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# Successful Incident Management on a Major Reconstruction Project

## Pacific Motorway Project, Queensland Australia

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## ABSTRACT

Reconstruction of high traffic roads presents considerable challenges to minimizing delays due to traffic incidents. The Pacific Motorway Project was a fast-track reconstruction of 43 km of one of the most heavily trafficked inter-urban routes in Australia, carrying up to 90,000 vehicles per day between Brisbane and the Gold Coast in South East Queensland. Reconstruction by the State Department of Main Roads involved upgrading from four to eight lanes, under traffic and along an existing corridor.

Keeping traffic flowing route was a priority, and key objectives during the construction and operation phases (with sections progressively opened to traffic) were to ensure smooth traffic flow, minimizing impact on road users; to ensure the Motorway operated safely; and, to limit project cost, balancing design and construction with the operation of the existing roadway, to reduce costs, traffic delays and safety risks to acceptable levels.

While these objectives are at times in tension, they were able to be satisfactorily achieved through a range of incident management initiatives, including setting clear objectives and performance standards, building good working partnerships, application of appropriate cost-effective technology and well thought out communication strategies. Successful incident management during the project meant that delays were minimized and response times to traffic incidents substantially reduced.

This paper focuses on institutional issues and outlines the experience in keeping traffic flowing during a major road reconstruction project, in particular the incident management techniques implemented and the results and lessons learned in managing the impact on traffic.

## INCIDENT MANAGEMENT AT ROADWORKS

Keeping traffic flowing is an important objective of highway reconstruction projects and non-recurrent congestion due to traffic incidents is a major challenge to be addressed. Incidents on key sections of a road network can have a significant impact on regional travel, safety of road users and road workers and on the economy of the local communities.

While effective management of traffic incidents can help to mitigate their impact on highways under normal operating conditions, it becomes even more important during reconstruction activities due to the constantly changing nature of the road environment (both along the project and with time) and often temporary reductions in available road space and standards. In this context, the objectives of traffic incident management for road construction works needs to consider:

- Rapid detection – reduce the time to detect and verify traffic incidents, whether crashes, load spills or broken-down vehicles
- Quick clearance – reduce the time taken to respond and clear incidents
- Work zone safety – exercise proper and safe on-scene and work zone management, while keeping traffic flowing
- Road-user information – provide timely, accurate and useful information to the traveling public that enables them to make informed choices
- Keep traffic flowing – restore normal traffic flow as quickly and safely as possible.

The current application of incident management in South East Queensland can best be described as embryonic and developing. This paper focuses on the institutional issues and strategies and builds on a paper by Higgins at the *Smart Traffic – deploying incident management* conference held in Brisbane in May 2001 (1).

## THE PROJECT

The A$950 million Pacific Motorway Project was a fast-track reconstruction of 43 km of one of the most heavily trafficked arterial routes in Australia, carrying up to 90,000 vehicles per day, between Queensland's capital city, Brisbane and its premier tourist destination, the Gold Coast in South East Queensland. It also forms part of a major interstate link between Brisbane and Sydney.

The Motorway took four and a half years to plan and design, including three years to construct, and was completed in October 2000 by the State Department of Main Roads. Reconstruction involved retrofitting a new eight lane facility, including extensive use of two lane service roads, to replace the existing four lane highway, under heavy traffic and along an existing corridor. Major horizontal and vertical realignment of the highway was required to achieve the 110 km/hr operating speed for the new Motorway. The onsite construction workforce peaked at 1,700, under six major construction contracts over the 43 km length. To the north of the project another major construction project was also underway – the South East Transit project.

Key issues in the project corridor included:

- No viable alternative route over most of the project length
- Sheer size and nature of the works – retrofitting a world class motorway to an existing highway under heavy traffic and within a restricted road corridor
- Target dates set by Government meant the project had to be fast-tracked
- Need to maintain a safe site for both construction workers and road users
- Concern among road users and local businesses about traffic delays during construction.

To address these issues an Impact Management Plan (2) was developed for the project, in consultation with a wide range of stakeholders, covering a range of issues. Among other key elements, the Plan included strategies and guidelines to manage traffic impacts, especially the need to ensure the motorway continued to operate safely and efficiently and reduce traffic delays and safety risks to acceptable levels. This was based on experience in the United States on corridor traffic management planning (3).

## INCIDENT MANAGEMENT APPROACH

### Planning and leadership

Defining goals and a set of traffic management objectives for the Project was critical. Using a framework documented by the University of Washington (4) an implementation plan for traffic management during the construction phase, known as the Corridor Traffic Management Plan was developed by the Pacific Motorway project team in consultation with key stakeholders. This differed from previous construction traffic control plans in that it took a wider network approach and included a number of operating standards, such as:

- Keeping two lanes open each way during daylight hours
- Maintaining a mandatory speed limit of at least 80 km/hr through the construction site
- Using positive separation (ie concrete barriers) between the construction site and road users.

Keeping traffic flowing on this major route during construction was a priority and Main Roads took a leadership role by establishing and publishing key objectives during the construction and operational phases (as sections were progressively opened to traffic) which were:

- Ensure the Motorway operates safely – for both road users and construction workers – measured by safety levels
- Ensure a smooth flow of traffic – minimize impact on road users and adjoining businesses and properties – measured by travel time through the total length of the site
- Minimize project cost – design and construction of the new roadway and operation of the existing roadway rationalized to reduce costs, traffic delays and safety risks to acceptable levels.

Incident prevention was also a core consideration during design and construction planning and special efforts were made to ensure the safety and orderly flow of traffic through the work zone. This included the provision of some 42km of concrete barriers to separate traffic from the worksite and between opposing flows in constrained conditions (Figure 1).

### Performance targets

The Pacific Motorway project team developed a number of key indicators to monitor effectiveness of incident management. The chosen indicators (listed in Table 1) were:

- **Travel time** along the length of the 43 km construction site, measured by weekly travel time surveys at a fixed time during morning & afternoon peak flows – target of less than 10 minutes additional travel time when compared to average travel times before construction
- Number of observed or reported **traffic incidents** – measured by the number of reported or observed incidents each month that impacted on traffic flow, classified as low, medium and high severity, based on the potential impact and response required – target of no worsening in the number of incidents
- Reduction in **incident clearance times** – measured by the time taken to clear breakdowns and crashes and restore traffic flow – target of sustained reduction in incident clearance time
- Number of **traffic crashes** – measured by the number of major damage, injury and fatal crashes recorded – target of sustained reduction in number and severity of crashes. Data on traffic crashes is routinely collected and reported on all roads by state agencies (Police and Transport)
- **Traffic information**– measured monthly by the number of calls to Traffic Hotline and number of hits on the website – with a target of sustained public access.

These indicators aimed to provide a useful measure of the overall effectiveness of the incident management on the project, with both qualitative and quantitative targets, or in some cases without a target but a commitment to a principle.

## Partnerships

The Pacific Motorway project team were committed right from the early stages of the project to establish and maintain good working partnerships, as these were critical to success. An Incident Management Group was established comprising key stakeholders and partners and included:

- Transportation agencies
  – Queensland Main Roads (state road agency) – incident management response during construction project operated 14/7 (14 hours a day/7 days a week) – with on-call staff being available out of hours
  – Queensland Transport (state agency) –responsible for traffic safety and heavy vehicle regulation
  – local authorities (eg Gold Coast City Council) responsible for local roads in the area
- Law enforcement and public safety agency – Queensland Police Service – emergency communications center operated 24/7 – attended all major incidents and provide site command and control
- Fire and Rescue agencies – Queensland Fire & Rescue Service; Queensland Ambulance Service – both operating 24/7
- Construction contractors – onsite or on-call 24/7 – formal requirements for traffic management incorporated into construction contracts
- Towing contractors – private sector companies operated 24/7 – under contract to Main Roads to provide motorist assistance, plus on call to clear major incidents.

Representatives from the Incident Management Group met regularly (usually monthly) to consider operational issues, debrief on major incidents, review performance and review and evaluate procedures. Joint desktop and field exercises were conducted with incident response agencies – a critical step to improving response times and facilitate communication. An example of a joint desktop exercise involved responder agencies proceeding through a major incident scenario, requiring key players to respond to events as they unfold, followed by a debrief of the outcomes. This allowed personnel from responder agencies to understand who best to contact for different requirements, build relationships with partner agencies personnel, and obtain a better understanding of other agencies' perspectives and procedures. It also allowed a frank discussion of issues and where action could be taken, such as purchasing of specialized equipment, or training of key staff.

This Group has continued overviewing and coordinating incident management, with some changes to the stakeholders involved and recently reviewed the first twelve months of operation of the Pacific Motorway since construction was completed in October 2000.

## Technology

The conceptual operation of the Traffic Management System, as outlined in Figure 2, was established on the project site. This recognized the realities of construction sequencing and resulted in the use of a combination of manual and technology systems to provide a cost-effective approach.

**Traffic Management Center** – a temporary Traffic Management Center (TMC) facility (Figure 3) with limited cost-effective technology and simple systems was established and staffed by a small team between 6.00 am and 8.00 pm, seven days per week. In addition to monitoring traffic flow through the reconstruction site, the project team also managed any unexpected and planned incidents and provided communications links to responding agencies. The staff used standing operating procedures, developed in conjunction with police and emergency services and other incident response agencies.

The TMC received information from CCTVs, construction personnel, motorists, residents and businesses along the route. Center staff were able to quickly assess an incident and through communication links with police, emergency services and construction contractors were able to implement agreed response plans. Information about the incident was also relayed to road users through phone-in hotlines, with variable message signs, Internet web site, and through media announcements on commercial radio.

A permanent TMC has subsequently been established at the Gold Coast, incorporating lessons learned from the Motorway project and covers all the major roads in the District.

**Fixed and Mobile CCTVs** – closed-circuit television (CCTV) were very cost-effective and efficient for incident verification – a total of 19 fixed CCTV cameras were installed along the project at the commencement of road works, providing coverage for about 60% of the project – strategic camera placement directed at key lengths were used in place of blanket coverage. Images were transmitted to the TMC via existing telecommunications (ISDN) leased communications links. The cameras were installed in their final positions wherever possible, to form part of the ultimate Traffic Management System for monitoring traffic operations on the Motorway when fully operational.

To cater for unexpected requirements for video monitoring, two additional trailer-mounted CCTV camera systems were also deployed. These units were battery powered with capacity for 15 days operation and linked to the TMC via dial-up cellular data communications. The cameras had full pan, tilt and zoom capabilities, and were successfully used to monitor temporary road closures, for example during times of controlled rock blasting and at major incident sites.

**Variable Message Signs** – ten trailer-mounted mobile variable message signs (VMS) and two fixed installations were used at key locations (just prior to major interchanges) where motorist needed information on traffic flow ahead. The mobile signs were relocated along the Motorway as required. Communications between the VMS and the TMC were via a leased cellular data network. Six of the portable units were also coupled with speed radar cameras to provide individual speed management messages to passing vehicles as a safety initiative, with considerable success.

Permanent VMS have progressively been commissioned to cover all the major roads in the District, controlled through the permanent TMC. Portable VMS are now being used on all minor and major construction works to provide road user information.

## Responding to Incidents

Rapid detection and verification of incidents enabled faster and appropriate levels of response, by obtaining clear details on location and the nature of the incident.

The TMC was the central point for receiving information from several sources such as the CCTV's, the Traffic Hotline number, which was regularly displayed on VMS and advertised in newspapers, and a volunteer *Traffic Watch* program using project team and response agency members. The CCTV's and *Traffic Watch* were mostly used to verify an incident. A range of techniques were used to remove the incident from roadway so as to restore highway capacity as quickly as possible.

**Minor Incidents** – involving vehicles immobilized by a breakdown or fuel shortage, a Motorist Assistance Program was introduced where tow trucks were hired by Main Roads to assist disabled vehicles. With the agreement of the vehicle driver, the tow truck provided basic assistance in removing the vehicle from the highway. This allowed more rapid clearance as the towing contractor was quickly called by the TMC and there was not an issue about who paid to clear the road. The cost of this activity was very minor in comparison to the cost of construction works and the benefits in quicker clearance and improved customer service to stranded motorists far outweighed the costs.

**Major Incidents –** Police took control of the site and through response plans, including diversion routes, the project team and contractors provided support such as access for emergency staff through the construction site, detouring of traffic around the incident, construction machinery and materials.

## Communications

**Traffic information** – experience on the project has shown that by keeping motorists informed, they are more likely to have greater tolerance for inconvenience and delays. It was important the information be both timely and accurate. Systems were established to collect accurate information relevant to the incident, traffic conditions and any available alternate routes on a real-time basis and quickly pass onto road users. Techniques of providing information to the public included using a dedicated phone-in hotline with a recorded message and an option of talking to a operator at the TMC, VMS, Internet web site and through media announcements on commercial radio stations.

**Traffic Hotline** – an traffic hotline was established using a dedicated regional phone number (nominal phone charge), operated from 6.00am to 8.00pm (outside these hours, the hotline was linked to an after hours service), which enabled motorists to obtain current traffic information or report an incident. It

was widely advertised, including on variable message signs along the corridor and received up to 8,100 calls per month. Mobile (cell) phone calls were a valuable means of incident detection.

**Internet Web Site –** a Web site was developed to provide an overview of the Pacific Motorway project, and information on current and planned construction activities and traffic operations. Video from the CCTV cameras was also available from the Web site by clicking on an icon on a map of the project. The update time for each image was approximately one minute.

**Information to the Media –** information on operating conditions and incidents on the Motorway was made available to the media by telephone and broadcast facsimile, for timely radio traffic broadcasts.

**Inter-agency communications** – one of the keys to improving clearance times was improving communications between responder agencies. Most traffic incidents are usually reported through the emergency phone number (000 in Australia) which is handled by Police Communications. For the Pacific Motorway project this was supplemented by a traffic hotline, which was advertised on VMS along the project length and through radio announcements and newspaper advertisements. Building good working relationships, through regular interaction and training exercises, communication between the agencies was also improved.

### Resourcing

One of the biggest challenges to incident management programs is securing adequate resource commitments, in terms of funding, capable personnel and appropriate equipment. One of the benefits of a large Motorway construction project, and the tight completion deadlines, was that resourcing was not an issue. Construction contractors were required as part of their contract to provide assistance and access to equipment on site; and Main Roads was able to install temporary and permanent CCTV and VMS equipment, provide the Motorist Assistance Program and establish a temporary TMC for the project, using construction funding.

The Motorway project team involved partner agencies in regular meetings, in developing joint procedures and in training exercises, enabling a better understanding of each others procedures, capabilities and equipment, resulting in incidents being better managed and better utilization of resources.

## PERFORMANCE RESULTS

Using the performance measure and targets referred to earlier and by regular data gathering, the performance in terms of incident management, as well as a number of other aspects were regularly monitored and reported. Both quantitative and qualitative performance assessments were carried out focusing on the key measures agreed with stakeholders as outlined in Table 1. In broad terms, the following results were achieved over the duration of the Pacific Motorway project:

- **Travel time** – prior to construction the travel time for the section of Highway was 28 minutes on average – regular weekly measurements were undertaken using an instrumented vehicle and, except for a limited number of major incidents, the additional travel time (example shown in Figure 4) was an additional 5-6 minutes. This was better than the target of less than an additional 10 minutes. A major contributor was posting a consistent 80 km/h speed limit prior to commencement of construction and targeted enforcement by police in consultation with the project team. However, increased focus on maintaining smooth flow through the construction work zone and attention to clearance of incidents were the other major contributors.
- **Traffic incidents** – were difficult to benchmark as accurate information on incidents along the Motorway project were not available. Anecdotal evidence indicated that the number of incidents were less than or at the same level as prior to construction, and trends in the number of incidents indicated that the number and/or frequency was stable, with a slight decreasing tendency. Full management reports were prepared on all major incidents and debrief on the outcomes were undertaken by the Incident Management Group.
- **Incident clearance times** – again difficult to benchmark, as little prior data was available. However response and clearance times (see Figure 5) were monitored from the start of project, with a wide variation in clearance times for breakdowns (around 30 minutes on average) and major

incidents anywhere from 30 minutes to 2 hours – but considerably less than previously and than experienced in other areas in South East Queensland

- **Traffic crashes** – there was a gradual decline in the number and severity of crashes during the construction period
- **Traffic Information** – high level of public access with peak monthly access of over 8,000 calls to the hotline and up to 9,000 hits on the website. An indication of motorist satisfaction was able to be gauged from calls to the Traffic Hotline.

As a result of the combination of incident management measures implemented response and clearance times were substantially reduced and actual delays to road users were minimized.

## LESSONS LEARNED

Keeping the traffic flowing during the construction of the Pacific Motorway project was a major challenge to the project team and other agencies responsible for responding to traffic incidents. The key lessons learned from this project were:

- **Leadership –** strong leadership by the highway agency and the project team in particular, provided the ongoing focus on achieving desired outcomes
- **Planning and setting performance standards** – having clear objectives and committed performance targets provided a focus for the partners involved in managing and responding to traffic incidents
- **Good working partnerships –** successful incident management required involvement and commitment from multiple agencies, adding to the challenge of building unified support due to the range of goals and personalities involved. The *Traffic Watch* program was also very successful as informed observers in the traffic were available to verify and provide critical intelligence on incidents much more rapidly than otherwise possible. The *Incident Management Group* enabled relationships to be built and better understanding and cooperation between agencies, plus joint desktop and field training exercises helped identify issues and how performance could be improved
- **Application of appropriate technology –** use of appropriate cost-effective ITS such as the TMC, CCTVs, VMS and Internet (a mixture of temporary and permanent facilities), combined with manual procedures proved to be most cost-effective and practical. The TMC provided a focus for information and communication between the project team, road users, construction contractors and responder agencies
- **Improved incident clearance times** – setting targets for response and clearance times and developing inter-agency cooperation and understanding of each others' procedures through regular interaction and combined training exercises, resulted in sharing resources and improved communication and a greater focus on restoring traffic flow
- **Reaching motorists with real-time information** – using fixed and portable CCTV and VMS equipment, providing the Traffic Hotline and website and providing information to the media. Keeping the motorist informed reduced frustration and assisted keeping traffic flowing and maintaining safety. An indication of motorist satisfaction was able to be gauged from calls to the Traffic Hotline
- **Response service** – providing a contract Motorist Assistance Service for breakdowns was key to restoring regular traffic flow and improved clearance times particularly where road space was constrained.

## CONCLUSION

In view of the limited general application of incident management in South East Queensland, the achievements on the Pacific Motorway project provides a catalyst for increased emphasis on incident management as part of traffic operations in the future and provides incident management techniques that can be readily applied on other highway construction projects.

ACKNOWLEDGEMENTS

The views expressed in this paper are those of the authors and do not necessarily reflect the opinions of the Queensland Government or its departments.

## REFERENCES

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## TABLES



## FIGURES

Table 1 – Key Performance Measures and Targets

| Measure | Description | Reporting Frequency | Target |
|---|---|---|---|
| **Travel Time** | Weekly travel time surveys of time to traverse project at a fixed time during morning & afternoon peak flows, compared to travel time prior to construction | Weekly | < 10 minutes extra |
| **Traffic Incidents** | | | |
| – Number | Reported or observed number of incidents that impact on traffic (low/medium/high severity) | Monthly | No worsening |
| – Clearance Time | Time taken to clear incidents and restore traffic flow | Monthly | Sustained reduction |
| **Traffic Crashes** | Reported number of major damage, injury and fatal crashes | Monthly | Sustained reduction in number and severity of crashes |
| **Traffic Information** | Provision of information through FVMS, Hotline (number of calls) and Internet (number of hits) | Monthly | Sustained public access to information |

Figure 1 – Positive Separation by Concrete Barrier

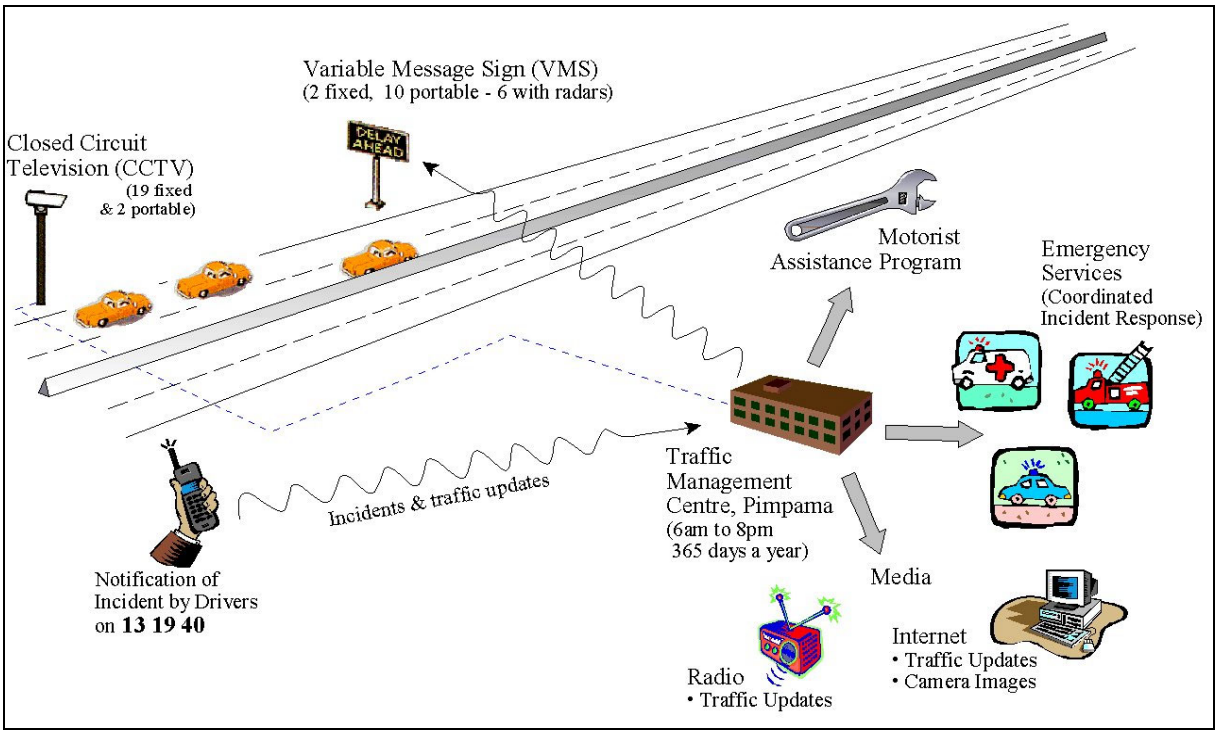


Figure 2 – Conceptual Operation of the Traffic Management System


Figure 3 – Project Traffic Management Center

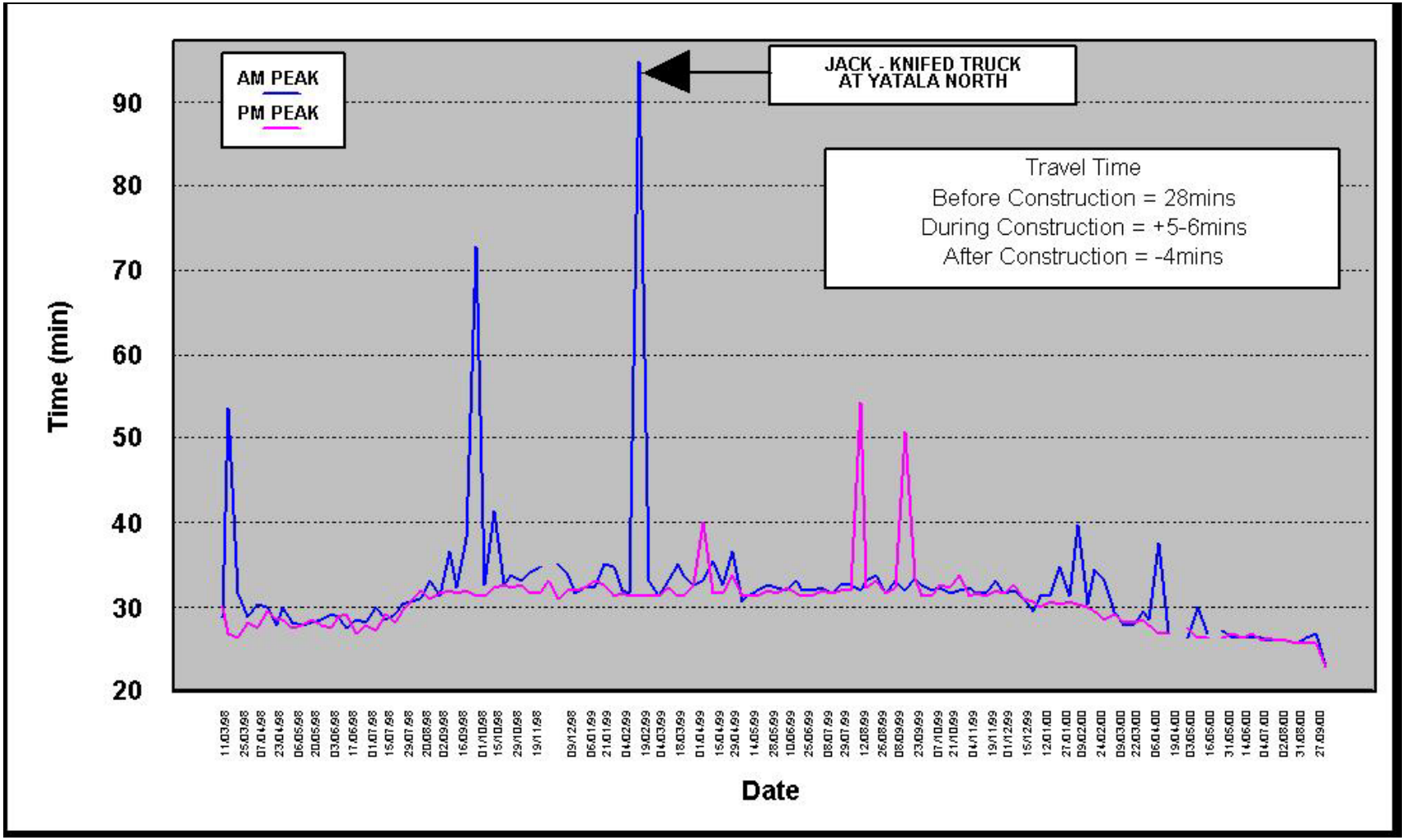


Figure 4 – Weekly Travel Time Survey Results – Northbound peak hour

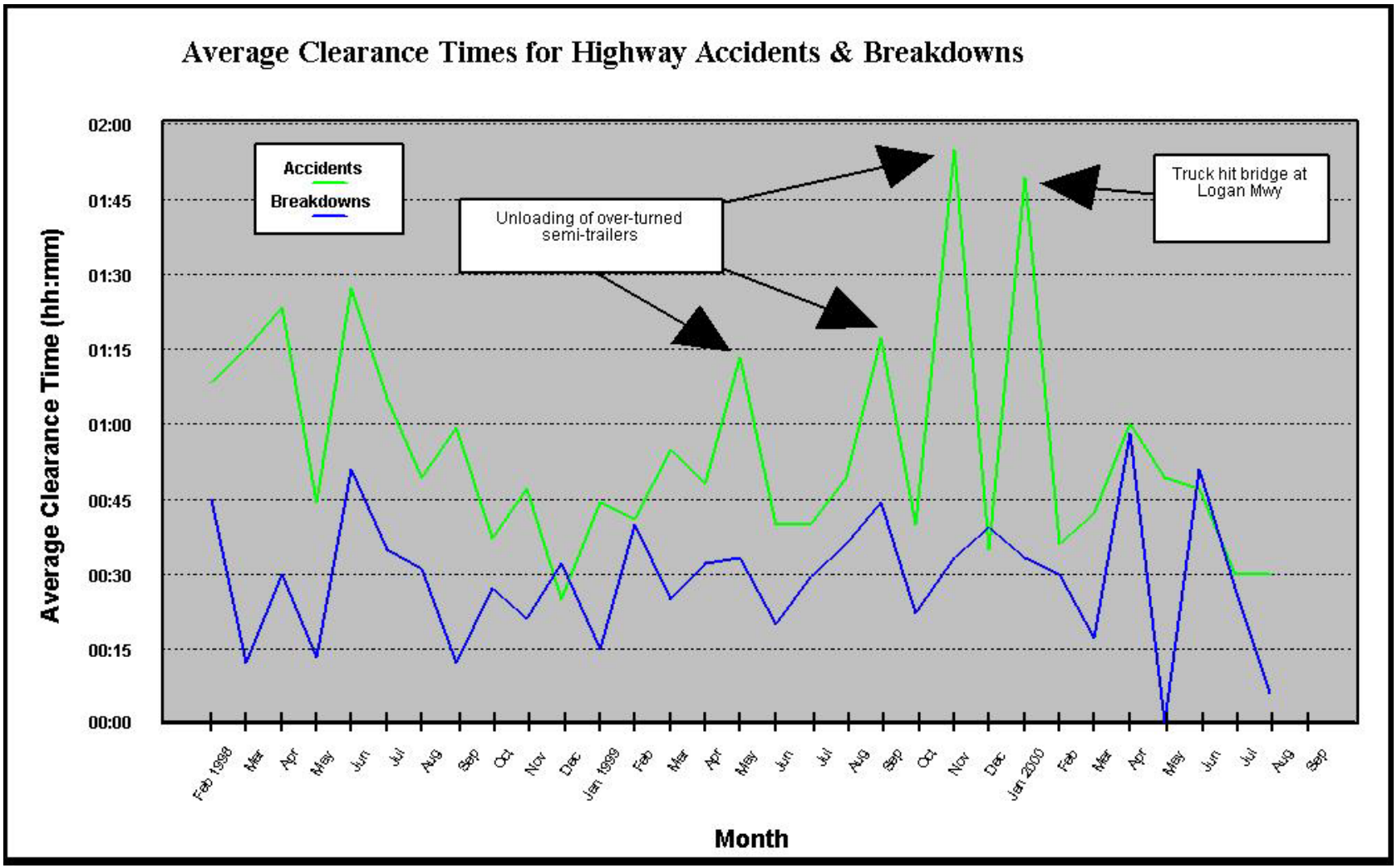


Figure 5 – Average Incident Clearance Times