KCITE

Integrated Corridor Management

Transportation of the Future

Ray Webb, PE, PTOE
Jennifer Russell, EISE

OPERATION GREENLIGHT
Turning Stop Lights into Go Lights

GARVER

Sept 22, 2016

Agenda



- What is ICM? (~ 30 mins)
  - Concept
  - Processes
- Ongoing ICM across the US (~ 30 mins)
  - US DOT ICM Pilot Projects
  - KDOT/MARC I-35 ICM
- Team ICM exercise (~ 30 mins)

Your instructors



Ray Webb, PE, PTOE

OPERATION GREENLIGHT
TURNING STOP LIGHTS INTO GO LIGHTS



Jennifer Russell, EISE

GARVER

+ You

What we do

- Room orientation
- Cell phones
- Breaks
- Questions

- Your expectations?



What does our transportation future look like?

The Electronic Highway: How 1960s Visionaries Presaged Today's Autonomous Vehicles

By Evan Ackerman (/author/ackerman-evan-)

Posted 2 Aug 2016 | 17:00 GMT



Photo: The Ohio State University

Agenda



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  - **Concept**
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What is ICM? - Concept

- Integrated – working together as one
- Corridor – a space of movement for people and goods
- Management – monitoring & controlling

- Using and managing all transportation resources in a corridor
  - Highway
  - Transit
  - Arterials
  - ITS
  - Operations managers

"ICM provides the opportunity to proactively improve and maximize the performance of the transportation system by serving as an alternate to traditional major infrastructure investments which may be more expensive or constrained by environmental issues. " Alex Estrella, ICM Manager, San Diego Association of Governments

SANDAG

What is ICM? - Concept

US DOT definition

What is Integrated Corridor Management?



What is ICM?

- Multi-modal
- Pro-active
- Max use of existing capacity
- System-wide perspective

- Increase reliability
- Efficient flow

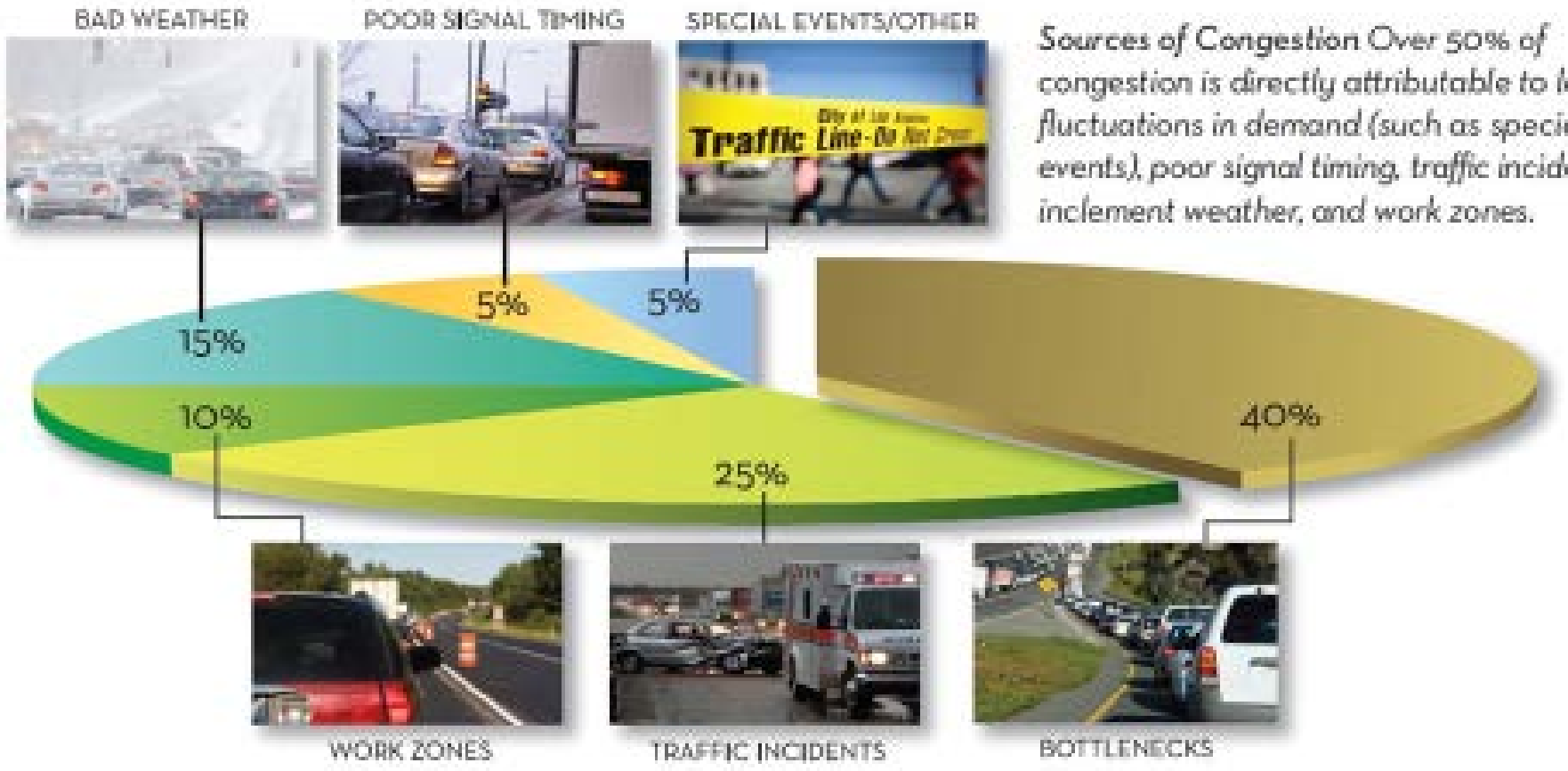
- Cooperative







Why Planning for Operations?

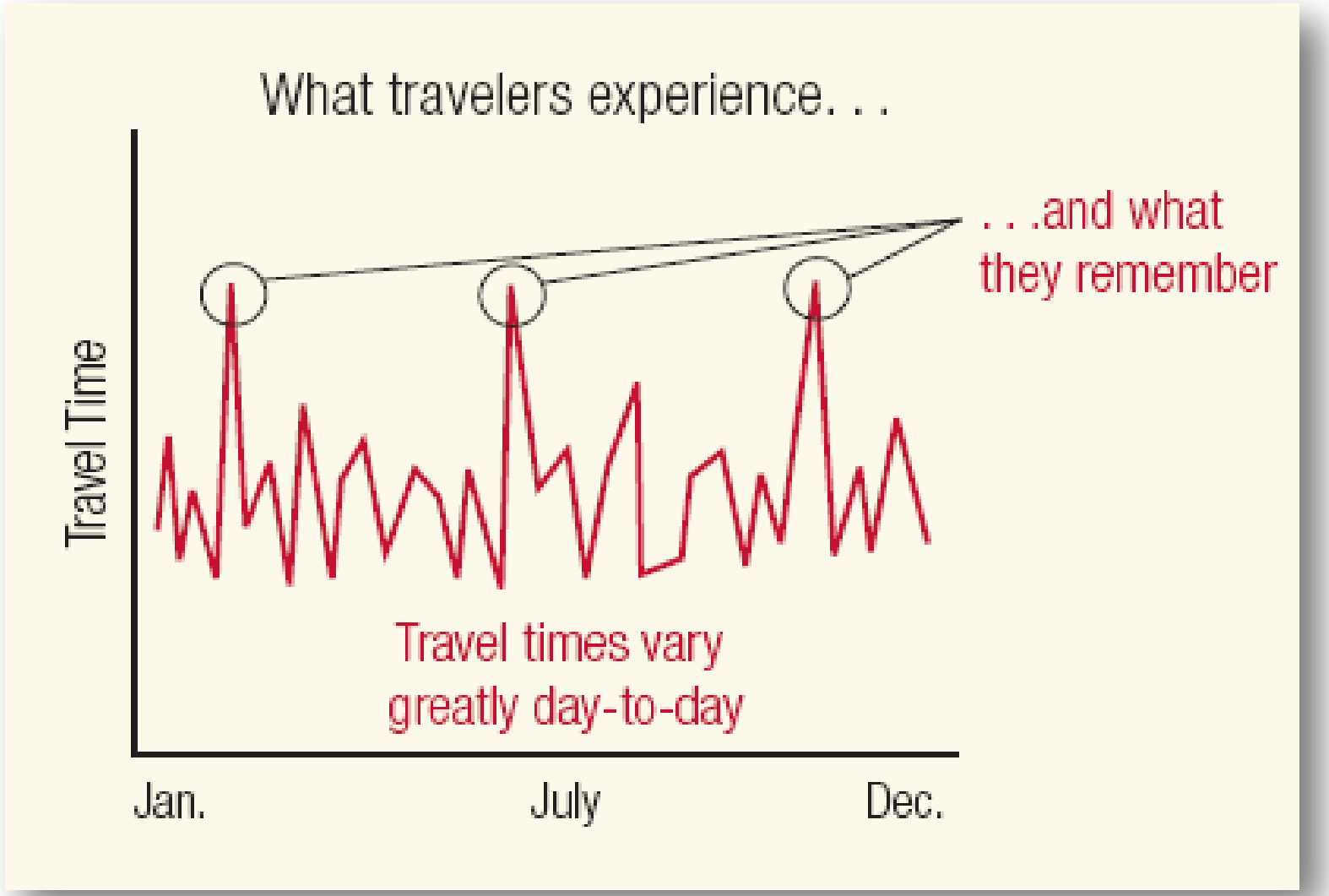


Sources of Congestion Over 50% of congestion is directly attributable to large fluctuations in demand (such as special events), poor signal timing, traffic incidents, inclement weather, and work zones.

US DOT view

What is ICM? - Concept

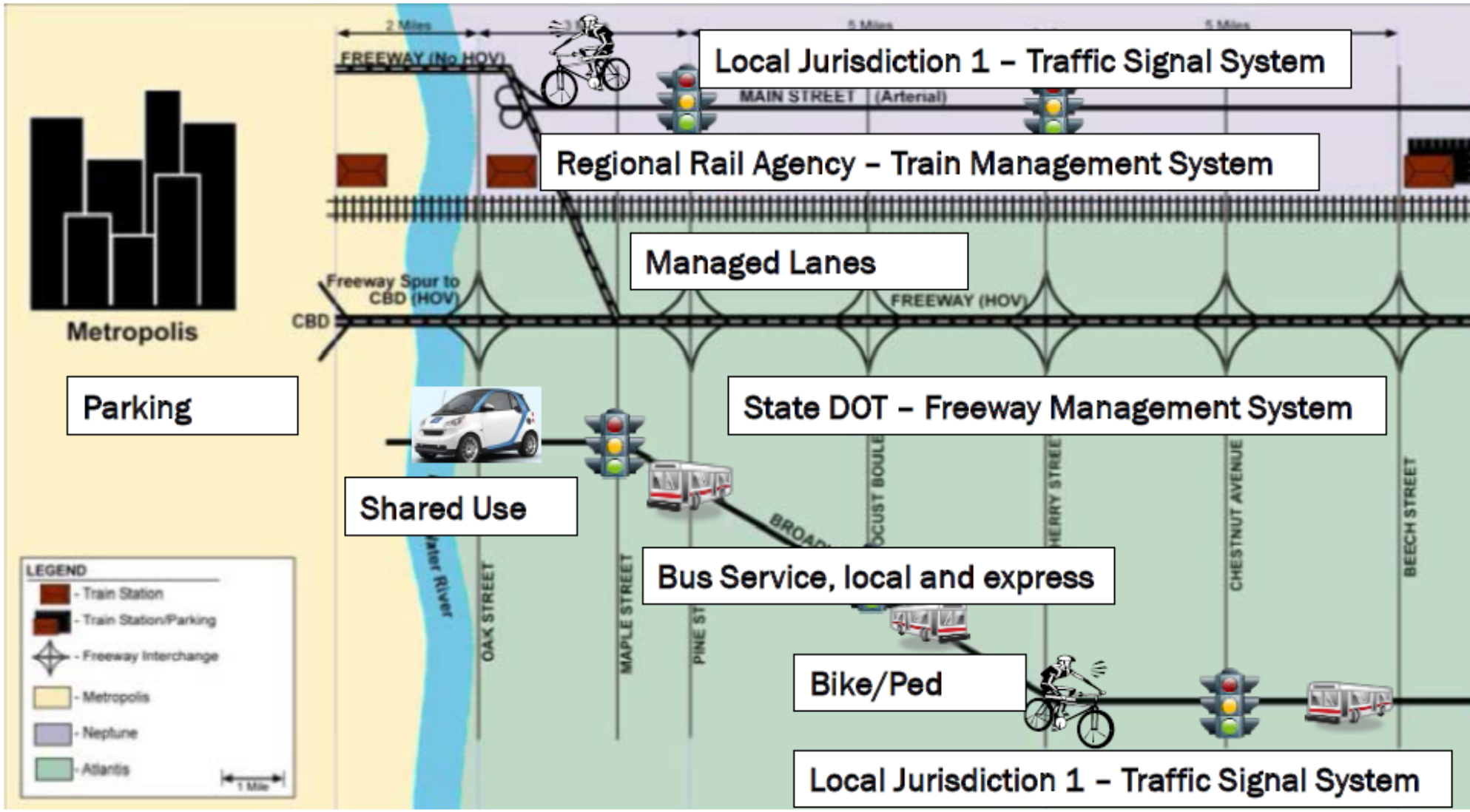
Travel time reliability



Source: FHWA Travel Time Reliability brochure

Cross traditional transportation boundaries

What is ICM - Concept



http://www.fhwa.dot.gov/ipd/images/revenue/webinars/congestion_pricing_022415/generic_corridor_map.png

What is ICM - Concept

- Is KC **Active** or **Integrated** or **Both**?

What is ICM - Concept

Active

- Optimizes system performance and user experience within a *region* or *road segment*
- Strategies may be applied together with other strategies or in isolation to dynamically manage operations
  - E.g. dynamic ramp metering
- Multi-agency coordination is *needed*

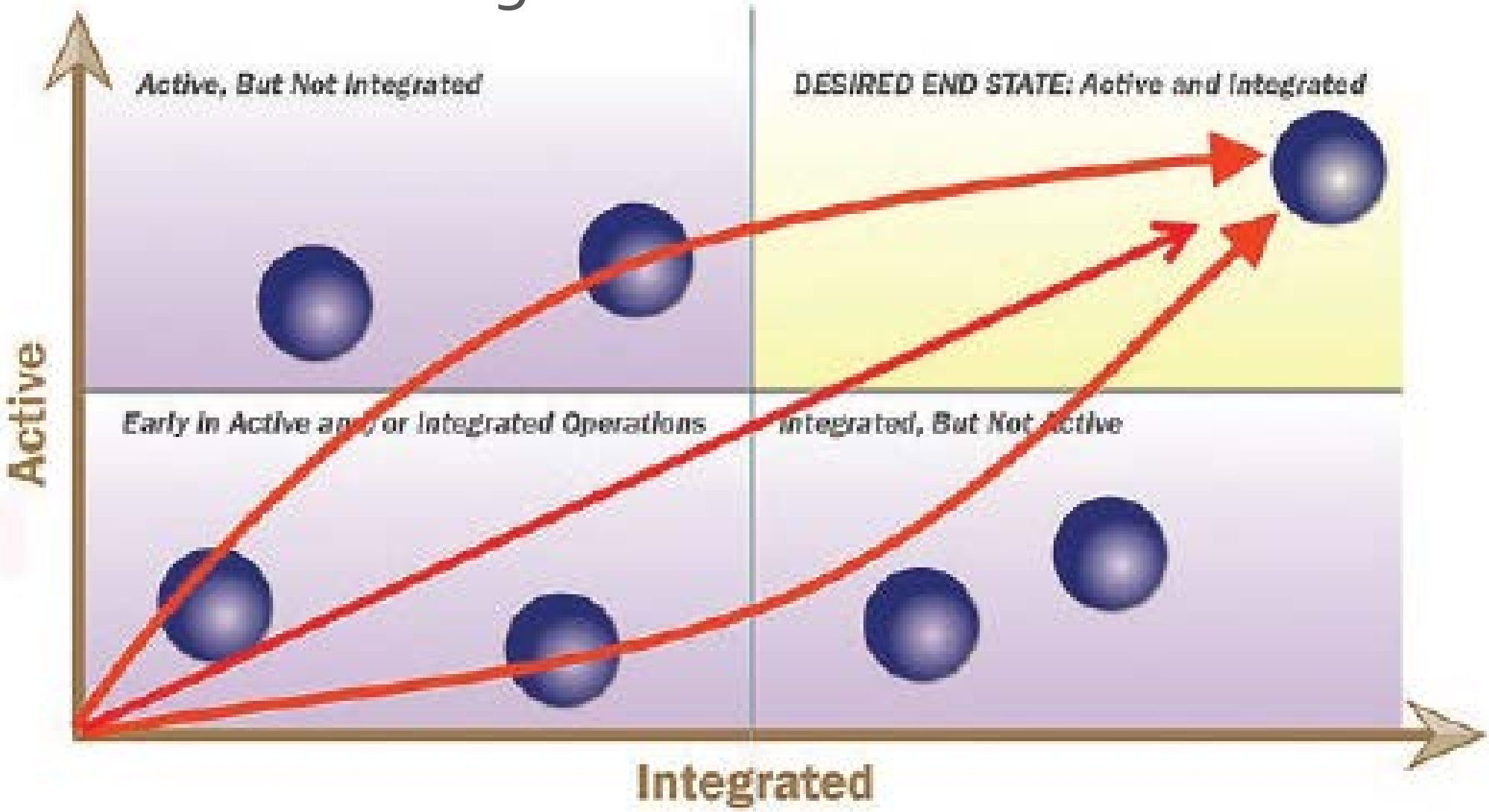
Integrated

- Optimizes system performance and user experience within a *multimodal corridor*
- Strategies are integrated across mode (highway/arterial) and transit
  - E.g. dynamic ramp metering + mode shift options
- Multi-agency coordination is a *must*

Adapted from: US DOT ICM Deployment Workshop, 2012

What is ICM - Concept

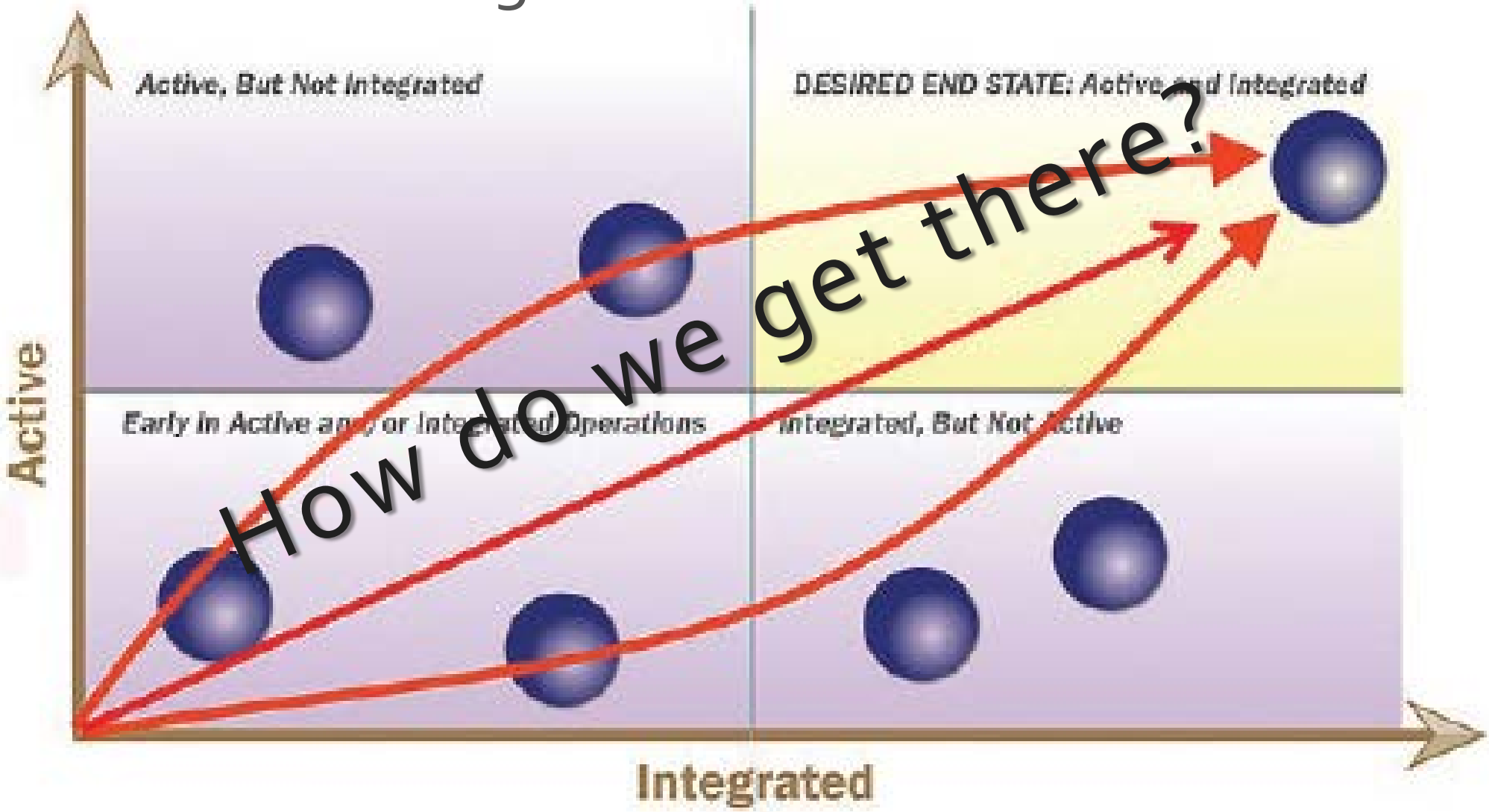
Active – Integrated Continuum



http://www.ops.fhwa.dot.gov/publications/fhwahop16036/images/f2.png

What is ICM - Concept

Active – Integrated Continuum



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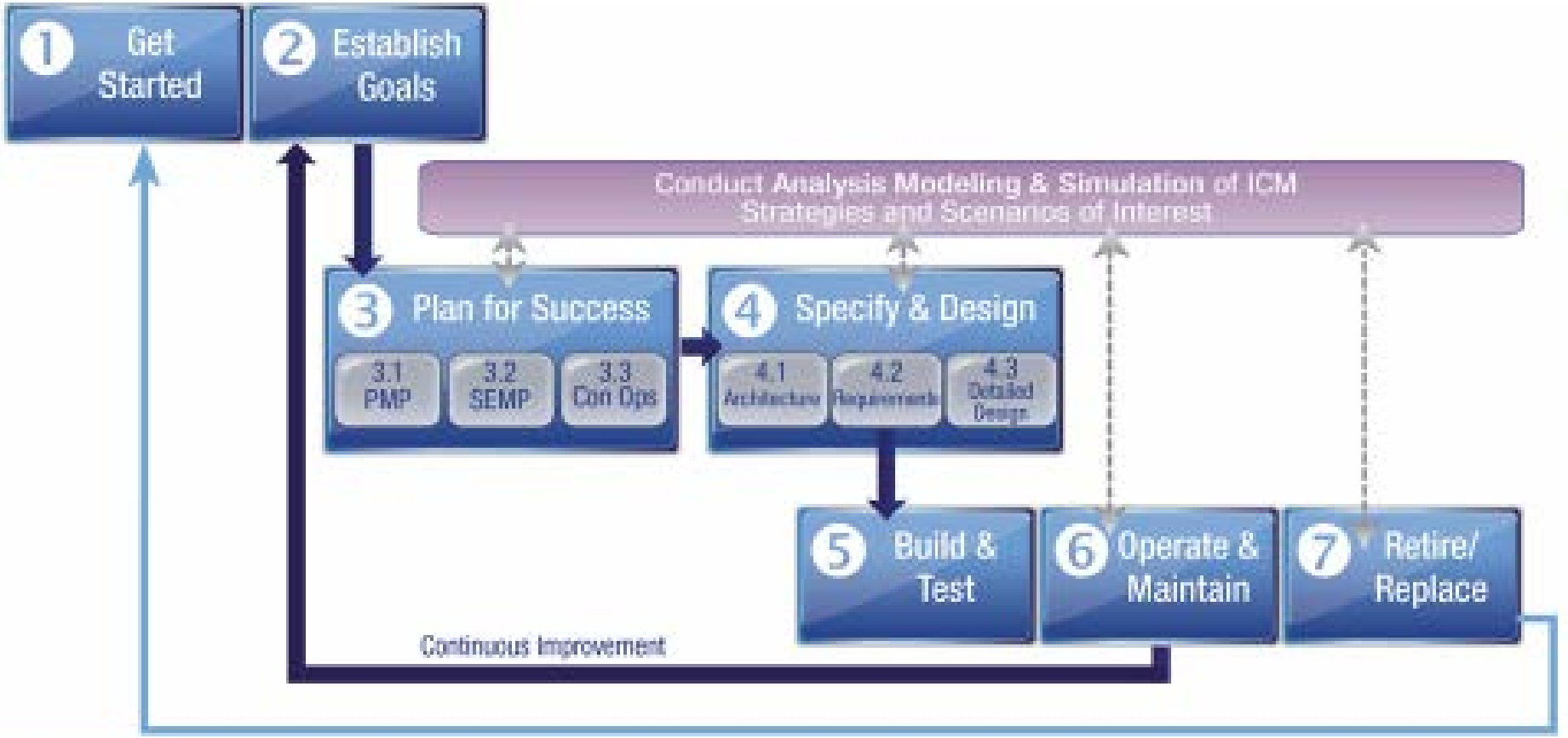


- What is ICM? (~ 30 mins)
  - Concept
  - **Processes**
- Ongoing ICM across the US (~ 30 mins)
  - US DOT ICM Pilot Projects
  - KDOT/MARC I-35 ICM
- Team ICM exercise (~ 30 mins)

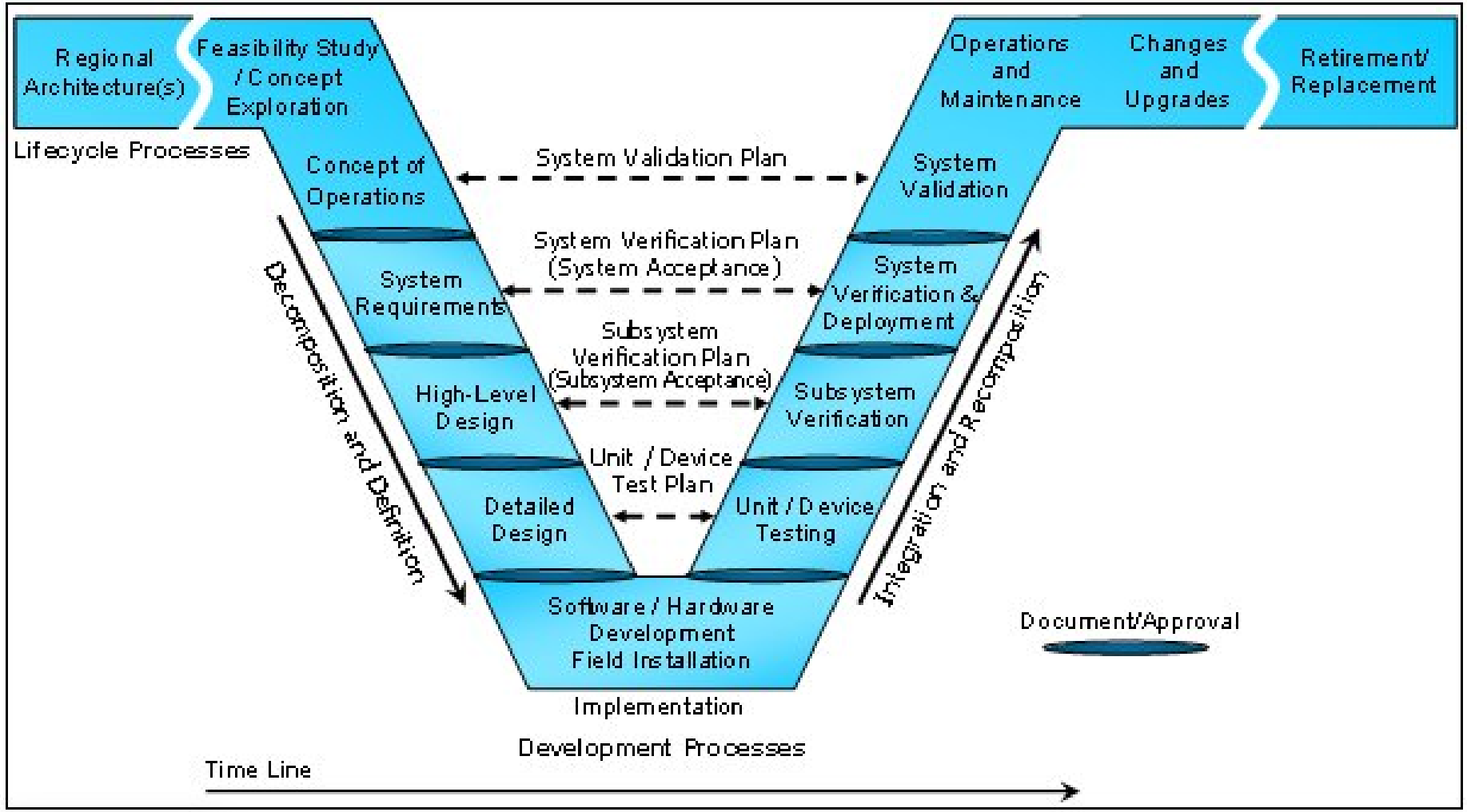
What is ICM - Process

US DOT definition

7-Phase ICM Implementation Process



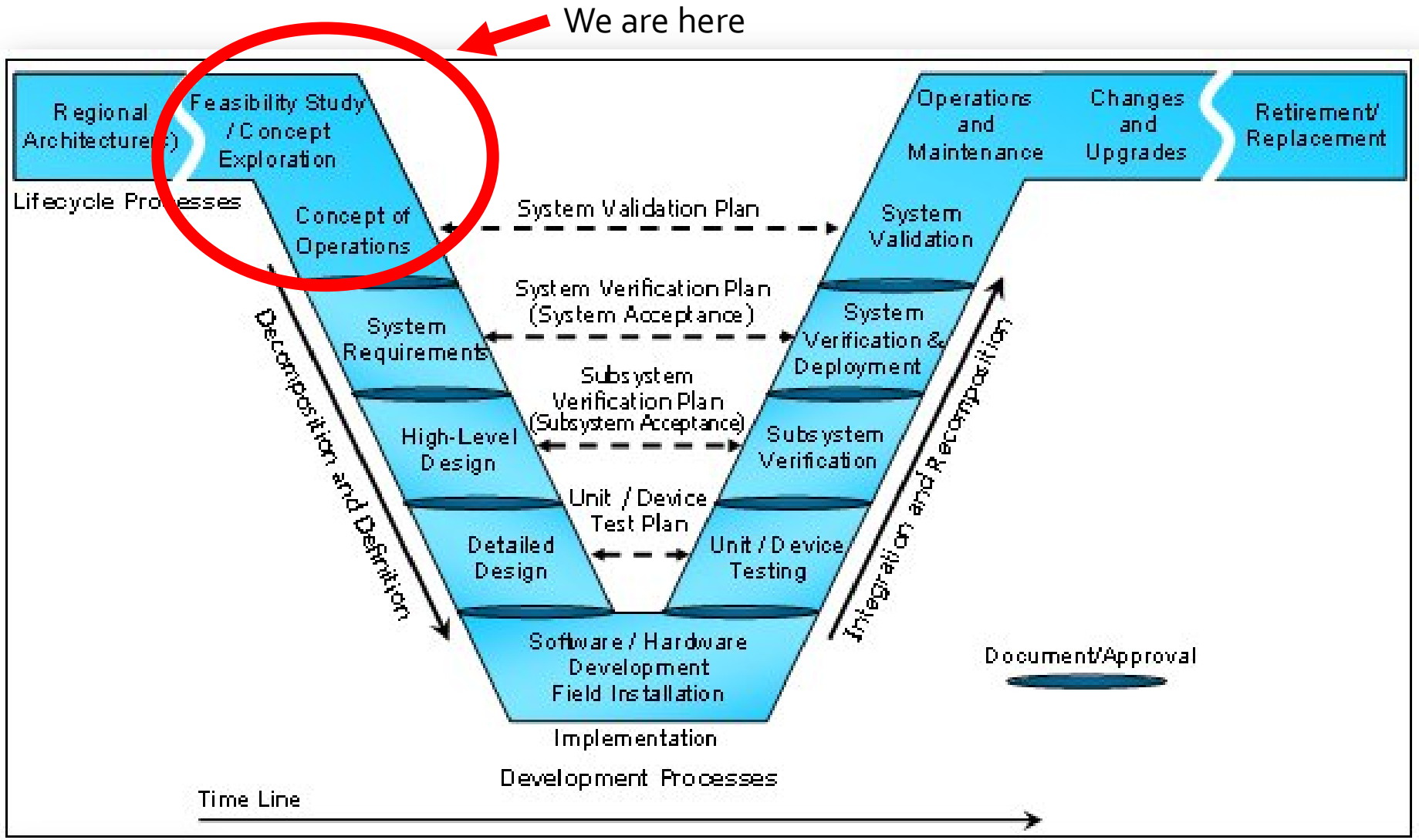
What is ICM - Process



FHWA – ITS model

Systems Engineering – Flying Vee

What is ICM - Process



FHWA – ITS model

Systems Engineering – Flying Vee

What is ICM - Process



stakeholders



plan



ICM CMM Model

		Level 1 Silo	Level 2 Centralized	Level 3 Partially Integrated	Level 4 Multimodal Integrated	Level 5 Multimodal Optimized
Institutional Integration	Inter-agency Cooperation	Agencies do not coordinate their operations	Some agencies share data, but operate their networks independently	Agencies share data, and some cooperative responses are done	Agencies share data, and implement multi-modal incident response plans	Operations are centralized for the corridor with personnel operating the corridor cooperatively
	Funding	Single Agency	MPO tracks funding	Coordinated funding through MPO	Cooperatively fund deployment projects	Cooperatively fund deployment and operations and maintenance of projects
Technical Integration	Traveler Information	Static information on corridor travel modes	Static trip planning with limited real-time alerts	Multimodal trip planning and account based alerts	Location-based, on-journey multimodal information	Location-based, multimodal proactive routing
	Data Fusion	Limited or Manual	Near real-time data for multiple modes	Integrated multi-modal data (one-way)	Integrated multi-modal data (two-way)	Multi-source multi-modal data integrated and fused for operations
Operational Integration	Performance Measures	Some ad-hoc performance measure based on historic data	Periodic performance measures based on historic data	High-level performance measures using real-time data	Detailed performance measures in real-time for one or more modes	Multi-modal performance measures in real-time
	Decision Support System	Manual coordination of response	Pre-agreed incident response plans	Tool selection of pre-agreed plans	Model based selection of pre-agreed plans	Model based creation of incident response plans

Agenda



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Ongoing ICM across the US



ITS Intelligent Transportation Systems
U.S. Department of Transportation

Three AMS Sites

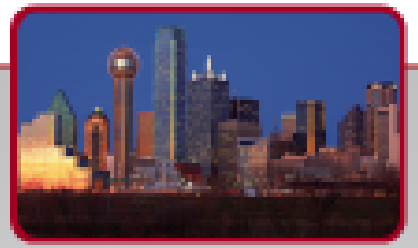
San Diego, CA



- *Popular freight, tourist and commuter corridor*
- *Lengthening peak travel periods*

- **Integrated management**
- **Coordinated incident management**
- **Dynamic ramp metering**
- **Reversible HOT lanes**
- **Increased transit ridership**
- **Congestion avoidance rewards**

Dallas, TX

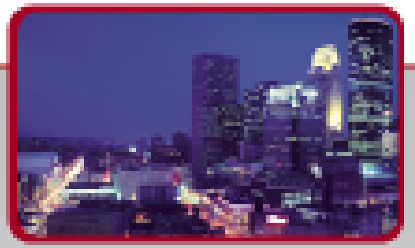


- *Major employers*
- *No ability to expand*
- *Surrounding construction planned*

ICM Strategies

- **Integrated management**
- **Coordinated incident management**
- **Integrated operational systems**
- **Increased park and ride capacity**
- **HOV**

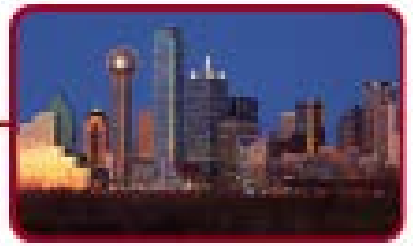
Minneapolis, MN

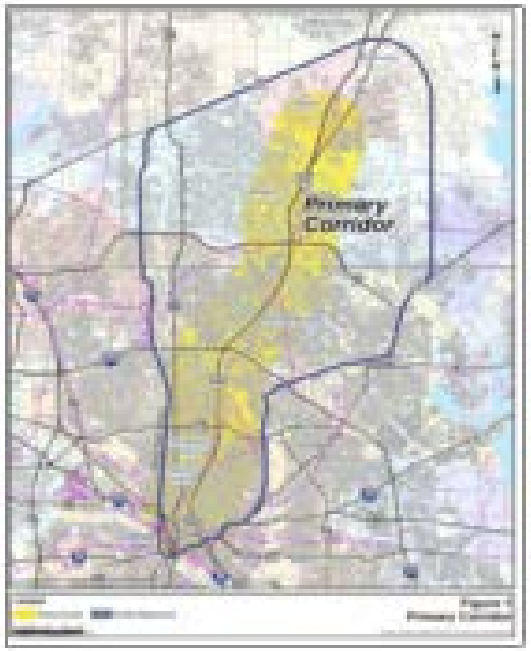


- *Busy commuter corridor*
- *Limited expansion capacity*
- *Major construction planned*

- **Integrated management**
- **Coordinated incident management**
- **Multi-agency data exchange**
- **Managed lanes**
- **Transit signal priority**
- **Signal timing**

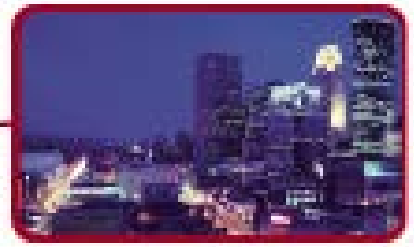
Dallas, Texas



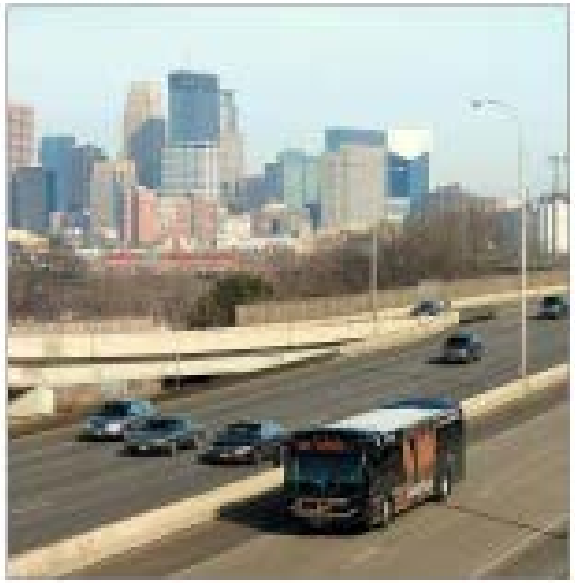




Minneapolis, Minnesota





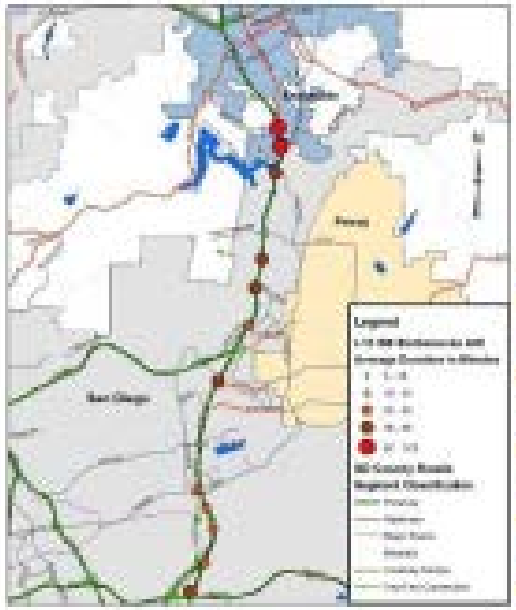




ITS Intelligent Transportation Systems
U.S. Department of Transportation

San Diego, California









1. Main Lanes
2. Managed Lanes
3. Drop Ramps
4. Park-and-Ride
5. BRT Station
6. Direct Access Road to Arterial



SAN DIEGO I-15 TEST BED FOR INTEGRATED CORRIDOR MANAGEMENT

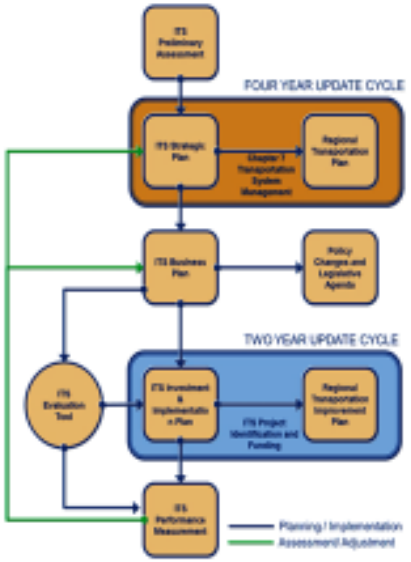
Rule 940: Methodology, Madness, and Measures Materialize
January 27th, 2015
8:30am – 12:00pm

SANDAG

Planning for Transportation Technology Adoption

- Multimodal Integration and Performance Based Management
- Traveler Information
- Arterial Management
- Freeway Management
- Transit Management
- Electronic Payment System





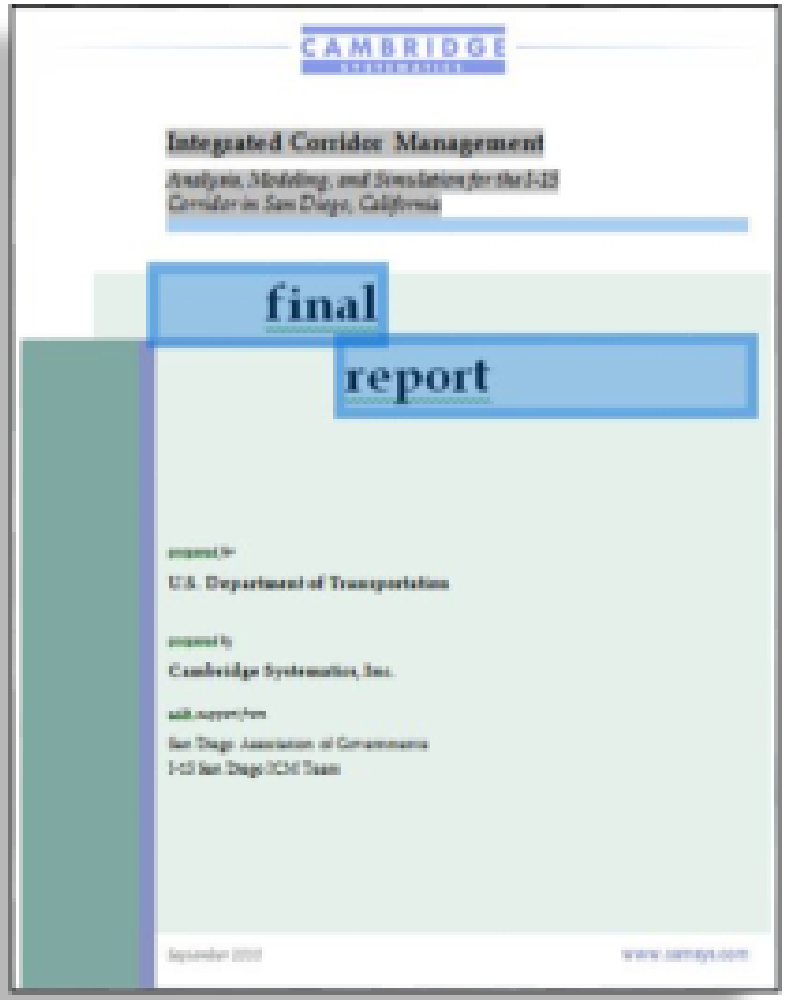
SANDAG 5

Source: Peter Thompson presentation to INCOSE Transportation Working Group, 1/27/15

Phase II: Was it Feasible



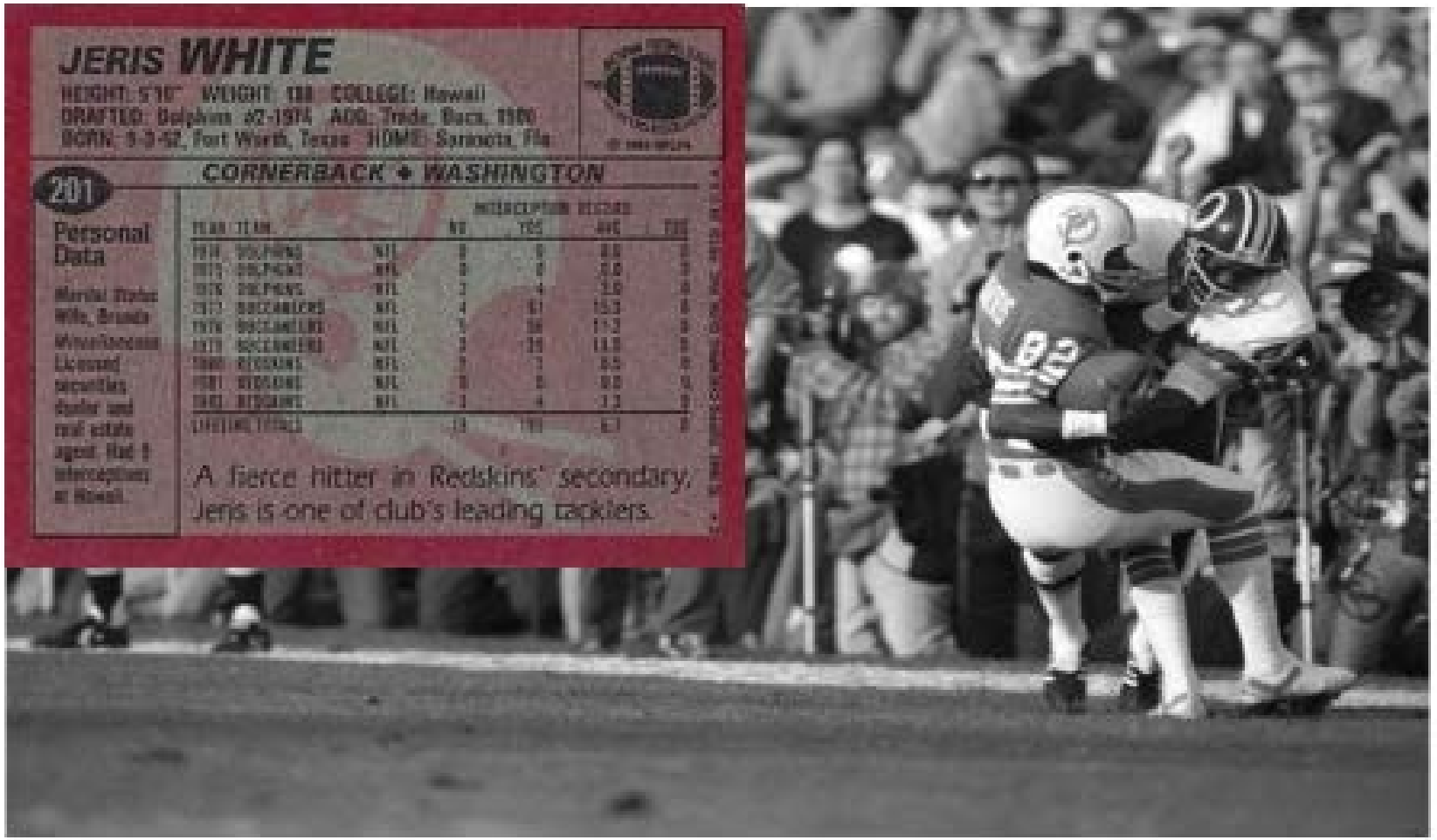
- Overall, significant benefits
- Reduced travel time and improved travel time reliability are two largest expected benefits, followed by fuel consumption and emissions benefits.
- $13.7 million in user benefits per year
- 10-year life cycle total benefit of **$115.9 million**.
- Costs are estimated at $1.42 million per year. 10-year life-cycle cost at **$12.0 million**.
- Benefit/cost ratio over the 10 life cycle is **9.7:1**.



Source: Peter Thompson presentation to INCOSE Transportation Working Group, 1/27/15

Phase III: Design

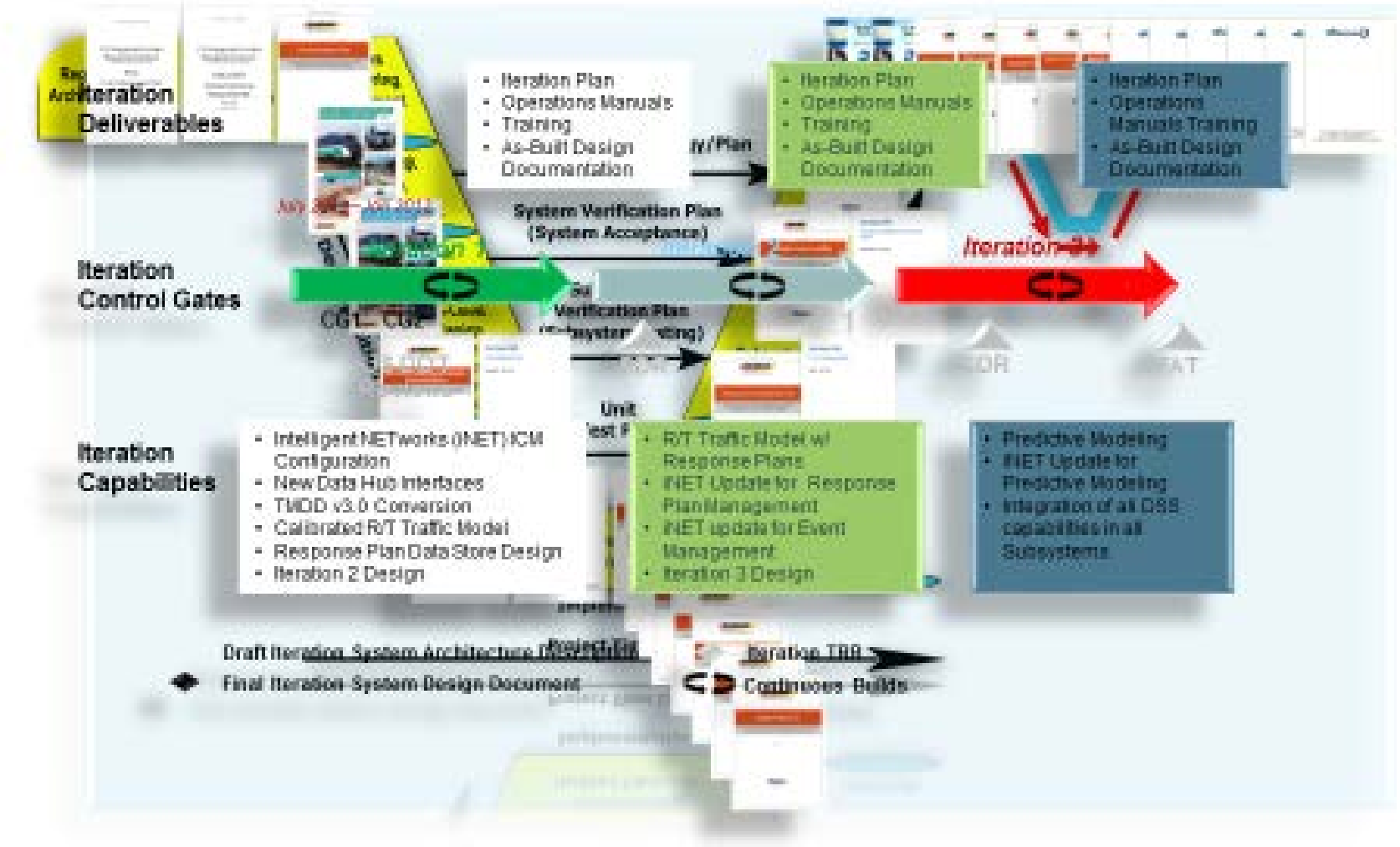
Should we brace…?



Source: Peter Thompson presentation to INCOSE Transportation Working Group, 1/27/15

Phase III: Delivery (with a twist)

Looks like a lot of paper work…



Source: Peter Thompson presentation to INCOSE Transportation Working Group, 1/27/15

…with significant benefits

Three Benefits

- Maintenance
  - Staff turnover happens
  - Corporate memory retained in document set. [now somebody just needs to read them again]
- Repeatability
  - From concept exploration to project execution.
- Choice
  - Reduced vendor “lock-in” risk

Agenda



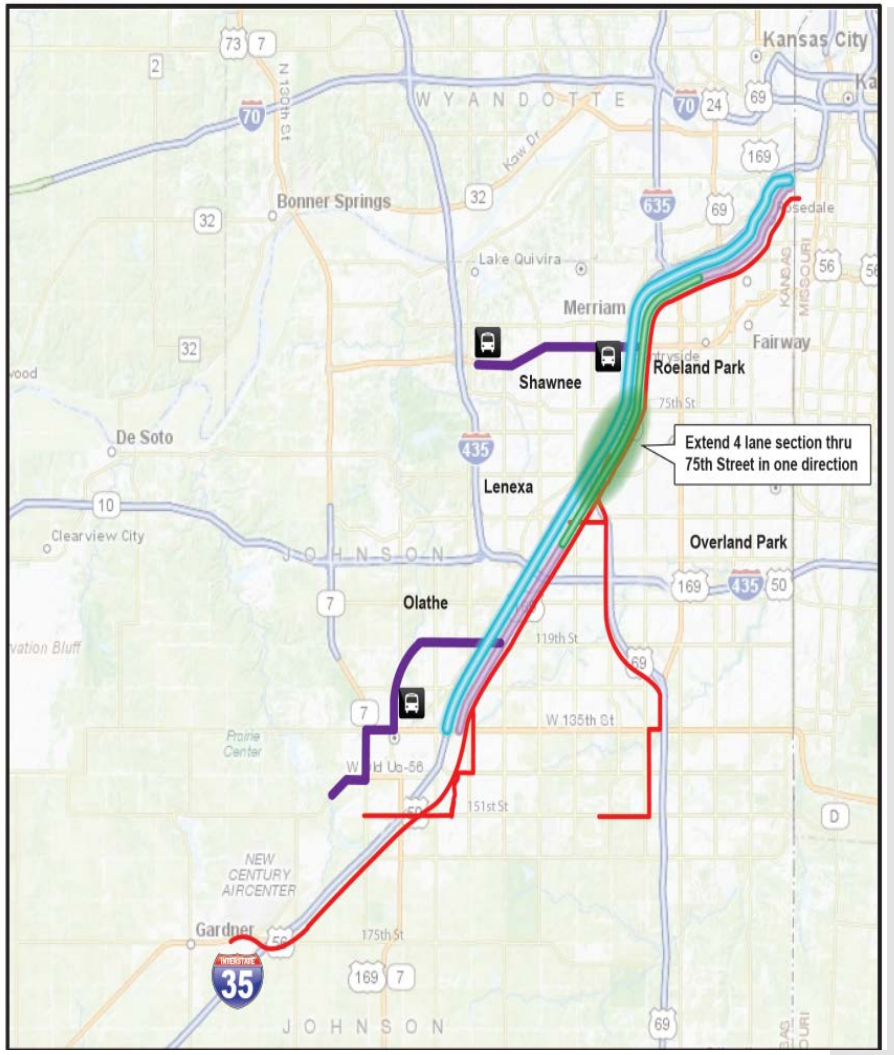
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  - **KDOT/MARC I-35 ICM**
- Team ICM exercise (~ 30 mins)

KDOT/MARC I-35 ICM

What it means to I-35

- Consider I-35 Corridor as one system
- Each organization is part of system
- Within existing plans and resources
  - KC Scout
  - Operation Green Light
  - Agree on coordinated response plans
  - Use technology

Highlights of short-term recommendations (2013 - 2020)

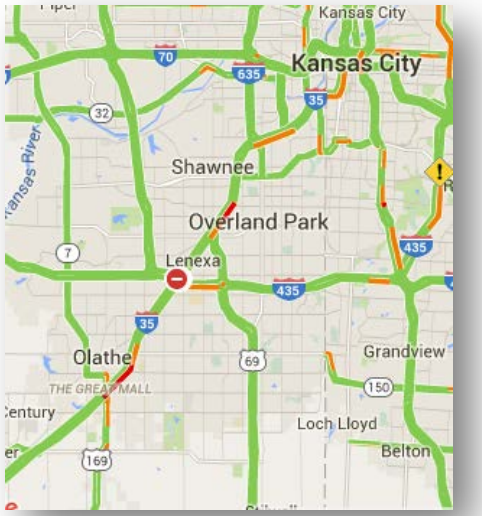


Source: I-35 Moving Forward

KDOT/MARC I-35 ICM

Scope of this project

- Concept of Operations planning doc
- Use Cases
- Build on existing plans



- Create supportive case for funding
  - Federal grants
  - Smart Cities (?)

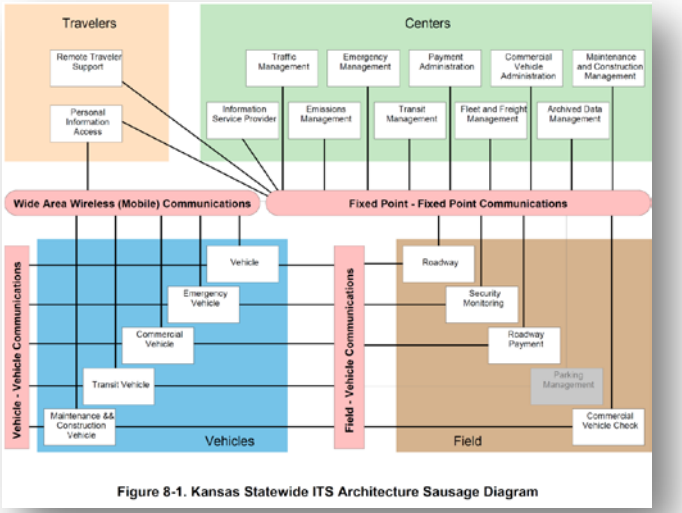
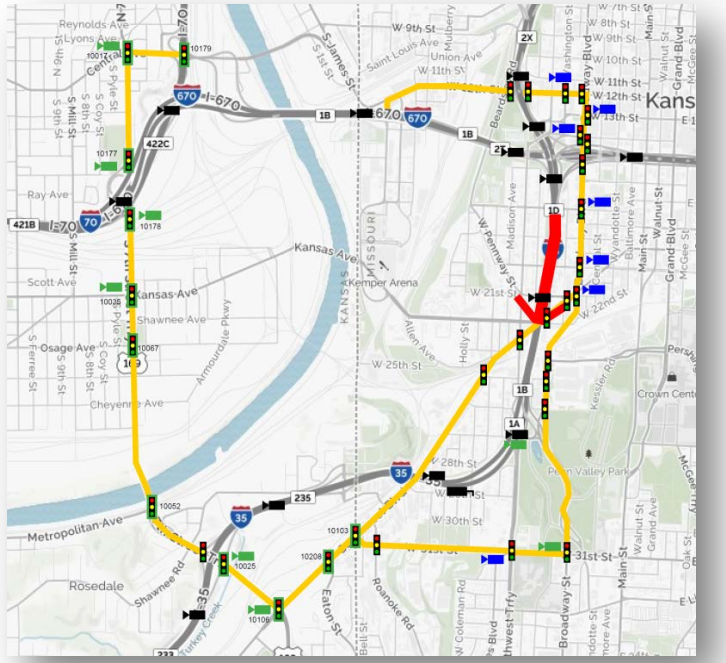


Figure 8-1. Kansas Statewide ITS Architecture Sausage Diagram



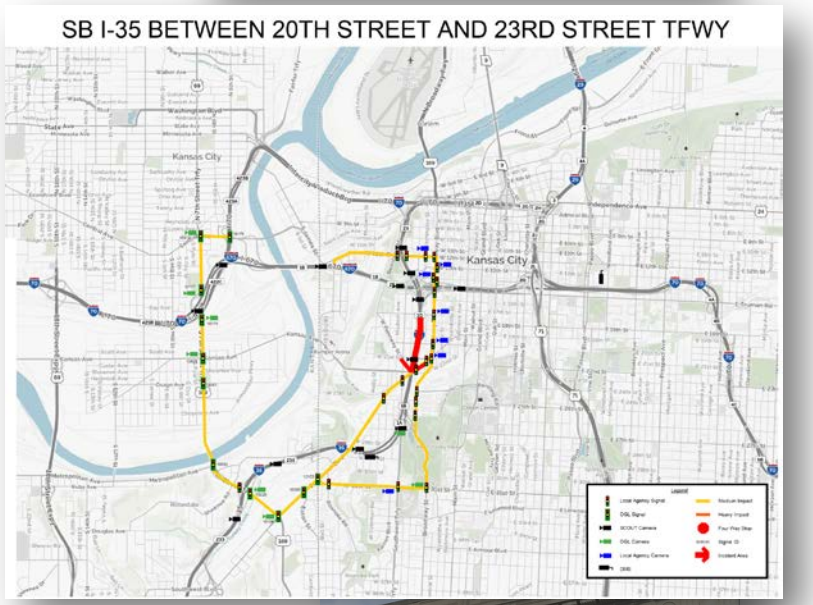
KDOT/MARC I-35 ICM

Stakeholders

- Regional travelers
- KDOT
- MARC
- KC Scout
- OGL
- Counties
- Cities/Municipalities
- Transit
- Emerging technology

Met April 28, 2016





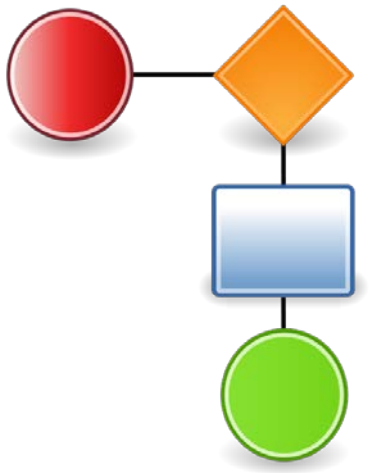


KDOT/MARC I-35 ICM

3 Components in Focus

- Institutional
  - Cooperation
  - Funding
- Technical
  - Traveler information
  - Data fusion
- Operational
  - Performance measures
  - Decision support system







One user, one trip, many conditions

Use Case Based Analysis

Current (2016)	Typical
	Incident
	Planned Construction
	One Time Event
Future (2030)	Typical
	Incident
	Planned Construction
	One Time Event
ICM	Typical
	Incident
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	One Time Event

KDOT/MARC I-35 ICM

Use Cases Considered

Stakeholders selected



Potential Use-Case	User Info	Traveling From	Traveling To	Purpose	Time of Day
A	Male 18 – 24 years Single	K-7 and W. Santa Fe, Olathe, KS	Johnson County Community College	School	A.M. [non-peak]
B	Female 25 - 30 years Single	127th & N Mur-Len, Olathe, KS	KU Medical Center	Work	A.M. [peak]
C	Male 25 - 30 years Married	151st & S. Pflumm, Olathe, KS	Downtown, Kansas City, MO	Work	A.M. [peak]
D	Male 30 – 35 years Married w/kids	Downtown Kansas City, KS	Near Johnson County CC	Home/ Recreation	P.M. [peak]
E	Female 40 – 45 years Single w/kids	75th & Antioch Area (near Shawnee Mission Medical Center)	BSNF Intermodal Facility, Edgerton, KS	Work	A.M. [peak]
F	Male 50 – 55 years Married	BSNF Intermodal Facility, Edgerton, KS	Armourdale Rail Yard, Kansas City, KS	Freight	A.M. [non-peak]
G	Female 60 – 65 years Widowed	127th & N Mur-Len, Olathe, KS	Shawnee Mission Parkway,	Pick up Grandchild from	P.M. [peak]

Our User

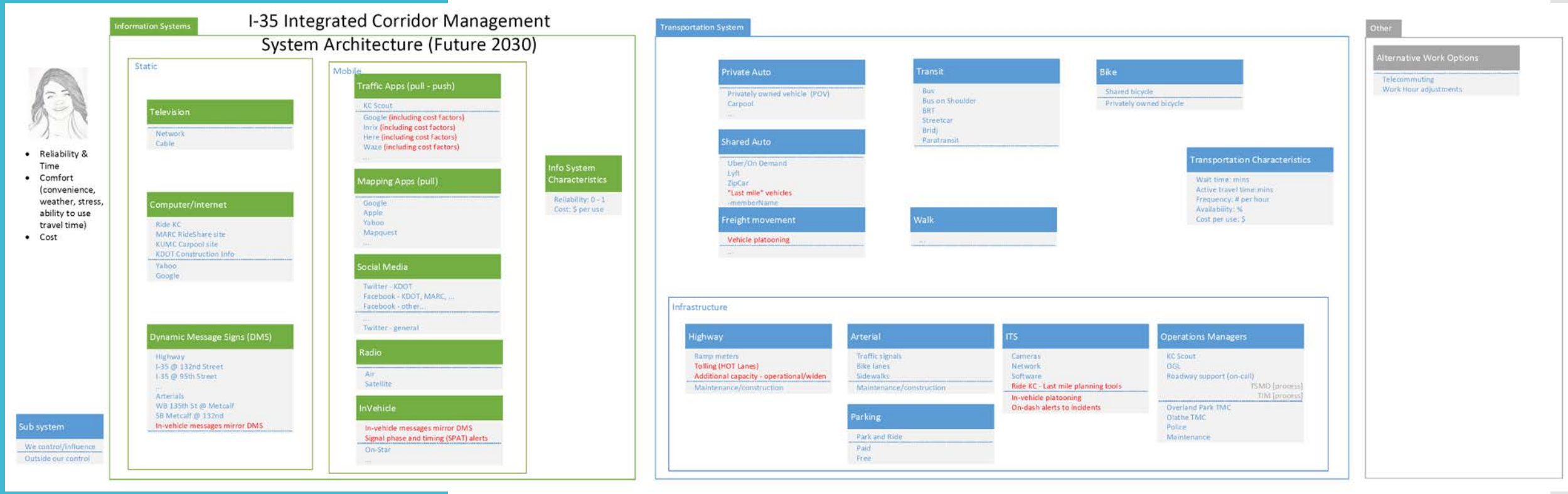


Sarah

- 29-year old radiologist at KU Med
- Likes country music
- A Roasterie coffee fan
- Owns a townhouse at 127th and Black Bob
- Has a young child
- Plays volleyball on co-ed, evening league

On Tuesday morning, Sarah needs to get to work at KU Medical Center for an 8:45 A.M. patient appointment. She will depart from her townhouse so she can arrive 30 minutes prior to her appointment to turn on her radiology equipment. On the way to work, Sarah drops her child off at her parents' house at West 61st Street (east of Antioch) in Merriam for day care.

KDOT/MARC I-35 ICM



KDOT/MARC I-35 ICM



- Reliability & Time
- Comfort (convenience, weather, stress, ability to use travel time)
- Cost

I-35 Integrated Corridor Management System Architecture (Future 2030)

Information Systems

Static

Television
- Network
- Cable

Computer/Internet
- Ride KC
- MARC RideShare site
- KUMC Carpool site
- KDOT Construction Info
- Yahoo
- Google

Dynamic Message Signs (DMS)
- Highway
- I-35 @ 132nd Street
- I-35 @ 95th Street
- ...
- Arterials
- WB 135th St @ Metcalf
- SB Metcalf @ 132nd
- In-vehicle messages mirror DMS

Mobile

Traffic Apps (pull - push)
- KC Scout
- Google (including cost factors)
- Inrix (including cost factors)
- Here (including cost factors)
- Waze (including cost factors)
- ...

Mapping Apps (pull)
- Google
- Apple
- Yahoo
- Mapquest
- ...

Social Media
- Twitter - KDOT
- Facebook - KDOT, MARC, ...
- Facebook - other...
- ...
- Twitter - general

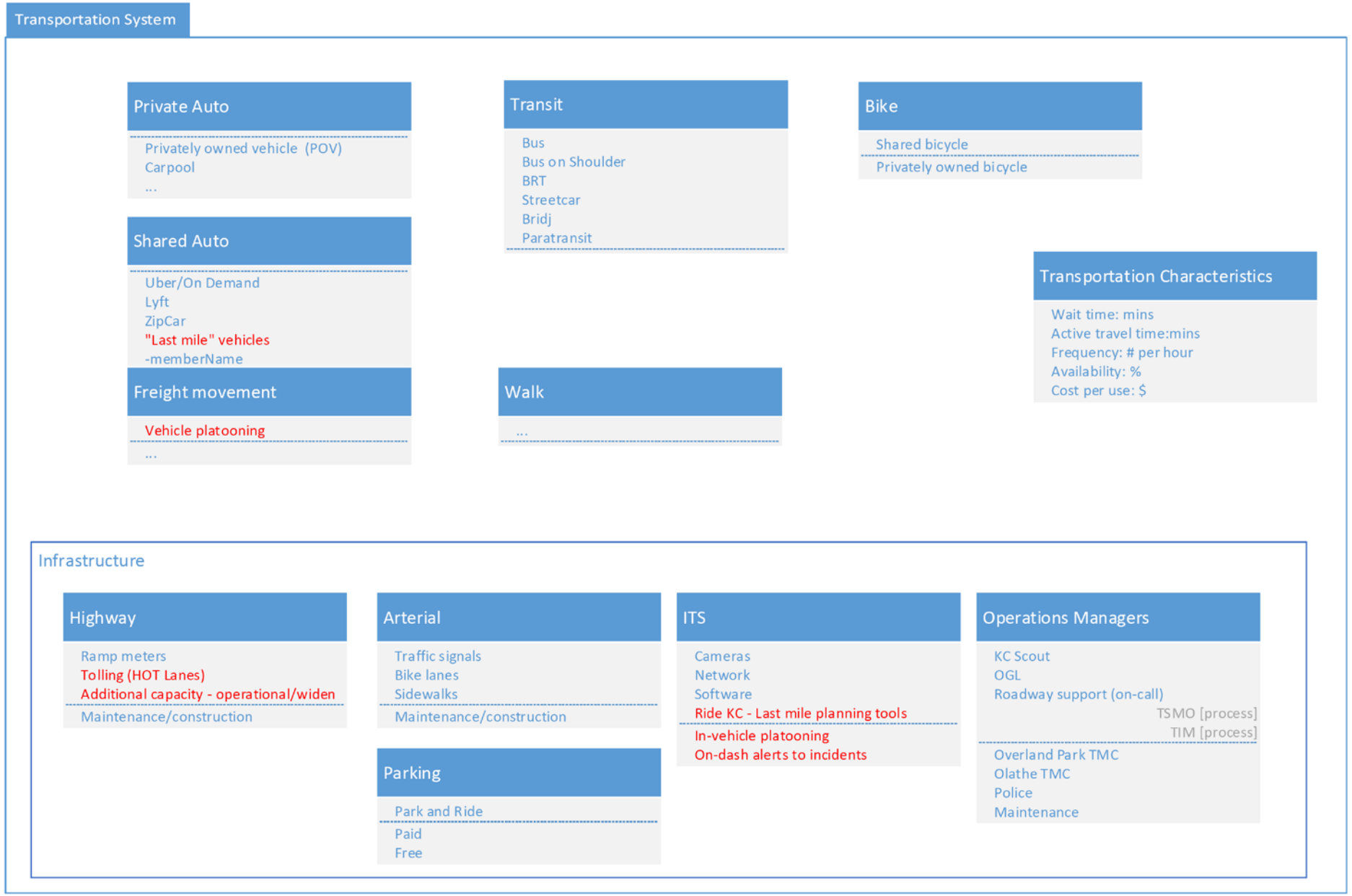
Radio
- Air
- Satellite

InVehicle
- In-vehicle messages mirror DMS
- Signal phase and timing (SPAT) alerts
- On-Star
- ...

Info System Characteristics
- Reliability: 0 - 1
- Cost: $ per use

Sub system
- We control/influence
- Outside our control

KDOT/MARC I-35 ICM



KDOT/MARC I-35 ICM

Other

Alternative Work Options

- Telecommuting
- Work Hour adjustments

ICM Qs



Agenda



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- **Team ICM exercise (~ 30 mins)**

Your turn…

- 5 small groups

- ICM operations
- Future
- Incident



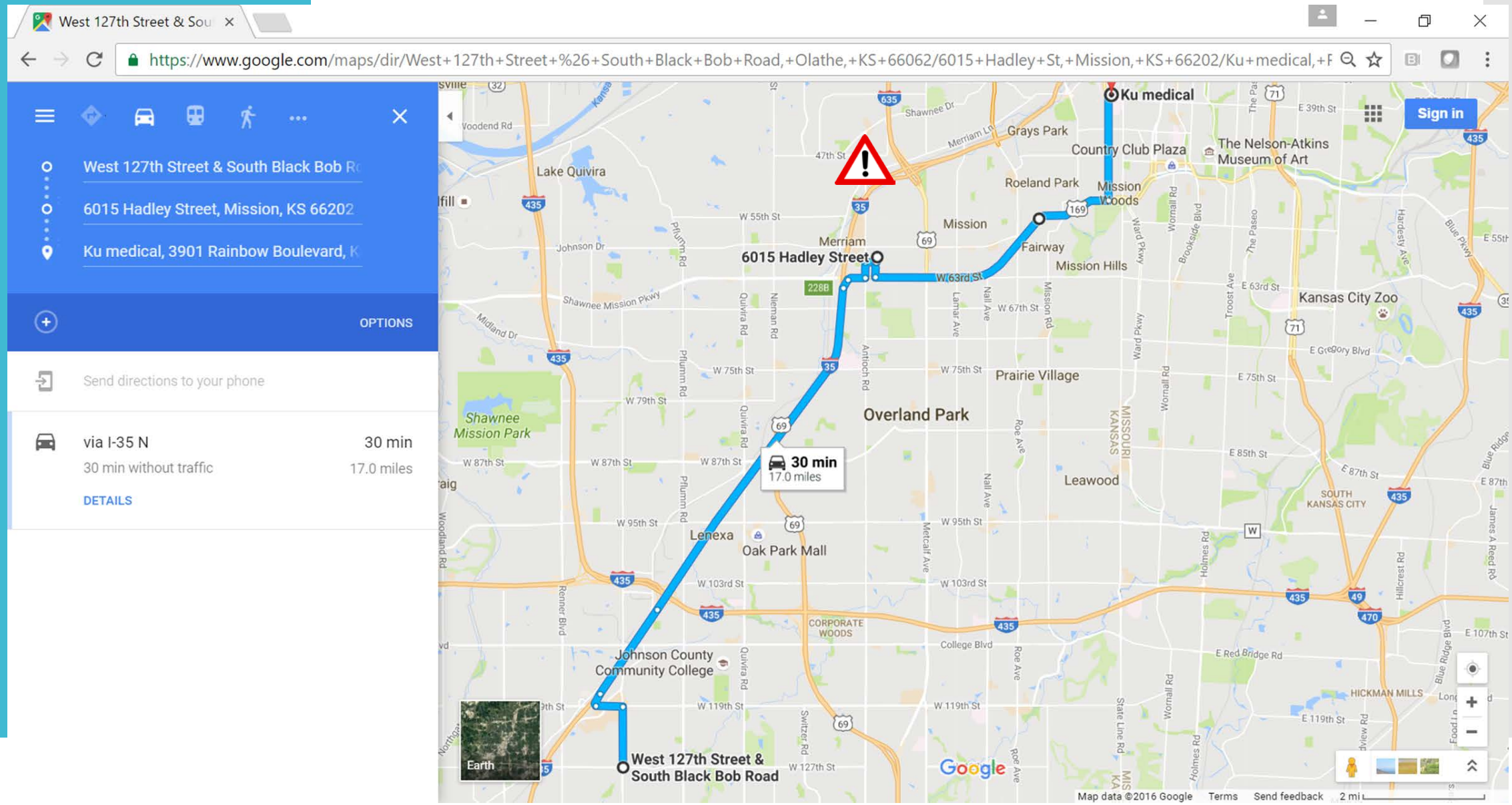
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KDOT/MARC I-35 ICM



Trip time and cost table

Time

Travel time

miles

Cost of car ownership in 2030

Future ICM - Incident					
AM	**Begin**	0	mins		
AM	Drive home to day care		mins		mi @ 0.77/mi
AM	Drop off at day care		mins		
AM	Depart from day care		mins		mi @ 0.77/mi
AM	Park at KU		mins	$ 1.22	day/annual parking
AM	**Arrive**		**Total**		**Cost (2030 dollars)**

Total cost

Team Concepts