the temporal and antorbital fenestræ of reptiles are reinforced by much additional evidence.

3. The inferred conditions of the jaw musculature of *Cynognathus* are entirely in harmony with the views (*a*) that in the mammal the back part of the reptilian jaw became transformed into the accessory auditory ossicles; (*b*) that the basal portion of the mammalian alisphenoid is homologous with the reptilian pterygoid as suggested by Watson,[8] while the ascending portion seems to have been derived from the epipterygoid, as held by Broom and Watson.

4. In the transitional pro-mammals the reptilian pterygoid muscles pterygoideus anterior) became greatly reduced in correlation with the reduction of the elements behind the dentary; a possible vestige of these muscles may be the tensor tympani muscle, which runs from the basicranial region to the handle of the malleus. The mammalian internal and external pterygoid muscles are only partly homologous with those of existing reptiles and represent slips of the capiti-mandibularis mass, developed as the new joint between dentary and squamosal became established. The loss of the descending flange of the reptilian pterygoid, the secondary separation of the pterygoids along the mid-line and the transformation of the reptilian transpalatine into the true mammalian pterygoid (as held by Watson) all become more intelligible when considered in connection with the above-described changes in the musculature.

5. As a working hypothesis it is assumed that the transformation of certain elements in the temporal and occipital regions of early Tetrapoda was partly conditioned by the stresses induced upon the skull roof by the jaw and neck muscles. Comparison with lizards, *Sphenodon,* etc., clearly indicates that the prolongation of the parietal into a postero-external process joining the true squamosal was correlated with the squeezing effect of the capiti-mandibularis and depressor mandibulæ muscles. This may also be responsible for the appression and coalescence of the superior and lateral temporal elements (supratemporal and squamosal), in the early reptiles. The shifting of the post-parietals (dermosupraoccipitals) and tabularia from the dorsal to the posterior aspect of the occiput was no doubt influenced also by the forward growth of the neck muscles upon the occiput.

[8] *Ann. Mag. Nat. Hist.* (8), Vol. VIII., Sept., 1911, pp. 322–23.

W. K. GREGORY,
L. A. ADAMS
AMERICAN MUSEUM OF NATURAL HISTORY

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
SECTION D—MECHANICAL SCIENCE AND ENGINEERING

THE first session was held in the morning of Wednesday, December 30, in the engineering building, Vice-president Frederick W. Taylor and Dr. Charles S. Howe in the chair, with an attendance of about 130. It was announced that the sectional committee had recommended for election to the general committee for the office of *Vice-president,* Dr. Bion J. Arnold, of Chicago. The following officers were elected by the section:

Member of Council—Dr. Rudolph Hering, of New York City.

Member of General Committee—Morris L. Cooke, of Philadelphia.

Member of Sectional Committee—Dr. Charles S. Howe, of the Case School of Applied Science.

The program of the session was as follows:

Principles of Scientific Management: DR. FREDERICK W. TAYLOR.

Which is to Control Public Works—a Board or a Single Head?: MORRIS L. COOKE.

The Improvement and Enlargement of Transportation Facilities: GEORGE S. WEBSTER.

A Study in Cleaning Philadelphia's City Hall: WILLIAM H. BALL.

Every city, town and hamlet which owns a public building of any kind is confronted with the problem of efficient and economical cleaning. Public buildings are constantly growing in size and it is becoming more and more possible to handle the problems of their maintenance and operation on a technical basis. The fact that after what must be admitted to have been a crude study, extending over only a few months, we were able to effect economies amounting to over $30,000 a year, or $100 a day, in the cleaning of one public building, shows the possibilities. According to technical and other literature the cleaning of public buildings has been given very little

consideration, particularly from an engineering standpoint.

We must look to the development in this field of definite standards as to both appliances and methods. This standardization must be of such a character as to be applicable wherever work of this kind is done. Most of our present appliances and materials are crude and the outgrowth of almost no study that could be called scientific. While there are undoubtedly inherent difficulties in handling the personnel on the same basis that they are handled in industrial establishments, improvement in this direction has been so rapid in the last few years that we have every reason to look forward to further radical improvements in this direction.

It should be pointed out that there are no inherent differences between the cleaning of private buildings. Therefore, in looking at the whole problem of cleaning buildings, and judged by what it means both in dollars and cents and in the comfort of the occupants, the problem is a proper one for engineering attack and solution.

Experience in Locating and Mapping Pipes and Valves in an Old Water Works System: Carleton E. Davis.

The necessity for complete plans and records of pipes and valves in a water-works system is evident. In many cities, too much dependence has been placed upon the memory of employees and too little stress has been laid upon the importance of accurate and enlightening records so distributed as to be immediately available by as many employees as possible.

In the definite scheme of obtaining and recording such information, much spare time of employees can be used in obtaining data without adding to the general expense. The city of Philadelphia is operating such a system with reasonable success.

New Water Supply Conduit of the City of Hartford Water Works: Caleb Mills Saville.

The development of a new water supply for the city of Hartford, Conn. (pop. 131,000 in 1914), comprises a collecting and storage reservoir, located 14 miles from the city, with a capacity of 9 billion gallons; a compensating reservoir of 3 billion gallons to compensate mill owners for the stream flow taken for the collecting reservoir; a pipe line, conduit and tunnel from the collecting reservoir to one of the existing distributing reservoirs; a filtration plant and a large size main supply line from the distributing reservoir to the city.

This paper tells in detail of the construction of the 3,667 feet of concrete conduit, 2,333 feet of concrete lined tunnel, and 39,660 feet of 42-in. cast iron pipe line. The conduit is of horseshoe section, cut and cover type 5 ft. × 4.75 ft. vertical and horizontal dimensions. Some excavation as deep as 30 feet in the overlying glacial drift was necessary. The construction of the tunnel was preceded by complete diamond drill borings. The geological structure encountered was a basalt lava flow overlying the Connecticut red sandstone.

The construction of the 42-inch cast iron pipe line 7½ miles long is fully described. The canvass of the bids is given, and an unusual way of discriminating between bids for furnishing steel and cast iron pipe, whereby 15 per cent. was added to all bids received for steel pipe.

Latest Advances in Inoffensive Sewage Disposal: Rudolph Hering.

The paper covered the latest advances made towards obtaining an inoffensive collection and disposal of sewage, which has now reached practically satisfactory solutions for nearly all possible cases.

The chief means to prevent all foul odors in the collection of sewage are to maintain (1) a continuous flow and no deposits and retentions of sewage, (2) a frequent flushing and (3) a free air circulation in all sewers.

A large number of sewer systems with these means now continuously deliver an inoffensive sewage.

The means for an inoffensive final disposal of sewage depend on the local possibilities. In nearly all cases the solids and liquids require separate treatment.

1. In sufficiently large masses of flowing water. The liquids can be dispersed in them in well known proportions so that no offense is possible and so that automatic oxidation of organic matter takes place. The solids can be retained and, according to their quantity and character, can be treated economically and inoffensively in efficient ways.

2. On land. The liquids must be oxidized by sufficiently extensive thin film surface contact with bacterial slime, as by percolation through sand, gravel or broken stone, the surfaces of the grains being well covered with slime, and well exposed to air circulation. The oxidation of all organic matter may thus be graded in degree and always be inoffensive.

The solids must be collected under water in tanks under conditions preventing putrefaction, but which cause a sufficient decomposition by bacteria producing chiefly methane gas and carbon dioxide, both inoffensive, and a final sludge re-

sembling humus soil in forests, also inoffensive. This has been made possible by the recent extensive introduction of Imhoff tanks. Quite recently it has been found that a daily mechanical agitation of the sludge and always maintaining its alkalinity, materially hastens the decomposition.

Operation and Efficiency Reports from Water and Sewage Purification Plants: RALPH E. IRWIN.

In Pennsylvania the state commissioner of health is required by law to give a permit for the construction of all water purification plants supplying water to the public for domestic purposes and for all municipal sewage treatment plants. To intelligently issue a permit for the construction of such plants it is necessary to have detailed information concerning the efficiency, manner of operation and construction of existing plants. The commissioner has, therefore, created a section in the engineering division which, under the direction of the chief engineer, inspects and tests plants already in operation.

Operation and efficiency reports should be submitted to the commissioner of health:

1. That the commissioner may know accurate records are being kept by each plant.

2. To give information for answering complaints from those served.

3. To assist in locating the cause of water-borne disease apparently due to public water supplies.

4. That information may be at hand from all parts of the state, thus forming a clearing house for information from plants treating similar waters or sewages and make it possible to indicate the most efficient and economical method of treatment when considering improvements, or the construction of new plants.

5. To allow checking results from one plant with another to show inaccuracies or carelessness.

6. To give information for interpreting results of analyses submitted by plants, those served, or results of samples analyzed at the commissioner's laboratory.

7. To give information upon which to base suggestions for the prevention of waste of chemicals, wash water, etc.

8. To assist in judging the efficiency of operators in charge of plants.

9. To have records at hand showing when inspections and tests are necessary and to assist in this work.

At the present time in Pennsylvania there are 115 water filtration plants and 91 sewage treatment plants in operation. Also, there are a large number of chemical dosing plants installed for the disinfection of dangerous water supplies and insufficiently treated sewage.

The New York Sewage Disposal Experiments and Plant at Brooklyn, N. Y.: GEORGE T. HAMMOND.

The experiment plant described in this paper was authorized by the Board of Estimate and Apportionment of the City of New York, $50,000 being provided to cover the cost. One of the most difficult sewage disposal problems which the city must solve is afforded by the rapidly progressing pollution of Jamaica Bay—a tidal reservoir 19.28 square miles in area and very shallow, the situation of an important oyster industry. The population contributing sewage to this bay is 250,000 persons, of whom 210,000 are in Brooklyn. The sewers are on the combined plan and discharge 18,000,000 to 22,000,000 gallons of dry-weather flow into the bay daily. Storm-water flow from the sewers at times reaches over 1,000 cubic feet per second and is very foul. One of the principal purposes of the experimental plant is to find the best means of treating this sewage.

The plan of the experimental plant provides for pumping the sewage to an elevated supply tank, from which it is fed by gravity to the experimental units. The amount of sewage used by the plant is about 1,200,000 gallons per day. The experimental plant includes three Imhoff tanks of varying size and depth; six sprinkling filter beds; one tank-aerator for treatment of sewage with compressed air supplied by an air compressor; one siphon-aerator, which treats sewage by compressed air, which is supplied by the flowing stream of sewage through a hydraulic air compressor siphon; one gravel strainer, or roughing filter; four settling or sedimentation tanks; six secondary sedimentation tanks; ten sludge drying beds of the Imhoff type. Various types of screens, including a Riensch-Wurl screen. Various experiments are also provided for the disinfection of sewage effluents and for various methods of treating and disposing of sludge and screenings. All of the units of the plants are constructed on a working scale, each one large enough for testing the actual operation conditions of a full-size plant.

Some Considerations Affecting the Disposal of Sewage at Seaside Resorts: MARSHALL R. PUGH.

For a distance of approximately one hundred and twenty-five miles the coast of New Jersey has an almost continuous line of summer resorts, some large and some small. Some of the considerations theoretical and constructive, affecting the disposal of sewage at seaside resorts may be briefly stated as follows:

The Collecting System.—(1) Use self-cleansing velocities where possible, but do not be bound by them when they result in a cost incommensurate with their benefits. (2) When self-cleansing velocities can not be wisely adopted, make adequate provision for flushing. The sewers must be kept clean.

The Disposal Plant.—(1) The plant must be adapted to great seasonal variations in flow. (2) The capacity of the ocean to digest and purify the sewage, being the most economical and effective means of attaining this end, should be made use of. (3) Where bathing is an asset, the discharge of crude sewage to sea is not permissible. (4) Single-story tanks furnish in general the method best adapted to treating the sewage of resorts before its discharge to sea. (5) Nuisances from such effluent do not arise if tanks and appurtenances are correctly planned and the discharge effected through a properly designed outlet, at a sufficient distance from shore, and in ten feet or more of water. (6) It would appear from what evidence we now possess that no ill effects to health result from the proper discharge of such effluent. (7) Owing to the difficulties encountered in work along the coast and under the surface of the ocean, careful consideration must be given to durability and to the means of executing the work called for by the plans.

Preservation of Wood: P. A. Maignen.

The railroads are said to spend $121,500,000 a year in cross ties. If all these ties were treated properly by a good preservative process, it would be possible to save more than $450,000,000 in 25 years. Wood is composed of two principal parts, cellulose and sap. Cellulose resists decay a long time. The decay begins in the sap and extends to the cellulose. It is therefore urged that some ways and means of removing the sap from the wood be found. Many attempts have been made to render the sap proof against decay without removing it, but the result has not been satisfactory.

The preservatives used in the United States in 1913 were: 108,373,359 gallons of creosote; 26,466,803 pounds of zinc chloride, and 3,885,758 gallons of other preservatives. In that same year there were 153,613,888 cubic feet of timber treated by all preservatives. Of the creosote used only 38 per cent. was produced in this country and 62 per cent. was imported.

At present 30 per cent. of the railroad ties are treated. If a satisfactory method of impregnation could be devised so that the wood could get the full benefit of a thorough penetration it would not be long before all the ties would be treated. Unfortunately the impregnation, as carried out now, does not penetrate the wood sufficiently. In experiments it was found that one specimen from which the sap had been removed was impregnated throughout the whole length of the wood; whilst the other specimen of the same kind, but whose resins had not been extracted, was impregnated not more than a few inches from each end.

The second session was held on the afternoon of Wednesday, December 30, Vice-president Dr. Frederick W. Taylor and Mr. O. P. Hood in the chair, with an attendance of about 95. The program of the session was as follows:

Municipal Highways—a Problem in Maintenance: William H. Connell.

The three foremost problems involved in the operations of a highway department are: Organization, maintenance and construction.

A good organization is essential particularly in so far as maintenance is concerned, as it is practically impossible to continuously and systematically maintain pavements and roads in first-class condition, in an economical manner, without a good working organization built up along the lines best adapted to cope with the conditions involved in this important branch of work coming under the jurisdiction of a highway department. By this it is not intended to give the impression that the maintenance organization should be separated from the construction, as separate organizations are apt to result in an overlapping of jurisdiction and a tendency to shift responsibility, and open up a field for unlimited excuses as to whether the construction or maintenance division is responsible for any unsatisfactory conditions that may arise relative to the pavements. Furthermore, it is obvious that the logical organization to maintain the pavements is the one that saw them laid and is familiar with every detail of the construction, as very often a knowledge of apparently trivial conditions in connection with the construction bears an important part in the future maintenance.

Routine maintenance includes such work as the regular street cleaning in municipalities, and the cleaning of country roads and gutters, and any other work of this character that is more or less routine and should be performed under definite schedule. The streets in the thickly populated sections of the city should be cleaned every day; in less thickly populated sections, every other day; every third day, and so on until we come to the

country roads which should be cleaned once a week, once every two weeks and some only once a month, depending upon the amount and character of the traffic which largely governs the frequency with which the cleaning should be done. The amount and schedule of work and the force necessary to perform it can be determined upon in advance and carried on in a systematic manner under a regular organization, more or less military.

General maintenance includes repairs to streets and roads, and involves different characters of work, each requiring special knowledge on the part of those engaged in the actual performance of the physical work for which special gangs have to be organized. Stone block, wood block and brick repairs, for example, require skilled laborers who have made a specialty of this work and are employed under the title of pavers and rammers; while repairs to asphalt and bituminous pavements must be performed by men specially skilled in this line of work, in addition to the necessary force engaged at the mixing plants. Macadam road repairs, the care of earth roads, and bituminous surface treatments, also require men specially trained, and while it is desirable to train the gangs for each particular branch of this work, such, for example, as bituminous macadam built by the penetration method, water-bound macadam, bituminous surface treatments and the care of earth roads, the three classifications, namely, block repairs, bituminous pavement repairs (mixing method), and macadam, earth road and bituminous surface treatments, represent the three branches into which the organization is usually divided.

Methods for the Elimination of Politics from Administration of Highway Departments: LOGAN WALLER PAGE.

We have a system, if it may be called such, of public roads approximating 2,300,000 miles. The people as a public corporation are yearly consenting to the expenditure of about $200,000,000 in a haphazard endeavor to make this vast road investment pay. That it is a losing investment, conducted on lines directly opposed to those of the best managed private corporations, is an established fact. It is estimated by road experts who have made a careful study of the various phases of the road question, that the American people yearly lose at least $50,000,000, directly and indirectly, because of their careless supervision of these traffic facilities.

State supervision seems to be the first and most effective step toward obtaining satisfactory road conditions. But there are certain evils for which the people of the state should provide safeguards in planning their system of state road management: First, the appointment in each unit or subdivision of only that number of road officials necessary to do the definite duties required of each in that unit, and the necessity for distinct placing of responsibility for work done. Second, some arrangement should be made whereby the road officials shall give the roads continuous and systematic attention, instead of the existing irregular care, which has proved so costly in the long run. Third, the requirement of necessary qualifications which the road official must possess to discharge his duties efficiently. Fourth, the demand that wherever practicable the incumbent of any road office shall be appointed because of his qualifications, in this way avoiding election of those who may prove more able politicians than engineers. Fifth, road officials would best serve the people if the term of office were limited by merit, and not terminated at regular periods. Sixth, provision should be made for a careful study of traffic needs in the individual localities so that political considerations may not be the deciding factor in the location of road improvement, distributing of appropriations, and appointing of needed officials.

Illinois has recently made a notable advance toward centralizing road control, and the placing of men on merit, as each county engineer takes a competitive examination, and is made an assistant to the state highway engineer, thus providing correlation and centralized oversight. In fact, the whole trend of state participation has been toward placing a broader scope of duties and authority in the central state department. This continued trend, it is hoped, will be one of the main factors in solving the problem of supervision, while the intelligent application of the merit system in securing this skilled supervision in road work is the only promising method of eliminating politics from road administration.

Plant Inspection for Pavements: JULIUS ADLER.

It has been a recognized fact that the complete inspection of any engineering structure begins with the materials to be used in that structure, and it is safe to say that this statement applies with full force to street and roadway pavements, in which such a wide variety of materials is now being used, and in which the life of the structure depends so very largely upon the strength, durability and suitability of the materials in resisting the effects of traffic and the atmosphere. The fact, however, that so many uncertainties and diffi-

culties exist even to-day in regard to fixing the desirable qualities of many paving materials is a certain indication that this subject has not received the close study and systematic observation that its importance merits; furthermore, while there has been too great a tendency in some lines to charge all failures to the materials used, or some one of them, rather than to the methods of construction, it is also certain that a considerable proportion of failures in paving work can still be traced to the use of materials, which, if not actually of poor quality, were unsuitable for the conditions at hand.

The desirable scope of plant inspection must first be established before the actual duties and details can be determined. The work may be confined to the general inspection and sampling of materials and mixtures, requiring nothing more than that the contractor shall keep within the more or less broad limits of the specifications, but allowing him discretion and variations within these limits. Going a step beyond this idea, the inspection may be carried on as actual plant control, in which the highway organization assumes the right to specify narrower limits for a given piece of work as to amount of bitumen, hardness of the asphaltic cement, temperature of mixtures, and even to some extent the exact details of the method by which these mixtures are to be obtained. The latter plan, that is, plant control, is the logical one to follow on standard, if not patented pavements as well, from the standpoint that the organization which formulates the specifications should also be most capable of regulating their application.

Specifications Covering the Rolling of Road Crusts of Various Types: Major W. W. Crosby.

The assumption is made that the contract and specifications are to be in the more usual form under which the contractor is "to furnish all the labor and materials and do all the work."

Before proceeding to details, it seems necessary, for the sake of clearness, to state certain general principles in regard to specifications.

In the first place, while it may be necessary sometimes to restrict in details the methods to be followed, generally it will be found more satisfactory to specify the results to be obtained rather than one exact method for reaching the result. Elasticity for meeting variations in conditions encountered will then not be wanting. This is especially true as regards rolling.

Secondly: Where necessary the methods of producing the result may be limited by specific description but this should be done only when unavoidable for the insurance of proper results and for preventing the production of a result which will be offered for acceptance as "just as good."

Thirdly: For economic reasons as much elasticity in the provisions for limits, in the descriptions of the machinery or tools allowed for use, should be given as is practicable.

Fourthly: The specification of the result to be secured should be absolutely definite, clear, and as brief as may be consistent. The specification should so describe the product that no more room for argument as to the fulfillment of the specification will exist than will be occupied by a few questions whose answers can and must be determined by scientific methods, such as physical or chemical analyses and arithmetical calculations or measurements.

The author cites the following specification covering the rolling of the second course of a macadam road as embodying the fundamental principles cited.

Second Course

"After the metal for the second course shall have been spread to the proper thickness and cross-sections, it shall be rolled as hereinbefore provided under the head of 'First Course,' except that water, in connection with the rolling, shall be used as follows: When the rolling shall have been carried on to the point where the metal of the second course will not push or 'weave' ahead of the roller and any depressions or unevennesses have been properly remedied, as provided, the rolling shall be interrupted and a thin layer of sand, screenings or other approved binding material, shall be evenly spread over the surface of the second course metal with as little disturbance of the latter as possible. The quantity of fine material so applied shall be just sufficient to cover the metal and care shall be exercised to avoid its use in excess. Water shall then be sprinkled on the roadway surface and the rolling at the same time resumed, the quantity of water used being such as will prevent the fine material from sticking to the wheels of the roller. The combined watering and rolling shall be continued until the voids of the metal shall become so filled with the finer particles as to result in a wave of water being pushed along the roadway surface ahead of the roller wheel. The watering and rolling shall then be discontinued until the macadam shall have dried out. If then the metal shall begin to loosen and to appear on the roadway surface, or if the voids in the metal shall appear to

be not properly filled, the watering and rolling shall be resumed with the application of only as much additional fine material as may be necessary. Any depressions or unevennesses appearing during the above operations shall be remedied by the contractor as hereinbefore provided, and when completed the macadam shall be uniform, firm, compact and of at least the thickness required and shall have an even surface nowhere departing by more than one inch from the grade and cross sections shown on the plans.''

Life of Bond Issues for the Construction of State Highways: E. P. GOODRICH.

Financial Problems Involved in the Selection of a Suitable Type of Road or Pavement: JOSEPH H. CONZELMAN.

The most common methods of obtaining funds for highway improvements are: by general taxation, by special taxation, by assessments on those particularly benefited, by bond issues and by combinations of these methods. A large part of the work done by state highway departments is financed by appropriations from the general tax.

The paving work of many cities in the United States is paid for with money secured by assessing the abutting property. Some revenue is collected in this way in a few rural districts. Special assessments are not, however, very popular or just in these sparsely settled sections because of the large extent of abutting property owned by individuals, and the low property value. Where assessments are practicable and are paid immediately, this method is an economical means of financing highway improvements.

Bond issues have come into general use as a means of obtaining money for state and county highway work, where a large amount of construction is planned. They render large sums of money available for immediate use, making possible a large amount of improvement which probably could not otherwise be financed. Bonds have been issued, however, in many localities with little consideration of the principles of economics. Money obtained in this way has been used to build roads, parts of which, at least, have worn out long before the bonds issued were redeemable. In other instances no provision has been made for retiring the bonds.

Bonds issued for a period of years not greater than the life of the roads which are to be built, when proper provision is made to retire them, is certainly an economical method of obtaining money. The conditions in some parts of the country, for example, in the grain districts, would seem to justify the issuance of bonds whose term extended beyond the life of parts of the highways built, if money for the work could be raised in no other way. Where fifty-year bonds are used to finance the building of roads or pavements, the fairest method, to the present and future generations, of redeeming the bonds and providing for the necessary reconstruction during the life of the bond, is that method which distributes the cost of the improvement most evenly among those deriving the benefits. The method which will most closely accomplish this endeavor must provide for the determination of the life of the several parts of the improvement, and, on the basis of this determination, distribute the cost of the improvement.

Preliminary Surveys and Mapping of National Highways: CHARLES HENRY DAVIS.

A national highway must be interstate. They must be located along the line of densest population so they may carry the heaviest traffic. This is between the large cities and those lying between them on the center line of water sheds. Fifty thousand miles of such national highways will serve, in the counties through which they pass, 88 per cent. of the urban and 53 per cent. of the rural, or a total of 69 per cent. of the people of the United States. It is here that the greatest rural population and tonnage will be served the best, not by so-called radial roads from railroad stations or towns. If a system of 100,000 miles was built, such roads would carry so nearly the entire rural tonnage as to make the balance negligible. The data for locating such a system has been secured for the forty-eight states. Seventeen have been completed, engraved and printed. Five more are ready for engraving. Every named place on these highways will be shown, whether city, town, village, hamlet, post office or otherwise. Also adjacent communities are shown. These maps will be standard and will require but little revision to keep them accurately up-to-date. The scale is such that straightening or relocating a road between two places will not require alteration of the maps. If a traffic census were taken on the alignment of such a mileage we would gain conclusive evidence as to the correctness of the above statements and thus avoid costly and fatal errors. When completed these maps will occupy a volume 5 in. $\times$ 10 in. of only 100 pages (50 sheets 10 in. $\times$ 10 in.) which with 44 pages of index of every named place will only be $\frac{1}{4}$ in. thick, including maps and index. When compared with maps available at present their usefulness and convenience are at once apparent.

Construction of Highways with Convict Labor in West Virginia: A. D. Williams.

The labor of the prisoner should not be exploited for the profit of a few and to the detriment of the honest laborer, but in justice to the man in prison and to society the prisoner should be given some useful and beneficial employment. This employment should be of such a nature as to give back to society in a measure atonement for the debt of transgressing society's laws, so that the prisoner will feel that he has rendered a just compensation for his own acts. The labor should be of such a class as would render the broadest service to all of the people, and not infringe upon the rights of any free laborer any more than possible. But the free laborer should not ask that society support an idle prison population so that he might monopolize all the work. The free laborer has as much right to ask a pension, and would do society much less harm in procuring a pension than in compelling the support of an idle criminal population which will turn on to society a weakened bunch of men. The prisoner for his own good must be employed. This labor should be given upon some class of property or the improvement of some class of property held in common by all the people. Therefore, improvement upon the public roads is a class of development that benefits everybody. This is public property, improved for public advancement, and the prisoner being a public charge can here be justly used for the public's good.

The great good that can come to the public from the use of any prisoner or prisoners is not his labor, but is the improvement of the individual by making of him a useful and beneficial citizen. An investigation on the part of the writer reveals that men or prisoners worked in the open air under a system wherein appeals can be made to the better manhood in their natures make better citizens than those employed in confinement.

West Virginia has a law which provides that the prisoner may elect to labor prior to his trial in case he is denied bail and is unable to give bond. This is a humane step and offers an opportunity for the man who has been wrongly accused to keep up his muscles and to provide in a measure for his family while being detained. The law at the present only permits payment of 50 cents per day if released or gives a credit of $1.00 per day on fine if convicted. The writer believes that this should be made a credit of $1.00 in case of release. The writer further believes that prisoners who work upon their honor and give good service should receive a wage which should be retained until the expiration of the sentence or in case of needy families be given to them. Because a man has transgressed a law and is deprived of his liberty is no reason why he should not retain his responsibility to his family and society should give him this privilege because oftentimes the innocent wife and children are punished more than the man in prison.

Utilization of Short-term Convicts for Highway Work in Georgia: James L. Stanford.

To secure accurate data to form a basis for the investigation of road work for misdemeanant convicts, a questionnaire was prepared and sent to every county in Georgia and the results obtained are presented in a condensed form in this preliminary report.

The State Prison Commission reports that practically all of the misdemeanant and felony convicts, with the exception of the women and those in poor health, are employed in some phase of highway work; 2,441 misdemeanant and 2,740 felony convicts were worked by 124 counties during 1914.

Regardless of the kind of work undertaken by a convict gang, the following factors will be involved, the usual interest on the first cost and depreciation of the equipment of the annual expense of maintaining the convicts. The economical solution is to so adjust the size of road gang as to render the sum of these factors a minimum.

According to reports received and actual experience, which may be said to have passed the experimental stage, a guard can most economically and advantageously handle fifteen men. The number of units composing a gang should be proportionately determined by such factors as the expense per man, mileage of roads to be constructed and repaired, the character of the work to be done, the class of men in the gang, and the equipment provided. The expense per man both as to food and guarding at night increases rapidly as the number of men in a gang falls below thirty and decreases just as rapidly as the gang increases by units up to a certain limit. One night guard can handle a camp of ninety convicts quite easily since the day guards sleep near by and are ready to give him assistance at any time. The guards act as road foremen, hence the expense of employing foremen is obviated and balanced by guard hire. The guards should be hired at a stipulated amount and their wages gradually raised as they become more efficient foremen.

Arthur H. Blanchard,
Secretary

(*To be continued*)