



Pilot Proposal – Version G(iii)

Why Harrogate "Metro" Line?





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Harrogate Line Development Company Ltd. 2011

WHY HARROGATE "METRO" LINE?

1 **Executive summary**

This report has been produced at the request of key stakeholders of the Leeds-Harrogate-York railway, in particular Harrogate Chamber of Trade & Commerce and Harrogate Borough Council who have a majority interest in the route in terms of revenue generation and usage. The relevant Transport Authorities, North Yorkshire County Council, West Yorkshire PTE and York City Council, have already been appraised of this ongoing exercise. The report explores the outline feasibility of making a step change in service provision, passenger carrying capacity, reliability, operating efficiency and potential for further development by re-deploying electric rolling stock from elsewhere in the UK from 2014.

This is a significant but relatively low cost "invest to save" scheme to provide a step change in capacity, frequency, reliability and developmental capability that could be delivered by 2014-15 on the well used Leeds-Harrogate-York Line, meeting both the aspirations of all of its stakeholders and the needs and expectations of the existing customer base. It would also provide a much needed springboard for further service developments including additional stations being sought by the stakeholders (including Leeds Bradford International Airport) and more frequent services.

On account of the very unlikely scenario that 25kV electrification will be both viable and that suitable cascaded or new 25kV rolling stock will be available in the foreseeable future, this study recommends a full feasibility and design exercise to cascade D78 six-car electric rolling stock from London Underground (with a standardised capacity of 280 seats plus significant standing room for short hop journeys) along with a modern form of low cost DC conductor rail electrification for the route and including a purpose built maintenance facility for the new rolling stock.

On completion, the benefits realised will include:-

- An immediate estimated and consistent 40-60% increase in overall seated carrying capacity, with significant additional space for short-distance standing passengers (essential to deal with events around the route)
- An estimated 12% improvement in transit times by virtue of the train's significantly better performance characteristics and shorter station dwell times and/or
- The ability to accommodate new station stops without seriously compromising either journey • times or the rolling stock resource available to provide the services.
- Emission-free trains and the capability to use renewable energy sources •
- More frequent trains (subject to peak time capacity constraints) •
- Reduced operating and maintenance costs
- The potential economies including single-person operation (for which the trains were • designed and are currently operated)
- A solution that is consistent with the Leeds city (and adjoining) regions and transport authorities transport strategies for the route i.e. conversion to light rail, whilst retaining the ability to operate some long-distance services.

The report is intended to inform key stakeholders of the potentially deliverable options available for delivery "in our lifetime" and to seek initial funding to develop the project to a point where reliable project costs can be established and if considered to present compelling value, to allow a further bid for capital funding as a pilot study for a lower cost regional railway, in line with the recommendations of the McNulty Report.

2 Harrogate Line Economy

Harrogate's economy depends largely on visitors for both business and leisure, whilst many of its residents depend on Leeds or York for employment, shopping and entertainment. With only one direct train to and from London each day, most journeys to and from London have to be on the local franchise (Northern) connections with the East Coast Main Line services at Leeds or York.

The population along the route has grown over the past 5 years alongside usage, which has risen by almost 14% in the last four years, with individual rates approaching 30% in the Harrogate and Knaresborough district, primarily due to traffic congestion and the route's high propensity to stimulate travel, particularly by rail. This effect was particularly identified in an economic study assessing the provision of additional direct London trains in 2007-8 and which was shared with the Harrogate Chamber of Trade & Commerce. That formed the basis for their bid to East Coast Trains for more direct services in 2010 which was partly fulfilled with effect from 22nd May 2011.

3 Harrogate Line Destinations

The Harrogate line itself is one of the most intensively patronised routes in the Northern franchise, exhibiting one of the highest sustained growth rates and carrying approaching 3.5m passenger journeys p.a. It links Harrogate to the major Yorkshire centres of Leeds and York, whilst also connecting significant destinations and communities along the route, including Leeds University, Headingley Stadium, Horsforth town, the Great Yorkshire Showground (Hornbeam Park) and Knaresborough. Journeys to and from the Harrogate district provide the single most significant proportion of revenue upon which the route's economic well-being is sustained.

The line also comes within approximately 2km (1.2 miles) of the Leeds Bradford International Airport terminal (at the southern portal of Bramhope tunnel) and passes under the A1M near Junction 47 (Flaxby) where significant park and ride potential exists both for journeys to Harrogate, Knaresborough, Leeds and York but also as a park and Ride railhead for Boroughbridge and Wetherby. Both locations (along with several others) provide significant potential to generate additional economic and social benefits from the provision of park and ride stations, as well as connecting Yorkshire's primary Airport with Leeds, Harrogate and York by rail. A new purpose built depot facility located close to the route for the maintenance of approximately 20-25 six-car trains is included in this proposal.

An important feature of the route is that its economic health is heavily influenced by its role as a feeder at both Leeds and York stations for interchange to and from long-distance services, particularly London and which represents a significant proportion of the overall network revenue generated as a consequence of its existence. London-Harrogate (& v.v.) is understood to represent the 14th largest revenue flow in the East Coast franchise at an estimated annual value of over £5m. Other significant longer-distance flows include Manchester, Edinburgh, Newcastle and Birmingham. Improved capacity, frequency, connectivity, reliability and efficiency are therefore vital.

4 Passenger Growth

This chart illustrates how maximum forecast growth in average train load factors for peak (64%) and high peak hours (70%) is higher in Leeds than any other conurbation outside London. The estimated average load factor for the Harrogate Line is *already* over 75-85%, derived from 2010 usage data and an observed average train capacity of 170-205 seats.



(Source Network Rail CP4 Delivery Plan)

There is ongoing repeated media reporting of complaints about the quantity and quality of rolling stock used on the line, with frequent overcrowding and poor performance of trains on the route. The demand for an improved service over the route is warranted due to continued growth over recent years, overcrowding on many services, slow journey times delivered by diesel trains and perceived poor connectivity with main line services at Leeds and York because of the low frequency. The most significant majority of the route's internal revenue is generated by journeys to and from Harrogate in particular and as noted earlier the scale of "off-route" revenue generated (particularly to and from London) is very significant.

Around 11% of Northern's worst crowded services operate between Leeds and Harrogate. It is not unusual, particularly during major events, for passengers to be unable to board trains because they are full to capacity. Increasing recent evidence has seen passengers left behind at Harrogate, Headingley and Burley Park stations, with police attendance required on at least one occasion because of the consequent civil misbehaviour as the trains were relatively infrequent at the times concerned.

Key initial benefits of the proposal would be a significant increase in seated carrying capacity consistently to 285 i.e. approximately 40-60%. Carrying capacity of the proposed trains with standees is more than double this. The recently sampled/observed average seating capacity is approximately 170 seats per train and an illustrative weekday planned rolling stock provision suggests an average capacity of 206 seats per train. This provides an average load factor of around 75-85% - which is high by any measure.

5 Alternative Upgrade Options

A number of possible options were considered including the procurement of new diesel rolling stock; 25kV overhead main line electrification; or conversion to tram operation which would also require new and bespoke rolling stock. A potentially more compelling and affordable option has been identified that should be deliverable relatively quickly, which is to electrify the line at ground level to enable a cascade of suitable rolling stock to take place in the foreseeable future. (See Appendix A)

To minimise costs a low-level 750v DC scheme should be evaluated, but using a modern 3rd rail underrunning design of current collection system similar to that used on the Docklands Light Railway (DLR) in London, the Copenhagen Metro and in Berlin.

This is an alternative modern, evolutionary, reliable and appropriate railway electrification system more suited for routes like the Harrogate line with lower line speeds, closely spaced stations and significant structures (low overbridges, tunnels and viaducts) which are highly costly to provide with an overhead (25kv) system.

The current collection system is elevated from the ground, fixed to sleeper ends, and insulated against unintentional contact on the top and sides, current collection taking place on the underside of the lightweight high conductive conductor rail. This also makes it immune from the common icing problem that occurs during the winter on older top contact third rail systems in use elsewhere in the UK, including surface sections of the London Underground. It is suitable for speeds up to 80 mph. The current maximum line speed over the route is 60-65 mph and in the Harrogate area, the average distance between five of the stations is currently approximately 1.8 miles. Claimed benefits include higher traction efficiency, reduced maintenance and reduced arc damage at the working interface.

There is no recent comparable UK data available to provide reliable costs for the infrastructure provision, but the installed unit costs provided by the key suppliers suggest that with a proactive and positive "can-do" project approach, this type of system should be deliverable at a price which is very competitive in comparison with standard main line 25kV electrification. When taken as a whole and including the rolling stock which is likely to be scrapped, the case becomes even more compelling.

6 Rolling Stock

With assistance from London Underground, suitable potentially surplus rolling stock has been identified as being ideal for redeployment to facilitate an affordable and eminently suitable electrification scheme without any immediate requirement to fund new rolling stock for approximately 20 years.

The proposed rolling stock is the D78 Metro-Cammell train currently in use on the District Line, heavily refurbished in 2003-2007, with new bogies in 2000/01. Consequently it is in an excellent condition, with very recently upgraded interiors and equipment. It has an estimated forward asset life of 20 years with good spares availability. For subsequent replacement vehicles, this represents a standard rail construction platform of either Metro vehicles or dual voltage main line vehicles, which are already in use across the UK network and could be suitably adapted for 750v DC current collection using the proposed system.

Lightweight metro rolling stock is felt to offer the optimum long term solution for the route as a whole given the close proximity between stations, their passenger carrying capability and superior performance characteristics above traditional heavy rail electric trains. Existing metro rollling stock can also negotiate tighter curve radii and steeper gradients (e.g. 1 in 28 at Bow Road). This is an important consideration where the potential for further segregation or route reinstatement exists as it provides for more cost effective infrastructure options.

This rolling stock is ideal for the Harrogate line, where many stations are close together and where the levels of usage are relatively high. The anticipated acquisition cost of sufficient rolling stock is less than £1 million plus a budget estimate of approx £0.3m per train for mandatory fleet modifications necessary for operation on the national network outside London. Additional stakeholder modifications have also been budget costed by Wabtec for optional items e.g. DDA toilet @ £70k per train, or a modern electronic traction package @ £0.6m per train (if the benefits outweighed the cost). No future leasing costs would arise.

Other key benefits include significantly improved journey times (by approx 12%), improved reliability and greater efficiency (fuel costs, maintenance costs and single person operation).

7 Train capacity

The D78 trains would offer approximately 40% additional seating capacity and 12% improved journey times, whilst also offering panoramic views of this scenic route. Service development is currently significantly frustrated by the non-availability of scarce diesel rolling stock, limiting frequency, carrying capacity and the realisation of any new stations.

In addition to the significantly greater seating capacity of the D78 trains, they are designed to accommodate large numbers of standing passengers over short distances and this increases the effective carrying capacity to 685 passengers per train. This would be particularly valuable when events take place at various venues over the route, where the current rolling stock is simply unable to cope with demand, resulting in passengers being left behind at stations, unable to board already full trains.

Typical examples include both cricket at rugby events at the Headingley stadia, where very large volumes of passengers attempt to make the short-hop journey between Leeds and either Burley Park or Headingley stations & v.v. There has been recent history of civil disturbances arising as a consequence of large volumes of passengers being unable to board trains at both Headingley and Burley Park stations because of inadequate capacity being available.

8 Additional Stations

However, significant secondary benefits can also be realised through the subsequent unlocking of the current diesel rolling stock resource constraints, thereby facilitating increased frequencies (e.g. 15min intervals) and the opening of new stations to allow the route to better serve the area through which it runs. Diesel multiple unit trains released from the Harrogate line can also be re-deployed elsewhere within Yorkshire to address capacity constraints and crowding on other routes (see below).

An electrified railway using lighter weight Metro rolling stock will facilitate the creation of additional Stations at key points along the line that are not possible with the existing slow diesel rolling stock. The provision of new stations at strategic locations including several Park and Ride sites will significantly improve accessibility and encourage a modal shift from car to rail by business people, commuters, shoppers and leisure visitors, thereby expanding the sustainable revenue base across the full operational day.

9 McNulty Report Recommendations

The recommendations of the Study by Sir Roy McNulty *"Realising the potential of GB Rail"* (May 2011) provide clear pointers as to expectations in achieving improved value for money and efficiency in the rail industry.

The McNulty report highlights, amongst other important issues, the ongoing opportunity for substantial growth in GB rail:-

- "Increased demand for travel, as well as the imperative to adopt more sustainable methods for the movement of passengers and freight, offer the prospect of doubling the current level of traffic by the year 2030. Few other industries have sound prospects of growth on this scale, and it offers real opportunities for everyone involved in the industry."
- "However, there is widespread recognition that the industry has problems in terms of efficiency and costs. Unit costs per passenger kilometre have not improved since the mid 1990s. The Study's initial "should cost" analysis, against the 2008/09 baseline used in the Study, suggested that GB rail's costs ought to be 20-30% lower."
- "There is a clear imperative to give taxpayers and passengers a better deal"
- *"There can also be a vision of a future for GB rail in which.....the subsidy for Regional services, while still continuing, is better controlled and much more precisely targeted"*
- "A greater degree of local decision-making by PTEs, and/or local authorities, brought more closely together with budget responsibility and accountability."
- Closer alignment of route-level infrastructure management with TOCs, at one or other of the following levels:
 - -- minimum cost and revenue sharing, and joint targets; or
 - -- intermediate joint ventures or alliances; or
 - -- maximum full vertical integration though a concession of infrastructure management and train operations combined .
- The Study recommends having at least two joint ventures/alliances in place by 2013/14.

In respect of lower-cost regional railways, McNulty's recommendations are summarised as follows:

"Regional railways provide a number of key services and the Study recognises that there is a need to identify where the existing delivery philosophy does not deliver maximum value. Opportunities to improve value are likely to be centred on:

- •• different service levels;
- •• different equipment;
- •• lower-cost infrastructure;
- •• different working methods; and
- •• different standards.

Experience elsewhere in Europe suggests that it is possible to define a more appropriate level of specification for both infrastructure and operations that can maintain existing standards of safety, but which can reduce the costs of supporting networks which are used less intensively. Local authorities and PTE's could potentially play an important role in examining the options in Great Britain."

"It is recommended that several routes with different characteristics are identified where the principles of lower-cost regional networks could be developed, piloted in operation and benchmarked."

(Source: Summary para. 6.16 "Realising the Potential of GB Rail", May 2011)

10 Vision for the Harrogate Line

In line with the McNulty recommendations, this study has been undertaken on behalf of Harrogate Chamber of Trade & Commerce and Harrogate Borough Council, led by Mark Leving (former Managing Director of Hull Trains with 10 years prior experience working for Network Rail). With assistance from Network Rail, London Underground, the Rail Safety & Standards Board and the Office of rail Regulation, the study provides a well informed clear sense of strategic direction and vision for the Leeds-Harrogate-York line that could be deliverable. It will realise optimum passenger, taxpayer and stakeholder value from the infrastructure and drive the future development of the route to achieve the vision. This is essential to meet both passenger expectations and future demand whilst simultaneously targeting a reduction in unit costs per passenger km. Within this framework it has been vital to recognise the priorities and diverse functions the route performs to the users and locations it serves and the need for greater efficiency.

A key recommendation is that an achievable vision, meeting the key objectives delivering significantly improved stakeholder and passenger value could be achieved through the use of modern cascaded electric Metro rolling stock and low cost electrification of the route in parallel with service frequency improvements, train capacity increases and improved accessibility through additional car parking, Smartcard ticketing and new stations to stimulate passenger significant revenue and usage growth.

11 Operating Management

It is felt that the establishment of a locally governed "not for dividend" or "mutual" operating and development company could provide a suitable vehicle to provide the necessary focus, drive and responsiveness essential to deliver services and iterative route development in a significantly improved manner than appears possible whilst the route is but a small part of a large franchise. This includes consideration of the possibility of a long-term infrastructure concession from Network Rail, assuming that suitable terms and liabilities could be agreed.

12 Next steps

In order to bring together all the key stakeholders along the Harrogate Line, a not-for-profit Company Limited by Guarantee has been set up by Harrogate Chamber of Trade & Commerce called the Harrogate Line Development Company Ltd. This Company will aim to accumulate funds from the Stakeholders sufficient to promote the scheme to Government and attract funding to further research and develop the proposition.

It is proposed to validate the project by seeking funding to undertake outline feasibility & design studies in two key areas initially i.e.

- (i) Signalling immunisation and associated works including power supplies, distribution, stray currents, return conductor etc.
- (ii) An outline gauging study at low level to identify areas where gauge envelope infringements might occur (e.g. through sheer faced station platforms) and low cost means of resolution
 Subsequently the proposal could be developed through a more complete Reference Design (GRIP stages 3 & 4+) via Network Rail. For this stage, detailed design and costing for the electrification and associated works will need to be procured. The project will then gain more certainty in terms of cost, solutions and timescales.

In parallel, it is also proposed to allow the private sector market to price the necessary infrastructure works as a complementary or alternative mechanism to Network Rail's GRIP process.

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APPENDIX: HARROGATE LINE OPTIONS CONSIDERED (Issu

OPTION	DESCRIPTION	COMPONENT	IMPACT ON	IMPACT ON	CONSTRUCTABILITY	MAIN	MAIN DISADVANTAGES
		PARTS	OPERATIONS	MAINTAINABILITY		ADVANTAGES	
1.	Additional	Procure	Scarce	Additional	New vehicles not	No	Vehicles unavailable.
	diesel	new or use	maintenance	diesel/oil	available. DfT	infrastructure	Diesel traction unable to
	vehicles	cascaded	capacity at	contamination	sources suggest	work required	fulfil any additional stations
		diesel	Neville Hill	on track.	no new build		without seriously and
		vehicles	depot for any		anticipated		adversely impacting on the
			additional	Diesel vehicles			journey times between key
			vehicles	maintenance			points.
				hungry and			No maintenance or
			Train length	require regular			operational cost efficiency.
			and capacity	refuelling.			(20-30%)
			restricted by				Cascaded vehicles not
			absence of	Very limited			single-person operation
			selective	capability for			compatible.
			door	additional			
			operation	vehicles at the			Less reliable than electric
			(SDO)	only local depot			vehicles
				at Neville Hill			
				(Leeds)			

APPENDIX:	HARROGATE LINE OPTIONS CONSIDERED	Issue 3)	
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OPTION	DESCRIPTION	COMPONENT	IMPACT ON	IMPACT ON	CONSTRUCTABILITY	MAIN	MAIN DISADVANTAGES
		PARTS	OPERATIONS	MAINTAINABILITY		ADVANTAGES	
2.	Tram-Train	Bespoke new	Unknown – no	Unknown – no	No suitable vehicles	Suitable for	Comparative estimates suggest a significantly higher
		build vehicles	comparable	operating experience	currently exist	low speed	"per vehicle cost" and fewer seats per vehicle.
		required plus	operating	in the UK		street	Additional track maintenance possible.
		overhead	experience in the		Very high cost of	running.	
		electrification	UK	Low floor vehicles	construction		Unlikely to be capable of dealing with high volume
		assumed and/or		understood to	envisaged.	Tolerant of	demand experienced on the route for commuting and
		hybrid diesel-	Driving by sight	demand higher		gradient with	events.
		electric vehicles	considered high	quality vertical track		good	
			risk, particularly in	alignment due to		climbing	Higher cost overhead electrification or bi-mode diesel
			areas of poor	more rigid structure		capability	tram currently assumed. (See also Option3.) Very high
			visibility (e.g.				cost of street running infrastructure.
			tunnels) therefore	Additional cost of		Tolerant of	
			lower maximum	overhead		tight radius	Unlikely to generate maintenance cost efficiencies
			speed as a key	electrification		curves	over other electric rail vehicles
			mitigation.	infrastructure (if			
				provided)		Could be	Proposal does not link Harrogate or York to LBIA &
			Street running			adapted to	some key direct journey flows (e.g. Burley Park-
			generates	Unknown cost of		operate using	Harrogate) no longer possible.
			significant	maintaining street		low level	
			additional risks and	running infrastructure		electrification	Emerging consensus that T-T inappropriate for longer
			consequences.			on segregated	distance journeys beyond Leeds city centre and city
			Would also			lines.	boundary (10 miles) and where significant volumes of
			adversely impact on				long distance connectional rail journeys are involved.
			journey times				
							Street running expected to generate lower levels of
			Improved track				punctuality and to increase running times to reach
			quality anticipated				Leeds station for interchanging passengers
			as being required				
							Exposure to increased levels of incident whilst involved
			Lower capacity per				in street running.
			tram vs.				
			conventional train				No prospect of future automation with street running
			1				

OPTION	DESCRIPTION	COMPONENT	IMPACT ON	IMPACT ON	CONSTRUCTABILI	MAIN ADVANTAGES	MAIN DISADVANTAGES
		PARTS	OPERATIONS	MAINTAINABILITY	ТҮ		
3.	25kV (or	e.g. using class	Scarce	Additional	Possible. High	Standardised 25kV	No cascaded rolling stock
	other)	315/319	maintenance	maintenance cost	costs envisaged	main line high speed	available until 2018-20 and the
	overhead	cascaded	capacity at Neville	of overhead 25kV	through	electrification	route still unlikely to be of
	electrification	rolling stock	Hill depot for any	system,	Bramhope tunnel,	system.	sufficient priority on the
	using	plus 25kV	additional		many original low		national network for 25kV
	cascaded	electrification	vehicles.	Requirement to	overbridges (>16		electrification.
	rolling stock			maintain heights	No.)and across 4		
	(or electric		Known risk of	and staggers on	major viaduct		Potential rolling stock older
	tram-train)		overhead line	OHLE with	structures. All key		than D78 and less suitable for
			dewirement in	specialist	structures Grade		the route.
			extreme	equipment. , OHLE	II listed.		
			conditions	general			High cost of 25kV electrification
			including	maintenance,	A number of		system envisaged because of
			ice/wind (also	power supply	overbridge		route features and topography.
			pertinent to	maintenance	structures already		
			option 2).		provide sub-		Possible power supply
				Embankment	standard		constraints over the route
			OHLE defects	stability issues may	overhead		restricting service frequency
			quoted as	demand very deep	clearances and		without additional 25kV feeder
			accounting for 5%	piling for masts in	would require		provision.
			of infrastructure	some areas.	reconstruction		
			delays nationally		(see 2 above)		Route is a low priority in the
				(also pertinent to			Electrification RUS and
			Train	option 2)			generates no wider 25kV
			length/capacity				network benefits.
			constrained by				
			absence of SDO				Cannot be used by standard
							750v DC Metro rolling stock

APPENDIX: HARROGATE LINE OPTIONS CONSIDERED (Issue 3)

OPTION	DESCRIPTION	COMPONENT	IMPACT ON	IMPACT ON	CONSTRUCTABILITY	MAIN ADVANTAGES	MAIN
		PARTS	OPERATIONS	MAINTAINABILITY			DISADVANTAGES
4.	750v DC low	750v DC	Reduced	Similar to 25kV but	Minimal disruption,	Rolling stock tried, tested and reliable.	Electrification
	level	modern	trespass as a	reduced scale and	night-time working	Already operates on NR infrastructure	system currently
	electrification	underrunning	consequence of	more accessible for		in single person operation mode,	non-standard on
	and using	contact	improved	maintenance/repair			Network Rail
	cascaded	system + 12	lineside fencing.			High carrying capacity (280 seated +	infrastructure.
	Metro (D78)	No.3mW sub		Low rolling stock		685 standing). High performance spec	
	rolling stock	stations +	Improved	maintenance costs		= 12% improved point to point timings	No recent cost
	ex LU.	approx 20 6-	pathing /	@ estimated		+ reduced station dwell times.	comparisons
		car D78 train	platforming	£0.42p.v.m.			available.
		sets	arising from	including L5 reserve		Lower cost procurement and	
			higher	costs for heavy		maintenance, suitability and available	Uncertain scale
			performance	item overhaul.		rolling stock. 20% more energy	of signalling/TC
			capability			efficient than equivalent age	immunisation
						25kV/750vDC ex BR rolling stock.	costs etc.
			Shorter station				
			dwell times			Underrunning DC system not subject	Low level gauge
			arising from			to icing/wind	clearance to
			increased				assess to
			number of			Tolerant of gradient (works at 1 in 28)	accommodate
			doors			with good climbing capability. Tolerant	underrunning
			conveniently			of tight radius curves (90m operating,	contact system
			placed and			down to 46m in depots)	(e.g. through
			shorter open-			Motored veh's 27% lighter than 150	sheer faced
			close cycle.			diesel veh, 25% lighter than 507.	station platforms)
						Trailer veh's 27% lighter than 507.	
			Improved				
			operational			Existing SDO provision front and rear	
			flexibility –			cars simultaneously	
			standard length				
			/ capacity			Infrastructure could be used by Dual	
						Voltage EMU's in the future.	

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