

# PERFORMANCE OF VOLUNTEER MONITORS USING CITIZENS BAND RADIO FOR A HIGHWAY COMMUNICATIONS SERVICE

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A 2-year study of the performance of Ohio REACT volunteer monitors using Citizens Band (CB) radio to provide a highway and emergency communication service has been completed. The report describes how CB radio is used for aid and information purposes. Measured performance data are used to analyze monitoring coverage in the state. It is shown that in Ohio volunteer CB monitors annually contribute a public service having an economic value of approximately \$10.2 million.

•REACT (radio emergency associated citizens teams) is a nationwide organization of volunteer monitors who use the official U.S. emergency channel, No. 9, in the Citizens Radio Service band to provide assistance to motorists and others in need.

The Ohio REACT program was initiated in June 1970, in cooperation with the Ohio State Highway Patrol, to measure the performance and evaluate the potential of a volunteer-operated radio link as a highway communication service. The program proved conclusively that thousands of volunteers, donating time worth an estimated \$10 million while providing emergency highway communications, are a major public service resource. The Ohio study represents only the tip of the iceberg, because some 40,000 REACT volunteers around the country use Citizens Band (CB) two-way radios to communicate pleas for assistance to monitoring REACT teams. The program is significant in that Class D Citizens Radio Service (CB) provides the largest possible user population with which to study a highway communications system using two-way radio from the motorist to an emergency monitor. The Citizens Radio Section of the Electronic Industries Association (EIA) claims that one out of every 60 automobiles and one out of every 10 recreational vehicles are equipped with CB radio. The Federal Communications Commission (FCC) states that approximately 800,000 licenses are active. Overall, CB radio provides a low-cost, widely deployed means of providing the motorist with a two-way communications system.

Our objective here is to report the phase 2 performance of the Ohio REACT program (2). Phase 2 extended from September 1, 1971, through August 31, 1972, second and final year of the program. Phase 2 differed from phase 1 (1, 2, 3) in two respects. The call log form used by REACT monitors was expanded to provide documentation of more categories. This step was undertaken to better define the "other incident" category that accounted for 22.3 percent of all calls reported during phase 1. The "action taken" category was expanded for the same reason.

In addition to changes in the call log form, a monitoring hours form was introduced to document how comprehensively REACT teams were achieving their primary goal of monitoring the national emergency channel 24 hours per day. This is the first attempt that has been made to directly document monitoring hours and is the most interesting aspect of this report.

The role of the state highway patrol has been vital to the success of the program. When the program started in 1970, 23 of the patrol's 57 posts were equipped with CB radio. Today, 40 posts are so equipped. The REACT teams have been primarily responsible for this growth, because they donate and install the equipment. State highway

patrol dispatchers monitor these radios on a volunteer basis. Calls received by the state highway patrol directly are not included in this report. More important than any monitoring conducted by the patrol has been their enthusiastic support of the program, which continues to be a source of encouragement to REACT volunteers in Ohio.

### TEAM PARTICIPATION

There are 80 REACT teams located in 75 cities in Ohio. These teams are distributed according to city population as shown in Figure 1. The distribution has a pronounced mode with 40 percent of the teams located in cities with populations of 10,000 to 50,000. Team participation in the program is given in Table 1. Of the 80 teams, 52, or 65 percent, consistently participated in the reporting process. In view of the fact that this is a completely voluntary operation with no monetary compensation, we judge this to be good participation. The other 28 teams accounted for less than 4 percent of the call reports and less than 2 percent of the reported gross monitored hours. From the monitoring hours reports, we were able to document the participation of 889 individuals in the program. This number is about 10 percent below that expected because husband and wife pairs reported their monitoring hours on a common form.

### CALL REPORTS

The purpose of the call reports was to document how motorists make use of CB radio to satisfy their needs for aid and information. A completed report form is shown in Figure 2. The forms, as received from the monitors, were used by keypunch operators to prepare record cards. One record was prepared for each column of information with the boxed header information common to each record. The records were then machine-tabulated by entry code (an accident is code 20) and by month. The total calls reported were also tabulated according to team number and month.

#### Type of Incident

A total of 14,750 calls were documented. The callers used CB radio for the purposes given in Tables 2 and 3. About 82.8 percent of the calls were road-related, and 21.96 percent were non-road-related. These data are approximate because 4.78 percent of the calls involved more than one incident category. The statistics on road-related uses are consistent with previously published data (1, 3). The significant categories of accidents, occupied stalled vehicles, and requests for road information account for 58.2 percent of all calls or 71 percent of all road-related calls.

Documentation of non-road-related calls has not been done before by us. There is a residual unidentified call category that accounts for 7.39 percent of all calls, and we believe that most of these calls are time checks and information exchanges between monitors. The net non-road, non-trivial use of CB radio by the callers accounted for 14.57 percent of all calls.

#### Sources of Calls

The sources of calls are given in Table 4. Note that 76.14 percent of all calls (85.62 percent of the calls that specified source) originated from a passerby, mobile REACTer, or trucker. These latter two categories might also be classified as passersby. In only 9.18 percent (10.32 percent of calls that identified the source) was the caller involved in the incident.

#### Time to Complete Calls

Figure 3 shows the distribution of time in minutes to complete call transactions. This is the time from which the call was received by the monitor until appropriate action was initiated and the caller was advised of the action taken. The most frequently reported time to complete a transaction is 1 minute or less. We calculate that 84.9 percent of the transactions are reported as complete in 5 minutes or less. Other researchers (4) have estimated that the use of CB radio on the Detroit expressway system saves an average of 17 minutes in detection time.

Figure 1. Distribution of Ohio REACT teams according to city population.

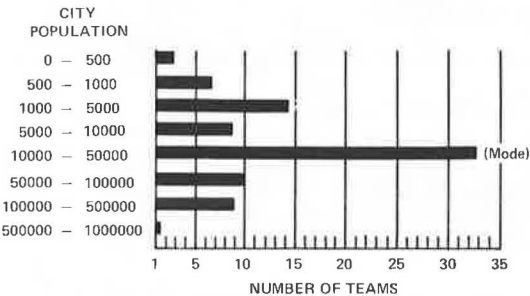


Table 1. Participation of REACT in phase 2.

Participation	Number of Teams	Percent of Teams
None (neither call nor hour reports)	7	0.88
Call but no hour reports	9	11.25
Trivial hour reporting <sup>a</sup>	12	15.00
Consistent participation	52	65.00
Total	80	
Teams reporting any monitored hours	64	

<sup>a</sup>Monitoring of less than 10 percent of the available time (8,784 hours) was reported.

Table 2. Call reports by type of road-related incident.

Incident	Total Calls	Percent
Accident count	3,476	23.57
Vehicle count	6,618	
With injuries	579	
With fatalities	56	
Stalled vehicle, occupied	2,497	16.93
Stalled vehicle, unoccupied	817	5.54
Abandoned vehicle, no plates	94	0.64
Road obstruction or traffic hazard	1,216	8.24
Major traffic jam	310	2.10
Traffic control equipment malfunction	707	4.79
Reckless or drunk driver	351	2.38
Request for road information	2,611	17.70
Vehicle fire	134	0.91
Total		82.82

Table 3. Call reports by type of non-road-related incident.

Incident	Total Calls	Percent	Incidents	Total Calls	Percent
Aircraft accident	9	0.06	Natural disaster	4	0.03
Alarm ringing	35	0.24	Non-vehicle fire	87	0.59
Animal on road	91	0.62	Persons fighting	52	0.35
Boating emergency	14	0.09	Railroad accident	9	0.06
Civil disturbance	43	0.29	Red Cross business	22	0.15
Crime report	175	1.19	Relay personal call	568	3.85
Dead animal	73	0.49	Severe weather	116	0.79
Explosion	17	0.12	Street lights out	59	0.40
Family emergency	86	0.58	Telephones out	59	0.40
Flood	39	0.26	Unconscious person	44	0.30
Gas leak	10	0.07	Vandalism	137	0.93
Industrial accident	5	0.03	Water leak	32	0.22
Medical emergency	103	0.70	Wires down	80	0.54
Missing child	116	0.79	None of these	1,090	7.39
Missing person	64	0.43	Total		21.96

Table 4. Sources of call reports.

Source	Total Calls	Percent
Caller involved in incident	1,354	9.18
Passerby	7,212	48.89
REACTer	3,751	25.43
Police	259	1.76
Base station	273	1.85
Trucker or commercial vehicle	269	1.82
Total		88.93

Figure 2. Call report form.

TEAM NAME: Summit County REACT TEAM # 0480

TEAM ADDRESS: 805 Douglas Rd OPERATOR'S NAME: Lisa Pickney UNIT # 3

COUNTY: Summit STATE: Ohio ZIP 44306 BASE STA. ☒ OR MOBILE ☐

	CALL	CALL	CALL	CALL	CALL
ENTER DATE OF CALL (MO/DA/YR)	4/21/22	4/21/22	4/21/22	4/21/22	4/21/22
ENTER TIME (24 Hr Clock) OF FIRST CONTACT (XXXX)	0945	1030	1605	2350	1130

TYPE OF INCIDENT:

ACCIDENT (20)		20			
THE ACCIDENT INVOLVED INJURY/S (21)					
THE ACCIDENT INVOLVED FATALITY/S (22)					
ENTER THE NUMBER OF VEHICLES INVOLVED (XX)		3			
STALLED VEHICLE - OCCUPIED (23)	23		23		23
STALLED VEHICLE - UNOCCUPIED (24)					
ABANDONED VEHICLE - PLATES REMOVED (25)					
ROAD OBSTRUCTION AND/OR TRAFFIC HAZZARD (26)					
MAJOR TRAFFIC JAM (27)		27			
TRAFFIC CONTROL EQUIPMENT MALFUNCTION (28)					
RECKLESS AND/OR DRUNK DRIVER (29)					
REQUEST FOR ROAD INFORMATION (30)				30	
VEHICLE ON FIRE (31)					
OTHER INCIDENT (Enter Code #, See List) (XX)					

TYPE OF ROAD:

LIMITED ACCESS (Expressway) (32)		32	32	32	32
TOLL ROAD (Turnpike) (33)					
URBAN (City Street) (34)	34				
RURAL (Out-City Street/Road) (35)					

SOURCE OF CALL:

	KD4	KD4	KAK	KD2	KES
CALLER'S SIGN (XXXXXXX)	6054	2040	2975	1528	3559
CALLER INVOLVED IN THE INCIDENT (36)					
PASSERBY (37)		37	37	37	37
REACTOR (38)	38				
POLICE (39)					
BASE STATION (40)					
TRUCKER AND/OR COMMERCIAL COMPANY (41)					

ACTION TAKEN BY YOU:

NOTIFIED STATE HIGHWAY PATROL (State Police) (42)					
NOTIFIED CITY POLICE (43)	48	43	43		
NOTIFIED SHERIFF (44)					
NOTIFIED FIRE DEPARTMENT (45)					
NOTIFIED HIGHWAY DEPARTMENT (46)					
NOTIFIED HOSPITAL AND/OR AMBULANCE (47)					
CALLED SERVICE STATION AND/OR WRECKER (48)					48
CALLED UTILITY COMPANY (49)					
CONTACTED OTHER REACT TEAM (50)					
COMPLETED PERSONAL CALL FOR CALLER (51)					
GAVE PERSONAL SERVICE TO MOTORIST (52)	52				
GAVE CALLER INFORMATION (53)					
NONE (54)					
ACTION COMPLETED VIA LANDLINE (TELEPHONE) (55)		55	55		55
ACTION COMPLETED VIA CB RADIO (56)	56			56	
TIME (24 Hr. Clock) MOTORIST NOTIFIED (XXXX)	0940	1035	1610	2350	1135

## "OTHER INCIDENTS" CODE LIST:

AIRCRAFT ACCIDENT (60)	EXPLOSION (67)	MISSING PERSON/S (74)	SEVERE WEATHER (81)
ALARM RINGING (61)	FAMILY EMERGENCY (68)	NATURAL DISASTER (75)	STREET LIGHTS OUT (82)
ANIMAL ON ROAD (62)	FLOOD (69)	NON-VEHICLE FIRE (76)	TELEPHONES OUT (83)
BOATING EMERGENCY (63)	GAS LEAK (70)	PERSONS FIGHTING (77)	UNCONSCIOUS PERSON (84)
CIVIL DISTURBANCE (64)	INDUSTRIAL ACCIDENT (71)	RAILROAD ACCIDENT (78)	VANDALISM (85)
CRIME REPORT (65)	MEDICAL EMERGENCY (72)	RED CROSS BUSINESS (79)	WATER LEAK (86)
DEAD ANIMAL (66)	MISSING CHILD (73)	RELAY PERSONAL CALL (80)	WIRES DOWN (87)
			NONE OF THESE (88)

### Distribution of Teams by Number of Calls

Figure 4 shows the distribution of teams according to the number of call reports processed. Twenty teams reported 51 to 100 calls. The next most frequent statistic was 1 to 20 calls reported by 18 teams. Of the 71 teams that submitted any call reports, 69 percent submitted 100 or less during the 12-month period of the program. The average number of calls logged by each REACT monitor was 16.6.

### MONITORED HOURS

Our major purpose during phase 2 of the program was to determine the comprehensiveness of monitoring coverage in Ohio. In the past, coverage has been implied from the quantity of call reports, but it has never been directly measured. To obtain a direct measure we distributed the form shown in Figure 5 to each REACT team. The team monitors (unit operators) were requested to use the form to document their monitored hours for each month and to total the hours in the right-hand column and bottom row. Each unit operator was requested to use a separate sheet for each channel monitored and for base-station and mobile hours. The sheets were used to keypunch record cards for date code, channel number, team number, unit number, base station or mobile operation, and the hours data in the right-hand column.

Teams frequently have more than one unit operator monitoring at the same time. Thus, the gross hours submitted by the team do not reflect its net performance factor. We define the team monitoring performance factor as the percent of available hours monitored by at least one unit operator. (Available hours equal  $366 \text{ days} \times 24 \text{ hours/day} = 8,784 \text{ hours}$  for the phase 2 period.) To calculate team performance factors, we prepared forms to show net monitoring hours for each team. A sample of these data is shown in Figure 6.

The data were prepared by overlaying the gross time reports, submitted by each unit operator in a given month, and inking in each hour that was monitored by at least one person. The result is a composite of the net hours monitored for each team for each month. These data were then processed in a manner similar to the gross hours data.

The results of the tabulations are summarized in Table 5. A total of 388,976 gross monitored hours were reported. Of these hours, 89.9 percent were spent in monitoring channel 9 and 96.6 percent of the gross hours were reported as monitoring Channel 9 or 11.

The net monitored hours tabulation yielded 220,628 hours. This is 56.7 percent of the gross hours and indicates the degree of redundancy (43.3 percent) in team monitoring activities. The net average performance factor for participating teams was 39.24 percent of available hours. Redundancy in monitoring coverage may not be wasteful; it is often necessary to achieve full coverage of a team's geographical area.

### Team Reporting Performance

The conscientiousness with which teams participated in the program by submitting their monitored hours reports is shown in Figure 7. Of the 80 teams, 64, or 80 percent, participated in the program to some extent. Of those teams, 28.75 percent reported for all 12 months of the program and 79.64 percent reported for 6 or more months.

### Monitoring Performance Factor

The distribution of teams according to their monitoring performance factor is shown in Figure 8. Two (3.12 percent) of the 64 participating teams achieved more than a 90 percent performance factor. The average monitoring performance factor was 39.1 percent.

### Number of Monitors

During the 12-month period we received monitored hours reports from 889 unit operators. The distribution of teams according to their number of unit operators is shown



Figure 3. Relative density of time required for monitors to complete call transactions.

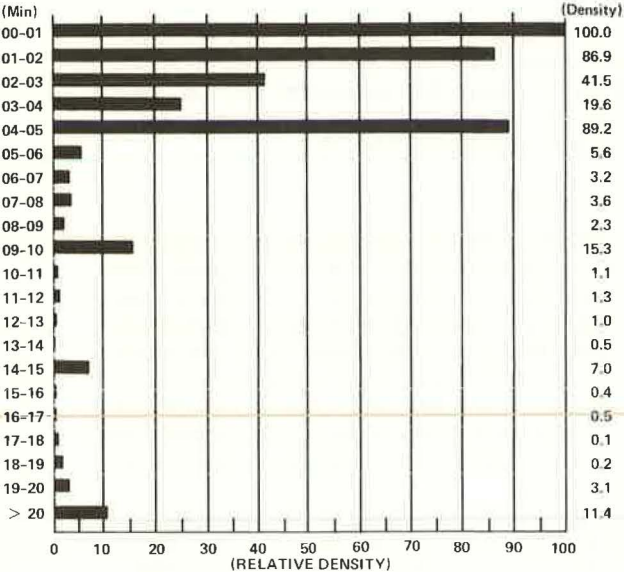


Figure 4. Distribution of teams by number of call reports.

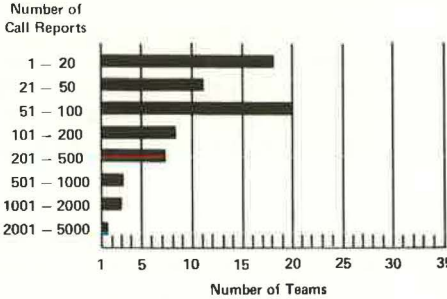


Figure 5. Monitored hours reporting form.

STATE OHIO  
MONTH SEPT TEAM NAME SUMMIT CO REACT, TEAM# C4K0 BASE STATION 1  
CB CHANNEL # 9 OPERATOR'S NAME Kenny COX, UNIT# 43 MOBILE

HR. OF DAY	DAY OF THE MONTH																															TOTALS	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31		
0001-0059 12:00-12:59 A.M.														X	X	X								X					X			5	
0100-0159 1:00-1:59 A.M.														X	X	X								X					X			5	
0200-0259 2:00-2:59 A.M.														X	X	X								X					X			4	
0300-0359 3:00-3:59 A.M.														X	X	X																1	
0400-0459 4:00-4:59 A.M.																																	
0500-0559 5:00-5:59 A.M.																																	
0600-0659 6:00-6:59 A.M.																																	
0700-0759 7:00-7:59 A.M.																																	
0800-0859 8:00-8:59 A.M.													X	X	X	X	X	X			X			X		X		X		X		10	
0900-0959 9:00-9:59 A.M.												X	X	X	X	X	X	X			X			X		X		X		X		10	
1000-1059 10:00-10:59 A.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		13	
1100-1159 11:00-11:59 A.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		13	
1200-1259 12:00-12:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		13	
1300-1359 1:00-1:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		12	
1400-1459 2:00-2:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		12	
1500-1559 3:00-3:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		11	
1600-1659 4:00-4:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		11	
1700-1759 5:00-5:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		11	
1800-1859 6:00-6:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		11	
1900-1959 7:00-7:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		12	
2000-2059 8:00-8:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		12	
2100-2159 9:00-9:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		11	
2200-2259 10:00-10:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		11	
2300-2359 11:00-11:59 P.M.				X				X				X	X	X	X	X	X	X			X			X		X		X		X		11	
TOTALS				14				14				16	16	20	19	18	16	7			5	16		9	7		14	8				119 Hrs	

Figure 6. Net monitored hours form.

MONTH

121  
DEC.

TEAM NAME \_\_\_\_\_

TEAM#

480

5, 9, 13, 68, 69, 72

HR. OF DAY	DAY OF THE MONTH																															TOTALS
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
0001-0059 12:00-12:59 A.M.																																9
0100-0159 1:00-1:55 A.M.																																7
0200-0259 2:00-2:59 A.M.																																7
0300-0359 3:00-3:59 A.M.																																7
0400-0459 4:00-4:59 A.M.																																8
0500-0559 5:00-5:59 A.M.																																8
0600-0659 6:00-6:59 A.M.																																21
0700-0759 7:00-7:59 A.M.																																22
0800-0859 8:00-8:59 A.M.																																22
0900-0959 9:00-9:59 A.M.																																31
1000-1059 10:00-10:59 A.M.																																14
1100-1159 11:00-11:59 A.M.																																14
1200-1259 12:00-12:59 P.M.																																10
1300-1359 1:00-1:59 P.M.																																13
1400-1459 2:00-2:59 P.M.																																19
1500-1559 3:00-3:59 P.M.																																31
1600-1659 4:00-4:59 P.M.																																31
1700-1759 5:00-5:59 P.M.																																30
1800-1859 6:00-6:59 P.M.																																30
1900-1959 7:00-7:59 P.M.																																26
2000-2059 8:00-8:59 P.M.																																25
2100-2159 9:00-9:59 P.M.																																31
2200-2259 10:00-10:59 P.M.																																31
2300-2359 11:00-11:59 P.M.																																21
TOTALS																																

(Use separate sheets for each channel monitored and for base station and mobile operations. Submit reports monthly.)



in Figure 9. The mode of the distribution is 6 to 10 monitors, with a population of 16 teams. The average is 13.89 unit operators per team.

### Geographic Considerations

The geographic location of participating teams and their monitoring performance factors are shown in Figure 10. Of the 88 Ohio counties, 42, or 47.72 percent, had a team that participated in the reporting program. The distribution of Ohio cities and REACT teams, by city population, is given in Table 6. It is interesting to note that, as city size increases, the probability of a REACT team being formed there also increases. Although there is very good probability that cities with populations greater than 50,000 people will have a REACT team, a team performance factor does not correlate with city size.

### CB RADIO AS A RESOURCE

Several projections based on the data presented here and in the 1969 FCC survey (5) were made. We have documented the participation of 889 individuals who contributed a total of 388,976 hours of monitoring time. This averages to 437.5 hours per man per year or 1.19 hours per day. The economic value of this contribution is estimated at \$661,259 when a minimum labor rate of \$1.70 is used. Furthermore, the average capital investment of a REACT team member is estimated by REACT National Headquarters at \$600. The equipment used in this study then represents a capital investment of approximately \$533,400.

The FCC survey reports that in 1969 there were 39,587 CB licensees in Ohio and that 74 percent of all licensees, or 29,294, were actively using CB radio at the time the survey was taken. Furthermore, the FCC report estimates that 47 percent of active licensees use CB radio for emergency communications. These data indicate that there are approximately 13,768 active licensees using CB radio for emergency communications in Ohio.

The FCC report further estimates the average operating licensee's investment at between \$311 and \$793. By projecting these data for Ohio, we estimate the capital investment at between \$4.3 million and \$10.9 million.

We note that the FCC report indicates that CB radio is used an average of 17 times a year for emergency communications per qualifying licensee. Our data agree very closely with this figure. The 889 REACT participants documented 14,750 calls in phase 2 of the program, or 16.6 calls per participant.

We observed that these calls required an average monitoring time of 437.5 hours per participant. Extending this monitoring time to the 13,768 Ohio licensees, we calculated 6.0 million man-hours. This volunteer labor has an estimated economic value of \$10.2 million even at a minimum wage rate of \$1.70 per hour. The investment in time and capital is continuing to grow. EIA reports 180,000 new transmitters are being put into service annually in the United States. Ohio's share is estimated at 7,200 new installations per year.

The use of CB radio for emergency communications is a substantial existing and constantly growing resource that makes no demands on public money.

### ACKNOWLEDGMENTS

We wish to thank the 889 REACT team operators in Ohio who devoted personal time to seeing that we received their documentation: Robert M. Chiaramonte, Superintendent, Ohio State Highway Patrol, and his officers and men for their splendid cooperation; and Henry B. Kreer, REACT National Director, for his assistance and encouragement. Special thanks are due to Vincent W. Coppola of General Motors Research Laboratories, who reviewed many of the call and hour reports and who compiled the net monitored hours data.

### REFERENCES

1. Summary of REACT Log Reports, Ohio Monitoring Project: Phase 1 Final Report. General Motors Research Laboratories, Warren, Michigan, Nov. 1971.



Table 5. Classification of monitored hours.

Monitoring Subject	Gross Hours	Percent of Gross
Gross monitored hours, total	388,976	100.0
Channel 9	349,885	89.9
Channel 11	25,996	6.7
Other channels	13,095	3.4
Base station operators	378,377	97.3
Mobile operators	10,599	2.7
Net monitored hours*	220,628	56.7

\*Net hours = number of available hours that at least one team member reported monitoring.

Figure 7. Distribution of teams making monthly monitored hours reports.

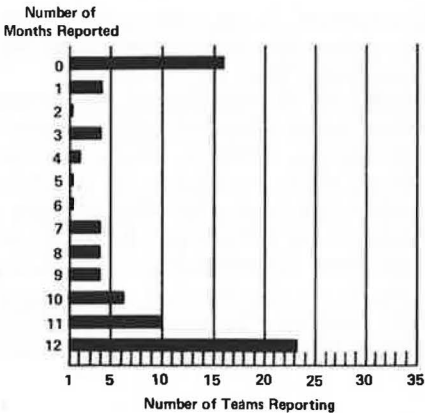


Figure 8. Distribution of teams by net monitored hours performance factor.

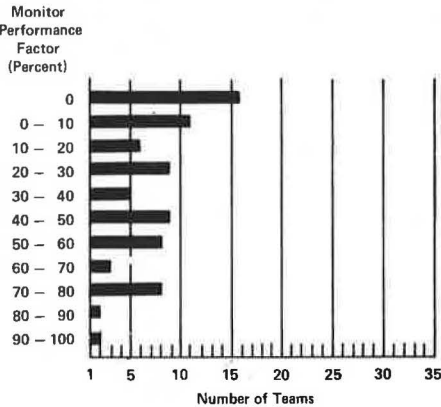


Figure 9. Distribution of teams by total number of participating unit operators (monitors) on team.

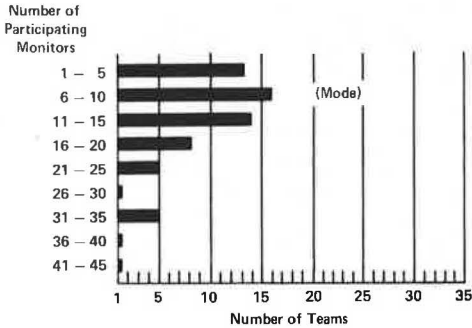


Figure 10. Geographic distribution of Ohio REACT teams and their monitoring performance factors.

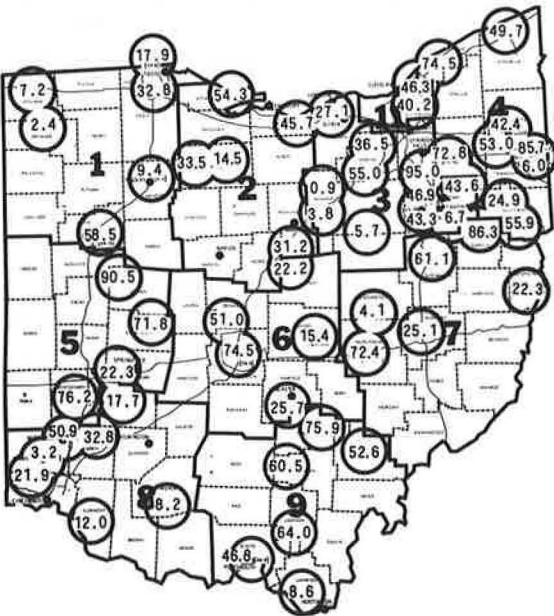


Table 6. Distribution of Ohio cities and REACT by city population.

City Population	Number of Cities	Number of Teams	Percent of Cities With Teams
<1,000	No data	4	
1,000-5,000	106	15	14.15
5,000-10,000	94	5	5.31
10,000-50,000	133	33	24.81
50,000-100,000	11	7	63.63
100,000-500,000	7	6	85.70
500,000-1,000,000	2	2	100.00

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