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U. S. Steel Case Study

Distraction and Fatigue Detection and Intervention for Mine Haul Truck Drivers

The United States Steel Corporation (U. S. Steel) operates Minnesota Ore Operations (MOO), which includes two open-pit taconite mines dependent on 240-ton haul trucks. These trucks, operating under 12-hour shifts—day and night—are susceptible to operator fatigue and distraction, posing serious safety risks. Recognizing the threat these factors pose, U. S. Steel implemented the Caterpillar Driver Safety System (DSS) across 58 haul trucks in 2024 as part of a comprehensive safety initiative aimed at real-time detection and intervention.

The DSS uses a non-intrusive, infrared-based in-cab camera to monitor facial features (without facial recognition) and detect signs of microsleep and distraction. If a driver's eyes close for 1.5 seconds while moving over 6.5 MPH, or if their gaze shifts for over 5.5 seconds at over 10 MPH, the system triggers audible alarms and seat vibrations. When an event is detected, a short video clip is sent to a central monitoring center for confirmation. Verified events are then transmitted to the mine's dispatch center for supervisor response. The system does not function while trucks are stationary, ensuring it only intervenes during operational driving.

To ensure successful implementation, U. S. Steel launched a phased rollout:

- Initial Deployment with training and audible alerts
- Enhanced Alerts, adding seat vibrations and centralized verification
- Full Implementation, enabling dispatch to intervene and offer breaks or reassignments

Despite early concerns over privacy and false alarms, employee trust grew through educational meetings and system refinements. Infrared technology addressed performance challenges from low-light conditions, sunglasses, and reflective surfaces, while software and hardware adjustments improved accuracy.

The program has delivered measurable benefits:

- Verified distraction events fell from 203 per day in October 2024 to 31 in January 2025
- Fatigue events dropped from 47 to 19 per day over the same period
- Equipment repair costs were reduced through fewer off-road incidents and collisions
- Undiagnosed health issues such as sleep apnea were detected in several employees

Given that each truck travels approximately 240 miles per day (120 miles per shift) and completes 44 round trips (22 round trips per shift), these reductions indicate a meaningful improvement in unsafe driving behaviors—particularly during night shifts when fatigue risk is highest.

To enhance system capability, U. S. Steel is upgrading its GPS vehicle tracking to high-precision systems. This will further improve positional accuracy, reduce collision risk and support proactive incident prevention.

Looking ahead, the company plans to:

- Expand DSS use to more mobile equipment
- Roll out the system at additional sites
- Collaborate with other mining companies to share best practices
- Leverage system data to redesign haul roads and reduce congestion

Beyond technology, U. S. Steel is promoting long-term operator wellness by encouraging improved sleep habits, nutrition and fatigue education. The program's success has proven the value of addressing fatigue at its source, not just monitoring its effects.

The DSS initiative demonstrates a replicable model for other industries—such as logistics, construction, and transportation—seeking to reduce fatigue-related risks. Key lessons include the importance of transparency, customization for operational environments and integrating employee health into safety planning.

Through continuous monitoring, data-driven improvements and workforce engagement, U. S. Steel's fatigue management program is not only enhancing site safety but also setting a new standard for proactive, technology-driven health and safety leadership in industrial operations.