# TRANSPORTATION FOR THE NATION

# STRATEGIC PLAN

PRODUCED FOR

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Geospatial Information Officer

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# Executive Summary

## Background

The notion of Transportation for the Nation (TFTN) was originally put forth in a 2008 "Issues Brief" from the National States Geographic Information Council (NSGIC). In that brief, NSGIC noted the fundamental nature of transportation data which is universally utilized by geospatial practitioners and also the fact that there is redundancy and at least three overlapping efforts that create nationwide transportation data sets. These inefficiencies cost taxpayers millions of dollars. Under the Office of Management and Budget's Circular A-16, the US Department of Transportation (USDOT) was designated as the framework "theme leader" for transportation data sets. This study emanates from USDOT investigating whether a TFTN program could help the agency meet its own internal business needs, fulfill its Circular A-16 responsibilities and help the country more efficiently provide transportation data that is widely demanded for activities such as:

- Transportation system planning and management
- E911 dispatching
- Postal and delivery services
- Consumer-based navigation systems

## Vision & Goals

This study puts forward a simple and direct strategic goal:

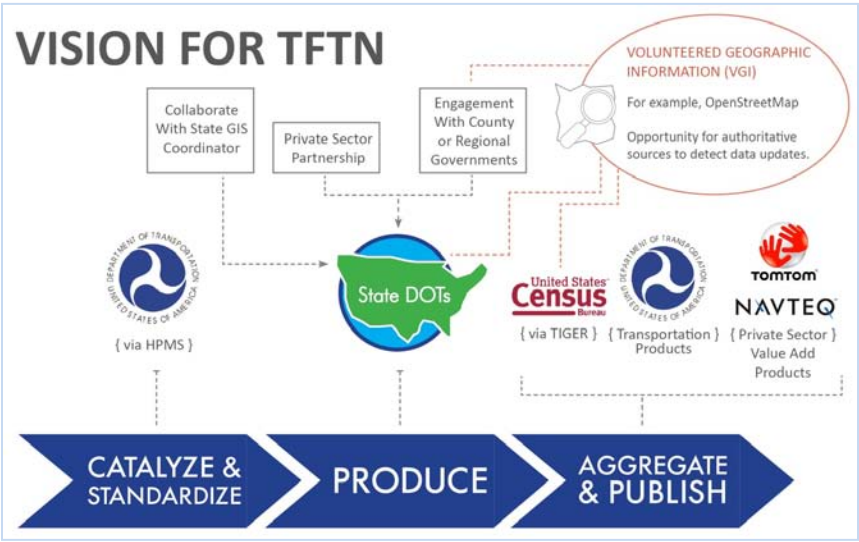
> Commence the development of **comprehensive, publicly available, nationwide transportation data sets**. Ultimately, Transportation for the Nation (TFTN) will encompass data sets covering multiple modes of transportation, however, the initial focus will be on producing a **road centerline** data set that includes all types of roads, both public and private. The initial TFTN data set will include consistent, current, high quality road centerline data for the entire country.

Fundamental to a TFTN program is that all resulting data will be widely available and in the **public domain**.

## General Approach

The approach for TFTN identified in this study involves the coordinated efforts of number of organizations across three core elements required for the production and maintenance of TFTN:

1. **Catalyzing** the development of standardized road centerline data through USDOT's Highway Performance and Measurement System (HPMS) program



2. **Producing** accurate and current road centerline data through state departments of transportation (DOT), including state-level public-private partnerships
3. **Aggregating** statewide data as a national data set through partnerships with the US Census and the private sector and **publishing** the data through a variety of distribution channels

The identified approach also envisions capitalizing on the emergence of volunteered geographic information (VGI) processes to maintain quality and provide a user feedback mechanism.

### Conclusion

There is widespread demand for public domain transportation data and strong opportunities to better align the multiple parties currently involved in overlapping efforts to create these data and make more efficient use of resources. With a proper focus on coordination and collaboration a program such as TFTN can generate nationwide transportation data that meets both USDOT's internal business needs and the broader requirements of other stakeholders across the country. The time is right for a program such as TFTN and it should proceed to more detailed business planning and proof-of-concept prototyping.

# 1 Current Situation

## 1.1 Background

Transportation for the Nation (TFTN) is the term originally applied by the National States Geographic Information Council (NSGIC) to the initiative needed to build a nationally shared transportation data set that would support diverse stakeholders and be publicly available. It was formally announced as a priority item on the NSGIC Advocacy Agenda in an Issues Brief in 2008, with the following vision for the future:

> "The federal government will coordinate development of a seamless nationwide dataset of addressable roads that is built in a collaborative and shared environment."

In essence, NSGIC was giving a fresh voice to a longstanding national goal, to build a national transportation data set as a "framework" layer or theme within the National Spatial Data Infrastructure (NSDI), which is a notion that goes back decades. In 1990, Office of Management and Budget (OMB) Circular A-16 on the "Coordination of Geographic Information and Related Spatial Data Activities," called for the creation of the Federal Geographic Data Committee (FGDC), and for the "development of a national digital spatial information resource, linked by criteria and standards that will enable sharing and efficient transfer of spatial data between producers and users." This national resource was defined in Executive Order 12906 (1994) to be the NSDI, with FGDC responsible for coordinating across federal agencies and other stakeholders to make NSDI real.

OMB A-16 was revised in 2002, to include a list of lead federal agencies for the data themes identified for NSDI. The "Transportation" theme was assigned to the Department of Transportation, Bureau of Transportation Statistics, and defined as follows:

> "Transportation data are used to model the geographic locations, interconnectedness, and characteristics of the transportation system within the United States. The transportation system includes both physical and non-physical components representing all modes of travel that allow the movement of goods and people between locations." (*Appendix E, OMB Circular A-16 Revised, 2002*)

The role of Theme Leader was given greater definition when OMB Circular A-16 Supplemental Guidance was issued in late 2010. The term "National Geospatial Data Asset" (NGDA) was introduced to apply to themes, which are further subdivided into data sets. This fits the TFTN outlook going forward, as all modes, and the intermodal connections between, them are eventually addressed as part of a logical grouping of NGDA data sets belonging to the Transportation Theme. A portfolio management approach can then be applied to investment alternatives within each theme, as envisioned by OMB.

It is a TFTN objective that the program's data be distributed freely, as a public domain asset, for the benefit of all stakeholders. Fundamentally, the geographic data contemplated for TFTN will communicate knowledge of our nation's road network, thereby promoting innovation, commerce, informed public discourse, basic research, and sharing within open communities of interest.

## 1.2 Widespread Demand For Nationwide Road Centerlines

Road centerline data are one of the most widely used geospatial information products in modern society. Some pervasive applications include: on-board vehicle navigation, E-911 dispatching and emergency vehicle routing, census enumeration, postal and delivery services, disaster response and relief efforts, tax collection, mapping accidents, asset inventories, map directions on smart phones, and other location-based systems.

In addition to the **general uses** of road centerlines outlined above, transportation professionals utilize road centerlines extensively for explicit **transportation planning and management** activities. These activities include: highway safety involving issues like road geometry and guardrail placement; intelligent transportation system planning; congestion management; environmental issues such as wetlands and air quality along rights-of-way; and highway performance issues to gauge the health and usability of the transportation system.

Given the diverse transportation specific and general uses of road centerline data there are many different types of data content that can make up a road centerline data set.

- Different users have a varying needs for specific content and characteristics, such as:
  - Basic geometry and naming
  - Basic attributes, e.g., functional class
  - Enhanced cartographic display and labeling/annotation
  - Addressing and geocoding support

- Boundary delineation
- Linear referencing methods/systems (LRM/LRS)
- Routability (e.g., network connectivity; speed limits; lane and turn restrictions; etc.)
- Integration with image/photo catalogs
- High positional accuracy
- High update frequency
- Compatibility with real-time data feeds

A great deal of duplication of effort is evident across Federal agencies and other levels of government. Nationwide programs that collect and integrate transportation geospatial data from local, state, regional and federal sources – or acquire such data from commercial sources -- are usually done with a *single* purpose, rather than a ***multi-purpose use***, in mind. Several commercial data providers as well as government agencies have built transportation data sets for different use cases. In the absence of an effective and organized national program, and without incentives and insistence to cooperate, each level of government perpetuates and duplicates independent efforts by creating these data primarily to meet their own, specific and solitary mission requirements. This practice leads to duplicate spending, wasted taxpayer dollars and inefficient government.

The transportation data needs of Federal agencies was the subject of a survey and summit meeting titled Geospatial Transportation Data Needs for Federal Agencies sponsored by US Census Bureau in October, 2009. Fourteen Federal agencies responded to the detailed survey on specific requirements. A key recommendation emanating from that meeting was the notion of creating a single data set, flexible enough to meet federal agency needs as they change over time and usable by all participating federal agencies:

- ★ Existing road centerline initiatives and independent spending from Federal agencies include, but are not limited to:
  - **The National Map** from Department of the Interior, US Geological Survey (USGS) who has licensed TomTom[1] road data for producing printable topographic maps
  - **TIGER** from the Department of Commerce, Census Bureau who has built TIGER from local sources for census enumeration and demographic applications, license-free
  - **HSIP** from the National Geospatial Intelligence Agency (NGA) who has licensed NAVSTREETS commercial data from Navteq for use by both federal and state agencies engaged in emergency management

[1] TomTom was formerly known as TeleAtlas

- The **FCC** who licensed commercial, nationwide street centerline data to support geocoding
- **The National Transportation Atlas Database** (NTAD) distributed by USDOT that contains information on road networks and associated infrastructure.
- In addition some agencies such as USGS, Census, and NGA are looking at OpenStreetMap (OSM) and other volunteered geographic information alternatives as means of supplementing their road centerline requirements.

In addition to national road centerline programs, the USDOT has many internal business requirements for road centerlines. These include but are not limited to:

- **The Federal Highway Administration's** (FHWA) **Highway Performance Monitoring System** (HPMS), which covers all public roads that are eligible for Federal-aid highway funds, including the National Highway System.
  - Detailed HPMS-specific attributes are collected for all roads eligible for Federal-aid
  - Annual HPMS reporting required by states
  - FHWA works with states to develop basic standards
  - Enables states to utilize FHWA funding for creation and maintenance of inventory
  - States develop their own plans and data management strategies
  - FHWA facilitates information exchange on state "best practices"
  - Includes the submission of road geometry
  - FHWA provides the States information from Federal agencies on Federally-owned public roads within their State boundaries
  - States provide an authoritative source of information about all public roads within their boundaries
- **USDOT Safety** for accident mapping
  - Large emphasis on reducing fatalities from accidents
  - Requires information for all roads, not just Federal-aid roads
- **FHWA Asset Management** for bridges

While current Federal government expenditures on road centerlines are not precisely known, they are estimated to be many tens of millions of dollars per year. Getting a better estimate of this figure is recommended as part of the business planning effort associated with TFTN and will be an important component of demonstrating the overall business case.

## 1.3 Existing Status Of Nationwide Road Centerlines

At one of the workshops during the TFTN strategic planning process, a strong recommendation was made to consider the time dimension as alternatives are evaluated. Specifically, the planning team was asked to distinguish existing *short-term* alternatives from *long-range* developmental alternatives. The three existing sources of nationwide road centerline data described below are available as alternatives for the short-term, while a fully built-out TFTN (as described in Section 2) should be strongly considered for the long-term.

1. **US Census TIGER Data**
2. **Commercial Data Providers**
   - NAVTEQ
   - TomTom
3. **Volunteered Geographic Information**
   - OpenStreetMap (OSM)
   - Esri's Community Base Maps (CBM)

Each of these three existing sources of information has distinct advantages and disadvantages. These "pros" and "cons" serve as a useful baseline for the long term planning of TFTN.

### 1.3.1 US Census TIGER Data

**PROS**

- ★ TIGER is a mature product that is already in the public domain
- ★ Data can be used for nationwide geocoding purposes
- ★ Provides a comprehensive, nationwide road centerline inventory including private roads and high quality in rural areas
- ★ Many users depend on it for a variety of applications, including:
  - Base map geometry
  - Access to US Census Bureau statistical information
  - National broadband mapping efforts aggregate broadband availability data to Census Geography
- ★ Significant improvements in latest, 2010 TIGER files
  - Positional accuracy improved (7.6 meter)
  - Substantial input from local sources incorporated

- Added 2.5 million updates based on 2010 Census field operations

★ Planning for more frequent updates (depending on funding)

**CONS**

★ TIGER did not meet requirements for nationwide roads in The National Map (TNM) as defined by USGS[2]

- Positional/Horizontal accuracy
- Depictions of interchanges and dual-carriageways
- Attributes to support high-quality cartography

★ Costs to retrofit TIGER were prohibitive for use in TNM, in the opinion of USGS

★ USGS replaced TIGER with TomTom data (but is working with Census to resolve issues, and might eventually go back to TIGER)

- Commercial data was competitively priced, but licensed for restricted use

★ While Census Bureau became a transportation data *provider* by default and necessity, they are Census domain experts and are more of a transportation data *integrator*, in principle. In addition, the Census Bureau is a user of roads, railroads and other transportation centerlines. They are used for orientation of field staff during censuses and surveys, geocoding addresses to census blocks, address range determinations and delineation of statistical and administrative boundaries. The collection of housing unit locations required a shift in accuracy requirements from a relative approach to a highly accurate positional approach using GPS technology and high resolution imagery. Thus, transportation is neither the US Census Bureau's line of business, nor their OMB A-16 Theme responsibility and TIGER is not designed as a *transportation* data set (e.g., its integrated topological structure contains many nodes not related to a transportation network).

★ Data maintenance: Census road centerline data maintenance schedule does not meet the more frequent needs for current road centerline data, such as E-911 and local needs.

### 1.3.2 Commercial Roads

**PROS**

★ NAVTEQ and TomTom are considered industry leaders and have developed customer-driven markets and business processes to sustain nationwide road centerline data sets for on-board navigation and other popular applications.

[2] The US Census Bureau has provided outreach to the USGS and is working with USGS on efforts to address these deficiencies. In addition, it should be recognized that while these deficiencies exist they are not necessarily systemic and some a present in <10% of situations.

- They have existing data that meets some of the basic requirements of TFTN, and at least one of them has expressed willingness to let their data matriculate into the public domain as part of a TFTN arrangement. The specifics of any such offer must be fully fleshed out and meet with federal agency mission requirements.
- Both companies have people and other resources dedicated to ongoing map updating, and are driven by business imperatives and competitive pressures to strive for the most accurate and current data possible.
- In urban areas, their data tends to be well regarded, for the most part. Rural data tends to have lower quality and reliability.
- There are scenarios where such companies could license their data to the Federal government for unrestricted use, with some limitations on the content, particularly in terms of attributes.
- They have also shown willingness to engage in public/private partnerships to ensure that they capture data from authoritative local sources, as well as their own compilation efforts and unique data acquisition methods. There are several examples, including one documented below in the case studies (see Section 1.4.1), of states pursuing public/private partnerships with these companies.
- The cost of acquiring existing commercial data is less than building equivalent road data from scratch.

**CONS**

- Because there are fewer customers for their data in rural areas, it is generally believed that their road coverage in such areas is weak compared to other alternatives.
- If a public/private partnership was pursued on a nationwide basis the lag between when the data are licensed and when they matriculate into the public domain could be as long as 12-24 months.
- The role of the government and associated public interests is limited to contractual arrangements and/or regulation.

### 1.3.3 Volunteered Geographic Information (VGI)

The notion of Volunteered Geographic Information can take a wide variety of forms. Examples of VGI roads data range from OpenStreetMap as a nationwide initiative with direct editing by volunteers to Esri's Community Base Map program which provides tiles that include roads data "volunteered" by authoritative sources for select metropolitan areas within the USA. For the purpose of the pros and cons described below, a "direct editing" program such as OSM is most relevant.

**PROS**

- Crowd-sourced
- Free of cost for use
- In the US, was seeded with TIGER data (and there is consideration of re-seeding with the greatly improved 2010 TIGER data)
- Anyone with a location-aware device can participate
- Tremendous developer support for add-on applications
- Used by MapQuest

**CONS**

- Crowd sourced and dependent upon the interests of volunteers to update
- Variable and inconsistent participation thereby resulting in non-uniform quality and coverage.
- Not necessarily authoritative source
- Unclear where liabilities might lie
- Licensing agreement issues need to be further clarified
- Does not adhere to an accuracy standard

### 1.3.4 Summary of Existing Approaches for Nationwide Centerlines

The table below provides a comparison of various traits across the three major, existing nationwide data sets -- i.e. TIGER, Commercial, and Volunteered Geographic Information (VGI) as represented by OpenStreetMap. The comparison traits are not weighted for relative importance in this version, and the ratings of high (H), medium (M) and low (L) are strictly subjective, based on professional opinion and stakeholder feedback. It should be noted that "high" is not always a positive quality, depending on the trait.

The table is intended to serve as a baseline for future analysis and refinement; both the traits and the methodology for comparison should be further refined and developed as part of a more detailed Business Plan. This type of comparison table is designed to be helpful in assessing and weighing specific TFTN alternatives, including some that are not considered in this version of the table.

| COMPARISON TRAIT | TIGER | COMMERCIAL | VGI* |
|---|---|---|---|
| a. Cost to the nation | H | M | L |
| b. Current completeness | H | H | H |
| c. Geospatial accuracy | M | M | M |
| d. Resolution | M | H | M |
| e. Transportation attributes | M | H | L |
| f. Currency as of 2011 | H | H | M |
| g. Frequency of updates | M | H | M |
| h. Required federal staffing to support | H | L | L |
| i. Urban quality | M | H | H |
| j. Rural quality | H | M | M |
| k. Value | H | H | H |
| l. Government oversight | H | L | L |
| m. Suitability for transportation | M | H | L |
| n. Nationwide seamlessness | H | H | H |
| o. Application & service versatility | H | H | M |
| p. Free availability | H | L | H |

*** NOTE:** Since OSM has comprehensive national coverage, whereas CBM does not (yet), OSM is used as the VGI example for comparison purposes.

## 1.4 How Are Road Centerline Data Currently Created?

Generally speaking, the constituent parts of nationwide data are created from scratch by original data collection using a variety of methods that include:

- Scanning and digitization of paper maps
- Ingesting, older best available electronic data sources
- On board vehicle GPS devices
- Field surveys
- Compilation from aerial imagery
- Data are created via crowd-sourcing inputs on top of an initial data set

In addition to data creation, many of these same techniques are employed in data updating processes.

These methods may be employed by local and state governments and/or the private sector. Once created, existing state and local government data may be collected, standardized and incorporated into regional, statewide, and nationwide data sets by:

- **Regional Metropolitan Planning Organizations** for local and regional planning and public safety

- Statewide road centerlines for **State DOT**, statewide GIS and Public Safety
- **Private sector** companies such as NAVTEQ and TomTom
- TIGER from **US Census Bureau**
- The National Map from **US Geological Survey** (USGS)
- Volunteer developed **OpenStreetMap** (OSM)

### 1.4.1 Statewide Road Inventories

States DOTs and/or state GIS programs are increasingly creating statewide road inventories. Such inventories can be incorporated into nationwide data sets. There are several models and emerging best practices for statewide road inventory creation. The following sections provide several case studies on different approaches, including:

- Activate local/county government to contribute
- Public/private partnership
- State DOT led efforts
- State GIS Office collaborative efforts

#### 1.4.1.1 Activate Local/County Government To Contribute

**Ohio: Example of County Collaboration on Statewide Street Centerlines**

- The Location Based Response System (LBRS) is a partnership between state and local government to develop highly-accurate (+/- 1M), field-verified street centerlines and address point locations for the entire state.
- The state has developed a set of standards and provides financial incentive to counties that participate and contracts with the county through a Memorandum of Agreement (MOA) to provide funds upon successful completion of a data collection and maintenance system meeting LBRS requirements.

This effort has resulted in the successful collaboration of many organizations working together to provide accurate centerline data throughout the state. The data are then available for use by both emergency response organizations and state and local geospatial programs.

#### 1.4.1.2 Public-Private Partnership

**New York: Example of a Public-Private Partnership to Create a Multi-purpose Centerline with Involvement from State GIS Office**

- In the late 1990s, New York State launched a statewide base mapping program utilizing GIS. Until this point, the New York DOT/DMV maintained their road data in both paper maps and legacy CAD systems.

- Existing road data needed to be upgraded to conform to the new state standard which at the time adhered to a limited set of established standards focused mainly on Federal program regulations such as the Federal Highway Administration's Highway Performance Monitoring System (HPMS).

- The original contract to develop the data, awarded in 2001 to TomTom (who went by GDT at the time), allowed the state to own whatever was built. In 2008, TomTom's contract ended and NAVTEQ was awarded a contract to continue to update and maintain the street data.

- Program has now developed/licensed a single, statewide street centerline layer. These data are available to other agencies that are able to consume them to support multiple applications. In addition, county and local government GIS/Transportation initiatives are also provided access to these data.

- A web portal where counties can upload/download data has been created. Submitted data are verified and incorporated in to the working set and then disseminated back to State and other entities such as NAVTEQ.

#### 1.4.1.3 State DOT

**Kentucky: Linkage of the Transportation Centerline to HPMS, other route-dependent datasets and E-911**

- In the late 1990's the Kentucky State Public Centerline project was originally conceived by the Kentucky Department of Transportation (KDOT) as a way to derive better statistical information and analytical products from all of the centerline data for the State. KDOT realized very early on that there was a need to move the State's geospatial data infrastructure in to a geographic information system (GIS) powered by a data model compiled entirely by linearly referenced and routable data.

- Tremendous effort was put forth to contract with Area Development Districts (ADDs) from around the State to gain proper funding and the momentum needed to move forward with the project to collect all the centerline data from around the state.

- These data became the foundation data layer that could be used by other agencies within the state, the Federal Highway Administration (FHWA) as well as the general public. These data and related activities cover original GPS collection, data dissemination, a recurring update cycle, population of the statewide E-911 repository and linkages between other data sources. The versatility and quality of these data would not have been possible without a high level of collaboration between all stakeholders within the State.

- The resulting efforts have made for seamless submission to HPMS and help to enhance its performance and accuracy

#### 1.4.1.4 State GIS Office

**Michigan: Example of a State GIS Office Assisting the Michigan DOT**

- The Michigan State GIS office is currently undergoing an effort called the Transportation Data Stewardship Enhancement Plan. This initiative has been accomplished under a project funded as part of the National Spatial Data Infrastructure (NSDI), Cooperative Agreement Program (CAP) Category 5. The CAP grant program is administered by the Federal Geographic Data Committee (FGDC) housed within the U.S. Geological Survey (USGS).

- The Enhancement Plan defines a framework and specific initiatives to enhance and expand the Michigan Geographic Framework (MGF) transportation data themes through building an environment that encourages broad participation through shared responsibility, shared costs, shared benefits, and shared control.

- The program utilizes five full time staff members who work constantly to maintain the data through the use of standardized models and systematic workflows from the county level up to the State. These workflows help to identify changes in the road system and reduce the amount of error in the final data set. Because of the strict nature and use of the State data model, it has been reported that the State's submission to HPMS has had no errors over the past several years.

- The Michigan State GIS office has assembled a robust and accurate road centerline that covers a majority of the State. These data meet the business requirements and accuracy standards for Michigan DOT. The data are also wholly owned by the State and freely disseminated without any vendor licensing restrictions or reliance on external partnerships.

### 1.4.2 Regional & Interstate Road Inventories

In addition to state-specific efforts, there have been initiatives that take a multi-state regional approach, or an intra-state regional approach. The examples profiled in this section include:

**I-95 Corridor: Example of Multi-state Data Assemblage Challenges**

- In support of the I-95 Corridor Coalition, Cambridge Systematics is coordinating the development of a Corridor-wide information system that consolidates existing state roadway network databases into a single multi-state roadway network to guide regional transportation planning and emergency management efforts.

- The consolidated road network is comprised of the 'best publicly-available' road centerline databases from each of the 16 states and the District of Columbia, who are members of the I-95 Corridor Coalition. The individual state roadway databases are 'stitched together' at the state borders to form a topologically integrated network that can be used both for network analysis and for overlaying other data of interest, such as crashes, traffic, roadway conditions, and planned improvements.

- Many variations in data contents and consistency for road datasets were encountered from state-to-state; but generally, useful and reasonably accurate road features were available to produce a public domain road network for the corridor that met the requirements of the project.

- Doing this once was the "easy part"; the "hard part" is doing this on a regular, *repeatable* basis to keep the road network updated and current.

- Looking back project participants observed that an alternative approach using a stripped down commercial roadway centerline network as a framework might have been easier. Such an approach would have relieved integration requirements, and improved the consistency and convenience of updates. The challenge with such an approach would have been ensuring and maintaining public domain accessibility, with no license restrictions to inhibit use.

### Washington Pooled Funds: Example of a Multi-state, Regional Effort

- The Washington State Transportation Framework project (WA-Trans) is an exemplary project for cooperation and partnership across all levels of government, including 8 federal agencies, 7 states, 14 Washington State agencies, 23 counties, 10 cities, 9 tribal governments, and 20 other private and public entities, to build a framework transportation data layer.

- The primary goal of this project is to build a statewide transportation database using a continuously evolving and improving collaborative effort. WA-Trans has been working in cooperation with six other state departments of transportation to develop computer-based tools that facilitate transportation data sharing and integration. The computer-based tools portion of the project has been financed with federal funds, specifically Transportation Pooled Funds (TPF).

- The WA-Trans program has shown that a successful framework data program can be executed at the state level in which data can be collected from a local level, integrated at a state level, and shared to all project participants while saving money and benefiting the users at all levels of government. In addition, having individual states coordinate with the local government agencies within their states is a model that has been successful and is a model that can be reproduced and expanded to create a national framework data set.

- The incorporation of addressing into the WA-Trans program has proven that this collection of data plays a vital role in a Statewide Transportation Framework and addressing should be part of a national program to fully engage local government. Finally, it is critical to a state and/or a national program to have adequate funding for not only infrastructure, tools, staffing and data, but also for outreach and communication efforts.

### Northern Virginia Regional Routable Road Centerline

- The Data Collection and Analysis project consisted of five jurisdictions in the Northern Virginia area, which are all Public Safety Answering Points (PSAP), as well as the Virginia Information Technology Agency (VITA) and the Virginia Department of Transportation (VDOT). All partners worked in active collaboration to develop a routable centerline data standard and data set usable by *computer-aided dispatch* (CAD) systems.

- The purpose of this project is to enhance Virginia Geographic Information Network (VGIN) road centerline (RCL) to create a regional data set capable of supporting routing, geocoding, and persistent updates to local 911 map systems. It will allow for design, development, updating, and population of an enhanced RCL which will fully support each individual CAD system for data outside their own jurisdiction, while not forcing them to change the data model currently used in CAD.

- The VGIN RCL project is considered a huge local success because of the communication and handshaking that occurs between the counties and the state DOT. This is an ongoing project that will eventually have a seamless flow from participating cities and counties up to the state and then back again to complete the round trip. Additional work on the project includes the development of maintenance tools and the integration of regional data into CAD systems.

## 1.5 Strengths & Weaknesses Of Current Situation

### 1.5.1 Strengths

- Clear data theme responsibility for USDOT in OMB A-16 and need for increased collaboration across Federal agencies on geospatial data coordination.

- Common interest across Federal agencies in a single data set for road centerlines for the nation, for all roads.

- Widespread support across diverse stakeholders for the TFTN concept.

- Availability of practical, operational models and best practices for statewide road inventories. Key best practices include collaborative approaches involving counties and also a multi-purpose outlook that involves transportation interests as well as other key stakeholders such as the 911 community.

- Availability of several distinct alternatives to meet TFTN requirements

### 1.5.2 Weaknesses

- Duplication of effort and spending at the federal level
- The total amount of money currently being spent on road centerlines is unknown
- Federal data set maintenance schedules not frequent enough for many local, regional and state uses.
- State led road centerline efforts inconsistent across the country and can include duplication of effort and spending
- Traditional state DOT data use does not consider locality needs for addressing and public safety
- Accuracy and completeness challenges for rural area data sets
  - Particularly problematic for public safety use where accurate addressing is required
  - Private sector data strong in high demand urban areas but weaker in low demand rural areas

## 1.6 Opportunities & Challenges

### 1.6.1 Opportunities

- Recognition within USDOT that nationwide roads, not just Federal-aid roads, are a business requirement, for example:
  - Mapping and displaying accident locations for Safety applications
  - Mapping and displaying asset inventories (e.g. bridges)
- Increasing recognition by state DOTs that statewide road inventories are important and valuable for meeting mission requirements, especially in the context of HPMS, Bridge Inventory, and Safety applications
- Next Generation 911 (NG911) is a potential driver for improved road centerline and address data quality
- Momentum from data.gov and other initiatives to encourage open and transparent government and freely available and free-flowing government data

### 1.6.2 Challenges

- Road data changes frequently and needs regular update, for instance annual, to keep current
- Interagency/intergovernmental collaboration and the coordination of funding across agencies requires new relationships, agreements, and approaches
- The pace of change in government tends to be slow, while the pace of change amongst commercial companies and private citizens can be very fast, especially when it comes to adopting new technology and innovative applications. Accelerating change in government practices is a particular challenge, and bureaucratic resistance to change tends to be high.
- Inadequate funding to address requirements and achieve desirable outcomes

# 2 Vision & Goals

## 2.1 Strategic Goal

The overarching strategic goal for Transportation for the Nation is to:

> Commence the development of **comprehensive, publicly available, nationwide transportation data sets**. Ultimately, Transportation for the Nation (TFTN) will encompass data sets covering multiple modes of transportation, however, the initial focus will be on producing a **road centerline** data set that includes all types of roads, both public and private. The initial TFTN data set will include consistent, current, high quality road centerline data for the entire country.

## 2.2 Vision

Given the complexity of roads data and the extremely wide variety of uses for such data (see Section 1.2), it is recognized that Transportation for the Nation by itself cannot meet the needs of all road data consumers. However, in light of the large amounts of existing, overlapping effort (see Section 1.3) aimed at creating road data, TFTN does aim to establish **shared baseline geometry** and **basic attribute** content that can be utilized by and built on by specific constituencies and users. The creation of TFTN should reduce redundancy in road data creation and maintenance thereby conserving resources that may enable investments in data quality improvement, data updating and value added complements to the baseline.

### 2.2.1 The Common Baseline

Transportation for the Nation will provide a common foundation that can be built on by a variety of public and private sector organizations. In order to limit complexity and facilitate rapid and efficient development, the common baseline should be as simple as possible. In this manner it can provide a lowest common denominator for the wide variety of road data uses. Potentially, the common baseline for TFTN could be as simple as:

- Road centerline geometry for **all roads**, plus
- Basic road centerline attributes that might include:
  - Persistent Road ID number
  - Road name

    - Road functional classification
    - Road status (e.g., open/closed to public traffic[3])
- Address range that can be used for location finding and to facilitate vehicle routing on road centerline network

It should be noted that there are varying opinions on whether, or not address ranges should be included in the common baseline. Given the fact that the original NSGIC vision for TFTN included addressing and given that TIGER, OSM and commercial centerline data sources include addressing, it is recommended that addressing be part of the common baseline.

In addition, it should be noted that while USDOT has a program orientation that can be focused on "public roads" or "public mileage" there are classes of "private roads" that fulfill important public functions, or require emergency response and thus belong in TFTN. Examples include roads on university campuses and ring roads associated with shopping malls. These types of roads need to be considered in the detailed planning that would follow this strategic plan.

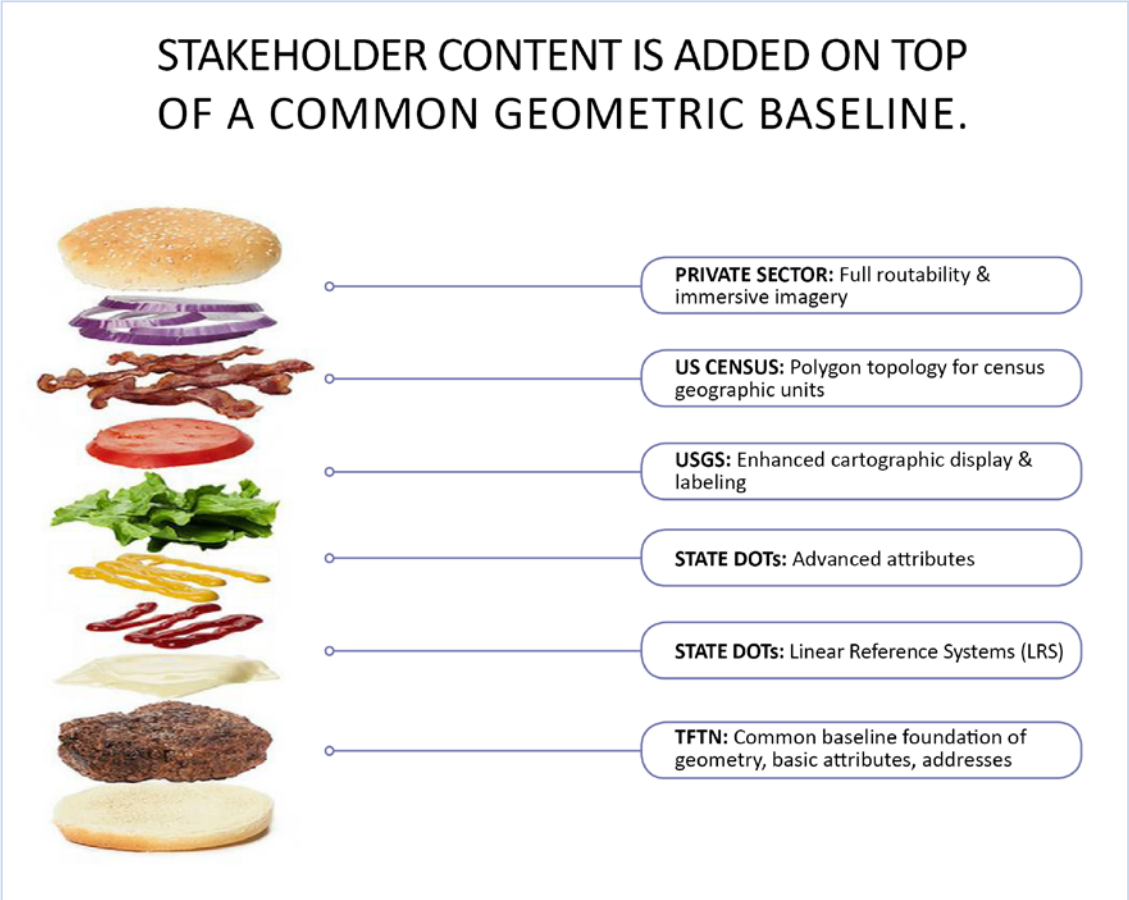
### 2.2.2 Value-Added Additions to the Baseline

If a common baseline was in place, a wide variety of stakeholders could build on this baseline to create more advanced data sets that would meet specific business requirements. Important examples of value added additions to a TFTN baseline that were identified in this study include:

- **Linear referencing systems** (LRS) that can be used – most often by state and local Departments of Transportation – for the assignment of locations and attributes along a road centerline network
- **Additional road attributes** that can be used to track business data associated with roads. Examples include pavement condition, speed limits, lanes and parking.
- **Enhanced cartographic display** for variable road symbology, scale dependent labeling and the placement of highway shields
- Coding to **identify road segments that constitute** political, administrative or census **boundaries**
- **Advanced network topology** and attributes to enable **robust vehicle routing** including turn restrictions, vehicle restrictions, one-way streets and the integration of real-time traffic feeds.

[3] For example, some US Forest Service roads are never open to the public.

One stakeholder from the private sector used the analogy of a fully featured road centerline being a "hamburger with special sauce and fixings." Using this analogy, and as illustrated below, TFTN would comprise the beef patty and any number of additional condiments could be piled on top by consumers of the burger/data.

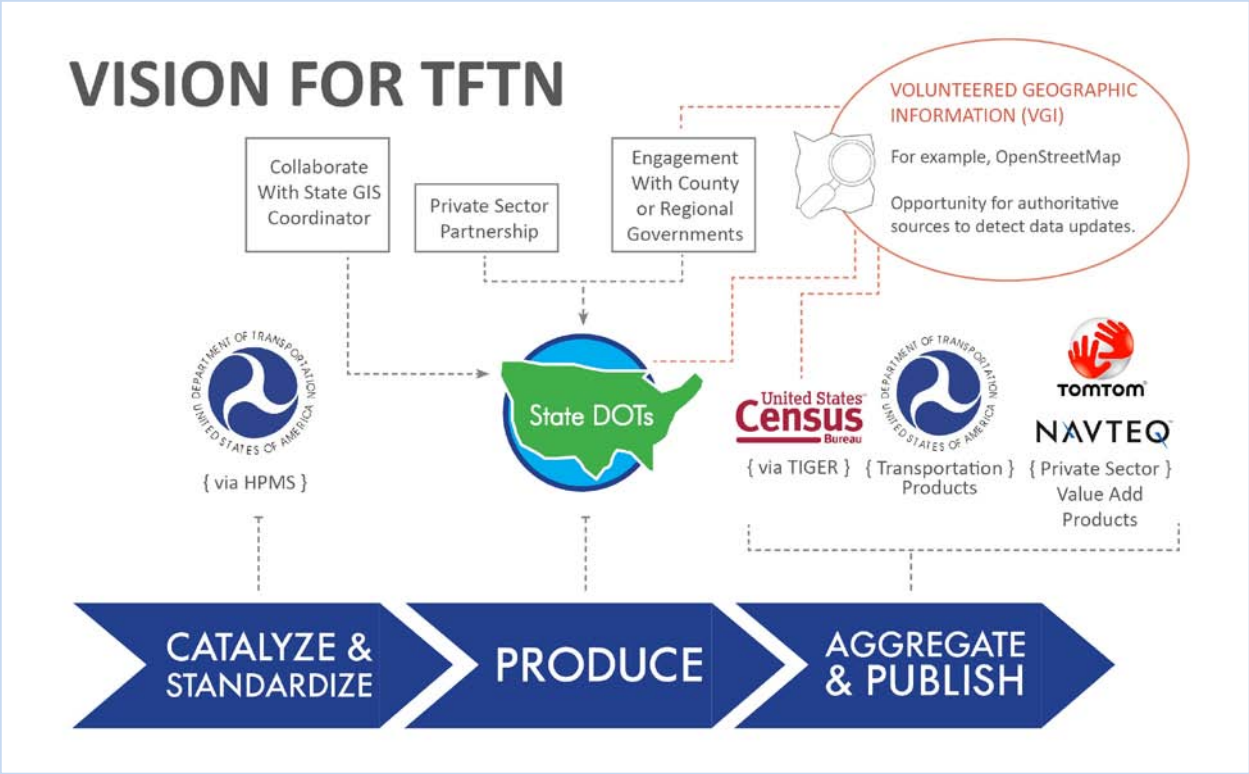



## 2.3 Programmatic Goals

Developing a resource such as TFTN is not a simple task and will involve the coordinated efforts of number of organizations. The programmatic goals described below identify the stakeholders that will have integral roles in three core elements of producing and maintaining TFTN:

4. **Catalyzing** the development of standardized road centerline data
5. **Producing** accurate and current road centerline data
6. **Aggregating and publishing** statewide data as a national data set

The figure below provides a high level overview of the content covered in the following sections:




### 2.3.1 Catalyze Development Of TFTN Via USDOT Federal Highway Administration HPMS Reporting Requirements

The US Department of Transportation, Federal Highway Administration (FHWA), Highway Performance Monitoring System (HPMS) program currently requires all States to submit a variety of condition and performance data pertaining to their "Federal-aid roads" (i.e. roadways that are eligible to receive Federal-aid funding to be utilized for infrastructure improvement purposes). Fulfilling this reporting requirement is necessary for FHWA to determine the amount of Federal-aid funds each State is eligible to receive. Currently, for HPMS purposes, the States submit their condition and performance data to the Office of Highway Policy Information (OHPI) on an annual basis. This annual submittal includes a defined set of attributes that describe the States' Federal-aid roads, and the associated roadway geometry in a geospatial format. Most often, only geospatial network data for the Federal-aid roads are submitted. But, sometimes States will submit data for roads beyond the extent of their Federal-aid system (i.e.

roadways functionally classified as Rural Minor Collector or Local), even though it is not currently required.

The HPMS program is also involved in evaluating and verifying the "certified public mileage" submitted by each state. This element of HPMS would also have a requirement for seeing "all roads" as opposed to just the "Federal-aid" roads and would benefit from TFTN. While these elements of the HPMS program are focused on "public roads" and "public mileage" it is important to recognize that as described above, TFTN is envisioned to include **all roads**, including potentially private roads.

Given this existing requirement, and the large funding incentive for States to meet this requirement, there is the potential for the OHPI to alter their HPMS reporting requirements so that the geospatial network data must be submitted in the context of a comprehensive statewide road inventory, including all roads. The attribute data that is reported for HPMS purposes would continue to be required only for Federal-aid roads, but the geometry for the Federal-aid roads would need to be provided within the context of the statewide road network.

If FHWA had a requirement to request the States to provide centerline geometry for all public roads within their State, then HPMS could be the means for collecting nationwide road centerlines. This approach is attractive for several reasons:

1. This is an annual requirement so there is a built-in update cycle
2. Given the nature of a reporting requirement, the OHPI has the ability designate a standard submittal format for HPMS purposes that will result in consistent data from state to state
3. States are allowed to use FHWA funding to meet their HPMS reporting requirements, thus there is a funding stream that can be accessed
4. While meeting HPMS requirements is not a mandate, due to the large volume of FHWA funding that depends on meeting this requirement, the States are highly incentivized to submit good data
5. USDOT has recognized an increasing internal need for nationwide roads data - for example to support safety initiatives - and inter-program collaboration makes business sense for the agency

To achieve this goal the OHPI would need to:

1. Formally alter its HPMS reporting requirements and notify the States of this change. Alternatively, a new TFTN requirement could be instituted.

2. Identify a standard format and accuracy guidelines for the submittal of comprehensive statewide geospatial networks consisting of geometry for all roads. Such a standard would likely be developed in close consultation with all State DOTs, but more importantly the heavily impacted State DOTs.

3. Institute a data acceptance regime that would include validating that the standard was properly met by states

### 2.3.2 Support States in Developing Statewide Inventories

While the OHPI would identify standards and guidelines for content, formats and accuracy for HPMS purposes, it would be up to States to determine the best method for meeting the annual submittal requirements. As described above in the case studies (see Section 2.4.1), States that already have statewide road inventories have established a variety of "best practices" that have proven to be effective.

Best practices for statewide road inventories include the following, and a state may pursue a strategy that implements more than one of these approaches in combination:

- **Activating and supporting county-based data contributions**: in essence, the state establishes the statewide inventory by collecting and aggregating county data
- **Partnering with private sector firms**: states establish collaborative or contract relationships with the private sector to create a statewide road data set
- **Coordinating state DOT efforts with state E911 and NG911 efforts**: states build active, multi-agency alliances that co-fund road centerline creation
- **Collaboration between state DOTs and state GIS offices**: state GIS offices assist state DOTs in assembling the statewide centerline in GIS format

A survey on state DOT road networks was conducted by the American Association of State Highway and Transportation Officials (AASHTO) in 2011. The results indicated that approximately 75% of the states who responded (46 responses in total) included all public routes plus local streets in their road network geometry[4]. These data could provide a valuable input to TFTN; and for those states that do not include all roads, TFTN could be an incentive to achieve complete coverage. Currently, there is very little

[4] See http://www.gis-t.org and click on the link for "State Summary"

independent verification of the completeness or accuracy of these networks, but TFTN could lead to increased use and scrutiny of these data.

In addition, the states may experiment with and potentially take advantage of volunteered geographic information (VGI) technologies to assist in the development of, or quality control of statewide road inventories. Ultimately, this type of "crowd sourcing" approach engages the public in reviewing and improving the statewide inventory. While less developed in the US, initiatives such as OpenStreetMap, particularly in European countries, have clearly shown that these kinds of approaches are viable for the large scale production and dissemination of road centerline data. While VGI is not an authoritative source by itself, it is a tool and technique that authoritative data managers can take advantage of to improve their own products.

Another option that exists is that the USDOT may choose to establish a partnership with a private sector firm that could supply **nationwide data** if minimum standards of accuracy and currency for all geographies (i.e. rural) were achievable. If this was the case, then the USDOT would be in a position to offer these data to states that do not yet have statewide street inventories as a "starter kit." This type of partnership would need to be different than a conventional licensing agreement due to the objective of having statewide road inventories and TFTN remain in the public domain.

The USGS's National Hydrography Dataset (NHD), a component of The National Map (TNM), provides a positive example of this type Federal-State collaboration based on local data stewardship and federal coordination. Under the NHD program, USGS provides guidance, and at times funding, to states to produce and maintain high quality hydrography (i.e., surface water) data at a state level that can then be integrated into a national data set.

### 2.3.3 Aggregate State-level Data Into Nationwide Map & Publish Data To Stakeholders

Once the States submit their statewide road inventories to the OHPI for HPMS purposes, the needs of that program are fulfilled. The HPMS program has a state-by-state outlook and does not currently require a nationwide data set to fulfill its own business needs. Thus, once HPMS catalyzes the development of state-based data other activity is required to knit the 50 state data sets into a seamless, nationwide quilt.

#### 2.3.3.1 Data Aggregation

Once the OHPI collects the annual statewide inventory for HPMS purposes, some other entity within USDOT such as Safety or the Research and Innovative Technology Administration (RITA), or a partner agency will need to perform the work of assembling the nationwide data set. The following describes the basic steps that will need to be followed:

1. Individual state contributions will need to be assessed for quality and conformance to the data submittal guidelines/standards

2. Each state data set will need to be compared to the data sets from its neighboring states to identify, and rectify potential edge issues. Edge issues need to be resolved so that roads that cross state lines properly match on both side of the border so that nationwide routing can take place across the country.

3. It is possible that state inventories may initially be missing certain types of roads, particularly roads that are managed by Federal agencies, such as the USDA Forest Service (USFS) and the DOI Bureau of Land Management (BLM). If needed, and for an interim period the entity that is aggregating and assembling TFTN would have to work with the USDOT Federal Lands Highway Office and potentially the USDA and DOI directly so that the best federal roads data can be integrated into TFTN. Over time, federal agency road improvements can be returned to state DOTs and this type of workflow should help reduce the potentially redundant efforts of state and federal agencies to map these same roads.

There are three main options for identifying an entity to do this work:

1. The **US Census** has existing expertise and capacity in performing this type of data aggregation and integration as part of their TIGER program. The TIGER program is responsible for creating a nationwide data set that houses US Census information, including the geographic representation of Census geographical units such as blocks, block groups and tracts. Since roads are integral to identifying Census geography, the TIGER file contains a nationwide road data set. Thus, US Census could perform a data aggregation function on behalf of TFTN based on raw, but consistent statewide data provided by USDOT and emanating from HPMS submittals. Since the Census already has a large geography unit that performs this type of work, this might prove the most cost effective option. Significantly, if TFTN can prove to meet the needs of Census, there are significant opportunities for cost savings since the Census spends significant resources on collecting the road centerlines that are currently included in TIGER. Using this option would also involve workflow changes on the part of the US Census Bureau since current practice involves communicating with multiple levels of government, not just the states.

2. The **USDOT** could assign to, or develop this function via FHWA or another program. For instance, the Safety program has a business requirement for nationwide roads data and

they could potentially build the capacity to integrate HPMS statewide inventories into a nationwide data set.

3. The USDOT could enter into a comprehensive **partnership with one of the private sector nationwide data providers.** Under this model, USDOT would recognize the extensive existing, nationwide data that exists in the private sector as well as the private sector's extensive workforce that is aimed at keeping it current (e.g., fleets of GPS enabled vehicles). With this model the USDOT would provide the private sector firm access to the statewide road inventories collected through HPMS and the firm would incorporate changes that come from the authoritative, state data sets into the nationwide product. In addition, the private sector firm would add the HPMS attributes onto the nationwide data set. Such an agreement would be involved and far different from a simple licensing agreement. At a minimum, such an agreement would need to cover the following:

    - The completed data set would need to be publicly available.
    - Data would potentially need to be made available to state DOTs to act as a "starter kit" and substrate for statewide road inventories, when states do not yet have a complete statewide network (see Section 2.3.2 above).
    - The firm would need to be responsible for significant, annual data integration and standardization work involving the incorporation of updated geometric information and HPMS attributes from statewide road inventories.

The firm would be free to incorporate the public domain version of the data into their own, proprietary "value added" data sets.

#### 2.3.3.2 Data Publication

To fulfill the vision and full potential of TFTN, once the nationwide data set is assembled it needs to be published and made available to governmental agencies, industry and the general public. In this manner, these entities can begin building on TFTN and adding specific, additional value such as full routability, advanced attributes, addresses and LRS. Ideally, the TFTN product will be made available through a variety of media, including:

- ★ Published web services and APIs
- ★ Data download
- ★ Physical media (e.g. DVDs)

Once again, the easiest mode of publication might be through the US Census and their well established TIGER product. Over the past two decades Census has proven that it is capable of both producing and distributing such a product and maintains an infrastructure for producing and disseminating it.

In addition to Census, it can be expected that other entities will publish products that are based-on or derived from TFTN. Examples include:

- **USDOT** expects to assemble and publish "transportation oriented" data products using TFTN data. Such products include the National Transportation Atlas Database (NTAD) which could use the common baseline geometry and attributes in association with more detailed transportation attributes and geospatial data on other modes of transportation and transit.
- Companies in the **private sector** may harvest (in whole, or in part) TFTN baseline geometry to seed their own products which could include a variety of "value added" data elements to enable capabilities such as a fully routable road data for commercial navigation systems

As with the state data producers, TFTN data publishers may choose to take advantage of VGI/crowd sourcing technologies to gain consumer input on data quality and the need for data update.

Regardless of how TFTN ends up being created and published, it is important to consider appropriate licensing models, even while it is planned to be in the public domain. For instance, Open Source Software is not license-free, rather there are a variety of "open source licenses" such as the Gnu General Public License (GPL) that may be applied. Toward that end, in 2004, the National Research Council (NRC) of the National Academies published a book, Licensing Geographic Data and Services. This publication is directly relevant to licensing considerations that may come up as TFTN comes into being. The publication is filled with good examples and advice, including the observation that licensing data is not mutually exclusive with unlimited rights to distribute the subject data. At the same time, it is important to understand that licensing is not necessarily a requirement and government data sets such as TIGER are distributed license-free.

### 2.3.4 Keeping TFTN Current: data update and maintenance

It is important to acknowledge that TFTN is not envisioned as a onetime effort. Given continual changes in roads across the country it is critical that there be a mechanism to regularly update TFTN. Indeed, one of the advantages of proposing the HPMS program as a catalyst for TFTN is the fact that HPMS involves *annual submittals* of data to USDOT. These annual submittals would provide a recurring mechanism to update TFTN. While many individual states and counties keep their road data more current on a more frequent basis (e.g., monthly), given the nationwide scope of TFTN setting an **annual update target** is a reasonable starting place. States and other levels of government would continue their current practices and would not need to match TFTN's update cycle. Rather, they would simply provide an annual snapshot of their state's data as part of their HPMS submittal.

After all HPMS submittals are received, the general workflow outlined above in Sections 2.3.2 and 2.3.3 would be replicated to produce a new nationwide data set. Over time, and with greater experience reducing the update cycle (e.g., to bi-annually) could be explored.

## 2.4 Next Steps

Transportation for the Nation has been a concept for at least the past five years. With this strategic planning effort, it is beginning to take on a more tangible shape. The programmatic goals recommended above provide a realistic path for this resource to come into being. As such, the most important next steps are focused on continuing to **build support and advocacy** for the concept and filling in **further planning details** to move closer to actual implementation.

- **Continue working with stakeholders and advocates to sustain support for the development of TFTN.** Existing supporters should be called on to educate other stakeholders and to advocate the federal government to move forward. Existing interested parties and advocates include, but are not limited to:
  - Existing project Executive Steering Committee and At Large Committee
  - The National States Geographic Information Council (NSGIC) community
  - The GIS-T/AASHTO community

- **Determine if FHWA has a requirement for States to provide centerline geometries for all roads within their State.** Once this determination is made then a timeline can be established and additional planning details can begin to be fleshed out. Key near-term activities would include:
  - HPMS outreach to appropriate state DOT and state GIS Coordinators to develop information that will help the program implement potential new requirements.
    - A key initial question to answer will be determining what constitutes the common baseline for both geographic data and attributes
  - Identifying opportunities for "pilot projects" at the state level. For instance, identifying states that already have good, statewide road inventories and working with them to develop an HPMS submittal with detailed HMPS attributes delivered on top of the statewide data.

- **Commence creation of a TFTN Business Plan.** A business plan will be critical to help answer the following questions:

  1. What is the business case for pursuing TFTN? What are the costs, benefits and rates of return (ROI)? What are the resultant priorities and decision factors based on the business case?

2. What are the specific roles of agency participants? What is the level of interest/willingness to participate?
3. What are the details of the programmatic goals described above? What is a feasible timeline for moving forward?
4. How would intergovernmental agreements work? How might public-private partnerships be formed?
5. What does the implementation path look like?

★ **Begin formally engaging US Census and other federal partners such as USDA or DOI on interdepartmental cooperative agreements and/or pilot projects.** With the completion of the 2010 nationwide, decennial census, the timing may be particularly good for engaging the US Census Bureau.

## 2.5 Monitoring & Measuring Progress

Given the current governmental fiscal situation, it can be expected that the development of TFTN will unfold incrementally and over time. Realistically, it may take 5-10 years for a sustainable, fully operational TFTN data set to come into being. Approaches such as more aggressive partnering with the private sector have the potential to expedite the timeline due to the existing capacity of the nationwide data providers. The following outlines some potential metrics for measuring progress:

1. **Determine whether a return on investment is being realized**. One key element of a TFTN business plan would be an effort to identify current federal expenditures on road centerline data. These expenditures would include both direct costs of producing data – for example, Census road expenditures to support TIGER – as well as the cumulative licensing expenditures of federal agencies that obtain road centerlines from commercial sources. As TFTN becomes available, it can be expected that some of these expenses should be reduced, or eliminated all together. Reductions in federal expenses for road centerline data would be a significant indicator of progress, even if there were new costs that might offset some of those savings.

2. **Review state road inventory efforts to catalog current activity and monitor complete statewide inventories that come on-line.** As described above, statewide road inventories are a key component of TFTN. This study identified a small number of successful, existing efforts in the form of case studies. This work should be broadened to fully catalog the status of statewide road initiatives in all 50 states. Once this baseline is created, it can be updated on an annual basis to track state level progress in creating high quality, complete road inventories.

3. **Work with the US Census Bureau to identify TIGER 2020 data content that may emanate from TFTN catalyzed activity.** If USDOT and the Census Bureau collaborate to produce TFTN, with Census taking on the role of data aggregation and publication via their existing TIGER product, then it will be important to compare how production of the 2020 TIGER data compared with the 2010 effort. Since the Census Bureau also produces annual versions of TIGER to support the annual American Community Survey, the annual Population Estimates Program and other current surveys there are also other nearer-term opportunities to assess how TFTN may be providing benefits. It is presumed that TFTN would be able to assist Census in producing the 2020 products (and interim surveys) by ensuring that high quality statewide data are more readily available. The 2020 Census provides an opportunity to track the progress that is made both in building TFTN and in integrating the result data into Census Bureau workflows for producing new TIGER data.

# 3 Requirements

## 3.1 Organizational Needs

One of the most important near-term objectives of a TFTN initiative will be navigating the path from a "study phase" into an "implementation phase." With implementation, some of the informal committees that have been established will need to be formalized. Similarly, some of the informal organizational relationships and partnerships that have been explored will need to be formalized as agreements and commitments. The following describes several of these organizational requirements and opportunities.

- There is a need to establish potentially several **TFTN Steering Committees** that would be focused on different sets of issues:

    1. **USDOT Steering Committee:** It is critical that USDOT remain committed to a single, consolidated, nationwide street centerline data. This means that all units and administrations within USDOT need to be informed of the initiative and have an opportunity to participate in shaping the product. As outlined above, at a minimum the HPMS and Safety programs are extremely interested. In addition, the Research and Innovative Technology Administration which houses the GIO, The National 911 Program (within the National Highway Traffic Safety Administration) and Asset Management are key users and stakeholders. USDOT needs to "lead by example" in terms of getting multiple, independent entities to collaborate on a group effort.

    2. **Federal Agency Steering Committee:** A good deal of the return on investment of TFTN will originate from all Federal agencies using this resource, both as end-users and as an aid in maintaining federal roads data such as that maintained by the USDA Forest Service. Other Federal agencies, such as Census have been identified as potentially being key, active participants in creating TFTN. Again, this means that all federal agencies need to be informed of the initiative and have an opportunity to participate in shaping the product. This initiative literally hinges on the ability of large federal agencies to effectively collaborate with one another and a steering committee will be an important tool towards meeting that goal.

    3. **Broad-based Stakeholder Advisory Committee that includes local, regional, state, federal, and private sector representation:** It is anticipated that at least three levels of government – local/county, state and federal and tribal governments – will be involved in the production of TFTN, and it is anticipated to be used widely by the private sector and general public. As such, this advisory committee will serve as a structured forum for sharing progress and obtaining ongoing input and ideas for strengthening the program.

4. **Leverage FGDC Transportation Sub-committee expertise:** The FGDC has established a Transportation Subcommittee that has been more or less active depending on priorities. In light of the Circular A-16 nature of USDOT's involvement in TFTN, and USDOT's role as the lead agency of this subcommittee, this existing forum should be kept abreast of developments. When possible, this committee has the potential leverage the deep transportation expertise of its membership to addressing TFTN issues.

5. **Seek guidance from, and report progress to the National Geospatial Advisory Council (NGAC):** The NGAC has an active interest in the NSDI and in how federal agencies are carrying out their OMB A-16 data theme stewardship responsibilities. As such, NGAC has solicited two briefings on the TFTN strategic planning effort and it is assumed that progress reporting to, and seeking guidance from NGAC will continue.

- There is a similar need to establish at least **two formal inter-departmental agreements** that are necessary to initiate TFTN. The precise nature of the agreement (e.g. Memoranda of Understanding) will be determined at a later time.

  1. **Between USDOT HPMS and USDOT Safety** and others such as Intelligent Transportation Systems (ITS) to arrive at a mechanism for co-funding the TFTN effort where there is a shared, mutual interest. Progress will be hampered until there is some ability to fund the next phases of this effort such as the Business Plan describe above.

  2. **Between USDOT and US Census** to fully explore the potential for a collaborative arrangement for producing and publishing TFTN. Initial activities would likely focus on identifying small scale pilot projects that would test the technical premises of TFTN and could be pursued in tandem.

## 3.2 Executive Support

The TFTN effort will result in a fundamental alteration in how the federal government approaches creating and sharing road centerline data. In addition, the strategic vision requires significant levels of both interdepartmental and intergovernmental collaboration and cooperation. Executing these types of changes and building productive partnerships will require senior level executive support. Indeed, this strategic planning effort is largely aimed at generating the information necessary to explain the initiative, and its benefits to an executive audience. Specific examples of key executive support that must be solicited and built include:

- **Within the USDOT:**

  1. **FHWA** executive leadership that can make the determination that statewide road inventories should be required from states

2. **Safety Administration** which has a significant need for nationwide roads data and is in a position to potentially provide funding

3. **RITA** which houses the USDOT GIO and has initiated the planning for TFTN

- **Within other federal agencies:**

4. **US Census Bureau**: who is envisioned to be a significant partner in the aggregation of statewide inventories into a national data set.

5. **USGS and FGDC**: who are currently involved in overseeing the development of the NSDI and the implementation of OMB Circular A-16 and the emerging National Geospatial Platform. Ideally, executives within **OMB** itself would also be briefed on TFTN.

6. **USDA and USFS**: who are currently the stewards of significant road data sets covering the national forest system.

Having executives understand the TFTN initiative and the critical role of partnerships will be integral to establishing those partnerships and the funding that is necessary for the overall success of the effort.

## 3.3 Staffing

As described throughout this report, a great deal of the effort involved in TFTN would be carried out by existing programs and personnel that are involved in road inventories and road data both within USDOT and other federal agencies, such as the US Census. In addition, the largest amount of actual effort is most likely to occur within the state DOTs and/or private sector partners that will physically produce the underlying data in the context of statewide inventories.

At present, the USDOT GIO has served as the project manager for TFTN strategic planning. As the program potentially gains traction and transitions into detailed planning, prototyping and then implementation there will likely be a need for a **fulltime TFTN project manager** within USDOT.

Later, and during potential implementation there may be a need to identify additional tasks that may be carried out by existing personnel within both USDOT and US Census. For example, HPMS personnel may be required to receive and review statewide road inventory data submitted by the states. Similarly, existing US Census personnel may be redirected from other TIGER tasks to the assembly of nationwide roads data from a collection of statewide road inventories.

Ultimately, a fuller picture of required staffing will emerge following the completion of a TFTN Business Plan and a more detailed implementation plan.

## 3.4 Costs

It is not yet possible to determine the overall costs for implementing TFTN. Ultimately, the completion of the Business Plan will identify the specific tasks and levels of effort necessary to carry out this type of program based on a set of assumptions. Thus, the major near term costs outlined below are to fund the development of the Business Plan and near-term prototyping of technological and data development approaches.

| ITEM | COST |
|---|---|
| Development of detailed TFTN Business Plan | $250,000 |
| Development of prototypes in association with partners | $200,000 |

## 3.5 Assessing Risk

There are three significant risks that will need to be considered and managed in forming an effective TFTN program:

1. **Inadequate federal interagency collaboration:** In many ways, this strategic plan hinges on the ability of independent governmental programs being able to work together for increased efficiencies. This includes collaboration both for independent programs *within* the USDOT as well as for USDOT *working in association with* other federal departments/bureaus such as US Census. Such collaborations are not commonplace and given the size of federal agencies are not easy to achieve. If such collaboration is not possible, then the proposed model for TFTN will have a difficult time succeeding. However, it is fair to observe that collaboration and cooperation on geospatial matters is one of the core principles behind OMB Circular A-16. The federal government should build needed data once, and then use it many times across the entire government. If the well planned collaboration that is envisioned for TFTN does not materialize, then it is reasonable to wonder whether the promise of Circular A-16 can ever be carried out within the current environment.

2. **Government moves too slowly:** As documented in this report there are several active efforts that are constructing nationwide roads data. These efforts will not stop due to the fact that planning for TFTN is underway, and the public perception is that they are gaining momentum as a function of their widespread adoption and use by consumers as well as public and private organizations. If it takes too long for TFTN to come into being as an authoritative, publicly

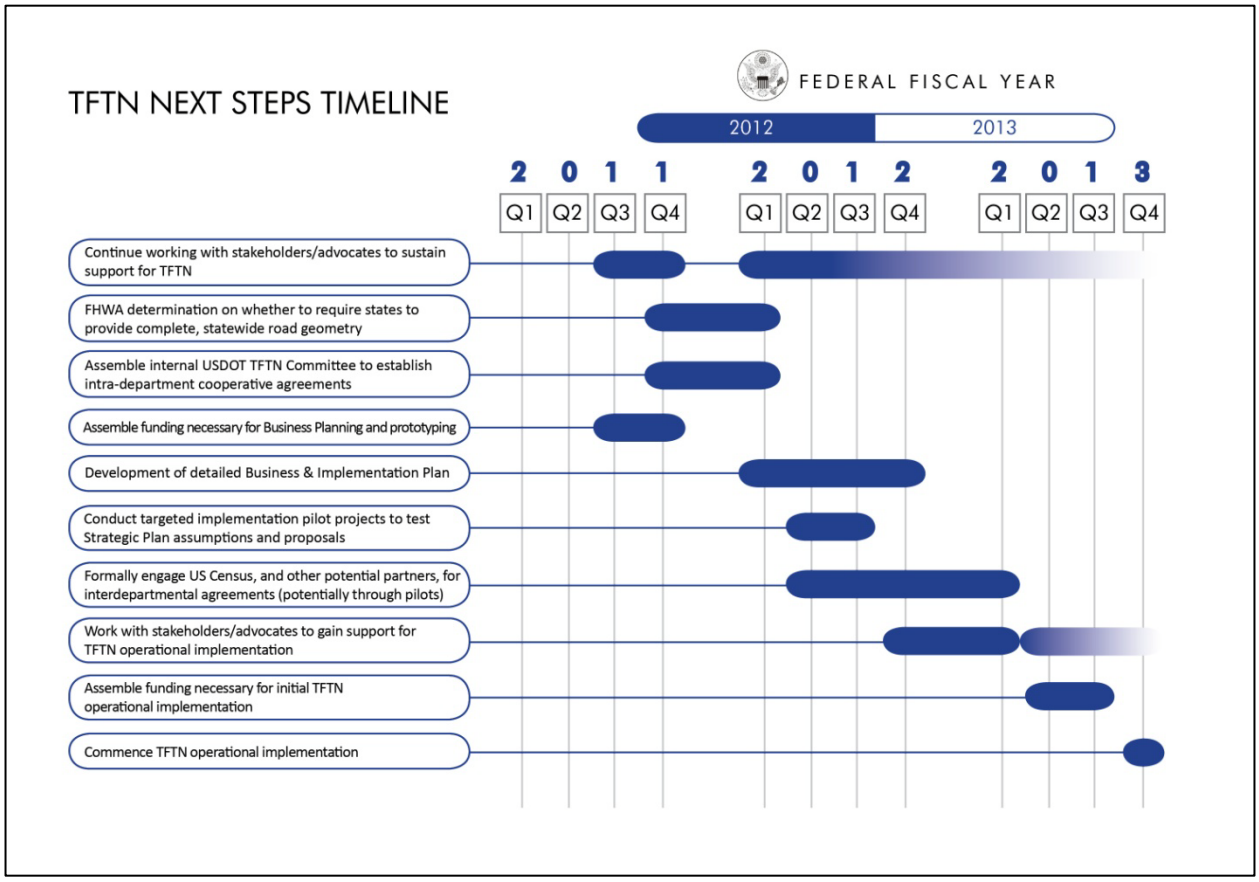
available nationwide resource then there is a risk the other efforts from the private or non-profit sectors – such as OpenStreetMap - may take further root and supersede the TFTN vision.

3. **It is too difficult to identify a single product that meets a wide diversity of needs:** The data within TFTN are envisioned to be a common baseline framework of shared geometry and basic attributes that can underpin a wide variety of products. As described in the report, additional content such as linear referencing systems, advanced cartography, census boundaries, addressing and imagery can be constructed on top of the TFTN baseline. There is some risk that it will be too difficult for a diversity of stakeholders to come to consensus agreement on what should be included in the common baseline framework. Absent such agreement, there is a risk that certain stakeholders may conclude that TFTN will not be useful to them. As such, identifying the common baseline content is one of the key questions that needs to be addressed in the detailed TFTN Business Plan.

# 4 Implementation Overview

## 4.1 Phasing & Milestones

The timeline below is focused on the activities that are described above under the heading of "next steps" (see Section 2.4). Ultimately, it is premature to speculate on the *full implementation* timeline as there are several important activities that need to be completed prior to embarking on operational implementation.



# Appendices

## Appendix 1: Strategic Planning Methodology

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## 1 Project Governance

There are four distinct governing bodies involved with the Transportation for the Nation imitative. The bodies consist of a strong cross section of Federal Stakeholder, Non-Federal Government Agencies and Private Firms with expertise in the transportation sector.

1. **Project Management**: USDOT Research & Innovative Technology Administration
   - ★ Advisory input from NSGIC
2. **Consulting Team**: Koniag Technology Services (KTS) & AppGeo
3. **Executive Steering Committee:** Membership includes:
   - ★ **Steve Lewis,** USDOT, Research and Innovative Technology Administration
   - ★ **Timothy Trainor,** U.S. Census Bureau
   - ★ **Dave Blackstone**, Ohio Department of Transportation
   - ★ **Randall Johnson**, MetroGIS, St Paul Minnesota
   - ★ **Dan Widner**, VA Information Technologies Agency/VA Geographic Information Network
   - ★ **Don Cooke**, Esri
   - ★ **Tom Roff**, USDOT, Federal Highway Administration

**At-Large Steering Committee:** Please see http://www.tftn.org/about/steering-commitee/ for a complete listing of the 37 members of this group.

## 2 Stakeholder Outreach

Throughout the strategic planning process, numerous presentations were given at conferences and direct stakeholder interviews were held in order to solicit as much input and feedback from the stakeholder community as possible. The following list represents some of the key events where the TFTN strategic plan was presented. The complete list can be found on the project website http://www.tftn.org.


### 2010-2011 CONFERENCE & MEETING WORKSHOPS/PRESENTATIONS

- ★ **GIS-T** - April 2010, March 2011

- **National States Geographic Information Council** (NSGIC) **Mid-Year Meeting**: 2010 & 2011
- **NSGIC Annual Meeting**, September, 2010
- **URISA GIS Pro** – October, 2010
- **Esri Federal User Conference** - January, 2010
- **Esri International User Conference** - July, 2010
- **National Geospatial Advisory Council** (NGAC) – September, 2010 and March, 2011
- **National Association of Regional Councils** (NARC) – September, 2010
- **Transportation Research Board Meeting** (TRB) – January, 2011

### STAKEHOLDER INTERVIEWS

- **USDOT**
  - HPMS
  - Safety
  - Asset Management
  - Intelligent Transportation Systems
- American Association of State Highway and Transportation Officials (AASHTO)
- United States Census Bureau
- United States Geological Survey (USGS)
- Federal Commerce Commission (FCC)
- Transportation Research Board (TRB)
- United State Department of Agriculture (USDA)
- United States Forest Service (USFS)
- I-95 Corridor Coalition
- Fairfax County, VA and Loudon County, VA
- National Emergency Numbers Association (NENA)


## 3 Analysis & Report Authoring

- Developed vision iteratively through conference workshops and steering committee reports and presentations
- Vision was vetted and reviewed with stakeholders and steering committees
- Development of a draft outline
- Production of the draft final report
  - Review and comment by Executive Committee
  - Final publication to the web-site