Prospectus

Management and Tracking of Tractor-Trailer Parking
(Technical Topic)

Evaluating the Social Problems and Limitations behind Tractor-Trailer Parking along the Virginia Section of Interstate 81
(STS Topic)

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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Introduction

Anyone who has ever driven on Interstate 81 (I-81) down the western side of Virginia knows that tractor trailers run rampant through this corridor. At 325 miles, I-81 is the longest interstate in Virginia (Weakley, personal communication, October 13, 2020). Finished in 1977, it was created to join the Northeast region of the United States with the non-Atlantic South. Most of this was built to be a four lane highway, with two southbound and two northbound lanes (Economic Development, 2008). Although general traffic has increased in the ensuing decades, most of this interstate remains untouched except for minor roadwork. I-81 was built under the assumption that only 15% of traffic would account for tractor-trailers, but data has shown that the actual percentage of tractor-trailer traffic is over 25% of the total (Interstate 81 Fact Sheet, 2005). This increase in vehicles on the road has caused the demand for parking spaces at rest stops to rise, and yet the number available has remained largely static. Truck drivers are also required to meet federal rest guidelines, which include mandatory 10 hour rest periods after 14 hour driving periods (Summary of Hours, 2020). With an increasing number of tractor-trailers moving through the Virginia corridor and needing reliable places to rest, it poses the question: where will they all park?

When rest stops reach their capacity, truckers are faced with a conundrum: (1) should they park illegally and risk getting a ticket and causing an accident or (2) continue driving, violate their driving hours, and risk getting in trouble with federal driving regulators and the company for which they work. Many are forced to choose the former, and road safety must be sacrificed in order to not lose their job. Currently, the approach to reduce the number of illegally parked trucks at rest stops is to have a state trooper force them out of the lot or give them a ticket. Some areas of the US have experimented with reserving parking spots and various

sensor-based solutions, but these approaches are flawed and usually short-lived, as no laws regulate them. This is a significant problem because there is currently no good, centralized way to track parking availability, and choosing between two illegal options is unideal for truck drivers. The solution will include a way to track and report truck parking to a centralized database to give drivers the most up to date knowledge as possible.

While a technical solution is necessary, there are also social aspects that need to be considered to fully understand the issue of illegal truck parking. Various social entities, such as politics, the environment, and the trucking industry, have begun to negatively impact the truck parking network. Regarding politics, budgetary constraints and trucking laws are being constantly changed while the parking network is remaining stagnant. Environmental concerns also prove to be a legal and ethical concern due to I-81's location between the Shenandoah National Park and the George Washington National Forest. While many may point the blame at the truckers themselves for illegally parking, the real blame is not on any one social group but rather on many. By failing to address both the technical and social reasons behind illegal truck parking, the issue can never be fully resolved, and unnecessary vehicular accidents will continue to occur. In only solving the technical issue, any future increase in demand for parking will result in the same issue: having too many tractor trailers and not enough parking spaces for them.

Below, my team and I will summarize a spacecraft-related solution that could be implemented to remedy the issue of illegal truck parking in Virginia. I will also use a Science, Technology, and Society (STS) approach to analyze the social reasons behind why building more parking spaces is not such an easy solution, as one must also take into account politics, environmental concerns, and the trucking network in addressing this problem.

Technical Research Problem[1]

The poor management of freight truck parking has led to illegal parking and overcrowding, causing traffic and safety issues along major interstate highways in Virginia. Truckers must adhere to legal requirements regarding maximum vehicle operation time, and parking is expected to occur at waypoints and designated locations. However, because there is no centralized system to locate vacancies and relay that information to truckers effectively, parking stations often become overcrowded. This leads drowsy truckers to either illegally park on the highway or continue driving in search of an available space, endangering themselves and others on the road. The larger issue that has been identified is the lack of total parking spots, for which greater infrastructure changes must be made. For the purposes of this capstone project, the aim is to develop a space-based solution to conduct remote sensing of trucks and parking spots, and then construct a systems architecture to process the data and disseminate it to truckers in a non-intrusive way. We have partnered with the MITRE Corporation under the mentorship of Dr. CJ Rieser and Dr. Michael A. Balazs, as well as our technical advisor Professor Chris Goyne, to investigate and tackle the problem.

The team has reached out to the Eastern Transportation Coalition, I-81 Corridor Coalition, Owner-Operated Independent Drivers Association, and the American Transportation Research Institute. Interviews with the first three have already been conducted, and the common theme driving the truck parking problem is the lack of initiative from the government despite its importance to roadway safety. Thus, it falls into the hands of independent research groups to explore this problem. As this problem extends beyond the borders of Virginia, a comprehensive solution will take more cooperation and awareness of the issue to implement.

[1] This section was co-authored by Xavier Castillo-Vieira, Luke Dennis, Graham Fitzgerald, Brandon Ghany, Alex Griffin, Dominic Pinnisi, Jimmy Smith, Anish Vegesna, Ian Wnorowski, and Victor Yang

Despite limitations, past organizations have attempted to remedy the truck parking problem in localized areas using different data collection and management techniques. As part of the process, the team conducted research on state-of-the-art solutions and developments. Crowd-sourced tracking apps as well as “detectors installed in the ground, and video cameras for additional monitoring” with truck detecting algorithms (see Figure 1 below) are all solutions that are currently commercially available; however, all of these solutions have major inefficiencies (I-95 Corridor Coalition, 2009). Tracking apps require truckers to input and update current data, a method with obvious drawbacks as drivers without access to the app and unreliable users can lead to flawed data (Woodrooffe, 2016).

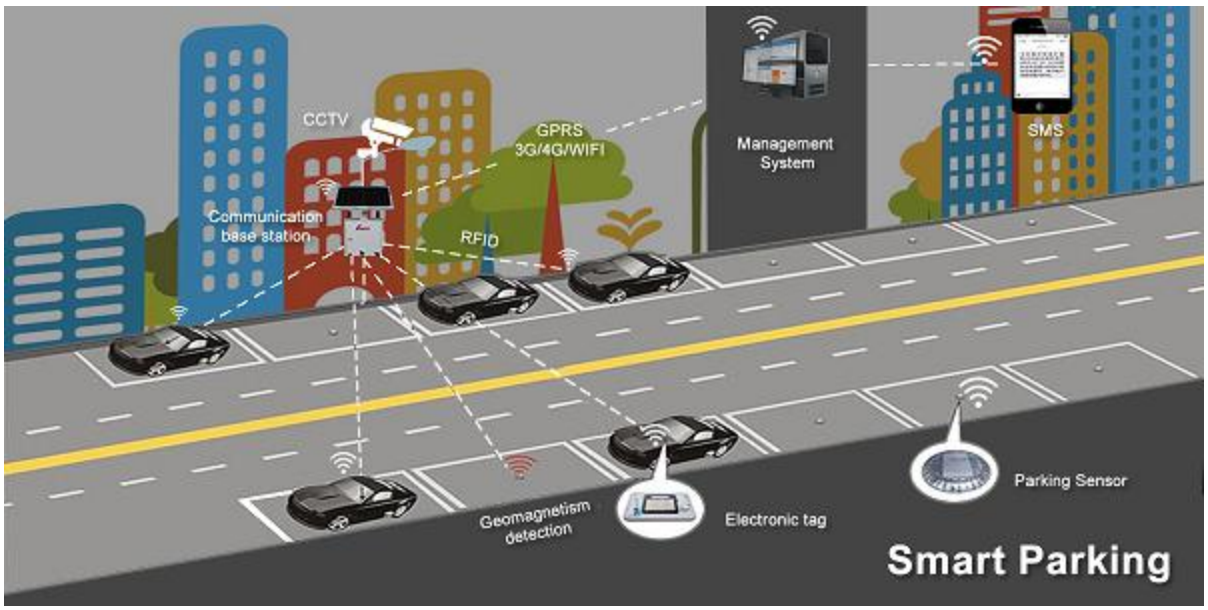

Figure 1: Example of a sensor based parking system with video cameras to demonstrate the inefficiency of this design. (Research N Reports, 2018)

In an interview with the I-81 Corridor Coalition, the use of in-ground sensors was discouraged due to the Virginia Department of Transportation’s (VDOT) apprehension to damage the existing infrastructure - the pavement - to install the sensors. On-site cameras are currently the most favorable solution, but this still requires the installation of a camera at every

parking site and the establishment of a communications network between them (Morris, 2017). From interviews with the organizations listed and research on current solutions, we have gathered that our solution needs to have a relatively high data collection frequency - as knowing there was a space available hours ago is not useful - and should be widely applicable, avoiding the installation of sensors or cameras at every parking location in the state.

Due to the research and design emphasis of this project, there are minimal initial resource requirements necessary to complete this semester's tasks successfully. One requirement would be ample access to the stakeholders previously mentioned, as they provide first hand accounts about where the problem lies and what solutions have been implemented in the past. Additionally, the mentorship of Dr. CJ Rieser and Dr. Michael A. Balazs provides valuable input on gaps in our team's knowledge and on possible shortcomings of proposed space-based solutions. The last resource requirement is access to literature on the current state-of-the-art.

This capstone project is broken down into 12 tasks, the first three of which have been completed. The next three will be completed this fall semester, and the final six will be completed in the spring semester. The 11-member team has already presented its initial progress to MITRE and will present again at the end of the semester.

STS Research Problem

In an interview I conducted with former trucker and current Director of Operations at the Owner-Operator Independent Drivers Association (OOIDA) Thomas Weakley, he said that parking is the biggest issue facing the trucking industry. Currently, many truckers believe that this system is failing purely due to the lack of available parking spaces (Weakley, personal communication, October 13, 2020). While building more spaces can indeed solve the issue at hand, it fails to take into account various social factors in understanding the problem itself. As a

result, I believe that there are various social factors that have negative impacts within the truck parking network. Limited tractor-trailer parking is a symptom of larger social problems related to the interconnection and power dynamics of politics, the environment and regional geography, and the trucking industry as a whole.

Politics at the local, state, and federal levels has influenced the amount of money put towards road infrastructure maintenance which includes the expansion of parking lots at public rest stops. For 2020, the state of Virginia has allocated $6.4 billion towards the support of the VDOT. 42% of this budget goes towards construction projects that occur throughout the state in the given year (Fiscal Year 2020, 2019). Since this budget is already limited, the average person in the state likely does not see parking for tractor-trailers as a priority for roadway construction projects. Given that elected officials create state budgets every year, it makes more sense for a politician to run on a platform that promotes road improvements for the most people possible instead of focusing on just the trucking community. The budgetary allocation would thus reflect this thought, with projects deemed more important to the majority taking priority over smaller interests like tractor-trailer parking. The public seems unaware that solving this problem would be in their benefit too, as reducing the number of illegally parked trailers would reduce the number of crashes and deaths that are associated.

When looking at the location of I-81, the geographical and environmental concerns with increasing tractor-trailer parking become more apparent. I-81 is situated in the “Great Valley” of the Appalachian Mountains between Shenandoah National Park and the George Washington National Forest (Great Appalachian Valley, 2020). This placement between two largely protected areas limits the region in which construction can occur and can increase pushback from environmental groups. In terms of the environment, building new parking spaces for

tractor-trailers would likely require years of work, billions of dollars in total, and the destruction of large portions of land to be paved over. Environmentally speaking, this means years of pollution and the deforestation of parts of the region.

The issue of truck parking cannot be discussed without mentioning the trucking industry itself. Actors within this system such as the companies scheduling deliveries and the individual trucking companies increase the strain on parking availability. With large online retailers like Amazon promising millions of members free two day shipping, other companies are also starting to promise faster deliveries of their goods. While this is great for the consumer, it requires more truckers to be out on the roads delivering these products.

If the social factors behind tractor trailer parking are not better understood, and if a greater understanding of the factors causing this problem is not reached, the issue will persist in the future. My analysis of the issues behind tractor-trailer parking will rely on the STS framework of Actor-Network-Theory (ANT), which analyzes the power dynamics between both human and non-human actors within the extended network of the problem (Cressman, 2009), to show that the parking deficiencies cannot be solved by 'just building more spaces.' By defining VDOT as the network builder, I will analyze the shortcomings within the current system to understand why the network is failing. Though VDOT's network originally worked back when the road was built, it's unseen flaw is that it assumed the heterogeneous actors within the system would remain stagnant as time moved forward; the system has thus not been updated to handle the increased number of trucks nor the changing policies within the government. If we continue to believe that this network is completely successful, we will overlook the vulnerability of the actors and power dynamics within the system. Politics and environmental concerns are beginning to act as rogue actors working against the system, and without understanding how and why they

are going rogue, the network will continue failing its objective of providing enough parking infrastructure for tractor trailers. I will also analyze a case study that specifically looks into Virginia's roadways and their tractor-trailer-related parking deficiencies, mostly focusing on the almost 700-space deficiency found along I-81 (Kimley-Horn Inc., 2015),(H. W. Lochner Inc. 2018).

Conclusion

Over the course of the year, these STS and technical projects will analyze the depth of the parking problem for tractor-trailers and propose an easily implemented, low cost solution to try and remedy problems related to parking availability. The technical project will propose a system by which to physically monitor available parking at rest stops. The STS project will develop a greater understanding of the failing network that regards truck parking. By understanding the network of players involved, a solution better tailored to the problem can be created. Though the technical project focuses largely on Interstate 81 through Virginia, tractor-trailer parking deficits exist at a national and international level. If a viable solution can be implemented in a smaller region, it could potentially be used at larger scales to address this problem within the global trucking network. This socio-technical problem can be better solved by first using the STS project to understand the problem from the network builder's perspective and then using the technical project to implement a system to track truck parking along Virginia's highways.

Word Count: 2239

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