

The rail industry and government have agreed that rapid electrification of the rail network is needed but which routes should be electrified first?

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Network Rail has analysed relevant characteristics of each individual line comprising the overall rail network and has proposed which sustainable mode of traction would present the optimum strategic choice for each line. The objective is to create a rolling implementation plan which will gradually eliminate diesel haulage from the UK rail network altogether. The output is known as the Transport Decarbonisation Network Strategy (TDNS) and includes a network route map showing the strategic choices for each route. TDNS has also come up with 5 'Pathways' with differing rates of implementation measured in STks (single track kilometres electrified per annum), cost and benefit and also dates by which zero carbon emissions will be achieved, none of which is earlier than 2050. The highest feasible STK annual rate is 691 and the lowest is 377.

There are 'Core' electrification routes (top priority) and 'Ancillary' routes which presumably have a lower priority. Battery, hydrogen and 'alternative' traction routes are also shown (although 'alternative' does not specify a particular type of low carbon traction). Not surprisingly, 25kV AC overhead is the most common strategic choice for decarbonisation but to date nothing has been published stating exactly what the priority order is for the many 'core routes'.

Railfreight Solutions has therefore come up with what it believes should be the top 10 priority routes to be electrified first in a specific order from 1 to 10.

A few points should be borne in mind before reviewing the output:

It places a lot of emphasis on freight services; note that since the pandemic began freight volumes moved have more or less continued unchanged unlike passenger numbers which have plunged by 60-70% and are not expected to revert to previous typical levels for a long time (if ever).

Freight trains already reduce carbon emissions by 76% per tonne mile compared to road haulage and if more freight trains can be electrically hauled (rather than diesel) total carbon emissions can be halved again; furthermore, electric locomotives can shorten journey times compared to diesel making rail freight more attractive to customers which should result in further modal shift from road to rail. Modal shift also leads to reduced road congestion and noise pollution.

The sequence of implementation aims to build on each previous incremental step thereby increasing through route possibilities at a greater rate rather than would be the case if geographically isolated schemes were tackled in a random order.

The strategic aim is to create an '**Electrified Lattice**' network of north south and east west routes which would provide best overall value by allowing longer distance passenger and freight traffic to switch to electric traction as soon as is practically possible. Based on the lowest STK implementation rate quoted within TDNS (377 STks p.a.), these 10 schemes could be completed in around 12 years.

To fully 'knit' these schemes together a further 6 **short infills** totalling just 18 miles would ideally be wired too.



The TDNS map is shown on page 2, over which has been laid the proposed 10 priority routes (in blue).

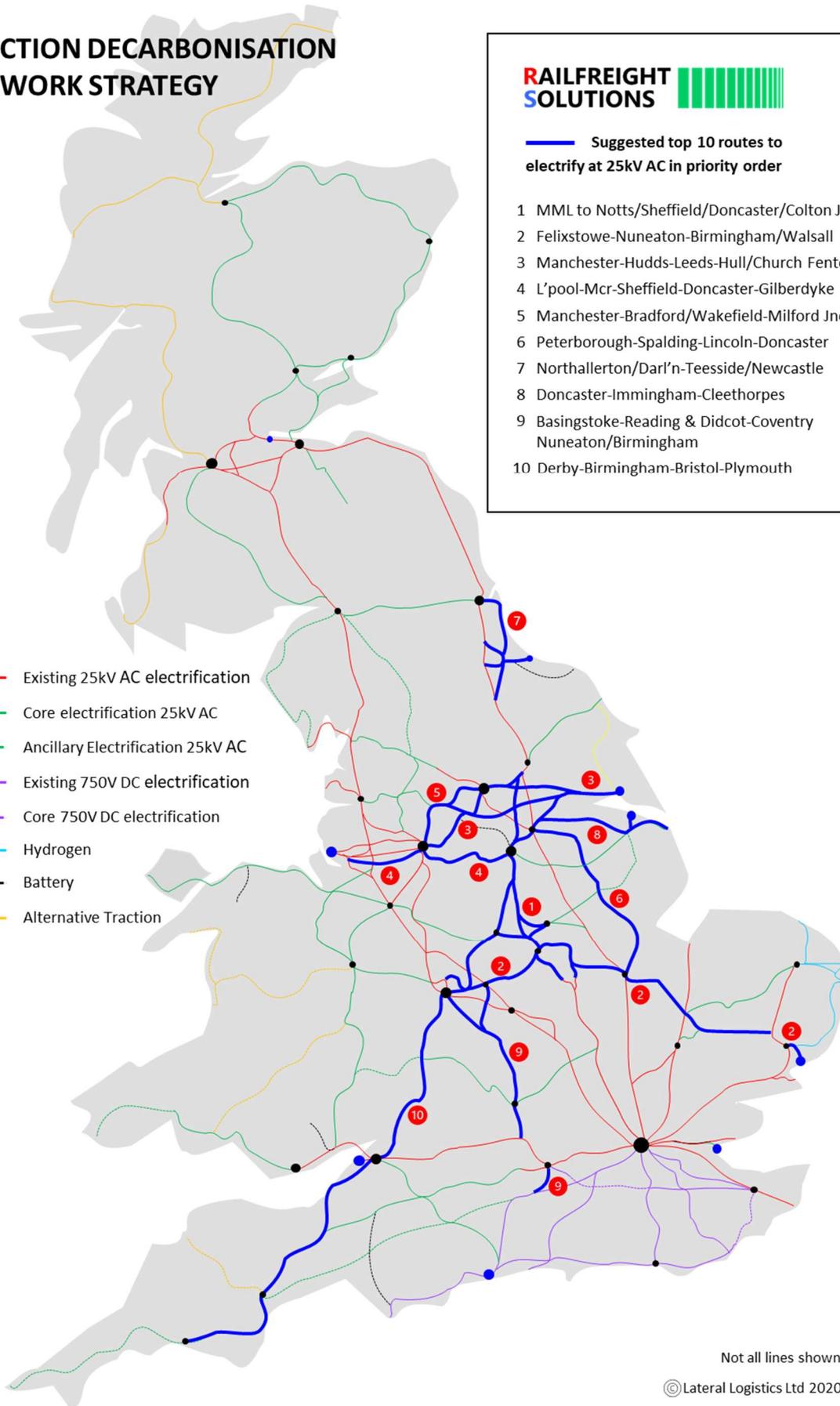
TRACTION DECARBONISATION NETWORK STRATEGY



Suggested top 10 routes to electrify at 25kV AC in priority order

- 1 MML to Notts/Sheffield/Doncaster/Colton Jnc
- 2 Felixstowe-Nuneaton-Birmingham/Walsall
- 3 Manchester-Hudds-Leeds-Hull/Church Fenton
- 4 L'pool-Mcr-Sheffield-Doncaster-Gilberdyke
- 5 Manchester-Bradford/Wakefield-Milford Jnc
- 6 Peterborough-Spalding-Lincoln-Doncaster
- 7 Northallerton/Darl'n-Teesside/Newcastle
- 8 Doncaster-Immingham-Cleethorpes
- 9 Basingstoke-Reading & Didcot-Coventry Nuneaton/Birmingham
- 10 Derby-Birmingham-Bristol-Plymouth

- Existing 25kV AC electrification
- Core electrification 25kV AC
- - - Ancillary Electrification 25kV AC
- Existing 750V DC electrification
- - - Core 750V DC electrification
- Hydrogen
- - - Battery
- Alternative Traction



Not all lines shown

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The following table provides the thought process behind the strategic choices made for the 10 key routes:

No.	Route	STks	Rationale	Yrs*
1	Midland Mainline extension <ul style="list-style-type: none"> • Kettering to Sheffield via Derby, Nottingham, Erewash Valley • Sheffield to Doncaster • Sheffield to Colton Jnc to meet ECML 	680	<ul style="list-style-type: none"> • Provides a third strategic, route linking London with Yorkshire serving the 3 major East Midlands cities as well as Sheffield (total urban population >2m) • Significant freight volumes from Peak District & Leicestershire to South East could be hauled by suitable bi-mode traction • Provides diversionary route for ECML 	1.8
2	Felixstowe to Nuneaton <ul style="list-style-type: none"> • Felixstowe to Ipswich • Haughley Jnc to Ely Dock Jnc • Ely North Jnc to Peterborough • Helpston to Syston • Wigston to Birmingham • Water Orton to Walsall via Sutton Park 	760	<ul style="list-style-type: none"> • Allows all Midlands, North West and Yorkshire intermodal traffic from Felixstowe (70 trains per day) to be 100% electrically hauled avoiding London • Introduces first East-West link within future 25kV 'Electric Lattice' linking 5 North-South routes GEML/WAML/ECML/MML/WCML • Provides diversionary route for WCML to from or around Birmingham • Cross Country, GA services etc. can migrate to 100% electric traction 	3.8
3	Trans-Pennine North (Diggle) <ul style="list-style-type: none"> • Manchester Victoria to Leeds via Huddersfield & Dewsbury • Guide Bridge to Stalybridge • Leeds to Hull • Micklefield to Church Fenton 	380	<ul style="list-style-type: none"> • Completes full 25kV between Liverpool, Manchester, Leeds, Hull, & Newcastle • 2nd East-West route expanding Electric Lattice linking WCML with ECML • Reduced transit times due to ability of electric traction to tackle steep Pennine gradients compared to diesel 	4.8
4	Trans-Pennine South (Hope Valley) <ul style="list-style-type: none"> • Allerton to Trafford Park • Stockport to Dore via Edale • Ashburys to New Mills • Doncaster-Gilberdyke 	312	<ul style="list-style-type: none"> • 3rd East-West route expanding Electric Lattice linking WCML with ECML via MML • Liverpool-Nottingham EMT route fully electrified • Peak District aggregate traffic to London & South East virtually electrified throughout 	5.5
5	Calder Valley <ul style="list-style-type: none"> • Miles Platting to Bradford via Rochdale and Halifax • Milner Royd Jnc to Heaton Lodge Jnc via Brighouse • Ravensthorpe to Milford Jnc via Wakefield Kirkgate 	261	<ul style="list-style-type: none"> • 4th East -West Electric Lattice spoke linking North West with MML/ECML • Primary trans-Pennine freight route linking Liverpool with Hull avoiding Leeds • Allows introduction of EMU operation on Calder Valley route plus Huddersfield-Bradford and Huddersfield-Wakefield services 	6.2
6	GNGE Joint Line <ul style="list-style-type: none"> • Peterborough Werrington Jnc to Doncaster Bessacarr Jnc via Spalding & Gainsborough 	330	<ul style="list-style-type: none"> • Allows all Felixstowe-Yorkshire intermodal traffic to be electrically hauled throughout • Strategically important ECML diversionary route 	7.1
7	Teesside & Wearside <ul style="list-style-type: none"> • Northallerton to Newcastle via Eaglescliffe & Sunderland • Darlington to Redcar • Norton Jnc to Ferryhill 	315	<ul style="list-style-type: none"> • Provides Teesside, Sunderland and County Durham with 100% local electric network • Through electric services from Sunderland and Middlesbrough to London • High volume freight network • ECML diversionary route 	7.9

8	South Humberside Main Line <ul style="list-style-type: none"> Thorne Jnc to Cleethorpes via Scunthorpe Brocklesby to Immingham 	230	<ul style="list-style-type: none"> Completes eastern leg of Trans Pennine South route Substantial freight volumes (incl. metals, biomass, petroleum, infrastructure) to and from Immingham 	8.5
9	Basingstoke-Reading/Didcot to Nuneaton & Birmingham <ul style="list-style-type: none"> Basingstoke to Reading Didcot to Nuneaton via Coventry Leamington Spa to B'ham Snow Hill via Solihull Bordesley Jnc to Grand Jnc 	427	<ul style="list-style-type: none"> Primary freight route from Southampton to West Midlands, North West & Yorkshire For freight Class 92s would be required unless Southampton to Basingstoke 25kV AC is also added (while retaining 750V) Primary South East spoke of Cross Country franchise 	9.6
10	Derby to Bristol and Plymouth <ul style="list-style-type: none"> Derby to Water Orton Birmingham Camp Hill line Bromsgrove to Westerleigh Jnc Bristol Parkway to Plymouth 	902	<ul style="list-style-type: none"> Primary South West spoke of Cross Country franchise Infills North East spoke of XC network Provides fully electrified freight route from North East via East Midlands to South West and Wales avoiding Birmingham New Street 	12.0

All STK distances include 20% uplift to allow for loops and sidings.

*Year figures are cumulative

The choices have been difficult; other key routes such as Derby to Stoke, Newcastle to Carlisle and the Berks & Hants line have been deliberated but it is considered that the above combination of routes together with this phased plan of implementation provides the best overall value for both passenger and freight traffic.

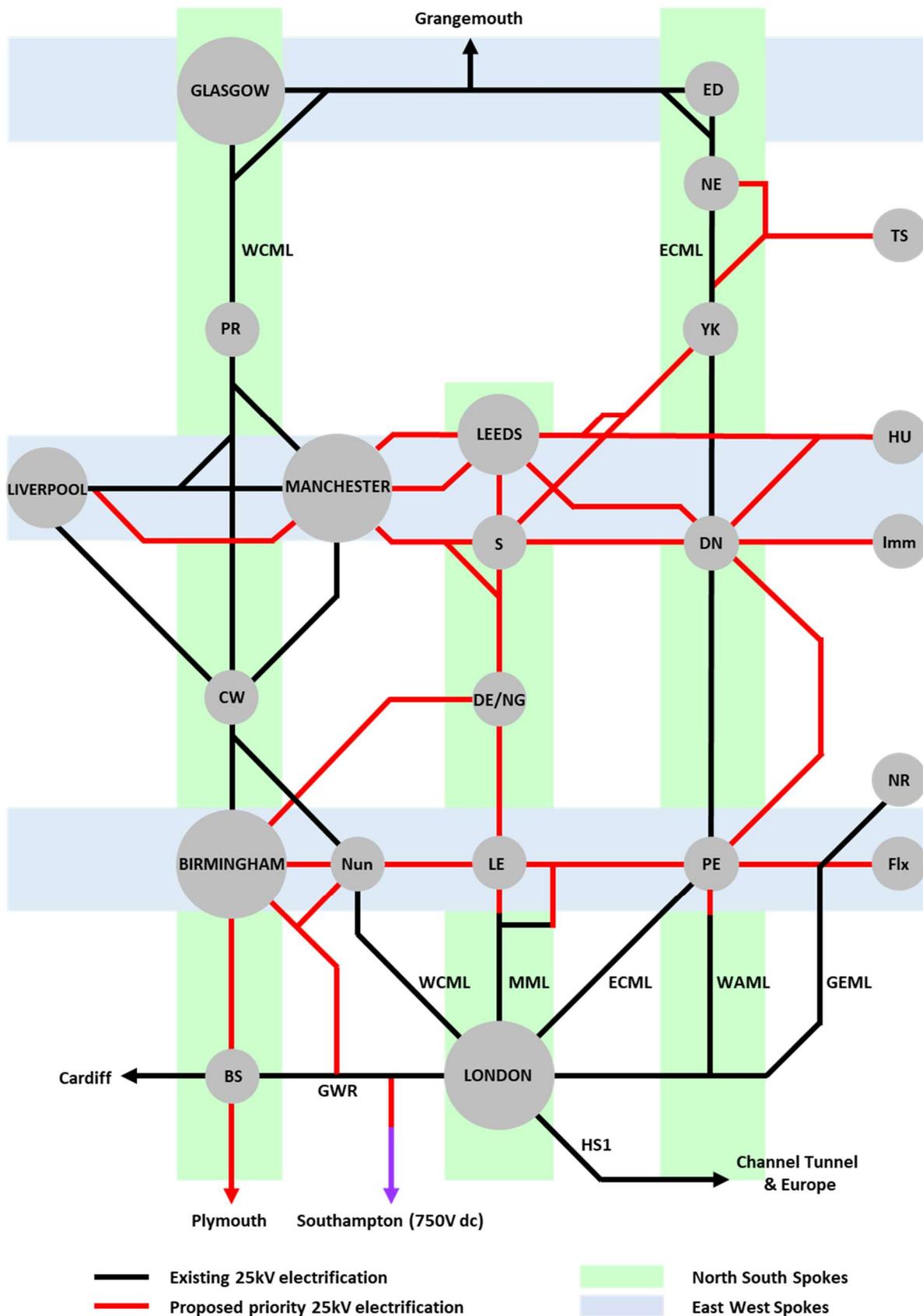
The East-West route currently under construction from Oxford to Bedford (and ultimately Cambridge) would have been included but since it has recently been announced that the line will not be wired as part of the construction phase, regrettably, it has had to be omitted for now. When it is finally wired it will provide a 5th East-West spoke of the Electric Lattice.

Recommended 6 infill projects

No.	Route	STks	Rationale	Yrs.*
1	Acton to Willesden <ul style="list-style-type: none"> Acton Main Line to Mitre Bridge Jnc via Acton Wells 	6	<ul style="list-style-type: none"> Links GWR to NLL and WLL allowing cross-London transits from all radial routes 	1.0
2	Carlton Rd Jnc to Junction Rd Jnc	5	<ul style="list-style-type: none"> Links MML to GOBLIN line, LTS and Essex Thameside 	
3	LTS to London Gateway <ul style="list-style-type: none"> Thames Haven Jnc to London Gateway port 	5	<ul style="list-style-type: none"> Connect the 3rd major deep sea intermodal port to the entire GB electrified network 	
4	Dudding Hill Line <ul style="list-style-type: none"> Cricklewood Jnc/Brent Curve Jnc to Acton Wells 	16	<ul style="list-style-type: none"> Links MML with GWR and Southern Region and WCML with GWR via Acton Canal Wharf spur 	
5	South Acton to New Kew Jnc <ul style="list-style-type: none"> Including Gunnersbury to Old Kew Jnc 	5	<ul style="list-style-type: none"> Provides fully electrified cross London link from WCML, MML, ECML, WAML, GEML, LTS to Clapham Jnc and Southern Region 	
6	Olive Mt Jnc to Liverpool Docks	26	<ul style="list-style-type: none"> Significant freight traffic on heavily graded branch Links into WCML and Trans-Pennine routes 	

Applying TDNS STk rates and an assumed sufficient work force, these 6 schemes could be completed in 1 year! The resultant Electric Lattice is shown on page 5.

ELECTRIC LATTICE



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Not all electrified lines shown