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CONTENTS

CHARACTERISTICS OF A GOOD JOURNAL ARTICLE

EXTRACTS FROM A PAPER READ AS A PART OF THE SYMPOSIUM ON "PUBLICATION OF RESULTS OF AGRONOMIC RESEARCH" AT THE MEETING OF THE AMERICAN SOCIETY OF AGRONOMY AT WASHINGTON, D. C., ON NOVEMBER 18, 1926,
BY
DR. M. C. MERRILL, EDITORIAL CHIEF OF PUBLICATIONS,
UNITED STATES DEPARTMENT OF AGRICULTURE.

* *

CHARACTER

"A DISTINGUISHING FEATURE IN THE CHARACTER OF A SCIENTIFIC JOURNAL ARTICLE IS THAT IT IS SCIENTIFIC. THE ARTICLE IS BASED ON FACTS. IT IS INFORMATIVE. IT IS NOT DESIGNED TO PERSUADE TO ACTION, ALTHOUGH IT MAY BE ARGUMENTATIVE. BUT HOW ARGUMENTATIVE? YOU CAN ALL RECALL SUPPOSED-TO-BE SCIENTIFIC PAPERS THAT CONTAIN A GRAM OF EXPERIMENTAL DATA AND A KILOGRAM OF THEORETICAL ARGUMENTATION. THE QUESTION MIGHT APPROPRIATELY BE ASKED, WHY ARGUE ABOUT DEMONSTRATED FACTS INSTEAD OF LETTING THEM SPEAK FOR THEMSELVES? TECHNICAL WRITING SHOULD RECOGNIZE CLEAN-CUT DISTINCTIONS BETWEEN FACT AND THEORY, KNOWLEDGE AND BELIEF, ACCOMPLISHMENT AND PROPAGANDA.

"THE TECHNICAL ARTICLE MUST HAVE STABILITY AND DEPENDABILITY. ITS FOUNDATION MUST BE WELL LAID AND REACH DOWN TO SOLID SUBSTANTIAL DATA DERIVED FROM CAREFUL EXPERIMENTATION OR STUDY. THE READER MUST HAVE CONFIDENCE IN IT. THERE MUST BE NO TRICKINESS AND NO SUBTERFUGES. THE STRUCTURE MUST BE SUBSTANTIAL AND ENDURING, NOT FLIMSY AND TEMPORARY - IT MUST BE SOLID STONE, NOT STUCCO.

"AN ELEMENT IN THE CHARACTER OF TECHNICAL JOURNAL PAPERS THAT IS SOMETIMES OVERLOOKED IS THAT THEY ARE TECHNICAL, AND ARE WRITTEN FOR THOSE WHO CAN UNDERSTAND THEM. THEY ARE THEREFORE WRITTEN IN THE LANGUAGE OF THE PROFESSION, AND IT SHOULD NOT BE NECESSARY TO DEFINE, EXPLAIN, OR DISCUSS THE TERMS AND PRINCIPLES THAT CONSTITUTE THE COLLEGE COURSE IN THE SUBJECT. THE AUTHOR OF ONE OF THE JOURNAL OF AGRICULTURAL RESEARCH PAPERS COULD BE ONLY PARTLY CONVINCED THAT HIS PAPER WAS MADE MUCH STRONGER BY THE OMISSION OF A DETAILED DISCUSSION OF ELEMENTARY PRINCIPLES OF CHEMISTRY AND PHYSICS AS APPLIED TO SOILS WHICH ARE STUDIED TODAY BY EVEN HIGH SCHOOL STUDENTS. IN ANOTHER CASE IT TOOK A TWO-HOUR ARGUMENT TO PERSUADE THE WRITER OF A TECHNICAL BULLETIN TO CONSENT TO THE ELIMINATION OF ABOUT 30 PAGES OF INTRODUCTORY ELEMENTARY MATERIAL WITH WHICH ANY FRESHMAN COLLEGE STUDENT OF THE SUBJECT IS ACQUAINTED.

Purpose

"What is the purpose of technical writing? Is it to enable workers to establish reputations for achievements in science, or is it to make contributions to scientific knowledge? In a good journal article the subject and the results are of paramount importance and the personality of the author is kept subordinate. His viewpoint is objective, not subjective. The data are therefore objectively considered for what they are worth. That highest type of honesty - scientific honesty with one's self - should be a guiding influence in presenting the results and conclusions to the world. Prejudice and personal bias should play no part whatsoever. If the data run counter to the writer's pet theories they should nevertheless be courageously given even though the writer thereby fails to attain scientific eminence. If fame comes to the scientific writer as a by-product of his contribution, well and good. But the underlying purpose for which he writes, however, should be to increase the world's knowledge, not his own prestige.

"It is a strange thing that many scientific workers are aglow with enthusiasm in the prosecution of that part of their research pertaining to the obtaining of data which blaze the way to new truths, but when the discovery is made and the scientific curiosity is satisfied the authors are very loath to stop, sit down, take stock, and carry on the laborious process of assembling, verifying, tabulating, comparing and checking the data, and especially of interpreting, explaining, and discussing them and pointing out their significant relationships. Under such circumstances writers are apt to forget or not be fully conscious of the purpose of their writing and of the fact that the ultimate value of research is determined by either its use or its availability to others. Publication of the results in creditable form should therefore be a paramount consideration.

Scope

"The scope of a journal paper needs careful attention at the outset. How broad and inclusive, how narrow and exclusive, in other words just how comprehensive should it be? Should it be short and confined to a single aspect of the subject, or should it be long and monographic and give relatively complete information about a certain subject? Apparently here is a field upon which no hard and fast lines can be drawn. So much depends upon the subject, upon the writer's relation to it, upon the extent of the investigation and the nature of the results.

"Unnecessary length and extreme brevity should both be avoided. We are all familiar with journal papers which are so long and disjointed, and the parts so distantly related, that we wonder why the material was not presented in two or three concise articles. On the other hand, there are impatient workers in science who burden the literature with fragmentary bits of information. This frequent rush

INTO PRINT WITH THESE FRAGMENTS GIVES RISE TO THE SUSPICION THAT THE AUTHOR CARES MORE ABOUT SEEING HIS NAME IN PRINT THAN ABOUT ADDING TO THE DIFFICULTIES OF HIS COWORKERS WHO MAY BE EARNESTLY TRYING TO FOLLOW HIS WORK. SUCH PRACTICE UNNECESSARILY CLOGS THE LISTS OF 'LITERATURE CITED.' ONE SOLUTION WOULD BE FOR JOURNALS TO REFUSE TO ACCEPT SUCH FRAGMENTS FOR PUBLICATION UNTIL THEY HAD BEEN JOINED INTO AN IMPORTANT CONSTRUCTIVE CONTRIBUTION." * * * * *

TECHNIC OF PRESENTATION

"INTRODUCTION. - SOME AUTHORS PLUNGE SO SUDDENLY INTO THEIR SUBJECT THAT THE READER MUST BEGIN TO STRUGGLE AT ONCE IN THE STRANGE SURROUNDINGS TO GET HIMSELF PROPERLY ORIENTED BEFORE HE CAN PROCEED. IT IS ORDINARILY CONSIDERED BETTER TO INTRODUCE THE READER MORE GENTLY AND FORMALLY TO THE SUBJECT. HE IS THUS INFORMED IN SUFFICIENT DETAIL OF THE PURPOSE OF THE EXPERIMENT OR RESEARCH, AND EXACTLY WHEN AND WHERE IT WAS PERFORMED. THE SPECIFIC RELATION OF THE PRESENT WORK TO PREVIOUS RESEARCH, IF ANY, ALONG THE SAME LINE SHOULD ALSO BE GIVEN IN ORDER THAT A PROPER ORIENTATION OF THE FIELD MAY BE HAD AT THE OUTSET." * * * * *

"METHODS OF EXPERIMENTATION. - THE QUESTION 'HOW' SHOULD BE ANSWERED FULLY AND CLEARLY. OTHER WORKERS IN THE FIELD MAY WISH TO DUPLICATE THE WORK. TO DO SO THEY SHOULD BE ABLE TO UNDERSTAND THE METHODS, APPARATUS, AND CONDITIONS UNDER WHICH THE WORK WAS DONE. IF THE TECHNIC IS NEW OR DIFFICULT TO UNDERSTAND, DRAWINGS OR PICTURES ARE VERY DESIRABLE. AT THIS POINT IT IS WELL TO NOTE THAT APPARATUS OR TECHNIC WHICH MAY APPEAR VERY SIMPLE TO THE WRITER MAY BE VERY DIFFICULT FOR OTHERS TO UNDERSTAND. IT SHOULD BE NOTED, HOWEVER, THAT WHILE THE READER'S INFORMATION SHOULD NOT BE OVERESTIMATED, NEITHER SHOULD HIS INTELLIGENCE BE UNDERESTIMATED. HENCE WHEN THE METHOD IS ONCE DESCRIBED IT IS NOT NECESSARY TO REPEAT IN LATER PARTS OF THE PAPER WHAT HAS ALREADY BEEN GIVEN.

"DATA. - IN THE PROSECUTION OF RESEARCH IT MUST NEEDS BE THAT DATA ARE OBTAINED. THEY ARE THE MATERIALS OF WHICH SCIENTIFIC DISCOVERIES ARE MADE. NOTEBOOK AFTER NOTEBOOK BECOMES FILLED WITH THEM. BUT HOW ARE THEY TO BE HANDLED IN PREPARING A MANUSCRIPT FOR PUBLICATION? THAT IS ONE OF THE BIG PROBLEMS WHICH THE WRITER FACES. MANY PROCESSES ARE USED FOR THE EXTRACTION OF THE DATA FROM THE MATERIALS AT HAND, BUT WHATEVER THE PROCESS, EACH FIGURE IS OBTAINED WITH SOME EFFORT AND AFTER MUCH PLANNING AND DELIBERATION. NATURALLY ALL THE DATA ARE THEREFORE PRIZED, FOR THEY ARE IN LARGE PART THE OFFSPRING OF PAINS, INGENUITY, AND FORETHOUGHT. HENCE THE WRITER OFTEN FINDS IT DIFFICULT TO DISCARD ANY OF THEM, AND FINALLY CONSIDERS THAT THE ONLY JUST AND IMPARTIAL PLAN IS TO INCLUDE THEM ALL. THE RESULT IS TABLE AFTER TABLE OF DETAILED FIGURES OF LITTLE SIGNIFICANCE. FROM THE VIEWPOINT OF THE READER HE HAS NOT PROPERLY EVALUATED AND SEGREGATED HIS DATA. MANY A LIFELESS PAPER HAS BEEN VITALIZED BY A PROPER GROUPING, CLASSIFICATION, AND SUMMATION OF DATA INTO SIGNIFICANT VALUES READILY SEEN AND APPRECIATED.

"Most data are presented either in tabular or graphic form. In this paper only the tabular form will be discussed. Properly prepared, a table has unified organization and logical order and is not a conglomeration of unrelated figures. The primary purpose of a table is to group and arrange the data so that significant relationships may be readily comprehended. Hence if a table is not clear or easily understood it largely fails of its mission." * * *

"Interpretation of Data. - Now that the data are all assembled, assorted, and assimilated, what do they mean? What is their significance? Shall the reader be left to guess? This happens in many papers. The writer apparently feels that his duty is fully done - that he has given the reader the facts, let him analyze and interpret them as he wishes. The natural result is that the data will go down in history uninterpreted, unwept, unhonored, and unsung.

"Another type of misdemeanor for which there should be jail penalty is the listless repetition in the text of the data that can be seen much more plainly in the tables, without any attempt to indicate significant relationships or to interpret them in any way whatsoever.

"In the interpretation of data it is exceedingly important that the author base his analysis upon the figures as they are and be guided accordingly. Some papers show evidence of bias in favor of certain conclusions which are not substantiated by the data. A manuscript submitted to the Journal of Agricultural Research had to be rejected because the author drew conclusions in support of a fine theory from data which in themselves were hopelessly conflicting and inconclusive.

"Conclusions and Summary. - Too often there seems to be confusion regarding the conclusions and the summary. These have entirely different functions. The conclusions come naturally after a logical discussion in which various phases of the subject are analyzed, weighed, and balanced against results presented by others. The conclusions of a paper constitute the essence of the author's interpretation of his results. The summary is just what its name implies. In very abbreviated form it summarizes the important points in the entire paper.

"For the average reader the sections containing the conclusions and the summary are the most important parts of a scientific paper. Here he will turn first to get a bird's-eye view of the paper and to ascertain what it is all about. If he is especially interested he will turn back and read all or parts of it, but if he is interested only in a general way he will be entirely satisfied with the information in the summary if it is well prepared." * * * *

Form and Finish

"Science is exact and its language should be precise. Anyone, therefore, who writes a scientific article should be painstaking in his choice of words, and these should precisely express his meaning. Not infrequently a sentence is subject to two or more interpretations. The writer knows definitely which he had in mind but not so the reader.

"Closely related to precision in the use of words is clearness. This quality in writing is intimately associated with clear thinking. If clearness and logic characterize an author's thinking, these virtues are likely to be reflected in his writing. Many scientific papers are exceedingly well written. Others contain vague or needless words or words used incorrectly. Common faults are the use of abstract words instead of concrete and the hopeless mixture of the two in the same sentence. For example, can one analyze the sugar content? What are rooty characteristics? Can the starch content of potato varieties be determined? Does the presence of water puddle the soil? When did a condition of saturation lower the temperature? One critic calls such writing 'jargon,' as also the indiscriminate use of such phrases as, on the basis of, in the prosecution of, the occurrence of, the proposition, from the standpoint of, according as to whether or not, in the case where, in connection with, the situation in regard to.

"A consideration much neglected in scientific writings is brevity. Brevity is not altogether determined by the number of pages. Some manuscripts of 10 pages are too long, others of 50 pages are too short. Lack of brevity is an indication of lack of definiteness in the writer's mind or of appreciation of the reader's intelligence, or both. Coupled with this lack there is commonly a failure to discriminate between the essential and the unessential. As in the tabular matter, so in the text the author puts in written form many ideas which were incubated during the experiment but which have no real function in the presentation of his results. Probably the worst sin against brevity, however, is needless and tiresome repetition. Instead of lending emphasis it arouses exasperation.

"The purpose of scientific writing being serious, the style should be conservative and appropriate, and free from indications of striving for flashy uniqueness so characteristic of modern composition. Simplicity not only of expression but of arrangement should be sought. Roman numerals so long in use for numbering tables, plates, text figures, journal numbers and volume numbers should give way to Arabic.

"A GOOD ARTICLE WILL HAVE BEEN REWRITTEN AND REVISED SEVERAL TIMES BEFORE IT IS CONSIDERED TO BE IN FINAL FORM. NO MATTER HOW WELL A MAN WRITES, HIS FIRST DRAFT OF A PAPER CAN BE IMPROVED. ONLY THE LITERARY GENIUS CAN RUN OFF A THOROUGHLY SATISFACTORY ARTICLE ON THE FIRST WRITING, AND HE IS SELDOM FOUND IN RESEARCH LABORATORIES.

"BUT HOW THE ENTHUSIASM RISES AND THE DESIRE FOR A PERFECT PRODUCT BEGINS TO BURN WHEN THE AUTHOR SEES HIS MANUSCRIPT IN PROOF! THEN IT IS THAT HE PERCEIVES THE NUMEROUS OPPORTUNITIES FOR IMPROVEMENT. THERE SEEMS TO BE A COMMON AFFLICTION AMONG AUTHORS WHICH RENDERS THEM UNABLE TO SEE PLACES NEEDING IMPROVEMENT UNTIL THE MANUSCRIPT GETS INTO PRINT. IF AN AUTHOR WOULD AT THE OUTSET GIVE THOUGHT TO THE CHARACTERISTICS OF A GOOD ARTICLE, TAKE PAINS IN ITS PREPARATION AND REVISE IT UNTIL HE IS THOROUGHLY SATISFIED WITH IT AND IT CAN WITHSTAND THE ONSLAUGHTS OF CRITICS, THERE WILL BE NO NEED FOR DOING MORE TO THE PROOF THAN CORRECTING MISTAKES IN PRINTING. THE WHOLE PROCESS WILL REQUIRE OF THE WRITER MUCH EFFORT BUT IT WILL BE EFFORT WELL EXPENDED."


HIGHWAY FINANCING
THE FARMER IS JUST AN INNOCENT BY-STANDER
Traffic on the main state roads originates largely in the city
RIGHT AND WRONG TAXATION
RIGHT
DON'T PASS THE HAT TO THE COUNTIES
They have nearly three million miles of their own roads to look after
afford to
with the main state
roads
PUT THE MAINTENANCE MONEY IN THE BANK BEFORE YOU START CONSTRUCTION
DON'T LET GOOD ROADS GO BAD FOR LACK OF A LITTLE FINANCIAL ASSISTANCE

WILLITE PAVEMENT PATENT No. 1,190,615 HELD INVALID BY U. S. CIRCUIT COURT OF APPEALS

CONTRIBUTED BY L. E. BOYKIN
CHIEF OF THE LEGAL SECTION.
(NOT FOR RELEASE)

THE UNITED STATES CIRCUIT COURT OF APPEALS ON DECEMBER 8, 1926, AFFIRMED THE DECREE OF THE LOWER COURT THAT THE WILLITE PAVEMENT PATENT No. 1,190,615 WAS INVALID.

THE SUIT IN WHICH THE DECREE WAS RENDERED GREW OUT OF A CONTRACT FOR CERTAIN PAVING WORK IN THE CITY OF ST. LOUIS. IN 1924, THE CITY CALLED FOR BIDS IN DUE FORM FOR THE PAVING OF A SECTION OF PENDLETON AVENUE UNDER SPECIFICATIONS PRESCRIBING "WILLITE." THESE SPECIFICATIONS WERE FORMULATED BY THE PLAINTIFFS AND WERE CLAIMED TO EMBODY THE INVENTION DESCRIBED AND CLAIMED IN LETTERS PATENT 1,190,615. AT THE LETTING, THE DEFENDANT, THE TRINIDAD ASPHALT MANUFACTURING COMPANY, WAS THE LOWEST BIDDER AND RECEIVED THE CONTRACT. IT DECLINED, HOWEVER, TO BECOME A LICENSEE OF THE MISSOURI WILLITE COMPANY AND REFUSED TO BUY THE MATERIALS FOR THE PAVING FROM THAT COMPANY. THEREUPON SUIT WAS FILED.

AT THE TRIAL THE DEFENDANTS ASSAILED THE VALIDITY OF THE PATENT AND DENIED INFRINGEMENT. NUMEROUS PRIOR ART PATENTS WERE CITED DISCLOSING COMPOSITIONS COMPRISING CERTAIN GENERALLY DESCRIBED MINERAL OR EARTHY AGGREGATES COMBINED WITH VARIOUS BITUMINOUS AND PITCHY MATERIALS, TO WHICH WERE ADDED VARIOUSLY FOR HARDENING PURPOSES, SULPHUR IN COMBINATION WITH METALLIC BASES, INCLUDING BLUE VITRIOL AND BLUESTONE, WHICH ARE RECOGNIZED TERMS FOR COPPER SULPHATE. THE COURT HELD THAT THESE COMBINATIONS, DESCRIBED IN THE PRIOR ART, DEPRIVED THE PATENT IN SUIT OF THE ESSENTIAL QUALITY OF INVENTION UNDER THE DOCTRINE OF EQUIVALENTS.

THE ORIGINAL SUIT WAS FILED IN 1924 IN THE DISTRICT COURT OF THE UNITED STATES FOR THE EASTERN JUDICIAL DISTRICT OF MISSOURI (EASTERN DIVISION) BY THE WESTERN WILLITE COMPANY, THE MISSOURI WILLITE COMPANY, THE AMERICAN WILLITE COMPANY, AND THE WESTERN WILLITE ROAD CONSTRUCTION COMPANY, PLAINTIFFS, AGAINST THE TRINIDAD ASPHALT MANUFACTURING COMPANY, SHELBY L. HEMAN, JOHN C. HEMAN, AND THE CITY OF ST. LOUIS, DEFENDANTS, ALLEGING INFRINGEMENT OF LETTERS PATENT NOS. 1,190,615 AND 1,328,310, AND ALSO ALLEGING INFRINGEMENT OF A TRADE-MARK CONSISTING OF THE WORD "WILLITE" IN GOTHIC LETTERS.

Patent No. 1,190,615 was issued on July 11, 1916, to Harry P. Willis, and was by him assigned to the Western Willite Road Construction Company of America, one of the plaintiffs. Subsequently, the Western Willite Road Construction Company granted an exclusive license for the State of Missouri to the Western Willite Company, which, in turn, granted an exclusive license for that State to the Missouri Willite Company. The application for this patent was filed December 7, 1914, and on July 10, 1916, Harry P. Willis made application for letters patent upon "asphaltic pavement and foundation for pavements." This latter application was filed as a division of the prior application of December 7, 1914, which later became patent No. 1,190,615. This divisional application of July 10, 1916, finally, on January 20, 1920, resulted in letters patent 1,328,310 being issued. While the bill of complaint charged infringement also of this latter patent (No. 1,328,310) complainants formally withdrew this shortly before the trial and announced they would not charge infringement thereof. The decision, therefore, does not go to the validity of this patent. Upon final hearing the District Court, under date of July 3, 1925, adjudged the patent (No. 1,190,615) invalid for anticipation and dismissed the bill, from which decision the case was appealed to the United States Circuit Court of Appeals, Eighth Circuit. The District Court also found that there was not sufficient evidence to establish infringement of the trade-mark consisting of the word "Willite" in Gothic letters, and no evidence of infringement of this trade-mark was urged in the appeal to the Circuit Court.

The Circuit Court of Appeals, in reviewing the case and affirming the decree of the lower court, under date of December 8, 1926, said, in part, the following:

> "The court below found 'that the chemical reactions, if they are such, or the catalytic effect, if this be the fact, are the same in the case of all the metallic sulphates.' This, the record seems to establish. It is contended, however, that there is a difference in the degree of effectiveness; this, if true, can not aid appellants. The selection from known equivalent materials one which does the work better than others previously used and known does not amount to invention, when the difference is only one of degree.
>
> "All the elements in this patent, or their equivalents, have been frequently employed in some combination for the production of the same or a kindred product; their functions remain unchanged. In

THE PRESENT COMBINATION IT IS CLAIMED THAT A BETTER RESULT IS OBTAINED, BUT THIS DOES NOT AMOUNT TO INVENTION. AS SAID BY THE SUPREME COURT IN SMITH V. NICHOLS SUPRA, AND BY JUDGE HOOK IN SLOAN FILTER CO. V. PORTLAND GOLD MINING COMPANY, SUPRA, IT INVOLVES THE MERE CARRYING FORWARD, OR MORE EXTENDED APPLICATION OF, AN ORIGINAL IDEA INVOLVING A CHANGE IN FORM, PROPORTION OR DEGREE, AND RESULTING IN THE DOING OF THE SAME WORK IN THE SAME WAY AND BY SUBSTANTIALLY THE SAME MEANS. ALSO BY THE SUPREME COURT IN FLORSHEIM V. SCHILLING, 137 U. S. 64, 'A NEW ARRANGEMENT OR GROUPING OF PARTS OR ELEMENTS OF A PATENTED ARTICLE, WHICH IS THE MERE RESULT OF MECHANICAL JUDGMENT, AND THE NATURAL OUTGROWTH OF MECHANICAL SKILL, IS NOT INVENTION.' IT REQUIRED NO INVENTIVE GENIUS TO SELECT A BITUMINOUS SUBSTANCE, A MINERAL AGGREGATE OR FILLER, AND A METALLIC SALT AS A HARDENING AGENT - ALL WELL-KNOWN IN THE PRIOR ART - TO PRODUCE A RESULT DIFFERING, IF AT ALL, ONLY IN DEGREE FROM THAT ALREADY KNOWN AND OBVIOUS." * * * * *

"IN SUPPORT OF THEIR PATENT APPELLANTS DEVOTE MUCH TIME AND SPACE IN ARGUMENT, RECORD AND BRIEF, TO THE UTILITY CLAIMED FOR THE PATENTED COMPOSITION; THIS CLAIM IS VIGOROUSLY CONTESTED BY APPELLEES. THE SIGNIFICANCE OF USEFULNESS TO THE VALIDITY OF A PATENT IS WELL UNDERSTOOD. A PATENT WILL NOT BE DECLARED VOID FOR LACK OF UTILITY IF IT POSSESSES ANY UTILITY WHATSOEVER. (GIBBS V. HOEFNER, ET AL., 19 FED. 323). EXTENSIVE USE OF A PATENTED ARTICLE IS STRONG PROOF OF UTILITY, BUT NOT OF INVENTION, AND IS ENTITLED TO CONSIDERATION, ON THAT ISSUE, ONLY IN DOUBTFUL CASES. 'THE MERE FACT THAT A PATENTED ARTICLE IS POPULAR AND MEETS WITH LARGE AND INCREASING SALE IS UNIMPORTANT WHEN THE ALLEGED INVENTION IS CLEARLY WITHOUT PATENTABLE NOVELTY.' DUER V. CORBIN CABINET LOCK COMPANY, 149 U. S. 216." * * * * *

"MEASURED BY THESE RULES, APPELLANTS' DEVICE FAILS TO MEET THE TEST. IT IS IN EVIDENCE IN THE TEN YEARS SINCE THE ISSUE OF THE PATENT IN SUIT APPROXIMATELY TEN MILLION SQUARE YARDS OF WILLITE PAVEMENT HAVE BEEN LAID, AN AVERAGE OF ONE MILLION SQUARE YARDS PER YEAR, BUT IT IS LIKEWISE IN EVIDENCE THAT IN ONE OF THESE YEARS ALONE THERE WERE LAID ONE HUNDRED AND TWELVE MILLION SQUARE YARDS OF ASPHALT PAVEMENT OF ALL TYPES, NOT INCLUDING THE CONCRETE PAVEMENTS OF DIFFERENT CHARACTER. IT THUS APPEARS THAT THE PATENTED COMPOSITION, AS APPLIED TO PAVEMENTS, HAS NEITHER GONE INTO

WIDE, GENERAL USE, NOR DISPLACED OTHER FORMS OF PAVEMENT WHICH HAD PREVIOUSLY BEEN USED. IN FACT, ITS USE FALLS FAR SHORT OF EVIDENCING A DEMAND WHICH THE PRIOR ART WAS NOT ADEQUATE TO SUPPLY. THE EFFECT OF THAT USE UPON THE VALIDITY OF THE PATENT, EVEN THOUGH THAT WERE DOUBTFUL, MAY BE DISREGARDED.

"THE EXAMINER OF THE PATENT OFFICE EVIDENTLY BECAME IMPRESSED BY THE ALLEGED ECONOMICAL CHARACTER OF THE PROPOSED FILLER, TAKEN INDISCRIMINATELY FROM ANY PLACE AT WHICH THE PATENTED COMPOSITION WAS TO BE USED, AND BY THE ARGUMENT THAT SULPHATE OF COPPER AND MINERAL ASPHALT WERE NOT SHOWN TO BE ASSOCIATED IN ANY SINGLE PATENT OF THE PRIOR ART. HE LOST SIGHT OF THE WIDE USE IN THE ALLIED ARTS OF OBVIOUS EQUIVALENTS.

"APPELLANTS MAKE THE SUGGESTION COMMONLY URGED IN PATENT SUITS, WHERE THE DEFENSE OF ANTICIPATION IS INTERPOSED, THAT IF OTHER ELEMENTS ARE DEEMED TO BE EQUIVALENT TO THOSE SPECIFIED IN THE PATENT, THE WAY WAS OPEN TO APPELLEES TO USE SUCH CLAIMED EQUIVALENTS, AND THUS AVOID CONFLICT. BUT IT IS NOT DISCLOSED IN THE PRESENT CASE THAT APPELLEES ARE VOLUNTARILY, AND FROM CHOICE, APPROPRIATING THE FORMULA OF APPELLANTS; SUCH A DESIRE IS EXPRESSLY DISCLAIMED. FOR SOME REASON, NOT MADE CLEAR BY THE RECORD, THE CITY HAD, IN SUBSTANCE, SPECIFIED THE WILLITE FORMULA FOR THIS PENDLETON AVENUE PAVEMENT, AND HAD ADVERTISED FOR COMPETITIVE BIDS, UNDER WHICH ALL SUCH CONTRACTS FOR MUNICIPAL IMPROVEMENTS ARE LET. APPELLEES WERE COMPELLED EITHER TO CONFORM TO THE SPECIFICATIONS OR TO ABANDON THE FIELD AS BIDDERS. UNDER SUCH CIRCUMSTANCES, THEY ELECTED TO CHALLENGE APPELLANTS' CLAIMED MONOPOLY."

IN THE FOREGOING EXCERPTS, THE WORDS APPELLANTS AND APPELLEES REFER, RESPECTIVELY, TO PLAINTIFFS AND DEFENDANTS.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

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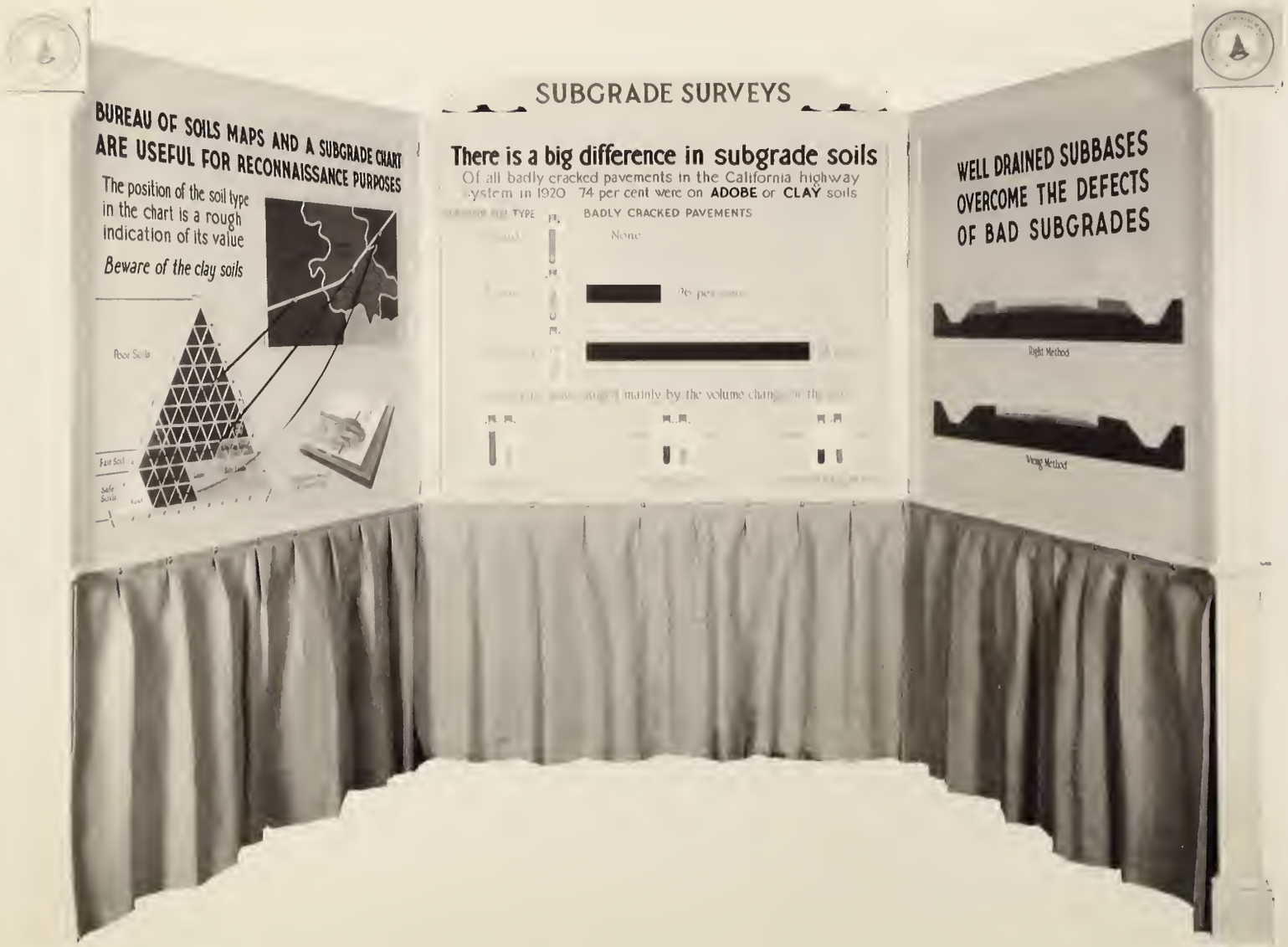
STATUS OF CURRENT FEDERAL AID ROAD WORK

FOR THE FISCAL YEAR ENDING JUNE 30, 1927

AS OF FEBRUARY 28, 1927

STATES	BALANCE OF FEDERAL AID FUND AVAILABLE FOR NEW PROJECTS	* UNDER CONSTRUCTION			APPROVED FOR CONSTRUCTION			AMOUNT PAID STATES DURING FISCAL YEAR	COMPLETED AND PAID DURING FISCAL YEAR			AGREEMENTS NOW IN FORCE			P.S.&E. RECOMMENDED BY APPROVAL BY DISTRICT ENGINEER			STATES
		FEDERAL AID	MILES ORIGINAL	MILES STAGE	FEDERAL AID	MILES ORIGINAL	MILES STAGE		FEDERAL AID	MILES ORIGINAL	MILES STAGE	FEDERAL AID	MILES ORIGINAL	MILES STAGE	FEDERAL AID	MILES ORIGINAL	MILES STAGE	
ALABAMA	$ 3,469,415.48	$ 2,812,159.58	336.4		$			$ 959,727.98	$ 899,114.95	101.9	4.6	$ 2,436,647.14	270.6		$ 375,512.44	65.8		ALABAMA
ARIZONA	3,529,146.31	839,667.40	71.9		16,607.49			384,244.89	426,049.45	39.9		856,274.99	71.9					ARIZONA
ARKANSAS	1,902,595.09	1,372,942.68	240.3		590,151.53	62.4		789,903.04	1,351,422.35	157.1		1,629,338.78	242.9		333,655.43	59.9		ARKANSAS
CALIFORNIA	4,307,475.04	4,069,081.60	188.3	0.4	269,959.72	18.2		2,163,218.97	2,906,144.34	199.6	17.3	3,877,622.71	157.7	0.4	461,417.61	26.8		CALIFORNIA
COLORADO	2,675,624.05	2,981,014.29	266.8	9.1	496,228.34	54.2		836,043.14	522,177.14	37.9		2,697,120.07	254.7	9.1	680,122.56	66.3		COLORADO
CONNECTICUT	873,063.51	1,580,896.95	70.4					559,643.59	245,719.74	13.6		1,444,212.28	69.6		136,794.67	0.9		CONNECTICUT
DELAWARE	234,628.92	241,755.90	17.6		129,565.50	14.9		316,654.52	452,067.19	28.0		218,310.90	15.0		153,010.50	17.4		DELAWARE
FLORIDA	1,624,016.98	3,668,934.53	201.2	24.8	359,552.23	24.5		732,979.45	1,507,479.94	90.9		3,276,448.98	199.1	11.9	752,037.78	26.6	13.0	FLORIDA
GEORGIA	1,959,029.90	4,397,796.94	395.4	87.5	90,594.24	0.8	12.7	1,929,094.39	2,299,503.16	264.0	42.2	4,331,390.93	395.4	87.5	157,010.20	0.8	12.7	GEORGIA
IDAHO	1,079,141.52	1,369,755.66	170.1	15.5	105,900.00	11.1	0.1	1,064,904.01	1,057,910.12	102.9	13.1	1,244,836.07	169.7	6.4	230,819.59	11.6	9.2	IDAHO
ILLINOIS	5,115,447.60	4,549,927.23	339.5		1,240,229.14	96.5		2,058,014.08	1,461,027.29	102.2	2.0	4,483,596.56	336.3		1,306,559.31	100.7		ILLINOIS
INDIANA	777,159.06	7,744,250.68	467.2	11.6	1,690,000.00	125.0		1,725,204.99	1,747,232.07	117.7		7,559,014.76	455.7	11.6	1,975,235.92	136.5		INDIANA
IOWA	234,035.53	5,745,290.30	614.6	232.4	1,859,747.08	111.3	35.4	1,969,247.57	1,765,186.99	237.7	48.3	5,524,743.13	670.2	235.3	2,040,294.20	55.7	32.5	IOWA
KANSAS	1,995,332.77	5,477,192.80	706.1	4.0	581,376.14	67.1	4.5	1,829,613.31	903,552.04	177.6		5,252,688.16	713.2	5.0	785,980.78	60.0	3.5	KANSAS
KENTUCKY	695,156.92	3,634,966.56	359.2	49.7	956,832.04	85.9	4.9	1,196,463.37	852,818.24	88.7	14.6	3,639,070.37	365.6	48.7	952,626.22	79.6	4.8	KENTUCKY
LOUISIANA	1,250,391.34	2,244,095.30	208.5		94,457.90	3.7		657,767.34	562,031.47	54.5		1,956,574.37	196.1		371,978.33	23.1		LOUISIANA
MAINE	1,421,968.90	991,364.43	68.0		43,956.00	5.6		956,009.91	595,925.29	49.4		935,320.43	73.6					MAINE
MARYLAND	657,559.23	455,369.54	42.4					535,732.45	334,258.01	46.0		441,313.54	42.4		14,050.00			MARYLAND
MASSACHUSETTS	2,573,065.61	1,493,354.92	79.2		382,195.10	24.3		74,025.25	121,949.75	5.1		1,603,435.02	86.7		236,115.00	15.8		MASSACHUSETTS
MICHIGAN	2,292,112.91	6,594,975.68	392.0	39.3	1,033,575.00	57.5	6.5	2,231,127.90	809,340.11	55.0		6,395,735.68	401.5	39.3	1,232,915.00	49.0	6.5	MICHIGAN
MINNESOTA	667,276.43	1,110,993.90	229.6	46.2	988,100.00	172.3	63.5	2,479,945.13	3,460,029.11	461.6	114.6	494,900.00	151.7	49.2	1,514,299.90	249.2	67.5	MINNESOTA
MISSISSIPPI	1,431,395.15	3,749,082.00	395.8		170,310.37	33.9		1,066,164.98	670,574.98	84.8		3,432,357.23	358.5		487,035.64	71.1		MISSISSIPPI
MISSOURI	1,652,705.62	4,590,775.87	308.5	40.3	781,334.30	101.3	3.7	3,196,432.91	4,430,780.36	301.0	22.9	4,309,549.32	299.4	36.1	1,062,560.95	111.4	7.9	MISSOURI
MONTANA	5,950,808.81	1,365,907.90	131.6	8.2	469,991.80	94.1		791,263.48	857,209.60	82.9	60.1	1,805,409.51	220.6	8.2	29,490.19	5.1		MONTANA
NEBRASKA	3,151,595.24	5,919,993.10	1,310.2	613.5	271,753.97	40.2	56.4	1,996,970.24	1,402,828.17	279.5	132.3	6,046,027.97	1,343.6	634.6	145,719.10	6.8	41.4	NEBRASKA
NEVADA	1,142,120.65	1,298,930.80	198.5	32.1				637,940.29	2,171,838.96	259.6	5.1	1,295,988.40	198.5	32.1	2,932.40			NEVADA
NEW HAMPSHIRE	467,326.97	303,902.51	18.7					414,921.59	396,537.45	26.4		303,902.51	18.7					NEW HAMPSHIRE
NEW JERSEY	946,532.96	855,223.56	55.0		104,910.00	7.0		732,592.69	2,397,022.27	26.0		855,223.56	55.0		104,910.00	7.0		NEW JERSEY
NEW MEXICO	2,004,969.80	2,361,013.57	278.5		389,782.29	7.9		607,411.30	73,736.96	15.6		1,991,554.92	234.4		749,240.94	52.0		NEW MEXICO
NEW YORK	7,007,974.69	9,234,162.70	578.3		1,050,747.50	57.0	8.6	3,933,944.31	2,475,669.92	158.4		10,178,267.70	631.9		106,642.50	3.5	8.6	NEW YORK
NORTH CAROLINA	1,714,652.58	2,025,475.48	135.6		238,440.59	20.1		1,587,423.25	2,274,655.41	124.7	37.5	2,168,916.07	147.7		95,000.00	9.0		NORTH CAROLINA
NORTH DAKOTA	1,216,972.87	2,465,214.07	656.3	61.4	560,006.20	82.7	254.9	2,245,720.64	1,669,657.09	506.1	362.9	2,641,878.03	719.7	114.8	383,342.24	19.2	201.5	NORTH DAKOTA
OHIO	4,550,705.29	4,437,869.14	352.5	10.9	542,398.22	17.9		2,246,278.78	1,541,246.32	123.1	6.7	4,503,747.29	348.1	10.9	526,519.07	22.3		OHIO
OKLAHOMA	1,816,479.22	1,606,662.90	212.8	20.9	675,043.17	102.5	20.7	1,006,284.86	553,433.56	47.0	7.1	1,958,325.64	250.4	29.1	423,386.43	64.9	12.5	OKLAHOMA
OREGON	1,010,387.07	1,701,704.59	116.7	23.5	241,271.15	12.0	12.3	792,324.04	514,971.40	34.3		1,914,959.27	128.7	28.9	24,016.47		6.3	OREGON
PENNSYLVANIA	3,454,219.19	6,223,438.86	432.5		1,031,149.14	60.0		2,347,453.93	2,393,976.77	174.0		7,074,566.27	480.9		186,021.73	11.5		PENNSYLVANIA
RHODE ISLAND	754,874.94	205,665.00	13.7		74,175.00	4.9		466,586.24	439,630.00	29.3		279,840.00	18.6					RHODE ISLAND
SOUTH CAROLINA	1,073,720.52	2,289,560.24	197.0	8.0	15,000.00	2.2		831,126.66	711,908.31	75.3	15.4	2,220,760.24	169.5	6.2	83,800.00	29.7	1.8	SOUTH CAROLINA
SOUTH DAKOTA	1,230,170.86	1,718,482.12	571.4	25.0	89,849.59	23.7	56.2	1,007,312.07	744,524.46	261.5	129.4	1,669,031.30	584.3	57.6	139,250.41	10.9	23.6	SOUTH DAKOTA
TENNESSEE	1,872,296.07	3,963,994.70	266.0	54.1	35,000.00	0.3		1,599,659.96	747,432.21	48.1	7.9	3,495,260.60	217.3	50.1	503,724.10	47.4	4.0	TENNESSEE
TEXAS	6,174,080.35	7,349,945.18	656.2	174.7	1,270,190.30	76.9	73.4	3,411,264.90	2,970,231.95	387.9	27.2	7,140,527.58	617.7	178.1	1,478,607.90	115.4	70.0	TEXAS
UTAH	1,146,562.35	1,375,360.14	139.9		423,767.73	32.7		504,544.98	615,614.05	79.1		1,389,403.39	146.7		415,724.53	25.9		UTAH
VERMONT	731,824.43	649,673.79	32.0					581,139.86	235,929.73	11.1		647,644.23	32.0		1,034.55			VERMONT
VIRGINIA	570,879.02	2,056,910.00	131.1		513,269.92	34.9		1,565,412.66	1,417,440.95	100.2		1,593,567.32	111.9		976,612.60	54.1		VIRGINIA
WASHINGTON	1,230,155.05	1,698,600.00	61.1		52,000.00	7.0		1,057,959.01	463,642.49	42.5		1,673,600.00	51.3		77,000.00	16.9		WASHINGTON
WEST VIRGINIA	593,219.82	2,212,606.59	164.3	12.0	776,573.58	79.6		64,155.60	432,685.36	26.5		2,589,372.07	210.1	12.0	399,908.10	33.9		WEST VIRGINIA
WISCONSIN	4,393,063.00	3,514,754.09	322.6	6.8	120,000.00	4.7	4.3	2,162,027.66	889,747.18	95.1	7.8	3,387,379.38	309.9	6.8	247,374.71	17.4	4.3	WISCONSIN
WYOMING	1,290,472.32	1,115,591.63	114.1	33.7	42,256.00	16.7		683,248.42	1,011,436.00	172.5	32.8	1,115,591.63	114.1	33.7	42,256.00	16.7		WYOMING
HAWAII	905,975.36	464,352.64	23.1		98,010.00	6.5		124,275.80	97,440.00	6.5		562,362.64	29.6					HAWAII
TOTALS	$ 99,704,701.10	$ 139,974,398.02	13,310.6	1649.6	$ 20,910,263.82	1,861.8	624.0	$ 62,894,884.49	$ 58,771,933.48	6,011.5	1,111.9	$ 138,438,364.44	13,377.0	1,741.4	$ 22,346,297.40	1,795.4	532.2	TOTALS

* INCLUDES PROJECTS REPORTED COMPLETED (FINAL VOUCHERS NOT YET PAID) TOTALING: - FEDERAL AID $ 40,222,319.15 MILES ORIGINAL 3,712.1 MILES STAGE 441.1


SUBGRADE SURVEYS
BUREAU OF SOILS MAPS AND A SUBGRADE CHART ARE USEFUL FOR RECONNAISSANCE PURPOSES
The position of the soil type in the chart is a rough indication of its value
Beware of the clay soils
Poor Soils
Fair Soil
Safe Soils
There is a big difference in subgrade soils
Of all badly cracked pavements in the California highway system in 1920 74 per cent were on ADOBE or CLAY soils
BADLY CRACKED PAVEMENTS
None
WELL DRAINED SUBBASES OVERCOME THE DEFECTS OF BAD SUBGRADES
Right Method
Wrong Method

PRESENT PRACTICE IN HIGHWAY SUBDRAINAGE, FOUNDATION DESIGN, AND SUBGRADE TREATMENT IN THE NEW ENGLAND AREA

CONTRIBUTED BY E. J. WAKEFIELD OF THE DIVISION OF DESIGN
(NOT FOR RELEASE)

THE DESTRUCTIVE FROST ACTION AND WIDE VARIATION IN SOIL TEXTURES WHICH OCCUR IN THE NEW ENGLAND AREA, MOST OF NEW YORK STATE, AND THE NORTHERN PART OF NEW JERSEY ACCOUNT FOR THE CONSPICUOUS PLACE WHICH FOUNDATION DESIGN, SUBDRAINAGE, AND SUBGRADE TREATMENT HOLD IN THE HIGHWAY ENGINEERING PRACTICE OF THOSE STATES. WINTER TEMPERATURES FALL AS LOW AS 50 DEGREES BELOW ZERO IN THE EXTREME NORTHERN PORTIONS AND THE GROUND, IN THE ABSENCE OF A HEAVY BLANKET OF SNOW, SOMETIMES FREEZES TO A DEPTH OF SEVERAL FEET. THE SOIL, BECAUSE OF ITS GLACIAL ORIGIN, IS EXTREMELY VARIABLE AND EMBRACES EVERY GRADATION OF TEXTURE, FROM HEAVY, PLASTIC CLAYS THROUGH LOAMS, SANDS, GRAVELS AND HARDPAN, TO VERITABLE NESTS OF BOWLDERS. FREQUENTLY THERE IS A WIDE VARIATION WITHIN THE LIMITS OF A SINGLE PROJECT, ALTHOUGH THERE ARE CONSIDERABLE AREAS WITHIN WHICH THE SOIL IS REMARKABLY UNIFORM IN CHARACTER, SUCH AS THE SAND COUNTRY OF NORTHERN NEW YORK WHERE ALMOST PURE SAND OVERLIES MANY SQUARE MILES.

DUE TO THE OCCASIONAL ALTERNATION OF PERVIOUS AND IMPERVIOUS STRATA DEPOSITED OVER MUCH OF THIS AREA BY THE GLACIAL PERIOD ICE SHEET, THE PERCOLATION OF GROUND WATER IS FREQUENTLY INTERRUPTED, AND NOT UNCOMMONLY ENCOUNTERED IN THE FORM OF SURFACE SEEPAGE IN SHALLOW CUTS ON HILLSIDES. THE COMBINATION OF EXCESS MOISTURE AND LOW WINTER TEMPERATURES IS PROBABLY BY FAR THE MOST DESTRUCTIVE NATURAL CONDITION WITH WHICH THE ENGINEER, ENGAGED IN HIGHWAY DESIGN AND MAINTENANCE, HAS TO CONTEND. THE CRITICAL PERIOD OCCURS IN EARLY SPRING WHEN "THE FROST IS COMING OUT." THE INITIAL THAWING OF THE SUBGRADE, PARTICULARLY A CLAY SUBGRADE, LEAVES THE PAVEMENT UNEQUALLY SUPPORTED ON A SUPER-SATURATED STRATUM OF SOIL, THE COMPACT TEXTURE OF WHICH HAS BEEN, TO A CONSIDERABLE DEGREE, DESTROYED BY FREEZING. THE MOISTURE RELEASED BY THIS INITIAL THAWING IS OFTEN IMPOUNDED BETWEEN THE LOWER SURFACE OF THE PAVEMENT AND THE STILL FROZEN SUBSOIL. UNLESS PROVISION IS MADE FOR THE LATERAL ESCAPE OF THIS EXCESS MOISTURE, THE SUBSEQUENT ALTERNATIONS OF FREEZING AND THAWING ARE QUITE LIKELY TO RESULT IN THE FORMATION OF ICE UNDER THE PAVEMENT AT POINTS WHERE THE WATER IN THE SUBGRADE TENDS TO CONCENTRATE. THE RESULT IS THE FAMILIAR FROST-BOIL OF NORTHERN LATITUDES, THE DESTRUCTIVE ACTION OF WHICH IS WELL KNOWN TO HIGHWAY MAINTENANCE ENGINEERS OF THAT SECTION.

In general, the purpose of subgrade treatment - using the broader meaning which covers the related features of subdrainage, foundation design and subgrade replacement - is fourfold. First, it is desired to reduce the content of moisture in the subgrade if practicable; second, it is desired to prevent the rise of capillary moisture to the lower surface of the pavement and to furnish a means of escape for any free water which may accumulate on the surface of the subgrade; third, it is desired to improve the distribution of concentrated traffic loads by spreading them over wider areas on weak subgrades, and to insure a more uniform support for the pavement; and, fourth, it is desired to provide an insulating layer against the spring fluctuations of thawing and freezing which will, at the same time, make for greater uniformity in these processes.

The practice in this field of highway design differs in the several States of this area, but chiefly in the thoroughness of the provisions rather than in the nature of the treatment of similar cases. Subgrade treatment practice has thoroughly crystallized in a number of these States; and, although there has been considerable improvement and progress during the past few years, the general trend is clearly defined and the following generalities may be taken as typical of modern practice in New England.

Two early types of corrective provisions, namely, herringbone drains and V-drains, appear to have been completely abandoned - probably because equally effective results are obtainable at less expense with other methods of treatment.

The use of an underdrain is now confined chiefly to the drainage of wet side-hill cuts, where it may function properly as an intercepting drain to cut off the lateral seepage of percolating ground water. These underdrains are commonly constructed with vitrified-clay pipe, of 6 inches diameter or larger, usually laid on about 2 inches of crushed stone or gravel in the bottom of the trench, which is then refilled with coarse broken stone or screened gravel for the greater part of its depth. Careful construction and clean refill material are emphasized in most of the standard specifications for this item. The depth and width of trench vary in the several States, but a depth of 4 feet and bottom width of 18 inches, with 6-inch vitrified-clay pipe, may be taken as fairly typical.

For maximum effectiveness the underdrain is usually constructed under the shoulder, near the edge of the pavement. This practice is open to criticism because of the likelihood of seriously impairing the lateral support of the subgrade, no matter how thoroughly the refill material is tamped in place in the trench. From the standpoint of ultimate stability it is probably better to keep the underdrain well away from the edge of the pavement; particularly since its true function as an interceptor of lateral seepage will not be seriously affected thereby.

Formerly it was not unusual to provide underdrains with a view to reducing the capillary moisture in the subgrade where wet clay soils were encountered. This use of underdrains appears to have been largely discredited in the New England area, not only because of doubtful efficacy, but because superior results, from the standpoint of pavement stability, are obtainable by an equal expenditure for gravel subbase. There are, perhaps, some conditions (such as may be found in parts of New Jersey where the water-table lies close to the surface and the soil is fairly porous) under which the use of underdrain for this purpose would be justifiable; but, in general, the provision of extra subbase is a more economical investment of funds.

The most common method of treatment for wet and unstable subgrades in New England is the provision of porous foundation courses, designed to meet the requirements of each specific case and varied within the limits of a single project to meet the varying conditions of soil and subgrade moisture. This method of treatment may vary from the provision of an additional thickness of broken stone or slag base course, or the provision of a 2 or 3-inch blanket of sand and gravel under the pavement; to the virtual replacement of inferior subgrades such as is often practiced in Massachusetts. In this State it is not uncommon for an improvement to be constructed in four separate courses with an aggregate thickness of 20 inches or more. The type of foundation course will usually be determined, to some degree, by the kind of local materials available. Field stone from old stone fences is available in many parts of New England, and suitable gravel is generally available within easy haul. These two materials are, therefore, in most common use for foundation and subbase courses; although quarry stone, broken slag and cinders are also suitable for the same purposes and are used where more available than field stone or gravel, as in many parts of New York and New Jersey.

Typical practice in foundation design, particularly for bituminous macadam pavements, is the provision of 9 to 12 inches of heavy stone foundation course, bedded on sand or gravel 2 inches or more in thickness, with a leveling or intermediate course of broken stone between the heavy stone and the bituminous course. The heavy stone foundation, consisting of field or quarry stone, roughly hand-placed, chinked with smaller fragments, and filled with broken stone and coarse sand or gravel, furnishes the necessary lateral rigidity in the case of flexible pavements; the sand or gravel bedding course or subbase effectually prevents the upward penetration of plastic subgrade material and facilitates the drainage of water from the surface of the subgrade; while the broken stone leveling, or intermediate course takes up the irregularities of the heavy stone foundation and serves as a cushion for the bituminous surface under traffic. This type of foundation construction, when provided with adequate outlet drains through the shoulders at frequent intervals, will generally take care of the most unfavorable subgrade conditions. Where the subgrade is especially bad, an additional thickness of gravel subbase under the heavy stone foundation will usually provide the necessary bearing power.

Although the above described type of foundation has been used to a considerable extent under concrete pavements, it is probably not so well suited to that type of pavement as gravel - either screened or run-of-bank. The trend of recent practice seems to be toward the use of run-of-bank gravel under concrete pavements - probably because it fulfills the requirements at a lesser cost, and is actually better adapted to satisfy those requirements. A concrete pavement requires, probably more than any other type, a uniform foundation support, and this is very difficult to obtain in foundations constructed of large fragments of varying size. Rigidity of the subgrade is less needful since the flexural resistance of the slab is sufficient to distribute the traffic loads over a wide area of support. The main desiderata in foundations for concrete pavements are, that they be sufficiently porous and of sufficient depth to take care of excess water and minimize frost action, and that they furnish a uniform support to the pavement at all times. Broken slag, cinders, or other equally porous materials satisfactorily fulfill these requirements.

A recent trend in subbase and foundation construction is the use of a width in excess of that of the pavement, with the foundation carried out from 6 inches to as much as 3 feet on each side of the pavement area. This is advantageous in a number of ways: It

STRENGTHENS THE SUPPORT OF THE PAVEMENT AT ITS WEAKEST POINT - THE EDGE; IT PROVIDES A MORE STABLE FOUNDATION FOR THE SHOULDERS; AND, IT PROVIDES A FOUNDATION FOR FUTURE WIDENING, WHICH MAY WELL BE ANTICIPATED ON MANY OF THE MAIN ROUTES AT THE TIME OF INITIAL IMPROVEMENT.

PERHAPS NOT SUFFICIENT CARE IS TAKEN TO DRAIN FREE WATER FROM THE BOTTOM OF FOUNDATION AND SUBBASE COURSES, PARTICULARLY ON GRADES. EFFECTIVELY TO INTERCEPT SUCH WATER AND CARRY IT THROUGH THE SHOULDERS REQUIRES CAREFULLY CONSTRUCTED OUTLET DRAINS, PREFERABLY EXTENDING UNDER THE FOUNDATION OR SUBBASE IN THE FORM OF SHALLOW INTERCEPTION TRENCHES, AND EMPTYING FREELY INTO THE SIDE DITCHES AT AN ELEVATION LOWER THAN THE LOWEST PART OF THE DRAIN. IT IS SUGGESTED THAT SMALL-SIZE TILE MIGHT WELL BE INSTALLED IN THE BOTTOM OF THESE DRAINS UNDER THE SHOULDERS, BECAUSE OF THE TENDENCY OF SHALLOW BLIND DRAINS OF BROKEN STONE OR GRAVEL TO BECOME CLOGGED AND INOPERATIVE AFTER A FEW YEARS.

THE USE OF TELFORD BASE, WITH ITS MORE ELABORATE CARE IN CONSTRUCTION, HAS BEEN PRACTICALLY ABANDONED BECAUSE OF THE HIGH COST. TELFORD CONSTRUCTION MAY HAVE BEEN A GOOD INVESTMENT IN THE DAYS OF WATERBOUND MACADAM AND LOW LABOR COSTS. AND IT WAS ESPECIALLY SUITABLE AS A HEAVY BASE FOR WATERBOUND MACADAM, BUT WITH PRESENT PRICES AND THE PREVAILING TYPES OF PAVEMENTS, THERE APPEARS TO BE NO PLACE FOR THIS RATHER COSTLY REFINEMENT IN HIGHWAY PRACTICE.

IN THE INTEREST OF AVOIDING UNFAVORABLE SUBGRADE CONDITIONS AND REDUCING THE COST OF FOUNDATION CONSTRUCTION, NEW HAMPSHIRE APPEARS TO HAVE A CONSISTENT POLICY OF AVOIDING DEEP CUTTING, AND SO LAYING THE GRADE LINE AS TO TAKE ADVANTAGE OF THE EXISTING ROAD CRUST WHEREVER PRACTICABLE, WITH THE CONSEQUENT INTRODUCTION OF BORROW FILLS FOR PURPOSES OF GRADE CORRECTION AND WIDENING. IN MASSACHUSETTS, ON THE OTHER HAND, IT IS NOT UNCOMMON FOR GRADE ELEVATIONS TO BE GOVERNED BY THE ELEVATIONS OF ABUTTING PROPERTY AND MANY HUNDRED FEET OF PREVIOUS IMPROVEMENT MAY BE TORN UP AND REPLACED WITH NEW CONSTRUCTION IN ORDER TO AVOID RAISING THE PAVEMENT SURFACE AN EXCESSIVE HEIGHT ABOVE THE ADJACENT PROPERTY ELEVATION.

THE USE OF AN INCREASED THICKNESS OF CONCRETE PAVEMENT AND HEAVIER REINFORCEMENT OVER UNSTABLE SUBGRADES HAS BEEN PRACTICED TO A LIMITED EXTENT, AND ONE STATE VARIES THE POSITION OF THE PAVEMENT REINFORCEMENT, PLACING IT NEAR THE UPPER SURFACE IN CUTS AND NEAR THE LOWER SURFACE ON FILLS, ON THE THEORY THAT HIGHER TENSILE STRESSES WILL OCCUR AT THE TOP OF THE PAVEMENT IN THE ONE CASE AND AT THE BOTTOM IN THE OTHER. THESE VARIATIONS IN DESIGN (WITHIN ECONOMICAL LIMITS) ARE, OF COURSE, ENTIRELY INADEQUATE UNDER REALLY UNFAVORABLE SUBGRADE CONDITIONS UNLESS SUPPLEMENTED BY SOME SORT OF SUBGRADE TREATMENT.

The use of clay or loam as a material for subgrade treatment might seem paradoxical; but such material may sometimes be used on sand subgrades very advantageously. In these cases the purpose of the treatment is not so much the correction of subgrade weakness as to improve the facility of pavement construction. In general, sand subgrades give no trouble when confined by an adequate pavement, but it is often impossible properly to shape and compact a sand subgrade unless a small quantity of clay or loam is spread and admixed with the upper stratum of the sand. This use of clay is provided in the standard specifications of Maine and has been practiced very effectively elsewhere under the writer's observation.

Massachusetts has developed a type of construction for the sand country of Cape Cod, and the similar conditions on the contiguous mainland, which is an excellent example of the adaptation of design to local conditions and materials available. Here a sand-asphalt pavement is constructed, using the local sand for aggregate. For a base course, 4 inches of clay or loam are spread on the sand subgrade and compacted to provide a firm and smooth surface, on which the sand-asphalt mixture is then spread and compacted in two 2-inch courses. There is no admixture of the clay or loam with the sand subgrade, but the material acts as a more or less cohesive blanket which prevents the displacement of the loose sand subgrade during construction, and after completion, serves to distribute the wheel loads to some extent.

The conditions of soil and drainage in the New England area are so variable that highway design is not amenable to any fixed rules; and the engineer in charge of construction may well be allowed considerable latitude in the exercise of his discretion in the actual location of underdrains, extra foundation, etc. Ordinarily the subdrainage and foundation requirements can be determined, with a fair degree of approximation, by inspection of the terrain during the spring months; but often conditions are observed during construction which can not be foreseen when the plans are prepared. Probably a more thorough study of subsoil and ground water conditions prior to preparation of the plans would permit worth-while economies in the distribution of expenditure for these items. The judicious use of a post-hole auger in the season of maximum saturation would undoubtedly afford much more reliable information regarding subgrade conditions than can be obtained by any superficial examination of the highway location.

So far, the determination of subdrainage and foundation requirements has been largely dependent on the personal judgment of the designing engineer, and there has been only a limited application of the valuable information respecting soil behavior fast

ACCUMULATING THROUGH RECENT RESEARCH. A CERTAIN AMOUNT OF INERTIA IN THIS CONNECTION IS NATURALLY TO BE EXPECTED, ESPECIALLY IN VIEW OF THE EXTREME NOVELTY OF THE SCIENCE. RULE-OF-THUMB METHODS MAY BE EXPECTED TO PREVAIL IN THIS FIELD FOR SOME TIME TO COME, PARTICULARLY WHERE RULE-OF-THUMB METHODS HAVE DEVELOPED OVER A LONG PERIOD OF YEARS TO A STAGE OF REASONABLY SUCCESSFUL PRACTICE. HOWEVER, AS TRAFFIC DEMANDS AND EXPENDITURES FOR HIGH-TYPE PAVEMENTS INCREASE, INCREASING STUDY WILL UNDOUBTEDLY BE GIVEN TO ECONOMIES IN DESIGN, AND RECOGNITION OF THE PRIMARY IMPORTANCE OF SUBGRADE SOIL ANALYSIS IN THAT CONNECTION MAY CONFIDENTLY BE EXPECTED.

PROBABLY NO EXPENDITURE FOR HIGHWAY IMPROVEMENT HAS GREATER JUSTIFICATION THAN FUNDS PROPERLY SPENT TO CORRECT WEAK SUBGRADES. IT IS BELIEVED PERMISSIBLE TO SAY THAT, GIVEN COMPARABLE STANDARDS IN TYPE AND QUALITY OF PAVEMENT CONSTRUCTION, THE BEST ROADS AND THE LOWEST MAINTENANCE COSTS WILL BE FOUND IN THOSE STATES WHICH GIVE MOST ATTENTION TO SUBDRAINAGE, FOUNDATION DESIGN, AND SUBGRADE TREATMENT.

NEW A.S.T.M. SPECIFICATIONS FOR PORTLAND CEMENT IN FORCE

CONTRIBUTED BY THE DIVISION OF TESTS

(NOT FOR RELEASE)

THE ATTENTION OF THE DISTRICT MATERIALS ENGINEERS IS CALLED TO THE NEW A.S.T.M. SPECIFICATIONS AND TESTS FOR PORTLAND CEMENT WHICH ARE NOW IN FORCE. THESE SPECIFICATIONS DIFFER FROM THE OLD STANDARDS IN A NUMBER OF PARTICULARS. THE PRINCIPAL CHANGES CONSIST OF THE RAISING OF THE TENSILE STRENGTH REQUIREMENTS FROM 200 TO 225 POUNDS PER SQUARE INCH AT 7 DAYS, AND FROM 300 TO 325 POUNDS PER SQUARE INCH AT 28 DAYS. THESE CHANGES WERE RECOMMENDED BY THE COMMITTEE ON CEMENT OF THE AMERICAN SOCIETY FOR TESTING MATERIALS, WITH THE APPROVAL OF THE REPRESENTATIVES OF THE PORTLAND CEMENT ASSOCIATION WHO SAT UPON THE COMMITTEE.

CERTAIN CHANGES HAVE LIKEWISE BEEN MADE IN SECTION V - REJECTION - OF THE SPECIFICATIONS. ONE CHANGE COVERS THE RETESTING OF CEMENT WHICH HAS BEEN IN STORAGE FOR PERIODS LONGER THAN SIX MONTHS, AND THE OTHER GIVES THE PURCHASER THE RIGHT TO REJECT CEMENT BASED UPON A RETEST OF THE SOUNDNESS OR THE TIME OF SETTING AT THE TIME OF DELIVERY ON THE WORK, EVEN THOUGH THE CEMENT MAY HAVE BEEN PREVIOUSLY ACCEPTED AT THE MILL.

Numerous changes have also been made in the section entitled Methods of Test. The requirements relative to temperature conditions during the testing period have been changed so as to provide specific maximum and minimum temperatures at which the various operations may be performed. A specific requirement relative to the pressure which may be exerted in molding cement briquettes has also been inserted. These features were covered by general clauses only in the old specifications and the committee felt that the lack of such specific requirements accounted in large measure for the wide variations in results reported by different laboratories on identical samples.

The American Association of State Highway Officials has also amended its Portland cement specifications in so far as the strength requirements are concerned. The Association specifications have always differed from the American Society for Testing Materials specifications as regards certain paragraphs under Section V - Rejection. This section has not been amended as yet by the Association and still differs from the new A.S.T.M. specifications in two important particulars. The Association specifications contain a uniformity clause which states that marked deviations from uniform results may be considered cause for rejection even though the test requirements may be otherwise fulfilled. The Association specifications also contain a clause which permits the purchaser or engineer to base rejection upon the results of retests at any time, regardless of the results of previous decisions. The new A.S.T.M. specifications limit retesting to determinations of soundness and time of setting.

The Association has not as yet revised its methods of test to conform to the new A.S.T.M. standard and, until such action is taken which will probably be during the coming year, the Bureau feels that the A.S.T.M. methods of test should be employed by the State highway departments.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

P-1 (1927)
R. S. A.

PROGRAM OF ESTIMATED STATE AND LOCAL HIGHWAY AND BRIDGE EXPENDITURES

FOR CALENDAR YEAR - 1927.

STATES	GRAND TOTAL EXPENDITURES (ESTIMATED) ON STATE AND LOCAL ROADS	PROBABLE EXPENDITURES BY STATE HIGHWAY DEPARTMENTS							PROBABLE EXPENDITURES ON ROADS AND BRIDGES BY LOCAL AUTHORITIES	ESTIMATED ROAD MILEAGE TO BE BUILT BY STATE HIGHWAY DEPARTMENTS				MILES OF ROAD MAINTAINED BY STATE HIGHWAY DEPARTMENT	STATES
		TOTAL STATE ROAD EXPENDITURES	CONSTRUCTION EXPENDITURES			MAINTENANCE (1)		MISCELLANEOUS INCLUDING OVERHEAD (2)		TOTAL MILEAGE	EARTH IMPROVED	SAND-CLAY, GRAVEL, AND MACADAM	ASPHALT, CONCRETE, AND BRICK		
			TOTAL ROADS AND BRIDGES	ROADS	BRIDGES	RECONSTRUCTION	ROAD UPKEEP								
ALABAMA	$ 20,950,000	$ 10,950,000	$ 9,600,000	$ 8,000,000	$ 1,500,000	$ -	$ 750,000	$ 700,000	$ 10,000,000	406	67	279	60	2,700	ALABAMA
ARIZONA	3,600,000	2,900,000	2,200,000	2,000,000	200,000	-	700,000	-	700,000	100	30	67	3	1,620	ARIZONA
ARKANSAS	16,000,000	6,900,000	4,600,000	4,000,000	600,000	-	2,000,000	300,000	9,100,000	580	250	300	30	7,500	ARKANSAS
CALIFORNIA	42,550,000	15,550,000	3,280,000	2,500,000	780,000	6,500,000	5,000,000	770,000	27,000,000	80	-	65	15	6,131	CALIFORNIA
COLORADO	9,020,000	6,020,000	4,090,000	3,590,000	500,000	NONE	1,600,000	330,000	3,000,000	124	32	49	43	8,647	COLORADO
CONNECTICUT															CONNECTICUT
DELAWARE	2,625,000	2,325,000	2,000,000	1,600,000	400,000	-	200,000	125,000	300,000	75	-	15	60	600	DELAWARE
FLORIDA	38,674,800	18,674,800	16,557,320	13,057,320	3,500,000	-	1,977,480	140,000	20,000,000	775	275	100	400	2,104	FLORIDA
GEORGIA	23,600,000	10,100,000	7,800,000	6,900,000	900,000	100,000	1,600,000	600,000	13,500,000	506	100	250	156	6,300	GEORGIA
IDAHO	3,280,000	2,780,000	1,700,000	1,200,000	500,000	300	(3)1,019,700	60,000	500,000	145	25	105	15	2,200	IDAHO
ILLINOIS	68,091,000	41,091,000	36,849,000	33,261,200	3,587,300	-	2,750,000	(4) 1,492,000	27,000,000	1,255	219	-	1,036	5,857	ILLINOIS
INDIANA	39,840,000	14,840,000	11,000,000	9,500,000	1,500,000	NONE	3,000,000	840,000	25,000,000	415	40	100	275	5,000	INDIANA
IOWA	34,432,000	17,432,000	13,787,000	12,287,000	1,500,000	-	3,000,000	645,000	17,000,000	1,090	308	519	263	6,674	IOWA
KANSAS	33,031,000	21,031,000	18,396,000	15,842,000	2,554,000	NONE	2,500,000	135,000	12,000,000	1,598	836	522	240	8,690	KANSAS
KENTUCKY	19,500,000	13,500,000	10,000,000	10,000,000	(5) -	-	3,000,000	500,000	6,000,000	900	400	330	170	3,200	KENTUCKY
LOUISIANA	19,000,000	11,500,000	8,500,000	6,500,000	2,000,000	-	3,000,000	-	7,500,000	500	-	450	50	4,750	LOUISIANA
MAINE	15,151,300	11,251,300	8,761,300	5,720,560	(6) 3,040,740	-	1,936,000	(7) 554,000	3,900,000	414	-	359	55	5,000	MAINE
MARYLAND	10,400,000	7,500,000	3,500,000	3,000,000	500,000	-	4,000,000	-	2,900,000	124	-	35	89	2,500	MARYLAND
MASSACHUSETTS	30,358,000	16,358,000	7,750,000	7,500,000	250,000	5,500,000	3,000,000	108,000	14,000,000	240	-	50	190	(8) 1,565	MASSACHUSETTS
MICHIGAN	52,750,000	20,750,000	16,600,000	15,000,000	1,600,000	NONE	4,150,000	-	32,000,000	415	50	165	200	7,300	MICHIGAN
MINNESOTA	31,700,000	14,500,000	8,525,000	7,860,000	665,000	-	4,500,000	(9) 1,475,000	17,200,000	1,007	490	390	127	(10) 6,956	MINNESOTA
MISSISSIPPI	9,630,000	4,630,000	2,780,000	2,780,000	(5) -	50,000	1,700,000	100,000	5,000,000	524	231	238	55	4,000	MISSISSIPPI
MISSOURI	28,893,825	18,893,825	14,543,825	13,043,825	1,500,000	-	3,000,000	(11)1,350,000	10,000,000	922	450	350	122	7,640	MISSOURI
MONTANA	8,655,000	3,655,000	3,140,000	2,890,000	250,000	100,000	315,000	100,000	5,000,000	251	-	250	1	1,100	MONTANA
NEBRASKA	17,100,000	7,100,000	4,600,000	4,000,000	600,000	250,000	2,000,000	(12) 250,000	10,000,000	1,310	600	700	10	6,000	NEBRASKA
NEVADA	2,360,530	1,860,530	1,390,185	1,330,185	60,000	71,000	279,000	120,345	500,000	149	-	145	4	1,502	NEVADA
NEW HAMPSHIRE	5,520,000	4,020,000	1,400,000	1,300,000	100,000	700,000	1,800,000	120,000	1,500,000	100	10	75	15	2,000	NEW HAMPSHIRE
NEW JERSEY	35,400,000	19,400,000	14,600,000	11,600,000	3,000,000	-	2,000,000	(13)2,800,000	16,000,000	120	10	-	110	3,390	NEW JERSEY
NEW MEXICO	3,882,000	3,582,000	2,410,000	1,900,000	510,000	125,000	838,000	209,000	300,000	179	45	125	9	4,860	NEW MEXICO
NEW YORK	85,400,000	61,400,000	54,000,000	51,000,000	3,000,000	-	7,400,000	-	24,000,000	1,006	-	-	1,006	9,781	NEW YORK
NORTH CAROLINA	(14) 25,000,000	15,000,000	11,000,000	11,000,000	(5) -	-	4,000,000	-	10,000,000	650	-	500	150	6,400	NORTH CAROLINA
NORTH DAKOTA	4,490,000	1,900,000	1,060,000	960,000	100,000	60,000	590,000	190,000	2,590,000	1,042	521	521	-	2,746	NORTH DAKOTA
OHIO	53,000,000	25,000,000	13,000,000	12,000,000	1,000,000	4,000,000	8,000,000	-	28,000,000	850	50	500	300	9,900	OHIO
OKLAHOMA	26,250,000	11,250,000	8,650,000	6,900,000	1,750,000	NONE	2,000,000	600,000	15,000,000	850	300	400	150	5,500	OKLAHOMA
OREGON	15,000,000	6,750,000	3,600,000	3,000,000	600,000	400,000	2,400,000	350,000	8,250,000	252	125	125	2	3,000	OREGON
PENNSYLVANIA	(15) 84,350,000	67,850,000	49,000,000	48,000,000	1,000,000	5,000,000	12,500,000	(16)1,450,000	16,400,000	1,300	100	400	800	12,033	PENNSYLVANIA
RHODE ISLAND	7,475,000	6,650,000	5,650,000	2,500,000	(17) 3,150,000	-	825,000	175,000	825,000	44	-	-	44	450	RHODE ISLAND
SOUTH CAROLINA	23,925,000	12,925,000	10,250,000	9,250,000	1,000,000	475,000	2,200,000	-	11,000,000	600	-	350	250	5,250	SOUTH CAROLINA
SOUTH DAKOTA	10,456,650	3,956,650	2,344,500	2,100,000	244,500	460,350	836,800	315,000	6,500,000	450	-	450	-	4,669	SOUTH DAKOTA
TENNESSEE	37,000,000	20,000,000	16,000,000	10,150,000	5,850,000	-	4,000,000	-	17,000,000	529	223	113	193	5,000	TENNESSEE
TEXAS	31,000,000	22,000,000	13,350,000	11,350,000	2,000,000	1,000,000	7,000,000	650,000	9,000,000	1,800	600	1,000	200	19,000	TEXAS
UTAH	3,770,000	2,540,000	1,800,000	1,600,000	200,000	140,000	600,000	-	1,230,000	100	-	93	7	3,300	UTAH
VERMONT	(14) 4,500,000	3,750,000	2,000,000	1,500,000	500,000	-	1,750,000	-	750,000	110	-	100	10	3,000	VERMONT
VIRGINIA	21,089,950	13,089,950	9,200,000	9,200,000	(5) -	-	3,266,730	623,220	8,000,000	225	50	100	75	5,207	VIRGINIA
WASHINGTON	18,620,000	9,250,000	7,250,000	6,250,000	1,000,000	650,000	1,250,000	100,000	9,370,000	385	170	165	50	3,200	WASHINGTON
WEST VIRGINIA	(14) 17,300,000	11,300,000	9,500,000	9,000,000	500,000	-	1,800,000	-	6,000,000	425	200	150	75	2,200	WEST VIRGINIA
WISCONSIN	24,772,000	21,462,000	17,262,000	15,262,000	2,000,000	1,200,000	3,000,000	-	3,310,000	1,569	-	1,195	374	(18) 10,000	WISCONSIN
WYOMING	4,214,000	3,215,000	2,180,000	1,700,000	480,000	109,000	666,000	260,000	999,000	350	150	200	-	2,925	WYOMING
TOTALS (EXCEPT CONN.)	1,123,607,055	648,483,055	477,356,130	420,884,090	56,472,040	26,990,650	125,698,710	18,536,565	475,124,000	26,841	6,957	12,395	7,489	239,847	TOTALS (EXCEPT CONN.)

REMARKS: THE ABOVE DATA IS REPORTED BY THE STATE HIGHWAY DEPARTMENTS OF THE RESPECTIVE STATES WITH BUT FEW EXCEPTIONS AS NOTED. THE FIGURES WHICH ARE CONSERVATIVE ESTIMATES AS A RULE, REPRESENT PRELIMINARY BUDGETS, EXCEPT THAT ROAD BOND PAYMENTS WHICH AMOUNT TO OVER $100,000,000 ARE EXCLUDED.

(1) SOME STATES INCLUDE RECONSTRUCTION OF ROAD COSTS IN MAINTENANCE EXPENSES AND WHEN SO REPORTED ARE SHOWN HERE SEPARATELY. IN OTHER STATES RECONSTRUCTION IS INCLUDED WITH CONSTRUCTION, THE ALLOCATION DEPENDING UPON THE POLICY OF THE STATE IN REGARD TO ROAD CONSTRUCTION. (2) WHERE NO ENTRY IS SHOWN, OVERHEAD IS INCLUDED IN CONSTRUCTION AND MAINTENANCE. IF LARGE MISCELLANEOUS EXPENSES ARE REPORTED SAME ARE NOTED. (3) INCLUDES 300 MILES OF ROAD OILING, $360,000. (4) REPRESENTS ROAD BUILDING THROUGH CITIES AND REFUNDS; OVERHEAD INCLUDED IN CONSTRUCTION AND MAINTENANCE. (5) INCLUDED IN ROAD CONSTRUCTION. (6) INCLUDES KENNEBEC BRIDGE, $2,090,740 (7) INCLUDES $464,000 FOR OTHER THAN OVERHEAD (8) STATE HIGHWAY MILEAGE THOROUGHLY MAINTAINED: EXCLUDES 6,000 MILES OF TOWN ROADS PARTLY MAINTAINED. (9) INCLUDES $500,000 FOR PURCHASE OF RIGHT OF WAY. (10) EXCLUDES LOCAL ROAD MILEAGE FORMERLY REPORTED MAINTAINED BY STATE HIGHWAY DEPARTMENT. (11) INCLUDES $650,000 FOR MISCELLANEOUS EXPENSES. (12) MISCELLANEOUS ONLY (13) INCLUDES $1,500,000 FOR PURCHASE OF RIGHT OF WAY. (14) ESTIMATE (BASED ON PREVIOUS YEAR'S DATA) MADE BY BUREAU OF PUBLIC ROADS (15) PARTIAL ESTIMATE BY BUREAU OF PUBLIC ROADS. (16) EXCLUDES $2,300,000 EXPENSES FOR HIGHWAY PATROL AND MOTOR VEHICLE REGISTRATION BUREAU. (17) INCLUDES $3,000,000 BOND ISSUE FOR WASHINGTON BRIDGE AT PROVIDENCE. (18) IN ADDITION STATE MAINTAINS 12,200 MILES OF LOCAL SYSTEM.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

MOTOR VEHICLE REGISTRATION FEES, LICENSES, PERMITS, FINES, ETC. 1926
ALSO GROSS RECEIPTS AND DISPOSITION OF FUND (1)
(FOR CALENDAR YEAR) (2)

MV-2 (1926)
R.S.A.

STATES AND DISTRICT OF COLUMBIA	TOTAL GROSS RECEIPTS	REGISTRATION RECEIPTS (3)					MISCELLANEOUS RECEIPTS			DISPOSITION OF GROSS RECEIPTS					STATES AND DISTRICT OF COLUMBIA
		MOTOR CAR RECEIPTS			OTHER VEHICLES		DEALERS' LICENSE	CHAUFFEUR & OPERATOR PERMITS	OTHER MISCELLANEOUS	COLLECTION AND ADMINISTRATION	FOR RURAL HIGHWAY PURPOSES			FOR OTHER PURPOSES	
		TOTAL FROM MOTOR CARS	PASSENGER CARS & BUSSES	TRUCKS & TRACTORS	TRAILERS	MOTOR-CYCLES					STATE HIGHWAYS	LOCAL ROADS	STATE AND COUNTY ROAD BONDS (4)		
ALABAMA	$ 2,889,252	$ 2,873,119	-	-	-	-	$ 3,304	$ 9,243	$ 3,586	$(5) 111,262	$ 550,760	$ 560,258	$ 1,666,835	$ 137	ALABAMA
ARIZONA	467,795	422,490	-	-	-	$ 596	4,543	4,294	35,872	18,500	449,295	-	-	-	ARIZONA
ARKANSAS	3,656,368	3,611,161	+	-	-	-	5,798	23,911	15,498	73,433	1,176,405	604,367	(C)1,802,163	-	ARKANSAS
CALIFORNIA	8,477,233	7,201,314	$ 4,523,157	$ 2,673,157	$ 245,420	37,157	45,120	285,549	662,663	1,034,404	3,721,415	3,192,285	-	(6) 529,129	CALIFORNIA
COLORADO	1,507,379	1,455,452	1,228,341	226,611	1,209	2,588	26,738	21,108	284	75,369	716,005	716,005	-	-	COLORADO
CONNECTICUT	6,220,668	4,751,388	3,675,495	1,075,893	7,620	13,485	70,465	884,894	492,816	-	6,220,668	-	-	-	CONNECTICUT
DELAWARE	775,577	592,964	425,207	167,757	3,167	1,324	7,105	147,465	23,552	-	775,577	-	-	-	DELAWARE
FLORIDA	6,764,468	6,702,911	-	-	-	5,302	33,351	18,231	6,623	122,111	4,957,406	1,684,951	-	-	FLORIDA
GEORGIA	3,331,725	3,323,296	2,769,453	553,843	-	3,898	41,970	6,140	6,431	119,703	3,262,022	-	-	-	GEORGIA
IDAHO	1,385,930	1,343,991	1,127,940	216,051	4,190	2,416	23,895	829	10,611	-	143,179	1,242,752	-	-	IDAHO
ILLINOIS	14,047,208	13,108,642	8,996,135	3,112,507	57,936	20,800	91,072	370,314	398,444	-	8,536,365	-	5,510,843	-	ILLINOIS
INDIANA	5,093,176	4,744,318	3,633,211	1,061,107	27,233	6,899	48,100	37,395	229,231	270,307	4,822,869	-	-	-	INDIANA
IOWA *	10,203,416	-	-	-	-	-	-	-	-	357,294	9,851,122	-	-	-	IOWA
KANSAS *	4,803,130	-	-	-	-	-	-	-	-	247,584	2,666,828	1,888,718	-	-	KANSAS
KENTUCKY	4,131,745	4,007,551	3,142,977	864,574	-	5,103	32,630	17,761	68,700	174,358	3,525,100	432,237	-	-	KENTUCKY
LOUISIANA	3,993,466	3,836,324	-	-	-	-	-	-	157,142	93,508	3,457,302	-	54,425	(7) 383,231	LOUISIANA
MAINE	2,355,365	1,804,455	1,425,202	379,253	2,869	6,540	44,220	377,854	113,437	175,809	1,400,893	-	653,663	(8) 125,000	MAINE
MARYLAND	2,928,268	2,270,658	1,993,281	277,377	16,057	13,963	29,209	195,324	404,057	292,827	2,108,353	-	-	(9) 527,088	MARYLAND
MASSACHUSETTS	13,077,857	10,586,446	7,134,754	3,451,692	20,011	41,675	109,666	1,527,902	792,157	1,028,834	12,049,023	-	-	-	MASSACHUSETTS
MICHIGAN	16,953,685	15,468,556	11,647,731	3,820,825	169,568	13,274	94,462	265,733	942,092	-	9,745,860	6,000,000	-	(10) 1,207,825	MICHIGAN
MINNESOTA	9,976,560	9,855,487	8,076,504	1,778,983	13,026	10,010	39,338	20,736	37,963	-	6,366,660	-	(c)3,610,000	-	MINNESOTA
MISSISSIPPI	1,973,412	1,966,379	1,737,310	179,069	6,435	598	-	-	-	59,202	-	1,914,210	-	-	MISSISSIPPI
MISSOURI *	7,903,025	-	-	-	-	-	-	-	-	1,391,041	2,860,049	-	3,651,935	-	MISSOURI
MONTANA	1,029,383	895,605	751,875	143,730	-	1,178	33,825	626	98,149	35,788	-	989,595	-	-	MONTANA
NEBRASKA	3,636,087	3,463,831	2,866,116	597,575	-	4,103	40,299	-	123,004	96,575	1,062,487	2,477,035	-	-	NEBRASKA
NEVADA	209,920	209,320	-	-	-	410	-	-	190	13,433	64,676	131,811	-	-	NEVADA
NEW HAMPSHIRE	1,710,905	1,343,381	-	-	-	8,648	26,800	240,095	91,981	95,555	1,615,350	-	-	-	NEW HAMPSHIRE
NEW JERSEY	11,870,529	8,603,103	5,135,531	3,367,572	55,024	14,470	66,310	2,224,703	1,006,919	240,088	7,456,070	4,174,391	-	-	NEW JERSEY
NEW MEXICO	513,743	490,355	437,133	3,222	2,175	600	7,250	-	13,363	38,020	317,149	158,574	-	-	NEW MEXICO
NEW YORK	28,786,421	25,737,573	18,064,298	7,673,275	59,815	77,418	159,652	2,367,433	384,525	2,166,001	19,581,470	4,311,830	-	(11) 2,727,120	NEW YORK
NORTH CAROLINA *	(12) 9,400,000	-	-	-	-	-	-	-	-	150,000	9,250,000	-	-	-	NORTH CAROLINA
NORTH DAKOTA	1,578,081	1,545,586	1,354,473	191,113	-	1,528	-	-	30,967	280,000	645,041	649,040	-	-	NORTH DAKOTA
OHIO	9,818,873	1,450,248	-	-	-	-	-	-	8,338,627	(13) -	4,909,437	4,909,436	-	(14) -	OHIO
OKLAHOMA *	5,515,045	-	-	-	-	-	-	-	-	40,000	2,166,018	3,309,027	-	-	OKLAHOMA
OREGON	6,017,759	5,314,502	4,937,783	816,719	26,324	12,513	28,913	70,968	64,539	200,000	4,363,319	1,454,440	-	-	OREGON
PENNSYLVANIA	24,045,349	18,338,633	12,746,483	5,592,150	34,801	37,444	328,748	1,406,800	3,998,923	2,564,134	15,988,045	-	5,001,400	(15) 491,770	PENNSYLVANIA
RHODE ISLAND	1,962,893	1,563,067	1,154,236	408,831	754	4,548	13,720	253,260	127,549	175,400	1,737,493	-	-	-	RHODE ISLAND
SOUTH CAROLINA	1,951,569	1,869,961	1,588,972	280,989	16,358	824	24,085	152	40,179	176,560	1,772,180	2,819	-	-	SOUTH CAROLINA
SOUTH DAKOTA	2,429,180	2,401,800	2,106,000	295,800	-	1,104	26,276	-	-	48,584	1,214,590	1,166,006	-	-	SOUTH DAKOTA
TENNESSEE *	3,591,296	-	-	-	-	-	-	-	-	214,000	1,688,648	1,688,648	-	-	TENNESSEE
TEXAS *	14,362,333	-	-	-	-	-	-	-	-	-	10,486,326	3,876,007	-	-	TEXAS
UTAH *	634,048	-	-	-	-	-	-	-	-	-	57,245	-	576,803	-	UTAH
VERMONT	1,696,582	1,447,679	1,249,047	198,632	-	4,234	29,497	189,312	25,860	85,955	1,610,627	-	-	-	VERMONT
VIRGINIA	4,624,475	4,251,509	3,612,282	639,227	4,095	7,422	56,914	38,073	266,462	272,431	4,352,044	-	-	-	VIRGINIA
WASHINGTON	6,056,003	5,472,663	4,266,572	1,205,091	39,758	14,828	87,619	431,816	9,319	218,071	4,543,424	857,692	-	(16) 431,816	WASHINGTON
WEST VIRGINIA	3,723,935	3,286,593	2,771,375	515,223	2,381	5,001	52,396	134,075	248,484	232,837	887,073	-	2,246,213	(17) 352,312	WEST VIRGINIA
WISCONSIN	9,074,490	8,683,997	7,207,564	1,476,433	-	18,864	91,519	170,460	109,660	549,752	5,214,738	3,310,000	-	-	WISCONSIN
WYOMING	499,873	439,371	393,899	95,472	-	958	9,102	-	547	-	-	-	499,873	-	WYOMING
DIST. OF COL.	566,312	120,728	98,986	21,742	-	1,327	1,908	204,122	238,229	36,670	-	-	-	(18) 529,642	DIST. OF COL.
DETAILED TOTALS (3)	231,864,509	197,336,270	(19) -	(19) -	815,218	402,949	1,835,817	11,944,622	19,529,635	-	-	-	-	-	DETAILED TOTALS
GRAND TOTAL	283,242,352	-	-	-	-	-	-	-	-	13,579,380	190,406,060	51,702,184	25,274,158	7,320,570	GRAND TOTALS

NOTES: (1) FINANCIAL DATA ONLY ON THIS TABLE: FOR NUMBER OF REGISTRATIONS, LICENSES, ETC. SEE TABLE MV-1 (1926) (2) ALL STATES REPORT AMOUNTS FOR CALENDAR YEAR EXCEPT NORTH CAROLINA WHICH REPORTS FOR SIX MONTHS JULY 1 TO DECEMBER 31 AS REGISTRATION YEAR COMMENCES JULY 1. (3) THE STATES STARRED DO NOT SHOW COMPLETE RECEIPT DETAILS AND ARE NOT INCLUDED IN TOTALS UNDER FIRST NINE RECEIPT COLUMNS, SHOWN AS "DETAILED TOTAL" THE DISPOSITION OF TOTAL GROSS RECEIPTS IS SHOWN FOR ALL STATES AND SUCH TOTALS ARE SHOWN IN THE LAST FIVE COLUMNS- (4) COUNTY BOND PAYMENTS MARKED (C) (5) INCLUDES $71,828 TO PROBATE JUDGES (6) TRAFFIC OFFICERS EXPENSES (7) SPECIAL HIGHWAY FUND TAKEN FROM CERTAIN COUNTY REGISTRATION REVENUES FOR SPECIAL ROADS (8) FOR STATE POLICE (9) FOR BALTIMORE STREETS (10) FOR EXPENSES OF BRANCH OFFICES AND MOTOR VEHICLE "THEFT DEPARTMENT" (11) NEW YORK CITY GENERAL FUND (12) CONSERVATIVE ESTIMATE, AS DATA WAS NOT RECEIVED (13) STATE APPROPRIATION OF $326,265 OMITTED (14) A PORTION OF LOCAL ROAD SHARE GIVEN TO MUNICIPAL CORPORATIONS FOR STREET REPAIR: AMOUNT NOT STATED (15) FOR STATE HIGHWAY PATROL (16) FOR "HIGHWAY SAFETY FUND" (17) INCLUDES $45,801 REFUNDS AND $317,011 FOR ADMINISTRATIVE EXPENSES OF STATE ROADS COMMISSION (18) FOR REPAIR AND CONSTRUCTION OF WASHINGTON STREETS (19) ONLY 33 STATES REPORT DETAILS OF MOTOR CAR REGISTRATION RECEIPTS WHICH TOTAL HERE AS FOLLOWS: PASSENGER CARS AND BUSSES, [illegible],536,823; TRUCKS AND TRACTORS, $43,272,495 MAKING A COMBINED TOTAL OF $176,857,318.

MOTOR VEHICLE REGISTRATIONS, 1926 (1)

(CALENDAR YEAR) (2)

STATES AND DISTRICT OF COLUMBIA	(3) 1926-REGISTERED MOTOR VEHICLES, INDIVIDUALLY & COMMERCIALLY OWNED			OTHER REGISTERED VEHICLES		TAX-EXEMPT OFFICIAL MOTOR CARS AND MOTORCYCLES			NUMBER OF LICENSES, OR PERMITS (AUTOS)			1925 GRAND TOTAL REGISTERED MOTOR CARS AND TRUCKS	YEAR'S INCREASE MOTOR VEHICLE REGISTRATIONS		STATES AND DISTRICT OF COLUMBIA
	GRAND TOTAL REGISTERED MOTOR CARS AND TRUCKS	PASSENGER AUTOMOBILES TAXIS AND BUSSES	MOTOR TRUCKS & ROAD TRACTORS	TRAILERS (4)	MOTOR-CYCLES	U. S. CARS	STATE AND LOCAL CARS	MOTOR-CYCLES (OFFIC.)	DEALERS	OPERATORS	CHAUFFEURS		NUMBER	PER CENT	
ALABAMA	225,930	197,983	27,947	983	401	167	-	-	447	-	1,813	194,580	31,350	16.1	ALABAMA
ARIZONA	73,682	63,294	10,388	-	337	176	675	-	232	86,221	192	68,029	5,653	8.3	ARIZONA
ARKANSAS	209,419	179,480	29,939	1,584	279	39	629	-	527	-	5,131	183,589	25,830	14.1	ARKANSAS
CALIFORNIA	1,600,475	1,384,152	(5) 216,323	(6)30,818	10,363	1,217	(7) 20,248	416	3,194	112,170	(8) -	1,440,541	159,934	11.1	CALIFORNIA
COLORADO	248,613	227,708	20,905	(9) 86	1,480	283	(10) -	-	3,400	21,967	7,762	240,097	8,516	3.5	COLORADO
CONNECTICUT	263,235	222,283	40,952	326	3,108	71	2,326	-	5,231	292,253	-	250,669	12,566	5.0	CONNECTICUT
DELAWARE	44,834	36,246	(5) 8,588	199	342	44	-	-	630	46,067	4,038	40,140	4,694	11.7	DELAWARE
FLORIDA	401,562	(11) 331,892	(11) 69,670	(12)1,000	1,390	75	2,926	180	3,295	-	10,854	286,388	115,174	40.2	FLORIDA
GEORGIA	277,468	241,949	35,519	-	841	934	-	-	864	-	3,197	248,093	29,375	12.3	GEORGIA
IDAHO	94,760	86,239	8,421	180	483	103	1,125	26	402	-	414	81,506	13,254	16.3	IDAHO
ILLINOIS	1,370,503	1,195,897	174,606	3,258	6,156	979	(13) -	(14)-	4,703	-	93,368	1,263,177	107,326	8.5	ILLINOIS
INDIANA	772,326	665,126	107,200	5,697	3,738	3,184	3,593	-	2,489	-	39,828	725,410	46,916	6.5	INDIANA
IOWA	698,998	648,218	50,780	153	1,934	44	2,700	79	2,291	-	11,047	659,202	39,796	6.0	IOWA
KANSAS	491,276	441,373	(5) 49,903	1,221	1,330	192	2,150	50	2,534	-	-	457,033	34,243	7.5	KANSAS
KENTUCKY	281,557	252,632	28,925	(15) -	672	90	1,444	40	1,162	-	9,299	261,647	19,910	7.6	KENTUCKY
LOUISIANA	239,500	204,000	35,500	-	500	209	-	-	-	-	-	207,000	32,500	15.7	LOUISIANA
MAINE	151,436	124,158	27,328	311	1,124	64	1,050	71	1,210	173,917	6,327	140,499	10,987	7.8	MAINE
MARYLAND	252,852	240,743	12,109	634	4,039	1,969	-	-	6,027	37,938	39,816	234,247	18,605	7.9	MARYLAND
MASSACHUSETTS	690,190	593,234	96,956	464	9,215	556	900	-	2,134	763,951	-	646,153	44,037	6.8	MASSACHUSETTS
MICHIGAN	1,118,785	969,686	(5) 149,099	13,628	3,438	371	(16) 5,875	(14)	2,133	224,697	81,382	989,010	129,775	13.1	MICHIGAN
MINNESOTA	630,285	559,128	71,157	2,666	2,551	252	306	-	2,193	-	-	569,694	60,591	10.6	MINNESOTA
MISSISSIPPI	205,200	184,133	21,067	757	92	74	(13) -	(14)	5,468	-	-	177,262	27,938	16.3	MISSISSIPPI
MISSOURI	654,554	587,856	66,698	1,489	2,005	311	1,350	5	2,293	5,242	24,933	604,166	50,388	8.3	MISSOURI
MONTANA	103,958	88,840	15,118	-	192	229	1,026	11	447	-	384	94,656	9,302	9.8	MONTANA
NEBRASKA	366,773	337,989	(17) 28,784	-	1,268	226	-	-	2,834	-	-	338,719	28,054	8.3	NEBRASKA
NEVADA	24,014	19,300	4,714	60	82	42	379	-	110	-	-	21,169	2,845	13.4	NEVADA
NEW HAMPSHIRE	85,001	78,400	10,601	535	1,444	22	300	-	484	66,600	32,550	81,498	7,503	9.2	NEW HAMPSHIRE
NEW JERSEY	651,415	531,702	119,713	1,602	7,235	708	5,251	-	2,460	745,659	-	580,554	70,861	12.2	NEW JERSEY
NEW MEXICO	54,996	53,173	1,823	143	200	156	527	5	145	-	-	49,111	5,885	12.0	NEW MEXICO
NEW YORK	1,815,434	1,508,314	307,120	6,175	18,303	1,666	(16) 10,847	-	4,414	1,568,540	554,769	1,625,583	189,851	11.7	NEW YORK
NORTH CAROLINA	(18)385,047	352,217	32,830	500	870	429	4,110	-	8,157	-	-	340,287	44,760	13.1	NORTH CAROLINA
NORTH DAKOTA	157,822	145,571	12,251	-	305	3	122	-	-	-	-	144,972	12,850	8.9	NORTH DAKOTA
OHIO	1,480,246	1,295,020	185,226	(19)9,150	(19)12,130	2,362	7,418	278	3,777	-	4,703	1,346,400	133,846	9.9	OHIO
OKLAHOMA	499,938	449,955	(20) 49,983	-	719	530	-	-	-	-	-	424,345	75,593	17.8	OKLAHOMA
OREGON	233,568	214,946	18,622	812	2,123	141	1,754	92	604	44,677	15,328	216,553	17,015	7.9	OREGON
PENNSYLVANIA	1,455,184	1,264,453	190,731	3,313	13,672	1,383	3,047	937	28,167	1,637,189	-	1,330,433	124,751	9.4	PENNSYLVANIA
RHODE ISLAND	110,746	91,798	18,948	45	1,303	86	577	50	279	126,630	-	101,756	8,990	8.8	RHODE ISLAND
SOUTH CAROLINA	181,189	163,551	17,638	1,006	270	91	5,048	-	519	152	-	168,496	12,693	7.5	SOUTH CAROLINA
SOUTH DAKOTA	168,230	153,840	14,390	-	249	85	768	-	1,051	-	-	168,028	202	0.1	SOUTH DAKOTA
TENNESSEE	279,639	254,342	25,297	(15) -	751	132	(16) 2,066	--	599	-	-	244,626	35,013	14.3	TENNESSEE
TEXAS	1,049,469	944,905	104,964	6,920	2,679	2,505	-	-	3,635	-	10,978	975,083	74,786	7.7	TEXAS
UTAH	85,380	72,880	12,500	430	576	173	(16) 705	-	-	-	-	(21) 73,427	11,953	16.3	UTAH
VERMONT	74,063	68,524	5,539	133	606	28	-	-	700	66,154	13,432	69,576	4,487	6.4	VERMONT
VIRGINIA	322,614	273,764	48,850	447	2,125	1,141	(16) 2,551	471	3,915	-	8,700	282,650	39,964	14.1	VIRGINIA
WASHINGTON	383,279	310,386	52,893	1,826	2,740	637	4,260	163	4,914	427,507	-	328,442	34,837	10.6	WASHINGTON
WEST VIRGINIA	227,836	201,645	26,191	329	1,273	33	2,007	-	12,011	60,355	27,000	217,589	10,247	4.7	WEST VIRGINIA
WISCONSIN	662,282	581,994	80,288	(15) -	3,107	92	484	76	2,785	681,800	-	594,386	67,896	11.4	WISCONSIN
WYOMING	49,883	44,358	5,525	-	179	209	212	-	293	-	-	47,711	2,172	4.6	WYOMING
DIST. OF COL.	111,497	97,794	13,703	-	1,327	837	2,006	194	1,906	70,146	-	103,092	8,405	8.2	DIST. OF COL.
TOTALS	22,001,393	19,237,171	2,764,222	99,430	131,546	(22) 33,179	102,762	3,133	137,064	7,258,831	1,007,295	(21) 19,937,274	2,064,119	10.3	TOTALS

NOTES (1) THIS TABLE LISTS ONLY THE NUMBER OF MOTOR VEHICLE REGISTRATIONS, LICENSES AND PERMITS: FOR THE FINANCIAL STATEMENT SEE TABLE MV-2 (1926) (2) ALL STATES REPORT CALENDAR YEAR TOTALS EXCEPT NORTH CAROLINA WHICH REPORTS ONLY 6 MONTHS TOTALS (JULY 1 TO DECEMBER 31) AS THEIR FISCAL YEAR FOR REGISTRATION ENDS JUNE 30. (3) THE FIRST 3 COLUMNS RECORD THE REGULARLY REGISTERED MOTOR CARS AND TRUCKS WHICH PAY THE REGULAR LICENSE FEES ELIMINATING REREGISTRATIONS AND NON-RESIDENT OWNERS CARS. THE GRAND TOTAL OF FIRST COLUMN IS SUBDIVIDED AS INDICATED: PASSENGER SERVICE CARS BEING SHOWN IN SECOND COLUMN AND FREIGHT SERVICE TRUCKS AND ROAD TRACTORS IN THE THIRD COLUMN. SOME STATES, AS NOTED, CLASSIFY BUSSES WITH TRUCKS. SPECIAL TABLES SHOWING THE EXTENT AND KINDS OF BUS SERVICE FROM NON-GOVERNMENT SOURCES CAN BE FOUND IN THE FEBRUARY 1927 ISSUE OF "BUS TRANSPORTATION." (4) SOME STATES INCLUDE TRAILERS WITH MOTOR TRUCKS, AS NOTED. (5) BUSSES INCLUDED WITH TRUCKS. (6) EXCLUDES 2232 TAX EXEMPT TRAILERS OF WHICH 1490 ARE OWNED BY PUBLIC SERVICE CORPORATIONS. (7) INCLUDES 8278 CARS AND TRUCKS OF PUBLIC SERVICE CORPORATIONS EXEMPT BY LAW. (8) INCLUDED WITH OPERATORS (9) INCLUDES ROAD TRACTORS (10) INCLUDED WITH REGISTERED CARS AS ALL PAY REGULAR LICENSE. (11) NON-RESIDENT REGISTRATIONS ESTIMATED AND EXCLUDED FROM FIGURES REPORTED (12) ESTIMATED AND EXCLUDED FROM MOTOR TRUCKS AS REPORTED. (13) INCLUDED WITH PRIVATE CARS AT A SPECIAL LOW FEE. (14) INCLUDE WITH PRIVATE MOTORCYCLES (15) NOT REGISTERED (16) AS REPORTED ON JULY 1, 1926 (17) INCLUDES ONLY TRUCKS AND BUSSES OVER 3000 POUNDS IN WEIGHT; OTHERS CLASSED AS PASSENGER CARS. (18) FIGURES ESTIMATED FOR LAST SIX MONTHS OF CALENDAR YEAR AS REGISTRATION BEGINS ON JULY 1ST. (19) ESTIMATED AS TRAILERS AND MOTORCYCLES REPORTED TOGETHER (20) EXCLUDES 16,274 AGRICULTURAL TRACTORS REPORTED (21) CORRECTED FIGURES; AS PREVIOUSLY PUBLISHED TOTAL INCLUDED REREGISTRATIONS IN UTAH. (22) AS REPORT BY BUREAU OF BUDGET, AND INCLUDED 7959 "CARS-AT-LARGE", NOT ALLOCATED TO ANY STATE.

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS

G-1 (1926)
R. S. A.

GASOLINE TAXES, 1926

TOTAL TAXES EARNED ON MOTOR VEHICLE FUEL, REFUNDS ON GROSS TAX, DISPOSITION OF FUND AND GALLONS OF TAXED GASOLINE CONSUMED.

STATES AND DISTRICT OF COLUMBIA	GROSS TAX ASSESSED PRIOR TO DEDUCTION OF REFUNDS	EXEMPTION REFUNDS: (DEDUCT FROM GROSS TAX)	TOTAL TAX EARNINGS ON FUEL FOR MOTOR VEHICLES (1)	DISPOSITION OF TOTAL TAX EARNINGS					TAX RATES, 1926			NET GALLONS OF GASOLINE TAXED AND USED BY MOTOR VEHICLES	ESTIMATED ADDITIONAL GALLONS (NOT TAXED) USED BY MOTOR VEHICLES	STATES AND DISTRICT OF COLUMBIA
				COLLECTION COSTS (2)	CONSTRUCTION & MAINTENANCE ON RURAL ROADS: STATE HWYS.	CONSTRUCTION & MAINTENANCE ON RURAL ROADS: LOCAL ROADS	STATE AND COUNTY ROAD BOND PAYMENTS	FOR MISCELLANEOUS PURPOSES	CENTS PER GALLON: JAN 1ST	CENTS PER GALLON: DEC 31 ST	DATE OF RATE CHANGE			
ALABAMA	$ 2,558,651	-	$ 2,558,651	$ 9,582	-	$ 2,549,069	-	-	2	(3) 2	-	127,932,538	-	ALABAMA
ARIZONA	1,206,660	$ 228,396	978,264	-	$ 489,132	489,132	-	-	3	3	-	32,608,821	-	ARIZONA
ARKANSAS	3,785,304	200,000	3,585,304	-	1,991,834	684,488	(4) $ 908,982	-	4	4	-	89,632,594	-	ARKANSAS
CALIFORNIA	17,910,077	1,407,954	16,502,123	-	8,251,062	8,251,062	-	-	2	2	-	825,106,169	-	CALIFORNIA
COLORADO	2,169,456	77,707	2,091,749	(5) -	1,045,875	1,045,874	--	-	2	2	-	104,587,460	-	COLORADO
CONNECTICUT	2,689,372	-	2,689,372	-	2,689,372	-	-	-	2	2	-	134,468,607	-	CONNECTICUT
DELAWARE	399,309	8,895	390,414	-	390,414	-	-	-	2	2	-	19,520,687	-	DELAWARE
FLORIDA	11,431,486	-	11,431,486	8,400	8,567,315	2,855,771	-	-	4	4	-	285,787,156	-	FLORIDA
GEORGIA	5,653,140	-	5,653,140	4,200	2,420,974	1,613,983	-	(6) $ 1,613,983	3½	3½	-	161,518,296	-	GEORGIA
IDAHO	1,182,584	60,367	1,122,217	6,820	1,115,397	-	-	-	3	3	-	37,403,986	--	IDAHO
ILLINOIS	-	-	-	-	-	-	-	-	0	0	No Tax	-	650,000,000	ILLINOIS
INDIANA	9,213,828	242,087	8,971,741	11,902	5,973,226	2,986,613	-	-	3	3	-	299,088,025	-	INDIANA
IOWA	5,020,086	177,659	4,842,427	10,736	1,610,564	3,221,127	-	-	2	2	-	242,121,370	-	IOWA
KANSAS	4,406,653	103,265	4,303,388	(7) -	3,576,210	727,178	-	-	2	2	-	215,169,393	-	KANSAS
KENTUCKY	4,935,078	-	4,935,078	(8) -	4,935,078	-	-	-	3	5	2/21/26	103,477,862	-	KENTUCKY
LOUISIANA	2,708,567	-	2,708,567	-	2,708,567	-	-	-	2	2	-	135,428,367	-	LOUISIANA
MAINE	1,964,596	(9) 41,250	1,823,346	10,069	1,511,064	302,213	-	-	3	3	-	60,090,659	-	MAINE
MARYLAND	2,357,577	63,723	2,293,854	2,500	1,833,083	-	-	(10) 458,271	2	2	-	114,692,672	-	MARYLAND
MASSACHUSETTS	-	-	-	-	-	-	-	-	0	0	No Tax	-	280,000,000	MASSACHUSETTS
MICHIGAN	10,758,109	676,333	10,081,776	23,737	4,764,422	(11) 1,211,557	4,082,060	-	2	2	-	504,088,814	-	MICHIGAN
MINNESOTA	5,072,854	268,166	4,804,688	(12) -	4,804,688	-	-	-	2	2	-	240,234,332	-	MINNESOTA
MISSISSIPPI	(13) 4,088,200	-	4,088,200	3,150	1,940,186	1,990,912	(14) 50,727	(13) 103,225	3	4	4/1/26	105,887,426	-	MISSISSIPPI
MISSOURI	5,777,163	116,018	5,661,145	54,698	5,606,447	-	-	-	2	2	-	283,057,270	-	MISSOURI
MONTANA	870,712	-	870,712	-	131,002	477,707	-	(6) 262,003	2	(15) 2	-	43,535,576	-	MONTANA
NEBRASKA	3,055,705	15,778	3,039,927	7,028	3,032,899	-	-	-	2	2	-	151,996,357	-	NEBRASKA
NEVADA	433,820	28,002	405,818	-	202,909	202,909	-	-	4	4	-	10,145,454	-	NEVADA
NEW HAMPSHIRE	781,453	12,871	768,582	-	768,582	-	-	-	2	2	-	38,429,100	-	NEW HAMPSHIRE
NEW JERSEY	-	-	-	-	-	-	-	-	0	0	No Tax	-	255,000,000	NEW JERSEY
NEW MEXICO	762,851	-	762,851	25,428	737,423	-	-	-	3	3	-	25,428,358	-	NEW MEXICO
NEW YORK	-	-	-	-	-	-	-	-	0	0	No Tax	-	720,000,000	NEW YORK
NORTH CAROLINA	8,113,044	326,571	7,786,473	-	(16) 7,786,473	-	(16) -	-	4	4	-	194,661,825	-	NORTH CAROLINA
NORTH DAKOTA	1,083,531	95,038	988,493	-	820,101	-	-	(6) 168,392	1	2	7/31/26	73,689,462	-	NORTH DAKOTA
OHIO	13,556,253	298,987	13,257,266	-	5,965,770	3,314,316	-	(17) 3,977,180	2	2	-	662,863,296	-	OHIO
OKLAHOMA	6,237,989	(18) 25,580	6,212,409	(19) -	4,141,606	2,070,803	-	-	3	3	-	207,080,296	-	OKLAHOMA
OREGON	3,536,142	202,313	3,333,829	7,693	3,326,136	-	-	-	3	3	-	118,493,937	-	OREGON
PENNSYLVANIA	(20) 11,781,782	-	11,781,782	-	8,709,213	2,903,071	-	(6) 169,498	2	2	-	588,379,021	-	PENNSYLVANIA
RHODE ISLAND	629,024	117,128	511,896	(21) -	511,896	-	-	-	1	1	-	51,189,641	-	RHODE ISLAND
SOUTH CAROLINA	4,505,694	8,726	4,496,968	(21) -	2,698,181	1,798,787	-	-	5	5	-	89,939,352	-	SOUTH CAROLINA
SOUTH DAKOTA	2,284,761	360,003	1,924,758	-	1,924,758	-	-	-	3	3	-	64,158,589	-	SOUTH DAKOTA
TENNESSEE	3,852,524	-	3,852,524	38,525	3,813,998	-	-	-	3	3	-	128,417,453	-	TENNESSEE
TEXAS	5,226,009	1,123	5,226,886	-	3,920,164	-	-	(22) 1,306,721	1	1	-	522,688,578	-	TEXAS
UTAH	1,258,009	-	1,258,009	3,750	1,057,159	-	197,100	-	3½	3½	-	35,943,117	-	UTAH
VERMONT	553,093	-	553,093	(23) -	553,093	-	-	-	2	2	-	27,654,594	-	VERMONT
VIRGINIA	6,158,124	302,454	5,855,670	(24) 697	3,903,316	1,951,657	-	-	3	4½	3/11/26	135,814,061	-	VIRGINIA
WASHINGTON	3,701,678	219,583	3,482,093	(25) -	3,482,093	-	-	-	2	2	-	174,104,636	-	WASHINGTON
WEST VIRGINIA	3,001,131	78,456	2,922,675	(26) -	2,922,675	-	(27) -	-	3½	3½	-	83,504,998	-	WEST VIRGINIA
WISCONSIN	5,373,667	163,862	5,209,805	9,982	2,238,574	2,961,250	-	-	2	2	-	260,490,262	-	WISCONSIN
WYOMING	571,449	2,860	568,589	-	568,589	-	-	-	2½	2½	-	22,743,572	--	WYOMING
DIST. OF COL.	1,020,050	4,857	1,015,193	-	-	-	-	(28) 1,015,193	2	2	-	50,759,671	-	DIST. OF COL
TOTALS	-	-	187,603,231	238,897	129,441,520	43,609,479	5,238,869	9,074,466	AVER.	2.38 CENTS		7,983,983,560	1,905,000,000	TOTALS

NOTES: (1) THIS IS THE NET TAX AFTER DEDUCTION OF REFUNDS FOR EXEMPTIONS ACCORDING TO LAW AND REPRESENTS THE ACTUAL TAXES AVAILABLE FOR DISPOSAL: THE FIRST TWO COLUMNS SHOW ONLY THE PROCEDURE AND ARE NOT TOTALED, BEING OF MINOR IMPORTANCE. (2) COLLECTION COSTS IN MANY STATES ARE PAID FROM OTHER STATE FUNDS, AND WHEN AMOUNTS AND SOURCES ARE REPORTED NOTES ARE ENTERED BELOW. (3) CHANGED TO 4 CENTS ON JANUARY 4, 1927. (4) ALLOTTED BY APPROPRIATION BUT OF GASOLINE TAX FUND, BUT CLAIMS EXCEED THIS BY $225,000. (5) COLLECTION COSTS CHARGED TO STATE CONTROLLER'S OFFICE FUND. (6) FOR STATE GENERAL TREASURY FUND. (7) PAID $8,750 FROM GENERAL REVENUE OF STATE (8) FROM GENERAL STATE FUND. (9) REFUND OF 2 CENTS ONLY, ALLOWED BY LAW. (10) FOR MAINTENANCE OF BALTIMORE STREETS. (11) "STATE REWARDS" TO COUNTIES. (12) PAID FROM OIL INSPECTION APPROPRIATION. (13) INCLUDES $103,225 FROM EXTRA 2 CENT TAX COLLECTED FROM HARRISON COUNTY FOR SEA-WALL TO PROTECT STATE HIGHWAY IN THIS COUNTY. (14) SEA-WALL BONDS. (15) CHANGED TO 3 CENTS ON JANUARY 1, 1927. (16) LARGE PART OF STATE HIGHWAY SHARE IS PAID FOR INTEREST AND SINKING FUND ON STATE HIGHWAY BONDS. (17) FOR REPAIR AND MAINTENANCE OF MUNICIPAL STREETS. (18) DEDUCTION OF 3% ALLOWED FOR EVAPORATION. (19) PAID $17,616 FROM STATE FUNDS. (20) INCLUDES $14,202 FROM DELINQUENT ONE CENT TAXES DUE IN 1921-23. (21) STATE APPROPRIATION OF $5,000. (22) FOR FREE SCHOOL FUND. (23) COLLECTION COST OF $500 FROM MOTOR VEHICLE BUREAU APPROPRIATION, (24) ONLY PART OF COST, REMAINING COST OF $5,803 IS FROM STATE APPROPRIATION. (25) FROM MOTOR VEHICLE LICENSE FUND, $5000. (26) STATE APPROPRIATION OF $7500. (27) STATE ROAD BOND PAYMENTS TAKEN FROM GASOLINE TAX: AMOUNT NOT REPORTED. (28) FOR IMPROVEMENT AND REPAIR ON WASHINGTON STREETS.

PROGRESS OF FEDERAL HIGHWAY LEGISLATION

(NOT FOR RELEASE)

THE FOLLOWING INFORMATION GIVES THE STATUS OF FEDERAL HIGHWAY LEGISLATION AT THE CLOSE OF THE SECOND SESSION OF THE SIXTY-NINTH CONGRESS ON MARCH 4, 1927. AT THAT TIME NO FURTHER ACTION HAD BEEN TAKEN UPON THE FOLLOWING BILLS MENTIONED IN PREVIOUS ISSUES OF THE NEWS LETTER:

H.R. 14254 - C. C. DOWELL, IOWA
14565 - SCOTT LEAVITT, MONTANA
14828 - S. S. ARENTZ, NEVADA
14929 - W. F. STEVENSON, SOUTH CAROLINA
15422 - B. C. REECE, TENNESSEE
15669 - C. J. McLEOD, MICHIGAN
15970 - SCOTT LEAVITT, MONTANA
16464 - E. E. DENISON, ILLINOIS
16777 - O. B. BURTNESS, NORTH DAKOTA
17250 - A. M. WYANT, PENNSYLVANIA
S. 4675 - C. DUPONT, DELAWARE
5730 - J. E. WATSON, INDIANA
5776 - G. W. NORRIS, NEBRASKA

TWO BILLS WERE PREVIOUSLY REPORTED AS HAVING BECOME ACTS, AS FOLLOWS:

H.R. 14827 - INTERIOR DEPARTMENT APPROPRIATION BILL, PUBLIC 541
15008 - AGRICULTURAL DEPARTMENT APPROPRIATION BILL, PUBLIC 552.

IN ADDITION TO THESE, NEW BILLS WERE INTRODUCED AND ACTION WAS TAKEN ON THOSE ALREADY INTRODUCED AS FOLLOWS:

H.R. 16249 - WAR DEPARTMENT APPROPRIATION BILL. INTRODUCED IN THE HOUSE ON JANUARY 13. SIGNED BY THE PRESIDENT AND BECAME AN ACT ON FEBRUARY 23, AS PUBLIC 630. AS SIGNED, THE BILL PROVIDES $1,000,000, INSTEAD OF THE $700,000 OF THE ORIGINAL BILL, FOR THE CONSTRUCTION, REPAIR AND MAINTENANCE OF ROADS, TRAMWAYS, FERRIES, BRIDGES AND TRAILS IN THE TERRITORY OF ALASKA. THE $15,000 FOR REPAIRS TO ROADWAYS TO NATIONAL CEMETERIES CONSTRUCTED BY SPECIAL AUTHORITY OF CONGRESS REMAINS UNCHANGED.

H.R. 16462. - URGENT DEFICIENCY APPROPRIATION BILL. INTRODUCED IN THE HOUSE ON JANUARY 19. SIGNED BY THE PRESIDENT AND BECAME AN ACT ON FEBRUARY 28, AS PUBLIC 660.

PROVIDES AN APPROPRIATION OF $1,400,000 FOR FOREST ROADS AND TRAILS, BEING THE REMAINDER OF THE SUM OF $7,500,000 AUTHORIZED TO BE APPROPRIATED FOR THE FISCAL YEAR 1927.

H.R. 16551. - INTRODUCED IN THE HOUSE ON JANUARY 21, BY W. A. OLDFIELD OF ARKANSAS. SIGNED BY THE PRESIDENT AND BECAME AN ACT ON MARCH 4, AS PUBLIC 773.
PROVIDES THAT EXISTING FEDERAL-AID ROAD LEGISLATION BE SO AMENDED AS TO PERMIT FEDERAL AID TO BE GRANTED, ON THE SAME BASIS AS IN THE CONSTRUCTION OF A FREE BRIDGE, TO ANY TOLL BRIDGE AND APPROACHES THERETO, CONSTRUCTED BY A STATE, COUNTY OR OTHER POLITICAL SUBDIVISION. PROVIDES THAT ALL TOLLS, LESS MAINTENANCE COSTS, SHALL BE APPLIED TO THE REPAYMENT OF THE PORTION OF THE COST PAID BY THE STATE, COUNTY OR OTHER POLITICAL SUBDIVISION, AND THAT WHEN THIS IS ACCOMPLISHED THE TOLLS SHALL CEASE AND THE BRIDGE SHALL THEREAFTER BE FREE. THE COMMITTEE ON INTERSTATE AND FOREIGN COMMERCE REPORTED A SUBSTITUTE BILL TO REQUIRE OPERATION BY THE STATE OR THE POLITICAL SUBDIVISION, AND ADDED A NEW SECTION MAKING THE PROVISIONS APPLY TO APPROACH ROADS TO ANY TOLL BRIDGE OR TOLL FERRY. THIS SECTION WAS RULED OUT BY THE SPEAKER OF THE HOUSE ON A POINT OF ORDER, AND THE SUBSTITUTE BILL MINUS THIS SECTION WAS PASSED.

H.R. 13576. - APPROPRIATION BILL FOR THE DEPARTMENTS OF STATE, JUSTICE, COMMERCE AND LABOR. INTRODUCED IN THE HOUSE ON JANUARY 22. SIGNED BY THE PRESIDENT AND BECAME AN ACT ON FEBRUARY 24, AS PUBLIC 638. BILL AS PASSED PROVIDES $40,000 (ORIGINAL BILL $30,000) FOR ROAD CONSTRUCTION WORK IN ALASKA UNDER THE BUREAU OF FISHERIES.

H.R. 17372. - INTRODUCED IN THE HOUSE ON MARCH 1, BY CHARLES BRAND OF OHIO, AND REFERRED TO THE COMMITTEE ON ROADS. PROPOSES TO AMEND SECTIONS 8, 11 AND 12 OF THE FEDERAL HIGHWAY ACT AS AMENDED TO PROVIDE ESSENTIALLY THAT THE PLANS OF FEDERAL-AID ROAD PROJECTS AND THE CONSTRUCTION OF SUCH PROJECTS SHALL BE SUBJECT TO THE APPROVAL OF THE SECRETARY OF AGRICULTURE ONLY WHEN THE [illegible] SHARE OF THE COST PAYABLE BY THE UNITED STATES EXCEEDS 50 PER CENT OF THE TOTAL ESTIMATED COST.
THE REFERENCE TO THE COMMITTEE WAS THE ONLY ACTION TAKEN ON THIS BILL, AND IT DIED WITH THE ADJOURNMENT OF CONGRESS. IT IS OPPOSED BY THE BUREAU.

H.J. Res. 329. - Introduced in the House on January 10, by J. C. Linthicum of Maryland, and referred to the Committee on Foreign Affairs. Passed by the House without amendment on January 17. Reported out without amendment by the Senate Committee on Foreign Relations, January 18. Passed over without consideration by the Senate on February 2, 7, and 28, and died with the adjournment of Congress.
Provided for an authorization of $15,000 for the expenses of participation by the United States in the Second Pan-American Conference on Highways at Rio de Janeiro.

S. 3889. - Introduced in the Senate by E. B. Mayfield of Texas. Signed by the President and became an act on March 4, as Public 805.
The bill as passed authorizes the Secretary of War to prescribe rates of toll over highway bridges across the Red River between Oklahoma and Texas.

S. 4530. - Introduced in the Senate on June 23, 1926, by T. L. Oddie of Nevada, and referred to the Committee on Post Offices and Post Roads. Reported without amendment on February 4, 1927. Passed over by the Senate without consideration on February 7, 28, and March 2, and died with the adjournment of Congress.
The bill contained three provisions: (1) To amend existing Federal-aid road acts to permit under certain conditions, increased Federal aid on projects in public-land States to any percentage up to and including the total cost, with the proviso that the aggregate of the Federal aid allotted on projects approved during any fiscal year for construction in any State shall not exceed the pro rata heretofore payable in such State under the provisions of the law; (2) to make $20,000 the minimum year's allotment of Federal aid for forest roads in any State; (3) to allow increased Federal aid on projects involving construction in mountainous, swampy or flood lands on which the average cost per mile for the grading and drainage structures other than bridges of more than 20 feet clear span will exceed $10,000 per mile, and also in the case of any project which, by reason of density of population or character and volume of traffic, the State highway department and the Secretary of Agriculture may determine shall be improved with a surface of greater width than 18 feet.
An amendment proposed by Senator Oddie on February 23, was designed to eliminate the $20,000 minimum for Federal aid on forest roads.

S. 4602. - Introduced in the Senate on December 7, 1926, by T. L. Oddie of Nevada and passed by the Senate without amendment on February 28, 1927. Did not become an act.
Provided: (1) That the shield or other insignia of the United States shall not be used as a highway marker except by the State highway departments or the U. S. Department of Agriculture; (2) that not more than 60 per cent of all Federal aid allotted to any State shall be spent on the primary or interstate highways until provision has been made for the improvement of the entire system.

S. 4933. - Introduced in the Senate on December 20, 1926, by Hiram Bingham of Connecticut. Signed by the President and became an act on February 25, as Public 650.
The bill as passed would authorize the appropriation of $100,000 from the Treasury to enable the Secretary of Agriculture to construct, reconstruct and maintain public highways in the Virgin Islands. No moneys appropriated under the authorization contained in this act shall be expended for construction, reconstruction, or maintenance of any highway until suitable contracts have been made by all owners of lands adjoining such highway with the Secretary of Agriculture, whereby such owners agree that they will sell at least one-half of such lands to actual settlers.
The appropriation authorized by this act was not made.

S. 5031. - Introduced in the Senate on January 3, by R. H. Cameron of Arizona. Passed the Senate without amendment on February 28. Did not become an act.
Provides for the creation of a Pan-American Peoples Great Highway Commission whose duty will be to locate the most feasible highway route from Canada, through the United States, Mexico, and Central and South America. To carry on the work $200,000 is authorized to be appropriated.

S. 5717. - Introduced in the Senate on February 15, by G. H. Moses of New Hampshire and reported out without amendment by the Committee on Post Offices and Post Roads on February 25. Passed over by the Senate without consideration on March 1. Did not become an act.
Authorizes the appropriation of funds for the construction of a highway from Red Lodge, Montana, to the boundary of the Yellowstone National Park, near Cooke City, Montana. (This bill is identical with H.R. 15970)