Exit Lane Staffing

Fiscal Year 2023

June 30, 2023

Fiscal Year 2023 Report to Congress

Homeland Security

Transportation Security Administration

Message from the Administrator

June 30, 2023

I am pleased to submit the following report, "Exit Lane Staffing," prepared by the Transportation Security Administration (TSA).

This report was compiled pursuant to the requirements detailed in the Joint Explanatory Statement, accompanying the Fiscal Year (FY) 2023 Department of Homeland Security (DHS) Appropriations Act (P.L. 117-328). The report discusses technological solutions to secure exit lanes and the feasibility of implementing such solutions.

Pursuant to congressional requirements, this report is being provided to the following Members of Congress:

The Honorable David Joyce
Chair, House Appropriations Subcommittee on Homeland Security

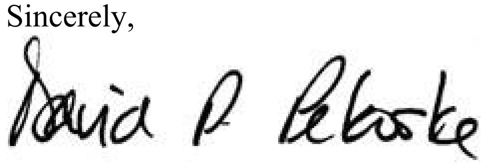
The Honorable Henry Cuellar
Ranking Member, House Appropriations Subcommittee on Homeland Security

The Honorable Chris Murphy
Chair, Senate Appropriations Subcommittee on Homeland Security

The Honorable Katie Britt
Ranking Member, Senate Appropriations Subcommittee on Homeland Security

Inquiries relating to this report may be directed to me at (571) 227-2801 or TSA's Legislative Affairs Office at (571) 227-2717.

Sincerely,



David P. Pekoske
Administrator

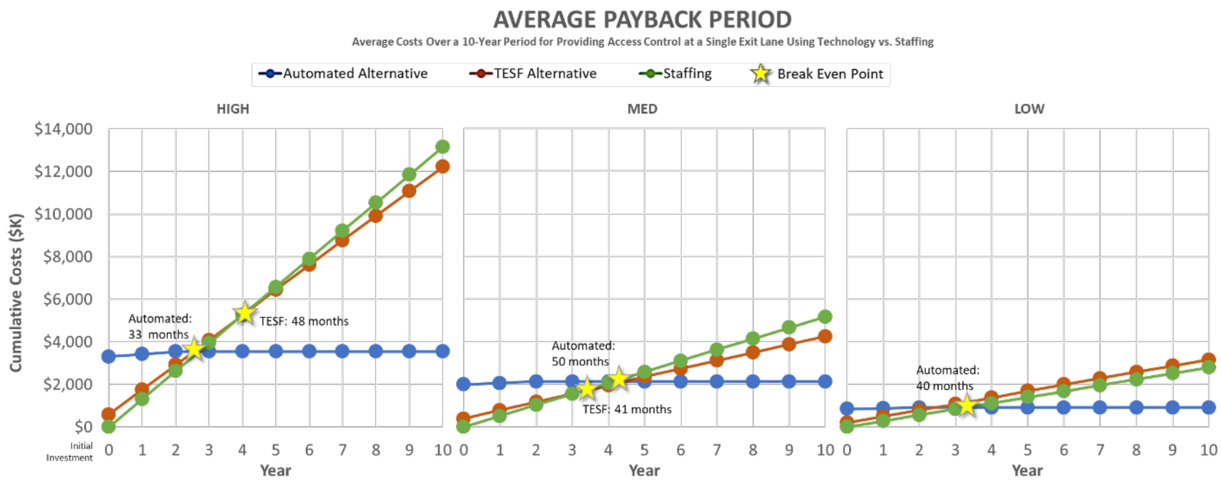
Executive Summary

The TSA Portfolio Review Committee (PRC) commissioned an internal study to help gather evidence to support developing a strategy for transitioning the primary method of exit lane security from Transportation Security Officers (TSO) to an alternate method. This study was conducted from October 2022 through January 2023 and explored alternative methods of securing exit lanes from unlawful entry into sterile areas, the results of which are detailed in this report to provide technological solutions to secure exit lanes and the feasibility of implementing such solutions. Based on the cost benefit results from the Alternatives Analysis, it is feasible to substitute TSOs with technological solutions to secure exit lanes. The results show that TSA can achieve substantial cost savings by shifting from staffed to technology-based exit lanes.

Exit lanes are areas within an airport that provide transitions between sterile areas where individuals have undergone security screening and public areas where they have not. Most U.S. airports rely on continuous exit lane guarding by a security monitor, generally either a TSO or airport security personnel. However, frequent periods of low activity can cause personnel to occasionally become inattentive, increasing the likelihood of error. TSA has spent millions of dollars staffing exit lanes. For example, in the current Budget, the FY 2023 Homeland Security Appropriations Act provided $94.1 million, for nearly 1,300 TSO full-time equivalents (FTE) to staff exit lanes, many of which are adjacent to security checkpoints. For a number of years, the Budget Request proposed eliminating the funding requirement to staff exit lanes with TSOs. However, previous proposals to eliminate this funding have been rejected by Congress. Recent advances in automated exit lane technology are being closely followed by TSA and airport authorities, with a particular interest by TSA for potential areas of savings or cost avoidance by transitioning TSO labor to technology.

TSA found substantial cost savings by shifting from staffed exit lanes to technology-based exit lane access control solutions. **Figure 1** presents a series of plots showing the average payback periods for each technological solution alternative for different investment models – airports with exit lane staffing costs greater than $800,000 (HIGH), between $400,000 and $800,000 (MED), and less than $400,000 (LOW). As demonstrated in **Figure 1**, TSA found that if an airport can assume the upfront costs associated with a given exit lane technology, it is not only feasible to implement technological solutions to secure exit lanes, but also reach a cost savings in the long-term after the “break-even point,” indicated with a star.

Figure 1: Payback Period for Each Investment Model and Exit Lane Security Alternative



If authorized to migrate from TSOs staffing exit lanes to using technology to secure exit lanes, TSA could analyze and select the most appropriate strategic approach to accomplish this, depending on the necessary investments and unique airport environments. As demonstrated by the cost-benefit analysis, the initial investment can be amortized reasonably rapidly and would be a multi-year endeavor. The payback period is generally 3-4 years regardless of the investment model.

Exit Lane Staffing

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I. Legislative Language

This report is submitted in response to direction in the Joint Explanatory Statement accompanying the Fiscal Year (FY) 2023 Department of Homeland Security (DHS) Appropriations Act.

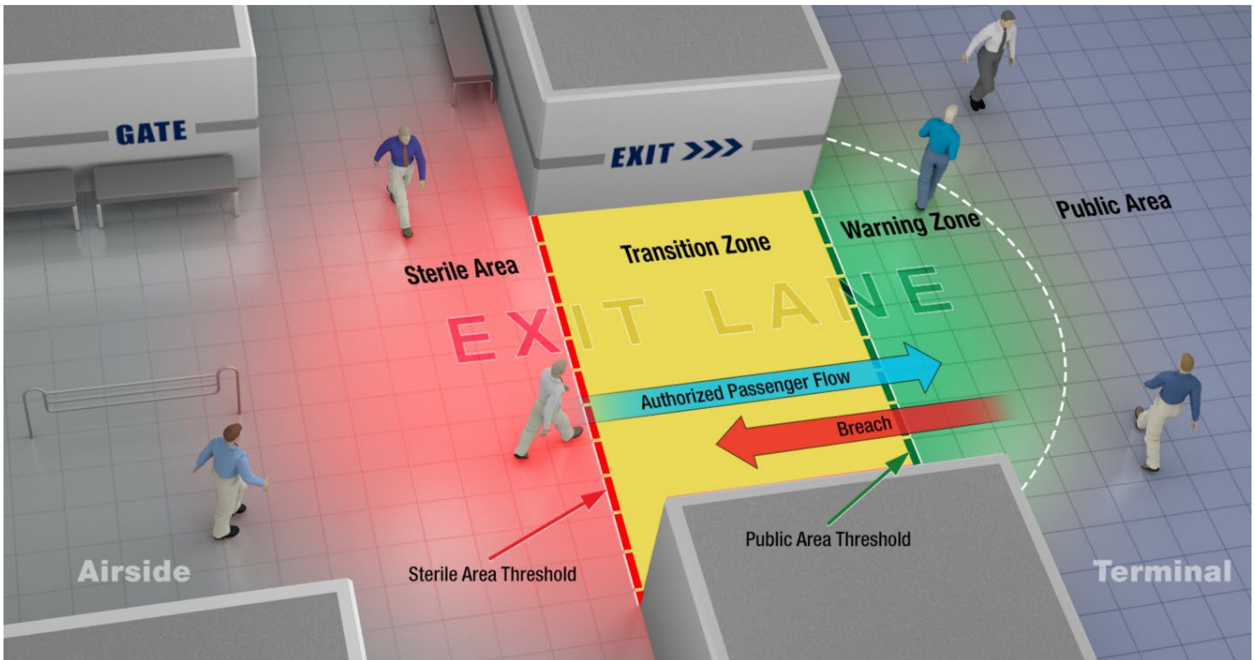
The Joint Explanatory Statement states:

> *Exit Lane Staffing.*—Within 120 days of December 29, 2022, TSA shall provide a report to the Committees on technological solutions to secure exit lanes and the feasibility of implementing such solutions.

II. Background

As detailed in **Figure 2**, exit lanes are areas within an airport where passengers may transition from the sterile security screening areas, where individuals have undergone security screening, to the terminal's public areas.

Figure 2: Anatomy of an Airport Exit Lane and Definitions of Exit Lane Zones



- **Transition zone** – Passageway that facilitates screened individuals moving from the sterile to the **public area**. Within the transition zone, access is controlled to prevent unauthorized individuals from entering the **sterile area** without submitting to screening.
- **Thresholds** – Boundaries between the transition zone and the adjoining sterile and public areas. A breach occurs when an unauthorized individual or object moving against the authorized flow of traffic, crosses the sterile area threshold.
- **Warning zone** – Region adjacent to the transition zone but sitting existing entirely within the public area. Loitering, wrong-way motion, and other actions that occur in this region may result in audible warnings, cautioning individuals not to enter or re-enter the exit lane from the public area.

Securing exit lanes is an issue of access control, detecting and preventing unauthorized personnel, as well as preventing prohibited items from being introduced into the sterile area through the exit lane. Failure to control access through the exit lane can result in a security breach that disrupts airport operations and results in significant costs to the airport and airlines. Most U.S. airports rely on continuous guarding of the exit lane by a security officer, generally either a Transportation Security Officer (TSO) or airport security personnel, to monitor for individuals attempting to gain unauthorized access to the sterile area. TSA, as required by the Aviation and Transportation Security Act, (49 USC 44903(n)) as amended the Bipartisan Budget Act of 2013 (P.L. 113-67), has been using TSOs to monitor approximately one quarter of the sterile area exit lanes nationwide.

For many years, Congress has provided hundreds of millions of dollars to staff these exit lanes. The FY 2023 Homeland Security Appropriations Act provides $94.1 million for nearly 1,300 TSO full-time equivalents (FTE) to staff these exit lanes, many of which are adjacent to security checkpoints. TSOs monitoring exit lanes provide a credible solution that safeguards the “open lane” against unauthorized access. However, during periods of low activity in these areas, security personnel can become especially prone to inattentiveness, increasing the likelihood of human error.

For this reason, the demand by airports for better security beyond that provided by security guards has been increasing. At the same time, recent advances in automated exit lane technology have spurred market growth. In the past decade, the commercial technology marketplace for exit lanes has grown to more than 20 different vendors with various product offerings. As shown in **Figure 3**, these technologies can be grouped into four different technology-based solution categories. A more detailed discussion of these technology alternatives is also provided in Appendix D, Exit Lane Access Control Solution Categories.

Figure 3: Exit Lane Access Control Solution Categories

As the technology has matured, approximately 25 percent of the Nation’s federalized airports have increasingly transitioned to technology-based alternatives for exit lane security, often in conjunction with other construction projects and site improvements. Installation of exit lane technology, and therefore reduction or elimination of TSOs guarding the lanes, has not reduced TSO staffing at those airports. Rather, many airports have instead increased security by reassigning TSOs to checkpoint and checked baggage screening.

The airport industry and Congress are closely following exit lane technology development and are particularly interested in determining whether the use of technology can improve exit lane security and decrease long-term personnel costs. TSA continues to be interested in potential cost savings in TSO labor if technology can be implemented. However, beyond technology modeling and marketplace awareness, no funding has yet been allocated to further explore technology-based alternatives and their cost benefit.

The TSA Portfolio Review Committee (PRC) commissioned an internal study to gather evidence to support a strategy for transitioning exit lane security from TSOs to alternate methods. The study, conducted from October 2022 through January 2023, explored technology options of securing exit lanes from unlawful entry into sterile areas, the results are detailed in this report, providing technological solutions to secure exit lanes and the feasibility of implementing such solutions.

The effects of Pay Equity are not included in the study, as the analysis was developed and submitted before Pay Equity was approved. Although Pay Equity is accounted for in the staffing costs listed in the report, the model is routinely updated, and Pay Equity costs will be reflected in the future. The Consolidated Appropriations Act of 2023 supports critical efforts to modernize TSA's pay structure by including funding to bring TSA employee compensation in alignment with other federal agencies. TSA employees, in particular TSA's frontline workforce, have generally been paid up to 30 percent less than their federal counterparts. Congress approved TSA's pay equity plan in recognition of the critical work TSA employees do day in and day out to protect the nation's transportation systems. Because Pay Equity increases personnel costs, it actually increases the cost benefit of migrating to use of exit lane security technology.

III. Exit Lane Staffing Challenge

TSA is responsible for staffing co-located exit lanes at approximately 106 airports[1], per a statutory requirement of the Aviation Security and Transportation Act, 49 USC 44903(n). In FY 2023, TSA monitored 228 of the 661 total exit lanes (or 35 percent) using 1,285 FTE TSOs co-located with security checkpoints at 106 airports throughout the federalized airport system. Exit lanes not staffed by TSA are controlled by the airports as part of their access control responsibility.

Generally, although TSOs or airport security personnel are widely used solutions to monitor exit lanes against unauthorized access to the sterile area, there may be frequent periods of low activity in these areas. It is during these times that human security personnel can become especially prone to inattentiveness, and the likelihood of human error can increase. For this reason, the demand by airports for better security than human security guards have been increasing. At the same time, recent advances in automated exit lane technology have spurred market growth. In the past decade, the commercial technology marketplace for exit lanes has grown to more than 20 different vendors with various product offerings.

Airport exit lanes not staffed by TSA have increasingly transitioned to technology-based alternatives for exit lane security. These developments are being closely followed by the airport industry and Congress, who maintain particular interest in determining whether the use of technology can both improve exit lane security and decrease long-term personnel costs. TSA continues seeking potential cost savings in TSO labor and availability if technological solutions can be implemented. However, beyond technology modeling and marketplace awareness, no funding to date has been allocated to further explore technology-based alternatives and their cost benefit. This significant problem will continue until resolved by widespread implementation of the most effective types of exit lane security technology.

[1] Total numbers of airports and associated exit lanes are based on FY 2023 data from Transportation Security Administration Security Operations (SO).

IV. Exit Lane Internal Study

A. Study Approach

The TSA PRC commissioned an internal study to gather evidence to support developing a strategy for transitioning the primary method of exit lane security from TSOs to an alternate method. This study, conducted from October 2022 through January 2023, explored alternative methods of securing exit lanes to prevent unlawful entry into sterile areas.

TSA's alternatives analysis used technology-compatibility inputs and staffing data for selected airports' exit lane locations of interest. It then generated cost-benefit estimates (including the impact of reallocating TSO FTE from exit lanes to other TSO-staffed locations) and potential cost implications.

B. Airport Site Selection

TSA analyzed data on the number of exit lanes and FY 2022 exit lane FTE coverage. This was done by using the FY 2022 planned costs[2] for 109 airports and a prioritized list based on operational need of 21 Category (CAT) I, II, and X airports.

The FTE values were normalized by dividing the exit lane FTE by the number of exit lanes at that airport, to produce per-lane FTE values. This normalization was performed to facilitate comparison across airports and airport categories. Finally, the CAT X[3] and I[4] airports were grouped based on per-lane FTE and level of exit lane technology (ELT) implementation.[5] TSA used these groupings to select eight airports that represented a span of potential future investments – from large (large per-lane FTE with no/minimal technology) to small (low per-lane FTE with automated technology already implemented at some exit lanes).

The following airports were included in the study:

- Chicago Midway International Airport (MDW)
- Memphis International Airport (MEM)
- Harry Reid International Airport (LAS)
- Miami International Airport (MIA)
- Detroit Metropolitan Wayne County Airport (DTW)
- Norman Y. Mineta San José International Airport (SJC)
- Richard E. Byrd International Airport (RIC)
- Baltimore/Washington International Thurgood Marshall Airport (BWI)

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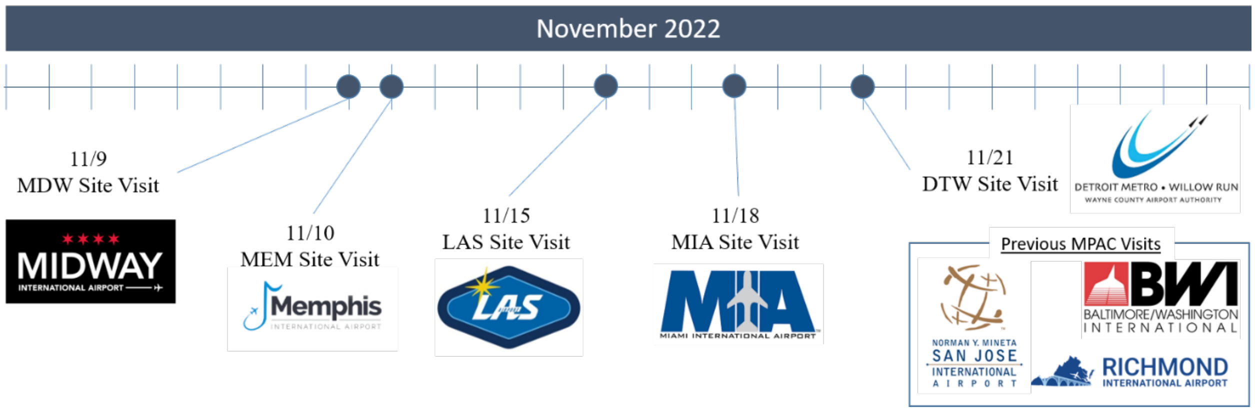
[2] FY 2022 planned costs are documented in TSA's FY 2022 Resource Allocation Plan (RAP)
[3] CAT X: Represent the nation's largest and busiest airports as measured by the volume of passenger traffic.
[4] CAT I: Represent the second highest tier of airport annual enplanements.
[5] Estimates the degree that the airport has to-date invested in ELT. The three bins span from fully automated solutions implemented at some exit lanes, to barrier-type technology that enhances existing guards (such as smart one-way doors), to staffed only, or staffed-without-barrier type technology (video analytics).

C. Site Visits

Airport site visits were made to collect data and gain insight on the physical layout of the exit areas to perform the cost-benefit analysis. **Figure 4** shows the timeline of site visits that were performed by the team to accomplish the internal study.

Figure 4: Airport Visits Timeline



Each visit had the following objectives:

1. Survey the airport's exit lanes, in particular focusing on exit lanes to be included in the study.
2. Provide a briefing to local TSA and the airport authority that explained the study and oriented them to common exit lane terminology and concepts.
3. Use the ELT Toolbox[6] to determine technology solution compatibility with the exit lanes of interest and generate preliminary cost-benefit estimates.

To maximize efficiency, TSA requested data in advance, including data on each exit lane, its width, how access control is done, and if staffed, the current staffing model. After an introductory brief, the study team typically toured the airport's exit lanes, especially any lanes of interest identified by the airport. During these tours, dimensional measurements were taken, comments on staffing details were recorded, and observations on the physical characteristics of the lanes that could affect technology implementation were noted.

The team next engaged in discussions with representatives from both local TSA and the airport authority. These discussions included providing briefings that explained the reason for the internal study and airport visit, introduced the study methods, and provided additional context related to nationwide TSA exit lanes efforts. Following the briefings, a live demonstration of the ELT Toolbox was provided. The demonstration also allowed for real-time collection from the local TSA and airport for the data and insights needed to determine compatible exit lane

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[6] To help airport stakeholders plan and implement exit lane access control solutions, TSA developed the ELT Toolbox. It is an interactive, web-based platform containing decision support tools and resources that airports can request access to and leverage for planning purposes. A deeper discussion of how the ELT Toolbox was leveraged for this study is provided in Appendix D. The ELT Toolbox was utilized for this study.

technologies and the prospective return on investment of installing technology. The following components of the ELT Toolbox were demonstrated:

- The **Decision Aid Tool** guided those in attendance through a series of questions aimed at identifying technology-based solutions that meet baseline Class 1 and desired supplementary Class 2 exit lane access control capabilities. Based on the capabilities selected (along with exit lane physical characteristics) the study team was able to share with the airport which technology alternatives would be most compatible with their exit lanes of interest, along with considerations for future implementation.

- The **Exit Lane State-of-Tech Report (SOTR)** is a part of the Technology Resources area of the ELT Toolbox. Portions of the SOTR were shared with those in attendance to help them better understand the Class 1 and 2 capabilities, as well as introduce them to the range of technology products currently in the commercial marketplace.

- The **Cost Benefit Tool (CBT)** estimates the savings associated with switching from a staffed exit lane to a technology solution. The study team generated and shared preliminary results from the CBT to give those in attendance a feel for the type of return on investment that could be expected with a transition to technology.

In some cases, the airport authority could not be present due to the timing of the visit. When that occurred, the study used preliminary insights from the local TSA, and then made a follow-up teleconference call with the airport to corroborate the inputs.

TSA also used data collected from airports visited earlier in FY 2022. Although the visit format was not exactly like the five airports visited in November 2022, the same general premise of conducting tours of the exit lanes, briefing local TSA and the airport authority, and collecting insights on current staffing details and technology compatibility remained the same. The study team used this previously collected data to generate cost-benefit estimates and contacted these airports to get specific details needed for this study that had not previously been collected.

D. Analysis & Reporting

Using the data collected from each airport, an analysis was performed that incorporated three alternatives for securing exit lanes: an open lane with guard, an automated exit lane, and a technology-enhanced security force. **Figure 5** describes the alternatives analyzed.

Figure 5: Study Alternatives for Analysis

Open Lane With Guard*

- Solution involving use of security personnel and no technology; likely not capable of meeting Class 2 security capabilities
- Staffing could be provided by TSA and/or the airport (via contracted security personnel)
- Staffing costs estimated based on airport-provided data or calculation using the Cost Benefit Tool

Automated Exit Lane Alternative*

- Fully-automated technology solutions that do not require staffing after implementation
- Decision Aid Tool identifies any automated solution compatible with each exit lane's physical characteristics and desired Class 2 capabilities; study team selects optimally compatible option
- For exit lanes of interest, cost benefit analysis projects initial investment, breakeven point, and lifestyle maintenance costs

Technology-Enhanced Security Force Alternative

- Pairs technology with some staffing to enhance security and/or reduce FTE needed to secure the exit lane
- Meets minimum requirements, but likely not compatible with all desired Class 2 security capabilities
- For exit lanes of interest, cost benefit analysis projects initial investment, breakeven point, and lifecycle maintenance costs; recurring cost still includes some staffing FTE

* - Depending on the airport and exit lane, either Open Lane With Guard or Technology-Enhanced Security Force could be the baseline alternative that currently exists

For each alternative, the provided security capabilities were discussed, and the CBT was used to estimate costs to TSA and the airport over a 10-year life cycle. This information was compiled into a two-page airport snapshot summarizing the results for each airport included in the study (See Appendix E: Airport Snapshots).

Each snapshot provided information on the following:

- Airport and its exit lanes (including the ones of interest specified for the study)
- Desired Class 2 capabilities selected
- Notes and assumptions for each alternative
- Photos of an existing lane
- Artist rendition images showing technology alternatives superimposed in one of the airport's exit lanes
- Results from the cost analysis for both TSA and the airport (See Appendix E: Airport Snapshots)

Cost metrics included the following:

- **Staffing Costs** – Annual labor costs for both TSA and the airport (if applicable) to secure the exit lane as an open lane with guard solution.[7]

- **Total Equipment Cost** – The unit equipment cost, multiplied by the total number of technology units (automated lanes or Smart One-Way Door (SOWD) pairs) to be implemented. The number of technology units for each exit lane location were determined from the width of the location, factoring in any physical obstructions and ensuring enough units were in place to accommodate surge passenger volume during peak periods of the day. The total number of technology units was then determined as the aggregate sum across all of that airport's exit lane locations of interest.

- **Implementation Cost** – All other costs (besides equipment cost) to implement the technology, including vendor installation of technology units, as well as non-vendor related infrastructure modifications and integration work that may be needed (for example, disposal of existing technology, electrical wiring, storefront design/implementation, sprinkler modifications, integration into the camera/access control system). For the automated alternative, it is assumed that staffing will still be needed for a 30-day period. In that case, labor is also included in the implementation costs.

- **10-Year Lifecycle Maintenance Cost** – Cumulative cost over 10 years associated with maintaining the technology units for each alternative; includes costs associated with annual maintenance, technology upgrades, and end-of-life disposal.

- **Payback Period** – The duration of time in months to recover the total cost associated with acquiring technology (equipment cost plus implementation cost). This is the length of time a potential exit lane technology investment is estimated to reach a breakeven point.

- **Cumulative Savings** – The cumulative amount of savings over a 10-year period that can be expected when staffing costs are replaced by the lifecycle costs of a particular technology.

Following the site visits and airport data compilation, an analysis that compared the data summarized in the airport snapshots was performed. Observations and considerations for future technology implementation were provided for each airport. The airport results were then grouped into investment models, based on current estimated staffing costs. The concept of investment models provided a way of normalizing results across the studied airports, representing the cost-benefit data to allow TSA to see potential future outcomes of ELT investment decisions for the diverse range of airports nationwide.

[7] The analysis was developed and submitted prior to final determination in law regarding Pay Equity. Pay Equity is not taken into account for the staffing costs listed in the report, but the model is routinely updated, and Pay Equity costs will be reflected. Pay Equity increased personnel costs actually improve cost benefit of migrating to use of exit lane security technology.

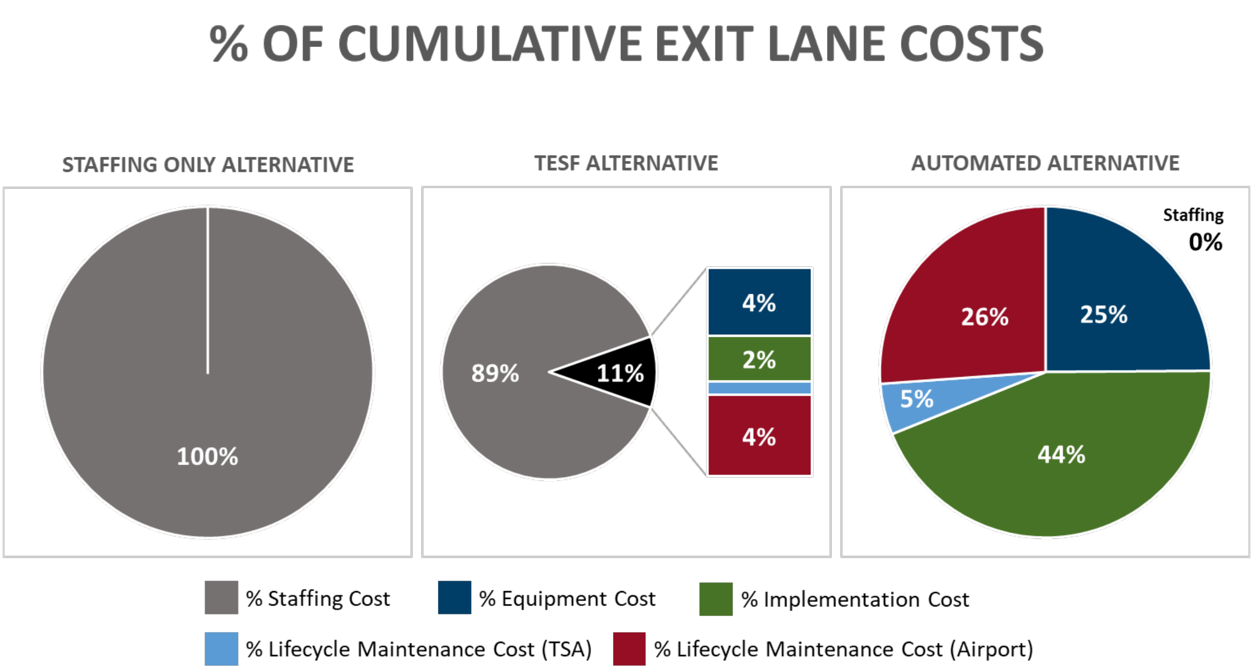
E. Alternatives Analysis

Using the data collected from each airport, an alternatives analysis was performed to examine the contribution of technology acquisition elements to overall exit lane costs. This included the potential payback periods associated with each alternative, and the projected yearly cost savings that the technology alternatives could produce when compared to staffing only. Based on the cost-benefit results from the Alternatives Analysis, and detailed in Appendix E, it is feasible to replace TSOs with technological solutions to secure exit lanes. The results show that TSA can achieve substantial cost savings by shifting from staffed to technology-based exit lane access control solutions. Key findings and conclusions are summarized Section V. Findings for Exit Lane Alternatives.

Percentage of Lifecycle Exit Lane Costs

Exit lane technologies tend to have a 10-year lifecycle. Thus, when examining the cost associated with transitioning from staffing only to a technology-based alternative, understanding the contribution of different lifecycle cost components is important. To do this, the 10-year cumulative lifecycle cost data computed for each of the eight airports in the study were averaged, and the percentage cost contribution of different components was calculated. **Figure 6** presents the percentage of lifecycle exit lane costs in a series of pie charts showing the breakdown for each of the *Staffing Only Alternative*, *Technology-Enhanced Security Force (TESF) Alternative,* and *Automated Alternative*.

Figure 6: Percentage Breakdown of Cumulative Lifecycle Exit Lane Costs



For the Staffing Only alternative, the only cost component is due to staffing.[8] As compared to the TESF alternative, staffing costs reduce to 89 percent of the total lifecycle cost. This suggests that while technology options in the TESF category can certainly improve security, staffing will continue to be the dominant lifecycle cost component. The technology costs that do exist for the TESF alternative will primarily be driven by the purchase cost of the equipment, coupled with the lifecycle maintenance of that equipment.

The cost breakdown changes substantially for the Automated alternative because staffing costs drop off completely. A fully automated exit lane does not require staffing past an initial burn-in period.[9] Of the remaining lifecycle costs, implementation costs are the largest component (44 percent), since there can be significant non-equipment costs related to infrastructure upgrades, electrical work, storefront design, and network integration to properly implement multilayer portal automated technologies. In addition to these implementation costs, TSA would also be responsible for the equipment purchase (25 percent) and maintenance costs for the first 2 years (5 percent).

Overall, TSA would bear under 75 percent of the lifecycle cost for the Automated alternative. Since those costs all occur in the initial 2 years, the remaining 8 years of the lifecycle could bring compounding cost savings, compared to the Staffing Only alternative. These findings support the idea that 2-year technology investments made at various airports could result in significant exit lane staffing cost avoidance to TSA, with the potential to reallocate those members of the screening workforce to security checkpoints.

Investment Models

The alternatives analysis also included the cost estimates from the eight Exit Lane Internal Study airports. But instead of examining the results of each airport directly, the study airports were grouped into the following three investment models based on estimated annual staffing costs for exit lanes. Grouping the eight study airports into these investment models, allowed TSA to apply the normalized findings beyond the airports that participated in this study.

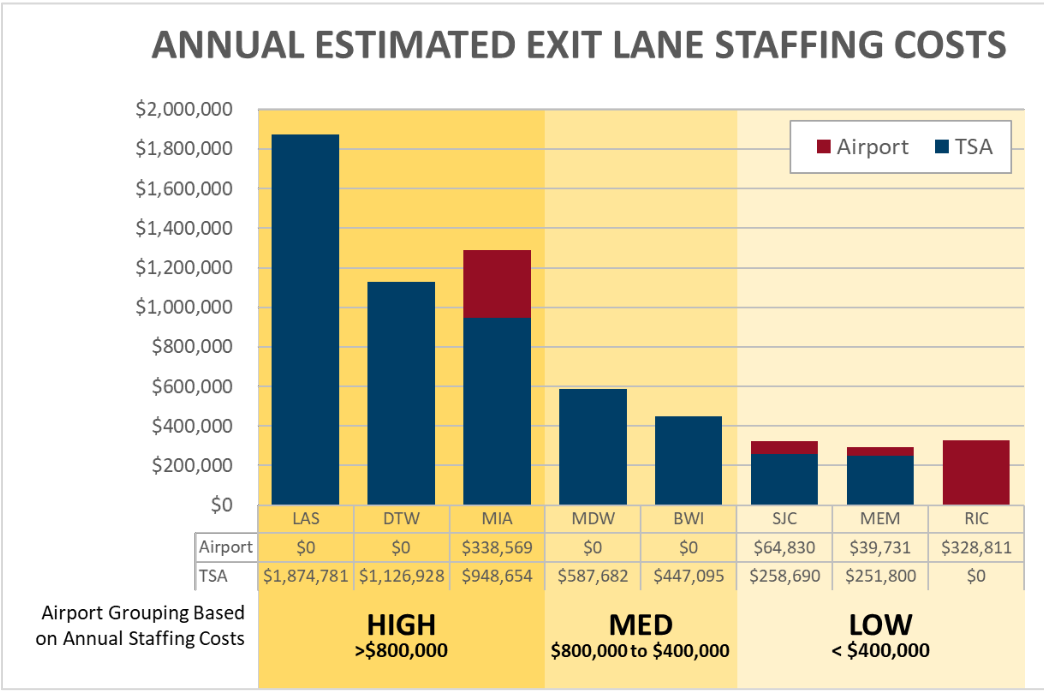
- HIGH – Airports with TSA staffing costs greater than $800,000 per year;
- MED – Airports with TSA staffing costs between $400,000 and $800,000 per year; and
- LOW – Airports with TSA staffing costs less than $400,000 per year

Figure 7 shows how the eight study airports were grouped into these investment models. In this stacked bar chart, TSA costs are represented in blue and the airport costs are shown in red. The airports are ordered from left to right by decreasing estimated annual staffing costs to TSA. For example, for the five exit lane locations included in this study for Harry Reid International Airport, TSA annually pays an estimated $1,874,781 to cover exit lane staffing and the airport

[8] Staffing costs do not account for Pay Equity. See Footnote 3 (Page 8).
[9] Burn-in is a period during implementation of an exit lane technology. After the equipment has been installed, integrated, and testing has shown that it is performing as expected, burn-in is a probationary observation period where some staffing remains, even though the automated technology is fully managing access control of the exit lane. Based on discussions with vendors, most recommend a 30-day burn-in period. After burn-in, there would be no exit lane staffing costs.

pays nothing.[10] At Miami International Airport, it is a shared cost for the four locations included in this study. TSA pays an estimated $948,654 annually, for TSOs and the airport pays an additional $338,569 for contracted security guards.[11] On the other hand, TSA has no annual exit lane staffing costs at RIC. The airport authority bears the entire cost of staffing their one exit lane location with contracted security guards and local police officers.

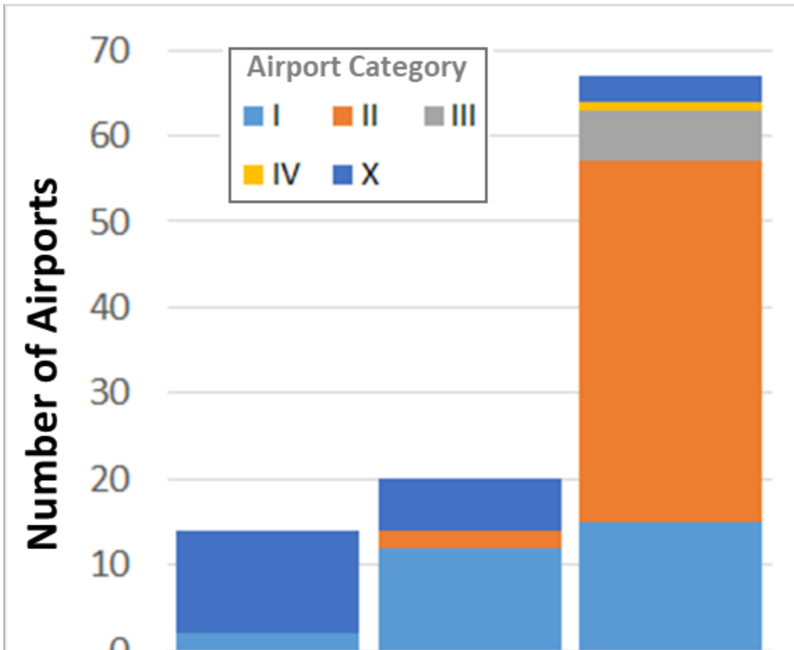
Figure 7: Study Airports Grouped into Investment Models



[10] Staffing costs do not account for Pay Equity. See Footnote 3.
[11] Additional data received from MIA indicates that future contracted security staffing costs could be even higher. While a locality-adjusted pay rate of about $30/hour was used in this study, MIA reported that a new contract that will go into effect in August 2023 may increase the pay rate to approximately $35/hour.

To ensure the validity of this approach, the exit lane FTE for the other 101 airports considered during the airport selection portion of this study were converted to annual exit lane staffing costs, and those airports were placed in the same investment model groupings (See **Figure 8**).

Figure 8: Investment Model Groupings for Additional Airports



	HIGH	MED	LOW
X	12	6	3
IV			1
III			6
II		2	42
I	2	12	15

The data indicates that 13 percent (14 of 101) fit into the HIGH group, 18 percent (20 of 101) fit into the MED group, and 61 percent (67 of 101) fit into the LOW group. Examining the breakdown by airport category, revealed the following additional observations:

- **All seven CAT III and IV airports fell into the LOW group** – This result is likely because of the smaller number of exit lanes and staffing used to secure airports in these categories, in comparison to larger airports.

- **Most CAT II airports were in the LOW group** – 42 of the 44 CAT II airports could be placed into the LOW group; the other two airports were in the MED group. These findings flow similarly with the observations for the CAT III and IV airports and suggests that most small-to-medium sized airports nationwide will likely fit in the LOW group.

- **CAT X and I airports were in HIGH, MED, and LOW** – The CAT X airports made up 12 of the 14 airports in HIGH, while the CAT I airports made up 12 of the 20 airports in MED, and 15 of the 67 airports in LOW. Out of necessity to handle higher passenger volumes, airports in these categories tend to have wider diversity in terms of number of staffed exit lane locations, physical characteristics of these locations, and level of staffing utilized. Consequently, CAT X and I airports may fit into any of the investment models, depending on the specific combination of these factors.

As the CAT X and I airports included in the Internal Study fell into the HIGH, MED, and LOW staffing costs TSA was able to group the eight study airports into these investment models and apply the normalized findings beyond the airports that participated in this study.

These results validated the decision to use the results for the CAT X and I airports selected for this study, group the results by investment model, and perform the alternatives analysis using cost estimate data that are averages for these groupings. This approach provides a way of seeing the potential cost benefit of transitioning to automated or TESF alternatives that can also be extended to the general population of airports nationwide.

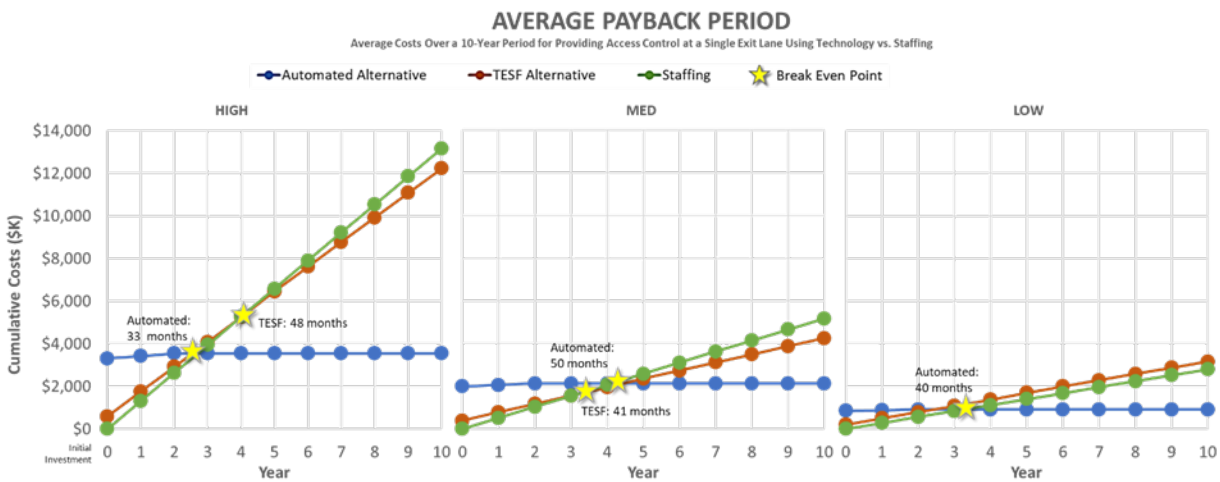
The following sections present the results of the alternatives analysis showing the three alternatives for exit lane security: Open Lane with Guard [or Staffing Only], Automated, and TESF−using the HIGH, MED, and LOW investment models.

Payback Period

The alternatives analysis next looked at payback period, the duration of time in months for TSA to recover its investment in technology.[12] **Figure 9** presents a series of plots showing the payback periods for each alternative and investment model. Each plot shows the average costs incurred (in thousands of dollars) in each year of the 10-year lifecycle, as related to securing a single exit lane location using technology-based alternatives or staffing, for each of the three investment models. The point at which the cumulative cost of staffing begins to surpass the cumulative cost of a technology-based alternative is called the breakeven point, and it is depicted with a yellow star on the plot. The duration of time associated with reaching that breakeven point, or the payback period, is also listed next to the yellow star.

[12] Staffing costs do not account for Pay Equity. See Footnote 3 (Page 8).

Figure 9: Payback Period for Each Investment Model and Exit Lane Security Alternative



Findings from the payback period plots include:

- **Both exit lane staffing and equipment costs generally decrease when moving from HIGH, to MED, to LOW investment models** – This is primarily driven by corresponding reductions in the number of exit lane locations, when moving from larger airports with more passenger deplanements to smaller airports that service less flights per day. As the number of exit lanes decreases, fewer TSOs are required, and smaller technology investments are generally needed to meet exit lane access control needs.

- **Across all cases, the payback period is generally 3-4 years** – Regardless of the investment model, the Automated alternative always reaches the breakeven point within 50 months (just over four years). For the HIGH and MED models, the TESF alternative breaks even in 48 and 41 months respectively.

- **Avoid implementing TESF at smaller airports** – Because staffing costs may be reduced, but not eliminated with the TESF alternative, it is not possible to breakeven for the LOW investment model (corresponds to smaller-sized airports). As a result, there would be no return on investment. While this scenario may be unavoidable in some instances, (for example, if there is a glaring need to enhance exit lane security), careful balancing of security objectives with up-front TSA technology investments should be considered.

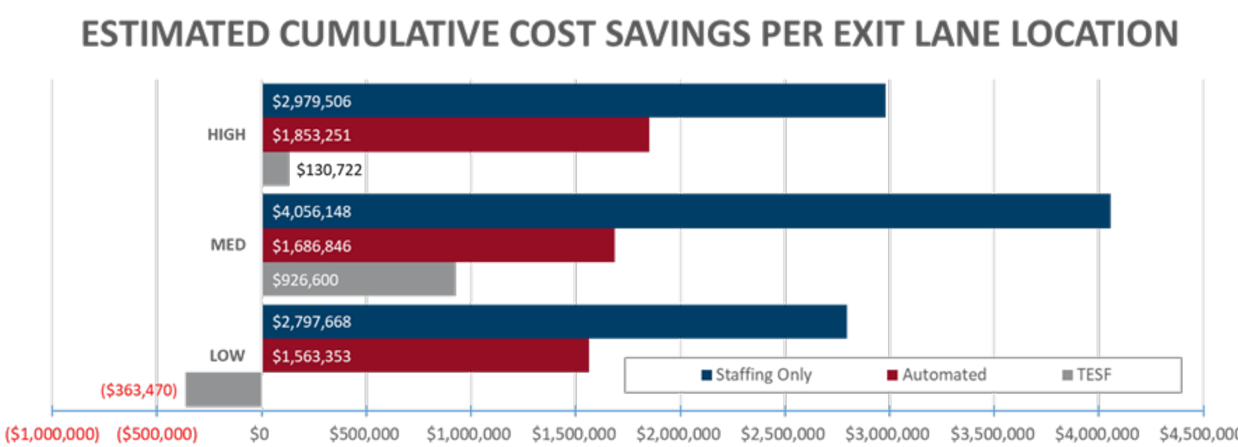
- **Cost savings may be significant when automated technology is implemented at larger airports** – As represented in the HIGH investment model case, larger airports typically have the greatest number of exit lane locations, and as a result, the highest exit lane staffing costs. While the up-front cost is higher when automated technology is implemented at these airports, the payback is fastest (33 months). Since automated technology can secure the exit lane with no staff, the avoidance of staffing costs to TSA can compound quickly and the return on investment can be rapid. Under certain conditions, the potential cost benefit to TSA over the 10-year lifecycle could be a total savings of as much as $1.8 million per exit lane.

Lifecycle Cost Savings Per Exit Lane Location

The alternatives analysis next looked at the lifecycle cost savings to TSA per exit lane. This metric was calculated by taking the cumulative cost savings to TSA over the 10-year lifecycle for each of the study airports, dividing that total by the number of exit lane locations for that airport, and averaging the savings values across the airports in each investment model.[13]

Figure 10 presents the results. The blue bars show the per-lane lifecycle TSA exit lane staffing costs. The red bars present the estimated per-lane savings over the lifecycle associated with the Automated alternative. The grey bars display the per-lane savings for the TESF alternative. For example, for the HIGH model and Automated alternative, TSA is estimated to save more than $1.8 million per exit lane location over the 10-year lifecycle, compared to the cumulative staffing costs that would be paid out over that same 10-year period.

Figure 10: Cumulative Per-lane Cost Savings for Technology Alternatives



Findings from the analysis of lifecycle cost savings per exit lane location include:

- **No per-lane cost savings for TESF alternative and LOW model** – TSA would pay approximately $363,000 more over the 10-year lifecycle than if staffing only were used. Similar to the result discussed for the payback period (see Section IV. B. iii.), this is due to TSA bearing the cost of procuring and maintaining SOWD technology with no reduction in exit lane staffing.

- **Lifecycle staffing costs may be highest for the MED model** – As previously mentioned, both CAT X and I airports may fall into this grouping, where there can be

[13] Staffing costs do not account for Pay Equity. See Footnote 3 (Page 8).

wide variation in the number of staffed exit lane locations, exit lane physical characteristics, and level of staffing utilized. The higher lifecycle costs for the MED model are most likely being driven by MDW, where per-lane lifecycle staffing costs were estimated to be more than $5.8 million (one exit lane staffed 40 hours per 24-hour day) versus just over $2.2 million at BWI (per-lane average of 15 TSO hours per 24-hour day).

- **Lifecycle cost savings will occur with Automated alternative** – Regardless of the investment model, lifecycle cost savings can be realized with the Automated alternative. This is primarily because staffing would not be required with automated technology.

- **Largest per-lane lifecycle cost savings for the TESF alternative occurs with the MED model** – The results indicate that per-lane lifecycle cost savings of $926,000 can be achieved when the TESF alternative is used with the MED investment model. This alternative might be especially appealing at airports like MDW, where implementing TESF technology could reduce current staffing levels from two TSOs per lane to one per lane. In these instances, the compounding savings in staffing costs can offset the acquisition and initial maintenance costs of the technology over the 10-year lifecycle.

Per-lane TSA Investment Metric

The objective of the final part of the alternatives analysis was to create a per-lane investment metric.[14] This involved estimating the average per-lane TSA initial investment for the technology alternatives and presenting the results in comparison to the per-lane staffing costs over the same two-year period[15]. To arrive at these results, the total initial investment value for each of the study airports was divided by the number of exit lane locations for that airport (to get an investment cost per exit lane location). Then, those per-lane values were averaged for each investment model. The resultant metric is intended to provide a way of projecting the potential per-lane TSA investment needed, as applied to airports that were not directly included in this study.

Figure 11 shows projected per-lane TSA initial investments. The blue bars show the comparable TSA exit lane staffing costs over the same time period that the initial investment would be made (that is, years one and two of the lifecycle). The red bars present the TSA initial investment associated with the Automated alternative. The grey bars show the TSA initial investment for the TESF alternative.

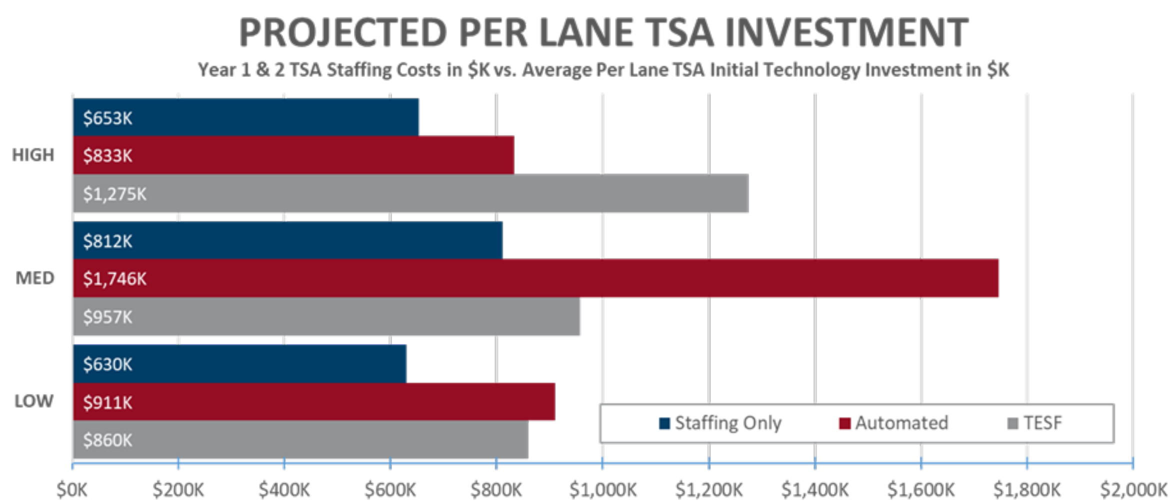
The study team applied this investment metric to Boston Logan International Airport (BOS) to show how it could be applied to airports not directly included in the study. According to the data, BOS used 70.6 FTE to secure five exit lane locations in FY 2022. As a result, estimated

[14] Staffing costs do not account for Pay Equity. See Footnote 3.
[15] This analysis assumes that TSA makes the initial investment in technology, bearing the procurement and all implementation costs. TSA would also cover annual maintenance for the first 2 years of the 10-year lifecycle. The airport would then bear maintenance costs for the remainder of the lifecycle (years 3 to 10), which would include annual equipment maintenance, a 1-time major equipment upgrade (in year 4 or 5), and disposal of the equipment at the end of the lifecycle (year 10).

annual staffing costs are about $2.9 million, or about $580,000 per exit lane location. That puts BOS squarely within the HIGH investment model case.

If TSA were considering investing in technology at BOS, **Figure 11** could be used to help estimate the potential TSA investment needed for each technology alternative. Using the HIGH investment model, TSA would need to invest roughly $4.2 million (or $833,000/location multiplied by five exit lane locations) to transition from using TSOs to automated technology. For the TESF alternative, an investment of roughly $6.4 million would be needed.

Figure 11: Projected Per-lane TSA Initial Investments



V. Findings for Exit Lane Alternatives

Based on the cost-benefit results from the Alternatives Analysis, and detailed in Appendix E, it is feasible to replace TSOs with technological solutions to secure exit lanes. The results show that TSA can achieve substantial cost savings by shifting from staffed to technology-based exit lane access control solutions.[16] Key findings and conclusions are summarized in the table below:

Summary of Findings for Exit Lane Alternatives Analysis		
#	Finding	Discussion
1	**TSA can achieve substantial cost benefit with the Automated alternative**	Because a fully automated exit lane access control solution does not require staffing past an initial burn-in period, staffing costs drop off completely. As a result, lifecycle cost savings can be realized in all investment models, with potential savings to TSA of as much as $1.8 million per exit lane location, over staffing only. The Automated alternative also provides the quickest return on investment, with a payback period of 33 months for the HIGH investment model.
2	**Realizing cost savings with the TESF alternative requires reducing staffing**	Estimated lifecycle cost savings of as much as $926,000 per exit lane location can be achieved with the TESF alternative; however, those savings are only possible if the level of staffing can be reduced. An example of this is an airport like MDW. Implementing TESF technology could reduce current staffing levels from two TSOs per shift to one TSO at their one exit lane location. Despite an initial TSA investment of $443,000, breakeven would be reached in 21 months (i.e., payback period), and a cumulative savings of more than $2.1 million over the 10-year lifecycle would be possible. This cost benefit is primarily being driven by exit lane staffing reductions.

[16] Staffing costs do not account for Pay Equity. See Footnote 3.

Summary of Findings for Exit Lane Alternatives Analysis		
#	Finding	Discussion
3	**The HIGH, MED, and LOW investment models were an appropriate way of examining cost benefit for all airports nationwide**	An analysis of estimated annual staffing costs for the 8 study airports and 101 additional airports (examined as part of the airport selection process but not directly included in the study), was performed. The results indicate that most CAT II, III, and IV airports will fit into the LOW investment model. CAT X and I airports will fall into the MED and HIGH models, with the combination of number of staffed exit lane locations, physical characteristics of these locations, and level of staffing utilized, determining the most applicable model. It was also noted that, because exit lane staffing and equipment costs generally decrease when moving from HIGH, to MED, to LOW investment models, there will be a corresponding reduction in the level of TSA investment needed.
4	**Implementing TESF at smaller airports should generally be avoided**	Because staffing costs may be reduced, but not completely eliminated with the TESF alternative; reaching a breakeven for the LOW investment model (corresponds to smaller sized airports) would not be possible and there would be no return on investment. While this scenario may be unavoidable (for example, if there is a glaring need to enhance exit lane security), careful balancing of security objectives with up-front TSA technology investments should be considered.
5	**A payback period of 3-4 years can generally be expected**	Regardless of the investment model, the Automated alternative always reaches breakeven within 50 months (just over four years). For the HIGH and MED models, the TESF alternative breaks even in 48 and 41 months respectively. As previously mentioned, no return on investment occurs when TESF is used with the LOW investment model.
6	**Implementation costs should be more accurately determined before a TSA investment program makes technology investments at specific airports**	The airport visits highlighted the diverse nature of exit lane locations and the need for careful consideration of several factors that can influence implementation. For example, the MDW exit lane is effectively a sky bridge spanning a busy street, and the MEM Concourse B exit lane has varying widths along with a down escalator midway down its length. In both cases, these unique characteristics necessitate careful consideration of technology placement and installation. LAS and SJC, two airports that have already implemented Automated technology,

Summary of Findings for Exit Lane Alternatives Analysis		
#	Finding	Discussion
		also shared that they experienced higher than originally expected implementation costs. This included the need for additional power runs, storefront, structural support to handle the weight of the units, communication and power lines to facilitate infrastructure integration, installation of Closed Circuit Television cameras, new flooring, permitting costs, installation of a temporary wall during the construction, and addressing sprinkler/fire safety requirements. These experiences demonstrate the need for detailed surveys of each airport before finalizing technology investment decisions.
7	**An exit lanes technology investment program must work closely with candidate airports**	Several of the study airports shared that they are planning terminal modernization projects in the coming years. That is why not all their exit lane locations may have been included in the study. This underscores the need for close collaboration between any TSA exit lanes program and airport stakeholders to maximize TSA investments around the construction projects airport authorities are already planning.

As the cost-benefit analysis demonstrates, it is feasible to secure exit lanes with a variety of technological solutions. If such a strategy were decided, TSA can analyze and select the most appropriate approach to accomplish this given the necessary investment and unique airport environment. However, any such approach will likely require a large initial investment and would be a multi-year endeavor. As established by the cost-benefit analysis, the initial investment can be amortized reasonably quick. The payback period is generally three to four years, regardless of the investment model.

TSA believes additional effort will be needed to refine the estimated technology implementation costs from this study. While the level of information gathered for this study was more than sufficient for showing cost benefit, these estimates are not as detailed as what would be needed for specific investment purposes. If a TSA exit lane investment program is pursued, detailed surveys of each exit lane location should be conducted to understand how airport-specific characteristics influence implementation cost. Such a program should also work closely with the airport authority to ensure that TSA investments are maximized and do not conflict with terminal modernization projects that are already planned.

Appendix A: Abbreviations and Airport Designations

Acronyms

CBT	Cost Benefit Tool
COTS	Commercial Off-The-Shelf
ELT	Exit Lane Technology
FIS	Federal Inspection Station
FTE	Full-Time Equivalents
FY	Fiscal Year
N/A	Not Applicable
PRC	Portfolio Review Committee
RAP	Resource Allocation Plan
SCP	Security Checkpoint
SOTR	State-of-Tech Report
SOWD	Smart One-Way Door
TSA	Transportation Security Administration
TSO	Transportation Security Officer
TESF	Technology-Enhanced Security Force

Airport Designations

BOS	Boston-Logan International Airport (Boston, MA)
BWI	Baltimore/Washington International Thurgood Marshall Airport (Baltimore, MD)
DTW	Detroit Metropolitan Wayne County Airport (Detroit, MI)
LAS	Harry Reid International Airport (Las Vegas, NV)
MDW	Chicago Midway International Airport (Chicago, IL)
MEM	Memphis International Airport (Memphis, TN)
MIA	Miami International Airport (Miami, FL)
RIC	Richard E. Byrd International Airport (Richmond, VA)
SJC	Norman Y. Mineta San José International Airport (San Jose, CA)
SLC	Salt Lake City International Airport (Salt Lake City, UT)

Appendix B: Acknowledgments and References

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From Richard E. Byrd International Airport, thank you Andrew Burton and Scott Walker.

From Norman Y. Mineta San José International Airport, thank you James Rumble.

References

1. FY 2019 passenger enplanement data: last accessed on 11 January 2023 from: https://www.faa.gov/airports/planning_capacity/passenger_allcargo_stats/passenger/
2. AOS-22-0425 State-of-Tech Report: Exit Lanes, dated 07 April 2022

Appendix C: Key Definitions

Exit Lanes: Areas within an airport that provide transitions between the sterile areas where individuals have undergone security screening and public areas where they have not. When technology is implemented, one exit lane location could have several exit lanes that work independently to guide the flow of arriving passengers at the air terminal.

Transportation Security Officer (TSO): Provides security screening of all passengers and baggage in airports to ensure that prohibited items are not transported on board aircraft. A TSO is responsible for performing screening functions, operating security equipment such as X-Ray machines and advanced imaging technology; and in some cases, perform access control duties at exit lanes.

Sterile Areas: An area inside an airport that provides passengers access to boarding aircraft, where the access generally is controlled by TSA as detailed in 49 CFR part 1540.5, by an aircraft operator under 49 CFR part 1544, or a foreign air carrier under 49 CFR part 1546, through the screening of persons and property.

Public Area: Sidewalks, concourses, corridors, lobbies, passageways, restrooms, elevators, escalators, and other similar space made available by the airport from time to time for use by passengers, airport and airline employees, and other members of the public.

CAT X: Represent the nation's largest and busiest airports as measured by the volume of passenger traffic.

CAT I: Represent the second highest tier of airport annual enplanements.

Exit Lane Technology Toolbox: An interactive, web-based platform containing decision support tools and resources for airports to leverage for planning purposes.

High Staffing Cost (HIGH): Airports with TSA staffing costs greater than $800,000 per year.

Medium Staffing Cost (MED): Airports with TSA staffing costs between $400,000 and $800,000 per year.

Low Staffing Cost (LOW): Airports with TSA staffing costs less than $400,000 per year.

Appendix D: Solution Categories for Exit Lane Access Control

Open Lane with Guard

Most airports across the country are using manned exit lanes, including approximately 228 exit lanes at roughly 106 commercial airports where TSA is providing security officers. Maintaining these manned exit lanes is costly due to the required staffing to ensure continuous monitoring. A recent TSA survey of 114 small, medium, and large airports indicated a range of exit lane staffing approaches, including by TSA, airport authorities, airlines, city employees, local law enforcement officers, and paid contractors. Providing such coverage requires that millions of dollars are spent each year towards salary alone.

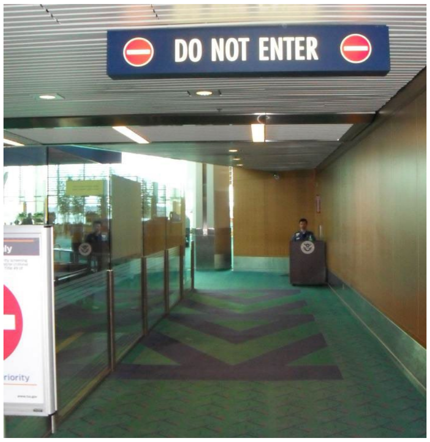

Figure 12: Open Lane with Guard

Staffed exit lanes also carry risks associated with human surveillance error, such as inattentiveness and fatigue. Unless the security officer possesses law enforcement credentials, they may not be able to control an individual attempting a breach. As a result, an increasing number of U.S. airports have been investigating and even implementing technology-based solutions with automated capabilities that achieve the same or better security than a manned exit lane.

Interlocking Doors

Solutions considered under this category have two solid closures that extend from floor to ceiling, one at each end of the exit lane. They operate in a coordinated fashion, where both cannot simultaneously be opened. Hence, technologies in this category do not provide a clear path through the transition zone from the public to the sterile area. One common product uses two solid, floor-to-ceiling, symmetric doors operating in an interlocking fashion. These doors are, themselves, the sterile and public thresholds, and the enclosure between the doors serves as the transition zone.

Figure 13: Interlocking Doors

Most solutions use either sliding or revolving doors to seal off the sterile and public areas; however, some manufacturers may include the additional option of a half-height swing gate as an additional barrier to wrong-way motion. Products in the interlocking doors category are typically turnkey, and they have sensors and cameras capable of detecting individuals and objects anywhere inside the transition zone. In comparison to the other alternatives, interlocking doors are among the best at preventing a breach; however, their interlocking behavior can slow passenger flow, especially during heavy traffic periods.

Multilayer Portal

This alternative includes turnkey solutions that couple multiple detection layers with at least two solid closures, extending from floor to ceiling. In most cases, several units are installed side-by-side, creating an independent, multi-lane corridor. The doors and sensors of each lane operate in concert; they may independently but simultaneously open to allow passenger exit, while still preventing a breach. Common features include enclosed security portals featuring two solid doors and sensors inside and/or outside the portal that trigger warnings to passengers moving the wrong way, alerts to authorities, and control door operation.

Sensor types and quantities vary among manufacturers and models, as do their programmable behavior and logic features; however, many systems utilize passive microwave sensors, infrared motion detection sensors, or cameras with motion detection video analytics. Additional physical features, such as half-height swing gates and divider railings, are also common. Finally, multilayer portals may feature different operating modes, including ones that allow it to function as a symmetrical interlocking set of doors.

Figure 14: Multilayer Portal

Multilayer portal exit lanes are likely to be sufficient for preventing unintentional entry by individuals, provided that the sensors give enough lead time for the sterile side barrier to close. Solutions where the sterile side barrier is normally closed and only opens when an individual approaches from the sterile side, will provide more security than those that do not. Regardless of how the sterile side operates, these solutions can accommodate high volume passenger flows, except when operating in an interlocking mode or during breach prevention procedures when access to the transition zone from the sterile side is blocked.

Custom Multilayer

A custom multilayer solution integrates specially selected Commercial Off the Shelf (COTS) components into the exit lane to form a custom system. Solutions in this category can take on a vast number of designs. While this versatility offers the benefit of being able to tailor the solution to the unique physical configuration of an exit lane without significant construction or infrastructure demands, the drawback is that design and engineering by a third-party systems integrator may be needed. Regardless of the specific design, most solutions of this type provide three layers of protection – one of which serves as a physical barrier, while the other two provide some combination of detection, warning, or alerting capabilities.

Figure 15: Custom Multilayer

Solutions in this category are typically well-suited for unique exit lane shapes and physical characteristics such as turns, ramps, escalators, or narrow hallways. For example, Harry Reid International Airport uses custom multilayer solutions at certain escalators that are also exit lanes. Also, because each layer consists of COTS components, a custom multilayer system could be built up in stages or added to existing exit lane security solutions.

Technology Enhanced Security Force (TESF)

This category includes solutions that enhance the effectiveness of the open lane with guard solution by adding selected COTS sensors and components. Solutions in this category consist of a single technology layer. There are three main types:

<u>Doors/Turnstiles/Barriers</u>

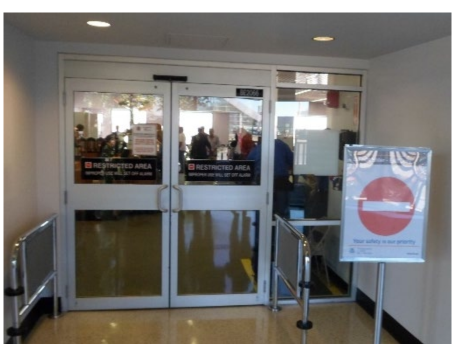
Figure 16: Sensor Activated Doors

Sensor-activated technology that opens for passengers exiting the sterile area and closes after they pass through. This category includes smart one-way doors (SOWD). Because these solutions are single layer, they have a small footprint and require about the same level of infrastructure modification as a normal door. In comparison to alternatives that use multiple physical layers, doors and turnstiles are less expensive to implement. Additionally, for exit lanes that are very short, it may be impossible to implement a transition zone that provides enough lead time for an interlocking door or a multilayer portal system to be effective. SOWD and other barriers/turnstiles offer a physical presence for those situations that may deter or at least slow the progression of a breach attempt.

Video Analytics

Another approach to enhancing the effectiveness of a manned exit lane is to incorporate video analytics. This would include on-camera or centrally monitored software that creates a soft barrier within a camera's field of view that could include virtual tripwires and/or wrong-way motion detection. Depending on implementation, virtual barriers may be created in either the warning or transition zones. Because security cameras today often have a low profile and are inconspicuous, they do not serve as a visible physical deterrent, in comparison to physical barriers. Some video analytics vendors require the use of particular cameras, while others offer the option of using existing cameras with additional hardware.

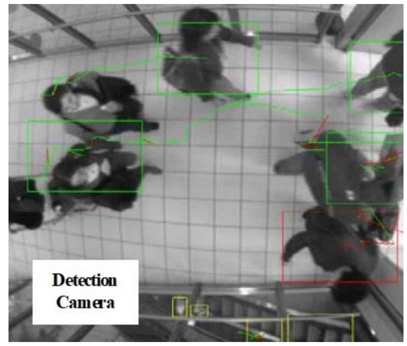

Figure 17: Video Analytics Detection Camera

The primary advantages of a video analytics approach are the unrestricted passenger flow, low acquisition and maintenance costs, and applicability to virtually any lane with minimal changes to the existing infrastructure. Additionally, many airports already use video analytics in other access control or security situations within the airport. As a result, video analytics have become an attractive technology enhancement for manned exit lanes in many airports.

Other Sensors

Figure 18: Example of Virtual Tripwire

Many of the turnkey solutions, as well as a custom multilayer solution, use COTS sensors as part of their overall system; however, they can also be used in a standalone fashion to enhance the effectiveness of manned exit lanes. Sensors can be placed in the warning or transition zones where they serve as virtual tripwires and detect wrong-way motion. Common sensor types include microwave and passive infrared motion detectors, as well as laser scanners.