Verkada

User Guide

Smart Trends

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Overview

Verkada cameras leverage artificial intelligence and computer vision to analyze people and vehicles moving across a device's field of view. This, coupled with the Command platform's ability to ingest third-party data through Helix, delivers a series of capabilities that go beyond physical security.

Organizations can leverage Verkada's smart trends (which live within the camera analytics page) to build custom dashboards that monitor operational trends and provide actionable, data-driven insights. Five types of widgets can be added to these dashboards:

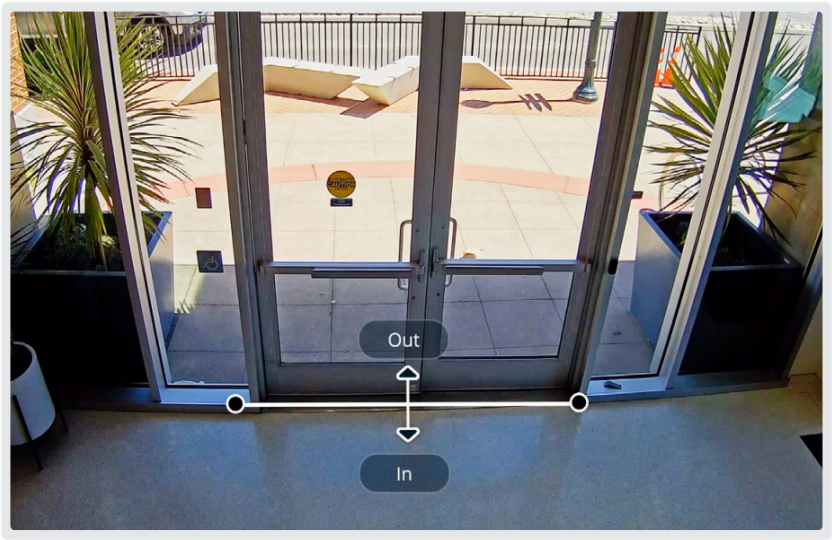
- Occupancy trends
- Queue trends
- Helix trends
- Conversion trends
- Alert trends

In this overview, we will examine each widget type, including the data they display, best practices for setup, and relevant industry use cases.

02

Occupancy Trends Widget

Occupancy trends count the number of people or vehicles entering and exiting a specific area. This is accomplished by drawing virtual lines on specific cameras and defining "in" and "out" directions to indicate directionality.



Up to five discrete lines can be drawn on a single camera's field of view. Lines can also be drawn across multiple cameras to account for traffic moving through various entrances and exits.

The occupancy trends widget displays graphs of **traffic** (the total number of people entering and exiting) and **net cumulative occupancy** (the number of people within a space, calculated by subtracting the number of people who have exited the space from the number of people who have entered the space).

Organizations can leverage the occupancy trends widget to gain valuable insights into traffic patterns, view both peak and real-time occupancy numbers, and prepare accordingly for specific days or time windows that see high foot or vehicle traffic.

Optimal Camera Installations and Line Placements for Occupancy Trends

In order to optimize use of the occupancy trends feature, we recommend keeping the below best practices in mind:

Installing cameras for best performance

1. **Choose a one-directional path:** Occupancy trends works particularly well when set up in a location where people follow a one-directional path that traverses the line, such as doors and hallways. Cameras should be mounted on the ceiling directly in front of the door or path.

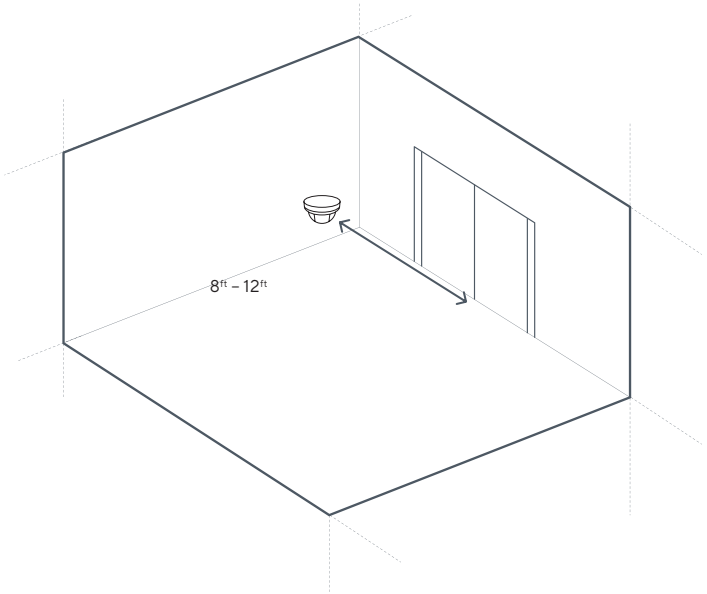
2. **Install the camera 8 – 12 feet (3 – 4 meters) from the digital line:** Cameras provide the most accurate data when the digital line is no less than 8 feet and no more than 12 feet away from the camera.

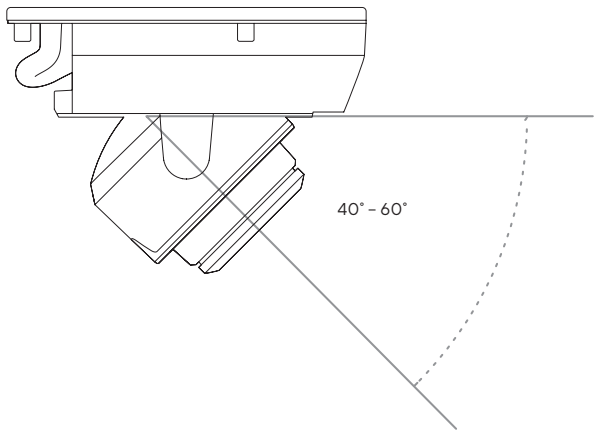
3. **Proper positioning improves accuracy:** Cameras should be positioned no more than 40˚ – 60˚ degrees vertically from the location of the digital line.

4. **Minimize occlusions and obstructions:** It is important to establish the line in a part of the frame that is not blocked by an object, and in an area that minimizes occlusions (e.g., people overlapping.)

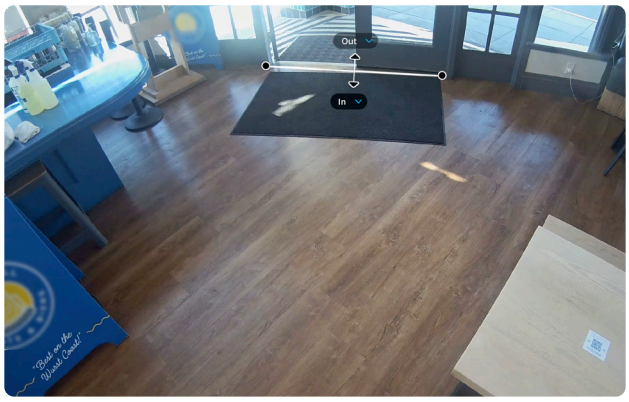
5. **Ensure good illumination on both sides of the line:** Significant discrepancies in lighting can make it difficult for our model to accurately monitor subjects and register when they cross the line. Avoid placing the count line in a naturally dark area where external lighting might intermittently turn off.

6. **Ensure good visibility on both sides of the line:** People must be clearly visible on both sides of the line for at least a second prior to crossing the line. Avoid placing the count line where someone might suddenly appear. For example, on a corner, or right on the doorway of a wooden or opaque door that opens inwards.





Examples of bad installations



Poor line placement on the camera feed. If a line is established at the top of a camera feed, our model might not be able to track a clear trajectory across the line and register the crossing occurrence.

The line is not established across the entire entrance to an area. If a line does not span the width of an entry or hallway, our model will not register people crossing outside of the established span. If the supporting camera is installed at a viewpoint which is not head on, we recommend establishing a line that is wider than the entrance.

The line is established in an area where occlusions will naturally occur. In situations where one person's body may obstruct the view of a person following behind, our model is likely to not register the person behind. This issue could occur in areas with queues.

The line is established in an area where people commonly stand on top of the digital line. People standing on the digital line might get counted multiple times, skewing the trends.

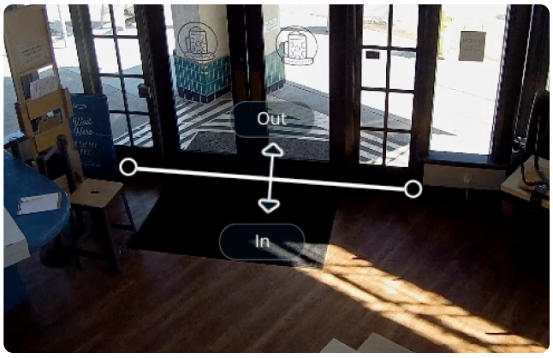
Examples of bad installations (cont.)

The line is established in an area with different levels of luminosity on one side and the other of the count line.

Our model will have a difficult time accurately registering crossing occurrences if bright areas in the feed are overexposed.

Users can enable wide dynamic range (WDR) to help compensate for dramatic differences in light exposure across a camera's image.

With WDR



Without WDR

Example of a good installation

- One-directional path
- Camera 12 feet from door
- Camera positioned at 50 degrees vertically

Limitations and Factors Affecting Accuracy

Since our occupancy trends model relies on the ability to interpret visual inputs, its people and vehicle detection capabilities may occasionally miss individuals or objects. Factors such as lighting, camera placement, and line placement (as detailed above) can impact people and vehicle counting accuracy. Below, we list key areas of potential failure that can contribute to inaccurate counts:

Occlusion

As a person or vehicle passes in front of a camera, they may be temporarily or permanently hidden from view by another object. This can lead to undercounting, especially if the person's or vehicle's trajectory is broken while it crosses the user's counting line. In cases of partial occlusion, we may be able to estimate the original size of the person or vehicle to maintain the trajectory of the person or vehicle.

People or vehicle Loitering

People or vehicles positioned on or near the “counting line” may trigger multiple line crossings, potentially leading to overcounting. Proper camera installation can help mitigate occlusion and person/vehicle loitering on the “counting line,” but some discrepancies are possible.

False positives from mannequins (retail)

In retail environments, human mannequins can be misinterpreted as people by the system, leading to false positives.

External traffic through windows

Floor-to-ceiling windows can cause the system to detect outside movement if the camera is positioned too close. A recommended distance of 1-2 ft (30-60 cm) from the window can help mitigate this issue.

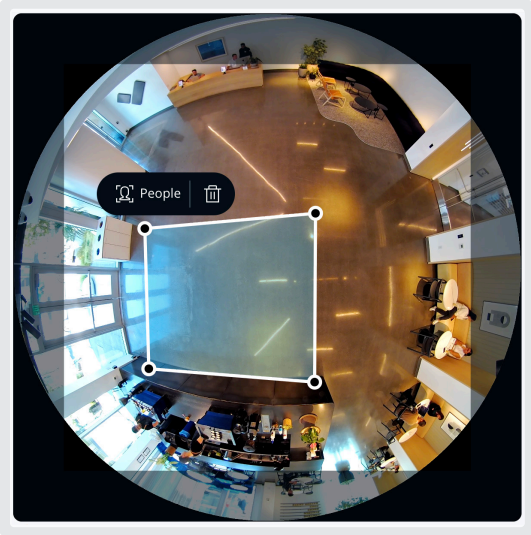
Reflections

Cameras positioned near mirrors can create reflections that are misinterpreted as people, leading to inaccurate counts.

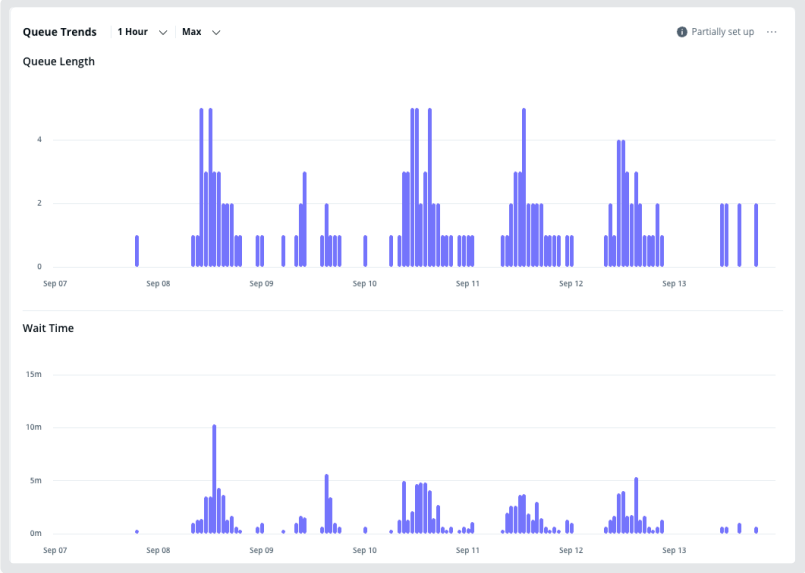
03

Queue Trends Widget

Queue trends measure how many people or vehicles are present in a defined queue area and how long they wait. This is done by drawing a polygon over the region of interest to designate the “queue”.



The queue trends widget measures the **queue length** (total number of people or vehicles within the region) and **wait time** (amount of time people or vehicles have spent within that given region). Users can view this data as either the maximum or average over selectable timeframes of 15 minutes, 1 hour, or 1 day.



One queue region can be drawn per camera. If a single queue region spans multiple cameras, users can aggregate that data across cameras within a single widget. To track queue length and wait time across discrete queue regions, more than one queue trend widget can be created.

Organizations can use the queue trends widget to better understand the traffic patterns of paying customers, helping to deliver an improved experience by optimizing staffing and improving the design and management of queue areas. The queue trends widget is capable of extracting valuable information pertaining to traditional register lines, drive-thrus, and even waiting rooms or lobbies.

Optimal Camera Installations and Region Placements for Queue Trends

In order to optimize use of the queue trends feature, we recommend keeping the below best practices in mind:

Installing cameras for best performance

1. **Use a top-down view, when possible:**

   Queue trends work particularly well when a camera is positioned directly above the queue region. A ceiling-mounted fisheye camera in pan-tilt-zoom mode will yield the best results

2. **Install the camera 8 - 12 feet (3 - 4 meters) above the queue region:**

   Cameras provide the most accurate data when the queue region is no less than 8 feet and no more than 12 feet below the camera. For spaces with high ceilings, cameras can be attached to a drop pole using a pendant cap mount.

3. **Proper positioning improves accuracy:**

   For non-fisheye cameras such as dome cameras, the lens should be angled as close to 90° as possible while continuing to capture the entire queue region.

4. **Minimize occlusions and obstructions:**

   It is important to establish the region in a part of the frame that is not blocked by any objects, and in an area that minimizes occlusions (e.g., people overlapping.)

5. **Ensure good illumination in and around the queue region:**

   Significant discrepancies in lighting can make it difficult for our model to accurately monitor subjects and register when they cross the line. Avoid placing the count line in a naturally dark area where external lighting might intermittently turn off.

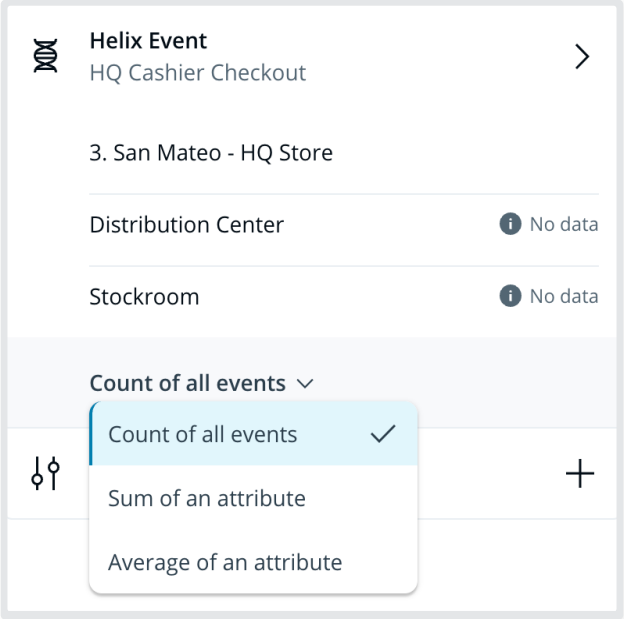
6. **Ensure good visibility inside and outside the queue region:**

   People and vehicles must be clearly visible and detectable before entering the queue region. Avoid placing a queue region where someone might suddenly appear, such as on the edge of a camera's field of view.

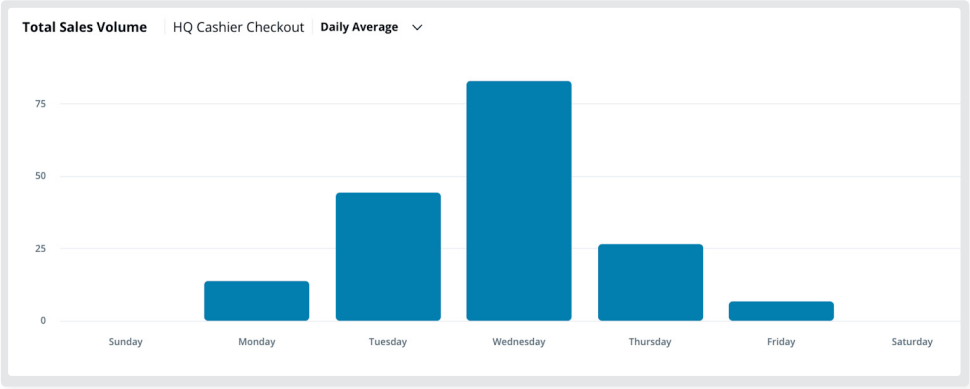
04

Helix Trends Widget

Helix trends display information about relevant Helix events over specified time periods. This flexible widget can display **the count of all matching events**, **the sum of a specific attribute across events**, or **the average of a specific attribute across events**.



Similar to other widgets, users can toggle between showing daily, weekly, and monthly data, and historical hourly or daily averages.



For example, a retailer may use:

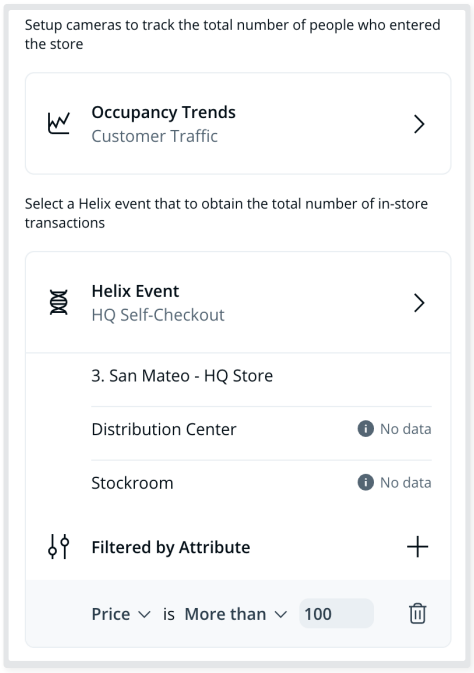
- The **count of all events** widget to display the number of transactions over a given time period.
- The **sum of an attribute** widget to display the total sales revenue over a given time period.
- The **average of an attribute** to display the average discount percentage and identify potentially fraudulent behaviors.

The Helix trends widget is as flexible as Helix itself – these dashboards can be used to track and provide insight into retail purchases, parts traversing a manufacturing line, or any other data ingested into Command using Helix.

05

Conversion Trends Widget

Conversion trends combine Helix-integrated point-of-sale data with occupancy trends to reveal how traffic translates into purchases. By linking a Helix event with occupancy trends data, users are able to quickly understand sales conversion rate evolution throughout a given timeframe. Conditional filters can be added to focus on specific transactions (e.g. purchases over $100) for deeper insights.



The conversion trends widget displays a line graph of the **conversion rate** over the selected time period in either 1 day or 1 hour increments. The cumulative hourly average over the selected time period can also be displayed.

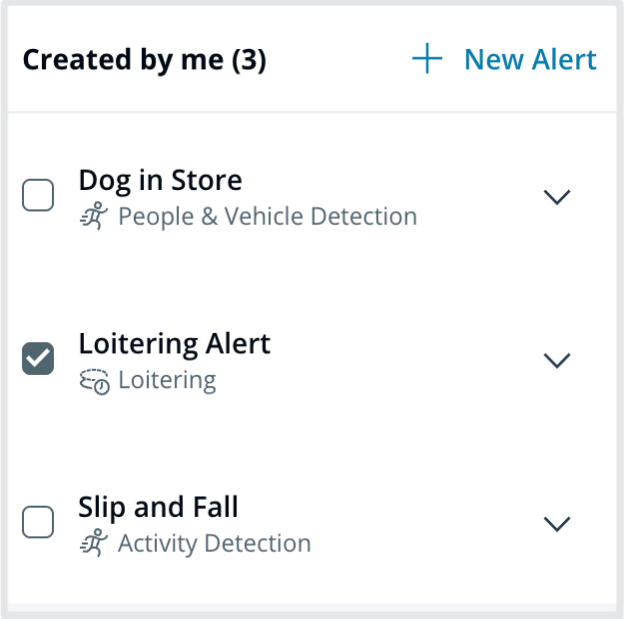
Conversion trend widgets rely on a one-to-one relationship between a Helix event and occupancy trends data. To track multiple types of conversion rates or conversion rates across stores, separate widgets can be created.

Organizations can use the conversion trends widget to better understand how effectively they are turning shoppers into paying customers. Historical trends provide insight into whether changes like additional staffing, revamped product placement, and discount campaigns are having the intended effect.

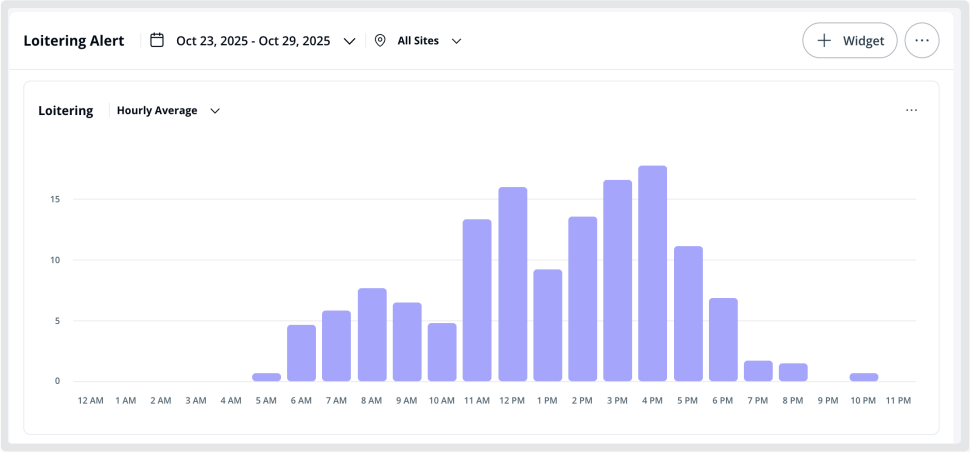
06

Alert Trends Widget

Alert trends visualize the **number of camera alerts triggered over specified time periods**. Users can select an individual alert or combine data from multiple alerts.



Similar to other widgets, users can toggle between showing daily, weekly, and monthly data, and historical hourly or daily averages.



The alert trends widget makes it easy to visualize a wide variety of camera alerts – from traditional loitering, crowd, and motion alerts to customizable AI-powered alerts. For example, organizations can use alert trends to better understand peak times for loitering alerts at curbside pickup zones, or to visualize the frequency of AI-powered alert detections for delivery trucks.

07

Exporting Data

Smart trends data isn't limited to viewing within Command. All data captured and displayed on widgets can be easily exported or ingested into third-party software for further analysis.

Data associated with a specific widget can be downloaded in CSV format by clicking on the three-dot icon in the upper right-hand corner of the widget.

Additionally, Verkada's API endpoints can be used to pull camera analytics data directly from Command into third-party software. For more information on Verkada's API capabilities, see our API documentation here.

08

Industry-Specific Use Cases

Widgets are not mutually exclusive; rather, they can be used in conjunction with one another to provide detailed business insights and uncover key trends. Common use cases for the smart trends page include:

Retail

- **Optimize staffing and store layout:** Use **occupancy trends** and **queue trends** to analyze foot traffic, reduce bottlenecks, and staff appropriately during peak hours.
- **Detect and prevent fraud:** Leverage the **Helix trends** widget for exception-based reporting to flag suspicious transactions – such as discount abuse or return fraud – and instantly verify with video.
- **Improve conversion rates:** With **conversion trends**, automatically measure how store traffic translates into sales. Adjust staffing strategies and optimize product placement to boost revenue.

Manufacturing

- **Track production rates:** Use **Helix trends** to visualize the number of parts produced by a specific facility or manufacturing line over time. Quickly identify bottlenecks and adjust staffing to maximize output and revenue.
- **Monitor workplace safety:** Use **alert trends** to count instances when employees are seen without personal protective equipment like hard hats or high-visibility vests. Compare violations across production lines and facilities to ensure company policies are being enforced.

Logistics

- **Optimize loading and unloading:** Use **occupancy trends** and **queue trends** to monitor loading docks, ensuring efficient vehicle flow and minimizing delays.
- **Boost operational visibility:** Use **occupancy trends** and **Helix trends** to measure throughput across key checkpoints, identify bottlenecks, and streamline supply chain efficiency.