

FREEWAY MANAGEMENT AND THE IMPACT ON RESPONSE AND CLEARANCE TIMES

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ABSTRACT

The first Freeway Management System (FMS) was launched as a pilot along the Ben Schoeman Freeway in Gauteng during 2007/2008. Since, then complete systems were rolled out in the larger Gauteng Area, the Western Cape and KwaZulu-Natal for the 2010 Soccer World Cup. These systems are currently being expanded in all three these areas to cover nearly 500 kilometres of freeways and which are controlled from three state-of-the-art control centres in Midrand, Cape Town and Pietermaritzburg.

In general, FMS offers various benefits, amongst others real-time information to the public for real-time route choices but it also offers faster detection times of incidents that should result in faster responses to the scene and better management of the scene. This paper explores the benefits of the FMS's specifically in terms of what has happened to incident response and clearance times over the past 3,5 years. The focus is specifically on the performance of the Western Cape FMS. The system has been in place since May 2010, i.e. for nearly four years. Data was collected throughout this period and these are used to investigate operational trends.

From the available data, it is evident that response times have reduced with at least 67% over the past three years. This applies to all responding services in the Western Cape. Clearance times of incidents involving fatalities have also reduced significantly from more than four hours to around 2, 5 hours. However, lately there has been an increasing trend which needs to be management carefully.

BACKGROUND

The Western Cape Freeway Management System (FMS) is an application of Intelligent Transport Technology which was initiated in 2008 and completed in 2010 before the 2010 Soccer World Cup. The first phase was rolled out as collaboration between the City of Cape Town (CoCT), the Western Cape Government (WCG) and the South Africa Roads Agency Soc Ltd. (SANRAL).

Since 2010 the network coverage has been slightly extended and additional functionality has been introduced such as additional cameras to improve visual coverage, thermal camera coverage to improve night vision, additional variable message signs (VMS), vehicle counting/detector stations (VDS), environmental/weather stations (ESS), improved communication network and new management and control software. The FMS has been successfully implemented to cover approximately 154 km of the busiest freeways in the Cape Town Metropolitan area. Refer to Figure 1 for a map of the extent of the system.



Figure 1: Extent of the network covered by the FMS
(CoCT – green, WCG – blue, SANRAL – Red)

The motivation behind the application of Intelligent Transport Technology, specifically related to Freeway Management is essentially to improve overall network operations by detecting, reacting and clearing incidents faster and at the same time provide information to the motorists to allow optimum route choices and to reduce delays. Faster detection and reaction to accidents significantly improves road safety by getting medical assistance to an accident scene as quickly as possible. The FMS also allows for the collection of data on incidents and overall network performance which can be translated into useful management information to guide decisions on operations and network improvements.

This purpose of this paper is to present the role of the FMS in improved network operations by reviewing the operations and performance of various agencies actively involved in FMS, specifically in terms of response times to incidents, as well as the clearance times of incidents.

The FMS network covers nearly 160 km of the freeways in the Cape Town Metropolitan area. Road authority ownership of sections of the FMS network can be summarised as:

Table 1: Extent of the FMS Road Network per Authority

AUTHORITY	COCT	WCG	SANRAL
Length per Authority	11.95	57.96	87.24
Total Distance	157.15 km		
Percentage split	8%	37%	56%

One of the primary reasons for deploying freeway management is freeway incident management and specifically early detection of incidents, quick response to the scene and effective scene management. These actions not only result in significant road safety benefits, but also increase the efficiency of the whole network in terms of reduced delays and optimised travel times. Co-ordination of the on-scene management of the responding services at an incident is central to reducing the delay caused by an incident and also to reducing the probability of secondary incidents.

The success of the Western Cape FMS to date has been the collocation of incident management stakeholders in the same building, viewing the same video feeds and collectively deciding on the appropriate response and management actions. This not only leads to beneficial response times, but also to more efficient management of the scene. The various services work together to ensure the best quality of service to road users. The ability to coordinate a multi-agency response to a major incident from a single location with real time video feed has already resulted in significant savings to Cape Town motorists.

The following timeline provides an indication of the key incident management events and the indicative targets under which the current operations are being performed.



Figure 2: Timeline of the key incident management events and target durations

INCIDENT RESPONSE TIMES

Response time is defined as the time it takes from when an incident is detected up to the time a specific response vehicle arrives on the scene. Not all services necessarily respond to an incident and obviously, only arrival times of those that arrive at the scene can be recorded. Fast response times are dependent on speedy detection, fast notification as well as efficient response protocols. The average monthly response times for all the responding services in the Western Cape, between October 2010 and December 2013 are illustrated in Figure 3. The variation from month-to-month is significant and depends on many factors, amongst others, the number of incidents to which a specific service responded in the month, the location of the incident, the time of the incident and the number of responding vehicles available at the time.

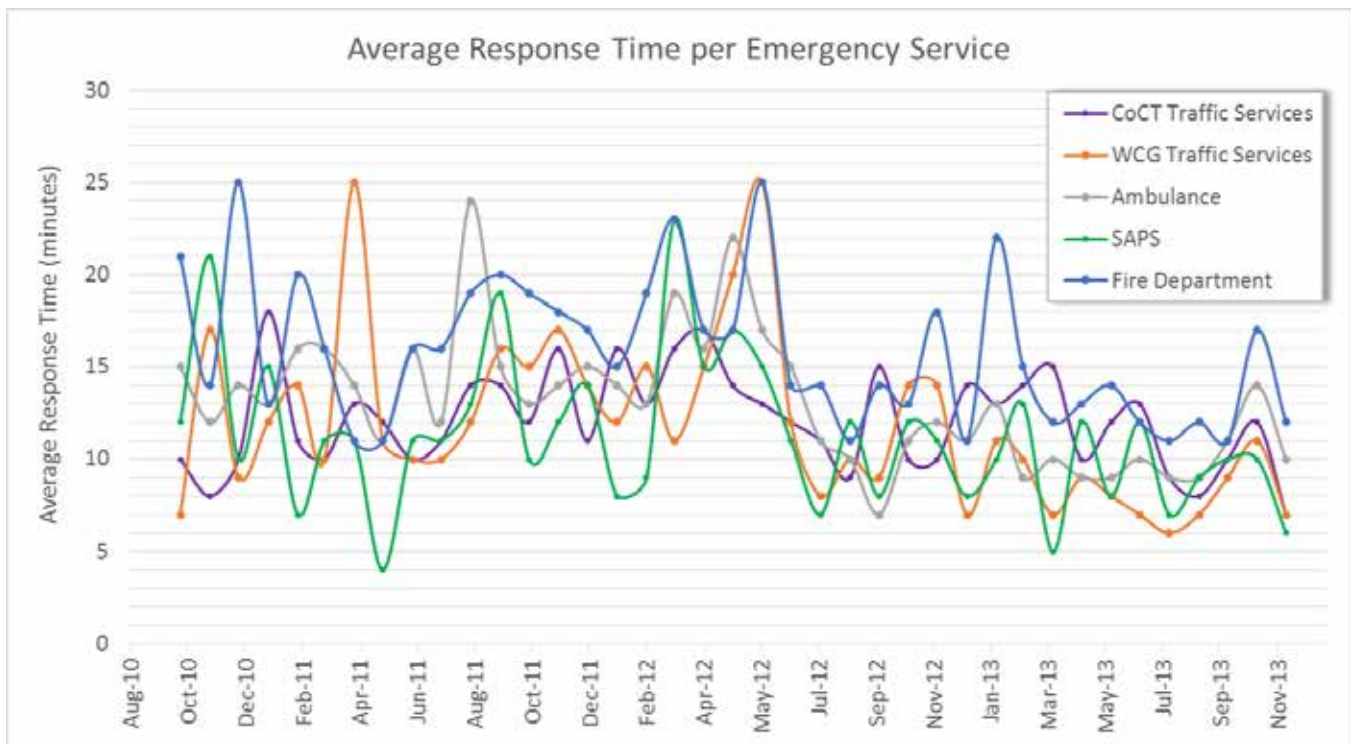


Figure 3: Average response time per month per Emergency Service

From the above figure it is evident that there was a definite change in response times around April/May 2012. Response times were increasing or constant up to April/May 2012 from when it started to decrease. From then the trend has been downward to below an average of 10 minutes.

The operations in the TMC started around May 2010, but at the time, it was only the FMS operators which were later joined by the City of Cape Town traffic and in early 2012, Provincial Traffic Services and a representative from SAPS also moved into the TMC. It is not evident what actually cause the downward trend. It could be that after two years, the correct protocols and processes were in place and that the staff were sufficiently trained and becoming efficient in their tasks, or just simply increased efficiencies due to the collocation and associated synergies amongst all the different responding agencies and the FMS Operators.

The following figures illustrate the average response time per month, per responding service since April 2012 up to December 2013. The response times are reported for the City of Cape Town Traffic Services, the Western Cape Government Traffic Services, the Emergency Medical Services, the SAPS and the Fire Department An indicative trend line (straight line) was fitted through the data points to illustrate the change per month, on a month-by-month basis.

Average Response Time (minutes)

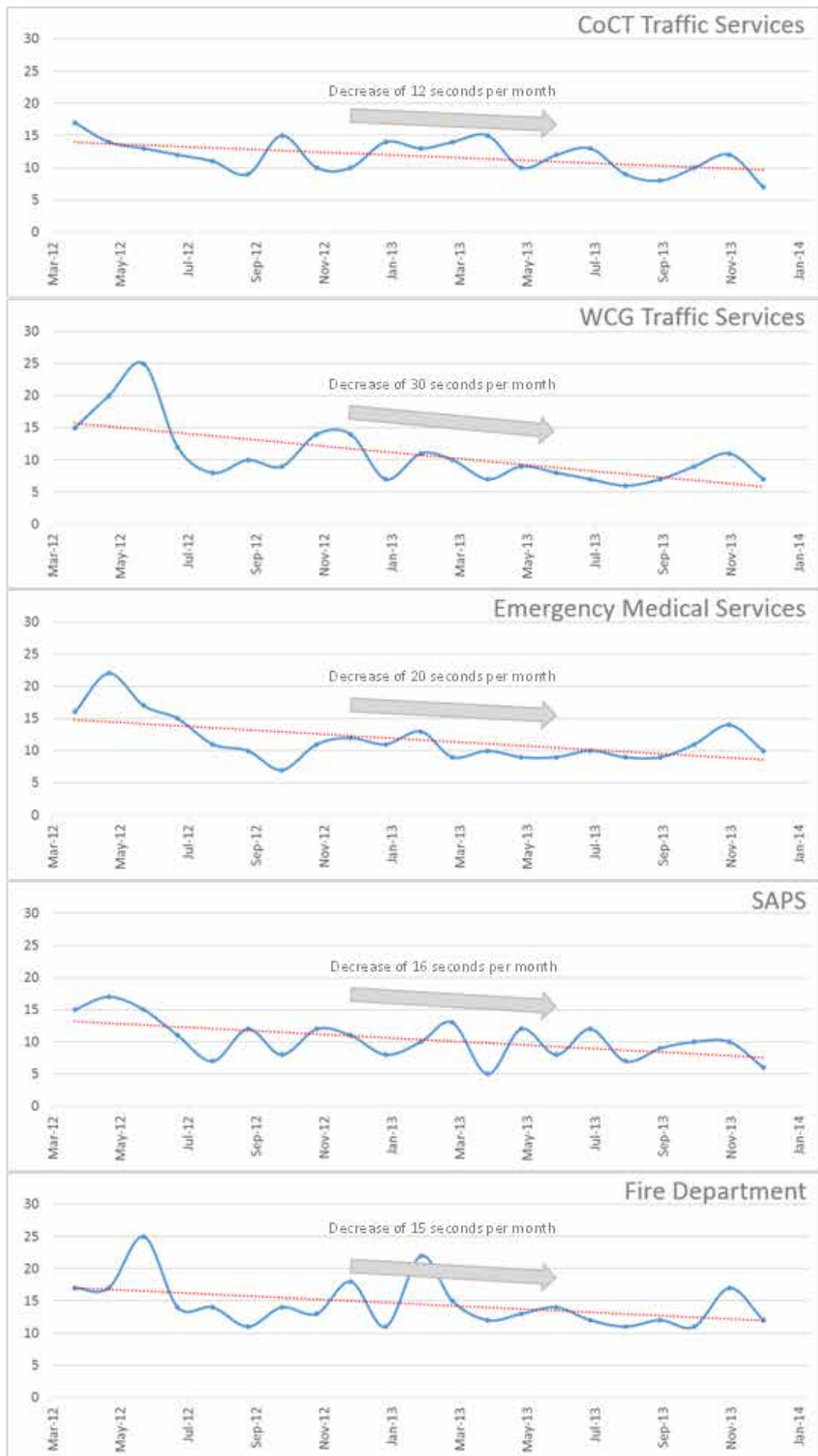


Table 2: Summary of Response Time Improvements

Response Time Improvements	
City of Cape Town (CoCT) Traffic Services	12 seconds per month
Western Cape Government (WCG) Traffic Services	30 seconds per month
Emergency Medical Services	20 seconds per month
SAPS	16 seconds per month
Fire Department	15 seconds per month

From the above, the following can be concluded:

- Response times for all the responding services have reduced from more than 15 minutes per incident in April 2012 to less than 10 minutes per incident at the end of 2013.
- This represents a reduction of 66% in response times in just less than 2 years.
- The trend is still downward and response times should reduce even further.
- The reasons for the reductions are not evident. It can only be hypothesized as possible one or more of the following:
 - Faster detection times
 - Fast confirmation and notification times
 - Visual CCTV feeds impressing the need on all for fast responses.
 - Optimised resource allocation due to the co-location of services and co-operation amongst services.

CLEARANCE TIMES

The average clearance time of an incident is defined as the time that elapses from the time an incident is detected to the time the incident is cleared and the road is open for normal traffic operations. At this point, traffic flow is not necessarily back to normal, but should soon return to normal.

Clearance Times per Injury Type

In Figure 4 are illustrated the average clearance time (from September 2010 to December 2013) for all types of accidents and categorised in terms of injury severity as follows:

- Accidents with no injuries
- Accidents with minor injuries
- Accidents with slight injuries
- Accidents with serious injuries
- Accidents with fatalities

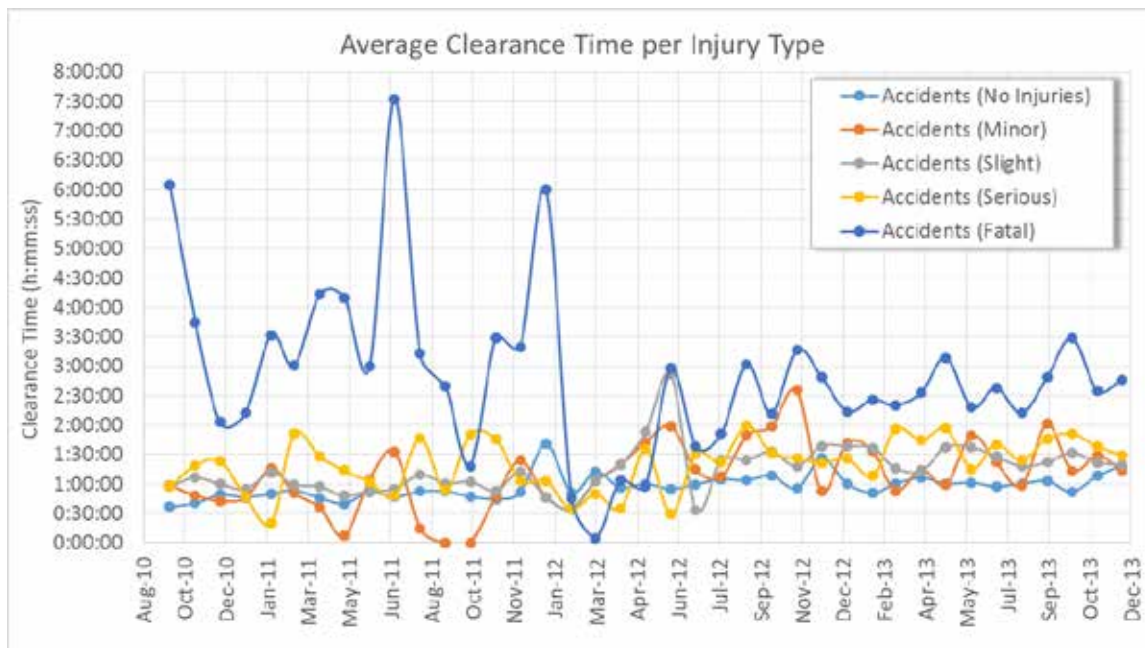


Figure 4: Average Clearance Time per Injury Type

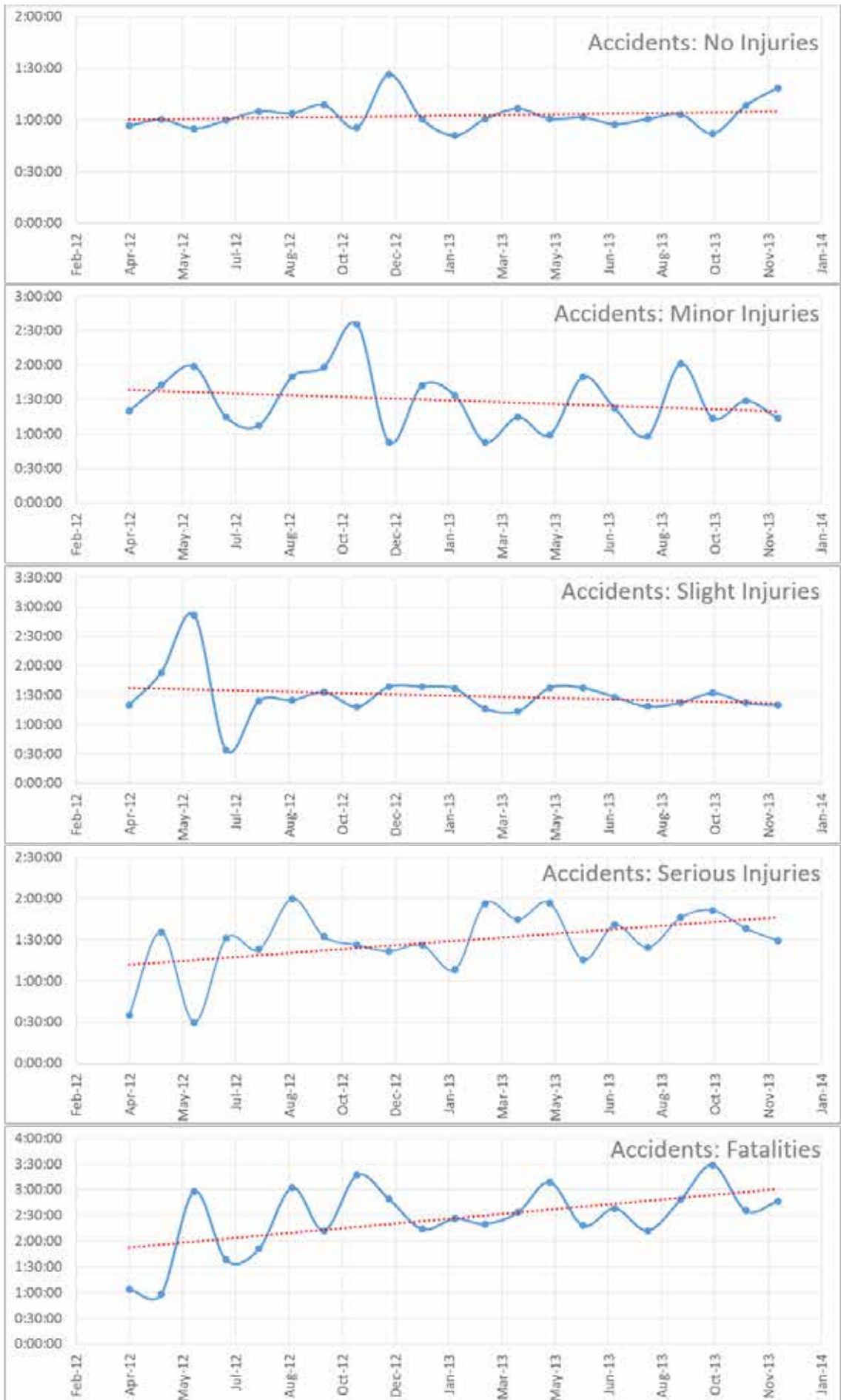
One of the apparent successes of the FMS is the reduction in the clearance time of scenes with fatalities. This came down from an average of more than 4 hours to just over 2.3 hours. The change also occurred in early 2012. It is hypothesized that the change is due to the activities of the FMS and specifically the improved co-operation of the different services in the TMC.

A more detailed evaluation of the clearance times per responding service were done and the results are included in the following graphs. The graphs illustrate the average clearance time per month, per injury type from April 2012 to December 2013. Similar to the response time analysis, an indicative trend line (straight line) was fitted through the data points to show the trend. The average change per month is summarised in Table 3.

Table 3: Summary of Clearance Time Improvement or Regression

Clearance Time Improvements / Regression	
Accidents with no injuries	Increase of 0.2 min/month
Accidents with minor injuries	Decrease of 0.9 min/month
Accidents with slight injuries	Decrease of 0.7 min/month
Accidents with serious injuries	Increase of 1.7 min/month
Accidents with fatalities	Increase of 3.3 min/month

Average Clearance Times (h:mm:ss)



From the analysis outlined in the above graphs, the following can be concluded:

- The trend in the change in clearance times are not consistently reducing, dissimilar to the response times. From an analysis of the data and discussions with the stakeholders it is evident that because the field personnel know that they are being watched they are generally more careful in the way the scene is managed and when they decide to re-open the road for traffic. Debriefings that are held with the responsible scene management personnel when the scenes are not properly managed, could also contribute to this.
- The above applies specifically to accidents with serious injuries and fatalities. It was noted before that one of the more significant achievements of the FMS is the reduction of clearance times of scenes with fatalities from more than 4 hours to around 2.3 hours. This clearance time has been steadily increasing again from the low of less than an hour in early 2012. This is of concern and will be monitored carefully. The same applies to the clearance times for scenes with serious accidents
- Clearance times for scenes with no or minor injuries have stayed the same or have been reducing over time.

SUMMARY

Since the onset of the FMS in mid-2010, the performance of the FMS team, including all the responding services have been monitored. This includes specifically the response time to an incident scene and the clearance times of the incident scene. Note that the services are not specifically working together as one team in terms of how performance is measured. The FMS Operations that monitor, confirm and notify the responding services of any incidents, provide this service under contract of the South African National Roads Agency (SANRAL). The responding services, report to their specific management and command lines, which could be the City of Cape Town, the Western Cape Government or the South African Police Services. The measures reported on in this paper, reports on the performance of the whole team providing the total service regardless of the command line of the different services.

During the first two years of the FMS operations (early 2010 to early 2012) while not all the responding services were located in the TMC, and while operational processes and teething problems were resolved, there were no significant changes in the performance of the team. The response and clearance times were either increasing or constant. These trends would probably have continued if the FMS was not in place. The increase could have been due to the increase in the number of incidents to respond to with the same resources. It is evident that since early 2012, a change occurred in the response and clearance times.

In most cases the change in response and clearance times have been beneficial to the travelling public. The response times reduced from an average of more than 15 minutes to less than 10 minutes. Any person involved in an incident/accident will be attended to faster, not only on the scene but also in transferring the injured to hospital.

In general, the clearance times of incident scenes have and are also reducing. In some instances, the clearance times are increasing, which is also due to the impact of the FMS CCTV coverage. This results in better scene management and the responding services ensuring that the scene is managed correctly and safely and that the road is not opened to traffic until it is safe.