

**OPTIMIZATION OF VDOT SAFETY SERVICE PATROLS TO IMPROVE VDOT
RESPONSE TO INCIDENTS**

**THE ROLE OF THE AMERICAN INTERSTATE SYSTEM IN REINFORCING
RESIDENTIAL SEGREGATION IN URBAN AREAS**

An Undergraduate Thesis Portfolio
Presented to the Faculty of the
School of Engineering and Applied Science
In Partial Fulfillment of the Requirements for the Degree
Bachelor of Science in Systems Engineering

By

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SOCIOTECHNICAL SYNTHESIS

The American Interstate System is overcrowded and desperate for restoration. Years of neglect and poor design choices have manifested in the form of extreme congestion which creates losses in time, productivity, and money for millions of Americans each year. To mitigate the impacts of congestion, many state and local governments are seeking creative solutions to assist the drivers across their region. The Virginia Department of Transportation (VDOT) sponsors a fleet of Safety Service Patrol vehicles to monitor highway conditions and assist emergency responders in scene clearance and traffic management. The technical research proposes a route scheduling algorithm that assigns patrol routes with the goal of maximizing the program's impact on reducing congestion. As state governments are making more choices about improving conditions on highways, it is important to understand the historical background in which the original design choices were made. The loosely coupled STS research analyzes the cultural and systematic factors that allowed the design of the Interstate System to prioritize social and political goals over transportation efficiency.

The Virginia Department of Transportation aims to ensure that their current patrol schedules optimize their limited resources while also maximizing their impact on congestion reduction. Current patrol routes are county based and do not employ the use of any optimization or analytical algorithm, leading to potential inefficiencies in time and resources. With these goals in mind, the technical team of Bunny Campbell, Emma Chamberlayne, Julie Gawrylowicz, Colin Hood, Allison Hudak, Matthew Orlowsky, and Emilio Rivero advised by Professor Michael Porter of the Department of Systems Engineering developed an optimization system to distribute the covered mileage on I-95 into routes that minimize the time vehicles are stranded in need of assistance. The transportation agency has accrued vast amounts of incident and traffic data that

make a more analytical selection of route schedules within reach. Using complex algorithms, optimization of their current route schedules could lead to faster response times, thus increasing safety and reducing costs. The team cleaned and analyzed the available data to develop an evaluation metric, then created statistical models to predict incident rates and patrol vehicle response times to input into the optimization algorithm.

Using the optimization system that fuses information from various VDOT information sources, the team created an optimized route schedule. The new schedule suggests that adjustments to mile coverage and route length can increase performance by approximately 13%, saving approximately 442,000 minutes of driver waiting time each year. Additionally, the team recommends shifting coverage to focus on the regions of I-95 surrounding Richmond and Northern Virginia and decreasing the average route length during the week. Overall, these results recommend further consideration of maintaining separate weekend and weekday route schedules due to high traffic volume as well as decreasing the average route length throughout the week.

The passage of the Federal-Aid Highway Act of 1956 marked the beginning of a period of incredible change for the United States as the federal government embarked on a journey to construct the largest public works project ever attempted, the American Interstate System. The construction of the system, however, disproportionately impacted low-income, minority communities. These discriminatory design choices led to an increase in residential segregation and concentrated poverty in many American cities. The drastic impacts of the prejudiced design of the Interstate System cause many to question the lack of government intervention on behalf of the impacted communities. In the late twentieth century, the federal government formed new initiatives to protect against further damage to marginalized citizens, however recent developments in infrastructure revitalization threaten these protections. In order to prevent

further reinforcement of discriminatory barriers like the highways, the STS research answers the following question: what tools did highway engineers wield in order to arrange the Interstate System as a means to reinforce residential segregation?

The technocratic idea of progress and the relationship between urban renewal and highway construction provided local officials and highway engineers with sufficient resources to systematically reinforce residential segregation in American cities with the construction of the Interstate System. Across the country, years of discriminatory housing policies and racial oppression prohibited marginalized communities from voicing their concerns about new construction projects or deliberately excluded these groups from the decision making process. The adversary culture of the 1960s led to several policy initiatives that serve to protect against this trend being repeated. However, without continued protections specifically designed to defend minority communities from destruction due to new infrastructure, our government stands to further the wrongs that were committed during the initial construction of the Interstate System.

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PROSPECTUS

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