

Needs, Issues, and Technology Perspectives to Consider when Developing TMC Dashboards

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Keith Smith
VHB
Applied Technology Manager



Identifying the Need for a Dashboard

- Developing a dashboard starts with many questions:
 - What does the dashboard need to do?
 - Who will use it? Who are my stakeholders?
 - What type of data is needed?
 - Where will the dashboard reside? Should I secure it?
 - Does something already exist?

- Where do we begin?

Stakeholder Engagement

- Remember different users with different needs:
 - Operators – Require the ability to quickly find the answer they need.
 - Planners and Engineers – Approach more planning centric and may be looking for detailed performance metrics over a wider range of time.
 - Managers and Executive Leadership – Understand the value of both and may require fast access to reporting outputs.



Establish Goals of the Dashboard

- Identify, prioritize, and elaborate goals of the dashboard:
 - This forms the foundational backbone of the dashboard.
 - Guides decision making to keep the dashboard on track.
- Goals should be SMART:
 - Specific.
 - Measurable.
 - Attainable.
 - Realistic.
 - Timely.



Source: *Federal Highway Administration.*



Establish Goals of the Dashboard

- Review overall traffic management system and transportation systems management and operations program goals to ensure dashboard goals are in alignment.
- Do NOT develop goals in a vacuum.
 - Engage stakeholders.
- Verify goals do NOT conflict and are completing identified needs in measurable ways.
- Do NOT allow goals to be overly broad, each goal should have a clear measure of success.



Determine Project Level Architecture and Process

- How does the dashboard fit into the overall architecture?
- Will the dashboard reutilize existing components and infrastructure or will the dashboard be completely standalone with customizable controls?
- Identify development methodology for projects and software development.
- Is dashboard access intended for internal users, external users, or both?

Establish Project Requirements

- Identify clearly the technologies, databases, and policies needed to support the dashboard:
 - Database technology and data storage.
 - Security policies or procedures.
 - Development schedule and timeline.
 - Licensing requirements for data or software.
 - Determine roles and responsibilities for staff.
 - 508 compliance and testing.
 - Regional architecture (Rule 940).
 - Dashboard user interface.

Project Requirements – User Interface

- Project requirements should be able to answer the following:
 - What technology is supported by the organization for user interfaces?
 - Does staff have the technical expertise to successfully deliver a dashboard in the desired language/platform?
 - Is there a data management platform in place that can support the dashboard's data?
 - Where will the data and dashboard reside?
 - Is a cloud solution supported for dashboard hosting?
 - How customizable does the user interface need to be?

Data Drives the Dashboard

- TMC dashboard common data needs:
 - Low latency data collection.
 - High speed analytic capability.
 - Ability to receive and analyze variety of different data sources.
- Data can be split into input types:
 - Static or slow changing.
 - Dynamic.



Data Drives the Dashboard – Questions to Answer

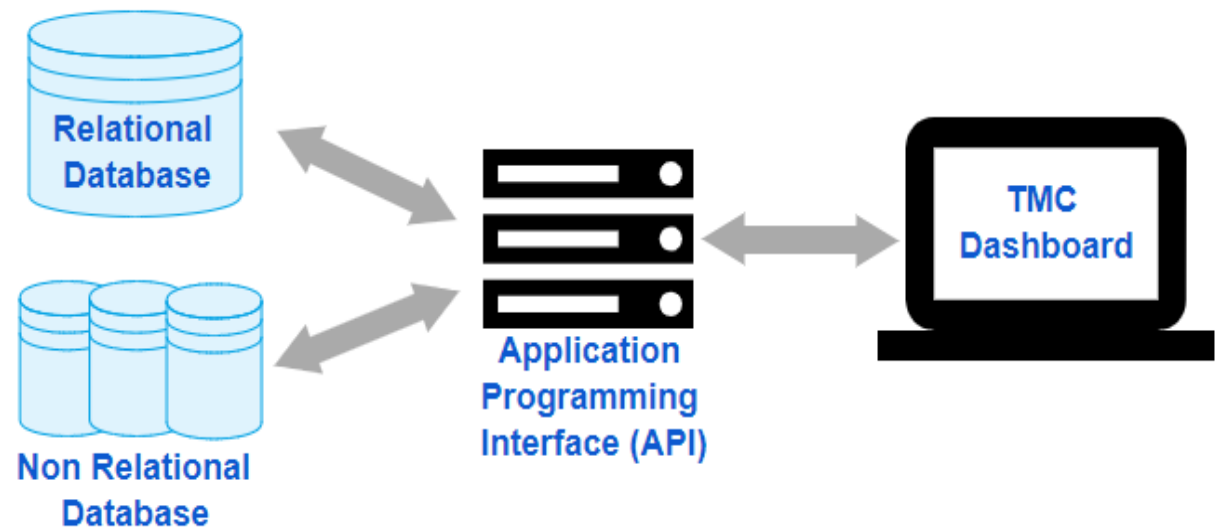
- How is the data formatted? Are adequate data dictionaries available?
- Is there a clear relationship between data and its context?
- Who is responsible for maintaining the data?
- What is the frequency of update to the data? Does this update frequency satisfy identified needs?
- What is the latency of the data? How reliable is this information in making real-time decisions?
- How often will the data be accessed?

Data Drives the Dashboard – Questions to Answer

- Does the data require any modification or extract, transform, and load (ETL) procedures prior to use in the dashboard?
- Does the data need to be saved, stored, and made available for historic analysis?
- Are there data retention laws that must be adhered to in data storage?
- Are there license or other agreements that limit the sharing or ETL processes of a dataset?
- Is the data considered sensitive? Are additional security measures required to protect data and access?

Where Does the Data Live?

- As technology continues to change, so does data storage and access options.
- Relational vs. Non-Relational.
- Hot vs. Cold.
- Cloud vs. On Premise.
- Secure vs. Open.



Source: *Federal Highway Administration.*



Analytics Techniques – Ready to Analyze

- Requires a transformation to become dashboard ready for performance measures and metrics.
- Arrives via an application programming interface with consistent pace through information (such as speeds from a segment).



Analytics Techniques – Data Fusion

- Refers to the combination and creation of multiple data.
- Provides detailed analytics calculations from raw data:
 - Access to central raw storage without the need to store intermediate data.
- Provides a foundation for future machine learning opportunities.
- Occurs around time/date splits allowing dashboard users to “dig in” on analytics.



Analytics Outputs

- Expected data outputs from analytics can be categorized as follows:
 - Roadway status and performance.
 - Operations status and performance.
 - Transportation operations/planning programmatic information.
 - Data analysis.



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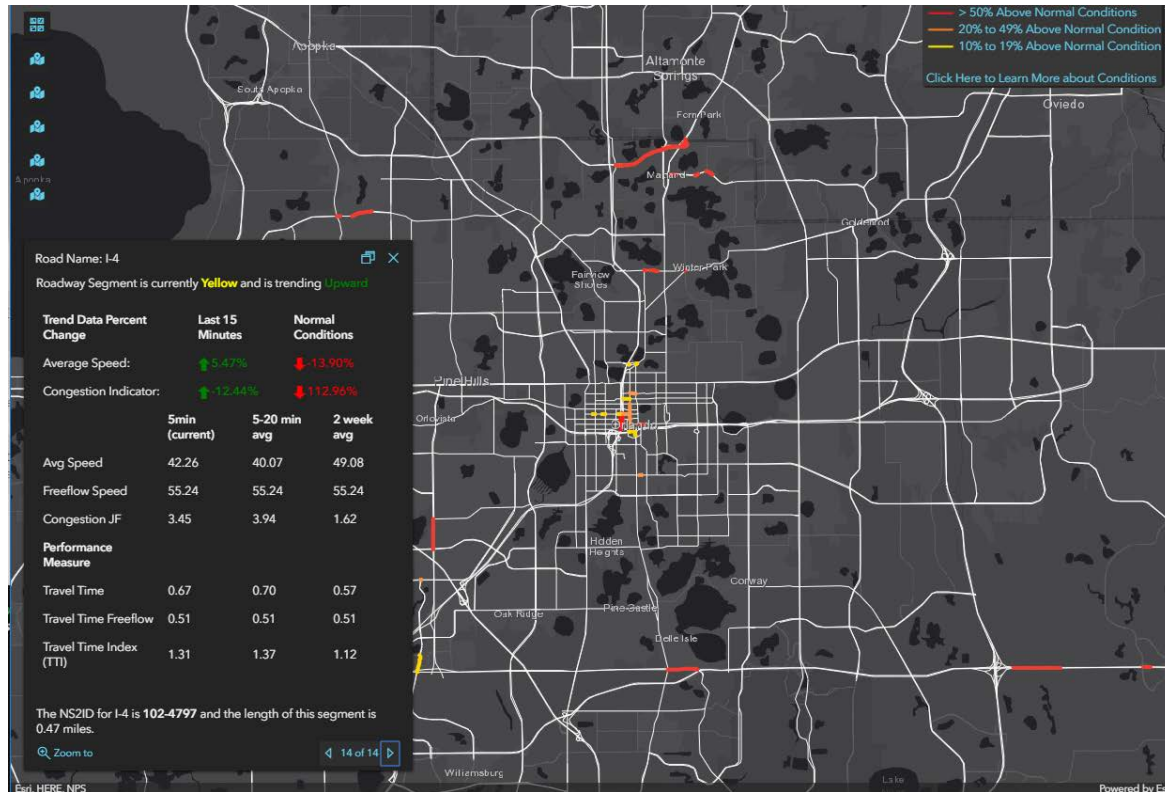
- Signed into law 2012 (P.L.112-141).
- Mandated use of performance measures to address many changes facing the United States transportation system.
- Required when developing certain transportation plans, such as the statewide Transportation Improvement Plan, with the goal of providing more efficient investment of federal transportation funds and the ability to provide data-driven qualitative metrics.



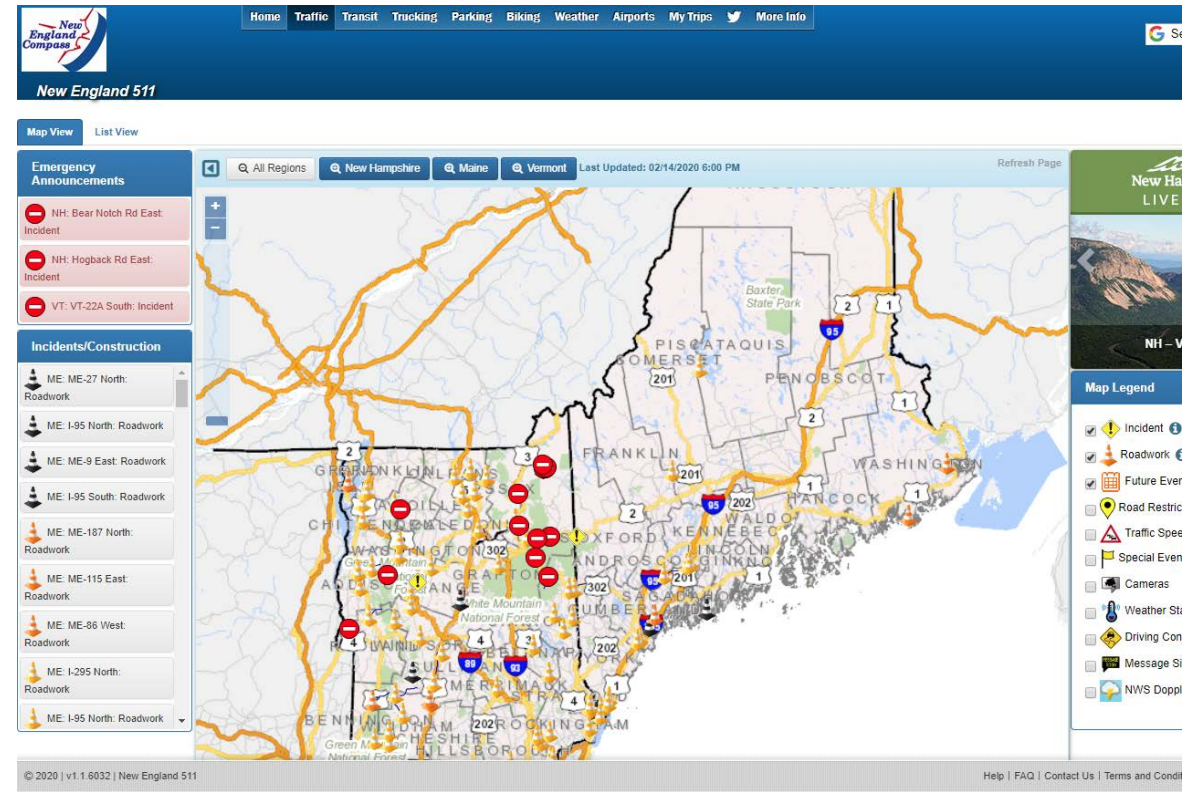
Visualization

- A number of visualizations can be extended such as:
 - Color to indicate the status of the road in terms of speed or travel time reliability.
 - Labels to indicate the existence, location, and status of traffic incidents.
 - Customizable messages such as dynamic message signs provide a quick glance of relevant information about the road network.
 - Spatial information and landmarks such as community features, restaurants, or other points of interest.
 - Displaying navigation routes to guide users to or from a location.

Dashboard Example – Map Centric



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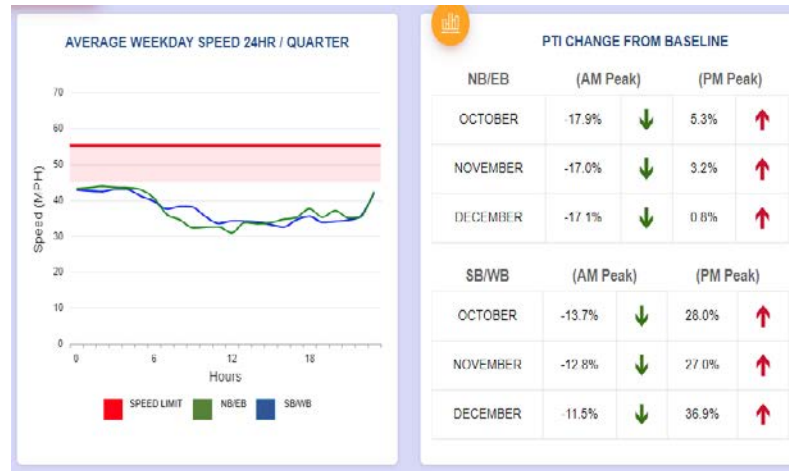


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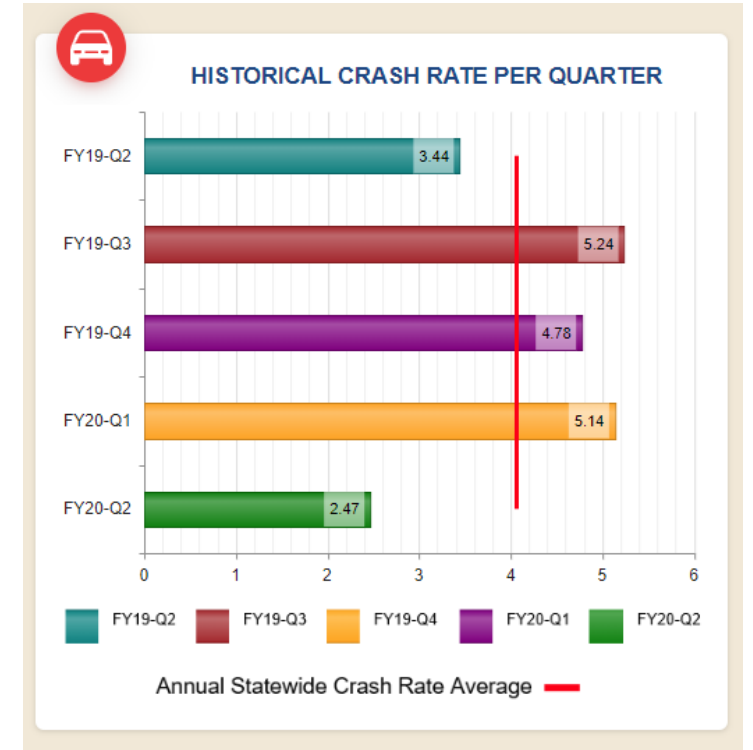
Dashboard Example – Charts, Graphs, Tables



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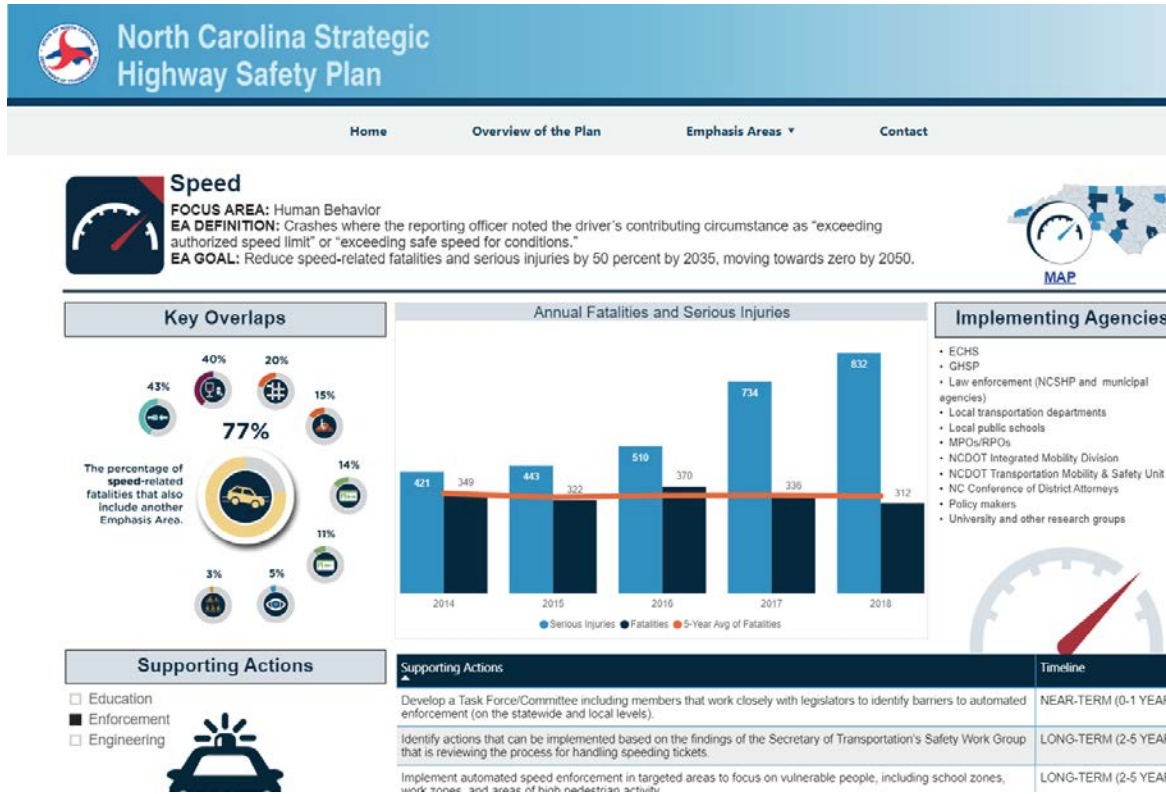


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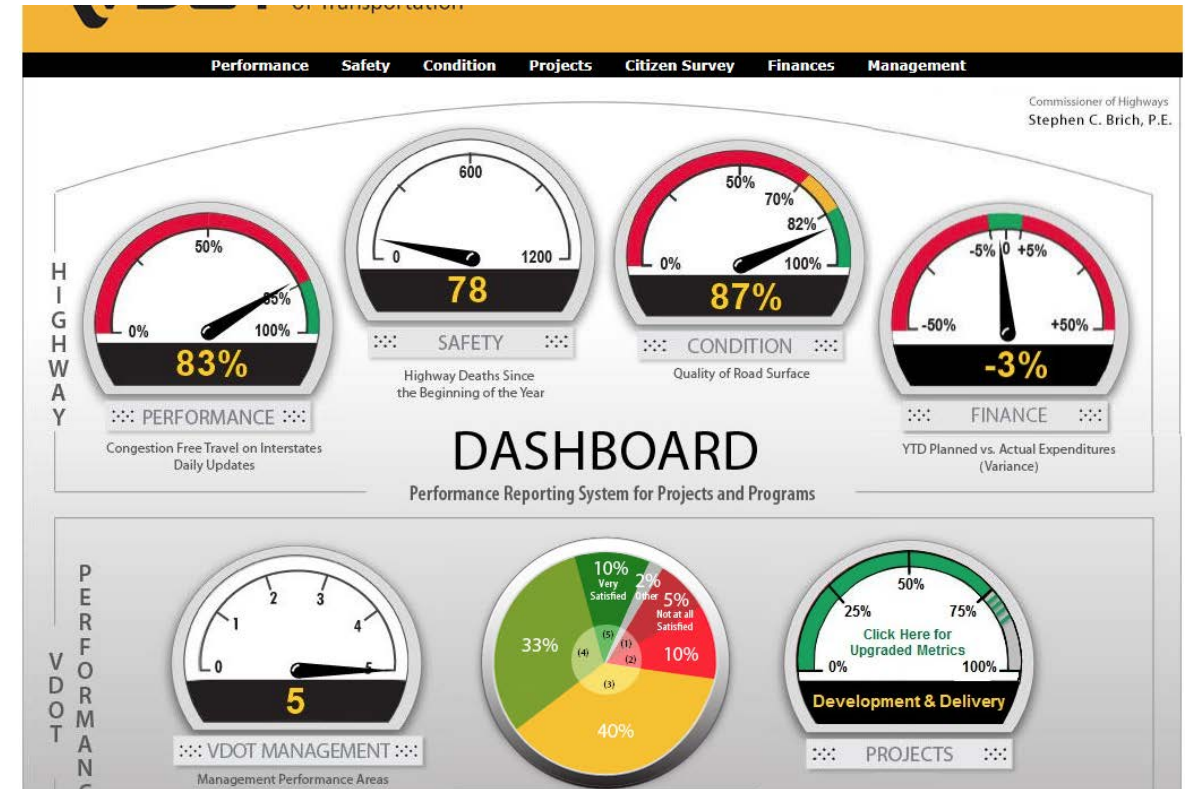


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Dashboard Example – Analytics and Infographics



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For additional information:

Transportation Management Center
Performance Dashboards Final Report
FHWA-HOP-20-032

TMC Pooled Fund Study:
<https://tmcpfs.ops.fhwa.dot.gov>