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# THE CANADIAN CONTRACT RECORD

A WEEKLY JOURNAL

PUBLIC WORKS • TENDERS •  
ADVANCE INFORMATION •  
AND MUNICIPAL PROGRESS

EVERY THURSDAY

This paper reaches every week the Town and City Clerks, Town and City Engineers, County Clerks and County Engineers, Purchasers of Municipal Debentures and leading Contractors in all lines throughout Canada.

Vol. 7.

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No. 22.

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## TENDERS

Separate and collective, including heating and plumbing, are invited up to July 13th, for the erection of a brick veneer residence for James Sharpe, Esq., Barks Falls, Ont. Plans may be seen at the office of the owner, also at the office of the architect,

J. FRANCIS BROWN,  
Board of Trade Building, Toronto.

The lowest or any tender may be accepted.

## ASPHALT PAVEMENTS IN WINNIPEG

Sealed Tenders, addressed to the undersigned, for ASPHALT PAVEMENTS, BOULEVARDING and STONE CURBING on portions of Assiniboine Ave. and Donald, Hargrave and Kennedy streets, in all about 22,000 square yards, will be received at the office of the Clerk of Committees up to

8.30 p.m. on Wednesday, July 15.

Plans and specifications can be obtained at the office of the City Engineer on and after the 12th inst.

Each tender to be accompanied by a marked cheque, payable to the order of the City Treasurer, for the sum called for in the form of tender supplied, which will be subject to usual terms of forfeiture for non-completion of contract.

I. M. RO'S,  
Chairman Committee on Works.

Winnipeg, June 16th, 1896.

## TENDERS

Sealed Tenders will be received by the undersigned for the following works. The lowest or any tender will not necessarily be accepted:—Additions and alterations to a store building in Queen Street East; closes Monday, July 6th, at 5 o'clock. A brick residence in Madison Ave.; closes Friday, July 10th, at 5 o'clock.

Plans, specifications, etc., at the office of  
CURRY, BAKER & CO., Architects,  
70 Victoria Street.

## TENDERS

DEBENTURES—\$13,500—DEBENTURES

CITY OF FREDERICTON, N. B.

Sealed Tenders will be received for THIRTEEN THOUSAND FIVE HUNDRED DOLLARS CITY OF FREDERICTON DEBENTURES as follows:

\$7,000.00 FREDERICTON SCHOOL DEBENTURES, 4 per cent., payable THIRTY years from the date of issue.

\$2,500.00 FREDERICTON WATER DEBENTURES, 4 per cent., payable THIRTY years from the date of issue.

\$4,000.00 FREDERICTON DEBT DEBENTURES, 5 per cent., payable ELEVEN years from the date of issue.

The above tenders will be received at the City Treasurer's office, Fredericton, up to WEDNESDAY, the 15th DAY OF JULY NEXT. The highest or any tender not necessarily accepted.

Information bearing on the issue will be furnished on application to Chas. W. Beckwith, City Clerk. Tenders must be addressed to John Moore, Esq., City Treasurer, Fredericton, N. B.

JOHN MOORE,  
City Treasurer.

Fredericton, N. B., June 26th, 1896.



## NOTICE TO CONTRACTORS

Tenders for Brick Pavement in  
St. Lawrence Market

Tenders will be received by registered post only, addressed to the Chairman of the Board of Control, City Hall, Toronto, Ont., up to 5 o'clock p.m. on WEDNESDAY, JULY 15, 1896, for the construction of a

BRICK PAVEMENT IN ST. LAWRENCE MARKET.

Specifications may be seen and forms of tender obtained at the office of the City Engineer, Toronto, on and after Wednesday, July 6th, 1896.

A deposit in the form of a marked cheque, payable to the order of the City Treasurer, for the sum of 5 per cent. on the value of the work tendered for up to \$1,000, and 2½ per cent. on the value of the work tendered for over that amount, must accompany each and every tender, otherwise they will not be entertained.

Tenders must bear the bona fide signatures of the contractor and his sureties, or they will be ruled out as informal.

Lowest or any tender not necessarily accepted.

R. J. FLEMING, Mayor,  
Chairman Board of Control.

Toronto, July 2, 1896.

## GRANOLITHIC SIDEWALK

Sealed Tenders, addressed to the undersigned, for Granolithic Pavement in Court House Grounds, Walkerton, in all about 2,100 square feet, will be received at the office of the Clerk of the County, up to

12 a. m. Friday, July 31st.

Plans and specifications may be obtained at the office of County Clerk on and after July 13th inst.

Each tender to be accompanied by a marked cheque payable to the order of County Treasurer for the sum called for in the form of tender supplied, which will be subject to usual terms of forfeiture for non-completion of contract.

W. S. GOULD,  
County Clerk.

Walkerton, June 29th, 1896.

## Toronto Public Schools

TO BUILDERS AND CONTRACTORS

Sealed tenders will be received by the Secretary-Treasurer of the Toronto Public School Board until MONDAY, JULY 13TH, AT 10 a. m. SHARP, for the usual midsummer repairs, alterations and improvements at the several schools, in the following trades:—Mason, Carpenter, Painter, Steam Fitter, Plumber and Tinsmith.

Plans and specifications may be seen and all information obtained at the office of C. H. Bishop, Superintendent of Buildings, on and after SATURDAY THE 4TH INST., between the hours of 8 a. m. and 6 p. m., including Saturdays.

Each tender must be accompanied by the deposit mentioned in the said specification and form of tender as per regulation of the Board.

The lowest or any tender will not necessarily be accepted.

JAMES BURNS, W. C. WILKINSON,  
Chairman of Committee. Sec'y-Treas.

## CONTRACTS OPEN.

SOUTH WOODSLEA, ONT.—J. A. Smith is preparing to rebuild his store.

PEMBROKE, ONT.—James McLean proposes erecting a residence shortly

TRURO, N. S.—The sum of \$7,000 will be expended in extensions to the water works.

ST. THOMAS, ONT.—It is said that new machinery will be placed in the M. I. N. shops here.

BARRIE, ONT.—A. J. Carson will erect a brick house and a brick stable; Eustace Bird, architect.

PENETANG, ONT.—The G. T. R. will build three wooden bridges between here and Perkinsfield.

NIAGARA FALLS, ONT. The Niagara Falls Metal Works Co. will install an electric lighting plant.

DUNDAS, ONT.—The time for receiving tenders for repairs at the cotton factory bridge has been extended to the 4th inst.

ST. CATHARINES, ONT.—W. Manson, Secretary School Board, will receive tenders until the 6th of July for school desks.

ST. JOHN, NFD.—Work will shortly be commenced on a railway to extend from St. Johns to Port au Basque, a distance of 560 miles. About 130 miles will

be built this summer. Estimated cost of road, \$8,000,000.

**SPRINGHILL, N. S.**—The Board of Works is urging the expenditure of \$100,000 for the construction of a waterworks system.

**BERLIN, ONT.**—The erection has been commenced of a large hotel at the corner of King and Yonge streets. The owner is A. Walter.

**YARKER, ONT.**—E. Benjamin is erecting a wheel and hub factory 45x72 ft., a brick warehouse 36x75 ft., and a brick dry kiln 45x45 ft., three storeys high.

**HINTONBURG, ONT.**—The council is considering the question of submitting a by-law to raise \$5,000 by the issue of debentures for enlarging the public school.

**SHERBROOKE, QUE.**—Mr. Burke, of the electric street railway company, is making arrangements to commence the construction of the road at an early date.

**KINGSTON, ONT.**—Power & Sons, architects, invite tenders until the 4th inst. for the erection of an office and residence, corner King and Earl streets, for C. L. Curtis, M. D.

**CHATHAM, ONT.**—Fred. Lee contemplates erecting a brick block adjoining the post-office.—The waterworks committee will shortly invite tenders for the construction of a filtering basin.

**TREHERNE, MAN.**—The Farmers' Elevator Co. invite tenders, addressed to Joseph Cooper, secretary, until the 7th inst. for the erection of a grain elevator, with a capacity of 60,000 bushels.

**WINNIPEG, MAN.**—James Burridge, manager of the Guiney-Tilden Co., is having plans prepared for a new warehouse to be erected on Rupert street, 40x100 feet, four storeys and basement.

**KINGSVILLE, ONT.**—Rev. Canon Matthews is asking for tenders for a residence.—W. A. Grenville, clerk, will receive tenders until the 5th inst., for the drilling of a gas well 1,100 ft. in depth.

**LISTOWELL, ONT.**—On the 22nd of August the ratepayers will vote on a by-law to authorize the expenditure of \$15,000 in constructing a system of water works and electric light. Louis Bolton is town clerk.

**LONDON, ONT.**—Ratepayers on Wolfe street have petitioned the City Council for an asphalt pavement.—The Dominion Cold Storage Co., of Montreal, proposes erecting a storage warehouse here, at a cost of \$125,000. A proposition has been submitted to the city council which will be considered at an early date.

**LITTLE CURRENT, ONT.**—A staff of engineers has recently gone over the route of the Manitoulin & North Shore Railway to estimate the probable cost of construction, and it is thought that at an early date work will be commenced. Mr. Jas. Hasketh, of Toronto, is the engineer in charge.

**QUEBEC, QUE.** Mr. H. J. Beemer is said to have made arrangements for the immediate construction of the proposed electric railway.—David Ouellet, architect, is preparing plans for a new church for the parish of Thetford Mines.—Building permits have been granted as follows: Repairs of a house on des Remparts street, Prop. A. Letellier, contractor Mr. Frs. Parent, repairs of a house on Lamontague street for M. Jos. Bussières, contractor, M. Jos. Bussières.

**OTTAWA, ONT.**—The building of the new work shops and round houses of the Ottawa, Arnprior & Parry Sound Railway will be commenced early this month. The plans for the same have already been prepared.—Notice has been given by the Department of Railways and Canals of the further postponement of the date for receiving tenders for the Iroquois division of the St. Lawrence canal until Friday,

the 3rd inst.—J. H. Balderson, secretary Department of Railways and Canals, will receive tenders until Friday, the 10th inst., for the construction of a railway bridge at Auburn. Specifications may be seen at the above department, and at the office of the superintending engineer, Peterboro.—Messrs. Keefer and Davy, the special engineers who were engaged to prepare plans for a main drainage scheme, expect to make their report at an early date.—The Young Liberal Club have under consideration a project to erect a handsome residence for the newly-elected Premier.

**MONTREAL, QUE.**—The property owners of Outremont have passed a by-law authorizing the council to borrow \$100,000 for road improvements and drainage. Extensive building operations are expected as a result of this loan.—Repairs are requested at the low level reservoir. Mr. Laforest, acting superintendent, estimates the cost of putting the reservoir in proper condition at \$50,000.—It is understood that the Melville Presbyterian church congregation contemplate erecting a new building on Cote St. Antoine road.—The School Commissioners of Westmount have purchased a lot, 160x250 ft., on the west side of Western avenue, on which it is proposed to erect a new school building.—W. E. Doran, architect, will award contracts this week for reparations and alterations of a house on Berni street for Mde. J. P. Cuddy.—Building permits have been granted as follows: Repairs of a house on St. Lawrence street for J. Schneider. Ed. Munich, architect. Carpenter and joiner's work, D. Houle; one house on Seaton street, 26x108 ft., for M. Hector Larivé. Carpenter and joiner's work, Emile Niquette.—It has been estimated that it will cost \$50,000 to put the city hall in a proper sanitary condition.

**HAMILTON, ONT.**—W. A. Edwards, architect, will receive tenders until Saturday next, the 4th inst., for the erection of a brick residence for S. McKay.—The projectors of the proposed electric railway from the Mountain top through Ancaster to Alberton will ask the municipalities for a bonus of \$15,000 instead of \$25,000 as formerly proposed.—Mr. B. B. Osler, President of the Hamilton & Dundas Railway Co., which it is proposed to convert into an electric line, states that as soon as Mr. McKenzie returns from England arrangements will be made to proceed with the work. He estimates the total cost of changing the system at \$50,000.—Building permits have been granted as follows: Guy Munson, two storey brick dwelling on Napier street, cost \$1,400; W. P. Witton, brick Sunday School building for Erskine church, cost \$4,900; John K. McMaster, two-storey brick dwelling on Bay street south, cost \$2,200.—The Hamilton, Grimsby & Beamsville railway officials expect that the City Council will release the \$20,000 bonds held as security, in which case the extension of the line to Grimsby will be carried out.—The city clerk will receive offers until the 6th inst. for the construction of sewers on the following streets: Nelson street, from Pearl street to Locke street; Alanson street, from Blyth street to Erie avenue; Peter street, from Hess street to Queen street; York street, from Sophia street to Dundurn street; Macauley street, from Ferguson avenue to Wellington street.—A proposal is on foot to make extensive improvements at Burlington Beach, including the erection of a large hotel containing 150 rooms and costing \$55,000. The projectors estimate the total cost of improvements at \$100,000.

**TORONTO, ONT.**—The Toronto Radial Railway Co. will ask incorporation at the next session of Parliament. The scheme includes the acquisition of the present belt line railway and its conversion into

an electric system.—A petition has been presented to council to have Spencer avenue paved with brick.—Mr. Mark Hall has been appointed architect for the new \$6,000 addition to be built to the machinery hall in the Exhibition grounds.—The C. P. R. have been given permission by the Parks and Gardens Committee to erect an extensive addition to their buildings at the Exhibition grounds.—The asphalt pavement on Yonge street, from Bloor to Davenport road, has been petitioned against.—A meeting of the projectors in the construction of a palace hotel in Toronto will probably be held this week. Among those interested are Messrs. Edward Gurney, J. W. Langmuir, E. B. Osler, H. P. Dwight, Robert Jaffray and others.—The City Engineer has been instructed to invite tenders for a bridge across the Don at Cherry street, and also for brick paving of Market street.—Building permits have been granted as follows: W. S. Essery, pr. three-storey bk. stores, 1,184 and 1,186 Queen street west, cost \$7,000; D. Selway, two-storey and attic bk. residence, 247 Broadview, cost \$2,000; Joseph Simpson, three-storey brick warehouse on Esplanade street, near Berkeley street, cost \$7,000; C. J. Gibson, pair semi-detached two storey and attic brick houses on Triller street, cost \$4,000; Separate School Board, new school on Bathurst st. near Bloor, cost \$4,000; T. R. Whiteside, three att. 2 story and attic bk. fronted dwellings, 180 Sumach st. cost \$2,600; J. Beatty, 1497 Queen w., 2 story bk. addition to dwelling, cost \$1,500.—Tenders for repairs to the various Separate schools of this city are invited until the 5th inst. Plans at 28 Duke street. Address Rev. J. L. Hand, chairman committee of management.

#### FIRES.

The roller mill and grain elevator of H. M. McLean, Quyon, Que., was destroyed by fire on the 27th inst. Loss partially covered by insurance.—The factory of the Chanteloup Mfg. Co., Craig street, Montreal, was recently damaged by fire to the extent of \$40,000. The loss on the stock is estimated at \$15,000.—A two storey dwelling at Victoria, B. C., owned by J. McLarty, was burned last week. Loss, \$2,000; covered by insurance.—A large wooden academy at Dalhousie, N. B., valued at \$3,000, has been burned.—The flour mill at Alexandria, Ont., owned by J. O. and H. Mooney, was completely consumed by fire on the 26th inst. Loss, \$25,000; partially covered by insurance.—The large planing mill and sash and door factory at Penetanguishene, Ont., owned by A. Tessier, has been destroyed by fire.—J. W. Donaldson's residence at Kingston, Ont., has been burned.—The residence of Mr. Carman, at Springfield, Ont., was destroyed by fire last week. Loss, \$1,200; covered by insurance.—Matthew's pork packing factory at Hull, Que., was consumed by fire on Thursday last. Loss, \$7,000. Mr. A. E. Matthews, the proprietor, has not yet decided to rebuild.—The barrel factory of W. H. Matthews, Trenton, Ont., was recently destroyed by fire.

#### CONTRACTS AWARDED.

**BELLEVILLE, ONT.**—The tender of Walter Alford has been accepted for school improvements.

**WOODSTOCK, N. B.**—The tender of the Merchants Bank of Halifax has been accepted for the purchase of \$10,000 of sewerage debentures, at \$125 for every \$100.

**QUEBEC, QUE.**—Francois Parent, has the contract for four cottages for the Montmorency Cotton Mfg. Co., also one club house for the Montmorency Social and Literary Clubs.

**VERNON, B. C.**—The contract for the new drainage system in the Spallumcheen

municipality has been awarded to Morrow Bros., of Okanagan Mission. The price is 16 cents per yard, or about \$5,200 for the contract.

**BARRIE, ONT.**—Smith & Bird, architects, have awarded the following contracts: Office buildings for the Stewart Estate, Goderich, to Buchanan & Rhymes; alterations and additions to the Standard Bank, Bradford, to cost \$1,000, to W. Lawrence of Bradford.

**HINTONBURG, ONT.**—Contracts for the new wing to be built to the public school have been let as follows: Brick and stone work, Mr. H. Ross, Hintonburg; carpenter work, Messrs. Gilchrist & Buchanan, Ottawa; painting, Mr. W. Bones, Hintonburg; plumbing, McKinley & Northwood, Ottawa; boiler, W. J. Campbell & Son, Ottawa.

**LONDON, ONT.**—Tenders have been accepted as follows for a two-room addition to Lorne avenue school: carpentering, Davidson & Hessel, \$1,050; brickwork, Everett & Sing, \$1,490; painting and glazing, A. H. Cook, \$93; plastering, A. Dowel, \$159; slating, J. Whittaker, \$140; metallic ceiling and galvanizing, \$132; heating, McLaren & Parkinson, \$173. The latter firm will also supply the heating apparatus for St. George's school at \$347.

**ST. JOHN, N. B.**—The school trustees opened tenders on Friday last for erecting the new High School building. The following were received: Mason work—George McArthur, \$14,600; John Flood, \$15,300; Charles F. Tilley, \$17,413; B. Mooney & Sons, \$14,578; carpenter work—J. Drury & Sons, \$18,000; John Duffy, \$15,660; Andrew Miles, \$17,788. Whole building—W. L. Prince, \$33,183; R. C. Donald, \$34,475. The tenders of Messrs. B. Mooney & Sons and John Duffy were accepted. The total cost of the building will be \$30,238.

**PETROLEA, ONT.**—The following is a statement of bids received for the construction of a system of waterworks for this town: William Garson & Co., St. Catharines, \$131,945, (accepted); J. H. Armstrong & Co., Toronto, \$133,727; Harding & Leathorn, London, \$138,264; Robert Grant, Toronto, \$138,297; Secretan & O'Boyle, Ottawa, \$141,548; McQuillan & Co., Toronto, \$139,549; Clark & Connolly, Toronto, \$142,000; A. W. Godson, Toronto, \$144,799; M. M. McCarthy, Sherbrooke, Que., \$145,300; Lyons & Wagner, Windsor, \$146,000; George A. Dana, Brockville, \$151,847; Burns & McCormack, Toronto, \$152,917.

**MONTREAL, QUE.**—The contract for the erection of a new school at St. Lambert has been awarded to George Beatty and work will be commenced immediately. The architect is Mr. Findlay.—The roofing and galvanized iron work for the Grand hotel, St. Hyacinthe, has been awarded to J. H. Moni, and the heating, lighting and plumbing to A. Blondin & Co.—A. C. Hutchison, architect, has awarded contracts as follows for one house on Peel street, two and a half stories, for W. Denon: Masonry, J. B. St. Louis; carpenter and joiner's work, A. Laurence; roofing, not let; plumbing and heating, A. MacKay & Co.; brick, A. Beland; plastering, W. J. Cook; painting and glazing, F. Lefebvre & Co.—J. B. Resther & Son have awarded contracts as follows for one house on Mount Royal street for Rev'd Father of St. Sacrement: Masonry, Martineau & Prenoveau; carpenter and joiner's work, Desire Houle; roofing, plumbing and heating, Bluin, Desforges & Latourelle; brick, Mr. Bourgeois; plastering, G. Leveille; painting and glazing not let.

The Erie Ironworks Co., St. Thomas, Ont., have found it necessary to wind up their business.

## FOUNDATIONS PRACTICALLY CONSIDERED.

### DOVETAILING CONCRETE MASSES.

The foundations of the piers of the Tower Bridge having consisted of separate masses of concrete, of which the lower portions of the caissons formed the encasing shells, it was necessary to form a bonding connection between them. The permanent encasing caissons were wholly embedded in the London clay of the river bottom to a depth of over 20 ft., and the bonding of the central and surrounding concrete masses was affected throughout this depth by means of a succession of sections of large dovetailing masses of concrete in two vertical tiers in each caisson. There were three tiers of small dovetails between the adjacent square caissons and four between the triangular caissons within the height of the top metal plate of the permanent caisson, which was removed afterwards, as noted further on. The caisson concrete masses were dovetailed to the central concrete in vertical sections corresponding to the undersides of the horizontal timber frames successively until the top of the rolled vertical joists was reached. The boxes forming the small dovetails were removed before the concrete was allowed to fill them, when the adjoining mass of concrete was formed. A further bond was affected from the level of the top of the rolled joists where the horizontal joint of the upper skin plate of the permanent caisson occurred, this plate having been removed by means of the provision previously made. The concrete mass extended continuously over the caissons, forming a uniting cap, which constituted an effectual bond between the four adjoining concrete masses.

### THE MASONRY.

The level of the concrete foundation being 2 ft. below the top of the permanent caissons, brickwork of this thickness was laid all over the concrete. On this bed of brickwork the granite facing was laid within the temporary caissons. The courses were between 2 ft. and 2½ ft. high, and were laid with a header or thorough bonding stone at every second stretcher. The masonry was commenced in the four square caissons on each side of the piers. The Cornish granite facing was backed up with wire-cut gault bricks laid in Portland cement mortar one part

to 2½ parts of sand. Staffordshire brindle bricks were laid in the inside face-work of the pier chambers for machinery, etc., and also in the part of the pier supporting the bascule lifting spans of the bridge. The mortar for the Staffordshire bricks and the granite facing was one part of Portland cement to 1½ parts sand. The brickwork was laid in English bond of alternate header and stretcher courses, and along the ends of the square caissons, which butted against each other, the alternate stretcher courses were made to tightly butt against the caisson iron plates, the intermediate (heading) courses being set back to form a *toothing bond* of a quarter brick with the brickwork, which was to be afterwards built in the triangular caissons and in the centre rectangle of the pier. The large dovetails formed in the caisson concrete masses was continued up in the brickwork, and formed an additional bond between the brickwork masses. At the ends of the rows of square caissons adjoining the triangular caissons and between the latter, the brickwork was racked back until the masonry had been brought to the level in the latter and all was bonded together.

### A CONTRAST OF BONDS.

A difference may here be observed between the engineering mason's brickwork bonds and those of the architectural mason or bricklayer. The latter would have inevitably used tarred and sanded hoop-iron bond, which it is believed was first brought into use by Brunel (Sir Marc Isambart) in the construction of the circular land shafts of the Thames Tunnel. The architectural bricklayer, perhaps, would have endeavored to obviate, running the hoop iron continuously through the whole length of the temporary caisson of solid brickwork, by fastening the hoop iron to iron anchors embedded in the brickwork a few feet from the ends, or turned up the ends of the hoop iron and built them in the solid brickwork a few courses high. Again, in America, block bonding of separate walls or buildings of brickwork is used more than tooth bonding. The block bonding is usually in four or more courses in height, projecting a quarter brick length beyond similar intermediate spaces. The block bonding possesses more transverse strength, but less longitudinal tenacity, than the toothing bond. The dovetail bond will possess

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more longitudinal tenacity than the toothing bond. As the masonry progressed in height, the cross and diagonal timber bracing of the temporary caissons interfered. It was therefore necessary at such stages to substitute other means of bracing the sides of the caissons against the external pressure of the constantly fluctuating tides of the Thames. For this purpose the horizontal timber frames which supported the metal-plate sides of the caisson were strutted against the masonry. In some cases, where the timber frame came too high to effectively brace against the masonry by reason of too much slope in the struts, longitudinal timber backing the iron-plate caisson sides were put intermediately between the regular original frame timbers. The struts were butted between these temporary timbers and the masonry, where it was solidly backed up with brickwork. When the masonry in the several caissons forming the external of the pier had been completed in a continuous surrounding mass, the external and other remaining sides of the temporary caisson were removed. The piles which closed the intervals between the caissons on the external side were also removed down to the permanent caisson. The similar piles between the internal sides of the caissons were, however, not removed until the central rectangle of the pier had been excavated.

#### PIER CENTRAL RECTANGLE.

The excavation of this portion of the Tower Bridge piers was not commenced until the encircling masonry, limited by the internal sides of the temporary caissons, were completed. The tide had in the meantime been allowed free access to this central portion through a 12 in. pipe placed in the interval between two adjacent caissons, and passing through the timber piles which formed the water-tight joint between them. This pipe was furnished with a sluice to shut off the water when required. It was found that the greatest difference between the internal and external water levels was never more than 20 in., so that the water pressures nearly balanced each other. The stability of the caissons was therefore not at any time severely tried with this small water head. When the progress of the work had rendered it necessary to exclude the tide, it was considered advisable to place five double-timber struts across the centre between and butting against the surrounding masonry. This was merely done as a precaution against the external water pressure unduly compressing the London clay underneath the inner edge of the concrete foundation surrounding the centre. It was found when the water was pumped out that the bottom of the central rectangle had silted up about 14 ft. above the river bed level in a period of about 13 months as regular

the north pier. The south pier had silted up about 12 3/4 ft. in a somewhat shorter time. The silt was excavated by the grabs. When the excavation had reached the bottom of the temporary caissons the internal sides were removed and a second set of timber struts were butted against the opposite masonry walls in the centre of the pier sides. The excavation over the whole surface of the centre rectangle at once was carried down to a depth of 5 ft. below the top of the permanent caissons. In consequence of the swelling of the freshly exposed London clay, it was only excavated in sections. The divisions of these sections corresponded with the joints between the caissons, and the excavation was done in alternate sections simultaneously. In this way the walls were not opposed to the external pressure of the surrounding clay with its weight of submerging water for a greater length than about 30 ft. at a time. The masonry walls were found to be water-tight, so that no pumping was required after the final exclusion of the tide. There was, however, a slight weeping through some pores in the concrete of about two-thirds of a gallon per minute. This was trivial considering that there was an internal face exposure of about 318 ft. lineal, with an extreme depth of about 22 ft. in the alternate sections as they were excavated until they were filled with concrete, up to within 4 ft. of the general concrete level. As the excavation of the sections was completed

the internal iron sides of the permanent caissons were removed, and the dovetail recesses in the surrounding concrete was cleaned out. The section was then filled with concrete, including the dovetails, up to within 4 ft. of the ultimate concrete level. When the four sections have all been thus filled with concrete, the remaining 4 ft. of the height was laid all over in one mass of concrete together at the same time and finished off level to receive the brickwork. The four sections were thus firmly united, and each was bonded to the surrounding concrete by the vertical dovetails. The brickwork which followed was bonded to the surrounding brickwork by the toothings, which had been left for the purpose. These required careful raking out and fitting in of the bonding bricks in the alternate courses.

The cost of the concrete, brickwork, and granite in both piers up to 4 ft. above Trinity high-water level was about £2. 3s. 7d. per cubic yard.

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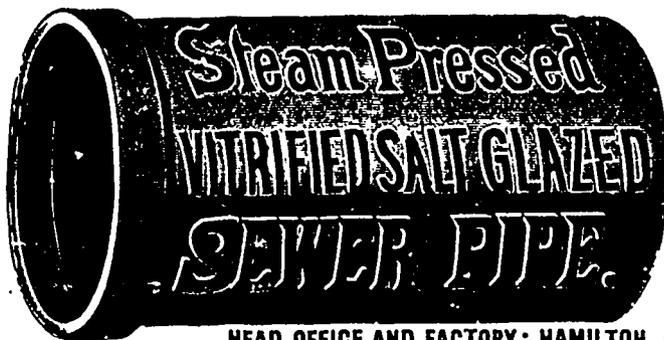
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# MUNICIPAL DEPARTMENT

## THE SEWERAGE OF VICTORIA, B.C.\*

The construction of a sewer system for Victoria was decided upon in 1890. As the site of the city was nearly surrounded by salt water, toward which the slopes are such as to easily carry off surface water, and as the rainfall of the summer months is so light that large sewers would not be self-cleansing, it was determined to adopt the separate system. This determination was further influenced by the great expense to be incurred in constructing a combined system where good brick were scarce and rock excavation unavoidable. The corporation having called for competitive plans, nine sets were presented. These were submitted to Mr. Rudolph Hering, M. Am. Soc. C. E., of New York City, who reported in favor of Mr. Mohun's plans. Mr. Mohun was accordingly appointed Chief Engineer, and Mr. E. A. Wilmot, M. Can. Soc. C. E., resident engineer. The sewers range in size from 8 inch vitrified pipe to 34x51 inch egg-shaped concrete sewers. In designing them it was estimated that each 25 feet of frontage in the closely built area and each 60 feet of frontage in residential area represented a dwelling inhabited by five persons, from each of whom five gallons of sewage an hour might be expected. The Doulton syphon type of automatic flush tank was used and Stone ejectors raise the sewage of several low-lying districts into the gravity outfall system. The 34x51 inch outfall sewer terminates in a concrete house, from which the sewage, after falling through a grating, is conveyed in a 22-inch steel pipe to a point below low water mark and 240 feet from shore. There is also a 16-inch steel overflow pipe 120 feet long. Both these pipes are laid in a trench through solid rock and imbedded in concrete. The concrete sewers were laid with a fall of 1 in 1,200. The concrete was made of 2½ parts shingle, 2½ parts sand, and 1 part best English Portland cement. The shingle and sand were both from the sea beach and were perfectly free from impurities. Very great care was exercised in mixing. On a roomy platform a rectangular frame, without top or bottom, was placed; in this was deposited 2½ barrels of shingle, which was spread to an even depth; on this 2½ barrels of sand were similarly spread, the two layers aggregating 6 inches in thickness; on top of the sand one barrel of cement was evenly spread and the frame removed; the whole was then turned over with shovels two or three times while dry till thoroughly mixed, after which the turning was continued, while water was gradually added through a rose nozzle until a sufficient consistency was attained, when it was immediately

wheeled into place, deposited in thin layers, and immediately rammed. All surfaces unfinished at the close of the day were left rough and porous and well grouted on the resumption of the work.

During the construction of the concrete sewers malicious reports were constantly being circulated to the effect that the sewers were leaky, that the grades ran in the wrong directions, etc., yet upon the completion of the work, when men were sent through for the special purpose of detecting any flaws, it was found that the sewer from invert to springing line was a monolith 9,244 feet long without crack or flaw; at the junction with the arch a few small leaks were discovered which were easily stopped with a little cement. As the ground water was higher than the crown of the sewer, it is thought impossible that a leak in the invert or sides should have remained undiscovered.

The method adopted in building the concrete sewers was as follows:

In earth the trench was excavated 4 inches wider than the outer measurement of the sewer, and 9 inches below the level of the invert, and the sides planked with 2-inch lumber. In fine sand a plank bottom 9 inches below the invert was also placed. In rock or hardpan the planking was altogether omitted, and the concrete was in this instance to be not less than 6 inches thick.

In the bottom of the trench the concrete was well rammed to a sufficient height to allow the channel pipe to be laid with absolute accuracy both as to grade and alignment. Lightly resting on the channel pipe, and secured to the planking on each side, molds shaped to the lower section of the sewer were placed, and the concrete well rammed between them and the plank wall with a T-headed iron having a slightly curved handle. These molds were allowed to remain 36 hours; that is to say, the molds placed on Monday would be removed on Wednesday, another set being used for Tuesday's work. Upon the removal of the molds the surface was rendered perfectly smooth with 2 to 1 cement mortar, after which centers for the arch, resting on the channel pipe, were placed, and the top of the walls having been well grouted the work was carried on in a similar manner.

In order to give some employment to the Victoria brick yards it was originally proposed to build the arch of radial brick, but the difficulty of obtaining thoroughly good material caused this plan to be abandoned, after between 1,700 and 1,800 feet of brick arch had been built, and concrete was substituted. As the work proceeded, water was pumped into the sewer to prevent the concrete drying too rapidly. The concrete for the manholes was handled in a similar manner.

It may be stated that the manholes and flush tanks were made rectangular to save the heavy carpenter's bill which would have been incurred in making oval or circular molds, as many different ones would have been required, the manholes varying much in size and shape, particularly on the main sewers. By using the rectangular form the frames of rough

plank could be set by common labor, and if not used again for the same purpose, could be utilized in timbering trenches, etc.

## PIPE SEWERS.

In rock trenching the excavation was carried down 6 inches below the invert and the bed brought to its true grade with 14 to 1 concrete. When unsound ground was found in the bottom of a trench it was removed and replaced with 14 to 1 concrete, except when a plank flooring and piling were needed.

Pipe on being delivered at the corporation yard were inspected and tested, and the rejected pipe broken up or carted away. The good pipe were then provided with Stanford joints and delivered to the contractor's teams. Inspectors of pipe laying, of course, examined each pipe as laid. A few large and but slightly cracked pipe were surrounded by concrete and used, and other slightly imperfect pipe used as ventilators. The kettles for boiling the tar, to evaporate the ammonia, and for melting the "compo" for the Stanford pipe joints, were heated by gas at a cost of about 13½ cents each per day. The "compo" was made of crude rock sulphur, clean sharp sand (not sea) and coal tar. A greater proportion of sand was used for the larger sizes than for the smaller. An average mixture would probably be about 4 of sulphur, 6 of sand, and 1 of tar, by measure. The cost of making this joint was somewhat larger than was anticipated, but it cost less to lay than a cement joint. A defective pipe can be replaced, or a junction substituted for a straight, and an absolutely water-tight joint made under water with reasonable care. No separate account was kept of the time spent occupied in joining, receiving, testing, culling and delivering, but Mr. Mohun thinks that one-third of the cost may reasonably be deducted for the latter. Upon this basis the following would approximate the cost of jointing per lineal foot of pipe—viz: 8-inch, 6½ cents; 9-inch, 7½ cents; 10-inch, 8¼ cents; 12-inch, 10 cents; 15-inch, 12¼ cents; 18-inch, 15 cents; and 20-inch, 16½ cents. The contract price for laying was 10 cents per lineal foot for 18 and 20 inch pipe and six cents for the smaller sizes. This price included loading, hauling and unloading.

At manholes in leading the subsidiary into the larger stream the former follows a curve whose radius is five times the diameter of the sewer, and the tangents of which are the direction of the two sewers. The invert of the smaller sewer is in all cases raised above that of the larger, and the fall is slightly increased on the curve to compensate for friction. Manhole inlet have vulcanite flap valves, and the outlets have gate grooves to enable them to be used as flush tanks.

Ventilators which serve also as lamp-holes are spaced about 300 feet apart. They consist simply of a vertical pipe surrounded by 7 to 1 concrete, 3 feet square, the surface of which is 1 foot below the street level. On this stands a cast-iron curb with a perforated cover.

(To be Continued.)

\* Abstract of a paper read by Mr. Edward Mohun before the Canadian Society of Civil Engineers.

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TORONTO: Builders' supplies are in a condition very unsatisfactory to the trade so far as Toronto is concerned. In London and Hamilton a better feeling exists and purchases are made with more freedom. For country account there is a fair call for supplies. Orders are coming in a little more freely for cut nails. The base price is \$2.55 per keg, with a rebate of 5c. allowed to retailers. An advance of 1/8c. per lb. is announced in galvanized iron, for which there is a good demand. Iron pipe also shows considerable life.

MONTREAL: The past week's transactions have been confined to immediate requirements, with the result that a restricted trade has been done. In no line is there much activity. Paints and oils are in greater demand, perhaps, than other lines, with prices steady. There has been no improvement in cement, and sales thus far this season are reported to be the smallest for many years past. The demand is principally for small lots to fill actual needs. Arrivals have been of an average, but prices notwithstanding, hold firm.

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Table listing lumber prices for Toronto and Montreal, including items like clear picks, pickings, spruce culls, and various shingles.

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Table listing various quotations for materials like mill cull boards, shipping cull boards, hemlock scantling, and sawn lath.

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Table listing brick prices for Toronto and Montreal, including Common Walling, Good Facing, and various types of bricks.

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Table listing sand prices for Toronto and Montreal, including Per Load of 1 1/2 Cubic Yards.

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Table listing stone prices for Toronto and Montreal, including Common Rubble, Large flat Rubble, and various types of granite and limestone.

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Table listing cement and lime prices for Toronto and Montreal, including German and London brands.

Toronto, Montreal.

Portland Cements.—

Table listing Portland cement prices for Toronto and Montreal, including Newcastle, Belgian, English, and Canadian brands.

Hydraulic Cements.—

Table listing hydraulic cement prices for Toronto and Montreal, including Thorold, Queenston, Napance, Hull, and Ontario brands.

Table listing other cement and plaster prices for Toronto and Montreal, including Keene's Coarse Whites, Fire Bricks, Lime, and Plaster.

HARDWARE.

Table listing hardware prices for Toronto and Montreal, including Cut nails, Steel, and various types of nails.

Table listing casing and box, flooring, shook, and tobacco box prices for Toronto and Montreal.

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Table listing lead pipe prices for Toronto and Montreal.

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