

Dublin to Cork railway line - Formation remediation and ballast cleaning program

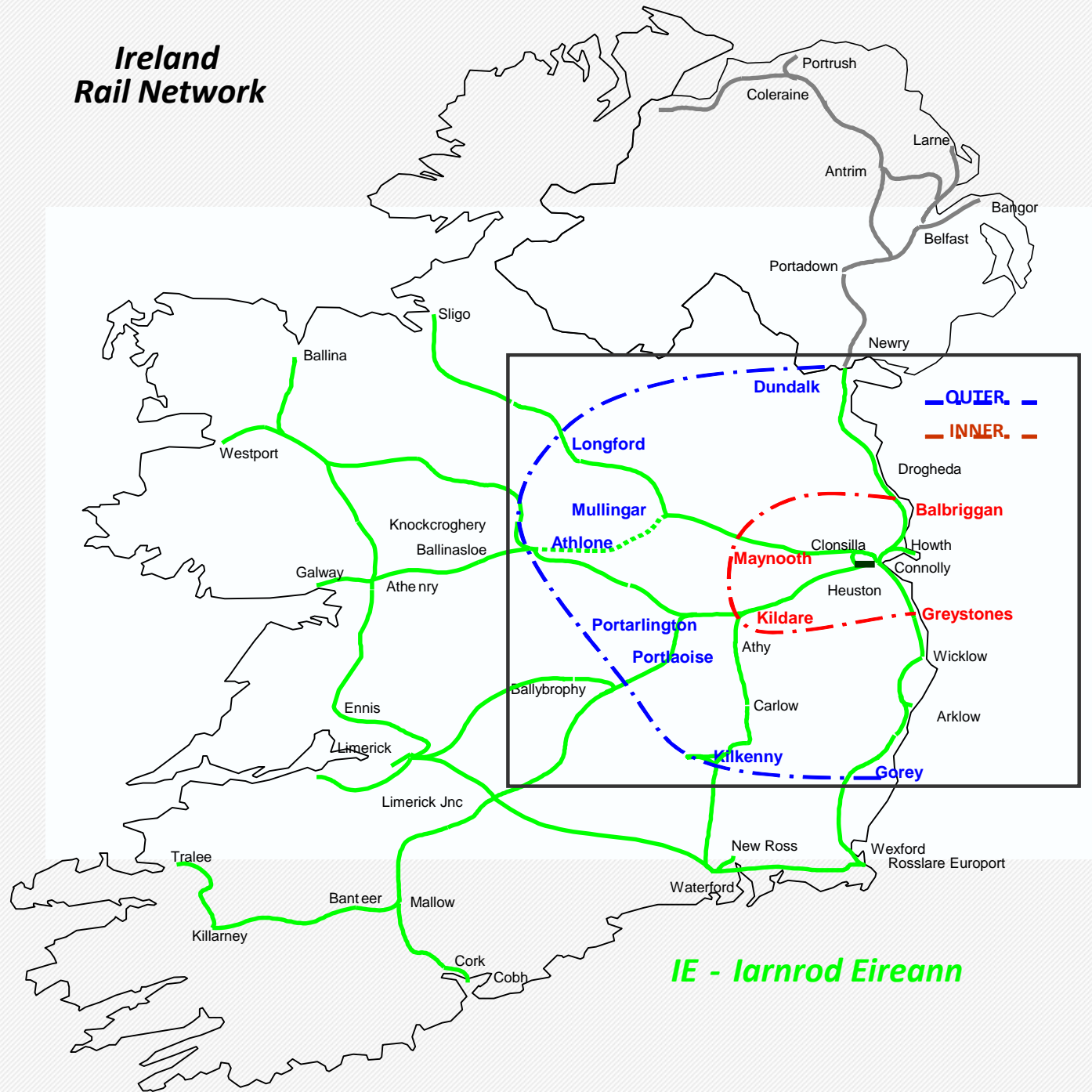
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Irish Rail



Ireland Rail Network



Dublin to Cork Railway - Strategic Route for Irish Rail



Strategic Route - Serving commuting communities



Background:

- In 2013 and 2014, following decades of under investment, it became apparent that the Dublin to Cork Railway Line was facing a crisis from an operational and potentially safety perspective.
- The ballast and formation generally, as well as the vertical alignment of the track had degraded to such an extent that maintenance costs were increasing, whilst performance in terms of sustainable and reliable line speeds were decreasing.
- Following the submission of a business case to the Department of Transport Tourism and Sport (DTTS) additional funds to address this issue on a multiannual basis was sought and approved
- Some 140 miles of track was targeted as requiring early intervention.

Dublin to Cork line formation remediation - Formation failure



The solution :

- The solution was a targeted formation renewal project, including the installation of new ballast to current standards, the installation of drainage and improvement of the track geometry, particularly its gradient and vertical curvature.
- The funding level of €10 million per year was to be spent on a risk ranked basis with the worst formation sections of track being attended to first.
- The deployment of the 'Plasser and Theurer' Ballast cleaner (model RM 90) was selected as the central tool to excavate the track formation.
- A project team, under a dedicated project manager, was established.

Dublin to Cork line formation remediation - Ballast Cleaner



Development of the Project Plan:

- A number of scenarios for project delivery were proposed by the project team; the primary mission being to make the best use of the project funding in terms of the lowest cost per mile for formation renewal; whilst minimising impact on rail services and all the while working within a safe operating environment.
- In summary the main options were :
- Carry out the work in non disruptive possessions at night - both mid week and at weekends.
- Carry out the work in disruptive possessions at night - both mid week and at weekends.
- Carry out the work by total shut down of the line at weekends
- Carry out the work by partial shut down at weekends whilst keeping a reduced rail service operational at all times.

Development of a Project Plan:

- It was clear that a full weekend Closure of the Cork line would be the quickest and cheapest option - and potentially safest because without trains operating, the potential of an incident with a passenger/freight train is removed. However from a business and customer service perspective this model is unacceptable.
- The option to carry out works with non disruptive possessions was unacceptable from a cost, performance and value for money perspective - it was the most expensive option and likely to take 20 years to achieve the asset renewal .
- The option of reduced services over week ends using line closures with adjacent line open was initially rejected as having too many potential safety issues.
- One other option that remained was a regime of disruptive possessions by night.
- ALL of the above were actively considered.

Our Decision:

- After further review and consultation, the option:
- **“... of reduced services over week ends using line closures with adjacent line open”** was finally selected ...
- The point of this paper is to show how, a proactive Project team along side a dedicated Safety team were able to identify the best option and then, in a spirit of interdepartmental cooperation - risk assess the methodology and produce mitigations (including rule book changes) to facilitate the delivery of the project - while meeting its objectives in terms of sustaining operational safety/reliability, value for money, minimal impact on services and a safe delivery for all involved.

Think Tank

We organised a workshop in Portlaoise and invited the decision makers from all relevant departments and set a tone where there was a willingness to look for solutions rather than just say 'NO its not safe and CANT be done' Immediate task was for all departments to log issues of concern:

Rail Operations (including train drivers)

Infrastructure Safety Department

Environmental

Signalling / Telecoms

Technical / Production

Key Infrastructure operatives (IM staff, Signalmen, DTE's, Safety executives, Supervisors, Plant and Labour contractors)

Revised weekend timetable for all services to Heuston

Resource dedication and consistency



Dublin to Cork line formation remediation - Portlaoise Demo Day



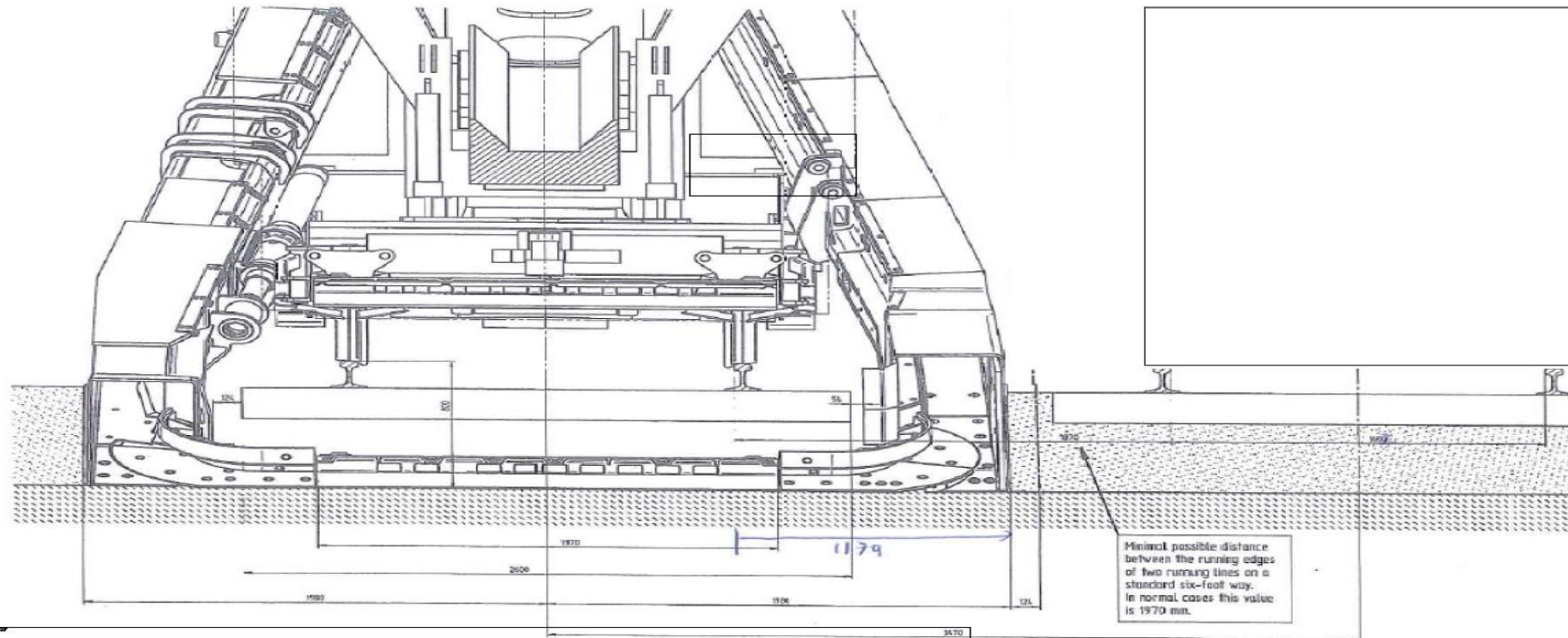
Risk assessment of the project execution plan :

- Key issues that had to be addressed:
 1. How to safely pass trains with adjacent line open **LIVE TRIALS**
 2. Technical Risks (clearances, geometry, bridges, etc..)
 3. Environmental Risks (Waste material, drainage, etc.)
 4. Disruptive Possessions - New time table (for weekends) and Driver briefings
 5. Train Staff for pilot working
 6. Site access control of 36 hours - staff rostering
 7. Protecting and diverting Signalling / Telecoms equipment
 8. Alterations to the Rule Book to allow Road Rail Vehicles (RRV's) stay on track with trains passing

Rule book change to permit Road Rail Vehicle on the line



Dublin to Cork line formation remediation - Controlling clearances



In Arrangement Shown

Minimum 6ft = $1179 + 100 + 647 + 124 = 2050$ RE to RE

In Arrangement Shown

Minimum 6ft = $1179 + 100 + 647 + 56 = 1982$ RE to RE

NO.	REV.	DESCRIPTION	DATE
1	1	ISSUED FOR CONSTRUCTION	10/01/2010
2	2	REVISION	10/01/2010
3	3	REVISION	10/01/2010
4	4	REVISION	10/01/2010
5	5	REVISION	10/01/2010
6	6	REVISION	10/01/2010
7	7	REVISION	10/01/2010
8	8	REVISION	10/01/2010
9	9	REVISION	10/01/2010
10	10	REVISION	10/01/2010

Dublin to Cork line formation remediation while trains Pass



Rule book change to permit Road Rail Vehicle on the line - TII Possession



Formation remediation - Keeping services moving safely

while train services continue to operate

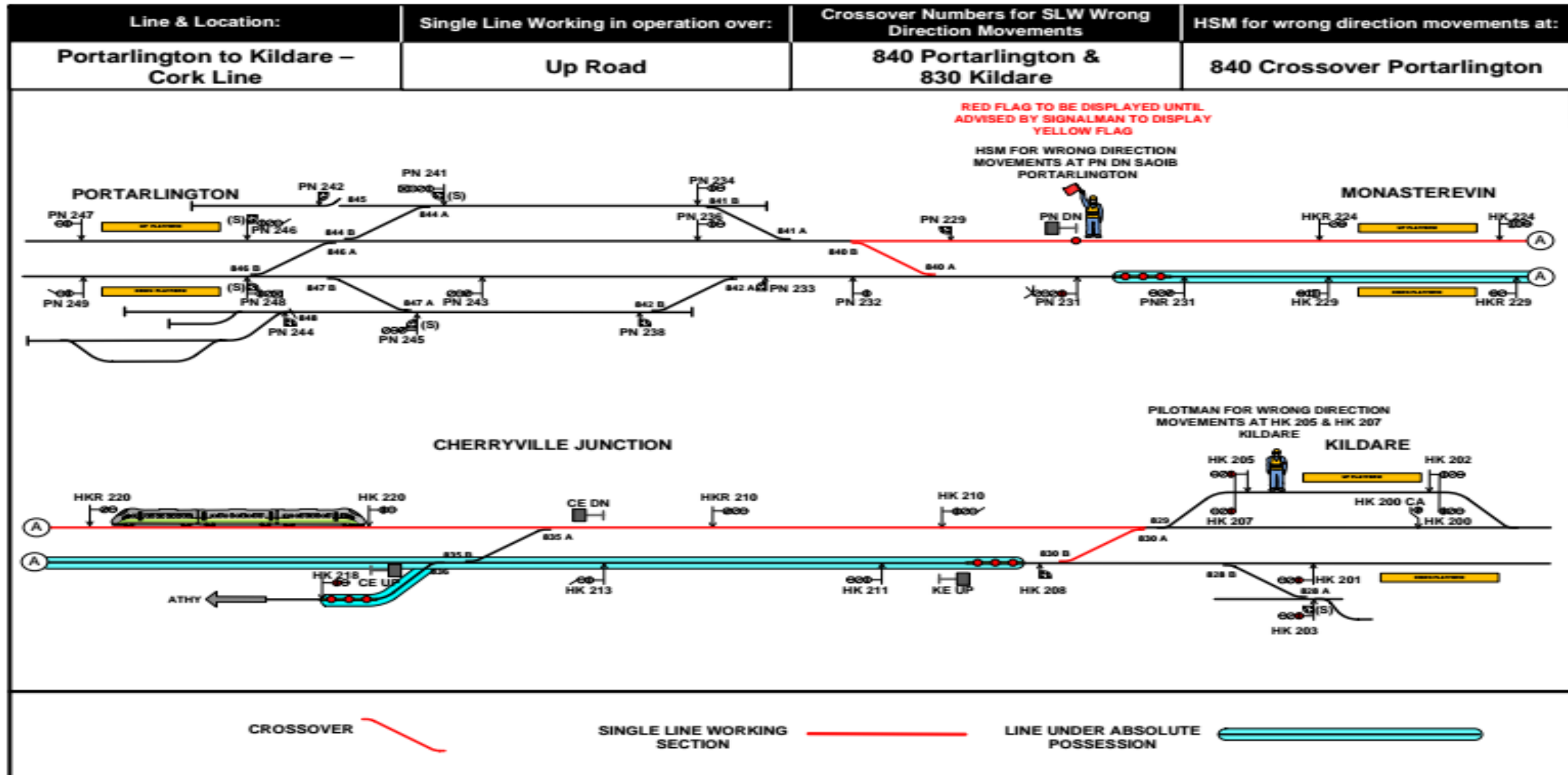


Formation remediation - Identifying site features / Planning

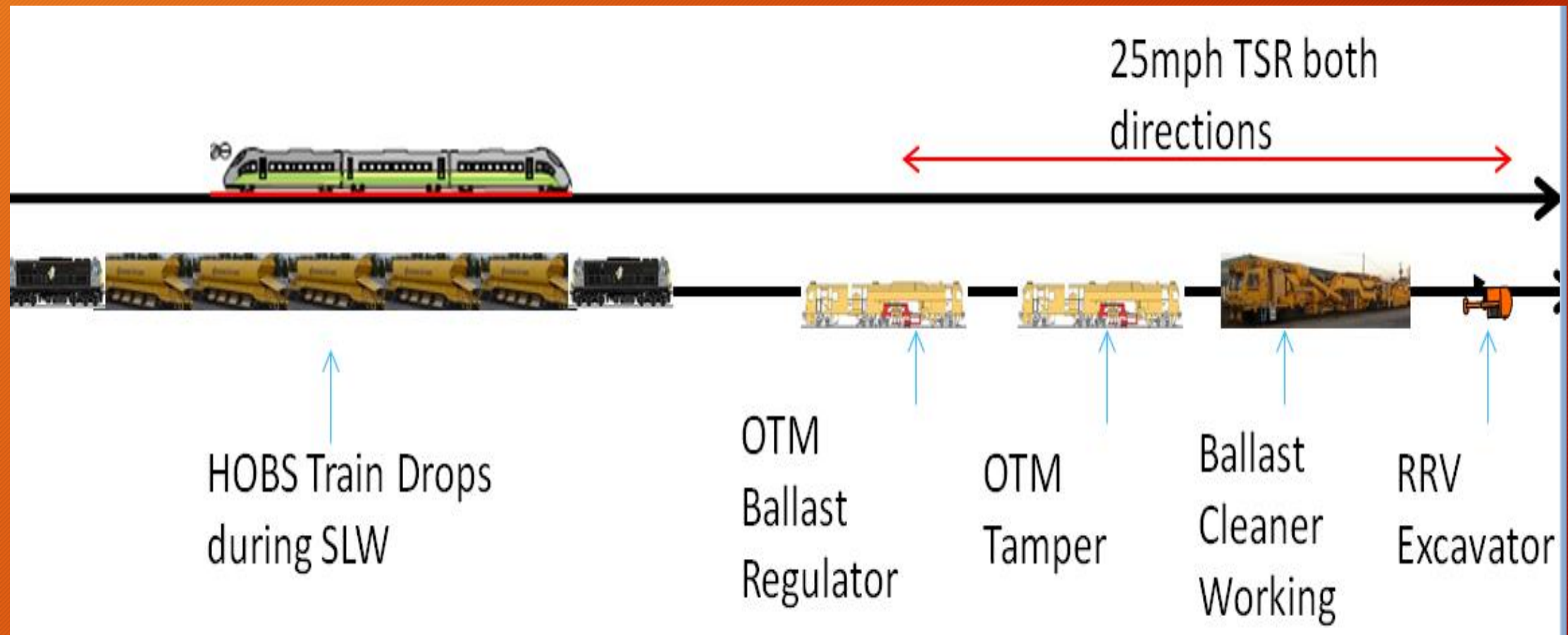
Curve Details; Cant: 120 Radius Spans from 39Miles 1120yards to 40Miles 224yards



Dublin to Cork line formation remediation - Possession maps / Planning



Formation remediation - Typical site layout when ballast cleaning



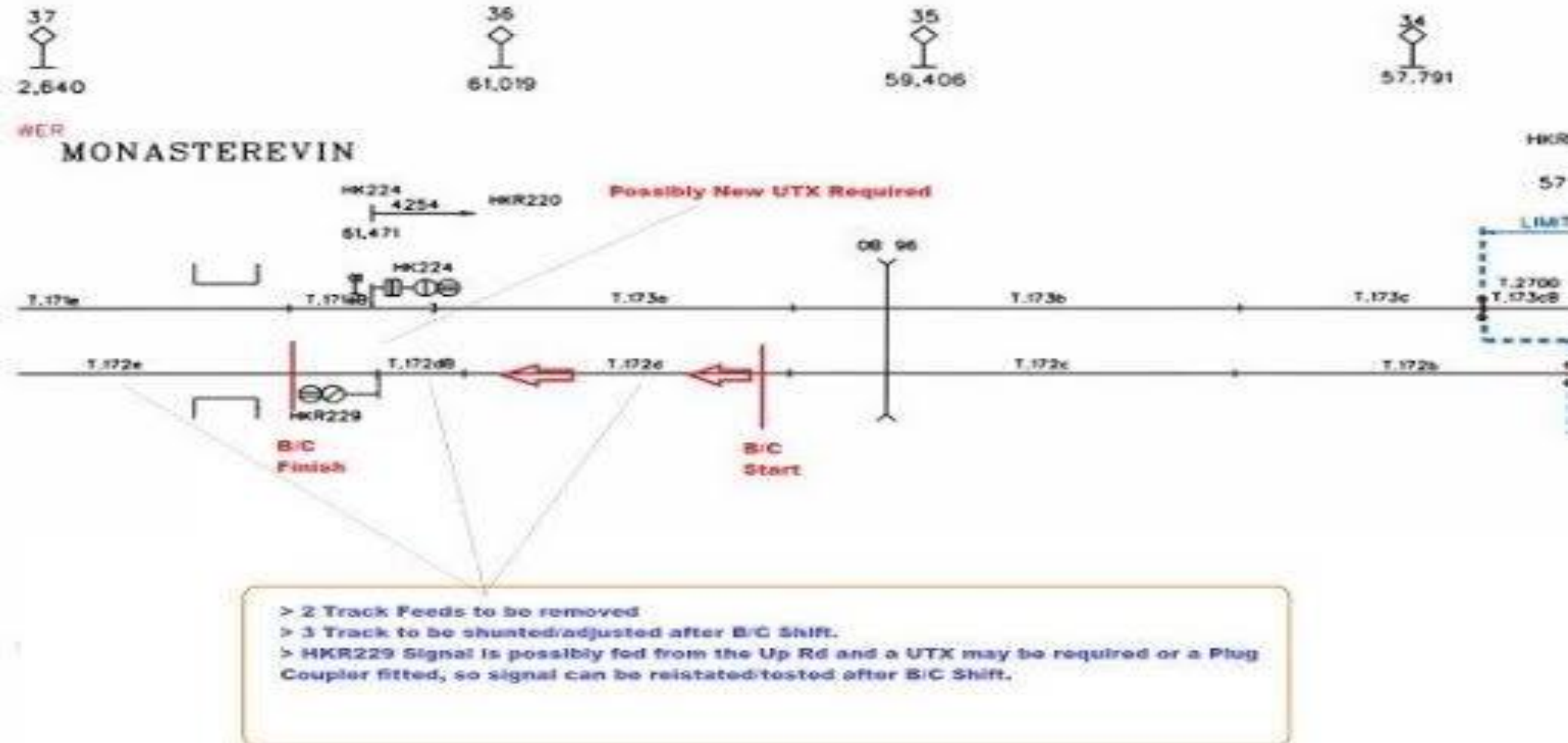
Planning Formation remediation - Preparing Embankments for Side Casting



Preparing Portarlinton for Engineering Trains and storage of material



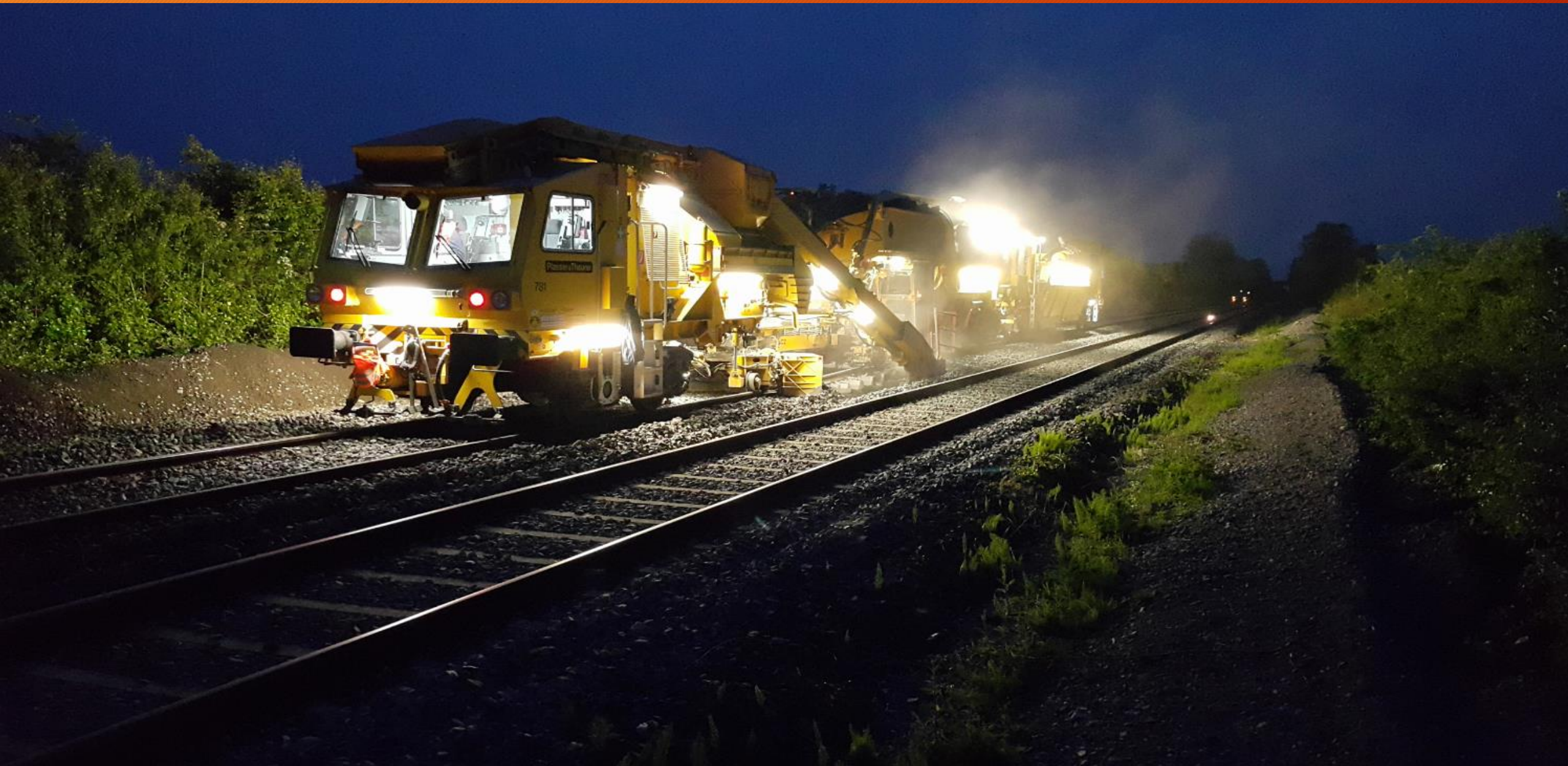
Dublin to Cork line formation remediation - Mapping signalling alterations



Project Delivery - Reinstall dual drainage and signalling duct routes



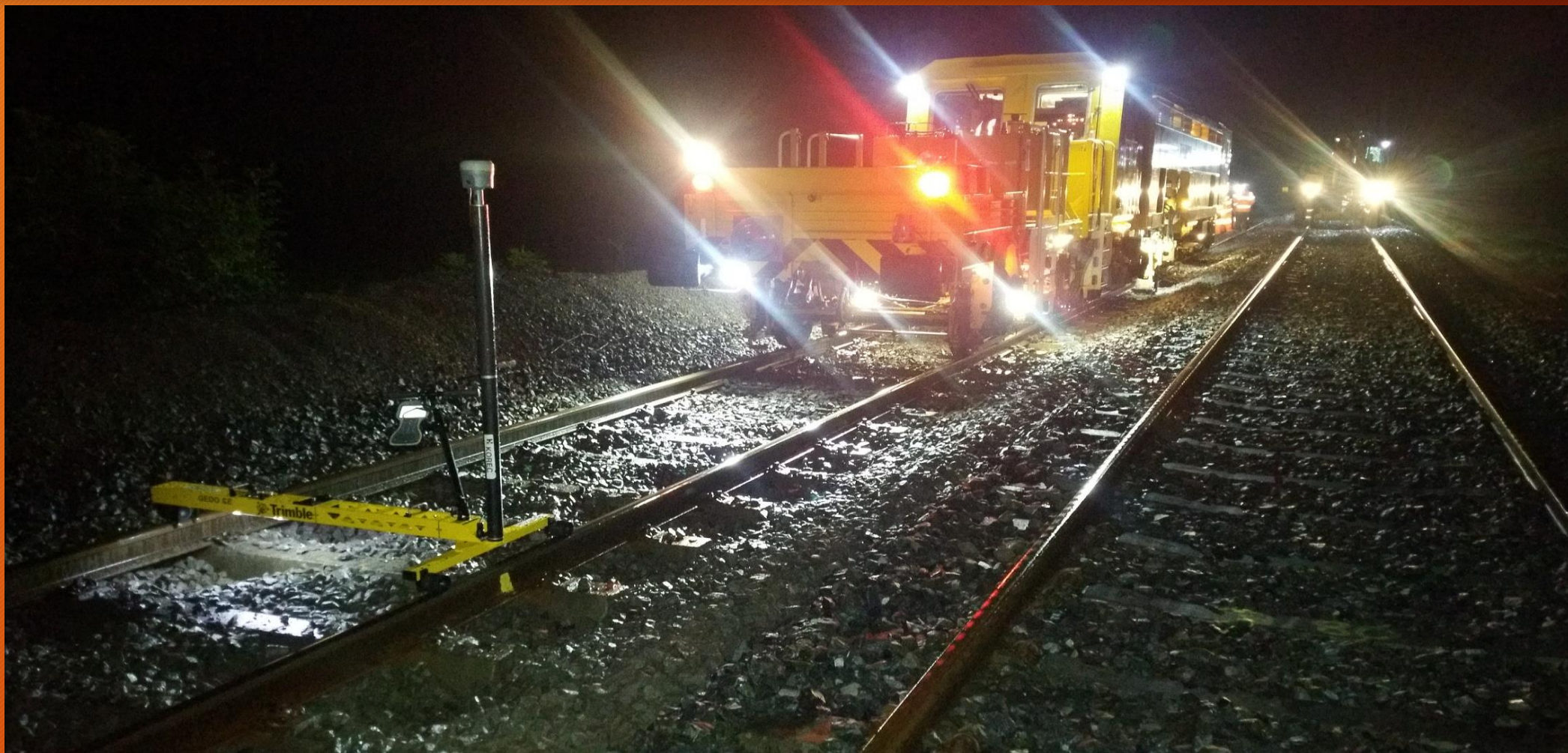
Dublin to Cork line formation remediation - Ballast Cleaning by night



Dublin to Cork line formation remediation - Ballast deliveries



Dublin to Cork line formation remediation - GPS Rail Trolley



Dublin to Cork line formation remediation - Geometry Control

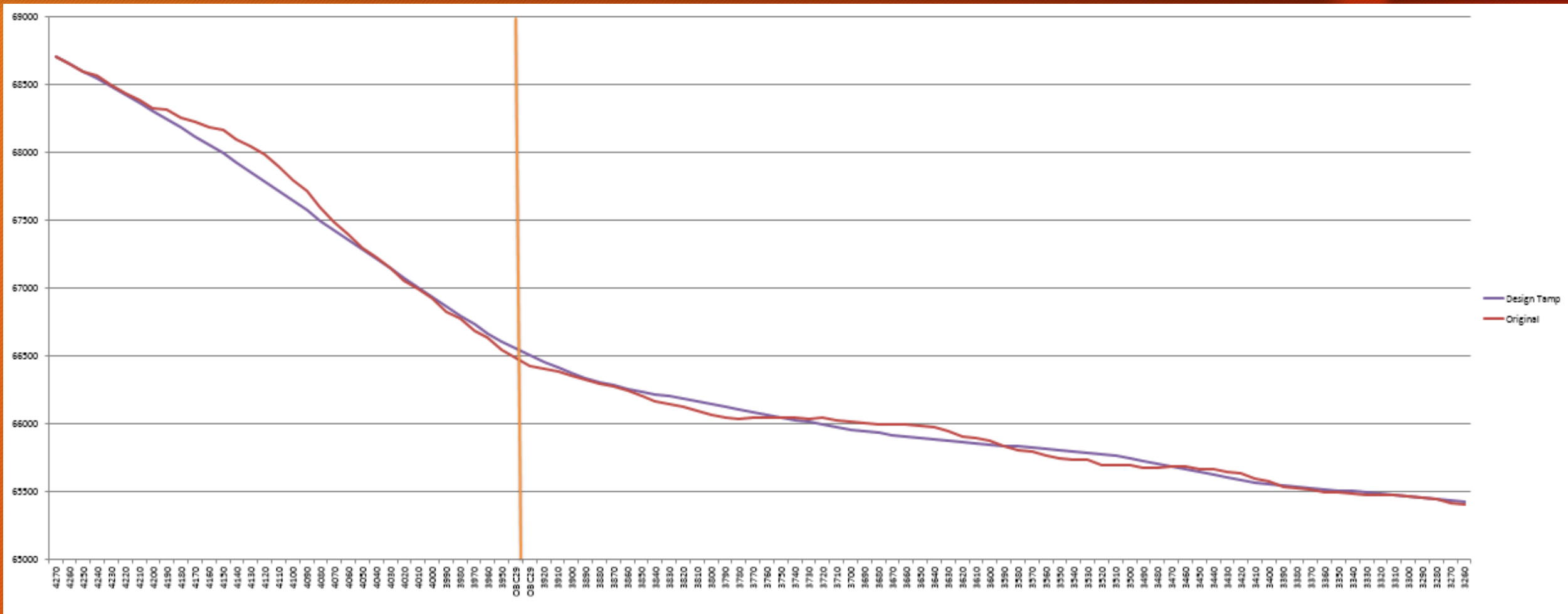
1. Accurate GPS level information for vertical curve design
2. Vertical curvature comparisons both before and after on all Ballast Cleaning Sites
3. Cant Measurement Accuracy $\pm 0.5\text{mm}$
4. Track Gauge Measurement Accuracy $\pm 0.3\text{mm}$
5. Vertical information assisting Ballast Cleaner for design cleaning by adjusting cutting bar and formulating final track designs.

Improved Geometry for higher Handback speeds

GedoOffice2		Analysis: Post Ballast Cleaning Date: 11/11/2015 Time: 10:59														
		Calculation of centre line: D = measured gauge / 2														
		Horizontal reference for rail points: Running edge														
		Vertical reference for rail points: Middle of head														
Name	Code	East(left)	North(left)	Elev(left)	East(centre)	North(centre)	Elev(centre)	East(right)	North(right)	Elev(right)	Cant[mm]	Gauge[mm]	Chainage[m]	LineName	PrismSide	HeightRef
1	H=0.008 /	661699.1	710654.4	66.8954	661698.9	710655.1	66.8956	661698.6	710655.9	66.8958	-0.4	1603.9	0	dn post bc	0	1
2	H=0.008 /	661689.6	710651.4	66.8645	661689.4	710652.2	66.864	661689.1	710653	66.8635	1	1604.7	9.952	dn post bc	0	1
3	H=0.007 /	661680.7	710648.6	66.8416	661680.5	710649.4	66.8418	661680.2	710650.2	66.8421	-0.5	1604.3	19.289	dn post bc	0	1
4	H=0.007 /	661668.3	710644.8	66.8315	661668.1	710645.5	66.8318	661667.8	710646.3	66.8322	-0.7	1604.7	32.248	dn post bc	0	1
5	H=0.007 /	661658.9	710641.9	66.7713	661658.7	710642.6	66.7694	661658.5	710643.4	66.7676	3.7	1602.2	42.081	dn post bc	0	1
6	H=0.007 /	661649.2	710638.8	66.7169	661649	710639.6	66.7156	661648.8	710640.4	66.7143	2.5	1607.4	52.23	dn post bc	0	1
7	H=0.007 /	661639.8	710635.9	66.6988	661639.6	710636.7	66.6983	661639.4	710637.4	66.6978	1	1603	62.072	dn post bc	0	1
8	H=0.008 /	661630.5	710633	66.6969	661630.2	710633.7	66.6964	661630	710634.5	66.696	1	1602.7	71.906	dn post bc	0	1
9	H=0.008 /	661620.7	710629.9	66.7013	661620.5	710630.7	66.7017	661620.2	710631.5	66.702	-0.8	1603.6	82.116	dn post bc	0	1
10	H=0.008 /	661611.4	710627	66.696	661611.2	710627.8	66.6967	661610.9	710628.6	66.6975	-1.5	1604.3	91.864	dn post bc	0	1
11	H=0.008 /	661602	710624.1	66.7091	661601.8	710624.9	66.7097	661601.6	710625.7	66.7103	-1.2	1603	101.663	dn post bc	0	1
12	H=0.008 /	661592.3	710621.1	66.7191	661592.1	710621.9	66.7194	661591.8	710622.6	66.7197	-0.6	1605	111.885	dn post bc	0	1
13	H=0.008 /	661582.7	710618.1	66.7217	661582.4	710618.9	66.7224	661582.2	710619.6	66.7231	-1.4	1604.4	121.963	dn post bc	0	1
14	H=0.008 /	661573.4	710615.2	66.7253	661573.2	710616	66.7256	661572.9	710616.7	66.7259	-0.7	1602.4	131.66	dn post bc	0	1
15	H=0.008 /	661564	710612.3	66.7339	661563.7	710613	66.7345	661563.5	710613.8	66.7351	-1.3	1606.1	141.559	dn post bc	0	1
16	H=0.008 /	661553.8	710609.1	66.754	661553.6	710609.9	66.7549	661553.4	710610.7	66.7559	-2	1603.2	152.144	dn post bc	0	1
17	H=0.009 /	661545.2	710606.4	66.7603	661544.9	710607.2	66.7609	661544.7	710608	66.7615	-1.3	1603.2	161.25	dn post bc	0	1
18	H=0.009 /	661535.6	710603.4	66.7671	661535.3	710604.2	66.7662	661535.1	710605	66.7652	1.9	1604.2	171.303	dn post bc	0	1
19	H=0.008 /	661526	710600.5	66.7813	661525.8	710601.2	66.7812	661525.5	710602	66.7811	0.2	1604.8	181.297	dn post bc	0	1
20	H=0.008 /	661516.6	710597.5	66.7974	661516.3	710598.3	66.7978	661516.1	710599.1	66.7982	-0.8	1603.1	191.198	dn post bc	0	1
21	H=0.008 /	661507.1	710594.6	66.8019	661506.9	710595.4	66.802	661506.6	710596.1	66.8021	-0.2	1604.3	201.107	dn post bc	0	1
22	H=0.008 /	661497.4	710591.6	66.8108	661497.2	710592.4	66.8113	661496.9	710593.1	66.8118	-1	1602.1	211.234	dn post bc	0	1
23	H=0.008 /	661488.1	710588.7	66.8082	661487.8	710589.5	66.8086	661487.6	710590.2	66.809	-0.8	1602.9	221.023	dn post bc	0	1
24	H=0.008 /	661478.5	710585.7	66.805	661478.3	710586.5	66.8051	661478.1	710587.3	66.8053	-0.3	1601.1	231	dn post bc	0	1
25	H=0.008 /	661468.9	710582.7	66.8036	661468.7	710583.5	66.8041	661468.4	710584.3	66.8046	-1	1603	241.089	dn post bc	0	1

Vertical Geometry

Straffan UP Road (12 ½ to 13 ¼ MP) - completed October 2016



Bridge Ballast Guard & Walkway Upgrade



Improved Quality and higher Handback speeds



Improved Cess locations for staff to stand 'clear and safe'



Regraded embankment post ballast cleaning



Successful Delivery - WHY?

- Many groups/departments risk assessing problems and searching for solutions rather than just saying 'NO its not safe and CANT be done'
- Safety - Safe delivery to date without operational incidents
- Timescale - Delivering of a more reliable asset over a shorter period of time - job done in 5 years rather than 20 years, because of the re-introduction of Single Line Working
- Hand back speed increased - Introducing new technology, along with more detailed planning and Control, we have come from hand back speeds of only 5mph to 40/50mph
- Less impact on our customers due to less restrictive TSRs (longer in length but higher speed and shorter in time)
- Line speed improvements because of greater detail in respect of Geometry Control - 100mph to Portlaoise - less unplanned TSR's due to formation failure - therefore reduced maintenance costs
- Team ethos - Buy in from all groups & departments who realised the value that the Project was delivering for the Railway - Regular meetings, briefings and lessons learned after each weekend
- Acknowledgment of achievement and commitments from staff and contractors

Dublin to Cork line formation remediation - Weekend reviews with stakeholders

Headline Board							
Ballast Cleaning Project 2015 Weekend 4 27/3/15 to 29/3/15							
Start Location	24 3/4	Milepost	Up Road	Newbridge			
Delivered							
•	1 1/4 Miles of Ballast Cleaning completed with time loss						
•	40mph Hand back Speed was achieved						
•	Freight Restriction can be removed at OBC63						
•	New 100mph Horizontal Track Curvature Design						
•	Ballast Cleaned through Overbridges during single line working						
Issues to be addressed							Status
•	Balfour Beatty Rostering - Time transiting to/from site						
•	Condition of cess for BBRI crew to walk in - need to level where possible						
•	HOBS train teaming too heavily on site resulting canceling of a track re-stress						
•	Possession delayed by 1.5hrs Friday night						
•	Pway Shift times to be review						
•	Create Stratgey for spoiling additional ballast if extremely wet areas - dealt with on site						

Project Conclusions :

Great efficiencies have been possible in the deployment of the ballast cleaning machine during longer possessions with the adjacent line open - initial targets have been exceeded and routinely 2000 metres are being achieved during a ballast cleaning weekend programme - 90 miles (approx.) of the formation has been renewed since 2015

The reduction in the value in the unit rate per/mile, as a direct result process adopted has seen us deliver more for less. The unit rate compares very favourable against other railway locations

It is proposed to continue with this project for the next number of years (subject to funding allocations), this will allow the Iarnród Éireann to achieve a high standard of track formation with adequate drainage, the correct depth and quality of ballast and improved vertical and horizontal alignment over the entire route. A further project to allow the replacement of the aged rails and sleepers is currently under development, which (subject to funding) will further enhance the safety, reliability and performance of the Dublin - Cork railway line.

To date the project has been delivered with no operational safety incidents and in 2016, the Project was awarded the 'Infrastructure Project of the year' in Iarnród Éireann's internal safety awards.

Formation renewal

Thank you for your time - Any Questions?

