

REAL-TIME ADAPTIVE SAFETY IN TEMPORARY TRAFFIC MANAGEMENT

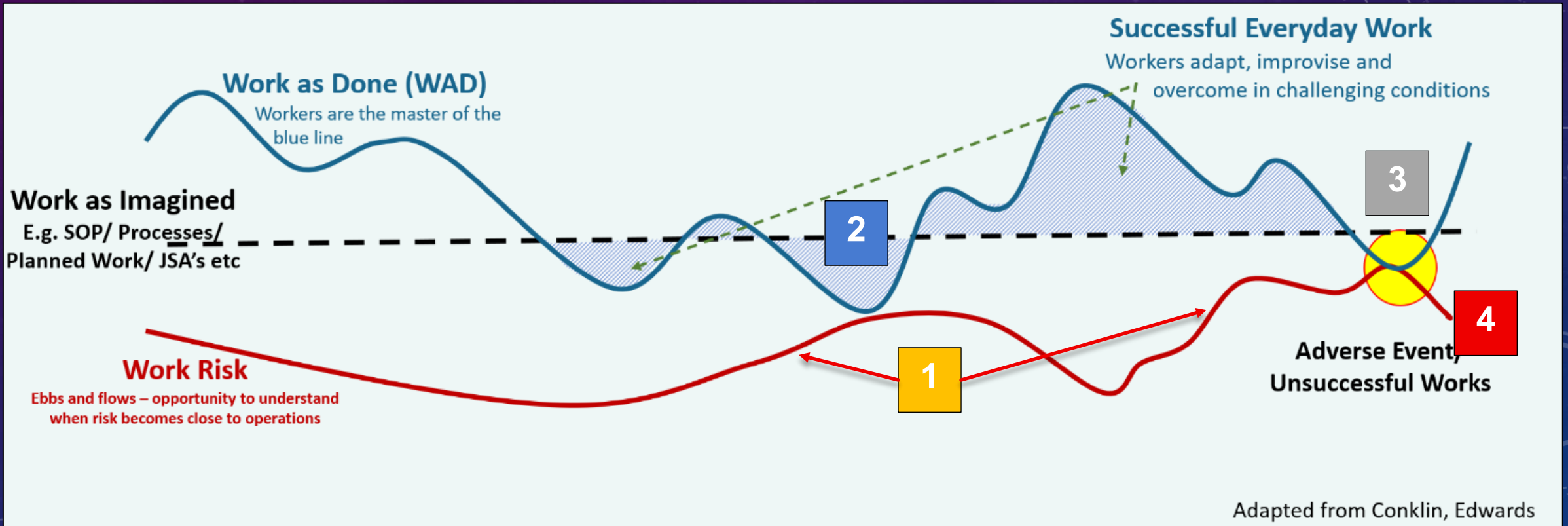
TRANSPORTATION CONFERENCE 2026

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THE PROBLEM

Static traffic management systems are **expected** to address **dynamic, unpredictable risks**.

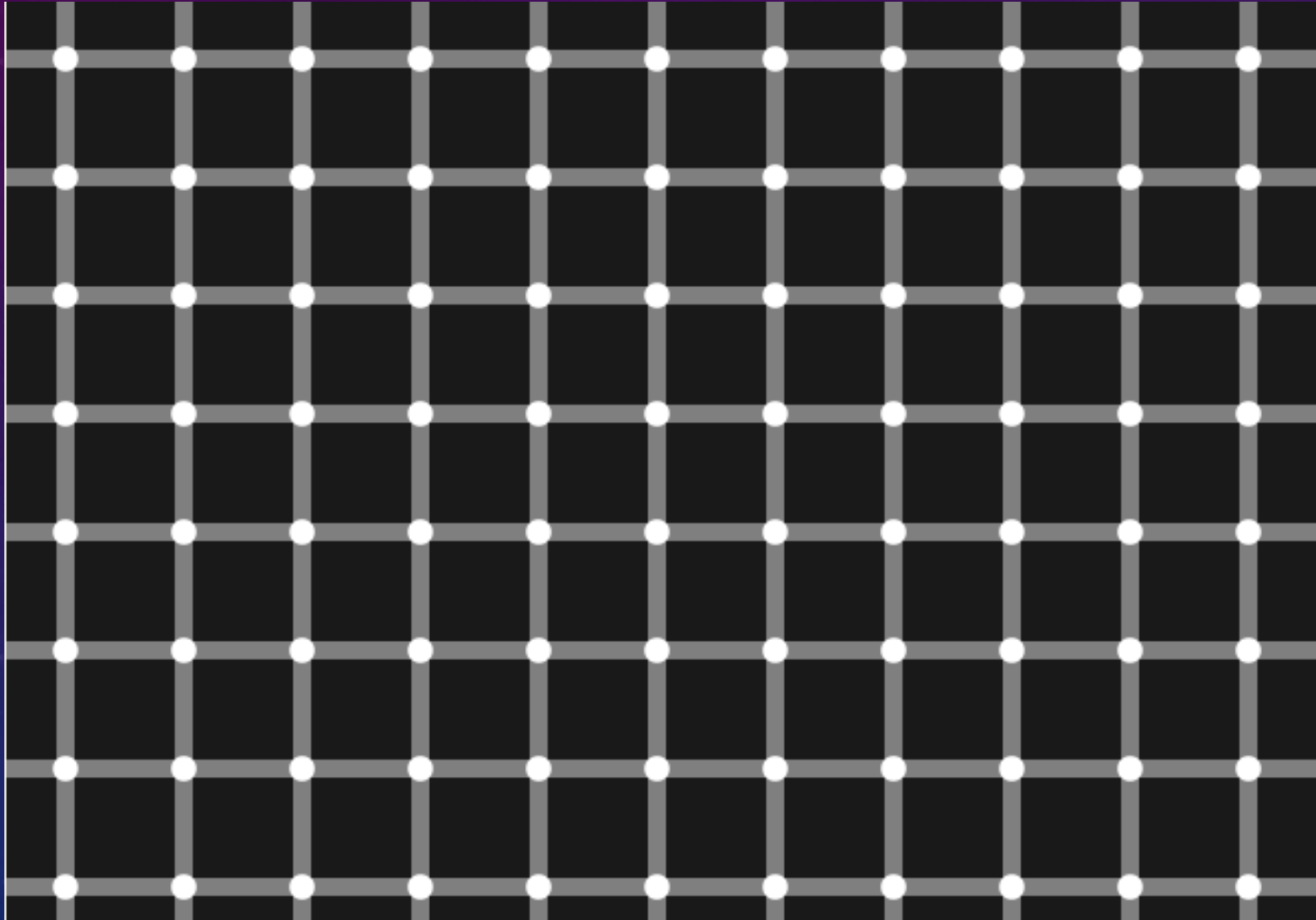
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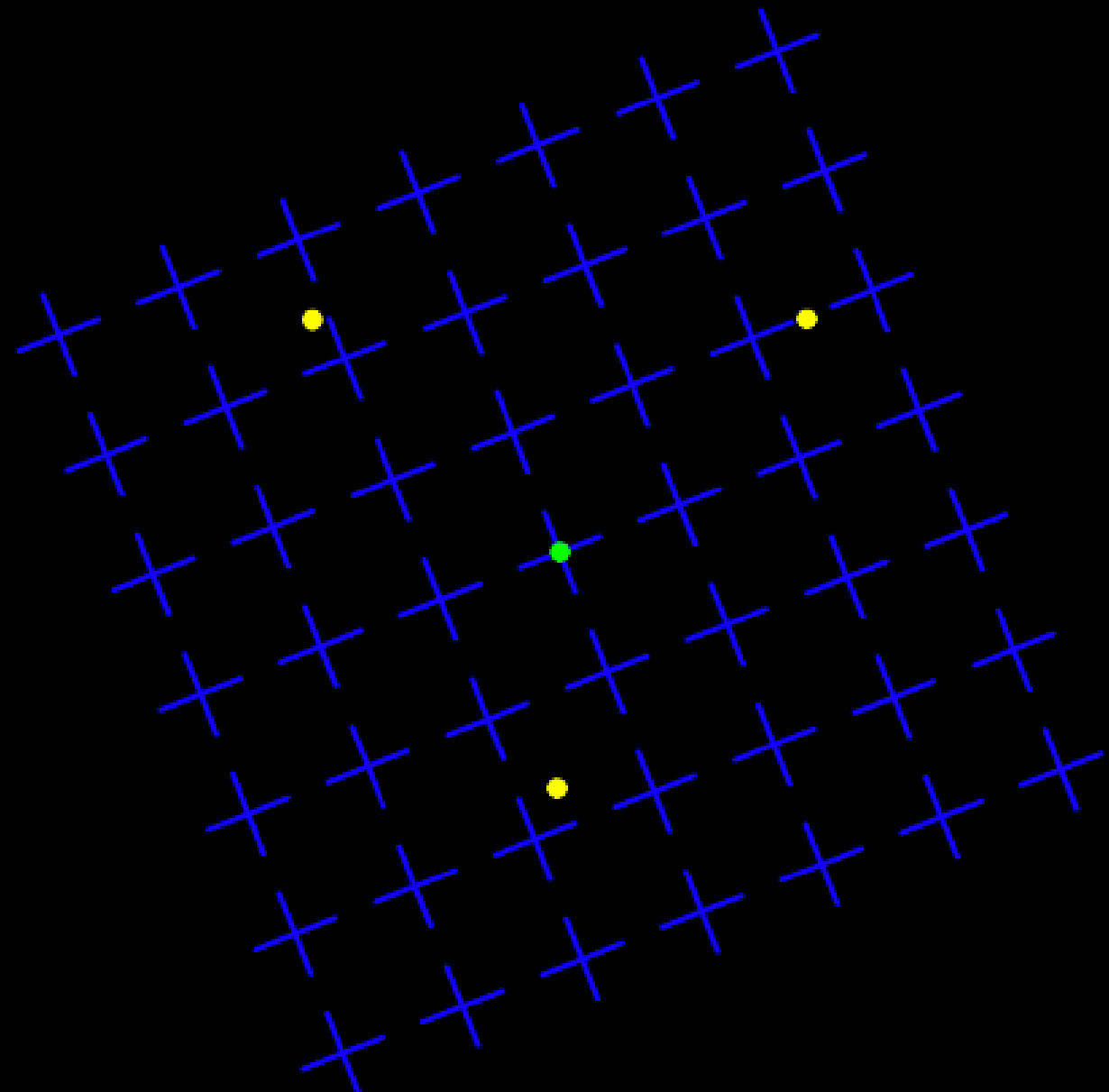


HUMAN PERCEPTION LIMITS

Drivers and workers only see a fraction of the hazards present in real work zones.

WHAT YOU SEE IS NOT WHAT YOU GET





ADAPTIVE SAFETY LOOP

1. Combine human and sensor perception
2. Machine-learning risk profiling
3. Adaptive control (speed, spacing, warnings)
4. Capture outcomes - feedback

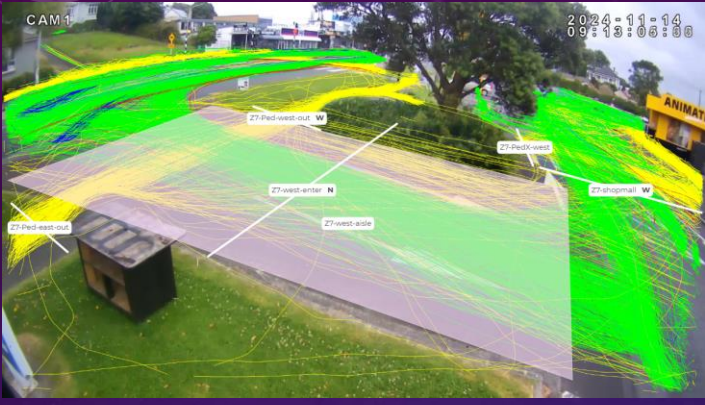
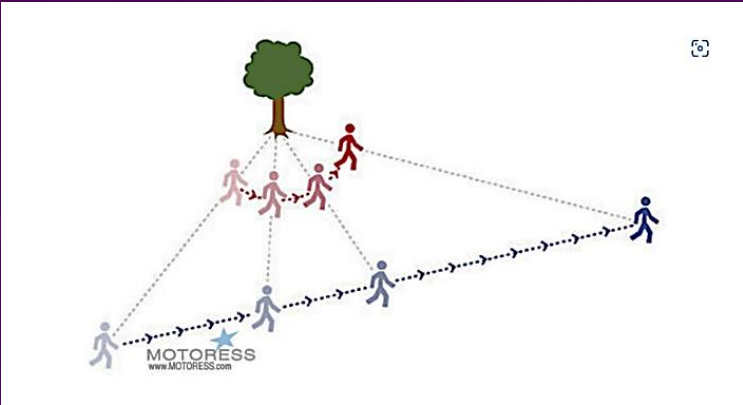


FOUR-LAYER ADAPTIVE RISK FRAMEWORK

- **Perception & Context** – SAFEye and environmental sensing
- Interpretation – AI/ML analysis and expert review
- Decision Support – Adaptive layout recommendations
- Feedback & Learning – Continuous organisational improvement

PSYCHOENGINEERING

Integrating psychology and engineering to understand how people perceive and respond to risk.



Driver Cognitive Workload



Attention Level



Visual Processing



Decision Pressure



Auditory Load



Overload Risk

Smart Traffic Worksite System

AI Processing



Image Recognition



Decision Making



Data Streams



Real-time Data



Traffic Patterns



Traffic Patterns

Risk Prediction



Camera



Accident Prediction



Dynamic Adjustments

PILOT OUTCOMES – AUCKLAND

- **35%** faster TMP approval times
- **25%** improvement in assurance verification
- **40%** reduction in administrative duplication
- **15%** improvement in operational decision productivity

FUTURE OF TTM

Moving from compliance-based traffic control to adaptive risk intelligence.

CONCLUSION

Adaptive systems allow temporary traffic management to:

- learn,
- adapt, and
- respond in real time.

PILOT KPI SUMMARY

Key Performance Indicator	Baseline (Traditional TTM)	Adaptive Framework Result	Change (%)	Supporting References
TMP Review & Approval Time	10.0 days (mean)	6.5 days (mean)	-35%	ISO 9001:2015; OECD (2019); Elvik (2001)
Control-Assurance Verification Rate	68% effective	85% effective	+25%	HSWA (2015); Hopkins (2005); Hollnagel (2014)
Administrative Duplication	40% duplicated fields	24% duplicated fields	-40%	Dekker (2011); Wears et al. (2015)
Decision-Making Productivity	4.0 decisions/shift	4.6 decisions/shift	+15%	Rasmussen (1983); Endsley (1995)
Near-Miss Event Rate*	11/month	7/month	-36%	Heinrich (1931); Hallowell & Gambatese (2009)
Worker Risk Awareness Score†	68/100	82/100	+21%	Bezuidenhout (2019); Wickens et al. (2015)
Alignment with NZGTTM Guardrails	Partial	Full	—	NZTA (2023); Hollnagel (2014)