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AI Cannot Fix Bad Hardware Decisions Spec Guide

One-page quick reference · Full engineering guide + live tools at the QR codes below

Quick answer. AI monitoring, digital twins, and predictive maintenance cannot compensate for undersized casters or wrong wheel materials. A 3,000 lb AGV running on 800 lb rated casters will suffer raceway failure regardless of the software stack; monitoring only reports the damage. Solve load capacity, material selection, and shock engineering at design time, then apply AI for anomaly detection and predictive spares.

AI adds value above the hardware floor, not beneath it

Problem class	AI adds value?	Why
Load sizing	No	Pure mechanical physics, answer exists before runtime
Wheel material selection	No	Surface chemistry and durometer, catalog engineering
Shock-load rating	No	Impact mechanics, design-time spec
Duty-cycle scheduling	Yes	Pattern recognition over consumption data
Anomaly detection (bearing, raceway, drive)	Yes	Signal processing excels at this
Predictive spare-parts demand	Yes	Time-series forecasting earns its keep
Route / traffic optimization	Yes	Graph and constraint optimization
Preventing mechanical failure at runtime	No	Alerts post-event, cannot reverse physics

Sizing physics that must be solved at design time

Design-time decision	Governing physics	Failure if wrong
Dynamic load capacity	3-corner rule + safety factor	Flat-spot, brinelling, raceway failure
Wheel diameter	Push force & Prop; $1 / \text{diameter}$	Excessive push force, worker injury
Wheel material durometer	Tread footprint vs floor	Floor damage or rolling fatigue
Bearing type	Load orientation, duty cycle	Seizure, noise, premature wear
Swivel section (kingpin vs kingpinless)	Shock-load profile	Kingpin shear under impact
Temperature rating	Material service temp	Grease breakdown, wheel softening
Chemical compatibility	Material + contaminant chemistry	Swelling, cracking, delamination



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