AUTOMATIC TRAFFIC OPERATIONS AND MAINTENANCE IN THE PORT OF NEW YORK AUTHORITY

Alan T. Gonseth, The Port of New York Authority

The Port Authority is a bi-state agency created by compact between the states of New York and New Jersey in 1921. The organization has two primary functions: to promote and protect trade within the port district; and to build, develop, and operate terminal and transportation facilities within the port district. The Port Authority has grown to where it now operates 23 facilities that cost more than $2.5 billion to construct. These facilities include four airports, two heliports, four bridges, two tunnels, two bus terminals, two truck terminals, two freight terminals, four marine seaports, one railroad, and the World Trade Center.

The complex roadway and highway systems, either within these facilities or contiguous to them, are prime candidates for automatic traffic operations because of the unusually heavy traffic demands and high construction costs associated with them. Improved traffic operations and maintenance through automatic means can provide high dividends in public service in these congested areas.

AUTOMATIC TRAFFIC OPERATIONS

The tunnels and bridges that are operated by the Port Authority are toll facilities. Because there are significant operating costs associated with toll collection, various types of automated tolls have been implemented or are under study to improve patron service at less cost. These programs include such things as automatic computer recording and summarizing each toll collector's transactions and performance. The automatic collection of cash is a proven toll-road technique; however, the Port Authority has been testing the application of automatic vehicle identification and magnetic cards as an automatic toll operation. Apart from the tolls operation, the direct automatic control of traffic has been implemented in the Holland and Lincoln Tunnels, an automatic traffic-control system has been installed at Kennedy International Airport, and another is in progress as part of the new Newark Airport ground-transportation plan. A Traffic Measurement System (TMS) has recently been installed at all tunnel and bridge facilities to automatically give instantaneous operational information.

Tunnel Traffic Control System

The forerunner of all freeway surveillance systems was the basic tunnel traffic control system (TTCS) project. In 1959, after a year of preliminary theoretical research, gaps were manually inserted in the streams of traffic entering the Holland Tunnel. This crude manner of metering traffic eventually proved the concept that vehicular throughput is improved by maintaining good speed and density characteristics. Since then, the development of the automatic flow-control system has been reported at a number of Highway Research Board and other technical meetings.

At the present time, final work is being completed on the 5-tube, or 10-lane, control system that uses 140 vehicle detectors, 3 mini-computers, and 12 changeable-message signs to measure and control the traffic automatically. The system is augmented by closed-circuit television, tunnel radio communication, and a rapid catwalk transportation system.

The detectors constantly measure actual, not calculated, speed and volume at a point and measure the actual density or inventory vehicles over a zone. Computer logic can predict imminent deterioration in the traffic stream and can call for the appropriate degree of control that will ensure restoration of optimum flow. The sensitivity of the system is such that extremely accurate measurements of the traffic-stream characteristics are required, and that is the backbone of the density-oriented logic system. Controls currently used are changeable-message signs at the tunnel portals that read either PAUSE HERE THEN GO or STOP. The former is used in conjunction with a flashing amber signal unless there is an unusual circumstance that requires the latter message in order to return traffic to a fluid flow.

The system also detects stoppages or other discontinuities and alerts the operating police who can confirm the trouble source by closed-circuit television and radio for emergency response.

TTCS has improved peak-hour traffic flow by approximately 10 percent, which, when applied to 10 traffic lanes, is equal to the construction of an additional tunnel lane. In 1957, the construction of the 2-lane third tube of the Lincoln Tunnel cost more than $90 million, which would certainly cost more than double that if it were built today. However, the TTCS program was actually installed in four tubes at a cost of $3.4 million, and the automation aspects greatly improved the operation and reduced enough labor costs to pay for the project in 8 years.

Therefore, TTCS has provided greater capacity at less annual cost while also providing improved communications and operational features to the tunnel management.

Traffic Measurement System

For years Port Authority staff discussed the need for developing a system that would automatically classify vehicles. When the Tunnels and Bridges Department adopted a one-way tolls policy (pay double toll going east and travel free going west), it was recognized that half of the vehicle classification data would be lost. Annual, monthly, weekly, and certain weekday data could be approximated by using appropriate eastbound data. However, valuable weekend, peak-period, and hourly data would be lost. Consequently, an automatic system was developed to classify traffic and provide operating personnel with constantly updated information as well as alert planners to changes in trends.

The system basically measures the speed of a vehicle over a pair of detectors and the blockage time of one of the detectors. From this the length of the vehicle can be determined within an inch. A look-up table then provides the classification.

Kennedy International Airport Traffic System

Kennedy International Airport can be thought of as five separate airports with several routes connecting all areas. In the early years of its operations a simple crosswalk was sufficient to move air travelers from the terminals to many of the parking areas in the central terminal areas (CTA). The increase in the number of air passengers resulted in increased ground traffic; pedestrian conflicts and traffic delay resulted. The long-range solution, to be implemented in the near future, is multilevel parking with direct overhead connections to the terminals to eliminate all conflicts. An intermediate step of installing pedestrian bridges or tunnels was rejected because people refuse to use them unless there is no alternative. Another intermediate solution considered was the installation of a traffic-responsive signalized crosswalk system. Such a system was put into operation at the airport in September 1967. The analog system calculates traffic stream density at strategic locations on the CTA roadway network and automatically adjusts signal cycle lengths based on the traffic density and pedestrian pushbutton demands. In addition, a diversionary signing system that recommends alternate routes within the CTA is produced by the same sensing devices.

Pedestrian crosswalk accidents decreased 22 percent overall and 55 percent during peak hours despite a 50 percent increase in both vehicular and pedestrian traffic. The overall vehicular accident rate also decreased about 7 percent whereas travel times remained the same.

MAINTENANCE

Maintenance in the Port Authority is performed by different groups. Certain jobs are done by contract with outside organizations, other major jobs are done by a special unit called Central Maintenance Services, and the remaining work is done by facility employees.

Contract Maintenance

Special recurring maintenance work, such as computer maintenance, is usually done by contract. Similarly, major nonrecurring jobs such as bridge-deck replacements, sandblasting, and buried standpipe-system inspection are also done by contract as are other jobs that can be handled within the organization but where time or manpower does not permit.

Central Maintenance Services

Central Maintenance Services does the recurring major maintenance jobs at the various Port Authority facilities. This work includes such things as pavement patching, electromechanical equipment maintenance, and bridge painting.

Facility Maintenance Unit

The facility staff performs the daily operational maintenance. All maintenance jobs are classified as either routine or nonroutine. As their labels indicate routine jobs are ones that can be predicted in advance and for which a logical cycle can be planned. A nonroutine job is, of course, one that does not occur regularly.

A roster has been developed for all routine jobs. A work-order number is assigned to each job as is other pertinent information such as skill required, accounting code, description and locations, frequency per year, and biweekly periods scheduled. A daily work sheet can be automatically made in advance for supervisory planning purposes, and then actual performance can be added for later review on a day-to-day basis. With these data in computer storage and employee time cards geared for keypunching, it is obviously easy to produce monthly, quarterly, and annual reports on variances from schedule, program costs, and efficiencies.

The nonroutine jobs utilize approximately 40 percent of the crew's time and are requested as they arise. Prefix code numbers describe the urgency as immediate, within 24 hours, or whenever convenient.

Obviously the judicious scheduling of manpower must be tempered by the judgment of the supervisory staff. A 3- or 4-day snowstorm disrupts any rigid schedule such that adjustments have to be made. The variations from schedule can be identified and explained at a later date.