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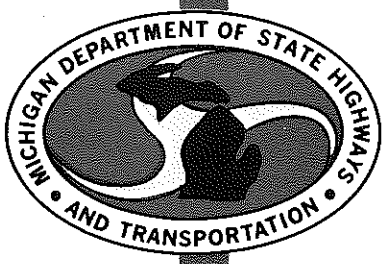
ADDENDUM TO AIR QUALITY REPORT FOR THE AMBASSADOR BRIDGE TOURIST INFORMATION CENTER

Research Report No. R-1148



TESTING AND RESEARCH DIVISION
RESEARCH LABORATORY SECTION

ADDENDUM TO
AIR QUALITY REPORT FOR THE AMBASSADOR BRIDGE TOURIST INFORMATION CENTER

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An air quality assessment of carbon monoxide was performed for an additional receptor site directly across Porter St from the Bridge Plaza. The site is adjacent to Porter St approximately 75 ft west of 21st St. Since all alternate schemes produce essentially the same carbon monoxide levels, estimates were performed only for Scheme C in 1983. One-hour and eight-hour estimates at this site were 9.7 mg/cu m and 2.5 mg/cu m, respectively, producing totals of 21.3 mg/cu m and 5.8 mg/cu m when background carbon monoxide is included.

AIR QUALITY REPORT FOR THE AMBASSADOR BRIDGE TOURIST INFORMATION CENTER

Research Laboratory Section
Testing and Research Division
Research Project 80 AP-28A
Research Report No. R-1148

Michigan Transportation Commission
Hannes Meyers, Jr., Chairman; Carl V. Pellonpaa,
Vice-Chairman; Weston E. Vivian, Rodger D. Young,
Lawrence C. Patrick, Jr., William C. Marshall
John P. Woodford, Director
Lansing, July 1980

This report presents air quality information for a proposed Travel Information Center near the Ambassador Bridge in the city of Detroit, Wayne County. Three alternate sites for the Center, along with the roadway alignment schemes that may result from each if the proposed Center is constructed, are considered and shown in Figure 1. Also included is the existing roadway alignment, or no-build alternate. Meteorological data and estimates of pollution that might occur adjacent to receptor sites along with the total pollutant burden for the various schemes are included.

Terrain and Demography

The proposed project is located in a moderately developed residential-commercial area. The terrain surrounding the project is generally flat with no tall buildings or structures in the immediate vicinity which might hinder dispersion of pollutants.

Meteorology

Meteorological conditions in Michigan are generally good for dispersion and dilution of air pollutants. According to air pollution publication AP 101, U. S. Environmental Protection Agency, 1972 (p 96) there are few days with a high meteorological potential for air pollution.

Daily weather data recorded every third hour at Detroit City Airport were obtained from the National Climatic Center in Asheville, North Carolina for the years 1967 through 1973. Figure 2 shows a 36-point bar graph of wind speed and direction occurrences. Figure 3 is a 12-point wind rose obtained by condensing the 36-point wind data.

Figure 4 shows the distribution of wind speed observed. Wind speeds are greater than 5 mph more than 90 percent of the time. The most probable daytime wind speed was found to be 11 mph.

Existing Ambient Air Quality

Carbon monoxide levels were measured with the Department's mobile air quality monitoring laboratory near the proposed project during the period of August 26, 1977 to December 16, 1977. Data were recorded every five minutes, 24 hours a day. The laboratory was located near the north end of the bridge plaza, about 50 ft north of Porter St. This particular site was a compromise selection since there were few suitable monitoring sites in the project area. It was not an ideal site for measuring background air quality because it was in a very high traffic area with many idling and slow moving vehicles (including many trucks) entering and exiting the plaza.

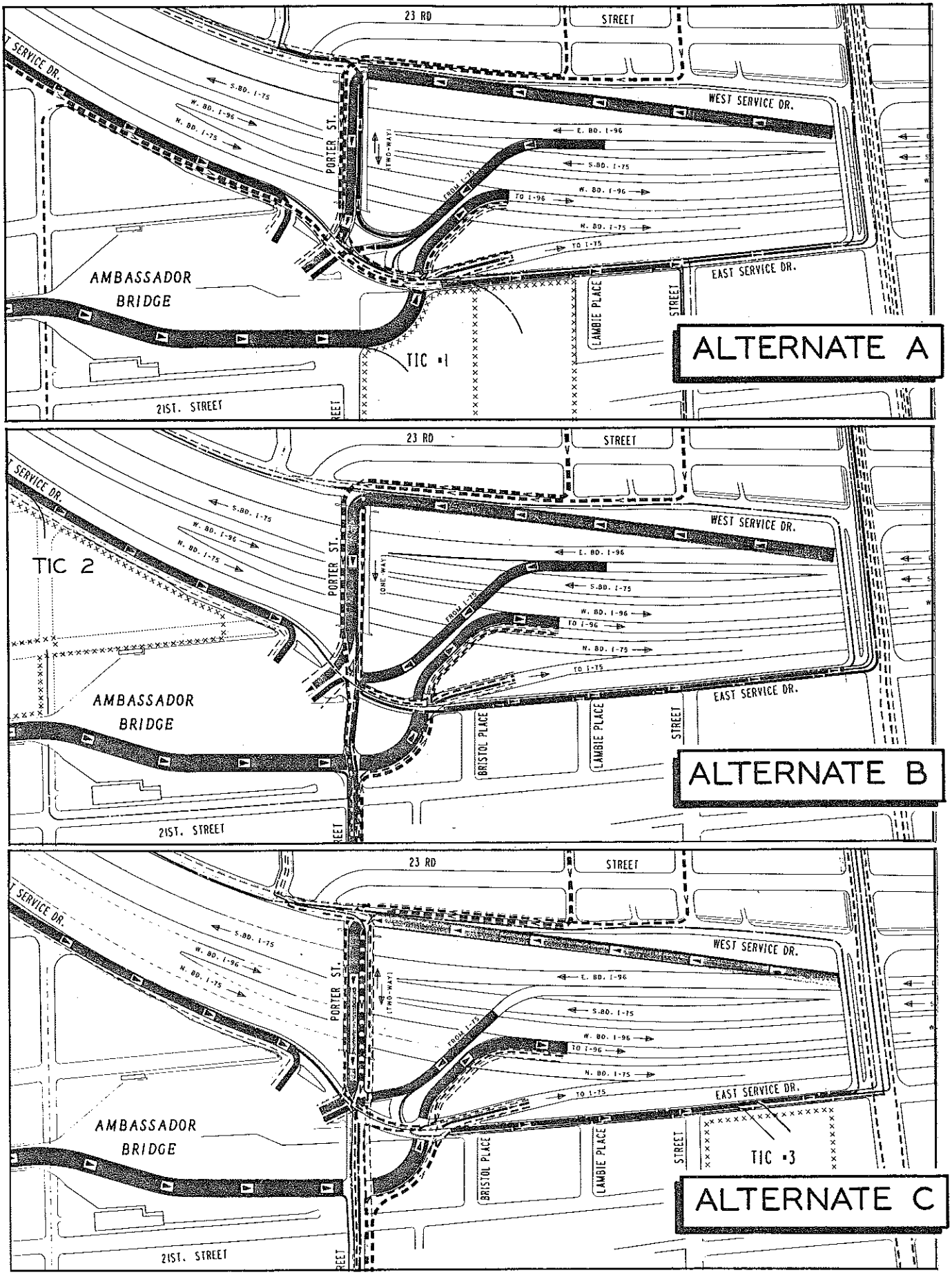

Figure 1A. Alternates A, B, and C showing the alternate locations of the proposed travel information center and accompanying traffic patterns.

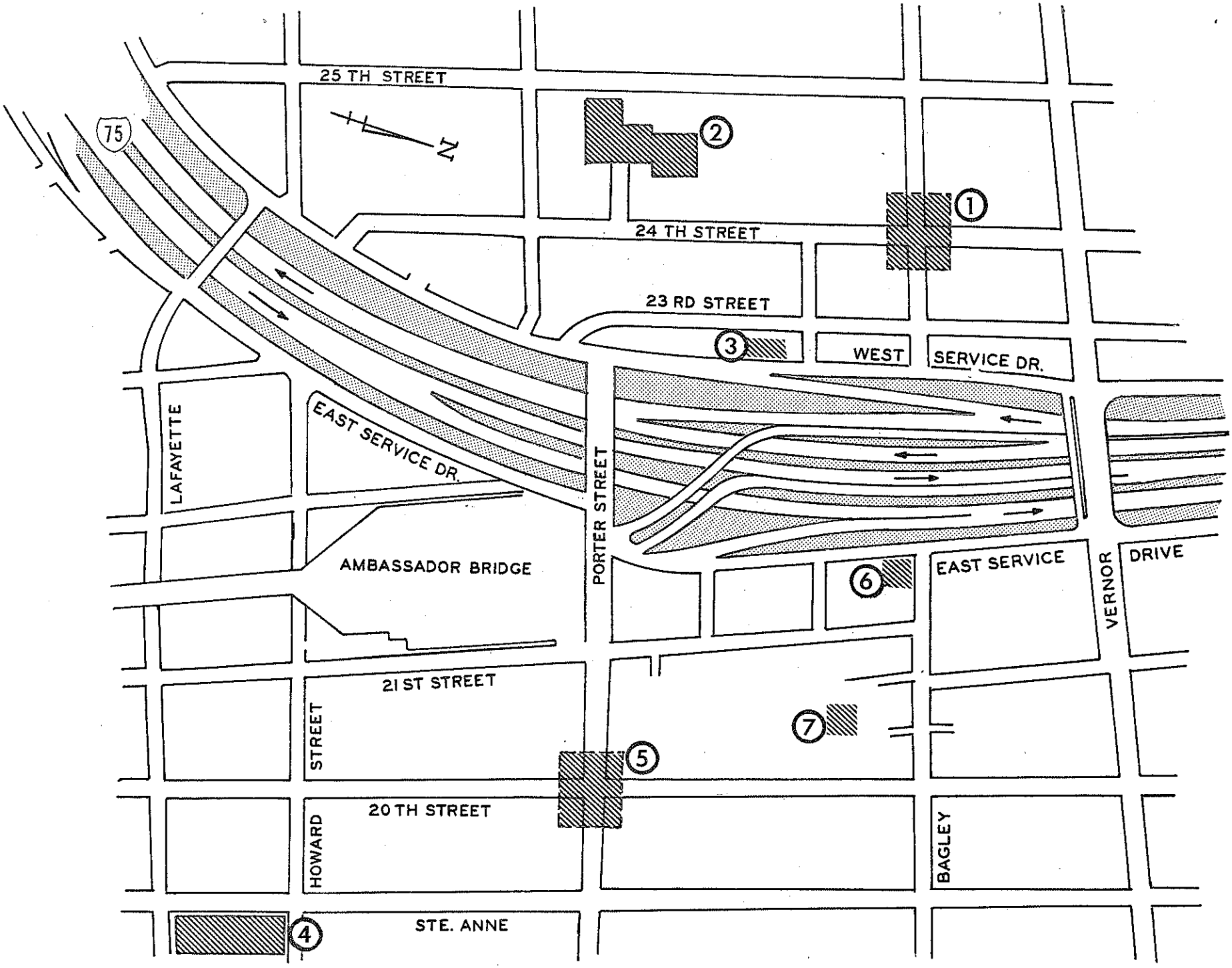

Figure 1B. Existing traffic pattern (no-build alternate) showing the receptor sites modeled.

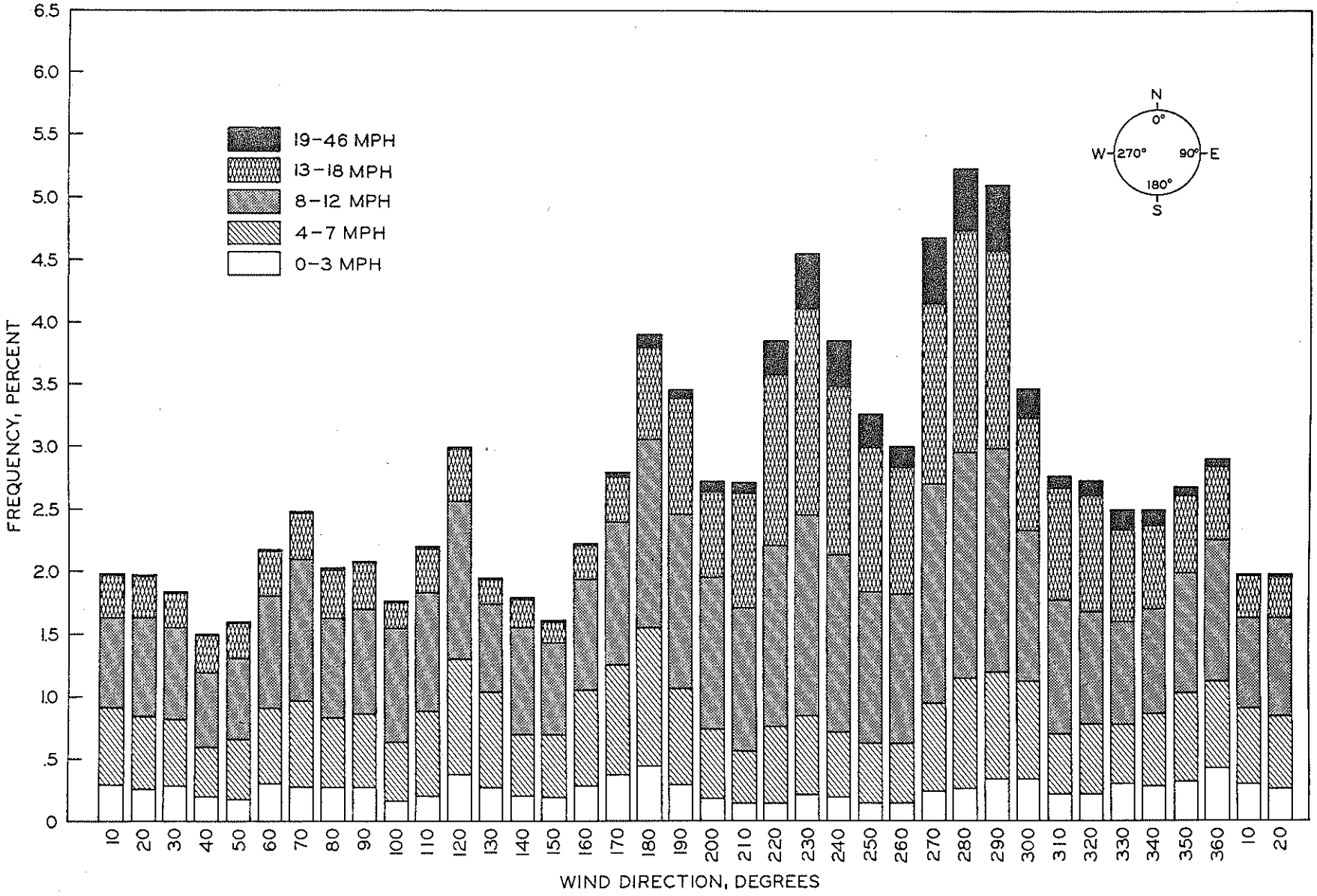

Figure 2. Wind speed and direction occurrences at Detroit City Airport.

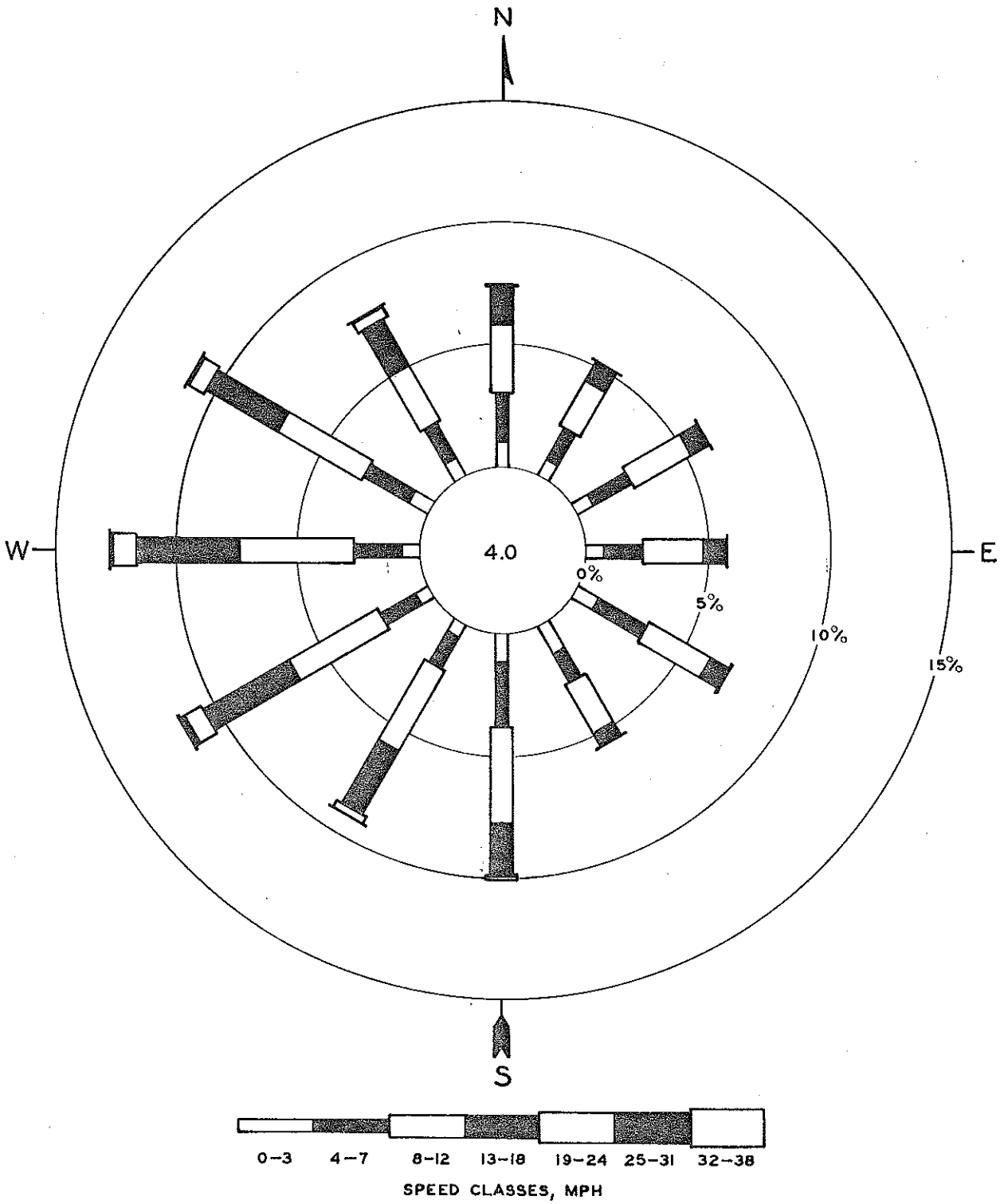

Figure 3. Frequency of wind direction and speed, percent (calms distributed).

TABLE 1
BACKGROUND CARBON MONOXIDE MEASURED
AT AMBASSADOR BRIDGE IN 1977

Date	1-hr Average mg/cu m	Date	8-hr Average mg/cu m
October 14	15.7	October 27	4.4
October 14	13.9	September 13	4.2
October 14	9.5	October 27	4.0
October 14	9.3	September 13	3.9
September 25	8.1	November 19	3.9
October 27	7.6	October 27	3.9
September 13	7.5	September 13	3.8
September 29	7.5	November 16	3.8
October 20	7.5	September 30	3.8
October 14	6.8	September 24	3.7
October 27	6.6	November 16	3.7
September 24	6.4	November 29	3.7
October 27	6.4	November 29	3.7
September 28	6.1	November 19	3.6
September 30	6.1	October 15	3.6
October 14	6.1	October 15	3.6
October 28	6.0	October 21	3.6
October 14	5.9	October 27	3.6
October 14	5.9	November 29	3.6
November 2	5.8	November 29	3.6

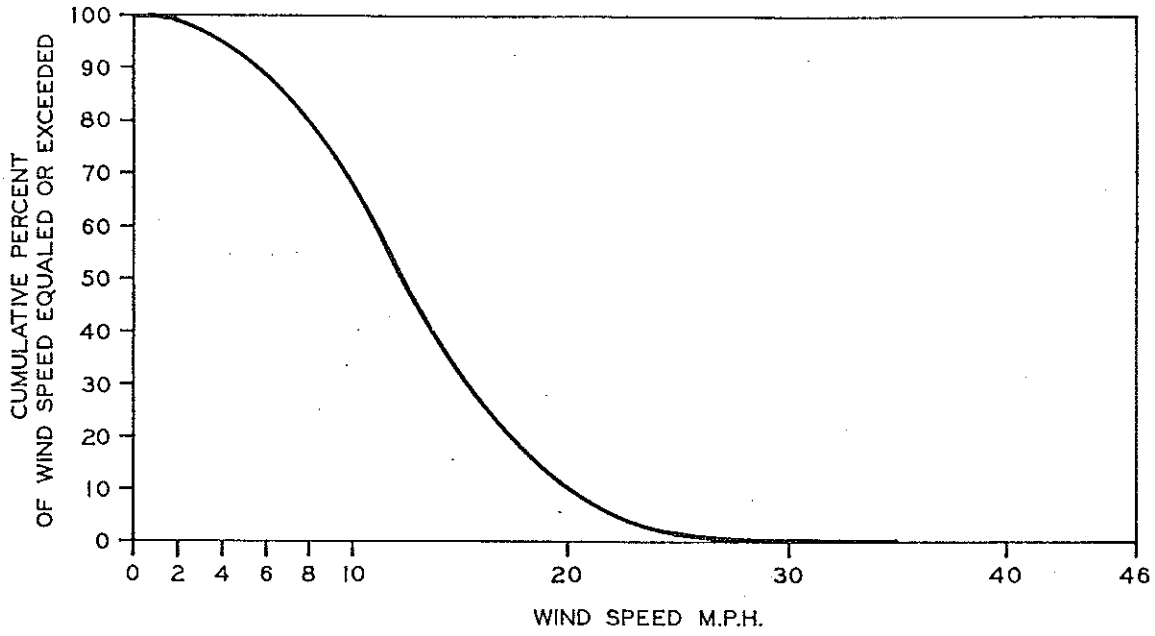

Figure 4. Wind speed distribution at Detroit City Airport.

The traffic flow is controlled by traffic signals at Porter St. The parking area on the east side of the plaza also contributed to the slow moving traffic. These idling and slow moving vehicles are essentially a point or stationary source of air pollution. The Environmental Protection Agency's Office of Air Quality Planning and Standards publication, "Guidance for Air Quality Monitoring Network Design and Instrument Siting," recommends that background air quality monitoring stations not have proximity to stationary sources. Analysis of the monitoring data revealed that if winds from 280 degrees clockwise to 100 degrees were not included, the effect of the idling and slow moving vehicle traffic was reduced, resulting in a more valid picture of the actual background air quality. In this analysis of the air quality for the proposed project, the data for the periods when the wind was blowing from 100 degrees clockwise to 280 degrees is considered the background for carbon monoxide. These background data will include carbon monoxide emanating from vehicles on the bridge plaza, I 75/I 96, and vehicles in the residential area west of I 75/I 96. The data require no seasonal adjustment since most of the monitoring occurred during the season of the year (October through March) when the highest concentrations are found in the area. Table 1 presents the 20 highest one-hour and eight-hour averages recorded for winds from 100 to 280 degrees.

TABLE 2
ESTIMATES OF ONE-HOUR CARBON MONOXIDE CONCENTRATIONS, mg/cu m (INCLUDING BACKGROUND)

Receptor Site		Alternate							
		No-Build		Scheme A		Scheme B		Scheme C	
		1983	2000	1983	2000	1983	2000	1983	2000
1	Max. 1-hour	1.8	1.4	1.7	1.1	1.8	1.2	1.9	1.4
	Background	11.6	8.8	11.6	8.8	11.6	8.8	11.6	8.8
	Total	13.4	10.2	13.3	9.9	13.4	10.0	13.5	10.2
2	Max. 1-hour	2.4	1.8	2.7	1.8	2.5	1.8	3.0	1.9
	Background	11.6	8.8	11.6	8.8	11.6	8.8	11.6	8.8
	Total	14.0	10.6	14.3	10.6	14.1	10.6	14.6	10.7
3	Max. 1-hour	5.7	4.5	5.4	4.0	5.4	4.2	6.6	4.7
	Background	11.6	8.8	11.6	8.8	11.6	8.8	11.6	8.8
	Total	17.3	13.3	17.0	12.8	17.0	13.0	18.2	13.5
4	Max. 1-hour	1.7	1.5	1.8	1.5	1.7	1.5	1.8	1.4
	Background	11.6	8.8	11.6	8.8	11.6	8.8	11.6	8.8
	Total	13.3	10.3	13.4	10.3	13.3	10.3	13.4	10.2
5	Max. 1-hour	9.8	7.0	6.4	4.3	8.1	5.7	11.4	7.3
	Background	11.6	8.8	11.6	8.8	11.6	8.8	11.6	8.8
	Total	21.4	15.8	18.0	13.1	19.7	14.5	23.0	16.1
6	Max. 1-hour	7.4	6.1	7.7	6.3	7.8	6.3	8.2	6.4
	Background	11.6	8.8	11.6	8.8	11.6	8.8	11.6	8.8
	Total	19.0	14.9	19.3	15.1	19.4	15.1	19.8	15.2
7	Max. 1-hour	1.8	1.1	1.7	1.1	1.8	1.1	1.9	1.1
	Background	11.6	8.8	11.6	8.8	11.6	8.8	11.6	8.8
	Total	13.4	9.9	13.3	9.9	13.4	9.9	13.5	9.9

TABLE 3
ESTIMATES OF EIGHT-HOUR CARBON MONOXIDE CONCENTRATIONS, mg/cu m (INCLUDING BACKGROUND)

Receptor Site		Alternate							
		No-Build		Scheme A		Scheme B		Scheme C	
		1983	2000	1983	2000	1983	2000	1983	2000
1	Max. 8-hour	0.5	0.4	0.5	0.4	0.6	0.4	0.6	0.4
	Background	3.3	2.5	3.3	2.5	3.3	2.5	3.3	2.5
	Total	3.8	2.9	3.8	2.9	3.9	2.9	3.9	2.9
2	Max. 8-hour	0.7	0.5	0.8	0.5	0.7	0.5	0.8	0.6
	Background	3.3	2.5	3.3	2.5	3.3	2.5	3.3	2.5
	Total	4.0	3.0	4.1	3.0	4.0	3.0	4.1	3.1
3	Max. 8-hour	1.8	1.4	1.7	1.3	1.7	1.3	2.0	1.5
	Background	3.3	2.5	3.3	2.5	3.3	2.5	3.3	2.5
	Total	5.1	3.9	5.0	3.8	5.0	3.8	5.3	4.0
4	Max. 8-hour	0.5	0.4	0.5	0.4	0.5	0.4	0.5	0.4
	Background	3.3	2.5	3.3	2.5	3.3	2.5	3.3	2.5
	Total	3.8	2.9	3.8	2.9	3.8	2.9	3.8	2.9
5	Max. 8-hour	2.8	1.7	1.8	1.3	2.3	1.6	3.2	2.1
	Background	3.3	2.5	3.3	2.5	3.3	2.5	3.3	2.5
	Total	6.1	4.2	5.1	3.8	5.6	4.1	6.5	4.6
6	Max. 8-hour	2.1	1.8	2.3	1.9	2.3	1.8	2.4	1.8
	Background	3.3	2.5	3.3	2.5	3.3	2.5	3.3	2.5
	Total	5.4	4.3	5.6	4.4	5.6	4.3	5.7	4.3
7	Max. 8-hour	0.6	0.4	0.5	0.4	0.6	0.4	0.6	0.4
	Background	3.3	2.5	3.3	2.5	3.3	2.5	3.3	2.5
	Total	3.9	2.9	3.8	2.9	3.9	2.9	3.9	2.9

The highest one-hour and eight-hour background concentrations were 15.7 mg/cu m and 4.4 mg/cu m, respectively. Since the measurements were performed in 1977 these values required correction to represent conditions in 1983, the estimated time of completion, and 2000. The corrections were accomplished as follows:

1) Carbon monoxide in the project area is estimated to be 80 percent transportation related. Non-transportation related carbon monoxide is not expected to increase significantly and may decrease.

2) Transportation-related emissions will decrease by 40 percent between 1977 and 1983 and by 50 percent between 1983 and 2000, due to Federal controls on emissions of new vehicles.

3) Traffic volumes in the project are estimated to increase by 12 percent between 1977 and 1983 and by 40 percent between 1983 and 2000.

The correction of the highest one-hour and eight-hour measurements to 1983 and 2000 follows:

1983

Let Vn = non-transportation related carbon monoxide, which is 20 percent of the 1977 value (0.2 x 1977 value).

Let Vt = transportation related carbon monoxide, which is 80 percent of the 1977 value increased by 12 percent (multiplied by 1.12) due to the increase in traffic and reduced by 40 (1 - 0.40 = 0.60) percent due to reduction in emissions because of emission controls, thus Vt = 1977 value x 0.8 x 1.12 x 0.6.

then: the 1983 value = Vn + Vt and: 1983 background one-hour value = (0.2)(15.7) + 0.8 (15.7)(1.12)(0.6) = 11.6 mg/cu m. 1983 background eight-hour value = (0.2)(4.4) + 0.8 (4.4)(1.12)(0.6) = 3.3 mg/cu m.

2000

Let Vn = 0.2 x 1983 value.

Let Vt = 1983 value x 0.8 x 1.40 (traffic increased 40 percent) x 0.5 (emissions decreased 50 percent).

then: 2000 background one-hour value = (0.2)(11.6) + 0.8 (11.6)(1.40) (0.5) = 8.8 mg/cu m. 2000 background eight-hour value = (0.2)(3.3) + 0.8 (3.3)(1.40)(0.5) = 2.5 mg/cu m.

These corrected values will be considered the background carbon monoxide in the project area and are used in Tables 2 and 3 to show the total carbon monoxide concentrations at the receptors for each alternate scheme.

Pollution Estimates

Estimates of carbon monoxide concentrations were made at a receptor height of 5 ft (1.5 m). A mathematical model based on the Gaussian diffusion equation employing a mixing zone concept was used[1]. Inputs to the model include wind speed and direction, traffic volumes, vehicle emission factors, highway design, and site characteristics.

1) Carbon monoxide concentrations were estimated for seven sites near the proposed project for each of the alternate schemes (Fig. 1). The sites are identified as follows:

1. At the intersection of Bagley St and 24th St.
2. Webster School near the intersection of Porter St and 24th St.
3. The residence near the intersection of the I 96 off-ramp and the West Service Drive.
4. Saint Anne's Roman Catholic Church near the intersection of Howard St and Saint Anne St.
5. At the intersection of Porter St and 20th St.
6. The residence near the intersection of Bagley St and the East Service Drive.
7. The residence on 20th St between Bagley St and Porter St.

2) The years 1983 (estimated time of completion) and 2000.

Information used as input to the model consisted of:

1) Vehicle emission factors, shown in the following table, were calculated using "Mobile Source Emission Factors," March 1978, U. S. Environmental Protection Agency. Emission factors were calculated at temperatures of 30 F with 20 percent of the vehicles in a cold start condition, 27 percent of the vehicles in a hot start condition, and the remainder of the vehicles in a hot operation mode. Vehicle age mix data used were

[1] Benson, P. E., "Caline 3 - A Versatile Dispersion Model for Predicting Air Pollutant Levels Near Highways and Arterial Streets," Prepared by California Department of Transportation, Report No. FHWA/CA/TL-79/23, November 1979.

for Michigan registrations, and average annual miles driven for various age vehicles were national estimates from "Mobile Source Emission Factors." Some of the vehicles traversing the project area are of Canadian origin and their vehicle emissions standards allow higher emissions than U. S. standards. This was not thought to have a significant effect on the project assessment because these vehicles are included in the measured background and the various project alternates do not change the proportions of Canadian vehicles.

EMISSION FACTORS FOR
CARBON MONOXIDE, g/m, 30 F

Year	Average Vehicle Speeds, mph												
	10 (5)*	10 (9)	10 (10)	10 (11)	10 (12)	10 (14)	10 (15)	10 (22)	20 (21)	30 (11)	35 (10)	35 (11)	45 (10)
1983	98.2	99.2	99.9	101.2	103.2	106.6	108.3	120.1	69.7	--	--	37.4	31.7
2000	45.2	48.9	49.8	50.7	51.6	53.5	54.4	60.8	37.1	22.0	19.4	19.9	16.9

* (Percent commercial traffic)

2) Design hour traffic volume (DHV). For most roadways DHV was the p.m. peak. Traffic estimates and peak traffic speeds are shown in Table 4.

3) Meteorological Conditions. The model was run at several wind angles to the roadways to determine the angle which produced the highest carbon monoxide levels (worst case) at each of the sites for each of the alternates. A wind speed of 2.2 mph (1 m/sec) under atmospheric stability class D was used with all wind angles. Table 5 shows the frequency distribution of atmospheric stability classes for the meteorological data used.

4) Road Profile. All roadways are at grade except I 75 and I 96 which are depressed 20 ft, and the Ambassador Bridge is elevated 20 ft over Howard St and 40 ft over Lafayette St. Since the I 75 and I 96 on and off-ramps were partially depressed and partially at grade, an average profile height of minus 10 ft was used.

5) Roadway Widths.

6) Surface Roughness. A value of 108 cm was used. This is a typical value for city land use with predominantly single family residential.

TABLE 4
TRAFFIC ESTIMATES FOR MAJOR ROADWAYS INFLUENCING THE PROPOSED TOURIST INFORMATION CENTER

Roadway	No-Build		Scheme A		Scheme B		Scheme C	
	1983	2000	1983	2000	1983	2000	1983	2000
Ambassador Bridge, Northbound	10,380 ⟨940(21)⟩ [540]	15,260 ⟨1,300(21)⟩ [610]	← Same as No-Build →					
Ambassador Bridge, Southbound	10,380 ⟨980(21)⟩ [540]	15,260 ⟨1,390(21)⟩ [610]	← Same as No-Build →					
East Service Drive South of Porter St	5,760 ⟨480(14)⟩ [230]	8,230 ⟨700(14)⟩ [330]	6,480 ⟨530(22)⟩ [260]	8,470 ⟨720(22)⟩ [340]	6,020 ⟨510(22)⟩ [240]	6,740 ⟨570(22)⟩ [270]	6,720 ⟨560(22)⟩ [270]	8,820 ⟨740(22)⟩ [350]
Porter St Bridge	10,540 ⟨880(12)⟩ [420]	14,240 ⟨1,220(12)⟩ [570]	6,240 ⟨520(11)⟩ [250]	8,740 ⟨720(11)⟩ [350]	7,570 ⟨630(15)⟩ [300]	9,740 ⟨860(15)⟩ [390]	11,520 ⟨1,010(15)⟩ [460]	15,150 ⟨1,290(15)⟩ [610]
I 75 (Southbound) Exit Ramp to Porter St	4,720 ⟨360(11)⟩ [190]	6,800 ⟨580(11)⟩ [270]	← Same as No-Build →					
I 96 (Northwestbound) On Ramp	7,250 ⟨590(11)⟩ [290]	10,600 ⟨810(11)⟩ [420]	← Same as No-Build →					

TABLE 4 (Cont.)
TRAFFIC ESTIMATES FOR MAJOR ROADWAYS INFLUENCING THE PROPOSED TOURIST INFORMATION CENTER

Roadway	No-Build		Scheme A		Scheme B		Scheme C	
	1983	2000	1983	2000	1983	2000	1983	2000
I 75 (Northbound) On Ramp	4,620 ⟨400(11)⟩ [170]	6,800 ⟨560(11)⟩ [270]	——— Same as No-Build ———					
East Service Drive North of Porter St	2,740 ⟨190(10)⟩ [110]	3,860 ⟨320(10)⟩ [150]	3,700 ⟨250(10)⟩ [150]	4,780 ⟨380(10)⟩ [190]	3,630 ⟨280(10)⟩ [150]	4,840 ⟨410(10)⟩ [190]	3,920 ⟨310(10)⟩ [140]	5,160 ⟨430(10)⟩ [210]
Porter St East of Bridge Plaza	10,000 ⟨800(14)⟩ [400]	11,710 ⟨1,080(14)⟩ [470]	4,770 ⟨370(14)⟩ [190]	5,600 ⟨410(14)⟩ [220]	7,960 ⟨580(15)⟩ [320]	9,300 ⟨710(15)⟩ [370]	10,000 ⟨800(14)⟩ [400]	11,710 ⟨1,080(14)⟩ [470]
I 75 North of Porter St	47,700 ⟨3,870(10)⟩ [1,910]	64,600 ⟨5,250(10)⟩ [2,580]	←——— Same as No-Build ———→					
I 96 North of Porter St	34,430 ⟨2,870(9)⟩ [1,380]	52,400 ⟨4,350(9)⟩ [2,100]	←——— Same as No-Build ———→					
I 96 (Southbound) Off Ramp to Porter St	7,250 ⟨510(11)⟩ [290]	10,600 ⟨740(11)⟩ [420]	←——— Same as No-Build ———→					

TABLE 4 (Cont.)
TRAFFIC ESTIMATES FOR MAJOR ROADWAYS INFLUENCING THE PROPOSED TOURIST INFORMATION CENTER

Roadway	No-Build		Scheme A		Scheme B		Scheme C	
	1983	2000	1983	2000	1983	2000	1983	2000
West Service Drive North of I 96 Off Ramp	3,650 ⟨260(12)⟩ [150]	4,750 ⟨370(12)⟩ [190]	3,160 ⟨230(12)⟩ [130]	4,050 ⟨310(12)⟩ [160]	2,630 ⟨250(12)⟩ [110]	3,550 ⟨280(12)⟩ [140]	4,780 ⟨380(12)⟩ [190]	6,050 ⟨480(12)⟩ [240]
I 75 (Southbound) East of West Grand Blvd	43,550 ⟨3,670(10)⟩ [1,740]	63,700 ⟨5,230(10)⟩ [2,550]	← Same as No-Build →					
I 75 (Northbound) North of Lafayette St Off Ramp	41,060 ⟨3,380(11)⟩ [1,640]	58,500 ⟨4,800(11)⟩ [2,340]	← Same as No-Build →					
Lafayette St	6,770 ⟨720(12)⟩ [270]	7,700 ⟨800(12)⟩ [310]	9,160 ⟨1,030(12)⟩ [370]	10,000 ⟨1,300(12)⟩ [400]	6,770 ⟨720(12)⟩ [270]	7,700 ⟨800(12)⟩ [310]	8,730 ⟨930(12)⟩ [310]	9,700 ⟨1,030(12)⟩ [390]
Vernor St East of East Service Drive	7,820 ⟨500(10)⟩ [310]	8,520 ⟨550(10)⟩ [340]	← Same as No-Build →					
Vernor St Bridge	8,340 ⟨530(5)⟩ [330]	9,260 ⟨620(5)⟩ [370]	9,470 ⟨590(5)⟩ [380]	9,800 ⟨650(5)⟩ [390]	9,800 ⟨640(5)⟩ [390]	10,660 ⟨720(5)⟩ [430]	9,690 ⟨660(5)⟩ [390]	10,760 ⟨740(5)⟩ [430]

TABLE 4 (Cont.)
TRAFFIC ESTIMATES FOR MAJOR ROADWAYS INFLUENCING THE PROPOSED TOURIST INFORMATION CENTER

Roadway	No-Build		Scheme A		Scheme B		Scheme C	
	1983	2000	1983	2000	1983	2000	1983	2000
Vernor St West of West Service Drive	10,800 ⟨680(10)⟩ [430]	12,620 ⟨820(10)⟩ [500]	← Same as No-Build →					
20th St South of Porter St	8,550 ⟨730(9)⟩ [340]	10,350 ⟨1,000(9)⟩ [410]	5,380 ⟨440(10)⟩ [220]	6,600 ⟨590(10)⟩ [260]	8,550 ⟨730(9)⟩ [340]	10,350 ⟨1,000(9)⟩ [410]	8,680 ⟨730(10)⟩ [350]	9,530 ⟨800(10)⟩ [380]
20th St North of Porter St	1,440 ⟨120(9)⟩ [60]	1,760 ⟨190(9)⟩ [70]	← Same as No-Build →					
Bagley St	3,970 ⟨400(10)⟩ [150]	4,900 ⟨490(10)⟩ [200]	← Same as No-Build →					
West Service Drive South of I 96 Off Ramp	11,000 ⟨770(12)⟩ [440]	15,350 ⟨1,110(12)⟩ [610]	11,100 ⟨790(12)⟩ [440]	14,650 ⟨1,050(12)⟩ [590]	11,000 ⟨770(12)⟩ [440]	15,350 ⟨1,110(12)⟩ [610]	12,660 ⟨930(12)⟩ [510]	16,450 ⟨1,220(12)⟩ [660]

000 = average daily traffic, vehicles in 24 hours

⟨000⟩ = design hour volume (DHV), vehicles per hour

[000] = off-peak traffic, vehicles per hour

(00) = percent commercial vehicles

Average peak speeds: all surface streets, 10 mph both years; Ambassador Bridge, 20 mph both years; I 75 south of Porter St, 35 mph in 1983, 30 mph in 2000; I 75/I 96 north of Porter St, 45 mph in 1983, 35 mph in 2000.

7) Mixing height - 1,000 m. The model is not significantly sensitive to mixing height except for extremely low values. There is no detectable difference in sensitivity between 100 m and 1,000 m.

All estimates of carbon monoxide levels represent maximum worst case one-hour concentrations and are in addition to existing background levels. Worst case conditions are peak traffic, stability D, and a 2.2 mph (1 m/sec) wind. Table 2 presents the calculated estimates, the background, and the total carbon monoxide concentration at the receptor sites for each alternate scheme.

TABLE 5
STABILITY CLASS FREQUENCY DISTRIBUTION BY HOUR
(Percent)

Hour	Stability Class					
	A	B	C	D	E	F
1	0.0	0.0	0.0	50.8	19.8	29.5
4	0.0	0.0	0.0	50.4	19.5	30.1
7	10.6	14.4	9.4	50.3	8.3	7.0
10	4.4	14.9	22.3	58.5	0.0	0.0
13	1.8	9.2	23.0	66.1	0.0	0.0
16	1.2	7.5	23.1	66.1	1.9	0.2
19	0.0	0.0	0.0	66.7	23.7	9.7
22	0.0	0.0	0.0	53.2	22.8	24.0
Overall percent	2.2	5.7	9.7	57.8	12.0	12.6

Comparison of Estimates with Air Quality Standards

a) One-hour carbon monoxide standard - 40 mg/cu m (35 ppm)

The maximum estimated one-hour concentrations of carbon monoxide at each of the receptor sites in 1983 along with the estimated background and total carbon monoxide concentrations for all schemes are shown in Table 2. All schemes produce essentially the same carbon monoxide levels and all are below the standard.

TABLE 6
TRAFFIC ESTIMATES FOR TOTAL POLLUTANT
BURDEN (MESOSCALE) ANALYSIS

	1983	2000
Ambassador Bridge, Northbound		
VMT	3,200	4,900
Average Speed	20	20
Percent Commercial	21	20
Ambassador Bridge, Southbound		
VMT	3,200	4,900
Average Speed	20	20
Percent Commercial	21	20
East Service Drive South of Porter St		
VMT	1,300	1,900
Average Speed	20	20
Percent Commercial	24	42
Porter St Bridge		
VMT	900	1,200
Average Speed	20	20
Percent Commercial	22	22
I 75 (Southbound) Ramp to Porter St		
VMT	800	1,200
Average Speed	20	20
Percent Commercial	28	28
I 96 (Northwestbound) On Ramp		
VMT	1,000	1,600
Average Speed	20	20
Percent Commercial	21	21
I 75 (Northbound) On Ramp		
VMT	1,000	1,600
Average Speed	20	20
Percent Commercial	22	22
East Service Drive North of Porter St		
VMT	600	900
Average Speed	20	20
Percent Commercial	21	21

TABLE 6 (Cont.)
TRAFFIC ESTIMATES FOR TOTAL POLLUTANT
BURDEN (MESOSCALE) ANALYSIS

	1983	2000
Porter St East of Bridge Plaza		
Westbound		
VMT	800	900
Average Speed	20	20
Percent Commercial	27	27
Eastbound		
VMT	700	800
Average Speed	20	20
Percent Commercial	25	25
I 75 North of Porter St		
VMT	10,600	15,000
Average Speed	55	55
Percent Commercial	28	28
I 96 North of Porter St		
VMT	7,400	12,100
Average Speed	55	55
Percent Commercial	21	21
I 96 (Southbound) Off Ramp to Porter St		
VMT	1,600	2,400
Average Speed	20	20
Percent Commercial	22	22
West Service Drive North of I 96 Off Ramp		
VMT	600	700
Average Speed	20	20
Percent Commercial	22	22
West Service Drive South of I 96 Off Ramp		
VMT	2,900	4,100
Average Speed	20	20
Percent Commercial	9	9
I 75 (Southbound) East of West Grand Blvd.		
VMT	9,800	14,700
Average Speed	55	55
Percent Commercial	28	28

TABLE 6 (Cont.)
TRAFFIC ESTIMATES FOR TOTAL POLLUTANT
BURDEN (MESOSCALE) ANALYSIS

	1983	2000
I 75 (Northbound) North of Lafayette St Off Ramp		
VMT	9,000	13,400
Average Speed	55	55
Percent Commercial	28	28
Lafayette St		
VMT	2,200	2,500
Average Speed	20	20
Percent Commercial	25	25
Vernor St East of Bridge		
VMT	1,200	1,300
Average Speed	20	20
Percent Commercial	25	25
Vernor St Bridge		
VMT	500	500
Average Speed	20	20
Percent Commercial	25	25
Vernor St West of Bridge		
VMT	600	700
Average Speed	20	20
Percent Commercial	25	25
20th St South of Porter St		
VMT	2,600	3,100
Average Speed	20	20
Percent Commercial	26	26
20th St North of Porter St		
VMT	400	500
Average Speed	20	20
Percent Commercial	22	22
Bagley St		
VMT	500	600
Average Speed	20	20
Percent Commercial	22	22

b) Eight-hour carbon monoxide standard - 10 mg/cu m (9 ppm)

The Federal Highway Administration's report "Project Level Considerations to Assure Adequate Air Quality Analyses," June 1977, suggests the use of the following technique for determining the eight-hour carbon monoxide concentration from the one-hour concentration.

$$\frac{V_8}{V_1} \times (\text{1-hr CO concentration}) \times P = \text{8-hr CO concentration}$$

where V_8 = average hourly traffic volume in both directions during the eight-hour period of interest

V_1 = peak hour traffic volume in both directions

P = one to eight-hour meteorological persistence factor for the eight-hour period.

A value of $P = 0.6$ is suggested unless data are available to calculate a persistence factor for the proposed project. If this technique is used to calculate the eight-hour carbon monoxide level for each scheme the highest eight-hour concentrations at the receptor sites in 1983 including background are presented in Table 3. A typical calculation for alternate scheme B at site 5 in 1983 follows:

Porter St $- \frac{300 \text{ vehicles per hour}}{630 \text{ vehicles per hour}} \times 2.6 \text{ mg/cu m} \times 0.6 = 1.6 \text{ mg/cu m}$

20th St south of Porter St $- \frac{340 \text{ vehicles per hour}}{730 \text{ vehicles per hour}} \times 2.1 \text{ mg/cu m} \times 0.6 = 0.6 \text{ mg/cu m}$

20th St north of Porter St $- \frac{60 \text{ vehicles per hour}}{120 \text{ vehicles per hour}} \times 0.3 \text{ mg/cu m} \times 0.6 = 0.1 \text{ mg/cu m}$

TOTAL 2.3 mg/cu m

The maximum estimated eight-hour concentrations of carbon monoxide from the project at each of the receptor sites along with the estimated background and total carbon monoxide concentrations for all schemes are shown in Table 3. All schemes produce essentially the same carbon monoxide levels and all are below the standard.

Conclusions

The estimated concentrations of carbon monoxide, including existing background at all of the receptor sites for all alternate schemes of the proposed project are within Federal air quality standards. There is no significant difference between the alternate schemes.

Total Pollutant Burden Analysis

An estimate of total pollutant burden for carbon monoxide, hydrocarbons, and oxides of nitrogen is included for the years 1983 and 2000 at ambient temperatures of 30 and 60 F. The vehicle emission factors calculated as described previously in Item (1) under information used as input to the model were used to calculate vehicle emissions. Table 6 shows traffic data for the significant roadways in the study area used to calculate total emissions. Since the total traffic volumes, vehicle miles traveled, vehicle speeds, and percent commercial traffic in the study area do not significantly change for the various alternate schemes and the total pollutant burden would accordingly be essentially the same for all alternate schemes, including the no-build, only one total pollutant burden estimate was performed and is presented in Table 7.

TABLE 7
ESTIMATES OF TOTAL POLLUTANT BURDEN

Traffic Projection Year	Pollutant, tons per day					
	Carbon Monoxide		Hydrocarbons		Oxides of Nitrogen	
	30 F	60 F	30 F	60 F	30 F	60 F
1983	3.55	3.23	0.29	0.27	0.45	0.45
2000	2.76	2.57	0.22	0.20	0.41	0.41