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PAPERS AND DISCUSSIONS

OF GENERAL INTEREST

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THE OVERPASS AT COTTAGE FARM BRIDGE

BY LEWIS E. MOORE, MEMBER*

(Presented at a meeting of the Boston Society of Civil Engineers held on September 27, 1939)

WHEN the Boylston Street subway was opened in 1914 I happened to be among the invited guests. At that time I remarked to some of the assembled dignitaries that it seemed too bad not to continue it under Governor (or Kenmore) Square out Commonwealth Avenue and Beacon Street so that the trolley cars would not have to cross traffic in the square. I was politely told that there was no possibility of any congestion ever occurring in that enormous square and that there would always be ample room for every vehicle that would ever use it.

The intolerable conditions which arose within a few years made the building of these extensions which I had suggested a necessity and they were completed finally in 1932 at a cost of $4,900,000.

The above is mentioned only to call attention, through the medium of a familiar example, to the tremendous change which has taken place in traffic. There is no sign portending a diminution.

Incidents like the above could be multiplied to an almost indefinite extent, but I must get to the main subject of the evening.

The handling of traffic, so far as engineering construction, or provision of facilities, is concerned naturally divides itself into two parts. One of these is the provision of new or widened thoroughfares

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to allow traffic to move freely over considerable distances and the other is to provide relief of some kind at isolated points of congestion in otherwise reasonably freely moving streams.

Memorial Drive comes under the latter classification. It extends along the Cambridge bank of the Charles River from the Charles River Dam to a junction with Mt. Auburn Street, a distance of about 5¼ miles as shown in Figure 1. Through much of its length

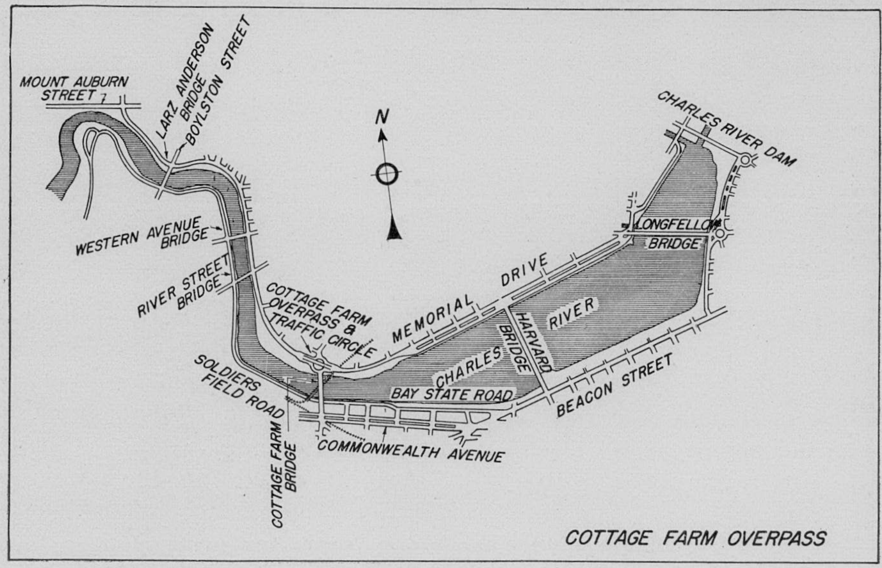

Fig. 1—Charles River Basin and Location of Overpass at Cottage Farm Bridge

it carries from one to four of the numbered through-routes for passenger automobiles. Trucks and busses are excluded, with certain access exceptions. Because of its situation on the river bank it is in an ideal location for a traffic artery. In all this length it is crossed at only six places, which are the Longfellow Bridge, carrying Main Street, the Harvard Bridge, carrying Massachusetts Avenue, the Cottage Farm Bridge, joining Essex Street, Brookline to Brookline Street, Cambridge, River Street, Western Avenue and Boylston Street. The first three and the last named have heavy cross traffic at all times, but more particularly during the evening rush hours.

Fig. 2—Airplane View of Locality at Cottage Farm Bridge before Construction of Overpass Commenced

When the Longfellow Bridge was built in 1908 topographical considerations led to the building of an underpass through the Cambridge approach. Narrow though it is, and accompanied by tortuous turns and a certain amount of crossing of traffic both sides of the bridge, it nevertheless has rendered excellent service in preventing serious congestion at this point.

At Massachusetts Avenue an underpass was constructed in 1931 to relieve intolerable delays.

The next point was the Cottage Farm location, which was really the worst one of the three because of the very heavy turning movements in addition to the cross traffic. (See Figure 2.)

The whole situation in this vicinity merits consideration. Through-routes 1, 28 and 38 make a left turn here from Memorial Drive outbound to the Cottage Farm Bridge. Long delays, particularly during the evening rush hour, were the rule. Between five and six in the evening there was, very commonly, a double line of automobiles extending for a distance of one-half to three-quarters of a mile easterly from Brookline Street. This means from 200 to 300 cars waiting their turn to pass this point. Delays of from ten to fifteen minutes were regular. On one occasion I left Warren Brothers' building, east of the Massachusetts Institute of Technology, at 5:10 P.M. and crossed the Cottage Farm Bridge at 6:03 P.M. Fifty-three minutes to travel 1¾ miles seems an unnecessary drain on one's patience.

The Cottage Farm Bridge is a very short traffic artery, less than ¼ mile long, crossing the Charles River and the Grand Junction branch of the B. & A. Railroad. It furnishes a cross connection between Commonwealth Avenue on the Boston side and Memorial Drive on the Cambridge side and carries through routes 1, 28 and 38 from Memorial Drive to a level crossing with Commonwealth Avenue. When traffic is moving along Commonwealth, the cross traffic from the bridge is necessarily held up and sometimes blocks the Memorial Drive intersection. Let me say that, considering the difficulty engendered by the left turns from Commonwealth Avenue to the bridge, the Boston traffic police handle their part of the situation excellently.

The above considerations, and provisions for future traffic, indicated that the solution, so far as turning movements were concerned, was a traffic circle of liberal proportions.

To prevent blocking of through traffic on Memorial Drive because of congestion on the bridge blocking the circle, an overpass was

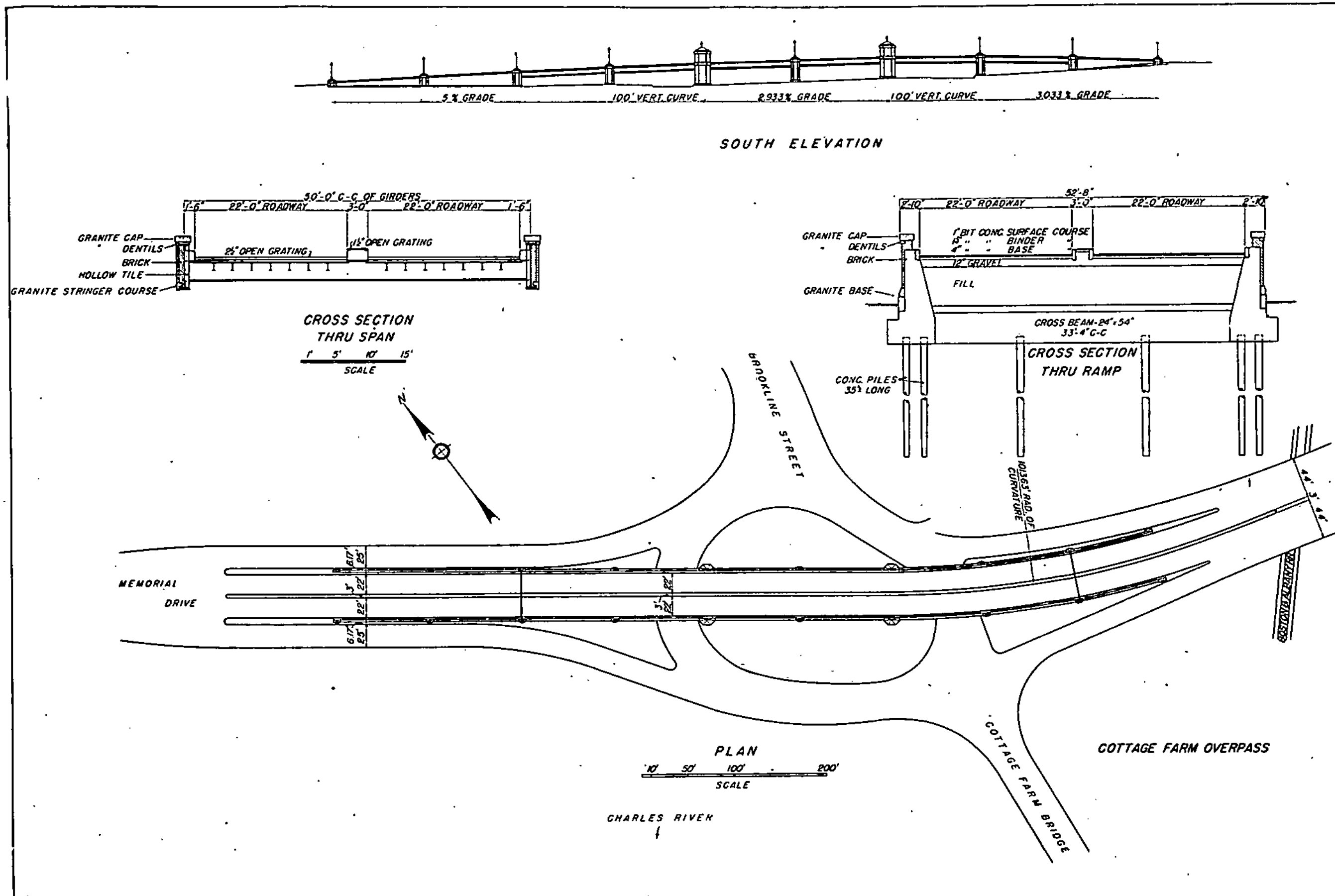

Fig. 3—Plan, Elevation and Section of Overpass Structure

considered necessary. To visualize this possibility consider for a moment the circle at Charles and Cambridge Streets at the Boston end of the Longfellow Bridge. It is not unusual for a traffic jam on Charles Street to block this circle completely so that traffic cannot move across the river either from or toward Cambridge. The Overpass at Cottage Farm was decided upon to guard against a similar difficulty occurring at this point.

After this rather long introduction your attention is directed to Figure 3 showing the plan as finally agreed upon. In brief it consists of an irregular circle surmounted by the Overpass. The latter consists of six spans of masked through plate girders each about 100 feet in length, with a filled approach between retaining walls about 170 feet long at the easterly end and a similar one about 320 feet long at the westerly end, making a total length of about 1,100 feet. The circle goes under the second span from each end in order that the open space under the first span may provide a clear view of approaching traffic.

Each roadway is 22 feet wide on the straight away which was considered to be sufficient as each is one-way. The curves on the ground are suitably widened.

A central dividing strip three feet wide is provided for the whole length of the Overpass. This serves as an emergency sidewalk, as well as a traffic separator. Walks on the structure are not provided otherwise. Sidewalks on the ground are provided alongside all roadways and across the circle.

It is not unusual for bridge railings and other structural parts to be so arranged that they interfere with or completely block the view from bridges. In this case the top of the coping was purposely kept low enough so that automobilists could see their surroundings.

An appropriation of $250,000 was made by the Commonwealth to be applied by the Metropolitan District Commission for improvements to the Park system. Earnest efforts by Commissioner Eugene C. Hultman of that Commission, who has worked hard for several years to obtain this public improvement, secured a grant from the P. W. A., which made the Cottage Farm project possible. The estimated total cost is $454,000.

To expedite matters, the work was divided into three contracts, the first one covering the widening of the bridge over the Boston & Albany at the easterly end of the work. The grades were such that the best solution was to start the overpass at the top of the bridge over the railroad. The roadway at this point was 40 feet wide. To mingle four twenty-two foot roadways with a central dividing strip required a roadway width of ninety-one feet. The existing structure was a beam bridge 40 feet wide with concrete jack arches and reinforced concrete abutments constructed with counterforts. When word was received to go ahead with the plans for this part of the work, only one week was allowed for their completion. We met this requirement. The new structure is an extension of the old one and is similar in design, presenting no novel features.

The second contract covered the circle and driveways and all other work not included in the overpass and was entirely designed by the Engineers of the Metropolitan District Commission.

The third contract was for the Overpass and was designed by us, with the collaboration of an architect, and the Engineers of the Metropolitan District Commission.

Foundation

The borings showed compact sand and gravel about 25 feet below the surface. Above the compact material was a layer of peat mud with gravel fill near the surface.

A pile foundation was decided upon with a footing on top of the piles, the bottom of the footing being about 5 feet below the finished grade. The piles were steel tubes with a cast iron point and had a minimum diameter at the point of 12 inches and a taper of one inch in eight feet. After driving, the shells were filled with concrete. The calculated load on the piles was 30 tons. A test pile stood 60 tons with 5/8″ movement at the top, probably mostly shortening of the pile. The piles were 30 to 35 feet long.

Figure 4 shows the typical arrangement of piles. It will be noticed that under portions of the wall a single row of piles was used. In such cases they were driven as close as practicable to the point where the resultant pressure on the bottom of the foundation passes into the ground. The footings were practically grade beams and were substantially reinforced. To allow for variations in the location of the resultant pressure, stiffen the structure, and give general stability to the foundations heavy reinforced concrete cross beams, shown in the figure, were placed 33 feet 4 inches apart.

After careful consideration, it was decided to omit expansion

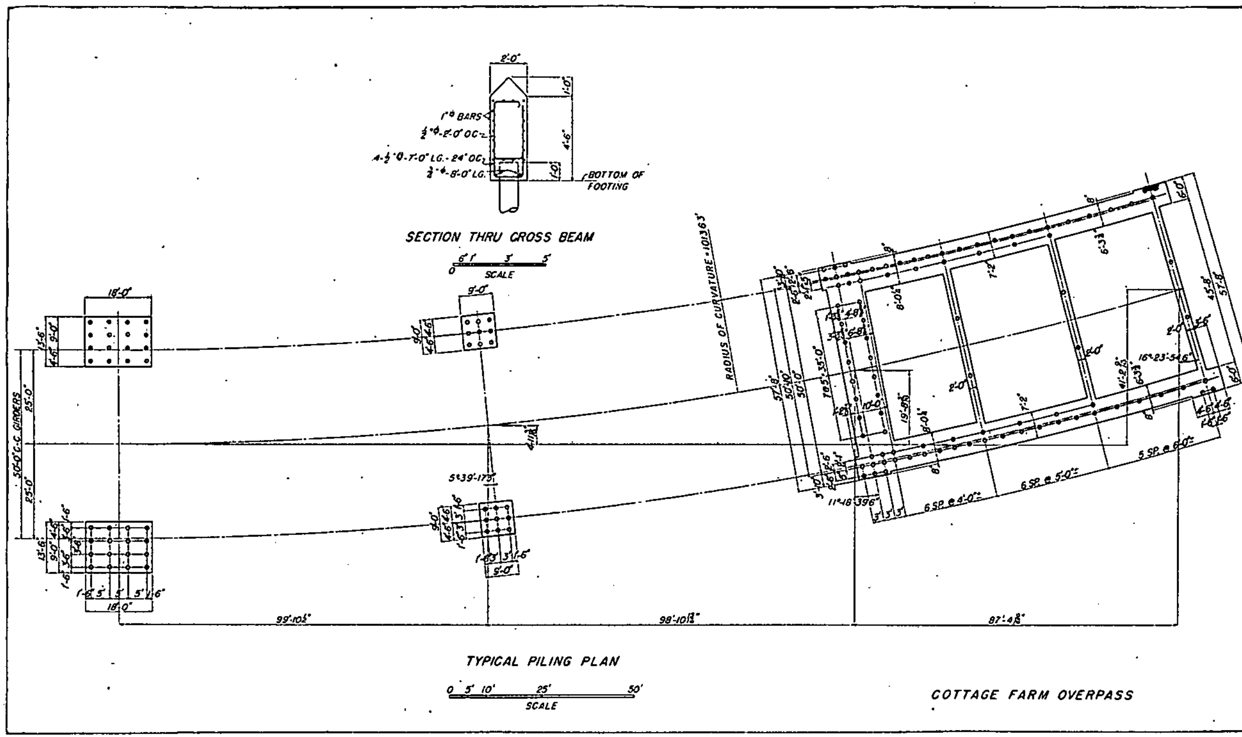

FIG. 4—TYPICAL PILING PLAN

joints in the foundation. The concrete walls above ground have a brick face between a granite base course and granite coping. An expansion joint would surely cause a crack in the facing which probably would be troublesome later on as well as unsightly. If the concrete wall cracks of its own volition anywhere, the crack will probably stabilize itself with little further movement, and any resulting damage to the facing can be readily repaired once and for all.

The dead loads on the superstructure were actual loads except that the grating was figured at 47 pounds per square foot to provide for its possible future filling.

The live loads departed from usual practice because of the unusual conditions. All details were designed to carry one 15-ton truck to allow for maintenance service, etc. The live load on the girders was assumed to be 40 pounds per square foot over the whole roadway surface. The reason for this assumption is that only passenger cars use the structure and if such cars were placed so as to touch each other on all sides the average load over the area covered would not exceed that figure. A further justification for using the 40-pound load is that if, in case of emergency, heavy trucks, army ordnance, or similar loads have to pass along Memorial Drive the circle is available for them at ground level. To provide at considerable expense for a condition that need never occur did not appear to be good judgment.

The superstructure consists of through plate girders supporting floor beams, stringers, sills and open grating. The girders have 72″ x 5⁄8″ webs, 8″ x 8″ x 3⁄4″ flange angles and 2 18″ x 5⁄8″ and 2 18″ x 1⁄2″ cover plates in each flange. The floor beams are 36″-159-pound girder beams. The stringers are 12″-25-pound beams and support 5″-12 1⁄4-pound I-beam sills which are spaced 15 inches on centers. The open grating floor rests on these sills and on bars on top of the floor beams. The sills are riveted at their ends to 18-inch channels which serve as both curbs and stringers. The plate girders rest on columns which have been the subject of some comment from various inspired and uninspired sources. It is interesting to note that the steel erector ran a caterpillar crane out on the structure when it was only partly bolted up and did his erection from it with no trouble. To answer the critics it should be noted that when the structure is complete six of the columns will each form an integral part of a reinforced concrete pier 4 feet by 8 feet and the remaining four will each be part of a reinforced concrete pier about 8 feet by 16 feet. The use of the steel columns materially shortened the time of construction as the upper part of the piers and the masking of the girders could be installed at the same time.

The steel details at the tops of the columns are shown in Figure 5.

FIG. 5—STEEL DETAILS AT TOP OF COLUMNS

Beauty was neglected because these details will be completely concealed from view. The girder at the left is riveted to the column forming a fixed end. The girder at the right rests on a shoe curved to allow deflection with a phosphor bronze plate to permit longitudinal expansion and contraction.

The lateral bracing, seen in the figure, is very long and, because of vertical curves in the roadway, which are of course followed by the floor beams, it is at very variable distances below the floor beams. The usual angle and plate, or split beam, supports would have had to be all different, so the support was afforded by L shaped square bars which were hooked over the bottom flanges of the floor beams and welded both to them and to the laterals in the field. This detail eliminated much fussy shop work and sorting of small pieces in the field.

An unusual feature of the superstructure is the curving of the girders over two spans to follow the curve of the roadway. You are all aware of the awkward appearance of a curved roadway supported by girders which form straight chords. This would be particularly objectionable in a parkway such as the one with which we are dealing. By curving the girders the appearance is improved and incidentally the floor beam connections can be kept square. The stringers are straight, but all the knees at their ends make the same angle with the stringer, so that part of the construction is simplified.

The curved construction has the added advantage that it is very simple to bank the roadway, if desired, although on this Overpass the roadway is not banked.

Figure 6 shows how the curved girders were suspended for erection.

The most remarkable curved bridge which I have ever seen is on the Elevated in Paris where a right angle is turned in, I think three, spans of curved trusses, between the stations Bastille and Quai de la Rapee.

FIG. 6—SUSPENSION OF CURVED GIRDERS BEFORE ERECTION

I have recently built several spans of curved girders with superelevated roadway for a bus bridge over the Rapid Transit tracks at Everett Station on the Boston Elevated Railway with entire success.

The theory of the curved girder is quite simple. I note that a recent American publication devotes 36 pages to the mathematical theory of such girders.

After seeing the bridge in Paris I dug around for the theory and found it in a French publication. The entire theory was covered by a few lines in a general paragraph. I copied it with annotations sufficient so that no part would be left to my memory on a single three-inch by five-inch notebook page with a considerable margin left.

The curvature adds a moment to the outer girder and subtracts one from the inner girder. Determine the moments in the usual way regarding the girder as straight. Determine the cross moment caused by the curvature by composition and resolution of moments at the end of each floor beam. Divide the cross moment so determined by the distance between girders and you have the additional vertical load whose moment must be provided for in the girder.

The middle ordinate on the outer girders is $14\frac{3}{4}''$ and $14^1/_{16}$ inches on the inner girders. They are approximately 100 feet long. The middle ordinate on the Boston Elevated Railway bridge mentioned above was about 19 inches in a 34-foot span with a superelevation of $\frac{1}{2}$ inch per foot along the floor beams.

The principal difficulty in the design of the curved girders arises in the connection of the floor beams to the outer girder. There is a tendency for the outer girder to revolve outward away from the floor beam. This was particularly difficult to care for in this case because the usual top flange brace had to be dispensed with to provide space for electric conduits. The presence of the masking on the outside of the girder made it possible to cover up an adequate but rather clumsy detail consisting of two $7'' \times 4'' \times 1''$ angles on the outside of the girder and one of the same size on the inside extending the depth of the girder. Their connection to the floor beam was sufficient to develop the necessary moment.

The masking on the girders consists of a granite stringer course resting on the bottom flange and projecting far enough down on the outside to cover the edges of the flange plates. On top of this is a brick facing, backed by hollow tile reaching to the top of the girder. On top of the girder is a granite coping.

FIG. 7—THE COMPLETED OVERPASS AT COTTAGE FARM BRIDGE

The stringer course is anchored by short longitudinal bars resting in notches in the tops of the courses and passing through holes in the girder stiffeners. Similar anchor bars pass through other holes in the stiffeners and are grouted into the hollow tiles. The coping rests on top of the brick on the outside and on a longitudinal bar welded on top of the girder near its inside and extending up into a groove in the bottom of the coping.

The project was carried out by the Metropolitan District Commission, Eugene C. Hultman, Commissioner, with the aid of Federal funds supplied by the P.W.A. The traffic circle and its roadways were designed by the Metropolitan District Commission Engineers, Mr. B. R. Davis, Chief Engineer. The railroad bridge widening and the overpass were designed by Moore & Haller, Inc., consulting engineers, in conjunction with the Engineers of the Metropolitan District Commission. The architectural embellishment was added by Mr. W. W. Drummey, working under the direction of the consulting engineers.

The contractor for the grading, roadways and traffic circle is Walter Reed Corporation. The contractor for the widening of the railroad bridge and for the overpass is Coleman Brothers, Inc. The steel was erected by Oscar H. Horovitz Company. The granite was furnished by the H. E. Fletcher Company, of North Chelmsford, Mass., and the brick by the Dolben Brick Company, of Westfield, Mass.

HIGHWAYS OF THE BOSTON METROPOLITAN DISTRICT, THEIR ORIGIN AND EVOLUTION

By O. D. Fellows*

Presented at a Meeting of the Highway Section, Boston Society of Civil Engineers, Held on April 26, 1939

The highway pattern of the Boston Metropolitan District was fore-ordained and established to some extent long before the founding of the colonies at Plymouth in 1620 and at Boston in 1630. For many years—perhaps centuries—the Indians had been following trails that were later adopted by the white man and those trails eventually became some of the highways of today.

Once they were narrow paths through the woods, paths worn smooth and deep by thousands of moccasined feet; today they are wide, hard-surfaced highways, but they are still used for the same purpose—transportation and travel. Some of those old trails are among the oldest known thoroughfares of this continent. They were given names such as the "Coast Path," between Boston and Plymouth; the "Kennebunk Road," following the coast northerly; the "Bay Road," from Boston through Stoughton to Taunton; the "Old Connecticut Path" through Cambridge, Waltham, Weston, Framingham, etc.; the "Old Roebuck Road" through Dedham, East Walpole, Foxboro, North Attleboro to Providence. These were the principal routes which centered in Boston.

As the fertile fields of the inland districts began to attract settlers away from the coast towns it became necessary to have paths or roads to connect the new home sites with the earlier settlements and thus a rough pattern of radial roads came into being—radiating inland from the coast—particularly from Boston.

The General Court of the Massachusetts Bay Colony took action on November 5, 1639, with reference to better travelling conditions and ordered that all roads be definitely laid out. To quote from the General Court order: "Every town shall choose two or three men who shall joyne with two or three of the next town and they shall have

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power to lay out ways where most convenient, notwithstanding any man's property or any corne ground, so as it not occasion the puling down of any man's house or laying open any garden or orchard, and in comon ground or where the soyle is wet or mirye they shall lay out the ways the wider as 6 or 8 or 10 rods or more in comon ground"—

Boston in the Early Days

In 1630, the small peninsula of Boston had only one narrow connection with the mainland, namely, at the narrow neck where Washington Street is located. This isthmus was about 40 rods wide and so low that the road was often washed by the high spring tides. Until a bridge was built about a hundred and fifty years later, the neck provided the only thoroughfare leading to the neighboring towns.

In 1631, a ferry was in operation between Boston and Charlestown, and, in 1635, another ferry was handling the traffic across the Charles River near the location of the Lars Anderson Bridge. On account of the accidents, delays and dangers in crossing on this ferry, it was superseded in 1662 by a bridge at about the same site.

In 1786, the Charlestown Bridge was opened to the public between Boston and Charlestown. It was 1503 feet long, cost $50,000, and was considered a major project for those days. Other bridges were built and put in use as follows:—

In 1793, the West Boston or Cambridge Bridge
In 1805, the Dover Street Bridge from the neck to South Boston
In 1809, the Craigie Bridge, called the Canal Bridge
In 1828, the Warren Bridge and the Federal Street Bridge
In 1872, the Broadway Bridge
In 1891, the Harvard Bridge

When one realizes that it was not until three years after the American Revolution that the first bridge was built to connect the little peninsula with the main land, it is easy to understand the importance of knowing whether the British were moving by land or by sea on that momentous night of the 18th of April in 1775.

The lower post road to New York was in use in 1737. The middle route through Medfield and Bellingham in 1759, and the upper route via Marlboro and Worcester in 1764.

In 1783, the last year of the revolution, stage service to New

York by way of Shrewsbury, Worcester, Springfield, and Hartford was in operation at four pence per mile. In 1814, these coaches started daily from Boston, making the trip to Springfield in two days. At the end of the stage coach period there were six lines and 18 coaches operating regularly between Boston and Springfield.

Turnpikes

The turnpike era began in Massachusetts in 1796, when the first Massachusetts Turnpike was begun from Warren to Palmer. During the ten years thereafter, 41 other turnpike companies were incorporated in Massachusetts. This was a long step forward, both in engineering and in finance. Attention was given to careful surveys, grading, and road bed with some attempt at scientific construction. From a financial angle the offer of turnpike corporation stock as a profitable investment enabled the incorporators to raise the money for construction, but the failure of most of the corporations to return a satisfactory record of dividends, reminds one of the wild cat mining stock era of a later day.

The Newburyport Turnpike

Until the Charlestown Bridge was opened in 1786, the only way to Boston by vehicle from the North, was a long, circuitous route through Medford, Cambridge, Brookline, and Roxbury. The Newburyport Turnpike Corporation was granted a charter on March 8, 1803, and work of construction began at the head of State Street, Newburyport, on August 23, 1803. The specifications provided that the grades should not exceed 5%, and that road should consist of 10 inches of gravel. Three and one-half miles were built for $8,000 and a hogshead of rum. On one section of the work each worker was paid one dollar per day and board and one-half pint of rum. The pay for a man with a cart and oxen was $1.57 per day. The turnpike was opened for public travel on February 11, 1808. The southern terminus was later changed from the Chelsea Bridge to the Malden Bridge.

In 1840, the Eastern Railroad was completed to Newburyport, and that marked a decline of the business of the turnpike, and the turnpike lasted only seven years after that. By 1852, that entire road had been taken over by the Towns and made free from tolls.

Other Turnpikes

The Salem Turnpike charter was granted March 6, 1802. Although an attempt was made to operate a stage in 1766, it took four days for the first journey to Boston by land. History informs us that only one vehicle was owned in Salem in 1700, and the roads were so poor it was not safe to use it. All land travel had been either by foot or horseback and most of the travel was still by water.

Norfolk and Bristol Turnpike was Chartered on March 8, 1802. Before this turnpike was completed the journey from Boston to Providence took 10 hours and the rest of the week to get to New York.

The Charters of other turnpikes were granted as follows:—

Medford Turnpike—March 2, 1803.
Braintree and Weymouth—March 4, 1803.
Taunton and New Bedford—March 3, 1804.
Hartford and Dedham—March 9, 1804.
Andover Medford—June 15, 1805.
Middlesex—June 15, 1805.
Worcester—March 7, 1806.

The Turnpike corporations however did not long survive the coming of the railroads.

Thus, from early Indian trails through the crude systems of roads of the Colonists to the turnpike era, a dozen or more radials found their way into Boston traversing the district from almost all directions. There were no circumferential routes.

There was a long period without much important road construction, only occasional widenings and some water-bound macadam construction, late in the nineteenth century. Until well into the nineteenth century, each village was an independent community with its own shops, mills, and stores, and there was little need for intercourse between these communities; in fact, the condition of the roads did not encourage travel.

Many persons find a great fascination in studying transportation. It is also the history of civilization. The trail, the footpath, the ford (or ferry) of earlier days have now become the highway, the boulevard and the bridge. Many people of course, in their span of life have seen great developments take place in transportation facilities, so short has been this period of evolution. Yet, there are still many miles of narrow, rocky or sandy roads winding into the woods here in New England, many of them the remnants of old turnpikes.

From my own reminiscences I can recall that practically all the roads and streets, outside of large cities, were like the bridle paths of today, just narrow dirt or gravel roads. Only yesterday the traffic consisted of an occasional horse-drawn vehicle drawn wearily through the heavy sand, whereas today, out in the country, the traffic roars steadily past on concrete highways.

State Highways

State highway construction was first inaugurated in this state when the Massachusetts Highway Commission was established in 1893. In 1920, that Commission was abolished and it became the Division of Highways of the Department of Public Works.

That original Commission, in its first annual report dated 1893, stated that "The condition of the roads of this Commonwealth is to a great extent determined by the peculiar shape of its surface." Other fundamental statements included the following, "Experience in all countries has shown that the soil covering is in its normal state unfitted to be converted into a roadway", and "Excepting in a few of the cities and in a small number of the wealthier towns, the highway of the Commonwealth may properly be said to be in bad condition", and as to costs, "$16.20 per mile, a sum which experience shows is quite inadequate for the work" (of road building and maintenance).

The first mention of the automobile in the highway reports was in 1904, when it seems that there were 3241 automobiles and 502 motor cycles, a total of 3743 motor vehicles registered in the state. The same report indicates that there were 482 miles of State Highways completed. Most of the improved roads at that time were water-bound macadam, fifteen feet wide, but ranging from a minimum of 12 feet to a maximum of 24 feet.

Of course in the cities cobblestone pavements were in use in the 1850's. Wooden block pavements were tried out in 1856 in Boston, and Belgian block was in great favor from 1862 on; but these were expensive pavements and could be afforded only in the cities where the traffic was heavy, especially heavy truck haulage near the docks.

If we go back to 1910 (the end of the horse and buggy era), and compare an early traffic count of that year in the City of Boston with a count recently taken at the same point, we find an interesting example of evolution operating over a brief span of years.

TRAFFIC AT CHARLES RIVER DAM

	November 1910 6 A.M. to 6 P.M.		June 1938 7 A.M. to 12 Midnight
Automobiles	104		28,581
Trucks	0		5,964
Teams (Horse drawn)	5,123		51
Trolley Cars	810		
		Busses	57
Total	6,037		34,653

Consider the Sumner tunnel and its traffic. In spite of the single tube, single-lane-in-each-direction conditions, the traffic figures are remarkable. It took a race horse named Discovery, running at Suffolk Downs in East Boston on August 7, 1935, to bring out the fact that the single east-bound lane could carry 1438 cars in one hour, with west-bound traffic using the other lane. That week of August 5 to 11, 1935, was the all time maximum to date, 183,370 vehicles or an average of 26,196 cars daily. The minimum count, January 20 to 26, 1936, showed only 56,698 cars for the week or an average daily count of only 6,100 vehicles. However, the tunnel traffic now serves between five and six million cars per year.

THE BOSTON METROPOLITAN DISTRICT

There are several Boston Metropolitan Districts, only three of which will be mentioned, namely,—

1. The Boston Metropolitan Transit District comprising fourteen cities and towns served by the Boston Elevated Railway System.
2. The Boston Metropolitan District, comprising forty-three cities and towns included in the Metropolitan Parks, Sewer and Water Districts, which are administered by the Metropolitan District Commission (fourteen cities and twenty-nine towns).
3. The Boston Metropolitan District as defined by the United States census and which includes eighty cities and towns.

The second district listed is the one to which I shall refer and the one in which we are particularly interested. This area was originally

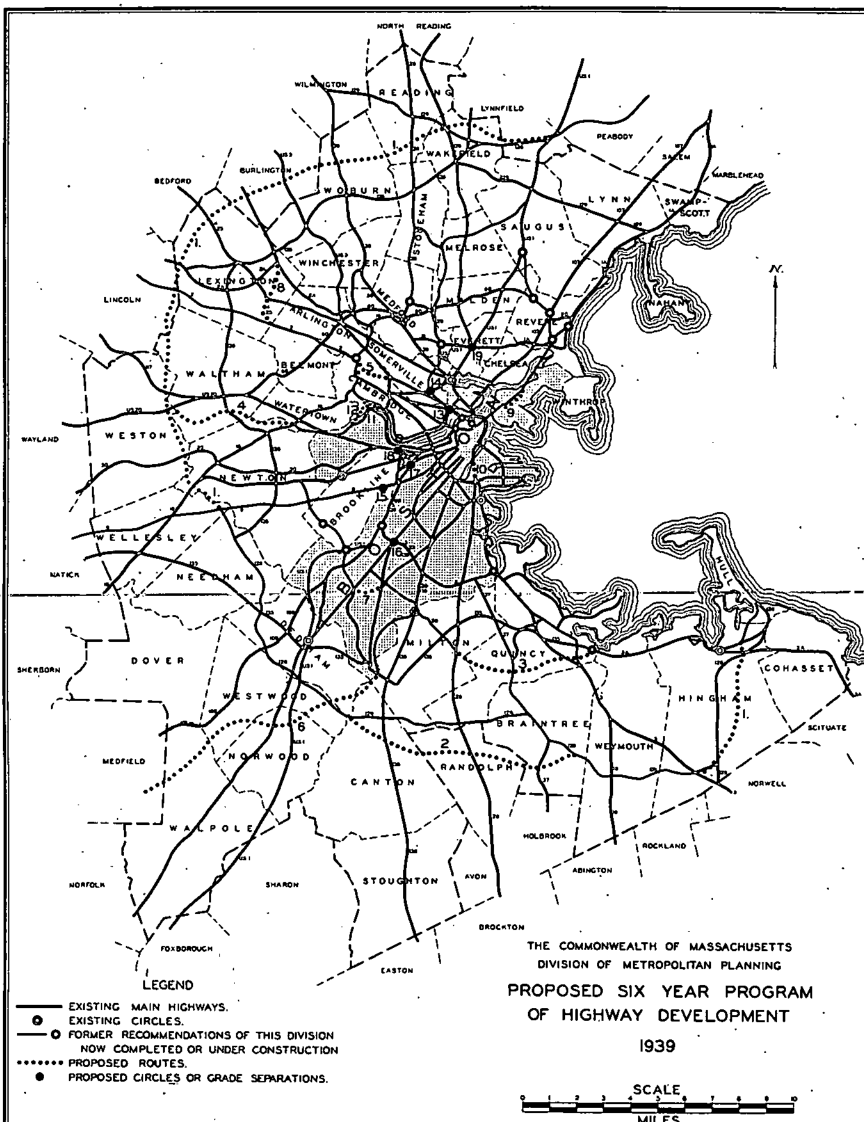
THE COMMONWEALTH OF MASSACHUSETTS
DIVISION OF METROPOLITAN PLANNING
PROPOSED SIX YEAR PROGRAM
OF HIGHWAY DEVELOPMENT
1939
LEGEND
EXISTING MAIN HIGHWAYS.
EXISTING CIRCLES.
FORMER RECOMMENDATIONS OF THIS DIVISION NOW COMPLETED OR UNDER CONSTRUCTION
PROPOSED ROUTES.
PROPOSED CIRCLES OR GRADE SEPARATIONS.
SCALE
MILES
NORTH READING
WILMINGTON
READING
LYNNFIELD
PEABODY
SALEM
MARBLEHEAD
BEDFORD
BURLINGTON
WOBURN
WAKEFIELD
STONEHAM
LYNN
SWAMPSCOTT
SAUGUS
MELROSE
WINCHESTER
LEXINGTON
LINCOLN
MEDFORD
MALDEN
REVERE
NAHANT
ARLINGTON
EVERETT
CHELSEA
BELMONT
SOMERVILLE
WALTHAM
CAMBRIDGE
WINTHROP
WATERTOWN
WAYLAND
WESTON
NEWTON
BROOKLINE
WELLESLEY
NATICK
NEEDHAM
HULL
DOVER
MILTON
QUINCY
COHASSET
SHERBORN
WESTWOOD
HINGHAM
BRAINTREE
SCITUATE
MEDFIELD
NORWOOD
WEYMOUTH
RANDOLPH
CANTON
NORWELL
WALPOLE
HOLBROOK
ROCKLAND
ABINGTON
NORFOLK
SHARON
STOUGHTON
AVON
BROCKTON
FOXBOROUGH
EASTON
N.

FIGURE 1

determined as including those cities and towns contained in, or touched by, a circle drawn with the State House as the centre and a radius of ten miles. This District was established in the horse and buggy era and that explains why it remains today a horse and buggy area.

Owing to the automobile and its speed of travel, the cities and towns of the Metropolitan District bear about the same relationship to each other as the wards of a city in the pre-automobile era.

Population and Automobile Registration

This District contains forty-three cities and towns and has a population of 2,021,670, according to the last State census of 1935. The population of the City of Boston, according to that same census, was 817,713, or 40% of the whole District. That leaves 1,204,000 or 60% as the total population of the other forty-two cities and towns.

In 1895, which was approximately the dawn of the automobile era (there were actually three hundred automobiles in the whole United States at that time) the population of Boston was just one-half of the Metropolitan District. Since that time, the population of the District has increased more rapidly than that of the City of Boston, and it is likely that by 1970, Boston's population will be only 30% of that of the whole District, instead of 40%, as at present, and 50%, as it was in 1895.

The following table gives an interesting picture of the varying rates of population increase in the Metropolitan District and its cities and towns during a period of 160 years:

	1776	1800	1895	1935	Ratio of increase
Boston*	6,025	32,000	508,756	817,713	135 times
Met. Dist.	34,000	65,000	1,030,000	2,021,670	60 "
Newton	1,625		27,590	66,144	40 "
Dover	450	511	668	1,305	3 "

The motor vehicle registration of Boston is 110,000, 10% of the total registration in the Commonwealth. The registration of the Metropolitan District is 440,000, or 40% of the State registration, which is approximately 1,100,000 vehicles. In other words, there are three times as many vehicles in the forty-two cities and towns

*Boston in 1776—Of course this figure is the population after the evacuation—the population and been greater than this before the Revolution.

around Boston as there are in the City of Boston alone. In the year 1927, there were 1,860,264 persons in the Metropolitan District with a motor vehicle registration of 329,183 and it was estimated at that time that the population of the District would reach 2,914,100 in 1965 and the motor vehicle registration in that year would be 690,700, or an increase of 56% in population but an increase of over 100% in registration. If the years prove these figures to be correct, the number of cars per 1,000 persons will have increased from 177 to 237 and there will be a car for approximately every four persons.

A town, a city or a whole district is the accumulation of what the people and government have done and sometimes of what the people have wanted, or been too ignorant to prevent. When it comes to roads and streets, we cannot blame them too much for certainly the old settlers knew no other kinds of roads and surely they could not have foreseen the automobile. However, it is now forty odd years since the automobile came into our lives and it has been obvious for many years that some attempt should be made to provide means for the safe and efficient travel of over a million vehicles on our streets and highways.

The Boston Park System dates back to 1875 although the first real parkway was not constructed until 1877.

The first Metropolitan Parkway was begun in 1895 and, shortly after, a real and continuous program of parkway construction was in operation until the present time when there are over 113 miles of parkway roads and over 12,700 acres of parks and reservations.

There was little real highway development in the District until after the twentieth century was reached, although there were a few remarkable boulevards constructed the latter part of the nineteenth century, before the automobile was considered as a possible factor in transportation.

Beacon Street extension in Boston and Brookline was authorized in 1887 and completed in 1888. It was built 160 feet wide.

Blue Hill Avenue in Boston, from Warren Street southerly to Mattapan, was built 120 feet wide and completed in 1894.

Commonwealth Avenue in Boston and Newton was completed in 1896, 200 feet to 160 feet wide in Boston and 120 feet wide in Newton.

Boylston Street through Newton from the Brookline line to the Wellesley line was completed in 1902 at a width of 90 feet. All of these highways or boulevards were double-barrelled with a centre reservation for street cars but they were looked upon by many people as a foolish waste of good land.

Studies have been made and many improvements have been carried out but the highway traffic has increased in recent years faster than increased highway facilities have been constructed.

The following list will give an idea of what has already been accomplished during the last fifteen years:

The Circumferential Route (Southern Half)
The New Providence Turnpike
The Southern Artery
The West Roxbury Parkway
The Brook Farm Parkway (Veterans of Foreign Wars Parkway)
American Legion Highway
Worcester Turnpike (so-called super-highway)
Charles River Basin Parkways
Alewife Brook Parkway
New Concord Highway (Route No. 2—gateway to the Mohawk Trail)
Lynn Fells Parkway
Northern Artery
Northern Outlet (McClelland Highway) to three main routes
East Boston or Sumner Tunnel
Northern Circumferential (portion of)
Widening and reconstruction of the Newburyport Turnpike
Traffic Circles—many of these in Boston and in the District
Overpasses and Underpasses—such as the intersections of:
  Memorial Drive and Massachusetts Avenue, Cambridge
  Commonwealth Avenue and Massachusetts Avenue, Boston
  Newburyport Turnpike
  Worcester Turnpike, etc.

The highway system of a metropolitan district should provide for the free and easy circulation of traffic over well-constructed radial and circumferential routes, but, in addition, the system should comprise trunklines, by-pass routes, old roads made better as to width, alignment and grades, and the planning of new routes ahead of the increasing growth of population and motor vehicle registration. There should also be a system of parkways for pleasure vehicles and recreational areas, and commercial routes for heavy trucking so that different types of vehicles travelling at different speeds may be segregated to the extent deemed necessary.

The Division of Metropolitan Planning has studied this subject and recommended a long term program of highway and parkway improvements to be carried out over a period of six years. The program includes a long list of projects which are indicated on Figure .
How soon this program may be carried out depends to a considerable extent on how soon highway funds will be used for highway purposes.

Conclusion

Planning is simply looking ahead, making certain that there will be a bridge to cross when it is needed. This is true in the cases of states and regions as well as in the affairs of individuals. To those who have hope and ambition, planning is as natural as breathing. Planning to save and planning for the future—these are the things we all must do as long as "Hope springs eternal in the human breast."

OF GENERAL INTEREST

THE JOHN R. FREEMAN LECTURES ON HYDRAULICS

The Boston Society of Civil Engineers is sponsoring a series of eighteen lectures on hydraulics to be given by Dr. Kenneth C. Reynolds, Associate Professor of Hydraulics in the Massachusetts Institute of Technology and by a limited number of other nationally known hydraulic engineers. This series of lectures is supported by the Society's John R. Freeman Fund.

John R. Freeman Fund:—This fund was established by the late John R. Freeman, noted civil engineer, hydraulic investigator and advocate of hydraulic research. Mr. Freeman was Past-President of the Boston Society of Civil Engineers and Honorary Member of that Society, as well as Past-President and Honorary Member of the American Society of Civil Engineers. His interest in research led him to establish a fund to be administered by the Boston Society of Civil Engineers, the income of which has the purpose of advancing the science of hydraulics, endowing scholarships for travel and study in foreign countries, and supporting publications in the field of hydraulics.

Dr. Reynolds, a former holder of the John R. Freeman Travelling Fellowship of the Boston Society of Civil Engineers, studied for two years in the hydraulic laboratories of Europe, and has been on the teaching staff at Massachusetts Institute of Technology for about eighteen years. For the last ten years he has been in charge of the River Hydraulic Laboratory of the Institute.

The lectures will deal with the theories and natural laws relating to flow of fluids, open channel problems, the hydraulic pump, propagation of waves in channels and use of river models.

The lectures are scheduled tentatively for Tuesdays, and Thursdays, from 5:15 P.M. to 6:45 P.M., commencing October 17, 1939, and continuing until December 19, 1939, inclusive (omitting November 30). The exact hour of the meetings will be determined at the time of the first meeting on October 17, 1939. The lectures will be given at 715 Tremont Temple, unless otherwise announced at the first meeting.

Attendance at the lectures is limited to members in good standing (Members or Junior Members), of the Boston Society of Civil Engineers.

GORDON M. FAIR, *President*, B.S.C.E.

CARL STEPHENS ELL ELECTED PRESIDENT OF NORTHEASTERN UNIVERSITY

The Board of Trustees of Northeastern University has accepted the resignation of Dr. Frank Palmer Speare, founder and president of Northeastern for the past forty-two years, and has elected as his successor Dr. Carl Stephens Ell, formerly vice president of the University and dean of the College of Engineering. Dr. Ell joined the staff of Northeastern in 1909 and since 1917 he has served as dean of the College of Engineering and director of the entire

Day Division program of the University. Under his direction the coöperative plan of instruction has been developed into one of the most useful educational technics in the field of higher education. He was instrumental also in forming the Northeastern University Section of the Boston Society of Civil Engineers.

Dr. Ell received an A.B. degree from DePauw University in 1909; an S.B. from Massachusetts Institute of Technology, in 1911; an M.S. from the same institution in 1912, and an Ed.M. from Harvard, in 1932. DePauw University honored him with the degree of Sc.D. in 1935.

He is a Fellow of the American Association for the Advancement of Science, a member of the American Society of Mechanical Engineers, Boston Society of Civil Engineers, American Society of Civil Engineers, Engineering Societies of New England, the Harvard Teachers' Association, the Massachusetts Schoolmasters' Club, the New England Association of Colleges and Secondary Schools, the Massachusetts Civic League, and the Boston Chamber of Commerce. He has long been active in the Society for the Promotion of Engineering Education and at the present time is chairman of its Committee on Instructional Methods.

Dr. Ell is vice president and trustee of the New England Deaconess Hospital, and a trustee of the Newtonville Methodist Church. He is also a member of Phi Delta Kappa, Delta Upsilon, and the University Club of Boston. He is permanent president of the New England DePauw Alumni Association.

Dr. Ell will take office next June when Dr. Speare will become president emeritus.

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETING

Boston Society of Civil Engineers

SEPTEMBER 27, 1939.—A regular meeting of the Boston Society of Civil Engineers was held this evening at the Engineers Club and was called to order by the President, Gordon M. Fair. One hundred eight members and guests were present; ninety-one persons attended the dinner preceding the meeting.

The President announced the deaths of the following members:

Guy C. Emerson, who had been a member since February 15, 1899, and who died July 17, 1939.

Ephraim Harrington, who had been a member since February 21, 1893, and who died July 20, 1939.

Thaddeus Merriman, who had been a member since May 17, 1939 and who died September 26, 1939.

Announcement was made of the election of the following members on September 27, 1939:

Grade of Member: Charles N. Bush, *Walter E. Butler.

The President called upon Past-President Karl R. Kennison to outline the plans for the John R. Freeman Lectures on Hydraulics, a series of eighteen lectures to begin October 17, 1939, to be given by Dr. Kenneth C. Reynolds, Associate Professor of Hydraulics at Massachusetts Institute of Technology, and other nationally known hydraulic engineers. This series is supported by the John R. Freeman Fund.

The President also announced the Student Night, which will be held on Friday, October 20, 1939, at Walker Memorial, M.I.T.

*Transfer from Grade of Junior.

The President then presented the speaker of the evening, Col. Lewis E. Moore, who gave a very interesting talk on "The Overpass at Cottage Farm Bridge." The talk was illustrated with lantern slides and motion pictures.

The meeting adjourned at 9.00 P. M.

EVERETT N. HUTCHINS, *Secretary.*

SANITARY SECTION

OCTOBER 4, 1939.—A regular meeting of the Sanitary Section was held this evening in the Society Rooms. Twenty-two members attended the supper at Patten's Restaurant prior to the meeting which was called to order by Chairman Ralph M. Soule at 7:30 P. M.

The matter of the Section's sponsoring a series of lectures on the design of sewage treatment and disposal works and on stream sanitation, which had been under discussion by the executive committee, was presented to the Section by Mr. Edwin B. Cobb of the committee who outlined the various subjects considered. After a brief discussion the sense of the meeting was obtained by a show of hands, the majority favoring such a series of lectures. No further action was taken, however.

The Chairman introduced the speaker of the evening, Mr. Donald F. Horton, Associate Civil Engineer, U. S. Engineer's Office, Boston, who read most interestingly a scholarly prepared paper on "Flood Control and Its Relation to Problems of Stream Pollution". Mr. Horton discussed the two general types of reservoirs being constructed by the Corps of Engineers of the U. S. Army. Of these two types the open sluiceway type of flood control reservoir is of but little value in improving the sanitary condition of a stream. The multiple purpose reservoir with controlled storage when operated to increase the dry weather flow of a polluted stream is, however, of considerable value by increasing the dilution with water from a generally much cleaner source.

After an interesting discussion by President Fair of the Boston Society of Civil Engineers, E. Sherman Chase, Edward Wright and R. S. Weston, the meeting gave Mr. Horton a rising vote of thanks and adjourned at 8:30 P. M.

Forty-six members were present.

GEORGE W. COFFIN, *Clerk.*

DESIGNERS' SECTION

OCTOBER 11, 1939.—The Designers' Section of the Boston Society of Civil Engineers held a regular meeting in the new building of Northeastern University on Wednesday, October 11, 1939.

The meeting was called to order at 7:00 P. M. by the Chairman, Professor J. D. Mitsch. The minutes of the previous meeting were read by the Clerk and were approved.

The Chairman then introduced Dr. Arthur R. Anderson, Research Associate at M.I.T., who spoke on the subject of "Design of welded bridges in Germany." Dr. Anderson described various research projects which have been carried out in Germany in connection with the strength of welded connections and illustrated several types of details used in Germany in welded construction. He then showed slides illustrating the use of welding in German bridges. Following the talk, members of the Society entered into a discussion of welding, and Dr. Anderson made some remarks concerning living conditions in Germany.

The meeting was adjourned at 8:15 P. M. after which many of those present inspected some of the laboratories of the new building.

Thirty-six members and guests were present.

JOHN B. WILBUR, *Clerk.*

APPLICATIONS FOR MEMBERSHIP

[October 20, 1939]

THE By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

For Admission

ROBERT W. ANDERSON, Boston, Mass. (b. Jan. 9, 1914, Pittsburgh, Pennsylvania). Graduated June 1937, from Brown University, with B.S. degree in Engineering, with the stress placed on the courses in Civil Engineering. While at Brown University served as Secretary and President of Brown University Chapter of American Society of Civil Engineers. After graduation was employed by Commonwealth of Mass., Metropolitan District Water Supply Commission as Junior Engineering Aid, and in such capacity acted as rodman, chainman, instrumentman, and notekeeper and was at times in charge of field party. In the same capacity, as Junior Engineering Aid, was employed in their office as computer and checker of the various construction work, and has worked with the flows and diversions of the Swift and Ware Rivers. In connection with this work received this year (1939) the grade of Senior Engineering Aid. At present Senior Engineering Aid, Commonwealth of Mass., Metropolitan District Water Supply Commission, Junior, American Society of Civil Engineers. Refers to *K. R. Kennison, L. M. Gentleman, S. M. Dore, G. W. Coffin, C. L. Coburn.*

GEORGE ANTHONY, Boston, Mass., (b. Greece, Sept. 17, 1912). Graduated from the English High School in Boston, Mass., in June 1930. Attended Northeastern University in 1930, graduating in June, 1935, with a B. S. degree in Civil Engineering. From June, 1935, to April, 1937, employed as instrument man on local control survey and triangulation in the State of Massachusetts by the Massachusetts Geodetic Survey in Boston, Mass. From April, 1937, to present, employed as hydraulic engineer on stream gaging by the U. S. Geological Survey in Boston, Mass. Refers to *C. O. Baird, Jr., A. H. Engborg, E. A. Gramstorff, H. B. Kinnison, A. E. Everett.*

MANUEL ALBERT BENSON, Brighton, Mass., (b. November 2, 1911, Boston, Mass.). Graduated in 1933 from Harvard Engineering School with a B.S. degree in Civil Engineering. Temporary employment with Truscon Steel Company, Boston, Mass., June and July, 1933. Temporary employment with Howard M. Turner, Boston, Mass., August and September, 1933. Engineer for City of Boston Assessing Dept., C.W.A. project, September, 1933 to August, 1934. With C. J. Maney Company, August, 1934 to January, 1938, estimator and engineer on construction. Appointed Junior Hydraulic Engineer (Civil Service), September, 1938 with U. S. Geological Survey, Boston, Mass., present occupation. Refers to *H. B. Kinnison, H. M. Turner, A. E. Haertlein, G. M. Fair.*

RUSSELL HAYWARD BROWN, West Roxbury, Mass., (b. October 7, 1916, Ashland, Mass.). Graduated from Massachusetts Institute of Technology June, 1938, with B.S. degree in Civil Engineering. Experience, June, 1938 to August, 1938, National Park Service, Salem, Mass. October, 1938, to June, 1939, U. S. Geological Survey, Boston, Mass., Junior Hydraulic Engineer. June, 1939, to September, 1939, Senior Engineering Aid, U. S. Geological Survey, Boston, Mass. September, 1939, to date, Junior Hydraulic Engineer. Refers to *J. B. Babcock, A. J. Bone, C. B. Breed, H. B. Kinnison, H. J. Shea.*

ALLEN J. BURDOIN, Natick, Mass., (b. May 23, 1906, Cleveland Ohio). Graduate of Harvard Engineering School, with degrees of S.B. in Civil Engineering, 1927, and S.M. in engineering (Sanitary), February, 1934. Experience, Junior Engineer, Sanitary Detailer, and Asst. Civil Engineer with the Sanitary District of Chicago, from July, 1927 to January, 1932, on sewer design, reports and sanitary studies (3 years) and operation of sewage treatment plants (1½ years). Assistant in Civil Engineering at the Harvard Engineering School, Sept., 1932 to June, 1933. Engineer with Howard M. Turner and Samuel Ellsworth, February, 1934 to October, 1934, and from April, 1935 to July, 1938. Duties consisted of design of sanitary and hydraulic engineering works, assistance in the preparation of reports. Engineer with Metcalf & Eddy, October, 1934 to April, 1935, and from July, 1938 to date, on design of sanitary engineering works, studies, and supervision of construction. Member of the New England Sewage Works Association, and Member of the New England Water Works Association. Refers to *E. S. Chase, S. M. Ellsworth, A. L. Shaw, P. W. Taylor, H. M. Turner.*

ISAAC CHASE, JR., Providence, R. I., (b. April 15, 1913, Portsmouth, Rhode Island). September, 1932 to June, 1936, Civil Engineering at Rhode Island State College. September, 1937 to August, 1939, selected subjects in Sanitation with the International Correspondence School. September, 1936 to June, 1937, employed by the U. S. Engineer Office, Flood Control Division, Providence, R. I., as an under-engineering aide keeping daily progress charts and tabulations of field progress on dike construction, core drilling and soil samples, and topographic surveys. November, 1937 to October, 1939, employed by the same office as assistant engineering aide at hydraulic computations, stream gauging (field measurements, computations, and rating curves), assembling rainfall data and drawing isolayetal maps. Also a few weeks doing pencil layouts for reënforcing steel and bar schedules and design of retaining walls for flood protection. At present, employed by the U. S. Engineer Office, Flood Control Division in the Hydraulics Sections (under John B. Drisko) as an assistant engineering aide at general hydraulic computations. Refers to *J. C. Dingwall, W. I. Kenerson.*

JOHN JAMES DEVINE, Boston, Mass., (b. September 5, 1902, Springfield, Mass.). Graduated from Rhode Island State College in 1927, with B.S. degree. Brown University 1933 to 1936, S.M. degree. 1927 to 1931, Plant Engineer, New York Telephone Company, Albany, N. Y. 1933 to 1936, Assistant in Engineering teaching, Rhode Island State College. At present instructor in Engineering at Northeastern University. Refers to *C. O. Baird, A. J. Bone, C. B. Breed, A. E. Everett, E. A. Gramstorff.*

KENNETH EFF, Providence, Rhode Island, (b. December 4, 1911, Hartford, Conn.). June, 1933 graduated from Rensselaer Polytechnic Institute, Troy, N. Y., with degree of Chemical Engineer. Took several civil engineering courses including structures, resistance of materials, mechanics, hydraulics, surveying and testing of materials. Dec., 1933 to May, 1934, chainman with U. S. Coast & Geodetic Survey, 2d order control survey of Connecticut triangulation, precise levelling, chaining. July, 1934 to December, 1934, inspector, ass't to supervisor. Watershed Pollution to Study of State of Connecticut, prepared final report under direction of Gen. S. H. Wadhams. December, 1934 to September, 1936, Senior Engineer, State Ground Water Survey, Hartford, Conn., assistant to project supervisor, observation well measurements, salinity studies of lower Connecticut River, flood studies, under direction of B. L. Bigwood, U .S. Geological Survey, Hartford, Conn. September, 1936 to June, 1937, Student Engineer, U. S. Engineer Office, Providence, R. I., in hydraulics section, flood control studies, unit hydrographs, model studies, power reports, flood histories. August, 1937 to November, 1937, hydraulic engineer, with J. G. White Engineering Corp., New York City; Flood control studies of T. V. A. dams, routing, economics, estimates. December, 1937 to present, Junior Civil Engineer (formerly Principal Engineering Aide), U. S. Engineer Office, Providence, R. I., in hydraulics and Report Section directed by G. T. McCarthy and later J. B. Drisko, in charge of Flood Mobilization plans for District, rainfall studies for Chief's Office and pollution studies. Refers to *J. C. Dingwall, W. I. Kenerson, H. B. Kinnison, A. J. Ober.*

CHARLES G. EDSON, Springfield, Mass. (b. December 12, 1916, West Springfield, Mass.). Graduated from Massachusetts State College, 1938, with B.S. degree, major; Mathematics and Civil Engineering. Experience, December, 1938, to present, Assistant Engineering Aide, U. S. Engineer Office, Providence, R. I.

FRANCIS JOSEPH FLYNN, Brookline, Mass. (b. December 10, 1913, Taunton, Mass.). Graduated from Northeastern University in 1936 with B.S. degree in Civil Engineering. From 1933 to 1936 co-operative work as transit man for R. Loring Hayward, Civil Engineer, Taunton, Mass.; 1935-1936 clerk, Northeastern University, Section BSCE,. May, 1936, to June, 1937, and from July, 1938, to September, 1938, with U. S. Engineer Office, Providence, R. I., as under and Junior Engineering Aide on Flood Control and River and Harbor projects. From June, 1937, to June, 1938, with U. S. Engineer Office, Memphis, Tenn., in drafting section on Hydrographic drafting work. September and October, 1938, with U. S. Bureau of Public Roads, Jackson, Miss., as assistant Engineer Aide on layout of drainage structures for the Natchez Trace Parkway. From October, 1938, to present, junior hydraulic engineer with Water Resources Branch of the U. S. Geological Survey. Refers to *H. B. Kinnison, C. O. Baird, C. S. Ell, J. L. Dallas.*

ROBERT J. GREER, Medford, Mass. (b August 14, 1913, East Boston, Mass.). Graduated from Massachusetts Institute of Technology with S.B. degree in Electrical Engineering in June, 1935. From June, 1935, to March, 1939, with U. S. Engineer Dept., Cape Cod Canal, as inspector of waterway construction and Civil Engineer Aide. From March, 1939, to date, U. S. Geological Survey, Boston, Mass., as Junior Hydraulic Engineer. Refers to *H. B. Kinnison, Frank E. Packard, Jr., A. N. Rae.*

JOHN WILLIAM GURRY, Boston, Mass. (b. Nov. 11, 1911, Schenectady, N. Y.). Graduated from Union College, June 11, 1934, with B.S. degree in Civil Engineering. Feb. 1929 to Sept. 1930, clerk in Engineering Dept., of General Electric Co., Schenectady, doing minor drafting. Feb. 1934 to Sept. 1934, survey at Union College Campus. June 1935 to August 1935, survey man for U. S. Coast Geodetic Survey, on first order level runs tying in previous networks in Pennsylvania. October 1935 to Feb. 1936, survey man for U. S. Army Engineering Corps in Flood Control Survey. April 1936 to August 1936, Architectural Draftsman for Eastman Kodak Co., on concrete beam design, structural and architectural drafting of plans for special construction of factory building. October 1936 to December 1936, Engineering Assistant, for N. Y. State Department of Public Works, Highway Division, drafting and form inspection for highway construction. Dec. 1936 to Jan. 1938, Reserve Aviation Cadet at U. S. Naval Air Station, Pensacola, undergoing ground school and flight training courses. May 1938 to July 1938, Assistant Hydraulic Engineer for N. Y. State Executive Department, Division of State Planning. July 11, 1938 to present, Junior Engineer at U. S. Geological Survey, Water Resources Branch, Boston District Office. Refers to *H. B. Kinnison.*

WILLIAM L. ISHERWOOD, JR., Stoneham, Mass. (b. January 29, 1914, New Bedford, Mass.). Graduated from University of New Hampshire with B.S. degree in Civil Engineering, in 1935. June 1935 to Nov. 1936, worked as surveyor and draftsman for City of Berlin, N. H. Nov. 1936 to Sept. 1939, employed as Junior Hydraulic Engineer by U. S. Geological Survey at Boston, Mass. At present employed as Junior Hydraulic Engineer by U. S. Geological Survey at Boston, Mass. Refers to *H. B. Kinnison, M. R. Stackpole, A. H. Engborg, J. H. White.*

KARL JETTER, Jamaica Plain, Mass., (b. June 27, 1897, Boston, Mass.). Graduated from Massachusetts Institute of Technology in 1921, with B.S. degree in Civil Engineering. Received Master of Science degree in Hydraulic Engineering at University of Iowa in 1931. Experience, 1921 to 1930, field and office experience with the U. S. Geological Survey, Water Resources Branch, in Hawaii, Virginia, W. Virginia, Washington, D. C., Maryland, North and South Carolina, and in charge of field work in Iowa. Duties consisted of, collection, analysis and preparation of stream flow data for reports, construction and operation of stream gauging stations. Also extensive observation of hydraulics of stream flow and of projects for utilization of water. 1924, July to November, in immediate charge of irrigation construction, concrete lined canal and appurtenant structures. Employed by Hawaiian Commercial and Sugar Company, Hawaii. 1931 to 1936, hydraulic studies and hydraulic model tests of navigation locks and dams made for the War Department, Engineer Office at Large, St. Paul District at the Iowa Institute of Hydraulic Research, Iowa City, Iowa. 1936 to 1939, hydraulic studies and design of flood control projects, for War Department, Engineer Office at Large, Boston District. Refers to *E. F. Childs, L. M. Hersum, D. F. Horton, H. B. Kinnison.*

JOSEPH M. KENNEDY, Providence, R. I., (b. May 25, 1914, New York City, N. Y.). Graduated from Manhattan College, New York City, 1935, with B.S. degree in Civil Engineering. Experience, September, 1935 to February, 1936, employed as Junior Draftsman in the Queens Topographic Bureau in New York City, engaged in office and field surveying work. March, 1936 to April, 1936, employed under the title of Junior Draftsman by the New York City Department of Water Supply, Gas & Electricity, engaged in running performance tests on water meters. May, 1936 to August, 1936, employed as piping and foundation layout draftsman in the Diesel engine department of the New York office of Fairbanks, Morse and Company. September and October, 1936, employed as electrical layout drafstman by Cleveland and Ryan, Inc., electrical contractors, New York City. November and December, 1936, employed as Topographical Draftsman by the U. S. Engineer Office in Hornell, New York. January, 1937 to present, employed as Junior Engineer in the U. S. Engineer Department, first in the Pittsburgh (Pa.) District Office and, since January, 1939, in the Providence District Office, engaged in hydraulic and hydrologic studies. Refers to *J. C. Dingwall, W. I. Kenerson.*

VICTOR H. KJELLMAN, Boston, Mass. (b. March 9, 1908, Brooklyn, New York). 1925-1928, Antioch College, Yellow Springs, Ohio; 1929-1932, Alabama Polytechnic Institute, Auburn, Alabama, receiving B.S. degree; 1934-1935, Pratt Institute (evenings), Brooklyn, New York; 1937-1939, Lowell Institute, Cambridge, Mass.; 1937-1938, Mass. Institute of Technology, Cambridge, Mass., summer school. Experience, 1925-1926, Frank H. Smith, Construction Company, Dayton, Ohio, laborer and later timekeeper. 1927-1928, McCain Realty Company, Dayton, Ohio, carpenter's helper, various capacities, also Big 4 R. R., Cleveland, Ohio, Construction camp, timekeeper. 1928-1929, Cleveland Excavating Company, Cleveland, Ohio, laborer and clerk. 1929, New York Edison Company, New York, brushman, conditioning equipment. 1933, Raymond Concrete Pile Company, Jones Beach, Long Island, New York, steel man. 1934, Arundel Corp., Jones Beach, Long Island, New York, steel man. 1935, Brooklyn Navy Yard, Brooklyn, New York, shipfitters' helper. 1935, U. S. Engineer Office, Eastport, Maine, student engineer, drafting. 1936, U. S. Engineer Office, Boston, Mass., flood control. 1938-1939, Junior Engineer and Assistant Engineer, layout work, dams and appurtenant structures. Detailing reinforcing and masonry. Power studies under supervision. Design of major concrete structures, stability studies. Refers to *E. F. Childs, D. F. Horton, A. N. Rae, H. I. Wyner.*

CHARLES E. KNOX, Melrose, Mass. (b. February 6, 1906, St. Paul, Minn.). Graduated with a B.C.E. degree from the University of Minnesota, in 1928. Employed by the Water Resources Branch of the U. S. Geological Survey. From June, 1928, to January, 1932, assigned to the Chattanooga District, building and maintaining gaging structures and making discharge measurements. From February, 1932, to May, 1932, assigned to the Washington Office, reviewing and assembling data for publication. From June, 1932, to May, 1936, assigned to the Chattanooga District, collecting and computing stream flow data, having charge of a sub-office in Johnson City, Tenn. From May, 1936, to date, assigned to the Boston District collecting and computing discharges for the March, 1936, and September, 1938, floods. Rated as Junior engineer from June, 1928, to June, 1930; Asst. engineer from June, 1930, to September, 1939; Associate engineer from September, 1939, to date. Refers to *H. B. Kinnison, M. R. Stackpole, T. H. Safford, J. H. White.*

JOHN PAUL LUBY, Dedham, Mass., (b. August 12, 1903, St. Paul Minnesota). From June, 1923, to Sept., 1924, employed by St. Paul Union Depot Company, as chainman, rodman, and instrumentman successively, on construction of large passenger terminal. From 1924 to 1928, a student at Massachusetts Institute of Technology, graduating in June, 1928, with B.S. degree in Civil Engineering. While at Massachusetts Institute of Technology, was a member of Honor Group in Civil Engineering, and member of Tau Beta Phi, and Chi Epsilon, honorary engineering Societies. Experience, 1925, timekeeper, C. M. St. P. & P. Railway, on construction of engine terminal. 1926, instrumentman on survey for hydro development near Ashland, Wisconsin, (L. E. Meyers Company, Chicago). 1927, Chief of party for C. B. Breed on survey of developments of summer resort at Lucerene, in Maine. Following graduation, engaged in a number of positions involving work varying greatly in character and geographical location, including power plant construction for L. E. Meyers Company, San Benito, Texas; hydraulic work with the Mississippi River Power Company, Keokuk, Iowa; railroad work with the Pennsylvania and Wabash Railroads in Ohio, Indiana, Illinois and Missouri, and construction work with the Diamond Alkali Company, Painesville, Ohio. In December, 1930, employed in U. S. Engineer Office, St. Paul, Minnesota, as surveyman. Work in Engineer department has been concerned with investigations, plans and reports on a great variety of navigation, power and flood control projects in St. Paul, Minnesota, Little Rock, Arkansas, and Denison, Texas. August, 1939, transferred from Little Rock, Arkansas, to the U. S. Engineer Office at Boston, employed as Associate

Engineer engaged in the preparation of reports on various river and harbor projects in the Boston District. Refers to *J. B. Babcock, H. K. Barrows, C. B. Breed, C. M. Spofford.*

JOHN B. MCALEER, Providence, R. I., (b. December 5, 1910, Chicago, Illinois). Graduated from Massachusetts Institute of Technology. Experience, employed by the Mass. Geodetic Survey in December, 1933, and continued until March, 1934, when employed on similar work with the U. S. Corps of Engineers, and a short period with the U. S. Coast Geodetic Survey at Boston, Mass. October, 1934, employed by Prof. R. W. Carlson of Massachusetts Institute of Technology making and calibrating strain gauges for testing concrete, and later assisted Prof. J. B. Wilbur in the design of a machine for solving simultaneous equations. The first six months of 1935, was a supervisor of E.R.A., design and construction in the town of Weymouth, Mass. From July, 1935, to August, 1936, was assistant project supervisor on Blackstone and Connecticut River Flood Control Projects under the Massachusetts State Planning Board. August, 1936 to present date, with U. S. Engineer Office at Providence, R. I., in the Hydraulics and Reports Section of the Flood Control Division. In the capacity of Assistant Engineer on work related to the economics of proposed flood protection at the present time. Refers to *J. B. Babcock, J. C. Dingwall, W. I. Kenerson, H. B. Kinnison, L. W. Ryder.*

ARTHUR F. MCVARISH, Somerville, Mass., (b. November 28, 1916, Somerville, Mass.). Graduated from Tufts College, June, 1938, with B.S. degree in Civil Engineering. Experience, worked two weeks as a draftsman for City Engineer, Somerville, Mass. July, and August, 1937, for B. Perini and Sons, contractors, as rodman and draftsman on the Newburyport Turnpike. October, 1938, began work for the water resources branch of the U. S. Geological Survey, in the Boston district. Work consisted of flood surveys, computations and at present the regular work which is done by the survey. Now employed by the Water Resources Branch of the U. S. Geological Survey, as a Junior Engineer. Refers to *H. P. Burden, C. H. Holmberg, H. B. Kinnison, F. N. Weaver.*

DONALD L. MILLIKEN, Boston, Mass., (b. March 30, 1917, Stratford, Conn.). Graduated from Worcester Polytechnic Institute, June, 1938, with B.S. degree. Experience, J. G. Roy and Sons Company, 1938. U. S. Geological Survey, December, 1938. At present, Junior Hydraulic Engineer, U. S. Geological Survey, Boston, Mass. Refers to *C. M. Allen, A. W. French, J. W. Howe, H. B. Kinnison.*

GEORGE H. MITTENDORF, Providence, Rhode Island (b. November 6, 1910, Ironton, Ohio). Received B.S. degree from Virginia Military Institute, 1932. M.S. degree from Ohio State University, 1933. Majored in Civil Engineering. Experience, hydraulic engineer employed by the corps of Engineers from 1934 to date. Work has consisted of flood control studies on the Muskingum River in Ohio for the Muskingum Conservancy District, 1934 to 1936; hydraulic studies on the Passamaquoddy Tidal Power Project at Eastport, Maine; flood control studies for the Providence District of the Corps of Engineers on the Connecticut, Blackstone, Thames, Pawtucket and Housatonic Rivers in New England, 1936 to 1939. At present, Associate Hydraulic Engineer, U. S. Engineer Office, Providence, R. I. Refers to *J. C. Dingwall, R. K. Hale, W. I. Kenerson, H. B. Kinnison.*

CLARENCE N. MORANG, Providence, R. I., (b. November 14, 1907, Melrose, Mass.). Graduated from Tufts College, 1929, with B.S. degree in Civil Engineering and received M.S. degree (hydraulics) Iowa State College, 1937. Junior member of American Society of Civil Engineers. Experience, June 1929, to December, 1929, Massachusetts Department of Public Works, Highway location studies and topographic drafting. January, 1930, to October, 1931, U. S. Engineer Office, Huntington, W. Virginia, hydraulic studies for canalization of Kanawha River, W. Va. Hydraulic studies on water resources surveys of Muskingum and Kanawha Rivers. October, 1931, to February, 1934, U. S. Engineer Office, St. Louis, Mo., hydraulic studies for canalization plans on upper Miss. River and tributaries. Design of locks. Study of floods in lower Miss. Valley. February, 1934, to November, 1936, U. S. Engineer Sub-Office, Iowa City, Iowa. Design, construction and operation of hydraulic models used in studying canalization problems on upper Miss. River. Extensive work on large scale (1/18) roller gate models. November, 1936, to present, U. S. Engineer Office, Providence, R. I. Flood control studies for Connecticut River and tributaries. Refers to *C. M. Allen, H. P. Burden, L. J. Hooper, H. B. Kinnison, F. N. Weaver.*

Clarence L. Muntz, Greenwood, Mass. (b. November 25, 1905, Salem, Ohio). Graduated from Rose Polytechnic Institute, June 1929. Started to work immediately for the water resources division, U. S. Geological Survey, surface water division. Has worked in the following district offices: Columbus, Ohio, June 1929 to March 1931, Urbana, Illinois, March 1931 to September 1934, Boston, Mass., September 1934 to date. Refers to *H. B. Kinnison, T. H. Safford, M. R. Stackpole, A. H. Engborg.*

William Chester Murray, Marblehead, Mass. (b. January 3, 1908, Salem, Mass.). Graduated in 1930 from Massachusetts Institute of Technology, with B.S. Degree. From 1930 to 1932, Atmospheric Nitrogen Corp., Hopewell, Virginia, Plant Engineering. From 1933 to 1934, Hygrade Sylvania Corp., Salem, Mass., Plant Engineering. 1935 to 1937, State Planning Projects, Boston, Mass., Sanitary engineering work in conjunction with the State Department of Public Health. 1938 to present, U. S. Geological Survey, Water Resource Branch, Boston, Mass., Hydraulic engineering, dealing in stream discharge determinations, including flood peaks. Refers to *H. B. Kinnison, J. H. Harding, A. H. Engborg, J. H. White.*

Ralph C. Palange, Providence, R. I., (b. July 16, 1911, Italy). Graduated from Tufts College, 1936, with B.S. degree in Civil Engineering, and received M.S. degree in Sanitary Engineering from Harvard University, 1938. Junior member of American Society of Civil Engineers. Experience, September, 1935, to June, 1936, Hydraulic Laboratory Assistant, Tufts College, acting as instructor, correcting reports and problems, testing apparatus. July, 1936 to September, 1937, Massachusetts Geodetic Survey, Boston, Mass. Triangulation and the adjustment of observations by the method of least squares. August, 1938, with S. M. Ellsworth, Boston, Mass., investigation at pipe line and standpipes with relation to flows, quantities, and costs. September, 1938, to November, 1938, with E. T. Killam, New York, N. Y., sewer design, cost estimates, rainfall studies, drafting. November, 1938, to June, 1939, U. E. Geological Survey, Boston, Mass., flood surveys, field surveys, computation of flood discharges. June, 1939, to date, hydraulics and reports section, U. S. Engineer Office, Providence, R. I., unit graph studies, flood control economic studies. Refers to *H. P. Burden, G. M. Fair, C. H. Holmberg, H. B. Kinnison, F. N. Weaver.*

Marshall Arthur Patch, Winchester, Mass. (b. Boston, Mass., May 19, 1913). Graduated from the University of Vermont in 1935, with B.S. Degree in Civil Engineering. From Sept. 5, 1935 to Jan. 18, 1936, worked as highway draftsman for the Vermont State Highway Department, computing line, grade, and estimate quantities for construction bids. March 29, 1936, to July 28, 1936, with Morton

C. Tuttle Co., of Boston, Mass., at Pasadena, Texas, who was constructing a pulp mill for the Champion Paper and Fibre Co., computed earthwork estimate quantities, set and maintained line and grade, inspected reinforcing steel and concrete in heavy industrial building foundations. Since July 29, 1936, with the U. S. Geological Survey as Junior Hydraulic Engineer. Began work in this capacity in the Tucson, Arizona, District office. Later in the same district was resident engineer at Camp Verde, Arizona, making discharge measurements and doing maintenance work. On April 28, 1938, returned to Boston and worked in the Boston District office on stream gaging, flood surveys, and gage house construction mostly in the field. Refers to *H. B. Kinnison, M. R. Stackpole, A. H. Engborg, T. H. Safford.*

RUSSELL SHEPARD PEASE, Providence, Rhode Island. (b. Sept. 19, 1916, Somerville, Mass.). Graduated from Tufts College in June 1938 with a degree of B.S. in Civil Engineering. The summer of 1937 did graduate work at Massachusetts Institute of Technology. October 1938 to June 1939, employed in District Engineers Office, Boston, Massachusetts. From June 1939 to present employed at the U. S. Engineering Department, at Providence, Rhode Island. Refers to *B. S. Brown, H. P. Burdon, H. B. Kinnison, C. R. Main, F. N. Weaver.*

CHESTER AUGUSTUS RICHARDSON, Stoneham, Mass. (b. October 17, 1877, Pelham, N. H.). Graduated from Pinkerton Academy, Derry, N. H., in class of 1896. Graduated in Course 1 (civil engineering) Class of 1900, Massachusetts Institute of Technology. Railroad survey (Grand Trunk Pacific), Jan. 1905 to Nov. 1907. Boston Elevated Ry. Co., August 1908, to October 1911, as designer on Cambridge Subway. October 1911 to Feb. 1917, Boston Transit Commission studies and design for subways. Feb. 1917 to August 1917, designer with Fay, Spofford & Thorndike. October 1917 to Jan. 1918, designer with Monks & Johnson, on Victory Plant at Squantum. Jan. 1918 to May 1919, designer with Fay, Spofford & Thorndike. May 1919 to August 1934, employed continuously and intermittently until Jan. 1933, as structural designer by Chas. T. Main, Inc., on design of wide variety of structures of reinforced concrete, structural steel, and timber in general for industrial plants. 1934 to 1938, twice employed as structural designer for Metcalf & Eddy, twice by Lever Bros. Co., in engineering dept., and once by Fay, Spofford & Thorndike. Jan. 1938 to October 1938, structural designer on power plants with Jackson & Moreland. October 1938 to Feb. 1939, structural design and estimates for town bridges in Berkshires damaged in 1938 flood, for Cleverdon, Varney & Pike. With same office as structural designer until July 1939. Assistant Civil Engineer with Metropolitan District Water Supply Commission, working on design or checking structural drawings for new aquaduct from Marlborough to Boston, from July, 1939 to date. Refers to *H. S. Cleverdon, C. L. Coburn, F. H. Fay, F. M. Gunby, C. R. Main, W. F. Pike.*

HAROLD A. SCOTT, Providence, R. I., (b. October 15, 1906, Yankton, South Dakota). Graduated from the University of South Dakota, June, 1931, with B.S. degree in Civil Engineering. Experience, June, 1931, to March, 1932, South Dakota State Highway Commission, inspector and instrument man in charge during contruction of concrete bridges. March, 1932, to April, 1934, Peerless Automatic Sprinkling Company, New York, N. Y., inspection, making layouts and installation of automatic sprinkling system. April, 1934, to June, 1935, Air-Way Electrical Appliance Company, New York, N. Y. Sales Supervisor, selling electrical equipment.

June, 1935, to November, 1935, U. S. Gypsum Company, New York, laboratory testing of plasters and plaster boards. November, 1935, to March, 1936, U. S. Engineer Office, Eastport, Maine. Studies on Hydraulic Equipment and Materials Corosion investigations. March, 1936, to August, 1936, U. S. Engineer Office, Eastport, Maine. Resident Engineer at Massachusetts Institute of Technology. Made special cavitation study and research on metals. August, 1936, to date, U. S. Engineer Office, Providence, R. I., hydraulic studies on flood control of the Connecticut River and tributaries. Power report on Flood Control Reservoirs. Made backwater, rainfall and frequency studies. Hydraulic design of diversion channel and appurtenant structures. Refers to *W. I. Kenerson, J. C. Dingwall, H. B. Kinnison, A. J. Ober.*

HERBERT B. SHUMWAY, Fall River, Mass. (b. August 10, 1897, Fall River, Mass.). Entered Civil Engineers' office (F. S. Borden, Fall River, Mass.) in summer of 1915. Pursued further studies by International Correspondence School course in engineering and night school sessions. Employed for F. S. Borden, Civil Engineer, for 20 years (1935). Supervisor of local engineering projects on W.P.A., at Fall River, Mass., 1935-1937. Experience, varied, consisting of building construction, electric transmission lines, underground conduits, sewer construction, wharves, bulk oil plants and tank farms, land surveys, and in one instance, all preliminary engineering work for large suspension bridge (borings, triangulation, tide and current observations, etc.) Mt. Hope Bridge over northern end of Narragansett Bay, Bristol, Rhode Island. 1937, worked for City Engineer of Fall River, as senior engineer on outside work and drawing Plymouth Avenue Bridge plans (concrete slab-skew bridge 2-32′ spans center pier). At present engaged with U. S. Engineer Department, Providence, Rhode Island (under civil service), with rating of Senior Draftsman (civil) but doing hydraulic studies for flood control on Connecticut River Basin. Refers to *W. E. Noble, A. J. Ober.*

HARRY M. SOLOMOS, Boston, Mass. (b. Sept. 8, 1913, Lynn, Mass.). Graduated from Tufts College, 1935, with B.S. degree in Civil Engineering, and Northeastern 1 year Law School in 1936. Experience, 1936 to 1937, with W.P.A. State Planning Board. 1937 to 1938, W.P.A. State Board of Health. 1938 to 1939, Hayden, Harding & Buchanan, Consulting Engineers, Boston, Mass. At present, U. S. Engineer Office, Providence, R. I., inspector of dredging (Hydraulic Section). Refers to *R. Abbott, H. P. Burden, C. Holmberg, F. N. Weaver.*

HAROLD ALLEN THOMAS, JR., Cambridge, Mass. (b. August 14, 1913, Terre Haute, Indiana). Graduated from Carnegie Institute of Technology, 1935, B.S. in Civil Engineering. Received M.S. in Sanitary Engineering from Harvard University in 1937. Received S.D. in engineering from Harvard University in 1938. Instructor of Sanitary Engineering, Harvard University, 1938-1939. Refers to *G. M. Fair, A. E. Haertlein, H. M. Turner, S. M. Ellsworth.*

MEDFORD THEODORE THOMSON, Melrose, Mass. (b. June 9, 1904, Buffalo, N. Y.). Graduated from Medina (N. Y.) High School in June, 1921, from Cornell University in June, 1925, with degree of Civil Engineer. Employed as Rodman by Pennsylvania Railroad on maintenance of way work from June, 1925, to May, 1926. Employed by Water Resources Branch of U. S. Geological Survey from June, 1926, to date, successively as Junior Engineer, Asst. Engineer and Associate Engineer and located successively in Chattanooga, Tenn., University, Va., So. Charleston, W. Va., Washington, D. C., on all phases of the surface water investigation work of the geological survey. Since July, 1938, in the Boston District of Geological Survey in the capacity of Principal Assistant to the District Engineer. Refers to *H. B. Kinnison, H. K. Barrows, H. M. Turner, M. R. Stackpole, T. H. Safford.*

WILLIAM R. WILLIAMS, Brookline, Mass., (b. April 1, 1912, Howe, Texas). Attended Texas Technological College during 1933 and 1934, California Institute of Technology, 1935 and 1936, Massachusetts Institute of Technology 1936 to 1938, receiving B.S. degree in Civil Engineering. Experience: worked as draftsman for one month during 1938, with D. A. Schulte, Inc., Boston, Mass., under supervision of M. Goldberg, district manager. The summer of 1938, employed three weeks by M. P. Scullin, American Oil Products Company, Somerville, Mass. September, 1938, temporarily appointed Junior hydraulic engineer, U. S. Geological Survey, Boston, Mass., October, 1938, permanently appointed. At present, Junior Hydraulic Engineer, U. S. Geological Survey, Boston, Mass. Refers to *J. B. Babcock, H. K. Barrows, C. B. Breed, H. B. Kinnison, K. C. Reynolds, C. M. Spofford.*

GARDNER K. WOOD, Brookline, Mass. (b. November 3, 1905, Palermo, N. Y.). Graduated with a C.E. degree from Syracuse University in June, 1928. Employed continuously by the Water Resources Branch of the U. S. Geological Survey. Junior engineer with this organization from June, 1928, to December, 1930, an assistant engineer from the latter date until present time. During this period assigned to the Boston Office of the Geological Survey except for the period November, 1928, to May, 1929, when attached to the Augusta, Maine, office. Refers to *H. B. Kinnison, M. R. Stackpole, T. H. Safford, J. H. White.*

ARTHUR J. YARDLEY, North Kingstown, Rhode Island (b. April 17, 1914, Warwick, Rhode Island). Graduated from Rhode Island State College, 1936, with B.S. degree in Civil Engineering. Junior member of the American Society of Civil Engineers. Experience, July, 1936 to December, 1938, worked for Taco Heaters Inc., Providence, R. I., Mechanical experience on construction of hot water heaters. December, 1938 to present, U. S. Army Engineers, Hydraulic Report Section, Providence, R. I., Unit Graph Studies and Flood Control Economic Studies. Refers to *J. C. Dingwall, W. I. Kenerson.*

CHARLES E. DOWNE, Providence, Rhode Island (b. July 3, 1912, White Plains, N. Y.). Graduated from Yale School of Engineering, 1934, with B.S. degree C. E., 1938, Department of Civil Engineering, Yale School of Engineering. Experience, Sept., 1934 to June 1935, Graduate Study. July, 1935 to November, 1938, U. S. Engineer Office, Nashville, Tenn. This experience, as topographic draftsman and junior engineer, started with general engineering, drafting and computing and progressed to the design and checking of the masonry and hydraulic features of the navigation locks on the Tennessee River. About a year was spent in hydraulic and engineering studies of dams and river flows, coupled with some report and specification writing. Nov., 1938 to date, U. S. Engineer Office, Providence, R. I. The majority of this work has been in the hydraulic design of spillway and outlet structures for flood control dams. Other work involved the study of river discharge data for flood flows. Refers to *J. C. Dingwall.*

DANIEL A. HOWE, Needham, Mass., (b. November 24, 1903, Worcester, Mass.). Graduated from Worcester Polytechnic in 1925. Mechanical Engineering. Five and one-half years Assistant Superintendent, Building Construction with H. Wales Lines Company of Meriden, Conn. Two and one-half years, Sales, Design and etc., Ornamental Ironwork. Two and one-half years Concrete Steel Company, Boston, Mass., reinforced concrete and details. Refers to *S. M. Dore, L. M. Gentleman, C. J. Ginder, K. R. Kennison, E. D. Morteson.*

RALPH F. REINHARDT, Providence, Rhode Island, (b. July 23, 1910, Aviston, Illinois). Graduated from Washington University, St. Louis, Missouri, June, 1932, with B.S. degree in Electrical Engineering. Experience, employed in six districts with U. S. Engineers as follows: St. Louis, Mo., November, 1932 to July, 1934, Zanesville, Ohio, July, 1934 to July, 1935, Eastport, Maine, July, 1935 to April, 1936, Boston, Mass., April, 1936 to Sept., 1937, Memphis, Tenn., Sept., 1937 to Nov., 1938, Providence, R. I., Nov., 1938 to date. Work at all the offices was in connection with hydraulics and hydrology, covering general river hydraulics at St. Louis and flood control hydraulics at all the rest, with the exception of Eastport, Maine, where the work was in connection with the Passamaquoddy Tidal Project. Present employment is with the Providence, R. I. U. S. Engineer Office. Work covers hydrological and hydraulic studies in connection with flood control. Refers to *E. F. Childs, J. C. Dingwall, D. F. Horton, H. B. Kinnison.*

Transfer from Grade of Junior

FREEMAN W. TOWERS, East Lynn, Mass., (b. June 12, 1908, Lynn, Mass.) Graduated from Lynn Classical High School, 1927, and from Northeastern University in 1931. Employed as Junior Engineer Aid, Massachusetts Department of Public Works, Division of Highways, 1931 to 1937 inclusive. 1938 to present, Senior Engineer Aid, Division of Waterways. Refers to *C. O. Baird, P. C. Danforth, R. K. Hale, H. D. Hurley.*

ADDITIONS

Members

CHARLES N. BUSH, 144 Marlboro Street, Boston, Mass.

WALTER E. BUTLER, 724½ W. Gandy Street, Denison, Texas.

Deaths

GUY C. EMERSON.......July 17, 1939
STEPHEN DEM. GAGE....Oct. 2, 1939
EPHRAIM HARRINGTON...July 20, 1939
THADDEUS MERRIMAN, Sept. 26, 1939

BOOK REVIEWS

The Poison Trail, 1939, by DR. WILLIAM F. BOOS. Hale, Cushman & Flint, Boston. 330 pages. Price $3.00.*

Poison! Poison! It's all around us —in our food, in the fields, in factories, and in our homes. Don't get scared; but read *The Poison Trail* by Dr. William F. Boos. Dr. Boos is a Bostonian with an international reputation as a toxicologist. His name is sufficient to guarantee authority behind this book. From boyhood a trail of poison stretched before him, ever widening until it encompassed him.

The Poison Trail is a peep into the life of a man who has spent his years with poisons of all kinds. In a candid, to the point style, Dr. Boos explains what poisons are, how they act, and describes the signs and symptoms of the victim. He tells about the work of a toxicologist—how he goes about his business of testing foods or other material for the presence of poison and how he determines what poison is present. Many case histories show the important part played by the toxicologist on the witness stand in court. In short, Dr. Boos does not leave the reader guessing.

Many generally accepted beliefs are exploded. Who hasn't had ptomaine poisoning? Well, Dr. Boos says you haven't, for in order to get "real ptomaine poisoning" you would have to eat food in such a state of decomposition that neither man or beast would

*By R. Newton Mayall, Landscape Architect and Engineer, 115 Newbury Street, Boston, Mass.

get near it, much less pass it by the nostrils into the mouth. "Even a starved alley cat wouldn't be interested."

How can you avoid the *trichinella spiralis* (the cause of the dread disease trichinosis) that is so prevalent in raw pork? This and many other common questions are answered.

Dr. Boos has expertly woven anecdotes, reminiscences, and case histories, to make wholesome and interesting reading in a subject usually only found in textbooks. He says of the cups that cheers—"Alcohol, caffein, nicotin—all are poisonous, but I am afraid that people will not pay much attention to me if I say 'Stop using them.' And I must confess that at this moment I am enjoying the aroma of a fine Habana cigar, that I had my demi-tasse at dinner, and that I would accept with pleasure the gift of a bottle of good golden sherry—one of the most delicious drinks I know."

No more fascinating story of man's struggle with his most insidious enemy—poison—has been written. It is as hard to stop reading *The Poison Trail* before the last page is turned as it is to leave a good detective thriller just as things are about to happen.

"Modern Sewage Disposal," 1938, edited by LANGDON PEARSE, published by the Federation of Sewage Works Associations, 371 pages. Price, $3.50.*

Modern Sewage Disposal was issued to commemorate the tenth anniversary of the formation of the Federation of Sewage Works Associations. This volume consists of a compilation of thirty-two papers contributed by well-known workers in the field of sewage treatment and disposal. It is of local interest to note that eleven of the authors are alumni of M.I.T.

The book is neither a textbook nor a handbook but a series of coordinated articles from which the reader can obtain a general review of the historical developments of sewage disposal practice and its present status. The several articles deal with the following topics: sedimentation, sludge digestion, trickling filters, activated sludge, chemical treatment, chlorination, mechanical equipment, utilization and disposal of sludge, laboratory control, plant operation, bacteriological, bio-chemical and limnological aspects, agricultural use of effluents, disposal of sewage in inland waterways and in the oceans, research, regional and national aspects and industrial wastes.

An adequate digest of the contents of the book is impossible within the limits of a short review. In the compilation and coordination of articles by a large number of authors with independent viewpoints and different methods of presentation of material, an editor is confronted with a difficult task and it is to Mr. Pearse's credit that he has succeeded remarkably well in producing an interesting and readable book. It is a volume well worth possessing by those interested in the problems of sewage treatment and disposal.

*Review by E. Sherman Chase, Metcalf & Eddy, Boston, Mass.