

# Smart Stations

## Willesden Green Station

End of PoC Review



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# What is a Smart Station?

Safety and security are paramount to Transport for London (TfL) and in 2021, TfL's Technology and Data (T&D) department in collaboration with operational frontline colleagues and Virgin Media O2 began exploring the use of smart technology at Willesden Green Station. Smart Stations is an exciting proof of concept (PoC), which uses an enhanced video analytics platform, with the aim to provide station staff with real-time insights and notifications on customer movement and behaviour.

The smart technology uses existing CCTV images (100 cameras in total), Artificial Intelligence (AI) algorithms and numerous detection models. Staff can receive notifications and insights related to incidents via a dashboard that visualises the information. This dashboard can be accessed via a desktop or iPad.

Using image recognition and machine learning to identify trends and hazards, enables staff to respond to incidents that require their attention. Smart Stations does not make decisions for staff but equips them with comprehensive information about their station and customers.

The PoC went live in October 2022 and finished at the end of September 2023.

## Background

The Customer Services (now Customer Operations), Customer Safety Group was responsible for driving continuous improvements with a clear outcome to reduce customer injuries across the network. In February 2021, Virgin Media O2 (instigated by T&D) presented to the group a new concept which they had delivered for Network Rail, which provided real-time analytics and intelligence using smart cameras, internet of things (IoT) sensors and 5G connectivity to help station staff to understand passenger movement, security, and safety issues and to improve their customer service.

Following further engagement between T&D and Network Rail, we had seen promising results from their trials at Waterloo, Dawlish, and Marsden. Based on the business benefits demonstrated at Network Rail it was agreed at the Customer Safety Group to explore how a similar PoC could be delivered within London Underground, Sponsored by Ray Adabra (formerly Head of Customer Services Jubilee Line).

Although TfL has a long history of using data science techniques and data analysis for decision making, this is the first time we have used AI algorithms and behaviour detection using live CCTV images to provide real-time alerts for operational staff.

## Scoping & Design

Early engagement with Network Rail enabled us to learn lessons and gather important insights such as selecting a large, central London station caused several issues for their

engineering teams and installing new Smart Meraki cameras added huge cost to the project.

Following several design workshops led by T&D, which involved key stakeholders from specialist areas such as Customer Operations, SHE and Network Security etc. we agreed on the following design principles:

- The smart technology stores the image of the incident for 14 days (aligned with LU's CCTV retention policy and **ALL** faces are blurred).
- The analytics can tell the difference between staff and customers.
- **NO facial** recognition is performed.
- Smart Station technology will not be used in any disciplinary procedure.
- The Smart Stations dashboard will not be used as a tool to measure or manage the performance of station staff.
- No audio is analysed or recorded – our cameras have no microphones.
- Smart Station technology will not replace station staff, they are essential to decide how to resolve an identified incident.

An important output at this stage was to define our use cases and triggers. Our initial classification of **77** use cases, established **33** with a high and medium category. Following several prioritisation discussions with staff from Willesden Green and subject matter experts, we agreed on the following **11** use cases:

- **Crowd Movement**
  - A count of all customers entering and exiting the station (Insights only)
  - A count of all customers entering and exiting the gate-line (Insights only)
- **Unauthorised Access**
  - Customers accessing unused platform (Real-time alert)
  - Customer using platform end barriers (Real-time alert)
- **Safeguarding**
  - Person(s) sat on bench for longer than 10 minutes (Real-time alert)
  - Person(s) leaning over the platform edge (Real-time alert)
  - Loitering in safeguarding area for longer than 10 minutes (Real-time alert)
  - Loitering in the ticket hall for longer than 15 minutes (Real-time alert)
  - Person(s) over the yellow line for longer than 30 seconds (Real-time alert)
- **Mobility Assistance**
  - Person(s) with a wheelchair (Real-time alert)
  - Person(s) with pram (Insights only)
  - Person(s) with excessive luggage (Insights only)

- **Crime & Anti-Social Behaviour**
  - Arms raised, acts of aggression (Real-time alert)
  - Carrying or using a weapon (Real-time alert)
  - Smoking & Vaping (Real-time alert)
  - Unfolded bikes & e-scooters (Real-time alert)
- **Person on Track**
  - Person(s) on track (Real-time alert)
  - Animal on track (Real-time alert)
- **Injured & Unwell**
  - Person(s) on floor (Real-time alert)
- **Hazards**
  - Wet floor and puddles (Real-time alert)
  - Litter and debris in the station (Real-time alert)
- **Unattended Items**
  - Any package/bag left unattended in the station (Real-time alert)
  - Animal without a lead (Real-time alert)
- **Stranded Customers**
  - Person(s) unable to exit or enter the station (Real-time alert)
  - Person(s) stuck at the top or bottom of the stairs (Real-time alert)
- **Fare Evasion**
  - Person(s) jumping over a closed gate (Insights only)
  - Person(s) jumping over a non-gated area of the gate-line (Insights only)
  - Person(s) crawling under a closed gate (Insights)
  - Person(s) tailgating “double gating” (Insights)
  - Person(s) walking through an open gate without tapping (Insights)

Review sessions with staff from Willesden Green enabled the team to understand key processes related to each use case, ensuring there was no change or impact to existing processes, standards, or rule books.

## Governance

To support the PoC, T&D established and Chaired the Smart Station Steering Group (attendees listed in Appendix A) to provide specialist advice, ensure delivery of the initiative outcomes and the achievement of outputs, this included:

- Provide input to the development and design decisions
- Monitor the progress against its objectives
- Provide a point of escalation for risks and issues
- Review outputs and outcomes against objectives

- Provide representation from all key business areas
- Actively promote the outputs of the initiative.

Early engagement with Trade Unions (TU), enabled us to build strong interest and support. T&D continued to maintain good engagement, providing regular updates at all levels from Functional Council to meetings with local TU representatives.

T&D worked closely with colleagues from General Council, specifically from Legal and Data Privacy, ensuring the PoC was fully compliant. The team developed an extensive Data Protection Impact Assessment (DPIA), which was updated following changes to the solution.

Although the PoC had been managed and led by T&D's Technology Advisory Team, the project required additional technical resources such as a Cyber Security Analyst and a Network Architect etc. T&D initiated a Gate Zero paper to ensure all technical designs were approved and compliant to our standards and policies.

## Why Willesden Green?

Using the feedback and learnings from Network Rail, we selected a 'Local Station', as our focus was on helping a station that has high customer footfall and minimum staffing levels. Our Sponsor, Ray Adabra also wanted the project team to select a station on the Jubilee Line.



GATEWAY



DESTINATION



METRO



LOCAL

### Key aspects of Local Stations:


- These are smaller stations, and are in outer London, have consistent customer numbers and serve mainly regular customers. These stations will tend to be quiet outside of peak hours
- Local stations have a station control point and generally have a low number of station assets as well as a low number of operational assets
- [REDACTED]
- If a Customer Service Assistant is rostered, they are visible and available to assist customers with ticketing and journey queries, or are performing platform duties

Reviewing all Local stations on the Jubilee Line, we assessed the station heritage, camera infrastructure and station characteristics e.g. number of gates, public help points, stairs, escalators, lifts etc. Following our assessment, we were left with 3

possible candidate stations and the Steering Group's decision was to select Willesden Green.

Station	Line	Type	Heritage	Camera Type	Camera Quantity	Gates	Step Free Access	Lifts	No. of Escalators	PHPs
Kilburn	Jubilee	Local - A	Not Listed	Tecton Dalek	[REDACTED]	5	Y	1	0	7
Kingsbury	Jubilee	Local - A	Local listing pending	VisioWave	[REDACTED]	4	Y	2	0	12
Neasden	Jubilee	Local - A	Not Listed	VisioWave	[REDACTED]	4	N	0	0	5
Stanmore	Jubilee	Local - A	Locally Listed	VisioWave	[REDACTED]	6	Y	0	0	11
West Hampstead	Jubilee	Local - A	Not Listed	Liberator	[REDACTED]	6	Y	0	0	5
Willesden Green	Jubilee	Local - A	Grade II	VisioWave	[REDACTED]	8	N	0	0	8

Preferred stations



Listing unlikely to have an impact on installation of camera and connectivity technology. Further exploration to be done at chosen station.

All cameras are analogue. TfL Engineering has a preference for VisioWave as this is newer technology, others are at end of life and due for replacement.

Preference will be to have a station with stairs and/or lifts, to align with such use cases as stranded customers, vulnerable customers, customer/staff injuries etc..

Number of PHPs installed in stations, further investigation needed on how many are in operation.

At this stage, T&D had been working collaboratively with colleagues in TfL Engineering and Asset Strategy. It was important to assess the existing CCTV infrastructure and at Willesden Green they use analogue cameras, which are circa 20 years old.

Our Telecoms Engineer was responsible for engaging and instructing our communication assets maintainer 'Telent' to work on the design and installation of hardware at Willesden Green station.

## Camera Analysis

Our next step was to analyse and assess the [REDACTED] cameras in total at Willesden Green and select the cameras in scope for the PoC. Using the CCTV snapshots which TfL Engineering maintain for all stations across the network, we reviewed the station layout maps, CCTV images and agreed with staff from Willesden Green, which cameras we had to include and were aligned to the use cases in scope.

See example below:



## Installation & Architecture

[REDACTED]

[REDACTED]

Prior to install, architecture designs had to be produced and approved by TfL Engineering and T&D's Architecture Review Board. Telent installed and tested the hardware at their test site and following a successful test install, we arranged for Telent to install the kit at Willesden Green during non-operational hours.

[REDACTED]

## Commercial & Funding

As this was a PoC, we wanted to prove the benefit by leveraging our existing technology partner, in this case Virgin Media O2. To mobilise the project, we engaged early with T&D Commercial who worked closely with our supplier to define a statement of works and contract variation.

[REDACTED]

[REDACTED]



Component	Description	6 Month Initial Trial Programme	3 Month Extension (optional) to Trial Programme
Mobile Wireless Connectivity	The hub of this solution – O2 resilient data connectivity for communications between the Edge device and remote servers.	██████████	██████████
New Hardware	No new hardware included. Edge processing device included free of charge.	██████████	██████████
Spatial Insights (data license)	Includes hardware, software licenses, training and on boarding, AI modelling and data hosting. Up to 15 camera views to address 14 individual Use Cases	██████████	██████████
Initial site survey - set up, review and selection	For camera selection / positioning – 2 site visits during the Trial Period	██████████	██████████
Trial Set up, Customisation and In Life Support	Project Management / 1 day a week for 6 month Trial System Architecture 0.5 days a week for 6 month Trial Period Estimated total in region of ~40 days	██████████	██████████
Visualisation Dashboard / Alerts	Data dashboard to provide customised visualised and tabulated outputs Real time Alerts once triggers have been met	██████████	██████████
O2 Innovation Contribution to project	Discount of 50% against Supplier resource inputs (Trial Set Up, customisation and in life support)	██████████	██████████
TOTAL PRICE		██████████	██████████

Towards the end of the 6 months, the Smart Station Steering Group agreed to extend the solution for a further 6 months. Several additional requirements had been established to support the fare evasion use case, examples below:

1. Unblurring of faces for images
2. To generate a unique reference number per fare evasion
3. New fields and data items to capture on fare evasion alerts.
4. To be able to identify a fare evasion is a repeat offender fare evasion
5. To be able to retain images and metadata for repeat offender fare evasions longer than 14 days
6. To be able to link fare evasions together – if it is identified that multiple fare evasions involve the same person
7. Able to remove fare evasions from linking e.g. if done incorrectly or not part of it
8. To be able to hold repeat offender fare evasions to be able to link to others
9. To be able to view export fare evasions/linked fare evasions
10. To be able to search for fare evasions and information

Extending the trial for a further 6 months and incorporating the additional requirements the cost was ██████████.

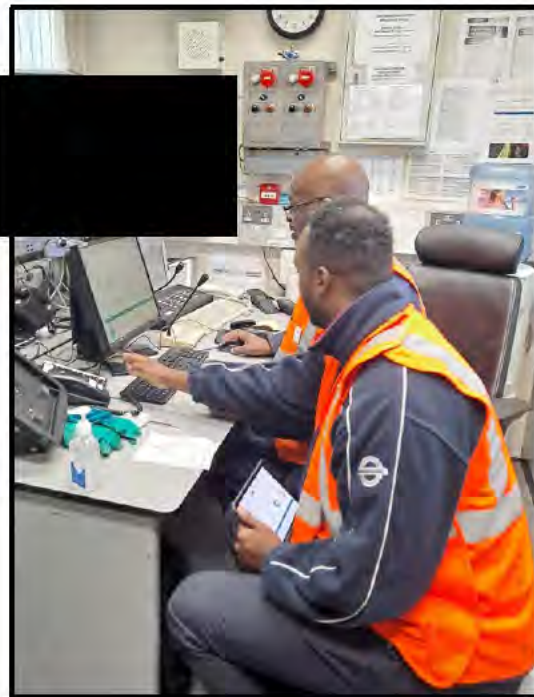
Component	Description	Price	Notes
Initial site survey - set up, review and selection	For camera selection / positioning	£0	No charge - surveys already undertaken Assumes no new cameras are added
Mobile Wireless Connectivity	02 Resilient Data Connectivity for communications between the Edge Device and remote servers.	██████████	As per corporate tariff of £50 per month
New Hardware	Edge processing device.	██████████	Currently on loan for this PoC. The price for the hardware if needs to be swapped out would be ██████████
Spatial Insights (data license)	Includes software licenses, AI modelling and data hosting. Use cases and cameras remain unchanged from current PoC	██████████	Data license term is for 6 months. Retained pricing from Dec 2021
API	Provision of API output	██████████	No charge for the API to date. This cost is a one off for all API access for the solution to TfL. The cost includes: a. R&D investment in creating an API architectural framework b. Implement the specific API e.g. to PowerBI etc c. Associated background work for API support
Visualisation Dashboard / Alerts	Data dashboard to provide customised visualised and tabulated outputs Real time Alerts once triggers have been met	£0	No charge - already undertaken. Assumes no new alerts or changes to dashboard beyond those defined for Fare Evasion
PoC Professional Services and In Life Support	Project Management / 1 day a week for 6 month PoC Estimated total 26 days across the 6 month PoC	██████████	Project Management resource of 1 day a week across the 6 months
Refinement of Fare Evasion use case	Refinements and enhancement of AI, alerts, functionality across 6 months	██████████	Includes refinement/ enhancement of Fare Evasion - anticipated to cover points 1 to 9
<b>TOTAL POC PRICE</b>		██████████	

## Staff Engagement & Adoption

Early engagement with the staff at Willesden Green was supported and encouraged by Ray Adabra (Head of Customer Services Jubilee Line), the previous Area Manager and the now current Area Manager, Chris Weaver. During the design and scoping phase, Nas Ali (Customer Service Manager) was assigned to help and support the PoC. Nas played a pivotal role by defining the user requirements and use case triggers, planning and facilitating briefing sessions to staff, and leading on multiple simulation sessions.

Leading up to the launch of smart stations, the delivery team developed briefing packs and met with over 20 Customer Service Supervisors face to face. Meeting face to face, enabled staff to ask questions and provide feedback. Separately, the team developed interactive guides which can be accessed via the Smart Station SharePoint site, a one-stop-shop for all information and help.

Throughout the PoC, T&D continued to engage with staff and sent regular updates via emails, informing staff of changes to the system and the launch of a new use case trigger. Representatives of the T&D delivery team would often locate and work at Willesden Green station, this provided additional support to staff who required help.



It was agreed by the station management team that the key user of the dashboard and recipient of the alerts would be the Customer Service Supervisors. Each Supervisor was provided with individual log-in credentials, which they could use for either the desktop or their corporate device (iPad).

During the design phase we established 3 user profiles, Administrator, Operational Supervisor and Non-Operational. For each profile, we designed specific permissions which would provide the user with functionality within the dashboard e.g. the ability to acknowledge an alert. It was the responsibility of the T&D delivery team who created the user accounts, ensuring the correct profiles had been assigned.

We made several enhancements and changes to the system following feedback from Supervisors. Meeting with Supervisors at Willesden Green provided the delivery team with excellent feedback. T&D also developed surveys when seeking feedback from the wider group of Supervisors. An example of a change post feedback was when our night shift Supervisors requested all triggers (excluding person on track) to be switched off during non-operational. The night shift Supervisors felt they had a good awareness of the station and who was working in the station at night.

Recognising that staff already have several applications to monitor and only the one desktop screen in the office, T&D installed a large, fixed iPad next to the desktop monitor. This enabled staff to see the application's pop-up notifications, every time an alert was generated. The iPad was configured with restrictions which only allowed staff to access the smart station application. Installing the fixed iPad enabled staff to monitor important applications (e.g. Tracknet) and visibly see when alerts were generated in the dashboard.

Images below show the fixed iPad next to the single desktop monitor.

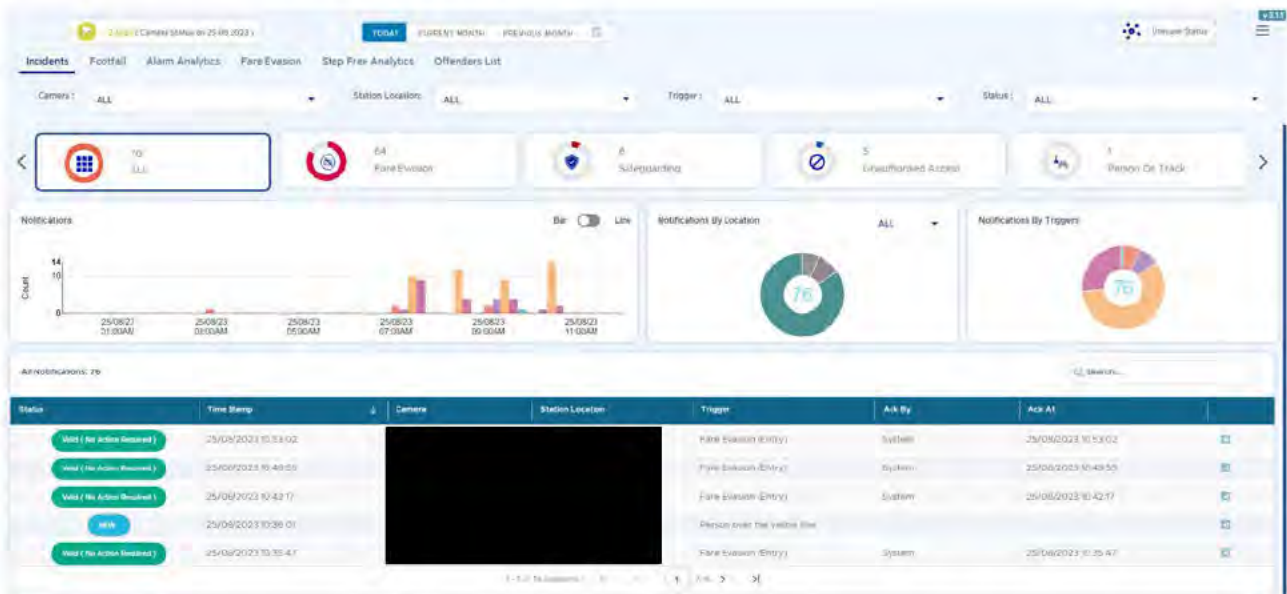


## Dashboard

Throughout the PoC, T&D adopted an agile approach to delivery, setting out clear requirements at an early stage and building on those requirements following analysis and importantly feedback from staff. Our key purpose was to deliver a solution built on the requirements and feedback from staff at Willesden Green station. Over time, this involved several changes to the look and feel of the system.

There are two ways staff can access the dashboard, via a desktop or iPad. Both require the user to log-in with their personal credentials. The mobile application includes popup notifications which is standard for many mobile applications. The notifications appear on the screen in real-time, alerting staff to incidents happening in the station.

The user is also presented with various visual aids, which breakdown the type of alerts. Further reports and data are available to examine such as footfall, alarm analytics, data on fare evasion and step free analytics.



The purpose of smart stations is to aid staff by providing additional situational awareness and complement existing applications. With that in mind, we made sure the system did not duplicate existing systems such as the Station Logbook and the Electronic Incident Report Form (EIRF). We recognised that both systems listed, act as the primary source of information relating to incidents that occur in a station.

To ensure the system is easy to use, when an alert is sent, the Supervisor can view the alert details and image(s) provide comments and select one of the following three actions:

- **Valid (Action Required)** - this action is required when the detection model has correctly identified the behaviour, movement or object and it requires the Supervisor to act on the information provided. It's likely the next steps and action taken by the Supervisor will be recorded in either the Logbook or EIRF.
- **Invalid** – this action is required when the detection model has incorrectly detected the behaviour, movement or object defined in our requirements.
- **Valid (No Action Required)** – this action is selected when the detection model has successfully detected the movement, behaviour, or object, however it requires no further action from the Supervisor. An example of this is when it's a member of staff accessing areas which have been included for our unauthorised access use case triggers.

# Technical Issues

During the early phases we encountered technical issues which resulted in outages. Examples of these outages are listed below:

There was a power outage following the fire panel testing at Willesden Green station, and this resulted in the switch defaulting to its original settings. This outage identified that the 'Uninterruptable Power Supply' (UPS) was not installed as originally designed and planned. Shortly after the power outage, Telent returned to the station and re-configured the switch and installed the UPS.

Following a few days of online activity, we noticed that planned triggers of the system were not being presented as alerts in the dashboard. After further investigation by the supplier it was confirmed that one of the 'Graphics Processing Units' (GPU) was not working. To fix the issue, our supplier had to deliver a new edge processing device which required Telent to carry out a new install on-site. The new device was successfully installed, and we continued to have two working GPU's as per the design.

Following several days offline, and numerous on-site visits by Telent we established that the sim in the router had reached its data allowance. Once the issue had been identified, Virgin Media O2 quickly changed the allowance to 'unlimited' and we continued to monitor data usage.

In September 2022, we were experiencing numerous daily outages of the dashboard over several weeks. The team carried out extensive analysis and multiple tests on the edge device and network components to identify the root cause. During the investigation, it was established that the encoder was sending the frames (CCTV images) in bursts which was overloading the edge device memory. As the edge device was accepting all the frames and then trying to process them, it limited the edge device's capability to process further streams, reducing the frames per second (FPS) to zero. The system was auto recovering after some duration. It was also identified that around 4 million frames were sent to the edge device in a period of 10 minutes, instead of the expected 330K at the 25 FPS for 24 cameras. This was quickly resolved, and no further outages occurred.

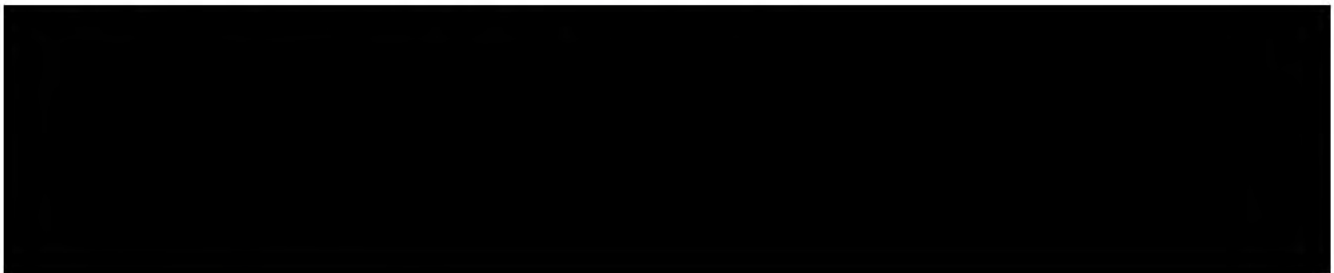
The above outages did highlight our need for improved reporting, enabling the team to identify quickly when the system was offline. This resulted in several reports being developed, for example, camera availability (is the camera online) and a separate report showing the frames per second output.

# Simulations

Prior to the launch of each use case trigger, we had to carry out extensive simulations at Willesden Green station. This required detailed planning and support from our operational colleagues. Due to the nature of some of the use case triggers e.g. weapons detection and person on track, we had to conduct the simulations during non-operational hours.

Simulations were required for machine learning e.g. many days at Willesden Green station simulating the exact behaviour we wanted the AI to detect and alert staff on. The more data and examples of the behaviour and movement we wanted detected, improved the AI models, and minimised the risk of alerting staff to false incidents.

Below are 3 stills taken from a simulation for 'Person(s) on floor'. In this example you will see a member of staff walking down the stairs, at first, the system is showing green boxes around each person which is a normal reflection. When our colleague falls to the floor, the system detects the person on the floor and will show a red box, this would then be sent as an alert via the end user dashboard.



## Use Case Triggers


In this section, you will see examples from each use case trigger and an overview of the results. The figures presented for each will include data captured during the simulations. For some use cases, the numbers may seem high and above average, this is due to the number of simulations that were required and therefore counted within the system.

### Unauthorised Access

At Willesden Green station they have two Boswick Gates in use, prohibiting non-personnel access to platforms 1 and 4.

In scope was the platform end gates. Staff at Willesden Green wanted to be made aware of incidents when someone had opened and crossed the platform end gates.

The unauthorised access use case has proven to be extremely useful to staff, however following feedback from staff, we de-scoped one of the platform gates, as the system was accurately detecting a person i.e. the train operator, every time there was a de-trainment at the station.





A key lesson for unauthorised access, was not recognising the impact and frequency of de-trainments at Willesden Green. When a train terminated at Willesden Green, it was the responsibility of the train operator and station staff to ensure the train is empty before departing the station.

In total, we received slightly over **7000** alerts for unauthorised access. The data shows **38%** of the alerts were linked to the Boswick Gates and **62%** for the end of platform gates.

### Safeguarding

During the design and scoping phase, we worked closely with our LU Safeguarding Leads and defined the thresholds and parameters for each trigger. Using the alerts as a preventive measure, allowed staff to act quickly and investigate matters further.

Throughout the PoC we have seen a huge increase in the number of public announcements made by staff, reminding customers to step away from the yellow line. For some triggers, we have defined time parameters which reflect previous behaviour related to suicide attempts on our network.



In total, the system generated over **4500** alerts relating to the safeguarding triggers and **36%** were acknowledged by staff. A breakdown of the alerts is listed below:

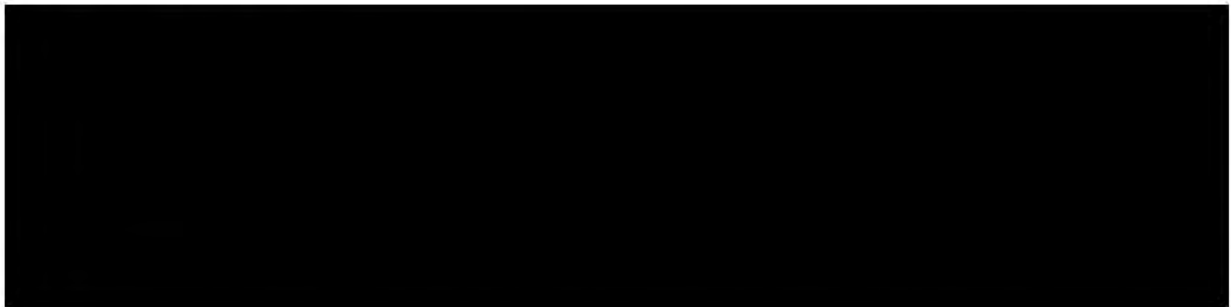
- Person(s) over the yellow line generated **2194** alerts

- Person(s) sat on bench generated **1953** alerts
- Loitering in safeguarding area generated **433** alerts
- People leaning over the edge generated **39** alerts
- Loitering generated **20** alerts

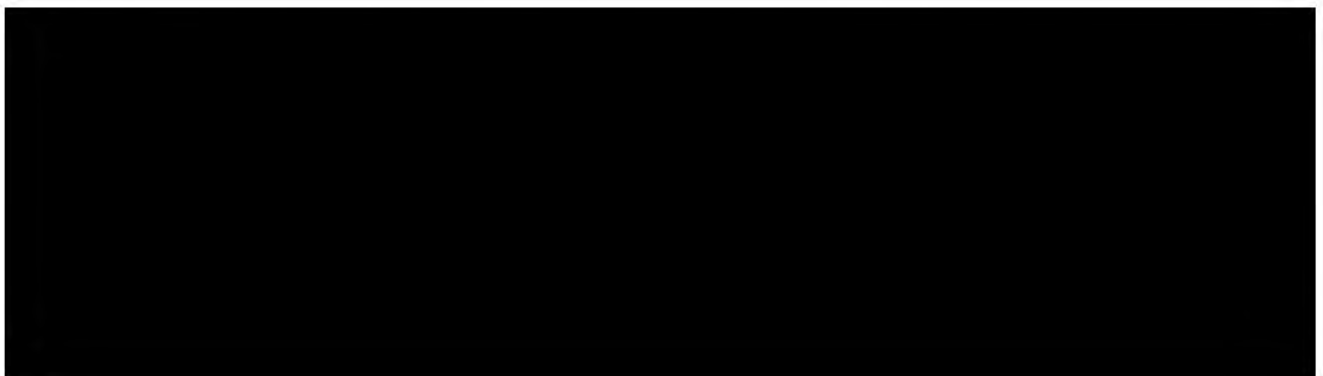
### Mobility Assistance

Accessibility is extremely important to TfL, and a key use case trigger was to test if the system can correctly detect wheelchairs. Willesden Green is not a step free access station and with one main staircase leading to the platforms it is not safe for wheelchair users.

Kilburn, which is the next station southbound, is a step free station and the staff at Willesden Green highlighted previous events where customers enter the station not aware that the station does not have a lift. Staff also highlighted events where customers have got off the train at Willesden Green, assuming there would be a lift. In these instances, we wanted to alert staff to when a wheelchair was detected, enabling staff to provide the necessary care and assistance. In total, the system generated **59** alerts for wheelchairs.



We also included two triggers which we believe can showcase how smart technology can assist with the decision making and analysis when it comes to deciding on future stations becoming step free. We were also conscious that Willesden Green has one main staircase leading to Platforms 2 and 3, and the biggest contributor to customer injuries on stairs and escalators is excessive luggage e.g. large suitcases. During the PoC, the system detected **4276** people with prams and **226** for people carrying excessive luggage.



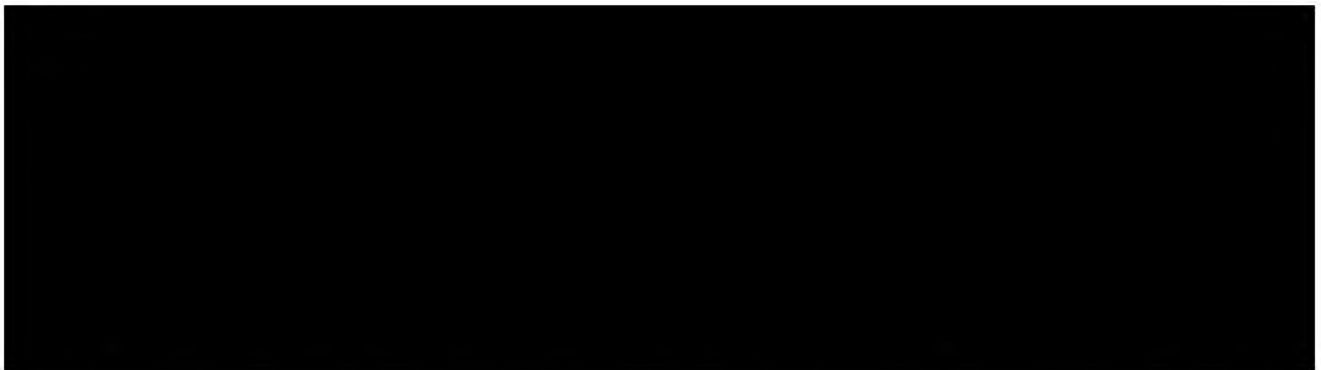


## Crime and Anti-Social Behaviour

Initially, we wanted to include acts of aggression, however due to [REDACTED] and the training data needed for the detection model, we were unable to pursue. Although we were unable to successfully detect acts of aggression, we changed the trigger to 'arms raised', which is common behaviour linked to acts of aggression.

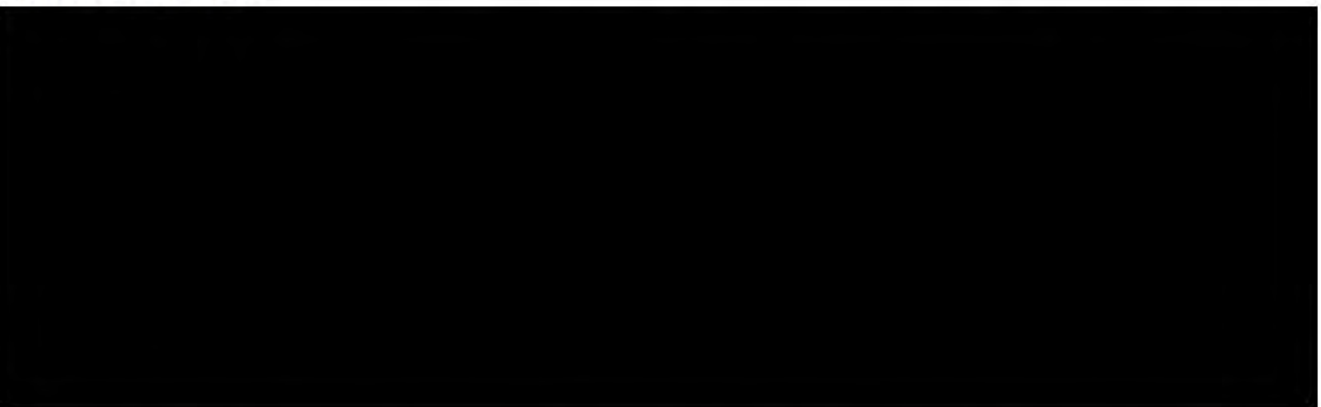
Changing the trigger to arms raised, provided staff with an additional safety precaution e.g. if a member of staff felt threatened and they were unable to use their radio, they could raise their arms which would generate an alert to the Supervisor, who can then raise the alarm or request additional support.

Thankfully, there were no reported workplace violence incidents during the period of the proof of concept at Willesden Green.



Although unfolded bikes and e-scooters were not initially raised as a concern by staff at Willesden Green, we wanted to assess if the smart technology can successfully detect bikes and e-scooters.

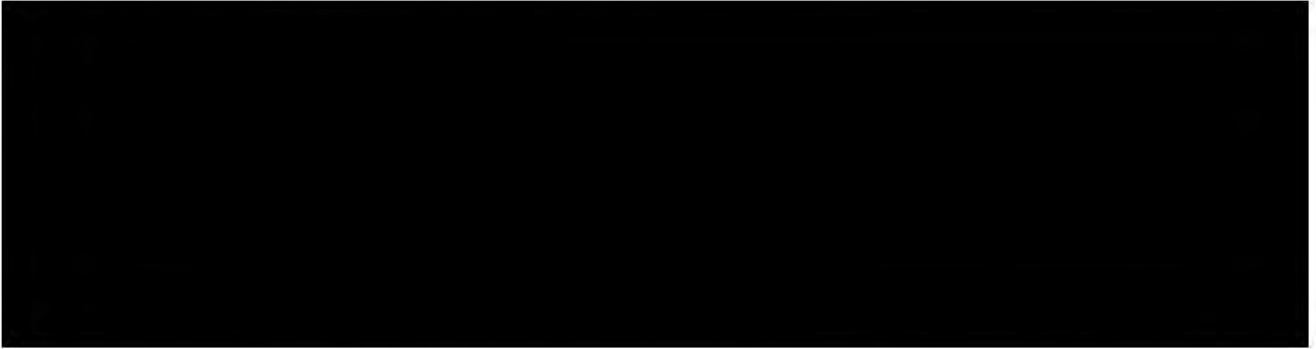
Following several months of staff feedback, testing and analysis of data, we eventually switched off the detection models for both, as the AI could not differentiate between an unfolded bike and normal bike and an e-scooter and children's scooter. This meant that the dashboard generated high numbers of false alerts which did not require the attention of staff.



Working closely with our colleagues in Network Security, we included a weapons detection trigger. This required detailed planning and engagement with our policing partners, the British Transport Police (BTP).

A trained firearms officer was able to help with the simulations and we conducted several tests throughout the station during non-operational hours. Considering the limitations with the quality of images, we were pleased with the results and thankfully, there were no reported alerts or reported incidents for weapons at Willesden Green.

In the images below, you will see the BTP officer holding a machete and handgun in different locations within the station.



In total, the triggers for crime and anti-social behaviour generated **720** alerts and **63%** were acknowledged by staff. A breakdown of the alerts is listed below:

- Unfolded bikes and e-scooters generated **644** alerts
- Arms raised, acts of aggression generated **66** alerts
- Weapons detection generated **6** alerts
- Smoking and vaping generated **4** alerts

#### Person on Track



[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]

[REDACTED]


[REDACTED]

#### Unattended Items

A key priority for the PoC was to drive enhancements in safety and security and we recognised the security challenges we have across the network with regards to unattended items.

We did see promising results for this trigger which resulted in staff carrying out further investigations when needed.



The unattended items use case was active throughout the station and included  cameras. Overall, the system generated **76** alerts.


### Person on Floor

Another important trigger prioritised by staff at Willesden Green. Throughout the trial the system successfully detected several incidents where customers fell on the floor and required assistance.

We also received several alerts for person on floor, highlighting the challenging behaviour of a small minority group of customers who risk their safety when using our services by sitting on the floor with their legs over the edge of the platform (see middle image for an example).




The system also generated several alerts for rough sleepers and beggars at both entrances to the station. Alerting staff early, enabled them to remotely monitor the situation and provide the necessary care and assistance.





### Litter and Debris

Station cleanliness and ambiance is very important, and our first trigger launched was the detection of litter. Although Willesden Green has a regular cleaning schedule, the system generated many alerts which caused frustration amongst staff. The detection model was very accurate, detecting newspapers that customers had left, and paper cups. Following feedback from staff, we disabled the litter alert.



### Stranded Customers

Staff at Willesden Green raised the need to be alerted to when customers are stranded, either at the gateline or staircase.  Alerting staff enables them to quickly provide the assistance required. In total, the system generated 127 alerts for stranded customers.



## Fare Evasion

The triggers for fare evasion were the last to be deployed and it was agreed at the design phase and with our Trade Union colleagues to not alert station staff due to concerns raised with workplace violence.

During the PoC we made several enhancements to the detection models, this involved watching several hours of CCTV recordings and noting when the AI detection model had missed incidents of fare evasion. Using the missed incidents to machine learn and enhance the models resulted in a huge increase in fare evasion alerts.



The fare evasion use case generated the highest number of alerts with over **26,000** from the 1st of November 2022 to the 30th of September 2023. The triggers for fare evasion included tailgating, jumping over the gate, crawling under the gate, and pushing the gate open.

Initially, we had planned for members of the Revenue Control team to acknowledge the alerts, however due to the large number of daily alerts (in some days over **300**) and the high accuracy in detections, we configured the system to auto-acknowledge the alerts.

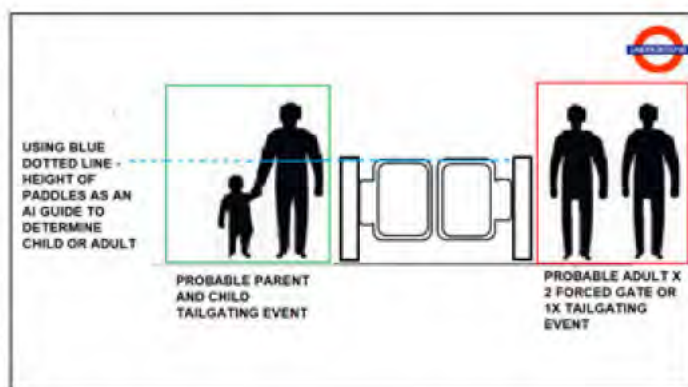
In scope for fare evasion included [redacted] cameras covering [redacted]  
[redacted] This resulted in only **17** alerts generated for fare evasion.

For some of the triggers, including fare evasion, we configured the system to provide 3 images of the incident, all taken one second between them. This enabled staff to click through the 3 images and enhance their understanding of the incident that had just occurred. See example below for fare evasion alerts:



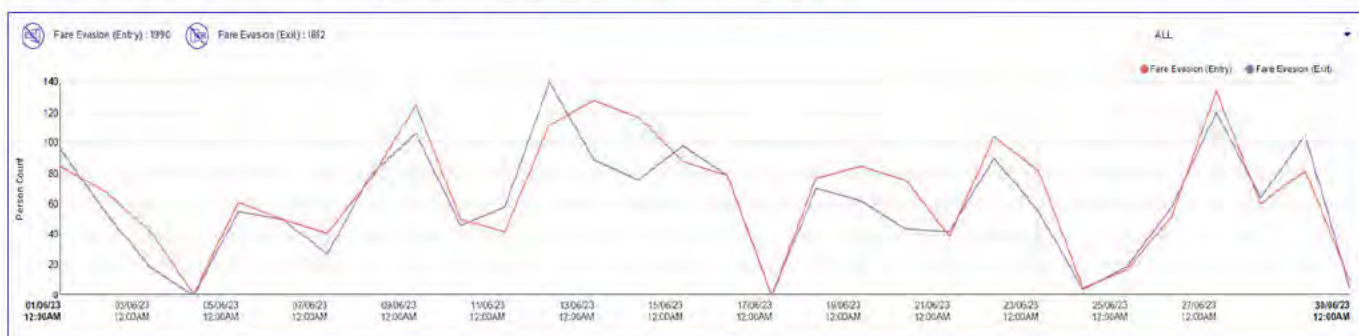
Following the deployment of the fare evasion triggers, we quickly noticed that the system was correctly detecting incidents of tailgating, however, it was obvious that it was travelling adults with children. During school travelling hours, we would see a spike in parent and child tailgating alerts.

To correct this, we acknowledged the alerts that were parent and child tailgating as “Invalid” and configured the detection model to not include any tailgating alerts for people whose height was below the gate. See example below:



An important requirement for the PoC was to visualise all data from the alerts. For each report we had the ability to select time periods e.g. day, month, year. For the fare evasion use case, we trained the AI model to detect if the fare evasion was happening when entering or exiting the station.

Visualising the data in graphs, enabled the team to identify trends in behaviour and highlight periods of travel when fare evasion was frequently occurring at Willesden Green. Below is a monthly view of fare evasion in June 2023.



## Usage & Dashboard Alerts

During our early engagement with our TU colleagues, it was agreed that the dashboard would be 'voluntary use' and not mandated.

In total, 25 Customer Service Supervisors and Customer Service Managers used the dashboard, which is extremely encouraging. However, towards the latter months, we did see decline in the number of alerts that had been acknowledged by staff.

The T&D delivery team continued to track usage and responses to the alerts by developing a Microsoft Power BI report which added to the visualisations developed in the Smart Station dashboard.

Throughout the PoC, T&D would frequently engage with staff at Willesden Green and at planned intervals we also sought feedback via online surveys. Continued feedback from staff enabled us to ensure all changes during the PoC benefited the staff. From the feedback gathered we identified 3 types of users:



There were Customer Service Supervisors who were advocates of the system and would use the system for every shift. They valued the alerts and embraced the enhanced situational awareness.



There were Customer Service Supervisors who did not frequently work at Willesden Green station due to changes in local rosters. When this occurred, we encountered experiences when Supervisors had forgotten their login details and how to use the system.



Acknowledging that the agreement to use the dashboard was voluntary, there was a small group of Supervisors who do not want to use the dashboard.

As mentioned previously, we had Nas Ali, who was our operational lead who conducted multiple briefing sessions and was on-site to encourage staff, build momentum and eagerness to use the system. [REDACTED] and



although T&D's delivery team frequently visited the station, [REDACTED] which did result in a decline of usage.

Although the delivery team monitored the average response times to the alerts, we established that some Supervisors were acknowledging alerts hours later and in some cases days later which increased the average response time. To mitigate this from happening, we configured the system to auto-acknowledge alerts that had not been responded to by Supervisors after 1 hour.

In total, Smart Stations generated over **44,000** alerts, **25,000** were auto acknowledged by the system and over **19,000** were sent to Supervisors. Over **60%** of the alerts were acknowledged by staff and on average, staff would receive **55** alerts a day relating to the use cases.

## Fare Evasion Phase 2

Towards the end of the initial 6-month trial and following the success of detections relating to fare evasion, T&D presented options to extend the PoC. The options included extending the PoC at Willesden Green or installing the smart technology at either [REDACTED]. The three stations all have high levels of fare evasion and were recommended by our colleagues in the Revenue Control Investigations Team.

At this stage, we had presented updates and findings from Smart Stations to the Pan-TfL Revenue Protection Steering Group (RPSG) which was Chaired by Swian Hayward (Director Security Policing Enforcement). The RPSG, including the Smart Station Steering Group endorsed the extension at Willesden Green.

Extending the PoC at Willesden Green enabled the delivery team to work with the Revenue Control Investigation team and design new ways of working and changes to the system. At this stage, the delivery team worked closely with colleagues from Data Privacy to update the Data Protection Impact Assessment (DPIA), following the approval to remove the anonymity (blurred face) of people committing the crime of evading fare.

The primary focus for phase two was to establish if the smart technology can help identify, report and support with the intervention of persistent fare evaders. Using the data from the dashboard to establish patterns of travel would result in our Revenue Control Inspectors visiting Willesden Green station and stopping the offender.

Following options analysis and successful system testing, we agreed to align ways of working to the current process to how staff report incidents of fare evasion i.e. Workplace Aggression Anti-Social Behaviour (WAASB) application. This meant the success of the process was reliant on Customer Service Assistants (CSA) visibly seeing repeat offenders and reporting them via the WAASB application.

This involved additional face to face briefings with the CSAs who worked at Willesden Green. Our engagement with the CSAs was extremely positive and all voiced their frustration with fare evasion and supported the process we had planned.

Although we received a handful of WAASB entries from CSAs, we did not receive enough from staff to build any cases against repeat offenders. During this phase we would often remind staff of the process and encourage staff to submit their WAASB entries. Feedback from staff suggested this was mainly due to the [REDACTED]

[REDACTED]. At times this was also reflected in the regular reports we would receive showing when the gates at Willesden Green would be open due to staff availability.

The process was successfully tested and although we did not see the results we had hoped, we also ran out of time. Following the analysis, system configuration, staff engagement etc. we quickly approached the final weeks of the six-month extension.

Appendix B includes story boards which provides a step-by-step view on the process for fare evasion.

## Key Learnings

There are several learnings from Smart Stations which we must consider if the decision is to extend the smart technology into other stations:

### Support & Performance

Overall support was provided by the small T&D delivery team. As this was a PoC, we wanted to ensure we kept costs to a minimum and recognising that the system was voluntary to use. A mailbox was created and included within our briefing sessions and guidance material; we highlighted the need to submit any issues to the Smart Stations mailbox. The mailbox was monitored by the delivery team and would respond promptly.

Performance was monitored by the T&D delivery team. System outages would generate an email notification that would be sent to the delivery team. It was also the T&D delivery team who would conduct tests for each use case, to determine if the AI models were correctly identifying the desired behaviour and movement. This would involve the team conducting simulations on the station to see if the alerts would appear on the dashboard and reviewing recordings from our CCTV to determine if the system had missed any use case incidents.

If the decision is to expand Smart Stations, we must consider the support arrangements, specifically if Smart Stations becomes an essential part of kit. Logging, tracking, and resolving issues will require the input and design from our service teams and supplier.

### Networks

[REDACTED] In future, we must consider our network design options to

determine the best network design (e.g. LAN vs WLAN). Other considerations when designing our future network include firewalls, remote management capability, server grade edge processors and server grade switchable power supplies. For future phases, the network design will need to adhere to existing project governance and be approved by T&D's Architecture Review Board.

### Camera Limitations

We must consider the existing camera infrastructure and the enhanced accuracy of detections when using digital cameras versus analogue cameras. Camera position and the line of sight has a huge impact on the accuracy of detections and although our existing camera positions meet our safety and security standards, we may need to consider adding or moving cameras to increase the accuracy of detections.

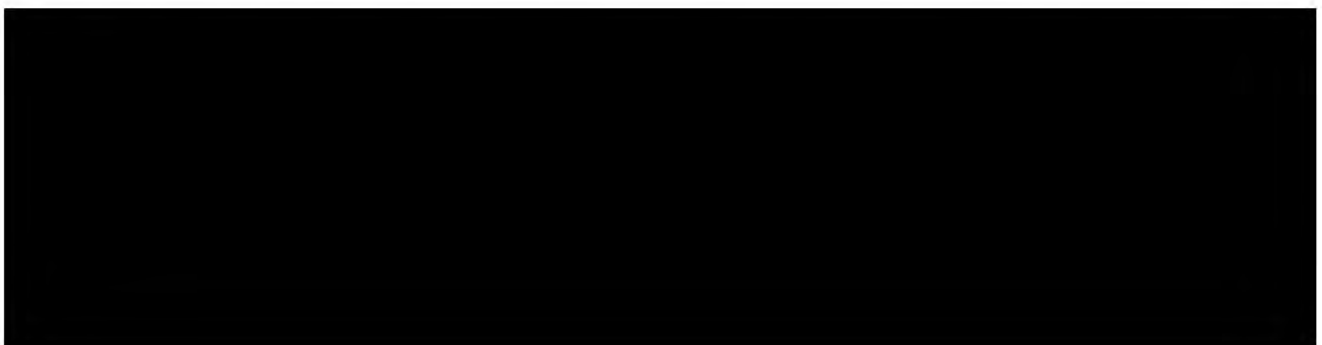
Modern digital cameras are recommended to improve the detection accuracy and the range of accurate detections in each area. For the purposes of the PoC, we **did not move or add** any additional cameras at Willesden Green station. The existing analogue cameras are circa 20 years old and have been in the same position for circa 20 years. This has resulted in several learnings which we must consider if the decision is to expand smart technology into more stations.

For most of our use cases, we had to set regions of interest, this is a clearly defined area which requires the person or object to be present in. Within the region of interest, the trigger is active, if the movement or behaviour occurs outside of the region of interest, it is unlikely to be detected. Regions of interest had to be defined at Willesden Green due to the quality of images from our existing CCTV infrastructure.



### Weather

Direct sunlight on the camera resulted in negative detections, and where extreme sunlight caused shadows over the benches, it did impact some use case detection models.



## Simulations

Before the deployment of each use case trigger the T&D delivery team conducted extensive simulations at Willesden Green. This required careful planning to ensure all simulations were conducted in a safe environment. As mentioned previously, some simulations e.g. person on track had to be conducted during non-operational hours.

On occasions, it did require the help and support from operational colleagues to notify customers when simulations were happening on the stations. Nas Ali also conducted many simulations at times when the delivery team were unable to visit Willesden Green station.

It is likely that further simulations would be required if smart stations were to be extended into more stations. Conducting simulations will require people to support in the process and it will take time to complete, this must be considered when identifying project roles and responsibilities.

## Human Factors

To improve the response rate to alerts, we must consider making Smart Stations an essential part of kit for Station Supervisors. Ensuring all alerts are acknowledged by staff will improve the situational awareness and response to incidents.

This may also result in future integration requirements into other existing applications, removing duplication and driving efficiencies.

Future phases must build on the existing guidance material and adopt a similar engagement model and conduct face to face briefings. This may prove a challenge if the station has high numbers of staff rostered at that station. Implementing Smart Stations at a larger station will take longer and will require more frequent engagement with staff.


# Appendix A

Members of the Smart Station Steering Group:

- Nick Allen – Lead Technology Advisory Manager (Chair)
- Jacqueline Attoh-Ammah (Product Manager, Transport Services)
- Ray Adabra – Senior Stations Delivery Manager
- Daniel Howarth - Head of CO Strategic Delivery & Change
- Simon Abernethy – Strategic Delivery & Change Manager
- Christopher Weaver – Area Manager Jubilee North
- Naz Ali – Area Manager (Seven Sisters)
- Trevor Hardy – Head of T&D Portfolio, Infrastructure Transformation
- Alistair Montgomery – Strategic Delivery & Change Manager
- Simon Ponsonby – Customer Service Manager (Willesden Green)
- Kayode Jimoh – Customer Service Manager (Jubilee Line)
- Patricia Horgan - Head of Business Partnering
- Jacqueline Robertson – HR Business Partner
- Simon Guild – Head of Privacy and Data Protection
- Craig Marshall - Privacy Adviser
- Mandy McGregor - Head of Policing and Community Safety, Policing & Community Safety
- Helen Dimond - Customer Experience Lead, Cust Insight Strategy and Experience
- Dipen Patel – Telecoms Engineer
- Fikriye Erdogan - Senior Sourcing Manager Connect, PC - IT
- Daniel Knight - Open Innovation Manager, Strategy & Innovation
- Luke Nicholls – Senior Business Analyst
- Nicola Brady – Senior Operations Policy & Problem-Solving Manager
- Jon Poett – Operational Policy Manager
- Gordon Barnes – Network Security Risk and Planning Manager
- Felicia Harris – SHE Business Partner
- David Kelly – London Underground CCTV Data Manager
- Roberto Rincon – Technology Strategy Manager
- Daniel Middlehurst – Revenue Control Inspector
- Fabia Barrenger – Change Design Lead
- Tilly MeehanGooch - Strategic Delivery & Change Manager

# Appendix B

Appendix B includes story boards which provides a step-by-step view on the process for fare evasion.

 The Smart Stations system spots an occurrence of fare evasion and creates a record with 3 CCTV images, which is displayed in the Smart Stations dashboard.



Station staff spot someone fare evading, however they are not known to the staff. Station Staff gets their iPad out to fill in WAASB, but take no other action.



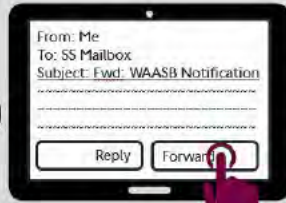
Station staff spot someone fare evading, and they are a known individual to staff, who is one of their 'top 10' repeat offenders. Station Staff gets their iPad out to fill in a WAASB.

THEN



Station staff raise a WAASB for the repeat offender, including key details.

THEN



Station staff receive the WAASB notification email, and forward it onto the Smart Stations Mailbox.

THEN



Revenue Control Inspector opens the Smart Stations mailbox and reviews the forwarded WAASB.

THEN

All Notifications: Search...

Status	Time Stamp	Camera	Station Location	Trigger	Ack By	Ack At
Valid (No Action Required)	10/04/2023 07:26:12			Fare Evasion (Exit)	System	10/04/2023 07:26:12
Valid (No Action Required)	09/04/2023 22:52:40			Fare Evasion (Exit)	System	09/04/2023 22:52:40
Valid (No Action Required)	09/04/2023 22:52:37			Fare Evasion (Exit)	System	09/04/2023 22:52:37

Revenue Control Inspector logs into the Smart Stations dashboard, and filters for fare evasion alerts, these having already been auto validated by the system.

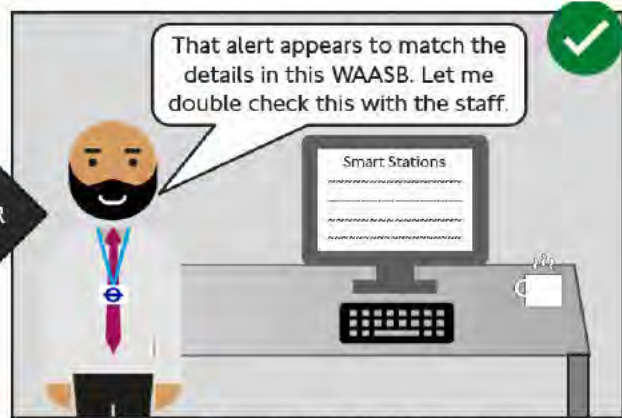
THEN



Revenue Control Inspector looks through the Smart Stations dashboard for a corresponding fare evasion alert that matches the details in the WAASB, but is unable to find an alert.

In this instance, the Revenue Control Inspector reverts to using the legacy CCTV process.

OR



Revenue Control Inspector finds the fare evasion alert in Smart Stations that corresponds with the details shared on the WAASB, and exports the images in order to confirm they are the same individual with the Station Staff that raised the WAASB.

In this instance, the Revenue Control Inspector sends the images to the staff member who raised the WAASB to confirm the images match the offender.

THEN



The member of Station Staff replies to the request to confirm that the images are NOT of the offender they witnessed committing fare evasion.

In this instance, the Revenue Control Inspector receives the confirmation from the staff that this is not the same individual, and at this point looks again at the alerts. If nothing is found, the Revenue Control Inspector reverts to using the legacy CCTV process.

OR



The member of Station Staff replies to the request to confirm that the images ARE of the offender they witnessed committing fare evasion.

In this instance, the Revenue Control Inspector receives the confirmation from the staff that this is the same individual, and proceeds to add the WAASB details to the alert in Smart Stations, mark as repeat offender, and looks for any other alerts.

THEN

Doesn't appear to be any other alerts for this individual, let me move onto the next case.

Smart Stations

Revenue Control Inspector has not seen any other alerts for this fare evader individual, and no further action is taken at this point.

OR

I'm going to link these alerts together, they are of the same individual.

Alert 005  
Alert 012  
Alert 023

Revenue Control Inspector recognises/notices other alerts of fare evasion for the same individual, and links them together on the Smart Stations dashboard.

THEN

Revenue Control Inspector can export alerts from the Smart Stations dashboard, and these can be fed into the existing repeat offender case building process.

Irregular pattern

18:00  
14:00  
10:00  
6:00

M T W T F S S

Revenue Control Inspector looks at the trends of the linked alerts within Smart Stations, but finds no obvious patterns of behaviour by the offender.

In this instance, the Revenue Control Inspector could contact BTP for any additional information, and if a last known address is found, a request for interview may be sent out.

OR

Regular pattern

8:00  
7:30  
7:00  
6:30

M T W T F S S

Alert 023

Revenue Control Inspector looks at the trends of the linked alerts within Smart Stations, and observes consistent patterns of behaviour by the offender, entering/exiting Willesden Green at similar times every day.

In this instance, the Revenue Control Inspector proceeds to schedule a visit to stop the offender. They could also contact BTP for any additional information they may hold on the offender.

THEN

TfL RESTRICTED



I've got a case here at Willesden Green, could you make a visit? The offender usually passes through Mon-Fri between 07:00-07:30.



Sure!

Revenue Control Inspectors coordinate a team to visit Willesden Green station at a time the offender usually passes through the station.

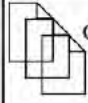
THEN



Excuse me Sir, can I see your ticket please?

Revenue Control Inspectors make a visit to Willesden Green station, and stops the offender for questioning under interview, presenting the evidence from Station Staff and Smart Stations.

THEN



Once the Revenue Control Inspector has interviewed the offender, all the required evidence artefacts will be passed to the Prosecutions Team to start the prosecution processes.

## Nick Allen

Lead Technology Advisory Manager

Technology Planning & Management

Technology & Data

Customer Strategy

Transport for London

Email: [REDACTED]@tfl.gov.uk





## Smart Stations – Willesden Green

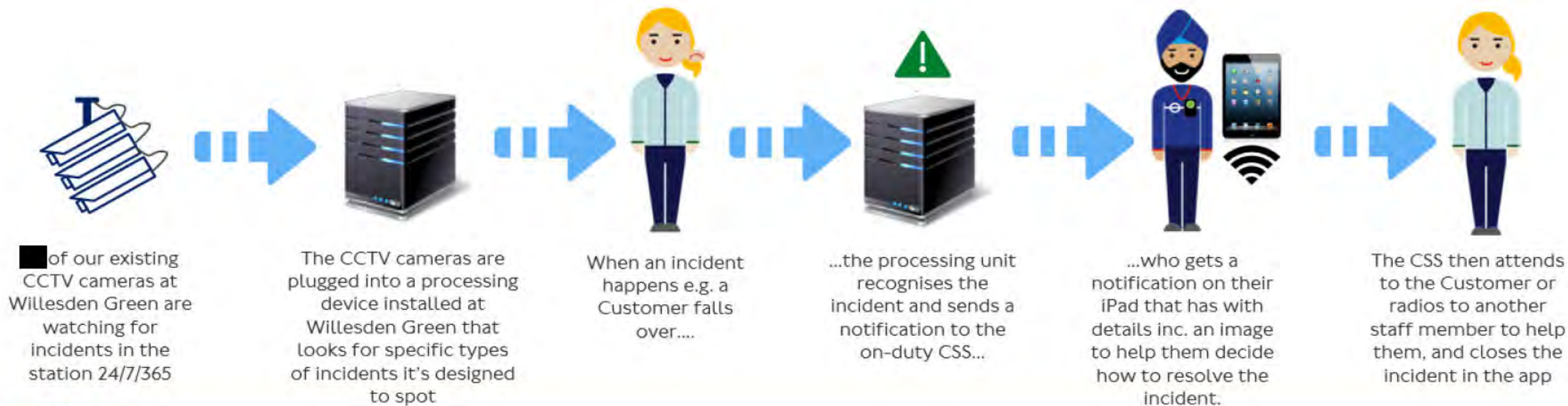


## 2 What is a Smart Station?

Safety and security are paramount to Transport for London (TfL) and in 2021, TfL's Technology and Data department in collaboration with operational frontline colleagues and Virgin Media O2 began exploring the use of smart technology at Willesden Green Station. Smart Stations is an exciting proof of concept at Willesden Green station, which uses an enhanced video analytics platform, with the aim to provide station staff with real-time insights and notifications on customer movement and behaviour.

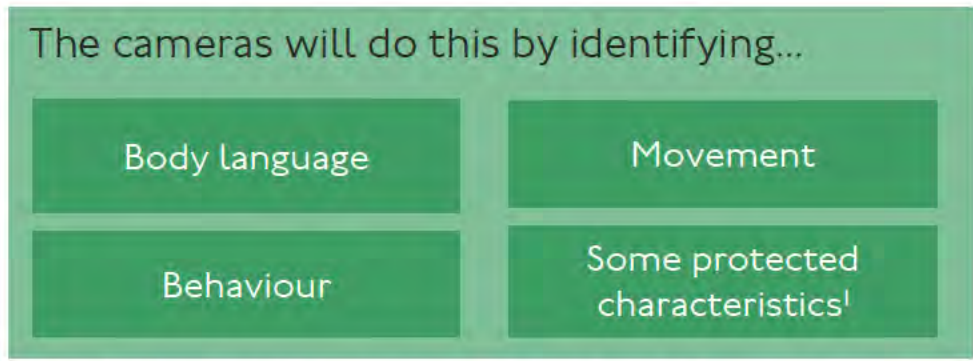
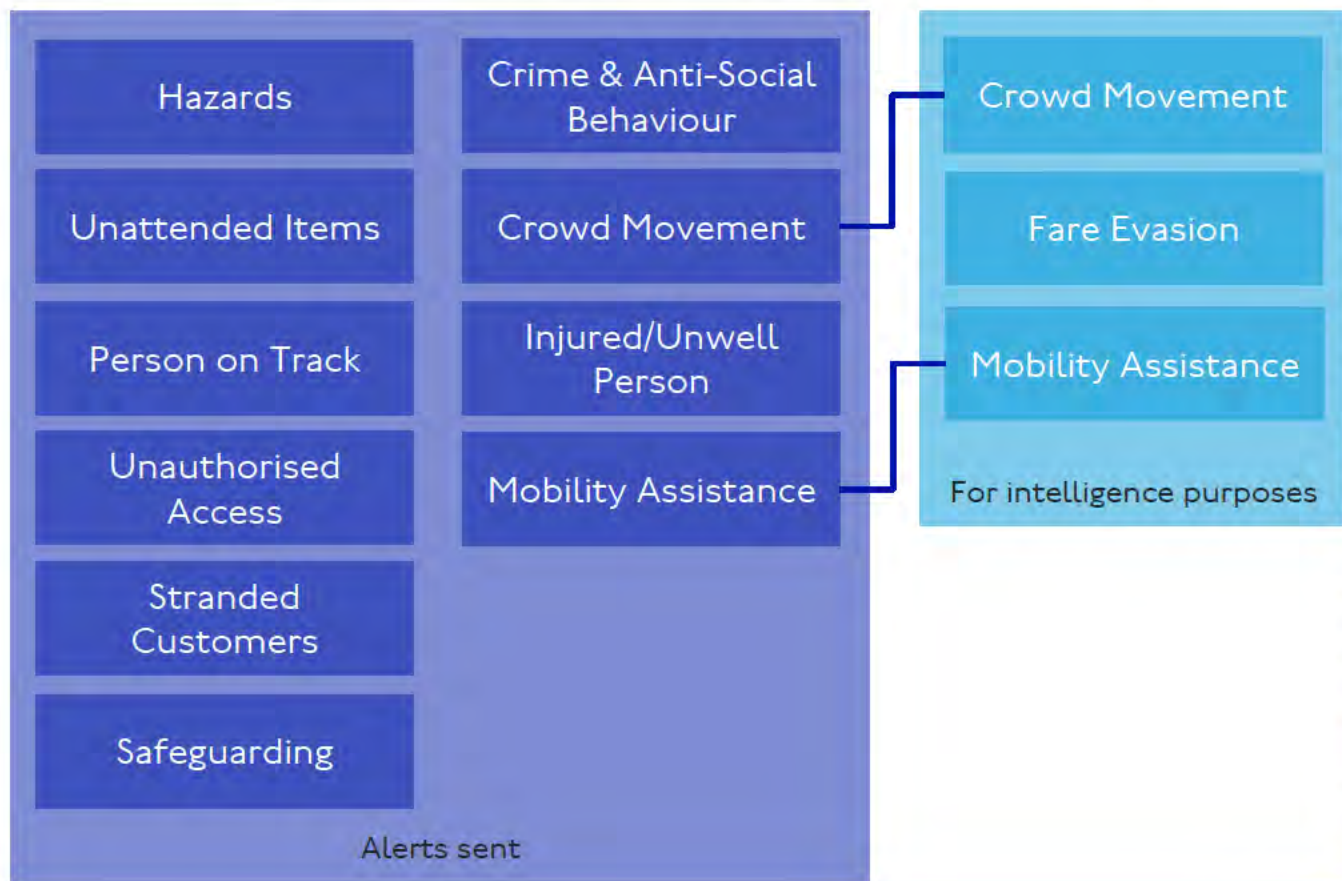
### How does it work?

The smart technology uses existing CCTV images (100 cameras in total), Artificial Intelligence (AI) algorithms and numerous detection models. Staff can receive notifications and insights related to incidents via a dashboard that visualises the information. Using image recognition and machine learning to identify trends and hazards, enables staff to respond to incidents that require their attention. Smart Stations does not make decisions for staff but equips them with comprehensive information about their station and customers.



### 3 What does a Smart Station look for?

Our initial classification of 77 potential use cases, established 33 with a high and medium category. Following several prioritisation discussions with frontline staff from Willesden Green and subject matter experts, we agreed on the following 11 use cases:



<sup>1</sup>This includes: disability, pregnancy/maternity for the purposes of the mobility assistance use case. All identification is performed in accordance with our data protection impact assessment and equality impact assessment.

#### Objectives:



## <sup>4</sup> Scoping & Design

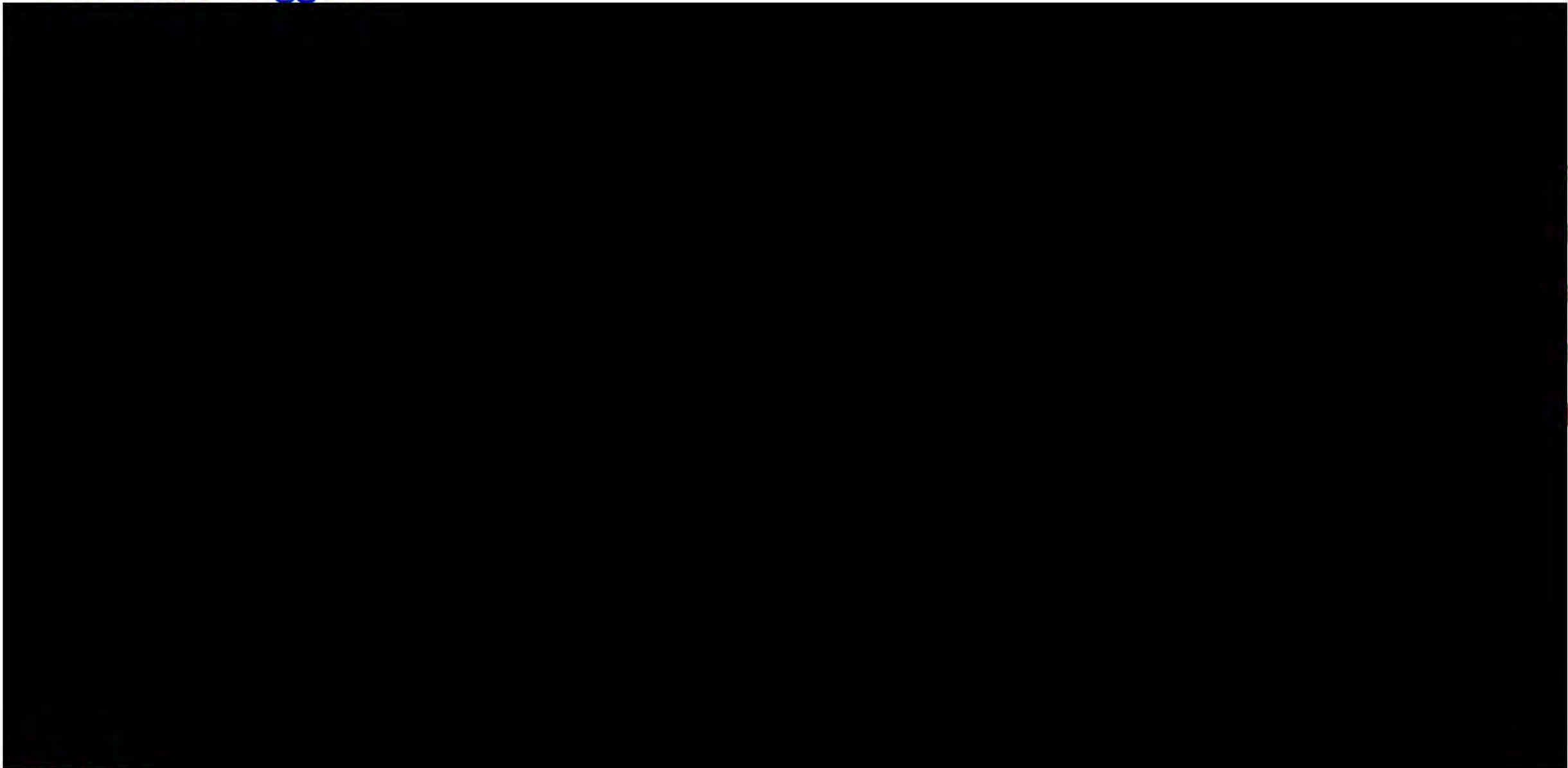
Early engagement with Network Rail enabled us to learn lessons and gather important insights such as, selecting a large, central London station caused several issues for their engineering teams and installing new Smart Meraki cameras added huge cost to the project.

Following several design workshops led by T&D, which involved key stakeholders from specialist areas such as Customer Operations, SHE and Network Security etc. we agreed on the following design principles:

- The smart technology stores the image of the incident for 14 days (aligned with LU's CCTV retention policy and ALL faces are blurred).
- The analytics can tell the difference between staff and customers.
- NO facial recognition is performed.
- Smart Station technology will not be used in any disciplinary procedure.
- The Smart Stations dashboard will not be used as a tool to measure or manage the performance of station staff.
- No audio is analysed or recorded – our cameras have no microphones.
- Smart Station technology will not replace station staff, they are essential to decide how to resolve an identified incident.

An important output at this stage was to define our use cases and triggers. Our initial classification of 77 use cases, established 33 with a high and medium category. Following several prioritisation discussions with staff from Willesden Green and subject matter experts, we agreed on 11 use cases.

## 5 Use Case Triggers



## 6 Why Willesden Green?

Using the feedback and learnings from Network Rail, we selected a 'Local Station', as our focus was on helping a station that has high customer footfall and minimum staffing levels. Our Sponsor, Ray Adabra also wanted the project team to select a station on the Jubilee Line.



GATEWAY



DESTINATION



METRO



LOCAL

Reviewing all Local stations on the Jubilee Line, we assessed the station heritage, camera infrastructure and station characteristics e.g. number of gates, public help points, stairs, escalators, lifts etc. Following our assessment, we were left with 3 possible candidate stations and the Steering Group's decision was to select Willesden Green.

At this stage, T&D had been working collaboratively with colleagues in TfL Engineering and Asset Strategy. It was important to assess the existing CCTV infrastructure and at Willesden Green they use analogue cameras, which are circa 20 years old.

Our Telecoms Engineer was responsible for engaging and instructing our communication assets maintainer 'Telent' to work on the design and installation of hardware at Willesden Green station.

Station	Line	Type	Heritage	Camera Type	Camera Quantity	Gates	Step Free Access	Lifts	No. of Escalators	PHPs
Kilburn	Jubilee	Local - A	Not listed	Tecton Dalek		5	Y	1	0	7
Kingsbury	Jubilee	Local - A	Local listing pending	VisioWave		4	Y	2	0	12
Neasden	Jubilee	Local - A	Not listed	VisioWave		4	N	0	0	5
Stanmore	Jubilee	Local - A	Locally Listed	VisioWave		6	Y	0	0	11
West Hampstead	Jubilee	Local - A	Not listed	Liberator		6	Y	0	0	5
Willesden Green	Jubilee	Local - A	Grade II	VisioWave		8	N	0	0	8

Preferred stations

Listing unlikely to have an impact on installation of camera and connectivity technology. Further exploration to be done at chosen station.

All cameras are analogue. TfL Engineering has a preference for VisioWave as this is newer technology, others are at end of life and due for replacement.

Preference will be to have a station with stairs and/or lifts, to align with such use cases as stranded customers, vulnerable customers, customer/staff injuries etc.

Number of PHPs installed in stations, further investigation needed on how many are in operation.





## 7 Camera Analysis

Our next step was to analyse and assess the [REDACTED] cameras in total at Willesden Green and select the cameras in scope for the PoC. Using the CCTV snapshots which TfL Engineering maintain for all stations across the network, we reviewed the station layout maps, CCTV images and agreed with staff from Willesden Green, which cameras we had to include and were aligned to the use cases in scope.



## <sup>8</sup> Installation & Architecture

[REDACTED]

[REDACTED]

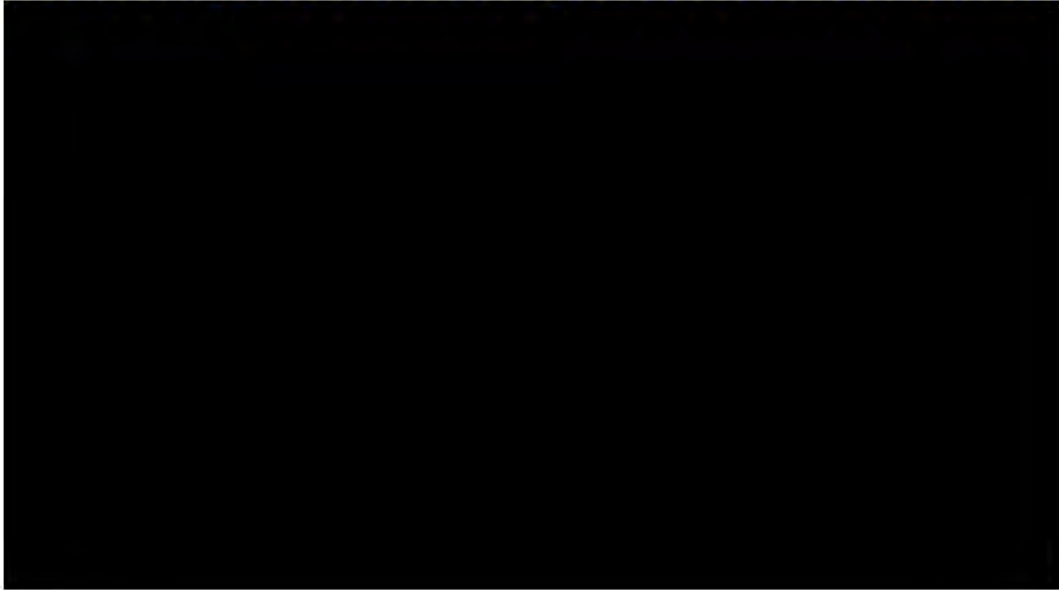
Prior to install, architecture designs had to be produced and approved by TfL Engineering and T&D's Architecture Review Board. Telent installed and tested the hardware at their test site and following a successful test install, we arranged for Telent to install the kit at Willesden Green during non-operational hours.

[REDACTED]

## 9 Simulations

Prior to the launch of each use case trigger, we had to carry out extensive simulations at Willesden Green station. This required detailed planning and support from our operational colleagues. Due to the nature of some of the use case triggers e.g. weapons detection and person on track, we had to conduct the simulations during non-operational hours.

Simulations were required for machine learning e.g. many days at Willesden Green station simulating the exact behaviour we wanted the AI to detect and alert staff on. The more data and examples of the behaviour and movement we wanted detected, improved the AI models, and minimised the risk of alerting staff to false incidents.



# 10 Smart Station Dashboard

There are two ways staff can access the dashboard, via a desktop or iPad. Both require the user to log-in with their credentials.

The mobile application includes popup notifications which is standard for many mobile applications. The notifications appear on the screen in real-time, alerting staff to incidents happening in the station.

Status	Timestamp	Camera	Station location	Trigger	Act By	Act At
Active	14/09/2022 12:11:23	[Redacted]	[Redacted]	unauthorised access (platform)		
Active	14/09/2022 11:53:46	[Redacted]	[Redacted]	person on floor		
Active	14/09/2022 11:50:14	[Redacted]	[Redacted]	person on floor		
Active	14/09/2022 11:40:50	[Redacted]	[Redacted]	unauthorised access (platform)		
Active	14/09/2022 11:38:32	[Redacted]	[Redacted]	Unauthorised access (Platform)		

### Mobile Application Version

### Alarm Details

Time : 03/10/2022 14:10:15

Use Case : Item/Person on track

Triggers : Unauthorised access (platform)

Criticality : High

Location : [Redacted]

Camera : [Redacted]

Action : [Redacted]

User Comment :

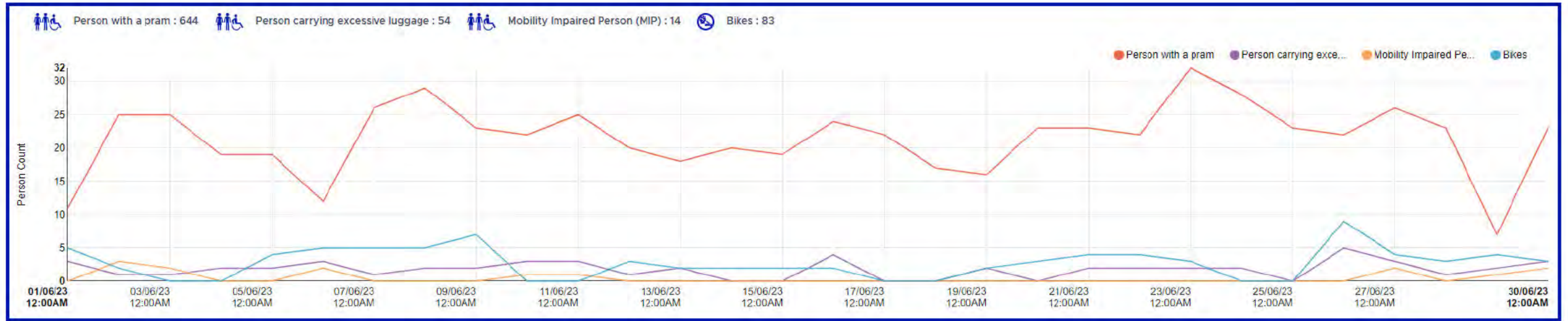
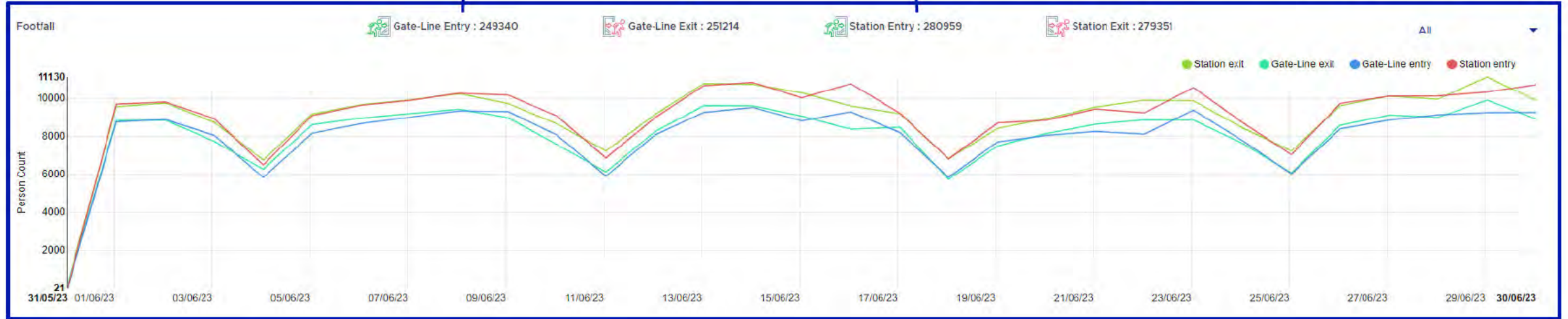
Admin Comment : please specify the reason

SAVE

# Analytics & Insights



31,619 – Insights for commercial planning



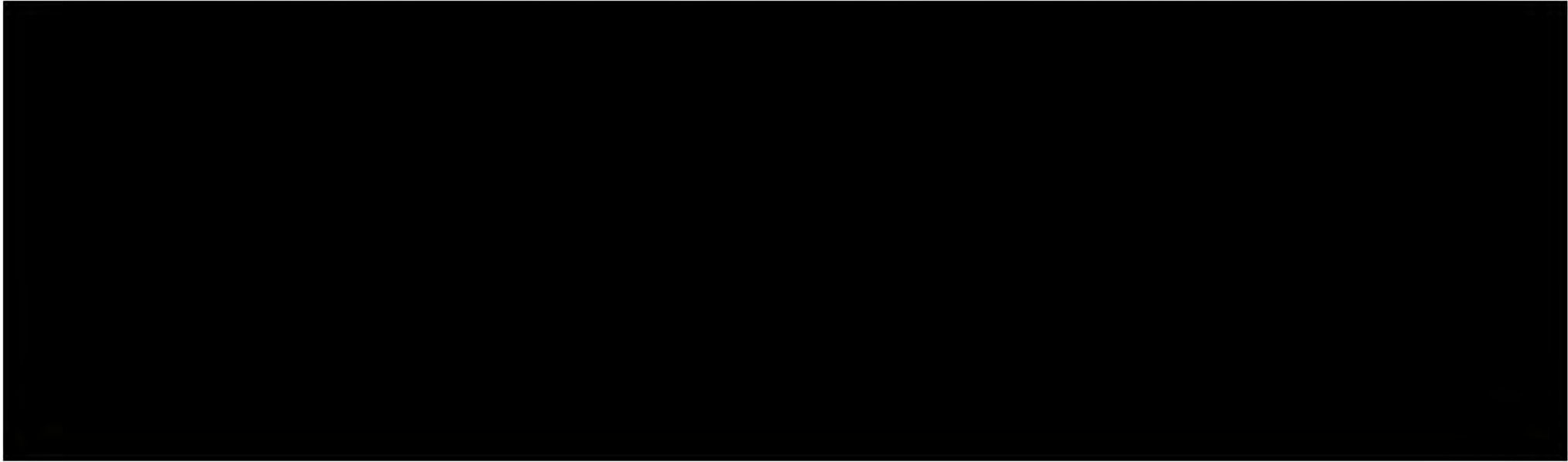
## 12 Use Case Review

### Unauthorised Access

At Willesden Green station they have two Boswick Gates in use, prohibiting non-personnel access to platforms 1 and 4. [REDACTED]

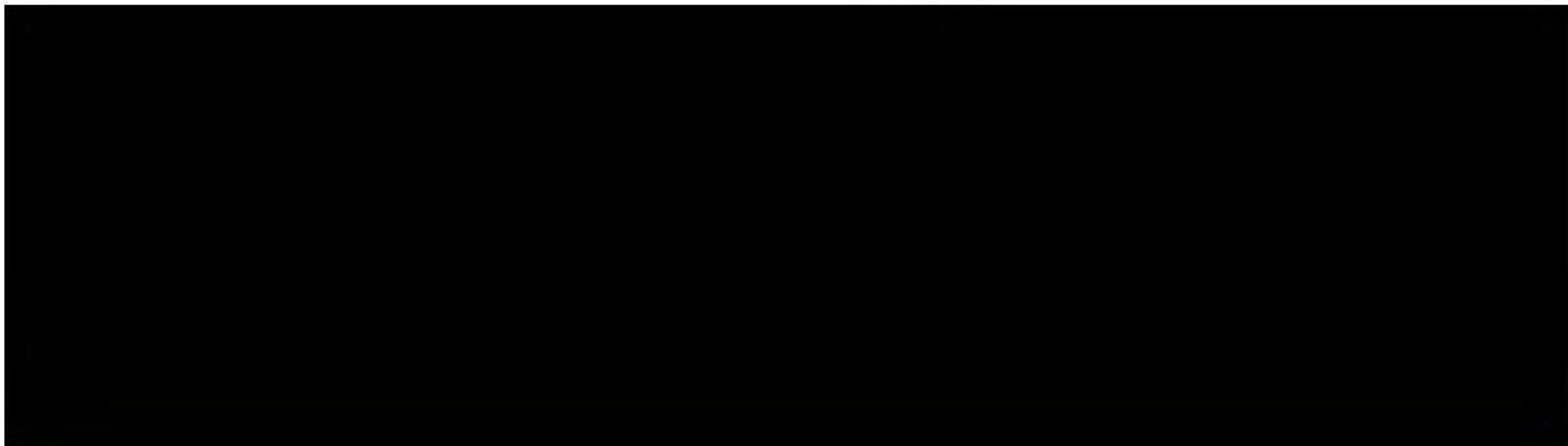
In scope was the platform end gates. Staff at Willesden Green wanted to be made aware of incidents when someone had opened and crossed the platform end gates.

The unauthorised access use case has proven to be extremely useful to staff, however following feedback from staff, we de-scoped one of the platform gates, as the system was accurately detecting a person i.e. the train operator, every time there was a de-trainment at the station.



### Safeguarding

During the design and scoping phase, we worked closely with our LU Safeguarding Leads and defined the thresholds and parameters for each trigger. Using the alerts as a preventive measure, allowed staff to act quickly and investigate matters further. As a result of the notifications, there was an increase in the number of public announcements made by staff, reminding customers to step away from the yellow line. For some triggers, we defined time parameters which reflected behaviour related to suicide attempts on our network.

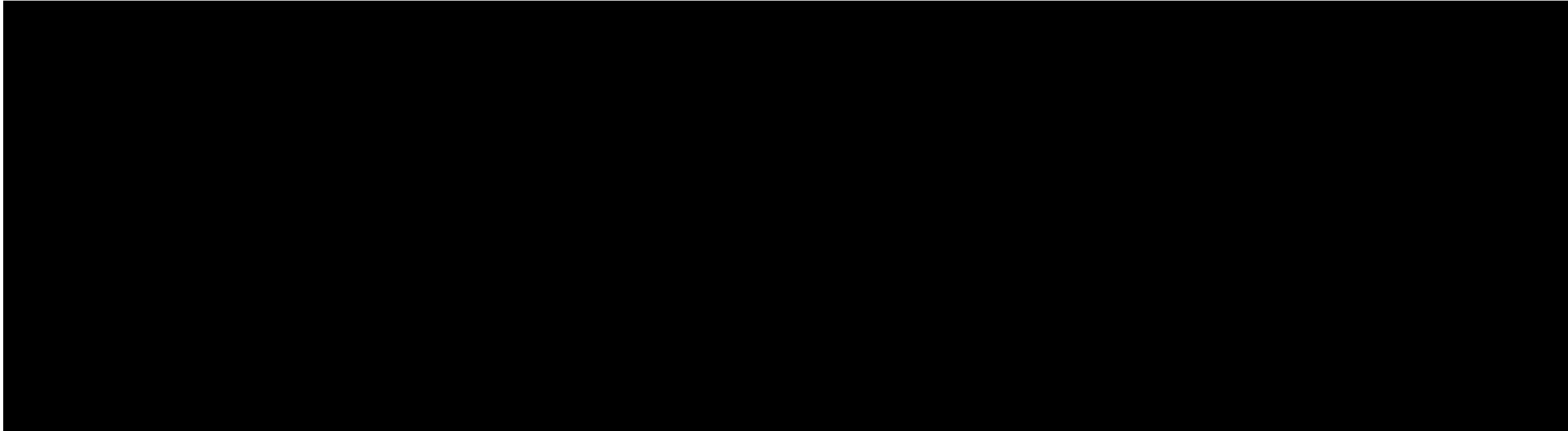


# 14 Use Case Review

## Mobility Assistance

Accessibility is extremely important to TfL, and a key use case trigger was to test if the system can correctly detect wheelchairs. Willesden Green is not a step free access station and with one main staircase leading to the platforms it is not safe for wheelchair users.

We also included two triggers which we believe can showcase how smart technology can assist with the decision making and analysis when it comes to deciding on future stations becoming step free. We are also conscious that Willesden Green station has one main staircase leading to Platforms 2 and 3, and the biggest contributor to customer injuries on stairs and escalators is excessive luggage e.g. large suitcases.





# 15 Use Case Review

## Crime and Anti-Social Behaviour

Initially, we wanted to include 'acts of aggression', however due to [REDACTED] insufficient training data needed for the detection model, we were unable to pursue. Although we were unable to successfully detect acts of aggression, we changed the trigger to 'arms raised', which is a common behaviour linked to acts of aggression.

Changing the trigger to arms raised, also provided staff with an additional safety precaution e.g. if a member of staff felt threatened and they were unable to use their radio, they could raise their arms and an alert would be sent to the Supervisor, who can then raise the alarm or request additional support. Thankfully, there have been no reported workplace violence incidents linked to this use case.



## 16 Use Case Review

### Crime & Anti-Social Behaviour cont....

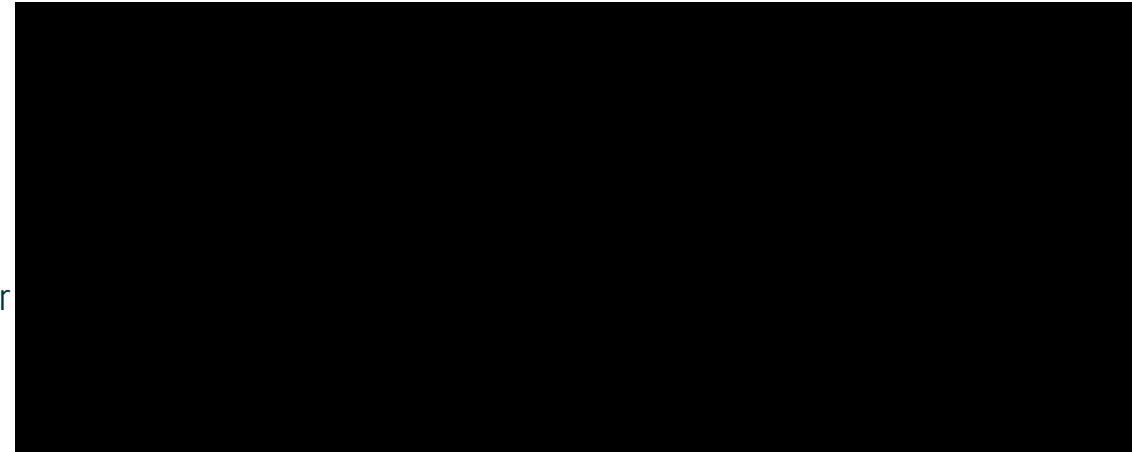
Although unfolded bikes and e-scooters were not initially raised as a concern by staff at Willesden Green, we wanted to assess if the smart technology can successfully detect bikes and e-scooters.

Following several months of staff feedback, testing and analysis of data, we eventually switched off the detection models for both, as the AI could not differentiate between an unfolded bike and normal bike and an e-scooter and children's scooter. This meant that the dashboard generated high numbers of false alerts which did not require the attention of staff.

Working closely with our colleagues in Network Security, we included a 'weapons detection' trigger. This required detailed planning and engagement with our policing partners, the British Transport Police (BTP).

A trained firearms officer was able to help with our simulations and we conducted several tests throughout the station during non-operational hours.

[REDACTED], we were pleased with the results and thankfully, there have been no reported alerts or incidents for weapons at Willesden Green station. In the images below, you will see the BTP officer holding a machete and handgun.



# 17 Use Case Review

Person on Track

[Redacted]

[Redacted]

[Redacted]

[Redacted]

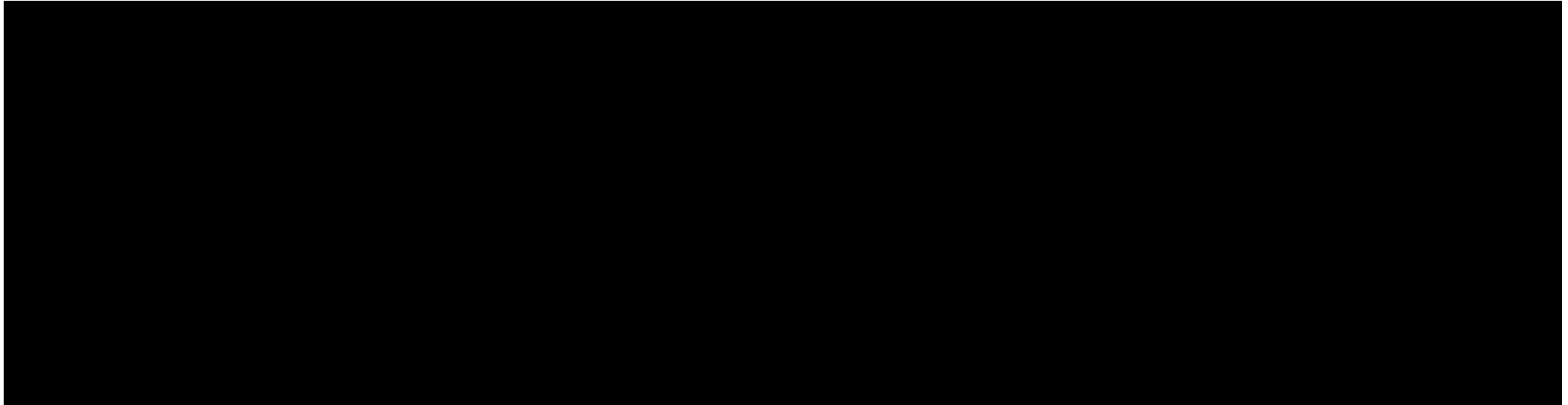
[Redacted]



# 18 Use Case Review

## Unattended Items

An objective for the project was to demonstrate how smart technology can to drive enhancements in safety and security and we recognised the security challenges we have across the network with regards to unattended items. We have seen promising results for this trigger which has resulted in staff carrying out further investigations when needed.



## Litter and Debris

Station cleanliness and ambiance is very important, and our first trigger launched was the detection of litter. Although Willesden Green station has a regular cleaning schedule, the system generated many alerts which caused frustration amongst staff. The detection model was very accurate, detecting newspapers that customers had left, and unwanted paper cups. Following feedback from staff, we disabled the litter alert.

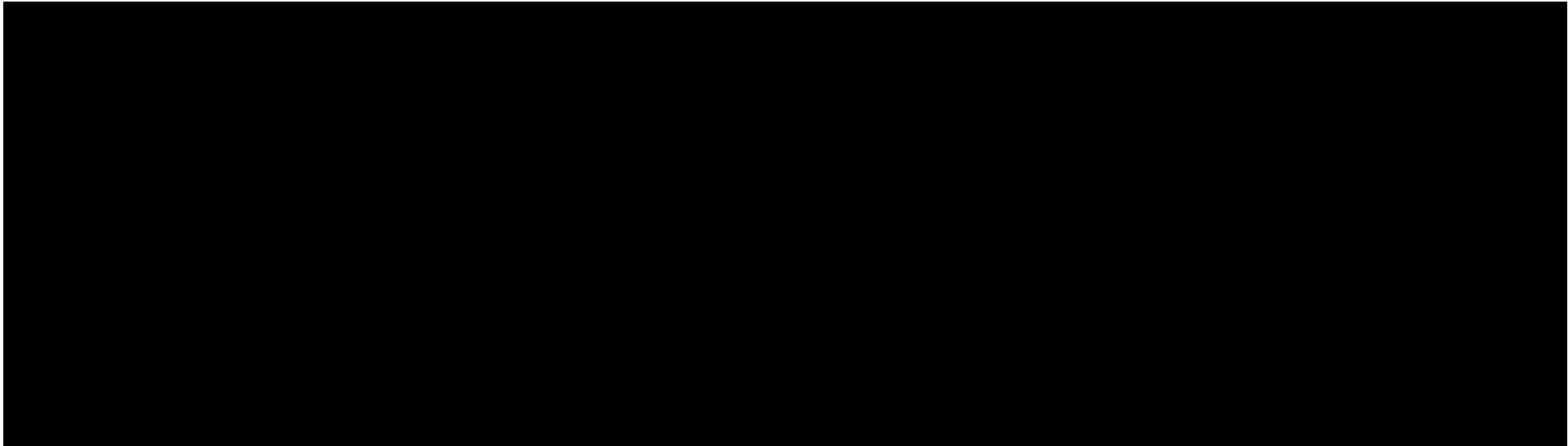
# 19 Use Case Review

## Person on Floor

Another important trigger prioritised by staff at Willesden Green station. Throughout the trial we successfully detected several incidents where customers fell on the floor and required assistance.

We also received alerts, which highlights the challenging behaviour of a small minority group of customers who risk their safety when using our services.

We have also seen several alerts for rough sleepers and beggars at the entrance of the station. Alerting staff early, has enabled them to remotely monitor the situation and provide the necessary care and assistance.



### **Stranded Customers**

Staff at Willesden Green station raised the need to be alerted to when customers are stranded, either at the gateline or staircase. [REDACTED]

[REDACTED] Alerting staff enables them to quickly provide the assistance required.

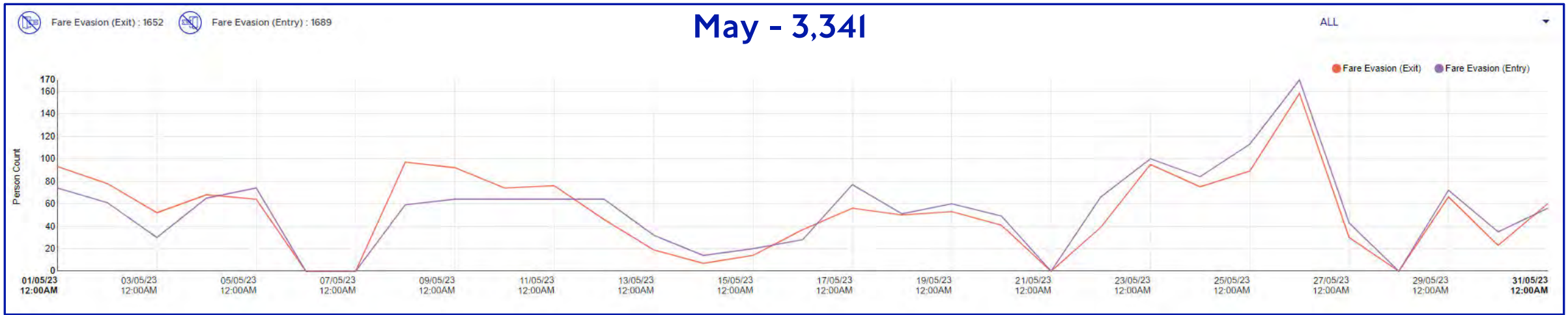
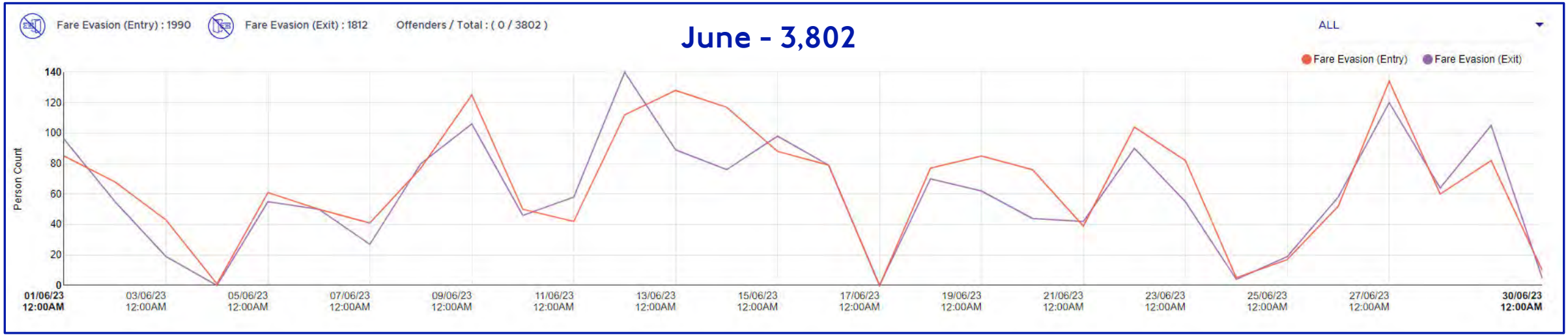
### **Fare Evasion**

The triggers for fare evasion were the last to launch and it was agreed at the design phase and with our Trade Unions to not alert station staff due to concerns raised with workplace violence.

Following the launch of the fare evasion triggers, we made several enhancements to the detection models, this involved watching several hours of CCTV footage and recording the times of incidents that the AI detection model missed. Using the missed incidents data to machine learn and enhance the models resulted in a huge increase in fare evasion alerts.



# 21 Smart Station Fare Evasion Alerts



## <sup>22</sup> Smart Station Learnings

- Following a **12-month** period, the system detected over **44,000 triggers** which included real-time alerts (**19k**) and alerts for insights (**25k**) only. Smart Stations was designed by station staff and their continued feedback and collaboration with T&D, enabled an agile delivery to ongoing changes when required. On average, staff would receive **55 alerts** a day relating to the use cases.
- Following extensive Trade Union engagement it was agreed that the dashboard would be used voluntarily by Station Supervisors and therefore, staff were encouraged to use the dashboard when on shift. This resulted in over **60% of alerts** were acknowledged by station staff and only **1% was recorded as 'Invalid'** which is when the system has incorrectly detected the behaviour, movement or object as required.
- Early detections via the Smart Stations dashboard enabled staff to monitor and observe the situation, ensuring a speedy response is provided. Data shows that over **300 alerts** resulted in the Supervisor making an additional public address announcement, reminding customers to stand behind the yellow line.
- The dashboard alerted Station Supervisors to incidents when customers had accessed non-public areas and the track, resulting in the Station Supervisor sending staff to assist and prevent any major incident or risk to life.
- Feedback from staff suggests smart technology has a key role to play in the future, by helping and protecting our staff and improving the overall customer experience within stations.



## <sup>23</sup> Smart Station Learnings

There are several learnings from Smart Stations which we must consider if the decision is to extend the smart technology into other stations:

### **Support & Performance**

Overall support was provided by the small T&D delivery team. As this was a PoC, we wanted to ensure we kept costs to a minimum and recognising that the system was voluntary to use. A mailbox was created and included within our briefing sessions and guidance material; we highlighted the need to submit any issues to the Smart Stations mailbox. The mailbox was monitored by the delivery team and would respond promptly.

Performance was monitored by the T&D delivery team. System outages would generate an email notification that would be sent to the delivery team. It was also the T&D delivery team who would conduct tests for each use case, to determine if the AI models were correctly identifying the desired behaviour and movement. This would involve the team conducting simulations on the station to see if the alerts would appear on the dashboard, and reviewing recordings from our CCTV to determine if the system had missed any use case incidents.

If the decision is to expand Smart Stations, we must consider the support arrangements, specifically if Smart Stations becomes an essential part of kit. Logging, tracking, and resolving issues will require the input and design from our service teams and supplier.

### **Networks**

For future phases, the network design will need to adhere to existing project governance and be approved by T&D's Architecture Review Board.

## <sup>24</sup> Smart Station Learnings

### Camera Limitations

We must consider the existing camera infrastructure and the enhanced accuracy of detections when using digital cameras versus analogue cameras. Camera position and the line of sight has a huge impact on the accuracy of detections and although our existing camera positions meet our safety and security standards, we may need to consider adding or moving cameras to increase the accuracy of detections.

Modern digital cameras are recommended to improve the detection accuracy and the range of accurate detections in each area. For the purposes of the PoC, we did not move or add any additional cameras at Willesden Green station. The existing analogue cameras are circa 20 years old and have been in the same position for circa 20 years. This has resulted in several learnings which we must consider if the decision is to expand smart technology into more stations.

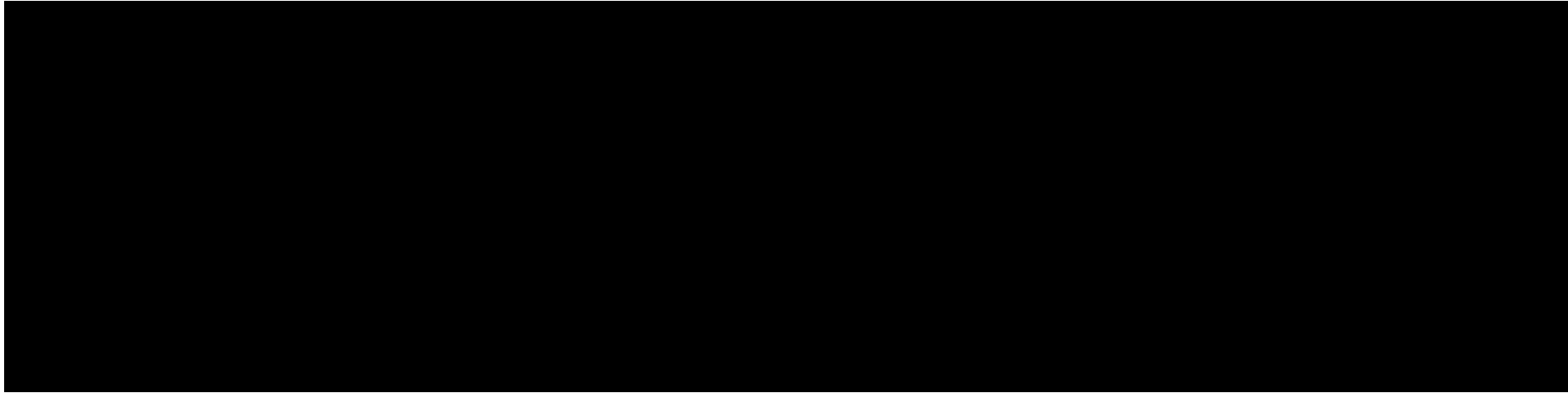
For most of our use cases, we had to set regions of interest, this is a clearly defined area which requires the person or object to be present in. Within the region of interest, the trigger is active, if the movement or behaviour occurs outside of the region of interest, it is unlikely to be detected. Regions of interest had to be defined at Willesden Green due to the quality of images from our existing CCTV infrastructure.



## <sup>25</sup> Smart Station Learnings

### Weather

Direct sunlight on the camera resulted in negative detections, and where extreme sunlight caused shadows over the benches, it did impact some use case detection models.



### Simulations

Before the deployment of each use case trigger the T&D delivery team conducted extensive simulations at Willesden Green. This required careful planning to ensure all simulations were conducted in a safe environment. As mentioned previously, some simulations e.g. person on track had to be conducted during non-operational hours.

On occasions, it did require the help and support from operational colleagues to notify customers when simulations were happening on the stations. Nas Ali also conducted many simulations at times when the delivery team were unable to visit Willesden Green station.

It is likely that further simulations would be required if smart stations were to be extended into more stations. Conducting simulations will require people to support in the process and it will take time to complete, this must be considered when identifying project roles and responsibilities.

## <sup>26</sup> Smart Station Learnings

### Human Factors

To improve the response rate to alerts, we must consider making Smart Stations an essential part of kit for Station Supervisors. Ensuring all alerts are acknowledged by staff will improve the situational awareness and response to incidents.

This may also result in future integration requirements into other existing applications, removing duplication and driving efficiencies.

Future phases must build on the existing guidance material and adopt a similar engagement model and conduct face to face briefings. This may prove a challenge if the station has high numbers of staff rostered at that station. Implementing Smart Stations at a larger station will take longer and will require more frequent engagement with staff.

**Thanks**

## F7526 A4 Data Protection Impact Assessment (DPIA) Checklist

Any initiative, project or proposal to change processes that involves the processing of personal information (or the use of privacy intrusive technologies) is likely to give rise to various privacy and data protection concerns. Undertaking a DPIA helps to ensure that data protection risks are identified as soon as possible. A DPIA should continue to be maintained and updated throughout the project lifecycle. The GDPR makes a Data Protection Impact Assessment (DPIA) mandatory for certain types of processing, or any other processing that is likely to result in a high risk to individual's interests.

This assessment tool is designed to examine a new project / initiative, or a significant change to an existing process at an early stage. It will result in an initial assessment of privacy risk and determine which level of further assessment is necessary. The Privacy and Data Protection team will assess the completed DPIA and may request further information to assist in the identification and mitigation of privacy risks.

Your details			
Name:	Nicholas Allen	Date DPIA completed	27/01/2022 (last updated 22/06/2023)
Job title:	Technology Improvement Lead - LU	Proposed launch date	Q1 2022

Name and description of the project:	Name of Project: Smart Stations Proof of Concept Description: Trial of an enhanced analytics platform at Willesden Green London Underground Station. The analytics technology uses data from CCTV cameras to deliver real-time insights to station staff on customer movement, security, safety, and the station environment, to enable them to provide the best possible customer experience. Phase 1 of the deployment focused on use cases that did not identify specific individuals. Phase 2 trials the
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Issue no. A3 Issue date: November 2018



	technology to assess how it can be used to detect and tackle fare evasion. Whereas Phase 1 used facial blurring, CCTV images that indicate fare evasion will be used to identify, apprehend and prosecute fare evaders, and will not be blurred.				
Personal Information Custodian (PIC)	Ray Adabra (Head of Customer Service – Jubilee Line)	Is PIC aware of this DPIA?	Y	Project Sponsor	Ray Adabra (Head of Customer Service – Jubilee Line)

A DPIA is **mandatory** in certain circumstances. Please tick each box where it likely that the proposal will meet the criteria:

Use <a href="#">profiling</a> or <a href="#">automated decision-making</a> to make decisions that will have a significant effect on people. <a href="#">Significant effects</a> can include financial or legal outcomes, intrusions into private life or restrictions on access to services, opportunities or benefits.		Process <a href="#">special category data</a> (relating to: racial or ethnic origin; political opinions; religious or philosophical beliefs; trade union membership; <a href="#">genetic</a> or <a href="#">biometric</a> data; health; sex life or sexual orientation) or criminal offence data on a large scale.		Make changes to processes and systems that are likely to result in significantly more employees having access to other peoples' <a href="#">personal data</a> , or keeping personal data for longer than the agreed period.	
Use data concerning children or <a href="#">vulnerable</a> people. A person with vulnerability is usually described as someone who is at a higher risk of harm than others.		Process <a href="#">personal data</a> which could result in a risk of physical harm or psychological distress in the event of a <a href="#">data breach</a> .		Process children's <a href="#">personal data</a> for <a href="#">profiling</a> or <a href="#">automated decision-making</a> or for <a href="#">marketing</a> purposes, or offer online services directly to them.	
<a href="#">Systematically monitor</a> a publicly accessible place on a large scale – e.g. through the use of CCTV or Wi-Fi tracking.	Y	Process <a href="#">personal data</a> in a way which involves tracking individuals' online or offline location or behaviour.	Y	Match, compare or combine datasets, or have the potential to deny anonymity or re-identify people.	

Use new technologies or make novel use of existing technologies.	Y	Process <a href="#">personal data</a> on a large scale or as part of a major project.		Process <a href="#">personal data</a> without providing a <a href="#">privacy notice</a> directly to the individual.	
Use <a href="#">personal data</a> in a way likely to result in objections from the individuals concerned.		Apply evaluation or scoring to <a href="#">personal data</a> , or <a href="#">profile</a> individuals on a large scale.		Use innovative technological or organisational solutions.	Y
Process <a href="#">biometric</a> or <a href="#">genetic</a> data in a new way.		Undertake <a href="#">systematic</a> monitoring of individuals.	Y	Prevent individuals from exercising a right or using a service or contract.	



## Step 1 – Identify the need for a DPIA

Explain broadly what your project aims to achieve and what type of data and [processing](#) it involves.

You may find it helpful to refer or link to other documents, such as a project proposal.

Summarise why you identified the need for a DPIA.

Our objectives are to:

- a) Help staff improve the passenger experience within stations
- b) Drive enhancements in station safety, security and environment, and
- c) Test the viability of Smart Station technology in LU
- d) Detect, monitor and prosecute fare evasion

As part of the Proof of Concept we expect the Smart Stations technology to process real-time analytics of CCTV imagery from ████ cameras around Willesden Green Station. Our current scope is aiming to deliver insights across 26 use cases, including four fare evasion use cases. Each of which will have its own success criteria and benefits. Ultimately the technology aims to deliver meaningful operational prompts to station staff of instances that may warrant their attention.

The analytics technology will make use of advanced image recognition to pick up on environmental and people movement conditions and prompt alerts to station staff devices via an app/dashboard. The technology does not make any biometric measurements of the people in the CCTV imagery. With the exception of images used to identify and take action against fare evaders, data outputs are anonymised. The technology will also not make any decisions for station staff, it is intended only as an enabler to make them aware of a potential situation that may require their attention. No automated decisions will be taken by the technology as a result of the analytics processing performed. We have discussed this project with Simon Guild, TfL's Head of Privacy and Data Protection from the initial scoping phase as we are aware there are data protection risks to be considered when processing CCTV imagery, and in feeding analytics to station staff.

**Step 2: Describe the nature of the processing**

<p>How will you collect, use, and delete data? What is the source of the data?</p> <p>Will you be sharing data with anyone?</p>	<p>Smart Stations utilises a solution provided to TfL by O2 Telefonica, from their partner Integration Wizards.</p> <p>Our discussions with Commercial colleagues have indicated that we have a robust contract in place with O2 for the various services that they provide to us, Smart Stations will be delivered by them as part of a proof of concept using the transformation fund we have built up with them. Integration Wizards are a third party engaged by O2, we have a contract variation that has been worked through between the TfL Commercial Team, O2 Legal, as well as colleagues in TfL Data Protection. All stakeholders are satisfied that we have the necessary data protection clauses updated and included into the contract with O2.</p> <p><b>How will you collect, use, and delete data? What is the source of the data?</b></p> <p>Data will be gathered from analysing real-time CCTV camera images from █ Willesden Green Station cameras. The analytics engine will be looking for instances of use cases occurring such as a passenger falling over. If the analytics engine detects this, an alert will be triggered and sent to the Smart Stations dashboard.</p> <p>For the purposes of training the analytics engine, we will provide sample footage from the selected CCTV cameras to Integration Wizards in order to train the AI what to look for and set the parameters of the triggers. The sample footage will be facially blurred by TfL before it is shared with Integration Wizards.</p> <p>For the most part, no personally identifiable data is stored as a result of the operation or evaluation of the system. Where snapshots are taken, faces will be blurred. The exception in phase 2 of the project is that images that appear to detect fare evasion will be saved and reviewed by station staff and Revenue Control Inspectors with the express purpose of identifying individuals. Fare evasion images will not be blurred.</p> <p><b>Will you be sharing data with anyone?</b></p> <p>Data will be processed by Integration Wizards via their on-premise edge processing device in order to generate use case alerts for station staff. Data generated from the analytics and anonymised images will</p>
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<p>Are you working with external partners or suppliers?</p> <p>Is there an agreement/contract in place with the third parties? (If so, please provide a copy with the assessment.)</p> <p>Will the data be combined with, or analysed alongside, other datasets held by TfL? If so, which ones?</p> <p>How and where will the data be stored?</p>	<p>be hosted in a cloud environment hosted at a data centre within the UK (Microsoft Azure).</p> <p>Discussions are underway with British Transport Police (BTP) to explore whether images of prolific fare evaders might be shared by TfL with the BTP for the purpose of identification and to establish their address so that TfL can bring a private prosecution. This will be taken forward under a separate information sharing agreement if it progresses.</p> <p><b>Are you working with external partners or suppliers?</b></p> <p>Yes, the trial is being provided by O2 Telefonica and their visual analytics partner, Integration Wizards.</p> <p><b>Is there an agreement/contract in place with the third parties? (If so, please provide a copy with the assessment).</b></p> <p>Yes, a contract variation has been agreed with O2 and TfL to the existing O2 contract. TfL Commercial have led the drafting in consultation with Simon Guild for updates to the necessary data protection clauses within the contract. Current data protection clauses within the contract are sufficient as they do not mention the anonymity of images.</p> <p><b>Will the data be combined with, or analysed alongside, other datasets held by TfL? If so, which ones?</b></p> <p>Anonymized data relating to instances of fare evasion at Willesden Green will be shared with the data and analytics team in TfL, specifically around the gateline footfall data and instances where customers have been identified as having evaded paying a fare. No personally identifiable images of fare evasion will be provided, only redacted images including the time, and date of the evasion incident, as well as the type of gate, and type of fare evasion, and location within the station, and direction of travel i.e. in or out of the station. Fare evasion incidents will be compared with WASAAB reports to identify footage of prolific fare evaders.</p> <p><b>How and where will the data be stored?</b></p> <p>All communications to and from the device are encrypted using TLS 1.2 and AES 256 BIT encryption. [REDACTED] devices are certified as Microsoft security compliant. Data will be stored in an Azure data</p>
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Will any data be processed overseas?

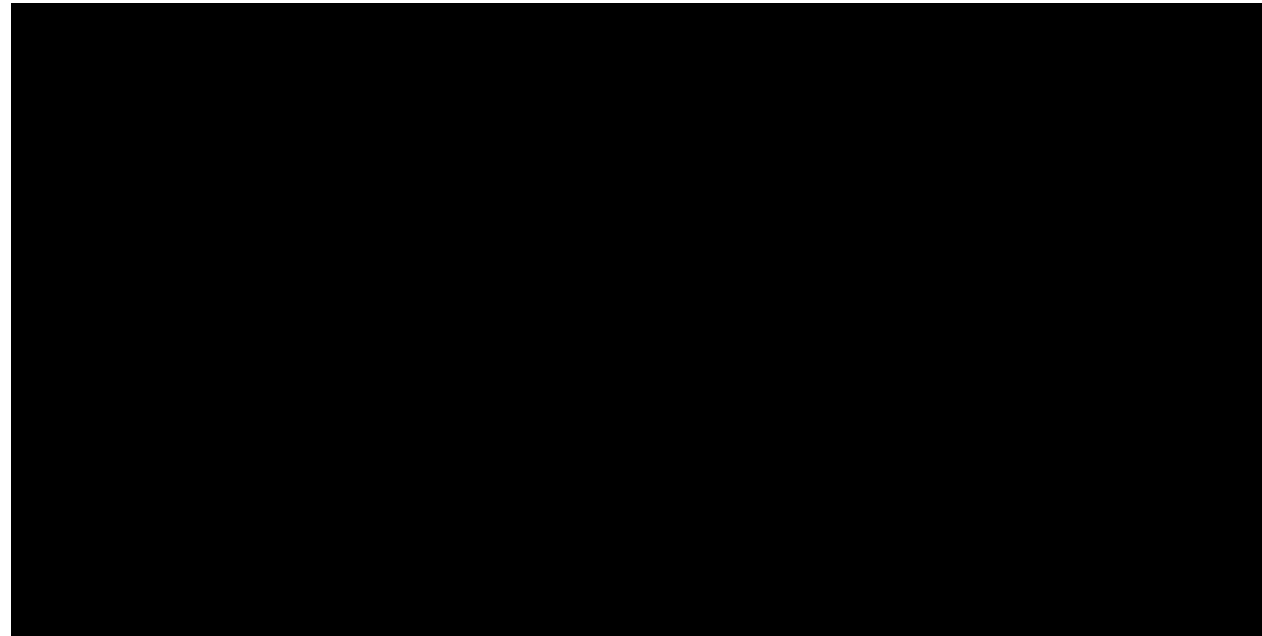
You might find it useful to refer to a flow diagram or other way of describing data flows.

centre within the UK.

**Will any data be processed overseas?**

No, the data processing we be performed on site at Willesden Green Station, by the [REDACTED] processing device supplied by Integration Wizards. Once the alerts data is extracted from the CCTV footage it is stored in a cloud hosted Azure database within the UK.

You might find it useful to refer to a flow diagram or other way of describing data flows: See also the Architecture section in page 20 of the Appendix 1



**Step 3: Describe the scope of the processing**

Who does the data relate to?

**Who does the data relate to?**

Customers and staff at Willesden Green Station.

How many individuals are affected?

**How many individuals are affected?**

Pre-pandemic there were approximately 25,000 customer entries and exits to Willesden Green per day (according to data on gateline taps). [REDACTED]

No monitoring of specific staff members shall be performed using the Smart Stations dashboard. This has been agreed with the CSM and AM at Willesden Green and will be made clear to TU Reps and all Willesden Green staff. As the technology is a proof of concept rather than a standard operational tool, we are also communicating the technology as voluntary for staff members to use. Though it would help to prove the utility of the technology if as many staff members would participate as possible.

Does it involve children or [vulnerable](#) groups?

**Does it involve children or vulnerable groups?**

Yes, the analytics may identify children or vulnerable groups that may trigger an alert to a station staff member of those customers are identified to have fallen into one of the use cases, including someone who may require mobility assistance with a mobility or visual disability, someone requiring assistance on stairs with a pram, or a lost child. However, whilst an alert will be generated, no information captured will be attributable to the individual alert concerns, as no personal information about the customer shall be captured, only that in that instance there is a customer in the station that may require assistance.

Integration Wizards will not collect sensitive types of personal data, classed as Special Categories of Personal Data under GDPR.

<p>If children's data is collected and used, are they aged under 13?</p> <p>What is the nature of the data? (Specify data fields if possible; For example, name, address, telephone number, device ID, location, journey history, etc.)</p> <p>Specify which <a href="#">special category data</a> or criminal offence data</p>	<p><b>If children's data is collected and used, are they aged under 13?</b></p> <p>The analytics will be trained to identify whether a person is an adult or a child for the purposes of excluding children from scenarios such as fare evasion by using height relative to the gate. No data about the children's identify will be captured and with the exception of fare evasion images, all faces of all persons shall be blurred by the analytics engine.</p> <p><b>What is the nature of the data? (Specify data fields if possible; For example, name, address, telephone number, device ID, location, journey history, etc.)</b></p> <p>Data captured by the solution shall fall into two categories. The first is details of a use case being triggered as a result of customer behaviour in the station. This shall include which behaviour or situation has been triggered, the date and time of the trigger, and the camera location. The data captured involves analysing CCTV imagery every 1/10<sup>th</sup> of a second and tracing body movements to identify triggers. Therefore, with the exception of fare evasion images (which do not involve biometric identification), there is no capturing of an identity about an individual or biometric measurement, only their position and behaviour. This data shall be retained for 4 years for trend analytics purposes.</p> <p>The second the of data captured is a series of snapshot images to assist the station staff in resolving the incident identified. The images shall be facially blurred by the solution before they are viewable by station staff. Only CSSs and CSMs shall be able to view the images (in line with access to the station CCTV system). Images shall be retained by the solution for 14 days from the point when the alert was triggered, after this point they shall be permanently deleted.</p> <p>Images of fare evasion incidents are not blurred. WASAAB reports of regular fare evaders are used to find footage that can be used to identify fare evaders. The automated saving of fare evasion images greatly reduces the time it takes for Revenue Inspectors to locate footage of fare evasion events. The basis for any fare evasion prosecution is the witness statements of LU employees, so the inclusion of an apparent fare evasion incident identified through the Smart Stations trial is not used to determine whether or not a fare evasion offence has taken place.</p> <p><b>Specify which special category data or criminal offence data are to be processed?</b></p> <p>None</p>
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<p>are to be processed?</p> <p>Can the objectives be achieved with less <a href="#">personal data</a>, or by using <a href="#">anonymised</a> or <a href="#">pseudonymised data</a>?</p> <p>How long will you keep the data? Will the data be deleted after this period? Who is responsible for this deletion process?</p> <p>Is the data limited to a specific location, group of individuals or geographical area?</p>	<p><b>Can the objectives be achieved with less personal data, or by using anonymised or pseudonymised data?</b></p> <p>We believe we are capturing the minimal possible anonymised data in order to achieve the aims of the proof of concept. Integration Wizards utilise face blurring technology so that no personal identification of individuals is performed by the analytics engine. A unique identifier is assigned to an individual identified by the engine.</p> <p><b>How long will you keep the data? Will the data be deleted after this period? Who is responsible for this deletion process?</b></p> <p>We would expect to be compliant with TfL data retention policies – P023 A3 Privacy and Data Protection Policy, and with G2206 A3 - Information and Records Management Factsheet 6: Legislative requirements for managing and disposing of TfL’s information assets.</p> <p>Images captured by the solution shall be retained for 14 days, in alignment with LU policy concerning retention of CCTV data. Data captured about alerts shall be retained for 4 years from the date of creation.</p> <p><b>Is the data limited to a specific location, group of individuals or geographical area?</b></p> <p>Yes, only inside Willesden Green Underground Station, at selected camera locations that satisfy the proof-of-concept use cases.</p>
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**Step 4: Describe the context of the processing**

Is there a [statutory basis](#) or requirement for this activity?

What is the nature of TfL's relationship with the individuals? *(For example, the individual has an oyster card and an online contactless and oyster account.)*

How much control will individuals have over the use of their data?

Would they expect you to use their data in this way?

**Is there a statutory basis or requirement for this activity?**

There isn't a statutory requirement to carry out processing in this way. However, the objectives of the processing may fall under GLA Act 1999 - general duty to develop and apply policies to promote and encourage safe, integrated, efficient and economic transport facilities and services to, from and within London. Schedule 11 of that Act contains powers to carry out research into matters affecting, or arising out of, the exercise of the functions of Transport for London or any of its subsidiaries,

**What is the nature of TfL's relationship with the individuals? (For example, the individual has an oyster card and an online contactless and oyster account.)**

Customers and staff.

**How much control will individuals have over the use of their data?**

None. CCTV cameras cover large areas of the station environment.

**Would they expect you to use their data in this way?**

Customers may not expect LU to be using intelligent analytics at a station. However, they are aware of the use of CCTV within stations. Therefore, we will notify customers within the station environment, likely within the ticket hall and platforms, that the Smart Station PoC is operational. There is signage in stations which states that CCTV is in operation and is being recorded and monitored for the purposes of safety, security and the detection of crime.



<p>Are there prior concerns over this type of <a href="#">processing</a> or security flaws?</p> <p>Is it novel in any way, or are there examples of other organisations taking similar steps?</p> <p>What is the current state of technology in this area?</p> <p>Are there any security risks?</p>	<p><b>Are there prior concerns over this type of processing or security flaws?</b></p> <p>Not that we are aware of, however we are engaged with our Cyber Security and Solution Architecture Teams, and we will go through the Architecture Review Board process to ensure the necessary TfL T&amp;D stakeholders have reviewed and approved the solution design.</p> <p><b>Is it novel in any way, or are there examples of other organisations taking similar steps?</b></p> <p>Network Rail have been trialling the O2 technology for 12 months or so. O2 also utilise it within their own retail stores.</p> <p><b>What is the current state of technology in this area?</b></p> <p>TfL operates CCTV technology across all stations on the network. [REDACTED] Camera footage is stored for 14 days before being deleted. [REDACTED]</p> <p>A trial was performed to take historic CCTV footage and analyse mask compliance at up to 30 stations on the network. Whilst this used similar image recognition technology it was not used in a live operational environment to assist station staff. Refer to the DPIA published here: <a href="https://content.tfl.gov.uk/dpia-face-covering-compliance.pdf">https://content.tfl.gov.uk/dpia-face-covering-compliance.pdf</a></p> <p><b>Are there any security risks?</b></p> <p>We are engaged with our Cyber Security and Solution Architecture Teams, and we will go through the Architecture Review Board process to ensure the necessary TfL T&amp;D stakeholders have reviewed and approved the solution design.</p>
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<p>Are there any current issues of public concern that you should factor in?</p> <p>Are you or your delivery partner signed up to any code of conduct or certification scheme?</p>	<p><b>Are there any current issues of public concern that you should factor in?</b></p> <p>No, We have discussed this with Simon Jones from the Customer Experience Team.</p> <p><b>Are you or your delivery partner signed up to any applicable code of conduct or certification scheme?</b></p> <p>No</p>
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**Step 5: Describe the purposes of the processing**

What do you want to achieve?  
 What is the intended effect on individuals?  
 What are the benefits of the [processing](#) – for TfL, for other external stakeholders, for the individuals concerned and for society in general?

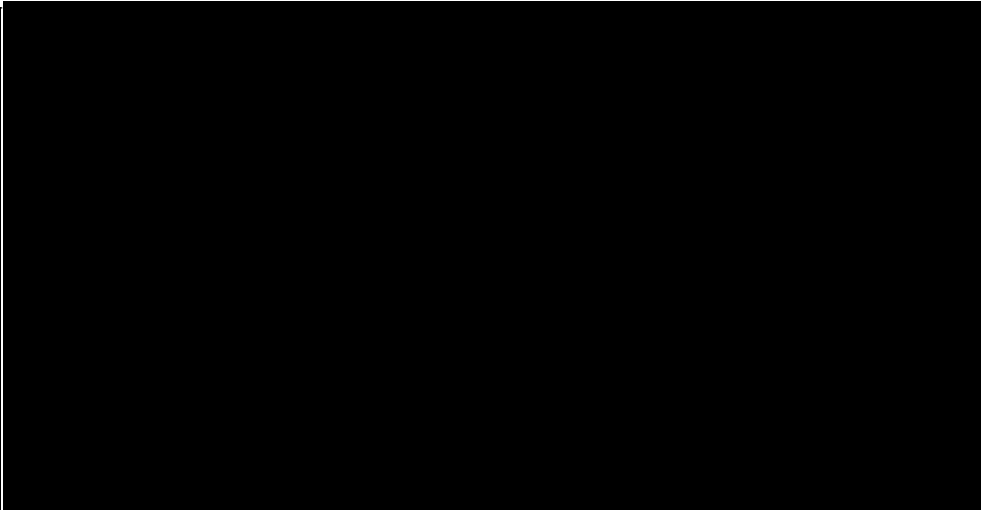
Refer to our use cases below – success criteria and customer outcomes to be confirmed.

Grouping	Ref	Use Case	Use Case Description
Station Environment	UC1	Slip/trip hazards	Monitor the movement customers and the station environment to identify instances where there are slip or trip hazards within key areas of a station on a real-time basis, and prompt action(s) to remove hazards where necessary.
Station Environment	UC2	Items on tracks	Monitor the environment and customers around tracks within a station in order to identify items that have fallen/been dropped onto tracks and may cause a safety issue on a real-time basis, and prompt action(s) to remove hazards where necessary.
Station Environment	UC3	Unattended items	Monitor the environment and customers around key areas of a station in order to identify unattended items that may have been left unattended on a real-time basis, and prompt action(s) to direct staff to attend to these items where necessary.  Monitor the environment and customers around key areas of a station in order to identify suspicious items / packages that may have been discarded by customers on a real-time basis, and prompt action(s) to direct staff to items / packages where necessary.
Movement and Behaviour	UC5	Anti-social behaviour	Monitor the movement of customers around key areas of a station in order to identify instances when customers may either be carrying out or be

				the victims of anti-social behaviour on a real-time basis, and prompt action(s) to influence customer behaviour where necessary.
	Movement and Behaviour	UC6	Stranded customers (individuals unable to exit gate line)	Monitor the movement of customers around key areas (including the gate line) of a station in order to identify instances of individuals that are unable to exit or enter the station, or use lifts, on a real-time basis, and prompt action(s) to assist customer(s) where necessary.
	Movement and Behaviour	UC7	Vulnerable customers	Monitor the movement of customers around key areas of a station in order to identify instances of passengers that may be lost, not moving, or stuck in an area within the station on a real-time basis, and prompt action(s) to assist customer(s) where necessary.
	Movement and Behaviour	UC8	Injured / unwell customers and staff	Monitor the movement of customers around key areas of a station in order to identify customers who are injured or unwell on a real-time basis, and prompt action(s) to assist customer(s) where necessary.
	Movement and Behaviour	UC9	Workplace violence incidents	Monitor the movement, audio and behaviour of customers and staff around key areas of the station in order to identify instances of violence against staff members by customers, and prompt action(s) to be taken to intervene on a real-time basis
	Movement and Behaviour	UC10	Crowd anomalies (e.g. running en masse)	Monitor the movement of customers around key areas of a station in order to identify mass crowd movements such as running en masse and crush incidents on a real-time basis, and prompt action(s) to influence customer movement where necessary.
	Movement and Behaviour	UC11	Unauthorized access	Monitor the movement of customers in public and

	Behaviour		to non-public areas of a station	non-public areas of a station to identify instances when customers have gained access to non-public areas on a real-time basis, and prompting action to remove the customer from the non-public area.
	Movement and Behaviour	UC12	Historic crowd movement (Flow)	Store all customer movement information around key areas of a station for a defined period of time in order to perform analysis on trends in crowd movement. Data may be aggregated in order to aid speed of analysis.
	Movement and Behaviour	UC13	Face coverings	Monitor the movement of customers around a station to identify whether customers are wearing face coverings or not. This shall be tracked for analytical purposes and will not result in real-time alerts to station staff.
	Movement and Behaviour	UC14	Fare evasion	Monitor the movement of customers through station gatelines in order to identify instances where customers may have evaded paying a fare, or the correct fare, for their journey. This shall be tracked for analytical purposes and will not result in real-time alerts to station staff.
	Technical Feasibility	UC16	Use of Existing Cameras	Test the viability of a representative selection of existing cameras to ensure that the image quality and connectivity are suitable to enable the smart camera analytics for the Smart Stations initiative.
	Technical Feasibility	UC17	Camera Alignment or Moves	Monitor the positioning of cameras to ensure that they are not out of the desired alignment, and prompt action to be taken by the appropriate staff member if instances of misalignment/movement of the camera have been identified.
	Technical Feasibility	UC18	New Camera Integration	Ensure that any new camera added to the TfL estate would be able to comply with the integration requirements of TfL Engineering,

				<p>including but not limited to: integration with the station management system, LUCC, and ability to use cameras for other purposes in future where required.</p> <p><i>Comment: We do not expect to have to install any new cameras as part of this project, but we will explore this if the current camera quality is insufficient to be able to recognise use cases.</i></p>



**Step 6: Consultation process**

**Consider how to consult with relevant stakeholders:**

Describe when and how you will seek views from the individuals whose data you will be collecting – or justify why it's not appropriate to do so.

Who else do you need to involve within TfL?

Have you discussed information security requirements with Cyber Security?

Do you plan to consult with external stakeholders? If so, who?

Who will undertake the consultation?

We have consulted with a wide range of internal TfL colleagues to understand and scope this initiative. A full of scoping stakeholders is below.

Name	Role	Function
Nick Allen	Technology Improvement Lead - LU	T&D - LU
Ben Gillard	Business Technology Design Lead	T&D - LU
Will Henderson	Senior Business Analyst	T&D - Tech Dev
Kelvin Blackie	Business Technology Design Lead	T&D - LU
Alan Perryman	Senior Product Manager - LU Operations	T&D - LU
Nick Ruzs	Product Manager	T&D - LU
Andrew McKeever	Product Manager	T&D - LU
Jose Pereira	Improvement Lead (Network Ops)	LU - Customer Operations
Alistair Montgomery	Improvement Manager (Network Ops)	LU - Customer Operations
Ryan Sweeney	Data and Analytics Portfolio Manager	CCT - Data & Analytics
Lisa Johns	Data & Analytics Product Manager	CCT - Data & Analytics
Vasiliki Bampi	Data Scientist	CCT - Data & Analytics
Jamie Case	Technology Improvement Lead - LU	T&D - LU
Felicia Harris	SHE Business Partner	SHE
James Ingram	Senior SHE Environment Manager	SHE
Simon Abernethy	CS Modernisation Delivery Manager	LU - Network Ops
Jessica Bradley	CS Modernisation Delivery Manager	LU - Network Ops
David Kelly	CCTV Data Manager	LU - Network Delivery
Gordon Barnes	Network Security Risk & Planning Manager	LU - Network Delivery
Sarah Swalheim	Customer Experience Manager	CCT - Customer
Simon Jones	Customer Experience Manager	CCT - Customer
Helen Dimond	Customer Experience Lead	CCT - Customer



What views have been expressed by stakeholders?	Ray Adabra	Head of Customer Service Jubilee Line	LU - Customer Operations
	Amanda Elias	Fit for the Future - Stations Resource	LU - Customer Operations
	Gemma Davies	Change Design Manager	LU Finance - Change Design and Delivery
	Trevor Hardy	Technical Head - Telecoms	LU - Engineering
	Roberto Rincon	Technology Strategy Manager	LU - Engineering
	Waqas (Kye) Hussain	Commercial Innovation Manager	ST - Innovation
	Rikesh Shah	Head of Commercial Innovation	ST - Innovation
	David Mead	Continuous Improvement Manager	LU - Line Operations
	Jacqueline Attoh-Ammah	Relationship Manager (Systems)	T&D - Surface
	Ben Jones	Solution Architecture Manager	T&D
	Kulvinder Matharu	Senior Product Manager	T&D
	Campbell Mcilroy	T&D Ops Tech Principal Sec Eng (sec)	T&D
	Simon Guild	Head of Privacy and Data Protection	General Counsel
	Nas Ali	Customer Service Manager 3	LU - Customer Operations
	Vanda Bruce	Area Manager Jubilee North	LU - Customer Operations
	Kevin Jones	CSS2 (5D) Early	LU - Customer Operations
	Carl Vincent	Customer Service Supervisor 2	LU - Customer Operations
	Kayode Jimoh	Customer Service Supervisor 2	LU - Customer Operations
Simon Ponsonby	Customer Service Manager 3	LU - Customer Operations	

**Operational Consultation**

We have consulted with operational staff members about the scope and use cases in the PoC via the LU Staff Engagement Team facilitated by **Amanda Elias**, on 5<sup>th</sup> July 2021.

We have been in consultation with the LU Strategy and Development Trade Union Reps Sub-Group. Our proposal for running the proof of concept was taken to them for initial consultation on 24<sup>th</sup> August 2021.

We have since consulted local Trade Union representative for the Willesden Green Area on 24<sup>th</sup>

November 2021, and Functional representatives on 2<sup>nd</sup> December 2021. No significant concerns that would hold back the project were raised at either of these sessions. However, colleagues provided very useful feedback to help us with delivering the PoC in the most effective means possible.

We are also involving staff from Willesden Green in the design of the proof- of-concept, and have the approval of the HOCS for the Jubilee Line and the Area Manager for Jubilee North to proceed. These stakeholders will be involved throughout the design and running of the proof of concept.

### **Technical Consultation**

We have involved the following technical SMEs in our initial technical discussions with O2 and Integration Wizards:

Tom Williams (Operational Tech Principal Security Engineer)

Alan Harding (Senior Cyber Security Analyst)

Kulvinder Matharu (Senior Product Manager)

Hardy Trevor (Technical Head – Telecoms, Network Technology)

John Nield (SEL Telecoms, TRAIN SYSTEMS)

Michael Hauptfleisch (Communications Engineer, GM STN - Premises Station Services)

Jesse Field – Solution Architect

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## Step 7: Assess necessity and proportionality

### Describe compliance and proportionality measures, in particular:

Does the [processing](#) actually achieve your purpose?

Is there another way to achieve the same outcome?

How will you prevent [function creep](#)?

How will you ensure [data quality](#) and data [minimisation](#)?

### Does the processing actually achieve your purpose?

We strongly believe that the best way to test the appropriateness of the Smart Stations technology is to run a real-world trial at one of our stations. Network Rail have run similar PoCs at three of their stations and have seen significant benefits and insights from running this to augment their day-to-day operations.

### Is there another way to achieve the same outcome?

To achieve the same level of visibility and customer assistance in a station as the camera analytics achieves, you would need to employ far more staff members than we do now. Either to watch camera footage live, or to physically watch the station areas. Therefore, we believe the Smart Stations technology will be a useful addition to our current staffing model and help them to be even more effective.

### How will you prevent function creep?

We have a project steering group in operation which is accountable for the outcomes of the proof of concept, and ensuring that the scope remains within the agreed objectives. The steering group is chaired by Nick Allen and meets every three weeks.

### How will you ensure data quality and data minimisation?

The approach that Integration Wizards will take, will continually look to improve the accuracy of the alerts generated based on machine learning and feedback from the users of the dashboard. Only minimal amounts of data are created by the analytics engine based on the footage that it sees. Alerts will only be generated when a use case is triggered by the [REDACTED] module.

<p>What information will you give individuals about how their data is used?</p> <p>What measures do you take to ensure suppliers processing personal data on our behalf provide adequate assurances about their ability to process this data safely and lawfully?</p> <p><b>To be completed by Privacy &amp; Data Protection team</b></p> <p>What is the lawful basis for processing?</p> <p>How will data subjects exercise their <a href="#">rights</a>?</p> <p>How do we safeguard any international transfers?</p>	<p><b>What information will you give individuals about how their data is used?</b></p> <p>We have signage in stations and publish our privacy notice at <a href="https://tfl.gov.uk/corporate/privacy-and-cookies/cctv">https://tfl.gov.uk/corporate/privacy-and-cookies/cctv</a></p> <p><b>What measures do you take to ensure suppliers processing personal data on our behalf provide adequate assurances about their ability to process this data safely and lawfully?</b></p> <p>The processing is covered by a data processor contract and steps have been taken to ensure that data is both minimised and secured during processing.</p> <p>The lawful basis is Public Task.</p> <p>Data subjects already have the right to request access to their data. There is a right to object to processing of personal data where the lawful basis relied upon is public task, but as this involves a balancing test between the rights and freedoms of the individual and the legitimate grounds for the project to proceed, it is unlikely that any objection would be successful.</p> <p>There are no international transfers.</p>
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<p>Could data <a href="#">minimisation</a> or <a href="#">pseudonymisation</a> be applied?</p> <p>Are data sharing arrangements adequate?</p>	<p>The camera images will be blurred unless necessary for fare evasion detection, no further opportunities for data minimisation have been identified.</p> <p>Data sharing will be subject to contract with O2 and between O2 and IW.</p>
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<b>Step 8: Identify and assess risks</b>			
<b>Describe source of risk and nature of potential impact on individuals.</b> Include risks of damage or distress as well as associated compliance and corporate risks as necessary.	<b>Likelihood of harm</b> Remote, possible or probable	<b>Severity of harm</b> Minimal, significant or severe	<b>Overall risk</b> Low, medium or high
<b>Hidden processing caused by lack of signage and supporting information</b>	Possible	Minimal. There is no change to the CCTV images being recorded, or the stated purposes it is used for. With the exception of fare evasion, the images are depersonalised. Revenue Inspectors already review CCTV recordings when investigating fare evasion, the Smart Stations tool simply makes it quicker to locate and extract incidents.	Low
<b>Loss of control of LU data processed by O2 and Integration Wizard</b>	Possible	Significant. Whilst the data would remain subject to GDPR, LU would no longer control how it is processed	Medium

**Step 9: Identify measures to reduce risk**

Identify additional measures you could take to reduce or eliminate risks identified as medium or high risk in step 8

Risk	Options to reduce or eliminate risk	Effect on risk Eliminated, reduced or accepted	Residual risk Low, medium or high	Measure approved Yes/no
<b>Hidden processing caused by lack of signage and supporting information</b>	Monitor project and consider changes to web page if the project is taken into wider rollout.	Reduced	Low	Yes
<b>Loss of control of LU data processed by O2 and Integration Wizard</b>	Check contract with O2 and request copy of O2 – IW contract.	Reduced	Low	Yes



<b>Step 10: Sign off and record outcomes</b>		
<b>Item</b>	<b>Name/date</b>	<b>Notes</b>
Measures approved by Privacy Team:	Simon Guild – 02/08/2023	Integrate actions back into project plan, with date and responsibility for completion.
Residual risks approved by Privacy Team:	Craig Marshall – 18/08/2023	If accepting any residual high risk, consult the ICO before going ahead.
Privacy & Data Protection team advice provided:		Privacy & Data Protection team should advise on compliance, Step 9 measures and whether processing can proceed.
Comments/recommendations from Privacy and Data Protection Team:	Blurring of images and human decision-making mean that there are low risks to individuals. Privacy Team will be represented on the Smart Stations Steering Group Have reviewed contract variation and risks - 18/08/2023 - Craig Marshall	
DPO Comments:		
PDP Team / DPO advice accepted or overruled by (this should usually be the Project Sponsor):		If overruled, you must explain your reasons below.
Comments:		
Consultation responses reviewed by:		If your decision departs from individuals' views, you must explain your reasons.

Comments:

This DPIA will kept under review by:

The DPO may also review ongoing compliance with DPIA.

## Glossary of terms

<b>Anonymised data</b>	<p>Anonymised data is information held in a form that does not identify and cannot be attributed to individuals.</p> <p>Anonymous information is not subject to the GDPR, and, where possible and appropriate, should be used in place of identifiable or <a href="#">pseudonymised</a> personal data, particularly where sharing information with third parties or contemplating publication of data.</p> <p>Anonymised data will often take the form of statistics. If you are reporting statistics on a small number of individuals, or there is a level of granularity that allows reporting on small groups of individuals within the overall data set, you must exercise caution to avoid inadvertently allowing the information to be linked to an individual.</p> <p>If information can be linked to an identifiable individual the data is not anonymous and you must treat it as personal data.</p>
<b>Automated Decision Making</b>	<p>Automated Decision Making involves making a decision solely by automated means without any meaningful human involvement. Automated Decision Making is restricted and subject to safeguards under the GDPR. You should consult with the Privacy and Data Protection team before rolling out a process involving Automated Decision Making based on personal data.</p>
<b>Biometric data</b>	<p>Biometric data is a general term used to refer to any computer data that is created during a biometric process. This includes test samples, fingerprints, voice recognition profiles, identifiers based on mouse movements or keystroke dynamics and verification or identification data excluding the individual's name and demographics.</p> <p>Biometric data is subject to additional safeguards under the GDPR when it is processed for the purpose of identifying individuals.</p>
<b>Data breaches</b>	<p>A 'personal data breach' means a breach of security leading to the accidental or unlawful destruction, loss, alteration, unauthorised disclosure of, or access to, personal data that is transmitted, stored or otherwise processed. Personal data breaches must be reported immediately to <a href="mailto:DPO@tfl.gov.uk">DPO@tfl.gov.uk</a>.</p>

<p><b>Data minimisation</b></p>	<p>Data minimisation means using the minimum amount of personal data necessary, and asking whether personal data is even required.</p> <p>Data minimisation must be considered at every stage of the information lifecycle:</p> <ul style="list-style-type: none"> <li>• when designing forms or processes, so that appropriate data are collected and you can explain why each field is necessary;</li> <li>• when deciding what information to record, you must consider what information is required, what is relevant and whether any information is excessive;</li> <li>• when deciding whether to share or make use of information, you must consider whether using all information held about an individual is necessary for the purpose.</li> </ul> <p>Disclosing too much information about an individual may be a personal data <a href="#">breach</a>.</p> <p>When deciding how long to keep information, you must consider what records you will need, and whether some personal data can be deleted or <a href="#">anonymised</a>.</p>
<p><b>Data Protection Rights</b></p>	<p>The GDPR provides the following <a href="#">rights for individuals</a>:</p> <ul style="list-style-type: none"> <li>• The right to be informed;</li> <li>• The right of access;</li> <li>• The right to rectification;</li> <li>• The right to erasure;</li> <li>• The right to restrict <a href="#">processing</a>;</li> <li>• The right to data portability;</li> <li>• The right to object;</li> <li>• Rights in relation to <a href="#">automated decision making</a> and <a href="#">profiling</a>.</li> </ul>
<p><b>Data quality</b></p>	<p>The GDPR requires that <i>"every reasonable step must be taken to ensure that personal data that are inaccurate, having regard to the purposes for which they are processed, are erased or rectified without delay."</i></p> <p>This means you must take steps to ensure that the data you use is sufficiently accurate, up to date and comprehensive for your purposes, and that you take steps to effectively mitigate any detriment to individuals that is likely to result from inadequate data.</p>

<b>Function creep</b>	Function creep describes the gradual widening of the use of a technology or system beyond the purpose for which it was originally intended, especially when this leads to potential invasion of privacy. Review and update your DPIA, or undertake a new DPIA to reflect changes in the purpose or the means by which you process personal data.
<b>Genetic data</b>	Genetic data is personal data relating to the inherited or acquired genetic characteristics of a natural person which result from the analysis of a biological sample from the natural person in question, in particular chromosomal, deoxyribonucleic acid (DNA) or ribonucleic acid (RNA) analysis, or from the analysis of another element enabling equivalent information to be obtained.
<b>Marketing</b>	<p>Direct marketing is “the communication (by whatever means) of advertising or marketing material which is directed to particular individuals”.</p> <p>This covers all advertising or promotional material directed to particular individuals, including that promoting the aims or ideals of not-for-profit organisations.</p> <p>Genuine market research does not count as direct marketing. However, if a survey includes any promotional material or collects details to use in future marketing campaigns, the survey is for direct marketing purposes and the <a href="#">privacy regulations</a> apply.</p> <p>Routine customer service messages do not count as direct marketing – in other words, correspondence with customers to provide information they need about a current contract or past purchase (e.g. information about service interruptions, delivery arrangements, product safety, changes to terms and conditions, or tariffs).</p> <p>General branding, logos or straplines in these messages do not count as marketing. However, if the message includes any significant promotional material aimed at getting customers to buy extra products or services or to renew contracts that are coming to an end, that message includes marketing material and the <a href="#">privacy regulations</a> apply.</p>
<b>Personal data</b>	<p>Personal data is information, in any format, which relates to an identifiable living individual.</p> <p>Personal data means any information relating to an identified or identifiable person (data subject). An identifiable person is one who can be identified, directly or indirectly, in particular by reference to an identifier such as a name, an identification number, location data, an online identifier or to one or more factors specific to the physical, physiological, genetic, mental, economic, cultural or social identity of that natural person.</p> <p>This definition provides for a wide range of personal identifiers to constitute personal data, including name, identification number, location data or online identifier, reflecting changes in technology and the way organisations collect information</p>

	<p>about people.</p> <p>The definition can also include <a href="#">pseudonymised</a> data (where we hold data that has had the personal identifiers replaced with codenames); depending on how difficult it would be to re-identify the individual.</p>
<b>Privacy notice</b>	<p>A privacy notice must let people know who we are, what we intend to do with their personal information, for what purpose and who it will be shared with or disclosed to.</p> <p>TfL adopts a layered approach to privacy notices, with clear links to further information about:</p> <ul style="list-style-type: none"> <li>• Whether the information will be transferred overseas;</li> <li>• How long we intend to keep their personal information;</li> <li>• The names of any other organisations we will share their personal information with;</li> <li>• The consequences of not providing their personal information;</li> <li>• The name and contact details of the Data Protection Officer;</li> <li>• The lawful basis of the processing;</li> <li>• Their <a href="#">rights</a> in respect of the processing;</li> <li>• Their right to complain to the Information Commissioner;</li> <li>• The details of the existence of <a href="#">automated decision-making</a>, including <a href="#">profiling</a> (if applicable).</li> </ul>
<b>Processing</b>	<p>Doing almost anything with personal data. The GDPR provides the following definition:</p> <p>‘processing’ means any operation or set of operations which is performed on personal data or on sets of personal data, whether or not by automated means, such as collection, recording, organisation, structuring, storage, adaptation or alteration, retrieval, consultation, use, disclosure by transmission, dissemination or otherwise making available, alignment or combination, restriction, erasure or destruction</p>
<b>Profiling</b>	<p>Profiling is the use of personal data to evaluate certain personal aspects relating to an individual, in particular to analyse or predict aspects concerning that individual’s performance at work, economic situation, health, personal preferences, interests, reliability, behaviour, location or movements.</p>
<b>Pseudonymise</b>	<p>Pseudonymisation separates data held about an individual from information that identifies the individual. This can be</p>

<p><b>d data</b></p>	<p>achieved by encrypting (hashing) the individuals name, MAC address or ID code, masking an individual’s exact location or changing an image to make an individual unrecognisable.</p> <p>TfL can hold the same data in identifiable and anonymous form, provided appropriate controls are in place to prevent re-identification of the pseudonymised data.</p> <p>The advantages of pseudonymisation are that it may allow further processing of the personal data, including for scientific, historical and statistical purposes.</p> <p>Pseudonymised data (if irreversible) is not subject to the individuals rights of rectification, erasure, access or portability.</p> <p>Pseudonymisation is an important security measure and must be considered as part of Privacy by Design and Default approach. If you use pseudonymised data you must ensure that an individual can not be re-identified with reasonable effort. The risk of re-identification is higher when information about the same individual is combined. For example, whilst a post code, a person’s gender or a person’s date of birth would be very unlikely to identify an individual if considered without other reference data, the combination of these three pieces of information would be likely to enable a motivated individual to re-identify a specific individual in most circumstances.</p> <p>If you use a “key” to encrypt or hide their identity you must ensure it is sufficiently protected to prevent the individual being re-identified. A Data Protection Impact Assessment can help you assess whether pseudonymisation is reversible in a given scenario.</p>
<p><b>Significant effects</b></p>	<p>A DPIA will be required for processing relating to an individual, or group of individuals that has an effect on their legal status or legal rights, or will otherwise affect them in a significant way. These effects may relate to a persons:</p> <ul style="list-style-type: none"> <li>• financial circumstances;</li> <li>• health;</li> <li>• safety;</li> <li>• reputation;</li> <li>• employment opportunities;</li> <li>• behaviour; or</li> <li>• choices</li> </ul>

<b>Special Category data</b>	<p>Special category data consists of information about identifiable individuals':</p> <ul style="list-style-type: none"><li>• racial or ethnic origin;</li><li>• political opinions;</li><li>• religious or philosophical beliefs;</li><li>• trade union membership;</li><li>• genetic data;</li><li>• <a href="#">biometric</a> data (for the purpose of uniquely identifying an individual);</li><li>• data concerning health; or</li><li>• data concerning a person's sex life or sexual orientation.</li></ul> <p>Information about criminal convictions and offences are given similar protections to special category data under the <a href="#">Law Enforcement Directive</a>.</p>
<b>Statutory basis for processing</b>	<p>TfL is a statutory body created by the <a href="#">Greater London Authority (GLA) Act</a> 1999. This Act gives the Mayor of London a general duty to develop and apply policies to promote and encourage safe, integrated, efficient and economic transport facilities and services to, from and within London. The Act also states that we have a duty to help the Mayor complete his duties and implement the Mayor's Transport Strategy.</p> <p>In particular, we are required to provide or secure the provision of public passenger transport services, to, from or within Greater London. As a highway and traffic authority for GLA roads, we regulate how the public uses highways and we are responsible for:</p> <ul style="list-style-type: none"><li>• Traffic signs</li><li>• Traffic control systems</li><li>• Road safety</li><li>• Traffic reduction</li></ul> <p>We are also the licensing authority for hackney carriages (taxis) and private hire vehicles (minicabs).</p> <p>The GLA Act contains specific powers to provide information to the public to help them to decide how to make use of public passenger transport services and to provide or secure the provision of public passenger transport, as well as a broadly scoped power to do such things and enter into such transactions as are calculated to facilitate, or are conducive or incidental to, the discharge of any of its functions. Further miscellaneous powers are set out in Schedule 11 of the Act.</p>



	<p>Activities may have a statutory basis related to other legislation, for instance the requirements to publish information under the Local Government Transparency Code.</p>
<p><b>Systematic processing or monitoring</b></p>	<p>Systematic processing should be interpreted as meaning one or more of the following:</p> <ul style="list-style-type: none"> <li>• Occurring according to a system</li> <li>• Pre-arranged, organised or methodical</li> <li>• Taking place as part of a general plan for data collection</li> <li>• Carried out as part of a strategy</li> </ul> <p>Examples of activities that may constitute a regular and systematic monitoring of data subjects include:</p> <ul style="list-style-type: none"> <li>• operating a telecommunications network;</li> <li>• providing telecommunications services;</li> <li>• email retargeting;</li> <li>• data-driven <a href="#">marketing</a> activities;</li> <li>• <a href="#">profiling</a> and scoring for purposes of risk assessment (e.g. for purposes of credit scoring, establishment of insurance premiums, fraud prevention, detection of money-laundering);</li> <li>• location tracking, for example, by mobile apps;</li> <li>• loyalty programs; behavioural advertising;</li> <li>• monitoring of wellness,</li> <li>• fitness and health data via wearable devices;</li> <li>• closed circuit television;</li> <li>• connected devices e.g. smart meters, smart cars, home automation, etc.</li> </ul>
<p><b>Vulnerable people</b></p>	<p>A person is vulnerable if, as a result of their situation or circumstances, they are unable to take care of or protect themselves or others from harm or exploitation. All children are considered vulnerable by virtue of their age and immaturity.</p>

## APPENDIX 1



[05.22](#) (OBJ)