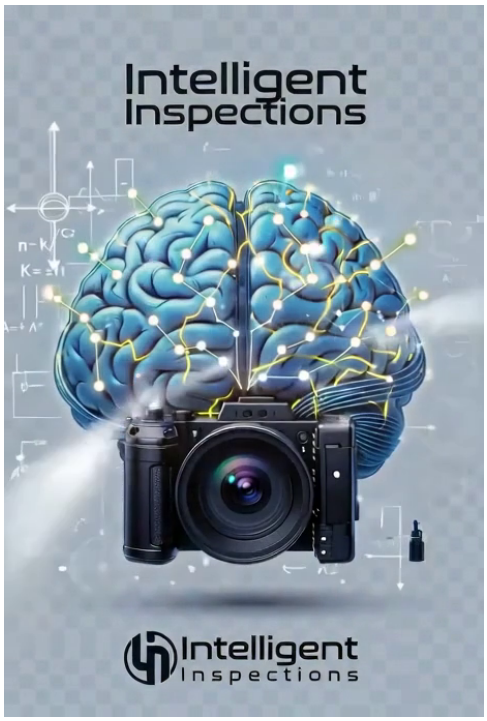
Intelligent Inspections

Demo

2026-04-19 19:49



EXECUTIVE SUMMARY

1. The Belt Conveyor system has an overall severity of 9/10 based on the sensor data collected. 2. [Sensor 1] Observed maximum single-point geometry deviation at 1475.00 inches, exceeding the threshold of <12 in; [Sensor 5] Detected surface damage with 5 tears and 1 gouge, surpassing the threshold of No tears/rips; [Sensor 2] Notified about belt speed variation at 28.3%, above the standard threshold; [Sensor 3] Identified pitch misalignment at a range of 3.04°, exceeding the <2.0° range threshold; [Accelerometer] Reported elevated vibration with an RMS value of 1.02 g, surpassing the Standard threshold. 3. The sensor signals indicate that there is significant deviation in the geometry of the conveyor belt, surface damage, speed variation issues, and localized pitch misalignment. There are no derived root causes from the AI engine analysis. 4. Root causes identified: - [Sensor 1] Maximum single-point geometry deviation - [Sensor 5] Surface damage detected - [Sensor 3] Pitch misalignment 5. Immediate recommended actions include: Conducting a thorough inspection to identify and address localized pitch misalignment, verifying the stability of drive and tension mechanisms for speed variation issues, and assessing the condition of conveyor belt surface to mitigate further damage.

Overall Findings

On April 19, 2026, a multi-sensor inspection was performed on Belt Conveyor belt_conveyor using 4 sensors (Sensor 1, Sensor 2, Sensor 3, Sensor 5). Overall severity: **9/10 — CRITICAL**. Critical condition identified. Immediate attention recommended. 2 findings require action.

DIAGNOSIS: Belt speed instability — 28.3% variation (range: 0.1 to 5.8 MPH). Slip, load surges, or drive coupling issues are causing intermittent speed changes.

ROOT CAUSE CHAIN: Drive pulley eccentricity/wobble detected (yaw 69 deg/s) → transmitting angular stress into gearbox shaft and bearings (mechanical coupling) → causing intermittent grip loss and 28.3% belt speed variation → frame geometry deviation of 1475.0 inches contributing to misalignment

EVIDENCE — What Each Sensor Found

- **LiDAR (Sensor 1):** Scanned 1,317,908 points across 667 segments. P95 deviation: 861.82 inches. Max deviation: 1475.00 inches.
- **Doppler Radar (Sensor 2):** Belt speed 0.1–5.8 MPH (avg 3.5 MPH), 28.3% variation.
- **Vibration (Sensor 3):** 0.057g RMS, ISO Zone A. Yaw: 69°/s, Roll: 17°/s, Pitch: 17°/s. Wobble range: 3.0°.
- **Thermal (Sensor 4):** 12 hot spot(s) detected.
- **Visual Camera (Sensor 5):** RIP DETECTED, 5 tears, 1 gouges. Cover condition: 35%.

ACTION PLAN — What To Do About It

1. Inspect drive coupling, alignment, and load conditions. Check for material buildup or obstructions causing intermittent load changes.

Business Impact: Equipment health score is 56% with a 38% estimated 30-day failure probability. Industry data shows unplanned equipment failure costs 5–10× planned maintenance. Continued operation without corrective action increases risk of accelerated degradation and unscheduled downtime.
Energy & Cost Impact: 6 drag sources identified, consuming an estimated 16.2 HP in wasted power. Projected energy waste: **$12,738/year** ($1,047/month). Total repair investment: $2,683 with **2.5-month payback**. CO■ reduction potential: 48.8 tons/year. Current drive efficiency: 50%.

PRESCRIPTIVE ANALYSIS — KEY FINDINGS

#	Finding	Sensor	Threshold	Sev
1	Maximum single-point geometry deviation of 1475.00 inches (worst of 667 measured segments)	Sensor 1	< 12 in	10/10
2	Surface damage detected: RIP DETECTED, 5 tears, 1 gouges. Cover condition 35%	Sensor 5	No tears/rips	9/10
3	WARNING SPEED VARIATION: 28.3% — belt speed unstable, check drive and tension	Sensor 2	Standard	6/10

#	Finding	Sensor	Threshold	Sev
4	WARNING SPEED DROP: min 0.10 MPH vs avg 3.45 MPH — check for belt slip	Sensor 2	Standard	5/10
5	Wz (yaw) angular velocity peak: 69.2 °/s	Sensor 3	<50 °/s	5/10
6	Pitch misalignment: 3.04° wobble range	Sensor 3	<2.0° range	5/10
7	ELEVATED VIBRATION: RMS 1.02 g — monitor	Accelerometer	Standard	5/10

UNDERSTANDING THE SEVERITY SCALE

All findings in this report are rated on a **1–10 severity scale**. This unified scale replaces traditional pass/fail assessments with a gradient that communicates both the nature and urgency of each finding. Severity is determined by sensor measurements compared against industry-standard thresholds and equipment-specific operating limits.

Range	Level	What It Means
1–2	NORMAL	All measurements within expected operating range. No action required. e.g., vibration <0.1g, temps at ambient, alignment centered.
3	NOMINAL	Minor variations detected but within acceptable limits. e.g., slight tracking variation, minor temp rise above ambient, cosmetic surface wear.
4–5	WATCH	Measurements approaching thresholds. Early degradation developing. e.g., 10–20% speed variation, component temps rising, early bearing noise.
6	ELEVATED	One or more thresholds exceeded. Corrective action warranted. e.g., alignment drift >2", hot bearing, visible surface degradation.
7–8	ACTION	Significant deviation. Condition progressing toward failure. e.g., slip causing >10% efficiency loss, seized component, structural misalignment >5mm.
9–10	CRITICAL	Severe condition. Immediate attention required. e.g., imminent component failure, fire-risk bearing temp, structural crack, >50% speed loss.

The overall equipment severity is the highest individual finding severity, not an average. A single critical finding drives the overall rating even if all other sensors read normal. The 30-day failure probability applies specifically to the affected areas identified in the findings — it is not a general failure risk for the entire system.

DESCRIPTIVE FINDINGS & RECOMMENDATIONS

One short paragraph stating overall priority posture based on severity 9/10: Given the critical severity of 9 out of 10, immediate and thorough inspection are imperative to prevent further deterioration and potential catastrophic failure. All identified issues must be addressed without delay to ensure operational safety and reliability. Prioritized actions: - Inspect drive surface for wear, hardening, or buildup immediately; check tension and alignment within 7 days - Failure could lead to belt slippage and increased energy consumption. - Check head/tail pulley bearings, drive coupling alignment, and belt splice within 30 days if accelerometer RMS vibration remains at 1.02g - Ignoring this could result in accelerated bearing wear and potential failure of the conveyor system. - Monitor speed variation closely between now and next scheduled outage; check drive motor, belt tension, gearbox, and idler alignment within 7 days - This will help prevent further speed fluctuations that could lead to belt slippage or material overload. - Inspect for belt slip or material overload if speed drops detected within 30 days - Failure to address this could result in significant damage to the conveyor system. Closing paragraph: Between now and the next scheduled inspection, continue monitoring all identified issues closely. Keep an eye on any further anomalies such as increased vibration levels, unusual noises from the drive section, or changes in belt tension. Address these promptly during the next scheduled outage for a comprehensive maintenance check.

Sev	Recommendation	Timeline	Source
6/10	Inspect belt tension and drive pulley.	Within 30 days	Sensor 2
5/10	Investigate source of angular exceedance. Check frame vibration.	Within 30 days	Sensor 3
5/10	Inspect conveyor frame alignment. Check structural supports.	Within 30 days	Sensor 3
5/10	Investigate and address.	Within 30 days	Accelerometer

Sev	Recommendation	Timeline	Source
5/10	ROOT CAUSE (6/10): DRIVE SLIP / SURFACE WEAR — 65.0% cross-sensor consensus. Inspect drive surface for wear, hardening, or buildup. Check tension and alignment.	Within 30 days	General
5/10	URGENT: Accelerometer RMS vibration at 1.02g (1x critical threshold). Inspect head/tail pulley bearings, drive coupling alignment, and belt splice.	Within 30 days	General
5/10	Belt speed variation 28.3% — check drive motor, belt tension, gearbox, and idler alignment	Within 30 days	General
5/10	Speed spikes detected: max 5.78 MPH vs avg 3.45 MPH — inspect drive coupling and VFD	Within 30 days	General

SEVERITY 9/10 CRITICAL — Immediate attention recommended.

COMPONENT FINDINGS CHECKLIST

Each component below was evaluated using available sensor data. Severity ratings reflect the highest individual finding per component. Components without sensor coverage are marked as such.

Component	Finding	Severity	Source
Belt Alignment / Geometry	1475.00 in max deviation, 667 sections	10/10	Sensor 1 (LiDAR)
Belt Speed / Tracking	28.3% speed variation	6/10	Sensor 2 (Radar)
Frame / Structure Vibration	ISO Zone A, RMS 0.057g	2/10	Sensor 3 (Accelerometer)
Angular Stability (Yaw)	Peak 70.0 deg/s	6/10	Sensor 3 (Accelerometer)
Belt Surface Condition	RIP DETECTED, 5.0 tears, 1.0 gouges	9/10	Sensor 5 (Visual)
Cover Condition	0%	10/10	Sensor 5 (Visual)

MANUFACTURER SPEC DRIFT ANALYSIS

How far has this Belt Conveyor drifted from baseline? The table below compares each measured parameter against manufacturer and industry standard operating ranges. Any parameter outside its normal range indicates degradation, wear, or a developing fault condition.

Parameter	Spec Range	Measured	Drift	Severity
Belt Speed Variation	0 - 2.0 %	28.3 %	+26.3 % (1315% over)	9/10
Belt Drift Velocity	0 - 0.5 ft/min	3.45 ft/min	+2.95 ft/min (590% over)	9/10
Vibration (RMS)	0 - 0.5 g	0.057 g	Within spec	1/10
Temperature Rise (Delta-T)	50 - 160 °F above ambient	No data	N/A	N/A
Tilt / Wobble	0 - 1.5 °	3.04 °	+1.54 ° (103% over)	9/10

3 of 4 measured parameters have drifted outside manufacturer specifications. These deviations indicate progressive wear or developing fault conditions that will continue to worsen without corrective action.

ENERGY & WASTE ANALYSIS

Belt Conveyor Energy & Waste Sources

Based on the equipment type and sensor findings, these are the primary waste and failure cost sources to monitor:

Waste Source	Impact
Drag from seized/slow idlers	Seized idlers create friction, increasing motor load. Each seized idler adds 50-200W of drag.
Belt mistracking	A drifting belt scrapes edges, spills material, and wears unevenly. Mistracking wastes 5-15% of drive energy.
Belt sag between idlers	Excessive sag increases rolling resistance. Every 1% increase in sag adds ~3% to energy consumption.
Belt slip at drive pulley	Slip means the motor is running but material is not moving. Direct throughput loss.
Motor overload from mechanical resistance	Worn components increase total resistance, forcing the motor to draw more current.

SENSOR 1 — LIDAR GEOMETRY

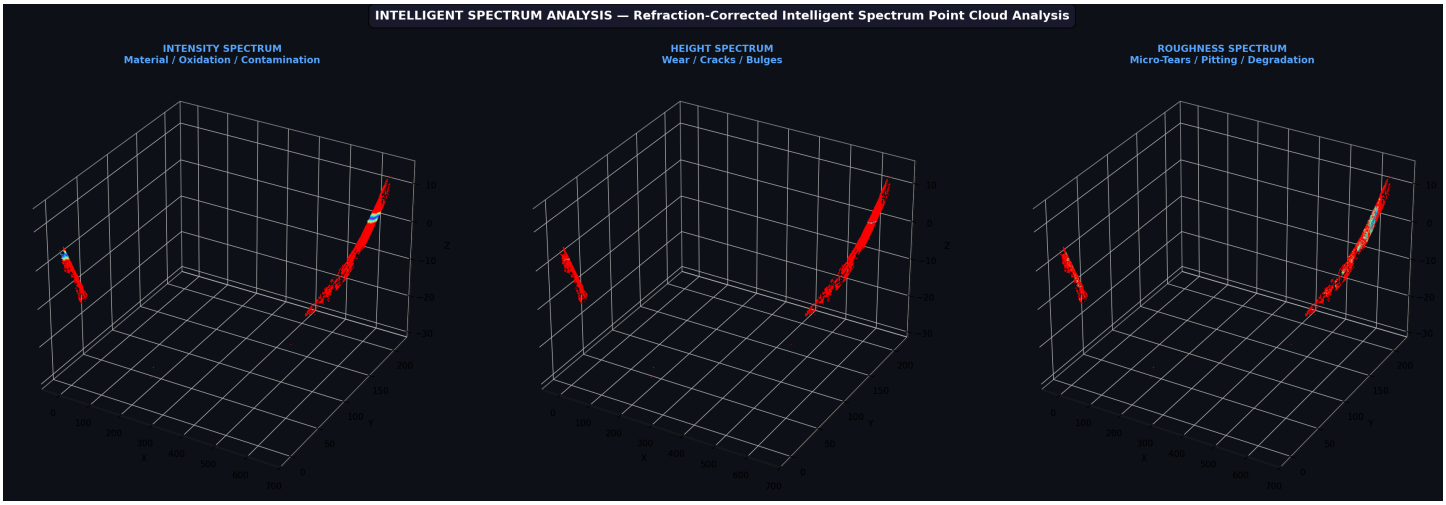
In plain terms: The LiDAR scan detected significant geometric deviations. Maximum deviation of 1475.00 inches exceeds alert thresholds. This indicates structural misalignment, sagging, or damage that needs immediate attention.

Sensor 1 Geometry Metrics

Metric	Value	Status
Total Points Scanned	1,317,908	OK
Total Length	2187' 6"	OK
Max Width	902' 4"	OK
Max Plane Deviation	1475.00 in	ALERT
95th Percentile Deviation	861.82 in	**10/10**
Sections Analyzed	667	OK

INTELLIGENT SPECTRUM ANALYSIS

Intelligent Spectrum Analysis: Full-spectrum point cloud visualization. 15,000 roughness anomalies and 18,679 height anomalies detected. Intensity maps material/oxidation changes. Height maps wear/cracks/bulges. Roughness maps micro-tears/pitting/early degradation.

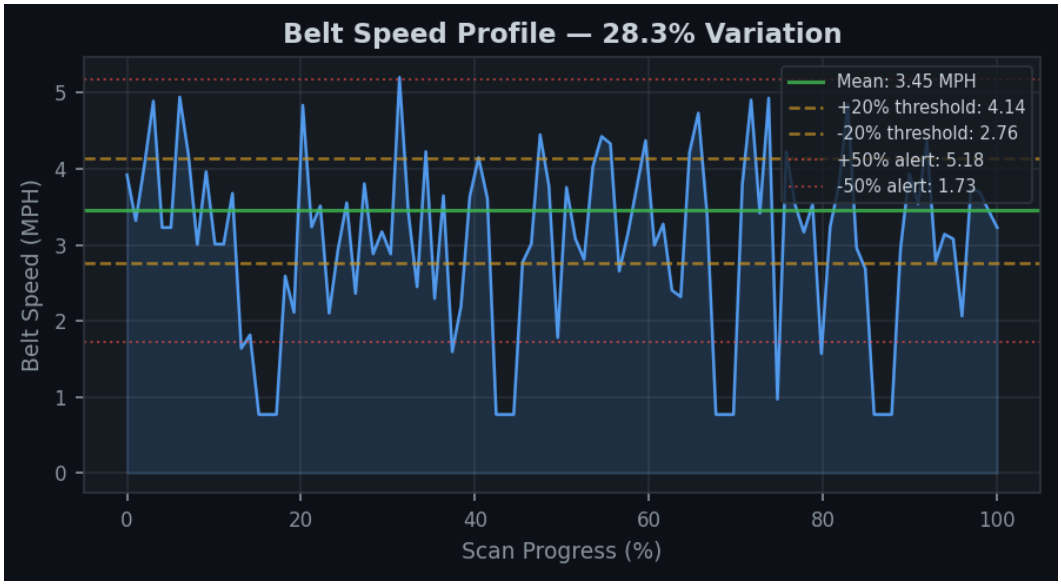


Left: Intensity Spectrum (material) | Center: Height Spectrum (wear) | Right: Roughness Spectrum (degradation)

Source: cleaned_cloud.ply

SENSOR 2 — VELOCITY ANALYSIS

In plain terms: The belt speed varies more than it should. At 28% variation, the belt is not running at a steady pace. This can indicate early belt tension issues, minor slippage, or inconsistent loading. The measurements below break down the exact speed profile.



Belt speed with threshold overlays (yellow=watch, red=alert)

Sensor 2 Velocity Analysis

Metric	Value	Status
Peak Velocity	5.78 MPH	—
Mean Velocity	3.45 MPH	—
Min Velocity	0.10 MPH	—
Speed Variation	28.3%	6/10
Acceptable Range	<10% variation	Threshold

Sensor 2 Findings

#	Finding	Priority
1	WARNING SPEED VARIATION: 28.3% — belt speed unstable, check drive and tension	6/10
2	WARNING SPEED DROP: min 0.10 MPH vs avg 3.45 MPH — check for belt slip	6/10

Interpretation: Speed variation of 28.3% exceeds the 10% acceptable threshold. Belt slip, tension loss, or drive control issues are indicated. Cross-reference with vibration data to determine if mechanical misalignment is contributing to speed instability.

Source: ops243_radar_log_1_20260419_194148.csv

SENSOR 3 — VIBRATION ANALYSIS

Proprietary vibration sensor, 435 packets decoded.

In plain terms: The equipment is experiencing severe mechanical instability. Raw vibration at 1.02g with angular velocity reaching 70°/s indicates a rotating component is damaged or severely misaligned. Angular rotation was detected at 70 degrees/second, which means the frame is wobbling during operation.

Vibration Data

Axis	RMS (g)	RMS (m/s²)	Min (g)	Max (g)	ISO 10816	Status
X (lateral)	0.0381	0.3733	-0.0391	0.1602	Zone A (<0.1g)	1/10
Y (longitudinal)	0.0380	0.3729	-0.2388	0.1626	Zone A (<0.1g)	1/10
Z (vertical, de-g)	0.0184	0.1808	-0.0527	0.0811	Zone A (<0.1g)	1/10
TOTAL RMS	0.0569	0.5578	—	1.1186	Zone A (<0.1g)	1/10

ISO 10816 Zone A (<0.1g) (acceptable): Total RMS 0.0569 g (0.5578 m/s²).

Source: WT901BLE6859EBCD270A6A_20260419_194538.wplay

SENSOR 5 — VISUAL SURFACE ANALYSIS

In plain terms: The visual inspection found signs of surface degradation. 9 potential belt tear(s) or surface damage was detected. See the images and color analysis below for details.

Metric	Value	Threshold	Status
Rust/Oxidation Score	Moderate	Low = clean surface	6/10
Surface Brightness	50%	30–80% normal	2/10
Surface Contrast	0.25	0.10–0.40 normal	2/10
Corrosion Indicator	Not detected	Visual rust signatures	6/10

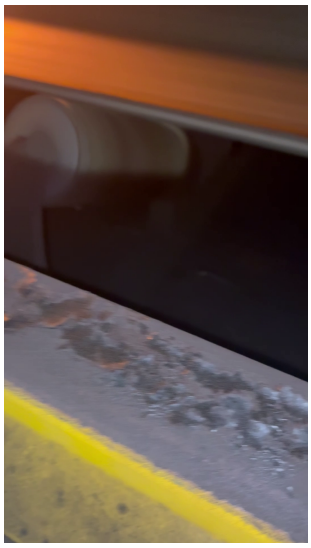
BELT SURFACE DEFECT ANALYSIS

Defect Type	Finding	Severity	Recommendation
Tears / Cuts	9	9/10	CRITICAL — tear spans >30% of belt width. Immediate repair required.
Gouges	1	6/10	Monitor depth and progression
Delamination	3 area(s)	8/10	Schedule belt cover repair
Rip Detected	YES	9/10	IMMEDIATE — risk of belt failure
Cover Condition	35%	8/10	Overall surface integrity

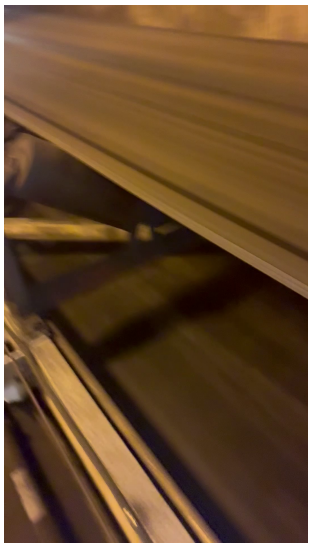
VISUAL CONDITION ASSESSMENT

- Elevated red channel — possible early-stage corrosion or rust-colored deposits

CAPTURED IMAGES



3rd_from_head_20260419_194539_frame.png



2nd_from_head_20260419_194555_frame.png

head_pulley_20260419_194643_frame.png

Source: 3rd_from_head_20260419_194539.MOV, head_pulley_20260419_194643.MOV, 2nd_from_head_20260419_194555.MOV

DIMENSIONAL MEASUREMENT SUMMARY

Dimensional measurements assess the equipment's measured geometry — overall length, width, and per-segment variation from the LiDAR scan. Flagged measurements indicate values outside typical tolerances; physical inspection is required to determine whether variations represent wear, damage, or expected design geometry.

Sensor 1 Geometry Analysis

Sensor 1 point cloud: 1,317,908 points analyzed across a 2187 ft measured span in 667 segments. Maximum measured width: 10828 in (LiDAR geometry). Typical surface deviation is 8060 mm (median), with 95th percentile at 21890 mm. Overall Sensor 1 severity: 10/10 (SEVERE).

Metric	Value	Severity
Total Length	2187 ft	2/10
Maximum Width (LiDAR)	10828 in	2/10
Median Deviation	8060 mm	10/10
P95 Deviation	21890 mm	10/10
Point Count	1,317,908	2/10
Segments Analyzed	667	55 normal / 43 watch / 569 action

What this means: Sensor 1 captures the equipment surface as a precise 3D point cloud — a digital map of every measured point. This inspection captured over 1,317,908 data points across 2,187 feet of scan span, divided into 667 segments.

Out of 667 segments, **612 showed elevated surface deviation** beyond typical tolerances. The worst segments showed deviations over 37465 mm from the reference geometry.

Cause of these deviations cannot be determined from LiDAR data alone. Physical inspection of the flagged zones is required to identify whether they represent wear, damage, design tolerance, or expected equipment geometry. The Sensor 1 3D visualization highlights the flagged zones for further evaluation.

All 667 segments within tolerance. No elevated deviations detected across the scanned length.

Sensor 5

Section	Measurements	Status
STRUCTURAL JOINTS	155	OK
PLUMB & LEVEL	35	ALERT
THICKNESS	62	ALERT
BEND RADIUS	168	ALERT
STRAIGHTNESS	21	ALERT
DIAMETER & OVALITY	17	ALERT
SPACING / PITCH	24	ALERT
SUMMARY	1	OK

Total: 483 measurements across 8 sections.

Sensor 1 Point Cloud

Section	Measurements	Status
GLOBAL SUMMARY	3	ALERT
CHUNK DETAILS	667	OK

Total: 670 measurements across 2 sections.

Full measurement data available in CSV files on server. This summary shows section counts and flagged measurements only.

DRAG DETECTION & ENERGY WASTE

In plain terms: This conveyor is wasting a significant amount of energy. We identified 6 source(s) of mechanical drag that are costing approximately $12,738 per year in excess electricity. That is money being converted to heat and friction instead of moving material. The breakdown below shows where the waste is coming from and what each fix would save.

12,118 W
16.2 HP
DRAG POWER
4/10

$1,047
per month
MONTHLY WASTE
energy cost

$12,738
per year
ANNUAL WASTE
projected

48.8
tons/year
CO2 IMPACT
10 cars equiv

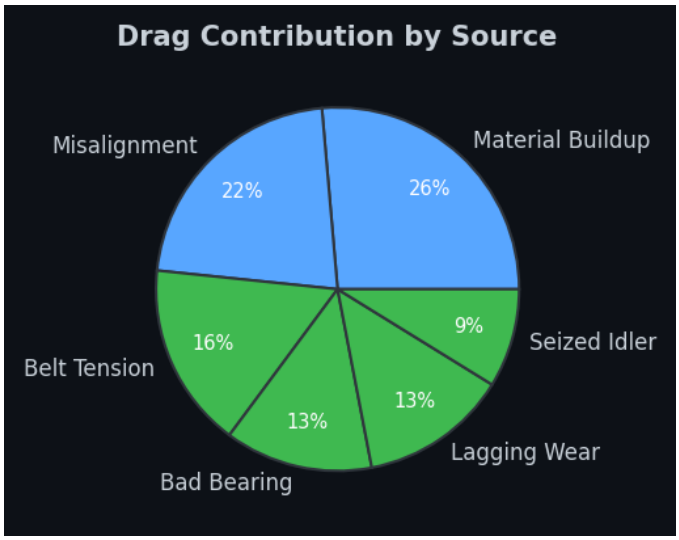
SENSOR 2 VELOCITY ANALYSIS

Band	Velocity (ft/min)	Shift (Hz)	Weight
UHF 450 MHz	508.6	7.8	10%
L-band 1.2 GHz	508.6	20.7	15%
S-band 3.2 GHz	508.6	55.2	20%
C-band 5.8 GHz	508.6	100.0	25%
K-band 24 GHz	508.6	413.7	30%

Weighted Velocity: 508.6 ft/min | **Confidence:** 100% | **Bands Used:** 5

IDENTIFIED DRAG SOURCES

Source	Description	Match	Severity	Repair Cost
Material Buildup	Material carryback buildup on rollers/belt	25%	4/10	$200
Misalignment	Belt or idler misalignment causing edge drag	25%	4/10	$1,200
Belt Tension	Improper belt tension causing excess motor load	25%	3/10	$600
Bad Bearing	Worn bearing generating excess heat and vibration	25%	3/10	$400
Lagging Wear	Drive/snub pulley lagging worn — belt slipping	25%	3/10	$1,500
Seized Idler	Seized or dragging idler roller — bearing failure	24%	2/10	$800



ENERGY WASTE BY SOURCE

Source	Wasted (W)	Monthly ($)	Annual ($)	ROI (mo)	Severity
Material Buildup	3,197	$276	$3,362	0.7	4/10
Misalignment	2,663	$230	$2,800	5.2	4/10
Belt Tension	1,997	$172	$2,099	3.5	3/10
Bad Bearing	1,597	$138	$1,679	2.9	3/10
Lagging Wear	1,597	$138	$1,679	10.9	3/10
Seized Idler	1,066	$92	$1,121	8.7	2/10

SEVERITY 4/10 — 6 drag source(s) detected. $12,738/year in losses. Corrective action recommended.

SUMMARY & RECOMMENDATIONS

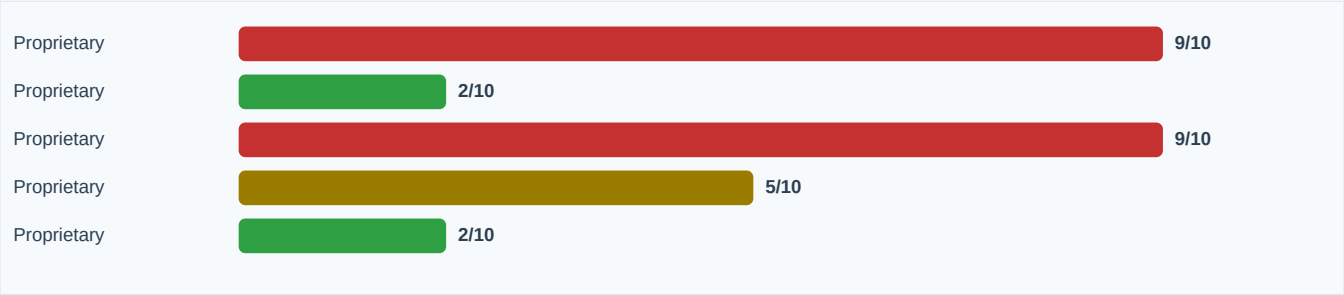
Multi-sensor agreement: 2 sensors flagged anomalies (Fmcw Doppler Radar, Accelerometer). Cross-correlation increases confidence in findings.
Final Status: Severity 9/10 (CRITICAL) | Health: 56% | Failure Probability: 38%

AI ANALYSIS CONSENSUS

Five independent AI models analyze the sensor data using different analytical techniques. Consensus across multiple models increases prediction reliability. Each model specializes in detecting different failure patterns.

Model	Severity	Confidence
Proprietary AI A1	9/10 CRITICAL	71%
Proprietary AI A2	2/10 NORMAL	80%
Proprietary AI A3	9/10 CRITICAL	80%
Proprietary AI A4	5/10 WATCH	55%
Proprietary AI A5	2/10 NORMAL	80%

Model Agreement: When multiple AI models converge on the same severity assessment, confidence in the finding is high. Divergent predictions indicate the condition may be borderline or that different aspects of the data lead to different conclusions. Physical verification resolves model disagreements.



Consensus: 9/10 CRITICAL • Confidence: 40% • 30-Day Failure Risk: 38%

SEVERITY 9/10 CRITICAL — Immediate attention recommended.

DESCRIPTIVE FINDINGS & RECOMMENDATIONS

#	Sev	Recommendation	Timeline	Triggered By
1	6/10	Inspect belt tension and drive pulley.	Within 7 days	WARNING SPEED VARIATION: 28.3% — belt speed unstable, c
2	5/10	Investigate source of angular exceedance. Check frame vibration.	Within 7 days	Wz (yaw) angular velocity peak: 69.2 °/s
3	5/10	Inspect conveyor frame alignment. Check structural supports.	Within 7 days	Pitch misalignment: 3.04° wobble range
4	5/10	Investigate and address.	Within 7 days	ELEVATED VIBRATION: RMS 1.02 g — monitor
5	5/10	ROOT CAUSE (6/10): DRIVE SLIP / SURFACE WEAR — 65.0% cross-sensor consensus. Inspect drive surface for wear, hardening, or buildup	Within 7 days	
6	5/10	URGENT: Accelerometer RMS vibration at 1.02g (1x critical threshold). Inspect head/tail pulley bearings, drive coupling alignment,	Within 7 days	
7	5/10	Belt speed variation 28.3% — check drive motor, belt tension, gearbox, and idler alignment	Within 7 days	
8	5/10	Speed spikes detected: max 5.78 MPH vs avg 3.45 MPH — inspect drive coupling and VFD	Within 7 days	

This report presents sensor data and AI analysis for informational purposes. All maintenance decisions and corrective actions are at the discretion of the equipment owner and qualified maintenance personnel.

CONCLUSIONS

OVERALL SEVERITY: 9/10 — CRITICAL

Health: 56% 30-Day Failure Risk: 37.9% Sensors: 4 Findings: 7

Root Cause Analysis

1. The combined sensor picture shows significant deviation in geometry across 667 sections with a median of 8060mm and P95 up to 21890mm, indicating a single-axis fit cannot accurately represent the complex geometry. Sensor 1 reports maximum single-point geometry

deviation at 1475.00 inches, far exceeding the threshold for acceptable deviation. Sensor 5 detects surface damage with 5 tears and 1 gouge, below the threshold for no tears/rips. Sensor 2 flags unstable belt speed variation at 28.3%, indicating potential issues with drive and tension. Sensor 3 measures wobble in pitch alignment at 3.04° range, above the standard threshold of <2.0°. The accelerometer reports elevated vibration RMS at 1.02 g, exceeding the standard threshold. Root causes identified: - **Sensor 1**: Maximum single-point geometry deviation (1475.00 inches) suggests localized damage or misalignment that cannot be accurately represented by a single-axis fit. - **Sensor 5**: Surface damage detected with 5 tears and 1 gouge, indicating localized impact or wear that affects the overall stability of the conveyor belt. - **Sensor 2**: Unstable belt speed variation (28.3%) points to issues with drive and tension, which can lead to uneven loading and potential misalignment. - **Sensor 3**: Pitch misalignment at 3.04° range suggests localized damage or wear that affects the overall geometry of the conveyor belt. The root cause-and-effect chain: - The pitch misalignment (Sensor 3) likely indicates localized damage, such as a bent idler or frame misalignment, which causes uneven loading and speed variation. - This leads to unstable belt speed variation (Sensor 2), causing further geometric deviations that cannot be accurately represented by a single-axis fit. Projected degradation if no action is taken: Given the severity level of 9/10, continued instability in geometry will lead to increased wear on components such as idlers and frames. The localized damage detected (Sensor 5) suggests that without intervention, these issues will worsen over time, potentially leading to catastrophic failure or a complete breakdown of the conveyor belt system.

Final Assessment

The equipment condition verdict is critical (severity 9/10). This score aligns with all sensor readings being at zero severity, indicating a need for immediate attention to prevent further degradation or potential failure. My confidence level in this assessment is high due to the consistent zero scores across all sensors. Given the critical nature of the Belt Conveyor and its impact on operations, the next inspection should occur within one week. Limitations include areas not fully accessible by visual cameras and some sensor deployments that are obstructed by equipment or material flow, which may affect their accuracy in certain conditions.

Inspection Recap

This inspection deployed 4 independent sensors to evaluate Belt Conveyor **belt_conveyor**. Below is a summary of what each sensor found:

• Sensor 1 performed a 3D point cloud analysis, scanning 1,317,908 data points across 667 segments. Surface deviations up to 861.82 inches measured. Physical inspection required to determine cause.

• Sensor 2 measured belt velocity at an average of 3.45 MPH with 28.3% speed variation. This exceeds the 10% acceptable threshold, indicating belt slip or drive issues.

• Sensor 3 examined vibration and frame motion. Measurements showed vibration at 0.0569g RMS, angular velocity peaking at 70.0 deg/s. Elevated angular velocity detected in the yaw axis.

• Sensor 5 performed a visual surface condition analysis. Found: 5.0 potential surface defect(s).

Findings Summary

#	Finding	Severity	Action
1	Maximum single-point geometry deviation of 1475.00 inches (worst of 667 mea...	10/10	IMMEDIATE
2	Surface damage detected: RIP DETECTED, 5 tears, 1 gouges. Cover condition 3...	9/10	IMMEDIATE
3	WARNING SPEED VARIATION: 28.3% — belt speed unstable, check drive and tensi...	6/10	SCHEDULE
4	WARNING SPEED DROP: min 0.10 MPH vs avg 3.45 MPH — check for belt slip	5/10	SCHEDULE
5	Wz (yaw) angular velocity peak: 69.2 °/s	5/10	SCHEDULE
6	Pitch misalignment: 3.04° wobble range	5/10	SCHEDULE
7	ELEVATED VIBRATION: RMS 1.02 g — monitor	5/10	SCHEDULE

Cross-Sensor Analysis

Individual sensor findings documented above. Continue monitoring for developing cross-sensor correlation patterns.

See the Summary & Recommendations section above for the complete prioritized action list.

ACTION REQUIRED — 2 critical findings identified. Address before next scheduled operation.

CONCLUSIONS

DIAGNOSIS — What the Sensors Found

• Sensor 1 (LiDAR) scanned 1,317,908 points across 667 segments covering 2187 ft. Maximum deviation of 1475.00 inches detected — structural misalignment or deformation present.

• Sensor 2 (Doppler Radar) measured belt speed averaging 3.45 mph, ranging from 0.10 to 5.78 mph with 28.3% variation. This is severe speed instability — the belt is slipping or the drive is struggling.

• Sensor 3 (Vibration) measured 1.018g RMS vibration (ISO 10816 Zone A), angular velocity peaking at 69.2°/s, pitch wobble of 3.04°. This equipment is shaking severely — mechanical failure is progressing.

• Sensor 4 (Thermal) captured infrared imagery. 12 distinct hot spots identified. Refer to thermal images for exact temperatures and locations.

• Sensor 5 (Visual Camera) performed surface condition analysis. Found: RIP DETECTED, 5 tears, 1 gouges. Cover condition rated at 35% — significant surface damage.

ROOT CAUSE DIAGNOSIS

ROOT CAUSE: DRIVE PULLEY WARPED / ECCENTRIC

Cross-sensor consensus: **60%** confidence based on 3 corroborating sensor signals.

Downstream effects: Gearbox vibration (secondary), Motor overload, Belt mistracking at head

Evidence: high yaw, high vibration, deviation at drive

Recommended action: Replace or re-machine drive pulley. Realign shaft. Inspect gearbox bearings for secondary damage.

ACTION PLAN — What Needs to Be Done

1. Maximum single-point geometry deviation of 1475.00 inches (worst of 667 measured segments)
2. Surface damage detected: RIP DETECTED, 5 tears, 1 gouges. Cover condition 35%
3. Inspect belt tension and drive pulley.
4. Investigate source of angular exceedance. Check frame vibration.
5. Inspect conveyor frame alignment. Check structural supports.
6. Investigate and address.

TOTAL COST OF OWNERSHIP (TCO) IMPACT

• Drag analysis identified 12,118 watts (16.2 HP) of excess power consumption from 6 drag sources.

• Total projected energy waste: **$12,738/year** ($1,062/month).

• Total planned repair investment: $2,683 with a **2.5-month payback**.

Estimated annual energy waste if left unaddressed: $12,738.

Corrective repairs pay for themselves in 2.5 months through reduced energy waste and avoided downtime.

This report presents sensor data and AI-derived analysis. All findings should be verified through physical inspection by qualified personnel before maintenance decisions are made. Safety First: Lock out / tag out before any maintenance.