

Curb Vision

Real-Time Parking and Lane Use Detection on Edge Devices in New York City

ITE 2026 Western District Annual Meeting |
Panel 9A: Parking and Curb Space

Jiacheng (Ciel) Sun | AIWaysion, Inc. | July 1, 2026



SBIR
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AIWaysion



PARTNER AGENCY: NYCDOT **AIWAYSION**

AIWaysion is a University of Washington spin-off that specializes in developing Smart & Digital Infrastructure Solutions using Artificial Intelligence (AI), Computer Vision (CV), and Edge Computing technologies for safer and more efficient transportation.



SBIR
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Transit Tech Lab



PARTNERSHIP FUND
for New York City

- **Edge AI Curb Vision system**
 - Edge + cellular → simple, low-cost installation
 - Deployed since Dec 11, 2024
 - Robust, field-proven hardware
 - System uptime: **100%**
- **Computer vision algorithms**
 - Detect and classify curb events 24/7
 - Occupancy: 95%+ (>90% KPI)
 - Detection & classification: **98%+** (>90% KPI)
 - Event accuracy: same-side: **95%+** (>90% KPI), both sides: **~80%** (occlusion impact)
- **System capability**
 - **Curb data APIs** (CDS-aligned, NYCDOT-customized event definitions)
 - Real-time **edge processing (24/7, minimal operational cost)**
 - **Web dashboard** for monitoring & analytics
- **Supports data-driven curb management for DOT**
 - Real-time curb status and activity monitoring
 - High-resolution curb event data for planning and design to improve efficiency and safety

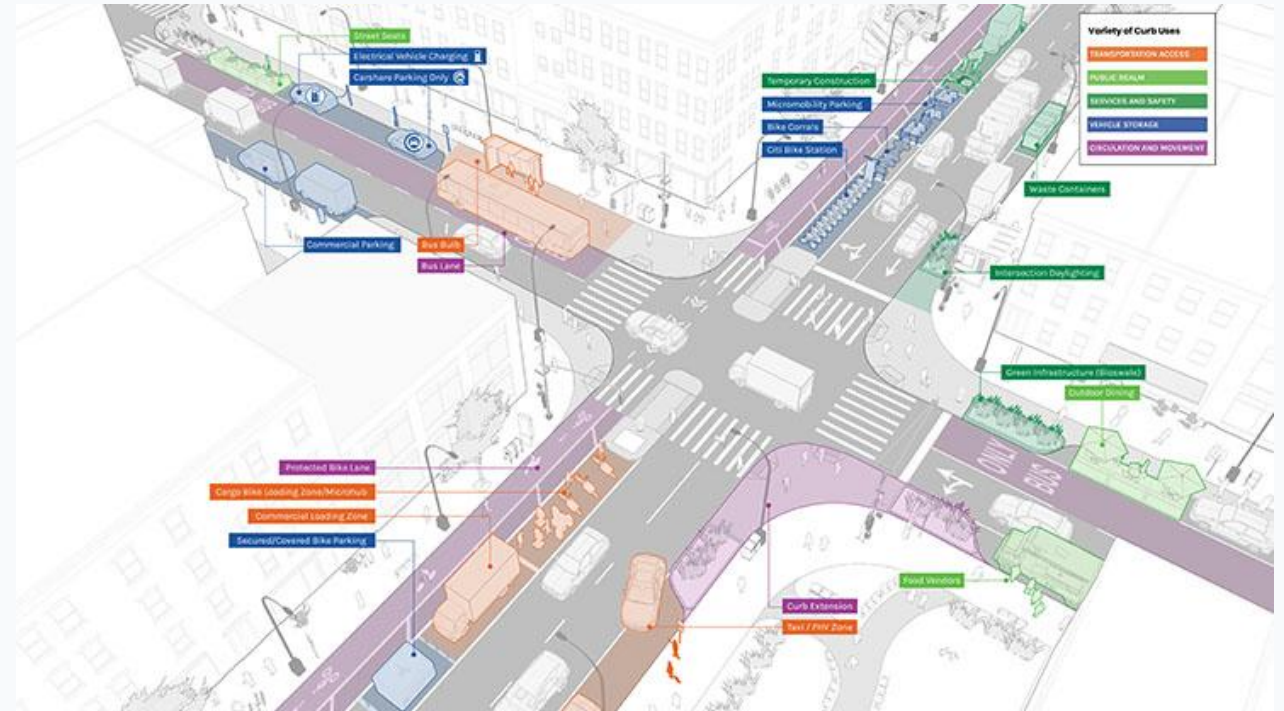
Presentation Overview

- Problem Statement
- Pilot Project Context
- System Overview
- System Performance
- Lessons
- Agency Value



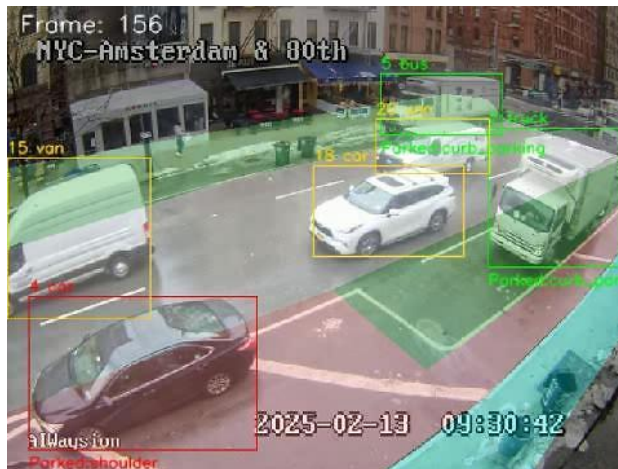
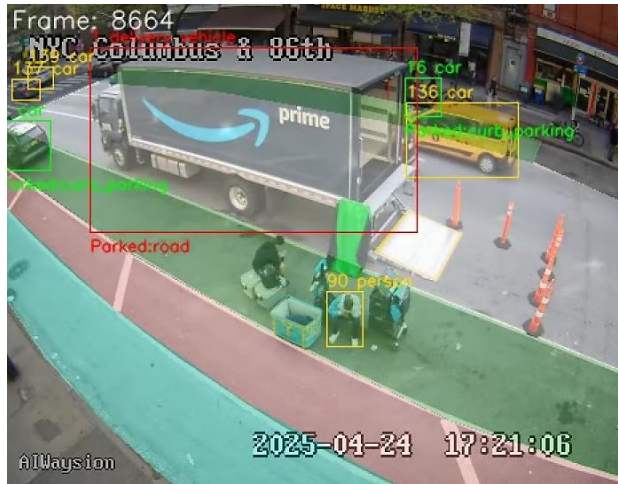
“With rapid growth in on-demand delivery, ride-hailing, and shared mobility, cities are seeing dramatic increases in demand for limited curb space.”

— CurbSpace Management Challenges and Opportunities from Public and Private Sector Perspectives, Transportation Research Record



Source: project slides; system design notes; <https://www.nyc.gov/html/dot/html/pr2023/nyc-dot-public-outreach-smart-curbs-pilot.shtml>
; <https://journals.sagepub.com/doi/full/10.1177/03611981211027156>

The curb is now an operational bottleneck



Agency pain point

Manual observation and citations are useful snapshots, but they do not provide continuous, lane-level curb activity data.

ITS opportunity

Edge computing sensors provide holistic real-time curb insights along with long-term usage data trends.

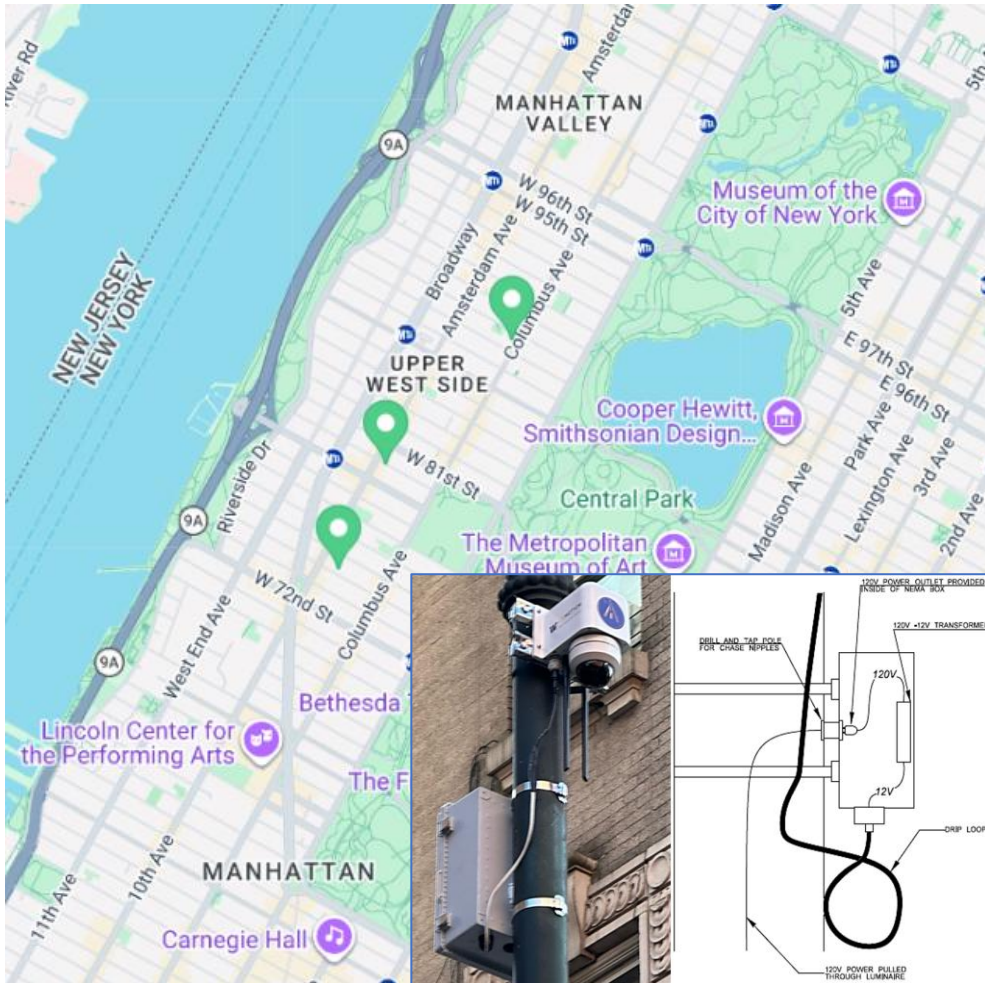
Core question

Can we convert video streams into structured events that agencies can trust for operations and planning?

Source: project slides; system design notes.

NYC pilot context

Three NYC pilot sites test distinct curb behaviors



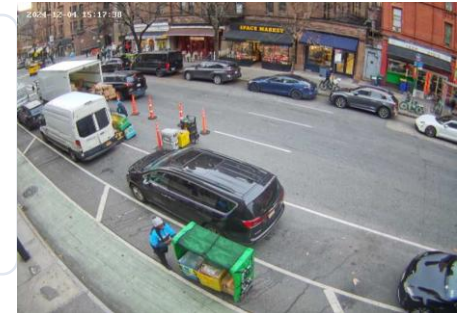
Amsterdam & 80th

Commercial loading and outdoor seating



Columbus & 86th

Diverse usage with heavy rush hour traffic and near red light



74th b/w Amsterdam & Columbus

Residential and simpler traffic



What the system detects

The value is not just detection — it is standard, queryable curb activity data.

Events

park_start
park_end
occupancy

Purposes

parking
delivery
illegal_parking
emergency_use
public_transit

Vehicle types

Car / Van / Truck /
Freight / **Taxi** / Moped /
Bicycle / Scooter / Police
Car / Ambulance / Waste
Truck / Motorcycle /
Cargo Bike / Other

Lane context

parking lane
travel lane
bike / bus lane
buffer zone
...



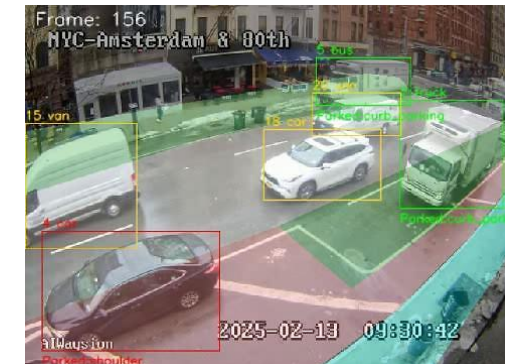
Other



Waste Truck



Cargo Bike

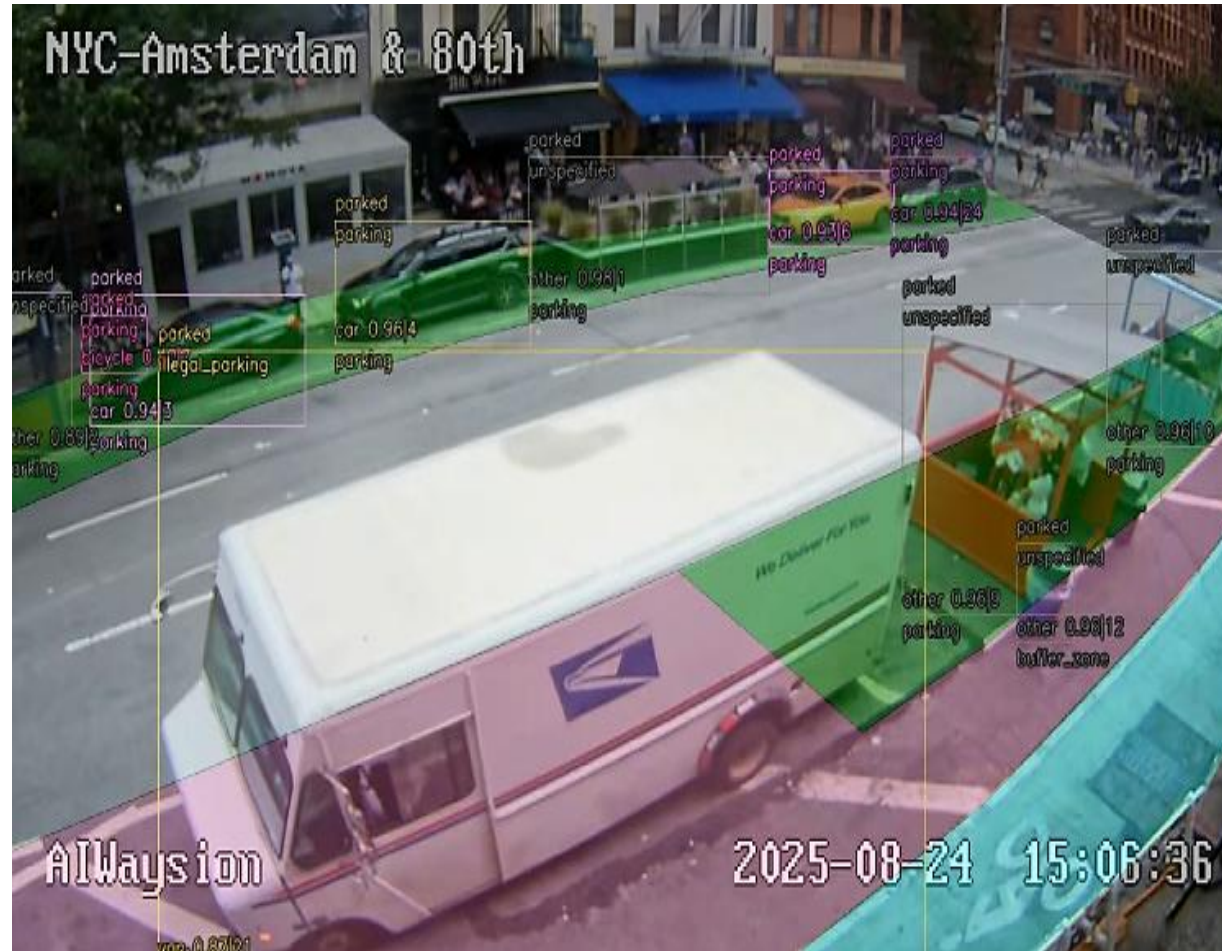


Lane Region of Interest (ROI)

Source: Curb Data Specification / project specification slides.

Spatial policy: from pixels to curb rules

A stopped vehicle means different things depending on where it stops.



Parking
Travel lane
Buffer zone
Bike lane

Source: project ROI specifications and system design notes.



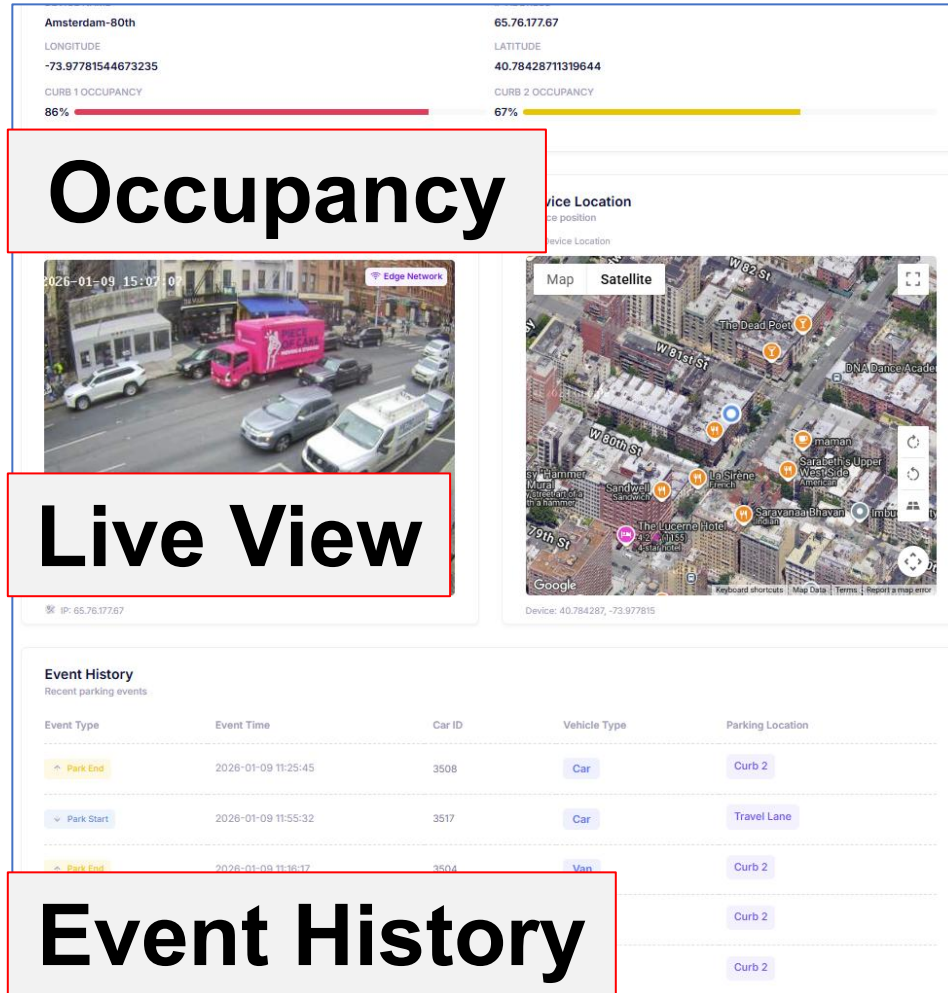
PTZ IR Camera **AI/ML Edge Computing Module with CPU & GPU** **Industrial Router (4G LTE & 5G)**



Curb Data: Activities & Occupancy

Field-ready edge deployment for curb operations



Source: system design notes and project dashboard slides.

Edge Compute & Analysis

Pole-side processing reduces cybersecurity concerns and avoid large data transmission

Real-time operational awareness

Supports live curb occupancy, stopped-vehicle events, and blocked-lane indicators for review and response.

Agency-ready integration

Events can feed dashboards, databases, APIs, and reporting workflows for planning and operations.

Edge performance: sustained real-time throughput on live stream

Field performance across 44,654 live curbside video intervals

Site	Video interval	Avg. time to produce results	Intervals slower than real-time
74th–Amsterdam–Columbus	180s	148.8s	2.2%
Amsterdam–80th	180s	137.5s	0.2%
Columbus–86th	180s	140.4s	8.1%

- Performance is measured over repeated 3-minute live video intervals

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Third-party evaluation

Evaluation Dataset

20 hrs

Evaluation
video

3 sites

Upper West
Side

5 windows

6–7 AM | 10–11AM |
1–2 PM | 5–6 PM |
9–10 PM

Coverage conditions

Sunny and wind/rain weather conditions were included to test performance under realistic field variability.

Independent Reviewer

CCNY Civil Engineering team
independently reviewed the evaluation
video.



The City College
of New York

Evaluation Metrics

- **Event precision**
Correct detected
events
- **Event recall**
Real events found
- **F1 score**
Precision +
recall signal
- **Missing events**
False negatives
flagged

CCNY evaluation results

Evening (5 PM) events are detected more reliably than morning (9 AM) across all three sites.

78%

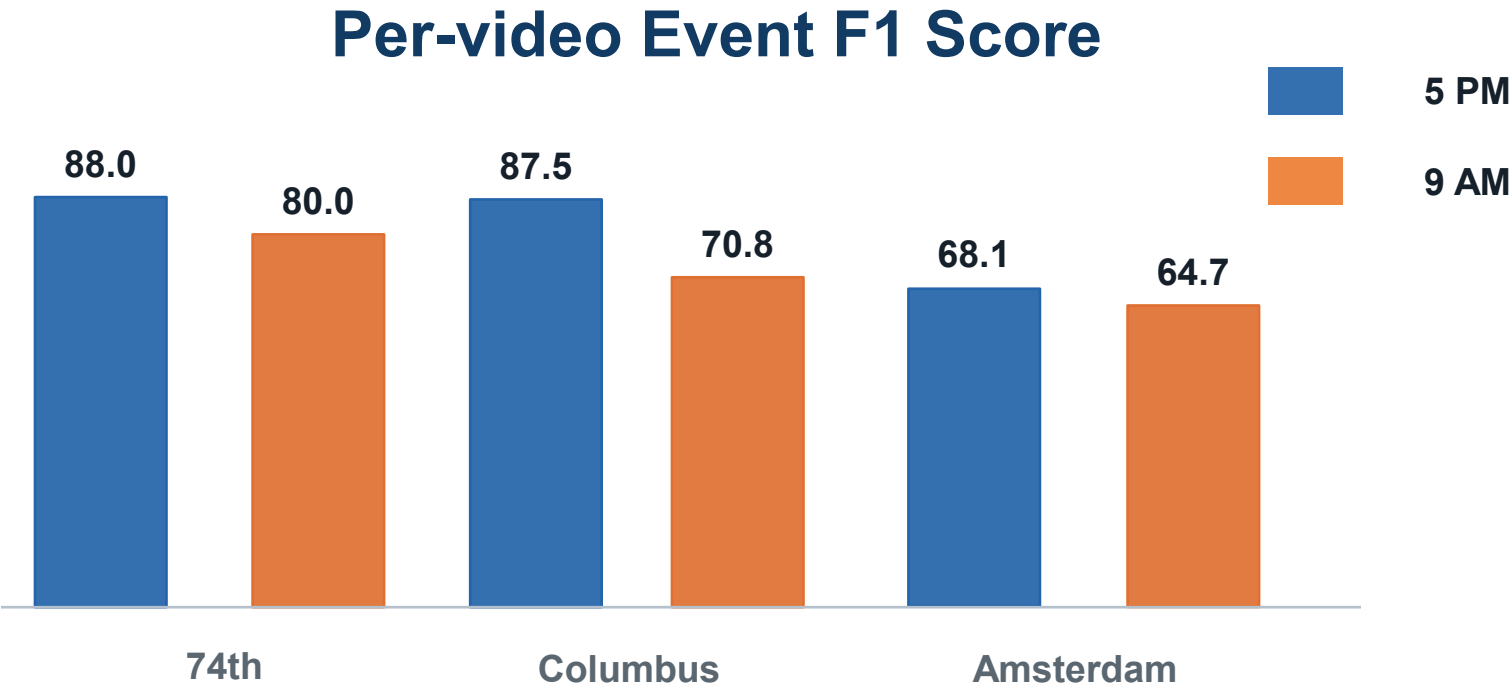
Event Approval (85 / 109)

33

Missed Events

98%

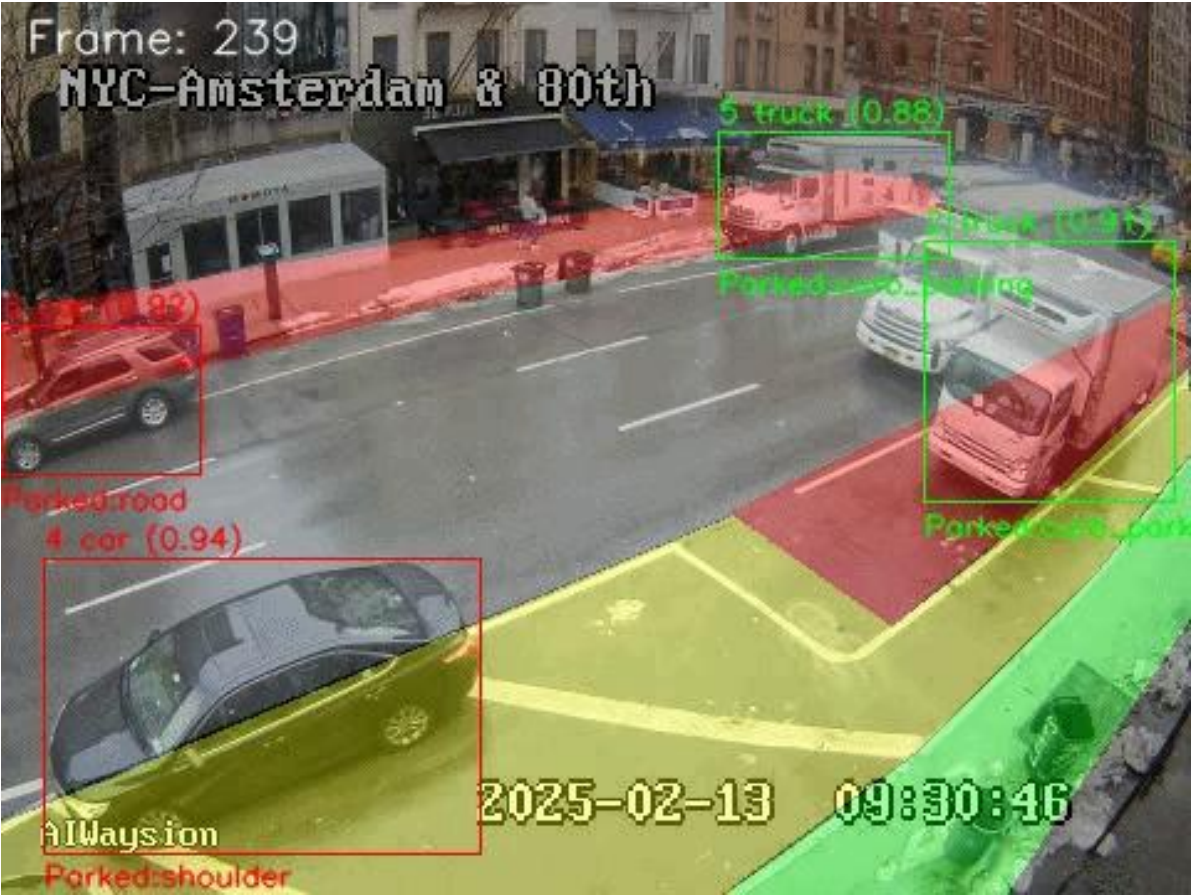
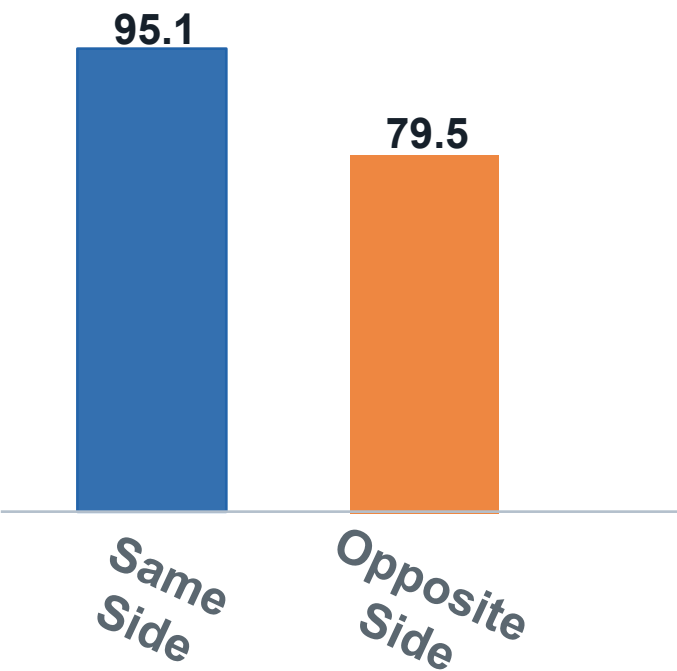
Vehicle
Classification Accuracy



Source: CCNY evaluation report; six one-hour videos.

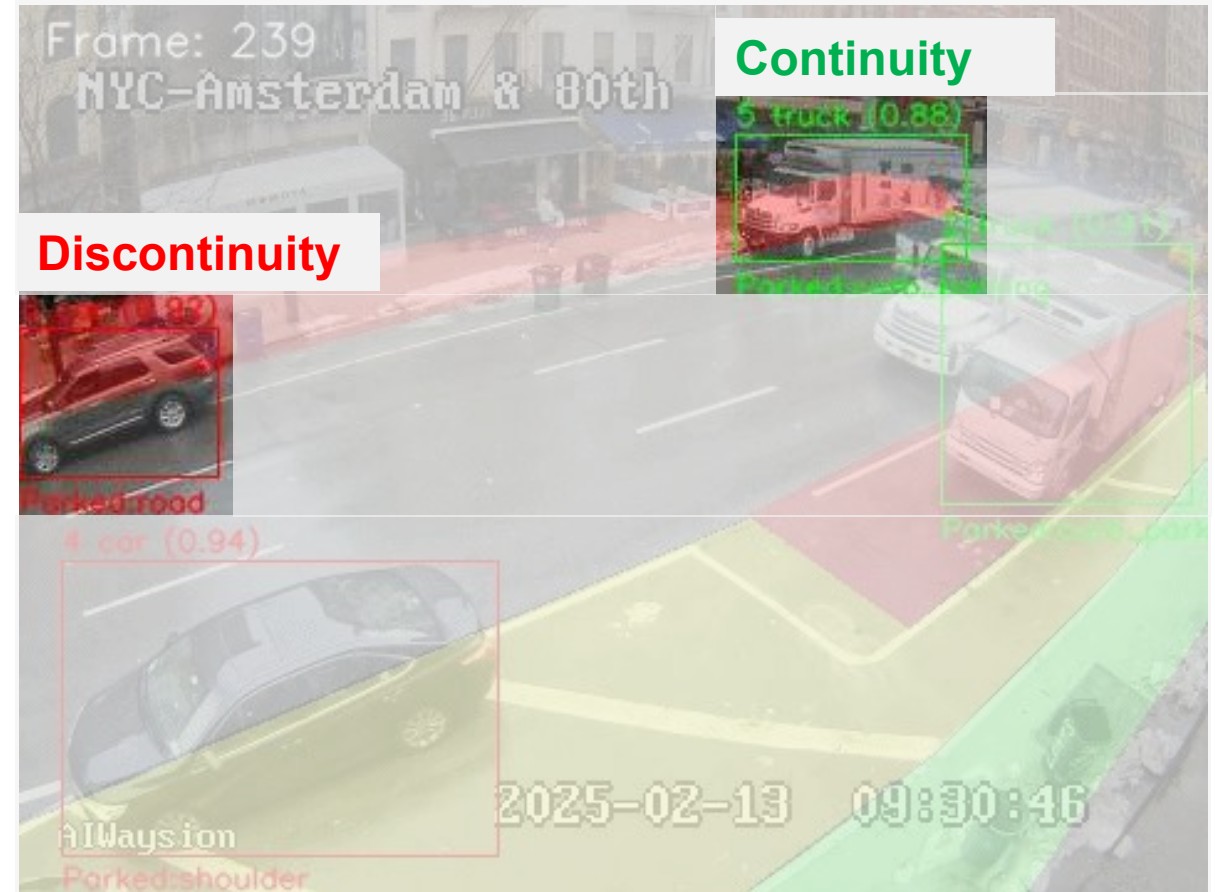
Self evaluation: Same vs. Opposite sides

Per-curb side Event Precision
(20 hour-long videos)



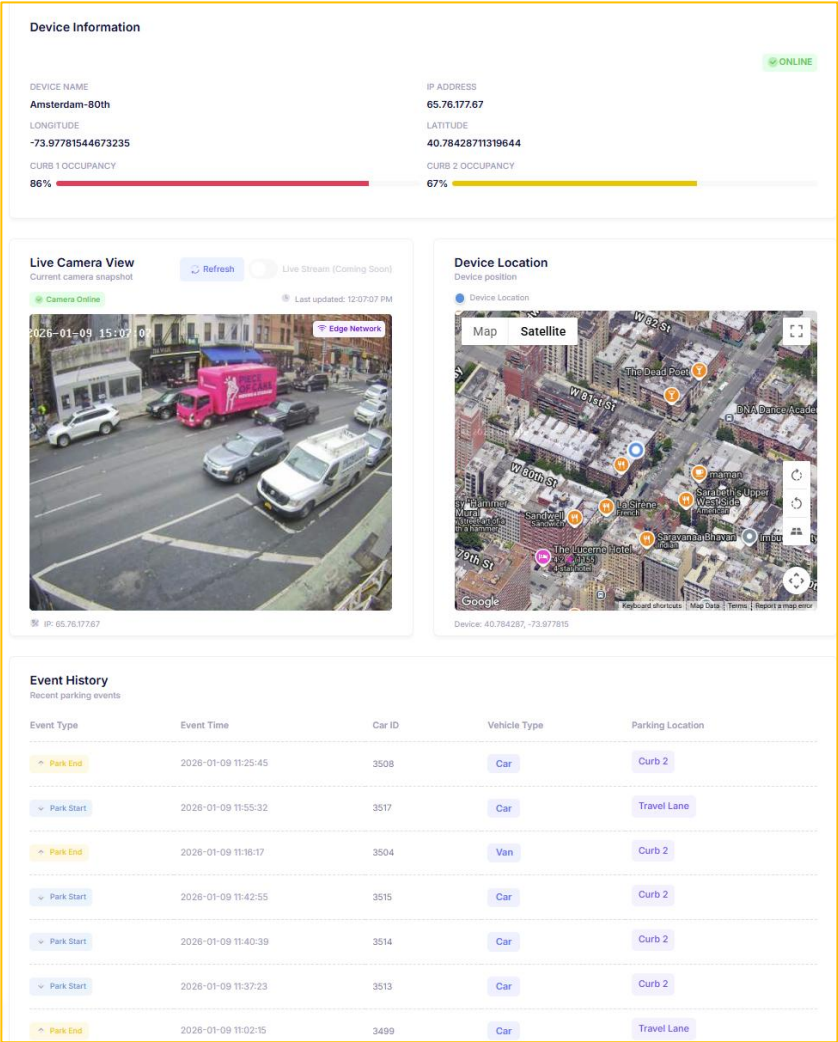
Lesson learned: visibility is the limiting factor

- Same-side views provide a clearer line of sight to curb activity
- Opposite-side monitoring is more vulnerable to trucks, buses, and traffic queues
- For reliable event data, prioritize same-side curb analytics

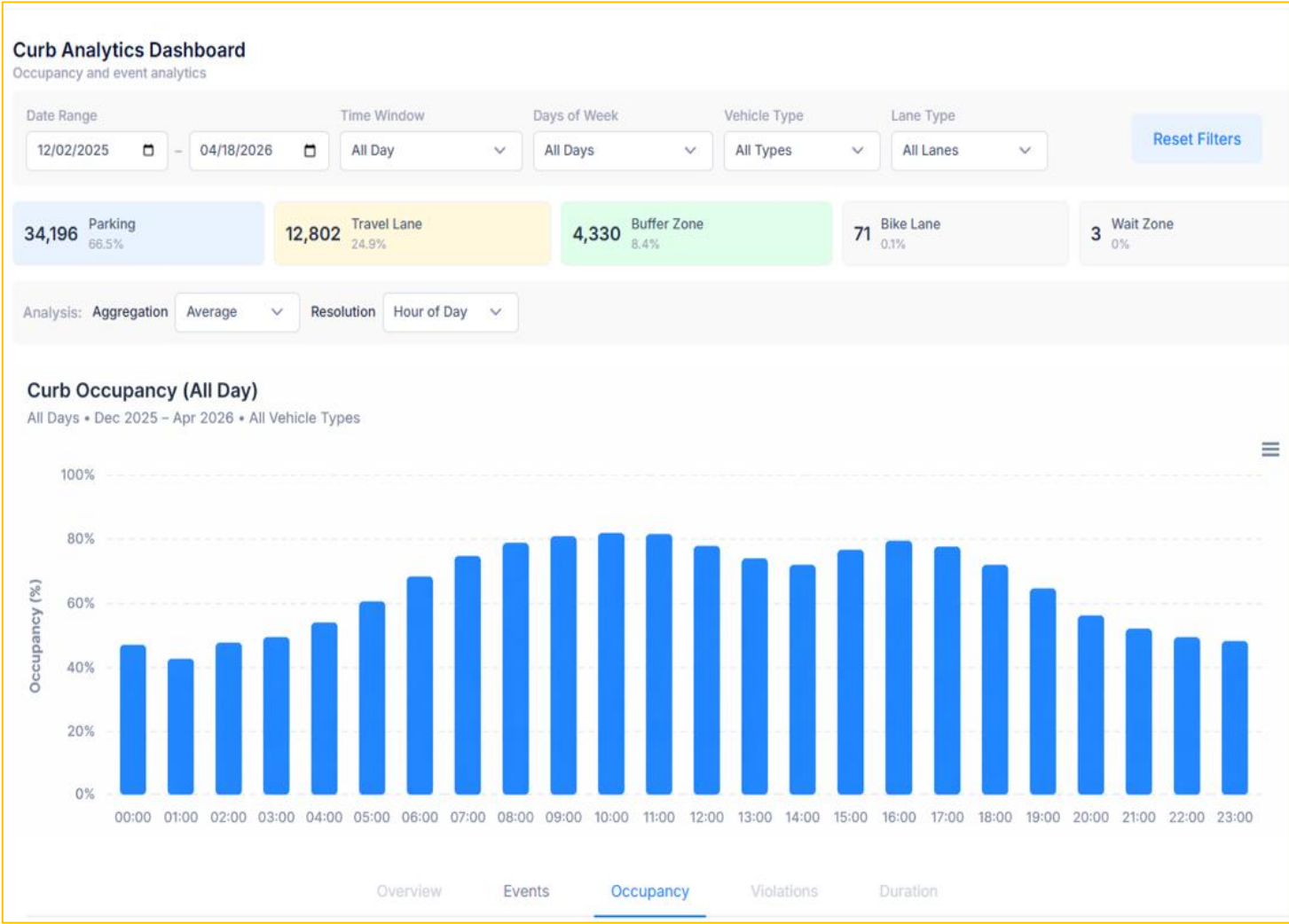


Tracking visualization from earlier iteration

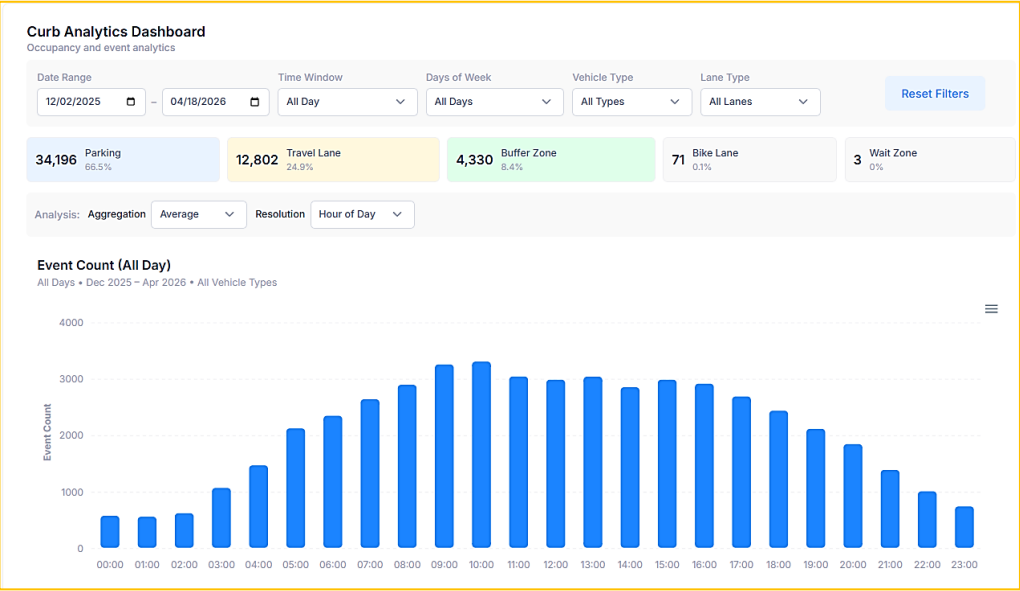
Web Dashboard: Curb Data Analytics



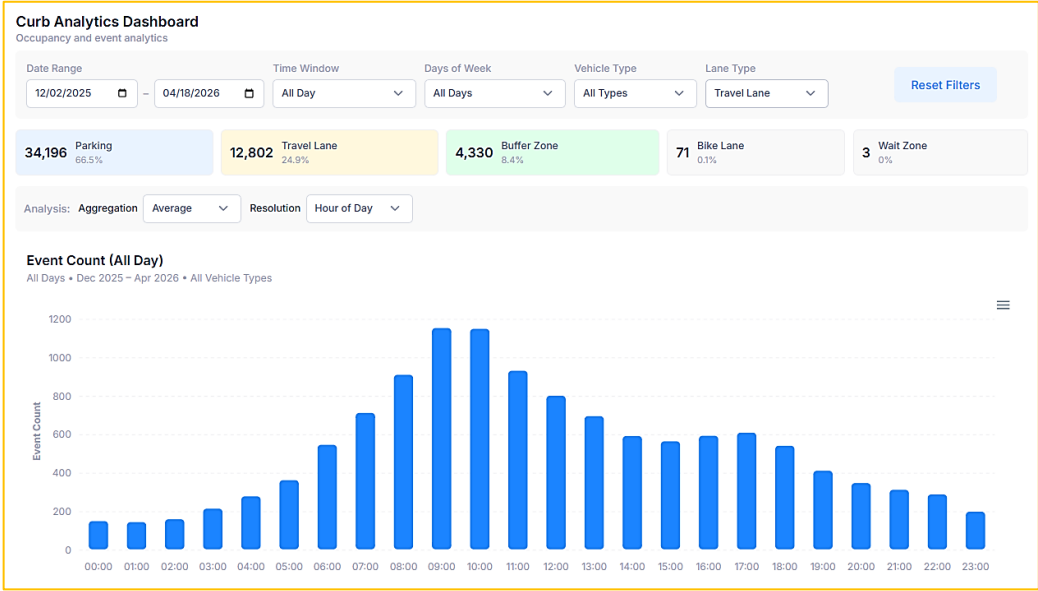
Real-time curb occupancy & events



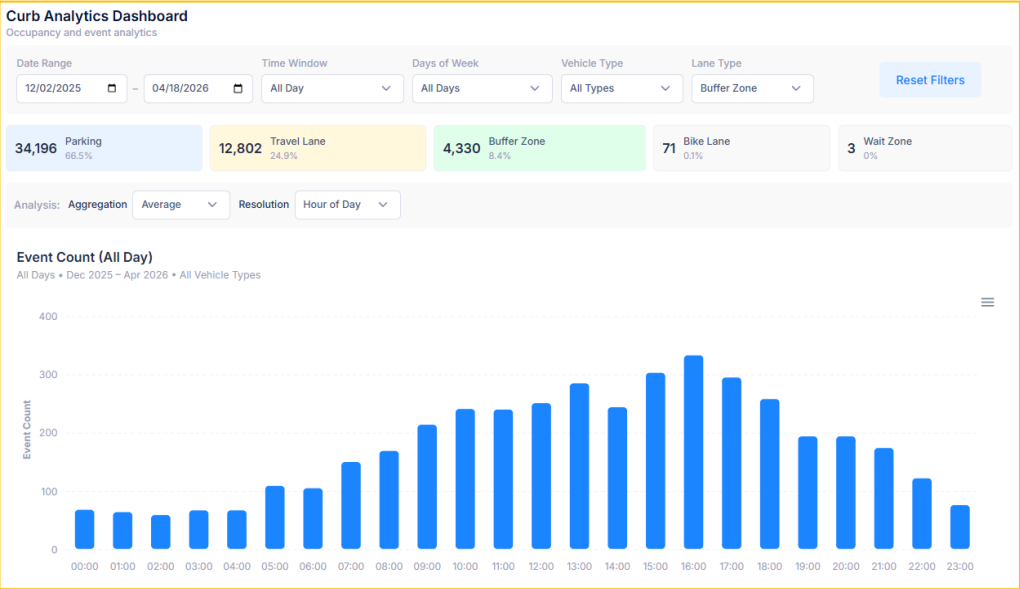
Curb Activity Insights



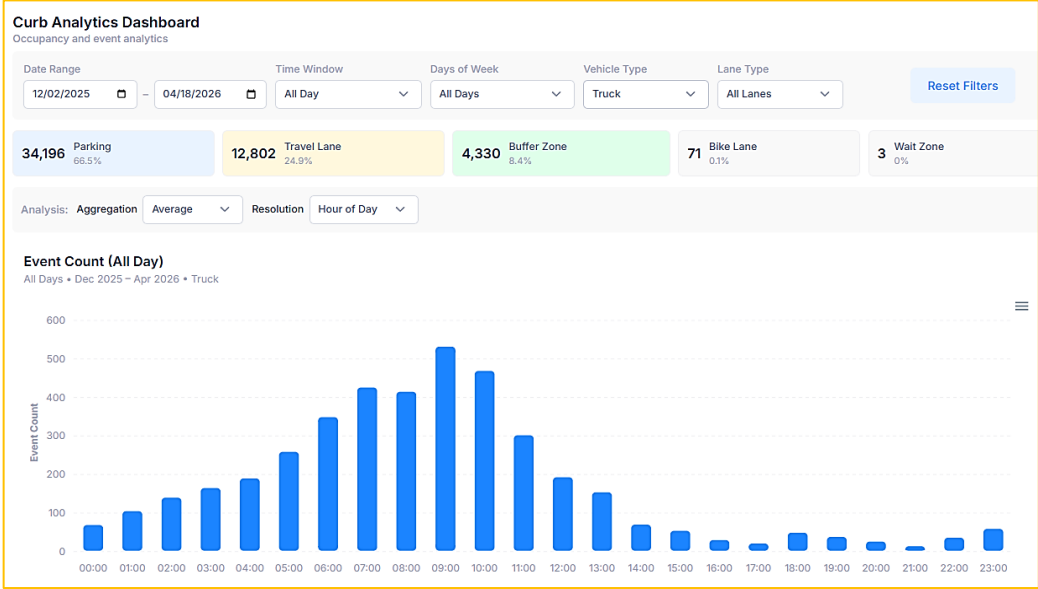
All vehicle types & all lanes



All vehicle types & travel lane (double parking)

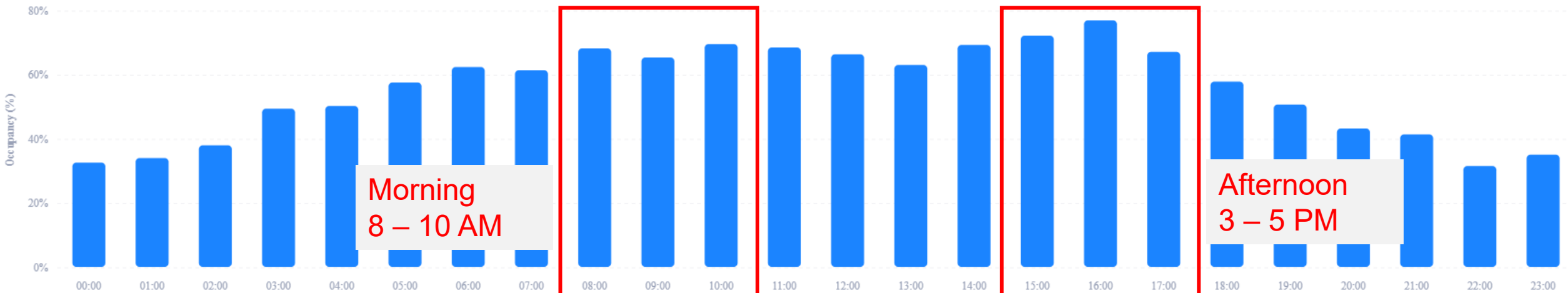


All vehicle types & buffer zone (illegal parking)

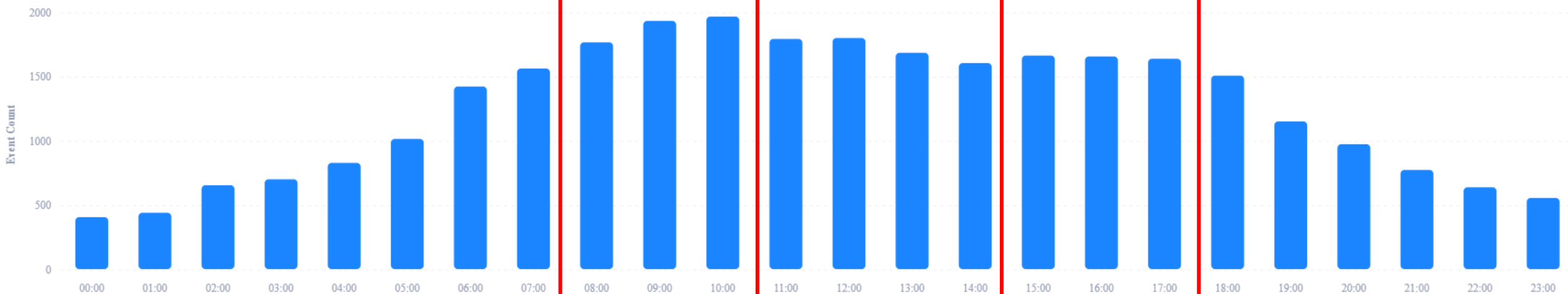


Truck & all lanes

Sample Occupancy (Average) by Hour of Day



Sample Event Count (Aggregated) by Hour of Day



Agency deployment suggestions

The near-term value is evidence for planning and operations

1. Start with planning analytics

Use curb occupancy, dwell time, loading patterns, and blocked-lane indicators to gain curb usage insight and evaluate policy.

2. Validate by use case

Planning, operations, and enforcement support require different accuracy thresholds and review workflows.

3. Design camera geometry carefully

Prioritize same-side curb views. Occlusion, glare, and lane boundaries can affect reliability as much as the analytics model.

Source: ITS-NY abstract guidance and project evaluation materials.

Thank you!

Q & A

