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The Canadian Engineer

A Weekly Paper for Civil Engineers and Contractors

Classification and Salaries of Engineers

Toronto Engineers Adopt Schedule of Titles, Qualifications and Minimum Salaries for Technically-Trained Men Employed by Railways, Municipalities, Industries, Public Works and Large Public Utilities—Salaries Range from $1,200 to $12,000 Per Annum

At a meeting held last Thursday evening, the members of the Toronto branch of the Engineering Institute of Canada approved of the schedule prepared by the Salaries Committee of that branch. This schedule classifies engineers employed by railways, municipalities, industrial firms, large public utilities and the Public Works Department of Canada. It groups the engineers employed in these five lines of work in clear-cut classes, with non-conflicting titles, and states the qualifications deemed requisite for each class, and also states the minimum salary which, in the opinion of the members of the branch, should be paid to each class.

In some of the classifications, the minimum salary stated in the schedule does not exceed that which prevails at present on the most important works in Canada, but in general the classification, if adopted by employers, will mean a most substantial increase for many engineers, especially when it is borne in mind that the salary mentioned in the schedule is meant to be the minimum salary to be paid in any case.

The schedule, having now been adopted by the Toronto branch, will be sent to every one of the other branches of the Institute throughout Canada for comment and to aid them in the preparation of similar schedules. Many of the other branches of the Institute have committees at work upon similar schedules, although no other branch, so far as is known, has as yet definitely completed a schedule. The Niagara Falls, Ont., branch is said to have made very great progress in the preparation of a schedule. The branches in the maritime provinces and also many of those in the western povinces have discussed the desirability of uniform classification.

The Toronto schedule will also be forwarded to the council of the Institute at Montreal, with a recommendation that it be formally adopted by the Institute as a whole.

Personnel of Salaries Committee

The personnel of the Salaries Committee of the Toronto branch is as follows:—

Geo. Clark (chairman), designing engineer, Toronto Harbor Commission; H. A. Goldman (secretary), assistant engineer, Toronto Harbor Commission; L. M. Arkley, assistant professor of mechanical engineering, University of Toronto; N. L. Crosby, contracting engineer, Toronto Structural Steel Co.; F. B. Geodike, assistant engineer, railway department, Hydro-Electric Power Commission of Ontario; E. G. Hewson, railway engineer, Hydro-Electric Power Commission of Ontario; Thomas Hogg, assistant hydraulic engineer, Hydro-Electric Power Commission of Ontario; H. J. Lamb, superintending engineer for Ontario, Department of Public Works of Canada; James Milne, mechanical and electrical engineer, works department, city of Toronto; G. G. Powell, deputy city engineer, Toronto; A. F. Stewart, chief engineer, Canadian National Railways; and Thomas Taylor, designing and construction engineer, Bloor St. Viaduct, Toronto.

Andrew Harkness, consulting structural engineer, Toronto, who is chairman of the Toronto branch, and W. S. Harvey, engineer of sewers, Toronto Harbor Commission, who is secretary of the Toronto branch, are ex-officio members of the committee.

Approximately, 60 members of the branch were present at the meeting last Thursday evening, Mr. Harkness presiding. After the routine business had been quickly finished, Mr. Clark was asked to present the report of the Salaries Committee, which had been considering the proposed classification and schedule of salaries for the past six months.

After Mr. Clark had read the schedule in regard to railway work, Mr. Harkness enquired regarding the present rate of pay received by railway brakemen, and was informed by Mr. Clark that it amounts to between $300 and $330 per month.

J. R. W. Ambrose, chief engineer of the Toronto Terminal Railway Co., enquired as to how the schedule of salaries recommended by the committee compares with the schedule used by the American Association of Engineers, and was informed that the proposed Toronto schedule is about $200 per annum higher than that of the American Association.

Railway Salaries are Discussed

The only change made in the railway classification was to substitute the title "Designing Engineer in Structural Department," for "Leading Draftsman in Structural Department."

Mr. Ambrose contended that rodmen should receive more than chainmen, as they are considered on the railways to be superior to chainmen. Mr. Clark, however, expressed the opinion that men employed for this class of work are largely from high schools or else are junior students at the universities, and may all be considered as equal in ability, but the members decided to support the increase for rodmen as proposed by Mr. Ambrose.

The railway salaries reported by the committee were unanimously adopted excepting for the following changes: Assistant Bridge Engineer $4,800 instead of $4,200; Designing Engineer in Structural Department, $3,600 instead of $3,000; Rodman, $1,500 instead of $1,200.

Frank Barber, consulting engineer, Toronto, enquired as to how officials such as county engineers and road commissioners should be scheduled in view of the fact that some of them are only employed part time and that others are not qualified engineers, and that the conditions of employment differ so greatly in the various cases. Mr. Clark stated that these matters are covered by the municipal schedule.

J. C. Krumm, railway bridge designer, Hydro-Electric Power Commission of Ontario, said that in respect to bridge engineers the railway schedule does not conform to what he considers to be the usual distinction between the various classes of technically-trained men, and he proposed that the schedule be referred back to the committee for revision. This was not carried, however, as G. A. McCarthy, engineer of railways and bridges, city of Toronto, and many other expressed the view that the classification regarding bridge engineers is satisfactory and should not be changed.

Mr. McCarthy objected, however, to the qualification requiring bridge engineers to be college graduates; he thought that it would be somewhat severe to confine future appointments in bridge work solely to men who are graduates of universities. He stated that he knows some very able bridge engineers who are not college graduates. He moved, with Mr. Ambrose as seconder, that the wording "should be a college graduate" be changed to "should preferably be a college graduate," and it was decided to make this change throughout all of the classifications excepting that relating to public works. The public works classification is that which had been adopted by the Civil Service Commission of Canada, and it had been accepted in its entirety by the Salaries Committee of the Toronto branch, therefore no changes were made in the classification relating to that field of work.

Discussion on Municipal Salaries

After Mr. Clark had read the schedule relating to municipal work, R. E. W. Hagarty, consulting engineering Toronto, expressed the opinion that the salaries should be increased by 25%, especially the lower salaries. George Hogarth, chief engineer, Ontario Highways Department and and R. O. Wynne-Roberts, consulting engineer, Toronto, believed that the salaries of deputy city engineers, first assistants and second assistants should be increased.

Mr. Clark stated that the present depreciation in value of the dollar should not be taken too much into account in determining a permanent schedule of minimum salaries, and that due regard should be paid to the circumstances of individual employment and to the value of services rendered in other fields of engineering work of similar nature. After debate, the members decided to add $600 per annum to the salary of chief engineers of municipalities of less than 100,000 population, $400 per annum to the salary of first assistants in cities between 100,000 and 300,000 population, and $600 per annum to the salary of designers.

F. A. Dallyn, sanitary engineer, Ontario Board of Health, expressed the opinion that the experience required is just as great for cities of 7,000 population as for those of 10,000 population, and he thought the dividing point should be at 7,000 instead of 10,000. No motion to this effect was made, however.

Public Works Schedule Altered

The industrial, public utilities and public works schedules were adopted without much discussion, no changes being made in the industrial or public utilities schedules. It was emphasized, however, that the classification and salaries mentioned for public utilities can be considered effective only for the larger type of public utilities, and that it is not practical at present to recommend their strict observance by small public utilities.

In the public works schedule, the following changes in salaries were made: Senior Assistant Engineer, $3,200 instead of $2,700; Resident Engineer, $3,140 instead of $2,640; Chief Draughtsman, $2,500 instead of $2,280; Inspector, $1,800 instead of $1,500; Draughtsman, $1,500 instead of $1,200; Junior Instrumentman, $1,500 instead of $1,200.

Following is the schedule as finally adopted by the Toronto branch, the salary figures mentioned in each case being the minimum salary, which in the industrial schedule is supposed to be graded according to the size of the industry:—

Railway Schedule

1. Chief Engineer, $10,000.
2. Assistant Chief Engineer, $7,200.

3a. Engineer of Maintenance, $6,600. Should preferably be a graduate from an engineering school recognized by the Institute, and should have 8 to 10 years' practical experience in engineering work, or, if not a graduate, should have from 12 to 15 years' practical experience, and should be thoroughly familiar with the mathematics of engineering.

3b. Engineer of Construction, $6,600. Same qualification as for Engineer of Maintenance.

3c. Bridge Engineer, $6,000. Same qualification as for Engineer of Maintenance.

3d. Principal Assistant Engineer, $6,000. Same qualification as for Engineer of Maintenance.

4a. District Engineer, $4,800. Should preferably be a graduate from an engineering school recognized by the Institute, and should have 6 to 8 years' practical experience in engineering work, or, if not a graduate, should have from 10 to 12 years' practical experience, and should be familiar with the mathematics of engineering.

4b. Signal Engineer, $4,800. Should preferably be thoroughly familiar with the theory and practice of signalling, and of train operation, and should have had, in addition, at least five years' practical experience in mechanical and electrical signal work on railways.

4c. Architect or Engineer of Buildings, $4,000. Should have sufficient architectural training to design railway stations, shops, round-houses, dwellings, etc., of normal types, and should have 6 or 8 years' practical experience in responsible design of railway buildings.

4d. First Assistant Engineer, $4,200. Same qualification as for District Engineer.

4e. Assistant Bridge Engineer, $4,800. Should preferably be a graduate engineer with from 5 to 6 years' practical experience in the office and in the field.

5a. Division Engineer, $3,600. Should preferably be a graduate engineer with 3 or 4 years' experience of practical engineering, or, if not a graduate, should have 8 to 10 years' practical experience and should be well grounded in the mathematics of engineering.

5b. Second Assistant Engineer, $3,000. Same qualification as for Division Engineer.

5c. Chief Draughtsman, $2,500. Should have a thorough knowledge of general draughting, but not necessarily knowledge of design, and should be able to control a number of subordinates and supervise their work.

5d. Designing Engineer in structural department, $3,600. Should be thoroughly grounded in the theory of design and detail in his particular department, and should be able to control a number of subordinates and supervise their work.

5e. Leading Draughtsman in architectural department, $2,400. Same qualification as given for Designing Engineer in structural department.

5f. Signal Supervisor, $2,400. Should be thoroughly familiar with the mechanical and electrical details of signalling, should have sound elementary knowledge of the principles of signalling, and should be qualified to carry out and supervise construction and maintenance of all types of signal plants.

6a. Resident Engineer (construction only), $2,700 and expenses. Should preferably be graduate engineer or have 3 or 4 years' practical experience in the junior branches of engineering work.

6b. Third Assistant Engineer, $2,400. Same qualification as for Resident Engineer.

6c. Draughtsman, $1,800. Should be able to plot accurately from field notes or notes and sketches supplied to him by a senior officer.

6d. Inspector (class A), $2,400 and expenses. Should have a thorough knowledge of the class of work that he is employed to inspect, and in the case of steel or reinforced concrete structures, should be a man of sufficient intelligence to understand the elementary principles of design and realize the necessity for close adherence to plans, and must be able to read and interpret plans correctly.

7a. Junior Assistant or Instrument Man, $1,800 and expenses. Should have sufficient training in the use of level or transit, or both, to do accurate work at a reasonable rate of speed, and should be thoroughly grounded in the mathematics required for the proper reduction and application of his instrumental work.

7b. Inspector (class B), $1,800. Should have some practical experience in the class of work that he is employed to inspect, and have sufficient intelligence and firmness to enforce the carrying out of specifications.

7c. Junior Draughtsman, $1,500. Should have passed through his training as a tracer, and should have working knowledge of the use of draughting instruments.

8a. Chainman, $1,200. No previous experience required.

8b. Rodman, $1,500. No previous experience required.

8c. Tracer, $1,200. No previous experience required.

Municipal Schedule

1a. Chief Engineer of municipality greater than 300,000 population, $12,000. Should preferably be a graduate from an engineering school recognized by the Institute, and should have had 15 years' practical experience, covering two branches in municipal engineering, and should have served for about 5 years in the capacity of Deputy City Engineer, or of First Assistant in municipalities of over 300,000, or as Chief Engineer in municipalities of over 100,000, and should possess proven executive ability.

1b. Chief Engineer, 100,000 to 300,000, $8,000. Should preferably be a graduate with 10 years' experience, covering two branches in municipal engineering. Three years of his experience should be in the capacity of either one of the following:—Chief Engineer in municipality of over 50,000, First Assistant in municipality of over 100,000, or Second Assistant in municipality of over 300,000. He should possess proven executive ability.

1c. Chief Engineer, 50,000 to 100,000, $6,600. Should preferably be a graduate with 8 years' experience in municipal engineering, 2 years of which should be in the capacity of any one of the following:—Chief Engineer in city of over 10,000, First Assistant in city less than 100,000, or Second Assistant in city under 300,000. He should possess proven executive ability.

1d. Chief Engineer, 25,000 to 50,000, $5,400. Should preferably be college graduate or licensed land surveyor with 5 years' experience in municipal engineering, and possess proven organizing ability.

1e. Chief Engineer, 10,000 to 25,000, $4,200. Should preferably be college graduate or licensed land surveyor with 3 years' experience in municipal engineering, or should have completed apprenticeship to municipal engineer, and have been subsequently placed in responsible charge of engineering work. He must have ability to handle men.

1f. Chief Engineer, less than 10,000, $3,000. Same qualifications as for cities between 10,000 and 25,000 unless work is confined to routine construction and maintenance, in which case he should have had 5 years' experience as First Assistant in similar work, and should have ability to handle men.

1g. Other Municipal Engineers (employed part time), Daily Rate. Land Surveyors,—requirements prescribed by law. For routine construction and maintenance, qualification to be same as for Chief Engineer of city less than 10,000. Other casual work probably done by consulting engineers.

2. Deputy City Engineer or Principal Assistant in cities over 300,000, $8,000. Same qualification as for Chief Engineer in city of from 100,000 to 300,000.

3a. First Assistant having charge of (any one of the following) roadways, sewers, water works, light, transportation, structures, testing and inspection in cities over 300,000, $5,000. Should preferably be a graduate with 8 years' experience in municipal engineering, 4 years of which should have been in the capacity of First Assistant in municipality of 100,000 to 300,000, or, as Second Assistant in municipality of over 300,000. Should be able to handle office, construction and maintenance forces.

3b. First Assistant in charge of one or more departments in cities 100,000 to 300,000, $4,000. Should preferably be a graduate with 6 years' experience in engineering, 2 years of which should have been in the capacity of First Assistant in city of less than 100,000, or, as Second Assistant in city of over 100,000. Should be able to handle office, construction and maintenance forces.

3c. First Assistant in cities less than 100,000, $3,000. Should preferably be a graduate with 4 years' experience in engineering, 2 years of which should have been in the capacity of Second Assistant, and should be able to handle office, construction and maintenance forces.

4a. Second Assistant reporting to the First Assistants in larger municipalities and to the Chief Engineer in smaller municipalities, in responsible charge of design, drafting and engineering records, cities over 300,000, $3,600. Should preferably be a graduate with 6 years' experience in engineering, 4 years of which should have been as Second Assistant in city under 300,000, or as Resident Engineer on construction with designing experience, or as Designer. Should be able to handle office staff for designing, drafting and keeping records.

4b. Second Assistant in responsible charge of design, drafting and engineering records, cities less than 300,000, $3,000. Should preferably be a graduate with 4 years' experience in engineering, 2 years of which should have been either as Designer or as Resident Engineer on construction with designing experience. Should be able to handle office staff for designing, drafting and keeping of records.

4c. Second Assistant in responsible charge of surveys, cities over 300,000, $3,000. Should preferably be a graduate engineer or licensed land surveyor with 4 years' experience as Instrument man in municipal work, preferably on construction, and should be able to handle several parties and to keep them employed to advantage.

4d. Second Assistant in responsible charge of surveys, cities less than 300,000, $2,400. Should preferably be a graduate engineer or licensed land surveyor with 2 years' experience as Instrument man in municipal work, preferably on construction, and should be able to handle several parties and keep them employed to advantage.

4e. Second Assistant in responsible charge of construction, operation or maintenance (one or more), cities more than 300,000, $3,600. Should preferably be a graduate with 6 years' experience in engineering, 4 of which should have been as Inspector or as Resident Engineer on construction, and should be able to handle construction and maintenance forces.

4f. Second Assistant in responsible charge of construction, operation or maintenance (one or more), cities less than 300,000, $3,000. Should preferably be a graduate with 4 years' experience in engineering, 2 of which should have been as Inspector or as Resident Engineer on construction, and should be able to handle construction and maintenance forces.

5. Resident Engineer on construction, $2,400. Should preferably be graduate with 3 years' experience in municipal work, or should have completed apprenticeship in municipal work. Should have ability to use survey instruments, make calculations arising therefrom, and keep track of quantities and labor.

6. Designer, $3,000. Should preferably be a graduate with 4 years' experience, and should be familiar with the mathematics and practice of the branch of work in question.
7. Draughtsman, $1,800. Should be high school or preferably a college graduate, and should be able to plot accurately from field notes and produce correct working drawings from designer's sketches and computations.
8. Inspector, $2,100. Should have a thorough knowledge of the class of work that he is employed to inspect, and in the case of steel or reinforced concrete structures, should be a man of sufficient intelligence to understand the elementary principles of design and realize the necessity for close adherence to plans, and must be able to read and interpret plans correctly.
9. Instrument Man, $1,800. Should be high school or preferably a college graduate and should have sufficient training in the use of level or transit, or both, to do accurate work at a reasonable rate of speed, and should be thoroughly grounded in the mathematics required for the proper reduction and application of the instrumental work. In case of construction he should understand the special requirement for the class of work in question.
10. Chainman or Rodman, $1,200. No previous experience required.
11. Tracer, $1,200. No previous experience required.

Industrial Schedule

1a. Chief Engineer, $10,000 down to $3,600.
1b. Research Engineer, $10,000 down to $3,600. Should preferably be a graduate from an engineering school recognized by the Institute, with from 10 to 15 years' experience in his special line.
1c. Mechanical Engineer, $10,000 down to $3,600. Same qualification as for Research Engineer.
1d. Electrical Engineer, $10,000 down to $3,600. Same qualification as for Research Engineer.
1e. Chemical Engineer, $10,000 down to $3,600. Same qualification as for Research Engineer.
1f. Metallurgical Engineer, $10,000 down to $3,600. Same qualification as for Research Engineer.
2a. Assistant Chief Engineer (in large industries only), 75% of salary of Chief Engineer, with a minimum of $3,000. Preferably technical graduate with from 5 to 10 years' experience.
2b. Engineer in general charge of all outside construction, 75% of salary of Chief Engineer, with a minimum of $3,000. Preferably technical graduate with from 5 to 10 years' experience.
2c. Efficiency Engineer (usually a consulting engineer, but occasionally on the permanent staff), 75% of salary of Chief Engineer, with a minimum of $3,000.
3a. Designing Engineer, having responsible charge of all design in mechanical engineering, 50% of salary of Chief Engineer, with a minimum of $2,700. Should preferably be a technical graduate with 5 years' practical experience in his special line, or, should be a high school graduate with 10 years' practical experience, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering.
3b. Designing Engineer, having responsible charge of all design in electrical engineering, 50% of salary of Chief Engineer, with a minimum of $2,700. Same qualification as for mechanical engineering.
3c. Designing Engineer having responsible charge of all design in structural engineering, 50% of salary of Chief Engineer, with a minimum of $2,700. Same qualification as for mechanical engineering.
3d. Designing Engineer having responsible charge of all design in heating and ventilating engineering, 50% of salary of Chief Engineer, with a minimum of $2,700. Same qualification as for mechanical engineering.
4a. Engineer in charge of estimating, figuring costs, etc., 35% of salary of Chief Engineer, with a minimum of $2,400. Should preferably be a technical graduate with 3 years' practical experience in his special line, or, should be a high school graduate with 8 years' practical experience, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering.
4b. Testing Engineer in charge of tests, 35% of salary of Chief Engineer, with a minimum of $2,400. Same qualification as for Engineer in charge of estimating.
4c. Resident Engineer on construction, 35% of salary of Chief Engineer, with a minimum of $2,400. Same qualification as for Engineer in charge of estimating.
4d. Chief Draughtsman responsible for all working drawings, 35% of salary of Chief Engineer, with a minimum of $2,400. To be qualified by training and experience for the special work required of him.
4e. Designer, assistant to Designing Engineer, 35% of salary of Chief Engineer, with a minimum of $2,400. Should preferably be a technical graduate with 2 years' practical experience, or should be a high school graduate with 4 years' practical experience, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering.
5a. Estimator, assistant to Engineer in charge of estimating, $2,400. Should preferably be a technical graduate with 2 years' practical experience, or should be a high school graduate with 3 years' practical experience, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering.
5b. Squad Boss in charge of small squad of Draughtsmen, $2,400. Should be a high school graduate with 3 years' practical experience, 1 year as checker, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering.
6a. Chief Shop Inspector in charge of shop inspection, $2,100. Should preferably be a technical graduate with 1 year's experience, or should be a high school graduate with 3 years' experience as inspector, and should have a good general knowledge of mathematics and the fundamental physical laws used in engineering.
6b. Checker, responsible for the correctness of working drawings, $2,100. Similar qualification as for Chief Shop Inspector.
7a. Draughtsman, making detailed working drawings, $1,800. Should preferably be a technical graduate, or 3 years' experience in drawing, tracing, etc.
7b. Shop Inspector, $1,800. Should have some practical experience in the class of work that he is employed to inspect, and have sufficient intelligence and firmness to enforce carrying out of specifications.
7c. Field Inspector, $1,800. Same qualification as for Shop Inspector.
8. Tracer, $1,200. No previous experience required.

Public Utility Schedule

1. Chief Engineer, $12,000.
2. Assistant Chief Engineer, $9,000.
3a. Departmental Engineer having charge of surveys, specifications for and design of hydraulic structures, drafting and engineering records, and hydrometric records, $7,500. Should preferably be a graduate from an engineering school recognized

by the Institute, with from 10 to 15 years' experience in his particular work.

3b. Departmental Engineer having charge of specifications for, and design of, electrical work, substations, powerhouses and switching stations, $7,500. Same qualifications as for 3a.

3c. Departmental Engineer having charge of surveys and design of transmission lines, high tension and low tension, $5,000. Same qualifications as for 3a.

3d. Departmental Engineer having charge of construction, $7,500. Should preferably be a graduate from an engineering school recognized by the Institute, with from 10 to 15 years' experience on construction, with requisite executive ability to organize and handle large forces of men on the various works indicated by 3a, 3b and 3c.

3e. Departmental Engineer having charge of research and tests, $5,000. Same qualifications as for 3a.

3f. Departmental Engineer having charge of operation and maintenance, $7,500. Same qualifications as for 3a.

3g. Departmental Engineer having charge of power contracts, $5,000. Same qualifications as for 3a.

4a. Deputy Departmental Engineer having charge of surveys, specifications for and design of hydraulic structures, drafting and engineering records and hydrometric records, $4,800. Should preferably be a graduate from an engineering school recognized by the Institute, with 8 years' experience in his particular work.

4b. Deputy Departmental Engineer having charge of specifications for and design of electrical work, substations, powerhouses and switching stations, $4,800. Same qualifications as for 4a.

4c. Deputy Departmental Engineer having charge of surveys for and design of transmission lines, high tension and low tension, $3,000. Same qualifications as for 4a.

4d. Deputy Departmental Engineer having charge of construction, $4,800. Same qualifications as for 4a.

4e. Deputy Departmental Engineer having charge of research and tests, $3,000. Same qualifications as for 4a.

4f. Deputy Departmental Engineer having charge of operation and maintenance, $4,800. Same qualifications as for 4a.

4g. Deputy Departmental Engineer having charge of power contracts, $3,000. Same qualifications as for 4a.

5a. Assistant Departmental Engineer having charge of design of hydraulic structures and records, $3,600. Should preferably be a graduate from an engineering school recognized by the Institute, with 4 years' experience in his particular work.

5b. Assistant Departmental Engineer having charge of power surveys and field engineering on construction, $3,000. Same qualifications as for 5a.

5c. Assistant Departmental Engineer having charge of hydrometric investigation and records, $2,400. Same qualifications as for 5a.

5d. Assistant Departmental Engineer having charge of specifications for and design of electrical work, $3,600. Same qualifications as for 5a.

5e. Assistant Departmental Engineer having charge of specifications for and design of buildings, $3,000. Same qualifications as for 5a.

5f. Assistant Departmental Engineer having charge of field engineering on construction, $2,400. Same qualifications as for 5a.

5g. Assistant Departmental Engineer having charge of design of high tension lines, $3,000. Same qualifications as for 5a.

5h. Assistant Departmental Engineer having charge of design of low tension lines, $2,700. Same qualifications as for 5a.

5i. Assistant Departmental Engineer having charge of surveys for and field engineering on transmission lines, $2,400. Same qualifications as for 5a.

5j. Assistant Departmental Engineer having charge of construction of hydraulic structures, $3,000. Same qualifications as for 5a.

5k. Assistant Departmental Engineer having charge of construction of electrical work, $3,000. Same qualifications as for 5a.

5l. Assistant Departmental Engineer having charge of construction of building, $2,400. Should be a high school graduate with 5 years' experience in building trades.

5m. Assistant Departmental Engineer having charge of electrical testing, $2,400. Same qualifications as for 5a.

5n. Assistant Departmental Engineer having charge of structural testing, $2,400. Same qualifications as for 5a.

5o. Assistant Departmental Engineer having charge of chemical testing, $2,400. Same qualifications as for 5a.

5p. Assistant Departmental Engineer having charge of field and shop inspection, $2,400. Same qualifications as for 5a.

5q. Assistant Departmental Engineer having charge of operations of district or system, $3,000. Same qualifications as for 5a.

5r. Assistant Departmental Engineer having charge of power contracts of district or system, $2,400. Same qualifications as for 5a.

5s. Assistant Departmental Engineer having charge of right-of-way surveys, $2,700. Same qualifications as for 5a, and should hold his provincial land surveyor's certificate.

5t. Assistant Departmental Engineer having charge of cost estimates and power estimates, $2,400. Same qualifications as for 5a.

6. Designer or layout man, $2,400. Should preferably be a graduate from an engineering school recognized by the Institute with 2 years' experience.

7. Draughtsman, Instrument Man and Inspector, $1,800. Should preferably be a technical graduate, or 3 years' experience.

8. Tracer and Chainer, $1,200. No previous experience required.

Public Works Schedule

1. Chief Engineer, $12,000. Graduation in engineering from a school of applied science of recognized standing; at least 12 years of experience in engineering survey, design, estimate and construction work, 7 years of which shall have been in responsible charge of such work; thorough knowledge of Canadian engineering problems; the highest degree of administrative ability.

2. Assistant Chief Engineer, $8,000. Graduation in engineering from a school of applied science of recognized standing; at least 10 years of experience in engineering design, estimate, construction and maintenance work, 5 years of which shall have been in responsible charge of such work; thorough knowledge of dredging work and the general engineering problems of Canada; ability to organize, supervise, and manage large engineering works.

3. Supervising District Engineer, $6,000. Education equivalent to graduation in engineering from a school of applied science of recognized standing; at least 7 years of experience in engineering survey, design, estimate, construction and maintenance work, 4 years of which shall have been in responsible charge of such work; considerable knowledge of marine engineering work; ability to make constructive criticisms and reports on proposed works and supervise the construction of large works.

4. Senior Engineer, $5,000. Education equivalent to graduation in engineering from a school of applied science of recognized standing; at least 7 years of experience in engineering design, estimate, and construction work, 4 years of which shall have been in responsible charge of such work; wide knowledge of public works construction and maintenance work and ability to manage and supervise engineering works of considerable importance.

5. District Engineer (grade 2), $4,000. Education equivalent to graduation in engineering from a school of applied science of recognized standing; 5 years of experience in engineering estimate, survey and construction work, 2 years of which shall have been in responsible charge of such work; preferably thorough knowledge of local conditions and works; firmness, tact, good judgment and ability to manage men.

6. District Engineer (grade 1), $3,500. Same qualifications as for District Engineer (grade 2).

7. Dredging Engineer, $3,500. Education equivalent to graduation in engineering from a school of applied science of recognized standing; at least 5 years of experience in engineering survey, consrtuction, dredging, and maintenance of a dredging fleet, 3 years of which shall have been in responsible charge of such work; thorough knowledge of dredging operations; firmness, tact and ability to manage men.

8. Engineer Ottawa River Storage, $3,300. Education equivalent to graduation in engineering from a school of applied science of recognized standing; at least 5 years of experience in engineering survey, construction, and maintenance, 3 years of which shall have been in responsible charge of such work; thorough knowledge of river regulation works; firmness, tact, good judgment and ability to manage men.

9. Senior Assistant Engineer, $3,200. Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing, with 3 years of experience in engineering design, estimate, and construction work, 2 years of which shall have been in a position of professional responsibility; or 5 years of practical experience in engineering design, estimate, and construction work, 2 years of which shall have been in a position of professional responsibility; firmness, tact, good judgment, and ability to manage men.

10. Resident Engineer, $3,140. Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with 3 years of experience in engineering design, estimate, and construction work, 2 years of which shall have been in a position of professional responsibility; or 5 years of practical experience in engineering design, estimate, and construction work, 2 years of which shall have been in a position of professional responsibility; thorough knowledge of railway and harbor works; tact, good judgment, and ability to manage men.

11. Chief Draughtsman, $2,500. Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with 4 years of experience in an engineering draughting office, 3 years of which shall have been in responsible charge of such work, or 6 years of experience in an engineering draughting office, 3 years of which shall have been in responsible charge of such work; ability to visualize proposed engineering works; familiarity with various types of structures which will best serve local needs; firmness, tact and ability to manage men.

12. Assistant Engineer, $2,100. Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with 3 years of engineering experience, 1 year of which shall have been in a position of professional responsibility; or 5 years of engineering experience, 1 year of which shall have been in a position of professional responsibility; firmness, tact and ability to manage men.

13. Chief Inspector, $2,100. Education equivalent to graduation in engineering from a university of recognized standing; at least 4 years of supervisory experience in general construction work; supervisory ability, integrity, tact and good judgment, good physical condition.

14. Junior Engineer, $1,800. Education equivalent to high school graduation; either graduation in engineering from a school of applied science of recognized standing with 2 years of engineering experience, or 4 years of engineering experience in design, estimate, construction, and maintenance work.

15. Inspector, $1,800. Education equivalent to high school graduation; at least 2 years of experience in building construction work; ability to read and interpret blue prints and to judge concrete mixtures; supervisory ability, integrity.

16. Instrument Man, $1,800. Education equivalent to high school graduation, attendance for 2 years at a school of applied science of recognized standing, or passing of the preliminary Dominion Land Surveyors' examination with 1 year of experience as Rodman or Junior Instrument Man, or 3 years of experience in a survey party as Rodman or Junior Instrument Man; thorough knowledge of the transit and level and ability to make all adjustments to either instrument.

17. Draughtsman, $1,500. Education equivalent to high school graduation; either attendance for 2 years at a school of applied science of recognized standing with 1 year of subsequent experience in a draughting office, or 3 years of experience in a draughting office; ability to make neat, accurate, and complete plans and drawings from notes or sketches.

18. Junior Instrument Man, $1,500. Education equivalent to high school graduation; either a course of 1 year in engineering in a school of applied science of recognized standing with the passing of the preliminary provincial or Dominion Land Surveyors' examination, and 1 year of training with a survey party, or 2 years of training with a survey party.

19. Engineering Helper, $1,200. Preferably primary school education; willingness and energy; in some cases a good sense of direction and locations and ability to handle a boat or canoe; good physical condition.

[Note.—For typographical convenience, minor changes in the form of the schedules have been made in their presentation above, particularly in the numbering and lettering ahead of the titles and in the repetition or omission of portions of titles, but we believe that these changes are not material, and that they do not in any way alter the exact meanings expressed and implied in the original form of the schedules.—Editor.]

It is rumoured in Kingston, Ont., that Prof. Clark will be appointed dean of the School of Science, Queen's University, succeeding Dean Goodwin, who has retired.

With the nationalization of the Grand Trunk lines almost an accomplished fact, an agitation has begun for the purchase by the Dominion government of the Edmonton, Dunvegan & Peace River Railway. This line was constructed by J. D. McArthur, and its bonds were guaranteed by the province of Alberta. The owners of the road are said to be unable to carry it on and the settlers in the Peace river valley are complaining of poor service. The provincial government is unwilling to take over or operate the road.

Joint Town-Planning Conference at Ottawa

American City Planning Institute and Town-Planning Institute of Canada Discuss Zoning, Cost of Public Utilities and Street Improvements, Proper Widths for Streets and Other Fundamental Considerations of City and Town Planning

WITH the co-operation of the Commission of Conservation of Canada, a joint conference of the Town Planning Institute of Canada and the American City Planning Institute was held last Friday and Saturday at the Chateau Laurier, Ottawa, Ont.

The conference opened at 2 p.m. Friday. The sessions Friday afternoon, Friday evening and Saturday morning were arranged by the American City Planning Institute. The Saturday evening session was arranged by the Town Planning Institute of Canada. Saturday afternoon was reserved for drives and a visit to the Parliament Building.

After addresses of welcome by Hon. N. W. Rowell, president of the Privy Council, and Mayor Fisher, of Ottawa, reports were submitted by F. L. Olmsted (see next column) and B. A. Haldeman (see page 409 of this issue).

E. H. Bassett's report (see page 410 of this issue) was the chief topic for discussion on Friday evening.

The Saturday morning session was devoted to discussion of A. C. Comey's report, which will appear in the next issue of *The Canadian Engineer*, and Morris Knowles' report (see page 404 of this issue).

Address by Ottawa Planners

At noon Saturday the members were the guests at luncheon of the Canadian Club of Ottawa, and in the evening they were the guests at dinner of the Commission of Conservation and the city council of Ottawa.

Addresses by Thos. Adams and Noulan Cauchon, both of Ottawa, were the features of the final session, Saturday evening.

There was a very representative attendance of some of the leading town planners of Canada and the United States and all were enthusiastic regarding the benefits that will ensue as a result of this international conference.

In the addresses of welcome by Hon. Mr. Rowell and Mayor Fisher, both speakers laid stress on the advantages of international conferences of this nature, especially in the newer centres where development is rapid and the opportunity is great for housing more nearly approaching the ideal.

The committee reports relating to fundamental town planning principles, which comprised the greater portion of the program, were concise statements of about 1,000 words each, but the chairman of each committee elaborated upon his report when reading it.

While meeting in the main with the approval of the conference, these reports were not definitely adopted by the American City Planning Institute and are to be further considered.

Interesting discussion followed each report, especially in regard to the exact definition of terms used. To decide what the term "city planning" includes, and whether some other term might be preferable, was one of the matters left to a joint committee of the two institutes.

Zoning in Canadian Acts

In regarding to zoning it was pointed out that in Canada most of the provinces have in force town planning acts which incidentally provide for zoning amongst other features dealing with the amenities of the areas affected.

At the Canadian Club luncheon there were not only the members of the American and Canadian planning institutes, but also many other engineers. Dean Mitchell, of the Faculty of Applied Science and Engineering, University of Toronto, who was the speaker and guest of honor, discussed the aesthetics of the war and the lessons to be drawn therefrom. He announced that civics and town planning are to be included in the science courses at the University of Toronto.

One of the features of the conference that aroused very favorable comment was the exhibit of housing and town planning schemes and data. The exhibit was entirely of Canadian material and was supplied by the office of the Dominion Housing and Town Planning Adviser and other federal and provincial government offices, individual Canadian engineeers and architects also having made contributions to the exhibit.

The importance of housing was frequently referred to throughout the conference. In his address of welcome, Hon. Mr. Rowell described housing conditions and the environment in which thousands are compelled to live in the larger cities of the American continent, as the great crime of the past. He urged the members to strive during the present reconstruction period to bring about a new and better social order.

The members of the institutes visited the sites of two housing projects of the Ottawa Housing Commission, and at "Lindenlea," Thomas Adams explained briefly the salient features of that project.

The progress of housing in the United States and in some of the provinces of Canada was commented upon by various authorities conversant with the subject, and last Saturday evening Thos. Adams showed moving pictures of housing projects carried out in England and Canada.

"The Planning of Ottawa" was treated by Noulan Cauchon, chairman of the Ottawa Branch of the Town Planning Institute of Canada, in a broad and entertaining manner. Mr. Cauchon's address ended what was unanimously declared to have been a very successful conference.

Following are the committee reports presented by Messrs. Olmsted, Knowles, Haldeman and Bassett:—

FUNDAMENTAL CONSIDERATIONS OF CITY PLANNING

BY F. L. OLMSTED
Chief Town Planner for the U. S. Department of Labor

THE purpose of this statement is to set forth certain fundamental considerations of city planning as an explanatory introduction to any specific conclusions which the American City Planning Institute may see fit to adopt in relation to special and limited questions within its field; largely to avoid the danger that such specific conclusions standing alone might give a mistaken impression of the scope of the subject and the attitude of the institute.

City planning, which in this statement is used broadly to cover the entire subject-matter, designated also by such terms as town planning and regional planning, is concerned with the territory occupied or to be occupied by any community and with prospective physical alterations in that territory and the objects upon it, in so far as such alterations can wisely be controlled or influenced by concerted action in the interest of the community as a social unit.

In theory no prospective physical alteration is so small, so localized, or so specialized in technique as to be excluded merely for that reason from the scope of city planning, provided it can wisely and effectively be controlled in the common interest. A problem of city planning may be wholly within the field of one of the many well-established specialized technical professions having to do with the physical surroundings of community life, or may concern several such fields, or may lie in a sort of no man's land, inadequately covered by any one of these professions.

The field is so wide and so complex that on the one hand effective progress in mastering it requires specialization, and makes it inevitable that much of the progress in technical knowledge and skill on which successful city planning depends will arise from the activities of innumerable specialized organizations, most of which concern themselves little with city planning as a whole, and that on the other hand it is necessary for any organization which deliberately addresses itself to city planning as a whole to concentrate as far as possible upon those aspects of the field which cannot be, or are not, effectively dealt with upon any narrower basis.

In theory there are no limitations to the extent of co-ordination desirable among the diverse planning activities which shape the physical growth of a community or to the extent to which it is desirable to estimate future contingencies and take account of them in planning; but practically there are very decided limitations upon the amount of time and effort which can be withdrawn from the vital business of getting things done for the sake of study and planning what to do and how best to do it.

The Most Fundamental Consideration

The most fundamental consideration of all in city planning, therefore, is to apply sound, clear penetrating common sense to the problem of how far it will pay to go, under any conditions, in forecasting the future and adapting present plans to future contingencies, and in suspending plans for meeting definite limited objectives of a local or specialized sort and modifying them for the sake of community purposes with which they are not directly concerned.

The classes in specific city planning problems which are most distinctively matters of city planning are:—

(a) Those in which the permanent interests of a community justify the modification of plans so as not merely to secure the immediate objects of a contemplated improvement, but also to fit the probable contingencies of a remoter future or to fit community needs which are only indirectly connected with the objects immediately in view.

(b) Those in which a close co-ordination of planning in two or more fields of technical work ordinarily segregated from each other in practice is likely, through avoidance of conflict and fuller utilization of joint opportunities, to secure advantages commensurate with the effort of obtaining the necessary co-ordination.

(c) Those which lie so much outside of the fields which are effectively covered by any specialized planning agencies that the community is likely to suffer from their neglect.

Merely to recognize problems of the above classes as they arise in the routine of community growth and to consider them from the broad standpoint of the community's general interests is city planning in a conservative or defensive sense. But constructive city planning requires also that many such problems, long before they become acute, shall be anticipated and considered under the impulse of imagination applied toward the attainment of the larger social objectives of the community.

Limited in Three Ways

Any one discussion of city planning must be limited in one or more of these ways: (1) It may be general and superficial; or (2) it may be confined to the problems of planning a limited area in a more or less complete and co-ordinated way, as for example, the planning of a residential subdivision, or of an industrial terminal district; or (3) it may deal with a limited class of problems in wider application as considered from the city planning standpoint, as for example, the planning of main thoroughfares or the distribution of schools and playgronds.

Almost any limited subject of discussion in city planning might be, so far as mere title is concerned, as appropriate for discussion in some other technical society as in the City Planning Institute, but such subjects will be discussed here always in their bearing on all the rest of city planning rather than in their bearing on the rest of highway engineering or of the educational system or other special technical field in which they happen to fall.

COST OF UTILITIES AND STREET IMPROVEMENTS AS AFFECTED BY THE SIZE OF RESIDENCE LOTS

By Morris Knowles
Consulting Engineer, Pittsburgh, Pa., and Windsor, Ont.

At the outset it should be understood that there are other factors affecting the size at which lots should be designed, in addition to street improvements and utilities. It will be advantageous therefore to present a brief statement of these other various factors, in order that phases which are considered in this paper may be co-ordinated with them. Such factors are:—

1. Cost of land.
2. Size and arrangement of rooms in house.
3. Certain improvements that lie within the boundaries of the lot, such as grading (which is affected by topography), planting, fences, hedges and house walks.
4. Desirability of a front yard to properly set off house and to establish privacy from passers on street.
5. Desirability of a side yard to ensure sunshine, proper ventilation, adequate fire protection and suitable approach to rear.
6. Desirability of a rear yard to provide space for clothes line, house garden, garage perhaps, and playground for the children.

Elements Not Related

There are elements, even of street improvements and utilities, that in no way are related to size of lot. For example:—

(a) Those divisions of utilities that lie outside townsite boundaries, as water supply plant, both pumping station and filtration units; sewage treatment and disposal plants; power plant to generate electricity; steam plant, in event houses are to be heated from a central heating station; and in some cases a gas plant, though it may be doubtful whether such a plant would be erected.

(b) Various trunk supply lines which lead from the respective supply plants to townsite. These include water supply trunk line; gas and steam trunk lines; electrical transmission line; and sewer outfall line.

(c) There are certain portions of street improvements and utilities lying even within boundaries of townsite which are not directly and immediately affected by size of lot. For example, those street improvements and utilities that lie directly in front of house and that parallel the depth of house. These portions of utilities and street improvements are more affected by size and arrangement of house than by dimensions of lot. Likewise, there are certain elements of house connections which are not affected by size of lot; for example, conections to mains, curb-boxes, stop cocks, meters and the portions of house services that lie within the street.

The foregoing elements bear an important relation to the cost of utilities, in so far as they affect cost per capita or cost per house, but they are not in any way related to size of lot.

A well defined statement regarding those portions of utilities and street improvements which directly relate to size of lots can now be made.

(a) They include street improvements and utilities located directly in front of the space lying between houses.

(b) Street improvements and utilities located on minor streets that lie parallel to space occupied by front yards and by rear yards.

(c) Lengths of house service connections which are located in front yards and in rear yards.

Assumed Townsite

In order to estimate relative costs, it will be necessary to assume a town layout. Following are the factors:—

An industrial town with 1,000 houses. Houses are 22 ft. wide and 30 ft. deep. Lots are 42 ft. front by 80 ft. deep. Houses are located on center line of lots and are placed 15 ft. back from front property line. Main streets are 50 ft. wide; minor streets 40 ft. wide. Main streets have 24-ft.

(Concluded on page 409)

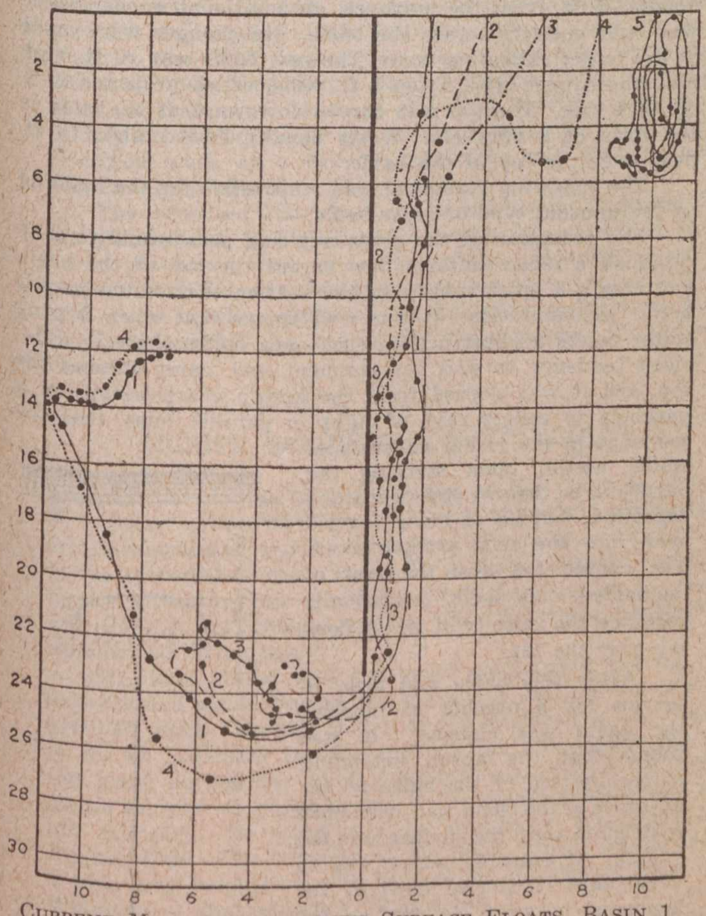
SOME OBSERVATIONS AND EXPERIENCES IN THE OPERATION OF COAGULATING BASINS*

By James Wadsworth Armstrong
Filtration Engineer, Water Works Department, Baltimore, Md.

THE two coagulating basins of the Montebello filters of the Baltimore water works are each 317 feet long, 232 feet wide and have an average depth of water of about 15 feet. A central baffle wall extends about three-quarters of the length of each basin. Water is admitted through five sluice gates, spaced at equal intervals, and, after passing around the baffle, is withdrawn through a similar number of gates. The water passes over a baffle at the entrance and over a skimming weir at the exit. It was the hope of the designer that the water would move with reasonable uniformity through the basins, but this has not been realized.

In the course of operation it was noticed that the movement of water through each of the two coagulating basins was different, although they were operated in parallel and apparently under the same conditions. It was also noticed that the water, while following characteristic lines in each basin, seemed to vary from time to time.

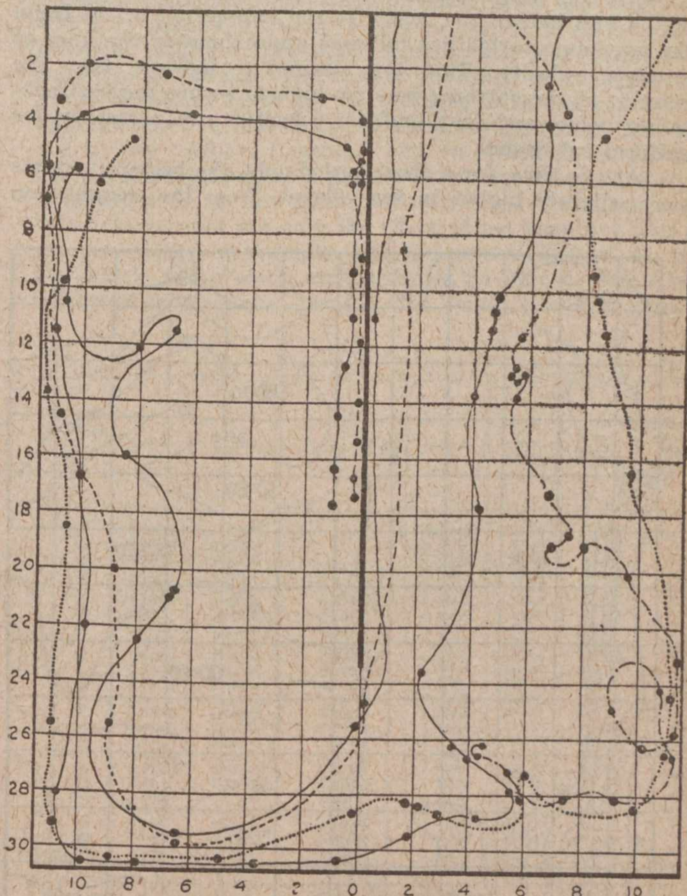
In order to learn something more definite regarding the exact movement of the water and its effect on the efficiency of the basins, a series of sixteen different current measurements was made. For making the observation, six identical



Current Measurements with Surface Floats, Basin 1
Readings of floats taken every five minutes; Venturi rate of flow, 123 m.g.d.; August 21st, 1917

aluminum floats were used. Each float was cross-shaped in plan, and was composed of four sheets of aluminum, each 6 by 12 ins., inserted in a pine strip. The floats were just heavy enough to half submerge a large cork, to which a number was pinned. The portions of the floats exposed to the wind were very small, and, as the observations were not made on windy days, it is believed that their movements indicate the currents through the basin with reasonable accuracy. Most of the observations were made with the floats submerged just below the surface or 4 ft. below.

The floats were started at the entrance of the basin, and readings were taken, locating their position, every six minutes. The floats in the main channel, both surface and at the 4-ft. depth, generally moved forward at relatively high velocities, while those along the outer edges of the basin



Current Measurements with Surface Floats, Basin 2
Readings of floats taken every five minutes except first reading on each float, which had six minutes interval; Venturi rate of flow, 128 m.g.d.; August 14, 1917

moved in very erratic ways, sometimes getting caught in eddies in the corners and staying there for hours. Basin 1 usually showed an eddy at the entrance in the north-west corner, probably due in part to a slight difference in the alignment of the baffle. Basin 2 showed no eddies at the entrance, but both basins showed eddies in the far corners and usually along the outlet side of the baffle wall.

On August 14th, 1917, surface floats were used for making current measurements in Basin 1. The velocity of the floats varied considerably. Some of them moved *forward* at rates as high as 32 ft. per minute. On the outlet side of the baffle, two of them were carried *backward*, adjacent to the baffle, for three-quarters of its length. On August 18th, 1917, the basin was cleaned, and on August 21st other surface float measurements were made. On this occasion the floats moved along entirely different lines. One of them circled around in the north-west corner, the other four moved slowly along the baffle wall at velocities of from 2 to 12 ft. per minute, and on the outlet side of the baffle showed no decided forward movement.

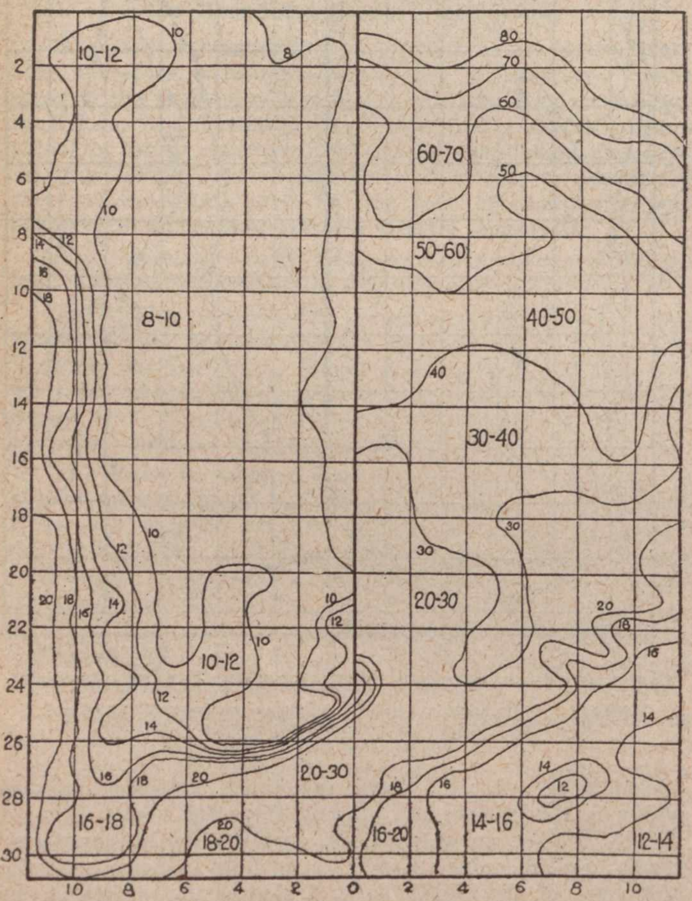
The greater velocity and more uniform movement of floats on August 14th was due to the fact that mud had filled the lower part of the basin, necessitating higher surface velocities. Most of the float measurements showed that higher velocities were obtained near the baffle wall on the incoming side and the outer wall on the outgoing side. A survey of the mud surface just before cleaning showed that the heaviest

*Paper presented to the American Water Works Association.

deposits followed approximately the lines of maximum velocity of flow, and that the greatest depth of deposit was at a point a little over 50 ft. from the entrance. The corners where eddies occurred had the least depth of mud.

On August 16th, 1917, two days before cleaning the basin, a turbidity survey of Basin 1 was made. Readings were taken at intervals of 10 ft. with a United States Geological Survey turbidity rod. The heaviest turbidities were observed at the entrance, and from there they decreased along pretty well defined but irregular lines toward the rear of the first half of the basin. In the second half of the basin the maximum turbidities followed approximately the lines of greatest velocity. This test seemed to indicate that the velocity at the entrance was too high to secure the best subsiding value, and that uniform velocities are necessary for uniform subsidence.

At one time, for a short period only, the bacterial counts were slightly higher in the effluent from the coagulating basins than in the raw water. The increase of growth in the basins led to the belief that bacteria were multiplying in the places where the currents were sluggish and were being gradually swept into the main current and carried to the filters.



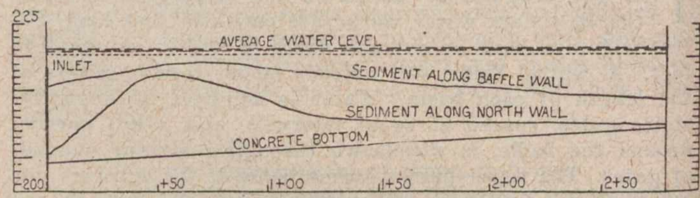
Surface Turbidity Measurements, Basin 1

Readings taken with U. S. G. S. turbidity rod ; Venturi rate of flow, 115 m.g.d. ; August 16th, 1917

In order to test the accuracy of this theory, several careful bacterial surveys were made. Numerous samples were taken at points showing the greatest difference of turbidity and velocity. One set was taken near the surface and another at a depth slightly above the mud line. The samples taken near the entrance of the basin showed slightly higher counts than those taken at other places, but none of the results showed any evidence of increased growth in any part of the basin.

In addition to the variations in velocity and the lack of uniformity in mud deposits, other irregularities were noticed in the functioning of the basins. As an illustration, it was noted on one occasion that Basin 1 gave decidedly better results than Basin 2, but upon making a slight change in the opening of one of the inlet gates, the condition was shortly reversed and Basin 2 gave markedly better results than Basin 1.

This phenomenon raised the question as to the possible effect of undercurrents upon the subsiding value of the basins. It was argued that if the elements of water in moving through the basin could be kept in nearly parallel lines, and if the movement could be confined to the surface of the water, leaving the lower stratum undisturbed, much greater subsiding value could be obtained.

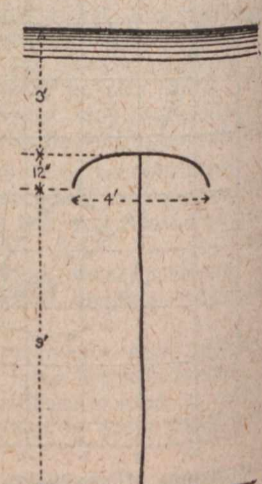


Sediment in Basin 1 on May 25th, 1916

With the purposes of testing out this theory, some modifications were made in the existing entrance baffle, and an additional cross-baffle was built in Basin 1. In order to give a positive outward sweep to the water entering the basin, increase the surface velocity and prevent returning undercurrents, a wooden apron about 2 ft. wide and sloping in an upward direction, was attached to the top of the existing entrance baffle. At the end of the existing concrete baffle, about 240 ft. from the entrance, an additional wooden baffle was built entirely across the basin. No changes were made at the outlet skimming weir. The new baffle was 10 ft. high and was capped with a top 4 ft. wide, which projected 2 ft. on each side. The top was curved downward at the ends in the form of a parabola. Water usually flowed about 3 ft. deep over the top of the baffle.

The following reasoning was responsible for the building of the unusual type of cross-baffle:—

The reduction of the cross-sectional area would tend to establish a more uniform flow across the top of the basin and create a quiet zone near the bottom that would permit better sedimentation. It was well known that when flowing water meets an obstruction, such as a baffle, there is a decided tendency to pick up sediment and carry it over the top, and it was argued from the known characteristic of a parabola to reflect rays of light in parallel lines that the sediment in the rising currents of water would, upon striking the parabola, be thrown downward and deposited, instead of being carried over into the next compartment. The curved top over the rear of the baffle is only useful in gradually reducing the velocity of water flowing over the top.



Wooden Baffle Across Basin 1

After this baffle had been in service for a number of months, the basin was cleaned. It was found that the apron extending across the top of the baffle at the entrance of the basin had been built a little too near the surface, and the velocity of entering water was so great that it carried most of the sediment outward as far as the cross-baffle. The results at the cross-baffle, however, were most gratifying. The parabolic top had evidently acted exactly as had been anticipated, for the mud was deposited adjacent to the baffle, almost to its full height, and sloped gradually backward to the entrance of the basin. The baffle on the return side had not performed so well, probably owing to the fact that the water in passing over it was not flowing in a direction normal to its face. It is believed that if this baffle had been placed about 70 ft. nearer the outlet it would have worked better.

As soon as the opportunity is afforded, the apron controlling the incoming water will be lowered so as to decrease the velocity at the entrance, and the baffle on the outgoing side will be removed forward. It is hoped that then the sediment will be deposited more uniformly.

This hopeful but imperfect experiment is made public with the thought that it may stimulate others to make further experiments or lead them to publish information which they already have.

COUNCIL OF THE ENGINEERING INSTITUTE SUPPORTS BILL CLASSIFYING CIVIL SERVICE

It has been decided by the council of the Engineering Institute of Canada that it is advisable to support the bill, now before the Dominion parliament, relating to the reclassification of the civil service of Canada, at least to the extent that this bill affects the engineering profession.

This decision was reached despite considerable dissatisfaction with the proposed classifications and remunerations. It was feared that any concerted opposition to the bill would mean that it would not be passed in any form at all this session, and possibly not for many years.

Recommendations have been made to the Civil Service Commission by the deputy ministers of the various departments, and those recommendations have been taken into consideration, and many changes will be made in the bill as a result. Although it is not clear that the recommendations will be accepted in full, the necessary machinery has been provided for dealing with individual cases. An advisory board to the Civil Service Commission has been appointed, and it is understood that a board of appeal will be constituted, so that any decision of the Civil Service Commission (acting on the advice of the advisory board or upon representation made by a deputy) regarding any classification, may be appealed and reconsidered.

The proposed bill elevates the engineers employed by the government, giving them a certain status which they never previously had, and also in the majority of cases grants increased remuneration, and for these reasons it is now urged by the council of the Engineering Institute that the proposed bill be supported by engineers throughout Canada.

LIGNITE BRIQUETTES NEXT AUGUST

Final decision as to the location of the plant to manufacture briquettes from the lignite deposits in south-eastern Saskatchewan and south-western Manitoba will be made in the immediate future, states R. A. Ross, chairman of the lignite utilization board, which held its first session in western Canada two weeks ago in the Manitoba legislative chamber at Winnipeg.

Mr. Ross stated that the board would visit the lignite deposits and would discuss the matter of the location of the $400,000 plant. He said that it is the intention of the board to let all contracts for the construction and equipment of the plant during the coming winter, construction to commence as soon as possible, and if the plans of the board do not miscarry, the plant will be producing briquettes by August, 1920. The capacity of the plant will be 30,000 tons a year and briquettes will be sold to the coal dealers in Winnipeg at approximately $9.40 a ton.

The briquettes will be made from coal supplied by the mines now operating in the district and the board will probably pay $1 a ton for this very poor grade of lignite. If the lignite is not available from the mines, the board will undertake mining operations.

When asked by Hon. T. H. Johnson how the board would fill the demand for briquettes if the demand is in excess of the supply, Mr. Ross replied that that is a political question. Mr. Johnson afterwards explained that the point upon which he was seeking information is whether the board will make a fair distribution of the product, under such conditions, between Manitoba and Saskatchewan.

PRESSURES IN PENSTOCKS CAUSED BY THE GRADUAL CLOSING OF TURBINE GATES*

By Ford Kurtz
Muscle Shoals, Ala.

Mr. Gibson has made a valuable addition to the too few and scanty English treatises on the mathematical theory of water-hammer. His treatment of the subject, however, is chiefly of value in obtaining, without the use of differential equations and from physical laws the import of which is readily grasped, formulas which give the same practical results as the much simpler and less cumbersome equations of Lorenzo Alliévi, first published in Rome, in 1903. These equations must not be confused with the confessedly approximate and inadequate formula designated by Mr. Gibson as the "Alliévi formula," and on which R. D. Johnson has apparently founded a pressure-time equation. The equations referred to are mathematically rigid formulas which take into account not only the effect of net head but also the compressibility of the water and the extensibility of the pipe and which, so far as the writer knows, have never before been published in English. In 1911, the writer prepared, for his

Table 1

Interval in terms of $\frac{2L}{a}$	$\phi(t)$	$\frac{F(t)}{H_0}$	$\frac{f(t)}{H_0} = \frac{F\left(t-\frac{2L}{a}\right)}{H_0}$	$z-1$	h_t, Alliévi	h_t Gibson	Percentage of divergence.
0	1.00000	0.00000	....	0.00000	0.00	0.00	.....
¼	0.95833	0.07338	....	0.07338	12.10	12.12	0.16
½	0.91667	0.15476	......	0.15476	25.53	25.53	0.00
¾	0.875	0.24503	....	0.24503	40.43	40.41	0.05
1	0.83333	0.34550	0.00000	0.34550	57.01	56.96	0.09
¼	0.79167	0.49780	0.07338	0.42442	70.03	69.94	0.13
½	0.75	0.66286	0.15476	0.50810	83.84	83.72	0.14
¾	0.70833	0.84160	0.24503	0.59657	98.43	98.31	0.12
2	0.66667	1.03529	0.34550	0.68979	113.82	113.63	0.17
¼	0.625	1.26152	0.49780	0.76372	126.01	125.78	0.18
½	0.58333	1.50125	0.66286	0.83839	138.33	138.05	0.20
¾	0.54167	1.75454	0.84160	0.91294	150.64	150.32	0.21
3	0.5	2.02152	1.03529	0.98623	162.73	162.42	0.19
¼	0.45833	2.30592	1.26152	1.04440	172.33	171.97	0.21
½	0.41667	2.60055	1.50125	1.09930	181.38	181.10	0.15
¾	0.375	2.90456	1.75454	1.15002	189.75	189.43	0.17
4	0.33333	3.21686	2.02152	1.19534	197.23	196.77	0.23
¼	0.29167	3.53609	2.30592	1.23017	202.98	202.49	0.24
½	0.25	3.86010	2.60055	1.25955	207.83	207.14	0.33
¾	0.20833	4.18755	2.90456	1.28299	211.69	211.00	0.33
5	0.16667	4.51715	3.21686	1.30029	214.55	213.79	0.35
¼	0.125	4.84719	3.53609	1.31110	216.33	215.75	6.26
½	0.08333	5.17707	3.86010	1.31697	217.30	216.71	0.26
¾	0.04167	5.50630	4.18755	1.31875	217.59	216.95	0.28
6	0.00000	5.83293	4.51715	1.31578	217.10	216.57	0.23
Average percentage....	....	....	....	....	....	....	0.20

own use, a translation of a German translation of Mr. Alliévi's work, and found the latter's treatment so remarkably comprehensive and thorough that he has used it ever since in all water-hammer problems. The German translation† can be found in the Engineering Societies Library.

In presenting the exact formulas of Alliévi, the following nomenclature will be added to that of Mr. Gibson's paper:

$R_0 = aV_0/g$ = excess, or water-hammer, head due to instantaneous complete closure of gate.

$m = aV_0/gH_0$ = ratio of instantaneous water-hammer head to net head.

$F(t)$ and $f(t)$, or simply F and f = certain functions of time, t.

$z = (H_0+h_t)/H_0$ = ratio of total variable head to net head.

$\phi(t)$ = gate-opening at time, t, as a ratio of maximum gate-opening.

The exact formulas of Alliévi contain a term which makes it possible to determine the pressure at any point of the pipe line at any moment, but the writer is presenting only the simple form for determining pressure at the outlet,

*Discussion (presented to the American Society of Civil Engineers) of Norman R. Gibson's paper (see September 4th and 11th issues of *The Canadian Engineer*).

†"Allgemeine Theorie über die veränderliche Bewegung des Wassers in Leitungen," von Lorenzo Alliévi, 1909.

or discharge section just up stream from the gate, as that is the problem investigated by Mr. Gibson. It is also assumed that the pipe line is of uniform thickness and diameter throughout its length. Then, during the period,

$0<t \leq 2L/a$,

$z = 1+F(t)/H_0$,

where

$F(t)/H_0 = m+\frac{1}{2}m^2[\phi(t)]^2-m\phi(t)\{1+m+\frac{1}{4}m^2[\phi(t)]^2\}^{\frac{1}{2}}$.

and, during the period,

$2L/a<t \leq T$,

$z = 1+F(t)/H_0-F(t-2L/a)/H_0 = 1+F(t)/H_0-f(t)/H_0$,

where

$F(t)/H_0 = m-f(t)/H_0+\frac{1}{2}m^2[\phi(t)]^2-$
$m\phi(t)\{1+m-2f(t)/H_0+\frac{1}{4}m^2[\phi(t)]^2\}^{\frac{1}{2}}$.

For the linear law of gate movement, $\phi(t) = 1-t/T$, as already stated by Mr. Gibson.

These formulas applied to Mr. Gibson's first example give the following equations:—

For $0<t \leq 0.35$ sec.,

$F(t)/H_0 = 10.35008+53.56185\phi^2-$
$10.35008\ (11.35008\phi^2+26.78092\phi^4)^{\frac{1}{2}}$

and, for $0.35<t \leq 6.0$ sec.,

$F(t)/H_0 = 10.35008-f(t)/H_0+53.56185\phi^2-$
$10.35008\{[11.35008-2f(t)/H_0]\phi^2+26.78092\phi^4\}^{\frac{1}{2}}$.

As already noted by Mr. Gibson, the values of $F(t)/H_0$ and $f(t)/H_0$ are so small compared with some of the individual terms of the equations, that it is necessary to use logarithms in solving the equations.

Using the exact Alliévi equations as given previously, Table 1 has been prepared, showing the rise of pressure and also the differences between the values of the rise obtained by Alliévi equations and those obtained by Mr. Gibson's equations. The maximum divergence of less than one-half of 1% shows the remarkable agreement of the two methods. It is apparent, however, that the simplicity of the solution by the Alliévi formulas, without giving heed to magnitude and direction of waves in the computations, makes it far superior to that of Mr. Gibson as a working method.

The exact formulas of Alliévi also furnish equations similar to those given previously for the case of the opening of a valve at the lower end of a pipe line, either from fully closed position, or from some initial partial opening. As already stated, in their complete form they also give the pressure at any time for any point along the pipe line, thus covering the matter mentioned by Mr. Gibson as to be discussed by O. V. Kruse.* Of course, there are also exact equations for the velocity at any time for any point along the pipe line.

The partial differential equations for the general motion of water in pipes are based on the fundamental differential formulas for the motion of water in general. Unfortunately, these partial differential equations, four in number, cannot be integrated (not even by approximate arithmetic integration so far as the writer knows) without making the following simplifying approximations:—

1. Velocity in direction of axis of pipe considered uniform over any chosen section of the stream.
2. Skin friction and viscosity neglected.
3. Velocities at right angles to the axis of the pipe, due to expansion or contraction of the pipe by changes in pressure, neglected.
4. Pressure considered uniform over any chosen section of the stream.
5. Assumed that the pipe consists of individual circular elements independent of each other, which are freely extensible.
6. Assumed that the ratio of velocity of water in the pipe to the velocity of propagation of pressure changes is small enough, compared with unity, so that its addition thereto or subtraction therefrom can be neglected in every case at every instant.

By making these approximations, we obtain the so-called exact formulas of Alliévi.

*See *The Canadian Engineer*, October 9th, 1919, p. 370.

Mr. Gibson's method of taking account of skin friction (which is only approximate, as has been pointed out by William P. Creager), could easily be applied to the exact Alliévi formulas by changing the factor m so as to have it correspond at all times to (H_0+h_t) instead of to H_0.

The exact Alliévi formulas can be applied so as to take account of varying diameters and thicknesses of pipe in the same line, but they soon lead to so much complication that they become impracticable. In such cases, the writer uses the formulas as already given for a pipe of uniform diameter and thickness, but gives to m the value, $Q_0\Sigma(L/A)/gH_0\Sigma(L/a)$, where Q_0 equals the flow of water in a pipe at full gate-opening, L equals the length of any section of pipe, A, its cross-sectional area, and a, its individual value of the velocity of propagation of pressure changes. Also the factor, $2L/a$, must everywhere be changed to read $2\Sigma(L/a)$. This is confessedly an approximation made without mathematical proof, but it is probably exact enough for practical purposes in the majority of problems.

U. S. WATER POWER LEGISLATION

EFFORTS are being made by the engineers of the United States to obtain some measure of improvement in the water power legislation of that country. A circular letter has been drafted by the Water Conservation Committee of the U.S. Engineering Council and is being sent to every U.S. senator. The letter, which was signed by Alfred D. Flinn, secretary of the U.S. Engineering Council, is as follows:—

"Engineering Council asks your consideration of H.R. 3184, 66th Congress, 1st Session, which provides for the development of water powers in the navigable streams and on the public lands in the United States. This bill has passed the House of Representatives and is now before the Senate.

"During the past ten years, water power development in the United States on the public lands and in the navigable streams has languished. A certain small amount of development has taken place under conditions over which the Federal Government has no authority, but the best and most feasible development sites require Federal consent. Bills suitably providing for such consent have been under debate for a decade and the one above referred to (H.R. 3184) is approved by the heads of the several Federal departments concerned and also by the President. Advocates of legislation who have been on opposite sides of the water power question are generally agreed as to the merits of this bill and it is believed that it is the best measure that has yet been before Congress with any chance of passage. Probably, those who are now in disagreement after ten years of study and debate would be in the same position ten years hence. Therefore, it is bad public policy to wait longer; also, detrimental to the public interest and to industrial development.

"The importance of water power development in stimulating all kinds of industry, especially manufacturing, and the vital necessity of conserving and economizing our fuel supply, which, in turn, would largely relieve our congested transportation facilities, are so generally recognized that they need not be here emphasized.

"We, as engineers, are aware that the penalties that the country has already suffered by reason of the embargo on water power development, and would suffer from the consequences of further delay, are greater than those which could possibly be produced by all of the defects claimed against the bill by its few remaining opponents.

"We therefore hope you will lend your influence in favor of the speedy passage of the pending measure."

One can obtain a good conception of the remarkable growth of the American Association of Engineers during the last year when it is known that the number of paid employees at the national headquarters has grown in that time from four to sixty.

COST OF UTILITIES AND STREET IMPROVEMENTS

(Continued from page 404)

paved roadway, 5½-ft. planting strips, combined concrete gutters and curbs, and 5-ft. sidewalks. Alleys are omitted. There are 24 houses in each block, making length of block 504 ft. and width 160 ft. There are approximately 42 such blocks in the townsite. Filtration plant and pumping station is assumed, two miles from townsite; sewage disposal plant, one mile away; and electric transmission line and gas trunk line each three miles long. Assumed that it will not be necessary to build electric plant or gas plant.

TABLE 1—ESTIMATE OF ASSUMED TOWNSITE

Item	Cost Per House	Percent of Total Cost	Including Overhead
House	$3,000.00	54.85	64.0
Land	336.00	6.14	7.2
Lot improvements	232.64	4.25	4.9
Street improvements	463.29	8.48	9.9
Water system	190.15	3.48	4.1
Electrical system	26.33	0.48	.6
Gas system	101.18	1.85	2.1
Sewers—Storm and sanitary	202.48	3.70	4.3
House connections	138.50	2.53	2.9
	$4,690.57		
Engineering and supervision at 10%	469.06	8.58	
	$5,159.63		
Interest at 6%	309.58	5.66	
	$5,469.21	100.00	100.0

It will be noted house is 64% of total cost, including distribution of overhead; land with lot improvements, 12.1%; street improvements, 9.9%; water, electrical, gas and sewer improvements, with house connections, 14%. Engineering, supervision and interest charges, which are distributed in these statements, are 14.24% of the whole.

Figures shown in Table 2 are cost per lineal front foot of side yard and per lineal foot depth of front and rear yards. Costs per lineal foot lot frontage and depth would be greater, as cost of house meters, shut-off valves, etc., would be included in this cost.

TABLE 2—COST OF UTILITIES AND STREET IMPROVEMENTS PARALLEL TO YARD SPACE

	Cost for Length Parallel to 20-ft. Side Yard	Cost Per Lin. Front Foot of Side Yard	Cost for Length Parallel to 50-ft. Front and Rear Yard	Cost per Lin. Foot Depth of Front and Rear Yard
Street improvements	$178.60	$ 8.93	$ 55.00	$1.10
Water system	36.40	1.82	13.00	.26
Electrical system	4.20	.21	.00	.00
Gas system	17.40	.87	6.50	.13
Sewers — Storm and sanitary	54.00	2.70	17.00	.34
House connections	.00	.00	32.50	.65
	$290.60	$14.53	$124.00	$2.48

Results in Table 2 show that if space between houses on main streets is increased one foot, cost of utilities and street improvements per house is increased $14.53. If front or rear yard is increased one foot in depth, cost of street improvemnets and utilities per house is increased $2.48. These computations bring out the interest fact that in so far as street improvements and utilities are concerned, 5.86 ft. can be added to depth of front or rear yard for same cost of adding one foot to width of side yard.

Assuming for sake of comparison a lot 42 ft. front by 80 ft. deep, the combined cost of land and lot improvements is equal to $568.64, or $13.54 per front foot. (See Table 1). If, for this lot, costs of main and minor street improvements and utilities are combined and quoted as cost per lineal front foot of side yard parallel to yard space, they equal $20.73 per lineal foot.

If the cost of land and lot improvements be combined with cost of utilities and street improvements on main street parallel to side yard, the cost per lineal front foot of side yard is $28.07. Assuming rents based on 10% return, rent for each front foot of side yard is 23 cents per month, of which 12 cents is for street improvements and utilities, and 11 cents is for land and lot improvements. This is the cost of air and sunshine, or $4.60 per family per month.

While no sweeping conclusions can be made, because we have discussed only one assumed townsite, it is interesting to note that cost per lot for "street improvements and utilities" is $1,121.93, compared with $568.64 for "land and lot improvements," the latter being 50% of former. If, however, we compare cost per front foot of those elements of street improvements and utilities directly related to size of lot, with cost per front foot of lot improvements and land, they are respectively $20.73 and $13.54, the latter being 65% of the former.

Some Suggestions

Following are some suggestions on economical design and construction:—

Use contour streets.
Grade lots and streets at same time.
Design street widths and pavements to meet demands of traffic.
Compare cost of reducing grades with cost of pavements suitable for steeper grades.
Do not make sidewalks unnecessarily wide.
Use combined gutter and curb.
Study relative merits of alleys and easements.
Study carefully location of utilities.
Use combined trenches where suitable.
Substitute direct sewer connections for catch basins.
Use combination manholes.
Connect roof leaders to gutters.
Omit storm sewers near summits of streets.
Install house connections at one time.
Carry house wire services on brackets attached to rear of house.

RULES OF PRACTICE FOR THE ESTABLISHMENT OF STREET WIDTHS AND THEIR SUBDIVISIONS

By B. A. HALDEMAN
Advisory Engineer, Zoning Commission, Philadelphia, Pa.

STREETS should be divided into the following four classes, based upon their immediate and future purpose and service: Main, secondary, minor and special service streets.

Main streets will form the principal routes for the immediate or future use of large volumes of mixed traffic moving between important centres within a community or from community to community.

Secondary streets will be those of lesser traffic importance, supplementing the main streets and serving to distribute mixed traffic to and from the latter and between centres of lesser importance.

Minor streets will be those laid out for purely local traffic use or to facilitate the subdivision or development of property.

Special service streets will be those designed and laid out for special purposes and restricted to special uses.

The General System

The location, width and subdivision, and also the grade, of main and secondary streets should be based upon their present and future value as traffic carriers. They will form the primary net of the street system and should be planned in advance of urban improvements as the controlling elements in the general development of the transportation and other circulatory facilities of the city and the adjacent region, and consideration should be had in their layout for the economic development of those facilities. At least a primary scheme of zoning for use should precede or accompany their layout.

Certain types of special service streets, particularly those designed to connect the units of a park system, should be laid out coincident with the traffic net.

With the net of main and secondary streets established, the areas lying between them may be subdivided by such system of minor or special service streets as may best serve the development of each particular area.

Street Widths

The width of a street shall be understood in all cases to mean the distance between the bounding property lines.

The width of main and secondary streets should be such as will adequately accommodate such classes and such volumes of traffic as are likely to be put upon them after the territory or region they serve shall be fully developed.

The width of minor streets should be such as will adequately care for local travel and service of abutting property.

As special service streets will be designed to serve special and particular uses, any attempt to standardize their widths would be futile.

Recommended widths are as follows:—

Main streets	108, 128 or 148 ft.
Secondary streets	60 or 80 ft.
Minor streets	12, 20, 40 or 50 ft.
Special service streets	Variable.

In cities and regions where the laying out of any considerable number of streets of a greater width than 80 ft. would be unwise, it is recommended that streets exceeding that width be placed in the special service class, the "secondary streets" classification eliminated, and the 60 and 80 ft. wide ones classed as "main streets."

Cross-Section Subdivisions

The unit width for a line of vehicles shall be 8 ft.

The unit width for a line of pedestrians shall be 2 ft.

The so-called "elastic" method should be employed in establishing and increasing the widths of subdivisions.

The roadway width of a street shall be the distance between curb lines, or between the centres of the gutters where there are no curbs.

No roadway for a single line of vehicles should be less than 8 ft. or more than 10 ft. wide.

Roadways to accommodate two lines of vehicles should be 20 ft. wide except that such roadways in minor and special service streets may be 16 or 18 ft. wide.

Roadways to accommodate three lines of vehicles should be 26 ft. wide.

Roadways to accommodate four lines of vehicles should be 36 ft. wide.

Any increase beyond a roadway width of 36 ft. should be made by adding an 8-ft. unit for each additional line of vehicles to be accommodated. Where the street is, or will be, occupied by street railway tracks, the unit should be undivided, but where there will be no tracks, the unit may be divided.

The minimum width of the space between the property line and the curb line, including width of the curb, should be as follows:—

On streets 40 ft. wide	11 ft.
On streets 50 or 60 ft. wide	12 ft.
On streets 80 ft. wide	14 ft.
On streets more than 80 ft. wide	18 ft.

Sidewalks and Planting Strips

The width of the paved footway on any street should not be less than 4 ft. Increases beyond that width should be by 2-ft. units or multiples thereof.

The planting strip between the property line and the nearest edge of the paved footway should not be less than 1 ft. wide on a 40-ft. wide street, or less than 2 ft. on a street of greater width.

The width of the planting strip between the curb line and the nearest edge of the paved footway, including the width of the curb, should in no event be less than 4 ft. in a street 60 ft. or less in width, or less than 6 ft., in a street of greater width than 60 ft.

Trees should be planted in such locations that they will not be disturbed by, or obstruct, any subsequent change in the curbs or paving.

Where dual roadways are laid, separated by a planting strip, the latter may be of variable width and the curbs adjacent to the sidewalk should be set in their permanent locations.

Where a central reservation for street railway tracks is established it should be at least 20 ft. wide.

The following are suggested typical widths and arrangements of cross-section subdivisions. (Figures indicate widths in feet):—

	40-ft. Streets.			50-ft. Streets.		
	(a)	(b)	(c)	(a)	(b)	(c)
Planting strip	1	1	1	2	2	2
Paved footway	4	6	4	4	4	6
Planting strip	6	4	5	9	6	4
Roadway	18	18	20	20	26	26
Planting strip	6	4	5	9	6	4
Paved footway	4	6	4	4	4	6
Planting strip	1	1	1	2	2	2
	40	40	40	50	50	50

	60-ft. Streets.			80-ft. Streets.		
	(a)	(b)	(c)	(a)	(b)	(c)
Planting strip	2	2	2	2	2	2
Paved footway	4	4	6	4	6	6
Planting strip	14	11	4	21	14	6
Roadway	20	26	36	26	36	52
Planting strip	14	11	4	21	14	6
Paved footway	4	4	6	4	6	6
Planting strip	2	2	2	2	2	2
	60	60	60	80	80	80

	108-ft. Streets.			128-ft. Streets.			148-ft. Streets.			
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(d)
Planting strip	6	4	2	6	4	2	6	4	2	2
Paved footway	4	6	8	4	6	8	4	6	8	8
Planting strip	8	8	8	8	8	8	8	8	8	8
Roadway	20	26	26	20	26	36	20	26	36	44
Reservation	32	20	20	52	40	20	72	60	40	24
Roadway	20	26	26	20	26	36	20	26	36	44
Planting strip	8	8	8	8	8	8	8	8	8	8
Paved footway	4	6	8	4	6	8	4	6	8	8
Planting strip	6	4	2	6	4	2	6	4	2	2
	108	108	108	128	128	128	148	148	148	148

ZONING

By Edward M. Bassett
Chairman, Zoning Committee, New York City

The subject should be called building zoning, the boards zoning boards or commissions. In laws and ordinances, the word "zoning" should be used in the title and the word "districts" in the body of the law to specify the areas affected. The word "zoning" is sufficient when city planning is under discussion.

Zoning is the creation by law of districts in which regulations differing in different districts prohibit injurious or unsuitable buildings and uses.

Zoning should be done under the police power of the state and not by condemnation.

Before attempting zoning, a city should obtain the power to do so from the state legislature. The essential statement in such donation of power is that the city may impose different regulations for buildings and for the uses of land and buildings in different districts.

Enhancement of value alone, or aesthetics alone, is not a proper basis for zoning when done under the police power.

Zoning is part of the city plan and should be applied to land at least as early as the street layout is adopted.

Zoning when applied originally to existing cities should be adapted largely to existing facts and normal tendencies.

In the same city, localities having substantially a like character and situation should be zoned in the same manner. This principle should prevent preliminary, emergency, piecemeal or partial zoning.

Zoning should be sufficiently permanent to protect those who comply with the law, but at the same time should be susceptible of change by the municipal legislature under strict checks, so that it can be altered to harmonize with the city's growth.

Provision should be made that property owners may initiate changes or restrict the freedom of the municipal legislature to make specific changes, but the actual application of the zoning regulations to the land, and any changes therein should rest with the municipal legislature and not with the property owners.

Zoning regulations may properly be supplemented by restrictions in deeds based upon purely aesthetic reasons or for the purpose of creating a uniform residential development.

Outside of Zoning's Scope

Regulations applicable to all buildings of a class, regardless of location, such as relate to plumbing, strength of material, safety devices, or protection of employees against fire, should not be placed in a zoning law. They are properly part of a housing law, factory law or building law. Only those requirements which differ in different districts enter into a zoning law.

Zoning by the exercise of the police power of the state must relate to the health, safety, morals and general public convenience of the community. It follows, therefore, that police power zoning must be confined to police power reasons such as fire risk, lack of light and air, congested living quarters and disease-promoting conditions. The preventive regulations based on these reasons, which necessarily must be applied differently and in different measure in different districts, naturally group themselves into zoning according to use, according to height of buildings, and according to bulk, arrangement or area of lot covered by buildings. Zoning could properly go further and embrace building material requirements, commonly called fire limits, fireproof construction, uniform setbacks and doubtless other classes of regulations.

Use districts are residence, business, light industry and heavy industry. Use districts should be few. The more minute adaptation to local needs should be provided for in the area and height zoning, and by permitting special uses under conditions stated in the ordinance or under the administration of a board of building exceptions. Districts described as one-family, two-family, attached house or apartment house, have no intimate relation to the police power and are apt to invite criticism by the courts.

Pressure on Non-Conforming Structures

Where zoning regulations apply only to new buildings (as is the safer practice), non-conforming uses should be placed under a constantly pressing incentive to become conforming through time and changes.

(a) The structural alterations made in a non-conforming building should in no case exceed one-half its value, nor should the building be enlarged, unless its use is changed to a conforming use.

(b) In a residence district, no building or premises devoted to a use permitted in a business district should be changed into a use excluded from a business district.

(c) In a residence or business district, no building or premises devoted to a use permitted in a light industry district should be changed into a use excluded from a light industry district.

(d) In a residence, business or light industry district, no building devoted to a use excluded from a light industry district should be structurally altered if its use shall have been changed since the time of the passage of the ordinance to another use also excluded from a light industry district.

(e) In a residence, business or light industry district, no building devoted to a use excluded from a light industry district should have its use changed to another use which is also excluded from a light industry district if the building has been structurally altered since the time of the passage of the ordinance.

In business and industry districts, towers without limit as to height should be allowed to occupy not over one-quarter of the lot area and they should be allowed on the street line all the way up. They should, however, stand away from side lines according to a suitable rule.

Height limitations should have a relation to street widths. A city, which has no buildings over 150 ft. in height, should allow none over that height.

Included in area limitations, there should be a limitation of families per acre extending from 140 families in the most thickly populated districts to 18 in parts of the suburbs. This regulation should also refer to the arrangement of the buildings and their adaptation for housekeeping units.

An administrative board should have power (a) to rectify on appeals the mistakes of building superintendents in passing on applications for permits; (b) to decide borderline and exceptional cases where specified in the ordinance; (c) to vary the literal requirement of the law where unnecessary hardship is caused and the intention of the law may be equally accomplished by an alternative method to be prescribed.

Not only should the powers of such a board be specified in the ordinance, but the state legislature should authorize the local legislature to create such a board and to delegate powers to it in the ordinance. It is prudent to have the ordinance prescribe a rule of conduct for such a board, as for instance that where unnecessary hardship is caused by the strict adherence to the ordinance, the board may vary the requirement in order to carry out the general purpose of the law in an equally safe or sanitary manner.

CONCRETING IN COLD WEATHER OFFERS STRONG ADVANTAGES TO OWNERS

By A. E. Wells
President, Wells Bros. Construction Co. of Canada, Ltd.

On the verge of winter; construction blocked in hundreds of cities; a shortage of many materials of construction and of labor; and yet withal, an acute shortage of homes, offices, stores and—in many cities—of office buildings, factories and warehouses,—what is the answer?

The answer lies in winter construction, in proceeding with work during December, January and February, which have been normally "closed" months. Winter work is not new. It has been practised for years, its safety adequately demonstrated, its economy proved. It should be more generally practised.

Any owner who, through prosecuting work during cold weather, can get occupancy of factory or warehouse, or can lease apartments, offices or store space on May 1st, stands to gain far more than the added costs of winter work.

Not only the owner, but builder, engineer and architect, gain. There is financial loss to the contractor who breaks up his trained organization, only to build it again in the spring. New men must take time to accustom themselves to working together and owners pay the bill in increased costs. Architects' and engineers' offices are frequently idle through much of the winter. Building superintendents have nothing to do and owners pay for unproductive overhead.

Perhaps the best way, then, to reduce the cost of building is to keep architects', engineers' and contractors' forces busy twelve months of the year.

Why Does Construction Stop?

Primarily the reason why building has been inactive in winter is that concrete does not harden so rapidly when its temperature hovers near freezing. But we heat our homes, offices and stores, and coal is a comparatively small operating cost. We are to-day able to enclose a structure, warm it with simple coke stoves, heat aggregates prior to mixing with Portland cement, and keep the concrete or mortar warm until hardening has occurred.

Without these precautions, cold weather work is impossible but the precautions are simple and reasonably inexpensive. Why not do the logical thing and consider the winter as an open season for all but the most exposed class of construction?

Our organization has continued to lay brick and place concrete under zero temperatures in Canada. A part of our normal equipment is sufficient tarpaulins to enclose practically any structure and sufficient salamanders or coke stoves to keep such enclosures warm. Boilers of any type, frequently those used to furnish steam for hoisting, supply live steam for heating aggregates and water, and for thawing snow and ice from forms and reinforcing steel.

While a heavy snow may temporarily delay the delivery of materials, yet deep snow is seldom encountered. It is temperature alone that commonly hampers work, and temperature need not be feared.

Plant Layout for Winter

In laying out a plant for handling concrete in winter, or where the work is likely to run on into winter before completion, there must be provision for the proper heating of materials and water. In case of sand and gravel in open storage piles, it is only necessary to lay a grid of steam pipes under the material piles and place a tarpaulin over the pile. From one main through the centre, branches should extend in both directions every 6 ft. These branches should be drilled with ⅛-in. holes spaced about 18 ins. apart. Several hundred yards of material stored in one pile can be heated in this way with the steam from an ordinary hoisting boiler. Several days prior to concreting, steam should be turned into the pile during working hours, which will be sufficient, except at times of extreme cold, to maintain the necessary temperature.

When material is stored in bins, a series of pipes should be laid on the floor of the bins, feeding from a main pipe at the top of the sloping floor. Steam radiates through the entire contents of the bin and if a canvas cover is pulled over the top when work is stopped at night, the material will retain its heat except in very cold weather, when a small amount of steam may be needed at night.

It is necessary also to heat mixing water, and a steam line running directly into the water tank is the customary way; a 1-in. line being sufficient to heat water for a 1-yd. mixer.

But concrete poured into forms exposed to cold would lose its heat before hardening had progressed sufficiently. Forms must, therefore, be protected and the most satisfactory means is a complete canvas enclosure, with salamanders or coke stoves to maintain a temperature of 45 degs., or over, within. Several hours before concrete is poured, salamanders are started in the story below the forms, unless that story is already heated. Immediately after pouring, a sufficient number of salamanders are placed above the new concrete to ensure its safe and thorough hardening. These will furnish heat for the floor above.

This method of enclosure and heating necessitates that the form work for the floor above that being poured shall be in place, in order to serve as a roof under which concrete may be kept warm; although in the case of steel frame structure, it may be possible to support canvas upon the steel because of the floor above.

Posts Set Upon Blocks

Forms for the story above are supported as usual, upon posts, but since the floor slab of the story supporting these posts is not yet poured, it is customary to set the posts upon concrete blocks of the proper depth, so that upon pouring, the block becomes a part of the finished floor. This requires setting blocks to grade and finishing their upper surface.

It is, of course, necessary that the workmen be watched somewhat more carefully on winter work. Snow or ice in the forms is detrimental to good work. Careful inspection is necessary at every stage of the work, but slipshod methods are probably no more likely to affect quality in winter than in summer.

Where the enclosure in canvas is comparatively complete, workers operate at practically normal efficiency, but there are some delays likely to occur through slow delivery of materials during periods of snow. Yet the added costs are more than compensated for by the certainty of quicker occupancy and reduction of interest on money tied up in the incompleted building. It would seem folly to cease work on a structure where there is need of early use.

FEDERAL CEMENT CO., OWEN SOUND

PUBLIC offering will soon be made of $1,000,000 six per cent. first mortgage bonds of the Federal Cement Co., which will operate at Owen Sound, Ont., it is said, but which is incorporated under the laws of the State of Delaware. This issue, it is understood, will be offered to the public at par and interest, with a bonus of 50% of common stock, by a Chicago financial concern.

The officers of the Federal Cement Co. are: J. G. Lind, vice-president of the St. Mary's Cement Co., president; J. E. Murphy, vice-president of the Vancouver Portland Cement Co., vice-president; J. E. Campbell, secretary-treasurer of the Hepworth Mfg. Co., Hepworth, treasurer; A. D. Creasor, of Owen Sound, secretary; with whom L. N. Rosenbaum, president of the Knickerbocker-Wyoming Oil Co., New York, will constitute the board of directors.

The Federal Cement Co. has contracted to acquire the plants formerly operated by the Union Cement Co. and the Imperial Cement Co. at Owen Sound, it is stated, and plans to remodel them to a capacity of 2,000 barrels daily.

$500,000 RESERVOIR FOR WINNIPEG

NOW that the $15,000,000 water scheme for Greater Winnipeg has been brought to a successful conclusion, that city must at once plan for a reserve supply in case of breakdown in any portion of the 100-mile aqueduct between Winnipeg and Shoal Lake, according to an official report which W. G. Chace, chief engineer, has submitted to the Greater Winnipeg Water Board.

This reserve has been figured on before and from time to time discussion upon it has been allowed to drop. Now, however, Mr. Chace says that the time has come for the board to authorize preparation of the plans, with the idea of completing the whole undertaking next summer. Along with the under-drainage, which experts have agreed is necessary, there will be considerable work to be carried out near Deacon as soon as the frost is out of the ground next year.

This reserve plan is a part of the original scheme as recommended in 1913 by the consulting engineers, Rudolph Hering, F. P. Stearns and J. H. Fuertes.

Deacon, about ten miles from Winnipeg, is where the reservoir will be built. It will have a capacity of 250,000,000 gallons, or, on present needs, a reserve supply sufficient to last 20 days.

The cost of the reservoir is estimated at approximately $500,000.

"Winnipeg and district have now the finest water supply anywhere on the North American continent," says Mr. Chace. "But Winnipeg will need a large reserve to be at all safe. If anything should happen to the aqueduct, we would be up against it within two days."

Asked if the city could not go back to the well system in case of emergency, Mr. Chace replied that the reservoir at Deacon has to be constructed sooner or later and the district might just as well do it next year as at any other time. Its maintenance cost would be negligible after construction, he says. Moreover, the wells formerly used could not be placed in shape again without a heavy expenditure, leaving out of consideration the disadvantage of again having to use hard water.

"This will be one of the best opportunities to provide work next summer that the city and district could wish for," says Mr. Chace.

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PRINCIPAL CONTENTS

QUEBEC MUNICIPALITIES' ENGINEERING BUREAU

ENGINEERS in private practice are viewing with alarm the growing tendency of governments and public commissions to offer "free" or "at cost" engineering services. The latest addition to the official or semi-official bureaus of engineering information—or, as sometimes happens, misinformation—is in connection with the new Union of Quebec Municipalities, which is to be launched at a meeting in Montreal toward the end of next month or early in December.

At a meeting held last month, thirty Quebec mayors or their representatives attended and appointed a committee to draw up a constitution and operating program. The plan of the association has now been prepared and is to be submitted at next month's meeting, to which twelve hundred Quebec municipal officials will be invited. In commenting upon the new Union, the Montreal Gazette says:—

"One feature of the Union, the constitution of which is drafted after those of the sister provinces, is the creation of a special bureau of consultation for all legal, engineering and accounting matters pertaining to municipalities, a feature which is an improvement on all the existing provincial unions."

The advantages of an engineering bureau of the sort proposed for the Union of Quebec Municipalities, are dubious. Assuming that the appointments to the staff of the bureau are kept out of politics, and that the men selected are very capable engineers of high integrity and great capacity for work, the experiment is still doubtful. Any employe of such a bureau tends to get into certain grooves of practice and to develop "hobbies." All work is standardized along certain lines of established practice and there is likely to be extreme reluctance to adopt new ideas. The municipalities are deprived of the competition of brains and skill that results from the employment of individual engineers or those in private practice. Unless the head of the bureau is also practically the head of his profession, the municipalities are debarred from obtaining the best advice that could be obtained from independent consultations. The head of the bureau may be somewhat in the same position as the "company doctor" in a mining community. Most of the miners prefer to hire their own doctor.

POWER IN BRITISH COLUMBIA

IN British Columbia there is said to be a surplus of developed hydro-electric power. The Vancouver Island Power Co., the Vancouver Power Co., the Western Canada Power Co., and the West Kootenay Power and Light Co., all have considerable power now available, the utilization of which is highly desirable from the standpoint of the capital invested in these companies. A recent suggestion by the "Mining and Engineering Record," of British Columbia, that Commissioner Retallack, who now has charge of the Public Utilities Department of the British Columbia government, should assist these companies in disposing of this power, is a reasonable suggestion and entirely in the interest of industry and employment in the Pacific province.

REPORT ON ST. LAWRENCE RIVER

SIR ADAM BECK, chairman of the Hydro-Electric Power Commission of Ontario, states that the report on the location of the dams for the St. Lawrence river power development, at present in course of preparation, will likely be completed within two or three months. He made this statement when interviewed in reference to the possibility of Toronto and all the large ports along the Great Lakes becoming "ocean ports" in consequence of the St. Lawrence power development, as pictured by Franklin K. Lane, U.S. Secretary of the Interior.

The building of the proposed dams at Morrisburg and the Long Sault raises the water level to accommodate boats of from 25 to 30 ft. draft. Sir Adam pointed out that Ontario would have 1,684 miles bordering on the Great Lakes and rivers, which would, as Mr. Lane says, take care of ocean-going traffic.

"The dam at Morrisburg," he continued, "will regulate the levels of Lake Ontario and create a storage system and largely eliminate floods on the St. Lawrence. It will also create a storage sufficient to make available 20,000 sec. ft. during the periods of the year when the water is low, and will raise the level of the harbor of Montreal from two to three feet.

"We have had engineers working on the St. Lawrence for the past three years, and hope to have the final report on the work in the course of three months, fixing the location of the two dams. That will be most desirable from the standpoint of navigation, and will create 2,000,000 h.p. of electricity, 1,000,000 for the United States and 1,000,000 for Ontario."

LARGE IMPORTS AND EXPORTS

WITH but one-fifteenth the population of the United States, Canada does one-fifth the amount of trade. This statement is based upon official figures just published showing the total of U. S. trade for the year ending August 31st. The comparison is made on the assumption that there are about 8 million people in Canada and 120 million in the United States. The report shows that the U. S. exports for the year totalled $7,415,000,000. Canada's $1,233,000,000, a proportion of one-sixth. Their imports were $3,233,000,000, ours $870,000,000, a proportion of one-fourth. Their total trade was $10,648,000,000, ours $2,103,000,000, a proportion of one-fifth.

PERSONALS

NORMAN McLEOD RAMSAY WILSON, inspector and water works engineer of the Canadian Fire Underwriters' Association, Toronto, has resigned in order to become chief engineer of the Brantford, Ont., water works. Mr. Wilson was born December 3rd, 1869, in Bombay, India. He was educated in England at the Paradise House School and the City and Guilds Technical College, London, where he studied mechanical engineering. Upon leaving college in 1885, he was articled to Richard Johnson, chief engineer of the Great Northern Railway, with whom he spent five years in general railway engineering. Upon leaving the Great Northern, Mr. Wilson spent two years in construction work with Lucas & Aird, contractors, who were then constructing the West Highland Railway, Scotland.

For the following six years he was assistant engineer of the Northeastern Railway, engaged in maintenance and construction of railway and docks. In 1898, Mr. Wilson was appointed assistant county surveyor for the North Riding of Yorkshire, where he spent three years on the design and construction of roads, bridges and public buildings, principally roads. In 1901 he was appointed resident engineer in charge of construction of the Dearne Valley Railway, a colliery line in South Yorkshire, now part of the Lancashire & Yorkshire Railway. In this position Mr. Wilson had further experience in both design and construction, and represented the railway throughout until the contractors turned the road over to the owners, after which he came to Canada in 1907, and secured a position with the bridge department of the Canadian Pacific Railway as resident engineer on the construction of the superstructure of steel bridges, chiefly in New Brunswick. In 1909, Mr. Wilson's services were secured by the Canadian Fire Underwriters' Association, by whom he has been employed continuously for the past ten years. His work with that association has consisted of inspection of water works plants throughout Ontario and the making of recommendations for the improvement of plants from a fire protection standpoint. Mr. Wilson reported upon and kept in touch with the water works and fire protection systems of 212 municipalities in Ontario and also a number in British Columbia. He compiled detailed records of the equipment possessed by every municipality, and also prepared plans of every municipality, showing the location of mains, hydrants, pumping stations, reservoirs, etc. At Brantford Mr. Wilson will be in charge of the proposed extensions to, and reconstruction of, the water works system, and in this work he will have the co-operation of R. S. & W. S. Lea, consulting engineers, Montreal, who have been engaged by the city council to advise regarding methods of increasing the present supply. Mr. Wilson has been a member of the Institution of Civil Engineers of Great Britain for more than 25 years.

SIR ALEXANDER BERTRAM has been appointed treasurer of the Engineering Institute of Canada, to succeed the late Ernest Marceau.

L. R. BROWN, formerly engineer and superintendent of the Toronto Chemical Co., Sault Ste. Marie, Ont., has accepted the position of road engineer with the Dominion Tar & Chemical Co.

DR. F. D. ADAMS, Dean of the Faculty of Applied Science, McGill University, is acting as head of that university until the new principal, Sir Eric Geddes, is free to resume the duties of his office.

ROY A. SPENCER, who served overseas as major of the 3rd Divisional Canadian Engineers, and who returned to Canada two months ago, has been appointed professor of engineering at Dalhousie University, Halifax, N.S.

R. S. L. WILSON is now the official head of the Faculty of Engineering at the University of Alberta, succeeding the late Prof. Muir Edwards. Mr. Wilson's appointment was recently confirmed by the president of the university. Prof. Wilson was formerly a designing engineer on the Welland Canal staff, having previously been a general contractor in Saskatchewan. Recently he has been associated with McGill University and has also acted as consulting engineer for a contracting firm in Montreal.

OBITUARIES

JAMES LOW, a prominent contractor of Ottawa, Ont., fell into the Rideau Canal two weeks ago and was drowned.

BARRY SMITH, resident engineer for the Dominion Construction Co., Toronto, on concrete construction in the Parry Sound District for the C. N. R., was fatally burned in the conductor's van of a construction train when the train was wrecked.

DUNCAN McD. CAMPBELL, of Halifax, engineer on the staff of the Nova Scotia Highway Board, died last week at his home. Mr. Campbell had been in ill-health for nearly a year. He was a native of Truro, N.S. Previous to his appointment two years ago to the staff of the highway board, he was assistant city engineer of Halifax.

R. A. ROSS TO BE E. I. C. PRESIDENT

FOR the year 1920, the president of the Engineering Institute of Canada will be R. A. Ross, city commissioner of Montreal, and chairman of the Lignite Utilization Board of Canada. Prior to his acceptance last year of the city commissionership, Mr. Ross was a prominent consulting civil and electrical engineer.

The report of the nominating committee has been received by the council of the institute. As usual, the president is chosen by acclamation. For all other offices, twice as many men are nominated as are to be elected. The nominations for vice-presidents are:—W. G. Chace, Winnipeg; A. S. Dawson, Calgary; C. H. Mitchell, Toronto; John Murphy, Ottawa.

Following are the nominations for councillors:—District No. 1—F. B. Brown (Montreal), J. Duchastel (Montreal), V. I. Smart (Montreal), and Julian C. Smith (Montreal); District No. 2—F. T. Cole (Quebec), and A. R. Decary (Quebec); District No. 3—F. A. Bowman (Halifax), and W. P. Morrison (Halifax); District No. 4—J. B. Challies (Ottawa), and Alex. Macphail (Ottawa); District No. 5—R. K. Palmer (Hamilton), and E. R. Gray (Hamilton); District No. 6 for one-year term—W. J. Dick (Winnipeg), and B. S. McKenzie (Winnipeg); District No. 6 for a two-year term—Guy C. Dunn (Winnipeg), and J. M. Leamy (Winnipeg; District No. 7—J. R. C. Macredie (Moose Jaw), and C. P. Richards (Regina); District No. 8—G. W. Craig (Calgary), and F. H. Peters (Calgary); District No. 9—H. M. Burwell (Vancouver), and C. Brakenridge (Vancouver).

G. D. Mackie, city engineer and commissioner of Moose Jaw, Sask., has been upheld by the city council in his refusal to permit one of his assistants to make a written report directly to the mayor, although the members of the city council intimate that they think it may be quite in order for the mayor to seek verbal information from any members of Mr. Mackie's department.