

For residential districts a bench-mark similar to the main system is placed in the parking of the boulevard, and is located out from the corner of the block so that it may be seen from different directions. In some localities it may be desirable to use the cast-iron cover instead of the wooden box.

In business districts, where the entire area is covered with sidewalks or roadway, we are locating bench-marks in the sidewalk area, at a corner along a property line, and three feet back from the curb face. The construction, which is shown in Fig. 2, is similar to that used in the main system, except that it is fitted with a cast-iron cap

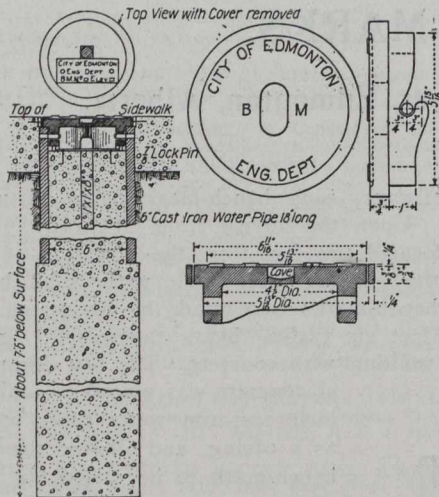


Fig. 2.

that locks into the iron casing. This cap is brought flush with the sidewalk level. By placing this bench-mark three feet back from the curb face it is out of the way of telephone or electric light conduits, and may be seen from four ways on intersecting streets. Where possible, those bench-marks established on buildings which have had time to settle and those of the earlier systems are used as secondaries.

The city has now a belt line of bench-marks running two miles apart throughout the length of the city. The elevations, as shown by the closing error, are nearly perfect. From this belt line secondaries are run out a mile on each side. This gives a system of elevations distributed over the total area of the city that are as correct as it is possible to make them with an ordinary engineer's level.

## THE GRAND RIVER CONTROL.

The Ontario Government was approached on Wednesday, August 21st, by a deputation representing the Grand River Improvement League. The deputation asked that a commission be appointed to investigate the conditions existing along the Grand River, and to recommend some method of improvement to conserve the water supply, prevent floods during spring time, and to consider the advisability of instituting some plan of river control by a Board of Commissioners. The deputation was a large and influential one, representing eight urban and twenty suburban municipalities. Mr. J. P. Jaffray, of Galt, the chairman of the League, headed the committee. Mr. W. H. Breithaupt, M. Inst. C.E., presented the engineering aspects of the proposal to the members of the Government.

After the different arguments were presented, Premier Sir James Whitney expressed his sympathy with the movement and added that the Government would consider the possibility for conducting an investigation with regard to the entire province.

Mr. Breithaupt's argument is given in full herewith.

The Grand River from its source in Melancthon Township, Dufferin County, within twenty-four miles of Georgian Bay, to its outlet into Lake Erie, below Dunnville, has a length along its windings of approximately 140 miles. Its course is mainly southerly. Its drainage basin contains approximately 2,600 sq. miles, about one-sixth the area of the peninsula of south-western Ontario, and comprises nearly the whole of the Counties of Wellington, Waterloo and Brant and parts of Dufferin, Halton, Oxford, Wentworth, Norfolk and Haldimand. Tributaries of the Grand River are the Conestogo from the west, rising near the source of the main river, the Speed from the east, and the Nith from the west.

In topography South Western Ontario presents a high tableland, at elevation of from 1,400 to 1,700 ft. above sea level, near the northerly limit of the peninsula with slopes, abrupt toward the north and east, gradual toward the west, and at first steep, then gradual and becoming flat, toward the south-west and south, to the almost level rim of water of Georgian Bay and Lake Huron, with elevation of 581 ft. above sea level and Lake Erie, elevation 572. Its original condition was one of dense forestation. This has, except to small extent, disappeared, without, however, materially affecting precipitation, rainfall and snowfall, as shown by records extending over the past 60 years; the large surrounding bodies of water maintain humidity.

On or near the high table land rise practically all the larger rivers of the peninsula. Originally half or more of this headwater area was in dense swamp, excellent natural reservoirs for maintaining streamflow. During the past thirty to forty years these swamps have also been cleared and drained so that very little of them remains.

The great change that has come with deforestation of the country has been in the rate of run-off, of water precipitation, as shown in the flow of streams. Where formerly run-off was retarded and stream flow well sustained, the water now goes off rapidly, with the result that there are great floods at times of snow melting and floods after any heavy rain, with smaller stream beds dry and larger ones approaching that condition, during the dry months of the year.

The upper part of the Grand River, extending well into Waterloo County, and including the Conestogo tributary, is the part on which fluctuation of flow most largely depends. The drainage area of the upper river is at first flat and extended; further along it is steep.

High floods occur only once in the year, in the spring, with snow melting on the upper river. These floods have steadily become higher and the low water flow less. This year occurred the highest flood on record, in quantity of water discharge.

The prevention of damage by floods is to large extent practicable in many places by enlarging the regular waterway and by raising the banks by means of levees or dykes. This is well demonstrated on the Grand River by what the city of Brantford has done. Such control gives local relief only, and this is the only benefit. A method of control which benefits the whole river below where it is applied, and gives not only flood relief but also the great benefit of sustained flow, is of much greater advantage. Such a method is storage in sufficient quantity. Reforestation on a large enough scale to have proper effect would require so large an area as to render it of doubtful practicability on the Grand River.

The conditions determining requirement for storage are

- (a) The flood flow of the river;
- (b) The amount of sustained flow, for low water period, that can be provided for.