Safety Service Patrol Route Optimization
(Technical Paper)

Transportation Systems a Political Artifact: How Infrastructure Can Improve Circumstances Unique to Native American Reservations

(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Introduction

With over three hundred billion dollars budgeted each year for transportation improvements and investments, the government must allocate funds to maximize its impact on constituents ("Government Transportation Revenues And Expenditures | Bureau of Transportation Statistics," 2018). For the Virginia Department of Transportation, that means managing a fleet of over 150 safety patrol vehicles responsible for clearing accidents and helping disabled vehicles ("Safety Service Patrol—Travel | Virginia Department of Transportation," n.d.). Armed with the tools and personnel to make an impact and keep Virginia moving, the agency seeks to minimize their response time to the incident scene and clear the roadway as quickly as possible. These time management goals require the creation of an optimal route schedule for the patrol vehicles to ensure all areas of the interstate are appropriately covered while minimizing the time to respond to the incident. The final technical deliverable, an optimal route schedule, will make efficient use of budgetary constraints faced by the state of Virginia while holding true to their core values of safety and efficiency.

On a different note of transportation spending, infrastructure investments can combat a variety of socioeconomic struggles in the United States. In comparison to other segments of the population, Native American reservations face greater economic stressors and public health scares like alarmingly high poverty and obesity rates ("Demographics | NCAI," n.d.). The benefits of transportation infrastructure spending have the ability to curb the effects of those unique struggles (McAndrews, Pollack, Berrigan, Dannenberg, & Christopher, 2017). With a troubled past relationship between the American government and tribal authorities, investments in transportation infrastructure present an opportunity to release some of the institutional power held within the transportation budget and improve the health and economy for those living on

reservations. An infrastructure investment would help repair this broken relationship by supporting tribal cultures in a healthy, sovereign manner.

Technical

The Virginia Department of Transportation manages all aspects of transport throughout the state, from roadways to bridges, maintenance to new development. The department receives government funding and works with other agencies to maintain safety across the state. Several decades ago, VDOT funded Safety Service Patrol Vehicles to assist in traffic control and general safety assistance. The purpose of the SSP program is "to promote the efficient and effective flow of traffic through effective incident detection, verification, and notification to appropriate agencies to initiate rapid clearance of an incident," (Edara & Dougald, 2006). Today, the VDOT SSP program is comprised of five operating regions, with a fleet of 168 vehicles covering approximately 846 miles of major interstates, including I-95, I-64, I-81, and I-66 ("Safety Service Patrol—Travel | Virginia Department of Transportation," n.d.). A patrol is tasked with servicing a designated range of roadway for the duration of the 8-hour shift period and will receive and respond to reported incidents via the traffic operations center. With accidents across the state and rapid emergency responses, the SSP vehicle program faces inefficiencies and constraints in their route selection and scheduling process. The capstone team will analyze current trends and draft a preemptive schedule to ensure VDOT makes the greatest impact.

With their core function to assist traffic control and help drivers navigate the scene safely, VDOT measures the performance of their program using a variety of metrics describing their actions on scene. Given Response Time to the scene is in control of VDOT personnel, the team will use this metric to measure performance of the routes. Additionally, one of the core goals of the SSP program is to help minimize incident duration through traffic management

(Truitt, 2019). In cases of more severe incidents, VDOT personnel largely serve to assist emergency responders and state police with traffic management (McCann, 2019). Roadway Clearance Time is not purely a reflection of SSP performance in these situations and thus will not be prioritized as heavily as Response Time. The team will use these metrics to help create an optimal schedule wherein response time to a scene and roadway clearance is minimized while the number of incidents covered is maximized (Porter, 2019). This new schedule will help VDOT use their resources efficiently while keeping Virginia moving.

The team will approach the route optimization in two phases of analysis. In the first phase, the team will evaluate the current SSP routes based on Response Time and Roadway Clearance Time. The analysis will include an investigation on where the accidents are primarily occurring and their detection sources. The comparative analysis of current and previous routes will help foster new insights surrounding route optimization. In the second phase of analysis, the team will work towards an SSP schedule with one driver on each route. This new schedule will identify areas of greater SSP demand by accounting for gaps in current routes and indicating areas of high response time and high volume of incidents. The recommended schedule will break interstate 95 into patrol routes and arrange shift times that minimize median Response Time of an SSP to an incident. Patrol routes will be described by mile markers, and time of operation will specify the hours of the day in which one SSP vehicle will be on patrol. This final deliverable will help VDOT effectively manage their fleet of vehicles and driver resources.

STS Topic

Home to some of the richest cultures and diverse communities, Native American Reservations face a variety of distinctive challenges. These struggles have a profound effect on

the individuals living on reservations, as well as their families and friends. The socioeconomic circumstances go beyond class differences describing economic barriers and public health inequalities of American Indians. Faced with historic displacement and lack of government support, the poverty rate and unemployment rate reflect the instability of the tribal economy. Native Americans have the highest poverty rate of all United States minorities, with a rate as high as 75% on the Cheyenne River Reservation (Asante-Muhammad & Initiative, 2017; Rotundaro, 2015). These geographic regions also boast a 14.6% unemployment rate, almost double that of the white population (Austin, 2013). Unemployment and resulting economic turmoil foster a foundation for depression and mental health disorders, perhaps a reason the suicide rate on reservations substantially surpasses the rate outside of reservations ("Demographics | NCAI," n.d.; Linn, Sandifer, & Stein, 1985). On a similar note of public health, Native Americans face challenges related to their health and safety that do not phase other demographics. Specifically, their diabetes rate is 189% higher and vehicle crash rate is 229% higher ("Demographics | NCAI," n.d.). These statistics threaten the lifestyle of American Indians and pose safety concerns unique to this minority. One possible cause of these socioeconomic inequalities is the transportation infrastructure investment gap on Native American Reservations vs. non-tribal geographies (Wiedman, 2012). Although several solutions may exist for these unique struggles, the government can curb some of the detrimental effects on Native American Reservations by investing in more transportation infrastructure.

With substantial evidence of challenges unique to Indian Country and its lack of transportation funding, fewer researchers have investigated the connection between the tribal economies and public health and the investment in transportation systems. However, there is substantial research on the benefits of such infrastructure in rural communities. I will use these

scholars' analysis of the public health and economic difficulties experienced in rural areas to offer a sustainable solution to the socioeconomic inequalities experienced on Native American Reservations.

Given the troublesome past relationship between the American Government and Native American Tribes, the transportation system investments offer a way for the government to mend previously broken bonds. The lack of trust of American Indians with the government stems from centuries of oppression and displacement, like the Indian Removal Act, the Dawes Act, and the Trail of Tears (Poupart, 2003). This difficult past does not relinquish the government's responsibility to protect and provide for Native American Reservations while recognizing their sovereignty (U.S. Commission on Civil Rights, 2018). As a national transportation system has expanded with highways and railroads reaching all corners of the continental United States, the American government has used transportation technology as a Political Artifact (Winner, 1980). The American Department of Transportation uses infrastructure to establish patterns of authority over Native American reservations to remind tribal leaders of their inferiority, reinforcing socioeconomic boundaries on tribal economies and public health. Although critics argue the political artifact theory based on the Moses Bridge is counterfactual by nature, there is a plethora evidence to support a history of dominance toward and inequalities on reservations that does not suggest coincidence (Joerges, 1999). An analysis of transportation technology in Winner's lens of political authority will lead to new insights on the role of infrastructure in closing the socioeconomic gap while proposing a way for the government to support American Indian communities in a sustainable, sovereign manner.

Methodologies

Research Question: How can transportation infrastructure improve the economy and public health on Native American Reservations?

To answer my research question, I will use the Wicked Problem Framing and Historical Case study methodologies. Beginning with background, I will give the context of socioeconomic patterns on Native American Reservations and the lack of transportation infrastructure investments in those same geographic regions. Seager's Wicked Problem Framing technique gathers evidence to reveal otherwise hidden relationships between actions and consequences (Seager, Selinger, & Wiek, 2012). After the debrief of the unique circumstances in Indian Country, I will reveal connections between the infrastructure investment gap and socioeconomic inequalities. The Wicked Problem Framing technique will connect struggles of rural communities to specific problems faced on reservations with regards to public health and economic growth. Academics have studied active commuting patterns, vehicle crash causes, economic opportunity and job creation tactics in rural areas that revolve around a developed transportation system (Eff & Livingston, 2007; Fan, Wen, & Wan, 2017; Gallagher & Albert, 2019; *Rural Connections: Challenges and Opportunities in America's Heartland*, 2019; Shoup & Of, n.d.). I will establish the connection of increased transportation infrastructure investment and an improvement in the public health and economy on American Indian Reservations. The Wicked Problem framing lens will set up an analysis of the relationship between reservations and the U.S. government establishing institutionalized power.

The historical case studies will frame the government's treatment of Native Americans since their relations began. I will use Winner's argument of transportation infrastructure as a political artifact using case studies of prior legislation to describe Native American relations with the government. With a combination of primary sources and secondary sources, I will analyze

the diction of the Indian Removal Act and the Dawes Act while reading accounts of the Trail of Tears (Jackson, 1830; "Our Documents—Dawes Act (1887)," n.d.). These case studies will describe the pattern of the U.S. government exercising authority over American Indians, limiting their social growth and not recognizing their sovereignty. Finally, I will connect this to government budgets not investing in tribal transportation infrastructure as a method of continued oppression of Native Americans.

Conclusion

This paper covers an investigation of VDOT's Safety Service Patrol System routes as well as the socioeconomic effects of underdeveloped transportation systems on Native American Reservations. The team will create a schedule for SSPs that minimizes the response time and roadway clearance times, helping VDOT reach its safety goals. We expect to schedule more coverage in metropolitan areas like Richmond and Northern Virginia while also scheduling shorter patrol routes to assist in the higher volume incident regions. These results will help VDOT efficiently allocate their spending on this safety initiative and keep Virginia moving.

On a similar note of transportation funding, this paper explores the socioeconomic effects of an underdeveloped transportation system, specifically exploring an increase in infrastructure investment leading to an improvement in the economy and public health on Native American Reservations. As a minority, American Indians face higher poverty rates, diabetes rates, and vehicle crash rates, reflecting a severe gap in opportunity compared to the rest of the population. These inequalities ultimately connect to a lack of tribal infrastructure, promoting greater investments in transportation systems on Native American Reservations. These investments will improve economic and health conditions while also mending the broken relationship with tribal governments. This research will identify ways the government can support American Indian

economies and public health in a non-invasive manner, ensuring their safety, protection and sovereignty.

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