Diversion of Freeway Traffic in Los Angeles: It Worked

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ABSTRACT

The California Department of Transportation (Caltrans) implemented a traffic management plan aimed at bringing about voluntary traffic diversion upstream of a section of freeway that needed to be closed for 6 hr for maintenance operations. Without an extensive traffic management effort, delays of more than 2 hr were anticipated. The plan was designed to limit delays on the affected high-volume freeways (160,000 to 225,000 average daily traffic) to a maximum of 20 min. The plan included an aggressive public information campaign before the closure by using both media and freeway signing and an extensive use of changeable message signs during the operation. Significant diversion from two freeways that feed the closure area was achieved. Congestion extended about 2.5 miles upstream of the closure at its maximum; actual delays never exceeded the targeted 20 min. The plan, how it was developed, and how it was implemented are described. Results of the operation are also presented.

How can adequate working space and time be provided to safely conduct activities on operating freeways in metropolitan areas without causing extensive traffic tie-ups? It is not a unique problem, but it was one that faced the California Department of Transportation (Caltrans) in May 1982 as plans were being made to replace lighting fixtures located within a tunnel on the Santa Ana Freeway near downtown Los Angeles.

The Santa Ana Freeway is a main artery from the suburbs of Orange County and southeastern Los Angeles County into and through central Los Angeles (Figure 1). Near its junction with the San Bernardino Freeway (where the maintenance work needed to be done), the inbound freeway consists of a two-lane tunnel section with no shoulders. Immediately upstream of the tunnel the Santa Ana Freeway consists of three lanes that carry about 120,000 vehicles per day. Each work day heavy congestion, with average speeds of about 10 mph, are common from about 7:00 to 9:00 a.m. During the midday off-peak hours the freeway is free of congestion, operating at about 60 percent of its capacity and carrying more than 3,000 vehicles per hour.

The required maintenance work would take about 6 hr to complete. It was not possible to keep the freeway partially open and, at the same time, provide the clearances between workmen and traffic prescribed in the safety regulations; the roadway is too narrow to do both things. Previously, maintenance on this section of freeway had been performed during those hours of low traffic volumes--either during the night or on weekends. Neither of these times was considered a satisfactory option for this operation; night work under traffic conditions is potentially hazardous, and it was desired to avoid the higher costs associated with weekend work. In addition, if the freeway could be fully closed, other needed maintenance work on traffic striping, raised pavement markers, signs, and general roadwork would be accomplished. Full closure of the inbound freeway from the East Los Angeles Interchange to the San Bernardino Freeway on a weekday was, from a maintenance operation standpoint, a desirable course of action.

There was a key traffic question: Could the freeway be closed without causing massive traffic jams that could affect a major portion of the downtown freeway system?

For several years Caltrans has had an extensive program to actively manage traffic through and

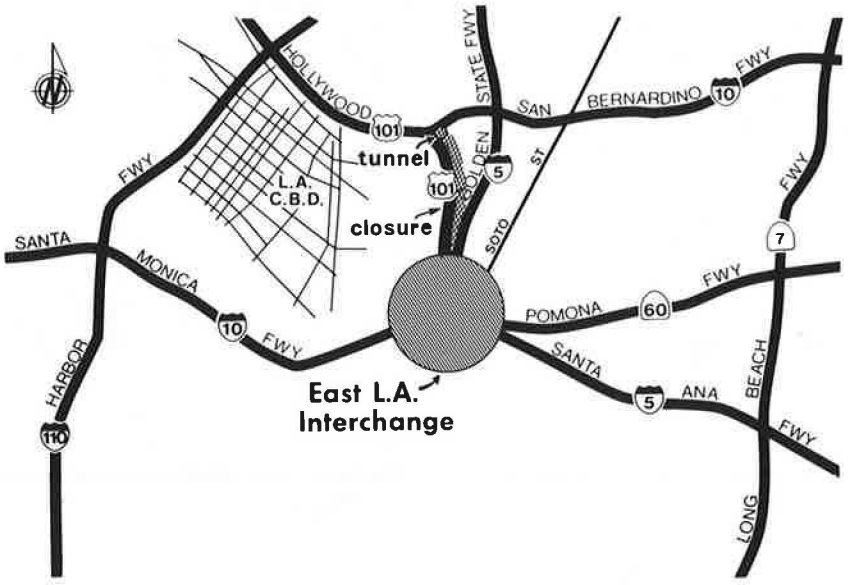

FIGURE 1 System map.

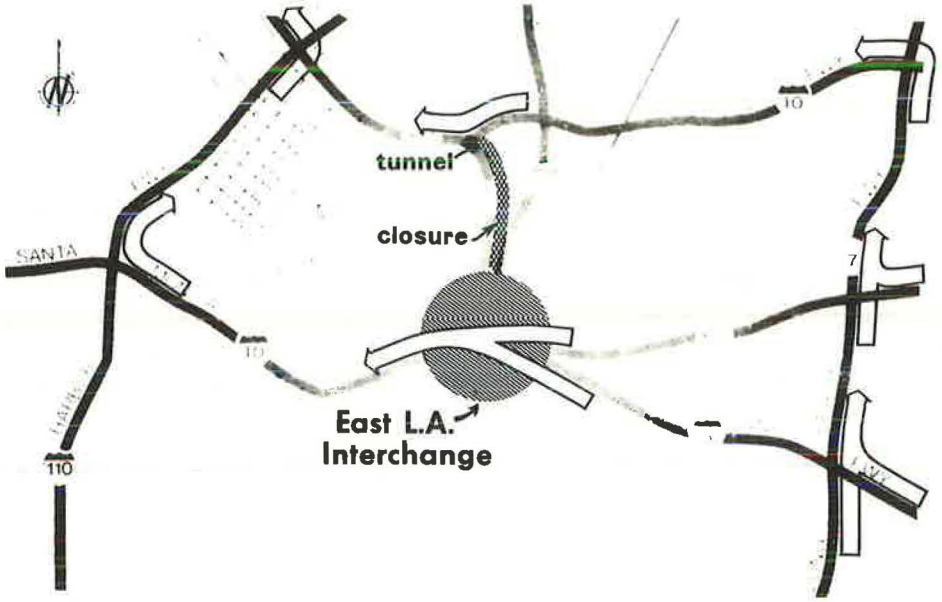

FIGURE 2 Planned diversion routes.

around freeway closures in the Los Angeles region. Based on that experience, and the anticipated reaction of the public to a midday closure in this location, it was generally concluded that a maximum delay of about 20 min would not be unreasonable. An analysis was then undertaken, looking at several alternatives, to develop a plan to manage the anticipated traffic and to keep delays to less than 20 min throughout the day.

A plan to establish a limited closure through the work site and to detour traffic to local surface streets or to other freeways in the immediate vicinity of the closure was not feasible. Alternate capacity to serve the historic demands throughout the day simply did not exist, nor could freeway off-ramps in the area handle the projected traffic loads. A capacity/demand analysis indicated that traffic on the freeways leading into the closure would be heavily congested for 7 miles, with expected delays to the motoring public of 2 hr or more.

A second plan (the one ultimately adopted) focused on closure of about 2 miles of the freeway between the East Los Angeles Interchange and the San Bernardino Freeway, on reducing the traffic approaching the area through diversion to other freeways upstream of the closure, and on providing alternate freeway routes for that traffic that approached the closure (Figure 2).

The area to be closed is fed by two routes--the Santa Ana Freeway and the Pomona Freeway. Approaching the East Los Angeles Interchange, the Santa Ana Freeway carries about 225,000 vehicles per day; at mid-day, hourly volumes of 6,500 vehicles are common (Figure 3). About 35 percent of this traffic, or 2,300 vehicles per hour, stays on the Santa Ana Freeway through the East Los Angeles Interchange and proceeds toward Los Angeles. The Pomona Freeway, which carries about 160,000 vehicles per day, contributes approximately 1,000 vehicles per hour during mid-day to the closure area. If traffic management was to be successful, and if the 20-min delay criterion was to be met, it was estimated that it would be necessary to reduce the hourly volumes approaching the closure on the Santa Ana Freeway and on the Pomona Freeway to about 5,000 and 2,800, respectively. If this could be accomplished the Santa Monica and Harbor freeways could handle the extra traffic load expected to be placed on them.

There was still a question regarding diversion: Would motorists on several freeways (not just the Santa Ana Freeway) voluntarily divert to other freeways at points several miles upstream of the actual closure? Adding to the uncertainty was the fact that those motorists had to be persuaded to take alternate routes even though no congestion from the closure might exist at their point of diversion. Prior experience in handling traffic at freeway closures resulting from major incidents led to the conclusion that the needed diversions could be achieved through the combined use of

1. A comprehensive public information campaign before the closure, and
2. The aggressive management of traffic, including extensive use of changeable message signs, during the closure.

Several days before the operation press releases were issued and information regarding the closure was included in traffic advisories furnished on a regular basis to radio stations throughout the Los Angeles region. The plan was given satisfactory coverage by both newspapers and radio. In addition, on the day before the closure motorists were advised of the plan by large signs placed along the section of freeway to be closed.

Maintenance, enforcement, and traffic operations

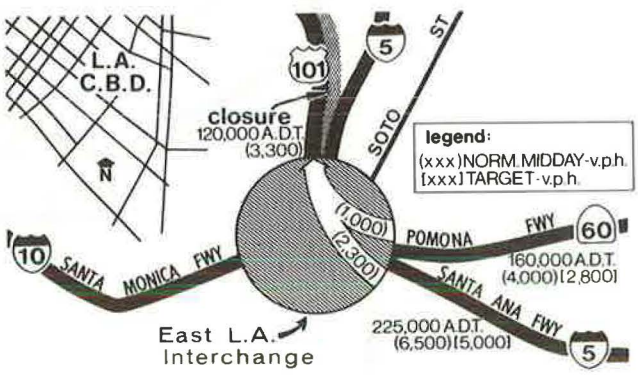

FIGURE 3 Volumes to be diverted.

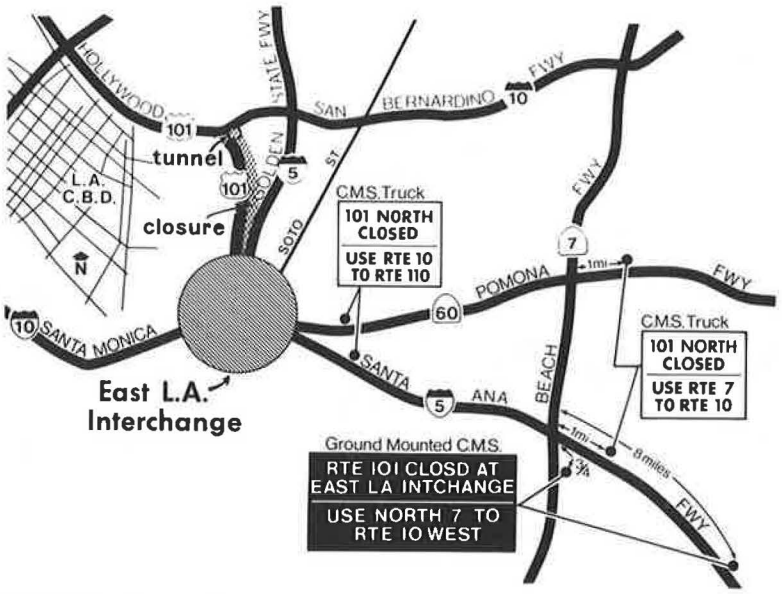

FIGURE 4 Changeable message signs.

personnel who would be involved in the implementation of the traffic management plan held a series of coordination meetings before the closure, and there was a full understanding of the overall strategy. Contingency plans to modify the operation to fit actual conditions as they developed, or to terminate the operation, were made.

Operations to begin closure were undertaken after the peak period and were completed at about 10:00 a.m. Several changeable message signs were activated to encourage the needed diversion (Figure 4). Other truck-mounted changeable message signs were used to warn approaching traffic of the end of queues. Extensive monitoring of the operation was performed by using both ground units and a helicopter. Teletype messages, this time presenting the actual traffic conditions, continued to be provided to radio stations.

The operation was carried out smoothly, with no major problems. Significant diversions to other freeways did take place, although not as great as was estimated. Congestion, however, was held to manageable levels, and delays were about what had been expected (Figure 5).

Traffic approaching the closure on the Santa Ana Freeway was reduced by about 16 percent, to 5,500 vehicles per hour. Two diversions contributed to this: traffic coming in the Santa Ana Freeway turned northward on the Long Beach Freeway (500 vehicles per hour), and many of those on the Long Beach Freeway continued northward instead of turning onto the Santa Ana Freeway (500 vehicles per hour).

It was observed that there was only a slight diversion of traffic from the westbound Pomona Freeway to the northbound Long Beach Freeway. A nominal increase in volumes flowing from the northbound Long Beach Freeway to the westbound Pomona Freeway was also observed. Thus there was virtually no change in the volume on the Pomona Freeway approaching the East Los Angeles Interchange (Figure 5). This condition was attributed to two factors:

1. There was no signing on the northbound Long Beach Freeway approaching the Pomona Freeway to ad-

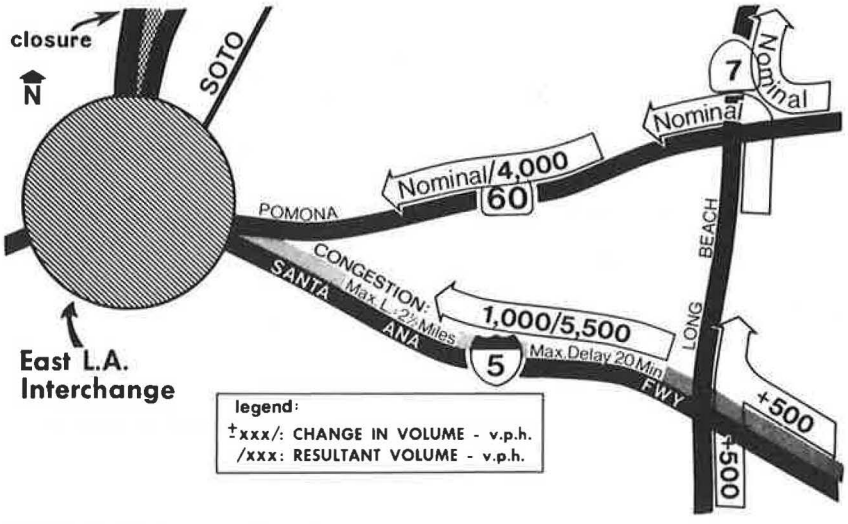

FIGURE 5 Upstream results: diversions.

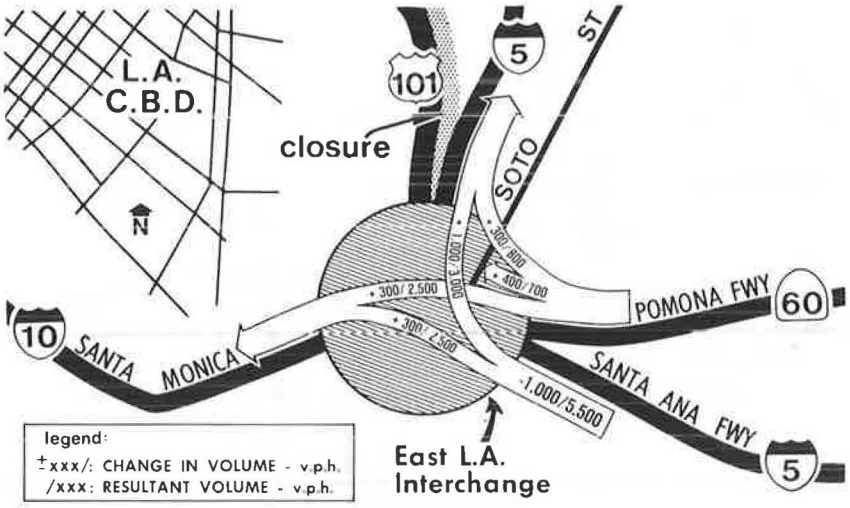

FIGURE 6 Results: diversions at East Los Angeles Interchange.

vise Los Angeles-bound motorists to continue northward to the San Bernardino Freeway, and

2. Congestion, which could have encouraged diversion, never occurred at the Long Beach/Pomona Interchange.

The overall result of the diversion upstream was that the traffic to be detoured around the closure was reduced by more than 30 percent, from 3,300 to 2,300 vehicles per hour.

There was an unanticipated redistribution of traffic from the Santa Ana Freeway at the East Los Angeles Interchange, with more traffic going to the Golden State Freeway (+1,000) than to the Santa Monica Freeway (+300), even though signing directed traffic to the Santa Monica Freeway (Figure 6). This was attributed to the geometrics of the closure, which were such that those who were caught in the congestion chose to escape onto the Golden State Freeway.

There was also some increase in the volumes on several off-ramps in the area (particularly to Soto Street), as motorists attempted to avoid congestion by leaving the freeway system altogether.

Although upstream diversion was not what had been hoped for, the unanticipated flows to the Golden State Freeway and to Soto Street provided the necessary relief that kept traffic moving reasonably well, which avoided termination of the operation. No problems developed on those freeways onto which traffic was diverted.

Congestion and maximum delays were about what had been expected, although the duration of congested conditions was less than anticipated. On the Santa Ana Freeway congestion built immediately after closure and extended back a maximum distance of 2.5 miles. Maximum delays, recorded through the use of tachometer-equipped cars that flowed with traffic, were about 20 min (Figure 5). This condition gradually dissipated throughout the morning and, by noon, a free-flow condition was reached; the freeway remained essentially free of congestion until the operation concluded at 3:30 p.m. On the Pomona Freeway free flow was maintained throughout the operation. Some localized congestion resulted at the Soto Street off-ramp.

The success of this operation can be attributed to several elements that were brought together to achieve the needed levels of diversion: development of a sound plan, mobilization of personnel and equipment to implement and monitor the operation, informing the public before the closure through media coverage and signing, use of changeable message signs during the operation, actively managing traffic during the event, and cooperation of the public. It was critically important that convenient, easily understood, straightforward alternate freeway routes existed.

It is highly doubtful that the operation could have been successfully conducted if diversion to local surface streets had been called for. Caltrans' experience in Los Angeles has established that there is a distinct reluctance on the part of the motoring public to voluntarily divert from the freeway system to surface streets, regardless of how adequate those surface streets might be.

As freeway systems age, the need for extensive maintenance and rehabilitation work, and the resulting impact on traffic, is increasing dramatically. At the same time traffic demands are burgeoning and there is a relatively low tolerance on the part of the public to disruption of their normal traffic patterns and levels of service.

This experience has clearly demonstrated that, given certain conditions, these seemingly competing needs can both be successfully met through the use of proven traffic management techniques.

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