

SYMPOSIUM ON HIGHWAYS WITH A NARROW MEDIAN - ILLINOIS

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Current design practices in Illinois do not employ the use of narrow curbed medians, except for the channelization of approach pavements to grade separations; the islandization of intersections at grade; and at locations where a reduced cross-section design is economically essential, providing that certain approach conditions are met and cross-conflicts are reduced. Our experience in the past with narrow medians as a separator or physical barrier between dual pavements in rural and in intermediate areas has given us a rather dim view of them, particularly if they are of the curbed type. Perhaps it is unfortunate that the Department of Public Works and Buildings has been criticised, although sometimes with bias by minority groups, for incorporating such design features in our highways. However, in all fairness to the use of narrow medians, the fact should be recognized that such unfavorable criticism has usually been voiced against separated highways in rural and in intermediate areas where operating speeds are high and which are without the benefit of access control. Such adverse criticism can be blamed upon several factors, such as the demand by certain private interests for unrestricted movement; secondly, the driving habits of the mid-western driver; and thirdly, the unfavorable operational accident experience on such constructed highways. In the first instance Illinois abutters hold certain inherent property rights of

access to non-controlled highways and consequently many private interests most vehemently oppose any plan which would prohibit, restrict or render circuitous the direct access to their business establishments or services. In the second instance the mid-western driver has, until quite recently, been able to travel in rural areas and even in the majority of urban areas completely free from traffic congestion with its accompanying slower operational speeds and restrictions in turning movements. With the tremendous increase in our post war traffic volumes, our highways, especially in the environs of our larger metropolitan cities, are rapidly becoming more congested but our drivers are still attempting to realize running speeds equal to or higher than those of a decade ago. In brief, they are not yet regimented to the necessity for slower operational speeds; to accept the fact that there are less passing opportunities; to the fact that many turning movements must be restricted; and to the inclusion of adverse travel distance. The third factor, unfavorable accident experience, is to a large degree the consequences of the lack of access control and the driver habits as discussed above and which, together with the inability of the human system to comprehend space interval opportunity, and the distance required for passing in relation to distances covered in split-seconds of travel time constitute the major contributing factors to our increas-

ing accident rate. It is the common butt of jokes that the driver of today - who in the sanctity of his own home is a just man, a loving parent and a considerate neighbor - becomes a veritable maniac and a menace on the highway the moment he gets behind the steering wheel of a car. In any event, there does exist among our drivers of today an increasing lack in the extending of common courtesy as well as an indifference to the rights and the consequential safety of others. It would, therefore, appear that there is as much need for "Human Engineering" as for "Civil Engineering" in the question of median dividers as well as in most other facets of the highway problem.

By the early 1930's, Illinois had become fully aware of the desirability of and the necessity for the physical separation of opposing streams of traffic on our more heavily travelled highways. However, at that time, little had been experienced to mold general engineering opinions relative to minimum or to desirable widths for the separating median. As a result, the physical dimensions of such design features were usually the consequences of experimentation and of comparative costs rather than of experience and essentialness. It was with such a background that Illinois prepared a divided pavement design in the late 1930's. US Route 12 was then in the process of being modernized and improved between Chicago and the Wisconsin State line. This was one of the more heavily travelled highways and was subject to considerable one-way congestion during the summer months by week-end vacation travel between Chicago and the Wisconsin lake resort area. In Cook County, this highway had been improved as a solid 40-ft. pavement and it was decided to modernize the highway through Lake County as a divided pavement having a general cross

section design of 2 at 22-ft. with a 30-ft. crowned earth median. However, due to right-of-way considerations, a cross section design of 2 at 20-ft. with a 24-in. curbed median and having a height of 4-in. finally appeared to be justified for that portion of the highway which utilized the existing alignment immediately north of the Cook-Lake County line. (Fig. 1A). Where the proposed alignment went into relocation the 24-in. curbed median expanded into the general cross section design. This resulted in a stretch of highway approximately one and three-quarter miles in length which used a narrow curbed median as a physical separator for a divided pavement design.

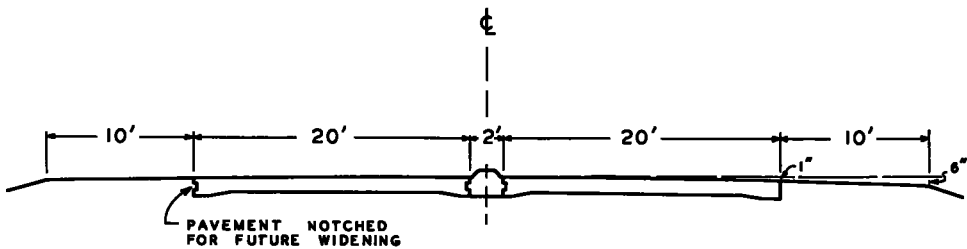
It was anticipated that at some future time a third lane would have to be added to the Chicago bound pavement in order to provide adequate highway capacity for the concentrated peak period flow of traffic representing the week-end vacationists who usually began returning to the city on Sunday afternoons. Standard 10-ft. earth shoulders were used having a slope of $\frac{1}{2}$ -in. per ft. of width and the ditch slopes were 3 to 1. The horizontal alignment was tangential except for one small deflection of 2 degrees and 50 minutes. The maximum grade was 2.38 percent and sight distances were unrestricted.

While the location was through an area generally rural in character, the improvement was fronted by a ribbon development consisting of a rural sub-division, farm units and a small crossroad community. Within the length of this improvement there were 22 homes, one roadhouse or tavern, one shop, two gasoline service stations and five "Bar-B-O" stands. As this highway was without the benefit of access control, three 12-ft. openings for single entrances and five 30-ft. double entrances were provided in the median for in-

gress and egress to these properties. Two local roads and a short side street likewise intersected the main highway at grade and one opening in the median of 80-ft. and two openings of 126-ft., the length depending upon the angle of intersection, were provided to serve the interchange needs. All traffic entering the new highway from these intersecting roads were under stop-sign control and there was no restriction in the turning movements.

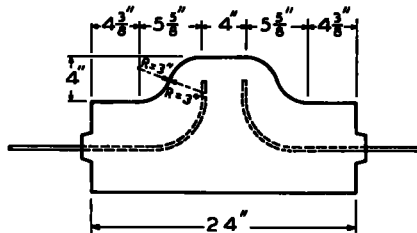
The median was 24-in. in overall

Libertyville, Illinois on August 30, 1938, and was completed and accepted by the Division of Highways on September 5, 1939. The cost of the improvement, including the item of \$21,323.25 for additional right-of-way amounted to a total of \$187,287.42 for 1.75-mi. of improvement or a cost of \$107,021.38 per mi. In order to realize a separation of the opposing streams of traffic, 9,051 lin. ft. of the curbed median were used at a unit price of \$0.47 per lin. ft. for a total cost of \$4,253.97.



U.S. ROUTE 12

(A) CROSS SECTION FROM COOK-LAKE COUNTY LINE NORTHWEST



(B) DETAIL OF 24" CURBED MEDIAN

Figure 1.

width, 4-in. high and with 4 3/8-in. gutter flags and the sloping faces were readily mountable. The flat width on top was 4-in. (Fig. 1B). The median was joined to the adjacent pavement on either side by means of a longitudinal notch.

The contract for this improvement, designated as S.B.I. Route 60, Section SY-3, was awarded to the Eric Bolander Construction Company of

The magnitude of the average daily traffic volumes on this highway was not startling in itself even for a two-lane highway, amounting in 1938 to 3,800 vehicles and in 1947 to 5,500 vehicles; but it was the peak hour directional traffic conditions related to the recreational characteristics of the road which created an abnormal congestion condition. In 1947 the Chicago outbound recre-

ational traffic, although spread over a two-day period, between the hours of 9:00 and 10:00 A.M. reached peak densities in excess of 1,100 vehicles; while for the return trip, between the hours of 6:00 and 7:00 P.M. peak densities of 1,400 vehicles were realized. The corresponding opposing traffic during these peak hours amounted to only 400 and 300 vehicles respectively. The composition of the traffic using this highway was predominantly passenger car traffic. In 1938, on a normal week day, trucks constituted only eight out of every 100 vehicles. By 1947 this value had increased to 12 percent in contrast to the State-wide average which was in excess of 20 percent. No data were collected relative to speeds on this highway but it is well within reasonable limits to say that on a normal week day the average speed on this highway was from 45 to 50-mi. per hr. with perhaps a small drop in speed for summer week-end outbound traffic. The average speed of the summer week-end inbound traffic was an entirely different matter. During the peak periods of inbound traffic, cars travelled bumper to bumper at snail's pace, and at some locations completely utilized both traffic lanes and some drivers even travelled on the earth shoulders. Due to this "moving barrier" of cars, it was impossible to either enter or cross the existing highway facility for long periods of time. After the completion of this improvement, together with other sections of the highway, the average week-day speed remained at 45 to 50-mi. per hr. and this value held relatively good for the summer week-end outbound traffic. The speed for the corresponding inbound traffic is now in the neighborhood of from 40 to 45-mi. per hr.

The expectation of trouble-free operation on this highway was short lived, for no sooner was it completed and opened to traffic in 1939 than

reports began pouring into the Department complaining of the 24-in. curbed median. Vehicles were running into or straddling the nose of the median at its beginning and it was continuously being "side-swiped" through-out its entire length by drivers attempting to overtake and pass vehicles already operating in the second or passing lane. (Fig. 2). The low visibility of the median, due to its narrow widths, its low height and its lack of color contrast, undoubtedly contributed heavily to the increasing accident record for this section. Adverse criticism by the public against this curb median increased, and in an effort to reduce the accident occurrence, a contract was let on October 11, 1940 for the installation of a Sodium Vapor lighting system at the beginning of the curbed median. Six 10,000 L Sodium Vapor Luminaire units were placed at a total cost of \$2,943.85. The results were very disappointing as accidents still continued to occur at this point.

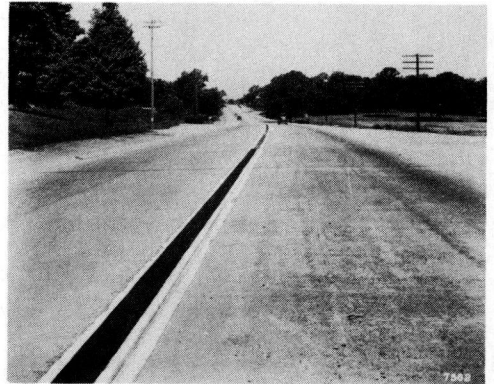


Figure 2. Photo of 24-in. Curbed Median on US Route 12

Ultimately the pressure became so great that on September 25, 1947, a contract was awarded to the same Eric Bolander Construction Company for the removal of this controversial 24-in. curbed median and its replace-

ment with a flush type median. The curbed median was not removed in its entirety but only the raised portion and to a depth of from 1-in. to 2½-in. below the surface of the gutter flags. This area was then filled flush with the edge of the two pavements with a ¼-in. crowned bituminous concrete surface course. The total cost of the curb removal and replacement, together with the few accompanying incidental items, amounted to \$22,309.25.

The reasons for the decision to use a narrow curbed median at this location were the lack of functional data relative to the use of narrow medians and the attempt to answer the question of justification for the expenditure required versus the comparative worth of the proposed feature. Had all additional right-of-way been secured from one side only of our existing highway, plus enough more to have provided for a 30-ft. earth flush median design, the entire right-of-way cost would have been less than twice the amount actually paid on the basis of the narrow median design. As it was, our so-called experimentation with this narrow median cost the State in actual cash outlay a total of \$29,507.07, plus an indeterminate amount to the traveling public in the form of property damage, personal injury and loss of time. From the above, it is evident that there is increasing need for the making of economic analyses to determine the benefits resulting from such an improvement to the cost of that improvement.

In reviewing our experiences with this narrow curbed median, two very interesting questions were raised. First, what effect would access control have had in regard to the reduction of accidents and second, is it possible for the public to become accustomed to separated highway design where such separation exists only for relatively short distances

and as a stage in the ultimate construction of a completed highway? The first is indeed a moot question but the accident reports did not indicate that the accidents were the result of interchange conflicts at the intersecting crossroads or private entrances but rather one of improper highway usage and low visibility. As to the second, it would appear that, if the failure of this narrow mountable curbed median to serve as a traffic control feature in the safe, rapid and efficient movement of traffic was due to the lack of education of the traveling public in the driving of such modernized highways, certainly such education should have been realized during a decade of time.

The continued accident occurrence over the period of years, in spite of the installation of the Sodium Vapor lighting system as a warning of a potential highway hazard, forced us to conclude that the use of a narrow curbed median, even though mountable, on sections under high speed operation created a definite travel hazard due primarily to its low shadow visibility and lack of color contrast and to the driving habits of the general public.

Illinois has another condition of a major highway, also without the benefits of access control, which runs through a residential or urban area, an industrial area and finally transforms into a major street running through residential and ribbon commercial developments. One of the first divided highways in the State was the portion of Route 64 on North Avenue extending from the DuPage-Cook County line eastward to Nagle Avenue in Chicago. The cross section design varied materially within these limits. Beginning at the Cook County line and progressing eastward is one section approximately 1.7 mi. in length having a cross section of 2 at 20-ft. with a 52-ft. depressed median. This is followed by a second

section of 0.85-mi. in length having a cross section of 2 at 20-ft. with a 32-ft. raised earth median drained by low gutter sections along the median side edge of the pavements. A third section approximately 0.33-mi. in length has a cross section of 2 at 20-ft. with a 12-ft. earth median crowned from 12-in. to 18-in. above a low gutter section, and a fourth section approximately 2.08-mi. in length has a cross section of 2 at 21-ft. with a 12-ft. earth median crowned from 12-in. to 18-in. above a low 2-in. curb and gutter section. Then the section under discussion, lying between Thatcher and Nagle Avenues, has a length of approximately 1.95-mi. and a cross section of 60-ft. or 68-ft. face to face of outside curbs with a 4-ft. curbed median and a curb and gutter section 6-in. in height. (Fig. 3). The area through which this section runs is a combination of residential and ribbon commercial development and there is a considerable amount of pedestrian cross traffic. Within this section and between Thatcher and Harlem Avenues a distance of approximately 0.94-mi., the street is 60-ft. face to face of curbs and it is planned at some future period to

widen the pavements to provide three lanes of moving traffic in each direction. Major continuous north and south cross-streets intersect North Avenue approximately every quarter of a mile and at these locations openings in the median, varying from 66-ft. to 100-ft. depending upon the importance of the cross-street, are provided for the interchange of traffic. On the north side of North Avenue there are three intermediate intersecting streets between these major cross-streets while on the south side there are only two intermediate intersecting streets within the same limits. (Fig. 4A). The remainder of this section lying between Harlem and Nagle Avenues, a distance of approximately 1.01-mi., has a street width of 68-ft. face to face of curbs. Within these limits, however, there are no continuous intersecting cross streets as the intersecting streets on the north are offset varying distances from the intersecting streets on the south. Openings through the median, varying in length from 140-ft. to 240-ft. depending upon the offset distance between adjacent north and south streets, are provided at approximately each quarter of a mile. (Fig. 4B). All traffic entering from any of these intermediate intersecting streets are required to turn right into North Avenue and in order to cross or to go left, must proceed to the first major cross-street where either a left or a U-turn through the median can be made. The area through which this improvement runs is relatively level and drainage is taken care of by the usual curb inlets and storm sewers. The barrier-type median is 4-ft. in width and has vertical curb faces 6-in. in height.

As this portion of North Avenue was built by agencies other than the State and in various construction stages, no data is available to the writer, as to the cost of the overall

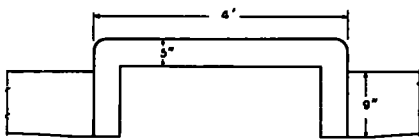
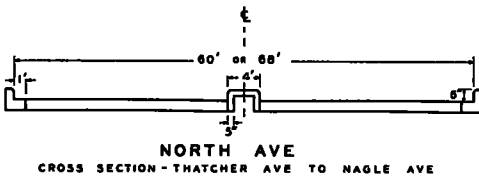
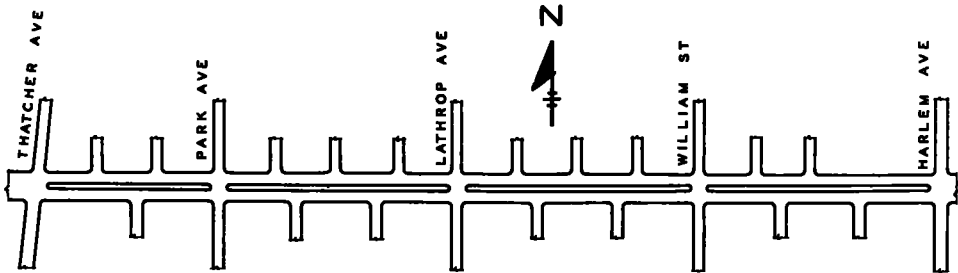
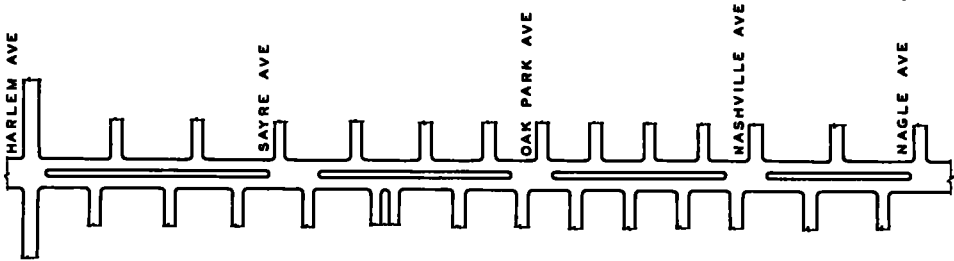


Figure 3.



NORTH AVE.

(A) THATCHER AVE TO HARLEM AVE BEFORE REVISION



NORTH AVE.

(B) HARLEM AVE TO NAGLE AVE BEFORE REVISION

Figure 4.

improvement nor of the median.

Due to the importance of this street as a major arterial highway and to the location thereon, a short distance to the west, of several large industrial plants in addition to numerous commercial enterprises the average daily traffic at this time is in the neighborhood of 25,000 vehicles. The average speed within this section approaches 30-mi. per hr. which, together with the multiple-lane width of street, makes pedestrian crossing a hazardous undertaking. For these reasons, if for no other, a barrier-type median is essential to serve as a pedestrian refuge.

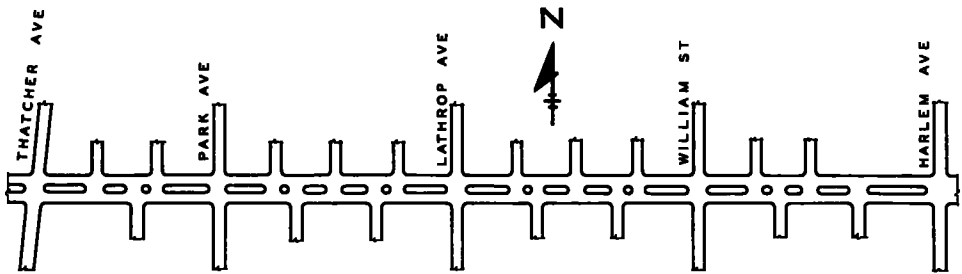
For several years pressure had been brought upon the Department to remove entirely the 4-ft. median in this section and also the 12-ft. median in the section to the west and in addition to permit crossovers, wherever desired by private interests, within the sections having the 32-ft. and the 52-ft. parkways. This pressure was not due to an adverse accident record but to the desire by private and commercial interests for unrestricted ingress and egress to their properties. As previously mentioned, this major street was without the benefit of access control and as a compromise between the elements of safety which

are believed to result from complete separation and the firmly expressed desires of abutters for unrestricted movement, the Department elected to revise the median design to provide openings at all intersecting cross-streets. (Figs. 5A and 5B). By this compromise, certain elements of safety were sacrificed and others were retained such as a general physical separation of opposing streams of traffic and a pedestrian safety refuge.

One comforting incident was injected into the picture in that after the contract was let a signed petition was received by the Department opposing the removal of the 4-ft. barrier-type median. In this instance, had this major street been

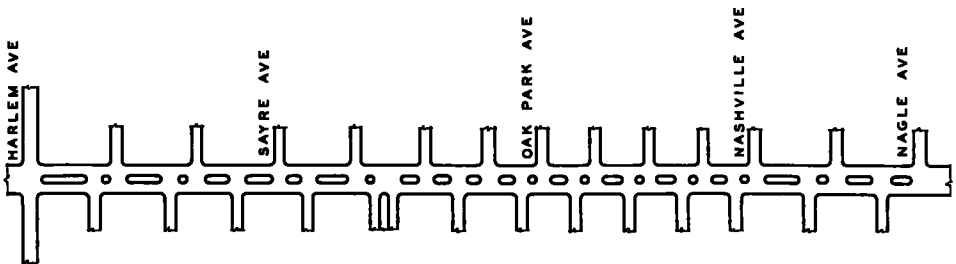
protected with the provisions of access control, it would not have been necessary to jeopardize the safe, free flow of traffic by the numerous openings through the median opposite each of the intersecting cross-streets.

Illinois does not wish to leave the impression that it believes narrow medians do not have their place in modern highway design for that is definitely not the case. On the contrary, they serve admirably well for the channelization and islandization of traffic at important grade intersections and also at specific locations in dual-pavement design where a reduced cross section width is economically essential and when conditioned by proper approach design



NORTH AVE.

(A) THATCHER AVE TO HARLEM AVE AFTER REVISION



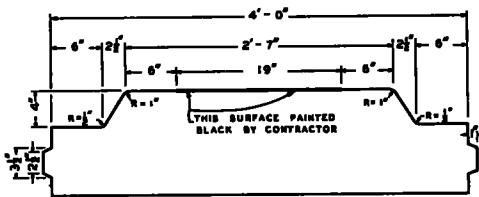
NORTH AVE.

(B) HARLEM AVE TO NAGLE AVE AFTER REVISION

Figure 5.

and the elimination of direct access thereto. An example where such a 4-ft. raised median (Fig. 6) has been used successfully is exemplified on a stretch of US 66 in McLean County known locally as the Bloomington Belt Line. (Fig. 7) This was built during the period from 1939 to 1947 at a total cost of approximately \$1,771,000.00. US 66, except for short local gaps, has been declared a Freeway between St. Louis and Chicago. At this particular location it was designed as a modified freeway with partial access control, wherein direct access from abutting property is restricted to farm units and scattered residences. Right-of-way and modified rights of access in the amount of \$231,738.28 have been purchased on the Belt Line to date and there still remains to be secured rights of access from several parcels, the appraised value of which amounts to \$7,604.05.

The overall length of the Bloomington Belt Line is roughly 9.2-mi. and the general design provides for dual-pavements, each 22-ft. in width, separated by a 30-ft. earth median. At the present time the connecting



BLOOMINGTON BELT LINE
DETAIL OF 4-FOOT CURBED MEDIAN

Figure 6.

highways at either end of the Belt Line consist of but one pavement of the ultimate dual-pavement construction. These are used for two-lane two-way operation. Where the single pavements transform into the dual Belt Line construction, the design is such that approaching traffic

enters its proper one-way pavement either on a straight-line approach or the natural curvature and pavement superelevation is such as to preclude the probability of inadvertent wrong-lane entry.

As this was a modified freeway with partially controlled access, crossovers through the median, varying in length from 10-ft. to 34-ft., were provided at approximately $\frac{1}{2}$ -mi. intervals as turn-around facilities. All traffic entering this highway is required to turn right into the one-way pavement and it is necessary that vehicles desiring to go left must proceed in the direction of travel to the first crossover where they can make a U-turn and then proceed in their desired direction.

Within the length of this Belt Line several major highways and important multiple track railroads are crossed where a separation of grades was essential. Other less important highways and a single track local branch railroad were intersected at grade. Due to economic considerations, the median through those portions which included the highway and railroad separations was reduced to a 4-ft. width. Consequently, within the length of this Belt Line we have numerous median designs which include a short stretch of 40-ft. depressed earth section, a 30-ft. depressed earth section; a 30-ft. curbed earth section; sections, both curbed and depressed, varying in width from 30-ft. to 4-ft.; and a 4-ft. curbed median. The use of the 4-ft. median section is quite justified in this particular instance, and due to the restricted entry into the highway at these points and to the design of the approaches thereto, it has functioned very effectively as a positive separator of opposing streams of traffic.

As the construction of this improvement was spread over an elapsed period of eight years during which our national economy passed from a

state of emergency into one of full scale warfare and thence into our present inflation period, the cost of similar items in the several portions of this improvement varied materially. In the first contract, awarded in September of 1940, the bid price on 4,501-ft. of Combination Curb and Gutter, Type II was \$0.80 per lin. ft. The next contract awarded two months later showed a bid price of \$1.05 per lin. ft. for 3,220-ft. of this same type median while in the third contract, awarded in September 1944, the bid price was \$3.75 per lin. ft. for 1,059-ft. All told, the overall cost of 8,870-lin. ft. of the 4-ft. curbed median amounted to \$10,953.05 for a weighted average of \$1.25 per lin. ft.

US 66 is an important component in the national system of interstate highways and is the major highway link between St. Louis and Chicago.

Serving in this capacity, it carries a large proportion of through traffic of which approximately 25 percent represents commercial vehicles. The average daily traffic on this Belt Line at the present time exceeds 4,700 vehicles. The operational speed on US 66 is quite high and the average speed will exceed 50-mi. per hr. These values hold true for the section of improvement under discussion. The accident record on this improvement does not indicate any unusual trends from normal dual-pavement operational records and there have been no complaints due to the inclusion of the stretches of narrow median.

As mentioned above, the reason for the inclusion of the narrow median in this Belt Line construction was based entirely on economic considerations due to the excessive costs of the long structures requir-

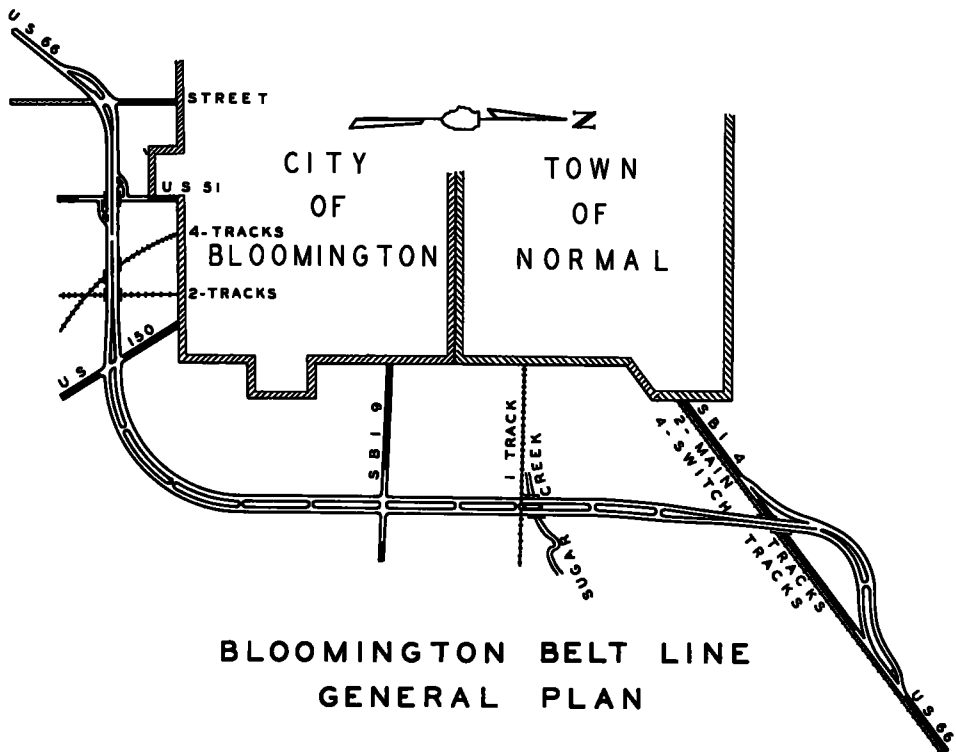


Figure 7.

ed for the various railroad and highway separations. The fact that it has functioned satisfactorily as a physical separator of opposing streams of traffic over the restricted zones of the various separation structures and approaches thereto does not, in itself, necessarily justify its use as a feature of dual-pavement design to the exclusion of wider medians for we have found that they have many objectional shortcomings. The narrow median does not separate opposing streams of traffic sufficiently to eliminate approaching head-light glare. Neither does it relieve the feeling of constriction in multiple-lane highway operation, nor does it eliminate the probability of vehicles figuring in an accident on one highway from ending up in the opposing lanes of traffic. Left turning lanes are precluded and little protection is offered for crossing vehicles. Another limita-

tion of the narrow median is that it does not provide sufficient width for the placement of signs, traffic signals and structural appurtenances. A narrow curbed median, even though mountable, creates a definite travel hazard due primarily to its low shadow visibility and usual lack of color contrast. Another objection to the use of narrow medians is in the matter of maintenance, particularly as regards snow removal or storage.

In conclusion, we wish to reiterate that narrow medians have a definite place in modern highway design especially for the channelization of approach pavements to grade separations; the islandization of traffic at important grade intersections; and at specific locations in dual-pavement design where a reduced cross-section design is economically essential providing that proper approach conditions are met and where cross-conflict or turning movements are limited.