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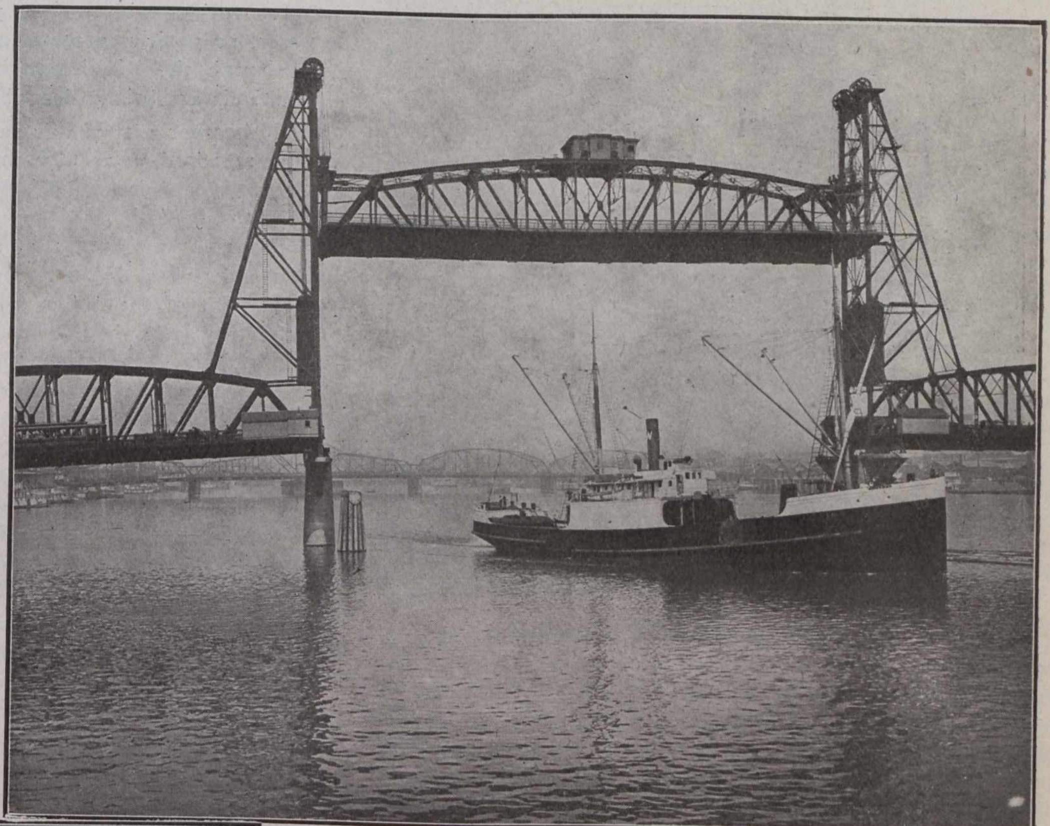
THE ELECTRICAL EQUIPMENT OF THE HAWTHORNE AVENUE BRIDGE, PORTLAND, OREGON.

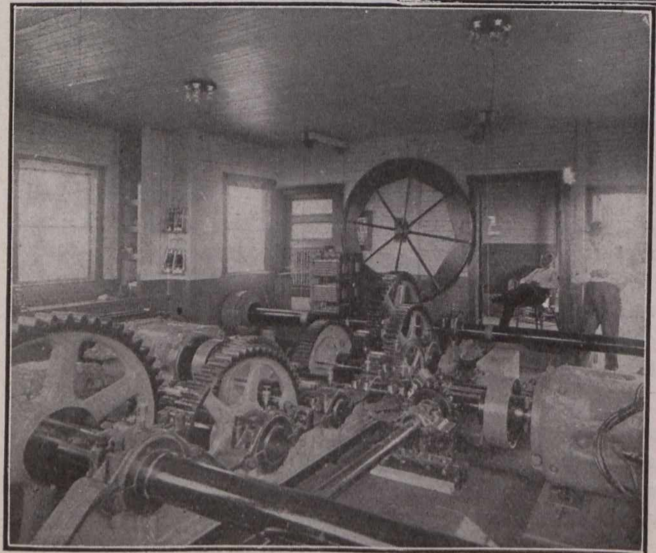
In laying plans for the installation of a draw bridge for Hawthorne Avenue, Portland, Oregon, the city officials endeavored to eliminate the many vexatious delays that were due to the constant opening and closing of the old draw span type Madison Street bridge, which formerly occupied approximately the same location as the present structure.

After looking over the various types offered, they finally decided on the lift span type as being the one which would most effectively alleviate these conditions. This has proven a very wise selection on the part of the city officials, as the time required to raise the bridge to the top of the span and lower it is less than that required to swing open the draw span type. The lift span type, however, possesses an additional advantage in that it is unnecessary in most cases to raise the span more than a few feet to accommodate the greater bulk of the river traffic, and consequently the delays to traffic across this bridge have been reduced to a minimum.

This type of span resolves itself, from an operating



View of Hawthorne Avenue Bridge, Portland, Oregon, with draw raised showing boat going through.



Interior view of motor house showing motors and operating gears.

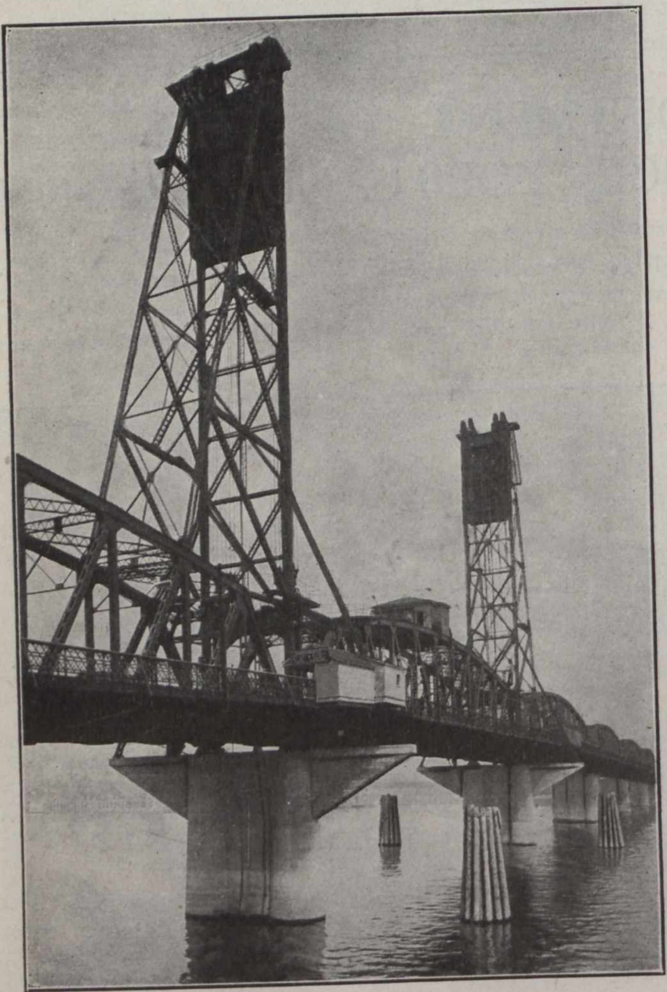
standpoint, into practically an elevator proposition, the weight of the span being balanced by means of large concrete counter weights connected to the span by means of steel cables operating over sheaves located at the top of the towers on either side of the span. These counter weights are clearly shown in their position in the photographs.

The bridge is operated by means of two No. 160 Westinghouse 125 horse-power, 550-volt, direct current railway crane type motors, which are directly coupled to a train of gears located in the machinery house on the top of the span; this reduction gearing, in turn, operates the bridge by means of steel cables. The lift span is guided in raising or lowering by means of steel roller bearings operating in the guides located in the vertical uprights of the towers. Besides the advantage of greater speed in operation, and consequently less delay to the traffic, this type of bridge also presents three great advantages from an engineering standpoint.

1st. There is no unequal expansion or contraction, due to the effect of the sun's rays, as would be the case with the draw span type pivoted in the centre.

2nd. The wind friction is practically negligible.

3rd. It offers the use of the entire channel.



View of bridge with draw in position.

The bridge was designed by Waddell & Harrington, consulting engineers, Kansas City, Mo., and was erected under the supervision of Mr. Leon Clarke, engineer in charge. The electrical equipment, including the motors and control equipment, was furnished by Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa.

BRITISH INVENTION FOR UTILIZATION OF PEAT.

A new process for the utilization of peat, invented by F. H. Nixon, of London, consists of cutting the turf, after it has been air dried, into corrugated blocks, which are sprayed with petroleum so as to form firelighters. The blocks are subsequently given a coating of highly inflammable material which also strengthens them and prevents them from breaking easily. It is claimed that this process overcomes the obstacles associated hitherto with the combination of peat and petroleum which have been connected mainly with the employment of a briquetting machine that is not only difficult to work, but also expresses too much of the petroleum from the finished blocks. It is stated that the process enables the firelighters to be produced at a cost which has not been approached before. It is proposed also to employ the method for the production of fuel on a larger scale.

POWER PLANT TESTS.

A valuable contribution to the literature on power station operations is contained in the report of the committee on power tests presented December 5 at the annual meeting of the American Society of Mechanical Engineers. Aside from its importance in establishing standards, the report is a collection of all the information necessary for making a test upon any kind of power-producing machinery, and notwithstanding the vast extent of the field, the report is in most surprisingly condensed form.

The subject matter is divided into three parts, of which the first is a set of general instructions for testing operations. This includes a series of brief descriptions covering the apparatus and instruments recommended for different operations, together with instructions for their use. As an example of the completeness of the report, among the methods described for measuring steam flow is included a table showing the weights of steam discharged through a given orifice with various pressure drops. There are, however, no positive recommendations for smoke determination, although the Ringleman smoke charts and several other methods are briefly described.

Another part of this section is devoted to a statement of the standard units recommended as a basis upon which to express capacities and efficiencies of power generating apparatus. Although the committee recognizes the recently proposed "myriawatt" at a unit for steam boilers by mentioning it in a footnote, in the body of the report the measurement of the boiler capacity is expressed only in terms of the weight of water evaporated from and at 212 deg. per hour. The expression "boiler horse-power" is sanctioned for stationary boilers, but also only by mention in a footnote. Steam turbines delivering mechanical power have been distinguished from turbo-generators in the list of standards by the use of the brake horse-power at the shaft as the unit of capacity for the former and of the kilowatt-hour for the latter. Engine-driven generators are included with turbo-generators, and in both cases the exciter output is excluded from that of the machine.

An interesting recommendation in this part of the report is that covering reserve capacity for power plant apparatus, or, in other words, the excess capacity which it should have over and above the commercial or manufacturer's rating. These reserve capacities are recommended to be 33 per cent. for boilers using standard fuel and 25 per cent. for steam engines and turbines with normal boiler pressure, together with the ability to deliver rated capacity at a boiler pressure 15 per cent. below normal. For pumping engines a reserve power of 20 per cent. is advocated, and the same percentage applies to gas producers and gas and oil engines. Water-wheels, however, are required only to have a reserve of 10 per cent. at the specified head of water.

The second section of the report includes standard codes of rules for different classes of apparatus, each of which is elaborated sufficiently with instructions to enable a test to be carried out in all necessary detail. The individual codes are, of course, revisions of the older standard codes, which are in this report brought up to date and, in consequence, differ but little from the previous form.

The report concludes with a series of appendices giving more elaborate descriptions of instruments and methods that are covered by the first section on general instructions. Among these are several devoted to the analysis of heat losses of the reciprocating steam engine, and a reference is made to the British standard of engine economy, the use of which is, however, made optional in the complete standard code and omitted altogether in the short form.

TOWN PLANNING AND CIVIC IMPROVEMENT.

By C. H. Mitchell, C.E.*

That the towns and smaller cities of Ontario are awakening to the importance and advantages of town planning and improvement is a most encouraging sign of the times. The larger cities of Canada and America generally have already become active in this respect, in practice as well as in the planning itself. They have realized within the past few years that if they are to escape the mistakes of older cities, and if they are to avoid the conditions which make possible these mistakes, brought about by the ever changing modern methods of life and work, they will require to meet the new situation by a rapid change of policy as to transportation, housing and sanitation.

It has become plainly evident that the time is here for national and provincial effort and for concerted civic activity in each community. One does not need to tell the citizens of any town or city in this young country that this movement is vital, in some manner or other, to each community because in this wonderful progressive Canada of ours every month sees the commencement of some little new settlement or hamlet, or the sudden rise of a village to cityhood. And how many of us in the years past, looking each at his own small town, has in his mind, seen it grow to a larger town and then to a city and to a great commercial and industrial community? And how many of the older ones amongst us have seen the dream come true, even in a few decades? And who will foretell for the next few years, and what will he prophesy for that busy part of Ontario which lies between the lakes?

In the larger Canadian and American cities the growth and congestion arising from a rapid development heedless of provision for the future has been recently marked by a sudden realization of the situation and the civic spirit has been aroused. In most large cities nearly everyone—even though he be styled public spirited—has been bent on money-making, an essentially necessary and a practical occupation but a community which is thus absorbed can hardly be expected to give serious thought to the welfare of future generations or to the benefits which might arise from efforts to make the home city attractive to work and live in. Now, however, a change is taking place, and this is evidenced by the fact that over fifty Canadian and American cities have adopted in some degree a course for improvement of existing conditions and systematic plans for the future. In order to provide wide and continuous business thoroughfares, convenient groupings of public buildings, rapid transit, adequate street traffic circulation, parks and squares, parkways and boulevards, children's playgrounds and gardens, clean and attractive streets, pure water supply and efficient sewage disposal, prohibition of sign and noise nuisances, enforcement of laws for structural building and fire safety and for tenement regulation and the encouragement of housing schemes—for all these, enormous financial undertakings are being projected.

Civic effort toward future planning and improvement, while it may be encouraged ever so much in each community, cannot in itself succeed sufficiently to meet the present-day conditions. Such effort must have encouragement from higher up and from the mutual assistance of sister towns and cities, in educating the people and in impressing upon the Provincial and Dominion authorities the great desirability of legislation designed to encourage, if not assist, various kinds of civic improvement which otherwise might not be rendered possible. This, I take it, is the spirit which brings together at this spontaneous and self-appointed inaugural congress, the many officials and citizens of the cities and towns of Ontario, and it is with such an object that, doubtless out of this meeting, some permanent organization will arise to inquire into the present situation and carry the movement to some conclusion.

Toronto, the "Queen City" of the province is becoming more and more interested each year in practical civic improvement and planning according to the general acceptation of the term. While many of the civic authorities are fully aware of the importance and necessity of changes and provision in anticipation of the future, it has been found that the most effective means of obtaining real action and conclusive legislation by the city government has been through the medium of citizens' organizations such at the "Civic Guild," the "Board of Trade" and the various Ratepayers' Associations which are spread over the city. These bodies have been enabled to study various civic problems without the distorting vision of the prospective candidate for municipal honors at the coming January election, and have brought to bear pressure from the outside, toward improvements either for the immediate present or the future which otherwise would have been overlooked or been incapable of realization owing to local or fractional opposition in various parts of the city. The Civic Guild, which has an active executive committee including prominent business and professional citizens meeting weekly, has been especially making a study of the needs of the city in this respect and has succeeded in inaugurating and in bringing about a great many improvements which all thinking citizens united in approving and supporting. Out of the efforts of the Guild grew the Civic Improvement Committee, appointed by the mayor in 1911, for specially studying and outlining a comprehensive system of civic planning; this report recommends and the Guild strongly urges a permanent commission for the city "clothed with the necessary powers for carrying out a broad, sane and comprehensive scheme of civic improvement."

The general subject of civic planning, which is really as old as the hills and not a recent development, embraces all of those allied subjects such as street routes and widths, depths of blocks and lots, buildings, street circulation and transportation, housing with its light and air problems, sanitation and cleanliness, railroad locations, distribution of factory areas, parks, playgrounds, boulevards and in general all those matters which influence the lives of the people in the community. The ideal, therefore, of city planning is that in which all these branches are harmonized to secure for the people of the city such conditions as will obtain a maximum of efficiency in work of health of body and of enjoyment of life; in other words, to make the city a good place to work and live in.

It has been a common idea in American cities until quite recently that city planning has been almost exclusively identified with city beautifying. This view is not fair to the whole subject because it loses sight of the practical sides of the question, which are very many and complex, as can be readily seen. City planning should mean the acquiring of a city convenient, useful, economical and healthful, as well as a city beautiful

Civic planning may be divided into three general divisions as affecting the city or town within its boundaries, with perhaps a fourth as affecting it from the outside. These are as follows:—

I. The first division is concerned with the circulation and transportation problem within the city, and embraces

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streets, railways, waterways and all means of communication.

II. The second division concerns all other public areas and buildings not devoted primarily for circulation, and would embrace firstly, such institutions as municipal buildings, schools, post offices and government buildings, hospitals, libraries, museums, churches, public halls, theatres, all of which have more or less land space surrounding them, and secondly, parks, gardens, highways, boulevards, playgrounds, amusement parks, cemeteries, etc.

III. The third division relates to all of the remaining or privately owned lands within the city, and concerns more particularly the character of their development in so far as the community can control, especially as to buildings, sanitation, fire risk, density of population, adornment as to trees, gardens, etc.

IV. A fourth division may very rightly be added to the foregoing, which concerns those areas and features of development lying outside the boundaries of a city in which the city is vitally interested, but over which it probably has no control, except through some higher authority such as the province.

It is not the purpose here to describe in detail the features of the various branches of civic improvement enumerated, but rather to draw to your attention the outstanding problems which are confronting our municipalities, large and small, and more especially those which now, or may in the near future, concern the cities and larger towns of Ontario. Following out these divisions we have:—

I. Division—Circulation and Transportation.

Street Planning.—Street planning in the full sense is the key of the whole subject, whether considered from the strictly practical or the artistic standpoint. After all, the primary principle, and the principle which is the very basis for the existence of cities is the facility of communication, and a city is probably more dependent upon this facility for its prosperity than upon any other physical factor under its control. This can be fully realized when it is considered that three-quarters of a city's traffic is either to or from its general centre.

The area allowed for streets in most cities aggregates at least 25 per cent., but there has been a pronounced tendency of late, even in Ontario, I am sorry to say, to reduce this in outlying portions by sub-divisions in residential districts which are placed on the market by proprietors and agents interested only in the selfish business of selling the lots. These proprietors—still absorbed in money-getting like their predecessors—have in most cases no interested desire to promote the common welfare of the citizens, and do not interest themselves in easy communication, but rather adopt any haphazard layout suitable to the plot of land they happen to have which may appeal to the temporary convenience or fancy of the prospective inhabitants.

Probably the worst fault with our early planning for cities has been the adherence to the "grid-iron" layout. There was a time when this was boasted of as the ideal system and even to-day it is being blindly followed in some of our western cities. It may have done in the days of the Romans and during last century in America, but this is the century of rapid transit and present-day automobile and motor truck transportation demands rapid circulation with the fewest corners and the fewest delays in traffic. Interesting examples of the avoidance of the "grid-iron" are the radial and fan-like systems which have been employed in the great European capitals, such as London, Paris, Berlin and Vienna, in America in Washington, and now in Australia, where the plan for the new Federal capital, about to be built, embraces several hub-like centres with radiating streets.

The obvious remedy for the "grid-iron" system after having been once established is the introduction of through diagonals, superimposed upon the "grid-iron" in order to facilitate rapid transit to the four corners of the city in addition to the four sides. This is the course proposed and in some cases being followed in various cities where the "grid-iron" routes zig-zagging back and forth on the two sides of the triangle have become intolerable under modern conditions. It is the proposal of the Civic Improvement Committee for Toronto to open diagonal streets northeast and northwest from Queen Street, near Yonge Street; these would rapidly serve the growing population in these corners of the city and their suburbs, and would carry traffic beyond the upper Don on the one side and the upper Humber on the other.

Street Widening.—Closely allied with the actual layout arrangement of streets is the question of their width. In the early days in Ontario nearly all streets, without regard to their probable uses, were laid out a uniform width of 66 feet, probably for no other reason than because it was convenient, being the length of a surveyor's chain. You who lived with this system know how it has worked out. Hardly ever can it be said to be too wide, because if in residential quarters the space not actually occupied in roadway can be profitably laid out with grass and trees. On the other hand, how often nowadays is it not found too narrow, even in our towns on the main business streets where traffic, moving and stationary, accumulates and congests and consequently delays the free course of business. In a recent report on an American city an eminent town planning expert states that "every delay in traffic adds to the expense of manufacturers, the cost borne by wholesale merchants and the prices charged consumers by retail merchants; in short, inadequate traffic facilities add to the cost of doing business and of living."

Three factors may be said to enter into the determination of street widths on business thoroughfares: Pedestrian traffic, vehicular traffic and street car traffic. On a main business thoroughfare in a large busy city it has come to be an accepted principle from the necessity of modern traffic that there should be sufficient space between the centre line and the curb for a street car line and three lines of traffic, one standing at the curb, one slow-moving and one fast-moving. If, in a busy retail store district, four lines of pedestrian traffic are provided for in each direction on each side a 16-foot sidewalk would be required. This brings the total width of such a street to 104 feet. If one of the three vehicular traffic lines were dispensed with on each side the width could be reduced to 86 feet, which is the absolute minimum sufficient under present conditions for down-town business streets having two lines of street cars and streets crowded with vehicles and pedestrians. So apparent and acutely has this been brought home to Toronto citizens, where the space for vehicular traffic is so narrow, that an automobile and street car cannot simultaneously pass a standing vehicle, that the civic authorities have been compelled to pass a by-law prohibiting automobiles passing a standing street car whilst loading its passengers. It has also been necessary to prevent vehicles of all kinds standing an undue length of time at the curb.

What is the result? Cities which are now feeling the pinch of narrow 66-foot business streets, and those cities ambitious to have attractive and convenient business streets in the future are quickly and seriously considering how they may widen their busy thoroughfares by at least an additional 20 feet either on one side or both. How this can best be done on streets already built up with stores and fine buildings is engaging the attention of town planners and civic authorities throughout the continent. Two methods have presented themselves. One, the establishment of a new line called the "homologated line," to which all new buildings as built will be moved back, and the second the establishment of such a line to which, at some future date many years distant, all buildings must be moved back. In the former case the cure is unsatisfactory, as has happened in Montreal, because new buildings built to the new line become "pocketted" between adjoining old ones, and thus, if they are stores, may temporily lose trade. The latter method is the one recommended by the Civic Improvement Committee of Toronto, and provides that after the new street line and a date, say, 20 years hence, are fixed, new buildings may proceed on the understanding that at the stated date the added strip will be purchased by the city at the price obtaining at the date of enactment for, say, only two or three stories of the building which must be torn away from the front. Such an arrangement makes easy construction and automatic land purchase by the city at a reasonable price, the owner having the use of it in the meantime.

Rapid Transit.—It is not the purpose here to enlarge upon the conditions brought about in civic matters by the introduction of rapid transit, either within the city and its suburbs, or outside the city in interurban traffic. The great tendency for people to live in the suburbs and country is to be noted, however, and the effect of this daily migration more than ever intensifies the traffic congestion within the city. It is a question, too, whether it does not increase the cost of living if there are not convenient and adequate facilities through the city streets for delivery of goods and supplies.

Railways and Waterways.—In olden days, when cities were walled about, the entrance was through elaborate and artistic gates which gave to the incoming visitor his first impression of the town. Nowadays, our gates are our railway stations and our harbors. These are the entrances, and from these our visitors receive their first impressions and judge of us. Too often do the railways approach our towns through dirty back streets, ill kept and unattractive, if not repellant. How many of our railway stations are situated in unattractive quarters of the town amongst surroundings which, with some attention from the civic authorities and public-spirited citizens, can be made to look inviting and cheerful to the incoming visitor. The railway companies are beginning to do their part by the beautifying of their own station grounds by gardens and lawns. It is the duty of the citizens to help.

The same holds true for our docks on our lake and navigable river gateways—perhaps the possibilities are not so apparent because each town has its own specific problems. The outstanding instance of this movement is the truly magnificent scheme which the harbor commissioners have outlined for the development of Toronto harbor which, when completed, will without doubt be at the same time one of the most attractive as well as serviceable harbors in the world.

Street Improvement.—Amongst the many things which can be accomplished by civic authorities in making a city attractive is by clearing the streets of various obstructions on business streets and by preserving the trees in residential streets.

The removal of electric wires and their forests of poles can be accomplished by placing them either on alleys or side streets of by meeting the question squarely and putting them underground, on the principal streets at any rate. This would then help to preserve the trees in fine residential streets where too often the tops and centres of fine trees are brutally cut away by linemen. The removal of unsightly signs overhanging or prominently situated on or near streets is possible, if concerted action is taken by determined citizens. The encouragement of planting trees and flowers and of sodding on residential streets commends itself, as does also the placing of fountains and watering places. Artistic bridges in the suburbs as well as in the centre of the city are just as easily and as cheaply built as heavy formal structures, and make a street more attractive, particularly if finished with neat balustrades and lamps. Street lighting, especially where the hydro-electric power system throughout the province provides such a cheap and convenient source of electricity, lends itself, as hardly anything else can, to the ready adornment of streets, either business or residential, if the individual lighting scheme by using lamp posts is carried out artistically. And one might go on to all the various street features, such as walks, curbs and pavements and make a plea for clean-cut, well-planned improvements, all of which are just as possible in the smaller cities as in the larger. And, after all this is done no community can have any excuse for permitting its streets to become unsightly with flying papers or other rubbish, and all citizens will have sufficient civic pride to see that their streets are kept looking attractive.

II. Division—Open Spaces and Parks.

When we think of city parks and open spaces we must think of them as utilitarian as well as beautiful—for we must have parks and recreation spaces and breathing places if we are to have happy, healthy and contented citizens. It is not necessary to dwell on the various attractions or valuable features desirable within the parks themselves, but the great question which is interesting all civic authorities nowadays is how to make the parks more accessible to the people; how to get them properly located, and whether it is possible to get them connected up one with the other by an elongated park or parkway, or by a combination of street and park termed a boulevard. This is the day of the electric street railway and of the automobile, so that the total distance to be travelled is not so much a matter as the advantage of getting quickly amongst trees and flowers and greenery as a relief from the hot and dusty working city. The parkway and tree-planted boulevard meet this demand and are to be commended as linking up several parks or open spaces as they bring the parks, so to speak, nearer the people's doors.

But all do not travel or have not the time or opportunity to travel in street car or automobile. For these and for down-town uses there must be small street corner parks or rest places with trees, shrubs and flowers.

All the principal public buildings, such as have already been enumerated, should be set, if possible, in fine, open spaces, not only to show them off to advantage architecturally, but in order to provide a suitable park and garden setting.

This brings us to the question of a grouping of public buildings in a convenient central location which has been called "The Civic Centre," and which is an ideal to which many large cities are aspiring. This, after all, is nothing much more than the old town square or market place of the early days, but now on a gigantic scale. The civic centre idea is being adopted in many American cities as being not only of utilitarian convenience, but best calculated to centralize civic activities and foster civic spirit. This is the scheme which has been proposed in Toronto by the Civic Improvement Committee for a grouping of municipal, county, provincial and federal buildings in one locality north of Queen Street and between Yonge Street and University Avenue. Within the heart of many of the Ontario cities there is a space which, it appears, has been going through a period of neglect the past few years—the market. It may be because of the changed transportation methods, or because of the roads leading in from the country, or the changed methods of marketing, but if a market is to be maintained duty still remains with the city authorities to make the market and its appurtenances and the streets leading to and about it attractive and convenient for carrying on trade under the new conditions. In these days of inquiry as to "The High Cost of Living," it appears to be of vital importance that farm produce and the other necessities can be marketed directly from the producer to the consumer in the easiest and quickest manner possible.

Other open places, such as playgrounds, gardens, recreation and amusement grounds are quite as necessary for our young and old as are schools, churches and hospitals, and the value, for instance, of supervised playgrounds and children's gardens to the rising generation, cannot be over estimated. In this respect the education of the young generation, and the old, for that matter, is of vital importance toward the preservation of trees, grass and flowers in public places.

There are doubtless many other miscellaneous areas and spaces within our home cities which, though now neglected and unattractive, might readily lend themselves to artistic and useful development. Such spaces may be peculiar to the natural situation of the city. It may be a creek or a river; it can be cleaned, old tumble-down buildings removed, the sides banked up and the shores planted with trees and grass. It may be a wooded valley; it can be cleaned of its refuse heaps, the wooded slopes preserved, the underbrush and stumps removed and the whole brought cheaply into a new park. It may even be an unsightly abandoned quarry; a little money spent on earth filling, walks and gardening might make it into an attractive garden. Or, it might be a winding sylvan roadway on a hillside; it can at least be kept clear of weeds and loose stones.

A picturesque valley can, at small expense, be utilized for a parkway and its drives terminate in terraced parks or connect various garden centres of the town. In some of the Ontario towns there are rivers which, on account of their annual freshets, discourage an attractive treatment of their banks—this is all the greater reason for these towns uniting to bring about conservation methods to prevent these floods; the banks within the towns could then be trimmed up with walls and the buildings upon them reconstructed in a permanent artistic manner. If factories must be on the river bank, they can, by the utilization of electric power, avoid, or at any rate, mask the unsightly ash and refuse dumps which are so common. To carry this idea still further, how much more attractive a river could be if it had a water-front space, its outer walk forming, wherever possible, a tree-shaded promenade provided with benches and other features of recreation?

III. Division—Privately Owned Lands.

At first glance it might seem that in a new democratic country like ours the municipality would have but small control over privately owned lands and their buildings and occupants. In a measure this is true, but as time goes on and we work out our various problems of civic government, be they in large or small communities, we have found that many measures must be framed by the people themselves in self-defence and the common interest.

The most important of such measures are, of course, with reference to health and sanitation, a discussion of which is not intended here except to draw attention to the necessity of regulations against overcrowding of houses and factories. The housing question is quickly becoming acute in large densely populated cities where industrial workers are crowded into areas and buildings in proximity to their work. While this question perhaps does not concern the younger and smaller cities in general, it has an interest in particular to those cities which have a proportionately large industrial population, such as have many of the Ontario towns in the hydro-electric power area. In these towns the municipalities can at least encourage in every manner possible the making of attractive, healthy and comfortable homes by the working people. This, as everyone knows, should be encouraged in every possible way by the employers—the manufacturers themselves—to ensure their work-people being contented and efficient. "Garden Suburbs" for working men can be readily organized and should be attractive and worth while for these smaller cities whose population is largely industrial.

On residential streets much attractiveness can be added by placing restrictions to keep the houses back a definite distance from the street and by encouraging tree planting and sodding the space both on and off the streets. Window gardening should be encouraged, especially on those streets where the houses are close to the sidewalk. Legislation is already provided for keeping houses back of the street.

The municipality can very much improve the city in its attractiveness by passing and enforcing regulations for smoke prevention and for removing noise nuisances—such as train whistling—and by discouraging unsightly sign boards on private property.

Reference has already been made to the selfish methods of many landowners in opening up their new sub-divisions. They should be prevented, if possible, from dividing residential property into individual lots too small or of unsuitable form for gardening and planting as is frequently the case, and they should be encouraged to place restrictions upon the locations of houses on their lots. It would not be amiss here to draw attention to the frequent misrepresentation of the location and features of sub-divisions placed before the public which has become so common of late, not so much in Ontario as in the West. While everyone admits that the speculative holding of land within a city is a detriment to its growth, no effective or equitable legislative measure to prevent it is yet apparent, unless it be by the whole reconstruction of our taxation system.

IV. Division—Land Outside the City.

Under modern conditions of transportation and the inevitable expansion of suburban areas outside of the small as well as the large cities, we must at once become interested in the development of the country surrounding the city.

There are two vital points which arise. The city authorities—as distince from the township—have under our present laws, no control over the layout of sub-divisions immediately adjoining or outside the city limits; they cannot, therefore, co-ordinate street planning or street widths with those inside the city, which is an absolute necessity. The city, moreover, does not exercise any control over such questions as park and open space allowances in such sub-divisions.

The arrangement and improvement of township and county roads not only to make them easy and convenient for transportation, but attractive as interurban drives and parkways, is of special interest to a city or group of cities, providing, as it would, a ready means of bringing farm products into town as well as convenient interconnection between towns. This would have a direct bearing on the cost of living and the attractiveness of a group of towns, and of the intervening country as places for residence and business. A noteworthy example of this development on a large scale is the Essex County park system in New Jersey.

Conclusions and Recommendations.

The cities and towns of Ontario, and especially those in the area between the Great Lakes, stand unique in Canada as being so grouped and favored by location as to benefit from hydro-electric power for industrial purposes. They become, in addition to their former activities, each a special industrial centre and their future depends much on this ability to expand while retaining attractive homes for their workers.

In this review of the subject of civic improvement many of the illustrations and the motives have been drawn from the experience and activity of the larger cities but, as has been pointed out, there are very many openings for the adoption of similar improvements and projects in the smaller towns and cities of Ontario. These cities can still be unique by leading in town planning and improvement as well as by leading in industrial activity.

Each city has its own specific outstanding feature. It may be its geographic situation or its transportation facilities, or its contiguous country. It may be some physical feature of landscape—a hill, a valley, a river, lake or waterfall. Whatever these features may be they can all lend themselves to practical utilization, combined with artistic and pleasing attractive treatment.

You who live in these towns and cities can, by taking thought, suggest lines along which your particular civic improvement might follow. Your civic officials, energetic and able though they may be in their proposals for improvements, probably have their hands tied by lack of public support and certainly they are powerless through inadequate laws. The civic authorities require more power and the citizens more understanding and education as to the benefits to be derived.

Much of the momentum for a movement of this character must come from the citizens themselves and from a sympathetic press which fully grasps the significance and advantages of the movement.

In order to inform and educate all our citizens it would appear that in each city, as a neucleus, a small committee or commission should be formed for the purpose of making a study—a stocktaking as it were—of the possibilities which present themselves. They might be improved, if it was thought expedient, to call in an expert to advise either on a comprehensive scheme or upon some particular detail. Any schemes arising from this preliminary study might then be discussed by the civic authorities and the citizens and some improvement programme laid out either in detail or in a comprehensive manner which might be spread over a number of years, but always conforming to a prearranged systematic plan which, when complete, will stand the city for all time.

It will, of course, be asked how such projects could be financed. The municipality may devote a definite portion of its tax rate each year for the purpose, in which each year's levy would be used for the upkeep and improvement of existing works, and for the purchase of new lands and for the construction of new works. Toronto has adopted this principle for its parks.

If it was possible to capitalize a yearly sum or a portion of it, and suitable legislation could be obtained, a capital sum might be raised by debentures and the proceeds devoted to a new work and purchases of lands, the whole managed and controlled by a special commission apart from the city council, which would be a body of a more permanent personnel. One of the great advantages of such a commission would be that it could enter into real estate transactions without publicity, and thus save money which could be put into actual improvements. Such a commission would require to be invested with special powers by the Legislature to enable it to carry on the financing of such projects; the relations of such a commission to the Ontario Railway and Municipal Board would require to be clearly defined.

For the purpose of giving effect to any proposals which might be made as a result of this and other conferences of representatives of the various municipalities of the province in seeking necessary legislation and outlining a course of action, it would seem advantageous to appoint a committee sufficiently representative to embrace the various phases to be considered.

In view of the experience acquired in the study of these questions in Toronto, and in view of the situation existing throughout Ontario it would appear opportune for the municipalities to seek, through their committee, such legislation as would facilitate those civic improvements which may be desirable. This legislation might include amongst other enactments:—

Provision for civic improvement commissions in the smaller cities.

Provision, applicable to cities smaller than already provided for in the Ontario Act, for the purchase by municipalities of lands required for opening streets, not only sufficient for the streets themselves, but for an adequate margin on each side which, after the opening has been completed, can be resold as lots, thus producing a revenue to help meet the cost of the improvement.

Provision for municipalities to secure streets wider than 66 feet on new subdivisions when necessary to conform to a town planning scheme.

A practical method for any necessary widening of business streets already built up.

An adequate control over new subdivisions so that the layout will conform to modern requirements and so that misrepresentation cannot be practiced. The embodiment of in- information such as contours and elevations is to be recommended.

Provision for the control, through the Ontario Railway and Municipal Board, by the municipality of the layout and street planning features of subdivisions outside the city limits for a stated distance.

With respect to the two last proposals the act passed by the Legislature at the last session provide for control by the board of street planning and the size and form of the lots in subdivisions, both within and for five miles outside, of cities "of not less than 50,000" population.

TESTING A CONCRETE BRIDGE.

On a bridge recently completed in England, a rather unique test was carried out. The bridge was loaded with water. The floor system of the bridge is carried by columns on three reinforced concrete arches. The clear span is 57 feet, and the rise 8 feet 3 inches. The parapets are solid concrete with sunken panels. In preparing for the test, a clay dam 3 feet thick at the base, and 1 foot thick at the top, was built at either end, and the water was conveyed through a 2½-inch hose. The load was applied in 8 hours, and although it exceeded the required loading of 250 lbs. per sq. ft., the deflection at centre was only 1/16 inch. The water test load was rapidly and easily applied and removed, at a very low cost. It would be a very easy matter in situations where water service is not available to pump water from the stream which the bridge spans.

STRUCTURAL-STEEL TOWERS AND POLES.*

By R. Fleming.†

Wood, Concrete and Tubular Poles.—According to the United States Census there were 3,870,000 wooden poles purchased during 1910. Of these 62% were cedar, 18% chestnut, 7% oak, the remaining 13% being pine, cypress and other woods. Classified according to length 17% were under 20 ft., 56% were 20 to 30 ft. (this being the length most commonly used by telegraph and telephone companies), 21% were from 30 to 40 ft., 5% were from 40 to 50 ft. and 1% over 50 ft. The bulletin from which the above statistics are quoted gives the number of poles purchased in 1909 as 3,738,000; in 1908, 3,249,000; in 1907, 3,283,000. Of the poles purchased in 1910 about 21% received some kind of preservative treatment before being set in place.

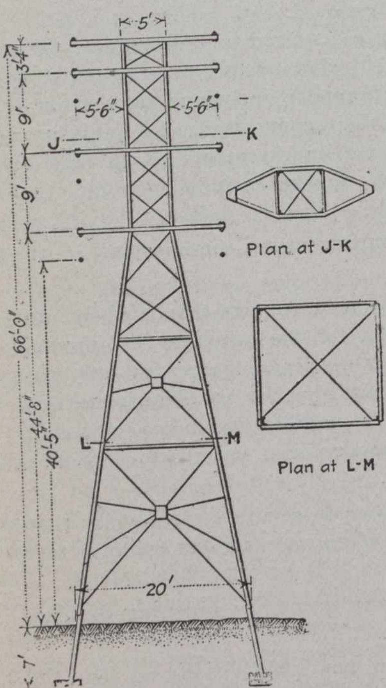

Fig. 1.—Standard Transmission-Line Tower, Connecticut River Power Co.

For 1909 the average first cost of wooden poles purchased was but $1.89. So, from the financial standpoint nothing has been found to take the place of wood for the ordinary telegraph or telephone line pole. The cost of renewals and maintenance is not great enough to warrant the additional first cost of either concrete, iron, or steel poles, and wood will continue to be largely used for some years to come.

Wood is increasing and fabricated steel is lessening in price. Fewer poles or towers are required if made of steel than of wood as they can be placed farther apart; this means fewer foundations, crossarms and insulators. In many cases, as for distribution systems in the yards of shops, wooden poles are not strong enough to carry the loads that will come upon them. Municipal authority has sometimes required the wooden pole on the city street be replaced by the steel pole. The fire risk is eliminated with the steel support, and this is important. A substitute for wood is therefore in many cases not only desirable, but necessary.

Reinforced concrete is being used to some extent for distribution lines of electric-light and power companies, and also for overhead construction of street railways. The general tendency seems to be in the direction of a more extended application.

Tubular poles, made of successive lengths of iron pipe, take up little room, present a round resisting surface to external loads, show excellent results when tested, and can easily be repainted when necessary. Their limitations as to size restrict their use to light loads.

Structural-Steel Towers.—This paper will be restricted to structural-steel supports—either poles or towers. The treatment of reinforced-concrete poles, tubular poles, or the different patented poles on the market will be left to others. The literature on steel towers is extensive—that on steel poles is limited.

We have yet no form of either pole or tower that can be called "standard." Present-day practice for poles is crystallizing about the latticed four-angle type. Towers are being built mostly of the square wind-mill type. An exception is the 140,000-volt line put in operation this year in Michigan, where the towers, of which there are 10 to the mile, are of the braced-tripod type, composed entirely of galvanized-steel angles. This line, at present 125 miles long, is being extended a hundred miles farther and carries the highest voltage yet undertaken, the previous maximum being 110,000 volts.

While the electrical features of a transmission line have received careful attention by the electrical engineer, the structural features have often been taken care of in a crude way, or left largely to chance. The electrical engineer fails sometimes to realize there are other problems to be solved besides those of a purely electrical nature. He should work with his brother, the structural engineer, as the chief item of cost in a transmission line is the structural-steel supports.

Loads.—In designing either a pole or tower the first question for determination is the loads to be carried. These loads are of three kinds: (1) Vertical or dead loads; (2) loads at right angles to the direction of line, due to lateral wind pressure; (3) unbalanced loading in the direction of the line, due to breaking wires. The forces of these three loadings are at right angles each to the other.

(1) The vertical or dead loads are: (a) the weight of the structure itself; (b) the weight of the wires supported by the structure; (c) the weight of the snow or ice coating, if any, on the wires. In sleet regions, ice is generally assumed to accumulate ½ in. thick around the wire. These vertical loads are easily determined, but are seldom a governing feature in the design of the structure, except for the crossarms. The crossarms should be designed for a minimum load of 1,000 lb. at each end. They carry not only the insulators and wires but at times a man or two to adjust them.

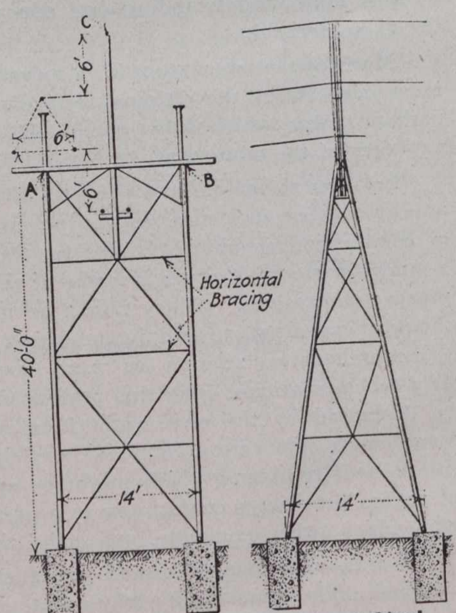

Fig. 2.—Standard Structural-Steel Tower, Georgia Power Co.

(2) The lateral wind pressure on transmission lines has been much discussed. Well known engineers have arrived at widely different conclusions. The author of the article on "Electrical Power Transmission in the Encyclopedia Britannica" writes:

> The actual possibility of wind pressure is very generally over-estimated, and has resulted in much needlessly costly construction.

* From a paper presented at the annual convention of the Association of Iron and Steel Electrical Engineers, Milwaukee, Wis., September 30 to October 5, 1912.

† American Bridge Co., 30 Church St., New York City.

Another writer (Joseph Mayer, Engineering News, Jan. 4, 1906), says:

Such lines should, therefore, be built strong enough to resist not only the commonly occurring, but also the exceptionally violent local storms.

From a mass of data, the writer recommends the use of the following wind loads: (a) On the structure itself, 30 lb. per sq. ft. of exposed surface; (b) on bare wires, 15 lb. per sq. ft. of projected area (length multiplied by diameter); (c) on wires covered with ½-in. coat of ice, 10 lb. per sq. ft. of projected area. In a sleet region (c) should be followed as it is the more severe.

It is noted at once that the requirements given for (1) and (2) do not in themselves determine the loads on the towers or poles unless their distance apart is known. In laying out a transmission line the first thing to find is the most economical span. This is both an electrical and a structural problem. The voltage, size and kind of wires, are to be decided. With these given, the spacing of towers can be determined. The foundations also enter in the calculations. Empirical formulas have been given for the most economical span, but so many variables enter into the question, that they can only be regarded as approximate. Each line is a problem by itself and must be solved independent of all other lines.

(3) The assumptions regarding unbalanced loading in the direction of the line will often determine the design of the tower. Practice as well as theory varies widely in this respect. The following is recommended: A tower having three line conductors or three conductors and one ground wire should be designed to withstand the unbalanced load due to any single wire breaking; a tower, having six line conductors or six conductors and a ground wire should be designed to withstand the unbalanced load due to any two wires breaking. The breaking of a wire throws upon the wire in the adjacent span and thence to the tower a load equal to that which caused the wire to break. For the smaller sizes of wire, No. 4 and under, this load should be taken as the ultimate strength of the wire itself. For No. 3, 90%; No. 2, 80%; No. 1, 70%; No. 0, 60%; and for No. 00 and larger wires it is recommended that 50% of the ultimate strength of the wire be used. The reason for the larger wires being given an advantage is that a break is not liable to occur in them until there has been a reduction of cross-section from burning due to a short-circuit from any cause. The smaller sizes will not permit any reduction of section without breaking.

For line conductors hard-drawn copper wire is generally used. The American Steel & Wire Co. find, from tests, the elastic limit of their copper wire to be 34,500 lb. per sq. in. and more and the tensile limit from 50,000 to 65,000 lb. per sq. in. For No. 00 copper wire, a size often used, the longitudinal pull due to one wire breaking will be 2,500 lb.; for No. 0000 copper wire 4,000 lb. will answer. Care must be taken to provide for torsional stresses caused by unbalanced loading.

In designing the standard towers of the line, the material is to be proportioned for maximum stresses due to any combination of loads (1), (2) and (3).

Unit Stresses.—Equally important with assumed loadings are assumed unit stresses. It might be well to divide proposed towers into three classes—(A), (B) and (C), and assume unit stresses in accordance with the classification of the tower. Two prominent features to be considered regarding any line are the importance of uninterrupted service and the probability of loss of life, due to accident of wires or towers giving way. If the purchaser of power insists upon service at all times under heavy penalty, the tower would come under (A) If interruptions under certain limitations are allowed, (B) may answer. From the standpoint of loss of life due to accident, a line over a thinly settled mountain country would come in (B), while the thickly settled zone about a town or city would require (A). Using open-hearth steel with an ultimate tensile strength of 55,000 to 65,000 lb. per sq. in. and an elastic limit of 55% of the ultimate strength, the working unit stress of steel in tension may be taken at 22,500 lb. per sq. in. for (A) and 27,000 lb. per sq. in. for (B). For steel in compression the recommended formula is:

$$\frac{22{,}500 \text{ or } 27{,}000}{1 + \dfrac{l^2}{18{,}000\, r^2}}$$

To (C) is consigned poles and towers where the primary feature to be considered is the cost. The question then too often becomes, not what the structure should be, but what are the least requirements that can be exacted and the line probably do its work. A common method of reducing material is to consider loadings (2) and (3) not acting at the same time, and increasing the unit stress to 30,000 lb. per sq. in. Some engineers think a high wind will not occur when the wires are covered with sleet.

Even admitting this to be true, arcing sometimes happens between wires when there is a high wind on the bare wires. Owing to lightning discharges, accompanied with wind, it may happen over insulators. This is certainly a combination of (2) modified, and (3) which should not be neglected. For wires covered with ½ in. coat of ice, 8 lb per sq. ft. of projected area for wind load is considered allowable by some good authorities. To this there is not the objection as to the use of 30,000 lb. per sq. in. for unit stresses. The latter comes too near the elastic limit of the steel likely to be used.

It may be said here that comparatively few existing towers are of classes (A) or (B). The engineer often finds it a commercial impossibility to have the towers built as he would like to design them. The situation is similar to that of the highway bridges 30 or 40 years ago. The bridges of that day would not be tolerated now. The towers of to-day will not be tolerated a generation or two hence.

Tests.—Specifications often require that towers withstand certain artificial tests. This means the minimum amount of material that will meet these tests will be used regardless of other considerations. The conclusions from artificial tests are often misleading. The material is new and in good order, and there is the friction of pieces bolted or riveted close together. The workmanship for the test pieces has at least not been slighted. The structure is assembled at the shop under more favorable conditions than will exist in the field. The loads are applied gradually and in one direction, quite different from those that will come after erection. The test generally takes but an hour or two, while the structure is built to last for years, during which it is subject to a continued test.

What is wanted in steel work is durability. This cannot be assured by a structure simply meeting an artificial test. It may be noted that almost every bridge that has failed or had to be replaced was "tested" before acceptance. This does not mean that a mechanical test has no value. The contention is that an artificial test alone does not give the true value.

For poles which are composed of few pieces and are of simple construction, a greater value may be placed upon the test than for towers which are made up of a multitude of pieces and are complicated in their structure, but for both poles and towers conditions should be imposed regarding thickness of material, relation of unsupported length of column to radius of gyration, and details—the last being considered especially important.

Special Cases.—A careful study should be made of special cases of loading. Generally when a pole or tower fails it is under conditions for which it was not designed. Horizontal and vertical angles in the line should be considered. Some English specifications allow the standard tower to be used without further calculation when a horizontal angle in the line does not exceed 8 deg. American specifications often allow this angle to be 10 deg., though there is no uniformity of practice in this respect. Frequently standard towers are used and the approach spans are decreased. In one large system, where the average cable span length on tangents for level country is 550 ft., the approach spans to angles in the centre line vary from 400 ft. on angles up to 8 deg. to 100 ft. on angles of 45 deg., the maximum angle turned on one tower. Sometimes a standard tower is used and guyed. This is generally objectionable. The most satisfactory practice is to use a tower calculated to withstand the increased loads due to the deviation in the direction of the line. Poles or towers adjoining railroads should be designed to meet special requirements. The specifications issued by some railroad companies for lines crossing their right-of-way are quite severe. The National Electric Light Association's "Specifications for Overhead Crossing of Electric Light and Power Lines" are less stringent. Poles used about manufacturing plants will be mentioned later.

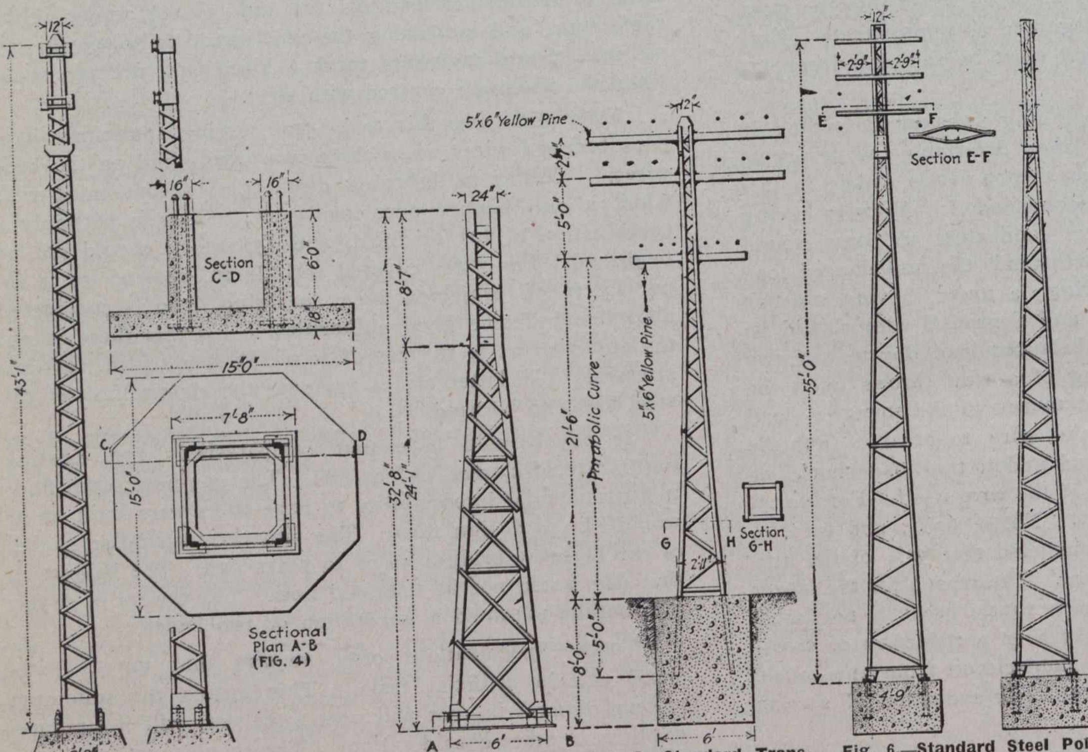

Fig. 3.—Standard 40-ft. Two-Arm Steel Pole, Indiana Steel Co.

Fig. 4.—Typical Electric-Line Pole for Railway Yards, Westinghouse, Church, Kerr & Co.

Fig. 5.—Standard Transmission-Line Pole, N. Y. C. & H. R.

Fig. 6.—Standard Steel Pole of the Tri-City Railway & Light Co., Davenport, Iowa; J. G. White & Co.

"Flexible" Towers.—What are known as "flexible" towers originated in Italy a few years ago, and are being used to some extent in this country. Semenza, an Italian engineer, conceived the idea of caring for the longitudinal forces in a line through a flexible system rather than by a single rigid tower. By this method an occasional tower, about one in ten, is "dead-ended" or made perfectly rigid to take longitudinal stresses, the intervening towers being made to withstand only the dead weigth and transverse wind loads. If a wire breaks there is a drop in the catenary and the shock is absorbed into the series of poles by each yielding at the top. The "dead-end" tower being designed for all the wires breaking, prevents the longitudinal pull extending farther along the line. The intermediate or standard towers are generally made A-shape of two channels latticed together with angles. The advocates of this method are enthusiastic over the saving they claim in steel material and foundations.

A point generally overlooked in making a comparison between the flexible and the rigid towers is that if flexible towers are used either heavier wire or higher towers are required. With the rigid type, if a wire breaks, the tower at each end will take up the unbalanced loading. In the flexible type, say with three line conductors and a ground wire, if a wire breaks the tops of the towers on either side of the break will be pulled over by the four cables in the next span until the total tension in them would be just balanced by that in the remaining conductors of the damaged span. That is, the three cables remaining would do the work of the four in the adjoining spans, showing the need of heavier wire. Of course, this unbalanced loading can be taken up by a greater sag and less tension in the cables, but this necessitates higher towers to maintain the required clearance underneath the wire. It is an open question just how far flexible towers are to be commended. Does the reduced cost overbalance the lessened reliability? For low voltages with towers or poles comparatively short distances apart, they may sometimes be used to advantage. Where high voltages are used with but eight or ten towers to the mile, rigid towers should be used. The city of Winnipeg in its municipal line from Pointe du Bois on the Winnipeg River to the city, a distance of 72 miles, compromises on the choice of towers. Rigid towers are spaced 1,200 ft. apart with a flexible tower midway between. Towers are 43 ft. to the crossarm and carry a double circuit or six wires.

Foundations.—It matters little how near perfect the superstructure may be, if it rests on insufficient foundation. It will then fail in the hour of stress. The theoretical considerations governing the design of foundations are well known, but it is folly to design these foundations in an office, unless it is known the assumptions made fit the actual conditions of the soil at the site. The attempt to do this will probably result in a footing with an undue margin of instability, causing unnecessary expense, or a footing of insufficient strength, liable to cause trouble ever after. Especially to be condemned is a prevalent practice of placing the steel anchorage without any thought of surrounding conditions. Some towers recently built showed excellent results when tested at the shop in the usual way by firmly fastening the foot of each leg to a heavy steel frame. In the field they were pulled over without any difficulty. The soil yielded and the steel anchorages pulled out. Such designing, or lack of designing, is foolish.

The usual method of anchoring is to run an angle stub 5 to 8 ft. in the ground. This stub extends a foot or so above the ground level, and at the top are open holes for bolts to take the corner legs of the tower. At the bottom of the stub is a cross piece 3 or four ft. long of either channels or angles. This anchorage is placed in a hole dug in the ground and the hole refilled. For light lines with short spans and good soil, this may be sufficient for a time. For the usual long-span transmission line, the overturning moment due to the side wind pressure becomes much larger. A platform at the bottom of the angle stub can easily be designed to withstand the uplift, if the soil conditions are known.

Without any protection save a coat of galvanizing, corrosion is bound to set in at or near the ground level. The writer, a year ago, saw some towers in a cultivated field against the corner angles of which the soil had been turned in plowing. The galvanizing had nearly disappeared, though the towers had been erected but two years. There is trouble at no distant future for those towers. The anchorage should extend not less than a foot above the ground line and should be entirely encased in concrete; though a sleeve of concrete extending from the top to two or three feet below the ground line is sometimes used. Here at once a practical objection is raised. To get water and material at the site of the various towers of a transmission line, make concrete and properly set it, is difficult and expensive. Unless a strict supervision is exercised the work is sure to be slighted.

Thicker steel sections used for the anchorage will delay, but not prevent, failure from corrosion. It has been suggested that the anchor stubs be designed in two lengths, the upper length to be removable and thus replaced without tearing down the tower. A large line installed last year used a preservative paint instead of galvanizing their anchorages.

Life.—The life of a wooden pole is given, if of cedar, as from 15 to 20 years, and longer if preservatives are used. The life of a steel pole or tower cannot yet be definitely stated. It is only as far back as 1903 that the first high-tension transmission line was built in which steel towers were used exclusively. This was a line 101 miles long in Mexico, with towers about 450 ft. apart. The present practice of a multiplicity of light sections will not be conducive to long life. Sections ⅛ in. thick are very common—more of this thickness than of any other are used in the average tower. Towers made of such material, galvanized at the shop, bolted together in the field, and then left alone cannot last for a long term of years.

The use of unusually thin metal for compression values calculated in accordance with accepted formulas is to be criticized. In a number of tower tests, under the writer's observation, the failure was always in the 4 x 4 x ¼-in. corner-angle leg. They were not good for their calculated value. This confirms Talbot & Moore in "An Investigation of Built-up Columns Under Load"* in which they write:

It would seem quite probable that, for columns of the same length and containing the same amount of metal, one which is of stocky form and in which the metal is distributed so as to resist local flexural and torsional action will be much stronger and more satisfactory than a column of more flimsy form, which has its metal spread in thinner sections, even though the slenderness ratio l/r of the former may be considerably more than that of the latter.

* Bulletin No. 44. University of Illinois Engineering Experiment Station.

Important changes will take place in the direction of thicker material after some of the present lines fail, and the present policy of purchasing only what will answer for the immediate present is abandoned. There is no reason why a tower properly designed, inspected at regular intervals, painted when necessary, should not last 50 years, perhaps longer.

Examples of Towers.

Connecticut River Power Co.—The 917 towers for the line of the Connecticut River Power Co. were designed and built by the American Bridge Co. Of these towers, 862 are the standard, shown in Fig. 1. The specifications, drawn up by J. G. White & Co., call for the strength of these towers to be as follows:

The towers shall be designed for, and shall be guaranteed to stand, the following test loads without stressing any member beyond its elastic limit:

Insulator pins and grounded wire cap:

(1) At top of insulators for line conductors, 1,600 lb. in any direction perpendicular to pin axis. (2) At top of iron cap support for grounded wire, 1,400 lb. in any direction perpendicular to axis of support.

Supports for pins and cap.

(3) 1,400 lb. load in any direction on grounded wire cap and 1,600-lb. loads in any direction on line conductor insulators to be applied singly or in any combination to produce maximum stress in the supports.

Main tower structure:

(4) A load of 4,800 lb. in any direction at point A (Fig. 1), and no load at B and C.

(5) A load of 4,800 lb. in any direction at points A and B, together with a load of 1,400 lb. in any direction at point C.

In proportioning material the unit stresses were taken at 24,000 lb. per sq. in. net for tension and for compression.

$$\frac{24{,}000}{1 + \dfrac{l^2}{13{,}500\ r^2}}$$

Georgia Power Co.—Some towers designed and built by the American Bridge Co. for the Georgia Power Co. are shown in Fig. 2. Suspension insulators are used. There are 735 towers of the dimensions shown in cut carrying six line conductors of No. 0000 copper wire, and two 7/16-in. galvanized-steel-strand ground wires. The data drawn up for the Georgia Power Co. by the Northern Contracting Co., C. O. Lenz, chief engineer, from which the towers are designed follow:

The test load shall be: (1) A longitudinal pull of 4,300 lb. at right angles to the end of any one cross-arm. (2) A vertical load of 1,500 lb. at the ends of any or all cross-arms. (3) A load of 1,500 lb. pulling in any direction at the top of tower. (4) A load of 10,000 lb. pulling at right angles to the line or parallel to the cross-arms, that is, 2,500 lb. at each cross-arm. At the same time a pull parallel to the line or at right angles to the cross-arms of 8,000 lb., that is, 4,000 lb. in the same or opposite directions at each end of any single cross-arm or at one end of any two cross-arms.

Cross-arms are proportioned for combined loading (see section on "Loads" under "Towers" above) of Case 1, Case 2, and 1,250 lb. horizontal thrust at end of arm. The tower is proportioned for maximum combination of Cases (2) and (3), or (2) and (4). Unit stresses used are 25,000 lb. per sq. in. net for tension and for compression.

$$\frac{25{,}000}{1 + \dfrac{l^2}{18{,}000\, r^2}}$$

There are also 816 standard towers carrying six line conductors of No. 00 copper wire and two ⅜-in. galvanized-steel-strand ground wires, the towers being 16 ft. square at the base and 70 ft. to the upper cross-arm. The loads for which they are designed are: (1) A longitudinal pull of 3,000 lb. at right angles to the end of any one cross-arm. (2) A vertical load of 1,200 lb. at the ends of any or all cross-arms. (3) A load of 1,200 lb. pulling in any direction at the top of the tower. (4) A load of 8,000 lb. pulling at right angles to the line or parallel to the cross-arms, that is, 2,000 lb. at each cross-arm. At the same time a pull parallel to the line or at right angles to the cross-arms of 5,000 lb., that is, 2,500 lb. in the same or opposite directions at each end of any single cross-arm or at one end of any two cross-arms.

The combination of loadings and unit stresses is the same as for the towers with No. 0000 wires.

In addition to the above standard towers there are 200 towers designed to meet special conditions.

Structural-Steel Poles.

It has been requested that structural-steel poles be given a prominent place in this paper. Much of what has been written is intended to be applicable to either poles or towers, though for transmission and distribution systems about the yards of manufacturing plants some of the conditions are quite different from lines through great stretches of open country. The size of base is restricted to as small an area as possible. This necessitates a pole instead of a tower.

The loads to be carried and the desired permanency demand a steel instead of a wooden pole. An interruption of service, even for a short time, means inconvenience and loss. Accidents to life and property, if any occur, are liable to be disastrous and must be guarded against. The seriousness of failure on such lines will justify heavy construction. For this reason it is recommended that each pole be designed to withstand, in addition to the dead and wind loads, the unbalanced load due to a majority of the wires coming upon it being broken. All conditions such as the probability of wires being added in the future, the deviation of the line from a tangent, or special loadings, should be considered. A unit stress of not more than 16,000 lb. per sq. in. net for tension and the same reduced by previous formula for compression should be used.

The foundations shall be of concrete and shall be designed in accordance with local conditions. These local conditions should be thoroughly understood. A clause from the specifications of New York Central & Hudson River R.R. for lines crossing railroads is applicable here:

The foundations shall be of concrete ond shall be designed so as to be able to resist the greatest tendency to overturn due to any combination of the loads specified. No steel shall be carried below the surface of the ground unless encased in concrete. The tops of foundations or tops of the concrete casing shall not be less than 12 in. above the ground and always above flood water.

Indiana Steel Co.—The latest word in the various departments of steel manufacturing may be found at Gary, Ind., in the plant of the Indiana Steel Co. Attention is called to a paper in the Transactions of the American Institute of Electrical Engineers for 1909 entitled, "The Industrial Application of the Electric Motor, as Illustrated in the Gary Plant of the Indiana Steel Company," by R. R. Shover. It is valuable on account of the detail with which the writer has gone into so many phases of his subject.

The standard 40-ft. two-arm pole is shown in Fig. 3. The poles and towers throughout are designed to carry the dead load of the construction, including a coating of ice on the wires equal in thickness to the radius of the wire, together with an overturning load of 20 lb. per sq. ft. on the towers, and 10 lb. per sq. ft. on the projected area of the wires; also a torsional stress in any pole produced by an unbalanced load resulting from the cutting of 25% of the wires in the adjacent span. The unit stresses used are those of the American Railway Engineering and Maintenance of Way Association. No material less than 5/16 in. thick is used.

Westinghouse, Church, Kerr & Co.—R. A. Marshall, structural engineer, has designed and built a number of poles for the yards of railroad shops. Fig. 4 shows a typical pole and its foundation.

Each pole is carefully worked out by itself. The dead loads are the structural steel and the wires with a covering of ice ¼ in. thick. The wind load is figured at 13½ lb. per sq. ft. on projected diameter of wire with ¼-in. ice coating. The tension in wire is figured on a basis of 100 ft. span with 3% sag at centre. A number of these poles take pulls at right angles to the main line which adds materially to the stresses. This is not an uncommon feature in the yards of railroad shops and manufacturing plants.

The steel is designed for two-thirds of the computed loadings with a unit stress of 16,000 lb. per sq. in. net in tension and 16,000 lb. reduced by the formula for compression. No material less than ¼ in. thick is used. Observe that the foundation is of ample proportions.

Pennsylvania R.R.—Among the interesting features of the New York tunnel extension of the Pennsylvania R.R. are the poles through the Meadows section in New Jersey. There are two lines, one for telegraph and telephone purposes, and one for power transmission; they were designed by R. D. Coombs. The poles of the telegraph lines are of concrete, 25 to 50 ft. high and spaced 70 to 135 ft. apart. The poles of the high-tension transmission line are of latticed steel, parabolic outline, square in cross-section, with one angle at each corner and single angle bracing. They are designed not only for present requirements but a liberal provision is made for future needs. The Hackensack River is crossed midway in the Meadows section. The adjoining poles, at the time they were built, were the highest in this country.

These poles (or tower-poles) are 765 ft. apart. Each one is 15 ft. square at the base and 3 ft. square at the top. The tops of foundations are 6 ft. above high water, and from the top of the foundation to the ground line is 188 ft. 4 in. Special features are: Large number of heavy wires, of voltage requiring some separation, carried at a minimum clear height above high water of 133 ft. No strain insulators were available of sufficient electrical or mechanical strength, therefore nests of pin insulators carrying saddles were used to support the wires on the poles. The poles present a graceful appearance. The base is small in area—a greater spread would further obstruct the river and increase cost of foundation. On account of the importance of the line in operating the terminal division of a great trunk-line railroad, conservative data were used for calculations. These data are as follows:

Wires—

River Span: One 250,000-circ. mils, hard-drawn stranded copper ground wire; twenty-four 250,000-circ. mils, hard-drawn stranded copper line wires; four 250,000-circ. mils, hard-drawn stranded copper signal wires; two 2,000,000-circ. mils, hard-drawn stranded copper feeder wires.

Adjoining span same as river span.

Second adjoining span, same as river span except for signal wires—four No. 00 hard-drawn solid copper.

Loading—

One-half-inch ice on all wires with 8 lb. per sq. ft. wind pressure on diameter multiplied by length.

Thirteen pounds per square foot of wind on 1½ times the pole area.

Normal sag 31.8 ft.

Transverse pull 24,900 lb.

Longitudinal pull 22,135 lb.

Unit stresses: Steel in net tension 15,500 lb. per sq. in.; steel in compression 17,600 lb. per sq. in. reduced by formula.

New York Central.—The poles near New York City for the electric-transmission lines of the New York Central & Hudson River R.R. are often quoted as good practice. Fig. 5 shows the standard pole carrying 12 high-tension conductors.

It is made of four corner 3½ x 3½ x ⅜-in. angles laced with 2½ x 2 x ¼-in. angles. Poles on a tangent are 150 ft. apart with a wire sag of 30 in., those on a 6 deg. curve are 107 ft. apart with wire sag of 15 in. The dead loads are the structure itself with the wires covered with ½-in. coating of ice. Wind pressure is taken at 30 lb. per sq. ft. on the surface of the pole and on all wires covered with ½-in. coating of ice. The unit stresses used are 30,000 lb. per sq. in. net for tension and for compression $\dfrac{30{,}000}{1 + \dfrac{l^2}{125\, r^2}}$. While these unit stresses seem high, the loadings are large. The foundation is a solid block of concrete. The cross-arms are of wood, probably to secure greater insulation.

Long Island R.R.—A similar substantial sonstruction is used by the Long Island R.R. for their steel poles on Long Island. The parabolic outline is abandoned. For the high-tension wires the wind is figured on the bare wire; for the low-tension wires it is figured on the wire covered with sleet ½ in. thick. Wind pressure is figured according to results of German high-speed railway tests, where pressure per square foot = 0.0027 V^2. With a velocity (V) of 100 miles per hour, wind pressure = 27 lb. per sq. ft. on flat surfaces and 13½ lb. per sq. ft. on projected areas of conductors. Side pull on pole is figured for a centre deflection of 6 ft. with poles on 150-ft. centres.

N. Y., N. H. & H. R.R.—The 40-ft. yard poles of the New York, New Haven & Hartford R.R. used in the electrification of the Harlem River Branch, are rectangular in cross-section of four 5 x 3½ x ⅜-in. angles, double latticed on all four sides with 2¼ x ⅜ and 2¼ x ½ in. flat bars. The poles, back to back of angles, are 2 x 3 ft. at base and 2 ft. by 2 ft. 2 in. at top. The base of each pole is made specially strong. From this base, four anchor rods of 1¾ to 2⅛ in. diameter and upset at ends run down 8 to 10 ft. in a concrete foundation.

J. G. White & Co.—Some poles designed by S. R. Jones, structural engineer of J. G. White & Co., are simple in construction. They are for a transmission system in the Middle West and are shown in Fig. 6.

The data upon which design is based is:

Power wires: One circuit No. 1 stranded medium hard-drawn copper; one circuit No. 4 stranded medium hard-drawn copper.

Ground wire: No. 8 copper-clad steel.

Maximum allowable tension in wires: Fifty per cent. of breaking strength with ½-in. coating of ice and wind load of 8 lb. per sq. ft. on horizontal projection of increased diameter of wire.

Assumed loads on pole: Vertical loads: Crossarm = 600 lb. at end of crossarm; pole = weight of pole + weight of wires covered with ½-in. thickness of ice.

Horizontal loads: Total pull of 2,500 lb. applied at middle crossarm in direction of line, or at right angles to line plus wind load on pole at 20 lb. per sq. ft. on exposed surface (both sides of pole included in surface exposed to wind pressure).

Unit stresses in steel: 24,000 lb. per sq. in. net for tension; 24,000 lb. per sq. in. reduced by formula for compression.

The preceding poles may be taken as illustrating the best practice of to-day. It will be seen that they have much in common. In each case the pole is made of four angles latticed.

Various Poles.—A pole made of two channels laced has been used, but such a pole is limited to light loads and low heights. The same can be said of a pole made of one plate and four angles. Foster ("Electrical Engineer's Pocket-Book") gives the deflection of some poles 6 ft. in ground and 24 ft. above ground, made of 6-in. to 12-in. by 3/16-in. plate and four 2½ x 2 x ¼-in. angles, for loads of 500 to 2,500 lb. applied 3 ft. from the top, to be from 1 to 5 in. These poles were used for electric railway service. The plate-and-angle pole has the advantage of being a good shape for inspection and painting.

Patented poles, made of rolled-steel sections fastened together at intervals, are on the market, and are meeting with considerable sale. They show good results for vertical loads, but the sections being battened and not laced together are adapted to carry only light lateral loads to the base. It is the custom to guy these poles from the top if the lateral forces are large. This restricts their use.

Conclusion.—The use of steel poles and towers is on the increase. This paper is not intended to be a complete discussion for the field is too varied and too large to be thoroughly reviewed in a single paper. It is hoped, however, what has been written may not be without interest, and lead to further discussion on the subject.

THE DIESEL ENGINE FROM THE USER'S STANDPOINT.

The Diesel engine is coming into such general use for the purpose of the generation of electrical energy that a few notes on its advantages, cost of running, and maintenance, may be of interest. Mr. Wm. J. U. Sowter read a paper recently before the Dublin local section of the Institution of Electrical Engineers. A few abstracts of the paper which are of particular interest follow:—

Although several papers have been written on the subject, most of the conclusions arrived at are based on estimated results, and it is, therefore, the intention of the author to discuss the matter from the user's standpoint, quoting as far as possible results obtained in actual practice.

The following is a specification of a suitable oil which the author has adopted with satisfactory results:—

1. The oil shall be either crude, refined, or a residue of petroleum.

2. It shall be free from tar, bitumen, or solid hydro-carbons; it shall be also be free from sand, fibrous matter, or foreign solid impurities.

3. The oil shall not contain more than one-half of 1 per cent. of water, nor 1½ per cent. of sulphur, and shall be free from acid.

4. The viscosity shall be such that the oil will flow in a continuous stream with 1 ft. head through a ½-in. copper pipe 6 feet long without pre-heating.

5. The calorific values shall not be less than 18,000 B.t.u. per lb.

Many other liquid fuels may be used, such as residue shale oil, gasworks tar oil, or creosote oil

Running Costs.—Contrasted with steam plant, there is but little difference in fuel consumption per B.H.P.-hour between large and small Diesel engines, nor does the fuel consumption increase largely per unit of energy as the load is decreased on the engine. It is well known that a large steam engine running at light load is grossly inefficient, the fuel required to maintain steam pressure in the boilers and to run the engine light, together with the necessary auxiliaries, being out of all proportion to the work done; also, a small steam engine requires many more pounds of steam per h.p. to run it fully loaded than does a large one. In addition to these considerations there is the serious question of stand-by losses, which are very great indeed with steam plants, while they are absolutely non-existent where the Diesel engine is used.

It is apparent from the foregoing remarks that it is unnecessary from the point of view of fuel economy to install large engines when a greater number of small engines will suit the circumstances of any particular case better, desirable as the former procedure may be so far as capital cost per kilowatt of plant installed is concerned.

The following figures show the cost of fuel per unit generated with oil at the prices mentioned, and at various loads, for a 50-B.H.P. engine coupled to a 33-k.w. generator:

Load.	Dynamo Efficiency. Per Cent.	Price of Fuel per Ton. 40s.	50s.	60s.	70s.
Full	88	0.161	0.201	0.242	0.281
Three-quarter	86	0.178	0.210	0.252	0.295
Half	83	0.208	0.261	0.314	0.365
Quarter	78	0.307	0.384	0.462	0.538

These figures are not merely manufacturer's "paper" figures, and the author is in a position to vouch for them personally, he having obtained similar results after repeated tests at irregular intervals. On larger plants the cost would be some 10 to 20 per cent. better, depending upon the size of the plant.

Figures such as the above clearly demonstrate the great advantages this type of plant offers for use in small generating stations.

Capital Cost.—The capital cost of a Diesel engine direct-coupled to a generator is considerably greater than a gas or steam-driven generator of similar capacity, but when the costs of complete plants, comprising either gas or steam, are compared, there is but little differences in the price per kilowatt. A Diesel station, however requires less land and building than similar stations employing steam or gas plant, so that the difference, if any, is in favor of the Diesel plant.

The following are approximate prices for small plants, delivered and erected on purchaser's foundations complete with all oil storage tanks, piping, etc., and may be taken as fairly representative:—

Size in Kilowatts.	Price.	Price per Kilowatt.	F.O.B. Works.	Weights.
100	1,950	19.5	1,340	19,450 lbs.
150	2,600	17.3	1,770	23,250 lbs.
200	3,260	16.3		
300	4,380	14.6		
400	5,300	13.3		

FILING SHOP DRAWINGS AND RECORDING PROGRESS OF WORK.

A very simple method of filing shop drawings and recording the progress of shop work has been adopted in the superintendent's office of the Dominion Bridge Company, at Lachine, Que., and is described in a recent issue of the Engineering Record. The drawings of all work in progress, amounting to fifty or more jobs, are uniformly filed in a very convenient and accessible manner and the main features are daily posted on to them in such a way that the condition of the work can be instantly determined by inspection. Each complete set of shop blueprints of standard size is clamped between two 2 x ¼-in. hardwood strips, 24 in. long, that are fastened across one end of the sheets. Attached to the centre of one of the strips is a U-shaped clamp of 2 x ⅛-in. iron with one leg about ¾ in. clear of the fixed strip. The ends of the drawings are placed between the fixed and loose strips, the latter being set inside the clamp and forced down to bearing by driving a thin steel wedge under the projecting leg of the clamp between it and the loose strip. This holds the blueprints tightly in position at the centre of the strip and prevents their slipping, while the edges of the sheets at the ends of the strips, although not held closely by the latter, cannot be displaced on account of the centre clamp and are protected by the wood strips which shield without clamping them.

The fixed strip has a frame for a title card close to the clamp and the clamp is provided with an eye by which it is suspended from the horizontal leg of a long hook having a vertical shank clamped between a small angle and a flat bar about 15 ft. long which are supported at the ends and intermediately. The hooks are set 3 or 4 in. apart at a height of about 5 ft. above the floor and provide for the very convenient and accessible filing of the drawing which can be selected or restored to the file independently.

Every day the number of pieces finished and inspected are checked off by red and yellow marks, respectively, on the blueprint, or as soon as any set of pieces is completed it is indicated by a circular check mark of the proper color. When all of the pieces on a sheet are finished large circles are drawn on the title to indicate it. The drawings are examined daily and when a job nears completion if scattering pieces are incomplete they are entered up in a "short-order" book which is posted daily and quickly shows any deficiency that may be made in shipment on an order.

OTTAWA LIGHT COMPANY'S CAPITAL INCREASE SANCTIONED.

The Dominion Government has sanctioned the proposed increase in the capital stock of the Ottawa Light, Heat and Power Company, Limited, from $2,000,000 to $5,000,000. This increase will be made by the issue of 30,000 new shares of $100 each. Of the present authorized capital of $2,000,000, at the end of 1911 $1,984,400 was subscribed and paid. This was an increase in paid-up capital of $404,000 over 1910. It represented 14,910 shares of the Ottawa Electric Company and 4,934 shares of the Ottawa Gas Company, which were exchanged at par for shares of the Ottawa Light, Heat and Power Company.

The Ottawa Light, Heat and Power Company this week declared a bonus of 1 per cent. with the usual quarterly distribution of 1¾ per cent. on the stock of the company. A similar bonus was paid last year with the dividend at the same rate as this year; a stock bonus of 25 per cent. was also paid in 1911. In 1910 the dividend rate was 6 per cent. with which a 2 per cent. bonus was paid, and in 1909 5 per cent. with a bonus of 1 per cent.

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CONTENTS OF THIS ISSUE.

YORK COUNTY GOOD ROADS.

A significant result of the improvement which has already been done on the roads throughout York County which lead into the city of Toronto is the falling off in the use of the elevators. This past fall the elevators within a radius of twenty miles and outside the city limits have only done about one-third of the regular business.

This has been due to the fact that the farmers are now able to draw their grain directly into the city, thereby securing better prices and increasing the business of the city elevators.

Good roads mean not only better prices for the farmer, but lower cost to the consumer. Increased facilities in marketing produce by the bettering and improvement of the highways always result in the forming of new business and the development of added sources of trade.

York County good roads have been vastly improved by the money already spent on them, but there is still much to be done. The by-law now before the ratepayers for the additional amount of $100,000 deserves the hearty support of the city.

TORONTO'S WATER BY-LAW.

Are the citizens of Toronto satisfied that the by-law now being placed before them, to provide six million dollars for a duplicate water supply from Scarboro Heights will give them the best and most economical location for the future water supply of the city?

It is interesting to note the reasons on which the Water Commissioners based their choice of Scarboro Heights. The proposed location of the intake crib off Scarboro is twelve miles from the present intake, while the effluent from the Morley Avenue sewage disposal works, which will ultimately handle practically all of the city's sewerage, is discharged about half-way between.

The Commissioners are agreed in their report that Lake Ontario must remain the future source of supply. They state that from the evidence to hand the transporting lake currents are from the east to the west, and that there is a lesser probability of impure water to be met with off Scarboro than off Mimico. They add that there is no location within ten miles of the north shore lake from which water can be drawn which will at all times present a safe supply, unless such water be subject to some form of purification.

On page 6 of the report the following are given as the reasons for the choice of Scarboro:—

"That all the available evidence points to the necessity of increasing the water supply to meet the demands of one million population, and that it is not advisable to rely upon the present location for such increased supply. Taking into consideration the probable future growth of the city, it is reasonable that the present location of supply be considered only as a central unit, and that extra units be installed either east or west of the central unit.

"That, owing to the demonstrated fact that pure water is obtainable for longer intervals of time east of the harbor than to the west, and, owing to the high elevation of the plateau at Scarboro, a second unit be first installed at this location.

"That until Toronto can be assured of a second independent and reliable supply of water from the lake, what have been considered as exceptionable and unpreventable circumstances may again arise, to the discomfort of the citizens and consequent lack of confidence in the organization of the Water Works Department of the city."

Evidently, then, their decision is based on these facts:—

1. That the past troubles with the present location of the intake debar Centre Island as the main source of supply.

2. That the increase in the city's population demands units east and west of the present plant.

3. That there is greater probability of obtaining pure water for greater length of time at Scarboro.

4. That there is high ground at Scarboro for the location of a reservoir to provide gravity supply.

The Scarboro project provides for an intake tunnel ten feet in diameter and two miles long; pumping machinery of sixty million gallons capacity; a mechanical filtration system; covered reservoir, and gravity mains from the reservoir throughout the city. The total estimated cost is given as $5,320,000. As a matter of fact, we believe that this amount will be considerably exceeded if the plant is constructed, as the amount estimated for many of the items is too low.

The past troubles with the intake of the present plant on Centre Island have been due to faulty design and construction. The Commission proposes at Scarboro to spend $1,346,600 for intake purposes alone. It will cost to do this work at least a million and a half. If this same amount of money, or even half of it, were spent in installing an intake crip with intake tunnel at Centre Island, an independent and duplicate supply could be secured at that point.

That the increase in the city's population demands units east and west of the present plant sounds like a reasonable argument by the Commissioners, but we note in their report that they expect to supply West Toronto with water from Scarboro, a distance of fifteen miles. If the reason for the choice of Scarboro is the extension of the city's area and population eastwards, then why do the Commissioners contemplate the supply of West Toronto from Scarboro? Why not use the Centre Island plant, which is much nearer? With the city's population increased to one million, it is very doubtful whether the eastern and western limits of the city will be extended beyond what they are to-day. The central system to-day has no difficulty in supplying all parts of the city.

There is a greater probability of obtaining purer water for greater lengths of time east of the sewage disposal works at the Scarboro location. There is little difference, however, in the quality of the water at Centre Island and at Scarboro, and in any case, as the Commissioners note, continuous filtration is absolutely necessary.

Coming to the last point in the choice of Scarboro is the fact that there is high ground for the location of a reservoir. The distance from the Scarboro reservoir to the present High Level Pumping Station is a matter of twelve miles. To deliver the ordinary output of the Scarboro pumping station of sixty million gallons a day there will be a loss of about forty-five feet of head. At times of peak load this loss through friction will increase to one hundred and fifty feet of head. The High Level Pumping Station is at practically the centre of gravity of supply of the city. A comparison of the Centre Island supply with the Scarboro supply delivered at the High Level Pumping Station shows that it will be necessary to pump against a head of from forty to one hundred and fifty feet greater with the Scarboro scheme, and, in order to secure this privilege (if it may be so stated) it will be necessary to spend over $6,000,000.

A city of such size and growing importance as Toronto demands an absolutely continuous supply of pure water, and it is therefore quite necessary that there should be provided in the near future a duplicate supply of the present one. In reading over the Commissioners' report we have wondered whether they analysed the possibility of obtaining that duplicate supply from Centre Island. At an expenditure of not over $3,000,000 an intake crib and intake tunnel similar to that outlined for Scarboro, a filtration system, and a second tunnel under the bay could be built. This would furnish an absolutely independent supply of water to the city at the logical point for supply, the centre of population of the city. The water would be furnished to the consumer as it is at present, under a minimum amount of pumping.

If Scarboro were located, say, fifty miles east of Toronto on the lake front, the absurdity of choosing such a location simply because a high plateau existed there would be quite apparent, unless the quality of the water was so very much better as to justify the increased cost. Because a high plateau exists some twelve miles east of the city, which affords an excellent location for a reservoir, it does not follow that it will be economical to pump the water up to this plateau and then let it gravitate to the city. It must be remembered that the advantages of a gravity supply are sadly minimized when it is necessary to elevate the water to the upper level by pumping, and then lose this extra head by friction loss in the many miles of pipe necessary to convey the water to the city.

The facts against the Scarboro location are this—the quality of the water is very little better than that at Centre Island, and must be continuously filtered. There will be a continuous future loss of head due to the flow of the water through twelve miles of pipe in order to reach the centre of population of the city. It will cost at least $4,000,000 more to install a plant there than to build a duplicate plat at Centre Island; that is, greater first cost of construction, greater continuous cost of operation, no better water after filtration, are the arguments against the Scarboro scheme.

The citizens of Toronto are not justified in proceeding with the construction of a Scarboro plant on the evidence submitted in the report of the Commissioners.

EDITORIAL COMMENT.

The annual meeting of the Canadian Society of Civil Engineers will be held on the 28th, 29th, and 30th of January next. It is expected that the Society's new building at 176 Mansfield Street, Montreal, will be finished by that date, and the meeting will therefore be held there. All members should make an earnest effort to be present.

GENERAL NOTES.

Precipitation was decidedly deficient in the Western Provinces and in New Ontario and in excess of the average over a portion of Ontario lying between Lake Huron and the Ottawa Valley and also throughout the Province of Quebec, elsewhere departures from average were not pronounced. Snow occurred in all the provinces.

At the close of the month, snow to a greater or lesser depth, was on the ground in many parts of Canada. In northern districts of the West the depth was over 10 inches, this being also the depth in the Ottawa Valley and the Gaspé Peninsula. In southern districts of the Western Provinces, the ground was nearly bare of snow, a trace being reported from most localities. Nova Scotia and Prince Edward Island were snow covered to a depth of 3 to 7 inches.

The table shows for fifteen stations, included in the report of the Meteorological Office, Toronto, the total precipitation of these stations for November, 1912:

	Depth in inches.	Departure from the average of twenty years
Calgary, Alta.	0.5	—0.22
Edmonton, Alta.	0.4	—0.44
Swift Current, Sask.	0.4	—0.25
Winnipeg, Man.	0.1	—0.98
Port Stanley, Ont.	2.3	—0.71
Toronto, Ont.	2.38	—0.15
Parry Sound, Ont.	4.5	+0.50
Ottawa, Ont.	6.7	+4.35
Kingston, Ont.	3.6	+1.01
Montreal, Que.	6.3	+2.86
Quebec, Que.	4.6	+1.53
Chatham, N.B.	4.6	+0.78
Halifax, N.S.	5.5	—0.38
Victoria, B.C.	5.0	—1.07
Kamloops, B.C.	..	.....

LETTERS TO THE EDITOR.

LIGHT COMPRESSION MEMBER.

Sir,—I wish to thank Mr. C. R. Young, through The Canadian Engineer, for his pertinent comments upon my letter of November 23rd.

I can hardly agree, however, with his opinion that the assumption of an unequal distribution of stress across the sectional area of a compression member is poorly founded theoretically. Permit me to call attention to an article entitled "Elastic Equilibrium of Circular Cylinders Under Certain Practical Systems of Load," by L. N. G. Filon, and published in the Philosophical Transactions of the Royal Society of London, Series A, Vol. 198.

Quoting from this article for the benefit of those who may not have the article at hand; speaking of a circular cylinder in direct axial compression, Mr. Filon states: "The axial pressure deviates throughout from uniformity over the cross-section, the total variation in any section remaining tolerably constant over nearly two-thirds of the length of the cylinder." We notice, also, that near the centre of the cylinder the greatest pressures occur at the centre of the cross-section, whereas the reverse takes place at the ends, the pressure at the perimeter of the ends amounting to about 1⅓ times the mean pressure." Further on, speaking of cylinders under the same condition, except that the ends are prevented from expanding, he states: "It is thus not surprising that the greatest pressure should be at the perimeter, being in fact nearly 2½ times the pressure at the centre."

It seems to me that this shows the assumption of a varying distribution of stress is theoretically more reasonable than the uniform distribution. Furthermore, the case cited is for a circular cylinder, and the distribution of stress depends on the shape of the sectional area, so that the case of a "built-up" section may be even much worse than that of the cylinder.

Hence, I must still maintain that my suggestions, although perhaps not convenient for engineering practice, are not at all impossible theoretically.

The important point brought out by Mr. Young, that the position of the points of application of the load and the way in which the load is applied is an important factor in determining the distribution of stress over the sectional area, is certainly very important in specific cases where the method of loading is known, but a general theory of "built-up" compression members could not be made to take all possible cases into account.

Perhaps the most sensible way to apply the idea of an unequal distribution would be to reduce the allowable stress on the cover-plates of a "built-up" column in some proportion depending on the percentage of area included in the cover-plates.

Thanking you for the attention which you have given me in this matter.

Yours very truly,

I. F. MORRISON.

University of Alberta, Edmonton South, December 12th, 1912.

* * * *

CANADIAN ENGINEERS AND DRAUGHTSMEN.

Sir,—The remarks of Mr. F. Tissington in your issue of November 14th do not in any way demonstrate further the alleged need of more technical schools to make up for the lack of experienced draughtsmen. Technical classes do not make experienced engineers and draughtsmen. This year 545 engineering students entered at McGill, and yet technical men are being engaged direct from Britain or the States, who cannot be said to be experts in a particular line. There must be a gap somewhere. And that gap is inexperience. The degree of competition in Canada can be judged from the dismal failure to recruit men for the still-born Canadian navy. If a man considers he is not fairly treated in a drawing office, nothing is easier than to get another job. This frequent moving about militates against a draughtsman becoming thoroughly experienced in one branch of engineering. I strongly resent Mr. Tissington's unwarranted insinuation as to the treatment of draughtsmen in Great Britain, and can only suppose that he was extremely unfortunate with his employers there. Office hours in Canada, even in Ontario, are longer than in England, South Africa, or probably any other country in the Empire.

As to draughtsmen in Britain having all had shop experience, I referred particularly to mechanical engineering, and I rigidly adhere to this statement.

Yours faithfully,

C. O. Thomas.

Montreal, December 20th, 1912.

PRODUCTION OF METALS IN ONTARIO.

The total production of metals in Ontario, as given below, is subject to a slight deduction, due to its including not only iron ore but also pig iron, into which some portion of it was doubtless smelted, states Mr. T. W. Gibson, deputy minister of mines, in the twenty-first annual report of the Ontario Bureau of Mines, but, after making allowances of this sort, the aggregate value cannot be less than one hundred and eighty million dollars.

Product.		Quantity.	Value.
Gold	oz.	165,521	$ 2,620,627
Silver	oz.	130,371,791	79,504,371
Platinum and palladium	oz.	3,364	62,784
Cobalt	tons	6,068	756,360
Nickel	tons	136,114	36,276,303
Copper	tons	108,064	15,655,221
Iron ore	tons	3,356,287	6,485,501
Pig iron	tons	3,182,715	49,191,732
Lead ore	tons	3,351	20,000
Pig lead	tons	1,143	96,000
Zinc ore	tons	7,704	92,410
Total			$190,761,30f

THE YORK COUNTY HIGHWAY COMMISSIONERS' REPORT

As an introduction to the second annual report dealing with the roads under control of the Board of Highway Commissioners, York County, the following facts concerning the early roads of York County may prove of interest.

The first survey of highways in what is now York County was made in 1791, by Augustus Jones, when he sub-divided what are known as the townships of Scarboro and York. In the following year York County was formed, although its area was many times its present size.

In the first Parliament of Upper Canada, which met at Newark (Niagara Falls), in 1793, the roads were placed under overseers who reported to the military authorities of the British Government, who provided the necessary money for construction and improvements.

The Parliament of Upper Canada granted in 1830, $512,000 for road construction throughout the Province, and in the same year the Statue Labor Act came into force.

By this Act every male resident of the Province between the age of 15 and 60 years were required to give two days' labor towards the building and repairing the highways of the Province.

The Act which united the Provinces of Upper and Lower Canada in 1841 also provided for municipal institutions and the road came more directly under the control of local officials.

In 1891 and each succeeding year efforts were made in the County Council of York to abolish the collection of tolls on York roads on condition that the City of Toronto cease to collect market fees other than cattle market fees.

In 1893, City of Toronto took over the Lake Shore Road and the tollgates on this road were abolished in 1896, under By-law 712, J. Slater being Warden. A by-law to abandon the York roads and transfer the same to the minor municipalities of York County was carried in 1896.

YORK HIGHWAY COMMISSION

JOHN GARDHOUSE, Warden, 1912. W. G. TRETHEWEY, Commissioner. D. SINCLAIR, Tres. Dept. E. A. JAMES, Chief Engineer. R. W. PHILLIPS, Secretary. R. J. BULL, Warden, 1911. W. H. PUGSLEY, Vice-Chairman. GEO. S. HENRY, J. J. WARD, Chairman.

In the following year, 1794, Yonge Street was surveyed and partly cleared, but as revenue for road work only amounted to $900.00 per annum, very little permanent construction could be undertaken.

The Don Mills Road was surveyed in 1799 and the following year an overseer was appointed, but it was not until 1821 that permanent improvements of an expensive character were undertaken.

The Danforth Road was commenced in the same year, and about 60 miles of this road was opened.

The Lake Shore Road was cleared in 1804.

The Dundas Street, the highway to the west, although partly opened in 1809, was not bridged until after the War of 1812.

The Northwest Fur Co. offered the Government in 1815, $60,000 to improve Yonge Street, but only a small amount of this money was ever contributed and the road, although used as a military highway, was not put in good condition until 1835.

Following the assuming of the roads by the townships, efforts were made from time to time to again establish a County System, Mr. W. H. Pugsley, at the June session in 1899, moved a resolution which was seconded by Mr. James Ley, "that the Council, resolve itself into Committee of the Whole to consider the advisability of organizing and assuming a system of leading roads as county roads, and also as to petitioning the Provincial Legislature to assist in the maintenance of the same."

With instruction the committee arose and reported the following resolution: "Resolved, that the Clerk be and he is hereby directed to procure all the information possible with reference to a scheme whereby a system of county roads may be maintained by the County and Provincial assistance, for the use of this Council at its November session."

This resolution was received and adopted.

The committee thus appointed, realizing the magnitude and importance of the subject, in order to obtain as much information as possible and also to act in union with other counties of the Province, called a convention of municipal representatives of the Province, on December 12th and 13th of that year, to consider the question. The report of this convention was printed and distributed, and doubtless had much to do in bringing the necessity of improved roads and the advisability of an early start in that direction before the electors of the county.

In January, 1902, the following resolution was carried by the York County Council: "That the By-law and Legislative Committee be and they are hereby directed to prepare and have introduced in the Local House a petition asking that the clauses of the Act under which bonuses are granted to street railways be made to apply to the making of improved roads in townships, with a further provision that when any locality in a township vote to provide two-thirds of the costs of any such improved roads, the townships in which any such locality is situated shall pay the other one-third." No action, however, was taken by the Government.

In order to take advantage of the Act for the Improvement of Public Highways, passed in 1901, whereby the Provincial Government agreed to bear one-third the cost of the construction and improvement of County Highway Systems approved by the Government, the following resolution was passed by the County Council in June, 1903: "That this Council be now resolved into Committee of the Whole to discuss the advisability of taking over and maintaining certain roads in the County as County Roads, and thereby receive a portion of the amount set apart by the Government for making good roads." This Committee afterwards drafted a by-law which was submitted to the various township councils. More than one-third of the township councils disapproved of the by-law, and, under the provisions of the Act covering such cases, it was necessary to put the question to the ratepayers. This was done in January, 1904, the result being a majority against the proposal.

The matter then lay dormant till June, 1906, when Mr. W. H. Pugsley moved that the Council resolve itself into Committee of the Whole at the November session to discuss the advisability of again submitting the question of County Roads to the electors of the County for their approval or otherwise.

This Committee at the November meeting reported the following resolution: "Resolved, that the Council do at this session of the Council report a by-law setting apart certain roads as County Roads, and that the by-law be submitted to the various Township Councils for their approval as provided by the Act of 1901 and amendment thereto." This was defeated.

At the June session, 1907, the by-law to assume certain leading highways as a County Road System was defeated by a vote of 10 to 16.

During the sessions of 1908 the question of County Roads was again considered, but it was not until the December session of 1909 that substantial progress was made towards the present scheme by the passing of a resolution forming South York for County Road purposes and directing the Legislative Committee to meet the Council of the City of Toronto with a view to securing city aid for the improvement of leading highways.

At the June session of 1910, Mr. Geo. Henry moved, and Mr. W. H. Pugsley seconded, that Messrs. Annis, Nigh, Longhouse, Gardhouse, Bull, the mover and the seconder, be a committee empowered to draft a schedule of highways for a County Road System in the part of the county within the riding of East and West York.

This committee secured legislation authorizing the York County Council to adopt a County Road System for the portion of the County included in the Electoral Districts of East and West York and for issuing debentures assessable on that portion of the County, only exempting the municipalities that compose the Electoral District of North York. The Committee drafted a schedule of the leading roads in this section of the County, which roads now comprise the County Road System.

At a joint meeting of the above Committee and representatives of the City Council, Toronto Board of Trade, and the Ontario Motor League, the following resolutions were passed:

"Moved by Reeve Henry, seconded by W. J. Gage, that this joint Committee representing the City of Toronto, the County of York, the Board of Trade, and the Ontario Motor League recommend that the City of Toronto and the County of York each contribute one-third cost of constructing permanent roadways within the County of York, the remaining one-third to be contributed by the Provincial Government under the conditions of the Statutes in relation to the improvement of highways."

"Moved by Reeve Bull, seconded by W. G. Trethewey, that the City of Toronto and County of York strongly recommend the vote of a grant of $100,000 to be set apart for the purpose of improving the highways mentioned in the resolution so that the work can be commenced at the earliest possible date."

"Moved by W. J. Gage, seconded by Reeve Annis, that this joint Committee recommend that the County of York, the City of Toronto and the Provincial Government each appoint a representative who would practically constitute a commission to have charge and supervision of the expenditure of moneys given by the different municipalities and the Government in connection with the improvement of highways."

In January, 1911, a by-law was submitted to the electors of the City of Toronto to raise the $100,000 recommended as the city's share of the project, which by-law was carried by a substantial majority.

Good Roads Scheme, York County.

Showing Roads Under the York Highway Commission.

Early in 1911 the County Council passed by-laws: to designate the roads to be improved; to raise $100,000 as the County's share by the issuing of debentures; to confirm the agreement with the City of Toronto whereby the city and the county were each to bear one-third of the expense of construction, the remaining one-third to be borne by the Government; to relieve the municipalities lying in North York from liability for the cost of the new roads; and to appoint Commissioners to act with others appointed by the city and the Government.

According to the agreement with the city, the Board of Highway Commissioners was to consist of three persons appointed by the County, two by the City and one or more by the Government. The original personnel of the Board was as follows:

For the County—Messrs. R. J. Bull, Wm. H. Pugsley, and Geo. S. Henry.

For the City—Messrs. J. J. Ward, and L. H. Clarke.

For the Province—Mr. W. G. Trethewey.

The County By-law appointing Commissioners included the Warden of the County by virtue of his office, hence in January, 1912, Mr. Bull was succeeded on the Commission by Mr. John Gardhouse, Warden for 1912.

The following is the engineer's report:

My first report, which was presented to you in December, 1911, outlined generally the work we had undertaken, but as this report is our first printed report, I am incorporating in it part of the work undertaken during 1911, as well as dealing more particularly with the work of this year. When we commenced construction work in 1911 we had great difficulty in securing contractors who were experienced in road building, and where we undertook to do the work by day labor we had greater difficulty in securing men who had experience in the construction of waterbound macadam highways.

That the work might not be delayed and that the Commission might have in their possession information as to the cost of construction, it was decided that in 1911 to purchase two outfits. These outfits were so successful in 1911 that in the spring of 1912 three more were purchased. The five outfits purchased, together with the contractor's equipment, made it possible for the Commission to put in the field during 1912, fourteen outfits.

YONGE STREET.

Road No. 1., Div. 11 and 12.

This section was completed by day labor with Ben. Flook immediately in charge of the work.

Double Cylinder Waterous Roller, Working on Yonge Street.

In 1911, a Waterous double cylinder 12½-ton roller was used, and in 1912 a Kelly-Springfield double cylinder 12½-ton gasoline roller was used.

With the exception of a short section opposite lots 15 and 16, which was built of limestone, the road is constructed of 2-inch granite from Washago, waterbound with limestone screenings, and the road has an average width of 15 feet.

From an observation of the wear on the limestone and on the granite, it would appear that the granite will give much better service.

The granite on this road cost $1.75 per ton f.o.b. Metropolitan Railway sidings.

The limestone cost $1.95 per ton. The high price of limestone was due to the fact that there are no limestone quarries on the C.N.O. Ry. and that this stone had to come over three railways, thus making us liable for three freight rates.

The following tabulated statement will give at a glance the various cost and charges:

YONGE ST., DIV. 11 AND 12—MR. BEN FLOOK.

	Total Cost 1911 & 1912	T't'l tons (1 ton= $1.75)	T't'l c.yds. (2600 lbs. to c. yd.)	Cost per c. yd.
Grit, stone and granite..	$20,982.62	11,990	9,223	$2.27
Labor	5,412.26			58 3/5c.
Teams.	3,066.43			33 2/10c.
Coal, gasoline and wood .	457.96			4 9/10c.
Oil & accessories for roller	64.24			7/10c.

YONGE STREET.

Road No. 1, Divs. 13, 14 and 15.

These sections were completed by day labor with John Sheardown in immediate charge of the work.

In 1911, a small section was completed in the Village of Richmond, but it was not until 1912 that much progress was made.

These divisions were built of granite from Washago, waterbound with limestone screenings, and the road has an average width of 15 feet.

The remarks as to wear and cost given under Divisions 11 and 12 apply in Divisions 13, 14 and 15.

YONGE ST. DIVS. 13 AND 14—MR. J. SHEARDOWN.

	Total Cost 1911 & 1912	T't'l tons (1 ton= $1.75)	T't'l c.yds. (2600 lbs. to c.yd.)	Cost per c. yd.
Grit, stone & granite.	$18,139.82	10,365.6	7,973.5	$2.27
Labor	4,164.24			52 2/10c.
Teams	2,705.50			33 9/10c.
Coal & wood	327.82			4 1/10c.
Oil & acc. for roller..	52.88			66/100c.

KINGSTON ROAD.

Road No. 2, Divs. 21 and 22.

This road was built by contract.

Contractor, Morris Reid, Dunbarton, Ont.

In the construction of this road limestone from Dundas and Kirkfield was used. It was waterbound with limestone screenings.

Although this road had been previous a stone road, the road had been left without repair and the traffic had been so heavy that for most of the road we had to commence at the sand and build up again so that it made it an expensive road using much material.

The road is well crowned, and well bound, anl well drained, and is built with an average width of 14 feet from the east city limits to lot 21, Con. C., Scarboro.

KENNEDY ROAD.

Road No. 3, Divs. 31 and 32.

This road was built by contract.

Contractors:

ROUTLEY & SUMMERS, Haileybury, Ont.

In the construction of this road limestone from Dundas and Kirkfield was used; it was waterbound with limestone screenings.

On one section of this road just south of the C.N.O. Ry. tracks a short section was surfaced with trap rock from Cobalt. This road is much more expensive to lay than limestone, but its wearing qualities are much superior, and I anticipate that in future large quantities of trap rock will be used for macadam highway. Trap rock will cost from $1.85 to $1.95 per ton, f.o.b. sidings, in York County.

On this road 15 ft. of 4-inch tile was laid.

Three concrete culverts was constructed with openings of 4-inch, 6-inch, 3-ft. and 3-ft.

This road is completed from the east city limits to lot 23, Con. D, Scarboro. The metal part of the road has an average width of 14 feet.

KENNEDY AND MARKHAM ROAD, UNIONVILLE.

Comprising parts of Division 34, Kennedy Road, No. 3, and Divisions 92 and 93, Markham side road No. 9.

Finished road extends on Con. VI., Markham, from lot 6 to lot 14, inclusive, also from G.T.R. track, Unionville, east to Con. VII. and a quarter-mile on Main Street, Markham Village.

This work was conducted by day labor, W. Huber in charge.

Total length of road finished 4 miles, varying from 10 to 16 feet in width, having a total area of 25,066 square yards.

This road is constructed of Kirkfield limestone, the material averaging 2 in. in size, waterbound with limestone screenings.

A large part of this work was done on a soft sub-grade, rendering satisfactory binding very difficult. Other difficulties were inability to secure sufficient stone to keep the work in progress, and much wet weather. In spite of these drawbacks, however, the cost of the road compares very favorably with those done by contract. Saved by doing the work by day labor as against contract prices. On this road a total of 5,100 feet of tile drain was laid at a cost of $300.

The total cost of material and labor was $15,000, being at the rate of less than 60 cents per square yard.

A total of 5,320 cubic yards of material was used, making the finished road cost at the rate of $2.82 per cubic yard. These figures clearly demonstrate the saving due to day labor methods.

WESTON ROAD.

Road No. 7, Divs. 72, 74, 75 and 76 (parts of).

The southern part of section 72 was built by contract.

Contractor, E. C. Lewis, Toronto, Ont.

The southern section of this road, the Black Creek Hill, receives very heavy traffic and as the hills were sandy it was thought best to use a concrete base with brick surfacing, and this has been done. At first the teamsters were afraid that this hill would be very slippery, but experience has shown that the brick has made an excellent road where, before, the highway was practically impassable.

From the Black Creek Hill north the work was done by day labor, James Gardhouse, Weston, Ont., being in charge.

The road is built of limestone waterbound with limestone screenings, average width 16 feet.

The Village of Weston are putting in a sewerage system, so that we could not build the road through the village.

From the North Boundary of Weston to the Etobicoke River, the road is built of limestone 13 feet wide.

The work in Divs. 75 and 76 was also done by day labor under Mr. Gardhouse.

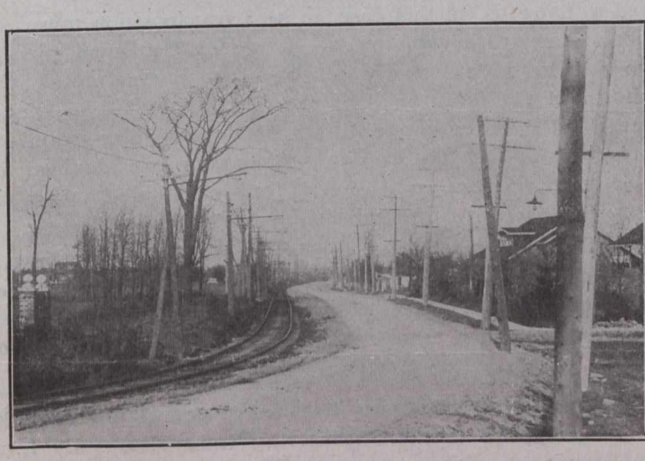
The material used was an extremely hard granite from Coldwater, but the quarries on the C.P.R. were closed down for such a long period that very little work was accomplished in this section. There are three quarries opening at Coldwater this year, and it is possible that shipments during 1913 to Woodbridge will be more regular and satisfactory.

LAKE SHORE ROAD.

Road No. 4, Div. 41.

This road was built by contract.

Contractors, J. H. McKnight & Co., 152 Bay St., Toronto.



Dolarway Pavement, Lakeshore Road.

During 1911 no work was done on this road, but from the first it was recognized that the character of the traffic here was such as to require an exceptionally strong pavement.

In June, 1912, a contract was let for a pavement with a concrete base 7 in. thick and surfaced with a bituminous preparation. The contractors undertake to maintain this pavement for three years.

Owing to the impossibility of keeping the traffic off the concrete, and the damp season, a good surface was not secured; but from the experience of the contractors on other sections of similar road, I am confident that next season they will get a good surface on this concrete. I am persuaded that our experience on the Lake Shore Road will lead to the adoption of permanent construction on our leading highways.

The Lake Shore Road is completed from the west city limits to within some 400 feet of Church Street, Mimico. The concrete is 15 feet wide with 3-ft. earth and stone shoulders on each side.

VAUGHAN ROAD.

Road No. 6, Div. 61.

This road was built by contract.

Contractor, E. G. Law, 74 Glenwood Ave., Toronto.

When the work was commenced on this road the teaming had to be done from Downsview Station. Later arrangements were made to ship in on the Belt Line.

This road is built of limestone with an average width of 14 feet. Because of the impossibility of securing stone, the contractor was not working one-third of his time this season.

Div. 64.

Work was commenced here by day labor with Mr. D. Watson in charge.

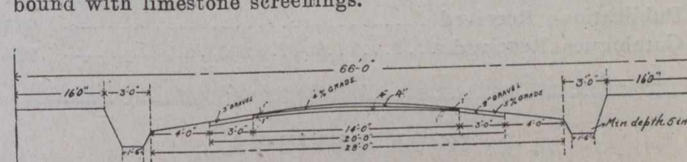
When work was commenced we were promised plenty of stone from Orillia, but the quarry was not well laid out and could only ship one car per day, and later only one car every other day. Arrangements are being made for the opening of three quarries on this line next year so that we should be able to get plenty of stone here in 1913.

SUMMERVILLE ROAD.

Road No. 5, Divs. 51 and 52.

Div. 51 was built by contract, Routly & Summers, Haileybury, Ont., being the contractors.

From the city limits to the Humber Bridge this road was built with an average width of 15 feet of limestone and waterbound with limestone screenings.



Proposed Cross Section.

General Cross-Section of Improved Roads.

Before the traffic had used the road, the road was treated with Tarvia B., and I have no doubt that the splendid condition of this road is due to the prompt treatment it received. Although this road takes extremely heavy traffic, and although it is showing some wear, yet not a single rut has developed and the road is wearing uniformally smooth.

Div. 52.

This division was built by contract, the contractor being I. M. Scott, Lambton Mills, Ont.

This division being a continuation of the section of Dundas Street built by the T. Eaton Co., it was thought wise to build a section of road with a special binder. Rocmac was used for binding this road. The material used was limestone and our experience here has led us to believe that trap rock bound with Rocmac is going to give an excellent class of construction for leading highways.

DON MILLS ROAD.

Road No. 8, Divs. 81, 82 and 83.

This road was built by contract.

Contractor, B. F. Law, 143 Kingston Road, Toronto.

A small section of Division 81 was built of limestone.

The road in Divisions 82 and 83 was built of granite, waterbound with limestone screenings.

In the foregoing report I have outlined briefly the condition of work on the various roads.

Up to the present time we have given our attention to the roads near the City of Toronto, and, of course, because of the nature of the traffic, they have taken more time and more money to build than will the roads that remain.

ENGINEERS' LIBRARY

Any book reviewed in these columns may be obtained through the Book Department of The Canadian Engineer.

CONTENTS.

BOOK REVIEWS.

Reviewed by H. G. Acres.*

Transmission Line Construction. Methods and Costs. By R. A. Lundquist, E.E., Consulting Engineer, Minneapolis, Minn. New York: McGraw-Hill Book Co. Cloth; 5½ x 7¾ in.; 285 pages; 180 illustrations and diagrams. Price, $3.00 net.

The reading matter is divided into thirteen chapters having the following tables: Preliminary Work; Location of Line; Types of Construction; Wooden Pole Construction; Steel Pole Construction; Steel Tower Construction; Reinforced Concrete Construction; Special Structures; Crossarms; Hardware; Pins and Insulators; Guying; Stringing Wire; Cost Data of Typical Transmission Lines; Organization and Tools; Standard Specifications for Line Apparatus and Material (Appendices).

The author's intention, as set forth in his preface, was to deal exclusively with the practical side of transmission line construction. This he has done to such good purpose that his book will form a timely and most acceptable addition to the engineer's library, the more so as such information as was heretofore available on this subject was in the form of miscellaneous articles in the technical press.

The outstanding feature of this book is the manner in which the author has supplemented his descriptions of the various stages of transmission line construction by an immediate reference to cost. His description of the method of distributing poles is followed by figures relating to the cost of distribution; a very clear and comprehensive description of various methods of setting steel tower footings is supplemented by a compilation of figures covering the cost of this class of work in various parts of the United States and Canada, and so on.

In the matter of costs, also, there is evidence of a conscientious effort on the part of the author to qualify his statements by reference to the variable factors affecting the same, such as labor rates, seasons, topographical and geographical conditions. Without these references the large amount of cost data which the book contains would be rather a source of danger than of benefit to the average reader

Chapters III., VI., IX. and XI. contain valuable data and descriptions, appropriately illustrated, in connection with the construction of modern high-tension steel tower transmission lines with suspension type insulators. In chapter IV. various methods of treating wood poles with preservative compounds are described and costs specified. Chapter VII. contains, among other things, a very interesting description of the manufacture of hollow reinforced concrete poles by the centrifugal process.

The text is interspersed with numerous useful references to articles that have appeared in the technical journals, and there is nothing in the book which could not be comprehended or put to practical use as well by the construction foreman as by the engineer.

The author is slightly in error in stating, with reference to Fig. 114, that "the towers are the **standard anchor structures** and the equipment the **same** as at regular strain tower installations." The middle tower in the illustration referred to happens, in this case, to be a transposition tower and not a standard anchor tower. A "typical" railroad crossing on the line in question would have two towers of the type shown in the foreground of the illustration. The "equipment" at these crossings differs from the regular strain construction in that the crossing conductors are doubled and tied every six feet, and a special form of double-strain clamp is used for supporting the doubled conductors.

Also on page 207 the author states that suspension type insulators must "necessarily" be attached to steel towers subsequent to their erection. It is quite feasible and in many cases much more economical, to attach the insulators to the towers before erection.

An Extension of the Dewey Decimal System of Classification Applied to the Engineering Industries. By L. P. Breckenridge and G. A. Goodenough. Originally issued as Bulletin No. 9 of the Engineering Experiment Station in 1906. Price 50 cents.

The filing and classification of engineering data has become a matter of much importance, and this bulletin was prepared for use as a guide in carrying out such work. The original edition of Bulletin No. 9 was subject to the usual gratuitous distribution, and the subsequent demands were such that a second edition was printed and ultimately distributed. Altogether 20,000 copies were sent out. The demand having continued, it was finally decided again to revise and to print a limited edition. This has now been ac-

* Hydraulic Engineer, Ontario Hydro-Electric Power Commission.

complished and the revised bulletin, much extended as compared with the original edition, is ready for distribution. It presents subdivisions of subjects in such detail as to constitute a complete classification for most engineering industries, even though they are highly specialized. The revision has been made in accordance with the 1911 edition of "Decimal Classification," by Melvil Dewey.

Copies may be secured on receipt of price from W. F. M. Goss, Director of the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

Reviewed by C. R. Young.*

A Treatise on the Design and Construction of Roofs. By N. Clifford Ricker, professor of architecture, University of Illinois; president, Illinois Board of Examiners of Architects, etc. New York: John Wiley and Sons; London: Chapman and Hall, Limited. Publishers' Canadian agents, Renouf Publishing Company, 25 McGill College Avenue, Montreal. Cloth; 6 x 9¼ in.; pp. xiii. + 419; 644 text figures. Price, $5.00, net, (21/- net).

The evident intention of the author in preparing this book was the assistance of junior designers and architectural draughtsmen, rather than the making of a notable contribution to the knowledge of structures. His work is, therefore, less valuable to the specialist in structural engineering than to the beginner. For those who require each step to be carefully indicated and each case treated specially, the guidance and instruction obtainable from this book will be invaluable. It is an excellent presentation in orderly and usable shape, of a large mass of information which, in the main, is available from other sources.

The author's method of treatment is very properly shaped to the purpose he has in view, in that instruction is given largely by numerous examples fully worked out, with each step carefully recorded. Considerable repetition thus characterizes the work, which perhaps will not be found objectionable by those who will use the book most.

As an introduction to the subject, three chapters are devoted to Graphostatics, Construction of a Trussed Roof, and Loads on Roof Trusses. The author then proceeds to obtain by graphical means the stresses in roof trusses of twenty-four different types of all grades of complexity, including combinations of cantilever trusses and monitors and an octagonal hip roof with lantern. For ease of reference there is assembled in Chapter V. outline and stress diagrams of a large number of roof trusses of both common and rare occurence. The method of moments is illustrated by one problem, thus affording to the student a comparison of graphical and analytical methods. An indication of the elementary character of much of the matter in the book is seen in chapter VII., in which 37 pages are devoted to the calculation of the lengths of members of roof trusses. Chapter VIII. concerns the stability of the supports of roofs under wind pressure, and contains a useful discussion of the resistance of walls to eccentric loading. Then, as a basis for the proportioning of truss members and details later, the simpler data of strength of materials and details of wood and steel construction are discussed in one chapter. Considerable valuable information in tabular form is given in chapter X., such as the safe loads on steel tension members of various make-up, safe loads on compression members of both steel and wood, properties of wooden beams, strength and weight of details, etc. The tables for the strength of wooden members would have been somewhat more useful if the net dimensions of the timber, after dressing, had been used. Dimensioning of members and the detailing of connections receive attention in chapters XI. and XII. Probably the one really bad feature of the book is the grotesque details of the steel roof trusses. Gusset plates of the most irregular shape and angles with all kinds of skew cuts are employed, with the result that trusses detailed according to the models set forth would cost more than their purchasers would care to pay for them and be no better than those conforming to the best bridge shop practice. The book is concluded by chapters on Deformations and Estimates of Weight.

Some rather unusual terms are employed in the text. For example, the author speaks of loads being "equilibrated," of balancing force as "antiresultant," of section "moduluses," etc.

Despite its somewhat high price, a large sale, among architects particularly, should be experienced for the book.

Water Supply and Drainage. By C. E. Housden. Published by Longmans, Green & Co., 39 Paternoster Row, London. Canadian agents, Renouf Publishing Co., 25 McGill College Avenue, Montreal. Cloth; size, 4¾ in. x 7¼ in.; 28 pages. Price, 45 cents.

This small volume is a supplement to the same author's book on "The Precise Calculation of Pipe Drain and Sewer Dimensions," which was reviewed a few months ago in these columns. The idea of this little volume is to afford a ready means for ascertaining precisely the dimensions of pipes, drains or sewers to be used for a projected water supply or drainage system. With the original work and the tables therein, this book should form a very valuable adjunct to the library of the engineer interested in sewerage work.

Reviewed by A. L. L. Barnes.*

The Indicator Handbook, Part II. By Charles N. Pickworth. Fifth edition. Published by Emmatt & Co., 65 King Street, Manchester, England. Price, 90 cents, net.

When a small handbook such as this reaches its fifth edition it may be taken for granted that most of its earlier faults have been eliminated, and that it has satisfactorily supplied a want and proved its worth.

Part I of the book deals with the indicator itself, whilst the section now under review is devoted exclusively to the indicator diagram.

The subject is treated in a very concise and practical manner, leaving little to be desired, and illustrations show the peculiar curves obtained under faulty or abnormal conditions of working.

Chapter I. is explanatory and describes various methods of constructing theoretically perfect diagrams for saturation and adiabatic curves.

In chapter II. the different periods of the indicator diagram, viz., the admission, steam, expansion, release, exhaust and compression lines are severally discussed, while chapter III. deals with the effects of variations of lap and of valve travel, and defective valve setting, leakage, under and overloading of engines, etc.

Compound steam engine diagrams and those from gas and oil engines are taken up in chapters IV. and V., and in the next, diagrams from air compressors, pumps, etc. Very interesting are the diagrams given in the latter chapter illustrating faulty working of boiler feed pumps, etc.; leakage past the plungers, defective valve action, etc., can be readily detected from the shape of the diagram.

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Chapter VII., the last, is headed "Diagram Calculation," and describes various methods which may be employed to ascertain all the information which a diagram is capable of supplying.

An appendix, containing several useful tables, and an index bring to a close a book which would be very serviceable to anyone whose duties require him to investigate the working of reciprocating plant.

Reviewed by C. H. C. Wright.*

Building Stones and Clay Products. A Handbook for Architects. By Heinrich Ries, Ph.D., Professor of Economic Geology in Cornell University. Published by John Wiley & Sons, New York. 428 pages; 6 x 9 in.; well illustrated; cloth. Price, $3.00.

This book will prove to be very valuable to the architectural profession for which it has been written. The author, Professor Ries, an eminent geologist, has realized our limited knowledge of mineralogy, geology and ceramico, and as a result his simple statements of facts, together with the necessary explanations, will be appreciated. His classification of the building stones has been made with the same desire for simplicity, and to further aid the reader he has provided a very complete index and an excellent glossary.

Throughout the book, whether in the chapters on the Rock Forming Minerals, the Granites, the Sandstones, Limestones, Marbles, or Clay Products, there is no sign of a desire on the part of the author to tell all he knows of these different materials, but always the plain intention to analyze the subject so as to give the architect the information he is looking for.

The second part of the book contains a complete and yet elementary description of the properties of clay, the methods of its manufacture into bricks, terra cotta, hollow-ware, tile, sewer pipe and sanitary ware, which will assist any architect to select and use these materials more intelligently.

It may be said by some that this book in Part I. is largely describing building stones that are quarried and manufactured in the United States, but the fact remains that at the present time there is imported into Canada a large amount of freestone, limestone and marble from Ohio, Indiana and Tennessee, etc.

The production of building stone in 1911 in Canada was $1,988,757; the stone imports were $1,140,846, of which most came from the United States.

Successful Homes and How to Build Them. By Chas. E. White, Jr. Published by The Macmillan Company, New York and Toronto. Cloth; 5 x 7¾ in.; 520 pages, including index; profusely illustrated with Photographs and line drawings. Price, $2.00, net.

This book, while written from the standpoint of the house-owner, will be found of considerable interest by the architect, the builder, and the engineer who contemplates a house for himself. The volume covers, authoritatively and completely, the entire field of building houses, large and small. The general make-up of the book is in line with the high standard of the Macmillan publications.

Each factor bearing on the erection and equipment of a house is taken up in order, beginning with the purchase of the site and the letting of the contract. The various building materials, arrangements of rooms, the different kinds of heating, ventilating and lighting systems, decorating inside, painting outside, are all fully treated. Consideration is devoted to city houses, town, country and farm houses, suburban houses and bungalows, camps, cottages, garages, barns and green houses. There are also several chapters on out-door accessories, such as terraces, walls, banks, sidewalks and pergolas.

* Professor of Architecture, University of Toronto, Toronto.

Reviewed by E. A. James, B.A.Sc.*

Street Paving and Paving Material. By G. W. Tillson, C.E. Published by John Wiley & Sons, New York. Cloth; size, 6 in. x 9 in.; 650 pages; 97 figures. Price, $4.00.

This is the second edition of a manual on street pavement. It gives methods of construction and the materials suitable for the various classes of pavement. The publication is extremely useful, not only to students and engineers, but to city officials generally.

The first edition was published in 1900, when the author, after 20 years' experience, particularly in pavements, produced the book in order to show not only the evolution of the modern city streets, but also what was being done at that time in pavement construction. The following pavements are dealt with: Stone; Asphalt; Brick-Clays and the Manufacture of Paving-Brick; Cement, Cement Mortar and Concrete; Cobble and Stone-Block Pavements; Asphaltic Pavements; Brick Pavements; Wood Pavements; Broken-Stone Pavements; and Concrete Pavements.

In addition, the author deals with the theory of pavements; Plans and Specifications; the Construction of Street-Car Tracks in Paved Streets; Width of Streets and Roadways, Curbs, Sidewalks, etc.; Asphalt Plants.

Since this work was originally given to the public a number of new pavements have been introduced and the methods of constructing the old have been so modified as to render necessary a pretty complete revision of certain chapters and the addition of a new chapter on concrete pavements. No attempt has been made to deal with road construction.

A chapter has been added on the protection of pavements. This is a matter that must be given serious attention in this country, where it seems necessary to have a great deal of subsurface street construction. This chapter will be of benefit to engineers who are about to take this matter under consideration.

Fourth National Conference Proceedings. Published by the association, office of secretary, 19 Congress Street, Boston, Mass. Cloth; 6 x 9½ in.; 232 pages. Price, $2.00.

This volume includes the proceedings of the Fourth Annual Conference on City Planning, held at Boston, Mass., May 27-29, 1912. These volumes are published by subscription, but there are a limited number to be had at the above price of $2.00. The precedent of former volumes has been followed in presenting the chief papers read at the conference in full, and condensing or summarizing the discussions.

Boundaries and Landmarks. By A. C. Mulford. Published by D. Van Nostrand Company, 25 Park Place, New York. Cloth; size, 5¼ x 8¼ in.; 90 pages. Price, $1.00.

This manual is intended to familiarize the surveyor with the different types of old boundaries that exist throughout the United States. It is written to provide a useful treatise in connection with the conveyances of the Eastern States.

* Engineer to the York County Highway Board.

Reviewed by H. P. Bell.*

Bleaching and Dyeing of Vegetable, Fibrous Material. By Julius Hübner, M.Sc., Tech., (Manchester). Published by D. Van Nostrand Company, 25 Park Place, New York. Cloth; 5¾ in. x 9 in.; 434 pages. Price, $5.00.

Mr. Hübner's book is, as the author states, a practical handbook intended for the use of working dyers. The chemistry and physics of dyes and dyeing are touched on only so far as is necessary to explain the methods and machinery which are described. A large part of the book is devoted to lists of dyestuffs now in use and directions as to the methods with which the best results may be obtained with them. These directions are, as the author points out, largely taken from the books issued by the various makers of dyestuffs, but they are here placed together in a way which makes it easy to compare the methods and to select those which are best for particular materials or particular purposes. The newest forms of machinery are very clearly described, not only in connection with the processes in which they are used, but also in a separate chapter, and the illustrations which accompany the descriptions deserve special mention for their excellence. Instead of the photographs of machinery, which are too commonly used in technical books, the present illustrations consist of sectional drawings and sectional diagrams, many of which are printed in two colors, so that the cloth or yarns passing through the machines is distinguished by being printed in red.

Besides the processes of dyeing, Mr. Hübner deals with bleaching, washing and mercerizing, and there are chapters on the testing and softening of water, the testing of dyestuffs and fibres, and the chemicals and mordants in general use, for many of which the current English prices are given. The book also contains a number of useful tables and an excellent index, and is likely to be valuable, not only to dyers and students of dyeing, but to engineers who have to do with machinery for the processes referred to.

Text Book on Roads and Pavements. By Frederick T. Spalding, professor of Civil Engineering, University of Missouri. Published by the McGraw-Hill Book Company, New York. Fourth edition, 1912; cloth; size, 5 x 7½ in.; 408 pages; 51 figures. Price, $2.00.

The size of this book has been increased about twenty per cent. with this edition. New chapters are added on bituminous, macadam and concrete pavements, and the chapters on brick, asphalt and wood pavements have been thoroughly revised. While the general character of the book has been very little altered, the advances in the method employed in the construction and maintenance of highways has rendered a number of changes necessary. The book has now been brought thoroughly up-to-date and in accordance with present practice.

Smoley's Tables. By Constantine Smoley, C.E. Published by McGraw-Hill Book Company, New York. Seventh edition, revised and enlarged; flexible leather; size, 4½ in. x 7 in. Price, $3.50.

These parallel tables of logarithms and squares, diagrams for solving right triangles, angles and logarithmic functions corresponding to given bevels, common logarithms of numbers and tables of logarithmic and natural trigonometric functions and other tables, for engineers, architects and students, are too well known to need much comment. The tables have with this issue reached the seventh edition. In this edition a special device has been added for solving right triangles of comparatively small dimension. The device is a diagram which will enable the user, after a little practice, to obtain almost at a glance results that are sufficiently accurate for most practical purposes.

* Technical chemist, 409 Kent Building, Toronto.

PUBLICATIONS RECEIVED.

Annual Report of the City Engineer of Halifax, N.S. for the year 1911. City Engineer, F. W. W. Doane, Halifax.

Civil Service List of Canada, 1912. Arranged and prepared under the direction of the Secretary of State, Ottawa.

Route Map of Part of Nass River, B.C. Issued by the Geological Surveys Branch, Department of Mines, Ottawa. R. W. Brock, director.

A Study in Industrial Water Charges. Being booklet No. 2, issued by the Bureau of Water, Water Supply Educational Series, City Hall, Philadelphia, Pa.

Report of the Department of the Naval Service of Canada, for the year ending 31st March, 1912. J. D. Hazen, Minister of the Naval Service, Ottawa.

The "Mechanical World" Electrical Pocketbook for 1913. Published by Emmatt & Company, Limited, 65 King Street, Manchester, England. Price sixpence, net.

Canada Car and Foundry Company, Limited. The third annual report for the year ending September 13th, 1912. General offices, Transportation Building, Montreal.

Report on the Building and Ornamental Stones of Canada, Vol. I. By William A. Parks. Pp. 382, illustrated. Canadian Department of Mines, Mines Branch, Ottawa.

Progress Report of the Experiments with Dust Preventatives. Being Circular No. 89, Office of Public Roads, U.S. Department of Agriculture. Logan Waller Page, director.

Special Road Problems in the Southern States. By D. H. Winslow. Being circular No. 95, Office of Public Roads, U.S. Department of Agriculture. Logan Waller Page, director.

Business Prospects Yearbook, 1913. Edited by Joseph Davies and C. P. Hailey. Published by the Business Statistics Company, Limited, 12 James Street, Cardiff, S.W. Price, $2.50.

The Production of Iron and Steel in Canada, for the calendar year 1911. By John McLeish, B.A. Issued by the Mines Branch, Department of Mines, Eugene Haanel, Ph.D., director, Ottawa.

Summary Report of the Mines Branch of the Department of Mines of Canada for the Calendar Year Ending December 31, 1911. Pp. 208, illustrated. Canadian Department of Mines, Mines Branch, Ottawa.

Bureau of Mines of Ontario, 1912.—Being the twenty-first annual report. Vol. 21, Part 1. Published by the Department of Lands, Forests and Mines, Toronto. Thomas W. Gibson, Deputy Minister of Mines.

Report of the Sanitary State of the City of Montreal, also an account of the operations of the Board of Health and the vital statistics, for the year 1911. By Dr. Louis Laberge, Medical Health Officer, Montreal, P.Q.

Water Resources of California, Part I., Stream Measurements in Sacramento River Basin. By H. D. McGlashan and F. F. Henshaw, Pp. 411, illustrated. Water-Supply Paper 198, U.S. Geological Survey, Washington.

Surface Water Supply of the United States, 1910. Part IX., Colorado River Basin. By W. B. Freeman, E. C. La Rue and H. D. Padgett. Pp. 233, illustrated. Water-Supply Paper 289, U.S. Geological Survey, Washington.

Forest Fires. Their causes, extent and effect, with a summary of recorded destruction and loss. By Fred G. Plummer. Being Bulletin No. 117, Forest Service, U.S. Department of Agriculture. Henry S. Graves, forester.

Brooklyn Engineers' Club. The proceedings for 1911, including the constitution and by-laws and the annual report of the board of directors. Published by the Brooklyn Engineers' Club, 117 Remsen Street, Brooklyn, N.Y. Price, $2.00.

Production of Cement, Lime, Clay Products, Stone and Other Structural Material, in Canada. For the calendar year 1911. By John McLeish, B.A. Issued by the Mines Branch, Department of Mines, Eugene Haanel, Ph.D., director, Ottawa.

Methods and Apparatus for the Prevention and Control of Forest Fires. As exemplified on the Arkansas National Forests. By Daniel W. Adams. Bulletin No. 113, Forest Service, U.S. Department of Agriculture. Henry S. Graves, forester.

Saw-filing and Management of Saws.—By Robert Grimshaw, M.E. Third edition, revised and enlarged. Published by the Norman W. Henley Publishing Company, 132 Nassau Street, New York City. Cloth; 4 x 6½ in.; 130 pages. Price, $1.00.

Proceedings Western Railway Club.—Vol. 24, 1911-1912. —Being the Official Proceedings of the Western Railway Club for the Club Year 1911-1912. Published by the Western Railway Club, 390 Old Colony Building, Chicago. Cloth; 6 x 9 in.; 272 pages. Price, $2.00.

Syllabus of Mathematics. A symposium compiled by the Committee on the Teaching of Mathematics to Students of Engineering, accepted by the Society for the Promotion of Engineering Education at the nineteenth annual meeting held at Pittsburg, Pa., in June, 1911. The secretary, Henry Norris, Cornell University, Ithaca, N.Y.

CATALOGUES RECEIVED.

Cooling Towers.—Edwin Burnorn & Company, 71 Wall Street, New York City, forward catalogue illustrating their "Burnorn" and "Acme" cooling tower.

Water Meters.—The Buffalo Meter Company, 290 Terrace, Buffalo, N.Y., forward copy of their 1912 catalogue of American and New Niagara Water Meters.

Boilers.—Fraser & Chalmers, Limited, 4 Philips Place, Montreal, P.Q., forward catalogue illustrating installations of the Bettington Boilers (water tube) for atomized fuel.

Pipe.—The National Tube Company, Pittsburg, Pa., forward N.T.C. Bulletin No. 11, which describes the Spellerizing process used in the manufacture of their pipe.

Turbo-Alternators.—The Canadian Westinghouse Company, Limited, Hamilton, Ont., Railway and Lighting Department, forward Circular No. 1094, illustrating and describing Westinghouse turbo-alternators.

Dynamos.—The Engineering Works of Canada, Limited, New Birks Building, Montreal, forward catalogue illustrating dynamos manufactured by Societe Alsacienne de Constructions Mecaniques, Belfort, of which they are the Canadian agents.

Non-Pulsating Pumps.—The General Machinery Co., Limited, 22 to 26 Mulock Avenue, West Toronto, forward the last catalogue describing the Luitwieler System of Non-Pulsating Pumps, manufactured by the Luitweiler Pumping Engine Company, Rochester, N.Y.

Concrete.—The Canada Cement Company, Limited, Montreal, forward copy of book recently issued, entitled "What the Farmer Can Do With Concrete." Copies may be secured by addressing Mr. L. S. Bruner, Manager of Publicity, Canada Cement Company, Montreal.

Powell Wood Process.—The Powell Wood Process Syndicate, Limited, through their selling agents, Messrs. Boving & Co., Limited, 9½ Union Court, London, E.C., have forwarded a booklet describing the Powell wood process for rapidly seasoning, preserving and improving wood.

Motor Truck Tires.—The Dunlop Tire and Rubber Goods Company, Limited, Toronto, forward their catalogue K-3, entitled "Dunlop Quick Removable and Band Type Motor Truck Tires," which contains price list and description of their different types of tires.

Steel Reinforcement.—The Standard Concrete Steel Company, 413 East 31st Street, New York, forward copy of their pamphlet, entitled "System M," of which this is the second edition. The pamphlet describes the system developed by this company for the steel reinforcement of reinforced concrete buildings.

Sewage Sprinklers.—Jones & Attwood, Limited, of Stourbridge, England, manufacturers of the Fiddian waterwheel type of sewage sprinkler, have forwarded a booklet describing these sprinklers. This booklet is a special edition for municipal engineers. Copies may be secured from The Canadian Engineer, 62 Church Street, Toronto.

Steel Pipe.—The East Jersey Pipe Company, of 50 Church Street, New York City, forward their last catalogue, containing recent photographs and data of interest in connection with the use of their lock-bar pipe and riveted steel pipes. Copies may be secured by addressing the company.

Measuring and Mixing Machine.—W. J. Fraser & Company, Limited, Dagenham, Essex, England, the sole licensees and manufacturers for Great Britain and the colonies of the Trump Measuring and Mixing Machine and the Trump Concrete Mixer, forward catalogue describing the operation of these machines.

Blueprinting.—The C. F. Pease Company has issued a 32-page booklet, entitled "Everything for Blueprinting," describing and illustrating various types of the Pease peerless blueprinting machines and equipment, the Pease simplex and duplex paper-coating machines and washing and drying machines and other equipment for use in the handling of blueprints.

Hydro-Pneumatic Sewerage System.—Hughes & Lancaster, Limited, sole licensees and manufacturers of the "Shone" patent Pneumatic Automatic Ejector, forward catalogue, entitled "The Shone Hydro-Pneumatic Sewerage and Water System," illustrating different installations of their ejectors. Copies may be secured from Hughes & Lancaster, Limited, 16 Victoria Street, London, S.W.

Logging Machinery.—The Clyde Iron Works, of Duluth, Minn., forward their new catalogue of Clyde Self-propelling Logging Machinery. The book is 9 x 12 in. in size, and contains 92 pages. It is profusely illustrated with very fine half-tones, illustrating different types of logging machinery. The pamphlet is beyond question one of the most artistic which has come to this office. Copies may be secured from the Clyde Iron Works, Duluth, Minn.

IRON ORE PRODUCTION.

There has been a rapidly growing demand for iron and steel products in Canada during the past few years, accompanied by a corresponding increase in the output of Canadian iron and steel furnaces, although this output probably supplies not more than 30 per cent. of the tonnage of iron and steel consumed.

The increase in production was continued during 1911, notwithstanding abnormally low prices received for pig iron and steel products, states Mr. J. McLeish, chief of the division of mineral resources and statistics in his latest report. Manufacturers, generally, report a very strong demand, but claim that business has been carried on with a very low margin of profit in order to meet prices quoted on imported products.

At the same time extensive preparations are being made to increase the output and supply a larger proportion of the home market.

The total shipments of iron ore in 1911 from mines in Canada were 210,344 tons, whereas blast furnaces consumed 1,695,802 tons, and steel furnaces, 42,892 tons. The shipments from iron ore mines in 1911 were the lowest recorded in twelve years. The production of pig iron was 917,535 short tons, and of steel ingots and castings, 882,396 tons.

The rate of production of iron ore has shown practically no increase during the past twelve years, while the present production of pig iron is nearly ten times that of 1900. About 6 per cent. only of the iron ore used in Canadian blast furnaces during 1911 was of domestic origin. Of the coke used, 52 per cent. was either imported or made from imported coal, and 22 per cent. of the limestone flux used was from sources outside of Canada. In each instance the proportion of imported raw material used is higher than was the case in 1910.

The total production of iron ore in Canada to the end of 1910 has probably not exceeded 5,500,000 tons, while the total consumption of ore in iron and steel blast furnaces since 1886 has been over 13,500,000 tons. During 1911 the tonnage of imported ores used was 1,628,368 tons, which was derived chiefly from Newfoundland and the south shore of Lake Superior.

The assistance granted by the Federal Government to the iron and steel industries in the form of bounties ceased on December 31, 1910, with the exception of the bounty on steel rods, which was continued to June 30, 1911, and the bounty on pig iron and steel made in electric furnaces, which is available until the end of this month.

IMPORTANCE OF CANADA'S CEMENT INDUSTRY.

The production of cement in Canada during the past few years though all classed as Portland, has included an output of Puzzolan cement, made from blast furnace slag at Sydney, N.S., and a small production of "natural Portland" made at Babcock, Manitoba, 75 miles southwest of Winnipeg on the Canadian Northern Railway. The total quantity of cement made in Canada during 1911, as per reports received from the manufacturers, was 5,677,539 barrels of 350 pounds net each, or 993,569 tons, as compared with 4,396,282 barrels, or 769,349 tons, made in 1910—an increase of 1,281,257 barrels, or over 29 per cent, states the report of Mr. J. McLeish, B.A., chief of the division of mineral resources and statistics.

The total quantity of Canadian Portland cement sold in 1911 was 5,692,915 barrels, or 996,260 tons, as compared with 4,753,975 barrels, or 831,946 tons, in 1910, an increase of 938,940 barrels, or nearly 20 per cent.

The total production of Portland cement in 1911, including Canadian and imported cement, was 6,354,831 barrels of 350 pounds net, or 1,112,095 tons, as compared with 5,103,285 barrels, or 893,075 tons, in 1910—or an increase of 1,251,546 barrels or nearly 25 per cent.

The cement industry has been rapidly growing in importance, and its output is now exceeded in value amongst non-metallic products by coal and clay products only.

An average of 3,010 men were employed in 1911, the total wages paid being reported as $2,103,838.

The increase in annual production since 1905 has been nearly four-fold. The production per capita in 1911 was about 278 pounds, as against only 79 pounds in 1905. The approximate consumption per capita has increased during the same period from 115 pounds to 310 pounds.

A similar rapid increase in both production and consumption has taken place in the United States, where the annual production now exceeds 75,000,000 barrels.

The production per capita in the United States was in 1910 about 332 pounds, as against 204 pounds in 1905.

The production of cement in 1911 was derived from 24 operating plants, having a total daily capacity of $28,281, the operating plants being distributed as follows: one in Nova Scotia, using blast furnace slag; one in Manitoba, making a natural Portland cement; one in British Columbia; three in Alberta; three in Quebec, using limestone and clay; and fifteen in Ontario, of which twelve use marl and three limestone.

Of the total quantity of cement made in 1911, 1,626,857 barrels were made from marl and 4,050,682 barrels from limestone and slag. In 1910, there were 1,214,479 barrels made from marl and 3,181,803 barrels from limestone and slag, and in 1909, 819,706 barrels were made from marl and 3,336,002 barrels from limestone and slag. Practically all of the newer plants erected during the past few years have been limestone plants. The proportion of cement made from marl in 1908 was about 45 per cent. of the total output, as compared with about 28 per cent. in 1911.

The consumption of cement is represented practically by the domestic production together with the imports, the exports being so comparatively small as to be negligible. The total consumption of Portland cement in Canada in 1911 was 6,354,831 barrels (1,112,095 tons), made up of 5,692,915 barrels (996,260 tons) of Canadian cement, and 661,916 barrels (115,835 tons) of imported cement; the Canadian cement representing 90 per cent. and the imported cement 10 per cent. of the total.

In 1910 the total consumption of cement was 5,103,285 barrels (893,075 tons), of which 93 per cent. was of domestic production and 7 per cent. imported. In 1901 the total consumption was 872,966 barrels (152,769 tons), of which only 36 per cent. was made in Canada and 64 per cent. imported.

The following is an estimate of the annual consumption of Portland cement in Canada during the past eleven years:—

Calendar Year.	Canadian Barrels	%	Imported. Barrels	%	Total. Barrels
1901	317,066	36	555,900	64	872,966
1902	594,594	52	544,954	48	1,139,548
1903	627,741	45	773,678	55	1,401,419
1904	910,358	54	784,630	46	1,694,988
1905	1,346,548	59	918,701	41	2,265,249
1906	2,119,764	76	665,845	24	2,785,609
1907	2,436,093	78	672,630	22	3,108,723
1908	2,665,289	85	469,049	15	3,134,338
1909	4,067,709	97	142,194	3	4,209,903
1910	4,753,975	93	349,310	7	5,103,285
1911	5,692,915	90	661,916	10	6,354,831

The effect of a by-law passed by the Cobalt town council is to repeal, in part, a previous $50,000 waterworks and sewerage system by-law. Of the $50,000 worth of debentures, only $6,500 were sold, when it was found unnecessary to dispose of the rest. The sanction of legislature will be applied for, for the cancelling of the other $43,500, as that had to be gained before the previous by-law was passed.

COAST TO COAST.

Winnipeg, Man.—It is probable that the University of Manitoba will establish, in the near future, a course of architecture.

St. Thomas, Ont.—A new system, costing $15,000, for washing out locomotive boilers, is now being installed in the Michigan Central Railway roundhouse here. The transfer table and turntable are now being operated with electricity.

Northern Ontario.—The Bell Telephone Company of Canada recently completed the extension of its long distance lines from North Bay to Mattawa. The circuit is branched in such a manner as to give connection with Bonfield and Rutherglen.

Victoria, B.C.—Mayor Beckworth, in an address to the ratepayers, stated that, in his opinion, the municipal council would have done better regarding the Sooke waterworks scheme to have the work completed under their own engineer by day labor.

Brantford, Ont.—The city engineer, Mr. F. H. Jones, has submitted to the city council a brief statement of the expenditures of the Board of Works for the present year, which totals $117,309; $73,141 was paid out for labor, while the cost of material was $29,368.

Montreal, Que.—The announcement is made that Mr. Farquhar Robertson and Lieut.-Colonel Labelle will be Montreal's new Harbor Commissioners. Mr. Robertson having declined the chairmanship, the third member of the board, who has not yet been appointed, will take that position.

Ottawa, Ont.—The report of the Transcontinental Railway Commission for the fiscal year has been submitted. It shows a total expenditure of $116,517,691 since the organization of the Commission in 1904. This does not include any interest on capital expenditure or any of the expenditure on the bridge approaches. For the fiscal year the expenditure was $21,221,997.

Niagara Falls, Ont.—It is proposed that a large shiplock be constructed in the Chippawa River, connecting it with the new Welland Canal, thus making Chippawa and this city accessable to the largest steamships on the lakes. A resolution was adopted by the City Council of Niagara Falls instructing Mayor Cole to appoint a Greater Niagara Falls Committee, composed of prominent citizens and officials, and also ask the officials of the surrounding townships to co-operate with the city in furthering the project. As originally planned, this lock, which will be large enough to receive any ship afloat on the Great Lakes, was to be placed near the town of Welland. City Engineer Gardiner, however, drafted a plan for the location of the lock in the Chippawa River. If this plan is finally adopted it will give the village of Chippawa and Niagara Falls the rating of a lake port; the largest ships would be enabled to come down the Canadian channel of the Niagara River and then up the Chippawa to the Welland Canal.

Hamilton, Ont.—The Hamilton Malleable Iron Company has been formed with a capital of $600,000, consisting of Toronto, Hamilton and Brantford capital. The names of the officials and directors of the company are withheld, but J. E. Hammond, formerly with Pratt & Letchworth Company, Limited, Brantford, will be one of the directors and assume management of the plant. The new concern will conduct a general malleable iron business, and the output will consist principally of malleable iron castings for railroad, agricultural and miscellaneous work for custom trade. The plant will cost in the neighborhood of one-quarter of a million dollars, and will employ about 500 hands, a large number of which will be skilled mechanics. The main foundry building will be 600 feet long and 200 feet wide. This building will be divided into two bays, with high-speed electric travelling cranes in each bay. In this building will also be located four melting furnaces with a capacity of 15 tons per heat. There will also be located in this building annealing furnaces sufficient to take care of the output; also the latest cleaning and finishing equipment. In addition to the main building will be an office building; also buildings for pattern storage, pattern shop, machine shop, core shop, carpenter shop and storehouse. Paralleling the main building will be an outside crane runway, by which all the raw material for the plant will be unloaded and stored. All the buildings will be of fireproof and modern construction throughout. The equipment will consist of the latest labor-saving devices, such as overhead cranes serving the entire foundry and yard, waste-heat boilers, moulding machines operated by compressed air, finishing equipment, including the latest type of sand blast installation, exhaust tumbling barrels, and all unloading of raw material and loading of finished product will be handled by electric power. The plant will be connected with the railways and have individual tracks leading to and serving the various buildings. The plans for the buildings are being prepared by Prack & Perrine, 36 James Street South, Hamilton, who will also have charge of the construction of the plans and installation of equipment. The plant is being designed in units, which will allow it to be enlarged to double capacity.

COMMON STANDARD LOCOMOTIVES.

Mr. H. H. Vaughan, assistant to the vice-president of the Canadian Pacific, in a discussion of a paper by Mr. O. S. Beyer on "Factors in the Selection of Locomotives in Relation to the Economics of Railway Operation," delivered before the American Society of Mechanical Engineers on December 5th, emphasized the importance of having standard locomotives and maintaining these standards until conditions change so much that it is possible to design another line of standard locomotives, making a distinct step in advance, rather than to modify the standard types from time to time. The time for standardization is before the equipment is built and not afterward. The Canadian Pacific now has about 865 standard locomotives out of a total of 1,800 or 1,900 on the system. It is always possible to introduce changes in the design of standard locomotives, bearing in mind that the new arrangement must be made so that it can completely take the place of the old part for renewals or repairs.

The advantage of standardizing the motive power may be summed up as follows: The standard locomotives can be transferred from one part of the road to another, when business becomes heavy on one section, without having to provide a new storehouse stock, or have the power crippled because of not having the proper parts in stock. It is also possible to keep the shop cost of the engines down because of fewer variations in the size and design of the parts. Where standard locomotives are used it has been found that the division officers are much more likely to offer suggestions as to improvements. Of course, the standardization has disadvantages, one of which is that it is not always possible to immediately take advantage of improvements in the permanent plant. The advantages of having common standards which can be used on any part of the system and with which the men over the entire system are familiar, greatly offset this, however.

VANCOUVER SEWAGE SYSTEM.

It is estimated that the carrying out of the work for the Greater Vancouver joint sewage system will entail an expenditure of $6,000,000. The Burrard Peninsula Joint Sewage System Committee have received the report of Mr. R. S. Lea, consulting engineer, which was practically a synopsis of the final report he anticipates being able to present before the end of the year.

In this report Mr. Lea, states in regard to the matter of population, that he estimates the city's population will have increased to 1,400,000 by the year 1950.

The report states that the most suitable points for discharge would be English Bay, off Imperial Street, about a mile out; Burrard Inlet, at any point except the shore of Coal Harbor between Brockton Point and Evans, Coleman & Evans' wharf; and the Fraser River, where it would be unwise, he states, to fix any point at the present time, but probably the most suitable point would be the low lying land near the Indian Reserve, for the area draining to the North Arm, and the flats near the mouth of the Brunette River for the area draining to that locality.

The lines of the proposed interceptors and trunk sewers are exhaustively dealt with, and refer to the English Bay and False Creek area, showing a foreshore line and an alternative tunnel line; the Balaclava, Bridge Street and Burrard Inlet areas; the Clark Drive, Stanley Park and Hastings Park outfalls; the Burnaby Lake and the Fraser River area.

On the subject of the constitution and powers of a joint board, Mr. Lea states as follows:

"In my final report I shall submit a draft of an act, together with methods of apportionment and assessment, etc., under the provisions of which I consider acceptable ways and adequate means may be found, for the inception, execution and operation of the Burrard Peninsula Joint Sewerage Scheme.

"I hope this preliminary report will give the committee such information as they desire at the present time. My final report, which will really only be an enlargement and elaboration of this present one, together with the data on which my conclusions are based, will be presented to you next month."

THE INTERNATIONAL ROAD CONGRESS.

Formation of a Traders' Committee.

The organization of the International Road Congress, to be held in London in June next, is in the hands of a committee formed of representatives of highway authorities, scientific institutions, learned societies, organizations of automobilists, cyclists, road users and others.

The Organizing Council received some time ago offers of practical assistance from firms and others engaged in the road industry, and it was decided to form a Traders' Committee.

This committee is composed of representatives of all branches of road-makers, including manufacturers of steam rollers and other heavy machinery, road-tarring appliances, stone paving and firms engaged in the construction of bituminous roads, wood-paved roads, quarry owners and others. The president of the committee is Lord Cowdray; the vice-president, Mr. Edward Hickman, J.P.; the chairman, Sir Herbert Praed, and the vice-chairman, Mr. E. B. Chittenden. Other members of the committee are: Messrs. J. W. Ashdown, H. K. Bamber, J. G. Barford, H. D. Blake, H. F. Berry, F. E. Bristowe, F. M. Bond, A. Brooks, W. Chappell, S. Constable, D. G. Comyn, L. Cooper, A. E. Dalzell, J. Duffy, H. T. Elliston, H. Grace, W. T. Graves, W. Penrose Green, T. J. Jennings, J. Mackay, W. Manuelle, T. Milne, P. Morris, H. Pitts, J. Purdy, Gibson Thompson and John Ward. The honorary secretaries are Messrs. H. Beadle and H. L. Wetteim.

The Executive Committee of the Congress will be glad to welcome any further offers of assistance, and to make any additions which may be necessary to secure that all branches of the industry are adequately represented.

AMERICAN ASSOCIATION OF MANUFACTURERS OF SAND-LIME PRODUCTS.

The ninth annual convention of this organization was held on December 3rd and 4th at the King Edward Hotel, Toronto. President S. O. Goho, of Harrisburg, Penn., occupied the chair. There was a large attendance. Among the technical papers presented were "The Results of Testing Sand-lime Brick," by Warren E. Emley, of the United States Bureau of Standards, Pittsburg; "The Present Condition of the Industry," by W. H. Crane. The delegate made an inspection of the local plants of the Toronto Sand-lime Brick Company and the Toronto and Harbor Brick Company, and declared the bricks equal to those manufactured in the large American cities. The election of officers resulted as follows: President, S. O. Goho, Harrisburg, Penn.; vice-president, F. B. Allan, Toronto, Ont.; secretary, W. G. Plummer, Jr., Buffalo, N.Y.; treasurer, John L. Jackson, Saginaw, Mich. Harrisburg, Penn., was chosen as next place of meeting.

CANADIAN MINING INSTITUTE (OTTAWA BRANCH) MEETING.

At a meeting held in Ottawa, December 4th, a branch of the Canadian Mining Institute was organized. The following officials were elected: Chairman, W. R. Askwith; secretary, George L. Burland; executive committee, J. McLeish, G. C. McKenzie, Dr. A. D. Cairns, Robert Harvey and W. J. Dick. Dr. A. E. Barlow, president, and H. Mortimer-Lamb, secretary of the Canadian Institute, gave addresses on the work and aims of the organization.

PERSONAL.

JOHN ROOKE-CROOWELL has been appointed manager of the Cordova mine, in Hastings County, Ont. He was formerly in California and more recently in Mexico.

W. P. NEAR has been appointed city engineer for the municipality of St. Catharines, Ont. For some time he has been resident engineer of the main drainage works, Toronto.

J. P. FORDE, of Revelstoke, for the past two years resident provincial engineer for this district, has been appointed resident federal government engineer for the whole of Kootenay electoral riding in succession to Hon. F. W. Aylmer.

ARTHUR N. JOHNSON, M. Am. Soc. C. E., State Highway Engineer of Illinois, on December 13th delivered an illustrated lecture on "Cement-Concrete Highway Bridges" before the graduate students in Highway Engineering at Columbia University.

FRANCIS P. SMITH, M. Am. Soc. C.E., Chemical and Consulting Paving Engineer, New York City, on December 20th, delivered an illustrated lecture on "The Mining and Refining of Asphaltic Oils" before the graduate students in Highway Engineering at Columbia University.

D. I. ROBERTS, of Montreal, general manager of the Napierville Junction Railway, and general manager and general freight and passenger agent of the Quebec, Montreal and Southern, has been elected president of the United States Express Company, with headquarters at New York, which office has been vacant since the death of the late Thomas C. Platt. Mr. Roberts is fifty-nine years old. He is well known to American railway men, having been in the service of the Pennsylvania Lines and the Erie from 1873 to 1901. For the ten years from 1891 to 1901 he was general passenger agent of the Erie.

OBITUARY.

WILLIAM JOHNSON BARCLAY, general manager of the Canadian Northern Quebec, the Quebec and Lake St. John, the Halifax and Southwestern and the Inverness Railway and Coal Company, with headquarters at Montreal, Quebec, died on December 13th, at Riverside, Cal., at the age of sixty-one.

COMING MEETINGS.

AMERICAN WOOD PRESERVERS' ASSOCIATION.—Ninth Annual Convention will be held at Chicago Jan. 21-23, 1913. Secy-Treasurer, F. J. Angier, Mount Royal Station, B. & O. R. R., Baltimore, Md.

AMERICAN INSTITUTE OF CONSULTING ENGINEERS.—Annual Meeting, January 14th, 1912, will be held at The Engineers Club, 32 West Fortieth Street, New York, N.Y. Secretary, Eugene W. Stern, 103 Park Avenue, New York.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—Annual Meeting will be held on Jan. 28th, 29th, and 30th, 1913, at the Society's new headquarters, 176 Mansfield St., Montreal. Secretary, C. H. McLeod.

THE INTERNATIONAL ROADS CONGRESS.—The Third International Roads Congress will be held in London, England, in June, 1913. Secretary, W. Rees Jeffreys, Queen Anne's Chambers, Broadway, Westminster, London, S.W.

THE INTERNATIONAL GEOLOGICAL CONGRESS.—Twelfth Annua Meeting to be held in Canada during the summer of 1913. Secretary, W. S. Lecky, Victoria Memoriam Museum, Ottawa.

ENGINEERING SOCIETIES.

CANADIAN SOCIETY OF CIVIL ENGINEERS.—413 Dorchester Street West, Montreal. President, W. F. TYE: Secretary, Professor C. H. McLeod.

KINGSTON BRANCH—Chairman, A. K. Kirkpatrick; Secretary, L. W Gill; Headquarters: School of Mines, Kingston.

OTTAWA BRANCH—
177 Sparks St. Ottawa. Chairman, R. F. Uniacke, Ottawa; Secretary, H. Victor Brayley, N.T. Ry., Cory Bldg. Meetings at which papers are read, 1st and 3rd Wednesdays of fall and winter months; on other Wednesday nights in month there are informal or business meetings.

QUEBEC BRANCH—Chairman, W. D. Baillairge; Secretary, A. Amos; meetings held twice a month at room 40, City Hall.

TORONTO BRANCH—96 King Street West, Toronto. Chairman, T. C. Irving: Secretary, T. R. Loudon, University of Toronto. Meets last Thursday of the month at Engineers' Club.

VANCOUVER BRANCH—Chairman, C. E. Cartwright Secretary, Mr. Hugh B. Fergusson, 911 Rogers Building, Vancouver, B.C. Headquarters: McGill University College, Vancouver.

VICTORIA BRANCH—Chairman, F. C. Gamble; Secretary, R. W. MacIntyre: Address P.O. Box 1290.

WINNIPEG BRANCH—Chairman, J. A. Hesketh; Secretary, E. E. Brydone-Jack; Meets every first and third Friday of each month, October to April, in University of Manitoba, Winnipeg.

MUNICIPAL ASSOCIATIONS

ONTARIO MUNICIPAL ASSOCIATION—President, Mayor Lees, Hamilton. Secretary-Treasurer, Mr. K. W. McKay, County Clerk, St. Thomas, Ontario.

SASKATCHEWAN ASSOCIATION OF RURAL MUNICIPALITIES.—President, George Thompson, Indian Head, Sask.; Secy-Treasurer, E. Hingley, Radisson, Sask.

THE ALBERTA L. I. D. ASSOCIATION.—President, Wm. Mason, Bon Accord, Alta. Secy-Treasurer, James McNicol, Blackfalds, Alta.

THE UNION OF CANADIAN MUNICIPALTIES.—President, Chase. Hopewell, Mayor of Ottawa; Hon. Secretary-Treasurer, W. D. Lighthall, K.C. Ex-Mayor of Westmount.

THE UNION OF NEW BRUNSWICK MUNICIPALITIES.—President, Councillor Siddall, Port Elgin; Hon. Secretary-Treasurer, J. W. McCready, City Clerk, Fredericton.

UNION OF NOVA SCOTIA MUNICIPALITIES.—President, Mr. A. S. MacMillan, Warden, Antigonish, N.S.; Secretary, A. Roberts, Bridgewater, N.S.

UNION OF SASKATCHEWAN MUNICIPALITIES.—President, Mayor Bee, Lemberg; Secy-Treasurer, W. F. Heal, Moose Jaw.

UNION OF BRITISH COLUMBIA MUNICIPALITIES.—President, Mayor Planta, Nanaimo, B.C.; Hon. Secretary-Treasurer, Mr. H. Bose, Surrey Centre, B.C.

UNION OF ALBERTA MUNICIPALITIES.—President, F. P. Layton, Mayor of Camrose; Secretary-Treasurer, G. J. Kinnaird, Edmonton, Alta.

UNION OF MANITOBA MUNICIPALITIES.—President, Reeve Forke, Pipestone, Man.; Secy-Treasurer, Reeve Cardale, Oak River, Man.

CANADIAN TECHNICAL SOCIETIES

ALBERTA ASSOCIATION OF ARCHITECTS.—President, G. M. Lang Secretary, L. M. Gotch, Calgary, Alta.

ASSOCIATION OF SASKATCHEWAN LAND SURVEYORS.—President, J. L. R. Parsons, Regina; Secretary-Treasurer, M. B. Weeks, Regina.

ASTRONOMICAL SOCIETY OF SASKATCHEWAN.—President, N. McMurchy; Secretary, Mr. McClung, Regina.

BRITISH COLUMBIA LAND SURVEYORS' ASSOCIATION.—President, W. S. Drewry, Nelson, B.C.; Secretary-Treasurer, S. A. Roberts, Victoria, B.C.

BRITISH COLUMBIA SOCIETY OF ARCHITECTS.—President, Hoult Horton; Secretary, John Wilson, Victoria, B.C.

BUILDERS' CANADIAN NATIONAL ASSOCIATION.—President, E. T. Nesbitt; Secretary-Treasurer, J. H. Lauer, Montreal, Que.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.—President, Wm. Norris, Chatham, Ont.; Secretary, W. A. Crockett, Mount Hamilton, Ont.

CANADIAN CEMENT AND CONCRETE ASSOCIATION.—President, Peter Gillespie, Toronto, Ont.; Secretary-Treasurer, Wm. Snaith, 57 Adelaide Street, Toronto, Ont.

CANADIAN CLAY PRODUCTS' MANUFACTURERS' ASSOCIATION.—President, W. McCredie; Secretary-Treasurer, D. O. McKinnon, Toronto

CANADIAN ELECTRICAL ASSOCIATION.—President, A. A. Dion, Ottawa; Secretary, T. S. Young, 220 King Street W., Toronto.

CANADIAN FORESTRY ASSOCIATION.—President, John Hendry, Vancouver. Secretary, James Lawler Canadian Building, Ottawa.

CANADIAN GAS ASSOCIATION.—President, Arthur Hewitt, General Manager Consumers' Gas Company, Toronto; John Kelilor, Secretary-Treasurer, Hamilton, Ont.

CANADIAN INDEPENDENT TELEPHONE ASSOCIATION.—President, W. Doan, M.D., Harrietsville, Ont.; Secretary-Treasurer, Francis Dagger, 21 Richmond Street West, Toronto.

THE CANADIAN INSTITUTE.—198 College Street, Toronto. President J. B. Tyrrell; Secretary, Mr. J. Patterson.

CANADIAN MINING INSTITUTE.—Windsor Hotel, Montreal. President, Dr. A. E. Barlow, Montreal; Secretary, H. Mortimer Lamb, Windsor Hotel, Montreal.

CANADIAN PEAT SOCIETY.—President, J. McWilliam, M.D., London, Ont.; Secretary-Treasurer, Arthur J. Forward, B.A., 22 Castle Building, Ottawa, Ont.

THE CANADIAN PUBLIC HEALTH ASSOCIATION.—President, Dr. Charles A. Hodgetts, Ottawa; General Secretary, Major Lorne Drum, Ottawa.

CANADIAN RAILWAY CLUB.—President, A. A. Goodchild; Secretary, James Powell, P.O. Box 7, St. Lambert, near Montreal, P.Q.

CANADIAN STREET RAILWAY ASSOCIATION.—President, Patrick Dubee, Montreal; Secretary, Acton Burrows, 70 Bond Street, Toronto.

CANADIAN SOCIETY OF FOREST ENGINEERS.—President, Dr. Fernow, Toronto.; Secretary, F. W. H. Jacombe, Department of the Interior, Ottawa.

CENTRAL RAILWAY AND ENGINEERING CLUB.—Toronto, President, G. Baldwin; Secretary, C. L. Worth, 409 Union Station. Meets third Tuesday each month except June, July and August.

DOMINION LAND SURVEYORS.—President, Mr. R. A. Belanger, Ottawa; Secretary-Treasurer, E. M. Dennis, Dept. of the Interior, Ottawa.

EDMONTON ENGINEERING SOCIETY.—President, J. Chalmers; Secretary, B. F. Mitchell, City Engineer's Office, Edmonton, Alberta.

ENGINEERING SOCIETY, TORONTO UNIVERSITY.—President, J. E. Ritchie; Corresponding Secretary, C. C. Rous.

ENGINEERS' CLUB OF MONTREAL.—Secretary, C. M. Strange, 9 Beaver Hall Square, Montreal.

ENGINEERS' CLUB OF TORONTO.—96 King Street West. President, Willis Chipman; Secretary, R. B. Wolsey. Meeting every Thursday evening during the fall and winter months.

INSTITUTION OF ELECTRICAL ENGINEERS.—President, Dr. G. Kapp; Secretary, P. F. Rowell, Victoria Embankment, London, W.C.; Hon. Secretary-Treasurer for Canada, Lawford Grant, Power Building, Montreal, Que.

INSTITUTION OF MINING AND METALLURGY.—President, Edgar Taylor; Secretary, C. McDermid, London, England. Canadian members of Council:—Prof. F. D. Adams, J. B. Porter, H. E. T. Haultain and W. H. Miller and Messrs W. H. Trewartha-James and J. B. Tyrrell.

INTERNATIONAL ASSOCIATION FOR THE PREVENTION OF SMOKE.—Secretary R. C. Harris, City Hall, Toronto.

MANITOBA ASSOCIATION OF ARCHITECTS.—President, W. Fingland, Winnipeg; Secretary, R. G. Hanford.

MANITOBA LAND SURVEYORS.—President, George McPhillips; Secretary-Treasurer, C. G. Chataway, Winnipeg, Man.

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NOVA SCOTIA SOCIETY OF ENGINEERS, HALIFAX.—President, J. N. MacKenzie; Secretary, A. R. McCleave, Assistant Road Commissioner's Office, Halifax, N.S.

ONTARIO ASSOCIATION OF ARCHITECTS.—President, C. P. Meredith, Ottawa; Secretary, H. E. Moore, 195 Bloor St. E., Toronto.

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ONTARIO LAND SURVEYORS' ASSOCIATION.—President, T. B. Speight, Toronto; Secretary, L. V. Rorke, Toronto.

TECHNICAL SOCIETY OF PETERBORO.—Bank of Commerce Building, Peterboro. General Secretary, N. C. Mills, P.O. Box 995, Peterboro, Ont.

THE PEAT ASSOCIATION OF CANADA.—Secretary, Wm. J. W. Booth, New Drawer, 2263, Main P.O., Montreal.

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.—Secretary, J. E. Ganier, No. 5, Beaver Hall Square, Montreal.

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ROYAL ARCHITECTURAL INSTITUTE OF CANADA.—President, H. C. Russell, Winnipeg, Man.; Hon. Secretary, Alcide Chausse, No. 5, Beaver Hall Square, Montreal, Que.

ROYAL ASTRONOMICAL SOCIETY.—President, Prof. Louis B. Stewart, Toronto; Secretary, J. R. Collins, Toronto.

SOCIETY OF CHEMICAL INDUSTRY.—Wallace P. Cohoe, Chairman, Alfred Burton, Toronto, Secretary.

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WESTERN CANADA RAILWAY CLUB.—President, R. R. Nield; Secretary, W. H. Rosevear, P.O. Box 1707, Winnipeg, Man. Second Monday, except June, July and August at Winnipeg.