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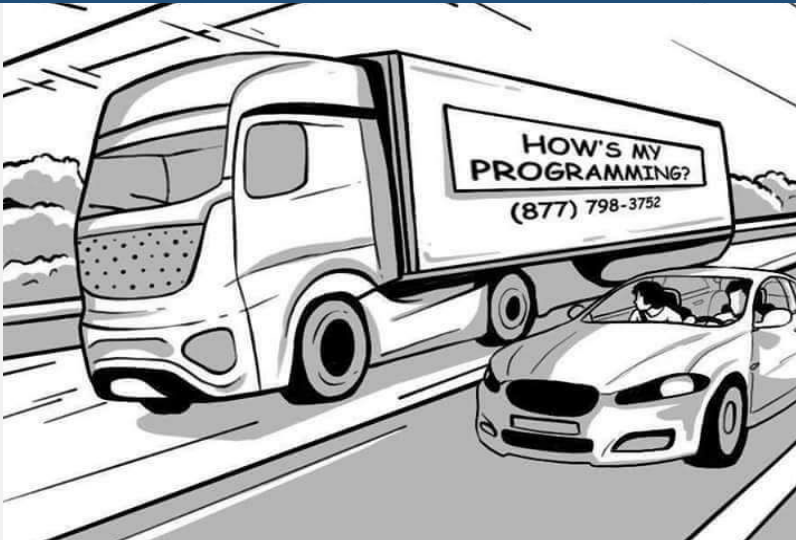
The Future of Mobility and Illinois Autonomous and Connected Track (I-ACT)

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Current Global Challenges

Climate Change

Global warming will reach the crucial threshold of **1.5°C** above pre-industrial levels by 2030

Food Security

Chronic food deprivation affected **821 million people** in 2017 and is expected to rise

Air and Water Pollution

Air and Water pollution was responsible for **16% of global premature deaths** in 2015



Overpopulation

Global Population is expected to reach **10 billion** by 2050

Transportation Demand

Car ownership is projected to reach the **two billion** by 2040

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Society Needs!

- Health (Medical cross icon)
- Education (Classroom icon)
- Goods/Services (Shopping bag icon)
- Markets (Shopping cart icon)
- Leisure (Family and dog icon)
- Work (Office worker icon)

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A Look into 2045

- U.S. Population**: +20% (2017-2045)
- Total U.S. Enplanement**: +81% (2015-2045)
- #3 Chicago O'Hare**: +68% (2015-2045)
- Weight of Freight**: +44% (2015-2045), Mainly due to e-commerce
- Vehicle Miles Traveled**: +27% (2015-2045)
- Congestion**: 30,000 miles of busiest highways clogged daily
- Housing Urban**: +107%

Capacity

Demand

S T L I

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Congestion!

Work Zone Delay Costs

Relative Cost

Low Traffic Medium Traffic High Traffic Very High Traffic

Axis Title

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USA

Transportation-Related Emissions

GHG EMISSIONS PER CAPITA (tCO₂ e/cap)

20.2
4x Larger than Worldwide Average

SHARES OF GLOBAL GHG EMISSIONS (%)

15%
Rank #2 Worldwide

TRANSPORTATION GHG EMISSIONS PER CAPITA (tCO₂ e/cap)

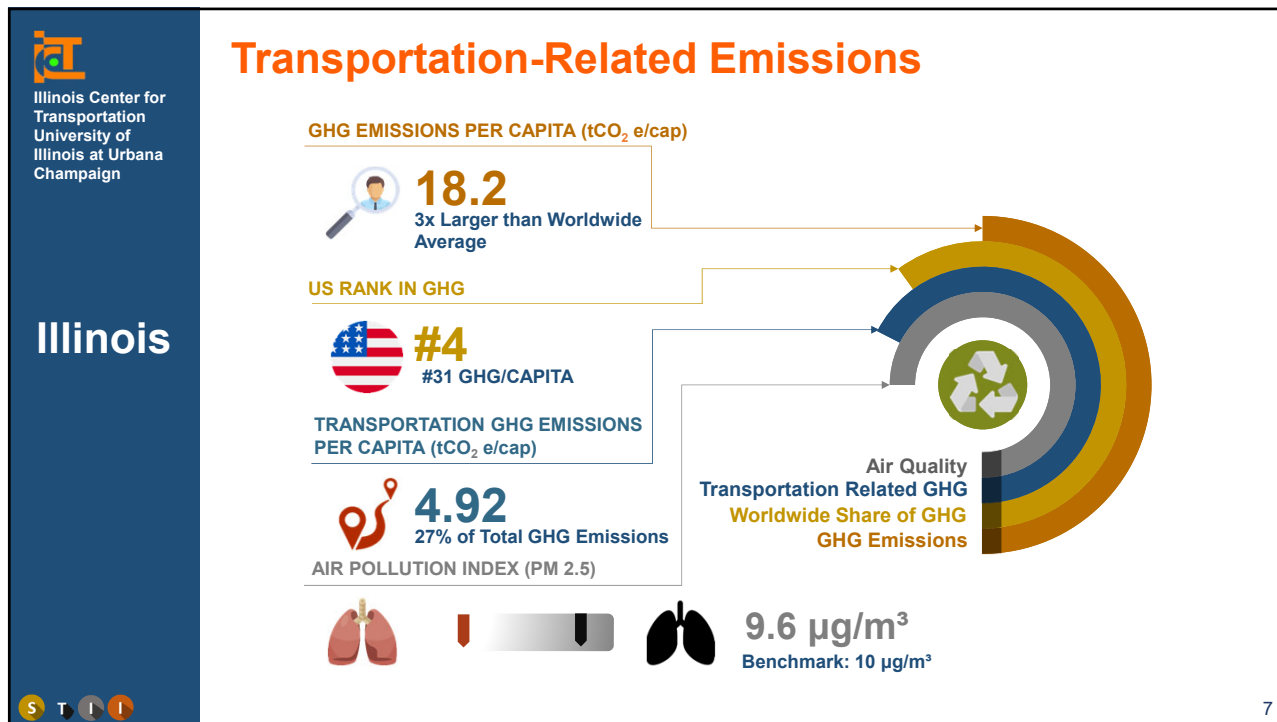
5.45
27% of Total GHG Emissions

AIR POLLUTION INDEX (PM 2.5)

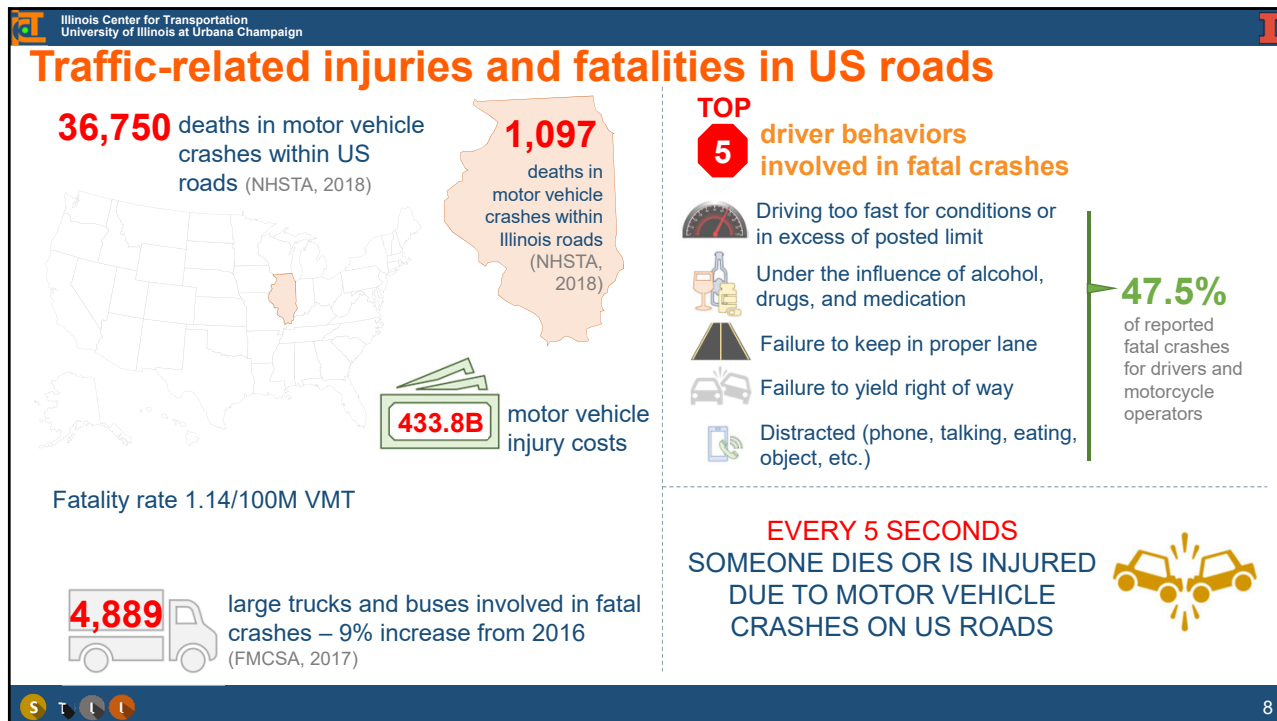
45 µg/m³
Benchmark: 10 µg/m³

Air Quality
Transportation Related GHG
Worldwide Share of GHG Emissions

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Connected and Autonomous Vehicles/Trucks Must Incorporate High Power and High Fidelity Sensing Technologies

Vehicle-to-vehicle
Vehicle-to-infrastructure
Vehicle-to-everything else

Emergency response
Traffic control and signs
Infrastructure assessment

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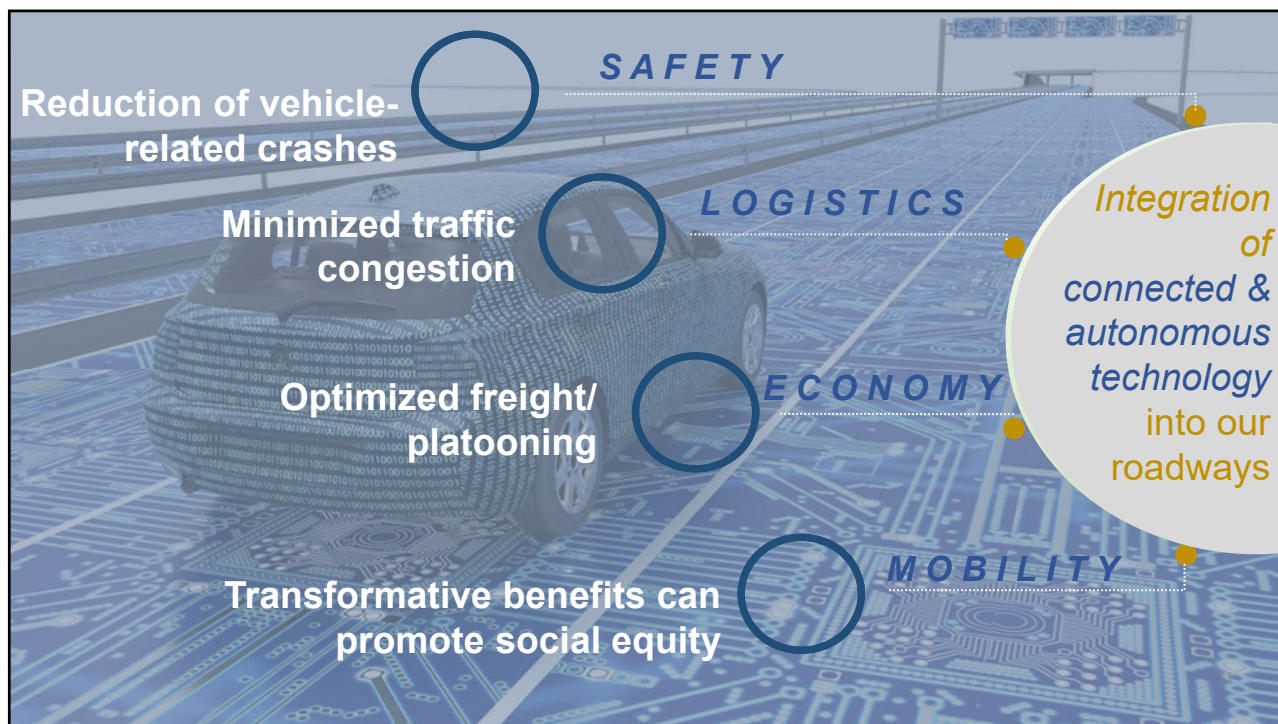
Automation and Connection Levels

1	2	3	4	5
Driver Assistance	Partial Automation	Conditional Automation	High Automation	Full Automation
	Vehicle	Infrastructure	Everything	Network
SAFETY			EFFICIENCY	

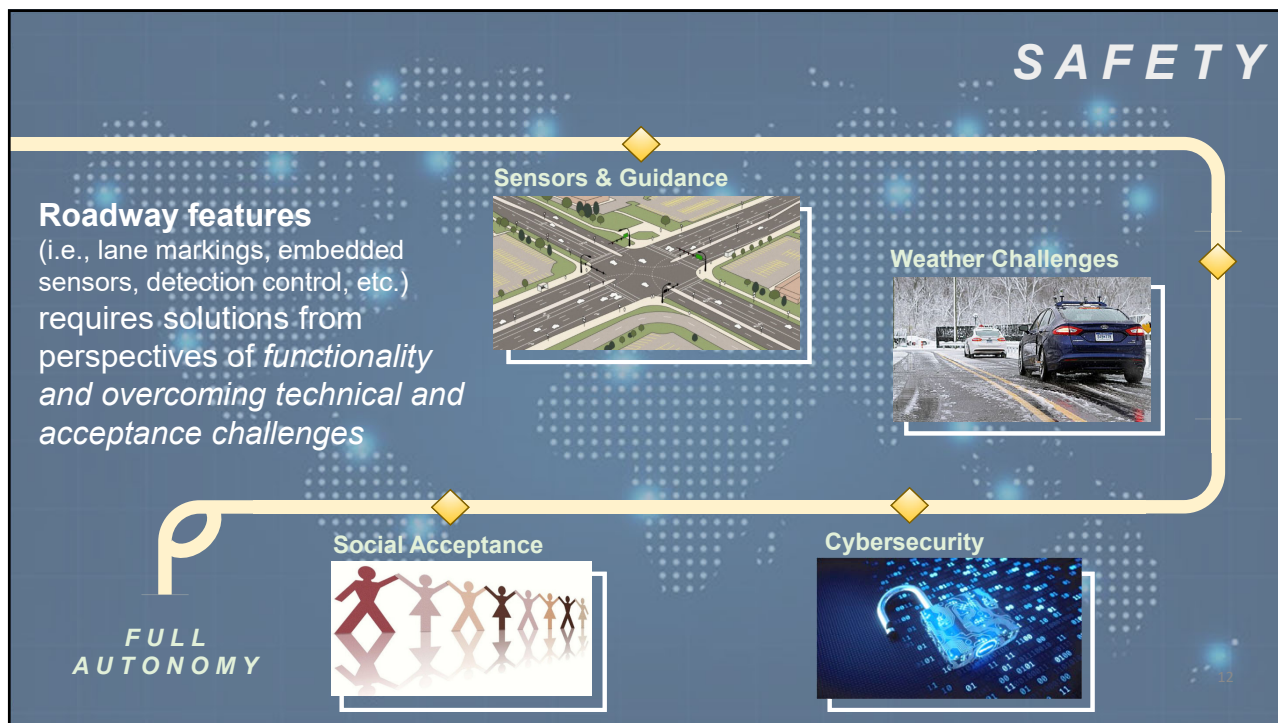
Safety, environment and intelligence must be built into design principles

"Where Excellence and Transportation Meet" Source: NHTSA

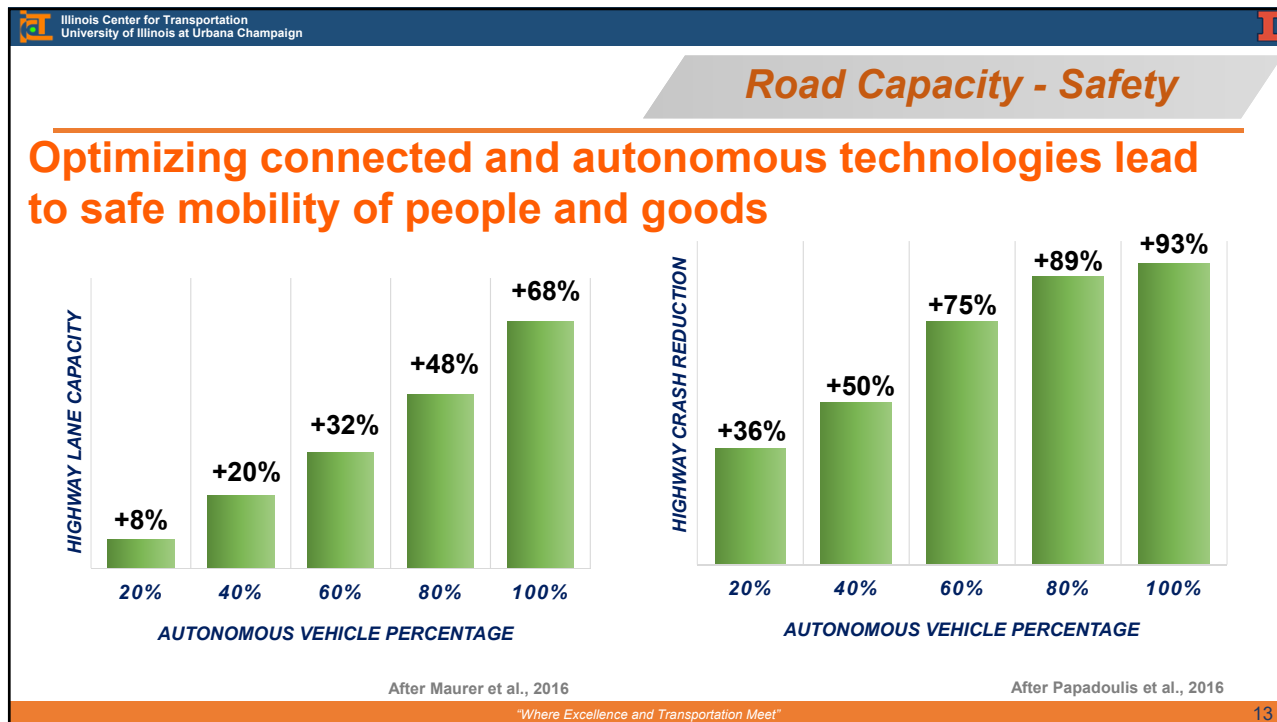
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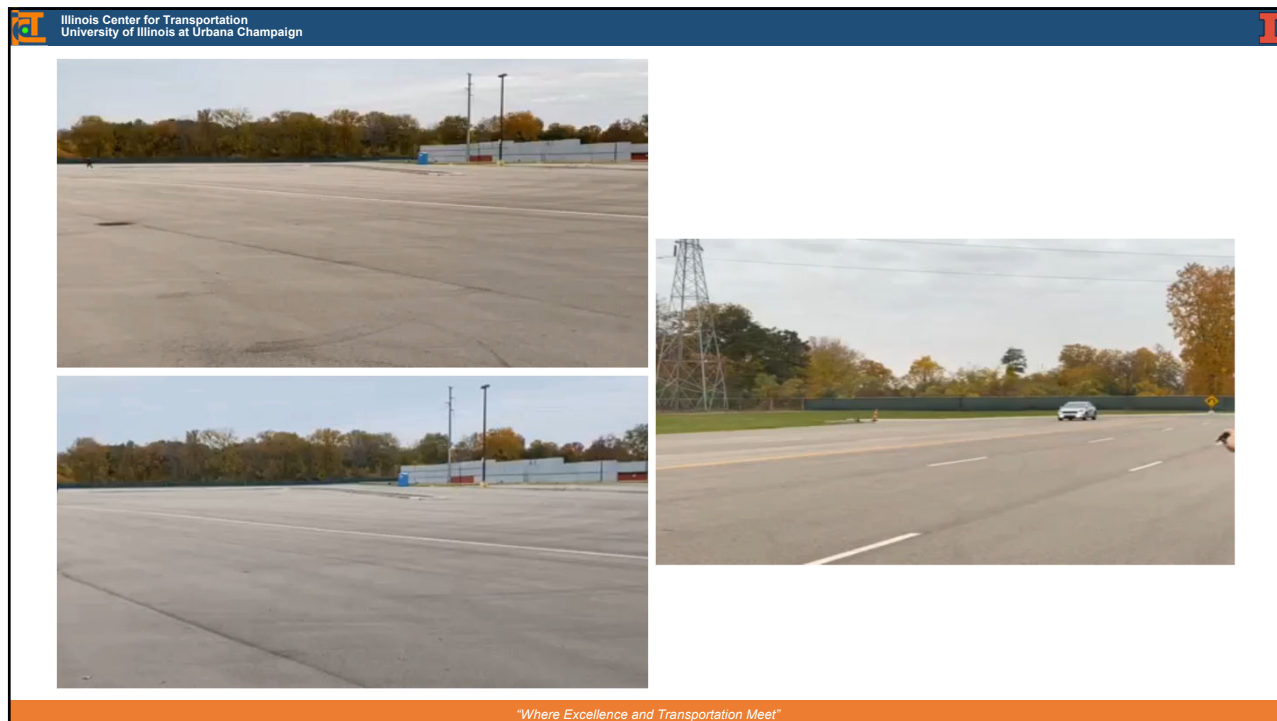
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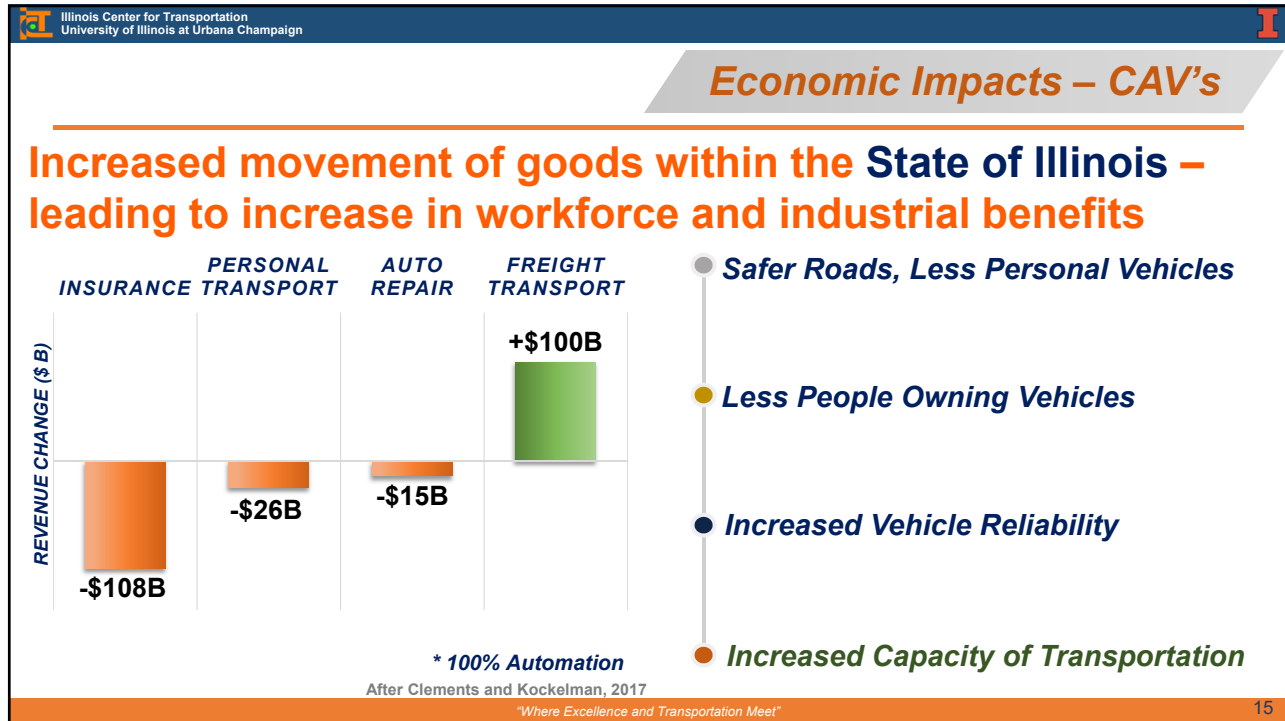
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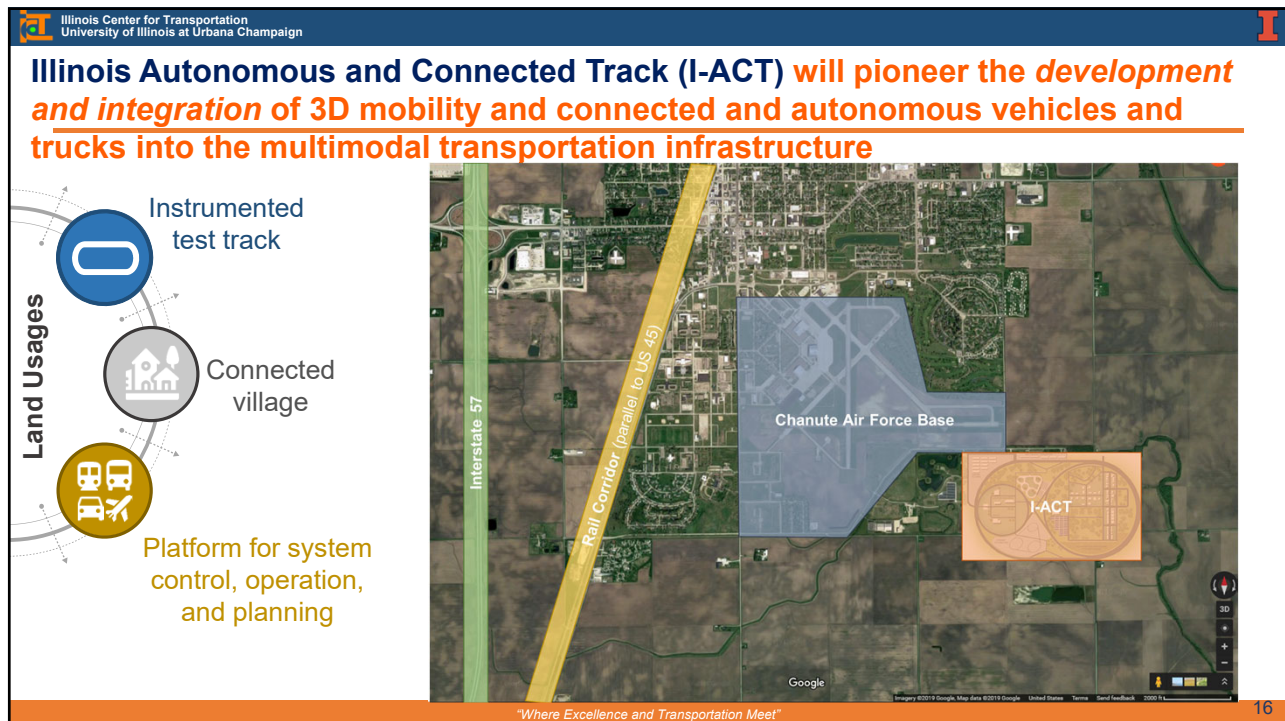
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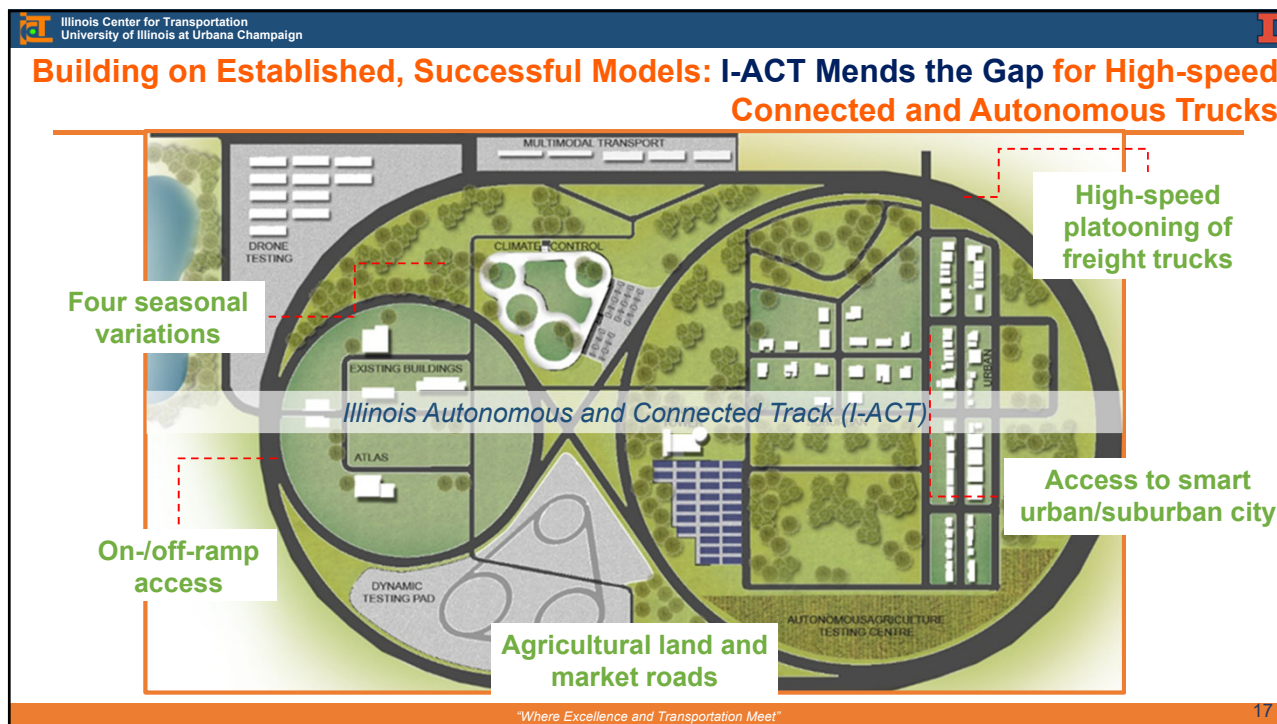
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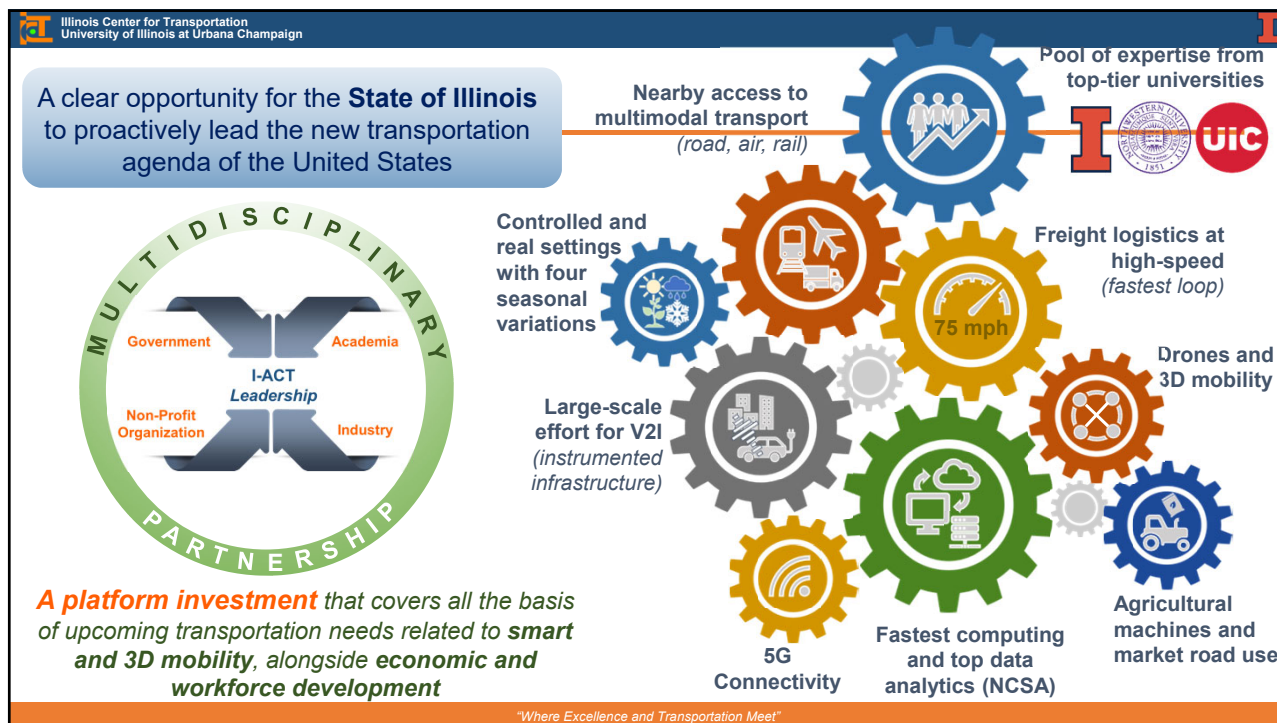
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Use	Freight & multimodal logistics	Testing, development, & validation	Smart city	Urban network and intersection	Testing, development, & validation	Testing, development, & validation
Management	Partnership	Non-Profit	U-M	Non-Profit	Florida	Virginia Tech
Academia, Government, Industry, & Non-Profit Partners	✓	✓	✓	✓	✓	✓
Vehicle calibration and dynamics	✓	✓	✓	✓	✓	✓
Small vehicle (car and shuttle)	✓	✓	✓	✓	✓	✓
Freight	✓	✓	X	✓	? (In construction)	✓
Highway speed ≥ 65 mph	75	55	25	60	75	45
V2V, V2I, & V2X Research	V2V, V2I, V2X	V2V, V2I	V2V, V2I	V2V, V2I	? (In construction)	V2V, V2I
Multi-platform test facility	Three-lane highway and arterial roads	Two-lane (new and old) highway and arterial roads	Campus and small city	Six-lane urban setting & intersection	? (In construction)	Limited surface street
Data management & real-time analytics	NCSA	✓	✓	✓	? (In construction)	✓
Four seasons	✓	✓	✓	✓	X	✓
Urban & suburban setting	New infrastructure	Old MDOT & new roads	Existing	Existing	? (In construction)	Existing
Interstate setting	✓	✓	Limited access freeway	X	✓	X
Instrumented infrastructure (including pavement, tunnel, & bridges)	✓	V2I for traffic flow	V2I for traffic flow	V2I for traffic flow	X	X
Loop track	✓	✓	X	X	✓	X
Tunnel and bridge	✓	✓	X	X	X	X
Controlled climate module	✓	Planned	X	X	X	X
Agricultural land & market roads	✓	X	X	X	X	X
Drone testing	✓	X	X	X	X	X
Nearby multimodal facilities (roadsystem network, rail, and airport)	✓	X	X	X	X	X

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Promoting Illinois as the New Hub of Interdisciplinary Technologies: New Branches, New Companies, and New Technologies

Infrastructure and Energy

- AECOM, COLAS, HNTB, HDR, Ameren, ComEd, Exelon, Invenergy, TranSmart, The Heritage Group, Exponent, Walsh

Multimodal fleet, first-/last-mile delivery, and ride-share

- COYOTE, Lyft, navya, ups, EASY MILE, CRUISE, GATX, ECHO, NEW WORLD, WAYMO, FedEx, Walgreens, US COACHWAYS, Uber

New CAV technology and retrofitting existing vehicles

- AUTOBON, innova ev, ADM, AM General, CATERPILLAR, SCHNEIDER, BOSCH, DAIMLER, BOYLE, Hub Group, tu simple, JOHN DEERE, RIVIAN, drive.ai, RUAN, WABCO

V2X telematics and analytics

- AUTONOMICUPP, applied, Sprint, CISCO, CROWN CASTLE, TRAFFIC CONTROL CORPORATION, FOXCONN, here, NOKIA, sigfox, IntelinAir, verizon, SAVARI

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Collaborative opportunities to invest and utilize the I-ACT testing arena

Academic Research Sponsorship
Sponsor involvement is strictly monetary, funding research to perform all tasks

Performance Testing
Private entity provides product to advance development, feasibility, commercialization, and deployment

Team Research & Development
Sponsor provides funds and collaborates with research team; tasks may include technology and/or protocol development

Founding Member
Entity invests in testing arena, motivated by long-term economical and/or social benefits

Technical Support
Entity or company leases a portion of the track or testing arena to use according to specific needs

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I-ACT timeline: ready by 2023

\$4M Planning and admin

- Project approval
- Feasibility and conceptualization
- Design and admin

\$36M Construction and instrumentation

- \$22M Testing arena
- \$7M Control center
- \$2M Environmental facility
- \$5M Instrumentation

\$17M Land acquisition

\$15M land acquisition, pledged by Rantoul

\$2M Additional land procurement (pending)

Complete construction

Ready to go!

Timeline markers: 4/19, 4/21, 8/22, 1/23

Logos: Illinois Department of Transportation, Illinois Autonomous Vehicles Association, Northwestern University, UNIVERSITY OF ILLINOIS AT CHICAGO, UIC, ILLINOIS

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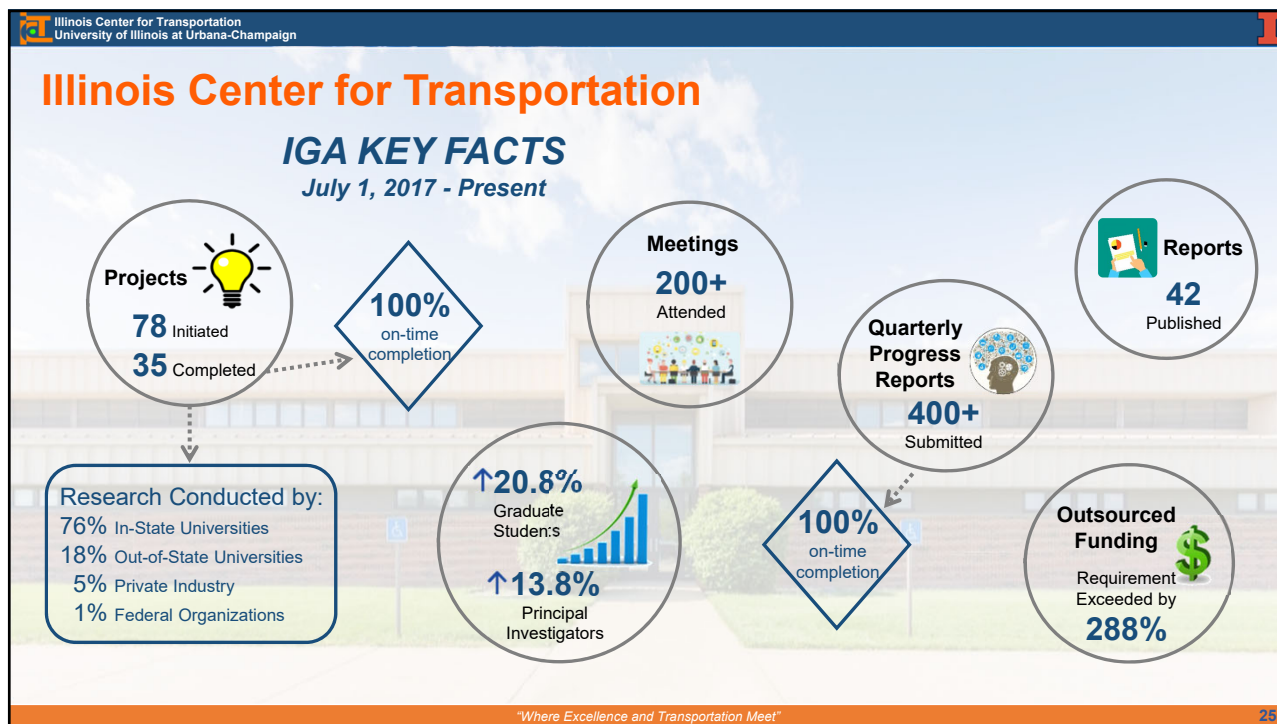
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222 projects completed	507 graduate students supported
43 active projects	53 Universities/ Industry participating

Year	Researchers	Students
2005	61	61
2006	49	49
2007	74	50
2008	103	54
2009	76	126
2010	88	170
2011	107	217
2012	116	255
2013	121	309
2014	127	336
2015	141	381
2016	145	420
2017	148	448
2018	154	463
2019	164	500

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R27-211: Policy and Design Guidelines to Plan for Connected and Autonomous Vehicles (CAVs)

Develop CAV-related policy and design guidelines organized by short-, medium-, and long-term objectives, generalized to various types of infrastructure, location, and socioeconomic context for mid-sized MPOs in Illinois

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R27-203: Truck Platooning on Illinois Flexible Pavements






This project will quantify the **effects** of autonomous and connected trucks (ACT) platooning on pavements and develop **recommendations** for the State of Illinois considering the **tradeoff** between ACT platoon fuel savings and **accelerated pavement damage** due to channelized traffic.

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THANK YOU
Any Question?

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