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TECHNICAL MEMORANDUM

TxDOT IAC – Technical Support to the CAV Task Force

DATE: September 10, 2020

TO: Zeke Reyna, TxDOT
Strategic Research Analyst, CAV

COPY TO: TTI_Reports@tti.tamu.edu
Tim Hein, Research Development Office, TTI
Ed Seymour, Executive Associate Agency Director, TTI
Robert Brydia, Senior Research Scientist, TTI

FROM: Beverly Kuhn, Research Supervisor
Senior Research Engineer Texas A&M Transportation Institute

RE: Safety, Liability, and Responsibility Subcommittee
September 2, 2020 Meeting Notes

Attendees:

Name	Organization
Andrea Chacon	Texas A&M Transportation Institute
Andrea Gold	Texas Innovation Alliance
Avery Ash	Inrix
Beverly West	TxDOT Strategic Planning Division
Brad Schlueter	USAA
Daniel Goff	Kodiak
Gary McCarthy	TuSimple
Gerardo Interiano	Aurora
Hannah Barron	Austin Transportation Smart Mobility
Jackie Erickson	Edge Case Research, Inc.
Jeff DeCoux	ATRIUS Industries, Inc
Jeff Peterson	First Transit
Jordan (Alex) Payson	Austin Transportation Smart Mobility
Julia Monso	Cintra
Julian Gomez	Julian C. Gomez Law Firm

Krishna Satti	Michael Baker International
Kristie Chin	Texas Innovation Alliance
Leighton Yates	Alliance for Automotive Innovation
Liz Fishback	Argo AI
Mark Worman	Texas Department of Insurance
Michael Moore	UT Transportation Research
Michael Walton	University of Texas Center for Transportation Research
Phil Koopman	Edge Case Research
Rachelle Celebrezze	Cruise
Robert Brydia	Texas A&M Transportation Institute
Sam Dreiman	Argo AI
Sam Lott	Automated Mobility Services, LLC
Steven Rundell	Texas Department of Public Safety
Sue Santo	Ike Robotics
Tony Reinhart	Ford Motor Company
Zeke Reyna	Texas Department of Transportation

Agenda / Discussion:

I. Opening Comments/Roll Call – Zeke Reyna, TxDOT

- Zeke welcomed committee members
- Encouraged everyone to follow along on Mural (link to be sent)
- Desire to hear everyone's unique perspective
- Roll call was taken

II. Chair Welcoming Statements – Steven Rundell, Texas DPS / Michael Walton, The University of Texas at Austin

- Steven expressed that this proved to be an interesting session with the addition of education by Guest Speaker, Philip Koopman, Ph.D.
    - Reminded committee of the previous 10,000-foot view ideas and the need to hone-in on more substantial recommendations
    - Safety cases – primary focus but recognize varied interests of group and don't want to overlook them
    - Provided we have time at end of guided discussion, we will tackle these
    - Grateful to all who prepared for today and all who showed up to participate
- Michael thanked all in advance for their participation
    - Emphasized that interdisciplinary support for our success is key
    - Looking forward to making Texas a success in technological advances

III. Review of Meeting Structure – Bob Brydia

- TTI reviewed the agenda and discussed using MURAL to support commenting on the white paper outlines.
- White Paper Polling Results

- Subcommittees chose to eliminate cross-coverage in early stages to eliminate duplication of efforts in WP's
- There will be more WP's written to cover other areas
- Don't want anyone's ideas to be marginalized – there will be time and opportunity to discuss many viewpoints

IV. White Paper Outline: Facilitated Discussion

- Terminology – one term suggested
- Guest Speaker Presentation: Philip Koopman Ph.D.
    - Co-Founder & CTO, Edge Case Research
    - Associate Professor, Carnegie Mellon University
    - "Safety Argument Considerations for Public Road Testing of Autonomous Vehicles"
    - **Presentation:** (based on 2019 SAE World Congress Paper)
        - Overview
            - ✧ Tempe AZ fatality
                - ◆ Make sure we learned the right lesson
                - ◆ Not just learning 'a' lesson but the proper one
            - ✧ How safe is safe enough?
                - ◆ Challenge: human supervisor effectiveness
            - ✧ Safety case for road testing:
                - ◆ Timely human supervisor response
                - ◆ Adequate human supervisor mitigation
                - ◆ Appropriate system failure profile
        - Learning the Right Lesson from Tempe AZ
            - ✧ NOT to blame the victim
                - ◆ Pedestrian in road is expected
                - ◆ People WILL cross outside crosswalks
            - ✧ NOT to blame the technology
                - ◆ Immature technology under test
                - ◆ Failures are to be expected – we are testing and maturing technology
            - ✧ NOT to blame the safety "driver"
                - ◆ Solo human drop-out is expected
                - ◆ Put in no-win situation
            - ✧ The REAL AV testing safety lessons:
                - ◆ If human safety driver, is unsafe testing is unsafe
                - ◆ Safety culture matters most
        - Valley of Autonomy Supervisor Dropout (graphic)
            - ✧ Autonomy will improve slowly over time
            - ✧ As it improves, harder for people to pay attention
            - ✧ Car keeping itself out of trouble combined with driver keeping out of trouble, leaves a gap in the middle *(personal opinion – no insider information)*
            - ✧ Use as a cautionary measure to keep Texas safe
        - How do You Know It's Safe Enough?

- ✧ Safety Case: a structured written argument supported by evidence, justifying the system is acceptably safe for intended use. (perfectly safe is not an option)
- ✧ Example structure for road testing safety:
  - Timely supervisor response
    - Human alertness
      - Effective for only 15-30 minutes! (data supported)
      - Science does not support the 2-hour shift
      - Examples given of airline pilot error
    - Autonomy failure detection
      - Latency in identifying/responding
      - Risk acclimatization and false confidence
    - Accuracy of mental model
      - How does a human supervisor model an opaque AI system?
    - ODD violation detection
      - Does supervisor know that light haze is a problem?
        - ✧ Do they know to disengage?
    - What if autonomy leaves no error margin?
      - Illustration: When do you disengage? (Tesla video)
      - Consider that you are test-driver and have observed the Tesla consistently avoiding the obstacle. It's necessary to be constantly alert every second on the road; no distractions to avoid accident/fatality.
    - Adequate Supervisor Mitigation
      - Situational awareness
        - ✧ Surrounding traffic; environment
      - Plan correct response
        - ✧ Takes time for driver to re-engage
        - ✧ Stop? Swerve? Hit?
      - Execute response properly
        - ✧ Risk of incorrect startle response to emergency
      - Vehicle response to supervisor commands
        - ✧ Disengagement should be natural

- ✧ Does disengagement really work? (conform to ISO 26262)
- Show Me the Data
  - ✧ Disengagements is the wrong metric for safe testing
    - Minimizing disengagements can incentivize unsafe testing
  - ✧ Data collection based on safety argumentation
    - Timely supervisor response
    - Adequate supervisor mitigation
    - Appropriate autonomy failure profile
    - Flowchart of Road-Testing Sufficient Safety
- Road Test Safety Cases Boiled Down
  - ✧ What do you mean by "you are safe?"
    - Goal for how safe is safe enough.
    - Includes zero fatalities for road testing
  - ✧ Why do you think you are that safe
    - Show argument
    - Show explanation
  - ✧ How do we know you are really that safe?
    - Evidence and data
  - ✧ For testing, it's not about a safe self-driving car. It's about the human safety driver
    - If the vehicle fails, will the driver be able to deal with it?

- Safety Cases and Related Data (Outline in Mural)
  - Introduction
    - Motivation
      - ✧ To enable the safe deployment of connected and automated vehicles, Texas is identifying safety cases and metrics for the determination of safety and liability processes.
    - Scope of White Paper
      - ✧ Current state of practice of safety standard development
        - Add current crash reporting methods for Texas (CR3 form)
      - ✧ Use of Safety Cases for data, metrics, and liability determination
      - ✧ Potential benefits to Texans
        - Why is data useful?
        - Identification of contributing factors
  - State of Practice of Safety Standards and Policies
    - Safety Standards and Policy Development
      - ✧ Federal – NHTSA/FMVSS review, USDOT Inspector General Audit
        - AV Test

        - Performance and safety regulation traditionally done at the federal level
    - State – strengthen this section with safety programs and policy sections; what's going on in other states; what's working/what's not
        - California – noted difficulties in obtaining testing permits for heavy-duty CAVs
            - Crash reporting
            - No guidance on fare collection
            - Is an AV involved
            - Is the ADS engaged?
        - Pennsylvania
            - "crash reporting" is defined under current "reportable crash" guidelines as defined by PennDOT
            - PennDOT excellent conduit for testing
            - One-on-one industry engagement process
        - Florida
            - No driver required
            - Welcoming regulator environment
            - 2-way dialogue
        - Michigan - welcoming regulator environment
        - Texas – owes its growth as testbed to a number of factors, but its regulatory structure plays a key role.
            - Critical that the legislature doesn't change direction
            - Needs predictable path to commercialize
            - Create predictability for path to deployment
            - AVs still in testing phase, so ensuring that TX maintains the ability to continue testing and learning without imposing specific additional requirements that are based on today's ideas of what future will look like critical
        - Arizona
            - May be relationships to explore
            - Good focus on commercialization
    - Research/University Institutes- UL 4600
        - NAMIC framework
- AV Data Initiatives
    - USDOT Data for Automated Vehicles Integration (DAVI)

- Safety Case Development
    - What is a safety case?
        - A structured, written argument, supported by evidence, justifying a system that is acceptably safe for intended use

            - ✧ As defined by PennDOT for reference: “A structure argument, supported by a body of evidence, that provides a compelling, comprehensible and valid case that a system is safe for a given application in a given environment”
            - ✧ Description of the components
        - Why are they needed?
        - What is the process for testing?
        - Common metrics and data needs
            - ✧ Disengagements
                - When drivers take over, due to an abundance of caution
                - Tell you nothing about whether the technology is safe
                - A problematic metric
                - Disengagement reporting may be indicative of testing aspects and not safety indications and how technology is progressing
                - Public (media) reporting of these statistics create a false sense of how companies and technologies are doing as they advance in testing.
                - There is no "this is it" metric that is agreed upon. Industry wants to have the conversation but there is no answer yet.
    - Safety Case Studies and Metrics
        - Uber ATG Safety Case Framework
            - ✧ Case Overview
            - ✧ Data and Metrics
        - Case #2
            - ✧ A desired recommendation might be to add a causation factor to the report maintained by TxDOT
            - ✧ Anytime an ADS contributes to a crash in any way, shape or form, that ALSO gets checked in addition to the other factors
            - ✧ Would allow for much more in-depth data analysis of any incidents involving ADS vehicles
            - ✧ We need to make sure to differentiate between having technology on board and having the technology involved in the accident. Checkbox would only be checked if in some way a failure of that system led to some contributing factor to a crash.
    - VI. Recommendations
        - For Texas Legislators
            - Ways to improve the crash reporting methodology
        - Data Sharing Opportunities
- Open Subcommittee Related Discussion – what do we NOT want to leave out?

- Having smart infrastructure easily readable, connectivity is part of equation to provide safe environment (we cannot operate in a vacuum)
- Importance of ability of technology to read environment it is in
  - Understands/learns difference between buildings, objects in motion
  - Involvement from public sector to make sure this happens
- Uniformity of striping, lights, signage not only makes for better tech environment, but safer roads for all vehicles
- Smart infrastructure needs to monitor/provide information to AV fleets

V. Next Steps – Zeke Reyna

- Bob Brydia detailed the tight deadline for WP development
  - First draft submitted to chairs of each subcommittee prior to next meeting
  - Each member will get a revised draft, prior to the next meeting
  - Leading up to legislature submission
  - Goal is to have WP finalized by mid-October
- Chairman encouraged anyone who plans to review the draft to give feedback as quick as possible, providing best product by representing a collaborative effort rather than an individual viewpoint.

VI. Closing Remarks – Steven Rundell / Michael Walton / Zeke Reyna

- Next meeting will be set up soon
- Thank you for adjusting you calendars and being flexible after the hurricane
- Thanks to the committee and all those who prepared