Potential C-ITS Research in Parallel with Toyota Motor Corporation Australia (TMCA) Proof of Concept Testing

1. Safety Benefits of C-ITS for the Australian Network

Objectives

(i) To use C-ITS data derived from the TMCA applications, AIMES intersections and AIMES mobility user groups to improve current estimates of C-ITS safety benefits

(ii) To better understand the impacts of phased introduction of C-ITS anywhere in Australia

Research Questions

(i) How effective are the TMCA applications in reducing risks of serious crashes?

(ii) What are the most safety-effective strategies for implementing C-ITS in the road infrastructure?

Current Status

Current understanding of C-ITS safety benefits is based on prevalence of crash types and relevance of V2V and V2I applications to those crash types; more is known about V2V applications than V2I applications. Most V2I work has been confined to urban intersections and traffic signal phasing. Model deployments have focused on road vehicles (light and heavy) rather than other road users and modes.

Potential Partners

State DOTs, Federal Government, IAG, ITS Australia, TAC, Bosch, RAC, RACQ, Telstra

2. Traffic Network Optimisation Using C-ITS Data

Objectives

(i) To apply C-ITS data derived from the TMCA applications, AIMES intersections and AIMES mobility user groups to real-time and rapid-response traffic control

(ii) To predict adverse traffic events based on C-ITS data

Research Questions

(i) How can traffic situation awareness be improved using data transmitted by moving C-ITS vehicles?

(ii) How effective is a small vehicle deployment of C-ITS in improving situation awareness?

(iii) What impact do the TMCA safety applications have on traffic flow?

(iv) What existing or new C-ITS applications would be most effective in addressing traffic flow?

Current Status

Most C-ITS research has concentrated on safety impacts, and most C-ITS applications have a primary purpose of safety. Research is needed to focus on the impact of C-ITS on traffic

flow. The field of traffic control, flow optimisation and incident management relies on a mature architecture of sensors, data sources, algorithms, controllers and traffic management centres. The path to integration of C-ITS data has not been explored.

Potential Partners
State DOTs, Federal Government, IAG, ITS Australia, TAC, Bosch, RAC, RACQ, Telstra, Transmax, Kapsch

3. Evaluation of HD Mapping Infrastructure for C-ITS Applications

Objectives
- (i) To identify potential benefits of HD mapping infrastructure for traffic safety, and explore possibilities to integrate with C-ITS use cases
- (ii) To understand cost-effectiveness of investments in HD mapping for C-ITS applications

Research Questions
- (i) What existing or new C-ITS applications could benefit from HD mapping?
  - a. E.g. Customised geometry-aware C-ITS for safety interventions
  - b. E.g. Crash risk tagging of HD map and location-based safety notifications
- (ii) What are the expected benefits of the potential C-ITS use cases integrated with HD mapping?

Current Status
HD mapping is being tested frequently by the ITS community, transport authorities and the automated vehicle industries. However, the potentials of HD mapping in conjunction with C-ITS applications and their value in reducing crash risks are unknown. Urban corridor management for multimodal traffic is extremely challenging because of the dense geometry of crowded urban corridors, shared right-of-way among alternative modes and frequent access points along the road. High volume of road users from competing modes and the mixed right-of-way create chaotic movements over the shared space and cause safety risks especially for vulnerable road users. A digitised and unified understanding of the shared roadway space combined with advanced communication technologies have a great potential to reduce conflicts and improve safety.

Potential Partners
State DOTs, Federal Government, Cohda, Easymile, IAG, ITS Australia, TAC, Bosch, RACQ, Telstra, Transmax, Kapsch

4. Safety Communication Use Cases with Public Transport Vehicles

Objectives
- (i) To test and evaluate C-ITS crash warning messages with trams and buses
  - a. E.g. Blind spot messages initiated by PT Vehicles
  - b. E.g. Right of way warning messages

Research Questions

(i) What existing or new C-ITS applications can help reduce crashes with PT vehicles
   a. Customised geometry-aware C-ITS use cases for PT operations
   b. Yellow zone violation messages from PT vehicles

Current Status

Crashes that involve heavy vehicles and public transport, especially Trams, incur significant disruption and cost on our transport system. Mixed right of way in dense urban areas can lead to inefficiency and safety risks. HD mapping in conjunction with C-ITS applications have the potential to reduce these risks and their significant impacts on urban transport.

Potential Partners

State DOTs, Federal Government, Yarra Trams, VDoT, Cohda, IAG, ITS Australia, TAC, RACQ, Telstra, Kapsch

5. HD Mapping and C-ITS Infrastructure for Regional Scales and Rural Network

Objectives

(i) To investigate the costs and benefits of HD mapping at the regional scale
(ii) Identify major safety benefit associated to crash risk reduction in rural areas

Research Questions

(i) What existing or new C-ITS applications in rural context could benefit from HD mapping?
   a. E.g. Customised geometry-aware C-ITS for safety warnings
   b. E.g. Crash risk tagging of HD map and location-based safety notifications
(ii) What are the expected benefits of the potential C-ITS use cases integrated with HD mapping in the rural context?
(iii) Can a unified HD mapping system be crowd-sourced to cover the network at the regional scale? What should be the standard specification requirements

Current Status

HD mapping is being tested frequently by the ITS community, transport authorities and the automated vehicle industries. However, the potentials of HD mapping in conjunction with C-ITS applications and their value in reducing crash risks are unknown. Rural crashes are among the most fatal in regional Australia. Contributing factors include higher speed, poor geometric design and lack of safety measures. HD mapping and communication technologies have the potential to address regional crash risks.

Potential Partners

State DOTs, Federal Government, Cohda, IAG, ITS Australia, TAC, RACQ, Telstra, Kapsch

6. Evaluating the Effectiveness of Connected Vehicles in Reducing Crash Risks for Vulnerable Road Users

Objectives

(iii) To use C-ITS data derived from the TMCA applications, AIMES intersections and AIMES mobility user groups to improve current estimates of C-ITS safety benefits for VRU's

Research Questions

(iii) How effective are the TMCA applications in reducing risks of serious crashes for VRU's?

(iv) What are the most safety-effective strategies for implementing C-ITS in dense urban areas addressing VRU crashes?

Current Status

Same as 1

Potential Partners

State DOTs, Federal Government, IAG, ITS Australia, TAC, Bosch, RAC, RACQ, Telstra