GIS and Traffic Analyses
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With the current congestion problems the United States is facing, the role of traffic and transportation engineers is becoming more crucial. In order to achieve the safe and efficient movement of people and goods, engineers have to account for many factors outside of their realm of study in order to do the best job that they can. The profession of transportation engineering is the application of technology and scientific principles to the planning, functional design, operation, and management of facilities for any mode of transportation in order to provide for the safe, rapid, comfortable, convenient, economical, and environmentally compatible movement of people and goods (Roess, Prassas and McShane, 2004). As technology increases the way that all professions operate, it comes as no surprise that the role of GIS has been integrated in all aspects of transportation engineering.

The most common approach to transportation planning and travel demand is understand the data needs, determine how many new trips will be generated, how they will get distributed, what mode of travel will people use, and what routes are going to be used. Traffic engineers have to conduct a traffic impact analysis, site analysis, and safety analysis in order to get a clear understanding of how a new development would influence a transportation network.

The Department for Transport (DfT) in the UK used the GIS consultant company GeoSolveIT to help them analyze and display their traffic counts on the web. The introduction of the website has been designed to enable the retrieval of traffic data, achieved in one of two ways – a search tool, or via the use of a map-based solution that enables the traffic survey sites to be geographically visualized (Robbins, 2008). With the help of GIS, 12 hour vehicle counts performed on over 18,000 major roads can be categorized by vehicle type and analyzed by everyday citizen.

The Site Impact Traffic Evaluation Handbook commonly used by professionals is and older spreadsheet-based technology used to determine the impacts on a network and surrounding traffic that a proposed development would have. New technologies like GIS-T, GIS for Transportation, allows for a more efficient and understandable end-product. Essentially GIS-T applies the same methods of GIS but focuses all of the data gathering, displaying, and analysis for transportation functions. The most widely used GIS-T software is TransCAD. TransCAD is GIS designed specifically for use by transportation professionals to store, display, manage, and analyze transportation data. TransCAD combines GIS and transportation modeling capabilities in a single integrated platform, providing capabilities that are unmatched by any other package (www.caliper.com).

State department of transportation (DOT’s) were probably the greatest beneficiaries of GIS-T. Stokes and Marucci (1995) site three reasons how state DOT’s have been the first to recognize the need to implement GIS: 1)DOT’s have a tradition of map making and geographic data management, 2) many other agencies need transportation data, and 3) DOT’s always have worked closely with local governments in transportation planning, engineering, aerial photography acquisition and large-scale mapping. In addition DOTs are such large landowners
and geographic data collection is so important to any DOT’s primary mission, these agencies typically assume the responsibility of GIS implementation (Stokes and Marucci, 1995).

One of the most exhaustive parts of a traffic analysis is gathering and displaying the accident data over a given period of time. It begins with requesting the data of the intersection(s), usually the last three years from the local police department. Once the data is made available either by CD or by hardcopy, the engineer then has to sift through each accident report along with their adjoining narrative to decide if the information is indeed relevant to the scope of the analysis. Many states use the statistical engine CARE (Critical Analysis and Reporting Environment) and align it with the mapping capabilities of ArcGIS. By moving towards GIS traffic engineers now have the ability to visually compare two roadways, provide context to the data, perform spatial queries and evaluate a surrounding area. Taking crash locations and turning them into rater data produces a grid of data that is based on the surrounding area rather than a specific location or a single rout. Evaluating crash frequency within each raster can indentify HotArea (high crash locations)(Smitb et al, 2007).

In Arlington, VA, their DOT used the Accident Information Management System (AIMS) to organized their accident data. The software was customized to meet the needs of the DOT. Engineers could input accident data the same they that the police department does with improved presenatation and analysis. AIMS Arlington is an effective tool in managing accident data and performing task such as accident analysis and safety studies. Using GIS-based technology is especially helpful while conducting corridor analysis, pedestrian safety studies and accident analysis (Thommana, 2006).

New sections of transportation engineering such as Intelligent Transportaiton Systems (ITS) certainly has a partner in GIS. As the adoption of ITS grows, the need for GIS-based technologies will mirror the growth (Robbins, 2008). Transit agencies that employ automatic vehicle location systems (AVL) on bus fleets need GIS to help track buses in real-time. The joining of GIS and internet applications means that information is more readily available and communicated to many users. When asked what role can GIS play in addressing the challegnes faced by transportation professionals, Terry Bills answered, “GIS is a vital tool that transportation professionals around the world use to make better informed decisions and offer valuable insight for numerous tasks, such as network planning and analysis, vehicle tracking and route-planning analysis. However, in addition to such benefits, GIS allows transportation professionals to effectively communicate both problems and solutions to other parties by linking complex data to visual representations for much simpler interpretation. With the endless list of challenges faced by transportation professionals in this day and age, technologies such as GIS provide the necessary means to handle these challenges in an effective and easy manner.” In the future GIS will countiue to play a lager role in transportation’s management and efficieny.

Cited Works
www.caliper.com
Annotated Bibliography

The paper explains what steps are involved in the urban transportation planning process (UTPP) and how GIS could benefit it. UTPP involves four activities of gathering inventories, analyzing existing conditions and model calibration, forecasting, and system analysis. Before the process can begin, the Transportation Analysis Zone first has to be delineated. The TAZ is the boundary of the study area where the transportation network within is defined. The very spatial nature of GIS helped planners with the difficult task of creating regional transportation networks that consisted of iterative calculations and large data collection efforts. At the time the paper was written, the primary use for GIS in transportation analysis with focused on inventory of accident and pavement management. GIS is key to TAZ’s because many transportation systems have linear structures like roads and paths which are appropriate for vector based data structures. Raster-based GIS was also important because of the need to analyze and design multiple polygon overlays. Ideally is GIS with raster-to-vector conversion capabilities would’ve been used. This paper gives the reader great insight into the potential the GIS had on expanding the transportation field.


At the time this paper was written GIS was still not integrated into many of the countries' state and local transportation agencies. The Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991 was legislation that put emphasis on intermodalism, intelligent transportation systems (ITS), and transit usage. The overall nature of GIS provided state DOT’s the ability to conduct spatial analyses related to transportation. It’s noted that state DOT’s have taken the lead in recognizing the innovation of GIS from the very start. The author cites the tradition of map making and geographic data management, and because DOT’s have always worked closely with aerial photography and large-scale mapping. The Federal Highway Administration’s (FHWA) Office of Policy Development first used GIS for highway policy analysis. It then began creating a national database of highway miles for functional classification, route numbers, access control types, etc. in the mid 1980’s. Various states like North Carolina, Pennsylvania, Ohio, and Wisconsin DOT’s have been at the forefront of GIS development. The obstacles facing many departments are the high costs of collecting new data and/or converting existing data, frequent changes in the software, and most GIS packages lack the functionality required to perform network analysis and travel demand modeling. The paper does acknowledge a very bright future for GIS and transportation. The FHWA sponsored a study for the creation of a system architecture, GIS-T packages that have integrated travel demand modeling with topological representations e.g. underpasses and overpasses.


Traffic impact studies are necessary for planners and engineers because they determine the possible impact that a new development will have on the surrounding road network. The Site Impact Traffic Evaluation (SITE) Handbook commonly used by professionals is and older spreadsheet-based technology that cannot keep up with the ever changing demands that is caused by time and geography. The authors identify the benefits of using GIS-T methods as computer based systems for gathering, displaying, and analyzing transportation information in map form. This allows the end user to view the
geographic areas potentially affected by the new site. TransCAD 3.0, a GIS-T system, was used to analyze the impacts of a proposed middle school, residential development, and a new urban mall in Rock Hill, NC. TransCAD uses the incremental approach to traffic analysis recommended by the Institute of Traffic Engineers (ITE). The incremental approach estimate yearly trip changes and distribution. GIS-T also allows backward modeling where the effects of a store closure can be analyzed as well.


This paper gives an account of Arlington, Virginia's use of GIS based software to assist their Division of Transportation (DOT) in performing accident analysis and safety studies. Arlington's DOT wanted to be able to organize, analyze, automate, and quickly analyze traffic data. The system that they decided to use was Accident Information Management Systems (AIMS), which is GIS based software that allows user the ability to display and generate accident reports. The first task that AIMS needed to accomplish before being implemented was customizing parameters to function with the needs of the Arlington's DOT. Once in use the system allows users to do the following: define intersection/non-intersection accidents, define multi-leg intersections, use a data entry screen similar to the screens used by Virginia, and customize angle accident type definition. Though AIMS has greatly improved the DOT's accident data software, it does not come without some limitations. Data entry input provided by the police department is a manual process which results in approximately 20 per month of data entry time. Staff also has to be trained to use the software effectively. A future plan for AIMS is to use the AcrView version which will allow overlaying the accident data with other layers.


The authors' aim was to use GIS in aiding in the decision making process of traffic safety in the state of Alabama. For transportation engineers, federal policy makers, and traffic safety professionals, the need to easily access statistical data in a way that makes sense to them is of the utmost importance. Alabama's DOT utilizes CARE (Critical Analysis and Reporting Environment) as a statistical Engine with filtering capabilities; it can analyze subsets of records like crashes involving motorcycles between 3-4pm on Tuesdays. The CARE software have been used in several states including Rhode Island because of it ease of use and storage requirements. The drawbacks of the software are the inability to visually compare multiple roadways and the lack of context by viewing the roadway in question on a map. Once integrated with GIS care now has the ability to show locations where crashes exceed user defined values, perform spatial queries by using the buffering capabilities in GIS. The authors believe that the future of CARE and GIS will include GPS to locate and map crash sites rather than the current use of mile posts and it will be expanded to work node-segment (intersection) data. Overall the integration of CARE with GIS has increased safety analyses, reduced that it takes renders data in a visually appealing manner.


The author of the paper explores some of the ways that transportation agencies, planners, and engineers can fully use GIS for their benefit. Understanding the strong linkage between transportation and geography, GIS technology is able to record into a database giving professionals the ability to analyze a number of possible scenarios, and provide dynamic tool for management and planning. Robbins sites the support for the geographic analysis of strategic travel-demand models, highway network forecasting, and results analysis, as some of the many ways that high-level GIS could be used
specifically for traffic analysis. A company by the name of GeoSolveIT has used the United Kingdom's traffic count data and now provides an online GIS application for the retrieval of traffic data.