DELDOT RESEARCH SUMMARY
Project: **Planning Data Analytical Support Services #1, FY22-23**
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Overview and Summary of Project Goals

This research conducted numerous efforts to develop information resources that can support traffic and travel demand data collection, management, processing, integration, and presentation.

Research goals include:

- Develop and integrate traffic and travel demand data from many sources to facilitate the understanding and prediction of travel in time.
- Be able to easily relate field traffic measurements to high resolution land use characteristics and travel demand estimates. Reference data in time and location in a way to allow comparative consideration and verification.
- Achieve a best understanding and prediction of the trips people make, accomplished through a development of high-resolution land use and demographics, incorporation of travel demand model output and trip generation, and collection and processing of measures from various sources.
- Get the most out of data we have. Develop greater access and ability to realize value in existing data from many sources.
- Be able to estimate travel where data is sparse and be able to suggest priorities for measurement.
- Development of a dynamic assessment of travel throughout Delaware's transportation network that updates with available data and estimates from several sources.

The project also includes consultation, services, and data development to:

- Offer technical assistance to DelDOT as needed, particularly in the area of demographics and spatial data.
- Provide assistance related to transportation issues and information systems to emergency management agencies as needed
- Produce the yearly Delaware Population Consortium estimates

Summary of Research and Progress
As discussed below, numerous activities were involved toward the above goals.

Travel performance information

- Several data sets were processed and integrated so that directional volumes, speeds, travel times, and other statistics can be referenced and displayed together. Examples and foundational layers for location and integration of transportation data have been produced. Bluetooth, Tubecount/One week counts, and TMC device data was processed into ESRI/ARCGIS time enabled web based map layers. Data resources have been developed and transportation data that is produced regularly is made more accessible. Data can be referenced in time and location in a way to allow comparison and verification. Traffic counts, intersection counts, loop counts, video interpretation, and other technologies tell us a great deal about travel at a high resolution. Tax parcel based land use and demographics translated to modeled or measured trip generation can be referenced on the travel network with volume, speed, and other performance measures. How transportation GIS data is stored and made available and presented was a continual focus. Processing of traffic count data could be facilitated if vendors provided data in other ways, and recommendations were prepared for improved delivery format of traffic counts

Travel Ways and Locational Reference
In the area of the development of resources for travel network analysis work included:

- Update of DelDOT Centerline based routing networks
- Development of access layers to assign high resolution travel demand data to points in the major road network.
- Development of cartographic map layers for directional flow on roads and for turning movements
- Study of the DelDOT TDFM network and assignment of Delaware Linear Referencing System identification on road segments
- Development of a multi-state (PA,MD,NJ,DE) routable network
- Study of the Open Streets Map and relation to other travel networks used in Delaware

Travel Demand Data
The DelDOT travel demand forecasting network and outputs were studied to understand how modeling can be supported with data and to relate modeled outputs to measures. Several data sets were addressed to be used in analysis of trip generation, land use, accessibility, and origin and destination information. Work with travel demand data included:

- Update of parcel based destination files
- Update of parcel based land use categorization time series to year 2022
- Creation of housing unit based door to door transit accessibility for New Castle County
- Location of employment centers
- Compilation and examination of DelDOT Travel Demand Forecasting Model data
- Study of TDFM multimodal trip generation
- Creation of software and hardware to measure trips using video interpretation

Integration

Integration capability is a primary consideration when preparing information from sources. The identification and locational referencing scheme address integration of volume and speed traffic data on travel network . Allocating travel demand trips to points and paths in the travel network allows for integration of traffic data and travel demand data toward the ultimate goal of providing a dynamic complete picture of travel on the roads in time. Activities and analysis was conducted to examine and picture the various data together.

Intersection Counts, TMC Device Volumes, and Travel Demand Trips

Study of Streetlight Data Estimates
Web based data analysis sites could have a very large impact on transportation planning and data development. Estimates can be performance data such as volumes and speeds but also travel demand information since trip estimates going into and out of various land uses can be produced. Streetlight Insight was studied, and research is discussed in one of the project documents.

Delaware Population Consortium
Delaware Population Consortium Projections were updated for 2023

Support of Emergency Management
This project area allows a smaller portion of time to advance resources for emergency management, and as needs arise, offer support to agencies (within DelDOT and DEMA, DTI, DSHS). This year focus has been to support capabilities to estimate impacts from coastal flood events on transportations assets and mobility of populations. This is in coordination with DelDOT Research project “Predictive Flood Risk Assessment of Road Network in Delaware Coastal Communities” and the DelDOT Transportation Resilience & Sustainability group. A comprehensive approach includes an approach to also judge impacts on populations, infrastructure, and services, as well as transportation related impacts. Also, consultation was provided to Sussex County regarding use of HAZUS for Sussex County Hazard Mitigation plan

Support Division of Planning information efforts
As need arises CADSR has provided technical assistance and communications. In the past months this included hosting of housing data for DelDOT multimodal planning, examination of InfoUSA destination and employment data, and assistance to DelDOT consultants in regards to employment data. Outreach includes attendance and presentation with DelDOT TMC Travel Demand Working Group , and TMC Integration of Operations and Planning group.

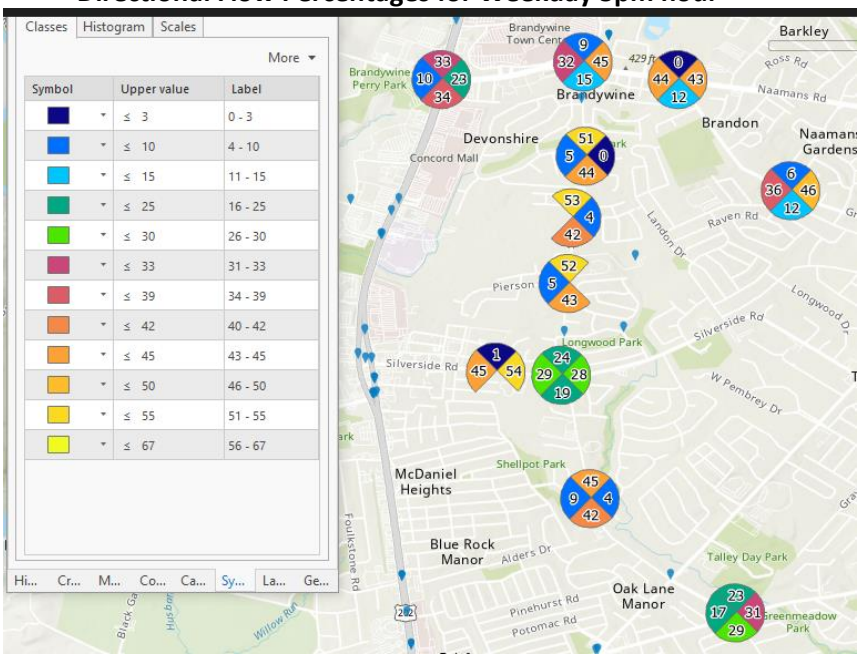
Research and development of internet based collaborative geographic information systems

This research is a good example of where goals depend on large amounts of data and numerous topics. Management and presentation take considerable effort and investments, so research that investigates and demonstrates strategies is valuable. As most all transportation data addressed has a spatial aspect, the focus here is on GIS resources and particularly on ESRI products such as ArcPro, ArcGIS.COM, and ArcHub All data libraries are converted to cloud based resources on ArcGIS.COM. This is proving to be highly effective and researchers can easily share work in complex projects. Users at DelDOT and other state agencies have access to arcgis.com and can share data in that manner. There are also resources to help generate spatial mapping web pages and to collect and preserve research.

Using Data to Estimate Directional Flow by Time of Day

Traffic counts can show measures of the expected direction of traffic by time of day. The figure below shows the percentage direction of traffic in each direction of roads or intersections for 5pm hour. Directional tendencies can also be provided by several data sources, for instance as available from TMC devices, bluetooth, NPMRDS, atrs, and tube counts. Directional flows or vector fields by time of day, by day of week, and by month can be produced. Understanding directional flow by time of day would greatly help in the extension of measures and fully understanding the flow of the system, and research was conducted to determine how that information might be calculated and managed.

Directional Flow Percentages for Weekday 5pm hour



Support of Students

Funding has supported 3 to 5 student interns each year allowing them to gain valuable career experience while playing important roles in various work such as land use analysis, emergency management, transportation planning, big data processing, and presentation of spatial data. Students have been grateful for the opportunity and there are many examples where their involvement has led to other educational and career opportunities.

Project Products

Project products are either various kinds of data sets as listed in “Project Datasets” below, or they are descriptions of study and findings and presentations. The datasets, documents, and presentations are to be ongoing products of the research.

The datasets are products developed from a range of sources. BEFORE DISTRIBUTING ANY OF THESE DATA SETS, SOURCE AGENCIES WILL BE CONTACTED FOR THEIR APPROVAL. Some of the sources, particularly traffic data, are DelDOT, some sources are CADSR or other agencies.

Project papers describing various activities are available for several topics as listed in the following pages. For each project paper, a presentation can be provided. The approach to sharing project results is expected to be focused on the generation of these documents and accompanying presentations. Presentations serve as efficient communication of the research, and provide knowledge sharing and collaboration opportunities, as well as input to determine priorities and focus. The same content can be used to populate web-based resources like this project transportation data hub, that was organized in ESRI’s ArcHUB, where topics are searchable pages/links of content. Documents and presentations of other past and current research that are in progress are also listed.

Summary of Project Datasets

The following data is described in the discussion of activities in the report sections that follow.

Transportation Data Framework GIS Data

- Linear referencing system centerline
- Cartographic directional layers
- Turning movements cartographic layers
- Turn tables
- Junctions
- Access points to the travel network

Location and travel network association of Traffic Data Sets (GIS Files)

- Bluetooth sensors
- TMC devices
- Tubecounts/48 hour counts

Traffic Data Collections

Time enabled, typical hourly summaries by day of week, hour of day, and season

- 2019 thru 2022 TMC Devices
- 2019 thru 2022 Bluetooth
- 2019 thru 2022 Tubecounts
- 2015 thru 2018 vehicle GPS

Transportation Networks

- GTFS DART transit network used for transit trip routing
- DELDOT Travel Demand Forecasting Network with DE LRS
- Open Streets Network with DE LRS

Land Use Data

- Parcel based land use categorization for land use
- Housing Unit Based Accessibility To Destinations
- Housing Unit Based Accessibility to Low Wage Centers by Transit
- Employment cluster locations
- Housing Unit based Accessibility
- Low wage employment centers

Delaware Population Consortium Estimates

Project Documents and Available Presentations

Planning Data Analytical Support Services #1, FY22-23
this document
analytics2223reportv2.docx (sharepoint.com)

Integration of Traffic and Travel Demand Data in Delaware
A description of a data framework for managing and integrating transportation data of many types
https://udspace.udel.edu/handle/19716/33341

Proposed Change in Delivery Format for Traffic Counts
Data formats that enable easier incorporation into databases
https://udspace.udel.edu/handle/19716/33337

Processing of Delaware Bluetooth Data
Describes processing and products from raw Bluetooth measures
https://udspace.udel.edu/handle/19716/33339

Examination of Streetlight Data
First view of Streetlight estimates and comparison to measures
https://udspace.udel.edu/handle/19716/33340

Estimating Accessibility for Transit
Discusses development of door to door transit accessibility estimation
https://udspace.udel.edu/handle/19716/33342

STROAD Presentation
An examination of crash data as it related to “stroads” , a presentation for Bike Delaware
https://udspace.udel.edu/handle/19716/33343

Documents and Presentations in Progress

Below are documents and presentations in progress about project topics that were researched and developed. Data and documents lists will be updated regularly as additional papers are made available.

Producing and Using Time Enabled Traffic Data
A discussion of preparation steps for time enabled traffic and travel demand data

20 year Tax Parcel Time Series for Allocating County Based Housing Unit Projections
The development of tax parcel time series and categorization of land use development potential

Video Interpretation To Estimate Trip Generation
Discussion of software, hardware, and data goals

Comparison of Origin-Destination Data for Delaware
Sources of origin-destination information will be discussed and presented including Travel Demand Forecasting Model outputs, Bluetooth, Streetlight, and other sources

Estimating Directional Traffic Flow by Time of Day
Describes the use of several data sets to estimate directional bias by time of day

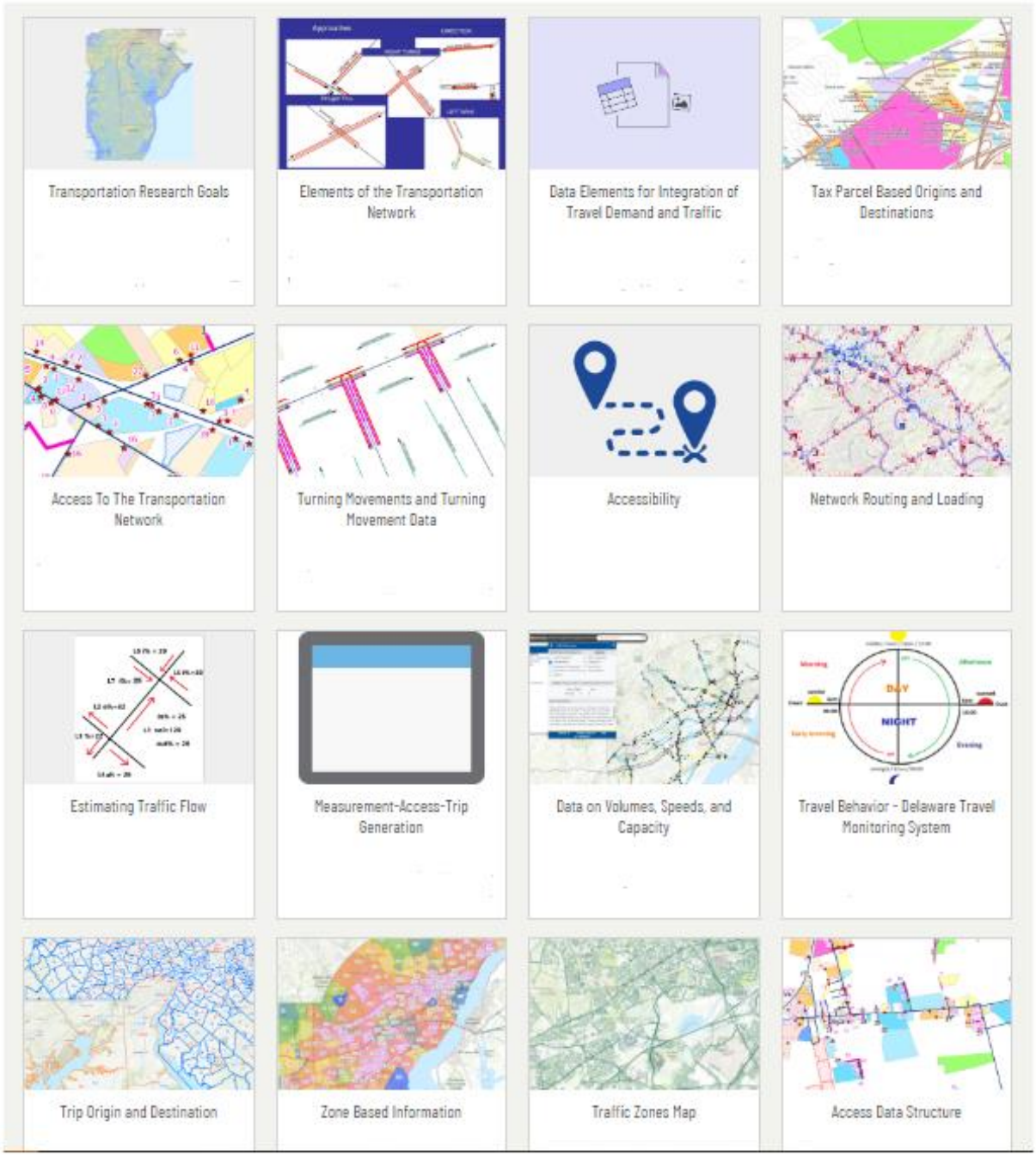
Comparison of Transportation Networks
Discussion of DelDOT, CADSR network, Travel Demand Forecast Modeling Network, Open Streets, and GTFS Transit network

Estimating Directional Traffic Flow by Time of Day
Describes the use of several data sets to estimate directional bias by time of day

Using ESRI Products (ARCPRO, ArcGIS.COM, ArcHub) for Transportation Research
Discussion of data management, presentation and workflow for traffic and travel demand information

Screenshot of Portions of CADSR Transportation Research Web Site

Topcics are organized as pages, and below is an example of a subset of topics available. The strategy for sharing research is based on topic papers, presentations, and this web site. The site is created using ArcHUB which has a number of features that can support geographic information system data.



Next Work

Below are current suggestions for next year's research, which can be discussed and modified. We look forward to discussing a plan.

Continued Processing and Integration of traffic and travel demand data
Processing and integration of TMC Loop devices, tube counts, intersection counts, bluetooth, and other traffic data sources will continue, and efforts will be made to share that information, and to apply it in applications to examine the performance of the transportation system.

Continued Preparation of High Resolution Land Use Products for use in Travel Demand
As in past research high resolution land use products will be developed and maintained for the study of travel demand. This includes:

- Tax parcel based destinations
- Tax parcel based land use
- Tax parcel based time series focused on showing development patterns over time and for prediction of the location of future development.
- Estimates of accessibility to destinations at the housing unit level for pedestrian and transit travel
- Concentrations of destinations and employment

Trip Generation and Travel Demand
DelDOT Travel Demand Forecasting Model (TDFM) outputs and trip generation models have been compiled and studied. This data will be compared with high resolution land use data and any available measures of trip generation to support model development and trip generation estimates. Research will include:

- Relate traffic data measures and estimates to trip generation
- ongoing study of outputs from the DelDOT TDFM
- Pursue measures of trip generation,in particular, use video interpretation for vehicle and person traffic, which will be advanced in other DelDOT sponsored research by CADSR
- Methods of using traffic measures to infer demand

Data Sharing and Presentation of Research
Previous work processed and created numerous data sets and examined many transportation related topics. The sharing and exchange of research data and findings will be a larger focus in next work. At this stage, future work needs to include presentation of the research and sharing of the data to familiarize DelDOT staff and their consultants with resources and approaches that may assist in DelDOT work and applications. The Summary of Project Data as shown in the previous pages can develop into a maintained resource based on interests of the planning and research community. As shown previously with Project Documents and Available Presentations, papers and presentations will be created and refined, and presentations will be offered to transportation professionals and researchers. Content from papers and presentations will also be added to cloud-based GIS (ARCGIS/ArcHUB) web sites as another way of making the information available.

Assistance as Needed with Division of Planning
The coming years plans for assistance to the Division of Planning will be discussed.

Big Data Web Platforms for Transportation Analysis
Web based data analysis sites could have a very large impact on transportation planning. If such resources can produce somewhat accurate and/or consistent results, there will be many applications. These systems are extraordinary in the ability to estimate flows, turning movements, and origin/destination in various time extents. The capability provided allows analysts to quickly analyze and show performance data at a road segment and access point level. A big question is "How 'correct'or reliable are the estimates when compared to what else we know?" This research has compiled and integrated an array of traffic and travel demand data which can now be used to examine estimates, as was piloted with the Streetlight data in the past year.

Study of Origin and Destination Estimates and Traffic Direction by Time of Day
A focus of transportation efforts can be around getting people and goods to where they want to go, safely and efficiently. Examining data on origins and destination pairs can provide information. In past research, zone to zone trip tables from the DelDOT TDFM were studied. Origin-destination information was also derived from the Bluetooth sensor network in Delaware. Other OD sources will be examined. Big data sites like Streetlight provide a very large amount of information of origin to destination flows for car and freight trips. Origin-Destination information along with various traffic counts can provide directional traffic flow tendencies by time of day and research will continue to specify travel with respect to direction.

Routing and Locational Systems for Transportation Data
In this area, planned work includes:

- Update of the locational framework of roads and other paths, junctions, access points, and cartographic layers for the display of performance data.
- The location of transportation data is built on linear referencing (route-milepoint). Therefore, standard values for milepoints on roads are needed. Milepoints to 3 decimal places are available in recent DelDOT publications, and centerlines, routing networks, and databases will be updated.
- Pedestrian, bicycle, and transit paths will continue to be updated.
- Progress will be made in allowing data to be related between other networks in use including the travel demand model network and Open Streets.

Conclusion

Progress has been made in many areas for the stated goals. Several data products have been created toward integration and presentation of traffic and land use data, and to support a detailed approach to estimating and understanding travel demand. Further discussion of topics is available in the project documents. Work will continue in the next year with a particular focus on sharing results.