

# Flank Protection - One way to skin a cat

*PYB Consulting*

# What is flank collision?



- **A flank collision is a collision with the side of another train**
- **Crashworthiness is low compared with head-on collision**
  - Anti-climb, crumple zones, coupling strength protect against head-on
  - Casualty rates are much higher for flank collisions

# Why focus on flank collision?



Peter Denton collection

The catastrophic collapse of the Clyde car when the set crashed into the rear end of a Comeng train at Syndal station on 20 November 1989.



Peter Denton collection

The rear end of the Comeng train following the collision. The damage was moderate and repairable.



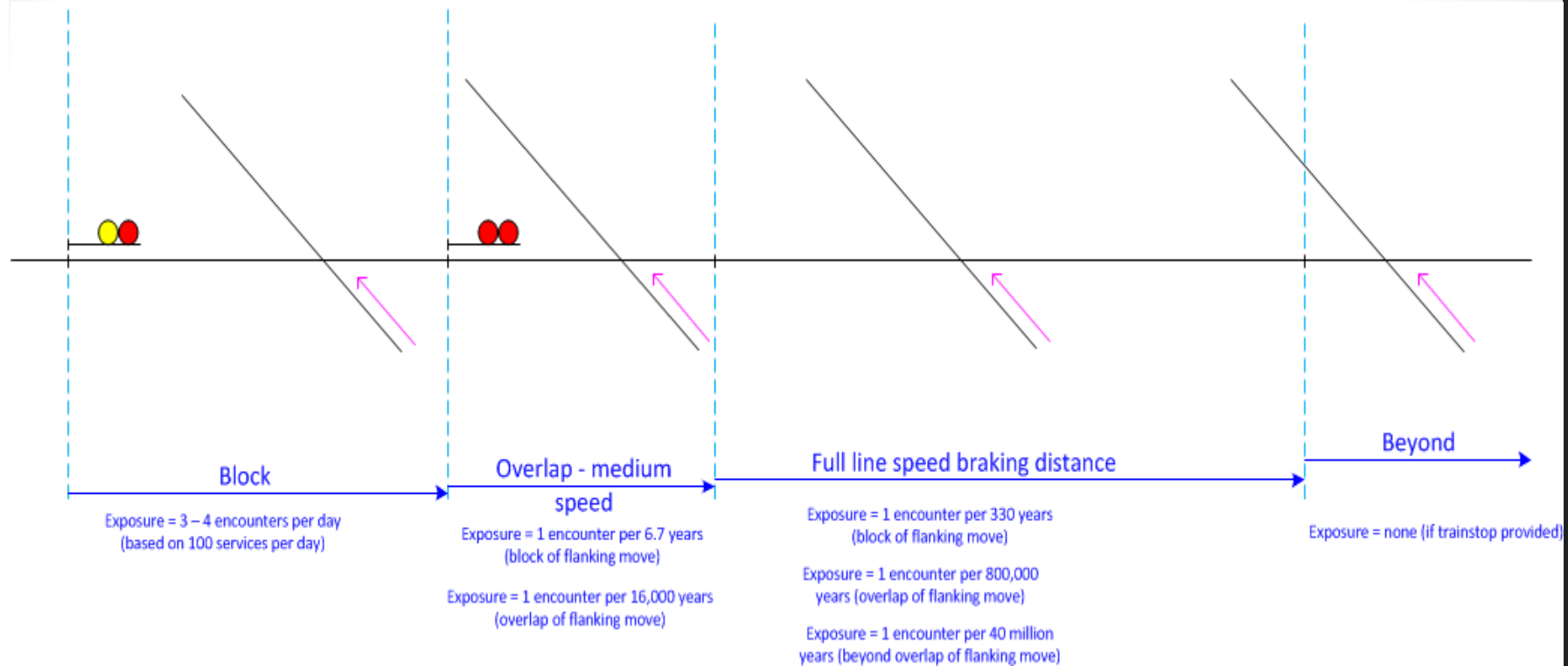
One of the *Indian Pacific* cars at Comeng Granville showing the extent of the damage when the train was sideswiped by a derailed goods train at Locksley during a trial run only five days before revenue service between Sydney and Perth was due to commence.

21 August 2013



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# What is the risk?



- **If no protection, risk depends on location of potential conflict**
  - Within block = 3-4 encounters per day (if 100 services per day at 40km/hr)
  - No overlap = 1 encounter per 6.7 years
  - Medium speed overlap = 1 encounter per 330 years
  - Medium speed overlap with protected zone = 1 encounter per 800,000 years

# Historical perspective – point locking

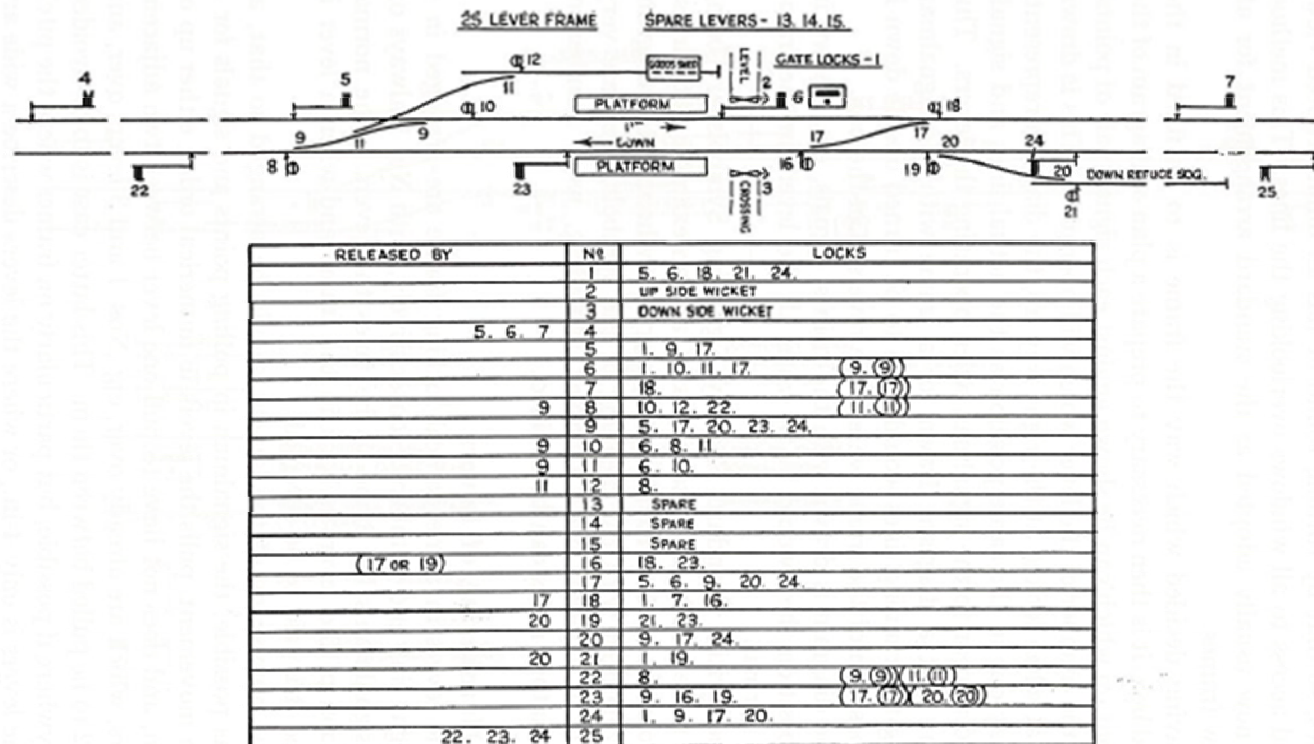
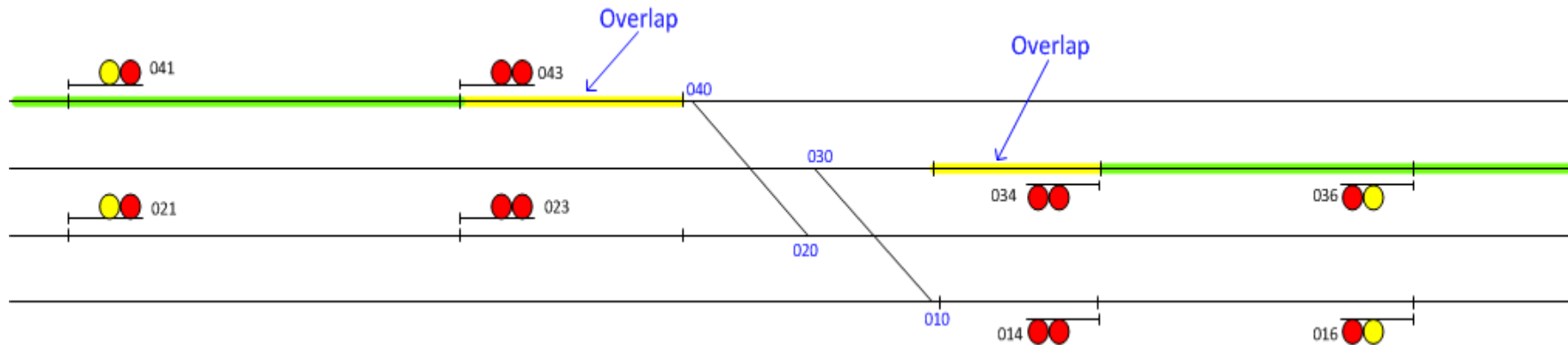


FIG. 2

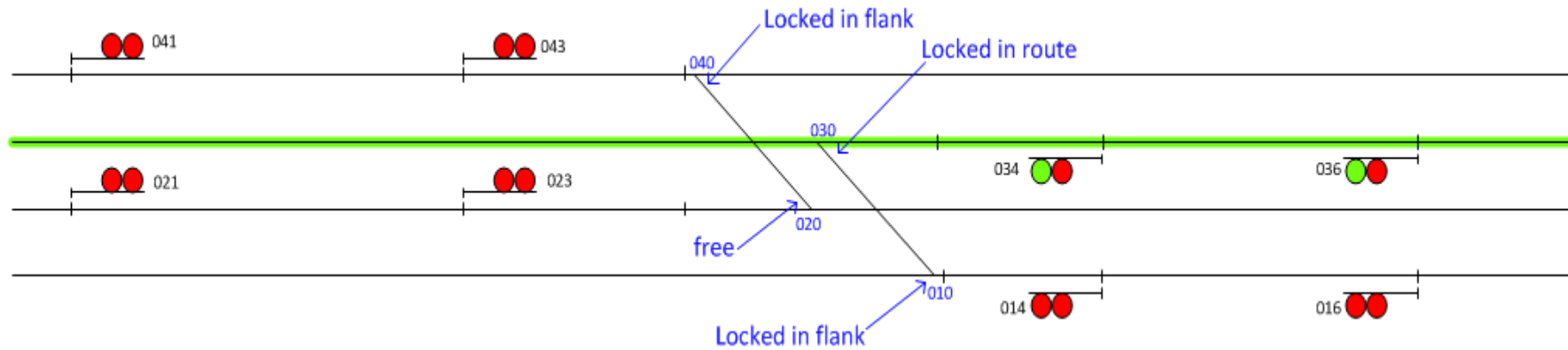
- **Mechanical interlocking practice**
  - No facing movements
  - “Point to point” locking (eg 20 locks 9)

# Past Victorian practice – Case 1



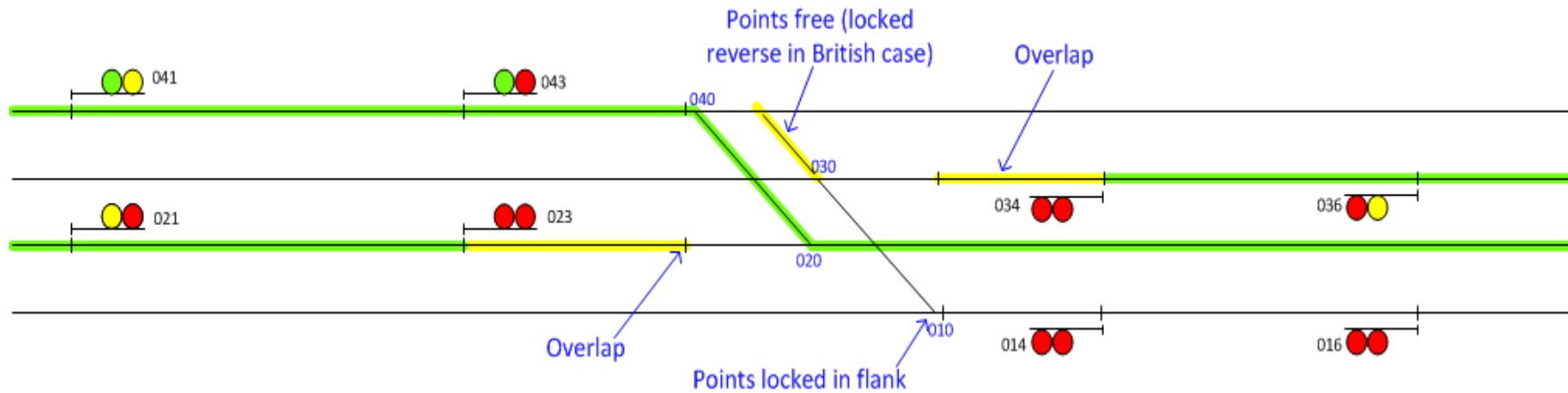
- **Medium speed overlaps apply**
  - Overlap (medium speed) protected by trainstop
  - No locking of points beyond end of overlap
- **Note on British practice**
  - 183m overlap not enforced
  - 010, 020, 030 and 040 points locked normal for flank (if flank locking required)

# Past Victorian practice – Case 2



- **Flank locking applied**
  - 040, 010 locked normal as facing moves though no route conflict
  - 030 locked in route (trailing points)
  - 020 points free (trailing move flank points)
- **British practice**
  - same

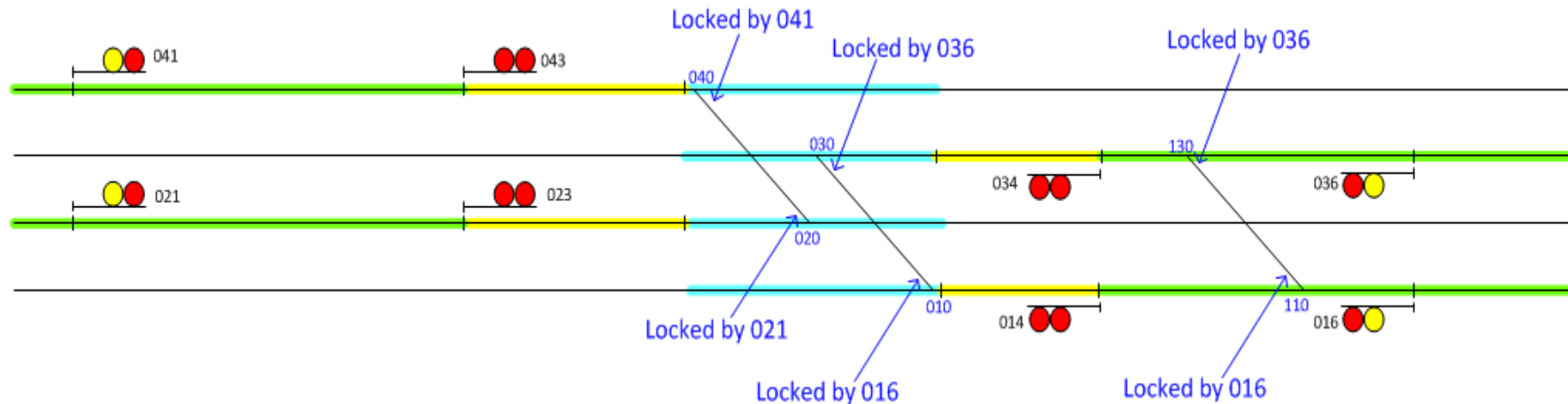
# Past Victorian practice – Case 3



- **Flank locking applied**
  - 040, 020 locked in route
  - 010 (crossover) locked in flank
  - 030 (crossover) free (reverse points for flank)
  - 021, 036 signals can show 'proceed'
- **British practice**
  - 030 (crossover) locked reverse in flank
  - 021, 036 signals can show 'proceed'

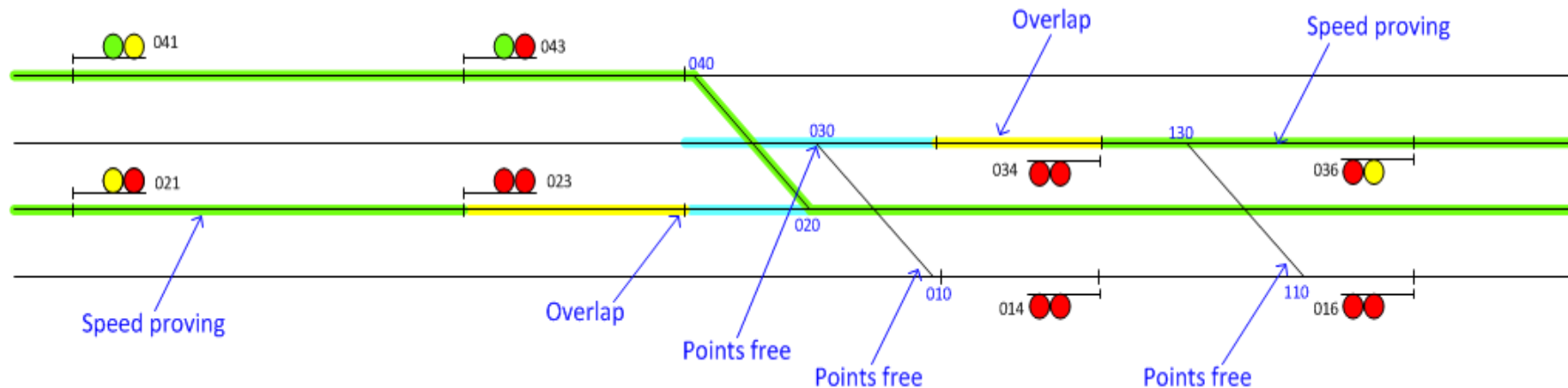


# A principled approach - 1



- **Principles**
  - Points locked as “overlap protection” up to enforcement boundary
  - Shortened protection “medium speed overlap” if speed proved
  - Risk of overruns beyond enforcement limits removed
  - Route locking provides flank protection fully
- **Route locking applied**
  - 040 locked by 041 (when 036 set) as “overlap protection”
  - 010 locked by 016 (when 041 set) as “overlap protection”
  - 021 does not lock 130 or 110 (beyond enforcement limit)

# A principled approach - 2



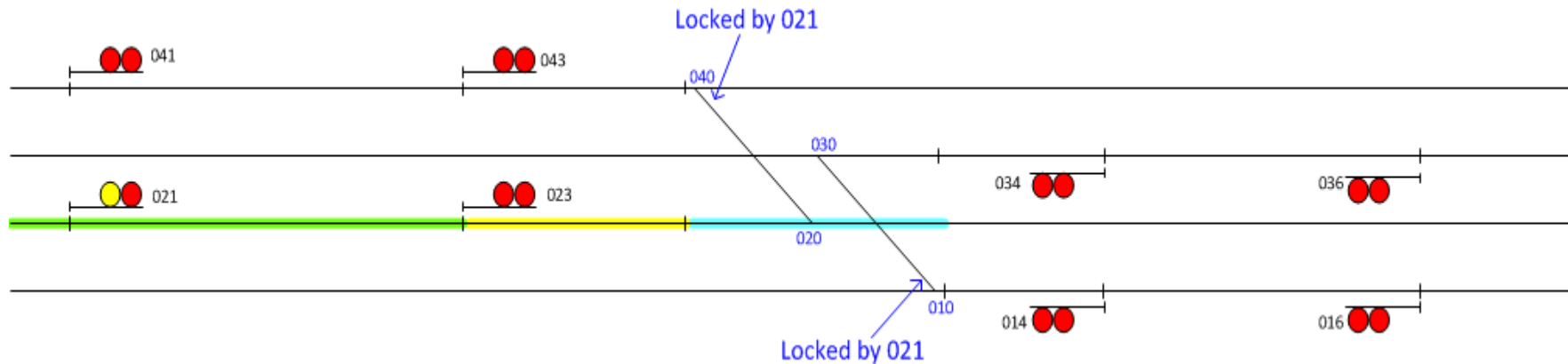
- **Principles**

- “Medium speed overlap” utilised for 021 and 036
- Overlap protection requirement resolved at aspect level

- **Route locking applied**

- 036 at proceed would lock 041 unless 040 points normal
- 041 aspect reduced (speed proved) if 036 at proceed (not speed proved)
- 040 swings normal to allow 041 and 036 to clear simultaneously (no speed proving)

# Alternate approach – Failure Mode



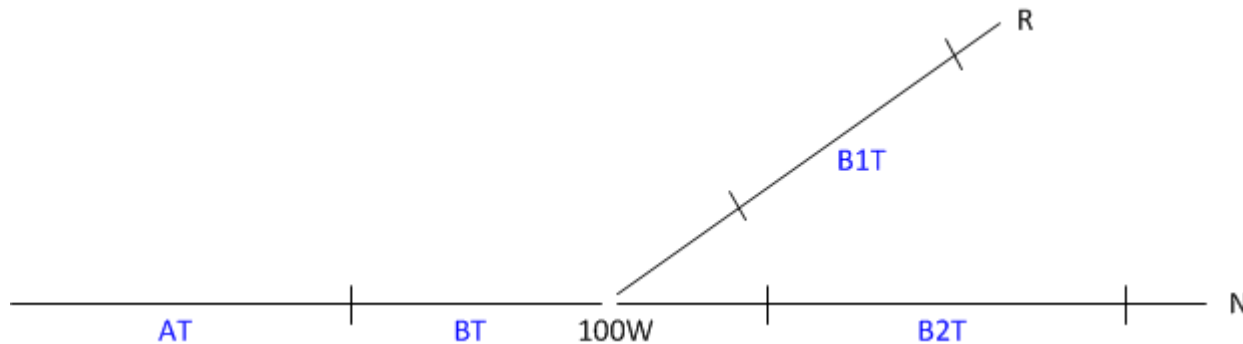
- **Principles**

- Flank protection applied unconditionally with 021 set
- 041 signal no longer requires direct 021 route locking

- **Reliability consequence**

- A fault on 040 or 010 points will cause 021 signal to fail

# Fouling tracks – a special case



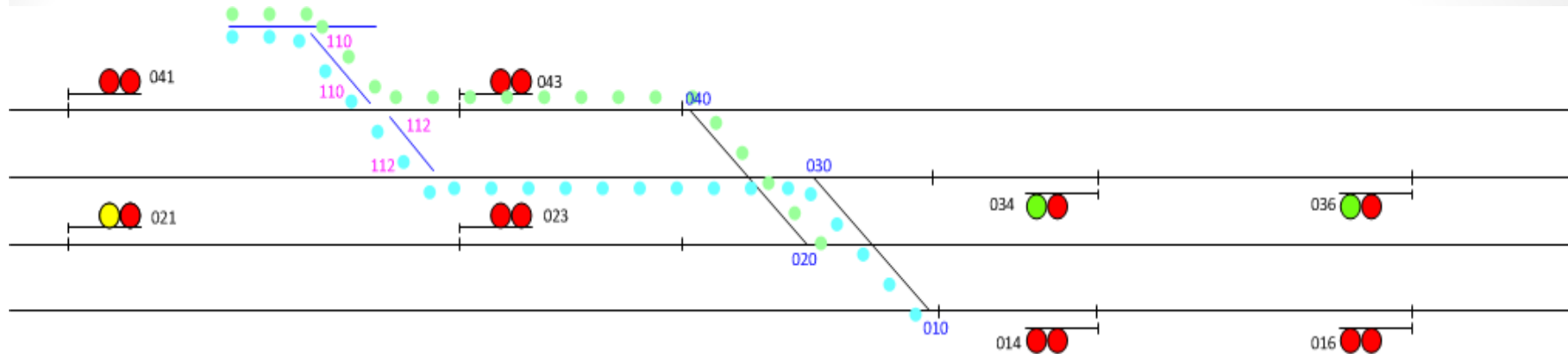
- **Principles**

- A track is fouling where a train, in progress over the road made by the points in the initial lie stops (either before the points or after passing over them) and, having stopped, can be foul of (ie have a flank collision with) a train progressing over the points in their final lie.
- In judging whether a train can be foul, tracks occupied with routes (subroutes or suboverlaps locked) set are taken to be in progress on that route.
- Trains do not arrive by helicopter.
- Switching points towards an occupied track not at clearance does not cause a risk of flank collision.

- **Sample fouling track locking**

- P100N: BT , B1T
- P100R: BT , B2T

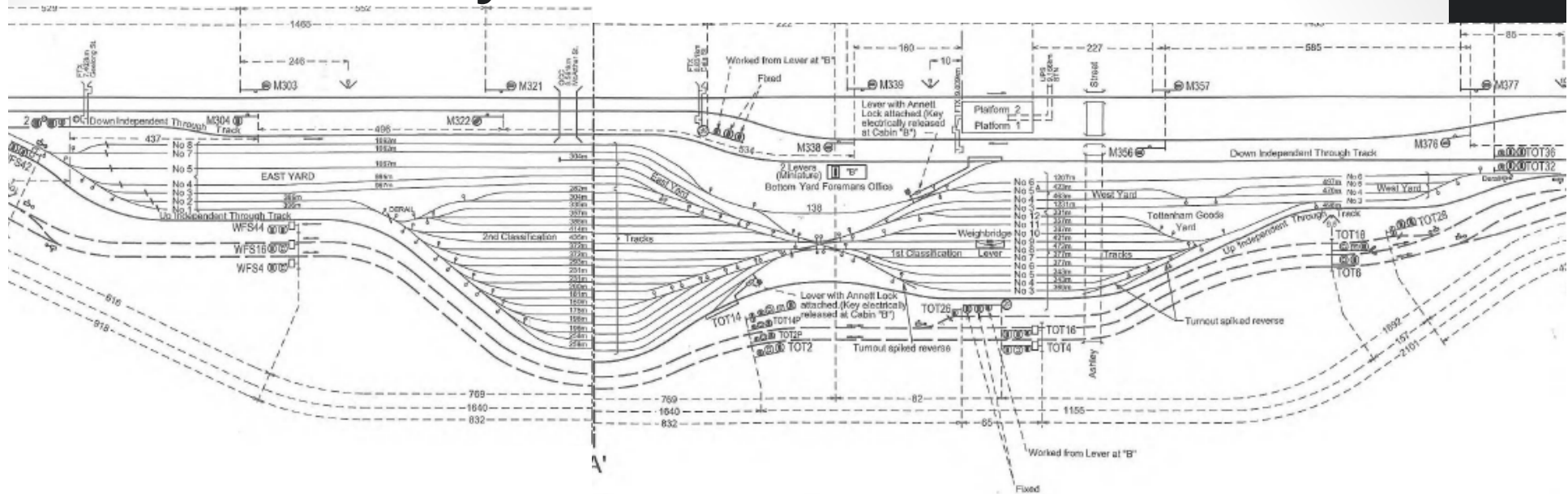
# Roll-out protection – a special case



- **Locking for roll-out protection**

- Rollout is only downhill? How far will the wagon roll?
- Only flank collisions considered
- Added conditions
  - R041: 110N
  - R036, 034: 110N or 040N
  - R021, 023: 110N or (112N w 040N) or (112R w 030N)
  - R014: 110N or 112N or 030N
- NB: A path is legal if from a signal into the siding.

# Collisions in yards



- **Typical yard conditions provide:**
  - Hand points without signals for balloon roads
  - No passengers
  - Low operating speeds (15 - 25 km/hr typical)
    - Crumple zone of 0.32m [Macfarlane (2006)] protects
    - Tram depot at Preston has/had many practical examples
    - Risk?
  - Consequence: damage to rolling stock rather than injury to person

# Our Responsibility

- **Responsibility of experts**

- Sheppard J:
  - “... the court will nevertheless take into account evidence given by persons experienced in the particular profession involved as to standards which are considered appropriate within a profession.”
- Hochfelder v Ernst & Ernst:
  - “... we are not constrained to accept faulty standards of practice otherwise generally accepted in an industry or profession.”
- There is a need for a profession to ensure that standards are “up to date” and have taken account changing circumstances and technology

