

**REAL TIME TRAFFIC CONTROL
OF URBAN FREEWAY WORK ZONE OPERATIONS**

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Introduction

Between 1979 and 1981, the need for repair work on Houston area freeways (particularly those over twenty years old or carrying traffic volumes near or over 200,000 vehicles per day) increased markedly. Complaints from the traveling public about traffic congestion caused by such work led to one legislative suggestion (not passed) that all freeway work in the Houston area be limited to night operations. Although no legislation was passed, a result of the above sentiment was that work zone operations were generally restricted to night-time hours and weekends. It is during these time periods that speeds are high and the chances for errant behavior increase. Unfortunately, these concerns became fact at an alarming frequency. In 1980 and 1981, 12 highway workers were killed and 34 injured while working on Houston's freeways. Most of these casualties were caused by drunk drivers and speeding motorists.

The Problem

With almost 600 miles of State-maintained roads in Harris County alone, and work predominantly restricted to weekends, the rate of maintenance activity had fallen far behind the needed rate. This situation became increasingly critical in light of funding limitations and extensive red-tape facing the initiation of major roadway rehabilitation efforts. Consequently, in the spring of 1982, the District Office of the State decided that a means for performing maintenance operations on even the highest volume roadways during previously restricted hours must be found. The objectives of this strategy were threefold:

1. Allow time for the needed remedial maintenance to be performed
2. Insure worker safety
3. Prevent intolerable delay to the traveling public

Deployment of Special Traffic Handling Crew

Several research studies have been conducted (2, 3, 4) on "traffic management type" capacity improvements for work zone operations. These have included the temporary use of shoulders as a travel lane, modifying intersection signal timing, encouraging traffic to divert to alternate routes and closing entrance ramps within the work zone area. Some of these measures have been successfully implemented on major rehabilitation efforts such as on the Edens Expressway in Chicago and the Gulf Freeway in Houston. However, these techniques have been used only on a limited basis for short-term operations. Some earlier efforts to apply such techniques to maintenance work in the Houston area showed promise.

Accordingly, it was decided that a specially trained crew should be formed

and specifically assigned the task of handling traffic during maintenance operations on high-volume roadways, thereby increasing the hours available for maintenance activity. The crew would have the authority and capability of implementing proven work-zone traffic management techniques, in a manner consistent with the "Manual of Uniform Traffic Control Devices". A major advantage of the special crew would be its ability to actively manage traffic during the maintenance operation.

Prior to this, a traffic control plan would be prepared based upon historical traffic volumes and flow-rates through a proposed work zone. The traffic data would indicate the number of lanes needed to minimize motorist delay -- or, if the work zone resulted in inadequate capacity, to handle anticipated flow-rates around the work area. Then, for example, shoulder signing would be deployed at the outset of the operation and remain until the operation was complete. This would occur despite changing traffic patterns.

With the special crew, the traffic control plan would be changed to react to changing traffic conditions. For example, one of the objectives is to insure worker safety. Excessive speed adjacent to the work zone is a contributing factor to accidents. The use of the shoulder to provide additional capacity at work sites may actually contribute to speeds higher than desirable during "lulls" in traffic. The crew would react to this situation and "turn off" the shoulder-use signing, thus lowering speeds. This method of handling traffic has been termed "Active Traffic Management".

The District Office decided that the special crew concept should be tried on an experimental basis. An urban freeway in Houston carrying 175,000 to 200,000 vehicles per day was badly in need of pavement repair and rehabilitation but a major contract could not be let for several months. Some of the needed repairs were critical, but high traffic volumes precluded use of normal techniques used by maintenance personnel. Interim repair was needed and this site provided the first test for the special traffic handling crew.

A group of individuals who were not usually involved in field activities, but who were experienced in traffic management techniques, were asked to handle traffic while the "interim maintenance" was performed. Workload analysis indicated that working Monday through Thursday during daytime off-peak for two consecutive weeks and one weekend would provide enough time to make the interim repairs. This schedule required three road-work crews to be available to work simultaneously. A job of this magnitude would have required at least 2 months if work was restricted to Sunday mornings. If motorist delay could be kept to an acceptable level of under 20 minutes (5) then the project would be successful.

Specifically, the crew was responsible for the following:

1. Prepare a daily report on the scheduled hours and areas of work zone activity and with the Department Public Affairs Section coordinate the dissemination of the information to the public through press releases and radio broadcasts on a daily basis.
2. Coordinate change in signal timings for traffic signals.

3. On parallel frontage roads along the project, since the signals are operated by the City of Houston, coordinate activities with the City's Traffic and Transportation Department to obtain their help in modifying affected intersection signal timings.
4. Arrange for the use of Selective Traffic Enforcement Program officers for the project.
5. Actively manage traffic by using the shoulder as a travel lane; closing entrance ramps as required, and utilizing other "active" traffic management techniques.

The project was successful. On the one day that a long queue developed, it was quickly dissipated when members of the special crew adjusted work-site traffic control. The "ultimate" measure of success applied to this project -- not one phone call of complaint was received from the public!

Managing Traffic During Special Sequences in Long Term Construction Projects

During certain construction sequences in long term freeway rehabilitation and widening projects, it has been necessary to close the freeway in one direction for 12 to 36 hours. At the committed annual funding level of \$1.2 billion for construction work in Houston, this type of activity is becoming more frequent. Work tasks primarily consist of the placement of concrete median barrier, striping placement, removal and pavement repair. By closing the freeway, the work could be performed without endangering the workers.

The weekends are targeted for this type of control, since traffic volumes are less than weekdays. However, the volumes are high enough to require the use of active traffic management.

A demonstration of this concept was conducted on IH-45 (Gulf Freeway). In order to place a concrete median barrier and restripe a section of this freeway, a freeway closure of 36 hours was needed. This was scheduled for a weekend when an ADT of 75,000 was expected.

Traffic was detoured from the freeway onto the parallel frontage road with a roadway width of three lanes. The exit ramp was temporarily modified to 2 lanes of capacity. Traffic proceeded through 2 signalized intersections before being allowed to reenter the freeway. The signal timings at these intersections were modified by the City of Houston Traffic and Transportation Department. Traffic operations at the intersections were monitored by the City of Houston Police Department. The entrance ramp used to reenter the freeway was one lane wide and could not be modified. Consequently, traffic cones and active control by police officers directed traffic in the middle and right lanes of the frontage road to the next downstream entrance ramp.

Alternative routes were available and extensive public information program was executed to increase diversion. Static changeable message signs were placed 7 days in advance of the freeway closure to identify these alternate routes. On the day of the closure, the traffic diversion strategy was supplemented with electronic changeable message signs to increase

diversion. In addition, a right lane closure of IH-45 (Gulf Freeway) Northbound was implemented at the IH-610 interchange. This lane closure was 3 miles upstream of the freeway closure setup, but presented an impression of work zone activity in the immediate area and resulted in increased diversion to IH-610.

It was estimated that over 50 percent of the traveling public avoided this section on the day of the closure. Delays to the traveling public never exceeded 10 minutes, which was an acceptable level.

With a much expanded work area available, the contractor was able to increase his equipment and man-power for this operation. As a result of this increased effort and the active traffic management strategies utilized, this work was accomplished in 12 hours; far less than the original 36 hour estimate. The final measure of success was again the total acceptance of the operation by the public - no complaints were received.

A second application of active traffic management to a construction sequence operation took place on IH-10 (Katy Freeway). The ADT in this section was over 100,000. The principal difference between this operation and the one on the Gulf Freeway was the lack of a good alternative freeway route. The operation started at 6:00 a.m. on Saturday and extended to midnight on Sunday. An extensive public information program was implemented. In addition, active traffic management was used in a similar fashion to the other projects. Therefore, work was accomplished without incurring an intolerable delay to the motorists.

Conclusions

Several conclusions can be drawn from the use of active traffic management in Houston. They are:

1. Advance public information of impending work zone activity can minimize public complaints and unsafe traffic operations.
2. The active presence of law enforcement officers in urban highway work zones can minimize erratic and unsafe driving.
3. Carefully planned "active traffic management techniques" can allow work zone activity to be done on high volume urban highways during daylight hours without severely inconveniencing the traveling public while protecting workers from errant motorists.
4. Cooperation with law enforcement agencies and other affected governmental agencies is a necessary part of the "active management strategies".

Future Applications of Active Traffic Management in Work Zones

In most instances, the number of travel lanes on urban highways cannot be reduced during peak periods for construction activities. This policy means that narrow lane widths (10 to 11 feet) and the use of the inside and outside shoulders for travel are needed. This traffic management technique is being used for projects on the IH-45 (North Freeway), the IH-45 (Gulf Freeway) and US

290 (Northwest Freeway). While this method has been successful in minimizing the delay to peak period motorists (7), it does not provide a refuge area for stalled motorists. To minimize the impact of such incidents, temporary shoulders have been constructed where possible. However, the need to reduce the time required to clear such incidents is very important. In Houston, approximately 50% of stalled vehicles can be attributed to flat tires, "dead" batteries and other problems that can be expeditiously handled by courtesy patrols or wrecker companies (8). The benefit/cost ratio of a privately funded courtesy patrol operation that utilizes Harris County Sheriff deputies is approximately 10 to 1 (8). Based upon the demonstrated effectiveness of such a program, provisions in the proposed plans for the reconstruction of freeways include a dedicated courtesy patrol. This type of program has been used in reconstruction projects in Pittsburgh, Chicago and Boston. In addition, methods for providing real time information to motorists of impending delays due to incidents are being studied. In addition to the already proven traffic management techniques (changeable message signs, static messages), the placement of computer terminals at major traffic generators along the corridor is being considered. These terminals would be linked to traffic service organizations and the State Highway Department. They would display real-time information on freeway conditions to motorists.

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