

**Improving Pedestrian and Bicyclist Safety and Comfort Along the Water Street Corridor**

(Technical Paper)

**The Impact of the Transportation Security Administration (TSA) Security Technologies on Passenger Privacy and Ethics Concerns**

(STS Paper)

**A Thesis Prospectus Submitted to the**

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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**

Do Transportation Security Administration (TSA) security technologies impact privacy and ethics concerns of passengers? The general public takes for granted safe travels when they fly, but the process used to ensure airport security is influenced singlehandedly by the organization who is behind it all: the TSA. The TSA was formed in response to the terrorist attacks on September 11, 2001 to help prevent a similar attack in the future (Smith, 2011). In recent years, however, there have been concerns that the TSA is overextending beyond its intended purpose, perhaps becoming “another federal agency infringing on constitutional rights” (Prince, 2017). How far is too far in the name of security? This STS topic is important because it brings into question airport security, which is something that the general public most likely experiences at least once per year, if not more. This topic is also very relevant because it explores how constitutional rights may or may not be violated, which is a cornerstone to the democracy in the United States.

On the other hand, unrelated to the STS topic, the proposed technical topic is about improving pedestrian and bicyclist safety and comfort along the Water Street corridor of downtown Charlottesville, Virginia. Due to an increased rate of pedestrian crashes in one of the main bicycle routes in the city, there is a need for design alternatives that will make the corridor safer. Ideally, Water Street would be able to accommodate vehicles, pedestrians, and bicyclists in a safe and efficient manner.

## **Technical Topic (Capstone)**

The Virginia Department of Transportation (VDOT) has identified the West Water Street corridor in downtown Charlottesville, Virginia as an area of focus due to a high rate of

pedestrian crashes between 2012 and 2016 (VDOT, 2018). Water Street also hosts one of the main bicycle routes in the city; however, there is a high level of traffic stress for bicyclists. Therefore, it is critical to determine pedestrian and bicyclist safety countermeasures. The goal of this project is to design Water Street so that vehicles, pedestrians, and bicyclists interact in a safe and efficient environment. The focus of this project is to research, create, and test alternative designs to improve bicyclist and pedestrian safety in the Water Street corridor. The research team is composed of both undergraduate Civil and Systems Engineering students. Available as external resources are PhD graduate student mentors, faculty advisors, and subject matter experts who will help support the research team and offer guidance.

At the beginning of the project, design requirements will be gathered through research and input from the industry mentors. These requirements will then be used to formulate design alternatives. The research team will survey Water Street to collect data and create planning level design documents. The research team will also analyze best practices from other bicycle- and pedestrian-friendly cities, and will research existing bicycle infrastructure designs. The research team will then work together to create design alternatives that will be tested and evaluated against the requirements.

Design and alternative evaluation processes will ensure that the Water Street infrastructure meets design standards and is feasible. The specific design changes will focus on the roadway characteristics, including pavement markings, additional roadway infrastructure (e.g., bicyclist and pedestrian safety barriers), re-allocation of space within the existing right-of-way, and signage. However, certain parameters will not be considered. While they would be important to analyze in an implementation project, they would be difficult to test and are infeasible within the project's constraints. These parameters include the removal of buildings,

signal timing changes, changes that require additional right-of-way, and widening of the roadway.

To evaluate the design alternatives, the design team will implement user testing. The research team will use virtual reality (VR) simulators in the University of Virginia's Omni-Reality and Cognition Lab (ORCL). ORCL researchers have developed a VR environment in Unity software that replicates the Water Street corridor, and the project team can alter this base environment to include the design alternatives. The research team will be responsible for gathering user feedback via physiological indicators such as heart-rate, skin temperature, and arm movement. Collected through wearable smart watches, this biometric data will be used to assess the comfort level of the users in each VR design alternative and will be taken into consideration when determining the final design recommendation.

By the end of this project, a technical report will be written that will describe the design alternatives and the final design recommendation. Along with the final report, a final presentation will convey the information within the technical report. Both of these deliverables will be presented at the Systems and Information Engineering Design Symposium (SIEDS) conference in the spring, 2020.

## **STS Topic**

September 11, 2001 marked the deadliest terrorist attack to ever happen on American soil. Nineteen terrorists hijacked four U.S. airliners, two of which crashed into the World Trade Center in New York, one into the Pentagon in Washington, D.C., and one into a field in Pennsylvania (Transportation Security Timeline). Nearly 3,000 people were killed as a result of these crashes. Shortly after the attacks, on November 19, 2001, President George W. Bush

signed into law the Aviation and Transportation Security Act (Smith, 2011). This landmark legislation authorized the creation of a new federal government agency that was specifically designed to strengthen the security of the nation's transportation systems, while also ensuring the free movement of people and commerce. Thus, the TSA was born. The TSA was created to oversee security in all modes of transportation. The agency was initially required to conduct screening by federal officials, have 100 percent checked baggage screening, expand the Federal Air Marshal Service, and implement reinforced cockpit doors. Since then, however, more technology has been implemented in their screening processes, such as pat-downs, full-body scanners, and biometric data collection. For example, at some airports, a passenger's face is their identification; but does that put their privacy at risk?

A new system to screen passengers at U.S. airports appears to be exposing more than it should (Rohrlich, 2019). According to a recent federal contracting document, the TSA has discovered that the technology the scanning equipment uses to render images poses privacy risks. The scanner's manufacturer is now working on enhanced privacy software to fix the issue. In addition to traditional body-scanner technology, the TSA is implementing the use of biometric data as a security measure (Kirkham). Facial and fingerprint recognition technology have been tested in U.S. airports, such as Los Angeles International Airport. According to the TSA's website, the TSA will collect the passenger's photo, along with certain biographic information from the passenger's identity document. Fortunately, this data will then be stored on a removable TSA-owned encrypted hard drive and will be deleted no later than 180 days following receipt (Biometrics Technology). However, many critiques warn that this technology is dangerously fallible, that facial recognition software elsewhere has delivered inaccurate results, and that this new approach could undercut civil liberties (Kirkham). In San Francisco,

California and Somerville, Massachusetts, city councils have banned their police from using facial recognition software. In addition, senators in Washington, D.C. are calling for greater transparency of how biometric data is handled and warned of data leaks. This issue is very pressing and relevant to the general public because it is directly related to a potential breach of personal information.

Overall, the technology in question is TSA security measure techniques, such as full-body scanners, and the social dimension is how this technology is affecting the public's privacy and ethics concerns. It is important to note that TSA technology may then lead into a focus on TSA policy. For example, if a full-body scanner indicates that someone has a concealed weapon, what is the next protocol? How do humans get involved with the security screening process after technology has been utilized? The STS topic lies where the line between security and privacy becomes blurry.

Due to the fact that the TSA is a federal agency and that there are laws surrounding citizen privacy, the STS theory of political technology is a natural fit. American political theorist Langdon Winner says that technological artifacts can have politics when they become "a way of settling an issue in a particular community" (Winner, 1980). In the case of the TSA, security technology and procedures are used to combat the threat of terrorism. Winner also states that a technology can be inherently political if it correlates with particular kinds of political relationships. The TSA is run by the federal government and is mandated to follow certain rules and regulations. Thus, any security procedures it wants to implement is guided by the politics of American law.

While the theory of political technology is a great fit for this topic, critiques of the theory will also have to be taken into consideration. In his article published in the Social Studies of

Science, Hans Radder makes the argument that many authors struggle to “combine an adequate theoretical STS perspective with a critical engagement of the political issues brought about by current science and technology” (Radder, 1998). Radder believes that, in order to make a successful political technology argument, an author must go beyond the traditional actor-network and sociology of scientific knowledge approaches. As I conduct research and formulate an analysis about this topic, I will take this critique into consideration and try my best to have both strong theoretical and critical engagements of the political issue.

### **Research Question and Methods**

The research question is: How do Transportation Security Administration (TSA) security technologies impact passenger privacy and ethics concerns?

This question is important to analyze because it involves a process that has become so second-nature to society that the general public may not realize how it is actually impacting them. Citizens should be aware of their ethical and privacy rights, and this topic addresses and highlights those issues. To answer this research question, documentary research, historical case study, and policy analysis methods will be used.

With documentary research methods, I will research, collect, and analyze documents to provide readers with background information about the topic. This information will include why the TSA was founded and what its current policies and procedures are. In addition, biometric data has been used recently in TSA security procedures. This biometric-related information will be researched through different resources, such as the master’s thesis *Airport Passenger Processing Technology: A Biometric Airport Journey* written by Vishra Patel. Also, international expert on privacy protection James O’Rielly explains in his paper the privacy concerns in terms

of the tensions between homeland security and the right to personal privacy in the War on Terrorism.

Examining historical case studies will go hand-in-hand with policy analysis. Historical case studies will provide evidence of citizen examples of privacy being violated by the TSA. For example, in “Fed up with Being Felt up: The Complicated Relationship Between the Fourth Amendment and Tsa’s “Body Scanners” and “Pat-Downs,” J.D. student Brittany Stancombe analyzes citizen’s personal interactions with the TSA. This analysis will tie-in with the policy analysis methodology. The analysis will also be used to explore current TSA policy to see how those procedures are either supported or contrasted by the historical case study evidence. That conclusion, in turn, will guide the creation of the argument to answer the research question.

## **Conclusion**

In conclusion, the STS topic that will be addressed is the impact of TSA security technologies on passenger privacy and ethics concerns, and the technical topic is improving pedestrian and bicyclist safety and comfort along the Water Street corridor.

From my STS topic, I hope to gain an improved understanding of TSA security technologies and their impact on passenger privacy. In addition, through my research paper, I strive to spread cultural awareness and edification about possible violations of privacy for something that we as a society take for granted as a second-nature process (i.e. TSA security procedures). Passengers have the authority to know if their rights are being violated and should be aware of what their freedoms are.



At the end of my capstone project at the SIEDS conference, I aim to put forth with my team a feasible, efficient, and effective design for bicyclist and pedestrian safety improvements. I am looking forward to working through the systems design lifecycle to accomplish this goal.

## References

- Biometrics Technology. (n.d.). Retrieved October 1, 2019, from <https://www.tsa.gov/biometrics-technology>.
- Did you know your security doesn't start or end at the security checkpoint? (n.d.). Retrieved October 1, 2019, from [https://www.tsa.gov/sites/default/files/resources/layers\\_of\\_security\\_factsheet.pdf](https://www.tsa.gov/sites/default/files/resources/layers_of_security_factsheet.pdf).
- Karoly, S. (2017, April 27). Checkpoint of the Future: Evaluating TSA's Innovation Task Force Initiative. Retrieved October 1, 2019, from <https://www.tsa.gov/news/testimony/2017/04/27/checkpoint-future-evaluating-tsas-innovation-task-force-initiative>.
- Kirkham, M. (n.d.). At some airports, your face is your ID. But does that put your privacy at risk? Retrieved October 1, 2019, from <https://www.latimes.com/travel/story/2019-08-22/facial-recognition-biometrics-at-airports-proliferating>.
- O'Reilly, J. T. (2008). Don't Stick Your Head in the Sand. *Vital Speeches of the Day*, 74(6), 258–266.
- Patel, V. (2018). *Airport Passenger Processing Technology: A Biometric Airport Journey* (unpublished Master's thesis, Embry-Riddle Aeronautical University). Retrieved from <https://commons.erau.edu/cgi/viewcontent.cgi?article=1384&context=edt>
- Prince, E. J. (2017, May 10). Does the TSA Go too Far? Retrieved from <https://merionwest.com/2017/05/10/should-we-even-have-the-tsa/>.
- Radder, H. (1998). The Politics of STS. *Social Studies of Science*, 28(2), 325–331. Retrieved from [https://www.jstor.org/stable/pdf/285605.pdf?casa\\_token=L3jifpVp9E4AAAAA:Zq-uJq8hU2jJwjT4bD24tJQhlilxY3pw9Aq5zWQjEQIghMZUm5Y9AdUBsalHRW6O05LRdNWyKu46MwVVIDhVC6EnDwi3NRzYbDESFC6Xv1rhZMzFCjg](https://www.jstor.org/stable/pdf/285605.pdf?casa_token=L3jifpVp9E4AAAAA:Zq-uJq8hU2jJwjT4bD24tJQhlilxY3pw9Aq5zWQjEQIghMZUm5Y9AdUBsalHRW6O05LRdNWyKu46MwVVIDhVC6EnDwi3NRzYbDESFC6Xv1rhZMzFCjg)

- Rohrlich, J. (2019, April 22). This new US airport screening camera would see too much. Retrieved October 17, 2019, from <https://qz.com/1601613/tsa-is-testing-an-airport-screening-system-with-privacy-issues/>.
- Security Screening. (n.d.). Retrieved October 1, 2019, from <https://www.tsa.gov/travel/security-screening>.
- Smith, M. (2011, September 1). *September 11 and the Transportation Security Administration*. Retrieved from <https://americanhistory.si.edu/blog/2011/09/september-11-and-the-transportation-security-administration.html>
- Stancombe, B. R. (2011). Fed up with Being Felt up: The Complicated Relationship Between the Fourth Amendment and Tsa’s “Body Scanners” and “Pat-Downs.” *Cumberland Law Review*, 42(1), 181–215.
- Taylor, C. L. (2013). Touched by an Agent: Why the United States Should Look to the Rest of the World for a New Airport Security Scheme and Stop Using Full-Body Scanners. *Houston Journal of International Law*, 35(2), 503–536.
- Transportation Security Timeline. (n.d.). Retrieved October 1, 2019, from <https://www.tsa.gov/timeline>.
- TSA Biometrics Roadmap. (n.d.). Retrieved October 1, 2019, from [https://www.tsa.gov/sites/default/files/tsa\\_biometrics\\_roadmap.pdf](https://www.tsa.gov/sites/default/files/tsa_biometrics_roadmap.pdf).
- VDOT. (2018). Pedestrian Safety and Action Plan. Retrieved from [http://www.virginiadot.org/business/resources/VDOT\\_PSAP\\_Report\\_052118\\_with\\_Appendix\\_A\\_B\\_C.pdf](http://www.virginiadot.org/business/resources/VDOT_PSAP_Report_052118_with_Appendix_A_B_C.pdf)
- Winner, L. (1980). Do Artifacts Have Politics? *Daedalus*, 109(1), 121–136.