

Twin-Guided Robotic Pavement Overlays (T-GRO): Safer, Faster, Cleaner Resurfacing

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Prospective Partners: Idaho Transportation Department (ITD); paving contractors; traffic-control vendors; sensing/IC providers

Vision Statement:

What if DOTs could renew pavements overnight—keeping traffic moving—by pairing a live digital twin with robotic paving fleets that cut lane-closure hours by 50%, reduce user delay and worker exposure by one-third, lower carbon emissions, and deliver pay-factor quality in real time?

Current Challenges:

- ⬇ Lane closures → queues, missed deliveries, safety risks
- ⬇ HMA compaction constrained by time/temperature windows
- ⬇ QA after-the-fact, not in real time
- ⬇ Closures increase exposure, emissions, labor strain



IDEAS • CHALLENGE

ADVANCED RESEARCH PROJECTS AGENCY • INFRASTRUCTURE

T-GRO Breakthrough:

Digital Twin → Generative AI Planner
→ Physics-in-the-Loop Scoring →
Robotic Fleet Execution under Model
Predictive Control (MPC)

Robotic Overlays



Innovations:

- Digital twin fuses traffic, fleet, QA telemetry
- Guardrails encode MUTCD/specs/safety
- Generative AI produces feasible nightly plans
- MPC optimizes convoy pace and roller patterns in real time

Target Outcomes:

- 50% fewer lane-closure hours
- 30% less user delay
- 40% fewer worker exposure hours
- 20% CO₂e reduction
- 2 pay-factor grade improvements



Stage-1 Pilots:

- Urban arterial night overlay
- Interstate freight mainline overlay

Validation:

Shadow operations → supervised robotic overlay trials → operator adoption

Transition & Impact:

- Containerized software, robot-ready playbooks
- OEM 'T-GRO-ready' certification
- Open-core + SaaS scaling model
- Multi-state consortium for libraries/benchmarks