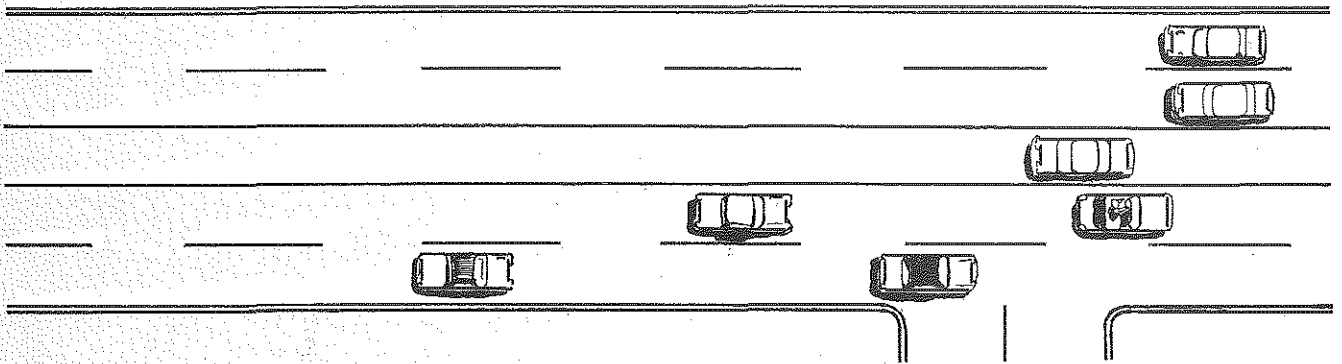
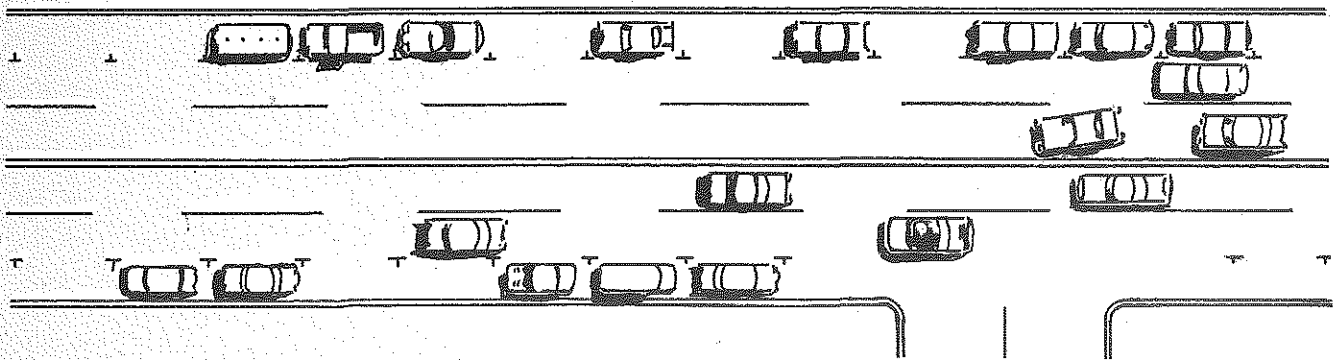


EVALUATION OF A REMOVAL OF CURB PARKING AND CONVERSION TO 5 LANE STREET OPERATION



M-153 (FORD ROAD) IN GARDEN CITY

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TRAFFIC AND SAFETY DIVISION

NOVEMBER 1968

EVALUATION OF
THE REMOVAL OF CURB PARKING
AND CONVERSION TO FIVE LANE STREET OPERATION

M-153 (Ford Road) through Garden City

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Michigan Department of State Highways
November 1968

ACKNOWLEDGEMENTS

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Synopsis

This study is part of a series of parking removal studies being conducted on Michigan trunklines by the Traffic & Safety Division of the Michigan Department of State Highways.

It involves an evaluation of parking removal on 3.25 miles of M-153 (Ford Road) within the corporate limits of Garden City which has a population of 40,000. In conjunction with the parking removal, the laneage was increased from four to five lanes providing a center lane for left turns.

The location had an accident reduction of 24% (659 to 501) in the two year period after the improvement. The cost of the project was \$5,347 and the cost benefit during the two years "after" the improvement was \$153,300.

Introduction

Parking removal is very desirable for functional traffic flow since it reduces accidents and increases the efficiency of traffic movement. However, both the public and merchants often oppose parking removal. The public oppose the inconvenience of a longer walking distance to the shopping establishments, and the merchants fear a loss in business.

In an effort to determine the merits of parking removal, the Michigan Department of State Highways is conducting a series of studies along trunklines where parking was removed.

The Location

This report, the first of a series, involves parking removal within the corporate limits of Garden City which is located on a major east-west trunkline (M-153). The study area covers 3.25 miles of M-153 within Garden City. M-153 lies between I-94 (Ford Freeway) in the City of Detroit, Wayne County, and M-14 freeway in Washtenaw County, a distance of approximately 25 miles (See Figure #1).

Garden City, approximately six and one-half square miles in area with a population of 40,000, is a suburb of Detroit. It is a residential city and does not have a major industrial development. The study location however, is highly commercialized.

The Economic Background

Garden City is a continuously growing community as evidenced by the figures in Table #1.

TABLE #1

<u>Year</u>	<u>Garden City Population</u>	<u>% of Change</u>	<u>Wayne County Population</u>	<u>% of Change</u>
1962	38,700		2,666,297	
1963	39,200	+1.27%	2,666,297	0%
1964	40,000	+2.00%	2,652,100	-0.53%
1965	40,000	0.00%	2,657,300	+0.19%
1966	41,400	+3.38%	2,654,900	-0.09%

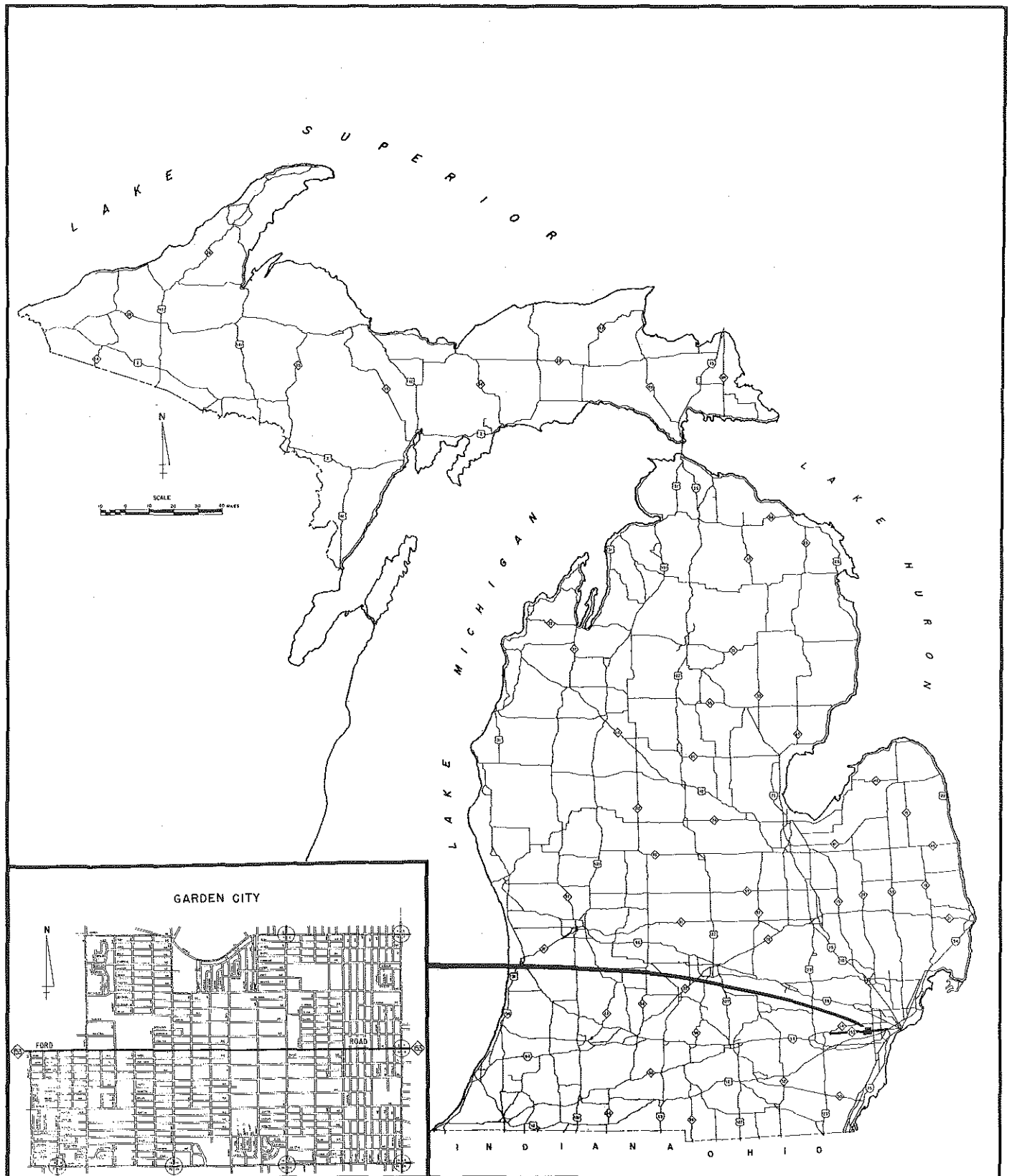


FIGURE I

Rapid commercial development in Garden City (primarily along M-153) is indicated by increasing sales tax collections (See Table #2).

TABLE #2

<u>Year</u>	<u>Total tax collected from Wayne County</u>	<u>Total tax collected from Garden City</u>	<u>% of Garden City tax collected against Wayne County total</u>
1961-62	\$152,329,509	\$1,285,803	0.84%
1962-63	161,629,594	1,449,320	0.90%
1963-64	171,143,476	1,640,021	0.96%
1964-65	189,185,773	1,906,770	1.01%
1965-66	204,952,459	2,561,769	1.25%

The Traffic Problem

Due to a severe traffic problem (659 accidents in a two year period) the Garden City officials requested the Michigan Department of State Highways to investigate and help alleviate the problem. The request initiated a Department review of the hindrances to traffic involving such related factors as; sight distance from abutting driveways, and interruption to through traffic caused by parking activity and vehicles executing left turns from the left through lane.

It was soon apparent that the continually increasing traffic volume (See Table #3), coupled with the hindrance of the left turn movement and the parking activity, had caused the resultant delay to through traffic creating the potential for rear-end and sideswipe accidents. As a result of the review the Department recommended the prohibition of parking along the 3.25 mile section of M-153 and the conversion of the 64 foot wide roadway from four traffic lanes plus two parking lanes to five traffic lanes including a center lane for left turns.

TABLE #3

AVERAGE DAILY TRAFFIC

<u>Year</u>	<u>West City Limits</u>	<u>East City Limits</u>	<u>Average Count</u>
1962	14,000	23,000	18,500
1963	15,000	25,000	20,000

TABLE #3 (Contd.)

<u>Year</u>	<u>West City Limits</u>	<u>East City Limits</u>	<u>Average Count</u>
1964	14,200	28,000	21,100
1965	18,000	33,000	25,500
1966	22,000	40,000	31,000

The Parking Removal

1. In the regular council meeting of October 14, 1963, the City passed a resolution agreeing to parking removal on M-153 (Ford Road) through the City.
2. On July 8, 1964, the following changes were made:
 - a. The parking was removed and "NO PARKING AT ANY TIME" signs were erected on the 3.25 miles of M-153 (Ford Road) in Garden City. See Figure #2 and #3 for details.
 - b. The roadway began operating as a five lane section.
 - c. "NO LEFT TURN" (7:00 A.M. to 9:00 A.M. & 3:00 P.M. to 6:00 P.M.) signs were removed at the intersections of Merriman Road, Henry Ruff Road, Middlebelt Road and Harrison Road for both eastbound and westbound traffic. At the intersection of Inkster Road the "NO LEFT TURN" was in effect for eastbound traffic only.
3. The installation of overhead "CENTER LANE FOR LEFT TURN ONLY" signs was completed on August 28, 1964.

The Accident Analysis

TABLE #4

ACCIDENT RECORD TABLE

<u>TYPE OF ACCIDENT</u>	<u>BEFORE</u>		<u>AFTER</u>	
	July 8, 1962 to July 7, 1964		August 29, 1964 to August 28, 1966	
<u>Total Accidents Involving M-153 Traffic</u>	659		501	
Property Damage	384		266	
Injury	272(445)*		228(396)*	
Fatal	3(4*,4**)		7(8*,8**)	
	<u>Intersec-</u>	<u>Mid-</u>	<u>Intersec-</u>	<u>Mid-</u>
	<u>tional</u>	<u>block</u>	<u>tional</u>	<u>block</u>
<u>Involving Parked Cars</u>	1	47	0	1***
<u>Rear-end</u>	96	87	82	73
<u>Right Angle</u>	57	5	36	2
<u>Type of Left Turn Accidents</u>				
Angle	79	19	84	17
Turning from Wrong Lane	17	7	12	7
Rear-end	53	48	10	9
<u>Type of Right Turn Accidents</u>				
Turning from Wrong Lane	18	6	18	14
Rear-end	10	12	21	13
<u>Other Accidents</u>				
Lost Control	2	16	9	22
Pedestrian Crossing	4	7	6	9
Sideswipe	7	36	12	22
Variety	9	16	7	15

*Number of persons injured.

**Number of persons killed.

***Fatal accident.



FIGURE #4

M-153 (Ford Road) after the parking removal and conversion to five lane street operation.

The Results

The additional usable street width, resulting from parking removal provided a center lane for left-turning vehicles and more adequate lane width for the through traffic lanes. The center lane allowed the removal of the left-turning vehicles from a through traffic lane, thereby increasing efficiency and safety. This is dramatically evidenced by the reduction of left turn rear-end accidents which were reduced by 81.3% (101 to 19, see Table #4) while the traffic volume increased sharply from 19,900 to 25,900 (See Appendix B and Table #3).

Table #4 further shows that: 1) the involvement of parked cars in accidents has virtually disappeared (48 before and 1 after). The one accident during the "after" period was in violation of parking prohibition; 2) in addition to the reduction of left turn rear-end accidents, there were also reductions in rear-end, right angle and sideswipe accidents which may be attributed to the five lane operation because such operation lessens the interruption to through traffic; 3) two types of left turn accidents (the right angle and turning from the wrong lane) did not change appreciably; 4) the right turn rear-end accidents increased at the intersection. This accident increase can be attributed to the lack of "shelter" from the parked vehicles, for those executing a right turn, since the outside lane was converted from a parking lane into a through lane; and 5) sideswipe accidents decreased. The parking removal apparently eliminated the interruptions to through traffic caused by the parking operations, which forced the vehicles in the right lane of the four lane section to weave and create a potential for sideswipe accidents.

Conclusion

It is concluded that the statistically significant 24% reduction in accidents*, coupled with a 32% traffic volume increase, is attributable to the removal of parking and utilizing the added pavement width for left turn movements. Also, the cost of the project \$5,347, which resulted in decreasing accidents, incurred a public benefit of \$153,300 in a two year period following the improvement.**

*See Appendix A for statistical analysis.

**See Appendix B for a cost benefit evaluation.

APPENDIX "A"

The Significance of the Accident Reduction

The percentage of total accident reduction for the two year "before" period and two year "after" parking removal and conversion to five lane operation on M-153 is: $100 \times \frac{659-501}{659} = 24\%$

To establish the significance of this improvement we can assume a Poisson distribution and condition on total number of accidents.*

This leaves the following limits of confidence bounds of percentage of improvement:

$$2 - \frac{1}{\frac{x}{n} - \frac{\frac{1}{2}B}{\sqrt{n}}} < P < 2 - \frac{1}{\frac{x}{n} - \frac{\frac{1}{2}A}{\sqrt{n}}}$$

where

x = number of samples for "before" period = 659

n = total number of samples for "before" and "after" period
= 659+501 = 1,160

A and B = probability limits for the "Binomial" distribution approximated by normal distribution

For 90% level of confidence A = - 1.64 & B = + 1.64

and

P = percentage of improvement

therefore

$$2 - \frac{1}{\frac{659}{1160} - \frac{0.82}{\sqrt{1160}}} < P < 2 - \frac{1}{\frac{659}{1160} + \frac{0.82}{\sqrt{1160}}}$$
$$0.165 < P < 0.31$$

These figures are based on the total number of accidents. The percent improvement is significantly greater than 16.5% at the 10% level, while the observed improvement was 24%.

*For details see the article "Statistical Methods of Poisson Processes and Experimental Populations" by Allen Barenbaum which appeared in AMERICAN STATISTICAL ASSOCIATION JOURNAL of June, 1954.

APPENDIX "B"

Cost Analysis

A method of evaluating accident costs is given in the Roy Jorgenson report of Highway Safety Improvement Criteria, page 67 of Mr. Jorgenson's report contains the method that is used below to evaluate monetary savings at the subject location studied. This same method is given in the Bureau of Public Roads IM21-3-67.

In the following analysis the costs as provided by the National Safety Council are:

Death - \$34,400

Non-fatal injury - \$1,800

Property Damage Accident - \$310

$$B = \frac{ADT_a}{ADT_b} (Q \times A_{fi} \times P_{fi} + 310 \times A_{pd} \times P_{pd})$$

where

B = annual benefit in dollars

$$ADT_a = \text{average traffic volume after the improvement} \\ \frac{21,100 + 25,500 + 31,000}{3} = 25,900$$

$$ADT_b = \text{average traffic volume before the improvement} \\ \frac{18,500 + 20,000 + 21,100}{3} = 19,900$$

A_{fi} = annual average number of fatalities and injuries combined at the location during the two years before (445+4+4=453)

$$P_{fi} = \text{percentage reduction in fatalities and injuries} \\ \frac{(453-412)}{453} \times 100 = 9.05\%$$

A_{pd} = property damage accidents in the two years before (384)

$$P_{pd} = \text{percentage reduction in property damage accidents} \\ \frac{(384-266)}{384} \times 100 = 30.8\%$$

$$Q = 34,400 + \frac{(I/F \times 1800)}{1+I/F}$$

Cost Analysis (Contd.)

where

I/F = ratio of injuries to fatalities that occurred state-wide during 1965 in cities with a population of over 25,000

$$I/F = \frac{84,368}{569} = 148$$

therefore

$$Q = \frac{34,400 + (148 \times 1800)}{1+148} = 1,950$$

Then the computed two years benefit in dollars for the two years after the completion of this project is:

$$B = \frac{25,900}{19,900} (1,950 \times 453 \times \frac{9.05}{100} + 310 \times 384 \times \frac{30.8}{100})$$

$$B = \$153,000 \text{ (for two years benefit in dollars)}$$

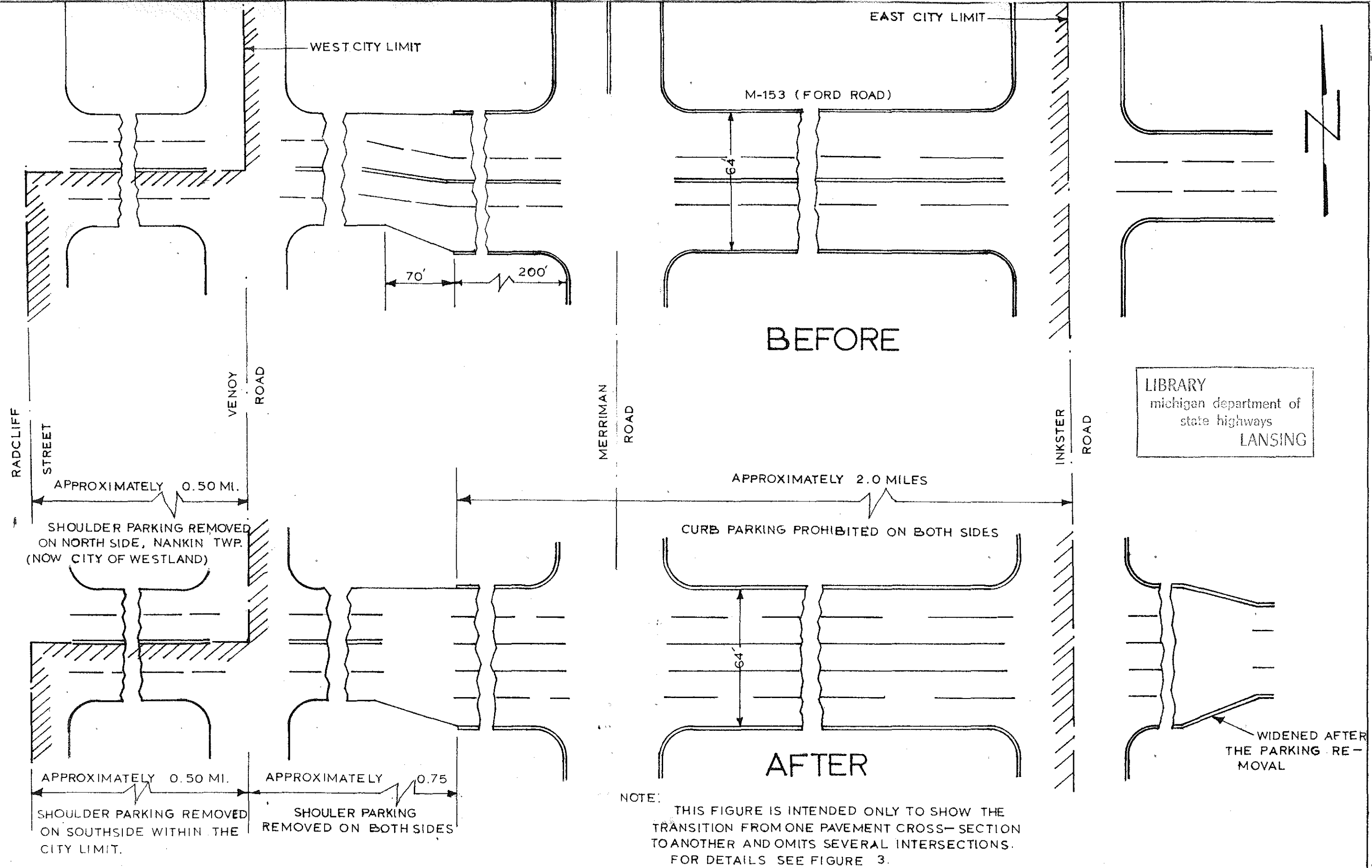
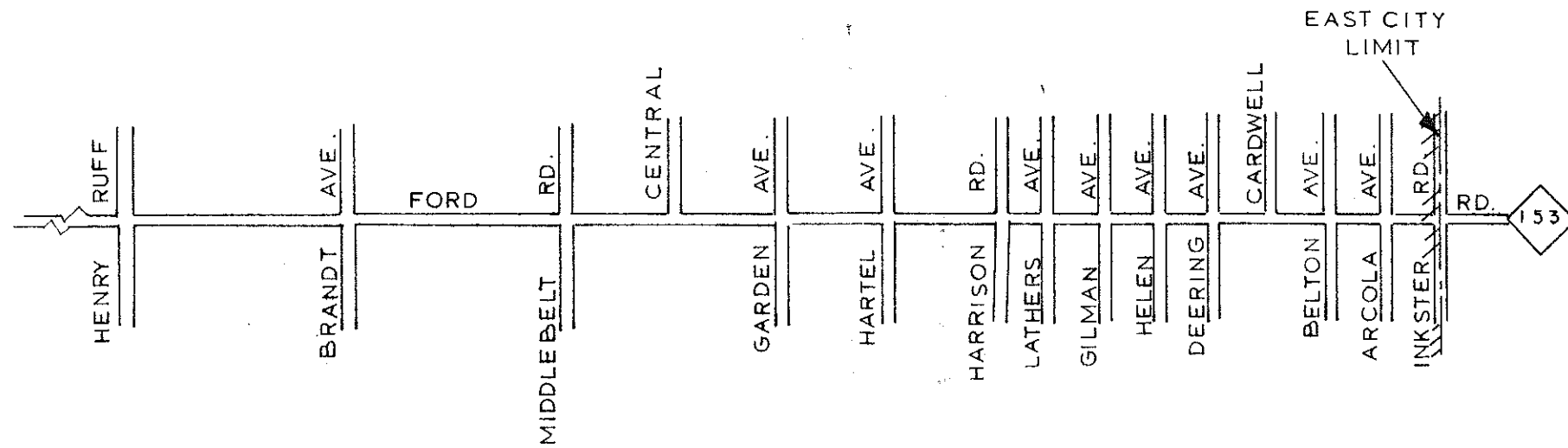
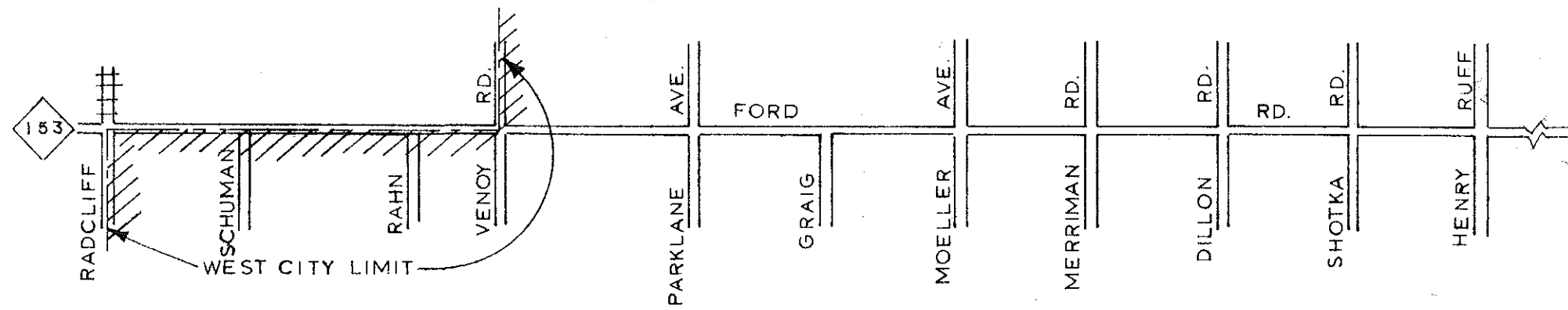


FIGURE 2



M-153 (FORD RD.)
GARDEN CITY

FIGURE 3

