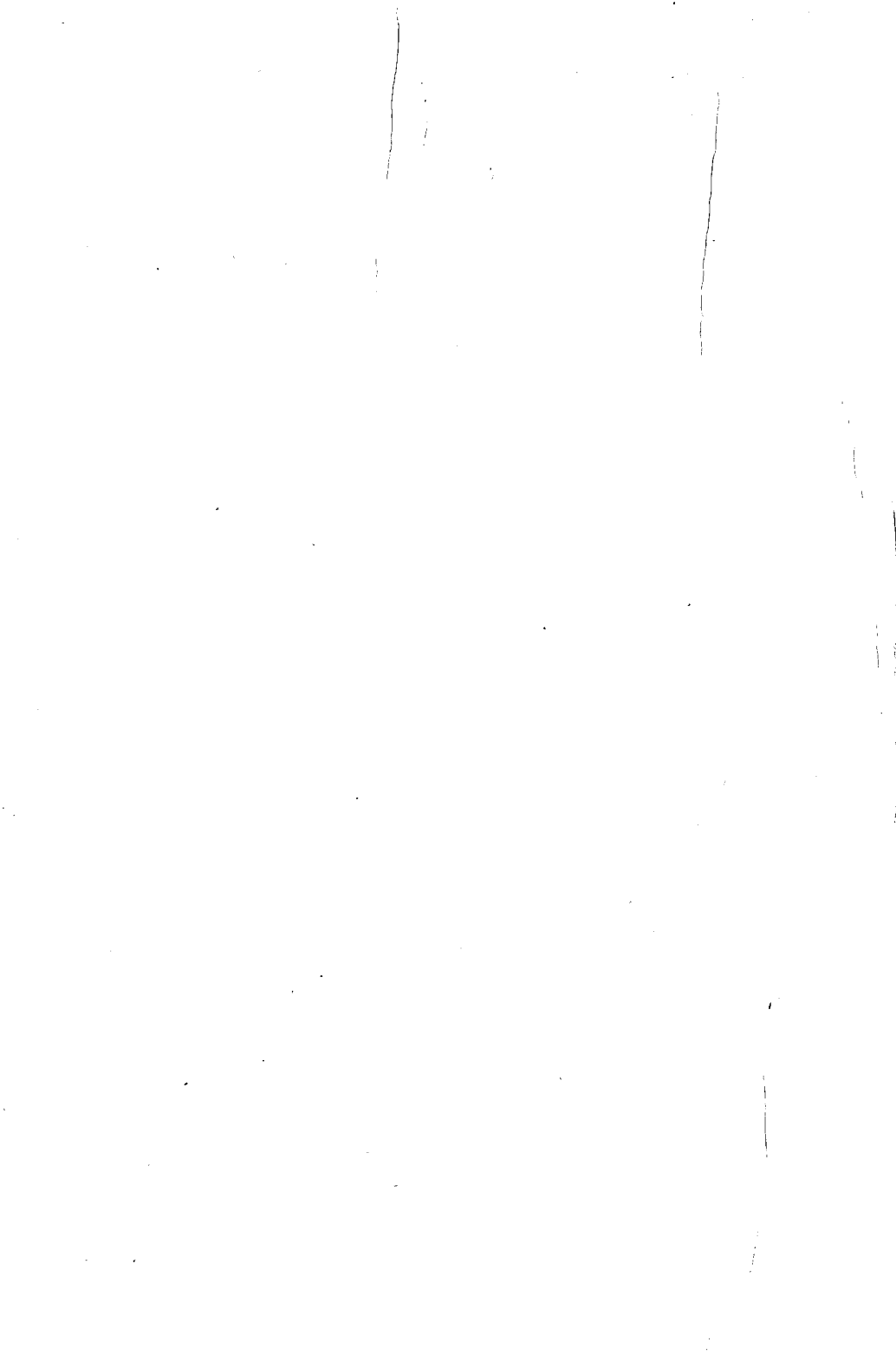
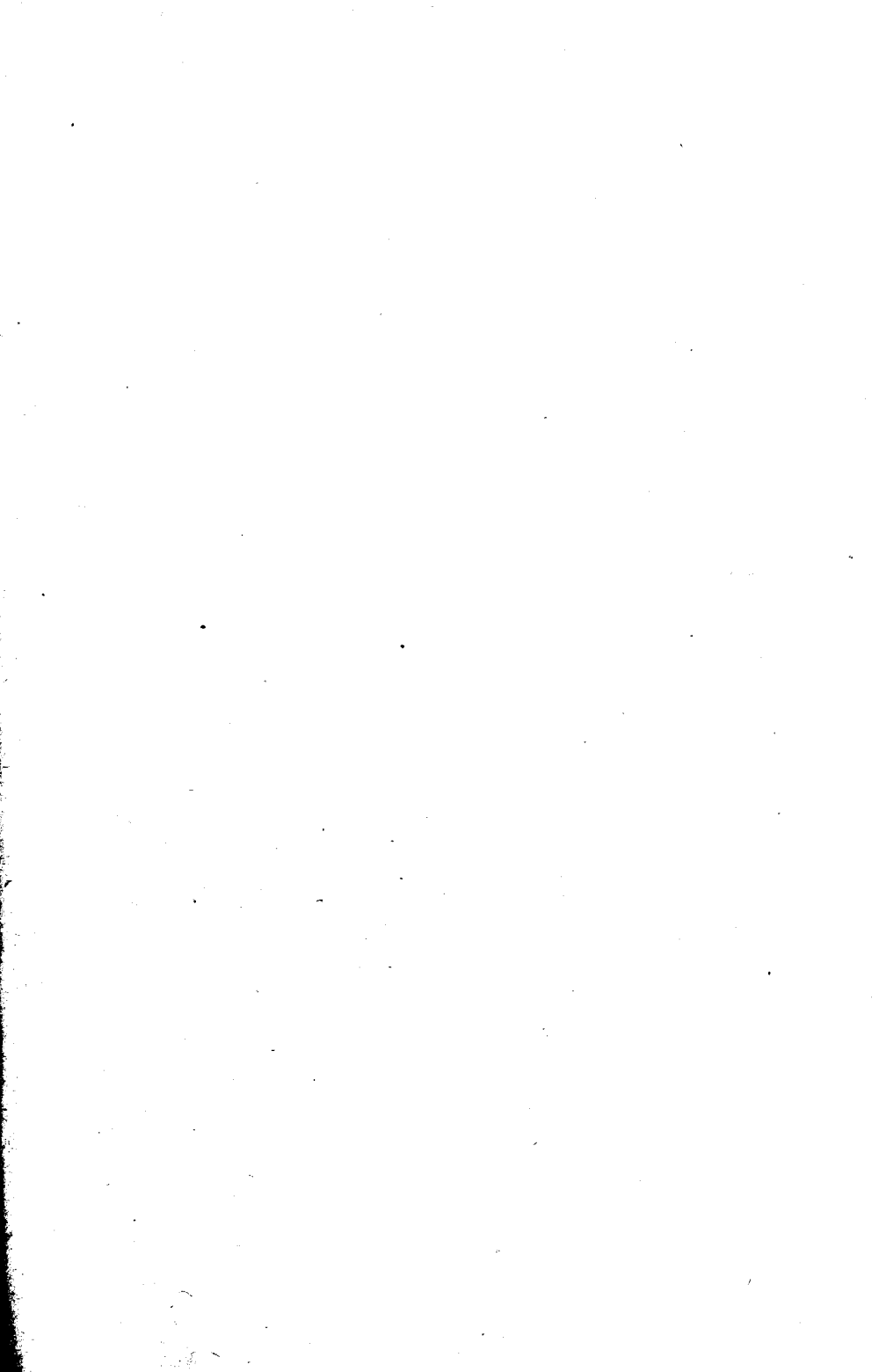


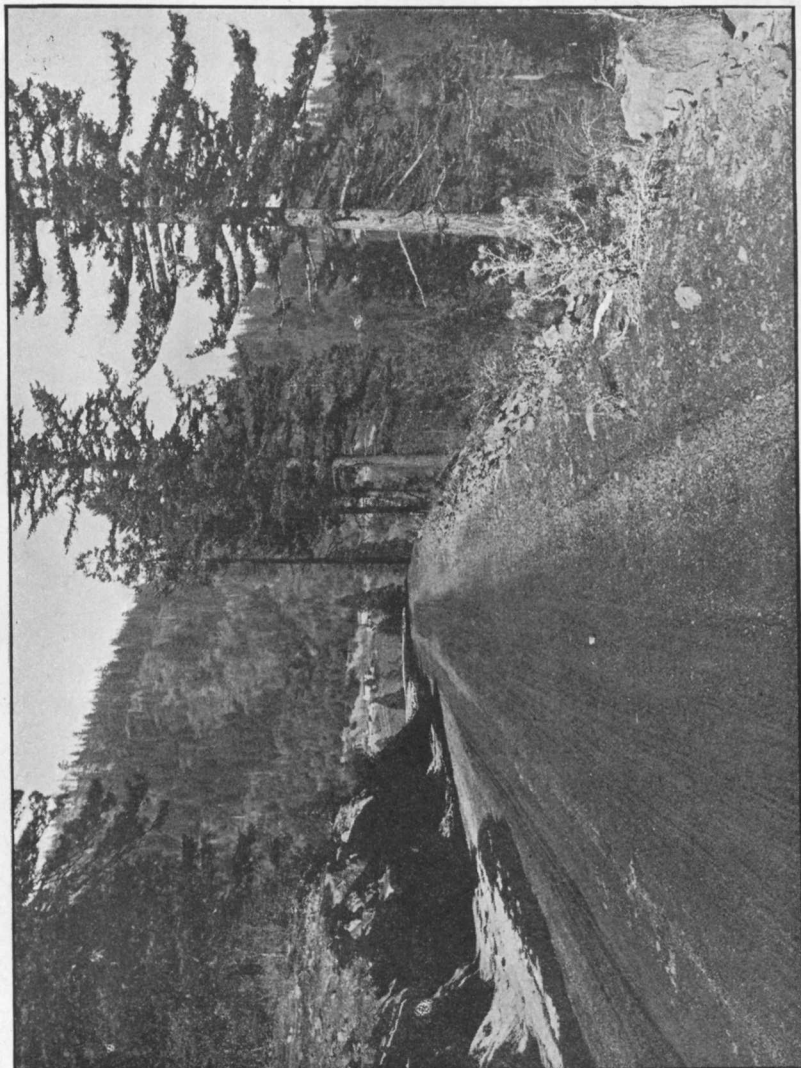
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STATE OF OREGON
REPORT
STATE HIGHWAY COMMISSION
1917 - 1918



**Oregon State Highway
Technical Library**





ON THE PACIFIC HIGHWAY IN THE SISKIYOU MOUNTAINS, JACKSON COUNTY. MACADAMIZED
IN 1917

Third Biennial Report

of the

Oregon State Highway Commission

Covering the Period December 1st, 1916
to November 30th, 1918

**Oregon State Highway
Technical Library**

OREGON STATE HIGHWAY COMMISSION

S. Benson, Chairman

W. L. Thompson, Commissioner; R. A. Booth, Commissioner
Herbert Nunn, State Highway Engineer

SALEM, OREGON :
STATE PRINTING DEPARTMENT
1919

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LETTER OF TRANSMITTAL

Salem, Oregon, December 1, 1918.

HONORABLE JAMES WITHYCOMBE,

Governor of the State of Oregon,

Dear Sir: In compliance with Section 5, Article II, Chapter 237, Laws of 1917, we have the honor to submit herewith the report of the State Highway Commission for the period December 1, 1916 to November 30, 1918.

The Commission desires at this time to express its appreciation of the courtesies and assistance rendered to it by the various state officers and county officials in the work of the past two years.

Respectfully submitted,

OREGON STATE HIGHWAY COMMISSION,

S. Benson, Chairman

W. L. Thompson, Commissioner

R. A. Booth, Commissioner

Attest:

Roy A. Klein, Secretary

TABLE OF CONTENTS

	Page
Letter of Transmittal to the Governor.....	4
Table of Contents.....	5
Report of the State Highway Commission.....	7
General Resume of the Work of the Biennium.....	7
Proposals Received on Construction Jobs.....	9
Bond Sales.....	10
Financial Statement.....	11
State Highway Engineer's Report to the Highway Commission.....	13
Letter of Transmittal.....	14
Work Accomplished.....	17
Moneys Available and Expended.....	17
Paving.....	18
Macadamizing.....	18
Grading.....	19
Bridges.....	19
Elimination of Grade Crossings.....	21
Federal Cooperation.....	22
Post Road Projects.....	23
Forest Road Projects.....	23
The Pacific Highway.....	27
The Columbia River Highway.....	28
County Work Supervised by the Highway Department.....	29
Construction Work by State Forces.....	29
State Highway Funds.....	30
Equipment.....	31
Office Organization.....	32
Cost Keeping.....	34
Employes in the Army Service.....	35
Tabulated Statements of Expenditures and Costs.....	39
Allotments to Various Highway Funds.....	40
Summary of Fund Allotments and Fund Expenditures.....	40
Expenditures Segregated by Counties.....	41
Expenditures Segregated Under the Heads of General Administrative, Surveys, Construction Engineering, Construction, Equipment, Etc.....	41
Expenditures for Construction Detailed by Jobs.....	42
Expenditures for Surveys Detailed by Jobs.....	45
Expenditures for Equipment, Bond Interest and Overhead.....	47
Summary of County Funds Expended by the Department.....	48
General Tabulated Information and Maps.....	51
Miles of Highway Construction by the Department During 1917 and 1918.....	52
Tabulation of Bridge Design and Construction.....	54
Miles of Location Surveys Made by the Department During 1917 and 1918.....	58
Miles of Different Types of Roads in Each County.....	59
Motor Vehicle Registration by Counties.....	60
County Bond Issues.....	60
Tabulation of Contract Prices.....	60
Yearly Expenditure of State Funds in Counties.....	61

TABLE OF CONTENTS—Continued

	Page
General Tabulated Information and Maps—Continued.	
Mileage Table of Main Travelled Roads.....	62
Map of Main Travelled Roads.....	62
Official Designation of State Highways.....	63
Employes of the Highway Commission.....	65
Numbers and Mileages of State Highways.....	66
Map of State Highway System.....	66
General Description of Work in Various Counties.....	69
Baker County	69
Benton County	71
Clackamas County	71
Clatsop County	75
Columbia County	80
Coos County	89
Crook County	89
Curry County	90
Deschutes County	91
Douglas County	92
Gilliam County	100
Grant County	101
Harney County	104
Hood River County	106
Jackson County	112
Jefferson County	117
Josephine County	117
Klamath County	122
Lake County	122
Lane County	122
Lincoln County	123
Linn County	123
Malheur County	124
Marion County	125
Morrow County	129
Multnomah County	131
Polk County	132
Sherman County	132
Tillamook County	133
Umatilla County	135
Union County	138
Wallowa County	141
Wasco County	142
Washington County	143
Wheeler County	146
Yamhill County	150

Third Biennial Report
of the
State Highway Commission
of the
State of Oregon
1917-1918

The law establishing this Commission was approved by Governor Withycombe on February 19, 1917 and on March 1 the following appointments were made: S. Benson, Portland, for the three-year period; W. L. Thompson, Pendleton, two-year period; E. J. Adams, Eugene, one-year period. The first meeting was held on March 6, 1917, when this Commission was organized and S. Benson elected Chairman and G. Ed Ross, Secretary.

The former Commission, consisting of James Withycombe, Governor, Ben W. Olcott, Secretary of State, and Thos. B. Kay, State Treasurer, held meetings on December 15, 1916 and January 15, 1917 and on the qualification of the members of the new commission, as provided in Section 14, Article II, Chapter 237, Laws of 1917, transferred all records, maps, equipment and property in its possession. The former Commission, in view of proposed legislation providing for a new highway code, made no appropriations nor were policies outlined, so that when the new Commission entered upon its duties, it was not embarrassed by policies made by its predecessors.

At a meeting on April 10, 1917, Herbert Nunn was appointed State Highway Engineer. On April 1, 1918, Robert A. Booth, of Eugene, was appointed by Governor Withycombe to succeed E. J. Adams. On August 6, 1918, Roy A. Klein was appointed Secretary to succeed G. Ed Ross, resigned.

The Commission has held fifty-one meetings for the transaction of its business. The State highway system as outlined in the law has been adopted and the work of the biennium confined to the various units of this system. Specifications covering hard surface pavement have been prepared by the State Highway Engineer and adopted by the Commission, as well as specifications for grading and bridge construction which have been acceptable to the United States Office of Public Roads and are used on all Federal Aid Projects in the State.

Surveys have been made on State highway routes to determine the best and most economical location, at the request of the counties, and also several important bridges have been designed and constructed under the supervision of the Department. Engineers have been furnished at State expense to supervise construction work being done by the counties on State highways in several instances.

The program for 1917 depending upon the passage of the \$6,000,000.00 Bonding Act, the working season remaining after ratification by the voters was short, but engineering parties were sent out and the first contract under this act was let on June 30, 1917. All except the smaller contracts entered into were carried over into the 1918 working season. No new paving or grading contracts of any magnitude have been awarded this year due to the rising costs of material and scarcity of labor.

There was early seen the necessity of conserving labor and capital in the national emergency and for that reason the Commission has been unable to give aid to many meritorious projects submitted by various sections of the State. At a meeting held on June 25, the Commission went on record, as a war measure, to devote its resources to the completion of the two trunk line highways, the Columbia River Highway and the Pacific Highway, completing projects under construction, temporary surfacing to keep trunk highways open or roads to develop resources which are an aid in the prosecution of the war. Notwithstanding the mandatory nature of the State law which created the Commission and provides funds for work under it, the Commission believes this course was warranted and that its action will be supported.

Due to the uncertainty of materials, supplies, labor conditions, etc., contractors have been unable to make satisfactory bids and on several occasions no satisfactory bids being received, the Commission undertook to do the work by day labor, in each case effecting a saving under the low bid.

In a few cases, either no bids being received or the ones received being considered excessive, work has been let on the cost plus basis with definite cost limit set, beyond which no percentage would be paid. Three of these force account jobs have later been taken over by the Commission, as it was felt that the work could be handled more economically with its own forces.

To determine the legality of the State and Federal co-operative bonds for co-operation on post and forest roads, a friendly suit was brought in the Supreme Court which was decided favorable to the issue.

The interpretation placed on the Federal Aid Road Law by the Secretary of Agriculture requiring actual carriage of the mails or a reasonable prospect before approving as eligible for Federal co-operation eliminated from the classification practically all of the Columbia River Highway and especially links in the Pacific Highway in Douglas county on which it was desired to receive Federal aid.

Under the post road law seventeen projects have been agreed upon, and to date ten have been approved, three disapproved, two pending and two in preparation. Construction work has been started on two of these projects. Under the forest road law fourteen projects have been approved. Construction has been started on four of these projects. Several will carry over into the 1920 program.

A railroad asphalt paving plant was purchased but not used during the 1918 season, since no bituminous pavements were constructed, under new contracts, in that period. Three concrete pavers are owned by the Commission, as well as three road rollers, four rock crushers, and six auto trucks, besides considerable grading construction equipment. A large part of this equipment has been in use this season and not only has saved the cost of rented equipment but has been available at times when it was impossible to get the same elsewhere.

A total of seventy-one projects have been advertised as follows. It will be noted that the number of proposals exceeds the number of bidders which may be explained by the fact that on paving work bidders have made proposals on more than one type of pavement.

Project	Date	Number of Proposals	Number of Bidders
Sheridan Paving	May 29, 1917	2	2
Sheridan Grading	May 29, 1917	8	2
Cummings Hill Grading	June 19, 1917	1	1
Pendleton Paving	June 29, 1917	8	4
Rex-Tigard Grading	July 20, 1917	5	4
Rex-Tigard Paving	July 20, 1917	9	4
Clackamas-Marlon Paving	July 20, 1917	9	5
Siskiyou Grading	July 20, 1917	1	1
Siskiyou Paving	July 20, 1917	1	1
Astoria-Svensen Grading	July 20, 1917	4	4
Astoria-Svenson Paving	July 20, 1917	7	4
Goble Section Grading	July 30, 1917	2	2
Rainier Hill Section Grading	July 30, 1917	4	4
Cascade Locks Section Grading	July 30, 1917	3	3
Viento Section Grading	July 30, 1917	4	4
Ruthton Hill Section Grading	July 30, 1917	7	7
Columbia County Bridges, Wood	Aug. 7, 1917	5	5
Columbia County Bridges, Concrete	Aug. 7, 1917	5	5
Wasco County, Macadam	Aug. 7, 1917	1	1
Cummings Hill, Macadam	Aug. 7, 1917	1	1
Condon-Thirty Mile Creek, Macadam	Aug. 7, 1917	1	1
Mult. County Line-Scappoose, Paving.....	Aug. 7, 1917	3	2
Bend-Lapine, Clinkering	Aug. 7, 1917	2	2
Clatsop County Line-Goble, Macadam.....	Aug. 7, 1917	2	2
New Era Grading	Aug. 7, 1917	1	1
Divide-Latham Macadam	Aug. 7, 1917	.....	.....
Pioneer Mountain Section, Grading.....	Aug. 7, 1917	.....	.....
Lakeview-Palsley Macadam	Aug. 7, 1917	.....	.....
Svenson-Westport Macadam	Aug. 7, 1917	1	1
Tillamook-Cloverdale Paving	Aug. 7, 1917	9	3
Oregon City-Canby Paving.....	Sept. 4, 1917	1	1
Lane County Line-Comstock Grading.....	Sept. 5, 1917	2	2
Comstock-Leona Grading.....	Sept. 5, 1917	2	2
Yoncalla-Oakland Grading	Sept. 5, 1917	3	3
Locust Hill Section Grading	Sept. 25, 1917	4	4
Wolf Creek-Grave Creek Grading	Nov. 6, 1917	9	9
Myrtle Creek-Dillard Grading	Nov. 27, 1917	7	7
Bridge Creek Section Grading	Nov. 27, 1917	2	2
John Day Bridge	Nov. 27, 1917	4	4
Goble Creek Bridge	Nov. 27, 1917	4	4
Onion Flat Bridge	Nov. 27, 1917	5	5
Canemah-New Era Grading	Nov. 27, 1917	3	3
Tualatin Bridge	Dec. 10, 1917	4	4
Umpqua Bridge 2 1/2 miles south of Dillard	Jan. 1, 1918	3	3
Umpqua Bridge 1 mile north of Dillard	Jan. 9, 1918	4	4
Pendleton-Echo Grading and Macadam	Jan. 9, 1918	5	5
Echo-Morrow County Line Grading and Macadam	Feb. 5, 1918	3	3
Umpqua Bridge 2 1/2 miles south Dillard	Feb. 5, 1918	5	4
Hood River Bridge	Feb. 5, 1918	4	4
Umpqua Bridge 2 1/2 miles south Dillard	Mar. 5, 1918	4	4
Beaver Creek Bridge No. 11	Mar. 5, 1918	3	3
Half Viaduct Little Jack Falls.....	Mar. 23, 1918	1	1
Svenson-Columbia County Line Macadam.....	Mar. 23, 1918	1	1
Sheridan-McMinnville Section Paving	Mar. 23, 1918	1	1
Graham Creek Bridge	Mar. 23, 1918	.....	.....
Plympton Creek Bridge	Mar. 23, 1918	.....	.....
Little Creek Bridge	Mar. 23, 1918	.....	.....
Big Creek Bridge	Mar. 23, 1918	.....	.....
Clatsop County Line-Tide Creek Macadam.....	Mar. 23, 1918	.....	.....

Project	Date	Number of Proposals	Number of Bidders
2 half viaducts in Columbia County.....	Mar. 23, 1918	.....	.....
Stone Wall Construction Columbia County....	Mar. 23, 1918	.....	.....
Cascade Locks Section Gravel.....	May 14, 1918	1	1
Salem-Aurora Paving unit No. 1.....	June 25, 1918	3	2
Salem-Aurora Paving unit No. 2.....	June 25, 1918	3	2
Fanno Creek Bridge.....	July 9, 1918	6	6
Elgin-Minam Section Grading.....	July 9, 1918	1	1
Union-Telocaset Section Grading.....	July 9, 1918	4	4
Elgin-Minam Section Grading.....	July 9, 1918	3	3
Ashland Paving.....	July 9, 1918	3	2
Divide-Comstock Macadam.....	July 9, 1918	1	1
Divide Overhead Crossing.....	Sept. 10, 1918	1	1
Divide Overhead Crossing Grading.....	Sept. 10, 1918	1	1
Marshfield-Coquille Macadam.....	Oct. 8, 1918	2	2
		216	182

Under the provisions of the Six Million Dollar Bonding Act, bonds to the amount of \$2,190,000.00 par value have been sold. These bonds bear four per cent interest and mature in from five to twenty-five years from date of issue. An average of six proposals were made for each issue.

Date of Sales	Date of Bonds	Numbers	Highest Bidder	Par Value	Price Paid
Aug. 7, 1917	Aug. 1, 1917	1-520	Lumbermens Trust Company.....	\$ 500,000	\$ 471,300
Sept. 12, 1917	Sept. 1, 1917	521-1040	E. H. Rollins & Sons	500,000	472,130
Mar. 15, 1918	April 1, 1918	1041-1560	Henry Teal.....	500,000	455,850
July 9, 1918	July 1, 1918	1561-2280	E. H. Rollins & Sons and A. B. Leach....	690,000	643,770
Totals				\$2,190,000	\$2,043,050

Under the provisions of Chapter 175 of the Laws of 1917, (Bean-Barrett) bonds to meet Federal co-operation are authorized. Four hundred thousand dollars par value of these bonds were sold August 18, 1918 by the Board of Control to the highest bidder, Clark-Kendall & Co., whose proposal was \$381,160.00. These bonds are four per cent and mature in from four to eight years.

The work accomplished during the biennium may be summed up as follows:

- 50 miles of hard surface.
- 111.8 miles of broken stone or gravel surface.
- 134.5 miles of graded roadbed.
- 40 bridges.

With the close of the war and the prospect of declining prices of material and a more plentiful supply of labor, the Commission looks forward to 1919 as a year in which a great deal can be accomplished and at this date a tentative program has been prepared providing for improvement of the State Highways in every county of the State.

The report of the State Highway Engineer to the Commission is hereto appended, showing in detail the work accomplished and the expenditures during the biennium.

FINANCIAL STATEMENT OREGON STATE HIGHWAY COMMISSION
STATEMENT FOR THE BIENNIUM ENDING NOVEMBER 30, 1918

ONE-QUARTER MILL TAX FUND—

Balance on hand December 1, 1916.....	\$ 94,418.14	
Turnover January 1, 1917.....	219,690.98	
Turnover January 1, 1918.....	232,151.39	
Total receipts	\$ 546,260.51	
Expenditures from ¼ mill tax fund to Nov. 30, 1918.....	528,789.99	
Balance on hand December 1, 1918.....		\$ 17,470.52

AUTOMOBILE LICENSE FUND—

Turnover October 1, 1917.....	\$150,000.00	
Turnover April 1, 1918.....	300,000.00	
Turnover October 1, 1918.....	125,000.00	
Total receipts	\$ 575,000.00	
Total expenditures to Nov. 30, 1918.....	281,902.67	
Balance, December 1, 1918.....		\$293,097.33

SIX MILLION DOLLAR BOND FUND—

August 7, 1917, \$500,000.00 bonds.....	\$471,300.00	
Accrued interest.....	2,333.33	
Sept. 12, 1917, \$500,000.00 bonds.....	472,130.00	
Accrued interest.....	1,833.33	
March 15, 1918, \$500,000.00 bonds.....	455,850.00	
Accrued interest.....	222.22	
July 9, 1918, \$690,000.00 bonds.....	643,770.00	
Accrued interest.....	2,606.54	
Total receipts from bond sales.....	\$2,050,045.42	
Expenditures to November 30, 1918.....	2,049,025.47	
Balance on hand December 1, 1918.....		\$ 1,019.95

STATE AND FEDERAL CO-OPERATIVE BONDS—

August 18, 1917, sold \$400,000.00.....	\$388,040.00	
Accrued interest.....	2,844.44	
	\$390,884.44	
Expenditure of Board of Control this issue.....	400.00	
Turnover by Board of Control to State Highway Commission.....	\$ 390,484.44	
Expenditures to Nov. 30, 1918.....	28,539.55	
Balance on hand December 1, 1918.....		\$361,944.89

SUMMARY

	¼-Mill	Auto	Six Million	Federal Co-operative Bonds State and	Bean-Barrett
Total Funds	\$546,260.51	\$575,000.00	\$2,050,045.42	\$390,484.44	\$3,561,790.37
Expenditures....	528,789.99	281,902.67	2,049,025.47	28,539.55	2,888,257.68
Balance.....	\$ 17,470.52	\$293,097.33	\$ 1,019.95	\$361,944.89	\$ 673,532.69



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Portland, Ore.

LITTLE JACK FALLS ON THE COLUMBIA RIVER HIGHWAY BETWEEN GOBLE AND RAINIER IN
COLUMBIA COUNTY

Report of the
State Highway Engineer

to the

State Highway Commission

of the

State of Oregon

1917-1918

Herbert Nunn, State Highway Engineer

LETTER OF TRANSMITTAL

Salem, Oregon, December 18, 1918.

TO THE HONORABLE STATE HIGHWAY COMMISSION,

S. BENSON, Chairman.
W. L. THOMPSON, Commissioner,
R. A. BOOTH, Commissioner.

Gentlemen :

I have the honor to submit report covering the operations of the Highway Department for the fiscal years ending November 30, 1917, and November 30, 1918.

In view of the fact that the State Highway Department did not complete its organization until late in the season of 1917 and due to the further fact that practically all contracts were awarded after the first day of July, 1917, it was impossible to place before the State Highway Commission a report which would be of any particular value to the general public at the end of the last fiscal year. Therefore, it has been decided to submit the two fiscal years under one cover in order that the public may have at its command a statement of public highway expenditures and the accomplishments of the State Highway Department under the supervision of the State Highway Commission.

It was considered advisable by the Highway Commission to award contracts and get work under way as early in 1917 as the necessarily late organization of the Department would permit. The matter of preparing estimates and calling for bids was therefore carried out as rapidly as possible, using the data and surveys of the previous administration as a basis for estimates.

It is believed that by awarding the contracts during the year 1917, approximately twenty per cent was saved on all construction for the reason that the shortage in labor and material did not become serious in the State of Oregon until late in that season.

I wish to call the attention of the Commission to the law which requires the State Highway Commission to make county surveys upon the State highway system within the boundaries of any county making application. I believe the law to be a good one, inasmuch as it furnishes free to counties engineering skill which they cannot afford and places at their command an organization which is in a position to carry out preliminary location and estimates. The law states that this work shall be charged to the counties under any future appropriation which may be made to them.

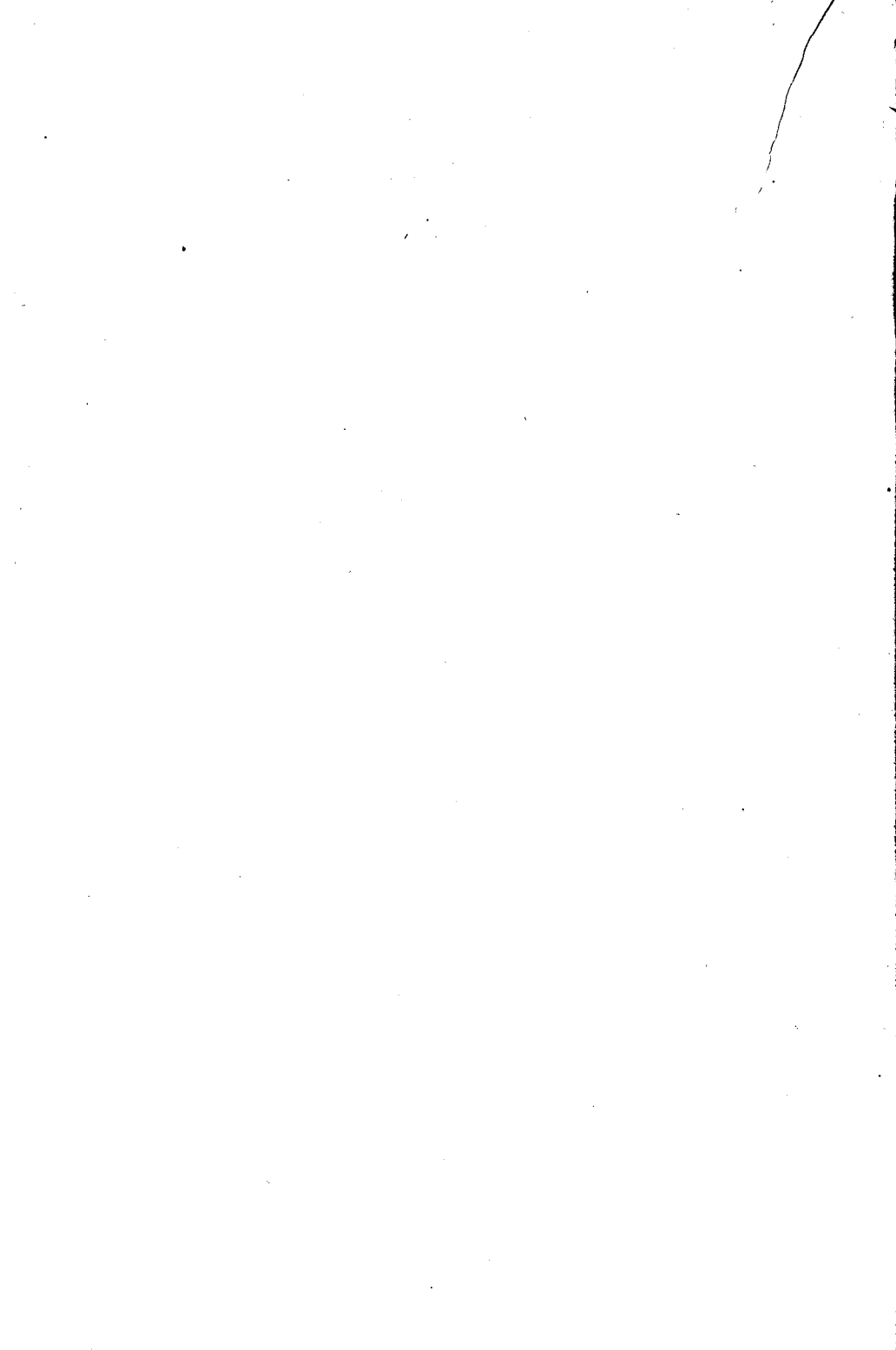
The law limiting the expenditures of the State Highway Department for engineering and administrative purposes to ten per cent of the total moneys appropriated for construction, is sufficient for all purposes of the State Highway Department, as an examination of the tabulated report will show. However, as there are no separate funds set aside for the county work as above noted, it has been necessary for this Department to charge in all such work against our own engineering forces, and when I state to you that the total sum for strictly county work, as requested by the county courts, amounts to \$137,954.74 in two years, you will see that the Department is carrying a rather heavy burden which in reality does not belong to it. So far the Department has been able to carry the burden and still live within the ten per cent, but at any time the counties increase their construction and engineering work and request our supervision, this might exceed the

lawful limit which we are allowed. I recommend that this law be made clearer and that certain funds be set aside for engineering work handled by the State Highway Department for counties.

In order to anticipate the large amount of construction for 1919, the State Highway Department has worked a rather large engineering force throughout the summer of 1918 and will continue it through the winter of 1918 and 1919. This preliminary work is absolutely necessary in order to award contracts early in the spring of 1919. The Federal Government requires very carefully prepared plans and estimates for all future Government work and this has been anticipated also, and practically every project has been completed as to engineering features and submitted to the Federal Government for approval.

Respectfully submitted,

HERBERT NUNN,
State Highway Engineer.



Report of the
State Highway Engineer
 To the
Oregon State Highway Commission
 December 1, 1916, to November 30, 1918

WORK ACCOMPLISHED

During the two-year period covered by this report, conditions have been unusually unfavorable for highway construction work. Labor and materials of all kinds have been difficult to secure, wages and prices have been very high, transportation facilities have been inadequate and many other conditions have operated to interfere with highway construction. During the last year public sentiment has been opposed to the prosecution of construction work and the restrictions imposed by the Federal Government have prevented the undertaking of any extensive program of road improvement. For these reasons the Highway Department has not handled nearly the amount of work that it would have handled under normal conditions, but nevertheless a great stride has been made in the development of Oregon's good roads system, and the Department feels that a fairly good showing has been made. The actual construction work undertaken and completed during the two years consists of fifty miles of paving, one hundred and eleven and eight-tenths miles of macadamizing, one hundred and thirty-four and five-tenths miles of grading and forty bridges and large culverts.

In addition to this actual construction work the Department has made surveys of nine hundred and two miles of State roads and has prepared designs for forty-two bridges for county authorities.

MONEYS AVAILABLE AND EXPENDED

From December 1, 1916, to November 30, 1918, the State Highway Department has had available for expenditure a total of \$4,271,515.16 of State and County funds. Of this amount \$3,597,982.47 has been expended. These amounts distributed over funds are as follows:

Funds	Amounts Available	Amounts Expended
State Funds:		
One-quarter mill tax fund	\$ 546,260.51	\$ 528,789.99
Automobile license fund	575,000.00	281,902.67
Six million dollar bond fund	2,050,045.42	2,049,025.47
State and Federal Co-operative bond fund.....	390,484.44	28,539.55
Total State funds	\$3,561,790.37	\$2,888,257.68
County funds	709,724.79	709,724.79
Grand total	\$4,271,515.16	\$3,597,982.47

PAVING

A total of fifty miles of pavement was completed by the Department during the 1917 and 1918 seasons. Had it not been for the entrance of the United States into the war, this mileage would have been more than doubled, but with need of paving materials, labor and capital for war uses, the Commission felt that it must curtail its paving program to the greatest possible extent. To this end, only three miles of pavement was started during the 1918 season, whereas under normal conditions the mileage of new work would have been greatly in excess of the forty-seven miles undertaken in 1917.

The sections of pavement completed are as follows:

	Miles
Clackamas County—	
Oregon City to Canby	7.5
Clatsop County—	
Astoria to Svensen	3.5
Columbia County—	
Scappoose to Multnomah County Line.....	2.5
Jackson County—	
Ashland Hill Section	0.8
Tillamook County—	
Tillamook-Cloverdale Section	5.0
Umatilla County—	
Pendleton to Adams.....	10.0
Pendleton to State Hospital.....	1.0
Washington County—	
Multnomah County Line to Yamhill County Line.....	12.5
Yamhill County—	
Newberg to Washington County Line.....	3.2
Sheridan east.....	4.0
Total miles paved.....	50.0

All of the above pavements are sixteen feet in width, and despite the fact that the prices of material and labor increased greatly during the period between the inauguration of the six million dollar paving program and the actual commencement of work, the cost of these paved roads has been only slightly in excess of \$1,000.00 per mile per foot width contemplated at the time the six million dollar bond issue was voted. The actual cost of the fifty miles of completed pavement was approximately \$872,500.00 which gives a unit cost of \$1,090.00 per mile per foot width.

Each of the sections paved is described in full in an article under the heading of the particular county in which it is located.

MACADAMIZING

One hundred and twelve miles of State roads have been surfaced with broken stone and gravel macadam. Practically all of this surfacing is sixteen feet wide; there are, however, a few short stretches of nine-foot width necessitated by the coming on of wet weather before the full sixteen-foot width could be completed. The total quantity of broken stone and gravel placed in these 112 miles of surface was 247,925 cubic yards, an average of 2,210 cubic yards per mile, which quantity of material per mile gives an average loose thickness of eight and one-half inches for macadam sixteen feet wide. The Department's specifications call for a minimum thickness of six inches. In many places, however, particularly on the lower Columbia River work it was found necessary to place as much as eighteen and twenty-four inches of rock before a satisfactory foundation could be secured.

The sections upon which broken stone or gravel surfacing was placed are as follows:

	Miles
Clatsop County—	
Astoria to Columbia County Line	24.4
Columbia County—	
Clatsop County Line to Goble.....	27.2
Deschutes County—	
Bend-Lapine Section (cinder macadam)	12.5
Douglas County—	
Divide to Leona.....	7.0
Gilliam County—	
Condon to Thirty Mile Creek.....	6.7
Hood River County—	
Cascade Locks to Hood River.....	18.0
Jackson County—	
Siskiyou Mountain Section	6.5
Lake County—	
Lakeview-Paisley Section	4.0
Lane County—	
Divide-Cottage Grove Section.....	1.0
Wheeler County—	
Cummins Hill Section.....	4.5
Total miles of macadam surfacing.....	111.8

A complete description of each of the above sections will be found in the chapter devoted to the county in which the work was performed.

GRADING

The grading work of the Highway Department is confined to the building of those sections of State roads which are so located that the counties in which they occur are not directly interested in their construction or which are so expensive that county funds are inadequate for their construction. The total number of miles graded during the last two-year period was 134.5 miles, most of which was on the Pacific and Columbia River highways.

While the grading work was greatly curtailed during 1918 on account of war conditions, work was continued in those localities where resident labor was available and where the work interfered in no way with more essential war industries.

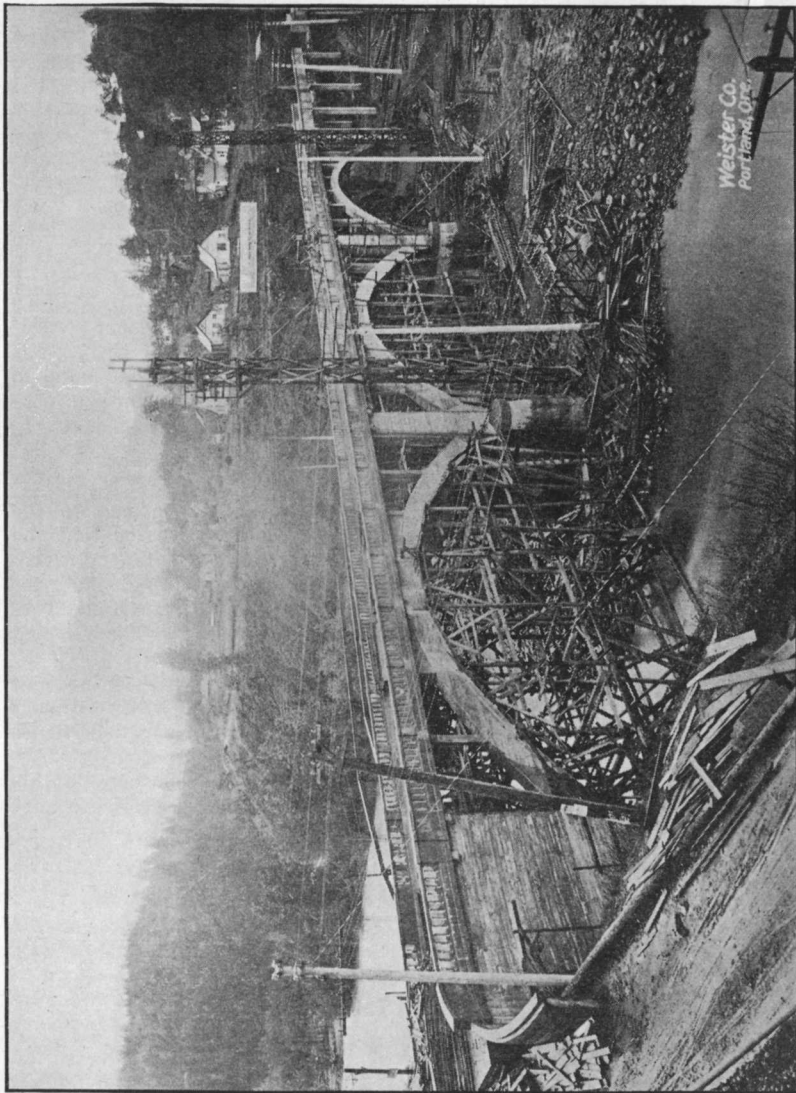
A complete tabulation of the grading jobs is given elsewhere in this report, and a detailed outline of each is given under the respective county headings. A few of the more important grading jobs are as follows:

	Miles
Grading between Cascade Locks and Hood River in Hood River County.....	14.2
Elimination of Roberts Mountain grades in Douglas County.....	12.8
Grading of Rice Hill section between Oakland and Yoncalla.....	10.4
Elimination of Wolf Creek-Grave Creek grades in Josephine County.....	4.9
Reduction of Cummins Hill grade in Wheeler County.....	3.5
Grading between Oregon City and New Era in Clackamas county.....	4.5

BRIDGES

The State Highway Department has, during the period covered by this report, prepared designs for ninety-six bridges and fourteen special culverts. Of these structures sixty bridges and ten culverts have been constructed at a total cost to State and Counties of \$617,388.09.

The structures paid for out of State funds consist of twenty-two reinforced concrete bridges, ten wood bridges, and seven culverts. The total expenditure of State funds for these bridges and culverts was \$239,044.85.



REINFORCED CONCRETE BRIDGE OVER HOOD RIVER, NEARING COMPLETION, ON THE COLUMBIA RIVER HIGHWAY AT HOOD RIVER CITY, BUILT IN 1918.

The structures paid for out of county funds consist of thirteen reinforced concrete bridges, fourteen wood and steel bridges, and four culverts; the total cost of these structures being \$378,343.24.

Of the structures paid for by the counties, the State Highway Department supervised the construction for three reinforced concrete bridges, four steel and wood bridges, and one culvert; the cost of which totaled \$288,743.24.

A complete tabulation of the bridges designed and constructed is given in another part of this report, and complete descriptions of the more important structures will be found in the articles devoted to the particular counties in which the structures are located.

The \$250,000.00 intercounty bridge across the Willamette River at Salem was completed, and has attracted more than local attention. While the cost of this structure was borne by Marion and Polk Counties the design and construction engineering were handled by this Department.

The reinforced concrete arch bridge at Hood River, the largest concrete bridge yet constructed in this State was designed and built under State supervision, although the County also contributed toward its cost.

Among the proposed bridges of considerable magnitude for which county officials have requested designs from this Department may be mentioned the Deschutes and Oregon City. The former will be located between the present toll bridge and the railroad bridge across the Deschutes River and will thus obviate the necessity of toll payments. It will consist of a series of reinforced concrete arches. The Oregon City bridge will replace the old suspension bridge across the Willamette. Studies are being made and comparisons of various types of bridges and locations of site are being made.

During the war period, both for patriotic and economic reasons the employment of steel bridges was discontinued and wooden truss bridges used instead. Now that the demand for steel for war purposes has subsided, and there are indications of a decline in the price of structural steel in the near future, the resumption of use of that material in the construction of bridges will probably be more general.

ELIMINATION OF GRADE CROSSINGS

The Department is working consistently for the elimination of dangerous grade crossings. No less than ten grade crossings have been done away with as far as through traffic on State Roads is concerned, during the past two years. Most of these eliminations have been brought about by holding roads on the same side of railway tracks instead of crossing over and back. Two of the eliminations, however, were brought about by grade separations; one near Rex in Washington County and another near Ashland in Jackson County, both of these grade separations being undercrossings.

An agreement was also reached whereby a reinforced concrete overhead crossing will be constructed to eliminate a very dangerous grade crossing on the Pacific Highway near Divide, in Lane County. This structure would have been built in 1918, but on account of the requirements of material for war purposes, the United States Highway Council ordered the construction delayed. It will undoubtedly be constructed during the 1919 season.

FEDERAL CO-OPERATION

In 1916, the United States Congress enacted a law making available \$85,000,000.00 of Federal Government moneys for co-operation with the several States in the construction and improvement of roads. Of this amount, \$75,000,000.00 is appropriated for co-operation on "Post Roads," roads over which either rural or star post routes are operated, and \$10,000,000.00 is appropriated for co-operation on "Forest Roads," roads within or partly within National Forests.

During the five year period prior to July 1, 1921, there will become available to the State of Oregon from the Government Funds set aside by this Act the following amounts:

	For Post Roads	For Forest Roads
July 1, 1916, to July 1, 1917.....	\$ 78,687.00	\$ 127,794.00
July 1, 1917, to July 1, 1918.....	157,375.00	127,794.00
July 1, 1918, to July 1, 1919.....	236,062.00	127,794.00
July 1, 1919, to July 1, 1920.....	314,749.00	127,794.00
July 1, 1920, to July 1, 1921.....	393,437.00	127,794.00
Totals	\$1,180,310.00	\$ 638,970.00

Total amount of government funds apportioned to the State of Oregon for co-operative work, \$1,819,280.00.

With the funds thus apportioned to the State, the Government will co-operate on approved road projects to not to exceed fifty per cent of their cost. Therefore, the State, or the State co-operating with the Counties, must provide amounts at least equal to the amounts set aside by the Federal Government in order to avail itself of the funds apportioned to it.

In 1917, the State Legislature passed a bill accepting the terms of the Federal Government's co-operative offer and authorizing the issue of bonds to the amount of \$1,819,280.00 to provide the funds necessary to match the Government funds. There is thus available for expenditure on post and forest roads in the State during the five years prior to July 1, 1921, the following amounts:

For Post Road Projects:		
Federal Government Funds	\$1,180,310.00	
State Funds	1,180,310.00	
		\$2,360,620.00
For Forest Road Projects:		
Federal Government Funds	\$ 638,970.00	
State Funds	638,970.00	
		1,277,940.00
Total		\$3,638,560.00

For Post Road Projects the plans are prepared, contracts let and work supervised by the State Highway Department, subject, of course, to approval and acceptance by the Secretary of Agriculture through the Federal Office of Public Roads and Rural Engineering. For Forest Road Projects, the plans are prepared, contracts let and work supervised by the Federal Office of Public Roads and Rural Engineering acting for the Secretary of Agriculture. The State Highway Department is, therefore, directly responsible for the work done on Post Road Projects, whereas on Forest Road Projects the responsibility rests with the Office of Public Roads and Rural Engi-

neering, the State Highway Department simply approving the projects and auditing the claims presented by the Federal Government against the State's share of the funds.

It is the policy of the Highway Department to match the Government Funds with equal amounts from State Funds only, any County Funds which may be available being used to increase the total amounts available rather than to reduce the amount of State co-operation. On projects approved to November 30, 1918, the amount of these additional funds provided by counties is approximately \$325,000.00.

POST ROAD PROJECTS

Up to November 30, 1918, fifteen Post Road Projects had been submitted to the Office of Public Roads for approval. Of these fifteen projects nine have received approval, three have been rejected as not complying with the government requirements as regards rural and star route mail service over them, and three are pending action by the Secretary of Agriculture. The rejected projects were the Wolf Creek-Grave Creek project in Josephine county, the Canyonville-Galesville project in Douglas County, and the Myrtle Creek-Dillard project also in Douglas County. The first and third of these projects have since been constructed without government co-operation, and the second is under construction as a "Forest Road."

Construction is now under way on two Post Road Projects both of which are in Union County. These are the Elgin-Minam project, estimated to cost \$41,151.00, and the Union-Telocaset project, estimated to cost \$30,000.00. The contracts for the construction of both jobs were let on July 9, 1918, to Union County, represented by the County Court, the lowest bidder. Subsequent to the letting, however, the Attorney General gave the opinion that the County Court had no legal authority to enter into a contract of this nature, and in order to facilitate matters and prevent delay in construction the State Highway Commission on September 10, 1918, agreed to take the work over at the prices bid by the County, the County agreeing to reimburse the State in case the cost of the work exceeded the bid prices.

The total estimated cost of all projects agreed upon to date is \$1,409,993.24 of which \$627,496.62 is to be paid by the Federal Government, \$627,496.62 by the State, and \$155,000.00 by the Counties interested. On page—is given a tabulation of the Post Road Projects approved, giving the estimated cost of each project with the respective amounts to be paid by the State, the Federal Government and the Counties.

FOREST ROAD PROJECTS

The Federal authorities and the State Highway Commission have to date agreed upon co-operation on fourteen Forest Road Projects. The total estimated cost of these fourteen projects is \$1,246,204.65; \$538,231.78 to be provided by the Government, \$538,231.78 by the State, and \$169,741.09 by the Counties.

Construction is already under way on three of the Forest Projects, namely: the Canyonville-Galesville section of the Pacific Highway in Douglas County, the Three Rivers Project in Tillamook County, and the Ochoco Canyon Project in Crook County.

The Canyonville-Galesville section is what is generally known as Cow Creek Canyon, one of the worst stretches on the Pacific Highway. This

POST ROAD PROJECTS
PROJECTS AGREED UPON TO NOVEMBER 30, 1918

Projects	Project Number	Miles and Kind of Work	Estimated Total Cost	Funds Provided		
				By Government	By State	By Counties
Baker County:						
Baker-Middle Bridge section.....	10	17.0 miles—grading	\$ 71,235.45	\$ 28,117.73	\$ 28,117.72	\$ 15,000.00
Sag Section of Baker-Cornucopia Road	9	4.9 miles—grading and gravel	41,926.00	17,983.00	17,983.00	6,000.00
Canyon Section of Baker-Cornucopia Road	11	4.5 miles—grading	22,498.00	8,249.00	8,249.00	6,000.00
Grant County:						
John Day to Fiske Creek Section.....	13	7.2 miles—grading and gravel.....	143,817.14	71,908.57	71,908.57	.....
Hall Hill to Prairie City Section.....	14	2.2 miles—grading and gravel.....	43,282.47	21,641.23	21,641.24	.....
Harney County:						
Burns-Crane Project.....	15	6.0 miles—grading and gravel.....	48,000.00	20,000.00	20,000.00	8,000.00
Malheur County:						
Project to be selected.....			100,000.00	40,000.00	40,000.00	20,000.00
Marion County:						
Salem-Aurora Project	7	18.0 miles—paving	347,232.60	173,616.30	173,616.30	.....
Union County:						
Elgin-Miram Project	5	9.3 miles—grading	41,151.00	20,575.50	20,575.50	.....
Union-Tolocaset Project	8	5.0 miles—grading	30,000.00	15,000.00	15,000.00	.....
Wasco County:						
The Dalles-Three Mile Creek Project		2.0 miles—paving	44,000.00	20,000.00	20,000.00	4,000.00
Wheeler County:						
Fossil-Sarvice Creek Project	4	9.5 miles—grading	36,733.40	18,366.70	18,366.70	.....
Wheeler and Grant Counties:						
Sarvice Creek-Valades Ranch Project	6	48.5 miles—grading	400,433.80	157,216.90	157,216.90	86,000.00
Yamhill County:						
Grande Ronde Project	12	2.8 miles—grading and gravel.....	39,683.38	14,841.69	14,841.69	10,000.00
Total estimated cost of all Projects.....			\$1,409,993.24	\$627,496.62	\$627,496.62	\$155,000.00
Federal Government Funds.....			.....	.....	.....	.....
State Funds.....			.....	.....	.....	.....
County Funds.....			.....	.....	.....	.....

section is 9.7 miles in length, and is to be graded sixteen feet wide; the estimated total cost being \$211,000.00. The work is under contract to John Hampshire & Co., of Grants Pass.

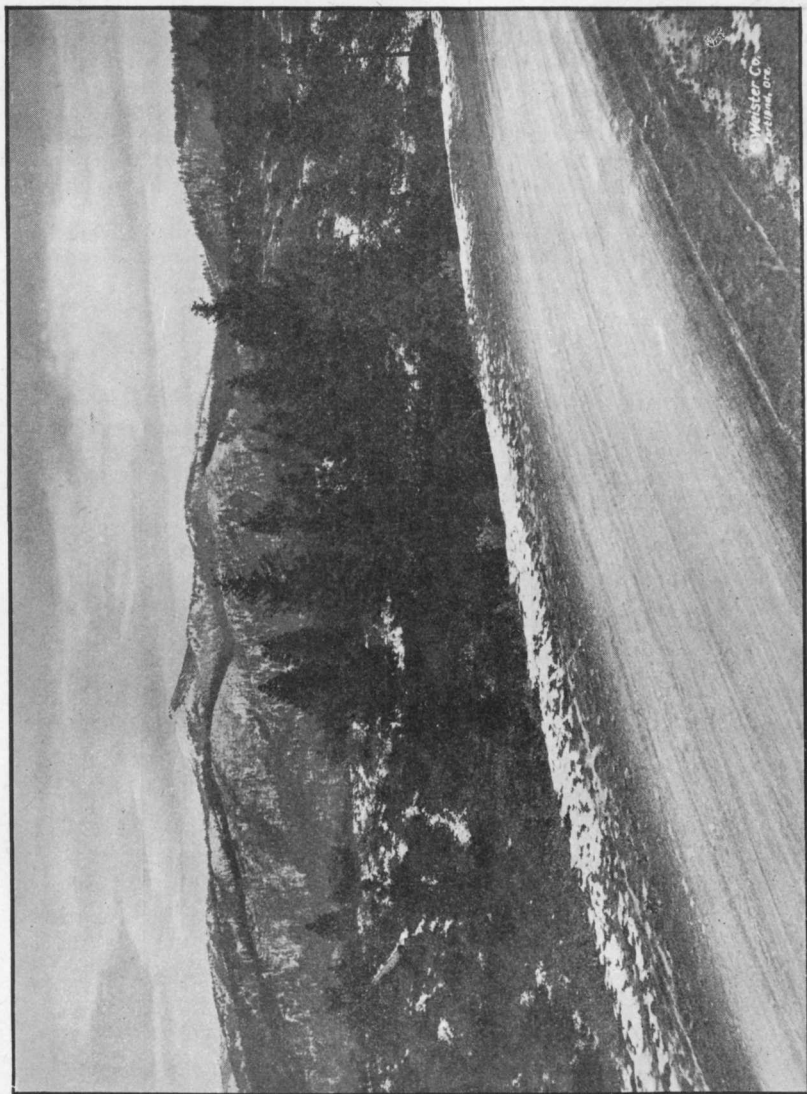
The Three Rivers Project is 10.35 miles in length and lies between Hebo and Dolph on the Portland-Tillamook Highway in Tillamook County. The County of Tillamook, represented by its County Court was the low bidder on this work, but before the contract was entered into, the Attorney General ruled that the County Court had no authority to contract work of this kind. The State Highway Department having available the necessary equipment and desiring to get this important piece of road work under way, agreed with the Federal Government to take the work over at the prices bid by Tillamook County.

A tabulation of Forest Road Projects approved to date and giving the estimated cost and amounts of County, State and Government Funds is given below.

FOREST ROAD PROJECTS

PROJECTS APPROVED TO NOVEMBER 30, 1918

Projects	Estimated Total Cost	Funds Provided		
		By Government	By State	By County
Clackamas County: Zigzag Section of Mt. Hood Road.....	\$ 48,000.00	\$ 24,000.00	\$ 24,000.00	.....
Crook County: Ochoco Canyon Project....	52,500.00	17,500.00	17,500.00	17,500.00
Curry County: Curry-Coos Project	110,000.00	55,000.00	55,000.00	.....
Deschutes-Lane Counties: McKenzie Pass Project....	190,455.00	82,078.00	82,078.00	26,299.00
Douglas County: Canyonville-Galesville.....	211,000.00	94,000.00	94,000.00	23,000.00
Tiller Trail Project	123,603.00	48,439.00	48,439.00	26,725.00
Lake County: Lapine-Lakeview Project	79,419.00	39,709.50	39,709.50	.....
Jackson County: Medford - Crater Lake Project	72,372.00	34,436.00	34,436.00	3,500.00
Josephine County: Grants Pass - Crescent City Project	31,476.00	15,738.00	15,738.00	.....
Klamath County: Anna Creek Section of Crater Lake Road.....	6,780.40	3,390.20	3,390.20	.....
Lane County: Eugene-Florence Project	123,951.25	41,317.08	41,317.08	41,317.09
Tillamook County: Three Rivers Project.....	122,000.00	50,250.00	50,250.00	21,500.00
Wallowa County: Flora-Enterprise Project	29,648.00	12,324.00	12,324.00	5,000.00
Wheeler County: Ochoco Canyon Project....	45,000.00	20,050.00	20,050.00	4,900.00
Total estimated cost of all Projects....	\$ 1,246,204.65			
Federal Govt. Funds		\$538,231.78		
State Funds			\$538,231.78	
County Funds				\$169,741.09



MOUNT ASHLAND FROM THE PACIFIC HIGHWAY IN JACKSON COUNTY. ELEVATION OF HIGHWAY
4,480 FEET

THE PACIFIC HIGHWAY

The Pacific Highway running from Portland, through Oregon City, Salem, Albany, Eugene, Roseburg, Grants Pass, Medford and Ashland to the California line, is probably the most important through highway in the State. Along it are situated nine of the most important cities of the State. It traverses the immensely productive valleys of the Willamette, the Umpqua and the Rogue Rivers. It is the intercommunicating road for nine of the thirty-five counties of the State, and passes through the county seats of all but one of the nine. It is the only continuous and direct road along the Pacific Coast west of the Cascade Mountains, and connecting as it does the metropoli of the three Pacific Coast States it is the most important interstate highway in the West. From the standpoint of the tourist, Oregon would not be on the map if it had no Pacific Highway. It is the road that makes Oregon accessible to tourists from other states.

Being the most important highway in the State, the Pacific Highway should be the best highway in the State. To make it the best and at the same time to bring it up to the standard of the same highway in the adjacent states of Washington and California is one of the ends toward which the Highway Commission has been working during the past two years. During that time 53.3 miles of the very worst stretches of this highway have been newly graded to trunk highway standards. This grading has eliminated practically all of those heavy and dangerous grades which have made Oregon notorious for bad roads and which have kept thousands of auto tourists from visiting the State. In addition to grading 53.3 miles on the Pacific Highway, the Highway Commission has put down 8.3 miles of pavement and 14.5 miles of macadam, the total cost of all of these improvements being \$971,000.00. As a part of the 1919 program, the Highway Commission has already appropriated for the improvement of the Pacific Highway the sum of \$1,147,000.00, with which it is planned to build 46 miles of pavement and 38 miles of macadam surface.

The particular sections of the Pacific Highway constructed during 1917 and 1918, together with their mileages and total costs are given below. All of these sections are completed with the exception of the Canyonville-Galesville Forest Road Project which is well under way.

Sections	Miles	Total Cost
Grading (including bridges)—		
Oregon City to New Era.....	4.0	\$ 75,000.00
Divide to Leona.....	7.0	50,000.00
Yoncalla to Oakland.....	10.8	101,100.00
Myrtle Creek to Dillard.....	12.8	165,500.00
Canyonville to Galesville.....	9.7	211,000.00
Wolf Creek to Grave Creek.....	4.9	68,300.00
Grants Pass to Jackson County Line.....	3.3	13,000.00
Ashland Undercrossing.....	.8	9,800.00
Macadam—		
Cottage Grove to Divide.....	1.0	6,100.00
Divide to Leona.....	7.0	64,000.00
Siskiyou to California Line.....	6.5	56,300.00
Paving—		
Oregon City to Canby.....	7.5	135,000.00
Ashland Hill Section.....	.8	15,900.00
Total cost of improvements completed and under way on Pacific Highway, 1917-1918.....		\$971,000.00

THE COLUMBIA RIVER HIGHWAY

The Columbia River Highway is second only to the Pacific Highway as a commercial necessity in the state of Oregon; furthermore, the Columbia River Highway is the only connecting link between Eastern and Western Oregon that can be kept open for vehicular traffic throughout the entire year.

From a scenic standpoint, the Columbia River Highway has now become world famous, not only because of its wonderful natural advantages of location, but because of the high standard of construction. A large part of this combined commercial and scenic road is now open to traffic and the coming year will see the elimination of the last almost impassable barrier—the summit between Hood River and Mosler, a piece of construction 5.8 miles in length which will cost approximately \$350,000 for the grading alone.

The Columbia River Highway parallels the Columbia River from the Pacific Ocean to Umatilla, a distance of 320 miles, thence southeast an additional 40 miles to Pendleton, where it connects with the Old Oregon Trail. The Old Oregon Trail continues southeast for a distance of 190 miles, crossing the Idaho-Oregon line at Huntington; making a continuous highway 550 miles in length.

At this date, the grading of the Columbia River Highway is practically complete from Astoria to Hood River, a total distance of 174 miles, and the greater part of it is now either paved or macadamized.

The cost of work completed on the Columbia River Highway between Astoria and Portland during the period covered by this report, after all payments are made will be approximately \$866,000.00, of which amount \$832,078.35 has been expended to date. The work accomplished consists of 9.4 miles of grading, 51.6 miles of macadamizing, 6 miles of paving, 15 reinforced concrete bridges and one covered wood draw bridge.

On the upper Columbia River Highway between Hood River and Cascade Locks, 14.2 miles have been graded, 18 miles gravelled, and a number of reinforced concrete bridges built, among which is the Hood River bridge at Hood River, costing \$48,000.00. The total cost of the work completed between Hood River and Cascade Locks will amount to \$466,000.00.

The sections improved during this period, with their mileages and costs are as follows:

Sections	Miles	Total Cost
Grading—		
Cascade Locks to Hood River.....	14.2	\$ 355,000.00
Goble to Clatskanie.....	8.2	78,500.00
Astoria to Svensen.....	1.2	15,000.00
Bridges—		
Hood River Bridge.....		48,000.00
Beaver Valley Bridges.....		32,000.00
John Day River Bridge.....		25,000.00
Other Bridges.....		31,000.00
Paving—		
Astoria to Svensen.....	3.5	65,000.00
Scappoose to Multnomah County Line.....	2.5	37,500.00
Macadamizing—		
Astoria to Svensen.....	5.5	30,000.00
Svensen to Columbia County Line.....	18.9	215,000.00
Clatsop County Line to Goble.....	27.2	335,000.00
Cascade Locks to Hood River.....	18.0	65,000.00
Total Expenditures 1917 and 1918.....		\$1,332,000.00

During 1919, work will be undertaken on the Columbia River Highway to the amount of \$1,400,000.00, comprising 10 miles of pavement, 85 miles of gravel macadam and 80 miles of grading. This work when completed will provide a surfaced highway between Astoria and Pendleton.

COUNTY WORK SUPERVISED BY THE HIGHWAY DEPARTMENT

That the Counties of the State have confidence in the Highway Department and recognize the ability of the Department to get results is evidenced by the fact that \$709,724.79 of county funds have been voluntarily turned over to the Department during 1917 and 1918 to be expended under its supervision.

This, \$709,724.79, is the actual amount of money paid out by Counties on vouchers audited and approved by the Department. In addition to this a large amount of work has been done by Counties under the supervision of the Department, for which payment was made direct by the Counties without being audited by the Highway Department. No record of the total amount thus expended is available, but it is estimated to be about \$200,000.00. No part of this amount is included in any of the tabulations of expenditures given in this report. The cost of engineering and supervision of work handled in this manner, has been paid by the Highway Department and is included in Table VI of the Financial Report as "Engineering County Construction."

For co-operation on Post and Forest Road Projects, a total of \$325,000.00 of County Funds have already been pledged. Of this amount \$155,000.00 will be expended under State supervision, and \$170,000.00 under Federal Government supervision.

CONSTRUCTION WORK BY STATE FORCES

While the major part of the work supervised by the State Highway Department is handled under the contract system, it has been found to be good business for the Department to go into competition with contractors and where satisfactory bids are not received to proceed to handle the work with State forces.

During 1917 and 1918, the Department handled in this manner the construction of 45.5 miles of macadam surfacing, 3.0 miles of concrete paving, and 27.3 miles of grading.

Although war conditions prevailed during the past year and every possible obstacle had to be surmounted, the work done with State forces made a creditable showing when compared with cost plus and contract jobs. Especially is this true of paving work where a comparison of costs with bid prices show a very substantial saving to the State, as illustrated by the following table:

	Length in Miles	Preliminary Estimate of Cost	Cost Based on Lowest Bid Price	Actual Cost With State Forces	Saving to State
Sheridan Paving.....	2.2	\$42,535.50	\$52,438.00	\$40,065.61	\$12,372.39
Ashland Hill Paving.....	.8	16,962.00	19,858.66	15,908.03	3,950.63
Total	3.0	\$59,497.50	\$72,296.66	\$55,973.64	\$16,323.02

Highway construction by the State Highway Department with its own forces has its limitation, however, in spite of the fact that it is often possible to do work at less cost than by contract. The Oregon State Highway Department is by law and of necessity an engineering organization and, in order to have the best success in handling construction work, it is necessary to have a distinct organization.

In the hiring of men for handling such construction, it is necessary for the State to compete with contractors for the higher priced and more experienced men, and the contractor is often in a position to offer more salary than the State. Furthermore, it is necessary for the State to carry large quantities of expensive equipment which is idle at least a part of the year, and, in fact, the amount of equipment necessary to handle all of the State work by force account would represent too large a portion of the year's available money for road work.

In handling its construction work direct, however, the Department has the advantage of not being required to make a profit on the work, neither has it to pay interest on the necessary moneys to carry payrolls and other incidentals, neither is there any loss in retained percentage. The State does not have to carry a construction bond and, in fact, there are many reasons why a state should handle its construction direct, cheaper than by contract.

There is much to be said on both sides of the question, but the Department at this time does not believe that it is justified in attempting to handle all of the State work, believing that only under certain conditions where the State does not receive reasonable bids the work should be handled direct.

The State Highway Department has many large construction jobs under contract at one time, and it is obvious, even to the layman, that an organization to handle all of this work with State forces is impossible under the present laws of the State of Oregon, and the Department recommends that force account be limited to such cases as are mentioned above and work for which the quantities and cost can not be closely estimated in advance of construction, such as maintenance work and light grading.

STATE HIGHWAY FUNDS

The funds at the disposal of the Highway Department are divided as follows:

The State Highway Fund provides for one-quarter mill tax on the assessed valuation of the State. This fund amounted to \$219,690.98 in 1917; \$232,151.39 in 1918 and in 1919 will equal \$246,883.47. The money available in this fund provides a sufficient sum for the salaries and expenses of the State Highway Department, and the cost of maintaining State highways which have been constructed or improved. It is provided also, that with the proceeds of this fund, the Commission may enter into co-operative agreements with any County for the survey, construction, improvement or maintenance of any State highway upon such basis or contribution as may be agreed upon. The Bridge Department is maintained out of this fund and furnishes designs for structures desired by the counties.

The Automobile License Fund. Under the provision of Section 12, Chapter 423, Laws of 1917, the Secretary of State is directed to transfer to an account under the jurisdiction of the State Highway Commission, the receipts from the automobile license fees, less the cost of administration.

The law provides that these funds be transferred on April 1 and October 1 of each year. The 1918 receipts from this fund were \$425,000.00 and with the rapid increase of the number of automobiles, it is expected that this amount will be increased from year to year. The fund provides for the payment of principal and interest, as the same shall become due, on the bonded indebtedness of the State of Oregon, contracted for road purposes under the provisions of the Six Million Dollar Bonding Act and the State and Federal Road Bonding Act. The unexpended balance may be expended on such State highway projects as the Commission approves.

This fund is also used for co-operative work in counties where the Six Million Dollar Fund may not be used and on State Highways not eligible for improvement under the Post and Forest Road Acts.

The Six Million Dollar Road Bond Fund provides for the issuance of six million dollars in bonds during the next five years. It provides for the sale of one million dollars in bonds in 1917; two million dollars in 1918, and the balance as the Commission may think advisable. The primary purpose of this act was to provide paving on the main highways of the State, contingent upon the counties preparing the road bed according to the plans of the State Highway Engineer.

It also provides funds for the grading of the road bed on the Columbia River Highway in Clatsop, Columbia and Hood River Counties and on the Pacific Highway in Jackson County.

At this date a total of \$2,190,000 par value of bonds have been sold.

State and Federal Co-operative Road Bonds. Under the Federal Aid Road Act there is provided for expenditure by the Federal Government during the next five years, \$1,180,310.85 for the construction of Post Roads in the State of Oregon and there is also available during the same period the sum of \$638,970.00 for the construction of highways within or partly within the National Forests of the State. The purpose of this Act is to meet Federal Aid in an equal amount and under this provision a total of \$1,819,280.85 in bonds is authorized to be issued by the Board of Control and placed in a special fund to be used in carrying out the provisions of this Act. A total of \$400,000.00 par value of these bonds have been sold.

EQUIPMENT

The State Highway Department owns construction and hauling equipment to the approximate value of \$100,000.00. This equipment is too varied and extensive to be shown in detail in this report. However, it includes six heavy auto trucks, two light auto trucks, twenty-two touring cars, three concrete mixers, two gasoline locomotives, three road rollers, one Brown holst, one asphalt paving plant, three rock crushers and an extensive supply of camp equipment, small tools, drills, steel, pipe, etc.

Most of this equipment is in fine working condition and adaptable to general highway work and has been used during the past year. However, we have on hand a certain amount of machinery which was bought for special purposes in former years, and while it has no doubt made a saving sufficient to justify its original cost, the Department has no more use for it and it would be advantageous to the Department if this equipment could be disposed of and the money invested in more necessary machinery. Under present conditions, the State law makes it necessary to return any money from the sale of materials, supplies or equipment into the General Fund of

the State, and it is impossible to get this money back into highway funds without a special act of the Legislature. Despite this fact, however, some equipment was disposed of during the past year and the money turned into the General Fund.

If the State Highway Department is to proceed with any considerable amount of work with State forces, it will be necessary to purchase some additional equipment so that the work may be prosecuted more economically, especially in this true of concrete bridge work and general maintenance work. These are special types of work and special types of equipment are necessary to handle them properly.

During the past year a great amount of equipment has been rented from private contractors and in case of short jobs and on special types of work, this is economical, but on long jobs, it is much more economical to purchase the necessary machinery as the amount paid out in rentals for a period of six or eight months is a considerable portion of the purchase price.

During the past season a warehouse was built by the Department for the purpose of housing construction equipment. This warehouse is located on State property near the Penitentiary. It is 40 by 80 feet in size and has railroad facilities.

All idle equipment and left over material is shipped to Salem, for storage, at the close of the season. There the equipment is overhauled, repaired, repainted, and placed in readiness for the next season's work. The warehouse was built by the Department with day labor.

It will probably be advisable during the coming year to erect two more units to the warehouse to take care of a larger amount of equipment and provide for repair shop and garage.

A garage was rented at 660 North Capitol Street, Salem, and an efficient automobile mechanic was placed in charge. By this means the automobiles of the Department are kept in good repair, oiled and tires vulcanized. Facilities are provided also for overhauling and repainting, which effects a considerable saving.

OFFICE ORGANIZATION

The work handled in the offices of the State Highway Department is of four classes, each requiring specialized training, and, in a way, of little or no relation to each other. For this reason, the office organization consists of four different offices or departments: the General Office, the Auditing Department, the Office Engineering Department and the Bridge Department. The work of these departments is outlined in the following paragraphs.

General Office.—All business of the Highway Commission and all business of the Department with the public is transacted through the General Office. Under the direction of the Secretary of the Commission and the First Assistant Engineer, this office handles all correspondence, the issuance of bonds, the execution of contracts, the purchase of supplies and equipment, and all general office detail.

The seal of the State Highway Commission and the minutes of the Commission meetings are in the custody of the Secretary. All mail is received and distributed through the Secretary's office, and in it filed all correspondence, legal documents, etc. This office also keeps a record of all State equipment and takes care of the charging out of rental and depreciation on same.

The purchase of office, engineering and construction supplies and equipment is handled by this department and a considerable saving is realized by buying in quantities. On all stock supplies, each job is charged with the amount furnished and similarly rental on our own engineering instruments and automobiles is charged, so that the cost of each job may be determined. On construction projects which are furnished with our own trucks, road rollers, etc., each piece of equipment is rented out to the job in the same manner. A record is kept of the rental charged on each piece of equipment so that its value can be determined at any time.

Auditing Department.—This department, working under the supervision of the Auditor, handles all claims against the Commission, verifies each one, prepares the vouchers to cover, sends them out to claimants to be certified, and mails out the warrants when received from the Secretary of State. All vouchers drawn from the counties for co-operative work or projects over which the Commission has supervision, are also audited in this department. In 1917 there were 1,782 State vouchers passed, aggregating a total of \$682,321.98; in 1918, 3,371 were passed, aggregating \$2,205,935.70. In 1917 there were 544 County vouchers totaling \$270,162.37, and in 1918, 410 vouchers totaling \$439,562.79. A total of all such vouchers for the biennium aggregating \$3,597,982.84.

Employees of the Commission are paid by payroll warrants drawn in favor of the State Highway Engineer and bank checks issued against the same. The total number of paychecks issued in 1917 was 2,771, and in 1918 there was a total of 7,350.

It will be noted that in the past two years the Commission has done considerable work by day labor and the above statement includes all direct employees. It is desirable to expedite payment of labor claims, especially to men who quit on short notice. The present law requires that claims be prepared in voucher form, approved by the Commission for payment and then sent to the Secretary of State for audit. The warrant when received is deposited in a bank and a paycheck issued. It is recommended that a revolving payroll fund be created on which pay checks could be drawn and sent out immediately as requested. These could later be listed and the payroll voucher prepared in the usual manner in favor of the State Highway Engineer. The warrant when received, to be refunded to the payroll fund which would be kept intact. The State Highway Engineer should furnish a payroll bond to cover. This fund could also be used for emergency claims to take advantage of trade discounts and permit the payment of small claims which it is desired to pay promptly.

In the numerous cases in which the Commission has taken over the work to do with its own forces, the necessary bookkeeping and detail records for handling material, supplies and labor payrolls have been carried by this office. On several force account jobs each invoice and payroll of the contractor has been carefully checked and verified before being paid.

The record of both State and County funds have been audited by reputable certified public accountants and found correct.

Mr. G. Ed Ross served in the capacity of Auditor until his resignation in July, 1918, when his duties were taken over by Roy A. Klein, Assistant Engineer.

Office Engineering Department.—In the Office Engineering Department are handled the numerous office details in connection with the engineering work of the Department. The more important of these duties are the

working up of maps, profiles, specifications and estimates for new projects; the checking of monthly and final estimates for payments on contract work; the filing of engineering records of all kinds; the keeping of cost distribution and the compilation of reports, statistics and other data.

During the past year this department, in addition to its other work, prepared and had published a road map of the State of Oregon. This map shows all of the main traveled roads of the State and is believed to be the most authentic as well as the most complete road map of Oregon yet published. A small reproduction of the map is contained in this report. Single copies of a larger size, 13 by 22 inches will be supplied upon application.

Bridge Department.—The Bridge Department prepares designs, plans, specifications and estimates for all bridges and similar structures. The inspection and the supervision of construction of bridges is also in charge of this department.

The laws of the State require that bridge designs be prepared for counties by the Highway Department, upon the request of County Courts. Twelve counties have taken advantage of this law during the past two years and have called upon the Department for designs for a total of thirty-four bridges and six culverts, and of these structures twenty-seven bridges and four culverts have been built.

A total of ninety-five bridges and fifteen culverts were designed by the Bridge Department, of which fifty-nine bridges and eleven culverts have been constructed.

COST KEEPING

The keeping of an accurate segregation of expenditures and a detailed distribution of costs for an organization handling the amount of work and the character of work handled by the Highway Department is a matter of the greatest importance. The Highway Department seldom has under way less than eighty or ninety separate and distinct jobs. These jobs are scattered all over the State, and few of them are of sufficient size to warrant the employment of timekeepers on the jobs to keep exact records of expenditures and costs. The records for all of these jobs must be kept in the main office where it is impossible for those keeping the records to be personally familiar with the details of the numerous expenditures made on each of the many jobs.

To secure proper records of expenditures, therefore, a system of cost keeping must be used which requires little attention from the engineers and superintendents in charge of the various jobs, and at the same time gives sufficient information to those keeping the records in the main office to enable them to segregate all expenditures so that detailed information as regards total expenditures, monthly expenditures, expenditures from different funds, expenditures for different purposes, unit costs, etc., are readily available at any time, and in such form that all jobs may be combined to give total expenditures of various kinds, so that the Department is always informed as to the financial status of each job and of all jobs.

The system of cost keeping now in use by the Department has been evolved from a number of other systems in use on work of a similar nature, and is a system specially devised to meet the requirements of the Department. For every cent expended by the Highway Department or under its supervision, there appears in the cost records, entries which give at a glance

the name of the County in which the expenditure is incurred, the name of the particular job, whether it is an engineering cost or a construction cost, the particular part of the work involved, the fund from which it is paid, and a reference to the original invoice or statement upon which the payment is made. These records are so arranged and so summarized each month that almost any desired combination of costs is available, such as the totals for each county, for each job, for each fund, for engineering, for construction, for surveys, for administration, for construction engineering, etc.

The expenditure tabulations given in various parts of this report, and especially those in the part devoted to the Financial Report, give a good idea of the results being obtained with the system in use although they do not give the detail which is readily available in the records themselves.

EMPLOYES IN THE UNITED STATES ARMY SERVICE

The State Highway Department is very proud of its representation in the Army Service and in recognition of the patriotism of those employes who have gone to the Front, the Department has maintained a Service Flag upon which there are now sixty stars. The men represented by these stars are listed on the following Roll of Honor :

HONOR ROLL

Name and Company	Former Position with Department
Abbott, Charles H., 23d Engineers.....	Inspector
Brown, Merle, Batt. F, 5th Field Artillery.....	Chainman
Chittick, Ernest	Chainman
Chrisman, William.....	Chainman
Coats, Solomon	Chainman
Conway, M. A., Navy	Timekeeper
Cook, Harold, Private, S. A. T. C., Willamette University.....	Blueprinter
Cooley, Lorrin D., Company Mechanic, 11th Co., Coast Artillery.....	Chainman
Cowgill, W. C. Jr., 1st Provisional Co., 32d Engineers.....	Resident Engineer
Cutler, Oscar, 472d Engineer Reg.....	Locating Engineer
Glass, D. G., 2d Lieut., Co. D, 42d Engineers.....	Locating Engineer
Grabenhorst, Eugene B., Private, Co. P, 5th Bn., 22d Engineers.....	Instrumentman
Green, E. R., Private, Co. A, 23d Engineers.....	Resident Engineer
Greenwood, P. S.....	Transitman
Grey, Ulric R, Camp 4-C, Spruce Squadron.....	Instrumentman
Hale, E. E.....	Chainman
Harris, Milton, 2d Lieut.	Transitman
Hodgman, K. E., Captain, Spruce Division, Signal Corps.....	Resident Engineer
Hyatt, Waldron, 22d Co., 1st Regiment, U. S. Marine Corps.....	Instrumentman
Ingels, Hollis G., H. Q. Co., 62d Inf.	Levelman
Ingram, R. C., Corporal, Co. L, 23d Engineers.....	Draftsman
Isakson, C. O., 1st Lieut., 12th Engineers	Instrumentman
Jones, Melville S., Master Engineer, Co. C, 116th Engineers.....	Computer
Judd, Henry C, 3d Co., Coast Artillery.....	Chainman
Junken, Fred S., Navy	Rodman

HONOR ROLL—Continued

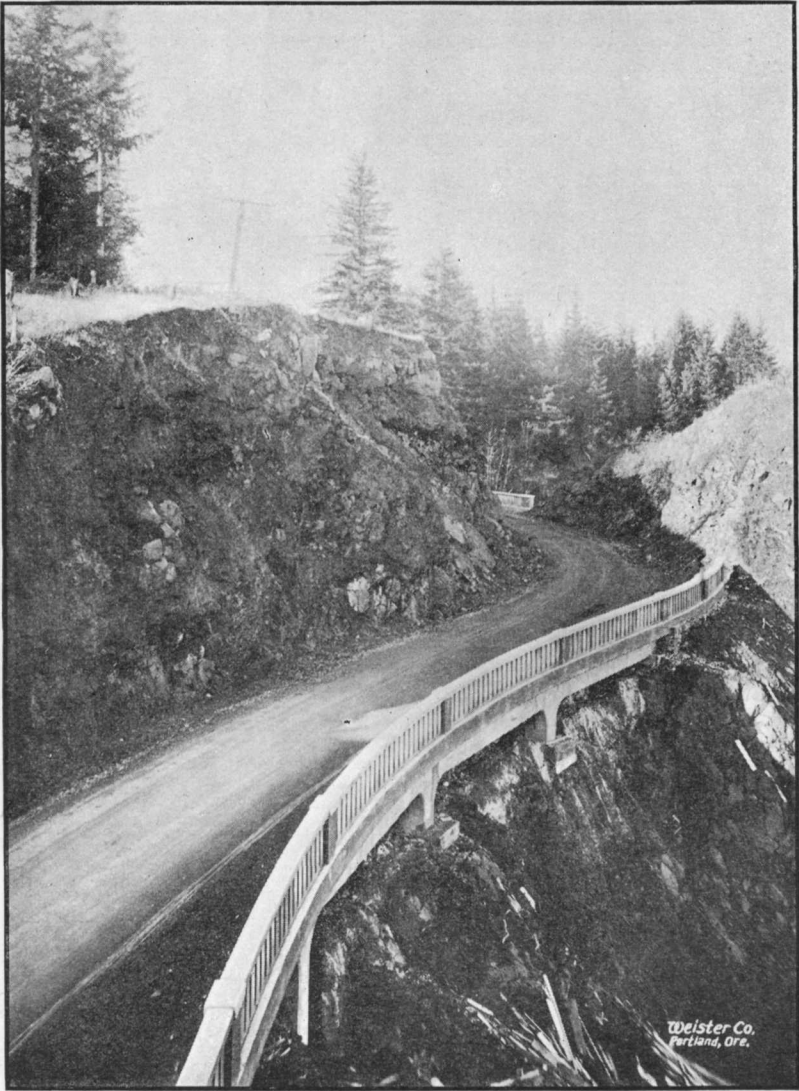
Name and Company	Former Position with Department
-Kelley, C. C., 1st Lieut., Co. E, 2d Bn., 20th Engineers.....	District Engineer
Kinsey, Claude, Co. A, 20th Engineers	Instrumentman
Lawrence, Perry, Amb. Co. No. 361	Topographer
-Lytle, K. D., Co. C, 43d Engineers	Transitman
McClintock, John, Hospital Unit, Coast Artillery	Chainman
McClintock, Leon, Hospital Unit, Coast Artillery	Rodman
-May, Aloys H.	Transit Rodman
Metzger, Floyd S., Co. C. Q. M. Unit No. 305.....	Timekeeper
Miller, E. V.	Draftsman
Miller, Ralph W. E., Corporal, Co. I, 62d Infantry.....	Costkeeper
Minton, Joseph, Co. M, 162d Infantry	Rodman
Moe, Forrest L., 9th Co. Coast Artillery	Chainman
Moore, Don H., Co. A, 116th Engineers	Chainman
Moore, Merton, Co. A, 116th Engineers	Chainman
Moore, Royal, Co. C, S. A. T. C., U. of California.....	Chainman
-Morgan, Silas B.	Rodman
Murdock, R. B., 2d Lieut., Co. C, 42d Engineers	District Engineer
Murphy, Thomas, Hospital Corps, 40th Division.....	Chainman
Noble, Chas. S., Y. M. C. A.	Locating Engineer
-Nunn, Roy, Sergeant, H. Q. Co., 166th Depot Brig.....	Resident Engineer
Oerding, Chas., Engineers	Chainman
Oerding, Harry, Co. A, 20th Engineers	Chainman
Quine, Ralph, Hospital Unit, Coast Artillery.....	Chainman
Reiter, C. G., 1st Lieut.	Locating Engineer
Rynning, P. B., Co. H, 23d Engineers	Resident Engineer
Schaffenberg, H.	Chainman
Smith, Frederic W., Co. C, Q. M. Unit No. 305	Timekeeper
-Smith, Thos. P.	Stakeman
Stretchberry, Ray, 17th Co., 23d Engineers	Rodman
Sutter, L. R., Co. F, 4th Engineers.....	Chainman
Tilley, Walker B., Co. K, 18th Railway Engineers.....	Instrumentman
Welborn, Forrest, Sergeant, 44th Machine Gun Company.....	Clerk
Wilson, Otis E.	Inspector
Withycombe, Earl, 20th Engineers	Resident Engineer
Vester, Albert	Chainman

SUMMARY

The classification of employes lost to the Department through enlistment in the Army is as follows:

District engineers	2	Timekeepers	3
Locating engineers	4	Inspectors	2
Resident engineers	6	Office clerks	1
Transitmen	9	Blue Printer	1
Draftsmen	2	Rodmen	6
Levelmen	1	Chainmen,	20
Computers	2		—
Topographers	1	Total number	60





REINFORCED CONCRETE HALF VIADUCT ON THE COLUMBIA RIVER HIGHWAY BETWEEN GOBLE AND RAINIER IN COLUMBIA COUNTY, CONSTRUCTED IN 1918

Financial Report

Fund Allotments and Expenditures

During the Fiscal Period

December 1, 1916, to November 30, 1918

Grand Total of Funds Allotted	\$4,271,515.16
Grand Total of Expenditures	3,597,982.47
	<hr/>
Balance on hand December 1st, 1918	\$ 673,532.69

The details of fund allotments and expenditures are set forth in tables as follows:

- Table I. Fund Allotments from all sources.
- Table II. Summary of Fund Allotments and Fund Expenditures.
- Table III. Expenditures Segregated by Counties.
- Table IV. Expenditures Segregated under the Headings of General Administrative, Surveys, Construction Engineering, Construction, Equipment and Unclassified.
- Table V. Expenditures for Construction Detailed by Jobs.
- Table VI. Expenditures for Surveys Detailed by Jobs.
- Table VII. Expenditures for Equipment, Bond Interest and Overhead.
- Table VIII. Summary of County Funds Expended by Department.

TABLE I

FUND ALLOTMENTS FROM ALL SOURCES—DECEMBER 1ST, 1916, TO
NOVEMBER 30TH, 1918

<i>One-Quarter Mill Tax Fund—</i>	
Balance on hand Dec. 1, 1916.....	\$ 94,418.14
Turnover January 1, 1917.....	219,690.98
Turnover January 1, 1918.....	232,151.39
Total	\$546,260.51
<i>Automobile License Fund—</i>	
Turnover October 1, 1917.....	\$150,000.00
Turnover April 1, 1918.....	300,000.00
Turnover October 1, 1918.....	125,000.00
Total	\$575,000.00
<i>Six Million Dollar Bond Fund—</i>	
Bond Sale, August 7, 1917.....	\$471,300.00
Accrued Interest.....	2,333.33
Bond Sale, September 12, 1917.....	472,130.00
Accrued Interest.....	1,833.33
Bond Sale, March 15, 1918.....	456,850.00
Accrued Interest.....	222.22
Bond Sale, July 9, 1918.....	643,770.00
Accrued Interest.....	2,606.54
Total	\$2,050,045.42
<i>State and Federal Co-operative Bond Fund—</i>	
Bond Sale, August 18, 1917.....	\$388,040.00
Accrued Interest.....	2,844.44
Less expenditures by Board of Control.....	400.00
Total	\$390,484.44
<i>County Funds—</i>	
Payments on Vouchers drawn by Department.....	709,724.79
Grand Total Funds Allotted to Highway Department, December 1, 1916 to November 30, 1918.....	\$4,271,515.16

(For description of the several funds provided for the work of the Highway Department see pages 30 and 31.)

TABLE II

SUMMARY OF FUND ALLOTMENTS AND FUND EXPENDITURES—DECEMBER 1ST, 1916, TO NOVEMBER 30TH, 1918

Funds	Allotments	Expenditures	Balance December 1, 1918
One Quarter Mill Tax Fund.....	\$ 546,260.51	\$ 528,789.99	\$ 17,470.52
Automobile License Fund.....	575,000.00	281,902.67	293,097.33
Six Million Dollar Bond Fund.....	2,050,045.42	2,049,025.47	1,019.95
State and Federal Co-operative Bond Fund	390,484.44	28,539.55	361,944.89
Total State Funds.....	\$3,561,790.37	\$2,888,257.68	\$673,532.69
County Funds.....	709,724.79	709,724.79	
Grand Total.....	\$4,271,515.16	\$3,597,982.47	\$673,532.69

TABLE III

EXPENDITURES SEGREGATED BY COUNTIES (INCLUDING COUNTY FUNDS EXPENDED UNDER STATE SUPERVISION)—DECEMBER 1ST, 1916, TO NOVEMBER 30TH, 1918

County	State Funds	County Funds	Total
Baker	\$ 7,578.68	.....	\$ 7,578.68
Benton	47.56	\$ 479.20	526.76
Clackamas	155,861.10	43,091.14	198,952.24
Clatsop	344,387.23	.....	344,387.23
Columbia	488,302.15	.....	488,302.15
Coos	16,967.68	170,781.83	187,749.51
Crook	3,053.72	.....	3,053.72
Curry	5,629.24	.....	5,629.24
Deschutes	20,716.37	.....	20,716.37
Douglas	159,769.58	173,550.18	333,320.76
Gilliam	35,999.48	.....	35,999.48
Grant	7,468.78	291.10	7,759.88
Harney	1,873.45	.....	1,873.45
Hood River	433,928.22	3,968.49	437,896.71
Jackson	86,619.88	.....	86,619.88
Josephine	77,998.14	.....	77,998.14
Klamath	819.23	.....	819.23
Lake	15,391.67	.....	15,391.67
Lane	14,529.52	.....	14,529.52
Lincoln	2,997.47	.....	2,997.47
Linn	791.07	5.00	796.07
Malheur	866.65	.....	866.65
Marion	5,083.59	223,794.99	228,878.58
Morrow	10,863.10	1,009.44	11,872.54
Polk	802.92	17,200.70	18,008.62
Sherman	3,052.14	.....	3,052.14
Tillamook	68,274.29	26,009.84	94,284.13
Umatilla	173,942.50	3,542.75	177,485.25
Union	32,188.17	78.59	32,266.76
Wallowa	765.07	.....	765.07
Wasco	4,313.79	19.45	4,333.24
Washington	246,769.05	9,395.00	256,164.05
Wheeler	69,214.78	18,233.60	87,448.38
Yamhill	124,958.84	18,273.49	143,232.33
Totals	\$2,621,825.11	\$709,724.79	\$3,331,549.90

TABLE IV

EXPENDITURES SEGREGATED UNDER THE HEADINGS OF GENERAL ADMINISTRATION, SURVEYS, CONSTRUCTION ENGINEERING, CONSTRUCTION, EQUIPMENT AND UNCLASSIFIED.

Classification	Total	State Funds	County Funds
General Administration and Supervision..	\$ 97,621.82	\$ 97,621.82	.....
Surveys and Engineering County Work...	144,086.67	137,954.74	\$ 6,131.93
Construction Engineering.....	127,806.58	127,803.08	2.50
Construction	3,059,657.65	2,356,067.29	703,590.36
Equipment	86,717.55	86,717.55	.....
Unclassified (Interest on Bonds, etc.)....	82,093.20	82,093.20	.....
Grand Total Expenditures.....	\$3,597,982.47	\$2,888,257.68	\$709,724.79

TABLE V
EXPENDITURES FOR CONSTRUCTION WORK DETAILED BY JOBS—DECEMBER 1ST, 1916, TO NOVEMBER 30TH, 1918

JOBS	TOTALS		STATE FUNDS		COUNTY FUNDS		Construction engineering cost. Included in preceding columns
	Estimated total cost of job	Expended to date	State's share of estimated cost	Expended from State funds to date	County's share of estimated cost	Expended from County funds to date	
Clackamas County:							
Paving—Oregon City to Canby	\$ 135,000.00	\$ 102,114.85	\$ 135,000.00	\$ 102,114.85	\$ 25,000.00	\$ 22,092.53	\$ 2,444.57
Grading—Cushman Hill Section	27,500.00	24,037.20	2,500.00	1,944.67	16,789.51	15,769.91	1,944.67
Grading and Rock Crushing—New Era	66,000.00	63,047.79	60,240.09	47,287.88	5,238.70	5,238.70	3,552.82
Grading—Multnomah Co. Line to Oswego	5,746.68	7,746.68	507.98	507.98			507.98
Clatsop County:							
Grading and Paving—Astoria to Svensen	236,000.00	96,955.97	236,000.00	96,955.97			5,906.19
Macadamizing—Svensen to Columbia Co. Line	216,000.00	210,079.16	216,000.00	210,079.16			4,443.13
John Day River Bridge east of Astoria	25,000.00	21,051.52	25,000.00	21,051.52			734.91
Plymouth Creek Bridge at Westport	6,413.19	6,413.19	6,413.19	6,413.19			255.08
Big Creek Bridge near Knappa	8,446.70	8,446.70	8,446.70	8,446.70			140.99
Little Creek Culvert near Knappa	929.69	929.69	929.69	929.69			140.99
Miscellaneous charges on work prior to 1917	247.94	247.94	247.94	247.94			37.02
Columbia County:							
Paving—Multnomah Co. Line to Seapooose	37,652.59	37,652.59	37,652.59	37,652.59			1,364.28
Macadam—Clatsop Co. Line to Clatskanie	121,000.00	118,922.90	121,000.00	118,922.90			554.62
Macadam—Clatskanie to Delena	142,000.00	135,650.40	142,000.00	135,650.40			5,398.96
Macadam—Delena to Goble	49,955.08	49,955.08	49,955.08	49,955.08			2,902.35
Macadam—Goble Section	23,000.00	21,478.97	23,000.00	21,478.97			548.12
Grading—Goble Section	45,282.64	46,262.64	46,262.64	46,262.64			2,925.64
Grading—Rainier Hill Section	6,550.61	6,550.61	6,550.61	6,550.61			468.38
Grading—Beaver Valley Section	20,978.22	20,978.22	20,978.22	20,978.22			163.30
Grading—Deer Island Section	2,398.10	2,398.10	2,398.10	2,398.10			
Concrete Viaduct, Cribbing and Masonry Wall, near Prescott	9,039.86	9,039.86	9,039.86	9,039.86			580.53
Beaver Valley Bridges	32,000.00	29,808.58	32,000.00	29,808.58			922.54
Seapooose Culvert	1,834.60	1,834.60	1,834.60	1,834.60			
Goble Creek Bridge near Goble	5,907.14	5,907.14	5,907.14	5,907.14			77.47
Graham Creek Culvert near Clatskanie	804.49	804.49	804.49	804.49			31.98
Coos County:							
Coast Highway and Myrtle Point—Coquille Road	180,235.18	180,235.18	9,453.35	9,453.35	170,781.83	170,781.83	14,612.33
Crook County:							
Ochoco Canyon Forest Road Project	52,500.00	3,053.72	17,500.00	3,053.72	17,500.00		
(Federal Government cooperates on this project to the amount of \$17,500.00.)							

TABLE V—Continued

JOBS	TOTALS		STATE FUNDS		COUNTY FUNDS		Construction engineering cost included in preceding columns
	Estimated total cost of job	Expended to date	State's share of Estimated cost.	Expended from State funds to date	County's share of estimated cost	Expended from County funds to date	
Umattila County:							
Paving—Wild Horse Creek Section.....	162,626.56	162,626.56	162,626.56	162,626.56			2,609.88
Union County:							
Grading—LaGrande to Hot Lake	5,000.16	5,000.16	5,000.16	5,000.16			821.68
Grading—Elgin-Minam Post Road Project.....	41,151.00	3,838.44	20,575.50	3,838.44			377.80
(The Federal Government cooperates on this project to the amount of \$20,575.50)							
Grading—Union-Telocaset Post Road Project.....	30,000.00	16,642.29	15,000.00	16,642.29			1,183.22
(The Federal Government cooperates on this project to the amount of \$15,000.00.)							
Washington County:							
Grading and Paving—Multnomah Co. Line to Newberg	332,000.00	278,976.93	322,605.00	269,581.93	9,395.00	9,395.00	9,445.56
Onion Flat Trestle near Sherwood	8,372.22	8,372.22	8,372.22	8,372.22			197.87
Tualatin River Bridge near Tigardville.....	12,968.60	12,968.60	12,968.60	12,968.60			
Fanno Creek Bridge near Tigard	1,882.81	1,882.81	1,882.81	1,882.81			
Wheeler County:							
Grading—Cummins Hill Section	14,532.35	14,532.35	7,065.15	7,065.15	7,527.20	7,527.20	1,402.73
Macadam—Cummins Hill Section	34,000.00	32,465.44	34,000.00	32,465.44			1,313.82
Grading—Bridge Creek Section	24,235.45	24,235.45	14,235.45	14,235.45	10,000.00	10,000.00	635.30
Resurfacing—between Fossil and Condon.....	15,000.00	444.88	15,000.00	444.88			
Yamhill County:							
Grading Rex to Newberg	6,153.05	6,153.05			6,153.05	6,153.05	
Sheridan Paving, 1917	38,216.04	38,216.04	28,216.04	28,216.04	10,000.00	10,000.00	1,131.35
Sheridan Paving, 1918	40,065.61	40,065.61	37,945.17	37,945.17	2,120.44	2,120.44	1,166.85
Completion of Sour Grass Cut-off	5,111.19	5,111.19	5,111.19	5,111.19			157.39
Totals.....	\$3,795,861.61	\$3,187,463.23	\$2,987,207.78	\$2,483,870.37	\$755,328.33	\$709,592.86	\$127,806.58

SUMMARY

State.....	Estimated total cost	Expended to date
County.....	\$2,937,207.78	\$2,483,870.37
Federal Government	755,328.33	703,592.86
	103,325.50	
Totals.....	\$3,795,861.61	\$3,187,463.23

TABLE VI

EXPENDITURES FOR SURVEYS AND ENGINEERING COUNTY CONSTRUCTION DETAILED BY JOBS—DECEMBER 1, 1916, TO NOVEMBER 30, 1918

JOBS	EXPENDITURES		
	By State	By County	Total
Baker County			
Survey, Baker-Middle Bridge Section.....	\$ 2,806.77	.....	\$ 2,806.77
Survey, Middle Bridge-Black Bridge Section	2,422.54	.....	2,422.54
Survey, Canyon Sec. of Baker-Cornucopia Road	928.08	.....	928.08
Survey, Sag Section of Baker-Cornucopia Road	719.61	.....	719.61
Survey, Unity to Baker.....	645.29	.....	645.29
Benton County			
Reconnaissance	47.56	.....	47.56
Survey, Corvallis to Polk County Line.....	.....	\$ 479.20	479.20
Clackamas County			
Survey, Zig Zag Creek Forest Road Project	427.30	.....	427.30
Survey, Oswego to Oregon City.....	972.85	.....	972.85
Survey, Oregon City to New Era.....	1,429.28	.....	1,429.28
Survey, Canby to Aurora.....	1,176.29	.....	1,176.29
Clatsop County			
Reconnaissance, Coast & Col. River Highways	471.05	.....	471.05
Columbia County			
Reconnaissance, Columbia River Highway	170.93	.....	170.93
Survey, Columbia City to Scappoose.....	177.04	.....	177.04
Coos County			
Survey, Coast Hwy. & Myrtle Point-Coquille Road	5,737.53	.....	5,737.53
Survey, Myrtle Point to Douglas County Line	1,456.80	.....	1,456.80
Curry County			
Survey, Coast Highway	5,629.24	.....	5,629.24
Deschutes County			
Survey, Harney County Line West Seven Miles	532.77	.....	532.77
Douglas County			
Survey, Canyon Creek Pass to Johns Ranch	197.89	.....	197.89
Survey, Johns Ranch to Jacques Ranch.....	829.03	.....	829.03
Survey, Brockway to Round Prairie.....	280.00	.....	280.00
Survey, Roseburg to Coos County Line.....	2,665.93	.....	2,665.93
Survey, Canyonville-Galesville Forest Project	442.99	.....	442.99
Miscell. Surveys and Reconnaissance.....	808.61	.....	808.61
Gilliam County			
Survey, John Day River to Blalock.....	3,865.66	.....	3,865.66
Survey and Engineering County Const. John Day River to Arlington.....	\$ 981.27	.....	\$ 981.27
Grant County			
Survey, Big Basin Section of John Day Highway	4,322.92	291.10	4,614.02
Survey, & Engineering County Const. Fisk Creek to Hall Hill.....	1,596.28	.....	1,596.28
Survey, Hall Hill to Prairie City.....	384.19	.....	384.19
Survey, John Day to Fisk Creek.....	1,165.39	.....	1,165.39
Harney County			
Survey, Burns to Crane.....	922.55	.....	922.55
Survey, Sage Hen to Burns.....	719.74	.....	719.74
Survey, Deschutes Co. Line East Seven Miles	231.16	.....	231.16
Hood River County			
Survey, Hood River to Mosler (Two Routes)	6,877.56	.....	6,877.56

TABLE VI—Continued

JOBS	EXPENDITURES		
	By State	By County	Total
Jackson County			
Survey, Ashland to Klamath Falls.....	\$ 2,789.87	.....	\$ 2,789.87
Survey, Medford to Crater Lake.....	1,151.78	.....	1,151.78
Josephine County			
Survey, Wolf Creek to Grave Creek.....	1,110.70	.....	1,110.70
Survey, Grave Creek to Grants Pass.....	2,038.11	.....	2,038.11
Survey, Wolf Creek to Stage Road Pass.....	151.33	.....	151.33
Engineering County Const. Grants Pass to Jackson County Line.....	1,117.07	.....	1,117.07
Klamath County			
Reconnaissance, Klamath Falls to Olene..	124.58	.....	124.58
Survey, Klamath Falls to Chiloquin.....	377.21	.....	377.21
Survey, Chiloquin to Sand Creek.....	172.95	.....	172.95
Survey, Anna Creek Forest Road Project	144.49	.....	144.49
Lane County			
Survey, Goshen to Cottage Grove.....	1,051.48	.....	1,051.48
Survey, Eugene to Florence.....	6,555.84	.....	6,555.84
Survey for Overhead Crossing at Divide..	233.25	.....	233.25
Lincoln County			
Surveys for Bridge at Toledo and Wald- port	293.42	.....	293.42
Linn County			
Survey, Albany to Jefferson.....	791.07	\$ 5.00	796.07
Malheur County			
Reconnaissance	93.02	.....	93.02
Survey, Cow Valley-Brogan Section.....	773.63	.....	773.63
Marion County			
Survey, Salem-Aurora	2,463.75	.....	2,463.75
Survey, Salem-Jefferson	2,511.84	.....	2,511.84
Morrow County			
Survey, Columbia River Highway.....	2,546.57	1,009.44	3,556.01
Survey, Oregon-Washington Highway.....	6,831.56	.....	6,831.56
Engineering County Const. Oregon-Wash- ington Highway	1,428.47	.....	1,428.47
Polk County			
Survey Between Monmouth and Dallas...	115.30	.....	115.30
Survey Near Eola.....	67.43	.....	67.43
Survey, Independence to Benton County Line	200.25	.....	200.25
Sherman County			
Survey, Columbia River Highway.....	2,995.64	.....	2,995.64
Tillamook County			
Survey, Tillamook to Hebo.....	807.03	.....	807.03
Survey, Neskowin to Salmon River.....	2,628.59	.....	2,628.59
Umatilla County			
Survey, Pendleton to Kamela.....	5,624.73	1,575.29	7,200.02
Survey, Pendleton to Umatilla.....	3,759.87	1,684.76	5,444.63
Survey, Pendleton to Gilliam Co. Line via Pilot Rock	1,793.58	282.70	2,076.28
Engineering County Const., Pendleton to Poor Farm	81.26	.....	81.26
Union County			
Survey, La Grande to Kamela.....	2,737.34	78.59	2,815.93
Survey, La Grande to Minam.....	2,834.18	.....	2,834.18
Survey, Union to Telocaset.....	364.64	.....	364.64
Survey, La Grande to Union.....	714.62	.....	714.62
Wallowa County			
Survey, Flora-Enterprise Forest Road Project	765.07	.....	765.07
Wasco County			
Survey, Seuferts to Deschutes River.....	1,757.29	.....	1,757.29
Design, Culvert over Three Mile Creek...	.....	19.45	19.45

TABLE VI—Continued

JOBS	EXPENDITURES		
	By State	By County	Total
Washington County			
Survey, Multnomah Co. Line to Newberg	\$ 2,036.55	.....	\$ 2,036.55
Survey and Engineering County Const.			
Beaverton to Gaston.....	2,326.94	.....	2,326.94
Wheeler County			
Survey, John Day River Highway.....	7,492.22	\$ 706.40	8,198.62
Survey, Mitchell to Dayville.....	5,451.58	.....	5,451.58
Survey, Fossil to Gilliam County Line...	791.47	.....	791.47
Survey, Ochoco Canyon Forest Road Pro-			
ject	242.26	.....	242.26
Engineering County Const. Sarvice Creek			
Summit Section	550.51	.....	550.51
Engineering County Const. Fossil to Gil-			
ham County Line	507.20	.....	507.20
Engineering County Const. Sigfrid Hill			
Section	28.62	.....	28.62
Yamhill County			
Survey, McMinnville to Dayton.....	655.03	.....	655.03
Survey, Grand Ronde Section.....	2,631.41	.....	2,631.41
Miscellaneous			
Reconnaissance Surveys in various Coun-			
ties	1,200.04	.....	1,200.04
Total expenditure for Surveys and Engi-			
neering County Construction Work.....	\$137,954.74	\$ 6,131.99	\$144,086.67

TABLE VII

GENERAL EXPENDITURES—DECEMBER 1, 1916; TO NOVEMBER 30, 1918

Administrative and General Supervision:

General Administrative.....	\$ 14,706.67
State Highway Commissioners.....	4,863.11
Auditing Department.....	14,770.77
Purchasing Department.....	531.17
Office Engineering Department.....	9,636.90
Bridge Department.....	15,064.48
Fendleton Office.....	10,917.05
Roseburg Office.....	819.59
State Highway Engineer and Assistants.....	26,322.08
Total	\$ 97,621.82

Equipment and Stock:

Equipment (This item represents all expenditures for purchase and maintenance of heavy equipment less monthly rentals charged against jobs).....	\$ 78,775.26
Stock (This item represents all expenditures for supplies and materials bought and held for distribution, less deductions made as supplies and materials are shipped out and charged to jobs).....	5,721.08
Construction of New Warehouse at Salem.....	2,221.21
Total	\$ 86,717.55

Unclassified:

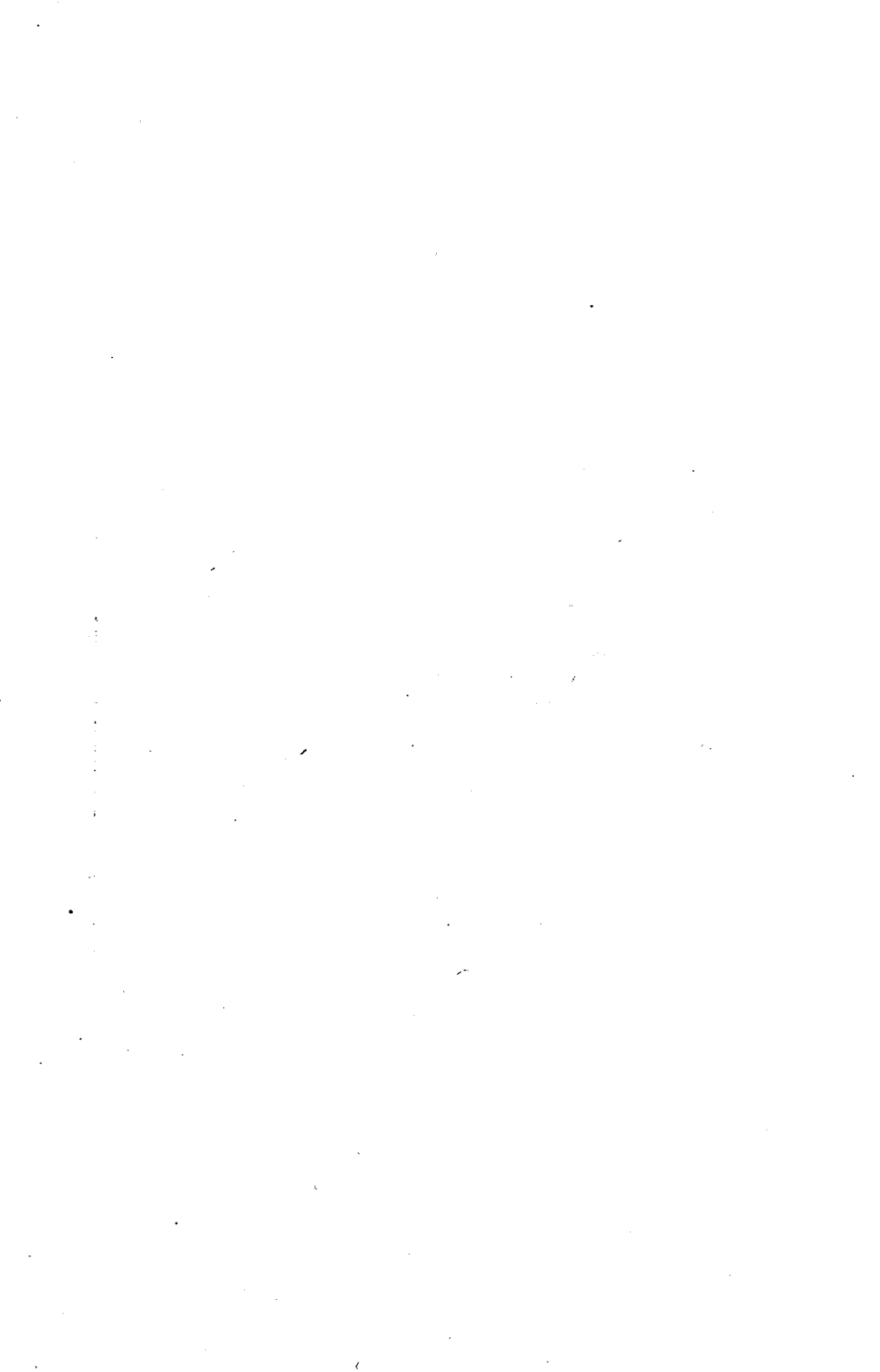
Interest and other costs on bonds.....	\$ 82,083.05
Miscellaneous	10.15
Total	\$ 82,093.20

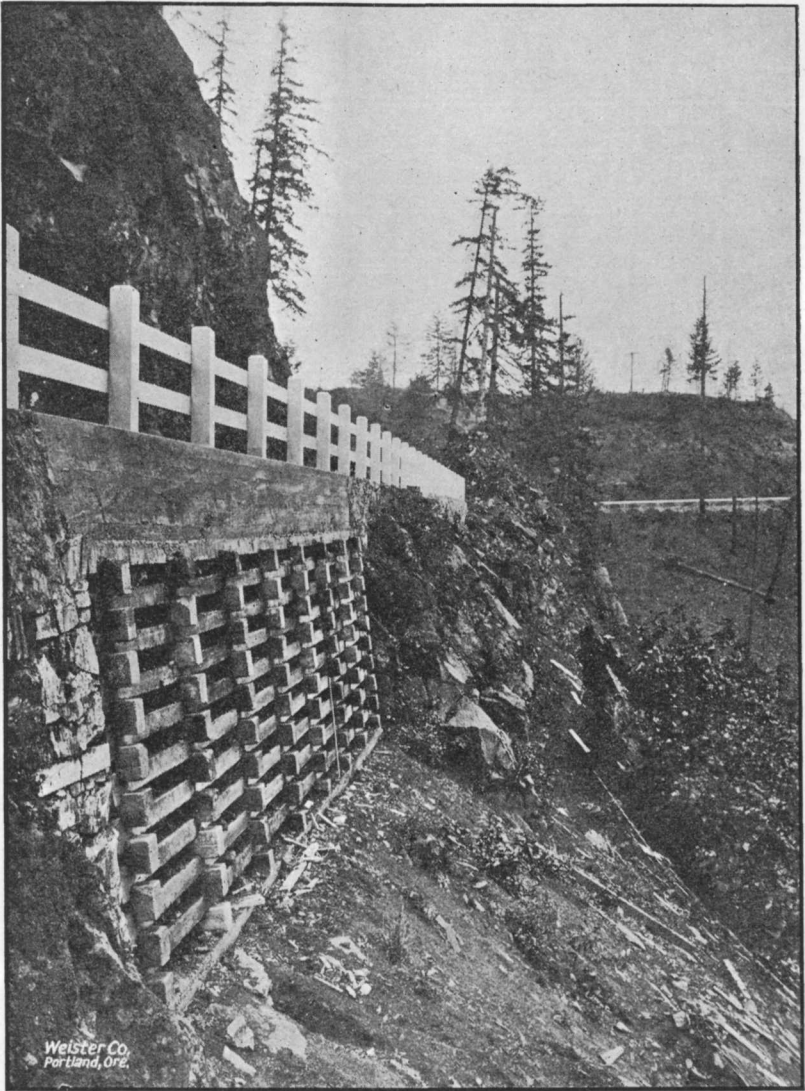
TABLE VIII

COUNTY FUNDS EXPENDED BY STATE HIGHWAY DEPARTMENT—
DECEMBER 1, 1916 TO NOVEMBER 30, 1918.

County	Amount on Each Job	Totals for Each County
Benton County		
Survey-Independence to Corvallis.....	\$ 479.20	\$ 479.20
Clackamas County		
Grading—New Era to Canemah.....	37,852.44	.....
Grading—Multnomah County Line to Oswego.....	5,238.70	43,091.14
Coos County		
Grading—Coast Highway & Coquille-Myrtle Point Rd.	160,781.83	160,781.83
Douglas County		
Grading—Divide to Comstock.....	17,119.44	.....
Grading and Macadam—Comstock to Leona.....	74,349.72	.....
Grading—Oakland to Yoncalla.....	82,081.02	173,550.18
Grant County		
Survey—John Day River Highway.....	291.10	291.10
Hood River County		
Hood River Bridge.....	3,968.49	3,968.49
Linn County		
Survey—Albany to Jefferson.....	5.00	5.00
Marion County		
Salem Bridge.....	223,794.99	223,794.99
Morrow County		
Survey of Columbia River Highway.....	1,009.44	1,009.44
Polk County		
Approach to Salem Bridge.....	4,548.10	.....
Dallas Bridge.....	10,754.43	.....
Bridge between Monmouth and Dallas.....	1,898.17	17,200.70
Tillamook County		
Grading & Paving—Tillamook to Cloverdale.....	26,009.84	26,009.84
Umatilla County		
Surveys—Pendleton to Echo.....	1,684.76	.....
Surveys—Pendleton to Pilot Rock.....	282.70	.....
Surveys—Pendleton to Kamela.....	1,575.29	3,542.75
Union County		
Surveys—LaGrande to Kamela.....	78.59	78.59
Wasco County		
Design for Three Mile Creek Bridge.....	19.45	19.45
Washington County		
Grading—Multnomah Co. Line to Newberg.....	9,395.00	9,395.00
Wheeler County		
Grading—Cummins Hill Section.....	7,527.20	.....
Grading—Bridge Creek Section.....	10,000.00	.....
Surveys—John Day River Highway.....	706.40	18,233.60
Yamhill County		
Grading—Rex to Newberg.....	6,153.05	.....
Sheridan Paving, 1917.....	10,000.00	.....
Sheridan Paving 1918.....	2,120.44	18,273.49
Total County Funds Expended by Department.....		\$709,724.79

The above tabulated amounts cover only those expenditures made on vouchers drawn by the Highway Department. The Department has supervised a very large amount of County construction upon which payment has been made direct by the County, which payments are not included above.





REINFORCED CONCRETE CRIBBIN NEAR PRESCOTT ON THE COLUMBIA RIVER
HIGHWAY IN COLUMBIA COUNTY. BUILT IN 1918

General Tabulated Information

and

Highway Maps

TABLES

Table A—Miles of Highway Construction Completed by the Highway Department during 1917 and 1918.

Table B—Tabulation of Bridge Design and Construction.

Table C—Miles of Location Surveys made by the Department during 1917 and 1918.

Table D—Miles of Different Types of Roads in each County.

Table E—Motor Vehicle Registration by Counties.

Table F—County Bond Issues.

Table G—Tabulation of Contract Prices.

Table H—Yearly Expenditure of State Funds in Counties.

Table I—Mileage Table of Main Traveled Roads.

Table J—Official Designation of State Highways.

Table K—Employes of the State Highway Department.

Table L—Numbers and Mileages of State Highways.

MAPS

Map I.—Main Traveled Roads of the State.

Map II.—State Highway System.

TABLE A
MILES OF HIGHWAY CONSTRUCTED BY HIGHWAY DEPARTMENT
1917-1918

Jobs	Concrete Pavement	Bituminous Pavement	Broken Stone Macadam	Gravel Macadam	Grading
Clackamas County— Oregon City to Canby.....		7.5			
New Era to Oregon City.....					4.5
Multnomah County Line to Oswego .....					.2
Clatsop County— Astoria to Svensen.....		3.5	5.5		1.2
Svensen to Westport.....			17.2	1.7	
Columbia County— Multnomah County Line-Scap- poose		2.5			
Westport to Clatskanie.....			8.6		
Clatskanie to Delena.....			9.0		
Delena to Goble.....			7.6		
Goble Section.....			2.0		2.0
Beaver Valley Section.....					4.0
Rainier Hill Section.....					2.2
Coos County— Marshfield to Curry County Line					20.0
Coquille to Myrtle Point.....					3.0
Deschutes County— Bend to Lapine (cinder ma- cadam)				12.5	
Douglas County— Myrtle Creek to Dillard.....					12.8
Oakland to Yoncalla.....					10.4
Divide to Comstock.....			2.4		2.4
Comstock to Leona.....			4.6		4.6
Gilliam County— Mayville to Wheeler County Line			1.0		
Condon to Thirty Mile Creek..			5.7		
Hood River County— Cascade Locks Section.....					8.2
Viento Section.....					3.6
Ruthton Hill Section.....					2.4
Cascade Locks to Hood River				18.0	
Jackson County— Siskiyou Mountain Section.....			6.5		
Ashland Undercrossing.....					.8
Ashland Paving .....	.8				
Josephine County— Wolf Creek to Grave Creek..					4.9
Grants Pass-Jackson County Line					3.3
Lake County— Lakeview to Paisley.....			4.0		6.4
Lane County— Divide to Cottage Grove.....			1.0		
Lincoln County— Pioneer Mountain Section.....					1.0
Tillamook County— Tillamook-Cloverdale Paving		5.0			5.0

TABLE A—Continued

Jobs	Concrete Pavement	Bituminous Pavement	Broken Stone Macadam	Gravel Macadam	Grading
Umatilla County—					
Pendleton-Adams Section.....		10.0			
Pendleton-West		1.0			
Union County—					
Elgin to Minam.....					.8
Union to Telocaset.....					3.0
La Grande to Hot Lake.....					3.7
Washington County—					
Multnomah County Line to Newberg		12.5			12.5
Wheeler County—					
Cummins Hill Section.....			3.5		3.5
Fossil-Cummins Hill Section..			1.0		
Bridge Creek Section.....					.9
Yamhill County—					
Sheridan Paving.....	4.0				4.0
Multnomah County Line, Newberg Paving		3.2			3.2
Totals	4.8	45.2	79.6	32.2	134.5

TABLE B
BRIDGE AND CULVERT DESIGN AND CONSTRUCTION DECEMBER 1ST, 1916, TO NOVEMBER 30TH, 1918

Name of Structure	Structure No.	Type of Structure	Total Length of Bridges and Approaches (Feet)	Width of Road-way (Feet)	Loading (See Footnote)	TOTAL COST Actual Cost if Complete; Estimated if Un-completed
Benton:						
Culvert on West Side Highway, 4 1/2 Mi. No. of Corvallis	207	Double 5'x5' R. C. Culvert	12	24	Heavy	800.00
Culvert on West Side Highway, 5 mi. No. of Corvallis	208	Double 6'x8' R. C. Culvert	14	24	Heavy	1,300.00
Bridge over Mill Race, South of Corvallis	230	Reinforced concrete bridge	85	20	Heavy	7,000.00
Clatsop:						
Drawbridge over John Day River	148	2-108' Wood Spans, 1-40' Lift Span	296	18	Heavy	25,000.00
Plympton Creek Bridge at Westport	185	R. C. Thru Span	60	20	Heavy	6,413.19
Big Creek Bridge near Knappa	186	R. C. Bridge	90	20	Heavy	8,446.70
Little Creek Culvert near Knappa	198	6'x12' R. C. Culvert	14	24	Heavy	929.69
Bridge over McDonald's Log Chute on Columbia River Hwy.	214	20' R. C. Bridge	20	20	Heavy	1,600.00
Columbia:						
Beaver Creek Bridge No. 1	132	90' R. C. Bridge	90	20	Heavy	5,000.00
Beaver Creek Bridge No. 2	134	70' R. C. Bridge	70	20	Heavy	4,300.00
Beaver Creek Bridge No. 3	136	70' R. C. Bridge	70	20	Heavy	4,300.00
Beaver Creek Bridge No. 4	138	70' R. C. Bridge	70	20	Heavy	4,300.00
Beaver Creek Bridge No. 5	140	60' R. C. Bridge	60	20	Heavy	3,200.00
Beaver Creek Bridge No. 6	142	70' R. C. Bridge	70	20	Heavy	3,200.00
Beaver Creek Bridge No. 7	144	60' R. C. Bridge	60	20	Heavy	3,200.00
Beaver Creek Bridge No. 8	146	50' R. C. Bridge	50	20	Heavy	3,200.00
Beaver Creek Bridge No. "A"	157	70' R. C. Bridge	70	20	Heavy	3,200.00
Beaver Creek Bridge No. "B"	155	105' R. C. Bridge	106	20	Heavy	3,600.00
Beaver Creek Bridge No. 10	150	30' R. C. Bridge	30	20	Heavy	3,600.00
Beaver Creek Bridge No. 11	152	30' R. C. Bridge	30	20	Heavy	3,600.00
Culvert near Scappoose on Columbia River Highway						
Graham Creek Culvert near Clatskanie	188	8'x10' R. C. Culvert	12	24	Heavy	1,834.60
Goble Creek Bridge at Goble	194	Double 8'x8' R. C. Box	14	24	Heavy	804.49
Half viaduct near Little Jack Falls	236	90' R. C. Bridge	90	20	Heavy	5,307.14
Coos:						
Overhead Railway Crossing at Overland	110	R. C. Viaduct	114	18	Heavy	10,000.00
45' Wooden Truss	111	Wooden truss	45	24	Medium	500.00
Haynes Slough Bridge	113	40' Lift (Wood)	60	16	Medium	4,000.00

North Slough Bridge.....	114	40' Lift (Wood)	16	Medium	†	4,000.00
Jathmus Slough Bridge.....	115	30' Draw Span	16	Medium	†	12,500.00
Larson Slough Bridge.....	116	80' Wood Lift and Trestle	60	Medium	†	4,500.00
Powers Bridge.....	252	2-126' Wood Spans	520	Medium	†	12,000.00
Bridge at Gravel Ford—No. Fork of Co- quille River.....	125	126' Wood Span	790	Medium	†	8,000.00
Douglas:						
Pheasant Creek Culvert near Curtin.....	187	8'x8' R. C. Culvert	10	Heavy	*	1,804.89
Pass Creek Culvert, 1 mi. North of Corstock.....	194	20' R. C. Bridge	20	Heavy	*	2,184.00
Umpqua River Bridge South of Dilhard.....	195	2-144' Wood Spans	340	Heavy	*	19,000.00
Rock Creek Bridge near Anlauf.....	196	30' R. C. Bridge	30	Heavy	*	2,163.70
Umpqua River Bridge North of Dillard.....	202	3-144' Wood Spans	480	Heavy	*	26,500.00
20' R. C. Bridge.....	216	20' R. C. Bridge	20	Heavy	†	1,200.00
Vantyne Creek Bridge between Myrtle Creek and Dillard.....	234	60' R. C. Bridge	60	Heavy	*	3,575.70
Viaduct 1 mile North of Myrtle Creek.....	245	58' R. C. Viaduct	58	Heavy	*	2,684.54
Viaduct 1 mile North of Myrtle Creek.....	246	45' R. C. Viaduct	45	Heavy	*	2,413.23
Pass Creek Culvert 1 1/2 miles North of Com- stock.....	190	Double 6'x7' R. C. Culvert	14	Heavy	*	1,380.03
Grant:						
John Day River Bridge at Monument.....	124	180' Wood Span	450	Medium	†	11,000.00
Gulch.....	239	40' Wood Span	40	Medium	†	700.00
Gulch.....	240	40' Wood Span	52	Medium	†	700.00
Gulch.....	241	40' Wood Span	52	Medium	†	700.00
Rock Creek.....	242	40' Wood Span	36	Medium	†	1,700.00
John Day River at Goose Rock.....	243	108' Wood Span	150	Medium	†	8,800.00
North Fork John Day River.....	244	144' Wood Span	184	Medium	†	11,500.00
Holmes Creek.....	255	40' Wood Span	78	Medium	†	1,500.00
Rattlesnake Creek.....	256	40' Wood Span	52	Medium	†	1,000.00
Dixie Creek Bridge at Prairie City.....	282	50' Wood Span	50	Medium	*	6,000.00
Hood River:						
East Fork of Hood River.....	119	140' R. C. Viaduct	140	Heavy	†	8,400.00
Neal Creek Bridge.....	120	25' Bridge R. C.	25	Heavy	†	1,000.00
Bridge over Hood River at Dee.....	121	126' Wood Span	126	Medium	†	3,500.00
Odel Creek Bridge.....	122	15' R. C. Bridge	15	Heavy	†	600.00
Herman Creek Bridge.....	129	100' R. C. Bridge	100	Heavy	†	7,389.06
Culvert for Flume Line at Mitchell Point.....	182	3'x6 1/2' R. C. Culvert	8	Heavy	*	3,778.44
Culvert for Pipe Line at Cascade Locks.....	171	20' R. C. Bridge	20	Heavy	*	642.41
Viento Creek Bridge at Viento.....	172	50' R. C. Bridge	50	Heavy	*	1,650.97
Gorton Creek Bridge.....	173	50' R. C. Bridge	50	Heavy	*	3,153.90
Parham Creek Culvert near Viento.....	182	4'x10' R. C. Culvert	12	Heavy	*	968.85
Indian Creek.....	187	Culvert	10	Heavy	†	1,500.00
Hood River Bridge at Hood River.....	200	420' R. C. Arch and Viaduct	420	Heavy	†	48,000.00
Half Viaduct on Ruthton Hill.....	273	54' Half Viaduct	74	Heavy	*	1,563.01

* Designed and construction supervised by Highway Department and construction super-
vised by Counties. † Designed by Highway Department but not yet constructed.
Where loading is referred to as "Heavy," the structure is designed for a twenty-ton roller and for 100 lbs. per sq. ft. Where
loading is referred to as "Medium," the structure is designed for a fifteen-ton roller and for 75 lbs. per sq. ft.

TABLE B—Continued

Name of Structure	Structure No.	Type of Structure	Total Length of Bridge and Approach (Feet)	Width of Roadway (Feet)	Loading (See Footnote)	TOTAL COST Actual Cost. Estimated if Un- Completed if Un- completed
Jackson: Big Applegate near Jacksonville	147	126' Wood Span, 100' approach	226	16	Medium	‡ 4,000.00
Joseline: Trestle over Dry Gulch East of Wolf Creek	210	120' Wood Trestle	120	18	Medium	* 1,852.78
Coyote Creek Bridge East of Wolf Creek	211	58' Wood Trestle	58	18	Medium	* 811.28
Lane: Overhead Railway Crossing at Divide	163	92' R. C. Viaduct	92	20	Heavy	‡ 6,500.00
Lincoln: Aisea River, 7 miles above Waldport	260	144' Wood Span	253	18	Medium	* 10,000.00
Linn: Bridge over Mill Race in Lebanon	274	40' R. C. Bridge	40	24	Heavy	‡ 2,000.00
Marion: Willamette River Bridge at Salem	123	Steel Bridge	2220	24	Heavy (†)	* 250,000.00
Slough	253	6'x7' R. C. Culvert	.....	.....	Heavy	‡ 1,200.00
Slough	254	Double 2 1/2'x3' R. C. Culvert	.....	.....	Heavy	‡ 500.00
Multnomah: Overhead Crossing—Ore. Elec. Ry. at Cap- ital Hill	169	106' Wooden Overcrossing	106	20	Heavy	‡ 800.00
Slough	258	60' Wooden Span	60	16	Medium	‡ 1,000.00
Polk: Mulkey Cut-off near Monmouth	201	40' Wood trestle	40	18	Medium	‡ 600.00
LaCreole Creek in Dallas (not designed by State)	231	70' R. C. Arch	70	22	Heavy	* 10,755.68
R. C. Bridge between Dallas and Monmouth	233	36' Wood Bridge	36	20	Heavy	* 1,898.17
Little Luckiamute	238	72' Wood Span	130	18	Medium	* 3,615.00
Big Luckiamute, at Montgomery School (See also Marion County for Salem Bridge)	283	160' Suspension Foot Bridge	160	4	.....	* 500.00
Sherman: John Day River Bridge on Columbia River Highway	108	2-126' Wood Deck Spans	372	18	Heavy	‡ 20,000.00
Tillamook: Bridge over North Fork of Nehalem River.	127	40' Lift and 90' Span	750	16	Medium	‡ 11,000.00
Bridge over Beaver Creek, North of Beaver	153	172' R. C. Bridge	172	20	Heavy	‡ 8,000.00
Bridge over Beaver Creek, in Beaver	154	120' R. C. Bridge	120	20	Heavy	‡ 6,000.00
Munson Creek Bridge	160	16' R. C. Bridge	16	20	Heavy	‡ 500.00
Umatilla: Bridge over Washout Gulch near Reith	229	54' Wood Span	54	18	Medium	‡ 1,500.00

Union:	174	2-126' Wooden Spans	270	16	Medium	8,000.00
Grand Ronde River Bridge	175	1-162' Wooden Spans	200	16	Medium	8,000.00
Bridge between La Grande and Hot Lake	275	12' R. C. Bridge	12	24	Heavy	1,900.00
Bridge between La Grande and Hot Lake	276	10' R. C. Bridge	10	24	Heavy	2,000.00
Bridge between La Grande and Hot Lake	277	26' R. C. Bridge	26	20	Heavy	1,500.00
Bridge between La Grande and Hot Lake	278	18' R. C. Bridge	18	20	Heavy	1,400.00
Bridge between La Grande and Hot Lake	279	14' R. C. Bridge	14	24	Heavy	1,800.00
Box Culvert near Hot Lake	215	7x8' R. C. Box Culvert	10	24	Heavy	3,000.00
Wasco:	106	60' R. C. Box Culvert	60	20	Heavy	700.00
Eight Mile Creek Bridge East of The Dalles	109	6'x8' R. C. Culvert	175	20	Heavy	7,000.00
Three Mile Creek Bridge—East of The Dalles	118	175' R. C. Viaduct	36	20	Heavy	1,800.00
Mosier Creek Bridge at Mosier	128	36' R. C. Bridge	78	20	Heavy	5,500.00
Butler Creek Bridge	129	78' R. C. Bridge	45	20	Heavy	2,700.00
Tygh Creek Bridge near Tygh Valley	203	45' R. C. Bridge	599	18	Heavy	8,372.22
Rock Creek Bridge	199	59' Wood Trestle	310	18	Heavy	12,968.60
Washington:	264	70' Wood Trestle	70	18	Heavy	1,882.81
Onion Flat Trestle between Rex and Tiggardville	176	162' Wooden Span	333	16	Medium	10,000.00
Tualatin River Bridge, 2 mi. So. of Tiggardville	177	90' Wooden Span	105	16	Medium	6,774.16
Fanno Creek Bridge at Tigard	178	30' Wooden Span	30	16	Medium	500.00
Wheeler:	179	162' Wooden Span	200	16	Medium	8,000.00
Bridge over Bridge Creek, near Mitchell	262	40' Wooden Span	97	18	Medium	1,000.00
Bridge over West Branch Creek, near Mitchell	263	30' Wooden Span	68	18	Medium	800.00
Yamhill:						
Bridge over Yamhill River—6 mi. West of Grande Ronde						
Bridge over Cedar Creek—4 mi. West of Grande Ronde						
Total						\$788,788.09

* Designed and construction supervised by Highway Department. † Designed by Highway Department and construction supervised by Counties. ‡ Designed by Highway Department but not yet constructed.
 Where loading is referred to as "Heavy," the structure is designed for a twenty-ton roller and for 100 lbs. per sq. ft. Where loading is referred to as "Medium," the structure is designed for a fifteen-ton roller and for 75 lbs. per sq. ft.

SUMMARY OF BRIDGE AND CULVERT DESIGN AND CONSTRUCTION

Designed and Construction Supervised by Highway Department	\$527,788.09
Designed by Highway Department and Construction Supervised by Counties	89,600.00
Designed by Highway Department but not yet constructed	171,400.00
Total	\$788,788.09

TABLE C

MILES OF LOCATION SURVEYS MADE BY HIGHWAY DEPARTMENT
1917-1918

Jobs	Miles
Baker County—	
Baker to Middle Bridge.....	17.0
Canyon Section of Baker-Cornucopia Road.....	4.5
Sag Section of Baker-Cornucopia Road.....	4.9
Middle Bridge to Black Bridge.....	13.0
Clackamas County—	
Canby to Oregon City.....	7.5
Oregon City to Multnomah County Line.....	6.5
Aurora to Canby.....	5.0
Columbia County—	
Columbia City to Scappoose.....	11.2
Coos County—	
Myrtle Point to Douglas County Line.....	24.4
Marshfield to Curry County Line.....	39.2
Coquille to Myrtle Point.....	9.0
Curry County—	
Coast Highway.....	20.0
Douglas County—	
Johns Ranch to Jacques Ranch.....	7.2
Canyon Creek Pass to Johns Place.....	2.3
Coos County Line to Roseburg.....	28.7
Gilliam County—	
Columbia River Highway.....	34.0
Grant County—	
Big Basin Section of John Day River Highway.....	23.5
John Day to Fisk Creek.....	7.4
Fisk Creek to Hall Hill.....	3.5
Hall Hill to Prairie City.....	2.2
Harney County—	
Burns to Crane.....	6.0
Hood River County—	
Hood River to Mosier.....	7.0
Jackson County—	
Ashland to Klamath Falls.....	15.6
Josephine County—	
Wolf Creek to Grave Creek.....	4.0
Grants Pass to Grave Creek.....	17.2
Wolf Creek to Stage Road Pass.....	2.4
Klamath County—	
Klamath Falls-Chiloquin.....	3.3
Lane County—	
Goshen to Cottage Grove.....	18.2
Eugene to Florence.....	37.5
Divide to Overhead.....	1.3
Linn County—	
Albany to Jefferson.....	7.8
Marion County—	
Salem to Aurora.....	22.2
Salem to Jefferson.....	15.5
Morrow County—	
Columbia River Highway.....	28.6
Heppner to Willows.....	43.0
Heppner to Umatilla County Line.....	28.4
Polk County—	
Between Monmouth and Dallas.....	.7
Between Salem and Dallas.....	.8
Sherman County—	
Columbia River Highway.....	14.0
Tillamook County—	
Tillamook to Cloverdale.....	15.0
Neskowin to Salmon River.....	8.0
Umatilla County—	
Pendleton to Umatilla.....	40.6
Pendleton to Pilot Rock.....	13.9
Pilot Rock to Morrow County Line.....	18.3
Pendleton to Kamela.....	26.8

TABLE C—Continued

Jobs	Miles
Union County—	
Elgin to Minam.....	9.4
Union to Telocaset.....	7.2
La Grande to Elgin.....	29.1
La Grande to Union.....	9.4
La Grande to Kamela.....	22.4
Wasco County—	
Seuffert to Deschutes River.....	12.5
Washington County—	
Multnomah County Line to Newberg.....	15.7
Beaverton to Hillsboro.....	7.6
Forest Grove to Gaston.....	6.7
Wheeler County—	
Sarvice Creek to Grant County Line.....	25.5
Ochoco Forest to Grant County Line.....	50.5
Fossil to Gilliam County Line.....	4.5
Fossil to mouth of Sarvice Creek.....	21.0
Yamhill County—	
McMinnville to Dayton.....	6.7
Grande Ronde Section.....	6.8
Total miles of surveys.....	902.1

TABLE D

MILES OF DIFFERENT TYPES OF ROAD IN EACH COUNTY

(These mileages are only roughly approximate as accurate data is obtainable in very few counties)

COUNTIES	Public Roads	Concrete Pavement	Asphaltic Concrete	Plank Roads	Broken Stone	Gravel Roads	Improved Earth Roads	Unimproved Earth Roads
Baker	3,500.0					30.0	470.0	3,000.0
Benton	550.0				10.0	200.0	200.0	140.0
Clackamas	1,220.0	2.0	24.0	99.0	177.0	221.0	441.0	256.0
Clatsop	310.0	4.5	25.0	26.0	94.5	19.0	141.0	
Columbia	575.0	4.5	4.5	19.0	116.5	42.0	17.0	376.0
Coos	675.0	.5	1.5	51.0	16.0	86.0	86.0	434.0
Crook	1,450.0				2.0	50.0	300.0	1,098.0
Curry	140.0				2.0	52.0	53.0	33.0
Deschutes	1,500.0					25.0	300.0	1,175.0
Douglas	2,000.0	1.0	1.0	8.0	150.0	340.0	500.0	1,000.0
Gilliam	600.0				10.0	5.0	50.0	535.0
Grant	850.0					12.0	15.0	823.0
Harney	1,000.0					8.0	192.0	800.0
Hood River	250.0		1.0		7.0	32.0	110.0	100.0
Jackson	750.0	8.0	10.0		12.0	20.0	300.0	400.0
Jefferson	1,500.0				30.0	25.0	500.0	945.0
Josephine	700.0				4.0	52.0	400.0	244.0
Klamath	1,200.0		2.0			4.0	300.0	880.0
Lake	1,400.0					5.0	20.0	1,175.0
Lane	1,450.0			26.0	137.0	425.0	78.0	784.0
Lincoln	385.0			5.0	20.0	10.0	250.0	100.0
Linn	1,900.0				70.0	530.0	500.0	800.0
Malheur	1,800.0					25.0	200.0	1,575.0
Marion	1,300.0		8.0		123.0	272.0	300.0	597.0
Morrow	900.0				4.0		33.0	863.0
Multnomah	500.0	12.0	77.0	3.0	125.0	136.0	120.0	27.0
Polk	1,100.0		1.0		40.0	300.0	300.0	459.0
Sherman	500.0					4.0	90.0	406.0
Tillamook	350.0	6.0	5.0	11.0		228.0	50.0	50.0
Umatilla	3,000.0		11.0			30.0	644.0	2,285.0
Union	800.0					3.0	187.0	600.0
Wallowa	1,500.0						300.0	1,200.0
Wasco	1,100.0				25.0	100.0	475.0	500.0
Washington	975.0		16.0	25.0	171.0	33.0	300.0	430.0
Wheeler	950.0				5.0		5.0	940.0
Yamhill	1,300.0	4.0			125.0	171.0	500.0	500.0
Total	39,980.0	38.0	187.0	273.0	1,518.0	3,527.0	8,907.0	25,530.0

TABLE E
1918 MOTOR VEHICLE REGISTRATION BY COUNTIES

County	Total Number of Motor Vehicles	Number Persons Per Auto	County	Total Number of Motor Vehicles	Number Persons Per Auto
Baker	1,409	12.8	Lane	2,618	12.9
Benton	1,080	9.9	Lincoln	170	34.6
Clackamas	2,299	13.0	Linn	2,184	10.4
Clatsop	1,409	11.4	Malheur	1,138	7.6
Columbia	632	16.8	Marion	3,982	10.0
Coos	1,128	15.9	Morrow	670	6.5
Crook	533	5.6	Multnomah	20,456	11.1
Curry	135	15.1	Polk	1,298	10.4
Deschutes	829	5.6	Sherman	737	5.8
Douglas	1,428	13.8	Tillamook	843	7.4
Gilliam	520	7.1	Umatilla	3,231	6.3
Grant	436	12.9	Union	1,609	10.1
Harney	488	8.3	Wallowa	811	10.3
Hood River.....	682	11.8	Wasco	1,324	12.3
Jackson	2,431	10.6	Washington	2,041	10.5
Jefferson	305	5.6	Wheeler	243	10.2
Josephine	743	12.9	Yamhill	1,862	9.8
Klamath	1,151	7.4			
Lake	463	10.0	Total	63,318	10.6

STATE REGISTRATION

Total number of passenger vehicles.....	58,000
Total number of Ford trucks.....	2,266
Total number of trucks of other makes.....	3,052
Total number of trucks, all makes.....	5,318
Total number of motor vehicles of all types and all makes.....	63,318

TABLE F

COUNTY BOND ISSUES

As proof that the people of Oregon are awake to the value of good roads, the following list is given of Counties which have voted bond issues for the development of their road systems:

County	Amount of bonds	Date voted
Coos	\$ 362,000.00	June 1916
Columbia	360,000.00	Feb. 1914
Clatsop	400,000.00	Nov. 4, 1913
Crook	90,000.00	1918
Douglas	500,000.00	Aug. 1917
Grant	140,000.00	June 4, 1917
Hood River	75,000.00	July 15, 1914
Jackson	500,000.00	Sept. 9, 1913
Multnomah	1,250,000.00	Mar. 1915
Wasco	260,000.00	Nov. 1916
Wheeler	80,000.00	Nov. 1916
Total	\$4,017,000.00	

TABLE H
YEARLY EXPENDITURES OF STATE FUNDS IN COUNTIES
1914, 1915, 1916, 1917, 1918

Counties	1914	1915	1916	1917	1918	Total
Baker			\$ 802.74	\$ 1,214.01	\$ 6,364.67	\$ 8,381.42
Benton		\$ 181.50	737.14	47.56		956.20
Clackamas			1,013.37	12,519.70	143,341.40	157,462.21
Clatsop		\$ 64,587.44	20,823.44	54,294.83	290,092.40	464,908.14
Columbia		35,110.03	11,143.48	76,449.91	411,377.24	604,900.22
Coos		92,068.72	1,375.81	16,703.28	264.40	113,443.49
Coquille						
Cook		57.17	12,052.32			15,163.21
Curry				79.91		5,629.24
Deschutes				7,244.37		13,472.30
Douglas				8,803.50		20,716.37
Gilliam		15,701.12	25,158.08	4,443.52	150,966.08	200,658.78
Grant			7.42		31,555.96	35,006.90
Harney			26.95	2,950.16	4,488.62	7,495.73
Hood River					1,373.45	1,373.45
Jackson	1,077.24	47,927.84	4,317.17	61,356.69	372,801.53	487,550.47
Josephine	59,569.82	31,954.91	25,774.49	54,416.20	32,143.68	208,919.10
Klamath		2,230.81	5,590.03	5,237.73	72,700.41	85,918.98
Lake				27.75	791.48	819.23
Lane		61.11	4,639.07	15,215.57	176.10	15,391.67
Lincoln		11.95	12.88	12,247.61	2,381.91	19,229.70
Linn		208.81	37.32	2,054.05	943.42	3,022.30
Malheur			189.61	287.67	503.40	1,037.20
Marion		79.79	712.55	93.02	773.63	1,056.26
Morrow	414.76		105.18	4,200.72	4,604.18	6,290.69
Multnomah					6,662.38	10,968.28
Polk	1,068.08	107.03	6,614.53	137.78	665.14	1,175.11
Sherman	414.15	74.54	1,88.87	48.87	3,003.27	7,906.14
Tillamook	4,523.20	953.26	1,735.01	5,213.34	63,060.95	48,757.47
Umatilla		116.59	13,449	100,608.75	73,333.75	170,125.89
Union			42.20	5,975.15	26,313.02	173,955.99
Wallowa					5,765.07	32,330.37
Wasco		134.31	10.34	286.02	4,027.77	4,459.04
Washington	4,998.14	14,321.44	4,975.48	70,139.95	176,629.10	271,064.11
Wheeler			5.64	13,094.26	56,130.52	69,290.42
Yamhill	408.34	108.37	2,106.03	38,714.45	86,244.39	127,581.58
Totals	\$191,933.78	\$241,450.90	\$129,230.64	\$574,670.74	\$2,047,154.37	\$3,183,540.43

TABLE I

MILEAGE TABLE

Main Traveled Roads

Showing distances between some of the important towns; for convenience in obtaining mileage for long trips; to be used in connection with the official automobile road map on opposite page.

All distances between points west of the Cascade Range and Eastern Oregon points are via Portland and the Columbia River Highway, unless otherwise noted.

	Portland	Salem	Albany	Eugene	Roseburg	Medford	Pendleton	Baker	Bend
Portland .....	.....	53	78	126	203	318	240	345	253
Salem	53	.....	26	73	150	265	293	398	*195
Albany	78	25	.....	48	125	240	318	423	*170
Corvallis	89	36	11	40	117	232	329	434	*162
Eugene	126	73	49	.....	77	192	366	*356	*122
Roseburg	203	150	125	77	.....	115	443	*433	*199
Grants Pass	285	232	207	159	82	33	525	*515	†265
Medford	318	265	240	192	115	.....	484	†490	†232
Ashland	331	278	253	205	128	13	471	†477	†219
Ore.-Cal. State Line	354	301	276	228	151	36	.....	.....	.....
Crater Lake	401	348	323	275	198	83	372	378	120
Klamath Falls	395	342	317	269	192	77	407	413	155
Astoria	107	160	185	233	310	425	347	452	360
Tillamook	107	91	116	150	227	342	347	452	360
Marshfield	†253	†200	†175	†127	88	190	493	*483	*249
The Dalles	91	144	169	217	294	409	149	254	162
Pendleton	240	293	318	366	443	558	.....	105	252
Walla Walla	285	338	363	411	488	603	45	150	297
La Grande	293	346	371	419	496	†542	53	52	305
Baker	345	398	423	*356	*433	†490	105	.....	258
Huntington	395	448	473	*406	*483	†540	155	50	298
Prineville	244	*208	*183	*135	*212	†269	226	221	37
Bend	253	*195	*170	*122	*199	†232	252	258	.....
Burns	396	*338	*313	*265	*342	†340	195	169	143
Lakeview	426	*368	*343	*295	†292	†177	358	332	173
Canyon City	317	*337	*312	*264	*341	†398	122	96	166

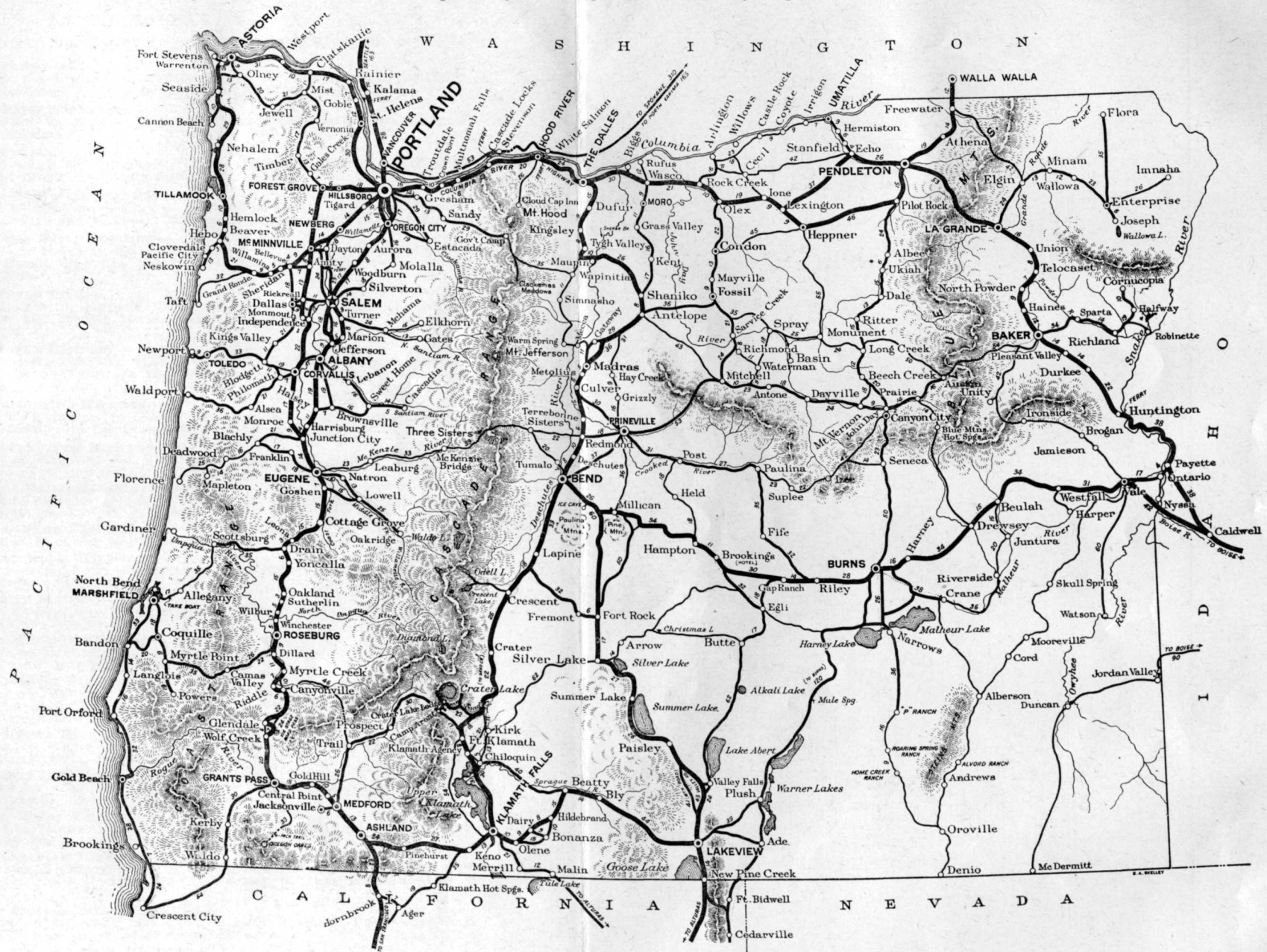
* Via Eugene and McKenzie River Highway.

† Via Klamath Falls.

‡ Via Scottsburg.

AUTOMOBILE ROAD MAP, SHOWING THE MAIN TRAVELED ROADS OF OREGON WITH MILEAGES

Prepared by the Oregon State Highway Department



This Is Not a Map of the System of State Highways. This map is intended as a guide to the main traveled, existing, through highways and roads connecting important centers of population. The heavier weight lines are intended to designate the most generally traveled, through routes, rather than their relative condition or importance.

TABLE J
OFFICIAL DESIGNATION OF STATE HIGHWAYS

- No. 1. Pacific Highway—**
From Portland south via Oregon City, Salem, Albany, Eugene, Roseburg, Grants Pass, Medford and Ashland to the Oregon-California State Line.
- No. 2. Columbia River Highway—**
From Astoria east via Rainier, Portland, Hood River, The Dalles, Arlington and Umatilla, to Pendleton.
- No. 3. Coast Highway—**
From Astoria south via Tillamook, Toledo, Florence, Marshfield, Coquille and Gold Beach to Oregon-California State Line.
- No. 4. The Dalles-California Highway—**
From a point on Highway No. 2, at or near The Dalles, south via Shaniko, Redmond, Bend, LaPine and Klamath Falls to the Oregon-California State Line.
- No. 5. The John Day River Highway—**
From a point on Highway No. 2, at or near Biggs, southeasterly through Wasco, Condon, Fossil, Dayville, Prairie City and Vale to the Oregon-Idaho State Line at Ontario.
- No. 6. The Old Oregon Trail—**
From a junction with Highway No. 2, at Pendleton, southeasterly through La Grande, Baker and Huntington to a junction with Highway No. 5 at or near Ontario.
- No. 7. Central Oregon Highway—**
From a point on Highway No. 4, at or near Bend, easterly through Millican, Riley, Burns, Crane and Juntura to a junction with Highway No. 5, at or near Vale.
- No. 8. Oregon-Washington Highway—**
From a point on Highway No. 2, at or near Willows, through Ione, Heppner, Pendleton and Freewater to the Oregon-Washington State Line.
- No. 9. Pendleton-John Day Highway—**
From a point on Highway No. 8, at or near Pilot Rock south to a junction with Highway No. 5, at or near John Day.
- No. 10. La Grande-Enterprise Highway—**
From a point on Highway No. 6, at or near La Grande, through Elgin and Enterprise to Joseph.
- No. 11. Enterprise-Flora Highway—**
From a point on Highway No. 10, at or near Enterprise, north to Flora.
- No. 12. Baker-Cornucopia Highway—**
From a point on Highway No. 6, at or near Baker, east through Middle Bridge and Halfway to Cornucopia.
- No. 13. Baker-Unity Highway—**
From a point on Highway No. 6, at or near Baker, southwest to a junction with Highway No. 5, at or near Unity.
- No. 14. Antelope-Mitchell Highway—**
From a point on Highway No. 4, at or near Antelope to a junction with Highway No. 15, at or near Mitchell.
- No. 15. McKenzie River Highway—**
From a point on Highway No. 1, at or near Eugene, easterly through the McKenzie Valley and through Sisters, Redmond, Prineville and Mitchell to a junction with Highway No. 5, at or near Dayville.
- No. 16. Albany-Sisters Highway—**
From a point on Highway No. 4, at or near Albany, southeasterly to a junction with Highway No. 15 near Sisters.
- No. 17. Bend-Sisters Highway—**
From a point on Highway No. 4, at or near Bend, northwesterly to a junction with Highway No. 15, at or near Sisters.
- No. 18. Lakeview-Burns Highway—**
From a point on Highway No. 19, near Lakeview, northeasterly to a junction with Highway No. 7, at or near Burns.
- No. 19. LaPine-Lakeview Highway—**
From a point on Highway No. 4, at or near LaPine southeasterly through Fort Rock, Silver Lake, Paisley and Lakeview to the Oregon-California State Line.
- No. 20. Klamath Falls-Lakeview Highway—**
From a point on Highway No. 4, at or near Klamath Falls, east to a junction with Highway No. 19, at or near Lakeview.
- No. 21. Ashland-Klamath Falls Highway—**
From a point on Highway No. 1 near Ashland, east to a junction with Highway No. 4, at or near Klamath Falls.

TABLE J—Continued

No. 22. Medford-Crater Lake Highway—

From a point on Highway No. 1 at Medford, northeasterly, through Trail and the Rogue River Valley to a junction with Highway No. 24 near Crater Lake.

No. 23. Klamath-Crater Lake Highway—

From a junction with Highway No. 22 near Crater Lake, southeasterly to a junction with Highway No. 4, at or near Chiloquin.

No. 24. The Rim Highway—

From a point on Highway No. 22 near Crater Lake, thence around Crater Lake to the point of beginning.

No. 25. Grants Pass-Crescent City Highway—

From a point on Highway No. 1 at Grants Pass, southwesterly through Kerby and Waldo to the Oregon-California State Line.

No. 26. Mt. Hood Highway—

From Portland through Gresham and Bull Run around the south and east sides of Mt. Hood and to a junction with Highway No. 2, at or near Hood River.

No. 27. Clackamas Highway—

From a point on Highway No. 1, at or near Oregon City, northeasterly to a junction with Highway No. 26, at or near Pleasant Home.

No. 28. The West Side Highway—

From a point on Highway No. 1, at or near Portland, thence south on the west side of the Willamette River through Newberg, McMinnville, Dallas, Independence and Corvallis to a junction with Highway No. 1, at or near Eugene.

No. 29. Forest Grove-McMinnville Highway—

From Portland through Hillsboro, Forest Grove and Carlton to a junction with Highway No. 28, at or near McMinnville.

No. 30. Salem-Independence Highway—

From a point on Highway No. 1, at Salem, southwesterly to a junction with Highway No. 28 at Independence.

No. 31. Albany-Corvallis Highway—

From a point on Highway No. 1, at Albany to a junction with Highway No. 28, at or near Corvallis.

No. 32. Yamhill-Nestucca Highway—

From a point on Highway No. 28, at or near McMinnville, through Sheridan, Willamina, and Dolph to a junction with Highway No. 3, at or near Hebo.

No. 33. Corvallis-Newport Highway—

From a point on Highway No. 28, at Corvallis westerly to a junction with Highway No. 3, at or near Toledo.

No. 34. Eugene-Florence Highway—

From a point on Highway No. 1, near Eugene, westerly through Goldson and Deadwood to a junction with Highway No. 3, near Florence.

No. 35. Coos Bay-Roseburg Highway—

From a point on Highway No. 3, at or near Coquille, easterly up the Middle Fork of the Coquille River, through Camas Valley and Brockway to a junction with Highway No. 1, near Dillard.

No. 36. Pendleton-Cold Springs Highway—

From a point on Highway No. 2, at or near Pendleton, northwest to Cold Springs.

TABLE K

EMPLOYEES OF THE OREGON STATE HIGHWAY COMMISSION

November 30, 1918

Herbert Nunn, State Highway Engineer

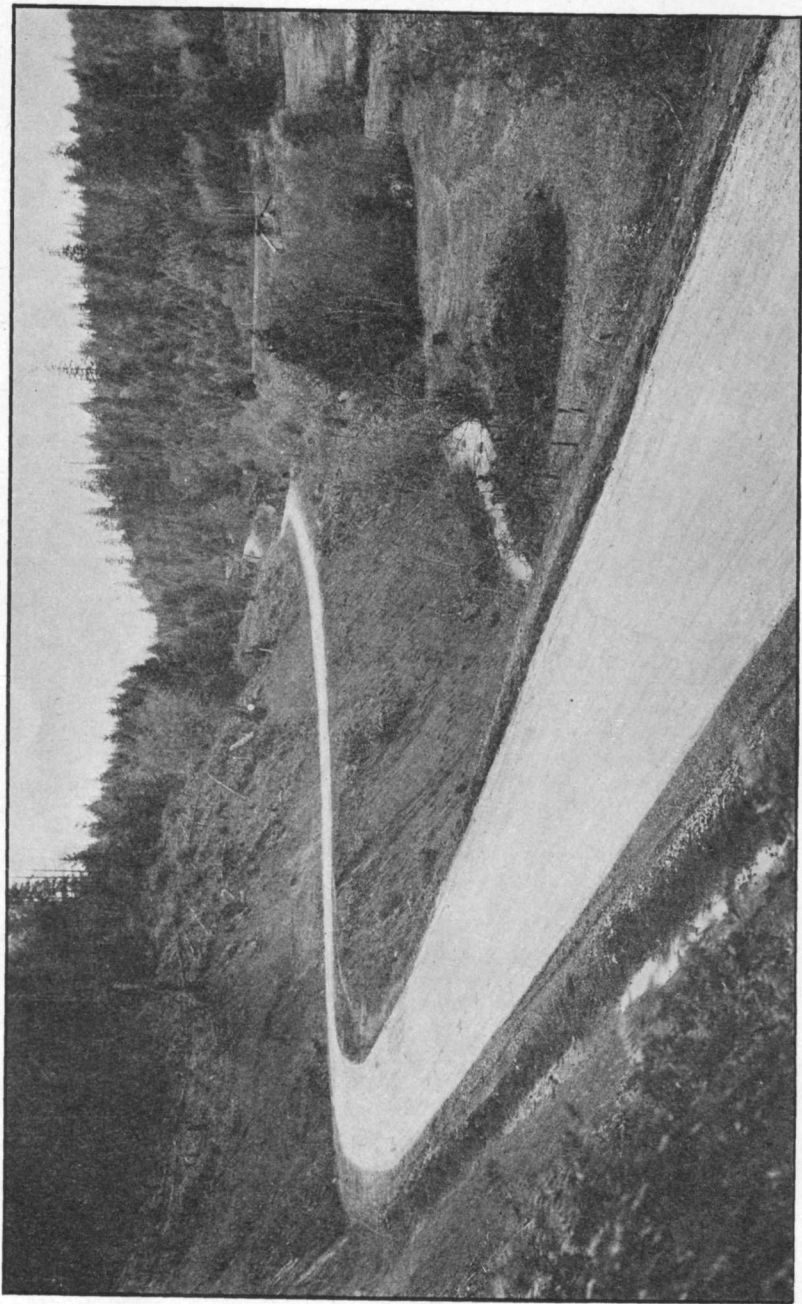
R. A. Klein, Assistant Engineer	J. E. Nelson, Resident Engineer
C. A. Dunn, Assistant Engineer	J. E. Peck, Resident Engineer
M. O. Bennett, Division Engineer	R. A. Pratt, Resident Engineer
C. H. Whitmore, Division Engineer	W. P. Smith, Resident Engineer
J. C. McLeod, Division Engineer	C. E. Carter, Resident Bridge Engineer
C. W. Wanzer, District Engineer	J. M. Baker, Supt. of Construction
P. M. Hall-Lewis, Asst. Div. Eng'r	C. L. Grutze, Supt. of Construction
S. H. Probert, Office Engineer	W. H. Burtis, Foreman of Repair Shop
L. W. Metzger, Designing Engineer	W. S. Hodge, Transitman
E. A. Skelley, Chief Draftsman	Tom Opedal, Transitman
L. C. Elwell, Voucher Clerk	Wm. T. Nelson, Field Draftsman
C. L. Turner, Cost Clerk	H. R. Wessell, Field Draftsman
M. S. Farwell, Bridge Draftsman	Chas. E. Lytle, Timekeeper
G. E. Farnsworth, Office Draftsman	L. N. Russell, Timekeeper
Theo. Rowland, Office Draftsman	F. A. Keith, Levelman
James Moberg, Office Draftsman	H. W. Lange, Levelman
W. C. Crews, Office Draftsman	M. M. Brown, Field Computer
R. E. Raley, Office Computer	L. D. Coppock, Field Computer
J. C. Tibbits, Clerk	Jack Slavens, Head Chainman
L. N. Myers, Clerk	Chas. Collier, Rodman
H. M. McDaniel, Clerk	Clyde Leghorn, Rodman
C. F. Smith, Clerk	Ora L. Nichols, Rodman
Helen Ingrey, Stenographer	M. S. Parker, Rodman
Margaret H. Hodge, Stenographer	Katherine Riddle, Rodman
Grace Fugate, Stenographer	Orville Widdows, Rodman
Gertie Witzel, Stenographer	Fred Busch, Chainman
Della Ferguson, Stenographer	Claire Hopper, Chainman
R. H. Baldock, Locating Engineer	J. F. Jones, Chainman
R. H. Coppock, Locating Engineer	J. A. Matott, Chainman
C. A. Harrington, Locating Engineer	Warren Pearson, Chainman
B. H. McNamee, Locating Engineer	Boyd Potter, Chainman
J. H. Scott, Locating Engineer	A. H. Rudd, Chainman
E. B. Bishop, Resident Engineer	J. J. Sturgill, Chainman
H. C. Compton, Resident Engineer	D. E. Tompkins, Chainman
M. E. DeWitt, Resident Engineer	E. Wiggins, Chainman
F. N. Drinkhall, Resident Engineer	Frank Galdabini, Rock Checker
H. B. Fletcher, Resident Engineer	Pete Knudson, Rock Checker
H. N. Hackett, Resident Engineer	L. Parker, Rock Checker
A. S. Kennedy, Resident Engineer	C. S. Peck, Rock Checker

TABLE L

STATE HIGHWAYS
Names, Numbers, Mileages.

Highways	Miles
No. 1 Pacific Highway	352
No. 2 Columbia River Highway	360
No. 3 Coast Highway	430
No. 4 The Dalles-California Highway	342
No. 5 The John Day River Highway	285
No. 6 The Old Oregon Trail	190
No. 7 Central Oregon Highway	270
No. 8 Oregon-Washington Highway	148
No. 9 Pendleton-John Day Highway	105
No. 10 La Grande-Enterprise Highway	68
No. 11 Enterprise-Flora Highway	35
No. 12 Baker-Cornucopia Highway	76
No. 13 Baker-Unity Highway	42
No. 14 Antelope-Mitchell Highway	43
No. 15 McKenzie River Highway	229
No. 16 Albany-Sisters Highway	100
No. 17 Bend-Sisters Highway	27
No. 18 Lakeview-Burns Highway	159
No. 19 LaPine-Lakeview Highway	151
No. 20 Klamath Falls-Lakeview Highway	100
No. 21 Ashland-Klamath Falls Highway	51
No. 22 Medford-Crater Lake Highway	78
No. 23 Klamath-Crater Lake Highway	14
No. 24 The Rim Highway	39
No. 25 Grants Pass-Crescent City Highway	46
No. 26 Mt. Hood Highway	105
No. 27 Clackamas Highway	18
No. 28 The West Side Highway	120
No. 29 Forest Grove-McMinnville Highway	25
No. 30 Salem-Independence Highway	12
No. 31 Albany-Corvallis Highway	11
No. 32 Yamhill-Nestucca Highway	39
No. 33 Corvallis-Newport Highway	60
No. 34 Eugene-Florence Highway	76
No. 35 Coos Bay-Roseburg Highway	81
No. 36 Pendleton-Cold Springs Highway	30
Total mileage State Highways	4,317





THE PACIFIC HIGHWAY IN PASS CREEK CANYON, DOUGLAS COUNTY. GRADED AND MACADAMIZED IN 1917 AND 1918

Description of Work of the
State Highway Department
In the
Counties of the State
1917-1918

BAKER COUNTY

Although Baker County is generally well supplied with railroads there are sections still isolated and much in need of improved transportation facilities. Some of the most fertile and productive areas of the County are not served by rail transportation and depend upon roads for communication with railway points. This situation with the character of the winter season and soil conditions found here render improved highways of extreme importance.

Since State and Federal aid have been made available the people of Baker County are fast coming to a realization of the situation and are making strenuous efforts to co-operate in highway improvement. No bond issues have been voted in this County but an example of their enthusiasm is supplied by the fact that private donations for co-operative improvement of one road amount to \$15,000.00.

State and Federal aid were extended in 1918 and the co-operation has resulted in plans for improving three sections of the Baker-Cornucopia Highway. Other roads in the County will receive the consideration of the Highway Commission during the coming season.

Four sections of the Baker-Cornucopia Highway have been surveyed, and plans for three of these are nearly complete. Together the four sections make about thirty-eight miles of location survey. Construction work will begin on this road early in the coming season.

Survey of the Baker-Cornucopia Highway

During 1917 and 1918 the State Highway Department surveyed a greater part of the Baker-Cornucopia Highway. The policy of giving first attention to those portions of the road most in need of improvement resulted in the surveying of four separate sections. These sections are designated as follows: Baker-Middle Bridge; Love Bridge-Black Bridge; Canyon and Sag Sections. These surveys were made under the direction of J. O. Kingsley and W. C. Crews, locating engineers for the State Highway Department.

The Baker-Middle Bridge section extends from Baker to a point near Middle Bridge on Lower Powder River. Beginning at Baker the line follows closely the present main traveled road east for about six miles, thence along the Palmer road to the present crossing at Ruckles Creek, thence down

Ruckles Creek to a point about two miles south of Keating, thence easterly, leaving Ruckles Creek, and entering the lower Powder River Valley near Middle Bridge. This survey is 18.64 miles in length. The plans for this work are completed.

The Love Bridge-Black Bridge section covers that portion of the route through the canyon between the Keating and Richland districts. At present all traffic passes through Sparta and over the mountains to the north of the Powder River there being no road through the canyon. This survey is about ten miles long and involves heavy and expensive construction. This project begins at a point about seven miles east of Keating and ends about five miles west of Richland. There is a four-mile section of the Baker-Cornucopia Highway lying between Middle and Love Bridges that has not been definitely located. No office work has been done for this survey.

What is known as the Canyon Section extends through the canyon east of Richland. This survey begins at a point 1.5 miles east of Richland and parallels the Powder River along the north bank for a distance of 4.64 miles. The project ends at the point where the proposed route leaves the Powder River and leads over the mountains toward Pine Valley. Plans are almost completed for this project.

The Sag Section is that part of the road leading north from the divide between Powder River and Pine Valley. This survey which is 4.69 miles long begins at the divide and ends at a point in the edge of Pine Valley two miles south of Halfway. The location follows very near the route of the present road. The office work in connection with this survey is nearing completion.

Baker-Cornucopia Post Road Project

The State Highway Commission requested Government aid in the construction of the Baker-Cornucopia Highway and this request has resulted in the approval by the Federal Office of Public Roads of three projects on this highway. These three projects, namely, Baker-Middle Bridge, Canyon Section and Sag Section have a combined length of 27.97 miles, and the total estimated cost of these constructions is \$94,731.00. Baker County will co-operate with the State and Government in defraying the cost of this construction. The following tabulation indicates the amounts and segregations of funds for each project.

Appropriated for expenditure in 1919	State Funds	County Funds	Government Funds
Baker-Middle Bridge Section.....	\$13,978.00	\$15,000.00	\$13,978.00
Canyon Section	8,249.00	6,000.00	8,249.00
Sag Section	11,639.00	6,000.00	11,639.00
Totals.....	\$33,866.00	\$27,000.00	\$33,866.00

No plans have been made for financing the Love Bridge-Black Bridge Section which was surveyed in 1917. This is an important section of the road and will probably receive early attention from the State Highway Commission.

BENTON COUNTY

During 1917 and 1918, very little work was done by the Highway Department in Benton County. At the request of the County Court a short section of the West Side Highway north of Corvallis was staked for grading to be done by the County, and designs were prepared for three concrete structures. Two of these were for box culverts for the Pacific Highway about five miles north of Corvallis. The other was for an 85 foot reinforced concrete bridge over a mill race south of Corvallis. A short reconnaissance was made of the Corvallis-Newport road between Blodgett and Eddyville.

For work to be done in Benton County in 1919, the Highway Commission has set aside \$129,500.00. With this amount it is planned to pave the West Side Highway from Corvallis north to the Polk County Line, approximately seven miles.

CLACKAMAS COUNTY

The work under the supervision of the Highway Department in Clackamas County during 1917 and 1918 has consisted of 4.5 miles of grading between New Era and Oregon City, 7.5 miles of paving between Oregon City and Canby, and 0.2 miles of grading between Oswego and the Multnomah County Line. The first of these jobs was done by the State and County in co-operation; the second was a strictly State job; and the third was a County job supervised by the State.

The total expenditure on the work done in Clackamas County was \$198,952.24, of which Clackamas County paid \$43,091.14 and the State \$155,861.10.

Between New Era and Oregon City, the Pacific Highway has been graded on an entirely new location, paralleling the Southern Pacific Railway along the bank of the Willamette River instead of following the location of the old road farther back from the river, where the grading is not so heavy, but where a number of heavy grades are required. In addition to eliminating these heavy grades, a considerable saving in distance is effected, and the dangerous crossing under the Southern Pacific tracks at Oregon City is avoided.

Grading—Vicinity of New Era

On August 20, 1917, bids were considered by the State Highway Commission for the grading of two and one-half miles on the Pacific Highway near New Era. The most satisfactory proposal received was a cost plus ten per cent proposal submitted by the Warren Construction Company, and a contract was entered into with that firm on the cost plus ten per cent basis.

This work involved the grading of New Era Hill, just south of New Era, and some heavy rock excavation from New Era north. After the work had started, it was decided to pave between Oregon City and Canby, and the contract for this paving let to the Oregon Hassam Paving Company. The most feasible place to secure the crushed rock necessary for this paving was from the rock being excavated under the grading contract with the Warren Construction Company, and the Highway Department entered into an agreement with the paving company, whereby the state would crush the rock from a big cut at New Era, and furnish the crushed rock for the paving upon certain agreed terms, the crushing to be done under the cost plus contract with the Warren Construction Company.

On this basis the work was carried on by the Warren Construction Company until March 1, 1918, at which time it was deemed advisable by the Highway Commission to take the work over and complete it with State forces.

The total cost of the grading and rock crushing was \$66,000.00, and the amount received for the crushed rock furnished for the paving was \$19,850.00. Clackamas County co-operated with the State on this work, the total amount paid out of County funds being \$15,009.91.

Grading—Canemah Hill Section

To complete the grading of the Pacific Highway between Oregon City and Canby preparatory to the paving of this section, Clackamas County



AT THE TOP OF CANEMAH HILL ON THE PACIFIC HIGHWAY IN CLACKAMAS COUNTY. GRADED AND PAVED IN 1918

agreed to appropriate \$25,000.00 toward the grading between Fly Creek and Oregon City, known as the Canemah Hill Section. On December 10, 1917, the Highway Commission received bids for this grading and the lowest bid having been submitted by Clackamas County, the contract was awarded to the County. This piece of work was about one and one-half miles in length and involved some very heavy rock excavation.

There has been expended on this work to date the sum of \$24,037.20, of which amount Clackamas County has paid \$22,092.53. The work complete will cost approximately \$27,500.00. Mr. M. E. DeWitt was the resident engineer in charge.

DETAILED STATEMENT OF EXPENDITURES TO NOVEMBER 30, 1918
 GRADING—CANEMAH HILL (Work in progress)

Engineering	\$	1,944.67
Construction—		
Clearing and grubbing	\$	500.00
Common excavation, 10,231 cu. yds. at 60c		6,138.60
Intermediate excavation, 8,689.4 cu. yds. at 80c		6,951.52
Solid rock excavation, 7,722.2 cu. yds. at \$1.25		9,652.75
12-inch reinforced concrete pipe, 391 lin. ft. at \$1.25		488.75
36-inch reinforced concrete pipe, 56 lin. ft. at \$4.00		224.00
6-inch porous drain tile, 585 lin. ft. at 10c		58.50
Class A concrete, 48 cu. yds. at \$15.00		720.00
Class C concrete, 2 cu. yds. at \$12.00		24.00
Rubble masonry, 2 cu. yds. at \$1.25		2.50
Overhaul per 100 lin. ft., 54,862 cu. yds. at 2c		1,097.24
Crushed rock for drain tile, 30 cu. yds.		46.20
18-inch concrete pipe in place, 45 lin. ft.		87.15
	\$	25,991.21
Less 15 per cent retained pending completion.....		3,898.68
		22,092.53
Total expended to November 30, 1918.....	\$	24,037.20
Paid by State—engineering		1,944.67
Paid by County—construction		22,092.53
Total	\$	24,037.20
This work is estimated to cost complete	\$	27,500.00



BITUMINOUS PAVEMENT ON THE PACIFIC HIGHWAY SOUTH OF OREGON CITY IN CLACKAMAS COUNTY. GRADED AND PAVED IN 1918

Paving—Oregon City to Canby

A contract was awarded on September 4, 1917, to the Oregon Hassam Paving Company of Portland, for a sixteen-foot bituminous pavement between Oregon City and Canby, a distance of 7.5 miles.

A considerable part of the crushed rock used in this pavement was furnished by the Highway Department from a rock point which it was necessary to remove in connection with the grading just north of New Era.

The paving of this section is practically complete at this date and the contracting company is to be complimented upon the excellence of its work. The cost of the work completed will be about \$135,000.00 of which amount \$102,114.85 has been paid.

Mr. M. E. DeWitt acted as resident engineer for the Highway Department on this work.

DETAILED STATEMENT OF EXPENDITURES TO NOVEMBER 30, 1918
PAVING OREGON CITY TO CANBY

Engineering	\$ 2,444.57
Construction—	
Standard Bitulithic pavement, 70,170 sq. yds. at \$1.26	\$ 88,414.20
Stone Shoulders, 68,208 lin. ft. at .05½	3,751.44
Hauling and placing broken stone furnished by State, 6,168¾ cu. yds., at \$1.18	7,278.54
Broken stone, loose measure, 12,872¾ cu. yds., at \$2.37	30,507.23
Installing wooden headers at railroad crossing	24.06
Filling low places after rolling, clearing debris after forest fire	59.53
Excavating spongy place in subgrade and refilling	67.10
Loading and hauling to bring outside 2 ft. of road-bed to grade; no material nearby	154.14
Grading 800 feet north from New Era, and dismantling and loading crusher	1,726.40
Total due contractor for work done to November 30, 1918	\$131,982.64
Less 15 per cent retained pending completion	19,797.40
	\$112,185.24
Less plant rock and miscellaneous items furnished by State	12,514.96
	\$99,670.28
Total expended to November 30, 1918	\$102,114.85
This work is estimated to cost complete	\$135,000.00

Oswego to the Multnomah County Line

On April 19, 1918, a contract was awarded by Clackamas County to the Glemorrie Quarry Company of Oswego for the regrading of a 0.2 mile section of the West Side Pacific Highway between Oswego and the Multnomah County Line. At the request of the Clackamas County Court the engineering supervision of this work was handled by the Highway Department, Mr. M. E. DeWitt, resident engineer, on work between Oregon City and Canby, being in charge.

This piece of work eliminated some very bad curves on the old road and greatly improved the grade. The work was completed on September 4, 1918, at a total cost of \$5,746.68. Of this amount \$507.98 was expended by the State for the engineering. The construction cost of \$5,238.70 was paid by the County.

DETAILED EXPENDITURE STATEMENT
Grading—Multnomah County Line to Oswego

Engineering.....		\$ 507.98
Construction—		
Clearing and grubbing	\$ 200.00	
Common excavation, 1,167.3 cu. yds. at 75c	875.47	
Intermediate excavation, 2,127.6 cu. yds. at \$1.00	2,127.60	
Solid rock excavation, 829.5 cu. yds. at \$1.85	1,534.58	
12-inch plain concrete pipe, 26 lin. ft. at \$1.50.....	39.00	
15-inch plain concrete pipe, 76 lin. ft. at \$1.80.....	136.80	
18-inch reinforced concrete pipe, 84 lin. ft. at \$2.00.....	168.00	
Class C concrete, 5 cu. yds. at \$15.00.....	75.00	
Drainage structures under roadbed to protect embankment and private water supply	82.25	
		5,238.70
Total cost		\$5,746.68
Paid by State	\$ 507.98	
Paid by County	5,238.70	
Total.....		\$5,746.68

Oregon City Bridge

The State Highway Department has been requested by the County Court of Clackamas County to prepare plans and estimates for a bridge over the Willamette River at Oregon City. This will replace the old suspension bridge at that place which is too light for the modern traffic conditions in that vicinity.

Surveys and studies of the site are being conducted at this time. In this case, as is customary, the State Highway Department will furnish plans free of cost to the County.

CLATSOP COUNTY

During the period from December 1, 1916, to November 30, 1918, the State Highway Department expended in Clatsop County the sum of \$344,387.23. The work accomplished consists of 3.5 miles of bituminous paving, 22.7 miles of broken stone macadam, 1.7 miles of gravel macadam, 1.2 miles of new grading, one covered wood draw bridge, two reinforced concrete bridges, and 1-6x12 ft. reinforced concrete box culvert, all of these improvements being on the Columbia River Highway between Astoria and the Columbia County Line.

Astoria-Svensen Paving

On July 20, 1917, the State Highway Department contracted with the Warren Construction Company for nine miles of paving between Astoria and Svensen. This contract called for a 16-foot bituminous pavement on a crushed rock base and with two-foot macadam shoulders. The contract also included the grading of a section 1.2 miles in length about midway between Astoria and Svensen, this section being known as the John Day Cut-off.

Work was started on the grading of the cut-off on August 6, 1917, and on the erection of the paving plant on August 15. On September 20, the first batch of hot stuff was placed on the road at the Svensen end. The work was just nicely started, however, when the rainy season which came on unusually early, started in and the work had to be discontinued. At this time the work on the grading of the cut-off was but fifty or sixty per cent complete, and only one mile of paving had been laid.

The following season, the roadbed did not become sufficiently dry to permit of resumption of work until about the 15th of June, but even at that



BITUMINOUS PAVING NEAR SVENSON IN CLATSOP COUNTY ON THE
COLUMBIA RIVER HIGHWAY. PAVED IN 1917

late date the contractors were not able to start work on account of the shortage in materials and labor resulting from the participation of the United States in the war, and it was not until July 23 the work was resumed. Continued shortage of labor and material made progress very slow particularly on the placing of rock base, and when the 1918 rainy season came on a total of only 3.5 miles of paving had been completed. The grading of the John Day Cut-off had been finished, however, and considerable progress made on the removal of slides and regrading of roadbed.

The paving was discontinued on October 2 but in order to provide a passable roadbed at as early a date as possible, it was decided to continue the placing of rock base during the winter months. This work is now in progress, and it is expected that a rocked surface over the remaining unpaved distance of 5.5 miles will be secured by about January 1, 1919.

The paving work will be continued again next season, and will undoubtedly be completed early in the season.

It is estimated that the grading and paving of this section will cost completed \$236,000.00. The total expenditures to November 30, 1918, amounted to \$96,955.97 and there remained unpaid to the contractor for work done to that date the sum of \$15,225.64.

The engineering work was in charge of Mr. J. E. Nelson, during the 1917 season, and in charge of Mr. H. N. Hackett during the 1918 season.

Svensen-Westport Macadam

From Westport to Svensen in Clatsop County, 13.55 miles of 16-foot waterbound macadam, 3.6 miles of 9-foot waterbound macadam and 1.76 miles of gravel was laid. This work was handled by the Warren Construction Company prior to December 26, 1917, at which time the State Highway Department took the work over and proceeded with State forces.

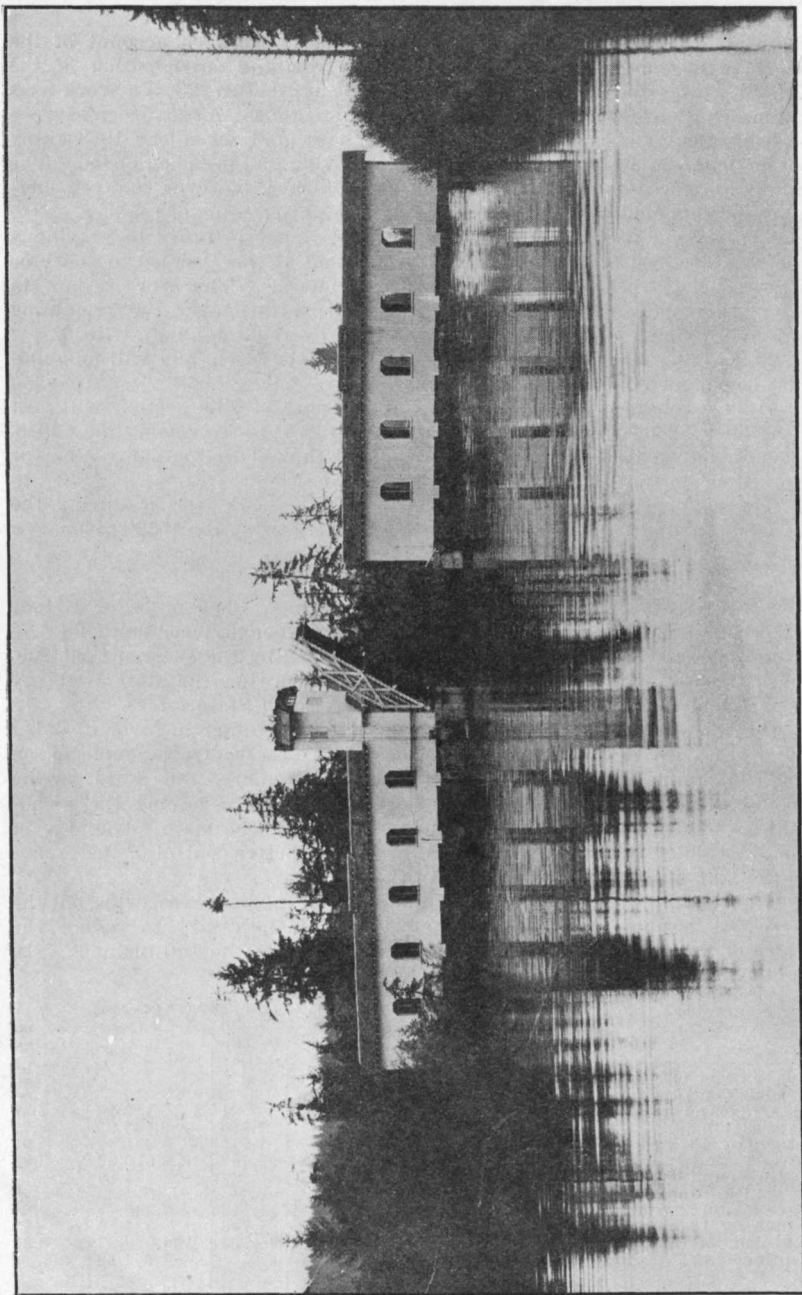
On this section the unit costs show a slight advantage in favor of doing the work with State forces. Conditions were practically the same as on the Clatskanie-Westport Section in Columbia County—the State paying higher wages than the contractor, but the contractor having the disadvantage of more unfavorable weather conditions. The main advantage in the State doing this work was gained by having better control of the organization and more direct supervision of the work.

The original intention was to complete all macadam 16-feet wide but the increased cost of labor, supplies, etc., made it necessary to reduce the width of the macadam to nine feet so as to complete the full distance with the money available.

COST STATEMENT—SVENSEN-WESTPORT MACADAM

Item	Unit	Quantity	Cost	Unit Cost
By Warren Construction Co., on cost plus contract—				
Clearing and grubbing	Acres	1	\$ 112.18	\$112.18
Excavation	Cu. Yd.	9,069	6,468.95	.71
6-inch by 12-inch pipe	Foot	1,519	4,472.69	2.90
Waterbound macadam	*Cu. Yd.	13,409	53,010.60	3.95
Engineering			971.84	
By State Forces—				
Excavation	Cu. Yd.	11,512	\$ 7,540.71	.64
6-inch by 12-inch pipe, laying only.....	Foot	1,760	328.80	.19
Waterbound macadam	Cu. Yd.	34,722	134,022.23	3.86
Engineering			1,651.69	
Total.....			\$208,579.69	

* Including 1,839 cubic yards of gravel purchased at a cost of \$1,839.00 and 5,278 cubic yards crushed rock purchased at a cost of \$6,333.60. All other rock was crushed and cost of crushing is included in the cost of the macadam.



COVERED WOOD DRAWBRIDGE ON THE COLUMBIA RIVER HIGHWAY IN CLATSOP COUNTY, OVER THE JOHN DAY RIVER
EAST OF ASTORIA. BUILT IN 1918. LIFT SPAN—40 FEET

John Day River Bridge

As a part of the improvement of the Columbia River Highway between Astoria and Svensen, a bridge was constructed over the John Day River about four miles east of Astoria.

The John Day River is a stream navigable to small boats, so it was necessary to provide a movable span of 40-foot clear opening. Owing to the unusually high price of steel it was decided to construct this bridge of wood. The movable span is of the single leaf bascule type operated by a windlass. Counter weights are employed to assist the movement of the span and in order to compensate for the variable pull required to lift the span at different phases of its movement, the counter weight cables operate over spiral drums in such manner that their pull is a maximum when the span is down, and is least when the span is raised, gradually changing between the two extremes. In order to guard against failure of the operator to close the gate on the side of the stream opposite the machinery, an automatic gate was constructed. It closes when the bridge starts to open and when the bridge closes it swings back out of the way automatically.

The bridge rests on concrete piers carried on piling, and besides the lift span there are two 90-foot covered wooden spans. The operating machinery is completely housed in by means of a tower.

The crossing was designed to carry 20-ton trucks and the covered spans have laminated wood floors with asphaltic wearing surface.

One of the most serious objections raised against covered wooden bridges is the lack of light. This was overcome in this case, as in other wooden bridges on primary roads designed by this Department, by white-washing the interior and the addition of open windows at panel points. These are provided with returns, and with the asphaltic wearing surface on the floors of such bridges prevent moisture coming in contact with the structural timbers of the bridge.

This bridge was built by the Portland Bridge Company and the total cost will be about \$25,000.00. The payments on the bridge to November 30, 1918, amounted to \$21,051.52. Mr. Leigh M. Huggins was resident engineer in charge of construction.

Big Creek Bridge

This bridge is located on the Columbia River Highway near Knappa. It consists of two forty-five-foot reinforced concrete spans, and was built by the State Highway Department with State forces at a cost of \$8,446.70.

Plympton Creek Bridge

The Plympton Creek Bridge is located on the Columbia River Highway in the town of Westport. It is a two thirty-foot span structure and was built by the State Highway Department with State forces at a cost of \$6,413.19.

Little Creek Culvert

This is a 6 by 12 reinforced concrete structure and is located on the Columbia River Highway near Knappa. It was built by the Highway Department with State forces at a cost of \$929.69.

COLUMBIA COUNTY

The State Highway Department expended in Columbia County during 1917 and 1918, the sum of \$488,302.15, which is the largest amount expended in any one county in the state. With this amount the following work was completed:

- 2.5 miles of bituminous paving.
- 27.2 miles of broken stone macadam.
- 8.2 miles of grading.
- 11 reinforced concrete bridges.
- 2 reinforced concrete box culverts.

All of this work is on the Columbia River, and all but the 2.5 miles of paving is between the Clatsop County Line and a point about two miles east of Goble.

Multnomah County Line-Scappoose Paving

A contract was awarded to the Warren Construction Company, August 22, 1917, for 2.5 miles of bitulithic pavement sixteen feet wide on crushed rock base, with two foot macadam shoulders. The old road bed on this section was in excellent condition for base for pavement being old macadam about sixteen feet in width. The grade was followed closely, scarified, and clean crushed rock spread over the entire surface and rolled. Material was borrowed along each side to obtain the required twenty-four foot of roadbed.

A sixteen foot span wooden bridge was replaced by an 8 x 10 feet reinforced concrete culvert built by Lindstrom Bros. on the basis of cost plus ten per cent.

CONSTRUCTION COST OF CULVERT

Class A concrete, 64 cu. yds. at \$22.43	\$1,435.64
Reinforcing steel, 2,900 lbs. at 8c.....	232.00
	\$1,667.64
Contractors percentage	166.96
Total cost	\$1,834.60

Paving work was started November 5, 1917, and completed December 20, with the exception of about 200 feet of new fill made at the culvert which was completed in June, 1918.

Engineering work was done by P. W. Marx, under the supervision of Chas. H. Whitmore, assistant engineer.

DETAILED EXPENDITURE STATEMENT—PAVING—MULTONAMH COUNTY LINE TO SCAPOOSE

Engineering	\$ 1,364.28
Right-of-way attorney fees	35.00
Contract Construction Work as follows:	
Common excavation, 800 cu. yds. at 45c.....	\$ 360.00
Standard Bith. pavement, 24,248.2 sq. yds. at \$1.17	28,370.39
Broken stone, loose measure, 3,115.5 cu. yds. at \$1.90	5,919.45
Broken stone shoulders, 26,974 lin. ft. at 5c	1,348.70
Force account:	
34 feet of 12-inch corrugated iron pipe and 120 feet of 6-inch porous drain tile.....	254.77
Total paid to contractor	\$ 36,253.31
Total cost	\$ 37,652.59

Westport-Clatskanie Macadam

On the Clatskanie-Westport Section, which extended from Clatskanie to the Clatsop County Line, the work was handled originally by the Warren Construction Company, on a cost plus ten per cent. basis. The State Highway Department took this work over December 26, 1917, and from that time on the work was handled by this Department. This work consisted of 8.62 miles of sixteen-foot waterbound macadam.

On this section the costs show that the Warren Construction Company laid crushed rock slightly cheaper than the State. However, the State did all the finishing on this section, which is more expensive than laying the base rock and it was necessary to raise the wages twenty-five per cent. after the work was taken over by the Department. C. L. Grutze was resident engineer on this work.

COST STATEMENT—WESTPORT-CLATSKANIE MACADAM

Item	Unit	Quantity	Total cost	Unit cost
By Warren Construction Co. on cost plus contract—				
Clearing and grubbing	Acres	½	\$ 49.87	\$ 99.74
Excavation	Cu. yd.	6,200	6,820.70	1.10
6-ft. by 12-in. drain pipe	Foot	1,085	2,752.38	2.80
Water-bound macadam	**Cu. yd.	7,742	27,698.87	3.59
Engineering			497.03	
By State Forces—				
Excavation	Cu. yd.	8,299	5,594.75	.67
6-ft. by 12-in. drain pipe (laying)	Foot	298	21.05	.07
Water-bound macadam	Cu. yd.	17,977	68,168.50	3.79
Engineering			25.09	
Total cost			\$ 111,628.24	

** 4,972 cu. yds. purchased at cost of \$5,966.40, all other rock crushed on this job.

Clatskanie-Delena Macadam

The section extending from a point three miles east of Clatskanie to a point two and one-half miles east of Delena, known as the Clatskanie-Delena Section, was completed by L. O. Herrold on a basis of cost plus ten per cent. This work consisted of eleven miles of sixteen foot waterbound macadam, one and one-tenth miles of nine foot waterbound macadam and all necessary grading, drainage, etc. The foundation on part of this section was very poor and 10,233 cubic yards of rubble base was used in order to make satisfactory foundation for macadam. While this increased the cost of the macadam, it was the only way in which a permanent foundation could be secured on this section. P. M. Hall-Lewis was resident engineer on this work.

**COST STATEMENT—CLATSKANIE-DELENA MACADAM
(COST PLUS 10 PER CENT)**

Item	Cost
Engineering	\$ 5,998.96
General construction	11,759.14
Clearing and grubbing	892.37
Excavation and embankment	22,529.95
Drainage structures	3,596.27
Miscellaneous structures	1,454.76
Quarrying and crushing	43,714.47
Placing, rolling, sprinkling, etc.	46,502.97
Camp construction and operation	111.51
Total	\$136,560.40

This work includes 25,405 cubic yards of excavation, 22,170 cubic yards of crushed rock macadam and 10,298 cubic yards of rubble base, besides numerous small structures, drains, etc.

Delena-Goble Macadam

Clark & Dibble of Rainier contracted with the Highway Department to construct five and seven-tenths miles of broken stone macadam between Delena and Goble. The prices at which this work was taken by the contractors was very low, and the result was that almost from the first the work was handicapped by lack of proper finances. It became evident to the Department that the contractor would be unable to complete all of this work before the winter rains set in, so to facilitate matters and to provide a passable road for the winter, the Department took over the part of the work between Rainier and Goble after about \$10,000.00 worth of work had been done on this part by Clark & Dibble. The work of the Highway Department on this section is described in the article on the Rainier-Goble macadam.

Clark & Dibble successfully carried to completion the two and one-tenths miles of macadam west of Rainier. A complete statement of the costs of the work handled by the contractors is given below.

DETAILED EXPENDITURE STATEMENT—MACADAM—DELENA TO GOBLE

Engineering	\$ 2,519.50
Construction—	
Common excavation, 938 cu. yds. at 40c.....	\$ 375.20
Intermediate excavation, 75 cu. yds. at 60c.....	45.00
Solid rock excavation, 25 cu. yds. at \$1.15.....	28.75
Broken stone macadam, 12,911.5 cu. yds. at \$2.18.....	28,147.07
12-inch corrugated iron pipe, 420 lin. ft. at \$1.30.....	546.00
Clay filler, 1,403 cu. yds. at \$1.00.....	1,403.00
Force Account—	
Lowering 18-inch corrugated iron culverts.....	55.78
Lengthening existing culverts and opening ditches	15.62
18-inch corrugated iron pipe, 80 lin. ft.....	235.43
Clearing slides and ditching near Prescott.....	2,201.47
Removal of slides	1,377.22
Side ditches for macadam work	336.97
Preparation of subgrade for macadam.....	330.65
Spreading, sprinkling, and rolling macadam.....	27.07
	35,125.23
Less credit for 24 days use of State roller at \$5.00....	120.00
Total amount paid to contractor	35,005.23
Total cost	\$ 37,524.73

Rainier-Goble Macadam

In Columbia County the State Highway Department laid twenty-four and one-tenth miles of sixteen foot waterbound macadam and four and two-tenths miles of nine foot waterbound macadam between Goble and the Clatsop County Line. Of this the Rainier-Goble Section was taken over from the contractors, Clark & Dibble, after being partly completed. This was done in order to facilitate the work and get the road open for traffic before the rainy season.

While the work done by the State on this section cost more per cubic yard than the contractor was originally receiving, the actual difference in cost for the job was not sufficient to justify the Department in allowing the contractor to proceed with the work which would have entailed leaving the road closed to traffic for another winter.

COST STATEMENT—RAINIER-GOBLE MACADAM (STATE FORCES)

Item	Unit	Amount	Cost	Unit Cost
Engineering			\$ 382.85	
Intermediate Excavation	Cu. yds.		1,078.97	.72
Quarrying and crushing	Cu. yds.	2,555	3,828.71	1.29
Hauling stone	Cu. yds.	2,555	3,243.99	1.27
Placing and rolling	Cu. yds.	2,555	2,979.22	1.17
Camp construction and operation			719.27	
General construction			197.34	
Total			\$12,430.35	

Goble Macadam Work

A contract was awarded to Warren Construction Company September 4, 1917, for macadamizing the Goble Cul-off on a basis of cost plus ten per cent.

Columbia County has a quarry on the old road about three-fourths of a mile west of Goble, which was equipped with complete crushing outfit and arrangements were made by the contractor for the use of this equipment and all the rock for this job was crushed and hauled from this quarry.

Work was started March 1, 1918, and completed June 25, 1918.

Engineering work was done by H. C. Compton as resident engineer under the supervision of Chas. H. Whitmore.

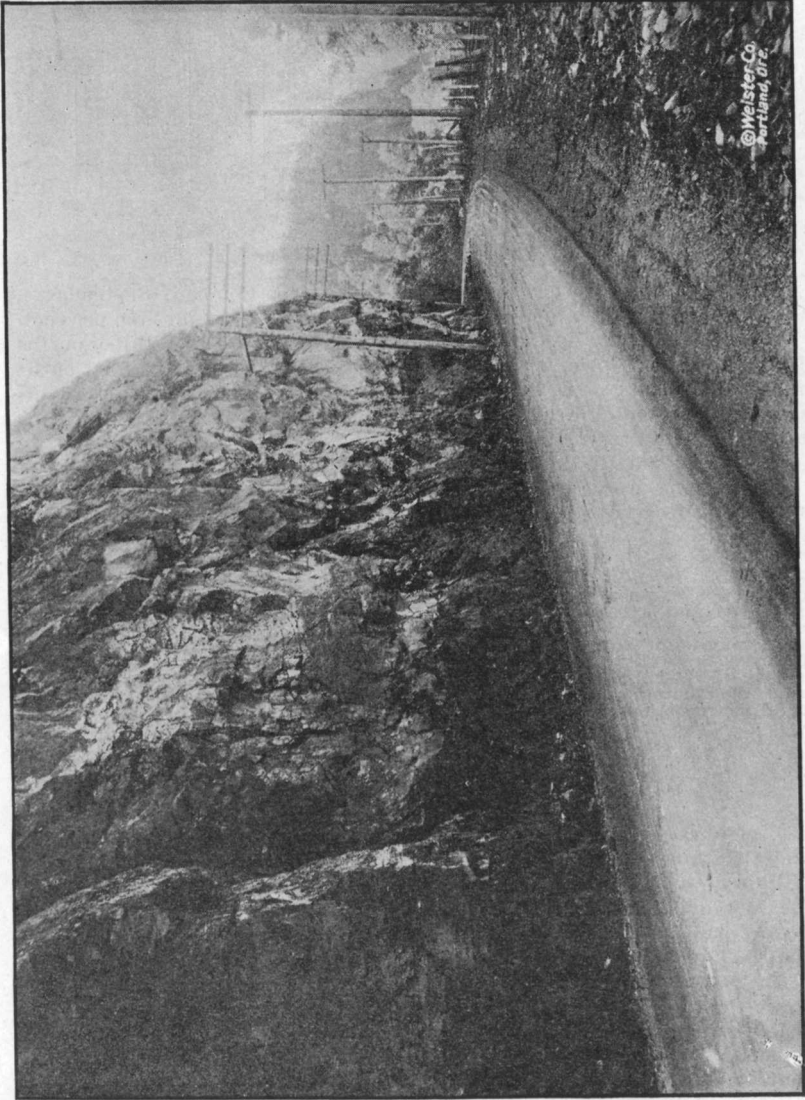
COST STATEMENT

Construction engineering	\$ 548.12
Excavation and embankment	137.24
Drainage	21.11
Quarrying and crushing (6,504 cu. yds. crushed)	9,627.92
Spreading and rolling (6,504 cu. yds.)	5,913.53
Hauling (6,504 cu. yds.)	4,371.62
Camp construction and operation	545.61
Corral construction and operation	313.82
Total cost	\$21,478.97

Goble Grading Section

A new location of the Columbia River Highway was made from a point two miles east of Goble to Goble Creek and a new concrete bridge built over Goble Creek, making a saving in distance of about one-half mile and doing away with several excessive grades, sharp curves and narrow roadbed, also a dangerous bridge and trestle across Goble Creek.

A rock cut between Goble and Goble Creek was taken out by the S. P. & S. Ry. Co. with steam shovels and the material used by them for riprap, thus making a considerable saving to the State Highway Commission. The material for the west approach to the new bridge was obtained by blasting and barring down rock from a dangerous perpendicular cliff about 1,000 feet west of the bridge, from which large rocks had fallen onto the highway. To make the highway safe it was necessary to remove this material and by using it in the bridge approach, did away with other borrow which would have been necessary. The cliff is about 200 feet high with the highway and S. P. & S. Ry. side by side at the foot, necessitating very light shots and careful work and was completed without accident to men or interruption of traffic on the railroad.



ON THE COLUMBIA RIVER HIGHWAY NEAR GOBLE IN COLUMBIA COUNTY. GRADED AND
MACADAMIZED IN 1917 AND 1918

The material for the east approach was obtained by trimming up the cut left by the railroad company.

A contract for grading the cutoff was awarded to the Warren Construction Company, August 7, 1917, and work started in July, 1917. From the east end of the section to Ruben, about one mile in length, the material was handled by teams. Rock work at Ruben and at Goble was sub-let to station men. The fill across the flat between Ruben and Goble was made from side borrow, by using a steam hoisting engine, with boom and clam shell bucket. This work was done in the fall and winter and the material was light loam and sand and very wet, and did not pack very solid in the fill, therefore a strip of rock sixteen feet wide and one foot in thickness, taken from the rock cuts at either end, was placed on the fill and rolled thus making a solid base for the crushed rock macadam.

The engineering work was done by A. F. Pratt, resident engineer and W. E. Eddy, assistant state highway engineer, until October 1, 1917, when it was taken over by H. C. Compton, resident engineer, under the supervision of Chas. H. Whitmore, assistant engineer.

DETAILED EXPENDITURE STATEMENT—GRADING GOBLE SECTION

Engineering	\$ 2,925.64
Guarding S. P. & S. Ry. tracks	527.02
Right-of-way damages	73.56
Rental on State Industrial Ry. track furnished contractor	138.00
Payments to contractor for work as follows:	
Clearing and grubbing	\$ 2,085.00
Common excavation, 20,106.5 cu. yds. at 45c.....	9,047.92
Intermediate excavation, 3,534.9 cu. yds. at 70c	2,474.43
Solid rock excavation, 11,947.2 cu. yds. at \$1.15.....	13,739.28
12-inch reinforced concrete pipe, 560 lin. ft. at \$1.50.....	840.00
24-inch reinforced concrete pipe, 92 lin. ft. at \$3.30.....	303.60
36-inch reinforced concrete pipe, 80 lin. ft. at \$5.30.....	424.00
Overhaul per 100 lin. ft., 18,032 cu. yds. at 2c.....	360.64
Force account—	
Replacing trestle for Warren Packing Co.'s plant, Goble	256.00
Borrowing approximately 400 cu. yds. rock to cover dirt fill	506.08
Removal of overhanging rock near Goble Creek bridge.....	6,454.32
Widening grade and building fill from Goble postoffice to Goble Creek bridge.....	5,853.31
Cutting off rock point to give safe sight distance around curve	47.12
Removal of slide west of Goble Creek.....	18.66
Placing 400 feet drain tile in quicksand.....	137.01
Placing timber foundation for culvert	51.05
Total paid to contractor	\$ 42,598.42
Grand total cost	\$ 46,262.64

Rainier Hill Grading

On July 30, 1917, a contract was entered into with A. L. Clark of Rainier for the widening of the Rainier Hill Section, a section two and two-tenths miles in length, located just west of Rainier. This work was let under a unit price contract, but the nature of the work was such that a considerable part of it could not be fairly measured and paid for on a unit, and on this part the contractor was allowed cost plus ten per cent. The total cost of this improvement was \$6,350.61. A detailed cost statement follows:

DETAILED EXPENDITURE STATEMENT—GRADING—RAINIER HILL SECTION

Engineering	\$ 468.38
Construction—	
Common excavation, 1,925 cu. yds. at 30c	\$ 577.50
Intermediate excavation, 1,071.9 cu. yds. at 48c	514.51
Solid rock excavation, 1,039.7 cu. yds. at \$1.25	1,299.62
Overhaul per 100 lin. ft., 905 cu. yds. at 3c	27.15
12-inch corrugated iron pipe, 228 lin. ft. at \$1.00	228.00
Force account—	
Excavation for cribbing and placing rip-rap	61.93
8-foot extension to 36-inch culvert	54.63
Widening old roadbed, removal of slides and general improvement work not subject to measurement	3,082.56
Culvert pipe furnished by State	36.33
	5,882.23
Total cost	\$6,350.61

Beaver Valley Grading

Before the Columbia River Highway through Beaver Creek Canyon between Delena and Inglis was opened for traffic in July, 1918, in order to reach Clatskanie from Delena, it was necessary to travel over a narrow, dangerous, earth and corduroy road, either by way of Maygar and Quincy or through the hills about eight miles into Clatskanie. Both of these roads were passable for autos only about three months during the dry season.

The grading of this section was partly completed by the County under supervision of Mr. Bowly, State Highway Engineer in 1914. This section being a very important link in the Columbia River Highway and no funds being available from County or State funds during 1915 or 1916, S. Benson decided to advance the necessary funds to make this section passable. About four miles of grading was completed between Inglis and Delena, leaving only the building of bridges to open this section. This work was later macadamized by the State.

The engineering work was done by A. K. Grondahl.

A bill was passed by the 1917 Legislature refunding to Mr. Benson \$20,978.22 which is a large portion of the amount expended by him.

COST STATEMENT

Clearing and grubbing	\$ 1,265.80
Grading—labor and teams	17,124.07
Explosives	2,275.31
Pipe culverts	313.04
Total	\$20,978.22

Prescott Hill Section

This section of the highway was built along the steep hillside, several slides having occurred narrowing the roadbed in some places to about eight feet and making it very dangerous, it was necessary to build several retaining walls, half viaducts and guard fences.

This was done by Oscar Lindstrom on a basis of cost plus ten per cent.

A half-viaduct seventy-five feet in length was built containing fifty-three cubic yards of concrete and 4,100 pounds reinforcing steel, with standard bridge railing for guard fence.

Two hundred and fourteen linear feet of rubble masonry walls were built on a slope of three-fourths to one, and standard bridge railing placed on top for guard fence. These walls contain 438 cubic yards of rock.

A reinforced concrete crib forty-one feet long, fifteen feet high and seven

feet wide was built and filled with large rock. The members were cast on the dock in Rainier and hauled to the location. A reinforced concrete slab on solid earth foundation was used for footing, on the required angle to give the crib a batter of one-fourth to one.

The total cost of the Prescott Hill improvement was \$9,039.86.

Goble Creek Bridge

A ninety-foot reinforced concrete bridge was built over Goble Creek on the Columbia River Highway about one-half mile east of Goble. This bridge has a pile foundation which was put in by the Warren Construction Company on a cost plus basis for \$1,583.32. The superstructure was built by Lindstrom and Fiegerson on a unit price basis. The cost of the structure complete was \$5,907.14.

The engineering work in connection with this work was handled by H. C. Compton, resident engineer, on the Goble Section, and the inspection of the placement of steel and pouring of concrete was in charge of L. M. Huggins.

COST STATEMENT—GOBLE CREEK BRIDGE

Engineering		\$ 77.47
Construction—		
Class A concrete, 135 cu. yds. at \$18.40	\$2,447.20	
Reinforcing steel, 17,925 lbs. at 7½c	1,344.38	
Concrete hand rail, 186 lin. ft. at \$1.75	325.50	
Construction of cement shed and unloading cement.....	129.27	
Pile foundation (force account)	1,583.32	
Total construction cost		5,829.67
Grand total cost of bridge		\$5,907.14

Beaver Creek Bridges

For a considerable distance between Rainier and Clatskanie the Columbia River Highway follows Beaver Creek, crossing the creek in many places. To replace a number of temporary wooden structures and to provide bridges at every crossing, the highway department in 1917 and 1918 constructed nine reinforced concrete bridges across this stream. The spans of these structures vary from thirty to 105 feet, there being one thirty-foot, one fifty-foot, two sixty-foot, four seventy-foot and one 105-foot spans in all.

The thirty-foot span structure was built by L. O. Herrold of Salem, on a cost plus ten per cent basis and cost \$3,600.00.

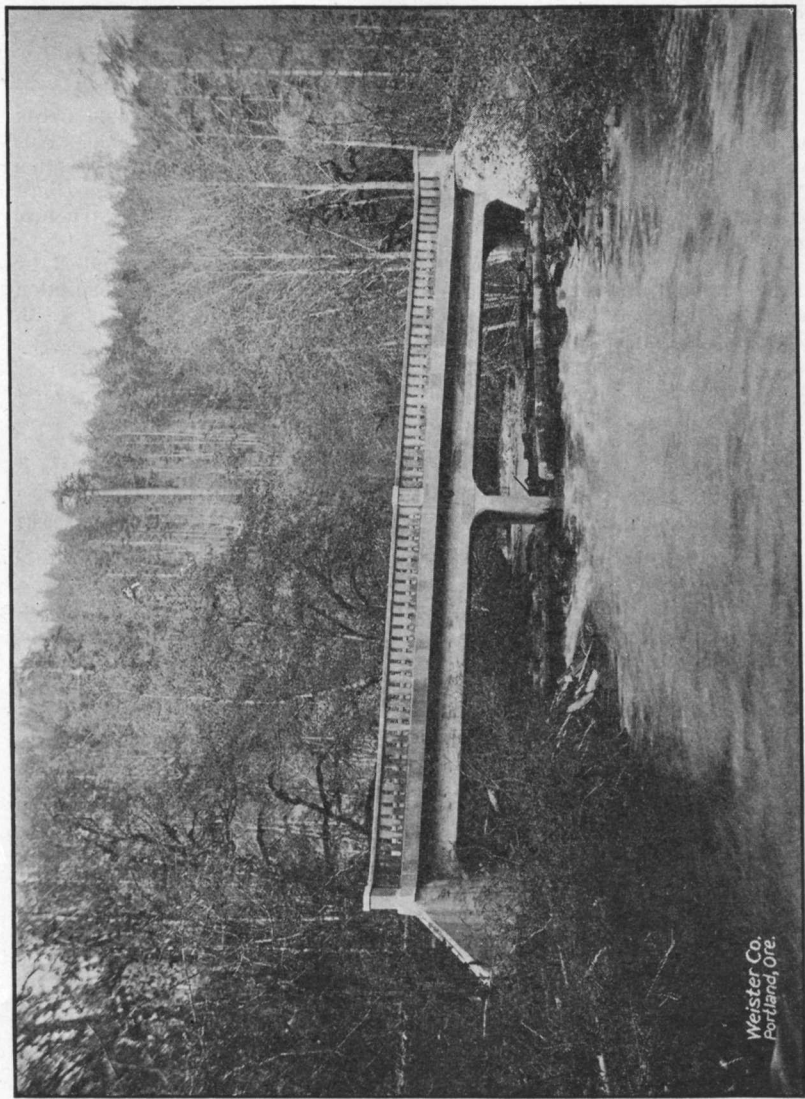
The other eight structures were built by L. O. Herrold of Salem, on a unit price basis, the cost of the eight being \$32,000.00.

Graham Creek Culvert

A double 6 x 6 foot reinforced concrete box culvert was built on the Columbia River Highway to provide passage for Graham Creek near Marshland. This culvert was built with State forces. It contains fifty cubic yards of concrete and cost \$804.49.

Survey—Columbia City to Scappoose

A survey was made between Scappoose and McBride a distance of eleven and two-tenths miles. This survey follows the S. P. & S. Ry. on the south side the entire distance and is shorter than the present traveled road by about one mile, and also does away with six grade crossings.



ONE OF NINE REINFORCED CONCRETE BRIDGES IN THE BEAVER CREEK VALLEY, COLUMBIA COUNTY,
ON THE COLUMBIA RIVER HIGHWAY BETWEEN RAINIER AND CLATSKANIE. ALL BUILT IN
1917 AND 1918

While most of the roadbed will be entirely new work, it will not be of heavy construction, the country being comparatively flat. Between Scappoose and St. Helens the material is mostly earth. Between St. Helens and McBride the material is mostly rock.

Two bridges of thirty foot spans or more are needed, also several box culverts and pipe culverts.

The survey from Scappoose to St. Helens was made by P. W. Marx; from St. Helens to McBride by H. C. Compton.

COOS COUNTY

The work of the Highway Department in Coos County consisted entirely in assistance given the County in the making of surveys and the engineering of construction work done under the County's bond issue of \$362,000.00. For this purpose \$16,967.68 of State funds were expended, and the total amount of County expenditures audited and vouchered through the Highway department was \$170,781.83. These expenditures were made on work on the Coast Highway between Marshfield and the Curry County Line, and on the Coos Bay-Roseburg Highway between Coquille and Myrtle Point. The engineering work was in charge of R. B. Murdock.

CROOK COUNTY

Crook County is one of the districts of Eastern Oregon where the road program is an expensive one. Prineville now has rail communication with outside points, and in sections of the County there is found some good natural roads, but much is wanting in the line of transportation facilities. Owing to a large portion of the County being mountainous in character, much of the roads are little else than trails.

Formerly the boundaries of Crook County encircled an area now comprising several counties. The paring process, caused by the forming of new counties left Crook County in a peculiar position. The local road map indicates that the County is divided into two communities with the dividing line following the rugged country a few miles east of Prineville. A single road that is a succession of heavy grades and poor alignment, is the sole medium of traffic communication between the two ends of the County.

The people of Crook County are fully aware of the importance of highways. Although local funds will not go far, a remarkable beginning has been made. A County bond issue of \$95,000.00 has been voted for road construction. The general progressiveness and co-operative spirit existing throughout the County is shown by the fact that \$85,000.00 of the bond issue is to be expended on one road. Reference is made to the proposed road up Crooked River from Prineville, connecting the east and west end of the County.

The State Highway Commission has ordered a location survey made of the Crooked River Highway between Prineville and the Shorty Davis Ranch. The length of this line will be about thirty miles, and practically a water grade can be secured. This work will start easily in 1918.

The immediate purpose of the survey is to gather definite data for the consideration of the State Highway Commission. The County authorities have made application for State aid and request early consideration of the matter.

The State Highway Commission is cooperating in the construction of the Ochoco Forest Road in Crook County.

Ochoco-Canyon Forest Road

The State Highway Commission extended aid to Crook County by helping to secure Federal aid and by appropriating State funds for the construction of a nine and seven-tenths mile section of the McKenzie River Highway between Prineville and Mitchell. This section is adjacent to the Wheeler County Line and connects up with proposed grading work in Wheeler County.

Construction work is in progress under the direction of the United States Office of Public Roads. The cost of this work will be defrayed by co-operative funds from the State, County and Government. The total estimated cost is \$52,500.00.

The following statement shows the appropriations made for this work:

Total estimated cost of work.....	\$52,500.00
Appropriated by State.....	17,500.00
Appropriated by Government.....	17,500.00
Appropriated by County.....	17,500.00

CURRY COUNTY

The most important highway in this County is, of course, the Coast Highway, which affords an outlet to California on the south and Coos Bay on the north. Between the Coos County Line and Port Orford the route of the Coast Highway lies along the foot of the mountains and on a comparatively level plain and, except in a few cases at river crossings, the grades of the present road are not excessive. The alignment could be improved but is satisfactory for the present. A gravel surfacing on this section makes it passable the whole year round.

South of Port Orford the topography of the County changes. The slopes are steep; in many cases reaching forty degrees, and are badly broken up. This section is also subject to slides of which there is abundant evidence of recent activity. The drainage being at right angles to the coast must be crossed by the highway requiring considerable rise and fall in the grade line.

A survey from Port Orford south was commenced in December of 1917. A line was located and staked ready for construction between Port Orford and Hubbard Creek, eliminating steep grades and sharp curves on the present road. A close preliminary line was run between Hubbard Creek and Mussel Creek (Arizona Inn), a thorough study made of the conditions and the following route recommended, which eliminates the excessive grades and high summit of 1,100 feet of the present road. The location lies between elevation 100 and 400, dropping into and crossing drainage as it is met, following close to the beach until Brush Creek is reached, then following up Brush Creek on the east side of Humbug Mountain until an intersection with the present road is reached, straightening out present road for about one mile, then following the coast between elevation 200 and 400, dropping into Mussel Creek.

The controlling points on this route are the slides which must be headed to secure a stable roadbed. A twelve-foot roadbed has been proposed for this project, with maximum six per cent grades and the construction even for this narrow width is heavy as it will be necessary to bench out the entire

width of the roadbed on solid ground, the slopes being too steep for fill to catch. Considerable bridging is required and a gravel surface provided throughout the entire length to insure an all year road, so the cost of even this narrow roadbed will be high.

A beach route located about ten feet above high tide has been proposed, and, while this has the advantage of shorter distance and no rise and fall, this route is not believed to be feasible because the underlying rock is soft and disintegrates readily and is eroded by tidal action to a considerable extent. The numerous slides at this elevation would also make construction on this location inadvisable for a permanent road.

A reconnaissance was made between Mussel Creek and Gold Beach. After leaving Mussel Creek, considerable development work is required to attain standard grade, and but a small portion of the present road could be used. Passing Euchre Creek, there will be utilized along Cedar Creek a new section of road about eight miles in length which has been recently graded by the County. If widened and the alignment corrected in a few locations, this would afford a direct route to the Rogue River where a ferry runs regularly. Between the river crossing and Gold Beach there is a fair road requiring only straightening out and widening.

A large portion of the total area of Curry County is in the forest reserve making the taxable area relatively small. For this reason and in view of the heavy cost of construction, aid is asked by the County from State and Federal sources. The most needed improvement is the section between Port Orford and Brush Creek. In view of the increasing probability of the Coast Military Highway by the Federal Government, which would be a great benefit to this County as well as to the State in general, it is desired to construct such sections as are undertaken on the correct location and standard grades, so that future widening and surfacing only will be necessary to bring it to the high standards which will undoubtedly be maintained on this military highway.

It has been proposed by the Commission to co-operate with the Forest Service in a joint Forest Aid Project in Coos and Curry Counties, each contributing \$50,000.00, the Forest money to be spent in northern Coos County and the State money, between Port Orford and Brush Creek. Curry County has offered to co-operate with County tax funds. It is hoped that this project can be carried out during the 1919 season.

DESCHUTES COUNTY

Bend-Lapine Cinder Macadam

During the year 1917, an appropriation was made by the Highway Commission for the construction of cinder macadam between Bend and Lapine. This work was advertised and proposals were received on August 7, 1917. As the bids submitted at that time were not considered favorable, all were rejected, and the work was undertaken under the supervision of the County Court.

This section, which had been graded under a previous administration, passes through a flat, pine district, with a surface formation of volcanic ash, which is a very poor road material, roads without surfacing becoming practically impassable during the summer season.

As no rock or gravel was available for macadamizing, scoria or volcanic cinder was used, of which material there is an inexhaustible supply along the right-of-way. This scoria is very light, weighing about 1,700 pounds

per cubic yard. It, however, has made an excellent macadam, and because of its lightness can be handled and placed cheaper than either rock or gravel. The results are as favorable as if the best pit-run gravel could have been had.

A total of 18,300 cubic yards of cinder macadam was placed on this section and twelve and five-tenths miles of completed surface was secured. The total cost was \$20,183.60, giving a unit cost of approximately \$1,600.00 per mile, which is proof of the economy of this type of construction where volcanic cinder is obtainable.

Survey—Rolyat to One Hundred Mile Road

In September and October, 1918, the State Highway Commission made a location survey on the section of the Bend-Burns Highway between Rolyat, in Deschutes County and the One Hundred Mile Road, in Harney County. The object of the survey at this time is to secure a more direct route and to avoid the bad section of the present road through the Glass Buttes district. The length of this survey is seventeen and one-tenth miles and it materially shortens the distance, as compared with the present road between the terminal points mentioned.

Fifteen and six-tenths miles of this line are in Deschutes County and one and five-tenths miles in Harney County. The northeast corner of Lake County is touched by the survey but only for a short distance. The definite limits are not shown as the County Lines could not be found and it was deemed not advisable to go to the cost of reestablishing the lines for the purpose of the survey. The new location leads in an easterly direction from Rolyat and continues to the north of the present road.

The plans for this survey will be made up in the near future. H. B. Wright was the locating engineer in charge.

DOUGLAS COUNTY

As a result of the liberal co-operation of Douglas County, a very large amount of work has been done during 1917 and 1918 on the Pacific Highway across that County. From a \$500,000.00 bond issue the County set aside \$200,000.00 for the improvement of the Pacific Highway north of Roseburg, with the understanding that the Highway Department would expend an equal amount on the same highway south of Roseburg. In accordance with this arrangement, it was agreed that the County would grade 10.4 miles between Yoncalla and Oakland, grade and macadamize 4.6 miles between Comstock and Leona, and grade 2.4 miles between Comstock and the Lane County Line; and that the State would grade 12.8 miles between Myrtle Creek and Dillard and macadamize 2.4 miles between Comstock and the Lane County Line. It was further agreed that if the County would cooperate with the State and Federal Government to the amount of \$23,000.00 on the Canyonville-Galesville Forest Road Project, this amount would be considered a part of the \$200,000.00 to be provided by the County in connection with the general scheme of improvement outlined.

All of the work contemplated in this co-operative agreement has been carried to completion, and when final payments have been made the total expenditure by the State will be approximately \$205,000.00 and by the County \$175,000.00.

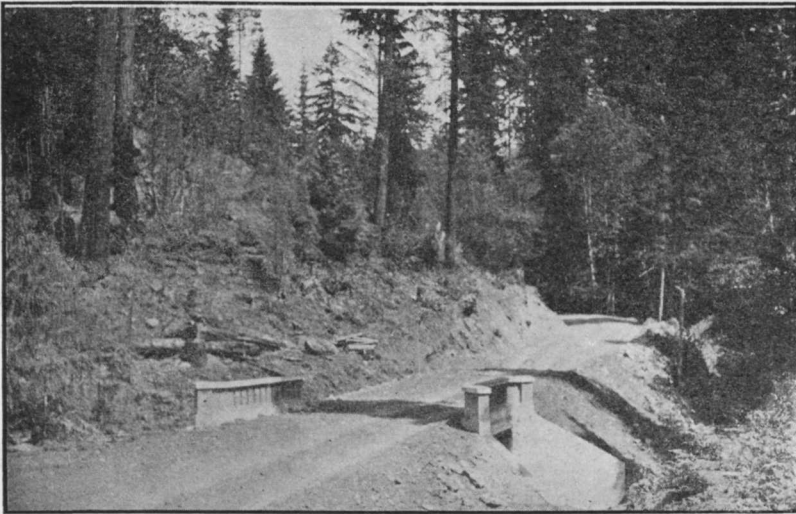
The Canyonville-Galesville Forest Road Project referred to above involves the grading of a 9.7 mile section over Canyon Creek Pass, and it will eliminate one of the very worst stretches on the Pacific Highway between

Portland and the California Line. This is estimated to cost \$211,000.00, of which the County will pay \$23,000.00, the State \$94,000.00 and the Federal Government \$94,000.00.

In summary, the improvement work on the Pacific Highway in Douglas County during 1917 and 1918, including the work now under way, consisted of 39.9 miles of grading and 7.0 miles of macadamizing.

The expenditures on the individual sections by the County, State and Federal Government when final payments are completed, will be approximately as follows:

Sections	By State	By County	By Federal Govt.	Total
Lane County Line-Comstock Grading.....	\$ 2,027.30	\$ 17,119.44	.....	\$ 19,146.74
Lane County Line-Comstock Macadam.....	15,185.09	.....	.....	15,185.09
Comstock-Leona Grading and Macadam.....	5,650.28	74,349.72	.....	80,000.00
Oakland-Yoncalla Grading.....	17,565.28	83,530.84	.....	101,096.12
Myrtle Creek-Dillard Grading.....	120,000.00	.....	.....	120,000.00
Canyonville-Galesville Grading.....	94,000.00	23,000.00	94,000.00	211,000.00
Umpqua River Bridges.....	45,500.00	.....	.....	45,500.00
Total.....	\$299,927.95	\$198,000.00	\$94,000.00	\$591,927.95



BRIDGE ON PASS CREEK—20 FT. SPAN. ON PACIFIC HIGHWAY NEAR COMSTOCK IN DOUGLAS COUNTY

Grading—Comstock to the Lane County Line

This section runs through the northern portion of the Pass Creek Canyon, and has been the dread of tourists heretofore. It has always been a hard road to travel under summer conditions and absolutely impassable in winter, even for horse-drawn conveyances.

The contract for this improvement involved 2.4 miles of grading and was awarded to S. S. Schell of Oakland, Oregon on September 5, 1917. The bulk

of the grading was done that fall and the job was completed in the spring of 1918. The road bed was graded to a width of 24 feet with 5 per cent maximum grades and easy curves. In addition to the grading, the contract included two drainage structures over Pass Creek, one a double 6x6 reinforced concrete box culvert and the other a 20-foot reinforced concrete bridge. All construction charges were paid by Douglas County. Engineering charges were paid by the State.

Mr. E. B. Bishop was the Resident Engineer in charge on this section.

DETAILED EXPENDITURE STATEMENT—GRADING COMSTOCK TO LANE COUNTY LINE

Engineering		\$ 2,029.80
Construction—		
Clearing and Grubbing	\$2,400.00	
Common Excavation, 11,688 cu. yds. at 45c	5,259.60	
Intermediate Excavation, 6,085 cu. yds. at 60c	3,651.00	
Solid Rock Excavation, 1,016 cu. yds. at \$1.15	1,168.40	
Overhaul per 100 ft., 7,220 cu. yds. at 3c	216.60	
12-inch Plain Concrete Pipe, 134 lin. ft. at \$1.00	134.00	
24-inch Reinforced Concrete pipe, 160 lin. ft. at \$2.50	400.00	
6-inch Porous Drain Tile, 591 lin. ft. at 20c	118.20	
Class A Concrete, 120.46 c. y. at \$24.00	2,891.04	
Class B Concrete, 11.62 c. y. at \$16.00	185.92	
Metal Reinforcement, 7,625 lbs. at 8c	609.84	
Repairing Timber Bridge	26.34	
Laying 315.5 lin. ft. of Drain Tile and Backfilling	56.00	
Total paid to Contractor		17,116.94
Total Cost		\$19,146.74
Paid by County	17,119.44	
Paid by State	\$ 2,027.30	
Total		\$19,146.74

—Macadam—Comstock to Lane County Line

On August 6, 1918, a contract was awarded to S. S. Schell for macadamizing the above newly graded section in Pass Creek Canyon, by the State Highway Commission, same to be a standard three course broken stone, water bound surface. This work was carried through in a very able manner on the part of the Contractor and completed November 16, 1918. This surfacing makes an all year road, of one of the worst pieces of road in the State. The entire cost of this work was paid by the State.

DETAILED EXPENDITURE STATEMENT—MACADAMIZING—COMSTOCK TO LANE COUNTY LINE

Engineering		\$ 302.09
Advertisements for bids		66.90
Construction—		
Broken Stone Macadam, 4,354 cu. yds. at \$3.35	\$14,585.90	
Earth Filler, 150 cu. yds. at 75c	112.50	
Removing Slides	117.70	
Total Paid to Contractor		14,816.10
Total Cost		\$15,185.09

Grading and Macadam—Comstock to Leona

This section is through the south end of Pass Creek Canyon, beginning approximately a mile and a half south of Comstock and extending to a point a half mile north of Leona, being 4.6 miles in length. The contract was a joint contract signed by the County Court and State Highway Commission and was awarded to Hall & Soleim of Eugene on September 5, 1917. Work covered by the contract was for grading and macadamizing, culverts and bridges.

Due to shortage of labor, poor shipments on macadam rock, and financial difficulties, the contractors were obliged to ask the State Highway Commission to take over the work. On August 20, 1918, after a conference with

the County Court and the Contractor's Surety Company, this was done. The work was completed November 30, 1918. The construction details under the State supervision were handled by a State construction engineer, representing the Contractors and Surety Company, and the engineering details by the resident engineer on the work—the latter rendering regular monthly estimates of work done on the unit contract prices, of the original contract.

This work complete will cost approximately \$80,000.00 of which the County will pay \$74,349.72 and the State \$5,650.28.

The construction of this section was in charge of E. B. Bishop, resident engineer, and F. E. LaPointe, construction superintendent.

Grading—Oakland to Yoncalla

This work extends from the Calapooya River Bridge at Oakland to a point two miles south of Yoncalla, a total distance of 10.4 miles. A contract for clearing, grading and culverts was awarded the Warren Construction Company, September 5, 1917, being the last of three contracts signed jointly by the County Court and State Highway Commission.

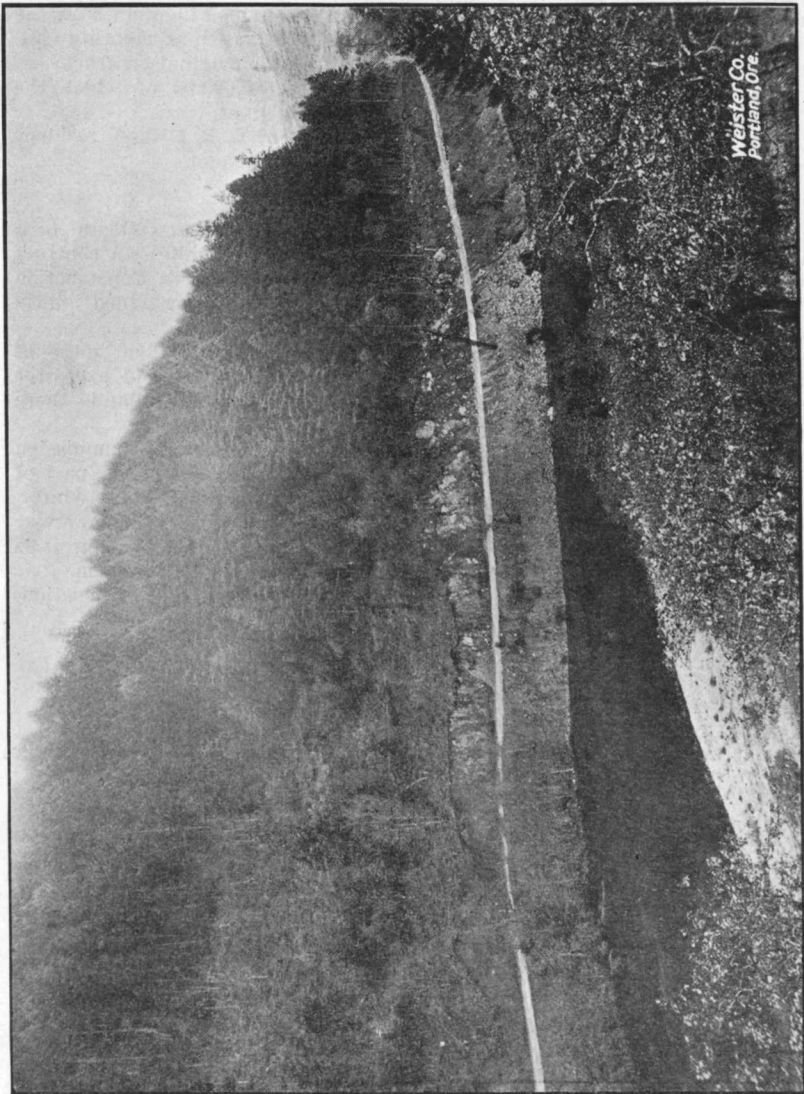
This work was completed July 25, 1918, and is an excellent piece of standard construction 24 feet in width. It eliminates the old excessive grade over Rice Hill, and some bad sections just north of Oakland—there being now no grades over 5 per cent.

On the completion of the grading the State Highway Commission requested permission of the Capital Issues Committee to sell bonds, part of which were to cover the rocking of this unit to make it passable for winter. This request was refused on the ground that it was not a necessary war measure. The road will therefore not be passable this winter, but it is expected that the section will be macadamized during the 1919 season.

Mr. Robert A. Pratt was resident engineer in charge of the construction.

DETAILED EXPENDITURE STATEMENT—GRADING—OAKLAND TO YONCALLA

Engineering.....		\$ 5,864.31
Construction—		
Clearing and Grubbing	\$ 6,350.00	
Common Excavation, 45,563 cu. yds. at 49c.....	22,325.87	
Intermediate Excavation, 37,544 cu. yds. at 77c.....	28,908.88	
Solid Rock Excavation, 17,976 cu. yds. at \$1.30.....	23,368.80	
Overhaul per 100 lin. ft., 61,580 cu. yds. at 2c.....	1,231.60	
12-inch Plain Concrete Pipe, 2,463 lin. ft. at \$1.10.....	2,709.30	
18-inch Corrugated Galvanized Iron Pipe, 742 lin. ft. at \$2.75	2,040.50	
24-inch Corrugated Galvanized Iron Pipe, 108 lin. ft. at \$3.44	371.52	
6-inch Porous Drain Tile, 1,055 lin. ft. at 20c	211.00	
Class A Concrete, 146.5 cu. yds. at \$24.00.....	3,516.00	
Class B Concrete, 102.2 cu. yds. at \$22.00.....	2,248.40	
Metal Reinforcement, 9,067 lbs. at 8c	724.56	
Lumber, 3,545 F. B. M. at \$45.00.....	159.52	
Extra work on culverts, drain ditches, rock back filling.....	174.48	
Hauling and Placing rip-rap for embankments, approximately 350 cu. yds.	203.97	
Lowering water pipe crossing	13.64	
Rebuilding right of way fence	170.50	
Grubbing for borrow pit	21.12	
Extra clearing and grubbing account of line change.....	74.82	
Gasoline furnished State	9.19	
32-ft. by 36-in. Corrugated Iron Pipe (Hauling and Placing)	28.09	
68-ft. by 36-in. Corrugated Iron Pipe in place.....	370.04	
Total paid to contractor		\$ 95,231.80
Total cost		\$101,096.11
Paid by State	\$ 19,015.09	
Paid by County	82,081.02	
Total.....		\$101,096.11



ALONG THE UMPQUA RIVER NORTH OF MYRTLE CREEK IN DOUGLAS COUNTY. GRADED IN
1917 AND 1918

Grading—Myrtle Creek to Dillard

On November 27, 1917, a contract was awarded to Calvert & Wolke of Grants Pass (now known as the Grants Pass Construction Company, James Logan, President), for the clearing, grading, culverts and concrete bridges on a section of 12.8 miles between Myrtle Creek and the junction of the Pacific Highway with the Roseburg-Coos Bay Highway, one mile and a half north of Dillard. This construction eliminates the well but unfavorably known Roberts Mountain grade just south of Roseburg, on which several lives have been lost and also, seven grade crossings of the Southern Pacific Railway. It will be a water grade highway along the beautiful Umpqua River.

The road will not be open to the public until the completion of two bridges over the Umpqua, which are now under construction and which are expected to be completed about January 1, 1919. It is expected that this entire section will be macadamized during the 1919 season.

Mr. F. N. Drinkhall is resident engineer in charge of the grading on this section.

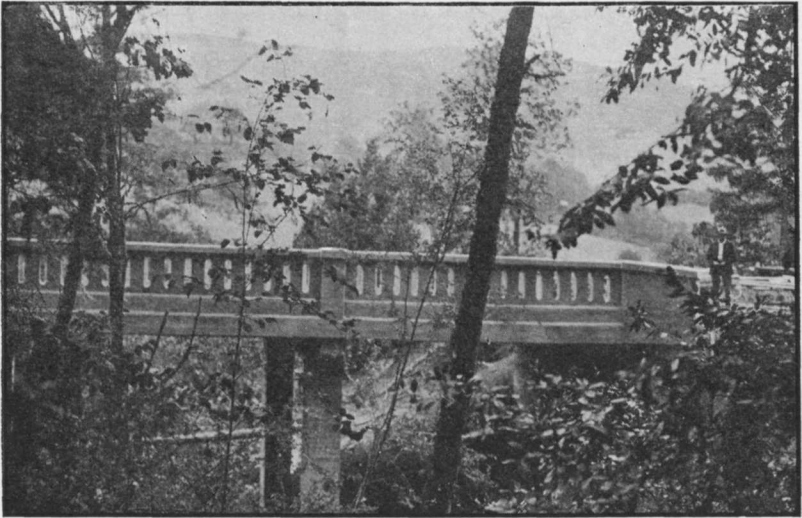
**DETAILED STATEMENT OF EXPENDITURES TO NOVEMBER 30, 1918—
GRADING—MYRTLE CREEK TO DILLARD**

Engineering	\$ 7,499.22
Culvert Pipe furnished by State	4,109.70
Construction—	
Clearing and Grubbing, 97% completed.....	\$ 3,395.00
Common Excavation, 49,146 cu. yds. at 35c	17,201.10
Intermediate Excavation, 42,951 cu. yds. at 56c.....	24,052.56
Solid Rock Excavation, 23,859 cu. yds. at \$1.14.....	27,199.26
Overhaul, per 100 lin. ft., 6,614 cu. yds. at 2c.....	132.28
12-inch Plain Concrete Pipe, 1,798 lin. ft. at 35c.....	629.30
18-inch Corrugated Galvanized Iron Pipe, 556 lin. ft. at 30c	166.80
24-inch Corrugated Galvanized Iron Pipe, 284 lin. ft. at 40c	113.60
36-inch Corrugated Galvanized Iron Pipe, 246 lin. ft. at 75c	184.50
6-inch Porous Drain Tile, 5,054 lin. ft. at 25c.....	1,263.50
Class A Concrete, 471.92 cu. yds. at \$22.00.....	10,382.24
Class C Concrete, 25 cu. yds. at \$20.50	512.50
Metal Reinforcement, 37,747 lbs. at 10c.....	3,774.70
Lumber and Timber, 17,058 F. B. M. at \$45.00.....	767.61
Rough Dry Walls (approx.) (Force Account) 122 cu. yds.	106.41
Clearing outside R. O. W. (Force Account).....	112.96
Back-filling over drain tile with gravel.....	321.06
Total Amount Earned by Contractor to Nov. 30, 1918...	90,315.33
15 per cent retained until completion of contract.....	13,547.31
Total paid contractor to Nov. 30, 1918.....	76,768.07
Total Amount expended to November 30, 1918.....	\$88,376.99

Umpqua River Bridge One Mile North of Dillard

This bridge consists of 3-144 foot covered wooden Howe Truss spans on concrete piers. The spans are continuous, thus forming a roof over 430 feet long. Open windows are constructed at panel points to light the spans and make a more artistic appearance, lack of light and unsightly appearance having been the chief objections to covered wooden bridges. This bridge being on the Pacific Highway, was designed for heavy traffic loading. A laminated wood floor system is used and provision is made for an asphaltic wearing surface although a three inch wooden decking is used temporarily.

This type of bridge is regarded as being very durable, and under conditions of the past year or two, very economical. The structure complete will cost approximately \$26,500.00. Mr. A. S. Kennedy was resident engineer for this bridge as well as the one two and one-half miles south of Dillard. The construction is being handled by the Portland Bridge Company.



VANTYNE CREEK VIADUCT NORTH OF MYRTLE CREEK IN DOUGLAS COUNTY. BUILT IN 1918

Bridge Two and One-half Miles South of Dillard

This bridge is similar to the one described above, except that there are two 144-foot spans instead of three. The cost of construction will be approximately \$19,000.00. It is being built under a contract with the Portland Bridge Company.

Van Tyne Creek Bridge

This is a 60-foot reinforced concrete viaduct on the Pacific Highway near Dole, north of Myrtle Creek. It was constructed by the Grants Pass Construction Company, under their grading contract for the section between Myrtle Creek and Dillard. The total cost of the structure was \$3,575.70.

Half Viaducts North of Myrtle Creek

These structures, two in number, were constructed within a few hundred feet of each other on the Pacific Highway between Myrtle Creek and Dillard and span crevices in the face of a rock bluff. They are of reinforced concrete construction of the through girder type and of spans of 45 feet and 58 feet respectively. The 45 foot structure cost complete \$2,415.28, and the 58 foot structure cost \$2,648.54. Both were built by the Grants Pass Construction Company under their contract for grading between Myrtle Creek and Dillard.

Myrtle Creek Bridge

The bridge over the Umpqua River at Myrtle Creek being inadequate for modern traffic a survey has been made for a new structure. As contemplated, the new bridge will eliminate a grade crossing that now exists at one end of the present bridge.

Canyonville-Galesville Forest Road Project

Under a co-operative agreement between Douglas County, the State and the Federal Government, a 9.7 mile section of the Pacific Highway between Canyonville and Galesville is being constructed. This project will eliminate the heavy grades and dangerous curves through what has been erroneously called Cow Creek Canyon. This section has heretofore been one of the very worst on the entire highway, and its improvement is of great importance.

The work is under contract to John Hampshire & Co. of Grants Pass. The supervision of the work is in the hands of the Federal Office of Public Roads. It is estimated that the project complete will cost \$211,000.00, of which the County will pay \$23,000.00, the State \$94,000.00 and the Federal Government \$94,000.00.

Survey—Coos County Line to Roseburg

During April and May 1917, a preliminary survey was made from the Coos-Douglas County Line eastward to a connection with the new Pacific Highway location between Roseburg and Dillard. Some construction on this line was contemplated in the spring of 1918, but was postponed until the close of the war. Location surveys were in charge of Mr. C. C. Kelley, locating engineer. The length of the survey is 28.7 miles.

Survey—Johns Ranch to Jacques Ranch

This survey was made in July 1917, and is on the Pacific Highway between Glendale and Canyonville. The survey was 7.2 miles in length and was made by Mr. C. C. Kelley, locating engineer.

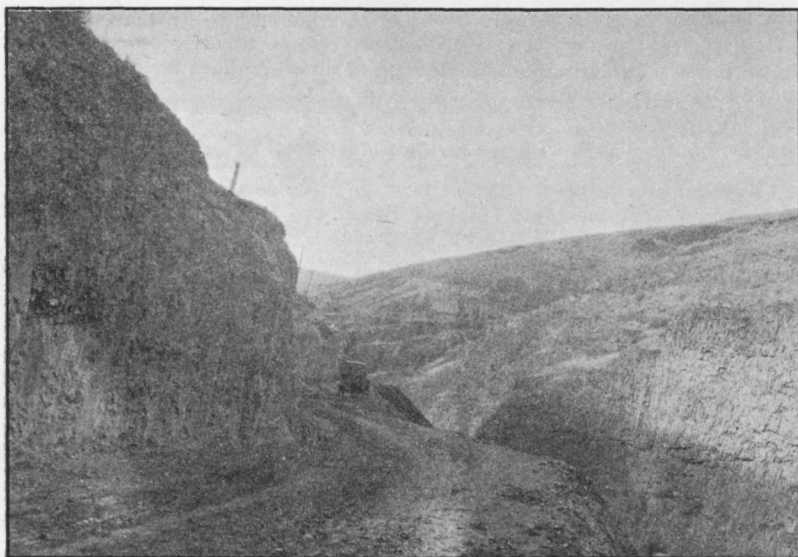
Survey—Canyon Creek Pass to Johns Ranch

This survey consisted of the location of a 2.3 mile section of the Pacific Highway from Canyon Creek Pass to Johns Ranch in Cow Creek Valley. It was made by C. C. Kelley, locating engineer, in August, 1917, and the section is now being constructed as a part of the Canyonville-Galesville Forest Road Project.

GILLIAM COUNTY

Gilliam County presents an interesting situation from the viewpoint of highways. Besides the Columbia River Highway the County is traversed by the John Day Highway, one of the important routes of Eastern Oregon. This large mileage of State highways along with the fact that there are many large agricultural communities to be served, renders important and necessary an extensive road building program.

The people of Gilliam County have long realized the value of good roads. Although continuous effort has been put forth, expensive construction and limited funds have resulted in only a beginning. County



THE JOHN DAY RIVER HIGHWAY SOUTH OF CONDON IN GILLIAM COUNTY
MACADAMIZED IN 1917

authorities have always shown a keen interest in the plans for state co-operation, regardless of whether Gilliam County was to be benefitted directly or whether improvements were to be made in the neighboring counties.

The State Highway Commission has always recognized the urgency of building the Columbia River Highway, and in addition has from the beginning realized the necessity of an improved road leading inland from Condon.

During 1918 the State Highway Commission made a location survey of the Columbia River Highway between John Day River and Arlington, and a reconnaissance survey has been made from Arlington east to the Morrow County Line.

Since August 1917 the State Highway Commission has expended \$28,673.43 for macadamizing the John Day Highway between Condon and Thirty Mile Creek. In addition \$9,000.00 of State funds has been set aside for maintaining and resurfacing this section during the coming winter.

Gilliam County Court and the road district in the north end of the County through heroic efforts have raised \$60,000.00 for grading the Columbia River Highway between Arlington and Blalock, a distance of eight and sixty-eight one-hundredths miles. This work is to be started at once and rushed during the winter season. The State Highway Department will supply engineering supervision.

Condon-Thirty Mile Creek—Macadam

In August 1917 a contract was let by the State Highway Department to Warren Construction Company of Portland for macadamizing a five and seven-tenths mile section of the John Day Highway between Condon and Thirty Mile Creek. The contractor was paid on the basis of cost plus ten per cent for labor and plus five per cent for materials.

Rock was quarried and crushed at two different points on the job and trucks and teams were used for hauling. The old road was scarified and re-dressed prior to laying the macadam. A dry macadam six inches thick was laid over the five and seven-tenths miles. The average width of the surface is about fourteen feet.

The State paid the entire cost of this work amounting to \$28,673.43 and it is thought that about \$1,500.00 per mile will be required for maintenance and re-dressing during the next few months.

C. A. Harrington was resident engineer and inspector for the Department on this work.

Mayville-Wheeler County Line—Grading and Macadam

At the completion of the state work on the Cummins Hill macadam, Gilliam County deemed it advisable to avail themselves of the opportunity to utilize the installed equipment and organization for macadamizing the John Day Highway between Mayville and Wheeler County Line, one mile south. Accordingly they graded and laid macadam for this distance thereby connecting Mayville up with the Wheeler County macadam. Gilliam County paid the full cost of this work amounting to about \$6,500.00 for both grading and macadam.

The engineering and inspection was done by the State Department with George Hibbet in charge.

Columbia River Highway—Survey

A location survey of the Columbia River Highway was made by the State Highway Department during 1918. Beginning at the John Day River near its mouth the line follows up the Columbia River paralleling the O-W R. & N. Railway and ends at Arlington. The total length of the survey is twenty-three and ninety-six one-hundredths miles. The plans for the eight and sixty-eight one-hundredths miles section from Arlington to Blalock have been completed but there are revisions to be made in the remainder of the line owing to right-of-way encroachments upon the railroad property.

This survey was made under the direction of C. A. Harrington and B. H. McNamee, locating engineers for the State Department.

GRANT COUNTY

Grant County lies in the mountainous section of the State and its limits on three sides, north, east and south follow water sheds. The

general slope of the lands and direction of the drainage is toward the west but even here the country is of such rugged character that no natural passageways are found to relieve the isolated condition. The roads in all directions are very rough and of little economic value to the County. The narrow gauge railway leading from Baker to Prairie City serves the whole County for both passenger and freight traffic.

It is readily seen that the call for improved roads for these settlements is an urgent one. To meet the demands for transportation facilities the County has made a very creditable showing towards financing highway improvements. In November 1916 a bond issue was voted providing \$140,000.00. The mileage is so great however, and the construction so heavy and expensive, that County funds available for permanent work are altogether inadequate.

Grant County was among the first to apply for State and Federal aid and its call did not go unheeded. The State Highway Commission drew heavily upon its first apportionments of Post Road Funds in order to provide a connecting road between Spray and Dayville through the Big Basin and Picture Gorge. The co-operative plans provide also for the improvement of the John Day-Prairie City sections.

Two sections of the John Day Highway in this County aggregating thirty-one and thirty-one hundredths miles in length have been definitely established by location surveys, an additional location is to be made in the near future. In November the State Highway Commission received bids for the grading and macadamizing of that section of the John Day Highway between Hall Hill and Prairie City. The cost of this work is to be defrayed by State and Government funds in equal amounts.

Funds have been set aside by the Commission for the matching of Federal and County funds in the construction of the John Day Highway between the Grant-Wheeler County Line and Dayville. This is a portion of Post Road Project No. 6 extending from the mouth of Sarvice Creek, Wheeler County to Valades Ranch, Grant County. The project covers a total of forty-eight and ninety-five hundredths miles, twenty-three and forty-five hundredths miles of which are in Grant County. The appropriations for the improvement are apportioned as follows: Grant County, \$50,000.00; State, \$93,871.20; Government, \$93,871.19. Total estimated cost, \$237,742.39.

The Department has also appropriated funds for the grading and macadamizing of that section between the town of John Day and Fisk Creek, seven and four-tenths miles east of the town. The total estimated cost of the work is \$145,051.50, which amount is to be supplied in equal amounts by the State and Government. The improvement from John Day to Prairie City is listed for early completion owing to an urgent request from the War Department to keep the road in condition for hauling chrome ore.

The following summary shows State and Federal aid to be extended Grant County during the next season.

Appropriated for expenditures in 1919	State Funds	County Funds	Government Funds	Total
Hall Hill to Prairie City.....	\$19,493.95	.....	\$19,493.95	\$ 38,987.90
Wheeler County Line to Valades Ranch	93,871.20	\$50,000.00	93,871.19	237,742.39
John Day to Fisk Creek	72,525.75	.....	72,525.75	145,051.50

Hall Hill Section—Grading and Macadamizing

In July of this season the Grant County Court turned over to the State Departments funds for the improvement of certain sections between John Day and Prairie City. The Hall Hill Section, three and five-tenths miles in length, received first attention as it was much in need of repair. The grading is almost completed and gravel macadam is laid on two and twenty-four hundredths miles. There has been expended on this work up to November 30, \$39,000.00, and approximately \$11,000.00 will be required for completion of the same. County funds will be supplied to finish this section. State forces and local labor are being employed on this work under the direct supervision of C. A. Harrington, resident engineer for the Department. In addition to the grading and macadamizing this work involves the construction of a 100-foot span bridge over the John Day River.

SUMMARY OF CONSTRUCTION QUANTITIES

Excavation—5,300 cu. yds. solid rock; 4,100 cu. yds. intermediate; 10,300 cu. yds. common.
Pipe—70 lin. ft. 18-inch; 150 lin. ft. 24-inch; 120 lin. ft. 9-inch.

Survey of Big Basin Section of John Day Highway

In 1917 a location survey was made from the Grant-Wheeler County Lines east of Spray to Valades Ranch, five miles west of Dayville. The line crosses the North Fork of the John Day River at Kimberly's Ranch and follows up the Big Basin Valley along the east bank of the John Day River. A crossing is made near the upper end of Big Basin and the line follows the west bank of the river through Picture Gorge Canyon. On leaving Picture Gorge the line enters the John Day Valley, and continues on the west side of the river to Valades Ranch where the project ends. Valades Ranch is five miles west of Dayville. This is a portion of the Sarvice Creek-Valades Ranch Post Road Project and the Grant County section is twenty-three and forty-five hundredths miles in length. This survey was made under the direction of R. H. Coppock, locating engineer.

Survey of John Day Highway From John Day to Prairie City

In 1918 a location survey was made from the town of John Day to Prairie City. The line follows the south limit of the valley east from John Day for eight and five-tenths miles and crosses the river to the north side of the valley at the bridge site on the present road. It continues thence along the north side of the valley to Prairie City. The length of this survey is twelve and seventy-four hundredths miles.

C. A. Harrington and R. H. Coppock were the locating engineers on this section. The office work for this survey is finished and plans are complete.

Sarvice Creek-Valades Ranch Post Road Project

(Same as for Wheeler county)

John Day-Fisk Creek Post Road Project

The State Highway Department has submitted to the Government for the purpose of securing Post Road aid, that section of the John Day High-

way between John Day and Fisk Creek. This project is five and seventy-two hundredth miles in length and the total estimated cost is \$145,051.50. The co-operation is to be on the basis of fifty per cent of the cost from each the State and Government.

Assurance has been received that the project will receive the support of the Government and it is expected that construction work will begin in the near future.

Hall Hill-Prairie City Post Road Project

The Office of Public Roads has approved the application for Post Road aid on the John Day Highway between Hall Hill and Prairie City. The length of this project is two and fourteen hundredths miles. The total estimated cost is approximately \$39,000.00. The road is to be graded and surfaced with gravel macadam. This improvement involves also the construction of a fifty foot span bridge near Prairie City. The apportionment of the costs provide for the payment of \$19,500.00 by each the State and Government.

Bids were received for this work on November 27 and a contract for the construction was later awarded Kern & Co. of Portland, Oregon. Work will begin in a short time and the bid price for this improvement was \$38,987.90.

HARNEY COUNTY

Roads in Harney County are few in number, but the combined mileage of these few is enormous. Fortunately a large portion of the County roads are good most of the year, but during the winter season communication by the valley roads is usually extremely difficult.

Highways are of extreme importance in this County owing to the scarcity of railroads. The value of improved highways is fully appreciated by the people and a very creditable beginning has been made on the roads in the vicinity of Burns. However, County funds are entirely inadequate for the carrying out of a road building scheme of any magnitude.

The State Highway Commission extended aid in 1918 to the amount of \$20,000 which appropriation calls for a like amount from the Federal Government. The County joins in the co-operative work to the amount of \$8,000.00. This makes a total of \$48,000.00 for a beginning. Present plans provide that work shall start early in 1919.

Additional support was secured from the State in the forms of surveys. Approximately nineteen miles of the Central Oregon Highway within Harney County was surveyed in 1918.

Survey of Central Oregon Highway—Burns-Experimental Farm Section

During 1918 the State Highway Commission surveyed a six mile section of the Central Oregon Highway leading east from Burns and past the Government experimental farm. This project begins one and one-half miles east of Burns and ends two miles east of the experimental farm. The plans for this survey are practically completed. This survey was made under the direction of H. B. Wright, locating engineer.

Sage Hen to Burns Section Survey

This is also a section of the Central Oregon Highway and is ten and thirty-nine hundredths miles in length. The line begins near Sage Hen Creek and parallels the present road into Burns, with a considerable saving in distance. This survey was made at the request of the County authorities in order that some improvements they have planned may be placed upon a permanent location. H. B. Wright was locating engineer on this survey.

Glass Butte Section Survey

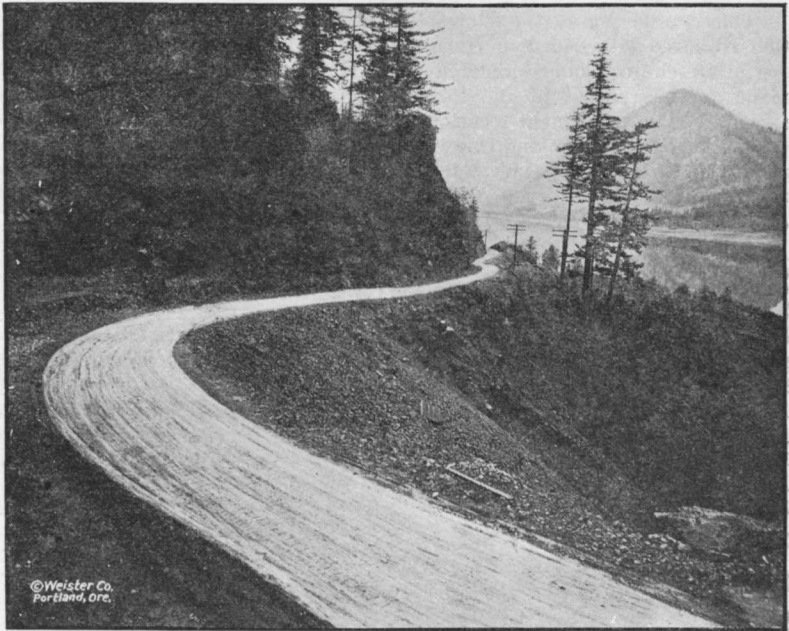
This is a portion of the survey between Rolyat in Deschutes County and One Hundred Mile Road in Harney County. Fifteen and six-tenths miles are in Deschutes County and fifteen in Harney County. This survey was made at the request of the Counties in order that local funds may be expended on a permanent location. The present road through Glass Butte section between Rolyat and One Hundred Mile Road is in poor material and much longer than necessary. Local plans provide for the opening of the new road as soon as practicable. H. B. Wright, locating engineer for the State Department directed the surveying of this line.

Reconnaissance Survey Burns to Vale

In April, 1918, the State Highway Department made a reconnaissance survey over the route from Burns to Vale. All possible routes were covered in the survey and reported upon fully to the State Highway Engineer and the Commission. The investigation resulted in the establishing of the route from Burns direct to Crane and down the Malheur River through River Side, Juntura, Harper and Vale. This survey was made by M. O. Bennett, division engineer for the State Highway Department.

HOOD RIVER COUNTY**Grading—Cascade Locks to Hood River**

That section of the Columbia River Highway from the Multnomah County Line to Hood River passes through the narrowest part of the Columbia River Gorge through the Cascade Range. The steep river banks rise directly up from the water's edge for a large part of the distance, so the space for both railroad and highway is necessarily restricted. At many points, the right of way of the railroad and highway is contiguous and construction under these conditions involved extremely heavy work which added materially to the cost.



THE COLUMBIA RIVER HIGHWAY WEST OF LINDSAY IN HOOD RIVER COUNTY

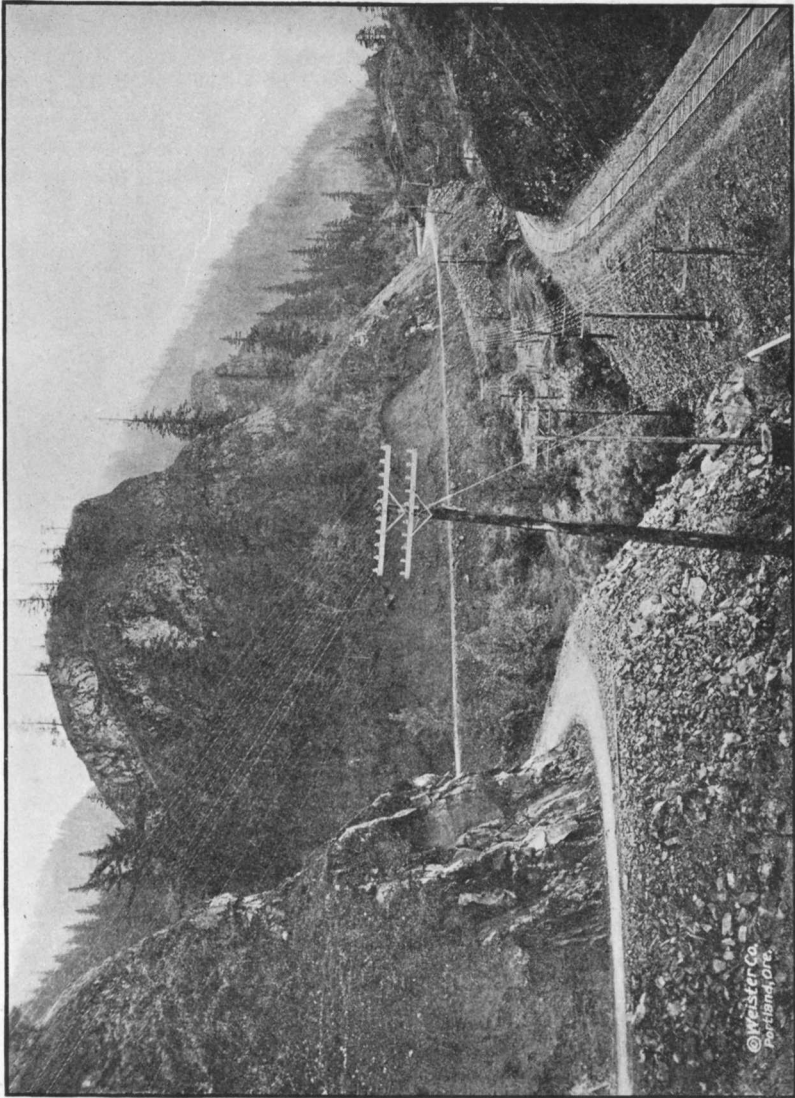
Previous to 1915, there was no road through the County, but from the proceeds of a bond issue of \$75,000, the County built on State standards a roadway to connect the uncompleted portions. In 1915, the State built about one mile, including the Mitchell Point Tunnel, one of the many scenic features of the Columbia River Highway. One mile of pavement adjoining the Multnomah County pavement was built in 1916 by Mr. S. Benson.

There remained about fourteen miles which require improvement, and on August 7, 1917, contracts were awarded to A. D. Kern for grading of these remaining sections to bring to standard grade and alignment. This improvement eliminated Ruthton Hill, with its narrow, steep grades, three railroad crossings, a narrow, steep grade near Wyeth and the improvement through the village of Cascade Locks to the end of the pavement. The work was divided as follows: Cascade Locks Section, 8.2 miles; Viento Section, 3.6 miles; Ruthton Hill Section, 4.2 miles. These contracts were completed

In September, 1918. Due to the close proximity to the railroad tracks, the work required extreme care and watchfulness but was accomplished without accident and without delays to railroad traffic. The costs of construction for each of the three sections follows:

DETAILED EXPENDITURE STATEMENT—GRADING—CASCADE LOCKS SECTION

Engineering.....	\$ 8,744.41
Construction—General—	
Common Excavation, 60,660 cu. yds. at 42c.....	\$25,477.20
Intermediate Excavation, 50,645 cu. yds. at 75c.....	37,983.75
Solid Rock Excavation, 44,500 cu. yds. at \$1.15.....	51,175.00
Overhaul, per 100 lin. ft., 133,229 cu. yds. at 3c.....	3,996.87
12-inch Reinforced Concrete Pipe, 1,102 lin. ft. at \$1.75..	1,928.50
18-inch Reinforced Concrete Pipe, 140 lin. ft. at \$2.25....	315.00
24-inch Reinforced Concrete Pipe, 284 lin. ft. at \$3.00....	852.00
30-inch Reinforced Concrete Pipe, 72 lin. ft. at \$4.25.....	306.00
Class A Concrete, 80.86 cu. yds. at \$20.00.....	1,617.20
Class C Concrete, 32.43 cu. yds. at \$14.00.....	454.02
Placing Reinforcing Steel, 3,197 lbs. at .00½.....	15.99
Catch Basins, 9 at \$25.00.....	225.00
Extra Clearing and Grubbing, 5.79 acres at \$200.00.....	1,158.00
Extra Clearing, 4.13 acres at \$100.00.....	413.00
Herman Creek Bridge—	
Class A Concrete, 137.61 cu. yds. at \$20.00.....	\$2,752.20
Class C Concrete, 3.57 cu. yds. at \$14.00....	49.98
Reinforcing Steel (Placing) 23,000 lbs.	
at .00½.....	115.00
Reinforcing Steel furnished by State.....	1,394.32
Removing old bridge and constructing	
temporary bridge.....	426.00
Wet excavation for piers.....	664.86
Concrete toe wall to protect fill.....	1,547.98
Railing.....	438.72
Total cost of Herman Creek Bridge....	7,389.06
Gorton Creek Bridge—	
Excavation for piers.....	\$ 483.44
Class A Concrete, 90.85 cu. yds. at \$20.00....	1,817.00
Placing Reinforcing Steel, 7,378 lbs.	
at .00½.....	36.89
Reinforcing Steel furnished by State.....	447.27
Railing.....	224.29
Rip-rap.....	145.01
Total cost of Gorton Creek Bridge....	3,153.90
Force Account Work as Follows—	
Construction and Removal of temporary bridge over	
Dry Creek.....	15.78
Removing Slide from O.-W. R. R. & N. Tracks.....	95.59
Gravel Surfacing—End of Pavement to Cascade Locks..	2,418.55
Railing for Viento Creek Bridge.....	106.11
Excavating in water and placing Corrugated Iron Pipe	
Excavation and placing drain tile in wet cuts.....	150.63
Excavation and placing box drain for form crossing.....	10.44
Riprap on slope to keep fill off O.-W. R. R. & N. Right	
of Way.....	177.29
Water pipe and private road crossing.....	40.16
Sinking test holes in gravel pit at Cascade Locks.....	24.93
Road crossing for Herman Creek Ranger Station.....	167.38
Hauling dirt to cover boulders.....	264.40
Placing concrete pipe.....	59.03
Flagmen guarding track (Contractor's force).....	1,234.83
Miscellaneous Construction Items Paid Direct by State—	
Replacing Fence.....	18.75
Reinforcing Steel for Concrete Culverts.....	193.77
Concrete Pipe furnished by State.....	71.50
Moving Building in Cascade Locks.....	1,400.00
Guarding O.-W. R. R. & N. Tracks (Ry. Co. Force).....	1,343.69
Guarding Western Union Telegraph Line.....	498.01
Total Construction Cost.....	\$144,809.25
Grand Total Cost of Job.....	153,553.66
Deduction for Rental of State Cars and Track.....	648.81
Total Cash Expenditure.....	\$152,904.85



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THE COLUMBIA RIVER HIGHWAY NEAR VIENTO IN HOOD RIVER COUNTY. GRADED AND GRAVELED
IN 1917 AND 1918

DETAILED STATEMENT OF EXPENDITURES TO NOVEMBER 30, 1918—
GRADING AND BRIDGES—VIENTO SECTION

Engineering	\$	4,513.24
Guarding O.-W. R. R. & N. Tracks		976.47
Guarding Western Union Telegraph Lines		184.64
Diverting Flume Lines		936.37
Reinforcing Steel Furnished by State		257.79
Contract Work as follows:		
Common Excavation, 9,480.4 cu. yds. at 39c	\$	3,697.35
Intermediate Excavation, 32,654.9 cu. yds. at 70c		22,858.43
Solid Rock Excavation, 54,031.9 cu. yds. at \$1.10		59,435.09
Overhaul, per 100 lin. ft., 82,711 cu. yds. at 3c		2,481.33
12-inch Reinforced Concrete Pipe, 622 lin. ft. at \$1.75		1,088.50
18-inch Reinforced Concrete Pipe, 304 lin. ft. at \$2.25		684.00
Class A Concrete, 62 cu. yds. at \$20.00		1,240.00
Class C Concrete, 20.8 cu. yds. at \$14.00		291.20
Placing Reinforcing Steel, 3,928 lbs. at .00½		19.64
Rubble Masonry, 12 cu. yds. at \$7.00		84.00
Catch Basins, one at \$25.00		25.00
Gravel Backfill in Rock cut (Force Account)		181.77
Repairing Lindsay Creek Bridge (Force Account)		149.92
Private Road Approach (Force Account)		168.30
Clearing Rock from Mitchell Point Tunnel (Force Acc't)		93.94
Viento Creek Bridge—		
Class A Concrete, 62.7 cu. yds. at \$20.00	\$	1,254.00
Placing Reinforcing Steel, 3,800 lbs. at .00½		19.00
Excavation for Footings (Force Account)		128.27
Material furnished by State		249.70
Total Cost of Viento Creek Bridge		1,650.97

Total Cost to November 30, 1918	\$	101,017.95
15 per cent Retained of Total Amt. (\$93,899.74) Earned by Contractors		14,084.96
Total Paid Amount to November 30, 1918	\$	86,932.99

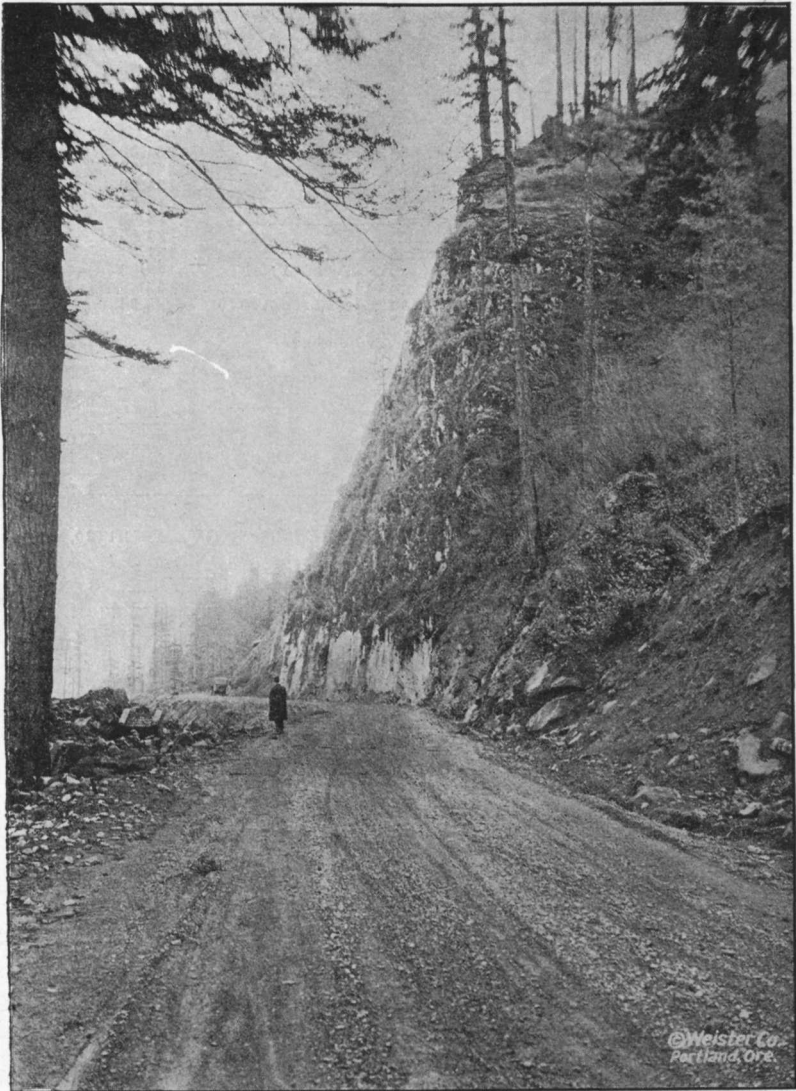
DETAILED STATEMENT OF EXPENDITURES TO NOVEMBER 30, 1918—
GRADING RUTHTON HILL SECTION

Engineering	\$	4,074.19
Material furnished by State for Concrete Half Viaduct		200.50
Guarding O.-W. R. R. & N. Tracks		804.57
Contract Construction Work as follows:		
Common Excavation, 2,669.5 cu. yds. at 39c	\$	1,041.10
Intermediate Excavation, 17,109.4 cu. yds. at 70c		11,976.58
Solid Rock Excavation, 79,213.3 cu. yds. at \$1.05		83,173.96
Overhaul per 100 lin. ft., 19,500 cu. yds. at 3c		585.00
12-inch Reinforced Concrete Pipe, 536 lin. ft. at \$1.75		938.00
18-inch Reinforced Concrete Pipe, 140 lin. ft. at \$2.25		315.00
Class C Concrete, 15.4 cu. yds. at \$14.00		215.60
Rubble Masonry, 30 cu. yds. at \$7.00		210.00
Force Account—		
Connecting road with Morton		285.50
Covering sharp rocks with clay		106.48
Reinforced Concrete Viaduct at Ruthton Hill		1,362.51
		\$100,209.73
Less 15 per cent retained pending completion of contract		15,031.46

Total payments to contractor to Nov. 30, 1918	\$	85,178.27
Total expended to November 30, 1918	\$	90,257.53

Macadamizing—Cascade Locks to Hood River

On July 4, 1918, a contract was awarded to A. D. Kern of eighteen miles of gravel surfacing between Hood River and the Multnomah County Line on the basis of cost plus fifteen per cent on labor and supplies and twelve and one-half per cent on equipment; provided, that no percentage should be paid on any cost over \$50,000. This work also includes the building of shoulders on the one mile of pavement built by S. Benson in 1916 adjacent



ON THE COLUMBIA RIVER HIGHWAY IN HOOD RIVER COUNTY TWO MILES EAST OF CASCADE LOCKS. GRADED AND GRAVELED IN 1917 AND 1918

to the Multnomah County Line. The gravel for this work was taken from pits at Cascade Locks, Herman, Sonny and Hood River, was loaded by steam shovels, screened at two of the pits and hauled by auto trucks. As a result there is now a gravel surface between Hood River and Cascade Locks. A total of 23,396 cubic yards was placed upon the road at an average cost of \$2.88 per cubic yard which represents total cost of excavating, screening, hauling, spreading and rolling.

Hood River Bridge

The largest concrete bridge so far designed and constructed by the State Highway Department is that spanning Hood River near the city of Hood River. It consists of three arch spans 95 feet, center to center of piers, 110 feet of reinforced concrete approach on the Hood River side and a short approach on the opposite side.

As in other arch work of similar magnitude studied by the Department, it was found economical to support the arch superstructures on ribs instead of using rings extending clear across the roadway, and the open spandrel idea was carried out.

The concrete viaduct approach on the west side crosses three railroad tracks which govern the height of the bridge. In order to minimize this height through concrete girders were used, the girders projecting above rather than below the roadway slab.

The total cost of the structure complete will be about \$48,000.00, of which Hood River County will contribute \$8,000.00. The bridge was built under contract by Parker & Banfield. Mr. C. E. Carter was resident engineer on the work.

Herman Creek Bridge

This is a ninety-foot reinforced concrete viaduct on the Columbia River Highway near Cascade Locks. This structure was built by A. D. Kern in connection with the grading contract on the Cascade Locks section. The cost complete was \$7,389.06.

Gorton Creek Bridge

This is a 50-foot reinforced concrete bridge at Wyeth on the Columbia River Highway. It was built by A. D. Kern under the grading contract for the Cascade Locks Section. The total cost was \$3,153.90.

Hood River-Mosier Surveys

Contemplating construction of the Columbia River Highway between Hood River and Mosier to eliminate the high summit, narrow road bed, and excessive grades between these points the Department made very thorough surveys for this important project.

A survey had previously been made developing distance up the Hood River Valley and reaching a summit of 1,107 feet with a corresponding additional length required on the Mosier end, making a total distance of 10.7 miles.

Because of its length and high summit a lower route was considered and a survey was made adjacent to the railroad, using a portion of the old abandoned railroad grade, but involving extremely heavy construction at certain points where the line skirts the high bluffs. The summit on this

route was only 160 feet and its length 5.8 miles. However, the railroad company was contemplating a revision in the alignment of their tracks on this section, as well as the construction of a second track, which would still further lessen the space available for a highway. Also taking into consideration the difficult nature of the work and the uncertain cost due to track protection in blasting operations and the limited conditions under which the work must be done to avoid interference with the railroad traffic, this route was revised in favor of a route further away from the tracks up on the side-hill. The summit reached is 522 feet and the length of this line is 6.3 miles, which includes a development of 5 per cent grade at each end and provides for a 24 foot roadbed.

This adopted route is very scenic and affords a splendid view of the Washington shore, as well as a view up and down the river. The construction is very heavy, being located on steep side-hill slopes and at one point involves a tunnel 200 feet long. This project is divided by the County line, making 4.0 miles in Hood River County and 2.2 miles in Wasco County. This project will be placed upon the 1919 program.

JACKSON COUNTY

The Highway Department expended in Jackson County during 1917 and 1918 the sum of \$86,619.88. The work accomplished with this amount



HEAVY GRADING ON RUTHTON HILL IN HOOD RIVER COUNTY.
CONSTRUCTED IN 1917 AND 1918

consists of six and five-tenths miles of 16-foot crushed rock macadam in the Siskiyou Mountains, an undergrade crossing with the Southern Pacific Railway just north of Ashland, and 4,200 lineal feet of grading and paving north of Ashland. A survey has also been started on the Ashland-Klamath Falls Road about fifteen miles of which was completed before weather conditions made it necessary to discontinue field work until spring.

Ashland Hill Grading and Undercrossing

On account of a contemplated undergrade crossing with the Southern Pacific Railway, a stretch of 4,200 feet on the Pacific Highway just north of Ashland was left unpaved between Ashland and Medford when the balance of the distance between those points was paved in 1914. In 1917 arrangement was made between the County and Railway Company for the construction of this undercrossing and the State Highway Commission set aside funds to cover the cost of the 4,200 feet of grading in connection therewith.

The installation of the undercrossing structure was handled by the Southern Pacific Railway Company. The grading was handled by the County grading forces under the supervision of the Highway Department. Mr. F. H. Walker acted as resident engineer. The grading was commenced on January 7, 1918, and completed August 1, 1918. The total cost of the grading was \$9,768.88, and was paid entirely from State funds.

COST STATEMENT ASHLAND HILL GRADING

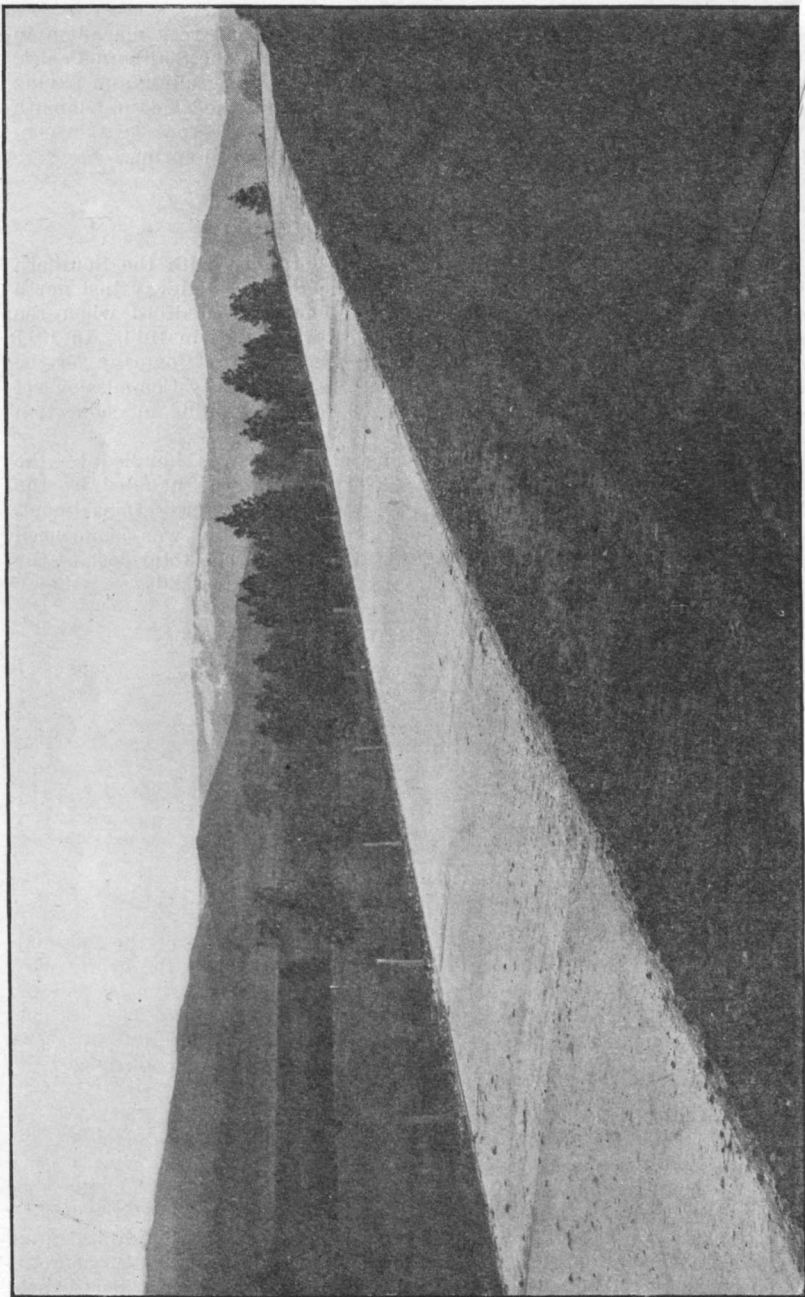
Industrial insurance	\$ 156.27
Grading, labor, teams, material, etc.	8,928.19
Explosives	102.08
Concrete drainage structures	14.70
Pipe culverts	287.03
Irrigation flume diversions	5.40
Total	\$ 9,493.67
Engineering	275.21
Total cost	\$ 9,768.88

Ashland Hill Paving

Bids were called for on August 6, 1918, for the paving of the Ashland Hill Section, but as no satisfactory bids were received the work was undertaken by the Highway Department with State forces. This section of paving is 4,200 feet in length, and the type of pavement laid is a 16-foot concrete, 5½ inches thick at the sides and 6½ inches thick at the center. The mixture was a 1:2:3½, and a ratio of 5.6 gallons of water per sack of cement was used.

The average haul on material was 1.2 miles and hauling was done by means of trucks. The cement was shipped to the job prior to the beginning of construction and stored at convenient locations near the work.

A sixteen cubic foot Koehring mixer equipped with boom and bucket was used for mixing the aggregate. The pavement, after being struck off, was finished by the roller and belt method. The pavement first being rolled from two to four times depending on the condition of the concrete and later belted with eight and ten inch belts. The eight inch belt being used first. A very satisfactory surface was obtained in this manner.



CONCRETE PAVEMENT ON ASHLAND HILL IN JACKSON COUNTY, ON THE PACIFIC HIGHWAY NORTH OF ASHLAND.
GRADED AND PAVED IN 1918

Continuous forms were used on this work and ¼x4 inch elastite joints were placed at 30 foot intervals, leaving approximately two inches of concrete above the elastite and giving the pavement the appearance of monolithic construction. It was found that a better riding pavement could be produced in this way as the inequalities at joints were eliminated and we believe that the use of this pavement will justify the adoption of this type on future work.

Gravel and crushed rock shoulders two feet wide were built on this section and the pavement was not covered while curing as the weather was cool and damp. However, the pavement was kept wet by sprinkling when necessary.

The crusher and roller on this work were furnished by Jackson County free of charge.

Mr. J. M. Baker was superintendent of construction on this work.

COST STATEMENT ASHLAND HILL PAVEMENT

4,200 feet 16' Concrete Pavement
Built in 1918

Quantity	Item	Total Cost	Unit Cost
7682 sq. yds.—1 : 2 : 3½ Concrete Pavement Average Thick- ness 6"		\$14,117.56	\$1.84
400 cu. yds.—Crushed Gravel in Shoulders		1,000.00	2.50
1000 pounds—Reinf. Steel		70.00	.07
2240 lin. ft.—Expansion Joints		89.60	.04
Total Cost of Construction		\$15,277.16	
Engineering		630.87	
Grand Total Cost		\$15,908.03	

Siskiyou Mountain Macadam

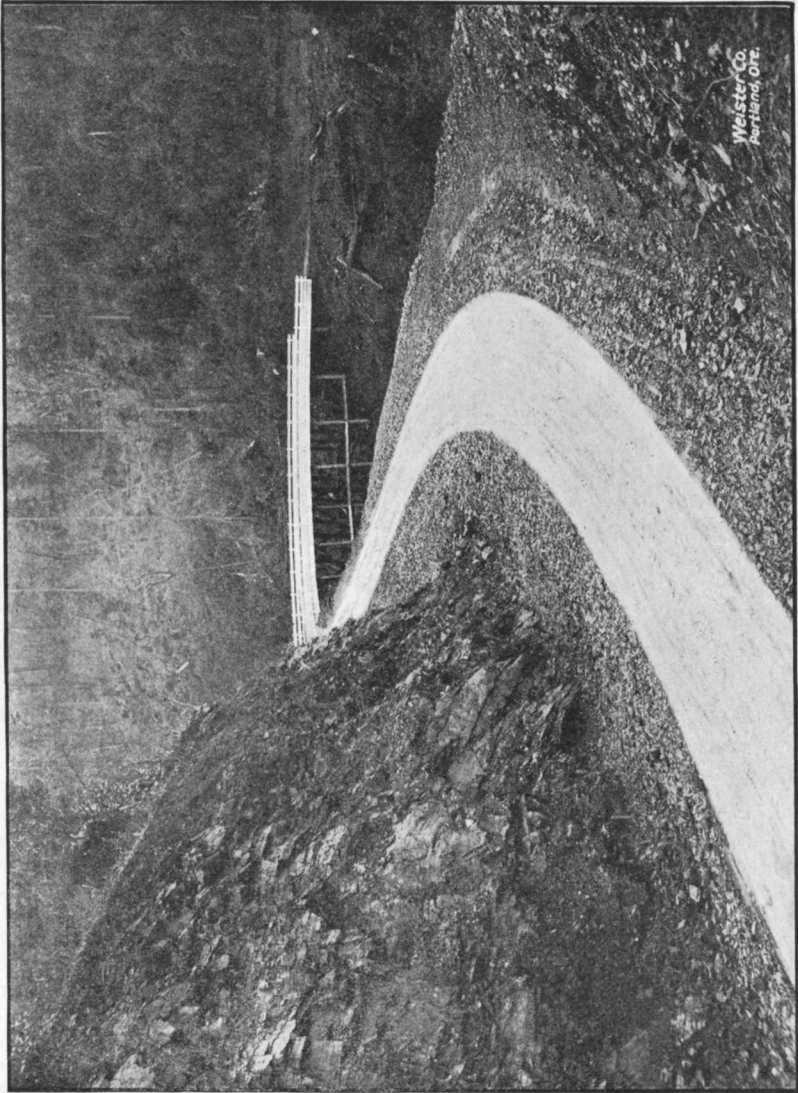
During the 1917 season, 6½ miles of broken stone macadam was constructed on the Pacific Highway in the Siskiyou Mountains. This macadam is sixteen feet in width, and extends from the California State Line to Siskiyou. It was constructed with State forces under the supervision of L. L. Clarke, construction superintendent. A total of 17,780 cubic yards of rock were crushed and placed on the road. The cost of the work complete was \$56,252.98.

Survey—Ashland to Klamath Falls

On August 25, 1918, a location survey was started between Ashland and Klamath Falls. After a careful reconnaissance of the low passes, the route via Green Springs Mountain was chosen, as against the Dead Indian Summit, 500 feet higher.

Surveys were continued until November 30, when they were discontinued for the winter months. The present road is in such poor condition, that maintaining a locating party at work during the winter would be very expensive.

During the short time the party was in the field, 15.6 miles of location were staked, a six per cent grade from the summit of Green Springs Mountain toward Ashland being obtained, whereas the present road has many stretches over 20 per cent. Also, over a section between the Green Springs Summit and Jenny Creek, 9 miles to the south, a location has been obtained that will give for the greater distance, very cheap construction and the lightest of grades. This will be appreciated by all who have traveled the present rocky road with its series of bad grades.



Weister Co.
Portland, Ore.

ON THE PACIFIC HIGHWAY SOUTH OF WOLF CREEK IN JOSEPHINE COUNTY. CONSTRUCTED IN
1917 AND 1918

This road is a very vital one to the Rogue River and Klamath Valleys. At present it is only passable during summer months for auto traffic, while a road built on standard line and grades would soon make it an all year highway.

There will be an enormous exchange of commodities between the two valleys when the road is constructed. It will make a three hour auto trip between Ashland and Klamath Falls, which now takes $8\frac{1}{2}$ hours by train via Weed, California.

The location will be resumed in the spring, and continued to Klamath Falls. Surveys have been in charge of Mr. J. H. Scott, locating engineer.

JEFFERSON COUNTY

Jefferson is the only county in Eastern Oregon that has not applied for State aid in some form. This County has been included in the State's general Post Road scheme and doubtless will receive early attention from the State Highway Commission.

The State Highway Commission has ordered a reconnaissance survey made from Kingsley and Tygh Valley in Wasco County south through the Warm Springs Indian Reservation into Jefferson County along the west side of the Deschutes River. This investigation will be made during the coming spring.

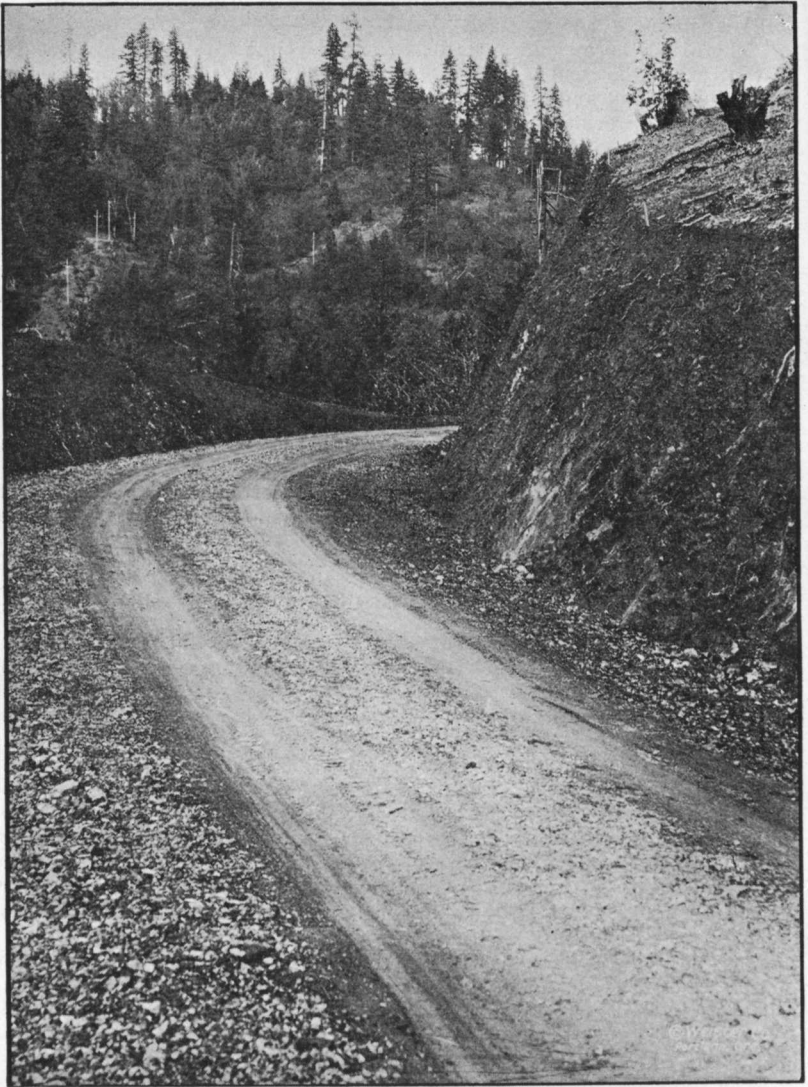
The County is traversed by The Dalles-California Highway which will be a very important road. The Antelope-Mitchell Highway also passes through the northeast corner of the County.

JOSEPHINE COUNTY

During the two year period covered by this report, a very marked improvement has been made in the Pacific Highway across Josephine County. During this time 8.2 miles, or more than one-quarter of the total mileage of this highway in the County, were completed on standard grades and alignment, eliminating some of the heaviest and most dangerous grades between Portland and the California Line. The work done by the State consisted of the grading of a 4.9 mile section between Wolf Creek and Grave Creek in the northern part of the County, and the grading of a one mile section, known as the Locust Hill Section, about three miles south of Grants Pass. The work done by the County consisted of 2.3 miles of grading between Locust Hill and the Jackson County Line. This County work was contracted under State Highway Department specifications and was engineered by the Department engineers.

In addition to this construction work, location surveys were made over 23.6 miles of the Pacific Highway, completing the location across the County. These surveys were made in three sections: One from Wolf Creek to Grave Creek; one from Grants Pass to Grave Creek; and one from Wolf Creek to Stage Road Pass.

The total amount of money expended by the State in Josephine County during the fiscal years 1917 and 1918 was \$77,998.14, and the amount expended by Josephine County under State supervision was approximately \$8,500.00. Some considerable amount of work was also done by the County in grading just south of Grants Pass. While this work was not under State supervision, it was on the State survey and is standard as regards grade, alignment, cross-section, etc.



ON THE WOLF CREEK-GRAVE CREEK SECTION OF THE PACIFIC HIGHWAY
IN JOSEPHINE COUNTY. GRADED IN 1918

Grading—Wolf Creek to Grave Creek

To eliminate four very heavy grades on the Pacific Highway between Wolf Creek and Grave Creek in Northern Josephine County, the Highway Commission appropriated funds for the grading of a 4.9 mile section between those points. The contract for the work was awarded to the American Exploration and Construction Company of Grants Pass on November 6, 1917. This construction was practically all on steep side-hills, and as only a small part of the material to be moved was hard rock, the job was an ideal one for steam shovel operation and over fifty per cent of the total yardage was moved by this method. The work was handled by the contractors in a very creditable manner, and an excellent roadbed was secured.

The grading was completed on October 20, 1918. The width of roadbed is 20 feet and the maximum grade is 5 per cent. Mr. J. E. Nelson was in charge of the work as resident engineer.

It is expected that this section will be macadamized during the 1919 season.

DETAILED EXPENDITURE STATEMENT—GRADING—WOLF CREEK TO GRAVE CREEK

Engineering	\$ 4,872.94
Culvert Pipe furnished by State	3,846.45
Payments to Contractor for Work as follows:	
Clearing and Grubbing	\$ 3,500.00
Common Excavation, 29,426 cu. yds. at .45.....	13,241.70
Intermediate Excavation, 21,258 cu. yds. at .45.....	9,566.10
Solid Rock Excavation, 21,558 cu. yds. at \$1.25.....	26,947.50
Overhaul, per 100 lin. ft., 6,767 cu. yds. at .02.....	135.34
12" Concrete Pipe, 1,077 lin. ft. at .55.....	592.35
18" Corr. Galv. Iron Pipe, 581.5 lin. ft. at .40.....	232.60
24" Corr. Galv. Iron Pipe, 162.5 lin. ft. at .50.....	81.25
30" Corr. Galv. Iron Pipe, 127.5 lin. ft. at .60.....	76.50
36" Corr. Galv. Iron Pipe, 166.5 lin. ft. at .75.....	124.87
Class "A" Concrete, 44.67 cu. yds. at \$22.50.....	1,005.07
Class "C" Concrete, 66.72 cu. yds. at \$18.00.....	1,200.96
6" Porous Drain Tile, 400 lin. ft. at .40.....	160.00
Trestle Timber, 45,968 f. b. m., at \$45.00.....	2,068.56
Metal Reinforcement, 2,506 lbs. at .15.....	375.90
Extra Clearing, 1.75 acres at \$100.00.....	175.00
Painting Railings on Coyote Creek and Dry Gulch	
Bridges (Force Account)	74.94
Gravel Backfilling for Drain Tile (Force Account).....	23.50
Culvert Pipe furnished by State	3,846.45
Total Paid to Contractors	<u>59,582.14</u>
Total Cost of Work	<u>\$68,301.53</u>

Grading—Locust Hill Section

To complete the grading of the Pacific Highway between Grants Pass and Rogue River, the Highway Commission set aside funds for the construction of the Locust Hill Section, a section one mile in length located about three miles south of Grants Pass. The contract for this work was awarded to Albert Anderson & Co. of Grants Pass, and the construction was completed about June 1, 1918.

The necessary engineering supervision of this work was given by Mr. J. E. Nelson, resident engineer of the Wolf Creek-Grave Creek Section.

DETAILED EXPENDITURE STATEMENT—GRADING LOCUST HILL SECTION

Engineering	\$ 162.88
Construction:	
Clearing and Grubbing	\$ 125.00
Common Excavation, 692 cu. yds. at .53.....	366.76
Intermediate Excavation, 2,552 cu. yds. at .63.....	1,607.76
Solid Rock Excavation, 1,954 cu. yds. at \$1.20.....	2,344.80
Overhaul per 100 lin. ft., 3,159 cu. yds. at .03	94.77
12" Plain Conc. Pipe, 168 lin. ft. at \$1.00.....	168.00
	4,707.09
Total Cost	\$ 4,869.97

County Construction—Locust Hill to Jackson County Line.

In the Spring of 1917, the County Court of Josephine County requested the Highway Department to engineer for them the construction of 2.3 miles of grading on the Pacific Highway between Locust Hill and the Jackson County Line. Plans and specifications were prepared for this work by the Highway Department and it was let by the County Court in two units: one to Albert Anderson & Co., of Grants Pass; the other to S. S. Schell of Oakland, Oregon.

The construction engineering was handled by the State Highway Department under resident engineer H. C. Compton. The work was completed in September, 1917, the total cost to the County being approximately \$8,500.00.

The final estimate to Albert Anderson & Co., was as follows:

FINAL ESTIMATE TO ALBERT ANDERSON—GRADING BETWEEN LOCUST HILL AND JACKSON COUNTY LINE

Clearing, lump sum bid	\$ 800.00
Common Excavation, 3,887.1 cu. yds. at .43	1,671.45
Intermediate Excavation, 3,931.3 cu. yds. at .63	2,476.72
Solid Rock Excavation, 650.0 cu. yds. at \$1.15.....	747.50
12" Plain Concrete Pipe, 320 lin. ft. at .90	288.00
18" Plain Concrete Pipe, 78 lin. ft. at \$1.45.....	113.10
24" Plain Concrete Pipe, 56 lin. ft. at \$2.10.....	117.60
Class "C" Concrete, 14.94 cu. yds. at \$14.50.....	216.63
6" Drain Tile, 100 lin. ft. at .22	22.00
Run-of-bank Gravel, 6 cu. yds. at \$1.35.....	8.10
Overhaul, per 100 lin. ft., 730 cu. yds. at .02.....	14.60
	\$ 6,475.70
Total	\$ 6,475.70

Survey—Wolf Creek to Grave Creek

The old county road between Wolf Creek and Grave Creek on the Pacific Highway in Northern Josephine County, passed over two summits about 250 feet above the valley levels of Grave and Wolf Creeks, giving four long, heavy grades, in some places the grade being as high as 25 per cent. These two summits were about one mile apart, and the nature of the ground was such that support could be had for a practically level grade between the two.

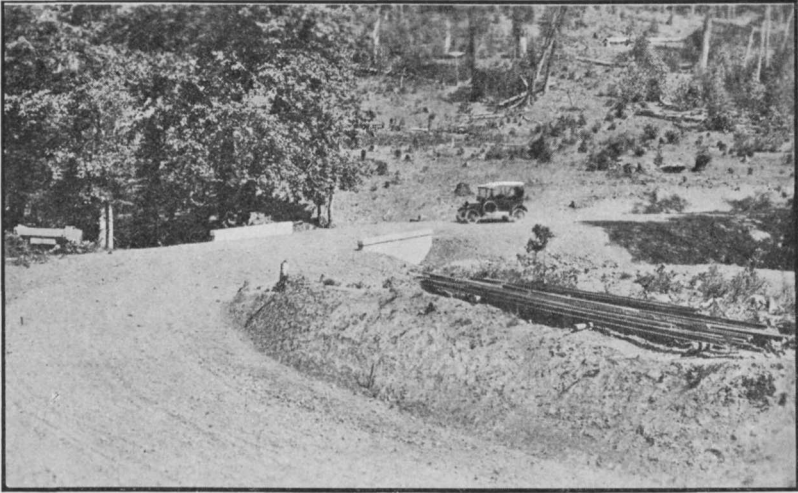
With a view to locating this level grade between the summits and developing five per cent grades down the sides, a preliminary survey was made in October and November, 1916, under the direction of Mr. S. H. Probert. This survey was worked up in the office during January and February, 1917, and in July, 1917, the projected location was staked on the ground by Mr. C. C. Kelley, locating engineer.

The length of the survey was 4.9 miles, the terminal points being about three-quarters of a mile east of Wolf Creek Post Office and about three-quarters of a mile west of the Grave Creek Bridge.

The construction of this section, which was undertaken in the fall of 1917, is described in another article in this report.

Survey—Wolf Creek to Stage Road Pass

This survey begins about three-quarters of a mile south of the Wolf Creek Post Office and follows, in a general way, the present county roads into the town of Wolf Creek and from Wolf Creek to a point about two miles south of Stage Road Pass. At this point it connects with a survey



ON THE WOLF CREEK-GRAVE CREEK SECTION OF THE PACIFIC HIGHWAY
IN JOSEPHINE COUNTY. GRADED IN 1918

made by the Highway Department in 1915, and which is the location survey for a five per cent grade down from State Road Pass, which pass is on the line between Douglas and Josephine Counties.

The length of the survey from east of Wolf Creek to the connection with the previous survey is 2.5 miles. It was made in July, 1917, under the direction of Mr. C. C. Kelley, locating engineer.

Survey—Grants Pass to Grave Creek

To complete the location of the Pacific Highway across Josephine County, a survey was made in 1917 between Grants Pass and Grave Creek. This survey follows, in a general way, the present road between those points, deviating from it only where improvements in alignment or grade can be secured. The most important feature of this location is that it is on a five per cent grade over the Sexton Mountain Summit. The total length of the survey is 17.2 miles. Mr. C. C. Kelley was in charge of the work as locating engineer.

KLAMATH COUNTY

In Klamath County the work of the Highway Commission to date has been limited to surveys.

A careful reconnaissance has been made from Klamath Falls to Bend, Klamath Falls to Olene, and Klamath Falls to Ashland. Funds were limited for more extensive surveys during 1918, but the location from Ashland to Klamath Falls (see Jackson County report) was started and will be continued to Klamath Falls in 1919.

A short section between the Klamath Falls City Limits, through Pelican City to a connection with the existing road to Bend was located by the Highway Department in August, 1918, and stakes set for 7,500 feet of grading. This section has since been graded and covered with a cinder surface by the County.

State surveys in this section were in charge of J. H. Scott, locating engineer.

LAKE COUNTY

Grading and Macadamizing Between Lakeview and Paisley

In 1917 the State Highway Commission appropriated funds to assist the County with the grading and macadamizing of a section of the Lakeview-Paisley Road through Crooked Creek Canyon. This work was handled by the County, and the total amount of State funds expended was \$15,391.67. The work done consisted of 6.4 miles of grading and 4.0 miles of rock surfacing.

LANE COUNTY

Macadam—Latham to Divide

In 1917 State aid was given to Lane County in the amount of \$6,099.86. This money was used in macadamizing the Pacific Highway between Latham and Divide. The work was handled by County forces under the supervision of H. W. Libby, county roadmaster.

Divide Overcrossing

For the elimination of the dangerous grade crossing of the Pacific Highway with the Southern Pacific Railway at Divide, the Highway Department made surveys and prepared plans for an overhead crossing at that point. The Public Service Commission of Oregon ordered that this overhead crossing be built, forty per cent of the cost to be paid by the Railway Company, thirty per cent by the State and thirty per cent by the County.

Bids were received for the construction of the structure and approach fills on September 10, 1918, but before work was begun, the United States Highways Council ordered that construction be delayed until after the war on account of the shortage in steel and cement. Work will, therefore, not be undertaken until the 1919 season.

The structure designed for this overcrossing is a three span reinforced concrete viaduct, providing clearance for the double tracking of the railway. The cost of the structure and the approach fills is estimated to be \$19,500.00. In connection with this, about 1.3 miles of new grade must be built to connect with the present road, no part of the cost of which will be shared by the Railway Company. This grading is estimated to cost \$9,000.00. As soon as the grading is completed, it will be macadamized by the Highway Commission.

Survey—Goshen to Cottage Grove

In June, 1917, a survey was made from Goshen to a connection with the Pacific Highway south of Cottage Grove. This survey is on the east side of the Southern Pacific Railway from Goshen to Creswell, crosses the railway at grade at that point, and continues on the west side all the way to Cottage Grove, closely following the Southern Pacific alignment the entire distance. The total length of the survey was 18.2 miles. Mr. C. C. Kelley was the locating engineer in charge.

LINCOLN COUNTY

Pioneer Mountain Grading

In 1917, the State Highway Commission extended State aid to Lincoln County in the grading of a one mile section of the Corvallis-Newport Road. This section is in the vicinity of Pioneer Mountain, and is known as the Pioneer Mountain section. The grading was handled by County forces and the total amount of State funds expended was \$2,054.05.

Bridge Surveys

In May, 1918, surveys were made by the Department for two large bridges in Lincoln County. One of these was for a bridge over Alsea River near Waldport and the other was for a bridge across the Yaquina River at Toledo. At the present time the only means of crossing the streams at these points is by ferry.

For the Alsea River Crossing a 264 foot bridge has been designed and is now under construction by Curtis Gardner, Bridge Contractor. This bridge consists of one 144 foot medium traffic wood span and 120 feet of wood trestle. The total cost of the structure will be approximately \$10,000.00. The construction is under the supervision of the Highway Department, but is being paid for by Lincoln County.

The design has not yet been prepared for the bridge at Toledo, but the total length of the bridge will be about 3,000 feet.

Neskowin-Salmon River Survey

In June, 1918, a survey was made between Neskowin in Tillamook County and Salmon River in Lincoln County. This survey was of a preliminary nature and was made to determine the feasibility of a road between these points. It was found that a five per cent grade could be obtained, but that owing to the extremely rugged nature of the country, a road of standard width and on a standard alignment would be so expensive as to be impracticable at this time.

The total length of the survey was eight miles. Mr. J. H. Scott was in charge of the work as locating engineer.

LINN COUNTY

Albany-Jefferson Survey

A survey of the Pacific Highway between the Marion County Line (Santiam River) and Albany, was made in December, 1917, and a definite route between these two points adopted. In a general way the located route follows the present road. Near the Jefferson end, however, the new loca-

tion cuts across the property of E. M. Miller, paralleling the Southern Pacific tracks with a net saving of 1,600 feet in distance over that of the present road. Near Miller Station the line again leaves the old road, eliminating four dangerous right angle turns by cutting diagonally across. The new location also provides for the elimination of the present grade crossing on the W. E. Fisher property by means of an overhead crossing just north of the grade crossing.

For the first one-half mile south of the Santiam River Bridge it will be necessary to materially raise the grade of the present road as it is considerably below high water, and therefore subject to overflow. It will also be necessary to construct a few low bridges on this section to provide waterways for flood waters.

It is expected that the Albany-Jefferson Section will be graded and paved during the 1919 season.

MALHEUR COUNTY

Malheur County is an important highway center. It is most favorably situated with respects to highways in Eastern Oregon, in that it serves as a common junction point for the Old Oregon Trail, John Day Highway and Central Oregon Highway. A fourth highway will enter the County from Nevada leading from Winnemucca north through Jordan Valley.

Malheur County is fairly well equipped for road work and has already made a most creditable showing. All the people are good roads boosters, having learned the value and necessity of improved roads. This was proven by their voting a \$20,000.00 bond issue at the recent election. The purpose of this fund is to meet the State and Federal appropriation of \$80,000.00.

In area, Malheur County is an empire in itself. The natural result is an extra large mileage of roads, and many of them run through mountainous districts. To improve only the main highways in Malheur County is a huge undertaking.

The State Highway Commission fully realizes the inability of most of the counties in Eastern Oregon to cope with the situation and has determined to extend aid in every manner possible. That State aid may be substantial and a benefit to all the counties, the Commission is making an urgent call for more State funds.

In Malheur County near Brogan a 9.85 mile section of the John Day Highway has been surveyed by the State Highway Department. The Commission has set aside \$20,000.00 for the construction of this road and an equal amount is requested from the Government. The County has appropriated \$13,958.00 for the purpose of co-operating in this construction.

State funds to the amount of \$20,000.00 have been set aside for the improvement of a 6.76 mile section of the Central Oregon Highway. This section extends from Vale 6.76 miles west to Burrell's Ranch. The Government is requested to share in the cost in amount equal to the sum given by the State. The County's share in this project will be \$14,420.00.

The following statement shows the amounts appropriated for expenditure in 1919:

Section	State Funds	County Funds	Government Funds	Totals
Cow Valley-Brogan Section.....	\$20,000.00	\$13,958.00	\$20,000.00	\$53,958.00
Burrell-Vale Section.....	20,000.00	14,420.00	20,000.00	54,420.00

Both of the above mentioned sections are Post Road Projects. Negotiations with the U. S. Public Roads Office are under way for the grading

of the Cow Valley-Brogan Road, and the Burrell-Vale Project will be submitted within a short time. It is hoped construction will begin early in 1919.

Survey of John Day Highway—Cow Valley-Brogan Section

During October and November, 1918, the State Highway Commission made a location survey of a 9.85 mile section of the John Day Highway between Cow Valley and Brogan. The line follows in the direction of the present road, but marked departures from the location were made in several places. Plans for this work are about fifty per cent complete. R. H. Coppock, locating engineer for the State Department, was in charge of this work.

Survey of the Central Oregon Highway—Burrell Ranch-Vale Section

A survey is in progress on the section of the Central Oregon Highway between Burrell's Ranch and Vale. This line will follow along near what is called the Post Hill road, and will be about seven miles in length. Immediately upon completion of the field work, the plans will be rushed in order that early action may be taken by the U. S. Office of Public Roads. The State Commission's 1919 construction program includes this section.

The survey is in charge of R. H. Coppock, locating engineer.

Reconnaissance Survey of Central Oregon Highway and Jordan Valley Road

During April, 1918, a reconnaissance survey was made by M. O. Bennett, division engineer, for the Department, over the routes between Burns and Vale for the purpose of establishing a definite route for the Central Oregon Highway. This investigation resulted in the choice of the river route by the State Highway Commission. The route as selected goes direct from Burns to Crane, thence down the Malheur River through Riverside, Jun-tura and Harper to Vale.

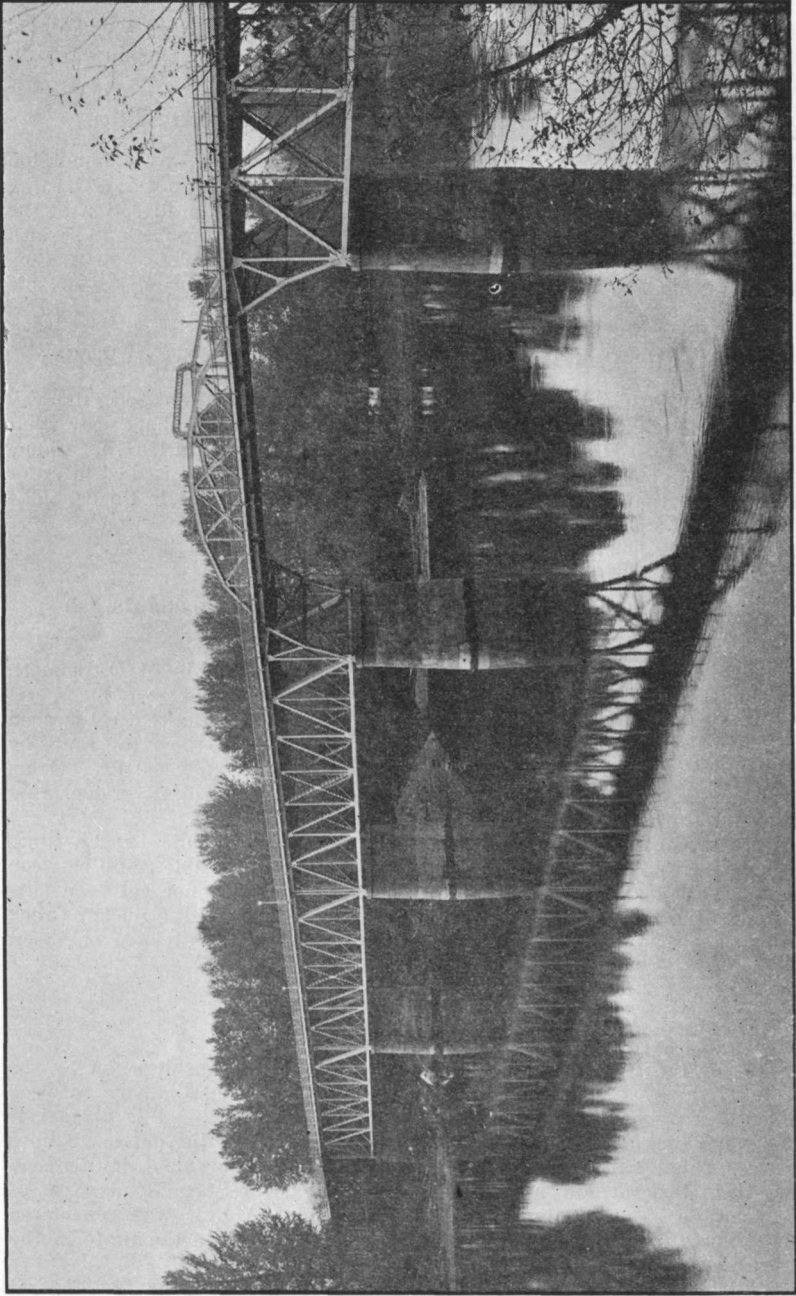
In November, 1918, a reconnaissance survey was made by the State Department for the purpose of establishing the most feasible route between Jordan Valley and Vale and Ontario. This report has not yet been submitted to the Commission, but the findings seem to favor the Sucker Creek Route. This survey was made by Manche O. Bennett, division engineer.

MARION COUNTY

Salem-Aurora Paving

One of the first paving projects to come up for consideration by the State Highway Commission was that of the Pacific Highway between Salem and Aurora in Marion County. Upon investigating this project, it was found that rural mail was carried over practically the entire distance between Salem and Aurora. This fact made the improvement of this road subject to Federal Aid, and as very few sections of State Roads west of the Cascade Mountains will qualify for Federal Aid, it was considered advisable to use some of the Federal money available to the State in the improvement of this section.

With a view to securing the approval of this project by the Federal Office of Public Roads, and to undertaking the construction during the



INTERCOUNTY BRIDGE OVER THE WILLAMETTE AT SALEM. BUILT BY MARION AND POLK COUNTIES IN 1917 AND 1918.
COST \$250,000.00. TOTAL LENGTH 2,220 FEET.

1918 season, the necessary surveys were made in January and February, 1918, and the plans submitted to the Office of Public Roads in March, 1918. The final approval by the Government was received June 15, 1918, and on June 25 proposals for the construction were received and opened. The lowest bid received was from Warren Construction Company, Portland, Oregon, but as it was in excess of the State Highway Engineer's estimate, and in excess of the available funds, all bids were rejected.

The work would have then been started by the Highway Department with State forces, but it was just at this time that the shortage of labor, materials, transportation facilities, etc., became serious, and the Federal Government called for curtailment of road construction, and the Highway Commission was forced to order the discontinuance of preparation for this paving, as well as for all other proposed work in the State.

Now, that Peace is in sight, there is every reason to believe that the Highway Commission will order that construction begin on the Salem-Aurora Paving at the very earliest date, and its completion may be looked for during the 1919 season.

This paving is to be sixteen feet wide with a two-foot rock shoulder on each side. The type will depend upon the bids received. The paving will start about four miles north of the city limits of Salem and extend to the Marion-Clackamas County Line, just north of Aurora, the total length being eighteen miles. It is estimated that this work will cost \$360,000.00.

The Salem Bridge

The new bridge over the Willamette River at Salem, designed and built under the supervision of the State Highway Department, is one of the largest strictly highway bridges erected in the United States in 1918. This structure has a total length of 2,220 feet, and consists of 352 feet of reinforced concrete approach on the Marion County end, six steel spans over the river aggregating 885 lineal feet, and 780 feet of high class pile trestle approach on the Polk County end.

To provide for the river navigation, the U. S. Engineers required a minimum horizontal clearance normal to the channel of 120 feet and a vertical clearance of at least sixty-six feet above low water, in case a high level type of bridge were adopted. After careful study it was decided to construct a high level bridge of the deck type, and to carry the pony channel span on cantilevers projecting from the adjoining spans, giving an arch effect over the channel. By this type of construction, a clear distance of about 145 feet between channel piers was obtained.

To minimize the cost of fabrication and erection of steel, four spans were made practically the same. The east span was necessarily shorter than the typical ones, since otherwise it would place the channel opening too far across the river. This span is not so deep as the adjoining one, and the difference in height is made up by means of a rocker under the small span, which, of course, also serves the purpose of movable shoes. The channel span rests on cast steel rockers on one end, which are carried by a shelf on the cantilever panel. The opposite end of the span was pin connected.

Previous to the design of the bridge, wash borings were made, which indicated in a general way that the bed of the stream was composed of a few feet of gravel, underlaid with sand for a considerable depth. It was accordingly decided to carry the foundations down below the probable

point of future scour, and carry the loads entirely upon piling. The two channel piers were sunk about thirty-five feet below low water.

The west approach is carried on fir piling treated in an open vat with carbolineum to a temperature of about 220 degrees F.

Lumber being comparatively cheap, the entire roadway deck of the bridge and wooden approach is composed of fir, three by seven inches and twenty-six feet long on edge, spiked together, thus projecting a foot outside the curb on either side, the roadway being twenty-four feet between curbs. An asphaltic wearing surface three and one-half inches thick effectively waterproofs the wood, and the small interstices between the pieces will allow sufficient circulation of air to preclude any possibility of attack of dry rot. The ends of the floor members were painted with hot carbolineum, as were also the wooden members contiguous to openings in the floor occasioned by expansion joints between spans.

The two five-foot concrete sidewalks are carried on brackets beyond the trusses. The curbs serve as reinforced concrete beams to carry half the sidewalk load to the trusses, there being small concrete struts extending up from the top of the top chords at panel and midpanel points. Between the bottom of the curb and the top of the wooden floor is a three-quarter-inch cushion of "Sarco." Since the bridge is on a grade, it was necessary to precast this in sheets the width of the curb. When the material hardened, it was rolled up in convenient lengths and placed. It will thus be possible in the future to renew the wooden floor with comparatively little difficulty, although it is believed that the wood floor base, protected as it is now, should last at least fifty years.

On account of the rather extreme length for pony trusses of the channel span, 123 feet between end pins, it was decided to tie the trusses together, and this was accomplished by means of two arched lattice struts placed each twenty feet and six inches from the center of the span.

A final coat of battleship gray paint was applied to the steel work, and has evoked considerable favorable comment, being an innovation from the black paint commonly used in this part of the country.

The bridge was built by the Coast Bridge Company and Robert Wakefield of Portland. The cost of the structure complete was \$250,000.00, of which Marion County paid approximately \$200,000.00 and Polk County \$50,000.00.

The engineering cost for the work is remarkably low. It includes surveys, borings, inspection of cement and steel fabrications, resident engineer's salary, cost of design, blue prints and supplies and stenographic work, and amounts to \$4,600.00, or about one and eight-tenths per cent of the total cost.

Survey—Salem to Jefferson

A reconnaissance between the city limits of Salem and the Linn County Line (Santiam River) just south of Jefferson, was made in the spring of 1918, and the following facts developed, as regards the comparison of three possible routes between these points:

Via Turner and Marion:

Length, 22.5 miles.

Railroad grade crossings, 5 with main line of Southern Pacific.

Bridges, 9.

Overflow, long stretches.

Light grades—very little rise and fall.

Via Liberty and Ankeny Hill :

Length, 18.6 miles.

No railroad crossings.

Bridges, small.

Undulating steep grades—heavy work to cut to 5 per cent or extensive alignment changes involving added distance.

New right of way required through valuable orchard property.

Present road macadamized or graveled entire length.

Jackson Hill Route :

Length, 17 miles.

No railroad crossings.

Bridges, small.

Five per cent grades.

Good alignment. Low summit obtained by alignment change going to the east of Jackson Hill, involving two miles of new construction.

Right of way required—unimproved except in one instance.

Direct route.

Present road macadamized or graveled except for five miles.

A detailed survey was made over this so-called Jackson Hill route, and its advantages caused the Highway Commission to adopt it as the route of the Pacific Highway between these points. It is estimated the cost will be \$109,000.00 to complete the subgrade, and it is expected this project will be commenced in 1919.

MORROW COUNTY

In Morrow County there are found all classes of conditions affecting roads and highway improvement. In some parts of the County there are good natural roads, while in other sections they are extremely poor. As in most other Eastern Oregon Counties, Morrow County has to wrestle with the problem of maintaining a large road mileage with a constant shortage of road funds. Highways are of extreme importance, as there are large agricultural communities that have no railway connections.

During the past two years the highway movement in Morrow County has experienced a wonderful growth. County authorities have broken the bonds of established custom, and have made a most creditable beginning in highway improvement. Although they have been supported by special road taxes, in most of the districts the available funds are far from adequate.

The State Highway Commission early realized the importance of good roads in this County, and took steps to extend the State aid through the Post Road Fund. The plans failed when the U. S. Office of Public Roads found it impossible to co-operate on the projects in question. This failure was due to nonfulfillment of post road requirements. Additional State aid was extended through the provisions of the \$6,000,000.00 fund, but the execution of these plans were delayed by war conditions. This fund is still available, and the State Highway Commission will begin work as soon as conditions will permit.

Morrow County has received favorable consideration from the Highway Commission in the matter of surveys, it being the only county in Eastern Oregon in which the total mileage of State roads has been surveyed. Those surveys cover the Columbia River Highway in the north end of the County, and the Oregon-Washington Highway via Heppner, Ione and Lexington.

The Columbia River Highway was first surveyed under the direction of M. O. Bennett, and later additional work was done by Oscar Cutler. This survey was 13.85 miles in length. R. H. Baldock was locating engineer on the Oregon-Washington Highway survey, which has a total length of 66.1 miles.

Heppner Grading—Oregon-Washington Highway

During 1918 Morrow County graded 2.26 miles of standard road adjacent to the town of Heppner. A 1.82-mile section begins at the west city limits of Heppner and extends down Willow Creek on the State survey. Another section extends from the east city limits up Hinton Creek for a distance of .44 miles.

The County paid the total cost of this improvement which required \$5,689.19. The State Department supplied the engineering supervision for this work through R. H. Baldock, resident engineer.

Following is a statement of construction quantities:

HEPPNER EAST	
Common Excavation, 1,190 cu. yds. at .43.....	\$ 502.53
Culverts	216.35
Total	\$ 718.88
HEPPNER WEST	
Common Excavation, 850 cu. yds. at .48.....	\$ 407.01
Intermediate Excavation, 2,150 cu. yds. at \$1.11.....	2,385.30
Culverts	2,178.00
Total	\$ 4,970.31

Jones Hill Grading

The 3.22-mile section of the Oregon-Washington Highway known as the Jones Hill Grade, lies about ten miles east of Heppner, and extends over the divide between Hinton and Butler Creeks. The State location involved the construction of an entirely new road. This improvement was paid for in full by the County, the total cost being \$25,050.26.

R. H. Baldock, resident engineer for the State Highway Department, was the engineer in charge.

Construction quantities are shown in the following statement:

Rock Excavation, 6,200 cu. yds. at \$3.98.....	\$18,504.26
Common Excavation, 7,300 cu. yds. at .59.....	4,350.00
Culverts	2,200.00
Total cost	\$25,054.26

Heppner Macadam

After grading the 1.82-mile section of the Oregon-Washington Highway west of Heppner, and .44 miles east, Morrow County proceeded to surface with a standard waterbound macadam. This work was done on a force account basis by the United Contracting Co. and Warren Construction Co. The work was completed and opened to traffic in July, 1918.

The 2.26 miles of macadam cost the County a total of \$19,280.35. A total of 4,208 cubic yards of rock was placed, making the unit cost \$4.56 per cubic yard. Crushed trap rock was secured from a quarry near the city limits, and suitable binder material was found near at hand. The engineer in charge was R. H. Baldock of the State Department.

MULTNOMAH COUNTY

Although the assessed valuation of Multnomah County is more than thirty-five per cent of the total assessed valuation of the entire State, this County has renounced all claim to any share of the State Funds available for road purposes, and will construct and maintain in a high state of improvement, at its own expense, all State Roads within its boundaries. This liberal attitude of the people of Multnomah County is to be commended, and it makes available for expenditure in counties outside of Multnomah County, a much greater amount of money than would otherwise be the case.

The roads of Multnomah County represent some of the heaviest grading construction, some of the best improved and some of the most scenic highways to be found anywhere in the world. The Upper Columbia River Highway is by many considered the most scenic highway in the United States, and attracts a multitude of tourists annually.

An interesting tabulation of the amounts expended by Multnomah County in the construction of the Columbia River Highway, both above and below Portland, is appended:

COLUMBIA RIVER HIGHWAY, EAST 82D STREET VIA SANDY ROAD TO HOOD RIVER COUNTY LINE

Section	Miles	Pavement	Grading	Bridges	Total
Sandy Road to Troutdale	10.29	\$183,001.41	\$ 5,000.00	\$ 14,845.33	\$ 202,846.74
Sandy Cut-off to Auto Club Bridge.....	2.47	47,506.74	94,389.04	.....	141,895.78
Columbia River Highway to County Line..	26.68	495,507.75	601,012.13	169,586.71	1,266,106.59
Totals.....	39.44	\$726,015.90	\$700,401.17	\$184,432.04	\$1,610,849.11

Total Construction Cost	\$1,610,849.11
Engineering	72,004.95
Grand Total	\$1,682,854.06

VISTA HOUSE AT CROWN POINT

Building	\$ 68,314.36
Retaining Walls and Pavement	30,833.69
Total	\$ 99,148.05

**ST. HELENS ROAD, PORTLAND TO COLUMBIA COUNTY LINE.
LENGTH, 16 MILES**

	1915	1916	1917	1918	Totals
Regrade and Macadam		\$35,330.82	\$ 16,444.10	.....	\$ 51,774.92
Hard Surface	\$80,944.11	4,111.79	200,047.81	41,393.37	326,497.08
Shoulders		5,031.80	.....	.....	5,031.80
Drainage .....		.....	5,022.19	.....	5,022.19
Bridges		28,591.39	14,203.21	.....	42,794.60
Right of Way and Miscellaneous .....		.....	2,538.06	.....	2,538.06
Engineering, Superintendence and Overhead	3,500.00	3,400.00	16,667.87	2,000.00	25,567.87
Total	\$84,444.11	\$76,465.80	\$254,933.24	\$43,393.37	\$459,226.52

SUMMARY

Pavement	\$326,497.08
Bridges	42,794.60
Grading	64,366.97
Engineering and Overhead	25,567.87
Grand Total	\$459,226.52

POLK COUNTY

The work of the State Highway Department in Polk County during 1917 and 1918 has been confined chiefly to the design and the supervision of construction of bridges. In addition to the design and supervision of the Salem Bridge which is partly within Polk County, and which is described in detail in an article in the chapter devoted to Marion County, the Department has handled, at the request of the Polk County Court, the following bridge work, all of which has been paid for by the County.

Between Monmouth and Dallas a 37 foot reinforced concrete bridge was built over a slough on the Mulkey Cut-off. This bridge complete cost \$1,898.17.

The Hollingshead Bridge over the Little Luckiamute River south of Dallas is a 72 foot covered wooden span on concrete piers. This bridge was built at a cost of \$3,615.00.

A 160 foot suspension foot-bridge was built over the Big Luckiamute River at a cost of \$500.00, to accommodate school children attending the Montgomery School.

The LaCreole Creek Bridge in Dallas is a reinforced concrete arch structure seventy feet long. This bridge was not designed by the Highway Department, but the Department supervised its construction. It is a very pretty structure with sidewalks and lighting fixtures. It was built at a cost of \$10,755.68.

SHERMAN COUNTY

Sherman County is so situated with respect to the State Highway System, that its boundaries include a comparatively small mileage of State roads. This however, is no indication of the value improved roads will be in the County. The situation is of both state wide and local importance.

This County is found with many miles of good natural road. In addition they have graded a large mileage and in some localities unusual attention is given to road maintenance. The County is fairly well equipped for road work and have plans for quite an extensive program.

State aid in Sherman County thus far has been confined to highway surveying, but the State Highway Commission has definite plans for extending aid in the construction of the Deschutes and John Day River Bridges and the grading of the Columbia River Highway. It is expected this work will start early the coming season.

The Deschutes River Bridge.

Various attempts have been made by Sherman, Wasco County and the State to raise funds for the construction of the Deschutes River Bridge on the Columbia River Highway. Success crowned these efforts recently when a final agreement was reached between the three.

The total estimated cost of this bridge is between \$70,000.00 and \$75,000.00. The State Department plans call for a reinforced concrete structure about 600 feet in length.

Sherman County has pledged \$25,000 towards defraying the cost of the bridge providing funds are raised for completing same. This condition has been met by the State Highway Commission and negotiations are already underway for securing right-of-way. In this connection it is pertinent to state that Wasco County also has appropriated \$25,000.00 for co-operation in this work. The State's share of the cost will be approximately \$25,000.00, according to the present estimate.

Columbia River Highway Survey

During 1918 the State Department made a location survey of the Columbia River Highway between the Deschutes and John Day Rivers. The line follows the river canyon through Sherman, Biggs and Rufus. The length of this survey is 14.66 miles. The field work only has been completed on this survey and construction plans will be made up soon. C. S. Noble was the locating engineer for the Department.

John Day Bridge

This inter-county bridge will be located on the Columbia River Highway across the John Day River, below McDonald, and will obviate the necessity for the toll ferry at McDonald.

As designed, the crossing calls for 2-123 foot wooden deck spans on concrete piers and about 120 feet of high class wooden approach and 100 feet of fill. The cost, which is estimated to be \$20,000.00, will be borne by Sherman and Gilliam Counties, and the State, and it is probable that construction work will start next spring.

TILLAMOOK COUNTY

Paving—Tillamook South

A contract was awarded on August 7, 1917, to Oskar Huber of Portland for the grading and paving of a five mile section extending south from the end of the paving then in place about three miles south of Tillamook City.

The old road which this paving was to follow in a general way contained many sharp curves and had a roadbed not eighteen feet wide on the average. On this was a light surfacing of gravel and rock macadam about twelve feet in width. The roadbed was widened to a twenty-four foot width, all excessively sharp curves were eliminated, and all wooden culverts, trestles, and bridges were replaced with modern concrete structures, and the decking on two steel bridges renewed and paved.

As there is available in this vicinity no ledge rock, it was found necessary to haul and crush large boulders from the creek bed to provide the necessary rock for the base and mixture. Some sand was obtained locally, but most of it had to be shipped in from Portland and hauled to the work from Tillamook.

The job was completed by December 15th of this year, and on account of the unusually bad conditions faced by the contractor as regards labor and materials, Mr. Huber is to be commended for the prompt completion of the work as well as for the excellence of construction.

By an arrangement between the County and the Highway Commission the County pays for all grading in connection with this improvement and also for twenty-five per cent of the cost of the paving. The total cost of the grading and paving complete is \$109,250.00 of which the County will pay \$34,325.00 and the State \$74,925.00.

Mr. C. W. Wanzer was in charge of this work as resident engineer.

DETAILED STATEMENT OF EXPENDITURES TO NOVEMBER 30, 1918—
GRADING AND PAVING—TILLAMOOK SECTION

Engineering.....	\$ 6,391.47
Contract Construction Work as follows—	
Common Excavation, 10,835.3 Cu. Yds. at 60c.....	\$ 6,501.18
Intermediate Excavation, 1,959.5 Cu. Yds. at 90c.....	1,763.55
Overhaul, per 100 Lin. ft., 6,314.8 Cu. Yds. at 2c.....	126.30
12-inch Reinf. Conc. Pipe (Placing only) 84 Lin. ft. at 48c	40.32
18-inch Reinf. Conc. Pipe (Placing only) 607 Lin. ft. at 78c	473.46
24-inch Reinf. Conc. Pipe (Placing only) 384 Lin. ft. at \$1.16	445.44
36-inch Reinf. Conc. Pipe (Placing only) 64 Lin. ft. at \$1.80	115.20
Clearing and Grubbing (Force Account).....	543.75
Moving Fences (Force Account).....	4.00
Standard Bitulithic Pavement, 47,555.5 Sq. Yds. at \$1.42..	67,528.81
Broken Stone Loose measure, 8,840 Cu. Yds. at \$2.20.....	19,448.00
Crushed Stone Shoulders, 7,466 Lin. ft. at 6c	447.96
Total Amount Earned by Contractors to Nov. 30, 1918	
Less 15% retained pending completion	97,437.97
	14,615.69
Total Payments to Contractor to November 30, 1918.....	82,822.28
Total Expenditure to November 30, 1918	89,213.75
Paid by State	
Paid by County	63,203.90
	26,009.85
Total.....	\$89,213.75

Three Rivers Forest Project

A Federal Aid Forest Road Project is now under construction between Hebo and Dolph in Tillamook County. This project is 10.3 miles in length, includes grading and nine foot rock surfacing, and is estimated to cost \$122,000.00 of which \$21,500.00 will be paid by the County, \$50,250.00 by the State, and \$50,250.00 by the Federal Government.

This work is handled under the supervision of Federal Office of Public Roads. The contract was awarded to the Tillamook County Court, but the State's Attorney General ruled that the Court had no authority which would allow them to contract to do work of this nature. To facilitate matters the Highway Commission took the contract over from the County, and the work is now in progress, the Highway Department acting as contractors and being paid for the work at the unit prices originally bid by Tillamook County.

It was so late in the year when this work was taken over by the State that little work can be done until the 1919 season. Work is in progress, however, on camp construction, clearing, and such other portions of the work as can be done during the winter months.

Mr. J. M. Baker is superintendent of construction on this work.

Tillamook-Cloverdale Survey

On the Tillamook-Cloverdale road a preliminary survey has been completed from Tillamook to Hebo, a distance of 18 miles, and of this about nine miles have been located. This is a very important section as it is the most direct route from the Willamette Valley to the beaches of Tillamook County, and is not served with a railroad. The engineer in charge of this work was Mr. C. A. Dunn.

UMATILLA COUNTY

The highway problem of Umatilla County is of greater magnitude than it would seem to be at first consideration. The fact that the County is well supplied with rail transportation only renders the demand for highways more urgent. Soil conditions are generally unfavorable for good natural roads although gravel deposits suitable for highway construction are found in most localities.

The County has made constant efforts towards an improved system of roads, but with 3,000 miles of county roads to care for and with considerable bridge work in the program, the available funds are found to be entirely inadequate. The main roads or trunk highways through the County have had the benefit of a large percentage of local funds but owing to a large mileage and character of improvement necessary, there remains a great deal yet to be done.

When the State of Oregon voted to expend \$6,000,000.00 in surfacing roads constructed by the counties, Umatilla County was among the first to take advantage of the State aid. The State Highway Commission extended additional aid through the Post Road Fund, but these plans were later cancelled owing to requirements of the U. S. Office of Public Roads.

The State Highway Department has surveyed the Old Oregon Trail for the entire distance across the County and 42.2 miles of the Oregon-Washington Highway have been surveyed. In addition a considerable mileage of reconnaissance surveys have been made preliminary to definite location.

In 1917 and 1918 the State Highway Department expended \$162,625.56 in constructing eleven miles of pavement near Pendleton. The cost of maintenance on this road has been divided equally between the State and County.

Funds were set aside by the State Highway Commission in 1917 to macadamize the 40 mile section of Old Oregon Trail from Pendleton west to the Morrow County line. War conditions caused a postponement of this improvement. The funds are still intact and work will proceed as soon as conditions will permit. Following are statements showing amounts of State funds expended in Umatilla County and funds appropriated to be expended in 1919.

Expended in 1917 and 1918 for paving on Wild Horse Road and Pendleton-Reith Section.....	\$162,625.56
Appropriated to be expended in 1919 on macadamizing Old Oregon Trail from Pendleton to Morrow County line near Umatilla.....	180,000.00

Wild Horse Paving

The State Highway Commission on June 29, 1917, let a contract to the Warren Construction Company for paving a ten mile section of the Wild Horse Road northeast of Pendleton and one mile of the Old Oregon Trail leading west from Pendleton. The pavement laid was bitulithic and the

subgrade was an old macadam road built by the County. The macadam road was of insufficient width for supporting a 16 foot pavement, which condition required widening of the grade, re-ditching and the placing of extra crushed rock for base.

The widening of the road bed was done with County funds expended under the direction of the State Highway Department. The work of widening the grade cost the County \$9,975.00 for the 11 miles.

Paving work begun in July, 1917, and an excellent pavement of the standard two-inch bitulithic type was secured, with a six inch crushed



ON THE PAVED ROAD BETWEEN PENDLETON AND ADAMS IN UMATILLA COUNTY. PAVED IN 1917

rock base. The total cost of this work was \$162,626.56 or \$14,784.22 per mile. M. O. Bennett was the engineer in charge and Chas. Noble was the inspector on this work. Following is a detailed cost statement:

DETAILED COST STATEMENT—WILD HORSE PAVING

Standard Bitulithic Pavement, 103,543.79 sq. yds. at \$1.29.....	\$133,571.49
Broken Stone loose measure, 10,994.8 cu. yds. at \$1.87.....	20,560.28
Crushed stone, 115,600 lin. ft. at 5c	5,780.00
Extra work on road approaches.....	104.91
	<hr/>
	\$160,016.68
Engineering and Inspection	2,609.88
	<hr/>
Total.....	\$162,626.56

Wild Horse Grading

When plans were made in 1917 for the Wild Horse paving, 16 feet was the width decided upon. Upon investigation it was found this would require widening of the old road bed from one foot to five feet, re-ditching for a large part of the 10 miles and the replacing of several culverts.

This work was done under the direction of the State Highway Department and the entire cost was defrayed from County funds. The total cost to the County was \$9,975.00. Oscar Cutler of the State Highway Department was resident engineer in charge.

Pendleton-Pilot Rock Section—Grading and Macadamizing

Upon the completion of the survey by the State Highway Department of the section of the Oregon-Washington Highway between Pendleton and Pilot Rock, the Umatilla County Court started grading. Where the construction is light the road grader was used to great advantage. Through the aid of the Division Office of the State Department new right-of-way was secured in some places and the alignment of the road naturally improved.

During September and October, 1918, the section between Pendleton and the County Poor Farm was graded and macadamized on a six per cent development over Grave Yard Hill. This work, both grading and macadamizing is of excellent character and will soon be opened to traffic. W. C. Crews, engineer for the State Department made the relocation on this section and was resident engineer during construction. The following is a statement showing quantities and total and unit costs:

Item and quantity	Total cost	Unit cost
Excavation, 4,795 cu. yds.....	\$3,164.70	\$.66
Gravel, 2,000 cu. yds.	2,600.00	1.30
Concrete Bridge	1,600.00	
Total cost	\$7,364.70	

An additional four miles from the County Poor Farm south was graveled by the County with an expenditure of \$2,000.00.

Survey of Columbia River Highway and Old Oregon Trail

During 1917 and 1918 the State Highway Department made a location survey over the entire east and west route across Umatilla County, excepting the six mile section between Pendleton and the Indian Agency. On this six miles a base line survey only was made.

The section of this road between the Morrow County Line and Pendleton is a part of the Columbia River Highway and has a total length of 40.5 miles. It passes through Umatilla, Hermiston, Stanfield, Echo and Reith. From Pendleton east the road is known as the Old Oregon Trail.

The survey in the east end of the County begins at the Umatilla Indian Agency follows the general direction of the present road up Cabbage Hill, passes through Meacham and ends at the Union County Line near Kamela. A five per cent grade was secured on the Cabbage Hill climb. The total length of this section is 26.8 miles. R. H. Baldock and Oscar Cutler were the locating engineers on this work. The plans for this survey are practically complete.

Survey of Oregon-Washington Highway

The State survey of the Oregon and Washington Highway extends from the end of the pavement ten miles northeast of Pendleton, through Pendleton, and Pilot Rock to the Morrow County Line west of Butter Creek. This survey was made in 1917 and a section south of Pendleton was relocated in 1918. The total length of this line is 42.2 miles. R. H. Baldock and Oscar Cutler were the locating engineers on this work and the revision was made under the direction of W. C. Crews.

UNION COUNTY

In the matter of highway improvement Union County has shown considerable progress. Substantial road building machinery is owned by the County in units sufficient to allow work to proceed simultaneously in various sections of the County. It is noticeable however that most of their work has been done (and justifiably so) on local and feeder roads rather than on trunk highways. Local funds and equipment are inadequate to make all the improvements needed when the mountainous sections of the main roads are considered.

As in other counties the State Highway Commission easily recognized the necessity and importance of co-operation and accordingly in 1917 plans were laid and steps taken to extend State and Federal Aid.

During 1917 and 1918 a total of 83.54 miles of survey was made on the two principal roads of the County. 45.26 miles on the Old Oregon Trail and 38.28 miles on the La Grande-Joseph Highway.

Agreements were signed by the Secretary of Agriculture providing for co-operation with the State on equal basis, for the grading of a six mile section between Union and Telocaset and a 9.37 mile section between Elgin and Minam. The respective amounts expended on each of these projects to the date of this report, November 30, 1918, are: \$16,642.29 and \$3,838.44. State funds amounting to \$5,000.00 have been expended for grading in co-operation with the County on the La Grande-Hot Lake Section. This road is 7.95 miles in length and involves the opening of a new road for the entire distance. The State Highway Commission has set aside funds for graveling this section preparatory to surfacing. The completion of these three projects will require approximately \$66,737.06 from the State, \$35,575.50 from the Federal Government, and \$3,000 from the County.

The following summary shows for each project amounts expended to date and funds set aside to be expended during 1919:

EXPENDED IN 1917 AND 1918

	State Funds	County Funds	Government Funds	Total
Union Telocaset	\$16,642.29	.....	.....	\$16,642.29
Elgin-Minam	3,838.44	.....	.....	3,838.44
La Grande-Hot Lake	5,000.00	\$3,000.00	.....	8,000.00
Total	\$25,480.73	\$3,000.00	.....	\$28,480.73

APPROPRIATED FOR EXPENDITURE IN 1919

	State Funds	County Funds	Government Funds	Total
Union-Telocaset .....	.....	.....	\$15,000.00	\$ 15,000.00
Elgin-Minam	\$16,737.06	.....	20,575.50	37,312.56
La Grande-Hot Lake	50,000.00	\$3,000.00	.....	53,000.00
Total	\$66,737.06	\$3,000.00	\$35,575.50	\$105,312.56

The absence of figures in the column headed "County funds" in the above tabulation is explained by the fact that Union County, in the matter of co-operation, has agreed to expend certain sums on other roads than those mentioned in the table. The County's appropriation for the improvement of the La Grande-Kamela section of the Old Oregon Trail is \$40,000.00 and \$10,000.00 additional has been stipulated for use in improving the Elgin-Willow Creek Section of the La Grande-Joseph Highway. The County has also provided funds for the completion of the grading between La Grande and Hot Lake.

Union-Telocaset Section Grading

In August, 1918, the State Highway Commission called for bids on the grading of a six mile section between Union and Telocaset. The Union County Court was the successful bidder and the Commission awarded the contract but it later developed that the County could not legally hold the position of contractor in doing State work. As the other bids were unsatisfactory the situation resulted in the State taking over the work and doing it with the State forces, and by November 30, the project was about 60% complete. The total estimated cost of this work is \$30,000.00 and \$16,642.29 has been expended to date. Mr. R. A. Pratt is resident engineer in charge.

Elgin-Minam Section

The State Highway Commission opened bids on the grading of a 9.37 mile section between Elgin and Minam Hill. In the letting of this work they experienced the same difficulty as with the Union-Telocaset work. (See report on the Union-Telocaset grading). The subsequent action of the State Highway Commission in taking the contract over to be done by State forces resulted in work starting in August, 1918. Owing to weather and soil conditions work on this section has closed down for the winter. The amount expended is \$3,838.44 and the total estimated cost is \$41,151.00. Mr. R. A. Pratt, resident engineer for the State Highway Department was in charge of this work and Mr. C. A. Dunn was superintendent.

La Grande-Hot Lake Grading

In November, 1917, the State Highway Department appropriated \$5,000.00 to co-operate on the grading of that section of the Old Oregon Trail between Hot Lake and LaGrande. Grading work started within the month and two miles were graded when work was closed for the winter.

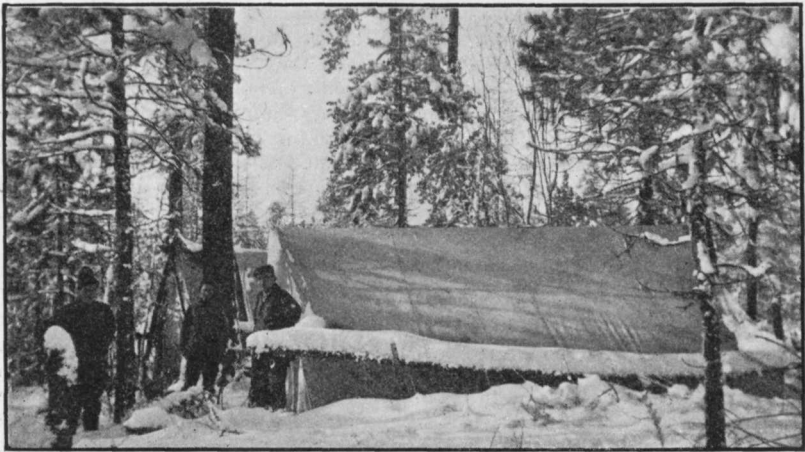
This work was continued during the present season and up to November 30, about five miles of grade had been completed. In addition to the \$5,000.00 of State money the County has expended about \$3,000.00. It will require about \$3,000.00 to complete the grading and an additional \$5,500.00 for bridges. The bridge plans call for concrete structures.

Survey of the Old Oregon Trail, Union County

The State Highway Department has made a location survey of 45.26 miles of the Old Oregon Trail in Union County. The survey begins at the Union-Umatilla County Line near Kamela and continues through La Grande, Hot Lake and Union and ends at Telocaset. Office plans are complete for most of this work. Locating engineer D. D. Glass made the survey from La Grande to Telocaset and R. H. Baldock, locating engineer, was in charge of the work between Kamela and La Grande.

Survey of La Grande-Joseph Highway, Union County

In 1917 a final location survey was made from La Grande to Minam, a distance of 38.28 miles. D. G. Glass, locating engineer for the State Department, was in charge of the crews. Beginning at La Grande the line runs through Island City, and Elgin and ends at Minam at the confluence of the Minam and Wallowa Rivers. Plans for this work are practically complete. The location from Island City to Elgin is to be reconsidered with the view of making some changes in the route.



A SURVEY CAMP IN EASTERN OREGON

Union-Telocaset Post Road Project

A co-operative agreement between the State and Government provides for the construction of a portion of the Old Oregon Trail between Union and Telocaset. This section six miles in length, begins at Union and follows up Pyles Canyon near the location of the present road to a point 1.5 miles north of Telocaset.

The total estimated cost of this project is \$30,000.00 making \$15,000.00 to be paid by each the State and Government. Union County joins in the co-operation of the work, in case the total cost exceeds the amount stipulated in the Federal agreement. If the total cost should exceed the estimate given in the project agreement, the County agrees to pay the full amount of such cost.

Work was started on this section August, 1918, and \$20,575.50 had been expended to November 30. R. A. Pratt is resident engineer for the Department. The work is being done by the State forces under the supervision of C. A. Dunn, assistant engineer.

Elgin-Minam Post Road Project

The State Highway Commission secured an agreement with the U. S. Office of Public Roads providing for the construction of a 9.37 mile section of the La Grande-Joseph Highway. The survey for this improvement begins at Elgin and follows east in the direction of the present road to the top of Minam Hill.

It is estimated that this work will cost \$41,151.00 or \$20,575.50 for each the State and Government. In case the cost of this work exceeds the estimate shown in the project agreement, the County agrees to pay such cost. In this manner Union County is co-operating in this improvement.

Work opened up here in August under the supervision of C. A. Dunn, assistant engineer, for the Department. State forces are employed on force account basis. The expenditures to November 30 amount to \$3,838.44, and the project is about 10% completed. R. A. Pratt is resident engineer for the State Department.

WALLOWA COUNTY

Wallowa County's road problem is entirely local in character as this district is not touched by a trunk road of the State system. Some very good natural roads are found in this district, while others are very bad. The latter designation applies more especially to some of the mountain roads, which are extremely narrow and very dangerous.

The La Grande-Joseph Highway is very important locally, since it is the only road connecting the valley with outside points. The people in general are very much interested in highway possibilities, but the County funds have proven inadequate to make much of a showing towards permanent work. Most of the available County funds are required for maintenance of the existing roads, many of which extend through mountainous areas. Additional State aid is much needed if any substantial improvements are hoped for.

A general reconnaissance survey was made in October, 1918, by the State Highway Department from Elgin to Joseph. The purpose was to gather general information for the use of the State Highway Commission. This survey was made by M. O. Bennett, division engineer for Eastern Oregon.

During this visit the matter of Post Road Aid was taken up with the County authorities. It was understood that the County would make application at once, but it appears that no further action was taken.

The State Highway Commission has extended aid to Wallowa County by co-operating on the Flora-Enterprise Forest Road and also helped to secure Government aid on the same project. The County made an appropriation to help in the construction of this road. Work is in progress on this road under the direction of the U. S. Office of Public Roads. The following statement shows the estimate cost and segregation of funds:

State appropriation	\$12,324.00
Federal appropriation	12,324.00
County appropriation	5,000.00
Total estimated cost	\$29,648.00

WASCO COUNTY**The Dalles-Three Mile Post Road Project**

An appropriation has been made, by the State Highway Department, from the Post Road Fund for co-operation in the paving of a two mile section of The Dalles-California Highway between the east city limits of The Dalles and Three Mile Creek.

A project statement has been prepared, requesting \$14,830.00 from the U. S. Office of Public Roads. The State will supply a like amount and Wasco County \$4,000.00. This makes a total of \$33,660.00 which is the estimated cost of the project.

The present gravel road will serve as a base for the pavement which is to be 16 feet wide. The improvement will include re-ditching of the road bed and the installation of culvert pipe in several places.

It is planned that work will start early in 1919.

The Pine Hollow-Kingsley Post Road Project

The section of The Dalles-California Highway in Wasco County between Pine Hollow, near Dufur, and Kingsley is designated by the State Highway Commission as a Post Road. This section is 4.0 miles long and follows near the line of the present road. The project begins at the road forks $2\frac{1}{4}$ miles south of Dufur and ends at a point on the present road $1\frac{1}{2}$ miles north of Kingsley.

The plans provide for the grading of the road bed, the estimated cost of which is \$14,500. The State and Government are each requested to appropriate \$2,500.00 and the County will expend \$9,500.00. It is expected this work will be done in 1919.

Antelope Grade Post Road Project

The State Highway Commission has designated as a Post Road a three mile section of The Dalles-California Highway immediately north of Antelope. This is known as the Antelope Grade Section. The new road will be a 6% grade along near the present road.

The total estimated cost of grading to standard width and properly draining is \$30,000.00; and the funds are to be provided as follows: State \$2,500.00; Government, \$2,500.00; and Wasco County, \$25,000.00.

It is hoped this work will start early in 1919.

Survey—Seufert to the Deschutes River

A survey was made in April, 1918, for the Columbia River Highway between Seufert and the Deschutes River, along the river for the purpose of comparison with a previous survey over the hill, conforming closely to the present road.

This route, which was subsequently adopted, has a summit of 210 feet against 780 feet on the hill route, and a length of 12.8 miles, a saving of 2.7 miles in distance. Between The Dalles and Seufert about two miles was graded to standard width and grade in 1917. The proposed route follows close to the railroad, which is crossed near Big Eddy on a proposed overhead bridge and utilizes the old State Portage Railroad roadbed, as well

as the already graded bank of the Government canal. Near Celilo, another overhead crossing of the O.-W. R. R. & N. Co. tracks is proposed, and from this point to the Deschutes River the highway is located between the Oregon Trunk Railroad and the O.-W. R. R. & N. Co., using about two miles of abandoned railroad roadbed.

This improvement requires only very light construction, except for short distances, and it is believed it can be kept free from drifting blow sand by the use of sand fences, as the Portage Railroad is used where the sand is the worst, and this was kept open with very little maintenance. With a smooth roadbed, and with nothing to cause drifting, it is thought that the maintenance on this account will be negligible.

The route is attractive, as it makes available at close range the Locks at Big Eddy, the Celilo Canal, and the magnificent Celilo Falls. The estimated cost of this project is \$142,500.00. It is proposed to include this project in the 1919 program.

Deschutes River Bridge.

Among the bridges expected to be built in the near future is the proposed reinforced concrete arch bridge over the Deschutes river at Miller, about a mile above the river's mouth. This will be a State and Inter-county structure, and will connect Sherman and Gilliam Counties on the Columbia River Highway, and will be located a few hundred feet below the present old wooden toll bridge which it will replace.

The design, which is practically completed, contemplates seven arch spans aggregating 580 feet in length with a filled approach at either end. The estimated cost of the bridge is \$75,000.00.

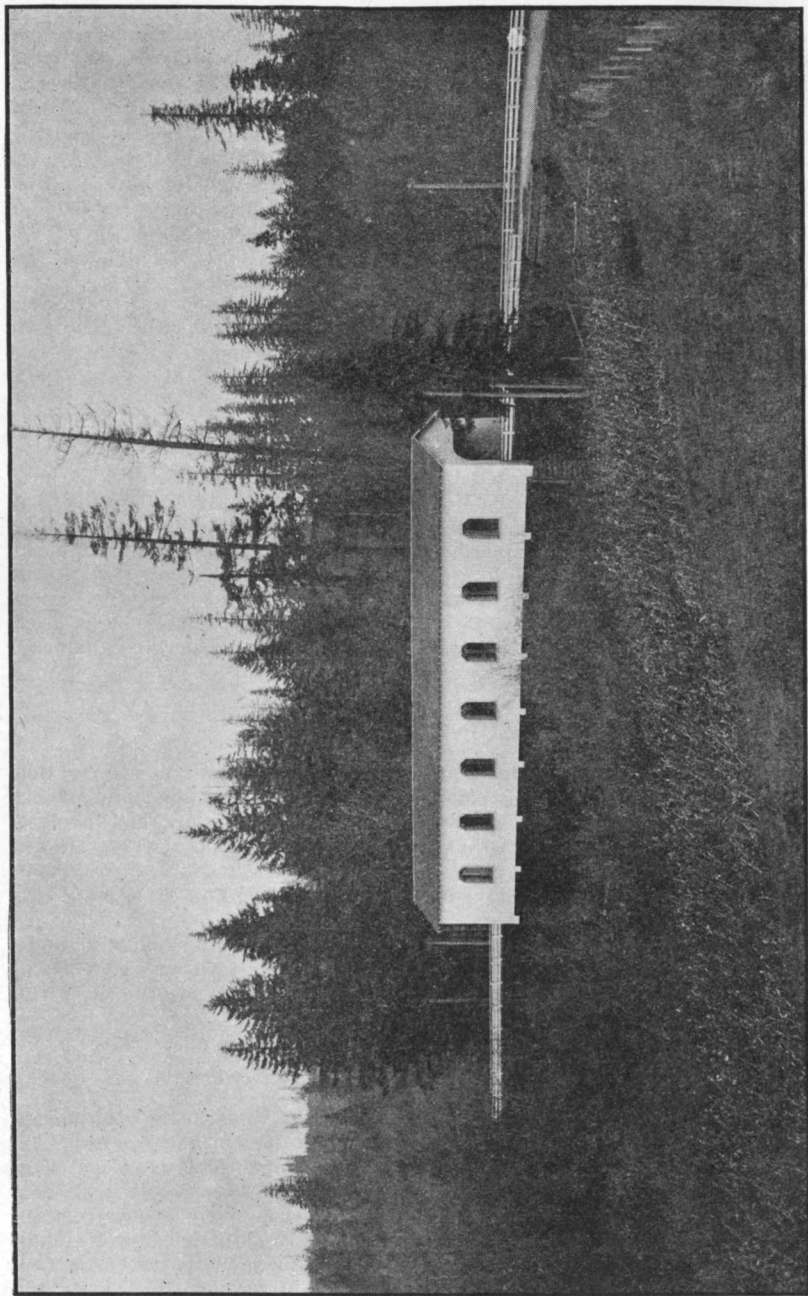
WASHINGTON COUNTY

During 1917 and 1918, the State Highway Department in co-operation with Washington County has completed the grading, bridging and paving of the West Side Highway across that County. This work has involved the grading and paving of 12.5 miles and the construction of three bridges and one undergrade railway crossing. On this work, when final payments are complete, the State will have expended \$292,000.00 and the County will have expended \$10,000.00.

In addition to this construction, the Department has made surveys between Beaverton and Hillsboro and between Forest Grove and Gaston, and has furnished the County engineering services in connection with the grading of these two sections.

Paving—Multnomah County Line to Newberg

The pavement on the West Side State Highway between the Multnomah County Line and Newberg is 15.7 miles in length, of which 12.5 miles is in Washington County and 3.2 miles in Yamhill County. This pavement is a two-inch standard bitulithic surface on a crushed rock base. It is sixteen feet wide with a two-foot macadam shoulder on each side. The grading in Washington County and the paving in both Washington and Yamhill Counties was done by Oskar Huber of Portland under a contract awarded him on July 30, 1917. The work was started in August, 1917, and was completed in October, 1918.



COVERED WOOD BRIDGE OVER THE TUALATIN RIVER ON THE WEST SIDE HIGHWAY IN WASHINGTON COUNTY
BUILT IN 1918

The grading in Washington County will cost complete approximately \$39,699.85 of which Washington County has paid \$9,395.00. The part of the paving within Washington County will cost complete \$234,750.00 all of which is paid for from State Funds.

DETAILED STATEMENT OF EXPENDITURES TO NOVEMBER 30, 1918
 GRADING AND PAVING MULTNOMAH COUNTY LINE TO NEWBERG

Engineering	\$ 9,445.56
Right-of-Way Costs	49.98
Construction:	
Crushed Stone Shoulders, 163,663.4 lin. ft. @ .06.....	\$ 9,819.80
Standard Bitulithic Pavement, 149,764.4 Sq. Yds. @ \$1.28	191,698.43
Broken Stone, Loose Measure, 34,885.75 Cu. Yds. at \$2.40	83,725.80
Clearing and Grubbing.....	1,250.00
Common Excavation, 46,773.9 Cu. Yds. @ .34.....	15,903.13
Intermediate Excavation, 9,224.4 Cu. Yds. @ .62.....	5,719.13
Solid Rock Excavation, 385 Cu. Yds. @ \$1.15.....	442.75
Overhaul per 100 Lin. Ft., 172,279.2 Cu. Yds. @ .01.....	1,722.79
12-inch Reinf. Conc. Pipe, 1,568 Lin. Ft. @ \$1.25.....	1,960.00
24-inch Reinf. Conc. Pipe, 52 Lin. Ft. @ \$2.45.....	127.40
36-inch Reinf. Conc. Pipe, 96 Lin. Ft. @ \$4.25.....	408.00
6-inch Porous Drain Tile, 7,191 Lin. Ft. @ .15.....	1,078.65
Rip-Rap, 32 Cu. Yds @ \$2.75.....	88.00
Force Account:	
Lowering and lengthening existing culverts.....	1,081.67
Replacing bridge approach at Tualatin River.....	50.27
Special wide ditches alongside road near Four Corners	814.50
Back-fill and planking at Onion Flat Trestle.....	405.94
Tearing down old trestles at Onion Flat.....	55.33
Replacing private water supply crossing.....	13.31
Rebuilding Right of Way Fences.....	70.85
Grading at Middleton R. R. Crossing.....	1,970.47
Blind Drains	189.68
New 30-foot Culvert	223.60
New 42-foot Culvert and special fill over it.....	468.26
Drain Tilling, back-filled with rock.....	582.09
Total amount earned by Contractor to Nov. 30, 1918	\$319,869.85
Less amount retained pending completion of contract.....	50,388.46
Total paid contractor to November 30, 1918.....	269,481.39
Total expended to November 30, 1918.....	\$278,976.93

Onion Flat Bridge

This crossing consists of a laminated wood deck on heavy stringers supported by a series of creosoted pile bents. It is on the West Side Highway about four miles southwest of Tigard and is designed for heavy traffic loading.

An asphaltic wearing surface prevents moisture coming in contact with the wooden floor and with the treated piling tends to give the maximum length of life to the main members of the structure. This bridge is 600 feet long and cost complete \$8,372.22.

Fanno Creek Bridge

The Fanno Creek bridge at Tigard on the West Side Highway consists of a superstructure similar to the Onion Flat bridge, carried on wood bents on concrete foundations. A sidewalk was built on one side to accommodate pedestrians. The bridge is 70 feet long and cost \$1,882.81.

Tualatin River Bridge

The bridge consists of a covered Howe truss wooden bridge of 144 foot span and 166 lineal feet of pile trestle approach.

Like the others constructed by the State on main highways, this bridge is of heavy traffic design, and the bridge and approaches have laminated wood floors with asphaltic wearing surfaces. Windows are provided at panel points to provide light and to add to the appearance of the structure. Cost \$12,968.60.

Votaw Undercrossing

A grade separation was made on the West Side Highway near Votaw, wherein a wooden trestle was constructed to carry the Southern Pacific line above the roadway. The structure was designed and built under the supervision of the railroad's engineering department.

Final settlement has not yet been made with the Railway Company, but it is estimated that the State's share of the cost of this structure will be \$4,000.00. The balance of the cost will be paid by the Railway Company, no share of the cost being borne by the County.

Survey—Beaverton to Hillsboro

A location survey was started January 1, 1918, from the West City limits of Beaverton and completed to the city limits of Hillsboro, a distance of 7.7 miles. The alignment parallels the Southern Pacific Railway on the north side of the tracks and eliminates four grade crossings. The entire section was graded by Washington County during the 1918 season.

Survey—Forest Grove to Gaston

A survey was made from Forest Grove to Gaston, a distance of approximately 6 miles. The alignment follows the existing road with the exception of a change at Dilley to eliminate two railroad crossings.

Considerable grading was done between Dilley and Gaston, reducing the grade to five per cent.

Mr. C. G. Reiter, County Surveyor of Washington County, was employed as locating engineer for the State, and also supervised the grading in both of the above sections.

WHEELER COUNTY

Wheeler County, being without either rail or water transportation facilities, is entirely dependent upon its roads for communication with outside points, as well as between points within the County. All of the large amount of agricultural products of the county must be transported for long distances over roads and highways, and likewise, all manufactured articles and other supplies from points without the County must be brought in over them. For that reason, good roads are of the utmost importance to all of Wheeler County, which fact is fully recognized by the Wheeler County people.

Every effort is being made by the County to build up and improve its road system, but the funds available within the County are entirely inadequate. In November, 1916, bonds were voted to the amount of \$80,000.00, the maximum allowed the County under the State laws, but this amount is

hardly enough to make a beginning on the necessary road construction in the county, as Wheeler County is rough and mountainous, and road construction is therefore heavy and expensive.

The State Highway Commission realizing the importance of the construction of roads in this County, and the impossibility of the financing of their construction by the County alone, early determined to assist to the greatest possible extent.

Surveys have been made by the Department over all but two miles of the two most important cross-county roads, the John Day River Highway and the McKenzie River Highway. During 1917 and 1918 the State Highway Department expended the sum of \$46,997.79, cooperating with the County in the construction of 4.2 miles of grading and macadamizing between Fossil and the Gilliam County Line. State aid was also granted the County to the amount of \$14,235.45 for the construction of nine-tenths of a mile, known as the Bridge Creek Section, on the McKenzie River Highway just west of Mitchell, the total cost of which was \$24,235.45.

For the construction of 25.5 miles on the John Day River Highway between the mouth of Sarvice Creek and the Grant County Line, the Highway Department has set aside the sum of \$63,345.70 to be added to \$63,345.70 of Federal Post Road Funds and \$36,000.00 of county funds to provide the total amount of \$162,691.40 which the project is estimated to cost.

The Department has further been instrumental in securing Federal Aid for the construction of a Forest Road Project 5.5 miles in length between Mitchell and the Crook County Line, known as the Ochoco Canyon Project. On this project the State will expend \$20,050.00, the Federal Government, \$20,050.00 and the County, \$4,900.00, \$45,000.00 in all.

In summary, State Aid and Federal Government Aid extended to Wheeler County during 1917 and 1918 and set aside to be expended in 1919 and 1920, are as follows:

	State Funds	County Funds	Federal Govt. Funds	Total
Expended in 1917 and 1918—				
On grading Cummings Hill Sec.....	\$ 7,004.85	\$ 7,527.50	.....	\$ 14,532.35
On macadamizing Cummings Hill Section	32,465.44	.....	.....	32,465.44
On grading Bridge Creek Sec.....	14,235.45	10,000.00	.....	24,235.45
Total	\$53,705.74	\$17,527.50	.....	\$ 71,233.24
Appropriated for Expenditure in 1919 and 1920—				
On Sarvis Creek-Grant County Line Section	\$63,345.70	\$36,000.00	\$63,345.70	\$162,691.40
On Ochoco Canyon Section	20,050.00	4,900.00	20,050.00	45,000.00
Total	\$83,395.70	\$40,900.00	\$83,395.70	\$207,691.40

Cummings Hill Grading

On June 19th 1917, a contract was let to the Elliott Contracting Co. of Portland, Oregon, for the construction of 3.5 miles of grade between the foot of Cummings Hill, north of Fossil, and the Gilliam County line. This construction was a five per cent development to eliminate the heavy grades and narrow roadbed of the former road. Work was commenced on July

6th, 1917, and completed on October 5th, 1917. The work of the contracting firm was very satisfactory, and an excellent piece of grading was secured. The Engineer in charge for the Highway Department was Mr. B. H. McNamee.

The total cost of the work was \$14,532.35, of which the State paid \$7,004.85 and Wheeler County \$7,527.50. The detailed cost statement follows:

DETAILED EXPENDITURE STATEMENT—
GRADING CUMMINGS HILL SECTION

Engineering		\$ 1,423.30
Construction:		
Common Excavation, 11,397 cu. yds. @ .40.....	\$ 4,558.80	
Intermediate Excavation, 6,017.4 cu. yds. @ .70.....	4,212.18	
Solid Rock Excavation, 2,816.5 cu. yds. @ 1.35.....	3,802.27	
12-inch Corr. Iron Pipe, 682 Lin. ft. @ .40.....	272.80	
24-inch Corr. Iron Pipe, 40 Lin. ft. @ 1.00.....	40.00	
Rubble Masonry, 22.3 cu. yds @ 10.00.....	223.00	
		13,109.05
		\$14,532.35

Bridge Creek Grading

The grading of a nine-tenth mile section in Bridge Creek Canyon was contracted to the United Contracting Co. of Portland, Oregon, on November 27th, 1917. This section is on the McKenzie River Highway about four miles west of Mitchell. In addition to the grading, the contract involved the construction of a ninety foot bridge over Bridge Creek.

The work was started on February 15th, 1918 and completed on June 20th, 1918. The engineering was in charge of Mr. R. H. Coppock.

The total cost of the work was \$24,235.45 of which the State paid \$14,235.45 and Wheeler County \$10,000. The detailed cost statement follows:

DETAILED EXPENDITURE STATEMENT—
GRADING BRIDGE CREEK SECTION

Engineering		\$ 635.30
Construction:		
Common Excavation, 3935.6 cu. yds. @ .60.....	\$ 2,361.42	
Intermediate Excavation, 549.4 cu. yds. @ .75.....	412.05	
Solid Rock Excavation, 9837.6 cu. yds. @ 1.40.....	13,772.64	
Overhaul per 100 lin. ft, 363 cu. yds. @ .03.....	10.89	
12-inch Corr. Iron Pipe, 20 lin. ft. @ .73.....	14.60	
15-inch Corr. Iron Pipe, 108 lin. ft. @ .83.....	89.64	
21-inch Corr. Iron Pipe, 60 lin. ft. @ 1.00.....	60.00	
Rubble Masonry, 1.58 cu. yd. @ 12.50.....	19.75	
Guard fence, 100 lin. ft. @ .85.....	85.00	
1 90-foot Bridge & approaches:		
Superstructure and trestle (Lump sum) \$	5,100.00	
Class "A" Concrete in piers, 49.24 cu.		
yds. @ \$34.00.....	1,674.16	
		\$ 6,774.16
		\$ 23,600.15
		\$ 24,235.45

Macadamizing on Cummins Hill Section

On August 7th, 1917, no satisfactory unit price bid having been received, the State Highway Department entered into a "cost plus" contract with the Warren Construction Company of Portland, Oregon, to macadamize with broken stone the Cummins Hill Section between Fossil and the Gilliam County line, on the John Day River Highway. The rock for this

work was crushed on the job, and the macadam surface was constructed sixteen feet wide with a compacted thickness of six inches.

Payment to contractor was made on the basis of actual cost plus a percentage of 10 per cent on labor and five per cent on materials.

To November 30th, 1918, the State had expended \$32,465.44 on this work, and it is estimated that there are bills outstanding against it to the amount of \$1,500.00.

In addition to the 3.4 miles of grading done by the State on Cummins Hill the County continued the grading at the foot of the hill for a distance of 0.7 miles, making a total of 4.2 miles. The full section has been macadamized, giving Wheeler County 4.2 miles of standard macadam road.

Butte Creek Summit Grading

During the 1918 season, the County has graded under State supervision, a one and seven tenths mile section about nine miles southeast of Fossil on the John Day River Highway. This section is known as the Butte Creek Summit Section. The construction was paid for entirely by the County. Engineering supervision was furnished by the State Highway Department, the engineer in charge of the work being Mr. B. H. McNamee.

The total amount expended by the County, prior to November 30th, on this work was approximately \$30,000.00, and the quantities of construction completed to this date were as follows:

Common Excavation	8,000 cu. yds
Rock Excavation	12,000 cu. yds.
Pipe, 12-inch	234 lin. ft.
Pipe, 20-inch	72 lin. ft.
Pipe, 16-inch	100 lin. ft.
Clearing	8 acres

Grading between Cummins Hill and Fossil

During April and May, 1918, Wheeler County graded, under the direction of the State Highway Department, a section of the John Day Highway between Cummins Hill and Fossil. This grade was .7 of a mile in length and joined up with the Cummins Hill grading. This improvement cost the County approximately \$4,000.00. Geo. Hibbert was inspector and transitman in charge for the State Department.

Survey of the John Day River Highway

With the exception of a two mile section immediately West of Fossil, the entire John Day River Highway through Wheeler County is covered by location survey made during the past two years. The total length of survey on this highway is 41.5 miles. For all but about twelve miles, of this total, the detailed plans are practically complete. The survey of this highway has been in charge of B. H. McNamee.

Survey of the McKenzie River Highway

The Sate Highway Department has completed a survey of the McKenzie River Highway in Wheeler County from the boundary of the Ochoco National Forest west of Mitchell to the Grant County Line near Dayville, a

total distance of 48 miles. This survey was made by Locating Engineer R. H. Coppock. The plans are complete except for the eight miles west from the Grant County line.

From the west end of this survey at Ochoco Forest boundary, the Federal Office of Public Roads has made a survey to the Crook County line, so the survey of the McKenzie River Highway is complete all of the way through Wheeler County.

Survey of Highway No. 14

In 1917, pursuant to a request from the County Court, a section of Highway No. 14 between Mitchell and Antelope was surveyed. This survey begins at the point on the Mitchell-Prineville survey about four miles west of Mitchell and extends 1.4 miles down Bridge Creek to where connection is made with the present road. This survey was made by R. H. Coppock, locating engineer.

Sarvice Creek-Valades Ranch Post Road Project

Application has been made to, and approved, by the Federal Office of Public Roads for Post Road co-operation on a 48.5 miles section of the John Day River Highway in Wheeler and Grant Counties. 25.5 miles of this project are in Wheeler County and 23 miles in Grant County. The total estimated cost of the project is \$400,433.79, and the funds are to be provided as follows: State \$157,216.90, Government \$157,216.89; Wheeler County \$36,000.00 and Grant County \$50,000.00.

The survey for this project parallels the John Day River on the north bank, through Wheeler County and extends from the mouth of Sarvice Creek in Wheeler County to Valades Ranch about four miles West of Dayville in Grant County. In Grant County a crossing is made to the west bank near the upper end of the Big Basin.

It is expected that construction will be commenced on the Sarvice Creek-Valades Ranch Project early in 1919.

Ochoco Canyon Forest Project

A Federal Aid Co-operative Agreement has been entered into between the State, the Federal Government, and Wheeler County for the grading of a 5.5 mile section on the McKenzie River Highway. This section is known as the Ochoco Canyon Section and extends from the Crook County line to a point about 16 miles west of Mitchell.

This work is estimated to cost \$45,000.00 of which the State will pay \$20,050.00, Wheeler County \$4,900.00, and the Federal Government \$20,050.00. It is expected that this section will be built during the 1919 season.

YAMHILL COUNTY

In Yamhill County the State Highway Department has co-operated with the County in the grading and paving of 3.2 miles between Rex and Newberg and of 4 miles between Sheridan and McMinville. The total expenditure on this work amounts to \$147,000.00 of which the County has paid \$18,273.49.

An effort has been made to secure Federal Aid in the construction of a section of the Portland-Tillamook Highway from Grande Ronde west.

With this in view, the necessary surveys have been made, and it is expected that Federal Aid will be secured so that the construction may be undertaken during the 1919 season.

Sheridan Paving—1917

In 1917 the Highway Department constructed with its own forces and equipment 1.8 miles of concrete pavement from Sheridan east on the Sheridan-McMinnville Road. This pavement was 16 feet wide, 6½ inches thick at the center and 5½ inches thick at the edges. The mix used was a 1:1½:3.

In connection with the paving there was a considerable amount of grading, the total expenditure for grading, culverts, etc., being \$5,651.70. The cost of the 1.8 miles of paving was \$31,432.99, the unit cost being \$1.82 per cubic yard.

Yamhill County co-operated in the payment for this work to the amount of \$10,000.00. A complete statement of the costs on this work is given below.

COST STATEMENT—SHERIDAN PAVING—1917

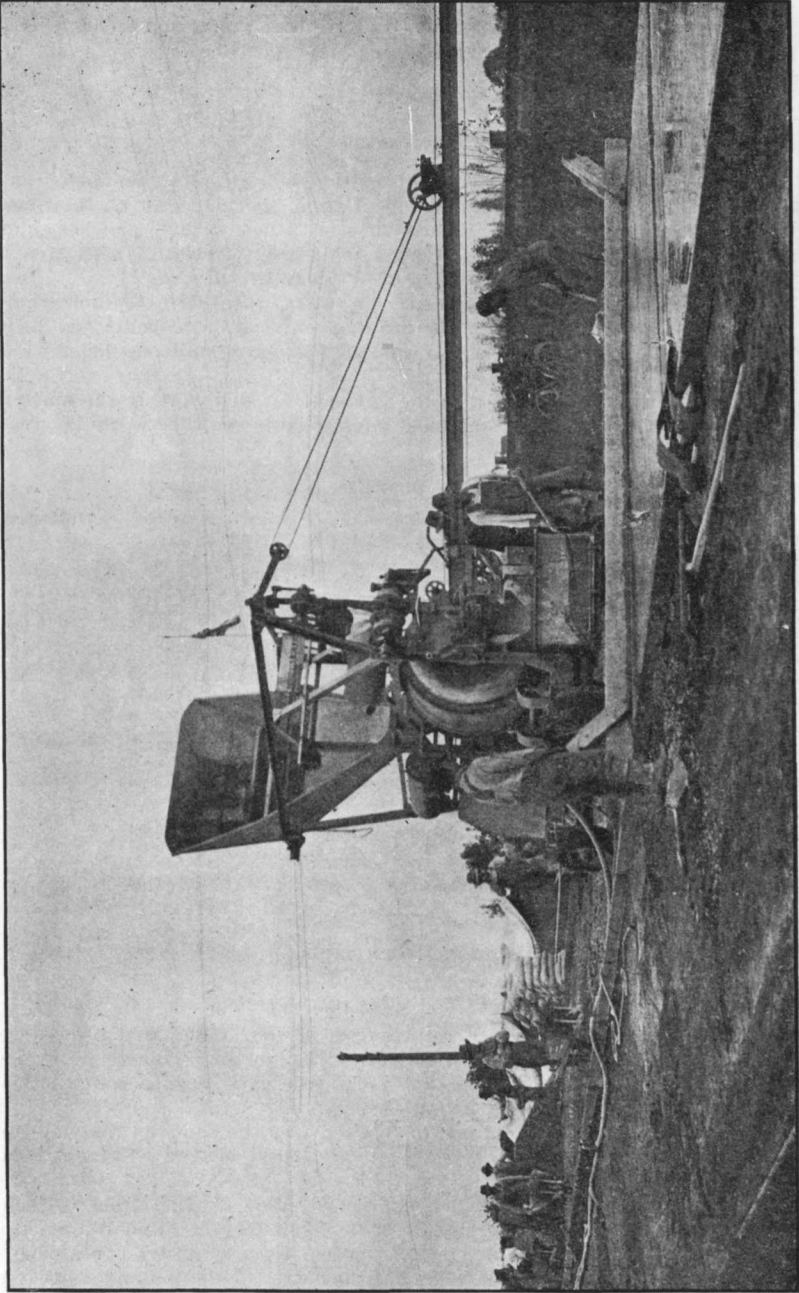
Quantity	Item	Cost	Unit Cost
2498 cu. yds.	Common Excavation.....	} 4,442.85	\$.906
652 cu. yds.	Intermediate Excavation.....		
1750 cu. yds.	Solid Rock Excavation.....		
182 lin. ft.	12-inch Culvert Pipe.....	283.90	1.56
118 lin. ft.	18-inch Culvert Pipe.....	276.00	2.34
44 lin. ft.	24-inch Culvert Pipe.....	134.20	3.05
290 lin. ft.	6-inch Porous Drain Tile.....	52.25	.18
25 cu. yds.	Class "C" Concrete.....	462.50	18.50
17,150 sq. yds.	Concrete Pavement.....	31,198.87	1.82
5050 lin. ft.	Expansion Joints.....	234.12	.046
Total Construction Cost.....		\$ 37,084.69	
Engineering		1,131.35	
Grand Total Cost.....		\$ 38,216.04	
Paid by State.....		\$ 28,216.04	
Paid by County.....		10,000.00	
Total		\$ 38,216.04	

Sheridan Paving—1918

Early in 1918, Yamhill County requested that the concrete pavement laid in 1917 be continued to a total length of four miles, and offered to pay for all grading necessary in connection therewith. This request was granted by the Highway Commission and in the early spring, construction was started on the additional 2.2 miles.

The type of pavement laid on this section was the same as that laid in 1917, except that crushed rock aggregate was used instead of gravel, and the mix was reduced to 1:2:3½.

The coarse aggregate consisted of crushed stone ranging from ¼ inch to 2½ inches. For the fine aggregate, both Columbia River and Willamette River sand was used. The stone was crushed from a quarry operated by the State on Deer Creek which was near the center of the job and consisted of an altered basalt of rather coarse texture. The quality of this stone



STATE OWNED PAVING PLANT IN OPERATION NEAR SHERIDAN IN YAMHILL COUNTY. ON THE YAMHILL NESTUCCA HIGHWAY

is not equal to the true basalt; but tests made by the Oregon Agricultural College showed that it was of good quality. The average haul on this material was .6 of a mile.

Crushing was begun early in March and 1200 cubic yards of material stored in a stock pile which was rehandled later by means of an automatic loader purchased by the State Highway Department for this class of work. The output of the crusher was insufficient to keep the mixer running and by means of this stock pile it was possible to keep the material coming on to the road steadily and finish the job in a minimum length of time and with the least inconvenience to traffic.

In this connection the experience on this job shows the advisability of using a stock pile of material to draw from in case of emergencies. When this is done the work is allowed to go ahead steadily, although a breakdown at the crusher may occur. The saving made by a steady run more than offsets the cost of rehandling the material, which is done very reasonably by the use of machinery.

The sand was shipped to Ballston and Sheridan by railroad, approximately equal amounts being shipped to both places and was so divided as to get a minimum length of haul on this material. The average haul was 3.5 miles. At Ballston the sand was unloaded from the cars into bunkers, which dumped directly into trucks, while at Sheridan no bunkers were available and the material was unloaded on the ground and rehandled by means of an automatic loader. No delay was caused by car shortage as we used our stock pile at Sheridan in emergencies. All the material was hauled and handled by means of trucks, two of which belonged to the State Highway Department, others working on a yardage basis.

The pavement, after being struck off, was finished by the roller and belt method; being rolled from two to four times, according to the condition of the concrete and later belted with eight and ten inch belts. The eight inch belt being used first. By using this method of finishing, we were able to eliminate the use of skilled labor, which showed a material saving in the finishing item, and at the same time secured a very satisfactory surface.

As soon as sufficiently hardened, the pavement was covered with earth from the roadside and kept moist for at least one week while curing. The earth covering was later removed by means of an ordinary road grader, when ready to be opened for traffic, the elastite joints being trimmed at the same operation.

A short stretch of pavement was left out at Deer Creek to allow a fill to settle during the winter rains. In conformity with our general practice, sufficient crushed rock was left on the job to complete this stretch and make repairs.

Elastite joints were placed every thirty feet and extended the entire width and depth of the pavement. Continuous forms were used on a portion of this pavement and were found to be much superior to the ordinary type, and the Department has adopted the continuous form for future work. These forms are made by using two pieces of form lumber $1\frac{1}{2}$ inches by $5\frac{1}{2}$ inches nailed together. The joints are lapped one-half the length of the stick. The finished form is $3 \times 5\frac{1}{2}$ inches and is easily placed on either tangents or sharp curves.

The concrete was mixed with a sixteen cubic foot Koehring Mixer equipped with bucket and boom. The plant is owned by the Department.

The grading was paid for by Yamhill County and the crusher, roller, grader, and scarifier were also furnished by them free of charge. Earth shouldered were built along the pavement by means of road grader.

Mr. J. M. Baker was Superintendent of Construction on this work.

COST STATEMENT—2.2 MILES, 16-FOOT CONCRETE PAVEMENT, EAST OF SHERIDAN—BUILT IN 1918

Quantity and Item	Total Cost	Unit Cost
Grading	\$ 1,853.07	
19,566 sq. yds., 1:2:3½ concrete pavement		
Average thickness 6 inches.....	36,378.01	\$ 1.86
6,192 lin. ft., Expansion Joints.....	247.68	.04
140 cu. yds., Broken Stone Macadam.....	420.00	3.00
Total Cost of Construction	\$ 38,898.76	
Engineering	1,166.85	
Grand Total Cost	\$ 40,065.61	

5099 bbls. Cement used on this work at a cost of \$13,299.00 F. O. B. Work.
15 yds. of Sand and 120 yds. broken stone left stored on job.

Paving—Multnomah County Line to Newberg

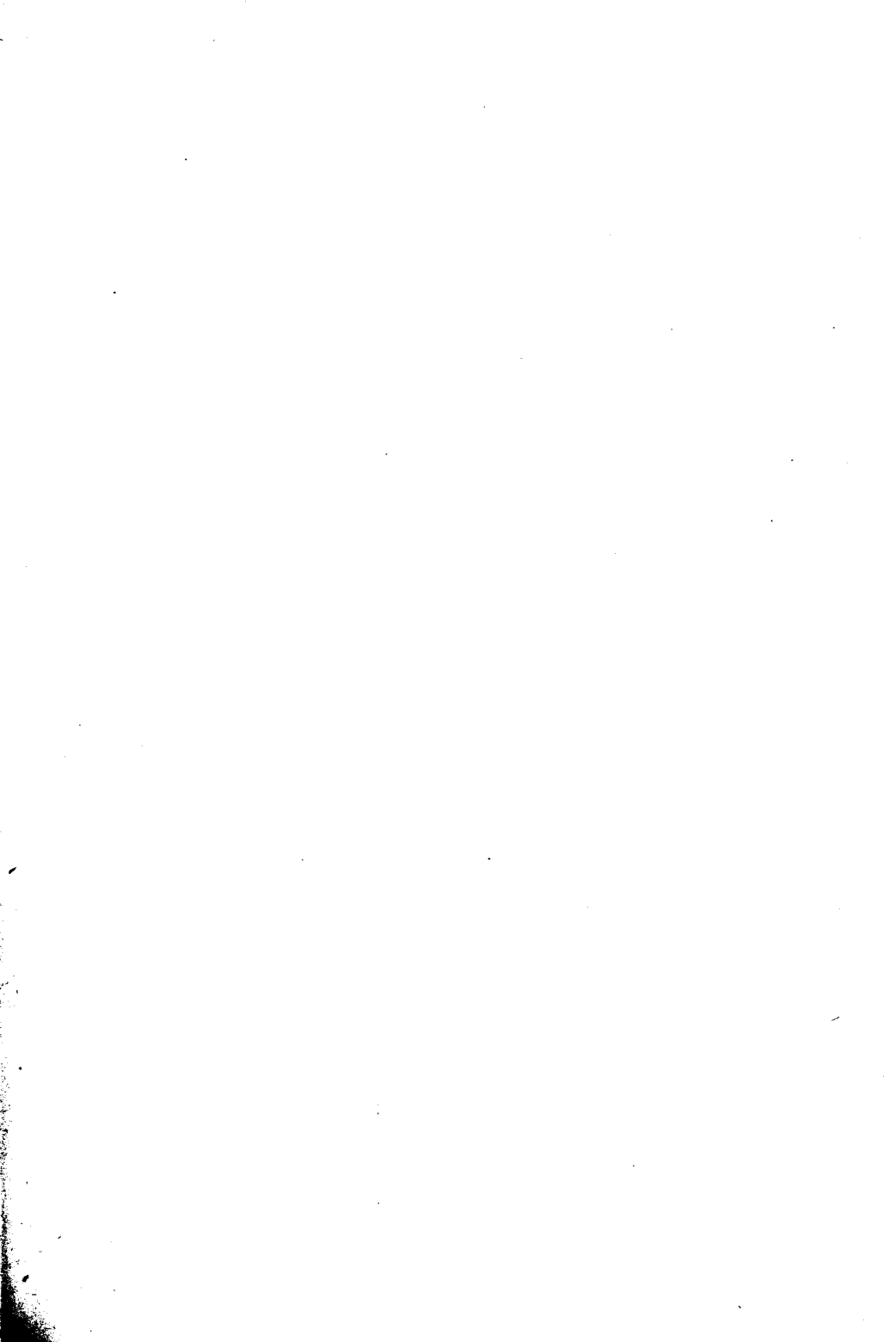
A complete description of the paving of the 15.7 mile section of the West Side Highway between the Multnomah County Line and Newberg is given in the Chapter devoted to Washington County. It should be mentioned here, however, that 3.2 miles of this pavement is within Yamhill County, and was built by the State at a cost of \$57,500.00. The construction of the subgrade was paid for by Yamhill County, part of it having been done by County forces and the balance of it by the paving contractor under a cost plus 10 per cent agreement with the County. For the work done under this agreement, the contractor was paid \$6,153.05.

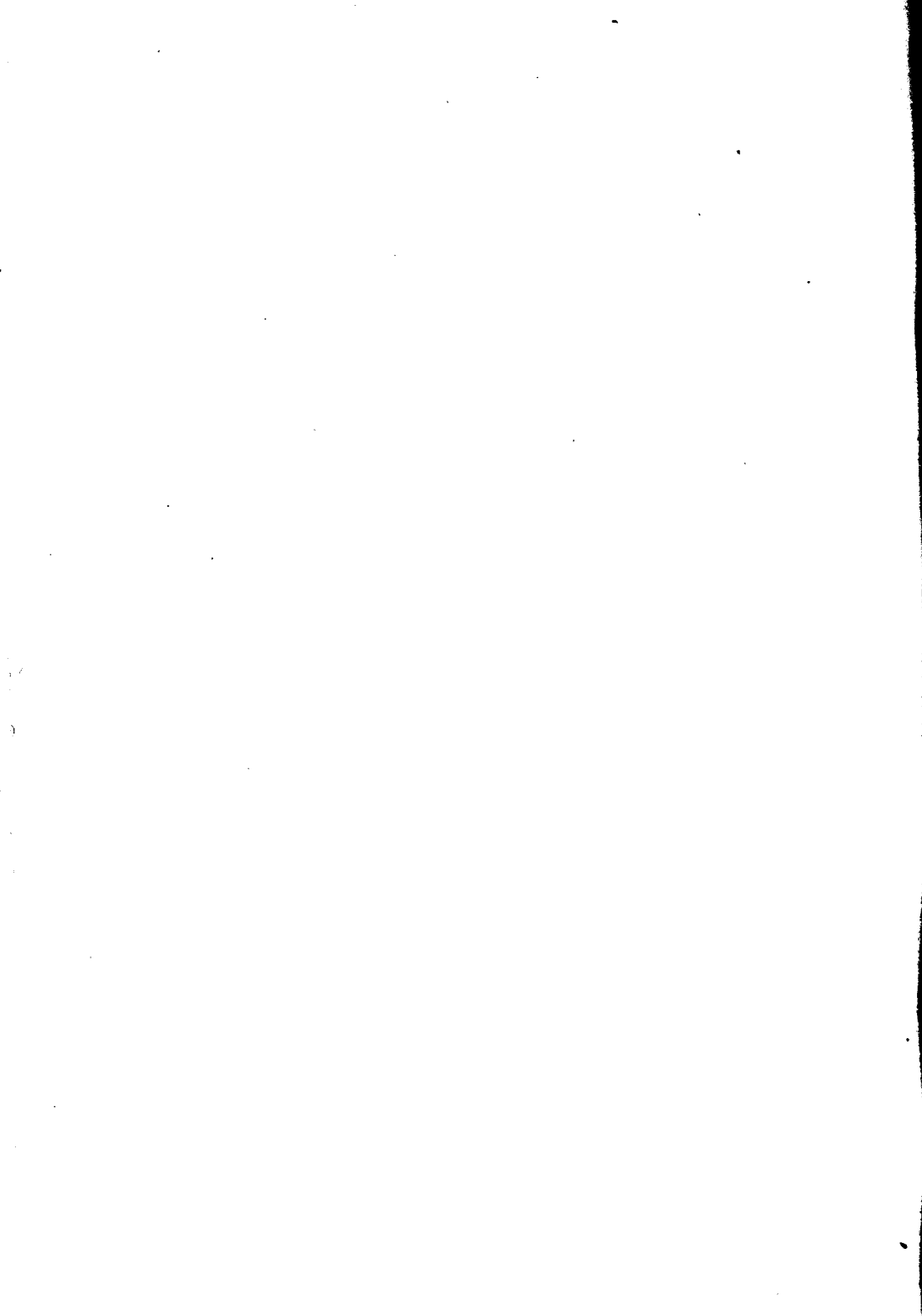
Survey—Grande Ronde Section

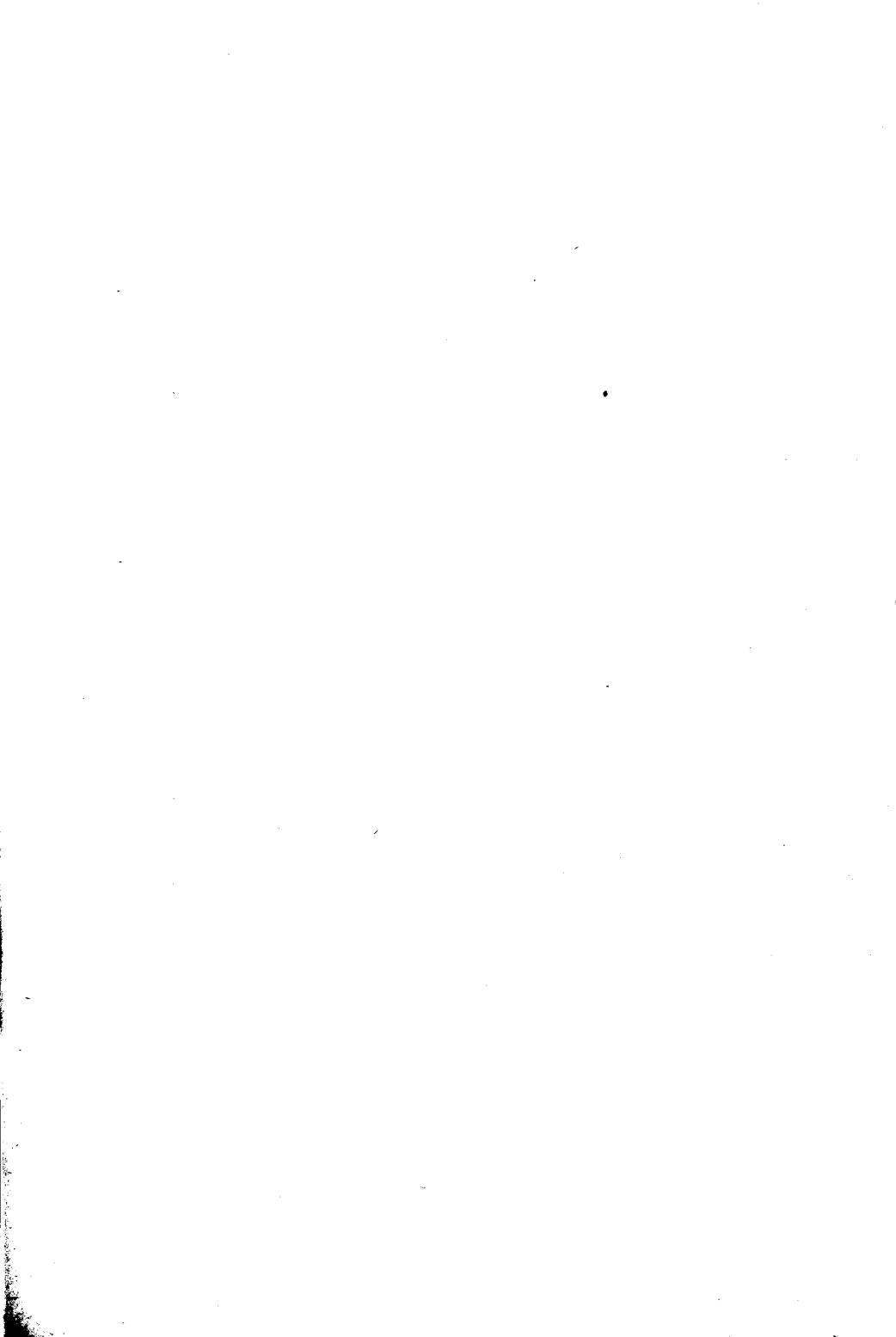
A survey was made in the spring of 1918 between Grande Ronde and the Bee Ranch at the east end of the Sour Grass road improved in 1916. This is an important link about 6½ miles in length on the Yamhill-Nestucca Highway, connecting as it does the cities of McMinville, Willamina, Sheridan and Tillamook. In addition it will afford a short and direct route between the hay and grain fields of the Willamette Valley and the dairy ranches of the coast. Further, this highway is used by hundreds of autoists in summer enroute to the Tillamook beaches.

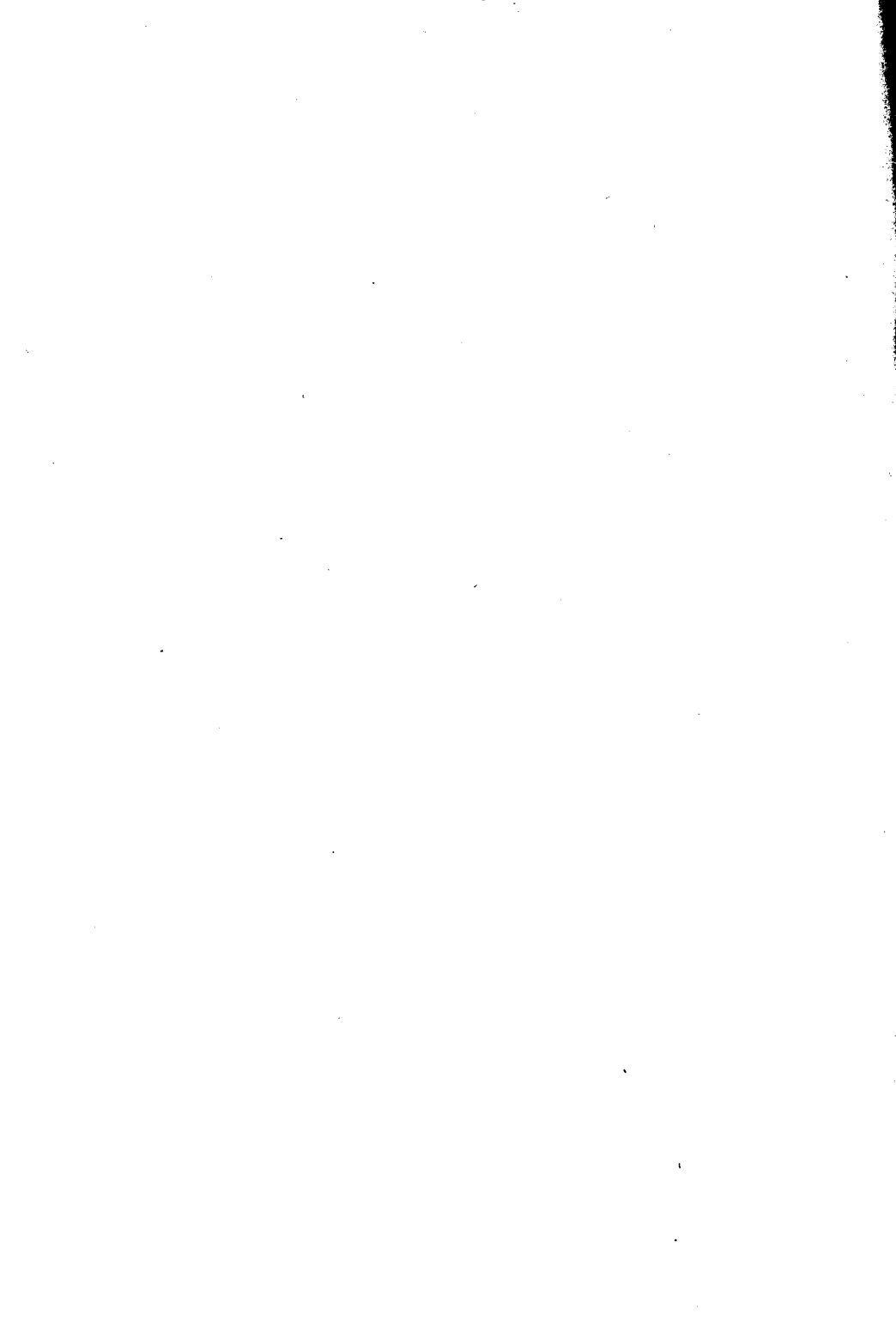
From the fact that only 2½ miles of this section are in service as a postal route, Federal Aid could be applied for only on that section and co-operation has been requested as follows: United States Government \$15,000; State of Oregon \$15,000; Yamhill County \$10,000. For the remaining four miles, Yamhill County has appropriated \$5,000 from the 1919 funds.

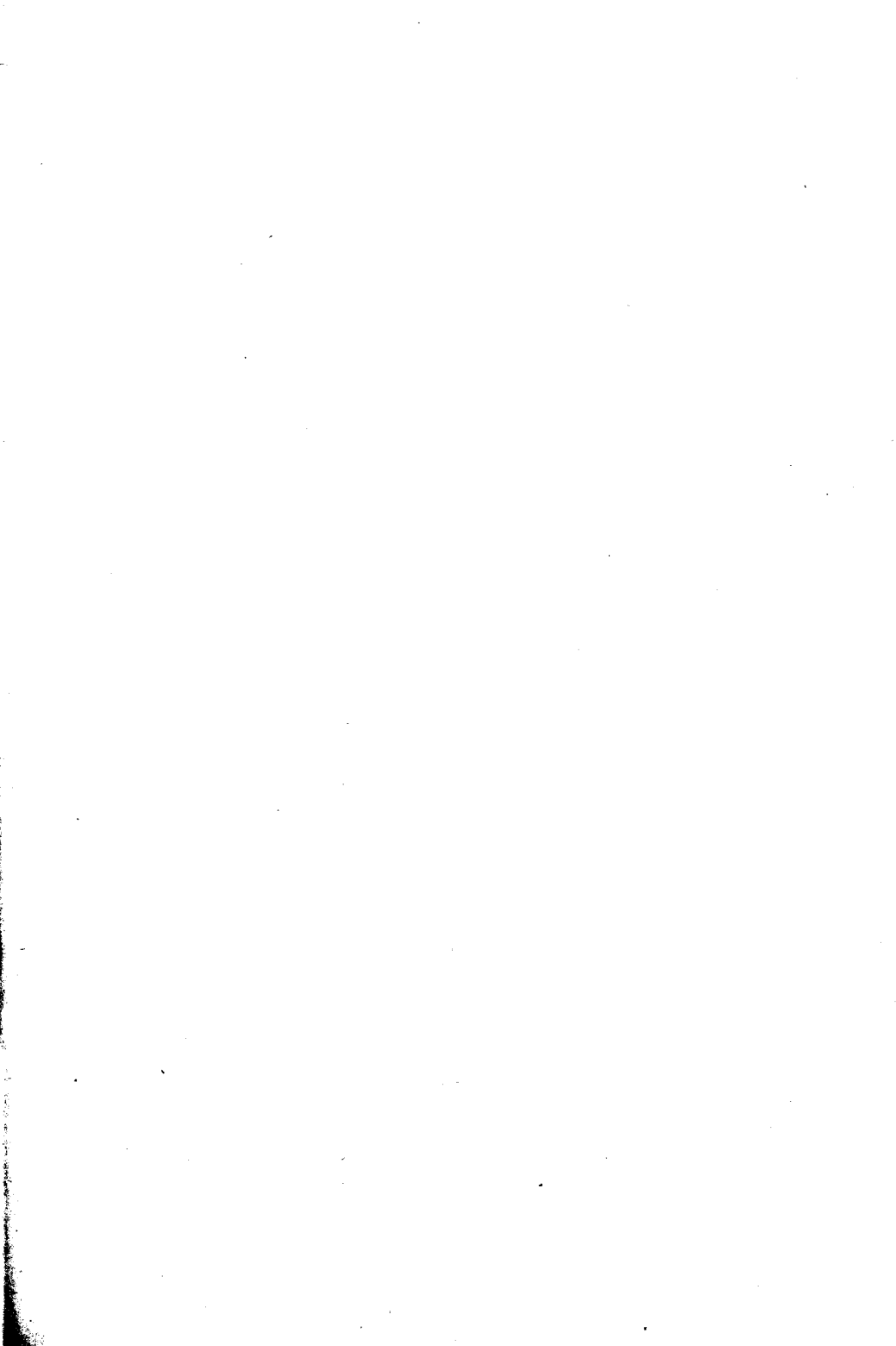
It is estimated that the total cost of the remaining section will be \$50,000 and it is expected that the work will be done in 1919. The entire project as proposed will be graded 24 feet wide, conforming to the State standards as to alignment and grade and surfaced with macadam 12 feet in width, thus closing the gap and affording a road between Portland and Tillamook which will be open the entire year.















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