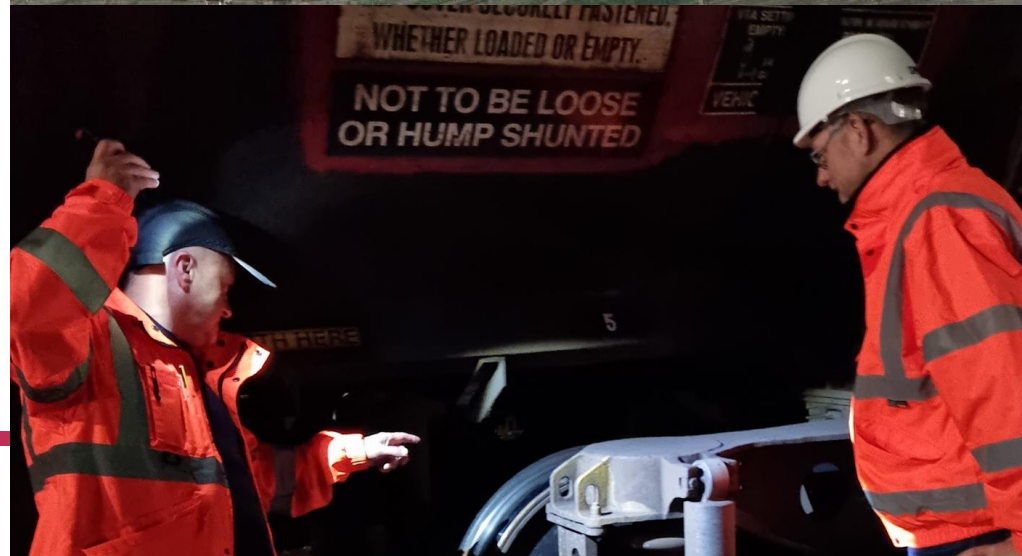
Human Factors in Freight Train Preparation: Current challenges and Future Directions

Dr David Golightly, School of Engineering, Newcastle University
David Ethell, David Ethell Consulting



Aim

- Consolidate published and ongoing work from Newcastle University in HF in the Freight Yard
- Raise the profile of this critical area for freight, and human factors

Motivation

- Critical importance of rail freight
- Safety (for people, for delivery)
- Condition of freight vehicles on the network
  - Importing risk onto the network
- Human performance is key to freight tasks
- Lack of systematic analysis

IRSC Spain

A STRUCTURED INCIDENT ANALYSIS OF HUMAN PERFORMANCE IN FREIGHT TRAIN PREPARATION

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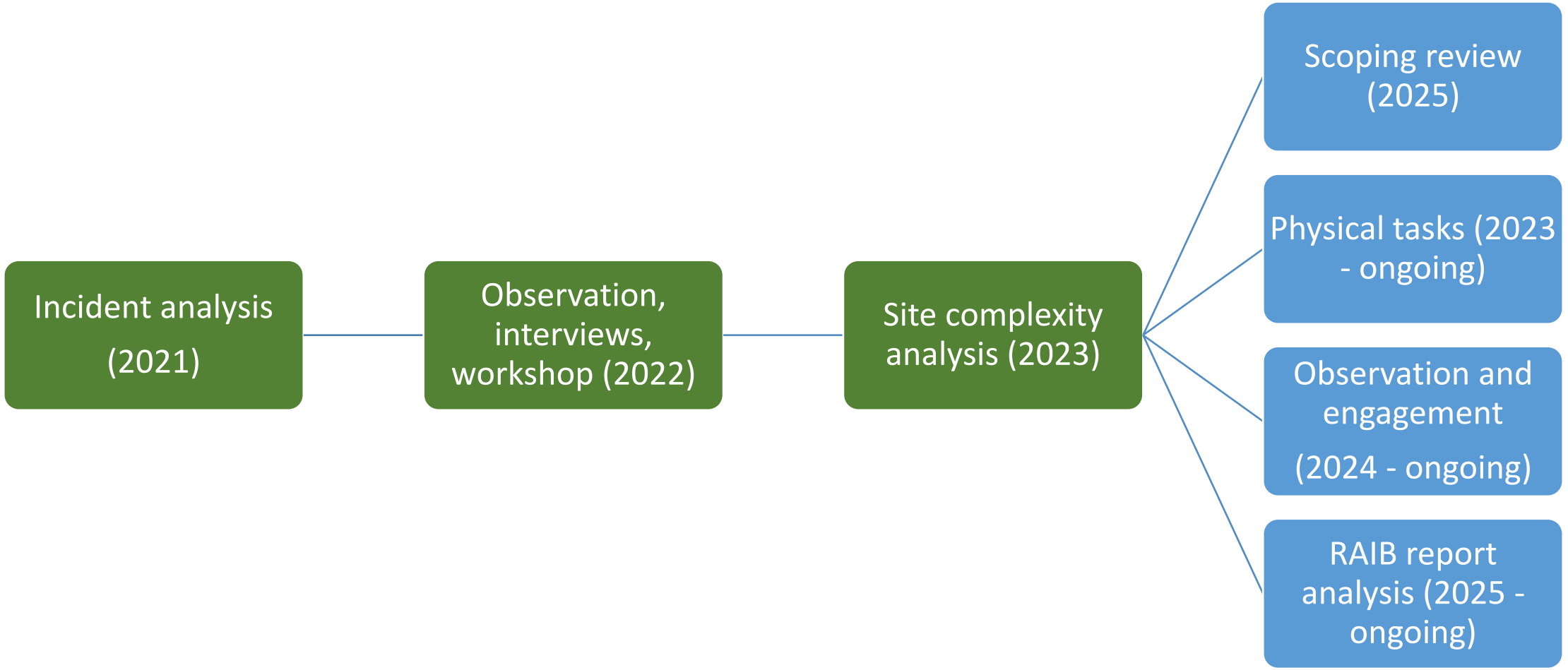
ABSTRACT

The condition of rail freight vehicles entering the network is a concern for the freight community. Human performance failures may be a significant source of operational risk. An analysis was performed of 31 freight preparation incident and accident reports. These reports were analysed using the Rail Safety and Standards Board (RSSB) Human Factors Framework. 27 of 31 reports included a significant human performance failure, identifying 45 human performance factors across the incidents, including 39 occurrences classified as a slip / lapse or decision-making failures. These were generally omissions of checks or actions to release brakes. 137 underpinning Incident Factors played a causal or contributory role. This included 'infrastructure, vehicles, equipment and clothing' (n = 43), including maintenance and equipment failure issues – primarily related to wagon condition - and design / usability issues related to a range of assets. Teamworking (8) and resourcing (17) issues were also present, which included factors related to inter-agency

Activities


Incident analysis (2021)
Observation, interviews, workshop (2022)
Site complexity analysis (2023)
Scoping review (2025)
Physical tasks (2023 - ongoing)
Observation and engagement (2024 - ongoing)
RAIB report analysis (2025 - ongoing)

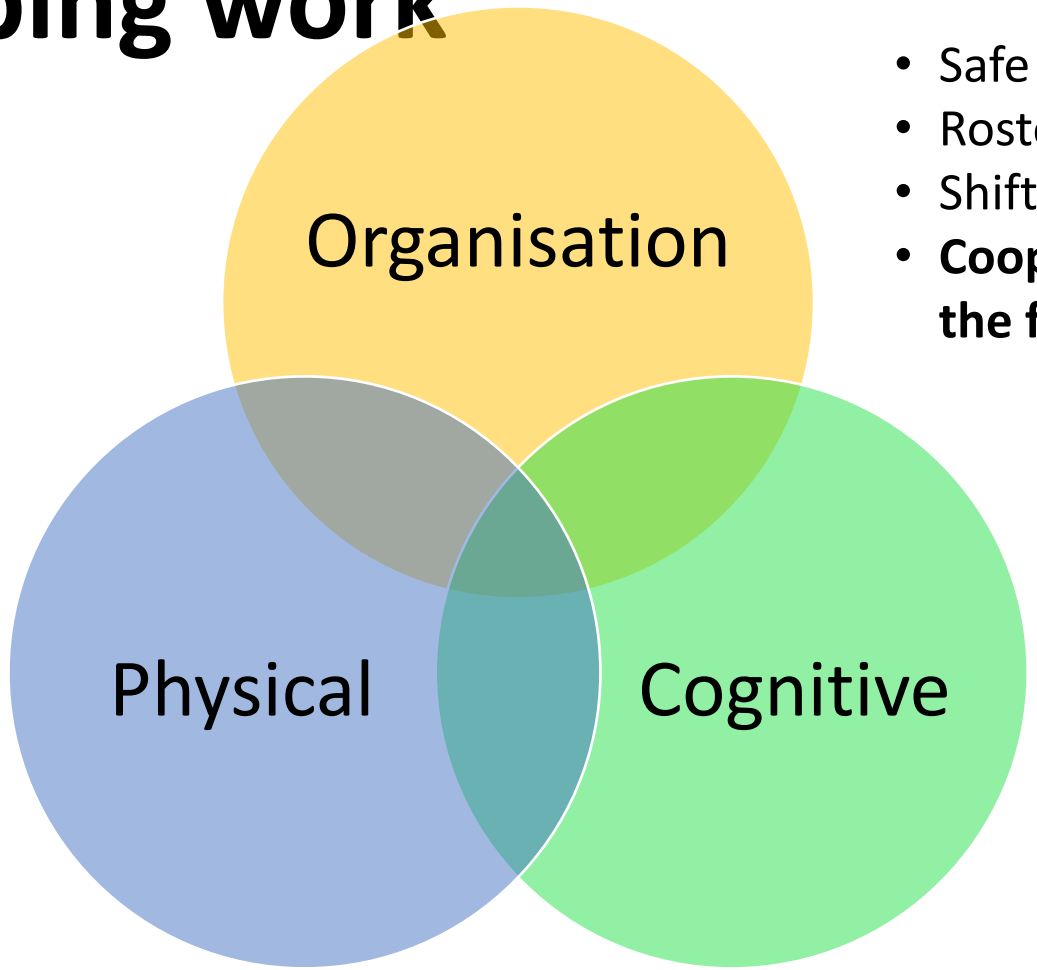
Freight yard

- In the UK
- £8bn industry; 75% growth by 2050
- c500+ sites
- c15000 operational wagons
- c3000 train moves per week between sites
- Unknown moves within sites

Role of groundstaff

- Stabling trains
- Preparing wagon and wagon loads
- Inspecting / checks wagons and whole trains
- Coupling and uncoupling
- Movements within the yard

Factors shaping work



- Safe working culture
- Rostering and resourcing
- Shift-work and fatigue management
- **Cooperation between third-parties in the freight yard**

- Coupling activities
- Working in cold / heat
- Lighting
- **Slips and trips; walking on ballast**

- Planning and **replanning** work for groundstaff
- Checking activities
- Remembering procedures
- Usability of planning and rostering tools

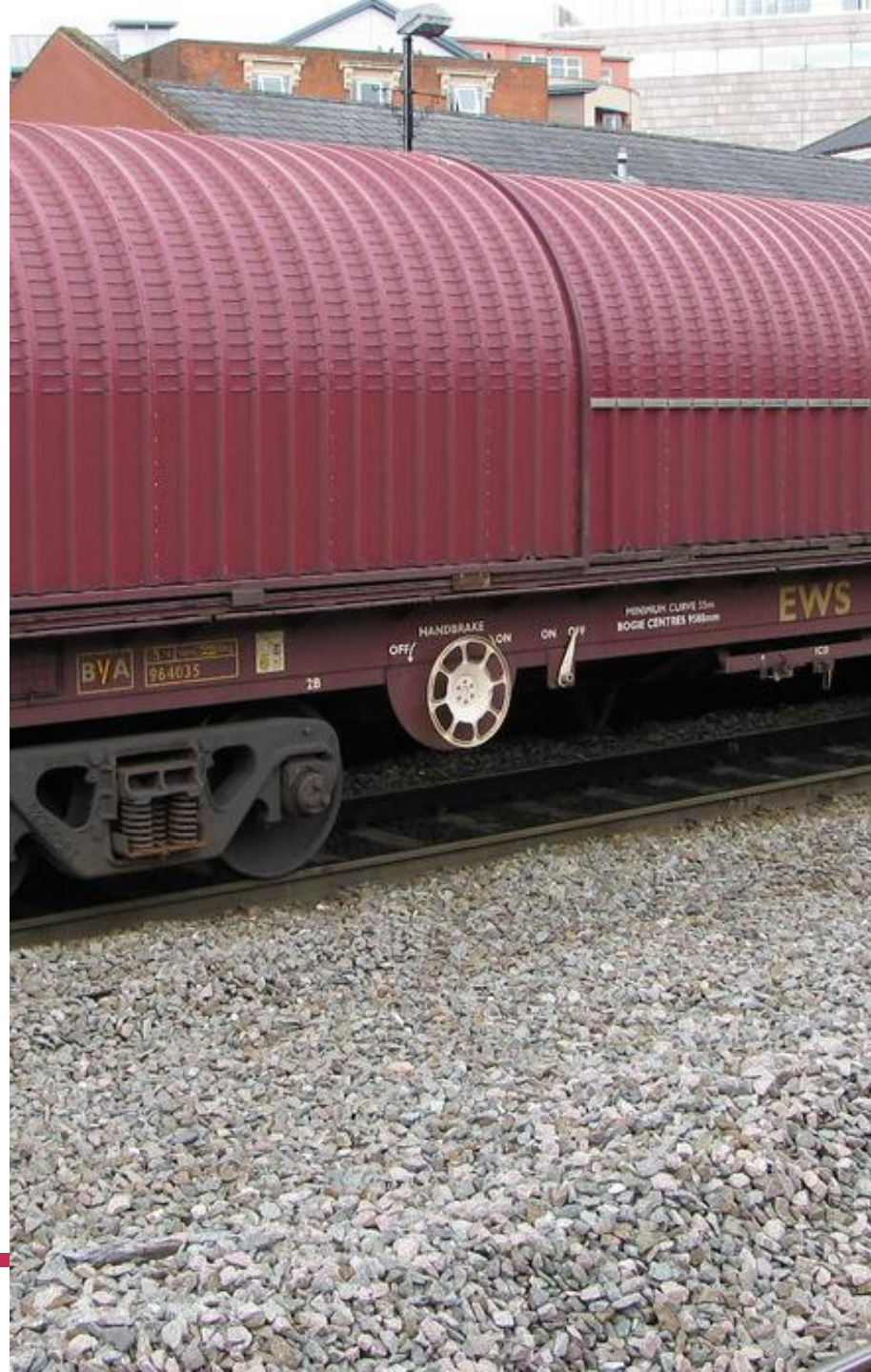
Scoping review

- Scoping review on rail freight ergonomics / human factors – 159 returns; 10 more from own sources and citations
- After deduplication and review around 15 look at the freight yard

- There isn't much!
- Yard work is highly variable
  - Location is key; country is key
- Time pressured work
  - Flexibility
- Highly tacit work – the importance of observation; cognitive task analysis
- Less systemic and formal methodology (eg HRA)

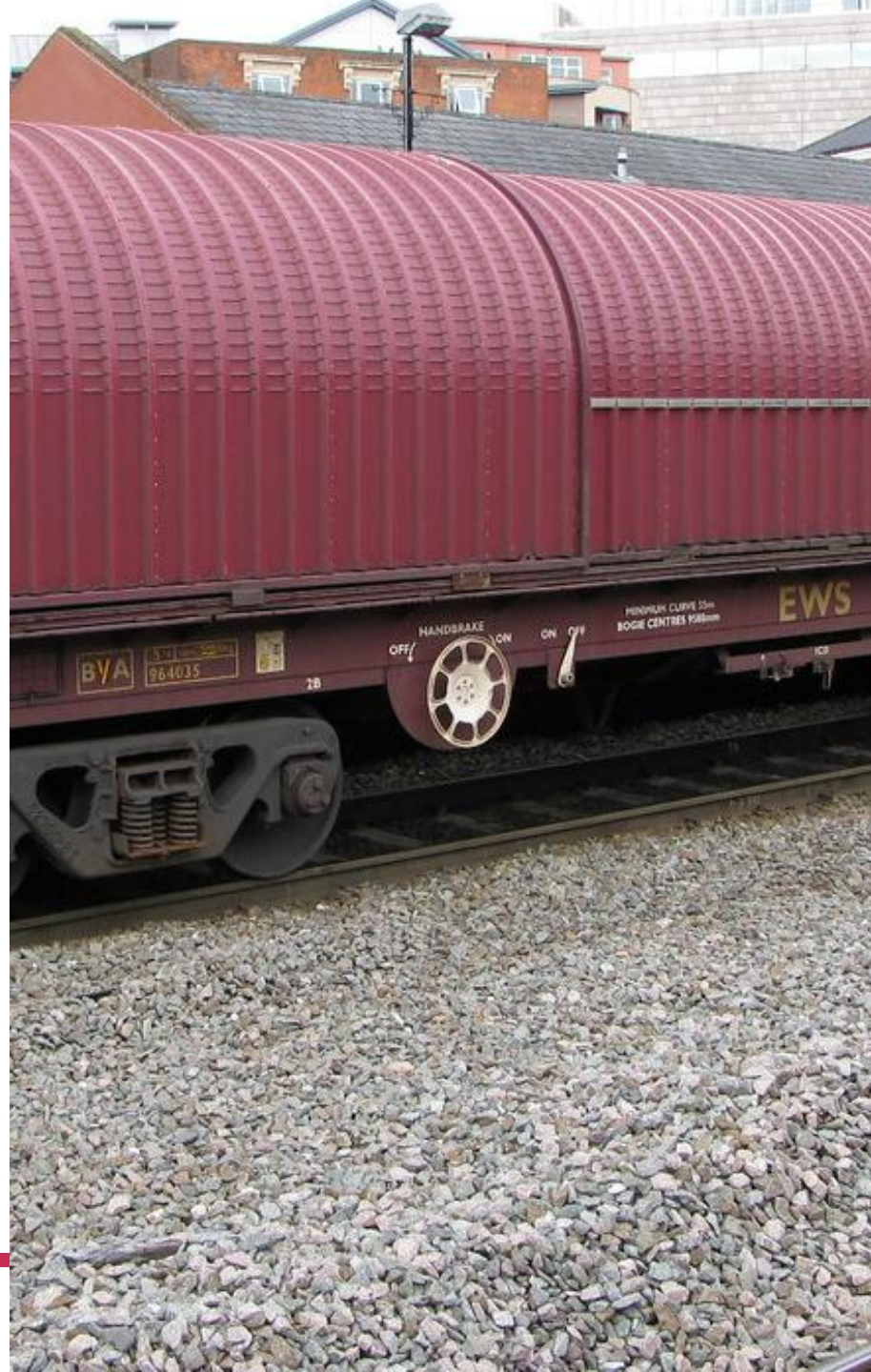
Physical tasks – The humble handbrake

- Secures the wagon
- Secures the whole train depending on SSOW
- Failure to apply
  - Runaways
- Failure to release
  - Flats and derailments



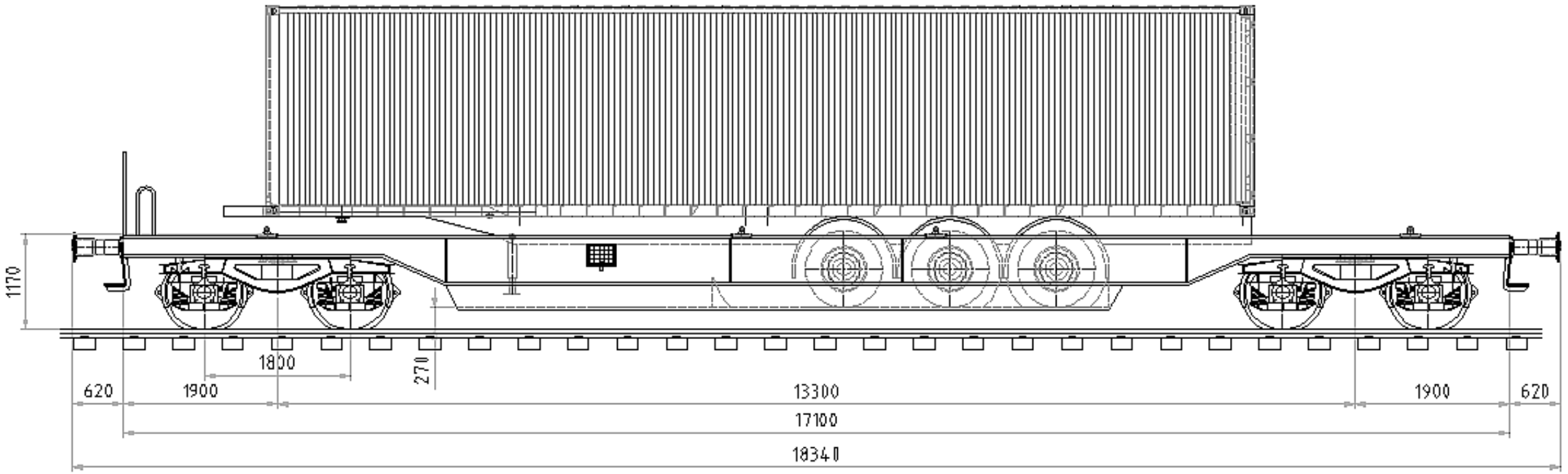
Operation

- 250N force
  - Inconsistent
- Faulty mechanisms
- Large differences in diameter (20cm – 60m)
- Large difference in height (50cm – 150cm)
- Multiple turns
- REBA scores indicating risk (5 – 6)
  - But other operations have higher REBA scores
- Importance of technique
- Variation in the same yard; on the same train




LA POSTA
DIE POST
Qui va bon train ?
CFF Cargo
83 85 493 3 052-3
SBB-FFS

Where did the ergonomics go?



Observations of work

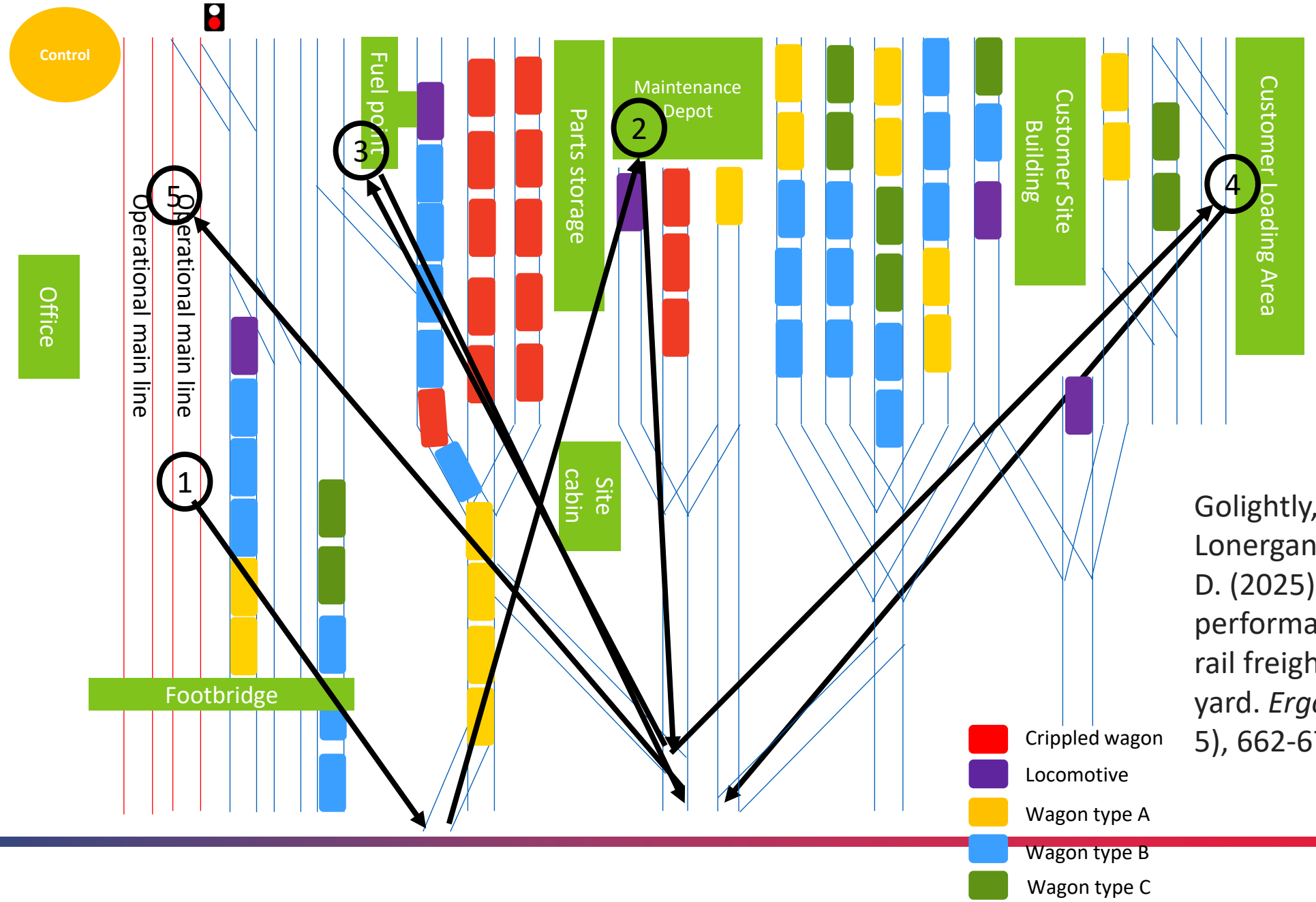
- Fluid combination of multiple tasks

(based on observational work in 2022 / 2023)

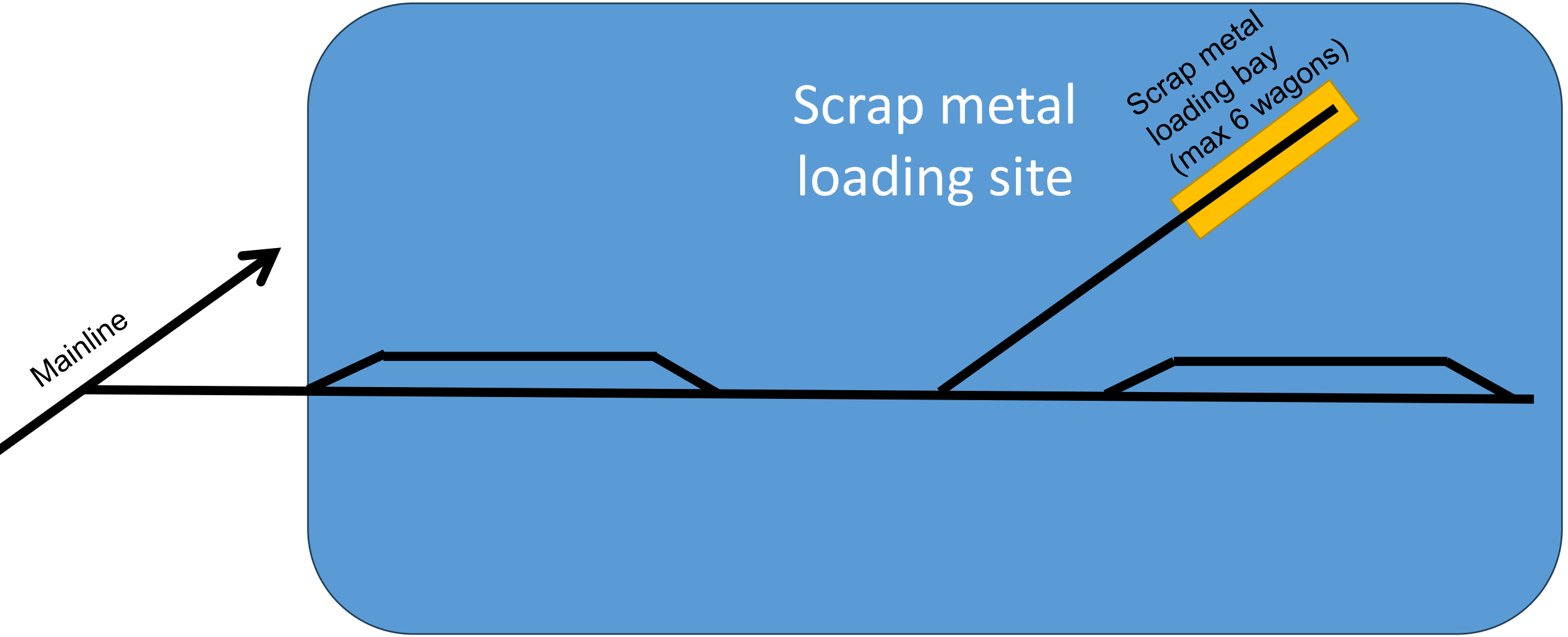
Versus

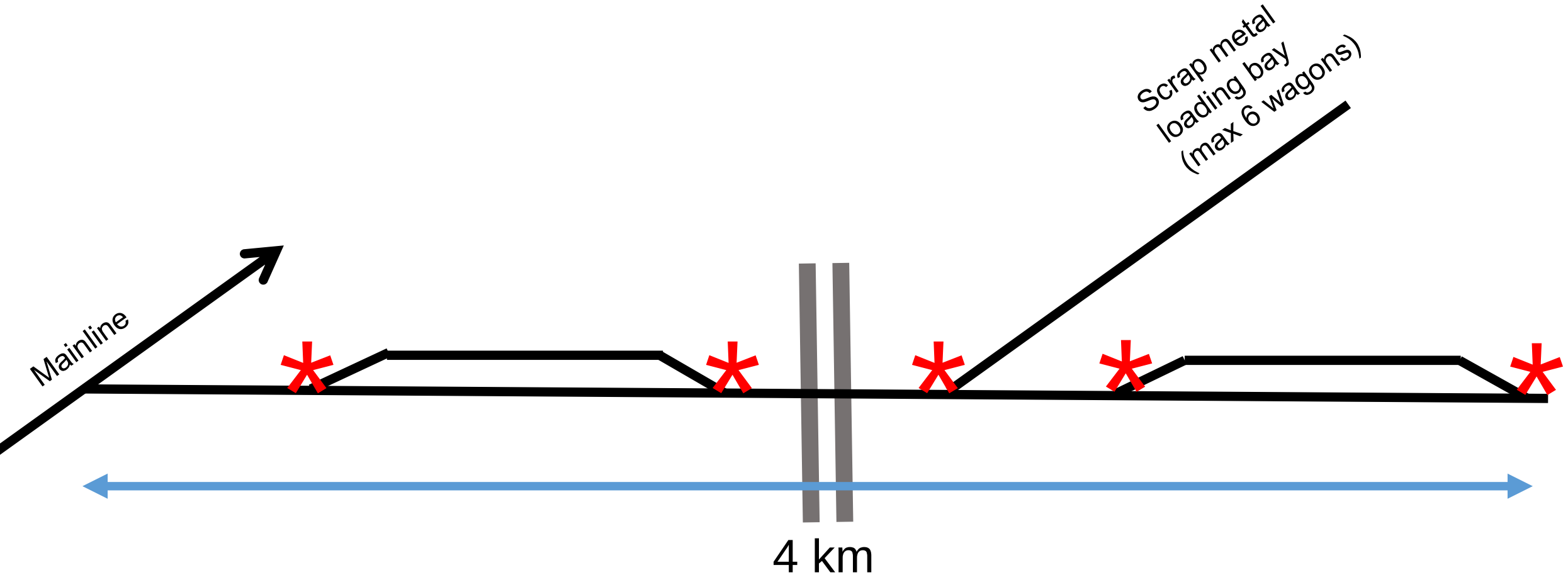
- Set sequences of complicated tasks, high volume of actions

(recent observational work + structured walkthrough)

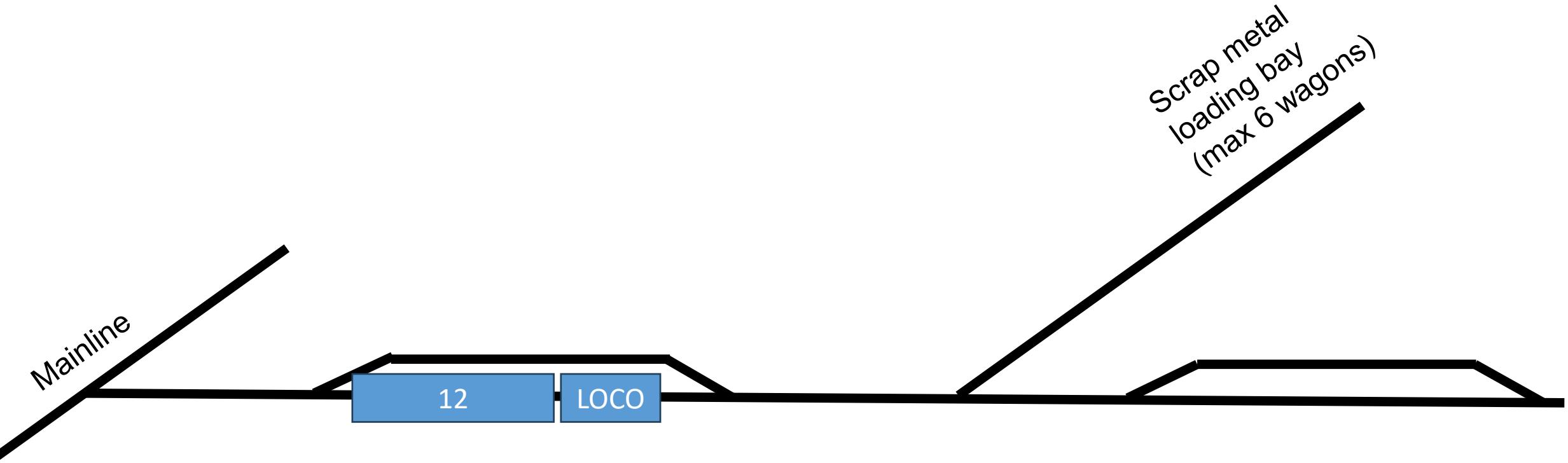


Golightly, D., Lonergan, J., & Ethell, D. (2025). Human performance in the rail freight yard. *Ergonomics*, *68*(5), 662-672.

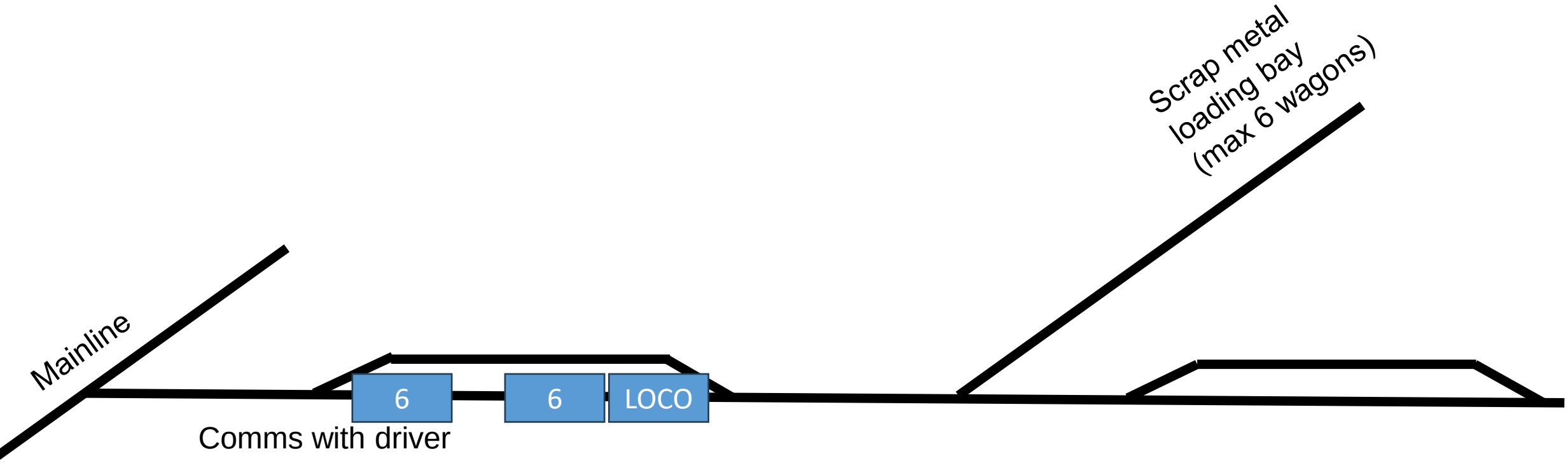

Scrap metal loading site
Scrap metal loading bay (max 6 wagons)
Mainline



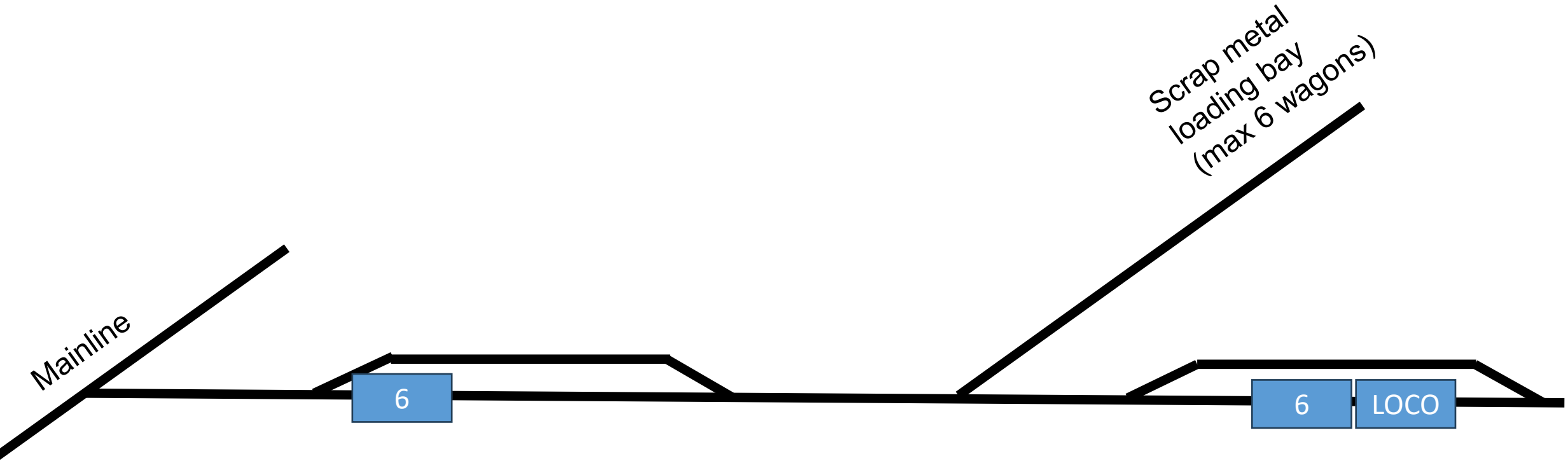
- Only the scrap metal bay is lit and covered
- Poor quality walking routes and ballast



Receive the train
Set traps
Comms with driver



Comms with driver
Get under buffers
Release air
Uncouple brake pipe and store
Uncouple wagons and store
Out from under buffers
Potential handbrake
Visual check
Comms with driver


Scrap metal
loading bay
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Mainline
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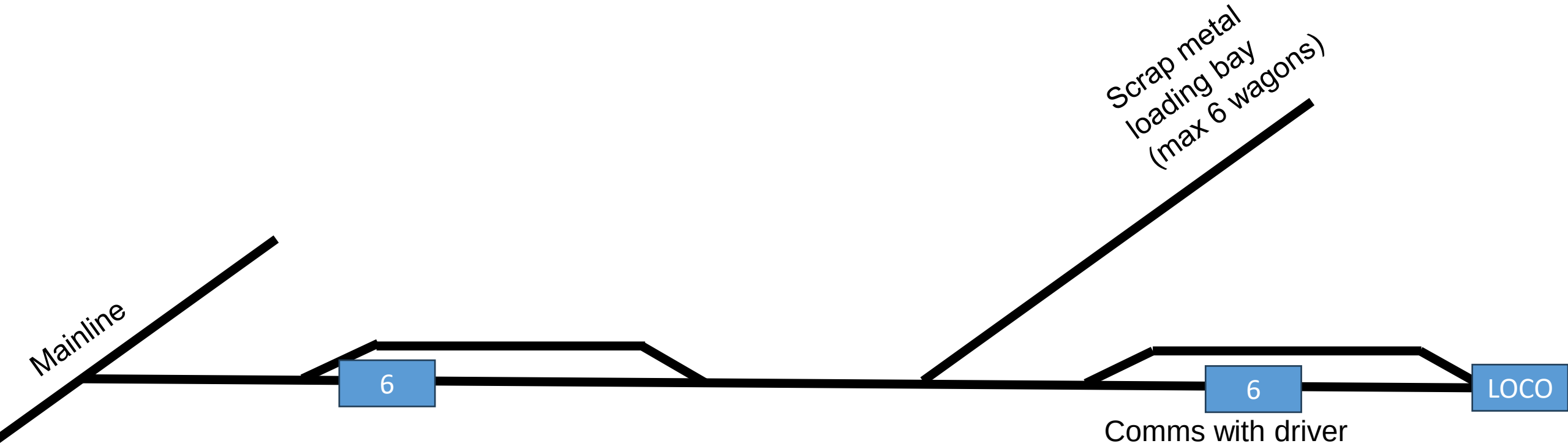
LOCO



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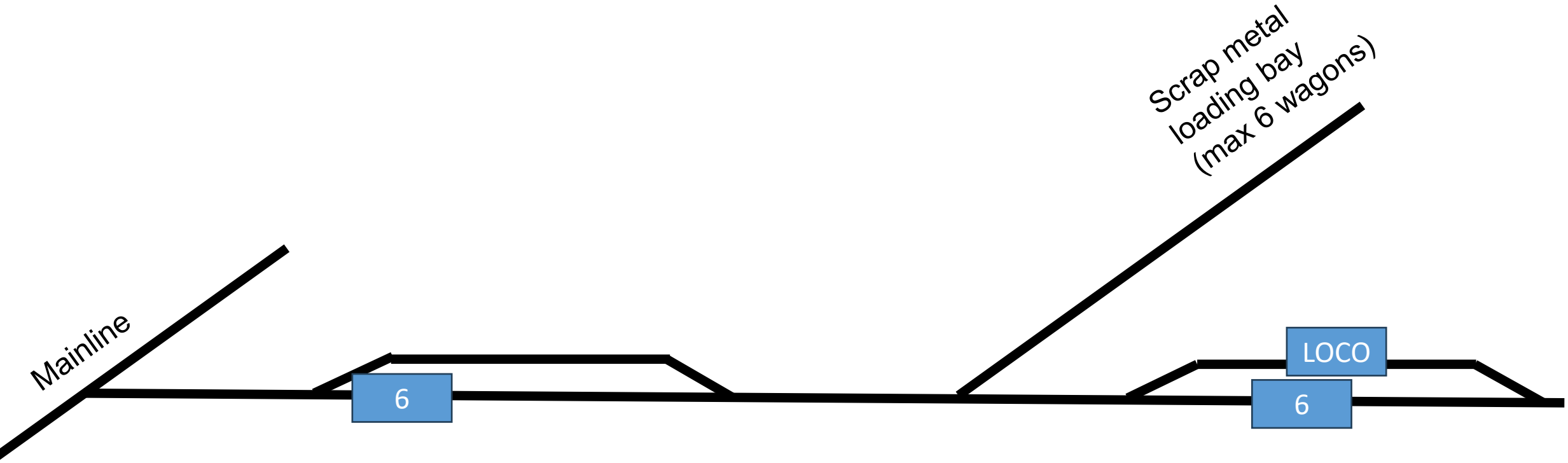
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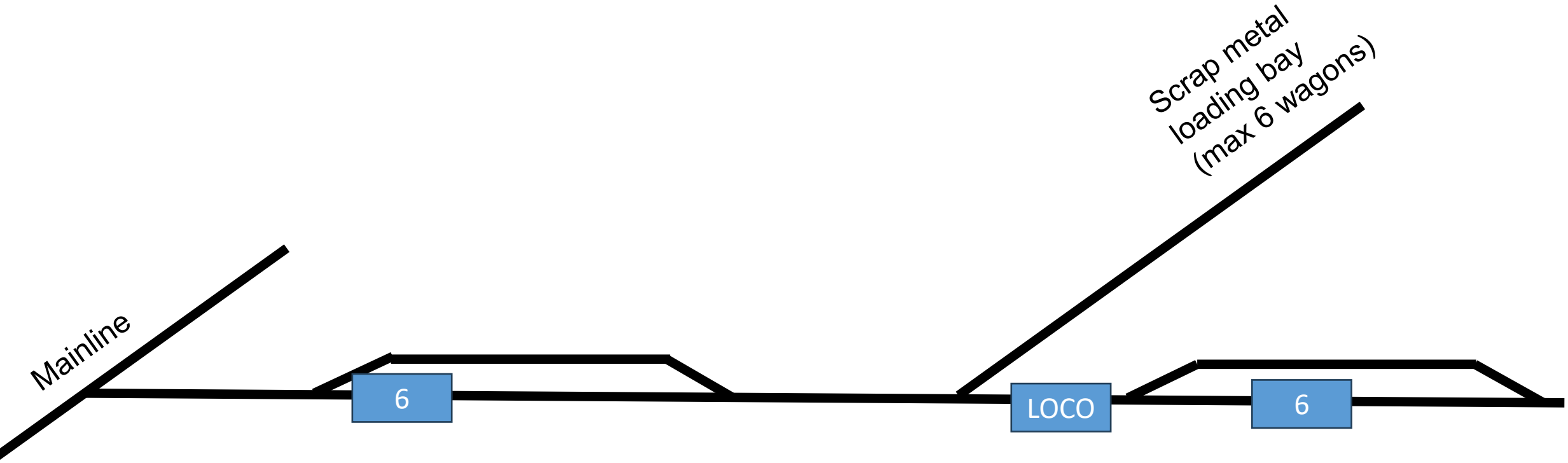
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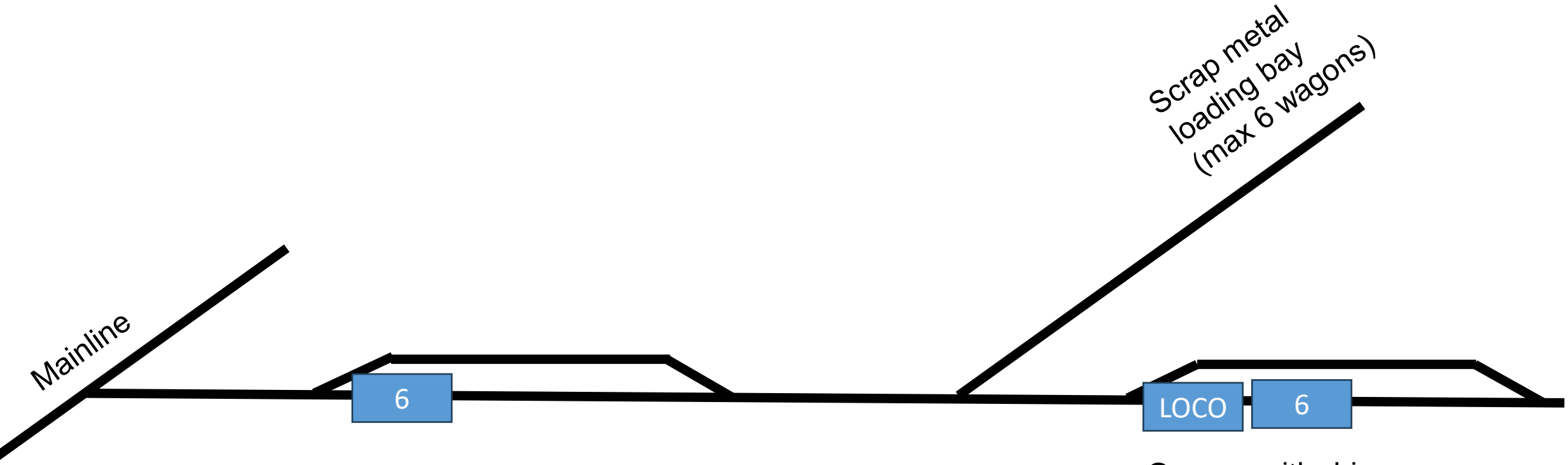

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Potential release handbrake
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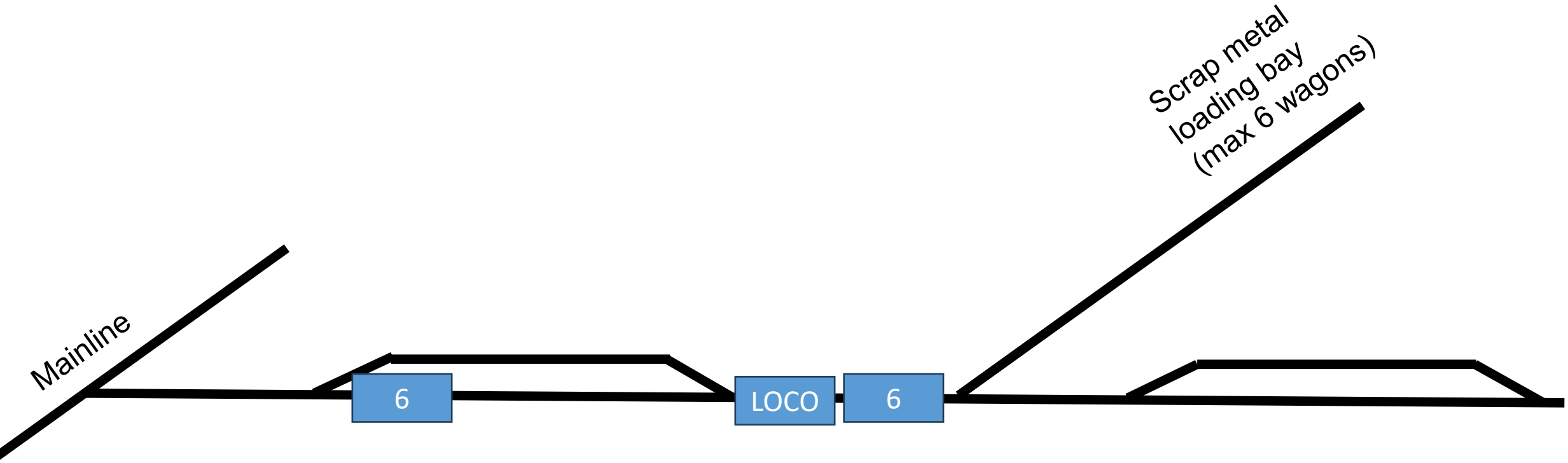
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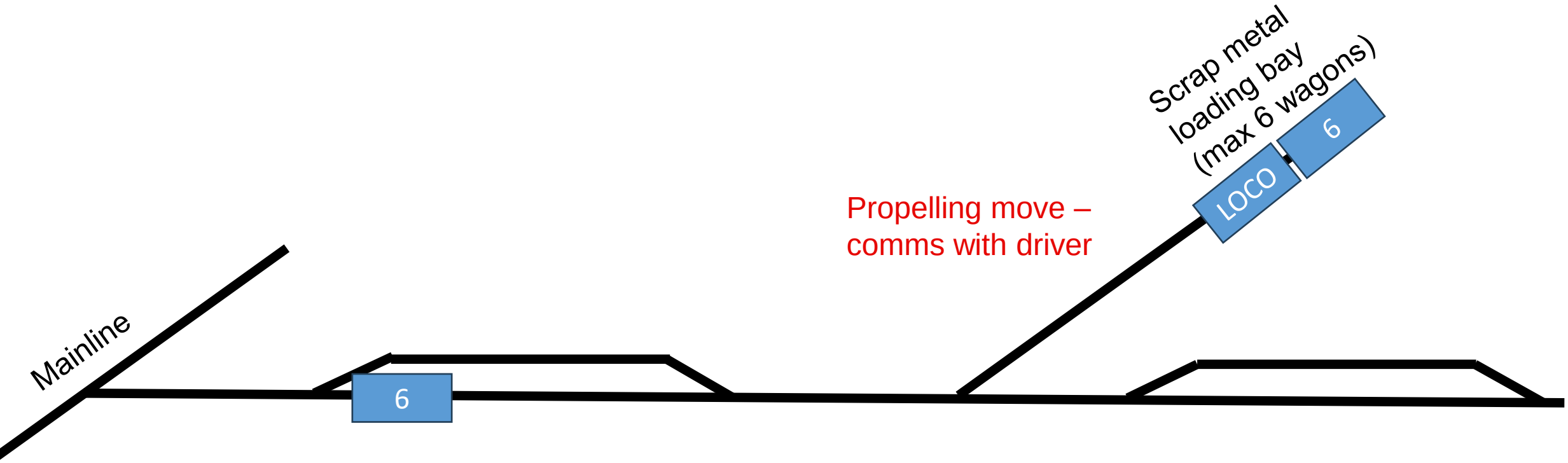
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LOCO
Propelling move –
comms with driver
Mainline
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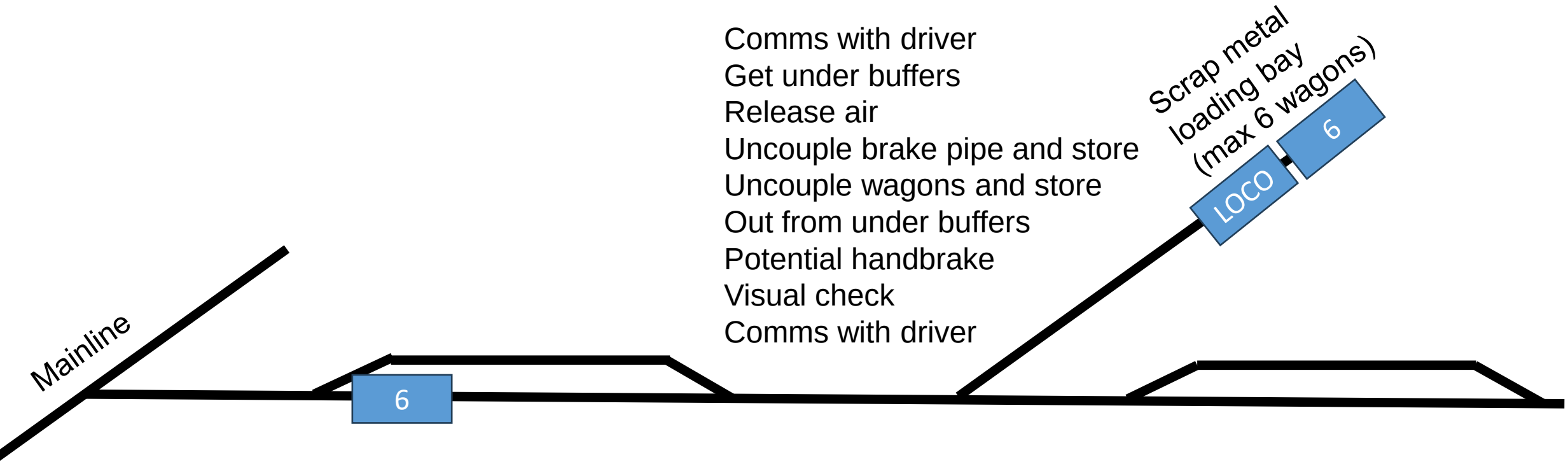

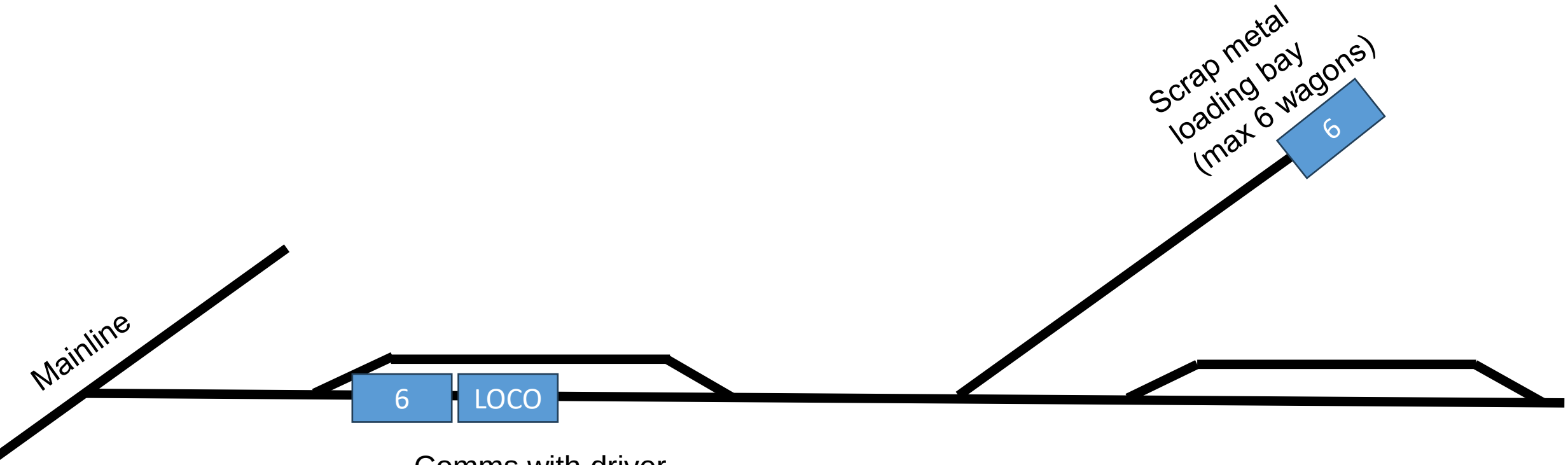

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Visual check
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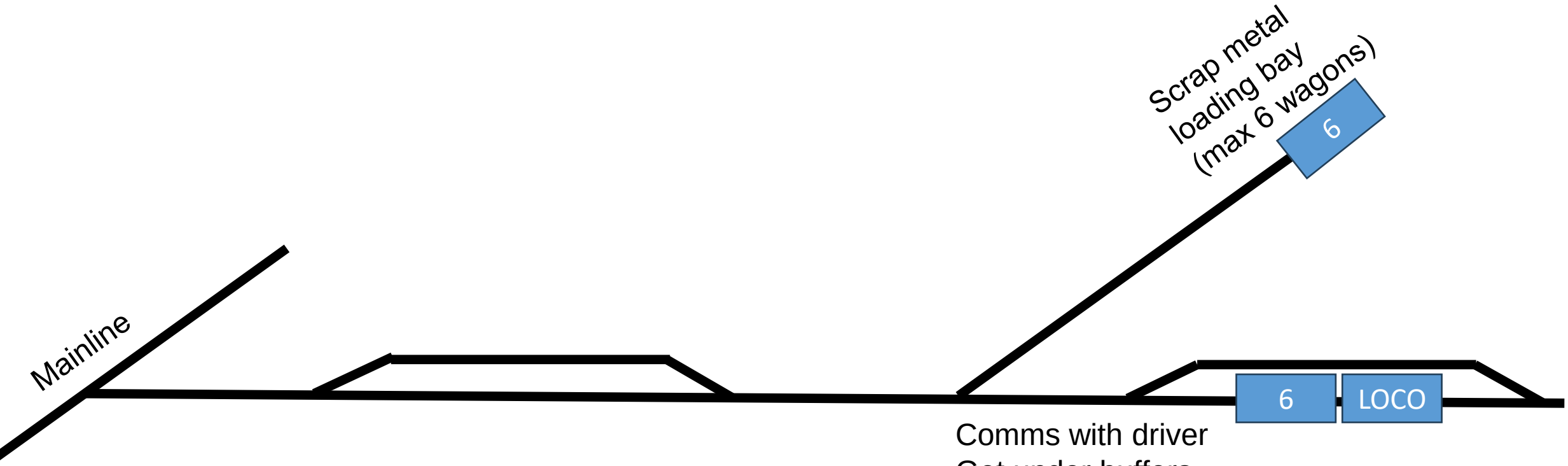

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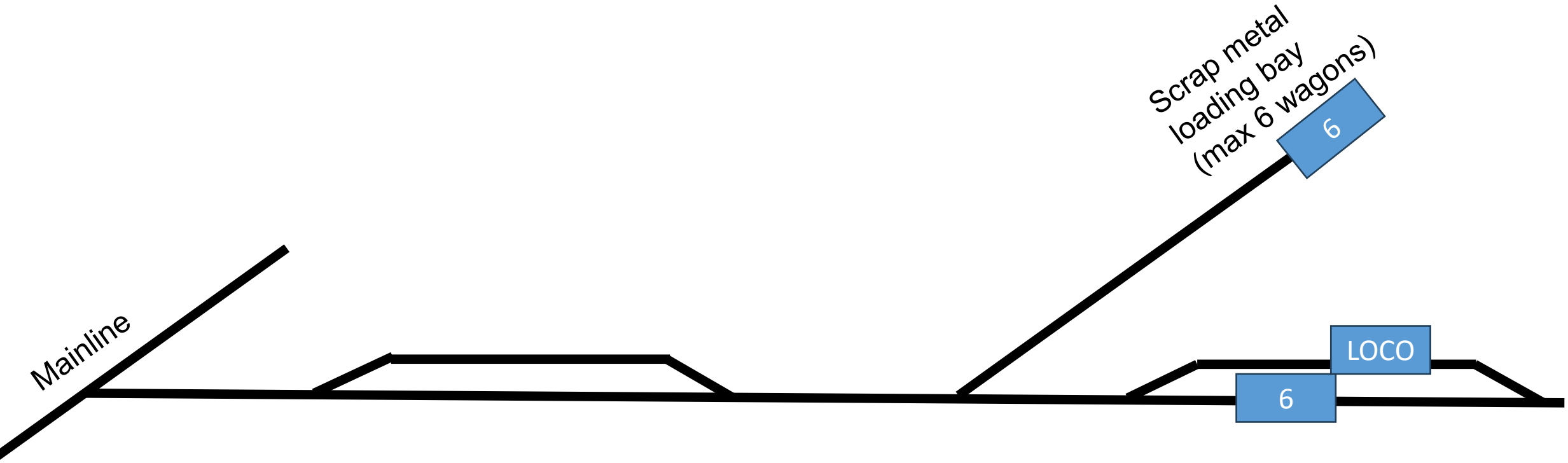
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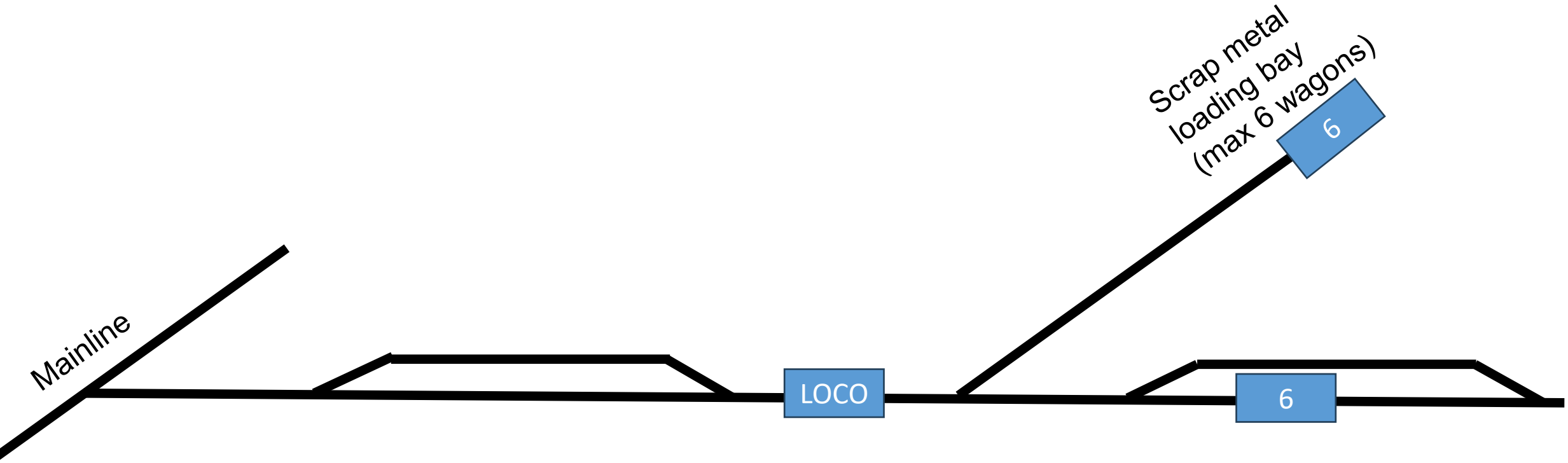
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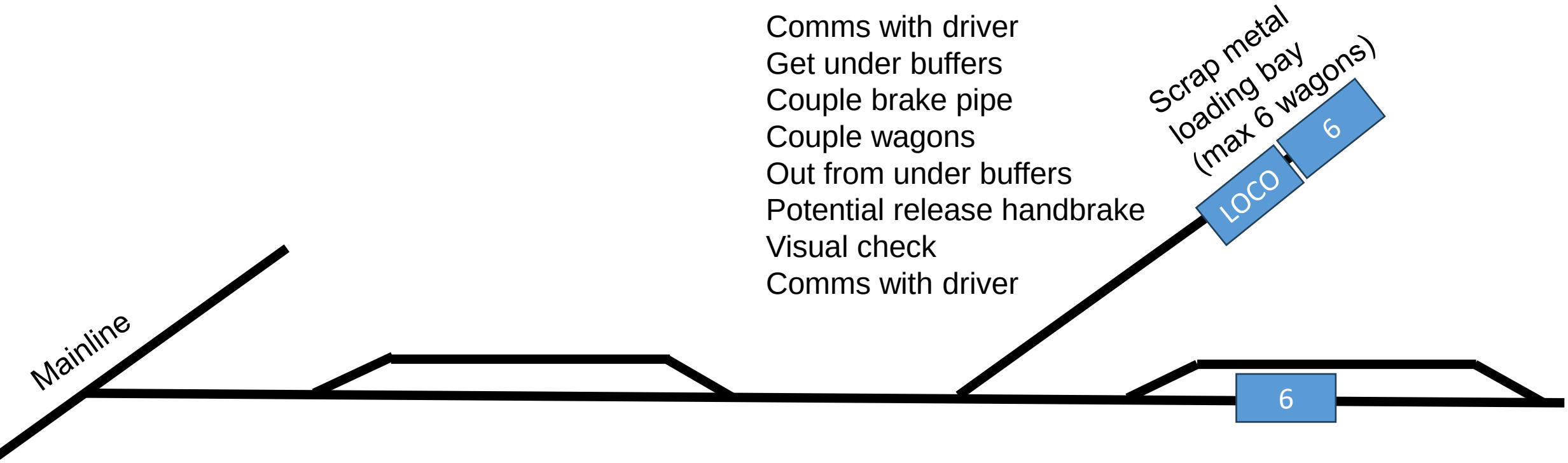

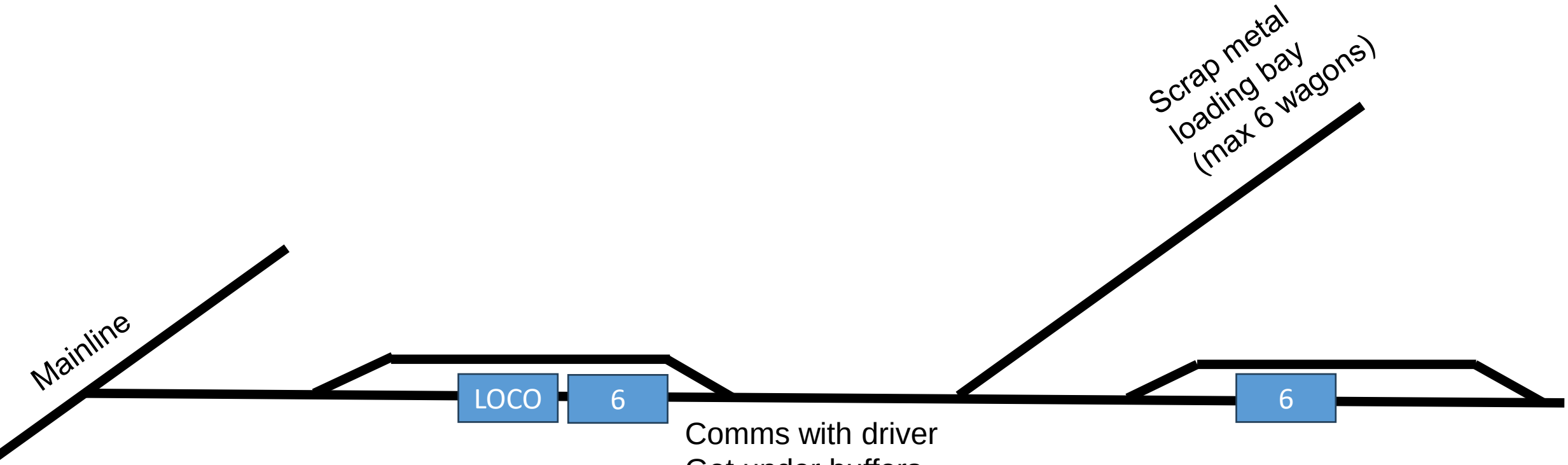

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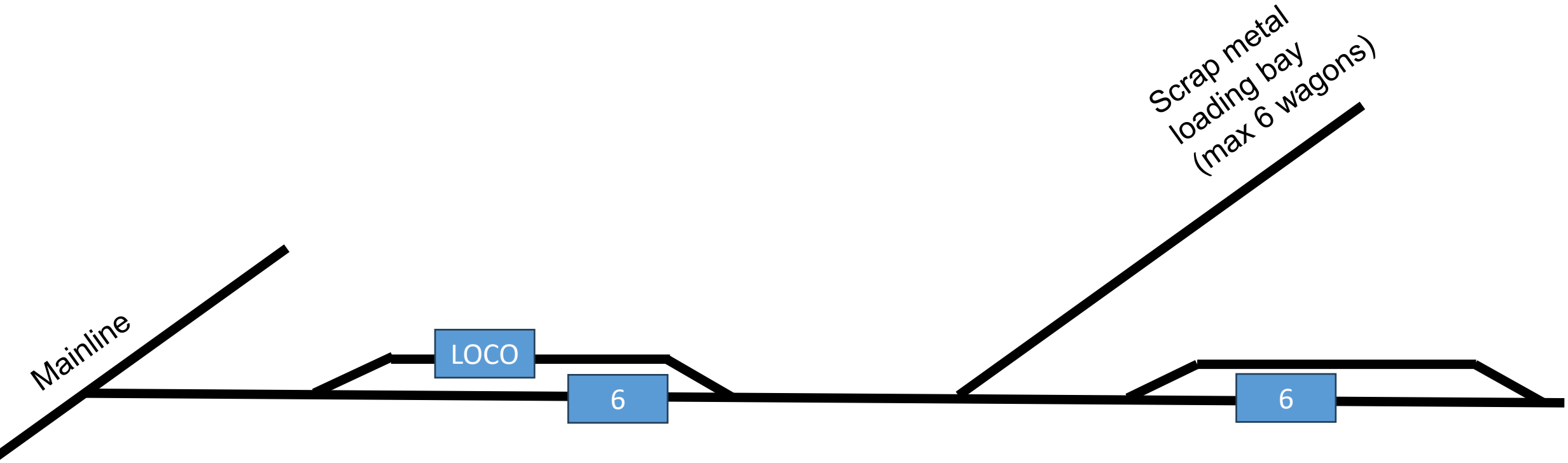
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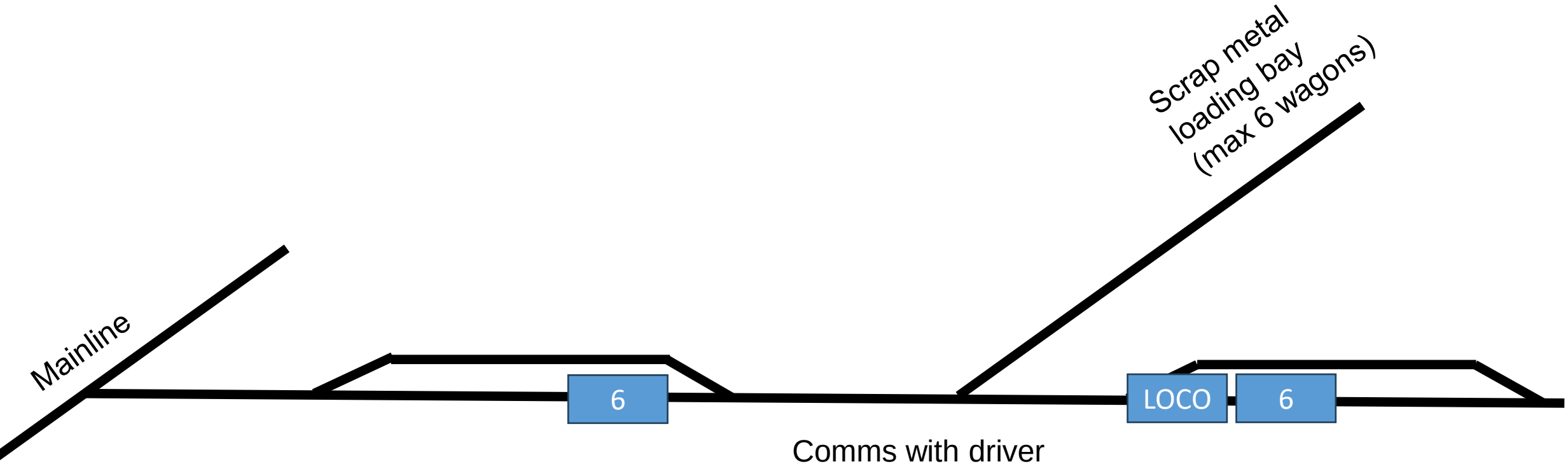

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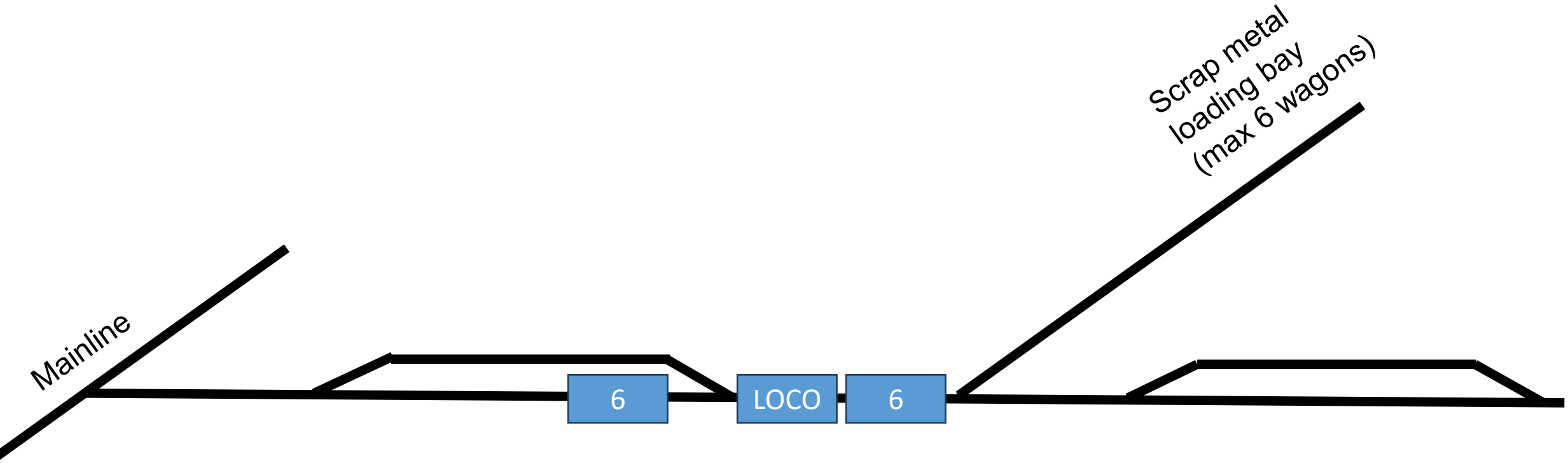
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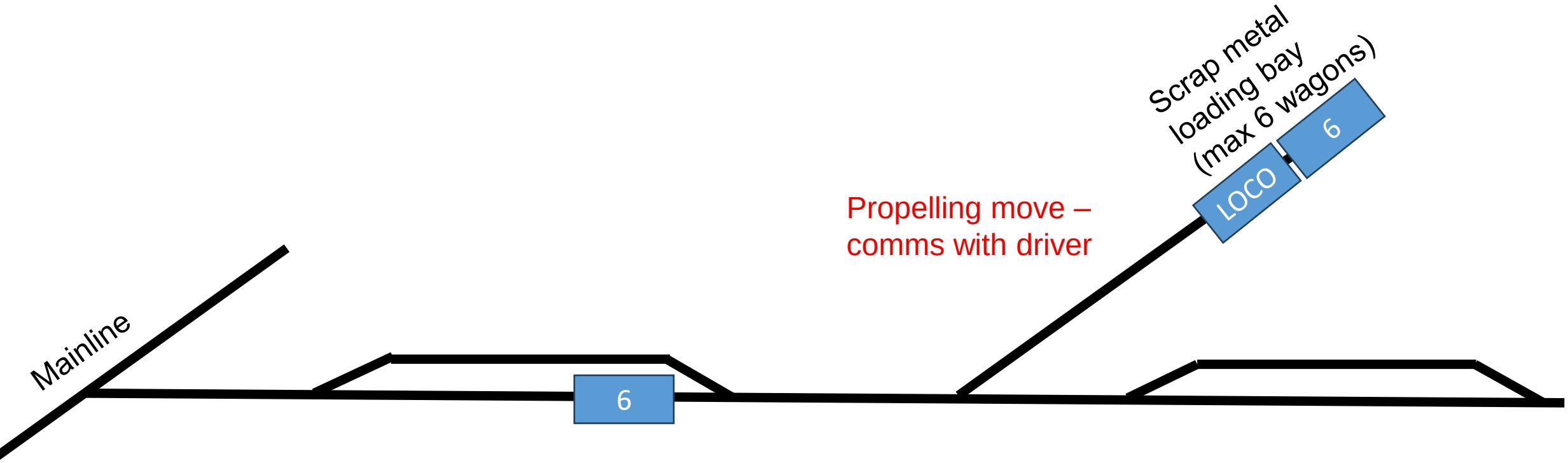
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LOCO
Propelling move –
comms with driver
Mainline
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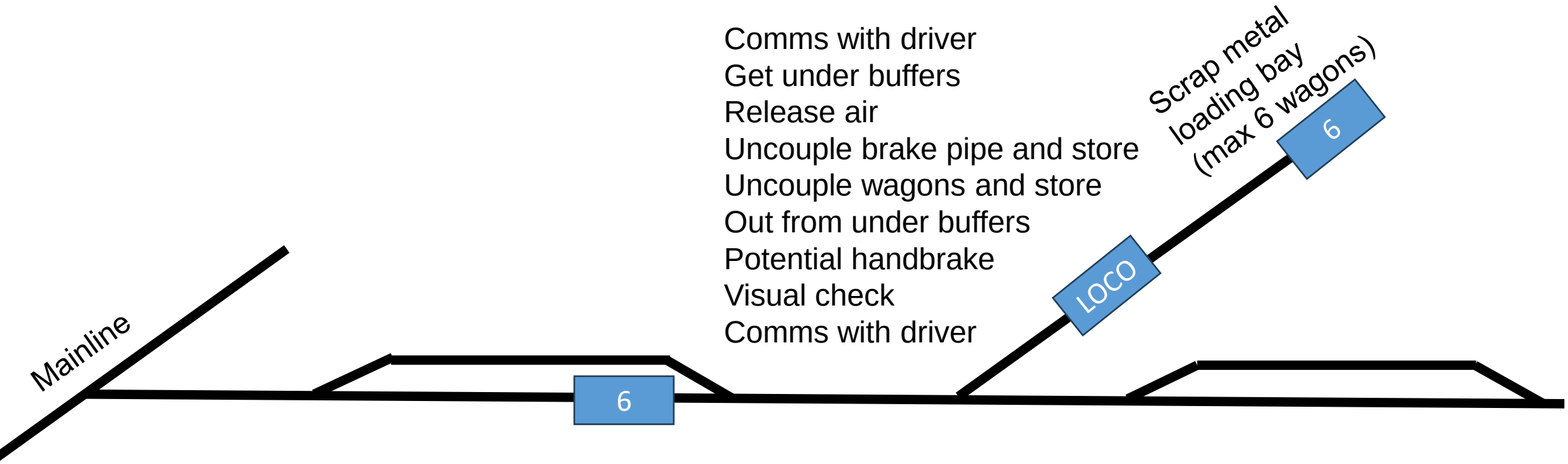

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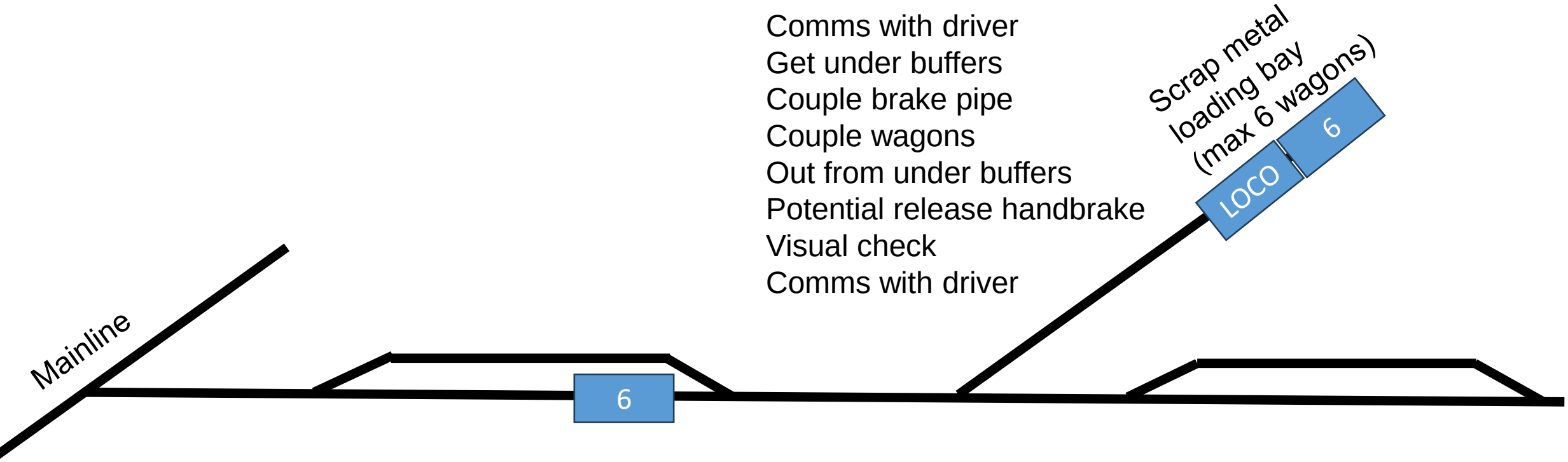

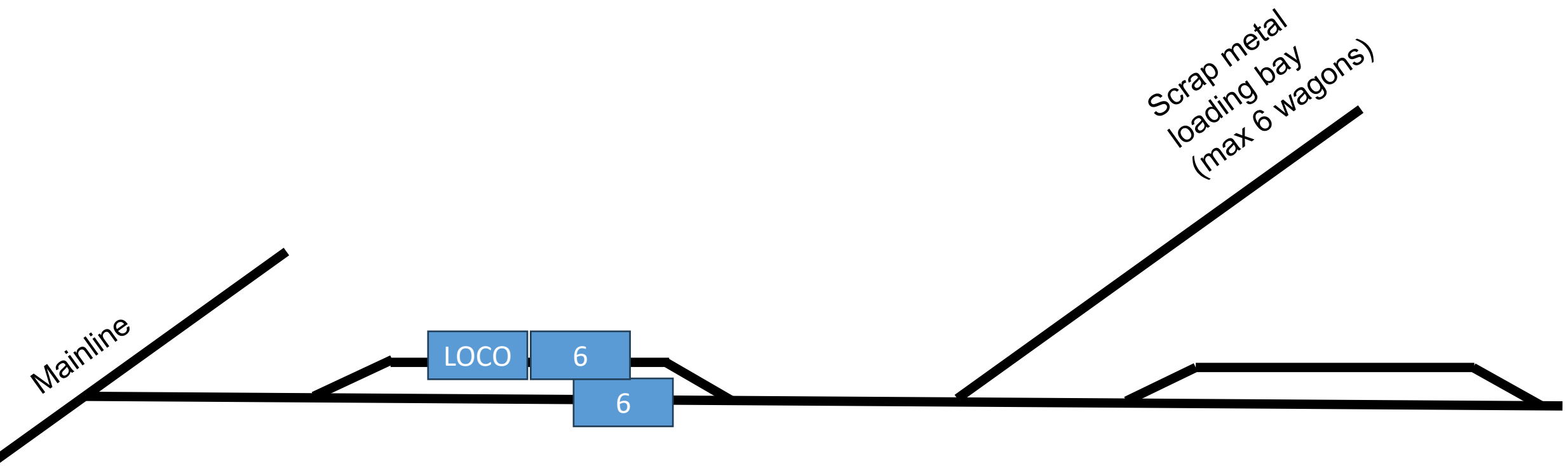
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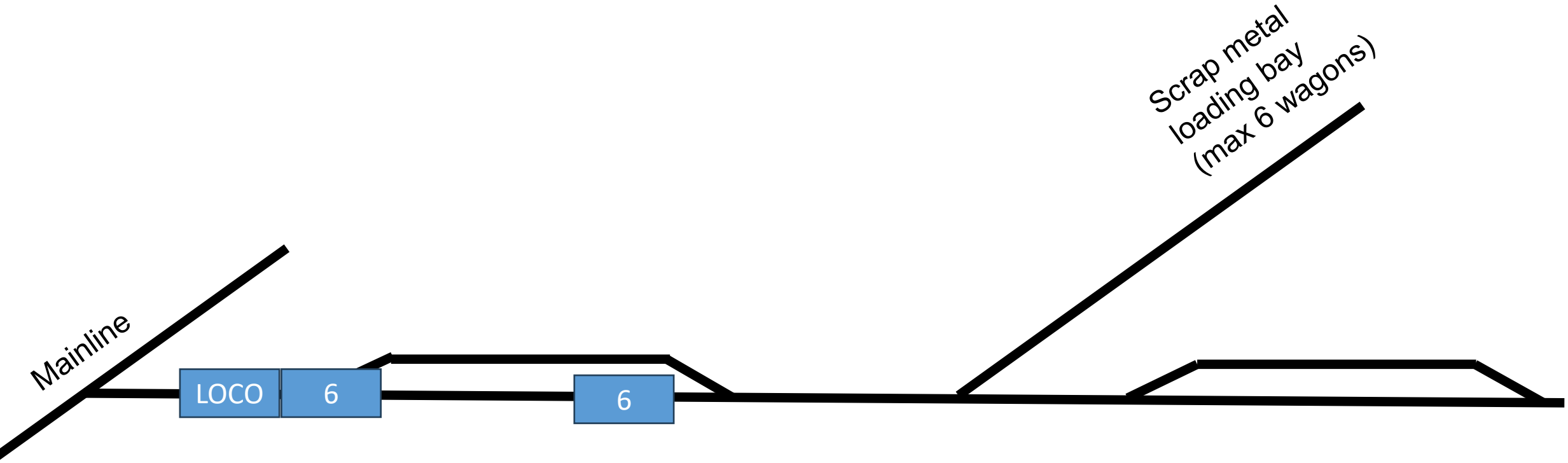
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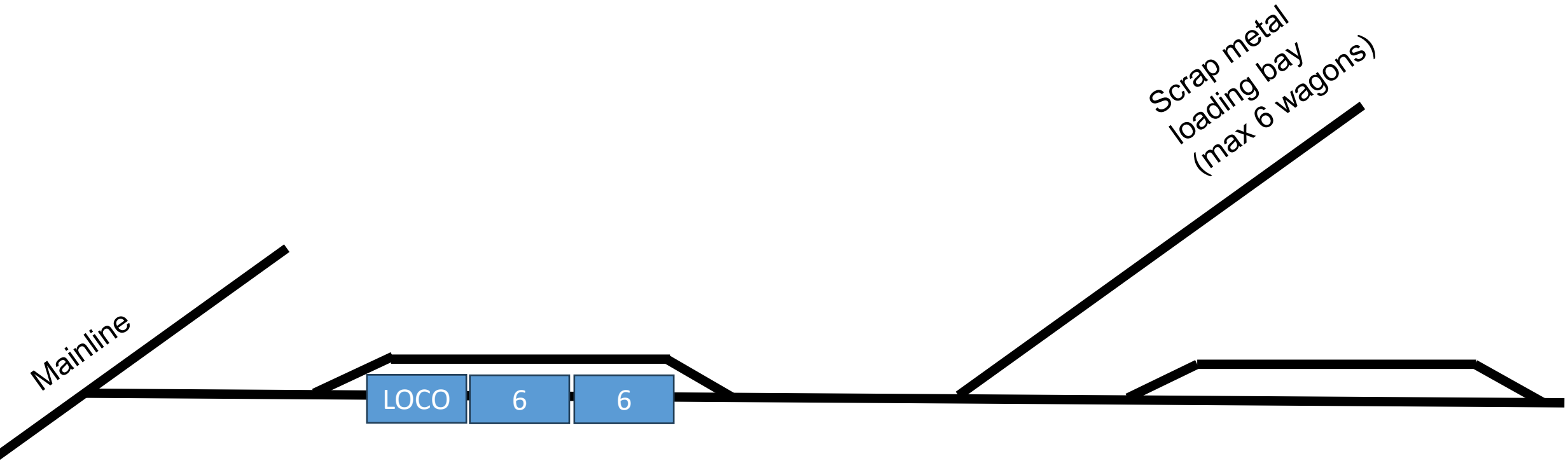
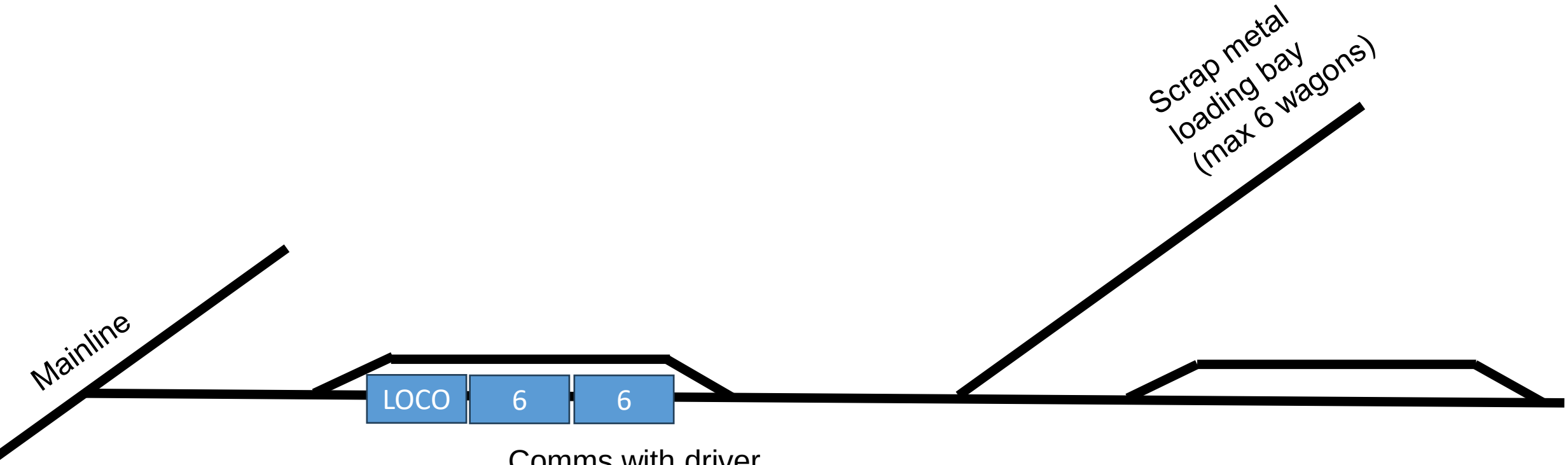


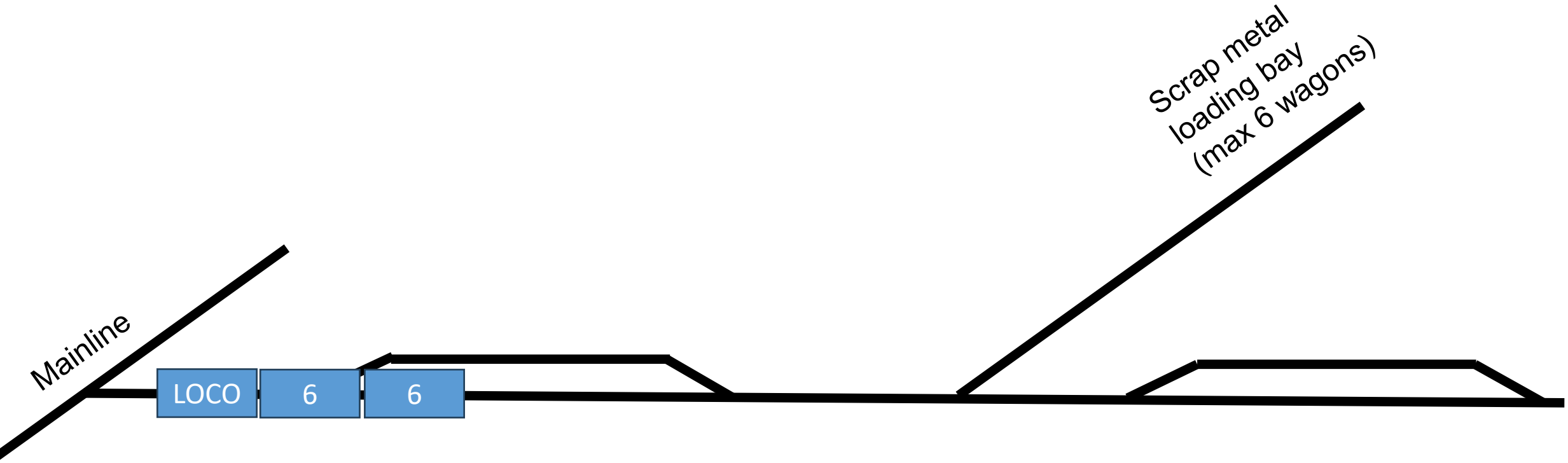
Propelling move –
comms with driver



Comms with driver
Get under buffers
Couple brake pipe
Couple wagons
Out from under buffers
Potential release handbrake
Visual check
Comms with driver

Adds up to…

- 11 coupling / uncouplings
  - 22 comms with driver
  - 22 stoops under buffers
  - 22 brake pipe coupling / uncoupling
  - 22 movements of coupler (25kg)
  - 11 visual checks
  - Multiple?? potential release / apply handbrake
- 3 propelling moves
- 13 points (250 Ns per go)
- 12 level crossing operations
- 19 significant changes of location



Roll-by check!

Current adaptation

- Short-term changes
- Multiple types of equipment and process (eg multiple types of wagon in the same yard, or same train)
- Constrained site with complex moves
- Few decision support tools
- Different supervisory structures
- Comms, esp during challenging shunt moves (reverse, or ‘propelling’ moves)
- 24/7 operations

What would help you?

Current adaptation

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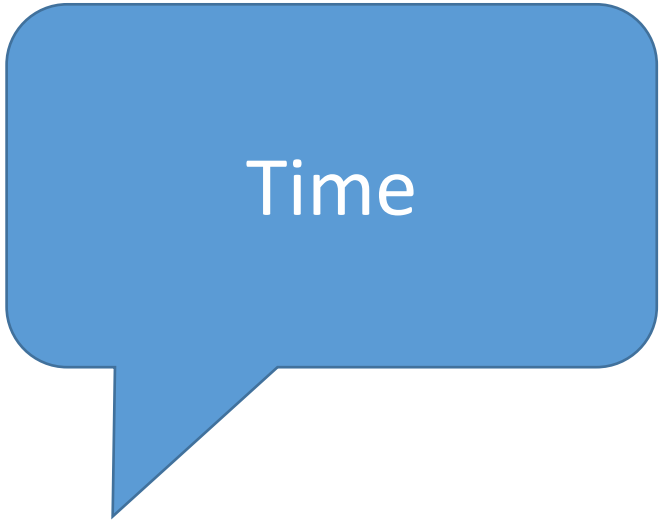

Future adaptation

RAIB
Rail Accident Investigation Branch

NetworkRail
Who we are
Runr
Home > Stories > Running longer, more ef

Bundesministerium für Digitales und Verkehr

DAC4EU

Project information
Project pha

DIGITAL AUTOMATIC COUPLING
IN

School of
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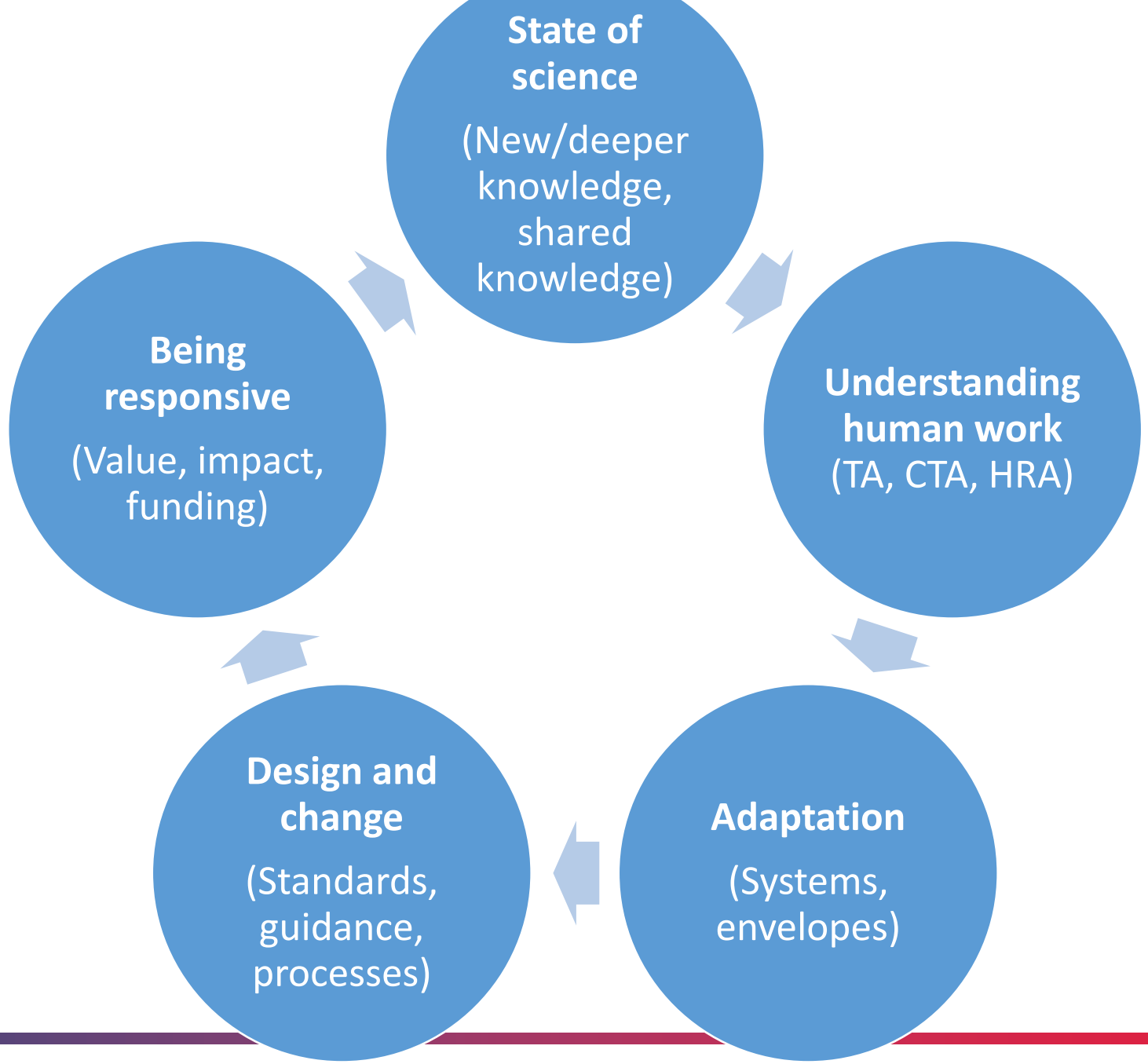
Rail Accident Report

Container detachments at Scout Green, Cumbria, 7 March 2015 and near Deeping St Nicholas, Lincolnshire, 31 March 2015

Future


State of science
(New/deeper knowledge, shared knowledge)
Understanding human work
(TA, CTA, HRA)
Adaptation
(Systems, envelopes)
Design and change
(Standards, guidance, processes)
Being responsive
(Value, impact, funding)

Human Factors in Freight Train Preparation: Current challenges and Future Directions

Dr David Golightly, School of Engineering, Newcastle University
David Ethell, David Ethell Consulting