a short period of time. Sodding should be incorporated in each stage of construction as needed to control erosion, obnoxious weeds, and for the insulation of the subsoils.

The use of the various types of sodding depends upon the type of soil encountered. Spot and trench sodding are adaptable to the fertile topsoils on relatively flat slopes while block, mulch, shovel, and sacked sodding together with grass retards are adaptable to sterile soils of varying slopes as the application of these types of sodding furnish both topsoil and sod. Where block sod is used on sterile subsoils, it is recommended that three inches or more of good topsoil be spread over the area, then spread an 11-48-0 fertilizer over the surface of topsoil before the block sod is placed. This will increase the initial cost of sodding but will provide sufficient soil to encourage deep root growth necessary to withstand drought periods. It is also recommended that mulch sod be increased in depth and an 11-48-0 fertilizer be used when mulch sod is placed on sterile subsoils. The 11-48-0 fertilizer (11 percent nitrogen, 48 percent phosphoric acid, and 0 percent potash) is suggested as most of the soils in the State have a sufficient amount of potash; however, they are deficient in nitrogen and phosphoric acid.

Spot, trench, mulch, and block sodding together with grass retards are described fully in Item 509 of the Texas Highway Department Standard Specifications. Shovel sodding is a special item not widely used as yet, but may be used extensively in place of block sodding. Shovel sodding is loaded by hand methods and roughly spread on areas to be sodded. Practically the same results are obtained as from block sod at a greater reduced cost. Another type of sodding used as a special item is called sacked sod, and is used where it is difficult to get sod established due to wave action or scouring. This type of sodding consists of placing sod in bags (sugar, flour, or cement) then placing the bags where needed as is illustrated on page 43 of Booklet No. 3 - *Suggestions for Roadside Development.*

The uses for various types of sodding as listed below are the usual practices in the field and are based on normal soil and climatical conditions. Allowances will have to be made in sod types and the degree of slope to fit local soil types, moisture conditions, and varying sizes of drainage areas.

Sodding will be more effective in the control of erosion of roadway ditches if a flat bottom of four (4) feet (minimum) is provided. As long as the shoulder slope and backslope converge to form the ditch, there will remain a low point subject to erosion.

GENERAL USE OF SPOT SODDING

(a) On shoulder slopes of fertile soil with slopes of 6:1 or flatter. (b) On fill slopes of fertile soil and where the height of fill is less than 5 feet with 2:1 to 6:1 slopes. (c) In roadway ditches through fertile soil with a grade less than 2 percent. (d) On berms if soil is fertile. (e) On backslopes with fertile soil and slopes are 6:1 or flatter. (f) For sodding on shoulders, see Booklet No. 9 - *Suggestions for Roadside Development.*

GENERAL USE OF TRENCH SODDING

(a) On shoulder slopes with fertile soil and moderate slopes of 4:1 to 6:1. (b) On fill slopes with fertile soil and the height of the fill is greater than 5 feet with 4:1 to 6:1 slopes. (c) In roadway ditches through fertile soil with a grade of 2 percent to 3 percent. (d) On berms if soil is fertile and erodes easily. (e) On backslopes if soil is fertile and the slopes are from 2:1 to 6:1.

GENERAL USE OF MULCH SODDING

(a) On shoulders when existing soils are sterile. (b) On shoulder slopes when existing soils are sterile. (c) On fill slopes when soil is sterile. (d) In roadway ditches where soil is sterile and the grade is less than 3 percent; also on grades from 3 percent to 4 percent when reinforced with grass retards. (e) On berms when the soil is sterile. (f) On backslopes where the soil is sterile and the slopes are from 2½:1 to 12:1.

GENERAL USE OF BLOCK SODDING

(a) On portions of fills that are subject to scouring and wave action. (b) In roadway ditches where the grade is 4 percent or greater. (c) In drainage channels with grades steeper than 3 percent and on backslopes of channels when slopes are from 1½:1 to 3:1. (d) On backslopes with slopes from 1½:1 to 2:1. (e) On slopes adjacent to structures and in channel inlets and outlets. (f) For spillways of dikes, terrace outlets, and flumes on fills.

GENERAL USE OF GRASS RETARDS

(a) In roadway ditches of erosive soils where the grade is steeper than 3 percent supplemental with shovel or mulch sod.

GENERAL USE OF SHOVEL SODDING

(a) On backslopes with slopes from 1½:1 to 4:1. (b) In roadway ditches with grades from 3 percent to 4 percent.

GENERAL USES OF SACKED SOD

(a) Adjacent to structure wingwalls and outlets. (b) For bases of fills subject to scouring and wave action. (c) In drainage channels subject to scouring. (d) In roadway ditches where it is impossible to get other types of sod established.

IV. SEASON FOR SODDING

In general, sodding may be done at any time of the year over the entire State, however, spring and fall are the most desirable seasons. During these seasons, growth is stimulated by the rains which are usually prevalent and sod becomes sufficiently established to withstand the heat of the summer and the cold of the winter. When desired, new construction work finished in late fall may be protected from erosion during the winter months by seeding the roadsides with Italian rye grass, clover, or other winter grasses.

V. MULCHING AND FERTILIZER

Fertilizer is not necessary when sods are planted in fertile soils; however, if a quick sod is desired, the application of fertilizer will stimulate the growth. On areas where sod is poorly established, the soil and sod may be improved by the application of fertilizer, straw, cotton-burrs, sewage, or other humus and then disked into the soil.

VI. RELATIVE COSTS OF SODDING TYPES

The following average costs are for the various types of sodding used in Federal-aid projects constructed during 1939 and 1940.

Grass retards	$1.37 per cubic yard
Block sodding	0.189 per square yard
Mulch sodding	0.65 per cubic yard
Trench sodding	0.031 per square yard
Spot sodding	0.023 per square yard
Shovel sodding	0.75 per cubic yard (estimated)
Sacked sodding	2.40 per cubic yard (estimated)

VII. SPRINKLING

Sprinkling for sod types varied widely on projects constructed in 1939. For spot sodding, sprinkling was estimated from 5 to 30 gallons per square yard with an average of 13.3 gallons per square yard; for trench sodding, 5

to 10 gallons per square yard with an average of 6.7 gallons per square yard; for block sodding, 5 to 18 gallons per square yard with an average of 13.2 gallons per square yard; for mulch sodding, 30 to 200 gallons per cubic yard with an average of 76 gallons per cubic yard; for grass retards, 30 to 300 gallons per cubic yard with an average of 81 gallons per cubic yard.

It will be noted that there is a great variation in the amount of sprinkling estimated. In normal seasons, two inches of rainfall is ample to support grass provided it comes at the proper season. As sprinkling may be done when desired, it is suggested that the quantity be estimated on the basis of a two-inch application which is approximately 11.5 gallons per square yard.

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DISTRICT 14 GROUP MEETING – SPARTANBURG, SOUTH CAROLINA

F. H. BRANT, *Coordinator*

(North Carolina, South Carolina, Virginia, West Virginia)

MARCH 25-26

1. ROADSIDE GUTTERS - Because of ease of construction with modern equipment, it is more feasible to design a *V*-type roadside gutter (ditch) instead of showing a flat-bottomed or rounded gutter on project plant. Although thus constructed, angular and with sharp lines of demarcation between the shoulder, gutter, and backslope, the entire cross section can be "rounded" by harrowing and dragging during subsequent seeding operations without any additional excavation being involved. That is, provided the proper class of *V*-type gutter is originally constructed. From the standpoint of erosion control there are three classes of *V*-type gutters.

(a) *Having an angle of less than approximately 120 degrees.* With an angle this sharp there is little use in attempting the establishment of grass cover. It should either be maintained as a bare, machine maintained ditch, or improved by some method of paving.

(b) *Having an angle of approximately 120 to 145 degrees.* A transition class where grass cover might be accomplished under favorable conditions. A frequent type of section which would fall in this class is the case of a relatively flat slope from shoulder to gutter, say 4:1, on which grass cover is possible, and a steep backslope, say 1:1, where vegetative cover is generally difficult and, if established, could not be mowed.

(c) *Having an angle of more than approximately 145 degrees.* This class is adaptable to being made into a rounded gutter