

AIR QUALITY ENVIRONMENTAL IMPACT
STATEMENT FOR PROPOSED I 275
FROM I 94 TO M 153

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MICHIGAN DEPARTMENT OF STATE HIGHWAYS

**AIR QUALITY ENVIRONMENTAL IMPACT
STATEMENT FOR PROPOSED I 275
FROM I 94 TO M 153**

**Research Laboratory Section
Testing and Research Division
Research Project 72 TI-112
Research Report No. R-840
(EV-19)**

**Michigan State Highway Commission
Charles H. Hewitt, Chairman; E. V. Erickson
Vice-Chairman, Claude J. Tobin, Peter B. Fletcher
Lansing, November 1972**

Background

The terrain of the project area is largely rural and quite flat, which facilitates dispersal and dilution of air pollutants by surface winds. Figures 1 and 2 present wind speed and wind direction information averaged for 1967 through 1971 from two airports (Willow Run and Detroit Metropolitan) near the project. Figure 3 shows the relative locations of the project and the airports. A one day in nine day sampling of hourly data was used. Wind data for the two airports were first compared to determine that they were quite similar. Figure 4 shows the overall frequency distribution of wind speeds for the data used. Figure 1 shows that wind speed and wind direction vary greatly - the most frequent wind direction occurs only 6 percent of the time. From Figure 4 it can be seen that 96 percent of the time, wind speeds equal or exceed 4 mph.

The potential for air pollution episodes is quite low in Michigan due to good horizontal ventilation by wind, and the infrequent occurrence of stagnating anticyclones (high pressure areas) which persist for a significant period of time. During the 30-year period 1936 to 1965 it was found that stagnating anticyclones lasting 4 days or more occurred in the Michigan vicinity only about once every two years.¹

Existing Ambient Air Quality

A limited number of determinations of carbon monoxide levels were made in the proposed construction corridor by Research Laboratory personnel, using the NBS Indicator Tube Method. Samples were taken near points where the proposed freeway will intersect existing major traffic arteries - I 94, US 12, and M 153 (Fig. 3). Existing carbon monoxide levels at locations away from these major intersections are estimated to be near 1 mg/cu m. Carbon monoxide levels found at the sampling stations are presented in Table 1. Table 2 shows weather conditions for the days that sampling was undertaken.

TABLE 1
AMBIENT CARBON MONOXIDE LEVELS

Location	Peak Morning Traffic 9/7/72, mg/cu m	Peak Afternoon Traffic 9/12/72, mg/cu m
Ford Rd (M 153)	1	4
Michigan Ave (US 12)	1	3
I 94	1	4

¹"Implementation Plan for the Control of Suspended Particulates, Sulfur Oxides, Carbon Monoxide, Hydrocarbons, Nitrogen Oxides and Photochemical Oxidants in the State of Michigan," January 1972, pp. 1-2.

The Wayne County Health Department has a carbon monoxide monitor on the campus of Madonna College, about two miles north and one mile east of the proposed construction corridor (Fig. 3). For 2,302 hours of sampling during the period April through September 1972 the average CO concentration was 2.7 mg/cu m. Since the college area is presently more urbanized than the proposed construction area, 2.7 mg of CO/cu m is probably higher than the average level of carbon monoxide in the proposed construction corridor even at locations where existing major traffic arteries cross.

No data were available for nitrogen oxide or hydrocarbon concentrations near the proposed construction corridor.

Estimation of Pollutant Levels

Ground level concentrations of traffic-emitted pollutants (carbon monoxide, nitrogen oxides) were estimated under varying conditions at several distances from, and normal to, the shoulder of the roadway. California's generally unpublished and unvalidated highway line source dispersion model was used. This model was recommended for use at the Institute of Air Training given by the Environmental Protection Agency at Durham, North Carolina during May 1972. It includes meteorological conditions, traffic volumes, traffic emission factors, and highway design as variables.

Meteorological data (hourly observations) recorded at Willow Run Airport and Detroit Metropolitan Airport were summarized for 1967 through 1971 based on a one day in nine day sampling with a random start each year.

Emission factors were obtained from the U. S. Environmental Protection Agency, Office of Air Programs Publication, "Compilation of Air Pollutant Emission Factors," No. AP-42, Table 3-1. The 1975 emissions were speed adjusted according to Figures 3-1 and 3-2 of the same publication in order to fit the peak and off-peak average traffic speeds for this project. These emissions were used as a base, and further adjusted based on the projected national urban emissions from motor vehicles as shown in Figures 1-3 in the August 14, 1971 "Federal Register." The emission factors so derived and used for this study are:

Emission Factors g/mi

Year	CO		NO _x
	50 mph	65 mph	
1975	32.0	26.0	4.9
1977	24.0	19.5	3.9
1980	14.4	11.7	2.5
1985	4.8	3.9	1.2
1990	3.2	2.6	0.5

Traffic Estimates

Available traffic estimates are shown below. These are for one direction only, since the 94-ft median requires that separate calculations be made for each set of three lanes and the pollutant concentrations summed at the appropriate distances.

Year	I 94 to Ecorse Rd		Ecorse Rd to US 12		US 12 to M 153	
	ADT	DHV	ADT	DHV	ADT	DHV
1975	21,050	2,400	21,750	2,480	23,050	2,630
1980	26,500	2,956	27,500	3,058	28,750	3,163
1985	32,000	3,520	33,000	3,630	34,100	3,756
1990	37,100	4,040	38,000	4,140	39,300	4,290

Peak traffic was predicted to occur between 7 and 9 p.m. on Friday night, when lanes for one traffic direction would carry DHV traffic and the opposing lanes 50 percent of DHV traffic. Off-peak traffic was approximated by $\frac{ADT - 2DHV}{22}$.

Pollution estimates were made for the following cases:

1. Peak traffic volumes

(a) Worst meteorological conditions

3 mph wind parallel to highway
 Atmospheric stability Class D (calculated values higher than for Class F)
 Traffic at 50 mph.

(b) Most probable 7-9 p.m. meteorological conditions

10 mph wind at 40 degrees to highway
 Atmospheric stability Class D
 Traffic at 50 mph.

2. Off-peak traffic volumes

(a) Most probable overall meteorological conditions

10 mph wind at 50 degrees to highway
 Atmospheric stability Class D
 Traffic at 65 mph.

The pollution estimates obtained are presented in tables 3 and 4. Ambient pollutant levels are not included. NO_x (as NO_2) values are included for information only. No emission factors for NO_2 are available, so no comparison of the reported NO_2 values with air quality standards is possible. Hydrocarbon data are not reported because photochemical smog is not thought to occur in Michigan to any significant degree.

The moderate levels of carbon monoxide predicted are not expected to cause adverse environmental effects.

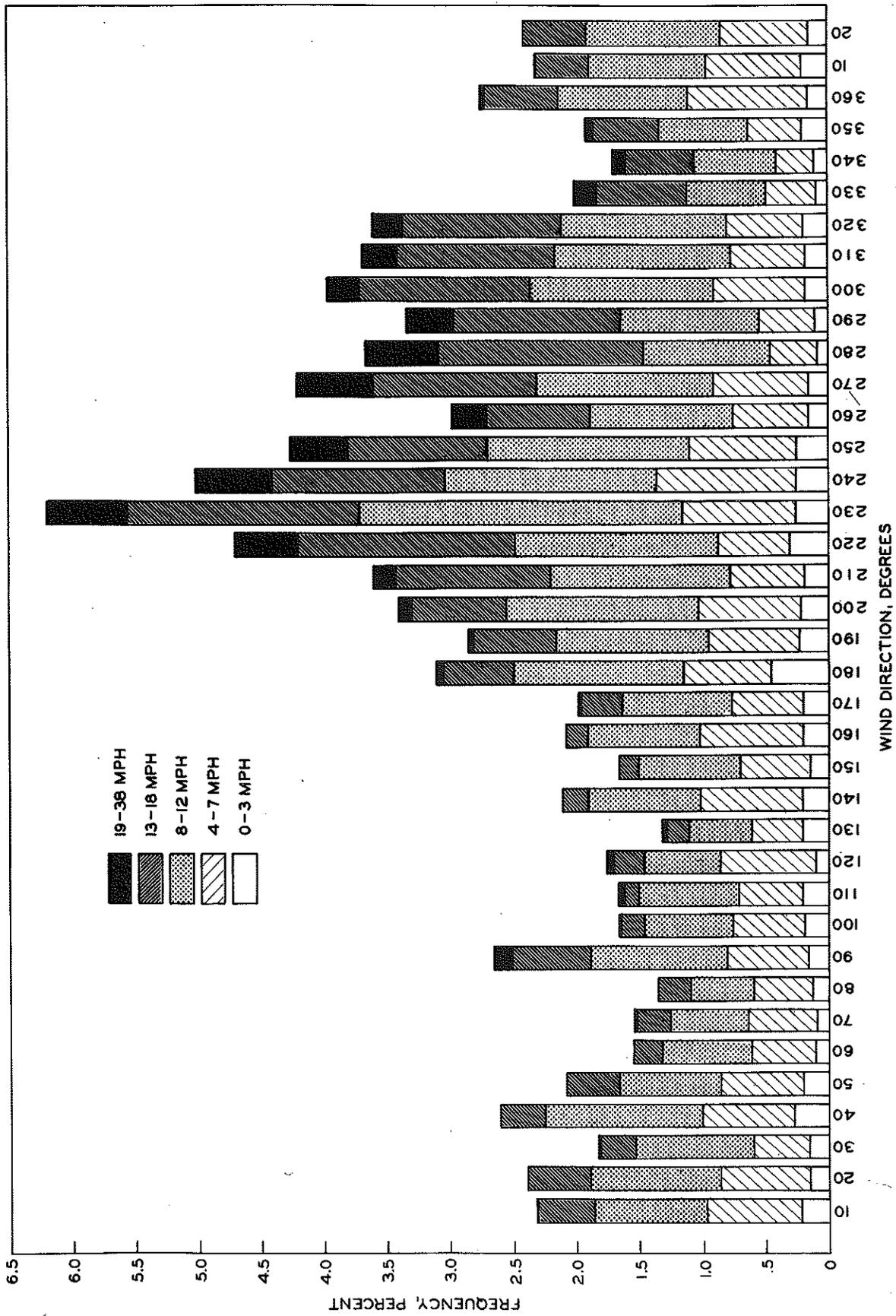


Figure 1. Thirty-six point summary of averaged wind data for Detroit Metropolitan and Willow Run Airports.

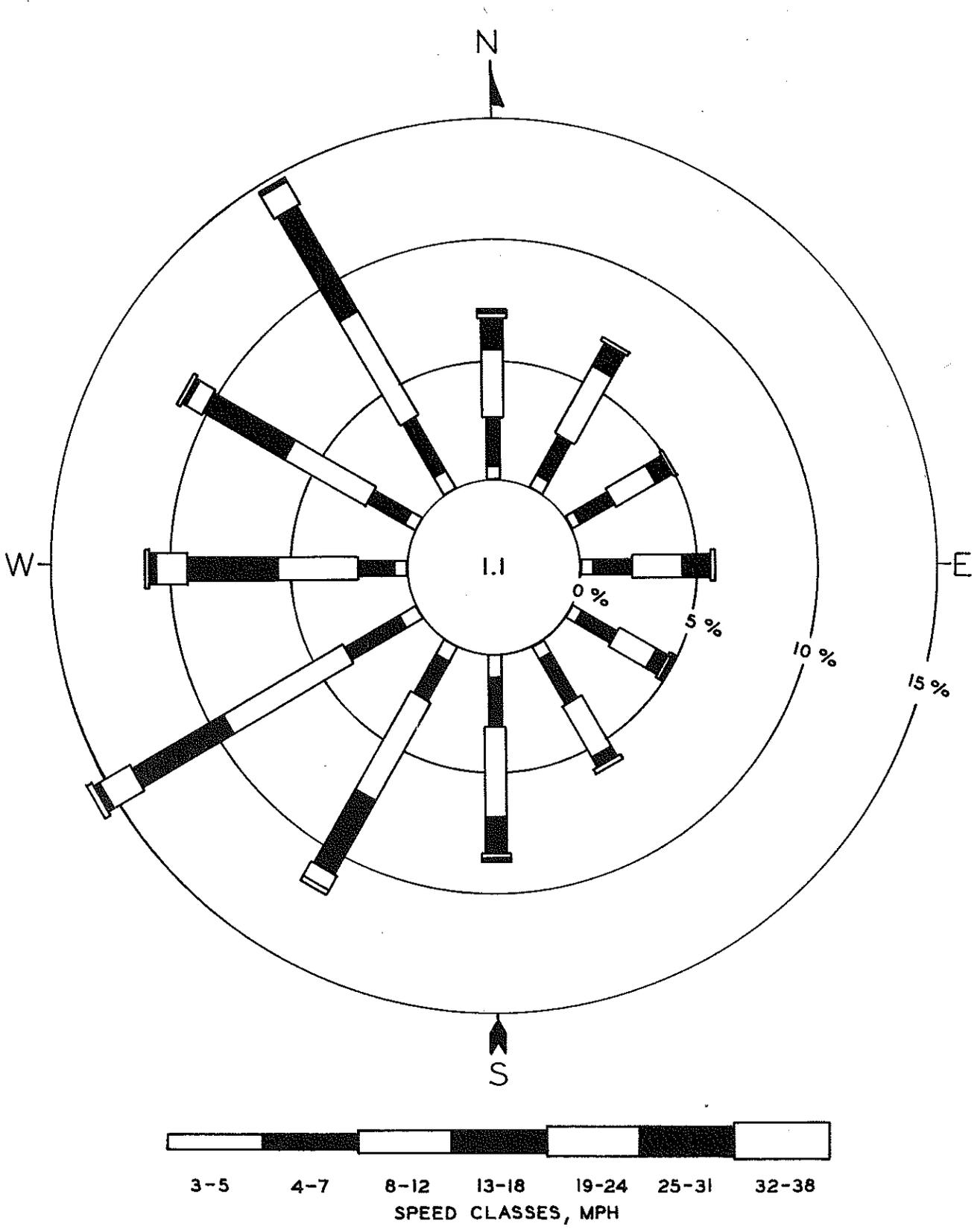


Figure 2. Wind rose, based on average of hourly weather data from Detroit Metropolitan and Willow Run Airports.

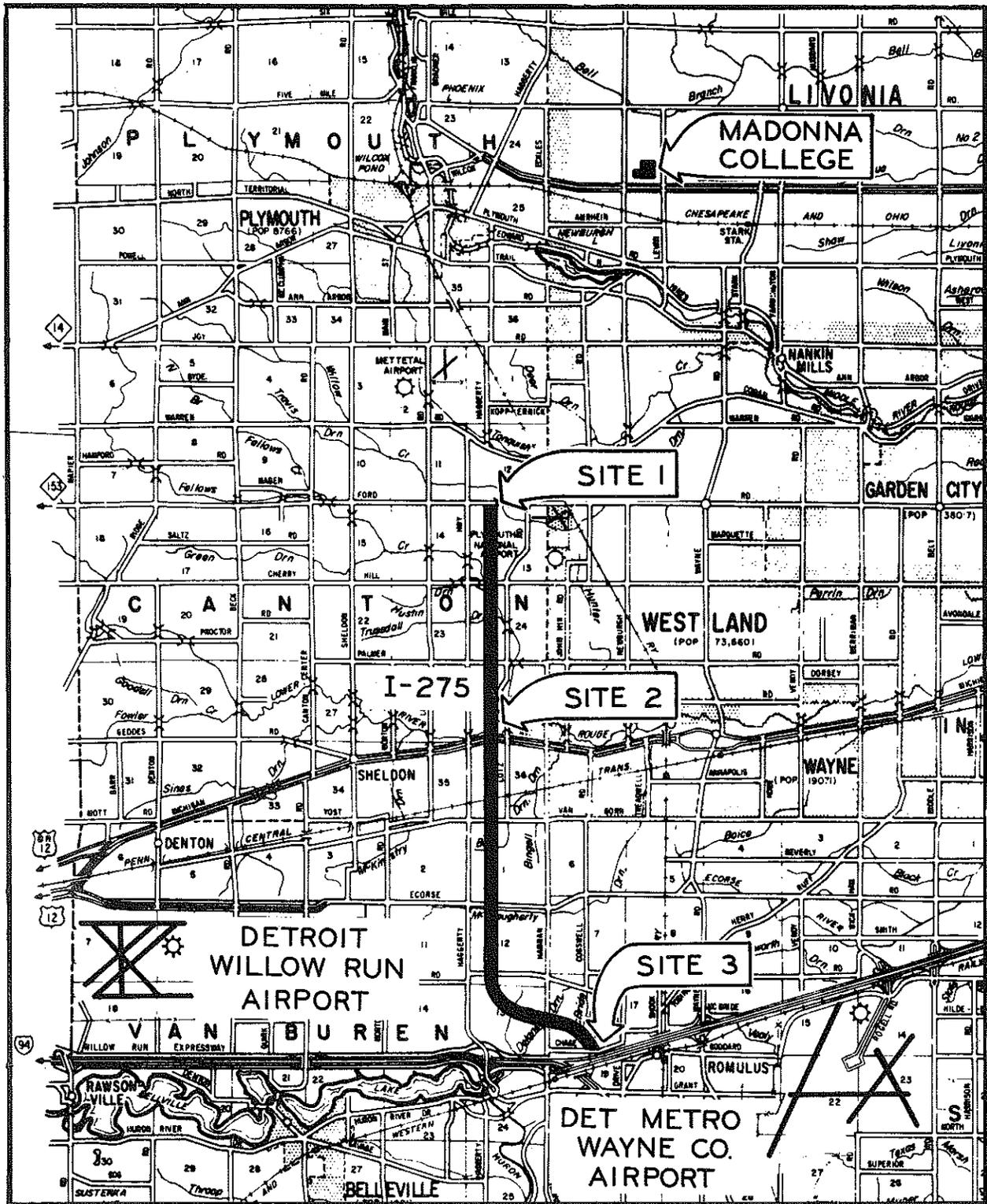


Figure 3. Area map showing CO sampling locations, Madonna College (Wayne Co. sampling site), and Willow Run and Detroit Metropolitan Airports.

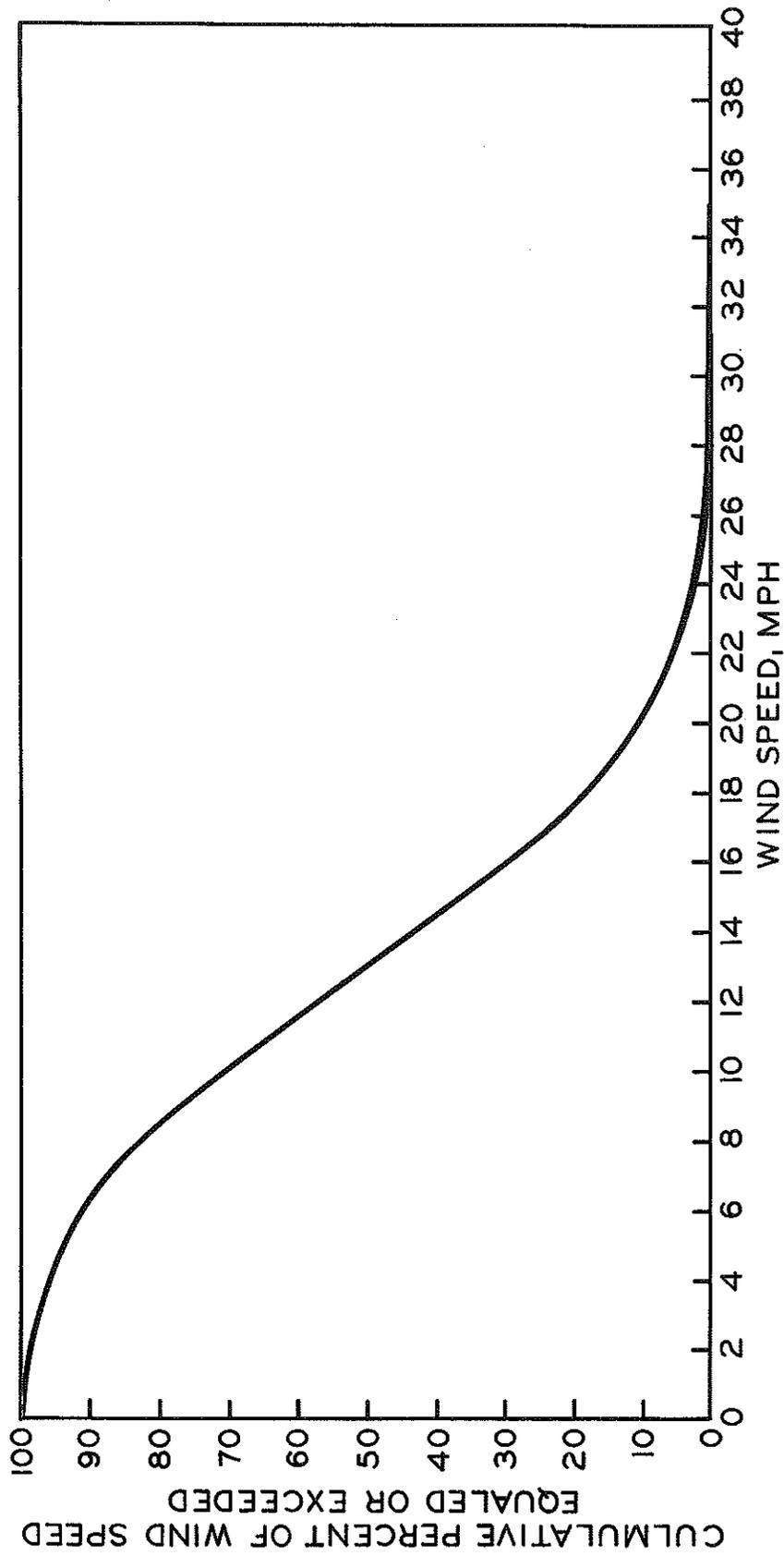


Figure 4. Wind speed frequency graph based on average of hourly weather data from Detroit Metropolitan and Willow Run Airports.

TABLE 2
 WEATHER DATA FOR DAYS WHEN AIR ANALYSES WERE MADE

Date	Airport	Hour	Sky Cover, tenths	Ceiling, hnds of ft	Visibility, miles	Weather*	Temp., F	Wind			
								Direction	Speed, mph		
9/7/72	Detroit Metro	7	2	200	5	KH	57	18	8		
		8	2	200	5	KH	61	19	10		
		9	3	200	6	KH	66	20	13		
		10	3	200	6	KH	71	18	12		
	Willow Run	7	6	60	3	KH	57	19	8		
		8	6	60	3	KH	61	19	12		
		9	6	120	3	KH	66	21	7		
		10	7	120	3	KH	70	21	12		
		9/12/72	Detroit Metro	15	10	30	2-1/2	KH	69	17	6
				16	10	16	2-1/2	KH	70	19	7
17	10			28	2-1/2	KH	70	18	7		
18	10			25	2-1/2	KH	68	18	6		
Willow Run	15	10	19	1-1/2	FKH	70	21	5			
	16	10	25	2-1/2	KH	70	20	7			
	17	10	23	2-1/2	KH	70	18	7			
	18	10	12	2-1/2	KH	70	18	6			

* K = smoke
 H = haze
 F = fog

TABLE 3
 WORST CASE AND MOST PROBABLE CASE POLLUTION ESTIMATES
 FOR PEAK TRAFFIC VOLUMES (50 mph)

Meteorological Conditions	Location	Year	Distance From Edge of Roadway					
			40 meters		60 meters		100 meters	
			CO mg/cu m	NOx µg/cu m	CO mg/cu m	NOx µg/cu m	CO mg/cu m	NOx µg/cu m
Worst case: parallel wind at 3 mph Atmospheric Stability Class D	I 94 to Ecorse Rd	1975	8.5	1,301	4.2	638	0.8	125
		1990	1.4	211	0.7	104	0.1	21
Worst case: parallel wind at 3 mph Atmospheric Stability Class D	Ecorse Rd to US 12	1975	7.7	1,179	3.9	595	0.8	116
		1990	1.3	194	0.6	97	0.1	19
Worst case: parallel wind at 3 mph Atmospheric Stability Class D	US 12 to M 153	1975	4.5	694	2.2	337	0.4	68
		1990	0.8	127	0.4	57	0.1	11
Most probable case (7 to 9 p. m.): 40-deg wind at 10 mph Atmospheric Stability Class D	I 94 to Ecorse Rd	1975	0.7	101	0.6	93	0.6	87
		1990	0.1	16	0.1	15	0.1	14
Most probable case (7 to 9 p. m.): 40-deg wind at 10 mph Atmospheric Stability Class D	Ecorse Rd to US 12	1975	0.6	95	0.6	88	0.5	82
		1990	0.1	16	0.1	15	0.1	14
Most probable case (7 to 9 p. m.): 40-deg wind at 10 mph Atmospheric Stability Class D	US 12 to M 153	1975	0.6	92	0.6	85	0.5	80
		1990	0.1	15	0.1	14	0.1	13

TABLE 4
 POLLUTION ESTIMATE FOR OFF-PEAK TRAFFIC
 UNDER MOST PROBABLE CONDITIONS
 (50-deg wind at 10 mph, 65 mph traffic, and Atmospheric Stability Class D)

Location	Year	Distance From Edge of Roadway					
		40 meters		60 meters		100 meters	
		CO mg/cu m	NO _x μg/cu m	CO mg/cu m	NO _x μg/cu m	CO mg/cu m	NO _x μg/cu m
I 94 to Ecorse Rd	1975	0.19	36	0.18	33	0.16	30
	1980	0.11	23	0.10	21	0.09	20
	1985	0.04	13	0.04	12	0.04	11
	1990	0.03	6	0.03	6	0.03	5
Ecorse Rd to US 12	1975	0.18	34	0.17	31	0.15	29
	1980	0.10	21	0.10	22	0.09	18
	1985	0.04	12	0.04	11	0.03	10
	1990	0.03	6	0.03	6	0.03	5
US 12 to M 153	1975	0.17	33	0.16	30	0.15	27
	1980	0.10	21	0.09	19	0.08	17
	1985	0.04	12	0.04	11	0.03	10
	1990	0.03	6	0.03	5	0.03	5

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