

THIRD BIENNIAL REPORT
OF THE
STATE ENGINEER
TO THE
GOVERNOR AND THE COMMISSION
OF STATE INSTITUTIONS



STATE OF ARIZONA

1916-17
AND
1917-18

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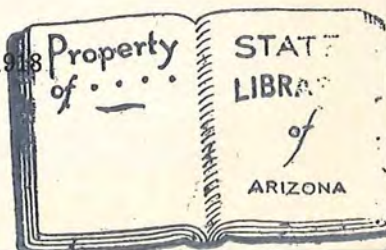
THIRD BIENNIAL REPORT
OF THE
STATE ENGINEER
TO THE
GOVERNOR AND THE COMMISSION OF
STATE INSTITUTIONS



GEO. W. P. HUNTGovernor
LEROY A. LADDChairman
LOUIS B. WHITNEY.....Member
CHAS. R. OSBURNMember

AND TO THE
Boards of Supervisors of the Several Counties
FOR THE PERIOD

July 1, 1916, to June 30, 1918





STATE HIGHWAY DEPARTMENT

June 30, 1918

B. M. ATWOOD, State Engineer

R. V. LEESON, Consulting Engineer

H. B. CASSIDY,

Chief Clerk.

T. F. NICHOLS,

Office Engineer

Division Engineers

F. R. GOODMAN

J. S. BARLOW

R. C. PERKINS

State of Arizona

OFFICE OF State Engineer PHOENIX

June 30, 1918.

To His Excellency, Geo. W. P. Hunt, Governor,
To the Honorable Commission of State Institutions,
Leroy A. Ladd, Chairman,
Louis B. Whitney, Member,
Charles R. Osburn, Member.

I have the honor to submit herewith the report covering the operations of the department of the State Engineer between the dates June 30th, 1916, and July 1st, 1918.

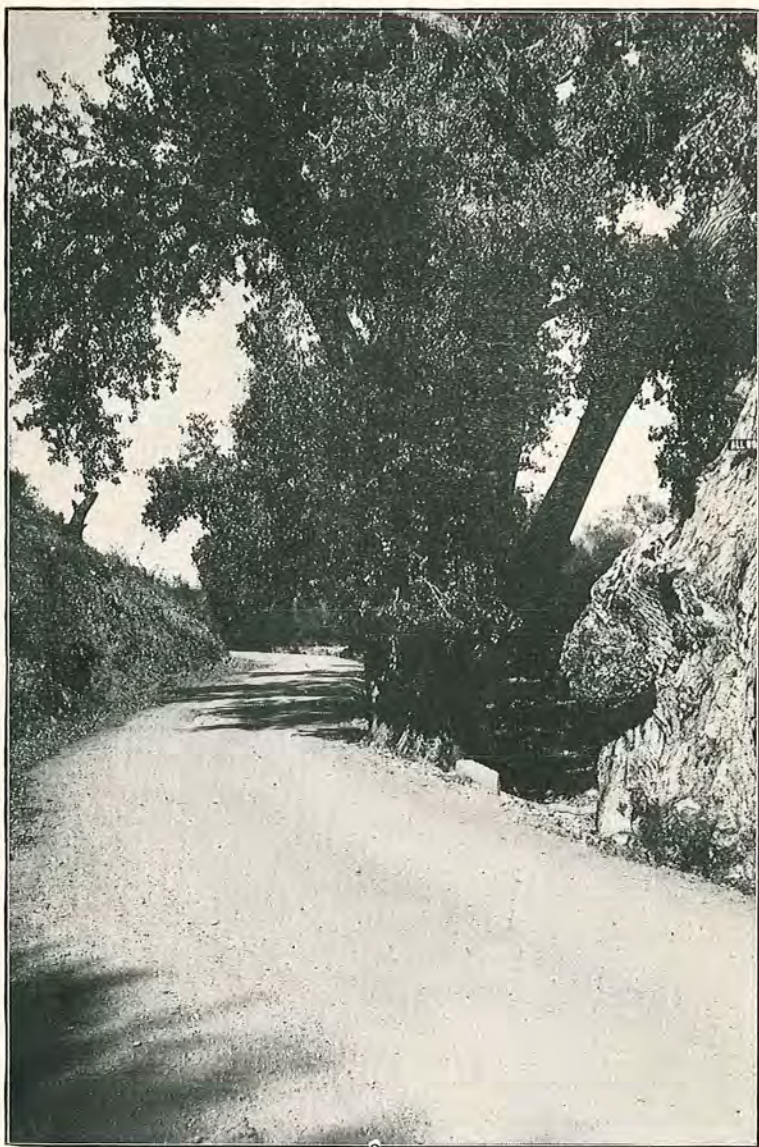
On June 30th, 1916, Mr. Lamar Cobb was State Engineer and was succeeded by Thomas Maddock on June 16th, 1917.

Mr. Cobb resumed this office on December 27, 1917, and resigned on February 5th, 1918, being succeeded by myself on that date.

The changes in control have been so numerous and have occurred at such times that it has not been practicable to divide the statement of work done consistently therewith. For this reason the statement here given covers the entire two year period without division.

Very respectfully,

B. M. ATWOOD,
State Engineer.



SANTA CRUZ COUNTY
Nogales-Tucson Highway



PREFACE

In addition to the changes in control noted in the letter of transmittal many of the most experienced and valuable members of our organization have temporarily left our employ in order to join the Armed Forces of the United States of America. We are pleased to here acknowledge the loss involved to this department and to accord to them as far as possible the recognition justly theirs as members of that greater organization, to which we have intrusted the preservation of our national life.

In spite of these changes and losses, and the many difficulties due to war conditions, some substantial progress has been made, as will appear in the body of the report following.

We have shown in this report a statement covering the entire two year period and in addition a statement showing the receipts and expenditures between the dates February 1st and June 30th, 1918, inclusive.

We wish further to express our appreciation of the co-operation and assistance of other state and county officers and of the loyalty and efficiency of the members of the State Highway Department.

B. M. ATWOOD,

State Engineer.



ROAD LEGISLATION

Road Legislation in addition to the laws shown in the second report of the State Engineer, issued June 30, 1916, in the Session Laws of Arizona, 1917. The following legislation is in connection with highway work.

AN ACT ASSENTING TO THE PROVISIONS OF THE FEDERAL AID LAW (Chapter 25, Session Laws 1917):

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ARIZONA: That the Legislature of the State of Arizona hereby assents to the provisions of the Act of Congress, approved July 11, 1916, entitled, "An Act to provide that the United States shall aid the States in the construction of rural post roads and for other purposes," thirty-ninth U. S. Statutes at Large, page 355. The State Engineer, with the approval of the State Board of Control, is hereby authorized to enter into all contracts and agreements with the United States Government relating to the survey, construction and maintenance of roads under the provisions of the said Act of Congress, to submit such scheme or program of construction and maintenance as may be required by the Secretary of Agriculture and do all other things necessary fully to carry out the co-operation contemplated and provided for by the said Act. For the construction and maintenance of rural post roads the good faith of the State is hereby pledged to make available funds sufficient to equal the sums apportioned to the State or by or under the United States Government during each of five years for which Federal funds are appropriated by Section 3 of said Act and to maintain the roads constructed with the aid of funds so appropriated, and to make adequate provisions for carrying out such maintenance.

Approved March 8, 1917.

AN ACT PROVIDING FOR THE CONSTRUCTION OF THE ANTELOPE HILL BRIDGE (Chapter 65, Session Laws 1917):

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ARIZONA: "There is hereby appropriated the sum of Fifty Thousand Dollars (\$50,000) for the construction of an extension and

approach to the state highway bridge across the Gila River near Wellton, Yuma County, Arizona.

This appropriation shall be covered into the State Road Tax Fund, twenty-five per cent portion, and shall be expended under the direction of the State Board of Control and the State Engineer under the provisions of Chapter 7, Title 50, Revised Statutes of Arizona, 1913.

Approved March 19, 1917.

AN ACT PROVIDING FOR THE REPAIR AND CONSTRUCTION OF THE FLORENCE BRIDGE (Chapter 67, Session Laws 1917.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ARIZONA: There is hereby appropriated out of any money in the State Treasury not otherwise appropriated the sum of Fifty Thousand Dollars (\$50,000), or such portion thereof as may be necessary for the repair and reconstruction, under the direction of the State Engineer, of the bridge across the Gila River and approaches thereto, in Panal County near the City of Florence at a point where the State highway crosses said river.

The State Auditor is hereby authorized and directed to draw his warrant upon the fund hereby appropriated from time to time upon receipt of properly verified vouchers, approved by the State Engineer, and the State Treasurer is hereby authorized and directed to pay such warrants.

Whereas, an immediate operation of this Act is necessary for the preservation of the public health and safety, an emergency is hereby declared to exist and this Act shall be in full force and effect from and after its passage and approval by the Governor, and is hereby exempt from the operation of the referendum provisions of the State Constitution.

All Acts and parts of Acts in conflict with the provisions of this Act are hereby repealed.

Approved March 19, 1917.



COCHISE COUNTY
Bisbee-Tombstone Highway

AN ACT PROVIDING FOR THE CONSTRUCTION OF THE AGUA FRIA BRIDGE (Chapter 68, Session Laws 1917:

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ARIZONA: There is hereby appropriated the sum of Twenty-Two thousand (\$22,000) Dollars for the construction of approaches to the State highway bridge over the Agua Fria River, near Coldwater, in Maricopa County, Arizona.

This appropriation shall be covered into the State Road Tax Fund, twenty-five per cent portion, and shall be expended under the direction of the State Board of Control and the State Engineer under the provisions of Chapter 7, Title 50, Revised Statutes of Arizona, 1913.

Whereas, an urgent necessity exists for the completion of this construction, an emergency is hereby declared to exist and this Act shall be in full force and effect from and after its passage and approval by the Governor, and is hereby exempted from the operation of the referendum provisions of the State Constitution.

Approved March 19, 1917.

AN ACT TO AMEND THE ROAD TAX LAW (Chapter 69, Session Laws 1917):

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ARIZONA: That Paragraph 5123, Chapter 7, Title 50, of the Revised Statutes of Arizona, 1913, Civil Code (Chapter 66, Laws of 1912, first Special Session, State of Arizona) be and the same is hereby amended to read as follows:

There shall be annually levied and collected in the manner in which other State taxes are levied and collected, by a levy of the officials provided by law, ten (10) cents on each one hundred (\$100) dollars, of the assessed valuation of taxable property within the State, for the purpose of raising a fund to be known as the "State Road Tax Fund," for the construction, reconstruction, repairing, improving and maintaining State highways and bridges, as follows:

Twenty-five per cent (25%) of the "State Road Tax Fund," herein provided for, shall be subject to be paid out upon the au-



COCHISE COUNTY
Bisbee-Tombstone Highway

thority and under the direction of the State Board of Control and the State Engineer, who are hereby charged with such responsibility.

Seventy-five per cent (75%) of such "State Road Tax Fund," herein provided for, shall be apportioned to the several counties in the amount to each county of seventy-five per cent of the taxes collected under this Act, by said county, and such amount shall be subject to be paid out for the construction, reconstruction, repair, improvement and maintenance of public highways, road and bridges in the manner as in this Act provided, for the work in this Act provided for, within such county, upon the authority and under the direction of the County Board of Supervisors of such county and the State Engineer, who are hereby charged with such responsibility.

Provided, that no obligation shall be assumed or expense incurred under the provisions of this Act, within any fiscal year, in the amount of any sum in excess of the levy herein provided, and the unexpended balance from the previous fiscal year.

All Acts and parts of Acts in conflict with the provisions of this Act are hereby repealed.

Approved March 19, 1917.

AN ACT PROVIDING FOR THE CONSTRUCTION OF A BRIDGE AT COTTONWOOD (Chapter 75, Session Laws 1917):

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ARIZONA: There is hereby appropriated out of any money in the State Treasury not otherwise appropriated not to exceed the sum of Twenty Thousand (\$20,000) Dollars, for the construction of a bridge across the Verde River and approaches thereto, near Cottonwood, in Yavapai County, under the direction of the Board of Supervisors of said county and of the State Engineer; provided, that no part of the money herein appropriated shall be expended until a like amount has been provided for the construction of said bridge by the County of Yavapai and deposited with the State Treasurer.

Any of the money hereby appropriated remaining in the State Treasury after the completion of said bridge, shall be equally

divided, one half thereof to be returned to the County Treasurer of Yavapai County and by him placed to the credit of the County Road Fund, and one half to be returned to the general fund of the State.

The State Auditor is hereby authorized and directed, upon notification by the State Treasurer, that said County of Yavapai has deposited with him the sum provided in this Act, Twenty Thousand (\$20,000) Dollars, to draw his warrants in favor of the Board of Supervisors of the County of Yavapai and the State Engineer for the sum appropriated under the provisions of this Act, and the State Treasurer is hereby authorized and directed to pay said warrants.

All Acts and parts of Acts in conflict with the provisions of this Act are hereby repealed.

“This bill having remained with the Governor ten days, Sundays excluded, after the final adjournment of the Legislature, and not having been filed with his objections, has become a law this 21st day of March, 1917.”

AN ACT PROVIDING FOR THE CONSTRUCTION OF THE GILA RIVER BRIDGE NEAR CLIFTON (Chapter 86, Session Laws 1917) :

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ARIZONA: There is hereby appropriated the sum of Thirty Thousand (\$30,000) Dollars for the construction of a bridge across the Gila River and approaches thereto in Greenlee County on the Clifton-Solomonsville State Highway now under construction, under the direction of the Board of Supervisors of said county; and the State Engineer; provided, that no part of the money herein appropriated shall be expended until a like amount has been provided for the construction of said bridge by the County of Greenlee and deposited with the State Treasurer.

Any money hereby appropriated remaining in the State Treasury, after the completion of said bridge, shall be equally divided,

one-half thereof returned to the County Treasurer of Greenlee County and by him placed to the credit of the County Road Fund, and one-half returned to the General Fund of the State.

When the State Treasurer notifies the State Auditor that said County of Greenlee has deposited with said Treasurer the sum of money that it shall pay according to the provisions of this Act, then the State Auditor is hereby authorized and directed to draw his warrants in favor of the Board of Supervisors of the County of Greenlee and the State Engineer for the sum appropriated under the provisions of this Act, and the State Treasurer is hereby authorized and directed to pay said warrants.

All Acts and parts of Acts in conflict with the provisions of This Act are hereby repealed.

“This bill having remained with the Governor ten days, Sundays excluded, after the final adjournment of the Legislature, and not having been filed with his objections, has become a law this 21st day of March, 1917.”

AN ACT RELATING TO THE MANAGEMENT AND CONTROL OF STATE INSTITUTIONS (Chapter 89, Session Laws 1917):

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ARIZONA: The Governor shall nominate and with the consent of the Senate, in executive session, appoint three electors of the State who shall constitute the Commission of State Institutions. Not more than two members of said Commission shall belong to the same political party. The members so appointed shall hold office at the pleasure of the Governor. Each member of the Commission shall take oath and qualify in the manner by law required of other State officers.

Before entering upon the duties of his office, each member shall give a bond to the State of Arizona, in the sum of Twenty-five Thousand Dollars for the faithful discharge of his duties, the cost of the premium of which shall be paid by the State. The bond when executed, shall be approved by the Governor, and when so approved, shall be filed in the office of the Secretary of State.

Each member of the Commission shall devote his whole time to

the duties of his office, and no member while holding such appointment may engage in any other occupation.

The Commission shall organize immediately upon this Act becoming effective and assume all powers and duties hereinafter specified. The Commission is hereby authorized to make all necessary rules not specified in this Act for the exercise of its powers and performance of its duties, and the securing of co-operation from all of its officers and employees. Each commissioner shall receive a salary of Three Thousand Dollars a year, payable semi-monthly. In addition to salary each member shall be entitled to necessary expenses when traveling on official business. No expenditure for traveling expenses to other states shall be made by the Commission or by any officer, agent or any employee thereof, unless authority for such trip shall first be granted in a written resolution adopted by the Commission stating the purpose of such trip, said resolution to be submitted to the Governor and by him approved in writing.

The Commission shall have an official seal and every Commission order or official paper executed by the Commission shall, under its direction, be attested with its seal affixed by the Secretary or any member of the Commission.

Under the regulations of this Act the Commission shall have oversight and general control of the Hospital for the Insane, the care and education of the Deaf, Dumb and Blind, the State Prison, the State Industrial School, the Pioneers' Home and all charitable, reformatory and penal institutions, that are or shall be by law established and maintained by the State of Arizona; the Arizona State Fair, the Arizona Pioneers' Historical Society and all State Institutions that are or shall be by law established and maintained by the State of Arizona.

Where in the Statutes of Arizona shall appear any words or terms referring to the management of the State institutions herein specified, the same shall be construed to mean the "Commission of State Institutions."

The Commission shall maintain its offices in the Capitol Building. It shall employ a Secretary at Twenty-four Hundred Dollars a year and may also employ at reasonable salaries such other assistants as are needed for the proper conduct of the office and the carrying out of the provisions of this Act.



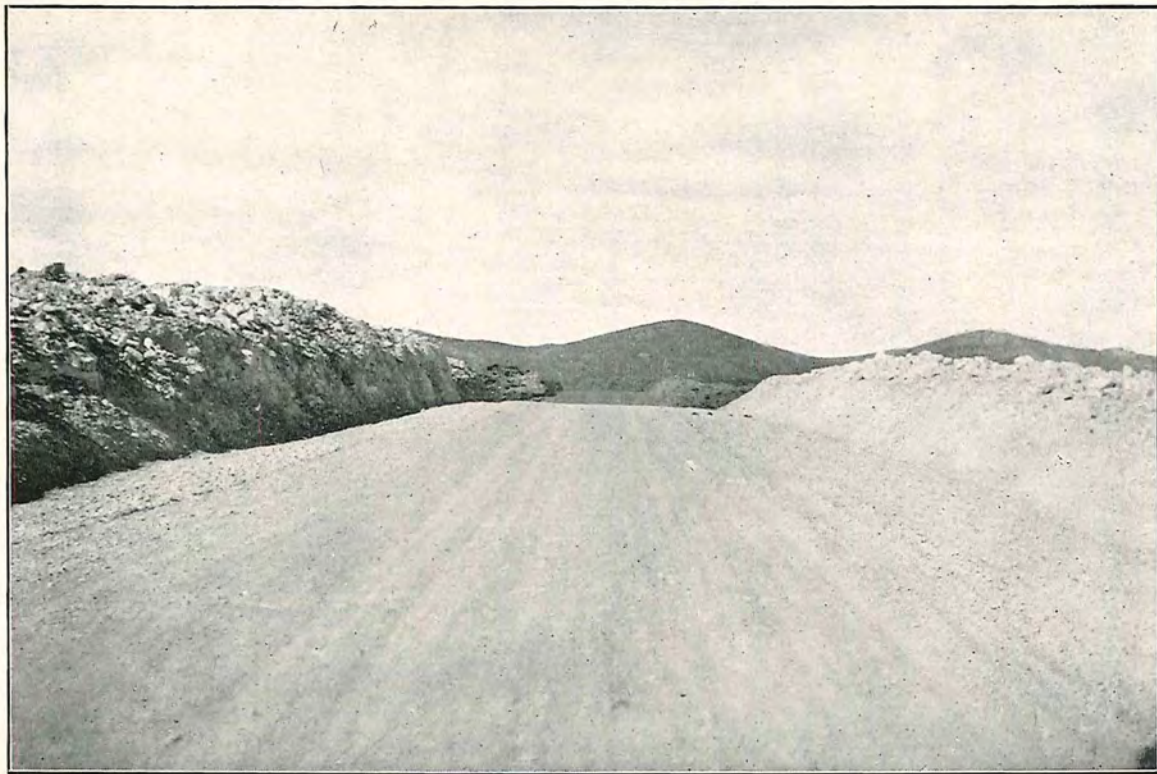
COCHISE COUNTY
Bisbee-Tombstone Highway

A complete record of each notice of appointment and other important papers shall be kept in the office of the Commission. The Commission shall prescribe a uniform system of records and accounts for all institutions under its control and shall provide all necessary books, blanks and other supplies for the making of reports and the keeping of accounts. It shall establish a uniform system of bookkeeping, so far as practicable, in similar institutions, and shall institute and require the keeping of a system of accounts and requisitions, showing the purchase, storage and consumption of supplies for subsistence, construction and other purposes. It shall keep in its office at Phoenix a complete set of books and accounts, with each institution, which shall show every contract made, every appropriation by the Legislature for the support of each institution, receipts from all sources, and every expenditure made for any purpose. Said books and records shall at all times be open to public inspection.

The Commission shall appoint all officers named in any statute of Arizona to be appointed by any management superseded by the Commission except the Law and Legislative Reference Librarian. All such appointments shall remain effective until revoked by the Commission.

The Superintendent or chief executive officer of each institution under the control of the Commission shall appoint all assistants, clerks, guards and employees required in the management of the same, the number of whom shall be determined by the Commission, except such employees as this Act requires shall be appointed by the Commission. Such Superintendent or chief executive officer may discharge for cause any person employed, subject to the approval of the Commission, which shall be in writing and give in detail the reasons for such discharge.

All salary schedules shall be fixed by the Commission, unless otherwise provided by law, and shall be included in the estimate of expenses submitted by the chief officers of the institutions concerned. Each chief executive officer shall furnish a monthly pay roll for the institution under his charge, showing the name of each officer and employee, monthly salary, and time of service. Such pay roll shall be audited by the Commission and a statement of the



COCHISE COUNTY
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amount found due shall be filed with the State Auditor and a warrant issued to each individual name therein contained.

An official bond, properly signed and executed, in a sum to be fixed by the Commission shall be required from each official and employee who is given the custody of funds or property belonging to the State of Arizona. All moneys derived from any source in any institution controlled by the Commission shall be remitted to the State Treasurer by the proper executive officer on the first day of each month. Detailed reports showing the source of all moneys received shall be made to the Commission every thirty days.

The Commission shall prepare annually a detailed statement of the cost of maintaining each institution under its control and shall furnish the Governor annually with a complete report of the condition and work of each institution, showing in detail every financial transaction and including the dates of official visits paid by each Commissioner to each institution. Such annual report shall also include reports by the chief executive officer of each institution, and shall be filed not later than the first day of December of each year. The Commission shall prepare an estimate of necessary appropriations for the support and needed improvements of the several institutions under its charge and a report of the operation of such institutions for the preceding biennial for the use of the Legislature. Such estimate shall be printed and may include a report of the results of investigations of methods of institution management and of treatment of patients and inmates, with suggestions for the betterment of any or all conditions.

Without giving advance notice of their coming, the entire Commission shall visit each institution under its charge at least once in six months. Some member thereof shall visit each institution at least once in thirty days. On such visits they shall inspect every part of each institution and all places, buildings and grounds belonging thereto or used in connection therewith.

The Commission shall purchase all necessary supplies for the institutions under their charge, except minor purchases excepted at their discretion. Estimates of needed supplies shall be furnished to the Commission by each chief executive officer. Such estimates

shall be examined by the Commission and an itemized statement of such as are approved by the Commission, showing the kind, quantity and quality, shall be filed with the Secretary and upon request shall be furnished to any applicant therefor. Such purchases shall be made under the provisions of the law relating to the Board of Control.

The Commission shall have general charge over the erection of new buildings and over all repairs and improvements of buildings, and of the improvement of grounds and other properties for which legislative appropriations are or shall be made.

No member of the Commission or employee thereof shall receive from any person, firm or corporation having dealings with the Board, or from any employee or representative of such person, firm or corporation, any gift or gratuity either directly or indirectly, for himself or for any other person. Any Commissioner or employee so doing shall be deemed guilty of bribery, and upon conviction thereof shall be punished as provided in Section 70 of the Penal Code of Arizona, 1913 and shall forthwith be removed from office.

No member of the Commission or employee thereof, shall attempt to influence the political views of any other member or employee, nor shall any Commissioner or employee directly or indirectly contribute money or other thing of value to any person for election or campaign purposes. Violation of this provision shall be followed by removal of the offender from office.

The Commission shall have power to bring suits necessary to protect the interests of the State, such proceedings to be instituted in the name of the State of Arizona.

The Commission shall have power to summon and examine as witnesses, under oath, officers, employees, or others to examine books and papers pertaining to the subject under investigation and to compel the production of said books and papers. Witnesses who are not employees of the State shall receive the same fees as witnesses in civil cases in the Superior Court, and their fees shall be paid by vouchers. Any officer or employee who interferes in any manner with the Commissioners' official investigation shall be deemed

guilty of a misdemeanor, and on conviction thereof, shall be removed from his position and be fined in a sum not less than ten dollars nor more than one hundred dollars. It shall be filed in the office of the Commission as soon thereafter as practicable, and thereafter such testimony shall be open for inspection. Any person failing to obey the orders of the Commission issued under the provisions of this section shall be reported by the Commission to the Superior Court, or any judge thereof, and shall be dealt with by the court or judge as for contempt of court.

The Board of Regents of the University of Arizona, the Boards of Education for the government and control of the Normal Schools of the State of Arizona, the Arizona State Fair Commission, the Board of Directors of the Arizona Pioneers' Historical Society, the Board of Curators of the State Library, and the Board of Curators of the State Law and Legislative Reference Library, are hereby made subject, in all matters effecting the receipt or expenditure of funds, to the superior authority and direction of the Commission of State Institutions; and the Board of Control is hereby abolished.

A sum of money sufficient to carry out the provisions of this Act is hereby annually appropriated out of the General Fund; provided, however, that this section shall not be effective after June 30, 1919.

All Acts and parts of Acts in conflict with the provisions of this Act are hereby repealed.

Approved March 20, 1917.

Federal Aid As Applied to Arizona Highways

The Federal Aid Road Act

(Public—No. 156—64th Congress)

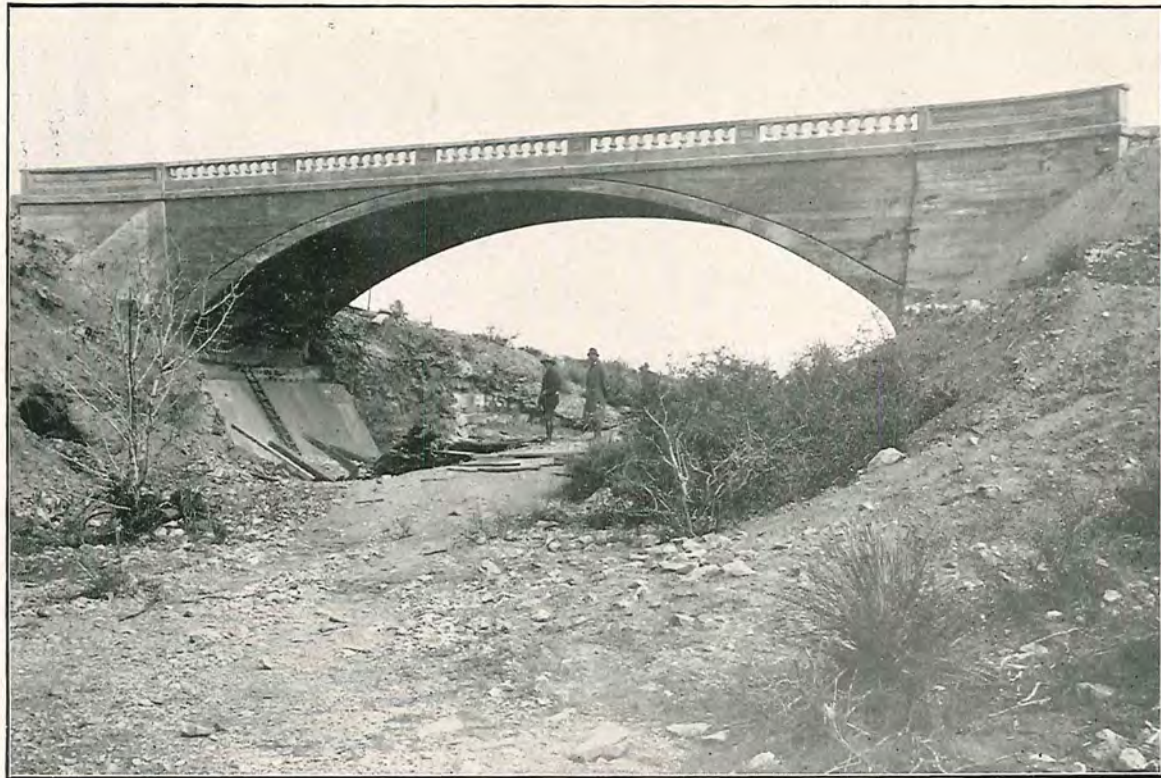
An Act to provide that the United States shall aid the States in the construction of rural post roads, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of Agriculture is authorized to co-operate with the States, through their respective State Highway departments, in the construction of rural post roads; but no money apportioned under this Act to any State shall be expended therein until its legislature shall have assented to the provisions of this Act, except that until the final adjournment of the first regular session of the legislature held after the passage of this Act, the assent of the governor of the State shall be sufficient. The Secretary of Agriculture and the State Highway department of each State shall agree upon the roads to be constructed therein and the character and method of construction; **Provided**, that all roads constructed under the provisions of this Act shall be free from tolls of all kinds.

Sec. 2. That for the purpose of this Act the term "rural post road" shall be construed to mean any public road over which the United States mails now are or may hereafter be transported, excluding every street and road in a place having a population, as shown by the latest available Federal census, of two thousand five hundred or more, except that portion of any such street or road along which the houses average more than two hundred feet apart; the term "State highway department" shall be construed

to include any department of another name, or commission, or official or officials, of a State empowered, under its laws, to exercise the functions ordinarily exercised by a State highway department; the term "construction" shall be construed to include reconstruction and improvement of roads; "properly maintained" as used herein shall not be construed to mean the making of needed repairs and the preservation of a reasonably smooth surface considering the type of the road; but shall not be held to include extraordinary repairs, nor reconstruction; necessary bridges and culverts shall be deemed parts of the respective roads covered by the provisions of this Act.

Sec. 3. That for the purpose of carrying out the provisions of this Act there is hereby apportioned, out of any money in the Treasury not otherwise appropriated, for the fiscal year ending June thirtieth, nineteen hundred and seventeen, the sum of \$5,000,000; for the fiscal year ending June thirteen, nineteen hundred and eighteen, the sum of \$10,000,000; for the fiscal year ending June thirtieth, nineteen hundred and nineteen, the sum of \$15,000,00; for the fiscal year ending June thirtieth, nineteen hundred and twenty, the sum of \$20,000,000; and for the fiscal year ending June thirtieth, nineteen hundred and twenty-one, the sum of \$25,000,000. So much of the appropriation apportioned to any State for any fiscal year as remains unexpended at the close thereof shall be available for expenditure in that State until the close of the succeeding fiscal year, except that amounts apportioned for any fiscal year to any State which has not a State highway department shall be available for expenditure in that State until the close of the third fiscal year succeeding the close of the fiscal year for which such apportionment was made. Any amount apportioned under the provisions of this Act unexpended at the end of the period during which it is available for expenditure under the terms of this section shall be reapportioned within sixty days thereafter, to all the States in the same manner and on the same basis, and certified to the Secretary of the Treasury and to the State highway departments and to the governors of States



COCHISE COUNTY
Emerald Gulch Bridge—Bisbee-Tombstone Highway

having no State highway departments in the same way as if it were being apportioned under this Act for the first time; **Provided**, that in States where the constitution prohibits the State from engaging in any work of internal improvements, then the amount of the appropriation under this Act apportioned to any such State shall be turned over to the highway department of the State or to the governor of said State to be expended under the provisions of this Act and under the rules and regulations of the Department of Agriculture when any number of counties in any such State shall appropriate or provide the proportion or share needed to be raised in order to entitle such State to its part of the appropriation apportioned under this Act.

Sec. 4. That so much, not to exceed three per centum, of the appropriation for any fiscal year made by or under this Act as the Secretary of Agriculture may estimate to be necessary for administering the provisions of this Act shall be deducted for that purpose, available until expended. Within sixty days after the close of each fiscal year the Secretary of Agriculture shall determine what part, if any, of the sums theretofore deducted for administering the provisions of this Act will not be needed for that purpose and apportion such part, if any, for the fiscal year then current in the same manner and on the same basis, and certify it to the Secretary of the Treasury and to the State Highway departments, and to the governors of States having no State highway departments, in the same way as other amounts authorized by this Act to be apportioned among all the States for such current fiscal year. The Secretary of Agriculture, after making the deduction authorized by this section, shall apportion the remainder of the appropriation for each fiscal year among the several States in the following manner: One-third in the ratio which the area of each State bears to the total area of all the States; one-third in the ratio which the population of each State bears to the total population of all the States, as shown by the latest available Federal census; one-third in the ratio which the mileage of rural delivery routes and star routes in each State bears to the total mileage of rural delivery



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Bisbee-Tombstone Highway

routes and star routes in all the States, at the close of the next preceding fiscal year, as shown by the certificate of the Postmaster General, which he is directed to make and furnish annually to the Secretary of Agriculture.

Sec. 5. That within sixty days after the approval of this Act, the Secretary of Agriculture shall certify to the Secretary of the Treasury and to each State highway department and to the governor of each State having no State highway department, the sum which he has estimated to be deducted for administering the provisions of this Act and the sum which he has apportioned to each State for the fiscal year ending June thirtieth, nineteen hundred and seventeen, and on or before January twentieth next preceding the commencement of each succeeding fiscal year shall make like certificates for such fiscal year.

Sec. 6. That any State desiring to avail itself of the benefits of this Act shall, by its State highway department, submit to the Secretary of Agriculture project statements setting forth proposed construction of any rural post road or roads therein. If the Secretary of Agriculture approve a project, the State highway department shall furnish to him such surveys, plans, specifications, and estimates therefor as he may require; **Provided, however,** that the Secretary of Agriculture shall approve only such projects as may be substantial in character and the expenditure of funds hereby authorized shall be applied only to such improvements. Items included for engineering, inspection, and unforeseen contingencies shall not exceed ten per centum of the total estimated cost of the work. If the Secretary of Agriculture approve the plans, specifications and estimates, he shall notify the State highway department and immediately certify the fact to the Secretary of the Treasury. The Secretary of the Treasury shall thereupon set aside the share of the United States payable under this Act on account of such project, which shall not exceed fifty per centum of the total estimated cost thereof. No payment of any money apportioned under this Act shall be made on any project until such statement of the project

and the plans, specifications, and estimates therefor, shall have been submitted to and approved by the Secretary of Agriculture.

When the Secretary of Agriculture shall find that any projects so approved by him have been constructed in compliance with said plans and specifications he shall cause to be paid to the proper authority of said State the amount set aside for said project; **Provided**, that the Secretary of Agriculture may, in his discretion, from time to time make payments on said construction as the same progresses, but these payments including previous payments, if any, shall not be more than the United States pro rata part of the value of the labor and materials which have been actually put into said construction in conformity to said plans and specifications; nor shall any such payment be in excess of \$10,000 per mile, exclusive of the cost of bridges of more than twenty feet clear span. The construction work and labor in each State shall be done in accordance with its laws, and under the direct supervision of the State highway department, subject to the inspection and approval of the Secretary of Agriculture and in accordance with the rules and regulations made pursuant to this Act.

The Secretary of Agriculture and the State highway department of each State may jointly determine at what times, and in what amounts, payments, as work progresses, shall be made under this Act. Such payments shall be made by the Secretary of the Treasury, on warrants drawn by the Secretary of Agriculture, to such official, or officials, or depository, as may be designated by the State highway department and authorized under the laws of the State to receive public funds of the State or county.

Sec. 7. To maintain the roads constructed under the provisions of this Act shall be the duty of the States, or their civil subdivisions, according to the laws of the several States. If at any time the Secretary of Agriculture shall find that any road in any State constructed under the provisions of this Act is not being properly maintained he

shall give notice of such fact to the highway department of such State and if within four months from the receipt of said notice said road has not been put in a proper condition of maintenance then the Secretary of Agriculture shall thereafter refuse to approve any project for road construction in said State, or the civil subdivision thereof, as the fact may be, whose duty it is to maintain said road, until it has been put in a condition of proper maintenance.

Sec. 8. That there is hereby appropriated and made available until expended, out of any moneys in the National Treasury not otherwise appropriated, the sum of \$1,000,000 for the fiscal year ending June thirtieth, nineteen hundred and seventeen, and each fiscal year thereafter, up to and including the fiscal year ending June thirtieth, nineteen hundred and twenty-six, in all \$10,000,000, to be available until expended under the supervision of the Secretary of Agriculture, upon request from the proper officers of the State, Territory, or county for the survey, construction, and maintenance of roads and trails within or only partly within the national forests when necessary for the use and development of resources upon which communities within and adjacent to the national forests are dependent; **Provided**, that the State, Territory, or county shall enter into a co-operative agreement with the Secretary of Agriculture for the survey, construction and maintenance of such roads or trails, upon a basis equitable to both the State, Territory, or county, and the United States; **And provided also**, that the aggregate expenditures in any State, Territory, or county shall not exceed ten per centum of the value, as determined by the Secretary of Agriculture, of the timber and forage resources which are or will be available for income upon the national forest lands within the respective county or counties wherein the roads or trails will be constructed; and the Secretary of Agriculture shall make annual report to Congress of the amounts expended hereunder.

That immediately upon the execution of any co-operative agreement hereunder the Secretary of Agriculture shall

notify the Secretary of the Treasury of the amount to be expended by the United States within or adjacent to any national forest thereunder, and beginning with the next fiscal year and each fiscal year thereafter the Secretary of the Treasury shall apply from any and all revenues from such forest ten per centum thereof to reimburse the United States for expenditures made under such agreement until the whole amount advanced under such agreement shall have been returned from the receipts from such national forest.

Sec. 9. That out of the appropriations made by or under this Act, the Secretary of Agriculture is authorized to employ such assistants, clerks, and other persons in the city of Washington and elsewhere, to be taken from the eligible lists of the Civil Service Commission, to rent buildings outside of the city of Washington, to purchase such supplies, material, equipment, office fixtures and apparatus, and to incur such travel and other expense as he may deem necessary for carrying out the purposes of this Act.

Sec. 10. That the Secretary of Agriculture is authorized to make rules and regulations for carrying out the provisions of this Act.

Sec. 11. That this Act shall be in force from the date of its passage.

Approved July 11, 1916.

The provisions of the Federal Aid Law were assented to by the Legislature of the State of Arizona, March 8, 1917 (Chapter 25, Session Laws 1917).

Statement showing apportionments to the State of Arizona under the Act, the allotments therefrom made to date and the balances available.



COCHISE COUNTY
Bisbee-Tombstone Highway

	Apportionments	Allotments	Cumulative Balance Available
Apportionment 1916-1917.....	\$ 68,513.52		\$ 68,513.52
Florence Bridge		\$ 61,899.89	6,613.63
Apportionment 1917-1918.....	137,027.04		143,640.67
Phoenix-Tempe Highway.....		38,600.00	105,040.67
Apportionment 1918-1919.....	205,540.58		310,581.25
<hr/>			<hr/>
To date.....	\$411,081.14	\$100,499.89	

Project Agreements have been prepared for co-operative construction under the Federal Aid Act of the following:

Arizona No. 1—Florence Bridge Extension.

Arizona No. 2—Phoenix-Tempe Highway Section 2, Reconstruction 4.15 miles.

Arizona No. 3—Holbrook St. Johns Highway Section 3, 3.22 miles.

Arizona No. 4—Phoenix-Yuma Highway Section 1, 50.03 miles.

Arizona No. 5—Kingman-Oatman Highway Section 3, 2.183 miles.

Arizona No. 6—Holbrook-St. Johns Section 4, 12.60 miles.

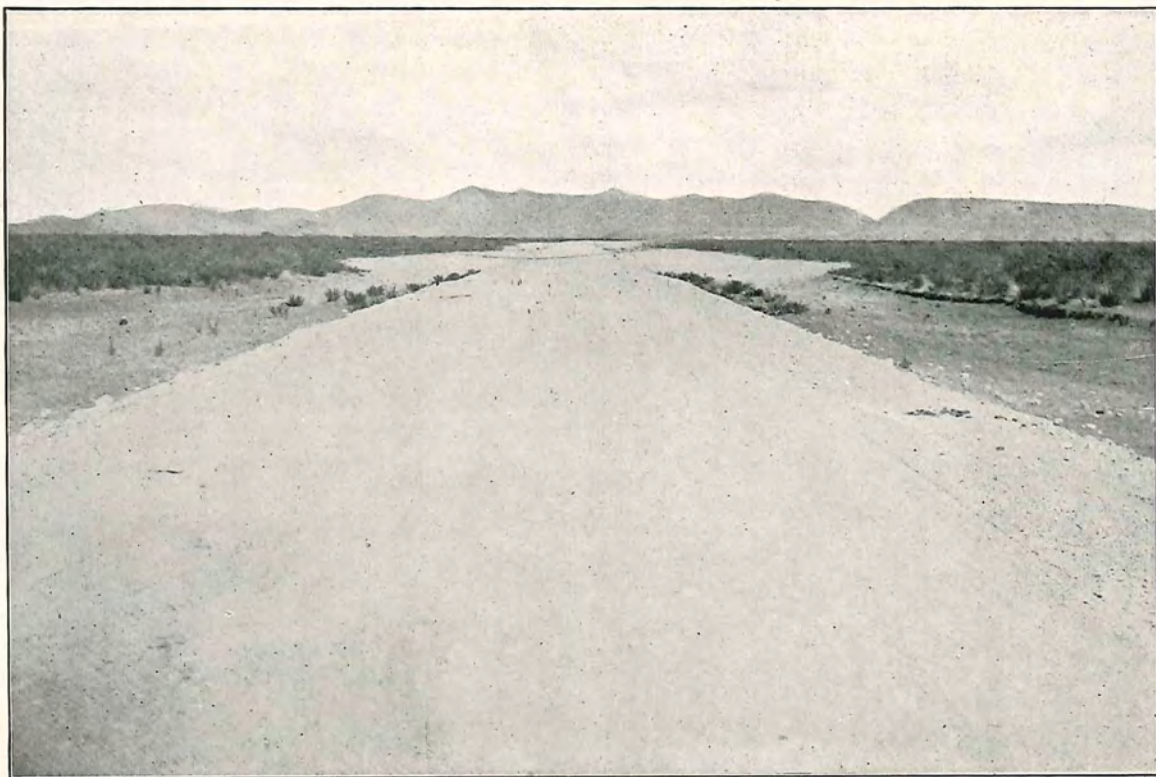
Arizona No. 7—Mesa-Superior Section 2-B, 12.707 miles.

Of these projects Nos. 1 and 2 have been approved and allotments made. No. 1 is nearing completion, as appears elsewhere in this report, and work is soon to begin on No. 2. No. 4 has been approved as to project but plans and specifications are still under consideration.

The others are in various stages of advancement in course of examination by the United State Office of Public Roads.

The estimated cost and amounts of Federal Aid requested on these projects proposed for Federal Aid but which have not yet been granted are as follows:

	Estimated Cost	Federal Aid Requested
Arizona No. 3.....	\$ 37,130.00	\$ 18,565.00
Arizona No. 4.....	360,000.00	180,000.00
Arizona No. 5.....	56,000.00	21,830.00
Arizona No. 6.....	100,690.00	50,345.00
Arizona No. 7.....	130,000.00	65,000.00
<hr/>		<hr/>
Total.....	\$683,820.00	\$335,740.00



COCHISE COUNTY
Bisbee-Tombstone Highway

In general, the workings of the Federal Aid Road Act have been found highly satisfactory by this department.

The only drawbacks that this department has noted are those necessarily connected with supervision and inspection of engineering work under a somewhat remote authority.

Some of these might possibly be alleviated by the delegation by the Bureau of Public Roads of more complete authority and responsibility to their local representative on the work.

It has appeared to us to be possible also, that it might be more consistent and satisfactory for the Bureau of Public Roads to, itself, make the location surveys, plans and specifications on all Federal Aid Projects.

These pieces of work would then serve the purpose of object lesson roads, quite as well as those built for that special purpose.

There would also seem to be necessary for the successful administration of the law some modifications of the requirements in regard to mail carriage. At present these do not always coincide with the actual needs of the community to be served.

Management of the Public Highway

In recent years the automobile industry has concentrated attention on so-called pleasure traffic and transportation by auto trucks. The public demand, so far as the highways are concerned, has been most insistent for better roads especially constructed to meet this demand.

Up to the present time the highway laws of the State of Arizona have been satisfactory and adequate for all the requirements demanded of the State and the several counties. With the demand for better roads and a connected system of highways some additions should be made to the present laws to provide for some form of governing body, that will co-ordinate the interests of the Federal Government, the State, and the several counties of the State, and make possible the planning and execution of a definite program covering a period of years.

There seems to be no question that improved public highways are essential for the proper development of our commercial activity and that the benefits accruing therefrom will repay any reasonable expenditures.

There is under consideration at the present time, a big national program for the building of good roads. Large sums have been provided by the Federal Aid Road Act to assist the local communities in the construction of post roads or roads that may become post roads. This national program promises to be greatly enlarged during the coming session of Congress. It is quite probable that several million dollars will be made available for expenditure within the State of Arizona, upon certain conditions and requirements. There is no doubt the State of Arizona will be required to share in a fixed proportion of the cost of any approved Federal Aid Project as under the present law. The administration of this law as well as the burden of the preparation of an adequate program of road

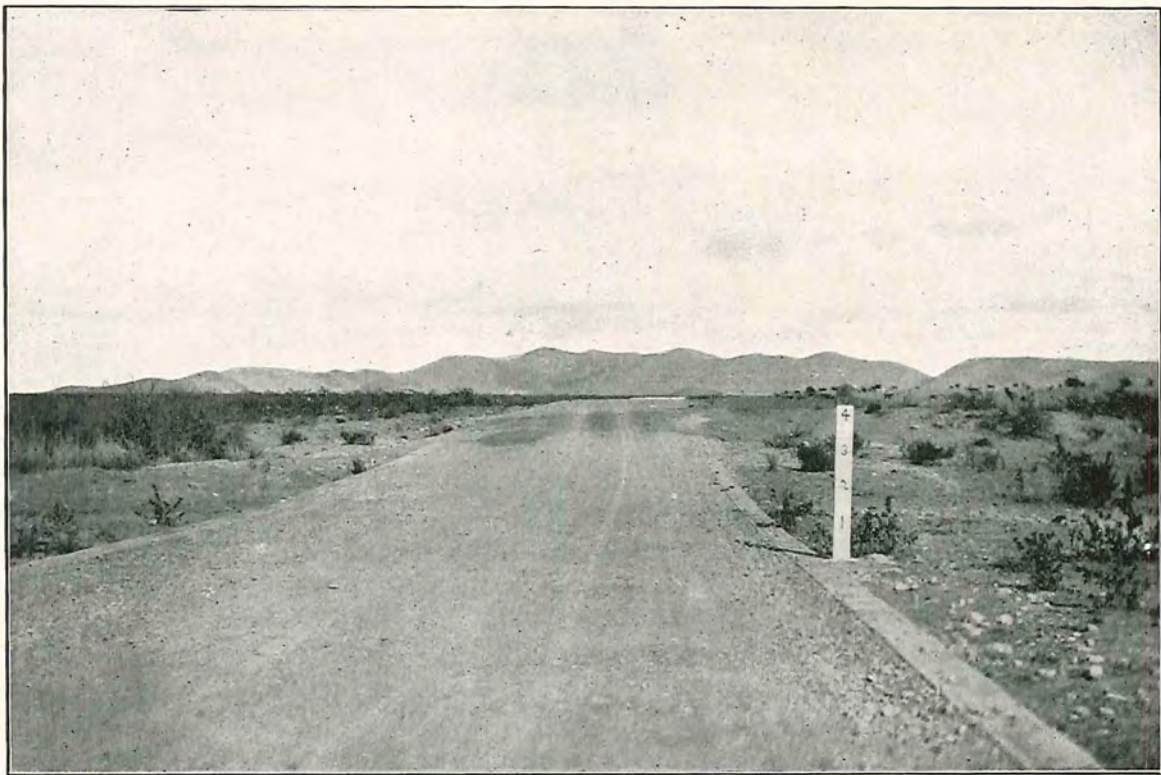
building covering a term of years, will also be vested in the State Highway Department.

This program will, of necessity, require careful consideration, of the location of proposed routes to be improved, and their relative values. To do this intelligently, surveys will be required involving not only the selection of suitable routes, but an exhaustive examination into the matter of available road building materials, types of construction, drainage and waterways, together with a detailed estimate of cost. It is very evident such a program must only be undertaken by an organization which will, in some measure, be permanent in character if satisfactory results are to be obtained.

The problem involved in the proper construction, repair, maintenance and general administration of our road system is of such magnitude, that its very extent is hard to realize; nevertheless, it is certain that we shall in the near future build a very large improved road mileage. It is practically assured that the next Congress will make available to the State of Arizona a sum in excess of \$8,000,000.00 contingent upon the State of Arizona providing a like amount. The expenditure of this will cover a term of years. This large sum of money will come out of the public purse and will be expended by public officials. This program of public improvement will exceed anything heretofore undertaken, and if wisely made, an important commercial advantage will ensue to our agricultural interests and industrial development.

From the standpoint of a business proposition, there should be provided a suitable governing body or head, clothed with adequate authority and clearly charged with full responsibility. If this authority is vested in a highway commission, it should be made up, as far as possible, of men who are interested in road work of the State, and so appointed that only a certain percentage of their number shall retire at one time. The work of this Commission should bear a relation to highway work similar to that of a board of directors to the work of its corporation.

The term of service of such commissioners should be of sufficient length to enable them to become thoroughly acquainted with



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the needs of the State in connection with highway work. The length of term should preferably be not less than six years.

To this Commission should be given authority to appoint a State Highway Engineer and provide for suitable assistants and employees. He should be a man of wide experience in highway work and have executive ability. The Engineer should be selected because of his fitness and familiarity with the duties required. He should be retained for a definite term of years.

The State Highway Engineer should be entrusted with the selection of all others who are to carry on the road work of the State, and their appointment, will of course be subject to the approval of the Commission.

Permanency of employment of the officials in the highway department is unquestionably in the interest of economic road building. There is nothing more disastrous to State road work than the frequent changing of the road forces and the engineers in charge. The value of an engineer to the State obtaining his services rapidly increases with the length of his service.

RECOMMENDATIONS

In connection with the new legislation that in our opinion should be enacted in order to improve the operations of this department, we have wished to call attention particularly to the following items:

No. 1. The operations of the various county road organizations and the State Highway Department might well be brought into closer relation with each other. This suggestion is made with the idea that it may lead to bringing about a co-ordination between these two agencies of road construction so that the State as a whole will sooner obtain a consistent and unified system of highways.

No. 2. Some legal method of designating State Highways for improvement might well be adopted so that their selection shall become a matter of record not subject to frequent change due to changes in the governing bodies in control of Highway construction.

No. 3. Legislation should be enacted improving the methods now available for acquiring right of way for State Highways. This legislation should definitely accept the grant made by the Federal Government of rights of way along the beaten trails through the public domain.

No. 4. It appears to us to be advisable for the State of Arizona to have a State Engineer to take charge of water rights, irrigation and miscellaneous engineering duties of the State separate and distinct from the State Highway Engineer and with an organization of his own. It will be noted in this connection that under present law the State Engineer is in effect only a Highway Engineer with no funds available for other uses.

No. 5. We consider it imperative that the State of Arizona should immediately undertake to improve the form of its organization for the selections, construction and maintenance of State Highways. A form of organization should be adopted that will be, as far as possible, non-partisan and free from revolutionary changes in personnel and policy.

It appears self-evident to us that the continuance of the present form of control endangers our ability to use the Federal funds available for road construction in Arizona. We cannot but foresee that portions of these moneys available would be lost to the State under the existing form of organization.

No. 6. In order to assure our ability to co-operate to the greatest extent with the Federal Government in providing labor for returning soldiers and in the National plans for the expansion of industries and development of natural resources, we must further revise and enlarge our schedule of taxes for highway work and our license fees for automobiles, which are, as you are well aware, also used for road construction and maintenance.

Respectfully submitted,

B. M. ATWOOD,
State Engineer.

Historical

Prior to 1909 all expenditures for road improvement were made under the direction of the County Board of Supervisors. From March 18, 1909, when the Territorial road law was approved, a fund known as the Territorial Road Fund was expended under the office of the Territorial Engineer as directed by the Board of Control of the Territory. Under this arrangement the Board of Control was authorized to cause the Board of Supervisors to levy in the several Counties from 5 to 25 cents on each \$100.00 assessed valuation to establish this fund.

Immediately after the admission to Statehood the State Road law was passed. The State Board of Control and the State Engineer performed the functions performed by the State Highway Commission of other States, though the Board of Control was not concerned with highway work only, but was in general charge of all public work and institutions of the State.

March 20, 1917, a law was passed creating the Commission of State Institutions, effective until June 30, 1919, to take over the duties of the Board of Control.

The State Highway Department is under the direct charge of the State Engineer, who must be a practical, competent civil engineer. He is appointed by the Governor for a term of two years.

The State Engineer is required by law to aid the Board of Supervisors of the several Counties in the selection and designation of State Highways and bridges. It is also his duty, when requested, to aid, by his advice, the County Engineers of the various Counties of the State relative to the methods of constructing and maintaining the County roads and bridges. He, in conjunction with the Commission of State Institutions, is also charged with the responsibility of disbursing the twenty-five per cent fund of the "State Road Tax Fund." In co-operation with the County Board of Supervisors

ors of each County he is charged with the responsibility of the expenditure of the seventy-five per cent fund, and he is responsible for the construction, reconstruction, repair, improvement and maintenance of roads and bridges constructed with money derived from the State Road Tax Fund, Prison Labor Fund, Motor Vehicle Fund and the Federal Aid.

Additional funds for the counties to be expended under the supervision of the County, with the advice and assistance of the State Engineer when requested, are provided by a tax levied on all the property in the County at a rate not to exceed 25 cents on the \$100.00

Highway Commissions and Boards of Trustees for districts also have power to levy special taxes for road purposes within their jurisdiction.

The law further requires that upon request of the Board of Supervisors of any County where work is being done on a State highway, he shall furnish such board with a duplicate copy of the plans and specifications for such work.

He may from time to time establish and maintain camps or enclosures for State convicts employed on State highway work. He is required to maintain such convicts, and he is authorized to make rules and regulations governing the conduct of the convicts so employed while engaged on such work and to provide suitable means and methods for the enforcement of such rules and regulations. Whenever any work upon which convicts are employed is completed, the State Engineer is required to cause the men to be returned to the State Prison or to be transferred to another camp or highway.

Under the State Engineer in the Central office are two main divisions, i. e., the Clerical division and the Engineering division. The former is under the charge of the Chief Clerk, who is responsible for the proper filing and preparation of all correspondence, keeping of records, purchasing, etc. He is given a bookkeeper and the necessary assistants for the proper supervision of the records, cost accounts and reports of the Division Engineer.

The Engineering division is in charge of the Office Engineer, also appointed by the State Engineer. It is his duty to check all plans and estimates that are made in the field and are sent into the office by the Division Engineers, and prepare in the Central office plans, profiles and specifications from notes which have been sent in by the Field Engineer. The Office Engineer is also responsible for the proper recording and filing of all maps and plans which are sent in from the field, and when requested by Counties and with the approval of the State Engineer, he prepares plans, specifications and estimates of cost for highway and bridge work.

During the past two years special attention has been given to the securing of proper right-of-way for both constructed and proposed highways.

Under the Direction of the State Engineer, Division Engineers are appointed and stationed at different points in the State. They are in direct charge of all highway work in their respective districts, whether it be advisory, making of surveys, or the construction of bridges or highways. The law provides for a certain amount of co-operation between the State and County Officials, and especially provides that the State Engineer, when so requested by the County authorities, shall advise with them regarding their highway work.

On several occasions the State Highway department has aided the Counties to the extent of loaning one of their Division Engineers to the County, in order to secure the best results from the expenditure of bond issue money. In one case an engineer was loaned in this manner for fourteen months.

The revenues devoted to the improvement of State Highways under the State Highway department are derived from six sources, as follows:

1. Under the original Road Tax law there was annually levied a sufficient tax on all the taxable property within the State to raise the sum of \$25,000, known as the "State Road Tax Fund." Chapter 69 of the Session Laws of 1917 amended this law by providing for a levy of ten (\$0.10) cents on each one hundred (\$100.00) dollars



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of the assessed valuation. Under the law this fund may be expended for construction, reconstruction, repairing, improving and maintaining highways, roads and bridges. This fund, however, has so far been expended principally for construction.

This fund is divided in two parts, known respectively as the 75 and 25 per cent funds.

(a) Seventy-five per cent fund.

Seventy-five per cent of the "State Road Tax Fund" is apportioned to the several Counties in the amount to each County of 75 per cent of the taxes collected under the law. This part of the fund is expended for any purpose in highway work except engineering.

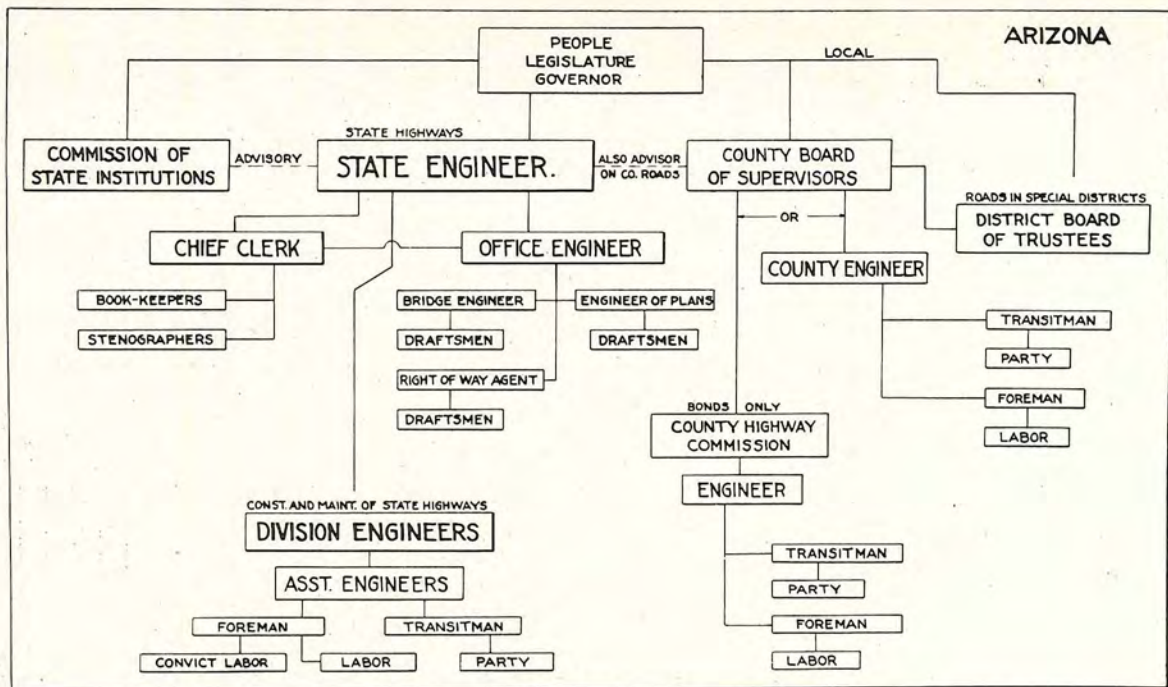
(b) Twenty-five per cent fund.

The twenty-five per cent of the "State Road Tax Fund" is expended under the direction of the Commission of State Institutions and the State Engineer. From this part of the fund all engineering expenses are paid; the balance may be apportioned by the Commission of State Institutions and the State Engineer in such manner as they think best.

The following tables show the assessed valuation of the various counties and the apportionment of both 75 and 25 per cent funds for the years 1916-17, 1917-18, and 1918-19.

APPORTIONMENT OF STATE ROAD FUND—1916-1917

County	Assessed Val.	Proportion	25 Percent	75 Percent
1 Apache	\$ 6,636,573.16	\$ 3,411.02	\$ 852.76	\$ 2,558.26
2 Cochise	114,837,338.56	59,023.34	14,755.84	44,267.50
3 Coconino	17,513,310.58	9,001.38	2,250.35	6,751.03
4 Gila	69,808,515.18	35,879.72	8,969.93	26,909.79
5 Graham	10,780,390.85	5,540.83	1,385.21	4,155.62
6 Greenlee	31,928,378.02	16,410.34	4,102.59	12,307.75
7 Maricopa	71,849,298.90	36,928.63	9,232.16	27,696.47
8 Mohave	15,670,094.10	8,054.01	2,013.50	6,040.51
9 Navajo	8,610,378.50	4,425.50	1,106.37	3,319.13
10 Pima	27,126,785.84	13,942.45	3,485.61	10,456.84
11 Pinal	30,841,272.84	15,851.59	3,962.90	11,888.69
12 Santa Cruz	8,038,798.76	4,131.73	1,032.93	3,098.80
13 Yavapai	58,279,022.07	29,953.87	7,488.46	22,465.41
14 Yuma	14,486,361.14	7,445.60	1,861.40	5,584.20
Total	\$486,406,518.50	\$250,000.01	\$ 62,500.01	\$187,500.00



APPORTIONMENT STATE ROAD FUND—1917-1918

County	Assessed Val.	Proportion	25 Percent	75 Percent
1 Apache	\$ 7,722,499.73	\$ 7,717.00	\$ 1,929.25	\$ 5,787.75
2 Cochise	151,789,316.47	151,675.09	37,918.77	113,756.32
3 Coconino	19,228,582.67	19,214.40	4,803.60	14,410.80
4 Gila	147,882,276.35	147,771.00	36,942.75	110,828.25
5 Graham	12,427,096.25	12,418.22	3,104.55	9,313.61
6 Greenlee	41,267,854.98	41,237.07	10,309.29	30,927.78
7 Maricopa	80,707,733.34	80,647.16	20,161.79	60,485.37
8 Mohave	18,432,332.20	18,418.75	4,604.69	13,814.06
9 Navajo	10,207,174.73	10,199.80	2,549.95	7,649.85
10 Pima	36,553,392.44	36,526.13	9,131.53	27,394.60
11 Pinal	46,599,174.00	46,559.34	11,639.83	34,919.51
12 Santa Cruz	9,282,403.69	9,275.73	2,318.93	6,956.80
13 Yavapai	98,716,072.38	98,641.90	24,660.47	73,981.43
14 Yuma	16,710,710.45	16,698.41	4,174.60	12,523.81
Total	\$697,526,619.68	\$697,000.00	\$174,250.00	\$522,750.00

APPORTIONMENT STATE ROAD FUND—1918-1919

County	Assessed Val.	Proportion	25 Percent	75 Percent
1 Apache	\$ 8,601,366.40	\$ 8,601.37	\$ 2,150.34	\$ 6,451.03
2 Cochise	169,348,466.17	169,348.47	42,337.12	127,011.33
3 Coconino	20,259,245.53	20,259.26	5,046.81	15,194.45
4 Gila	163,647,782.48	163,647.78	40,911.95	122,735.84
5 Graham	13,165,299.52	13,165.30	3,291.32	9,873.98
6 Greenlee	44,441,780.34	44,441.78	11,110.44	33,331.34
7 Maricopa	97,367,007.13	97,367.01	24,341.75	73,025.25
8 Mohave	22,074,655.38	22,074.66	5,518.66	16,556.00
9 Navajo	10,925,900.68	10,925.90	2,731.48	8,194.42
10 Pima	61,645,110.64	61,645.11	15,411.28	46,233.83
11 Pinal	63,224,173.72	63,224.17	15,806.04	47,418.13
12 Santa Cruz	10,619,611.78	10,619.61	2,654.90	7,964.71
13 Yavapai	130,575,381.62	130,575.38	32,643.84	97,931.53
14 Yuma	18,124,750.83	18,124.75	4,531.19	13,593.56
Total	\$834,020,532.22	\$841,020.52	\$215,505.12	\$625,515.40

2. The amount of fees secured by the Secretary of State from the licensing of automobiles and motor vehicles is paid into the State Treasury, to the credit of the "State Road Tax Fund," 25%

portion. From these fees there is appropriated annually \$2,500 to be used by the Secretary of State to defray the expense of collecting the Motor Vehicle Fund. In addition thereto the Legislature has appropriated \$4,000 per year for this expense. The Motor Vehicle Fund" the sum of \$60,000.00 to pay part of the cost of maintaining for the year 1917-18 it will yield \$150,000.00.

3. There is levied annually and paid into the "State Road Tax Fund" the sum of \$60,000.00 to pay part of the cost of maintaining and employing convicts.

4. That part of the cost of maintaining and employing convicts on the State highway which is equal to the clothing and subsistence at the Prison for the number of prisoners employed is paid from the Prison Maintenance Fund. In the years 1916-17 there was transferred from the Prison Maintenance Fund to the "State Road Tax Fund" the sum of \$6,610.26.

5. Specific funds created by the Legislature for special purposes.

6. Federal Aid to be expended jointly under the direction of the Office of Public Road and the State Engineer. Three factors enter into the determination of the amount of Federal Aid to be apportioned to the State, i. e., Area, population and mileage of star and rural routes. Arizona will receive the amounts shown in the following table for the development of highways under the Federal Aid Act.

YEAR ENDING—	Total Federal Appropriation for all States	Arizona
June 30, 1917	\$ 5,000,000.00	\$ 68,513.52
June 30, 1918	10,000,000.00	137,027.04
June 30, 1919	15,000,000.00	205,540.58
June 30, 1920	20,000,000.00	274,054.62
June 30, 1921	25,000,000.00	342,567.62
	<hr/> \$75,000,000.00	<hr/> \$1,027,702.86

The total available funds, including balances unexpended for the maintenance of the State Highway Department for engineering construction, reconstruction, repair, improvement and maintenance

CUMULATIVE STATEMENT OF RECEIPTS AND EXPENDITURES IN THE COUNTIES FROM JULY 1, 1911, TO JUNE 30, 1918

	State Road Tax Levy 100 P.C. Fund	Taxes paid in 75 P.C. Fund	Other increments and loans less repay- ments	Total Receipts 75 P.C. Fund	Expenditures 75 P.C. Fund	Cash Bal. 75 P.C. Fund	Cash and Available Bal. 75 P. C. Fund	Taxes Paid in 25 P.C. Fund	Prison Fund applied	Other increments	Total Prison and other	Total Expend. State Road Tax Fund Gen.	Expenditures from 25 P. C. portion only
Apache	\$ 29,967.46	\$ 19,579.56	\$	\$ 19,579.56	\$ 13,437.66	\$ 6,141.90	\$ 6,802.60	\$ 9,351.74	\$	\$	\$	\$ 30,325.88	\$ 30,325.88
Cochise	488,815.58	332,584.35		332,584.35	286,832.64	45,751.71	47,324.45	155,267.06	26,985.60		26,985.60	124,784.40	97,798.80
Coconino	81,961.62	52,816.05	14,717.00	67,533.05	68,259.54	726.49*	13.96	27,666.58				60,770.21	60,770.21
Gila	287,234.84	170,197.48	12,500.00	182,697.48	207,115.72	24,418.24*	9,327.86	73,011.57				68,944.87	68,944.87
Graham	50,350.18	32,254.93		32,254.93	22,666.67	9,588.26	10,286.73	17,203.21				56,578.80	56,578.80
Greenlee	150,025.86	105,488.38		105,488.38	103,601.29	1,887.09	2,579.18	47,533.74	138,864.97		138,864.97	179,220.38	40,355.41
Maricopa	351,288.52	220,041.50	19,557.74	239,599.24	205,743.63	33,855.61	36,061.80	123,014.97		28,000.00	28,000.00	228,176.58	200,176.58
Mohave	68,816.87	47,509.47	15,000.00	62,509.47	63,078.20	568.73*	0.00	21,379.26				52,726.90	52,726.90
Navajo	39,454.75	25,629.07	16,958.55	42,587.62	36,383.63	6,203.99	6,350.73	13,392.52				37,061.65	37,061.65
Pima	133,360.41	81,789.55		81,789.55	83,637.30	1,847.75*	0.00	47,345.34	26,945.50		26,945.50	119,068.86	92,123.36
Pinal	123,586.11	84,517.86		84,517.86	50,385.81	34,132.05	35,120.65	37,680.51				136,316.15	136,316.15
Santa Cruz	35,412.86	18,547.47	26,518.53	45,066.00	46,545.99	1,479.99*	61.54*	11,678.25		18,000.00	18,000.00	151,867.26	133,867.26
Yavapai	264,232.67	175,848.87		175,848.87	102,994.12	72,854.75	74,620.35	85,757.28				129,997.52	129,997.52
Yuma	67,423.24	42,982.22	9,324.31	52,306.53	52,078.37	228.16	434.01	23,952.88	10,802.34	50,000.00	60,802.34	68,684.45	7,882.11

*Items, indicated thus represent overdrafts.

of roads and bridges, for the periods 1916-17 and 1917-18, exclusive of any levies made by counties and cities for county and city highways and streets, are as follows:

Available Funds for period July 1, 1916-June 30, 1917.

State Road Tax Fund	\$ 250,000.00
Prison Maintenance Fund	6,610.26
Prison Fund	60,000.00
Motor Vehicle Fund.....	116,121.25
Agua Fria Bridge Fund	22,000.00
Florence Bridge Fund	50,000.00
Gila County Loan	12,500.00
Advanced by Counties 25 Per Cent Fund.....	24,000.00
Advanced by Counties 75 Per Cent Fund.....	27,500.00
Federal Aid Fund	68,573.52
State Engineer Fund.....	5,500.00

Total\$ 642,745.03

Available Funds for period July 1, 1917-June 30, 1918.

State Road Tax Fund	\$ 697,000.000
Prison Fund	60,000.00
Prison Maintenance Fund	12,254.71
Motor Vehicle Fund	143,518.25
Antelope Hill Bridge Fund	50,000.00
Advance Coconino County	10,000.00
Gila River Bridge Fund	30,000.00
Federal Aid Fund	137,027.04
State Engineer Fund	5,500.00

Total\$1,147,300.00

There is presented herewith a cumulative statement of receipts and expenditures apportioned to the various counties of the State and covering the period July 1, 1911, to June 30, 1918.

Pioneer Trails—National Highways

In only the rarest instances have lines of location as dictated by transit and level coincided with those of history, scenic beauty and tradition in the establishment of the routes of permanent highways. Arizona differs in this respect by building her highways largely along the lines of the old pioneer trails.

The Santa Fe Highway connects with the National Highway known as National Old Trails on the east near Magdalena, New Mexico, and follows the "Old Trails" through the county seats of four of the five northern counties to the California State line on the west near Needles.

The Borderland Highway connects with the National Highway of the same name on the east at New Mexico State line at Rodeo and follows that route through county seats of five of the six southern counties to the California State line at Yuma on the west.

One North and South Trunk line, known as the Grand Canyon-Nogales Highway, extends from Nogales on the extreme southern State boundary with the Republic of Mexico through county seats of remaining southern counties and of one central county, intersecting the Borderland and Santa Fe Highway and reaching the Grand Canyon on the north.

There is one connecting trunk line from east to west known as the Roosevelt Dam Highway, extending from the New Mexico State line on the east near Lordsburg through county seats of the three remaining counties to the Roosevelt Dam and connecting with the Borderland and Grand Canyon-Nogales Highways.

This system, in addition to connecting all county seats, reaches nearly all important centers of industry and population and lends itself to the establishment of a system of feeder lines for the development of the entire State.

On the other hand connections are made by each trunk line with transcontinental highways.

The Santa Fe Highway

This section, so called by reason of its following approximately the Santa Fe Railroad from east to west through the State, is more often referred to as the "Old Trails Route," as it is part of the National Old Trails Highway, or "Old Santa Fe Trail," along which the pioneers and explorers of the West made their perilous and historical journeys.

The Old Trails Route through Arizona was first traversed by Don Juan De Onate, Spanish Governor of New Mexico, in A. D. 1604, in an exploration journey from Santa Fe, New Mexico, to the Gulf of California. It remained, however, for Fathers Garces and Escalante, two Franciscan Friars, to make the definite location of this connecting link between the East and the unknown West. Fathers Garces and Escalante in 1776, the former from San Gabriel, near Los Angeles, California, and the latter from Santa Fe, New Mexico, completed the blazing of the trail between these points. The marvelous scenery and mysteries of nature unfolded to these pioneers and passed on through their teachings are still today the source of pleasure and food for reflection to the generations who have followed them.

Entering Arizona near Magdalena, New Mexico, at an elevation of 6862 feet this route leads westward through the Petrified Forest. This Forest extends over an area of more than 11,000 acres, and is often known as the "Forest of the Dead," the once majestic trees being now prostrate and turned to stone. Some measure two hundred feet in length and five feet in diameter. Every hue to be seen in the sparkle of the rarest gems is here a reality in the trunks of these monarchs of the past.

From the Petrified Forest the "Trail" continues westward through the Painted Desert and the Valleys of the Rio Puerco and Little Colorado to Meteor Crater, near Winslow. This crater, one mile in diameter, six hundred feet in depth and three miles around its rim, was formed by a meteor striking the earth at this point,



COCONINO COUNTY
Near Cliff Dwellings, Flagstaff

according to an Indian Legend, and splinters of meteoric iron are found in its vicinity today.

Near Flagstaff are the Cliff Dwellings of Walnut Canyon. This canyon is fourteen miles in length, six hundred feet in depth, and along its walls are nearly three thousand structures representing the architectural efforts of this extinct race, the Cliff Dwellers. Also in this vicinity are to be found many craters of extinct volcanoes, cinder beds and lava. In the lava beds are the wonderful ice caves. In these caves is to be found ice throughout the year.

Eleven miles from Flagstaff are the San Francisco Peaks, 13,000 feet above the sea level and six thousand feet above surrounding country. From the summit of these peaks is a panoramic view of over one hundred miles, including the Grand Canyon fifty miles distant, Hopi Indian villages, the scene of the famous Snake Dance, Meteor Crater, Cliff Dwellings and many other places of interest and beauty.

Sixty miles from Flagstaff is the Grand Canyon of Arizona, the marvels and beauties of which are of world-wide renown.

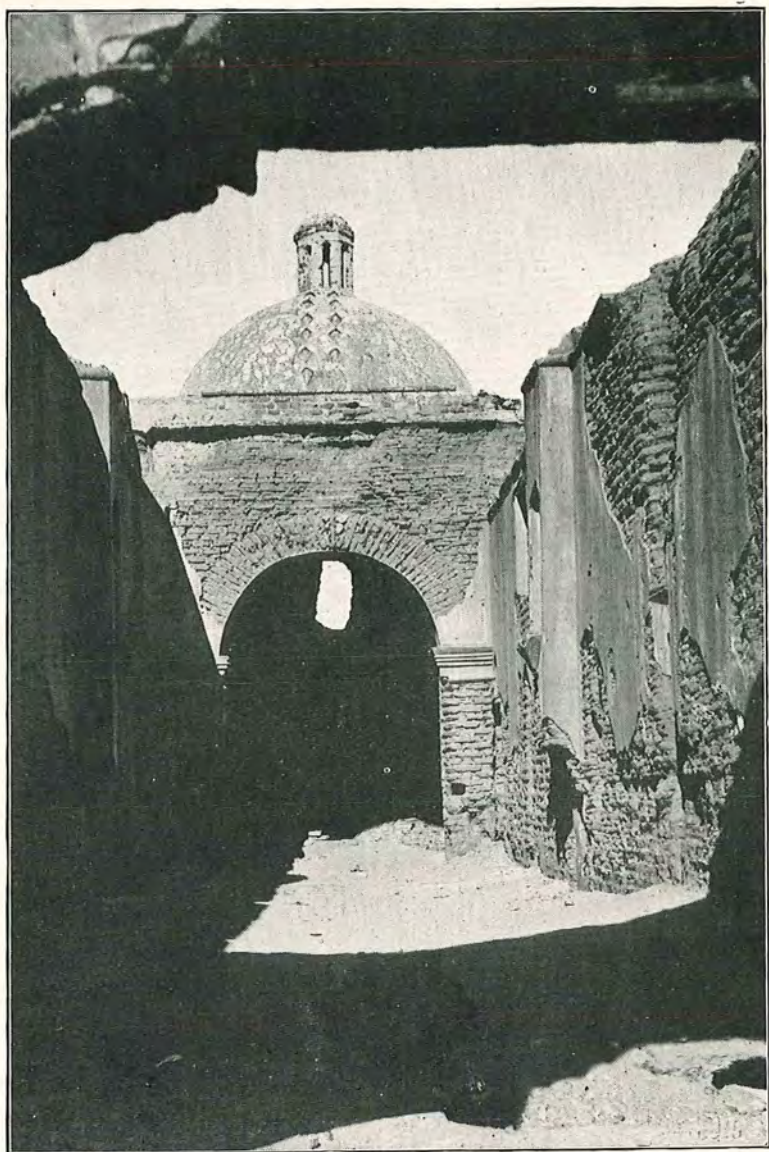
The trail extends through Flagstaff over pine clad mountains, and fertile valleys, to Ash Fork, near which was recently discovered one of the largest subterranean chambers known to exist. Twenty-five feet below the surface, several hundred feet in area, twelve feet in height and containing rare geological formations.

Leaving Ash Fork the trail leads over cactus covered plains and mesquite covered mesas to Peach Springs, from which point the bottom of the Grand Canyon is only twenty miles and easily reached by automobile.

The next point reached is Kingman, a center of one of the rich mineral districts.

From Kingman the trail leads through the mountains to Oatman, another prosperous mining camp.

From Oatman the trail leads to the Colorado River, where connection is made with the California State Highway after crossing



Old Spanish Mission Near Tubac

the \$75,000 steel bridge recently completed by the Interior Department, cost of which was borne equally by that Department, the State of California and Arizona.

Roosevelt Dam Highway

This highway, noted for the beautiful scenery along its route, cliff dwellings and old irrigation system of primitive man, takes its name from the Roosevelt Dam, one of the great engineering feats of the modern engineer and standing in marked contrast to the irrigation efforts of the prehistoric race first attempting solution of irrigation problems along this route.

Beginning at the New Mexico State line near Lordsburg on the east, this highway follows closely the line of the first railways built in Arizona, the Arizona and New Mexico Railway, to the copper mining camp of Clifton, thence through the Gila Valley to San Jose, at which point are the ruins on one of the larger ancient pueblos. Here are the ruins of dwellings, stone hedges, reservoirs and canals. The highway extends through Solomonsville, until recently the county seat of Graham County. Solomonsville is also built upon the site of another old pueblo. Ruins of habitations and other works of these extinct people are found along the route at the towns of Thatcher, Pima and Fort Thomas. Near the latter point is found an old canal 1,150 feet in length and eight feet in width leading from the mountain side to the old fields, indicating these people had taken advantage of the waters in this way to further their agricultural operations. From Fort Thomas the next points of interest reached are Globe and Miami, noted for their famous copper mines. From Globe this highway is called "The Apache Trail," and bears the distinction of being the oldest highway in the state, having been used by ancient Cliff Dwellers and discovered by Coronado in 1540. Their deserted pueblo is four and a half miles from Roosevelt.

The "Apache Trail" from Globe leads through the valley and up a plateau to the divide twenty miles distant from Globe, from which point is one of the most beautiful panoramic views in the State. The richly colored Mazatal range with its breaking canyons vie with the Sierra Anchas in a display of grandeur from opposite

sides of Lake Roosevelt. This picture can be seen reflected again in the inverted mirror of the blue lake resting peacefully in the valley below. The route continues by the cliff dwellings and along the banks of Roosevelt Lake to the Dam.

This dam was constructed by the United States Interior Department across a rocky gorge in Salt River Canyon, the first stone being laid September 20, 1906 and final dedication of the completed structure March 1, 1911. The dam is constructed of masonry and measures 284 feet in height, 168 feet thick at bottom, 20 feet at the crest, length at base 210 and at top 700 feet. The area of reservoir, or Roosevelt Lake, formed by the waters impounded by the dam is twenty-five and one-half square miles and capacity of water 7,941,307,440 gallons, or sufficient to irrigate 219,000 acres.

Leaving Roosevelt Dam, the highway follows the Salt River for about eight miles, thence over the mountain and into Fish Creek Canyon, where ascent is made of Fish Creek Hill, with more than a mile of ten per cent grade from canyon to the plateau. Here again the view brings the travelers' attention to the high hills and surrounding canyons while 1000 feet below is the Fish Creek station.

The road gradually descends to the lower valley, passing the base of Superstition Mountain, in which occurred the last stand made by the Apache Indians against the advance of civilization, and over the cactus covered mesa to a connection with the Borderland Highway near Mesa, eighteen miles from Phoenix.

The Borderland Highway

This section beginning on the east at the New Mexico boundary near Rodeo is a part of the transcontinental highway of the same title. The route is first in a southwesterly direction leading to Douglas, one of the large smelter cities of the State. One and one-half miles to the south is located the Mexican town of Agua Prieta, where several battles between Mexican forces have taken place during the last five years and during which Douglas has suffered more or less from bullets from long range rifles and shell fire.

From Douglas the highway extends to Bisbee, another rich

copper camp. This camp was discovered in 1877 and is still in active development.

Leaving Bisbee, a northwesterly course is taken over Mule Pass Mountains to Tombstone, the county seat of Cochise County. Tombstone was one of the earlier mining camps of the state, being established in 1877 and for the ten following years was one of the largest producers of gold and silver ore in the West. This camp has produced over \$50,000,000 in gold and silver ore, but by reason of difficulties experienced with underground flow of water the mines are now more or less inactive.

Around the first ten years of the activities of this camp are woven many of the stories of the mining camp life of the "Wild West" so often encountered in the East.

One mile to the west of Tombstone the highway passes the Schieffelin Monument. This monument was erected to the memory of Ed Schieffelin, discoverer of the Tombstone mine.

The highway extends westerly to Fairbank, across the San Pedro River and northwesterly through the San Pedro Valley over mesas and the Santa Rita Mountains to Tucson, where connection is made with the Grand Canyon-Nogales Highway, which is followed to Phoenix.

Leaving Phoenix, the Borderland Route extends in a southwesterly direction through the western portion of the Salt River Valley to Agua Caliente, which takes its name from the hot springs located at that point. These springs are noted for their health giving qualities.

From Agua Caliente the highway extends through the Gila River Valley to the crossing of the Gila River at Antelope Hill and thence to Yuma. Yuma is located on the east side of the Colorado river, which forms the boundary at this point between Arizona and California.

Grand Canyon-Nogales Highway

This section of the State Highway begins at the town of No-

gales, the gateway of Arizona to the West Coast of Mexico. Nogales was established as a town in 1882 and the international boundary with Mexico is marked by stone monuments in the center of one of its principal streets. During the border troubles of the last few years, several thousand troops of the United States Army have been stationed at this point in border service, and in two instances the town has been subjected to fire of combatants on the Mexican side.

From Nogales the route extends in a northerly direction to the village of Calabasas, established in 1760 as the headquarters of the Governor of Sonora.

Nineteen miles from Nogales the highway passes the old Mission San Jose de Tumacacori built by Indians and Spanish artisans under the direction of Padre Eusebio Kino in 1687. This old edifice although untouched by modern workmen, is preserved to a remarkable degree today. Three miles north of this Mission is the village of Tubac, established by the Spaniards as a garrison in 1752. Ten miles to the east are the Salero Mines, opened in 1688 and recorded as the first mines operated in America. At Tubac was published the first newspaper in Arizona, in 1859, and known as "The Weekly Arizonian."

The route continues in a northerly course over the mesa and Santa Rita Mountains to Tucson. The Mission of San Xavier del Bac, built under the direction of Padre Kino in 1692, is located nine miles south of Tucson. This old mission is well preserved and is still in use.

The ruins of the old Tucson Mission built near Tucson in 1692 are still standing. The city of Tucson, the county seat of Pima County, lies one mile from this old mission and was founded as San Cosme de Tucson in 1698. Tucson was made capital of the Territory from 1867 to 1877. The State University of Arizona is located at Tucson.

From Tucson the highway leads through the town of Florence, founded in 1867. For many years the United States Land Office in Arizona was located at this point. At Florence is also located the State Prison.



COCONINO COUNTY
Canon Padre Bridge

Leaving Florence the route crosses the Gila River one mile from the town and traverses the mesas and plains to the Salt River Valley, passing through the towns of Mesa, Tempe and Phoenix. Phoenix was founded in 1870 and made capital of the Territory in 1889.

From Phoenix the highway follows through the Salt River Valley by way of Hot Springs and the Bradshaw Mountains to Prescott, the county seat of Yavapai County. Prescott was founded in 1863 and was capital of the Territory from 1864 to 1867 and 1877 to 1889.

Leaving Prescott the route passes over the mountains into the Verde Valley and north to Flagstaff, the county seat of Coconino County. This town was established in 1876 and derives its name from the erection at that point of a flag pole on July 4, 1876, by emigrants from Boston, Massachusetts, en route to Prescott. The many scenic points surrounding Flagstaff are referred to under the description of the Santa Fe Highway.

From Flagstaff the highway leads through the mountains and plateaus to the Grand Canyon of Arizona.

Convict Labor on Road Work in the State of Arizona

The State of Arizona has been one of the pioneers in the use of convicts on the construction of State roads and bridges. Such labor has been in use in the State of Arizona from the year 1909 to date and has been used on practically all types of road construction including heavy mountain work, light grading across desert areas, the construction of reinforced concrete bridges and culverts and in the production of crushed stone, concrete pipe and other road materials.

At the present time there is a force of convicts from the State Prison engaged in the construction of a large reinforced concrete arch bridge across the Gila River, south of Clifton, and in the construction of the highway leading from Clifton over this bridge and through the mountain pass on the south side of the Gila River to Solomonsville..

There is also working in Cochise County a force of forty or fifty County prisoners who have been given a jail sentence for some misdemeanor. These County prisoners are engaged in the construction of a reinforced concrete arch bridge and also in the construction of the highway crossing the same and connecting Tombstone and Bisbee.

These two prison camps are not handled in precisely the same manner but nevertheless are both giving satisfactory results. Near Bisbee, in Cochise County, there are between forty-five and fifty-five men, the number fluctuating from time to time. These men are housed in a large bunk house surrounded by a high barb wire fence stockade closely wired and so constructed as to discourage thoughts of going over the top. Large gasoline lamps are used at night in order to thoroughly light up the stockade and the surrounding country, while guards are on duty at the two opposite diagonal corners of the stockade in a raised tower.

In each Camp strict adherence to the daily program is required,

the time for retiring being 9:00 o'clock and the time for rising being 6:00 in the morning. Promptly after the completion of the breakfast the men are loaded into auto trucks leaving camp in time to start the work at 8:00 in the morning. Each separate gang is in charge of a Foreman, who is assisted by armed guards accompanying the men wherever they go on the work. Dinner is brought out to the gangs on the road in auto trucks unless the men are working close to camp. The length of the working day is strictly confined to eight hours, this being the legal work day in Arizona for free labor.

At the Clifton camp, in Gila County, where the convicts from the State Prison are worked, the men are housed in large tents with bunks arranged in two rows of two tiers each extending down the sides of the tents with an open passage extending down through the middle of the tents. In both camps each man is provided with a pillow, two blankets and a mattress with the necessary linen. Absolute cleanliness is insisted upon in and around the bunk house, tents and stockade.

There is one tent for the camp barber shop, although the barber is required to perform other duties in addition to those of his trade. The stockade is equipped with a concrete toilet and good shower bath with proper sanitary arrangements. The dining room, kitchen and bakery are also located under canvass with ample facilities to care for one hundred prisoners.

Careful attention is given to the matter of proper feeding. It has been found that failure to furnish satisfactory food will cause trouble among the men quicker than any other single item. The cooks and assistants are selected from among the prisoners themselves in both camps. The rations are varied and the best effort is made to prepare them and serve them in an attractive manner. While working out in the desert regions the difficulty of obtaining fresh fruits and vegetables is so great that at times it is necessary under these circumstances to replace fresh fruits and vegetables that would otherwise be served, by canned goods and dried fruits. An effort is always made, however, to obtain the fresh articles in place of all forms of canned goods.

At the Clifton camp, where a force varying from ninety to one hundred men are worked and fed the following articles are included in the weekly diet:

For breakfast the men are served corn, bacon, mush, syrup, bread and coffee. Twice a week hot-cakes are added.

For dinner there are potatoes, beef stew, beans, bread, dried fruits and coffee.

Supper consists of either steak or stewed beef, potatoes, rice, macaroni, canned sweet corn, peas or tomatoes alternatively, bread and coffee.

For Sunday breakfast they get ham and eggs. Twice each week either pie or cake is served with the dinner and three times each week they are furnished with smoking or chewing tobacco.

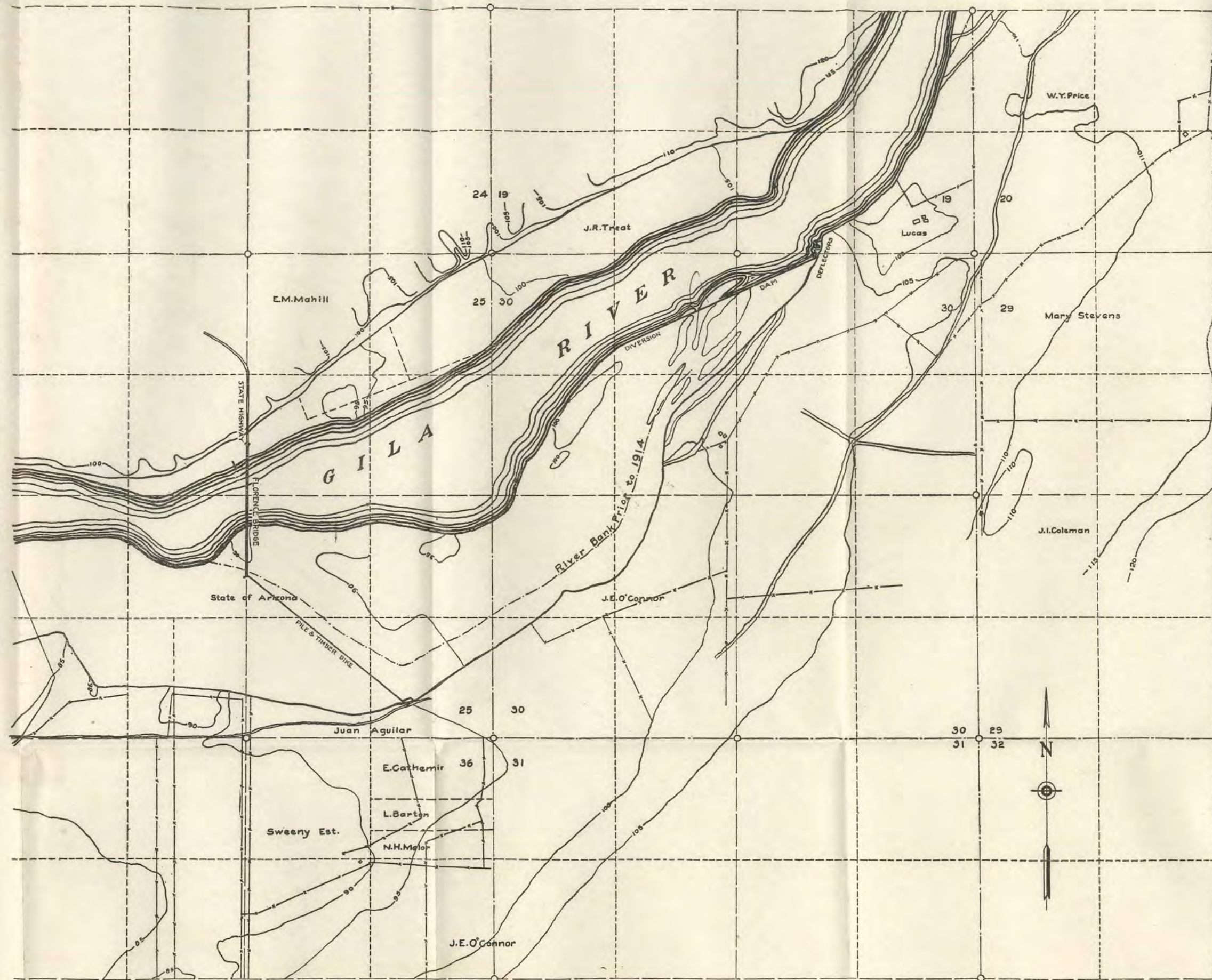
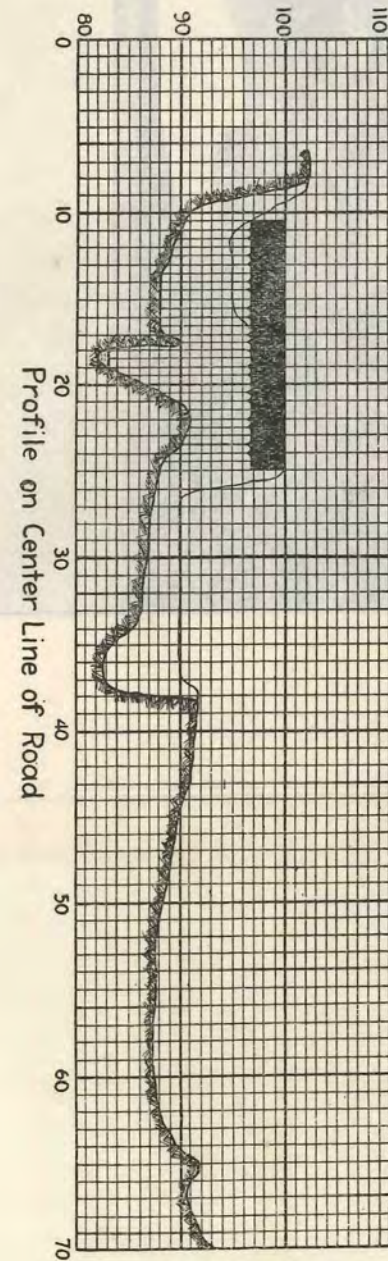
Complaint about the food is seldom heard and the men are found to be gaining in physical condition from the time they reach the work until they leave the same.

The following table shows the amount of food allotted to each convict during a month's time in the Clifton camp:

Flour, Wheat.....	12.0 lbs.	Fresh Beef, Pork or	
Flour, Milo Maize.....	1.6 lbs.	Mutton	23.5 lbs.
Rolled Oats.....	1.7 lbs.	Flour, Barley.....	2.0 lbs.
Sugar	3.0 lbs.	Corn Meal.....	22.0 lbs.
Prunes	1.5 lbs.	Macaroni	0.8 lbs.
Canned Peas.....	2.4 lbs.	Vermicelli	0.2 lbs.
Dried Peaches.....	0.1 lbs.	Dried Apples.....	2.0 lbs.
Canned Tomatoes.....	4.4 lbs.	Dried Apricots.....	4.0 lbs.
Cottolene	4.0 lbs.	Canned Corn.....	6.0 lbs.
Beans	1.6 lbs.	Bacon	5.2 lbs.
Onions	3.7 lbs.	Ham	1.6 lbs.
Velva Syrup.....	5.0 lbs.	Lard	1.5 lbs.
Coffee	2.6 lbs.	Condensed Milk.....	3.9 lbs.
Rice	1.7 lbs.	Potatoes	17.0 lbs.
Cheese	1.0 lbs.	Eggs	17.0 lbs.

During the nine or more years that Arizona has been employ-

TOPOGRAPHICAL MAP OF GILA RIVER NEAR FLORENCE ARIZONA





COCONINO COUNTY
Canon Diablo Bridge

ing convicts on State highways and bridges, there has been a wide variation in the character of the work done and in the satisfactory features attending such work. There have been times during this period when the work done by such convict labor has proven expensive, when they have been inefficient, when they have shown poor discipline and when the camps have been prone to show a big percentage of men idle and undergoing disciplinary detention.

It has been notable also that when the work has been going badly the percentage of escapes has often been high at the same time and the cases have necessarily gone up up as the efficiency has fallen.

At other times the convict camps have been a source of great satisfaction and have shown low costs, high efficiency, a praiseworthy disposition among the men and generally healthful and satisfactory results.

The general conclusion that has been reached in regard to convict labor is that such labor is capable of producing work of good quality, both in highway construction and in the construction of reinforced concrete bridges, together with low costs and few escapes. It appears to us, however, that such convict labor is more dependent on the quality of its leadership than is free labor and that a convict camp under poor management may easily become a source of great annoyance, of danger to the public, of loss in money and may fail to produce any work of value to the State.

We are inclined in fact to state without reservation that convict labor may be made a source of profit to the State. That such labor can be so led as to produce the best quality of work, that a convict camp may be so managed as to be reasonably contented, cleanly, healthful and of assistance to the men in improving their moral and mental condition and furthermore that whenever convict labor fails to achieve such results, the methods and personnel of the management should be held accountable for such failure rather than the quality of the labor that is used.

This broad statement is not intended as a personal criticism of

anyone who may fail to obtain satisfactory results in the control of prison camps. As a matter of fact there are relatively few men who are gifted with the quality of leadership required in handling this class of labor and somewhat different qualities are required in dealing with a mass of prison labor than with the average free labor camp.

It is only fair to state, however, in this connection that the mental endowment and training of the average convict laborer is somewhat below that of the average free laborer and that speaking generally, convict labor may not be developed so as to give the most satisfactory results in the handling of high class machinery or in the control of other laborers. In order to obtain satisfactory results, it has been found advisable to employ paid labor on such machinery as is in use on bridge and highway work and to employ paid labor exclusively for Foremen.

By considering the results obtained in the State of Arizona covering a period of nine years, we would feel warranted in stating that the cost of work done by convict labor under our laws has been approximately two-thirds the cost of similar work under the day labor system. In comparing work done by paid labor under our organization with work done under contract, we are inclined to the opinion that work may be done by prison labor for about two-thirds the cost of the same work under the contract system provided the contractor carries on his work in an equally satisfactory manner and that his bid is a reasonable one, satisfactory to himself.

There is no doubt that the moral and physical tone of the men employed on State highways has been much improved by taking them away from the surroundings of the State Prison and keeping them actively employed in the open on work that is interesting, more or less arduous and healthful in its nature. The benefits derived along these lines by the prisoners themselves are worthy of consideration and undoubtedly can be increased to a great extent.

In this connection too much importance cannot be placed upon keeping prison labor constantly employed either in some form of useful work or some form of healthful recreation. Each prison

camp in Arizona has, as a part of its regular equipment, baseball bats, balls and such facilities in the way of a baseball field and stands as it may be possible to provide, also such games as chess, etc., that tend to develop and improve their mental qualities, and in addition a small library with suitable magazines, books, etc.

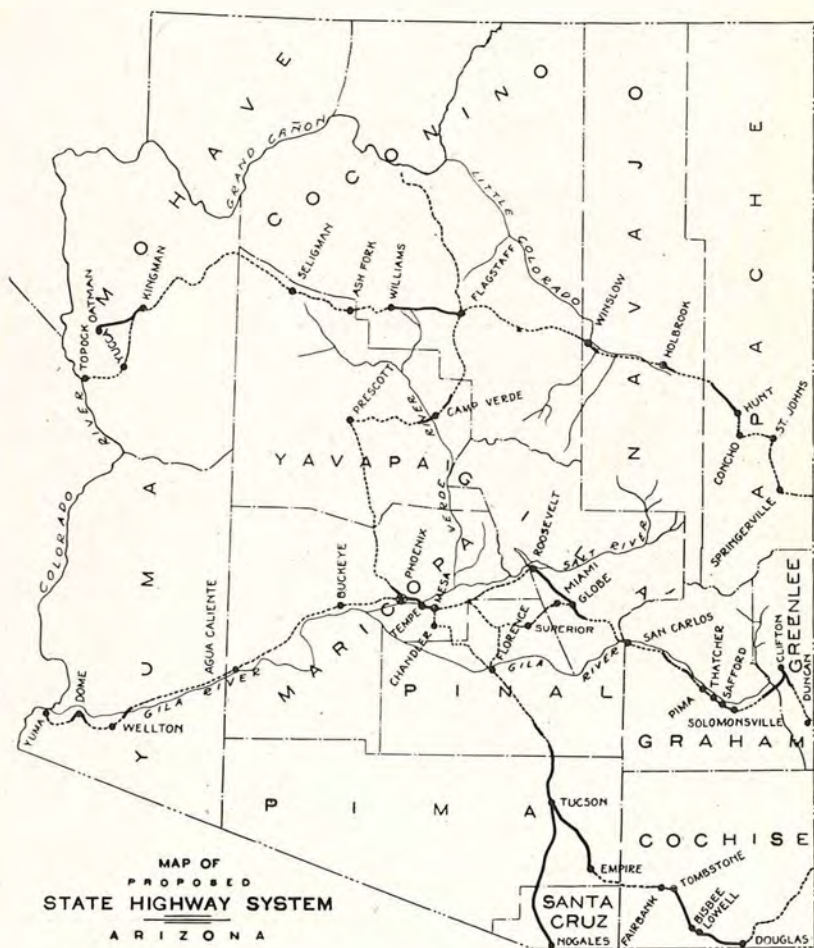
The importance of providing proper recreation is so great, we are inclined to the opinion that when recreation cannot be furnished the men, they should be assigned to different forms of work on different days in order to vary the monotony of their employment. Personally, we do not hesitate to say that it is better to insist on long hours of employment than to allow idleness without proper amusements. It need hardly be said in this connection, that the amusements should be insisted upon in a regular manner quite as much as the work.

In closing this article we wish to call attention particularly to the importance of arranging for some systematic reward for the convict laborer who performs his work to the complete satisfaction of the men in charge. This reward may be either in the form of scrip that can be exchanged for fruit, candy or such other things as may be available at the commissary or it may be in the form of a reduction to the length of his sentence or possibly in the form of funds held in trust for the benefit of the convict himself or his dependents.

It is important that the reward should be of such a nature that those convict laborers who co-operate with the management of the camp shall clearly appear to benefit from such reward more than their fellows who fail to render the service and obedience required. In Arizona the Superintendent or Engineer in charge of the Prison Camp makes a report to the State Engineer at the end of each month recommending for parole or commute those whose services have been such as to entitle them to this reward. The State Engineer in turn makes his recommendation to the Governor and the Parole Board.

In conclusion, we would urge upon all those contemplating the use of prison labor that they should visit some properly conducted

camp operating with such labor. They should be prepared for many disappointing instances in connection with its employment and much harsh criticism from those not familiar with all the facts. We feel certain, however, that taking the average results over a period of years they will find that it is no mistake to endeavor to use this prison population as far as it is available for public work.



APACHE COUNTY

Board of Supervisors

1916

L. R. GIBBONS

E. P. HOWELL

JOHN C. HALL

1917

HEBER JARVIS

W. A. SAUNDERS

JOHN C. HALL

Milky Wash-Beaver Dam Section

This section, constructed during 1915, together with four miles west of the Milky Wash bridge, constructed by the county has been maintained in good condition.

The section from the Milky Wash bridge west to the Navajo County line, four miles, was constructed under county supervision, and owing to the small openings installed, one serious washout occurred approximately one mile west of the Milky Wash Bridge. A standard paving 100 feet long is recommended at this point.

Owing to the small fund available, no construction work was contemplated during the year 1916. It is recommended that the section immediately west of the Milky Wash bridge be surfaced with gravel 8 inches deep loose measurement to a width of 16 feet, and also the section from the steel bridge near Hunt to that portion already surfaced east of the Beaver Dam bridge. Good gravel can be had for both sections.

The Holbrook-St. Johns Milky Wash Division has been maintained in good condition during the period.

Application has been made to the office of Public Roads and Rural Engineering, for Federal Aid on the section, from 2 miles

North of Hunt to the town of Concho, and location survey begun on same June 30, 1918, and will be completed within 15 days.

The location survey is for a graded earth road of 20 foot width, properly drained, and surfaced 16 feet wide with gravel 8 inches deep.

Total expenditures for period, and total costs of projects completed during period:

HOLBROOK-ST. JOHNS HIGHWAY

Milky Wash-Beaver Dam Section:

Engineering, 1916-17.....	\$	19.43	
Construction, 1916-17.....		37.86	
Additional cost	\$	57.29	\$ 57.29

County General Expense:

Division Engineer, 1916-17.....	\$	16.93	\$ 16.93
General Equipment, 1916-17.....		33.75	
General Equipment (credit) 1917-18.....		51.25	17.50
			\$ 34.43

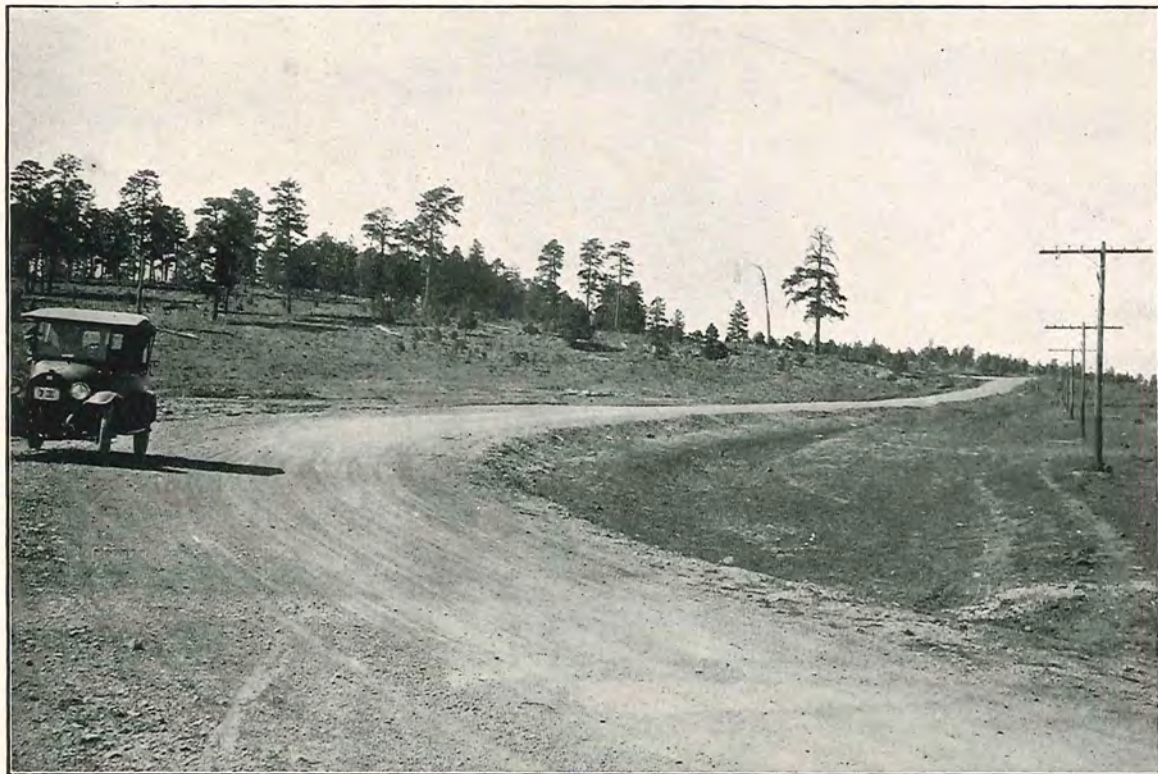
Maintenance:

County General, 1916-17.....	\$1,391.31	
Milky Wash-Beaver Dam, 1917-18.....	1,704.76	
		\$3,096.07

Note:—Figures shown in black are credit accounts.



COCONINO COUNTY
Kingman-Oatman Highway



COCONINO COUNTY
Flagstaff-Williams Highway—Gravel Surfacing

COCHISE COUNTY

Board of Supervisors

1916

J. M. SPARKS

VANCE M. JOHNSON

JOHN ROCK

1917

V. M. JOHNSON

J. M. SPARKS

JOHN ROCK

Bisbee-Tombstone Highway

The Bisbee-Tombstone Highway when completed will be one of the best highways in the State and forms a very important link in the Borderland Highway. The construction work has been done by prison labor. This work was begun under the direction of Mr. J. C. Ryan, Division Engineer, and prosecuted by him until March, 1918, when the work was taken over by Mr. R. C. Perkins as Division Engineer. Under an arrangement in effect between the office of the State Engineer and the Board of Supervisors of Cochise County all prisoners convicted of misdemeanor acts (violation of the Prohibitory law, vagrancy, petty larceny, etc.) are turned over to the State Highway Department for use in construction of the State Highways. The camp has been in charge of J. B. Chadwick as General Foreman and C. W. Douglas as Assistant Engineer.

The highway has been constructed 20 feet wide, with especial attention to the proper drainage. The country through which this highway traverses is mountainous with a very quick run-off. The rainfall during certain seasons of the year is very heavy and destructive to highways. The roadway is surfaced with Caliche (a lime and gravel conglomerate) from six to twelve inches in thickness. This surfacing is a very excellent material when properly applied and is even better in some respects than crushed rock, due to its cementing qualities. The clearing of the right-of-way one hundred feet wide was through heavy mesquite at a cost of \$14.00 per acre. The average cost for embankment was 7c per cubic yard and excavation for loose rock and earth cost 26c per cubic yard.

Sections 3 and 4

Section 3 was completed during November 1917, a distance of 5.99 miles at an average completed cost of \$9,379.46 per mile.

Work was started immediately on Section 4, which includes the remaining 8.8 miles to Tombstone. At this time, June 30, 7.3 miles of this section has been completed leaving only 1.5 miles on the Tombstone end to be completed. It is expected the highway will be completed including all the drainage by November 1st.

Government Draw

About 10 miles from Tombstone the highway crosses a large wash carrying a heavy flow of flood water during the rainy season. The wash has a quick run-off due to the very heavy gradient of the adjacent territory. The traffic is rarely interrupted for more than an hour or two due to the flood waters at this point. For this reason it was deemed inadvisable to construct a bridge at this location which would not only involve a large expenditure, but did not seem justified and might cause considerable trouble if insufficient water way was provided. Accordingly it was decided to put in a dip or paving by building two concrete side walls 230 feet long on either side of the highway and the roadway paved with caliche rolled and tamped to grade. Several floods have passed over this crossing since this section was completed with no damage to the highway, which seems to confirm the idea of the economy of the construction used.

On the mountain section some projecting rocks indicated signs of sliding into the roadway due to weathering. These have all been removed. On sharp curves additional work has been done to improve the view and remove the danger incidental to short sights ahead.

Emerald Gulch Bridge

Near Tombstone the highway crosses Emerald Gulch where a 75-foot span Luten Arch bridge will be constructed, plans for which have already been prepared and construction will soon be under way. The roadway across the bridge will be twenty feet. All

sand and gravel can be secured from the gulch nearby and the expense of hauling will be small. This bridge will also be built by prison labor.

The grading on the last 1.5 miles will be heavy.

When this highway is completed, the distance between Bisbee and Tombstone will be shorter by 2 miles and all the former heavy grades will be avoided.

The maintenance on the completed sections has been efficiently done and this promises to be a first-class highway comparing favorably with any in the State.

Total expenditures for period, and total costs of projects completed during period:

Whitewater River Bridge:

Engineering, Previous Report.....	\$ 665.71	
Engineering, 1916-17.....	418.83	\$ 1,084.54
<hr/>		
Construction, Previous Report.....	\$ 11,947.81	
Construction, 1916-17.....	417.76	\$ 12,365.57
<hr/>		
Completed Cost.....		\$ 13,450.11

Bisbee-Tombstone, Section 1:

Construction, 1916-17.....	\$ 94.71	
Total, Previous Report.....	81,552.37	
<hr/>		
Completed Cost.....		\$ 81,647.08

Bisbee-Tombstone, Section 2:

Engineering, 1916-17	\$ 1,355.25	
Engineering, Previous Report.....	4,231.68	\$ 5,586.93
<hr/>		
Construction, 1916-17 (credit).....	\$ 329.71	
Previous Reports.....	44,020.62	\$ 43,690.91
<hr/>		
Completed Cost.....		\$ 49,277.84
Previous Report.....		\$ 47,367.39
<hr/>		
Additional Cost.....		\$ 910.45

Bisbee-Douglas:

Additional Construction, 1916-17.....	\$ 234.60	
Additional Cost.....		\$ 234.60

Bisbee-Douglas Reconstruction:

Engineering, Previous Report.....	\$ 191.58	
Engineering, 1916-17.....	2,585.91	
Engineering, 1917-18	1,229.05	\$ 4,006.54
Construction, 1916-17.....	\$ 7,773.19	
Construction, 1917-18.....	51.75	7,824.94
Completed Cost.....		\$ 11,831.48

Bisbee-Douglas—West:

Engineering, Previous Report.....	\$ 790.49	\$ 790.49
Construction, Previous Report.....	11,255.54	
Construction, 1916-17 (credit).....	12.20	11,243.34
Completed Cost.....		\$ 12,033.83

Bisbee-Tombstone, Section 3:

Engineering, 1916-17.....	\$ 742.08	
Engineering, 1917-18.....	1,760.05	\$ 2,502.13
Construction, 1916-17.....	\$ 27,925.89	
Construction, 1917-18.....	31,584.31	59,510.20
Completed Cost.....		\$ 62,012.33

Bisbee-Tombstone, Section 4:

Engineering, 1917-18.....	\$ 1,415.93	
Construction	45,874.33	
Work in Progress.....		\$ 47,290.26

Emerald Gulch Bridge:

Engineering, 1917-18.....	\$ 112.00	
Work in Progress		\$ 112.00



MARICOPA COUNTY
Prescott-Phoenix Highway



MARICOPA COUNTY
Prescott-Phoenix Highway. Grand Ave. Division

General Expenses:

General Expense, 1916-17.....	\$	96.97	
General Expense, 1917-18.....		246.08	\$ 343.05
<hr/>			
General Equipment, 1917-18.....	\$	216.23	
1917-18 (credit).....		2,693.31	2,477.03
<hr/>			
Total (credit)			\$ 2,134.03

Maintenance:

Total County, 1916-17.....	\$	4,197.20	
Bisbee-Douglas, 1917-18.....		7,048.10	
<hr/>			
Bisbee-Tombstone, Secs. 1 and 2, 1917-18.....			\$ 13,168.27

COCONINO COUNTY

Board of Supervisors

1916

L. E. HART

R. T. BROWN

C. T. WOOLFOLK

1917

CHAS. T. WOOLFOLK

L. E. HART

FRED GARING

Flagstaff-Williams, Section 1

This section was surfaced from Station 86 to Station 98, and from Station 111 to Station 161, a total distance of 6200 lineal feet, at a cost of \$892.50. Surfacing material consisted of volcanic cinders. This section has been maintained in first class condition.

Flagstaff-Williams, Section 2

Grade on this section was constructed from Station 163 to Station 342, a distance of 17,900 feet, at a cost of \$19,356.01. This section was surfaced with volcanic cinders to a depth of 8 inches from Station 161 to Station 217, a distance of 3600 feet, and with the same material to a depth of 4 inches from Station 217 to Station 256, a distance of 3900 feet. The road has been maintained in good condition during the year.

Flagstaff-Williams, Section 3

Construction of Flagstaff-Williams Section 3 was begun in June, 1917, under Mr. Lamar Cobb, State Engineer. It was planned to construct a graded earth road, well drained, 20 feet wide with surfacing 18 feet wide and 8 inches deep, a distance as far as the available funds would justify. The grade was completed a distance of 3700 feet at a total cost of \$6823.52. On June 15th Mr. Thomas Maddock was appointed State Engineer, by Governor Campbell, and some changes were made in the plans.

On August 20th, 1917, Mr. F. R. Goodman resigned his position as Division Engineer, and Mr. Ben Pearce was appointed as General Foreman, to assume the duties of the Division Engineer and General Foreman as well. The project was completed on December 9th, 1917, at a cost of \$51,254.68 for grading 10 miles. Surfacing was omitted on the major portion of this work.

Flagstaff-Winslow

This section, between Canon Padre and Canon Pablo has not been improved during the year, due to lack of funds. It has become very rough in places, owing to the earth having blown and washed off the limestone ledges, which are numerous.

It appears that the best and most permanent solution of keeping this section in good condition would be to put crushed stone across these ledges. An abundance of rock is available immediately adjacent to the road, and by using the screenings for the top dressing, it is believed a lasting road bed can be obtained.

Flagstaff-Williams Section 3-A

Construction was begun on this section June 6, under Mr. B. M. Atwood, State Engineer, with Division Engineer F. R. Goodman again in charge, and construction work is under way at this time.

This section will consist of grading four miles of earth road immediately east of the town of Williams, surfacing same, and repairing, draining properly, and surfacing the section built in 1917.

Total expenditures for period, and total costs of projects completed during period:

Flagstaff-Williams Section 1:

Engineering, previous Cost	\$ 1,426.89	\$ 1,426.89
Construction, Previous Report.....	17,022.24	
Construction, 1916-17.....	892.50	17,914.74
Completed Cost.....		\$ 19,341.63

Flagstaff-Williams Section 2:

Construction, 1916-17	1,889.13	
Construction, 1916-17.....	18,317.80	
Completed Cost.....		\$20,206.93

Flagstaff-Williams Section 3:

Engineering, 1916-17.....	\$ 742.08	
Engineering, 1917-18.....	2,037.19	\$ 2,779.27
Construction, 1916-17.....	\$ 12,598.48	
Construction, 1917-18	38,773.02	51,371.80
Total for Period.....		\$ 54,150.77
Accrued Costs, payable 1918-19		13.33
Completed Cost.....		\$ 54,164.60

Flagstaff-Williams Section 3-A:

Engineering, 1917-18.....	\$ 333.57	
Construction, 1917-18.....	13,875.36	
Total for Period.....		\$ 14,208.93
Accrued Construction Costs.....		11,865.11
Work in Progress.....		\$ 26,074.04
Less Inventories.....		15,898.20
Net Work in Progress.....		\$ 10,175.84

Flagstaff-Winslow Section 1.

Engineering, 1917-18.....	\$ 28.00	
Work in Progress.....		\$ 28.00



MARICOPA COUNTY
Prescott-Phoenix Highway—Grand Ave. Division

General County:

General Expenses, 1916-17.....	\$ 532.25	\$ 532.25
General Equipment, 1916-17 (credit).....	24.20	
	<hr/>	
General Equipment, 1917-18 (credit).....	19.50	43.70
		<hr/>
		\$ 488.55

Maintenance:

General County, 1916-17.....	\$ 555.40	
Flagstaff-Williams Section 1, 1917-18.....	274.70	
Flagstaff-Williams Section 2, 1917-18.....	220.51	
Flagstaff-Williams Section 3, 1917-18.....	792.58	
Flagstaff-Winslow Section 1, 1917-18.....	178.00	
	<hr/>	
		\$ 2,021.19

GILA COUNTY

Board of Supervisors

1916

W. B. NASH

FRANK L. DORAN

PATRICK ROSE

1917

PATRICK ROSE

FRANK L. DORAN

E. C. TAYLOR

Globe-Roosevelt Highway, Section 1

Some work was done on the construction of Section 1 of the Globe-Roosevelt Highway, east of Pinto Creek during the period extending from July 1, 1917, to June 30th, 1918.

During the administration of Mr. Thomas Maddock, State Engineer, about 0.8 of a mile was resurfaced, owing to the bad condition of the road bed. In addition a section of 1½ miles long was constructed with a 20-foot road bed surface 6 inches with sand from Campaign wash. The apparent expectation was that traffic would force it into the clay road bed and form a resultant sand-clay sur-

face. This expectation was not fulfilled and it has since been necessary to scarify the entire portion so surfaced.

The remaining 3 miles of this section was constructed under the supervision of Assistant Engineer J. W. De Souza during the period extending from January 1st to June 30, 1918. Owing to the eroded nature of the country, being traversed by numerous washes, it became necessary to use a large number of drainage openings. The cost of the drainage structures almost equaled the cost of grading. The construction involved some changes in the original alignment effecting many improvements which resulted in shortening the mileage. The average haul for supplies was about 30 miles and the water haul about 6 miles. Sand was secured from washes with an average haul of five miles.

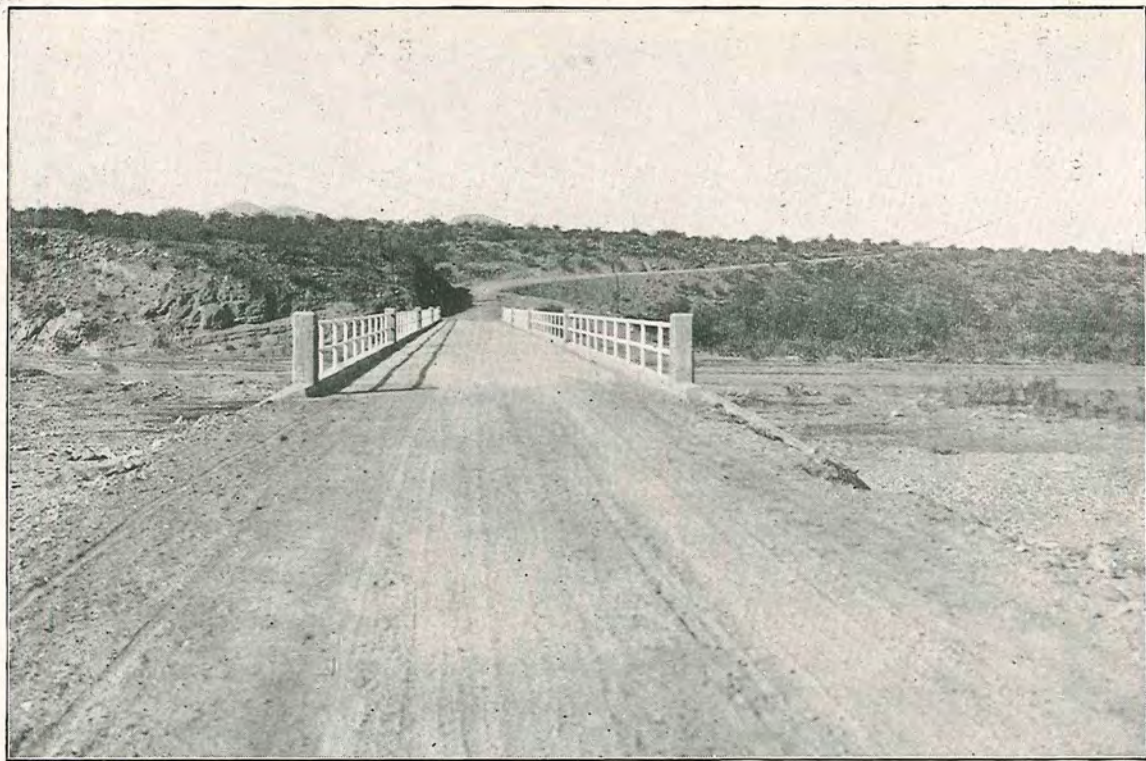
Globe-Roosevelt Highway, Section 2

This work consists of two separate revisions of the Globe-Roosevelt Highway, each of them being built from one central camp located at Burch.

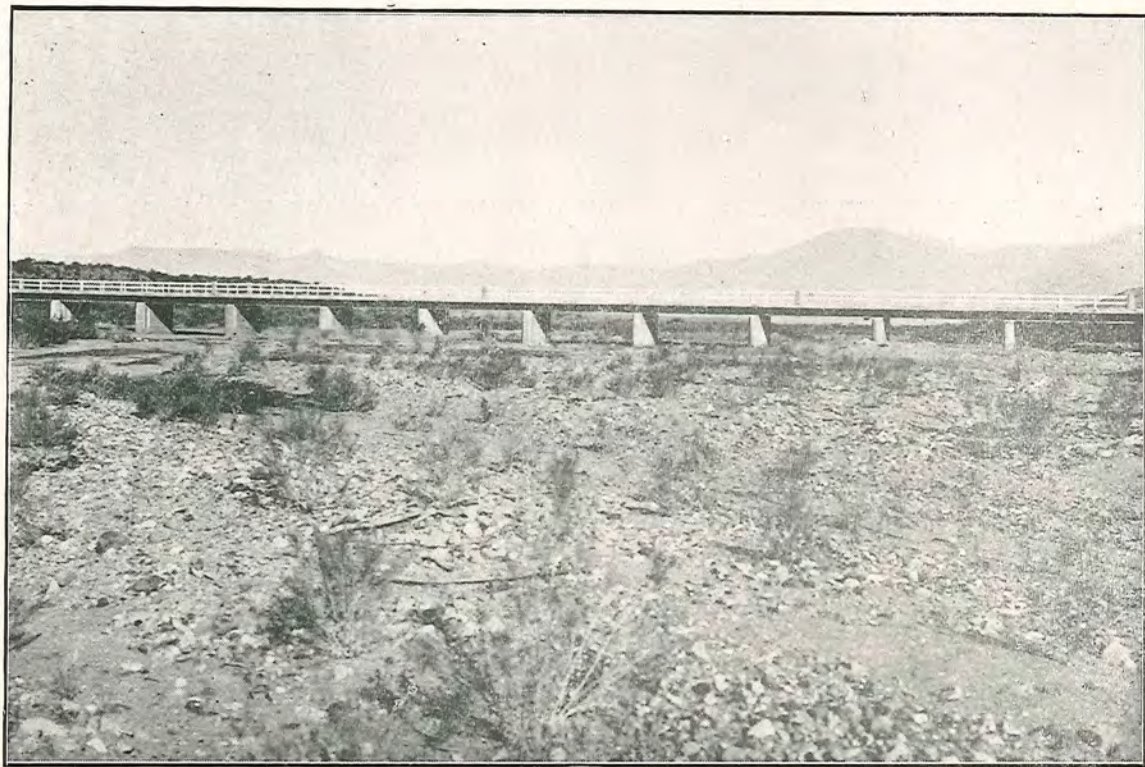
The first revision, being located at the junction of the State Highway with Globe-Miami Highway, is designated as the Junction-Revision. This revision is shorter than the old road by 800 feet, and the new alignment places the highway away from the flood danger. The old road was entirely washed away by past floods.

Right of way for this revision was donated by the Inspiration Consolidated Copper Company.

The second revision designated as the Burch Revision, extends from the Miami Copper Company's pumping plant at Burch to a tie with the previous road west of the junction of Pinal Creek and Miami Wash. The main feature of this revision is a 290 foot pile trestle across Miami Wash. In the past all traffic across this wash had been held up during the frequent floods. The only objectionable feature of this revision is the continuance of a grade crossing over the tracks of the Arizona and Eastern Railway. A higher line, which called for an overhead crossing of these tracks was



GILA COUNTY
Pinto Creek Bridge—Globe-Roosevelt Highway



GILA COUNTY
Roadway—Pinto Creek Bridge—Globe-Roosevelt Highway

considered but abandoned on account of prohibitive grades and expense. Right of way for this revision was donated by the Arizona Eastern Railroad and the Inspiration Consolidated Copper Company.

Work was commenced July 1, 1916 and completed October 31, 1916 by J. W. De Sousa, Assistant Engineer, under the direction of F. G. Twitchell, Division Engineer.

A 30-ton combination steam shovel and pile driver was rented from the Inspiration Consolidated Copper Company for the driving of piling at Miami Wash Trestle.

Maintenance

In addition to the above construction expenditures the sum of \$1,713.58 has been expended on maintenance on the Globe-Roosevelt and Globe-San Carlos Highways. The maintenance work on the Globe-San Carlos Highway consisted only of dragging, while on the Globe-Roosevelt Highway several changes were made in alignment and increasing sight distances ahead.

At the time of making this report the camp is engaged in moving solid rock to flatten two curves and making a channel change to protect the fill. This work is located two miles beyond Murray's on the Globe-Roosevelt Highway.

Pinto Creek Bridge

One of the principal highways of Gila County extends from the City of Globe to the Roosevelt Dam, a distance of about 36 miles, and forms the connecting link between Globe and the rest of the State.

On the Roosevelt end of this highway a connection is made with a highway running along the foothills of the Mazatal range, up the Tonto river, and forming an outlet to the Verde country, the Grand Canyon and the whole northern portion of the State. A connection is also made at Roosevelt with the Apache Trail leading to the Salt River Valley and the entire southern portion of the State. About 25 miles from Globe this highway crosses Pinto

Creek, a stream carrying a large volume of water, making it impassable at times for several days.

In April, 1917, the State Highway Department undertook the improvement of this crossing by the construction of a reinforced concrete highway bridge.

The bridge consists of 11 spans of a 2-girder T beam deck bridge. The spans are 32 ft. 6 in. center to center of piers and has a clear roadway of 18 feet. The bridge is provided with a 2-inch pipe hand rail and is 357 ft. 6 in. from end to end.

In view of the many large boulders contained in the bed of the wash, it was not deemed necessary, nor was it feasible, to attempt to sink foundations to a solid rock bearing. As the wash bed is gradually filling, it having risen 2 ft. 6 in. in the past three years, the structure was given a clearance of 9 ft. 6 in. from girder to stream bed.

Owing to the unsettled market conditions prevailing during the construction of this bridge, delays in securing delivery of materials and equipment have greatly retarded the proper prosecution of the work.

The approaches to the bridge were riprapped with rubble stone for a distance of 1150 lineal feet and cost \$2,030.00. The foundations were built of 1:3:6 concrete and contained 665 cubic yards. The cost of placing this concrete including excavation was \$8,373.00 or a unit cost of \$12.60 per cubic yard. The concrete in the beams, floor slab and curb was made in the proportion of 1:2:4 Portland Cement concrete. The superstructure contained 316 cubic yards. The cost of building the forms was \$2,977.75. There was used 68,320 pounds of reinforcing steel at a cost of \$5,118.24 including bending and placing. Concrete including materials, cost \$5,110.70, making a cost for the superstructure of \$13,206.69. The supervision and overhead expense, including the camp maintenance, transporting equipment and supplies over long hauls, engineering expense, etc., amounted to \$4,201.12. There was expended a further sum of \$442.19 for approaches to the bridge, making a completed total of \$32,253.00.

This bridge is one of the greatest improvements effected by the State Highway Department in Gila County.

The work was carried on by J. W. De Souza, Assistant Engineer, under the supervision of F. G. Twitchell, Division Engineer to May 15, and J. S. Barlow, Division Engineer since that date.

Total expenditures for period, and total costs of projects completed during period:

Pinto Creek Bridge:

Engineering, 1916-17.....	\$ 391.99	
Engineering, 1917-18.....	691.92	\$ 1,083.91
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Construction, 1916-17.....	\$ 18,878.09	
Construction, 1917-18.....	13,374.91	\$ 32,253.00
<hr/>		
Completed cost		\$ 33,336.91

Globe-Roosevelt, Section 2:

Engineering Previous report.....	\$ 397.44	
Engineering, 1916-17.....	2,094.21	
Engineering, 1917-18.....	6.00	2,497.65
<hr/>		
Construction Previous Report.....	1,436.72	
Construction 1916-17	10,752.61	12,189.33
<hr/>		
Completed cost		\$ 14,686.98

Globe-Roosevelt, Section 1:

Engineering, 1916-17.....	\$ 4,718.00	
Engineering, 1917-18.....	3,531.60	\$ 8,249.60
<hr/>		
Construction Previous Report.....	\$ 1,786.05	
Construction, 1917-18.....	88,048.01	89,834.06
<hr/>		
Total		\$ 98,083.66
Accrued construction costs outstanding..		7,056.27
<hr/>		
Total		\$105,139.93
Less Inventories		19,480.62
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Work in progress		\$ 85,659.31

Globe-San Carlos Section 3:

Engineering, 1917-18.....	\$ 4,285.39	
Work in progress.....		\$ 4,285.39

Superior-Miami Section 1:

Engineering, 1917-18.....	\$ 4,285.39	
Work in progress.....		\$ 4,285.39

County General Expenses:

General Expense, 1916-17.....	\$ 30.08	\$ 30.08
General Equipment, 1916-17 (Credit).....	235.31	
General Equipment, 1917-18 (Credit).....	122.65	\$ 357.96
Total (Credit)		\$ 327.38

Maintenance:

County General, 1916-17	\$ 14,362.87	
Globe-Roosevelt, 1917-18	11,571.77	
Globe-San Carlos Section 3, 1917-18.....	188.33	
Total		\$ 26,122.97

GRAHAM COUNTY

Board of Supervisors

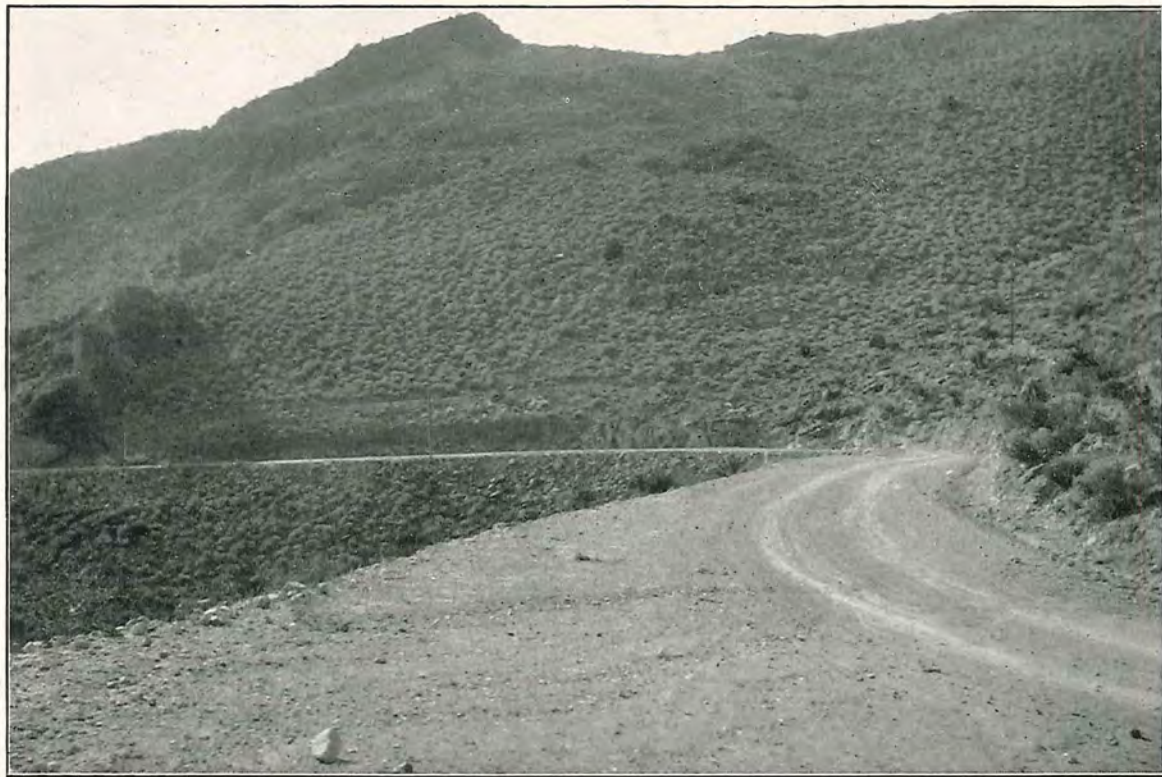
1916	1917
GEO. A. FOOTE	FRANK A. WEBSTER
GEO. A. MATTHEWS	J. R. WELKER
JAMES QUINN	JAMES QUINN

Clifton-Solomonsville Highway Section 3

On August 8th, 1916, a preliminary camp was established for the purpose of building a temporary road three miles long, extending from the old Coronado stage road to the camp site. This camp



MOHAVE COUNTY
Kingman-Oatman Highway



MOHAVE COUNTY
Kingman-Oatman Highway

was located about 12 miles from Solomonsville. Later the camp was established on the mesa at the foot of the grade ascending toward Clifton, at a point about sixteen miles from Solomonsville. There was employed in this camp about 90 convicts from the State Prison at Florence.

The highway traverses a rough, mountainous country of varying rock formations, principally malapai and lava. For this reason much heavy work was encountered, making it necessary to use a large amount of machinery and equipment, including air compressors, drills, and water trucks.

The work progressed satisfactorily during the period October 1st to December 31st, 1916, but much delay was experienced during the following two months on account of frequent snow storms. Work was discontinued on Section 3 on March 24, 1917, and the camp moved to Greenlee County on Section 2. This move was made necessary owing to the shortage of funds in Graham County appropriation.

Section 3 includes two miles of light mesa grading and four miles of heavy mountain work.

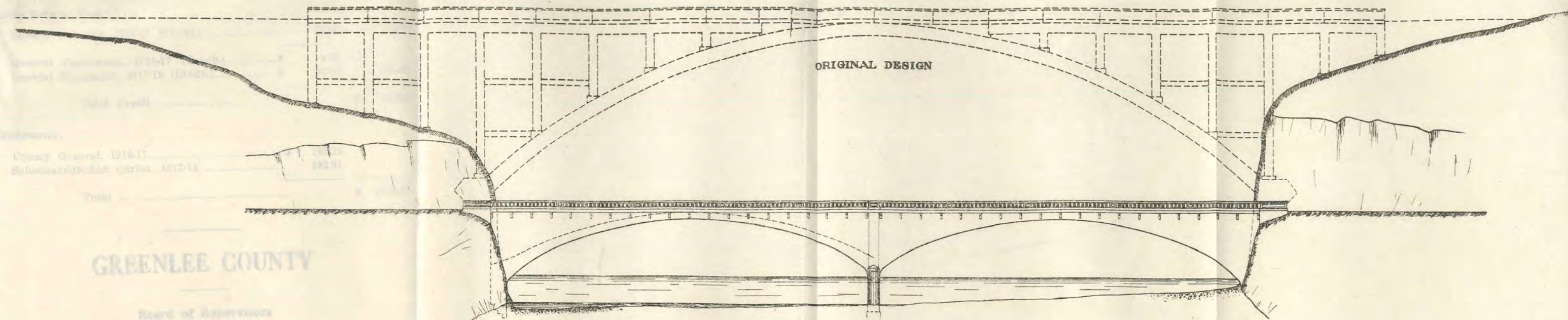
At the close of the period June 30th, 1918, all the mountain section in Graham County had been completed with the exception of one mile. Work on this incompleted portion is now in progress. The section between the end of Section 3 and Solomonsville, a distance of about sixteen miles, should be rebuilt. The highway is expected to be completed through the mountain section by December 1, 1918.

Clifton-Solomonsville Section 3:

Engineering, 1916-1917.....	\$ 4,736.56	
Engineering, 1917-1918.....	919.05	\$ 5,655.61
<hr/>		
Completed cost		\$ 47,972.09

Solomonsville-San Carlos Section 2-B:

Construction, 1916-17.....	\$ 44.03	
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Additional Cost		\$ 44.03



General Commission 1916-17
 General Commission 1917-18 (Continued)

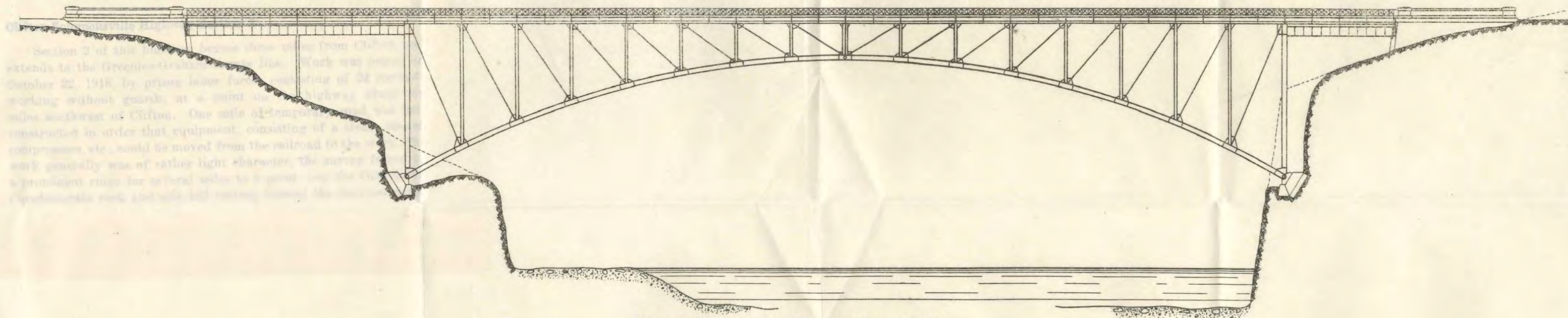
County General 1916-17
 School District 1917-18

GREENLEE COUNTY

Board of Supervisors

1916	1917
K. F. AWALT	W. W. DUTTON
W. W. DUTTON	W. B. MOON
W. F. WITT	W. F. WITT

REVISED DESIGN
 GILA RIVER BRIDGE
 CLIFTON-SOLOMONVILLE HIGHWAY



PROPOSED THREE-HINGE STEEL ARCH
 GILA RIVER CROSSING
 CLIFTON-SOLOMONVILLE HIGHWAY

Section 2 of this highway extends to the Greenlee-Solomonville line. Work was begun October 22, 1918, by placing large logs consisting of 24 logs working without guards, at a point on highway about 1/2 mile southwest of Clifton. One mile of temporary road was constructed in order that equipment consisting of a steam tractor, etc., could be moved from the railroad to the work. The work was of rather light character. The survey is a preliminary one for a final survey to report on the proposed highway.

County General Expense:

General Expense, 1916-17 (Credit).....	70.40	70.40
General Equipment, 1916-17 (Credit).....	\$ 9.40	
General Equipment, 1917-18 (Credit).....	\$ 25.00	104.80
Total Credit	\$	104.80

Maintenance:

County General, 1916-17.....	\$ 768.15	
Solomonsville-San Carlos, 1917-18	293.91	
Total	\$	1,062.05

GREENLEE COUNTY

Board of Supervisors

1916	1917
S. F. AWALT.	W. W. DUTTON.
W. W. DUTTON,	W. H. MOON,
W. T. WITT,	W. T. WITT,

Clifton-Solomonsville Highway Section 2

Section 2 of this highway begins three miles from Clifton and extends to the Greenlee-Graham county line. Work was begun on October 22, 1916, by prison labor forces consisting of 22 convicts working without guards, at a point on the highway about six miles southwest of Clifton. One mile of temporary road was first constructed in order that equipment, consisting of a steam shovel, compressors, etc., could be moved from the railroad to the work. The work generally was of rather light character, the survey following a prominent ridge for several miles to a point near the Gila River. Conglomerate rock and side hill cutting formed the heaviest work.

From the crossing of the Gila River southwesterly to the County line the work was more difficult and heavy rock was encountered.

On March 24, 1917, the camp was moved to the south side of the Gila River and consolidated with the camp then being moved from Section 3. The combined forces aggregated 103 convicts. Work progressed favorably and about five miles of completed road was finished by June 16, 1917.

The construction of the highway was under the administration of Mr. Thomas Maddock, State Engineer, from this date until December 31, 1917. During this period $2\frac{1}{4}$ miles of road were opened up and portions of it were brought to completion. This $2\frac{1}{4}$ miles remains substantially in the same condition in which it was turned over to Mr. Cobb's administration on Dec. 31, 1917.

On January 1, 1918, the work was again taken over under the administration of Mr. Lamar Cobb, State Engineer, and later on February 5, 1918, by Mr. B. M. Atwood as State Engineer. At the end of the fiscal year, June 30th, there remains less than one mile of Section 2 to complete and the section as a whole is 90 per cent complete.

The completion of this project, together with Section 3 in Graham County will make travel possible from Clifton to Solomonsville by this route. In order to provide a satisfactory roadway for the entire distance, however, considerable work is required between the west end of Section 3 and Solomonsville, a distance of approximately 16 miles.

Upon the completion of the work mentioned, this highway should furnish a most important and satisfactory link in our State highway system.

It will provide a route approximately thirty miles shorter than has been available heretofore between Clifton and Solomonsville, together with a most satisfactory roadway.

This road will also be distinguished by exceptional mountain scenery and a notable and beautiful bridge across the Gila river.

Altogether it seems safe to predict that this project will be regarded as a lasting credit to the prison labor employed in its construction.

Gila River Bridge

Where the highway crossed the Gila River on the preliminary location, the roadway grade was 101.5 feet above the bed of the stream. The banks of the stream at this point are walls of Gila conglomerate, precipitous in character, forming a chasm about 265 feet between the walls at low water mark. The bed of the stream is composed of sand, gravel and boulders. Owing to the great height of the roadway grade above the bed of the stream, and the favorable character of the banks of the river, for anchoring the foundations of a bridge in this rock formation, it was decided to construct a single span structure with the necessary approaches. Accordingly in March, 1917, Mr. Lamar Cobb, State Engineer, approved plans for a three-hinge steel arch bridge having a clear span of 312 feet with steel girder approaches, making a total length of 517 feet.

Bids were requested on this proposed bridge. The lowest bid received was about \$95,000.00. Inasmuch as the available funds provided for the building of this structure was but \$60,000.00 it became necessary to reject the proposals submitted and postpone the construction for a time.

Due to the disturbed industrial conditions incidental to the European war, the price of structural steel advanced rapidly. It therefore became necessary to wholly abandon the idea of constructing a steel bridge at this time. In September, 1917, under the administration of Mr. Thomas Maddock, State Engineer, a design for a reinforced concrete bridge for this location was prepared by Mr. R. V. Leeson, a designing engineer of Topeka, Kansas. Plans were prepared by him for a single span concrete arch bridge, 270 feet long with concrete trestle approaches the estimated cost of which was \$90,000.00. Before any definite action could be taken on these plans another change in the administration of this office took place. In March, 1918, at the request of Mr. B. M. Atwood, State Engineer, Mr. Leeson submitted a revision of the original plans for a concrete arch bridge, using a lower level for the grade

line of the proposed crossing. These revised plans were adopted and the construction is now under way. Prison labor is being used. The estimated cost of the bridge and approaches is \$50,000.00 and work will be completed January 1, 1919.

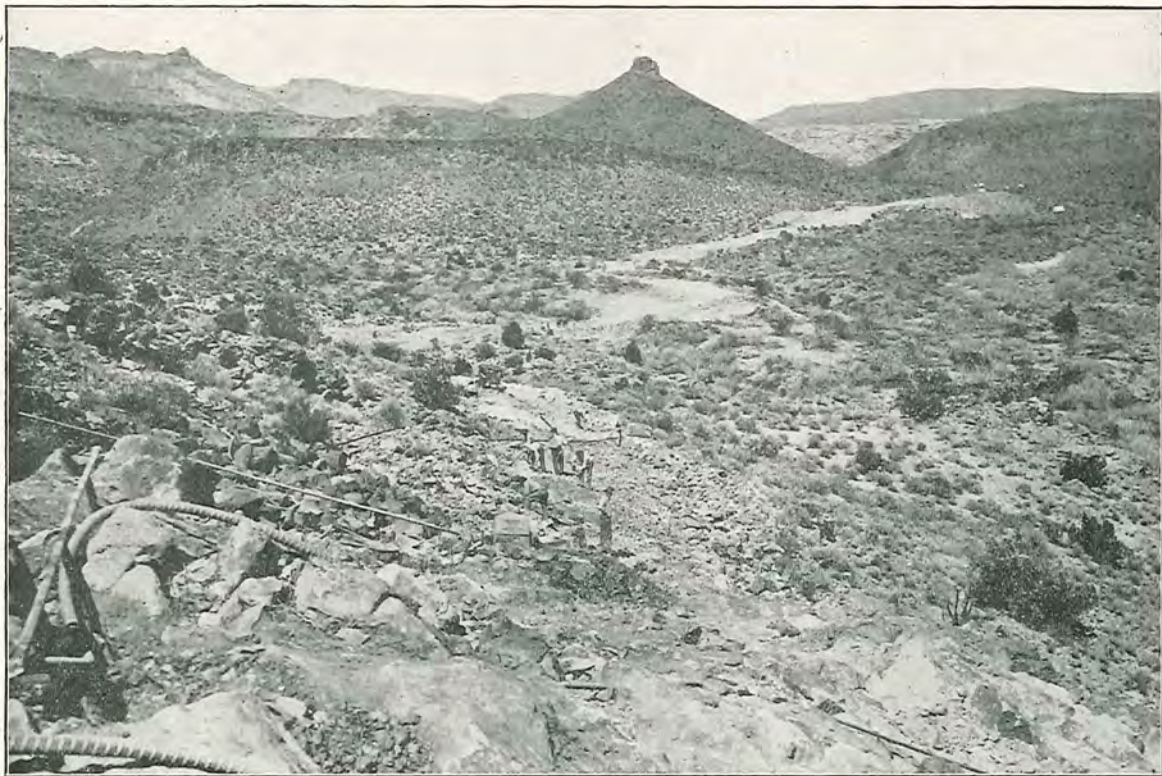
Convict Labor on the Clifton-Solomonsville Highway

The entire Clifton-Solomonsville Highway was constructed by convict labor. In view of the fact that this is considered one of the finest highways in the state, it may form a convenient comparison with highways built by paid labor.

There was an average of between 90 and 100 prisoners at this State convict camp located 10 miles south of Clifton on the Gila River.

The usual prison stockade, 150 feet square enclosed by a barb wire fence 16 feet high, surrounded the camp. On two opposite corners of this stockade were guard towers approximately 25 feet high. At night the fence is lighted by lanterns 30 feet apart. Two tents 18 feet by 50 feet provide the sleeping houses for the prisoners in which there are 2 rows of bunks, 2 tiers high. Sufficient bedding is provided to assure comfort. The dining tent is 18 feet by 50 feet in which 2 long tables accommodate 100 persons. The kitchen and barber shop adjoin this tent. Substantial food, including meat, vegetables and fruits provide the rations.

The prisoners are transported to and from the work on auto trucks. At the present time the men are working in the mountains about 11 miles from camp. It requires about an hour and thirty minutes to make the trip to and from the work. This work is closing the last gap between the construction of the Graham County Section 3 and Greenlee County Section 2. The camp is located near the Gila River where water is available and sanitation most economical. It was deemed advisable not to move the camp nearer the work in the mountains on account of the longer haul on supplies and absence of a water supply, as well as the small portion of the highway in this section remaining to be completed to the Graham County line. The length of the working day is strictly confined to eight hours, this being the legal work day in Arizona for free labor.



MOHAVE COUNTY
Kingman-Oatman Highway



MOHAVE COUNTY
Kingman-Oatman Highway

Most of the work is in heavy side hills which contain on an average of 60 per cent to 80 per cent solid rock. The width of the road bed is 20 feet and the maximum grade is 6 per cent.

It is our opinion that we would not be able to continue this work with paid labor within the present appropriation as labor is very scarce and wages are from \$3.75 to \$5.00 per day. We cannot make a comparison as we have never employed hired labor on this project. The working rate of the prisoners for April, May and June, 1918, are respectively \$3.5013, \$1.8524 and \$2.3220, or an average of \$2.5586.

This includes the general and overhead expenses, such as upkeep, guards, etc. The difference therefore between the average prisoners pay and the cheapest day laborer shows a saving of \$1.25 per man day.

Clifton-Solomonsville Section 1:

Engineering, 1916-17.....	\$	39.52	
Additional cost			\$ 39.52
			<hr/>

Clifton-Solomonsville Section 2 (Prison):

Engineering—Previous Report	\$	343.60	
Engineering, 1916-17.....		6,541.68	
Engineering, 1917-18.....		9,194.75	16,080.03
		<hr/>	
Construction, 1916-17.....	\$	78,923.06	
Construction, 1917-18.....		112,195.64	191,118.70
		<hr/>	
			\$207,198.73
Accrued construction costs outstanding.....			9,191.35
			<hr/>
			\$216,400.08
Less inventories			36,219.55
			<hr/>
Work in progress.....			\$180,180.53

Gila River Bridge:

Engineering, 1916-17.....	\$	2,857.62	
Engineering, 1917-18.....		14.80	
		<hr/>	
Total			\$ 2,872.42

STATE HIGHWAY DEPARTMENT

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Accrued construction costs unpaid.....	9,351.03
	<u>\$ 12,223.45</u>
Deduct inventories	6,931.66
Work in progress	<u>5,291.79</u>
County General Expense:	
General Equipment, 1916-17.....	\$ 36.30
General Equipment, 1917-18 (Credit)	70.00
Total Credit	<u>33.70</u>
Maintenance:	
County General, 1916-17.....	\$ 513.40
Clifton-Solomonville Section 1, 1917-18.....	<u>3,252.90</u>
Total	<u>\$ 3,764.30</u>

MARICOPA COUNTY

Board of Supervisors

1916

FRANK LUKE,
C. WARREN PETERSON,
W. K. BOWEN.

1917

C. W. PETERSON,
W. K. BOWEN,
J. R. BRADSHAW.

Agua Fria Bridge

This bridge is located on the Phoenix-Yuma Highway, 16 miles west of Phoenix. It was completed and open for traffic in December, 1916. The original plans called for the construction of a reinforced concrete deck girder bridge, 1235 feet long, consisting of thirty-eight 32.5 foot spans.

The location survey of the bridge site was made originally in 1915. Active construction operations began in December, 1915.

During the latter part of the same month, the first of the series of unprecedented floods, extending over a period of three months, stopped all construction work and little was done until about April, 1916. The deposit of fine sands and silt several feet deep over the entire river bed, one mile wide, and the excess of water handled in all subsequent excavation, necessarily increased the unit cost in handling material and excavating for foundations. The bridge was finished and opened for traffic in December, 1916, at a completed cost for the bridge proper of \$49,107.03. There was expended the sum of \$1,803.85 for channel work and \$3,773.83 due to storm loss. During the winter of 1916-17 the excessive flood waters washed out the approach on the west end of the bridge. An appropriation of \$22,000 was made by the State Legislature in March, 1917, to rebuild the approaches under the administration of Mr. Thomas Maddock. A timber deflector was constructed across the overflow channel about three-quarters of a mile above the bridge and the earth fill restored at the west end of the bridge. The grade of the fill was not built, however, to the same elevation as the bridge deck. Another very heavy flood came during the summer rainy season. The crest of the flood over-topped the approach fill to the west of the bridge and soon raveled out the embankment. It is believed that had the fill been carried to the same elevation as the bridge deck the approach would have resisted the action of the flood.

Early in 1917 title was acquired by the State Engineer for a right-of-way for a distance of one-half mile above the bridge. The old river bed has been cleared of timber and debris and channel excavations will be made sufficient to divert again the waters of the Agua Fria under the bridge. Under an agreement entered into with the Board of Supervisors of Maricopa County, the approach will be rebuilt to the same grade as the bridge deck and further stream protection work done above the bridge. It is believed when this work is done no further trouble will be experienced at this point so long as the channel is kept cleared of growing timber, and the grade of the approaches maintained to the elevation of the bridge floor. A complete topographical survey has been made to assist in determining the necessary work to be done.

Phoenix-Yuma Highway

Preliminary survey has been made for the construction of the highway extending from Arlington to the County line beyond Agua Caliente. This line practically retraverses the same alignment covered by the reconnaissance survey made during the period of 1914-15, and will connect at the west end with Phoenix-Yuma Section 7 which has been accepted as to project for Federal Aid. This survey is expected to be the basis of a Federal Aid project and upon the completion of which there will be a continuous constructed highway between Phoenix and Yuma. The present highway in some sections is very rough, dusty, full of pot holes and ruts. This construction is a very much needed improvement.

Prescott-Phoenix Highway—Grande Avenue Division

The old frame structure over Maricopa Canal on Grand Avenue has been replaced by a new reinforced concrete slab bridge at a cost of \$2,340.92.

Maintenance

During the past two years it has not been practicable to properly maintain the oiled road extending from the State Fair grounds to Glendale nor that part extending from 16th Street easterly to the Grand Canal of the Phoenix-Tempe Highway.

Both of these sections should have been given a coat of heavy asphalt oil and screenings during this period.

While it has not been possible to give this road this thorough going renewal that was desirable, repairs have been made from time to time by patching the broken places in the surfacing by the use of a small portable kettle of asphaltic oil and screening or pea gravel.

The condition of some portions of the Glendale road however, are so good that the conclusion is easily reached that the type of construction there used is worthy of more general employment.

The condition of that portion of the Phoenix-Tempe highway



MOHAVE COUNTY
Kingman-Oatman Highway



MOHAVE COUNTY
Kingman-Oatman Highway, Showing Roadway After Blasting Away Rock

having the oiled surface is not so satisfactory. The defects on this surface may be attributed to less satisfactory materials.

The portion of the Phoenix-Tempe Highway extending from the Grand Canal to the Tempe bridge has been maintained by dragging, sprinkling and by occasional scarifying.

At times the condition of this roadway has been good but the traffic carried is too heavy for this type of construction.

For this reason plans and specifications have been prepared for laying a concrete pavement 18 feet wide from the Grand Canal bridge to the east end of the east approach of the Tempe bridge.

These plans and specifications have been approved by the U. S. Office of Public Roads and Federal Aid will be granted in the amount of \$38,600.00.

Total expenditures for period, and total costs of projects completed during period:

Agua Fria Topographic Survey:

Engineering, 1917-18.....	\$	225.24	
			\$ 225.24

Agua Fria Bridge and Approaches:

Engineering, Previous Report.....	\$	2,028.84	
Engineering, 1916-17.....		1,935.64	
Engineering, 1917-18.....		423.32	\$ 4,387.80
Construction, Previous Report.....	\$	27,368.20	
Construction, 1916-17.....		43,882.74	
Construction, 1917-18		28,503.71	99,754.65
Completed cost			\$104,142.45

Arlington-Agua Caliente Div.—Phoenix-Yuma Hwy:

Engineering, Previous Report.....	\$	3,409.57	
Engineering, 1916-17.....		208.68	3,618.25
Construction, Previous Report	\$	33,875.32	
Construction, 1916-17 (Credit)		12,052.36	21,822.96
Completed cost			\$ 25,441.21
Previously reported as complete.....			25,301.97
Additional Cost	\$		139.24

STATE HIGHWAY DEPARTMENT

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Grand Avenue Division—Prescott-Phoenix Highway:

Engineering, 1916-17.....	\$ 454.55	
Construction, 1916-17.....	6,262.86	
		<hr/>
Additional cost		\$ 6,717.41

Phoenix-Tempe Highway:

Engineering, 1916-17.....	\$ 80.28	
		<hr/>
Additional cost		\$ 80.28

Phoenix-Yuma Highway:

Engineering, 1916-17.....	\$ 4,859.48	
		<hr/>
Work in progress		\$ 4,859.48

Phoenix-Yuma Highway Section 2:

Engineering, 1916-17.....	\$ 2,656.32	
Engineering, 1917-18.....	974.77	
		<hr/>
Work in progress		\$ 3,631.09

Phoenix-Yuma Highway Section 6:

Engineering, 1916-17.....	\$ 678.22	
		<hr/>
		\$ 678.22

Florence-Mesa Section 2:

Engineering, 1917-18.....	\$ 1,375.19	
Construction 1916-17.....	147.35	
		<hr/>
Work in progress		\$ 1,522.54

Maricopa Canal Bridge—Grand Avenue:

Engineering, 1917-18.....	\$ 56.36	
Construction, 1917-18.....	2,464.78	
		<hr/>
Total		\$ 2,521.14
Less construction credits accrued....		180.22
		<hr/>
Completed costs		\$ 2,340.92

Phoenix-Prescott Highway—Glendale Division:

Engineering, 1917-18.....	\$ 19.00	
Total		\$ 19.00

Phoenix-Tempe Highway Section 2—Reconstruction:

Engineering, 1917-18.....	\$ 1,777.49	
Construction, 1917-18.....	85.50	
Work in progress		\$ 1,862.99

Mesa-Superior Section 1:

Engineering, 1917-18.....	\$ 1,113.14	
Work in progress		\$ 1,113.14
General Expense, 1916-17	\$ 4,260.05	
Depreciation, 1916-17	3,168.36	7,788.41
General Equipment, 1917-1918 (Credit)	\$ 394.36	
General Equipment, 1917-18 (Credit)	476.95	871.31
Total General		\$ 6,917.10

Maintenance:

County General, 1916-17	\$ 5,843.29	
Grand Avenue Division, 1917-18.....	1,318.01	
Phoenix-Tempe Highway, 1917-18.....	9,340.06	
Florence-Mesa Section 2.....	2,452.43	
Tempe-Mesa	22.79	
Mesa-Superior	12.96	
Higley-Florence	33.65	
Agua Fria Bridge	769.46	
Total Maintenance		\$ 19,784.65

MOHAVE COUNTY

Board of Supervisors

1916

O. E. WALKER,

W. B. STEPHENS,

I. M. GEORGE.

1917

W. B. STEPHENS,

C. W. LYNCH,

L. H. FOSTER.

Kingman-Oatman Section 1:

Construction work on this project was begun March 1, 1916, and during the fiscal year ending June 30, 1916, one and one-quarter miles of road were completed at a cost of \$21,547.09. Work was completed September 7, 1916, at a total cost of \$36,661.42, the distance being 2.24 miles. Inability to get local teams, delay in receiving equipment, the high price of teams and labor, together with the hot weather, which reduced the efficiency of both men and teams, are items to consider in comparing the costs of this project with others.

Kingman-Oatman Section 2:

Construction on this project was started at Station 101 on December 10, 1917, with Mr. Ben Pearce, general foreman.

On December 27, 1917, Mr. Lamar Cobb was appointed State Engineer to succeed Mr. Thomas Maddock and January 1st, Mr. F. R. Goodman took charge of this project as division engineer. At the time this work was taken over by Mr. Goodman the road had been completed to Station 103, and additional work opened up to Station 107, at a cost of \$5,345.34. This project was completed May 31, under the administration of Mr. B. M. Atwood, State Engineer, at a cost of \$44,378.60.

Kingman-Oatman Section 3:

Application was made to the Office of Public Roads and Rural Engineering for Federal Aid to apply on the road between the towns of Gold Road and Oatman and location survey was made for a graded road, the distance being about two and a half miles.

Kingman-Needles:

This section comprises two divisions: Yucca-Drake Division and the Yucca-Topock Division. The country traversed by both divisions is desert and for the greater part of the year very dry, making maintenance a difficult problem. Although considerable sums have been spent on both portions of this highway for repairs, it is not practicable to maintain these highways as at present constructed.

Total expenditures for period, and total costs of projects completed during period:

Kingman-Oatman Highway

Engineering, Previous report	\$ 1,872.90	\$
Engineering, 1916-17	488.02	2,361.82
<hr/>		
Construction, Previous report	\$ 26,629.69	
Construction, 1916-17	25,691.61	52,321.30
<hr/>		
Completed cost		\$ 54,683.12
<hr/>		

Kingman-Oatman Sect. 2

Engineering, 1916-17	\$ 1,345.98	\$
Engineering, 1917-18	1,789.87	3,135.85
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Construction, 1917-18	\$ 22,739	22,739.39
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Total		\$ 25,875.54
<hr/>		
Accrued construction charges unpaid.....		21,644.52
<hr/>		
Completed cost		\$ 47,519.76
<hr/>		

Kingman-Oatman Sect. 3

Engineering, 1917-18	\$ 952.05	
<hr/>		
Work in progress		\$ 952.05
<hr/>		

Oatman-Topock

Engineering, 1917-18	\$ 89.05	
<hr/>		
Work in progress		\$ 89.05
<hr/>		

Kingman-Needles

Construction, 1917-18	\$ 2,914.44	
Completed cost		\$ 2,914.44

County General Expense

General Equipment, 1916-17, Credit.....	\$ 37.90	
Total, Credit		\$ 37.90

Maintenance

County, General, 1916-17	\$ 550.97	
Kingman-Topock, 1917-18	494.19	
Kingman-Needles-Yucca, 1917-18	124.50	
Kingman-Oatman, Sec. 1, 1917-18	962.49	
Total		\$ 2,132.15

NAVAJO COUNTY**Board of Supervisors**

1916

R. C. CRESWELL,
Q. R. GARDNER,
GEO. W. HENNESSEY.

1917

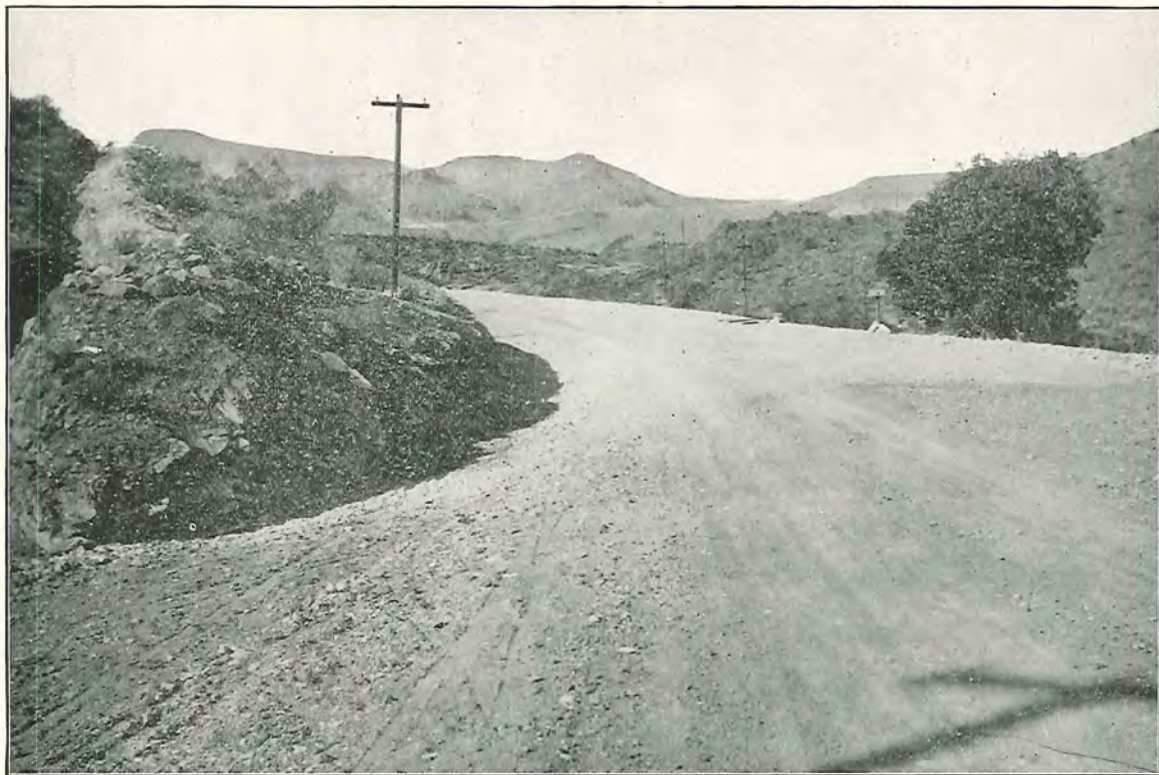
R. C. CRESWELL,
JOHN A. FREEMAN,
C. E. OWENS.

Winslow-Holbrook Section 2:

Construction on this section was completed a distance of 1500 feet, including surfacing with gravel to a depth of 8 inches, at a total cost of \$1,981.70. This section has been maintained since January 1st, 1918 in good condition. It was found necessary to resurface a part of this section, and at a greater expense than had the work been kept up continuously.

Winslow-Holbrook Section 3:

This section was completed a total distance of 4400 feet, includ-



MOHAVE COUNTY
Kingman-Oatman Highway



MOHAVE COUNTY
Kingman-Oatman Highway

ing surfacing with gravel to a depth of 8 inches, at a total cost of \$9,065.57. This work was done during winter, and the extremely cold weather, with snow storms, caused extra time and labor, which increased the cost. This section has been maintained in good condition.

Holbrook-St. Johns Section 1:

This section, extending from the town of Holbrook east for four miles has been repaired and maintained from time to time since January 1, 1918. On account of the fact that little attention had been given to maintenance prior to this date, it has been necessary to resurface about three-fourths of a mile. This work is under way at this time and two small concrete bridges are also under construction.

The construction of the Holbrook-St. Johns Highway Section 3 will result in a continuous mileage sufficient in length to justify a maintenance crew of proper organization to keep the entire mileage up to the standard of our other state roads.

Holbrook-St. Johns Section 3:

Application was made to the Office of Public Roads and Rural Engineering for Federal Aid to apply on this section, which extends through the Petrified Forest and is one of the worst pieces of road in Navajo County. Location survey was completed June 29, 1918 for a graded roadway twenty feet wide to be surfaced with gravel six inches deep.

Winslow Holbrook Sect 2

Engineering, Previous report	\$ 1,172.20	
Engineering, 1916-17	120.59	
Engineering, 1917-18	28.00	\$ 1,320.79
<hr/>		
Construction, Previous report.....	\$ 12,616.35	
Construction, 1916-17	2,771.07	\$ 15,387.42
<hr/>		
Completed cost		\$ 16,708.21

Winslow Holbrook Sect. 3

Engineering, 1916-17	\$ 428.18	\$
Construction, 1916-17	9,203.53	\$ 9,631.71
<hr/>		
Complete cost		9,631.71

Little Colorado River Bridge

Engineering, 1916-17	\$	2.63	\$
Construction, 1916-17		3.09	
<hr/>			
Additional cost		\$	5.72

Holbrook St. Johns Sect. 1

Engineering, Previous report	\$	573.06	\$
Engineering, 1916-17		49.46	
Engineering, 1917-18		17.00	639.52
Construction Previous report	\$	7,889.50	
Construction, 1916-17		182.89	8,072.39
<hr/>			
Completed cost		\$	8,711.91
Previous reported complete			8,382.06
<hr/>			
Additional cost		\$	329.85

Holbrook St. Johns Sect. 3

Engineering, 1917-18	\$	201.65	
<hr/>			
Work in progress		\$	201.65

Maintenance

County General, 1916-17.....	\$	840.88	
Winslow Holbrook Sect. 1, 1917-18.....		32.16	
Winslow Holbrook Sect. 2, 1917-18.....		91.48	
Winslow Holbrook Sect. 3, 1917-18.....		412.00	
Holbrook St. Johns Sect. 1, 1917-18.....		218.92	
<hr/>			
Total		\$	1,595.44

PIMA COUNTY**Board of Supervisors**

1916

JOHN W. ESTILL,

JOHN NELSON,

D. S. COCHRAN.

1917

JOHN W. ESTILL,

N. C. BERNARD,

W. A. BAKER.

Tucson-Bisbee 1:

On account of the lack of maintenance this section had become badly worn and rutted. There also were places where the roadway had been constructed of very poor material. During the rainy season these places became almost impassable.

What maintenance work had been done on this section prior to 1917 consisted principally of the filling in of ruts and holes. The grade was raised at some points, drain ditches constructed and portions surfaced with gravel. This work was done by prison labor under the honor system.

During the last portion of the current year the road has been maintained by the use of a 2½ ton truck in charge of a foreman and one helper. The truck is equipped with a small grader and three road drags chained together in such a way as to cover the entire road bed in a single operation.

The use of this outfit has reduced the maintenance costs and the highway is kept in excellent condition.

Tucson-Bisbee Section 2:

The work done on this section consisted of the construction of 3.3 miles of highway east of Vail at a cost of \$2,532.14. This highway is located on high ground and in good road-making material. The grading was light, very little scraper work being necessary, and the drainage was taken care of by the use of two small culverts and

two concrete pavings or dips. These dips are proving very satisfactory in dry sand washes and are less expensive than bridges to construct.

High maintenance charges on this section may be expected on account of the large amount of ore hauled over it; sixty-two freighters are using this highway at the present time.

All work on this section was done by convict labor under the honor system.

Nogales-Tucson Section 4:

This section begins at the north line of Santa Cruz County and extends to mile post 38 from Nogales. This section was finished in May, 1918, and is about 20 miles long. It has numerous small culverts and dips. By reason of quick run off, the drainage was handled very carefully. The road bed is 18 feet wide with six inches of native surface material. This road is maintained in excellent condition.

Santa Cruz River Bridge No. 2:

This bridge is located at Continental over the Santa Cruz River in Section 4 on the Nogales-Tucson highway. Survey has been made and plans and specifications prepared for a deck girder reinforced concrete bridge. Although this river is dry most seasons of the year, it is absolutely impassable during the flood period. The construction of this bridge is now in progress and will be completed by January 1, 1919. The bridge will consist of three spans 32.5 feet in length with an 18-foot clear roadway.

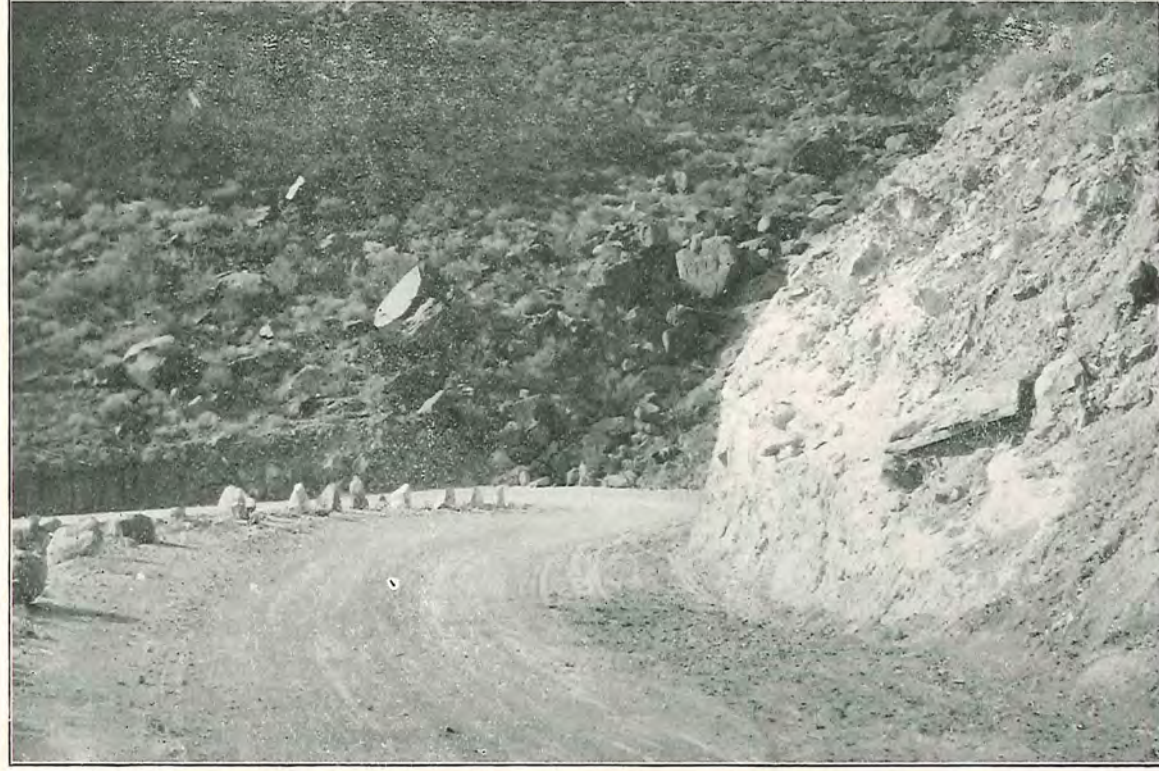
Total expenditures for period, and total costs of projects completed during period:

Tucson-Bisbee Sect. 1 (Prison)

Engineering, Previous report	\$ 121.33	\$	
Engineering, 1916-17	174.51		
Engineering, 1916-17	50.00		345.84
<hr/>			
Construction Previous report	\$ 1,616.01		
Construction, 1916-17	4,178.59		5,794.60
<hr/>			
Completed cost		\$	6,140.44



MOHAVE COUNTY
Kingman-Oatman Highway—Machine drilling on thirty-foot cut



MOHAVE COUNTY
Kingman-Oatman Highway

Tucson-Bisbee Sect. 2

Engineering, Previous report.....		\$ 1,304.73
Engineering, 1916-17	204.58	\$ 1,509.31
Construction, 1916-17	\$ 2,327.56	\$ 2,327.56
Completed cost		\$ 3,836.87

Tucson-Florence Sect. 2 (Prison)

Engineering, 1916-17	\$ 50.80	
Construction, 1916-17	\$ 294.73	
Additional Cost		\$ 345.53

Tucson-Florence Sect 2-A

Engineering, 1917-18	\$ 1.50	
Construction, 1917-18	467.95	
Total cost		\$ 469.45

Nogales-Tucson Sect. 4

Engineering, 1917-18	\$ 1,959.40	
Construction, 1917-18	57,391.18	
Total		\$ 59,350.58

Santa Cruz River Bridge No. 2

Engineering, 1917-18	\$ 140.00	
Work in progress		\$ 140.00

County General Expense

General Equipment, 1916-17	\$ 116.30	
General Equipment, 1917-18, Credit	297.75	\$ 181.45
Total		

Maintenance

County, general, 1916-17	\$ 7,173.29	
Tucson-Bisbee Sect. 1, 1917-18.....	2,728.21	
Tucson-Florence Sect. 2, 1917-18	1,932.68	
Nogales-Tucson Sect. 4, 1917-18	217.51	
Nogales-Tucson Sect. A & B, 1917-18.....	5,512.87	
Total		\$ 17,564.66

PINAL COUNTY

Board of Supervisors

1916

THOS. N. WILLS,
J. G. KEATING,
S. O. THOMPSON.

1917

THOS. N. WILLS,
C. F. SHILLING,
J. B. BOURNE.

The Florence Bridge Extension:

A reinforced concrete bridge was constructed across the Gila River at Florence by the Territorial Engineer in the years 1909-10, consisting of fourteen 50-foot spans. The bridge was of the four girder type with two fixed piers in each three span unit of the superstructure. Each such three span unit was poured monolithic and was designed in accordance with the theory of continuous beams.

The design of the end spans, however, was not uniform with the rest of the structure. The girders of the end spans were designed as beams fixed at the abutment and free at the adjacent pier. These end spans developed numerous cracks near the abutments soon after the construction was completed. This failure of the end spans was probably due to this design as spans fixed at the abutment end.

One of the fixed piers shows an undetermined amount of settlement causing stresses in the adjacent spans other than those for which they were designed.

Otherwise, the structure as originally designed has proven fairly satisfactory, except that, as noted in the previous report, the amount of waterway provided was inadequate.

In the winter of 1915-16 the Gila River floods were practically unprecedented in size and damage inflicted. The south bank of the Gila River was washed away for a distance of several miles and

receded from the south end of the bridge approximately twelve hundred feet, leaving the bridge intact except for the wing walls of the south abutment which were torn away.

In the report of the State Engineer for 1914-16 an account is given of the diversion dam constructed about one mile above the bridge site in order to turn the waters from the south channel so that they would flow in their former channel under the bridge. There was constructed also at the same time an embankment approach about twelve hundred feet long leading from the south bank of the river onto the bridge at its south end.

These were noted as temporary expedients at the time and it was recognized that the bridge must be extended in order to carry the extraordinary floods occurring from time to time in the Gila River. It was somewhat disappointing, however, to experience another flood of considerable violence in the succeeding winter of 1916-17 which almost totally destroyed the diversion dam and carried away the entire twelve hundred feet of the approach. This flood, however, was deflected to the north by the diversion dam with sufficient force to make a substantial channel along the north bank of the river bed.

Although this flood resulted in great money loss to the State, the result was most assuring in demonstrating that the river flow could be successfully diverted to the north side of the river bed and the farm lands and the town of Florence on the south bank properly protected. Accordingly plans and specifications were prepared for the construction of fifteen additional spans on the north end of the old structure, together with the construction of a channel changer as designed by the River Current Control Company at the site of the old diversion dam, a pile and timber dike extending from the south abutment diagonally across the flood channel that had been formed to the south of the old river bed, and a heavy approach embankment extending from the south end of the bridge to the south side of the flood channel. The grade of the old road bed on the south side of the river was also raised in order to prevent all overtopping of the roadway by flood waters.

The design of the additional fifteen spans on the north end of

the old structure was made to correspond with the structure in plan and appearance. It was made somewhat heavier, however, and was more liberally reinforced. A new abutment at the south end of the structure of the U type was also provided. These plans and specifications were approved by the United States Office of Public Roads and Rural Engineering early in 1917 and \$61,899.89 was allotted to this project under the Federal Aid Road Act. The Legislature in their session of 1917 also appropriated \$50,000.00 for this construction, the total estimated cost of the project being \$123,799.78.

Work was commenced on this construction in May, 1917, and the project is nearing completion at the present time at a cost somewhat in excess of the original estimate.

Mesa-Superior, Section 2-A

Work was begun on this project in May, 1918, on the Mesa-Roosevelt road, 14 miles from Mesa. This point is near the County line of Maricopa and Pinal Counties. The highway skirts Superstition Mountain and lies on fairly level country, cut by numerous washes. With the exception of 3 miles between Superior and Miami, (which is heavy rock) it will be in open country and will furnish a safer and more desirable highway for travel than the present Phoenix-Roosevelt route. With this work finished, there will be a main road to Florence, Superior, Miami and Globe that will shorten the present distance approximately 30 miles.

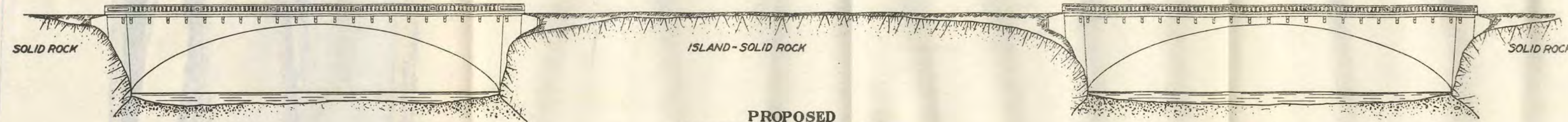
This highway will have a 24-foot road bed surfaced with excellent native material.

Maintenance

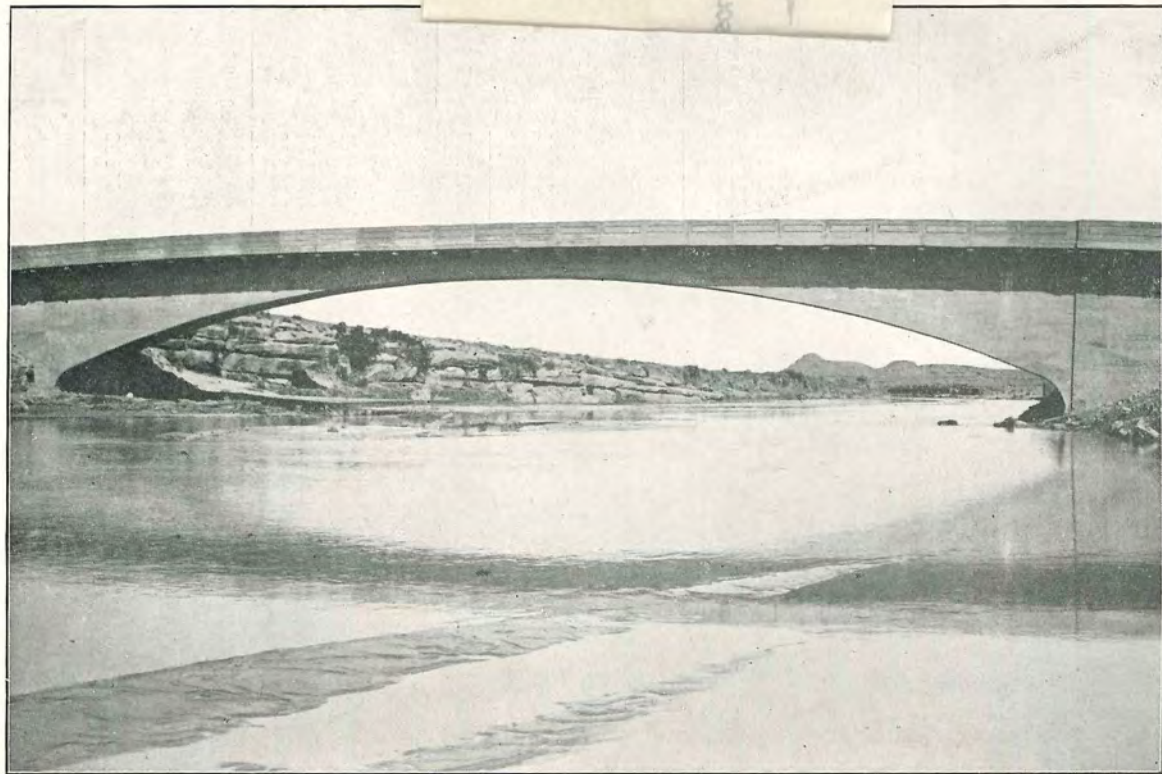
No other construction work has been done in this county. The Tucson-Florence Highway is maintained with a 2½ ton Mack truck, manned with a crew of 2 men, and equipped with a portable kitchen and bunk house mounted on the running gears of a heavy steel wheel wagon. Two plows and 1 Russell grader which has 3 blade drags chained together so that the whole road can be dragged in one operation. This outfit also has a small concrete mixer, as a part



NAVAJO COUNTY
Winslow-Holbrook Highway



**PROPOSED
QUEEN CREEK BRIDGES
MESA-SUPERIOR HIGHWAY**



NAVAJO COUNTY
Little Colorado River Bridge—Holbrook

of the maintenance equipment. Excellent results have been obtained by the use of this organization.

Total expenditures for period and total costs of projects completed during period:

Florence Bridge

Construction, 1916-17	\$ 3,569.18	
Additional Cost		\$ 3,569.18

Florence Bridge Extension

Engineering, 1916-17	\$ 1,149.68	\$
Engineering, 1917-18	1,154.77	2,304.45
Construction, 1916-17	38,111.68	
Construction, 1917-18	81,593.18	119,704.76
Total		\$122,009.31
Work in progress		

Tucson-Florence Sect. 1

Engineering, 1916-17	\$ 130.51	
Engineering, 1917-18	357.71	488.21
Construction, 1916-17	1,418.00	1,418.00
Additional cost		\$ 1,906.21

Mesa-Superior Sect. 2-A

Engineering, 1916-17	\$ 1,858.50	
Construction, 1917-18	1,115.02	
Total		\$ 2,973.52
Work in progress		

Mesa-Superior, Sect. 2-B

Engineering, 1917-18	\$ 654.92	
Work in progress		\$ 654.92

Queen Creek Bridge

Engineering, 1917-18	\$ 58.00	
Work in progress		\$ 58.00

Haynes in May, 1916. The completed cost of this bridge was \$38,012.29.

Pesquiera Bridge

This bridge is a one span reinforced concrete structure with retaining walls, 33 feet long over all, the completed cost of which was \$3,766.33. It is located approximately seven miles North of Nogales on the Nogales-Tucson Highway, and replaced a smaller structure which was constructed by Santa Cruz County, prior to the building of the State Highway.

The continual floods of July, 1917, undermined the south abutment causing the collapse of the former bridge. The heavy traffic and the treacherous ford necessitated the immediate construction of the present bridge, which incidentally was constructed amid a period of intermittent floods of August, 1917.

Nogales-Tucson, Section 2

The work consisted of the construction of 13.65 miles of road, commencing four miles north of Nogales at the end of the section previously built. The clearing and grubbing of the right of way was very expensive on account of the heavy growth of mesquite. This road follows the Santa Cruz River, and the drainage is heavy on account of the numerous washes that come down from the mountains. Culverts were placed in all the smaller washes, but the available funds did not permit taking care of the larger ones by either bridges or pavings. The material encountered was of such character as to give a good wearing surface, except in a few places. These were surfaced with gravel.

Nogales-Tucson, Section 3

This section extends from Santa Cruz County line towards Nogales three miles. The road was surfaced six inches with gravel. Numerous small concrete culverts and drainage devices were built to take care of the storm water. In some of the washes changes of channel were made involving much heavy work.

Sopori Wash Bridge

Sopori Wash is in Section 3 of the Nogales-Tucson Highway. Under flood it covers a low flat for a distance of about two miles. This material when saturated forms a soapy mud, from which the wash derives its name, and becomes impassable during the rainy season. At times this flat has been under water from 18 inches to 2 feet in depth. To confine this drainage into one channel it was necessary to construct a levy for a distance of several hundred feet. The restricted channel was spanned by a rail top concrete slab bridge consisting of three 33 foot spans. The footings were put down to a distance of 30 feet in order to secure suitable foundations. Water was pumped and hauled one and one-half miles. Concreting materials were secured near the bridge site. The completed cost of this work to date is \$4056.28.

Canoa Wash Bridge

During the year 1917 a rail top concrete slab bridge consisting of three 33 foot spans was constructed across Canoa Wash at a completed cost of \$6080.92. Material for the concrete foundation and superstructure was obtained at the bridge site. This bridge was a much needed improvement on this section of the Tucson-Nogales Highway and is located near the Northern end of the State constructed portion.

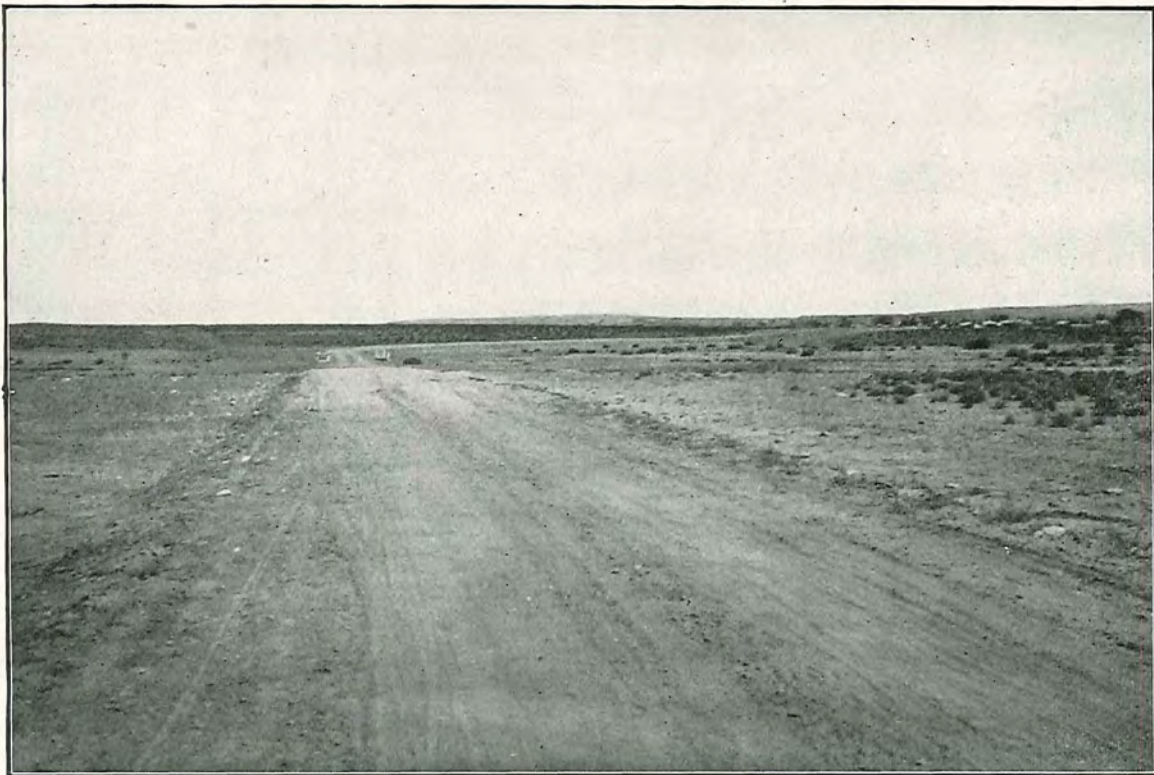
Maintenance

The Nogales-Tucson Highway is maintained in excellent condition by one crew which worked from Nogales to mile post 13. Another crew maintains the remainder in Santa Cruz County together with that portion in Pima County to mile post 38 which is the end of State constructed road. These crews drag the road at least once a week, wet or dry, keeping it in good condition at all times.

Total expenditures for period and total costs of projects completed during period:

Santa Cruz River Bridge No. 1

Engineering, Previous report	\$ 565.23	
Engineering, 1916-17	224.63	783.86
<hr/>		
Construction, Previous report	\$ 21,560.08	\$
Construction, 1916-17	15,662.35	37,222.43
<hr/>		
Completed cost		\$ 38,012.29



NAVAJO COUNTY
Holbrook-St. Johns Highway. Gravel Surface



SANTA CRUZ COUNTY
Sapori Wash Bridge

Nogales-Tucson Highway, Sect. 2

Engineering, Previous report	\$ 1,624.87	\$
Engineering, 1916-17	5,128.13	6,753.00
Construction, Previous report.....	\$ 12,784.91	
Construction, 1916-17	28,380.47	41,165.38
Completed cost		\$ 47,918.38

Nogales-Tucson Highway, Sect. 3

Engineering, 1917-18	\$ 2,858.97	
Construction, 1917-18	55,536.27	
Total		\$ 58,395.24

Pesquiera Bridge

Engineering, 1917-18	\$ 56.40	
Construction, 1917-18	3,709.95	
Completed cost		\$ 3,766.35

Canoa Wash Bridge

Construction, 1917-18	\$ 6,080.92	
Total		\$ 6,080.92

Sopori Bridge

Construction, 1917-18	\$ 4,056.28	
Total		\$ 4,056.28

County General Expense

Division Engineer, 1916-17	\$ 252.10	\$ 252.10
General Equipment, 1916-17.....	136.02	
General Equipment, 1917-18, Credit.....	78.47	57.55
Total		\$ 309.65

Maintenance

County, General, 1916-17	\$ 9,083.32	
Nogales-Tucson, Sec. 1, 1917-18.....	1,000.25	
Nogales-Tucson, Sec. 2, 1917-1918.....	6,601.18	
Nogales-Tucson, Sec. 3, 1917-18.....	241.40	
Nogales-Tucson, Sec. 3, 1917-18.....	241.40	
Total		\$ 18,812.81

YAVAPAI COUNTY

Board of Supervisors

1916

WILLIAM STEPHENS

HENRY J. SUDER

HARRY W. HEAP

1917

WILLIAM STEPHENS

C. C. STUKEY

J. A. JAEGER

Prescott-Flagstaff Section 4:

Construction work on this section was completed for a distance of 18,600 feet, at a total cost of \$22,780.34, including three standard 3x7 foot concrete culverts and one 27 foot clear span rail floor concrete bridge.

Prescott-Flagstaff Section 3A and 3B:

A great deal of inconvenience and considerable expense has been experienced at the crossing of Cherry Creek, same being at the end of Section 3-B, and it is recommended that a standard paving be constructed across this creek at the point mentioned. This section is on the mail route which supplies the lower Verde Valley, and carries the entire traffic of the Jerome and Clarkdale district.

Prescott-Flagstaff Beaver Creek Division

This section has been maintained in good condition, the principal work being dragging throughout and the removal of large boulders from Mogollon Hill grade.

Prescott-Phoenix Senator Mountain Division

This section has been maintained in good condition. During the extreme cold weather and heavy snows no attempt has been

made to keep the road open the entire distance, as the traffic accommodated has not, in the past, justified the high cost of using a snow plow.

This section taps a very rich mineral belt, and a large percentage of the traffic is ore teams from the mines.

As soon as sufficient funds are available from the 25% fund, it is recommended that the alignment of this section be straightened, and the road bed widened, especially on the curves.

Camp Verde Bridge

This structure of three 100 foot steel spans across the Verde River near the village of Camp Verde, has been painted and all rods adjusted. Necessary repairs were made to the approaches to this bridge during 1918.

Prescott-Phoenix Silver Mountain Division

This section accommodates no travel and has had no attention during the fiscal year.

Prescott-Jerome

By a majority vote of the Board of Supervisors of Yavapai County, the State Engineer was instructed to put a survey party in the field to locate the "Direct Route" from Prescott to Jerome. This work is under way and will be completed about Aug. 15th. Location is being made for a 20 foot roadway, and one that will be safe for the very heavy travel which will be accommodated. It is the aim to keep the grades below 6% where possible, even though the distance may be somewhat longer, although the preliminary notes showed grades as high as 10%.

Cottonwood Bridge

The construction of a bridge across the Verde River, near Cottonwood, was authorized by the last regular session of the State Legislature and site for the bridge was located at what is known as Thompson's crossing. A concrete bridge was recommended.

Prescott-Flagstaff Section 4

It is earnestly recommended that this section extending from Dewey towards Cherry post office be constructed as soon as the necessary funds are available.

Total expenditures for period and total costs of projects completed during period:

Prescott-Flagstaff, Sec. 4

Engineering, Previous report	\$ 1,212.07	
Engineering, 1916-17	2,157.14	
Engineering, 1917-18	820.51	\$ 4,189.72
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Construction, Previous report	\$ 3,153.75	
Construction, 1916-17	23,673.65	
Construction, 1916-17, Credit	599.79	26,227.61
<hr/>		
Completed cost		\$ 30,417.33

Prescott-Flagstaff, Sec. 1

Engineering, 1917-18	\$ 40.00	
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Additional cost		\$ 40.00

Prescott-Flagstaff, Sec. 2

Engineering, 1917-18	\$ 55.00	
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Additional cost,		\$ 55.00

Prescott-Dewey

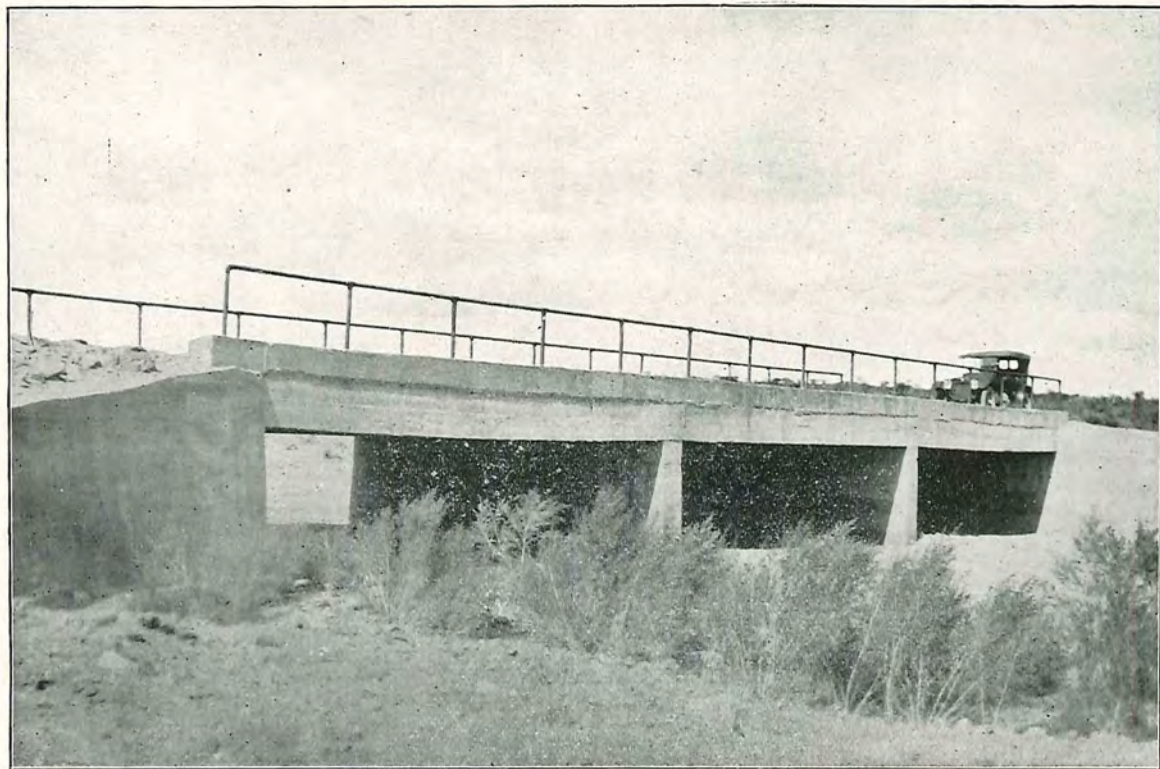
Engineering, 1917-18	\$ 52.00	
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Additional cost		\$ 52.00

Prescott-Jerome

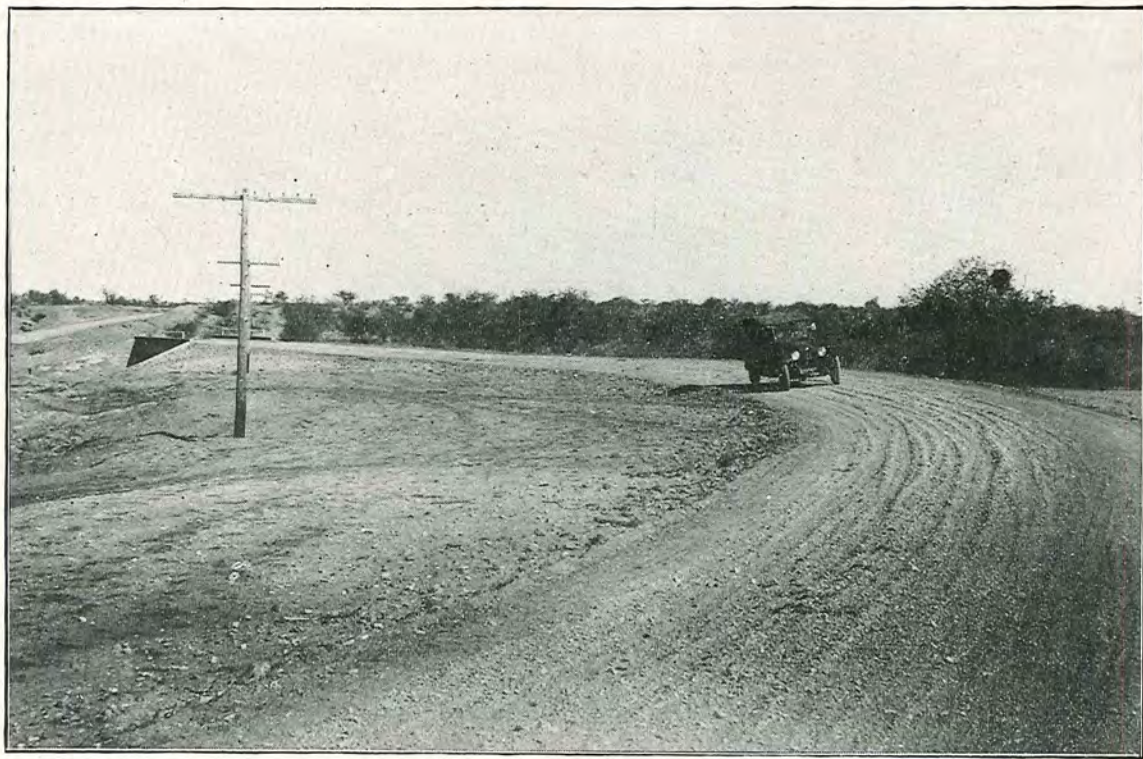
Engineering, 1917-18	\$ 1,293.73	
<hr/>		
Work in Progress		\$ 1293.73

Cottonwood Bridge

Engineering, 1917-18	\$ 477.56	
<hr/>		
		\$ 477.56



PIMA COUNTY
Canon Wash Bridge



PIMA COUNTY
Tucson-Nogales Highway

Camp Verde Bridge

Engineering, 1917-18	\$	173.44	
			\$ 173.44
County General Expense			
General Expense, 1916-17	\$	835.60	\$ 835.60
General Equipment, 1916-17		709.57	
General Equipment, 1917-18, Credit.....		974.94	265.37
Total.....			\$ 560.23

Maintenance

County, General, 1916-17	\$	2,673.37	
Camp Verde Bridge, 1917-18		838.58	
Prescott-Flagstaff Beaver Creek, 1917-18.....		174.30	
Prescott Flagstaff, Secs. 3 and 4, 1917-18.....		1,535.20	
Prescott-Flagstaff, Sec. 1, 1917-18		38.50	
Prescott-Phoenix-Senator Mt. Div., 1917-18.....		1,548.87	
Total			\$ 6,808.82

YUMA COUNTY

Board of Supervisors

1916	1917
J. A. DONOVAN	IKE PROEBSTEL
IKE PROEBSTEL	F. E. ELLIOTT
J. H. SHANSSEY	B. F. HOPKINS

Antelope Hill Bridge Extension

During the period 1913-14 plans and specifications were prepared for the construction of a reinforced concrete deck girder bridge over the Gila River at Antelope Hill about nine miles from Wellton, Arizona, on the Phoenix-Yuma Highway. This bridge was

under construction during the period 1914-15 being completed in August, 1915. The original plans for the bridge consisted of ten spans of sixty-five feet each with a width of roadway of sixteen feet. This bridge was reported complete in last report at a cost of \$42,320.66 and a flood loss of \$12,653.04 or a total cost of \$54,974.60.

The floods on the Gila River in 1916 washed out the north approach to Antelope Hill Bridge for a distance of 2 miles and also widened the channel of the river at the north end of the bridge some 300 feet. The only proper remedy for the latter problem was to provide for the extension of the bridge as well as the protection of the bank on the north side to prevent further washing away.

In March, 1917, the State Legislature appropriated the sum of \$50,000 from the General Fund for the extension of the bridge and building an approach on the north end of the present structure. This work is now in progress. The extension calls for five spans of sixty-five foot each on the north end of the constructed bridge. The new extension will be symmetrical with the present structure. The bridge should be surfaced with some sort of bitumenous paving of a character not yet determined. This should probably be put in place in the near future to prevent disintegration of the concrete.

The foundations for the new piers and abutment are now in place as well as the grading for the approach. During the summer, operations were suspended as it is difficult to maintain efficiency during the heated term.

Phoenix-Yuma Highway Section 7

A survey has been completed from the Northern end of the Antelope Hill Bridge as originally constructed and extending thence in an easterly direction for a distance of 52.0395 miles connecting with Phoenix-Yuma Section 6. Project agreement has been prepared for co-operative construction of 50.03 miles of this section under the Federal Aid Road Act. The project will begin at Station 105 from the north end of the Gila River Bridge and end at Station 2747+94.61, being about four miles north and two miles

east of Agua Caliente. When this project is completed there will have been constructed an important link in a continuous highway from Phoenix to Yuma. The present highway is in a very bad condition at this time.

Yuma-Maricopa Boundary Survey

Acting on the orders of the Supreme Court of Arizona dated May 28, 1918, the State Engineer initiated a survey for the correct determination of the meridian of 113 deg. 20 min. West longitude which is the statutory boundary between the counties of Yuma and Maricopa—by sending into the field on June 21, 1918, a party of ten men, well equipped, under the leadership of Division Engineer J. S. Barlow.

Some special equipment consisting of a fine theodolite graduated to ten seconds of arc on an eight inch vernier was purchased for this work. The work was progressing favorably at the end of the fiscal year and no doubt a correct determination of the disputed line will be effected within a reasonable length of time.

Total expenditures for period and total costs of projects completed during period:

Phoenix-Yuma Highway, Wellton-Mohawk Div.

Engineering, 1916-17	\$ 14.93	
Engineering, 1917-18	1,423.59	\$ 1,438.52
Construction, 1916-17, Credit.....	2,263.36	2,263.36
Credit		\$ 824.84
Total previously reported.....		\$ 14,326.79
Completed cost		\$ 13,501.95

Antelope Hill Bridge

Construction, 1916-17	\$ 185.95	
Additional cost		\$ 185.95
Total previously reported		\$ 57,999.46
Completed cost		\$ 58,185.41

Antelope Hill Bridge Extension

Engineering, 1917-18	\$ 409.14	
Construction, 1917-18	9,584.50	
Total		\$ 9,993.64
Accrued Construction Costs not paid.....		\$ 24,373.99
Total Cost		\$ 34,367.63
Deduct Inventories		18,182.78
Work in Progress		\$ 16,184.85

County General Expense

General Equipment, 1916-17	\$ 165.90	
General Equipment, 1917-18 Credit.....	160.40	5.50
Account receivable from Maricopa County, 1917-8	158.45	158.45
		\$ 163.95

Maintenance

County, General, 1916-17	\$ 1,159.28	
Yuma Bridge. 1917-18	14.30	
Antelope Hill Bridge, 1917-18.....	925.01	
Wellton-Mohawk Div., 1917-18.....	7,951.60	
Total		\$ 10,050.19

STATEMENT OF BALANCES

Hon. B. M. Atwood, State Engineer,
Phoenix, Arizona.

Dear Sir:

I have the honor to transmit to you the report of the Accounting Division of your Department in the form of the following schedules:

1—Financial statement for the year 1916-1917 showing gross receipts and disbursements, net expenditures, and balances in every fund administered by the State Engineer.

2—Financial statement for the year 1917-1918 as above showing also gross estimated balances available for operations for the year 1918-1919.

3—Supplementary financial statement for the period February 1, 1918, to June 30, 1918, this period being that of your incumbency as State Engineer.

4—Progressive statement of total receipts and expenditures in the 75% Fund and the 25% Fund as applied in each of the counties from July 15, 1911, to June 30, 1918.

5—Detailed statement of net expenditures from all funds for the year 1916-1917, showing distribution of charges to the various accounts and projects.

6—Detailed statement of net expenditures for the year 1917-1918 as above.

You must note that all these schedules represent the value of warrants drawn by the State Auditor for the periods mentioned, and not the actual indebtedness incurred during the period.

Thus, referring to Schedule 3, a large part of the warrants charged in February are issued upon claims approved by your

Schedule 1

STATE OF ARIZONA—HIGHWAY DEPARTMENT																				
Financial Statement for the Fiscal Year 1916-17																				
Schedule 1	GENERAL FUND			S. R. T. F. GEN'L. TOTAL	STATE ROAD TAX FUND—COUNTIES															
	State Engineer's Salary	State Engineer's Expense	Florence Bridge Extension		TOTAL 75%	01 APACHE	02 COCHISE	03 COCONINO	04 GILA	05 GRAHAM	06 GREENLEE	07 MARICOPA	08 MOHAVE	09 NAVAJO	010 PIMA	011 PINAL	012 SANTA CRUZ	013 YAVAPAI	014 YUMA	
Balance Forward to July 1, 1916.....	\$ 33,682.54	\$	\$	\$ 7,627.43	\$ 26,055.11	\$ 1,370.12	\$ 7,802.74	\$ 604.62	\$ 211	\$ 2,128.86	\$ 2,535.61	\$.28	\$ 136.15	\$ 1,485.29	\$ 2,003.82	\$ 292.41	\$ 300.31	\$ 7,362.54	\$ 30.25	
Back Taxes Transmitted.....	4,750.04			1,187.53	3,562.51	148.56	598.85	87.94	286.72	254.76	116.51		86.99	257.31	280.33	612.81		422.47	409.76	
Current Taxes Transmitted.....	247,134.63			61,783.63	185,351.00	2,486.44	43,665.31	6,617.60	26,565.82	3,910.53	12,197.19	27,907.84	6,083.13	3,224.44	9,777.16	11,855.69	3,354.58	21,905.48	5,799.79	
Various Revenues.....	5,500.00	3,000.00	2,500.00																	
Prison Fund.....	60,000.00			60,000.00																
Florence Bridge Extension Appropriation.....	50,000.00		50,000.00																	
Prisoner Maintenance.....	6,610.26			6,610.26																
Motor Vehicle Licenses.....	116,121.25			116,121.25																
Agua Fria Bridge Appropriation.....	22,000.00			22,000.00																
Loans to Counties from General Fund.....	12,500.00																			
Advanced by Counties.....	51,500.00			24,000.00	27,500.00			5,000.00	12,500.00			10,000.00					12,500.00			
Refunds against Gross Expenditures.....	62,239.93			37,779.57	24,382.92		1,133.85	151.92	1,035.59	70.40		11,983.43	5,692.03	1,392.35	71.22	31.00	2,713.73	107.40		
Total.....	672,038.65	3,000.00	2,558.73	337,109.67	279,351.54	4,005.12	53,200.25	12,462.08	40,390.24	6,364.55	14,849.31	49,891.55	11,998.30	6,359.39	12,132.53	12,791.91	18,868.62	29,797.89	6,239.80	
Warrants drawn (Gross).....	619,261.78	3,000.00	2,558.73	38,130.39	335,868.22	239,704.44	1,393.52	40,778.64	12,145.56	40,778.64	5,268.73	47,995.68	11,198.88	4,049.61	11,613.38	10,065.61	18,398.12	27,017.25	1,511.13	
Balance Cash on Hand.....	52,776.87			11,888.32	1,241.45	39,647.10	2,611.60	12,421.61	316.52	2,653.69	1,095.82	4,312.53	1,895.87	799.42	2,309.78	519.15	2,726.30	475.50	2,780.64	
Net Expenditures (Warrants less refunds)...	557,021.85	3,000.00	2,500.00	38,111.68	298,088.65	215,321.52	1,393.52	39,644.79	11,993.64	36,700.96	5,198.33	10,536.78	36,012.25	5,506.85	2,657.26	11,542.16	10,034.61	15,679.39	26,909.85	
Assessment Apportioned, 1916-17.....	249,999.61			62,499.61	187,500.00	2,558.26	44,267.50	6,751.03	26,909.79	4,155.62	12,307.75	27,696.47	6,040.51	3,319.13	10,456.84	11,888.69	3,098.80	22,465.41	5,584.20	
Current Taxes Collected.....	247,184.63			61,783.63	185,351.00	2,486.44	43,665.31	6,617.60	26,565.82	3,910.53	12,197.19	27,907.84	6,083.13	3,224.44	9,777.16	11,855.69	3,354.58	21,905.48	5,799.79	
Balance Taxes, 1916-17, available when collected.....	2,864.98			715.98	2,149.00	71.82	602.19	133.43	343.97	245.09	110.56	211.37*	4262*	94.69	679.68	33.00	255.78*	559.93	215.59*	
*Items indicated thus denote overdrawn balances.																				

*Items indicated thus denote overdrawn balances.

Schedule 2

STATE OF ARIZONA—HIGHWAY DEPARTMENT																				
Financial Statement for the Fiscal Year 1917-18																				
	TOTAL	GENERAL FUND				STATE ROAD TAX FUND GENERAL				STATE ROAD TAX FUND—COUNTIES										
		State Engineer's Salary	State Engineer's Expense	Florence Bridge Extension	Gila River Bridge Greenlee Co.	25% PRISON	TOTAL 75%	01 APACHE	02 COCHISE	03 COCONINO	05 GILA	05 GRAHAM	06 GREENLEE	07 MARICOPA	08 MOHAVE	09 NAVAJO	010 PIMA	011 PINAL	012 SANTA CRUZ	013 YAVAPAI
Balance Forward to July 1, 1917.....	\$ 52,776.87	\$	\$	\$ 11,888.32	\$	\$ 16,433.08	\$ 15,191.63*	\$ 1,241.45	\$ 39,647.10	\$ 2,611.60	\$ 12,421.61	\$ 316.52	\$ 2,653.69	\$ 1,095.82	\$ 4,312.53	\$ 1,895.87	\$ 799.42	\$ 2,309.78	\$ 519.15	\$ 2,726.30
Back Taxes transmitted.....	7,728.17					1,932.05		1,932.05	5,796.12	5,127.05	112,183.58	13,670.35	77,082.15	8,615.20	30,235.69	58,279.18	13,245.33	7,503.11	25,546.85	33,930.91
Current Taxes transmitted.....	688,827.89					158,497.14	54,839.21	213,336.35	475,491.54											
Various Revenues.....	5,500.00	3,000.00	2,500.00			50,000.00		50,000.00												
Antelope Hill Bridge, Chap 65, R. S. 1917.....	50,000.00					31,947.35		31,947.35												
Federal Aid.....	31,947.35					12,254.71		12,254.71												
Prisoner Maintenance.....	12,254.71					145,518.25		145,518.25												
Motor Vehicle License Fees.....	145,518.25					9,717.00		9,717.00												
Advanced by Coconino County.....	9,717.00					8,375.29	27,628.29	36,003.58	26,074.55	51.25	3,649.93	3,778.74	663.85	25.00	70.00	676.45	10,332.88	17.50	4,772.68	255.90
Refunds against Gross Expenditures.....	84,663.92					412,703.16	79,530.58	492,233.74	556,726.31	7,789.90	128,899.64	27,639.65	80,475.73	9,817.76	34,654.31	63,846.93	24,506.39	9,890.41	31,126.02	37,281.66
Total.....	1,088,934.16	3,000.00	2,556.34	34,417.77		29,021.54		29,021.54							2,625.84	13,668.92		3,041.45	1,014.76	6,349.82
Bridge Loans to Counties Repaid.....	29,021.54					412,703.16	79,530.58	492,233.74	527,704.77	7,789.90	128,899.64	27,639.65	80,475.73	9,817.76	32,028.47	50,178.01	24,506.39	6,848.96	31,126.02	37,281.66
Net Receipts.....	1,059,912.62					389,121.78	122,010.10	511,131.88	346,102.45	1,648.00	83,147.93	28,366.14	104,893.97	229.50	30,141.38	16,322.40	25,075.12	644.97	32,973.77	3,149.61
Warrants drawn (Gross).....	896,389.34	3,000.00	1,737.24	34,417.77		23,581.38	42,479.52*	18,898.14*	181,602.32	6,141.90	45,751.71	726.49*	24,418.24*	9,588.26	1,887.09	33,855.61	568.73*	6,203.99	1,847.75*	34,132.05
Balance Cash on Hand.....	163,523.28					380,746.49	94,381.81	475,128.30	320,027.90	1,596.75	79,498.00	24,587.40	104,230.12	204.50	30,071.38	15,645.95	14,742.24	627.47	28,201.09	2,893.71
Net Expenditures (Warrants less Refunds)...	811,725.42	3,000.00	1,680.90	11,888.32		174,250.00	60,000.00	234,250.00	522,750.00	5,787.75	113,756.32	14,410.80	110,828.25	9,313.67	30,927.78	60,485.37	13,814.06	7,649.85	27,394.60	34,919.51
Assessment Apportioned, 1917-18.....	757,000.00					158,497.14	54,839.21	213,336.35	475,491.54	5,127.05	112,183.58	13,670.35	77,082.15	8,615.20	30,235.69	58,279.18	13,245.33	7,503.11	25,546.85	33,930.91
Current Taxes collected.....	688,827.89					15,752.86	5,160.79	20,913.65	47,258.46	660.70	1,572.74	740.45	33,746.10	698.47	692.09	2,206.19	568.73	146.74	1,847.75	988.60
Balance Taxes, 1917-18, available.....	68,172.11					39,334.24	37,318.73*	2,015.51	228,860.78	6,802.60	47,324.45	13.96	9,327.86	10,286.73	2,579.18	36,061.80	0.00	6,350.73	0.00	35,120.65
1-Bal. Cash and Available Taxes, July 1, 1918.....	231,695.39					208,505.13	60,000.00	268,505.13	625,515.40	6,451.03	127,011.33	15,194.45	122,735.84	9,873.98	33,331.34	73,025.25	16,556.00	8,194.42	46,233.83	47,418.13
Warrants drawn (Gross).....	896,389.34	3,000.00	1,737.24	34,417.77		23,581.38	42,479.52*	18,898.14*	181,602.32	6,141.90	45,751.71	726.49*	24,418.24*	9,588.26	1,887.09	33,855.61	568.73*	6,203.99	1,847.75*	34,132.05
Balance Cash on Hand.....	163,523.28					380,746.49	94,381.81	475,128.30	320,027.90	1,596.75	79,498.00	24,587.40	104,230.12	204.50	30,071.38	15,645.95	14,742.24	627.47	28,201.09	2,893.71
Net Expenditures (Warrants less Refunds)...	811,725.42	3,000.00	1,680.90	11,888.32		174,250.00	60,000.00	234,250.00	522,750.00	5,787.75	113,756.32	14,410.80	110,828.25	9,313.67	30,927.78	60,485.37	13,814.06	7,649.85	27,394.60	34,919.51
Assessment Apportioned, 1917-18.....	757,000.00					158,497.14	54,839.21	213,336.35	475,491.54	5,127.05	112,183.58	13,670.35	77,082.15	8,615.20	30,235.69	58,279.18	13,245.33	7,503.11	25,546.85	33,930.91
Current Taxes collected.....	688,827.89					15,752.86	5,160.79	20,913.65	47,258.46	660.70	1,572.74	740.45	33,746.10	698.47	692.09	2,206.19	568.73	146.74	1,847.75	988.60
Balance Taxes, 1917-18, available.....	68,172.11					39,334.24	37,318.73*	2,015.51	228,860.78	6,802.60	47,324.45	13.96	9,327.86	10,286.73	2,579.18	36,061.80	0.00	6,350.73	0.00	35,120.65
1-Bal. Cash and Available Taxes, July 1, 1918.....	231,695.39					208,505.13	60,000.00	268,505.13	625,515.40	6,451.03	127,011.33	15,194.45	122,735.84	9,873.98	33,331.34	73,025.25	16,556.00	8,194.42	46,233.83	47,418.13
Apportionment and Appropriations 1918-19.....	899,520.53	3,000.00	2,500.00		60,000.00	60,000.00														
Gila River Bridge, Greenlee County....	60,000.00																			
2-Federal Aid, Estimated.....	9,600.00					9,600.00		9,600.00												
Prisoner Maintenance Estimated.....	150,000.00					150,000.00		150,000.00												
Motor Vehicle License Fees, Est.....																				
3-Cottonwood Bridge.....	1,350,815.92	3,000.00	3,319.10		60,000.00	397,839.37	32,281.27	430,120.64	854,376.18	13,253.63	174,335.78	15,208.41	132,063.70	20,160.71	35,910.52	109,087.05	16,556.00	14,545.15	46,233.83	82,538.78
Totals.....						59,132.47			59,132.47											
Outstanding Balance, Loans to Counties.....						28,748.64			28,748.64											
Liability for Repayment of Loans (1-3 of Apportionment (1918-19).....						290.95			290.95											
Accrued for Repayment of Loans, 1917-18...						29,039.59			29,039.59	13,253.63	174,335.78	15,208.41	12,500.00							
Total Liability on Loans (Subtract).....	29,039.59					825,336.59			825,336.59											
Net Balance Available for 1918-19.....	1,321,776.33	3,000.00	3,319.10		60,000.00	397,839.37	32,281.27	430,120.64	825,336.59	13,253.63	174,335.78	15,208.41	119,563.70	20,160.71	35,910.52	102,755.97	16,556.00	12,354.09	46,233.83	82,538.78

1-No statement of taxes assessed and uncollected as of date July 1, 1917, can be obtained. This amount will become available when collected.

2-Federal Aid available, \$379,133.79, apportioned by Department of Agriculture for use up to June 30, 1919, but all cannot be made available this year.

3-Cottonwood Bridge: There is available \$20,000.00 in the General Fund for this bridge, at such time as Yavapai County subscribes \$20,000.00 to meet it.

*Items indicated thus denote overdrawn balances.

1-No statement of taxes assessed and uncollected as of date July 1, 1917, can be obtained. This amount will become available when collected.
2-Federal Aid available, \$379,133.79, apportioned by Department of Agriculture for use up to June 30, 1919, but all cannot be made available this year.
3-Cottonwood Bridge: There is available \$20,000.00 in the General Fund for this bridge, at such time as Yavapai County subscribes \$20,000.00 to meet it.
*Items indicated thus denote overdrawn balances.

Schedule 3

STATE OF ARIZONA—HIGHWAY DEPARTMENT																							
Supplementary Financial Statement for Period Feb. 1, 1918, to June 30, 1918																							
	TOTAL	GENERAL FUND			STATE ROAD TAX FUND GENERAL				STATE ROAD TAX FUND—COUNTIES														
		State Engineer's Salary	State Engineer's Expense	Florence Bridge Extension	25%	PRISON	TOTAL	TOTAL 75%	01 APACHE	02 COCHISE	03 COCONINO	04 GILA	05 GRAHAM	06 GREENLEE	07 MARICOPA	08 MOHAVE	09 NAVAJO	010 PIMA	011 PINAL	012 SANTA CRUZ	013 YAVAPAI	014 YUMA	
Cash Balance Forward, Feb. 1, 1918.....	\$ 16,560.31	\$ 1,250.00	\$ 1,581.55	\$ 725.62*	\$ 55,960.97*	\$ 47,846.18*	\$ 103,807.15*	\$ 118,261.53	\$ 4,555.35	\$ 25,428.56	\$ 53,024.76	\$ 7,858.79*	\$ 2,535.49*	\$ 5,527.87	\$ 4,499.55	\$ 16,564.38	\$ 4,621.51	\$ 3,144.66	\$ 774.40	\$ 19,452.11	\$ 1,216.08	\$ 39,912.76	\$ 2,958.58
Current Taxes transmitted.....	310,041.31				71,339.52	24,683.12	96,022.64	214,018.67	2,367.29			6,470.72		22,995.71	14,602.65	28,830.80	5,705.87	3,620.05	11,731.86	16,749.96	2,595.88	35,427.42	5,724.81
Various Revenues—																							
Antelope Hill Bridge.....	50,000.00				50,000.00		50,000.00																
Federal Aid.....	22,154.81				22,154.81		22,154.81																
Motor Vehicle Licenses.....	131,496.25				131,496.25		131,496.25																
Prisoner Maintenance.....	5,431.98				5,431.98		5,431.98																
Refunds against Gross Expenditures.....	37,318.11				6,071.40	14,413.17	20,484.57	15,881.84		31.50		838.30	303.73		19,102.20	45,395.18	20,560.76	6,764.71	4,474.93	16,983.19	36,202.07	3,811.96	75,340.18
Net Receipts.....	573,002.77	1,250.00	1,600.66	206.97	225,101.01	3,317.91*	221,783.10	348,162.04	6,922.64	32,733.11		549.77*	176.72	103.50	17,215.11	11,589.57	5,291.95	560.72	18,359.94	2,070.02	5,291.95	2,485.43	8,455.23
Warrants drawn (Gross).....	409,479.49	1,250.00	781.56	206.97	201,519.63	39,161.61	240,681.24	166,559.72	780.74	45,751.71		726.49*	24,418.24*	9,588.26	1,887.09	33,855.61	568.73*	6,203.99	1,447.75*	34,132.05	1,479.99*	72,854.75	228.16
Balance, Cash on Hand.....	163,523.28		819.10		23,581.38	42,479.52*	18,898.14*	181,602.32	6,141.90	32,701.61		661.58*	44,878.46	103.50	17,215.11	11,539.57	10,896.11	560.72	14,161.01	2,070.02	5,291.95	2,485.43	8,455.23
Net Expenditures (Warrants less Refunds)...	372,161.38	1,250.00	762.45	725.62*	195,448.23	24,748.44	220,196.67	150,677.88	780.74	1,572.74			33,746.10	698.47	692.09	2,206.19	568.73	146.74	1,347.75	988.60	1,418.45	1,765.60	205.85
Balance Taxes, 1917-18, available.....	68,172.11				15,752.86	5,160.79	20,913.65	47,258.46	660.70	47,324.45		740.45	9,327.86	698.47	692.09	2,206.19	568.73	146.74	1,347.75	988.60	1,418.45	1,765.60	205.85
Balance cash and available taxes July 1, 1918	231,695.39		819.10		39,334.24	37,318.73*	2,015.51	228,860.78	6,802.60			13.96		10,286.73	2,579.18	36,061.80	0.00	6,350.73	0.00	35,120.65	61.54*	74,620.35	434.01
*Items indicated thus denote overdrawn balances.																							

predecessor for business prior to February 1, and similarly for any other period discussed.

I recommend that a new system of uniform weekly and monthly reports be installed along the lines suggested by me at various times, and a general ledger system be inaugurated to replace the present intiquated Cash Basis method of accounting. These reforms will afford greater accuracy and flexibility in handling costs of the work, and analysis of the methods employed in construction and maintenance, and will provide a systematic plan for handling all expenditures at the time that they accrue against the work, instead of waiting until a warrant is issued by the State Auditor. A step in this direction has been made by the opening of the Claim Register, but it has been impractical up to the present date to go further than this as the Department has been awaiting the action of the Commission of State Institutions, who, we have been given to understand, are preparing a so-called Uniformed System of Accounting to apply to the State Institutions and Departments.

Yours very truly,

FRED L. HUMPHREY, C.E.,

Chief Clerk.

SCHEDULE 4 will be found in another portion of this volume under the historical sketch concerning the organization and operation of the State Highway Department.



PIMA COUNTY
Florence-Tucson Highway



PIMA COUNTY
Florence-Tucson Highway

SCHEDULE 5

TOTAL NET EXPENDITURES, YEAR ENDING JUNE 30, 1917

General Expense	\$ 22,705.96
General Office Expense.....	\$ 22,705.96
Engineering	51,175.44
Construction	410,965.45
Maintenance	57,404.79
General Equipment Transaction	3,701.86
Equipment Replacement	4,771.80
Accounts Receivable (Industrial School)	225.79
	<hr/>
	\$557,021.85

(Figures in heavy type are credits.)

ITEMIZED STATEMENT OF GENERAL EXPENSE—Account 3—1917

	75%	25%	Total	Total 75%	County 25%
Apache					
Division Engineer	\$	\$ 16.93	\$ 16.93	\$	\$ 16.93
Cochise					
General Expense	96.97		96.97	96.97	
Coconino					
General Expense	532.25		532.25	532.25	
Gila					
General Expense	30.08		30.08	30.08	
Graham					
General Expense	70.40		70.40	70.40	
Maricopa					
General Expense	4,620.05		4,620.05	4,620.05	
Depreciation		3,168.36	3,168.36		3,168.36
Santa Cruz					
Division Engineer		252.10	252.10		252.10
Yavapai					
General Expense.....	835.60		835.60	835.60	
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
Distributed Totals....	\$6,044.55	\$3,437.39		\$6,044.55	\$3,437.39

STATE—GENERAL EXPENSE

Expense of Motor Vehicle License Dept.

Secretary of State\$ 4,681.66 \$ 4,681.66

State Engineer:

Salary*(3,000.00) 3,000.00
Expense*(2,500.00) 2,500.00

Assistance to City of Phoenix

So. Central Ave..... 19.36 19.36

Materials in Storage

Antelope Hill 1,071.22
Tubac 1,893.21
Phoenix 58.57 3,023.00

\$6,044.55-\$11,166.41- \$22,705.96

*\$5,500.00 General Fund

ITEMIZED STATEMENT OF GENERAL OFFICE EXPENSE—Account 0

Postage, freight and express.....	\$	503.54	
Telephone and telegraph		101.10	
Engineering Supplies		1,122.26	
Repairs to engineering instruments		58.68	
Engineering Office Salaries		4,070.32	
Accounting Office—Salaries		4,871.16	
Travel Expense: Office Engineer	\$	70.00	
Travel Expense: Chief Clerk		143.75	
Travel Expense: Auditor		270.00	483.75
General Office stationery and supplies.....			640.07
Blue Prints and Photographs			78.32
Books and periodicals			15.00
Annual Report			1,873.51
Miscellaneous Expenses: Office Repairs and Mtc.....			108.35
TOTAL 25%			\$ 13,926.06

DETAILED STATEMENT OF ENGINEERING—Account 1

	Total Project	Total Co.
Apache		
Milky Wash—Beaver Dam	\$ 19.43	\$ 19.43
Cochise		
Bisbee-Douglas Reconstruction	2,585.91	
Bisbee-Tombstone Section 2	1,355.25	
Bisbee-Tombstone Section 3	742.08	
Whitewater River Bridge	418.83	5,102.07
Coconino		
Flagstaff-Williams Section 2	1,889.13	
Flagstaff-Williams Section 3	918.11	2,807.24
Gila		
Globe-Roosevelt Section 1	4,718.00	
Globe-Roosevelt Section 2	2,094.21	
Pinto Creek Bridge	391.99	7,204.20
Graham		
Clifton-Solomonville Section 3	4,736.56	4,736.56
Greenlee		
Clifton-Solomonville Section 1	39.52	
Clifton-Solomonville Section 2	6,541.68	
Gila River Bridge	2,857.62	9,438.82
Maricopa		
Agua Fria Bridge	1,935.64	
Arlington Agua Caliente	208.68	
Grand Avenue Division	454.55	
Phoenix-Tempe	80.28	
Phoenix-Yuma	4,859.48	
Phoenix-Yuma	2,656.32	10,194.85
Mohave		
Kingman-Oatman	488.92	
Kingman-Oatman Section 2	1,345.98	1,834.90

Navajo

Winslow-Holbrook Section 2.....	120.59	
Winslow-Holbrook Section 3.....	428.18	
Holbrook-St. Johns Section 1	49.46	
Little Colorado River Bridge	2.63	600.86

Pima

Tucson-Bisbee Section 1 (P)	174.51	
Tucson-Bisbee Section 2	204.58	
Tucson-Florence Section 2	50.80	
Tucson-Florence Section 2A	1.50	431.39

Pinal

Tucson-Florence Section 1.....	130.51	
Florence Bridge Extension	1,149.68	1,280.19

Santa Cruz

Santa Cruz River Bridge No. 1	224.63	
Nogales-Tucson Section 2	5,128.13	5,352.76

Yavapai

Prescott-Flagstaff Section 4	2,157.14	2,157.14
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Yuma

Wellton-Mohawk Division	14.93	14.93
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TOTAL 25%\$ 51,175.44 \$ 51,175.44

DETAILED STATEMENT OF CONSTRUCTION ACCOUNT 2—1916-17

NOTE—Figures in heavy type are credits.

TOTAL FOR COUNTY

County	Project	75%	25%	Tot Project	75%	25%
Apache						
	Milky Wash Beaver					
	Dam Division	\$	37.86	\$ 37.86	\$	37.86
Cochise						
	Bisbee-Tombstone—					
	Sec. 1		94.71	94.71		
	Sec. 2	291.70	621.41	329.71		
	Sec. 3	26,948.02	977.87	27,925.89		
	Bisbee-Douglas		234.60	234.60		
	Bisbee-Douglas R. C... ..	7,699.81	73.38	7,773.19		
	Bisbee-Douglas West	12.20		12.20		
	Whitewater R. Bridge	417.76		417.76	35,345.09	759.15
	Sec. 2	7,329.75	10,988.05	18,317.80		
	Sec. 3	2,737.88	9,860.60	12,598.48	10,960.13	20,849.42

Coconino

Canyon Diablo Br.77	.77		
Flagstaff-Williams—					
Sec. 1	892.50		892.50		

Gila

Globe-Roosevelt Sec. 2	12,087.83	1,335.22	10,752.61		
Pinto Creek Br.	10,791.19	8,086.90	18,878.09	22,879.02	6,751.68

Graham

Clifton-Solomonville:					
Sec. 3	4,524.43	37,792.05	42,316.48		
Solomonville-San Carlos Sec. 2-B	44.03		44.03	4,568.46	37,792.05

Greenlee

Clifton-Solomonville:					
Sec. 2-P	9,987.08	68,935.98	78,923.06	9,987.08	68,935.98

Maricopa

Agua Fria Bridge	20,539.34	23,343.40	43,882.74		
Arlington Agua Caliente Div.		12,052.36	12,052.36		
Grand Ave. Div.	6,277.01	14.15	6,262.86		
Florence-Mesa Sec. 2		147.35	147.35	26,816.35	11,424.24

Mohave

Kingman-Oatman	5,008.78	20,682.83	25,691.61	5,008.78	20,682.83
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Navajo

Little Colo. R. Bridge		3.09	3.09		
Holbrook-St. Johns—					
Sec. 1	182.89		182.89		
Winslow-Holbrook—					
Sec. 2	2,741.13	29.94	2,771.07		
Sec. 3	931.43	10,134.96	9,203.53	1,992.59	10,167.99

Pima

Tucson-Bisbee—					
Sec. 1-P		4,178.59	4,178.59		
Sec. 2		2,327.56	2,327.56		
Tucson-Florence—					
Sec. 2-P	4,776.16	4,481.43	294.73		
Sec. 2-A	467.95		467.95	5,244.11	2,024.72

Pinal

Florence Bridge	3,640.13	70.95	3,569.18		
Florence Bridge (Extension)	(38,111.68)		38,111.68		
Tucson-Florence—					
Sec. 1	3,289.93	1,871.93	1,418.00	6,930.06	1,942.88

Santa Cruz

Santa Cruz R. Bridge

No. 1	12,982.07	2,680.28	15,662.35		
Nogales-Tucson Sec. 2		28,380.47	28,380.47	12,982.07	31,060.75

Yavapai

Prescott-Flagstaff—

Sec. 4	22,931.58	742.07	23,673.65	22,931.58	742.07
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Yuma

Antelope Hill Br. 185.95

Wellton Mohawk Div. 2,263.36 2,263.36 185.95 2,263.36

\$165,831.27 \$207,022.50 \$410,965.45 \$165,831.27 \$207,022.50

*38,111.68 general fund.

DETAILED STATEMENT OF MAINTENANCE—Account 6

County	Net Expenditures for County		Total
	75%	25%	County
Apache	\$ 1,359.77	\$ 31.54	\$ 1,391.31
Cochise	3,986.50	210.70	4,197.20
Coconino	525.46	29.94	555.40
Gila	14,027.17	335.70	14,362.87
Graham	709.67	58.48	768.15
Greenlee	513.40	513.40
Maricopa	4,970.21	873.08	5,843.29
Mohave	535.97	15.00	550.97
Navajo	703.16	137.72	840.88
Pima	6,181.75	991.54	7,173.29
Pinal	3,596.46	4,695.60	8,292.06
Santa Cruz	2,561.30	6,522.02	9,083.32
Yavapai	2,433.10	240.27	2,673.37
Yuma	1,159.28	1,159.28
TOTALS.....	\$ 43,263.20	\$ 14,141.59	\$ 57,404.79

DETAILED STATEMENT OF GENERAL EQUIPMENT TRANSACTIONS—

(Figures in heavy type are credits.)

Account 5			
County	75%	25%	Total.
Apache	\$ 33.75		
Cochise	216.23		
Coconino	24.20		
Gila	235.31		
Graham	9.40		
Greenlee	36.30		
Maricopa	394.36		
Mohave	37.90		
Navajo	38.49		
Pima	116.30		
Pinal	491.91		
Santa Cruz	136.02		
Yavapai	709.57		
Yuma	165.90		
At Large		3,884.36	
	<hr/>	<hr/>	<hr/>
	\$ 182.50	\$ 3,884.36	\$ 3,701.86

Schedule 6

TOTAL NET EXPENDITURES—YEAR ENDING JUNE 30, 1918

General Expense	\$ 10,433.05
General Office Expense	19,032.43
Engineering	54,930.21
Construction	632,959.56
Maintenance	80,275.98
General Equipment	8,476.65
Repairs to General Equipment	356.01
Accounts receivable	5,261.48
	<hr/>
	\$811,725.42

ITEMIZED STATEMENT OF GENERAL EXPENSE

	1918
Expense of Motor Vehicle License Dept. Sec. of State	\$ 2,500.00
State Engineer	
Salary	\$ 3,000.00
Expenses Travel	\$ 731.38
Expenses Auto	942.52
	<hr/>
	1,680.90

Right of Way Agent, Equipment Manager and Division Engineers not chargeable to projects

Salaries	\$ 731.47	
Expense Accounts	340.40	
Scrip Books	130.99	
Auto Expense	160.05	1,362.91

Sale of materials from storage (credit)	178.63
Printing Specifications	51.60
Freight, express and drayage on general equipment....	532.64
Storage and rental of material yard.....	261.00
Bonds, Filing Fees and Insurance.....	587.71
Miscellaneous expenses, including delayed charges against projects previously reported as complete....	388.88

Total 25% Fund	\$ 10,187.01
	75%

Cochise County

Delayed charge to completed work.....	\$ 312.60	
Delayed credit for material for storage.....	66.52	
Total 75% Fund	\$ 246.08	246.08
		\$ 10,433.09

STATEMENT OF GENERAL OFFICE EXPENSE—Account O—1918

Postage, Freight and Express	\$ 418.28
Telephone and Telegraph	352.44
Drafting and Engineering Equipment and Supplies.....	1,044.41
Engineering office salaries—general	5,247.98
Accounting office salaries	10,166.11
Office Engineer and Auditor Expense Accounts	684.82
General office stationery and supplies	715.25
Blue prints and photographs	122.03
Magazines and Newspapers	81.50
Miscellaneous expenses, office repairs and maintenance.....	199.60
Total 25% Fund	\$ 19,032.43

DETAILED STATEMENT OF ENGINEERING—Account 1—1918

	25%	Total for County 25%
Apache		
Holbrook-St. Johns, Sec. 4.....	\$ 95.81	\$ 95.81
Cochise		
Bisbee-Tombstone Sec. 3.....	1,760.05	
Bisbee-Tombstone Sec. 4.....	1,415.93	
Bisbee-Douglas R. C.....	1,229.05	
Emerald Gulch Bridge	112.00	4,517.03
Coconino		
Flagstaff-Williams Sec. 3	\$ 2,037.19	
Flagstaff-Williams Sec. 3A.....	333.57	
Flagstaff-Winslow Sec. 1.....	28.00	2,398.76
Gila		
Globe-Ray Sec. 1	\$ 21.00	
Globe-Roosevelt Sec. 1	3,531.60	
Globe-Roosevelt Sec. 2	6.00	
Globe-San Carlos Sec. 3	2,206.95	
Pinto Creek Bridge	691.92	
Superior-Miami Sec. 1.....	4,285.39	10,742.86
Graham		
Clifton-Solomonville Sec. 3	\$ 919.05	919.05
Greenlee		
Clifton-Solomonville Sec. 2.....	\$ 9,194.75	
Gila River Bridge	14.80	9,209.55
Maricopa		
Agua Fria Bridge.....	\$ 423.32	
Agua Fria Topographic Survey	225.24	
Florence-Mesa Sec. 2.....	1,375.19	
Maricopa Canal Bridge-Grand Ave.....	56.36	
Mesa-Superior Sec. 1	1,113.14	
Phoenix-Prescott, Glendale Div.....	19.10	
Phoenix-Tempe Sec. 2—Reconstruction	1,777.49	
Phoenix-Yuma Sec. 2	974.77	
Phoenix-Yuma Sec. 6	678.22	6,642.73

STATE HIGHWAY DEPARTMENT

159

Mohave

Kingman-Oatman Sec. 2.....	\$ 1,789.87	
Kingman-Oatman Sec. 3.....	952.05	
Oatman-Topock	89.45	2,831.37

Navajo

Holbrook-St. Johns Sec. 1	\$ 17.00	
Holbrook-St. Johns Sec. 3	201.65	
Winslow-Holbrook Sec. 2.....	28.00	246.65

Pima

Nogales-Tucson Sec. 4	\$ 1,959.40	
Santa Cruz River Bridge No. 2.....	140.00	
Tucson-Bisbee Sec. 1.....	50.00	2,149.40

Pinal

Florence Bridge Extension	\$ 1,154.77	
Mesa-Superior Sec. 2A	1,858.59	
Mesa-Superior Sec. 2B.....	654.92	
Tucson-Florence Sec. 1	357.71	
Queen Creek Bridge.....	58.00	4,083.90

Santa Cruz

Nogales-Tucson Sec. 2	\$ 171.00	
Nogales-Tucson Sec. 3	2,858.97	
Pesquiera Bridge	56.40	3,086.37

Yavapai

Prescott-Flagstaff Sec. 1	\$ 40.00	
Prescott-Flagstaff Sec. 2	55.00	
Prescott-Flagstaff Sec. 4	820.51	
Prescott-Dewey	52.00	
Prescott-Jerome	1,293.73	
Cottonwood Bridge	477.56	
Camp Verde Bridge	173.44	2,912.24

Yuma

Antelope Hill Bridge Extension.....	\$ 409.14	
Phoenix-Yuma Sec. 7	3,261.76	
Wellton-Mohawk Div.....	1,423.59	5,094.49

Total 25% Fund\$ 54,930.21



PINAL COUNTY
Temporary Road—Constructed by Maintenance Men—Florence-Tucson Highway



PINAL COUNTY
Gila River Bridge at Florence—Florence-Mesa highway

DETAILED STATEMENT OF CONSTRUCTION—Account 2—1917-18

County	Project	Net 75%	Net 25%	Tot. project	1917-18	
					Total by 75%	Counties 25%
Cochise						
	Bisbee-Douglas R.C..	\$ 51.75	\$	\$ 51.75	\$	
	Bisbee-Tombstone—					
	Sec. 3	29,092.07	2,492.24	31,584.31		
	Sec. 4	44,065.28	1,809.05	45,874.33	73,209.10	4,301.29
Coconino						
	Flagstaff-Williams—					
	Sec. 3	23,955.72	14,817.30	38,773.02		
	Sec 3A		13,875.36	13,875.36	23,955.72	28,692.66
Gila						
	Pinto Creek Bridge	10,292.27	3,082.64	13,374.91		
	Globe-Roosevelt Sl..	82,303.30	5,745.71	88,048.01	92,594.57	8,828.35
Greenlee						
	Clifton-Solomonville—					
	Sec. 2	27,008.58	85,187.06	112,195.64	27,008.58	85,187.06
Maricopa						
	Agua Fria Bridge..	1,093.12	27,410.59	28,503.71		
	Maricopa Canal Br.					
	Grand Ave.	2,449.18	15.60	2,464.78		
	Phoenix-Tempe—					
	Sec. 2 Reconstruc.		85.50	85.50	3,542.30	27,511.69
Mohave						
	Kingman-Topock	2,914.44		2,914.44		
	Kingman-Oatman S2	10,805.22	11,934.17	22,739.39	13,719.66	11,934.17
Pima						
	Nogales-Tucson—					
	Sec. 4	20,501.51	36,889.67	57,391.18	20,501.51	36,889.67
Pinal						
	Florence Br. Ext...*	(11,888.32)	69,704.86	81,593.18		
	Mesa-Superfior—					
	Sec. 2A	450.94	664.08	1,115.02	450.94	70,368.94
Santa Cruz						
	Nogales-Tucson—					
	Sec. 3		55,536.27	55,536.27		
	Canoa Wash Bridge		6,080.92	6,080.92		
	Sopori Bridge		4,056.28	4,056.28		
	Pesquiera Bridge		3,709.95	3,709.95		63,383.42

Yavapai

Prescott-Flagstaff—

Sec. 4 (credits).....	5.4471	55.08	599.79	544.71	55.08
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Yuma

Antelope Hill Bridge

Extension	23,591.40	23,591.40	23,591.40
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\$254,437.67	\$366,633.57	\$632,959.56	\$254,437.67	\$366,633.57
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*11,888.32 General Fund

DETAILED STATEMENT OF MAINTENANCE—Account 6—1918

County	Highway or Bridge	Net 75%	Net 25%	Total for Project	Total for County 75%	Total for County 25%
Apache						
	Milky Way Beaver Dam Div.	\$ 1,648.00	\$ 56.76	\$ 1,704.76	\$ 1,648.00	\$ 56.76
Cochise						
	Bisbee-Douglas	6,994.59	53.51	7,048.10		
	Bisbee-Tombstone—					
	1 and 2	1,741.54	181.43	1,922.97	8,736.13	234.94
Coconino						
	Flagstaff-Williams—					
	Sec. 1	73.34	201.06	274.70		
	Sec. 2	73.65	146.86	220.51		
	Sec. 3	503.89	288.69	792.58		
	Flagstaff-Winslow ..		178.00	178.00	651.78	814.61
Gila						
	Globe-Roosevelt	11,569.87	1.90	11,571.77		
	Globe-San Carlos S 3	188.33		188.33	11,758.80	1.90
Graham						
	Solomonville-San Carlos	229.50	64.41	293.91	229.50	64.41
Greenlee						
	Clifton-Solomonville—					
	Sec. 1	3,132.80	120.10	3,252.90	3,132.80	120.10
Maricopa						
	Grand Ave. Division	979.25	338.76	1,318.01		
	Phoenix-Tempe Hgy	8,565.14	774.92	9,340.06		
	Florence-Mesa S. 2. ..	2,271.00	181.43	2,452.43		
	Tempe-Mesa	22.79		22.79		
	Mesa-Superior	12.96		12.96		
	Higley-Florence		33.65	33.65		
	Agua Fria Bridge....	729.46	40.00	769.46	12,580.60	1,368.76

Mohave

Kingman-Topock	494.19		494.19		
Kingman - Needles- Yucca	124.50		124.50		
Kingman-Oatman— Sec. 1	403.89	558.60	962.49	1,022.58	558.60

Navajo

Winslow-Holbrook— Sec. 1		32.16	32.16		
Sec. 2	64.02	27.46	91.48		
Sec. 3	412.00		412.00		
Holbrook-St. Johns— Sec. 1	168.95	49.97	218.92	644.97	109.59

Pima

Tucson-Bisbee Sec. 1	1,601.56	1,126.75	2,728.31		
Tucson-Florence S.2	665.39	1,267.29	1,932.68		
Nogales-Tucson— Sec. 4	217.51		217.51		
Sec. A and B.....	5,512.87		5,512.87	7,397.33	2,394.04

Pinal

Tucson-Florence— Sec. 1	2,278.54	530.50	2,809.04		
Florence Bridge		125.15	125.15		
Florence-Mesa S. 1..	147.50	43.76	191.26		
Tucson-Florence— Sec. 2	269.68		269.68	2,695.72	699.41

Santa Cruz

Nogales-Tucson— Sec. 1	390.05	610.20	1,000.25		
Sec. 2	5,358.10	1,243.08	6,601.18		
Sec. 3	104.08	137.32	241.40		
Potrero Bridge	962.82	923.84	1,886.66	6,815.05	2,914.44

Yavapai

Prescott-Flagstaff— Sec. 3 and 4.....	1,535.20		1,535.20		
Phoenix-Prescott Sen. Mt. Division	1,548.35	.52	1,548.87		
Cottonwood Bridge..	91.08	91.08			
Camp Verde, Bridge	821.30	17.28	838.58		
Prescott-Flagstaff— Sec. 1	38.50		38.50		
Beaver Creek Div.....	174.30		174.30	4,208.73	73.28

Yuma

Yuma Bridge	14.30		14.30		
Antelope Hill Bridge	925.01		925.01		
Wellton-Mohawk Division	7,366.27	585.33	7,951.60	8,305.58	585.33
Totals.....	\$ 70,426.37	\$ 9,849.61	\$ 80,275.98	\$ 70,426.37	\$ 9,849.61

GENERAL EQUIPMENT—Account 5—1918

(Figures in heavy type are credits.)

Maintenance Equipment	\$ 1,902.65
Automobiles, Auto Trucks and Motorcycles	8,661.39
Machinery	557.85
Camp and Kitchen	656.81
Wagons	338.10
Mules	434.61
Auto Accessories	221.48
Field Engineering Equipment	912.00
Phoenix—General Office	105.36
Phoenix—Engineering Office	674.55
	\$ 8,476.66

25% Fund\$13,717.33

75% Fund 5,240.67

\$ 8,476.66

COUNTY—	75%	25%	Total
Apache	\$ 51.25		
Cochise	2,693.31		
Coconino	19.50		
Gila	122.65		
Graham	25.00		
Greenlee	70.00		
Maricopa	476.95		
Navajo	17.50		
Pima	297.75		
Pinal	252.95		
Santa Cruz	78.47		
Yavapai	974.94		
Yuma	160.40		
At Large		13,717.33	
	\$ 5,240.67	\$ 13,717.33	\$ 8,476.66



PINAL COUNTY
Canado del Oro—Florence-Tucson Highway



PINAL COUNTY
Gila River at Florence

STATEMENT OF REPAIRS TO GENERAL EQUIPMENT—Account 5-2, 1918

Concrete Mixer	\$ 9.45
Maintenance Equipment	24.28
Wagons	22.25
Autos and trucks	84.18
Compressor	25.02
Engineering instruments	94.10
Labor in equipment yard.....	183.50
Refunds for rental and freight overcharge....	86.77

 \$356.01

25% Fund—\$356.01

STATEMENT OF ACCOUNTS RECEIVABLE—Account 4—1918

State Engineer's Imprest Fund.....	\$ 4,977.01
State Fair Commission	329.34
State Capitol Building	55.50
State Hospital for the Insane	4.88
State Loan Board	3.50
Comission of State Institutions	23.25

 \$ 5,393.48

Less Collections—

To apply on last year's accounts.....	\$ 15.95
Sack credit to be applied to source when identified	274.50 290.45

 Total 25% Fund..... \$ 5,103.03

Yuma County, credit maintenance—

75% Fund	\$158.45 158.45
	<hr/>
	\$ 5,261.48

Rules and Regulations Governing Work of State Highway Department

In the prosecution of work under the State Highway Department, the following regulations have been adopted:

GENERAL

The Public

Employees must be courteous and reasonable in meeting and dealing with the public.

Information, when requested, should be cheerfully given.
Reasonable assistance should be offered where necessary.

Obligations

Failure to liquidate just obligations will be deemed sufficient cause for dismissal of any employee from the service.

Employment

Employees of one division shall not be offered employment by any other without knowledge and consent of those in authority in division in which employed.

Betterment of the Service

Heads of divisions should encourage suggestions from subordinates for betterment of work and service. When such suggestions are of general application, such head should forward to the General office.

Communications to Office

Nothing should be taken up with the General office except through the head of the division or with his knowledge and consent.

Route Cards

Employees travelling on State business will be furnished report cards to keep General office advised of routes and daily address.

Wages

The policy of the department will be to follow labor schedules of the County Road Department in the respective counties.

CORRESPONDENCE

Address of Mail

All communications unless of a personal nature should be addressed "State Engineer, Phoenix, Arizona." If of a nature requiring immediate and special attention of some member mark, "Attention of _____."

Postage

Mail matter of same class should be sent under one cover, and not each piece separately thereby increasing postage expense.

All letters should bear proper file number as per filing instructions here given.

File Numbers for Correspondence of State Highway Department.

SUBJECTS

- 00 Engineering.
- 010 Construction Equipment.
- 020 Material and Supplies.
- 030 Accounting.
- 040 Correspondence.
- 050—Prison Labor.
- 621 Administration.
- 622 State Highways.

- 623 State Bridges.
- 624 State Buildings.
- 625 Irrigation.
- 626 County Engineers.
- 627 Right of Way.

All above subjects subdivided on unit system, i. e., 01--Instructions to Engineer, 011--Pile Drivers. Instructions to Engineers regarding survey Globe-Roosevelt Highway, 4-622-1-01; Escaped prisoners on Bisbee-Tombstone Highway, 2-622-16-054. Prefix of 4 and 2 in latter two examples stand for County in which work is located. County numbers, as follows:

- 1—Apache.
- 2—Cochise.
- 3—Coconino.
- 4—Gila.
- 6—Greenlee.
- 7—Maricopa.
- 8—Mohave.
- 9—Navajo.
- 10—Pima.
- 11—Pinal.
- 12—Santa Cruz.
- 13—Yavapai.
- 14—Yuma.

FILES

- 00—Engineering General.
- 01—Instructions for surveying parties, etc.
- 02—Engineering Instruments, Equipment and Supplies.
- 03—Profiles, Maps, etc.
- 04—Estimates.
- 05—Reports—Annual.
- 06—Reports—Monthly and Weekly and other.
- 07—Engineering Data.
- 08—Cost Data.

- 09—Reconnaissance.
- 010—Construction Equipment.
- 011—Pile Drivers.
- 012—Road Drags, Scrapers.
- 013—Engines, Air Compressors, Concrete Mixers, etc.
- 014—Road Rollers and Graders.
- 015—Tractors.
- 016—Automobile and Motorcycles.
- 017—Stockades.
- 019—Other Equipment.

- 020—Material and Supplies.
- 021—Requisitions.
- 022—Cement.
- 023—Lumber.
- 024—Hardware.
- 025—Groceries, Meats, etc.
- 026—Hay and Grain.
- 027—Other Materials.
- 028—Inspection and Tests of Material.
- 029—Inventories.

- 030—Accounting.
- 031—Bills.
- 032—Expense Account.
- 033—Payrolls.
- 034—Deductions.
- 035—Department Invoices.
- 036—Sale of Material to Outside Parties.
- 037—Transfer of Material.
- 038—.....
- 039—.....

- 040—Correspondence.
- 041—Miscellaneous Letters.
- 042—Office Use Only.
- 043—Office Use Only.

- 044—Land Board of Arizona.
- 045—Data for Publicity.
- 046—Maintenance.
- 047—Office of Public Roads.
- 048—National Highway Association.
- 049—Federal Aid.

- 050—Prison Labor.
- 051—Transfer of men from and to Prison and Jobs, Discharge.
- 052—Clothing, Shoes and Maintenance.
- 053—Rules Regulating men and guards
- 054—Escapes.
- 055—Monthly Reports.
- 056—Bills—vs—Prison for Maintenance.
- 057—Guards.
- 058—.....
- 059—.....
- 621 —Administration.
- 621— 1—Legislative Acts Pertaining to State Engineer's Office.
- 621— 2—Funds Provided.
- 621— 3—Interpretation of Legislative Acts.
- 621— 4—Board of Control.
- 621— 5—
- 621— 6—
- 621— 7—
- 621— 8—
- 621— 9—

- 622 —State Highways—General.
- 622— 1—Globe-Roosevelt, Gila County.
- 622— 2—Prescott-Phoenix, Prescott Division, Yavapai County.
- 622— 3—Prescott-Phoenix, Senator Mt. Division, Yavapai County.
- 622— 4—Prescott-Phoenix, Grand Ave. Division, Maricopa County.
- 622— 5—Prescott-Phoenix, Silver Mt. Division, Yavapai County.
- 622— 6—Bisbee-Douglas, Cochise County.
- 622— 7—Prescott-Flagstaff, Beaver Creek, Yavapai County.

- 622— 8—Tucson-Bisbee, Division Canon, Pima County.
- 622— 9—Tucson Florence, Section 1, Pinal County.
- 622—10—Globe-Ray, Section 1, Pinal County.
- 622—11—Globe-Ray, Section 2, Gila County.
- 622—12—Florence-Mesa, Section 1, Pinal County.
- 622—13—Florence-Mesa, Section 2, Maricopa County.
- 622—14—Clifton-Solomonville, Section 1, Greenlee County.
- 622—15—Clifton-Solomonville, Section 2, Greenlee County.
- 622—16—Bisbee-Tombstone, Section 1, Cochise County.
- 622—17—Solomonville-San Carlos, Section 2, Graham County.
- 622—18—Tucson-Bisbee, Section 1, Pima County.
- 622—19—Phoenix-Tempe, Maricopa County.
- 622—20—Nogales-Tucson, Section 1, Santa Cruz County.
- 622—21—Tucson-Bisbee, Section 2, Pima County.
- 622—22—Solomonville-San Carlos, Section 3, Graham County.
- 622—23—Kingman-Needles, Section 1, Mohave County.
- 622—24—Prescott-Flagstaff, Section 2, Yavapai County.
- 622—25—Prescott-Flagstaff, Section 3, Yavapai County.
- 622—26—Prescott-Dewey, Yavapai County.
- 622—27—Flagstaff-Winslow, Section 1, Coconino County.
- 622—28—Globe-San Carlos, Section 1, Gila County.
- 622—29—Winslow-Holbrook, Section 1, Navajo County.
- 622—30—Prescott-Flagstaff, Section 4, Yavapai County.
- 622—31—Phoenix-Yuma Highway, Yuma County.
- 622—32—Globe-San Carlos, Section 2, Gila County.
- 622—33—Mesa-Roosevelt Highway, Maricopa County.
- 522—34—Holbrook-St. Johns Highway, Apache County.
- 622—35—Winslow-Holbrook, Section 2, Navajo County.
- 622—36—Flagstaff-Williams, Section 2, Coconino County.
- 622—37—Tucson-Florence, Section 2, Pima County.
- 622—28—Bisbee-Tombstone, Section 2, Cochise County.
- 622—39—Holbrook-St. Johns BD-Hunt, Apache County.
- 622—40—Kingman-Oatman, Mohave County.
- 622—41—Arlington-Caliente, Maricopa County.
- 622—42—Wellton-Mohawk, Yuma County.
- 623—43—Nogales-Tucson Section, Santa Cruz County.
- 622—44—Globe-Roosevelt, Section 2, Gila County.

- 622—45—Flagstaff-Williams, Section 2, Coconino County.
- 622—46—Clifton-Solomonville, Section 3, Graham County.
- 622—47—Tombstone, Section 3, Cochise County.
- 622—48—Winslow-Holbrook, Section 3, Navajo County.
- 622—49—Kingman-Oatman, Section 2, Mohave County.
- 622—50—Phoenix-Yuma, Section 2, Yuma County.
- 622—51—Flagstaff-Williams, Section 3, Coconino County.
- 622—52—Nogales-Tucson, Section 3, Santa Cruz County.
- 622—38—Bisbee-Tombstone, Section 2, Cochise County.
- 622—54—Superior-Miami, Section 1, Pinal County.
- 622—53—Globe-San Carlos, Section 3, Gila County.
- 622—56—Nogales-Tucson, Section 4, Pinal County.
- 622—57—Bisbee-Tombstone, Section 4, Cochise County.
- 622—58—Kingman-Oatman, Section 3, Mohave County.
- 622—59—Superior-Miami, Section 2, Gila County.
- 622—60—Mesa-Superior, 1, Maricopa County.
- 622—61—Mesa-Superior, Section 2-A, Pinal County.
- 622—62—Phoenix-Yuma, Section 7, Yuma County.
- 622—63—Mesa-Superior, Section 3, Pinal County.
- 622—64—Mesa-Florence, Section 2, Maricopa County.
- 622—65—Phoenix-Tempe, Section 2, Maricopa County, Reconstruction
- 622—66—Tombstone-Fairbanks, Section 1, Cochise County.
- 622—67—Mesa-Superior, Section 2-B, Pinal County.
- 622—68—Holbrook-St. Johns, Section 3, Navajo County.
- 622—69—Holbrook-St. Johns, Section 4, Apache County.
- 623 —Bridges—General.
- 623— 1—Plans, Maps, Estimates, etc.
- 623— 2—Material.
- 623— 3—Bids Covering Construction.
- 623— 4—Contracts.
- 623— 5—Approaches.
- 623— 6—Employment of Labor.
- 623— 7—Culvert—Corrugated Iron, etc.
- 623— 8—Cost Statements.
- 623— 9—.....
- 624 —Buildings.
- 624— 1—Plans, Estimates, etc.
- 624— 2—Material.
- 624— 3—Bids covering Construction.
- 624— 4—Contracts.

- 624— 5—.....
- 625 —Irrigation.
- 625— 1—Apache and Navajo Relief.
- 625— 2—Water Duty Investigation.
- 626 —County Engineers.
- 627 —Right of Way.

Communications to Outside Parties—

Where division heads find it necessary to communicate direct with outside parties relative to matters of importance to the General office, copies of such correspondence should be furnished the General office.

AUTOMOBILES

Employees are furnished cars to facilitate work and repair and garage bills must be kept to the minimum.

Tires

Excellent results in tire mileage are obtained by exchanging tires on wheels from time to time.

Reports

Monthly reports on automobile report form must be furnished not later than the 10th of the succeeding month. For trucks where use of speedometer is not practicable, mileage should be closely approximated daily and this used in preparation of report.

SHIPMENTS

Tracing

When requested to make shipment of material or equipment, shipper should mail bill of lading to consignee the day shipment is made and at same time request transportation company to trace shipment to destination. Shipper should also prepare department invoice in triplicate and forward to General office promptly.

Cost of Moving

In moving equipment from a completed project to a new one, all costs of delivery to nearest shipping point to completed project will be borne by such completed project and charges from that point to new project shall be borne by the new project.

Where transfer is for short distance only and made by team, the new project will bear all expense from time teams leave old camp. Where equipment is forwarded from a completed project to General Material and Equipment yard all expense is borne by such project.

PURCHASES

General

The purchase of all materials and equipment will be made by the General office.

Anticipating Needs

Division heads or their representatives must anticipate their requirements sufficiently in advance to allow securing of best qualities and prices which cannot be obtained on rush deliveries.

Emergency Purchase Authority and Maximum

Purchase of small supplies and repair materials necessary to avoid actual loss will be permitted to a maximum of \$25.00 on Emergency Requisition by division head or his authorized representative. In such cases copy of Emergency Requisition must be forwarded to General office at once and necessity for such purchase stated thereon.

Should emergency arise where a purchase locally is deemed necessary in excess of above maximum, authority must be obtained from the General office, by telegraph if occasion demands.

Requisition Required

Under no circumstances should employees purchase anything and have charged to the department without presenting requisition to the dealer at time of purchase.

(Also see Requisition.)

EQUIPMENT

Inventory

The proper supervision of equipment and resulting economy in this item of cost on construction cannot receive too close attention. The head of each division is charged with such responsibility and must see that inventory of all equipment in his camps is furnished the General office quarterly.

Items checking short from the previous inventory must be properly accounted for.

Depreciation

Upon completion of a project depreciation should be charged to the project and equipment credited on following basis:

	% per year
Engines, Gas and Steam	20
Fresnos	100
Graders	20
Mixers, Concrete	20
Mules	10
Pile Drivers	20
Plows	20
Rock Crushers	20
Steam Shovels	10
Tents	75
Wagons	20
Wheelbarrows and Concrete Carts.....	50

Trucks on daily rate on basis of life of three years. All small equipment such as picks, axes, shovels, etc., on value at time of transfer to new project.

ACCOUNTING

General

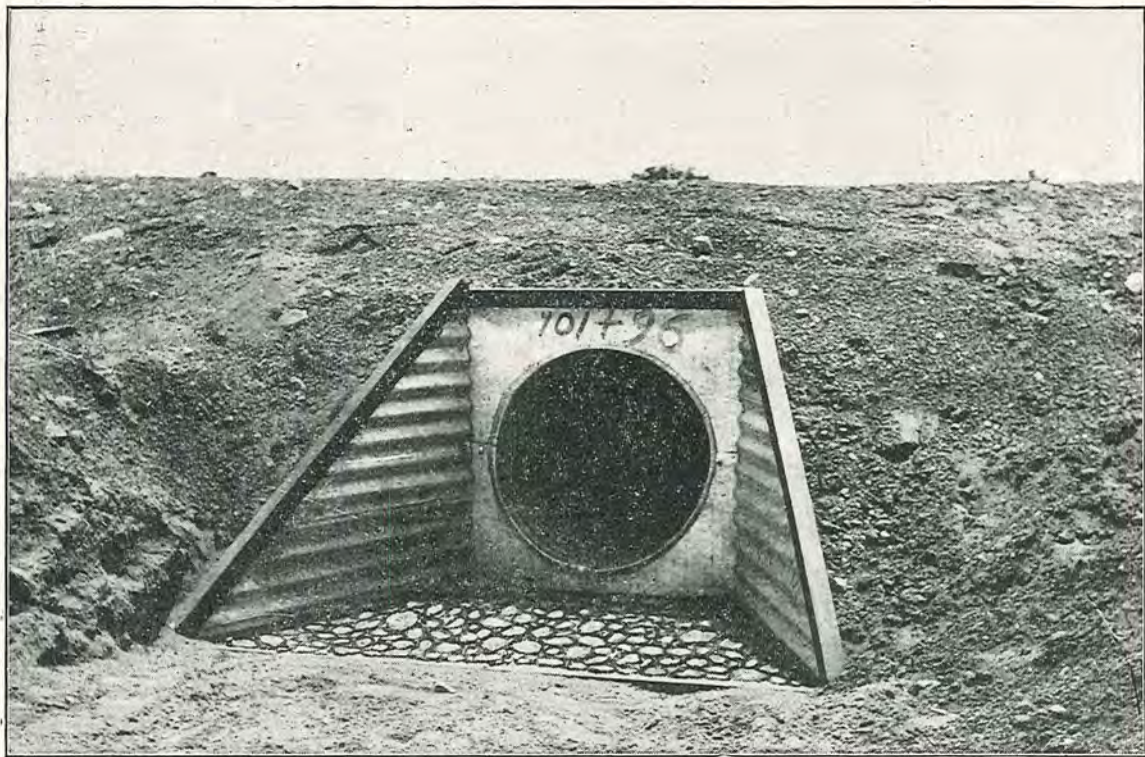
The funds derived from the 10-cent levy for State Highways are apportioned as follows:

75% to the various counties on the basis of their assessed valuation. These fourteen funds are designated "State Road Tax Fund _____ County (Apache, Cochise, etc.), and are expendable for construction, reconstruction and maintenance of State Highways in the respective counties under the joint authority of the Board of Supervisors of the County and the State Engineer. The prefix "o" followed by the proper county numeral is used to identify the different County apportionments, i.e., 01, Apache; 02, Cochise, etc.

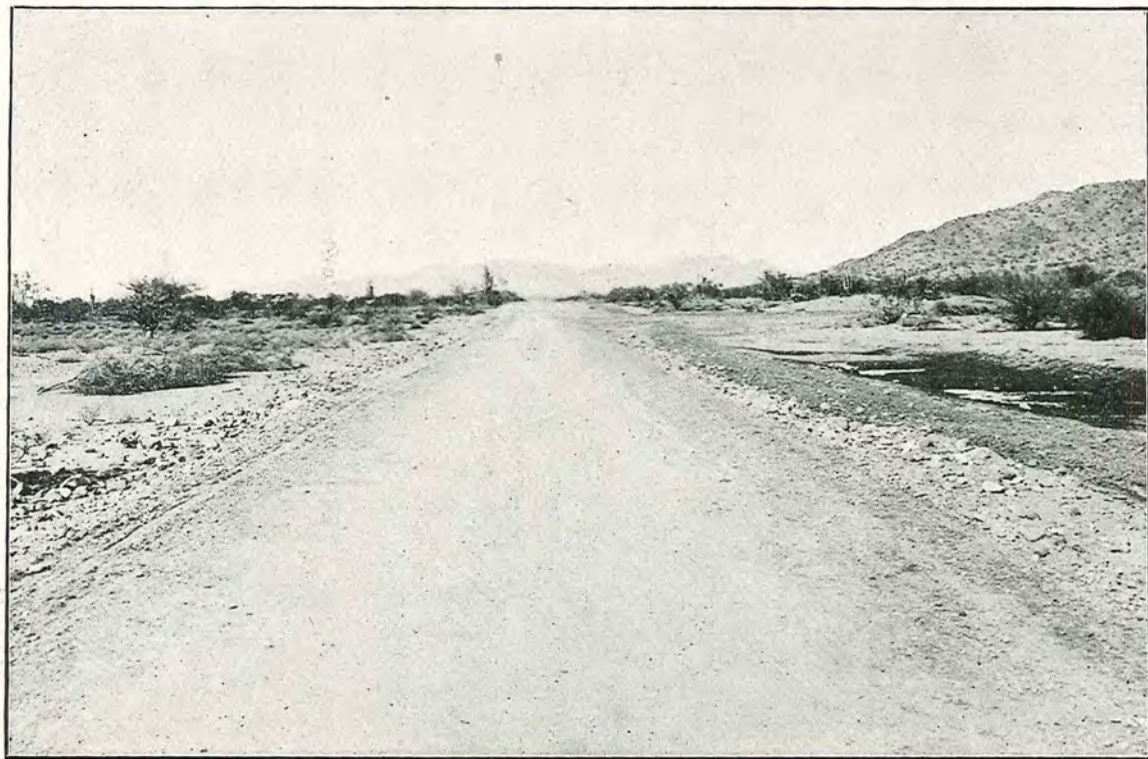
County Numbers

Apache	1	Mohave	8
Cochise	2	Navajo	9
Coconino	3	Pima	10
Gila	4	Pinal	11
Graham	5	Santa Cruz	12
Greenlee	6	Yavapai	13
Maricopa	7	Yuma	14

25% to the General Road Fund, designated State Road Tax Fund-General and is expendable under joint authority of the State Engineer and the Commission of State Institutions. "00" is used to designate this fund. All engineering expense is chargeable to the State Road Tax Fund-General and such construction as is specifically authorized by the State Engineer and the State Board of Control.



PINAL COUNTY
Corrugated Iron Culvert with Metal Wing Wall—Mesa-Superior Highway



PINAL COUNTY
New Construction—Mesa-Superior Highway

\$60,000.00 per year appropriated for working prisoners is paid into the State Road Tax Fund-General and all expense in connection with this labor is carried under "00" series.

Root Accounts

- 1 Engineering
- 2 Construction.
- 3 General Expense. (Office only)
- 4 Cash Advanced Accounts.
- 5 Equipment.
- 6 Maintenance.

Sub-Accounts

- 1—2 Surveys.
- 1—2—1—Surveys—Salaries.
- 1—2—2 Surveys—Commissaries, etc.
- 1—2—3 Surveys—Travel.
- 1—2—4 Surveys—Miscellaneous.
- 1—3 Office Engineering.
- 1—3—1 Office Engineering—Salaries.
- 1—3—2 Office Engineering—Other expenses.
- 1—4 Inspection (Engineering).
- 1—4—1 Inspection (Engineering)—Salaries.
- 1—4—2 Inspection (Engineering)—Other expense.

2—Construction—Highways

- 2—1 Camp.
- 2—2 Clearing and Grubbing.
- 2—3 Grading.
- 2—4 Culverts and Pavings.
- 2—5 Ditching.
- 2—6 Surfacing.
- 2—7 Right of Way.
- 2—8 Miscellaneous.
- 2—9 Materials.
- 2—10 Equipment.
- 2—11 Equipment Repairs.

Bridges

- 2—1 Camp.
- 2—2 Foundations.
- 2—3 Forms and Falsework—Superstructure.
- 2—4 Reinforcement.
- 2—5 Concrete-Superstructure.
- 2—6 Filling and Paving.
- 2—7 Approaches.
- 2—8 Miscellaneous.
- 2—9 Materials.
- 2—10 Equipment.
- 2—11 Equipment Repairs.

3—General

- 3—1 Salaries.
- 3—2 Material.
- 3—3 Other Expense.

4—Cash Advanced

For office only.

5—General Equipment

- 5—1 New Equipment.
- 5—2 Repairs to equipment.

6—Maintenance

- 6—1 Division Engineers Salary, inspection of maintenance projects only.
- 6—2 Division Engineers expense accounts, ditto.
- 6—3 Division Engineers automobile expense, ditto.
- 6—4 Labor.
- 6—5 Teams.
- 6—6 Feed.
- 6—7 Materials and supplies.
- 6—8 Auto Trucks.
- 6—9 Equipment repairs and rent.
- 6—10 Equipment.

SEGREGATION OF ACCOUNTS**1 Engineering****1-2—Surveys:**

1-2-1—Salaries and wages of engineering corps.

1-2-2—Commissaries and supplies, including the cost and transportation of all foodstuffs, ice, fuel, illumination oil, transportation of camp equipment and board and room of party where camp not established or maintained.

1-2-3—Travel—Includes railroad fares, hotel bills, bus fares, Pullman accommodations and other necessary expenses to points of beginning survey and return to headquarters upon completion.

1-2-4—Miscellaneous—Includes postage, telephone, telegraph, express, stationery, team hire, rental and repair of engineering instruments and equipment. Stakes or other expense not covered in above segregations.

Office

Field men must not make charges to this account.

1-3-1—Salaries—Includes salaries of office employees for such time as engaged in connection with particular projects.

1-3-2—Miscellaneous—Includes expense incurred by office account particular projects, such as express, stationery, blue printing, telephone, telegraph, etc.

INSPECTION

1-4-1—Salaries—Includes salary of Division Engineer while inspecting construction work, (where not actually employed as Superintendent of Construction) and of instrument man employed with construction forces running levels and inspecting.

1-4-2—Expense—Includes all other expense than salaries in connection with Inspection.

2 Construction

Road Work—

Prison Labor

2-1—Camp—

Prisoners—To include entire cost of maintaining prisoners under following segregations: Groceries, Beef, Fuel, Tobacco, Clothing, Medicine, Lighting, Transportation of Prisoners, Guards, Escapes, Hauling Supplies and miscellaneous expense. Monthly statement must show total number of prisoner days, number of prisoner days on camp work, number prisoner days idle (Sundays and inclement weather), number days actually on construction, cost per man per prisoner day and cost per working man day on the work.

Engineers' Mess—To include cost of maintaining mess for paid force under following heads: Groceries, Beef, Prison Labor and Fuel.

Monthly statement must show total number of meals served, cost per meal, number of meals furnished employees allowed board, and number of meals furnished for employees charged board.

Stable—To include cost of teams, both State and rented, under following heads: Hay, Grain, Shoeing, Harness Repairs, Prison Labor (corral), Hauling Hay and Grain and Paid teams Rental.

Monthly statement must show total number team days, number of team days idle (Sundays and inclement weather) number of team days actually on construction work, cost per team day to feed, cost per team day for entire stable expense, and cost per team working day.

Trucks—To include cost of operation of trucks under the following heads: Paid Labor, Prison Labor, Fuel and Repairs. Monthly statement must show total number days worked and cost per working day.

In addition to above segregations, carry under this account such other items as can be distributed accurately to the work-accounts at close of each month.

2-2—Clearing and Grubbing—

Carry following headings: Foreman, Prison Labor, Material and tool depreciation.

Monthly statement must show character of growth, number of acres and cost per acre.

2-3—Grading—

Carry the following headings and segregations thereof:

Earth Excavation—Foreman, Prison Labor, Plow Teams, Scraper Teams, Grader Teams, Material and Tool Depreciation.

Loose Rock Excavation—Foreman, Prison Labor, Teams, Explosives, Other Material, Tool Depreciation, Compressor, (Show detail of operation of Compressor—Foreman, Prison Labor, Fuel and Repairs).

Boulder Excavation—Foreman, Prison Labor, Teams, Material, Compressor, Tool Depreciation.

Embankment—Foreman, Plow Teams, Scraper Teams, Wagon Teams, Material and Tool Depreciation.

Monthly statement must show under each classification cost of each sub-head, number of cubic yards moved and cost per yard.

2-4—Culverts and Pavings—

Carrying the following headings and segregations thereof:

Excavation—Foreman, Prison Labor, Material and Tool Depreciation. Monthly statement must show classification of yardage, total number yards and cost per yard.

Pipe Culverts—

Transportation and distribution of pipe—Foreman, Prison Labor, Teams and Tool Depreciation.

Placing—Foreman, Prison Labor, Material and Tool Depreciation. Monthly statement must show cost for each sub-head and cost per lineal foot in place.

Concrete Culverts—

Forms-Framing—Foreman, Paid Labor, Prison Labor, Lumber, other material and Tool Depreciation. These same segregations for erecting.

Forms—Stripping—Foreman, Paid Labor, Prison Labor and Tool Depreciation.

Concrete—Material to Mixer—Foreman, Prison Labor and Tool Depreciation.

Concrete Mixing and Placing—Foreman, Paid Labor, Prison Labor, Cement, Sand, Gravel, Water, Fuel, Tool Depreciation.

Concrete—Miscellaneous—Wetting, etc. Foreman, Prison Labor, Tool Depreciation.

Masonry Culverts—

Quarrying Material and Distributing, Foreman, Prison Labor. Teams, Material, Tool Depreciation.

Placing—Foreman, Paid Labor, Prison Labor, Material, Tool Depreciation.

Bulkheads—

Use same segregations for concrete bulkheads as for concrete. Monthly statement for culverts must show total of each class and total of each subhead under each class. Show total number yards concrete and cost per yard. Total feet board measure of forms and cost per thousand feet B. M.

Pavings—

Use same segregations as for concrete and like information monthly statements.

2-5—Ditching—

Show following headings: Foreman, Prison Labor, Teams, Material and Tool Depreciation (Earth, Loose Rock, and Solid Rock) and average cost per yard.

2-6—Surfacing and Finishing—

Carry following headings and segregations thereof:

Pit—Foreman, Prison Labor, Teams, Material and Tool Depreciation.

Loading—Foreman, Prison Labor, and tool Depreciation, Steam Shovel.

Hauling—Foreman, Prison Labor, Teams and Tool Depreciation.

Spreading—Foreman, Prison Labor, Teams, Tool Depreciation.

Finishing—Foreman, Prison Labor, Teams, Tool Depreciation.

Monthly statement must show total cubic yards material, cost per yard quarrying, cost per yard loading, average haul and cost per yard for hauling and cost per yard for spreading.

Rolling: Carry the following headings: Foreman, Prison Labor, Teams, Fuel, Water, Tool depreciation. Monthly statement must show number square yards rolled, number times over and cost per square yard.

2-7—Right of Way—

To include all expense incurred account right of way. Where fencing or other construction work is necessary to secure right of way, show following segregations: Foreman, Labor, Teams, Material and Tool Depreciation.

2-8—Miscellaneous—

Under this account, carry such items as are a general charge and to be distributed on completion of work: Superintendence—Salary of Superintendent, and expense of same. Salary of timekeeper and expense of same. Office supplies. Camp Construction—Foreman, Paid Labor, Prison Labor, Lumber, other Material, Teams, and Tool Depreciation.

2-9—Materials—

To this account will be charged all materials of construction when purchased, and such supplies as may not conveniently be charged direct to the work when purchased. Credits to this

account will be made by Department Invoice at the end of the month, charging the working accounts for materials and supplies used during the month.

2-10—Equipment—

All equipment in use on a project will be charged to this account. Depreciation will be taken monthly on Department Invoice crediting this account and charging the working accounts

2-11—Equipment Repairs:

To this account will be charged all such repairs to equipment as cannot conveniently be charged direct to a working account at the same time that the expense is incurred. This account should be cleared monthly insofar as possible and must be cleared at the time the project is completed by Department Invoice charging the working accounts.

Road Work

(Paid Labor)

2-1a—Camp—

Includes cost of maintenance of mess for employees, Stable expense and any other general expense which can be accurately charged to working accounts monthly.

Mess—Groceries, Beef, Cooks and Waiters, Fuel, Miscellaneous. Monthly statement must show total number of meals served, number meals to employees allowed board, number meals to employees charged board and cost per meal.

Stable—Hay, Grain, Shoeing, Harness Repairs, Hauling Hay and Grain, Labor (corral). Monthly statement must show total number team days for month, number team days idle (Sundays and inclement weather), number team days on work, cost per team day for feed, cost per team day for total stable expense and cost per team working day.

2-2a—Clearing and Grubbing—

Carry following headings: Foreman, Laborers, Material and Tool Depreciation. Monthly statement must show character of growth, number of acres and cost per acre.

2-3a—Grading—

Carry the following headings and segregations thereof:

Earth Excavation—Foreman, Laborers, Plow Teams and drivers, Grader Teams and Drivers, Graderman material and Tool Depreciation.

Loose Rock Excavation—Foreman, Laborers, Plow teams and drivers, Scraper Teams and drivers, Grader Teams and rivers, Graderman, Drillers, Material and Tool Depreciation.

Solid Rock Excavation—Foreman, Drilers, Laborers, Powderman, Teams and Drivers, Steam Shovel, Explosives, Material and Tool Depreciation.

Boulder Excavation—Same segregation as Solid Rock.

Embankment—Foreman, Laborers, Plow Teams and Drivers, Scraper Teams and Drivers, Wagon Teams and drivers, Material and Tool Depreciation.

Monthly statement must show under each classification, cost of each sub-head, total number cubic yards moved and cost per yard.

2-4a—Culverts and Pavings—

Show following heads and segregations:

Excavation—Foreman, Laborers, Material and Tool Depreciation. Monthly statement must show classification of yardage moved and total yardage, with average cost per yard.

Pipe Culverts—

Transportation and distribution of pipe—Foreman, Laborers, Teams and Drivers, and Tool Depreciation.

Placing—Pipe, Foreman, Carpenters, Laborers, Lumber, other material and Tool Depreciation.

Forms Stripping—Foreman, Carpenters, Laborers and Tool depreciation

Concrete—Material to Mixer—Foreman, Laborers and Tool depreciation

Concrete—Mixing and Placing—Foreman, Laborers, Cement, Sand, Gravel, Water, other material, Fuel, and Tool depreciation.

Concrete—Miscellaneous— Foreman, Laborers and Tool depreciation.

Concrete Pavings—Carry same heads and segregations as concrete.

Bulkheads—Carry same heads and segregations as concrete.

Masonry Culverts—

Quarrying Material and Distribution—Foreman, Laborers, Teams and drivers, Material and Tool depreciation.

Placing—Foreman, Laborers, Carpenters, Material, Tool depreciation.

Monthly statement must show total quantities for each class, cost of each sub-head and cost per cubic yard for concrete, and masonry. Also total feet board measure of forms and cost per thousand feet B. M.

2-5a—Ditching—

Carry following headings and segregations: Foreman, Laborers, Teams and Drivers, Material and Tool Depreciation. Monthly statement must show classification of yardage moved. Total number yards and cost per yard.

2-6a—Surfacing and Finishing—

Carry following headings and segregations thereof:

Pit—Foreman, Laborers, Drillers, Plow Teams and Drivers, Material and Tool Depreciation.

Loading—Foreman, Laborers, Scraper Teams and Drivers, and Tool Depreciation. In case Steam Shovel used, give detail of cost of operating.

Hauling—Foreman, Teams and Drivers and Tool Depreciation.

Spreading—Foreman, Laborers, Teams and Drivers and Tool Depreciation

Finishing—Forman, Laborers, Teams and Drivers and Tool Depreciation

Rolling—Foreman, Engineer, Laborers, Water Teams and Drivers, Fuel and Tool Depreciation Monthly statement must show number of square yards rolled, number times over and cost per square yard

Monthly statement must show total cubic yards material, cost per yard quarrying, cost per yard for loading, average haul and cost per yard for hauling and cost per yard for spreading. Number of square yards surfaced (giving thickness) and cost per square yard surfaced.

2-7a—Right of Way—

To include all expense incurred account right of way. Where fencing or other construction work is necessary to secure right of way show, following segregations: Foreman, Labor, Teams, Material and Tool Depreciation.

2-8a—Miscellaneous—

Under this account carry such items as are a general charge and to be distributed on completion of work:

Superintendence—Salary and expense of Superintendent separately. Salary and expense of timekeeper separately. Office supplies.

Camp Construction—Foreman, Carpenters, Laborers, Lumber, Other Material, Teams and Drivers and Tool Depreciation.

2-9a—Materials—Refer to Road Work-Prison Labor.

2-10a—Equipment—Refer to Road Work-Prison Labor.

2-11a—Equipment Repairs—Refer to Road Work-Prison Labor.

2. Construction

Bridge Work—

Paid Labor (or Prison)

2-1b—Camp—

Same as Road Work.

2-2b—Foundations—

Carry following headings and segregations thereof:

Excavation—Foreman, Laborers, Teams and Drivers, Material and Tool Depreciation. Monthly statement must show classification of yardage, total number of yards and cost per yard.

Pumping—Foreman, Laborers, Fuel, Miscellaneous and Tool Depreciation.

Piles—Driving—Foreman, Engineer, Carpenters, Laborers, Piling, Fuel, Miscellaneous and Tool Depreciation. Monthly statement must show total feet driven and cost per foot.

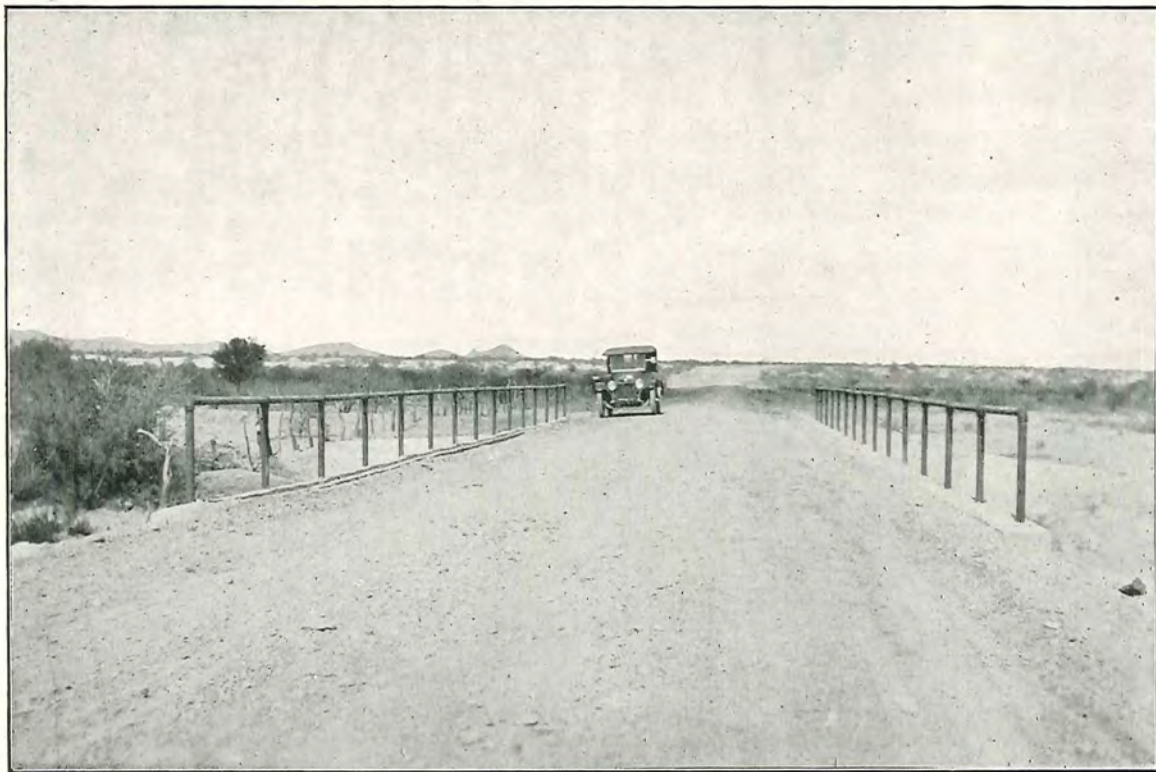
Piles—Cut-off—Foreman, Carpenters, Laborers, Material and Tool Depreciation. Monthly statement must show number piles and cost per pile.

Moving Driver—Foreman, Carpenters, Laborers, Teams and Drivers, Material, and Tool Depreciation. This item to cover moving from pier to pier and statement should show number of moves, distance and cost.

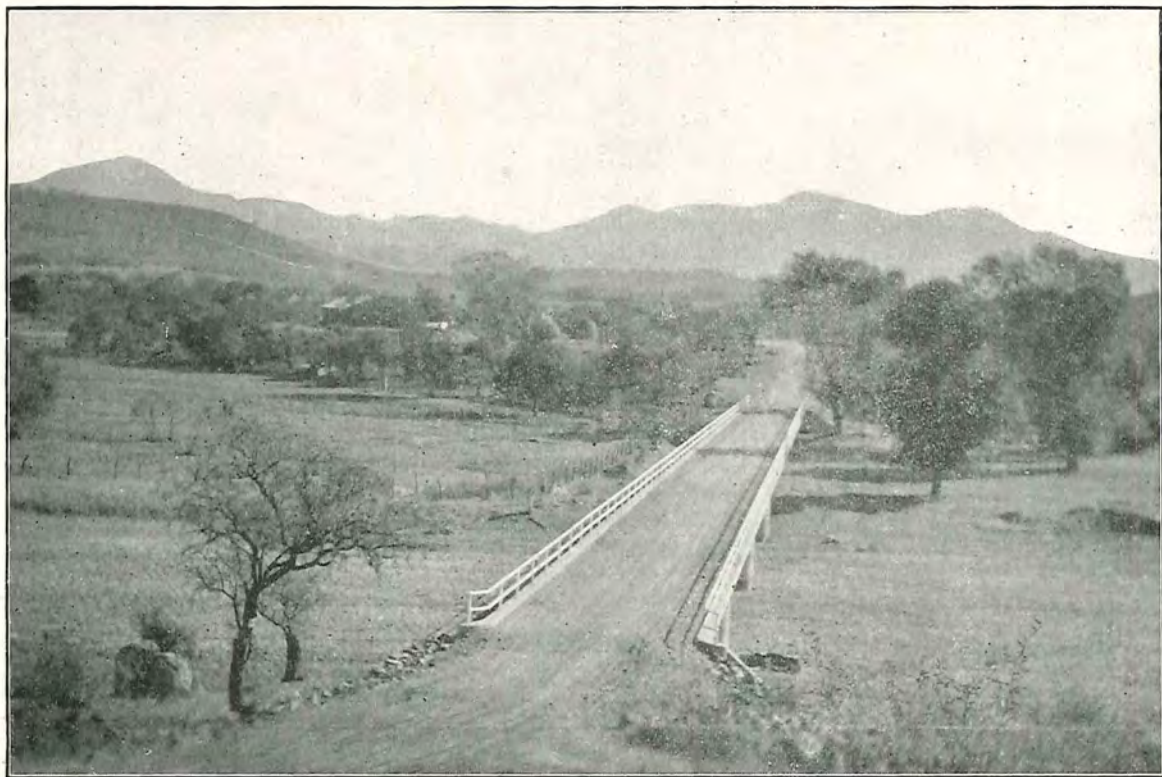
Forms—Framing and Erecting—Foreman, Carpenters, Laborers, Lumber, Other Materials, Miscellaneous and Tool Depreciation. Monthly statement must show total feet board measure and cost per thousand feet B. M.

Forms, Stripping—Foreman, Carpenters, Laborers, Material and Tool Depreciation. Monthly statement must show number of feet board measure and cost per thousand feet B. M.

Forms—Re-erecting—Foreman, Carpenters, Laborers, Material and Tool Depreciation.



SANTA CRUZ COUNTY
Roadway Sapor Wash Bridge



SANTA CRUZ COUNTY
Santa Cruz Bridge—Nogales-Patagonia Highway

Falsework—Framing and Erecting—Foreman, Carpenters, Laborers, Lumber, Other Material and Tool Depreciation.

Falsework—Stripping—Foreman, Carpenters, Laborers, Miscellaneous and Tool Depreciation. Monthly statements must show total feet board measure and cost per thousand feet B. M.

Falsework—Re-erecting—Foreman, Carpenters, Laborers, Material and Tool Depreciation.

Concrete—Material to Mixer—Foreman, Laborers, and Tool Depreciation. Monthly statement must show distance and cost per cubic yard.

Concrete—Mixing—Foreman, Laborers, Cement, Sand, Gravel, Water, Fuel, Miscellaneous and Tool Depreciation. Monthly statement must show total cubic yards and cost per cubic yard.

Concrete to Forms—Foreman, Laborers, and Tool Depreciation. Monthly statement to show cost per cubic yard and total cubic yards.

Concrete—Placing—Foreman, Laborers and Tool Depreciation. Monthly statement must show total cubic yards placed and cost per yard.

Reinforcing in place—Foreman, Laborers, Steel, Miscellaneous and Tool Depreciation. Monthly statement must show class of reinforcing, total pounds and cost per pound in place.

2-3b—Forms—Superstructure—

Carry following headings and segregations thereof:

Framing—Foreman, Laborers, Carpenters, Lumber, Miscellaneous and Tool Depreciation.

Erecting—Foreman, Carpenters, Laborers, Material and Tool Depreciation. Monthly statement must show total feet board measure and cost per thousand feet B. M., for framing and erecting.

Stripping—Foreman, Carpenters, Laborers, Miscellaneous and Tool Depreciation.

2-4b—Reinforcements—Superstructure—

Carry following headings and segregations thereof:

Bending—Foreman, Laborers, Miscellaneous and Tool Depreciation.

Placing—Foreman, Laborers, Steel, Miscellaneous and Tool Depreciation. Monthly statement must show total number pounds, class of reinforcements and cost per pound in place.

2-5b—Concrete—Superstructure—

Carry following headings and segregations thereof:

Material to Mixer—Foreman, Laborers, Teams and Drivers, and Tool Depreciation.

Mixing—Foreman, Laborers, Cement, Sand, Gravel, Water, Fuel, Miscellaneous and Tool Depreciation.

Concrete to forms—Foreman, Laborers and Tool Depreciation.

Concrete—Placing—Foreman, Laborers, and Tool Depreciation.

Concrete—Miscellaneous—Foreman, Laborers, Tool Depreciation. Monthly statement must show total of each head, total yardage and cost for each head per yard.

2-6b—Backfill and Paving—

Use same headings and segregation as for surfacing—Road Work.

2-7b—Approaches—

Use same headings and segregation as for Grading—Road Work.

2-8b—Miscellaneous—

Use same headings and segregation as for Supt. and other Miscellaneous Charges.

2—9b—Material—Refer to Road Work—Prison Labor.

2—10b—Equipment—Refer to Road Work—Prison Labor.

2—11b—Equipment Repairs—Refer to Road Work—Prison Labor.

General Equipment

5—1—Equipment—

To this account should be charged equipment purchased pending allocation to a project or transferred from a project into the State storage.

5—2—Repairs to Equipment—To this account should be charged all repairs to equipment of such a nature as can not at the time incurred be charged to any particular project.

RECORDS AND FORMS

Use of the various forms and manner of keeping records as shown below:

Form 1—Time Book—

On Prison Labor work, each foreman should keep book for his gang showing on occupation lines, classes of work on which men engaged and opposite in date columns number of prisoners on each class for the day, i. e.

	16	17
	—	—
	B3	B3
Drillers	5	7
	B3	B2
Laborers	10	10
	B3	
Teamsters	1	

indicating on the 16th, 5 men drilling, 10 laborers and teamster on Grading Solid Rock Excavation and on 17th, 7 drilling and 10 laborers on Grading—Loose Rock Excavation. At the

end of the day's work foreman must turn in time books to the bookkeeper who will enter in Daily Time Distribution and return to foreman.

Where time is taken on the work by bookkeeper the same form as shown will be used. On Paid Labor Work, foremen or timekeeper will show name of workman on first line. On second line occupation and in case of changes during the day in occupation show new occupations on third, fourth and fifth lines. Opposite occupation in proper date column show number hours on that occupation with symbol indicating class of work, i. e.

	16th
	<hr/>
	B3
John Doe, Driller	4
	E1
John Doe, Driller	4

indicating John Doe worked 4 hours as driller on Grading—Solid Rock Excavation and 4 hours as driller in Pit for Surfacing.

Principal segregations are shown under each class of work on cover of book and additional deemed necessary by General Foreman or Superintendent should be written in under each head.

Daily Time Distribution—

In a construction ledger book (Form 10) bookkeeper will fill in labor segregations and enter daily from Time Book labor for the day just as total pay roll is entered in Construction Ledger at end of period.

At end of payroll period the totals as shown in Daily Time Distribution Ledger will serve as distribution for Pay Roll of that period.

Daily statement will be prepared by bookkeeper from Daily Time Distribution and furnished the General Foreman giving labor costs for the previous day's work.

Form 2—Receipt—

Receipt on this form should be taken by employees for all money paid out by them on account of the Department for which they are to be reimbursed through expense account (Form 3).

Form 3—Expense Account—

This form for use in reimbursing employees for cash expenditures by them for account of the Department.

Same must be submitted to the General office in quadruplicate and all supporting papers in quadruplicate for expenditures payable from 75% portion of State Road Tax Fund and in triplicate for payment from 25% portion of State Road Tax Fund.

On Construction work expense accounts will be handled in same manner as invoices.

Form 4—Requisition—

This form must be used in ordering all material and supplies. Requisitions should be numbered consecutively using the County Number in which work is being done as prefix, i. e., 02—1, indicating Requisition No. 1 on Cochise County project.

Requisitions should be submitted to General office in duplicate, leaving name and address for firm on whom to place and date of quotation blank. When order is placed this information will be supplied and prices shown by General office and copy of requisition returned to Field office.

Like materials or equipment only should be shown on each requisition. General Foreman or Superintendent should sign original copy or requisition.

Field copies of requisitions should be filed on Arch File and as material or supplies covered by same are received

checked showing date received. When invoice has been received and checked against requisition, requisition should be marked covered by Invoice No. ———, and filed in numerical order in Transfer Case.

Form 5—Department Invoice—

This form to be used as follows:

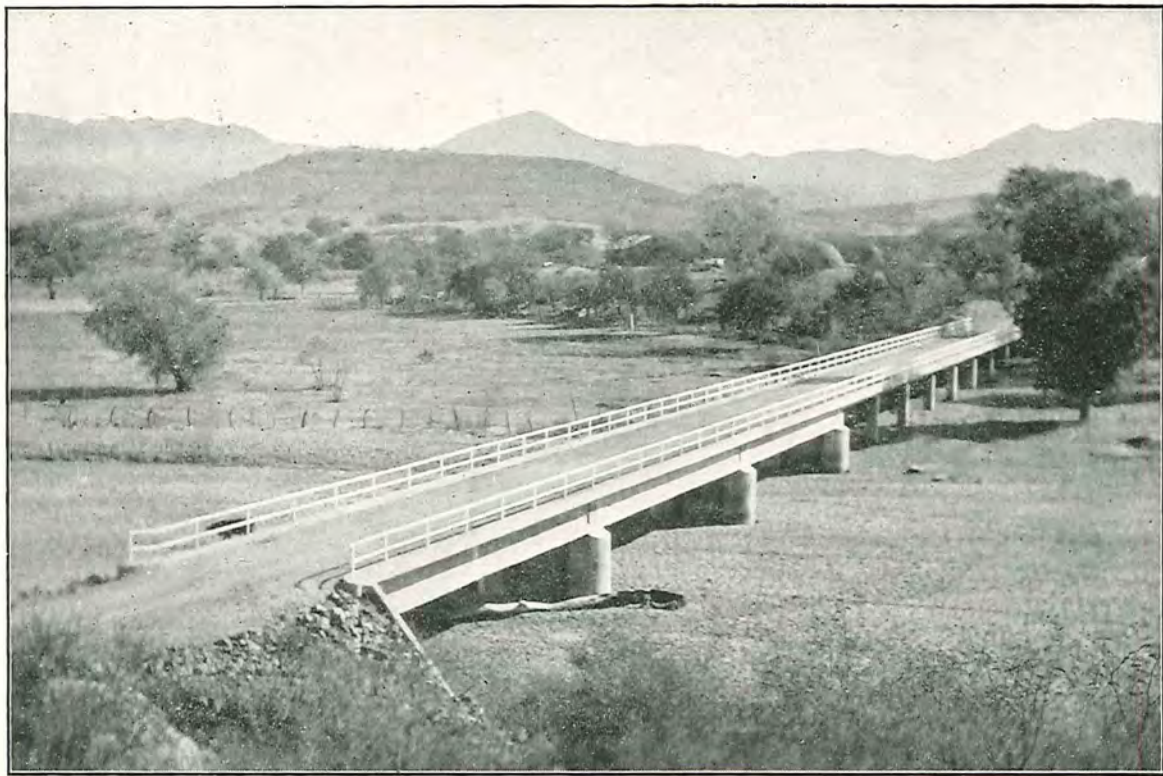
For transfer entries between accounts on the same project, one copy only being forwarded to General Office. For invoicing material, equipment or supplies when transferred to other projects, three copies being forwarded to General Office for charge to receiving project and credit to project from which transferred.

Form—Time Voucher—

This form for use in Paid Labor Camps where arrangements have been made with bank in that vicinity to carry payroll account until warrants can be issued from General Office. In such cases form is filled in and workman is required to sign when General Foreman's or Superintendent's check on the bank is given him. This form must be prepared in quadruplicate and be forwarded to General Office with payroll.

Form 9—Payrolls—

Payrolls should be prepared on the last day of the payroll period and forwarded to General Office at earliest possible date. Show men on payrolls in order of wages paid, highest rate heading roll. Payrolls together with supporting papers, to be paid from General Road Fund (00) must be forwarded to General Office in triplicate. Payrolls, together with supporting documents, to be paid from County Road Tax Fund (01, etc.), must be forwarded to General Office in Quadruplicate. Payrolls for construction work will be treated as invoices and given proper invoice number in upper right hand corner, entered in ledger and filed in invoice register. Payrolls for engineering work will not be numbered or entered in ledger by field force as this record is kept in General Office.



SANTA CRUZ COUNTY
Santa Cruz Bridge—Nogales-Patagonia Highway



SANTA CRUZ COUNTY
Tucson-Nogales Highway

All changes in rates of pay for monthly men must be approved by General Office before put in effect.

In cases where Time Vouchers (Form 7), have been issued for men shown on payrolls, the Time Voucher number should be shown in space on payroll provided for signatures and copy of Time Voucher attached to each copy of payroll. Where men have quit or been discharged and have been paid from personal funds, "Paid by....." should be written in space provided for signature and copies of receipt attached to each copy of payroll.

Invoices—

Check against requisition and charge tickets, show distribution on last copy, show requisition number, place proper number in upper right hand corner, enter in ledger and forward in quadruplicate to General Office on transmittal form. Field copies of invoices to be filed, after entry, in proper order in invoice register. Invoices for engineering expense will not be numbered or entered in ledger by field force, as this record is kept in General Office. After checking against invoices, file charge tickets alphabetically in transfer case, binding each firm's tickets for the month securely with fasteners.

Form 10—Construction Register—

This record to be kept on all construction projects, segregation headings of working accounts to be filled in space provided.

In this ledger should be entered all invoices, department invoices, payrolls and expense accounts carrying charges to the project with exception of engineering, the latter being sent direct to General Office where all engineering accounts are kept.

At the close of the month, the totals as shown in Ledger, will represent the cost to date and segregation thereof.

Monthly statement showing these figures with physical estimate applied should then be prepared and forwarded to General

Office in triplicate. This report must reach the General Office not later than the 10th of the succeeding month.

Invoice Books—All documents carrying charges to Construction after entry in Form 10 should be securely pasted in numerical order in Invoice Books.

Material and Equipment Register—Account should be carried in this ledger for each kind of material purchased and charged to material account, entries being made from Construction Ledger and credited as used and covered by documents entered in Construction Ledger.

Accounts should likewise be opened in this Register for all items charged to 2-10 account in Construction Register and credited as covered by documents entered in Construction Ledger.

Transmittal Form—This form to be used in forwarding Invoices or other documents to General Office where a letter of explanation is not necessary.

On this form forwarding closing documents of entry for the month notation should appear "No..... is last entry for " giving number and month.

Daily Record—

Bookkeeper will keep blotter giving happenings effecting the work, weather conditions, and supplies received. For supplies received reference to Requisition on which applying is all that is necessary as detail receipts will appear on requisition.

Copy of each day's blotter information together with statement of force employed, should be forwarded General Office daily.

The following detailed statement of expenditures cover the construction of Kingman-Oatman Section 2 during the period December 10, 1917 to May 31, 1918. This statement is appended as explanatory of the method of cost distribution used in the sundry accounts of this department as set forth in the preceding Rules and Regulations governing work of the State Highway Department:

08-2-2a—CLEARING AND GRUBBING....\$ \$ \$ 1,154.75

(1) Clearing and Grubbing Proper..... 886.07

Foreman	98.44
Laborers	307.51
Board	24.33
Removing Loose Boulders	262.70
Clearing for Ditch.....	12.25
Teams	8.38
Clearing for Dyke	7.00
Prop'n 8a Act. (Miscellaneous)..	133.14
Prop'n 11a Acct. (Tool Mtce.)....	32.32

14-2 acres cleared.

Cost per acre, \$62.399.

Nature of growth: Scrub cedar,
catclaw, cactus and desert
growth in general. Also loose
Boulders removed.

(2) Temporary Road Sta. 229-50 to
Old Road..... 268.68

Foreman	28.28
Clearing	43.25
Removing Loose Boulders.....	35.00
Labor	62.00
Plow and Fresno Labor.....	24.50
Teams	24.52
Prop'n 8a Acct. (Miscellaneous)	40.36
Prop'n 11a Act. (Total Mtce.)..	10.77

\$ 1,154.75

Total length of temporary road,
1800 ft.

Cost per 100 Lin. ft. \$14.927.

08-2-3a—GRADING

\$ 34,695.28

(1) Earth Excavation 600.47

Foreman	\$ 45.85
Plow Driver	31.65
Plow Holders	46.39
Fresno Drivers	62.72
Fresno Loaders, Dumpers.....	62.72
Plow Teams	72.90
Fresno Teams	116.67
Waterboy	2.08
Wagon Teams	4.34
Finishing	10.25
Wagon Drivers	1.75
Prop'n 8a Acct. (Miscellaneous)..	85.23
Prop'n 11a Act. (Tool Mtce.).....	21.16
Temporary Road	36.76
Clearing	\$ 15.75
Laborers	14.00
Fresno Labor	3.50
Fresno Teams	3.51

 \$600.47

Material moved 1385.7 cu. yds.

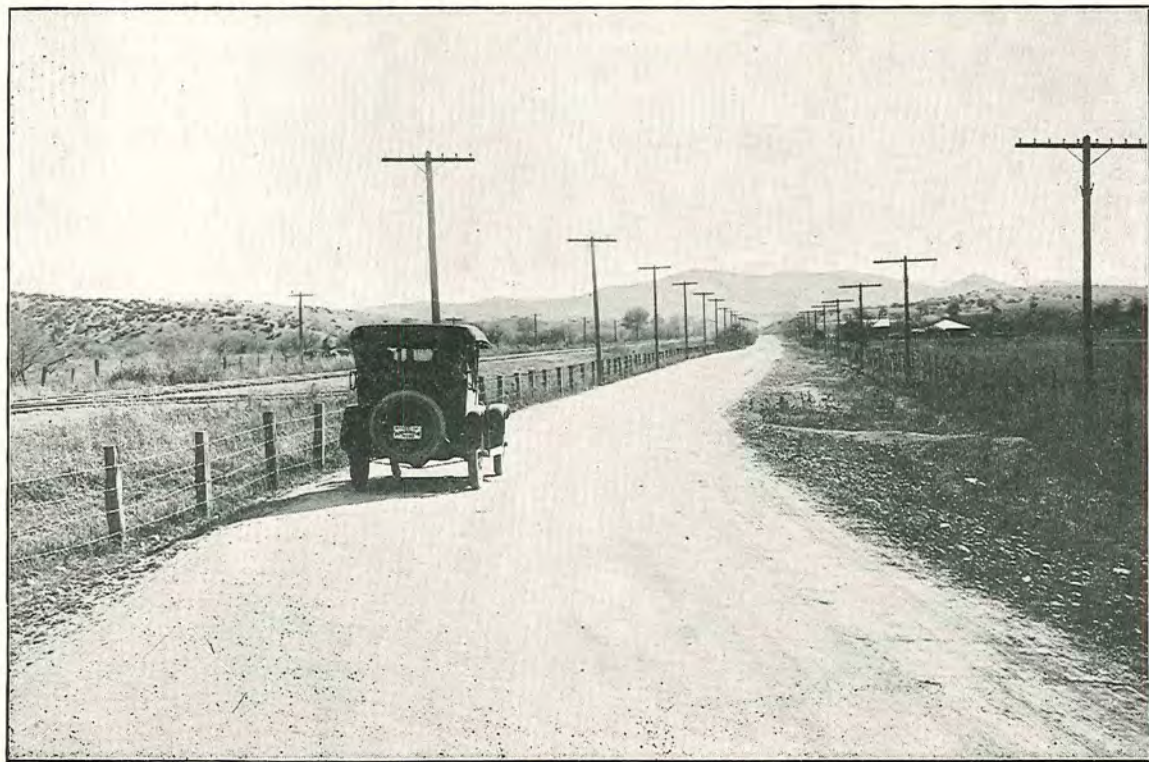
earth mixed with boulders.

Cost per cu. yd. 43 1-3c

Average haul 50 ft.

(3) Solid Rock Excavation..... 33,486.09

Foremen	1,276.67
Laborers	4,812.33
Powderman	634.88
Powderman Helper	462.47
Waterboys	395.92
Hand Drilling	2,970.59
Compressor Drilling	2,977.72
Compressorman	\$ 706.00
Jackhammerman	678.03
Jackhammer helper.....	673.43
Truck Hlg. Compressor..	52.14
Setting up Compressor....	54.19
Compressor Supplies.....	65.64
Compressor Repairs.....	248.31
Pipe and Compressor	
Rental	159.75



SANTA CRUZ COUNTY
Tucson-Nogales Highway

Power	287.63
Teams Hlg. Compressor and Pipe	17.10
Dismantling and return- ing Compressor and Pipe	35.50

Plow Drivers	454.88
Plow Holders	611.99
Fresno Loaders, Dumpers.....	1,121.83
Fresno Drivers	1,134.71
Wagon Drivers	253.50
Chain Team Driver.....	227.50
Stone Boat Driver.....	220.09
Foreman Finishing	228.50
Labor Finishing	1,091.34
Board	249.00
Explosives	4,532.51
Miscellaneous Material.....	23.41
Plow Teams	909.49
Fresno Teams	1,507.27
Chain Teams	224.98
Stone Boat Teams.....	254.19
Wagon Teams	275.06
Miscellaneous Teams.....	264.59
Prop'n. 8a Acct. (Miscel.).....	5,041.65
Prop'n. 11a Acct. (Tool Mtce.)....	1,252.09
Clearing muck from Taylor Prop- erty, account accident.....	76.93
Foreman	\$ 9.14
Laborers	29.75
Fresno Drivers.....	7.00
Fresno Loaders, Dprs.....	7.00
Chain Driver.....	3.50
Teams	15.29
Stone Boat Driver.....	1.75
Plow Driver.....	3.50

\$ 33,486.09

Excavated 14139.5 cu. yds.

Cost per cu. yd. \$2.36826.

Cost less finishing charge,
\$32,182.50.

Cost per cu. yd. after deducting
finishing charge \$2.2769.

Hand Drilling cost \$2,970.59.

Drilled 7756 ft. cost per foot

\$.2634.

Drilled 11684 ft. cost per foot

\$.383.

Average haul 50 ft.

(4) Earth Embankment\$ \$ \$ 608.72

Foreman 51.96

Plow Driver 39.87

Plow Holder 42.87

Fresno Driver 70.88

Fresno Loader and Dumper..... 68.44

Waterboy 3.75

Wagon Driver 5.25

Finishing 16.25

Labor 7.25

Plow Teams 59.65

Fresno Teams 115.77

Wagon Team 5.78

Dyke 7.00

Prop'n. 8a Acct. (Miscellaneous) 91.32

Prop'n. 11a Acct. (Tool Mtc.).... 22.68

\$ 34,695.28

Material moved 2139.5 cu. yds.

Cost per cu. yr. \$.284515.

Average haul 206 ft.

08-2-4a—PIPE CULVERTS\$ 7,937.18

(1A) Pipe Excavation—Earth\$ 71.42

Labor 58.00

Prop'n. 8a Acct. (Miscellaneous) 10.75

Prop'n 11a Acct. (Tool Mtc.).... 2.67

Excavated 113.5 cu. yds. earth

mixed with loose rock. Cost

per cu. yd.6304

(1B) Pipe Excavation—Solid Rock: .. 452.79

Foreman 27.41

Drillers 103.75

Laborers 226.19

Explosives 10.45

Prop'n 8a Acct. (Miscellaneous) 68.08

Prop'n 11a Acct. (Tool Mtc.).... 16.91

Excavated 130.2 cu. yds. solid rock. Cost per cu. yd. \$3.4778.	
(2) Pipe Transportation and Distribution	\$ 430.19
Labor	176.91
Teams	172.76
Prop'n 8a Acct. (Miscellaneous)	54.50
Prop'n 11a Acct. (Tool Mtc.).....	16.02
<hr/>	
(3) Placing Culvert Pipe	6,982.78
Foreman	9.62
Laborers	190.03
Head Walls, Labor	584.15
Head Walls, Stone Boat Team....	8.38
Pipe Foundations	45.50
Culvert Pipe	4,743.14
Clearing Openings	7.00
Concrete Apron Sta. 165-30:.....	82.80
Foreman	\$ 8.50
Hauling Sand & Gravel	16.20
Rock Labor	14.00
Excavating	7.00
Road Labor	3.50
Mixing and Placing	10.50
Cement	23.10
<hr/>	
Prop'n 8a Acct. (Miscellaneous)	1,051.12
Prop'n 11a Acct.	261.04
<hr/>	
\$ 7,937.18	
<hr/>	

938 Lin. Ft. Culvert Pipe placed.

Cost per Lin. Ft. \$7.44424.

Constructed 735.6 cu. yds. dry walls.

Cost per cu. yd. \$.7943.

Constructed 27 cu. yds. pipe foundations. Cost per cu. yd. \$1.685.

Concrete apron contains 2.6 cu. yds. material. Cost per cu. yd. \$3.1873.

08-2-5a—DITCHING \$ 548.23

(1) Earth 206.27

Foreman	27.03
Laborers	141.31
Prop'n 8a Acct. (Miscellaneous)	30.43
Prop'n 11a Acct. (Tool Mtce.).....	7.50

Excavated 126 cu. yds. earth and
loose rock ditch. Cost per cu.
yd. \$1.6366

(2) Solid Rock 341.96

Foreman	30.61
Compressor Drilling	7.75
Laborers	189.07
Hand Drilling	42.00
Powderman and Helper	7.50
Explosives	3.00
Prop'n 8a Acct. (Miscellaneous)	49.64
Prop'n 11a Acct. (Tool Mtce.)....	12.39

\$ 548.23

Excavated 64.5 cu. yds. solid rock
ditch. Cost per cu. yd. \$5.302.
Compressor drilling cost \$7.75.
Drilled 70 ft. Cost per foot \$.1107.
Hand Drilling cost \$42.00.
Drilled 137 ft. Cost per ft. \$.3066.
Constructed a total of 2498 lin.
ft. of 1x2 ft. Ditches, solid
rock, earth and loose rock com-
bined; cost per lin. ft. \$.2195.

08-2-7a—RIGHT OF WAY \$ 43.16

Removing Power Line	43.16
Foreman	1.80
Labor	20.29
Poles	11.00
Wire	1.75
Prop'n 8a Acct. (Miscellaneous)	6.67
Prop'n 11a Acct. (Tool Mtce.)....	1.65

Moved 1100 ft. of power line.

Total cost of project..... \$ 44,378.60

Total road constructed 13,900 ft. Cost per mile \$17,087.17
 Total number of days during period of construction 172
 Total number of days work.....158 5/16
 Total number of days idle 13 11/16
 5½ account Sundays and holidays
 8 3/16 account rain
 Average number of men employed 44 1/4.
 Average number of teams employed 8.285.

DETAILS OF EMPLOYEES' MESS ACCOUNT

Total cost \$ 7,764.30

Cook	\$ 580.90
Waiters	303.12
Camp construction	18.75
Labor	47.00
Fuel	251.03
Groceries	3,966.16
Fresh Meats	1,929.17
Cured Meats	412.04
Miscellaneous Supplies	91.29
Outside Meals	12.70
Drayage	152.14

Acct. was credited with 20,067 meals, amt.	6,682.36
Net Loss	1,081.94

Meals were charged at the rate of \$1.00 per diem.

Meals served 20,067; cost per meal \$.38193.

STATE HIGHWAY DEPARTMENT

DETAILS OF STABLE ACCOUNT

Total Cost		\$ 4,696.99
Corralman	\$ 565.92	
Shoes and nails	41.20	
Miscellaneous supplies	60.67	
Shoeing	179.72	
Board	18.00	
Hay	1,729.82	
Grain	1,778.48	
Building Corral	35.00	
Harness repairs	139.93	
Miscellaneous labor	22.88	
Moving corral	56.62	
Water	68.75	
		<hr/>
		\$ 4,696.99

Barn cost was distributed over
the several working accounts
monthly

Total team days	2162
Team days worked	1309
Team days idle	853
Cost of keeping teams \$2.1725 per diem.	
Cost of teams per work day \$3.58	
Cost of feed per team day \$1.6227	

DETAILS OF 08-2-8a ACCOUNT—MISCELLANEOUS

08-2-8a—MISCELLANEOUS		\$ 6,672.89
(1) Superintendence	\$ 2,402.54	
Gen. Foreman	\$ 926.29	
Bookkeeper	512.81	
Gen. Foreman's & Bookkeepers' Expenses	311.53	
Office Expense	159.12	
Auto Expense	260.65	
Foreman's Expense	13.00	
Saddle Horse	214.29	
Hospital Expense	24.85	
		<hr/>
(2) Camp Transportation		1,272.74

Railroad transportation	516.03	
Transportation Labor	443.79	
Teams Hauling Equipment	249.54	
Truck Hauling Equipment	47.57	
Hauling and Loading	12.50	
Material	3.31	
		<hr/>
(3) Camp Construction		363.05
Labor	180.70	
Supplies	7.22	
Board	69.00	
Dismantling	106.13	
		<hr/>
(4) Camp Maintenance		\$ 1,278.46
Labor	90.31	
Board	10.00	
Wood	88.43	
Supplies	7.78	
Less Employees' Mess Acct.	1,081.94	
		<hr/>
(5) Depreciation State Equipment		1,356.10
		<hr/>
		\$ 6,672.89
		<hr/>

DETAILS OF 08-2-11a ACCOUNT—TOOL MAINTENANCE

08-2-11a—TOOL MAINTENANCE		\$ 1,657.20
Blacksmith	670.82	
Helper	484.97	
Compressor Repairs	18.25	
Supplies	317.21	
Board	28.00	
Wagon Repairs	127.01	
Miscellaneous Labor	10.94	
		<hr/>
		\$ 1,657.20

Instructions to Engineers

Introduction

While in the employ of the Highway Department you are expected in the first place to devote your entire time to the service of the State.

You are not only to prosecute your work with energy and intelligence, but also to win for this department the good will and co-operation of the people in any community in which you may be stationed. You should, therefore, see to it that public opinion is favorable insofar as strict attention to your work and a business-like and courteous manner on your part can form such an impression.

You are particularly cautioned against becoming a party in any local or political controversy.

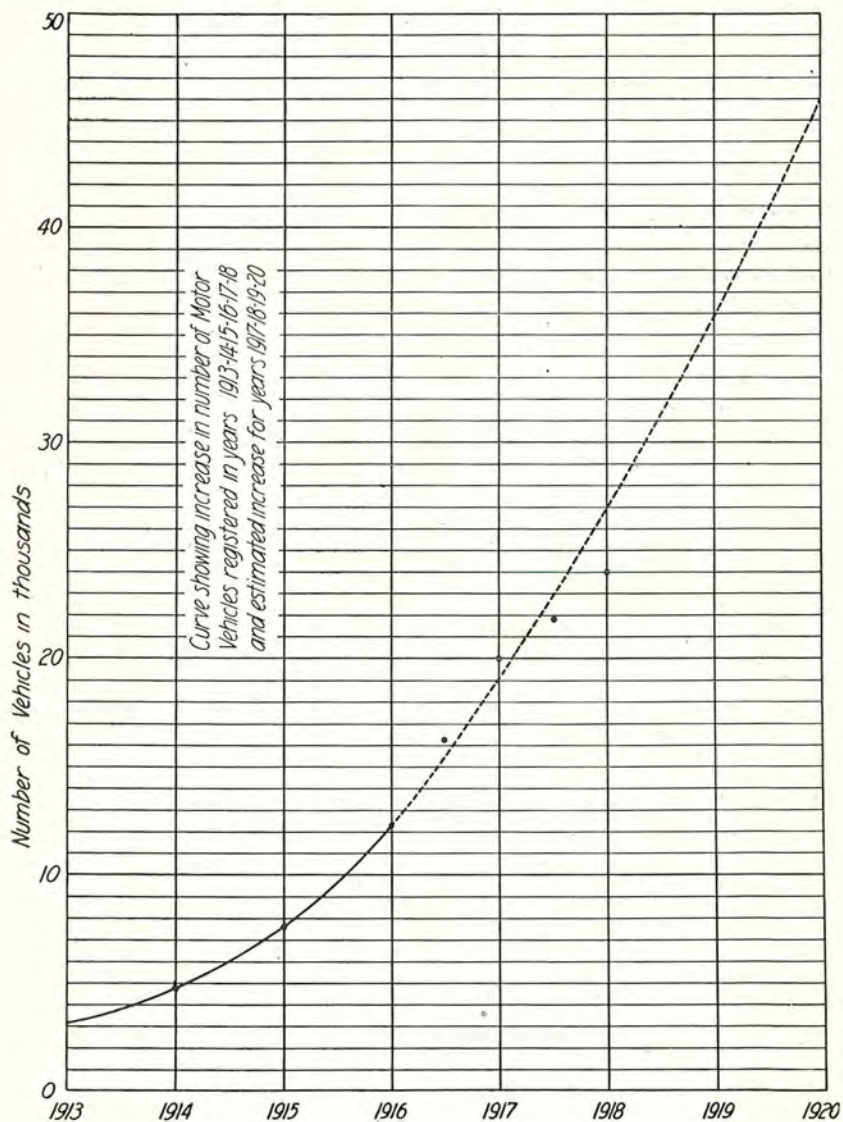
The plans for any piece of work as submitted to you from the office of the State Engineer should not be changed by you in the field without authority from this office. You should, moreover, request written instructions in case any such change is ordered in plans, specifications or contract.

Avoid making estimates in the field for the benefit or information of anyone outside of this office. Furnish all data of interest and information to this office alone. The State Engineer reserves the right for himself to give publicity to any information deemed advisable.

All surveys, methods of procedure, reports, notes, plans, etc., should invariably be made in accordance with the standards and instructions of this office.

Table of Even Radius Curves

Radius Ft.	Arc Length Ft.	Chord For Arc. Ft.	Deflection For Arc.	Deflection For One Ft. in Minutes	Chord For 100 Ft. Arc. Ft.	Degree Approx.
100	25	24.94	7°09.72'	17.190	95.89	60°00'
125	25	24.96	5°43.77'	13.751	97.35	47°10'
150	25	24.97	4°46.49'	11.460	98.16	39°00'
175	25	24.98	4°05.55'	9.822	98.64	33°10'
200	25	24.98	3°34.86'	8.594	98.96	29°00'
225	25	24.99	3°10.99'	7.639	99.18	25°40'
250	25	24.99	2°51.89'	6.875	99.33	23°00'
275	25	24.99	2°36.26'	6.250	99.45	21°00'
300	25	24.99	2°23.24'	5.729	99.54	19°10'
350	25	25.00	2°02.78'	4.911	99.66	16°30'
400	25	25.00	1°47.43'	4.297	99.74	14°20'
450	50	49.97	3°11.00'	3.820	99.80	12°40'
500	50	49.98	2°51.88'	3.438	99.83	11°30'
550	50	49.98	2°36.26'	3.125	99.86	10°30'
600	50	49.99	2°23.24'	2.865	99.89	9°30'
700	50	49.99	2°02.78'	2.455	99.92	8°10'
800	50	49.99	1°47.43'	2.149	99.94	7°10'
900	50	49.99	1°35.49'	1.910	99.95	6°20'
1000	50	50.00	1°25.95'	1.719	99.96	5°45'
1100	50	50.00	1°18.15'	1.563	99.97	5°10'
1200	50	50.00	1°11.60'	1.432	99.98	4°45'
1300	50	50.00	1°06.10'	1.322	99.99	4°25'
1400	50	50.00	1°01.40'	1.228	99.99	4°05'
1500	50	50.00	0°57.30'	1.146	99.99	3°50'
1600	50	50.00	0°53.70'	1.074	99.99	3°30'



Instructions to Engineers on Reconnaissance Surveys

Before going into the field, engineers undertaking a reconnaissance survey should obtain all maps available covering the region to be traversed and in particular any topographical sheets available of the United States Geological Survey.

When such maps are available a paper location of the proposed route may be made thereon prior to going into the field.

It is advantageous to provide township plats in surveyed land with the field notes accompanying the same to assist the engineer in identifying the section corners on the ground.

The equipment provided should include an aneroid barometer, a hand level, a pair of binoculars, a Brunton pocket transit, a pedometer, and a sketching tablet.

It is not practicable to give detailed instructions that will completely govern the selection of routes for highways. The following instructions must be regarded as incomplete and the locating engineer must often violate or disregard them. In such cases, the reason for any such disregard shall be definitely stated in the report submitted at the completion of the reconnaissance.

- 1 Make the total length of road between controlling points as short as possible.
- 2 Use gradients not greater than 5% nor less than 0.2%.
- 3 Avoid crossing drainage lines where practicable. Follow along tops of ridges as much as possible.
- 4 Locate road in good road building material where practicable.

- 5 Avoid sharp and excessive curvature. Sacrifice standard grade maximum for short distances where it is necessary to do so in order to preserve satisfactory alignment.
- 6 Provide for traffic a safe length of sight ahead along roadway on all curves.
- 7 Avoid grade crossings of railroads.
- 8 When practicable, without sacrificing more important considerations, follow along section lines. (See Paragraph 1.)
- 9 Consider the interests of the local traffic and local property holders wherever it is practicable to do so.
- 10 Locate all gravel beds, sand pits and other road building material contiguous to the work.
- 11 Engineers on reconnaissance should at the completion of their work on any section transmit to this office a detailed report with hard copy sketch of the route selected, with all information obtained in relation to the same shown thereon.

Instructions to Engineers in Charge of Location Surveys

Engineers undertaking location surveys should provide themselves with complete camp equipment and line wagon or light truck.

This equipment should include a transit, a level, two or more steel chain tapes 100 feet long, two sighting poles, four plumbobs, etc., to level rods, three 50-foot metallic tapes, six axes, black graphite marking crayon, pencils, note books, standard forms, etc.

All useful data of previous surveys in the vicinity shall be obtained. These shall include bench mark elevations, transit point ties, and the bearings of any tangents of adjoining surveys to which the work may be tied.

Preferably the party should consist of

1 Transitman	}	Transit Party
1 Flagman		
2 Chainmen		
2 Axmen		
1 Stake marker		
1 Combined Cook and line wagon driver	}	Level Party
1 Levelman		
1 Rodman		
2 Tapemen		

The purpose of this survey is

- 1 To select the most advantageous alignment of the proposed highway and to determine a proposed grade line thereon.
- 2 To furnish all information necessary concerning existing objects and conditions which will be needed by the Office Engineer in preparing plans and estimates for the proper construction of a highway and the necessary bridges and culverts along the surveyed line.
- 3 To furnish all information necessary in regard to property lines and property holders along the proposed highway.
- 4 To furnish cross section data sufficient to serve as the basis of accurate earthwork computations.
- 5 To so monument the line and to provide such reference points and bench marks that the constructing engineer may proceed without trouble or inconvenience.

In making the location survey the engineer is expected to be guided by the reconnaissance. In the event that an engineer finds good reason for departing substantially from the route determined upon in the reconnaissance survey he shall report his findings to the State Engineer and await his instructions.

In making the location survey, the same idea should govern as in the reconnaissance survey. In addition thereto the following instructions will apply:

- 1 Begin the survey at its westerly or southerly end so that when plotted from left to right the arrow will point to the top of the sheet or toward the right.
- 2 The survey will consist of a series of tangents and circular curves tangent thereto, except when the angle of deflection is 2 deg. or less the circular curve may be omitted.

- 3 Consider 400 feet as minimum radius in fairly open rolling country. Use no radius less than 200 feet in length, except in heavy mountain country.
- 4 Provide for traffic a clear sight ahead of at least 300 feet, grading high points back where necessary to secure the same. In case this is impossible in heavy mountainous work provide for widening the roadway at such curves. Provide also for danger signs.
- 5 Set a stake at each hundred foot station on center line of survey properly marked with its serial number, beginning with 0.00 at the initial point of survey. This stake may be of lath except at transit points and terminal points. A hub at least two inches square driven flush with the ground with tack on line shall be placed at each transit point and the two terminal points of survey. Such hubs shall have station number on a guard stake driven about ten inches from center line.
- 6 Reference points shall be established about 40 feet from the center line at initial and terminal points of survey and at many P. C. and P. T. points. The distance and position of such reference hubs shall be shown in the notes and such distance also marked on the guard stake driven beside the R. P. hub.
- 7 Tie the initial point of survey to the nearest section corner of public land survey where practicable.
- 8 When the survey starts from a point on a road already surveyed reestablish the tangent on such former survey, which passes through the Sta. 0.00 of the new line to be surveyed and measure the deflection angle between such old tangent and the new line tangent. Show the equation of station numbers and of bearings at such common point.
- 9 When it is practicable neither to tie to public land survey nor to any previous survey, the position of the initial point should be described as accurately as possible either with reference to

a town or railroad survey station nearby or a numbered pole of a power or telephone line or some well known and prominent natural object.

- 10 Note all intersections of center line with section lines and property lines. Show the station numbers of same and angle of intersection, and the distance to the nearest corner along such section line.
- 11 At the commencement of the survey take an observation on Polaris or on the sun and determine the true meridian at Sta. 0.00. Adjust the variation plate in the compass box so that the transit needle will read all bearings referred to the true north. If line runs easterly or westerly it will be found that observations will show a convergence of about forty seconds for a distance of one mile in longitude. The original meridian shall be used throughout the survey or equation of bearings recorded. The notes must show details of observation and amount of variation turned off on plate.
- 12 The circular curves shall be designated by the length of their radius. Their length shall be computed as the true length of the arc. This length may be obtained by multiplying the length of the corresponding arc of radius unity by the length of the given radius.
- 13 The bearing of each tangent shall be computed by means of the deflection angle from the previous tangent and the needle reading shall also be observed as a check on the computed bearing. Both shall be recorded and the deflection angle shall be doubled. Both single and double angle shall be recorded.
- 14 Immediately after the setting of each line needle and before the tape is removed from the ground additional points shall be marked with plus stakes where the level party is expected to take extra cross sections and the nearby topography shall be sketched by station numbers and offset. In case a culvert is desired at any station, a stake shall be set marked "Culvert."

The topography should show buildings, fences, brush, trees, pole lines, streams, railroads, etc.

Upon reaching the foresight with the stationing and taping. its exact location shall be established and hub set and referenced. Where tangents are short in length at least one hub shall be referenced in each one thousand feet.

- 15 Detailed information shall be obtained at each stream crossing and large scale sketches prepared showing the topography at the proposed bridge site. The location of suitable sand, gravel, and water, shall be reported. Detailed cross sections of stream bed shall be taken on center line of survey and at each ten feet interval for thirty feet on both sides of the center line. Each reading should show the character of the material on which rod is held, whether rock, sand or clay. The highwater marks shall be accurately determined and show on each section. If the highwater marks cannot be determined it may be necessary to run out drainage areas. Test pits shall be dug and the results reported. Recommendations shall be made in regard to the depth of foundations and the size of openings required.
- 16 The level party shall first establish permanent benches from ten to twenty stations apart along the center line and about forty feet therefrom.
- 17 Determine elevation of bench mark near 0+00 referred to mean tidewater datum either by connection with a government or railroad bench or by aneroid barometer.
- 18 Run a line of check levels over the line of benches established, reading rod to one hundredth of a foot.
- 19 Run a combined line of profile levels along center line of survey and cross sections at right angles to the same. These cross section levels consist of readings referred to the same datum as profile levels and taken at every break in the cross section profile. These cross sections shall show elevations thirty to forty feet each way from center line.

- 21 These sections shall be taken on every one hundred foot station stake, at all transit points and all breaks in the profile on center line, and on every proposed culvert location.
- 22 Take profile center line readings at stations one hundred feet, two hundred feet, and three hundred feet back from station 0+00, and ahead beyond the end of the line. In solid rock cuts not less than four cross sections should be taken on every one hundred feet of center line. On existing bridges and culverts four or five sections shall be taken, these should be at the top and bottom of slope on both sides of stream.
- 23 Show on each cross section the taped distance from center line to edge of beaten track of any existing road, edge of stream or distance to fence line, pole line, tree line, railway line, or rock outcrop. Show top and bottom of any existing bridge or culvert openings and elevations of any bridge seat.
- 24 Read all ground surface shots to the nearest tenth of a foot. Read all turns to the nearest hundredth of a foot. Do not allow an error of more than three hundredths of a foot between benches.
- 25 In taking cross section, to avoid confusion a regular routine should be followed. The rodman and tapemen should first stand together at stake on center line; the instrumentman should call the reading to the note keeper; the rodman should then proceed to the left carrying the end of the tape and rod, the tapeman holding tape on center line; the rodman selects the point and holds the rod; the instrumentman calls the rod reading and the tapeman calls the distance out and description of point wherever edge of road or solid rock or other description is needed.
- 26 The engineer in the field will prepare a map of center line on detail paper to a scale of 100'-1", showing topography and any notes and information desirable. This map should be in the rough only, with notes and lettering written in with no attempt at lettering but merely as a check on the notes submitted. He

shall also prepare a profile of the ground surface on center line to a horizontal scale of 100' to 1", and a vertical scale line of 10' to 1". This profile should be plotted up each night for the information and guidance of the locating engineer. He shall show on the same a recommended grade line and should note any portion of same not admitting of revision with the reasons therefor.

- 27 At the completion of the survey all notebooks and maps should be submitted to the general office in Phoenix, Arizona, where the plans, estimates, and specifications will be prepared.

Field Notes and Note Book

- 1 Engineers in charge of location surveys and their assistants shall furnish the general office with complete and comprehensive notes showing all details of the survey made.
- 2 The first page of each notebook shall show the name of the route surveyed and the name of the engineer in charge of the work.
- 3 The second page shall show a complete table of contents.
- 4 At the beginning of each day's notes the date, the names of the members of the party, and the duties performed by each, and the weather conditions must be recorded.
- 5 The level books may be submitted to the general office before the surface elevations are computed from the rod readings shown but if computed must show by whom. The level notes must show, however, complete computation of the elevation of all bench marks, and table of same with description.

Sample forms of notes are shown herein.

PHOENIX-YUMA HIGHWAY				"-LINE
Sta.	A	Def'l	C.C.	M.C.
8+00				
7+00				
6+00				
5+00				
4+00				
			N.36°46'E N.36°50'E	
3+26.7 P.T.		15°10'		A=30°20' R/L
+25		14°55.36'		2A=60°40'
3+00		11°20.50'		A=200.22
+75		7°45.64'		P.I.=2+75.09
+50		4°10.78'		T=54.21
+25		0°35.92'		Arc. 105.88
2+20.82 A.C.P.T.				
2+00				
1+00				
			N.3°26'E N.3°30'E	
0+00	= Beginning of Survey a point in center of County Road at North City Limits of ---- on ---- Street, County of ----			
Variation plate turned so needle reads from True North 14°20.				

MAY 1, 1918

Jones - Asst Engr.

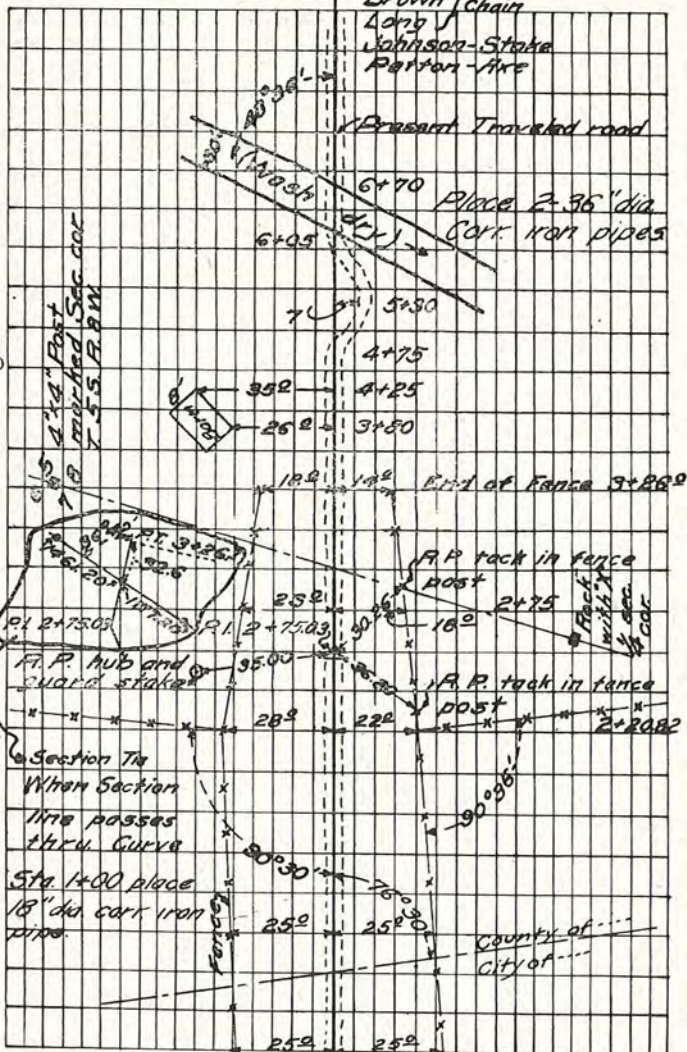
Bell - Inst

Brown - Chain

Long - Stake

Johnson - Stake

Patterson - Wire



PHOENIX-YUMA HIGHWAY "L"-LINE

Sta	+	H.I	-	El B.M.s & T.P.s
B.M. No. 1				3420.00 U.S.G.S
	3.82	3423.82		
0+300				
0+200				
0+100				
0+00				
+50				
1+00				
2+00				
T.P.			2.62	3421.20
	5.14	3426.34		
+20.82 P.C.				
+60				

MAY 1 1918

Hughes - notes

1

Lt

Taylor - K

Ives - road Rt

Note - tape

B.M. is bronze cap in rock 49' L of sta 0+30
 196' Ground elev.
 122' 0' County Road
 216' 0' County Road
 51' 18.6' County Road
 116' 0'

+ Lt 31 70 63 62 63 70 85 102
 40 F 23 9 E R 5 0 5 E R 25 F 40

94 50 60 50 51 52 70 70 110
 40 F 23 7 E R 7 0 5 E R 10 25 F 40

Culvert 70 20 26 E R 7 76 76 80 120
 40 F 26 2 E R 7 0 7 E R 23 F 40

12 40 50 64 65 64 70 125
 40 F 27 12 E R 10 0 5 E R 21 F 40

On H.P. hub 30' L. 2+60

120 30 34 70 71 87 120
 40 F cor 28 E R 3 0 6 E R 22 F cor 40

+ 40 40 25 41 40 41 125
 40 F 27 E R 7 0 6 E R 21 F 40

Office Work

All tracings, cross section estimates, and specifications shall be made in conformity with the requirements of the Bureau of Public Roads.

Construction

- 1 Engineers in charge of construction will be responsible for all purchases, expenditures for all pay rolls and for all engineering features of the work.
- 2 Standard forms will be provided for submitting weekly reports of the progress of the work and monthly estimates of the work done.
- 3 Engineers in charge of construction will make no changes in the plans or specifications except as authorized by the State Engineer.
- 4 Their first duty on arrival on the work is to check the elevation of all bench marks and to retrace and check the alignment.
- 5 Following the completion of these checks on the work of the preliminary survey, construction engineers must make a complete detailed location survey with permanent stakes so that this survey shall serve also as a staking out for construction in conformity with the plans and specifications furnished by the State Engineer. The notes shall show completely all the details of such location in a manner similar to that used on location survey notes.
- 6 The stakes used on this staking out may consist of 12d nails with red cloth on the head driven on center line and heavy stakes offset about thirty feet from center line. These heavy

stakes may best be cut wedge shaped about thirty inches long and must be driven to a firm bearing. Such heavy stakes must be set at all even stations, also at the beginning, end and each 50 foot station additional around curves.

- 7 In making this location survey and construction layout an equation in the station numbers shall be introduced about every one thousand feet in order to make such station numbers conform to those of the location survey.
- 8 Cross sections shall be taken with one sight read to hundredths of a foot taken on the top of offset at every stake and station. These cross sections shall be plotted five feet to the inch both horizontal and vertical.
- 9 A revised profile shall be laid and template showing proposed work shall be plotted on cross sections. The area of cut and fill shall then be determined by the use of the planimeter.
- 10 Each offset stake shall be marked with its station number, its offset distance to nearest tenth and the amount its top is above or below finished grade.
- 11 All transit points must be thoroughly referenced before construction begins.
- 12 The construction engineer shall be responsible for all work done, for all directions given by the foreman on the work, for the purchase of all supplies, and for the good treatment and payment of all labor employed.

Corrections:

Page 74 illustrates a volcanic cinder pit near Flagstaff

Page 82, line 10.—Transpose to line above and read: "Bisbee-Tombstone, Sections 1 and 2, 1917-1918.....\$1,922.97

Page 96, re. Clifton-Solomonsville Section 3. Insert third line following Construction 1917-1918\$42,326.48

W. J. T.

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