Considerations for Integration of Infrastructure Resiliency and Asset Management with Long-Range Planning in North Central Texas

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North Central Texas Council of Governments (NCTCOG)
NCTCOG – Regional Perspective

12-County Metropolitan Planning Area (MPA)

**Population**
- 2017: 7.2 million
- 2045: 11.2 million
- 6th Largest MPA

**Area**
- 12 Counties (3rd Largest MPA)
- Multiple Transportation Providers (TxDOT, CDA, Public)

**Economy**
- Home to 22 Fortune 500 Firms
- Represents 1/3rd 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

Prior to the 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
Nine of the top-10 warmest years in DFW have occurred after 1998:
- #1 – 2006; #2 – 2012; #3 – 2016
- Heat concerns at all hours of the day

Large weather variations:
- 2011 Summer Heat = 71 days > 100°F (average – 18 days)
- 2014 Precipitation Total = 21.32 inches (fifth year of worst drought since 1950’s)
- 2015 Precipitation Total = 62.61 inches (wettest year on record)
“Business-as-Usual” emissions scenario translates to substantial temperature rises and soil moisture reduction 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
2015 NCTCOG Vulnerability Assessment Study (cont.)

Notable Findings – Heat Risks

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

**Capability Maturity Model Framework**

- Built from Congestion Management Process
- Deficiency analysis used to identify regional priority corridors
- Corridor evaluation to identify specific projects
- Inventory of operational assets
- Statewide Pavement Management applied as a model to establish 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

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

- Candidate projects scored based on MAP-21 goals/measures and weighted by Regional Transportation Council (RTC) 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 (RTC) Feedback and Polling Data**

- 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

**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

- Congestion Reduction
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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
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/or 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
Impetus for applications using common spatial data to benefit 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.
INVEST Applications @ NCTCOG
(Infrastructure Voluntary Evaluation Sustainability Tool)

2013-2016: INVEST Implementation

- Mobility 2035 Re-Evaluation
- Sustainability-Related Performance Measure Development
- Planning and Environmental Linkages
- Linking Asset Management and Planning
- Infrastructure Resiliency
- Mobility 2040 Evaluation

Emphasis Areas

INVEST 1.0
INVEST 1.2
INVEST Applications @ NCTCOG (cont.)

Mobility 2035 vs. Mobility 2040 Scoring Results

SP-1: Economic Development and Land Use
SP-2: Natural Environment
SP-3: Social
SP-5: Access and Affordability
SP-6: Safety Planning
SP-7: Multimodal Trans and Public Health
SP-8: Freight and Goods Movement
SP-9: Travel Demand Mgmt
SP-10: Air Quality
SP-11: Energy and Fuels
SP-12: Financial Sustainability
SP-13: Analysis Methods
SP-14: Transportation Systems Mgmt and Operations
SP-15: Linking Asset Mgmt and Planning
SP-16: Infrastructure Resiliency
SP-17: Linking Planning and NEPA

INVEST - https://www.sustainablehighways.org/
Future TAM Needs/Considerations

Pursuing Mutual Benefits for Capacity & Resiliency

- USDOT final rules regarding State DOT Transportation Asset Management Plan (TAMP) development:
  - Schedule, frequency, and projected revenue distribution
  - MPO assistance with NHS-facility 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 require extensive agency coordination and comprehensive data-sharing program (Decision Lens)

- Emphasis on data that addresses extreme weather impacts to more readily adapt infrastructure while maintaining MTP goals
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FHWA Workshop (Austin, TX):
Resilience in the Transportation Planning Process Under the FAST Act

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