current and prior, can be retrieved for analysis, by using CRT devices and printers. Automatic incident detection uses the computer to analyze data and signal the occurrence and location of a traffic incident. Computerized incident detection logic attempts to automatically detect incidents with: 1) the highest possible detection rate; 2) the fastest possible response time; 3) the lowest possible false alarm rate; and 4) the minimum manual input. Most logic uses traffic pattern similarity to find significant differences in traffic flow characteristics between adjacent detector stations.

Once the location of an incident has been signaled, it is necessary to find out what the incident is. This can be done by dispatching a standby response vehicle, or a patrol vehicle, or additional electronic surveillance can be used to inspect the nature of the incident. Ground or aerial closed-circuit television could be provided for visual verification of the incident and its problems. With TV cameras to transmit incident pictures back to the traffic management center, personnel can make incident-handling and traffic management decisions.

Roadside motorist aid phones, call boxes, organized Citizen's Band radio networks, motorists with cellular telephones, and various mobile radio-equipped vehicles have been used to help detect and verify traffic incidents. Roving service patrols and police patrols are valuable for providing incident response services.

Selective remote monitoring of CB units stationed at regular roadway intervals is also useful. When combined with electronic roadway detectors, the nearest CB station can be dialed up upon suspected incident detection to selectively listen (only) to conversations on Channel 19. The local CB information is used to verify the nature and details of incidents, with the information increasing as the severity of the traffic problem increases.

Regardless of the incident detection and verification technique used, operating agencies must be prepared with people and equipment to initiate the proper response. This requires communications systems and facilities between all units involved, definition of agency responsibilities, coordination of response activities, and considerable advance planning for handling the range of incidents that occur.

One method for handling incidents is a fleet of service patrol vehicles, either publicly or privately operated. By providing these vehicles with trained drivers, radios, and the proper equipment, most minor and some major incidents can be handled soon after detection. Essential equipment needed includes gas cans, water cans, pressurized air tanks, fire extinguishers, first aid kits, various tools, jacks, brooms, and so forth. Tow rigs are useful for relocating vehicles (and other items) to sites not interfering with traffic flow. Towing is usually for a very short distance; towing to garages or service stations is the responsibility of the vehicle owner, once an initial relocation has been made.

The establishment of traffic regulations is essential to permit operating agencies to remove vehicles from traveled lanes. The use of inconspicuous accident investigation sites is one method for relocating minor accident vehicles.

Without a special patrol or response force, minor incidents are usually handled by nearby commercial operators, upon notification by police or highway agencies.

For major incidents, special units and equipment become involved when called upon. Jackknifed or overturned trucks may require several tow units or heavy wreckers. In many truck incidents the truck load may also need removing from the roadway. Sometimes the load may be salvageable by having highway maintenance workers remove it to a storage site where the owners can claim it upon reimbursement of incident damages and cleanup costs.

Spilled loads can be bulky, troublesome, and very time-consuming to clean up. Some incidents may force closing lanes or whole roadways for several hours, such as for hazardous material spills or flooding conditions. Fire units may be needed for fires or spilled gas washdowns. Some incidents requrire fire, police, towing and ambulance units, as well as cleanup forces and equipment.

To reiterate, the important points in managing incidents are providing people and equipment, communications facilities between all units involved, definition of agency responsibilities, coordination of response activities, and advance planning for all types of incidents that could occur.

For many incidents, considerable effort is needed to control traffic safely and efficiently. Timely and well-planned responses keep roadways operating at the highest reduced capacities circumstances permit. Diversion measures and pre-planned detours may be needed for any major long-lasting incidents. And, finally, incident information should be broadcast to the public to help manage the traffic approaching or planning to use roadways tied up with incidents. The shifting of vehicle trips to other routes, to other modes, or to other time periods, helps relieve traffic pressure at the incident site. Radio and TV traffic reporting, changeable message signing, and highway advisory radio can be used by the operating agencies involved.

ROUTE DIVERSION PLANS AND FREEWAY INCIDENT MANAGEMENT TEAMS

D. H. Roper, California Department of Transportation

Once an incident has been detected, steps must be taken to deal with the problem -- to remove the obstructions as quickly as possible, to restore roadway capacity, to detour traffic as needed, to keep the motoring public informed of the situation. In short, the incident needs to be managed to minimize delays to traffic.

It is essential that advanced planning for incident management take place. Detour plans need to be developed, teams need to be organized, equipment assembled, and procedures established. These all need to be in place in order to respond quickly and effectively.

Virtually every segment of the freeway and street system should be closely analyzed to determine how traffic will be diverted, and to which surface streets it will be detoured. Working together, the State and local enforcement and traffic engineering agencies need to examine such things as diversion

routings, signal timing, manually controlling intersections, and parking restrictions, and to develop a plan to handle detoured traffic. As a part of this planning phase, it is essential that involved agencies "buy in" to the plan, and commit to implementing their portion of the overall plan when the need arises. Periodically, these plans need to be reviewed and updated as street patterns and traffic conditions change.

Many agencies are (and should be) involved in managing most incidents. To be effective, a team approach is essential -- and organization of the teams and development of procedures and working relationships is vital. At every major incident, enforcement, traffic engineering, and highway maintenance agencies are invariably involved; these agencies, then, become the nucleus of the team. Other agencies -- fire, ambulance, tow truck, toxic materials control, etc. -- then join the team as called for by conditions at any particular incident.

The team has the responsibility to assess the situation at each incident, and, using the advance-planned alternate route map and the collective expertise of the various representatives, to make decisions on precisely how the incident should be handled: where traffic will be detoured, how and when the wreckage will be cleared, how and when repairs to the roadway will be made, when roadways can be partially opened, etc. Each agency can then carry out its part of the overall plan.

Experience in the Los Angeles region has demonstrated clearly the value of establishing an on-site command post for the team. Each agency involved assigns a representative to the command post; in this way, the individual actions can be blended together into an overall, coordinated incident management team.

The primary responsibility of the Caltrans traffic engineer team member is to expedite the safe and orderly movement of traffic through and around the incident. As a first step, he will take a lead role in determining the alternate routes to use; he then carries much of the responsibility to implement the selected detour plan. Appropriate barricading must be placed, changeable message signs (both truck-mounted and stationary) need to be activated to divert traffic, signs need to be placed along the detour to reassure motorists, and intersection controls must be implemented. Traffic conditions then need to be continuously monitored, and appropriate adjustments in the plan made, if needed.

In Los Angeles, the Caltrans/Highway Patrol traffic operation center becomes a key tool in managing traffic at the incident. Traffic conditions on the freeway system are monitored and relayed to the team, changeable message signs to support the incident management plan are activated, traffic advisories are sent to radio stations for broadcast, and helicopter surveillance of the incident site can be initiated.

As a final step in managing any particular incident, a critique of the operation is conducted. Deficiencies in the "system" are noted, and steps are taken to strengthen techniques. Adjustments are continuously made to improve incident management capabilities.

The same kind of incident management can be effectively used at "planned" incidents -- major events attracting large crowds, recurring spot congestion locations, and construction/maintenance activities. Use of many of the same techniques and procedures (teams, alternate route plans, diversion, etc.) can produce significant reduction in delays that result from these events.

Incidents on the freeway system cannot be eliminated; nor can the delays associated with those incidents. Delays and secondary accidents due to congestion can be markedly reduced, however, using well-thought-out, proven incident management techniques. That's exactly what's happening in Los Angeles -- and it's paying off.

TRAFFIC MANAGEMENT TEAMS

H. E. Haenel, Texas State Department of Highways and Public Transportation

Introduction

What is a traffic corridor? This question was asked of traffic engineers, police officers, and transit personnel at a Corridor Management Team Seminar in Texas. After considerable discussion, it was agreed an urban traffic corridor consists of two or more arterials that move people and goods between two points. Traffic corridors may cross each other and can change with time. Corridors can be either freeway corridors involving a freeway and one or more parallel streets, or street corridors consisting of two or more streets with the same basic origin and destination points.

Transportation is this country's lifeline and the urban freeway and street network is an important part of this lifeline. Mobility assures continued economic benefits for the urban area. The lack of mobility causes an economic loss to the community through increased accidents, motorist delay, fuel consumption and vehicle wear. Delay is a direct cost for added time needed for people to make appointments, provide services, and deliver goods. The Houston Chamber of Commerce estimated that delay due to lack of mobility cost the citizens of Houston $1.9 billiion during 1981.

Limited funds and rights-of-way encourage the highest and safest utilization of freeway and urban street corridors in urban areas. This can often be achieved through nominal-cost improvements having high benefits. Operational improvements include High Occupancy Vehicle (HOV) operations, ride sharing, staggered work hours, adequate police enforcement, and traffic handling. Physical improvements include geometric, traffic signal, and freeway control and surveillance along corridor arterials and retiming and rephasing of traffic signals. Benefit/cost ratios from 5/1 to 16/1 have been obtained from geometric improvements, freeway control and surveillance, and traffic-responsive signal systems.

Achievement of improved operations and safety has been difficult due to the number of agencies involved (e.g., city, county, state, and transit authority) and the number of organizations within these agencies (e.g., traffic, public works, and police for cities and traffic, maintenance and design for states). Too often, funds from the various organizations have been fragmented into uncoordinated improvements resulting in reduced overall benefits. Also, the movement of traffic