
Connected Intersections (CI) Committee Meeting

Mon July 19 (3:00 PM – 5:00 PM EDT)

Anti-Trust Guidance (Narla)

- The Institute of Transportation Engineers is committed to compliance with antitrust laws and all meetings will be conducted in strict compliance with these antitrust guidelines. Further if an item comes up for which you have conflict of interest, please declare that you have a conflict of interest on the matter and recuse yourself from action on that item.
- The following discussions and/or exchanges of information by or among competitors concerning are prohibited:
 - Prices, price changes, price quotations, pricing policies, discounts, payment terms, credit, allowances or terms or conditions of sale;
 - Profits, profit margins or cost data;
 - Market shares, sales territories or markets;
 - The allocation of customer territories;
 - Selection, rejection or termination of customers or suppliers;
 - Restricting the territory or markets in which a company may sell services or products;
 - Restricting the customers to whom a company may sell;
 - Unreasonable restrictions on the development or use of technologies; or
 - Any matter which is inconsistent with the proposition that each company must exercise its independent business judgement in pricing its service or products, dealing with its customers and suppliers and choosing the markets in which it will compete.

Agenda (Thai)

1. Call to Order
2. Anti-Trust Guidelines
3. Roll Call of Committee members
4. Meeting Purpose and Objectives
5. Validation Phase
6. Validation Sites Feedback
7. Future Activities
8. Adjourn

Roll Call of Committee Members (Thai)

- John Thai, City of Anaheim
- Raj Ponnaluri, Florida DOT (Derek Vollmer)
- Christina Spindler, Wyoming DOT (Ali Ragan)
- Ray Starr, Minnesota DOT (Kevin Chan)
- Ed Seymour, Texas A&M Transportation (Kevin Balke)
- Faisal Saleem, AZ Maricopa County DOT (April Wire)
- Whitney Nottage, Q-Free/Intelight (Doug Tarico)
- Steve Bowles, 360 Network Solutions (Billy Stalcup)
- Roy Goudy, Nissan
- Mike Schagrin, McCain (Jesus Ruiz)
- Mike Shulman, Ford Motors (Michael Maile)
- Vivek Vijayakumar, General Motors (Bo Yu)
- Michael Stelts, Panasonic (Mateusz Malinoski)
- Jim Misener, Qualcomm (William Whyte)
- Doug Schmidt, Aptiv (Chris Hedges)
- Jay Parikh, CAMP/IOO-OEM Forum
- Justin McNew, JMC Rota (Masoud Motammedi)
- Steve Sprouffske, Kapsch (Imran Inamdar)

Meeting Purpose and Objectives (Thai)

- Purpose:
 - Update the CI Committee on the progress
- Objectives
 - Present the Validation Phase activities
 - Feedback from Validation sites
 - Future Activities

Progress To Date (Thai)

- Each Task Force meeting as needed
- Task Force Chairs and Subject Matter Experts (SMEs) meeting every Friday for progress and coordination
- Validation Subcommittee meeting every week
- Validation sites are working to collect data for analysis
- Final CI Implementation Guide being drafted

Validation Phase

Testing/Conformity Task Force

Jay Parikh / Christina Spindler (co-chairs)

Validation Phase (Spindler)

– Objectives

- **Field verification/conformance** of equipped intersections' Over-The-Air (OTA) broadcast of SPaT and MAP messages per CI Implementation Guide
- **Feedback on CI Implementation Guide.**
 - Requirements and the design details for broadcasting the SAE J2735 Signal Phase and Timing (SPaT) message, MAP message and RTCM message are **unambiguous** and **complete** for action by a Red-Light Violation Warning application installed on a vehicle.
 - Requirements and the design details are **implementable**.
 - What are the technical and institutional challenges/lessons learned in preparing a CI deployment

Validation Phase (Spindler)

- Evaluation Subcommittee
- Validation Sites (13 participants, 15 sites)
 - Caltrans, City & County of Denver, City of Anaheim, Clark County (WA), DriveOhio, Florida DOT, Georgia DOT, Maricopa County DOT, Panasonic, San Diego, University of Alberta, UMTRI, Utah DOT
- Meeting Weekly: Thursdays, 12 PM – 1 PM ET
 - April 29 through July
 - Discuss field test analysis and issues, provide guidance and report progress
- Validation activities expected to be completed in July
- Results of the Field Data Analysis and Feedback will be used to finalize the CI Implementation Guide
 - Task Forces to meet in July-August if necessary
 - Proposed Draft Final mid-August
 - Approval by the CI Committee
 - Publication by September 17

Current Field Test and Analysis Status

Participants	Msg Log	# of Test Intersections	Remark
Caltrans	PCAP	4	Held a meeting about the defined intersection MAP
City & County of Denver	RSU PCAP → JSON	8	Test files received May 16. A second batch of data from the same traffic controllers.
City of Anaheim			
Clark County (to Randy.
DriveOhio			
Florida DOT			
Georgia DOT			limits at lane level.
Maricopa Cour			the MAP
Panasonic			tamp issues
San Diego			nal data from Port
Univ. of Alberta			
UMTRI	JSON	7 + 16 + 4	1 st Batch: May 5; 2 nd Batch: May 13. Batch #3 June 23 (4 sites) Processed and uploaded to Teams. Provided observations. Working on validation report.
Utah DOT	PCAP	1+3+2	Additional 2 C-V2X PCAP data processed. Analysis and observations provided. Reviewing timestamp issue.
PlugFest – Mcity	PCAP+Kapsch	12	Received Test files in PCAP and Kapsch JSON. Not yet processed.

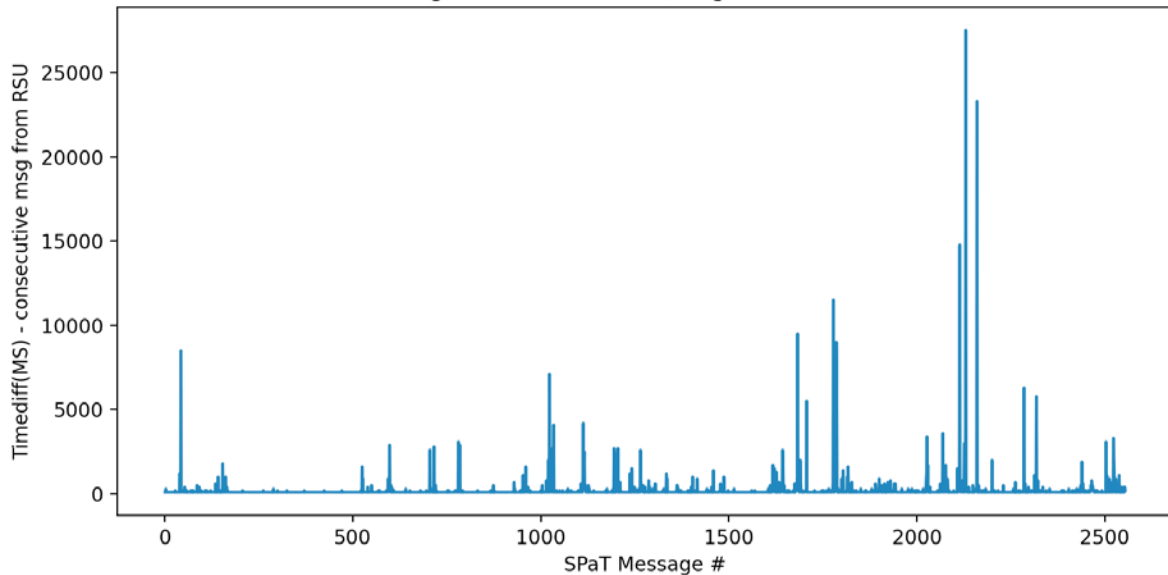
Processed Over 80 Field Test Data Files from 11 Sites

Observations from Field Test Analysis:

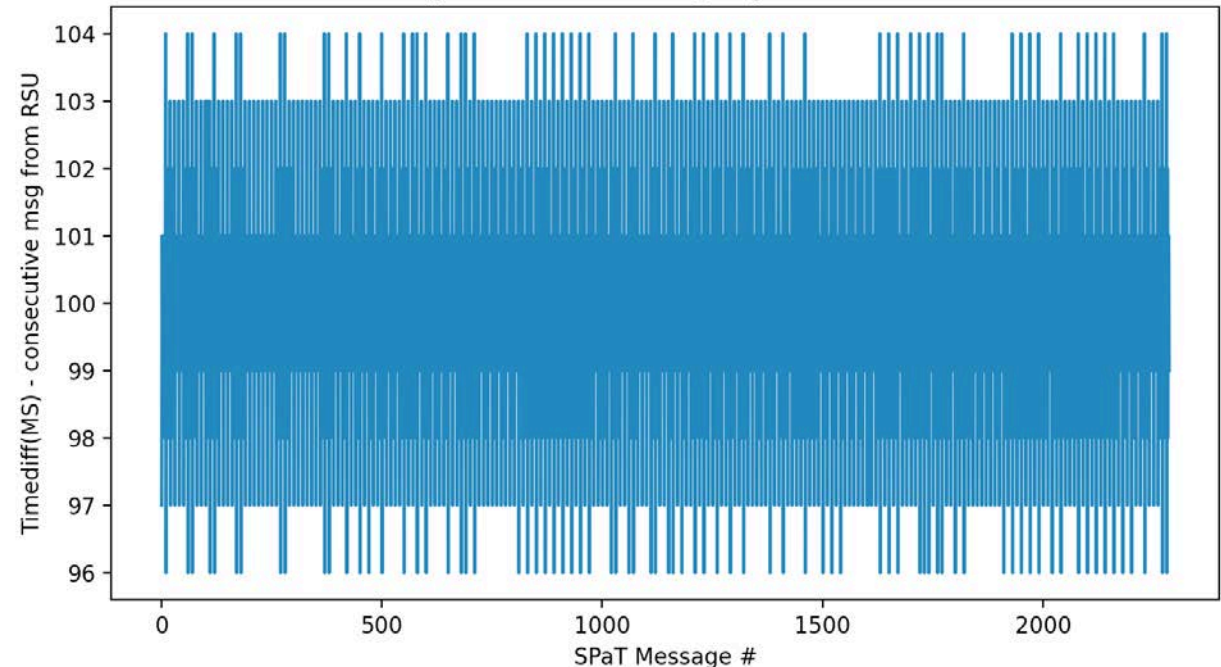
SPaT:

- Time diff between consecutive message from RSU not maintained at 100ms
- Difference in message timestamp generated by RSU and received by OBU timestamp
 - RSU and OBU clocks are not in synch
 - RSU message timestamp and OBU timestamp is used to compute message broadcast and receive time latencies and time remaining for min and max end times
- Need: Signal controller, RSU and OBU clocks in synch (GPS time source)
- Guidance Discussion: Actuated signal operation

File: c2p-01_Quebec-56th-20210511023558.pcap-55115-spat.csv
SPaT Msg Timediff from RSU; Avg time diff = 234.371



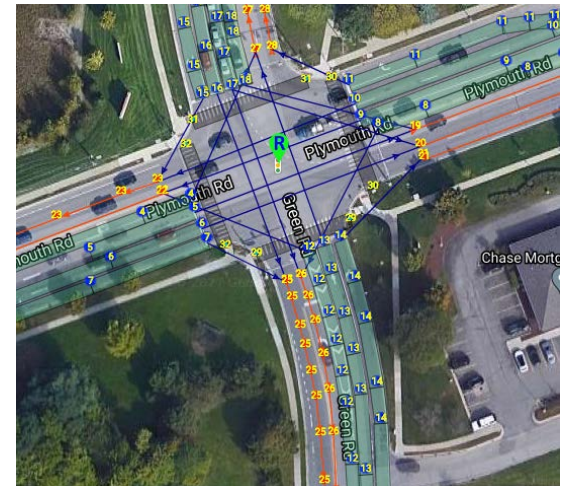
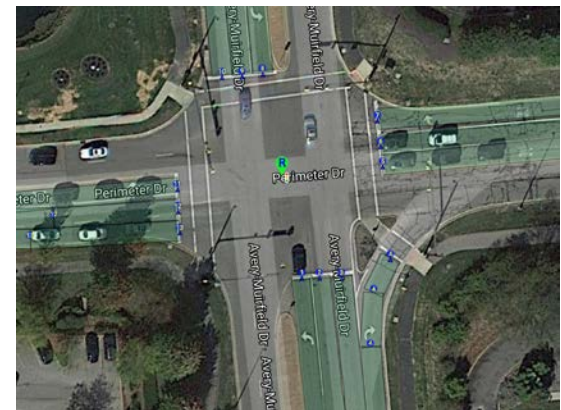
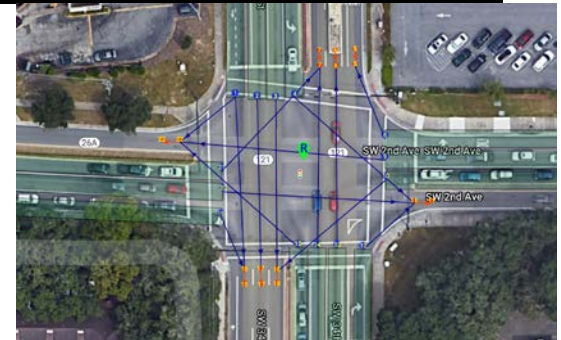
File: ecr_medical.rsu.tx-SPaT-0-1001.csv
SPaT Msg Timediff from RSU; Avg time diff = 99.916



Observations from Field Test Analysis/Visualization:

MAP Message Visualization:

- 1st node point in MAP extends well beyond the stop bar into the intersection / crosswalk
- Missing egress lane definition in MAP; ConnectsTo: lane id connects to itself
- Mapped lanes do not match the actual intersection geometry
 - Intersection is reconfigured since the MAP was generated
- Node points in reverse order
- ConnectsTo: Converging lanes (egress → egress and ingress → ingress)
- Guidance:
 - How to define speed limit at a lane level
 - CV PFS MAP Guidance Document



Security Task Force Report on Questionnaire (Whyte/Upton)

- Sent out questionnaires to the 13 sites
- Received responses from and interviewed 12 of those sites

Task Description:					
What precautions are you taking to ensure that SPaT/MAP/RTCM messages are correct?		How are you ensuring that valid updates do not have unintended bad consequences?		Who is your SCMS Provider (or providers)?	
What ongoing processes do you have to ensure the cybersecurity of your network as a whole?		If you are using digital signatures to protect software updates, how is the signing key protected and what procedures are in place to provide assurance that only intended software is signed?		Does the use of 1609.2 signing and certificate provisioning require new processes for procurement / installation / provisioning / operation of your devices?	
Do you have a formal threat analysis and review process or is the cybersecurity approach more informal?		1609.2 Signing and Certificates		Do you have any comments about interactions with your SCMS provider?	
How are you ensuring that RSUs and TSCs are connected to correct network or peer devices (i.e. that there isn't a man-in-the-middle or an accidental misconfiguration leading to wrong connections)?		Task Description:		How often are certificates renewed?	
How are you preventing bad software updates or other bad reconfigurations on RSUs and TSCs?		If you are not currently using 1609.2 signatures and certificates on SPaT, MAP or RTCM (i.e. if you are using at least one of these messages without 1609.2-signing them), what are the barriers to doing so and what is the plan to migrate to using full security?		Do you stop broadcasting messages when a certificate in the chain is expired?	
				How do you handle a situation where either the SPaT or MAP certificate is expired but not both?	

Security Task Force Report on Questionnaire (Whyte/Upton)

- Report posted under the Connected Intersections Project – General channel
- Many thanks to all the sites for their participation and candor
- Some details in the next few slides

The screenshot displays the Microsoft Teams interface. On the left, the 'Teams' sidebar lists several teams, including 'Task Force - Traffic Control Is...', 'Connected Intersections Project', 'Task Force - SPaT/MAP', 'Task Force - Positioning', 'Task Force - Security Task', 'Task Force - Testing & Confor...', and 'CIC Co-Chairs, TF Leads and S...'. The 'Connected Intersections Project' team is selected, and its 'General' channel is active. The channel view shows a header with 'CI General' and tabs for 'Posts', 'Files', and 'Wiki'. Below the header, there are sections for 'Connected Intersections Project' (last edited: Just now), 'Press Release' (with a link to 'Press Release on Validation Sites'), 'Follow On Activities' (with a link to 'Follow On Activities Descriptions - Dated May 17, 2021'), 'Validation Field Test Resources' (with links to 'CI Implementation Evaluation and Verification v2.1' and 'SPaT-MAP Message Capture Tool Alternatives for Validation Sites'), and 'Validation Final Report' (with links to 'Security Report - July 15' and 'Final Report Outline').

Security Questionnaire Report Summary

- Risk Analysis
 - Significant variation in the extent to which formal Risk Analysis has been done
 - Widespread acknowledgement that over the medium term (3-10 years) there will be more
- The Relationship between ITS and IT departments
 - IT departments are already sensitive to security issues
 - ITS deployments are a new potential risk
 - While this may create challenges for ITS departments, it is positive that IT is concerned
- Of the sites implementing RTCM, none are signing those messages
- Recommendations for a ‘Practitioners Guide’ or similar
 - Beyond our current Implementation Guide

Security Questionnaire Report Summary

- SPaT and MAP signing
 - Mostly MAPs are being loaded manually through an SSH login
 - Mostly SPaTs are being received into the RSU via physical connection
- Information Sharing
 - IOOs would welcome more sharing of successful operations and deployment plans
- Deployment Costs
 - Any requirements for HSMs on TSC would be a cost issue
- Software Updates
 - Most updates are being handled by SSH login
 - Some are signed
- Sites are just beginning their review of the SDD security requirements

CI Implementation Guide Feedback (Goudy)

- Several validation sites have confirmed they are providing feedback
 - Feedback received by July 30 may be incorporated into the ballot version

Validation Sites Feedback (Goudy)

- Any validation site would like to present their planned comments on the CI Implementation Guide.

Future Activities (Thai)

- Final Draft of the CI Implementation Guide to be provided to the CI Committee on August 6 for review
 - Ballot issued August 20
 - CI Committee Meeting August 23
 - Update CI Implementation Guide if necessary
- Publish Implementation Guidance Document by September 17
- Next CI Committee Meeting – August 23
 - Review Ballot CI Implementation Guide
 - Present Preliminary Validation Activity Results
 - Feedback from Validation Sites

Future Activities (Thai)

- Validation Report
 - Draft Validation Report by October 29 (Best Estimate)
 - Publish Validation Report by November 30 (Best Estimate)
- Develop Additional Guidance: Draft by October 29
 - TSCBM
 - Controller latency
 - Security examples
 - Addendum? By January 31 (Best Estimate)

Participation (Thai)

– ITE Project Website

- <https://www.ite.org/technical-resources/standards/connected-intersections/>

– Additional Resources

- Creation of a Guidance Document for MAP Preparation (Starr)
 - <https://virginia.box.com/v/MAPGuidanceFinal>
- Procurement Considerations for SCMS for a CV System Acquisition (Anderson)
 - https://www.pcb.its.dot.gov/documents/SCMS_Procurement_Resource_FHWA-JPO-21-862_v508.pdf

Closing Remarks

- USDOT
- ITE
- AASHTO
- NEMA
- standards@ite.org

Adjourn

– Thank you!