Accommodating Extreme Weather Adaptation to Planning and Sustainability in North Central Texas

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North Central Texas Council of Governments

October 4, 2016

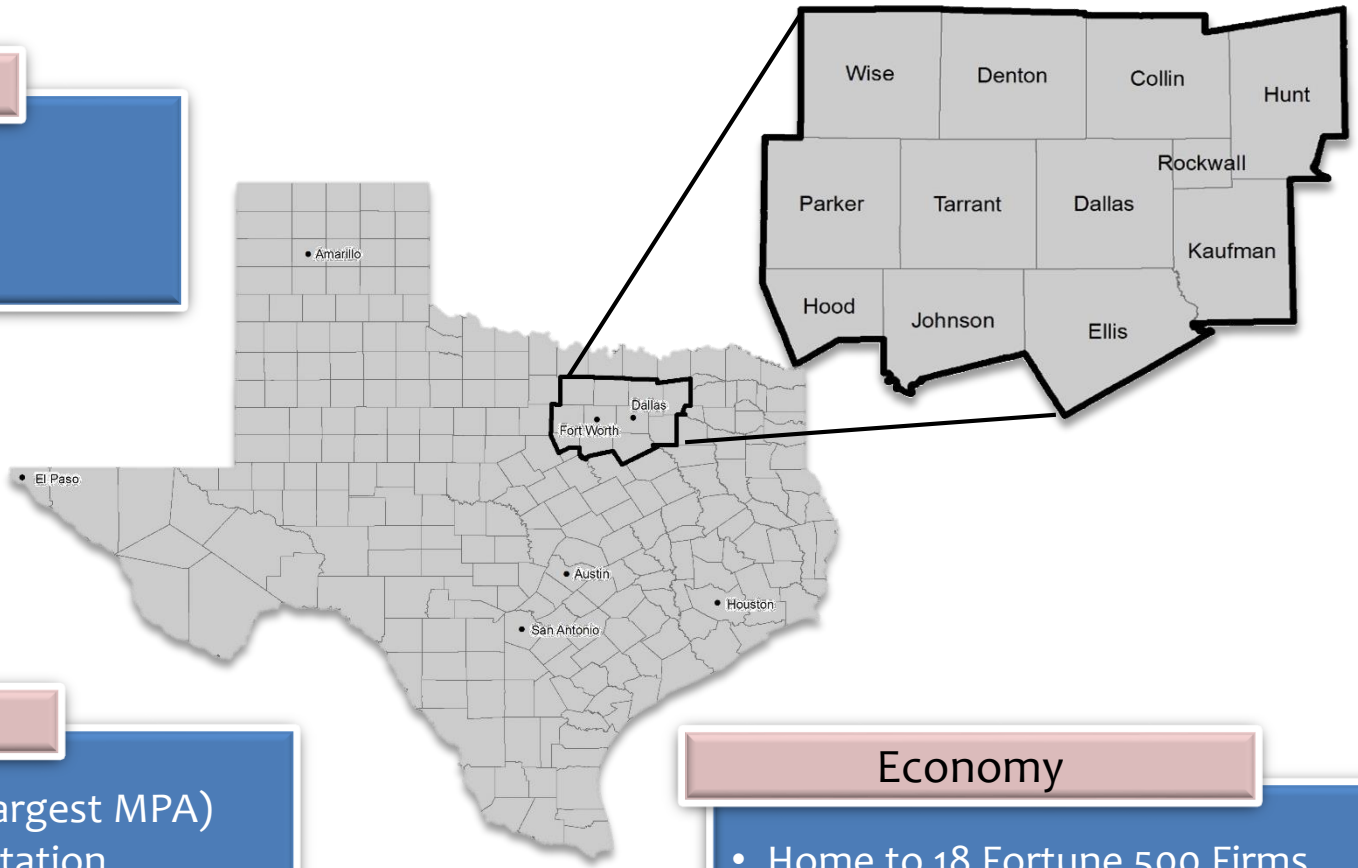
ARC/FHWA Climate Resilience Peer Exchange

NCTCOG – Regional Perspective

12-County Metropolitan Planning Area (MPA)

Population

- 2015: 7.0 million
- 2040: 10.7 million
- 4th Largest MPA



Area

- 12 Counties (2nd Largest MPA)
- Multiple Transportation Providers (TxDOT, CDA, Public)

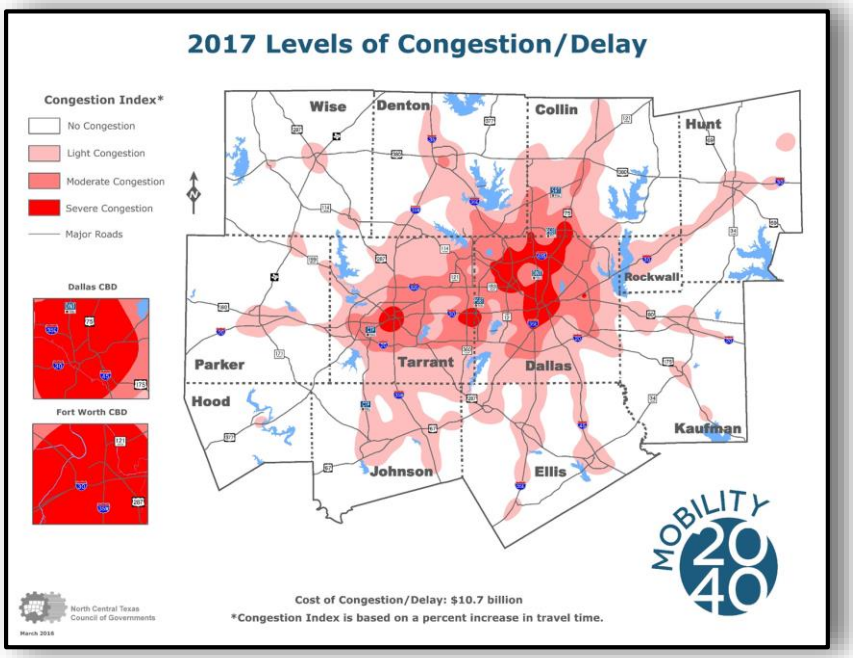
Economy

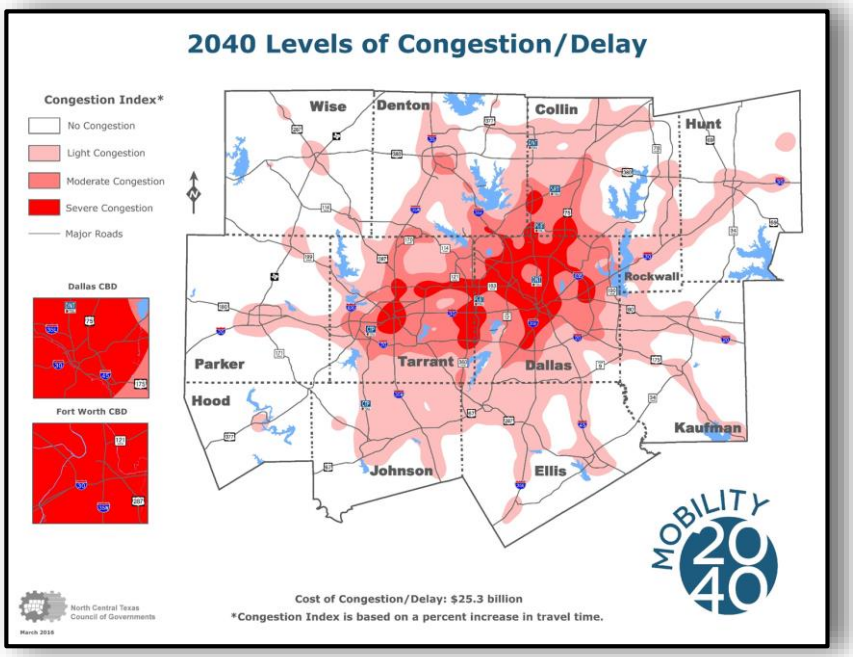
- Home to 18 Fortune 500 Firms
- Represents 30% of Texas GDP

Regional Context for Asset Planning

Dallas-Fort Worth Metroplex – "The Big Picture"

- Population/employment growth nearly 50% through 2040
- Increased vehicle-miles of travel, delay, and congestion costs, while numerous existing infrastructure/system burdens remain
- Mobility 2040 Plan identifies less than 1/3rd funding necessary to eliminate the worst congestion





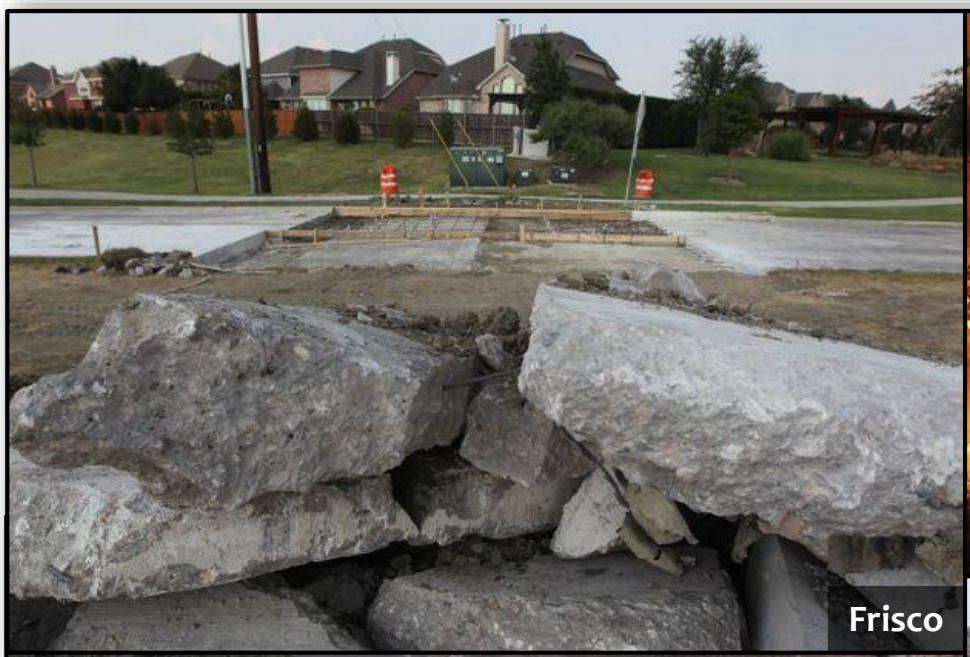
Regional Context for Asset Planning *(cont.)*

Setting the Stage for Potential Action Opportunities

- Prior to Mobility 2040 Plan, improvement options for major facilities were becoming increasingly limited:
  - Revenues from gas/sales taxes
  - Innovative financing/tolls
  - Maintenance needs (exacerbated by extreme weather events)
- Additional federal/state funding was recently approved:
  - Fixing America's Surface Transportation (FAST) Act
  - Proposition One (2014)/Proposition Seven (2015)
  - Ending DPS/DMV gas-tax diversions
- Mobility 2040 Plan identifies **$118.9 billion** for improvements:
  - Existing system maximization strategies > 27% compared to previous Plan
  - Increasingly important to address not just mobility, but also preservation, efficiency, and resiliency

Regional Context for Asset Planning *(cont.)*

Climate/Weather Challenges to Mobility & Functionality


Frisco

Palo Pinto County

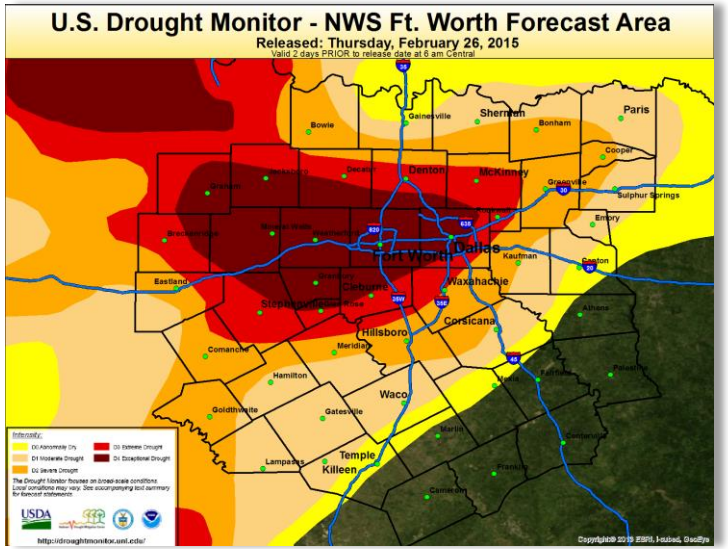
Fort Worth

Euless

NCTCOG Vulnerability Assessment Study

Climate Change/Extreme Weather is a Current Problem

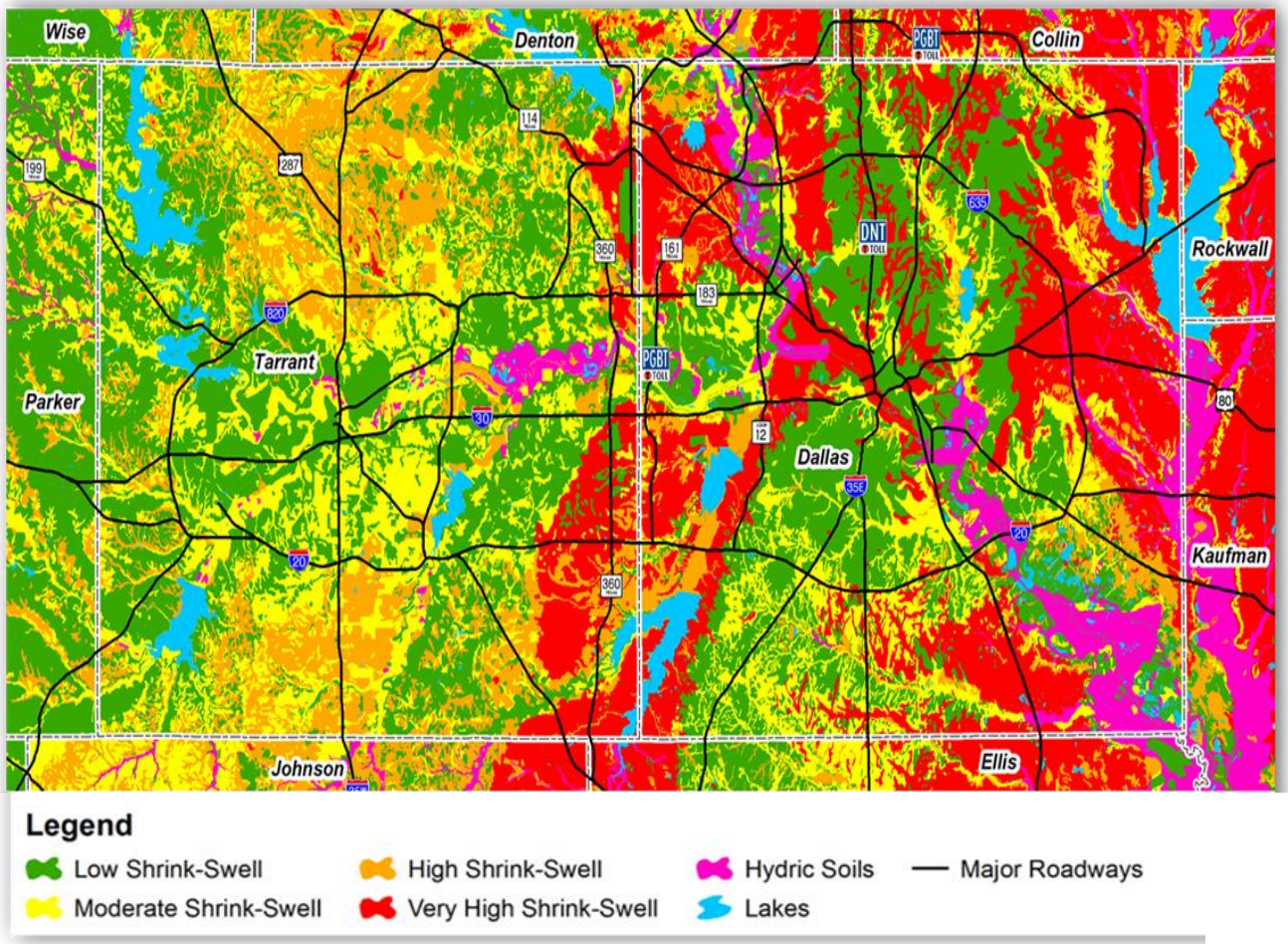
- Eight of the top-10 warmest years in DFW have occurred after 1998
  - #1 – 2006; #2 – 2012; #3 – 2008/2011
  - Heat concerns at all hours of the day
- 2014 Precipitation Total = 21.32 inches
  - Lowest annual total since 2005 (12th lowest in 115 years of records)
  - 5th year of worst drought since 1950's
- 2015 Precipitation Total = 62.61 inches
  - Wettest year on record (includes record monthly totals for May & November)
  - Significant flooding in all watersheds
- 2016 Above Normal Rainfall Continues


U.S. Drought Monitor - NWS Ft. Worth Forecast Area
Released: Thursday, February 26, 2015
Valid 2 days PRIOR to release date at 6 am Central
Bowie
Gainesville
Sherman
Bonham
Paris
Cooke
Denton
McKinney
Grayson
Sulphur Springs
Hunt
Fannin
Lamar
Red River
Wise
Collin
Rockwall
Dallas
Kaufman
Rains
Van Zandt
Wood
Franklin
Titus
Camp
Upshur
Morris
Cass
Gregg
Harrison
Marion
Panola
Shelby
Rusk
Smith
Cherokee
Anderson
Henderson
Navarro
Ellis
Tarrant
Parker
Hood
Johnson
Erath
Eastland
Callahan
Brown
Coleman
Runnels
Comanche
Hamilton
Mills
Coryell
Bosque
Hill
Ellis
Navarro
Freestone
Limestone
Leon
Madison
Grimes
Brazos
Robertson
Falls
Milam
Williamson
Bell
Lampasas
Burnet
Travis
Hays
Caldwell
Bastrop
Lee
Fayette
Washington
Austin
Waller
Harris
Montgomery
Liberty
Chambers
Galveston
Brazoria
Fort Bend
Wharton
Jackson
Matagorda
Colorado
Lavaca
Fayette
Bastrop
Lee
Burleson
Brazos
Grimes
Walker
Trinity
Polk
Tyler
Jasper
Newton
Orange
Hardin
Jefferson
Chambers
Liberty
Hardin
Tyler
Polk
Angelina
Nacogdoches
Sabine
San Augustine
Jasper
Newton
Orange
Jefferson
Hardin

NCTCOG Vulnerability Assessment Study *(cont.)*

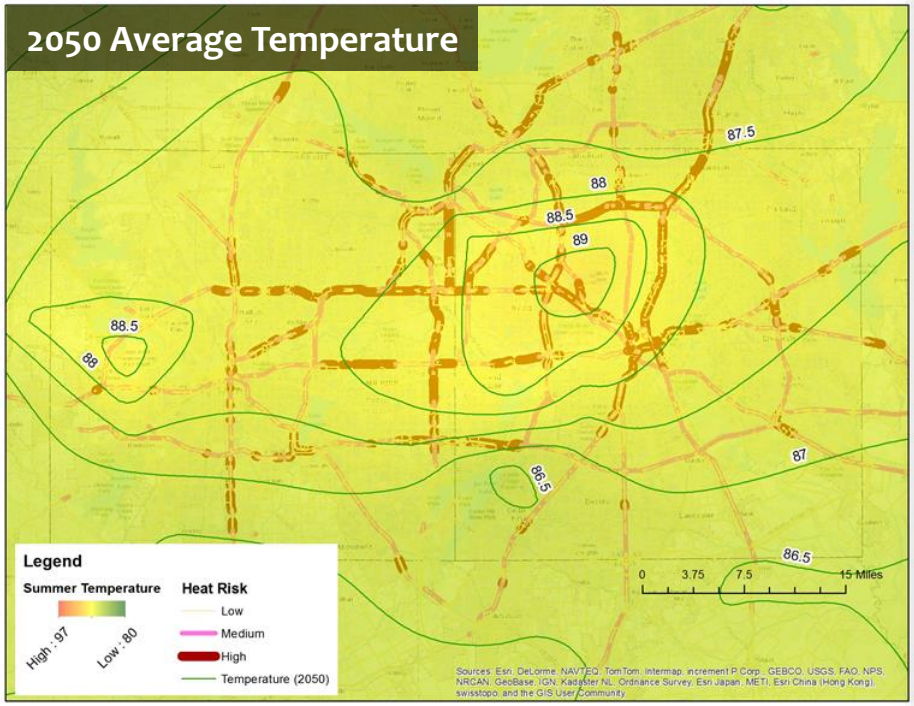
Notable Findings – Significant Future Climate Change

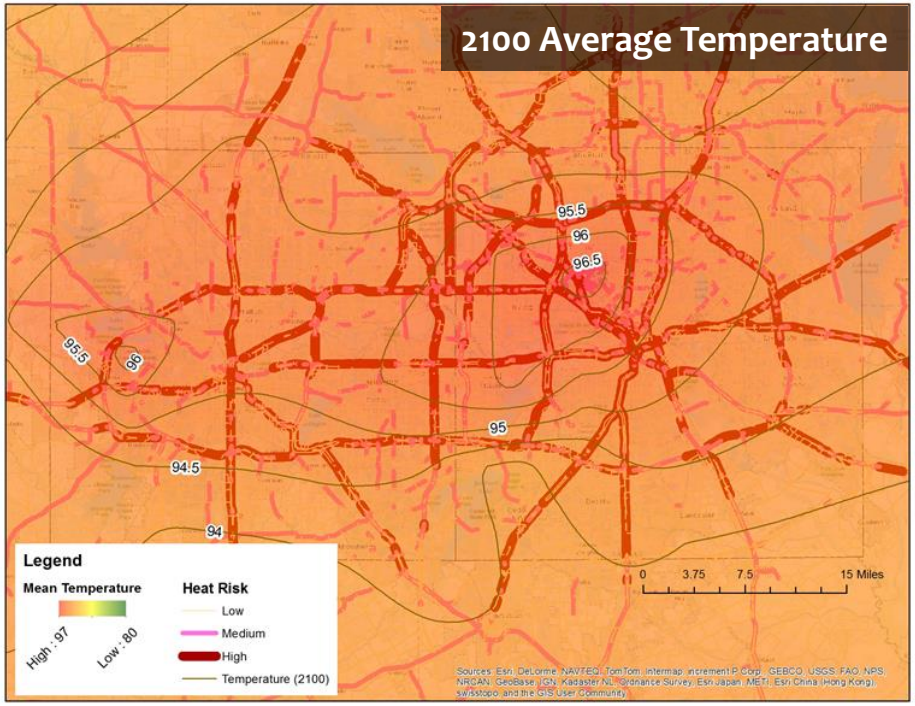
- "Business-as-Usual" emissions scenario by year 2100
  - Mean temperature > 8° F compared to current average (extreme > 13° F)
  - Lower annual rainfall, but punctuated by storms of greater intensity
  - Effects magnified due to large regional distribution of high-plasticity soils



NCTCOG Vulnerability Assessment Study *(cont.)*

Notable Findings – Heat Risks

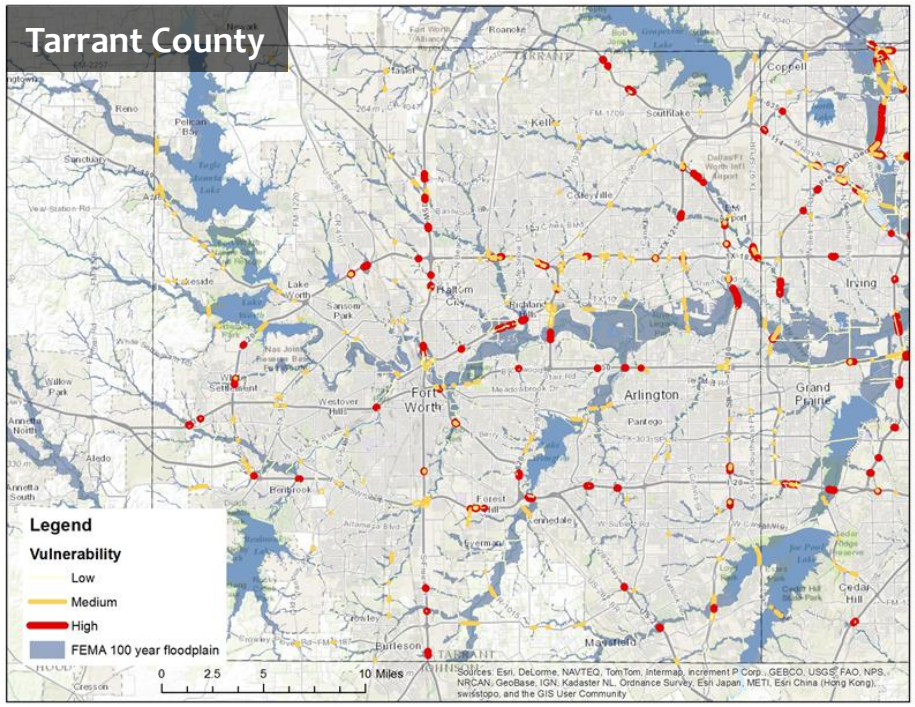


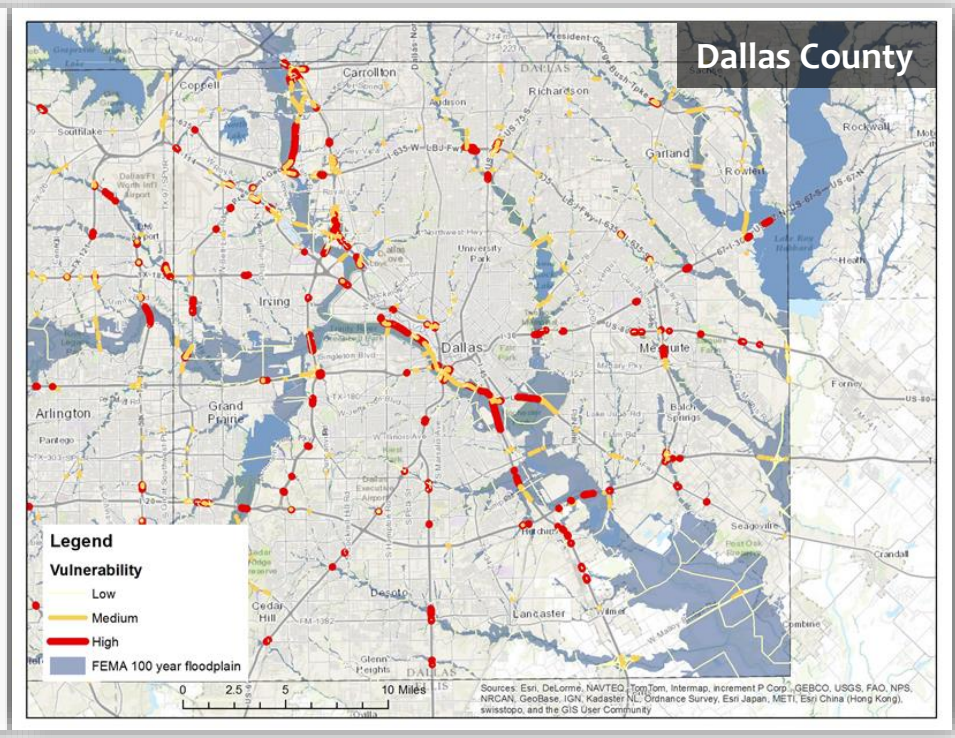


- Significant future temperature increases will accelerate pavement degradation, rutting, and joint failures
- Urbanization growth enhances heat island effect which amplifies moisture losses and substructure destabilization

NCTCOG Vulnerability Assessment Study *(cont.)*

Notable Findings – Flood Risks for Critical Roadways





- Many critical roadway segments cross the 100-year floodplain and/or exist in flood-prone or poorly drained areas
- Additional information required (surface elevation, engineering/design details, etc.) to determine overall vulnerability changes over time

Regional Context for Transportation Asset Management (TAM) Development

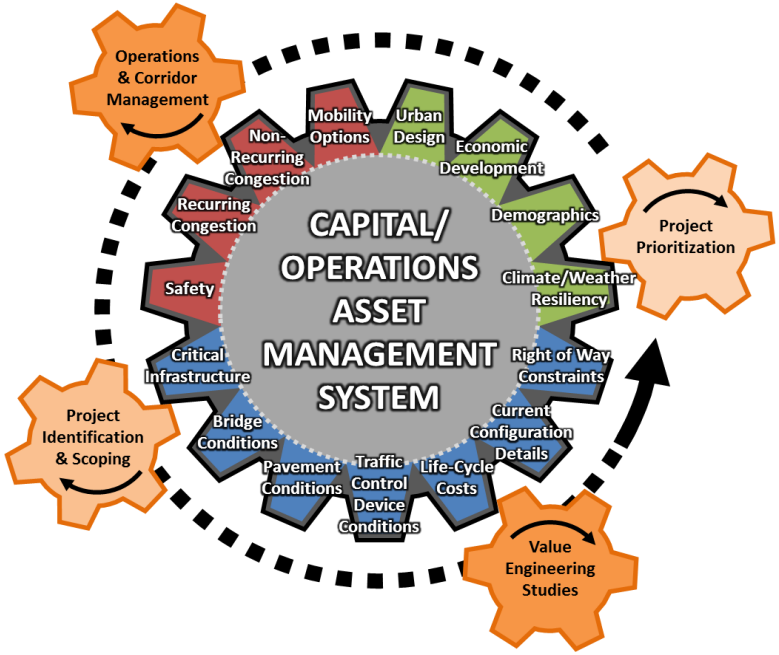
Capability Maturity Model Framework

- Build from Congestion Management Process
- Deficiency analysis to identify regional priority corridors
- Corridor evaluation to identify specific projects
- Inventory of operational assets
- Statewide Pavement Management as a model to operational asset performance measures
- Asset management training

Current/Ongoing TAM-Related Efforts

CAP/MAIN – Delivering Data-Driven Corridor Solutions

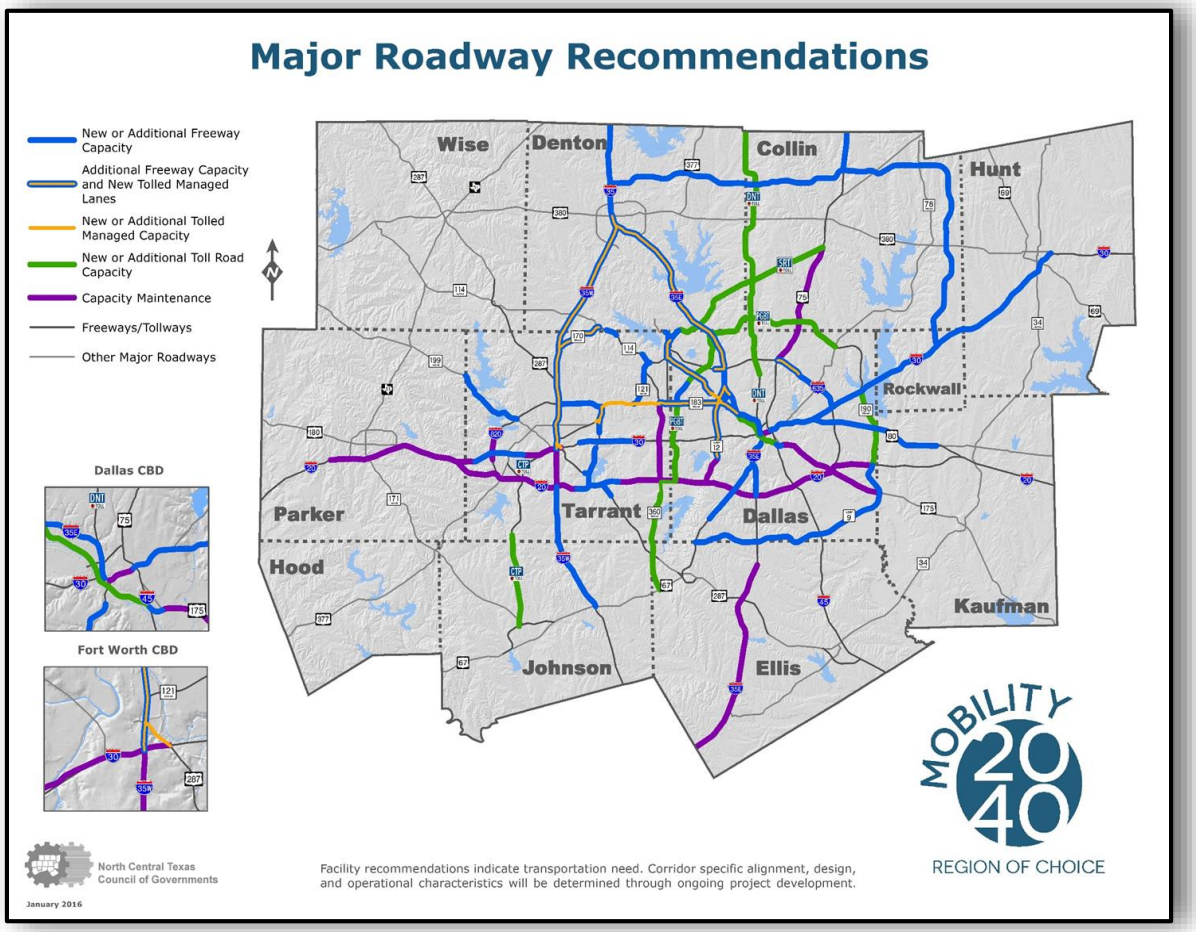
- Applies **asset management** business principles and **performance-based data analysis** tools (***TransFACTS***) to develop more holistic transportation planning and investment strategies
- Corridor deficiencies or performance gaps can be addressed using low/moderate-cost techniques with faster implementation
- Examples of ***TransFACTS*** data:
  - Traffic Volumes/Congestion Levels
  - Crash Data
  - Geometric Issues/Condition of Facilities
  - TDM/TSM Operation & Applications
  - Access/Circulation Preferences
  - Socioeconomic & Environmental Issues
  - Urban Design/Sustainability Efforts



Current/Ongoing TAM-Related Efforts *(cont.)*

CAP/MAIN Pilot Projects & Proposed Study Corridors

- Completed/Under Construction:
  - SH 161 Peak-Period Shoulder-Use Lanes (Irving)
  - IH 35E (Ellis County)
- Ongoing Studies:
  - IH 20/IH 30 (Tarrant/ Parker County)
  - US 75 Peak-Period Shoulder-Use Lanes (Dallas/Collin County)
- Total CAP/MAIN Program – $2.5 Billion



Current/Ongoing TAM-Related Efforts *(cont.)*

Mobility 2040 Planning – Project Categorization/Ranking

MAP-21 Goal	Performance Measure Criteria	Unit Measure
Congestion Reduction	Traffic Volume/Roadway Capacity	Traffic Volume/Roadway Capacity Ratio
System Reliability	Speed	Variance from Average Speed
Safety	Crash Rate	Fatal and Serious Crashes (per 100 Million Vehicle-Miles of Travel)
Infrastructure Condition	Pavement Conditions	Pavement Condition Score (TxDOT)
Freight Movement and Economic Vitality	Basic Employment	Employment Density
	Number of Trucks	Percentage – Truck Vehicle-Miles of Travel
Environmental Sustainability	Environmental Justice Index	Environmental Justice Population Density
Reduced Project Delivery Delay	Planning Status, Funding Availability, Constraints, and System Continuity	Information Purposes Only (Coordination with Regional Transportation Providers)

- Candidate projects scored based on MAP-21 goals/measures and weighted by Regional Transportation Council feedback
- Weighted absolute scores determine project categorization
- Relative scores within category determine project prioritization
- Evaluate ongoing/future project delivery factors/impacts

Current/Ongoing TAM-Related Efforts *(cont.)*

Mobility 2040 Planning – Emphasizing Project Delivery

STEP 1

MAP-21 Goals

- Congestion Reduction
- System Reliability
- Safety
- Infrastructure Condition
- Freight Movement/Economic Vitality
- Environmental Sustainability
- Reduced Project Delivery Delay

STEP 2

Scoring and Ranking Candidate Projects and Corridors

Local Priority Factors Considered

- Volume/Capacity Ratio
- Fatal and Serious Injury Crash Rates
- Pavement Condition Score
- Speed Coefficient of Variation
- Truck Vehicle Miles of Travel (VMT)
- Basic Employment
- Environmental Justice Index

Regional Transportation Council feedback and polling data

STEP 3

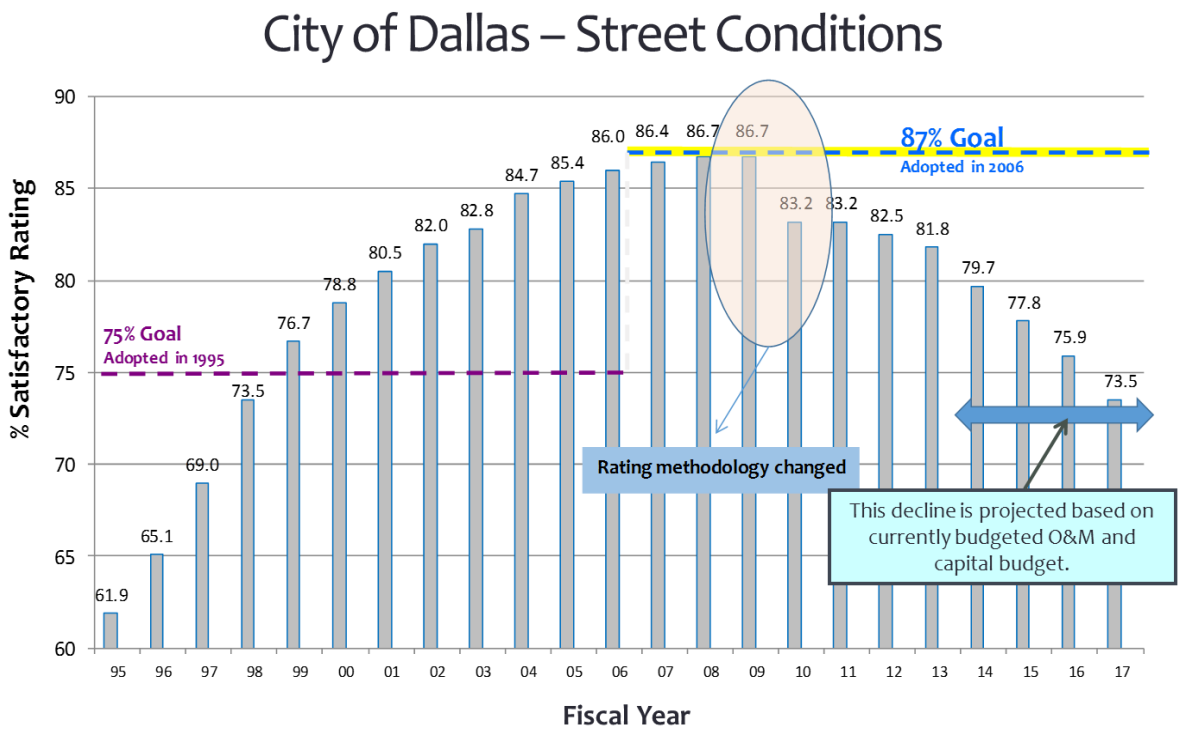
Candidate Priorities

Project Delivery and Constraints

- Physical Barriers/Geometrics
- Planning Status
- Funding Availability/Type
- Corridor Management Opportunities (e.g., TSM, TDM, ITS, transit)
- System Continuity
- Right-of-Way
- Staged Construction

Current/Ongoing TAM-Related Efforts *(cont.)*

Regional Coordination and Data Management Needs



- Numerous forms of asset data collected by multiple entities
- Data can address specific questions, but not all vital concerns
- Ensuring consistent linkages with minimal duplication and maximum cross-agency interest execution is the optimum goal

Current/Ongoing TAM-Related Efforts *(cont.)*

Emphasis on Operational/Technology Applications

- Many assets in operation, but are they working as they should and are they optimally maintained?
- More than just transportation operations, but also maximizing incident detection and enhancing potential alternate routes
- Identify all at-risk locations and apply technology to notify when weather events occur, such as flooding at low-water crossings
- Technology use/management to become a greater issue with advancement of connected and autonomous vehicles

NCTCOG Regional Ecological Framework

Preliminary Screening Tool for Environmental Impacts

NCTCOG **Regional Ecological Framework (REF)** composed of 10 ecological layers:

Green Infrastructure

- **Wildlife habitat**
- **Natural areas**
- **Agricultural land**

Water Considerations

- **Impaired water segments**
- **Flood zones**
- **Surface water quantity**
- **Wetlands**

Ecosystem Value

- **Rarity**
- **Diversity**
- **Ecosystem sustainability**

Created one-stop shop for region-specific environmental data

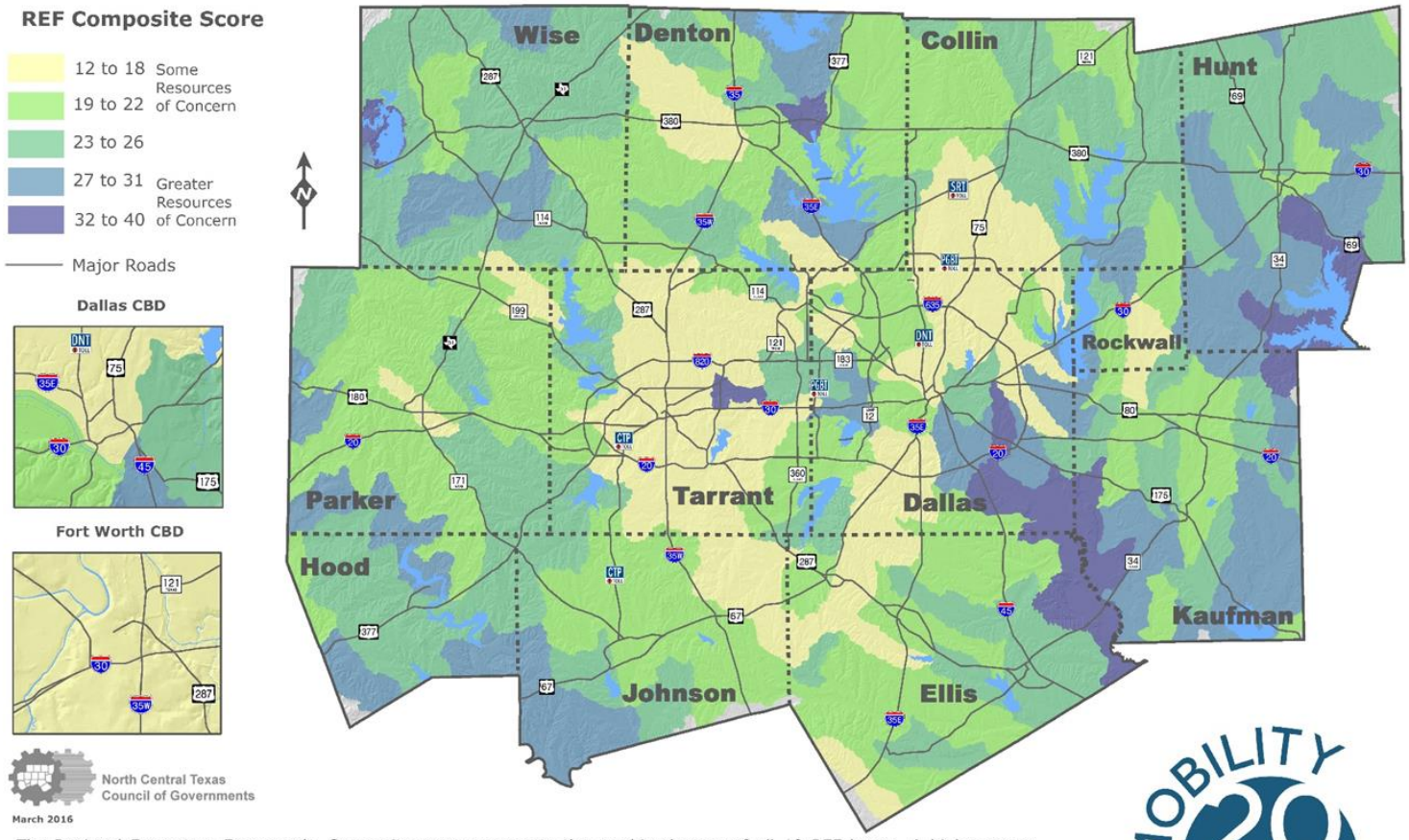
Built partnerships with non-traditional agencies

Started conversation about using common spatial data for both planning and NEPA

Process expandable to outline effects and mitigation strategies for extreme weather events

NCTCOG Regional Ecological Framework *(cont.)*

MPA Composite Map



The Regional Ecosystem Framework: Composite score represents the combined score of all 10 REF layers. A higher score indicates that resources of relatively high concern may be present and that additional review, documentation, and consultation with the applicable agency may be needed. The REF layers include: Green Infrastructure (Wildlife Habitat, Natural Areas, Agricultural Land); Water Quality and Flooding (Impaired Water Segments, Flood Zones, Surface Water Quantity, and Wetlands); and Ecosystem Value (Rarity, Diversity, and Ecosystem Sustainability). Data sources include the Texas GRID and EPA Region 6 Regional Ecosystem Assessment Protocol data. This information has been developed for the Dallas-Fort Worth MPA for use in long-range planning. These scores are meant to be used as a preliminary screening tool for potential impact identification. For more information on the calculations for this layer, please visit www.nctcog.org/REF.

MOBILITY 2040

www.nctcog.org/traces/Ref.asp

INVEST at NCTCOG
(Infrastructure Voluntary Evaluation Sustainability Tool)

Web-based self-evaluation tool of voluntary sustainability practices

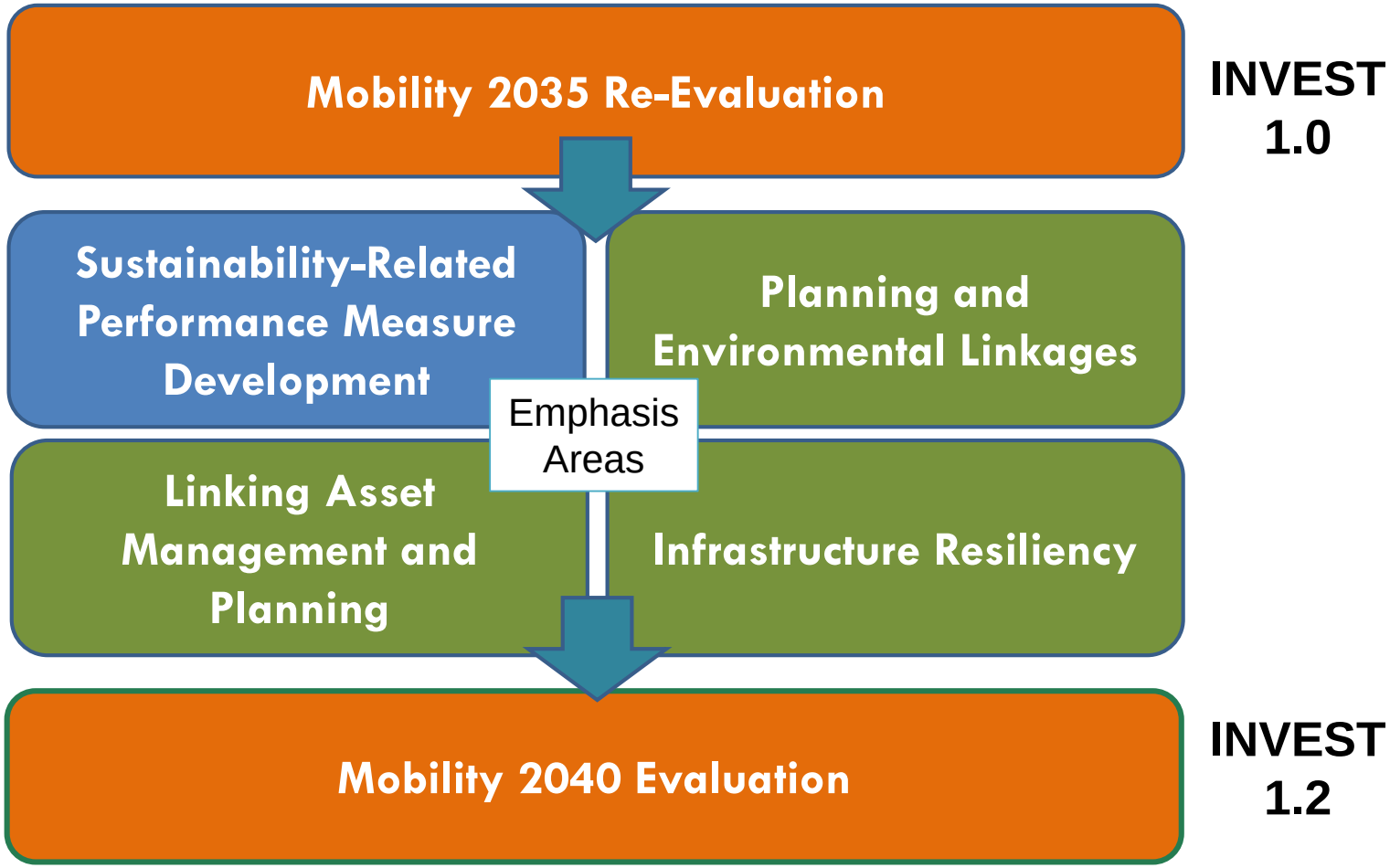
2012: INVEST Pilot Study Participant

- Evaluated all triple bottom line elements relative to our planning process and Metropolitan Transportation Plan (MTP)
  - Brought together all relevant program areas
  - Found it difficult to fit our efforts into scoring options
- Scored better than anticipated, but still had room for improvement
- Future efforts aim to address sustainability throughout the region at the system level

INVEST at NCTCOG *(cont.)*

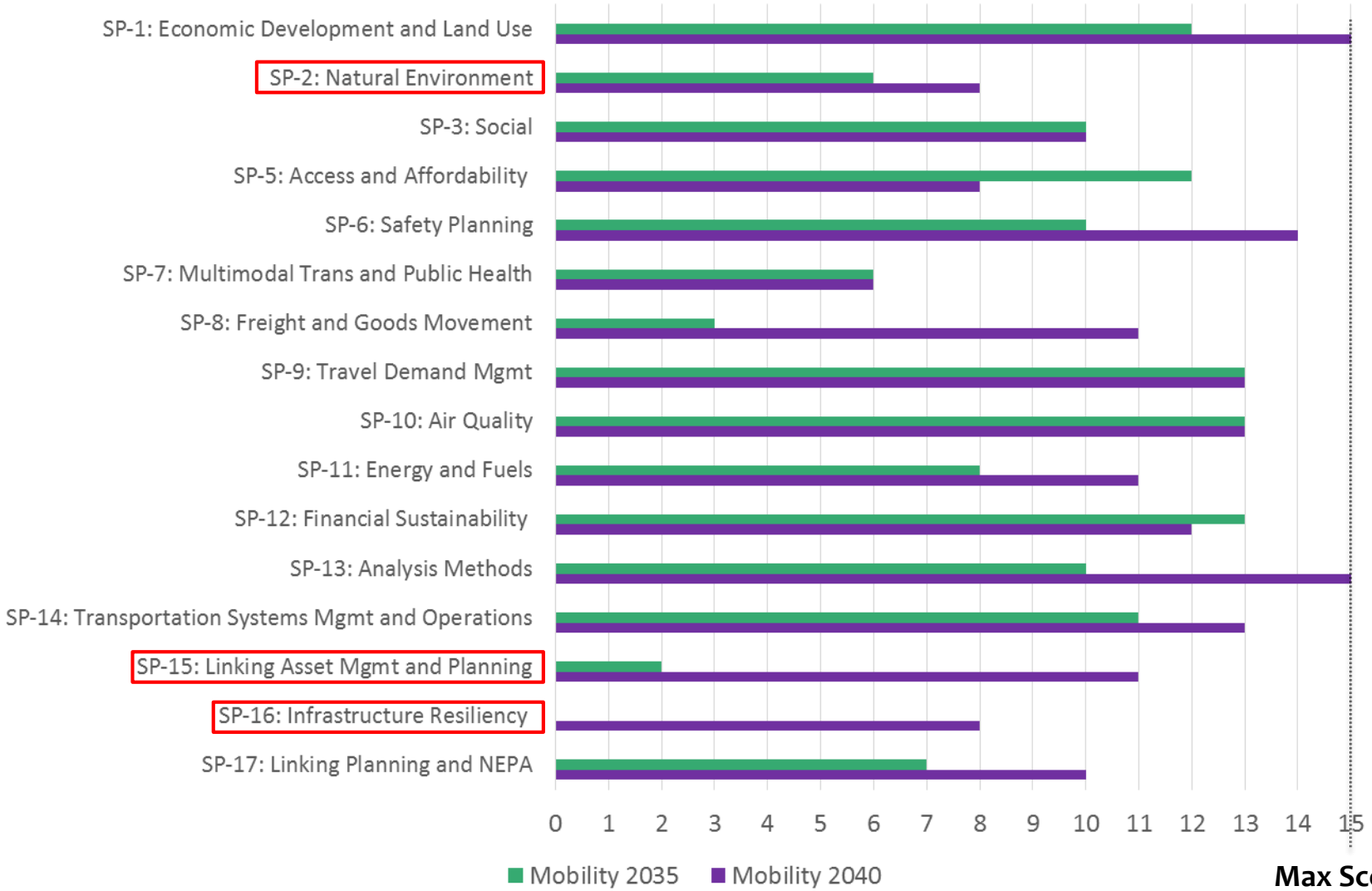
(Infrastructure Voluntary Evaluation Sustainability Tool)

2013-2016: INVEST Implementation Grantee



INVEST at NCTCOG *(cont.)*

Mobility 2035 vs. Mobility 2040



Future TAM Needs/Considerations

Pursuing Mutual Benefits for Capacity & Resiliency

- Awaiting USDOT final rulemaking regarding State DOT Transportation Asset Management Plan (TAMP) development:
  - Schedule, frequency, and projected revenue distribution
  - MPO assistance with data collection/analysis and reporting
- Texas House Bill 20 (2015):
  - Implement performance-based planning/programming that provides progress indicators toward attaining TxDOT goals/objectives
  - 10-year MPO plan required to dictate project/program funding allocations
- Critical planning linkages will require extensive, multi-lateral agency coordination and comprehensive data-sharing program
- Emphasis on data that addresses extreme weather impacts to more readily adapt infrastructure while maintaining MTP goals

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