



GROUP 1

FLEET SAFETY RISK ANALYSIS

Deepali Attavar

Vedansh Avlani

Ever Becerra

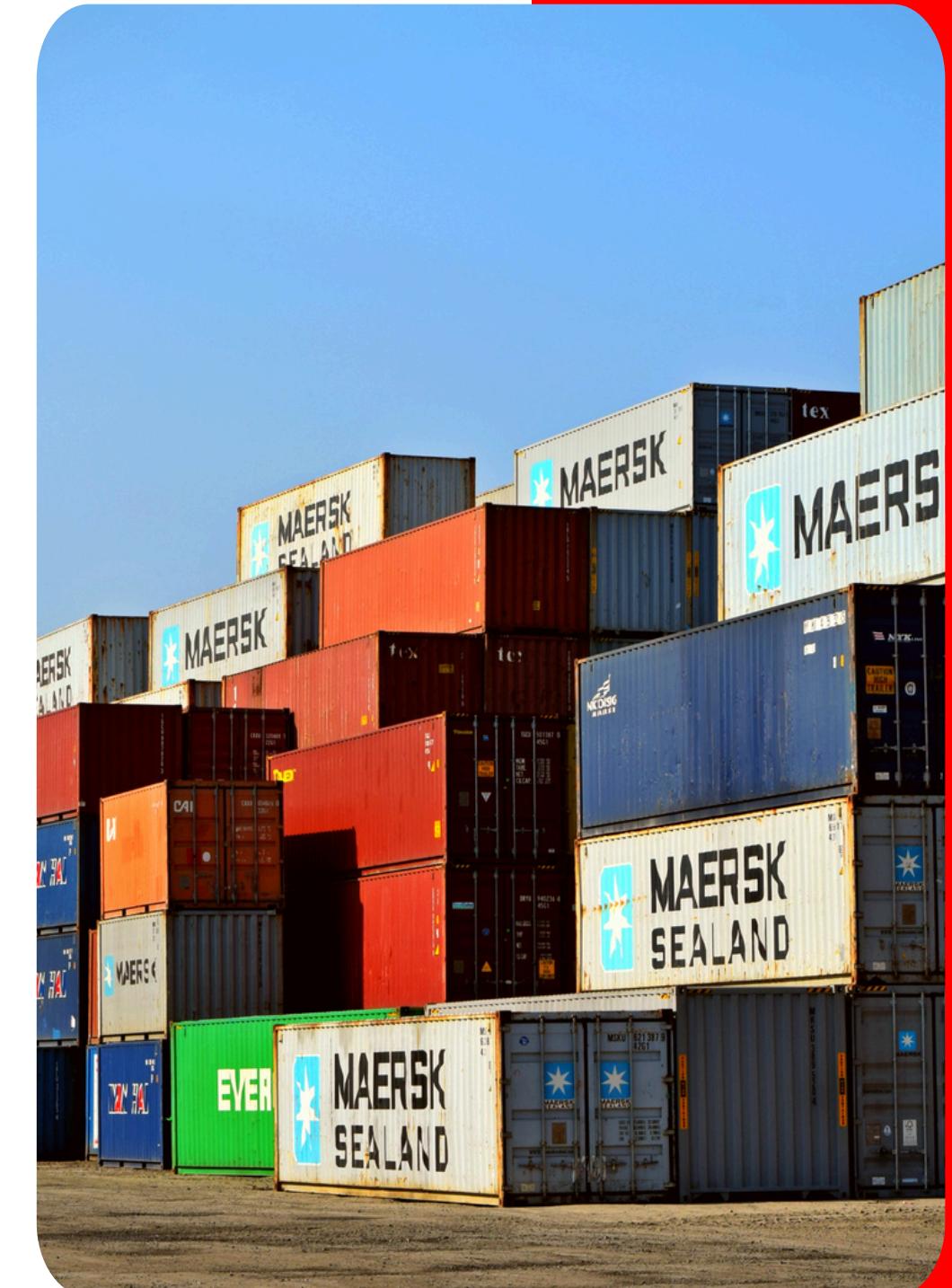
Hadia Butt

Keerthi Kiriti Chakali Murthy Gari



BUSINESS QUESTIONS

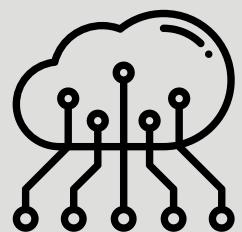
- **QUESTION 1:** *Which drivers exceed the 7.0 risk threshold, what specific dangerous behaviors are they exhibiting, and how can we prioritize intervention efforts?*
- **QUESTION 2:** *Are certain truck models contributing to higher risk factors, and how can fleet composition be optimized for safety?*
- **QUESTION 3:** *Where are the most dangerous cities for our drivers, and can we implement location-specific safety protocols?*



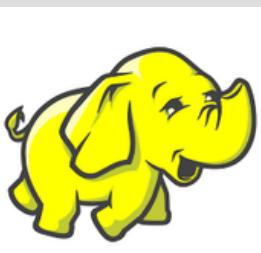
DATA PROCESSING



- Raw Data extracted from transactional CSV File



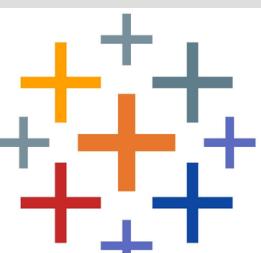
- Virtual Machine environment to host and process large scale data



- Hadoop processes data to compute efficiently



- Hive enables SQL queries on Hadoop data for insights

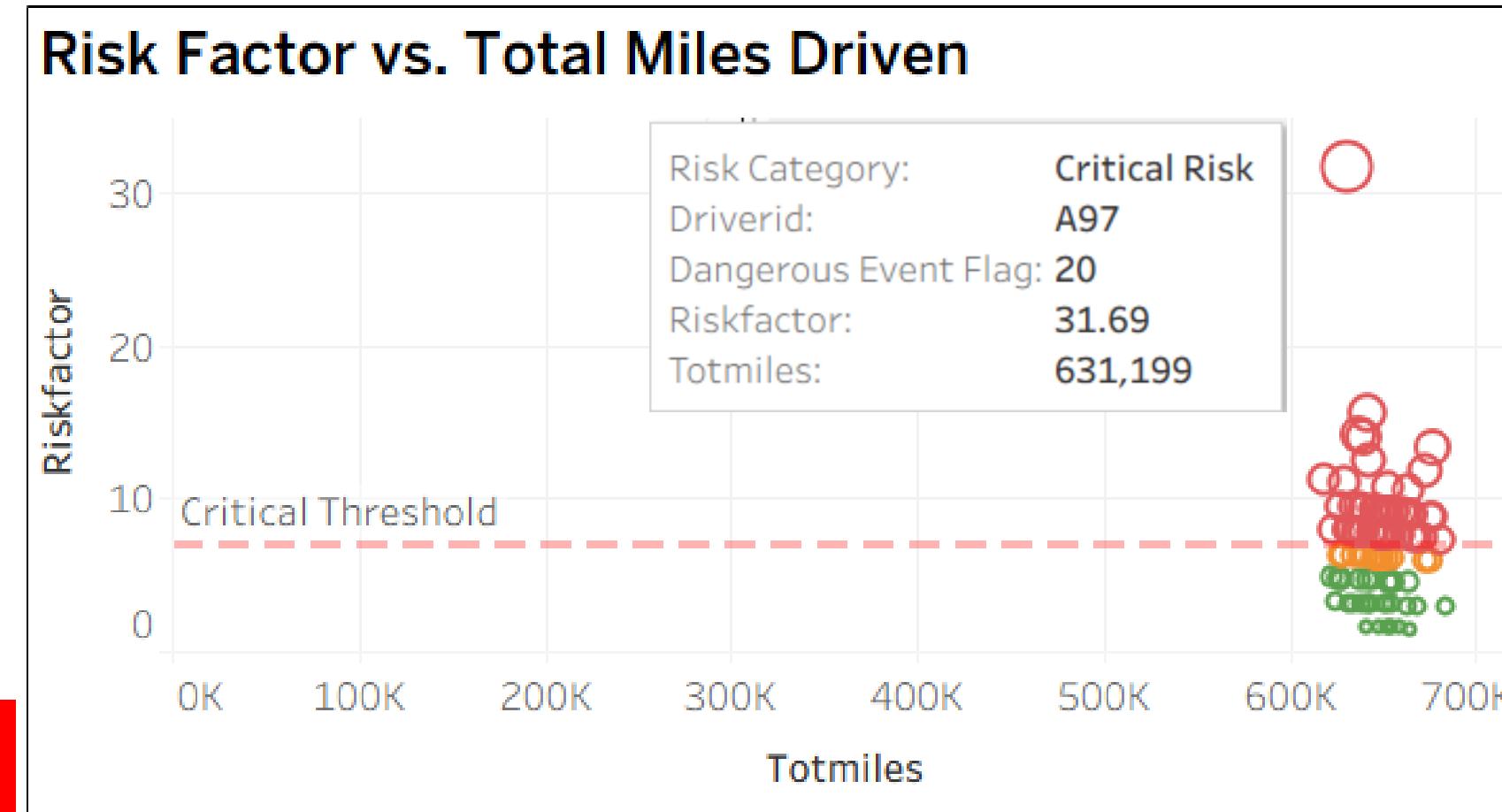
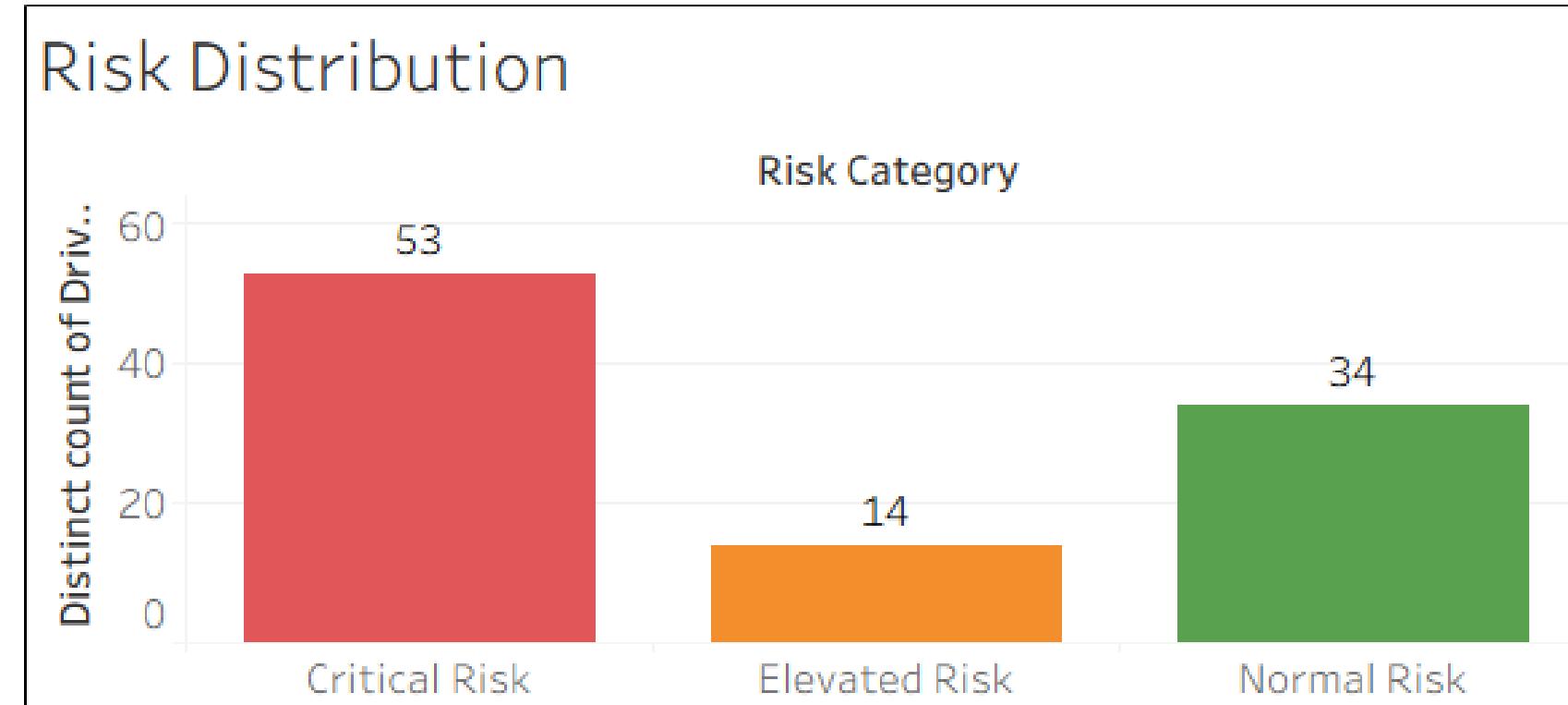


- Tableau visualizes insights to track income growth trends

PROBLEM 1: Critical Risk Driver Management

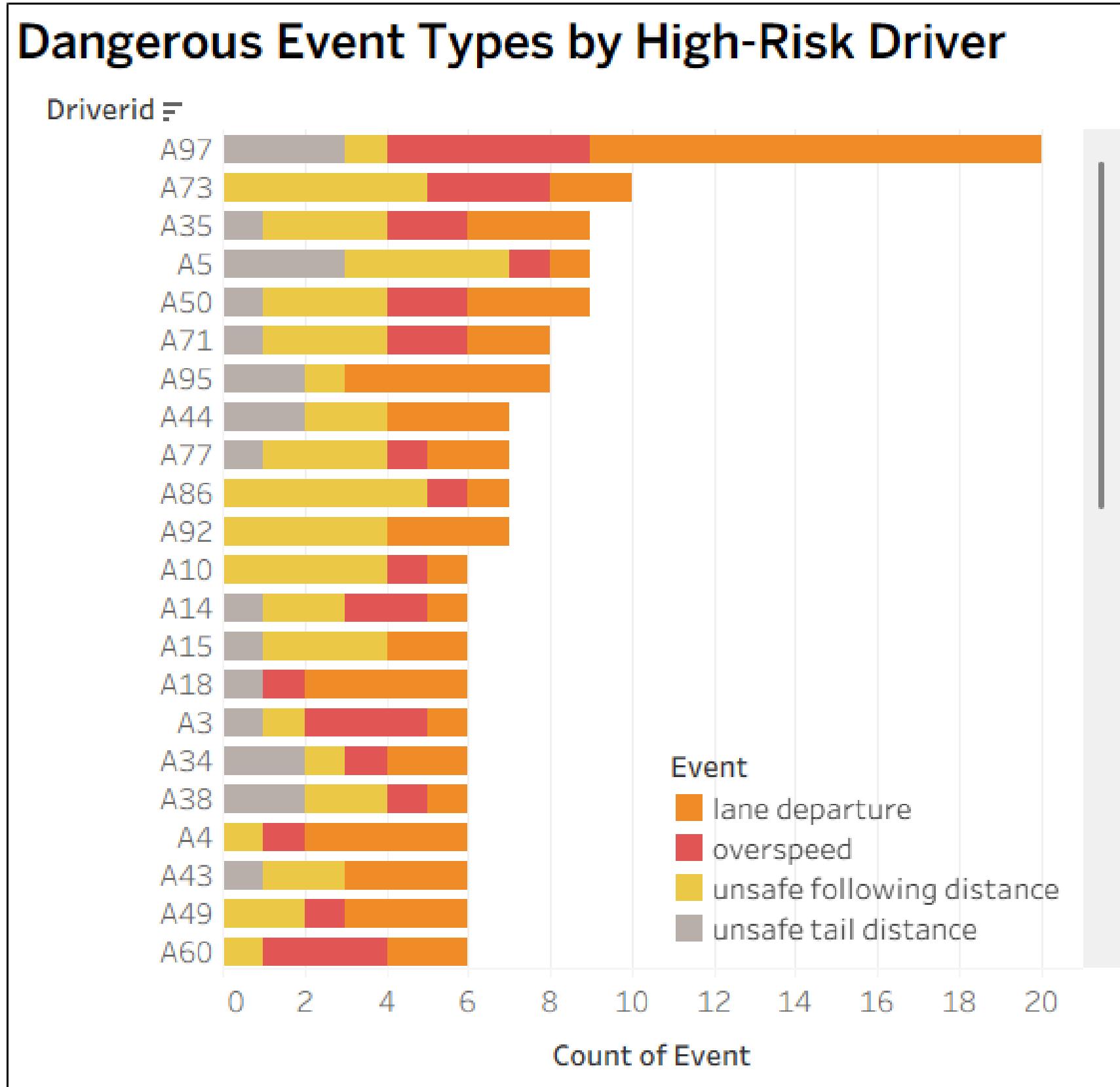
High Risk Drivers (≥ 7)	Total Dangerous Events	% of Fleet at Critical Risk	Avg Risk Factor (High-Risk)
53	457	52%	9.7

- More than half of the truck fleet is of critical risk i.e. risk factor > 7
- 14% drivers at Elevated risk i.e. risk factor > 5
- Avg. risk factor of the fleet is quite high at 9.7
- The risk doesn't decrease with experience
- Immediate action needs to be taken to ensure driver and public safety



PROBLEM 1: Critical Risk Driver Management

- Top 10 riskiest drivers have more than 7 reported risky incidents
- Driver with ID A97 is the riskiest driver with highest lane departure incidents
- Overall, unsafe following distance is the most common dangerous event
- Can't use one size fits all training approach



RECOMMENDATION

Solution 1: Immediate Intervention Program

- Mandate immediate retraining for all 53 drivers with Risk Factor ≥ 7.0
- Suspend drivers with Risk Factor ≥ 9.0 until safety certification completed
- Expected Impact: 30-40% reduction in dangerous events within 3 months

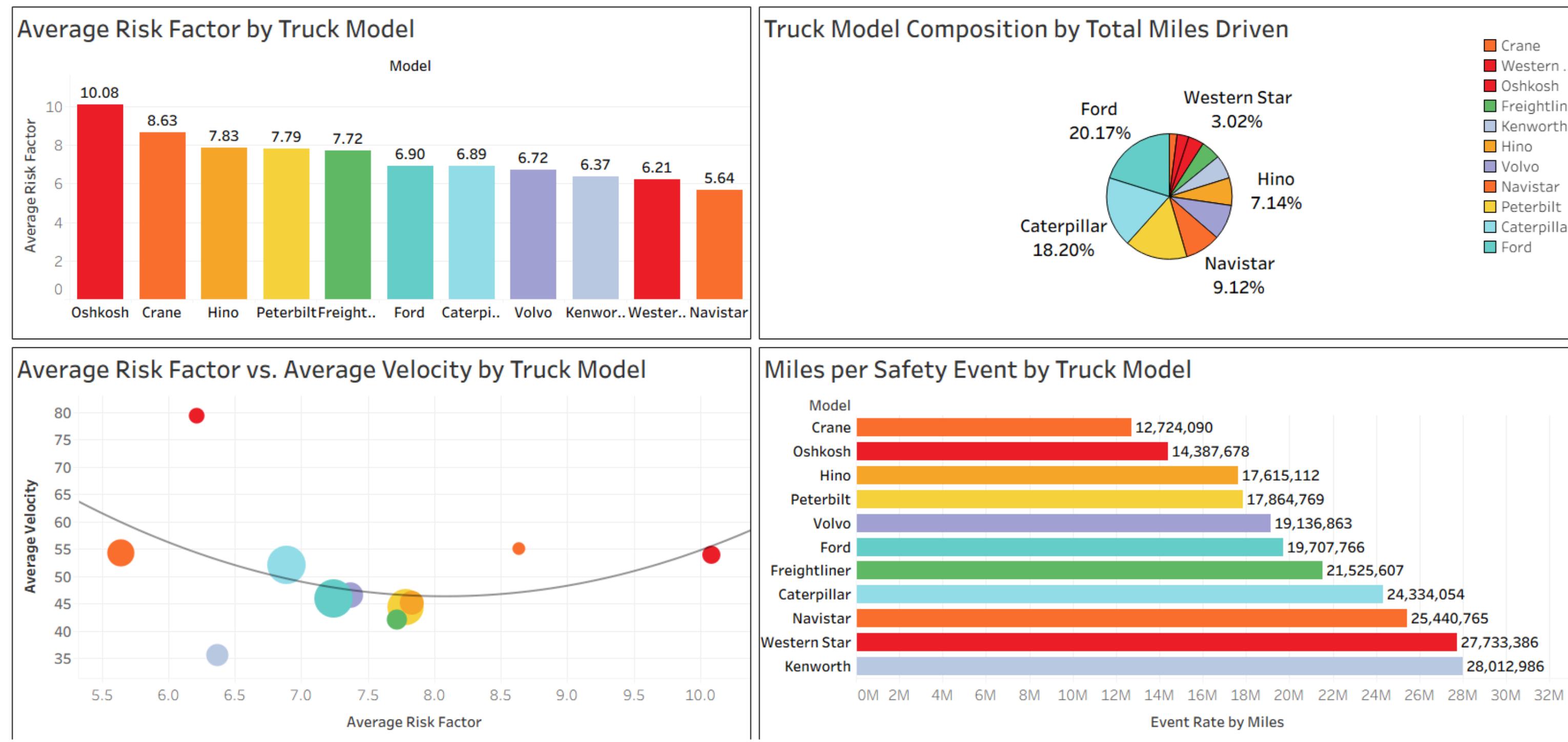
Solution 2: Behavior-Specific Coaching

- Create targeted training modules based on dominant event type (e.g., if driver's main issue is speeding vs. lane departure, customize training)
- Assign safety mentors (low-risk drivers) to high-risk drivers for ride-alongs
- Implement progressive discipline: 1st offense = warning, 2nd = mandatory training, 3rd = route restriction

PROBLEM 2: Vehicle Performance & Model Risk

Risk is driven by truck-model-specific factors, not speed or total miles. Focus corrective actions on the highest-risk models.

Truck Model Analysis



RECOMMENDATION

- **Targeted Risk Reduction Program:** Create a focused improvement plan for Oshkosh and Crane models, which consistently exceed the risk threshold.
- **Driver Behavior Intervention:** Implement event-based coaching (speeding, close following, close tail) since these events drive most of the risk.
- **Model-Specific Action Plans:** Conduct root-cause analysis on high-risk, low-mileage models to identify mechanical, routing, or operational issues.
- **Enhanced Preventive Maintenance:** Increase inspection frequency for the highest-risk models to reduce event occurrences and improve reliability.
- **Refined Monitoring:** Since velocity is not a meaningful driver, shift monitoring focus toward event patterns, vehicle condition, and environmental factors.

PROBLEM 3: Geographic Risk Analysis

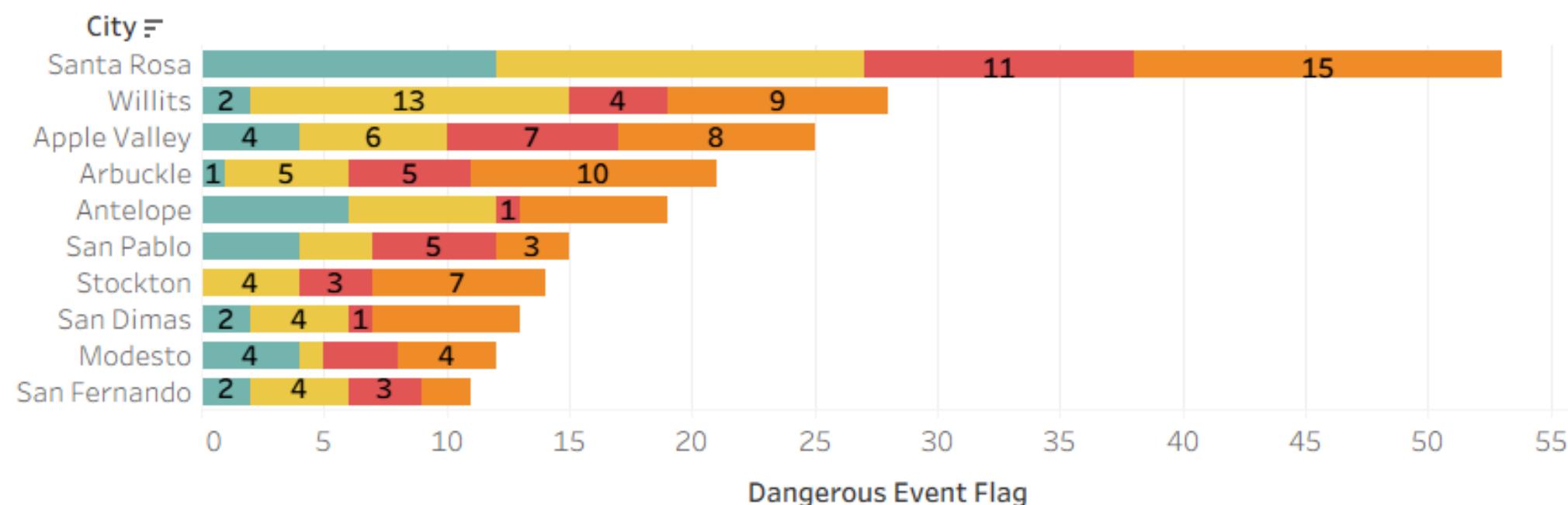
City-level risk varies widely, creating clear hotspots.

- Six cities consistently emerge as risk hotspots.
- Overspeed and lane-departure events dominate, indicating behavior-driven risk rather than random variation.
- The top 5 cities alone account for 146 high-risk events, showing extreme risk concentration.
- Some hotspots show 5–10× more incidents than similar areas, pointing toward road-design, traffic density, or enforcement factors.
- Targeting these cities provides the fastest and highest ROI in risk reduction

Number of Events in Top 5 Risky Cities:
6

Events in Top 5 Risky Cities:
146

Top Dangerous Cities

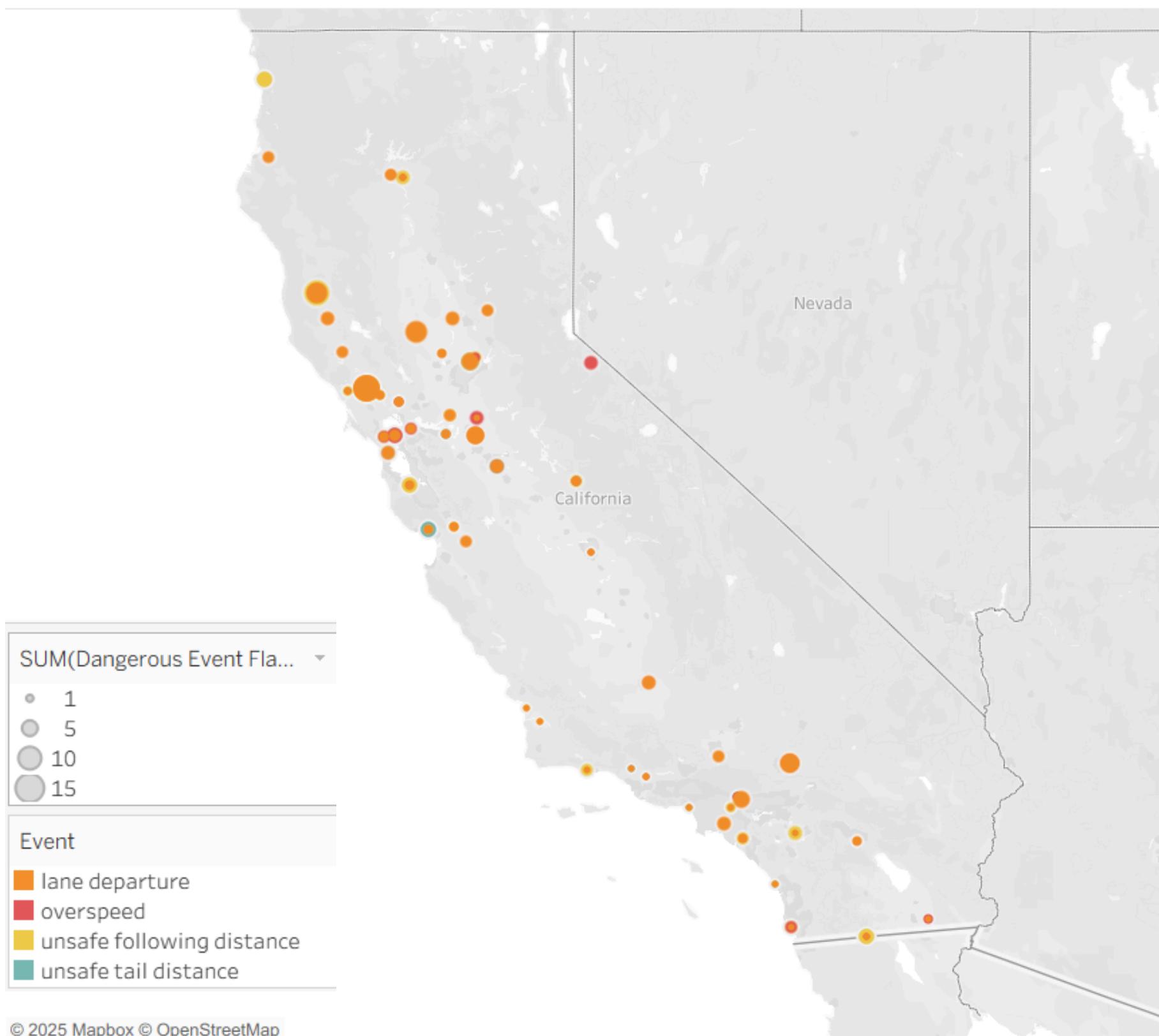


City Distribution & Event Patterns

Spatial patterns highlight operationally critical corridors.

- High-risk clusters align with northern & central California corridors (I-5, US-101, CA-99).
- Urban-rural transition zones show spikes in overspeed and lane-departure events.
- Congested city zones show more following-distance violations.
- Southern California shows fewer, more isolated incidents, suggesting localized rather than systemic risk.
- The map highlights where geo-fencing, driver coaching, and route adjustments would deliver the highest impact.

Map - Risk Events



RECOMMENDATION

1. Prioritize Interventions in 6 Hotspot Cities

Target Santa Rosa, Willits, Apple Valley, Arbuckle, Antelope, and San Pablo .the locations driving 146 high-risk events.

2. Enable Geo-Fenced Safety Alerts

Trigger automatic speed/lane warnings when trucks enter hotspot zones.

3. Reroute & Reschedule High-Risk Corridors

Reduce exposure in extreme outliers (Santa Rosa, Willits) by adjusting routes and limiting night-time runs.

4. City-Specific Micro-Coaching

Deliver quick coaching based on each city's dominant risk pattern (e.g., overspeed vs. lane departure).

5. Partner with Local DOT for Fixes

Use hotspot data to request improvements like better signage, lane markings, or surface repairs

CONCLUSION

- Fleet risk is driven by a small group of high-risk drivers, specific truck models, and a set of clearly identifiable geographic hotspots.
- High-risk vehicle models exhibit patterns unrelated to speed or mileage, indicating model-specific or operational factors.
- Geographic analysis shows extreme concentration of incidents in a few cities and along major freight corridors.
- Combining driver coaching, targeted maintenance, and city-specific safety measures provides the most effective strategy for reducing overall fleet risk.



GROUP 1

THANK YOU

