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

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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

Access to smart urban/suburban city

Agricultural land and market roads

Four seasonal variations

Multimodal transport

High-speed platooning of freight trucks

Illinois Autonomous and Connected Track (I-ACT)
Illinois Autonomous and Connected Track (I-ACT)

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

- **Nearby access to multimodal transport** (road, air, rail)
- **Freight logistics at high-speed** (fastest loop)
- **75 mph**
- **Fastest computing and top data analytics** (NCSA)
- **5G Connectivity**
- **Large-scale effort for V2I** (instrumented infrastructure)
- **Drones and 3D mobility**
- **Agricultural machines and market road use**

- **Pool of expertise from top-tier universities**

- **Multidisciplinary Partnership**
  - Government
  - Academia
  - Non-Profit Organization
  - Industry
  - I-ACT Leadership

A clear opportunity for advancing the transportation agenda of the United States.
<table>
<thead>
<tr>
<th>State</th>
<th>Illinois</th>
<th>ACM</th>
<th>Mcity</th>
<th>SMARTCenter</th>
<th>SunTrax</th>
<th>Smart Road</th>
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</thead>
<tbody>
<tr>
<td>Use</td>
<td>Freight &amp; multimodal logistics</td>
<td>Testing, development, &amp; validation</td>
<td>Smart city</td>
<td>Urban network and intersection</td>
<td>Testing, development, &amp; validation</td>
<td>Testing, development, &amp; validation</td>
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<td>Management</td>
<td>Non-Profit</td>
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<td>Partnership</td>
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<td>Vehicle calibration and dynamics</td>
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<td>Small vehicle (car and shuttle)</td>
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<td>Highway speed ≥ 65 mph</td>
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<td>25</td>
<td>60</td>
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<td>V2V, V2I, &amp; V2X Research</td>
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<td>Multi-platform test facility</td>
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<td>Data management &amp; real-time analytics</td>
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<td>Four seasons</td>
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<td>Instrumented infrastructure (including pavement, tunnel, &amp; bridges)</td>
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<td>Loop track</td>
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<td>Tunnel and bridge</td>
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<td>Controlled climate module</td>
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<td>Agricultural land &amp; market roads</td>
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<td>Drone testing</td>
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<td>Nearby multimodal facilities (grid-system network, rail, and airport)</td>
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Ready to provide a large-scale V2V/V2I/V2X testing arena and spearhead autonomous and connected transportation policies

**Infrastructure and energy harvesting**
- Three-lane highway and arterial roads
- V2V, V2I, V2X
- V2V, V2I, V2X
- Three-lane highway and arterial roads

**New CAV technology and retrofitting existing vehicles**

**Distribution**
- Multi-modal fleet, supply chain, and logistics

**Synergy**
- Near multimodal facilities (grid-system network, rail, and airport)

**Connectivity**
- Control climate module
- Loop track
- Instrumented infrastructure (including pavement, tunnel, & bridges)
- Tunnel and bridge
Collaborative opportunities to invest and utilize the I-ACT testing arena

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

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

**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

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

Reduced Damage

Increase Fuel Eff.

Sustainable Freight Transportation

Truck Configuration and Aerodynamics

ccse.lbl.gov

FluiDyna
Thank You

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