WRI 2023

HEAVY HAUL SEMINAR JUNE 8-9

Energy Management

Root Causes and

Draft System Comparison

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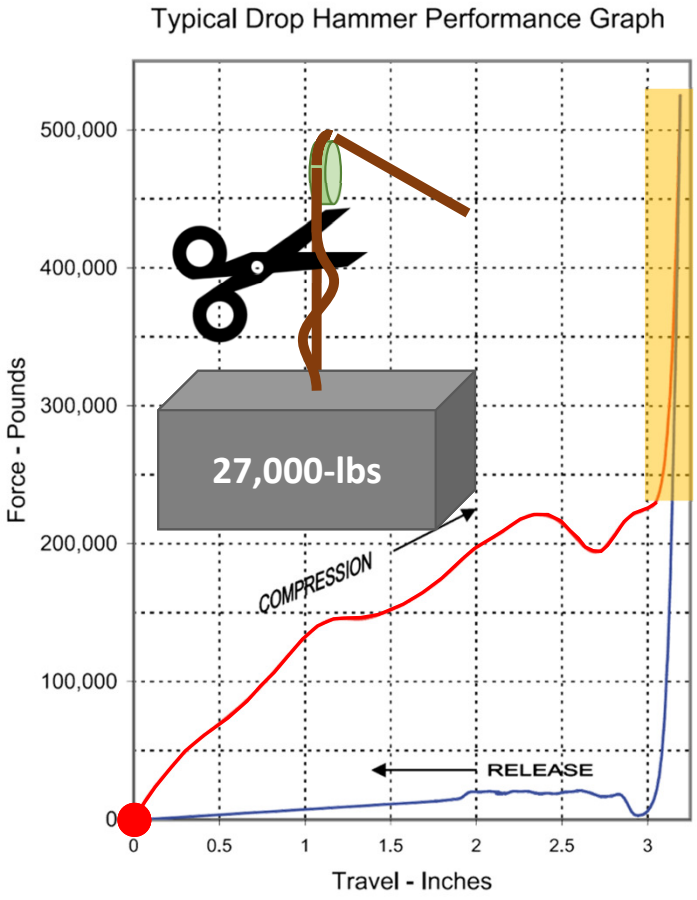
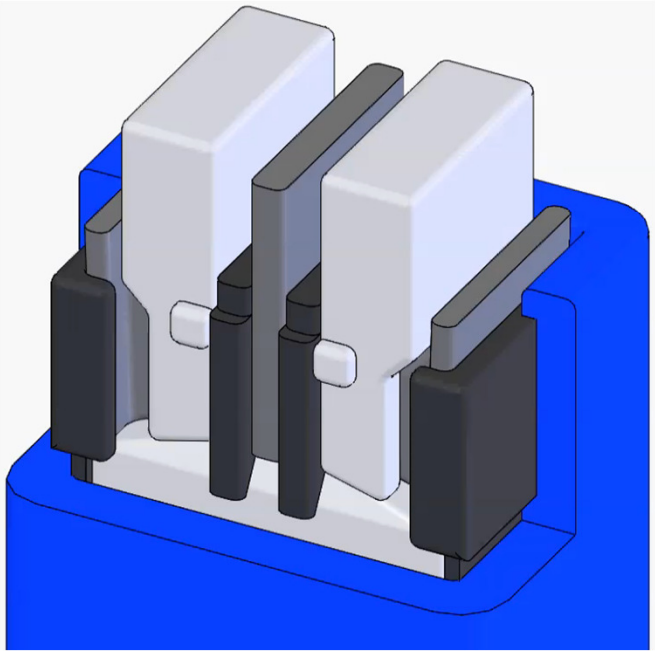
Estimated Length: *20 minutes*

1920's – Friction Draft Gear

1. *On compression, wedges forces friction shoes against outer wear plates in the housing.*
2. *On release, spring return force is substantially lower than that absorbed by the friction wedges.*
3. *Rectangular housing fills center sill for reduced wear.*

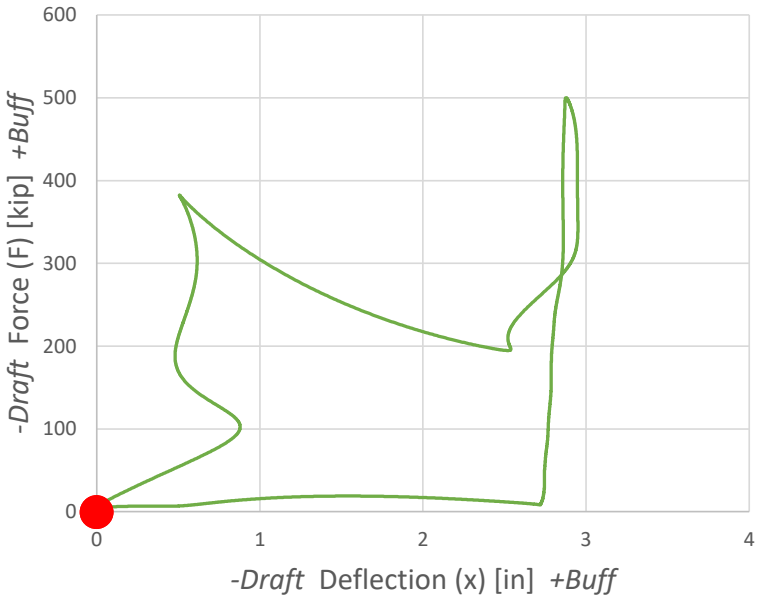


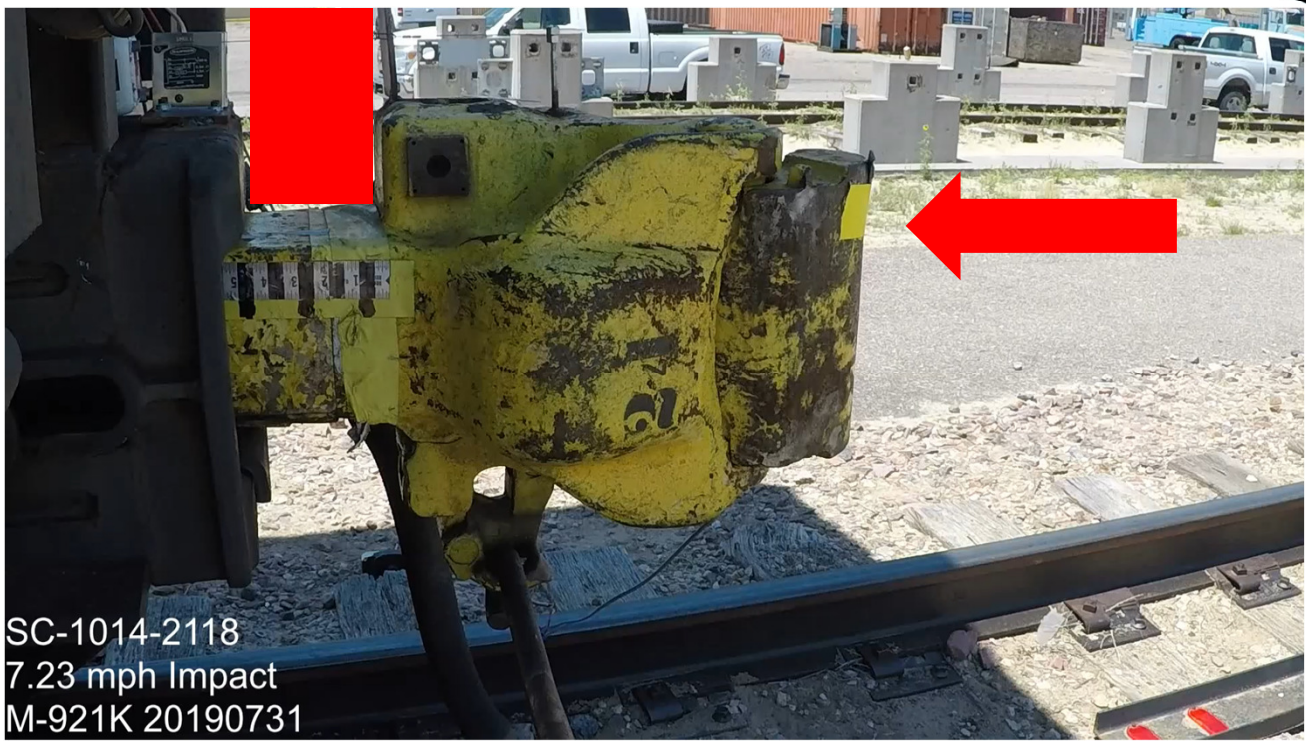


1920's – Friction Draft Gear

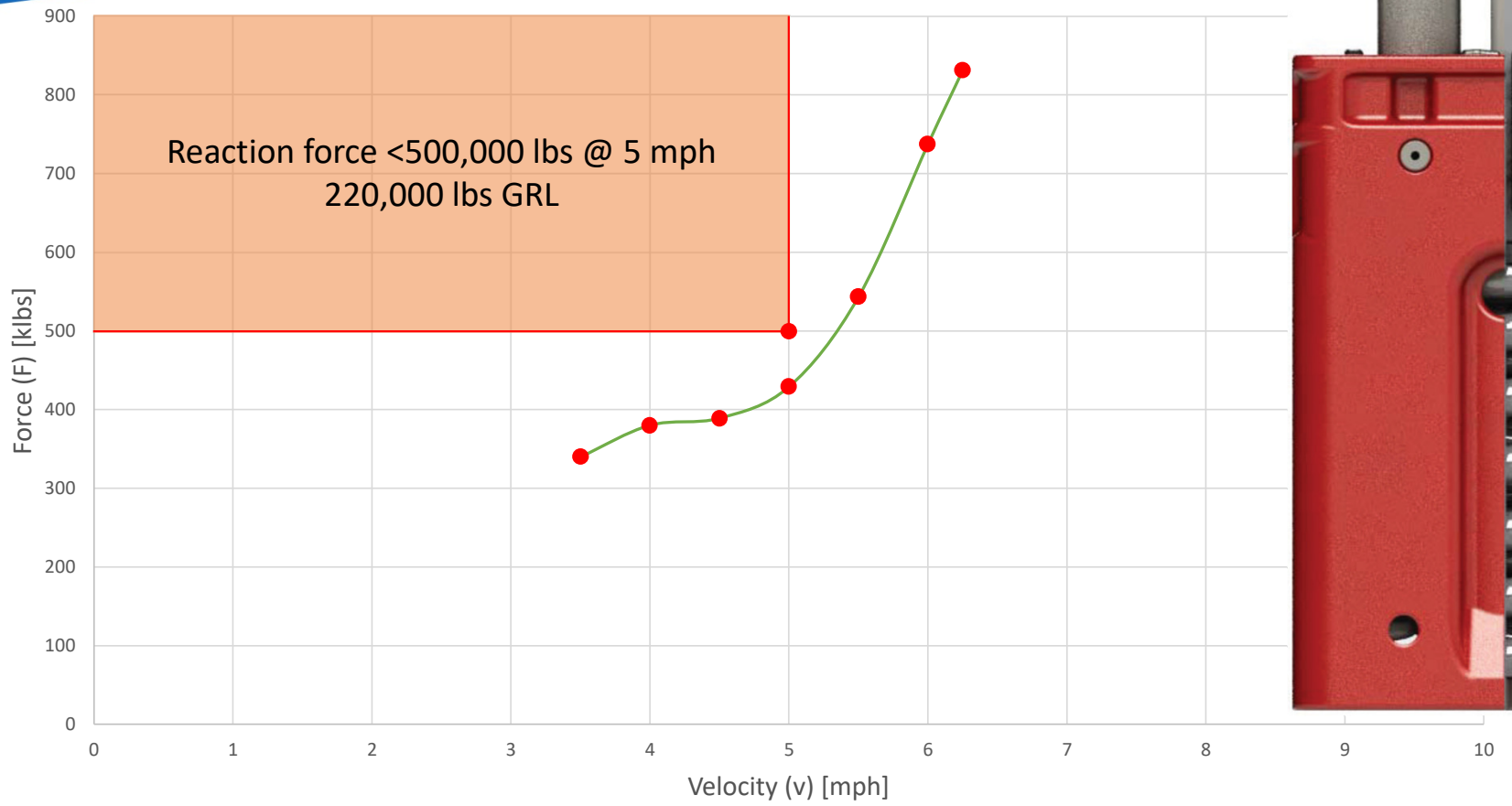
Actual Impact Performance

1. *Initial force buildup from static friction.*
2. *Little resistance provided once friction clutch begins to move.*
3. *Second "impact" greater than the first.*

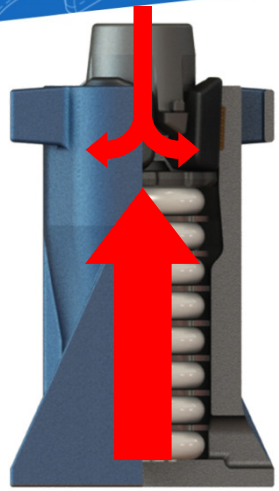




1920's – Friction Draft Gear

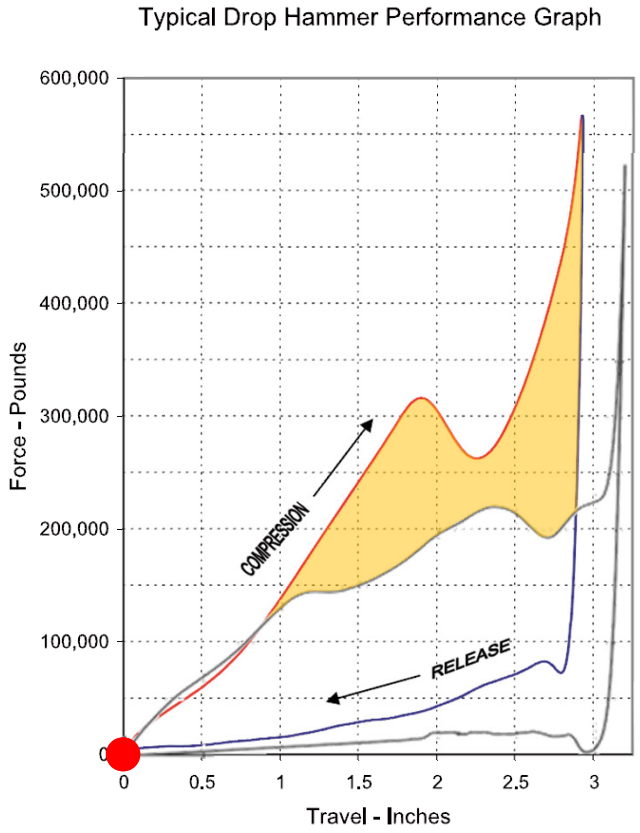


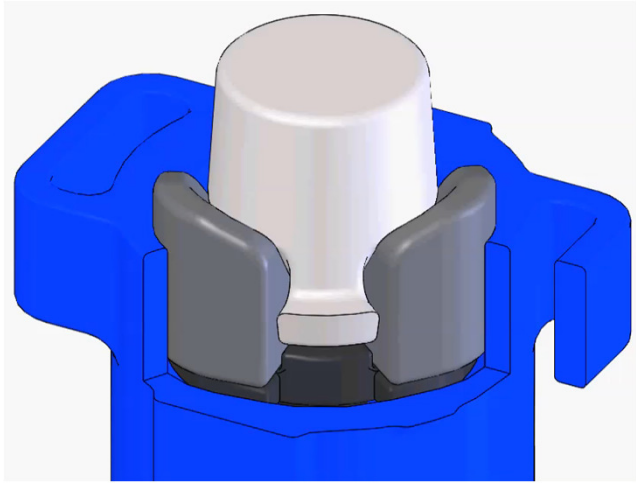
1970's – Polymer Draft Gear



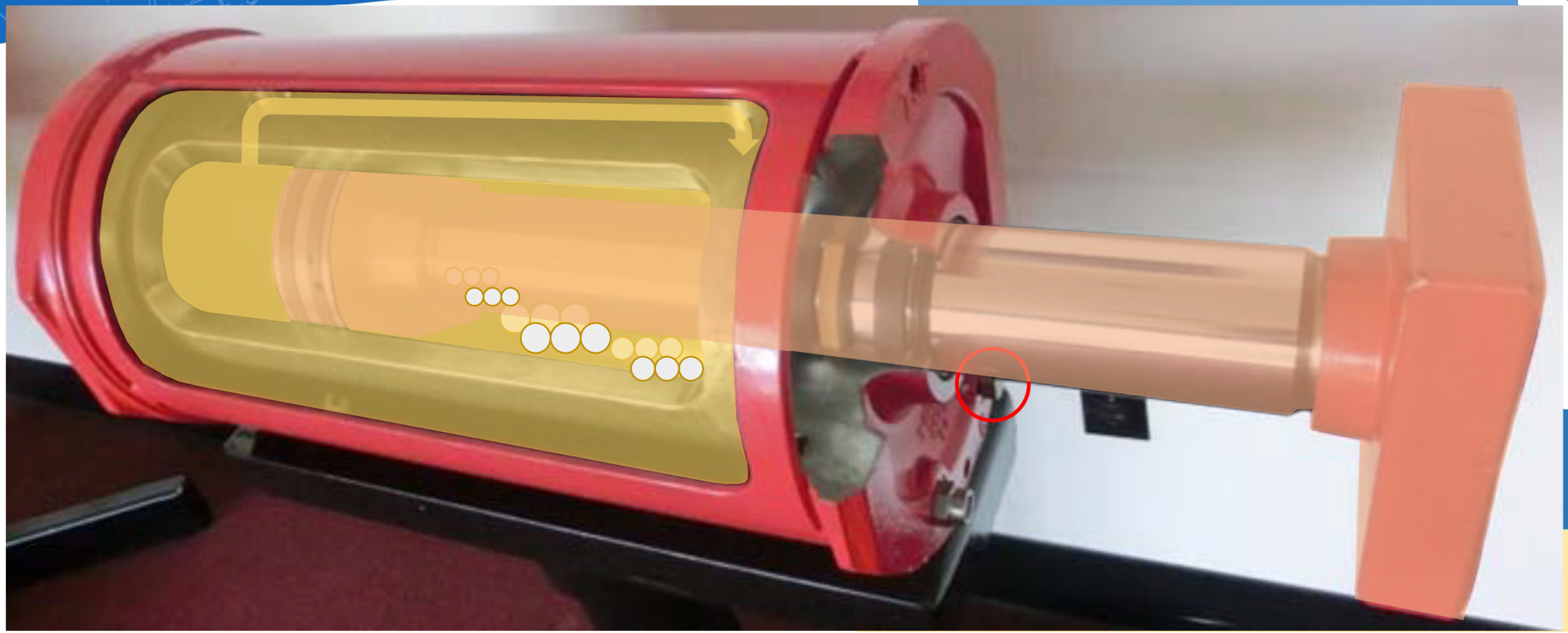
Elastomeric Pad (~270 lbs)

1. *On compression, plunger forces friction wedges against outer walls from resistive pad force.*
2. *On release, elastomeric pads provide substantially lower restorative forces.*
3. *Single pad stack allows for lighter weight housing.*





1980's – End-of-Car Cushioning



1980's – End-of-Car Cushioning

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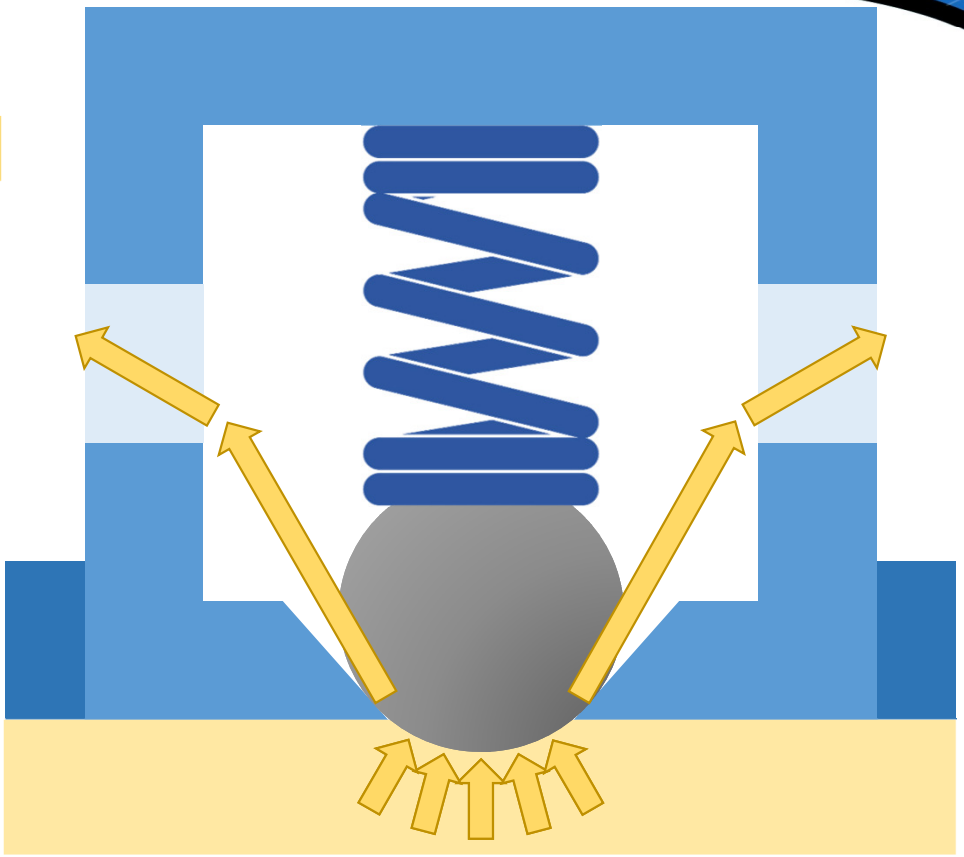
Year	Spec.	Title
1986	M-921A	Sliding Sill
1989	M-921B	End-of-Car
1993	M-921D	End-of-Car (auto rack)
2000	M-921E	End-of-Car Active Draft (auto rack)
2004	M-921F	End-of-Car Active Draft
2004	M-921H	Unit Condition Indicator



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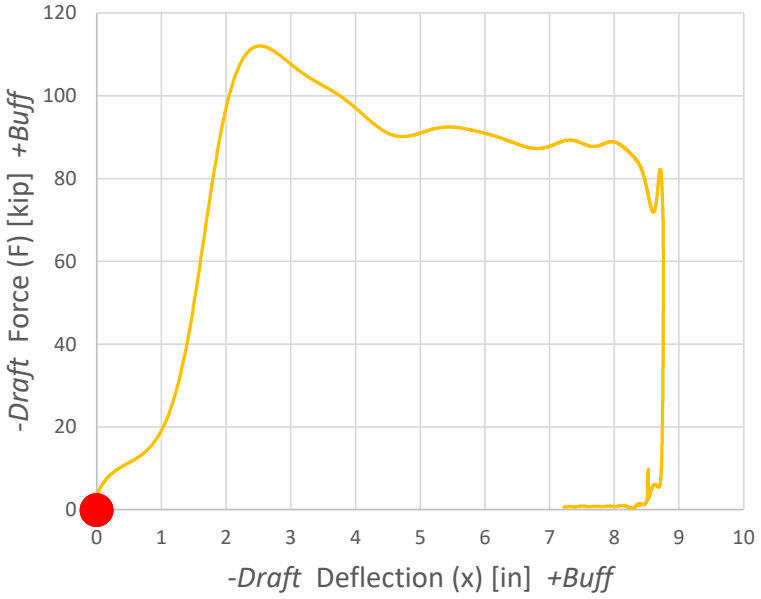
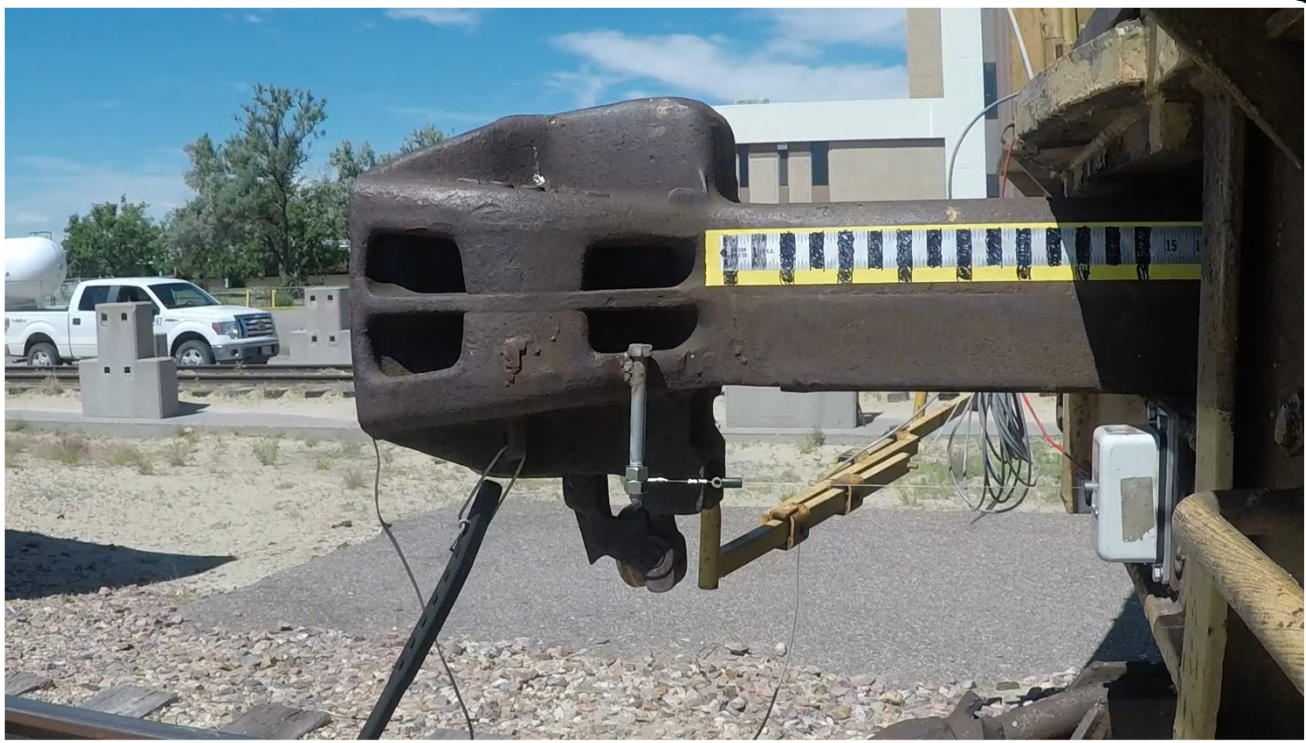
1980's – End-of-Car Cushioning

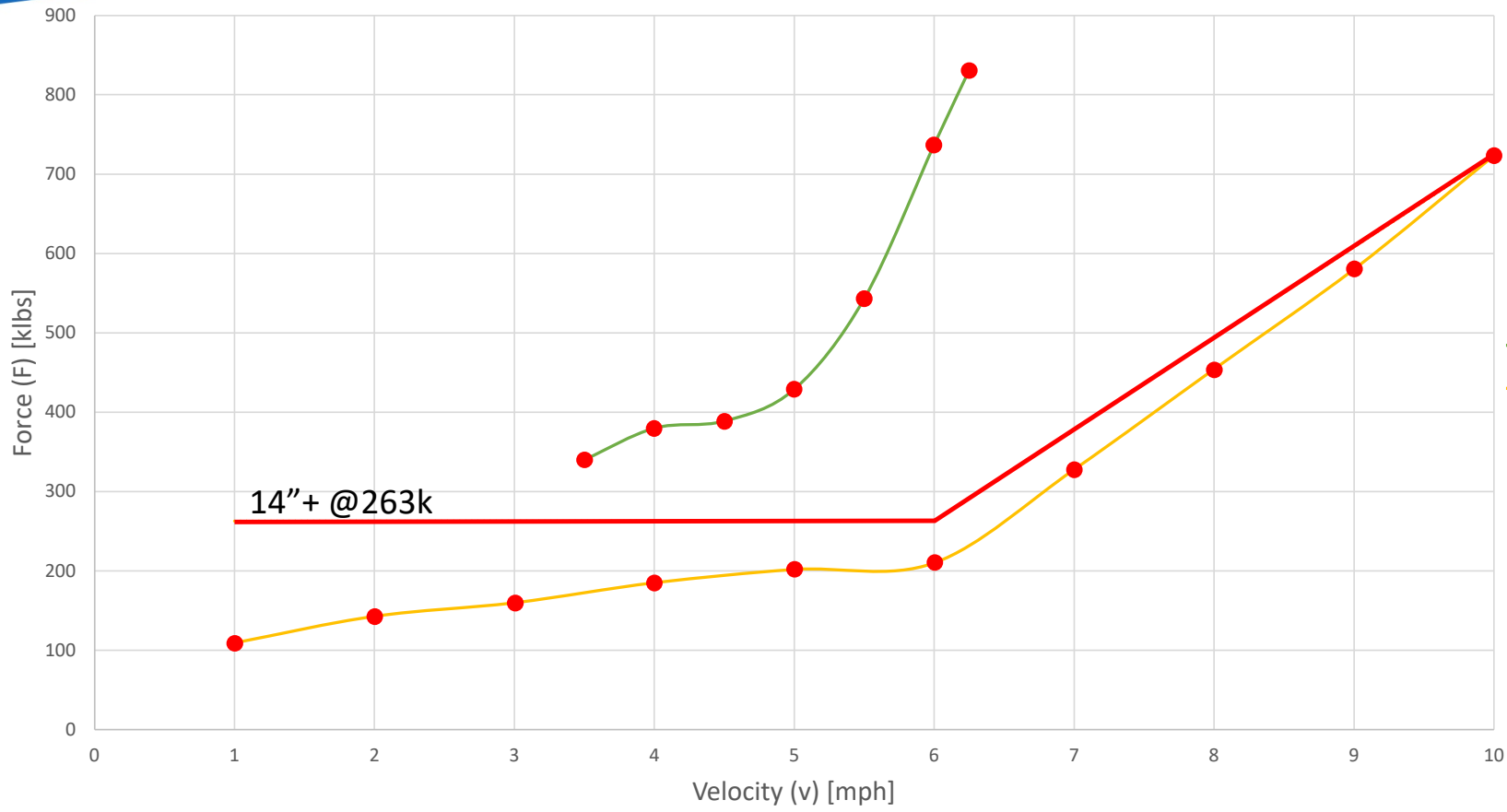
Actual Impact Performance

1. *Once preload is reached, the unit begins to compress smoothly.*
2. *Internal pressure returns unit to neutral.*
3. *Free slack can be seen after impact.*





1980's – End-of-Car Cushioning



In-train forces

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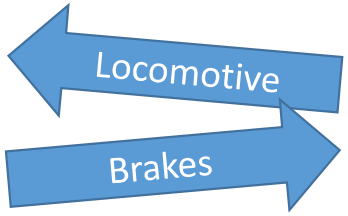
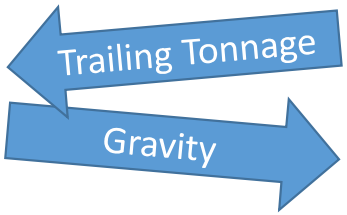
In-train forces





Draft System Resistance – Effect on forces

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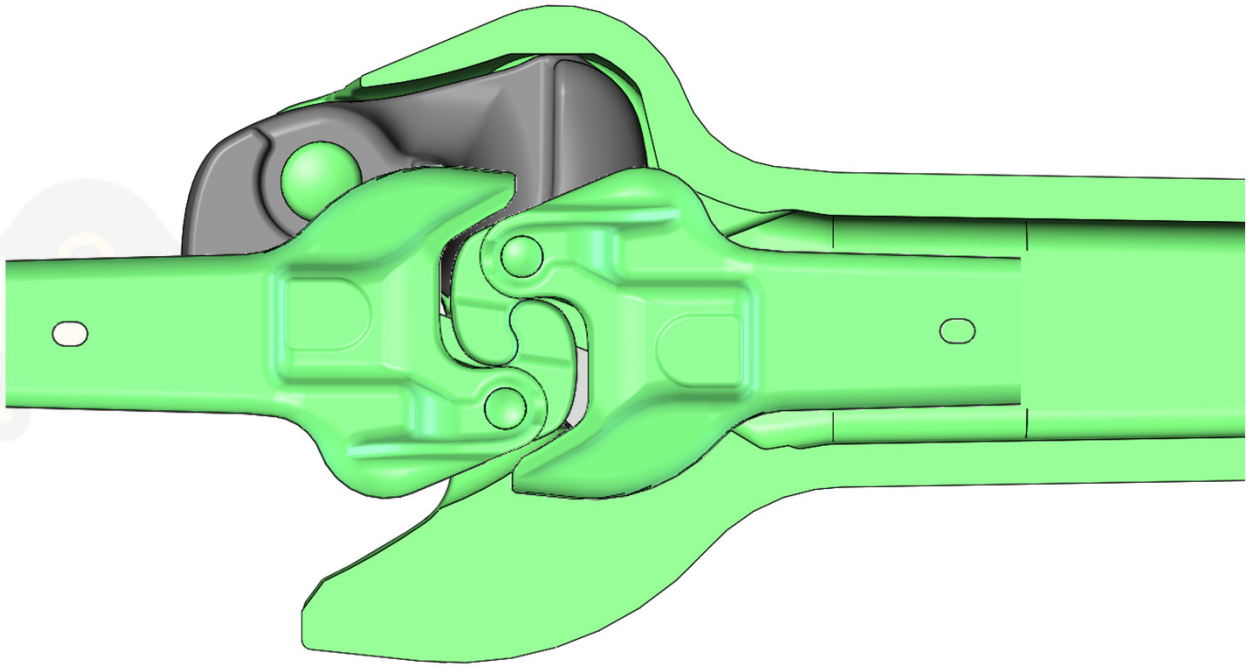

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Draft System Resistance – Effect on forces

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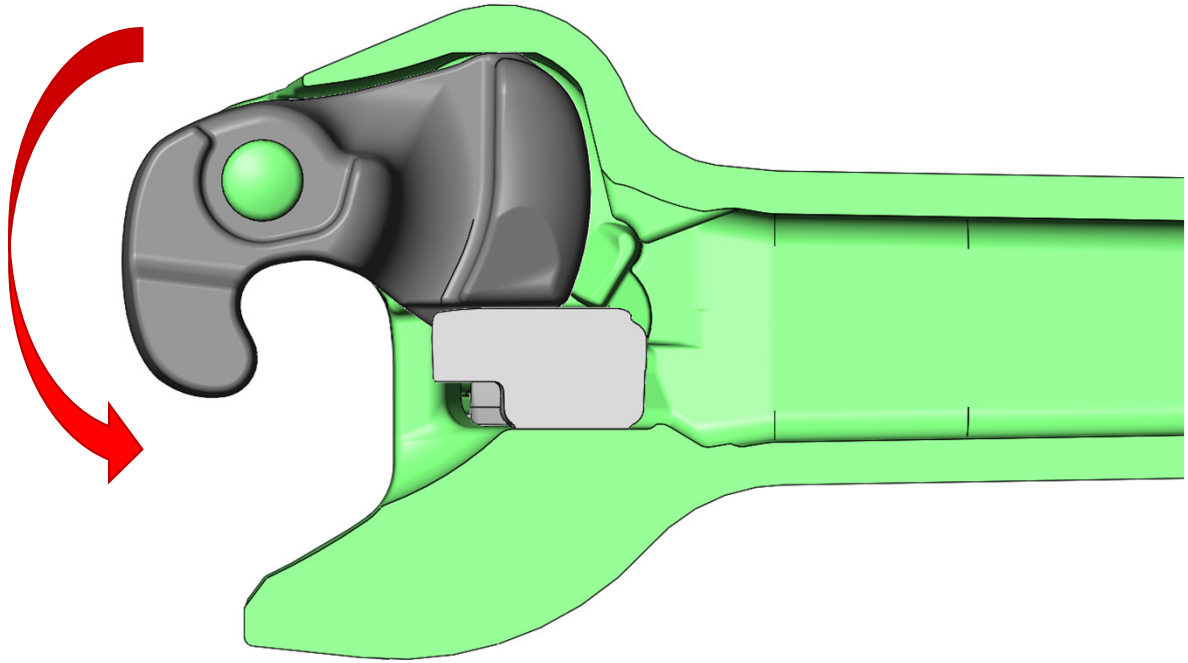
"Standard" free slack ~1/2"



Draft System Resistance – Effect on forces

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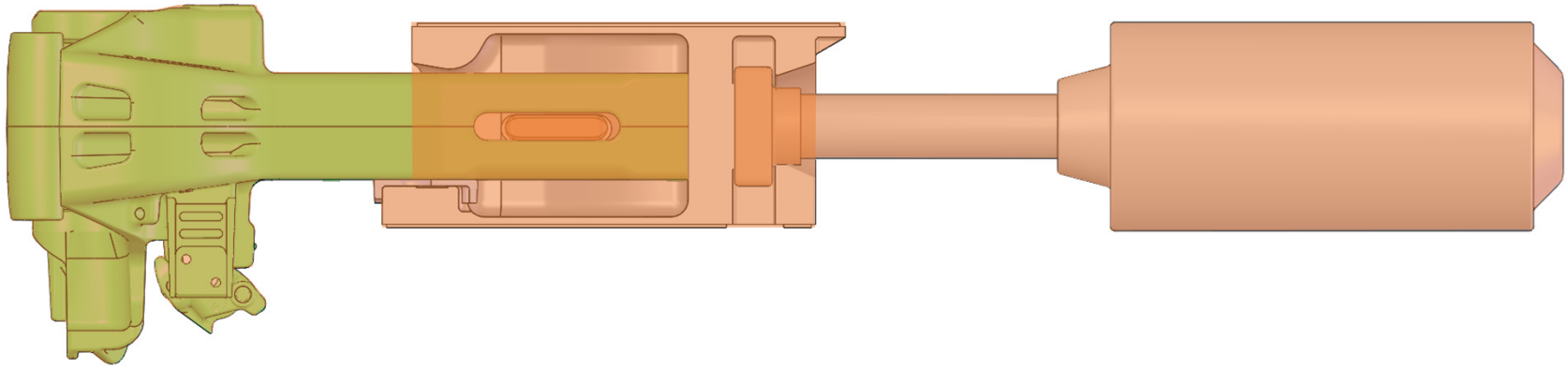

Undesired Slack

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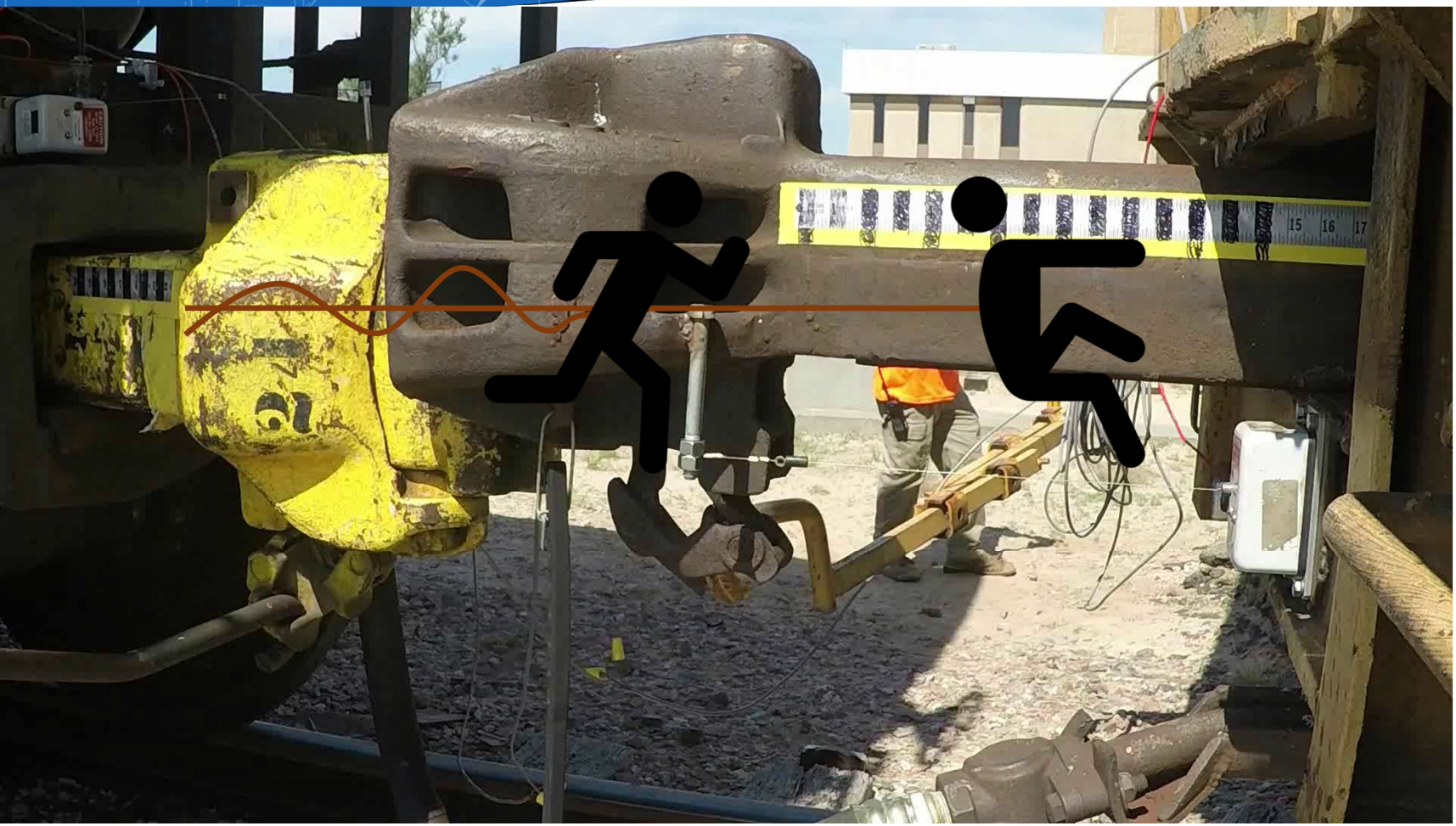

Amount of slack depends on draft system.

Some systems are designed to include slack.

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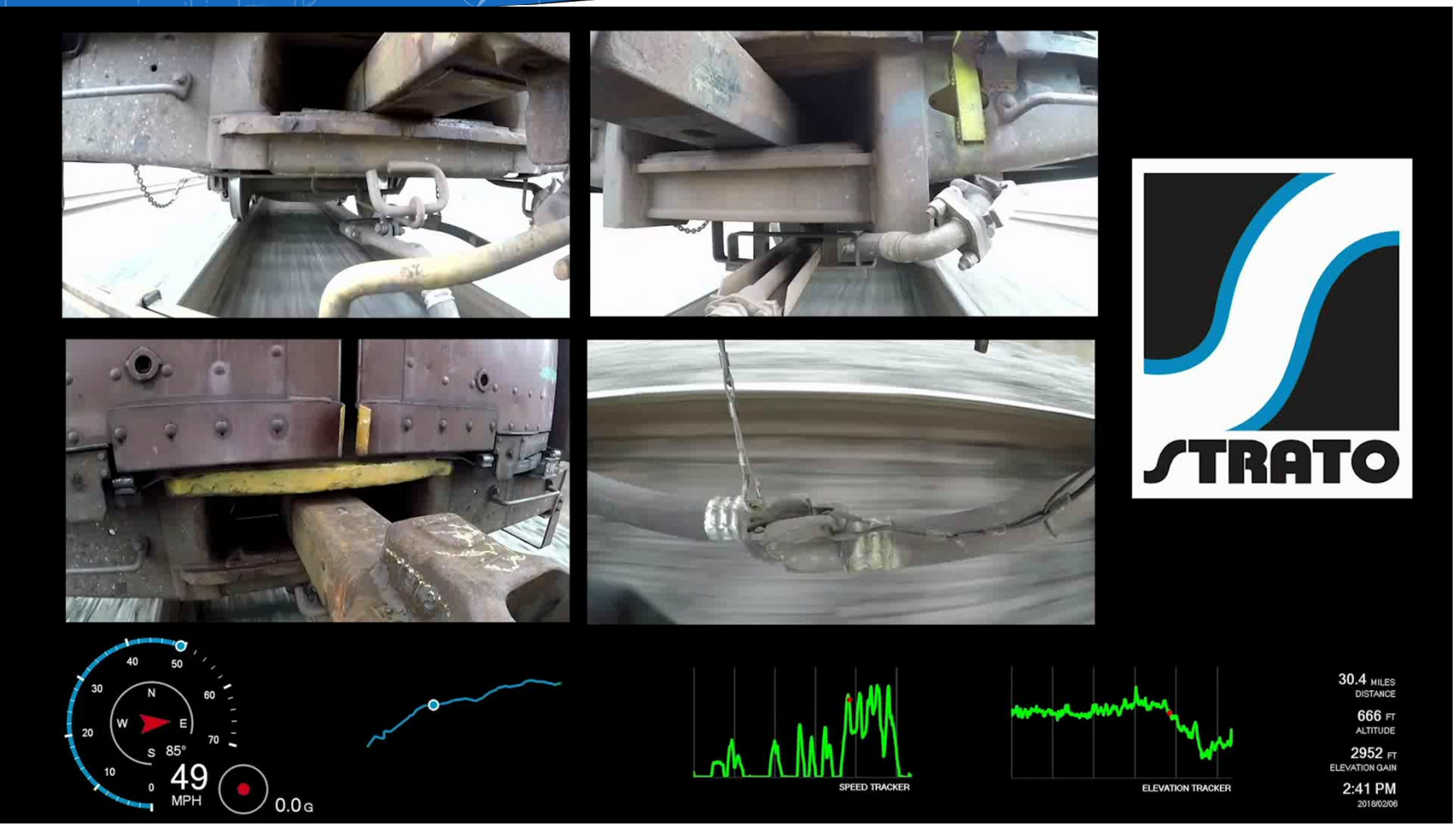
Over-the-Road Forces



Run-in event:
Deceleration
Brake application

Evidence:
Coupler snap
Contouring
Shank wear

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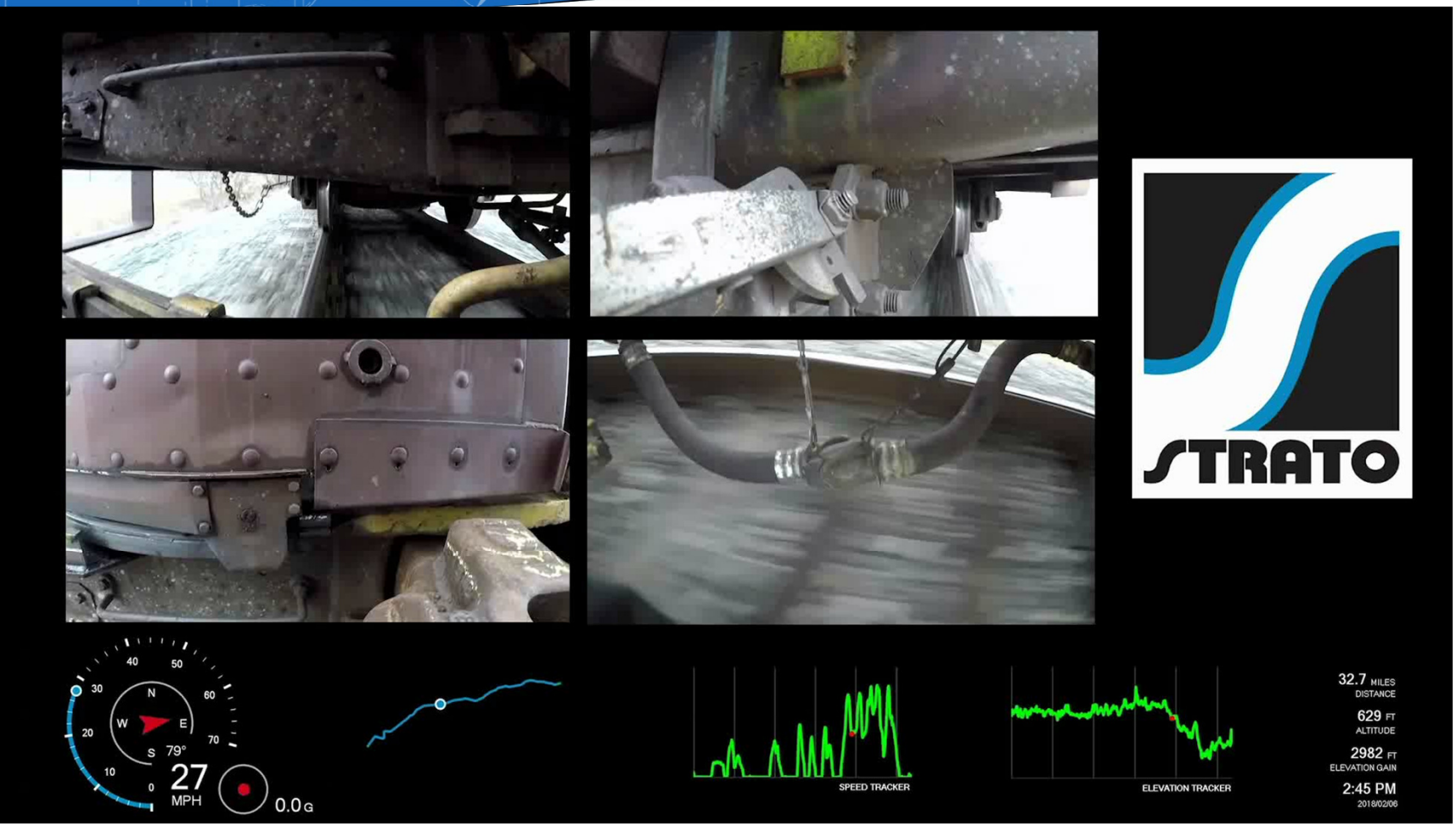
Over-the-Road Forces



Run-out event:
Acceleration
Throttle up

Coupler snap

Evidence:
….

Equipment Limitations

Reddit

Equipment Limitations

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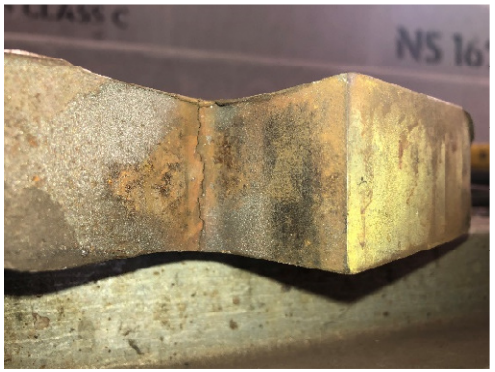

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Train Action – EOCC draft failure

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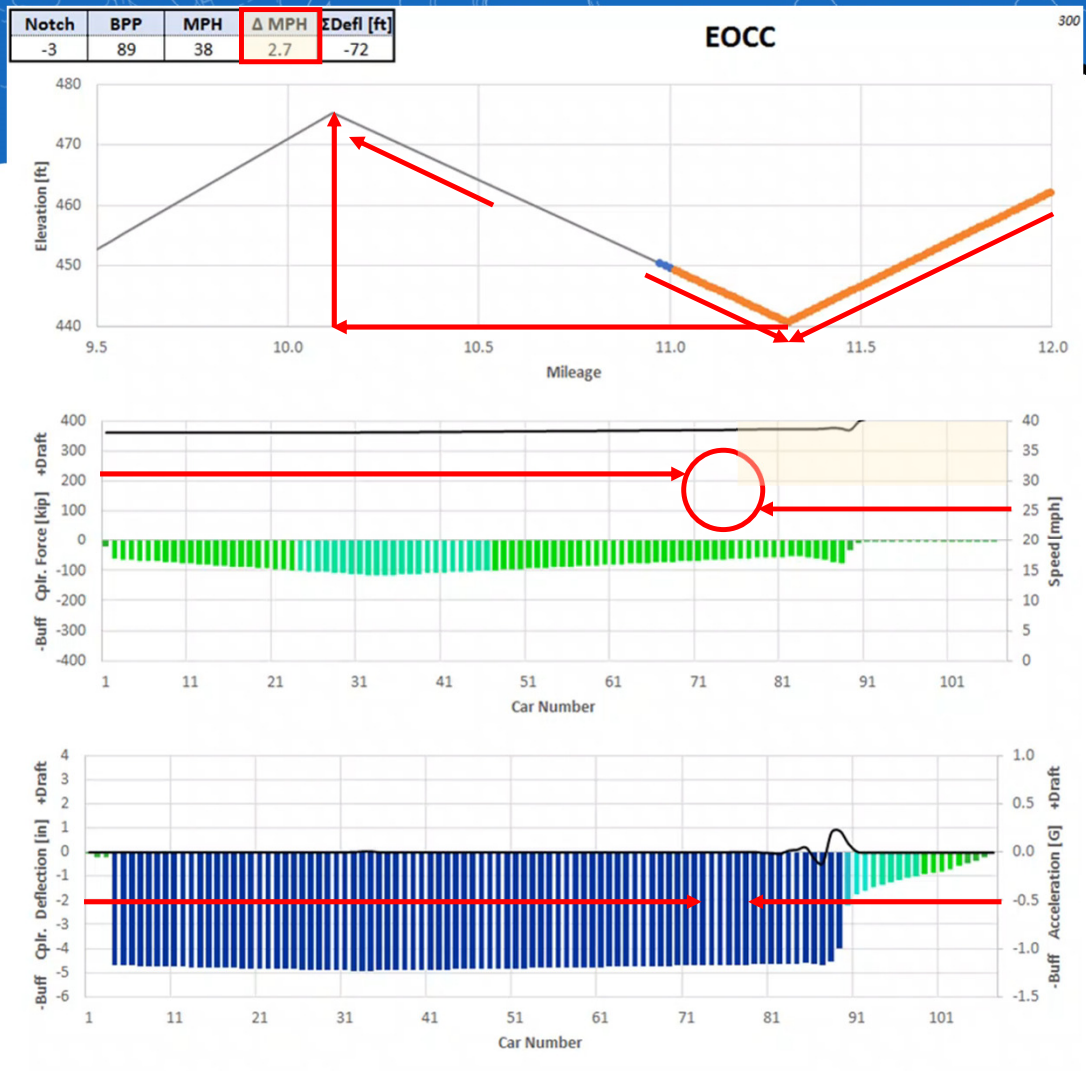
Notch	BPP	MPH	Δ MPH	ΣDefl [ft]
-3	89	38	2.7	-72



103-car coil steel train
(3) Head end locomotives
103 loaded cars, 0 empty = 12,500 tons & 5,500 ft
15" EOCC on 100 cars = 250-275 ft of slack

Frequent broken knuckles at rear of train.
Limit train to 80 cars = no knuckles break.

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Train Action – Draft failure prevented

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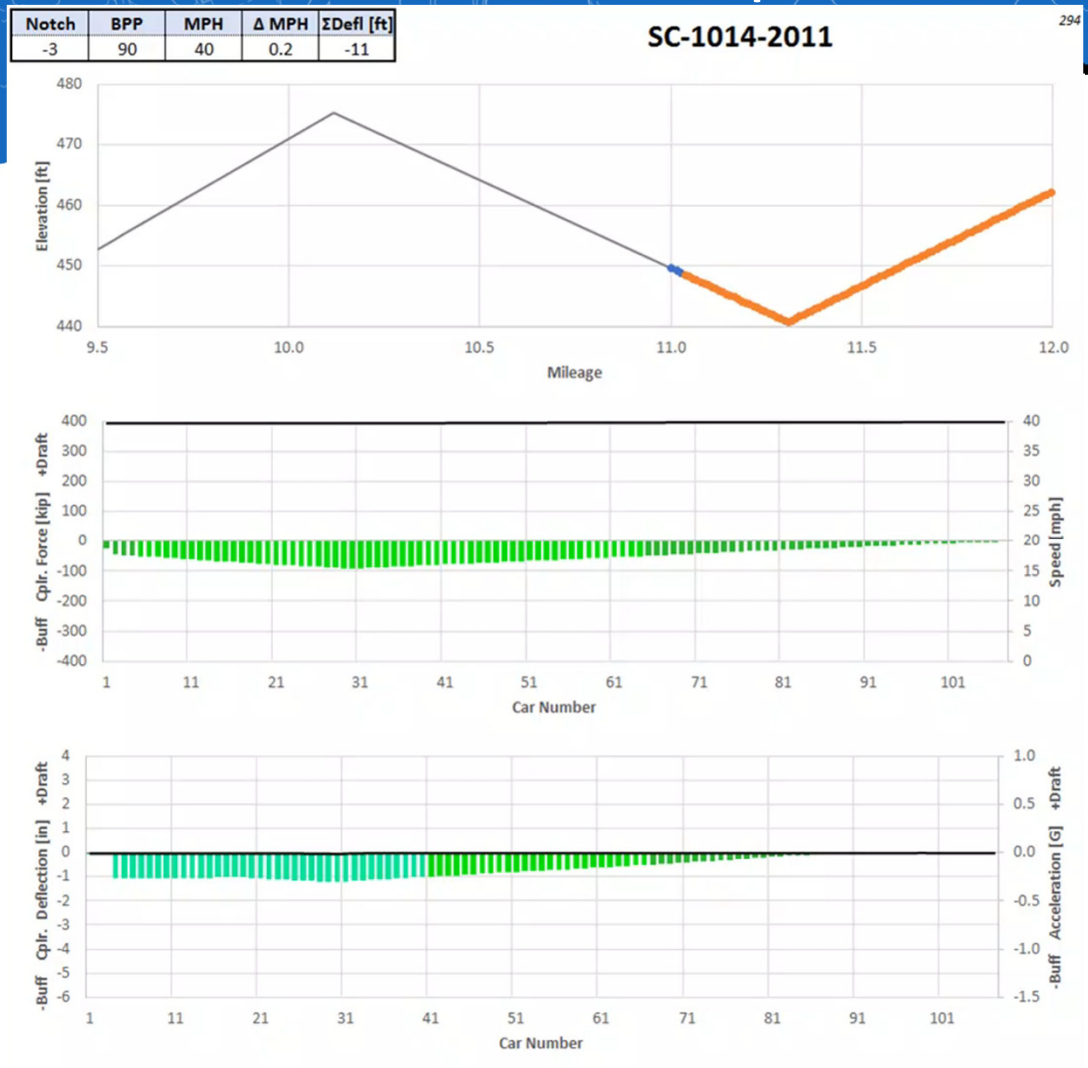
Notch	BPP	MPH	Δ MPH	ΣDefl [ft]
-3	90	40	0.2	-11



103-car coil steel train
(3) Head end locomotives
103 loaded cars, 0 empty = 12,500 tons & 5,500 ft
Selective Cushioning Unit on 103 cars

Prevents “velocity wave” produced by EOCC.
Extends knuckle life.

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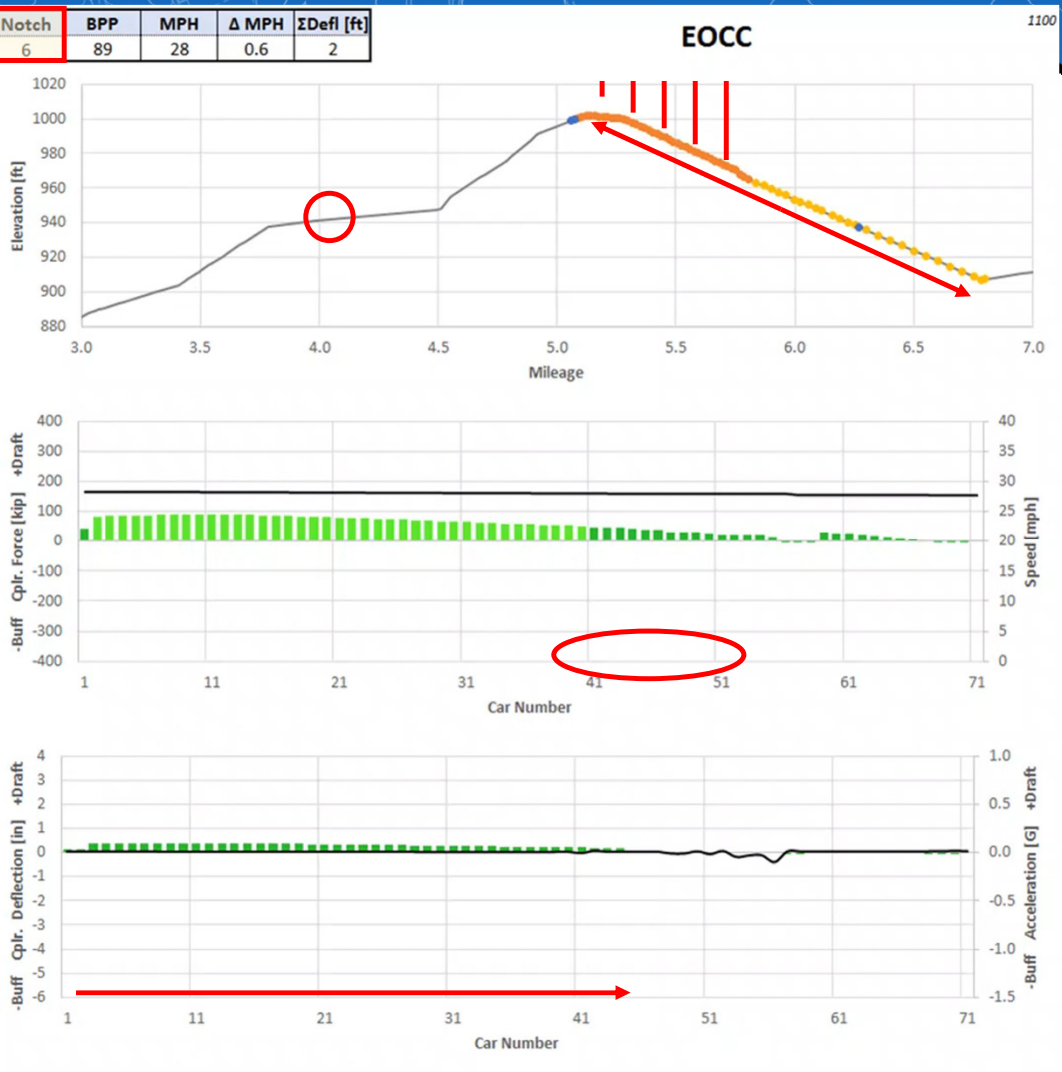
Train Action – EOCC buff failure

Notch	BPP	MPH	Δ MPH	ΣDefl [ft]
6	89	28	0.6	2



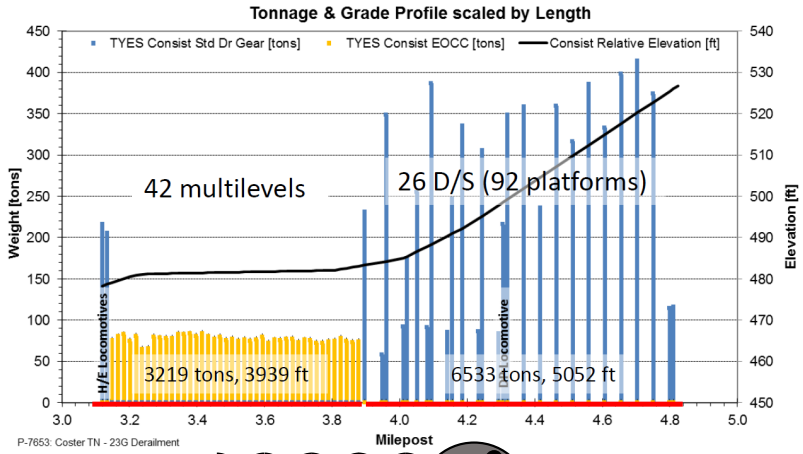
Auto racks and double-stacks

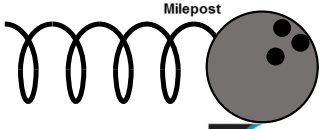
2x1 Mid-train distributed power

68 loaded cars, 0 empty = 9,752 tons & 9,211 ft

10” EOCC on 42 cars = 70-95 ft of slack

Gage ruptured under last M/L and first D/S





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Train Action – Buff failure prevented

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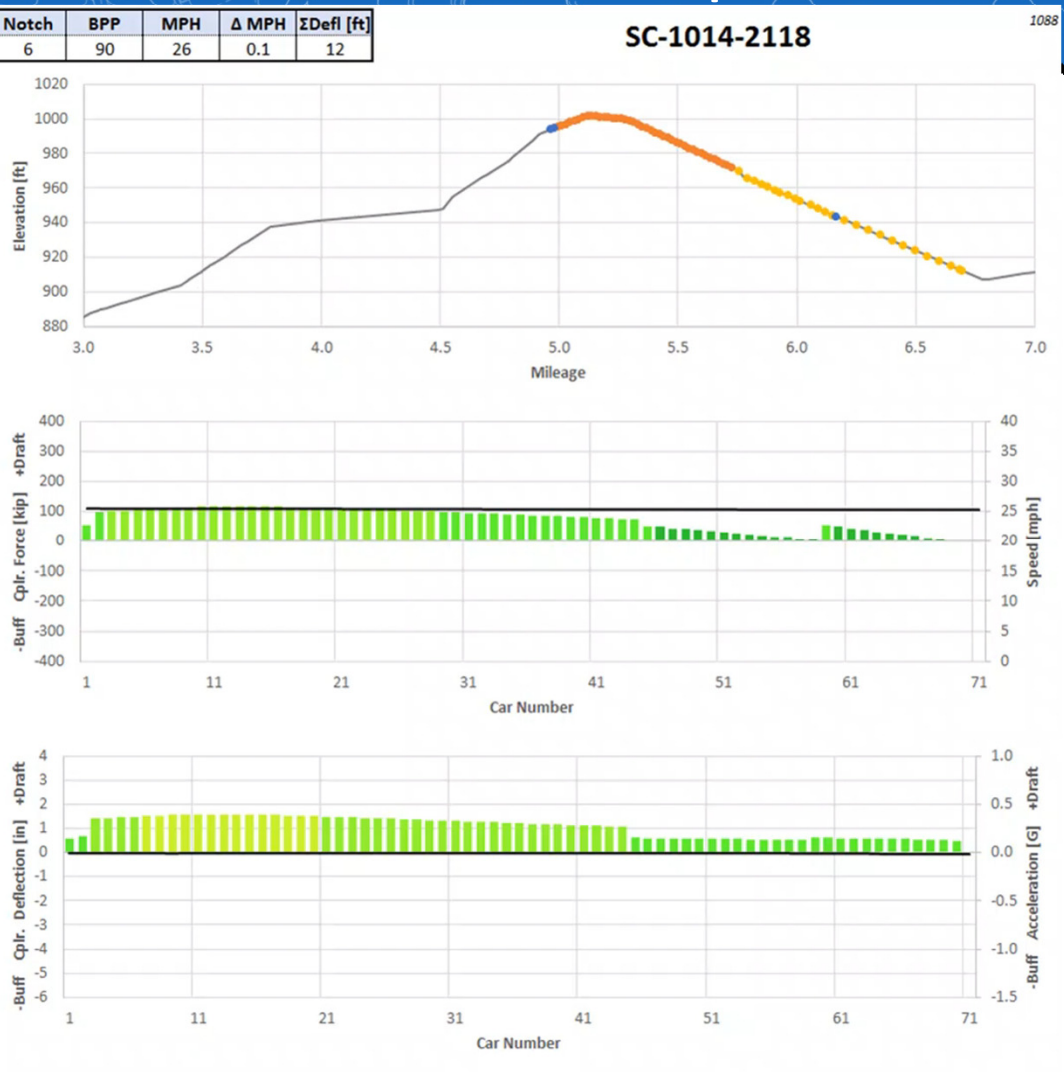
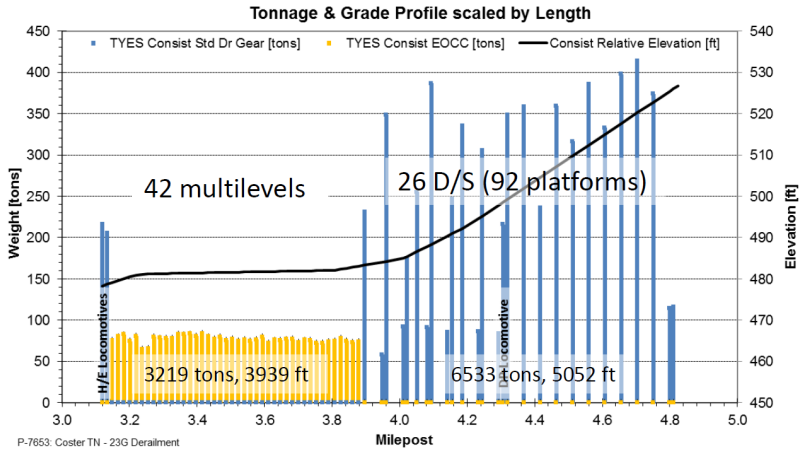
Notch	BPP	MPH	Δ MPH	ΣDefl [ft]
6	90	26	0.1	12



Auto racks and double-stacks
2x1 Mid-train distributed power
68 loaded cars, 0 empty = 9,752 tons & 9,211 ft
Selective Cushioning Unit on 42 cars

Prevents low-force run-in and run-out.
Avoids large buff forces and associated damage.



What about other draft systems?

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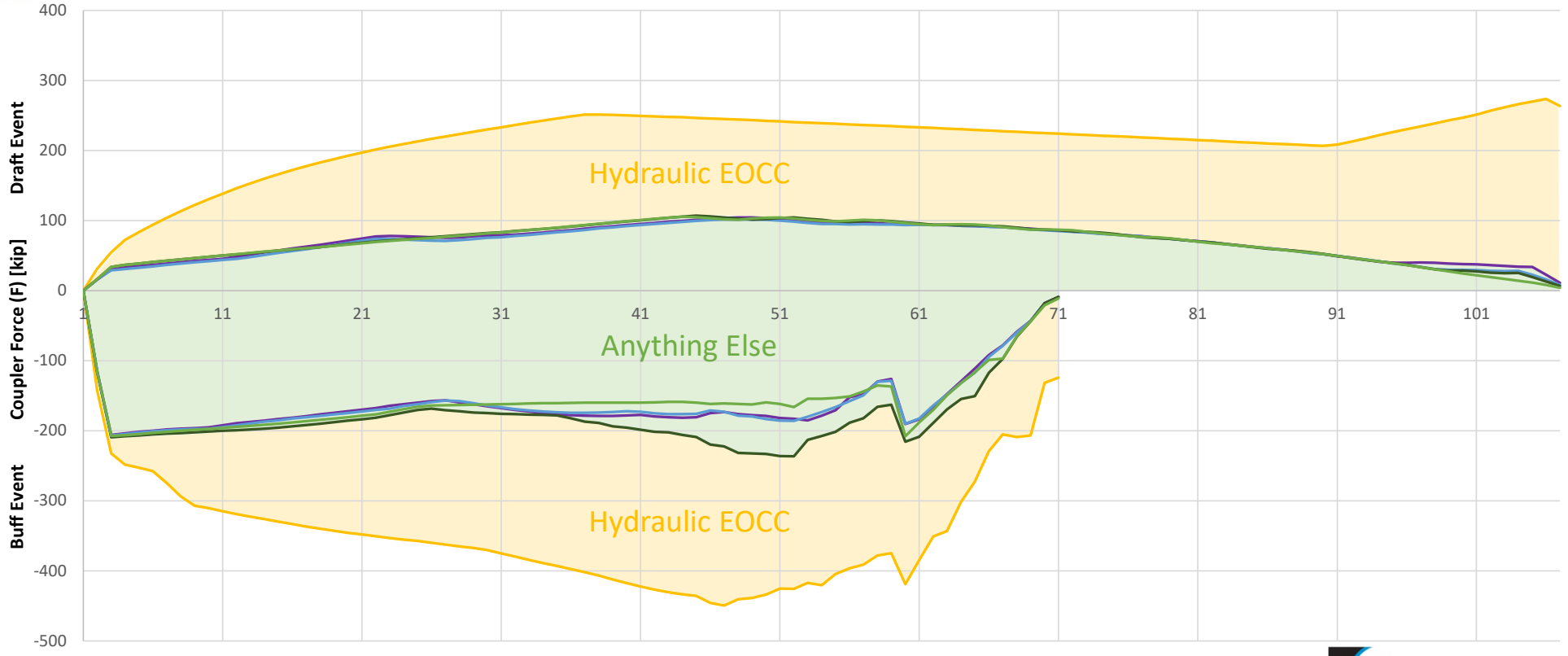

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Over-the-Road vs. Yard Impact

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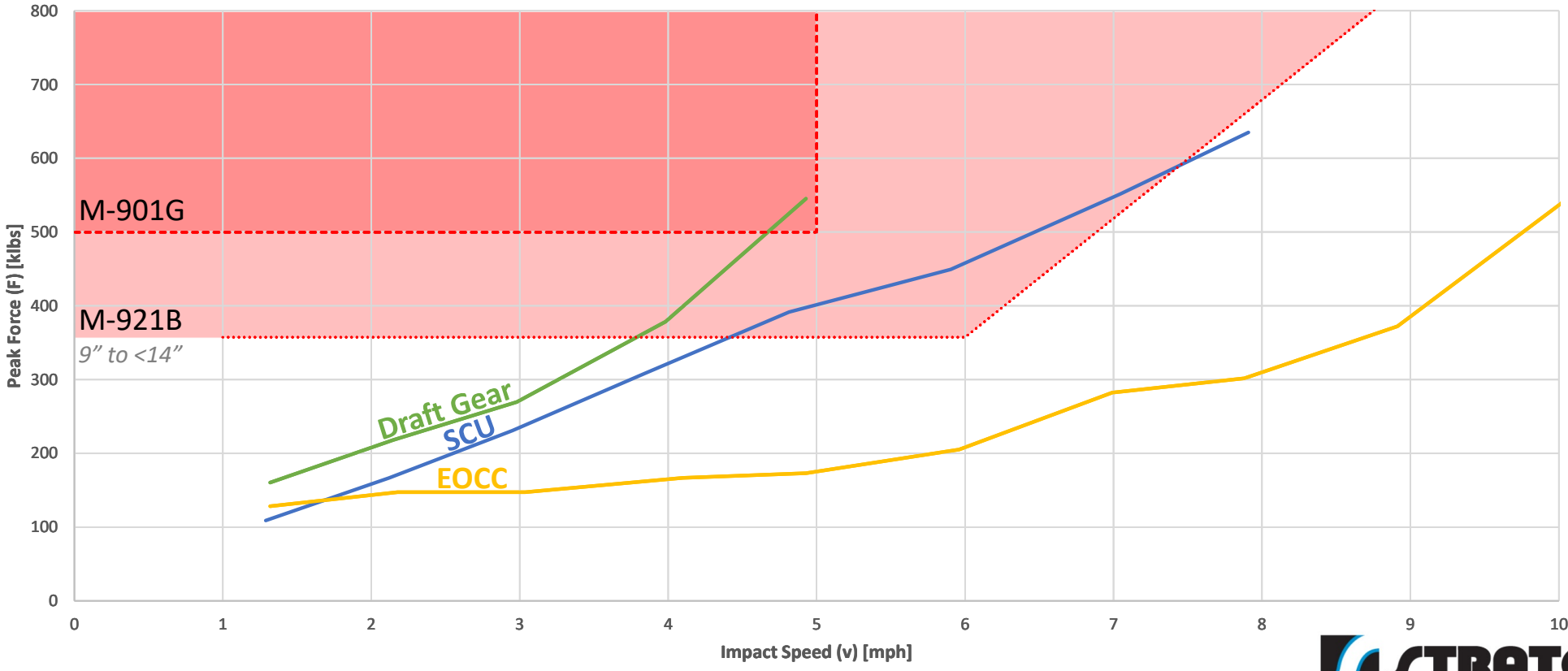
Tests stopped before 3G



Selective Cushioning Unit

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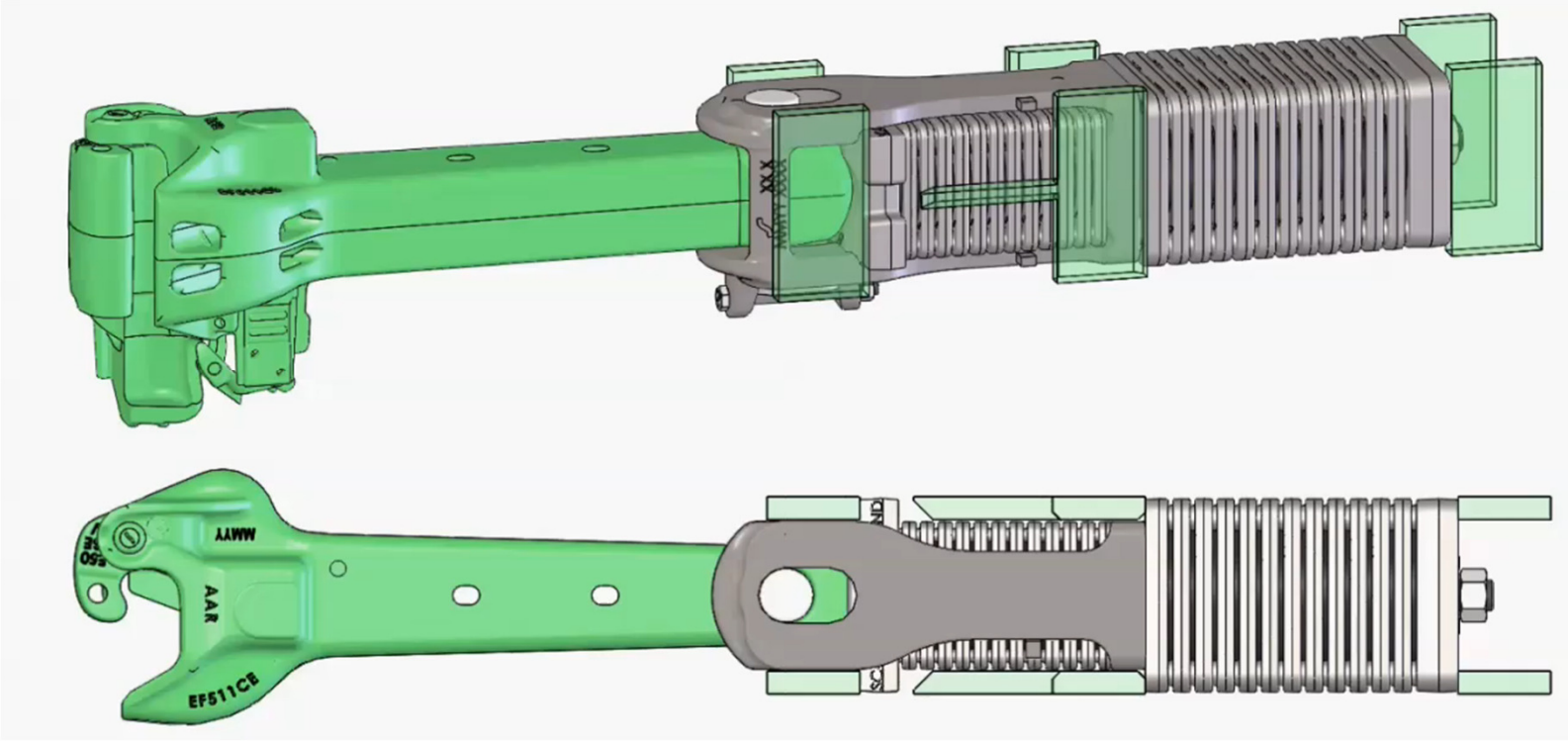
Highest capacity non-hydraulic draft system



Actively neutral-seeking
Solid-state design

AAR Conditional Approval
5+ years of field service data

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Selective Cushioning Unit

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Available in both E and F configurations for any pocket style.

Part of the ongoing need to revisit equipment standards for the demands of current and future operations.

Jonathan Sunde
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Thank you

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