

Regional Fast Rail

A new era for regional rail travel



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reliable

comfortable

safe

fast

TPWS Application in the RFR Environment

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Rail Technical Society Australasia / Institute of Railway Signalling Engineers

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Introduction

- Signalling Basics
- Signal Enforcement
- Contractor Solutions and Consultation
- Application Principles
- Typical Applications

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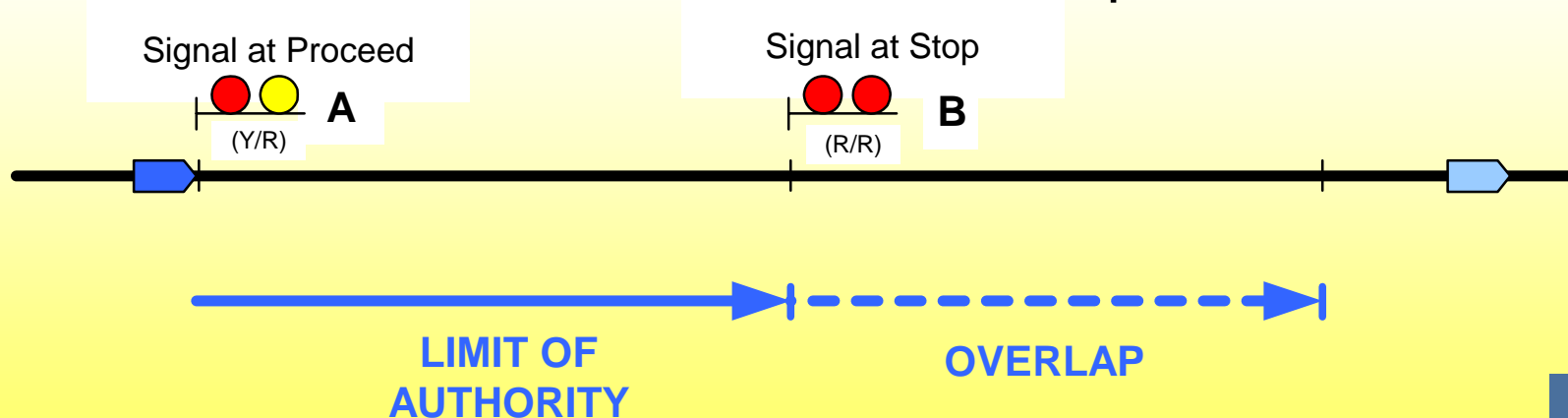
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Signalling Basics

- Signalling based on FIXED BLOCK
- 3 Position, colour light (LED) signals
- Limit of Authority from one signal to an end signal
- Overlap/overrun distance provided past the Limit of Authority as a safety margin
- For RFR, overlaps provided and sized to allow trains to brake from the authorised speed to stop



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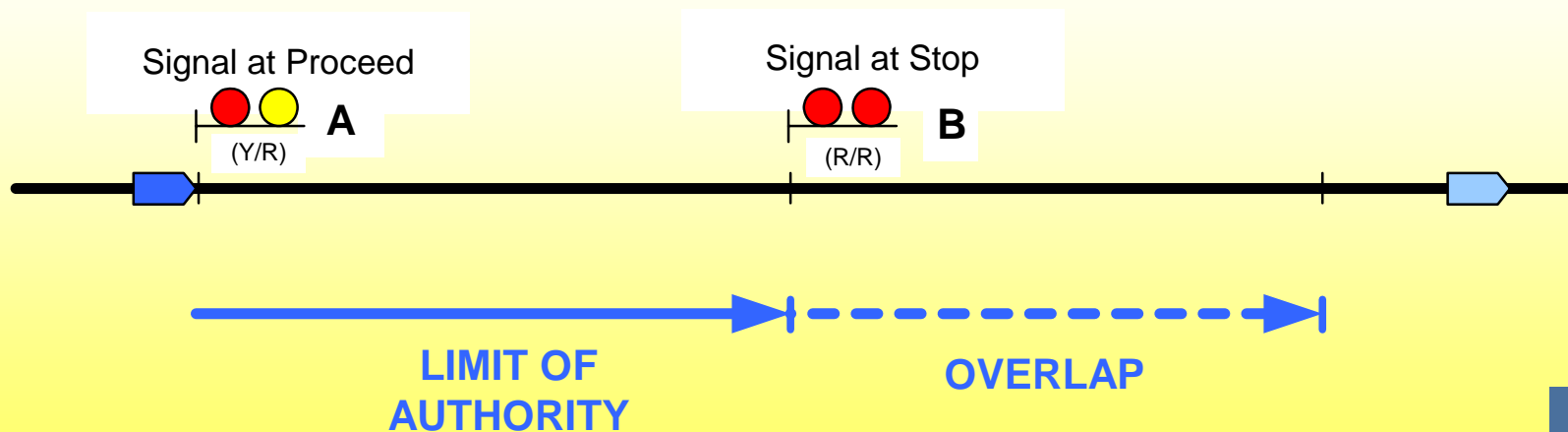
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Signal Spacing

- Signals spaced normal braking distance apart
- V/Locity max train speed is 160 km/h
- Need 1300 m to brake from 160 to 0 km/h
- RFR signal spacing a nominal 1500 m



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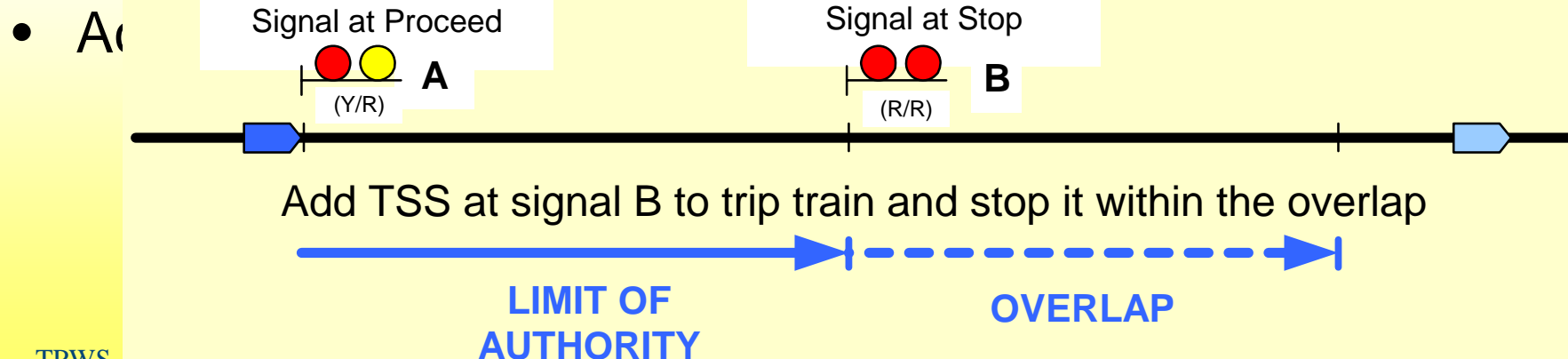
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RFR Signal Enforcement

- Additional Safety Protection Layer:
 - Operating speeds increased to >130 km/h
 - No less safe
- Enforcement of Limit of Authority (LOA)
- Enforcement of speeds for medium speed routes
- Such that:
 - Trains exceeding LOA or medium aspect speeds will be automatically braked to stop



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Contractor Solutions

- RFR Contract Environment
- Performance Based:
 - Project Brief / Non prescriptive requirements
 - Run time and train services objectives
 - Technical guidelines
- Signalling Solution:
 - 160 km/h operations
 - No less safe
 - Signal enforcement
- Resulted in different solutions from the two Contractors

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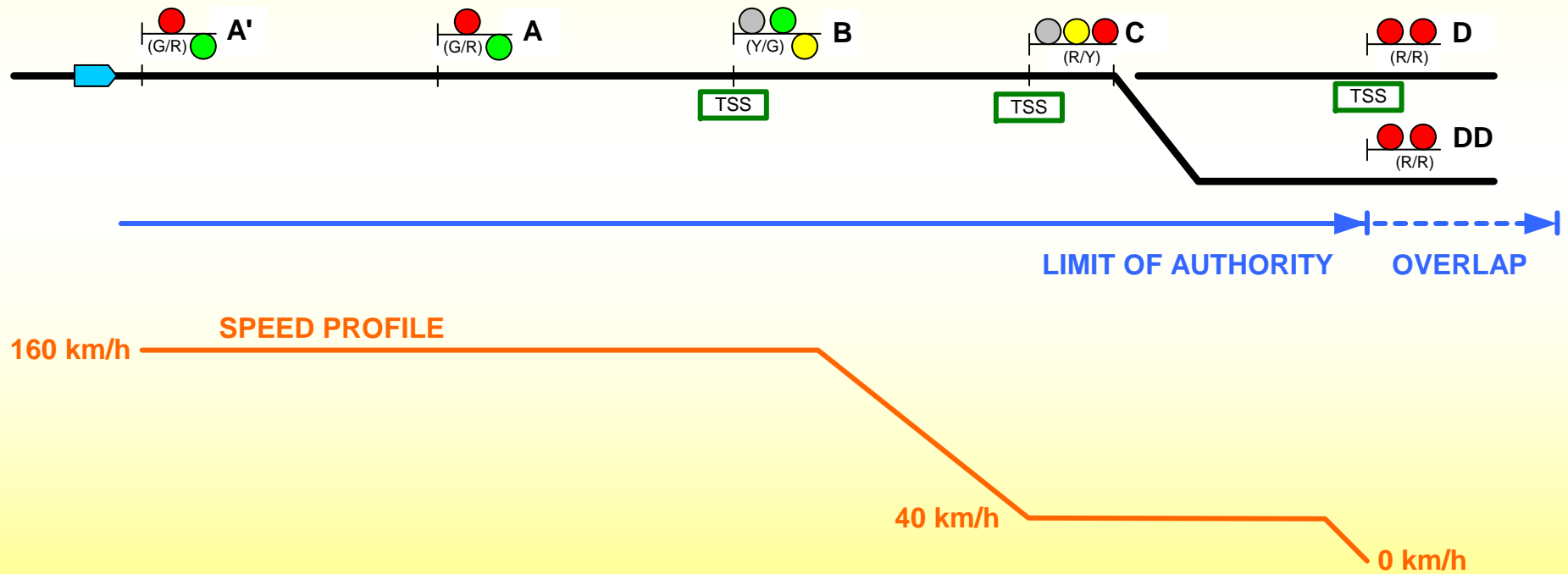
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Contractor Solutions

- Contractor A, scenario 1 (single – double line):



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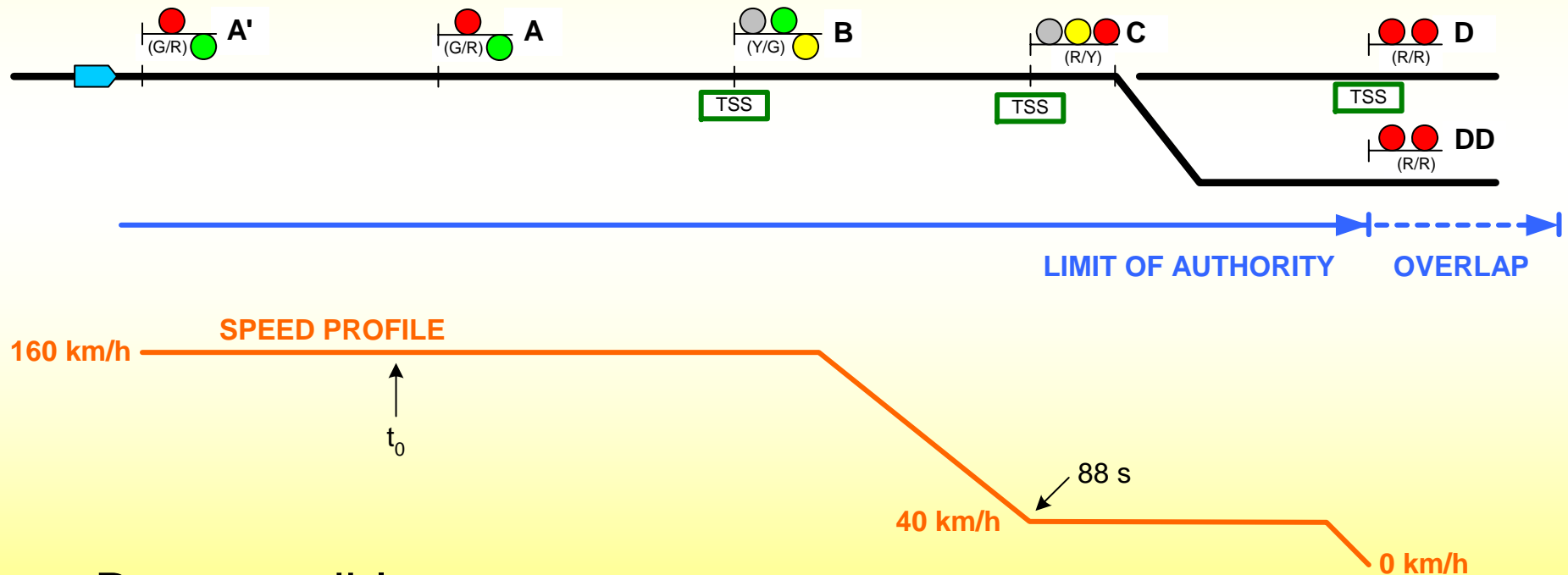
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Contractor Solutions

- Contractor A, scenario 1 (single – double line):



- Best possible aspect sequence

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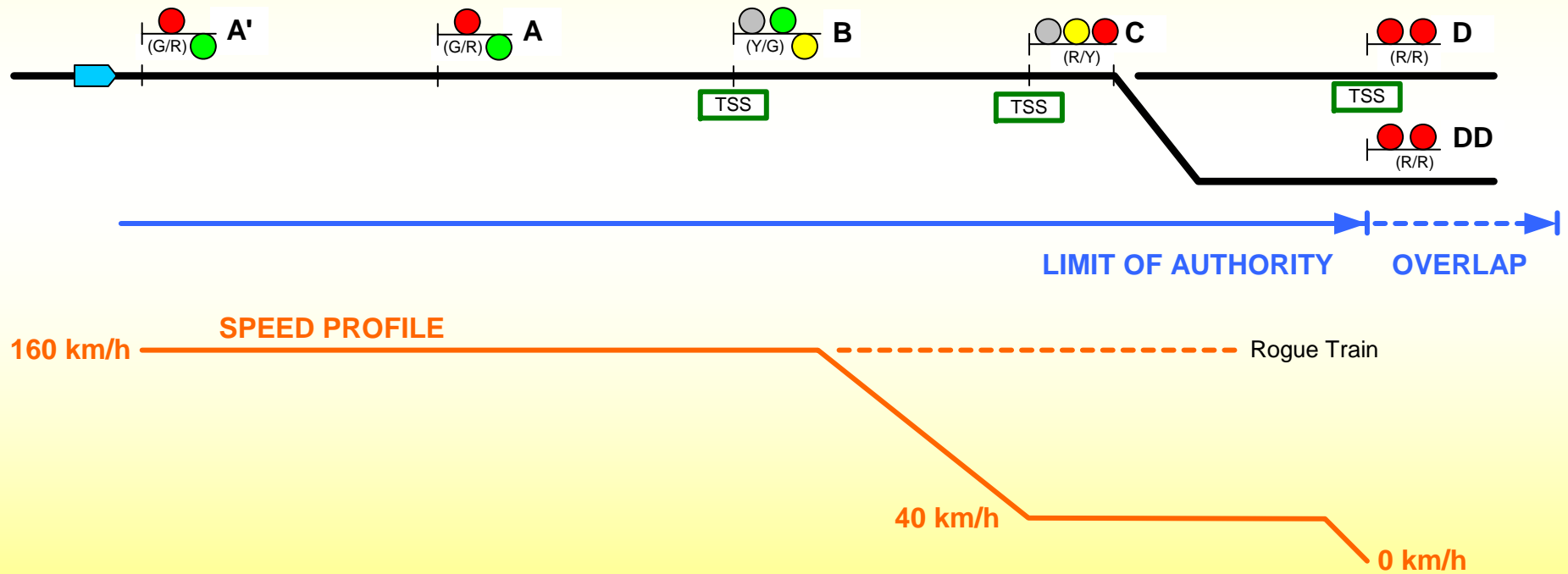
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Contractor Solutions

- Contractor A, scenario 1 (single – double line):



- Rogue train uncontrolled – Turnout speed? Overlap?

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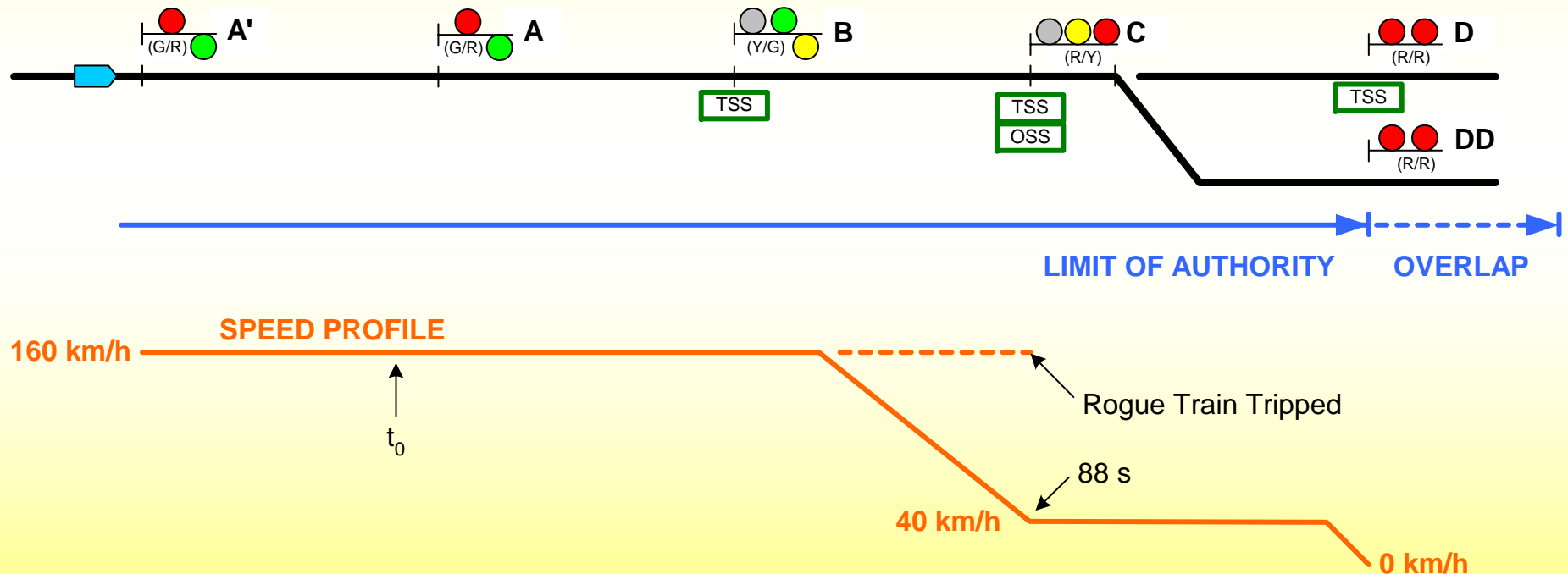
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Contractor Solutions

- Contractor A, scenario 1 refinement:



- Rogue train partly controlled by OSS – turnout speed ?

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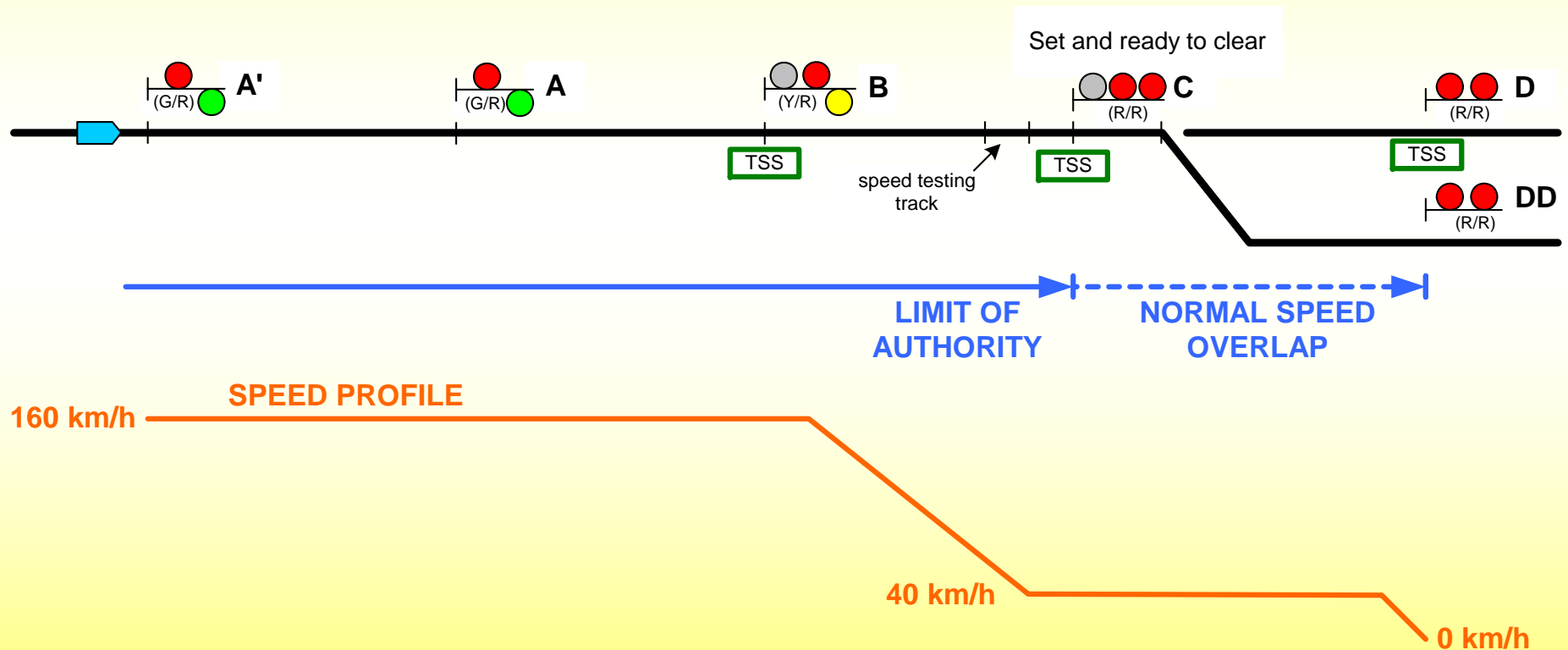
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Contractor Solutions

- Contractor A, scenario 2 (loop):



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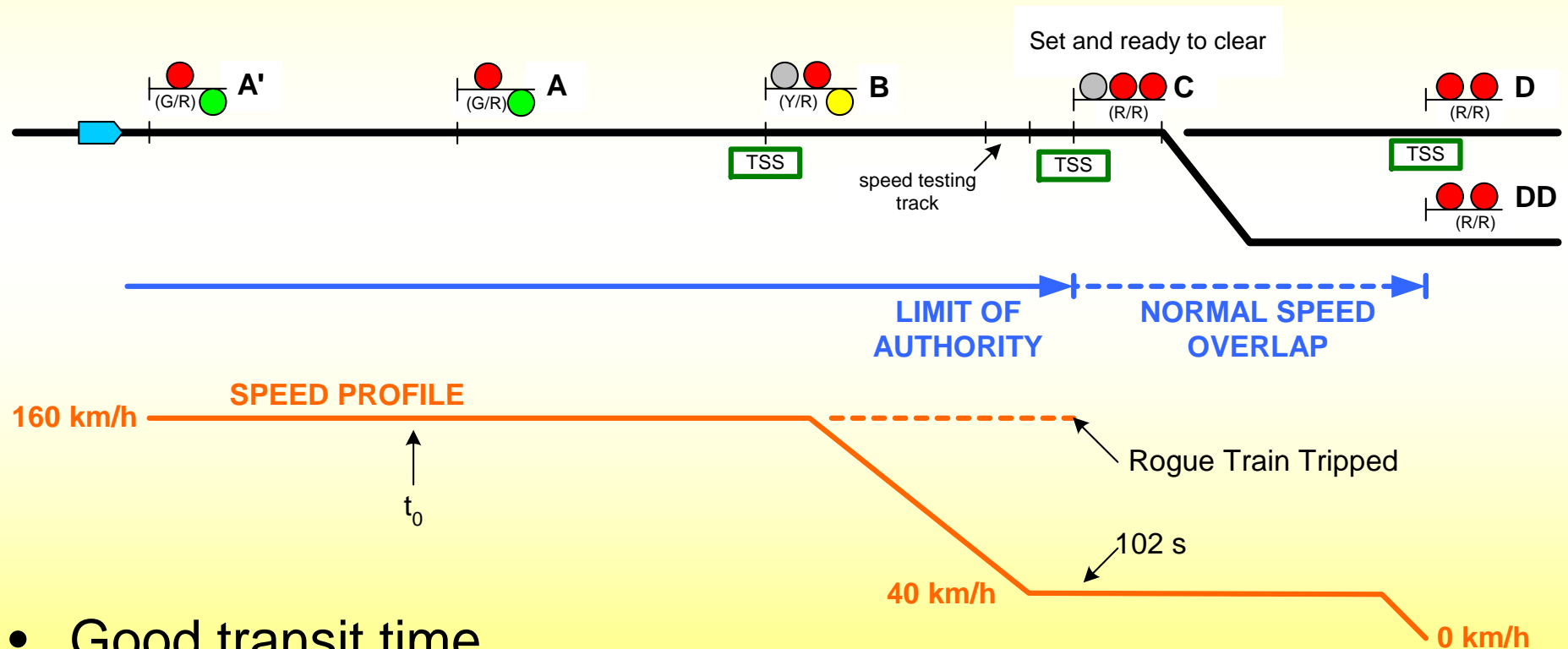
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Contractor Solutions

- Contractor A, scenario 2 (loop):



- Good transit time
- Rogue train controlled – Turnout speed ?

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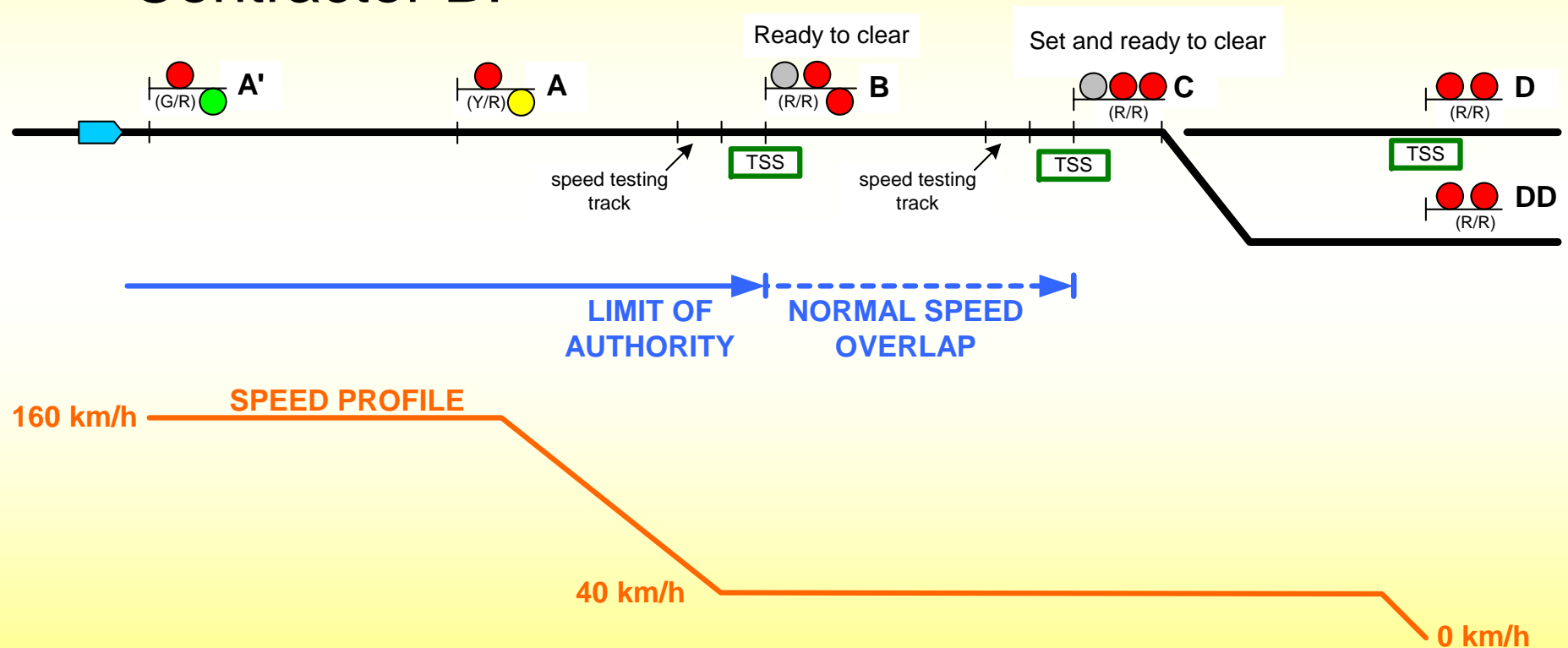
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Contractor Solutions

- Contractor B:



- Restrictive aspect sequence

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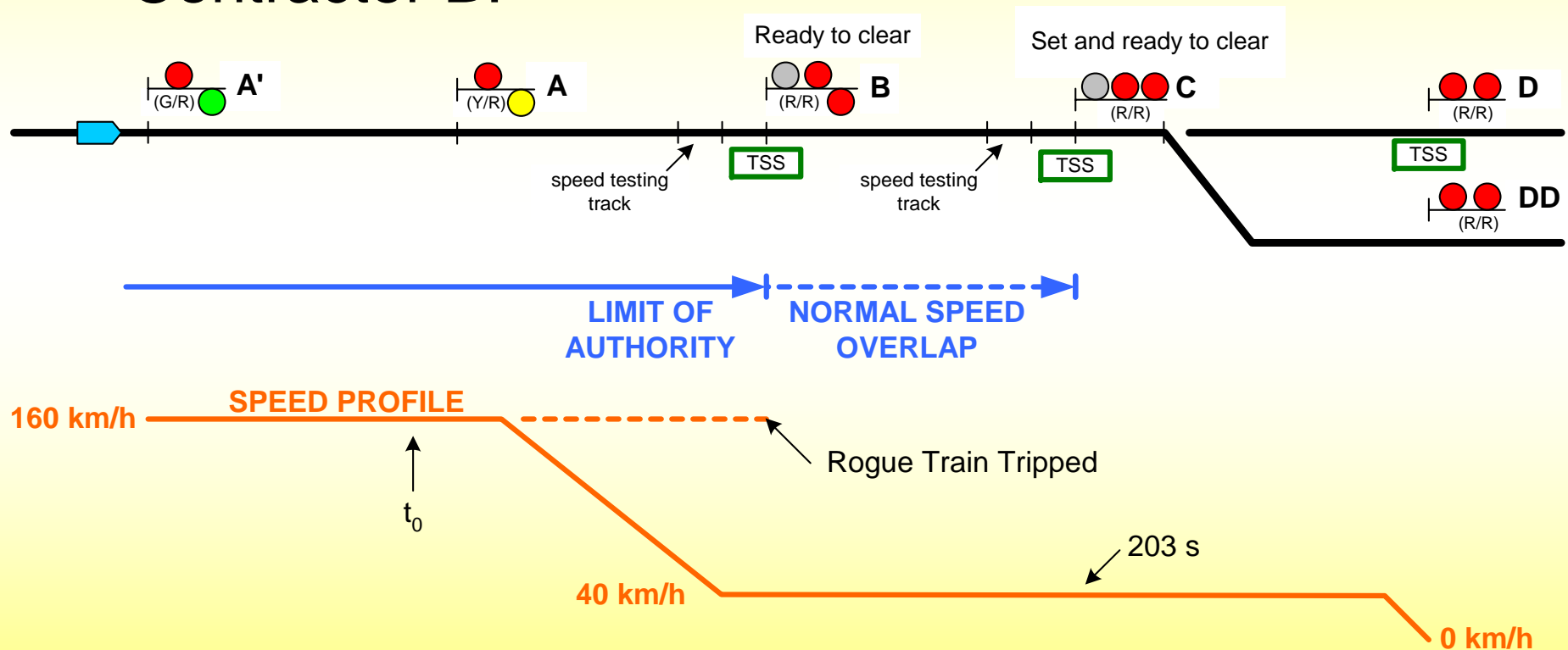
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Contractor Solutions

- Contractor B:



- Rogue train fully controlled
- Excessive train transit time

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Contractor Solutions Stakeholder Consultation

- Signalling Solution:
 - Enforce Limit of Authority
 - Normal overlaps only with points normal
 - Enforce medium speed aspect
 - Control speed through turnouts
- Best signal aspect sequence
- Consistency between Contractors

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Consultation Solution

- Result:
 - Retained reduce to medium signal aspect
 - Train speed checked on approach to signal in rear of junction signal (new timing track)
 - Drivers considered that 100 km/h was a satisfactory check that train under control
 - Junction signal approach operated and time cleared
 - Over Speed Sensors provided with junction signal to:
 - Enforce medium aspect speed
 - Control speed through turnout

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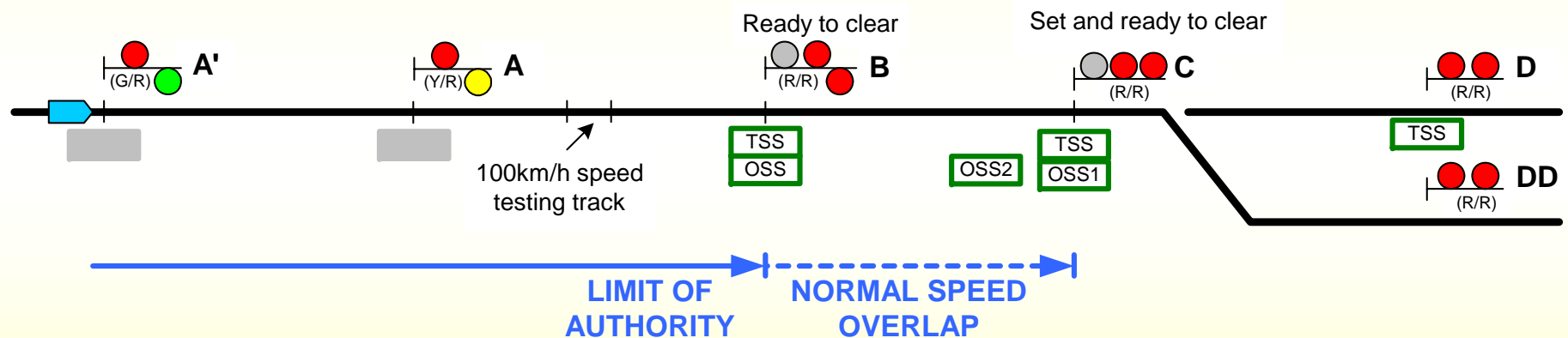
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Consultation Solution



- Retained reduce to medium signal aspect
- Train speed checked on approach to signal in rear of junction signal
- Drivers considered that 100 km/h was a satisfactory check that train under control
- Junction signal approach operated and time cleared
- Over Speed Sensors provided with junction signal to:
 - Enforce medium aspect speed
 - Control speed through turnout

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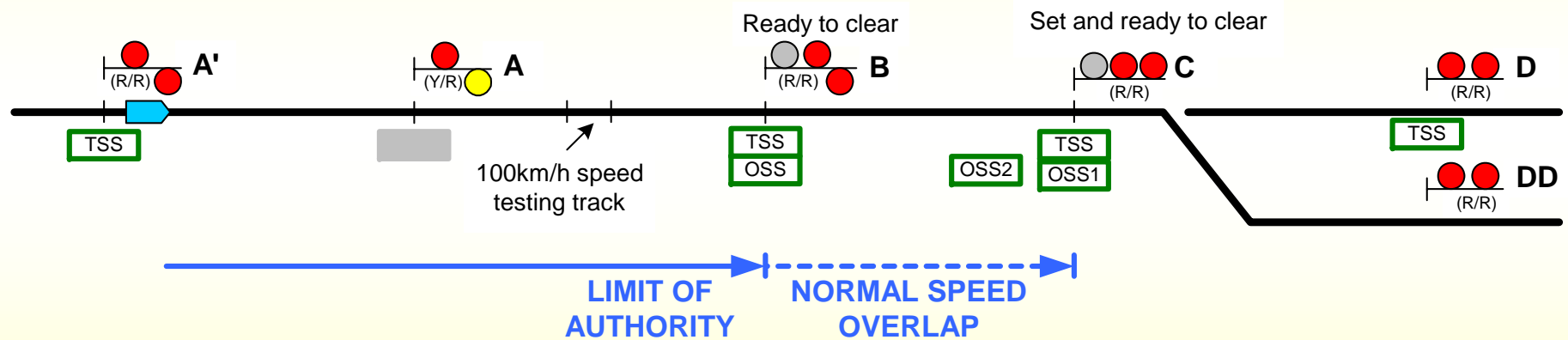
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Consultation Solution



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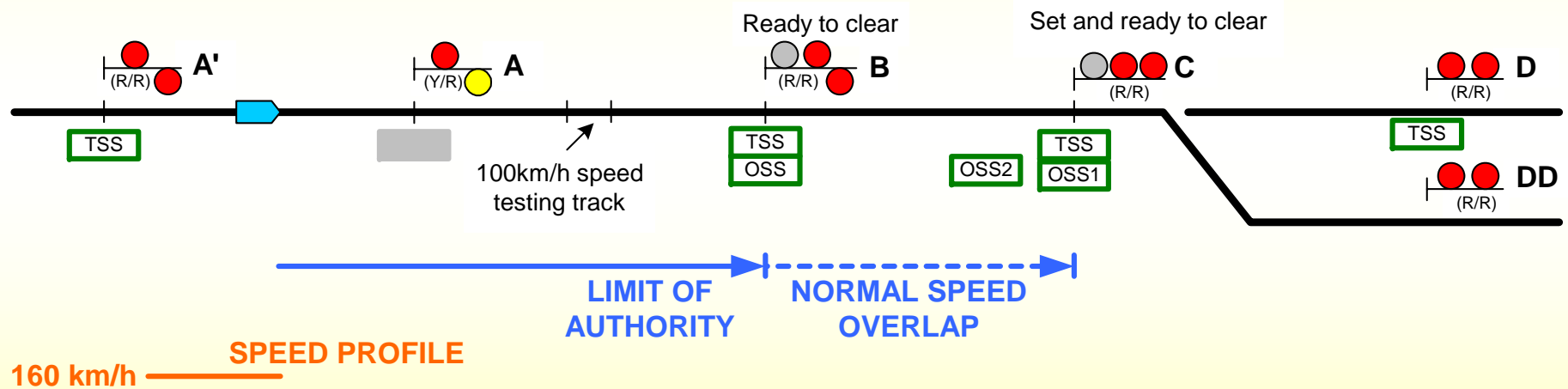
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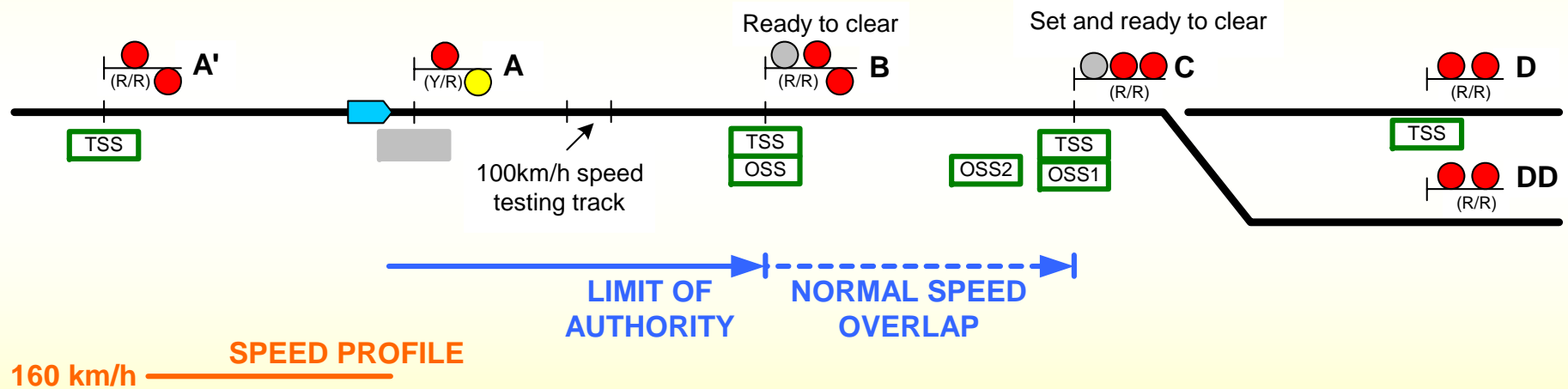
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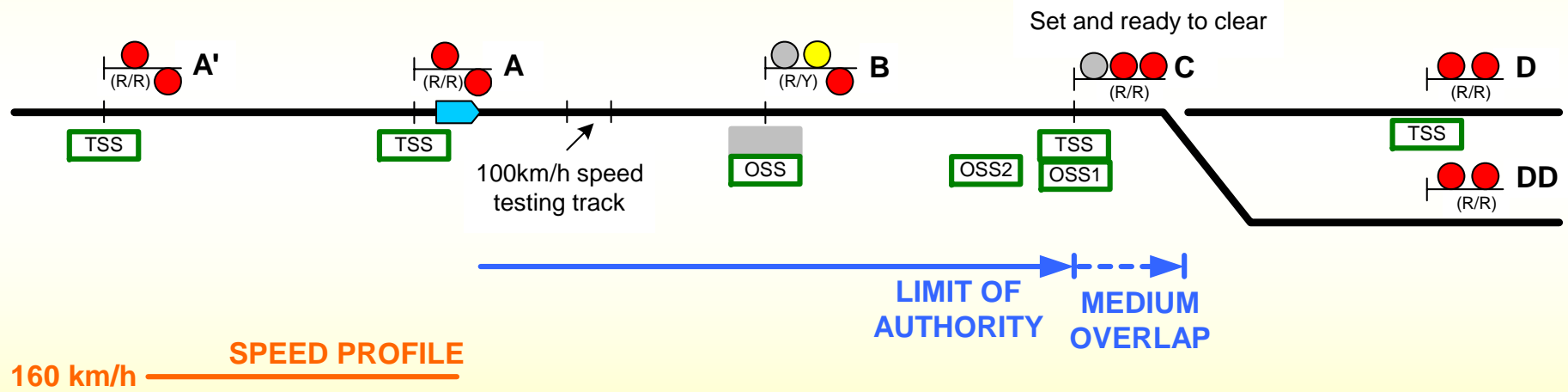
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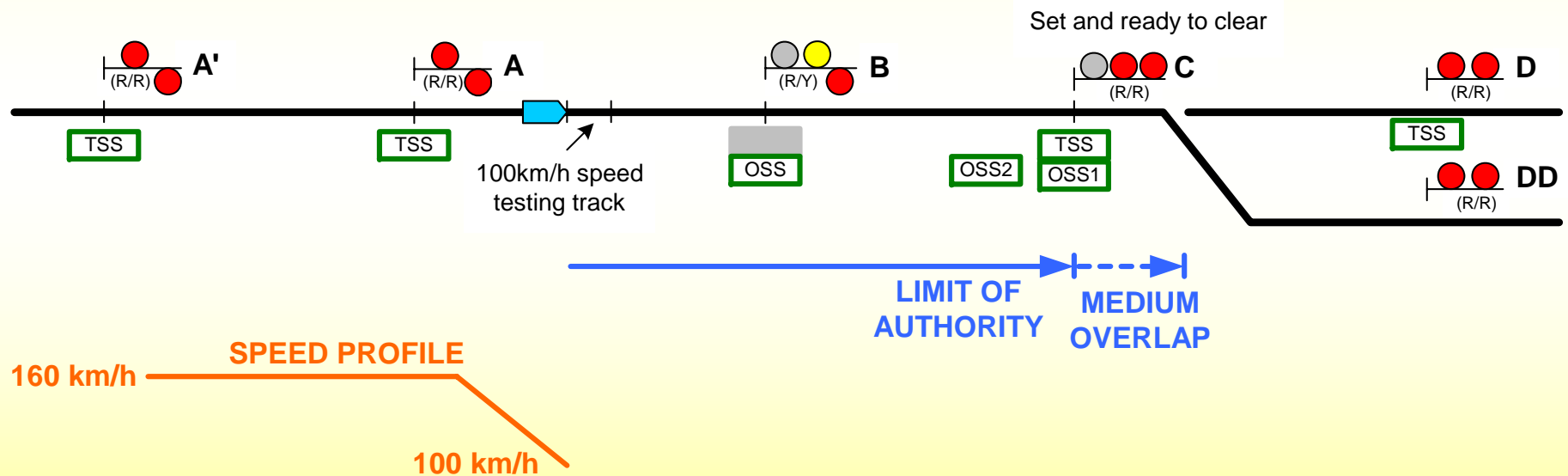
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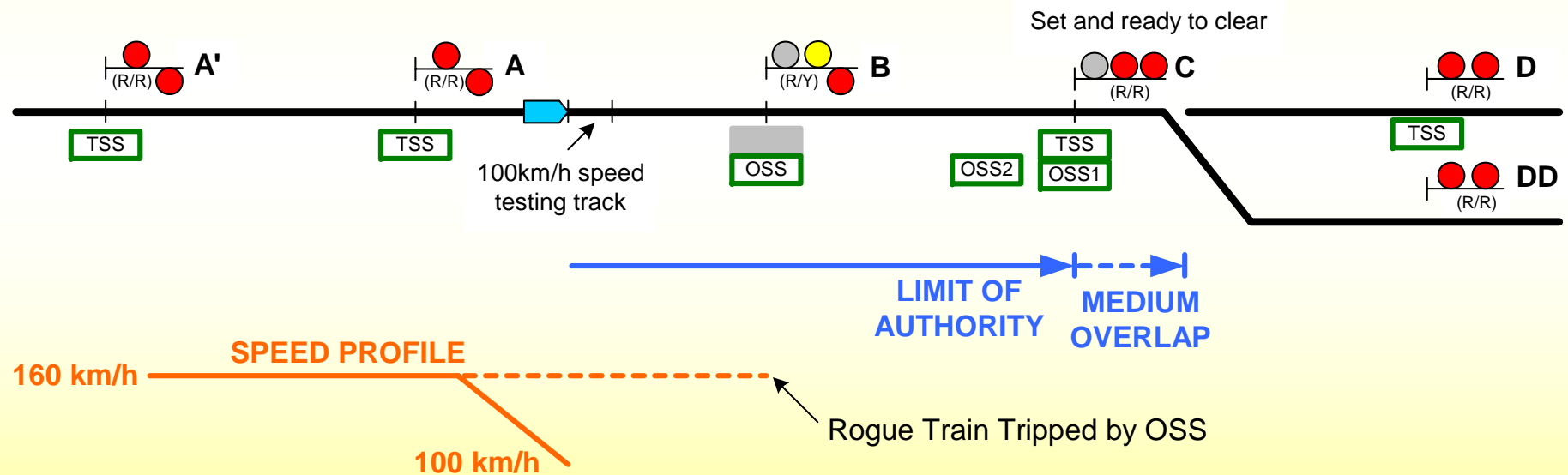
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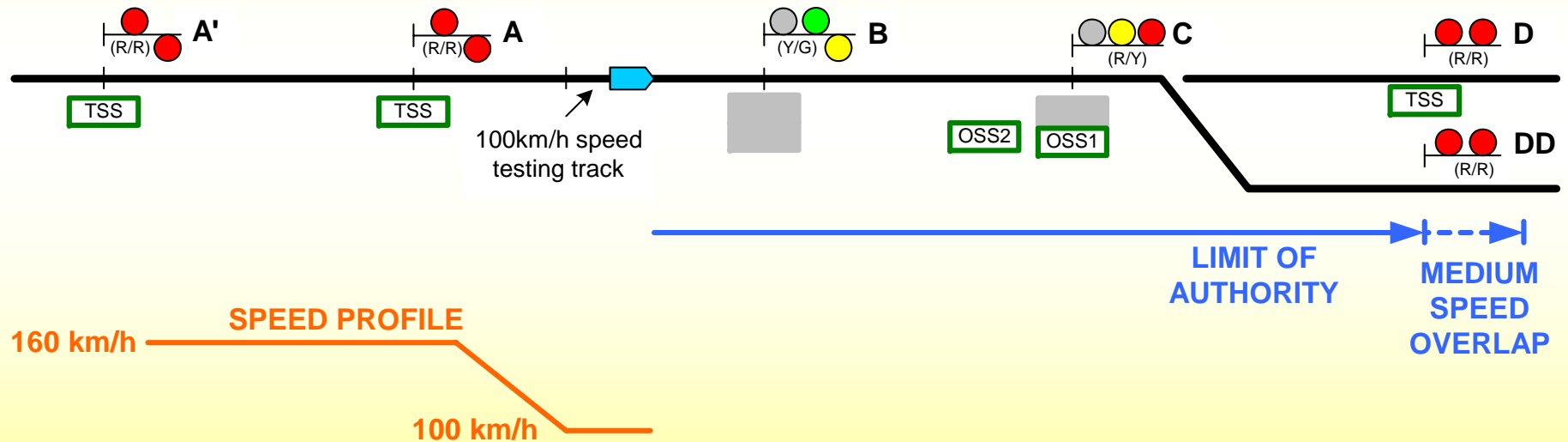
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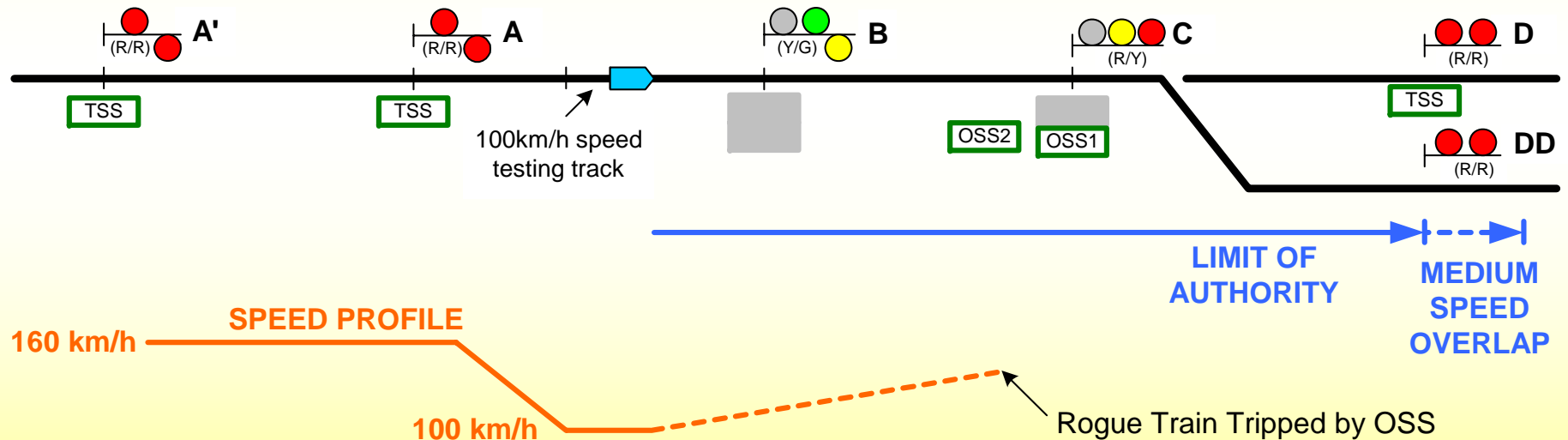
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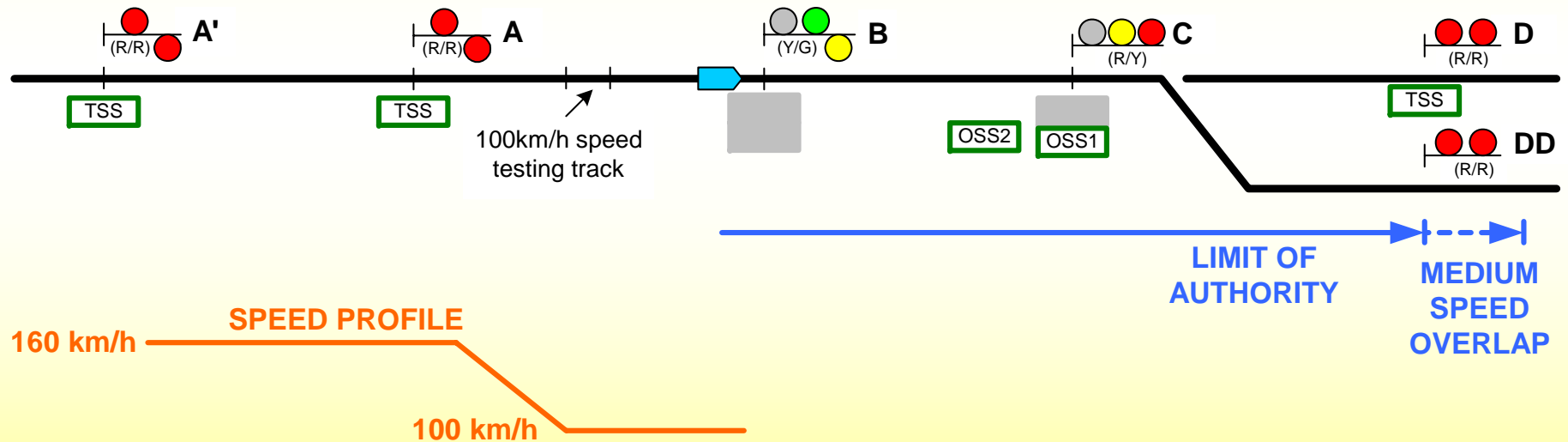
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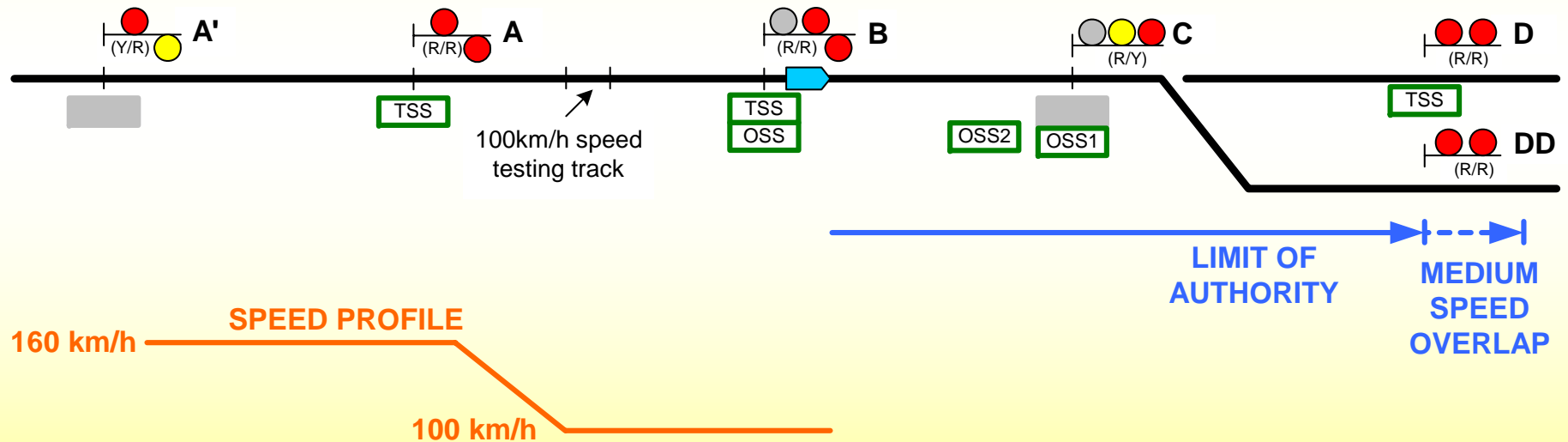
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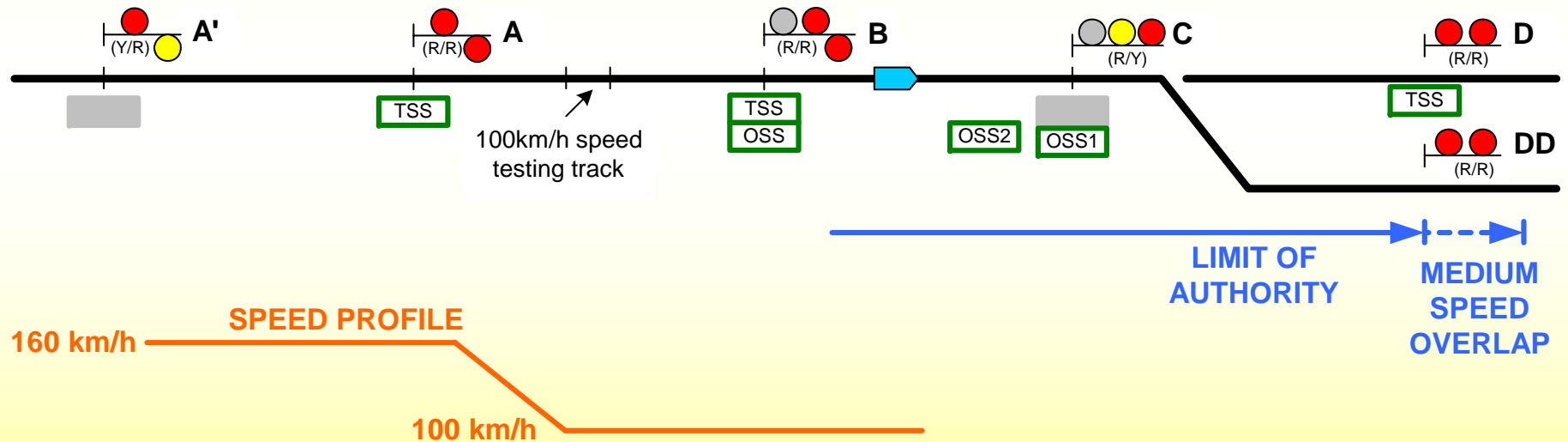
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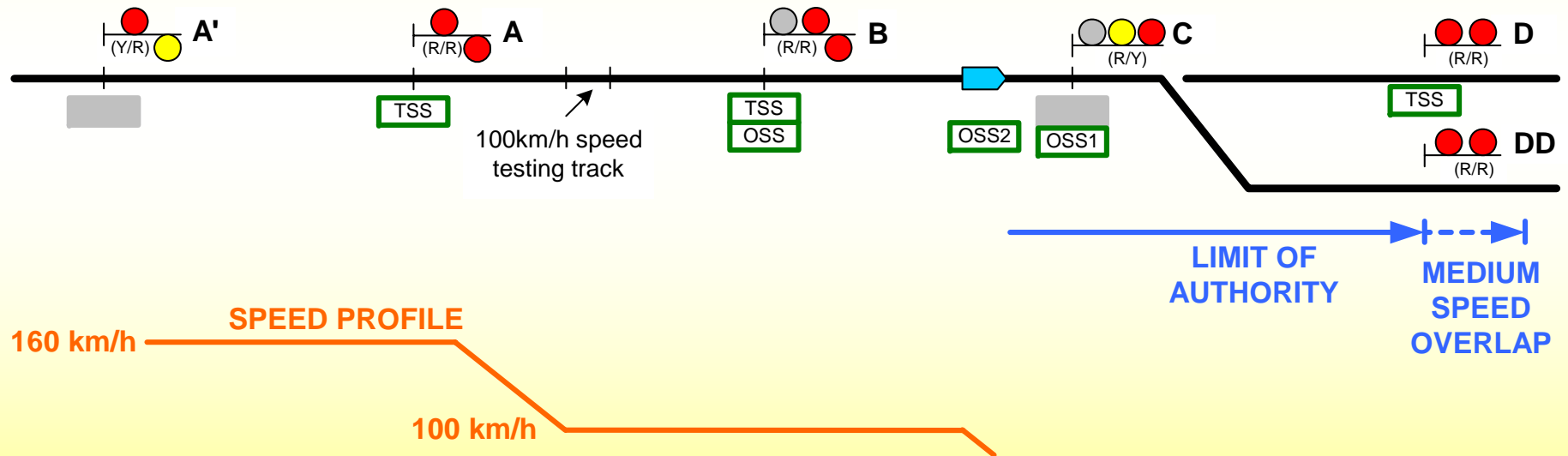
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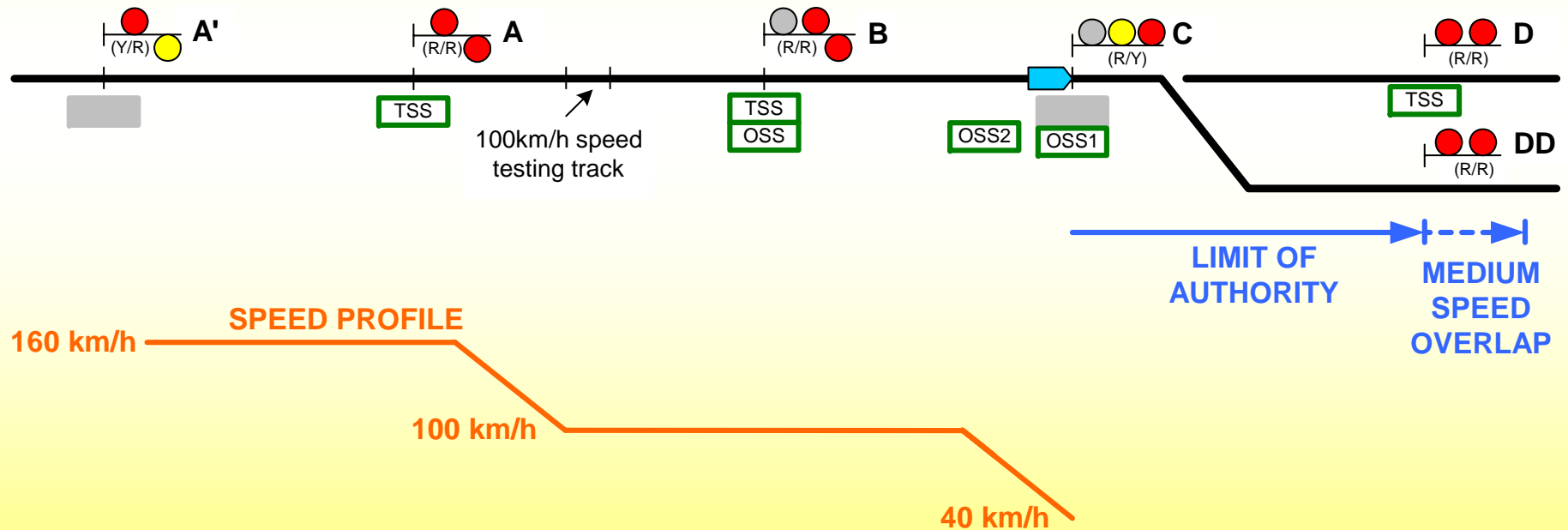
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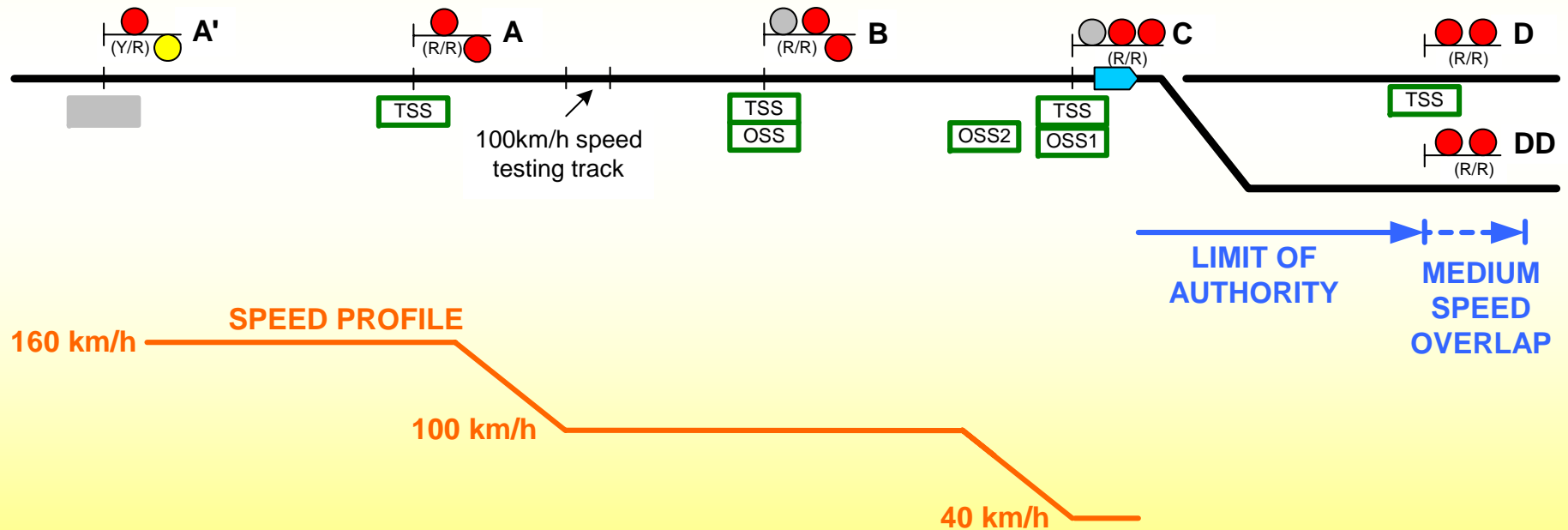
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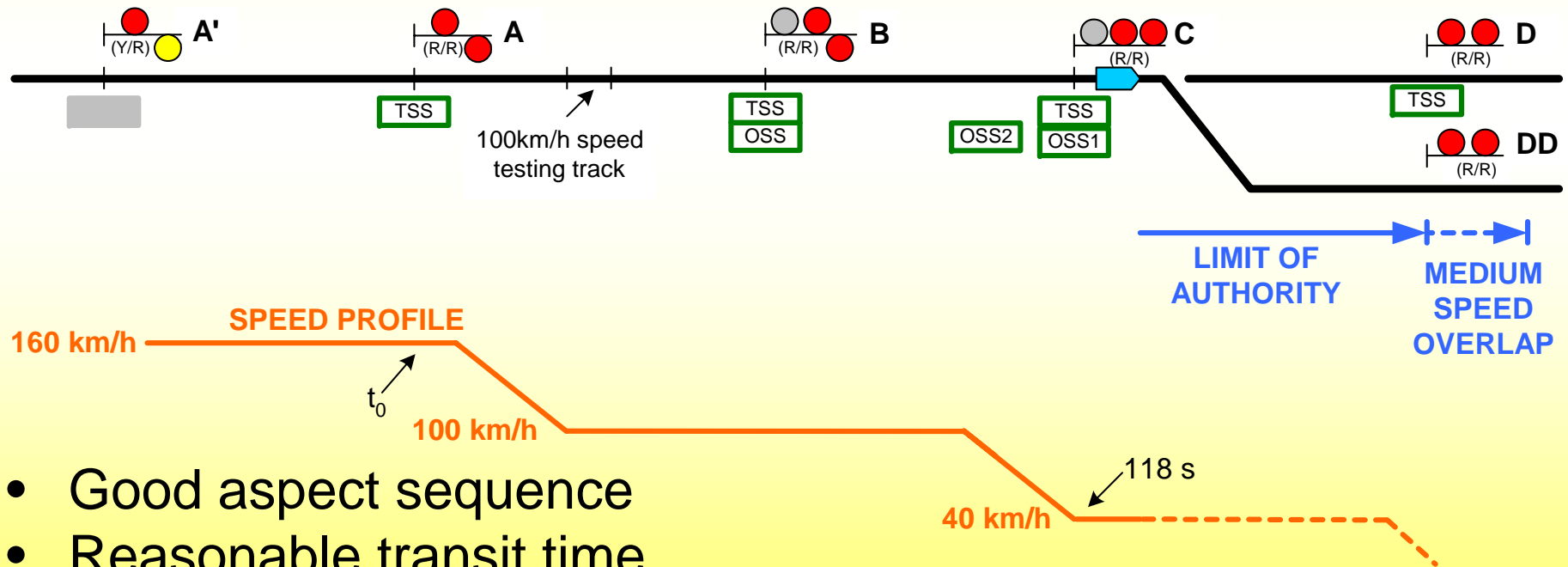
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Consultation Solution



- Good aspect sequence
- Reasonable transit time
- Rogue train controlled

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Controlling the Speed through Turnouts

- Objectives:
 - Must trip rogue train
 - Must not trip good train
- Need to provide a threshold margin above rated turnout speed to achieve above objectives
- And to take into account:
 - Different braking performance between DMU and N Class vehicles
 - Spacing between signal and turnout
- The Turnout Over Speed Value – default +20%

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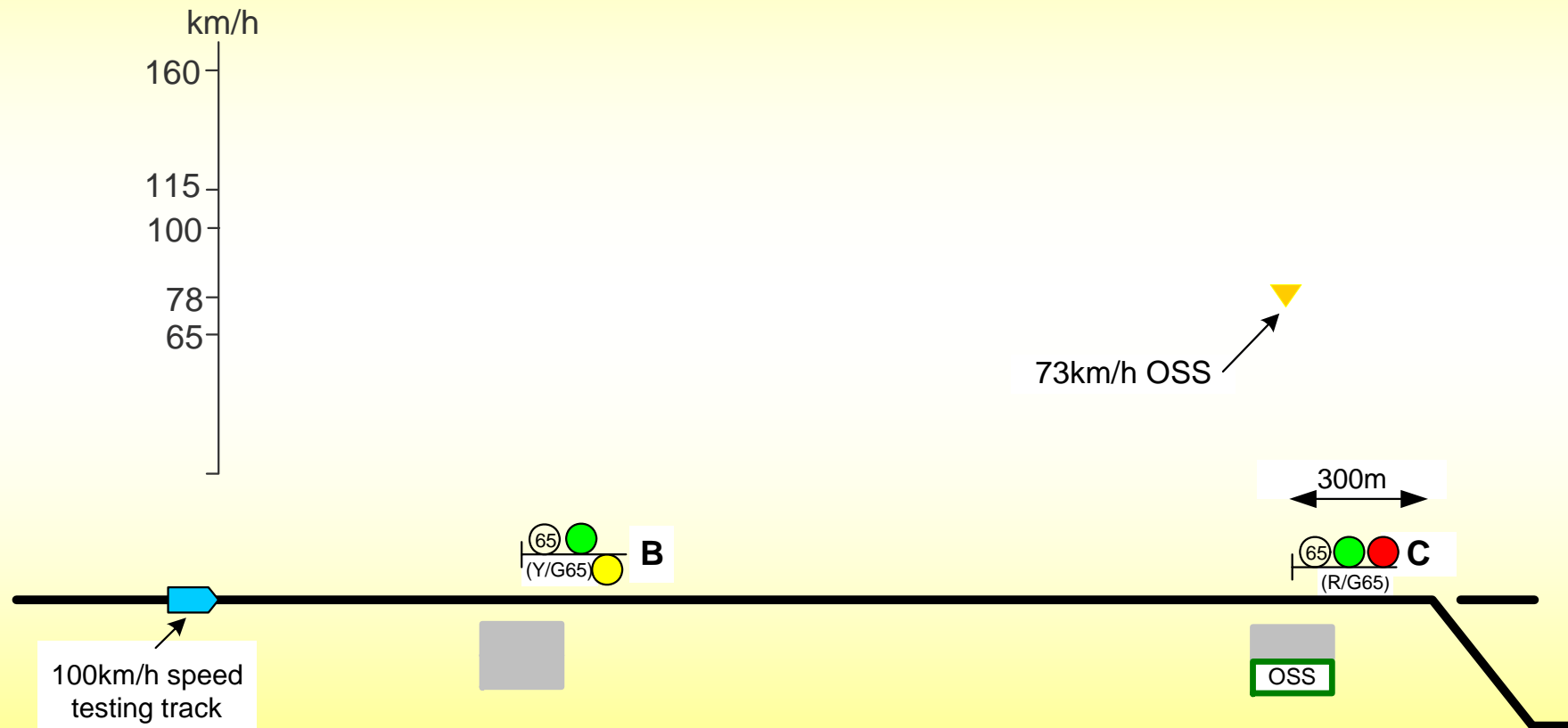
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Controlling the Speed through Turnouts



- OSS positioned at junction signal to enforce medium aspect speed.
- Set value to 8 km/h above medium aspect speed (need some tolerance as don't want to trip a good train).

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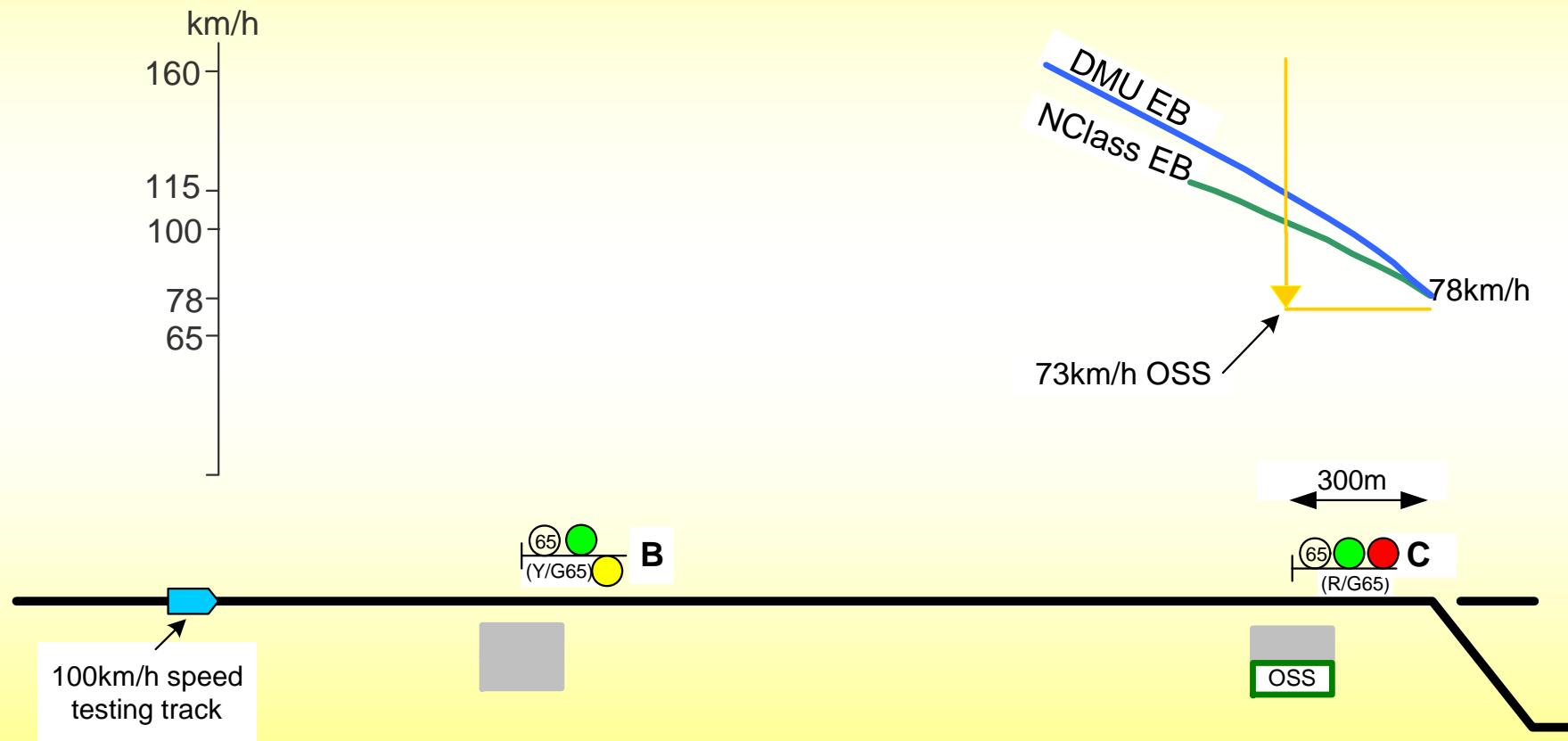
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Controlling the Speed through Turnouts



- Speed at turnout to be controlled to +20% above rated turnout speed.

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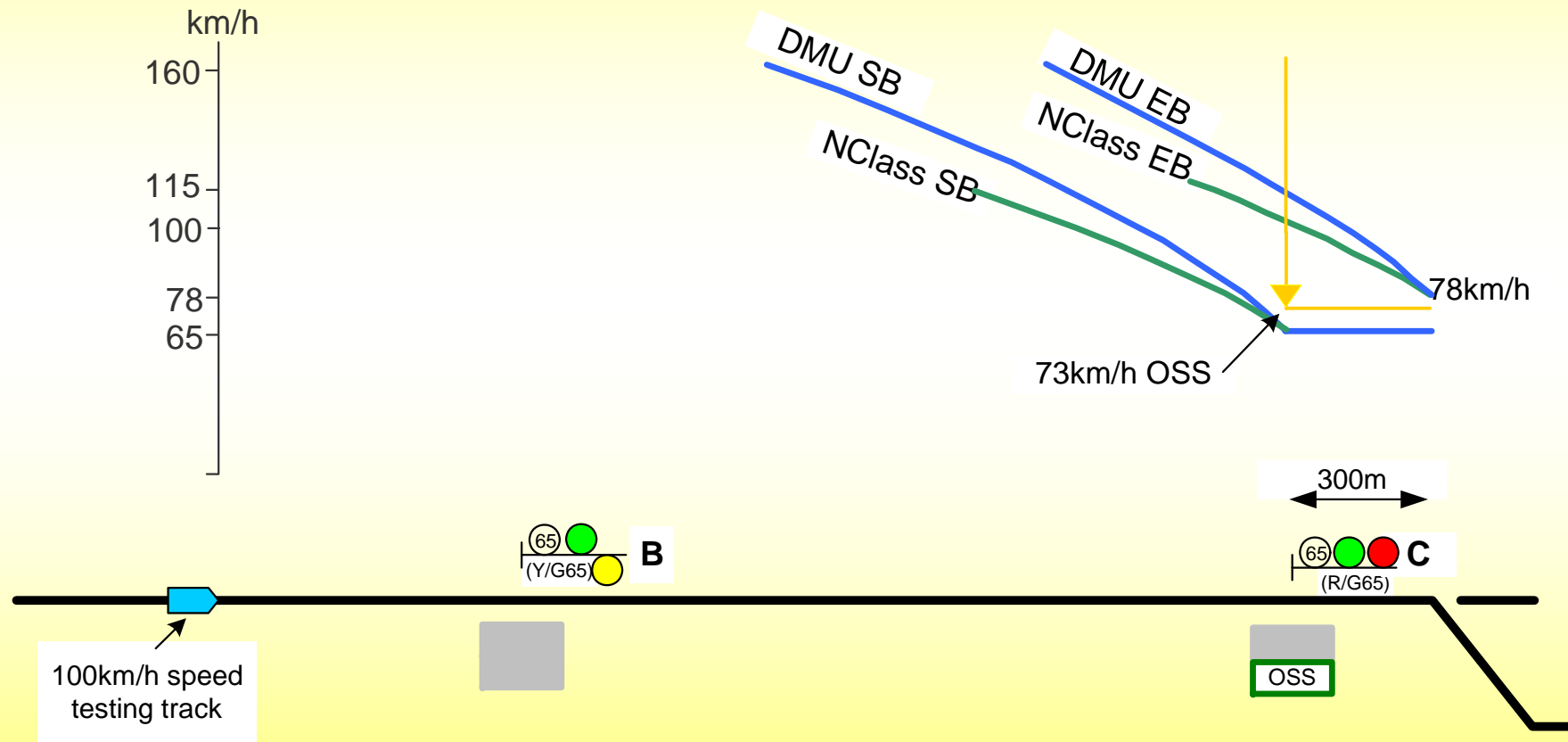
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Controlling the Speed through Turnouts



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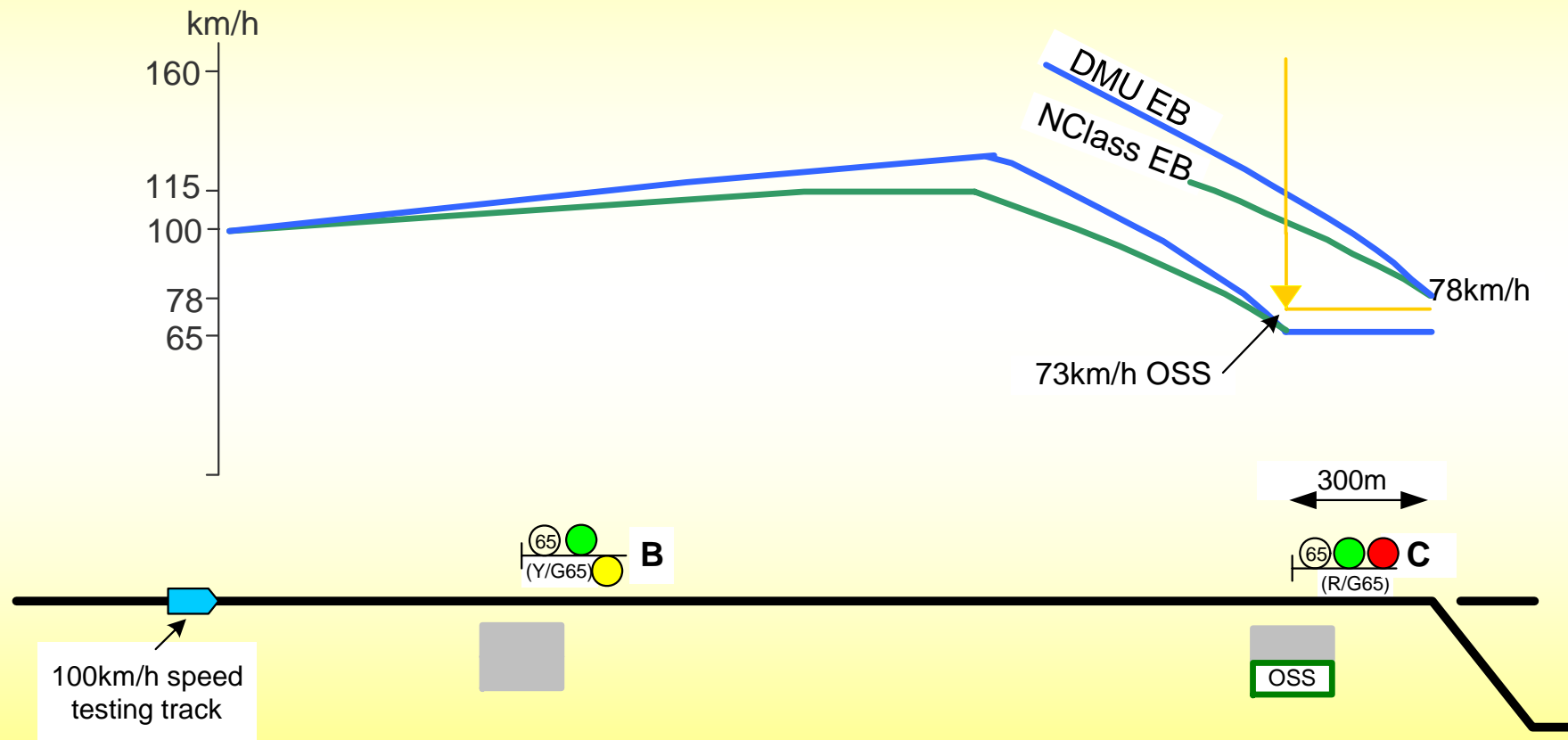
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Controlling the Speed through Turnouts



- Train running profiles driven at their maximum normal performance.

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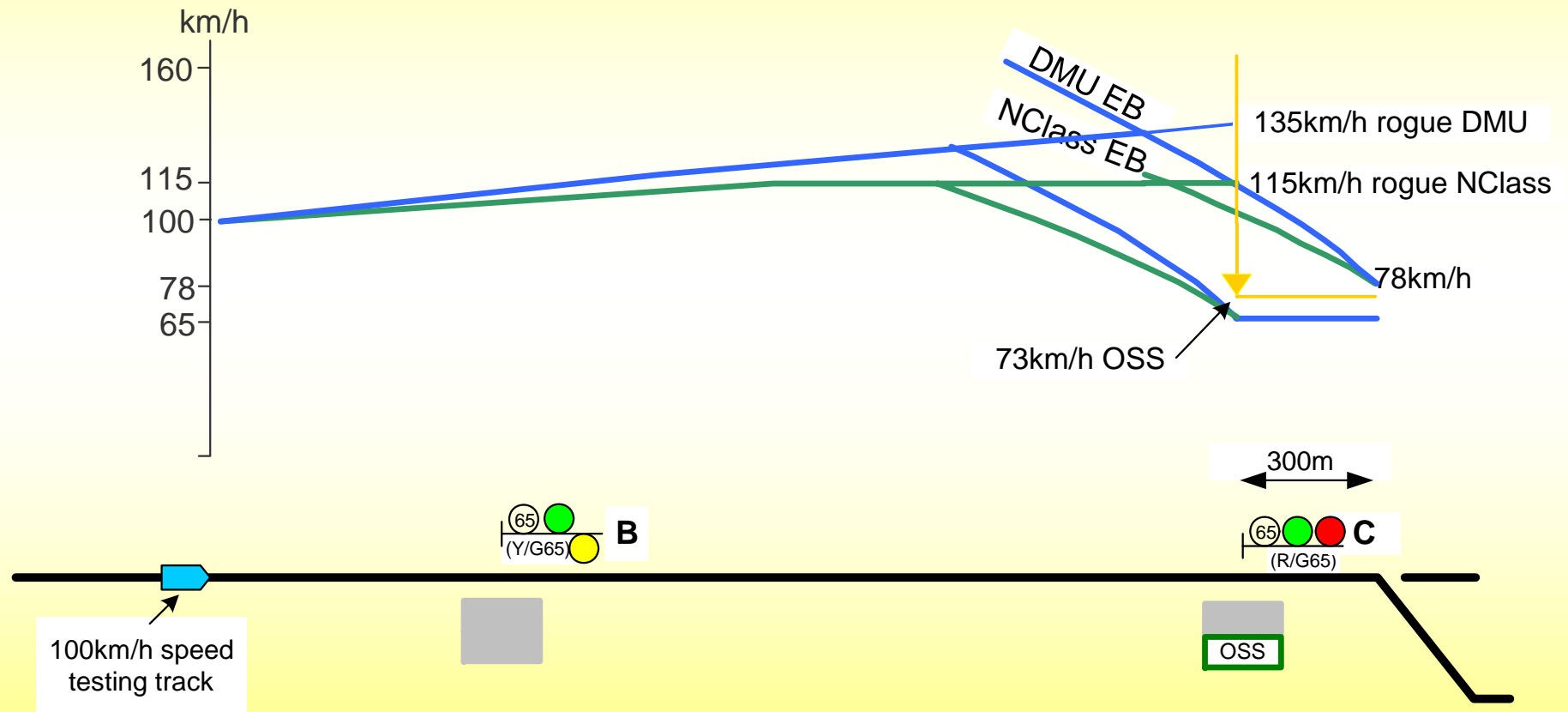
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Controlling the Speed through Turnouts



- OSS at junction signal will trip rogue, but speed through turnout will exceed 78 km/h.

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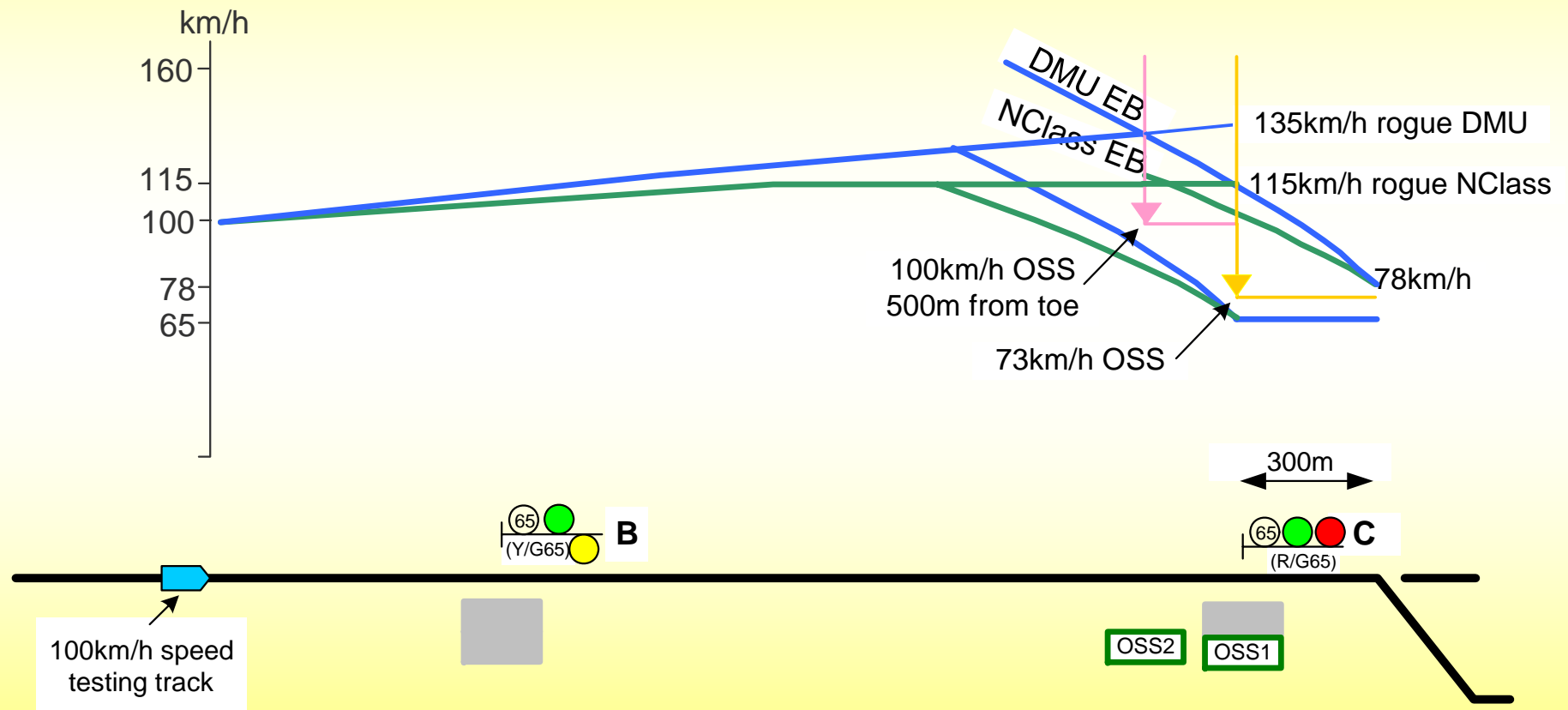
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Controlling the Speed through Turnouts



- Add in an OSS where the DMU rogue profile crosses the DMU EB profile.
- Set value to at least 5 km/h above DMU SB profile.

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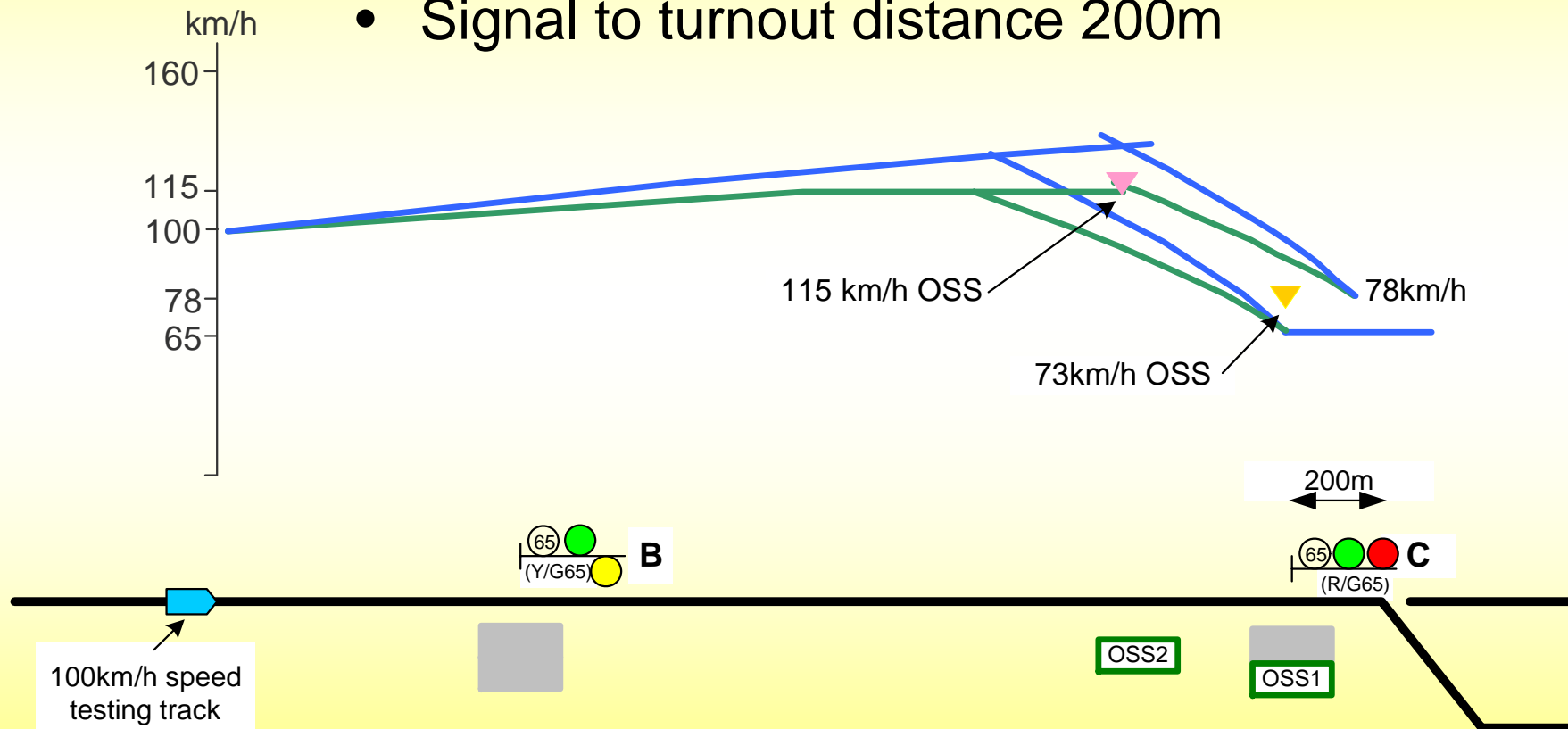
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Controlling the Speed through Turnouts

- Signal to turnout distance 200m



- OSS added where the DMU rogue profile crosses the DMU EB profile but trains passing at speeds just below OSS value will be still going too fast when tripped at OSS at junction signal.

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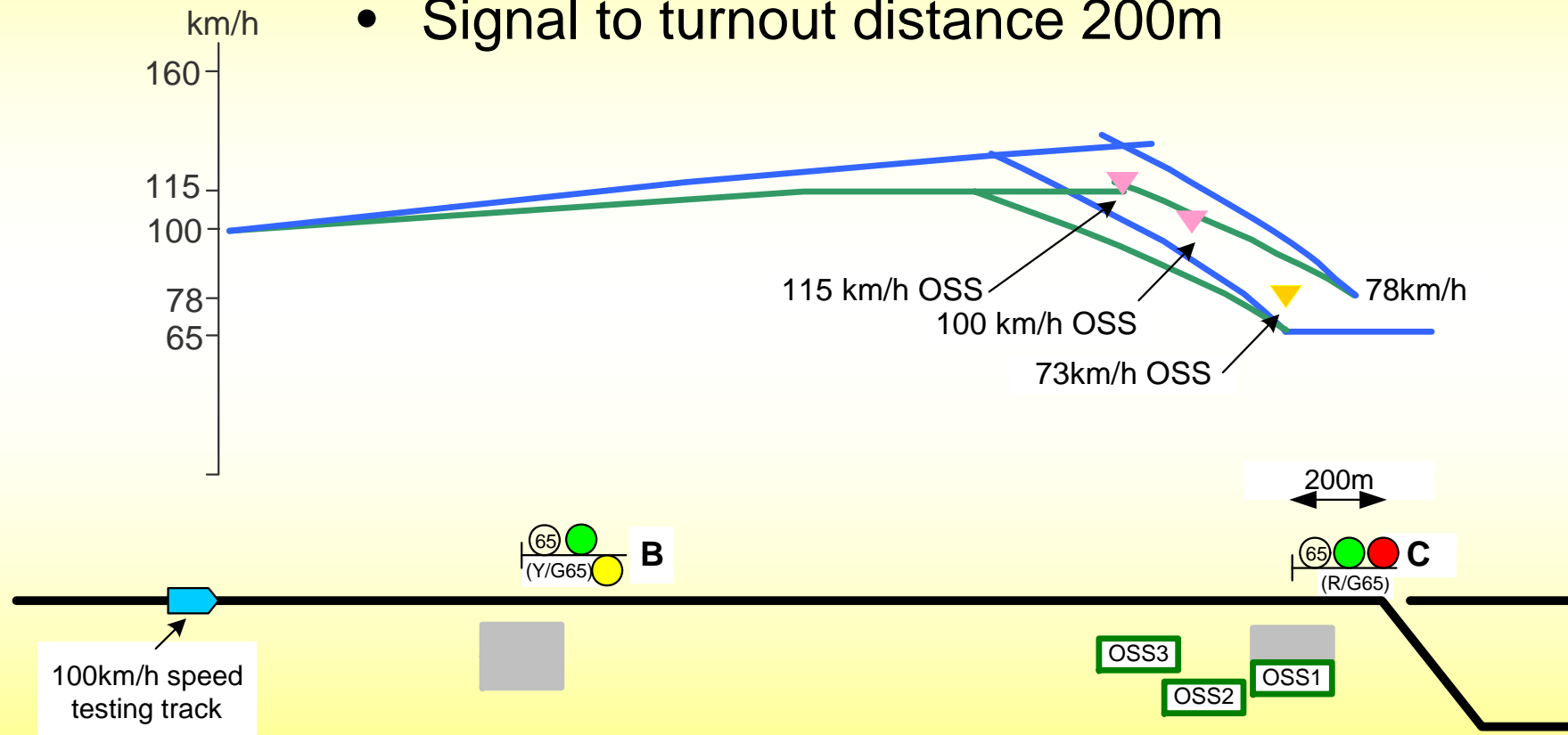
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Controlling the Speed through Turnouts

- Signal to turnout distance 200m



- A third OSS added to control potential rogue trains.

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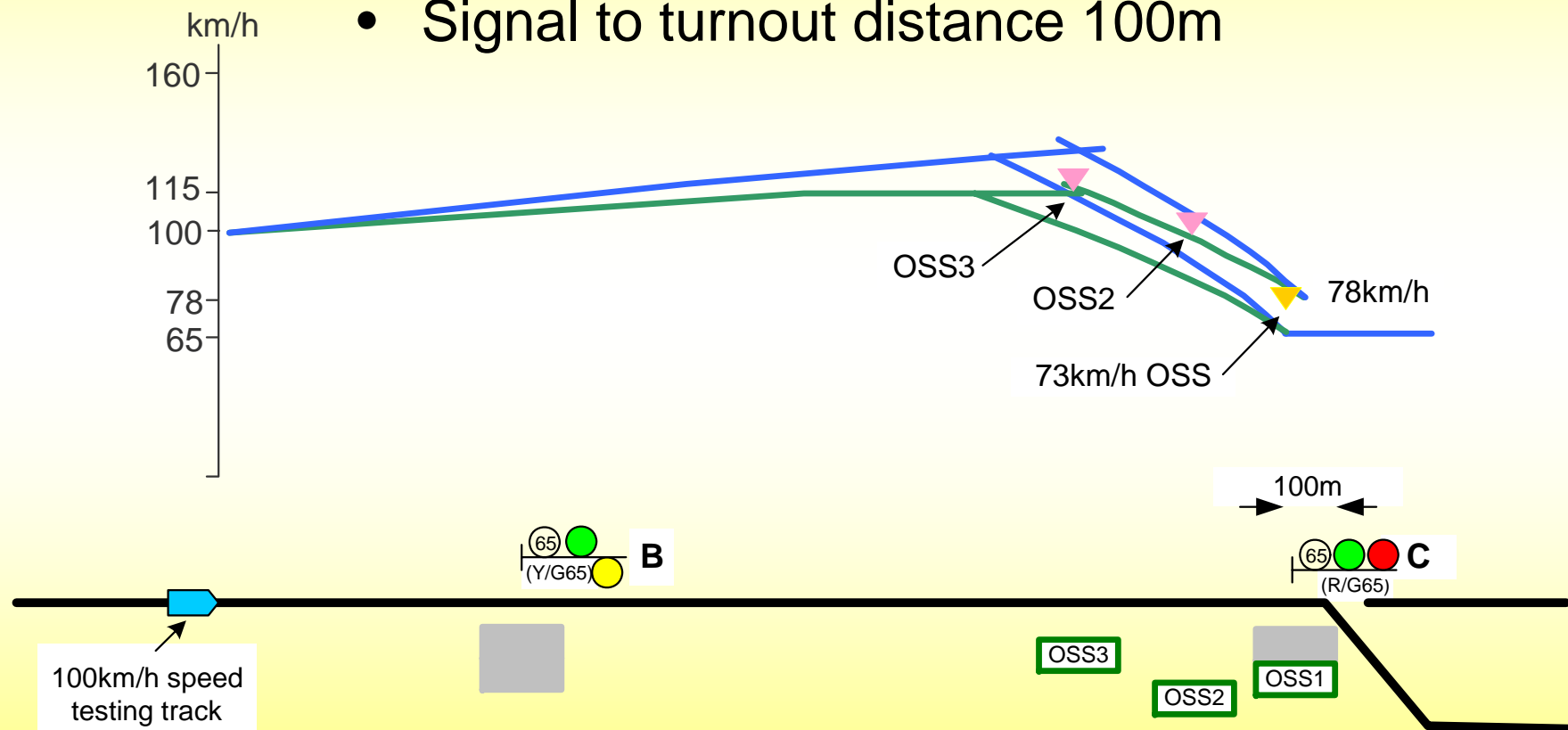
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Controlling the Speed through Turnouts

- Signal to turnout distance 100m



- Arrangement not able to be controlled via OSS design. OSS3 and OSS2 are too close to SB profile and will trip good trains. Junction signal and turnout distance need to be increased or higher speed rated turnout required.

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RFR TPWS Applications

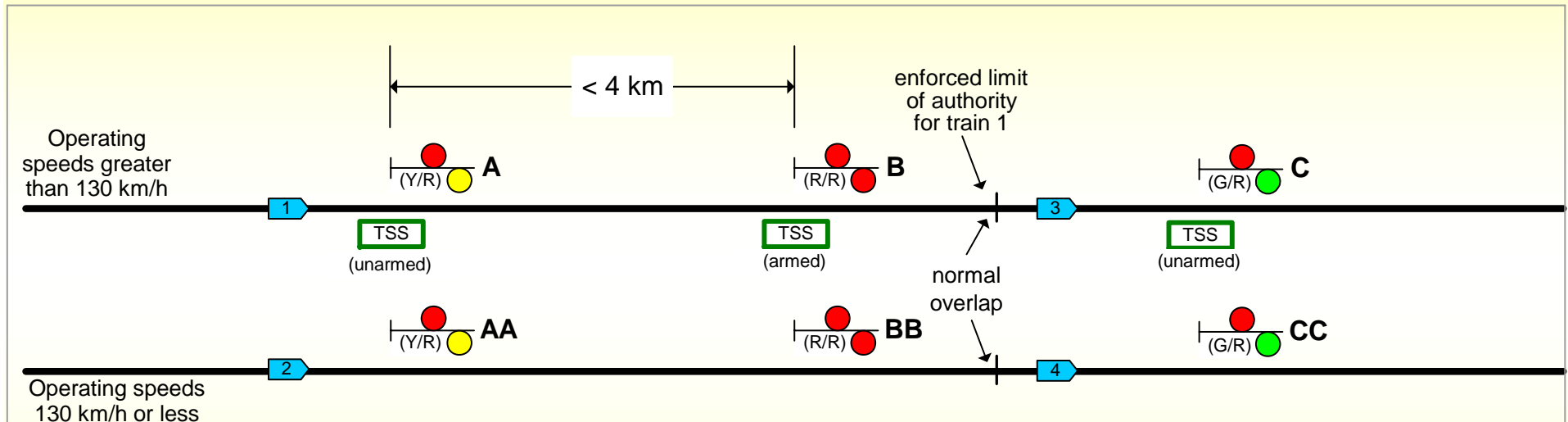


Figure 3.

For signals that can be approached at greater than 130 km/h TSS units shall be fitted.

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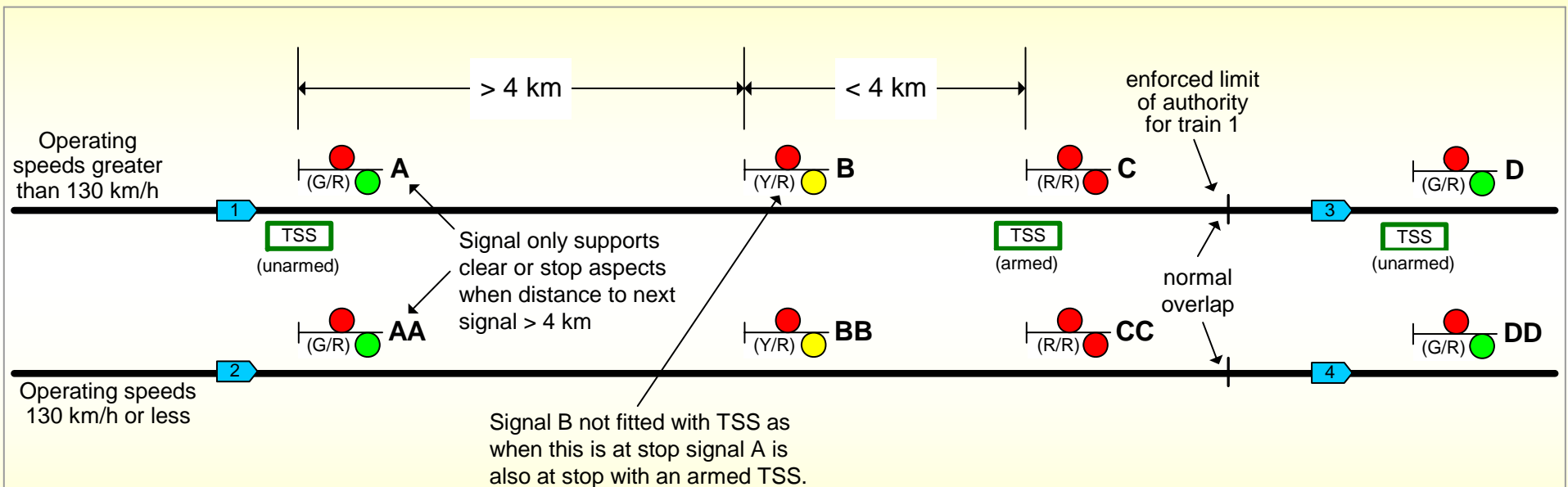


Figure 4.

For signals spaced greater than 4 km apart, signal A (and AA) must only support a clear and a stop aspect. Where the approach speed exceeds 130 km/h, signal A and signal C shall be fitted with TSS units. The intermediate signal (signal B) does not require a TSS unit.

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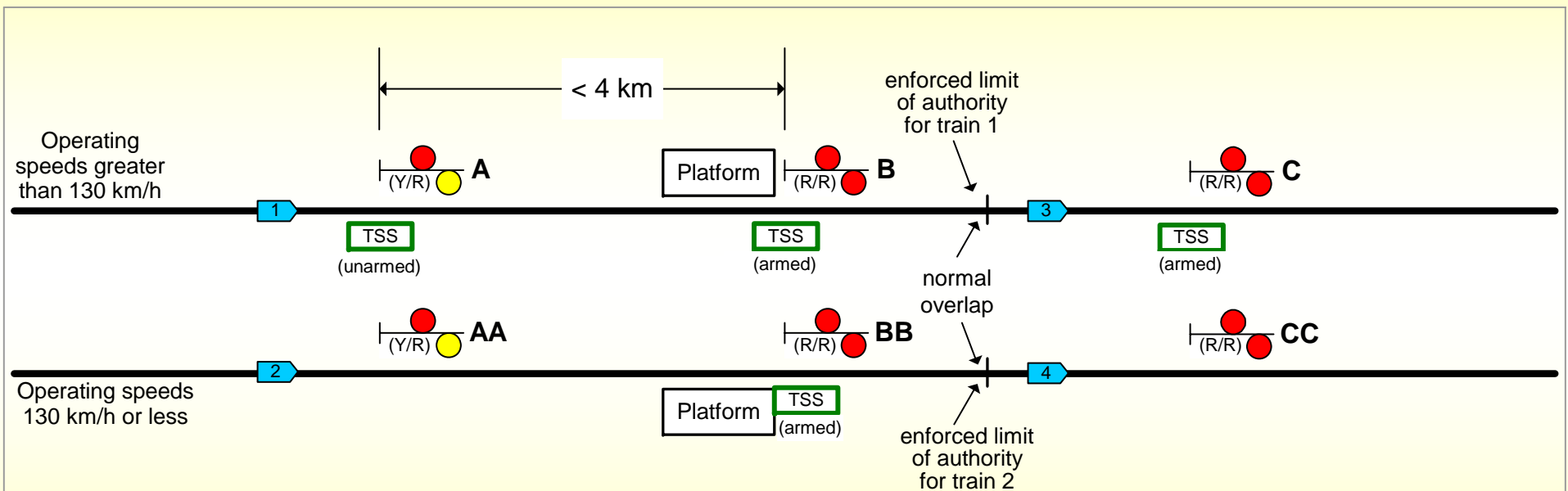


Figure 5.

For signals that can be approached at 130 km/h or less and a signal (BB) is the end of a platform or shortly past the platform and the previous signal (AA) can display a warning aspect and the next signal (CC) cannot be seen, the platform departure signal (BB) shall be fitted with a TSS (see train 2).

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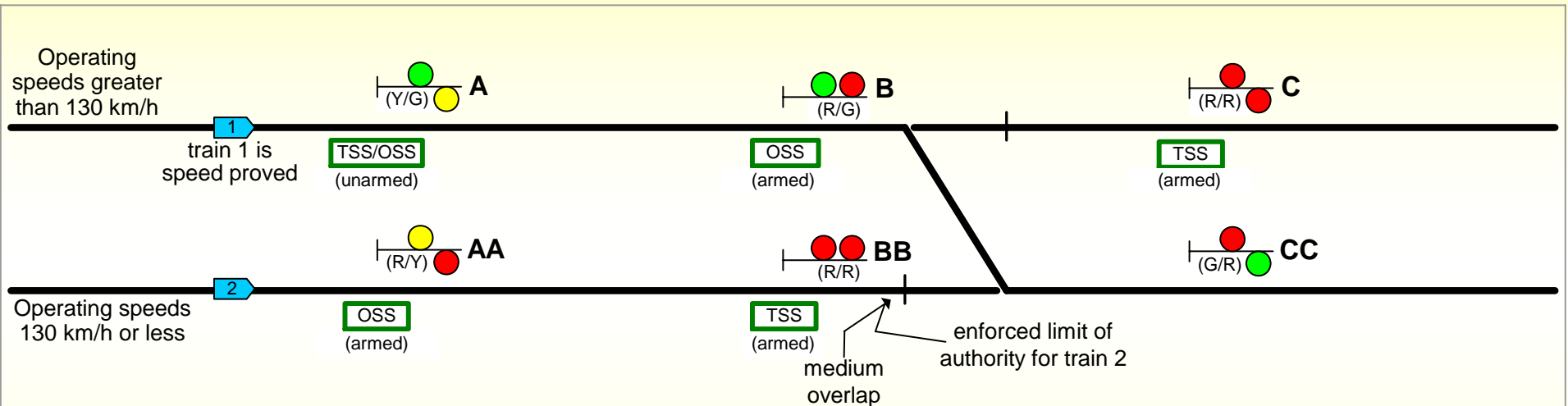


Figure 6.

1. For signals that can be approached at 130 km/h or less and a SPAD could result in a collision with a train off the high speed line, then the home signal (BB) shall be fitted with a TSS unit and the signal in rear (AA) fitted with an OSS to enforce a medium speed approach (see train 2).
2. For a diverge move from a high speed line, the junction signal (B) shall be approach operated and speed proved and the turnout speed enforced (see train 1).

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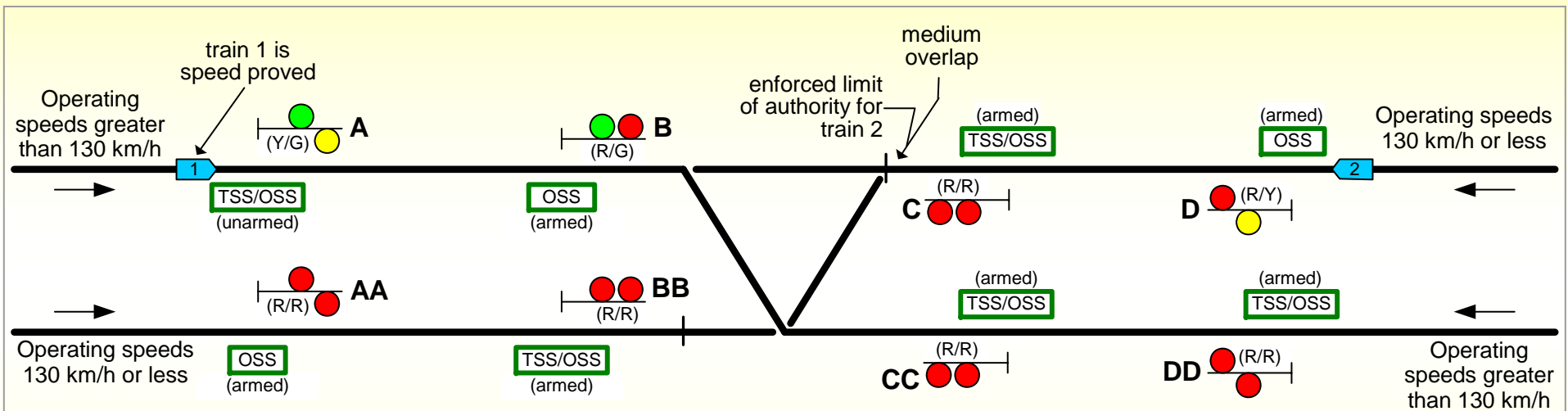


Figure 7.

1. For signals that can be approached at 130 km/h or less and a SPAD could result in a collision with a train operating in the opposing high speed direction, then the home signal (C) shall be fitted with a TSS unit and the signal in rear (D) fitted with an OSS to enforce a medium speed approach (see train 2).
2. For a diverge move from a high speed line, the junction signal (B) shall be approach operated and speed proved and the turnout speed enforced (see train 1).

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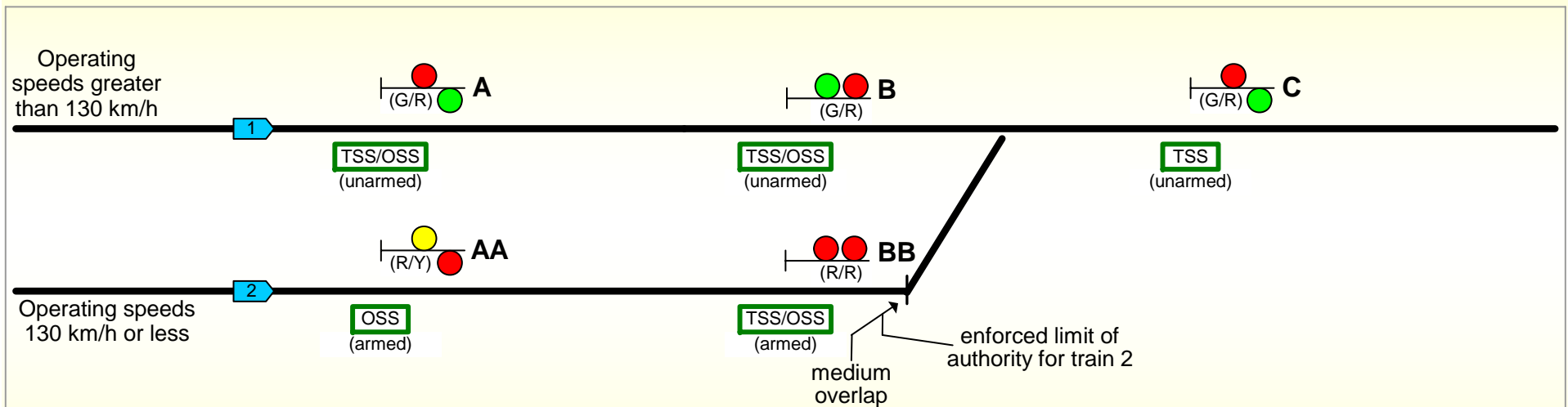


Figure 8.

For signals that control the departure to a single line with operating train speeds greater than 130 km/h, then the departure signal (BB) shall be fitted with a TSS unit and the signal in rear (AA) fitted with an OSS to enforce a medium speed approach (see train 2).

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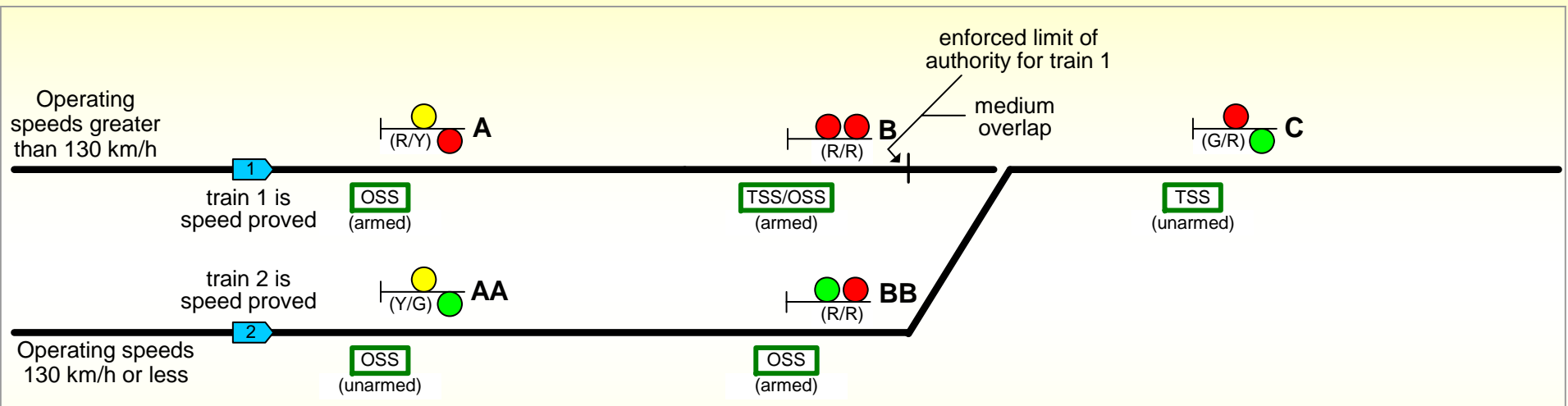


Figure 9.

1. For signals that control the departure to a single line with operating speeds greater than 130 km/h and the converging junction can be approached at 130 km/h, the departure signal (BB) shall be approach operated and speed proved and the turnout speed enforced (see train 2).
2. When approaching a junction signal at stop (signal B) on a line with operating speeds greater than 130 km/h, the signal in rear (A) shall be approach operated and speed proved and the medium speed aspect enforced with an OSS (see train 1).

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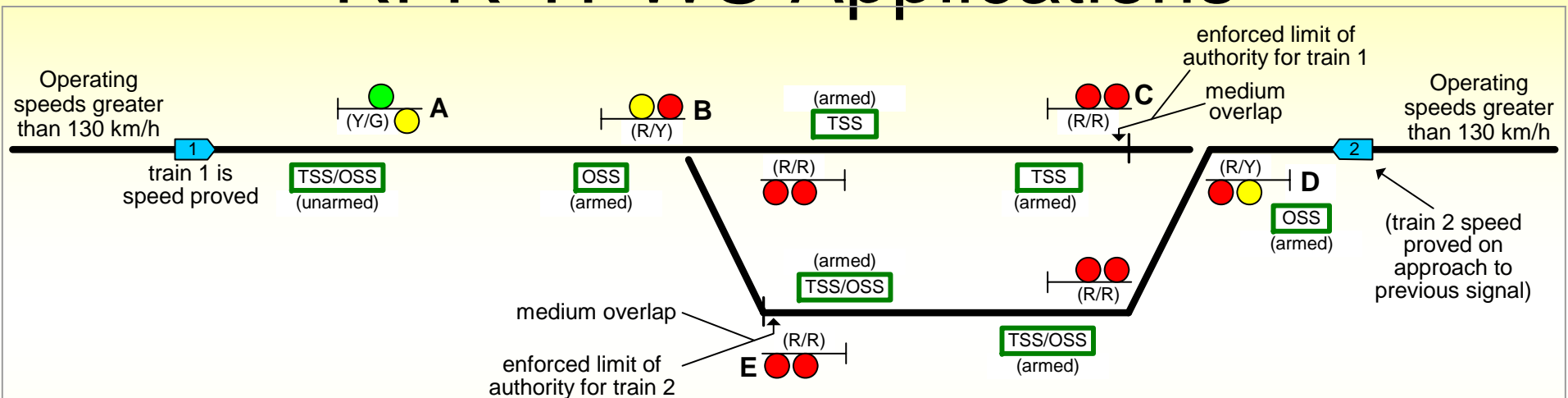


Figure 10.

1. For signals controlling the departure from a loop to a single line with operating train speeds greater than 130 km/h, then the departure signal (E) shall be fitted with a TSS unit. The departure signal shall also be fitted with an OSS to enforce the turnout speed.
2. For a diverge move from a high speed line, the junction signal (D) shall be approach operated and speed proved and the medium speed aspect enforced (train 2).
3. For a straight move along the high speed line when the departure signal (C) is at stop, the junction signal (B) shall be approach operated and speed proved and the medium speed aspect enforced (train 1).

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Summary - RFR Signalling

- Signalling Base Level – Improved Safety:
 - 3 Position signalling
 - Overlaps
 - Speed proving
- Signalling Enforcement System
 - Additional Layer of Safety Performance
 - TPWS

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Summary - RFR Signalling

- RFR TPWS:
 - Solution Engineered for Local Arrangements
 - Not the same as UK application
 - Not Speed Limited
 - Provides LOA Enforcement
 - Provides Medium Speed Aspect Enforcement
 - Relatively simple c/w alternative ATP systems
 - A new safety performance benchmark for Victoria

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