# HIGHWAYS WITH A NARROW MEDIAN - CONNECTICUT

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This paper, being one of several to be given on highways with a narrow median, is intended to present data that can be combined with that contained in other reports. For that reason, there will be no attempt made to elaborate by statistical method nor will conclusions be drawn.

The conditions set up in a proposal for a "Symposium on Highways With a Narrow Median" called for "A median 8 ft. or less in width, of raised curb, rounded or flush section". Elements to be included in the 8-ft. dimension have been defined as follows: The gutter pan is not considered as a part of the traffic lane when the pan is of contrasting color and texture and when used in conjunction with a barrier curb; in which case, the curb and gutter sections are part of the median and its width is measured between the outer edges of gutter pans. If the gutter pan is of the same surface color and texture as the traffic lane, and is not much steeper in cross slope than the adjoining pavement, it is considered as an element separate from the median when the curb is mountable.

Six narrow median conditions were contained in the proposal. The following four are dealt with in this paper: Major street through residential or suburban area, Major street with ribbon commercial development; Long structure; Expressway.

The remaining two conditions, rural divided highway, without control of access and major street through central business or industrial area, are not included in our highway system. From the beginning of our divided highway construction, we have been successful in keeping the median widths to a minimum of 20 ft. in rural areas where access is not controlled. As Connecticut was one of the early areas to be developed in this country, the city streets were generally not established to sufficient widths to permit construction of medians. Then, too, our State laws are such that the State is responsible for but a relatively small mileage of city streets. As late as 1937, the following law was enacted: "Sec. 2240. *Through routes in cities and towns.* One through route extending approximately north and south through each city and town and one through route extending approximately east and west through each city and town shall be included in the Trunk Line System of highways, provided the highway commissioner shall have authority to make agreements with such cities relative to the removal of snow."

The "Proposal" called for the selection of a narrow median section in use that is considered to be good design. Narrow medians, that have been constructed in Connecticut, have been in locations where a down-

ward grading of desirable standards was made necessary because of high property damage that would result, otherwise. Because of the limited number of highways with a narrow median from which to select, the ones treated in this paper are about the only ones in Connecticut that fit into the six suggested groupings.

At the present time, there are 2,948 mi. of State-maintained highways and 11,573 mi. of local roads and streets in Connecticut, making a combined total of 14,521 mi. Of the 11,573 mi. of local roads and streets, 194 mi. are on state-marked routes and, after reconstruction, will become a part of the State highway system.

The speed data, included in this report, were obtained by use of radar equipment. Placement studies were made by setting off lines, from the median curb outward, at one-foot intervals, and vehicular performance was recorded by an observer stationed at the site. Speeds were recorded for those vehicles that were included in the placement observations. Vehicles included in the sample were those which were traveling freely and were not influenced by the actions of other drivers.

*Major Street Through Residential or Suburban Area* - A section of Route US 5A in the Town of Windsor, and the Saltonstall Parkway, Route US 1 in the Towns of New Haven and East Haven, have been selected for major streets through residential or suburban areas. The Town of Windsor is devoted principally to residential and agricultural use. Industry is beginning to locate along the main line railroad that runs between Springfield, Massachusetts, and Hartford, Connecticut, but there has not been a sufficient movement up to this time to alter the residential and agricultural nature of the Town. The Saltonstall Parkway in New Haven and East Haven was constructed with a narrow median beginning at Townsend Avenue and extending some distance to the east. A narrow median was used because of the closely built-up nature of the area at the beginning of the project, because of the deep swamp that existed beyond the built-up section and because of the Shore Line tracks of The New York, New Haven and Hartford Railroad Company and an adjacent residential area.

Table 1 shows traffic data for all projects. It will be noted that Route US 5A in Windsor carries 11,000 vehicles per day, of which 15 percent is classed commercial. Route US 1 in New Haven and East Haven, has an indicated average daily traffic of 15,500 of which 16 percent is classed as commercial vehicles.

Figure 1 is a view in the Village of Wilson. On the right (east) side of the street there is a group of neighborhood stores and on the left (west) side, in the center of the figure, the local school may be seen. Each roadway is 25 ft. curb to curb. Roadways are separated by a median strip 6 ft. 2-in. wide between curb faces. Figure 2 shows the typical cross section of the roadway. Due to parking that occurs in front of business establishments, there is but one lane available for use by through traffic, and traffic in that lane is hindered by vehicles maneuvering to park.

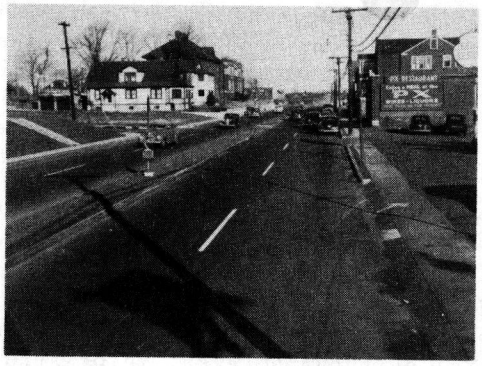
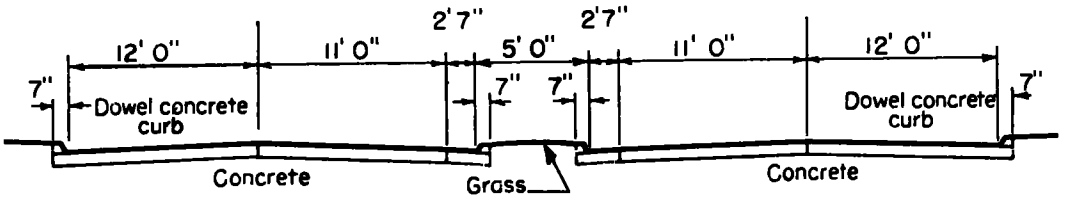
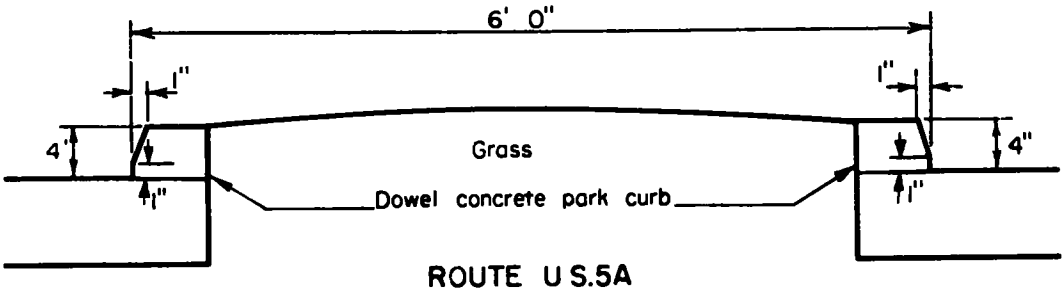


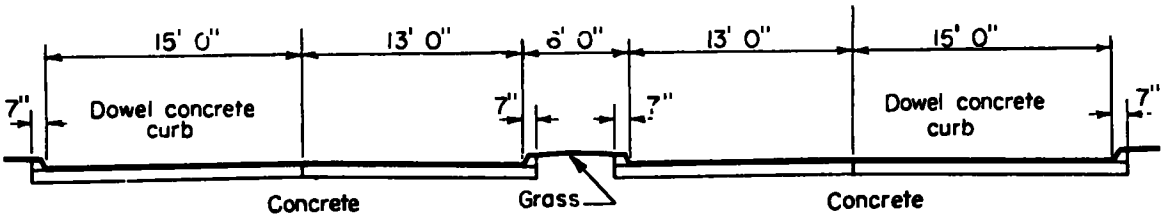
Figure 1. Town of Windsor - Route US 5A

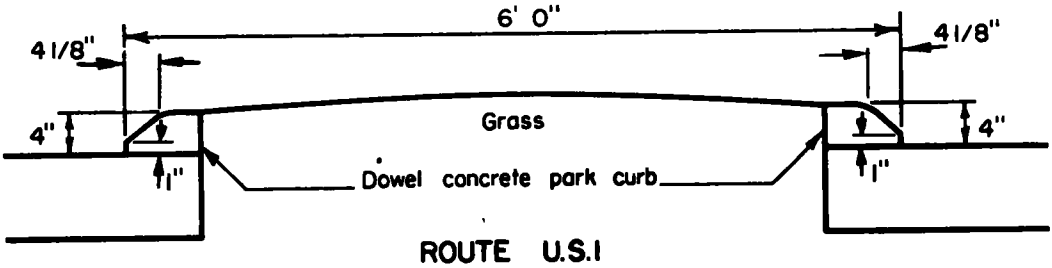
# TYPICAL SECTION




ROUTE U S.5A
HARTFORD—WINDSOR ROAD
TOWN OF WINDSOR




ROUTE U.S.I
NEW HAVEN — SAYBROOK ROAD
TOWNS OF NEW HAVEN & EAST HAVEN

Figure 2.

TABLE 1

TRAFFIC DATA

| LOCATION | 1950 | | | | | | |
|---|---|---|---|---|---|---|---|
| | LENGTH (MILES) | AVERAGE DAILY TRAFFIC | 30TH HIGHEST HOUR AS % OF A.D.T. | 30TH HIGHEST HOUR IN MAJOR DIRECTION AS % OF A.D.T. | VEHICLE MILES 100 MILLION 1946-49 | COMPOSITION | |
| | | | | | | % PASSENGER | % COMMERCIAL |
| WINDSOR ROUTE U.S 5A | 3.77 | 11,000 | 13 | 8 | .482 | 85 | 15 |
| NEW HAVEN-EAST HAVEN ROUTE U.S. I | 1.85 | 15,500 | 14 | 8 | .377 | 84 | 16 |
| BRIDGEPORT ROUTE U.S. I FAIRFIELD AVENUE | 1.50 | 21,000 | 12 | 6 | .418 | 74 | 26 |
| FAIRFIELD ROUTE U.S. IA KINGS HIGHWAY | 1.85 | 15,000 | 12 | 6 | .366 | 81 | 19 |
| HARTFORD RIVER FRONT BOULEVARD | 1.01 | 27,000 | 15 | 12 | .282 | 87 | 13 |
| NEW LONDON-GROTON THAMES RIVER BRIDGE ROUTE U.S. I | 1.12 | 16,000 | 12 | 7 | .292 | 92 | 8 |
| HARTFORD-EAST HARTFORD CHARTER OAK BRIDGE OVER CONNECTICUT RIVER ROUTE 15 | 0.61 | 33,000 | 12 | 7 | .184 | 91 | 9 |
| MILFORD-STRATFORD MERRITT PARKWAY OVER HOUSATONIC RIVER ROUTE 15 | 0.34 | 18,000 | 17 | 10 | .061 | 100 | 0 |

Figure 3 shows a view just beyond the built-up section shown in Figure 1. This section was built as a relocation and has remained rural in character until this year. A housing development is under construction to the left and just out of the view shown. It is expected that this area will build up rapidly now that the first development is under way. Openings were left in the median strip to accommodate future streets.

Figure 4 is a view across the deep swamp in New Haven and East Haven. The better ground to the east is being filled in and a Drive-In Theatre has been constructed within the last two years. We are working on plans, at the present time, that will convert this section of full access highway to a non-access highway. Service roads are planned to provide access to abutting properties.

Figure 2 shows the typical cross section for Route US 1 in New Haven and East Haven. Each roadway is 28 ft. wide between curbs, and the median strip is 6 ft. between curbs.

Figure 3. Town of Windsor - Route US 5A

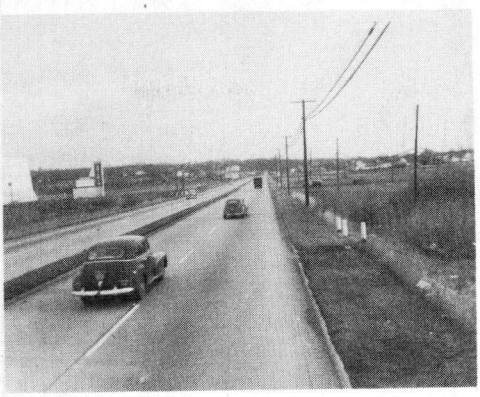


Figure 4. Towns of New Haven and East Haven, Route US 1, (Saltonstall Parkway)

Figure 5 shows a plan and profile for Windsor, Route US 5A. It will be noted that residences, businesses, churches and a school are located within the half-mile section shown. Openings have been provided in the median strip to accommodate side streets and the opening at Station 36 is for the convenience of abutting properties. The minimum length of opening within the area included on the figure, is 69.0 ft. opposite Allen Street and the greatest opening of 164.9 ft. is located at Station 45 to accommodate an offset intersection. Grades for most of the 3.77 mi. of this road are of the order shown on the profile. There is one grade of about 7 percent for a length of possibly 1,000 ft. as the road approaches the Village of Windsor.

Figure 6 is a plan and profile for the New Haven-East Haven highway. Median openings are well spread due to spacing of the established streets and also because no openings were provided through the swamp area east of Peat Meadow Road. Grades through the remainder of the sections under study are no greater than those shown on the Figure.

Figure 7 shows the speed curves for both Route US 5A in Windsor and Routes US 1 in New Haven and East Haven. The 85 percentile speed for for former is 31.5 M.P.H. whereas the latter has an 85 percentile value of 45.8 M.P.H. The speed differential is due, in part, to the more local nature of traffic on the Windsor section and also because of the frequency of marginal parking which results in one-lane operation with resultant congestion during periods of heavy traffic flow.

Figure 8 shows placement of left wheels in relation to the median curb for the Windsor Section. For the three speed groupings shown, the greatest number of vehicles travel with the left wheel between 6 and 8 ft. from the curb. The majority of drivers seem to stay about 7 or 8 ft. from the curb and there does not appear to be any great difference in the placement between the speed groupings shown.

Figure 9 shows the placement of vehicles on the New Haven-East Haven section. Because of the greater speed range, five groupings are shown. The greatest number of vehicles was observed at an offset of from 4 to 6 ft. from the median. The highest speed groups were about evenly distributed between the 3 and 7 ft. offset with the greatest percent being observed at 6 ft.

Accident data included on Table 2 show a greater accident frequency for Route US 5A in Windsor than for Route US 1 in New Haven and East Haven. It should be noted in Table 1 that the former is 3.77 mi. in length while the latter is 1.85 mi. in length. Accidents per hundred million vehicle miles are 690 for the Windsor section and 250 for the New Haven-East Haven section. Injuries for Windsor are indicated at the rate of 420 per hundred million vehicle miles and 160 for New Haven-East Haven. Property damage is at the rate of $160,000 per hundred million vehicle miles for Windsor, and $65,000 for New Haven-East Haven. The fatality rate is more severe in

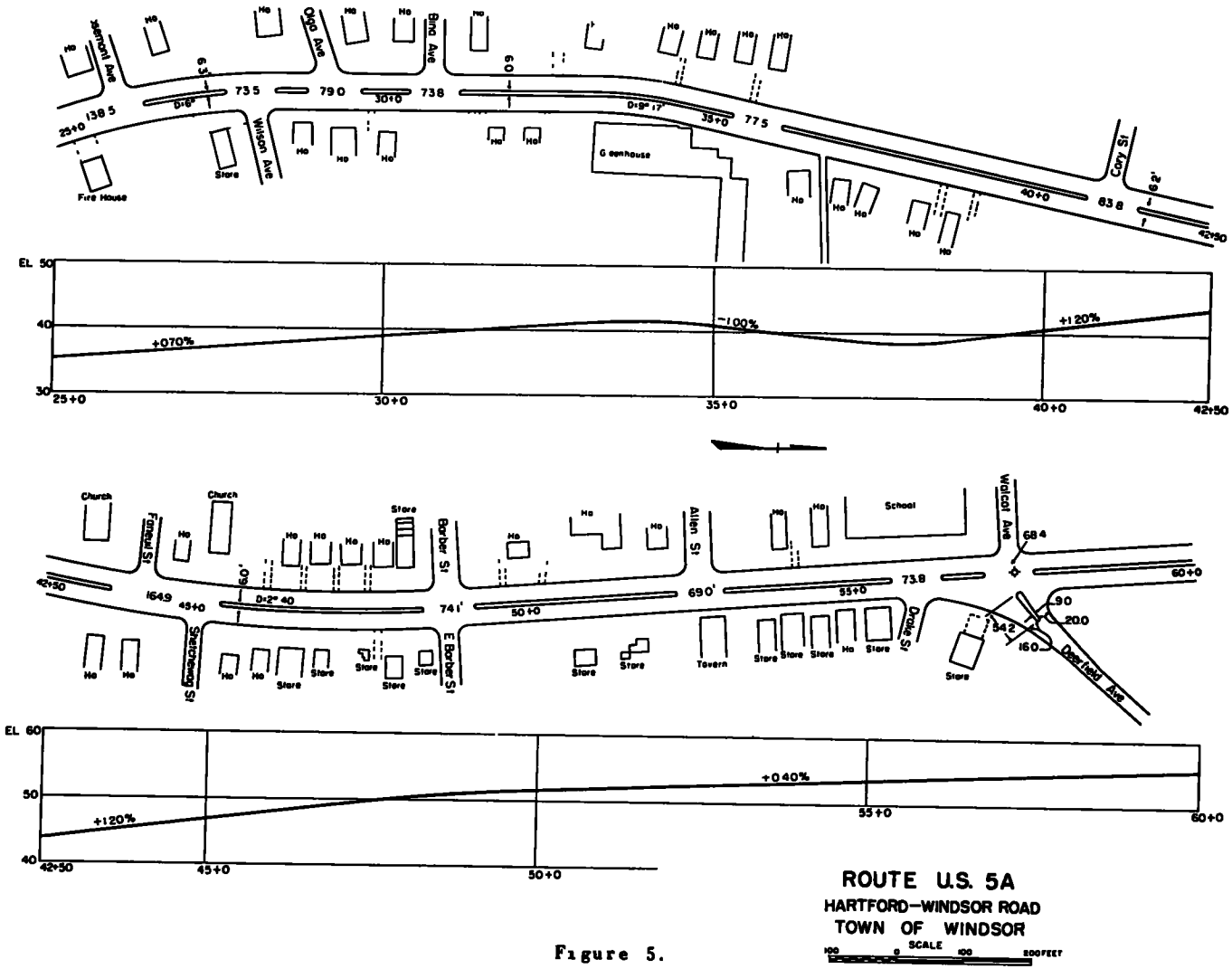

Ogo Ave
Bing Ave
Wilson Ave
Fire House
Store
Greenhouse
Cory St
Church
Fuller St
Sheldon St
Barber St
E Barber St
Allen St
School
Wolcot Ave
Tavern
Deane St
Deerfield Ave
EL 50
40
30
+070%
-100%
+120%
25+0
30+0
35+0
40+0
42+50
EL 60
50
40
+120%
+040%
45+0
50+0
55+0
60+0
ROUTE U.S. 5A
HARTFORD-WINDSOR ROAD
TOWN OF WINDSOR
SCALE
100 0 100 200 FEET

Figure 5.

New Haven-East Haven than in Windsor, the comparison being 6.2 per hundred million vehicle miles for the latter and 8.0 for the former.

Table 3 is a summary of State-wide accident experience for the various classes of highways found in Connecticut. The Windsor road is well above the State average for accidents for divided highways at grade, while the New Haven-East Haven road is below average. Windsor is at about the State average for fatalities while the New Haven-East Haven road is above average. Both injuries and property damage are above average in Windsor and below average in New Haven-East Haven.

Turning movements have not been included as part of the traffic data. There is a considerable difference in use of side streets between the two sections of highway. Streets that intersect Route US 5A in Windsor

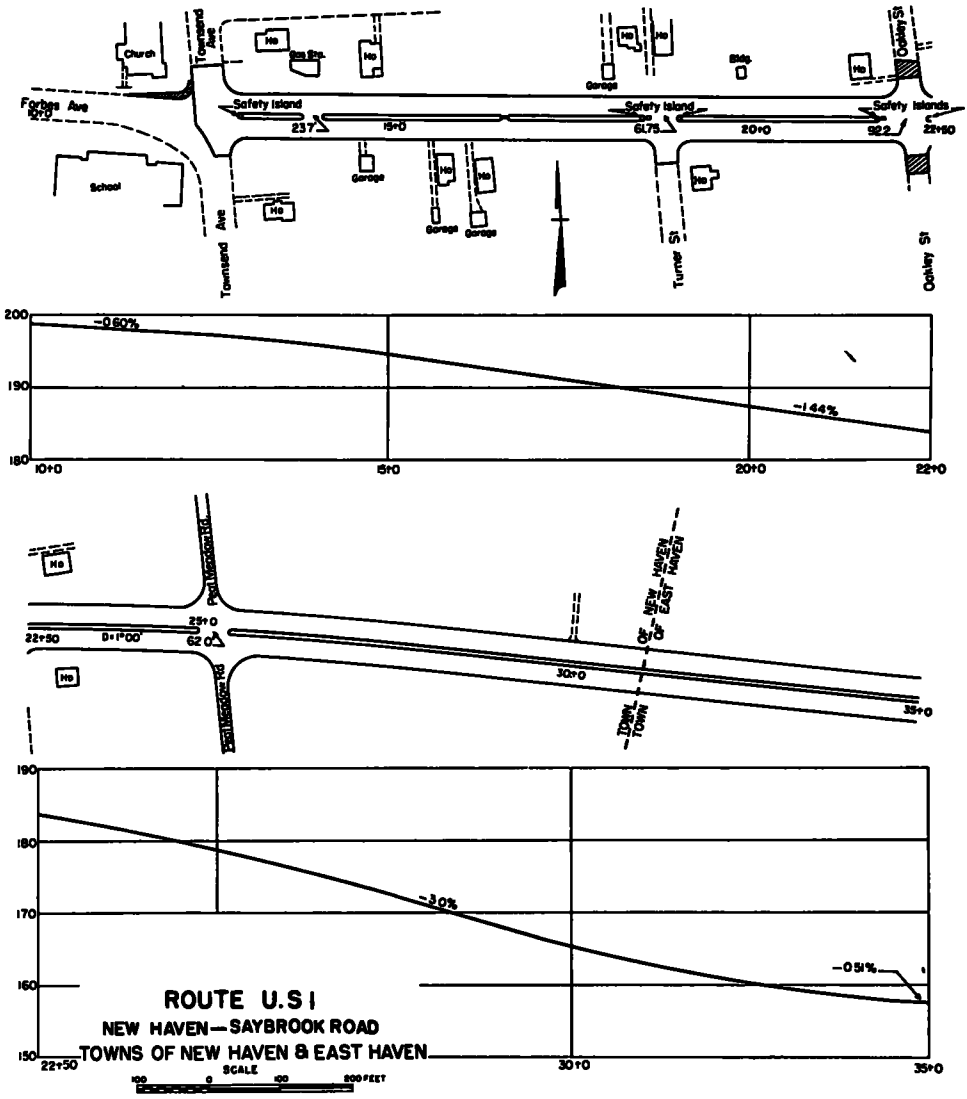



Figure 6.

serve residential areas for a considerable distance on each side with few streets paralleling the main highway. Streets that intersect the New Haven-East Haven highway serve only shallow streets that, in turn, intersect with streets parallel to, and not far from, the main highway. Turning movements along the Windsor road are, therefore, much greater than along the New Haven-East Haven road.

Although traffic volumes on Route US 1 in New Haven-East Haven are 40 percent greater than on Route US 5A in Windsor, there is a much greater freedom of movement on the former. The relative speeds, previously mentioned, also bear out this point.

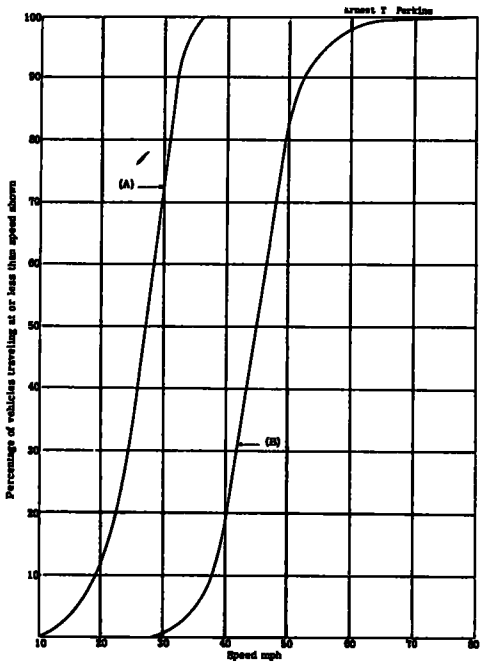



Figure 7. HIGHWAYS
(A) Windsor - Route US 5A Nov. 27, 1950 1.05-1 40 PM 100 OBS S-N AV. SP. 27.3 MPH 85 Percent SP. 31.5 MPH

(B) New Haven and East Haven Route US 1 Nov. 30, 1950 1:20-2 50 PM Dec. 1, 1950 12.05-2:40 PM 100 OBS W-E AV. SP. 45.8 MPH 85 Percent SP. 50.4 MPH

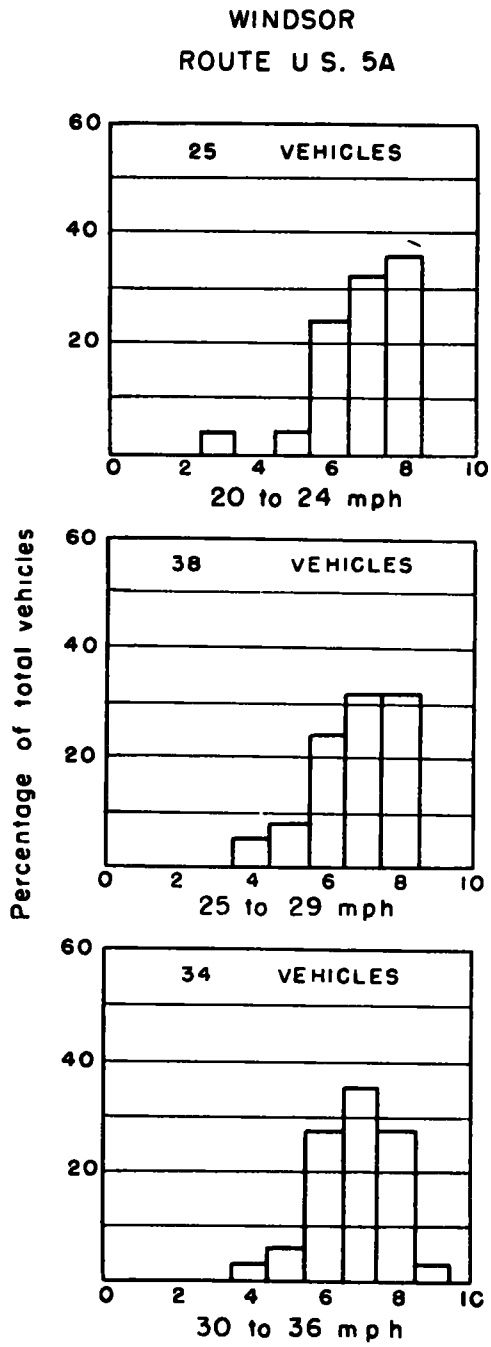



Figure 8. HIGHWAYS - Distance in feet that left wheels were to right of curb

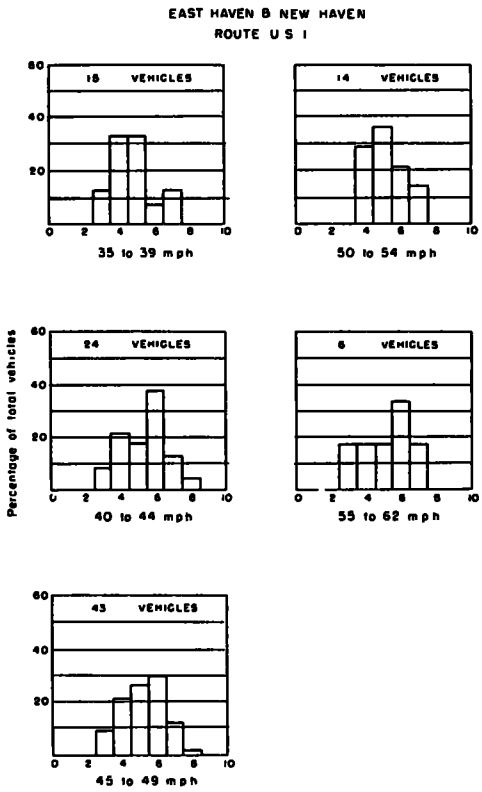



Figure 9. HIGHWAYS - Distance in feet that left wheels were to right of curb

Aside from the frequency of side streets on Route US 5A, there are also drives at closely spaced intervals. The greater turning frequency and marginal parking along Route US 5A, reduces the effective travelway to little more than one lane in each direction. This results in more congestion with the attendant higher accident frequency.

An examination of accident data for Route US 5A in Windsor and that shown in Table 3 for Multiple Lane Undivided Highways at Grade, reveals that the rate for Windsor is higher than the State-wide average for the lower class of highway. It was previously noted that the rate for Windsor was substantially higher than the State-wide average for Divided Highways at Grade. It must be concluded, therefore, that the median strip is more effective on Route US 1 in New Haven-East Haven where two-lane operation is possible and parking and turning movements are light.

The department is developing plans for a non-access expressway that will be located a short distance to the west of Route US 5A between Hartford and Windsor. Property damage would be prohibitive, if alteration of the present highway to higher standards were undertaken. The expressway should divert a sufficiently large volume of traffic that congestion along the present road would be greatly relieved.

Route US 5A in Windsor was constructed in 1942 at a cost of about $467,000 or about $131,000 per mile. Our cost index used 1939 prices as a base of 100. The present index is about 184.15 which means that it would cost about $226,000 per mile to carry out the same construction at the present time. The cost of constructing the median section is estimated at about $2.40 per foot.

Route US 1 in New Haven-East Haven was constructed in 1941 at a cost of about $160,000 per mile. This highway was largely a relocation while the Windsor project was principally along old Route US 5A with only one major cutoff about one-half mile in length. The cost of constructing the median in New Haven-East Haven was about $2.00 per foot.

*Major Street With Ribbon Commercial Development* - The two streets selected for this grouping are Route 1 (Fairfield Avenue) in the Town of Bridgeport, and Route US 1A (Kings Highway) in the Town of Fairfield. Route US 1 runs directly through the City of Bridgeport while Route US 1A follows a looping, northerly route through outlying residential and neighborhood shopping areas of Bridgeport.

TABLE 2

ACCIDENT DATA

| LOCATION | 4 YEARS (1946-1949) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | VEHICLE MILES 100 MILLION | TOTALS | | | | RATES PER 100 MILLION VEHICLE MILES | | | |
| | | ACCIDENTS | FATALITIES | INJURIES | PROPERTY DAMAGE | ACCIDENTS | FATALITIES | INJURIES | PROPERTY DAMAGE |
| WINDSOR ROUTE-U S 5A | 482 | 334 | 3 | 204 | 81,530 | 690 | 6 2 | 420 | 169,000 |
| NEW HAVEN-EAST HAVEN ROUTE U S. 1 | 377 | 94 | 3 | 62 | 24,460 | 250 | 8 0 | 160 | 65,000 |
| BRIDGEPORT ROUTE U S 1 FAIRFIELD AVENUE | 418 | 226 | 1 | 102 | 35,490 | 540 | 2 4 | 240 | 85,000 |
| FAIRFIELD ROUTE U S 1A KINGS HIGHWAY | 366 | 152 | 1 | 63 | 38,725 | 420 | 2 7 | 170 | 106,000 |
| HARTFORD RIVER FRONT BOULEVARD | 282 | 60 | 2 | 32 | 19,530 | 210 | 7 2 | 110 | 69,000 |
| NEW LONDON-GROTON THAMES RIVER BRIDGE ROUTE U S 1 | 292 | 52 | 0 | 86 | 11,120 | 180 | 0 | 300 | 38,000 |
| HARTFORD-EAST HARTFORD CHARTER OAK BRIDGE OVER CONNECTICUT RIVER ROUTE 15 | 184 | 39 | 0 | 20 | 5,625 | 210 | 0 | 110 | 31,000 |
| MILFORD-STRATFORD MERRITT PARKWAY OVER HOUSATONIC RIVER ROUTE 15 | 061 | 58 | 0 | 30 | 16,595 | 970 | 0 | 510 | 272,000 |

*Town of Bridgeport - Route US 1 - (Fairfield Avenue)* - Figure 10 shows the plan view and profile for a 3000-ft. length of the street. It can be seen that the street is largely commercial in character. This general pattern is followed throughout the 1.5 mi. involved. The block lengths are short with many of the opposite streets being offset one to another. This has resulted in long openings in the median strip and, in some instances, a short length of median strip was used in order to avoid an excessively long opening in the median strip.

The typical cross section for this street is shown in Figure 11. Roadways were constructed 31 ft. wide each side of a 5-ft. raised median. Barrier curbs were constructed as an aid to pedestrian safety and to channelize, more positively, traffic along this heavily traveled city street. Roadways are sloped each way from the median strip so as to require drainage only along the outside curbs.

Figure 12 is a view of the street. With a constant use of curb space for parking, the 31-ft. width of each roadway provides little more than one lane for through traffic on the lane adjacent to the median. The outside lane is devoted to parking and the frequency of vehicles entering and leaving the curb parking space just about eliminates the middle of the roadway as an additional through lane. It will be noted that a grass plot has been developed in the median area.

This street was reconstructed in 1940 at an average cost of $129,000 per mile. Using the 1950 index, the cost per mile would now be about

$238,000 per mile. The cost of constructing the median strip was about $3.40 per foot.

Data included in Table 1 show average daily traffic on this street to be 21,000 with 26 percent of the total vehicles being of the commercial class. The percent of commercial vehicles appears large because of the Merritt Parkway which runs to the north of, and parallel to, Route US 1 and which allows only passenger vehicles. The Merritt Parkway carries approximately 20,000 vehicles per day as it passes to the north of Bridgeport. Traffic volume for the 30th highest hour is shown as 12 percent of average daily traffic while the 30th highest hour in the major direction is 6 percent of average daily traffic.

Figure 12 is a photo of a section of the street. It will be noticed that curb parking is common and that the remaining apparent width is that of a wide single lane. A good turf has been developed in the median area and an occasional shrub has been planted.

Figure 13 shows the speed graph for the two streets included in this grouping. The 85 percentile speed is 32.5 mi. per hour.

Figure 14 shows the results of the placement study. The greater percentage of vehicles, in the four speed groupings shown, travel with the left wheel four feet from the

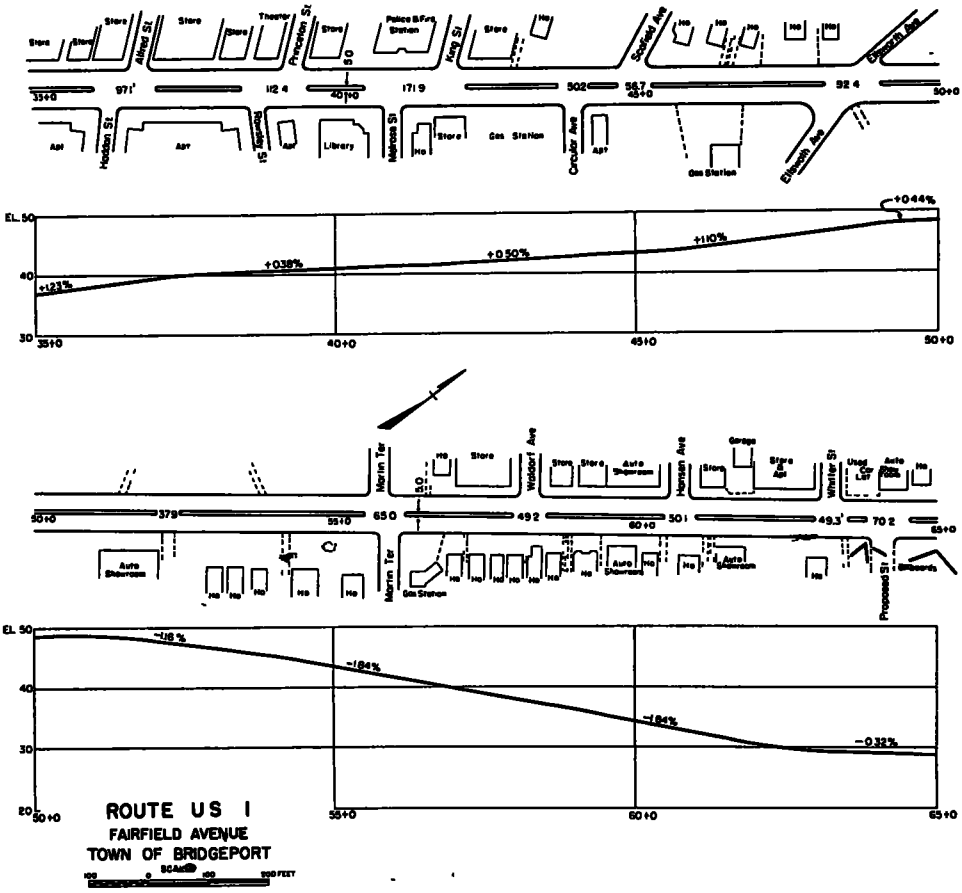
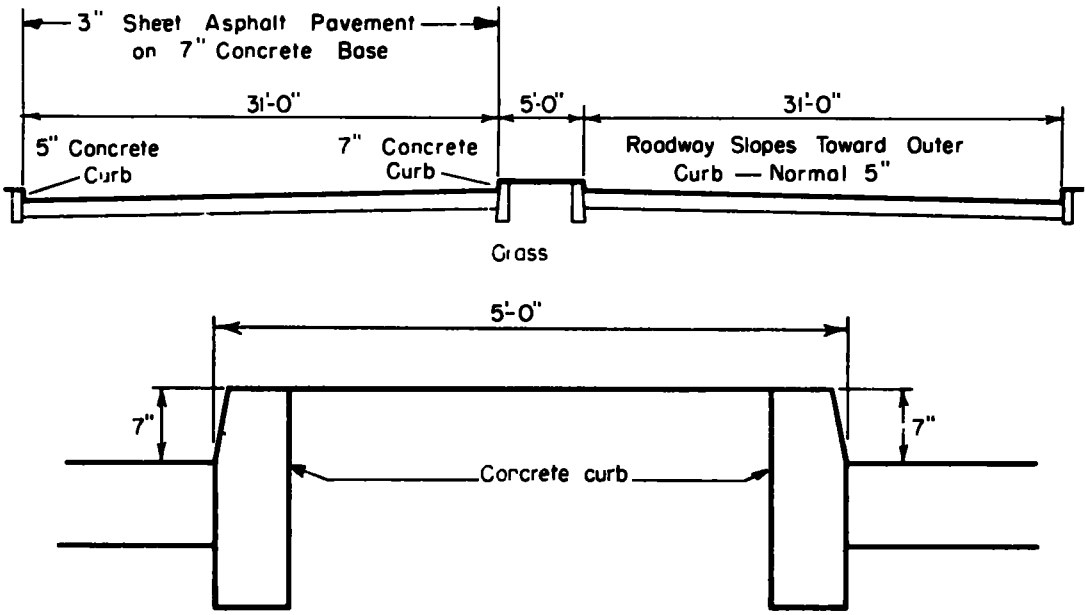
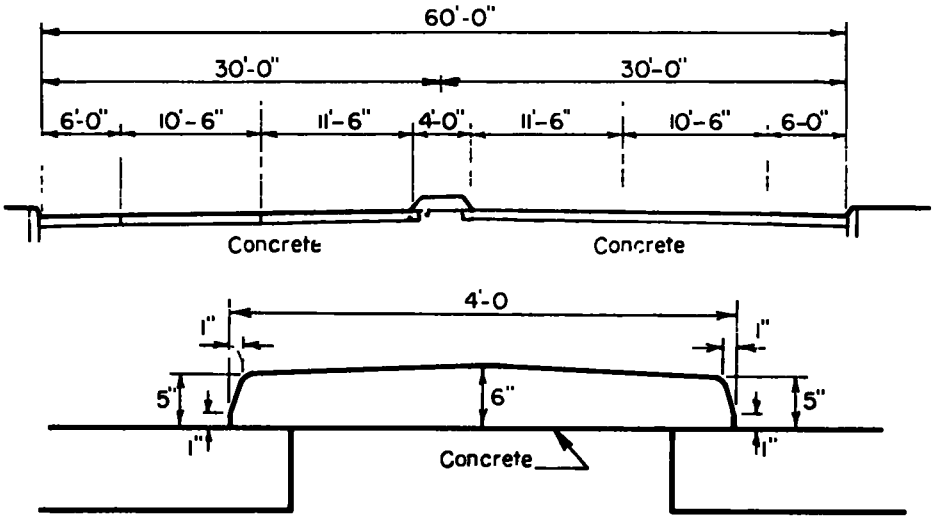



Figure 10.

## TYPICAL SECTION




ROUTE U.S I
FAIRFIELD AVENUE
TOWN OF BRIDGEPORT




ROUTE U S IA
KINGS HIGHWAY
TOWN OF FAIRFIELD

**Figure 11.**

curb. The highest speed group, 35 to 39 M.P.H. shows the usual tendency to move away from the curb with about 22 percent of group traveling at 6 ft. from the curb.

Table 2 shows the accident rate to be 540 per hundred million vehicle miles. There is no way of making a close comparison with a State-wide average for similar streets as there are too few on the State highway system. The property damage rate is shown as $85,000 per hundred million vehicle miles, fatalities are at the rate of 2.4 and injuries at the rate of 240 per hundred million vehicle miles.

The design used for this street was the most generous that could be obtained for the location. The closely built-up nature of the street would have made any encroachment on properties a prohibitively costly undertaking. The width of the street and the number of pedestrians involved made the use of a median refuge area mandatory. Barrier curbs were used for added pedestrian protection. It is believed that the median design has served the purpose for which it was designed.

Figure 12. Town of Bridgeport Route US 1, Fairfield Avenue

**TABLE 3**

AS A COMPARISON OF ACCIDENT RATES THE FOLLOWING ARE THE RATES (PER 100 MILLION VEHICLE MILES) FOUND ON VARIOUS HIGHWAY TYPES IN CONNECTICUT FOR THE FOUR YEARS 1946–1949

| | | RATES PER 100 MILLION VEHICLE MILES | | | |
|---|---|---|---|---|---|
| | MILES 1-1-'50 | ACCIDENTS | FATALITIES | INJURIES | PROPERTY DAMAGE |
| EXPRESSWAYS | 20 | 240 | 1.3 | 140 | $ 77,600 |
| PARKWAYS | 62 | 230 | 3.5 | 140 | 81,300 |
| DIVIDED HIGHWAYS AT GRADE | 46 | 430 | 6.5 | 230 | 111,500 |
| MULTIPLE LANE UNDIVIDED HIGHWAYS AT GRADE | 78 | 520 | 6.0 | 260 | 143,600 |
| TWO LANE HIGHWAYS | 2742 | 400 | 5.4 | 220 | 108,600 |
| ALL STATE MAINTAINED HIGHWAYS | 2948 | 400 | 5.2 | 210 | $ 109,400 |

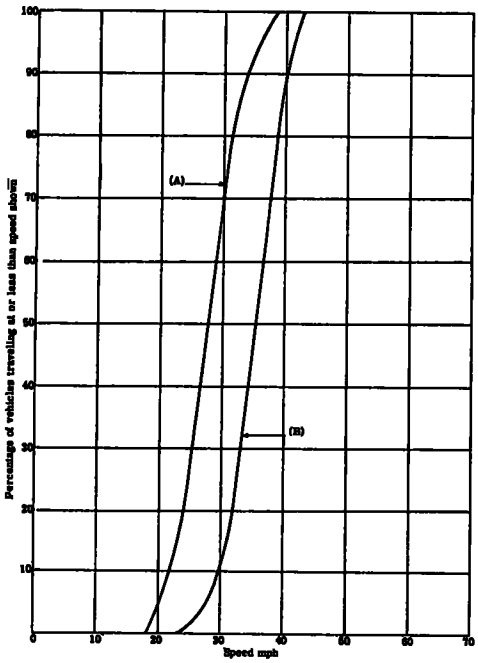



Figure 13. HIGHWAYS
(A) Bridgeport Route US 1 Dec. 1, 1950 10:10-10 45 AM 100 OBS W-E AV. SP. 28.5 MPH 85 Percent 32.5 MPH
(B) Fairfield Route US 1A Nov. 24, 1950 1·00-1·30 PM 100 OBS West Bound AV. SP. 35.6 MPH 85 Percent SP. 39.3 MPH

*Town of Fairfield - Route US 1A - Kings Highway* - Figure 15 shows the plan and profile for a section of this street. As noted previously, this street passes through an area that is principally residential in character with the usual scattering of neighborhood stores, churches, etc. This street passes through the outlying districts in the north part of the City of Bridgeport whereas the previously described section of Route US 1 leads directly into the center of the city.

Figure 11 shows the typical cross section of the street. Each roadway is 28 ft. in width, curb to curb,

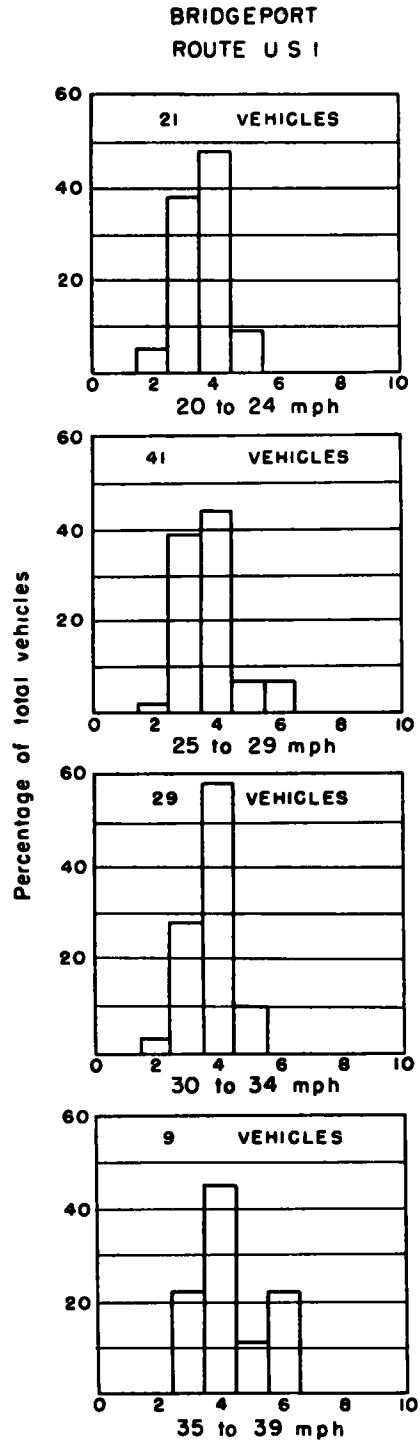



Figure 14. HIGHWAYS - Distance in feet that left wheels were to right of curb

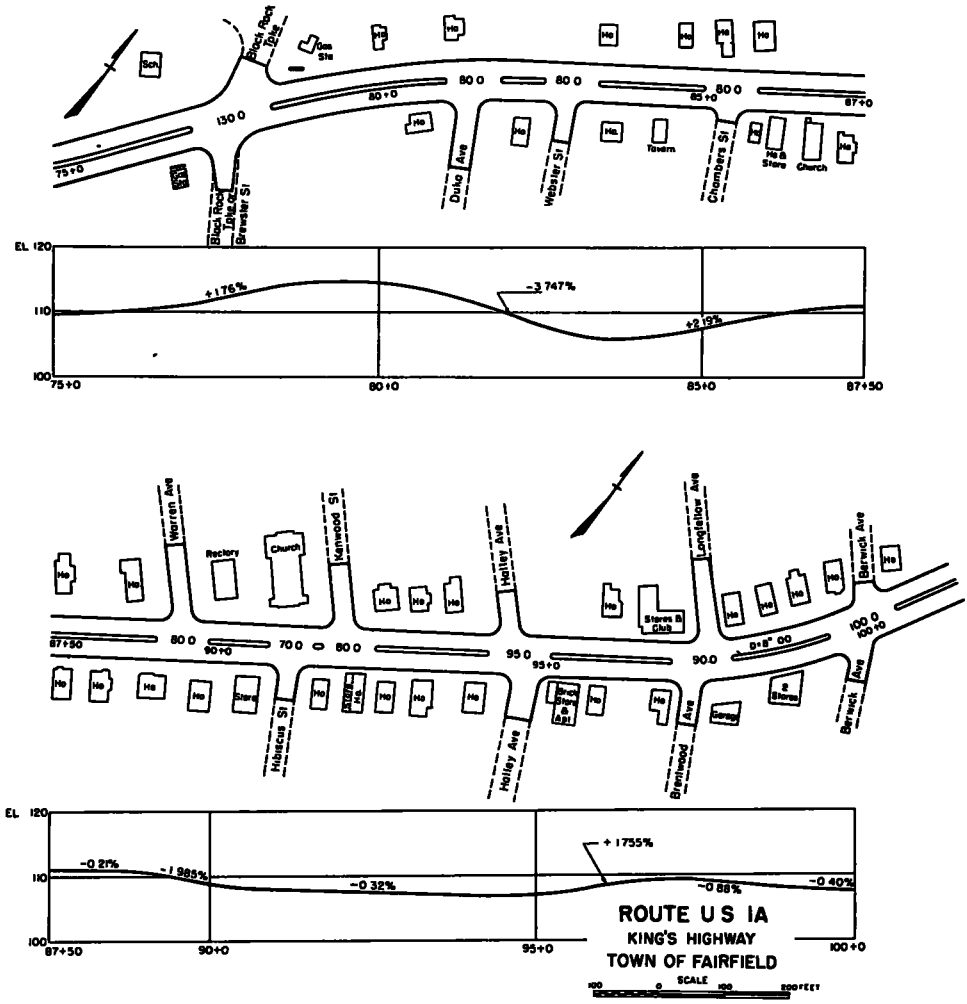



Figure 15.

with a 4-ft. wide median strip. The median was constructed of concrete as integral curb and filler. The pavement is concrete with the inside lane having a width of 11 ft. 6 in. and the outer lane having a width of 10 ft. 6 in. The extra width was built into the inside lane to allow more room for vehicles performing a passing maneuver and for those vehicles traveling at higher speeds. A marginal strip 6 ft. wide was provided for curb parking and for bus stops.

Figure 16 is a photo showing a section of the street. It will be noticed that a center line marking has been applied along the construction joint so as to give greater lane definition. The roadway is sloped away from the median strip, thus requiring drainage pickups at the outer curbs. The four-foot width of median is too narrow for successfully growing grass so an all concrete median was designed.

The street was reconstructed in 1940 and 1941 at a cost of about

$177,000 per mile which would mean $326,000 per mile on the basis of the 1950 index. The median strip was constructed at a cost of about $2.20 per foot.

Traffic data are included on Table 1. These show that the average daily traffic is 15,000 vehicles of which 19 percent is classed as commercial. The 30th highest hour is as 12 percent of A.D.T. and the 30th highest hour in major direction is 6 percent of A.D.T.

Figure 13 shows the speed curve for this street. The 85 percentile value is 39.3 M.P.H. which is 6.5 M.P.H. higher than that shown for Route US 1 in Bridgeport.

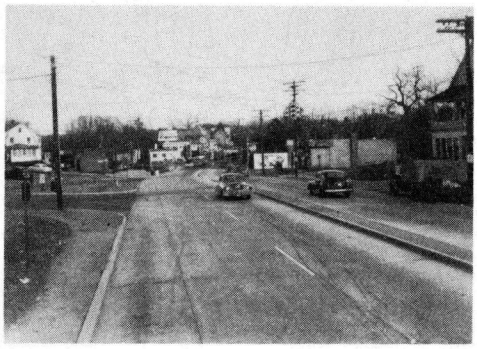


Figure 16. Town of Fairfield Route US 1, Kings Highway

Figure 17 shows the placement of vehicles with respect to the face of the median curb. It will be noticed that there is a distinct similarity to the placement shown in Figure 14 for Route US 1 in Bridgeport in that the greater percent of vehicles in all speed groupings was traveling with the left wheel at a 4-ft. offset from the median curb. Vehicles in the highest speed grouping showed a tendency to keep farther away from the curb than those in the lower speed groups.

Accident data for this street are shown in Table 2. The accident rate is shown as 420 per hundred million vehicle miles with injuries at the rate of 170 per hundred million vehicle miles. These rates are somewhat lower than for Route US 1 in Bridgeport. The fatality rate is 2.7 and property damage, $106,000 per hundred million vehicle miles. These rates are higher than those for Route US 1 in Bridgeport.

Operations resulting from the design used for the Bridgeport and Fairfield streets are similar in that there are outside parking lanes and two inside lanes for moving traffic. There does not appear to be enough difference in accident data to indicate that performance resulting from one design is better than the other.

As is the case in Bridgeport, it appears that the design is satisfactory for the location. With wider vehicles becoming more common, the 6-ft. parking lane is becoming too narrow and should be increased to a minimum of 8 ft.

*Long Structure* - The three tructures selected for this group are the Charter Oak Bridge spanning the Connecticut River in the Towns of Hartford and East Hartford, the bridge on the Merritt Parkway spanning the Housatonic River in the Towns of Stratford and Milford, and the bridge carrying Route US 1 over the Thames River in the Towns of New London and Groton.

The Charter Oak Bridge is a link in Conn. Route 15 which is a cross State highway beginning at the New York State Line and extending across Connecticut to the Massachusetts State Line. The Merritt and Wilbur Cross Parkways, a Section of Route US 5 and the Wilbur Cross Highway, are included in Route 15. The Housatonic River Bridge has been previously mentioned as being on the Merritt Parkway.

*Hartford-East Hartford, Charter Oak Bridge, Conn. Route 15* - The Charter Oak Bridge was constructed in 1941.

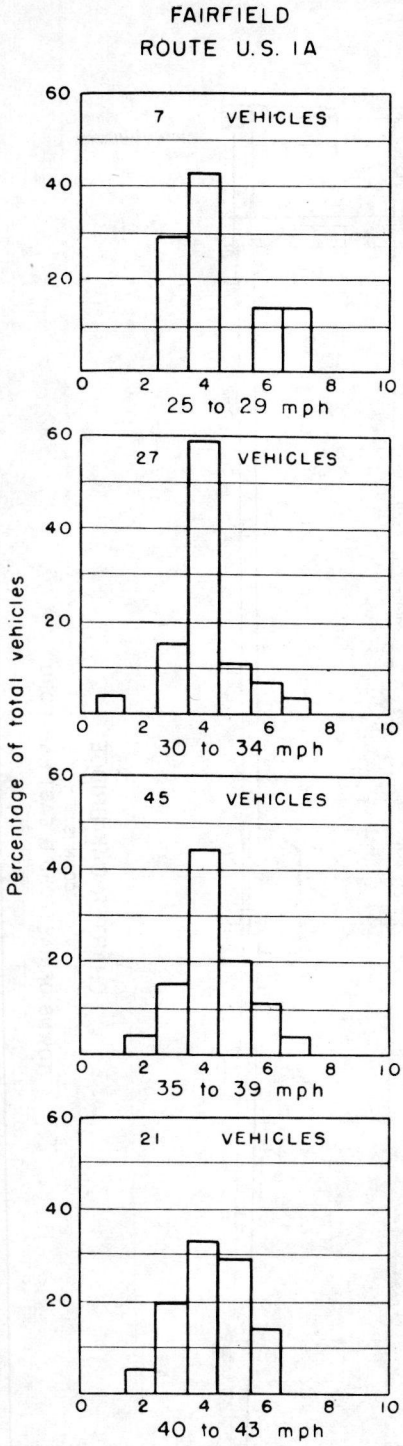



Figure 17. HIGHWAYS - Distance in feet that left wheels were to right of curb

It has a total length of 3,231 ft. between abutments. There is also an exit viaduct to the Riverfront Boulevard that is not included in the length shown. Approach grades on both the east and west portions of the structure are 4 percent.

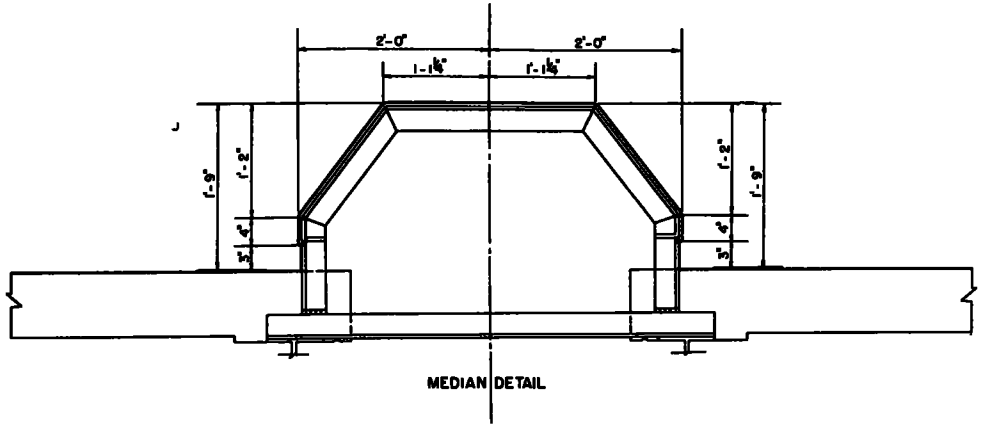
Figure 18 is a view on the westerly portion of the structure. Sodium vapor lights extend across the entire structure and for some distance on the approaches. There is a toll plaza a few hundred feet beyond the easterly end of the structure.

Figure 19 shows the roadway cross section and an enlarged cross section shows details of the medial divider. The total height of divider is 1 ft. 9 in. with the lower 7 in. having been constructed as a vertical section and the upper 1 ft. 2 in. laid back on a batter. The structure is speed zoned for 25 M.P.H.

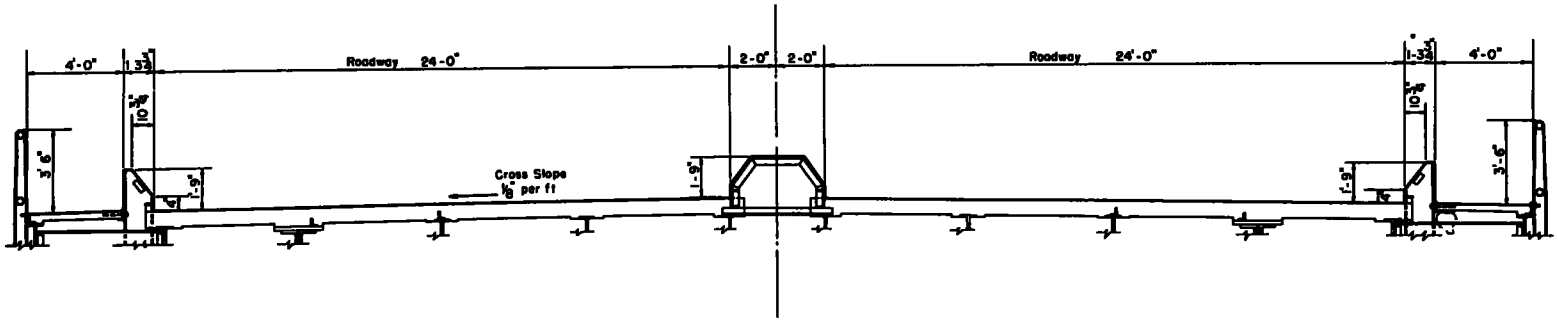
Average daily traffic on the structure is shown, on Table 1, as being 33,000 vehicles with 9 percent being of commercial class. The 30th highest hour is 12 percent of A.D.T. and the 30th highest hour in major direction is 7 percent of A.D.T.

Figure 18. Towns of Hartford and East Hartford, Charter Oak Bridge over Connecticut River, Route 15

Figure 20 shows the speed curves for the three structures included in this study. Observations on the




MEDIAN DETAIL




**CHARTER OAK BRIDGE**

**CONN 15**

**TOWNS OF HARTFORD & EAST HARTFORD**

Figure 19.

Charter Oak Bridge were taken on eastbound vehicles which had been traveling over a non-access highway, and speeds are higher than for westbound vehicles which are required to stop at the toll station at the easterly approach to the bridge. The speed curve indicates that about 60 percent of the vehicles included in the study was traveling in the speed range of about 36 to 42 mi. per hour. The 85 percentile speed value of all vehicles included in the sample, is indicated as 41 M.P.H.

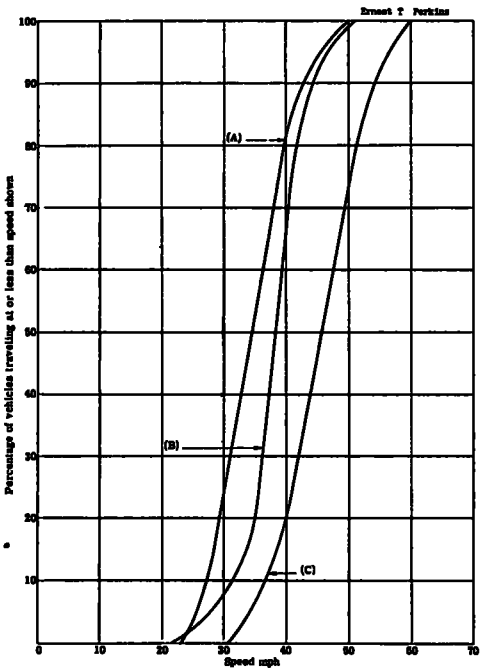



Figure 20. BRIDGES
(A) New London and Groton- Thames River Bridge Route US 1 Dec. 5, 1950 1:30-11·50 PM 100 OBS East Bound AV SP. 35.4 MPH 85 Percent SP. 41.0 MPH
(B) Hartford and East Hartford Charter Oak Bridge-Conn 15 Nov. 27, 1950 11 00-11·15 AM 100 OBS East Bound AV. SP. 38.6 MPH 85 Percent SP. 42.5 MPH
(C) Milford-Housatonic River Bridge Merritt Parkway Nov 29, 1950 10:30-11 15 AM 100 OBS East Bound AV. SP. 46.0 MPH 85 Percent SP. 52.5 MPH

Figures 21 and 22 represent a plot resulting from the placement study. The highest speed grouping shows the previously noted tendency for drivers to maintain a greater offset from the medial divider.

The accident summary shown in Table 2 indicates 39 accidents on the structure during the four periods included. There were no fatalities, and injuries and property damage were light.

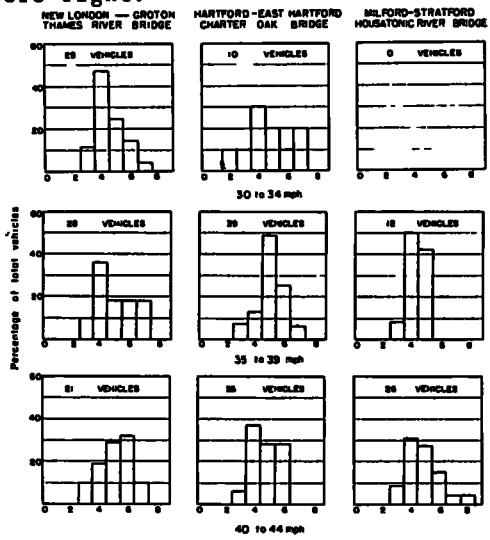



Figure 21. BRIDGES - Distance in feet that left wheels were to right of curb (continued on Figure 22)

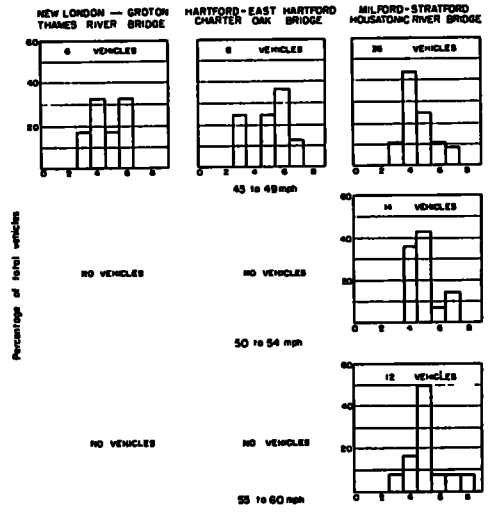



Figure 22. BRIDGES - Distance in feet that left wheels were to right of curb

*Towns of Stratford and Milford - Housatonic River Bridge on the Merritt Parkway, Conn. Route 15* - The Housatonic River Bridge on the Merritt Parkway was constructed in 1939. It has a total length of 1,824 ft. between abutments.

Figure 23 shows a view of the structure looking toward the west. The deck was originally constructed of a steel grid which has since been filled with bituminous concrete. The concrete section shown is over railroad tracks and was constructed as a concrete filled grid so as to avoid the smoke nuisance common to steam engine operation. The steel grid produced a swaying motion in moving vehicles and there was a decided rumble as cars rolled over the grid. There were numerous accidents at the westerly end of the structure on the eastbound lane. The Merritt Parkway was posted for a 50 M.P.H. speed for some time and vehicles traveling eastward entered the structure at about that speed. The sudden change from the concrete pavement to a grid, apparently, confused drivers and the result was an unfavorable accident experience. The bituminous surface was applied in an effort to overcome the objectionable grid features and has been partially successful. The toll station is located about 400 ft. beyond the easterly end of the structure.

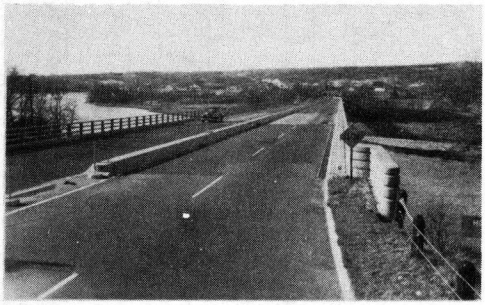


Figure 23. Towns of Stratford and Milford, Housatonic River Bridge on the Merritt Parkway Conn. Route 15

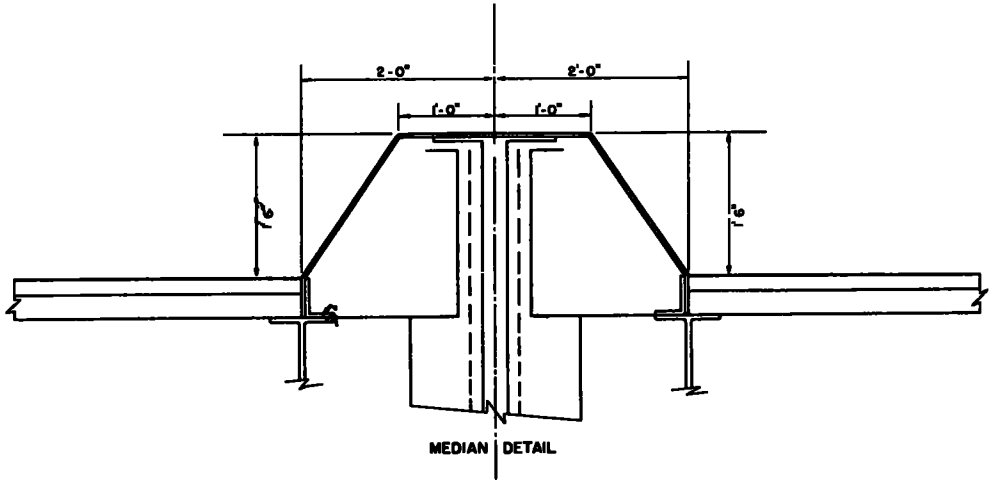
Figure 24 shows the overall roadway typical cross section and also an enlarged section of the medial divider. It will be noted that the medial divider is 1 ft. 6 in. in height and the face adjacent to the travel lane is on a batter for the entire height. A 26-ft. width was used for each roadway. This width is the same as the roadway width between curbs on the Merritt Parkway. The bridge is on a straight 3 percent grade.

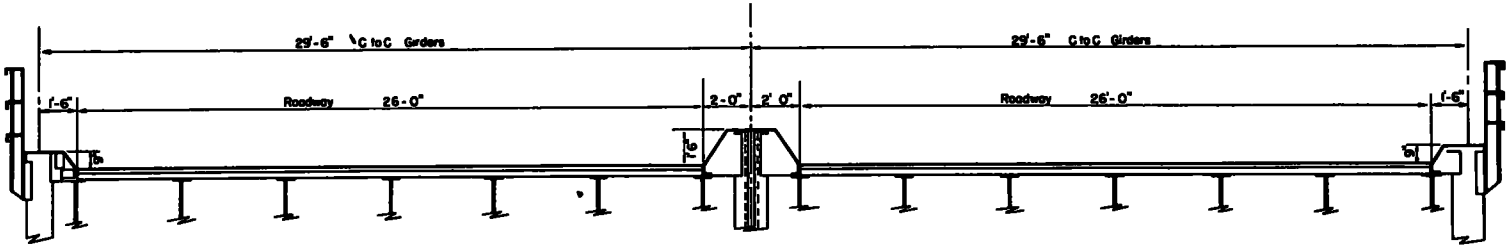
Traffic volumes are indicated in Table 1. A.D.T. is 18,000 passenger vehicles. The Merritt Parkway is closed to commercial vehicles of all classes. The 30th highest hour is shown as 17 percent of A.D.T. which is the greatest of all highways included in this study. Travel during a long 4th of July weekend and Labor Day weekend is especially heavy over the Merritt Parkway.

The speed curve for this structure is shown in Figure 20. Observations were made in eastbound roadway because of the influence, on the westbound lane, to vehicles having just left the toll station. The 85 percentile value is 52.5 M.P.H. which is only slightly under the present posted speed of 55 M.P.H. for the Parkway.

Results of the placement study are shown in Figures 21 and 22. For speeds between 35 and 49 M.P.H., the greatest percentage of vehicles was traveling at an offset of 4 and 5 ft. from the median with the greatest percentage being at 4 ft. In the 50 to 60 M.P.H. range, the vehicles shifted slightly to the right with the greatest percent of vehicles included in the sample traveling 5 ft. from the median.

The accident tabulation shown in Table 2 indicates 58 accidents on the structure for the 4-year period shown. There were no fatalities during the same period. The actual




HOUSATONIC RIVER BRIDGE
MERRITT PARKWAY
TOWNS OF MILFORD & STRATFORD

Figure 24.

totals of accidents, injuries and property damage are not great but when translated into terms of the rate per hundred million vehicle miles, seem large because of the relatively short length of structure.

The design of the medial divider was intended to allow vehicles to glance off of the battered section and be returned to their own roadway. Actually, vehicles have run up on the sloping face and have, in some instances, come to rest on top of the divider. The Charter Oak Bridge was constructed two years later and a vertical face of 7 in. at the bottom of curb was used in order to force a glancing movement rather than having vehicles actually mount the divider. It is believed that the Charter Oak medial divider is a better design than the Housatonic River Bridge divider.

*New London-Groton - Thames River Bridge - Route US 1* - The Thames River Bridge was constructed in 1941. It is a high-level structure and replaced a low-level, movable span structure. It has a total length of 5931.75 ft. between abutments. The straight grades on both the east and west approach viaducts are 3 percent.

The structure connects New London on the westerly bank of the Thames River with Groton on the easterly side. It is also a major link in Route US 1. A four-lane divided highway by-passing New London and Groton was constructed to provide suitable approach to the structure.

Figure 25 is a view of the easterly portion of the structure. Lighting is provided for the entire length of the structure and for some distance on the approaches. The toll station is several hundred feet beyond the easterly end of the structure.

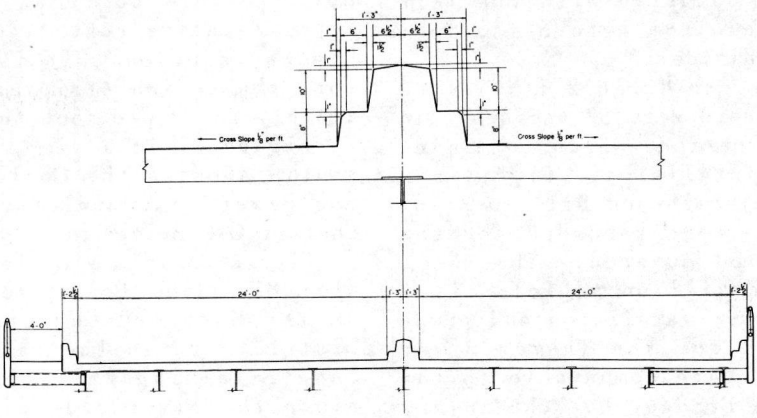
Figure 26 shows a typical cross section of the roadways and an enlarged section shows details of the medial divider. The divider is in the form of double curbs back to back, the lower barrier curb being 8 in. in height and the upper portion being 10 in. in height. Bottom face of curbs are separated by 2 ft. 6 in. Each directional roadway is 24-ft. wide which width is the same as that on the Charter Oak Bridge.

A.D.T. on this structure is 16,000 vehicles, as may be seen in Table 1. 92 percent of A.D.T. represents passenger vehicles, while 8 percent is classed as commercial. The 30th highest hour is 12 percent of A.D.T. and the 30th highest hour in major direction is 7 percent of A.D.T.

The speed curve is shown in Figure 20. Speeds are lower for this structure than the other two included in the study. The 85 percentile value is shown as 41.0 M.P.H. It will be noted in Figure 25 that the structure is speed zoned for 25 M.P.H. as is the Charter Oak Bridge. General observance of posted speeds seems to be slightly better on the Thames River Bridge but the range of speeds is similar. Observations were taken in the eastbound roadway so as to eliminate the effect of passing through the toll station.

Figures 21 and 22 show the results of placement observations. Vehicles in the 30 to 39 M.P.H. groupings favored a 4-ft. offset from the curb and the 40 to 49 M.P.H. groupings, again, were moving out to a slightly

Figure 25. Towns of New London and Groton, Thames River Bridge, Route US 1




THAMES RIVER BRIDGE
ROUTE U.S. I
TOWNS OF GROTON & NEW LONDON

Figure 26.

Figure 27. Town of Hartford, Conland Highway and Riverfront Boulevard with Charter Oak Bridge in background

greater offset. There is a decided preference by drivers at all three structures to drive with the left wheel placed from 4 to 6 ft. from the medial divider.

Referring to Table 2 it will be seen that there were 52 accidents in the 4-year period, which total included no fatalities. Eighty-six personal injuries and $11,120 property damage were recorded for the 4-year period covered. The rates per hundred million vehicle miles for accidents, fatalities and property damage for the Thames River Bridge are quite comparable to the Charter Oak Bridge, but the injury rate is approximately 3 times greater for the former as compared with the latter.

*Expressway* - Expressways constructed in Connecticut, to the present time, have not included sustained lengths of a narrow median. The Conland Highway and Riverfront Boulevard connect the Charter Oak Bridge and South Meadow Highway with streets adjacent to the center of the City of Hartford. Although there are two designating names for the highways, they form one continuous highway for a length of one mile. The construction of this access road was accomplished in connection with a major flood control project which was undertaken after the disasterous flood of 1936 and the nearly as damaging flood that accompanied the hurricane of 1938. One of the major items in the flood control project was the enclosure of the Park River in a large, twin box culvert. The Conland Highway was constructed on top of the box culvert and, largely, within the limits of the old Park River banks. The Riverfront Boulevard section is adjacent to the Connecticut River from which it is protected by an earth dike. The highway location was planned in conjunction with the dikes. Extensive filling was done by hydraulic methods. Because of the highway and dike work being so closely connected, it is not possible to break out a good representative cost figure for the highway section. It is estimated that the median strip cost approximately $3.30 per foot to construct.

Figure 27 is a view, toward the south, showing the Conland Highway and Riverfront Boulevard with the Charter Oak Bridge in the background.

Figure 28 is a view looking north along Riverfront Boulevard. Buildings in the Hartford Central Business District are in the background. A long retaining wall will be seen along the river side of the road. This wall retains the flood control dike. Industry confines the area to the left of the highway. The median width was kept to a minimum that would include installation of foundation for light standards.

Figure 29 shows a plan and profile for the section of highway shown in Figure 28.

Figure 30 shows the typical cross section of the highway and an enlarged sketch shows details of the median strip. It will be noted that the median strip is 4 ft. wide and that a mountable curb was used. It will be noted that two 12-ft. lanes were constructed for each roadway. The mountable curb was constructed along the edge of the inner 12-ft. lane so as to encourage drivers to make use of the entire inner lane. Inner lanes slope toward the median while the outer lanes slope toward the shoulders. Catch basins are provided along the median curbs to pick up center drainage.

Referring to Table 1, it will be seen that the average daily traffic amounts to 27,000 vehicles. The 30th highest hour is 15 percent of A.D.T. and the 30th highest hour in major direction is 12 percent of A.D.T. Commercial vehicles account for 13 percent of A.D.T.

Results of the speed study are presented in Figure 31. The 85

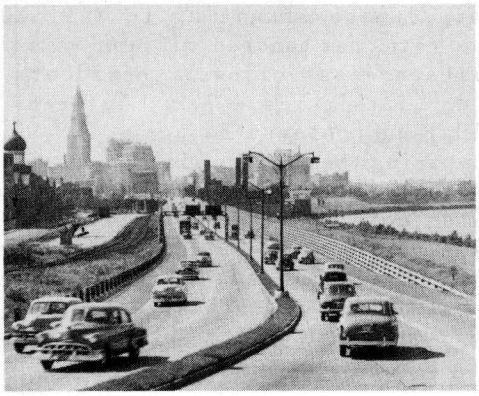


Figure 28. Town of Hartford, Riverfront Boulevard

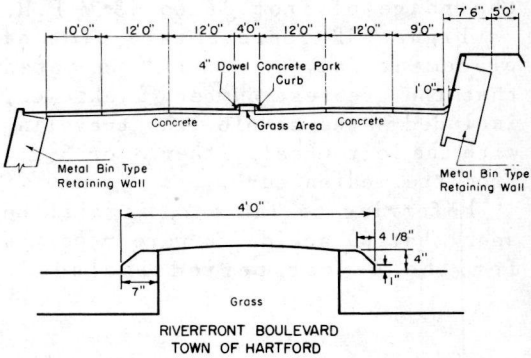



Figure 30. Typical Section

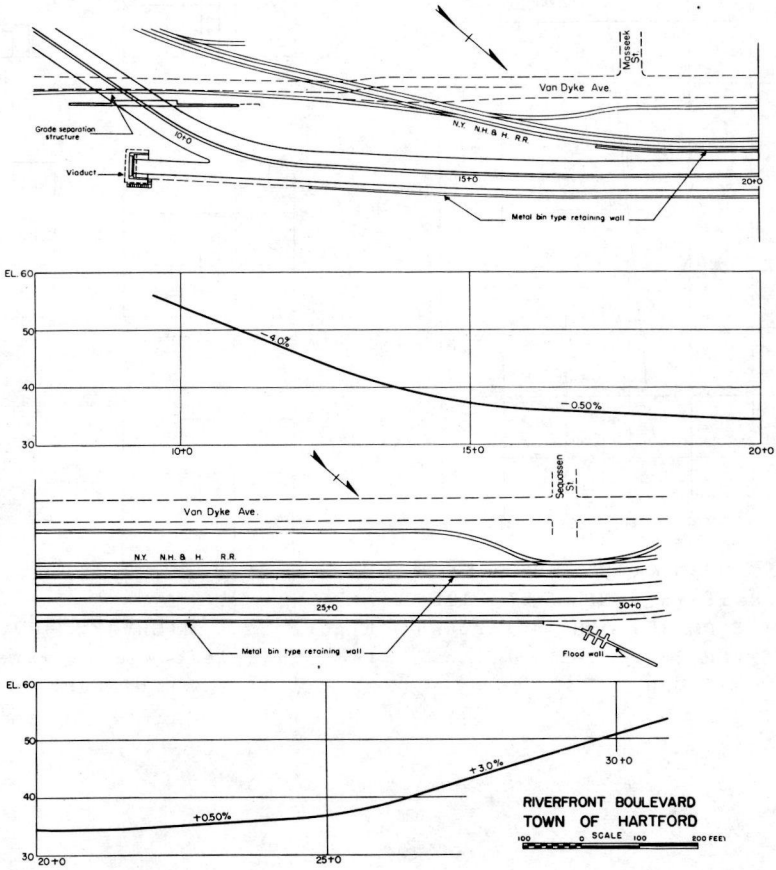



Figure 29.

percentile value is shown as 43.7 M.P.H. The curve is very steep and it will be noted that about 60 percent of the sample was traveling in the range of from 37 to 43 M.P.H.

Figure 32 represents a plot of placement data. It will be noted that the greatest number of vehicles, included in the sample, was traveling with the left wheel either 4 or 5 ft. from the median curb.

Referring to Table 2, it will be seen that 60 accidents were reported for the 4-year period included. Included in the total accidents were two fatalities, 32 injuries and property damage amounting to $19,530. The rates per hundred million vehicle miles are as follows: accidents - 210; fatalities - 7.2; injuries - 110, and property damage - $69,000. Comparing these rates with those shown in Table 3, it will be seen that the rates compare favorably with Statewide average except for fatalities. The two fatalities, on the short section involved, result in a large rate per hundred million miles.

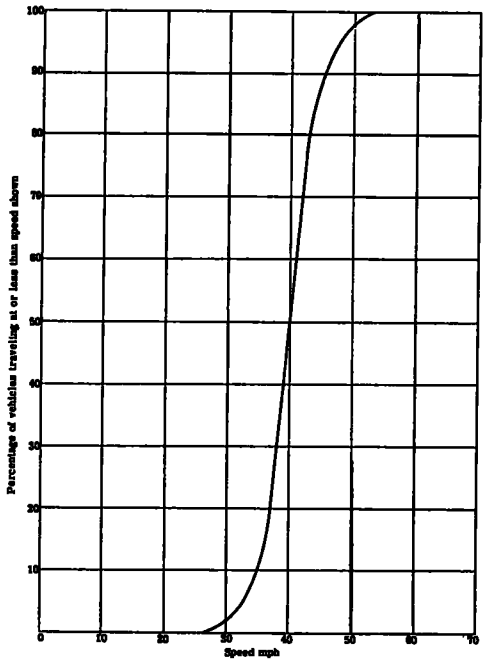



Figure 31 HIGHWAYS - Hartford Riverfront Boulevard Nov. 27, 1950 11:45 AM-12:15 PM 100 OBS Southbound AV. SP. 40.5 MPH 85 Percent SP. 43.7 MPH

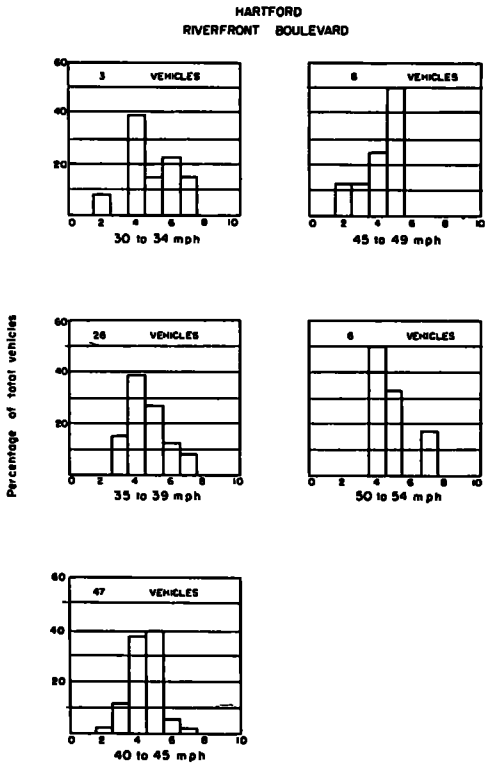



Figure 32 HIGHWAYS - Distance in feet that left wheels were to right of curb