

Undergraduate Thesis Prospectus

Soil and Water Contamination from Dry-cleaning: Evaluation of Remediation Techniques.

(technical research project in Civil Engineering)

How Social Ideologies Hinder the Development of Passenger Rail in the U.S.

(sociotechnical research project)

by

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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.

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General Research Problem

How may complex systems contribute to a more sustainable society?

Developing a sustainable society is key to the survival of humanity. Without intervention, climate change caused by greenhouse gas emissions is expected to claim 83 million lives by 2100 (Bressler, 2021). A sustainable society would not only reduce pollution, but would improve quality of life, protect ecosystems, and preserve natural resources for future generations. The United Nations lays out 17 sustainable development goals meant to transform our world if societies are built around them. Societal transformation through small, isolated actions is slow, which is where systematic change can help. Complex systems are difficult to model due to their many intricacies and dependencies. They are inherently interdisciplinary in nature, with technical, financial, policy, and social components affecting each other. Many US systems are structured this way, meaning small changes have widespread and non-obvious impact. These systems can serve as tools to create large impact with only small intervention.

Public transportation is a promising method to shift away from fossil fuels (Hodges, 2010) and is quite complex. It involves more than moving people from A to B. Passenger rail, specifically, involves making legal arrangements to use freight railroads as passenger rails, debating whether government or private entities should manage operations, determining funding sources, designing intricate travel networks, understanding how those networks affect interconnectedness of society, and much more. The extension of a passenger rail system creates a sustainable society not only by reducing fossil fuels, but by affecting commercial/consumer relationships, influencing policies, shifting mindsets, and creating more accessible communities. It does this without drastic changes and instead relies on the interdependencies of the complex system to do the work. Similarly, the remediation of a superfund site, a land area polluted by

hazardous waste and placed on the national priorities list, does more than improve the health of a single community. Superfund sites are designated by the US Government but remedied by an environmental consulting firm. The party responsible for contamination is sometimes involved. The collaboration between parties creates an interdependency similar to passenger rail. An element of contaminated systems that makes them complex is time. The idea that an environmentally harmful action of the past is being remedied in the present and is monitored for years after makes a statement on how a sustainable society should act.

Soil and Water Contamination from Dry-cleaning: Evaluation of Remediation Techniques.

How can remediation techniques be used to clean contaminated soil and groundwater from dry-cleaning sites and what are the associated risks?

The cleaning of hazardous soil and groundwater, called remediation, is crucial to restoring the environment, protecting humans and wildlife, and preventing disaster in the future (IAEA, 2014). An undergraduate team of 6 individuals is investigating remediation techniques for contaminated groundwater and soil in Ypsilanti, Michigan caused by chemical seepage from a dry-cleaning business. This research is carried out as a capstone project with Dr. Teresa Culver as the advisor (Department of Civil and Environmental Engineering) and GeoSyntec as the partner company. Site investigation data is provided, but we will use GIS software to model the system. After modeling, the undergraduate team will select appropriate remediation techniques by first conducting research on available technologies. Then, methods that reduce contaminant levels in both the short and long term most effectively are chosen. There are no unusual constraints, but the state's maximum contaminant levels must be observed. There is no budget, but lower cost should be prioritized between two techniques of equal efficiency.

How Social Ideologies Hinder the Development of Passenger Rail in the U.S.

How do competing ideologies of social groups hinder implementation of passenger rail?

Commuting by rail is more environmentally friendly than car (Miller, 2021) or air transit (Chaudhury, 2003), saves time, and is safer than driving. Yet, compared to many other countries, the U.S. lacks an extensive passenger rail system (Pouryousef et al., 2013). Competing social ideologies are among reasons for the hinderance of passenger rail development.

One of the largest obstacles for rail is the car-centric mindset of Americans. Rail struggles to attract car passengers partially because cars are a display of status and are ingrained in the “American Dream”. This term was first coined in the 1931 book, “Epic of America” which presented ideals of success, upward mobility, and liberty. Many car manufacturers appeal to these ideas by marketing their vehicles as modes of freedom and tools for adventure. The introductory message for the Mustang on Ford’s webpage is “running free” (Ford Motor Company, 2023). It’s an appeal not only to their mascot, but to the American dream’s promise for liberty. Car ownership, like homeownership, symbolizes American success and is a ladder through social classes. Even early on, prominent families like the Rockefellers publicly paraded their cars to signal wealth. While Henry Ford increased the accessibility of cars with the revolution of mass production, not owning a car is still seen as a disgrace. The perception is that non-car owners are poor or physically or legally incapable of driving. This creates the belief that rail is for the underserved and therefore promotes crime. In a public hearing held after an Atlanta suburb voted to join the city’s public transit network, a woman spoke her disdain saying that she sees “unsavory people” arriving to the subdivision through public transit (O’Brien, 2014).

Another prevalent ideology inhibiting rail is the prioritization of financial gain. This leads to the subconscious idea that money spent on public goods is money wasted. Particularly, people

are against their tax dollars funding new railroads. As the CEO of the Mississippi Center for Public Policy says in his argument against rail development, “taxpayers shouldn’t have to pay for passenger rail they aren’t using.” He doesn’t believe there is enough ridership to warrant public funds and challenges that a private company would have taken this opportunity “if profit really can be generated through such a service” (Pritchett, 2019). The belief that rail systems are feasible only if profitable and that only users should pay ignores the definition of transportation infrastructure as a public good - a commodity that is provided without profit to all members of society. Despite resistance to using tax money and the federal budget for rail, highways are largely funded through these means (FHWA, 2014) with little backlash. It is difficult to draw attention to this hypocrisy due to the longstanding notion that roads are user paid (i.e. from tolls, gas taxes, license plate fees), a conception fueled largely by the Federal Highway Administration’s funding of the early 20th century (Kent, 1982). Amtrak, the National Passenger Railroad Corporation, is open about their use of federal funds and their operating deficit (Amtrak, 2022). They continue to operate for the sake of the greater good. This ideology is conveyed through the intentions of Amtrak funding sources, including the Infrastructure Investment and Jobs Act, which aims to “create good jobs,” “tackle the climate crisis,” and grow the economy “equitably” (White House, 2021). Although policymakers and citizens in support of rail transit base decisions on the greater good, there is deep-rooted individualism in American citizens, which civilian critics of rail travel perpetuate through NIMBY protests. In 2011, San Francisco residents sued a rail company for inadequately analyzing “noise and vibration,” “traffic impacts,” loss of privacy, and decreased property values in their community from a high speed rail project (SCSC, 2011). Residents opposed trains crossing their town due to undetermined impacts on their affluent neighborhood, despite that a reroute would render the

train and all its benefits inaccessible for a larger population. American individualism also manifests as self-expression. Cars, again standing rail's way, are a tool for self-expression and individuality. Chevrolet capitalizes on this with the tagline "Every truck tells a story. Make yours count." to market their Silverado trucks (General Motors, 2023).

Even deeper than individualism, Americans have held distrust for government since the creation of the United States when the ability to speak out against a government was written into the constitution under the first amendment and when states were given significant power. This ideology of distrust comes as a hinderance when rail is initiated by state or federal government. Previous Florida governor Rick Scott refused \$2.4 billion in federal funding to develop rail claiming there is too much "risk" in accepting money from the government (Williams, 2011). He believed the government would revoke money after construction began, would stick Florida with unforeseen costs, and he doubted their ridership projections. Scott was the 3rd governor to reject joining the national rail system because of such distrust.

While there are many ideologies hindering passenger rail development, individualism and government distrust are some of the most deeply ingrained philosophies, while the prioritization of financial gain and the stereotype of public transit riders are some of the most widespread. With the complex nature of transportation systems, these ideologies become intertwined, and passenger rail flounders.

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