T H E S I S

NEBRASKA FEDERAL AID PROJECT NUMBER 88-C

Submitted by

Alfred L. Agle

for the degree of Master of Science

Colorado Agricultural College

Fort Collins, Colorado.

LIBRARY OF THE
STATE AGRICULT'L COLLEGE
FORT COLLINS, COLO.

378.788
A.O.
1925
4
v.1

THIS THESIS HAS BEEN READ, APPROVED

AND RECOMMENDED FOR CREDIT.

E. B. House

Head of Department of O.T.E.

Colorado Agricultural College

Fort Collins, Colorado.

46150

THIS THESIS HAS BEEN APPROVED AND

RECOMMENDED FOR THE DEGREE OF

MASTER OF SCIENCE.

C. R. Gillette
Chairman and Professor of Zoology

E. P. Sandsten
Professor of Horticulture

V. E. Newson
Professor of Veterinary Pathology

CONSTITUTING COMMITTEE ON
ADVANCED DEGREES

Colorado Agricultural College

Fort Collins, Colorado

Date_____

378.788
A.O
1925
4
v. 1

THIS THESIS HAS BEEN APPROVED AND RECOMMENDED FOR

THE DEGREE OF MASTER OF SCIENCE

C. A. Gillette
Chairman and Professor of Zoology

E. P. Sandsten
Professor of Horticulture

N. E. Jewson
Professor of Veterinary Pathology

Committee on Advanced Degrees
Colorado Agricultural College
Fort Collins, Colorado

Nebraska Federal Aid Project Number 88-C.

The general scheme of organization of the Department of Public Works used in Nebraska is as follows: At the head is the State Engineer with his assistants. There are two general divisions: (a)division of maps and plans and (b)division of road construction.

The "maps and plans" division is located at Lincoln and it is here that the plans are made for new roads and bridges. The chief of the bureau of roads and bridges has his office in Lincoln, and he is assisted by the several division engineers located at advantageous places throughout the State.

Under the division engineers are the preliminary and project engineers, who make the necessary surveys for proposed roads and for the construction of roads. These preliminary and project engineers keep notes of their surveys and make reports to their superiors.

The usual system followed in Nebraska in preparing estimation for Federal Aid roads has been to first make a preliminary survey of the proposed road, and then send the notes into the Lincoln office to be reduced, plotted and have suitable grades established. After the blue prints are made of the proposed grades, a plan-in-hand inspection is made by the division engineer in whose territory the proposed road lies. The division engineer must be accompanied by a federal engineer and often county highway commissioner is taken along on this inspection.

trips. As these inspectors drive over the proposed road notes are made on the plans where changes are desired and are agreed on by the field inspectors. Certain existing structures may be governing points in grade lines, or new structures may have to be built which will determine grades at these points. At certain places it may be desirable to raise a grade to prevent a snow blocade or to cut a hill more to reduce grades. These inspectors usually take particular note of drainage structures necessary and of soil conditions, as for instance in a very sandy country a portion of the road may need to be surfaced with clay to make traffic possible. After a careful field inspection has been made the blue prints are sent back to the Lincoln office and the original plans revised in accordance with recommendations written on these inspection prints. The plans and preliminary estimate are submitted to the government for approval and the job is ready to be advertised and let to the lowest bidder.

The contract for Project 88-C was awarded in the usual manner, and a set of plans and specifications were issued to the project engineer who established headquarters at West Point. The plans had been made from an old survey and the County had done so much work on the project that the profile was distinctly different and the plans became merely a guide indicating where to begin and end said project. Also several relocations were de-

sired by the County officials, making the road approximately straight and making a great difference in quantities and appearance of the road. A copy of the contract and specifications is submitted with this thesis and is make a part thereof.

The field party is usually composed of three men: one project engineer in charge, one roadman, and one chainman. Sometimes an instrumentman is added and other assistants, according to the nature of the work. The project engineer, in the case of a three man party, does all the instrument work, while the chaining and rodding is done by the two assistants.

In the case of a section line road like this one, the corners are all located by the county surveyor at the request of the project engineer. No project engineer has the authority to dig up a section corner, although this is sometimes done. The project engineer and his assistants then accompany the county surveyor over the proposed road and the corners are noted and referenced in. This is done by taking measurements from the corner to nearby objects, such as trees, blazed fence posts, or by setting reference hubs and recording their distances. As the points are located hubs are usually driven flush with the ground. Only the relative positions of the objects are noted in the field notes, but the distances are accurately recorded. Three ties are required to locate a point. And objects should be so chosen that the measurements to them will be not more

than one hundred feet, so that the point in question can be easily relocated at any future time by swinging an arc and scratching on the ground at the recorded distance the point is from the object. The intersection of three arcs should not vary more than a tenth for ordinary road work, and the objects should be well chosen so that the angles between them will give good intersections. The record of all transit points is shown under the head of location notes in the field notes. Notes are always recorded beginning at the bottom of the page and working toward the top. In this way all objects and notes are in their logical position. As you look up the page from the bottom, everything on the right hand side of the center line of the road will appear to the right of the center line of the page, and everything to the left of the road will appear on the left hand side of the page, just as if you were standing at the zero end of the project and looking down the road in the direction of increasing stations. This is the rule for all field notes. The station numbers of the transit points are recorded when the line is run and measured.

The line is run by setting the transit over the first center line point, and sighting it at the next point on the tangent, which may or may not be a section corner, and observing the magnetic bearing. If possible, however, the line is run straight between quarter corners. The chaining is done by two assistants. The rear chainman holds the rear end of the chain on the first point

and the head chainman is lined in from the instrument at the first chain length from station zero. The one-hundred foot steel tape is used for chaining and each one hundred feet is called a station. All chaining is horizontal and the plumb bob is used whereever necessary to accomplish this end. When the transit is set up over the second point on the center line, it is backsighted at the preceeding point and the deflection angle is read to the next transit point on line. At each center line station a ten-penny nail is driven, which has been previously punched through several thickness of red cloth, so folded as to form about a two inch square of cloth with the nail in the middle. These are driven flush with the ground. When the second point is reached by the chainman, the exact distance is noted and recorded by the head chainman. He then signals that he has reached the transit point, and both chainmen return to the instrument. The instrument is then put away or set aside and stakes are distributed from a car at each station, by driving along and throwing out two stakes at each station. Next the stakes are driven along the edge of the road at thirty-three feet from the center line. These offset stakes are set by measuring each distance separately from the center line nail and driving a hub at the desired distance and allowing it to protrude about one inch above the ground. A guard stake is driven a few inches in front of the hub in such a manner that the top part, for about six inches is visible. It is usually

sloped away from the road and is marked with the station number on the front face and the distance out from the road center line on the back face. The hub stake is not easily lost or destroyed as the guard stake. In some instances it is desirable to place the reference stakes at a greater distance out than thirty-three feet, which is half the right-of-way width on all State roads, and this is done in the case of a deep cut or high fill where the stake would be dug out or covered up during construction.

Usually after a portion of the road is staked out it is cross sectioned, while the center line nails are plainly visible. When the bench from the original preliminary can be found, the levels are always begun from one of these benches and all benches are checked as they come, but as in this case, where the old preliminary was useless, a bench mark is established at the beginning of the project. A spike in a fence post, or a root of a tree, or a half-inch rod driven almost flush, by a corner fence post, makes a good bench. Ordinarily fence posts and telephone poles are not considered permanent enough for bench marks. Cross sections are taken at each one-hundred-foot station and at each plus station where a break accurs. Rod readings are taken beginning at the center of the road and thirty-three feet or more each side of the center, in such a manner as to catch every break in the ground. In cross sectioning a roadway, the chainman stands in the center of the road over the nails

and reads the distances out on the chain while the rodman carries the rod and the forward end of the chain. In the notebook the bench marks and turning points are recorded on the left hand page together with the station numbers of the cross sections and the cross sections are recorded on the right hand page. Each reading being recorded to the right or left of the center line of the page and in logical order from the center out. The readings taken to the nearest tenth of a foot are recorded in the form of a fraction, the numerator being the rod reading and the denominator being the distance out from the center of the road. Bench marks and turning points are read to hundredths. This is illustrated in the preliminary notes accompanying this thesis.

Ordinarily the topography is taken at the same time the preliminary notes are taken and is recorded on the left hand page of the notebook, as was done in this case. The notes are reduced in the office, but the elevations of bench marks and turning points are always figured in the field. Usually every turn is recorded and such objects are used for turning points as can be again found and used. Instead of subtracting each rod reading from the H.I. it is customary to carry the H.I. in the head and write the result by addition, beginning at the right of each rod reading, and write above each figure some number which when added to the figure below will produce the corresponding figure in the H. I. For example consider

the H.I. to be 480.65 and the rod reading to be 9.6 at ten feet out (written $\frac{9.6}{10}$). The important part of the H.I. is 80.7. The .65 becomes .7 because the rod readings are only taken to the nearest tenth. Remember the H.I. thus, -7-0-8. The figure to be written above the .6 to make the addition 7, will be 1 and to make the 9 add to zero,1 must be added. The next figure to the left of the nine will be seven because there is one carried over from the preceeding addition and the result will be written $\frac{71.1}{9.6}$ This method speeds up the work immensely andwith a little practice, notes can be reduced almost as fast as the reductions can be written.

The cross sections are plotted on standard cross section sheets as illustrated by the accompanying blue prints. The method,I believe,will be easily understood. Each square inch represents five feet,and each square is subdivided into feet and half-feet, so that the elevation assumed for one of the heavy lines, spaced one inch apart, must be taken as five or a multiple of five. Beginning at the center, each elevation is then plotted relative to the center elevation and at the proper distance from the center. The points are then joined by a full line and the line inked with black ink. Each section is marked with its proper station number. The accompanying blue prints of the preliminary cross sections will illustrate this.

After the entire road, or a portion of it, has been staked out, cross sectioned, the notes reduced and cross

section plotted, the profile is plotted. Each inch horizontally represents one station or one hundred feet on the standard profile sheets. Each inch vertically represents ten feet in elevation. This distorted scale is used to show slight differences in elevation. The plan is plotted above theprofile in the space provided for it. The original blue print gave me only approximately the grade desired by the division and government engineers for the first two thousand feet. However, at station 13+60-A it was decided that a 6'x3'x24' Conc. Box was necessary and the flow line had been established, by a method to be described later. To the flow line must be added the three feet rise of the culvert, plus the thickness of the slab, plus one foot, which is the thickness of earth desired as covering. This made the minimum height of grade at this point known. At station eight, an eighteen inch diameter concrete pipe was desired, but this had plenty of headroom and did not affect the height of grade appreciably. Beginning then at station zero it was thought necessary to cut the hill in such a manner as to make a straight easy grade to the bottom,and at the same time establish such a grade that the cut taken from the hill would just make the fill at the bottom of hill. This required the cut to be approximately fifteen percent greater, in this soil, than the fill, to allow for shrinkage. It was also desired that the haul should be as short as possible. Down hill grades are indicated as negative and up hill grades are positive in the direction of the

stations.

The grades are determined by trial. After the preliminary center line profile has been plotted and inked in with black ink and the elevations of the various points written to the left of their respective vertical lines, a trial grade line is penciled on the profile. The percent of grade is usually calculated so that it will not be in hundredths, although this is permissible. The grades are then calculated for each station or plus station, as the case may be, and are recorded on the right side of their respective vertical lines in pencil on the profile sheet. Where two grades intersect, if their algebraic difference is equal to or greater than two a vertical curve is introduced, of such length as would be reasonable for the given conditions. Hence at station 6+50 it would not be economical to use a hundred foot curve and a hundred foot curve would be too abrupt. It was decided in this case to use a two-hundred foot vertical curve. To calculate the various grades along a vertical curve, first the elevations along the tangent must be calculated for the various stations in question, then the offsets may be calculated by the formula $y = \frac{a\ x^2}{2}$ in which a = rate of change ÷ length, y = correction, and x = distance from end of curve. A convenient way to find the correction for any plus station is to first determine the center correction from the formula

$\frac{G_2 - G_1}{8} \times \frac{\text{length of curve in feet}}{100}$ in which G_1 and G_2 are

the respective grades and must be preceded by the proper sign. The slide rule may then be used to great advantage and results obtained with sufficient accuracy. Use the ordinary slide rule in which the two lower scales are alike and are the ordinary logarithmic division, and the two upper scales are alike and the squares of the lower scales. Call the scales A, B, C and D beginning at the top. Set the center correction on the "A" scale, under this set the semi-tangent of the curve on the "C" scale. Then for any plus on the "C" scale, read the correction above on the "A" scale. After all grade points have been determined they are written on the cross section sheets vertically, and at the center of and usually just above the preliminary cross section. This is done in pencil. The typical cross section is shown on sheet two of the plan and profile. A template is made of heavy transparent celluloid corresponding to the scale used on the cross section sheets and with the center of this at the center elevation of road for the section in question, a line is drawn along the template, making a reproduction of the typical cross section at each station and plus station. In fill sections, slopes vary from three to one in light work, to one and one-half to one in heavy work, except in cases where the soil demands a flatter slope. For the sake of appearance slopes are never varied in one continuous stretch of cut or fill sections, but in passing from one to the other and back again, the slopes may be

changed. For instance one may have a thousand feet of heavy fill which has side slopes of one and one-half to one and then the road may cut into a hill and on the other side there may be a light fill with three to one side slopes. The typical cross section for this road shows the top to be twenty-four feet from shoulder to shoulder with the shoulder one half foot lower than the center and three to one side slopes down to the bottom of the ditch which is two feet lower than the center. The ditches are three feet wide on the bottom and then start up on a one and one half to one slope. From this it can be readily seen that where the original ground at the sides is two feet or more lower than the center of finished grade, there will be no cut.

After all the templates have been drawn for the proposed grade, the area under each template is run with a planimeter and recorded on the cross section sheets in the proper place. The letter "C" is used for cut and "F" for fill. This gives the end area in square feet. In running the areas of the sections the planimeter is set so that once around gives half of the desired area. If the reading is doubled by repeating the operation, the area is correct, and is recorded, but if it varies more than a half foot, the area is again run until the second time around does double the first reading. The planimeter is an instrument that can be made do very good work with a little practice.

The areas are now recorded in their proper column of the earthwork computation sheets, (form R-12) each being written on the same line corresponding to its station number. The distance in feet between any two cross sections is calculated and recorded and the cubic feet between any two end areas computed by taking the average of any two consecutive end areas and multiplying this by the distance between the two. This is illustrated by the standard computation sheets accompaning this thesis. In referring to sheet 1 of earthwork computations for the preliminary quantities, we find that from station minus 1 + 00-A to station 0 + 00-A, the distance is one hundred feet. The first station has an end area of thirty-two feet in cut and the second section has eighty-eight. The average of these two is 60, and this multiplied by the distance, which is 100, gives 6000 cubic feet. The same process is continued throughout.

If the proper grade has been decided on we will get a balance point somewhere near station eight. The excavation quantities are added up to the place that it is thought a balance should be obtained and the embankment quantities are likewise added. The total cut is then divided by the total fill and if a 1.1 to 1.2 balance is obtained the grade can be used. Sometimes by trying different stations a balance point can be obtained. However, the grades may have to be changed several times in order to get the proper balance fac-

tors. Whenever a balance point is found a heavy line is drawn across the computation sheet at the place where it occurs and the total cut and fill quantities for that balance are recorded in their proper column together with their balance factor, as shown by the accompanying computation sheets. In the next balance from station 8-A to station 13+55-A it was found necessary to borrow in order to get sufficient dirt to make the fill. Natural conditions and length of haul made it probable that the haul would not be past the culvert and hence a balance point was made here. The next balance from station 13+55-A to station 23-A was handled in a similar manner except here it was necessary to raise the grade high enough to prevent overflow of the road.

From station 32-A we had an entirely different condition. It was necessary here to cut the hill sufficiently to keep the grade below 6% and also make the balance point come near the top to prevent up hill haul. It must also be remembered that the next balance must be cared for, which in this case was determined to be from station 32-A to station 42-A. The portion from station 37-A to 45-A was subject to heavy floods and in order to keep the road from being swept by floods, it was necessary to use about a four foot fill. At station 44-A it was decided to use a 4'x5'x29' concrete box culvert to serve as a cattle pass and the county agreed to pay the cost of this over and above the cost of the culvert which would otherwise have been used.

Hence, it became necessary to establish such a grade as would cover the culvert sufficiently. After several trial grades had been laid the templates plotted, the areas run, and the quantities figured, the grades as shown in the preliminary profile were found to satisfy the given condition, and likewise vertical curves were introduced which would look well on the finished grade and be practical.

At station 57-A it was considered well to fill the depression and establish a long, straight grade. It is to be remembered that a long, straight grade presents the best appearance, but is not always the most economical and hence no two designers would lay the same grade on any particular road.

It might be well to mention here that the equation at station 26+18-A = 26-00-A was due to a difference in chaining of the old original survey and the present one, and it is always desirable to make the chaining agree with the original in so far as possible. A little beyond this, the old survey angles off to the left, whereas the present survey runs straight through and is all new location. The equation, station 60+20.7-A=35+39.8 was caused by the new survey again joining the old survey at this point and then the old survey stations were used. It will be seen that unless some distinguishing mark was used some of the station numbers would be repeated. The letter "A" was therefore, adopted to be used after all stations up to the point where the old alignment is again

used.

The balance from station 35+39.8 to station 43+45 presents no particular problems other than to get a fairly good grade without excessive haul and with the proper balance factor. It will be noted, however, that between stations 43 and 43+45 there is a split quantity in the fill column. This simply means that the balance does not occur exactly at either station, but somewhere between. The exact point is assumed to be the proportional part of the distance that the first quantity bears to the sum of the two parts of the split quantity.

From station 43+22 to station 53 there is an area subject to floods and hence it was necessary to raise the grade considerably at this point and borrow sufficient dirt to make up the deficiency.

From station 53 to station 58+18 the only necessary thing was to have sufficient fill to keep the road out of wet ground and get an economical balance. The same can be said of the balance from station 57 to station 65+95 and it is necessary to get such a grade as will not appear choppy and will not cut the top of the hill much at stations 69 and 70. The percent of grade here is light and it is always well to hold the grades as high as possible even on the hills to prevent snow from blocking the road.

In the next balance it is necessary for the grade to be even with the bridge floor at station 82+23 and

in order to keep the road above wet ground and make a good approach to the bridge, which was to be used in place. On the other side of the bridge it was necessary to make a good approach to the bridge and this required considerable borrow to fill the decided dip in the road at this point.

Beyond station 102+90 the road was all constructed and accordingly the grade was made to correspond with the original ground at this point. Therefore the hill at station 97 was cut sufficiently to make a good appearing grade on each side and to make the necessary fills without excessive hauls. There was a slight up hill haul between stations 96 and 97, but this was not objectionable in this particular instance.

Permission was obtained to lay the grade for the entire project irrespective of surfacing, which was known to be necessary at certain points, although this is unusually accounted for at the time the grade is designed by striking off the upper seven tenths of the roadway and deducting this area from the quantities at this point.

After the grades have all been established, the quantities computed and the balances determined, the summary sheets are filled in.

Form R-13 known as the summary of earthwork by balances represents the total number of cubic feet between the separate balance points taken in order

and is filled in, like the accompanying preliminary form R-13. The data is taken from forms R-12.

Next form R-14, which is the summary of earth work by columns, is filled in. The data for this is likewise taken from forms -R12, sheets 1,2 and 3,and is the summation of all earthwork quantities in each column. The totals of the summary of the earthwork by columns must check the totals of the summary of earthwork by balances.

Before the form R-15 can be filled out it will be necessary to compute the overhaul. All overhaul on ordinary earthwork is computed by the mass diagram, and it may be well here to explain the mass diagram, before showing the computations for this project.

1. Choose reasonable scales for plotting.
2. In the balance under consideration increase the fill quantities by the percent of the balance. Total cut and fill should then be equal.
3. Find the algebraic sum of the cut and fill at each station. The ordinate for any station is the algebraic total of the algebraic sums up to that point in the balance. Cut quantities are plus and are represented by ascending curves,while fill quantities are minus and represented by descending curves.
4. Plot the curve.
5. The free haul is five hundred feet. It is now necessary to find the section of the balance where the haul is free. To do this find the points where a line parallel to the base and five hundred feet long will

intersect the cut and fill lines of the curve. The curve above this line represents the cut and fill quantities within the limits of free haul. The curve below this line represents the quantities upon which there will be overhaul. (See line CD)

6. From the fact that the cut or fill at any point on the base line is represented by the ordinate of the curve at that point, where the five-hundred foot line (paragraph 5) cuts the ascending curve will give graphically the number of cubic yards to be overhauled (See line EC)

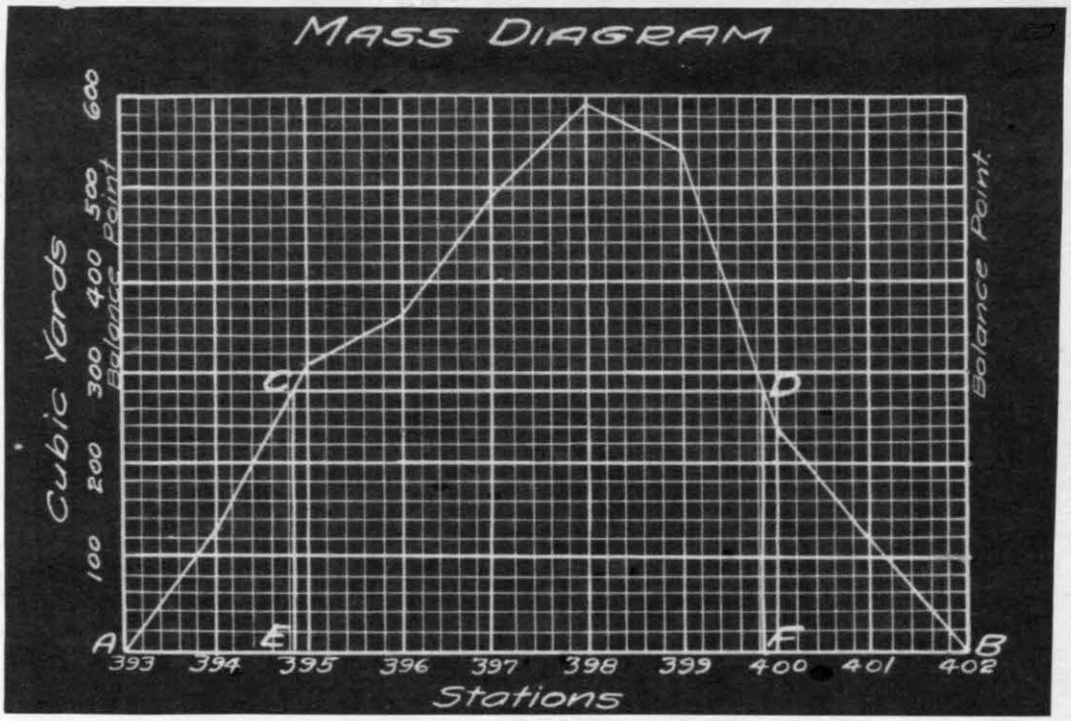
7. The center of gravity of cut and fill may be determined by the moment method and the haul determined, or it may be found from the mass diagram as follows:-

8. One square unit of area circumscribed by the curve will equal a certain number of cubic yard stations of haul depending upon the scales used. In our example each square unit equals one hundred cubic yard stations. Therefore the area ACDBA will give the number of cubic yard stations under consideration.

9. This number of cubic yard stations divided by the cubic yards overhauled will give the stations of haul. In our example 1920 ÷ 280 = 6.857 stations.

10. Free haul being 500 feet, this distance must be subtracted from the total haul. Example:-

6.857 - 5.00 = 1.857 stations.



Sta.	Cut(-)	Fill-20%(-)	Algebraic Sum	Vertical Ordinate
393	0	0	0	0
394	130	0	+130	+130
395	180	0	+180	310
396	100	48	+ 52	362
397	200	72	+128	490
398	220	120	+100	590
399	70	120	- 50	540
400	0	300	--300	240
401	0	120	-120	120
401	0	120	-120	0
	900	900	Balance 1.20	

From the above illustrative balance the curve of the mass diagram was plotted.

By this method the following results were obtained:-

Ordinate EC=2.80 units or 280 cubic yards of dirt overhauled.

Area of ABCDA = 19.20 square units.

1 square unit = 100 cubic yard stations.

19.2x100 = 1920 cubic yard stations.

1920 ÷ 280 = 6.857 stations haul.

Stations free haul = 5.0

6.857-5.0= 1.857 stations overhaul.

280x1.857 = 520 cubic yard stations.

An approximate method that may be used in finding the center of gravity of cut and fill directly from the diagram, when the ascending and descending lines of the curve are practically straight below the five hundred foot line, is as follows:

1. The line EC represents to scale the yardage of cut overhauled. Therefore half the length of this line will represent to scale half this yardage. Project this halfway point horizontally until it intersects the curve. The abscissa, or horizontal ordinate, of this point on curve, is the station where the center of gravity of the cut occurs.
2. Find the station of the center of gravity of the fill represented by DF in the same manner.
3. The difference between these two stations is average haul.
4. Subtract five stations free haul to determine pay haul.
5. Multiply by yardage to obtain cubic yard stations of overhaul.

Let us now consider the first overhaul problem on the project. Since there are no special forms for over-

haul computations they are usually put on form R-15-A by changing the column headings. It will be seen by inspection that the distance from station -1+00-A to station 8-A is greater than five hundred feet, which is the distance given in the specifications as free haul. First enter all the cut quantities in their proper column as described above, then multiple each fill quantity by 1.12 which is the balance factor, and enter it opposite its station number in the fill column. The slide rule is used for these multiplications as it gives results closer than can be plotted. The cut and fill columns should add up to the same number and if they do not, distribute the difference in the fill column by inspection, provided the difference is not too great. The algebraic sum and vertical ordinate are determined as described above. It is customary to use the horizontal scale as one inch equals one hundred feet or one station. The vertical scale may be chosen to any convenient scale and in the case of the first balance the scale of 1" = five thousand cubic feet was used. A line parallel with the base and five stations long was drawn. At the points where this meets the mass curve, vertical lines were drawn to the base. The graphic method was used, as this was the office practice at that time. The two vertical lines were bisected by the horizontal lines until these lines continued to meet the curve at which points vertical lines were again drawn to the base. The points where these ver-

tical lines meet the base line give graphically the station of the center of gravity of the cut and fill respectively as previously explained. The computation for overhaul is placed on the mass diagram sheets.

The second problem from station 23-A to station 32-A is somewhat different than the first. Wherever a low point or dip occurs in the mass curve as at station 26-A it indicates all quantities above this point balance and hence the curve above this point must be considered separately and a horizontal line is drawn at this point. This has the effect of raising the base line and means that the part above and below this line are to be considered separately. Sometimes additional base lines are introduced to increase the accuracy of the work if the mass curve is very irregular.

The remaining curves are similar to those already explained. It will be noted, however, that the curve from station 58 to station 66 lies below the base line. This means that the fill preceeded the cut in the direction of the stations.

After all overhaul has been computed in the above manner it is summarized on form R-15-A sheets. The borrow computations are also included on the same sheet in the space provided for them. Borrow is 1.2 F-C in which F is the fill and C the cut for the balance in question.

The summary of earth quantities may now be made.

This is shown on form R-15 included with this thesis.

Before setting any slope stakes, the grades are usually taken from the profile and written in the back of the notebook, and a notation is made of what the side slopes are,and where they change if there is any change in them. It is easy then to find the grade for any particular station by refering to the recorded grade notes. The typical cross section used in this state requires the use of three different grade rods. There is the center grade rod, the shoulder grade rod, the shoulder grade rod and the ditch grade rod. The shoulder grade rod is .5 lower than the center grade rod and the ditch grade rod is the center grade rod plus two feet. Usually the center grade and grade rods only are recorded and the others are carried mentally. The notes are kept as are shown in the slope stake notes. A rod reading is first taken at the center of the road and the cut or fill at this point recorded in the note book and also called out to the rodman, who is governed in his estimation by this center reading.

The regular typical cross section was used in the first part of the road. At station -1+00-A the center cut was 0.0 and on the right the cut was 1.3 at 21.5 feet out from the center. Since the slope stake is set where the side slope intersects the surface of the ground, the constant distance for cut sections would be 12 feet, which is one half the width of roadway,

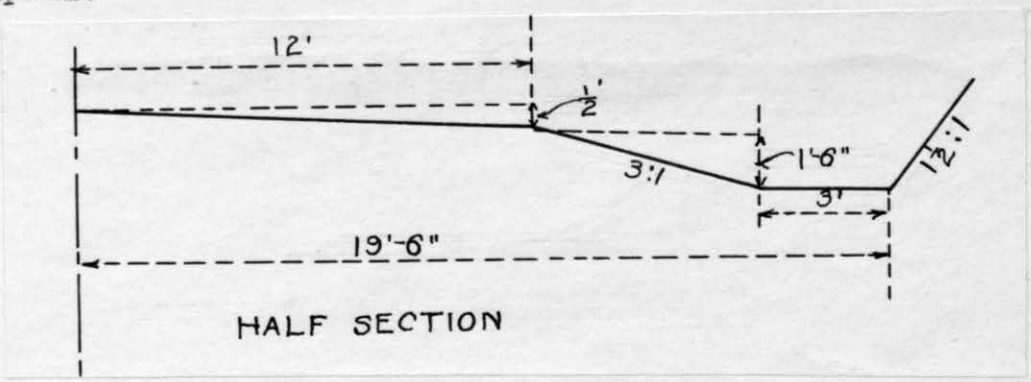
plus the distance from the shoulder to the bottom of the ditch which is four and one half feet, plus the width of the ditch bottom, which is three feet, making a total of 19.5 feet. Then the cut of 1.3 times 1.5 plus 19.5 =21.5 feet.

Consider now the fill section on the right of station three. In this case the slope atake would be set where where the toe slope of the fill strikes the original ground, and the constant distance from the center will be 12 feet, which is half the width of the roadway. Only one slope stake is set in each side of any station and in case the work is light, care must be taken not to miss any cut sections and stake them as fill. Slope stakes are marked on their front face with their cut or fill using the letters C and F respectively followed by the number, then a dash and the distance out. Both slope stakes are marked in the same manner except that the one on the right has the center cut or fill marked on the back.

Where convenient a reading is taken on the top of hub for any particular station and the cut or fill belowww or above the top os this hub, as the case may be, recorded in the notes and marked on the edge of the guard stake.

Speed in setting slope stakes comes with practice and after the party become accustomed to setting them the correct position for each stake can usually be obtained in the

second or third trial and quite often the first time if the ground is uniform. The following sketch may be helpful.



The contract on the project for earthwork was awarded to Peterson, Shirley and Gunther, an Omaha corporation of considerable size. They in turn sub-let this project to J. W. Ewing, who was very poorly equipped indeed to handle the job. He had only a few fresnos and fresno teams and this was or should have been a wagon job, owing to the amount of haul to be made.

Construction was begun near the zero end of the project with three fresnos and ten head of stock. Naturally progress was slow with such an outfit. In fact the writer has been in charge of projects on which more dirt was moved in one month than in an entire year on this project. Nevertheless there are so many problems involved in this short project that it is rather interesting to observe.

First observe the condition of the project before construction was started at station 0+00-A and looking in the direction of the project. (see picture #1, p46)

The actual construction work was begun at station 14-A and the new work was opened up to station 26-A during the first week of construction, which was the week of August 5,1922. This is shown on weekly construction report #4. Between stations 26-A and 32-A the proposed roadway was covered with trees and brush so that considerable clearing and grubbing had to be done. This same condition prevailed from station 50-A to station 58-A. As will be noted in the specifications on page 17, paragraph 77, all clearing and grubbing is to be done by the County, and if the County fail to do this, then the contractor shall do this by force account. In this case the county elected to have the work done by force account by the contractor. The accompanying picture will show the work of removing stumps. (see picture #3,p 48)

While the work of clearing and grubbing was in progress, the grading work was being done from stations 14-A to 26-A, and after the clearing had all been done the contractor started to cut the hill at station 32-A and to make the fills on each side of the hill. It was not known what kind of soil this hill was composed, as the kind of soil often varies a great deal in the same locality. The hill was found to be, however, almost a pure yellow sand and the fill slopes of two to one, had been well chosen. Before the hill at station 32-A had been cut to grade the work was stopped by inclement weather.

Before the freeze up, the contractor dropped back to station zero and completed his work up to station 26-A.

As all quantities are paid for in exacavation it is necessary to have cross-sections of all borrow pits before any excavation is made. However, the fill quantities must be known also in order to check against the excavation and to establish the balance points. So the road was now cross-sectioned before any surfacing was placed.

From time to time the contractor would check his grade by using a string line level, or the project engineer would check it for himself by using a hand level. The string line level is a small spirit level that can be hung from a string stretched from the center of the road to a reference hub of known elevation. If the center of the road is higher than the reference stake, the string is held on the center of the road and the other end raised or lowered until the level bubble indicates that the string is level, the distance is then measured down from the string to the top of the stake and if this distance checks the fill is written on the reference stake, the grade is correct. If the center of the road is below the reference stake, the string is held on the hub and the process reversed for the center of the road. If the hand level is used, a rod reading is first observed on the top of the reference stake of known elevation and then a reading is taken at the center of the road and opposite this reference stake. The difference in rod readings will give the difference in elevation between the top of the hub and the center of the road. Since the cut or fill is marked on the re-

ference hub, this will, therefore, be known at once for the road from the difference of rod readings.

Suitable material for surfacing was located about three quarters of a mile from the beginning of the project. In order to locate a clay pit, it is usually the custom to inquire of the county board of the existance of suitable materials and then to make further investtigations by prospecting with a spade. A good quality of clay can uaually be known by inspection and especially by the feel. Often the project engineer can locate clay better than any of the county commissioners. A dry lagoon is usually an especially good place for surfacing material. A sample of clay is sent to the testing engineer at Lincoln and recommendations are made by him for its use. The specifications contain special provisions for sand-clay roads.

After the clay pit was located, the county made an agreement with the land owner for the purchase of the material and the pit was staked out. A line of reference stakes was then run and all cross section measurements were taken from this line. A diagram of pit number one and the staking is shown in the notes on preliminary cross sections. Preliminary cross sections of borrow pits are necessary because surfacing material is all paid for in excavation as is all dirt work.

Surfacing was begun at station zero of the project

and was carried up to about station 26-A during the winter, the haul being made so that the wagons always passed over the material already placed. The material was disced and harrowed while being placed.

The borrow pit was kept free from frost during the winter by covering each night with straw and the clay was removed by plowing and scraping. The slips were driven over a trap and dumped into the wagon box. This is a somewhat slow process, but with a small outfit it is the only way the material can be handled.

About one foot depth of surfacing material was used and it was allowed to extend well down the side slopes because of the high sand content in the sub base.

The same capacity culverts were used wherever possible as recommended on the old plan. However, when culverts are staked in the field, the length often has to be changed to fit the flow line as staked. The culvert contractor usually tries to install all culverts ahead of the grading crew as this saves a great deal of digging for the culvert crew. Ordinarily the waterway of culverts is not changed by the project engineer unless after investigation the culvert is found to be too small. In this case it is called to the attention of the division engineer who either approves or disapproves of the proposed change. The division engineer's approval is necessary in making any changes of this kind.

Culverts are staked out in the field by first observing the natural drainage channel, when such can be seen by observation, and then staking the culvert so as to lie in this channel. Usually it is better to have a culvert a trifle high rather than a little low, especially in sandy countries where these structures fill up rapidly with silt. It is not always possible to give the culvert much fall, but a tenth in twenty-four feet is usually the minimum, in order that water will not stand in the culvert. The center line of the proposed road is located. This can usually be done from the offset stakes, if the line has been run, otherwise the center line must be run.

The instrument is then set up at the center of the road, where the culvert is to be placed and offset stakes are placed at 90° to the center line if the culvert is to go in straight or the stakes may be placed at the desired angle, one stake being placed on either side of the road and on the center line of the culvert. These stakes are placed out far enough to be out of the way of construction and their distance from the center line is recorded in the notebook for culvert staking. The determination of flow line is made in one of two ways; either a cross section of the road is taken at this point, or where the channel is well defined, a rod reading is taken at the present flow line on each side of the road and this raised or lowered slightly to fit the condition. A rod reading is taken then on the top

of the offset stakes, just set for the culvert center line and these driven so as to either read grade or to the half foot. The cut or fill below or above the top of these stakes is then recorded in the notebook and written on a guard stake in front of the hub stake. On the back of the guard stake is placed the distance that the end of the culvert is from the hub stake. To get the proper length of culvert the flow line is platted on cross section paper and likewise the cross section, if one is taken. Then the proposed finished roadway is plotted on or put on with a template and drawn in. The side slopes of the finished roadway will cut the line representing the top of the culvert, and the side slopes should be made to come part way up on the headwalls and not go over them. This can be done by observing where a standard headwall will fit the required condition as shown by the cross section diagram at each end. The right length of culvert will then be shown on the diagram. It must be remembered that the length of concrete pipe must be in multiples of four feet. The minimum length of culverts is twenty-four feet and they should never be less than twelve feet on either side of the roadway, although one or both sides may be longer than twelve feet to fit the side slopes. In staking culverts, the levels must be referred to a bench mark of known elevation in order to be able to correctly plot the grade elevation at this point.

At station 44-A a 4'x5'x29' concrete box culvert was built to act as a cattle pass as well as a waterway. It was estimated that a 30inch pipe would carry the water at this point, but the county agreed to pay the increased cost of this box culvert over the necessary length of 30inch pipe at this point.

At station 49-A the natural channel was such that the culvert had to be skewed to fit the natural condition and the angle of skew and staking is shown in the notes.

At station 81 an 18"x40' concrete pipe ditch crossing was installed. This culvert is parallel with the center line of the road and is used under an intersecting road. All culverts were staked in a similar manner to that described before.

The accompanying standard plans give the various dimensions for structures used on this project and the specifications govern the kind of materials to be used and give the particulars of construction.

As the culverts were installed, field measurements were taken of the necessary excavation and entered on the proper forms. Special attention is called to paragraph 75, second paragraph under "Class B" of the specifications.

The culverts on this project were all completed in due time and ahead of the grading.

At frequent intervals the division engineer and the

federal engineer make inspections of the progress of the work and make recommendations relative to the quality of the work or any desired changes. These inspections are usually made with the project engineer and may be made by both division and federal engineers in company with the project engineer or by either one in company with the project engineer. Both inspectors make separate reports to the Department of Public Works, copies of which are mailed to the project engineer in charge of construction.

When work was resumed on this project in the spring the contractor did a little work between stations 46 and 58, but this was just enough to fill out one slope of the road. Another sub, Charles Oakley, from an adjoining project moved over to station 96, and did some of the rough grading from this station to the end of the project. The progress of these two small outfits was highly unsatisfactory and it became necessary for the Department of Public Works to cancel the contract. The Sub at station 96 was removed from the work. The county took over the contract and allowed the first sub to complete the grading to station 60-A and the surfacing to station 48-A. The county then sub-let the remaining work to Schlueter Brothers. This company was well equipped to do the work. Their equipment included ninty-four mules, two elevating graders, fourteen dump wagons, two blade graders, and other

smaller tools.

The work of the Schlueter outfit was highly satisfactory and progressed at a rapid rate. The work was of such character that the whole community was well pleased.

As the work progressed it became necessary to acquire more dirt from borrow pits. These pits were all carefully cross sectioned before any dirt was removed and the stations noted where the borrow was deposited, as shown in the notebooks. Borrow pit number four was used not only as borrow from stations 41 to 52, but also for surfacing the road past station 48-A. After the borrow had been used this pit had to be again cross sectioned to determine just how much material was taken as borrow and after the surfacing material was taken out the pit was cross sectioned again.

Borrow pit number five was used for fill only and was the only available dirt near that point.

Borrow pit six was intended to be used for surfacing material, but was never used, as the ground at this point was too wet to be handled.

Changing contractors on a job requires a great deal of work for the project engineer, as all sections of road which have been started must be cross sectioned before another contractor may complete the work and then the semi-finals must be taken for sub grade when the road is to be surfaced and finally tha final cross sections

are taken. Not only does this require considerable field work, but it complicates the office work as well by making so many plotted cross sections at the same stations.

Some difficulty was experienced in acquiring the ground for borrow pit number four. At several times members of the county board and the project engineer had attempted to induce the land owner to sell the dirt at this point and the county board finally became disgusted and passed a resolution authorizing the county judge to appoint appraisers, but before any action was begun, the land owner finally consented to sell borrow dirt at this point to the county.

Before any gravel or cement is used in any drainage structure it must be tested by the testing engineer at Lincoln. A description of the material is entered on form T-1 and submitted with the sample. A copy of this form is sent to the division engineer, one to the Department of Public Works and one is retained. After the materials have been tested the test results are sent to the project engineer. If any material fails to pass the test it must be rejected.

At the end of each week the project engineer sends two progress reports to the Lincoln office and one progress report to the division engineer and retains one for himself. The Lincoln office in turn sends one of these reports to the federal engineer in charge of this district. These reports are self explanatory and are

submitted with this thesis.

At the end of each week also a time record is sent to the Lincoln office and a copy to the division engineer. This report gives in detail a record of each days' work done by the project engineer and his assistants. Since this report covered several projects it will not be submitted with this thesis. It was necessary in this report to show just how many stations were completed of each kind of work, the number of hours spent on each kind of work, the time of beginning and ending the work the condition of weather, and whether the work was office work or field work.

The payrolls were made up at the end of each month and are made up in such a manner as to show the total amount per month and the rate per working day. Separate payrolls were made up for each project worked on. The payrolls were accompanied by expense vouchers, which give the amounts expended for stakes, nails, red cloth etc, and must have receipts for the various items attached. The monthly automobile mileage report takes the place of a receipt for automobile expense. A certain rate permile is paid for cars driven in the State service. Each project engineer usually has his own car or he may be furnished one by the State, but it is much more preferable to use personal cars.

The monthly estimate is likewise made out at the end of the month. Under the heading, "Total estimated

quantities todate", the accumulation of all workdone to date is entered so that each estimate carries all the quantities previously estimated plus the current month's estimate. These quantities are always taken as less than the preliminary estimate shows, in order not to over pay the contractor. The item numbers and unit prices are taken from the contract itself. When two or more sub contractors are working on the job a subdivision is always made to the various contractors as indicated on the estimates. When drainage structure items appear on the estimate a form R-16 must accompany the estimate. This form lists all the structures affecting the estimate and gives the amounts previously estimated, if any estimate has been previously made on drainage structures.

Form P.W.K. 510 is sometimes used to accompany monthly estimates and gives the special excavation quantities. Most usually, however, it is used to accompany the final estimate on culverts. On this project the culverts were completed early and the final estimate was made up and sent in soon after the completion of these structures. In this estimate the column headed "Original Quantities," shows the quantities taken from the contract and their respective amounts are entered on the same line. The overruns or under runs are listed separately and represent excesses or deficiencies between the contract quantities and those

actually used.

The forms R-21 are used to cover excesses of difficiences in the original contract and five copies are sent first to the division engineer, who if he approves, sends them to the Lincoln office from where they are sent to the federal engineer in charge of the district. The approval of the federal engineer is necessary in making any deviation from the original plans.

The original contract and plans called for ditch checks at various places on the hills. After parts of the project had been subjected to moderately heavy rains the side ditches on the hills carried so little drainage that the ditches did not wash badly and consequently it was decided to eliminate all ditch checks on the project and so a form R-21 was submitted for the elimation of these ditch checks.

When ditch checks are staked, they are usually so placed that the apron of one will lie on a one percent grade above the crest of the spillway of the other. These checks must fit the natural ditch as nearly as possible and hence a profile of both ditch and shoulder line must be run, in order to establish the correct spacing for these ditch checks.

The original contract provided for only one hundred and fifty-two feet of guard rail, but after construction, lath were placed along the side of the road where guard rail was necessary and these sections measured, it was

then decided that 5464 lineal feet additional were needed to properly care for the project. Owing to the fact that the State was short of funds, it was found necessary to disapprove the R-21 asking for additional quantity and finally, by agreement with the contractor, the guard rail contract was cancelled. The necessary guard rail will be contracted at some future date. When guard rail is staked, however, the railing on opposite sides of the road must be built so as to be at least twenty-one feet apart. Any continuous section of guard rail must be in multiples of eight feet, as the posts are eight feet apart. Guard rail on opposite sides of the road must be parallel and should be in straight lines or curves where necessary. It should never be staked with angles in it. Guard rail should line up with the road in general and where it is in a depression between two hills, it should be in line with the tops of the hills. Where guard rail is on opposite sides of the road the opposite sides hardly ever begin or end at the same point. When driving down the right hand side of the road the dangerous side would be on the right hand side and hence, the guard rail would usually begin sooner. Likewise when proceeding past a section of guard rail, the right hand side would usually end first, as the momentum of the car would be sufficient to carry it past the danger point at the end of the guard rail section. Many feet of guard rail can be saved in this way by economical location.

Final cross sections are usually taken in a similar manner to the preliminary cross sections except, however that the center line is hardly ever re-run, unless the reference stakes have become destroyed or cannot be readily found. In case the reference stakes can be found, the center of the road can be located closely enough from these. Final cross sections are run, not only for the road but also for all borrow pits.

The notes are then reduced and plotted on the cross section sheets at their proper stations. In connecting up the points on final or semi-final cross sections, broken lines are used to distinguish them from the preliminary, which is a solid black ink line. The semi-finals are always inked in with red water color. Another reason for using broken lines on cross sections is because when blue prints are made all lines show up white and unless different combinations of broken lines are used, there would be no way to distinguish between them. The station numbers and preliminary center line elevations are all in black ink, but the final center line elevations are done in red water color and likewise for the areas.

The final center line profile is shown on the profile sheets in a solid red line and the points are always connected up in such a manner as to show a smooth curve. The preliminary center line profile is done in a solid black line and all points are connected by

straight lines. The preliminary elevations are written in black ink to the left of the vertical line representing the station and the final elevations are shown in red water color numbers and are written to the right of the vertical line representing the station. On the profile is also shown the elevations of flow lines of drainage structures in red and the bench marks and balances. The outline of the balances is stamped on the sheets and filled in with red numbers, and the balance points are indicated by arrows. A few of the bench marks are also shown on the final profile sheets and there should be at least one to every half mile.

On the plan, which is shown above the profile, everything is done in black ink with the exception of drainage structures, which are done in red water color, for plans.

Owing to the fact that several different sub-contractors worked on the same sections of roadway, the computations are somewhat more complex, than if one sub had completed any work that he had started. The semi-final quantities shown on the earthwork computations represent the work done on the project exclusive of surfacing. In cases where two different sub contractors worked on the same section, two different sets of computations must be shown, in order to show the work done by each sub contractor. This is essential in order for each contractor to be paid according to the work, which

he has done. Note that the semi-final quantities include all quantities on the project except surfacing which is computed separately. The borrow indicated for the various balances on the semi-final earthwork computation sheets for borrow pits and the stations where this borrow is used, is indicated on these sheets.

The balance points on the semi-final earthwork computations sheets are found by trial and the adding machine is a very essential instrument in this work. It is known from field inspection about where balance points occur, and although stakes are set in the field to show where the balance points should be, they are seldom strictly adhered to, and therefore some balance points may fall short of, or be longer than they were originally intended to be.

These quantities are then summarized on the forms P.W.K.-13 and R-14, which are the summary of earthwork by balances and the summary of earthwork by columns respectively. In this case where different contractors worked on the same sections, sepatate summaries by balances had to be made for each contractor, in order that the overhaul for each might be correctly computed. All irregular earthwork sheets contain notes explaining their irregularity. For the purpose of entering the quantities on the final profile the balances had to be combined and shown as one set of balances. This is done merely to show total quantities on the final without showing dou-

ble balances. This is an unusual condition and does not show the true balance points. This however, is taken care of on the computation sheets.

The overhaul for ordinary earth was now computated in the same manner as explained for the preliminary estimate, each balance being considered separately for each contractor's work. The mass diagram was plotted as before, but in this case the areas were run by planimeter and the overhaul computed from the area instead of using the graphical method. The planimeter is set so as to record the number of square inches under the curve and the vertical line at the end of the five-hundred foot horizontal line. This is done at each end of the five-hundred foot line. The two results are then added and multiplied by the vertical scale in cubic feet per inch and the result divided by 27. This gives the number of cubic yard stations overhauled.

One case is especially worthy of note. On sheet four of the Overhaul computations for final quantities, note that for the balance between stations 82+50 and 89+32, a part of the dirt was obtained from borrow pit number five. In order to apply the mass diagram to the haul from this pit, it is necessary to know the distance from the station on the project where the dirt was hauled onto the project and then to reduce the stations where cross sections were taken of the borrow pit, to stations along the project. The diagram on the overhaul computa-

tation sheet will illustrate this. After this is done, the computation may be made and the mass diagram plotted. It will be apparent from the diagram that the horizontal line at the top represents dead haul. Two vertical lines are drawn at the points where the curve begins to drop. An additional base line is introduced at the low point on the curve because the quantities up to this point balance. The areas are then run as shown on the diagram. The sum of the two areas, in each case, times the vertical scale times the number of stations between the two vertical lines minus five, all divided by 27 gives the number of cubic yard stations overhauled. The other cases are similar to the ones just described. The overhaul quantities and the borrow is then summarized on form P.W.K.-15-A and the earth quantities are summarized on the form R-15.

The surfacing quantities are computed in excavation from the pits and the amounts are summarized on form R-15. Overhaul for surfacing is computed in an entirely different way as provided for in the specifications. This is done by the moment method, which amounts to simply finding the center of gravity of the material in excavation and the material as applied on the road. The distances between these two points minus five-hundred feet will give the overhaul distance. The method is very simple. All stations affected are entered as shown on form R-9. The center of gravity between any two sections is assumed to lie half way between the two

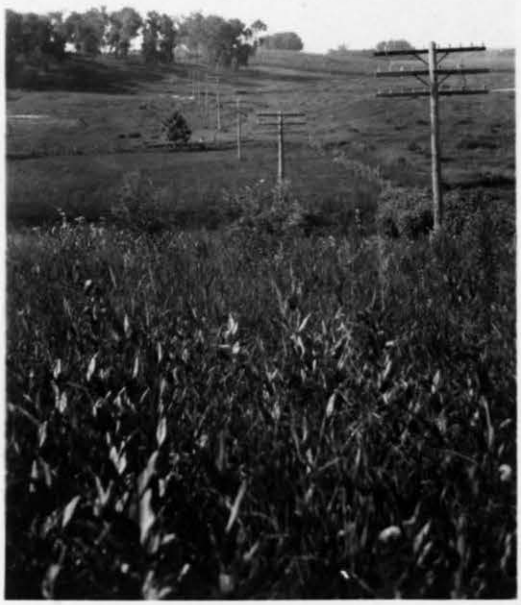
sections. The moment arm for the first section would then be one half of the section length and for the next section, it would be the length of the first section plus half the length of the second section and so on for all succeeding moment arms. The total number of cubic feet for any section multiplied by its moment arm, will then give the summation of moments at that point. The total of the summation of moments divided by the total number of cubic feet will give the distance of the center of gravity from the point where the moments were taken.

In making up the final estimate note that a revised detail estimate was made and the original quantities were then entered from this. This revised estimate was made up in the Lincoln office and was found necessary because of the large changes made in the project.

A few photographic illustrations might help to explain conditions on this project more clearly. Picture number one shows the beginning of the project looking

in the direction of increasing stations. This was the condition of the road before any work was done and shows the very sandy condition of the soil. The hill in the foreground was cut considerably to make the fill at the bottom.

Picture number two shows the project before construction from about station 35-A and is looking in the direction of increasing stations. The telephone poles are in



-2-

line with the project and to the left of the center line. Note that here is absolutely new location and that a low

swampy area lies at the bottom of the hill.

At about station 29-A a great deal of clearing and grubbing had to be done.

Picture number 3 shows the kind of clearing and grubbing encountered at this place. There was several hundred feet of roadway that had to be cleared near this place, which was all hand work. It is sometimes difficult to remove these stumps from the project when teams

-3-

and chains are used. A caterpillar tractor will usually pull a stump out after the roots have been cut away,

with ease. This clearing and grubbing was all done near a heavy telephone line, which necessitated first trimming the trees, cutting them off and then grubbing out the stumps. The work was paid for by force account, by the county.

Picture number 4 and 5 show a part of the project looking in the direction of decreasing stations. This fill was all made from the hill shown in the distance and the soil is quite largely composed of sand. This is the fill before any surfacing was applied. Note however, that the grade line is very regular.

-4-

-5-

-6-

Borrow pit number one is shown by pictures number 6 and 7. The hill shown here was of a good quality of clay and the material removed was all used as surfacing material. Picture 6 will illustrate the advantageous location of the material for trapping. The depth of the surfacing material can easily be seen from picture 8,

which shows material removed from borrow pit number one as applied to the project. Note the distinct difference in the shade and compact-ing qualities of the two soils at this point.

-8-

Borrow pit number four was also partly used for surfacing material and pictures number 9 and 10 show the material being removed by means of an elevating grader and loaded into wagons. This is a rapid method of obtaining and applying surfacing material, provided the contractor has enough dump wagons to keep the elevating grader moving. An elevating grader is always to be preferred on this work as it leaves the pit in such a smooth condition and free from depressions.

-9-

-10-

The cattle pass at 44-A station is shown in picture number 11. This is a 4' x 5' structure and is used not only as a cattle pass, but also as a drainage structure. This was a low marshy ground at this point and necessitated a rather high fill. Some idea of the wash may be seen by the exposed tree roots in the fore ground.

-11-

Picture number 12 shows the concrete box culvert at station 13+60-A. This illustrates very well the type of concrete work an this project. The concrete has a dense appearance, is free from board marks, and the edges are all straight, clean lines.

-12-

2a

NEBRASKA

FEDERAL AID PROJECT NUMBER 88-C

Cuming COUNTY

Standard Specifications
FOR
Highway Construction

DEPARTMENT OF PUBLIC WORKS

SAMUEL R. McKELVIE, Governor.

GEO. E. JOHNSON, Secretary and State Engineer.

Issued at the State Capitol, Lincoln, Nebraska

January 1, 1922.

RECOMMENDED FOR APPROVAL AS STANDARD FOR ALL FEDERAL AID PROJECTS IN NEBRASKA

.....

Bureau of Public Roads.

Approved:

.....

Bureau of Public Roads.

Date.....

Notice to Contractors

Sealed bids will be received at the office of the.....

at ..... Nebraska, on....., 192...., until .....

for .....

and incidental work on the.....

Project No. ..... Federal Aid Road.

Bids will be opened at the above office promptly after the time for receiving bids has closed.

The proposed work consists of constructing..... miles

of ..... road.

The approximate quantities are: .....

.....

.....

.....

.....

.....

Certified check for five per cent (5%) of the amount of the bid will be required.

Plans and specifications for the work may be seen and information secured at the office of the County Clerk at ....., Nebraska, or at the office of the State Department of Public Works at Lincoln, Nebraska.

The State and County reserve the right to waive all technicalities and reject any and all bids.

.....

County Clerk ..... County.

.....

County Clerk ..... County.

George E. Johnson, State Engineer.

Section No. 1

Specifications

In these specifications the following definitions obtain: 1 Definition of Term

Secretary of Agriculture: The Secretary of the Department of Agriculture of the United States, or his authorized agents.

Department of Public Works: The Department of Public Works of the State of Nebraska.

State: The State of Nebraska.

County: The County in which the work is to be done. Represented by its Board of Commissioners or Supervisors.

County Clerk: The Clerk of the County where the work is to be performed.

Contractor: The party of the second part in accompanying contract or contracts.

Engineer or Secretary of Department of Public Works: The State Engineer.

Chief of Bureau of Roads: The authorized representative of the Engineer in charge of all work in the State.

Division Engineer: An authorized representative of the Engineer in responsible charge of all work and of all project engineers in the Division to which he is assigned.

Project Engineer: An authorized representative of the Engineer, whose duties shall be to see that the work is carried out in accordance with the contract and specifications and perform such duties as are herein described as duties of the Project Engineer.

Inspector: An authorized representative of the Engineer assigned to make detailed inspection of any or all portions of the work or material therefor.

Board: The State Engineer and the County Board or Boards where the work is to be done.

Plans: The plans, profile and cross sections prepared by the Department of Public Works, to cover the work herein specified, together with all standard design sheets referred to thereon.

Specifications: The standard specifications prepared by the Department of Public Works and approved by the Secretary of Agriculture together with any attached amendments, corrections or special provisions.

INSTRUCTIONS TO BIDDERS.

The estimate of quantities given in the proposal is approximate only, but will be used as a basis for comparing the bids submitted. During construction the various items of work may be necessarily increased or decreased without impairing this contract. 2 Estimate of Quantities

After the grading is completed and before final payment is made therefor, the Project Engineer will cross section the road and make careful measurement to determine the units of various items of work performed, as the basis for final settlement. The Contractor, in all cases, will be paid for the actual amount of work performed as shown by the final measurements.

3
Examination of Roads

The plans show the location of the highways to be improved. Bidders are required to examine the plans, specifications, and special provisions carefully and make sure that the requirements are fully understood.

They must satisfy themselves by personal examination of the road as to the nature of the material to be excavated, the location and accessibility of material and other local conditions affecting the contract.

4
Laws

The bidders' attention is called to the fact that this work will be prosecuted under the Federal Aid Road Act, approved July 11, 1916, entitled "An Act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes," as amended, the regulations of the U. S. Department of Agriculture, and the State laws accepting Federal Aid.

Copies of these laws will be supplied upon request. Bidders should familiarize themselves with these laws and with any other laws affecting the work.

5
Use of Proposal Form

All bids must be on the proposal form furnished by the Department of Public Works for this project. These forms may be secured from the Department of Public Works or from the County Clerk.

6
Filling in Proposals

In filling in the proposal the bidder shall specify in ink or with typewriter the unit price for which he proposes to do each item of work. The unit prices shall be stated in words and figures, and the total amount for each item of work shall be computed for the quantities given and the unit price bid. In case the total amount does not agree with the unit price, the unit price will be taken as correct. A price shall be submitted on each and every item of work included in the group or division on which the bidder wishes to bid.

7
Signatures on Proposals

Anyone signing a proposal as agent, may be required to submit satisfactory evidence of his authority to do so.

8
Alteration of Proposal Prohibited

Any changes made in the proposal form prepared by the Department of Public Works for this project, or any addition thereto may cause the rejection of the bid. No bid will be considered which contains a clause in which the contractor reserves the right to accept or reject the contract awarded him by the Department of Public Works.

9
Certified Check

A certified check for five per cent (5%) of the total amount of bid, made payable to the Department of Public Works shall be filed with each bid.

10
Delivery of Proposal

Proposal must be placed in an envelope and the envelope sealed and so marked as to indicate its contents. This envelope shall be placed in another envelope and addressed to the office specified in the "Notice to Contractors."

11
Withdrawal of Proposal

Before filing their proposal, bidders must satisfy themselves that the same is correct, as no bidder will be permitted to withdraw his proposal after same has once been filed.

12
Opening of Proposal

Bids will be publicly opened and read at the time and place stipulated in the "Notice to Contractors." Bidders are invited to be present.

13
Disqualification of Bidders

No bidder shall submit more than one proposal. Contractors may be required to show satisfactory evidence of their experience and financial ability to satisfactorily perform this work.

AWARD AND EXECUTION OF CONTRACT.

14 Award of Contract

The contract will be awarded at the office of the Board to the lowest responsible bidder, as determined after the bids have been opened and the responsibilities of the various bidders have been investigated to the satisfaction of the Board. It is contemplated that the award will be made on the day on which the bids are received, but the right is reserved to postpone the award to a later date, of which bidders will be notified after bids have been opened, read and recorded.

All contracts awarded under these specifications are subject to the approval of the Department of Public Works, before becoming effective as contracts.

15 Return of Certified Checks

Certified checks will be returned to the unsuccessful bidders, promptly after the award has been made, and in no case will a certified check be held longer than ten (10) days without the bidder's written consent. If a bidder is not represented at the letting, his certified check will be returned by registered mail to the address given in the proposal.

16 Bond

The sucessful bidder will be required to furnish a bond of the form hereto attached, in an amount equal to one hundred per cent (100%) of his contract, issued by responsible surety, approved by the Department of Public Works, and shall be conditioned upon the faithful performance of the work in strict compliance with the plans, specifications, contract, the payment of all just bills incurred in connection with this contract, and the maintenance of the road as specified in paragraph No. 39.

17 Execution of Contract

The contract shall be executed at the office of the Board where bids are opened, within ten (10) days after the award has been made.

18 Liquidated Damages

Should the successful bidder, after receiving the award, fail to execute a contract, and file a bond within ten (10) days after the acceptance of his bid, his certified check will be forfeited to the State and County, or Counties interested, as liquidated damages.

19 Assignment of Contract

The contractor will not be permitted to sublet, sell or assign any portion of his contract, or the work provided for therein without the written consent of the Secretary of the Department of Public Works.

20 Patents

The contractor shall indemnify and save harmless the County, State and Federal Government against all claims for any infringement of patent or royalty for any tools, machinery, appliance, devices, or for material used in the construction and completion of the work. The County or State may deduct out of the moneys which may be due or become due, said contractor under this agreement, a sum of money sufficient to cover all claims for damages or royalties as above mentioned, and retain the same until said claims are paid and satisfactorily adjusted.

No patent or proprietary material, specifications, process, or type of construction will be used hereunder unless purchased or obtained on open actual competitive bidding at the same or at a less cost than unpatented articles and methods equally suitable for the same purpose.

GENERAL PROVISIONS.

21 Intent of Specifications

The intent of these specifications is to provide for the construction and completion in detail of the road work referred to in the "Notice to Contractors" and the Special Provisions, and it is understood that the contractor

for all or any part will furnish all labor, material, tools, transportation, and necessary supplies required under the terms of this contract to make each item complete in accordance with the plans, specifications and contract. Any deviations from these requirements must be stipulated in the Special Provisions.

22 Permits

Any and all necessary and local permits or licenses shall be secured by the contractor.

23 Plans and Drawings

The plans and specifications represent the foreseen conditions, and the work shall be done in accordance therewith. Any variation therefrom which may be required by the exigencies of construction, will in all cases be determined by the Engineer, or Chief of Bureau. No variation from such plans or specifications by the contractor will be permitted without the Division Engineer's written approval.

24 Interpretation of Plans

In the event of any discrepancy between the drawings and the figures written on them, the figures are to govern, and in case of any discrepancy between the drawings and the specifications, the specifications are to govern.

25 Special Work

Any work requiring deviation from these specifications, or of a nature peculiar to any particular contract hereunder, not fully covered herein, will be set forth under the heading "Special Provision" attached hereto, without impairing this contract.

26 Alteration of Plans

The plans represent the foreseen conditions. The various quantities required therein may necessarily be increased or disminished during construction without impairing this contract.

27 Additional Work

Should any changes made in the plans or specifications after contract has been awarded or in any particular part of the work partially completed, result in extra cost to the contractor, a fair and equitable amount in settlement therefor shall be agreed upon before the change is made, certified to by the Division Engineer, and approved by the Department of Public Works. Any changes made, resulting in an increase in the quantities of the various items of work for which bids are received, shall be paid for at the unit price stipulated in the proposal.

28 Extra Work

All extra work done on a "force account" basis will be paid for in the following manner:

(a) For all labor, teams, timekeeper, and foreman employed on the specific operation, the contractor shall receive the current local rate of wage, to be agreed upon in writing before starting such work, for each and every hour that said labor, teams and foremen are actually engaged in such work including liability and Workmen's Compensation Insurance thereon, to which shall be added an amount equal to fifteen per cent (15%) of the sum thereof.

The wages of any foreman or timekeeper who is employed partly on force account work and partly on other work shall be prorated between the two classes of work according to the number of men employed on each class of work as shown by the pay rolls.

(b) For all materials used, the contractor shall receive the actual cost of such materials delivered to the work, including freight and hauling charges, as shown by original receipted bills, to which cost shall be added a sum equal to fifteen per cent (15%) thereof.

(c) For any machine power and equipment, including fuel and lubricants but not including small hand tools, which it may be deemed necessary

or desirable to use, the Division Engineer shall allow the contractor a reasonable rental price, to be agreed upon in writing before such work is begun, for each and every hour that such equipment is in use on such work and to which sum no percentage shall be added.

The compensation as herein provided shall be received by the contractor as payment in full for extra work done on a force account basis, and shall include superintendence, use of tools, and equipment for which no rental is allowed, and profit. The contractor's representative and the Project Engineer shall compare records of pay rolls for labor furnished on a force account basis at the end of each day. All claims for extra work done on a force account basis shall be submitted to the Engineer by the contractor upon certified quadruplicate statements to which shall be attached original receipted bills covering the cost and the freight and haulage charges on all materials used in such work, and said statements shall be filed not later than the twentieth (20th) day of the month following that in which the work was actually performed, and shall include all labor charges, etc., and material charges in so far as they can be verified.

29 Unauthorized Work

No payment will be made for any work or material not required under the plans and specifications, unless authorized in writing by the Division Engineer.

30 Progress of Work

The contract time shall be divided into four equal periods. The progress of the work shall be such that at the end of the first period, at least one-eighth of the work shall be completed, at the end of the second period, at least three-eighths of the work shall be completed, at the end of the third period, at least three-fourths of the work shall be completed, and at the end of the fourth period, all work shall be completed. The Project Engineer will at frequent intervals, make progress reports to the Department of Public Works.

31 Limitations of Operation

The contractor shall conduct his work in such a manner as to create a minimum amount of inconvenience to traffic. If at any time in the judgment of the Division Engineer, the contractor has obstructed or closed, or is carrying on operations on a greater portion of the road than is necessary for the proper prosecution of his work, the Division Engineer may require the contractor to finish the section on which work is in progress before work is started on any additional section.

32 Character of Workmen and Equipment

The methods, equipment and appliances used shall produce a satisfactory quality of work and shall be adequate to maintain the schedule of progress specified. Any person employed on the work, who shall be detected doing improper or defective work, or shall refuse to, or neglect to obey the directions of the Project Engineer, or who shall commit any trespass upon any public or private property in the vicinity of the work, shall at once be removed from the work when so ordered by the Division Engineer, and shall not be re-employed on any of the work by said contractor unless written permission is given by the Engineer.

33 Co-operation of Contractor Required

The contractor shall at all times have a competent, authorized representative on the work to receive and obey orders of the Project Engineer. He shall keep an official copy of the plans and specifications of the work available at all times.

34 Laws and Ordinances

The contractor shall carry on the work so as not to conflict with any State, County or Municipal law.

35
Sanitary Provision

The contractor shall furnish the necessary sanitary conveniences, properly secluded, for the laborers on the work, and shall observe the rules of the State Board of Health and any local health officer, in the prosecution of this work.

36
Public Convenience and Safety

During the progress of the work, the contractor shall make suitable and adequate provision for the convenience of the public and that of the residents along the improvement. He shall maintain in a reasonable condition, such temporary highways and bridges as may be required by the Department of Public Works, to accommodate the traffic diverted from the road being improved.

Wherever it is possible to do so, a suitable road being available to detour, the Department of Public Works shall close the portion of the road under construction and shall cause suitable signs to be erected marking such detour. Signs shall be placed at each end of construction to read thus: "This road under construction. Travel at your own risk." Detour signs shall be plainly marked both on leaving the highway and returning to highway from both directions. The contractor is not required to maintain such detour roads. The contractor shall provide and maintain proper guards, suitable and efficient lights, and take all necessary precautions for the prevention of accidents. Materials brought upon the work shall be so placed as to cause the least obstruction possible. When the road is closed at the request of the Project Engineer, it shall be the duty of the contractor to provide and maintain such barriers necessary to prevent public traffic over the closed portion.

37
Restoration of Damaged Property

The contractor shall, at his own expense, replace or renew all fences, sidewalks, or other damage which may have been sustained by adjacent property due to the acts of negligence of his employees, or to prosecution of his work; shall preserve and replace, as directed by the Project Engineer, all monuments and shall leave the premises in a condition satisfactory to the Division Engineer.

38
Responsibility for Accidents

The contractor shall assume all responsibility in the event of accidents, either personal injuries or property damage, sustained by persons or property due to the carrying on of his work.

The responsibility of the contractor for all damages or injuries to the traveling public on any portion of the road shall not be released until the work on such portion has been approved by the Division Engineer.

Approval by the Division Engineer shall be construed to mean a written statement from him to the effect that the contractor may cease to maintain barriers and red lights as required above; that the road may be opened to traffic, and that the contractor is relieved from further maintenance of barriers and lights on that portion of the road.

The Division Engineer will inspect the project and tentatively accept all completed work, same to be turned over for State and County maintenance.

Approval by the Division Engineer shall not in any way be construed as a final acceptance of the road.

39
Responsibility for Protection of Work

The contractor shall be held responsible for the care of partially completed and finished work on any portion of the road until approval of that portion of the road by the Division Engineer. He shall repair at his own expense any damages due to slides or washouts or from any other causes, and shall do such repairing and re-shaping as is necessary to maintain the finished road in proper condition until such approval. He shall take all risks from floods and casualties of every description and make no charge for delay due to such causes.

The contractor will not be held responsible for damages to portions of the road which have been approved by the Division Engineer and opened to traffic prior to final approval and acceptance of the road, provided such damages are due to actions of the elements or to the ordinary action of traffic. The contractor is responsible for any damages which may have been occasioned by defective work or because of non-compliance with the plans, specifications and contract.

40 Responsibility for Road Opened to Traffic

Prior to final acceptance, any repairs to the roadway constructed hereunder made necessary by the construction or repairs of drains or sewers, the laying or repairing of pipes or conduits for telegraph or electric wires, or from any other disturbance of the said roadway by parties acting under permission issued by the county, the contractor shall, on notification from the Engineer, immediately make all necessary repairs in full conformity with the specifications for the particular type of roadway to be repaired. Such repairs shall be paid for by the County as extra work.

41 Opening Surface of Roadway

Samples of material shall be submitted to the Department of Public Works at Lincoln, Nebraska, for test at least ten (10) days prior to the time it is to be used.

42 Tests of Material

The materials used on this work shall be at least equal in quality to the requirements of these specifications or to the approved samples of material submitted hereunder.

43 Quality of Material

The contractor shall be held responsible for the care and storing of all materials delivered on the work or purchased for use hereunder. Should any material which has been delivered on the work become damaged before actual incorporation into the work, such material may be rejected by the Engineer, even though such material may have been previously accepted.

44 Storage of Material

Unless specifically stated to the contrary in the special provisions, all materials, such as stones, gravel, sand and timber found on the work or in the right-of-way of the highway, are the property of the County, and shall not be used or destroyed by the contractor without special permission from the County.

45 Use of Materials Found On Work

Any such material found on the right-of-way shall be disposed of as stipulated in the special provisions, or as directed by the Project Engineer if there is no special provision relating thereto.

46 Disposal of Material Found on Work

The Project Engineer shall set all necessary center line, slope and grade stakes promptly upon notification by the contractor that stakes are needed. Such stakes must be carefully preserved by the contractor and if destroyed, replaced at contractor's expense.

47 Lines, Grades and Measurements

The Department of Public Works shall not be responsible for delays due to lack of grade or line stakes unless the contractor shall have given the Project Engineer twenty-four hours notice that such stakes would be needed, and unless his work is being conducted in a satisfactory manner.

The cross section of the finished roadway shall be as shown on the typical cross section sheet, except when otherwise specifically directed by the Engineer. The Division Engineer shall make such change in cross section only where the drainage conditions or some other special feature required such change.

48 Cross-Section of Roadway

49
Duties of Inspector

The Department of Public Works may appoint inspectors to inspect all materials used and all work done. Such inspection may extend to all or any part of the work, and to the preparation or manufacture of the materials to be used. The inspectors will not be authorized to revoke, alter, enlarge or relax the prvisions of these specifications, nor to delay the fulfillment of the contract by failure to inspect materials and work with reasonable promptness. An inspector is placed on the work to keep the Engineer informed as to its progress and the manner in which it is being done. Also to call to the attention of the contractor any deviation from the plans or specifications. He will not be authorized to approve or accept any portion of the work or to issue instructions contrary to the plans and specifications. The inspector will have authority to reject defective materials, and to suspend any work that is being improperly done, subject to the final decision by the Engineer.

50
Secretary of Department of Public Works as Referee

Should the meaning of the requirements of these specifications be in doubt, the contractor shall refer the question to the Secretary of the Department of Public Works whose decision shall be final and binding on both parties.

51
Inspection of Materials and Work

The work as outlined is to be carried on in strict conformance with the plans, specifications and drawings relating thereto, and such instruction thereunder as may be given from time to time by the Engineers. All materials and each part of the work shall be subject at all times to inspection by the Engineers. The contractor shall be held strictly to the true intent of these specifications in regard to materials, workmanship and the diligent execution of this contract.

52
Defective Materials and Work

Any materials rejected by the Project Engineer shall be promptly removed from the work and shall not be incorporated therein. Any defective work shall, upon the direction of the Division Engineer, be removed and replaced at the contractor's expense.

53
Failure to Remove or Renew Defective Material or Work

Should the contractor fail or refuse to remove defective materials or work, when so ordered by the Project Engineer, the Division Engineer shall have authority to suspend further operations and to withhold the estimates until such defective material or work has been removed and replaced as directed.

54
Final Cleaning Up

Before final acceptance of the work, the contractor shall remove from the right-of-way all unused material and rubbish and shall leave the right-of-way in a neat and presentable condition, satisfactory to the Department of Public Works, and the Engineer.

55
Suspension of Work

If at any time in the judgment of the Project Engineer, inclement weather or the condition of the subgrade render further work inadvisable, he may suspend operations until such time as in his judgment a satisfactory quality of work can be produced, also work may be suspended by the Engineer as specified in Paragraph No. 53 hereof.

56
Time Allowance for Completion of Work

No time allowance will be made for suspension of work on account of failure of contractor to remove defective materials or work as directed by the Engineer.

An extension of time in which to complete his work may be given the contractor for suspension of work due to stormy or inclement weather or for other causes, beyond his control, if his claims for an extension of time

are filed with the Engineer within five days from the delay by reason of which the contractor claims an extension of the contract period. The claims for extension of time may be granted by the Department of Public Works.

57
Failure to Complete Work on Time

If the importance of any road to be improved under these specifications is such that the Department of Public Works holds it advisable, a liquidated damage stipulation may be added to the special provisions. When such a clause is inserted in the special provisions the Department of Public Works does not waive its right to collect all such additional damages as it may sustain by a failure on the part of the contractor to carry out the terms of the contract.

58
Annulment of Contract

If the rate of progress is such that it appears that the schedule specified in Paragraph No. 30 is not being maintained, the Department of Public Works shall order the contractor to take such steps as are considered necessary to maintain the rate of progress specified.

If the contractor should fail to comply with such order within the period in which the order is given, the Department of Public Works shall have the right to annul this contract and to take over the work and complete it at their option, either by day labor or by the re-letting of all or any part of the work. Neither the taking over of the work by the Department of Public Works, nor by the annulment of this contract, will the Department of Public Works forfeit the right to recover damages from the contractor for failure to complete his contract.

Should the cost of completing the work by day labor or by re-letting the same, be in excess of the original contract price, the contractor and his bondsmen shall be held responsible for such excess cost. Should the cost of completing the work by day labor, or by re-letting the same, be less than the original contract price, the amount so saved shall be given to the contractor.

59
Scope of Payment

The contractor agrees to receive and accept the prices submitted in his tender as full compensation for furnishing all materials and for doing all the work contemplated and embraced in this contract; for all loss or damage, arising out of the nature of the work aforesaid; or from the action of the elements, or from any unforseen difficulties or obstructions which may arise or be encountered in the prosecution of the work until its acceptance by the Department of Public Works and for all risks of every description connected with the work. Also for all expenses incurred by or in consequence of the suspension or the discontinuance of the work, and for well and faithfully completing his contract in the manner and according to the plans and specifications and the requirements of the Engineer under them.

60
Responsibility for Payment

Should the cost of the work hereunder be not in excess of the Federal State Aid Road Funds allotted to the County in which the work is located, payment will be made by the State of Nebraska from the State and Federal Aid Road Fund, excepting such costs the county or counties interested have agreed with the state to pay. In such case, the State will not be liable for any money in excess of the amount that the State has agreed to use on this project, the balance to be paid by the County as per agreement between the County Board and the Department of Public Works. Should the cost of the work be in excess of the Federal State Aid Road Funds allotted to this County, payment for the excess amount will be made by the county.

61
Partial Payment

All bills shall be filed in itemized form and certified to by the Project Engineer before being allowed by the Department of Public Works and before warrants in payment therefor are drawn. If satisfactory progress is being

made, the contractor will receive monthly estimates based on the amount of work completed and material furnished since the previous estimate or since the beginning of the work.

Each consecutive estimate shall be certified to by the Project Engineer and ten per cent (10%) of each estimate shall be deducted and held until the final acceptance.

62
Final Payment

Final acceptance by the Department of Public Works is stipulated to mean a written acceptance by the Department of Public Works followed by final payment in accordance with the Engineers final estimate. It is expressly stipulated that the Department of Public Works shall make final acceptance and payment promptly after the contract has been completed and the road approved. PROVIDED, HOWEVER, THAT NO WARRANTS WILL BE DRAWN FOR MONTHLY OR FINAL ESTIMATE IN EXCESS OF THE CASH ON HAND IN THE STATE AND FEDERAL AID ROAD FUND.

The monthly payments shall be approximate only, and all partial estimates and payments shall be subject to correction in the final estimate and payment. Before final settlement is made on this contract, the Department of Public Works may require the contractor to furnish a list of all persons furnishing labor and material, with evidence that such persons have been paid in full, shall be fully satisfied by thorough examination, of the faithful performance of each part of the work, and may reject any portion found to be inconsistent with the terms of this agreement. Should a reasonable doubt arise during construction work as to the integrity of any part of the completed work, the estimate for that portion shall not be allowed until the cause for such doubt has been removed.

63
No Waiver of Legal Rights

Inspection by the Engineer, or by any of his duly authorized agents; any order by the Engineer for the payment of money; any order, measurement or certificate by the Engineer or said agents; any extension of time; and any provision of this contract or any power therein preserved to the Department of Public Works or to any right to damages therein provided, and any waiver of any breach of the contract shall not be held to be a waiver of any other or subsequent breach.

64
Right-of-Way

All right-of-way for the road, borrow pits and necessary detours shall be provided by the County without cost to the contractor.

65
Claims Against Contractor

The contractor guarantees the payment of all just claims for material, supplies, tools, labor and all other just claims against him, or any sub-contractor in connection with this contract, and his bond will not be released by final acceptance and payment by the Department of Public Works unless all such claims are paid or released.

66
Incidental Work

Any minor work not specifically mentioned in the specifications or shown on the plans, but obviously necessary for the proper completion of the work, shall be considered as being a part of and included in the contract, and shall be executed in a proper manner and the contractor shall not be entitled to any extra or additional compensation for the same.

67
Disputed Claims for Extra Compensation

In any case, where the contractor deems that extra compensation is due him for work or material not clearly covered in this contract nor ordered in writing by the Engineer as an extra, as defined above, the contractor shall notify the Engineer of his intention to make claim for such extra compensation before he begins the work upon which he bases the claim. If such notification is not given, or the Engineer is not afforded proper facilities by the

contractor for keeping strict account of actual cost as defined for extra work, the contractor hereby agrees to waive the claim for such extra compensation. Such notice by the contractor and the fact that the Engineer has kept account of cost as aforesaid, shall not in any way be construed as proving the validity of the claim. The claim must be passed upon by the Department of Public Works.

In case the claim, after consideration by the Department of Public Works is found to be just, it shall be allowed and paid as an extra, as provided herein.

68 Liability Insurance

The contractor under these specifications, shall carry liablity insurance to indemnify the public for injuries sustained by reason of the carrying on of his work, and to meet the requirements of the Nebraska Workmen's Compensation Law.

69 Supervision

The work shall be done under the direct supervision and to the complete satisfaction of the State Department of Public Works, subject to inspection at all times and approval of the Secretary of Agriculture of the United States, or his agents, and in accordance with the laws of the State of Nebraska, and the rules and regulations of the said Secretary of Agriculture made pursuant to that certain act of Congress approved July 11, 1916, (39 U. S. Statutes, at Large, 355), together with subsequent amendments entitled "An Act to provide that the United States shall aid the States in the construction of rural post roads and for other purposes."

70 Documents Included in Contract

This contract shall include the: Notice to contractors, the instruction to bidders, these specifications, the special provisions, the proposal, the specific contract, the contractor's bond, and the general and detailed plans.

CONSTRUCTION DETAILS.

For Earth Roads.

71 Excavation

Under this head will be included all excavation and embankments required for the formation of the earth roadway, cutting all ditches along or contiguous to the road, forming the approaches to all side roads and farm entrances, changing of streams, channels, and all other excavations and embankments connected with or incident to the construction of the road. Excavation will be estimated under the following heads, viz:

Solid Rock Excavation.
Loose Rock Excavation.
Ordinary Earth Excavation.
Special Excavation.
Channel Excavation.

When, during excavation, material is encountered of such a character as to appear to the contractor that it shall be classified as solid rock excavation, loose rock excavation, or class C special excavation, the contractor shall cease work on such excavation and call the Project Engineers attention to this material in writing, who shall at once notify the Division Engineer. Upon receipt of such notice the Division Engineer shall immediately arrange a meeting of a representative of the U. S. Bureau of Public Roads, the Project Engineer, the contractor, and himself, at which time they shall view and inspect the material to be excavated and determine the proper classification of said material. The contractor may resume work on such excavation as soon as classification has been determined.

72
Solid Rock Excavation

Solid rock excavation will include all rock in masses which cannot be removed without blasting, also all detached rock or boulders measuring not less than one cubic yard each. Brule clay and shale and all such material that can not be handled with grading machinery and which necessitates the use of explosives will be classified and paid for as solid rock at the unit price bid for solid rock excavation.

73
Loose Rock Excavation

Loose rock excavation will include all slate, hard magnesia or other rock which can be quarried or removed without blasting, also detached rock or boulders measuring not less than one cubic foot nor more than one cubic yard each and shall be classified and paid for as loose rock at the unit price bid for loose rock excavation.

74
Ordinary Earth Excavation

Ordinary earth excavation will include all loose stones, boulders, and other material of every description as found, which are not included in the above specifications as solid and loose rock, special excavation, or channel excavation.

75
Special Excavation

Special excavation will be divided into three classes, Class A, Class B, and Class C.

Class A—Special excavation shall include actual necessary excavation, below the ground line as existing at the time the contract was awarded, for the purpose of removing or placing of pipe culverts, box culverts and bridges and for such other excavation as shall in the judgment of the Project Engineer necessitate hand excavation. The price bid for Class A special excavation will include placing this amount of material as back fill or otherwise disposing of it as directed by the Project Engineer.

Class B—Special excavation shall include all actual necessary excavation for inlet and outlet ditches for drainage structures, all necessary excavation of newly placed embankment for purpose of placing culverts and bridges, all necessary excavation for driveways as ordered by the Project Engineer, all necessary excavation or borrow of earth for backfilling of new culverts and bridges or filling of old structures removed, and for such other excavation of a similar nature as may be ordered by the Project Engineer where such excavation necessitates the use of other equipment than is usually used on ordinary excavation.

Necessary excavation for drainage structures shall be construed to mean all excavation enclosed within vertical planes parallel to and not exceeding 18 inches from the finished surface of the structure. Necessary excavation for all other purposes shall be construed to mean the excavation which in the judgment of the Project Engineer will be adequate for the purpose desired.

Class C—Special excavation. If in the normal progress of the work, material of a nature is encountered which is in natural condition and not in a condition resulting from temperature or weather conditions, and which does not properly come, under the classification for Solid Rock Excavation and Loose Rock Excavation, and is more difficult and expensive to handle than is contemplated for material under Ordinary Earth Excavation, the Engineer may, as outlined in paragraph 71, upon demand of the contractor, give such material a Class C Special Excavation, under which classification double the price bid for Ordinary Earth Excavation shall apply. The Engineer shall be guided in giving this classification by the output of the crew employed, under normal and favorable weather conditions; and such a classification shall not be given unless the output of the same crew is decreased by fifty per cent (50%) over the average output maintained in material which on the same work is classified properly under Ordinary Earth Excavation, and unless the contractor uses the ordinary tools, equipment and methods necessary to give the most efficient results.

The classification of any excavation under Class C Special Excavation shall be determined as outlined in paragraph 71, and if such classification is allowed, the material so classified will be confined to the exact yardage moved, and will not be taken as a percentage of any single excavation or the average of a number of excavations.

76 Channel Excavation

Channel excavation shall include the actual excavation made for the purpose of changing of stream channels where such are shown on plans or ordered by the Division Engineer on proper authority. Stream channels shall be construed to mean all ditches or channels of sufficient size to enable the use of elevating graders, fresnoes, drag lines and such equipmnet as is usually used on ordinary excavation.

The prices bid for Classes A and B of Special Excavation and for Channel Excavation shall cover the actual excavation of the material and the disposal of all such material in road embankment, backfill of structures, waste banks properly made, dykes which may be required or in such other manner as in the judgment of the Project Engineer may be required. In no case will extra payment be allowed to cover such excavation or disposal of excavated materials.

77 Clearing and Grubbing

All ground included in the highway must be cleared of trees, stumps, brush, weeds, and grass to the full width of excavated roadway in cross section as shown on plans. All timber, stumps, brush and other vegetable matter must be burned unless otherwise directed by the Engineer. Where the embankments are to be more than 2½ feet in height it will be sufficient to cut all trees, stumps and brush close to the ground. Where embankments are to be less than 2½ feet in height, all stumps and large roots must be grubbed out, burned or removed. The County will clear and grub all standing timber as described above, but will not be responsible for any buried stumps encountered in making excavations.

The grubbing should precede the grading for at least two miles. If the County fails to do this then the contractor for the earth work will be authorized to do the clearing and grubbing, and the same will be paid for by the County, as provided for in Paragraph 28.

78 Roadway Excavation

Excavation shall be made in all cases to the required grade, alignment, and cross section. All roots, stumps, or other timber encountered in the excavation shall be removed and burned or otherwise disposed of as directed by the Project Engineer, but shall not be placed in the embankments. All material taken from the excavation shall be deposited in the embankments unless otherwise specified or directed by the Division Engineer. The cost of moving of same when the average length of haul does not exceed five hundred (500) feet will be considered as included in the price per cubic yard for excavation.

79 Embankments

Where the proposed improvement includes surfacing the road with a pavement, embankments shall be carried up in horizontal layers six inches in thickness each of which shall be carried out to its full width in the cross section of the roadway. Each layer shall be rolled, the roller passing over the entire area of each layer of the fill at least twice. The sides of the embankment shall be kept lower than the center during all stages of the work, and the surface maintained in condition for adequate drainage. The size and type of roller is specified in "Construction Details All Paved Surfaces." If any material is encountered which will not compact under the roller, such material shall not be placed in the embankment, but shall be wasted as directed by the Engineer. Sod and other vegetable matter obtained in the cuts shall be so distributed in the embankment as to not form pockets or cavities. All existing slopes and surfaces of embankments shall be plowed

where additional fill is to be made, so that the new material shall bond with the old.

Where the proposed improvement does not include surfacing the road with a pavement, embankments shall be carried up in horizontal layers each of which shall be carried out to its proper width in the cross section of the roadway, but need not be rolled. Sod obtained in the cuts may be deposited in the embankments, provided it is thoroughly disced and pulverized. Stones obtained from cuts shall be so distributed in the embankments as to not form pockets or cavities. All existing slopes and surfaces of embankments shall be plowed where additional fill is to be made, so that the new material will bond with the old.

80
Disposal or Surplus Material

When the amount of cut exceeds the amount of fill the gross material shall be deposited as directed by the Division Engineer. Such material shall preferably be used in widening the adjacent fills to reduce the side slopes thereon.

81
Borrow Excavation

When sufficient material for the embankments is not obtainable within the side ditches and excavation as staked out, the contractor shall make up the deficiency from borrow pits laid out by the Project Engineer. Borrowing must be done from regular shaped pits in order to admit of ready and accurate measurements, care being taken not to unnecessarily injure or disfigure the land. The banks must be sloped, the pits so constructed that surface water will drain out, and the premises left in a condition satisfactory to the Engineer. The right-of-way for borrow pits will be furnished by the County.

82
Overhaul

Overhaul will be allowed at two cents for each cubic yard of excavation hauled each 100 feet in excess of 500 feet as herein provided. The amount of overhaul shall be determined by balancing against ambankment as free haul, overhaul shall be determined by balancing against embankment as free haul, all excavation made wthin the limit of 500 feet and determining the center of gravity of the remaining excavation and the corresponding embankment and allowing overhaul for the remaining excavation for the distance as traveled between the centers of gravity less 500 feet.

The route traveled shall in the judgment of the Project Engineer be the most economical route feasible.

83
Hauling Surfacing Material

Hauling of materials for top soil, sand or clay surfacing and binder will be allowed at the price bid for each cubic yard measured in excavation for each mile (5280ft.) hauled as herein provided. The price bid for excavation of such material shall include hauling for a distance not exceeding 500 feet. The number of cubic yard miles hauled shall be determined by computing the center of gravity of the materials in excavation and the center of gravity of the materials in place on road and multiplying the number of cubic yards in excavation by the measured distance in feet as traveled between the above centers of gravity less 500 feet and dividing by 5280.

The distance actually traveled will be allowed as the distance between centers of gravity only when in the judgment of the Project Engineer, the route traveled was the most feasable route available.

84
Other Contractors

The contractor is required, as far as possible, to arrange his work and dispose his materials so as not to interfere with the operations of other contractors engaged upon adjacent work. He is also required to join his work to that of others in a proper manner, and in accordance with the spirit of the plans and specifications, and to perform his work in the proper sequence in relation to that of other contractors, and as may be directed by the Division Engineer.

Grading shall be estimated and paid for by the cubic yard at the prices specified in the tender. Measurements of grading quantities will in all cases be made from the cuts or pits from which the material is taken, by cross sectioning before and after excavation and the volumes determined by the average end area method.

85 Measurements of Quantities

Excavation: The contract price for excavation per cubic yard shall include the excavation of the material, loading, transporting (provided the extreme haul does not exceed five hundred (500) feet), the depositing of the excavated material in the manner described in these specifications, the finishing of the earth roadway, side ditches and slopes, the discing and harrowing of sod where required, the repair and replacing of all fences carelessly and unnecessarily damaged or removed by the contractor, maintaining the dirt roads as specified in paragraph 39, and such incidental work as may be required to make the grading work complete. No extra payment shall be made for hauling material when the extreme length of haul does not exceed the free haul limit of five hundred (500) feet.

86 Basis of Payment

The price bid for removing and replacing fences will include removing the posts, removing and caring for the wire, digging the necessary holes, replacing posts, replacing the wire, furnishing any additional staples used, and such incidental work or materials as may be necessary to replace the fence in as good condition as before the same was removed.

87 Removing and Replacing of Fences

If it is necessary in the prosecution of the work to interrupt or obstruct the natural drainage of the surface, or the flow of artificial drains, the contractor shall provide for the same during the progress of the work in such a way that no damage shall result to either public or private interests, and shall restore such drains to proper working order. He shall be held liable for all damages which may result from any neglect to provide for either natural or artificial drainage which he may have interrupted.

88 Provision for Drainage

In cuts along side hills where there is a possibility of surface water causing damage by flowing down the side slope of the cut, a ditch shall be constructed to intercept the surface water and prevent it from flowing into the cut. The contractor will be paid for this work as additional work.

89 Intercepting Ditch

Wherever it becomes necessary to make an excavation along the side of an embankment over three feet in height as in the construction of borrow pits, ditches, etc., a berm not less than four (4) feet in width shall be left between the bottom of slope of the roadway embankment and the top of the excavation bank.

90 Berms

The center of the finished roadway shall conform in alignment to the center stakes. These stakes follow, as nearly as possible, the center line of the right-of-way.

91 Alligmment

The side ditches shall be excavated to the depth, alignment, and cross section shown on the drawings. Care shall be taken to secure a uniform grade of ditches so that the water will readily drain out, and to secure smooth uniform slopes on the ditch banks in strict conformance with the drawings.

92 Side Ditch

The project Engineer shall set suitable finishing stakes to guide the contractor in finishing the road.

93 Finishing Stakes

If the road is not to be surfaced with gravel or other material, the contractor shall, after having brought it substantially to grade, complete the

94 Finishing

work in such a manner that the finished road will be smooth and true to cross section, grade and alignment. No extra compensation will be allowed for finishing so this work must be included in the price bid for excavation.

If the road is to be surfaced with gravel or other form of surfacing the sub-grade shall be constructed in the manner specified for the class of surfacing to be used. The preparation of sub-grade for the surfacing is not included in the price for earthwork.

SECTION NO. 2.

TOP SOIL AND SAND CLAY SURFACE.

95
Subgrade

The graded roadway shall be brought to the elevation, alignment and cross section indicated for sub-grade on the plans, and shall be maintained free from ruts and other depressions until covered with the surfacing material.

96
Natural Sand Clay or Top Soil Surfacing

The Division Engineer will designate and the County will provide suitable places for obtaining natural sand-clay mixtures for surfacing. All unsuitable material that may over-lie the acceptable material shall be stripped off and removed, and the work will be paid for in the same manner as specified in paragraph 78, of Section 1.

The natural sand-clay mixture shall then be excavated, hauled to the road, and spread. All excavation shall be so conducted that the pits will be left in good condition, and that where possible, provisions will be made for draining the pits without additional excavation beyond their limits.

The sand clay or top soil shall be composed of a uniform mixture of hard, durable fragments of sand, together with silt and clay, and may advantageously carry a considerable amount of gravel. The mixture should be free from an excess of feldspar or mica. The cementing value of material under one-quarter (¼) inch shall be not less than 35.

The material which will pass a 10-mesh sieve shall, when tested by means of laboratory sieves, meet the following requirements for grading:

Clay	10 to 25 per cent
Silt	10 to 25 per cent
Total sand	50 to 80 per cent

97
Hauling

The hauling shall be done in wagons of approximately uniform capacity, and the loads shall be dumped at such a distance apart as will give the amount of material required to construct the surface according to the proposed cross section.

98
Spreading

The surfacing material shall be immediately spread on the prepared subgrade to such a depth that the surface, when compacted, will conform accurately with the profile, alignment, and cross section, as shown on the plans. All subsequent loads, may then be hauled over the surface thus formed.

The construction of the surface shall begin at that point on the road nearest the source of material and be continued from such point. In hauling over the material as deposited, wagons will be required to use the entire width of surfaced roadway so as to compact the whole section as nearly to a uniform density as possible. The teams will not be permitted to follow a single track or to form ruts.

99
Finishing

After five hundred (500) or six hundred (600) feet of roadway have been thus roughly constructed the surface shall be cut up and pulverized to a depth of two (2) or three (3) inches with a plow or harrow and at the

same time the shoulders on each side of the surfaced portion of the road shall, if necessary, be sufficiently loosened to permit of a smooth regular crown being constructed from shoulder to center of road.

When the roadway has been loosened sufficiently, the surface shall be worked with a road grader or drag to the true cross section until the entire surface becomes smooth and firm.

100 Mixing Sand-Clay

In case the natural sand-clay mixture, as found, does not contain a sufficient percentage of either sand or clay to give a durable surface, there shall be spread as much of the deficient material as the Engineer may direct, and this shall be thoroughly mixed and incorporated with the material previously spread. In places where a natural mixture is not available suitable amounts of clay or sand shall be hauled, spread and mixed as directed by the Engineer.

The process of mixing may require plowing to a depth of six (6) or eight (8) inches and harrowing with a disk or tooth harrow, and this work may be required in wet weather.

101 Method of Payment

The completed surface shall include all excavation of surfacing material, hauling, spreading, manipulation, building shoulders, and finishing. It shall be paid for at the unit price bid for excavation of surfacing material for top soil and sand clay roads, measured in excavation. As much of the surfacing material as is necessarily hauled more than five hundred (500) feet will be classed as top soil or sand clay overhaul and paid for at the price bid per cubic yard mile hauled, and calculated as specified in paragraph 83.

SPECIFICATIONS FOR GRAVEL ROADS.

102 Subgrade

After the roadway has been thoroughly dragged and shaped to the satisfaction of the Engineer, a layer of gravel shall be evenly spread to a depth and width as shown on plans or ordered by the Engineer over the surface of the road.

The gravel will be applied so that one square yard surface in place two inches thick will contain not less than one-eighteenth (1/18) cubic yard gravel measured in wagon or truck of uniform size of box at time they are dumped on the road. Likewise one square yard surface three inches thick will contain not less than one-twelfth (1/12) cubic yard gravel, and one square yard surface four inches thick will contain not less than one-ninth (1/9) cubic yard gravel. For other depths of surface the amount of gravel required per square yard will be determined by this same method.

103 Gravel

This gravel should meet with the following requirements:

Passing 1 inch screen	100%
Retained on No. 4 screen not less than	10%
Retained on No. 6 screen not less than	32%
Retained on No. 10 screen not less than	70%

104 Binder

If the gravel does not contain sufficient binder to compact well, a layer of the best binding material obtainable within reasonable distance will be spread on top of the gravel, the amount of this material to depend on the character of the gravel.

Payment for the application of binding material will be at the price bid per cubic yard for excavation of surfacing material for top soil and sand clay roads measured in excavation and at the price bid per cubic yard mile for overhaul of surfacing material for top soil and sand clay roads as specified in paragraph 83.

105
Hauling, Spreading and Manipulation

The hauling shall be done in wagons of approximately uniform capacity, and the loads shall be dumped at such a distance apart as will give the amount of material required to construct the surface according to the proposed cross section.

The surfacing material shall be immediately spread on the prepared subgrade to such a depth that the surface, when compacted, will conform accurately with the profile, alignment, and cross section, as shown on the plans. All subsequent loads, may then be hauled over the surface thus formed.

The construction of the surface shall begin at that point on the road nearest the source of material and be continued from such point. In hauling over the material as deposited, wagons will be required to use the entire width of surfaced roadway so as to compact the whole section as nearly to a uniform density as possible. The teams will not be permitted to follow a single track or to form ruts.

The gravel and binder must be thoroughly mixed by means of a harrow or similar tool. The road is then shaped to conform with the section as shown on the plans. A roller, tractor or drag is passed over the road until it is thoroughly compacted. It is then thrown open to traffic.

If necessary in order to obtain a good surface, the roadway must be scarified to a depth and width as ordered by the Engineer, this work to be done by a harrow or scarifier of an approved type.

Earth shoulders will be constructed, where called for on plans, or ordered by Engineer.

Under this item earth shoulders will be built as shown on the typical cross section. The ditches may be deepened slightly to provide for the shoulders.

106
Method of Payment

The completed surface shall be paid for by the square yard in place as shown on the plans. The price bid per square yard shall include the furnishing of all gravel, hauling of same, spreading, manipulation, scarifying, labor, tools and doing all the work necessary to complete the gravel surfacing and earth shoulders, exclusive of the application of material for binder, in accordance with these specifications.

SECTION NO. 3.

DRAINAGE AND MISCELLANEOUS STRUCTURES.

SPECIFICATIONS FOR CAST IRON RIBBED PIPE.

107
Cast Iron Ribbed Pipe

The pipe shall be made of cast iron of good quality and of such character as will make the metal of the pipe strong, tough and of even grain, and soft enough to admit of cutting. They shall be made in lengths of not less than three (3) feet, and may be either solid or sectional. If sectional, they shall be provided with suitable means to prevent displacement at longitudinal joints.

They shall be provided with bell end or other suitable means to insure continuity and prevent vertical displacement at junction of longitudinal sections.

The shape and size shall be proportioned so that the pipe will withstand a load of fifteen thousand (15,000) pounds applied upon any two feet of its length, according to standard test adopted for cast iron pipe by the United States Bureau of Public Roads.

Pipes which are to be used in culverts shall conform in dimensions to pipes of the same pattern which shall have passed the above test.

The thickness shall in no case be less than one-quarter (¼) inch, or less than one-twentieth (1/20) the distance between ribs.

Sections of pipe shall be free from distortion, so that when placed together the parts in contact shall have an even bearing along the whole length of the pipe.

Every pipe shall be coated inside and outside with coal-tar pitch varnish. The varnish shall be made from the coal-tar pitch, to which sufficient oil has been added to make a smooth coating, tough and tenacious when cold, and which has no tendency to scale off.

The price bid shall cover furnishing, delivering, handling, laying, cutting and caulking joints to the satisfaction of the Engineer, and all labor and material necessary to complete the work including back fill, except that the excavation necessary will be paid for under the item of special excavation.

SPECIFICATIONS FOR SOLID CAST IRON PIPE.

108 Solid Cast Iron Pipe

Cast iron pipe shall be made with bell and spigot joints and shall conform to the following table of minimum weights and thicknesses:

Inside Diameter Inches	Tickness Inches	Weight Per Foot Pounds
12	.54	72.5
14	.57	98.6
16	.60	108.3
18	.64	129.2
20	.67	150.0
24	.76	204.2
30	.88	291.7
36	.99	391.7

The weight shall not be less than the standard weight more than five (5) per cent. The pipe shall be straight and the inner and outer surfaces shall be true concentric cylinders. All pipe shall be made of cast iron of good quality and of such character that shall make the metal of the pipe strong, tough and of fine grain, and soft enough satisfactorily to admit of drilling and cutting. The metal shall be made without any mixture of cinder iron or other inferior metal.

The surfaces of the pipe shall be smooth, free from scale lumps, blisters, sand holes, and defects of every nature which unfit the pipe for the use for which it is intended.

Every pipe shall be coated inside and out with coal-tar pitch varnish.

The price bid shall cover furnishing, delivery, handling, laying, cutting and caulking joints to the satisfaction of the Engineer, and all labor and material necessary to complete the work including back fill, except that the excavation necessary will be paid for under the item of special excavation.

SPECIFICATIONS FOR CORRUGATED METAL PIPE.

109 Corrugated Metal Pipe

Three classes of base metal for use in corrugated metal pipe are recognized in these specifications as Pure Iron, Copper Iron and Copper Steel.

The base metal shall be made by the basic open hearth process and shall conform to any of the following chemical requirements:

LADLE ANALYSIS OF BASE METAL.

	Pure Iron	Copper Iron	Copper Steel
Sulphur	Not more than 0.04%	Not more than 0.04%	Not more than 0.05%
Phosphorus	Not more than 0.015%	Not more than 0.015%	Not more than 0.04%
Total of Carbon Sulphur, Phosphorus, Manganese and Silicon	Not more than 0.16%	Not more than 0.25%	Not more than 0.7%
Copper		Not less than 0.20%	Not less than 0.20%

No metal will be accepted under these specifications and no bids will be considered for either Pure Iron, Copper Iron, or Copper Steel requirements until after the sheet manufacturer's certified analysis showing the percentage of carbon, manganese, silicon, sulphur, phosphorus, copper, oxygen, hydrogen and nitrogen, and manufacturer's guarantee has been passed by the Department of Public Works.

Bidders shall specify in the proposal the kind of corrugated metal pipe upon which bid is based.

Misbranding or other misrepresentation and non-uniformity of product will each be considered a sufficient reason to discontinue the acceptance of any brand under these specifications by the Department of Public Works and the notice of discontinuance of any brand sent to the sheet manufacturer will be considered to be notice to any culvert companies which handle that particular brand.

Corrugated metal pipe for culverts shall be properly fabricated from the corrugated galvanized sheets of steel or iron, but each culvert shall be made of the same kind and quality of metal throughout. The sheets of metal before galvanizing shall be smooth and free from blisters, seams and pits, and shall be not less than sixteen (16) gauge, U. S. Standard, for pipe having a diameter of twenty inches or less, and shall be not less than fourteen (14) gauge, U. S. Standard, for pipe between twenty and thirty-six inches in diameter. The galvanizing shall consist of not less than two (2) ounces of prime spelter per square foot of sheet uniformly distributed over the surface of the sheets of metal. It shall be applied in such a manner that the spelter will not peel off during fabrication or in transporting and laying the pipe and any uncoated spots due to poor workmanship, rough handling, or any other reason, shall be sufficient cause for rejecting the pipe. The amount of spelter per square foot will be determined by the lead acetate method upon a sample taken from the culvert. The corrugations shall be not less than two and one-half (2½) inches and not more than three (3) inches from crest to crest and shall have a depth of not less than one-half (½) and not more than five-eighths (⅝) inch.

All joints shall be even and close and the jointed pipe shall be straight, circular in sections, true and rigid. In the longitudinal joints, rivets shall be driven in the valley of each corrugation; in the transverse joints rivets shall be uniformly spaced not more than six (6) inches apart. The rivets shall be driven in such a manner as to draw the sheets tightly together and to fill the rivet holes completely. The rivets shall be at least one (1) inch from the edge of the sheets.

All rivets shall be of the same quality of metal as the sheets in which they are used. They shall be thoroughly galvanized and shall be not less than five-sixteenths (5/16) of an inch in diameter and shall have neat workman-like semispherical or flat heads. The heads shall have a diameter of

not less than one and five-tenth (1—5/10) times the diameter of the rivet, plus one-eighth (1/8) of an inch, and all flat heads shall have thickness not less than four-tenths (4/10) that of the diameter of the rivet.

All pipe shall be furnished in the lengths ordered, except that pipe for culverts twenty-six (26) feet or more in length may be furnished in sections not less than twelve (12) feet in length, provided necessary field connections shall consists of bands not less than eight (8) inches in width, made from the same material as the pipe, and so fabricated that a secure and firm connection of the sections of pipe may be readily made in the field.

The diameter of the metal pipe shall be understood to mean the clear diameter. For example, a pipe eighteen (18) inches in diameter shall be of such size that a sphere eighteen (18) inches in diameter may be rolled through it except for interference of rivet heads.

In preparing the ditch the bottom shall be rounded out to fit the lowest ninety (90) degrees—forty-five (45) degrees each side of the center line of the circumference of the pipe, taking pains to secure an extra firm bearing near the outer edges of the ninety (90) degree strip. Upon the concave surface so prepared the contractor shall spread a layer, one (1) to two (2) inches thick, of pulverized soil, or sand free from pebbles larger than one-fourth (1/4) inch diameter, and shall firmly bed each pipe truly to line and grade thereon.

When rock is found in the ditch the bottom shall be excavated some six (6) inches below the lower surface of the pipe and replaced with clay or sand. The pipe shall at no place rest on solid rock. The minimum fill over pipe culverts will be 12 inches.

The price bid shall cover the furnishing, delivering, handling, laying, cutting, and all labor and material necessary to complete the work including back fill.

SPECIFICATION FOR REINFORCED CONCRETE PIPE.

110 Cement

The cement shall be of a standard Portland Cement of a brand approved by the Department of Public Works, and shall conform to the specifications of Circular No. 33 of the U. S. Bureau of Standards. The cement shall be shipped in carload lots and the Engineer shall have at least ten (10) days to make such tests as may be desired before it is used. Care must be exercised in the storing and protection of the cement on the work, and any cement damaged by moisture which fails to meet any of the above requirements shall be rejected.

111 Fine Aggregate

The sand shall consist of clean, silicious grains, uniformly graded in size, from finest particles up to a size passing a one-quarter (1/4) sieve, and shall conform to the following requirements:

Passing 1/4 inch screen	100%
Passing 20 mesh, retained on 50 mesh	20 to 45%
Passing 50 mesh, not more than	30%

Not more than 5% shall be removed by the alutriation test.

In no case shall fine aggregate containing lumps of frozen material be used. Fine aggregate shall be of such a quality that the mortar composed of one (1) part cement and three (3) parts fine aggregate by weight, when made into briquettes, will show a tensile strength at least equal to the strength of one (1) to three (3) mortar of the same consistency made with the same cement and Standard Ottawa sand.

The proportion shall be one (1) part cement to two (2) parts fine aggregate and three (3) parts coarse aggregate.

112 Coarse Aggregate

The broken stone or gravel aggregate shall consist of clean, hard, tough, durable rock. It shall contain no vegetable or other delecterious matter, and shall be free from soft, thin elongated or laminated pieces. The coarse aggregate shall be graded uniformly from the largest to the smallest pieces and shall all pass a screen having three-quarter (¾) inch diameter holes and be retained on a screen having one-quarter (¼) inch diameter holes.

Broken stone or gravel shall be sampled and tested for quality and grading in accordance with the method recommended by the American Society for Testing Material. A mixture of sand and gravel may be used in lieu of the coarse and fine aggregate as described in the foregoing paragraph.

113 Sand-Gravel Mixture

Sand and gravel mixture shall consist of clean quartzite of feldspar and shall contain no vegetable or other deleterious matter and shall be free from soft, thin elongated, or laminated pieces, and when tested by laboratory screen shall meet the following requirements:

Passing ¾ inch screen	100%
Retained on ¼ inch screen not less than	14%
Retained on 10 mesh screen not less than	50%
Retained on 20 mesh screen not less than	80%
Passing through 100 mesh screen, not over	1%
Loss by washing silt or clay not over	1%

And the fineness modulus shall not be less than 4.00.

Sand gravel mixture shall be sampled and tested for quality and grading in accordance with the method recommended by the American Society for Testing Materials.

114 Proportion

The unit of measure shall be one (1) cubic foot. A bag of cement containing not less than ninety-four (94) pounds net shall be assumed as one (1) cubic foot of cement. Unless otherwise specified, the proportions of concrete shall be one (1) part of cement and two and one-half (2½) parts of sand, or one (1) of cement to three (3) parts of sand gravel mixture.

The proportions of sand and gravel mixture may be varied by the Engineer, so as to insure maximum density.

115 Water

Water used for this work shall be clean, free from oil, acid, alkali or vegetable matter and shall be acceptable to the Engineer.

116 Steel Reinforcement

The reinforcement shall consist of American Steel & Wire Company's triangular mesh wire or other suitable reinforcing. The joint or draw bar shall be of mild steel, and both shall be of weight, size and style shown on the plans appoved by the Department of Public Works.

117 Mixing and Placing

The ingredients of the concrete shall be thoroughly mixed to the desired consistency, and the mixing shall continue until the cement is uniformly distributed and the entire mass is uniform and homogeneous. The concrete may be mixed by hand or in a suitable mixer approved by the Engineer in charge. If mixed by hand, the mixing shall be done on a water tight platform of sufficient size so as to permit rapid mixing. The sand shall be spread evenly upon the platform. Then the cement upon the sand and turned a sufficient number of times until the mixture becomes of an even color. The water necessary to produce a wet mix shall then be added and the mass shall then be turned again until the aggregates are thoroughly coated with mortar. The material shall be mixed wet enough to produce concrete of such consistency that it will flow into the forms and about the steel reinforcement. Concrete must then be placed in the forms immediately and special care must

be taken to insure perfect contact between the concrete and reinforcement. Under no condition shall concrete be used which has received its initial set. When the concrete is exposed to a hot or dry atmosphere, special precaution shall be taken to prevent premature drying by keeping it moist for a period of at least twenty-four (24) hours after taking its initial set.

118 Moulds

The moulds shall consist of steel sheets, which shall be rolled to a true cylinder, and the two casings shall be concentric when the mould is assembled. They shall be rigidly held together and shall be free from holes or cracks to keep water from escaping.

119 Inspection and Strength Tests

Concrete pipe shall be made in sections of not less than three feet in length and ends so formed that when laid together and cemented they shall make a continuous and uniform line of pipe. The ends shall be at least as strong as the body of the pipe, and all pipe shall be cured properly and aged at least four weeks before being installed. Each section of pipe shall be straight and of true circular or elliptical form. The least diameter of the elliptical pipe shall be the governing dimension in meeting the requirements as to size shown on the plan and in the proposal. It shall have a uniform thickness throughout and shall be free from porous and scaly spots and spalled edges. Pipe having defective spots patched or plastered over will not be accepted.

Strength—The pipe when tested without lateral support, according to the method proposed in Standard Specifications for Cement Concrete Sewer Pipe of the American Society for Testing Materials, serial designation C14-20, shall show a load supporting capacity per linear foot at least equal to that expressed by the formula:

$$W=2000\times D$$

in which "W" equals the breaking strength per linear foot of pipe and "D" the interior diameter of the pipe expressed in feet.

All pipe, as well as material and workmanship shall be subject to inspection at all times by the Engineer, and any condemned pipe or material shall be removed from the work at once.

Each manufacturer of concrete pipe is required to provide, at his plant, suitable testing equipment so that the Engineer or his authorized agent may at any time test specimens of pipe selected at random from his storage yard to ascertain its quality.

In preparing the ditch the bottom shall be rounded out to fit the lowest ninety (90) degrees—forty-five (45) degrees each side of the center line of the circumference of the pipe, taking pains to secure an extra firm bearing near the outer edges of the ninety (90) degree strip. Upon the concave surface so prepared the contractor shall spread a layer, one (1) to two (2) inches thick, of pulverized soil, or sand free from pebbles larger than one-fourth (¼) inch diameter, and shall firmly bed each pipe truly to line and grade thereon.

When rock is found in the ditch the bottom shall be excavated some six (6) inches below the lower surface of the pipe and replaced with clay or sand. The pipe shall at no place rest on solid rock. The minimum fill over pipe culverts will be 12 inches.

The price bid shall cover the furnishing, delivering, handling, laying, and sealing the joints in a manner satisfactory to the Engineer, back filling culvert trench and all labor and material necessary to complete the work except that the excavation necessary will be paid for under item of special excavation as specified in paragraph 75.

BULKHEAD FOR ALL CULVERTS.

120 Bulkheads

There shall be a concrete bulkhead constructed at each end of each culvert. The material shall be of the same as heretofore specified in para-

graphs 111, 112 and 113. Mixture shall be in proportion of: one (1) part cement, two (2) parts fine aggregate and four (4) parts coarse aggregate by measure.

Sand gravel mixture may be used in lieu of coarse and fine aggregate. This mixture to be the same as specified in paragraph 113 and will be used in proportion of one (1) part of cement to four (4) parts of sand gravel mixture.

When permission is obtained from the Engineer "Class 'A' pit run aggregate" concrete may be substituted for coarse and fine aggregate and sand-gravel mixture in constructing bulkheads.

Class "A" concrete—using pit run aggregate.

Sand Passing ¼ in. Screen	Wt. of Aggregate in lbs. per cu. ft.	Proportions Cement-Aggregate	No. Bags Cement per cu. yd. conc.
55%	114.4	1 sack to 5.0 cu. ft.	5.48
Up to 65%	113.0	1 sack to 4.5 cu. ft.	5.88
Up to 75%	112.5	1 sack to 4.25 cu. ft.	6.28
Up to 85%	107.5	1 sack to 4.0 cu. ft.	6.64
Up to 90%	102.5	1 sack to 3.75 cu. ft.	7.16

The bulkhead shall be constructed as shown on plans and the bid for concrete shall include all steel reinforcing, back fill and all material necessary to construct the bulkhead in place complete except the excavation which will be paid for under the item of special excavation.

All wood forms shall be wetted thoroughly or oiled, and metal forms oiled before any material is deposited against them. The oil must not be in such quantity or of such a character as to cause unsightly stains on the surface of the concrete.

Concrete shall be placed in the forms immediately after mixing. All concrete shall be deposited so as to maintain the top surface level and avoid flowing along the forms. It shall be worked continuously and sufficiently to expel the air. The concrete next to the forms shall be spaded so that sufficient mortar will exude from the mass to form a smooth surface. Care should be taken to fill every part of the form and to work the concrete around the reinforcement without displacing it. The contractor shall provide suitable methods for placing concrete in a satisfactory manner.

The bulkhead must be constructed in workmanlike manner and all exposed surfaces must be finished in a manner satisfactory to the Engineer.

SPECIFICATIONS FOR CONCRETE BOX CULVERTS.

121 Plans and Dimensions

All work shall be constructed according to State Standard or special plans prepared by the Department of Public Works and these specifications both of which shall be considered part of the contract. They contemplate a complete structure and any error or omission in the plans and specifications shall not release the contractor from building the structure complete. The contractor shall file his bid according to the attached proposal at a unit price per cubic yard for culvert and wing walls constructed in place, and the bid per cubic yard shall include all steel reinforcing and material necessary to construct a completed culvert in place.

In making settlement the Engineer shall use the table of quantities as shown on plans to determine the yardage in the completed culvert.

122 Cement

The cement shall be the same as heretofore specified in paragraph 110.

Fine aggregate used shall be the same as specified in paragraph 111.

123 Aggregate

Course aggregate shall be the same as specified in paragraph 112, except that three-fourths (¾) inches may be increased to two (2) inches.

Water used for this work shall be clean, free from oil, acid, alkali, or vegetable matter and shall be acceptable to the Engineer.

124 Water

The concrete shall consist of a mixture in the proportion of:

125 Proportions for Concrete Used in Culverts

1 bag cement.
2 cubic feet fine aggregate.
4 cubic feet coarse aggregate.

But the inspector may cause the contractor to increase the amount of mortar if necessary to fill all voids in the coarse aggregate, or in lieu thereof, one (1) part of cement to four (4) parts of mixture of sand and gravel. This mixture to conform in quality as heretofore specified in paragraph 113.

All material shall be accurately measured by volume, the cement shall be measured as packed by the manufacturer. A sack containing not less than ninety-four (94) pounds net being considered one (1) cubic foot. Fine and coarse aggregate shall be measured loose. The contractor shall furnish and use an approved timing device, a water measuring and discharging device, also boxes or pans of such dimensions as will give, when filled and struck, the exact volume of aggregate required for the class of concrete specified.

126 Measuring

Sufficient water shall be used, in mixing plain concrete to produce a mixture which will flatten and quake when deposited in place, but not enough to cause it to flow, and in mixing concrete in which reinforcement is to be embedded, to produce a mixture which will flow sluggishly when worked. In no case shall the quantity of water be sufficient to cause the collection of a surplus in the forms.

127 Consistency

The concrete shall be mixed in the quantities required for immediate use and any which has developed initial set, or which does not reach the forms within thirty (30) minutes after the water has been added, shall not be used. No concrete shall be mixed while the air temperature is at or below thirty-five (35) degrees Fahrenheit without the approval of the Engineer, and only when adequate means are employed to heat the aggregates and water.

128 Mixing Conditions

Concrete shall be mixed thoroughly in a batch mixer of approved type for a period of not less than one (1) minute after all materials are in the drum. The mixer shall run at the speed for which it is designed, but shall make not less than fourteen (14) nor more than twenty (20) revolutions per minute. The entire contents shall be removed from the drum before the materials are placed therein for the succeeding batch.

129 Mixing

As fast as concrete is deposited, it shall be thoroughly settled by spading, or other means, to bring the mortar in thorough contact with the forms and reinforcing steel. Concrete shall be deposited in the forms in layers of such thickness and position as specified by the Engineer in charge. Temporary planking shall be placed at the ends of the partial layers, so that none shall run out to a thin edge. In general, all concrete must be deposited in horizontal layers throughout. Each layer shall be left somewhat rough to insure bonding with the next layer above and if it be already set shall be thoroughly cleaned and scrubbed with coarse brushes and water before the next layer is placed upon it. In no case shall work on a section stop within eighteen (18) inches of the top.

130 Spading and Placing in Layers

Concrete shall not be placed when freezing temperature prevails or threatens, except upon written authority of the Division Engineer, and then only when adequate provision is made to protect the work from freezing until the concrete is thoroughly set.

When depositing in water is allowed the concrete shall be carefully placed in the space in which it is to remain in a compact mass by means of a tremi, bottom dumping bucket, or other approved method that does not permit the concrete to fall through the water without adequate protection. No concrete shall be placed in running water and forms which are not reasonably water-tight shall not be used for holding concrete deposited under water.

131
Forms

REMOVAL OF FORMS: No horizontal forms carrying loads shall be removed or centers struck for two (2) weeks or longer if directed after placing the last concrete and no load shall be allowed on the concrete for a period of thirty (30) days. Forms on vertical surfaces shall be removed within not less than twelve (12) nor more than forty-eight (48) hours after placing of concrete, unless otherwise directed. In cold, damp or freezing weather all forms shall remain in place until the concrete has set thoroughly. Forms for columns shall be removed before the shares are taken from beneath the beams or girders. Projecting wire or other metal devices used for holding forms in place, and which pass through the body of the concrete, shall be cut at least one-half (½) inch beneath the finished surface of the concrete and the holes or depressions thus made, and other holes, depressions and voids which show upon removal of the forms, shall be filled with cement mortar mixed in the same proportions as that which was used in the body of the concrete which is being repaired.

132
Reinforcing

The reinforcing steel used shall fulfill the requirements of the American Society of Testing Materials, Standard Specifications for Billet, Steel, Concrete, Reinforcing Bars, Serial Designation "A" 15-14.

The bid for concrete under this item shall include all steel reinforcement and all material necessary to construct the box culvert in place complete including back fill. The excavation for the box culvert will be paid for under the item of special excavation.

VITRIFIED CLAY PIPE CULVERT.

133
Work

Under this item the contractor shall furnish and place vitrified pipe as shown on the plans, and where directed by the Project Engineer.

134
Pipe

The pipe shall be first quality, double strength salt glazed, sound, vitrified stone ware and sewer pipe with bell joints.

135
Method

All pipe shall be laid true to line and grade with bells up-streams and shall have full and even bearing. The joints shall be filled with jute and mortar consisting of one (1) part cement and two (2) parts sand.

136
Measure and Payment

The price bid shall cover the furnishing, laying, back fill and all material and incidentals necessary thereto except that all excavation in connection therewith will be paid for under item of special excavation.

SPECIFICATIONS FOR WOODEN GUARD RAIL.

137
Work

The price bid for wooden guard rail shall include the furnishing of all lumber, posts, hardware and other material, and constructing the railing complete as shown in the plans, and the quantity to be paid for shall be the

number of lineal feet completed in place. The guard rails shall be located at the points shown on the plans, or at points as the Division Engineer may direct.

All wooden posts used for railing shall be made of cedar, oak, hard pine or cypress at no place less than six (6) inches in diameter or six (6) inches square, but both round and square posts shall not be used on the same contract. **138 Posts**

Tapering square posts may be used in lieu of round or square posts and the same must be not less than five (5) inches at the top and six (6) inches at the bottom.

All posts shall be not less than seven (7) feet in length, the bottom shall be sawed off square, the bark removed and all knots hewn flush with the face, and the surface shaved smooth.

The lower portions of all posts shall be coated with creosote oil before being set, which oil shall meet the following requirement: The oil shall be a pure coal tar product, free from any adulterations. It shall not contain more than three (3) per cent of matter insoluble in chloroform or benzole. No oil obtained wholly or in part from water, gas, tar or oil will be accepted. The Creosote shall be applied by means of a brush, in a full free coating covering the bottom and extending for a distance of four (4) feet. The posts shall not be treated until thoroughly dry.

The wooden rails shall be made of well seasoned, straight, sound planks, yellow pine or other satisfactory wood, nailed to the post in a satisfactory manner as shown on the plans. **139 Rails**

The paint used under this contract shall consist of approved ingredients proportioned and mixed in such manner to give the most desirable results. **140 Paint**

White lead for paint shall be basic carbonate of lead, ground in pure linseed oil. Resulting white lead shall not contain more than twelve (12) per cent by weight of oil or other substances. For use this shall be mixed with pure linseed oil in such proportions that the paint shall contain not less than twenty-five (25) per cent, or more than thirty-five (35) per cent by weight of oil.

The joints of the rail and posts shall be given one coat of white lead and linseed oil before being put together. The beveled tops of posts shall receive two (2) heavy coats of same. The entire surface exposed above ground shall be painted with three coats of white lead and linseed oil. No paint shall be applied in wet or freezing weather. Manufactured paints of an approved quality may be substituted for the white lead and oil. The approval must be made by the Engineer and must be in writing. **141 Painting**

WOODEN GUARD RAIL CONCRETE POSTS.

Where called for on the plan, or ordered by the Engineer wood guard rail with concrete posts will be constructed. This railing will conform in every respect to the design shown on the standard plan. **142 Wooden Guard Rail Concrete Posts**

The wooden rails shall be of the quality as called for under the specifications for wooden guard rail. **143 Rails**

The paint used and the manner of applying the same will be the same as specified for wooden guard railing. **144 Paint**

145
Concrete Posts

The posts shall be made of concrete, mixed in the following proportions: One (1) bag of cement to three (3) cubic feet of sand gravel mixture.

146
Reinforcement and Rail Connection

The reinforcement and rail connection shall be the same as shown on the standard plan.

147
Measure and Payment

The price bid shall cover the furnishing of all labor, material including reinforcement and painting necessary to complete the work. The quantity of guard rail to be paid for shall be the number of lineal feet completed in place.

STEEL CABLE GUARD RAIL WOODEN POSTS.

148
Steel Cable Guard Rail

Where called for on the plans or ordered by the Engineer steel cable guard rail with wooden posts will be constructed. This railing shall conform in every respect to the design shown on the standard plan. The wooden posts shall be of the quality and be creosoted as called for in paragraph 138 They shall be at no place less than seven (7) inches in diameter and seven (7) feet in length, the bottom shall be sawed off square, the bark removed and all knots hewn flush with the face, and the surface shaved smooth.

The paint used and the manner of applying the same shall be the same as specified in paragraphs 140 and 141. The price bid shall cover the furnishing of material and painting necessary to complete the work to the satisfaction of the engineer and the quantity of guard rail to be paid for shall be the number of lineal feet completed in place.

MISCELLANEOUS IRON AND STEEL.

149
Work

Under this item the contractor shall furnish and place all cast iron, wrought iron and steel not especially included in other items as shown on the plans and for miscellaneous structures as ordered by the Engineer. This item shall include beams, channels, and other structural shapes, as well as miscellaneous iron castings, wrought iron, dowels, etc.

150
Material

All structural steel, bolts, etc., shown on the plans may be of stock steel. Stock steel shall be subjected only to surface inspection and cold bending tests. Test pieces cut from finished materials shall endure bending cold, without signs of cracking, 180 degrees around a circle whose diameter is equal to the thickness of the test piece.

Iron castings shall be made of the best tough gray iron of uniform quality and shall be free from defects and uneven shrinkage. No mill cinder iron white or burnt, iron or scrap of any kind shall be used. They shall be clean, out of wind, and true to dimensions. Castings having blow holes plugged or filled with putty or crust shall not be used.

Wrought iron shall be tough, fibrous and uniform in quality and shall be manufactured by approved methods. Steel scrap shall not be used in its manufacture. Finished material shall be clean, smooth, true to shape, and free from defects.

151
Painting

All iron and steel except cast iron shall be given a shop coat of red lead and oil, and after being placed shall be given two coats of approved paint.

152
Measurement

The quantity of cast iron, wrought iron and steel to be paid for under this item shall be the number of pounds furnished and placed in accordance

with the plans or instructions of the Division Engineer. The price bid shall cover the furnishing, placing, painting and all other labor, materials, and incidental expenses necessary to complete the work.

PLAIN OR MASS CONCRETE.

Cement concrete for all structures where reinforcement is not needed shall be composed of a mixture of one (1) part cement, two and one-half (2½) parts fine aggregate, five (5) parts coarse aggregate; sand and gravel mixture may be used in proportion of one (1) bag of cement to four (4) cubic feet of the sand gravel mixture. **153 Proportion**

The quality of the cement shall be the same as heretofore specified in paragraph 110. **154 Cement**

The aggregate used for plain or mass concrete shall be the same as heretofore specified in paragraphs 111, 112 and 113. **155 Aggregate**

The price bid shall include the furnishing of all material, mixing, placing and all labor incidental to complete the finished structure as shown on the plan, except that the excavation will be paid for under the item of special excavation. The amount to be paid for will be the exact number of cubic yards placed. **156 Measure and Payment**

CONCRETE LEACHING BASINS.

Under this item the contractor shall build at places indicated on the plans or ordered by the Division Engineer, concrete leaching basins of a type shown on the detail plans. **157 Work**

The concrete used in these basins shall be plain concrete. The grating shall be of cast iron of the quality specified in item "Miscellaneous Iron and Steel." **158 Material**

For each basin completed the contractor shall receive the price bid. The price bid shall cover all concrete, stone, and all material, labor and incidentals necessary to complete the work, except that the excavation will be paid for under item of Special Excavation and the grating will be paid for under item "Miscellaneous Iron and Steel." **159 Measurements and Payments**

VITRIFIED PIPE LEACHING BASINS.

Under this item the contractor shall build at places indicated on the plans or ordered by the Division Engineer, leaching basins of a type shown on the detail plans. **160 Work**

Vitrified pipe shall be of double thickness, sound, and thoroughly tamped in place.

The gravel used for filling shall be such that fifty (50) per cent be retained on a number ten (10) sieve. **161 Material**

The grating shall be of cast iron of the quality specified in item "Miscellaneous Iron and Steel."

For each basin completed in accordance with plans and under orders of the Division Engineer, the contractor shall receive the price bid. **162 Measurement and Payment**

The price bid shall cover all materials, labor and appliances, and all expenses incidental to completing the work, except that the excavation will be paid for under item Special Excavation and the grating will be paid for under item "Miscellaneous Iron and Steel."

CONCRETE GUTTERS.

163 Work

Under this item the contractor shall furnish and place concrete gutters where shown upon the plans or ordered by the Division Engineer.

164 Material

The concrete gutters shall be of concrete composed of one (1) part cement to four (4) parts sand gravel mixture. They shall be of the shape and length as shown upon the plans and shall be placed true to line and grade.

The cement and sand gravel mixture shall be of the quality as heretofore specified in paragraphs 110 and 113.

165 Measure and Payment

The price bid shall cover the furnishing and placing of all concrete, the preparation of foundation, placing of forms, together with all labor, material and incidental expenses necessary to complete the work. Excavation necessary will be included under the item Special Excavation.

CONCRETE DITCH CHECKS.

166 Concrete Ditch Checks

Under this item the contractor will place concrete ditch checks as shown upon the plans, or ordered by the Division Engineer. Concrete shall be of same quality as specified in paragraph 164.

167 Payment

The price bid shall include the furnishing, delivering, handling, and placing so as to complete the structure in place in a manner satisfactory to the Engineer. They shall conform in every respect to the design shown on the Standard plan.

TIMBER DITCH CHECKS.

168 Timber Ditch Checks

Under this item the contractor will place timber ditch checks as shown upon the plans, or ordered by the Division Engineer.

169 Payment

The price bid shall include all labor and material required to complete the structure.

CONCRETE SIGN POSTS.

170 Concrete Sign Posts

Under this item the contractor shall furnish and erect concrete sign posts of the approved type where shown upon the plans or ordered by the Division Engineer.

171 Material

Concrete sign posts shall be made of concrete having the following proportions:

One (1) bag of cement to three (3) cubic feet of sand gravel mixture.

172 Measure and Payment

The price bid shall cover the furnishing of all labor, material, including reinforcement necessary to complete and erect the sign posts.

TIMBER AND LUMBER.

173 Work

Under this item the contractor shall furnish timber and lumber of various sizes as may be ordered for sills, or platforms, for culverts, bridges,

reinforcing existing structures and for other similar purposes as ordered by the Engineer.

Timber and lumber shall be of yellow pine or other acceptable kinds, sound, square edged, free from shakes, loose knots or decay, and shall be planed and tongued and grooved if required. **174 Material**

No payments will be made under this item for timber or lumber for forms, moulds, or center, for sheeting or bracing, scaffolds, fences, guard rails or any part of the contractor's temporary bridges, roads or plant; but payment for timber and lumber used in the above cases shall be included under the appropriate items covering the same. **175 Work Not Included**

The quantity of timber and lumber to be paid for shall be the number of thousand feet, board measure, actually placed in accordance with orders of the Engineer. If any round timber is used it shall be estimated as square timber of the largest size, omitting fractions of an inch, which can be inscribed in the small end of the log. **176 Measurement and Payment**

No second hand timber shall be used except with the approval of the Engineer. The price bid shall cover all bolts, spikes and other fastenings and all material and expenses incidental to furnishing, framing and placing the timber and lumber satisfactorily.

RELAYING OLD PIPE CULVERT.

Under this item the contractor will relay existing pipe culverts. Repair the same, seal joints to the satisfaction of the Division Engineer, including back fill. **177 Relaying Old Pipe Culvert**

The excavation will be paid for under the item of Special Excavation.

REMOVING OLD CULVERT.

Under this item the contractor will remove old culverts where shown on the plans or ordered by the Division Engineer. **178 Removing Old Culvert**

The bid price includes removing pipe from the trench and depositing the same on the right-of-way outside the road limits and back filling the trench.

The excavation will be paid for under the item of Special Excavation.

TILE SUB-DRAINS.

Tile sub-drains shall be put in wherever shown on the plans. The tile used shall meet the requirements of the standard specifications for Extra-Quality drain tile adopted in 1914; revised 1916, 1921 Serial Designation: C4-21 by the American Society for Testing Materials. The tile drain shall be laid true to grade and alignment established by the Engineer. For furnishing and laying tile drains, the contractor will be paid at the price bid for such work. **179 Tile Sub-Drains**

If possible, the flow line of the tile shall be placed a minimum depth of five feet below the elevation of the roadway shoulders. No tile less than six inches in diameter shall be specified. **180 Laying Drain Tile**

Where the grade of the side ditch is less than one per cent, inlets to the tile shall be provided at intervals of about three hundred feet. These

inlets shall be constructed by filling the trench for a length of about three feet with coarse gravel, broken stone, or other suitable porous material. The top of the porous material shall be raised about eight inches above the top of the trench.

181 Payment

The price bid per foot for laying drain tile shall include furnishing the tile, digging the trench, laying the tile, back filling the trench and all incidental work necessary to make the tile drain complete.

INDEX

SECTION NO. 1

	Par.	Page
Specifications		5
Definition of Term	1	5
Instructions to Bidders		5
Estimate of Quantities	2	5
Examination of Roads	3	6
Laws	4	6
Use of Proposal Form	5	6
Filing in Proposals	6	6
Signatures on Proposals	7	6
Alteration of Proposal Prohibited	8	6
Certified Check	9	6
Delivery of Proposal	10	6
Withdrawal of Proposal	11	6
Opening of Proposal	12	6
Disqualification of Bidders	13	6
Award and Execution of Contract		7
Award of Contract	14	7
Return of Certified Checks	15	7
Bond	16	7
Execution of Contract	17	7
Liquidated Damages	18	7
Assignment of Contract	19	7
Patents	20	7
General Provisions		7
Intent of Specifications	21	7
Permits	22	8
Plans and Drawings	23	8
Interpretation of Plans	24	8
Special Work	25	8
Alteration of Plans	26	8
Additional Work	27	8
Extra Work	28	8
Unauthorized Work	29	9
Progress of Work	30	9
Limitations of Operation	31	9
Character of Workmen and Equipment	32	9
Co-operation of Contractor Required	33	9
Laws and Ordinances	34	9
Sanitary Provisions	35	10
Public Convenience and Safety	36	10
Restoration of Damaged Property	37	10
Responsibility for Accidents	38	10
Responsibility for Protection of Work	39	10
Responsibility for Road Opened to Traffic	40	11
Opening Surface of Roadway	41	11
Tests of Material	42	11
Quality of Material	43	11
Storage of Material	44	11
Use of Materials Found on Work	45	11
Disposal of Material Found on Work	46	11

	Par.	Page
Lines, Grades and Measurements	47	11
Cross-Section of Roadway	48	11
Duties of Inspector	49	12
Secretary of Department of Public Works as Referee	50	12
Inspection of Materials and Work	51	12
Defective Materials and Work	52	12
Failure to Remove or Renew Defective Material or Work	53	12
Final Cleaning Up	54	12
Suspension of Work	55	12
Time Allowance for Completion of Work	56	12
Failure to Complete Work on Time	57	13
Annulment of Contract	58	13
Scope of Payment	59	13
Responsibility for Payment	60	13
Partial Payment	61	13
Final Payment	62	14
No Waiver of Legal Rights	63	14
Right-of-Way	64	14
Claims Against Contractor	65	14
Incidental Work	66	14
Disputed Claims for Extra Compensation	67	14
Liability Insurance	68	15
Supervision	69	15
Documents Included in Contract	70	15
Construction Details for Earth Roads		15
Excavation	71	15
Solid Rock Excavation	72	16
Loose Rock Excavation	73	16
Ordinary Earth Excavation	74	16
Special Excavation	75	16
Channel Excavation	76	17
Clearing and Grubbing	77	17
Roadway Excavation	78	17
Embankment	79	17
Disposal or Surplus Material	80	18
Borrow Excavation	81	18
Overhaul	82	18
Hauling Surfacing Material	83	18
Other Contractors	84	18
Measurements of Quantities	85	19
Basis of Payment	86	19
Removing and Replacing of Fences	87	19
Provision for Drainage	88	19
Intercepting Ditch	89	19
Berms	90	19
Allignment	91	19
Side Ditch	92	19
Finishing Stakes	93	19
Finishing	94	19
SECTION NO. 2		
Top Soil and Sand Clay Surface		20
Subgrade	95	20
Natural Sand Clay or Top Soil Surfacing	96	20
Hauling	97	20

	Par.	Page
Spreading	98	20
Finishing	99	20
Mixing Sand-Clay	100	21
Method of Payment	101	21
Specifications For Gravel Roads		21
Subgrade	102	21
Gravel	103	21
Binder	104	21
Hauling, Spreading and Manipulation	105	22
Method of Payment	106	22
SECTION NO. 3		
Drainage and Miscellaneous Structures		22
Specifications for Cast Iron Ribbed Pipe		22
Cast Iron Ribbed Pipe	107	22
Specification for Solid Cast Iron Pipe		23
Solid Cast Iron Pipe	108	23
Specifications for Corrugated Metal Pipe		23
Corrugated Metal Pipe	109	23
Specification for Reinforced Concrete Pipe		25
Cement	110	25
Fine Aggregate	111	25
Coarse Aggregate	112	26
Sand-Gravel Mixture	113	26
Proportion	114	26
Water	115	26
Steel Reinforcement	116	26
Mixing and Placing	117	26
Moulds	118	27
Inspection and Strength Tests	119	27
Bulkhead for All Culverts		27
Bulkheads	120	27
Specifications for Concrete Box Culverts		28
Plans and Dimensions	121	28
Cement	122	28
Aggregate	123	29
Water	124	29
Proportions for Concrete Used in Culverts	125	29
Measuring	126	29
Consistency	127	29
Mixing Conditions	128	29
Mixing	129	29
Spading and Placing in Layers	130	29
Forms	131	30
Reinforcing	132	30
Vitrified Clay Pipe Culvert		30
Work	133	30
Pipe	134	30
Method	135	30
Measure and Payment	136	30
Specifications for Wooden Guard Rail		30
Work	137	30
Posts	138	31
Rails	139	31
Paint	140	31
Painting	141	31

	Par.	Page
Wooden Guard Rail Concrete Posts		31
Wooden Guard Rail Concrete Posts	142	31
Rails	143	31
Paint	144	31
Concrete Posts	145	32
Reinforcement and Rail Connection	146	32
Measure and Payment	147	32
Steel Cable Guard Rail Wooden Posts		32
Steel Cable Guard Rail	148	32
Miscellaneous Iron and Steel		32
Work	149	32
Material	150	32
Painting	151	32
Measurement	152	32
Plain or Mass Concrete		33
Proportion	153	33
Cement	154	33
Aggregate	155	33
Measure and Payment	156	33
Concrete Leaching Basins		33
Work	157	33
Material	158	33
Measurements and Payments	159	33
Vitrified Pipe Leaching Basins		33
Work	160	33
Material	161	33
Measurement and Payment	162	33
Concrete Gutters		34
Work	163	34
Material	164	34
Measure and Payment	165	34
Concrete Ditch Checks		34
Concrete Ditch Checks	166	34
Payment	167	34
Timber Ditch Checks		34
Timber Ditch Checks	168	34
Payment	169	34
Concrete Sign Posts		34
Concrete Sign Posts	170	34
Material	171	34
Measure and Payment	172	34
Timber and Lumber		34
Work	173	34
Material	174	35
Work Not Included	175	35
Measurement and Payment	176	35
Relaying Old Pipe Culvert		35
Relaying Old Pipe Culvert	177	35
Removing Old Culvert		35
Removing Old Culvert	178	35
Tile Sub-Drains		35
Tile Sub-Drains	179	35
Laying Drain Tile	180	35
Payment	181	36

3 rd

88-C

Nebraska
Department of Public Works

Section No. 11

Culverts and Guard Rail

Special Provisions

Proposal Contract and Bond
FOR
Highway Construction

Special Provision

The following are special provisions supplementing the standard specifications and general provisions and applying particularly to the work to be done under this contract.

Proposal

BIDDER Western Bridge and Const. Co.

ADDRESS Omaha, Nebraska

Proposal for work on Federal Aid Project Number 88-C and County Paving District Number located on the West Point-Crowell road between West Point and Crowell

County of Cuming Nebraska.

To the Department of Public Works of the State of Nebraska and County Boards of Cuming

We have carefully examined the plans and specifications for the grading, paving, draining and incidental work on the road directed above, and we have made a personal examination of the site, and have inquired into the local conditions affecting the work. We propose to furnish all the necessary machinery, tools, apparatus, and other means of construction and do all the work and furnish all the materials to complete the work in accordaance with the plans and specifications on file for the following schedule of prices:

NOTE:—

Bidders' attention is called to paragraph 62, section 1, standard specifications regarding payments of estimates.

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1 COUNTY Cumming

Beginning at: a point 2.476 miles so. of West Point Ending at: West Point

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
		GRADING ITEMS				
1		Cubic yards earth excavated for _____ _____ per cu. yd.				
2		Cubic yards _____ excavation for surfacing _____ per cu. yd.				
3		Cubic yards solid rock excavated for _____ _____ per cu. yd.				
4		Cubic yards loose rock excavated for _____ _____ per cu. yd.				
5		Cubic yards special excavation "Class B" _____ _____ per cu. yd.				
6		Cubic yards channel excavation for _____ _____ per cu. yd.				
7		Cubic yards per 100 feet over haul for two cents _____ per cu. yd. per 100 ft.				
8		Cubic yards miles hauling surfacing material _____ _____ per cu. yd. mile				
9		Station excavation for _____ _____ per sta.				
10		_____ _____				
11		_____ _____				
		HARD SURFACE ITEMS				
12		Square yards gravel surfacing in place 4" deep _____ per sq. yd.				
13		Square yards gravel surfacing in place 2" deep _____ per sq. yd.				
14		Square yards gravel surfacing in place _____" deep _____ per sq. yd.				
15		Square yards brick pavement with asphalt filler on _____" concrete base _____ per sq. yd.				
16		Square yards bituminous concrete pavement coarse aggregate type on _____" concrete base				
17		Square yards bituminous concrete pavement Modified Topeka type on _____" concrete base for _____ per sq. yd.				
18		Square yards sheet asphalt pavement on _____" concrete base for _____ per sq. yd.				

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY Do

Beginning at: Do Ending at:

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
19		Square yards concrete pavement_____" thick for_____per sq. yd.				
20		Lineal feet_____" flat curb for_____per lin. ft.				
21		Lineal feet_____" curb and gutter as shown on plans_____per lin. ft.				
22		Concrete catch basin with cast iron covers_____each				
23		Cubic yards plain concrete for_____per cu. yd.				
24		Square yards_____wearing surface for_____per sq. yd.				
25		Extra reinforcing steel for_____per lb.				
26						
27						

DRAINAGE STRUCTURE ITEMS

28	250	Cubic yards special excavation Class "A" (Culverts)_____per cu. yd.		80	200	00
29	200	Cubic yards special excavation Class "B" (Culverts)_____per cu. yd.		80	160	00
30	20.8	Cubic yards concrete for headwalls, including reinforcing for_____per cu. yd.	26	00	540	80
31	20.7	Cubic yards concrete, including reinforcing for box culverts and wing walls for_____per cu. yd.	23	40	484	38
32		Lineal feet 18" corrugated metal pipe for_____per lin. ft.				
33		Lineal feet 24" corruguated metal pipe for_____per lin. ft.				
34		Lineal feet 30" corrugated metal pipe for_____per lin. ft.				
35		Lineal feet 36" corrugated metal pipe for_____per lin. ft.				
36	96	Lineal feet 18" concrete pipe for_____per lin. ft.	2	40	230	40
37	96	Lineal feet 24" concrete pipe for_____per lin. ft.	3	50	336	00
38	24	Lineal feet 30" concrete pipe for_____per lin. ft.	5	00	120	00

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY _____

Beginning at: _____ Ending at: _____

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
39		Lineal feet 36" concrete pipe for _____ per lin. ft.				
40		Lineal feet 42" concrete pipe for _____ per lin. ft.				
41		Lineal feet 48" concrete pipe for _____ per lin. ft.				
42		Lineal feet 18" vitrified clay pipe triple strength for _____ per lin. ft.				
43		Lineal feet 24" vitrified clay pipe triple strength for _____ per lin. ft.				
44		Lineal feet 30" vitrified clay pipe triple strength for _____ per lin. ft.				
45		Lineal feet 36" vitrified clay pipe triple strength for _____ per lin. ft.				
46		Lineal feet _____" vitrified clay drain tile for _____ per lin. ft.				
47		Lineal feet 6" porous clay drain tile for _____ per lin. ft.				
48		Lineal feet _____" porous clay drain tile for _____ per lin. ft.				
49		Lineal feet _____" porous clay drain tile for _____ per lin. ft.				
50		Lineal feet 6" porous concrete drain tile for _____ per lin. ft.				
51		Lineal feet _____" porous concrete drain tile for _____ per lin. ft.				
52		Lineal feet _____" porous concrete drain tile for _____ per lin. ft.				
53		Concrete leaching basin for _____ each				
54		Vitrified pipe leaching basin for _____ each				
55						
56						

MISCELLANEOUS ITEMS

57		Lineal feet steel cable guard rail Class "A" for _____ per lin. ft.				
58		Lineal feet steel cable guard rail Class "B" for _____ per lin. ft.				

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY Do

Beginning at: Do Ending at:

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
59		Lineal feet steel cable treated wooden guard rail Class "C" for_____per lin. ft.				
60		Lineal feet steel cable concrete post guard rail Class "D" for_____per lin. ft.				
61		Guard rail anchors for_____each				
62	152	Lineal feet wooden guard rail for_____per lin. ft.		60	91	20
63		Lineal feet woven wire guard rail for_____per lin. ft.				
64		Concrete ditch checks Class "A" for_____each				
65		Extra concrete centers Class "A" checks for_____each				
66		Concrete ditch checks Class "B" monolithic for_____each				
67		Extra concrete for Class "B" checks for_____per cu. ft.				
68		Galvanized corruguated metal ditch checks Class "A" for_____each				
69		Extra metal centers Class "A" checks for_____per sq. ft.				
70		Plain galvanized metal ditch checks Class "B" for_____each				
71		Extra metal centers Class "B" checks for_____per sq. ft.				
72		M. Ft. B. M. Timber and Lumber_____per M. ft. B. M.				
73						
74						

NOTE:—No payment will be made for excavating subgrade for curbing or pavement. This work shall be included in the price bid for curbing and pavement.

This proposal is made with the understanding that the various items of work may be necessarily increased or decreased, and that these unit prices will apply to the increased or decreased quantities as fully as to the estimates of quantities as given herein.

The only persons or parties interested in this proposal as principal are those named herein, and this proposal is made without collusion with any other persons, firms, or corporations.

Should any work be required which can not be properly classified under the unit prices herein, we propose to do such work as provided in the specification for "extra work." We agree to enter into a contract within ten days and to conduct the work in strict conformance with the plans and specifications therefor.

If awarded a contract, we agree to begin work by July 15, 1922

If awarded a contract we will complete work by Jan. 1, 1923

Except if awarded a contract for guard rail, ditch checks, or other items which can not be started until the completion or partial completionof contracts on prior stages of construction which have been awarded another party. We agree to start work within 30 days of written notice from the Department of Public Works advising that such work may be started and shall complete such work within_____ months of such notice.

The interval between the date of beginning and the date of completion specified herein shall be considered the "contract time."

We propose to furnish a bond as required in the specifications and in the amount equal to one hundred (100%) per cent of the amount of the contract awarded to us.

As an evidence of good faith in submitting this proposal we enclose herewith a certified check

for $_____ which in case we should refuse or fail to accept an award made to us to enter into contract and file a bond within ten days of such award, said check shall be forfeited to the State and County as liquidated damages.

Western Bridge & Const. Co.

By C. L. Dettman (signed)
Name

_____
Title

_____
Address

_____
Name

_____
Title

_____
Address

Road Contract

THIS AGREEMENT, made and entered into this 14 day of June, 1922, by and between the Board of County Supervisors of Cuming Co.

and the Department of Public Works of the State of Nebraska, parties of the first part, and Western Bridge & Const Co of Omaha, Nebraska party of the second part:

WITNESSETH: That the party of the second part, for and in consideration of the sum of Two thousand one hundred sixty two & 78/100 Dollars payable as set forth in the specifications constituting a part of this contract, hereby agrees to construct in accordanace with the plans and specifications therefor, and in the location designated in the instruction to bidders, the various items of road work awarded said party of the second part on the 14 day of June, 1922 as follows: being items numbered 28, 29, 30, 31, 36, 37, 38 & 62

Project 88-C

Cuming County

As shown in schedule of prices bid in the proposal attached and which is a part of this contract.

Said specifications and plans are hereby made a part of and the basis of this agreement, and a true copy of said plans and specifications are now on file in the office of the County Clerk, and in the office of the Department of Public Works.

The contractor expressly warrants that he has employed no third person to solicit or obtain this contract in his behalf, or to cause or procure the same to be obtained upon compensation in any way contingent, in whole or in part, upon such procurement, and that he has not paid, or promised nor agreed to pay, to any third person in consideration of such procurement, or in compensation for services in connection herewith, any brokerage, commission, or percentage upon the amount received by him hereunder, and that he has not, in estimating the contract price demanded by him, included any sum by reason of any such brokerage, commission or percentage; and that all money payable to him hereunder are free from obligation of any other person for services rendered, or supposed to have been rendered, in the procurement of this contract. He further agrees that any breach of this warrant shall constitute adequate cause for the annulment of this contract by the parties of the first part, and that the said parties of the first part may retain to its own use from any sums due or to become due thereunder an amount equal to any brokerage commission, or percentage, so paid, or agreed to be paid.

All work required in carrying out this contract shall be performed in compliance with the laws of the State of Nebraska. No minor under the age of 14 years shall be employed in carrying out the terms of this agreement; nor shall any minor between the ages of 14 and 15 years be so employed more than eight hours in any one day or more than 6 days in any one week, or before 6 a. m., or after 7 p. m. This provision shall be the essence of the contract.

"In employment of labor, in the performance of this contract, preference shall be given, other conditions being equal, to honorably discharged soldiers, sailors and marines, but no other preference or discrimination among the citizens of the United States shall be made." (Section 6 of the Act of Congress approved February 28, 1919, entitled "And Act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1920, and for other purposes." Public No. 299, 65th Congress.)

That the party of the second part further agrees to pay all just claims for material, supplies, tools, labor, and all other just claims filed against him or any of his sub-contractors in carrying out the provisions of this contract and further agrees that his bond shall be held to cover all such claims.

The party of the second part further agrees to perform the work under the direct supervision of the Department of Public Works, subject to inspection at all times by the Secretary of Agriculture, or his authorized agents, and in accordance with the laws of the State of Nebraska, and the rules and regulations of the Secretary of Agriculture issued for the purpose of carrying out the provisions of the Federal Highway Act of November 9, 1921 (42 Stat. 212.)

That in consideration of the foregoing, the party of the first part hereby agrees to pay the party of the second part, promptly, and in accordance to the requirements of the specifications, the amounts set forth herein, subject to the conditions set forth in the specifications.

That it is mutually understood and agreed by the parties hereto that the instructions to bidders, form of tender, Standard Specifications for Highway Construction of the Department of Public Works of the State of Nebraska, this contract, the contractor's bond and the general and detailed plans are and do constitute the basis of contract between the parties hereto.

That it is further understood and agreed by the parties to this contract that the above work shall be completed on or before the 1 day of January, of 1923, and that the time of completion of said work is the essence of this contract.

IN WITNESS WHEREOF, the parties hereto have set their hands for the purpose herein expressed, to this and _____ other instruments of like tenor, this 14 day of June, 1922.

Parties of the First Part

J. W. Norby (Signed)
Chairman, County Board of Cuming County

Chairman, County Board of _____ County

Chairman, County Board of _____ County

THE DEPARTMENT OF PUBLIC WORKS OF THE STATE OF NEBRASKA

(Signed) Samuel R. McKelvie, Gov.
(Signed) Geo. E. Johnson, Secy.
Department of Pub. Works.

Parties of the Second Part

Western Bridge & Const. Co.
(Signed) R. T. Wenstrand.

Bond of Public Contract

KNOW ALL MEN BY THESE PRESENTS: That we Western Bridge & Const. Co. of Omaha, Neb. as principal, and John W. Towle as sureties, are held and firmly bound until the Department of Public Works of the State of Nebraska, the County Board of Supervisors of the County of Cuming, Nebraska, and the County Board of _____ of the County of _____, Nebraska, in the penal sum of Twenty one hundred sixty two & 78/100 Dollars and for the payment of which we do hereby bind ourselves, our heirs, executors and administrators, jointly, severally, and firmly by these presents.

Date June 26, A. D. 1922

The condition of this obligation is such that whereas the above bounden Western Br. & Const. Co. has been awarded, by the Department of Public Works of the State of Nebraska, and the County Board of Supervisors of Cuming County and the County Board of _____ of _____ County of the State of Nebraska, the contract for Items 28, 29, 30, 31, 36, 37, 38 & 62 Proj. 88-C Cuming County copy of which the contract together with all of its terms, covenants, conditions and stipulations is incorporated herein and made a part hereof as fully and amply as if said contract was recited at lenth herein.

Now, therefore, if said Western Br. & Const. Co. as principal shall in all respects fulfill his said contract according to the terms and tenor thereof, and shall faithfully discharge the duties and obligations therein assumed, then the above obligation is to be void and of no effect; otherwise, to be and remain in full force and virtue in law.

The surety on this bond given to guarantee the faithful performance and execution of the work included in the contract shall be deemed and held, any contract to the contrary notwithstanding, to consent without notice:

To any extension of time to the contractor in which to perform the contract when each particular extension does not exceed sixty days.

To any change in the plans, specifications or contract when any change does not involve any increase of more than twenty per cent of the total contract price, and shall then be released only as to such excess increase.

No contract shall be valid which seeks to limit the time to less than five years in which an action may be brought upon the bond covering concrete work, nor less than one year upon the bond covering the other work, and this bond is made, executed and delivered with such understanding.

SIGNED this_____day of_____, 192____

_____
Principal

_____
Agent

_____
Surety

_____
Surety

_____
Attorney in Fact

88-C

Nebraska
Department of Public Works

Section No. 11

Grading

Special Provisions

Proposal Contract and Bond
FOR
Highway Construction

Special Provision

The following are special provisions supplementing the standard specifications and general provisions and applying particularly to the work to be done under this contract.

Proposal

BIDDER Peterson, Shirley & Gunther

ADDRESS Omaha, Nebraska

Proposal for work on Federal Aid Project Number 88-C and County Paving District Number located on the West Point - Crowell road between West Point & Crowell

County of Cuming Nebraska.

To the Department of Public Works of the State of Nebraska and County Boards of Cuming Co.

We have carefully examined the plans and specifications for the grading, paving, draining and incidental work on the road directed above, and we have made a personal examination of the site, and have inquired into the local conditions affecting the work. We propose to furnish all the necessary machinery, tools, apparatus, and other means of construction and do all the work and furnish all the materials to complete the work in accordaance with the plans and specifications on file for the following schedule of prices:

NOTE:—

Bidders' attention is called to paragraph 62, section 1, standard specifications regarding payments of estimates.

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1 COUNTY Cuming

Beginning at: A point 2.476 mi. so. of West Point Ending at: West Point

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price Dollars	Unit Price Cents	Total Amount Dollars	Total Amount Cents
		GRADING ITEMS				
1	18000	Cubic yards earth excavated for _____ per cu. yd.		31	5580	00
2	3600	Cubic yards Clay excavation for surfacing _____ per cu. yd.		40	1440	00
3		Cubic yards solid rock excavated for _____ per cu. yd.				
4		Cubic yards loose rock excavated for _____ per cu. yd.				
5	100	Cubic yards special excavation "Class B" _____ per cu. yd.		80	80	00
6		Cubic yards channel excavation for _____ per cu. yd.				
7	10000	Cubic yards per 100 feet over haul for two cents _____ per cu. yd. per 100 ft.		02	200	00
8	1700	Cubic yards miles hauling surfacing material _____ per cu. yd. mile		40	680	00
9		Station excavation for _____ per sta.				
10						
11						
		HARD SURFACE ITEMS				
12		Square yards gravel surfacing in place 4" deep _____ per sq. yd.				
13		Square yards gravel surfacing in place 2" deep _____ per sq. yd.				
14		Square yards gravel surfacing in place _____" deep _____ per sq. yd.				
15		Square yards brick pavement with asphalt filler on _____" concrete base _____ per sq. yd.				
16		Square yards bituminous concrete pavement coarse aggregate type on _____" concrete base				
17		Square yards bituminous concrete pavement Modified Topeka type on _____" concrete base for _____ per sq. yd.				
18		Square yards sheet asphalt pavement on _____" concrete base for _____ per sq. yd.				

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY _____

Beginning at:_____ Ending at:_____

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
19		Square yards concrete pavement_____" thick for_____per sq. yd.				
20		Lineal feet_____" flat curb for_____ _____per lin. ft.				
21		Lineal feet_____" curb and gutter as shown on plans_____per lin. ft.				
22		Concrete catch basin with cast iron covers_____ _____each				
23		Cubic yards plain concrete for_____ _____per cu. yd.				
24		Square yards_____wearing surface for _____per sq. yd.				
25		Extra reinforcing steel for_____ _____per lb.				
26		_____ _____				
27		_____ _____				

DRAINAGE STRUCTURE ITEMS

28		Cubic yards special excavation Class "A" (Culverts) _____per cu. yd.				
29		Cubic yards special excavation Class "B" (Culverts) _____per cu. yd.				
30		Cubic yards concrete for headwalls, including reinforcing for_____per cu. yd.				
31		Cubic yards concrete, including reinforcing for box culverts and wing walls for_____per cu. yd.				
32		Lineal feet 18" corrugated metal pipe for_____ _____per lin. ft.				
33		Lineal feet 24" corruguated metal pipe for_____ _____per lin. ft.				
34		Lineal feet 30" corrugated metal pipe for_____ _____per lin. ft.				
35		Lineal feet 36" corrugated metal pipe for_____ _____per lin. ft.				
36		Lineal feet 18" concrete pipe for_____ _____per lin. ft.				
37		Lineal feet 24" concrete pipe for_____ _____per lin. ft.				
38		Lineal feet 30" concrete pipe for_____ _____per lin. ft.				

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY _____

Beginning at:_____ Ending at:_____

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
39		Lineal feet 36″ concrete pipe for_____ _____per lin. ft.				
40		Lineal feet 42″ concrete pipe for_____ _____per lin. ft.				
41		Lineal feet 48″ concrete pipe for_____ _____per lin. ft.				
42		Lineal feet 18″ vitrified clay pipe triple strength for _____per lin. ft.				
43		Lineal feet 24″ vitrified clay pipe triple strength for _____per lin. ft.				
44		Lineal feet 30″ vitrified clay pipe triple strength for _____per lin. ft.				
45		Lineal feet 36″ vitrified clay pipe triple strength for _____per lin. ft.				
46		Lineal feet_____″ vitrified clay drain tile for_____ _____per lin. ft.				
47		Lineal feet 6″ porous clay drain tile for_____ _____per lin. ft.				
48		Lineal feet_____″ porous clay drain tile for_____ _____per lin. ft.				
49		Lineal feet_____″ porous clay drain tile for_____ _____per lin. ft.				
50		Lineal feet 6″ porous concrete drain tile for_____ _____per lin. ft.				
51		Lineal feet_____″ porous concrete drain tile for _____per lin. ft.				
52		Lineal feet _____″ porous concrete drain tile for _____per lin. ft.				
53		Concrete leaching basin for_____ _____each				
54		Vitrified pipe leaching basin for_____ _____each				
55		_____ _____				
56		_____ _____				

MISCELLANEOUS ITEMS

57		Lineal feet steel cable guard rail Class "A" for____ _____per lin. ft.				
58		Lineal feet steel cable guard rail Class "B" for____ _____per lin. ft.				

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY _____

Beginning at:_____ Ending at:_____

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
59		Lineal feet steel cable treated wooden guard rail Class "C" for_____per lin. ft.				
60		Lineal feet steel cable concrete post guard rail Class "D" for_____per lin. ft.				
61		Guard rail anchors for_____ _____each				
62		Lineal feet wooden guard rail for_____ _____per lin. ft.				
63		Lineal feet woven wire guard rail for_____ _____per lin. ft.				
64		Concrete ditch checks Class "A" for_____ _____each				
65		Extra concrete centers Class "A" checks for_____ _____each				
66		Concrete ditch checks Class "B" monolithic for____ _____each				
67		Extra concrete for Class "B" checks for_____ _____per cu. ft.				
68		Galvanized corruguated metal ditch checks Class "A" for_____each				
69		Extra metal centers Class "A" checks for_____ _____per sq. ft.				
70		Plain galvanized metal ditch checks Class "B" for _____each				
71		Extra metal centers Class "B" checks for_____ _____per sq. ft.				
72		M. Ft. B. M. Timber and Lumber_____ _____per M. ft. B. M.				
73		_____ _____				
74		_____ _____				

NOTE:—No payment will be made for excavating subgrade for curbing or pavement. This work shall be included in the price bid for curbing and pavement.

This proposal is made with the understanding that the various items of work may be necessarily increased or decreased, and that these unit prices will apply to the increased or decreased quantities as fully as to the estimates of quantities as given herein.

The only persons or parties interested in this proposal as principal are those named herein, and this proposal is made without collusion with any other persons, firms, or corporations.

Should any work be required which can not be properly classified under the unit prices herein, we propose to do such work as provided in the specification for "extra work." We agree to enter into a contract within ten days and to conduct the work in strict conformance with the plans and specifications therefor.

If awarded a contract, we agree to begin work by July 1, 192 2

If awarded a contract we will complete work by Dec. 1, 192 2

Except if awarded a contract for guard rail, ditch checks, or other items which can not be started until the completion or partial completionof contracts on prior stages of construction which have been awarded another party. We agree to start work within 30 days of written notice from the Department of Public Works advising that such work may be started and shall complete such work within_____ months of such notice.

The interval between the date of beginning and the date of completion specified herein shall be considered the "contract time."

We propose to furnish a bond as required in the specifications and in the amount equal to one hundred (100%) per cent of the amount of the contract awarded to us.

As an evidence of good faith in submitting this proposal we enclose herewith a certified check for $_____ which in case we should refuse or fail to accept an award made to us to enter into contract and file a bond within ten days of such award, said check shall be forfeited to the State and County as liquidated damages.

Peterson, Shirley & Gunther

By J. P. Shirley
Name

_____
Title

_____
Address

_____
Name

_____
Title

_____
Address

Road Contract

THIS AGREEMENT, made and entered into this 14 day of June, 1922, by and between the Board of County Supervisors of Cuming

and the Department of Public Works of the State of Nebraska, parties of the first part, and Peterson, Shirley & Gunther of Omaha, Nebr. party of the second part:

WITNESSETH: That the party of the second part, for and in consideration of the sum of Seven thousand nine hundred eighty & 00/100 Dollars payable as set forth in the specifications constituting a part of this contract, hereby agrees to construct in accordanace with the plans and specifications therefor, and in the location designated in the instruction to bidders, the various items of road work awarded said party of the second part on the 14 day of June, 1922 as follows: being items numbered 1, 2, 5, 7 & 8 Project 88-C Cuming County

As shown in schedule of prices bid in the proposal attached and which is a part of this contract.

Said specifications and plans are hereby made a part of and the basis of this agreement, and a true copy of said plans and specifications are now on file in the office of the County Clerk, and in the office of the Department of Public Works.

The contractor expressly warrants that he has employed no third person to solicit or obtain this contract in his behalf, or to cause or procure the same to be obtained upon compensation in any way contingent, in whole or in part, upon such procurement, and that he has not paid, or promised nor agreed to pay, to any third person in consideration of such procurement, or in compensation for services in connection herewith, any brokerage, commission, or percentage upon the amount received by him hereunder, and that he has not, in estimating the contract price demanded by him, included any sum by reason of any such brokerage, commission or percentage; and that all money payable to him hereunder are free from obligation of any other person for services rendered, or supposed to have been rendered, in the procurement of this contract. He further agrees that any breach of this warrant shall constitute adequate cause for the annulment of this contract by the parties of the first part, and that the said parties of the first part may retain to its own use from any sums due or to become due thereunder an amount equal to any brokerage commission, or percentage, so paid, or agreed to be paid.

All work required in carrying out this contract shall be performed in compliance with the laws of the State of Nebraska. No minor under the age of 14 years shall be employed in carrying out the terms of this agreement; nor shall any minor between the ages of 14 and 15 years be so employed more than eight hours in any one day or more than 6 days in any one week, or before 6 a. m., or after 7 p. m. This provision shall be the essence of the contract.

"In employment of labor, in the performance of this contract, preference shall be given, other conditions being equal, to honorably discharged soldiers, sailors and marines, but no other preference or discrimination among the citizens of the United States shall be made." (Section 6 of the Act of Congress approved February 28, 1919, entitled "And Act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1920, and for other purposes." Public No. 299, 65th Congress.)

That the party of the second part further agrees to pay all just claims for material, supplies, tools, labor, and all other just claims filed against him or any of his sub-contractors in carrying out the provisions of this contract and further agrees that his bond shall be held to cover all such claims.

The party of the second part further agrees to perform the work under the direct supervision of the Department of Public Works, subject to inspection at all times by the Secretary of Agriculture, or his authorized agents, and in accordance with the laws of the State of Nebraska, and the rules and regulations of the Secretary of Agriculture issued for the purpose of carrying out the provisions of the Federal Highway Act of November 9, 1921 (42 Stat. 212.)

That in consideration of the foregoing, the party of the first part hereby agrees to pay the party of the second part, promptly, and in accordance to the requirements of the specifications, the amounts set forth herein, subject to the conditions set forth in the specifications.

That it is mutually understood and agreed by the parties hereto that the instructions to bidders, form of tender, Standard Specifications for Highway Construction of the Department of Public Works of the State of Nebraska, this contract, the contractor's bond and the general and detailed plans are and do constitute the basis of contract between the parties hereto.

That it is further understood and agreed by the parties to this contract that the above work shall be completed on or before the 1 day of Dec, of 192 2, and that the time of completion of said work is the essence of this contract.

IN WITNESS WHEREOF, the parties hereto have set their hands for the purpose herein expressed, to this and _____ other instruments of like tenor, this 14 day of June, 1922.

Parties of the First Part

J. W. Norby (signed)
Chairman, County Board of Cuming County

Chairman, County Board of _____ County

Chairman, County Board of _____ County

THE DEPARTMENT OF PUBLIC WORKS OF THE STATE OF NEBRASKA

(signed) Samuel R. McKelvie, Gov.
(signed) Geo. E. Johnson, Secy.
Dept. of Public Works

Parties of the Second Part

Peterson, Shirley & Gunther
J. P. Shirley (signed)

Bond of Public Contract

KNOW ALL MEN BY THESE PRESENTS: That we Peterson, Shirley & Gunther as principal, and Phelan Shirley Co. as sureties, are held and firmly bound until the Department of Public Works of the State of Nebraska, the County Board of Supervisors of the County of Cuming, Nebraska, and the County Board of _____ of the County of _____, Nebraska, in the penal sum of seventy nine hundred eighty Dollars and for the payment of which we do hereby bind ourselves, our heirs, executors and administrators, jointly, severally, and firmly by these presents.

Date June 29, A. D. 1922

The condition of this obligation is such that whereas the above bounden Peterson, Shirley & Gunther has been awarded, by the Department of Public Works of the State of Nebraska, and the County Board of _____ of _____ County and the County Board of Supervisors of Cuming County of the State of Nebraska, the contract for Items 1, 2, 5, 7 & 8 Project 88-C Cuming County copy of which the contract together with all of its terms, covenants, conditions and stipulations is incorporated herein and made a part hereof as fully and amply as if said contract was recited at lenth herein.

Now, therefore, if said Peterson, Shirley & Gunther as principal shall in all respects fulfill his said contract according to the terms and tenor thereof, and shall faithfully discharge the duties and obligations therein assumed, then the above obligation is to be void and of no effect; otherwise, to be and remain in full force and virtue in law.

The surety on this bond given to guarantee the faithful performance and execution of the work included in the contract shall be deemed and held, any contract to the contrary notwithstanding, to consent without notice:

To any extension of time to the contractor in which to perform the contract when each particular extension does not exceed sixty days.

To any change in the plans, specifications or contract when any change does not involve any increase of more than twenty per cent of the total contract price, and shall then be released only as to such excess increase.

No contract shall be valid which seeks to limit the time to less than five years in which an action may be brought upon the bond covering concrete work, nor less than one year upon the bond covering the other work, and this bond is made, executed and delivered with such understanding.

SIGNED this 20 day of June, 1922

Petersson, Shirley & Gunther
Principal

By J. P. Shirley (signed)
Agent

Phelan Shirley Co.
Surety

By R. D. Shirley (signed)
Surety

Attorney in Fact

88-C

Nebraska
Department of Public Works

Section No. 11

Ditch Checks

Special Provisions

Proposal Contract and Bond
FOR
Highway Construction

Special Provision

The following are special provisions supplementing the standard specifications and general provisions and applying particularly to the work to be done under this contract.

Proposal

BIDDER Capitol Bridge Co.

ADDRESS Lincoln, Nebraska

Proposal for work on Federal Aid Project Number 88-C and County Paving District Number located on the West Point-Cromwell road between West Point & Cromwell

County of Cuming Nebraska.

To the Department of Public Works of the State of Nebraska and County Boards of Cuming County

We have carefully examined the plans and specifications for the grading, paving, draining and incidental work on the road directed above, and we have made a personal examination of the site, and have inquired into the local conditions affecting the work. We propose to furnish all the necessary machinery, tools, apparatus, and other means of construction and do all the work and furnish all the materials to complete the work in accordaance with the plans and specifications on file for the following schedule of prices:

NOTE:—

Bidders' attention is called to paragraph 62, section 1, standard specifications regarding payments of estimates.

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1 COUNTY Cuming

Beginning at: a point 2.476 mi. so. of West Point Ending at: West Point

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
		GRADING ITEMS				
1		Cubic yards earth excavated for_____ _____per cu. yd.				
2		Cubic yards_____excavation for surfacing _____per cu. yd.				
3		Cubic yards solid rock excavated for_____ _____per cu. yd.				
4		Cubic yards loose rock excavated for_____ _____per cu. yd.				
5		Cubic yards special excavation "Class B"_____ _____per cu. yd.				
6		Cubic yards channel excavation for_____ _____per cu. yd.				
7		Cubic yards per 100 feet over haul for two cents _____per cu. yd. per 100 ft.				
8		Cubic yards miles hauling surfacing material_____ _____per cu. yd. mile				
9		Station excavation for_____ _____per sta.				
10		_____ _____				
11		_____ _____				
		HARD SURFACE ITEMS				
12		Square yards gravel surfacing in place 4″ deep _____per sq. yd.				
13		Square yards gravel surfacing in place 2″ deep _____per sq. yd.				
14		Square yards gravel surfacing in place_____″ deep_____per sq. yd.				
15		Square yards brick pavement with asphalt filler on _____″ concrete base_____per sq. yd.				
16		Square yards bituminous concrete pavement coarse aggregate type on_____″ concrete base				
17		Square yards bituminous concrete pavement Modified Topeka type on_____″ concrete base for_____per sq. yd.				
18		Square yards sheet asphalt pavement on_____″ concrete base for_____per sq. yd.				

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY _____

Beginning at:_____ Ending at:_____

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
19		Square yards concrete pavement_____" thick for_____per sq. yd.				
20		Lineal feet_____" flat curb for_____ _____per lin. ft.				
21		Lineal feet_____" curb and gutter as shown on plans_____per lin. ft.				
22		Concrete catch basin with cast iron covers_____ _____each				
23		Cubic yards plain concrete for_____ _____per cu. yd.				
24		Square yards_____wearing surface for _____per sq. yd.				
25		Extra reinforcing steel for_____ _____per lb.				
26		_____ _____				
27		_____ _____				

DRAINAGE STRUCTURE ITEMS

28		Cubic yards special excavation Class "A" (Culverts) _____per cu. yd.				
29		Cubic yards special excavation Class "B" (Culverts) _____per cu. yd.				
30		Cubic yards concrete for headwalls, including reinforcing for_____per cu. yd.				
31		Cubic yards concrete, including reinforcing for box culverts and wing walls for_____per cu. yd.				
32		Lineal feet 18" corrugated metal pipe for_____ _____per lin. ft.				
33		Lineal feet 24" corruguated metal pipe for_____ _____per lin. ft.				
34		Lineal feet 30" corrugated metal pipe for_____ _____per lin. ft.				
35		Lineal feet 36" corrugated metal pipe for_____ _____per lin. ft.				
36		Lineal feet 18" concrete pipe for_____ _____per lin. ft.				
37		Lineal feet 24" concrete pipe for_____ _____per lin. ft.				
38		Lineal feet 30" concrete pipe for_____ _____per lin. ft.				

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY _____

Beginning at:_____ Ending at:_____

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
39		Lineal feet 36″ concrete pipe for_____ _____per lin. ft.				
40		Lineal feet 42″ concrete pipe for_____ _____per lin. ft.				
41		Lineal feet 48″ concrete pipe for_____ _____per lin. ft.				
42		Lineal feet 18″ vitrified clay pipe triple strength for _____per lin. ft.				
43		Lineal feet 24″ vitrified clay pipe triple strength for _____per lin. ft.				
44		Lineal feet 30″ vitrified clay pipe triple strength for _____per lin. ft.				
45		Lineal feet 36″ vitrified clay pipe triple strength for _____per lin. ft.				
46		Lineal feet_____″ vitrified clay drain tile for_____ _____per lin. ft.				
47		Lineal feet 6″ porous clay drain tile for_____ _____per lin. ft.				
48		Lineal feet_____″ porous clay drain tile for_____ _____per lin. ft.				
49		Lineal feet_____″ porous clay drain tile for_____ _____per lin. ft.				
50		Lineal feet 6″ porous concrete drain tile for_____ _____per lin. ft.				
51		Lineal feet_____″ porous concrete drain tile for _____per lin. ft.				
52		Lineal feet _____″ porous concrete drain tile for _____per lin. ft.				
53		Concrete leaching basin for_____ _____each				
54		Vitrified pipe leaching basin for_____ _____each				
55		_____ _____				
56		_____ _____				

MISCELLANEOUS ITEMS

57		Lineal feet steel cable guard rail Class "A" for____ _____per lin. ft.				
58		Lineal feet steel cable guard rail Class "B" for____ _____per lin. ft.				

SCHEDULE OF PRICES BID FOR THE WORK CONTEMPLATED

DIVISION NO. 1—(Continued) COUNTY Do

Beginning at: Do Ending at:

Item No.	Approximate Quantities	Item With Unit Price Bid Written in Words	Unit Price		Total Amount	
			Dollars	Cents	Dollars	Cents
59		Lineal feet steel cable treated wooden guard rail Class "C" for_____per lin. ft.				
60		Lineal feet steel cable concrete post guard rail Class "D" for_____per lin. ft.				
61		Guard rail anchors for_____each				
62		Lineal feet wooden guard rail for_____per lin. ft.				
63		Lineal feet woven wire guard rail for_____per lin. ft.				
64	10	Concrete ditch checks Class "A" for_____each	14	25	142	50
65		Extra concrete centers Class "A" checks for_____each	4	75		
66		Concrete ditch checks Class "B" monolithic for_____each				
67		Extra concrete for Class "B" checks for_____per cu. ft.				
68		Galvanized corruguated metal ditch checks Class "A" for_____each				
69		Extra metal centers Class "A" checks for_____per sq. ft.				
70		Plain galvanized metal ditch checks Class "B" for_____each				
71		Extra metal centers Class "B" checks for_____per sq. ft.				
72		M. Ft. B. M. Timber and Lumber_____per M. ft. B. M.				
73						
74						

NOTE:—No payment will be made for excavating subgrade for curbing or pavement. This work shall be included in the price bid for curbing and pavement.

This proposal is made with the understanding that the various items of work may be necessarily increased or decreased, and that these unit prices will apply to the increased or decreased quantities as fully as to the estimates of quantities as given herein.

The only persons or parties interested in this proposal as principal are those named herein, and this proposal is made without collusion with any other persons, firms, or corporations.

Should any work be required which can not be properly classified under the unit prices herein, we propose to do such work as provided in the specification for "extra work." We agree to enter into a contract within ten days and to conduct the work in strict conformance with the plans and specifications therefor.

If awarded a contract, we agree to begin work by As soon as notified, 192____

If awarded a contract we will complete work by July 1, 1923

Except if awarded a contract for guard rail, ditch checks, or other items which can not be started until the completion or partial completionof contracts on prior stages of construction which have been awarded another party. We agree to start work within 30 days of written notice from the Department of Public Works advising that such work may be started and shall complete such work within_____ months of such notice.

The interval between the date of beginning and the date of completion specified herein shall be considered the "contract time."

We propose to furnish a bond as required in the specifications and in the amount equal to one hundred (100%) per cent of the amount of the contract awarded to us.

As an evidence of good faith in submitting this proposal we enclose herewith a certified check for $_____ which in case we should refuse or fail to accept an award made to us to enter into contract and file a bond within ten days of such award, said check shall be forfeited to the State and County as liquidated damages.

Capitol Bridge Co.

By C. K. Ward (signed)
Name

Agent
Title

Address

Name

Title

Address

Road Contract

THIS AGREEMENT, made and entered into this 14 day of June, 1922, by and between the Board of County Supervisors of Cuming County

and the Department of Public Works of the State of Nebraska, parties of the first part, and Capitol Bridge Co. of Lincoln, Nebr. party of the second part:

WITNESSETH: That the party of the second part, for and in consideration of the sum of One hundred forty-two and 50/100 Dollars payable as set forth in the specifications constituting a part of this contract, hereby agrees to construct in accordanace with the plans and specifications therefor, and in the location designated in the instruction to bidders, the various items of road work awarded said party of the second part on the 14 day of June, 1922 as follows: being items numbered 64 & 65 Project 88-C Cuming County

As shown in schedule of prices bid in the proposal attached and which is a part of this contract.

Said specifications and plans are hereby made a part of and the basis of this agreement, and a true copy of said plans and specifications are now on file in the office of the County Clerk, and in the office of the Department of Public Works.

The contractor expressly warrants that he has employed no third person to solicit or obtain this contract in his behalf, or to cause or procure the same to be obtained upon compensation in any way contingent, in whole or in part, upon such procurement, and that he has not paid, or promised nor agreed to pay, to any third person in consideration of such procurement, or in compensation for services in connection herewith, any brokerage, commission, or percentage upon the amount received by him hereunder, and that he has not, in estimating the contract price demanded by him, included any sum by reason of any such brokerage, commission or percentage; and that all money payable to him hereunder are free from obligation of any other person for services rendered, or supposed to have been rendered, in the procurement of this contract. He further agrees that any breach of this warrant shall constitute adequate cause for the annulment of this contract by the parties of the first part, and that the said parties of the first part may retain to its own use from any sums due or to become due thereunder an amount equal to any brokerage commission, or percentage, so paid, or agreed to be paid.

All work required in carrying out this contract shall be performed in compliance with the laws of the State of Nebraska. No minor under the age of 14 years shall be employed in carrying out the terms of this agreement; nor shall any minor between the ages of 14 and 15 years be so employed more than eight hours in any one day or more than 6 days in any one week, or before 6 a. m., or after 7 p. m. This provision shall be the essence of the contract.

"In employment of labor, in the performance of this contract, preference shall be given, other conditions being equal, to honorably discharged soldiers, sailors and marines, but no other preference or discrimination among the citizens of the United States shall be made." (Section 6 of the Act of Congress approved February 28, 1919, entitled "And Act making appropriations for the service of the Post Office Department for the fiscal year ending June 30, 1920, and for other purposes." Public No. 299, 65th Congress.)

That the party of the second part further agrees to pay all just claims for material, supplies, tools, labor, and all other just claims filed against him or any of his sub-contractors in carrying out the provisions of this contract and further agrees that his bond shall be held to cover all such claims.

The party of the second part further agrees to perform the work under the direct supervision of the Department of Public Works, subject to inspection at all times by the Secretary of Agriculture, or his authorized agents, and in accordance with the laws of the State of Nebraska, and the rules and regulations of the Secretary of Agriculture issued for the purpose of carrying out the provisions of the Federal Highway Act of November 9, 1921 (42 Stat. 212.)

That in consideration of the foregoing, the party of the first part hereby agrees to pay the party of the second part, promptly, and in accordance to the requirements of the specifications, the amounts set forth herein, subject to the conditions set forth in the specifications.

That it is mutually understood and agreed by the parties hereto that the instructions to bidders, form of tender, Standard Specifications for Highway Construction of the Department of Public Works of the State of Nebraska, this contract, the contractor's bond and the general and detailed plans are and do constitute the basis of contract between the parties hereto.

That it is further understood and agreed by the parties to this contract that the above work shall be completed on or before the 1 day of July, of 1923, and that the time of completion of said work is the essence of this contract.

IN WITNESS WHEREOF, the parties hereto have set their hands for the purpose herein expressed, to this and _____ other instruments of like tenor, this 14 day of June, 1922.

Parties of the First Part

J. W. Norby (signed)
Chairman, County Board of Cuming County

Chairman, County Board of _____ County

Chairman, County Board of _____ County

THE DEPARTMENT OF PUBLIC WORKS OF THE STATE OF NEBRASKA

(signed) Samuel R. McKelvie, Gov.
(signed) Geo. E. Johnson, Secy.
Dept. of Pub. Works

Parties of the Second Part

Capitol Bridge Co.
C. K. Ward, agt. (signed)

Bond of Public Contract

KNOW ALL MEN BY THESE PRESENTS: That we Capitol Bridge Company as principal, and H. L. Ward as sureties, are held and firmly bound until the Department of Public Works of the State of Nebraska, the County Board of Supervisors of the County of Cuming, Nebraska, and the County Board of _____ of the County of _____, Nebraska, in the penal sum of one hundred forty-two & 50/100 Dollars and for the payment of which we do hereby bind ourselves, our heirs, executors and administrators, jointly, severally, and firmly by these presents.

Date June 22, A. D. 1922

The condition of this obligation is such that whereas the above bounden Capitol Bridge Co. has been awarded, by the Department of Public Works of the State of Nebraska, and the County Board of Supervisors of Cuming County and the County Board of _____ of _____ County of the State of Nebraska, the contract for Items 64 & 65 Project 88-C Cuming County

copy of which the contract together with all of its terms, covenants, conditions and stipulations is incorporated herein and made a part hereof as fully and amply as if said contract was recited at lenth herein.

Now, therefore, if said Capitol Br. Co. as principal shall in all respects fulfill his said contract according to the terms and tenor thereof, and shall faithfully discharge the duties and obligations therein assumed, then the above obligation is to be void and of no effect; otherwise, to be and remain in full force and virtue in law.

The surety on this bond given to guarantee the faithful performance and execution of the work included in the contract shall be deemed and held, any contract to the contrary notwithstanding, to consent without notice:

To any extension of time to the contractor in which to perform the contract when each particular extension does not exceed sixty days.

To any change in the plans, specifications or contract when any change does not involve any increase of more than twenty per cent of the total contract price, and shall then be released only as to such excess increase.

No contract shall be valid which seeks to limit the time to less than five years in which an action may be brought upon the bond covering concrete work, nor less than one year upon the bond covering the other work, and this bond is made, executed and delivered with such understanding.

SIGNED this 22 day of June, 1922

Capitol Bridge Co.
Principal

C. K. Ward (signed)
Agent

H. L. Ward (signed)
Surety

Surety

Attorney in Fact

LIBRARY OF THE
STATE AGRICULT'L COLLEGE
FORT COLLINS, COLO.