# *Great Western electrification project Frequently asked questions*

## *What are the benefits of electrification?*

Cleaner, quieter and more reliable trains will provide extra seats to run on the line upon completion. Electrification is a key tenet of the government's rail strategy as it promotes cleaner, more reliable travel and will help reduce the cost of running and maintaining the railway.

### Better for the environment

Electric trains are more reliable than diesel trains. On average, electric trains emit 21% less carbon per passenger mile.

### More seats and better journeys

The new fleet of trains will have more seats compared to the diesel trains they will replace and journey time savings can be made due to the superior performance of electric traction.

The passenger benefits also include quieter journeys due to reduced vibration as a result of the absence of diesel engines. Furthermore, electric trains provide a better service because they have a higher power-to-weight ratio, which means that they are generally faster than diesel trains and can accelerate more quickly, reducing journey times particularly on commuter services.

### Reduced costs

Electrification will reduce the ongoing cost of running and maintaining the railway. Electric trains are generally cheaper to buy and maintenance costs are typically 33% lower. Fuel costs are typically 45% lower because the trains are lighter and more efficient and electricity from the national grid is cheaper than diesel fuel.

In addition, electric trains are lighter and cause on average 13% less wear to the tracks, reducing our infrastructure maintenance costs.

### Intercity express programme (IEP)

Electrification of the Great Western is directly linked to the rolling stock renewal strategy and fully integrates with other major works taking place on the network. It presents a huge opportunity and is vital for long-term, low carbon economic growth.

The first units to be built as part of the IEP will be introduced into services on the Great Western Main Line from 2017.

The new trains will bring faster services and additional capacity to major UK cities, along the Great Western Main Line between London, Reading, Bristol, Cardiff and Swansea.

As well as building a new assembly facility in the UK, Hitachi is constructing maintenance depots in Bristol, Swansea and West London and upgrading existing depots throughout Great Britain to maintain the fleet.

## *What's wrong with the trains that we have?*

The existing HST 125 diesel powered trains have been in service since 1976. They are considered to be more expensive, environmentally inferior and less comfortable than the electric alternatives for the following reasons:

- Maintenance costs are typically 33% higher due to age and older technology
- Fuel costs are 45% higher because units are less efficient, heavier, and use diesel
- They are heavier and cause more track wear, increasing maintenance costs
- They emit pollution due to combustion of diesel
- Carbon emissions are 21% higher per passenger
- They are noisier and vibrate more

## *Why has overhead line electrification been chosen as the upgrade solution?*

Once the need to electrify the route was established, overhead line equipment (OLE) was chosen by the Department for Transport.

OLE was chosen ahead of other electrification systems such as DC third rail because:

- EU directives (and subsequent UK regulations) on trans-European interoperability make it a legal requirement for the project to be compatible with the European rail network
- Capital renewal costs (including track) are lower
- Innovative, modern design (the last major DC third rail scheme was implemented in 1967)
- OLE is much more efficient with vastly reduced energy loss in distributed energy
- Maximum line speed for DC third rail is 100mph, OLE theoretical max line speed is 250mph
- Potential for reduced journey times as more power available to units
- Less distribution infrastructure is required
- Distribution infrastructure is future-proof (can more readily accommodate future energy needs)
- Much better performance in winter (based on actual existing OLE vs existing DC third rail figures)
- Vastly superior safety performance.  DC third rail fatality rate is x10 higher than equivalent OLE

## How will the remaining non-electrified route be serviced?

The most efficient, cost effective and environmentally sound rolling stock solution is electric only trains, however, it is acknowledged that significant parts of the network, for example services to the South West are not currently earmarked for an electrification upgrade and as such will have to be serviced by diesel powered units.

Due to the significant track distances of the non-electrified sections of the network into the South West, the use of bi-modal trains has been sanctioned by the DfT. The minimum numbers of the more expensive, less efficient and less environmentally sound units have been procured to service the non-electrified route extremities.

## What are you doing to mitigate the appearance of electrification?

We recognise that the route is rich in heritage which of course makes any improvement programme complex.

As such, we are working closely with English Heritage to make sure sensitive structures are safeguarded.

Furthermore, we have appointed heritage specialists 'Alan Baxter Associates' to advise on sensitive area design solutions for electrification.

## Why does Network Rail need to remove vegetation along the route?

We need to clear all woody vegetation within 6.6 metres of the outside running rail on both sides of the track to avoid touch or fall potential from vegetation onto the overhead electrified lines.

Once cleared, this area will be maintained to avoid vegetation encroachment.

## Why can't Network Rail find an alternative means of electrifying the railway such as the "third rail"?

There are a number of fundamental constraints with the "third rail" system:

- It is not possible to run trains faster than 110mph
- It requires 20% more electricity to power trains compared with overhead line equipment
- It requires substations at closer intervals (every 8km) than overhead lines (every 40-60km)
- It is much more susceptible to service disruption caused by rain, snow, ice and leaf fall
- It puts trespassers and track workers at greater danger
- Its long-term maintenance and renewal costs are greater than OLE

## *Does Network Rail need planning consent to do this?*

The scheme will be delivered under our permitted development rights. However, the principles of good consultation, as set out in the Planning Act 2008, will be applied in order to assist in the project being managed responsibly.

## *What clearance is required between overhead power lines and the bottom of a bridge?*

The normal clearance required if a bridge is newly constructed (for 125mph line speed) would be at least 660mm, and ideally one metre.

However, in certain situations and to accommodate existing bridge constraints, this can be reduced. There are a number of engineering solutions to lower this to avoid the unnecessary cost of major work on a bridge.

This is considered on an individual basis, although whenever possible the maximum clearance is desirable.

## *What is a typical height of overhead power lines?*

The standard height for the contact wire is 4.7 metres. At locations where there are level crossings this increases to 5.6 metres to allow for clearance of vehicles crossing the infrastructure.

## *Where bridges are too low and significant remodelling is required, how do we approach this?*

Where bridges are too low and significant remodelling is required there are a number of options:

- Track lowering – the ballast level is reduced to lower the track and gain sufficient clearance

- Bridge jacking – some structures, generally more modern flat bed type construction, can be lifted relatively easily to gain sufficient clearance

- Bridge reconstruction – the least preferred and, generally, most expensive solution. However, in situations where there is no other alternative this option is available

All of the above options would be considered in each case and consideration is given to all the unique requirements of each structure, eg is it listed, is it a road bridge, does it have utilities running through or across it, etc.

Each solution is aimed to be the most cost effective with minimum possible impact and each solution would comply with all Building and Highway regulations.

## What is the required height of the sides of a bridge over overhead power lines (to stop people hitting the lines with poles etc?)

Where any structure on the route has electrical contact wire and / or any other live parts passing through it, this is evaluated on an individual basis, and the structure's parapets and other parts would be modified accordingly.

This would consider the possible risk of unintentional, accidental, or deliberate contact. This would assess the risks and take any practicable steps to prevent them.

Generally the parapet (side wall of the bridge) would be solid and 1.85 metres high as a minimum. Where necessary, caging or guarding would be fitted for additional safety in the vicinity of the bridge.

## Will electrification interfere with my TV reception?

All of the electrification work is immunised and should not affect television reception.

It is worth noting that we need to immunise our electrification equipment to make sure it does not interfere with the integrity of our safety critical signalling and telecommunications equipment.

In the event that you experience reception issues, we would recommend you contact the BBC's Radio & Television Investigation Service who may be able to help (www.radioandtvhelp.co.uk/).

## Are there any health risks associated with electrification?

We design, install, operate and maintain our infrastructure such that it complies with the Railway Group Standards produced by the Rail Safety and Standards Board (RSSB) and the appropriate European Standards, amongst others, covering Electromagnetic Capability.

This is also based in part upon research published by the RSSB specifically relating to electromagnetic fields, to ascertain whether they are within internationally accepted guidelines relating to public health.

In general terms, we conform to these standards based upon our technical knowledge of the railway infrastructure.

In respect of the possibility of health issues, we are not in a position to comment on this and any concerns people may have should be referred to the Health Protection Agency (www.hpa.org.uk).

## Is there an increase of fires associated with electrification due to electrical sparks in dry periods?

In order to reduce this risk, we cut back 6.6 metres of all woody vegetation from the outside running rail.

## Will electrification increase line speeds in South Wales?

Electrification will not increase line speeds per se. It will, however, not prevent any provision for future line speed increases, which are dependant upon other asset renewals.

The key point is that electrification will allow the provision for future line speeds but will offer journey time reductions: journeys between London and South Wales will be reduced by approximately 15-20 minutes – this will be achieved through faster rolling stock acceleration.

It is also worth noting that an increase in line speed does not always offer a journey time reduction. To explain, a train travelling at 100mph will need to break earlier than a train travelling at 90mph in order to stop at the given destination; as such, there may be little journey saving time between the two destinations.

Cardiff to be electrified by May 2017, Swansea to be electrified by May 2018.

## *Why are overhead electrical lines installed at Paddington station in the absence of electrical powered trains?*

Overhead electrification was installed on platforms 3 to 12 and the footbridge between platforms 6 and 10 was rebuilt in preparation for the introduction of the Heathrow Express service.

The electrification will be extended from Airport Junction to Maidenhead under the Crossrail scheme.

# *Bath*

## *Why can't the Bath loop remain a non-electrified section?*

Leaving gaps in the OLE network will restrict the movement of future electric powered rolling stock, including intercity, regional and freight trains. It will mean that the network is not adequately future proofed to meet the needs of tomorrow's railway.

If the Bath loop did remain a non-electrified section it would require one of two things:

1. Bi-modal traction units (see below).

2. Termination of intercity service London Paddington to Bristol Temple Meads via Bath.

   Bristol Temple Meads would be serviced via Bristol Parkway. Bristol Temple Meads (via Bath) to mainline (probably Swindon) would be serviced by regional services ie Bath and Chippenham would loose their direct London service and Bristol Temple Meads would see journey time to London increase.

   Additional local service rolling stock may need to be housed locally resulting in a new train shed somewhere in the Bath & North East Somerset / Wiltshire area.

## *Why are trains unable to free-wheel through Sydney Gardens and other sensitive parts of the line?*

Freewheeling should not be confused with neutral sections.

A neutral section is where the wires are in place but have no power. Even if power is not required it is important that, at moderate and high speeds, the train's pantograph remains in contact with the wire. Attaching and detaching the pantograph at speed can cause physical damage to the

overhead line equipment and pantograph as well as electrical damage to the train caused by surges etc.

Neutral sections are usually over very short sections (less than 5 metres) and as such there is no risk of a train becoming stranded.

Freewheeling (with no wires) through Sydney Gardens would not be possible as the contour and directional changes of the track severely restricts the line speed in the area and as such the risk of a train becoming stranded is far greater.

If a train was to perform an emergency stop for any reason it would become stranded.

If the freewheel were successful any re-connect would have to be carried out from standing, increasing journey times.

It should also be noted that whilst freewheeling some breaking systems may not regenerate properly and the air conditioning on the train would not function.

## *Can bi-modal units be used to service Bath?*

In theory yes, however the bi-modal units are more expensive, less efficient and less environmentally sound than the electric only units.

The bi-modal units have been earmarked for use in areas where there is no other suitable option.

It has been justified economically for use on the non-electrified part of the network (South West) because of the lack of an alternative option and the relatively high track mileage the units will need to cover in that area.

Bi-modal units cannot be justified over a very short track section such as Bath and its environs where other options are available.

The rolling stock including bi-modal units have been procured based on the network requirements discussed above.

Taking the above into account, if bi-modal units did become available for use on the Paddington to Bristol Temple Meads (via Bath) route, OLE will still be required to service potential future electric regional and freight services.

## *Will the scheme affect Bath's World Heritage status?*

The two biggest potential impacts of the scheme are the potential heritage impact and the potential visual impact.

If proper consideration is given to these areas then both potential impacts will be mitigated and ensure the World Heritage status is not affected.

## *Why is vegetation clearance taking place in bird nesting season?*

We had planned to undertake the vegetation clearance work for route section 3 in January 2013 but we have had to delay work as a direct result of identifying the potential for hazel dormice in this region.

## *What mitigation measures are in place for vegetation work in the nesting season?*

We have applied to Natural England for an EPS licence for hazel dormice for route section 3 above.

If we are awarded the EPS licence we propose a two stage approach to vegetation clearance. We would clear all vegetation above 20cm from ground level by the end of March, as the dormice will still be hibernating in burrows in the ground. We would then leave the site until June, when we could potentially clear the remaining low level vegetation below 20cm, as the dormice will have returned to nesting and foraging in the tree canopies.

The contractor (suitably qualified) will conduct a breeding bird survey prior to vegetation clearance each day in daylight.

An independent ecologist will verify the breeding bird survey work for the vegetation clearance each day.

## *What is the nature of the vegetation work?*

The works will require the removal of all woody and overhanging vegetation within 6.6 metres of the nearest running rail on either side of the railway.

This is required to facilitate construction and safe operation of the OLE system by removing the potential for vegetation to short out the live parts of the system through arcing or falling debris.

Work will be delivered via rail track possessions and night work.