Will I lose my job?

Challenges to the "Purpose and Need" Argument in the Autonomous and Connected Vehicle Environment

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Introduction

Technology can drive progress and never has this reality been true than in recent years. The advancements in the automobile industry has the potential to change the methods for planning and designing roadway projects. Technology also has the potential to disrupt traditional approaches for identifying and selecting projects. Intersection and corridor projects are justified using the purpose and need argument based on safety, capacity and air quality deficiencies. Safety concerns are driven by high crashes mostly involving rear end crashes and turning crashes. Capacity deficiencies can include high delays and extensive queuing issues. Long delays and excessive stopping along corridors affects air quality. Modern vehicles with safety technologies like lane assist, automatic braking, pedestrian detection, dynamic cruise control, etc. can improve safety along our roadways challenging the primary argument for roadway projects. Semi-autonomous and fully autonomous vehicles combined with connected vehicle technologies could effectively increase throughput of corridors by reducing headway needed between vehicles. Increased safety and throughput can potentially make existing deficient infrastructure more efficient. Air quality could also improve as a result of these technologies.

Deficient Intersection

Purpose and Need for Projects

Safety	High crashes and safety concerns
Capacity	High delays and long queues
Air Quality	Delays, Queues and Stops affect air quality

Typical Improvements Implemented

Safety	Geometrics, roadside safety and lanes
Capacity	Additional lanes, turning and through
Air Quality	Channelization, signal coordination

New Technology

Semi-autonomous

Automatic braking
Lane assist
Pedestrian detection
Adaptive cruise control
Could improve safety

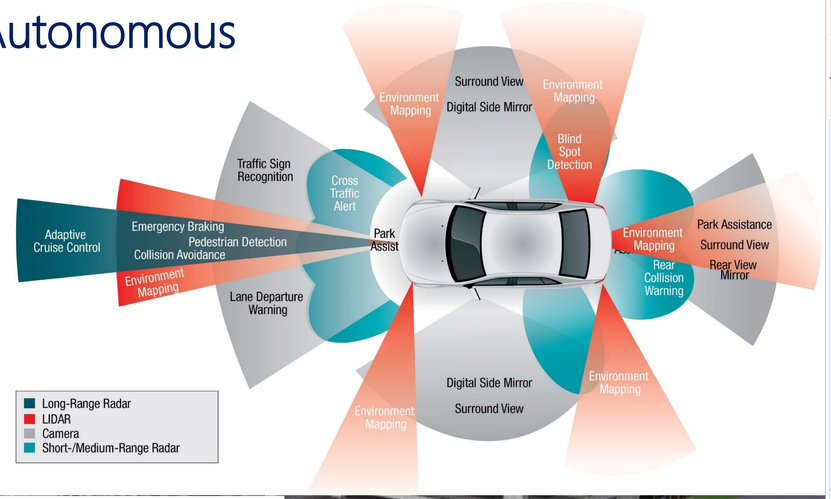
Autonomous

Complete driverless operation
Could improve safety
New opportunities for impaired drivers

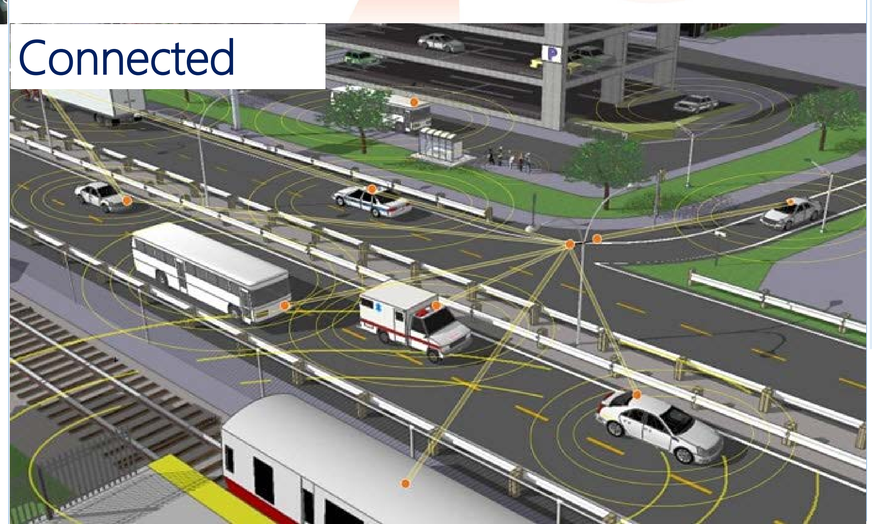
Connected Vehicles

V2V and V2I communication
Could improve safety and throughput due to lower headway

Autonomous



Connected



Effect of Reduced Headway

Criteria — Saturation/Headway	Typical 1800/2.0	Scenario 1 2050/1.75	Scenario 2 2300/1.56
Intersection Delay (s/veh)/LOS	63.7/E	44.7/D	31.8/C
Queue, NB Left (ft)	980	783	727

Existing Crash Experience

Year	Total Crashes	Predominant Types			
		1		2	
2010	18	Rear end	9	Turning	6
2011	26	Turning	11	Rear end	8
2012	19	Rear end	12	Turning	4
2013	15	Rear end	9	Turning	3
2014	22	Rear end	15	Turning	5
TOTAL	100	Rear end (45), Turning (11)		Turning (18), Rear end (8)	

Observations

- It is possible that autonomous and connected vehicles will require lower headway.
- The analysis presented above assumed lower headways for all vehicles, 100% market adoption, causing reduced delays and shorter queues.
- The reduction is delay is much greater than the reduction in the queue length when all other parameters are held constant.
- Safety could be greatly improved when predominant crash types caused by driver error would be reduced.
- Although 100% market adoption of autonomous and connected vehicles is unlikely, benefits could be derived from even partial market adoption.
- Additional studies are necessary to quantify the improved efficiencies in capacity and safety benefits from autonomous and connected vehicles.

Questions

? How much will the technology change?
? What would be considered "significant" market adoption?
? What will be the effect of increased Ride-sharing programs?
? What is Mobility as a Service (MaaS)?
? How will the project selection process change?
? Do we need different methodologies for selecting projects?
? How will the job market change?
? How will the engineers be educated?
? How does the industry prepare for an uncertain future?

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