Investment in resilience and economic development: the West Country rail network

Discussion note,
12 February 2014

JRC · Bridge House · Wanstrow BA4 4TE · jrc@jrc.org.uk · 07545 641204
A Registered Company in England & Northern Ireland.
Registration Number 6870225. VAT 974 1904 00

Resilience and the economy - floods and the Dawlish sea wall collapse: a permanent transport input for Somerset, Devon and Cornwall

Contents

Summary

There are three primary issues.
(1) Railway resilience
(2) Railways to support the regional economy
(3) Road issues.

This paper comments primarily on railway-related issues. The potential solutions may point to at least two different actions, addressing resilience, and stimulating economic development. These are discussed briefly below. JRC is a specialist transport consultancy and is available to discuss its ideas with stakeholders, elected members and officers.

Resilience: Dawlish sea wall

This is a vulnerable piece of railway. Repairs are required, but a robust medium term solution should investigate two options for new inland routeings:

- Via the former Exeter-Chudleigh-Newton Abbot railway
- Via a new inland express route between Exeter and Newton Abbot.

Detailed engineering and benefit-cost estimates will be required. There will be a trade-off between the costs and benefits of re-opening the former railway, compared to a new route.

Other resilience in the South West

There are other locations which re-occur regularly, or less frequently, as major blockages for days on end. Most commonly there are blocks caused by flooding at Cowley Bridge Junction on the GW Main Line just outside Exeter, or north and east of Taunton across the Somerset levels, or by landslips along the SWT route. A targeted list of locations, risks and assessed delay impacts should be developed, based on Network Rail and Train Operator evidence from recent years, with proposals for permanent remedial action which allow for projections of any worsening weather patterns over the next 10-20 years.

Value of economic impacts and stimuli

It is important that structural step changes can be achieved by investments, rather than just marginal gains, in order to make a real difference to the South West. However there is a project justification issue, that the South West peninsula is not on a through route to other destinations, therefore projected flows diminish the further west one is, and the case for large-scale investment can be diluted. The business case will need to look to wider economic growth, peripherality and Gross Value Added, rather than just to journey time savings.

There are current estimates of £1m to £20m a day economic losses in the South West from the current disruption – £20m is from the Cornwall and Isles of Scilly LEP. Turning this on its head, if there were just £1m a day gains to be secured from improved, robust infrastructure on a permanent basis – it could be more – then nominal valuation of gains (equivalent to a discounted 60 year project life) would be £9 billion over those 60 years. This ignores multiplier effects and other economic worth. Even if only a proportion were justified for rail investment, this makes a case for a multi-billion commitment for the future of South West accessibility.

High level investment options

Options are described at high level in this paper for generic rail infrastructure improvements such as electrification and new trains. Additionally, area specific options include:

- Improved railway connectivity in Somerset, between principal centres and the county town, and with the new economic hub stimulated by Hinkley Point new power station.
- Investment in electrification and new trains for South Devon and Plymouth, via the South Dartmoor line through Newton Abbot and Totnes. A resilient and electrified railway can reduce journey times by 10 minutes, just within the South West.
- Options to speed up rail access and shorten rail distances to West Devon and Cornwall, including the potential to re-use the North Dartmoor line as a fast ‘R30’ corridor. This could reduce journey times to Cornwall by a more fundamental 40 minutes.

Principal recommendations

It is recommended that:

- a detailed engineering and benefit-cost analysis is undertaken of the various railway improvement options set out in this high-level paper
- the recommendations are taken forward at stakeholder, county, LEP and national level, in order to inform future investment decisions which will benefit the South West’s economic development priorities.

Main discussion note: Investment and resilience

(1) Railway resilience

a. The Dawlish sea wall has a history of operational issues and occasional closures caused by dangerous sea conditions.
b. However the sea wall is not the only vulnerable location. For example there have been fairly frequent occasions when the main lines have been closed in the Exeter area because of flooding near Exeter St Davids in the Cowley Bridge Junction area.
c. There are mud slides above the line at Dawlish, causing serious delays last year, and they have started again this year.
d. The Taunton-Castle Cary and Taunton-Bridgwater lines have also been closed because of extensive flooding of the Somerset Levels.
e. The South Western main line to Exeter is also vulnerable in the River Axe valley (eg, flooding near Axminster) and has experienced several landslips in recent years, on Honiton bank and near Crewkerne.

(2) Railways to support the regional economy

a. There are the immediate economic consequences of closures which cause lost output in the short term. Figures being put about range from £1m-20m a day. The Cornwall and Isles of Scilly LEP says £20m.
b. There is also a disincentive to inwards investment to achieve structural change in the South West, if it can be that vulnerable to poor accessibility and delays. Anecdotal evidence has pointed to multi-million company investments being lost for that cause.
c. The coastal railway between Exeter, Dawlish and Newton Abbot, and the hilly and curved railway alongside South Dartmoor between Newton Abbot and Plymouth also causes slow journey times. The Cornwall main line is itself slow and accessible only via Dawlish and South Dartmoor.

(3) Road issues

a. The road corridors are also vulnerable, and are associated with the regional reliance on only two main corridors – the M5 via Taunton, and the A30/A303 which is limited in quality and capacity through the Blackdown Hills.
b. There are strategic issues concerning the choice of roads for upgrading, where options have been debated for a number of years about schemes for upgrading the A303 and the preferred routeing past the Blackdown Hills.

Solutions for railway resilience

Dawlish sea wall

The sea wall is located between Exeter and Newton Abbot. No one is suggesting that this line should be closed – it must be rebuilt – but it remains a most vulnerable piece of railway which with greater extremes of weather is at risk of more frequent closure in future years. Consideration of a new inland line is likely to be required.

Two options are frequently suggested, using a former branch line via Chudleigh, or via a pre-war GWR inland express scheme. An inland route between those points would resolve the

most vulnerable railway, with resilience benefits for towns and economies west of Exeter, including South Devon, Plymouth and Cornwall.

(A) Via the former Chudleigh railway

This would reinstate, largely along the former railway alignment, the 20¾ mile inland route between Exeter and Newton Abbot via Chudleigh and Heathfield. Under the GWR this line was maintained with a high weight limit, for sea wall diversions, though it was unsuitable for fast running. The line still exists for freight between Heathfield and Newton Abbot, and near Exeter St Thomas. However the route is partly built on, locally in South Exeter (mainly by roads), and is used for the A38 trunk road between Chudleigh and Heathfield. It was a hilly railway, unsuitable for fast running.

It might possible to reconstruct the railway alongside the roads and restore other missing sections. If rebuilt, it could offer a suburban service into Exeter from South Devon communities, but would only be there as a diversionary route for main line operations. Of course, in adverse weather, there is no guarantee that this route or any other could be guaranteed to be kept open, but it would avoid the sea wall and mud slide issues. The costs of reopening should not be under-estimated – sometimes such costs are not much less than building an entirely new railway.

(B) Inland express route between Exeter and Newton Abbot

The GWR planned a line just inland from Dawlish, but the route is no longer development-free. The area topography suggests that any new scheme for an express line would probably have to diverge from the existing route between Exminster and Powderham, then have a 300 yard tunnel under the ridge to reach the Kenn river valley, then SW along existing valleys past Whitcombe, then a 2-2½ mile tunnel towards

Chudleigh, then alongside the A38 trunk road until nearing Heathfield and the existing branch. This would allow faster, more direct running that the former railway between Exeter and Chudleigh, though probably at greater expense.

Investigation requirements

Clearly both options could be investigated in detail, and other options as well, such as a completely new High Speed line, direct from Exminster to Newton Abbot, and largely in tunnel because of the topography. Prima facie it is debateable if the journey time reductions would be sufficient to justify lengthy new tunnelling, for railway resilience alone.

The total route between Exeter St Davids and Newton Abbot would be about 18¾ miles with option B, which is similar to the present 20 miles via Dawlish sea wall. The normal railway timetable offers frequent 18-20 minute journey times between Exeter St Davids and Newton Abbot, so that a quick route would be required to make any appreciable difference.

Detailed engineering and benefit-cost estimates will be required. There will be a trade-off between the costs and benefits of re-opening the former railway, compared to a new route.

Other resilience requirements

There is merit in having a resilient railway between Exeter and points west, but it is of less benefit if the main line is then blocked up the Exe Valley, most commonly from flooding at Cowley Bridge Junction on the GW Main Line just outside Exeter, or north and east of Taunton across the Somerset levels, or along the SWT route.

Other frequent factors such as tree falls and other hazards should also be considered, and how to mitigate those. The most common flooding locations are a constant bother, and it is understood that Network Rail is considering raising track levels quite substantially in vulnerable locations. This could be made a priority for expenditure in the new Control Period 5 for investment, between 2014 and 2019, under preventative spend.

A targeted list of locations, risks and assessed delay impacts should be developed, based on Network Rail and Train Operator evidence from recent years, with proposals for permanent remedial action which allow for projections of any worsening weather patterns over the next 10-20 years.

Overall, a range of well thought-through, well justified and publicised solutions to resilience, can be a boost to the South West economy, as well as having lessons for railway resilience elsewhere in Britain.

Solutions to support the regional economy

What is the permissible size of investment?

The rationale for what solutions might be best value should be based on a judgment about the capacity for the South West economy to recover and grow in response to infrastructure stimuli. For example, estimates of a £20m a day disbenefit may be based on the general weather impact, not just on the transport issues arising. Because of the peripherality of the South West, schemes which promote structural change rather than marginal improvements may prove the more worthwhile in the medium and longer term, but may be harder to justify within normative processes. The business case will need to look to wider economic growth, peripherality and Gross Value Added, rather than just to journey time savings.

Nevertheless, a nominal £1m a day additional economic stimulus achievable from better accessibility across parts of Somerset, Devon and Cornwall, as a very cautious estimate, would equate to over £350 million, if extended for one year. This is cumulatively £3 billion over 10 years, £5 billion over 20 years, and £9 billion over 60 years, using Treasury rules for Present Value discounting. 60 years is a normal project assessment period for schemes requiring approval by the Department for Transport (DfT). This also makes no allowance for multiplier effects, whereas these are commonly 1½-2 times, from a cautious viewpoint.

Consequently there is the theoretical capacity for multi-billion investment in better accessibility across the outlying parts of the South West, even if costs incurred should not exceed 50% of overall benefits including multiplier gains, in order to confirm with Department of Transport appraisal of value for money, where a ratio of 2 : 1 benefits to costs equates to a “Good” scheme.

Looking specifically at rail links, a share of the theoretical pot would buy a serious amount of railway investment. With this somewhat encouraging starting point, it is now worth looking with renewed perspective on what sorts of schemes might achieve significant impact on accessibility, in these same areas.

Generic investment

Electrification

Electrification would assist by reducing inter-station times, with faster acceleration of trains away from stations, and faster acceleration up steep gradients. Electrification of the M4 corridor Great Western services between London, Bristol and South Wales is now authorised and due to be completed in 2016-18.

However no electrification is yet proposed in South West England. There is no timescale for electrification via the GW West of England Line, although it is known that studies are underway for wiring as far as Westbury. It is possible that the Waterloo-Salisbury line might be electrified as part of Southampton freight and London commuter passenger requirements, but again there is no immediate prospect for wires west of Salisbury.

Faster line speeds

These are appropriate either to achieve higher top speed running between towns, where track alignment permits this, or by revising upwards the line speed limit on slower

sections of line, for example where there are sharp curves. A simple rule of thumb is that most lines west of Exeter are more constrained by curvature than by theoretical top speeds, although the former Southern Railway line via North Dartmoor has some long stretches where top line speed could be improved.

Faster speeds on curves can be undertaken by greater canting of track to maintain passenger comfort during 'lateral acceleration', or by tilting trains which contain the same effect within the train. The introduction of tilting trains on the curved West Coast Main Line allowed significant acceleration of services, worth a quarter to a half hour over a 200 mile distance. Tilting trains do not need to be electric. The map below shows how curvy the existing and former main lines are between Exeter and Plymouth. They are at least as curvy in Cornwall.

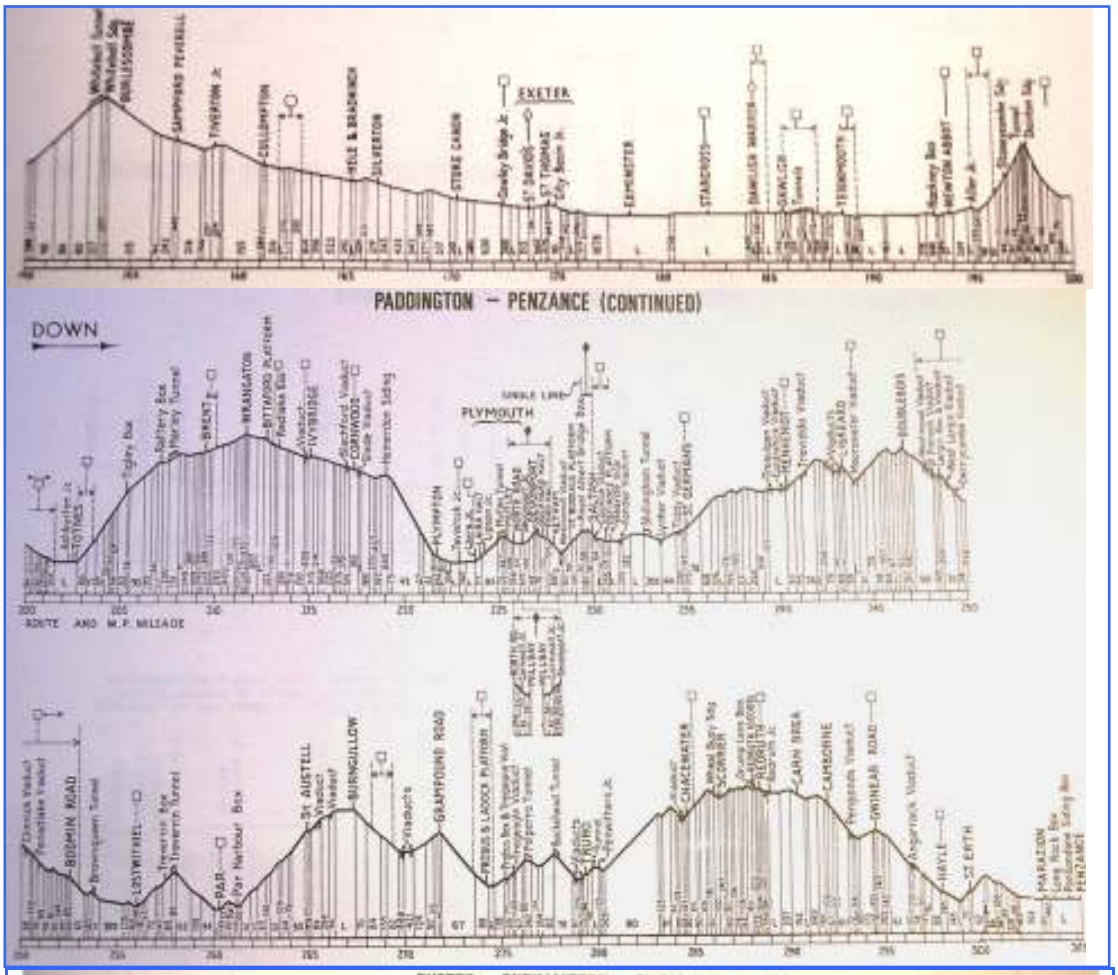
Profiles of the main lines via South Dartmoor and North Dartmoor are attached overleaf and illustrate the steepness of the gradients on these routes. This is another good reason for electrification or high power diesel trains.

The main lines in Somerset may yet be capable of higher top speeds, because the new GW Intercity Express trains (IEP) will permit an eventual top speed of 140 mph if electrified. In the case of lines in Devon and Cornwall, it may be the combination of electrification plus tilting which could make the greatest difference. This could require a new train design, or cascading of the present West Coast trains when their successors become available.

For commuter and inter-urban services, new electric trains now allow 110 mph, so that electrification of routes such as the Southern main line via Salisbury may now become worthwhile, since the previous upgrade in the early 1990s.

Studies into the combination of electrification, top line speeds, and tilting or other means to shorten journey times on curvaceous railways, should be part of the researched investment plan for South West England.

Gradient profiles of South West England main lines:

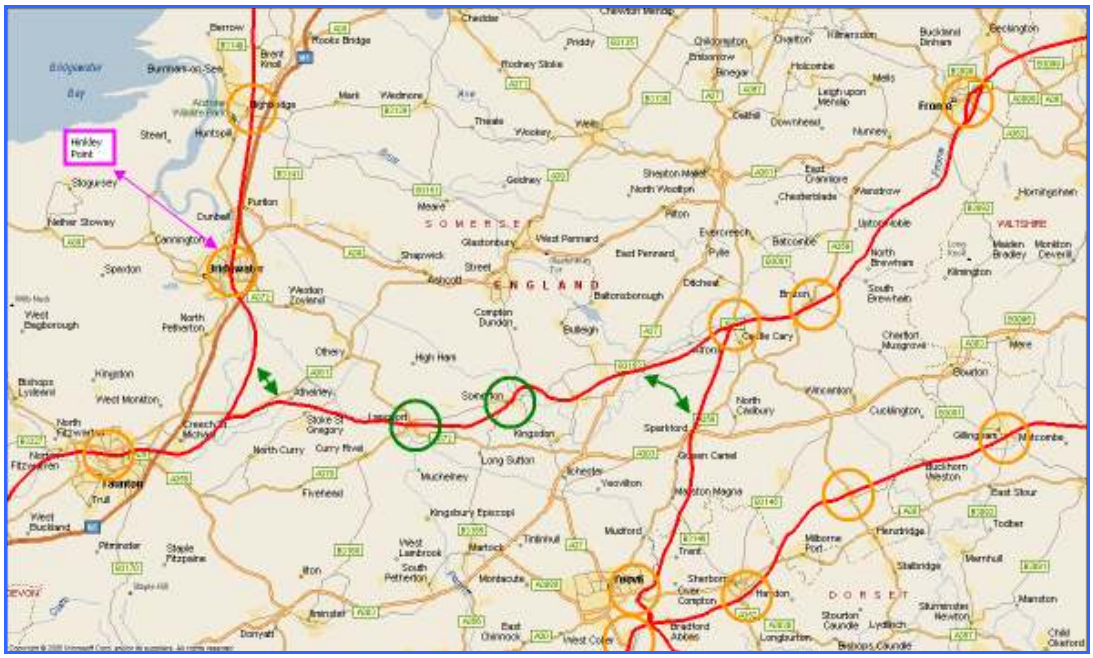


Specific area investment

Somerset

The railway has several shortcomings for the county. Three examples are set out:

- There is a poor frequency regional service to Taunton (the county town) and to some major county centres such as Frome which is bypassed by the West of England main line services. It is physically impractical to travel by train between Frome and Taunton despite there being a continuous line of Intercity railway!
- Intermediate major communities such as Somerton and Langport have no station, and are among those suffering the worst economic impacts of the present flooding across the Somerset Levels. Similar sized communities are served on the parallel South West Trains line between Salisbury, Yeovil and Exeter, with hourly trains. Introduction of a new inter-urban service on the West of England line could be a priority for the new Great Western franchise.
- Connectivity between Yeovil and Taunton/Bridgwater is also lacking, although investment in a chord west of Castle Cary might allow a direct rail service at least as far as Taunton, potentially serving Somerton and Langport. Access to the Hinckley Point new power station investment and its Section 106 opportunities would be feasible via Taunton or Bridgwater.



South Devon and Torbay

Quicker times via Exeter-Newton Abbot (on its own)

The option to accelerate services via an inland route between Exeter St Davids and Newton Abbot has been discussed above. On its own, it is likely to have only small journey time benefits, although it would advantage the maximum number of West of England passengers as it would help travel to and from South Devon and the Torbay area, as well as for Plymouth and Cornwall.

The ability to make significant time savings on the section of line between Exeter and Paignton via Newton Abbot is also limited because of the number of towns requiring trains to serve them (intermediately, these are Dawlish, Teignmouth, Newton Abbot and Torquay), while there also some local stations.

In such circumstances, one way to reduce overall journey times when using existing trains can be to provide a frequent service, thereby reducing waiting time for trains and speed the journey up that way. That could also be relevant for this section of railway with its closely spaced towns.

Quicker times via South Dartmoor between Exeter, Newton Abbot & Plymouth
(Great Western main line)

This was designed and built for the early Victorian version of fast-acceleration pollution-free power at the point of use – atmospheric traction! Trains could achieve 60-70 mph, with a vacuum in a pipe between the rails, and a paddle hung within the pipe below the carriages, to allow the train to be sucked along. This allowed steep gradients and curvaceous lines.

Unfortunately it didn't work reliably when installed between Exeter and Newton Abbot, because rats and sea water perished the leather flap which secured the vacuum. Conventional railway engines were used instead for the extension to Totnes and Plymouth, although the curves and gradients are still there.

Realignments of the railway route would be costly, and would ignore the fact that modern versions of atmospheric traction – electrification plus tilting trains – are available. **Consequently it is worth considering what combined journey time savings could be achieved from London, Birmingham and Bristol by electrifying the South West England main lines via Exeter, at least as far as Plymouth.**

It is also worth noting here, that though a (say) 1 minute total journey time reduction on an improved route between Exeter and Newton Abbot might not count for much in itself, useful headline time reductions might be achieved in combination with other time savings elsewhere as part of a wider package (ie, with significant round numbers of minutes saved).

It currently takes roundly 1 hour between Exeter and Plymouth, a little longer if serving more stations. This is a 52 mile journey. Between Newton Abbot and Plymouth via South Dartmoor it is roundly 40 minutes, depending on stops, for 32 miles. The potential benefits of electrification are self-evident, along with track alterations to permit higher speeds on curves, or tilting trains as used on the West Coast Main Line.

Plymouth, West Devon and Cornwall

Plymouth, West Devon and Cornwall can be reached **via South Dartmoor**.
The main alternative route between Exeter, Plymouth, West Devon and Cornwall was formerly the Southern Railway main line **via North Dartmoor**.

This was a longer route between Exeter and Plymouth, 58 miles. Its central section and most branches were closed in stages in the 1960s-70s. However the line is open at the eastern end for regional passenger trains between Exeter and Barnstaple, and on the

North Dartmoor section beyond Crediton for freight and special passenger trains to Okehampton (25 miles from Exeter St Davids) and Meldon (27 miles). Regular services from Okehampton as a railhead for West Devon and parts of North Cornwall have been advocated frequently, and formed part of several railway franchise bids in the 2000s.

There is also a commuter service at the southern end between Gunnislake/Bere Alston, and Plymouth. Devon County Council and the Kilbride Group are already proposing to reopen the line from Bere Alston to Tavistock (16 miles from Plymouth), for commuter services. The railway formation is intact on this section.

The missing 15 mile central section is mostly within the Dartmoor National Park, and is partly used as a cycleway. There are also isolated sections which would need restoration to railway purposes, particularly within Tavistock where premises have been erected. Meldon Viaduct might require reconstruction or strengthening, or a parallel viaduct built alongside. Reopening is therefore not simple, but is broadly straightforward in engineering requirements providing that a robust strategic case can be made.

This might need to focus on regional and national economic development grounds, if the main resilience topic was addressed already between Exeter and Newton Abbot, by one of the schemes noted above. If however no progress were made on an alternative route between Exeter and Newton Abbot, then the North Dartmoor route would have added value by serving Plymouth and Cornwall when diversions were required.

The former Southern Railway was curvaceous north of Tavistock, within the National Park area, and towards Plymouth, though fast between Okehampton and Exeter. If the railway were just reinstated 'as was', rather than with route modernisation to accelerate journey times, then end to end journey times are unlikely to be competitive with an electrified South Dartmoor route via Newton Abbot, **for travel to Plymouth**. Reversal at Exeter would also be required for trains from London Paddington, Birmingham and Bristol, as the line leaves northwards from Exeter.

Transforming the Southern Railway route

What would it take to transform the Southern Railway route into a modern main line, and what purposes could it serve? Ultimately these are economic questions to assess, stimulated by comparison of the benefits of investment in the South Dartmoor railway and the North Dartmoor railway, in different parts of South Devon and Plymouth, Mid and West Devon, and in Cornwall.

In a high level review, JRC has identified several possible interventions which could achieve fundamental changes in journey times using either route. It is proposed that these should be analysed in detail, to understand the short and longer term gains for South West England, achieved by investing in either or both routes, and in the different permutations of investment which are possible.

SD (via South Dartmoor): Primarily electrification along the existing main line, as far as Paignton and Plymouth, or to Penzance, and possibly tilting trains. It could take advantage of a possible faster inland line between Exeter and Newton Abbot.

ND (via North Dartmoor): Primarily line improvements as far as Okehampton, including a direct spur from the Paddington/Bristol/Taunton direction, then four basic route options:-
ND1 – Re-instate the former route via Tavistock, then to Bere Alston and Plymouth.
ND2 – A fast line between Brentor and Bere Alston, avoiding much of the Dartmoor National Park, to reach Plymouth quickly via Okehampton.
ND3 – A fast 'R30 corridor' railway SW of Okehampton, broadly paralleling the modern A30 trunk road via Launceston, to rejoin the Cornwall main line at Bodmin.
ND4 – A joint Plymouth fast and direct Cornwall line, mostly as ND2 and ND3, but also requiring a new fast section from east of Lifton to join route ND2, in order to avoid the Dartmoor National Park completely.[1]

Illustrative mapping of these options is set out on the following page.

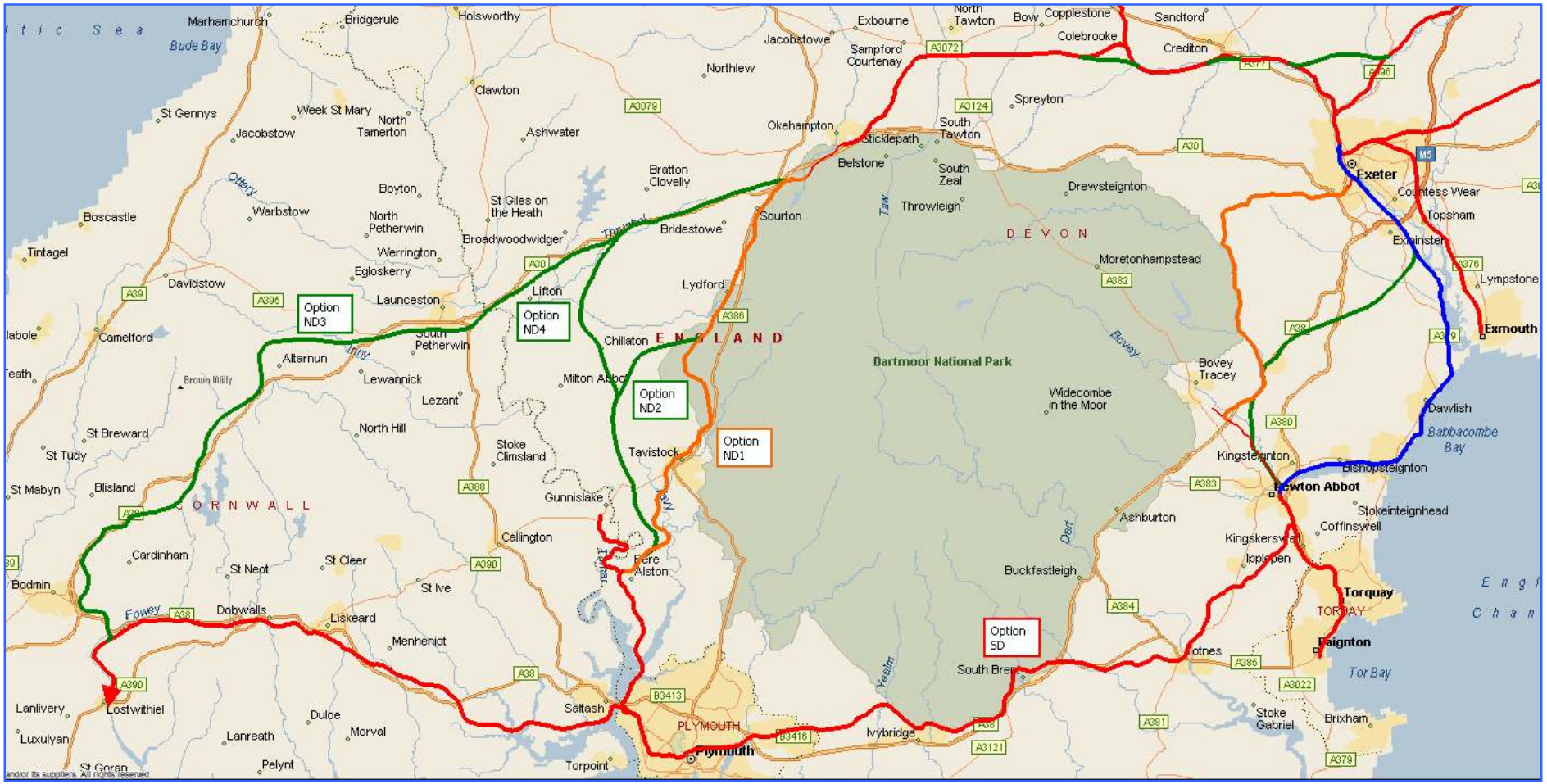
The targeted line speeds via both South and North Dartmoor would require consideration. Should any new sections of line or improvements to existing lines (where possible) be built for 110, 125 or 140 mph, or higher? All these speeds have validity as the new generation of electric commuter trains achieve 110 mph, the present InterCity trains diesel trains achieve 125 mph and the new replacement InterCity trains are designed for up to 140 mph.

A higher top speed such as 200 mph could be targeted as a TGV-equivalent, but it is less likely to secure a long-enough section of line to make that fully worthwhile, given the geography west of Okehampton with difficult topography and the need to stop at towns to serve the Cornwall catchment. Where considered possible, upper line speeds have been kept to a 110 mph limit although more may be practical in places. Lower line speeds are proposed on hilly, curved sections. So this specification may understate the possibilities, although a 40 minute time saving is feasible with it.

Electrification options would be included via North Dartmoor, on an equivalent basis to South Dartmoor. In ND2, ND3 and ND4, it is expected that the Bere Alston line would be re-extended to Tavistock, based on the Devon CC/Kilbride scheme, but not continued as a main line through the Dartmoor National Park (that would be the role of the new fast line). The line through Tavistock would be re-extended to Okehampton in ND1.

There is scope with the suggested infrastructure options, to define new economic development zones near railheads and on feeder corridors to those railheads. Examples could include Launceston, Bodmin and more generally in Cornwall and West Devon. Because transport is a means to an end, the opportunities to take advantage of easier access to the rest of the British economy should be part and parcel of final investment proposals. Headline journey times to Cornish centres could reduce significantly, with 40 minute time savings. For example it could be 3 hrs 50 mins from London to Truro, 4½ hrs to Penzance, under 3 hours from Bristol to Truro, and 45 minutes from Exeter to Launceston.

[1] A further option, to connect ND2 at Bere Alston with the Cornwall main line near Liskeard, was investigated briefly as an alternative to ND3, but on its own required about 10 viaducts and 3 tunnels because of the local topography, so was discarded from options. There is a fall-back possibility of a tunnelled connecting spur between ND1/ND2 and the Cornwall main line, in the Naval area near St Budeaux, This however would achieve only limited time savings to and from Cornwall, from east of Exeter, and is not considered a priority option to investigate.



Options for improved Plymouth, West Devon and Cornwall rail accessibility, with rail investment available to support economic growth.

Commentary on initial routeing outcomes

At this early stage, the comments which follow are largely made on the basis of outline journey times, taking account of routeings that appear feasible. This is not as simple as it looks, given the hilly country with deep river valleys, encountered in West Devon and East Cornwall, and across Bodmin Moor. A notional alignment, which has involved consideration of practical routeing issues, is offered for illustrative purposes to give a feel for the routes involved and what problems they might encounter.

(SD) Simplest option would be a more direct (and resilient) inland route between Exeter and Newton Abbot as described above, combined with electrification to Plymouth and either higher track cant or tilting Intercity trains. A continuation to Cornwall would be possible.

It would be 50½ route miles between Exeter and Plymouth this way. Reducing typical journey times by 7-10% between Exeter and Plymouth from a rounded 60 minutes, would be worth ca. 5-7 minutes. This includes the benefit of an inland route to Newton Abbot.

Continuing 28 miles to Bodmin (the comparator point in Cornwall for a route via Okehampton), on limited stop trains calling at Liskeard only, currently ca. 36 minutes, could achieve a 2½-3½ minute saving.

If no time savings were assumed from Tiverton Parkway to Exeter St Davids (16½ miles, and a 100 mph capability now to Cowley Bridge Junction outside Exeter), then the cumulative time between
Tiverton and Bodmin would reduce from ca. 110 minutes to ca. 100-102 minutes.
This includes stopping at Exeter, Newton Abbot, Totnes, Plymouth and Liskeard, but excludes station dwell times.

Similarly, **Tiverton to Plymouth would reduce from ca. 75 minutes to 67-69 minutes.**

(ND) A sequence of North Dartmoor indicative journey times from Tiverton Parkway is assessed below, to Bodmin and to Plymouth. As above, station stopping and starting times are included, and station dwell times are excluded. An annex is attached which sets out indicative specifications for line speeds on the different routes. Summary comparative times are:

		minutes
Tiverton Parkway to Plymouth:		
SD	via South Dartmoor (fully upgraded)	67-69 (75 now)
ND1	direct via North Dartmoor, then former Southern route	71
ND2	direct via North Dartmoor, then partial new line	68
ND4	direct via North Dartmoor, then new line to Bere Alston	64
Tiverton Parkway to Bodmin: (junction with Cornwall main line)		
SD	via South Dartmoor (fully upgraded)	100-102 (110 now)
ND3	'R30' direct via North Dartmoor and A30 corridor	71

This looks like a 'no-brainer'. Most of Cornwall, including North Cornwall, is better off by about 40 minutes with an new/improved North Dartmoor route. West Devon will also be reached proportionately faster. Plymouth has comparable time improvements by both routes, and can be up to 11 minutes faster than now if there were a direct route from North Dartmoor.

However, there will be genuine questions of affordability. If ND3 were advocated, there are 27 miles of improved line and new connections, to reach Okehampton/Meldon, and then nearly 40 miles of new main line to Bodmin and connections into the Cornwall main line. A lower cost ND1, recreating the North Dartmoor route, would still seek improvements to the Okehampton line and reopening between Meldon and Bere Alston via Tavistock.

A very narrow view would just be to value the estimated railway journey time savings. A 40 minute railway journey time saving is worth over £6 per passenger in Department for Transport WebTAG valuations, when combining proportions of travel on business, commuting and leisure journeys. Taking only a third of all existing travel from Bodmin Parkway and stations west, as amounting to travel to/from Exeter and beyond, is equivalent to 1.8 million passengers in ORR's 2011/12 data, with a strong growth from 1.5 million in 2010/11. No assumption is made about new travel generated in South/West/North Devon.

If all these passengers could benefit from a 40 minute time saving, this is worth £9 million a year just in journey time benefits. Example projections of a 1½% growth in travel per annum and then discounting the values over 60 years, point to benefits of over £400m over 60 years. In themselves, these would not justify a new North Cornwall main line, but this excludes the much larger catchment impacts and Gross value Added benefits. As noted above, the underlying opportunity is to use the suggested infrastructure options, to achieve structural change, for example by defining new economic development zones near railheads and on feeder corridors to those railheads.

Even on a much reduced estimate of travel time benefits (say 10 minutes per journey), this equates to £100+m value of time savings discounted over 60 years. Such benefits point to a probable case for electrifying the existing railway, as a minimum. It will be important to develop a more comprehensive benefit-cost and economic impact spreadsheet for South West England.

It is worth restating that the time estimates for the North Dartmoor route are conservative. The main gains are achieved because of two primary reasons:

- the new line saves ca. 18 miles on the overall journey from London and other major cities
- the new line is designed to allow travel at a higher average speed.

It is recommended that:

- **a detailed engineering and benefit-cost analysis is undertaken of the various railway improvement options set out in this high-level paper**
- **the recommendations are taken forward at stakeholder, county, LEP and national level, in order to inform future investment decisions which will benefit the South West's economic development priorities.**

Annex A: Suggested line specifications via North Dartmoor

(most to nearest quarter mile):

(ND1) Tiverton Pky-Okehampton-former railway-Tavistock-Plymouth:

- 100 mph (as on Great Western), 12 miles from **Tiverton Parkway** to the GW junction at Rewe. [If the GW route were accelerated, so could this option.]
- 110 mph, 18¼ miles from Rewe Junction to North Tawton, with local realignment of the North Dartmoor route at Crediton and Coleford Junction.
- 60 mph (as on South Dartmoor) + stop or start time, 6½ miles to **Okehampton**.
- 65 mph + stop or start time, 2¾ miles via **Okehampton** to Meldon old Junction.
- 75 mph average speed, 7½ miles to Meldon old Junction to Brentor ND2 junction.
- 50 mph + stop or start time, 6¼ miles Brentor ND2 junction to **Tavistock**.
- 50 mph + stop or start time, 6½ miles **Tavistock** to Bere Alston.
- 50 mph average speed, 7¼ miles Bere Alston to St Budeaux Junction.
- Current speeds incl stop or start time, 4 miles St Budeaux Junction to **Plymouth**.

(ND2) Tiverton Pky-Okehampton-partial bypass Dartmoor National Park-Plymouth:

- 100 mph (as on Great Western), 12 miles from **Tiverton Parkway** to the GW junction at Rewe. [If the GW route were accelerated, so could this option.]
- 110 mph, 18¼ miles from Rewe Junction to North Tawton, with local realignment of the North Dartmoor route at Crediton and Coleford Junction.
- 60 mph (as on South Dartmoor) + stop or start time, 6½ miles to **Okehampton**.
- 65 mph + stop or start time, 2¾ miles via **Okehampton** to Meldon old Junction.
- 75 mph average speed, 7½ miles to Meldon old Junction to Brentor ND2 junction.
- 75 mph average speed on New ND2 route + stop or start time, 8½ miles Brentor ND2 Junction via ND2/ND4 intersection to **East Cornwall A390 Parkway station**.
- 50 mph + stop or start time, $4^{1}/_{3}$ miles from **East Cornwall A390 Parkway station** to Bere Alston.
- 50 mph average speed, 7¼ miles Bere Alston to St Budeaux Junction.
- Current speeds incl stop or start time, 4 miles St Budeaux Junction to **Plymouth**.

(ND3) Tiverton Pky-Okehampton-A30 corridor-Bodmin Town-Cornwall main line:

- 100 mph (as on Great Western), 12 miles from **Tiverton Parkway** to the GW junction at Rewe. [If the GW route were accelerated, so could this option.]
- 110 mph, 18¼ miles from Rewe Junction to North Tawton, with local realignment of the North Dartmoor route at Crediton and Coleford Junction.
- 60 mph (as on South Dartmoor) + stop or start time, 6½ miles to **Okehampton**.
- 65 mph + stop or start time, 2¾ miles via **Okehampton** to Meldon old Junction.
- 110 mph + stop or start time, 15¼ miles from Meldon old Junction to **Launceston New** station.
- 90 mph + stop or start time, 7 miles from Launceston New to Altarnun.
- 60 mph + stop or start time, 15¾ miles from Altarnun via Bodmin Moor route to a new **Bodmin Town** station.
- 30 mph for 2 miles, from **Bodmin Town** via restored Bodmin railway, to new junction with Cornwall main line just south of Bodmin Parkway.

Calls are assumed by all trains, at Okehampton, Launceston New and Bodmin Town.
Speeds adopted on the new route are lower than the potential top design speed.

(ND4) Tiverton Pky-Okehampton-A30 corridor-Bodmin Town etc (set out above in ND3), plus A30 corridor-East Cornwall A390 Parkway-Plymouth (full National Park bypass):

- 100 mph (as on Great Western), 12 miles from **Tiverton Parkway** to the GW junction at Rewe. [If the GW route were accelerated, so could this option.]
- 110 mph, 18¼ miles from Rewe Junction to North Tawton, with local realignment of the North Dartmoor route at Crediton and Coleford Junction.
- 60 mph (as on South Dartmoor) + stop or start time, 6½ miles to **Okehampton**.
- 65 mph + stop or start time, 2¾ miles via **Okehampton** to Meldon old Junction.
- 110 mph, 7¼ miles from Meldon old Junction to Thrushel River Junction.
- 75 mph+ stop or start time, $11^{1}/_{3}$ miles from Thrushel River Junction via ND2/ND4 intersection to **East Cornwall A390 Parkway station**.
- 50 mph + stop or start time, $4^{1}/_{3}$ miles from **East Cornwall A390 Parkway station** to Bere Alston.
- 50 mph average speed, 7¼ miles Bere Alston to St Budeaux Junction.
- Current speeds incl stop or start time, 4 miles St Budeaux Junction to **Plymouth**.