File #: 2024-1124, **File Type:** Motion / Motion Response **Agenda Number:** 38.

REGULAR BOARD MEETING
FEBRUARY 27, 2025

SUBJECT: WEAPONS DETECTION SYSTEMS PILOT FINDINGS

ACTION: RECEIVE AND FILE

RECOMMENDATION

RECEIVE AND FILE the Weapons Detection System Proof-of-Concept Pilot Findings.

ISSUE

At its July 2024 meeting, the Board approved a proof-of-concept pilot of two weapons detection technologies - millimeter-wave radar detection and dual-lane detection systems - at two transit hubs on the rail system to deter weapons off Metro's transit system. Over the past four months, multiple vendors provided equipment at no cost to the agency to demonstrate how this technology could work on the Metro system. This report provides the findings of these proof-of-concept pilots.

BACKGROUND

At its April 2024 meeting, Directors Barger, Krekorian, Hahn, Najarian, Butts, and Solis authored Motion 34.1 (Attachment A), directing staff to perform an assessment of several security initiatives, including recommendations related to weapons detection.
Metro's Customer Code of Conduct prohibits "weapons or instruments intended for use as a weapon" (6-05-020.S), and through piloting advanced detection technology, Metro aimed to evaluate its effectiveness in identifying potential threats, supporting enforcement efforts, and enhancing overall security.

At its July 2024 meeting, the Board authorized the piloting of two weapons detection systems - millimeter wave technology and a dual-lane system- over a 30-day period at two Metro stations. At the time, the focus was on evaluating walkthrough screening technologies to detect concealed weapons efficiently while minimizing disruption to passenger flow.

As part of this process, Metro staff also researched lessons learned from peer transit agencies to identify best practices and potential challenges. Within the last year, the New York Metropolitan Transit Authority (NY MTA), Chicago Transit Authority (CTA), and Southeast Pennsylvania Transit Authority (SEPTA) all conducted various weapons detection pilots. NY MTA's pilot was for 30 days, and SEPTA's was for 12 months. CTA's one-year pilot is still underway. The NY MTA and SEPTA decided not to proceed with weapons detection after their pilots due to varying effectiveness and scalability.

DISCUSSION

Before launching a full-scale weapons detection pilot, it was essential to conduct a proof-of-concept pilot to determine the most effective approach. Variations in technology systems, operational environments, and insights from peer transit agencies allowed Metro to evaluate different solutions in a controlled setting. This initial phase helped assess feasibility, effectiveness, and integration with existing security measures, ensuring that future implementation would align with best practices and Metro's broader safety strategy.

Staff initiated the proof-of-concept piloting of two weapons detection systems at rail stations, millimeter wave technology, and a dual-lane system. However, as staff advanced these efforts, significant technical and operational challenges emerged. The millimeter wave system required infrastructure modifications and operational adjustments beyond what was initially anticipated, leading to the need for extensive integration efforts before broader testing and implementation could proceed. Similarly, the dual-lane system presented potential constraints as well.

Given these challenges, staff focused on scalable and readily deployable solutions employing advanced technologies, such as artificial intelligence (AI) and video analytics, to detect a wide range of weapons, including improved detection of concealed weapons and brandished firearms. The goal of these features is to enable non-invasive detection with minimal disruption to travel, even after accounting for additional verification needed. Staff continued researching non-intrusive concealed weapons detection options and introduced a pillar-type system to supplement the concealed weapons screening proof of concept pilots. This alternative offered key advantages, including portability, ease of deployment, and power autonomy. Additionally, staff researched and introduced standalone video analytics for brandished firearm detection to complement weapons screening and leverage existing CCTV infrastructure, testing its purported ability to detect visibly displayed firearms and generate real-time security alerts.

By adjusting the approach to focus on practical, flexible, and effective security measures, Metro refined its proof-of-concept pilot strategy. The proof-of-concept pilots of a concealed weapons passenger screening system and brandished weapons detection pilot were selected as they not only strengthened Metro's enforcement efforts but can also act as a visible deterrent, reinforcing Metro's commitment to creating a safer transit environment with minimal disruption to passengers.

From August through December 2024, staff conducted proof-of-concept pilots of passenger screening technologies (concealed weapons) and brandished firearms for three to four weeks with each system to determine their effectiveness and feasibility in the transit system. Staff assessed detection accuracy, false positives, effects on passenger flow, and integration with Metro's security infrastructure.

1. **Concealed Weapons Passenger Screening (October-December)**: As a passenger walks through this detection system, the system uses its advanced sensors, AI, and other technologies to detect concealed weapons without requiring them to stop and remove any belongings. A lane-type system (previously referred to as dual-lane) and a pillar-type system were tested at two Metro rail stations (Union Station B/D Line East and West portals and APU/Citrus College A Line Station).

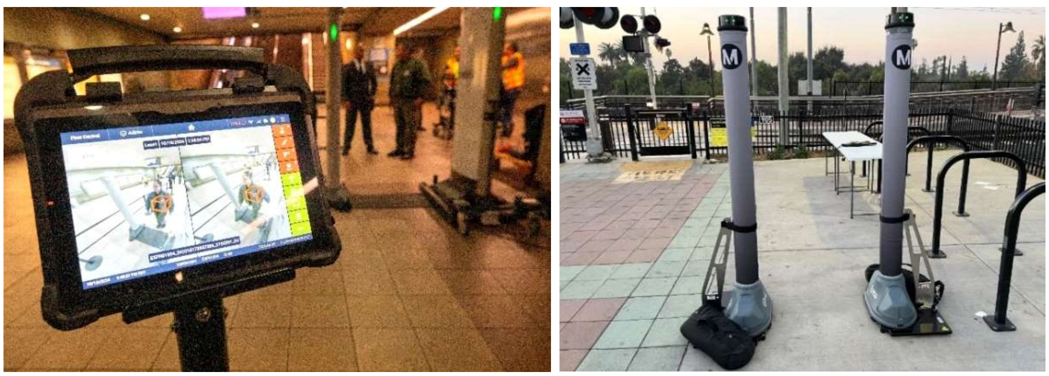


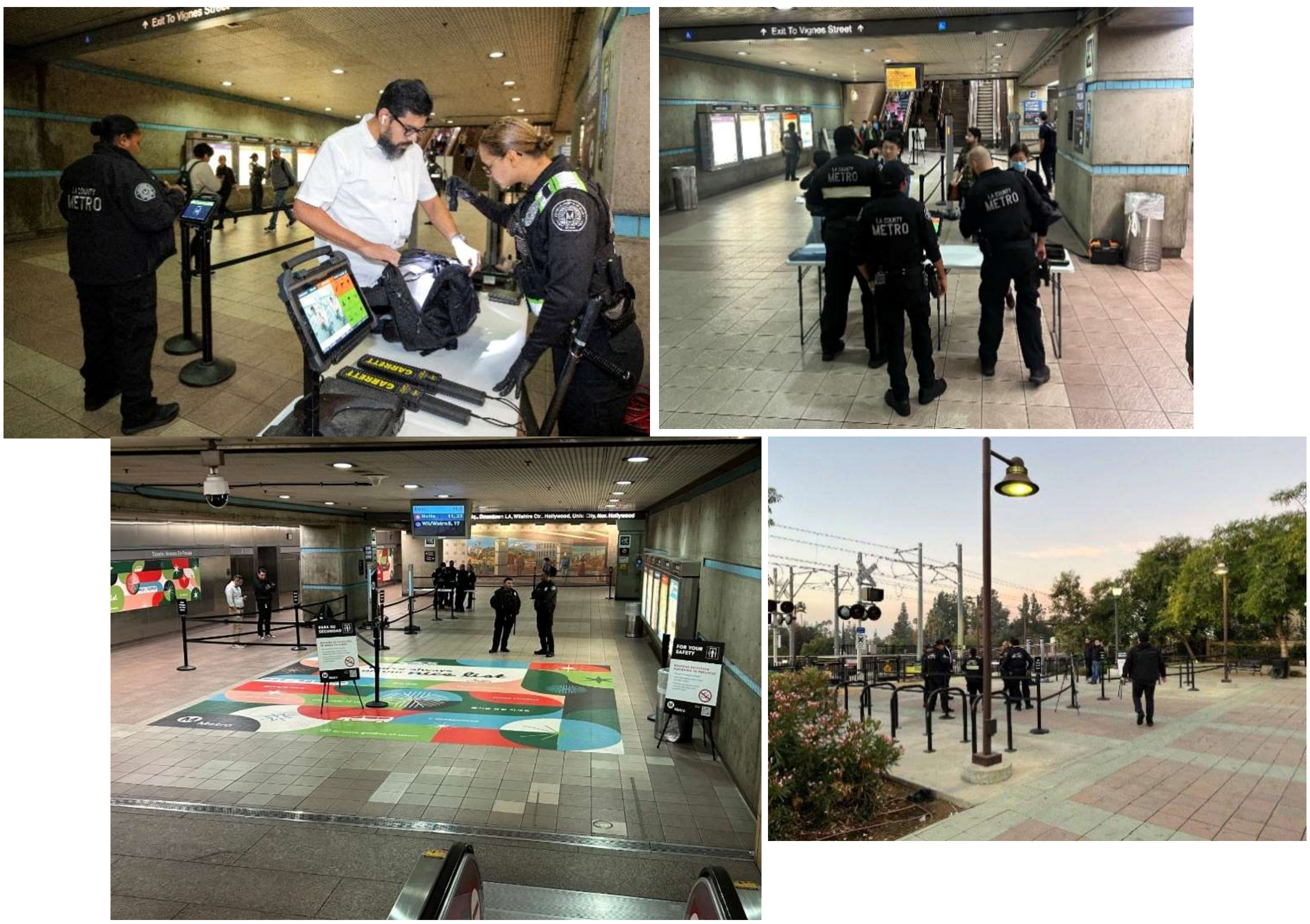
Photo of Lane Type System Screen (Left) and Pillar Type System (Right)

2. **Brandished Firearm Video Analytics (September-October):** This system scans existing CCTV video feeds in real-time to identify threats, including brandished firearms, and sends alerts to designated groups. Staff tested four different camera analytic software solutions utilizing the CCTV system in the Union Station West area to detect brandished firearms.

Photo of Brandished Firearms Analytics Detecting a Replica Firearm

Concealed Weapons Passenger Screening Proof of Concept

After comparing the advantages and disadvantages of different systems, staff collaborated with two vendors, based on their wide use across event venues, airports, and governmental facilities, to organize pilot demonstrations and deployment at two locations. Vendor A facilitated a system identified previously as the dual-lane system. Vendor B facilitated a system referred to as the pillar-type system. As part of the evaluation, staff conducted an analysis of the frequency of secondary screenings, false positive rates, public feedback on the screening process, and overall crime and safety metrics. Staff evaluation found that both systems performed similarly in detecting large, dense metallic items while omitting everyday metal objects in a transit environment. However, the pillar-type system's designed portability and power autonomy provided significant operational advantages by allowing for scalable deployment and reduced infrastructure requirements, better suited for Metro's dynamic transit environment.



Passenger Screening at Union Station (Top Left); MTS Officers at Secondary Screening Table (Top Right); Passenger Screening at Union Station (Bottom Left) and APU/Citrus Station (Bottom Right)

Pillar-Type System	
Advantages	**Disadvantages**
Screens many people quickly.	Higher Cost
Individuals do not need to remove items from their bags.	Relying on an app might pose challenges if there are technical issues with the app.
Designed to operate effectively in both indoor and outdoor environments.	Cannot be used onboard rail or bus fleet.
The system offers flexible power options.	Requires significant additional staffing to address false positives.
The system is engineered to minimize false alarms.	
Easy installation and can be managed remotely via a smartphone or tablet app.	
The system is lightweight (only 25 lbs.) and sets up in less than one minute.	

Dual Lane-Type System	
Advantages	**Disadvantages**
The system can scan up to 3,600 people per hour.	The initial investment can be high.
System uses sensor technology and AI to detect concealed weapons.	Regular updates and maintenance are necessary.
Analytics helps security teams make smarter decisions.	Possibility of occasional false positives.
Integrates with existing CCTV VMS cameras.	Security personnel need to be trained effectively.
Tablet interface makes it easier to train new users.	Use of advanced AI and data analytics raises potential privacy issues.
The system has received several awards.	Requires significant additional staffing to address false positives.
	Extreme weather conditions might affect its performance.
	Cannot be used onboard rail or bus fleet.

Findings

Enhanced Safety: After multiple iterations of screening deployments, staff found that the lane-type and pillar-type systems operate almost identically in detecting various metal materials. Across all iterations of screening deployments, no weapon threats were identified; however, to ensure adequate detection, armed officers were asked to walk through each system while carrying their standard-issued service firearm. Both systems detected the officers' service weapons with 100% accuracy each time. Additionally, staff used a series of testing and training firearm replicas and inert weapons to test the detection capabilities of each system. Those threats were also detected during testing. Throughout the pilot, "weapon-like" items were detected that were part of tools, such as box-cutters and chef cutlery, but were determined not to be an actual threat.

Impact on Riders: Screening methodologies varied based on location and passenger numbers. At APU/Citrus Station, staff were able to screen all passengers during peak hours. At Union Station, a pedestrian count was used during peak hours to manage screening efficiently and prevent queues due to the large number of customers.

The duration was less than two seconds for passengers who did not alert during primary screening. For those who did cause the system to alert and were routed to secondary screening, staff visually inspected the passengers' belongings in under 15 seconds.

One of the findings that stands out is the high incidence of false positives, ranging between 30% and 50%. False positive rates are directly correlated to the selected system sensitivity level. As the sensitivity level increases, so do false positives and its increased ability to detect smaller weapons. As the level decreases, so do false positives and their ability to detect weapons. For the duration of Metro's pilots, the chosen sensitivity level allowed for higher false positive rates but also ensured that the smallest firearms and knives with blades beyond a certain measurement would be detected. While sensitivity levels can be decreased to minimize false positives, so does the operation's ability to detect harmful weapons. These high figures can be readily attributed to the presence of personal electronics and other items with large metallic content, which frequently triggered the system's sensors. The screening systems are designed to omit alerts to the presence of small metallic items like keys, cellphones, and belts; however, many transit riders carry laptops, tablets, or other benign personal items with a high metal content as they commute to and from work, with the range in false positives largely dependent on the time of day and location. Staff found that these alerts did not significantly impact travel times.

As discussed above, the secondary search process was quick and efficient. During the pilot, primary screenings took an average of just two seconds per passenger, effectively filtering out non-alerting individuals. In cases where the system flagged a passenger for further inspection, secondary searches only lasted an average of 15 seconds, during which security personnel asked passengers to visually inspect their personal belongings. This expedited process helped maintain a steady flow with minimum impact on travel. Additionally, staff worked with the vendor to continuously analyze and adjust the system's sensitivity, working to target the detection of weapons over other items. Continued refinement of detection parameters and expedited secondary screenings are the primary strategies to ensure screening deployments remain an efficient and effective deterrent to weapons on the transit system. Due to the high level of false positives, significantly more security staff was needed to conduct secondary screenings and reduce queuing of passengers.

Screening Throughput: To manage operational impact, staff implemented a pedestrian count interval to determine how many passengers were selected for screening per hour. This allowed for up to 30 passengers to be screened per hour, a conservative limit designed to prevent excessive delays and ensure smooth operations. On average, about 120 passengers were screened during each four-hour screening deployment. Staff would need more experience with the screening system to determine if operational procedures can be optimized to increase the screening rate without compromising security effectiveness.

Deployment Flexibility: After multiple iterations of screening deployments, staff found that the lane-type and pillar-type systems operate almost identically in detecting various metal objects; however, noticeable differences are apparent in deployment readiness. The pillar-type system demonstrated an inherent advantage in its portable and self-powered design, while power and mobilization requirements severely challenged the lane-type system.

The pillar-type system's benefits include its self-contained power, data, and cable routing, which makes deployment and set-up easy and allows staff to flexibly deploy the pillar-type systems where needed and without power limitations. Its size and weight do not require a vehicle with a loading ramp or hydraulic/motorized lift, something the MTS fleet does not currently have. These critical factors mean Metro can swiftly set up and break down as security needs shift.

The lane-type system typically requires grid power and has a physical cabling connection between its two main components that require protection using a raised floor mat. This presents accessibility challenges, particularly for passengers using mobility devices, thereby raising accessibility and expediency concerns. The larger and heavier size of the lane-type system requires a large vehicle transportation with a motorized liftgate, limiting its overall mobility and adaptability for relocation and storage. These factors and the system's shore power dependency highlight areas where the single lane-type system is less suited for specific transit environments than the more portable pillar-type alternative.

Customer and Employee Feedback: The reception to the screenings in the field where the screenings were taking place was overwhelmingly positive. Most customers willingly participated and raised no significant concerns about privacy or inconvenience.

Whenever concerns about the screening process emerged, particularly with perceived profiling and general unease about being selected for screening, security officers addressed these instances effectively by providing clear information and disclosing how the selection for the screening process was based upon a pre-determined count and not at the officer's discretion.

- *"This is great! It's a good thing to have so people feel safe!"* - Passenger approached staff at the eastern portal of Union Station B/D Line
- "*It's a great idea! Long time coming!"* - Metro Facility Maintenance employee
- *"Thank you so much, brings safety and less guns to make it feel safe for my mom to ride Metro."* - Metro Custodian, at Union Station B/D Line
- *"This is great to see! My husband takes the train every Tuesday, so I know he'll be safe seeing this safety measure in place."* - Passenger, at APU/Citrus College Station
- *"This is great! Happy to see this!"* - Passenger rejoiced as they saw the weapons detection pilot occurring, at Union Station B/D Line

- Members of a faith-based group conducting outreach expressed their support as it would make the system safer - APU/Citrus College Station

Overall, these small-scale pilots provided valuable insights into the feasibility of concealed weapons passenger screening detection technology, focusing on operational performance, customer and employee feedback, and overall system impact. While limited in scope, the proof-of-concept phase helped identify key considerations for a potential larger-scale pilot, including ease of use, screening efficiency, and integration with existing security measures. The feedback gathered from employees and customers further informed how different safety systems align with Metro's operational needs and passenger experience. These findings serve as an important foundation for determining the most effective pilot moving forward.

Brandished Firearm Video Analytics Detection Proof-of-Concept

From September to October 2024, SSLE tested four video analytic-based solutions of brandished firearm detection technologies at Union Station West. These proof-of-concept pilots focused on using video analytics to detect brandished firearms through existing CCTV infrastructure in real-time. Detection capabilities varied widely between the different analytic systems, but the testing results established a clear ranking based on performance, with one system scoring higher than the rest. The best-performing system detected a replica full-size pistol every time it was brandished, in every testing session, and in every camera tested-the only system to do so. The same system achieved a high detection rate for other types of firearms. In addition to offering instant notification alerts via multiple communication channels, the system includes an online dashboard and mobile app.

To evaluate the detection capabilities of the different systems, staff developed and followed a uniform testing protocol consisting of brandishing replicas and training firearms, indistinguishable from functioning firearms to the naked eye, in front of cameras enabled with firearm detection. All items used for testing are disabled, inert items incapable of loading or actioning ammunition, and all testing occurred during station closure hours in the absence of the public and in the presence of onsite security officers and a supervisor.

The firearms were brandished sequentially and in different positions within a camera's field of view. Staff ensured the firearm was within the camera's field of view for an equal amount of time. Procedures were closely followed in testing the four systems, incorporating the vendor/manufacturer's recommendations to account for all systems' detection and alert latency and other special considerations equally.

<u>Findings</u>

All systems exhibited varying detection capabilities of different-sized firearms. One system misidentified everyday items, such as walking canes and bicycles, as threats, particularly under certain lighting conditions, partly because it did not have the element of human review built into the alert workflow. These limitations highlighted the necessity of human-in-the-loop verification to enhance accuracy and operational response, a built-in feature in the top-ranked-performing solution-all systems with a human-in-the-loop performed better than the one system that did not have that element.

While firearm detection was the predominant factor in evaluating a system's performance, staff also assessed ancillary features such as text/email/push notifications, application user interface, the incidence of false positives, and integration with existing and upcoming security technologies. The result of these additional considerations yielded further support for the best-performing system with valuable support features.

Unlike the challenge of meeting system requirements across all CCTV infrastructure, alert-based brandished firearm detection technology carries a lesser strain on personnel sources. All systems piloted generally sent notifications in eight seconds or less. Overall, the proof-of-concept pilot for brandished weapons detection provided valuable insights into the technology's potential to enhance security by leveraging existing CCTV infrastructure. While all four tested systems performed well, further evaluation is necessary to fully understand their effectiveness in a variety of real-world conditions. Although staff conducted tests in both indoor and outdoor environments under different lighting conditions, additional testing would be needed to account for factors such as camera quality and age, weather, crowd density, lighting variations, background colors, cabling infrastructure, and network bandwidth and speed**.** These findings highlight the need for a more expansive assessment to ensure the technology can be effectively deployed across Metro's diverse transit environment.

Scalability

Determining the long-term viability of weapons detection technology requires careful consideration of Metro's ability to expand and implement these security solutions effectively across the transit system. While the proof-of-concept pilots provided valuable insights into feasibility and operational performance, further testing pilots are necessary to assess how these systems perform on a larger scale. This includes evaluating infrastructure compatibility, operational impact, cost efficiency, and integration with existing security measures. A thorough understanding of these factors will help ensure that any future implementation is both effective and sustainable, enhancing customer and employee safety.

Brandished Firearm Video Analytics Detection

For a full systemwide implementation, AI technology requires integration with more than 30,000 cameras currently on the Metro system today. The majority of Metro CCTV infrastructure and vehicles are analog cameras, while AI technology relies on digital cameras. Implementing brandished firearm detection at locations and onboard transit vehicles with outdated CCTV and communications infrastructure involves extensive research and significant investments in infrastructure, maintenance, and engineering upgrades, such as replacing or retrofitting outdated CCTV systems, before procuring AI technologies.

Although CCTV upgrade projects are underway along various rail lines, it will still be several years before the agency can implement brandished firearm detection, systemwide. Improvements for transit vehicles would include retrofitting outdated CCTV systems and communication infrastructure on each vehicle. Given the undetermined state of all infrastructure constraints, a comprehensive implementation cost estimate for the entirety of the CCTV ecosystem under the agency's ownership cannot be determined at this time.

Since network and CCTV infrastructure are in varying states at different Metro locations, leveraging this security solution would only be possible at the West area of Union Station and the upcoming Metro Transit Center. Staff has determined that the CCTV systems at all rail stations, bus and rail divisions, and Union Station, comprising about 3,600 cameras, are within discernable reach of meeting specifications. Security Control Specialists already stationed at Metro's Security Operations Center (SOC) would be responsible for managing alerts, and the necessary coordination with field security personnel like MTS, law enforcement, and private security officers would occur similarly to how Transit Watch app reports, phone calls, and text-based reports regarding firearms are currently handled.

At facilities that meet or exceed specifications, including the rollout of the unified Video Management System (VMS), Genetec, and enhancements to network bandwidth and camera infrastructure, the brandished firearm detection solution could be integrated into the facilities' existing security framework.

The cost of a longer and larger scale pilot at Los Angeles Union Station, rail stations, bus terminals, and Metro Operating Divisions is shown in the table below:

SYSTEMWIDE VIDEO ANALYTICS BRANDISHED FIREARM DETECTION IMPLEMENTATION COST				
Note: All cost figures in millions	Prerequisite CCTV System Upgrades	Detection Hardware	Detection Licensing	Total
Year 1	$0.6	$1.7	$2.4	$4.7
Year-Over-Year	-	-	$2.4	$2.4

Concealed Weapons Passenger Screening

Building on the insights gained from the proof-of-concept phase, the next step is to conduct a larger-scale pilot utilizing a pillar detection system. The pillar-based approach offers key advantages, including portability, ease of deployment, and minimal disruption to passenger flow, making it a viable solution for enhancing security across the transit system. A broader pilot will allow for further evaluation of system performance in high-traffic areas, integration with existing security operations, and overall effectiveness in detecting concealed weapons.

Since the proof-of-concept phase lasted 30 days, a longer-term pilot would be necessary to better understand operational requirements, resource allocation, and sustainability. While expanding this system to all 222 station entrances would significantly enhance security, it would also require an immense amount of personnel to operate effectively. While the technology is highly portable and adaptable, its effectiveness relies on dedicated personnel to operate screening equipment, direct passenger flow, and conduct secondary inspections. Given these staffing and cost considerations, full system-wide implementation may not be feasible. However, an extended pilot would help assess alternative deployment strategies, such as implementation at high-risk locations based on data or strategic integration with existing security measures, to maximize impact while maintaining

operational efficiency. Systemwide expansion of weapons detection screening will require significant financial and personnel investments. Ongoing assessment and refinement of weapons detection deployments will ensure necessary infrastructure, personnel, and funding are in place to support program augmentation
.
Staff developed the following cost model designed as reference point for the scalability of passenger screening deployments systemwide:

ESTIMATED SYSTEMWIDE PASSENGER SCREENING EQUIPMENT AND LABOR COST FTEs, SCREENING EQUIPMENT, AND VEHICLE NEEDS *ALL RAIL STATION ENTRANCES* **All costs in millions*				
Personnel				
FTE numbers based on 5 days/week deployments	**FTEs**	**MTS TSO II FTEs**	**MTS Sergeant FTEs**	**Cost**
Metro Transit Security[1]	**1066**	888	178	$141.2
Project Manager FTE[2]	**1**			$0.1
Total	**1067**			
Annual Labor Cost				$141.3
Equipment[3]				
Current Number of Rail Stations	107			
Total Number of Station Entrances	222			**Cost**
Screening Equipment	222			$6.9
Vehicles[4]	223			$18.1
Equipment Cost Subtotal				$24.9
1st Year Total				$166.3
5-Year Total				$731.6

[1] FTE personnel cost assumes MTS TSO II $124,800/yr, MTS Sergeant $170,560/yr, and Project Manager $148,928/yr
[2] One FTE Project Manager for the program.
[3] Assumes a 5-year useful life for screening equipment.
[4] Includes vehicles for equipment and personnel transport, as well as one field operations unit.

Compliance with Bias-Free Policing and Public Safety Data Analytics
Metro is committed to ensuring all weapons detection initiatives comply with its Bias-Free Policing and Public Safety Data Analytics policies. Before the start of the proof of concept pilots, staff engaged in a comprehensive review process to ensure that screening procedures, security practices, and data collection efforts were substantiated by the legal framework governing the agency's public safety policies and practices. In consultation with County Counsel, staff worked to establish the legal basis for conducting weapons screenings and searches, ensuring that all

detection measures were implemented to protect our passengers' rights and individual freedom. Similarly, the use of video analytics for weapons detection through CCTV has been carefully evaluated to balance security objectives with privacy considerations and data protection. Multiple discussions helped shape preparations, transparency, and procedural safeguards to ensure screening technology's fair and equitable application.

DETERMINATION OF SAFETY IMPACT

The proof of concept pilots had a positive impact on the safety of the Metro system, ensuring a safer experience for passengers and employees.

EQUITY PLATFORM

Before the start of the weapons detection evaluation, there were concerns regarding racial profiling, the use of facial recognition, and how these technologies may impact Black, Indigenous, and other People of Color (BIPOC). Notably, the facial recognition function within weapons detection technologies was not piloted as it potentially conflicted with Metro's Bias-Free Policing policy. Furthermore, to ensure the screening process was bias-free, staff took extra precautions by using a random interval to select individuals for secondary screening (e.g., every 15^{th} person).

Staff observed accessibility challenges for the lane-type passenger screening system, which had cables that ran beneath a rubber mat, elevating it slightly from ground level and possibly creating a challenge for those in a wheelchair; as a result, this system is not being recommended. Additionally, KPIs would play a vital role in tracking potential bias while implementing weapons detection systems, ensuring adherence to Metro's Bias-Free Policing and Public Safety Data Analytics policies. These KPIs would be integrated into Metro's reporting framework, with findings shared transparently with stakeholders, including the Public Safety Advisory Committee (PSAC) and the Community Advisory Council (CAC).

VEHICLE MILES TRAVELED OUTCOME

VMT and VMT per capita in Los Angeles County are lower than national averages, the lowest in the SCAG region, and on the lower end of VMT per capita statewide, with these declining VMT trends due in part to Metro's significant investment in rail and bus transit.* Metro's Board-adopted VMT reduction targets align with California's statewide climate goals, including achieving carbon neutrality by 2045. To ensure continued progress, all Board items are assessed for their potential impact on VMT.

This item supports Metro's systemwide strategy to reduce VMT through operational activities that will improve and further encourage transit ridership, ridesharing, and active transportation. Metro's Board-adopted VMT reduction targets were designed to build on the success of existing investments, and this item aligns with those objectives.

*Based on population estimates from the United States Census and VMT estimates from Caltrans' Highway Performance Monitoring System (HPMS) data between 2001-2019.

IMPLEMENTATION OF STRATEGIC PLAN GOALS

The recommendation supports Strategic Plan Goals #2.1: Deliver outstanding trip experiences for all users of the transportation system; Metro is committed to improving security and #5.6: Provide responsive, accountable, and trustworthy governance within the Metro organization; Metro will foster and maintain a strong safety culture.

NEXT STEPS

Metro staff have maintained communications with one other vendor to explore the feasibility of deploying a weapons detection solution on board buses and trains. Unlike transit stations, buses present unique challenges for weapons detection, including limited space, power constraints, and the need for rapid passenger boarding. Staff have been working closely with the vendor to determine whether millimeter wave screening can be adapted for rolling stock. If possible, that capability would allow for on-board weapons detection and instant notifications sent to Metro's Security Operations Center. Staff will keep the Board informed of the progress with the vendor.

ATTACHMENTS

Attachment A - Board Motion 34.1

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