



The DVC - Using Data Visualization to Improve Communication of FHWA Data

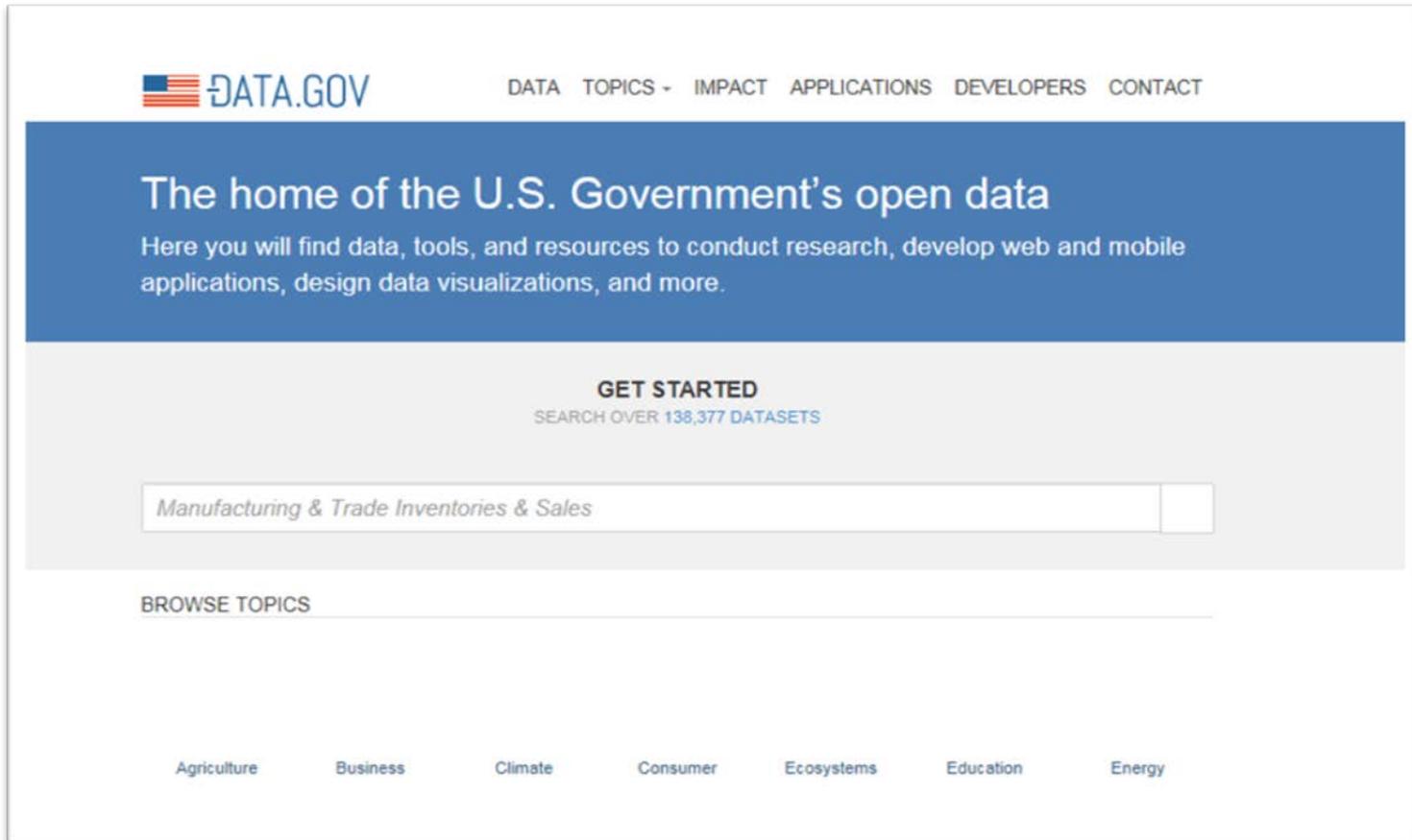
Highway Information Seminar, September 2015

Justin Clarke - FHWA Office of Policy and Governmental Affairs



Why Data Visualization?

Big (and Small) Data is here to stay



The screenshot shows the Data.gov homepage. At the top left is the Data.gov logo, which includes a small American flag icon. To the right of the logo are navigation links: DATA, TOPICS, IMPACT, APPLICATIONS, DEVELOPERS, and CONTACT. Below the navigation is a blue banner with the text "The home of the U.S. Government's open data" and a subtext: "Here you will find data, tools, and resources to conduct research, develop web and mobile applications, design data visualizations, and more." Underneath the banner is a "GET STARTED" section with the text "SEARCH OVER 138,377 DATASETS" and a search input field containing the text "Manufacturing & Trade Inventories & Sales". Below the search field is a "BROWSE TOPICS" section with a horizontal line and a list of topic categories: Agriculture, Business, Climate, Consumer, Ecosystems, Education, and Energy.



Executives (and MAP-21) require better communication and customization of data

2060 Florida Transportation Plan Scorecard

The 2060 Florida Transportation Plan (FTP) Scorecard provides a snapshot of the performance of Florida's transportation system and shares progress toward FTP implementation with FDOT partners and the public.

● Improving or At/Above Target
 ● Maintaining
 ● Worsening

Progress represents change from most recent data year or target achievement.



| Indicator | Trend Overview | Desired Direction | Progress | Analysis |
|---|--|-------------------|----------|---|
| <i>Economic Competitiveness / Mobility and Connectivity</i> | | | | |
| Florida Share of U.S. Trade Flow | | ↑ | ● | Florida increased its share of U.S. trade in 2011, moving goods worth \$149B. |
| Economic Impact of Transportation Investments | <i>Jobs Created: Approximately 15,000 to 64,000 annually</i> | ↑ | NA | Investments in Florida's transportation system provide long-term economic benefits for residents and businesses. Overall return of \$4.92 in benefits per \$1 of investment is consistent with prior studies. |



Increased demand for visually appealing information

ANNUAL VEHICLE DISTANCE TRAVELED IN MILES AND RELATED DATA - 2012 (1)
BY HIGHWAY CATEGORY AND VEHICLE TYPE

Jan 2014

Table VM-1

| YEAR | ITEM | LIGHT DUTY VEHICLES SHORT WB 2/ | MOTOR-CYCLES | BUSES | LIGHT DUTY VEHICLES LONG WB 2/ | SINGLE-UNIT TRUCKS 3/ | COMBINATION TRUCKS | SUBTOTALS | | |
|------|--|---------------------------------|--------------|-----------|--------------------------------|-----------------------|--------------------|----------------------------|--|--------------------|
| | | | | | | | | ALL LIGHT DUTY VEHICLES /2 | SINGLE-UNIT 2-AXLE 6-TIRE OR MORE AND COMBINATION TRUCKS | ALL MOTOR VEHICLES |
| 2012 | Motor-Vehicle Travel: (millions of vehicle-miles) | | | | | | | | | |
| 2011 | Interstate Rural | 141,090 | 1,279 | 1,674 | 43,889 | 9,249 | 48,691 | 184,979 | 57,940 | 245,872 |
| 2012 | Other Arterial Rural | 140,603 | 1,243 | 1,670 | 42,961 | 9,495 | 47,616 | 183,564 | 57,111 | 243,587 |
| 2011 | Other Rural | 231,314 | 2,880 | 2,036 | 88,842 | 17,194 | 29,689 | 320,156 | 46,883 | 371,954 |
| 2012 | | 232,433 | 2,815 | 1,982 | 89,667 | 16,951 | 29,328 | 322,100 | 46,279 | 373,176 |
| 2011 | | 226,777 | 3,358 | 2,031 | 94,356 | 17,961 | 14,316 | 321,133 | 32,277 | 358,799 |
| 2012 | | 227,027 | 3,033 | 2,069 | 93,914 | 18,224 | 14,762 | 320,941 | 32,986 | 359,028 |
| 2011 | All Rural | 599,181 | 7,516 | 5,741 | 227,086 | 44,403 | 92,696 | 826,268 | 137,100 | 976,624 |
| 2012 | | 600,063 | 7,090 | 5,721 | 226,541 | 44,671 | 91,706 | 826,604 | 136,377 | 975,782 |
| 2011 | Interstate Urban | 345,091 | 2,815 | 2,359 | 84,130 | 14,539 | 35,614 | 429,220 | 50,153 | 484,547 |
| 2012 | Other Urban | 341,865 | 2,134 | 2,112 | 82,652 | 14,126 | 33,815 | 424,517 | 47,942 | 476,704 |
| 2011 | | 1,119,085 | 10,967 | 6,654 | 289,872 | 46,018 | 35,047 | 1,408,957 | 81,065 | 1,507,643 |
| 2012 | | 1,104,354 | 9,318 | 5,975 | 294,983 | 45,006 | 38,270 | 1,399,337 | 83,276 | 1,497,906 |
| 2011 | All Urban | 1,464,176 | 13,782 | 9,013 | 374,001 | 60,557 | 70,662 | 1,838,177 | 131,219 | 1,992,191 |
| 2012 | | 1,446,220 | 11,452 | 8,087 | 377,634 | 59,132 | 72,085 | 1,823,854 | 131,218 | 1,974,610 |
| 2011 | Total Rural and Urban 5/ | 2,063,357 | 21,298 | 14,755 | 601,089 | 104,960 | 163,358 | 2,664,445 | 268,318 | 2,968,815 |
| 2012 | | 2,046,282 | 18,542 | 13,807 | 604,175 | 103,803 | 163,791 | 2,650,458 | 267,594 | 2,950,402 |
| 2011 | Number of motor vehicles registered 2/ | 183,171,882 | 8,454,939 | 764,509 | 50,588,676 | 8,190,286 | 2,469,094 | 233,760,558 | 10,659,380 | 253,639,386 |
| 2012 | | 183,522,635 | 8,437,502 | 666,064 | 50,318,787 | 7,819,055 | 2,451,638 | 233,841,422 | 10,270,693 | 253,215,681 |
| 2011 | Average miles traveled per vehicle | 11,265 | 2,519 | 19,299 | 11,882 | 12,815 | 66,161 | 11,398 | 25,172 | 11,705 |
| 2012 | | 11,150 | 2,198 | 20,730 | 12,007 | 13,276 | 66,809 | 11,334 | 26,054 | 11,652 |
| 2011 | Person-miles of travel 4/ (millions) | 2,866,797 | 22,940 | 312,797 | 803,023 | 104,960 | 163,358 | 3,669,821 | 268,318 | 4,273,876 |
| 2012 | | 2,843,075 | 19,972 | 292,716 | 807,148 | 103,803 | 163,791 | 3,650,223 | 267,594 | 4,230,505 |
| 2011 | Fuel consumed (thousand gallons) | 88,541,453 | 489,115 | 2,059,305 | 35,093,224 | 14,286,505 | 27,925,585 | 123,634,677 | 42,212,090 | 168,395,187 |
| 2012 | | 88,358,664 | 426,378 | 1,936,151 | 35,334,618 | 14,215,431 | 28,181,039 | 123,693,282 | 42,396,470 | 168,452,281 |
| 2011 | Average fuel consumption per vehicle (gallons) | 483 | 58 | 2,694 | 694 | 1,744 | 11,310 | 529 | 3,960 | 664 |
| 2012 | | 481 | 51 | 2,907 | 702 | 1,818 | 11,495 | 529 | 4,128 | 665 |
| 2011 | Average miles traveled per gallon of fuel consumed | 23.3 | 43.5 | 7.2 | 17.1 | 7.3 | 5.8 | 21.6 | 6.4 | 17.6 |
| 2012 | | 23.2 | 43.5 | 7.1 | 17.1 | 7.3 | 5.8 | 21.4 | 6.3 | 17.5 |

1/ The FHWA estimates national trends by using State reported Highway Performance and Monitoring System (HPMS) data, fuel consumption data (MF-21 and MF-27), vehicle registration data (MV-1, MV-9, and MV-10), other data such as the R. L. Polk vehicle data, and a host of modeling techniques. Starting with the 2009 VM-1, an enhanced methodology was used to provide timely indicators on both travel and travel behavior changes.

2/ Light Duty Vehicles Short WB - passenger cars, light trucks, vans and sport utility vehicles with a wheelbase (WB) equal to or less than 121 inches. Light Duty Vehicles Long WB - large passenger cars, vans, pickup trucks, and sport/utility vehicles with wheelbases (WB) larger than 121 inches. All Light Duty Vehicles - passenger cars, light trucks, vans and sport utility vehicles regardless of wheelbase.

3/ Single-Unit - single frame trucks that have 2-axes and at least 6 tires or a gross vehicle weight rating (GVWR) exceeding 10,000 lbs.

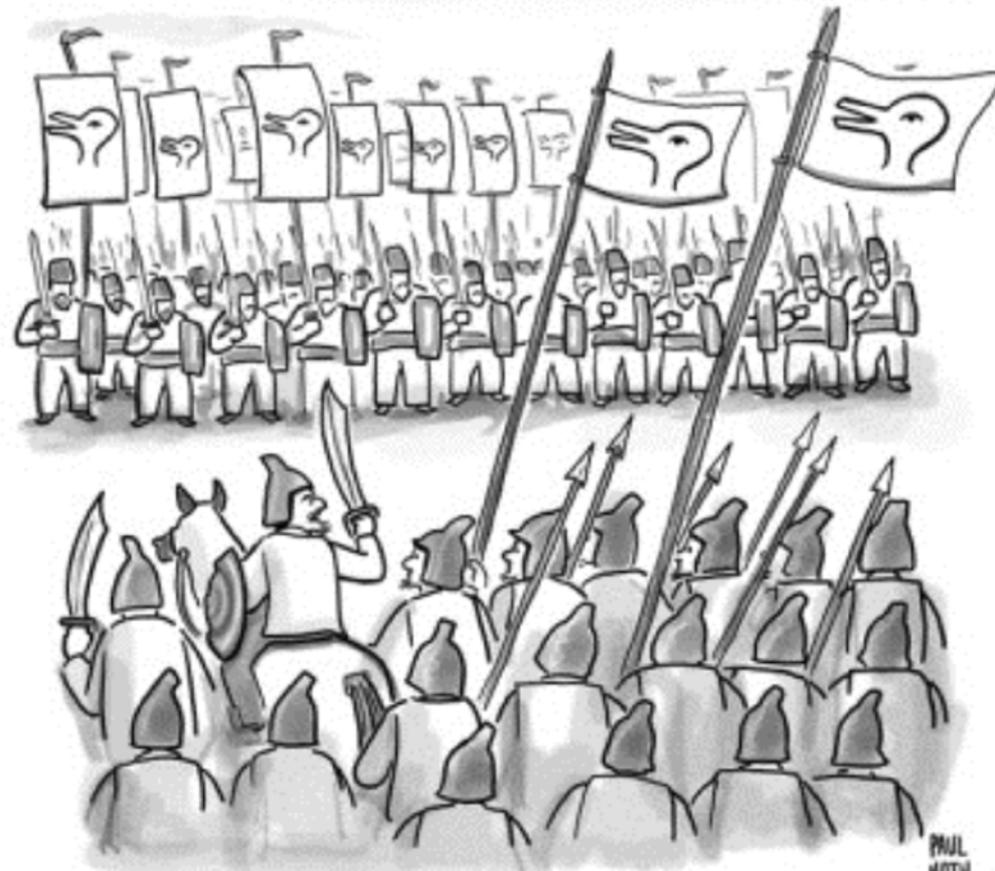
4/ Vehicle occupancy is estimated by the FHWA from the 2009 National Household Travel Survey (NHTS); For single unit truck and heavy trucks, 1 motor vehicle mile travelled = 1 person-mile traveled.

5/ VMT data are based on the latest HPMS data available; it may not match previous published results.



FHWA Data visualization experience is lacking





“There can be no peace until they renounce their Rabbit God and accept our Duck God.”

(The New Yorker, December 1, 2014)

Building Data Vis. Into FHWA

DVC

Data Visualization Center

On demand data visualization service
for FHWA Staff.



Project Team

Federal Highway Administration

DVC

High
Street
Consulting
Group





Our Project Model

- Funded for two and a half years
- Anyone at FHWA can make a request
 - Headquarters, Divisions, Resource Centers
- Requests can be made online
- Each project is customized



Services of the Center



Infographics – Static illustrations that visually communicate complex information and data



Web Applications – Web software that allows user to interact and visualize large data sets



Motion Graphics – Video animations that explain a story or message



Consulting Services – Assistance and advice on visualizations such as charts, graphics, etc.

We have 52 projects completed or underway

| Type of Visualization Request | | Type of Support | | |
|-------------------------------|-----------|-----------------|--------------------|--------------|
| | | Create New | Assist on Existing | Consultation |
| Static | 43 | 21 | 16 | 6 |
| Chart | 10 | 3 | 7 | 0 |
| Dashboard | 4 | 2 | 2 | 0 |
| Graphic | 7 | 5 | 0 | 2 |
| Infographic | 8 | 8 | 0 | 0 |
| Map | 5 | 2 | 2 | 1 |
| Report | 8 | 0 | 5 | 3 |
| Web | 1 | 1 | 0 | 0 |
| Interactive | 9 | 5 | 3 | 1 |
| Dashboard | 2 | 0 | 2 | 0 |
| GIS | 2 | 2 | 0 | 0 |
| Web | 5 | 3 | 1 | 1 |
| Grand Total | 52 | 26 | 19 | 7 |

The First DVC Project: The Top Interstates Infographic

Top U.S. Interstates By Length and Travel

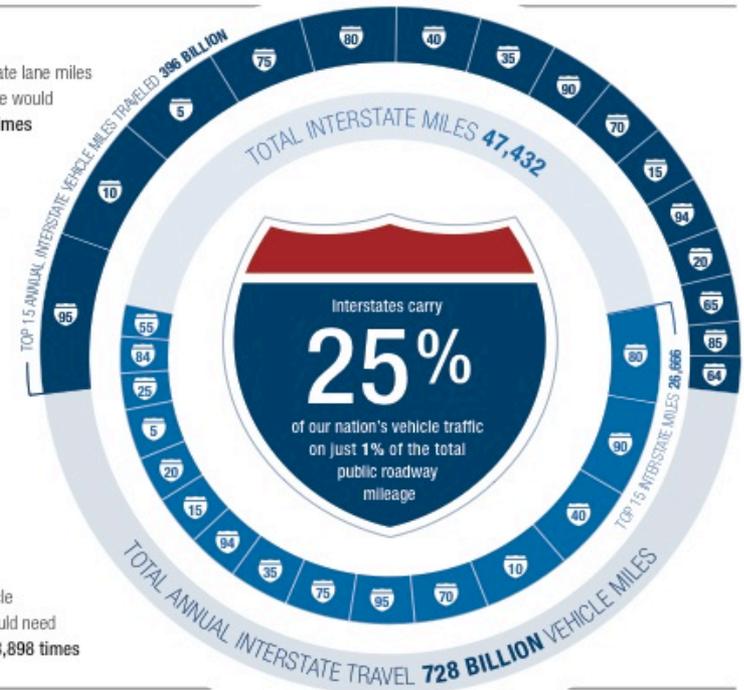
DISTANCE CONTEXT:

If you stretched all the Interstate lane miles along the equator, the distance would almost circle the Earth **nine times**

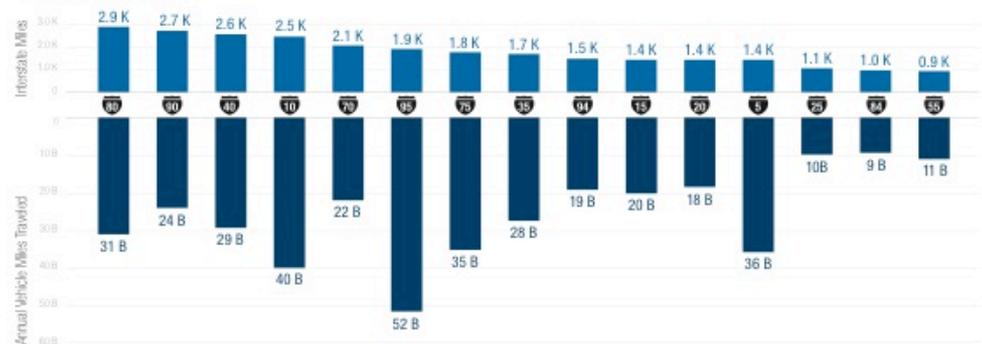


TRAFFIC CONTEXT

To equal the total annual vehicle miles traveled, one person would need to travel to the sun and back **3,898 times**



TOP 15 INTERSTATES



Bike – Ped Safety Infographic

SAFER PEOPLE, SAFER STREETS

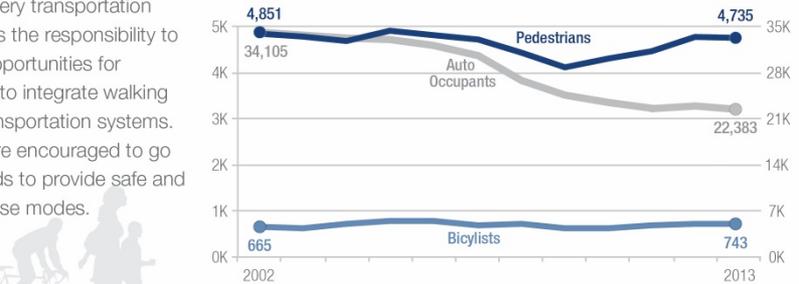
USDOT Pedestrian and Bicycle Safety Initiative

The DOT policy is to incorporate safe and convenient walking and bicycling facilities into transportation projects. Every transportation agency, including DOT, has the responsibility to improve conditions and opportunities for walking and bicycling and to integrate walking and bicycling into their transportation systems. Transportation agencies are encouraged to go beyond minimum standards to provide safe and convenient facilities for these modes.



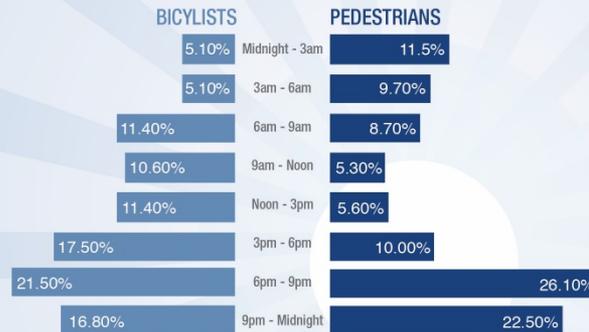
Source: USDOT Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations (2010)

Pedestrian and bicyclist fatalities have increased in recent years, as auto occupant deaths declined



Source: 2013 Motor Vehicle Crash Data from FARS and GES

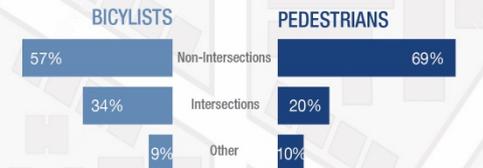
Fatalities and time of day



Source: FARS 2012 Final File, 2013 ARF.

Fatalities at intersections vs non-intersections

A large percentage of pedestrian and bicycle fatalities occur in mid-block locations.



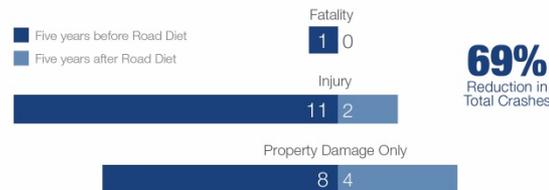
Source: FARS 2013 ARF.

Note: Unknown values were removed before calculating percentages.

* Other includes parking lane/zone, bicycle lane, shoulder/roadside, sidewalk, median/crossing island, driveway access, shared-use path/trail, non-trafficway area, and other.

Case Study: Implementing a Road Diet To Improve Safety for Everyone, including Pedestrians and Bicyclists

After implementing a road diet that added a turn lane and bike lanes on Lawyers Road in Fairfax County, the Virginia Department of Transportation documented a 69% reduction in overall crashes.

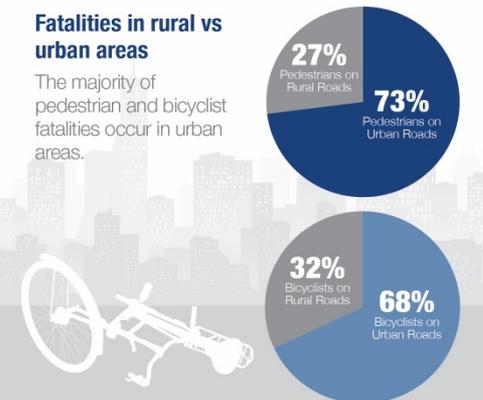


For more information on road diets, visit: http://safety.fhwa.dot.gov/road_diets.

Source: Virginia Department of Transportation

Fatalities in rural vs urban areas

The majority of pedestrian and bicyclist fatalities occur in urban areas.



Source: 2013 Motor Vehicle Crash Data from FARS and GES

Strategic Initiative Metrics

Research and Technology Strategic Initiatives

Summary of Accomplishments, 2008-2014

The Research and Technology (R&T) Strategic Initiatives program directs resources to address strategic needs, fill in current research gaps, and focus on emerging cross-cutting issues

Funding began in 2008 at \$14 million annually as a part of SAFETY-LU

In 2013 FHWA leadership increased the funding level to \$20 million annually as a part of MAP-21

Since 2008, 100 projects have been awarded for a total of \$108 million

As of 2014, 55 projects have been completed and 45 are in progress

DETAILS BY PROJECT AREA

| Number of Projects 2008-2014 | Funding |
|------------------------------|---------|
|------------------------------|---------|

■ Completed Projects ■ Projects in progress



SELECTED HIGHLIGHTS

Encouraged Sustainability of Transportation Projects

- Researched, designed, and pilot tested a sustainability rating tool called Infrastructure Voluntary Evaluation Sustainability Tool (INVEST) to help State DOTs and MPOs evaluate sustainable projects and practices
- Developed a sourcebook on transportation-related greenhouse gas mitigation strategies, identifying potential options and estimate costs for greenhouse gas reductions

Improved Transportation Options for Non-Motorized Travel

- Developed a rating tool to model neighborhood characteristics that influence walkability
- Developed a set of tools to measure community characteristics that enhance livability and improve quality of life, such as a walkability index, WalkScore, and PlaceFit
- Advanced the understanding of livability concerns through support of data collection and analysis efforts

Enhanced Bridge and Tunnel Safety

- Designed and delivered four updated and enhanced bridge inspection and bridge management training courses to produce quality inspection data and uniform condition evaluation and assessment of bridges.
- Captured the current state-of-the-practice in bridge management by conducting five bridge management peer exchanges to enhance quality and improve effectiveness.

Improved Road Safety

- Produced a set of tools, online guides, clearinghouse websites, training courses, peer exchanges, technical assistance, and workshops on Rural Highway Safety to assist local and rural highway agencies address safety problems and implement best practices
- Supported the deployment and implementation of a new generation of highway safety analysis tools, including the Highway Safety Manual, the software SafetyAnalyst, the Interactive Highway Safety Design Model, and the Crash Modification Factors Clearinghouse

Research and Technology Strategic Initiatives

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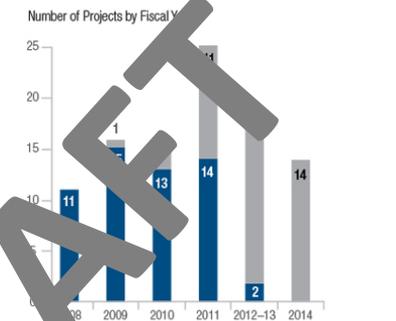
DETAILS BY PROJECT AREA

| Number of Projects 2008-2014 | Funding |
|------------------------------|---------|
|------------------------------|---------|

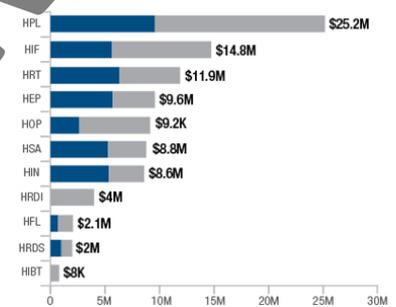
■ Completed Projects ■ Projects in progress



Status of Strategic Initiatives Projects



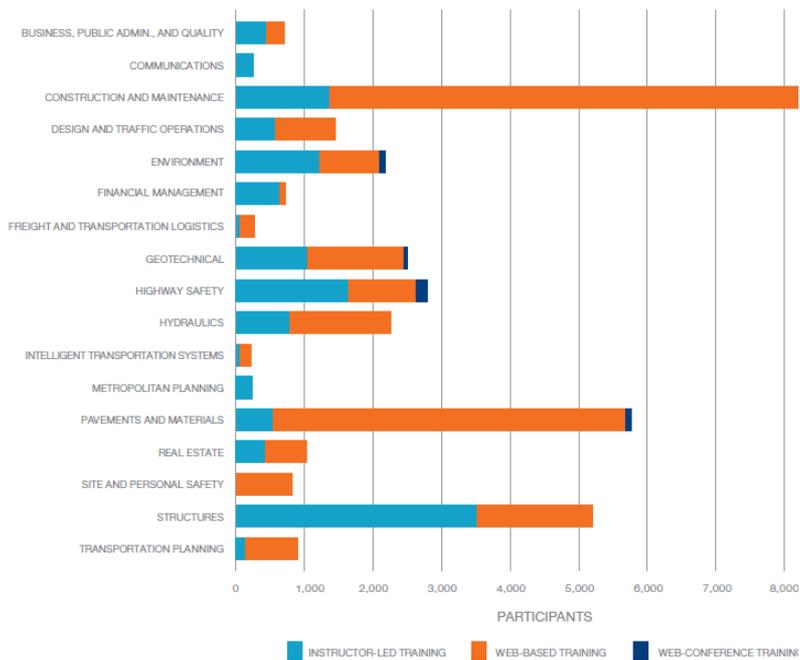
Funding by Lead Office



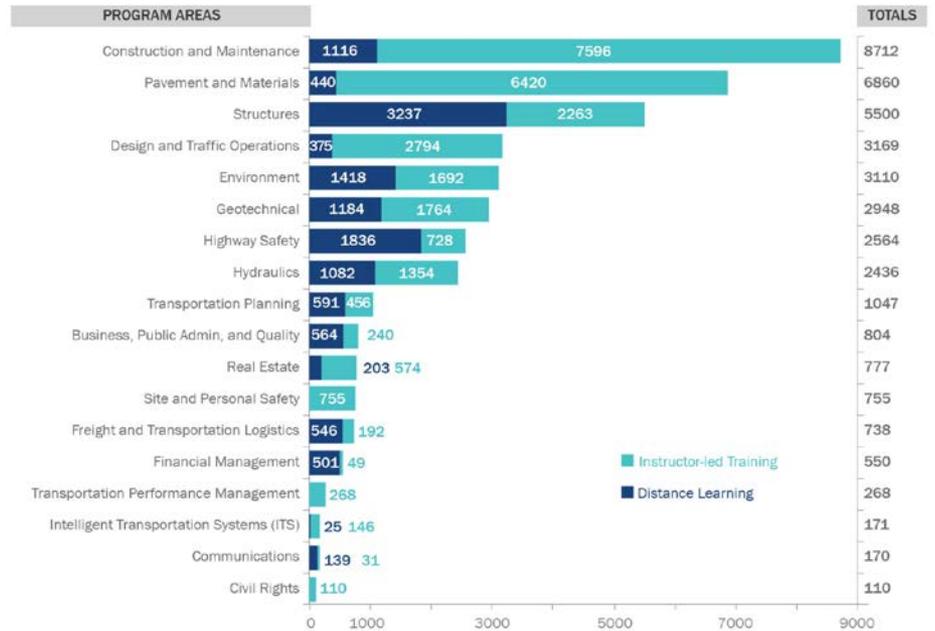
■ Completed Projects ■ Projects in progress

NHI Annual Report

PARTICIPATION BY DELIVERY TYPE AND PROGRAM AREA

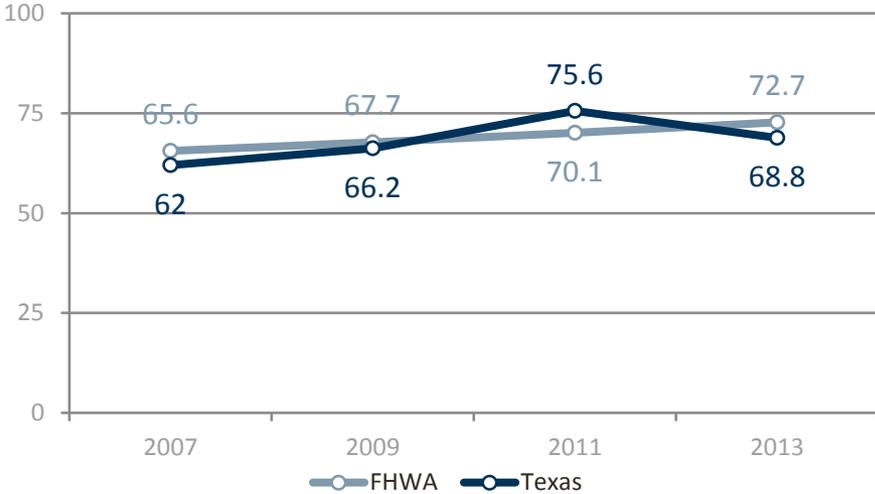


PARTICIPATION BY PROGRAM AREA AND DELIVERY TYPE

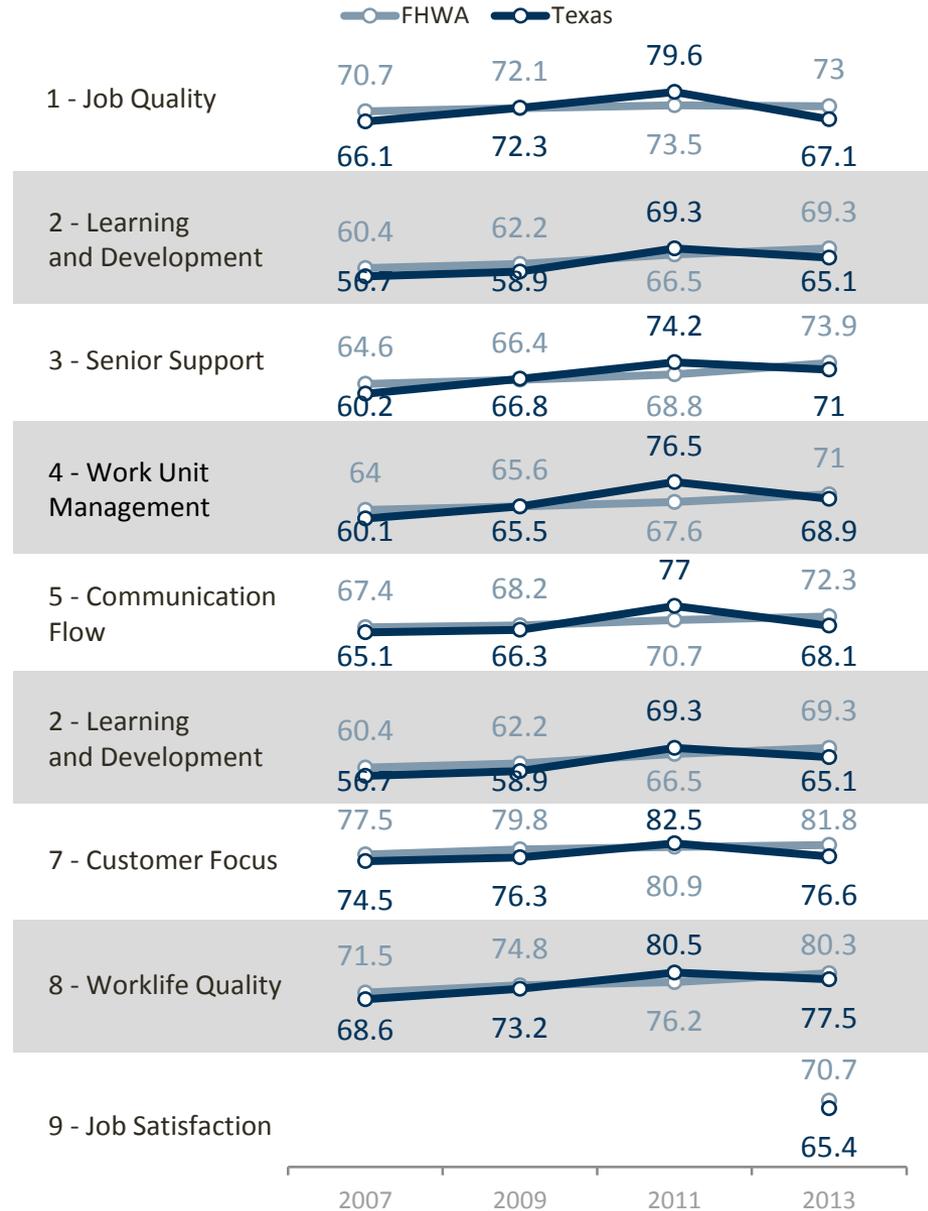


Texas Division Dashboard

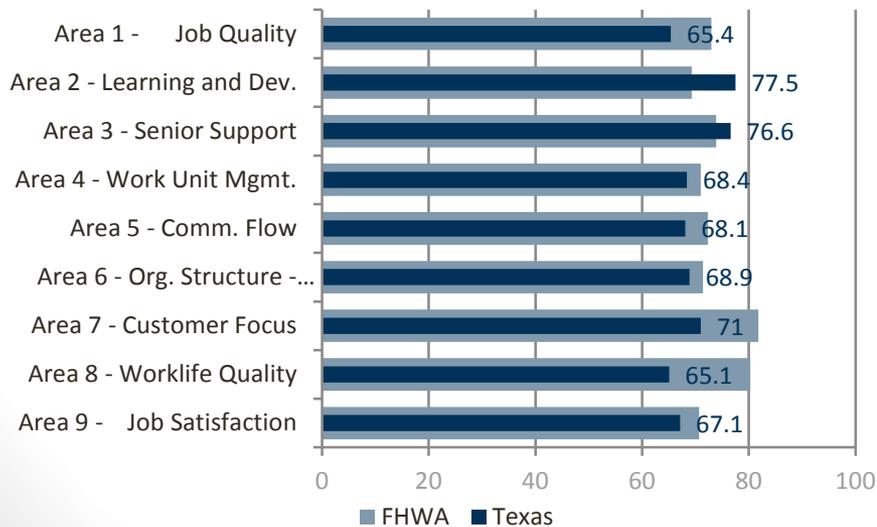
All Employee Survey Climate Quotient Score



TX All Employee Survey Trend

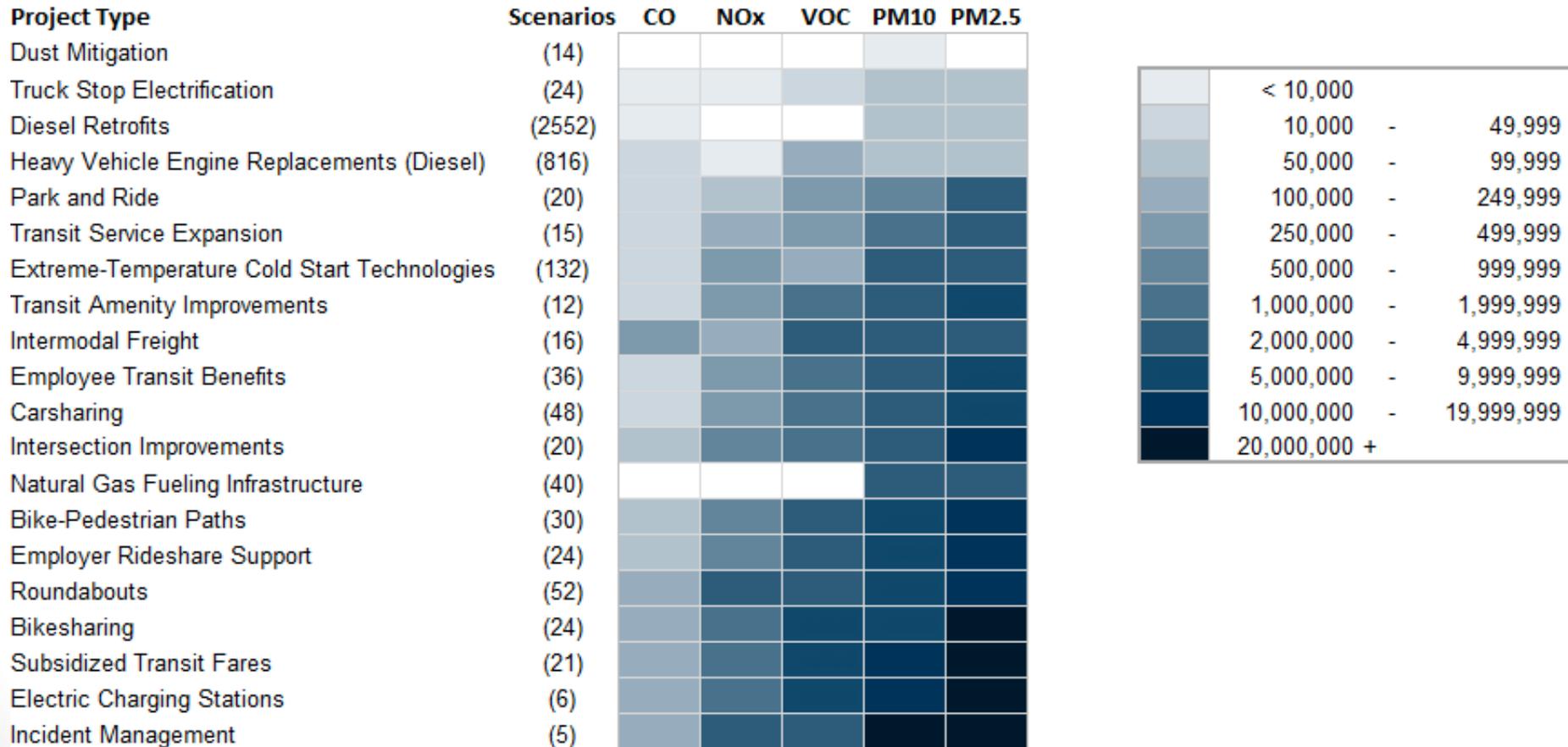


All Employee 2013 Snapshot



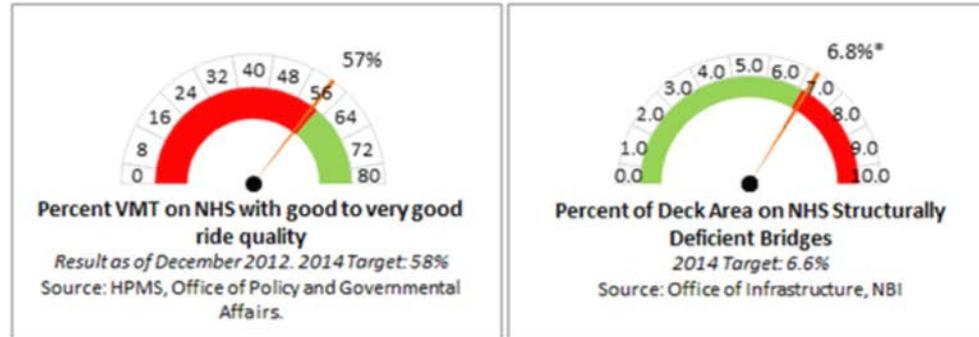
CMAQ Project Effectiveness

Cost per ton of pollutant abatement



Existing Dashboard

STRATEGIC GOAL: SYSTEM PERFORMANCE – INFRASTRUCTURE



| Dashboard Measure | Q1 12/13 | Q2 3/14 | Q3 6/14 | Q4 9/14 | FY 2014 Target | Status | Notes (Owner) |
|--|----------|---------|---------|---------|----------------|--------|---|
| Percent of States with NBIS bridge load rating compliance metric assessed as satisfactory. | 33% | 33% | 35% | | 42% | Y | FY 2013 actual was 39%. Q1 percentages are reduced because several States adjusted their target completion dates as a result of underestimating the level of effort required. (Waidelich) |
| Percent of States with NBIS bridge scour compliance metric assessed as satisfactory. | 56% | 63% | 63% | | 67% | Y | FY 2013 actual was 63%. Q1 percentages are reduced because several States adjusted their target completion dates as a result of underestimating the level of effort required. (Waidelich) |

Status: Green – exceeding FY14 target; Yellow – on track to meet FY14 target; Red- at risk of not meeting FY14 target, Blue – Measure currently under development, Gray – Data Not Available.

QUARTERLY HIGHLIGHTS:

Significant Accomplishments:

- Provided National NBIP Review training to new Division bridge staff and load rating assistance to MDSHA in April.
- Conducted a webinar on the comparison of AASHTO load rating methods in May; 29 States attended this webinar

Revised Dashboard

STRATEGIC GOAL: SYSTEM PERFORMANCE – INFRASTRUCTURE

FY 2014 Leadership Team Dashboard, [Date], Page 8

Performance Improvements - Make significant improvements to critical aspects of highway system performance and condition

STRATEGIC OUTCOMES

Percent VMT on NHS with good to very good ride quality

FY 2015 Target: 59%

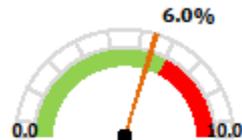
Source: HPMS, Office of Policy and Governmental Affairs.



Percent of Deck Area on NHS Deficient Bridges

FY 2015 Target - 5.9%

Source: NBI, Office of Infrastructure



HIGHLIGHTS

(In this section, we want to list only the Big Initiatives and Key Events that all of the leadership team needs to be aware of or need to key in on. They should also be forward looking.

DASHBOARD MEASURES

Percent of States with NBIS bridge load rating compliance metric assessed as satisfactory.



Status: **R**

Notes: FY 2013 actual was 30%. Q1 percentages are reduced because several States adjusted their target completion dates as a result of underestimating the level of effort required. (Waidehich)

Percent of States with NBIS bridge scour compliance metric assessed as satisfactory.



Status: **G**

Notes: FY 2013 actual was 68%. Q1 percentages are reduced because several States adjusted their target completion dates as a result of underestimating the level of effort required. (Waidehich)

SIP STATUS

SP-4. Use asset management principles and techniques to achieve and sustain a state of good repair of pavements, bridges, and tunnels with a focus on the National Highway System (NHS) and FLMA's roadways. (Lead Office: HIF)

Status: **G**

Contact Information

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Opportunities

- **Software**
 - DVC provides services, not software
 - Dynamic, Map/GIS platforms
 - Versions
- **Motion Graphics**
 - Video animations that explain a story or message
- **508 Compliance**





Creating a Data Vis. Culture

- Do we need all that Text?
- Are we packaging the data appropriately?
- What is the best role for visualization in social media?
- Respect the big data but don't forget the small data.



Objectives

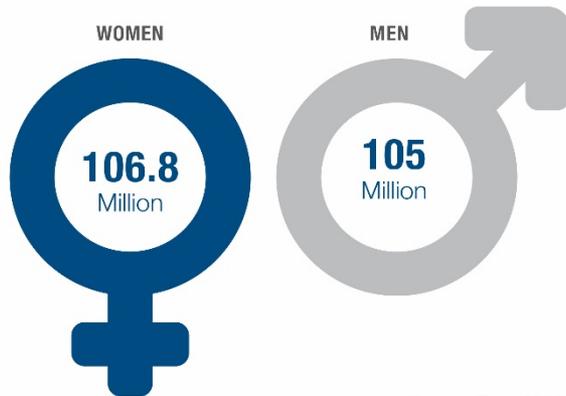
- **Improve information sharing** related to large, dynamic and important data sets.
- **Demonstrate the utility of visualization techniques**
- **Enhance communication of data** within the FHWA, with FHWA partners and with project stakeholders.
- **Build data visualization capacity**



Social Media Examples

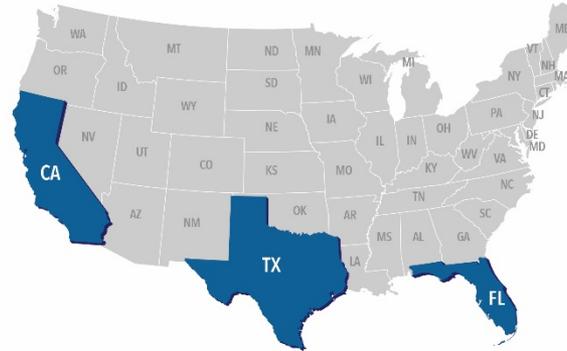
1.8 MILLION MORE FEMALE DRIVERS THAN MALE DRIVERS

Licensed Drivers in the USA



Source: From 2012

California, Texas, and Florida account for over 25% of all registered vehicles in the United States



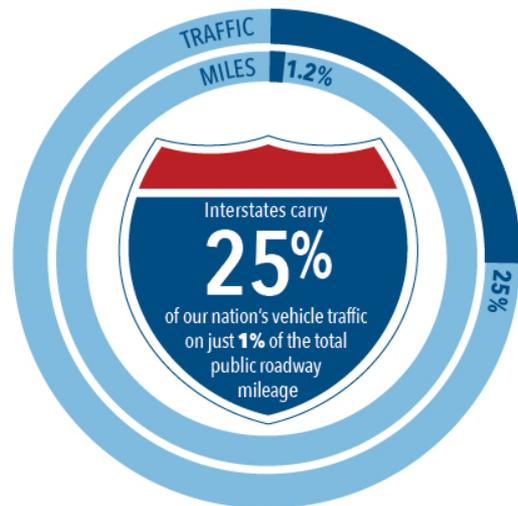
CALIFORNIA
27.7 Million

TEXAS
20.2 Million

FLORIDA
15.7 Million

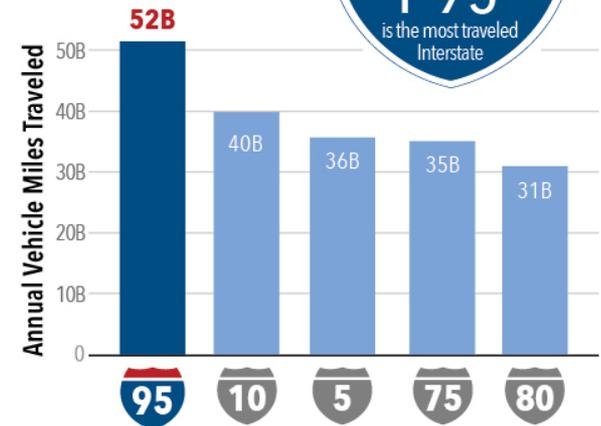
Over **25%** of all registered vehicles

TRAFFIC AND MILEAGE ON THE NATION'S INTERSTATES



Source: 2012 Highway Statistics Data Series

TOP 5 MOST TRAVELED INTERSTATES



Source: 2012 Highway Statistics Data Series