

Special Events and Carbon Monoxide Violations: TSM, Crowd Control, Economics, and Solutions to Adverse Air Quality Impacts

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Issues involved with the staging of short-term special events, including regulatory concerns, transportation systems management (TSM), crowd control, carbon monoxide (CO) incidents, and economics, are examined. Five of these events in the Twin Cities Metropolitan Area of Minneapolis and St. Paul are then investigated. Although TSM efforts can improve traffic flow during special events, the unplanned nature of some of these events, lack of integrated interjurisdictional coordination, and perceived financial benefits lead to CO incidents. Impacts of these incidents may be felt areawide and have economic and policy costs not usually considered. Therefore, special efforts need to be made to control the impacts of these events on air quality levels.

Special events require special transportation system management (TSM) actions to control their impact on the transportation system. Although literature exists on incident and special event control for improved TSM actions, readily available information does not examine the link between special events and carbon monoxide (CO) incidents. [For purposes of this paper, an incident is an occurrence in which the Minnesota standard of 9.0 parts per million (ppm) or the U.S. standard of 9 ppm is exceeded.] Three types of special events are characterized: short-term repeating, anticipated unique events, and unplanned events and their impacts in the Twin Cities metropolitan area. Each presents different problems for TSM and for CO control.

THREE TYPES OF SPECIAL EVENTS

Short-Term Repeating Special Events

Short-term repeating special events, such as festivals, fairs, and athletic meets are considered beneficial to the economy of the area in which they are held, because they bring new visitors. They also bring unwanted side effects. These include additional costs for traffic and crowd control, in the form of special signage, added police, and overtime duty for traffic engineering and other public works personnel. A less apparent impact they bring is that they can result in adverse air quality impacts.

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Anticipated Unique Events

These considerations also enter into other types of special events, such as narrowing of capacity because of temporary construction, official visits of foreign dignitaries, and one-time sports events. Although these types of events can considerably disrupt the transportation system, they are easier to plan for, and their impacts tend to be more controllable.

Unplanned Events

The third category of special events is ones whose impacts are not necessarily anticipated, nor the impacts fully known, because they occur without consent of the government of the affected area. Examples of this type of special events are demonstrations and warm-weather cruising by automobile drivers. Although authorities do have published strategies to deal with anticipated crowds of varying sizes, minimizing the TSM and CO problems of the situation is possible only if these events repeat in the same location under similar circumstances.

PREVIOUS INFORMATION ON SPECIAL EVENTS AND TSM

The traffic management of incidents and special events has been a subject of considerable research interest in the last 10 to 20 years, with an emphasis on management of freeway emergencies (1). As noted by Dudek (2), special events, even with the best of planning, may still result in traffic congestion because drivers are unaware of the extent of congestion along particular roadways leading to the events, or the events themselves are one-of-a-kind. One type of special event, which included a system of off-site ticket sales with guaranteed remote lot parking spots, bus transportation to the event, and admission all in one ticket, alleviated congestion (3). Recent work on special events indicates that interagency or intercity cooperation may be the key to managing the events, an approach that requires surrendering some independence for the sake of areawide TSM (4,5).

SPECIAL EVENTS IN TWIN CITIES AREA

Short-Term Repeating Special Events

Short-term repeating special events have become common in the Twin Cities area. These events only last one or a few days. Typical yearly street festivals in 1985 to 1990 and their respective attendance levels include the Cinco de Mayo festival (8,000) across the river from downtown, the Grand Olde Days festival (300,000 on 1 day) along Grand Avenue in the Crocus Hill and Macalester-Groveland neighborhoods, and the Taste of Minnesota (35,000 average, 100,000 on July 4) by the Capitol near downtown, all in St. Paul. In Minneapolis, the Uptown Art Festival is held each year at the high-volume Hennepin Avenue and Lake Street intersection, with a total attendance of 250,000. All of these events close off major streets to traffic. The Taste of Minnesota also leads to interruptions in access onto Interstate 94 freeway entrance ramps.

Annual short-term repeating special events that last a week or longer but have varying locations for events and parades include the Winter Carnival (15,000 average, 100,000 for parades) in St. Paul in February, and the Aquatennial Festival in July in Minneapolis. Most of the traffic for these events originates in their respective cities. The State Fair (207,000 on 1 day), which is not located officially in any city or county, but is on a special tract of land that borders the city of St. Paul on the south and east, the Village of Falcon Heights on the north and east, and the University of Minnesota on the west, is a yearly 12-day event. Its traffic is dispersed to St. Paul and surrounding suburbs. There are also short-term repeating special events that occur every few years rather than annually. These events include ones that last a few days, such as the meeting of the National Street Rod Association at the State Fairgrounds. This event also attracted mobile source activity near the intersection of Snelling and University Avenues. As at the Hennepin-Lake intersection, a monitor there has periodically recorded CO violations.

Anticipated Unique Events

Temporary events in recent months include street closures because of sewer construction, the visit of Mikhail Gorbachev to the Twin Cities, and the Olympic Festival. Sewer construction has lasted for several years. Temporary freeway construction lasting more than a year is coordinated with the State of Minnesota Pollution Control Agency (MPCA) to ensure that CO standards are not violated. Gorbachev's visit will probably remain unique to Twin Cities history. Security considerations ensured that every aspect of the visit included TSM planning. Except for the 1992 Superbowl, events such as the Olympic Festival (which does not draw major crowds to any one event) will not likely occur in the near future.

Unplanned Events

Spontaneous demonstrations include marches and protests on political issues, such as U.S. involvement in Central America, and environmental ones, such as air pollution, both at the Hennepin-Lake intersection. Others, mostly political, are held in downtown Minneapolis. Celebrations also fall into this cat-

egory, such as the one held adjacent to the Metrodome on the edge of downtown Minneapolis when the Minnesota Twins won the World Series. Warm-weather cruising near the Hennepin-Lake intersection occurs in the spring and early summer, when cars cruise from the intersection to Lakes Calhoun and Harriet and Lake of the Isles, some on regular city streets and some on parkways.

REGULATORY HISTORY

The Clean Air Act (CAA) Amendments of 1977 required that areas that would not meet CO standards by December 31, 1982, adopt an inspection and maintenance (I/M) program for automobile emission control systems. They would then be required to meet the standards by December 31, 1987. By mid-1990, however, the U.S. Environmental Protection Agency (EPA) listed over 29 areas that still did not meet CO standards and would have to have strengthened I/M programs.

Failure to Meet 1982 Deadline

Some 1982 areas failed to meet their deadlines because they relied on the Federal Motor Vehicle Emissions Control Program (FMVECP), which tightened emission standards. Implementation of the FMVECP was delayed a year by the EPA. Other 1982 deadline areas failed to meet the deadline because they did not implement all TSM measures required by the CAA [called "transportation control measures" (TCMs)]. Some 1982 areas that did not meet the deadlines relied on modeling that assumed unrealistically high ambient air temperatures for vehicle operation, on the basis of EPA procedures. (These procedures test emissions of cars at higher temperatures than they are actually driven in cold-weather states under worst-case CO conditions.)

Areas Subject to Sanctions

Areas that failed to submit an acceptable state implementation plan (SIP) to meet the 1982 or 1987 deadlines or failed to make good faith efforts to implement the SIP were subject to potential and actual sanctions. These sanctions were left somewhat to the discretion of the EPA under CAA provisions. Sanctions included bans on stationary source construction; halts of federally funded transportation projects except for those of mass transit, safety, or TCMs; cutoffs of sewer construction funds; and cutoffs of program grants to air quality agencies. Lesser-known sanctions included refusal to allow new water or sewer hookups and refusal to give consent to bonds needed for construction of inner city housing. The EPA and FHWA have often disagreed in the past as to whether the transportation sanctions are enforceable without FHWA consent.

CO NONATTAINMENT IN THE TWIN CITIES AREA

The Twin Cities metropolitan area surrounding the cities of Minneapolis and St. Paul has a population exceeding 2,240,850.

Modeling for the SIP predicted that the FMVECP and TCMs (one-way pairs, traffic signal timing changes, and improved transit service) would enable the area to meet the 1982 deadline. Except for the Snelling-University intersection in the St. Paul Midway area, located between the two downtowns, all monitors indicated the expected modeled compliance by the deadline.

NONATTAINMENT STATUS OF THE INTERSECTION

The MPCA with the Metropolitan Council (the metropolitan planning organization), submitted a new SIP amendment that included intersection signal timing changes for the intersection and surrounding ones. The changes would become operative when CO reached a certain level. Attached was a request to redesignate the entire seven-county Twin Cities metropolitan area to attainment for CO standards, except for the Snelling-University intersection, because in previous years the whole area was designated as the CO nonattainment area to watch in the Metropolitan Council's jurisdiction.

The EPA modified the request. It approved instead a cross-shaped area in St. Paul considerably larger than the intersection. In response, the MPCA, in cooperation with the Minnesota Department of Transportation (Mn/DOT), posted additional CO monitors in the cross-shaped area, and at the Hennepin-Lake intersection in Minneapolis to demonstrate that the EPA was in error. Instead of compliance, a number of the monitors (including the Hennepin-Lake one) indicated violations of the CO standard. At the EPA's urging and under the threat of possible EPA sewer and air program sanctions, the MPCA, Mn/DOT, and Metropolitan Council won legislative approval of an I/M program. It will begin in the summer of 1991.

INVESTIGATION OF CO INCIDENTS

In Spring 1990, five CO incidents related to special events were investigated to determine whether such incidents could be prevented in the future through improved TSM. Controlling special events at the source appeared to be a more equitable and less costly way to control CO than tightening the whole future I/M program. If so, these types of events would not tighten the I/M program's cutpoint levels to achieve a reduction in emissions. Governmental officials, peace officers in charge of traffic management and those heading police reserve activities, and traffic engineering staff were interviewed to obtain a complete picture of causes and possible preventions of the incidents.

The events, occurring in 1985 and 1989, included two incidents affecting the Snelling-University intersection monitor south of the State Fairgrounds in St. Paul, one affecting the Snelling-Larpenteur intersection monitor in Falcon Heights north of the Fairgrounds, and one at the Hennepin-Lake intersection. All other CO incidents in 1985 to 1990 (a total of 77 in the Twin Cities area), did not appear to be related to pin-pointable special events, but to general traffic, preholiday shopping, or traffic and inversions.

STREET RODS AND CRUISING

Alteration of Pollution Equipment

Two CO incidents were clearly related to a short-term repeating special event, the meeting of the National Street Rod Association in July of 1985, and again in 1989, at the state fairgrounds. Each meeting drew over 100,000 participants and spectators. Members drove cars whose bodies were designed to look like older classic models. The vehicles had newer engines that were altered to provide added power or other features designed to increase particular performance aspects. Pollution control equipment was sometimes removed in this process. The exact amount of excessive CO produced is not known, but removal of a catalytic converter can increase CO production by 400 percent. The street rods were tuned to extremely high performance standards, perhaps reducing that percentage.

Mobile Source Activity by Street Rod Owners and Traffic Control

Street rods participating in the event were based over the entire Twin Cities area, but gathered for events by cruising north on Snelling Avenue to the fairgrounds, and west and east on University Avenue. Traffic control problems were compounded by owners of the street rods on weekday mornings, who cruised north to the fairgrounds in advance of the gate opening. Those that arrived early at the gates assured themselves of tree-shaded positions on the grounds. The traffic resulting from maneuvering for position backed southwards to the Snelling-University intersection.

Spectators and Traffic Control

The cruising attracted spectators, who cruised in regular cars next to the street rods. Sidewalk-sitters parked near the Snelling-University intersection, walked to it, lawn chairs in tow, sitting as close to the curb as possible to see the maximum number of street rods. Spectators also drove to the fairgrounds to view the street rods after paying an admission price of \$8.00. The free viewing at the intersection was therefore more appealing for many.

Efforts of the St. Paul Police, Police Reserves, and Neighborhood Assistance Officers to control traffic by preplanning (through use of public events control guideplans) and spontaneous problem solving (banning left-turns without official prepermission to do so) were somewhat thwarted by spectators. Some tried to pour bleach under the tires of street rods. The bleach caused tires to warm up rapidly, producing clouds of white smoke and extremely rapid acceleration. This led to some loss of control in steering, and danger to persons on the sidewalk. Failure to respond to the requests to do "bleach burns" resulted in threats to "key" a car—ruining the finish by scratching it with a key. In 1989, the cruising street rods and spectators were finally dispersed by Public Works department trucks, which were mobilized to water the streets. The water caused spots, temporarily marring the highly polished wax finish of the street rods. The National Street

Rod Association has declined to return to the Twin Cities in the immediate future, probably because of the Public Works department actions.

STATE FAIR OPERATIONS

The Minnesota State Fair is the fourth largest in the nation, with the largest paid attendance of all state fairs, recording over 153,000 on a weekday in 1989, and the 207,000 noted before on a weekend day. It is owned and operated by the Minnesota State Agricultural Society, a quasi-governmental organization governed by elected representations from county fairs. It passes its own ordinances, and contracts for police patrols. With the exception of the traffic it generates, it is an extremely popular institution with almost all Minnesotans, and with visitors from surrounding states.

Traffic Control at the Fair

During the 12 days of the Fair, traffic is directed from the fairgrounds to the outside by a team of off-duty peace officers (licensed police) from communities around the state, headed by an off-duty Ramsey County sheriff's officer also hired by the Fair. The rest of the year, the St. Paul Police Department patrols the grounds and tries to handle traffic from events, such as the street rods or visitors to the annual July 4th fireworks show. Falcon Heights has in the past contracted with the Ramsey County sheriff for traffic control during the 12 days. For 1990 and future years, its contract is with Roseville, a city whose southern border is several blocks north of the fairgrounds. Roseville is also in Ramsey County.

Most of the traffic leaving the fairgrounds heads to the south, to St. Paul. It is headed directly at the Snelling-University intersection. This is partly because of the general solution used by the Ramsey County and Roseville police forces of sending the traffic elsewhere. It is also caused by the large crowds that find Fair ingress easiest from the Snelling Avenue exit of Interstate 94.

Parking Management at the Fair

Parking space on the fairgrounds is inadequate, with room for at most 15,000 cars. Spaces in lots probably turn over at least once a day, but parking has been free and lots often fill by 10:30 a.m. on weekends. One-third of all fairgoers are from rural areas located many hours from the Fair. They feel uncomfortable trying to find a parking space elsewhere. Like other fairgoers faced with filled on-site lots, they prefer to cruise the fairgrounds and the surrounding neighborhood. Many make use of a St. Paul policy that permits paid parking on lawns of fair neighborhood residences during the 12 days. The off-street parking, which includes officially tolerated curb jumping to access the lawns, slows traffic and may contribute to pedestrian safety problems.

The Fair has tried a number of approaches to manage the parking, from agreements with the University of Minnesota, to leasing of remote lots, to rideshare arrangements. Agreements with the University of Minnesota involve use of the

parking lots adjacent to the fairgrounds that are part of the St. Paul portion of the Twin Cities campus. (The University is similar to the Fair in that with the exception of some legislative funding approvals, it is largely independent of any jurisdiction except that of the state of Minnesota.) Spaces in its lots, normally in great demand, are available because the University is not in session at the time of the Fair.

Remote lots are leased by the Fair in 14 locations, serving 10,000 vehicles. Parking in the lots is free to the public, but there was a charge for bus service to the fairgrounds. In 1991, bus fare from the lots will become free. Although buses travel between the lots and the fairgrounds on a regular basis, arrival and departure times are not definite because the buses themselves become enmeshed in Fair traffic. The Fair is attempting to find additional remote lots. An attempt by the Fair to display a portable changeable message sign directing persons to remote lots was withdrawn after St. Paul received a complaint about the noise the generator for it made from a nearby homeowner. The sign was not effectively diverting much traffic. Additional changeable signs remain in place. More remote lots are needed, especially south of the Snelling-University intersection. Although parking remains free in the shuttle lots, a new plan in 1991 will charge vehicles with less than three persons for parking on the fairgrounds. The revenues from parking will pay for free bus rides from the remote lots, and discounts on admissions for remote lot parkers.

Ridesharing at the Fair

The Fair has contacted Minnesota Rideshare, part of the Metropolitan Transit Commission (MTC), and the Regional Transit Board, which governs the MTC, to improve ridesharing among 2,200 permanent, but mostly seasonal, and 3,800 temporary employees during the 12 days. Providing incentives for carpooling by giving close-in spots to employees who ride-share, and working with the MTC to improve already increased bus service to the Fair are strategies it is actively pursuing. The seasonal characteristics and variety of shifts have resulted in few matches.

TRAFFIC BY THE LAKES

Determining the Impact of the Aquatennial

The CO incident at the Hennepin-Lake monitor in Minneapolis was apparently caused by an event of the Aquatennial, the Minneapolis festival centered around its lakes. After talking to the Minneapolis Police Reserves and to Minneapolis Traffic Engineering, it was apparent that the event did not cause the incident. The event was held downtown, and not near the intersection. It was unlikely that the parade sent traffic far south enough to affect the intersection.

Lake Cruising

Further discussions revealed that the day in question was a perfect July day with cooler-than-usual temperatures in the 70s Fahrenheit. Much of the lake traffic was caused by cruis-

ing, an unplanned special event that occurs frequently near the lakes. The traffic on the lake parkways was managed by the Minneapolis Park Police. (Except at upper levels of command, they are governed by the Minneapolis Park Board, a separate public entity.) Parks surrounding the lakes were closed in late evening, leading to cruising of the lake parkways. If the Minneapolis Park Police then restricted parkway traffic to stop cruising, the cars moved west to the Hennepin-Lake intersection, where they became a problem for the Minneapolis Police. Given the two-way average daily traffic of 32,000 through the intersection, additional traffic from the lakes tended to increase CO levels there, especially at night. Most CO incidents occurred during late-night hours at this intersection. A one-way pair was implemented for air quality reasons through this intersection in 1990. No violations have been recorded since.

SEWER CONSTRUCTION AND CO VIOLATIONS

One special event became a CO incident by surprise. In late October 1989, many monitors around Minnesota recorded CO incidents as record-breaking warm air combined with a statewide inversion to trap CO. Even background non-hot-spot monitors recorded incidents caused by traffic and the unusual meteorology. None of the incidents could be explained in any other way, with one exception.

The one explainable CO incident occurred in downtown St. Paul. The monitor, located on a one-way street, rarely recorded CO incidents. After investigation, the MPCA staff concluded that the incident was caused by rerouting of traffic from an Interstate freeway exit to avoid temporary construction near the exit. More than 16,000 additional vehicles, many driven by persons unfamiliar with the area, at slower than normal speeds, were routed past the monitor by Mn/DOT. The construction was for mandated separation of storm overflow and regular sewers, required by the EPA.

METEOROLOGY AND REPEATING AND UNPLANNED SPECIAL EVENTS

All CO incidents for monitors in the Twin Cities, St. Cloud, and Rochester, Minnesota, were examined for those years in which they were in operation from 1972, the year monitoring started, through 1990, the last year of verified data. The aim of the examination was to determine what the possible role of meteorology was in creating patterns of incidents, compared to that played by the special events. The sheer volume of incidents (over 1,500) makes it difficult to analyze the meteorology in detail. Instead, the patterns of occurrence were examined.

In the examination of the dates of occurrence of the incidents, a recurring special event that especially affected monitors was Christmas shopping. Although five incidents did occur on the day after Thanksgiving, the busiest shopping day of the year, this is not a high number. Monitors were likely to indicate violations in the period 2 weeks before Christmas (18 in the period December 10 to 17), and in the period right before Christmas (22 in the period December 18 to 24). Hot-spot monitors usually indicated several violations in the latter period if they had any in the former.

Traditional explanations based on meteorology would note that although Thanksgiving can sometimes have mild weather, December is almost always very cold in Minnesota. The atmosphere is also very stable. Table 1 (National Climatic Data Center, U.S. National Oceanic and Atmospheric Administration) indicates that the December mean temperature for 1959 to 1988 is 19.3°F, the January temperature 12.9°F. The atmosphere is probably not more stable. Although there are occasional inversions (often statewide in nature) that are correlated with CO incidents in January, the same type of pattern does not emerge for any particular weeks. More detailed examination of temperatures and wind direction and speed would be needed to come to a definitive conclusion about the effect of Christmas shopping or any other special recurring event during the period of November through January.

All CO incidents were also examined to determine their correlation with cold weather and atmospheric stability, given the popular assumption that incidents are related to winter weather. Although most do occur in colder temperatures, many of the 1,500 incidents occur in temperatures above 60°F. As indicated in Tables 2 and 3 (Air Quality Division, Minnesota Pollution Control Agency), in the years for which summary temperature data are available, 1987 to 1990, there were 10 out of 53 CO incidents for which the temperature was above 60°F. Of these 10, 8 occurred at the Lake-Hennepin intersection monitor, lending credence to the possibility that the unplanned special event of cruising contributed more than meteorology.

RECOMMENDATIONS: COORDINATION FOR SPECIAL EVENTS

Handling Repeating Special Events

The previously mentioned CO incident to the north of the Fair at the Snelling-Larpenteur intersection monitor in Falcon Heights occurred the day the Fair attendance recorded a record 207,000 paid attendees. The cruising from the street rods led to violations at the Snelling-University monitor in 1985 and 1989. (A monitor malfunction made it impossible to determine if a similar incident occurred in 1982.) Thus, repeating special events need special attention to avoid having them cause CO incidents.

A combination of police reserve officers, traffic control agents, regular police, or off-duty officers can be mobilized to handle large special events such as parades or festivals. This procedure is now being implemented in some areas. In order to avoid conflicts on union issues and to ensure that integrated work is done by all forces, these personnel need to be explicitly under one command that can choose which ones to use and how to mobilize them. This policy is probably not feasible for smaller unplanned events, because city budgets do not allow routine traffic direction by police, given more pressing needs of increased crimes and more violent crimes, which are of greater importance to the victims.

Sending the Traffic Elsewhere

Whether an event is repeating or not, long-term or 1 day, and planned or unplanned, traffic control techniques can be

TABLE 1 AVERAGE TEMPERATURES (DEGREES F) FOR MINNEAPOLIS-ST. PAUL, MINNESOTA

YEAR	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUGUST	SEPT	OCT	NOV	DEC	ANNUAL
1959	10.6	17.2	34.0	47.1	60.6	70.6	74.5	75.2	63.1	44.4	25.4	30.1	46.1
1960	17.5	17.8	19.8	45.9	57.0	63.8	71.7	72.1	61.8	48.7	33.3	16.8	43.8
1961	12.0	22.5	32.0	38.5	54.7	68.1	70.8	71.3	59.1	52.2	33.5	15.3	44.2
1962	7.1	11.7	24.5	42.2	60.6	66.2	67.5	68.3	56.4	50.2	35.0	19.0	42.4
1963	2.9	2.1	34.2	47.3	55.4	69.8	73.5	68.9	62.2	58.1	38.3	10.0	44.4
1964	20.0	23.9	25.8	46.8	61.5	68.7	76.0	68.5	58.9	48.2	35.0	14.8	45.7
1965	10.0	11.8	19.5	41.8	58.7	66.5	70.5	68.6	52.8	50.7	33.1	28.0	42.7
1966	3.3	16.3	35.8	42.2	53.6	68.4	76.8	68.2	60.3	47.5	30.1	18.1	43.4
1967	14.6	8.7	29.8	44.7	52.3	66.9	68.8	66.2	60.3	46.3	30.7	21.8	42.6
1968	14.3	15.2	38.8	48.5	53.4	67.2	71.1	70.7	61.1	50.7	34.0	16.9	45.2
1969	9.4	19.3	24.1	49.3	60.6	61.8	73.6	74.4	63.0	46.5	33.6	20.3	44.7
1970	5.6	15.4	26.0	46.1	58.5	71.2	75.2	71.9	61.2	49.6	32.7	18.2	44.3
1971	6.5	17.0	28.0	47.0	55.4	71.5	68.8	69.6	62.8	51.4	32.7	18.4	44.1
1972	5.5	10.5	26.5	41.9	61.3	66.0	68.5	69.8	57.9	43.7	32.2	11.3	41.3
1973	17.4	21.6	40.2	44.4	55.2	69.5	73.8	73.4	60.1	53.8	34.3	16.7	46.7
1974	11.9	16.9	29.5	47.1	54.4	65.5	76.6	67.3	55.3	49.8	33.7	24.4	44.4
1975	14.5	15.5	22.1	38.9	60.9	68.8	76.3	71.7	57.7	52.8	37.5	21.3	44.8
1976	11.6	27.8	31.4	51.8	58.9	71.7	76.1	73.3	61.8	44.6	28.3	13.6	45.9
1977	0.3	22.7	37.5	53.0	66.9	68.4	74.8	66.1	60.5	47.1	30.8	14.4	45.2
1978	5.5	11.6	30.0	45.2	61.8	67.8	71.1	72.2	67.3	49.8	32.5	15.2	44.2
1979	3.2	10.0	28.9	44.0	55.5	67.3	73.6	69.9	63.4	46.6	31.7	26.0	43.3
1980	15.3	15.3	27.3	49.2	61.5	67.6	75.2	70.7	59.5	45.1	36.6	19.8	45.2
1981	18.0	23.4	37.7	49.1	57.1	67.0	70.9	69.3	60.0	46.7	38.0	17.5	46.2
1982	2.3	15.8	29.0	43.8	62.5	63.7	75.6	71.8	60.9	50.3	31.5	25.7	44.4
1983	19.6	26.9	34.2	42.3	54.6	68.0	77.2	76.8	62.6	48.4	34.0	3.7	45.7
1984	12.0	27.5	24.8	47.1	56.0	69.7	72.2	73.5	57.2	50.7	33.3	17.9	45.2
1985	10.1	16.5	35.6	52.1	62.2	63.9	73.9	67.6	59.9	47.5	24.8	7.7	43.5
1986	17.5	15.7	33.9	49.6	59.4	68.6	73.9	67.1	59.8	49.2	28.2	24.7	45.8
1987	21.2	37.6	38.7	53.5	63.5	72.8	76.0	69.0	62.5	44.6	37.9	25.0	49.7
1988	10.4	13.9	33.8	47.4	65.4	74.4	78.1	73.9	62.4	44.0	32.7	20.5	46.4
RECORD													
MEAN	12.9	17.1	30.0	46.0	58.2	67.9	73.2	70.7	61.5	49.7	32.9	19.3	45.0
MAX	21.5	25.7	38.3	55.8	68.5	77.8	83.3	80.6	71.3	59.0	40.5	26.8	54.1
MIN	4.3	8.5	21.7	36.3	47.9	58.0	63.1	60.7	51.6	40.3	25.3	11.7	35.6

improved to deal with it provided political will and funding are available. Sending the traffic elsewhere can work provided it is evenly dispersed so as not to cause or aggravate an existing hotspot condition. (This technique, for example, was used by the Minneapolis police reserves to send cruising traffic celebrating the Twins victory to sites away from downtown. They forced celebrants involuntarily in four directions onto routes leading directly to Interstate highways.) It is not a good planning tool for repeating special events, which need integrated advance planning to handle unexpectedly large crowds, such as occurred with the record attendance day at the Fair in 1989.

Restricting Certain Events or Actions

Banning certain events or actions is bound to be politically unpopular. Nevertheless, if the events are virtually uncontrollable, or lead to traffic control actions, such as lawn parking, which have possible safety or other adverse traffic management impacts, the temptation is strong to regulate the events. Many of these events (such as the State Fair) are immensely popular with the public. As indicated below, the

financial impact of doing so may also outweigh the desire for control of CO incidents. Therefore, it is necessary to carefully investigate other TSM methods, coordination of forces, and methods of neighborhood cooperation to control the CO implications, because it is probably not desirable or possible to eliminate the events. For some events, such as the street rods, increased CO levels may not be controllable except by prohibiting the event.

ECONOMICS OF EVENTS

Most special events are categorized by promoters as contributing heavily to the local economy. The Olympic Festival, for example, was expected to contribute \$23 million to the local economy. Its cost, however, is harder to determine. Expenditures by state and regional agencies and the University of Minnesota to speed up construction of new facilities and provide traffic management for the Olympic Festival are expected to exceed that figure. In the case of the National Street Rod Association meet, 90 percent occupancy for Twin City hotels and motels was not uncommon, so its economic impact was great. The Fair, while receiving no legislative appropriations,

TABLE 2 CO EXCEEDANCES FOR 1987 AND 1988

1987 CO EXCEEDANCES			
DATE	LEVEL	TEMPERATURE	LOCATION
01-12-87	12.8 PPM	38 degrees F.	Duluth
02-01-87	11.6 PPM	37 degrees F.	University & Lexington
02-06-87	16.0 PPM	43 degrees F.	University & Lexington
02-06-87	10.2 PPM	43 degrees F.	Larpenteur & Snelling
02-06-87	13.7 PPM	43 degrees F.	University & Snelling
02-07-87	10.6 PPM	43 degrees F.	University & Rice
02-07-87	9.7 PPM	43 degrees F.	Nalpak Bldg.
02-09-87	10.1 PPM	41 degrees F.	University & Lexington
02-09-87	9.8 PPM	43 degrees F.	Larpenteur & Snelling
02-09-87	9.3 PPM	41 degrees F.	University & Snelling
02-19-87	9.9 PPM	38 degrees F.	University & Lexington
10-13-87	9.2 PPM	49 degrees F.	University & Lexington
11-02-87	9.9 PPM	61 degrees F.	Lake & Hennepin
11-13-87	12.0 PPM	41 degrees F.	Lake & Hennepin
11-13-87	11.4 PPM	43 degrees F.	St. Cloud
11-13-87	9.0 PPM	48 degrees F.	University & Lexington
11-14-87	9.6 PPM	38 degrees F.	University & Lexington
11-30-87	9.2 PPM	31 degrees F.	University & Snelling
12-19-87	9.0 PPM		Rochester
12-23-87	11.6 PPM		Rochester

1988 CO EXCEEDANCES			
DATE	LEVEL	TEMPERATURE	LOCATION
01-11-88	14.3 PPM	14 degrees F.	University & Lexington
01-11-88	14.2 PPM	14 degrees F.	Lake & Hennepin
01-15-88	9.4 PPM	17 degrees F.	Lake & Hennepin
01-15-88	9.1 PPM	29 degrees F.	Lake & Hennepin
01-17-88	9.8 PPM	20 degrees F.	Lake & Hennepin
01-18-88	9.7 PPM	29 degrees F.	Lake & Hennepin
01-28-88	9.1 PPM	13 degrees F.	University & Lexington
01-28-88	9.4 PPM	8 degrees F.	Lake & Hennepin
05-20-88	10.7 PPM	78 degrees F.	Lake & Hennepin
06-05-88	9.2 PPM	78 degrees F.	Lake & Hennepin
08-15-88	9.6 PPM	94 degrees F.	Lake & Hennepin
09-17-88	9.3 PPM	81 degrees F.	Lake & Hennepin
10-14-88	9.7 PPM	58 degrees F.	Lake & Hennepin
11-03-88	9.9 PPM	48 degrees F.	Lake & Hennepin
12-19-88	9.6 PPM	34 degrees F.	Lake & Hennepin
12-30-88	9.1 PPM	14 degrees F.	Lake & Hennepin

*The Levels reflect the highest 8 hour average exceedance for that date.

charged admission and space rental fees for the Fair and for use of the fairgrounds. It ended 1989 on a strong financial note. Although governmental and quasi-governmental organizations do contribute financially to traffic management efforts, the special events run by them and their financial quasi-independence may make it more difficult to reach agreements with them or require financial commitments than if they were subject to the normal fiscal and legislative controls imposed on municipalities in the state.

The calculation for the cost of Christmas shopping cannot be easily made. Spinoff effects, such as revenue for cities in terms of meter parking fees and taxes on parking ramps would have to be considered. So would the secondary impacts of increased restaurant patronage, gasoline taxes, and other unusual expenditures that affect the local and national economies.

CONCLUSIONS

The management of special events to control CO incidents varies with the type of event, its proximity to a violating monitor, and the institutional arrangements for handling the traffic. Some events appear to have traffic and crowd control impacts that are virtually uncontrollable. If held near monitors, they require special institutional arrangements to avoid CO incidents. For Christmas shopping, as done abroad, these could include shuttle buses and other ridesharing arrangements to ferry shoppers and parcels to and from the stores.

These arrangements are especially critical when coordinating TSM from areas surrounded by multiple jurisdictions. Agreed-on coordinators, a traffic management plan, and integrated police enforcement are the most important elements

TABLE 3 CO EXCEEDANCES FOR 1989 AND 1990

1989 CO EXCEEDANCES			
<u>DATE</u>	<u>LEVEL</u>	<u>TEMPERATURE</u>	<u>LOCATION</u>
01-04-89	11.4 PPM	23 degrees F.	University & Lexington
01-04-89	9.9 PPM	28 degrees F.	Lake & Hennepin
03-10-89	9.9 PPM	38 degrees F.	Lake & Hennepin
03-27-89	10.1 PPM	53 degrees F.	Duluth
07-08-89	9.6 PPM	79 degrees F.	Lake & Hennepin
07-20-89	10.8 PPM	76 degrees F.	University & Snelling
07-23-89	9.7 PPM	73 degrees F.	Lake & Hennepin
07-23-89	11.3 PPM	73 degrees F.	Lake & Hennepin
09-02-89	10.3 PPM	57 degrees F.	Larpenteur & Snelling
10-23-89	9.9 PPM	55 degrees F.	Duluth
10-23-89	10.3 PPM	59 degrees F.	University & Snelling
10-23-89	9.2 PPM	72 degrees F.	Nalpak Bldg.
10-23-89	12.1 PPM	59 degrees F.	University & Lexington
10-24-89	10.7 PPM	58 degrees F.	Nalpak Bldg.
10-24-89	12.0 PPM	50 degrees F.	1829 Portland Avenue S.
11-24-89	9.4 PPM	30 degrees F.	Lake & Hennepin

1990 CO EXCEEDANCES			
<u>DATE</u>	<u>LEVEL</u>	<u>TEMPERATURE</u>	<u>LOCATION</u>
02-08-90	9.9 PPM	29 degrees F.	University & Lexington

*The Levels reflect the highest 8-hour average exceedance for that date.

in preventing violations. Regular meetings of interjurisdictional task forces do much to establish good relations that can then be used when handling these events. Jurisdictions involved need to exercise some self-discipline, both in scheduling events and dealing with their impacts on surrounding areas. They need to refrain from sending the problem elsewhere in hopes that it will disappear. Under certain conditions, it will reappear as a CO air quality incident. If it does, it will affect not only the area where the traffic was sent, but may result in sanctions or an overly tightened I/M program affecting jurisdictions far from the site.

Most special events will not result in a CO incident. Analysis of special events in the Twin Cities indicates local traffic flow problems on streets near monitors that extend onto the freeway entrance ramps, but the problems do not cause shock waves in traffic flow on the freeways. When the problems involve both the freeways and the local streets, involve vehicles that are without operating pollution control equipment, or are during the worst-case meteorological season, the potential for incidents must increase of necessity.

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