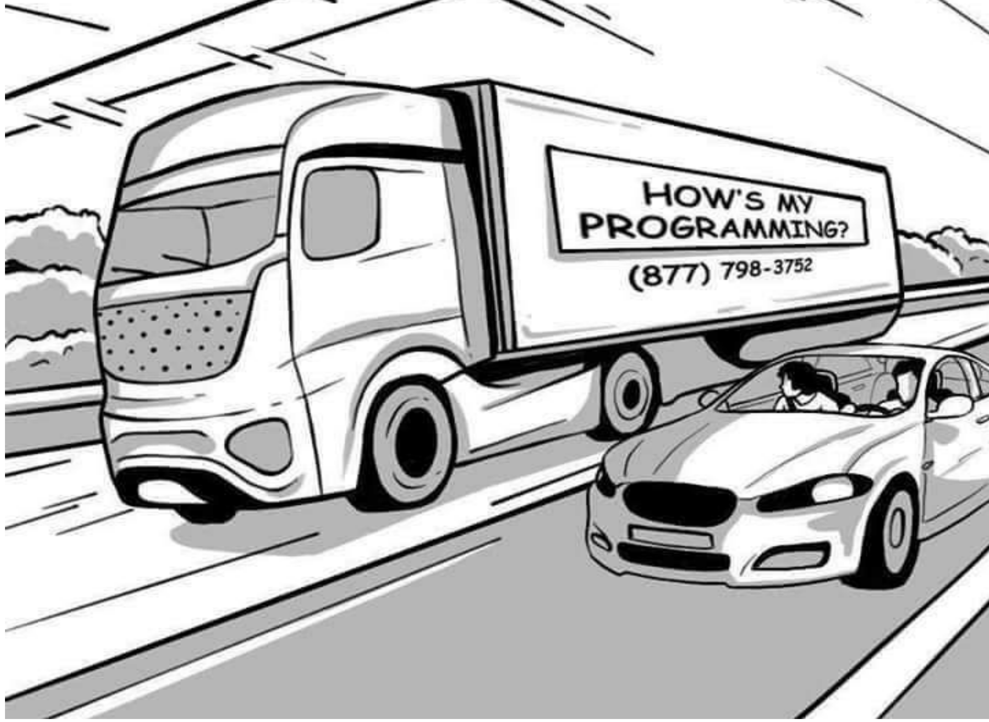
Illinois Autonomous and Connected Track (I-ACT) and The Future of Mobility



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Smart Transportation Infrastructure Initiative

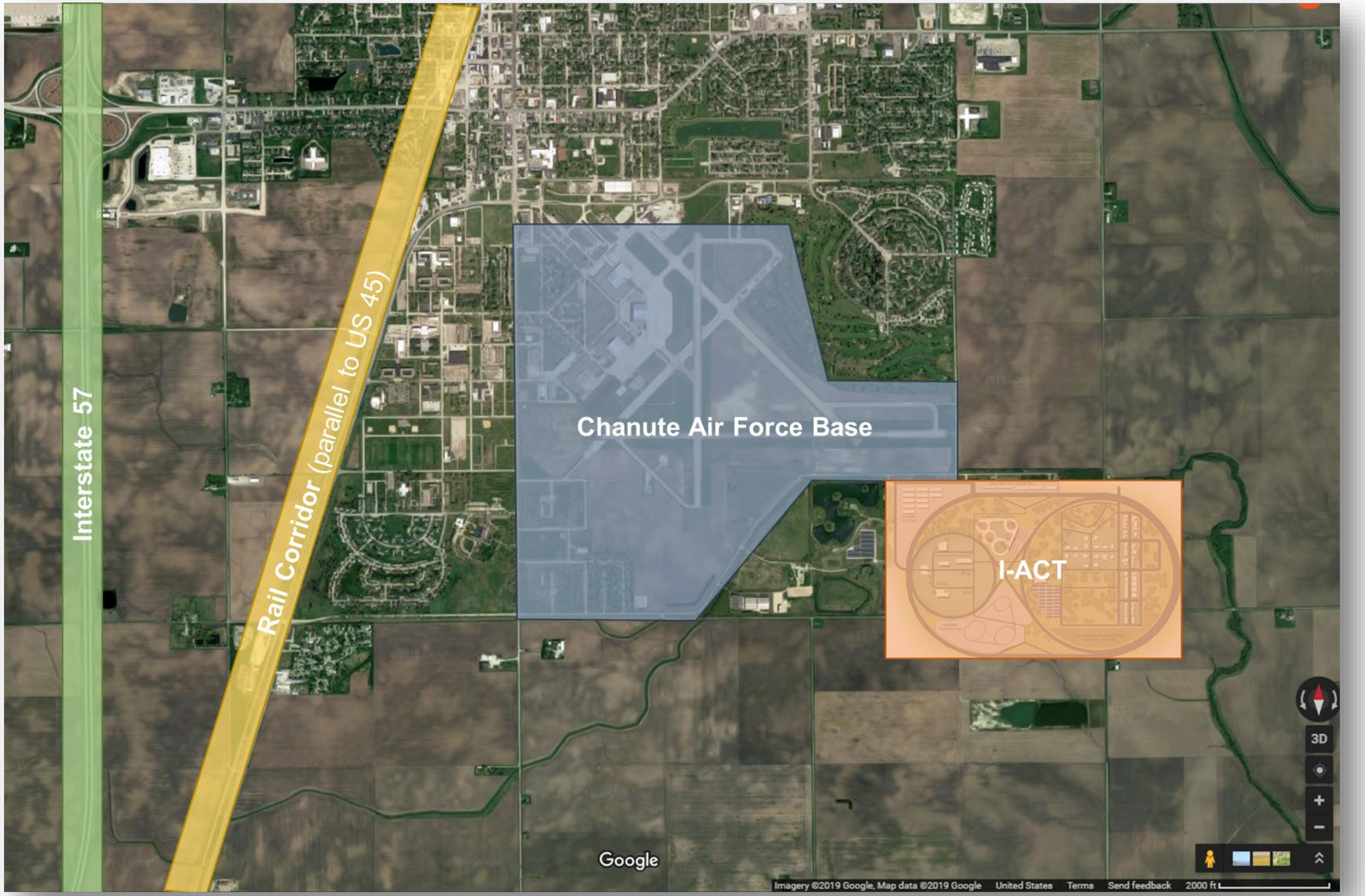
Illinois Department of Transportation · Governors State University · ILLINOIS · University of Illinois at Chicago UIC · Northwestern University · Illinois Autonomous Vehicles Association

Illinois Autonomous and Connected Track (I-ACT)

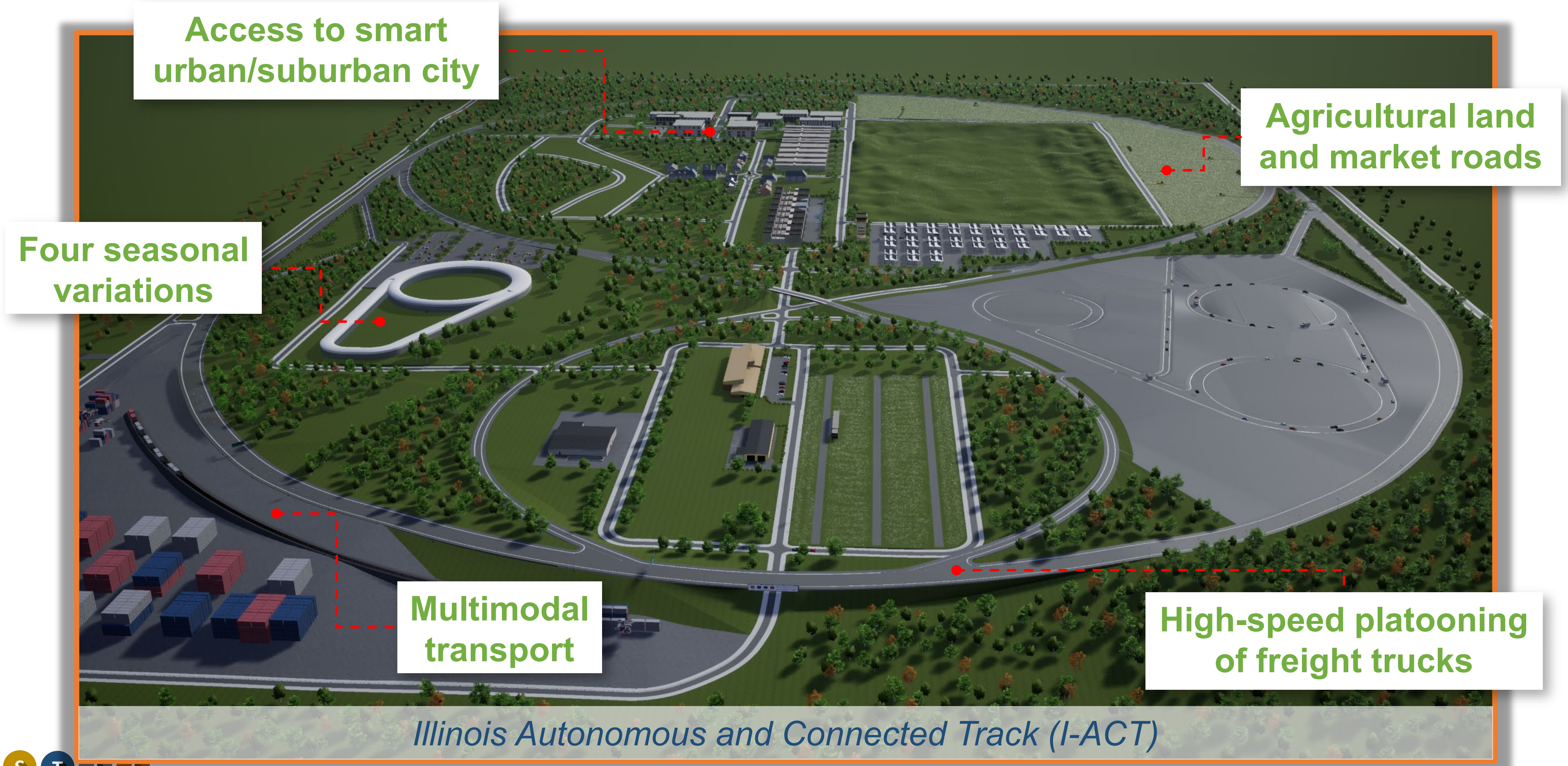
Instrumented test track

Connected village

Platform for system control, operation, and planning



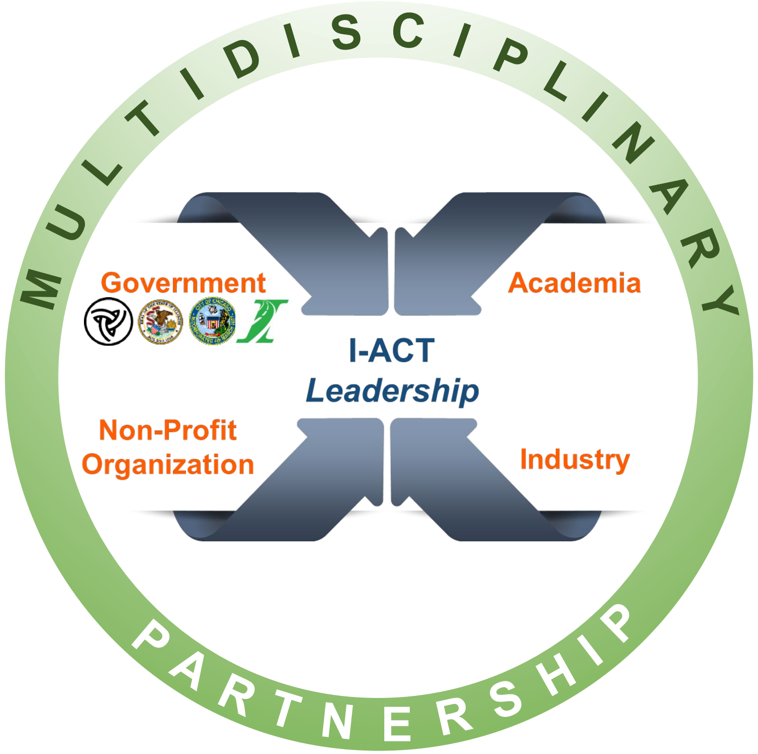
Building on Established, Successful Models: I-ACT Mends the Gap for High-speed Connected and Autonomous Trucks

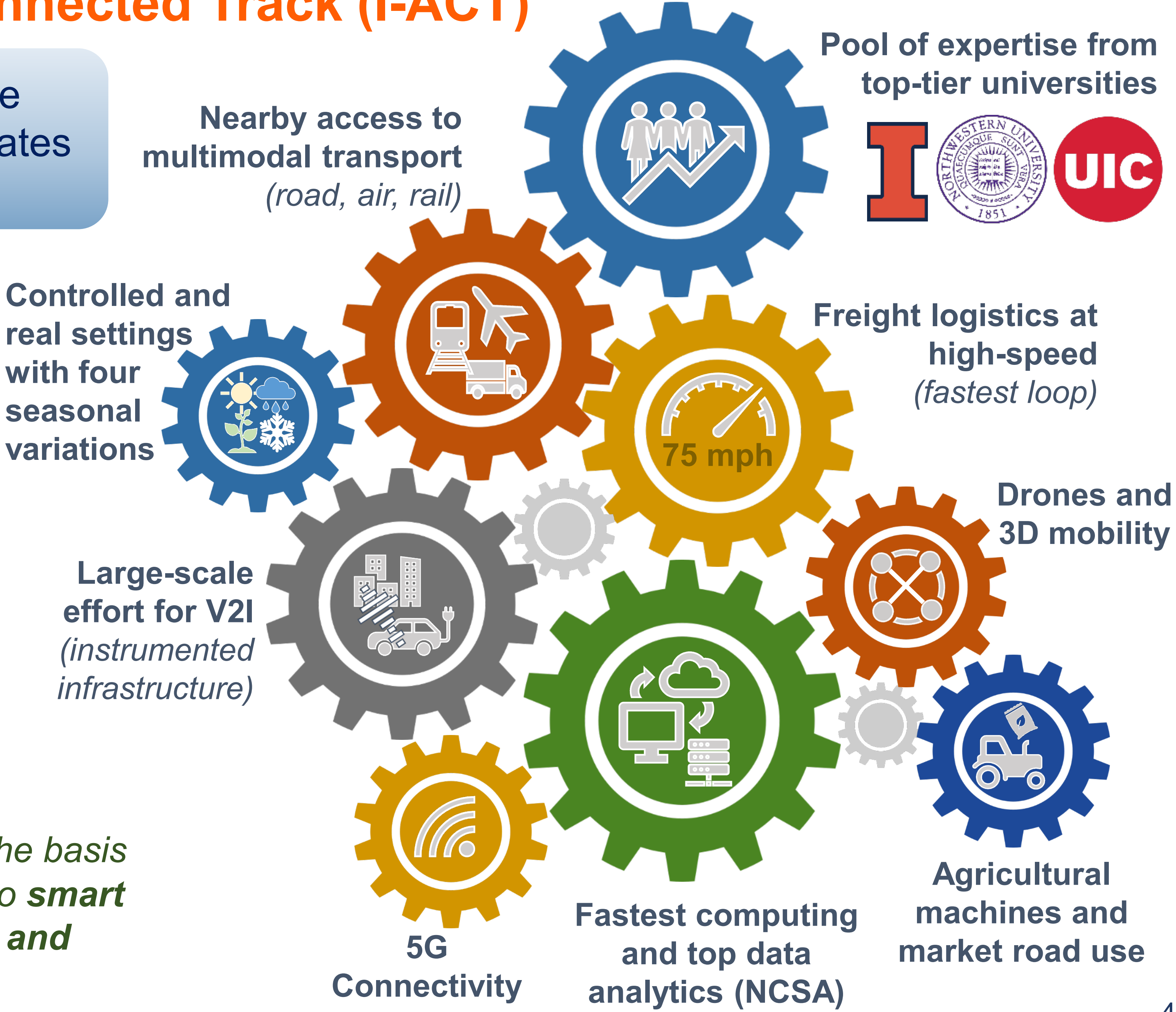


Illinois Autonomous and Connected Track (I-ACT)

Illinois Autonomous and Connected Track (I-ACT)

A clear opportunity for advancing the transportation agenda of the United States





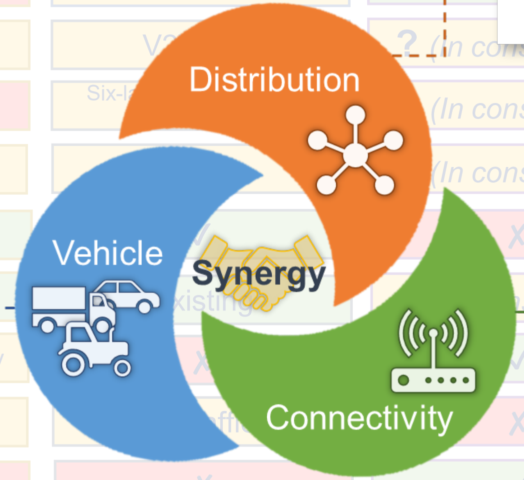
A platform investment *that covers all the basis of upcoming transportation needs related to* ***smart and 3D mobility****, alongside* ***economic and workforce development***

	I-ACT	ACM	Mcity	SMARTCenter	SunTrax	Smart Road
State	Illinois	Michigan	Michigan	Ohio	Florida	Virginia
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	✓	✓	[illegible]	[illegible]	[illegible]	✓
Small vehicle *(car and shuttle)*	✓	✓	[illegible]	[illegible]	[illegible]	✓
Freight	✓	✓	✗	✓	? *(In construction)*	✓
Highway speed ≥ 65 mph	75	55	25	60	[illegible]	[illegible]
V2V, V2I, & V2X Research	V2V, V2I, V2X	[illegible]	V2V, V2I	V2	? *(In construction)*	V2V, V2I
Multi-platform test facility	Three-lane highway and arterial roads	T highway and arterial roads	...pus and small city	Six-l	*(In construction)*	Limited surface street
Data management & real-time analytics	NCSA	✓	✓	[illegible]	*(In construction)*	✓
Four seasons	✓	✓	✓	[illegible]	✗	✓
Urban & suburban setting	New infrastructure	Old MDOT & new roads	Existing	xisting	...struction)	Existing
Interstate setting	✓	[illegible]	...ess freeway	✗	✓	✗
Instrumented infrastructure *(including pavement, tunnel, & bridges)*	✓	V	...affic flow	...ffi	✗	[illegible]
Loop track	✓	✓	✗	✗	✓	[illegible]
Tunnel and bridge	✓	✓	✗	✗	✗	✗
Controlled climate module	✓	Planned	✗	✗	✗	✗
Agricultural land & market roads	✓	✗	✗	✗	✗	✗
Drone testing	✓	✗	✗	✗	✗	✗
Nearby multimodal facilities *(grid-system network, rail, and airport)*	✓	✗	✗	✗	✗	✗

Ready to provide a large-scale V2V/V2I/V2X testing arena and spearhead autonomous and connected transportation policies

Infrastructure and **energy harvesting**

Multimodal fleet, supply chain, and logistics



New CAV technology and **retrofitting** existing vehicles

V2X telematics and analytics

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

Founding Member

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

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

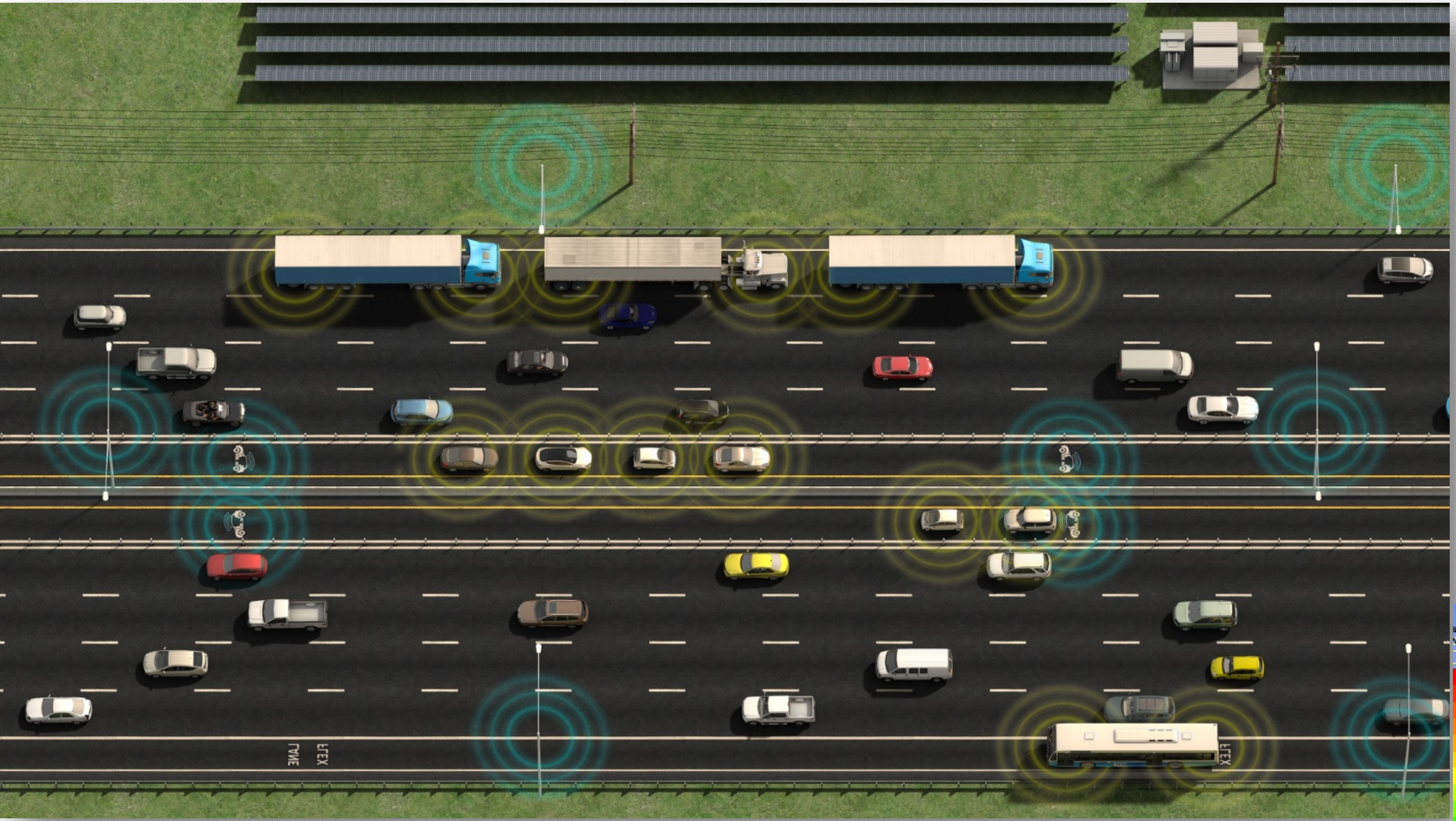
Academic Research Sponsorship

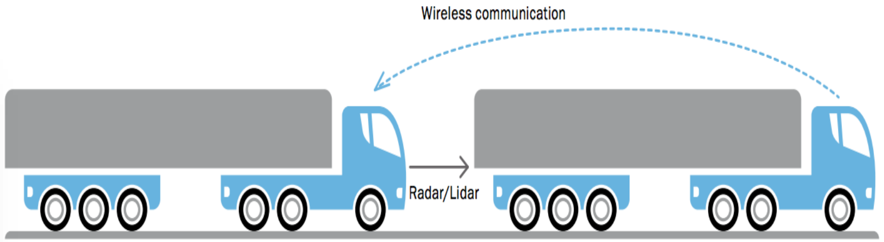
Sponsor involvement is strictly monetary, funding research to perform all tasks

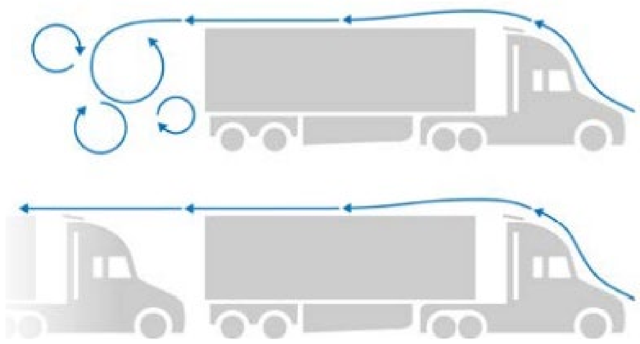
Technical Support

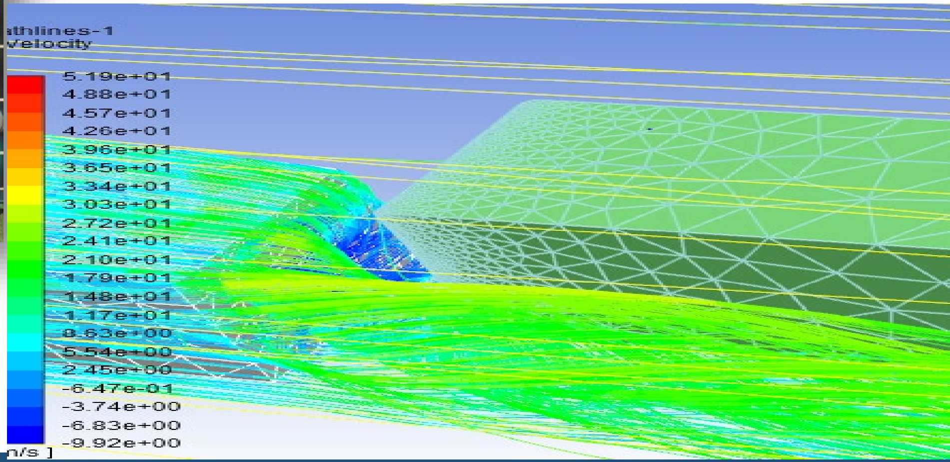
Entity or company leases a portion of the track or testing arena to use according to specific needs

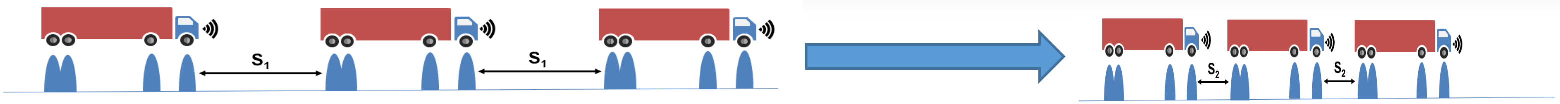
Autonomous Truck Platooning





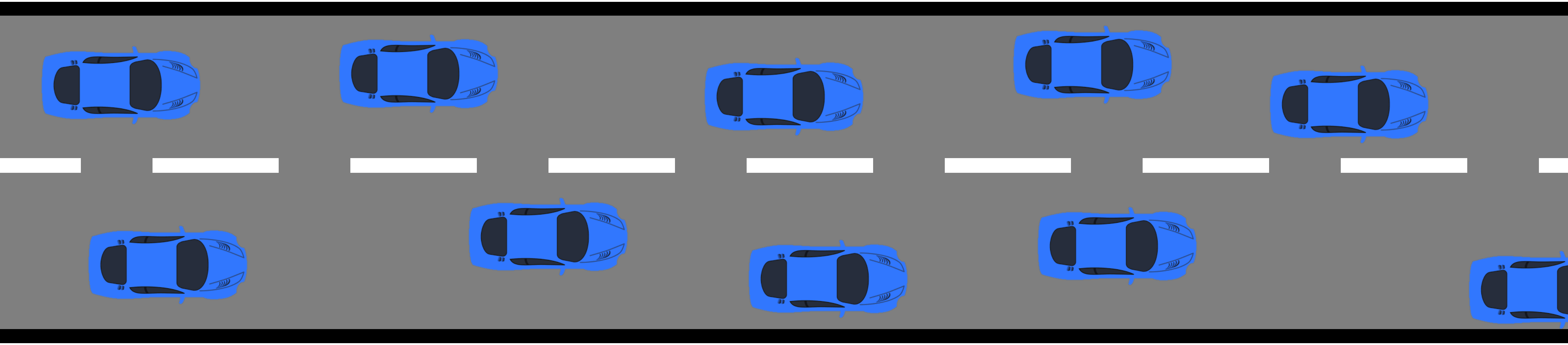






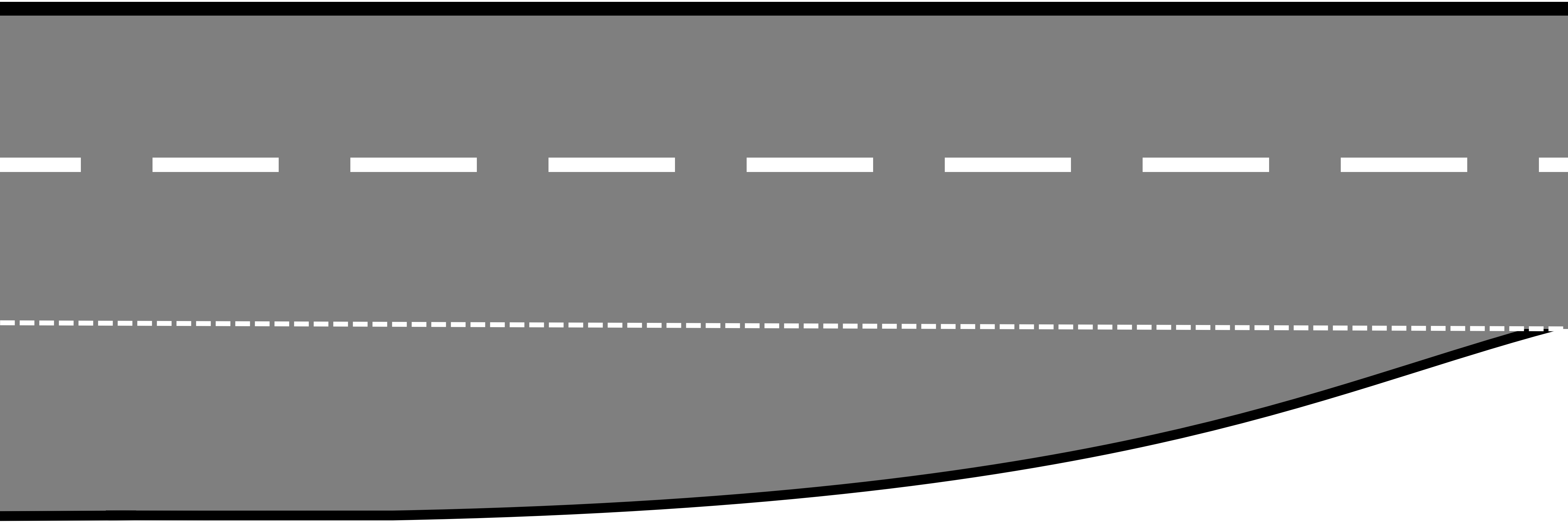
Potential Challenges for Platooning

- Vehicle density may compromise free flow speeds

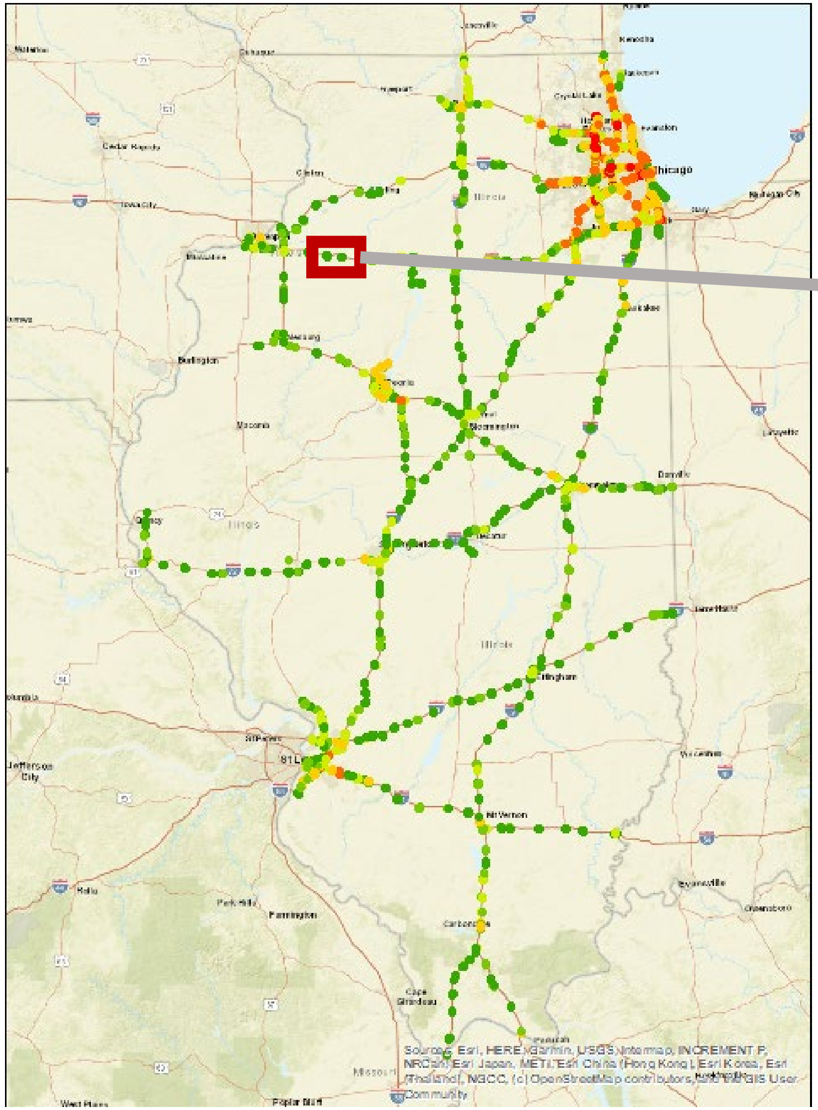


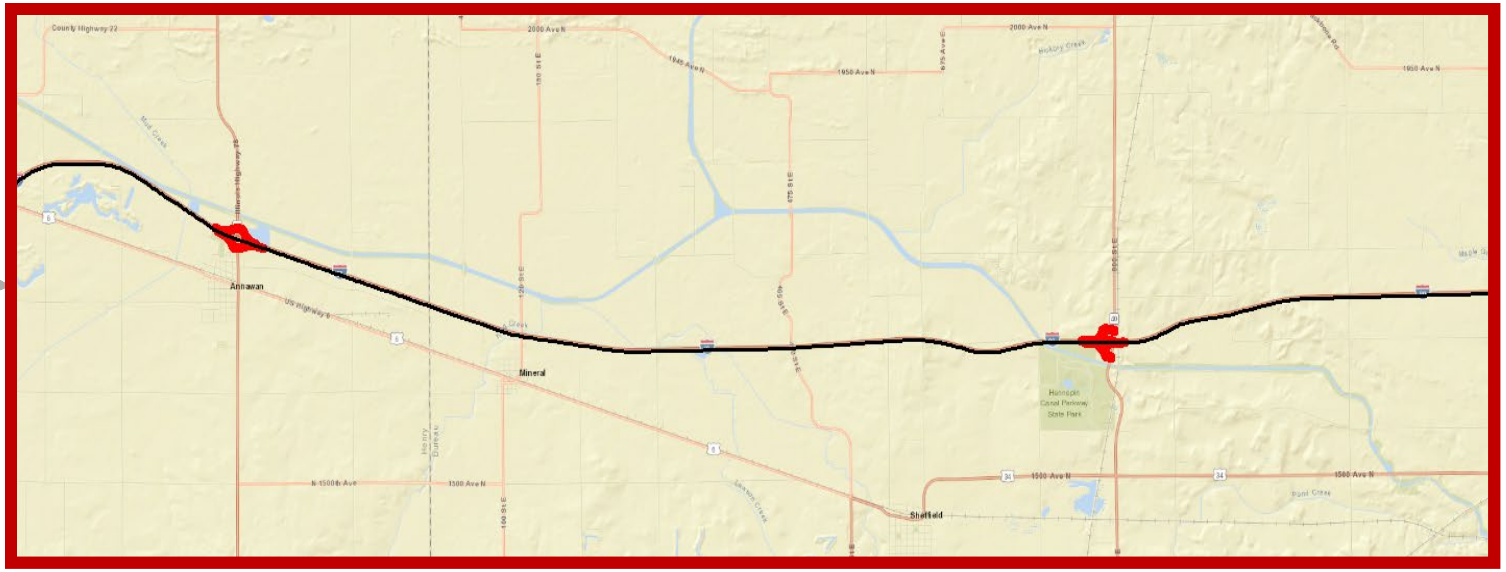
Potential Challenges for Platooning

- Possible conflicts near entry and exit ramps



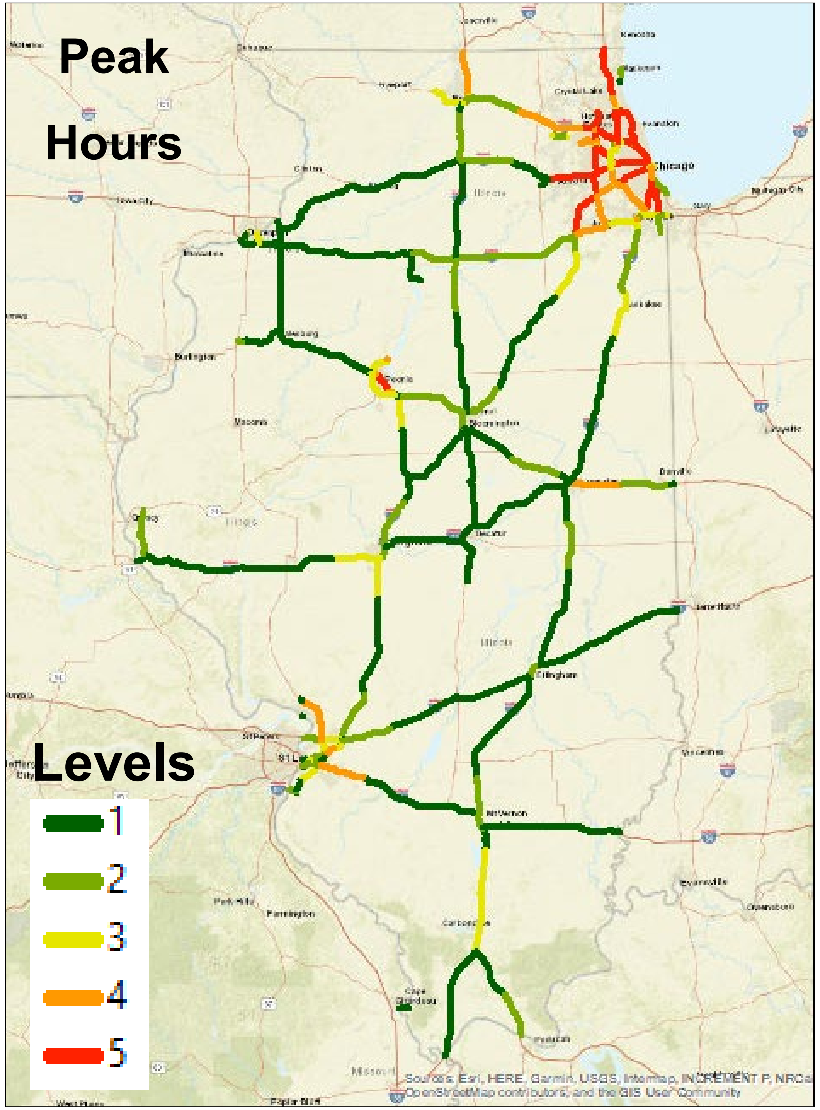
Platoonability of Illinois Roads

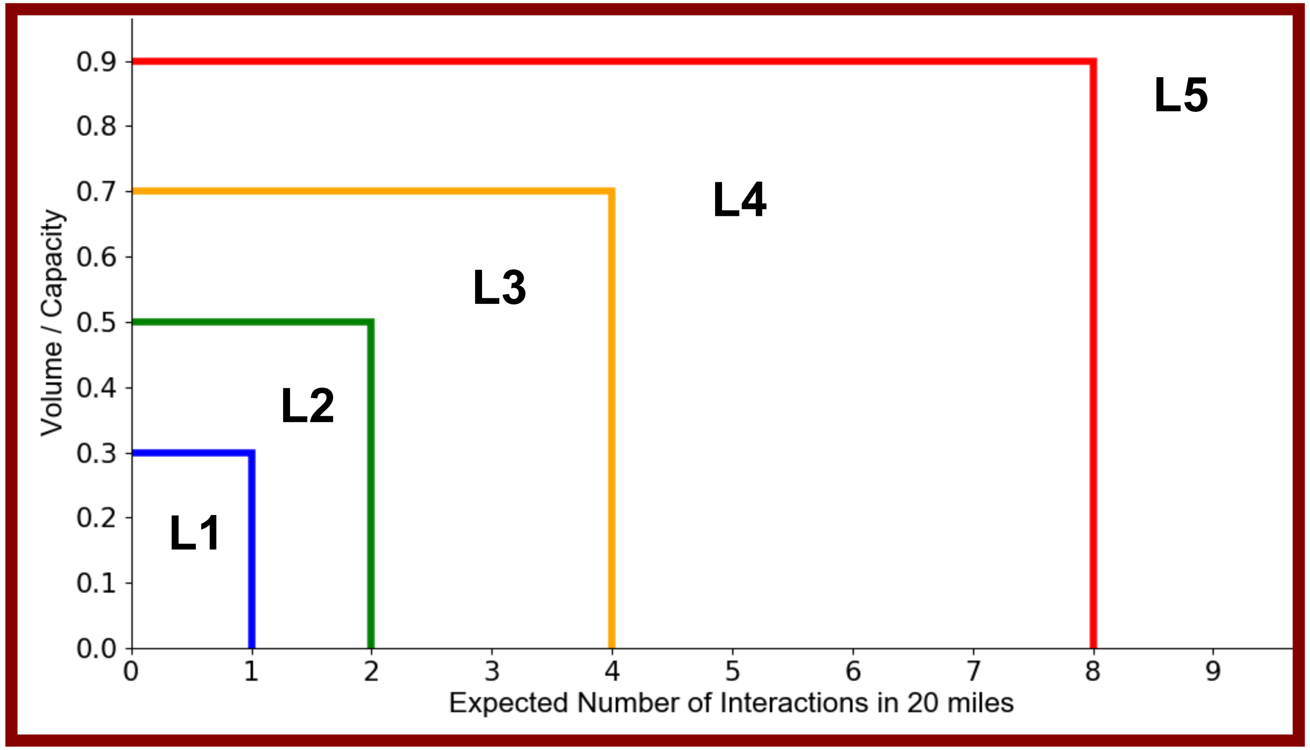




IDOT GIS data were analyzed considering traffic density and possible conflicts per 20-mile segments.

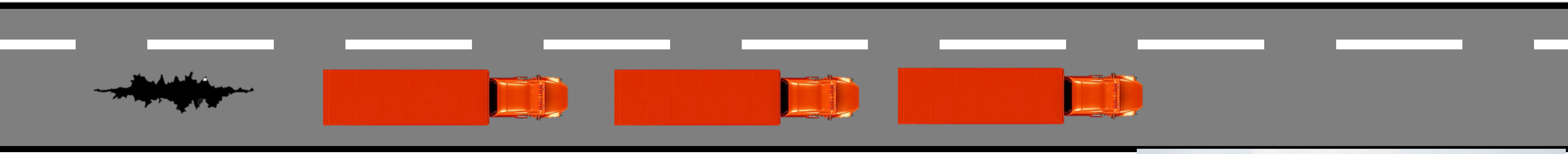
Platoonability of Illinois Roads

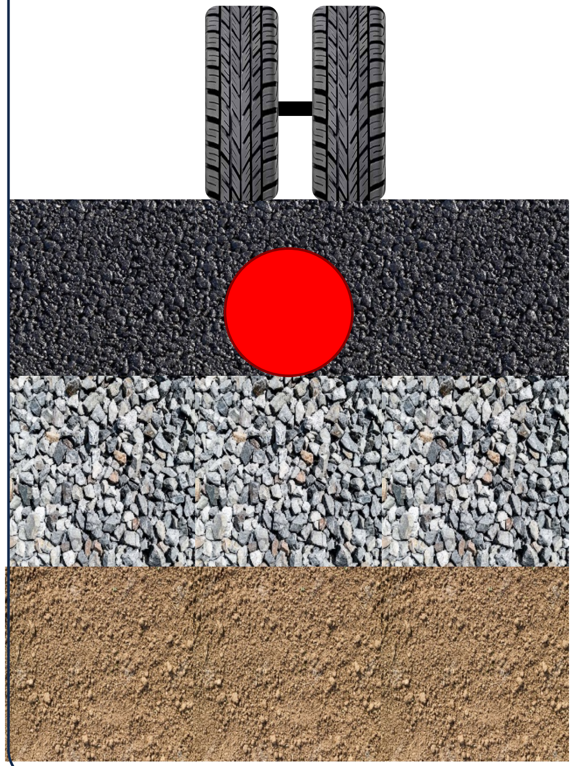




Roads are divided into 5 platoonability levels with level 3 being the threshold for platoonability. 89% of interstates are platoonable during peak hours

Pavement Damage and Platooning

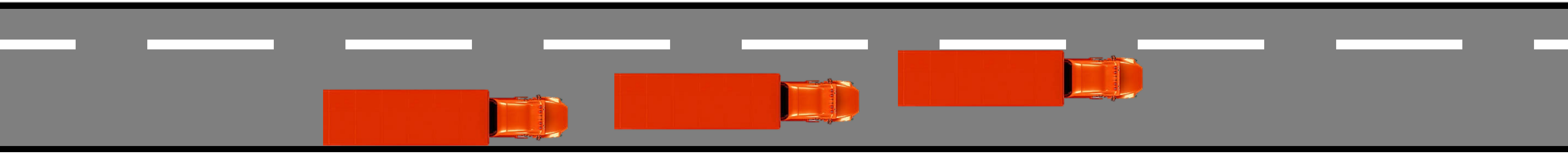


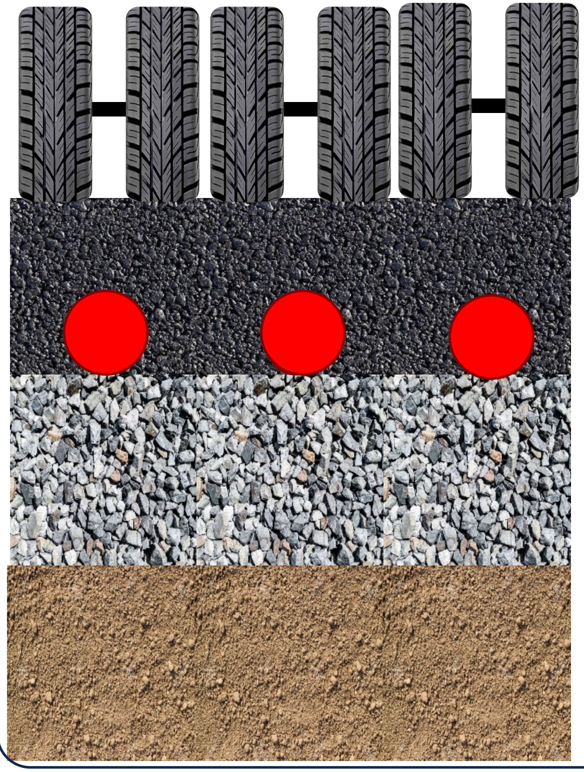


Scenario 1 – Channelized Traffic

- Trucks always follow the same path on the pavement
- Most damaging to system due to load concentration
- **Platooning is more damaging than traditional traffic in this scenario**

Pavement Damage and Platooning

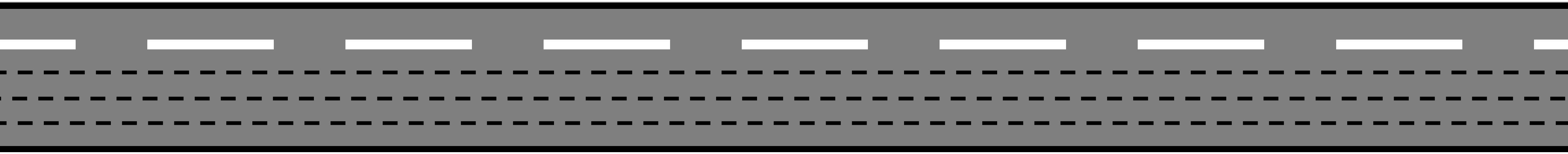


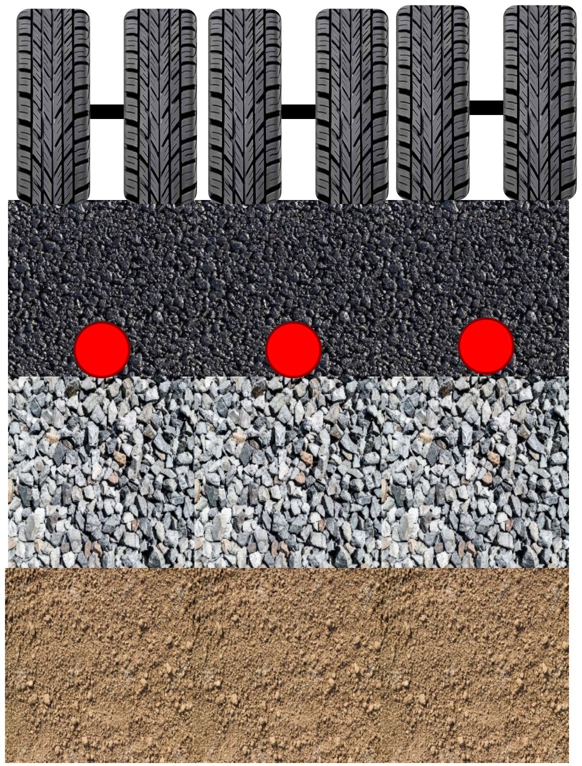


Scenario 2 – Local Optimization

- Trucks follow each other with slight offset
- Decreases the damage by decreasing load concentration
- **However, increases fuel consumption by increasing drag**

Pavement Damage and Platooning





Scenario 3 – Centralized Optimization

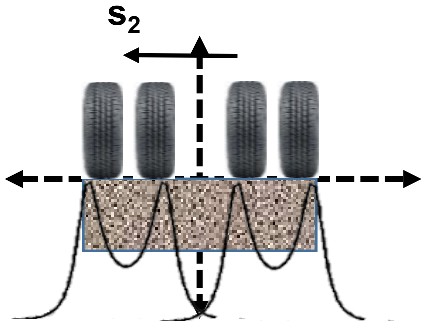
- Each platoon follow a specified path
- Path is selected and communicated to platoon by a centralized optimization policy
- **Optimizes fuel savings and pavement damage at the same time**

Platooning: a Challenge to Opportunity

Lateral Position and Speed of Trucks

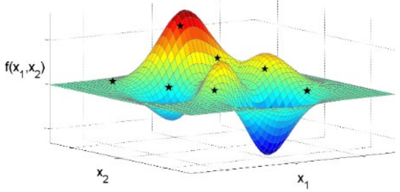
+

Distance between Trucks



Pavement Analysis

Optimization



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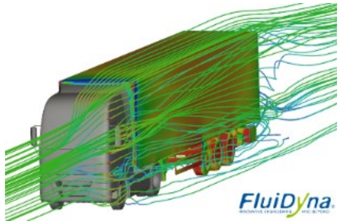

Truck Configuration and Aerodynamics

Reduced Damage

Increase Fuel Eff.

Sustainable Freight Transportation

Thank You

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