

Freight Marshalling Yard Operations Using OpenTrack

NextRail19

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Marshalling Yard Functions

Locomotive change location in this case from diesel to electric traction or 3kV DC to 25kV AC Electric Traction.

Join 2 x 100 wagon loaded trains to form 1 x 200 wagon loaded trains

Split 200 wagon empty trains to form 2 x 100 wagon loaded trains

Examine and brake test train consists.

Cut out defective wagons.

Crew change location.



Co Located Functions

Locomotive provisioning location (fuel, sand, water, decant, clean).

Locomotive servicing.

Wagon repairs and maintenance.

Freight loading / unloading.

Mainline Junctions.

Other locations may shunt wagons onto trains to different destinations although this is becoming uncommon with trains consisting of wagon blocks rather than individual wagons.



Freight Technology

- High axle load, heavy wagons.
- Dual voltage electric locomotives.
- Long trains (just over 2 km long, even wagon blocks are over 1 km long).
- High drawbar strength wagons and locomotives (but there is a limit).
- Low rates of acceleration.
- Electro pneumatic braking.
- Distributed power..





Yard Operation Complexities

Operating Environment

- Slow speed (max 15 km/h)
- Long Occupancies
- Large portions of “Single Line”.
- No published timetable. Some movements occur when they can.
- Change over point between Traction Supply systems.

Safeworking Environment

- All movements authorised by the Yard Master usually by radio.
- Yard Master cannot see the whole yard / train movements
- Dark territory no track circuits.
- Line of sight train operation.



Dangerous Environment

- Locomotive may be at the other end of up to 2 km of wagons and hence silent.
- Visibility poor line of sight obstructed due to other trains on other tracks.
- People and train in close proximity.
- High risk of collision between trains, people and trains and vehicles and trains.





Yard Operations - OpenTrack

- OpenTrack brings a new dimension to Yard Operations which have traditionally been simulated using event stepped simulation tools.
- Unlike event based models OpenTrack calculates the time taken for each train movement and the resulting occupancies and reservations.
- Process driven times are added using the dwell time functionality either as a deterministic value or distribution.





Yard Operations - OpenTrack

OpenTrack allows for:

- Stakeholder engagement
- Graphical animations – showing the cycle process
- Verification of cycle times
- Yard Track Occupancies
- Verification of throughput and compatibility with mainline operation.



Ermelo Yard Study

Scope to test viability of routing additional traffic through the yard using three proposed configurations and operating plans.

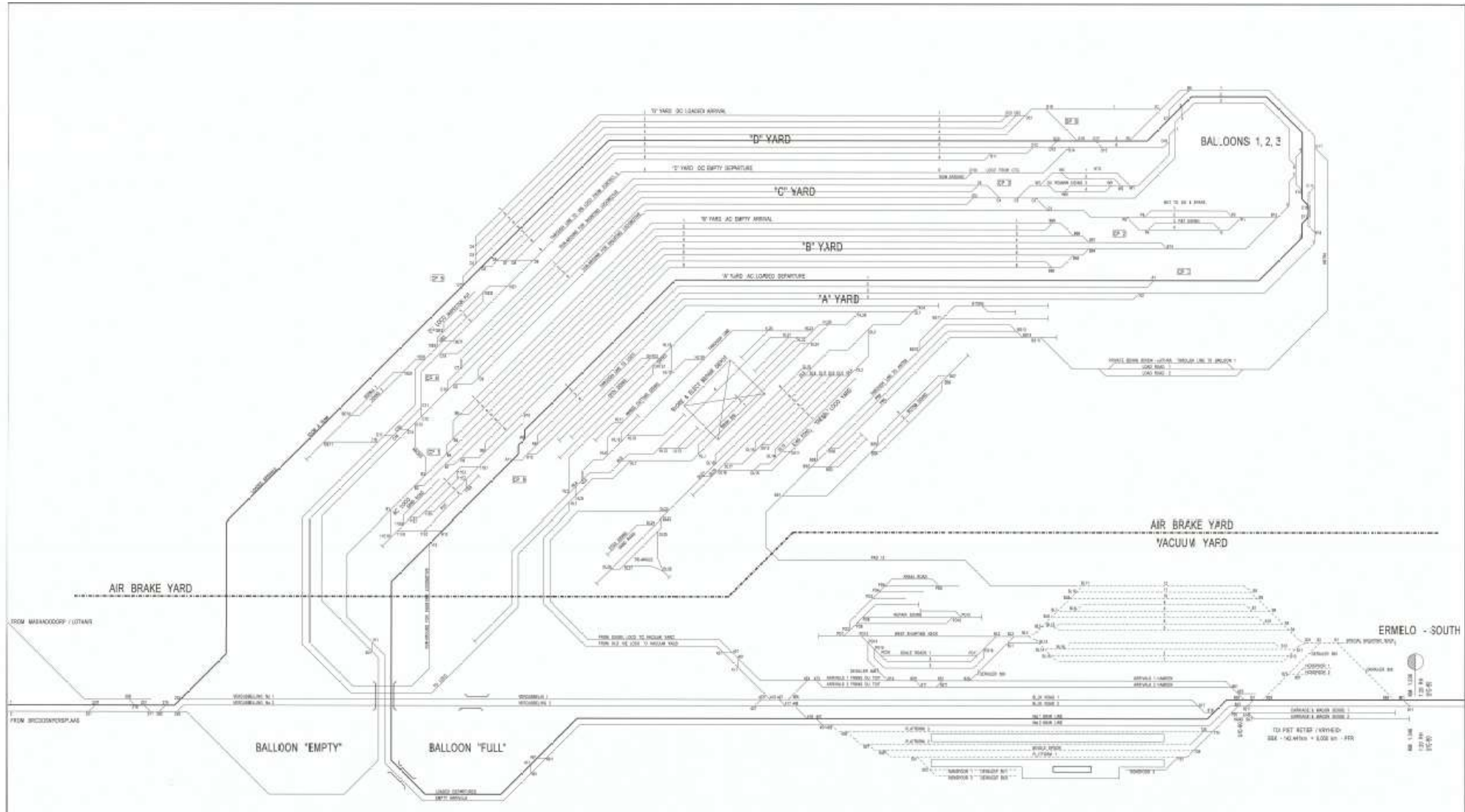
Yard capacity created by full electrification removing the need for diesel shunt locomotives.

Aim to reuse existing assets as far as possible.



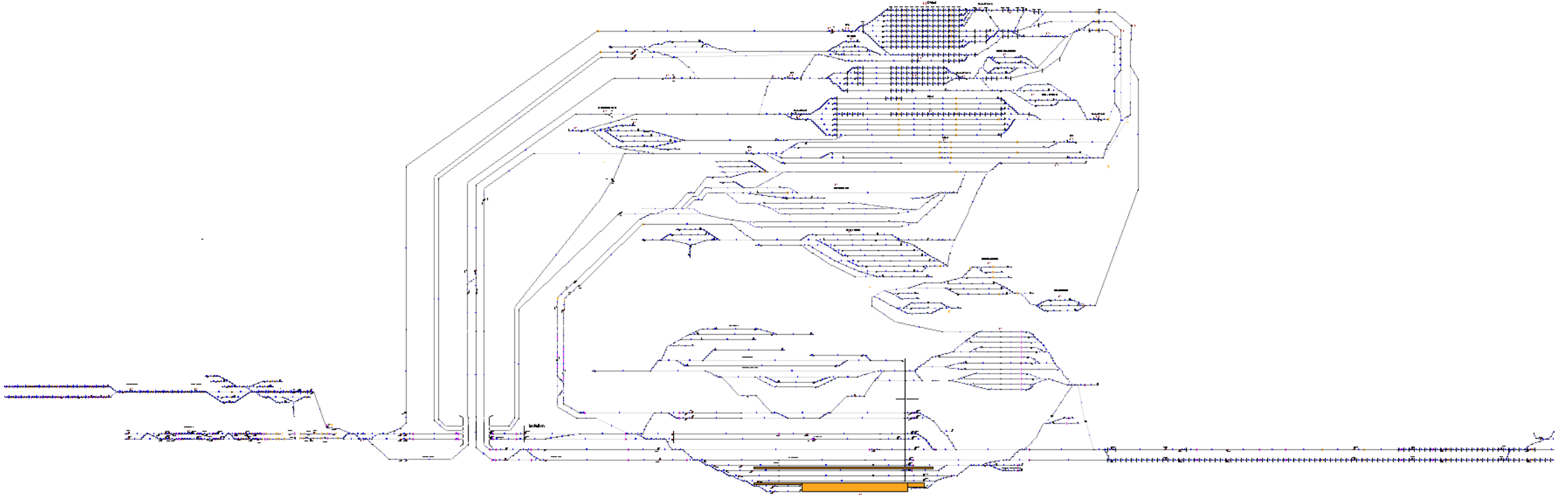


Ermelo Yard Study





Marshalling at Ermelo Yard





Modelling Technique Used

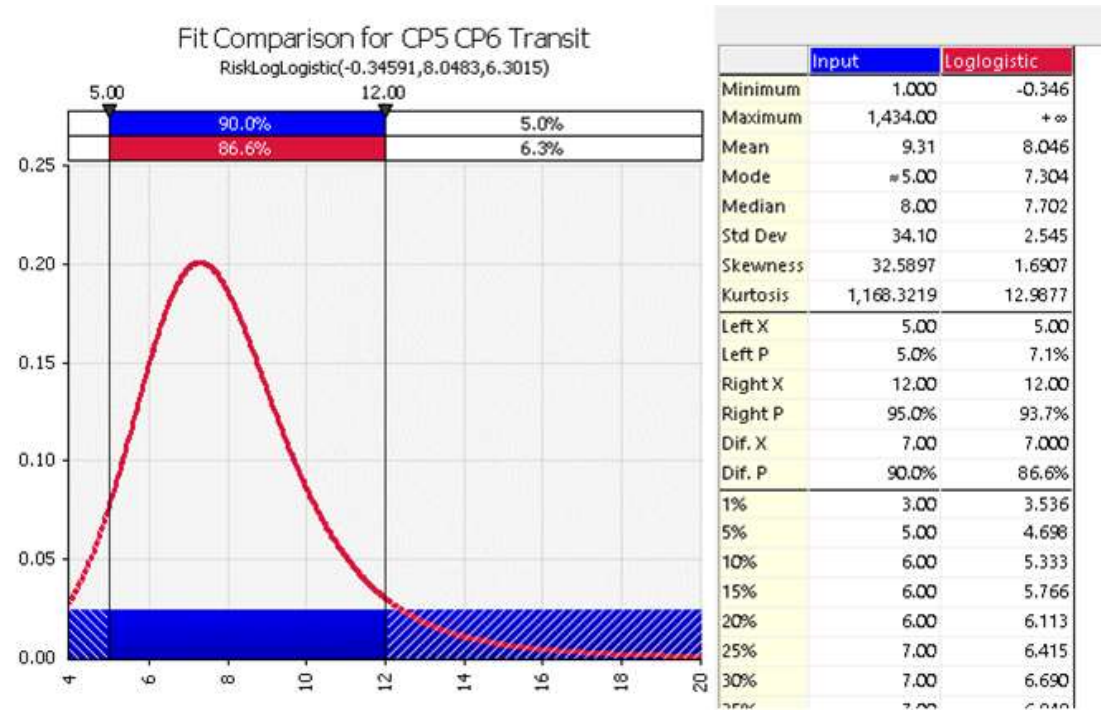
1. Construct OpenTrack model of existing yard and each proposed configuration using the CLIP Network Builder.
2. Quantify Sectional run times / Process Times using OpenTrack for each train type going through the yard.



Ermelo Yard

Using actual train running data to develop variance and most likely times for various processes occurring during dwell periods such as:

- Wagon inspections
- Coupling / uncoupling
- Charging air brakes
- Brake tests
- Changing direction





Capacity of the Adjacent Plain line.

- Previously calculated as a Mainline timetable slot based with 1 long coal train per hour arriving and departing and 2 short coal trains per hour arriving and departing.
- General Freight bypasses the yard currently but are proposed to operate through the yard in the future configuration.

Capacity the junctions, yards and terminals must match mainline.

- Rather than use OpenTrack in “Monte Carlo Mode” used Simple adjustment factor consistent with Transnet Policy. This was done to avoid the rescheduling required.



Modelling Technique Used

3. Build a 24 hour interval timetable using Viriato for each train type going through the yard.

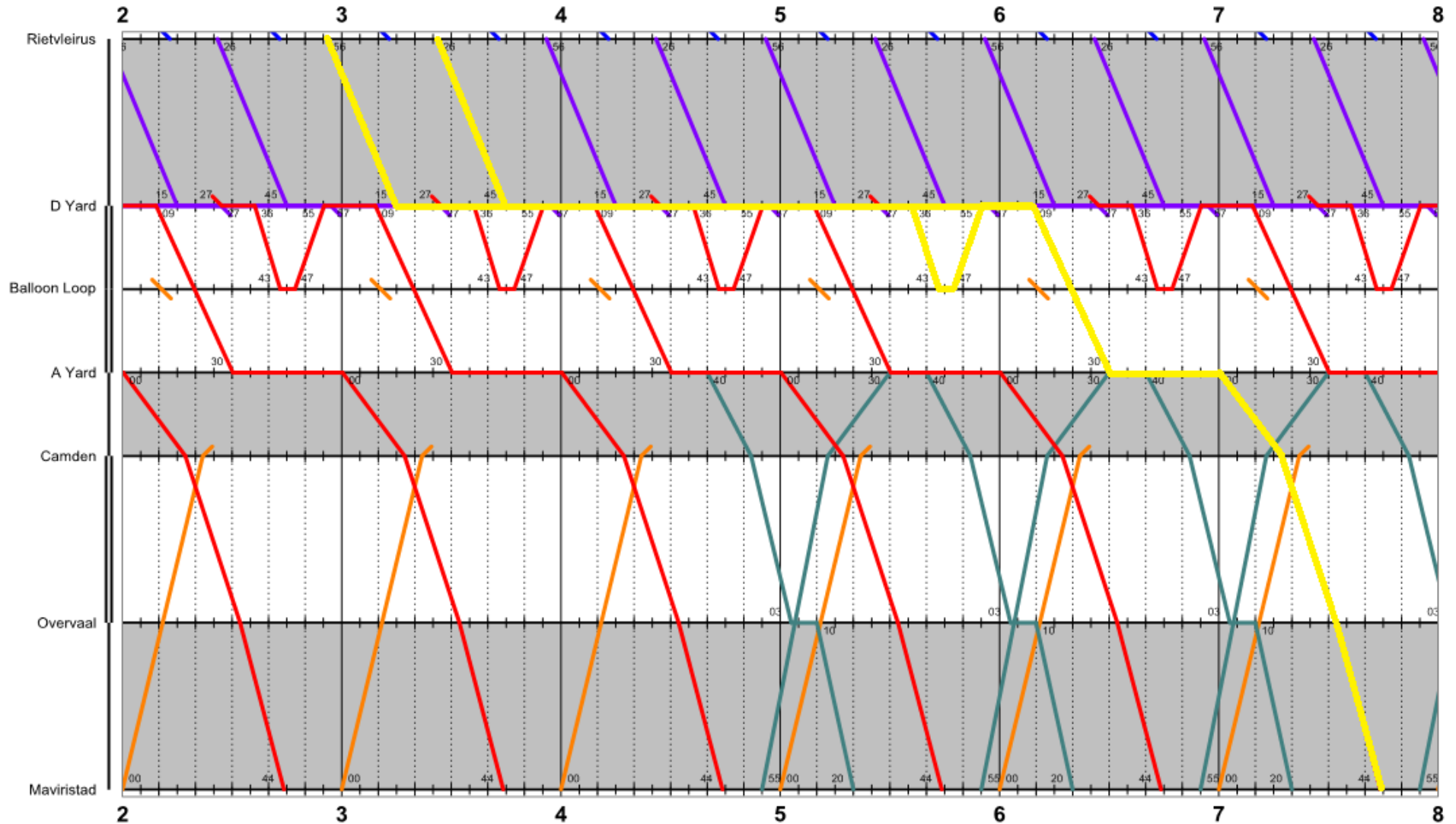
4. Allocate tracks in the Yard.

Aim to separate non essential train movements in time from process operations.

5. Check that times allow for a reasonable amount of natural system variability.

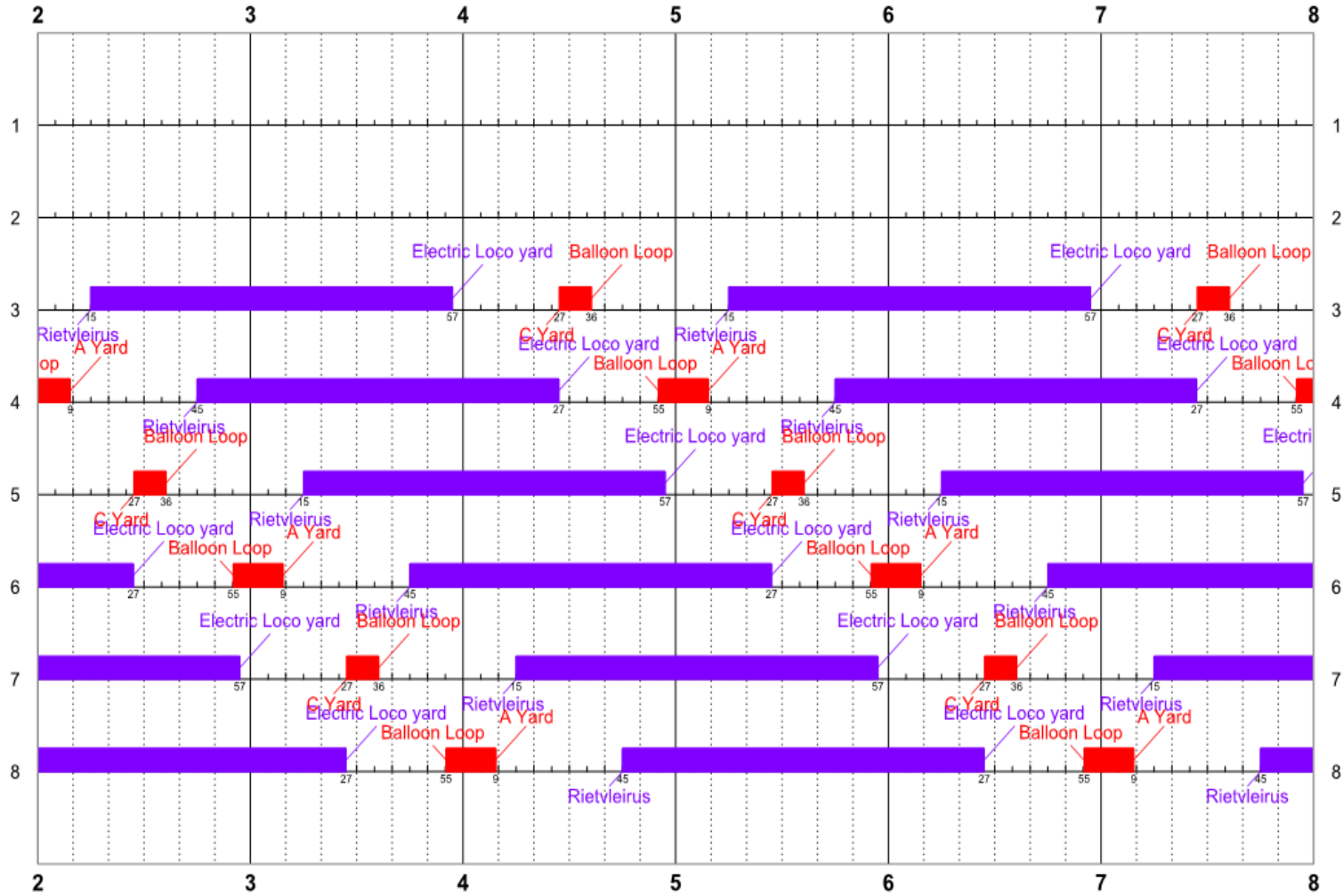


Modelling Technique Used





Modelling Technique Used





Modelling Technique Used

6. Validate the operation of the timetable using OpenTrack.
7. Produce animations of the OpenTrack Simulation to demonstrate to Stakeholders what is occurring.



Ermelo Yard

- An example yard movement shunt
 - 200 Wagons arrive at control point 3
 - Train split into a locomotives plus 100 wagons and goes into yard
 - Locomotives detach and change direction and pick up the other 100 wagons
 - Pull into another road in the yard
 - Locomotives detach and run away
 - New locomotives ready and attach to one of the 100 wagons and continue journey
- All modelled in OpenTrack



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