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PRACTICE PAPER:

NZ TRANSPORT AGENCY

COMPARATIVE TRAVEL TIME PILOT

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INTRODUCTION

Unplanned incidents such as crashes, breakdowns or flooding and planned activity including public events and road works can have significant effects on travel. If these unplanned or planned events occur on high-volume urban corridors particularly during peaks they can delay large numbers of private and commercial road users and have serious consequences including financial losses (for example through lost productivity, missed flights, supply chain interruptions), in addition to causing considerable customer frustration and potentially resulting unsafe driving behaviour.

One way a Transport Operations Centre can help manage the situation is to promote alternative routes (if available), including advising road users of the comparative travel times with the aim of:

a) providing more predictable journeys, and
b) diverting a greater percentage of drivers onto the alternative route.

Providing this real-time travel information should increase customer satisfaction, deliver net travel time savings, improve network recovery and potentially reduce the volume of secondary incidents.

To help determine the most effective methodology for providing comparative travel times and measuring the resulting outcomes and benefits, the Auckland Transport Operations Centre at Smales Farm (a joint venture between the NZ Transport Agency and Auckland Transport) is running a comparative travel time pilot. It is focused on serious incidents on the Northern Motorway (State Highway 1) and the alternative route to/from the city centre via State Highway 18 and 16. This paper outlines what has been implemented to date, the next steps and initial conclusions.

BACKGROUND

A range of customer research and anecdotal feedback has confirmed all key road user groups want timely, accurate travel information, particularly about unplanned incidents. Further, Chang et al (2014) has shown the majority would consider delaying their journey, changing their route or mode of travel if they were aware of conditions or incidents that would impact on their trip.

However, according to the Auckland Motorway Alliance's annual survey, very few Auckland motorway users seek information prior to starting their journey. Plus, from historic traffic data and institutional knowledge of network usage coupled with real-time monitoring of driver behaviour we know that for a range of reasons most road users opt for the 'main route', unless there is a compelling reason to deviate. This is supported by various studies quoted by McBride and Wee (2010) in a paper which proposes use of the Auckland Motorway 'mainline' Variable Message Signs (VMS) to provide live travel times. This paper references international evidence of the effective use of VMS to divert traffic via alternative routes to avoid congestion, particularly if there is an evident time saving, and the associated benefits related to reduced driver frustration.

In addition, over many years the Transport Agency has observed that when there is a serious incident on the Northern Motorway (one of the most congested parts of the national road network) it typically causes major delays on State Highway 1 (SH1), and therefore SH18/16 can become a viable alternative for motorists, despite being approximately 12km longer.

Unfortunately, without easily accessible real-time comparative travel time data, a standard operating procedure or any degree of automation, plus the lack of routine economic evaluation it has been difficult for staff to effectively or consistently promote the alternative route. Therefore it has been difficult to achieve the desired customer and operational outcomes or to measure the value of this incident management/network optimisation activity.

The SH1 vs SH18/16 comparative travel time pilot is intended to address this and create a model which, once proven, could be adapted for use elsewhere in Auckland and potentially nationally.

PROGRESS TO DATE

The following work has been completed.

1) Utilising existing travel time data sourced from sensors around the Auckland motorway network, specific travel time configurations have been implemented in the relevant NZTA system to calculate the travel times for the following journeys:
   I. southbound from the Constellation interchange to Queen St via SH1, exiting at Fanshawe St;
   II. southbound from the Constellation interchange to Queen St via Sh18/16, exiting SH16 at Nelson St;
   III. northbound from the Mountain Rd VMS on SH1 (between Gilles Ave on-ramp and SH16 exit) to the Constellation interchange via SH1;
   IV. northbound from the Mountain Rd VMS on SH1 to the Constellation interchange via SH16/18.
2) Using this data, four 'virtual' travel time signs have been created in the relevant part of ATOC Smales' Incident Logging system so the comparative times can be easily accessed by relevant staff, see Figure 1 below. The signs update automatically every 20 seconds.

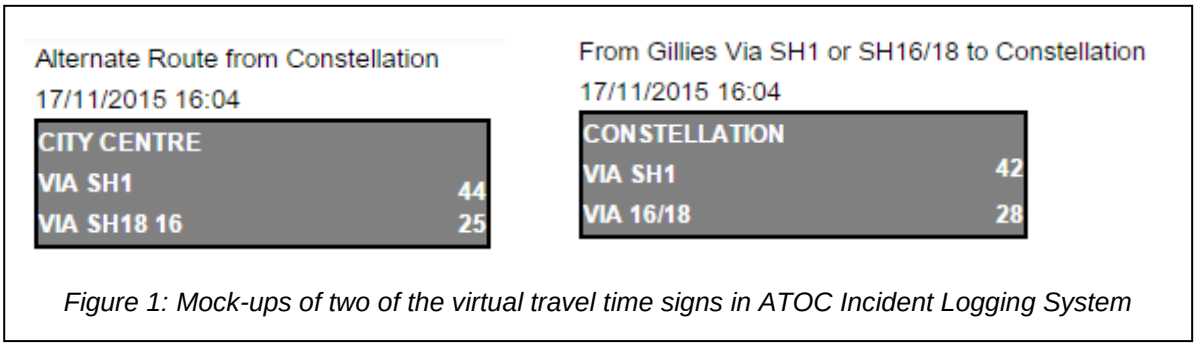

Figure 1: Mock-ups of two of the virtual travel time signs in ATOC Incident Logging System

3) These 'virtual' travel time signs are also being published on the Transport Agency and Auckland Transport websites, via an API from the NZTA Traffic Application Server, so the information is available directly to the public.
4) A Standard Operating Procedure (SOP) has been developed for ATOC Smales' Operations, Travel Information and Traffic Signals teams and is now being used to guide these three teams' actions during serious incidents on the Northern Motorway. This procedure notes the time differential recommended to prompt publishing the comparative travel times via various channels and the wording to use on the VMS located just prior to the relevant exits to the alternative route (see Figure 2 & 3 below).

   Note: This is the first SOP developed to cover all three teams. It has already been revised once based on lessons learned and recently updated to incorporate new details pertaining to northbound journeys, as the comparative travel times travelling via SH1 and SH16/18 northbound were not available originally. The SOP will continue to be reviewed and updated as appropriate.

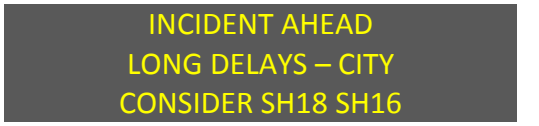

Figure 2: VMS message recommended in SOP for Stage 2 of process (southbound)

Figure 3: VMS message recommended in SOP for Stage 3 of process (southbound). Note: lines 3 & 4, marked above, alternate.

5) Two internal case studies have been completed, on incidents in October 2014 and January 2015 respectively. Nine incidents (including those two) have been selected for economic impact evaluation by the Auckland Motorway Alliance using a new network modelling tool and current general average values of time from the NZTA Economic Evaluation Model.
6) The October 2014 incident has been used as a case study for a more comprehensive assessment of the potential economic impact of ATOC Smales incident management.
7) Some initial, basic functionality to automatically identify potential secondary incidents on the Auckland motorway network has been introduced to ATOC Smales' Incident Logging System.

FINDINGS/DISCUSSION

- As our two case studies and real-time observation has found, going beyond advising people to 'consider the alternative route' or 'use the alternative route' and proactively providing comparative travel times when the alternative, longer route is notably quicker appears to influence more drivers to alter their route. This is based on anecdotal feedback from Transport Operations Centre and analysis of traffic data.

  On 19 January for example, the traffic flow on Constellation Drive off-ramp increased notably during the period from 4:30pm - 4:55pm (600 more than typical), following promotion of the comparative travel times via VMS and Twitter. Plus, there was an increase on normal traffic flows at the Upper Harbour Bridge, which helps validate the success of the exercise.

  Unfortunately, as is noted below the phase time for traffic turning onto SH18 from the off-ramp did not increase as it was outcompeted by demand on Constellation Drive. Consequently, the off-ramp queue ended up extending some distance, which we assume would've limited the volume of diversions.

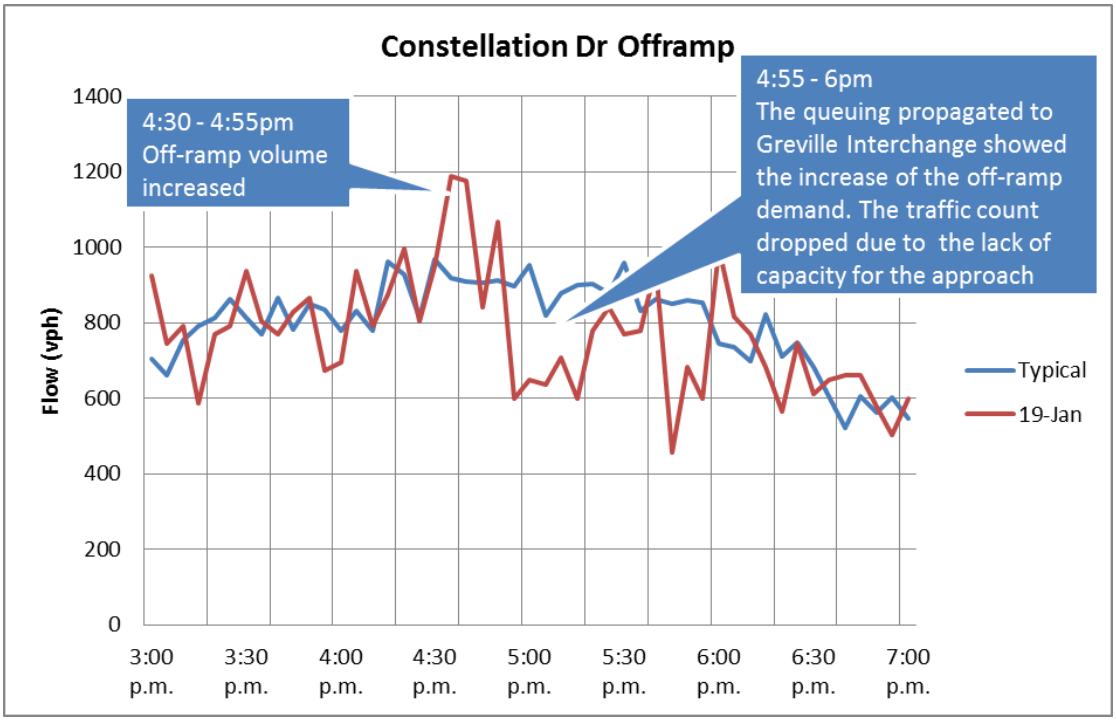

Figure 4: Traffic flow on Constellation Drive offramp

Similarly, on 21 October 2014 there was an increase in traffic flows on the Constellation Rd off-ramp (see Figure 7) and SH18 (compared to the same period the previous week), following use of a range of communications channels including social media (see Figures 5 & 6 below) – initially advising motorists to "consider SH18/16", and subsequently providing the comparative travel times as supporting evidence/incentive.

Figure 5: Initial Tweet via @NZTAKL 20.10.14

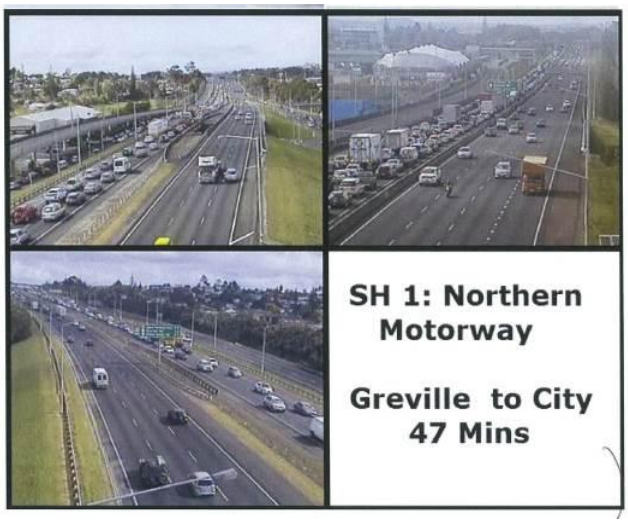

Figure 6: Follow-up image tweeted on 21.10.14, alternating with image showing SH18/16 time

Figure 7: Subsequent webcam image of traffic on Constellation offramp, 21/10/14

- In another case a serious incident southbound occurred during the start of the evening peak, resulting in a high volume of commuter traffic using the Constellation Drive off-ramp northbound coinciding the higher than normal volume of diverted southbound traffic through this area. In each example, real-time intervention by specialist staff has been required to adjust the traffic lights and/or ramp signals to optimise them for the specific conditions. i.e. no two incidents are identical.

- The current process is heavily reliant on operators being proactive throughout, for example doing ongoing monitoring of the comparative travel times and/or CCTV in order to determine what to communicate or if traffic signals may need adjustment. The planned alert will eliminate some of this, and the associated risks, by providing prompts to start/stop promotion of the comparative travel times.

- Determining the 'true' economic impact is not straightforward, and further work is required to develop models which take into account all the relevant factors in order to get a more accurate reflection of the net economic impact of this alternative route incident management.

  Based on work completed as part of a draft research paper for NZTA, Wilmshurst and Wallis (2015) concluded the Benefit:Cost Ratio (BCR) from implementing the alternative route incident strategy for the 21 October 2014 incident can be estimated as 6 - 7, a relatively high return on investment. This assessment factored in a range of things including: estimated system and staff costs, historic and real-time traffic volumes and travel times, plus applied EEM July 2014 Values of Time for the Inter-Peak including the congestion increment and (due to the additional travel distance experienced by the vehicles that rerouted to avoid the SH1 delays) the EEM July 2014 Vehicle Operating Cost (VOC).

NEXT STEPS

At the time of writing the next steps include:

1) Reviewing relevant incident reports and staff feedback to determine how effectively the SOP is being implemented and what if, any, refinements are required.
2) Reviewing current/developing economic impact analysis models to ensure they provide the most accurate results possible, along with conducting some targeted customer research to help assess the SH1 vs SH18/16 pilot's impact on customer satisfaction and/or behaviour.
3) Progressing work on an automated system to alert Transport Operations Centre staff when to start/stop providing the comparative travel times. It is proposed this would be triggered by an algorithm(s) which is yet to be developed based on network modelling, with calculations to be done in the agency's existing Travel Information Management system and the resultant alerts being generated in DYNAC, a system ATOC Smales uses to manage VMS. The DYNAC system has been selected as it is already configured to provide other alerts and because VMS are the key communications channel in the relevant cases.
4) Investigating the potential provision of the comparative travel times to developers etc via the Transport Agency's InfoConnect service which provides registered subscribers with some free travel information datafeeds.
5) Continuing work to enhance the systems and processes associated with recording secondary incidents, as a step towards establishing if there is a correlation between the number of those on SH1 and the volume of traffic diverted via the alternative route.

RELATED INITIATIVE

NZTA is also working with Auckland Transport on a multi-modal comparative travel time pilot in the same area, ultimately aimed at increasing use of public transport from North Auckland/decreasing congestion on the Northern Motorway. This is one of the most congested parts of the Auckland roading network, with a high-volume of single-occupancy vehicles and a public transport alternative operating on a dedicated busway for much of the route.

This project required development of an API to supply the specific Northern Express (NEX) journey times of interest and work to configure a virtual travel time sign to publish these times along with the corresponding motorway drive times.

In turn this has enabled us to provide customers with the travel time from the Albany Bus Station/Oteha Valley Rd to the city (Fanshawe St exit) and vice versa on each mode via various channels, as outlined below:

- on the Oteha Valley Rd travel time signs – both roadside and on the Transport Agency and Auckland Transport websites (from 6:15am to 9am each week day);
- via @AKLTransport and @NZTAAkl Twitter accounts, during peaks and relevant serious incidents (ad hoc);
- to radio stations and TVNZ Breakfast for inclusion in traffic reports (ad hoc).

While at the time of writing it is too early to report any conclusive results, the first phase of customer research has found there is a high level of existing awareness of a difference in travel times between the two modes, primarily from personal observation. Further, it appears the physical travel time signs on Oteha Valley Road are the most effective, with the comparative times having been seen there by the greatest number of survey respondents. Northern Express patronage is also increasing, however we have not [yet] been able to determine if there is a link to this initiative.

CONCLUSIONS

Initial conclusions at the time of writing this paper are summarised below, acknowledging they will be revised at the end of the SH1 vs SH18/16 pilot.

- The quantitative data and anecdotal feedback gathered to date suggests providing the comparative travel times when the alternative route is notably quicker is having a positive impact.
- In-depth analyis of more incidents and qualitative customer research is required to gain more evidence, with the latter need to measure the impact on customer satisfaction.
- Introducing an appropriate level of automation will be key to ensuring consistent and effective implementation, particularly if being done nationally. Given no two incidents are identical and there is somewhat of an 'art' to managing them well, there will need to be flexibility in systems, processes and technology to allow for operators discretion and also changes in network conditions, such as the Auckland Northern Corridor project which will impact the Constellation interchange and SH18.

ACKNOWLEDGEMENTS

I wish to acknowledge NZ Transport Agency National Travel Information Services Manager Luigi Cappel who instigated this pilot, completed the initial case study and remains the sponsor of this project along with being the co-sponsor of the NEX vs SH1 comparative travel time pilot.

I also wish to acknowledge Auckland Transport Public Transport Customer Experience Manager Peter Paton, who is co-sponsor of the NEX vs SH1 comparative travel time pilot

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