Data for Mobility Performance Measures

Florida and National Perspectives

Florida Data Symposium

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What we will cover

- Data to support Florida's Mobility Performance Measures Program

- Mobility Data Initiatives at the National Level

- Resources

# DATA FOR FLORIDA'S MOBILITY MEASURES

1. Data for current Mobility Measures Programs
   - Planning and ITS
2. Transition to field measured data
3. Recommended processing methods
4. TranStat Data Business Plan

Travel Time Reliability on Freeways During Peak Hour/Peak Period

Legend: State | 7 Largest Counties | Other Urbanized Areas | Non-Urbanized Areas | Turnpike
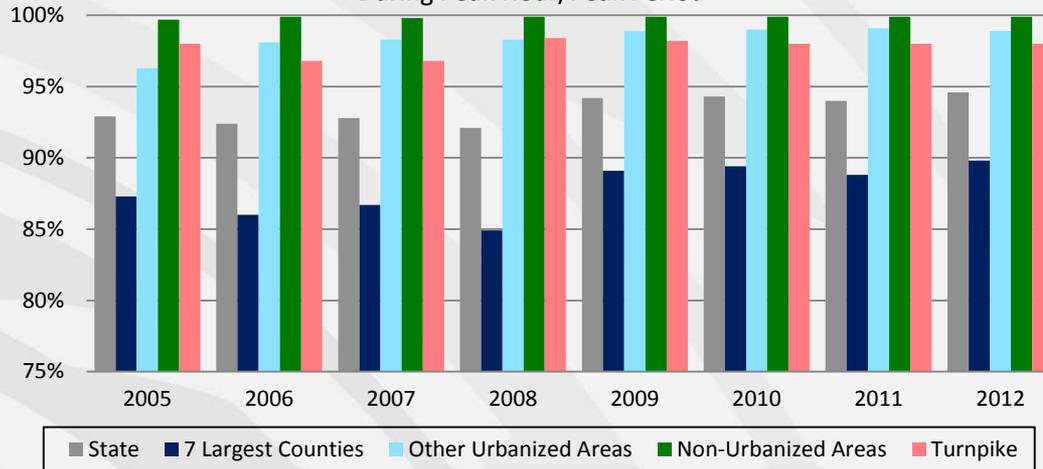
Travel Time Reliability

	Peak Hour/Peak Period					Daily				
Year	State	7 Largest Counties	Other Urbanized Areas	Non-Urbanized Areas	Turnpike	State	7 Largest Counties	Other Urbanized Areas	Non-Urbanized Areas	Turnpike
2005	92.9%	87.3%	96.3%	99.7%	98.0%	98.5%	97.4%	99.1%	99.9%	99.4%
2006	92.4%	86.0%	98.1%	99.9%	96.8%	98.5%	97.3%	99.4%	100.0%	99.2%
2007	92.8%	86.7%	98.3%	99.8%	96.8%	98.5%	97.3%	99.5%	100.0%	99.2%
2008	92.1%	84.9%	98.3%	99.9%	98.4%	98.2%	96.5%	99.6%	100.0%	99.6%
2009	94.2%	89.1%	98.9%	99.9%	98.2%	98.8%	97.8%	99.7%	100.0%	99.6%
2010	94.3%	89.4%	99.0%	99.9%	98.0%	98.9%	97.9%	99.8%	100.0%	99.6%
2011	94.0%	88.8%	99.1%	99.9%	98.0%	98.7%	97.6%	99.8%	100.0%	99.6%
2012	94.6%	89.8%	98.9%	99.9%	98.0%	98.9%	97.9%	99.7%	100.0%	99.6%

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MIAMI TO FT. LAUDERDALE I-95 CORRIDOR PERFORMANCE

From SR 5/U.S. 1/South Dixie Highway (Miami) to I-595 (Ft. Lauderdale)

AADT	Vehicle Miles Traveled		Average Speed		Delay			Freight (Daily)		
	Peak Hour/Period	Daily	Peak Hour/Period	Daily	Peak Hour/Period	Daily	Yearly	% Combination Truck	Combination Truck VMT	Combination Truck Delay
232,000 With a max of **261,500**	**0.78**	**5.22**	**50.5**	**59.3**	**5.58**	**33.1**	**12,100**	**4**	**0.11**	**618**
	millions of miles		miles per hour		thousands of hours			percent	million miles	hours

Travel Time Reliability (TTR) & Travel Time Variability (TTI$_{95th}$)

Corridor Length
23.4 miles

Peak Hour/Period
TTR **80%**   TTI$_{95th}$ **1.95**

Daily
TTR **93%**   TTI$_{95th}$ **1.21**

Congestion Analysis

% of Travel Meeting LOS Criteria
Peak Hour/Period **46.7%**   Daily **77.4%**

% of Travel Severely Congested
Peak Hour **52.7%**   Daily **17.2%**

1. FLA Turnpike to I-595/SR 862

		TTR	TTI$_{95th}$	Average Speed
Trip Length 10.2 miles	Peak Hour/Period:	74%	2.45	43.5 MPH
AADT 126,300	Daily:	90%	1.21	59.3 MPH

2. R 924/NW 119th Street to FLA Turnpike

		TTR	TTI$_{95th}$	Average Speed
Trip Length 3.4 miles	Peak Hour/Period:	77%	2.29	43.9 MPH
AADT 225,000	Daily:	86%	1.23	58.8 MPH

3. Airport Expressway/SR 112 to SR 924/NW 119th Street

		TTR	TTI$_{95th}$	Average Speed
Trip Length 5.0 miles	Peak Hour/Period:	98%	1.23	59.3 MPH
AADT 261,000	Daily:	99%	1.22	59.8 MPH

4. Dolphin Expressway/SR 836 to Airport Expressway/SR 112

		TTR	TTI$_{95th}$	Average Speed
Trip Length 1.6 miles	Peak Hour/Period:	98%	1.89	53.4 MPH
AADT 261,500	Daily:	99%	2.07	56.5 MPH

5. SR 5/US 1/South Dixie Highway to Dolphin Expressway/SR 836

		TTR	TTI$_{95th}$	Average Speed
Trip Length 3.2 miles	Peak Hour/Period:	88%	1.85	53.8 MPH
AADT 242,500	Daily:	97%	1.20	60.9 MPH

MAP: add legend and pattern color code by AADT and average speed (peak hour/Peak Period)

0   1.25   2.5
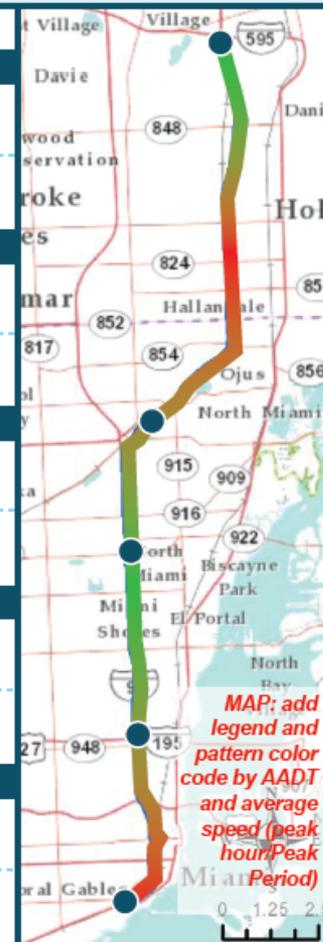
Mobility Performance Methodologies

- FDOT TranStat office
  - » Yearly Multimodal and General Interest Source Book (SB)
    - Quantity, Quality, Accessibility and Utilization
    - 26 highway related MPMs
  - » Roadway characteristics and traffic characteristics from FDOT RCI and TCI
  - » Speed/travel time estimated by models
    - Modified Davidson curve, BPR curve, Generalized Service Volume Tables, FDOT TTR models, etc.

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TranStat Office MPMs

FDOT SHS
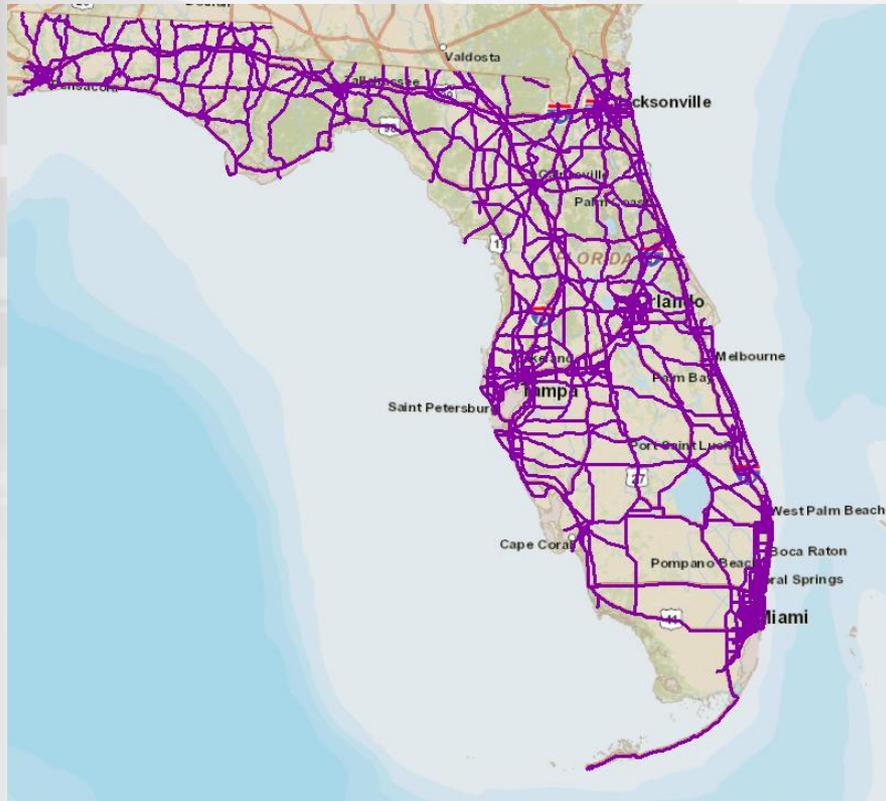
FDOT reliability facilities

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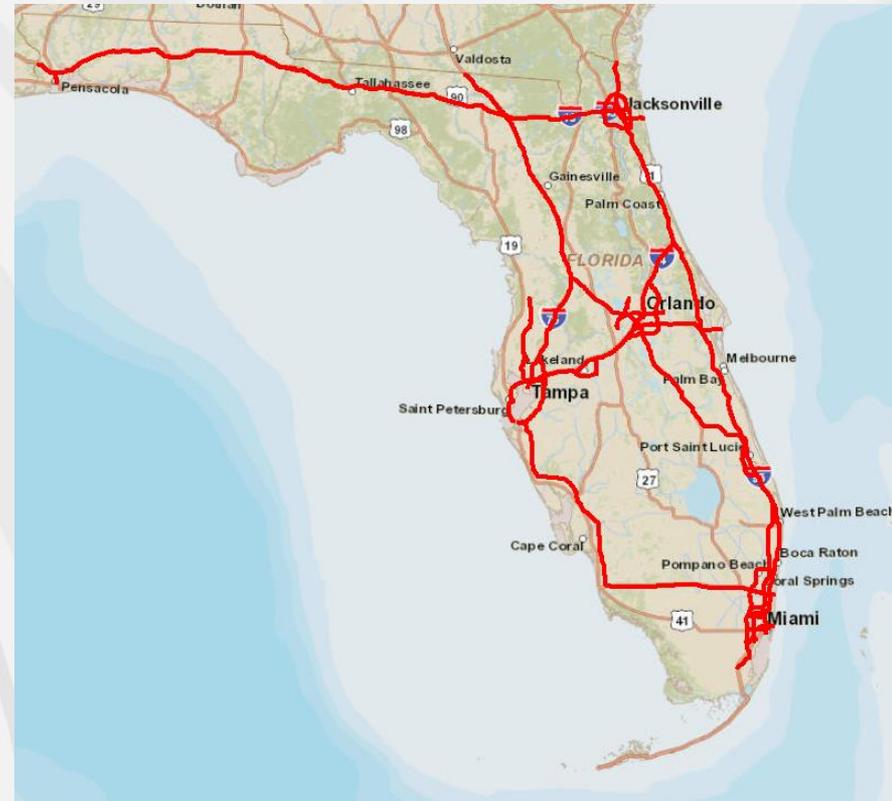
Mobility Performance Methodologies

MPMs using speed as input

Percent of Travel Meeting LOS Criteria
Percent of Miles Meeting LOS Criteria
Travel Time Reliability
Travel Time Variability
Vehicle Hours of Delay
Average Travel Speed
Percent of Miles Severely Congested
Percent of Travel Severely Congested
Hours Severely Congested
Travel Time Reliability (Freight)
Travel Time Variability (Freight)
Combination Truck Hours of Delay
Combination Truck Average Travel Speed
Percent of Miles Severely Congested (Freight)

Mobility Performance Methodologies

- FDOT ITS office

  » Manages 63% of interstate highways and expressways

  - Traffic probes and/or sensors

  - Real-time traffic information reporting coverage

  - Real-time incident response capabilities

  - Real-time traffic data availability to FDOT

  » Speed and travel time from roadside and in-pavement ITS detectors

  » HERE data for real time traveler information

  » Raw detector data and real time data are archived in RITIS

  » Quarterly report to FTC

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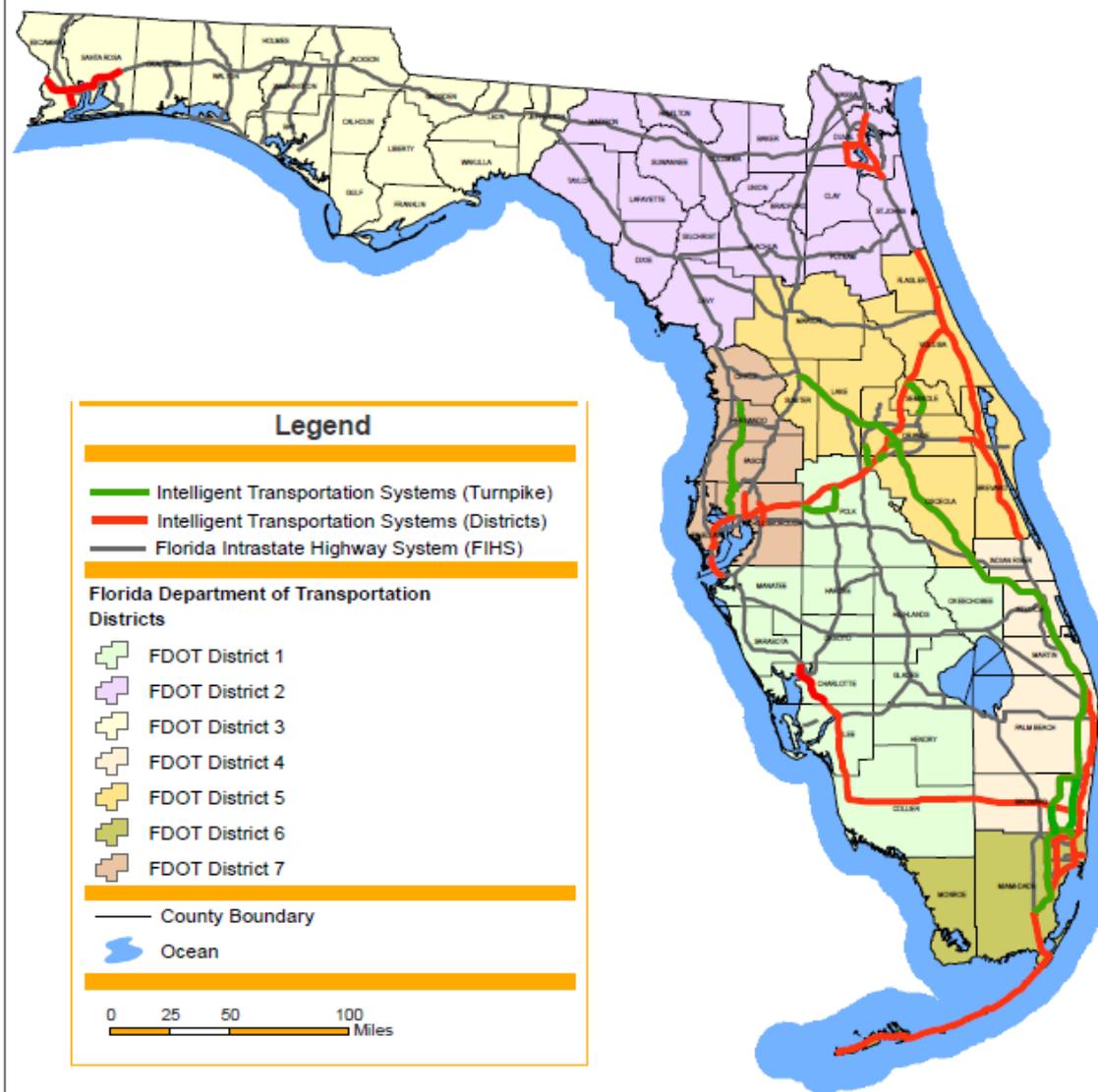
Mobility Performance Methodologies

○ Summary of TTR and Delay Methodology

	TranStat		ITS
	Delay	**Travel Time Reliability/Variability**	**Travel Time Reliability/Congestion**
Measure	Vehicle Hours of Delay	% of Travel >45 mph on Freeways (Reliability) 95th Percentile Travel Time Index (Variability)	**95th Percentile Travel Time (Planning Time Index), Travel Time Index**
Coverage	SHS	Limited Access Facilities	**ITS Miles Managed (freeways and exressways)**
Inputs	a) Traffic Volume b) Travel Time/Speed	Travel Time/Speed	**Travel Time/Speed**
Source	a) FDOT Planning Traffic b) Models	Models	**ITS Detectors, Vendor Probe Data**
Database	a) TTMS, TCI b) RCI	RCI, TCI	**SunGuide and RITIS**
Reports	Source Book MAP-21 Annual Performance Report	Source Book MAP-21 Annual Performance Report	**FTC**

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Possible Field Measured Data Sources

◉ Video Image Detection

◉ Microwave Radar

◉ Bluetooth

◉ Toll Tag Readers

◉ Vehicle probe data from private vendors

- HERE/NPMRDS

- INRIX

- TomTom

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Field Measured Data in Florida

- INRIX probe data from July 1st 2011 to June 30, 2012

- NPMRDS data is available beginning Nov, 2013

- HERE data purchased by FDOT ITS office for real time traveler information starting Sept 2013

- Districts

  » Several districts deployed bluetooth detectors on some arterial segments to collect travel time

  » In-pavement magnetic detectors

  » District 5 and Tpk use toll tag reader

  » Districts 6 and 7 use radar to collect speeds

NPMRDS - National Performance Management Research Data Set

- Average travel times

  - Every 5 minutes, 24 hours, 7 days a week

- For entire National Highway System

- Provided by HERE

- Segmentation = Traffic Message Channel (TMC)

- Data for freight (from ATRI) and passenger

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NPMRDS Issues

- 5 minute travel time for passenger cars and trucks
  - » Average travel time is the weighted averages of the samples, not necessarily consistent with field traffic compositions
  - » Historical vehicle composition data could be provided to vendor for quality control

- Travel Speed on NHS goes back to July 2013
  - » Not enough data for 2013
  - » SIS roadways not in NHS or align differently than NHS
  - » SHS is approximately 50% larger than NHS
    - SHS: 12,086 Centerline Miles
    - NHS: 8,147 Centerline Miles

Data Source Evaluation

» Data Coverage – SHS

» Data completeness - 30% completeness

» Data reported by individual TMC at 5 minute intervals throughout entire year

» Mean travel time and speed

- Status flag to indicate normal operations, periods of low traffic flow, inoperable status or unavailable data, etc.

- Quality indicator that reflects confidence in estimate of mean travel time and speed

» Network conflation/data integration

- Connect field measured speed/travel time data to other data sources

» Separate speed for passenger cars, trucks, and all vehicles

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Data Source Evaluation

Travel Time and Speed Data					
Data Set	Completeness	Granularity	Data Availability	Freight	Coverage
NPMRDS	Only uses raw data in generating speeds, wHERE tHERE are no observations tHERE are gaps in the data.	5 minute speed data.	New data is reported monthly - Historical data is made available.	Includes separate truck travel speeds.	Covers the entire National Highway System (NHS)
HERE	WHERE data is missing imputed data is used so tHERE are no gaps.	5 minute speed data.	Real time data can be accessed any time – Historical data requires an archiving system e.g. RITIS	Does not include separate truck travel speeds.	Covers the entire TMC network in Florida – 20,000+ miles and provides separate TMCs for HOT lanes
TOM TOM	Roughly 30% of overall travel speeds come from direct field measured observations.	15 minute speed data could be disaggregated to 5 minute data	Origin/Destination data is available. Travel time data can be provided monthly or annually.	Does not include separate truck travel speeds.	Provides data on a linear referencing system with smaller segment lengths than TMCs. TOM TOM likely provides the widest coverage
INRIX	Approximately 75% of travel speeds in the peak period come from field measured observations.	Speed data can be provided in 1 min intervals, 1 hour interval, and any interval in-between	INRIX Data Downloader allows the subscriber to download any data at any time.	Captures real time truck speeds which can be used to create a freight profile- No truck travel speed archive	Covers the entire TMC network in Florida – 20,000+ miles. INRIX provides additional data for minor arterials and collectors through the XD system

Recommended Data Source

- Archive of HERE ITS real time data + free NPMRDS was chosen for further evaluation

  - » Minimum additional cost to the department - obtaining data and data archiving

  - » HERE ITS data
    - Better coverage – complete TMC network
    - Data imputed by vendor

  - » NPMRDS data for
    - Truck data on NHS
    - Verifying HERE's data processing and imputation algorithms

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Feasibility of Transitioning to Field Measured Data

- Existing MPM calculation uses modeled travel time/speed
  - » Pros
    - Coverage-down to collector street level
    - Control over segmentation
      - ♦ FDOT defined segmentation vs TMC codes
    - Consistent with HCM methodology
  - » Cons
    - Need to obtain data from various sources
    - Based on modeling and assumptions rather than actual roadway conditions
    - Estimated speed vs continuous/up to date field data

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◉ Transition to measured data

  » Pros

  - Report based on actual field measured data

  - Accurate results to benefit both operation and planning

  - Other applications possible

  » Cons

  - Not every road of SHS has corresponding TMCs

  - TMC network not geographically aligned with FDOT base map

  - Higher initial cost

  - Different results from measured data will result in differences when analyzing trends

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Standard Data Processing Procedures

◎ Processes for successful transition to measured data

» Perform network conflation

- Align TMC Segments to FDOT base map segments, to connect other data in RCI and TCI

» Develop data QAQC and processing procedures

» Evaluate and modify MPM calculation procedures when appropriate

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Standard Data Processing Procedures

- MPM calculation
  - » TTR related performance measures
    - TTR – percentage of travel (VMT) meeting speed threshold

$$\frac{\sum VMT | Travel\ speed > speed\ threshold}{\sum VMT} \times 100$$

    - TTV – 95th percentile travel time index

$$TTI_{95th} = \frac{Travel\ time_{95th}}{Travel\ time_{free\ flow}}$$

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Standard Data Processing Procedures

- Existing TTR & TTI procedures

RCI & TCI →

**Weather, work zone, incident, ITS, etc.** →

FDOT TTR model

- HCM based speed estimation models
- Limited 24 scenarios
- Assumption on probability and impact of scenarios
- Sensitive to threshold and segment length
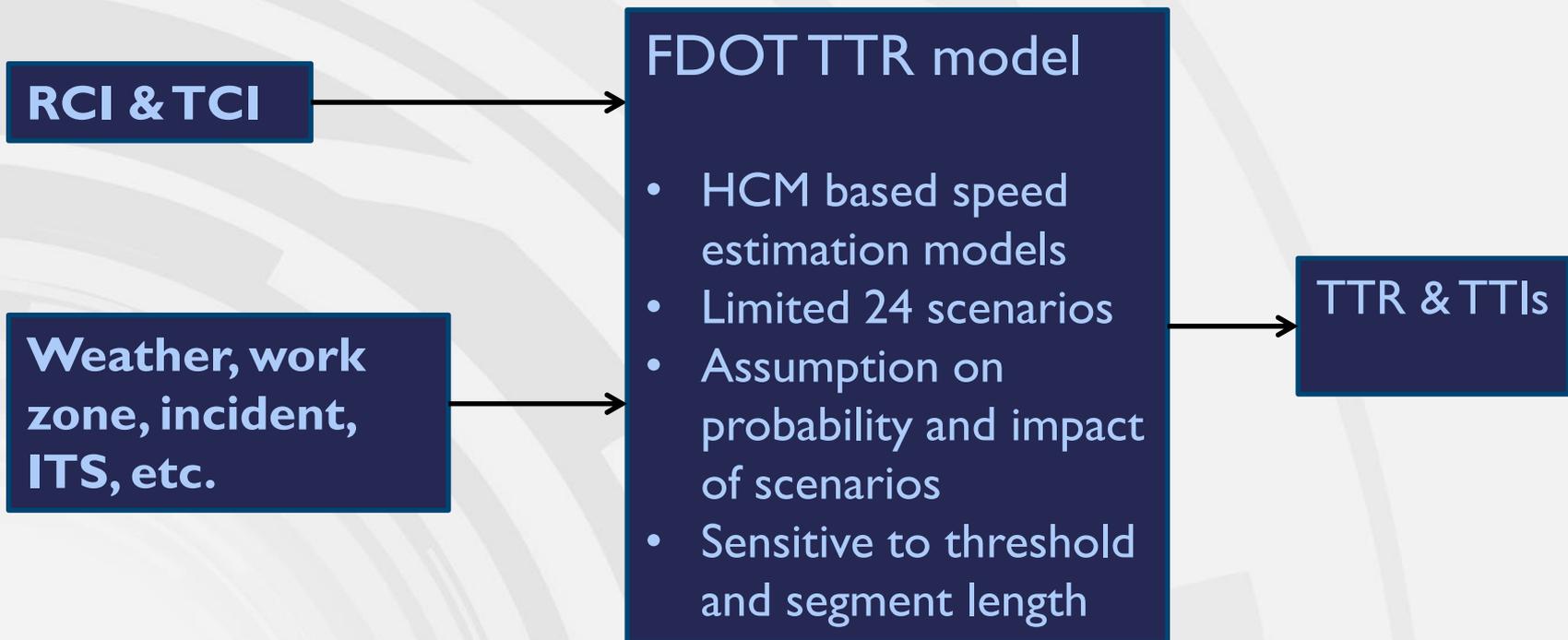
→ TTR & TTIs

Standard Data Processing Procedures

- Other existing MPMs procedures

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                    HCM Models
┌─────────────┐                ┌─────────────┐        ┌──────────────────────┐
│  RCI & TCI  │ ─────────────> │  Hrly Speed │ ─────> │  MPM Database        │
└─────────────┘                └─────────────┘        │                      │
       │                                              │  *Volume based LOS   │
       │                                              │  creterias           │
       │                                              │  *Truck speeds: 2mph │
       └──────────────────────────────────────────────> below general traffic│
                                                      └──────────────────────┘
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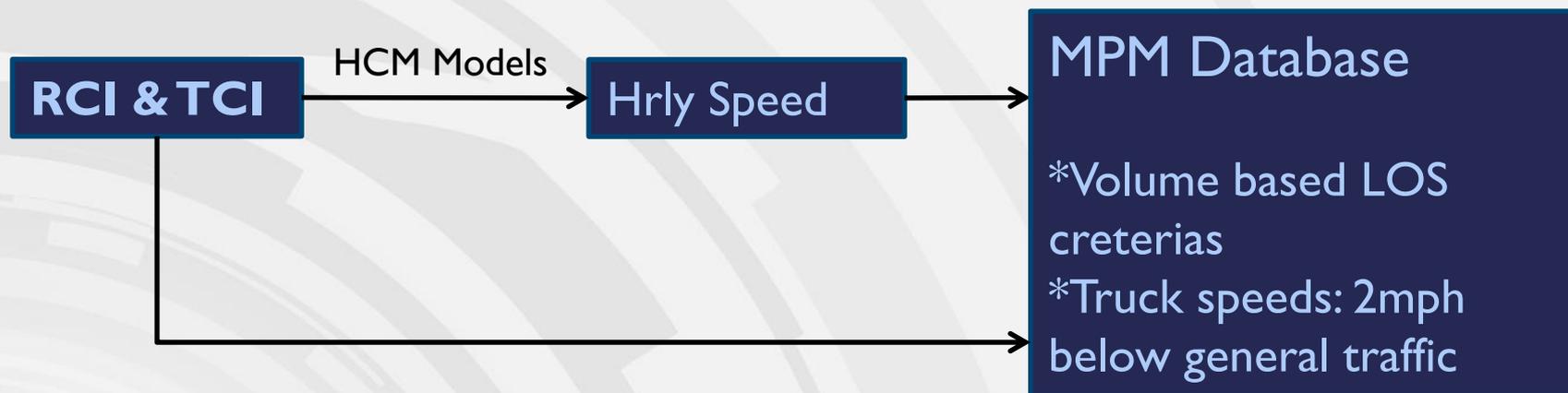
Standard Data Processing Procedures

◉ TTR&TTI procedures with measured data

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                                                    ┌────────────────────────┐
  ┌──────────────┐                                  │ TTR & TTIs             │
  │ RCI & TCI    │─────────────────────────────────▶│                        │
  └──────────────┘                                  │                        │
         ▲                                          │ • Continuous speed     │
         ┊                                          │   distribution         │
         ┊  Network Conflation                      │ • Based on actual      │
         ┊                                          │   condition in the     │
         ▼                         ┌──────────────┐ │   field                │
  ┌──────────────┐                 │ Hrly Speed   │ │ • Can be aggregated or │
  │ Field        │  Data Processing├──────────────┤ │   disaggregated for    │
  │ measured     │────────────────▶│ Separate     │▶│   higher gratuity      │
  │ speed        │                 │ Truck Speeds │ │                        │
  └──────────────┘                 └──────────────┘ └────────────────────────┘
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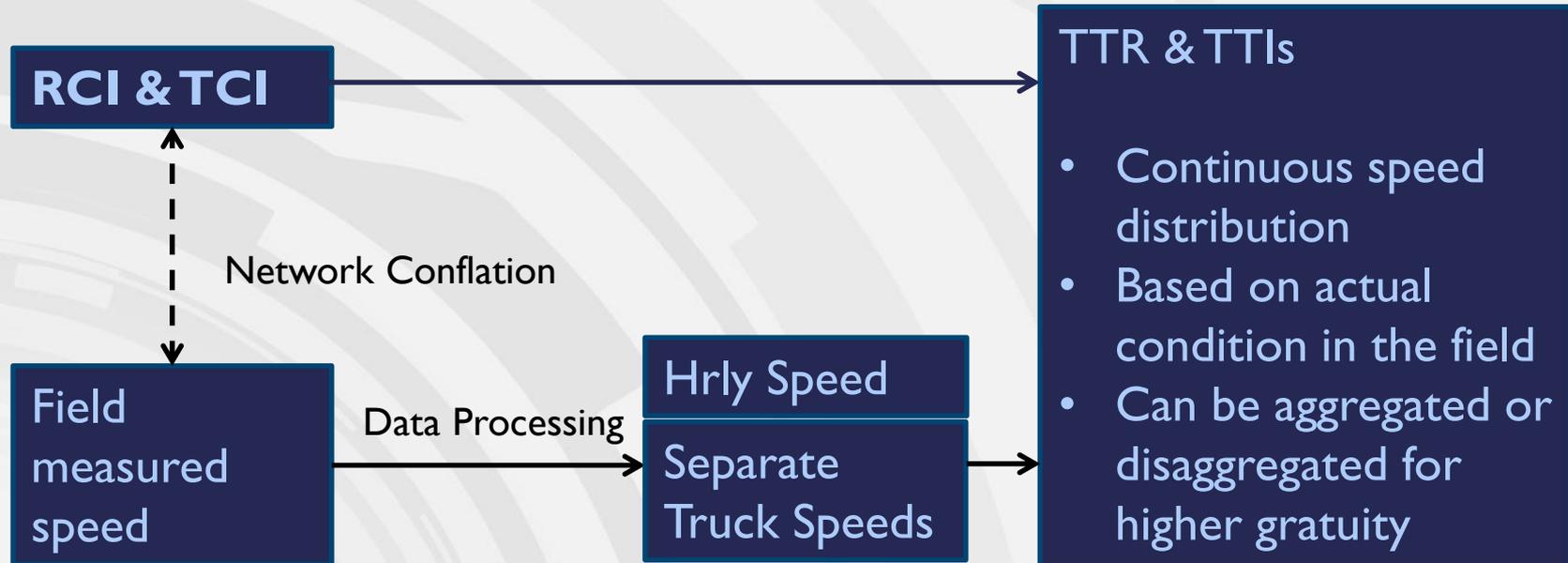
Standard Data Processing Procedures

◉ Other MPMs with Measured data

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┌─────────────┐                              ┌──────────────────────┐
│  RCI & TCI  │ ───────────────────────────▶ │  Revised MPM         │
└─────────────┘                              │  Database            │
       ↕                                     │                      │
   Network Conflation                        │  *Field measured speed│
       ↕                                     │  based LOS creterias  │
┌─────────────┐         ┌──────────────┐     │  *Field data based truck│
│  Field      │         │  Hrly Speed  │     │  speeds              │
│  measured   │ ──────▶ ├──────────────┤ ──▶ │                      │
│  speed      │  Data   │  Separate    │     │                      │
│             │ Processing│ Truck Speeds│     │                      │
└─────────────┘         └──────────────┘     └──────────────────────┘
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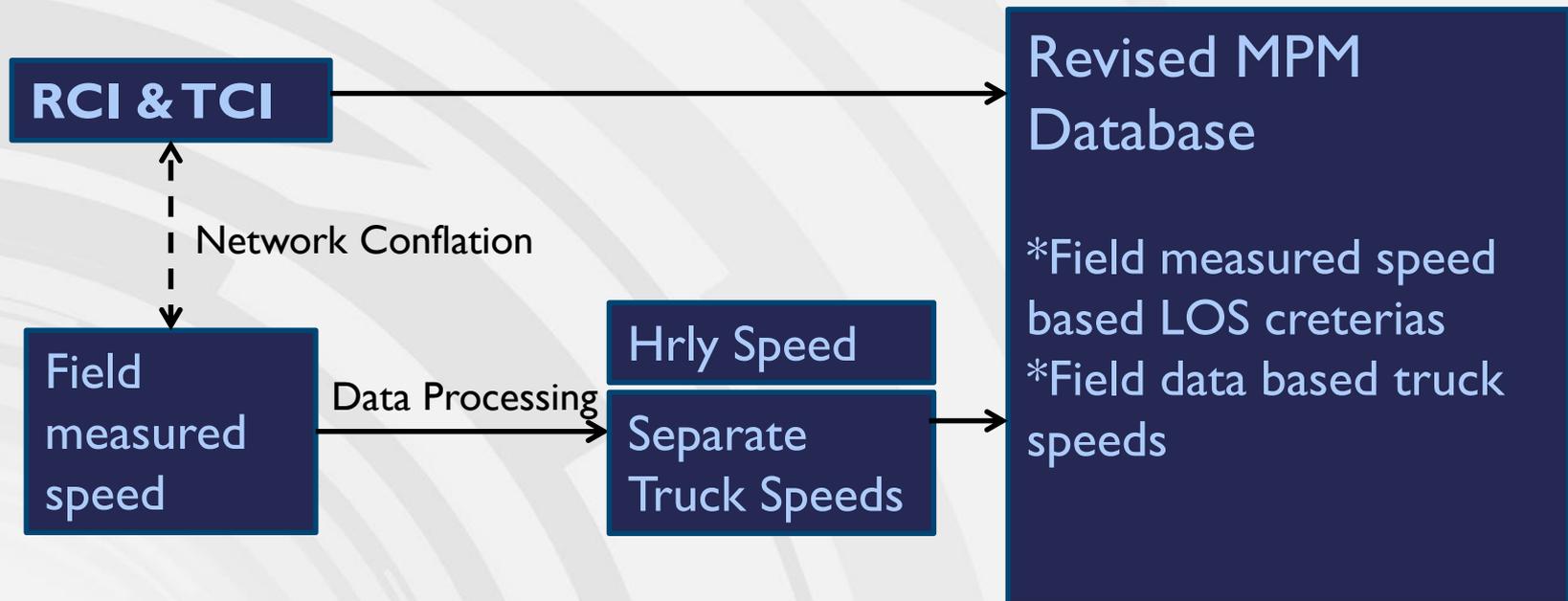
Recommendations for Data Processing

- ITS HERE data + NPMRDS data is recommended
  - » Minimum cost
    - Obtaining and archiving data
      - ♦ FHWA and FDOT ITS office
    - Network conflation
      - ♦ FDOT safety office
  - » Data quality checked by vendor
  - » Data coverage
    - Complete TMC network
    - Field data based models for SHS not covered by TMC network
  - » Data completeness
    - Data gaps over time filled by vendor
    - Raw data and separate truck data on NHS

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Florida's Transportation Data Plan

◎ Need

» More organized, collaborative, streamlined, cost effective approach to the collection, acquisition, storage, retrieval and distribution of transportation data within the Department and to its transportation partners

Transportation Data Plan

- Issues
  - » High priority has been placed on Freight Planning
    - • Need for consistent, reliable data sources to support integrated freight planning efforts in Florida
  - » MAP 21
  - » Asset Management
  - » Rapid technology changes
  - » Many offices, including modal offices, Districts, MPOs, etc., have individual growing needs for data
    - • Presents opportunities for collaboration, resource sharing and better return on investment

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Transportation Data Plan

◉ Living document

◉ Ensure efficient expenditure of resources in the areas of data acquisition and provision of data by consistently identifying/filling gaps and eliminating overlaps

◉ Encompass transportation data for all modes

◉ Address institutional issues (data silos, lack of sharing, lack of communication, lack of standards) AND technical issues (software, data compatibility).

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NATIONAL INITIATIVES

1. FHWA Data Business Plan
2. Resources

Overview of Data Business Plan

◎ GOAL 1:

» Improve the coordination and communication mechanism across U.S. DOT and FHWA offices involved with roadway travel mobility data to avoid investing resources in the same or similar types of data related programs.

- Objective 1.1. Identify gaps and redundancies in roadway travel mobility data programs

- Objective 1.2. Devise "rules of engagement" regarding collaboration of the data functions for roadway travel mobility data

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Overview of Data Business Plan

◎ GOAL 2:

» Improve the coordination of the data capture activities associated with ITS JPO-sponsored research in wirelessly connected vehicle technologies with roadway travel mobility data programs within U.S. DOT and FHWA.

- Objective 2.1. Identify how current and planned data from the connected vehicle initiative can support existing roadway travel mobility data programs

- Objective 2.2. Identify how data from roadway travel mobility data programs within U.S. DOT and FHWA can support the connected vehicle initiative

- Objective 2.3. Identify existing/future data inventory and data structures/policies/governance practices that could be applicable to the Research Data Exchange

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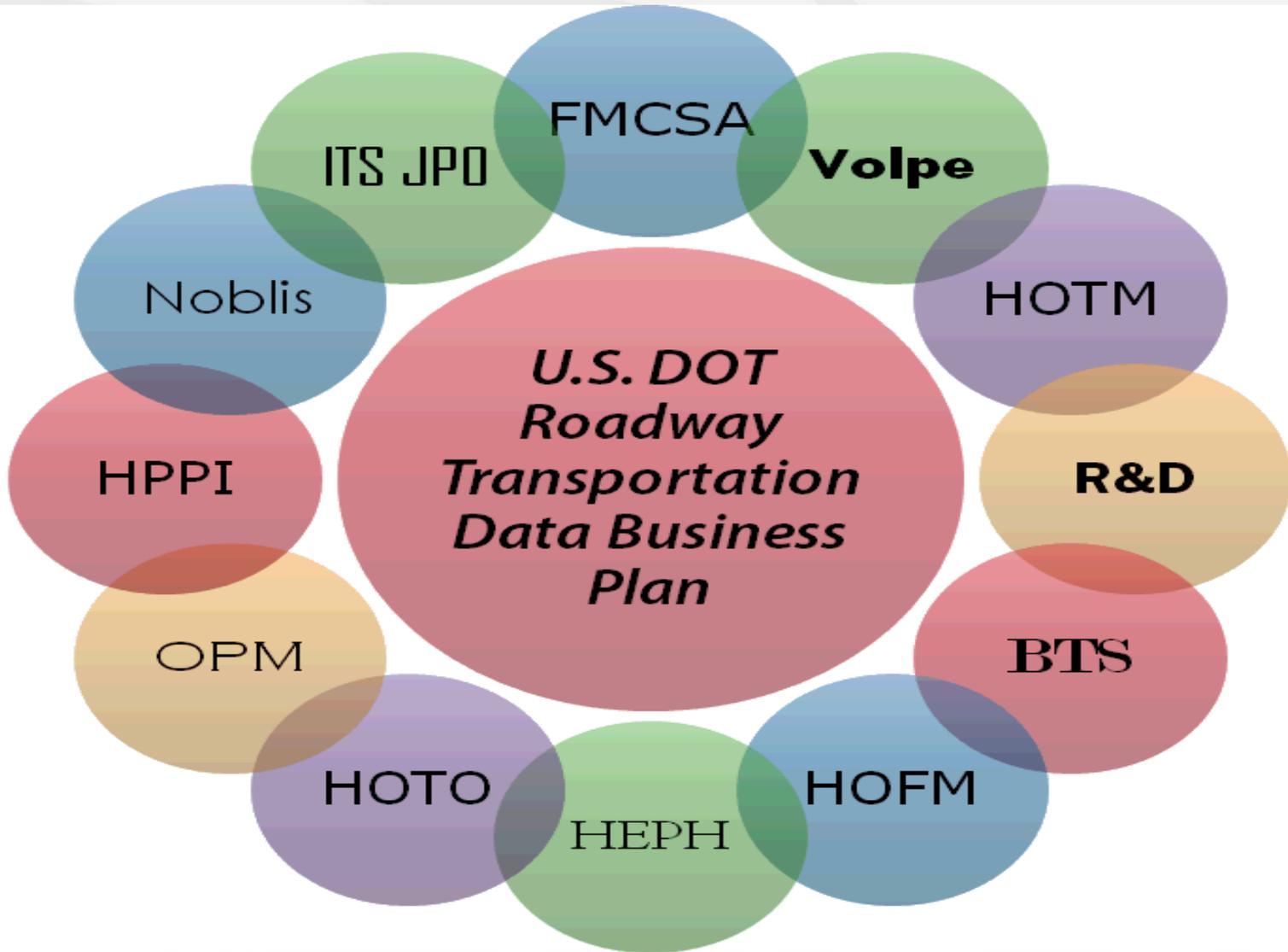
Stakeholders

Mobility Data Coordination Group

◉ A forum for U.S. DOT and FHWA stakeholders involved with roadway travel mobility data to:

  » **Share information** on current initiatives, activities, and/or best practices related to data strategies, policies, standards, metrics, etc.

  » **Identify needs and opportunities** to coordinate resources, reduce data redundancies, or enhance access to roadway travel mobility data

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Data Coordination Topics

- **Share RFPs** for current/upcoming mobility data initiatives

- Review and provide input on possible FHWA procurement actions

- **Share current initiatives**, activities, and/or best practices (i.e. data policies, standards, metadata, architecture)

- **Vet data standards/procedures** for linear referencing for data integration

- **Develop data standards/stewardship** recommendations for FHWA Data Governance Advisory Council

- **Identify/address gaps/redundancies** in mobility data programs

- **Identify needs/opportunities** to coordinate, reduce data redundancies, and implement cost sharing strategies

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Data Coordination Framework
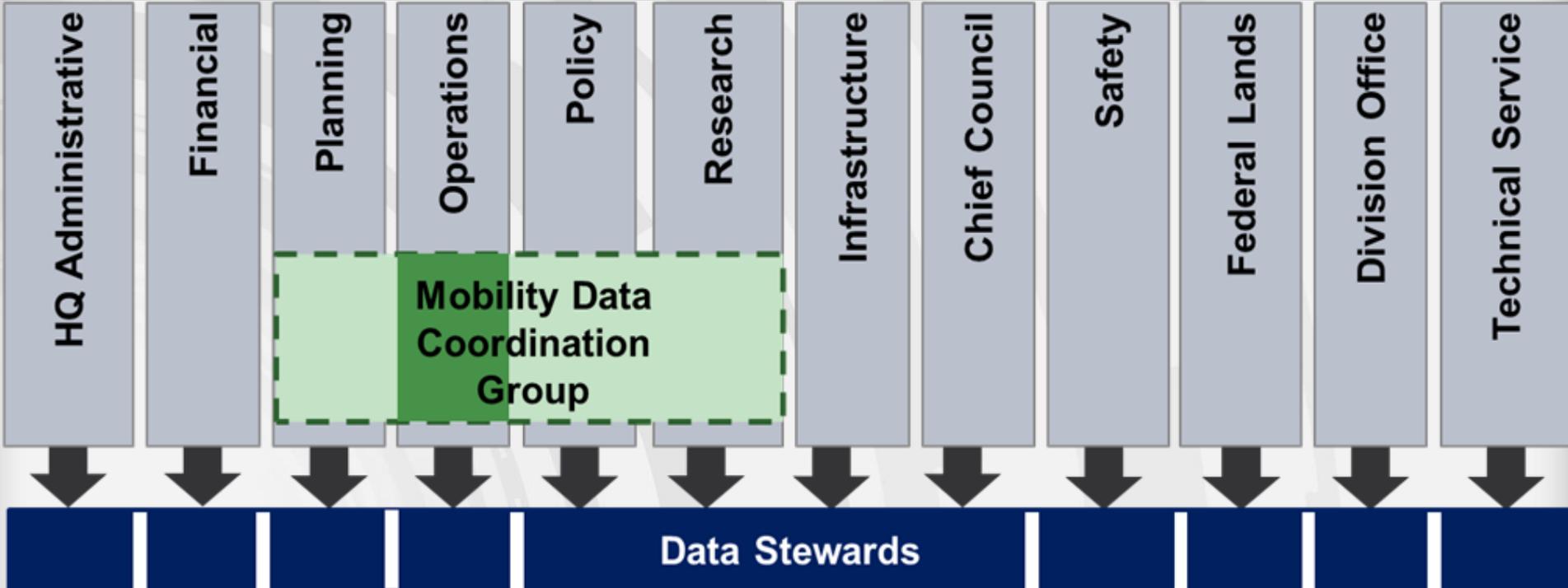
Data Principles

Principle 1 VALUABLE: **Data is an asset**

Principle 2 AVAILABLE: **Data is open, accessible, transparent and shared**

Principle 3 RELIABLE: **Data quality and extent is fit for a variety of applications**

Principle 4 AUTHORIZED: **Data is secure and compliant with regulations**

Principle 5 CLEAR: **There is a common vocabulary and data definition**

Principle 6 EFFICIENT: **Data is not duplicated**

Principle 7 ACCOUNTABLE: **Decisions maximize the benefit of data**

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Resources

- *NCHRP 666 - Target-Setting Methods and Data Management to Support Performance-Based Resource Allocation by Transportation Agencies*

- *NCHRP 8-36-100 – Self-Assessment of Transportation Data Programs*

- *DAMA Guide to The Data Management Book of Knowledge (DAMA-DMBOK Guide)*

- IBM Corporation, *The IBM data governance blueprint: Leveraging best practices and proven technologies*

- *Process for Assessing Status of Common Enterprise-Wide Data Governance Issues,* O'Connor, K.,

- Several states – Alaska, Oregon, Virginia, Colorado, Minnesota,

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Questions

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