Major Route Improvements

JAMES L. FOLEY, JR.
Commissioner of Transit and Traffic
City of Baltimore

Major route improvements fall into two general categories. The first is major physical improvements involving the expenditure of relatively large sums of money. The other is the use of traffic control measures either as extensive applications of one measure or a combination of several measures which together form a significant improvement.

Major physical improvements consist of widening, reconstruction, addition of medians, etc. The use of a series of traffic control measures is the second type of major route improvement. One example of this technique is the Wisconsin Avenue Study in Washington, D. C., which was presented in the BPR report "Increasing the Traffic Carrying Capability of Urban Arterial Streets." Another is the Jackson Boulevard study reported in Highway Research Board Proceedings, Volume No. 30.

There may be some feeling that the first category should not be included as a traffic engineering measure; however, many engineers believe that when street improvements are made, the traffic engineer should participate through the application of traffic engineering measures in order to obtain the greatest possible benefit. How he participates will vary depending on the type of organization in which he works. In some cases, he will be part of the highway or street department where he can exert his influence on the designer rather directly. In other cases, the traffic engineering department is completely separated, as it is in Baltimore. In this case, good liaison is required to assure that the best traffic engineering features are included in the design.

The effectiveness of an improvement can be measured by several criteria—the most important of which is probably accident reduction. Operating improvements such as increased capacity, improved operating speeds, and reduced delays are also important. The ideal solution would be one which resulted in improvements in all categories; however, the reduction of accidents without significant volume change or an increase in volume without an increase in accidents could both be considered effective.

In Baltimore, a major physical improvement was made to Druid Park Lake Drive. A 40-ft wide, two-way highway was widened to provide two 32-ft roadways with a 4-ft curbed median separating opposing traffic flows. Volume and accident data are given in Table 1, which is an example where the effectiveness of the improvement showed up as reduced accidents. The improvement may be somewhat more significant than would appear from figures, Table 1, because of a bias in the traffic count. This was due to a temporary closure of one of the major feeders from the north. During approximately one-half of the accident reporting period, this approach from the north was closed to traffic.

TABLE 1
DRUID PARK LAKE DRIVE[a]

Item	Before	After	Change (%)
Width	40 ft	Two 32-ft roadways plus 4-ft median	—
ADT	28,900	28,200	-2
Injury accidents	11	9	-18
Total accidents	39	30	-23

[a]Length of reconstruction, ½ mile.

It became apparent in the development of the data for this paper that before-and-after studies often require analysis of a complete system, or at least, an examination of what might be happening on adjacent thoroughfares. In the northwest portion of Baltimore, Jones Falls Valley forms a major traffic barrier. The character of the Valley limits the number of crossings possible. Two of these crossings are Northern

TABLE 2

NORTHERN PARKWAY[a]

Item	Before	After	Change (%)
Width	22 ft	Two 36-ft roadways plus 16-ft median	–
ADT	14,700	26,500	+79
A.M. peak hour	1,135	2,995	+172
P.M. peak hour	1,410	2,385	+69

[a]Length of reconstruction, 1 mile.

TABLE 3

COLD SPRING LANE[a]

Item	Before	After	Change (%)
Width	36 ft	50 ft	–
ADT	28,300	36,200	+28
A.M. peak hour	2,300	2,200	-4
P.M. peak hour	2,670	3,810	+43

[a]Length of major street widening, 3/4 mile.

Parkway and Cold Spring Lane. Both thoroughfares have been improved in recent years.

The Northern Parkway improvement was a major reconstruction of a magnitude which might be called a semi-expressway. It replaced a narrow 22-ft wide highway.

Traffic volume on Northern Parkway increased from an ADT of 14,700 before to 26,500 after. Additional data are given in Table 2.

Cold Spring Lane was widened from a 36-ft two-way road, to 50 ft. No significant alignment changes were made. While the Cold Spring Lane traffic increases were not as large, they were, nevertheless, significant. The daily traffic increased from 28,300 to 36,200, as given in Table 3. These significant volume increases occurred without a measurable change in accidents.

Widening roadways within the available right-of-way is probably the least expensive method of improving the capacity of a major street. Dundalk Avenue in Baltimore is an example of such an improvement. Before its improvement, it consisted of two 24-ft roadways separated by a wide median. The median was not particularly scenic, and in its early days, had been the right-of-way for interurban service to Sparrows Point. The improvement consisted of widening the two roadways to 36 ft and providing separate left-turn lanes in the median. Traffic data are given in Table 4.

Traffic volumes increased from 16,900 without transit vehicles to 20,250 including buses. Unfortunately, records do not show the improvement in operating speed, but a visual analysis indicates that the operating characteristics raised from level of service F to approximately D. The improvement raised the capacity of Dundalk Avenue to a point greater than that of the approach streets which supply traffic to it.

An example of the benefits obtained from limiting the opportunities for making left turns is the reconstruction of Skokie Boulevard in Skokie, Ill. Extensive commercial activity with numerous driveways resulted in a high incidence of mid-block accidents. Before the reconstruction, this type of accident accounted for 60 percent of the total.

The reconstruction consisted of widening a 56-ft two-way facility to two 36-ft roadways separated by a median with left-turn bays. Consolidating all turns at the cross streets required the addition of a multiphase traffic signal. The accident reduction was impressive, especially in the face of a city-wide increase of 26 percent. As would be expected, intersection accidents increased due to revised driving patterns. Data are given in Table 5.

TABLE 4

DUNDALK AVENUE[a]

Item	Before	After	Change (%)
Width	Two 24-ft roadways plus median	Two 36-ft roadways plus median	–
ADT	16,940	20,250	+20
A.M. peak	1,170	1,770	+51
P.M. peak	1,650	2,130	+29

[a]Length of reconstruction within right-of-way, 1 1/4 miles.

TABLE 5

SKOKIE BOULEVARD[a]

Item	Before	After	Change (%)
Width	56 ft	Two 36-ft roadways plus median	—
Total accidents	151	98	-35
Injury accidents	62	38	-39
Intersection accidents	59	75	+27
Mid-block accidents	92	23	-75

[a]Length of widening, ½ mile.

In 1963 the remaining streetcars were removed from Baltimore. This permitted application of specialized traffic engineering techniques such as left-turn lanes and improved traffic signal timing. In a 4-mile portion of the York Road-Greenmount Avenue System, it was possible to use both techniques. At two locations where the street is over 50 ft wide, by the use of pavement markings the center 10 ft was allocated as left-turn lanes. In addition, a PR traffic control system was installed on the northern portion of the system. Data are given in Table 6.

In the morning peak, the trip time decreased from 18 to 16 min. In the afternoon peak, the improvement in travel time was slightly better, from 19 min before to 15 min after.

These changes occurred in the travel time while traffic volumes increased 29 percent, from 16,900 to 21,600 ADT. Peak-hour experience was even more startling in that the morning peak direction traffic volume increased 55 percent, and the afternoon outbound increase was a surprising 170 percent. Undoubtedly, the large increase in volume partially accounted for the small change in running time and delays.

An additional benefit, for which no numerical value can be given, is the elimination of left-turn traffic from several residential streets. In one of the cases where the left-turn lane was provided, the turns could be allowed during the peak hour. These had been prohibited before due to delays which they caused to the fixed-wheel transit vehicles. Based on after traffic counts, some 200 to 250 left-turns "loopers" were removed from the residential side streets, which are heavily used pedestrian routes for school children.

To show that all improvements are not necessarily going to be successful, there is the case of a street widened from a winding, two-lane highway to a less winding, four-lane highway which resulted in traffic reducing from 15,200 veh/day to 6900 veh/day. This reduction is not due to any inherent failure of the improvement, but

TABLE 6

GREENMOUNT AVENUE-YORK ROAD[a]

Item	Before	After	Change (%)
Inbound:			
Peak travel time	18 min	16 min	-11
Number of delays	8	9	+12
Total delay	5 min 12 sec	3 min 39 sec	-30
Peak-hour volume	730	1130	+55
Outbound:			
Peak travel time	19 min	15 min	-21
Number of delays	10	10	0
Total delay	5 min 23 sec	4 min 46 sec	-11
Peak-hour volume	570	1550	+170
ADT	16,900	21,600	+28

[a]Length of improvement, 4¼ miles.

rather to the concurrent opening of a parallel freeway. It is likely, however, that the money has not been wasted because the street serves an area which has a very high growth potential. Several large apartment buildings are now under construction.

CONCLUSIONS

In view of the increasing volumes all over the nation, it is apparent that we must continue to provide for this growth. The cited examples show that both techniques, reconstruction and extensive applications of traffic control measures, are required to accomplish this goal.

Addenda

PHOENIX, ARIZ.

Major Street Improvement Examples

24th Street—McDowell to Thomas. This street was reconstructed in 1962. Prior to this, it was a two-lane street which flared to four lanes at major intersections. The pavement width varied from 28 ft in mid-block sections to approximately 44 ft at major intersections. The street was improved to a 64-ft pavement width with curbs and gutters, and was marked for four lanes throughout. Left-turn channels were provided at all important intersections.

Accident Data:

Before (6/1/61 to 6/1/62):
Total accidents = 29
Accident rate = 5.86 Acc./MVM
After (6/1/63 to 6/1/64):
Total accidents = 32
Accident rate = 4.43 Acc./MVM (26% reduction)

Traffic Volumes:

ADT:
Before (1962) = 13,600
After (1966) = 23,100 (70% increase)
Peak hour:
Before (1962) = 603
After (1966) = 1383 (130% increase)

Travel Time (Average Speed):

Before (1962) = 23.3 mph
After (1966) = 26.8 mph (16% increase)

Cost:

Engineering	=	$ 42,400
Right-of-way	=	140,000
Construction	=	293,100
Total		$475,500

Plus storm drain = $179,000

7th Street—Camelback to Bethany Home. This street was reconstructed in 1965. Prior to this, it was a two-lane street which varied from 25 to 35 ft in width along mid-block sections, and flared out to a four-lane street of 40 to 45 ft in width at major intersections. The street was reconstructed to a 64-ft pavement width with curbs and gutters. All curb parking was prohibited, and the street was marked for four lanes with a painted median which is converted to left-turn channels at street intersections.

Accident Data:

Before (9/27/64 to 3/27/65):
Total accidents = 28
Accident rate = 8.64 Acc./MVM
After (9/27/66 to 3/27/67):
Total accidents = 23
Accident rate = 6.46 Acc./MVM (25% reduction)

Traffic Volumes:

ADT:
Before (1964) = 17,900 to 17,600
After (1966) = 21,000 to 18,100 (10% increase)

Travel Time and Delay Rate:

Average speed:
Before (1962) = 25.2 mph
After (1966) = 30.2 mph (25% increase)

Delay rate:
Before (1962) = 296
After (1966) = none

Cost:

Engineering	=	$ 31,100
Right-of-way	=	157,000
Construction	=	311,200
Total		$499,300

7th Avenue Railroad Overcrossing. This overcrossing was completed in March 1967. Prior to construction, this section of 7th Avenue was a two-lane street, approximately 30 ft wide along mid-block sections, and flared to four lanes at major intersections. Traffic was required to cross 17 sets of railroad tracks at grade along this half-mile section. The overcrossing was constructed to provide four lanes of traffic, separated by an 8-ft raised concrete median divider. A right-turn lane was added at the termination of the structure at its intersection with a major one-way street at the north end and a left-turn lane was provided south of the structure at its intersection with a two-way major street.

Accident Data:

Before (2/18/65 to 2/18/66):
Total accidents = 26
Accident rate = 15.6 Acc.

Traffic Volumes:

ADT:
Before (1965) = 10,900

Travel Time and Delay Rate—Before:

Average speed = 16.7 mph
Delay rate = 835 min/mph

Cost:

Engineering	=	$ 67,900
Right-of-way	=	300,000
Construction	=	1,295,000
Total		$1,662,900

TABLE 7

SKOKIE BOULEVARD–CHURCH TO SIMPSON

Location and Accident Type	Number of Accidents		Change (%)
	Before[a]	After[b]	
Stage 1[c]			
Intersections			
Property damage	13	37	+185
Injury type	20	22	+ 10
Subtotal	33	59	+ 78
Midblock			
Property damage	52	13	- 75
Injury type	31	8	- 74
Subtotal	83	21	- 75
Total Stage 1	116	80	- 31
Stage 2[d]			
Intersection			
Property damage	18	9	- 50
Injury type	8	7	- 13
Subtotal	26	16	- 38
Midblock			
Property damage	6	1	- 83
Injury type	3	1	- 66
Subtotal	9	2	- 78
Total Stage 2	35	18	- 49
Total All	151	98	- 35

[a]1962 and 1963 for Stage 1, 1962 only for Stage 2.
[b]1965 and 1966 for Stage 1, 1966 only for Stage 2. (Average annual number of city-wide accidents increased 26 percent from 1962/63 to 1965/66.)
[c]1800-ft length, including two major intersections.
[d]800-ft length, including one major intersection.

The before data show a serious accident problem combined with low average speed and relatively high congestion (delay rate). The after studies will be completed after a comparable time period has elapsed.

SKOKIE, ILL.

Major Route Improvement

Skokie Boulevard was a 56-ft wide north-south major arterial, without parking. Abutting land use includes a community discount center, a neighborhood shopping center, two restaurants, a motel, a large bowling alley, and a large indoor theater. Total parking of these uses is 2300 spaces.

It was widened to six-lane divided, with a barrier median and recessed left-turn bays. Access to abutting land uses was reoriented to a new cross street. This intersection was signalized.

Stage 2 extended the same design one block north to Simpson. The Simpson intersection had 3 three-lane approaches and 1 two-lane approach. Each approach was widened to four lanes, including recessed left-turn bays for all legs, and recessed right-turn bays on two legs. Peak-hour entering traffic at the heaviest intersection is 3400.