March 26 2026 Hangar Update for Board

-Hangar 2: Built 1967 collapsed 2017…50 yrs
Having survived:

‘82–’83 El Niño 8.5’ in 36 Hrs
‘91 March Miracle 6.5’ in 48 Hrs
‘04–’05 8’ over a couple weeks
’11 Snowmageddon 8.5’ in single event

A summary of the current state of the hangars and our way forward

Topics to Present:

- Summary of Hangar inventory with associated risks and hazards
- History of failures on our existing hangars
- Preventative maintenance activities
- Way forward on emerging risk discovery, and continued mitigation of identified risks

Hangar Structural Parts
(Erect-a-Tube)

Purlin
Z Shaped medium weight

Beam
“I-Beam” Carries full weight

Door Lift Mechainism
Different types

Hangar Opening Truss
Strongest structure in hangar

Roof Panels
Thin sheet metal

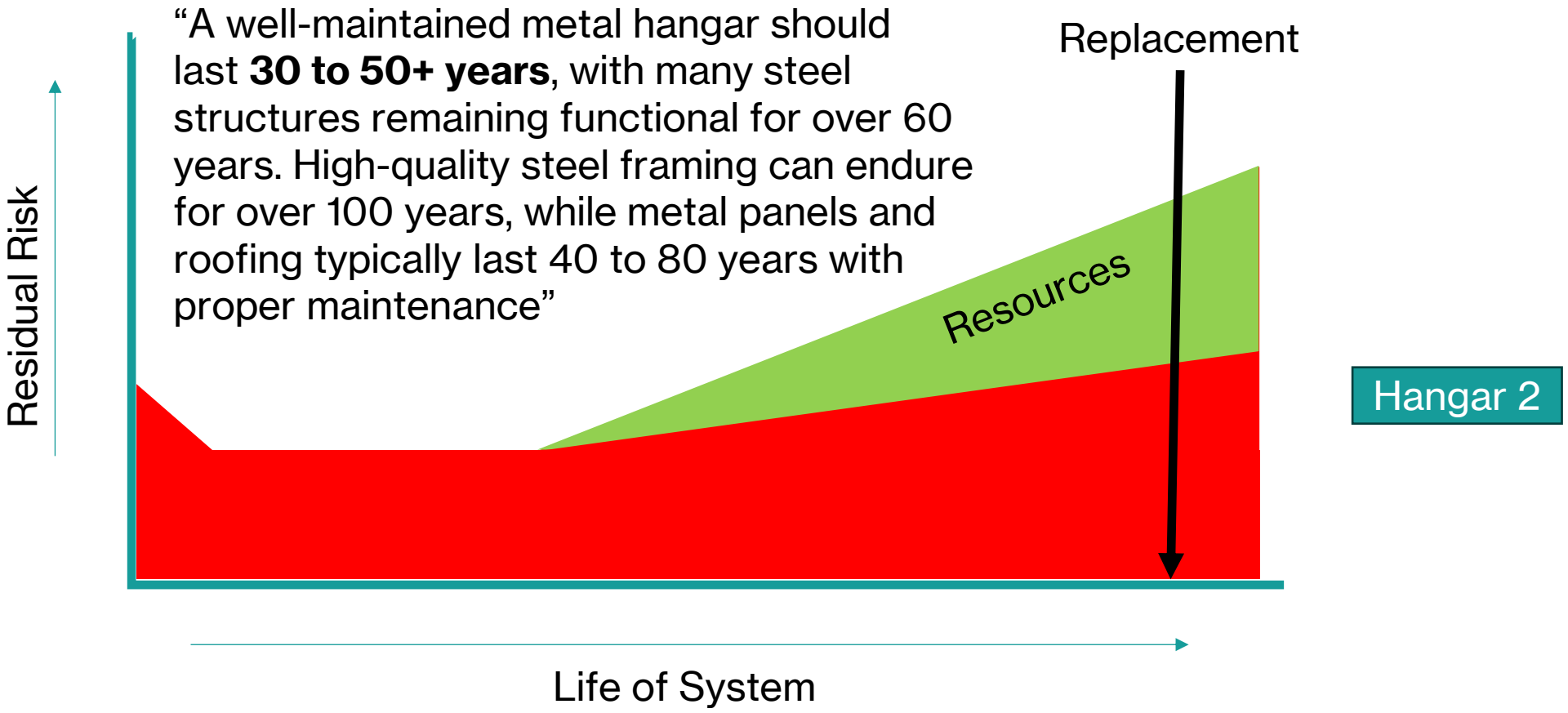
Structural Columns
Beams sit on columns and transmit weight to the Ground 15,000#-20,000# each

Engineered for Truckee Tee-Hangar

VP Buildings

Use of Terms

- Risk vs Hazard, Mitigation, Residual Risk, Lifetime Residual Risk Management (Shopping Cart Example)



Summary of Hangar Rows (Tees) *Mitigated Risk

Hangar Row	Year Built	Lift Mechanism	Snow Load (200 lbs Req'd)	Risks/Hazards
Alpha	1984	Single chain/cable	40	Purlin Fail*, Door Fall/Flail*, Fire, Roof Shed
Bravo	1977	Direct drive/cable	27	Fire, Manual Latch, Roof Shed
Charlie	1976	Direct drive/cable	27	Fire, Manual Latch
Delta	1981	Single chain/cable	27	Door Fall*, Fire, Roof Shed, Cable Wear*
Echo	1981	Single chain/cable	27	Fire, Cable Wear*
Fox	1987	Both direct and multi-chain/cable	40	Fire, Lack of Electric Brakes (some hangars), Cable Wear*
Golf	1988	Direct drive/cable	40	Fire, Cable Wear*
Juliet	1970	Single chain/cable	32	Fire, Purlin Twist, Shedding Roof, Cable Wear*
Kilo	1981	Single chain/cable	27	Door Fall*, Purlin Fail*, Fire, Roof Shed, Cable Wear*, Low Doors
Mike	2005	Dual chain – Dual motor/cable	130	Chain Alignment* Cable Wear* Roof Leaks

Single Chain/Cable | Direct Drive/Cable | Dual Chain | Worm Gear Transmission | L-Bracket Anchoring | Manual Latches

Summary of Hangar Rows (Executives) *Mitigated Risk

Hangar Row	Year Built	Lift Mechanism	Snow Load (200 lbs Req'd)	Hazards/Risks
Hotel	1991	Quad chain/cable	40	Purlin Fail* Interrupted Build
Lima	2005	Dual chain – Dual motor/cable	130	Poor Design of Closing Cables* Wilson Door, Roof Shed-Snow Accumulation Damage
November	2018	Quad chain – Dual motor/strap	131	Gearbox Failure* Lift Pins* Hinge Attachment* Electrical Design
Papa	2018	Quad chain – Dual motor/strap	131	Gearbox Failure* Lift Pins* Hinge Attachment* Electrical Design

Quad Chain/Strap

Quad Chain/Cable

Strap Door Risks

20 Yr History of Failures

(Continued in Back up Slides)

- 2026 Delta row – Door Fell (SPF). Chain failure resulting in free fall - SEVERE Mitigation underway, decisions pending
- 2026 Bravo and 2023 Charlie row – Manual Latch Injury. Doors lifted without unlatching manual latches. At least two injuries to persons after tenants tried to unlatch tensioned doors. MAJOR Mitigation: Momentary switch, Policy, Retrofit with 'Auto-latches?'
- 2023 Alpha, Hotel, and Kilo rows – Purlin Fail. Roof partially collapsed due to snow - SEVERE Mitigation: with Repairs, Additional Purlins, SRS, L-Bracket stiffening
- 2020 Alpha row (A9 Dual Door Specific) – Flailing Door. Wind gust caused a door to break its followers and flap in the wind SEVERE Mitigation: Policy
- 2018 Alpha row – Door Fell. Door jammed on the way down, cables unspooled, door unjammed and fell (video) SEVERE Mitigation: Momentary door switch
- 2018 Golf, Hotel rows – Lift Failure. Poor welding construction led to cable failure – SEVERE Mitigation: Inspected all doors for insufficient construction, rewelded / restructured 1,000 hrs of mechanical maint.
- 2017 Hangar 2 collapse SEVERE Mitigation: Demolition, other hangars monitored by SRS, snow load testing

Hangar 2 Collapse

SRS

20 Yr History of Failures

- 2015 Kilo Row – Door Fell (SPF). Chain failure (master link) resulting in free fall SEVERE Mitigated by increased chain inspection cycle. ***Fall averted in E14 2024***
- 2014 Hotel – Door Fell. Cable clamp failure. SEVERE Mitigated by changing cable clamps throughout all hangars, inspections
- 2007 Lima Row – Door Fell. Rigging problem, door missed tripping its upper limit switch - SEVERE Mitigation: A second, backup limit switch was added, eventually entire system replaced with a Schweiss strapped door to accommodate Care Flight's frequency of use.
- Ongoing Various Hangars - Bent vertical I-beam structure due to weight of door – SEVERE Mitigation: Lowering door opening heights and reinforcing per structural engineer's guidance
- 2005 and Ongoing Mike row – Leaking Roof. Roof construction deficient, cannot withstand designed snow load without leaks – MINOR Mitigation decision pending

Bent Vertical I Beams

Way Forward
(Ongoing Hazard/Risk Mitigation)

- Continue existing Mitigations through ongoing Quarterly Preventative Maintenance Inspections (AeroSimple)
- Discover emerging risks:
  - Hire Mechanical Engineering assessment of the condition of our aging hangars and door lifts
- Strap lift doors hinges/pins/transmissions/contactors:
  - Past/recent/future maintenance
- Cable lift doors with single points of failure:
  - Immediate inspection / short term solution / long term solution
- Distorted I-Beam columns:
  - Set standard opening height across all hangars / evaluate effectiveness of reinforcements
- Strap lift conversions? (Lima/Hangar 1)
- Under engineered roof structures: (Retrofitting deemed impractical)
  - SRS system and snow load correlation, roof snow removal contingency
  - L-brackets, and Juliet row purlin stabilization
  - Astragal Repair
  - Replace ten rows of Tee Hangars IAW size and type defined in next Airport Master Plan

Astragal Repair | L-Bracket Anchoring | SRS

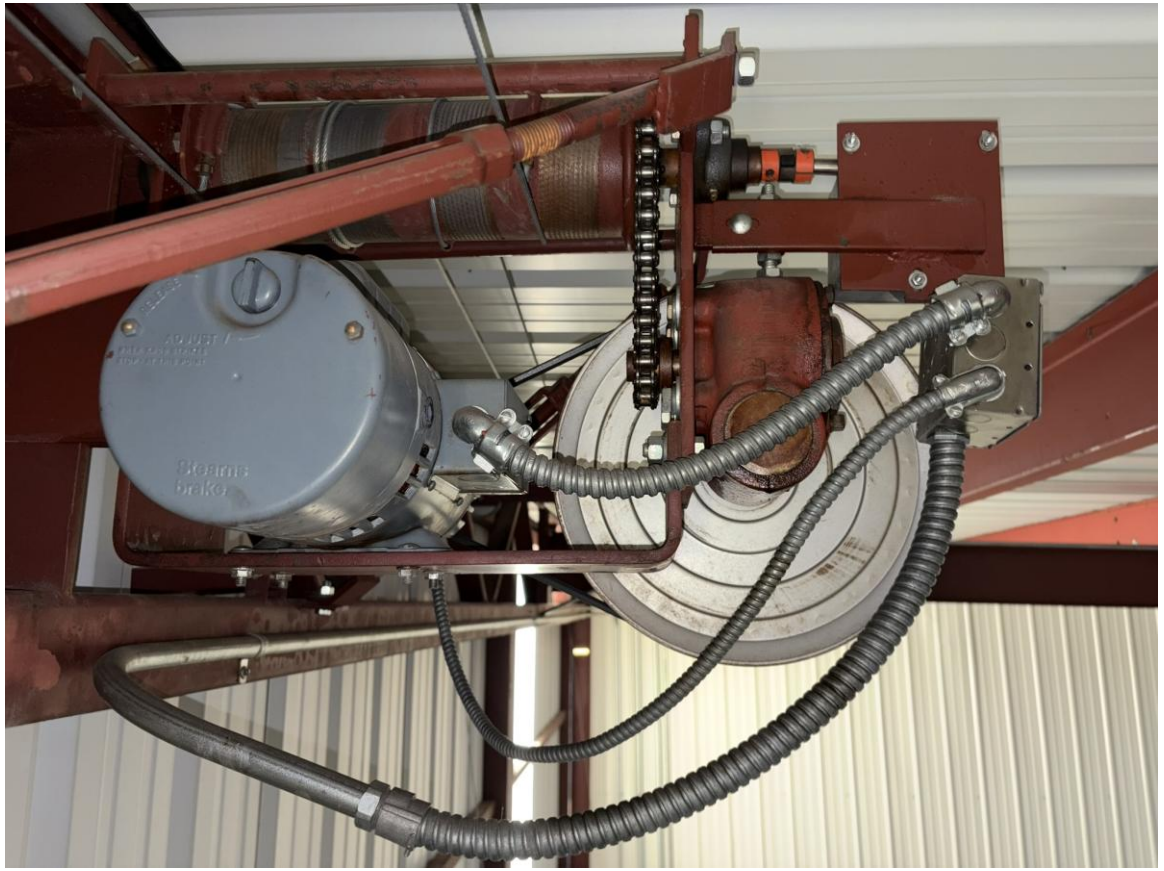
Back up slides

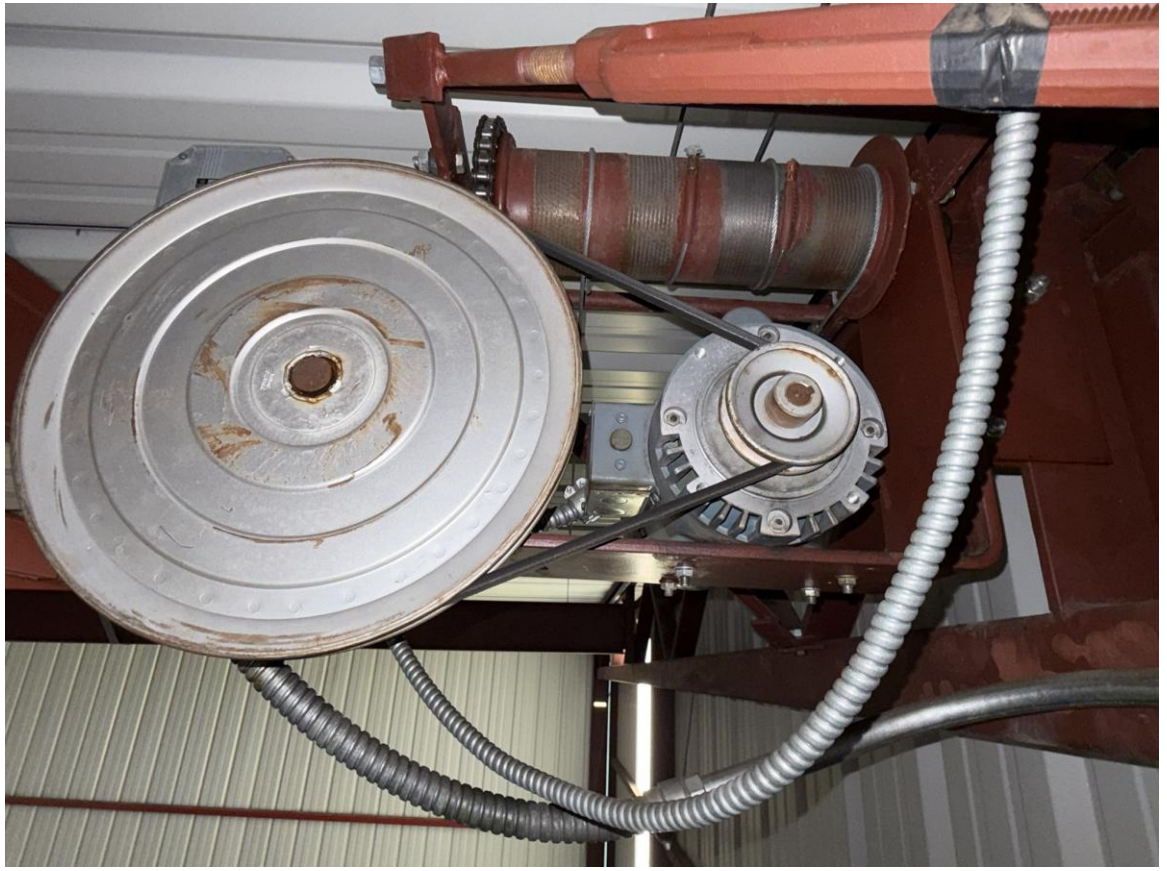
- Example of column failure: https://vgoinc.com/general/buckling-pop-can#:~:text=Ever%20see%20the%20trick%20were,crushed%20by%20the%20dead%20weight.

History of Failures Continued

- Juliet row – follower arm torn out of door structure – fatigue and rust
- Lima Row – original design allows closing cable to wear against sharp metal edge causing premature damage – most have been remedied
- November and Papa Row – tripping electrical contactors causes door to stop and must be reset by maintenance
- Papa Row – failed gearbox would not allow door to open – all gearboxes have been inspected and replaced if necessary
- Papa Row – Strap pins were bent which caused one to fail – door remained operational due to number of straps – all pins have been upgraded
- Before momentary switch, many doors were lowered onto objects, cable would slack and cause uneven wrapping in later cycles. This led to many premature failures of cables. Also causing damage to vehicles and planes.
- Before momentary switch use, several doors lowered beyond bottom limit switch if limit switch failed. Drum continued to rotate and wind cable backwards on drum (think YoYo) and door began to rise until door hung up, motor overheated. Caused severe door hang-up, dangerous conditions. Difficult to safely lower door.
- Bent vertical I-beam structure due to weight of door – have bolstered many with addition steel structure
- 50+ incidents of tenants bypassing momentary switches. D22 failure is first major failure since momentary switch install November of 2018

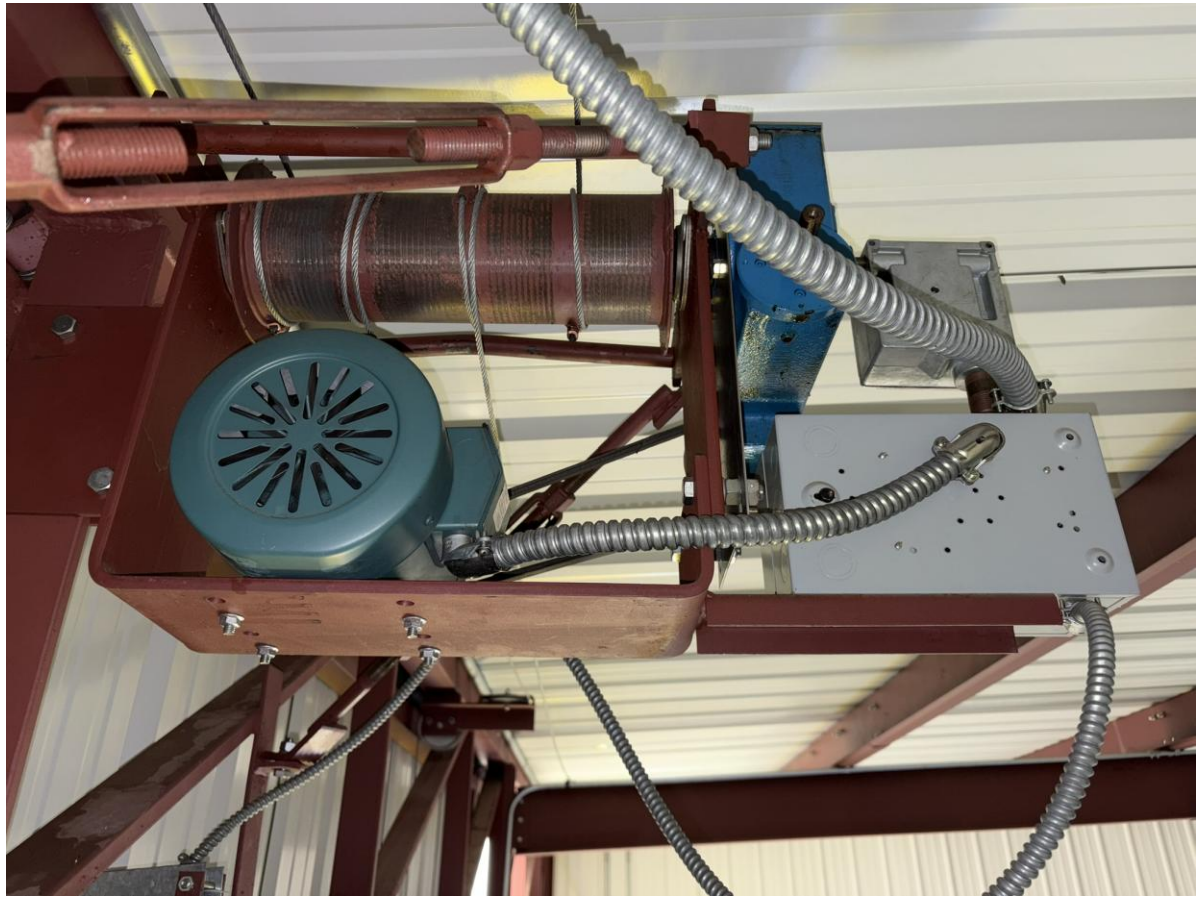
Alpha Row Single Point of Failure Chain



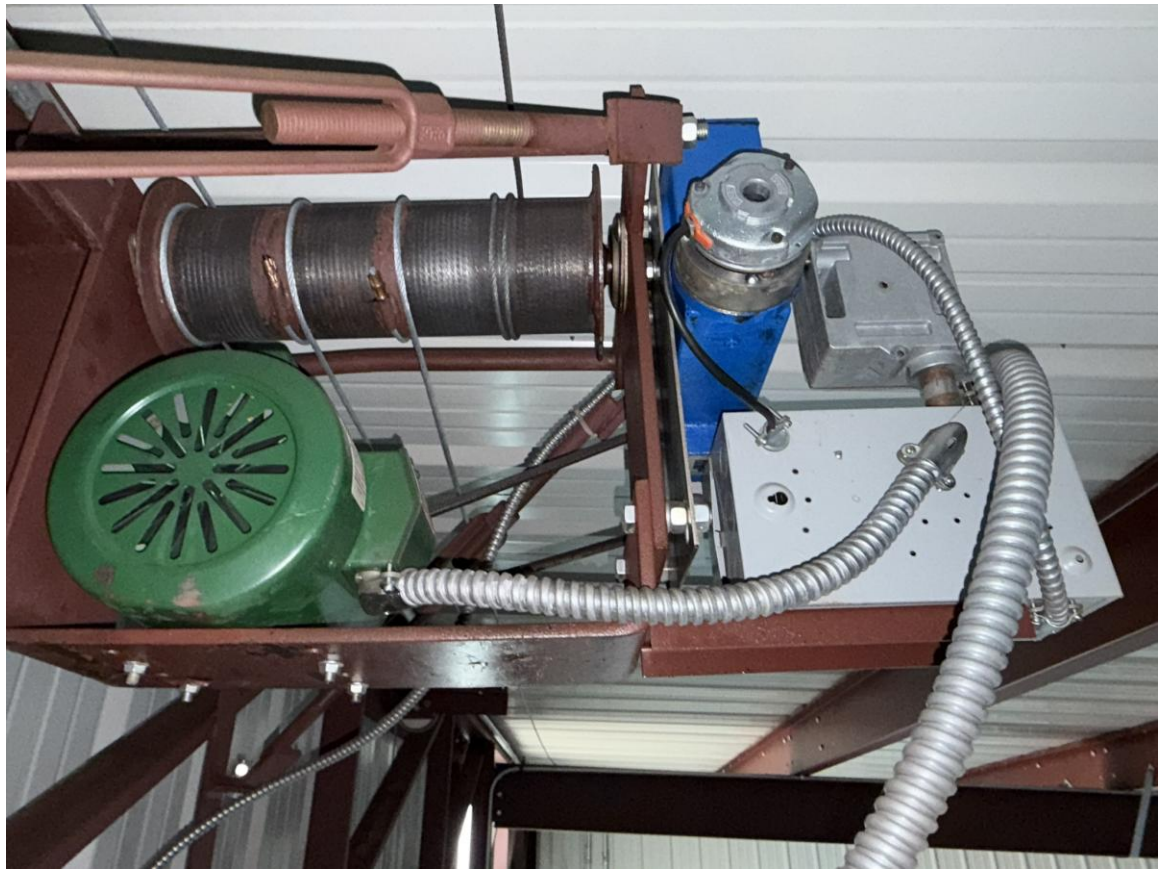


Bravo Row Direct Drive

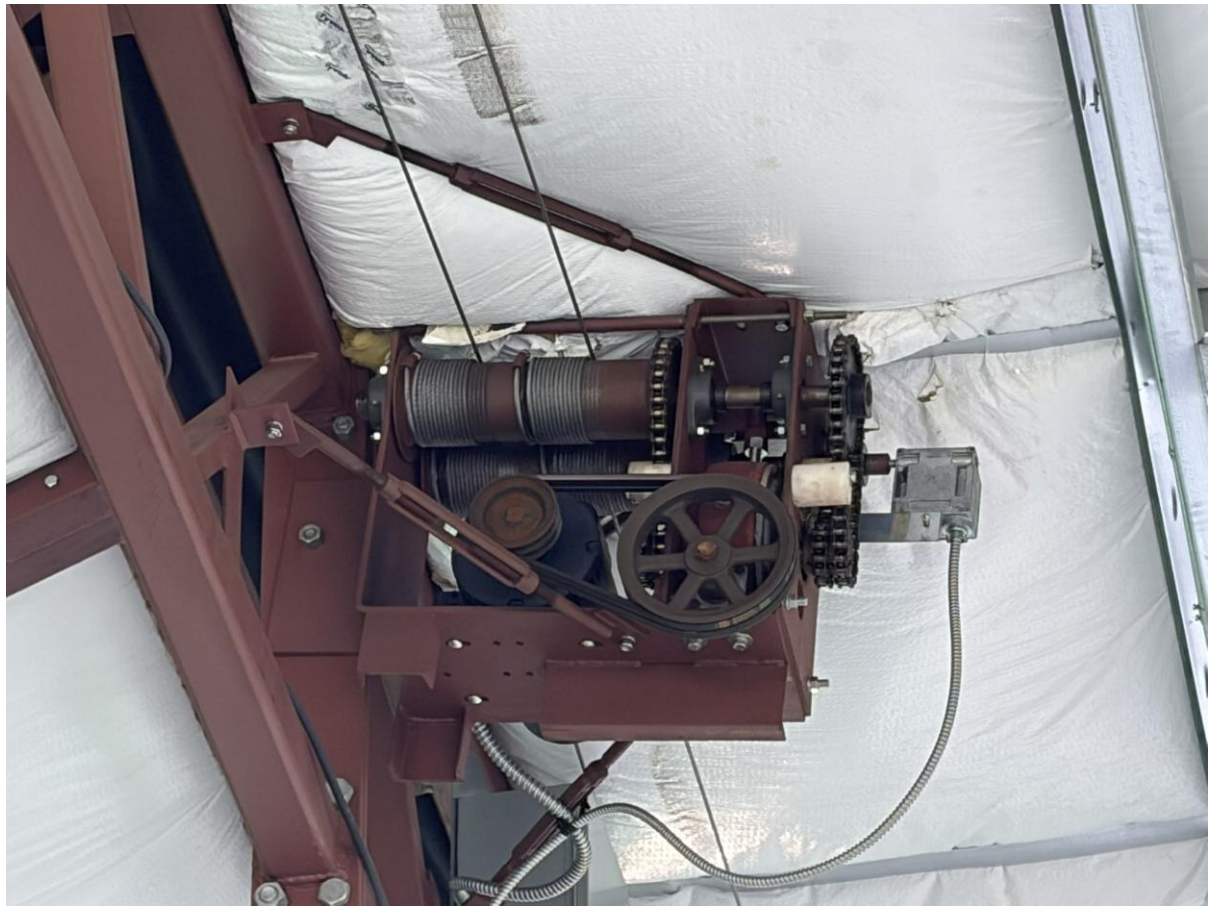
Foxtrot Row Direct Drive w/belt (No brake)



Golf Row Direct Drive w/belt



Hotel Row Dual Chain Drive



Lima Row Dual Motor Dual Chain

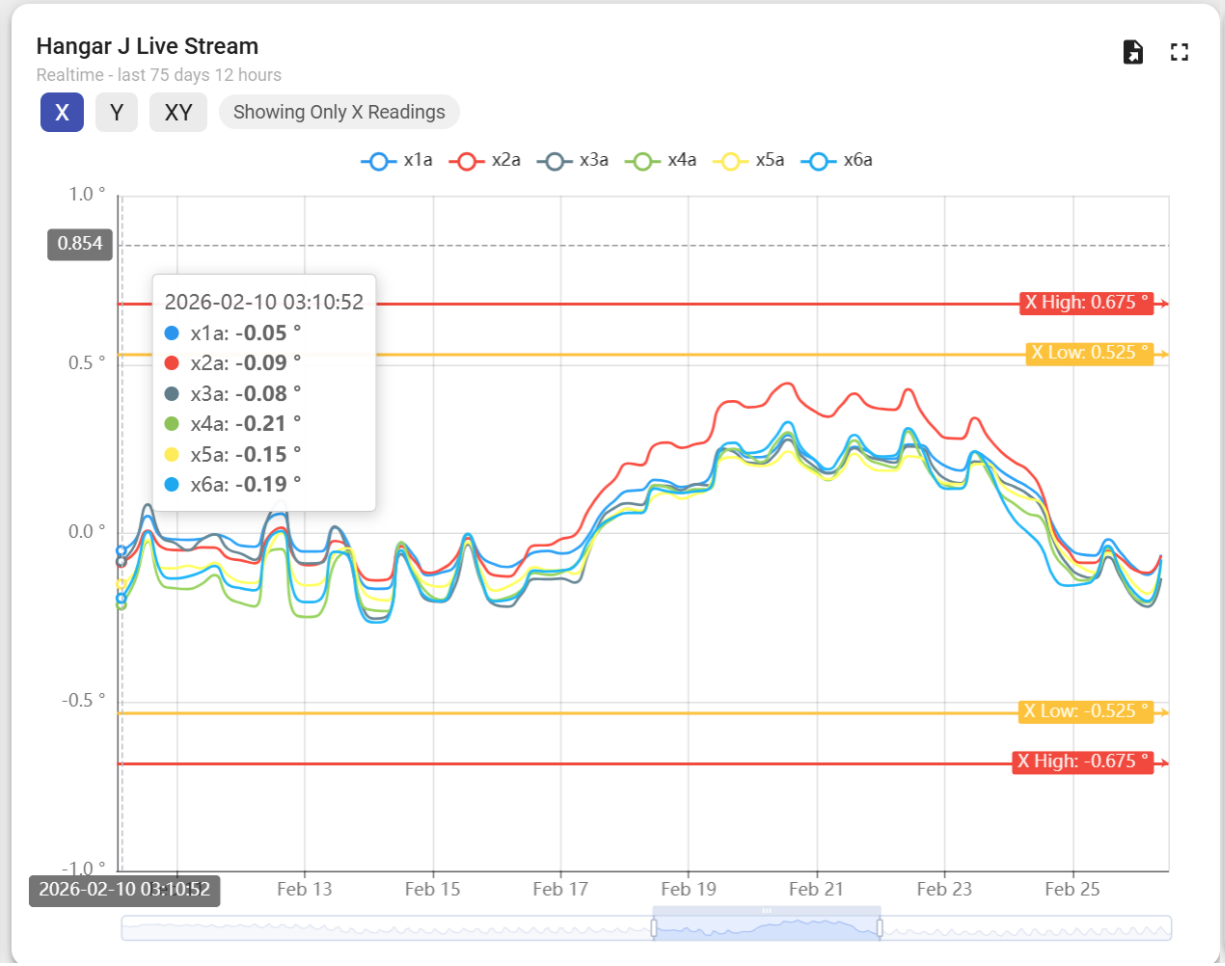
Mike Row Dual Chain

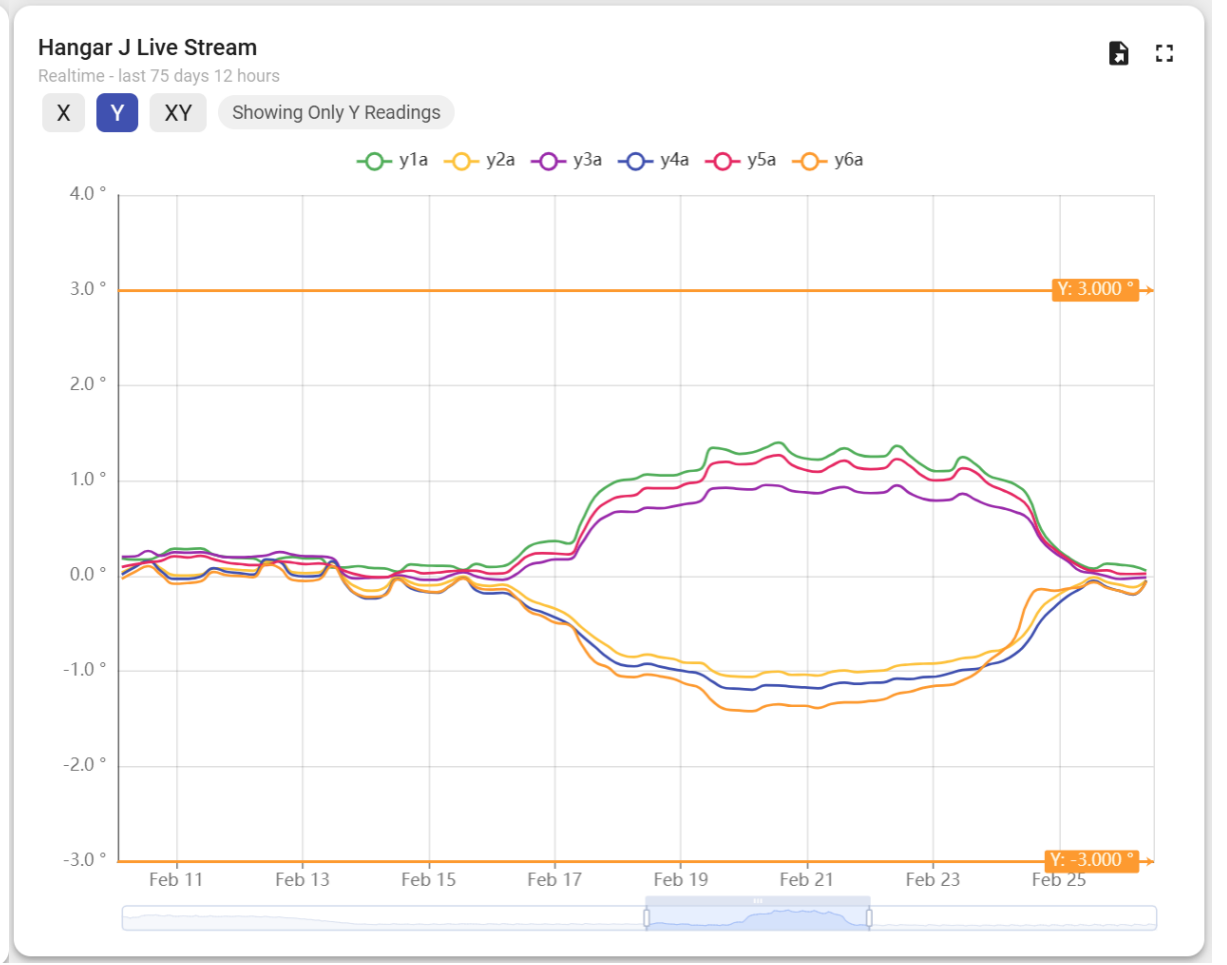
Papa Row Dual motor Quad Chain

Preventative Maintenance Actions

- Quarterly O&M Mechanical Inspection:
  - Pedestrian door and main door
    - Verify a 3 ft clear area around door. Check unimpeded access to: Fire Extinguisher, Momentary Switch, Electric Panel. Check door for proper function.
  - Main Hangar Door
    - Verify a 4 ft clear area along entire length of door, except for aircraft nose. Check rigging and function of latches as applicable. Check cable/strap condition. Verify cables/strap wrapping properly. Check cable/strap attach points. Check cable/strap tension. Verify cable routing and sheaves turning if applicable. Check upper and mid hinges and cotter pins as applicable. Check condition of motor and drive belts/chains
  - Lights
    - Are lights working, has the tenant made any modifications?
  - Insulations/Astragals
    - Are lights working, has the tenant made any modifications?
  - Walls
    - Are there any items permanently attached to walls. Are there lofts. Are walls in good condition?
  - Roofs
    - Any sign of leaking? Anything weird looking about roof or purlins?
  - Electrical
    - Are there any tenant modifications to wiring, or any unique situations requiring further attention
  - (Annually) Gearbox and gearbox oil inspection
    - Check gearbox oil of oil level and check color of oil

SRS Roof Feedback



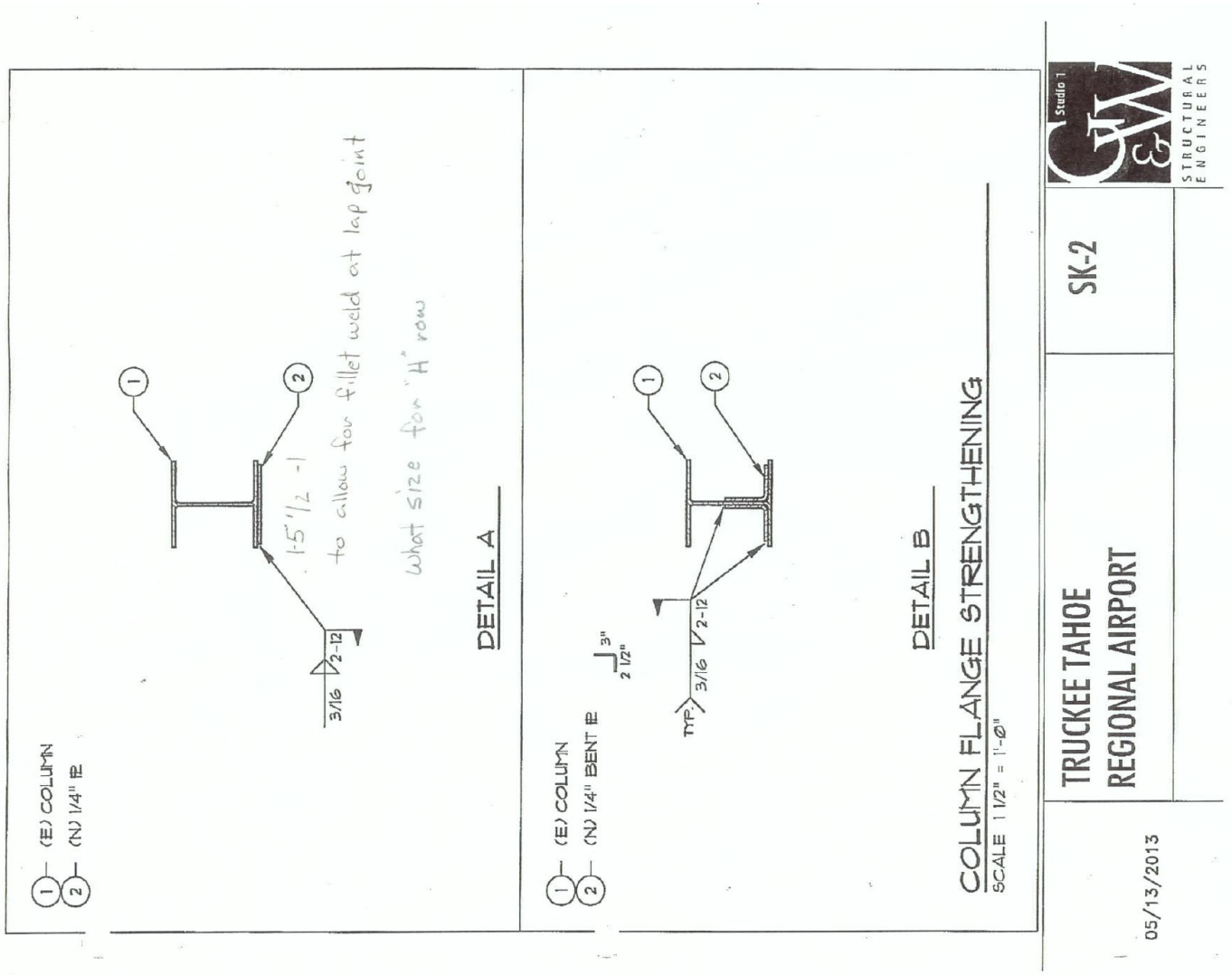


Hangar 2 Collapse

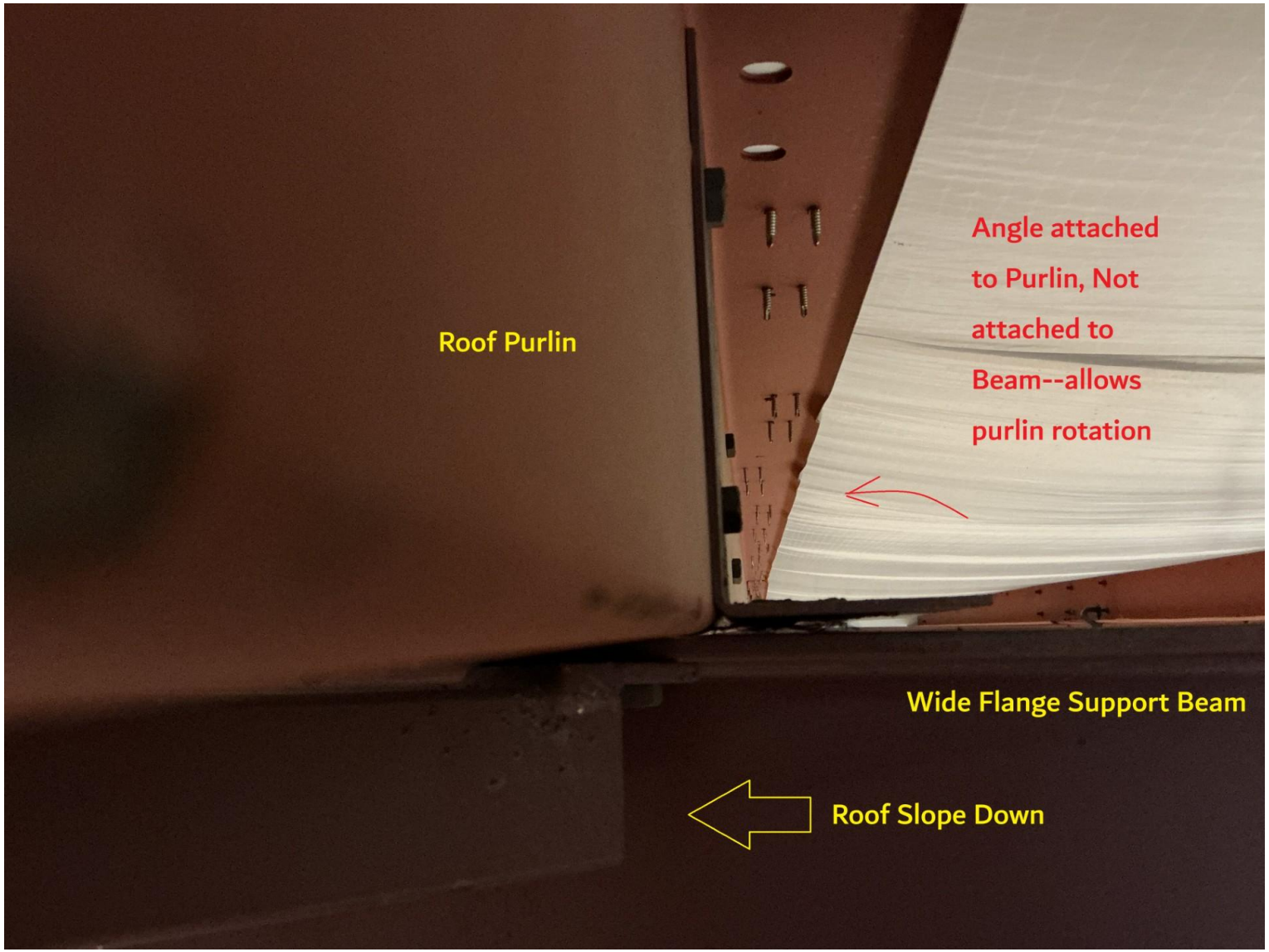
Back to Way Fwd

Truss Corrosion

Column Distortion Mitigation



L-Bracket Anchoring

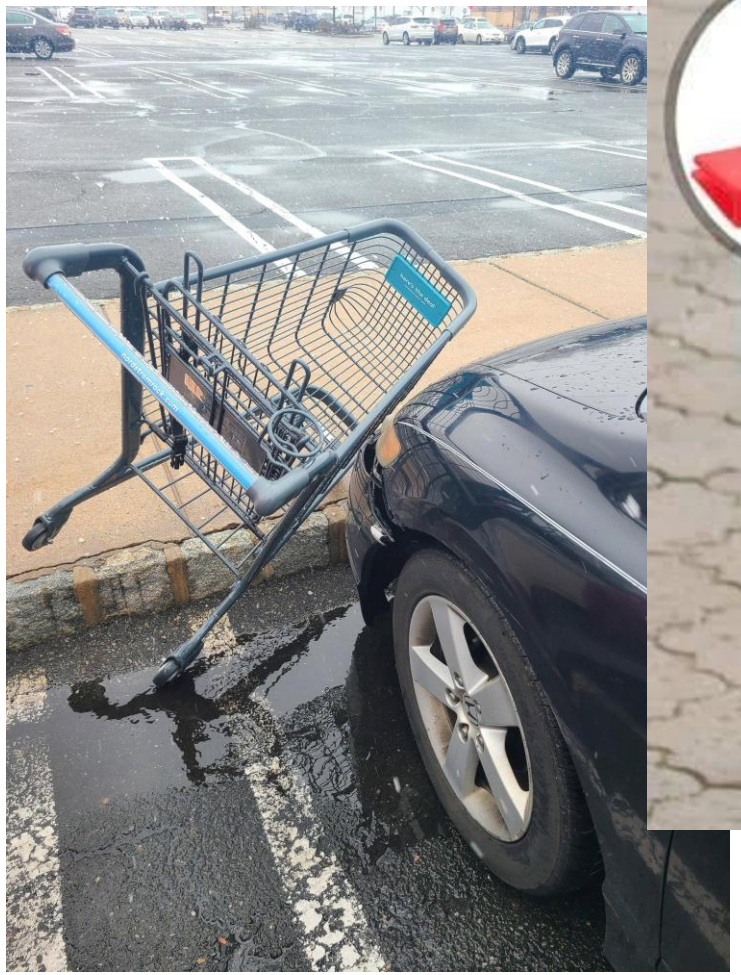


Worm Drive Transmission
(Machine Head)

Manual Hangar Latches

Truss Corrosion

Shopping Cart vs Car Example (a discussion of risk terms)



Compromised I-Beam Column

Schweiss Door Hazards

Links

- Columnar Structures: https://vgoinc.com/general/buckling-pop-can#:~:text=Ever%20see%20the%20trick%20were,crushed%20by%20the%20dead%20weight.