



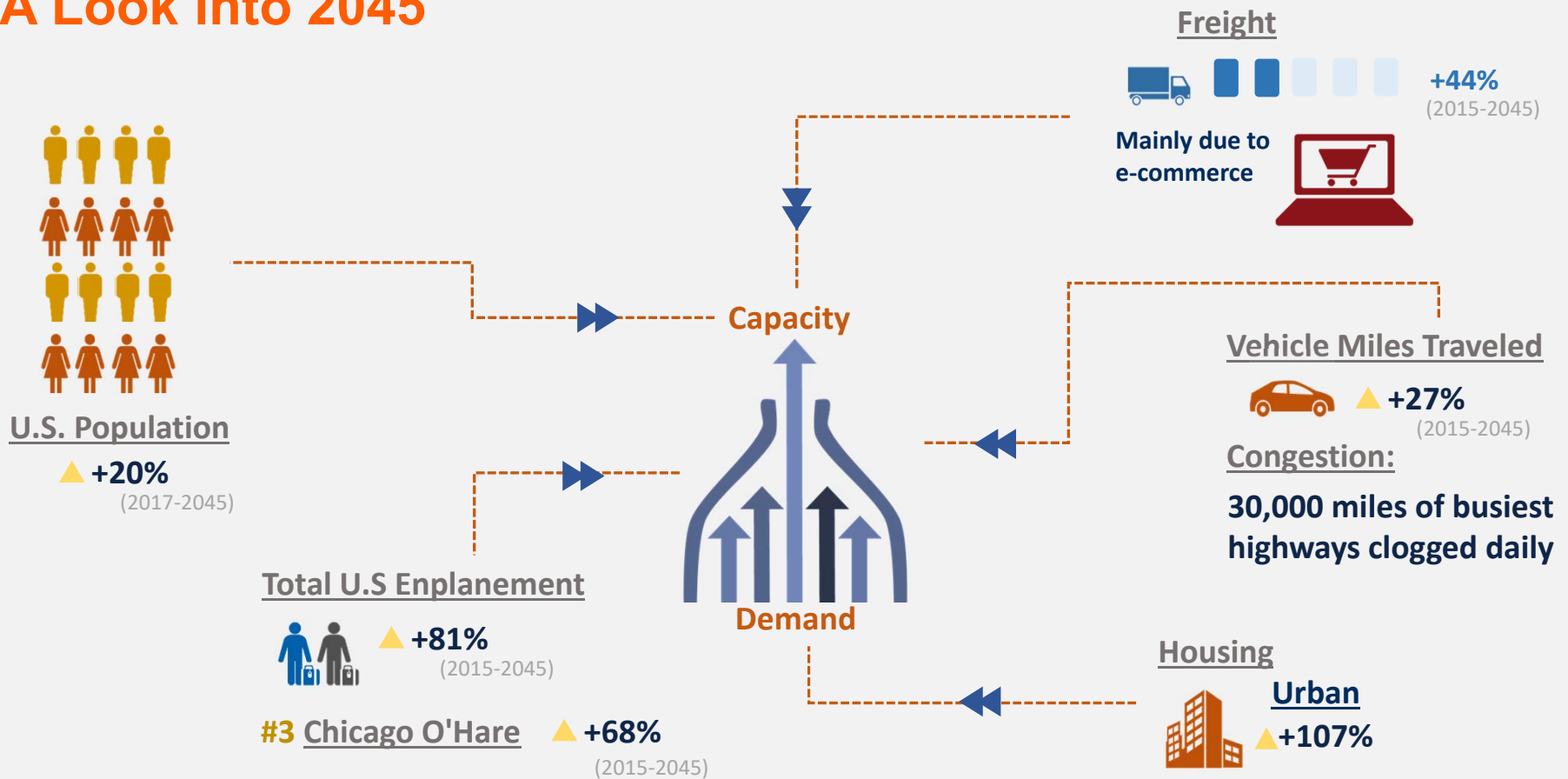
Smart Transportation Infrastructure Initiative

An Arena for the Future of:
Sustainable Mobility

Imad L. Al-Qadi



A Look into 2045





Water Street Market that ran parallel to the river, Chicago in 1890 (estimated)

Omnibus and Horse Cars

1880s



Ferries, Omnibus and Steam Trains

Traffic Jam on Randolph Street, Chicago in 1909

1900s



Traffic Jam in The Downtown Area, Chicago in 1927

Street Cars and Railways

1920-40s

Today

Trucks and Passenger Vehicles

Almost Daily Traffic Congestion, Chicago



Transportation Safety in the United States and Illinois

Yearly Injured and Disabled on USA Roads

2.35M



IL Total injuries
93,160 (2016)

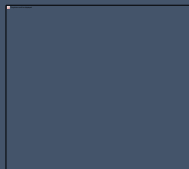


Yearly Death Toll on USA Roads (2017)

37,133



IL Death Toll
1,037 (2018)



Road Crashes Cost per Year

230.6B

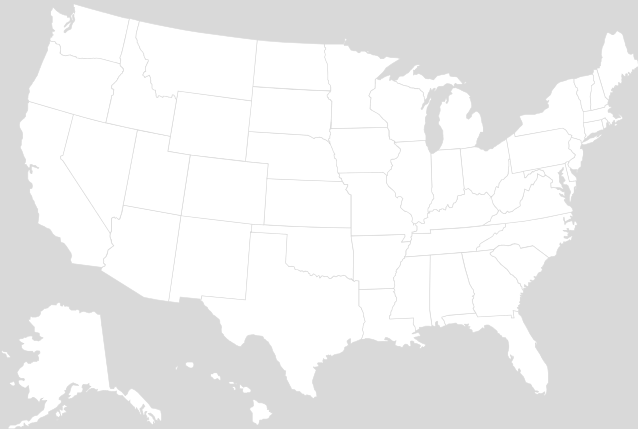


No. of crashes
in IL 324,473



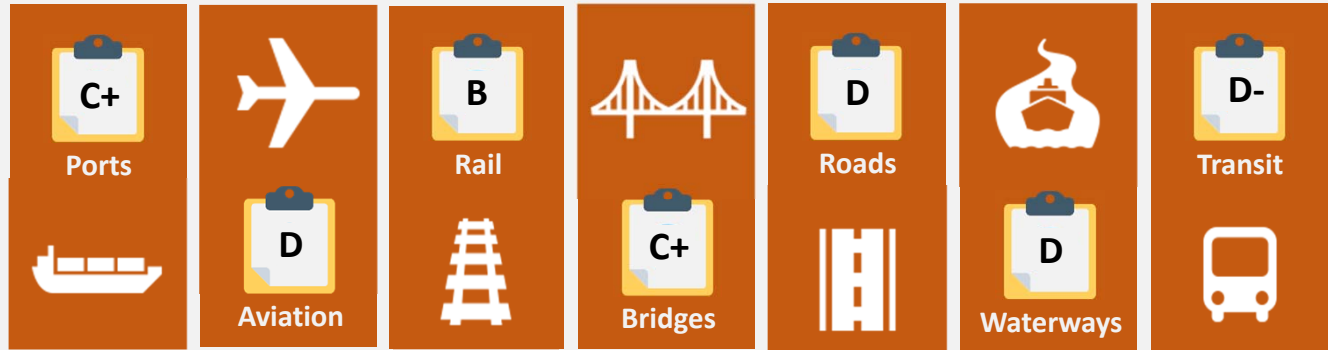
“Where Excellence and Transportation Meet”

2017 Infrastructure Report Card



America's Cumulative Infrastructure
Grade:

D+



A: Exceptional B: Good C: Mediocre D: Poor F: Failing

Loss in American Families Income

**\$3,400 per year — about \$9
each day**



Investment Needed

+2T ↑

Yearly Additional Investment Needed

+206B ↑

(by Congress and States)

Failure to Act

Losses to the U.S. GDP

3.9T ↓ (by 2025)

Losses in Business Sales

7T ↓ (by 2025)

Loss in Employment

2.5M ↓ (by 2025)



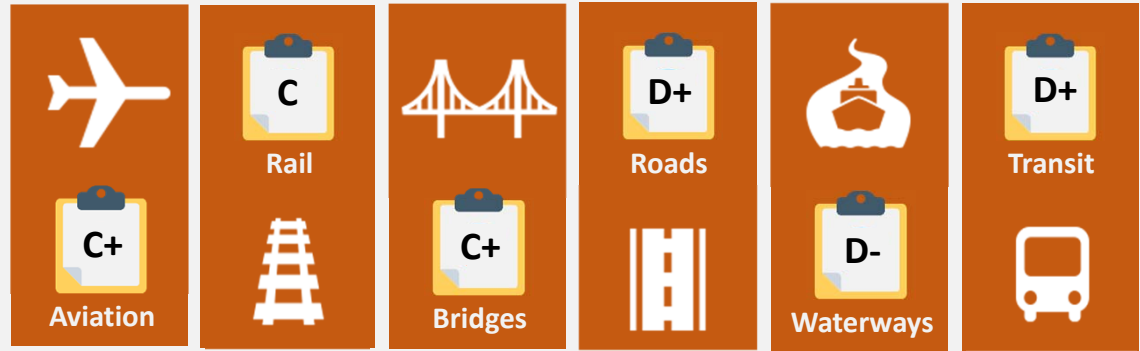
Illinois Center for Transportation
University of Illinois at Urbana Champaign

2017 Illinois Infrastructure Report Card



Illinois' Cumulative Infrastructure Grade:

C-



A: Exceptional B: Good C: Mediocre D: Poor F: Failing

Aviation:



Commercial Airports: 11
Passengers: 42M

Bridges:



3rd Largest Bridge Inventory
Nationwide – 16%
Structurally Deficient

Inland Waterway:



Goods Shipped: 116M Tons
Value: 23B

Roads:



42% Mediocre Condition
VMT ▲ 25% (1990-2012)

Rail:



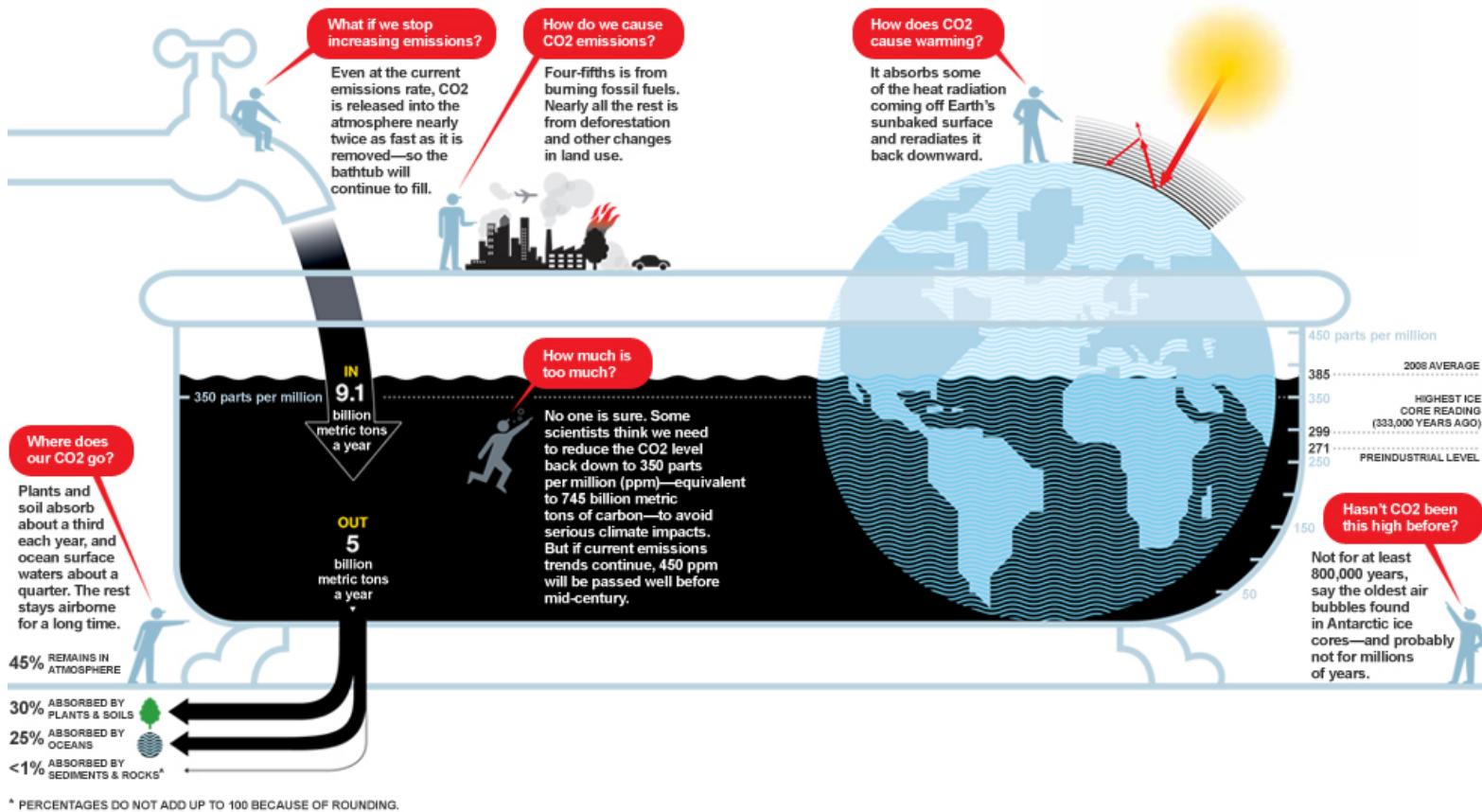
2nd Largest Nationwide
6M Riders (Amtrak)



Illinois Center for Transportation
University of Illinois at Urbana Champaign



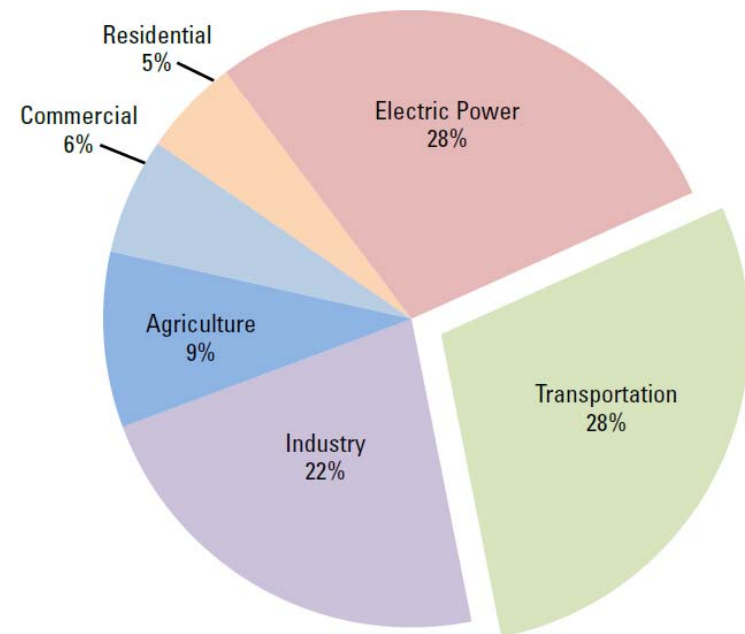
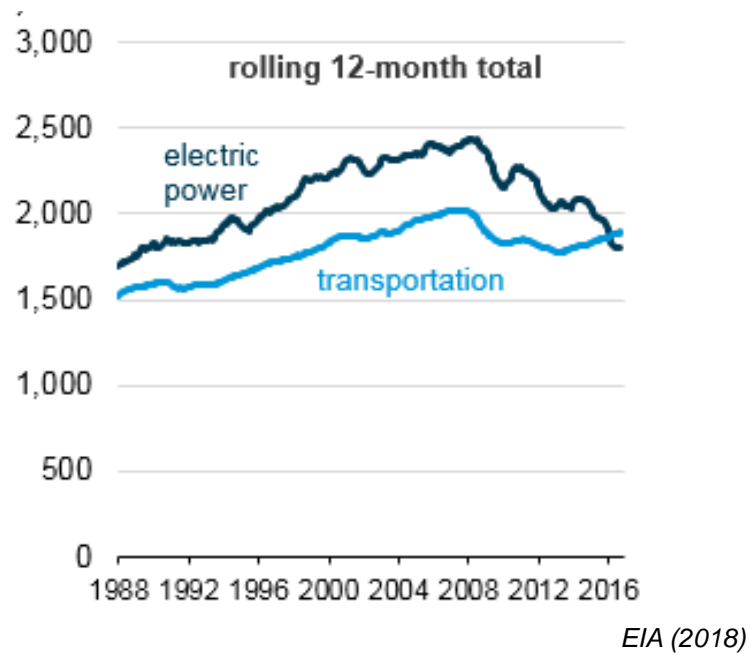
The “Carbon” Bathtub



“Where Excellence and Transportation Meet”



Carbon Dioxide Emission in The U.S.



“Where Excellence and Transportation Meet”



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Transportation
University of
Illinois at Urbana
Champaign

Transportation Related Emissions - USA

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
GHG Emissions





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Champaign

Transportation Related Emissions - Illinois

GHG EMISSIONS PER CAPITA (tCO₂ e/cap)



18.2

3.5x Larger than Worldwide
Average

US RANK IN GHG



#4

#31 GHG/CAPITA

TRANSPORTATION GHG EMISSIONS
PER CAPITA (tCO₂ e/cap)



4.92

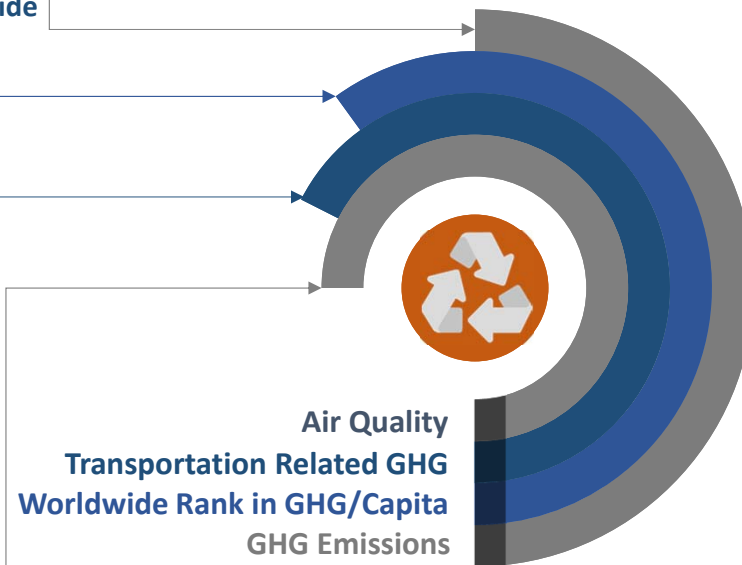
27% of Total GHG Emissions

AIR POLLUTION INDEX (PM 2.5)



9.6 $\mu\text{g}/\text{m}^3$

Benchmark: 10 $\mu\text{g}/\text{m}^3$

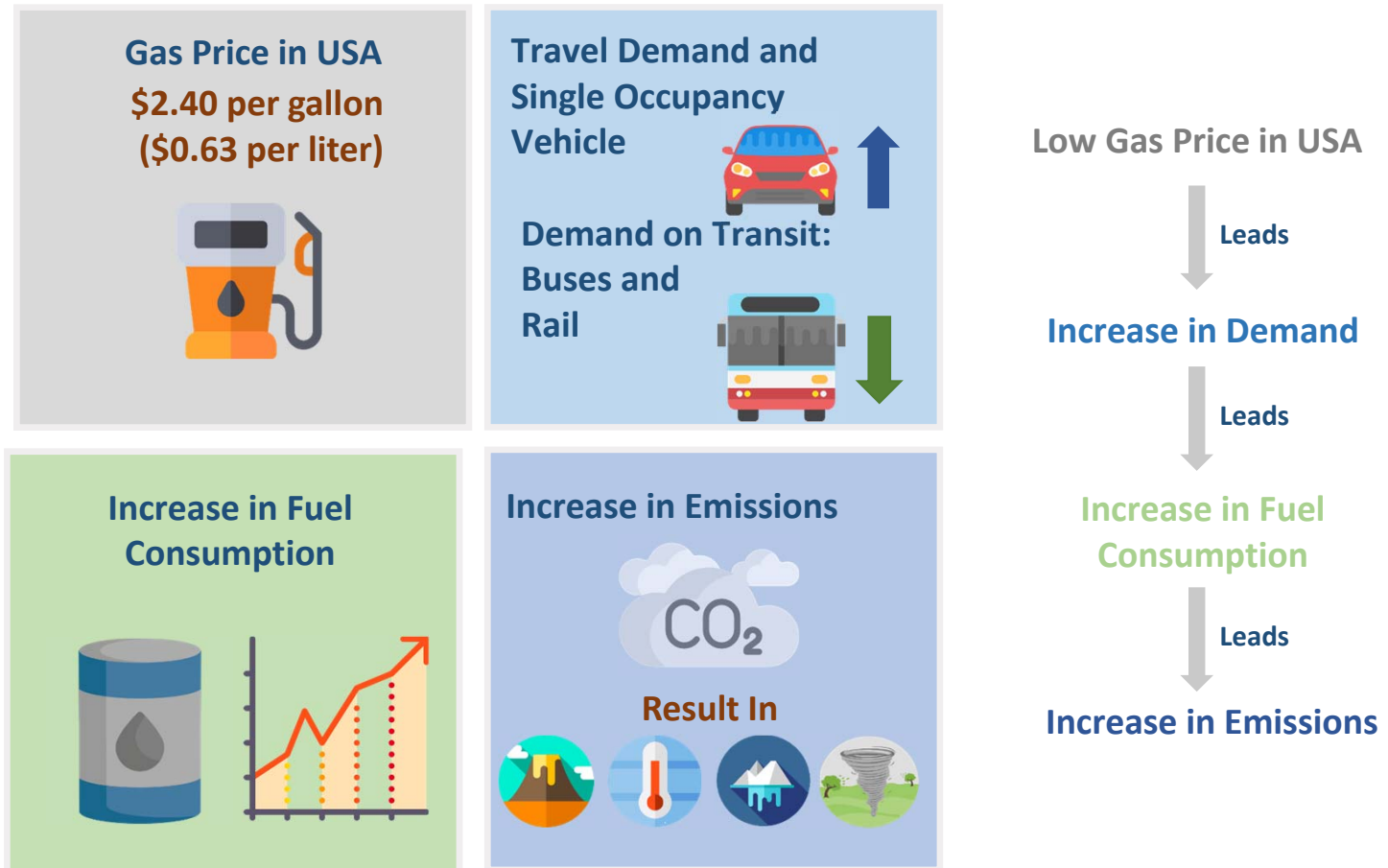




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Transportation Sustainability

Transportation Related Emissions - Illinois



Value Proposition

Multiplatform testing arena focused on continuous and connected autonomous high-speed mobility (i.e. freight transportation); including:

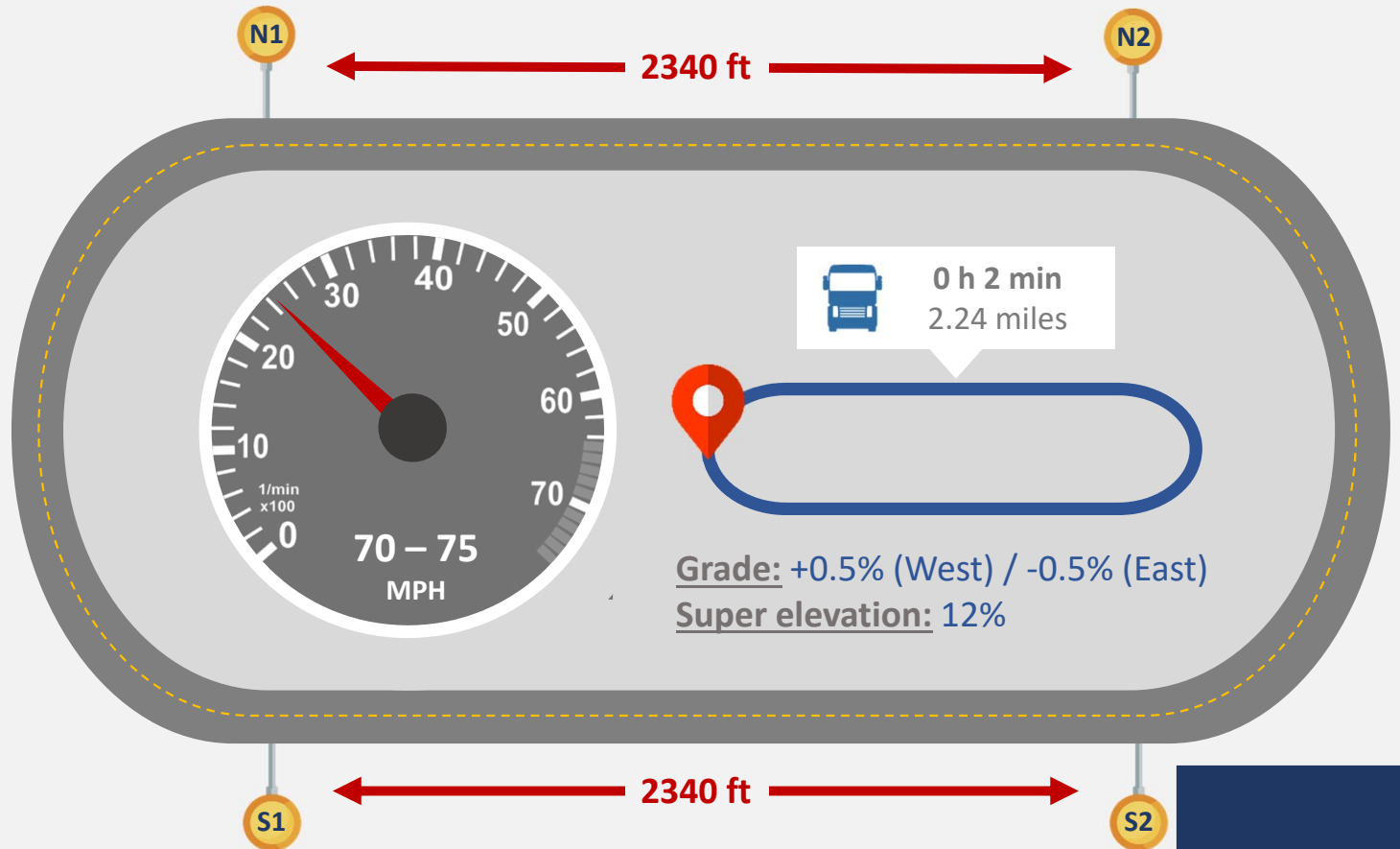
- Close testing environment
- Open municipal environment
- Open high speed road environment
- Workforce training



≈250 acres of land

Illinois Autonomous and Connected Tracks (I-ACT)

Smart Freight



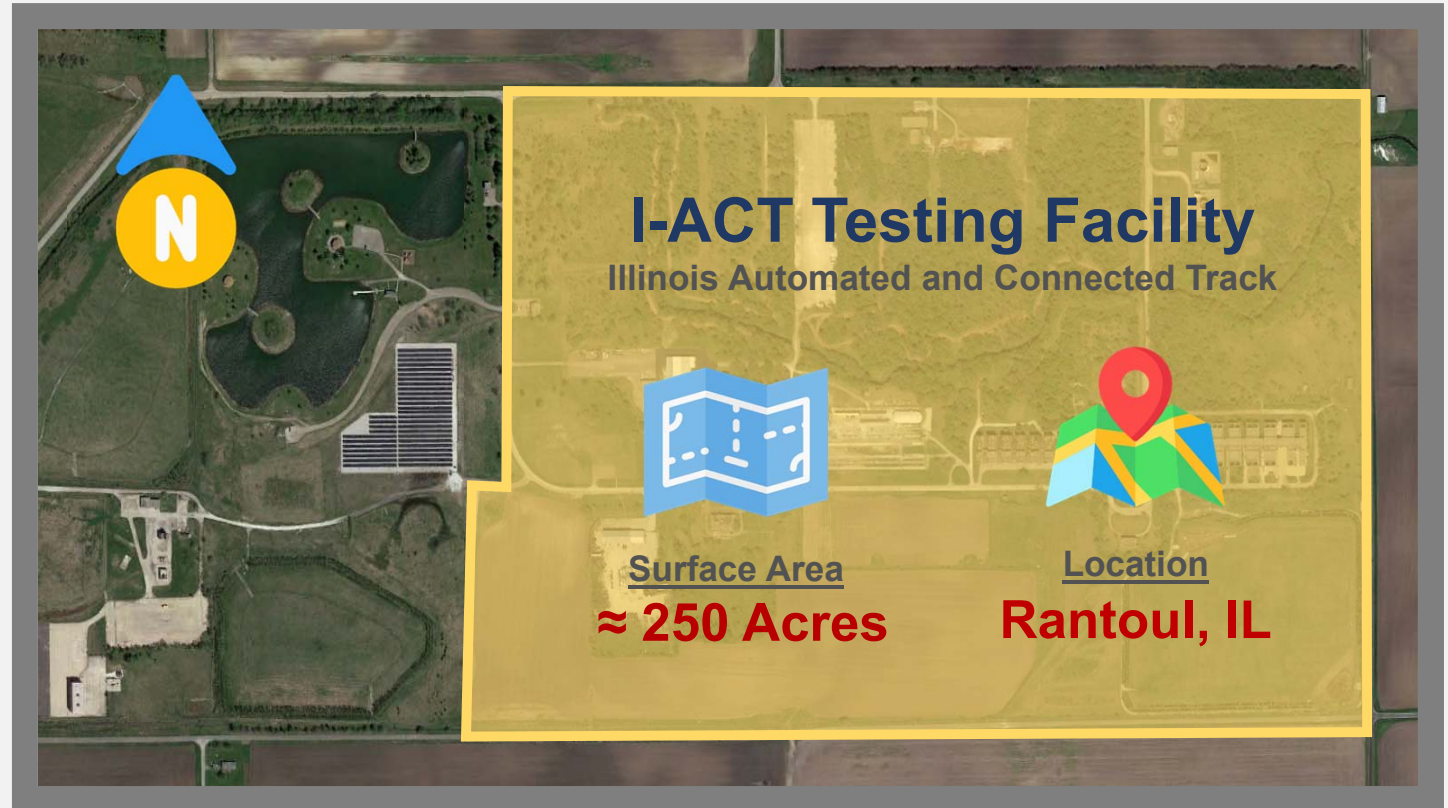
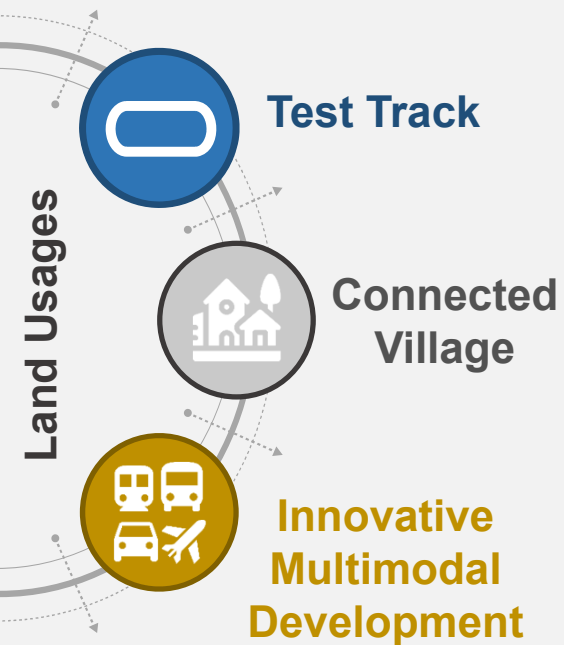
Track Length:

2.24 miles

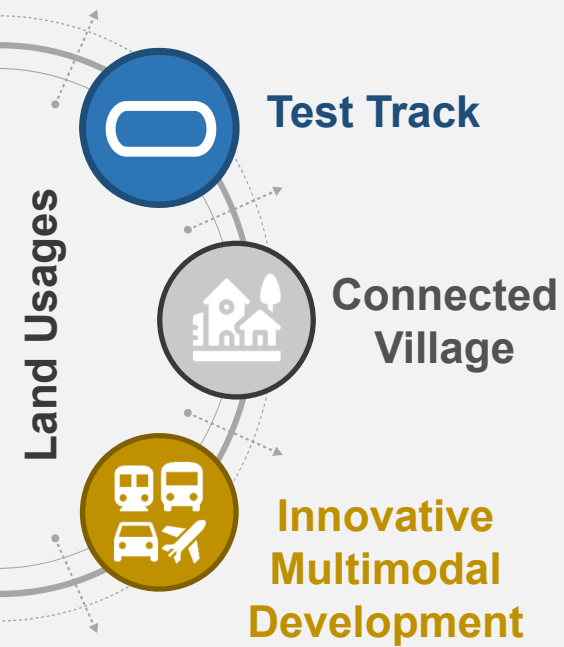
Speed: **70-75 MPH**



Land Acquisition Allocated to I-ACT and STII



Land Acquisition Allocated to I-ACT and STII

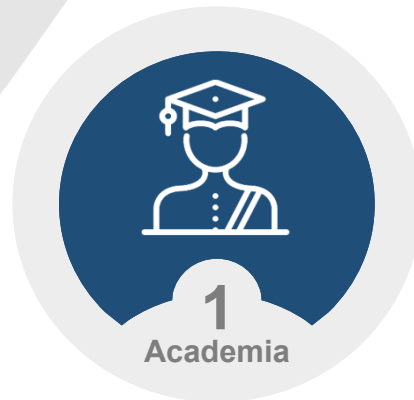




Partnerships



“ Parties interested in developing and testing products and technologies related to telematics, high-speed mobility, including freight (using V2V, V2I, V2X, V2H, V2G, V2I, and V2A) ”



1
Academia



2
Industry



3
Government

Facilitate Integration of New Concepts, Technologies, and Deployment

Sensing/control systems at various spatial-temporal scales; security and fault tolerance; Verification and Validation (V&V); flow and infrastructure performance implications; and IoT

Potential Collaborators

Physical Infrastructure

Road/ Bridge Construction
New Materials
Road Signage
DOT's
Energy Companies



Vehicles Entities

Car and Truck OEM
Tiers 1 and 2 Suppliers
Software Developers



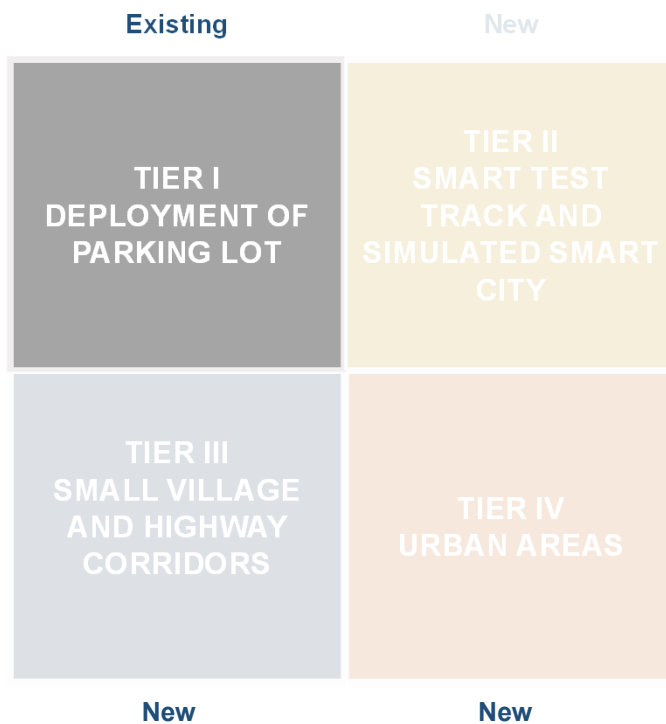
Communication/ Telemetry

Artificial intelligence
Data Analytics
Logistics
Car Share
Ride Share
V2V/ V2I /
V2H / V2A/ V2G/ V2X/
V2I/....



- We offer research expertise and deployment in:
Infrastructure, Sensing, Robotics, Artificial intelligence, Policy and law, Control, Security, Data science, Computing, Human factors, Economic & management, and Workforce training

Illinois Autonomous and Connected Tracks (I-ACT) Development Stages



- Immediate opening to testing trucks, vehicles, drones in open space
Parking lot of 15000 ft²
- Construction of a **2.24 miles of smart track** and “authentic smart city” including, intersection, bike paths, and sidewalks
- Use of interstate corridors and Village of Rantoul for validation
- Deployment of developed technology in urban areas (e.g., Chicago)

Illinois Autonomous and Connected Tracks (I-ACT) and Connected Village



Instrumented Physical Infrastructure



Cyber-Physical Infrastructure and Databases



Platform for System Control, Operation and Planning



Internal Zones of Loop

Multimodal Transport
Monitoring Tower
Drones Testing Facility
V2V and V2I
Communication

Smart Suburban City
Data Collection Center
V2H Interaction Facility
Freight Loading/
Unloading Stations
Parking Facility

Energy Harvesting

Solar Panels
Smart Material Laboratory



Autonomous Agriculture

Autonomous Testing
Fields

Smart Urban City

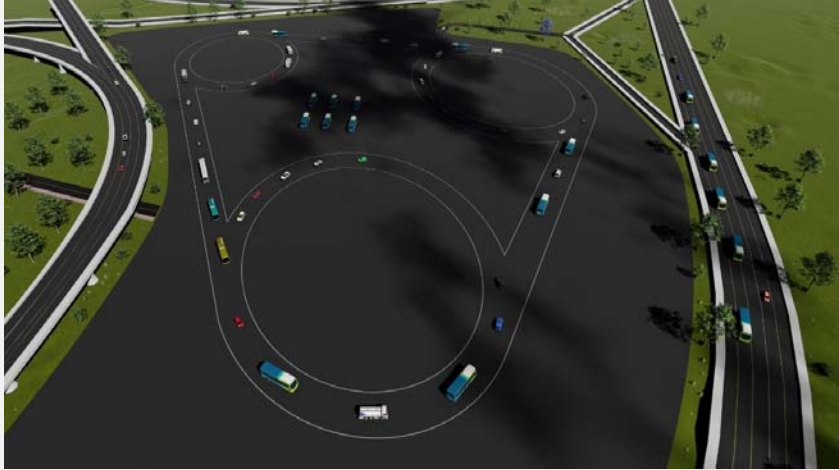
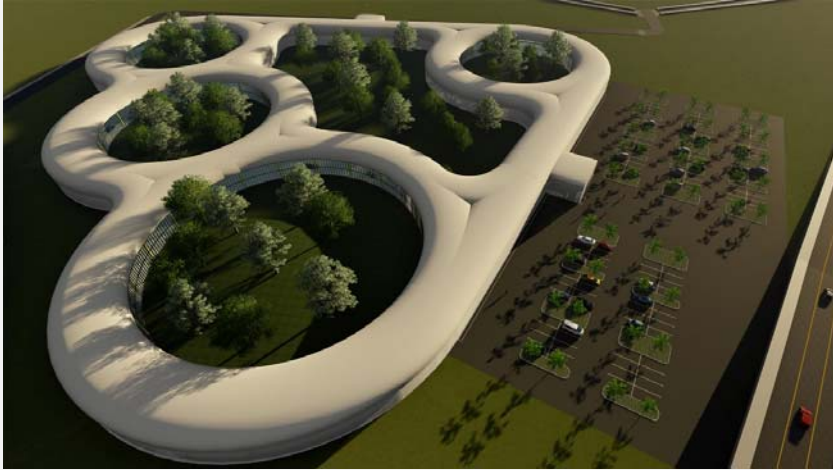
Public Transport
Emergency Response
Control

Climate Control

Indoor Track with
Controlled Climate



Illinois Autonomous and Connected Tracks (I-ACT)
Testing Facilities



Example: Local “Last-Mile” and Floating Warehouse

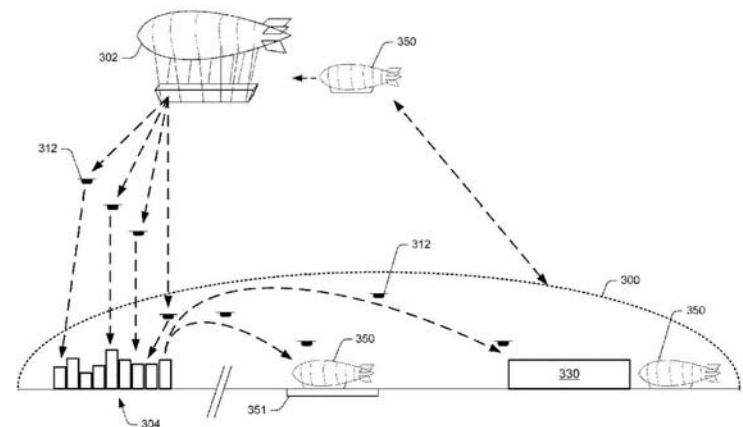
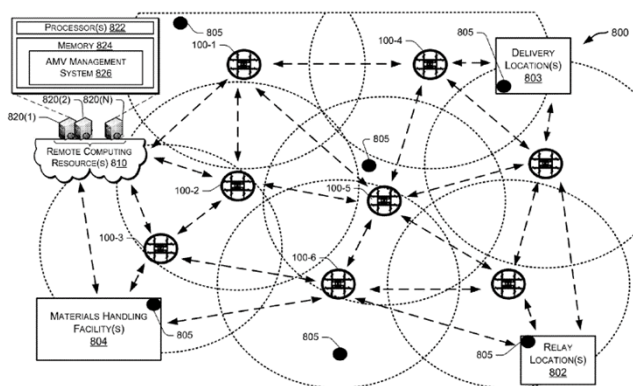
Freight industry (e.g., Amazon, DHL, UPS) has been exploring the possibility of using short-range unmanned aerial vehicles (i.e., drones) to deliver parcels from a mobile dispatch base near customer neighborhoods.

UPS has a delivery truck that can launch a drone

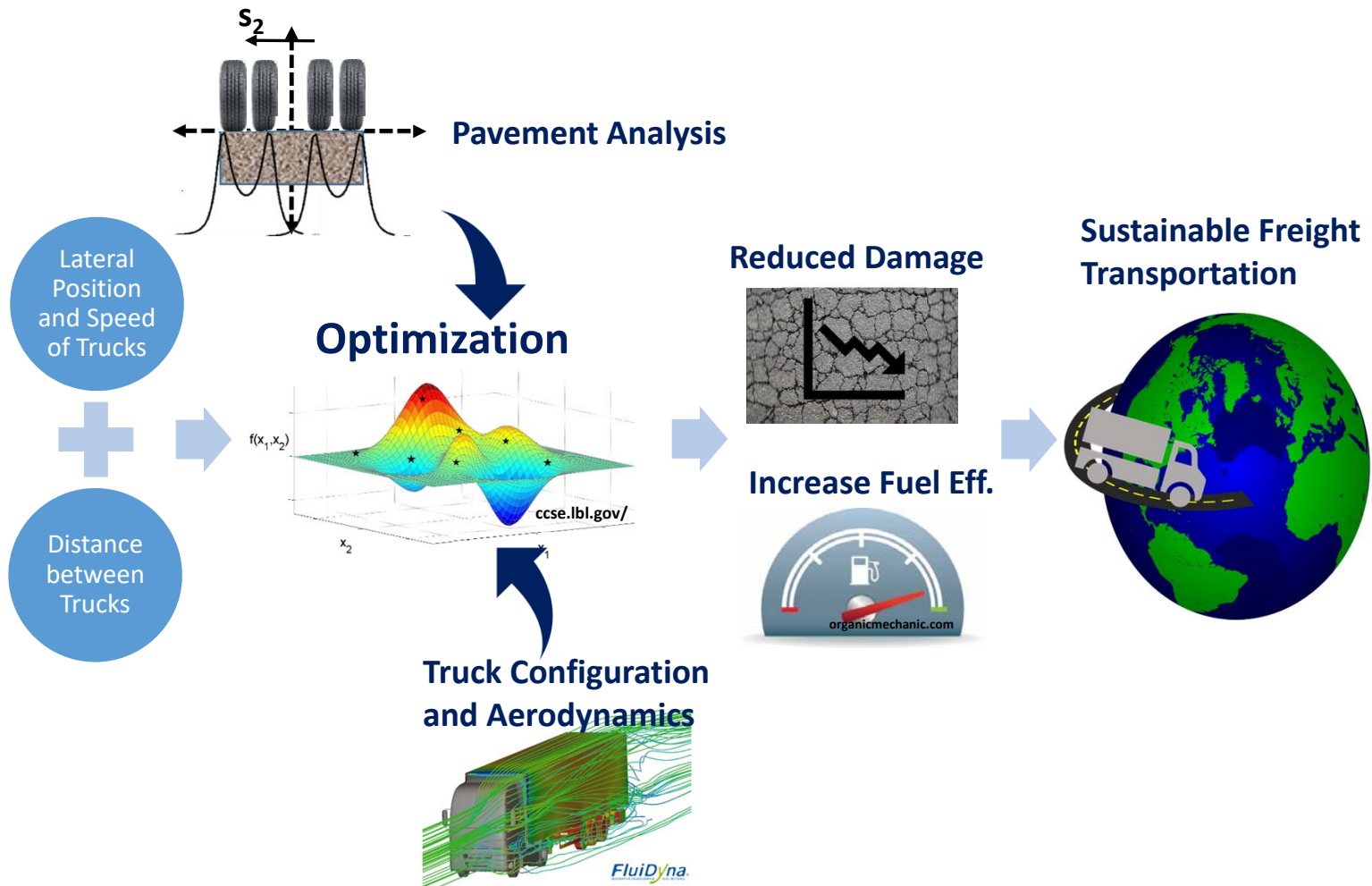
First residential drone delivery completed on Monday

By Jacob Kastrenakes | @jake_k | Feb 21, 2017, 5:36pm EST

f t s SHARE



Platooning: a Challenge to Opportunity



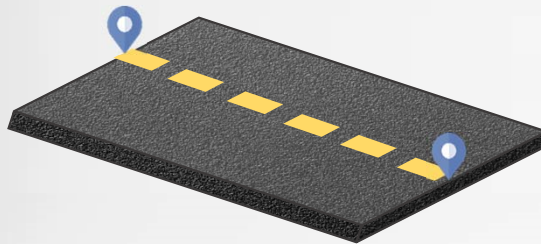
Cost – Benefit Analysis of Platooning Case Study



Truck Platooning comprises a number of trucks equipped with driving support systems, closely following the other.

Interstate I-90 - Chicago Urban

Length: **1 mile**
Annual average daily traffic (AADT): **285,600**
Truck %: **4**

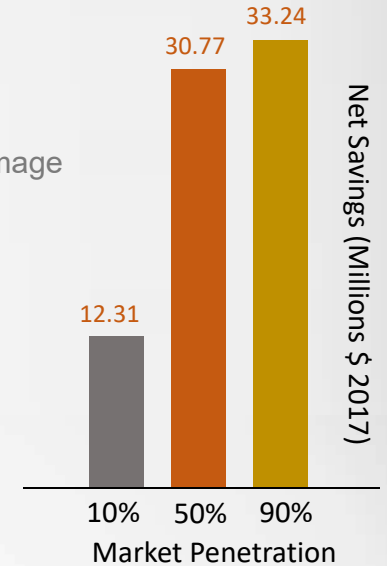


Benefits:

- Fuel Reduction Saving
- Emission Saving
- Reduced Pavement Damage
- Less Truck Crashes
- Reduced User Cost

Costs:

- Equipment Investment



Opportunities

Economic/Social Investment

An entity invests in the testing arena development

Performance Testing

A private entity provides a developed product and test its feasibility

Academic Research Sponsorship

Sponsor involvement is strictly monetary

Team Research and Development

The sponsor provides funds and collaborates with the STII team

Technical Support

A government entity or a company leases a portion of the track or the testing arena to use according to its needs.



Key Activities



Major Milestones to Date



**Smart
Transportation
Infrastructure
Initiative (STII)
Kick-Off**
December, 2017



**STII Industry Forum
in Chicago**
*Request for
Information*
June, 2018
*One-on-One
Meetings*
September 2018



**STII Educational
Leaders Meeting**
*UIUC, UIC,
Northwestern*
July, 2018



**IDOT leadership,
UIUC, NU, and UIC
leaders** *discussed
the I-ACT vision*
November 2018



On October 25, 2018, an executive order
was signed for the **creation of Autonomous Illinois**

The background of the top half of the slide features three statues of the University of Illinois. On the left is the 'Maiden' statue, in the center is the 'Minerva' statue, and on the right is the 'Cassidy' statue. The scene is set against a sky with clouds, with a blue-to-orange gradient overlay.

Thank You!

alqadi@Illinois.edu

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