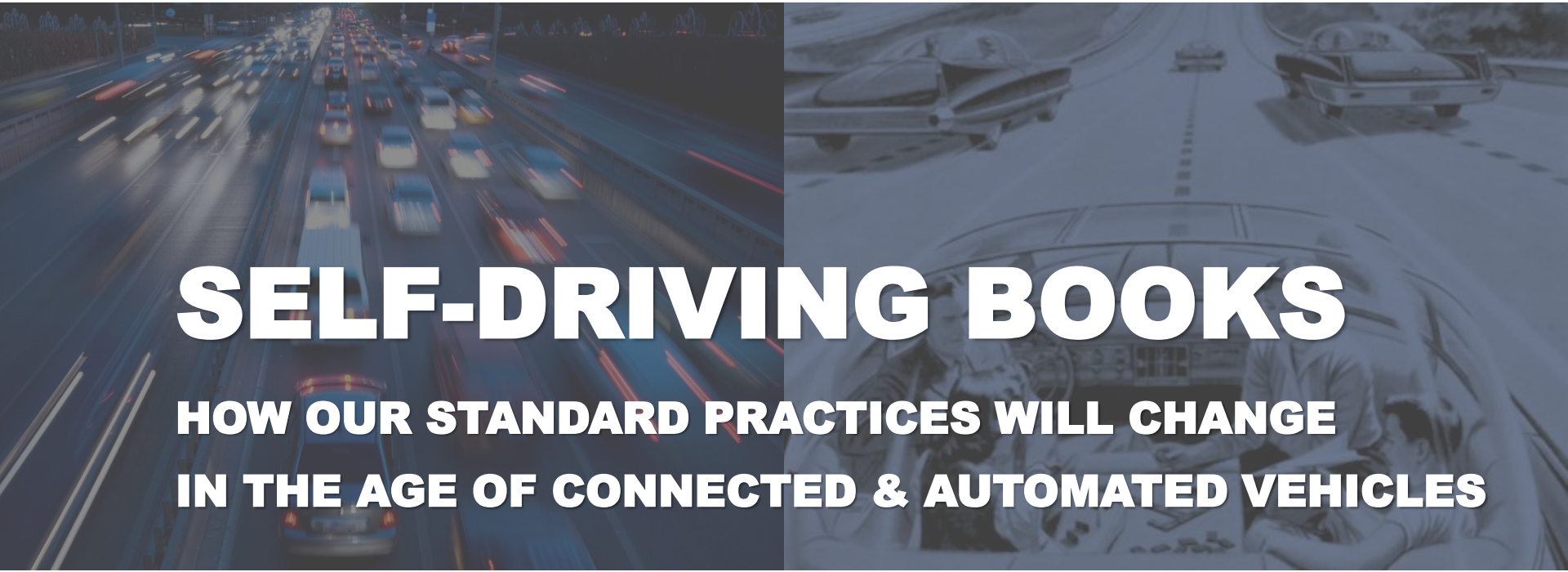

SELF-DRIVING BOOKS

HOW OUR STANDARD PRACTICES WILL CHANGE IN THE AGE OF CONNECTED & AUTOMATED VEHICLES

ABBY MORGAN, PH.D., P.E.
SENIOR ENGINEER

KITTELSON & ASSOCIATES

ite SAN DIEGO
2017 Western District Annual Meeting

Introduction

- Vehicle manufacturers are designing CAV systems to function in our existing transportation infrastructure.
- It will be a long time until we have a fully connected or automated fleet.
- Even longer until we can guarantee that all vehicles are properly maintained.
- Some standards will change in response to CAVs.
- Focus on value of investments for all road users.

Autonomous Vehicles

The Vision…

Photo: Randcorp

Photo: themelliniumreport

…The Reality

Will we ever have 100% penetration?

Photo: cartalk.com

Photo: tractorsupply.com

Photo: isas.illinois.edu

Photo: sk8all.com

What Problem are YOU trying to SOLVE?

What will You DO differently with the CAV DATA?

Design Standards

Past → Present → Future

Past: Consistency (not safety)

Present: Design for ***humans***

- Sight Distance
- Accelerations (Lat. & Long.)
- Start-up loss time
- Yellow & All-Red Clearance

Future: Design for ***vehicles***

Highway Capacity Manual (HCM) is data-driven

Headway Loss Time

Perception-Reaction Time

Capacity Merges & Weaves

HCM: Reliability

Photos: travelers.com, WYDOT, MnDOT

What will you DO with the CAV data?

USDOT CV Pilot Deployments

- Work Zone Warnings
- Spot Weather Impact Warnings
- Back of Queue Warning (Bottleneck)
- Pedestrian in Crosswalk Warnings
- Distress Notifications
- Intelligent Traffic Signal Systems

Highway Safety Manual (HSM)

Today → Tomorrow

Historical Crash Data

Simulation

- Test more scenarios
- Test new scenarios
- Consider different penetration rates
- Gather more behavioral information

Photo: ForThePeople.com

Manual on Uniform Traffic Control Devices (MUTCD)

- Automated Vehicles today…
  - Rely on sensors (camera, radar, lidar)
  - Are designed to operate in our current conditions
  - Struggle with **non-standard** or **inconsistent** conditions:
    - Poor pavement markings
    - Temporary Traffic Control

Photo: safety.fhwa.dot.gov

MUTCD

Do we need to change the material, placement, color, width, length of pavement markings?

- Agency investments depend on:
  - Which **sensors** CAVs use:
    - DSRC vs. 5G
    - RADAR, LIDAR, camera, mapping
  - Which **operational domains**
    - Physical, weather, time of day, urban/rural

Focus on maintenance & standardization

Policy & Infrastructure Challenges

- Hard to write policy for system that doesn't exist
- CAV challenges:
  - Adverse weather or non-standard conditions
  - Unconnected vehicles & road users
- OEMs will figure out V2V & V2I

Who will figure out how to communicate with bikes & peds?

Photo: archive.constantcontact.com

Making Changes

- We need…
  - To **collect** historical data on CAVs
  - To **identify** which vehicle is the CAV

Do we need new data collection methods?

- We can't forget…
  - All road users
  - Bottlenecks reduce managed lanes capacity
- We expect…
  - Some nudging of HCM averages

What can agencies do today?

- Maintain what you have today
- Upgrade signal controllers and communications
- Upgrade electronic toll collection
- Increase pavement and marking maintenance budget
- Know your land use goals
- Design for all road users
- Focus on safety

Focus on the **value** of our investments

What can agencies do today?

- Start **pilot testing** new systems
  - **Upgrade** current capabilities (hardware, software)
  - ***Train staff*** (maintenance and operations)
  - **Educate** decision makers (funding support)
  - **Share** data/findings with community

What will you DO *differently* with the CAV data?

"It's supposed to be hard.
If it wasn't hard, everyone would do it.
The hard is what makes it great!"

- Jimmy Dugan

Thank you

Abby Morgan, Ph.D., P.E.
Senior Engineer
amorgan@kittelson.com

KITTELSON & ASSOCIATES