Pantograph Gauging for Minimum Electrical Clearances

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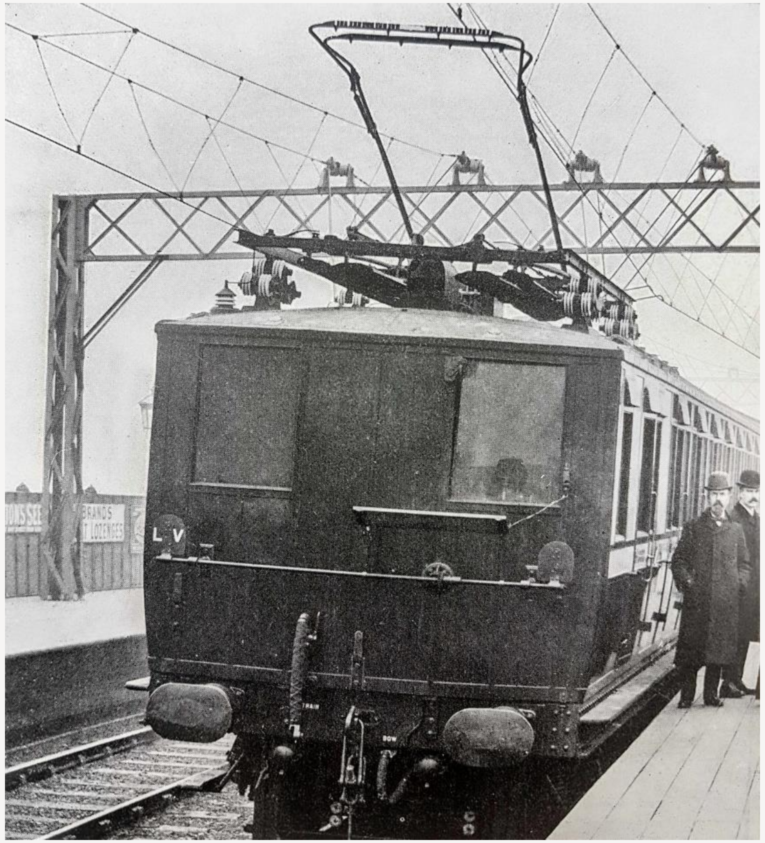
Talk Contents

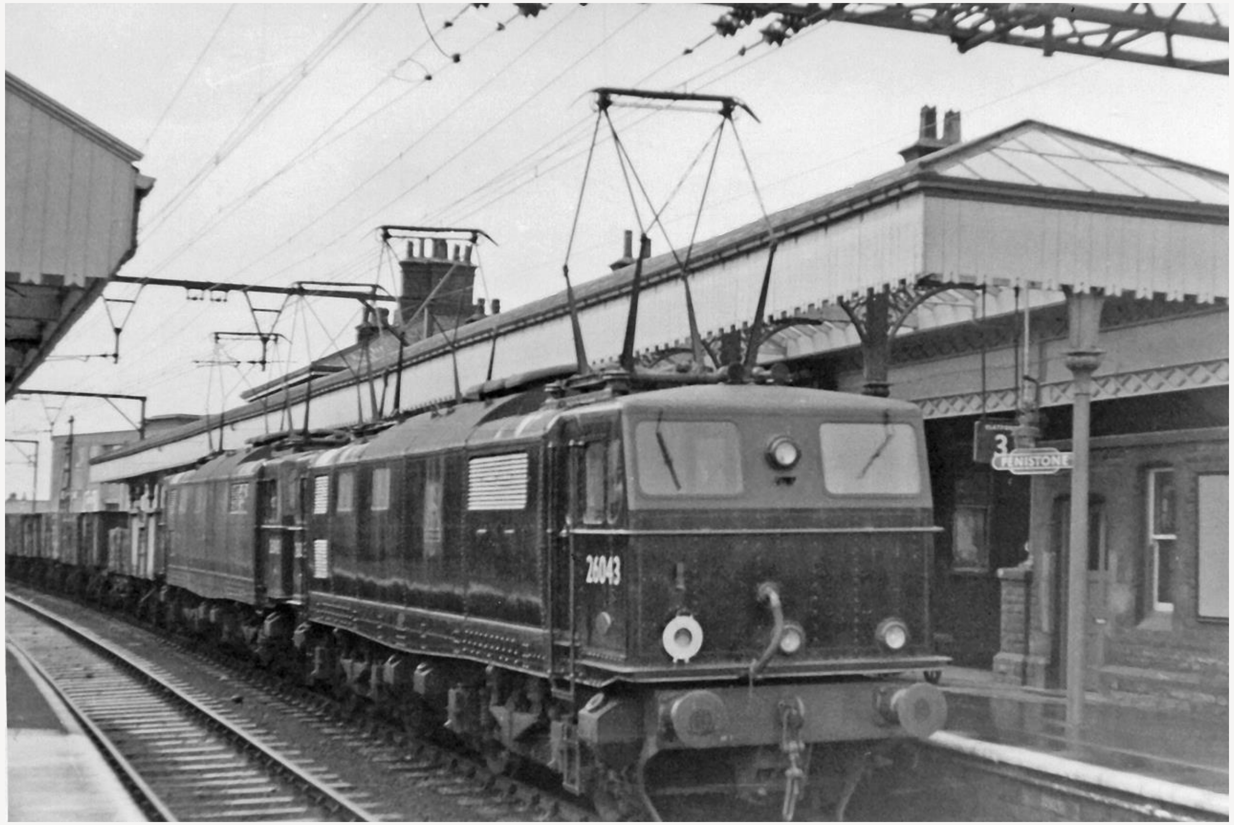
- A Brief History of Current Collection
- What is pantograph gauging?
- The traditional approach
- Why that doesn't work any more (at bridges)
- What we do instead
- Live PanGen demo
- Q&A

A Brief History of Current Collection – the Trolley Pole

A Brief History of Current Collection – the Bow Collector



A Brief History of Current Collection – the Diamond Pantograph



A Brief History of Current Collection – the Single Arm Pantograph

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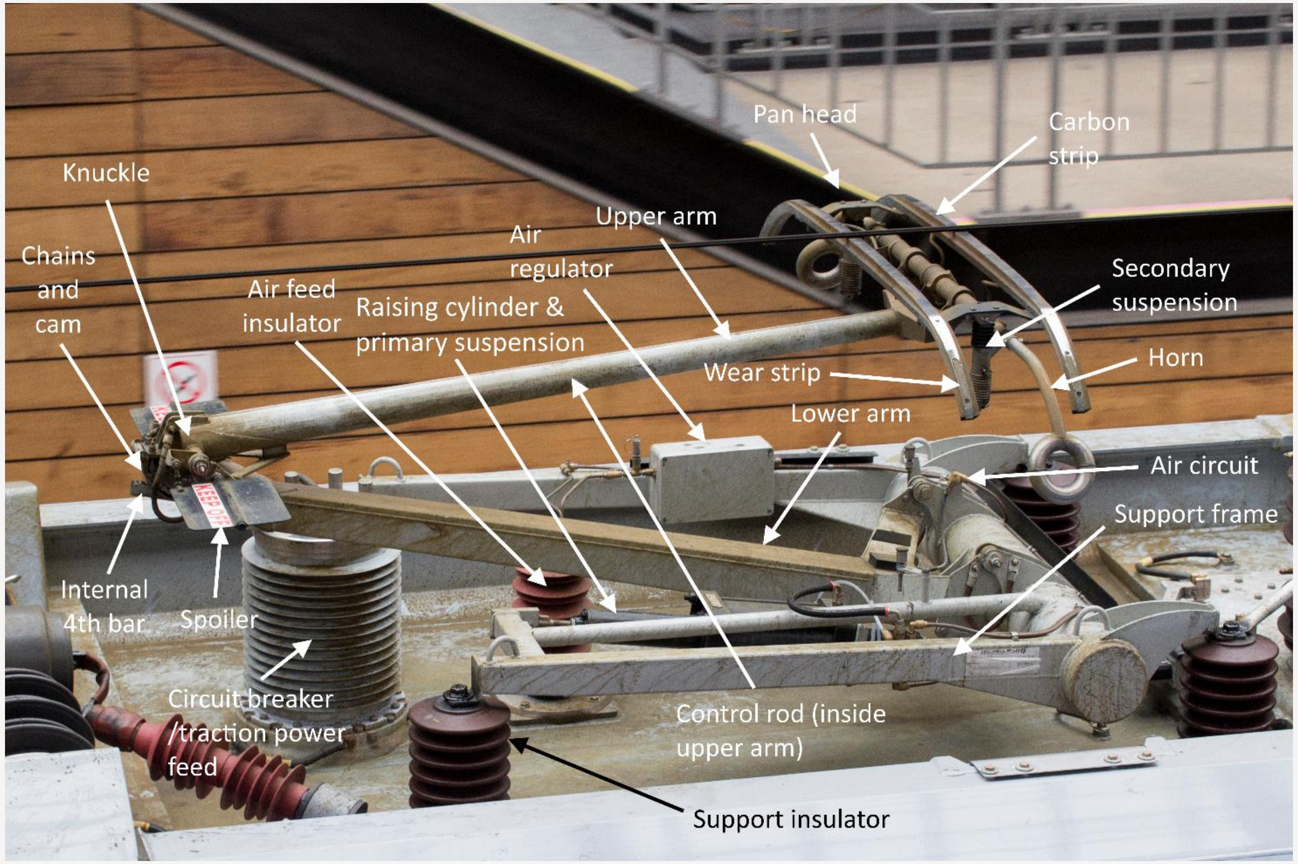
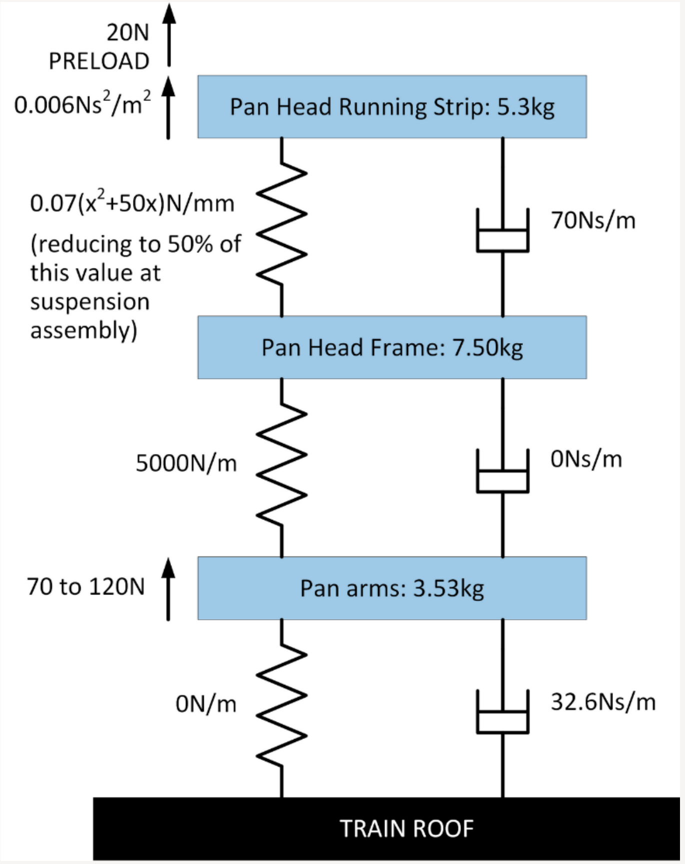
Pantograph Suspension



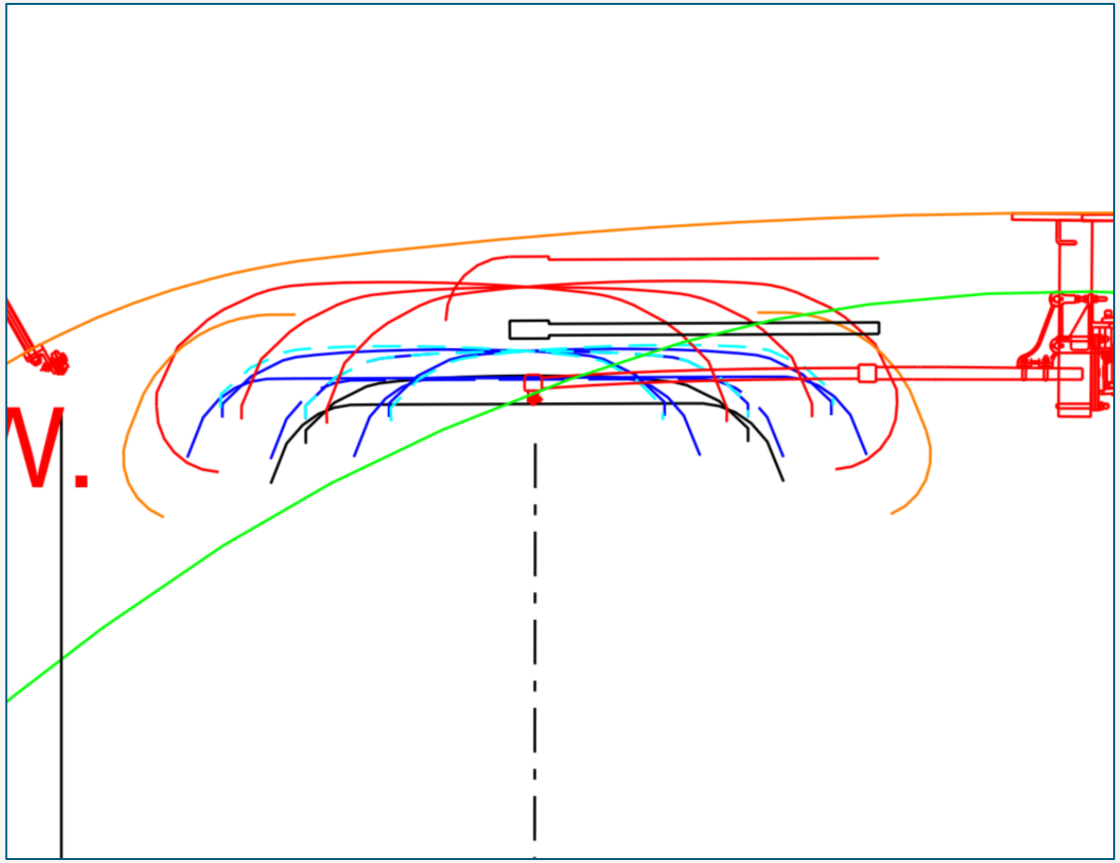


Pantograph Gauging – What is It?

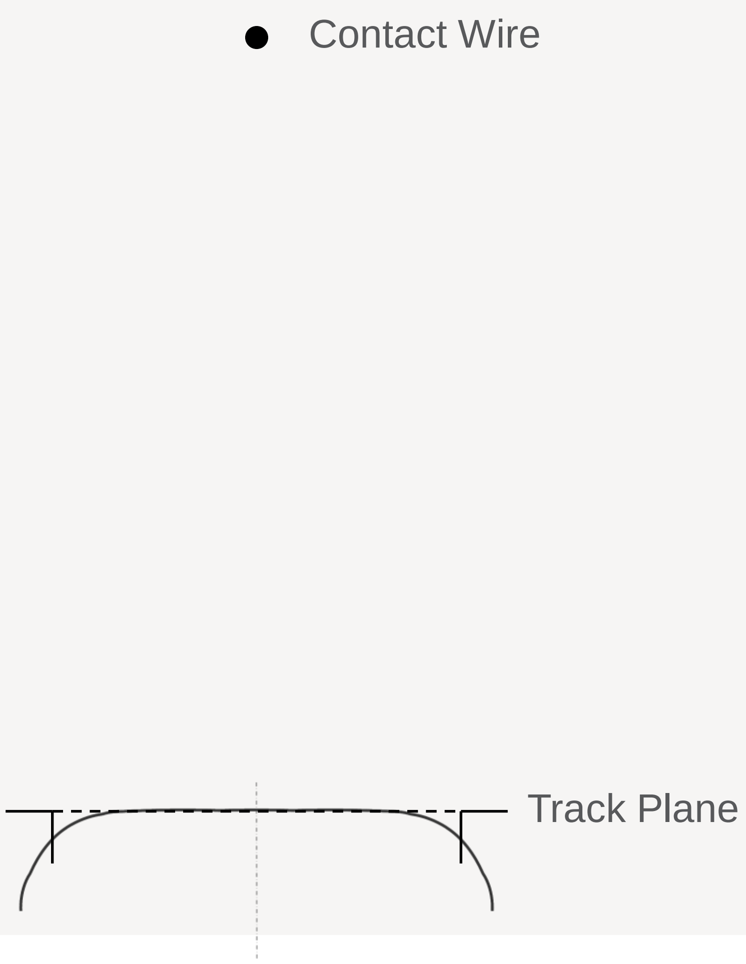
Gauging:

“The process by which swept envelopes of a vehicle or a standard vehicle gauge are used to determine clearances on a section of track between the vehicle and fixed infrastructure and between the vehicle and vehicles on adjacent tracks.”

- GIRT7073 “Requirements for the Position of Infrastructure and for Defining and Maintaining Clearances”



Pantograph Gauging – Traditional



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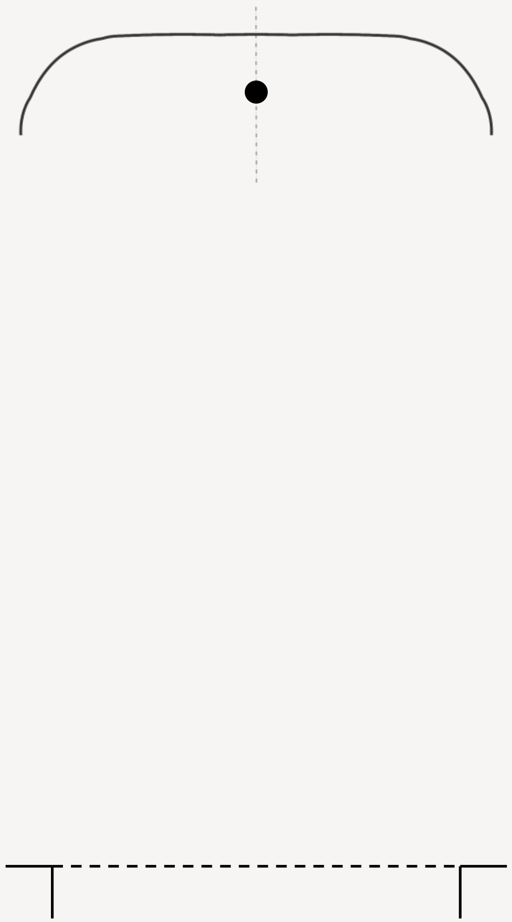

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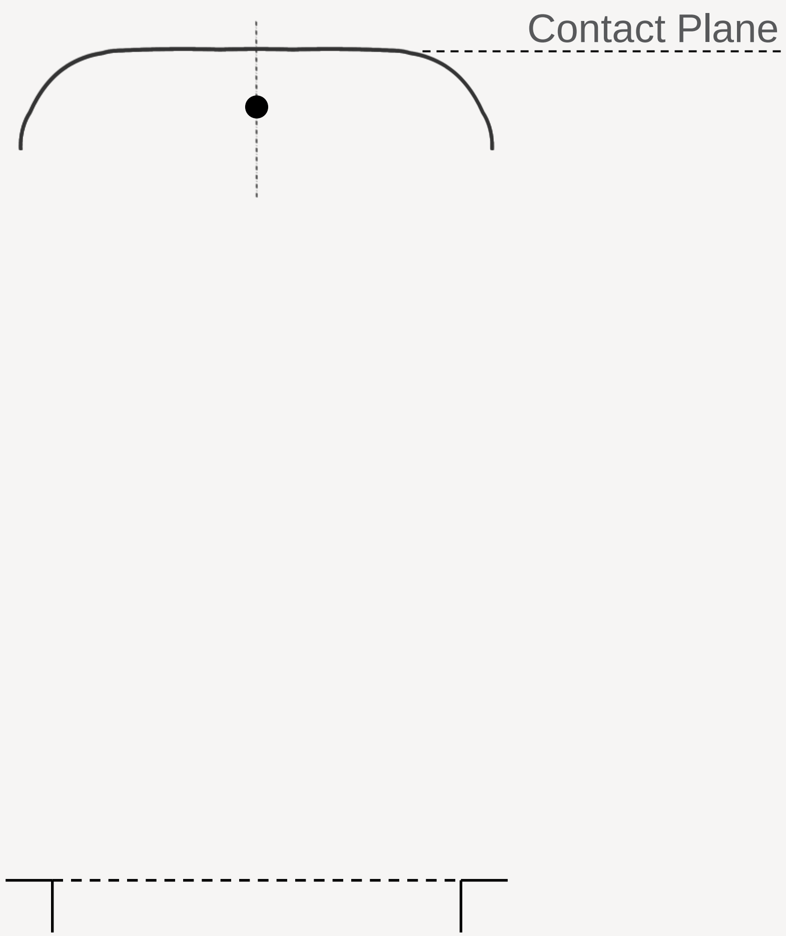

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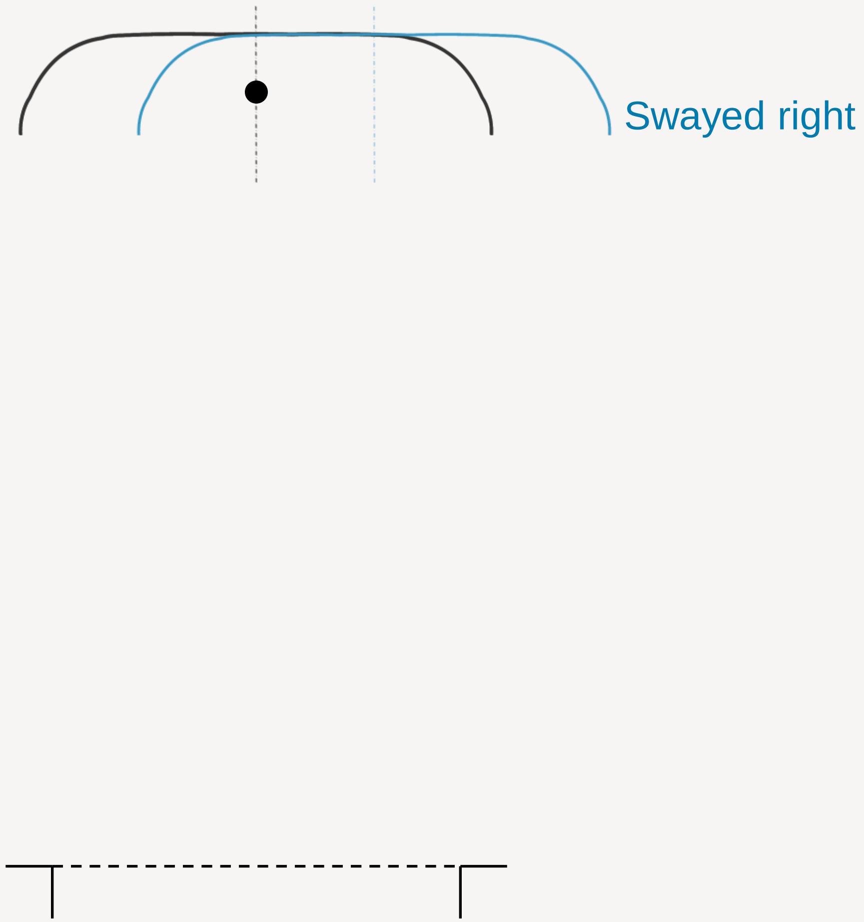

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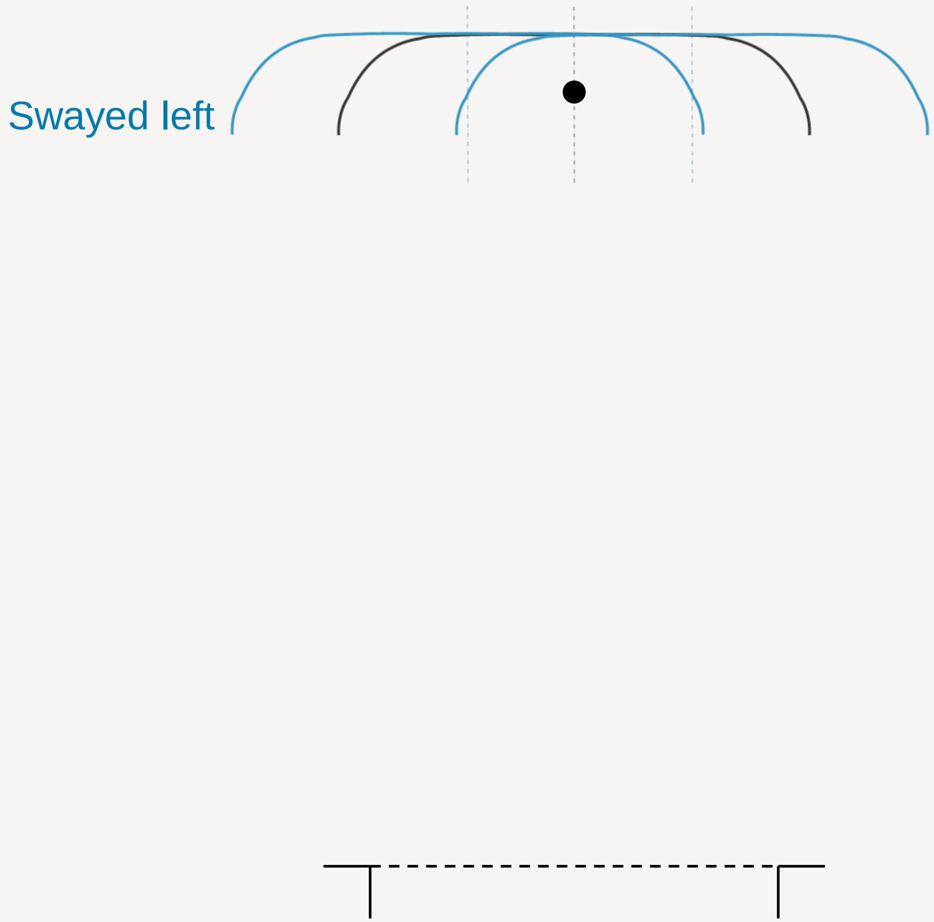

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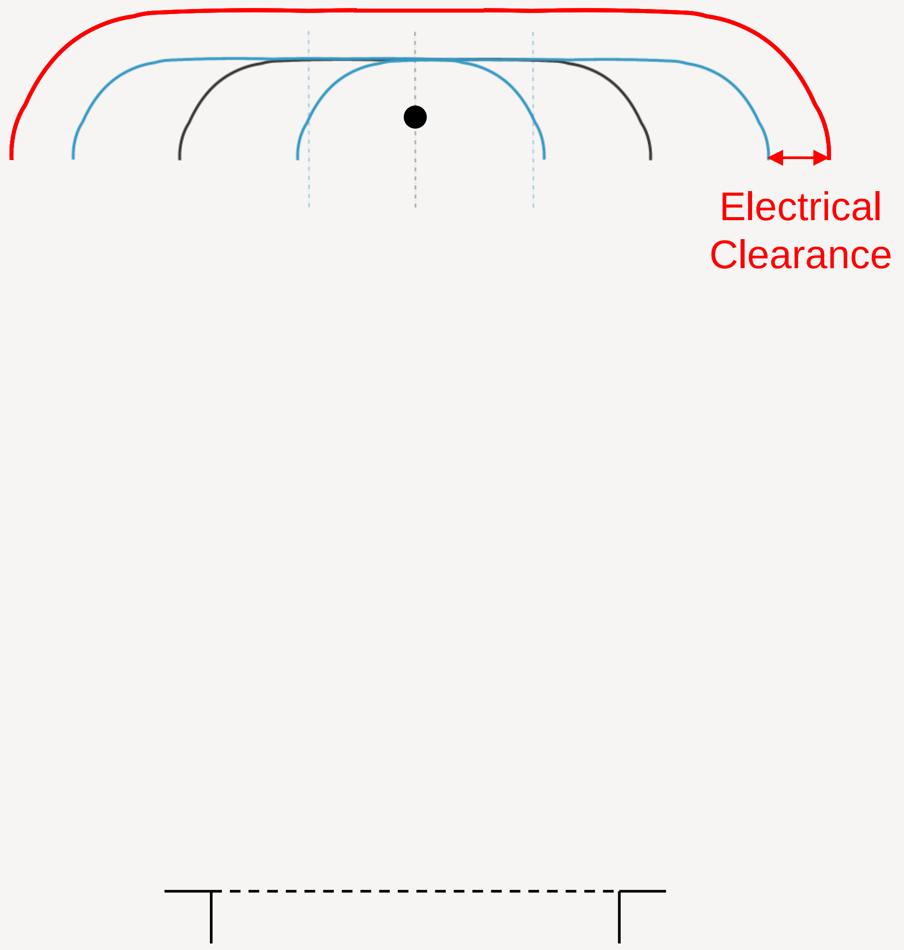

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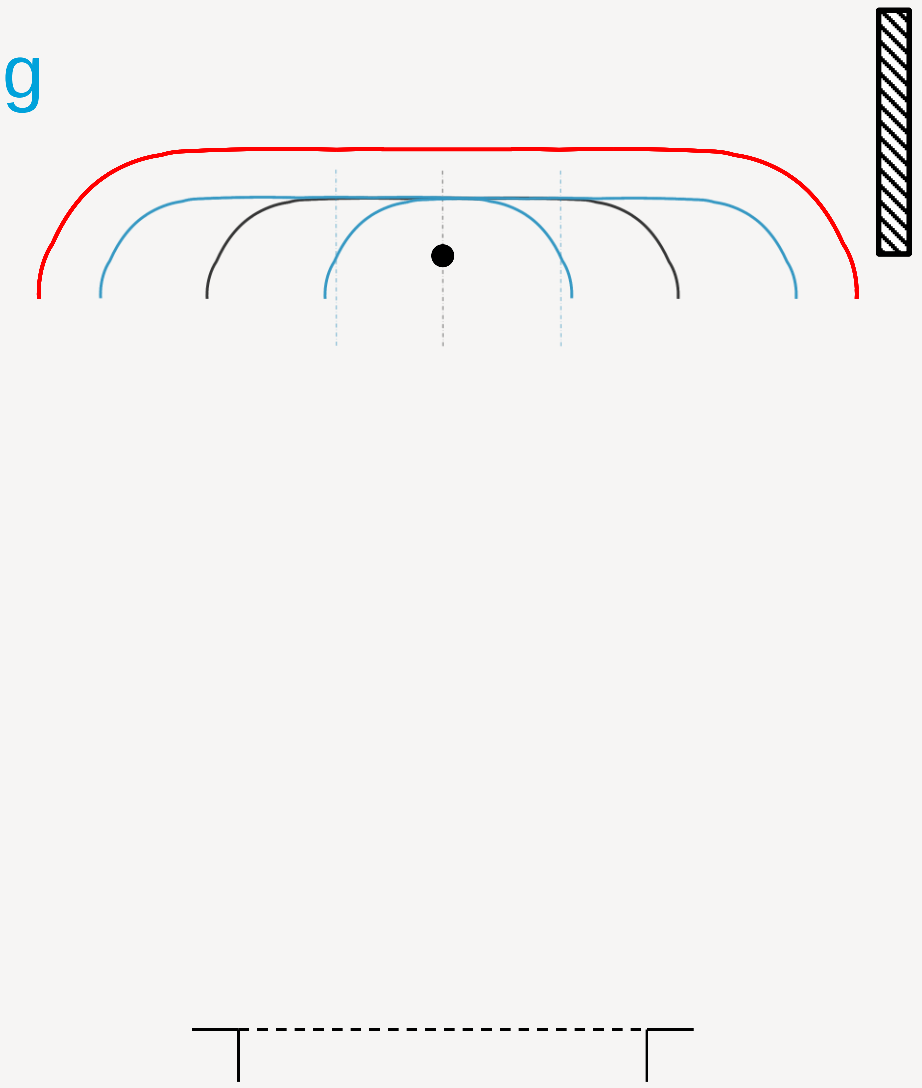
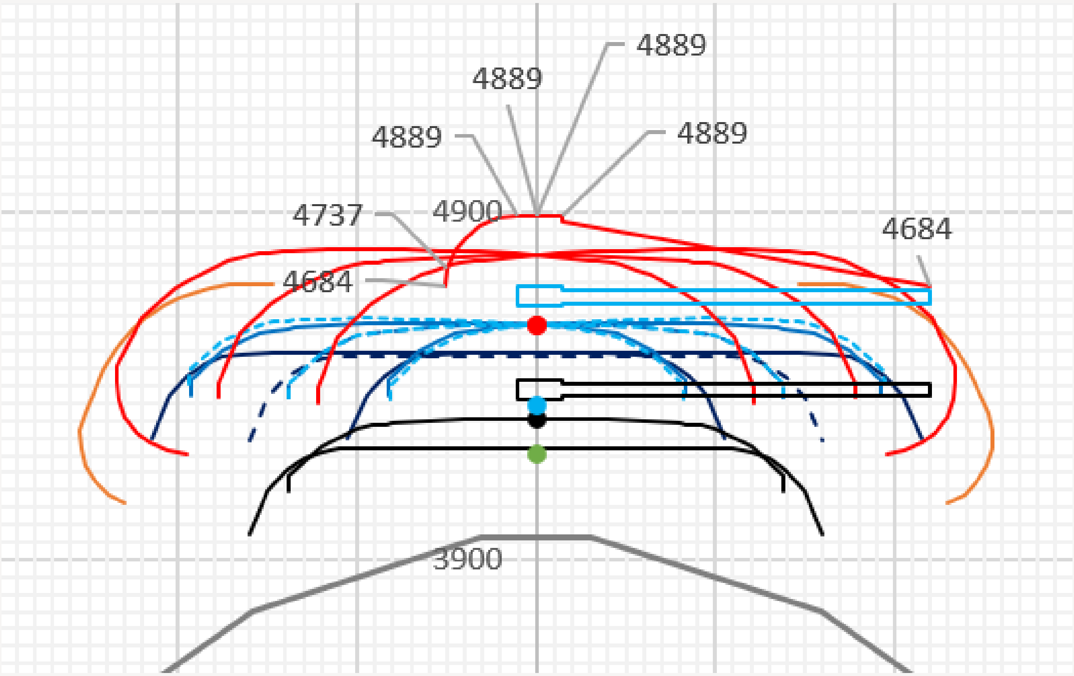
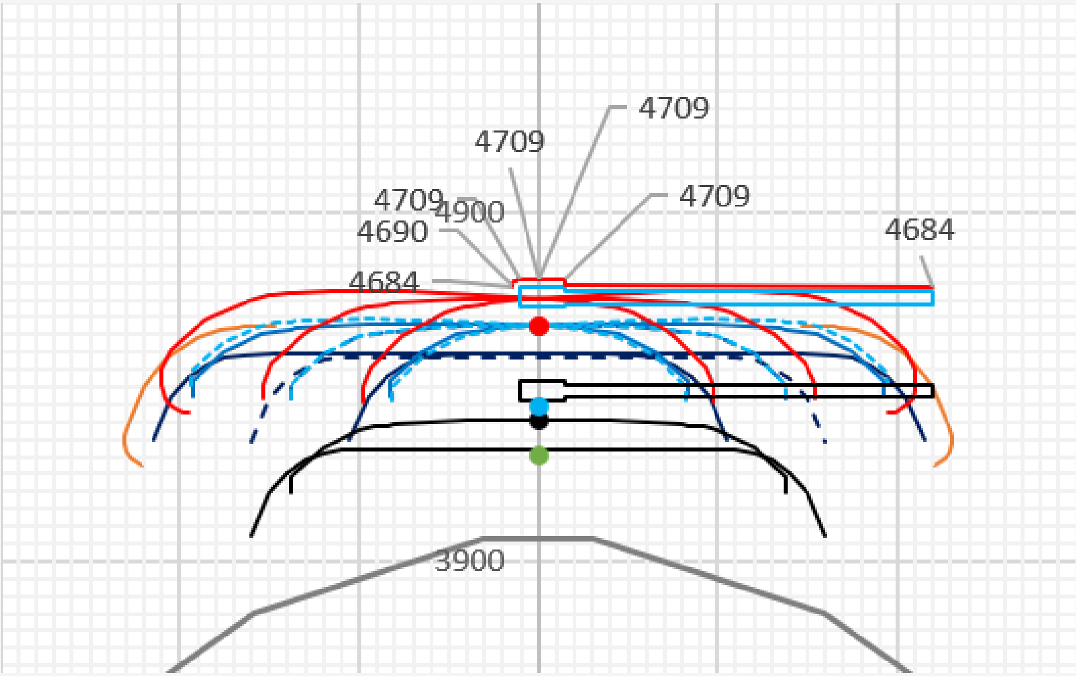


Why is this Approach no longer Valid?



Air Gap Clearances – no VCC



Air gap clearances with VCC

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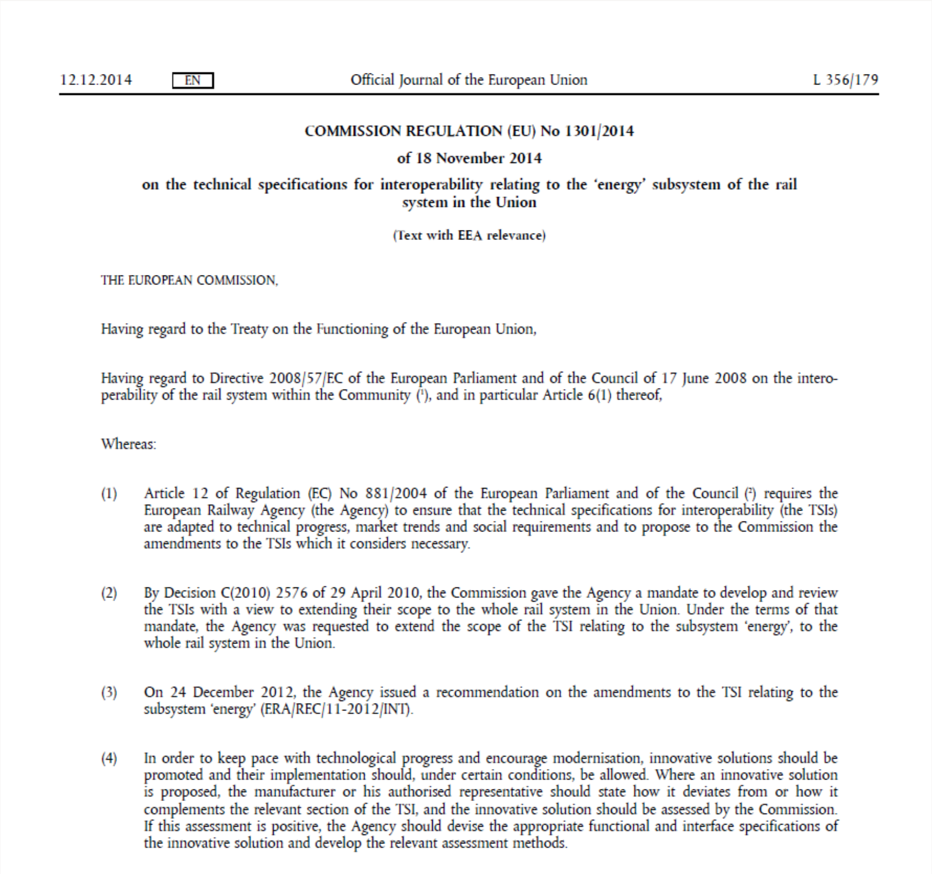

12.12.2014 | EN | Official Journal of the European Union | L 356/179

COMMISSION REGULATION (EU) No 1301/2014

of 18 November 2014

on the technical specifications for interoperability relating to the 'energy' subsystem of the rail system in the Union

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community [1], and in particular Article 6(1) thereof,

Whereas:

(1) Article 12 of Regulation (EC) No 881/2004 of the European Parliament and of the Council [2] requires the European Railway Agency (the Agency) to ensure that the technical specifications for interoperability (the TSIs) are adapted to technical progress, market trends and social requirements and to propose to the Commission the amendments to the TSIs which it considers necessary.

(2) By Decision C(2010) 2576 of 29 April 2010, the Commission gave the Agency a mandate to develop and review the TSIs with a view to extending their scope to the whole rail system in the Union. Under the terms of that mandate, the Agency was requested to extend the scope of the TSI relating to the subsystem 'energy', to the whole rail system in the Union.

(3) On 24 December 2012, the Agency issued a recommendation on the amendments to the TSI relating to the subsystem 'energy' (ERA/REC/11-2012/INT).

(4) In order to keep pace with technological progress and encourage modernisation, innovative solutions should be promoted and their implementation should, under certain conditions, be allowed. Where an innovative solution is proposed, the manufacturer or his authorised representative should state how it deviates from or how it complements the relevant section of the TSI, and the innovative solution should be assessed by the Commission. If this assessment is positive, the Agency should devise the appropriate functional and interface specifications of the innovative solution and develop the relevant assessment methods.

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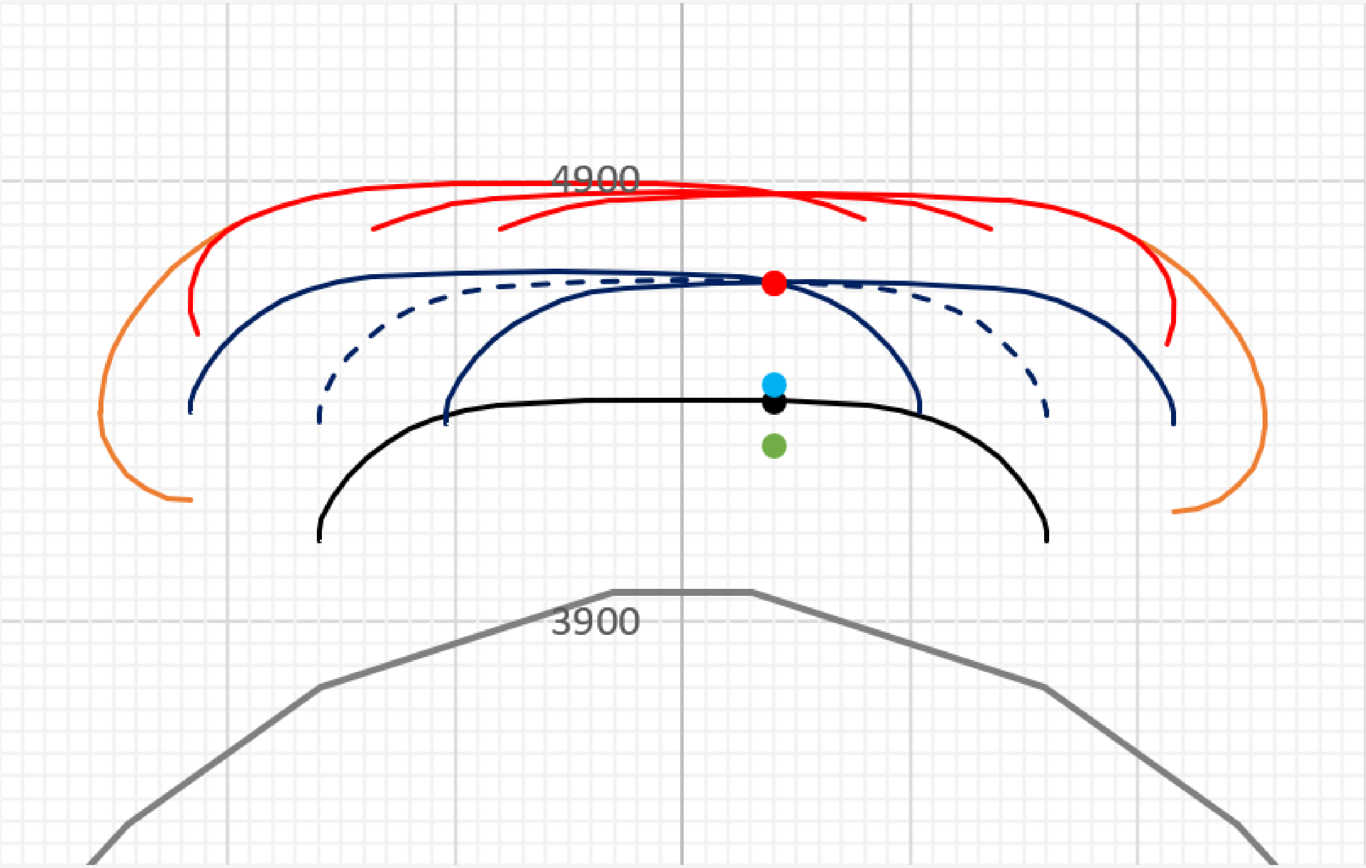

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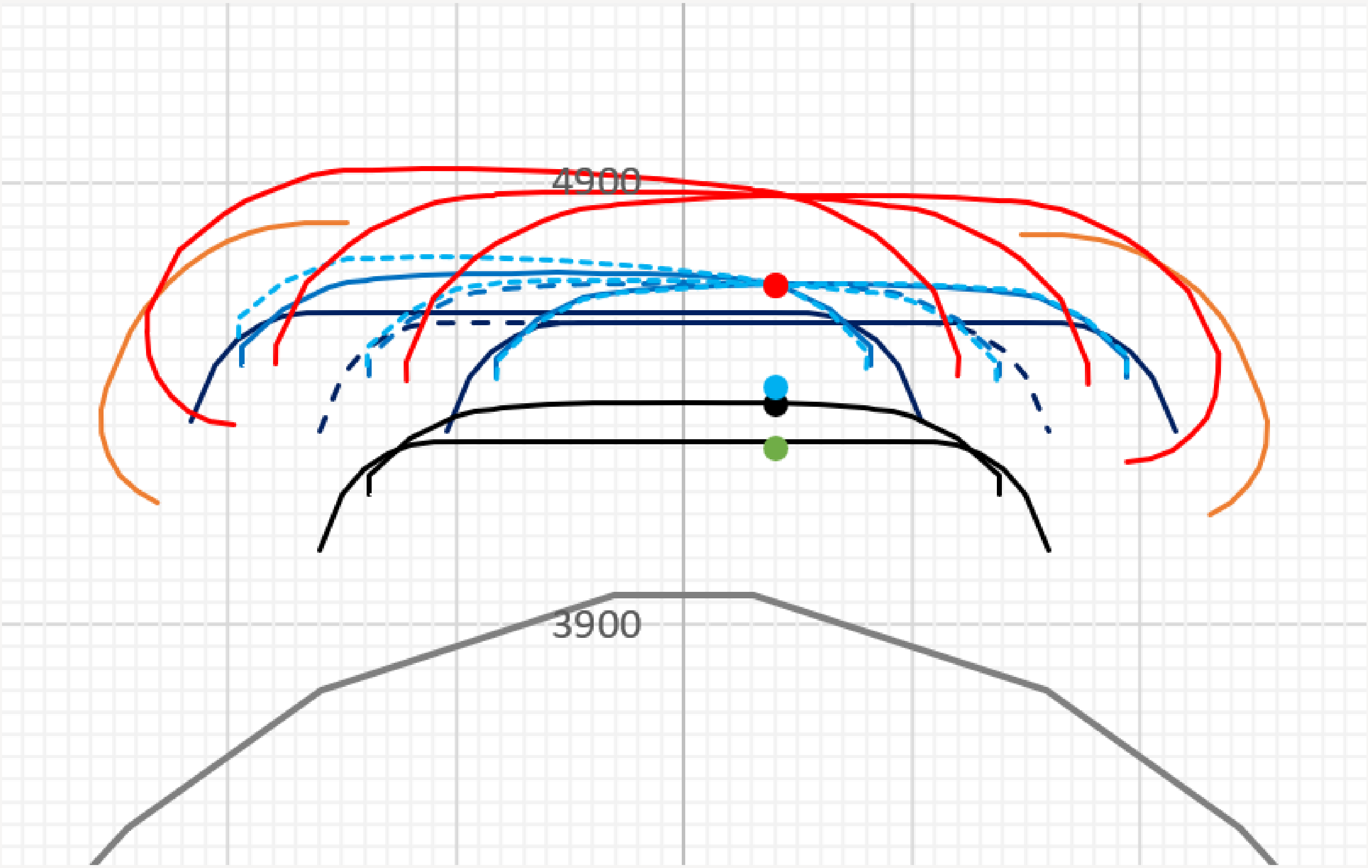


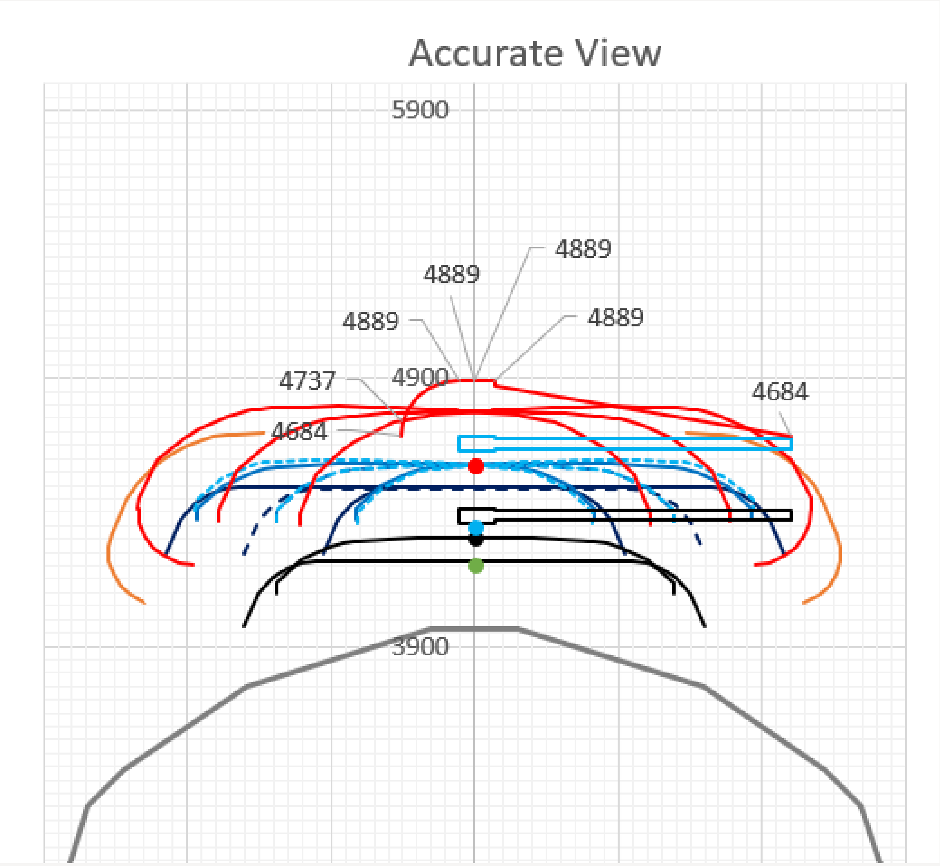
What is PanGen?

Vertical Dynamic Clearance Calculations

Code	Vertical Parameters	Value	Unit
C1	Survey tolerance	5	mm
V1	Track - vertical tolerance	15	mm
V2	Track Maintenance Lift Allowance	10	mm
V3	Track - cross level allowance	10	mm
V4	Load Gauge	3965	mm
V5	Dynamic Bounce Allowance	25	mm
V5a	Steam train allowance	15	mm
V6	Track Profile Effect	0	mm
V7	Vertical OLE construction tolerance	10	mm
V8	Minimum electrical clearance - fixed live parts (wire) to train body	200	mm
V9	Contact wire natural sag	10	mm
V10	Presag allowance	26	mm
V11	Contact wire sag due to weight of ice	0	mm
V12	Early design stage allowance	25	mm
VC1	**Minimum permissible CW height under all conditions**	**4205**	**mm**
VC2	**Minimum permissible design CW height at support point**	**4306**	**mm**
V13	**User-selected design CW height**	**4306**	**mm**
VC3	**User-selected minimum CW under all conditions**	**4205**	**mm**
V7	Vertical OLE construction tolerance	10	mm
V14	Contact wire uplift	125	mm
V15	Contact wire uplift Factor of Safety	2.0	
V16	Total contact wire uplift	250	mm
V17	Maximum contact wire wear	4	mm
V18	Rise of wire due to reduced weight through wear	5	mm
VC4	**Maximum dynamic CW height under all conditions (max contact plane)**	**4575**	**mm**
C2	Fitted or Free Running?	Fitted	
C3	Are one or more VCC measures used?	VCC	
V19	System Height	0	mm
V19a	User-selected design catenary/contenary height	4306	mm
V19b	**Maximum dynamic catenary/contenary height under all conditions**	**4575**	**mm**
V20	OLE construction depth - bridge arm	109	mm

Vertical Static Clearance Calculations

Code	Vertical Parameters	Value	Unit
C1	Survey tolerance	5	mm
V1	Track - vertical tolerance	15	mm
V7	Vertical OLE construction tolerance	10	mm
V13	User-selected design CW height	4306	mm
VC7	**Maximum static CW height inc tolerances**	**4345**	**mm**
V19	System Height	0	mm
V20	**Maximum static catenary/contenary height inc tolerances**	**4345**	**mm**
V21	OLE construction depth - bridge arm	109	mm
V22	OLE construction depth - contact wire cover	19	mm
V23	OLE construction depth - top half of wire	6	mm
VC8	**Maximum static height of live parts**	**4454**	**mm**
VC9	**Minimum Soffit Height - Static Case**	**4454**	**mm**



Live PanGen Demonstration

Summary

- Traditional pan gauging approaches are not suitable for low overbridges
- A site-specific absolute gauging approach is needed that takes into account encroachment
- Designers need new tools that account for this
- Atkins has developed a tool as a starting point
- Further development needed to make this fully dynamic and potentially incorporate into simulation tool (D-RSS)

Questions and Answers

Our values are the essence of our company's identity. They represent how we act, speak and behave together, and how we engage with our clients and stakeholders.

SAFETY

We put safety at the heart of everything we do, to safeguard people, assets and the environment.

INTEGRITY

We do the right thing, no matter what, and are accountable for our actions.

COLLABORATION

We work together and embrace each other's unique contribution to deliver amazing results for all.

INNOVATION

We redefine engineering by thinking boldly, proudly and differently.