

Capacity and Safety Opportunities and Challenges in the Transition Period

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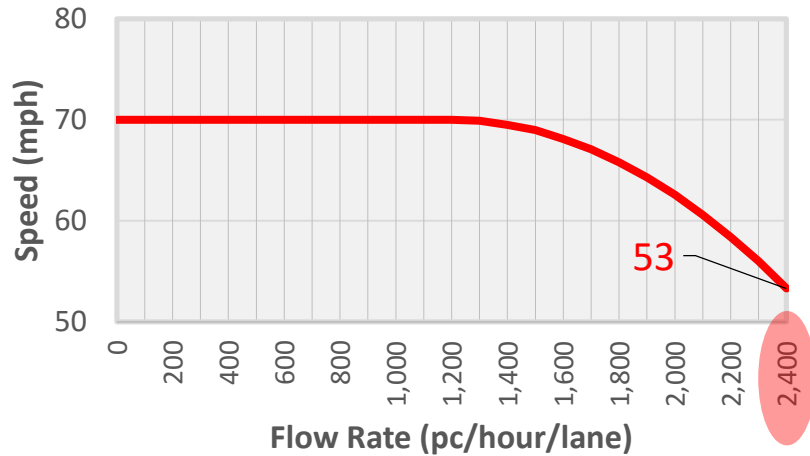
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Introduction

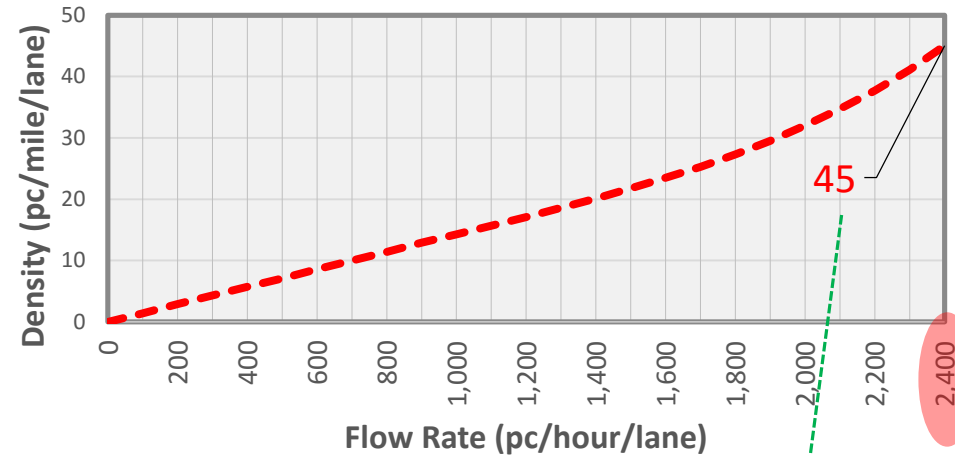
- Considerable changes of road capacity and safety
- A long transition period expected to start soon
- INDOT practice in transition – new data, methods, and solutions
- Engineering tools to support practice during the transition period
- Anticipated long-term research needs

Anticipated Capacity Effect (road segments)

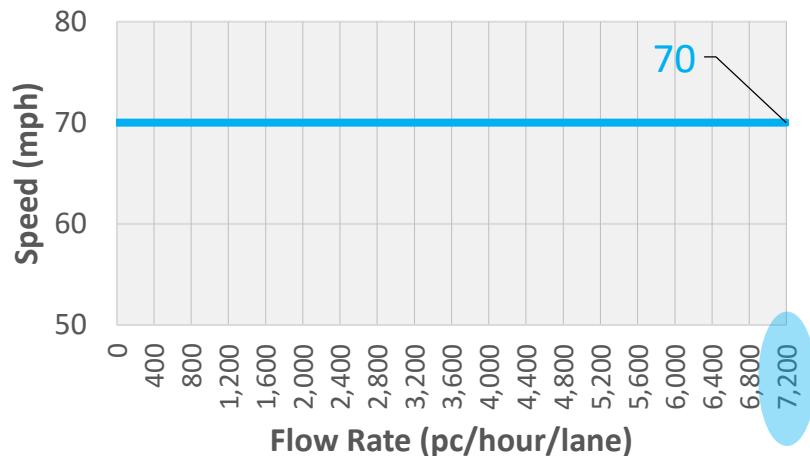
Traffic Speed & Flow Rate – Human Control
(FFS = 70 mph, h = 1.5 sec min., ideal conditions)



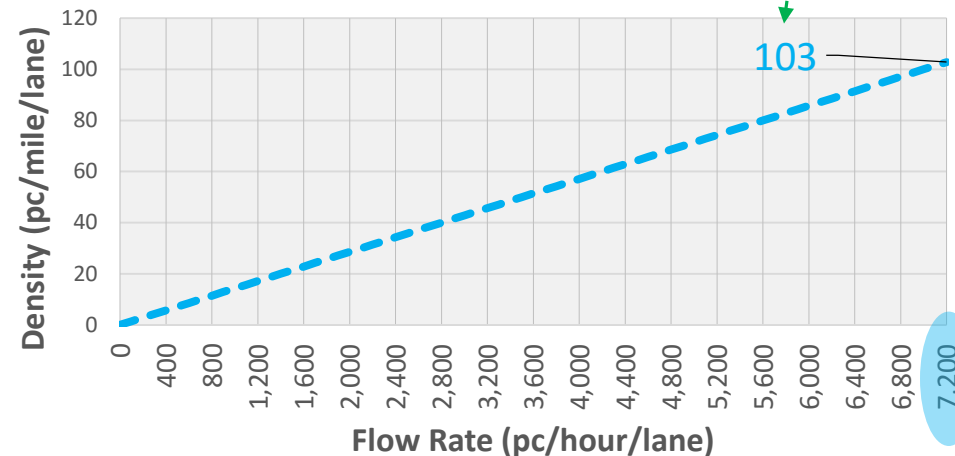
Traffic Density & Flow Rate – Human Control
(FFS = 70 mph, h = 1.5 sec min, ideal conditions)



Traffic Speed & Flow Rate – Machine Control
(S = 70 mph, h = 0.5 sec, ideal conditions)



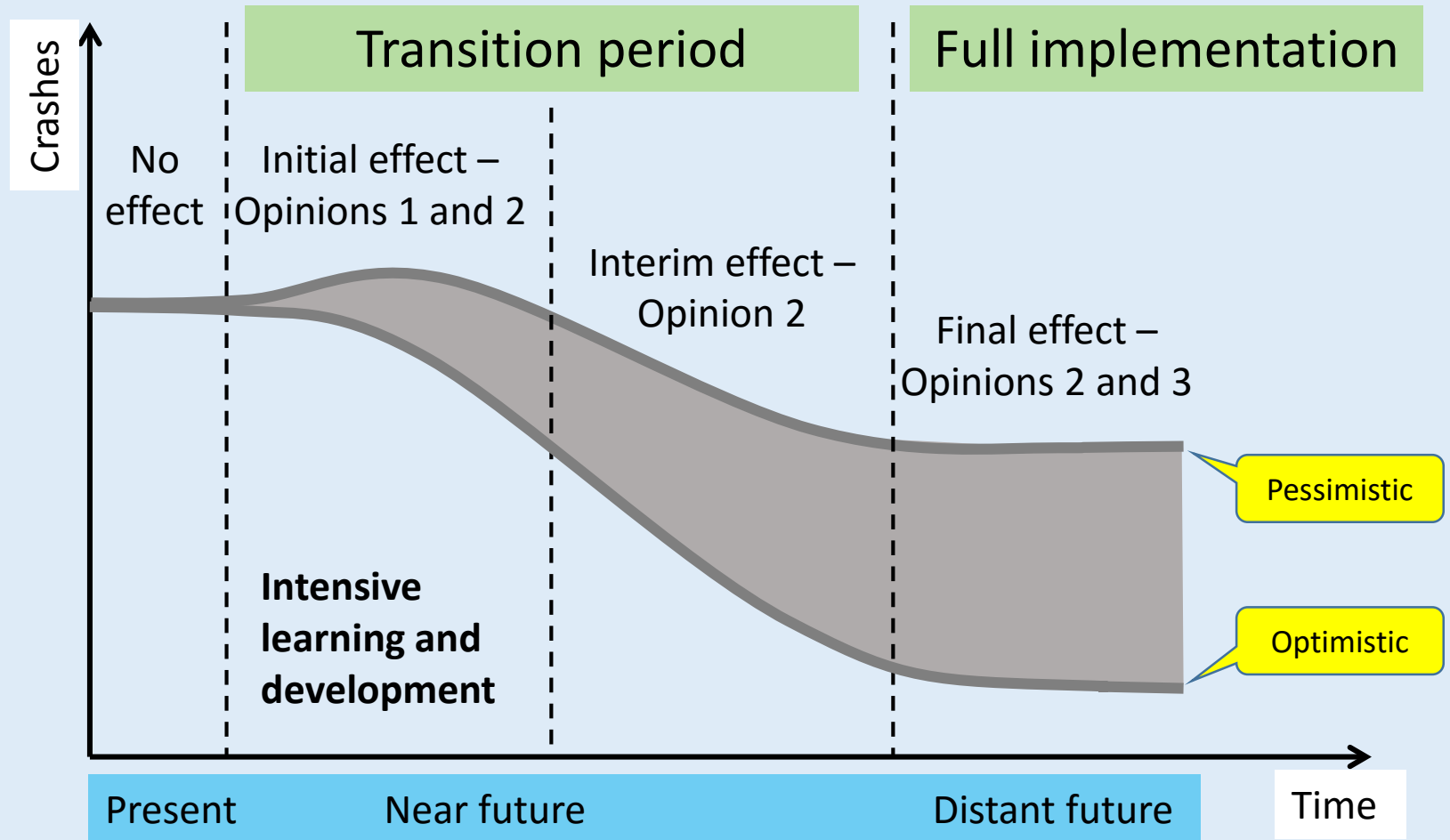
Traffic Density & Flow Rate – Machine Control
(S = 70 mph, h = 0.5 sec, ideal conditions)



Anticipated Safety Effect

- Safety & capacity relationship
- Risk compensation
- Range of opinions:
 - **Opinion 1: Autonomous vehicles are not safer** and even may reduce safety in a mix of self- and human-driven vehicles (Sivak and Schoettle 2015a).
 - **Opinion 2: Potential benefit considerably reduced** due to system failures, cyberterrorism (Bilger 2013), risk compensation, increased travel, higher involvement per crash (Ecenbarger 2009; Fung 2015; Kockelman, et al. 2016; Lin 2013; Ohnsman 2014),.
 - **Opinion 3: Crashes reduced by 90%** by eliminating human error (KPMG 2012; Fagnant and Kockelman 2013).

Possible Safety Trends



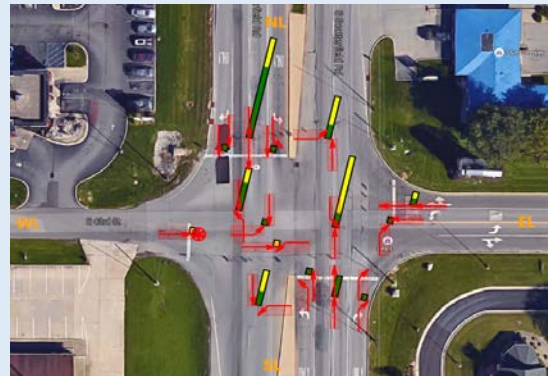
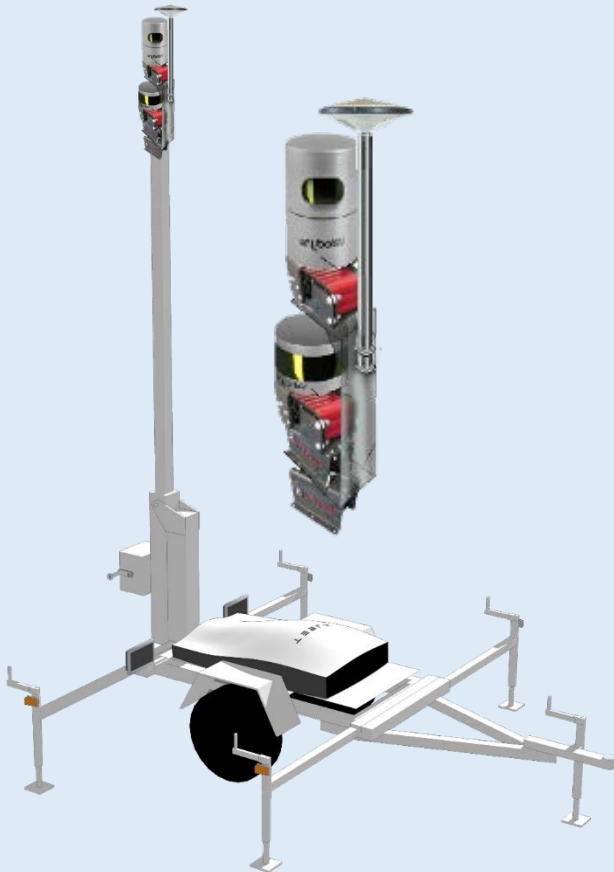
INDOT Practice in Transition

- Adapting to advances over near decades — some sustaining, some not — with mix of successes and failures
- Identifying new safety (also security) and capacity challenges
- Integrating vehicle, road, and system
- Instrumenting roads for traffic control and navigation support
- Adjusting decision-making today for (uncertain) design year travel conditions

Current CRS Research on Safety Tools Applicable in the Transition Period

- TSCAN - practical technique of observing near-crashes for safety evaluation of traffic with C/A vehicles (SPR-4102)

- CDB - tool for investigating patterns of crashes and conflicts (SPR-4103)



	01 - PDO	02 - Injury	03 - Fatality	Total
01 - REAR END	0	5	0	5
02 - HEAD ON	0	1	0	1
03 - REAR TO REAR	0	0	0	0
04 - SAME DIRECTION SIDESWIPE	0	0	0	0
05 - OPPOSITE DIRECTION SIDESWIPE	0	0	0	0
06 - RAN OFF ROAD	0	0	0	0
07 - RIGHT ANGLE	0	6	0	6
08 - LEFT TURN	0	8	0	8
09 - RIGHT TURN	0	0	0	0
10 - LEFT/RIGHT TURN	0	0	0	0
11 - BACKING CRASH	0	0	0	0
12 - OTHER - EXPLAIN IN NARRATIVE	0	4	0	4
13 - NON-COLLISION	0	0	0	0
Total	0	24	0	24

Filters:	
Severity	02 - Injury 03 - Fatality
Intersection:	43rd and Scatterfield Rd
Analyst:	JET
Date:	August 1, 2015
Year Of Data:	2011-2013
Notes:	There are no notes at this time



Near-term Needs of Safety Tools for the Transition Period

- Rapid estimation of safety of hybrid and C/A vehicles safety with traffic conflicts,

$$Crashes = k \cdot Conflicts$$

- Identifying traffic and road conditions with increased risk of crash under the presence of C/A vehicles
- Predicting the safety and capacity of traffic with C/A vehicles under various road and traffic conditions

Computer simulation of traffic with imperfect drivers and imperfect autonomous navigation.

Near-term Needs of Safety Tools for the Transition Period

- Data collection and management (crash, vehicle, and driver records)
- Re-evaluated existing and new safety countermeasures for C/A traffic and hybrid traffic
- Professional development and short courses to address changes in the transportation practice



Long-term Safety Research for the Transition Period

- Roadside instrumentation to support navigation and safety
- Roadside instrumentation to support fighting cyberterrorism
- Countermeasures for road and traffic-related safety hazards
- Traffic control, management, and enforcement of C/A traffic
- Roadway design for traffic with C/A vehicles
- New transportation planning
- Professional development and short courses



Perspective