is about 70 lbs. and the fire pressure from 100 to 130 lbs. per square inch. There are about 44 miles of mains ranging from 3 inches to 18 inches in diameter, all cast-iron pipe. There are also 4,323 services.

The total quantity pumped in 1916 was about 1,100,000,000 gallons, or an average of about three million gallons per day. The maximum peak rate was about 5½ million gallons per day. The average daily consumption of water in 1916 was about 136 gallons per capita. The cost of the water, inclusive of all charges, averaged about 4.95 cents per 1,000 gallons.

The Peterborough waterworks were first installed by a private company in 1882 and were acquired by the city in 1902.

The water commissioners are Mr. T. F. Matthews, chairman; Messrs. W. H. Moore and Robt. Hicks. Mr. R. L. Dobbin, B.A.Sc., is the waterworks superintendent, to whom credit must be given for the foregoing information, and Mr. Wm. Kennedy, Jr., Montreal, is the consulting engineer.

DESIGN FEATURES FOR CONCRETE AND REINFORCED CONCRETE CONSTRUCTION.*

THE span length for beams and slabs simply supported should be taken as the distance from centre to centre of supports, but need not be taken to exceed the clear span plus the depth of beam or slab. For continuous or restrained beams built monolithically into supports, the span length may be taken as the clear distance between faces of supports. Brackets should not be considered as reducing the clear span in the sense here intended, except that when brackets which make an angle of 45° or more with the axis of a restrained beam are built monolithically with the beam, the span may be measured from the section where the combined depth of beam and bracket is at least one-third more than the depth of the beam. Maximum negative moments are to be considered as existing at the end of the span as here defined.

When the depth of a restrained beam is greater at its ends than at mid-span and the slope of the bottom of the beam at its ends makes an angle of not more than 15° with the direction of the axis of the beam at mid-span, the span length may be measured from face to face of supports.

T-Beams.—In beam and slab construction an effective bond should be provided at the junction of the beam and slab. When the principal slab reinforcement is parallel to the beam, transverse reinforcement should be used, extending over the beam and well into the slab.

The slab may be considered an integral part of the beam, when adequate bond and shearing resistance between slab and width of beam is provided, but its effective width shall be determined by the following rules:—

(a) It shall not exceed one-fourth of the span length of the beam;

(b) Its overhanging width on either side of the web shall not exceed 6 times the thickness of the slab.

Beams in which the T-form is used only for the purpose of providing additional compression area of concrete should preferably have a width of flange not more than 3 times the width of the stem and a thickness of flange not less than one-third of the depth of the beam. Both in this form and in the beam and slab form the web stresses and the limitations in placing and spacing the longitudinal reinforcement will probably be controlling factors in design.

Floor-Slabs Supported Along Four Sides.—Floor-slabs having the supports extending along the four sides should be designed and reinforced as continuous over the supports. If the length of the slab exceeds 1½ times its width, the entire load should be carried by transverse reinforcement.

For uniformly distributed loads on square slabs, one-half the live and dead load may be used in the calculations of moment to be resisted in each direction. For oblong slabs, the length of which is not greater than 1½ times their width, the moment to be resisted by the transverse reinforcement may be found by using a proportion of the live and dead load equal to that given by the formula,

$r = \frac{l}{b} - 0.5$, where l = length and b = breadth of slab.

The longitudinal reinforcement should then be proportioned to carry the remainder of the load.

In placing the reinforcement in such slabs account may well be taken of the fact that the bending moment is greater near the centre of the slab than near the edges. For this purpose two-thirds of the previously calculated moments may be assumed as carried by the centre half of the slab and one-third by the outside quarters.

Loads carried to beams by slabs which are reinforced in two directions will not be uniformly distributed to the supporting beams, and the distribution will depend on the relative stiffness of the slab and the supporting beams. The distribution which may be expected ordinarily is a variation of the load in the beam in accordance with the ordinates of a parabola, having its vertex at the middle of the span. For any given design, the probable distribution should be ascertained and the moments in the beam calculated accordingly.

Continuous Beams and Slabs.—In computing the positive and negative moments in beams and slabs continuous over several supports, due to uniformly distributed loads, the following rules are recommended:—

(a) For floor-slabs the bending moments at centre and at support should be taken at $\frac{wl^2}{12}$ for both dead and live loads, where w represents the load per linear unit and l the span length.

(b) For beams, the bending moment at centre and at support for interior spans should be taken at $\frac{wl^2}{12}$ and for end spans it should be taken at $\frac{wl^2}{10}$ for centre and interior support, for both dead and live loads.

(c) In the case of beams and slabs continuous for two spans only, with their ends restrained, the bending moments both at the central support and near the middle of the span should be taken as $\frac{wl^2}{10}$.

(d) At the ends of continuous beams, the amount of negative moment which will be developed in the beam will depend on the condition of restraint or fixedness, and this will depend on the form of construction used. In the ordinary cases a moment of $\frac{wl^2}{16}$ may be taken; for small

*From the final report of the Special Committee on Concrete and Reinforced Concrete submitted January 17 at the annual meeting of the American Society of Civil Engineers.