The use of medians for highways of four or more lanes in width has become accepted practice for new facilities and also for modernization of existing roads. The maximum benefits from the use of medians occurs when they are of sufficient width to (1) provide freedom of operation from opposing traffic, (2) provide space for crossing and turning vehicles at intersections or island openings and (3) to minimize headlight glare.

A 16-ft. median is the minimum in which a left turn channel can be constructed. For this reason a median less than 16-ft. in width is not considered good design in New Jersey. However, the width of median is often limited by available width of right-of-way, economic considerations or other reasons and narrow medians, although not desirable, are sometimes necessary.

The medians on Route 17 and Route 28 in Northern New Jersey are believed to represent what may be considered the minimum in median design.

ROUTE 17

The Site - Figure 1 shows the general location of Route 17 in northern New Jersey. This north-south route crosses 3 major east-west routes (Routes S3, 6 and 4) and thus serves as a connecting road in addition to serving large concentrations of local traffic. Figure 2 shows a section of this route in relation to local streets and highways. This section of Route 17 may be considered in general as a major street through a residential or suburban area, with some business establishments.

At the time that studies were being made for the improvement of Route 17, the Highway Department had long range plans for the construction of other routes that would relieve traffic conditions on Route 17. Due to the topography, numerous intersecting streets and limited right-of-way, the expense of converting Route 17 to a high capacity route was considered excessive. For these reasons, the improvement of Route 17 was held to what may be considered an absolute minimum for a divided highway.

The Highway - Before dualization, Route 17 was a three lane road with 30 ft. of pavement, a 10-ft. shoulder on one side and a 2-ft. shoulder on the other side as shown in Figure 3. The dualization consisted of the installation of a 2-ft. wide low curbed island and two 24-ft. pavements. There are not any shoulders but parking is prohibited.

Figure 4 shows details at one of the major intersections. The 10 ft. of additional pavement on the northeast corner of the intersection was provided in order that thru vehicles could pass vehicles waiting to make a left turn.

Most of the major intersections have traffic signals with all turning movements permitted. These signals are not coordinated.

This section of Route 17 traverses
the edge of the marsh area, so that the grades are generally quite flat.

One of the disadvantages of a narrow median is the difficulty of providing adequate drainage. If each roadway has a two way crown, then the curb lines of the median are gutter lines. Vehicles riding close to the curb line throw water or slush across the narrow median onto cars traveling in the opposite direction. One way to remedy this condition is to provide inner shoulders with inlets on each side of the median.

On Route 17 it was not feasible to provide inner shoulders so the roadways were sloped away from the median and inlets were installed at the outside curb lines. This method has the disadvantage of that during periods of freezing and thaw, water from melting snow on the median will run part way across the pavement and then freeze.

The Median - Due to the many private driveways and entrances along Route 17, it was felt undesirable to use the usual high median curb with median openings as the numerous openings would practically nullify the benefit of the median. In addition, as the area developed, the Department would be put to the expense and trouble of constantly providing new openings for each new driveway. It was therefore decided to use a low mountable curb continuous between street intersections that could be crossed at any point by traffic desiring to make left turns.
Details of this curb are shown on Figure 5. The curb is made of cast in place white concrete with a scored reflecting surface. Expansion joints were installed every 12 ft.

Figure 6 shows a general view of the curb, and Figure 7 is a close-up view showing details of the scoring. Figure 8 is a photograph showing a typical section of the highway.

The median was constructed at a cost of $3.90 a lin. ft. or a total of $69,759.30 for the 17,887 lin. ft.

The Traffic - Due to the numerous intersecting streets, there is considerable variation in the traffic volumes along the four mile section of highway.

Average daily traffic for 1950 varied from about 18,000 at the southern end to over 30,000 near the center and dropping to about 25,500 near the northern end. The thirtieth peak hour volume is 11 percent of annual average daily traffic, one way.

Table 1 shows a traffic classification based on a count of 1442 vehicles taken on March 14, 1950, near the southern end of the project.

<table>
<thead>
<tr>
<th>Type of Vehicle</th>
<th>Number</th>
<th>Percent of Total</th>
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<tbody>
<tr>
<td>Passenger Cars</td>
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<td>Trucks</td>
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<tr>
<td>below 1½ tons</td>
<td>47</td>
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<td>2 axle dual tires</td>
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<td>3 axle dual tires</td>
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<td>Tractor Trailers</td>
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<td></td>
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<td>2.91</td>
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<tr>
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<td>.90</td>
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<tr>
<td>Buses</td>
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<td>.90</td>
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<tr>
<td>TOTAL VEHICLES</td>
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<table>
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<td>Fixed Object</td>
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<tr>
<td>Other</td>
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<td>5</td>
<td>3</td>
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<tr>
<td>TOTAL</td>
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<td>185</td>
<td>109</td>
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<td>Injuries</td>
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<tr>
<td>Fatalities</td>
<td>3</td>
<td>0</td>
<td>0</td>
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</tr>
</tbody>
</table>

NOTE: TRAFFIC INCREASE 8 PERCENT PER YEAR
Table 2 gives the accident summary for the year 1948 (the year before dualization) and for 1949 and the first half of 1950. It is interesting to note that there have been no opposite direction accidents.

The affect of the installation of the median on accidents cannot be determined from the records as other conditions were changed by the dualization.

Vehicles maintain an average daytime clearance of 1.8 ft. from the edge of the center curb when there is a vehicle on their right and 2.1 ft. when the lane on their right is unoccupied.

Average speeds of vehicles along Route 17 taken during November of 1950 shows an average speed of 40.0 m.p.h. for passenger cars and 35.7 m.p.h. for trucks. The 85 percentile speeds were 46 m.p.h. for trucks and 47 m.p.h. for passenger vehicles.

The Summary - This section of Route 17 presents the rather common problem of improving an old route having limited right-of-way and passing through built up areas. The cost of improving it to modern standards would be prohibitive. It is generally cheaper to build another road on new routes. On the other hand, some improvements should be made as the existing road passes through developed areas and will always carry fairly large volumes of traffic.

The above described improvements to Route 17 may be considered the minimum that can be done for the conversion of an existing 3 lane highway to a 4 lane divided highway.

This median may be considered an experimental type and has not been in use a sufficient length of time to reach final conclusions as to its merits. However it would appear to have the following advantages over the conventional higher type.

(1) Openings for driveways, left turns and "U" turns are not necessary and a continuous median can be used between street intersections. Before construction, some concern was expressed that motorists might not cross this curb for left and "U" turns. However, this has not proved to be the case as motorists do not hesitate to cross this curb in order to make a turning movement.

(2) It gives a positive separation of opposite direction traffic but can be crossed in an emergency (if

Figures 9 and 10 show turning movements at two of the major intersections.
the opposite lane is vacant) in order to avoid a collision.

(3) It facilitates the movement of police cars, fire apparatus etc.

(4) In case of fire or accidents, any section of one roadway can be closed off and two way traffic maintained on the other roadway.

(5) This type of curb seems to collect less debris and snow than the conventional higher type. This may be due partially to the fact that vehicles ride closer to it than they would to a higher curb.

ROUTE 28

The Site - Figure 11 shows the general location of Route 28 in relation to other main highways. This route is a direct east-west road across New Jersey from Pennsylvania to Newark and New York.

Figure 12 shows a two mile section of this route. This section is a rural road across a mountain with no intersecting roads of any importance.

The Highway - Before dualization, this section consisted of 20 ft. of pavement with earth shoulders. It has curves as sharp as 10 deg. and grades of 7.2 percent. There were but few sections where it was possible to pass slow moving vehicles.

Due to the topography, construction of a new highway on better alignment and grades would probably necessitate a tunnel. Grading costs would also be high. As money was not available for a new highway, it was decided to dualize the existing road as shown in Figure 13. The dualization consisted of resurfacing and widening the existing road to 23 ft., the construction of 23 ft. of new pavement and a 2 ft. 6 in. curbed median and outer shoulders 10 ft. wide.

The island openings vary from 30 to 50 ft. in length. Figure 14 shows a typical opening. All turns are permitted. Figure 15 shows the
transition in curb height at island openings and at the ends of the islands. This was done to present less of a hazard to the motorist who ran into the center island. It was designed to "hand up" the vehicle and cause it to slide along the top of the curb. Vehicles that have run into the ends of the islands come to a sliding stop without injury to the occupants and but little or no damage to the vehicle.

Figure 16 shows a typical section of the highway.

Figure 16

The Median - Figure 17 shows details of the median. The curb was cast in place with expansion joints every 20 ft. The interior consists of grey concrete with a minimum thickness of 2 in. of white concrete on the exposed surfaces. The top of the curb is scored.

Figure 18 shows a close up view of the median.

The Cost - The length of this project is 2.04 mi. and was completed in November of 1949. The total cost was $634,128.

The 7,550 ft. of median as shown in figure 14 was constructed at a cost of $5.74 a lin. ft. or a total of $43,337. In addition there was 1,613 ft. of median doweled to existing pavement at a cost of $5.10 a lin. ft. or a total cost of $8,226.30. The 9,163 lin. ft. cost $51,563.30.

The Traffic - The average daily traffic amounts to 8,000 vehicles. The 30th peak hour factor is 14 percent, giving a peak hour directional flow of 560 vehicles. Thirty percent of the vehicles consist of trucks.

The average speeds upgrade are 50 m.p.h. for passenger cars and 16 m.p.h. for trucks. The corresponding 85 percentile speeds are 56 m.p.h. and 30 m.p.h. The average speeds downgrade are 52 m.p.h. for passenger cars and 51 m.p.h. for trucks. The corresponding 85 percentile speeds are 58 m.p.h. and 60 m.p.h.

Vehicles are reluctant to drive close to this curb. After passing a slower moving vehicle, most cars moved over to the right hand lane. Vehicles maintain an average daytime clearance of 3 ft. from the edge of the center curb when there is a vehicle on their right. On curves to the left, there is some tendency to cut corners and the average clearance from the center curb is about 2.5 ft.

This route has not been open to traffic a sufficient length of time to reach conclusions as to accidents. For the first 8 months of 1950 there were 15 accidents involving 9 injuries and one fatality. Eight of
the accidents occurred in clear weather. There were no opposite direction accidents.

In 1948 (the last year before start of construction for the dualization) there were 13 accidents involving 12 injuries. Four of these accidents were opposite direction and 8 occurred in clear weather.

Summary - The cost of installing a wide median on this section of Route 28 would have been prohibitive. On the other hand, a narrow median with a standard 8 in. high curb was not considered adequate because of the sharp curvature, steep grades and high percentage of trucks.

The barrier curb has served its function of preventing crossing of the narrow median. Some high wheeled trucks have managed to straddle it but none have crossed into the opposite lanes. This curb has probably prevented some accidents from vehicles whose brakes have failed. On several occasions, marks on the curb show that trucks rub against the curb to keep the speed of the vehicle under control. This would not be possible with a lower curb.