Effect of Northwest Expressway on Alternate Arterial Streets

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•AT THE Sagamore Conference on Highways and Urban Development (1), the following observation was made:

> In order to properly locate new highways in existing urban areas, we need to know more about the highways' effect on the area and the area's effect on highway design and location requirements.

Bacon (2) states that the objective of a metropolitan highway system is to aid in the movement of people and goods within a metropolitan area with maximum economy, efficiency, and dispatch. An analysis of the benefits of an expressway, therefore, should include the before and after traffic characteristics on all major streets in the area of the new highway. Generally, planning engineers compute savings in time, fuel, and accidents on expressways and do not analyze benefits derived by vehicles remaining on old routes after traffic is diverted to the expressway.

This study includes before and after comparisons of travel time, fuel consumption, accidents, and other factors relating to highway benefits on major arterial streets serving as alternate routes to the new Northwest Expressway in Chicago. It is the purpose of the study to determine if there are any additional benefits to motorists using these alternate routes. Such information should be considered in the development of feasibility studies made in conjunction with contemplated expressways.

Because time and fuel saving are two of the most important benefits that accrue to users through highway improvement, much study has been devoted to them. Experience has shown that wherever stop-and-go maneuvers are reduced, the amount of fuel saving is quite noticeable (3). This benefit can be fairly accurately calculated. The amount of time motorists save on one facility as compared to another is difficult to measure in relation to monetary savings. However, despite the absence of reference to monetary saving, this report does seek the actual time saved with the thought that such information could be used for analytical purposes.

DESCRIPTION OF PROJECT STUDY

Northwest Expressway

The Northwest Expressway was opened to traffic November 5, 1960. It is part of Chicago's comprehensive system of radial highways. From its junction with Congress Expressway at the Halsted Interchange, it spans 16 miles of the city to link the central business district (CBD) with the Northwest suburbs and O'Hare International Airport (Fig. 1). Its first junction is with Edens Expressway and later the Northwest Tollway.

Between downtown and Edens Expressway, it consists of four lanes in each direction, separated by two additional lanes which are used for reversible lane movements during the rush hours. This portion of the expressway carries approximately 160,000 vehicles per day (4).

Alternate Routes

This study could not undertake a detailed analysis of all major arteries affected by

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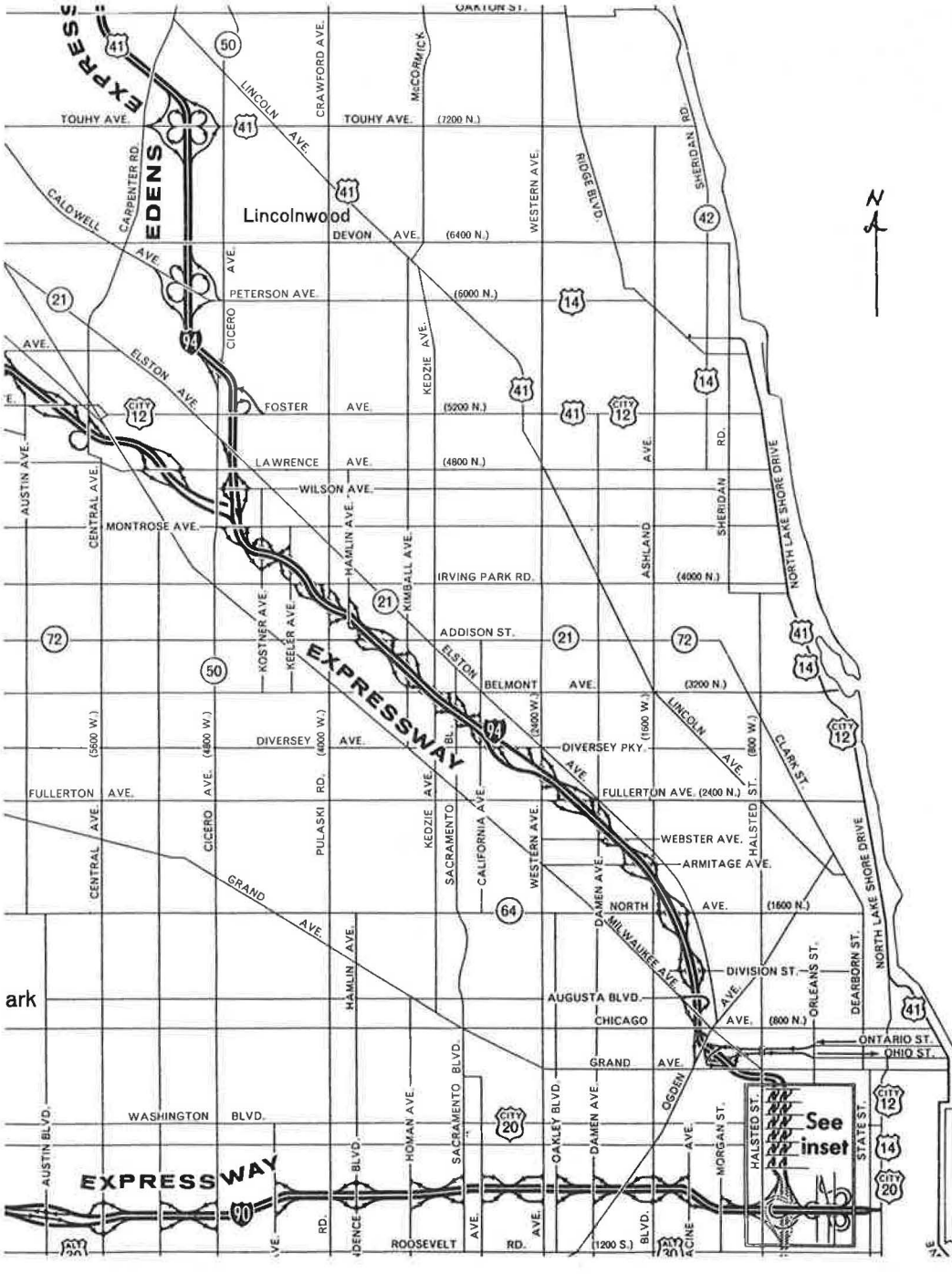

Figure 1. Study area.

the Northwest Expressway. Therefore, several important streets were selected as typical examples. For a more realistic comparison, several arteries were grouped to represent typical routes followed by motorists from the northwest side of Chicago to the CBD. The information derived from these data was used as a basis for all routes

influenced by the Northwest Expressway. The study routes are described as follows:

Route 1.—This route starts at the intersection of Cicero and Lincoln Avenue in Skokie and terminates in the CBD at Lake Shore and Ohio (Fig. 2). Its various sections are as follows:

Street	Section	No. of Miles
Lincoln Avenue	Cicero to Peterson	3.3
Peterson-Ridge-Hollywood	Lincoln to Sheridan Rd.	3.5
Lake Shore Drive	Hollywood to Ohio	7.3
	Total	14.1

Route 2.—This route beginning at Foster and Cicero was used for travel to the CBD:

Street	Section	No. of Miles
Foster Ave.	Cicero to Lincoln	3.0
Foster Ave.	Lincoln to Lake Shore Dr.	2.1
Lake Shore Dr.	Foster to Ohio	6.4
	Total	11.5

Route 3.—This route closely parallels the Northwest Expressway for almost its entire length. It was studied from Cicero on the north to North Avenue at the south for 6.9 mi. It does not terminate at the CBD but is part of a typical route to that area.

Summary

The analysis of this report covered a total of 32.5 mi of arterial streets, including Lake Shore Drive from Hollywood. The following studies were made on these routes before and after the opening of the Northwest Expressway:

1. Gas consumption.
2. Travel time.
3. Traffic volume.
4. Accident experience.

GAS CONSUMPTION

One of the major factors which measures the economy of a street system is the fuel consumption performance of a vehicle. Many studies have been made showing the relationship between frequent start-and-stop operations and fuel performance. Although overall speeds are increased where stop-and-go operations are reduced, the fuel saved from constant acceleration, idling, and deceleration surpasses the increased consumption due to speed (3).

Careful measurements were made of fuel consumption performance under similar conditions before and after the opening of the expressway. Each of the three routes were frequently traveled by a 1958 Chevrolet. The amount of gasoline consumed in each run was measured by a Vacumat gasoline mileage tester. In this device, the main gas source is disconnected and fed through a $^{1}/_{10}$-gal glass burette mounted on the inside door of the vehicle. The operator can easily measure the amount of fuel consumed in relation to distance traveled. The instrument used in this study is shown in Figure 3.

Tables 1 and 2 give the results of all the gas tests.

Datail of Gas Consumption Study

Details of the gas consumption study are given in Table 3.

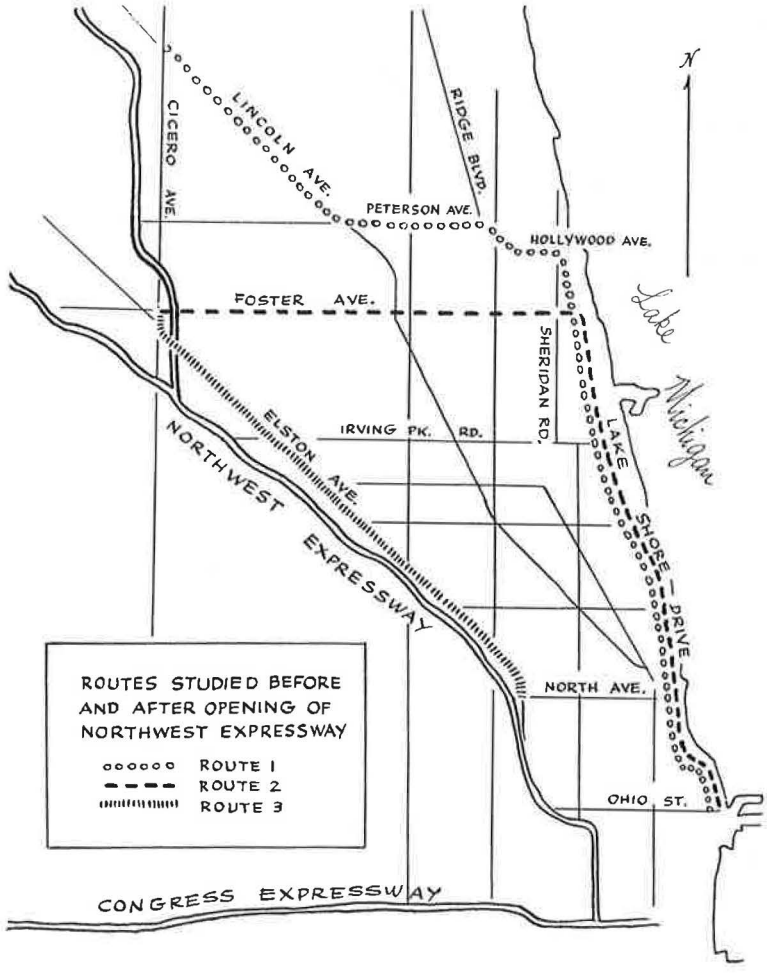

Figure 2. Routes studied before and after opening of Northwest Expressway.

Summary of Study

1. Average miles per gallon on arterial streets before expressway = 13.2
2. Average miles per gallon on arterial streets after expressway = 15.9
3. Average saving in gas in gallons per mile on arterial streets after expressway = 0.013
4. Average miles per gallon on Lake Shore Drive before expressway = 17.0
5. Average miles per gallon on Lake Shore Drive after expressway = 21.0
6. Average saving in gas in gallons per mile on Lake Shore Drive after expressway = 0.011

TRAFFIC VOLUME STUDY

Twelve-hour volume counts were made available by the Traffic Engineering Division of the City of Chicago for the various routes studied in this report. Table 4 summarizes counts on routes before and after the opening of the Northwest Expressway.

In the table, traffic volumes for route 1 show the decrease in volume after the opening of the expressway. The major arterial route, discounting Lake Shore comparisons, averaged 26,390 vehicles during a 12-hr period before the expressway, and 20,673 after. This represents a 26.6 percent reduction in traffic. On Lake Shore Drive, the reduction

TABLE 1

SUMMARY OF GAS CONSUMPTION STUDY BEFORE OPENING OF NORTHWEST EXPRESSWAY

Route	Date	Rush Period	Street	Section	Miles Studied	Gas Used	
						Amount (gal)	Miles per Gal
1	10/24/60	AM	Lincoln	Cicero-Peterson	3.0	0.20	
	10/24/60	AM	Peterson	Lincoln-Sheridan	3.1	0.21	
	10/24/60	PM	Peterson	Lincoln-Sheridan	3.1	0.19	
	10/24/60	PM	Lincoln	Peterson-Cicero	3.0	0.20	
	Subtotal				12.2	0.80	15.3
2	10/25/60	AM	Foster	Lincoln-Sheridan	2.4	0.15	
	10/27/60	AM	Foster	Cicero-Sheridan	5.5	0.33	
	10/25/60	PM	Foster	Sheridan-Lincoln	2.2	0.21	
	10/24/60	PM	Foster	Sheridan-Cicero	5.5	0.43	
	Subtotal				15.6	1.12	13.9
3	10/26/60	AM	Elston	Foster-North	6.9	0.58	
	10/26/60	PM	Elston	Foster-North	6.9	0.65	
	Subtotal				13.8	1.23	11.2
	Total for arterial streets				41.6	3.15	13.2
Lake Shore Drive	10/25/60	AM		Foster-Ohio	6.7	0.40	
	10/27/60	AM		Foster-Ohio	6.6	0.48	
	10/25/60	PM		Ohio-Foster	7.0	0.37	
	10/24/60	PM		Ohio-Foster	6.8	0.34	
	Total				27.1	1.59	17.0

was 17.0 percent. Although the reduction on Lake Shore Drive was not as significant as the arterial streets, nevertheless it can be assumed that the expressway was previously carrying a substantial number of vehicles that traveled a considerable distance to use the Lake Shore expressway. As later illustrated, the 17 percent reduction was impressive in relation to improved speed performance (Fig. 4).

For route 2, volume counts on Foster at Cicero does not reflect the normal experience of traffic changes at that location because the intersection has traffic generated from the expressway. Consequently, for before and after comparisons, the experience at Foster and Ashland is used in this study. The decrease in traffic since the expressway is 27.4 percent (Fig. 5).

The arterial street in route 3 is adjacent to the expressway and its phenomenal decrease in traffic is understandable. Before the expressway, it had an average 12-hr two-way volume of 18,516 as contrasted to a present count of 10,048, or a 45.2 percent decrease. This change in traffic volume is shown in Figure 6.

The combined decrease on the major arterial streets is given in Table 5.

TRAVEL TIME STUDY

Decreased travel times are of great significance to highway users. Not only are they appreciated but also their economic value is as important as such factors as fuel saving, accident reduction, and lower operating costs. In this study, travel times on arterial streets were measured to determine the increased speed made possible by diverting traffic to the expressway. It is an acceptable conclusion that lower traffic volumes produce faster running speeds. This relationship has been established in varying degrees by many researchers (5, 6, 7).

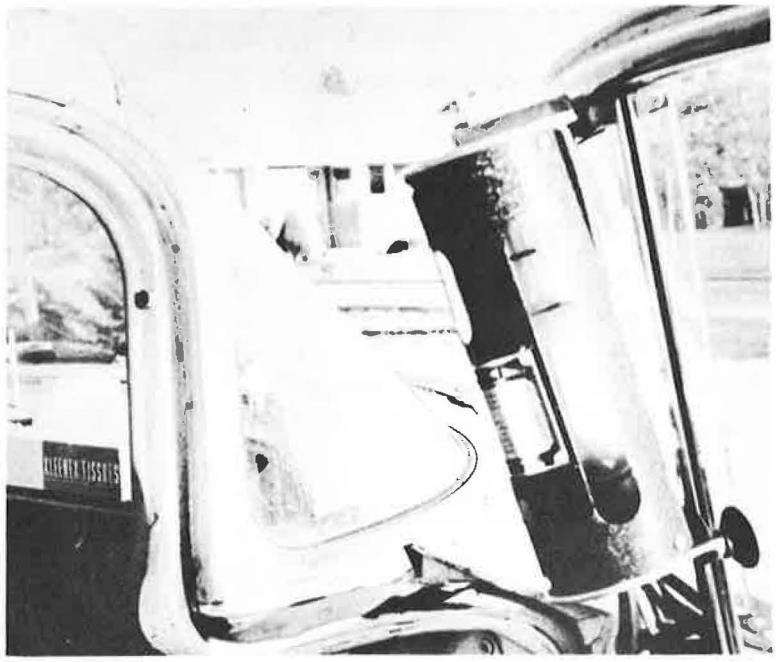

Figure 3. Vacumat gasoline mileage tester.

TABLE 2

SUMMARY OF GAS CONSUMPTION STUDY AFTER OPENING OF NORTHWEST EXPRESSWAY

Route	Date	Rush Period	Street	Section	Miles Studied	Gas Used	
						Amount (gal)	Miles per Gal
1	9/29/61	AM	Lincoln	Cicero-Peterson	3.0	0.18	
	9/29/61	AM	Peterson	Lincoln-Sheridan	3.1	0.18	
	9/27/61	PM	Peterson	Sheridan-Lincoln	3.0	0.18	
	9/27/61	PM	Lincoln	Peterson-Cicero	3.1	0.14	
	Subtotal				12.2	0.68	17.9
2	10/3/61	AM	Foster	Cicero-Sheridan	5.2	0.35	
	9/29/61	AM	Foster	Lincoln-Sheridan	1.4	0.10	
	10/3/61	PM	Foster	Sheridan-Cicero	5.2	0.40	
	Subtotal				11.8	0.85	13.9
3	9/29/61	AM	Elston	Cicero-North	6.8	0.40	
	9/29/61	PM	Elston	North-Cicero	5.5	0.36	
	Subtotal				12.3	0.76	16.2
	Total for arterial streets				36.3	2.29	15.9
Lake Shore Drive	9/29/61	AM		Foster-Ohio	5.5	0.26	
	9/29/61	PM		Ohio-Foster	6.5	0.30	
	10/3/61	PM		Ohio-Foster	7.1	0.35	
	Total				19.1	0.91	21.0

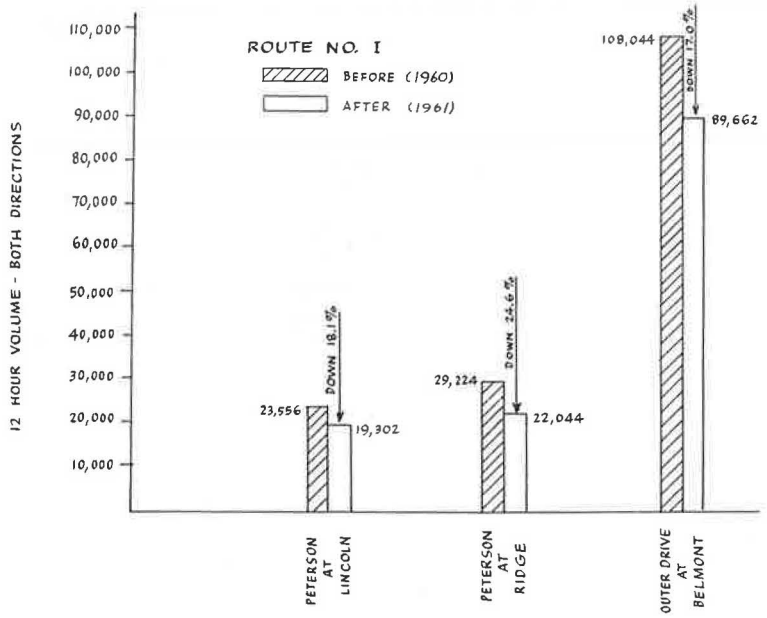

Figure 4. Vehicular volumes before and after opening of Northwest Expressway, Route 1.

To determine the time saving experience on each of the three routes, a series of runs were made before and after the opening of Northwest Expressway. All the studies were made during the two peak periods of the day. A more detailed account of these travel times for each respective route is given in Tables 6 and 7. The monetary value of this time reduction is treated later.

TABLE 3

GAS CONSUMPTION STUDY

Period	Route No.	Miles of Streets Studied	Avg. Gas Consumption (gal)	No. of Runs
Before	1	12.2[a]	0.80	4
	2	15.6[a]	1.12	4
	3	13.8	1.23	2
	Lake Shore Dr.	27.1	1.59	4
After	1	12.2[a]	0.68	4
	2	11.8[a]	0.85	3
	3	12.3	0.76	2
	Lake Shore Dr.	19.1	0.91	3

[a] Excluding Lake Shore Drive.

Route 1

The AM peak traffic can traverse the 14.1 mi of route 1 in 8 min 53 sec faster than before the expressway (Fig. 7). In the evening peak, the savings is 7 min 35 sec. The greatest decrease in travel time is reflected in the 5.2 mi of travel on the Lake Shore Drive. This distance can now be negotiated in 9.5 min as against the previous time of 12.5 min, or a savings of 3 min.

Route 2

Figure 8 shows that during the AM peak a vehicle starting on Foster at Cicero can reach Ohio and the Lake Shore Drive 7 min 38 sec faster than before the expressway, and 4 min 50 sec faster in the evening rush. As in Route 1, the greatest travel time decrease occurred on Lake Shore Drive.

Route 3

Elston Avenue (Fig. 9) has had a drastic decrease in travel time, partic-

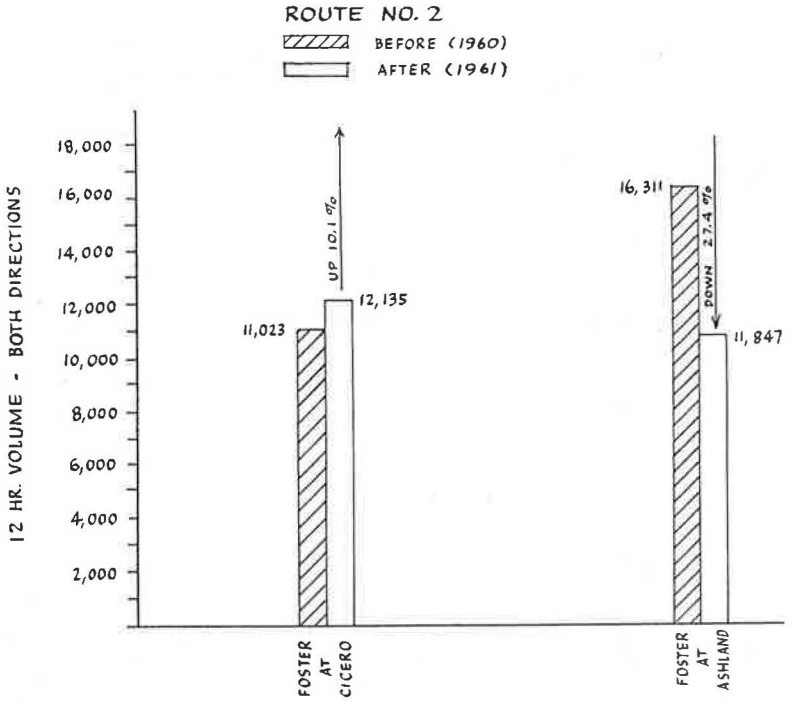

Figure 5. Vehicular volumes before and after opening of Northwest Expressway, Route 2.

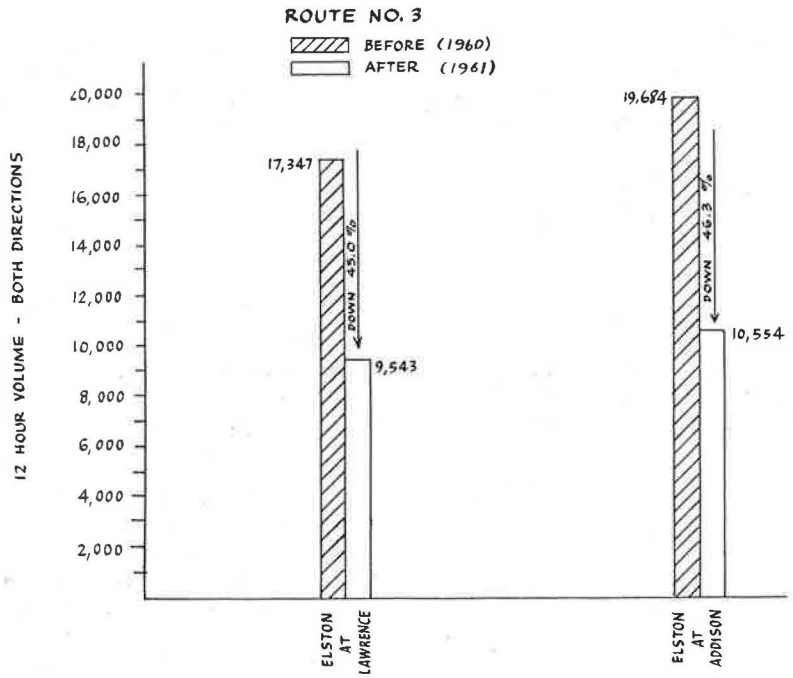

Figure 6. Vehicular volumes before and after opening of Northwest Expressway, Route 3.

TABLE 4

12-HOUR VOLUME COUNTS ON ROUTES BEFORE AND AFTER OPENING OF NORTHWEST EXPRESSWAY

Route No.	Location	Traffic Direction	12-Hr Volume	
			Before	After
1	Peterson at Lincoln	East	10,681	8,863
		West	12,875	10,439
		Two-way	23,556	19,302
	On Ridge at Clark	East	15,433	11,568
		West	13,791	10,476
		Two-way	29,224	22,044
	Lake Shore at Belmont	North	57,627	48,181
		South	50,417	41,481
		Two-way	108,044	89,662
2	On Foster at Cicero	East	5,576	5,740
		West	5,447	6,395
		Two-way	11,023	12,135
	On Foster at Ashland	East	8,602	6,025
		West	7,709	5,822
		Two-way	16,311	11,847
3	On Elston at Lawrence	Northwest	8,981	4,389
		Southeast	8,366	5,154
		Two-way	17,347	9,543
	On Elston at Addison	Northwest	9,392	5,462
		Southeast	10,292	5,092
		Two-way	19,684	10,554

ularly in the PM period. The 6.9 mi of major arterial street that were surveyed after the opening of the expressway, was negotiated in 20 min 5 sec faster on the average, than before the opening of the expressway. During the morning peak, the average decrease in travel time, after the opening of the expressway, was 4 min 57 sec.

Summary of Travel Time

Table 8 gives a summary of the saving in travel time per vehicle per trip experienced on the various major arterial streets in this survey.

The Lake Shore Drive experience is summarized as follows:

Avg. travel time before = 12 min 0.1 sec
Avg. travel time after = 9 min 31 sec
Time saved per mile after Northwest Expressway = 0.5 min

The monetary value of time saved is an important economic factor in highway planning. Many studies have been conducted in which the value of time was assigned a monetary amount. In commercial vehicle operations, it is not too difficult to assign a value to time saved. The time saved can be directly applied to wages (8). However, in private passenger operation, this value is variable, depending on various

TABLE 5

COMBINED DECREASE[1] IN AVERAGE 12-HR TWO-WAY VOLUMES ON MAJOR ARTERIAL STREETS

Route No.	Avg. Volume	
	Before	After
1	26,390	20,673
2	16,311	11,847
3	18,516	10,048
Total	61,217	42,568

[1]Average decrease = 31.5 percent.

TABLE 6

SUMMARY OF TRAVEL TIMES DURING RUSH HOURS ON ALTERNATE ROUTES BEFORE OPENING OF NORTHWEST EXPRESSWAY

Route No.	Rush Period	Route Path		Date (1960)	Travel Time (min:sec)
		From	To		
1	AM	Lincoln & Cicero	Lincoln & Peterson	10/21	7:10
				10/27	8:00
				10/28	7:31
				10/31	7:39
				Avg.	7:35
			Hollywood & Sheridan	10/21	20:45
				10/27	18:00
				10/28	19:19
				10/31	19:27
				Avg.	19:23
			Lake Shore & Ohio	10/21	33:15
				10/27	33:00
				10/28	33:04
				10/31	33:12
				Avg.	33:08
	PM	Lake Shore & Ohio	Lake Shore & Sheridan	10/24	11:30
				10/25	12:30
				10/29	11:45
				11/3	12:15
				Avg.	12:00
			Lincoln & Peterson	10/24	23:35
				10/25	24:20
				10/29	23:40
				11/3	24:25
				Avg.	24:00
			Lincoln & Cicero	10/24	31:35
				10/25	32:25
				10/29	30:45
				11/3	33:15
				Avg.	32:00
2	AM	Foster & Cicero	Lincoln & Foster	10/20	9:30
				10/22	14:00
				10/25	6:45
				Avg.	10:05
			Sheridan & Foster	10/20	15:00
				10/22	22:30
				10/25	14:15
				Avg.	17:15
			Lake Shore & Ohio	10/20	28:50
				10/22	33:10
				10/25	25:15
				Avg.	29:05
	PM	Lake Shore & Ohio	Foster & Ohio	10/12	8:50
				10/13	10:10
				10/24	9:10
				10/17	9:50
				Avg.	9:30
			Lincoln & Foster	10/12	19:15
				10/13	22:15
				10/24	16:30
				10/17	25:00
				Avg.	20:45
			Cicero & Foster	10/12	27:50
				10/13	30:00
				10/24	25:30
				10/17	32:20
				Avg.	28:55
3	AM	Elston & Cicero	Elston & North	10/26	23:00
				10/21	25:00
				10/12	22:25
				10/14	25:35
				Avg.	24:00
	PM	Elston & North	Elston & Cicero	10/14	35:30
				10/12	38.10
				10/26	42:40
				10/18	31:00
				Avg.	36:50

TABLE 7

SUMMARY OF TRAVEL TIMES DURING RUSH HOURS ON ALTERNATE ROUTES AFTER OPENING OF NORTHWEST EXPRESSWAY

Route No.	Rush Period	Route Path		Date (1961)	Travel Time
		From	To		
1	AM	Lincoln & Cicero	Lincoln & Peterson	4/3	7:30
				4/27	5:30
				5/9	7:00
				Avg.	6:40
			Hollywood & Sheridan	4/3	15:15
				4/27	13:30
				5/9	14:30
				Avg.	14:25
			Lake Shore & Ohio	4/3	26:00
				4/27	22:30
				5/9	24:15
				Avg.	24:15
	PM	Lake Shore & Ohio	Lake Shore & Sheridan	4/3	9:45
				4/9	10:00
				5/9	9:00
				Avg.	9:35
			Lincoln & Peterson	4/3	18:00
				4/9	20:00
				5/9	16:30
				Avg.	18:10
			Lincoln & Cicero	4/3	24:00
				4/9	26:30
				5/9	23:15
				Avg.	24:35
2	AM	Foster & Cicero	Lincoln & Foster	3/14	7:45
				4/4	6:30
				4/5	6:30
				Avg.	6:53
			Sheridan & Foster	3/14	13:00
				4/4	11:30
				4/5	11:00
				Avg.	11:50
			Lake Shore & Ohio	3/14	22:20
				4/4	21:00
				4/5	21:00
				Avg.	21:27
	PM	Lake Shore & Ohio	Lake Shore & Foster	3/16	10:00
				3/17	9:00
				3/28	9:30
				3/29	10:15
				Avg.	9:41
			Foster & Lincoln	3/16	16:35
				3/17	15:38
				3/28	16:30
				3/29	18:00
				Avg.	16:41
			Foster & Cicero	3/16	24:00
				3/17	23:52
				3/28	24:00
				3/29	24:30
				Avg.	24:05
3	AM	Elston & Cicero	Elston & North	3/14	16:00
				3/15	22:05
				3/16	17:35
				3/17	20:31
				Avg.	19:03
	PM	Elston & North	Elston & Cicero	3/14	17:35
				3/13	16:25
				3/17	16:00
				4/5	17:00
				Avg.	16:45

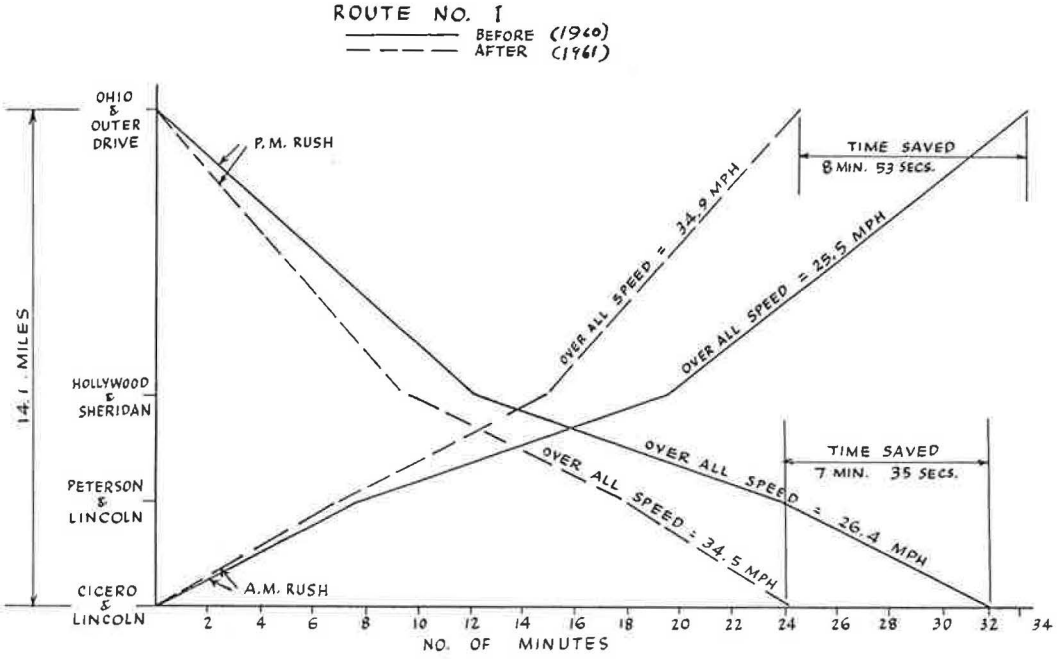

Figure 7. Travel times before and after opening of Northwest Expressway, Route 1.

conditions, day of the week, persons, etc. In the Chicago Area Transportation Study (14, 17), the time costs were given a definite amount:

> The value of time for automobiles was set at $1.17 per hour. This was based upon 75¢ per hour value of passenger time and an average occupancy of 1.56 persons per vehicle. The current Federal minimum wage is $1.00 per hour and no one may work in covered employment for less. Thus, $1.00 per hour per employed person would be a minimum figure. But since some passengers are unemployed, the hourly rate was dropped to 75¢ per hour.

The value of $1.17 per hour was applied to the travel time saved on arterials and North Lake Shore Drive as a result of less traffic.

STUDY OF TRAFFIC ACCIDENTS

An analysis of a highway improvement must include a study of its effect on traffic accidents. Much has been written (15) about the economic value of an expressway in relation to, among other factors, lower accident rates. Very little is known about the accident rate on major arteries influenced by the expressway.

Two studies were undertaken to appraise the effect the Northwest Expressway had on streets in its area. The first study was a general area analysis resembling a similar research project in the area of the Congress Street Expressway

TABLE 8

TRAVEL TIME SAVINGS PER VEHICLE PER TRIP FOR MAJOR ARTERIAL STREETS

Route No.	Length (mi)	Time Saved per Vehicle (min:sec)		
		AM	PM	Avg.
1	14.1	4:58	5:00	4:59
2	5.5	5:25	4:36	5:00.5
3	6.9	4:57	20:05	12:31.5
Total	26.5			22:31
Per mile				0:51

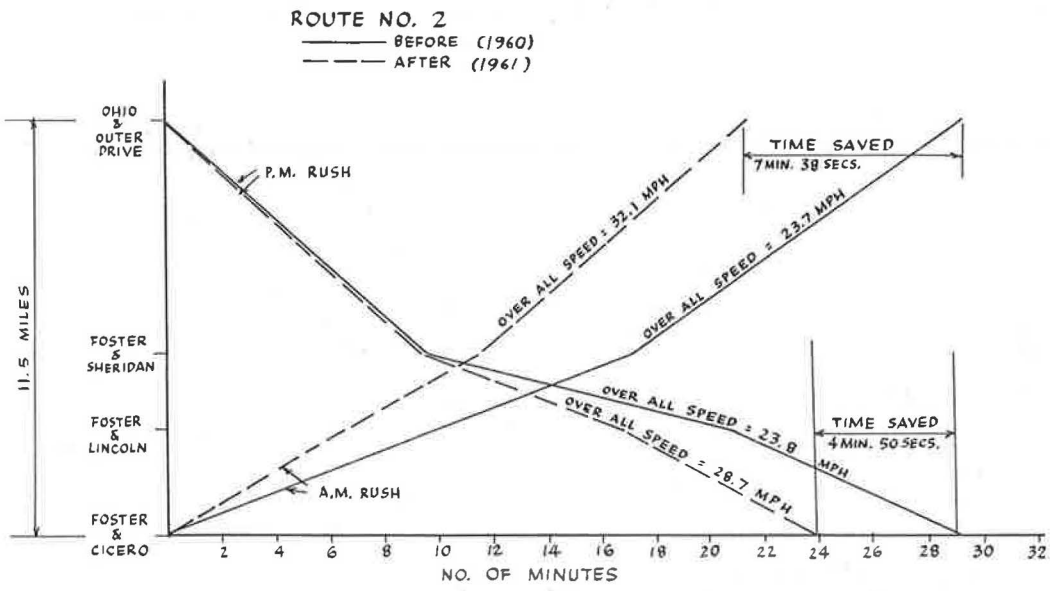

Figure 8. Travel times before and after opening of Northwest Expressway, Route 2.

conducted by the Chicago Area Transportation Study (16). The second study involved an analysis of accidents on the three routes used in other analytical studies in this report.

General Area

Accident data were obtained from the police department for each district adjacent to the Northwest Expressway. The area under surveillance is shown in Figure 10. The accident experience was tabulated for each police district one year before and after the opening of the Northwest Expressway. Table 9 gives this information for each area. Table 10 gives the before and after trend.

This study does not provide significant information for a benefit-cost determination. Perhaps the study included too large an area and consequently did not accurately represent the accident trend. However, total accidents in this study area decreased 1.2 percent, whereas throughout Chicago there was a 3.0 percent increase. This study did not result in the interesting findings made by CATS on Congress Expressway (9). That study revealed an area reduction of 28 percent in fatalities and 14.2 percent in injuries as a result of Congress Expressway.

Major Routes

In this analysis, accurate reports were obtained for every injury and fatal accident recorded on the arterials of each of the three routes. The records included the first six months of 1960 as compared to the first six months of 1961. Property damage accidents were not included for two reasons: (a) inaccuracy of reporting, and (b) difficulty in determining accident costs. This study realizes that there is much to be desired in better information regarding accident costs (10). Therefore, in an effort to minimize inaccuracies, only fatalities and injuries were included for analysis.

Table 11 summarizes the accidents recorded for each section of the three routes observed. There was a 25.8 percent reduction in these accidents for the entire combined arterial street mileage and a 17.0 percent decrease on Lake Shore Drive.

Benefit of Accident Reduction

The method used for determining the economic value of accident reduction is predicated on the accident experience on the three major routes expressed in monetary value

TABLE 9

TRAFFIC ACCIDENTS REPORTED BY POLICE DISTRICTS IN VICINITY OF NORTHWEST EXPRESSWAY

Police Dist.	Total Accidents	Fatal Accidents	Persons Killed	Personal Injury Accidents	Persons Injured	Prop. Dam. Accidents
(a) 1960, Before Northwest Expressway						
32	8,043	20	20	1,594	2,124	6,429
33	5,216	16	16	1,099	1,558	4,101
34	4,697	6	6	928	1,289	3,763
37	2,194	5	5	426	553	1,763
38	5,003	12	13	1,076	1,402	3,915
40	4,509	5	5	821	1,113	3,683
Total	29,662	64	65	5,944	8,039	23,654
(b) 1961, After Opening of Expressway						
32	7,652	12	14	1,545	2,200	6,095
33	5,107	6	6	1,053	1,538	4,048
34	4,993	11	11	943	1,320	4,039
37	2,272	4	4	455	617	1,813
38	4,973	17	17	1,042	1,377	3,914
40	4,318	7	7	821	1,122	3,490
Total	29,315	57	59	5,859	8,174	23,399

per vehicle-mile traveled. This information is then applied to all of the major routes affected by the Northwest Expressway. The computation of this factor is divided into (a) actual monetary saving on three major routes based on known traffic volumes and accidents, and (b) application of this monetary saving to the entire arterial system influenced by the expressway.

Three Major Routes.—As previously indicated, there were 55 fewer accidents reported on the combined street system after the opening of the expressway, of which 10 were on Lake Shore Drive. Table 11 gives the fatal and injury accident experience for the major routes whose travel characteristics were materially changed by the new highway. The volume and number of miles on the three principal routes were converted to total semiannual vehicle-miles traveled (Table 12). In the computation that follows, these data were used to compute the monetary saving resulting from accident reduction.

The determination of the actual cost per accident was based on information obtained from the National Safety Council's Memo 113. The unit cost for the type of accident studied in this project is $1,750 per injury. Because there are 1.43 persons involved in the average injury accident in Chicago, the cost per accident is $1,750 \times 1.43 = \$2,502.50$.

In 1960, the number of accidents per 100 mvm was 204. The total cost of accidents

TABLE 10

TOTAL BEFORE AND AFTER TREND OF ACCIDENT EXPERIENCE

Type of Total	No. Before	No. After	Change (%)
Accidents	29,662	29,315	-1.2
Fatalities	65	59	-9.2
Injuries	8,039	8,174	+1.7
Prop. dam. Accidents	23,654	23,339	-1.1
in Chicago	126,777	129,562	+3.0

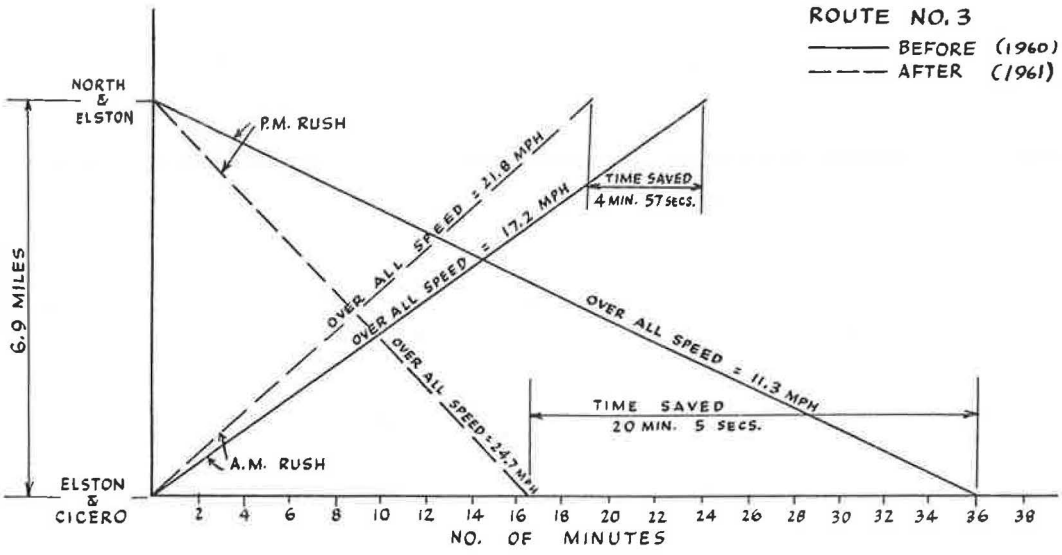

Figure 9. Travel times before and after opening of Northwest Expressway, Route 3.

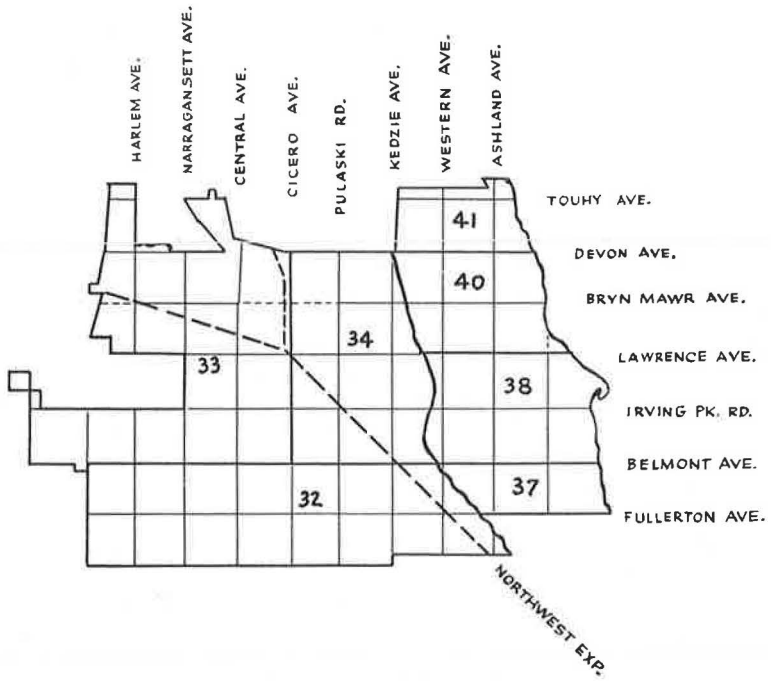

Figure 10. Northwest Expressway area police districts.

for that year on this system is (204 × 2,502.50)/100,000,000 = $0.0051 per vehicle-mile.

In 1961, the number of accidents per 100 mvm on this system was 225. The cost is (225 × 2,502.50)/100,000,000 = $0.0056 per vehicle-mile.

The computation for Lake Shore Drive for 1960 is (35 × 2,502.50)/100,000,000 = $0.0088 per vehicle-mile and $0.0088 × 166,000,000 × 2 = $292,000. For 1961,

TABLE 11

FATAL AND INJURY ACCIDENT SUMMARY ON 3 MAJOR ROUTES
(FIRST 6 MONTHS 1960 VS SAME PERIOD 1961)

Route No.	Street	Section	No. of Accidents						Accidents per 100 MVM	
			1960			1961				
			Other	Ped.	Total	Other	Ped.	Total	1960	1961
1	Lincoln Ave.	Devon-Peterson	9	0	9	15	3	18		
	Peterson Ave.	Lincoln-Ridge	35	4	39	31	1	32		
	Ridge Ave.	Peterson-Hollywood	19	2	21	16	1	17		
	Subtotal		63	6	69	62	5	67	252	306
2	Foster Ave.	Cicero-Sheridan	63	13	76	35	9	44	332	273
3	Elston Ave.	Cicero-North	22	7	29	15	3	18	82.3	93.8
Total for arterial streets			148	26	174	112	17	129	204	225
Lake Shore Drive		Hollywood-Ohio	54	4	58	44	4	48	35	32.4

(32.4 × 2,502.50)/100,000,000 = $0.0081 per vehicle-mile and $0.0081 × 140,000,000 × 2 = $227,000. Annual saving on Lake Shore Drive = $292,000 - $227,000 = $65,000.

All Affected Streets.—The computation of total savings due to accident reduction netted on all streets influenced by the new highway is accomplished by applying the mileage in Table 12 to all vehicle mileage on arterial streets. This total travel, together with the streets included, is given in Tables 13 and 14.

From this information, the computation for monetary saving on the entire arterial system due to lower traffic volumes is as follows:

For 1960, 434,000,000 × $0.0051 =	$2,212,500
For 1961, 337,661,500 × $0.0056 =	1,896,000
Saving	$ 316,500

The total saving due to lower accident rate for all influenced arterial streets and Lake Shore Drive is:

Arterial streets =	$316,500
Lake Shore Drive =	65,000
	$381,500

However, it is necessary to subtract from $381,500 the cost of accidents on Northwest Expressway by those vehicles that previously used the arterial streets and Lake Shore Drive. The cost of their accident experience on the Northwest is computed as follows:

Total distance, Edens to Ohio Street	= 6.5 mi
Average daily volume (1961)	= 122,000
Number of injury accidents (1961)	= 146
Number of accidents per 100 mvm	= 49.5
Number of annual vehicle-miles transferred to Northwest Expressway:	
Arterial	= 97,000,000
Lake Shore Drive	= 52,000,000
Cost of accidents by transferred traffic	= $184,000

Therefore, the total annual monetary saving due to accident reduction on parallel routes is $381,500 - $184,000 = $197,500. This computation is summarized in Table 15.

TOTAL BENEFITS TO USERS OF ARTERIAL STREETS

Fuel Saving

The total annual vehicle-miles traveled on the arterial streets is 337,661,500 (Table 13). The saving in fuel was calculated earlier as follows:

TABLE 12

VEHICLE-MILES TRAVELED ON THREE PRINCIPAL ROUTES 6 MONTHS BEFORE AND AFTER OPENING OF NORTHWEST EXPRESSWAY

Route No.	Semi-Annual Vehicle-Miles Traveled	
	1960	1961
1	27,400,000	21,950,000
2	22,850,000	16,242,000
3	35,200,000	19,162,500
Total for arterial streets	85,450,000	57,354,500
Lake Shore Drive	166,000,000	140,000,000

TABLE 13

ANNUAL VEHICLE MILEAGE[a] ON ALTERNATE ARTERIAL ROUTES BEFORE OPENING OF NORTHWEST EXPRESSWAY

Street	No. of Miles	24-Hr Volume	Total Daily Vehicle-Miles
Peterson Ave.	3.8	35,300	134,000
Ridge Road	1.0	44,000	44,000
Foster Ave.	5.1	24,500	125,000
Lawrence Ave.	5.0	21,900	109,500
Montrose Ave.	5.0	16,850	84,500
Irving Pk. Rd.	4.2	27,600	116,000
Addison St.	3.6	12,900	46,500
Belmont Ave.	3.4	12,400	42,100
Diversey Ave.	3.0	17,650	53,000
Fullerton Ave.	2.4	19,300	46,500
Elston Ave.	6.9	27,800	192,000
Lincoln Ave.	5.2	15,400	80,000
Milwaukee Ave.	5.5	20,000	110,000
Total			1,183,100

[a] 1,183,100 x 365 = 434,000,000 vehicle-miles per year (1960). 925,100 x 365 = 337,661,500 vehicle-miles per year (1961).

Arterial streets = 0.013 gal per vehicle-mile
Lake Shore Drive = 0.011 gal per vehicle-mile

By applying this fuel factor to the vehicle mileage during the rush hour over the entire system, the fuel saving benefit can be derived in actual monetary value.

In deriving the vehicle-miles traveled over the entire system, it becomes necessary to derive the rush hour directional traffic flow for each of the major streets influenced by the Northwest Expressway. This was accomplished by applying known traffic characteristics in Chicago (14). The Chicago rush-hour peak has been found to be 11 percent of the 24-hr daily volume. The predominant flow during the rush hour is 60 percent of the peak-hour total. Consequently, the formula used in deriving peak-hour directional flow is

$$C = 0.11V \times 0.60$$
$$= 0.066V$$

in which

C = peak-hour flow, and
V = 24-hr daily volume.

The entire peak-hour total consisted of four hours, 7 to 9 AM and 4 to 6 PM. Thus, the formula used was

$$C = 4 \times 0.066V$$

These calculated directional flows are given in Table 16. Knowing the street mileage and peak-hour volumes, the amount of gasoline saved is derived by the following computation:

1. Arterial Streets.—The total rush hour mileage is 244,150 (Table 16). The amount of gas saved on this system since the opening of the expressway is 0.013 gal per mi. Assuming a price of $0.33 per gal, including gas tax, the total monetary saving on this system is 244,150 x 0.013 x 0.33 x 261 = $274,000.

2. Lake Shore Drive.—The amount of money saved by less fuel used on this expressway is 214,000 x 0.011 x 0.33 x 261 = $204,000.

Accident Reduction

The amount of money motorists saved from accident reduction over the entire area influenced by the expressway was analyzed earlier. Summarizing the results of that study, the annual monetary saving is $234,000.

Time Saved

The daily time saved during the rush hour on the entire street system is recorded (Table 14). This is based on an average saving of 0.85 min per vehicle-mile on the arterial system and 0.50 min on the Lake Shore Drive. Using this factor, the total annual time saved is as follows: on arterial streets (207,600 × 251 days)/60 = 871,920 hr; on Lake Shore Drive (182,000 × 251 days)/60 = 762,000 hr for a total of 1,633,920 hr. The amount of money annually saved = 1,633,920 × $1.17 = $1,910,000.

Northwest Expressway Benefit

A recent study of the economic value of Northwest Expressway revealed that the annual monetary saving of that highway resulting from lower fuel costs, maintenance cost, and accident rates, amounts to $12,400,000 annually (13). The added benefits of this expressway in terms of monetary savings accrued on previous routes used by present expressway traffic.

TABLE 14

ANNUAL VEHICLE MILEAGE ON ALTERNATE ARTERIAL ROUTES AFTER OPENING OF NORTHWEST EXPRESSWAY

Street	No. of Miles	24-Hr Volume	Total Daily Vehicle-Miles
Peterson Ave.	3.8	29,000	110,000
Ridge Road	1.0	33,000	33,000
Foster Ave.	5.1	17,800	89,000
Lawrence Ave.	5.0	19,300	96,500
Montrose Ave.	5.0	14,000	70,000
Irving Pk. Rd.	4.2	21,300	89,500
Addison St.	3.6	11,500	41,500
Belmont Ave.	3.4	11,050	37,500
Diversey Ave.	3.0	17,050	51,100
Fullerton Ave.	2.4	20,400	49,000
Elston Ave.	6.9	15,000	103,500
Lincoln Ave.	5.2	11,750	61,000
Milwaukee Ave.	5.5	17,000	93,500
Total			925,100

Total Monetary Saving

The annual monetary saving to motorists now traveling major arterial streets in the area of the Northwest Expressway is as follows:

Fuel saving on arterial system	$ 274,000
Fuel saving on Lake Shore Drive	204,000
Accident reduction cost	197,500
Time saving	1,910,000
Total annual saving	$2,585,500

TABLE 15

SUMMARY OF COST OF ACCIDENTS ON ALTERNATE ARTERIAL STREETS AFFECTED BY OPENING OF NORTHWEST EXPRESSWAY

Category	Annual Volume in 100 MVM		Injury Accident Rate per 100 MVM		No. of Accidents		Change in Accidents	
	Before	After	Before	After	Before	After	Number	Value ($)
Alternate arterial streets	4.34	3.37	204	225	885	758	-127	-318,000
Traffic diverted from arterials to Expressway	0	0.97	-	49.5	-	48	+ 48	+120,000
Traffic diverted from Lake Shore Drive to Expressway	0	0.52	-	49.5	-	25.8	+ 25.8	+ 64,000
Lake Shore Drive	3.32	2.80	35	32.4	116.2	90.8	- 25.4	- 63,500
Total	7.66	7.66	-	-	1,001.2	922.6	- 78.6	-197,500

TABLE 16

TOTAL PEAK-HOUR DIRECTIONAL TRAFFIC VOLUME[a] AND GAS-TIME SAVED ON PARALLEL ROUTES AFTER OPENING OF NORTHWEST EXPRESSWAY

Street	No. of Miles	Avg. 4-Hr. Peak Total	Total Daily Vehicle-Miles	Daily Gas Saved (gal)	Daily Time Saved (min)
Peterson Ave.	3.8	7,650	29,100	378	24,800
Ridge Rd.	1.0	8,720	8,720	116.0	7,400
Foster Ave.	5.1	4,700	23,900	310.5	20,300
Lawrence Ave.	5.0	5,110	25,600	332.0	21,700
Montrose Ave.	5.0	3,710	18,550	240.5	15,750
Irving Pk. Rd.	4.2	5,620	23,600	307.0	20,000
Addison St.	3.6	3,030	10,900	143.0	9,250
Belmont Ave.	3.4	2,920	9,930	129.0	8,450
Diversey Ave.	3.0	4,550	13,650	177.0	11,600
Fullerton Ave.	2.4	5,380	12,800	166.5	10,900
Elston Ave.	6.9	3,960	27,300	354.0	23,200
Lincoln Ave.	5.2	3,100	15,700	204.0	13,350
Milwaukee Ave.	5.5	4,490	24,600	320.0	20,900
Total arterial streets	54.10	62,940	244,150	3,177.5	207,600
Lake Shore Drive	6.0	35,600	214,200	2,780.0	182,000

[a]Peak-hour total traffic volume includes traffic between hours of 7 to 9 AM and 4 to 6 PM.

SUMMARY OF STUDY

The opening of the Northwest Expressway has definitely changed traffic characteristics on major routes influenced by the freeway. Time studies, fuel consumption tests, and accident analyses made before and after the opening of the new highway reveal the following information:

1. Average saving in gas per mile on arterial system is 0.013 gal.
2. Average saving in gas per mile on Lake Shore Drive is 0.011 gal.
3. Traffic volume on the major streets was reduced by 31.5 percent, and Lake Shore Drive experienced a decrease of 17.0 percent.
4. The average saving in time per mile on major arterial streets is 0.85 min.
5. The average saving in time per mile on Lake Shore Drive is 0.5 min.
6. Fatal and injury accidents were reduced 25.8 percent on major arterial streets and 17.0 percent on Lake Shore Drive.
7. Accident reduction influenced by diversion of traffic to the new expressway amounts to a total monetary value of $197,500 per year.
8. The annual saving of fuel cost totals $478,000 for vehicles using the alternate routes.
9. The annual driving time saved by motorists using the alternate routes is 1,633,920 hr.
10. The annual monetary saving in time is $1,910,000.
11. The total economic value of the Northwest Expressway to those highway users, using major arterial streets in the vicinity of the expressway, amounts to $2,585,500 annually.

COMMENTS REGARDING STUDY

The tangible benefits derived from expressway driving is without question. This economic improvement has often been expressed in terms of time saved, accident reduction, ease of driving, and operating costs. The effect that Northwest Expressway has had in reducing travel times in the Metropolitan Area of Chicago has been reported elsewhere (13). That report demonstrates how this expressway will save motorists $12,400,000 a year.

In analyzing the effect of the Northwest Expressway on other major routes in its area, the report has demonstrated that the benefits derived are very significant and deserve the attention of highway planners seeking the entire answer to cost benefits of expressways. This is a bonus that is overlooked.

There is one factor not considered in this study—the additional traffic burden placed on intersections located close to ramps of the expressway. No attempt was made to place a value on this increased cost of congestion. This should be included in a comprehensive study.

Another weakness in this study is the omission of some additional routes influenced by the expressway. In future studies, more detailed traffic volume counts should be obtained so that a greater number of affected routes are included. By doing this, the additional benefit of the expressway to the major arterial users will be even greater than the data presented in this study.

The expressway, as this study revealed, has benefited motorists using arterial streets. These benefits have been measured in terms of money saved from lower fuel costs, less accidents, and faster travel time. The increased mobility of these arteries also has been advantageous to transit operation as well as transportation of cargo by commercial fleet operators.

In summary, future highway benefit studies should include the bonus values received by a reduction of travel on arterial streets affected by an expressway. This monetary value can be readily predicted, and the value derived demonstrates an additional benefit resulting from the construction of a modern expressway.

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