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Paper title: **Melbourne's emergency vehicle pre-emption trial**

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Abstract (200 words):

VicRoads has implemented a successful trial of an emergency vehicle priority system at traffic signals on a strategic corridor in the south east of Melbourne. Seven locally-based emergency services vehicles (Victoria Police, Metropolitan Fire Brigade and Metropolitan Ambulance Service) were fitted with mobile infrared transmitters (emitters). The emitters produce a strobing light of a pre-determined frequency. The light from the emitter is not visible or in any way harmful to road users. Key approaches at five intersections on the trial corridor were fitted with receivers. These receivers detect the approach of an activated emitter. On receipt of this detection, a call for a special emergency vehicle phase is activated through SCATS which is Melbourne's traffic signal system. The trial was commissioned in March 2003. Testing of the system has been conducted and the results are very encouraging. The results indicate the system is operating in accordance with the system parameters with an acceptable level of priority achieved for emergency services vehicles during 'urgent duty driving'. Victoria Police are evaluating the system from an emergency vehicle driver's perspective for the three emergency services participating in the trial. VicRoads is considering expansion of the system to other routes as well as adapting the technology to other related applications such as public transport priority.

Introduction

VicRoads is the State road authority for the Australian State of Victoria. Melbourne is the capital city of Victoria.

To date, in Melbourne, VicRoads has provided widespread traffic signal priority for certain vehicle types including trams as well as buses on certain routes, but not for emergency services vehicles.

This paper describes a recent emergency vehicle pre-emption (EVP) trial which was conducted in Melbourne. The trial involved a joint effort between Victoria Police and VicRoads, in which a trial of an emergency vehicle pre-emption system was implemented on a strategic corridor in the south east of Melbourne based around the Moorabbin/East Bentleigh area. The corridor is in close proximity to the Moorabbin Police Station and the Monash Medical Centre which is one of Melbourne's largest public hospitals.

The aims of the trial were to:

- improve public safety at traffic signals;
- improve the safety of emergency services personnel; and
- avoid delays for emergency service vehicles at the trial intersections.

Background

Traffic signal priority gives an advantage for certain vehicles over other general-purpose traffic by the use of special phases, 'early starts' or extended green time to avoid, or at least minimize, delays at signalised intersections.

The computer system used in Victoria for control and co-ordination of traffic is known as SCATS. This is a dynamic and adaptive system of traffic signal operation which is used in several Australian States as well as in a number of other countries. Through SCATS, VicRoads aims to provide the optimum balance of traffic signal linking, vehicle progression, pedestrian service and, in some instances, selected vehicle priority.

In general, the method in which priority is achieved at traffic signals involves the receipt of a priority request from a suitably equipped approaching vehicle. The local traffic signal controller is pre-programmed to enable changes to the traffic signal timing sequence so that a pre-determined level of priority can be provided.

The level of priority and, whether or not priority is granted, is dependant on a number of prevailing factors. This includes balancing the needs of other road users such as pedestrians, other public transport services and cross traffic demands.

In Melbourne, in a small number of cases, priority is given to vehicles which are declared by the Victoria Police as VIPs. In such cases, the VicRoads Traffic Management Centre manually intervenes in the traffic signal system to achieve the desired level of priority.

In 2003, VicRoads decided to investigate and trial general priority for emergency services at traffic signals.

Priority for emergency services

While general priority for emergency service vehicles has not been provided at traffic signals in the past, several fire brigade and ambulance stations in Victoria are linked to nearby traffic signals to provide efficient and safe egress from these facilities.

This usually involves a link between the station or depot and the nearby roadside traffic signal controller via a radio or 'hard wire' link. On detection of an emergency service vehicle which is about to leave the station to attend an emergency, the traffic signal controller is requested to implement a 'special' phase that will assist the emergency vehicle.

Selection of an emergency vehicle pre-emption system

Discussions between VicRoads and Victoria Police canvassed the feasibility of a localised trial of traffic signal priority for emergency services and the types of cost effective techniques which could be adopted for such a trial.

Victoria Police also approached the Metropolitan Fire Brigade and the Metropolitan Ambulance Service which both agreed to become involved in the trial.

VicRoads examined a number of potential pre-emption systems. In assessing the technologies, a system was needed which could cope with high speed vehicles and instantaneous calls for priority from an unlimited number of points in the general traffic stream.

Ideally, the system would also need to be secure, reliable, resistant to 'hacking', robust and low maintenance, easy to install and relatively low cost.

It was intended that traffic signal pre-emption for emergency service vehicles would only be activated during 'urgent duty driving' and would be used to activate special traffic signal phases, 'early phase starts' or extended green time to improve safety and avoid, or at least minimize, delays at the trial intersections.

Ultimately, VicRoads selected a Mobile Infrared Transmitter (MIRT) system for its emergency vehicle priority trial. Similar systems have been adopted in other countries including the United States.

With respect to the security of the system and cognizant of certain claims being made on the Internet and other places by those marketing such products, VicRoads wanted to be absolutely convinced that its system could not be operated by the intervention of a non-authorised user. Before the system was chosen for installation, a full check was conducted on its security.

The selected emergency vehicle pre-emption system uses individually coded emitters. Only these coded emitters will receive a response from the system. This means that without knowing the system codes, it cannot be activated by a third party device. The system is also capable of logging all emitter requests received at the traffic signals whether they are coded or not. This assists in checking the system operation and can also identify any non authorized attempts to activate pre-emption.

The trial

The trial involved several strategic intersections in the vicinity of the Moorabbin Police Station including on Warrigal Road and South Road (Figure 1). These routes are typically used by Moorabbin Police to access local 'trouble spots' as well as major activity generators like Monash Medical Centre.

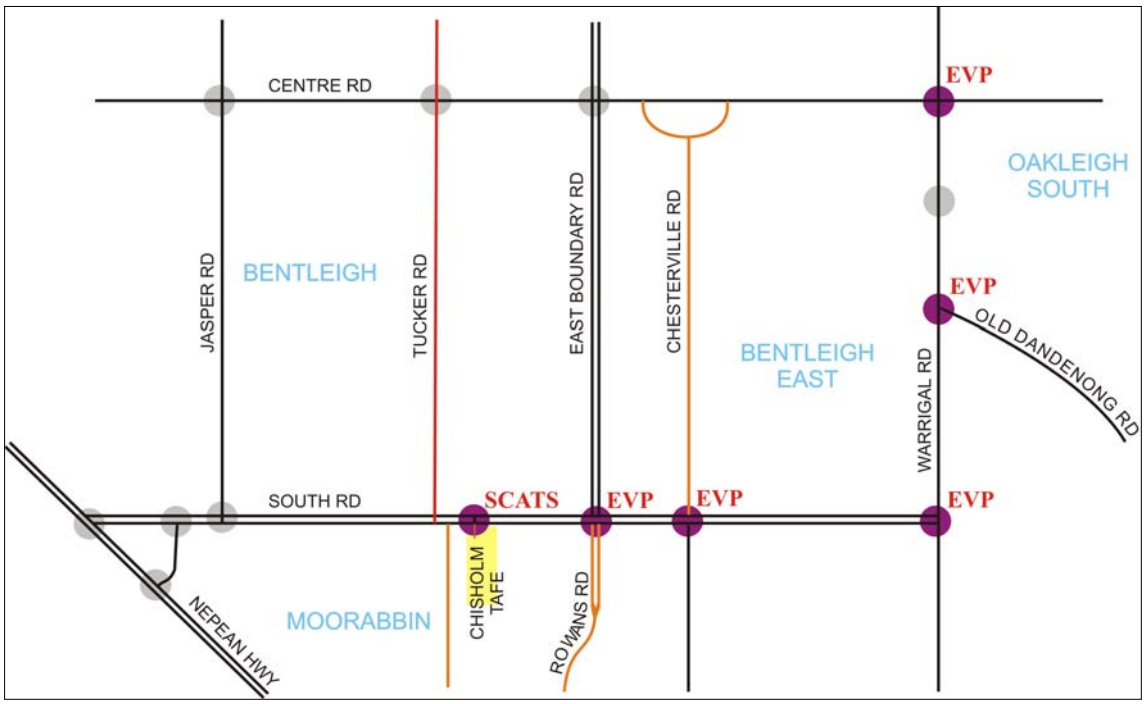

Figure 1 – The trial area

A number of emergency services vehicles from Victoria Police, Metropolitan Fire Brigade and Metropolitan Ambulance Service were subsequently fitted with emitters (Figure 2). The emitters, which are positioned on the top of the vehicle, are mobile infrared transmitters (emitters) which produce a white strobing light of a pre-determined frequency. The light from the emitter is neither visible nor harmful to road users.

Figure 2 – The mobile infrared transmitter (MIRT)

Key approaches at a number of intersections on the trial corridor were fitted with receivers

(Figure 3). The approaching vehicle communicates a signal pre-emption or priority request to the traffic signal controller. An identifier of the vehicle making the request (along with the type of vehicle) enables decisions to be made at the roadside signal controller regarding the priority strategy.

These receivers, which are installed on traffic signal poles, detect the approach of an activated emitter. The detection between the transmitter on the vehicle and the receiver at the signals is uni-directional and requires 'line of sight' for successful operation. On receipt of this detection, a call for a special emergency vehicle phase is activated through SCATS. An approaching vehicle is detected from a distance of up to approximately 500 metres. This distance is adjustable.

Figure 3 – MIRT receiver

Traffic signal pre-emption requests for emergency service vehicles are only activated during 'urgent duty driving'. For the trial, the decision to activate the system rested solely with the emergency services officer. For the purpose of the trial, Victoria Police activate the vehicle mounted emitter by manually pressing a switch which was installed in the vehicle (Figure 4). The activated emitter now enables emergency vehicle pre-emption to be requested until it is switched off. Fire brigade and ambulance vehicles linked their traffic signal pre-emption activation to the vehicle's lights and sirens.

Figure 4 – Victoria Police in-vehicle EVP switch

Discussion and results

The emergency vehicle pre-emption system was commissioned in March 2003. On site testing of

the system has been conducted and the results are very encouraging. The results indicate that the system is operating in accordance with the system parameters with an appropriate level of priority being achieved for emergency services vehicles.

Since installation, the system has proven to be robust and durable with little maintenance required. It has also shown itself to be reliable with no reports of 'missed' calls caused by the equipment where traffic signal pre-emption has been called by the vehicle mounted emitter but not received at the traffic signals.

A qualitative evaluation of the system from an emergency vehicle driver's perspective was undertaken by Victoria Police using feedback from drivers of the three emergency services participating in the trial. An example of the Victoria Police survey form is provided in Appendix A and a summary of the results of the survey, based on 165 survey responses are provided in Appendix B.

The evaluation indicated a high level of support from users of the system and reports of critical time savings resulting in major benefits for emergency services in terms of improved safety and response times.

All of the services indicated their support for the trial and a desire to have the initial system extended. The main users of the system were the ambulance service which is often in urgent duty driving mode. Anecdotally, the ambulance staff credits the emergency vehicle priority system with sometimes significant reductions in their travel times which, in some cases, have been critical to some of their emergency patients.

From VicRoads' perspective, SCATS has performed satisfactorily with no apparent disruption to the day to day operation of traffic signals in the area. It should be noted that not every signalized location on the subject routes was fitted with EVP equipment. VicRoads has adopted a pre-planned 'transfer of demand' technique through SCATS at certain locations where it was unlikely that the emergency services vehicle would divert from the main route. This removed the need to fit every location on the trial route with EVP equipment.

Next steps

VicRoads is proposing to extend the trial in 2004/05 by fitting additional emergency services vehicles and a number of additional traffic signal sites in the trial area.

With an expanded system including a broader network of equipped vehicles and traffic signal sites, VicRoads will complete its evaluation of the emergency vehicle pre-emption trial with a view to considering the incorporation of EVP into the VicRoads standard for signalised traffic signal installations.

VicRoads is currently considering expansion of the emergency vehicle priority system to other routes as well as the possibility of adopting the technology to other related applications such as public transport priority (Figure 5).

Figure 5 – Possible public transport application for EVP in Melbourne

Acknowledgement

I wish to acknowledge Acting Senior Sergeant Robert Hope of Victoria Police for his assistance in the development and implementation of the Melbourne's Emergency Vehicle Pre-emption trial.

Appendix A

Emergency Vehicle Preemption Survey

Emergency Service	Police/Ambulance/Fire	
Member Surveyed		
Contact Phone Number		
Date of Survey	/ /2003	
Were you the Driver or Passenger/Observer?	Driver/Passenger	
Reason for using EVP (eg. Attending cardiac arrest, fire, hold up alarm)		
Location of Job/Task	(Street & Suburb)	
Date of Job/Task	/ /2003	
Time Job/Task Given	Hours	
Time Attended	Hours	
What was the reason for selecting the route to the job that you used? (Select one or more)	☐ EVP Fitted ☐ Quickest ☐ Safest ☐ Most Convenient ☐	☐ Other (Please Explain)
What were the traffic conditions like?	Heavy/Moderate/Light	
What were the weather conditions like?	Clear/Raining/Fog/Other (Please Explain)	
Did you experience any problems in the operation of EVP on this occasion?	Yes/No If yes, please explain	
What effect did EVP have on your response time?	Increase/Decrease/None/Don't Know	
Can you estimate by how much? (minutes/seconds)		
What effect did EVP have on your stress level?	Increase/Decrease/None/Don't Know	
Why?		
What effect did EVP have on your safety?	Increase/Decrease/None/Don't Know	
Why?		
What effect did EVP have on public safety?	Increase/Decrease/None/Don't Know	
Why?		
Did you find EVP easy to use?	Yes/No	
If no, why not?		
Was the method of activation of EVP adequate?	Yes/No	
If no, what activation method would you suggest?		
Did the use of EVP effect the outcome of the job?	Yes/No	
If yes, how? (select one or more)	☐ Offender apprehended at scene ☐ Prevented damage/further damage ☐ Prevented injury/assault or further inj/ass. ☐ Saved a Life ☐ Other - Please Explain	
If damage/further damage was prevented, can you estimate the cost in dollars that was saved?	☐ $	
Was the training in the use of EVP adequate?	Yes/No	
If no, why not?		
Do you have any comments or criticisms regarding EVP or suggestions on improving the system?	Yes/No	
If yes, please explain.		
Would you support the large scale implementation of EVP?	Yes/No	

Appendix B

Summary of Survey Results (2 Months of Data)

Usage	Activations	Total Activations (%)	Surveys Received	Surveys Received (%)
Police	168	24	82	49
Ambulance	454	64	83	18
Fire Brigade	56	8	0	0
Total Operational	678	95		
Test	33	5		
Total	711	100	165	22

Traffic Conditions	Heavy	Moderate	Light
All Services	12	84	65
Operational Activations (%)	2	12	10
Surveys Received (%)	7	51	39

Response Time Effect	Increase	Decrease	None	Don't Know
Police	2	36	15	27
Ambulance	0	27	27	23
Fire Brigade	0	0	0	0
Total	**2**	**63**	**65**	**50**

Stress Level Effect	Increase	Decrease	None	Don't Know
Police	0	28	41	11
Ambulance	0	19	45	18
Fire Brigade	0	0	0	0
Total	**0**	**47**	**86**	**29**

Public Safety Effect	Increase	Decrease	None	Don't Know
Police	49	0	14	17
Ambulance	22	0	33	27
Fire Brigade	0	0	0	0
Total	**71**	**0**	**47**	**44**

Job Outcome	Person Detained	Prevented Damage	Prevented Injury	Life Saving	No Effect
Police	3	2	3	0	74
Ambulance	0	0	0	2	77
Fire Brigade	0	0	0	0	0
Total	**3**	**2**	**3**	**2**	**151**