

Sussex Route

Summary Route Plan

Foreword

Welcome to the Sussex Route Plan.

This document is a key building block towards Network Rail's Control Period 5 (CP5) Strategic Business Plan. It sets out the relevant outputs, activity and expenditure at route level to achieve the specified outputs. It also forecasts long-term activity and expenditure at route level to demonstrate that the route is delivering CP5 outputs based on a sustainable whole-system, whole-life, basis and should be read in conjunction with the other plans that have been produced.

Sussex as a devolved route

Network Rail has devolved significant accountability to the Routes. Within Sussex Route we have the opportunity for all teams to operate as a cohesive whole for the betterment of the whole system. We have the freedom to make local risk based, whole-business decisions rather than following a one-size-fits-all approach. We believe this puts us closer to our Rail Partners and passengers and should improve service and safety. This document sets out how we intend to do this. It details our plans on safety, sustainability, operations, asset management, and investment. It also sets out how we will work with our partners to unlock the expertise that exists in our organisation so we can improve service and performance.

A central part of the Network

The Sussex Route is a 'spine and rib' Route with the Brighton Main Line (London Victoria to Brighton) as the spine with a series of ribs (the branch lines) connecting to it. The Route is easily the busiest and most densely congested of the whole network with an average of 10 trains per route-mile at any time of day.

From the Route's 700 miles of track we have an influence on 16.6 per cent of the national Public Performance Measure (PPM). During the peak service there is frequently less than two minutes between trains. The Route serves a strong commuter market, mainly into Central London. We also have a strong leisure market which includes; airport flows to Gatwick and Luton Airports, day trips to London and the South Coast, and evening journeys to and from the Capital.

We recognise that we have a leading role to play in working with our customers, funders and wider stakeholders to support expected continued growth through Control Period 5 and beyond.

Building the future

This Route plan sets out the investments we are making for the future – particularly our focus on managing performance against a backdrop of increasing demand and customer expectation. The route planning goes beyond making physical investments in new infrastructure, it includes the culture we are developing to trust and empower our people, the innovations being introduced to drive our performance and the alliances created with our customers.

We believe this plan provides an informative and exciting overview of the Sussex Route's plans to achieve our full potential to improve safety, reliability, capacity and value for our customers and for taxpayers.

Mark Ruddy, Route Managing Director

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Executive summary

The key themes in the Sussex CP5 Route Plan are as follows:

- Everyone home safe every day
- Investing in our people
- Reliable timetable – balancing availability with access to undertake engineering work
- Increase in Route capacity
- Railway fit for the future
- Investment in technology to improve efficiency
- Reducing the cost of operating, maintaining and renewing the railway.

Everyone home safe every day

Sussex Route has a strategy that is being rolled out so that everyone goes home safely every day. For our employees in particular this involves the introduction of new life saving rules and an aim to further increase the use of green zone working (the physical separation of staff from trains).

Level crossings are one of the railway's biggest risks; and Sussex Route has 232 level crossings. During Control Period 5 (CP5) the Route will be commissioning the introduction of the new Manually Controlled Barrier Obstacle Detection (MCB-OD) equipment to 30 of the highest risk crossings. This equipment will detect movement within the barriers to level crossings and reduce the risk of injury and fatality to members of the public on the crossings when the barriers close.

Investing in our people

To facilitate Sussex CP5 strategy the Route is investing & developing our employees in a variety of new technologies e.g. ORBIS, Plain Line Pattern Recognition and introducing Traffic Management within our signalling assets. These new skills and technologies aim to maximise productivity, safety and efficiencies and performance throughout the Route. This approach will build upon the established safe system of work and recent introduction of 'Life Saving Rules' when developing and training our staff to adopt new technologies and safe ways of working.

The Sussex People plan confirms the need to develop not only current and future skills and behaviours but also resourcing pipelines to attract, motivate, grow and retain employees. Plans are also in place to create a transparent and diverse culture to facilitate improved performance. This will include openness to new ideas, sharing best practice, working closely with our industry partners and building on the relationships with key stakeholders such as trades unions and train operators to jointly improve industry performance.

Reliable timetable – Asset resilience

The reliability of Sussex Route assets met target in 2011/12 following a continuing improvement in mean time between failures. The only adverse trend was in track, for which there are improvement plans. The strategy for signal assets has been to focus on cable renewals, relay renewals, conversions from analogue equipment to digital, gauge at points and remote condition monitoring. The Route will continue with this strategy, particularly developing the plan for remote condition monitoring so that more assets can be monitored and the risk based infrastructure maintenance can continue to be developed and rolled out.

Notwithstanding the constant balance between operating more trains and improving asset reliability, the Route recognise the challenge to further improve train performance beyond the present Control Period 4 (CP4) exit target Joint Performance Improvement Plan.

The Thameslink Key Output 2 improvements will bring very welcome capacity increases to the Sussex Route in 2018, but it will bring very significant challenges to the Route during its construction. For the 3 year period from December 2014 to 2017, when London Bridge is being remodelled and reconstructed, the cross-London services will need to operate exclusively via Elephant and Castle and Tulse Hill to East Croydon with no available diversionary route through London Bridge. This is likely to put considerable strain on that infrastructure as there are no opportunities during that period to undertake renewals and heavy maintenance on this route. The Route has put forward a portfolio of schemes designed to increase the resilience of the route which has now received funding to the value of £8 million and is being developed by the Route team.

Reliable timetable – Network Availability

Because of the very heavy access and resource requirement of the Thameslink project at London Bridge the Sussex renewals and refurbishment plan has had to be constructed around the project. This has given rise to severe constraints and imported performance risk to the Sussex Route plan, particularly on the primary diversionary route via Herne Hill and the alternative diversionary route from Tulse Hill to East Croydon via Streatham Common.

Access for renewals and maintenance is already very constrained on Sussex, particularly on the Brighton Main Line slow lines, where 'working times' of just over 2 hours a night are available. This raises particular challenges for maintenance productivity. There are also challenges at weekends, when train operators and passengers understandably want the published timetable to operate when the Route needs to gain access for renewals and refurbishments. The Route and the train operators need to find different access regimes that improve the balance of the cost of infrastructure work against the needs of passengers and revenue generation. The Route is discussing ways of achieving this with train operators.

Increase in Route Capacity

Sussex Route is one of the main commuter routes in the south of England, carrying approximately 51,000 people in each morning peak into the Central London employment zone from key commuter towns such as Brighton, Horsham, East Grinstead and stations in-between. Passenger growth has been 40 per cent in the last 10 years and is forecast to grow by a further 30 per cent in the next 10 years.

Gatwick Airport is a major passenger hub for Sussex rail travel. The Gatwick Airport Master Plan published in July 2012 predicts an increase in the annual passenger numbers to 40 million by 2020/21 from 33.8 million in 2011/12. Looking beyond 2020 it forecasts that by 2030 Gatwick Airport could be handling around 45 million passengers on one runway and perhaps more if a second runway is added.

Passenger demand in Sussex has led to some major capacity improvements in Control Period 4, as set out in the CP4 High Level Output Specification (HLOS) commitments. It is predicted that Sussex Route will have delivered all of those commitments by the end of the Control Period. The CP4 capacity enhancements are expected to meet the demand requirements through CP5, particularly when the Thameslink Key Output 2 (TL KO2) programme of works is completed in 2018 and a full 12-car Thameslink peak service will operate under the new Thameslink franchise.

The High Level Output Statements, published in July 2012 gave approval for some key enhancements on the Sussex Route:

- Redhill platform 0
- 8 carriage trains on the West London lines
- 10 carriage trains on the Uckfield line.

The main infrastructure constraint to further growth in Sussex is a combination of the series of flat junctions along the Brighton Main Line (BML), the existence of a single up and a single down fast line all the way between East Croydon and Battersea Park and the number and current utilisation of fast line platforms at London Victoria. Increases in peak train numbers cannot be accommodated on the Sussex network between London Victoria and the coast without addressing all of these constraints coherently. The Route will put forward plans to improve capacity at these key locations in Control Period 6 (CP6).

Railway fit for the future

The increasing number of trains operating on the Sussex Route network has had an adverse affect on the rate of asset degradation. This is coupled with a renewal run rate that has resulted in an increasing asset age. It is for these reasons that the Sussex Route has a need for continuing investment in resilience work on signalling cables, relays, cable connections (Electrification & Plant (E&P) and signalling), point operating mechanisms and significant refurbishment work on switches and crossings, particularly on the Brighton Main Line (BML).

Electrification

The Direct Current (DC) power supply was upgraded in 2005 for the introduction of the modern rolling stock and again in 2011 for the introduction of 12-car services to and from East Grinstead. The Sussex DC traction power supply still operates below an N-1 capability in many places and the strategy in CP5 will be to bring the power supply network to an N-1 position that will give room for service growth and maintenance switch-outs without disrupting the timetabled services. It will be important that the whole system is upgraded where necessary to include the high voltage supply and equipment, the DC supply and associated equipment and the negative return bonding. The CP5 investment will be focused on DC switchgear renewal and electric traction equipment (ETE).

Track

The used life of track components in the Sussex Route is amongst the highest in the country. This is due to a combination of its age and the large growth in traffic over the last 5 years. This is resulting in track quality levels that are becoming increasingly difficult to sustain and an upturn in rolling contact fatigue and rail defects. The renewal and refurbishment plan for CP5 will substantially improve this position and will result in higher levels of track quality, particularly at switches and crossings and lower levels of rail defects.

Signalling

The signalling plan is constructed around the need for recontrol to the new Rail Operating Centre (ROC). 90 per cent of the signalling equipment in the Sussex Route is over 25 years old and there are locations where wire degradation is worsening. The signalling renewal plan will improve the overall position regarding asset condition, will facilitate lower signalling maintenance and operating costs and will increase the resilience of the equipment.

Civils

The work bank for structures assets in the Sussex Route, both over-bridges and under-bridges is a legacy of decades of under investment stretching back to the days of British Rail. The Sussex Route has a number of significant bridges that require costly strengthening works or reconstruction. The focus of the Route Plan is on a few large structures and this means that the bridge stock will end the control period in a slightly worse condition overall.

An Integrated Drainage Plan (IDP) developed from site inspections has been developed and forms the basis of the CP5 Route plan for drainage. Major drainage works are scheduled at Haywards Heath tunnel, Crowborough tunnel and Bletchingley tunnel.

The investment plan for earthworks is a bottom up programme of work containing a number of large embankment/cutting strengthening schemes.

Buildings

The station assets in the Sussex Route were mostly constructed in Victorian and Edwardian periods with further building taking place during the inter-war and post war years. Many of these assets are now considered heritage buildings which require more care and attention than other station structures constructed later in the 20th century where maintenance requirements were simplified.

Telecommunications

The Sussex Route has been in discussion with Southern regarding the Driver Only Operation (DOO) equipment in the Route with a view to moving towards train based DOO systems rather than infrastructure based equipment. A decision on this matter will be made when the time comes to renew the existing DOO equipment. One of the key features of the CP5 Telecoms investment will be the replacement of the Public Emergency Telephone System (PETS) system with the modern equivalent, now called KETS. The new Key Emergency Telephone System (KETS) system will reduce maintenance and faulting costs. Whilst recognising the significant benefits the new Global System for Mobile Communications–Railway (GSM-R) system brings to the railway, there is an increase in operational costs associated with the increased number of lineside assets and the ongoing requirement to maintain and renew the remaining copper communication cables.

Investment in technology to improve efficiency

The Sussex Route supports the implementation of technology to support the increased efficiency in asset management and implementation. The Route will be supporting key asset management enablers such as ORBIS and Plain Line Pattern Recognition as well as looking at technological opportunities tailored to the Route characteristics.

Reducing the cost of renewing, maintaining and operating the railway

The Sussex Route Plan achieves at the end of CP5 a 15.0 per cent exit efficiency for renewals, 14.1 per cent exit efficiency for operational expenditure. The Civils OPEX expenditure for structures and earthworks examinations has been assessed by the Route in accordance with the guidance provided. The total expenditure for CP5 is £13 million; the Route has assumed a 15 per cent efficiency based on the guidance provided. The Route will deliver efficiency opportunities in the renewals plans in the following areas:

- Reducing the development time for schemes;
- Producing options for whole system, whole-life cost infrastructure;
- Plan integration, giving opportunities for efficient contract packages and better use of access;
- More efficient use of resources on week days for track renewals;
- Reviewing contract types for delivery; particularly for Civils and Buildings work;
- The use of plug and play signalling equipment in re-signalling schemes to reduce commissioning times and maintenance costs;
- Increasing the migration to risk based maintenance and the further fitment of remote condition monitoring will continue the reduction in maintenance costs.

Summary of CP5 Renewal efficiencies

Efficiencies	FY15	FY16	FY17	FY18	FY19
Track	0%	3%	6%	9%	13%
Signalling	4%	8%	12%	16%	21%
Civils	2%	5%	8%	12%	15%
Buildings	10%	14%	16%	17%	17%
Electrification	9%	15%	19%	22%	22%
Telecoms	3%	6%	9%	12%	15%
Plant	8%	15%	17%	20%	20%

Summary of CP5 Efficient Expenditure

Operations

£m (12/13 prices)	2014/15	2015/16	2016/17	2017/18	2018/19	CP5 Total
Signaller	24.2	23.7	23.3	22.1	21.1	114.5
Non-Signaller	4.1	3.9	3.2	3.5	4.0	18.6

Maintenance

£m (12/13 prices)	2014/15	2015/16	2016/17	2017/18	2018/19	CP5 Total
Maintenance Function Controllable Costs	37.4	36.4	33.8	32.6	31.4	171.5
RAM Function Controllable Costs	1.1	1.0	1.0	1.0	1.0	5.1
CEFA element of RAM Function Controllable Costs	2.8	2.8	2.6	2.6	2.3	13.0

Summary of CP5 Route Headcount

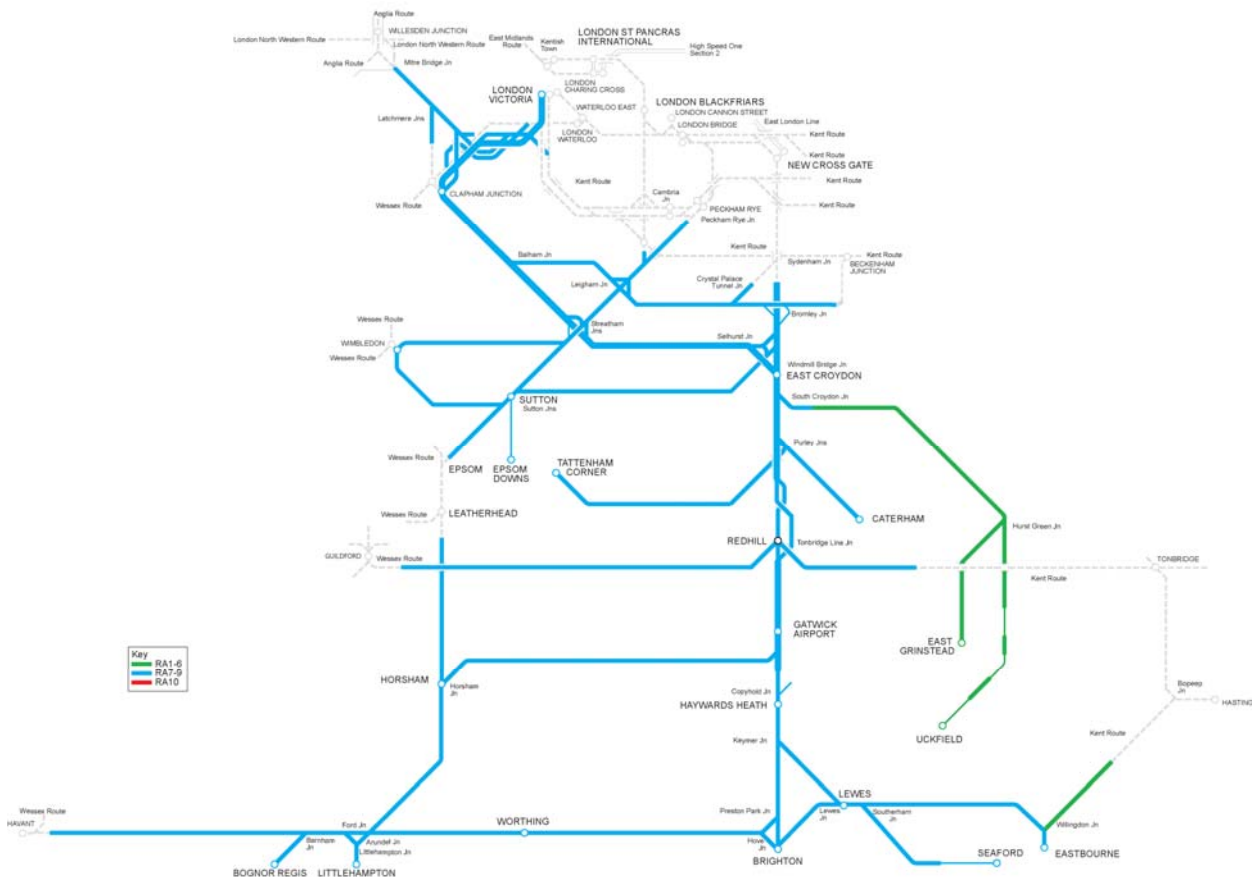
Headcount	FY15	FY16	FY17	FY18	FY19
Operations	429	411	381	354	327
Maintenance	669	662	623	609	595
RAM	32	32	32	32	32
Total	1,130	1,105	1,037	995	954

The ROC at Three Bridges allows the Route to deploy its signalling recontrol plan over the control period. This investment is the biggest single OPEX saving for Route Operations. Eventually, all signalling and electrification will be controlled from Three Bridges, which will also control the majority of the new Thameslink franchise area from 2018. Full benefits will not be realised until CP6 but at the end of CP5 the recontrol capability will span 57 per cent of all Sussex Route Signalling Equivalent Units (SEUs).

To reduce the industry costs Network Rail has identified a number of Alliancing opportunities with Southern in areas such as station improvements and mid-week night access. However, the Route recognises that the South-Central franchise terminates during CP5 and our efforts will need to take into account the development of the Thameslink franchise, to ensure there is continuity in the partnering approach on the Route.

Route overview

The Sussex Route covers the Brighton Main Line from London Victoria to Brighton, along with branch lines radiating from the Brighton Main Line which form a Sussex suburban network.



The route serves a large number of communities in South London, Surrey and Sussex; and carries significant numbers of commuter and holiday traffic to the south coast.

Recent history

Significant works have been delivered during the past five years including:

- The construction and migration to the new **ROC** in Three Bridges.
- Stage one of the Thameslink programme providing the Sussex Route with new and improved infrastructure between London Blackfriars and Brighton.
- **Arun Valley resignalling** which will reduce the signalling headways
- **East Sussex resignalling** which will involve a series of line speed improvements.
- **North Pole turn back** implemented in May 2009 allowed an additional Southern Railway shuttle service to operate on the West London Line.
- Installation and commissioning of the **FTN fibre-optic telecoms** network providing secure and reliable voice/data transmission.

These works have contributed to improved capacity on the Route and associated asset reliability and train performance. Some of these works will continue to be delivered in CP5 along with further planned renewals that will result in improved infrastructure and see the ROC in Three Bridges being the only signalling centre remaining on the Route by the end of CP7.

Key features

Elements causing capacity constraints and affecting performance are: the heavily used sections London to Brighton compounded by the high number of at-grade junctions.

Route strategy

Beyond CP5 the longer-term strategy for the Route is focused on enhancing the capacity of the Route to meet the forecast traffic growth whilst undertaking a renewal programme to address sustainability and asset performance. The asset age and condition for metallic underline bridges across the Route and Switches & Crossings on the Brighton Main Line is a concern.

Meeting demand

For the Route overall tonnage per km is forecast to grow by 8.5 per cent from 2011/12 to 2018/19 (CP5 exit). Busiest morning peak hour growth forecast for the Route's London Stations (London Victoria and London Bridge) can be found in the London and South East Route Utilisation Strategy – July 2011. To address this growth the Route proposes a number of specific interventions to address Route capacity and capability.

These key schemes include:

- Norwood Junction Platform 6&7 turnback
- Capacity improvement through the introduction of an additional platform at Redhill
- Phased introduction of the Thameslink Key Output 2 timetable in December 2018

Baseline to HLOS

At the core of our plans for CP5 is an asset management policy of targeted renewals and maintenance activity across the asset base to work towards an efficient sustainable asset intervention level. It assumes our delivery mechanism does not change from what we do now and that there will be no advancement in technology to drive down the cost of renewals.

Over and above the baseline core cost there is the opportunity to invest in the future. This is primarily delivered by amending our base signaling renewals plans to align with the **Network Operating Strategy** (NOS) and reduce the forward cost of operations.

The increase in signalling renewals activity reduces cost elsewhere in the business plan by removing or reducing maintenance/minor works requirements in other disciplines. Investment in track engineering processes, mechanisation and asset information systems allows us to significantly reduce the cost of managing the asset sustainably.

The High level Output Specification (HLOS) published in July 2012 requires changes to our '**baseline plus**' investment plans in order to **increased capacity in the route**. The main impact is seen in track renewals due to increase tonnage.

CP6 and Beyond

The Route will be looking at opportunities presented by the Three Bridges resignalling to de-conflict several key junctions including potentially Keymer Junction, Stoats Nest Junction and Windmill Bridge Junction (East Croydon Junction). The Route will also be working with Transport for London (TfL) on longer term strategy for new cross-London links.

Infrastructure summary

The Route infrastructure is varied in both type and age profile with operational signal boxes ranging from mechanical boxes to our future modern ROC at Three Bridges.

A summary of Route asset information is provided within the asset management plan.

Our customers

Maintaining a positive relationship with our lead operators as well as the other freight and passenger operators is important given the nature of services operated and the impact that these may have on adjacent routes.

Our Customers

Southern Railways, First Capital Connect (FCC), London Overground (LORL) and First Great Western (FGW) operate passenger services on the route, with DB Schenker, DRS, Freightliner and GB Railfreight providing freight services.

Thameslink services are operated by **First Capital Connect** between Bedford and Brighton/Sutton. As with all operators in the South East they have a strong commuter market, mainly into Central London. They also have a strong leisure market which includes; airport flows to Gatwick and Luton Airports, day trips to London and the South Coast, and evening journeys to and from the Capital

Southern Railways operates approximately 2,300 train services per weekday from London Victoria and London Bridge through south London suburban areas to Surrey and the Sussex Coast, including the Gatwick Express. As a busy London and South East train operator, they have a strong commuter market to London as well as to Brighton and East Croydon. They also have a considerable leisure market to Gatwick Airport, day trips to London and the South Coast, and late evening journeys from the Capital.

During CP5, Southern will look to run more and faster trains on their primary routes on Sundays. However, due to major engineering blockades taking place as part of the Thameslink Programme, trains on weekdays and at weekends will be affected by the closure of London Bridge station at certain times, and the diversion of Thameslink services via Tulse Hill, creating challenges for Southern Metro services already using this route.

London Overground operate services from Highbury & Islington to West Croydon and Crystal Palace via Sydenham and to Clapham Junction via Peckham Rye, and also on the West London Line between Willesden Junction and Clapham Junction. London Overground have indicated their aspiration to minimise disruption on their core routes, particularly during daytime operational hours.

The area covered by the Route is predominantly a passenger railway. However, there are five freight terminals within the geographical scope. Channel Tunnel Freight Route 3 between the continent and the London area traverses the Redhill corridor and the Brighton Main Line (BML) between Redhill and Clapham Junction.

Freight services are dominated by the three largest operators, **DB Schenker**, **Freightliner Heavy Haul** and **GB Railfreight**, although other smaller freight companies also run services in part on the Sussex Route.

Lead relationships

Sussex is the lead route for one passenger train operator which is Southern Railway.

Route Safety Improvement Plan (RSIP)

This section covers Sussex Route actions to deliver a safe railway for all our stakeholders, our workforce and contractors, passengers and the public. We also highlight our efforts to reduce the risk imported by Level Crossings – one of the greatest safety risks on the Rail Network.

Route Safety Improvement Plan

The Route Safety Improvement Plan (RSIP) has been prepared for Sussex Route to reflect both the National and our own Route based Vision for safety and sustainable development throughout CP5.

It draws on both local experience and knowledge to provide a framework for safety improvement. In the past our approach has been to use 'best practice' procedures at all times, but moving forward Sussex Route aim to exceed the expectations of our stakeholders with respect to safety of our staff, customers and the travelling public.

The RSIP aims to drive through these improvements and make it accessible and useful to all persons likely to need reference to how we will manage safety through CP5 in their day-to-day activity, as well to assist the Sussex Route in preparation of safety action plans. The RSIP also attempts in part to provide an overview of how we will improve safety in the workplace in general. Quite simply our safety vision is that:

We shall work together so that everyone returns home safely at the end of every day

The RSIP is a 'living' document, and it will be monitored and reviewed regularly. Progress on actions will be reported at the Route Managing Director's (RMD's) route team meetings to maintain visibility of the plan. Where legislative change, operational change, or in the unfortunate event of an incident occurring that reveals an unforeseen risk, the plan will be revised as appropriate to take into account the change.

Why have a Route Safety Improvement Plan?

Throughout the Sussex Route there is a continuous flow of safety activity reflecting our continuous drive for improvement. The RSIP collates all safety activity into one document providing all route employees with a single point of reference as to what is acceptable, and what is unacceptable activity and/or safety behaviour.

Since the RSIP is available for all to refer to, this helps greatly reduce misunderstandings and gives clarity of direction. The RSIP will set out clearly the steps we believe as a route we need to take to reach our ultimate safety goal.

Although any safety plan is only as good as the risks it identifies and the actions put in place to ensure that these are eliminated/controlled. The RSIP will be part of our overall people

management strategy package. Our vision is that safety is owned at all levels within the organisation from front line staff to the RMD and we will engage with people at all levels within our business to ensure this happens.

In the interest of producing the best possible outcome the RSIP must be considered active at all times, and therefore open to revision as technology, along with human resources, change to suit the business environment.

What does the Route Safety Improvement Plan contain?

The RSIP has two connected elements:

- National Safety & Sustainability Policy and Principles, and the application of these to the Sussex Route;
- Local route based safety and sustainability initiatives.

Network Rail has a national Safety & Sustainability strategy and suite of policies. The RSIP will apply these policies, where applicable to the route, and identify the benefit/impact of doing so.

Within any workplace there are risks and/or groups of risks that impact on our working environment. Many of these risks are generic and it is appropriate to deal with them via national policy, but it is often the case that geospatial and structural differences create route specific risks that will be managed on a route by route basis.

Planning for Safety

Safety planning must be considered as the methodology employed to manage the safety risks associated with business operations. The planning can be, and often is, overlapped in other areas of the business plan.

The RSIP is governed by the same rules as other business plans and will be reviewed and updated on a periodic basis.

Risk management

Our approach to risk management on the Sussex Route will be based on the principles below and will be supported by quarterly risk reviews chaired by the Route Managing Director (RMD).

Our approach to risk management on the Sussex Route will be based on the principles below and will be supported by quarterly risk reviews chaired by the RMD. Safety Risk will be managed as an integral part of business risk and we will:

- Develop a clear understanding of the safety risk profile of the Route;
- Minimise and where possible eliminate safety and sustainable development risks to our staff, passengers and public; to our neighbours and to supplier staff by making safety a core element of our design, management, maintenance and operational activities;
- Aim to eliminate work related injuries and ill health and associated losses and delays;
- Actively comply with our rules and to challenge where appropriate to develop clear, relevant, rules and standards that positively assist in the risk management process;
- Develop an increasingly risk based approach to our activities.

Investigating accidents and incidents

The core objective of any accident or incident investigation is to identify the root cause and eliminate it from future operations. Where it is not possible to eliminate root cause we aim to reduce the likelihood and consequence of future occurrence so far as is reasonably practical. Sussex Route will comply fully with NR/L2/INV/002 and ensure that all accidents/incidents warranting investigation are allocated an independent Designated Competent Person (DCP) from within the route, or where necessary external to the route.



Assurance

In its simplest form, providing assurance will show that what we say we are doing is in fact, what we are actually doing, and this will match what we are supposed to be doing.

Within Sussex Route our safety assurance regime will be primarily delivered via safety tours and assurance checks conducted by line managers and engineers in a consistent and regular manner.

Each year we will produce safety tour and assurance check plans that cover our obligations and allow us to track progress. All findings from safety tours and assurance checks will be consolidated and reviewed within the senior route teams on a quarterly basis.

Our assurance regime will include:

Validation that our systems, process, standards and guidance, are capable of delivering a railway asset that can be managed safely at best whole-life-cost. This will primarily be delivered by Engineering Verification and Peer Review;

Compliance with relevant legislation, policies, procedures and processes is in place and embedded in our management systems. This will be primarily be delivered by a weekly compliance conference call chaired by the Route Infrastructure Maintenance Director, the National Core Audit Programme (NCAP) and line management self-assurance checks;

Technical compliance with relevant legislation, standards and procedures is in place and embedded in our management systems. This will be primarily be delivered by the NCAP audit programme and line management self-assurance checks; and

Staff surveillance will be undertaken as a line management activity to provide assurance that staff are working to the correct standard in a safe, compliant and controlled manner. This will be primarily be delivered by management safety tours and line management self-assurance checks.

During safety tours and assurance checks we will focus on gap analysis to identify issues and implement beneficial change.

Key areas of focus

Sussex RSIP is built around the three key risk areas that both affect and are affected by, our business:

- Workforce Safety;
- Passenger Safety;
- Public Safety.

The key areas for safety improvement on Sussex Route are built into detailed action plans will be updated by action owners, and tracked/reviewed each period by the route management team.

This section covers a summary of the headline improvement actions by key risk area.



Workforce safety

Safety Leadership and Culture Change Programme

Our overall aim on the Sussex Route is that all our leaders and managers set high standards for safety, communicate openly, confront risk and involve/engage with their teams in this process. We will develop a culture where everyone not only follows rules, but is prepared to speak up and get involved in generating solutions. As a Route Team we will work to ensure the principles below are embedded into everything we do.

Leadership

- We will strive to develop active, visible and trusted leaders and managers across the Route.
- Provide effective leadership that fully engages and collaborates with our staff, suppliers and customers, encouraging all to take their safety and sustainable development responsibilities seriously.
- Ensure that all staff have the opportunity to lead on and be fully engaged in improving our health, safety and environmental performance.

Culture and behaviours

- The Route will put safety and sustainable development at the heart of everything we do.
- We will develop a culture that is just, flexible, learning, questioning and encourages reporting.
- We will be an open, communicating team, to maximise the benefits of sharing best practice and identifying opportunities.

Excellence

Our aim is for excellence in our own activities and deliverables, and to embed exemplary safety and sustainable development performance and risk management into everything we do.

- We will provide the skills and equipment required by our staff in order to do our jobs.
- We will continuously learn from all incidents.
- We will actively promote health and wellbeing for our staff.



Track Worker safety

All persons working on or near the line are to be protected by a Safe System of Work Pack (SSOWP) that is fit for purpose and supports the competence of the end user. We will work with our front line managers and supervisors to ensure that we develop our people into safety critical roles and provide the correct level of support, mentoring and coaching for them to maintain safety critical competencies effectively. Specifically we will:

- Target and Improve SSOWP embracing the new planning software and look to simplify the process and achieve greater buy-in;
- Improvement in the quality and competence of our SSOWP planners and look for opportunities to increase their empowerment to reduce the section managers work load;
- Maximise the use of green zone working with a target of 100 per cent by better use of Green zone availability; and
- Implement the new SSOWP planning tool in a controlled manner to ensure that risk is kept to a minimum and that the safe systems of work developed are robust and embraced by our front line staff.

Manual handling

Slips, trips and falls

Rail is an industry that requires its employees to work around uneven surfaces and at height, and thus slips, trips and falls are assessed as possible outcomes.

We will consider the possibility of slips, trips and falls in each and every workspace within the route. This will include all areas on-or-near the line, access and egress points to the railway environment, depot areas, operation control buildings, and the office environment.

Electricity

Sussex Route has approximately 1,073 route km of electrified railway and significant low-voltage power supply points. We are committed to establishing and enforcing, safe work methods for all persons when involved with the use of electricity. This applies to all staff working on electrical installations, and protecting those working within or adjacent to electrical installations. The consequences of working incorrectly with electricity are severe.

We intend to:

- Improve electrical awareness across the Route and a better understanding of the risks from electricity through briefing, training and staff surveillance;
- Analyse how we work with electricity and reduce the need to work live or adjacent to live electricity;
- Seek to improve our isolation processes and methodology for identifying the limits of isolation; and
- Ensure that where the electrification is renewed or newly installed that due diligence has been applied with regard to future maintenance and operational requirements.

Manual handling is a major contributor to workplace incidents across the Sussex Route. Our manual handling procedures, along with associated regulations, requires a risk based approach incorporating consultation at all levels of the organisation, along with hazard identification, risk assessment and risk control. This approach demands that all members of the workplace are involved with establishing safe manual handling techniques and, where possible, the elimination of manual handling hazards. We will reduce the incidence of manual handling injuries by:

- Creating alternatives to manual handling to reduce the risk to staff and increase efficiency of work;
- Promoting manual handling campaigns across the Route. Refresher training will be specific, identify best practice and cascade via master-class training; and
- We will increase use of Mechanical lifting and moving technology and seek to embrace technological improvements in this area.

Health Promotion and Education

We aim to raise awareness of occupational health and the benefits of a healthy lifestyle using a variety of media.

Public safety

Level crossings

We aim to reduce the overall level crossing risk across the Route by closure or diversion of all of our crossings and to better engage with users of level crossings to effectively reduce incidents of misuse and to actively discourage intentional misuse in the meantime. Our strategy on level crossing will align with the National Level Crossing policy and where possible seek closure as our first option.

Where this cannot be achieved we will bridge the crossings to eliminate the risk. Alternative options to actively manage and reduce the risk will be utilised for the period between identification of unacceptable risk level and a permanent solution being put in place, or to manage those level crossings where closure or bridging is not an acceptable option. Our primary aim is to focus on reducing risk and where appropriate utilise innovative and novel methods in order to increase the delivery pace.

Examples of our ongoing commitment to level crossing risk reduction through CP5:

- Within the Route we will maintain a register of level crossings prioritised by risk as measured by All Level Crossing Risk Model (ALCRM), but augmented with local knowledge and reasonable customer requirements. This level crossing strategy will be a living document that becomes the Route's long-term risk mitigation plan for each level crossing;
- We will maintain a living action plan for our highest risk level crossings on and detail what, when, how, and who in terms of activity to be undertaken, reviewed at monthly meetings. By undertaking continuous action in this way we will progressively reduce the collective risk of all out level crossings. By the end of CP5 it is our aim for the top fifty level crossings in our risk register to have been closed or moved out of the top fifty on the risk register;
- The Route executive team leads on all level crossing enhancement, replacement or closure, and a holistic approach is taken based on funding, risk and operational/user benefit. This will include providing additional input to renewal and enhancement schemes ensuring all activity aligns with our long-term plans for level crossing risk reduction;
- Seek new ways to work with our users and neighbours in order to raise awareness of the risks around level crossings utilising the successful road rail partnership groups;
- Develop and improve our level crossing inspection and maintenance regime including the use of remote monitoring equipment to enable improved consistency and efficiency in our management of level crossing assets;
- Develop and standardise use of Closed Circuit Television (CCTV) monitoring across the Route to reduce equipment cost and improve operation roll-out.

MCB-OD

The proposed implementation of Manually Controlled Barrier Obstacle Detection (MCB-OD) level crossing technology on the Sussex Route is detailed within the asset management plan.



Suicide Prevention

Overview

The prevention of suicides on the railway poses many challenges for the industry. The Route will be identifying funding streams to implement our proposals in CP5. An overview of initiatives, at Route Level, is listed below. At Route Level, funding across initiatives in these four areas combined with those already captured in Joint Suicide Prevention Plans should aim to deliver a 30 per cent reduction in railway suicides between 2014 and 2019 (based on incident levels at the end of CP4). Centrally delivered work will support the delivery of that target.

Education

Raising the awareness of the issue and becoming an effective communicator.

Potential Funding Initiatives (Route Level)

- Additional 'publicity' material for local events or initiatives;
- Facilitating meetings/work with route based media groups;
- Facilitating meetings/work with route based local authority groups;
- Facilitating meetings/work with route based local community groups;
- Facilitating meetings/work with route based personnel to reinforce training messages.

Enablement

Providing leadership and strategic support to reduce the number of instances of suicides on the railway.

Potential Funding Initiatives (Route Level)

- Explore with route based local authorities a 'joined up' approach to deter individuals from using the railway as a means of committing suicide.

Engineering

Finding effective and innovative ways of making railway related suicides less attractive or harder to commit.

Potential Funding Initiatives (Route Level)

- Platform fencing – at platform ends, mid platform or fast line segregation;
- Overbridge and underpass fencing;
- Enhanced line side fencing/additional fencing on approaches to stations;
- Inhibiting access to track, installation of 'cattle grids' or removal of redundant access points, e.g. barrow crossings;
- Platform painting – single continuous yellow lines, hatching or exclusion boxes;
- Vegetation clearance (to remove blind spots for drivers and privacy from those seeking to commit suicide);
- Enhanced lighting (to reduce the anonymity of those seeking to commit suicide);
- Poster cases;
- Platform help points;
- Emergency button points on stations;
- Landscaping to form natural obstructions to the line;
- Reducing the number of level crossings;
- Removing unauthorised footpaths;
- Obstruction detectors in station track areas.

Enforcement

Looking at ways to use modern security methods, and public sector intervention to reduce the incidence of railway suicides.

Potential Funding Initiatives (Route Level)

- Deployment of security personnel;
- CCTV – new installations or upgrading existing ones including installation of additional monitors for enhanced surveillance opportunities;
- Smart camera technology;
- Additional policing;
- Motion sensors/radar for unused station areas.

Route Crime, Theft and Vandalism

We will expand upon the successes we have made using both current and new initiatives across the various locations identified as hotspots in an attempt to both reduce railway crime and improve relations in the local communities that surround Network Rail Infrastructure. Specifically we will aim to:

- Reduce the number of incidents and minutes delay at our identified hotspots by developing a route crime reduction plan based around Education, Enablement, Enforcement and Engineering solutions, working closely with the Education Manager to ensure that we understand the demographics of offenders implementing effective solutions and work with British Transport Police (BTP) to ensure resources are used affectively to deter potential route crime and enforce action where this cannot be achieved;
- We will identify areas for potential fencing upgrades that have a significant effect on route crime and work with our delivery teams to effect this change;
- Develop a route strategy for scrap removal/collection to avoid stocking points around known route crime locations;
- Prioritise areas of high graffiti and look for alternative solutions at identified high incident areas;
- Continue to build on foundations established with local authorities, schools and enforcement agencies in reducing railway crime, and review other opportunities to work with other potential stakeholders.

Passenger safety

Irregular working

We will work to ensure that our irregular working events are fully understood and actioned as appropriate to reduce the occurrences of irregular working. By improving the consistency of risk ranking of irregular working events we will ensure resources are targeted in the correct areas and that we fully understand and are able to manage the risk on the route more effectively.

- We will seek to reduce/eliminate the wrong routing of trains due to signaller error by better support for the signallers from the Signal Shift Manager's, by better planning of engineering work, and by more intrusive and active management of the issue to understand the causes of wrong routed trains and ensure that action plans are developed in conjunction with our teams for poor performers in this area;
- Where wrong-routing is attributed to poor planning by Network Operations planning department we will provide quality feedback and follow this through to implementation where changes are required;
- We will support and seek opportunities for removal of swinging overlaps;
- We will ensure all operating irregularities are captured, reported in a timely manner; remedial measures will be developed and consistently implemented across the route. Our aim is for 100% reporting and closure of operating Irregularities;
- We will reduce the incidences of irregular working linked directly to failings in competence and training of individuals. Ensuring that where this has occurred the appropriate remediation is put in place to prevent the risk of a re-occurrence.

Seasonal management

Our aim is to drive out uncertainty around resilience and preparedness for changing seasonal weather patterns so that the appropriate controls can be applied at the right time and in the right place. A Seasonal Delivery specialist leads the Seasonal Management Plan's for the Route. Over the last control period we have made some significant gains in this area; we will build on this success to better manage the risks that arise from extremes of weather. We aim to achieve this by:

- Development of an annual route vegetation management plan and joint review with train operators and other stakeholders to ensure that we are targeting the areas of concern and managing their expectation effectively;
- Reviewing the effectiveness of the rail head treatment programme and technology in use at the moment and seek to improve on the process in place, thereby maximising safety and availability of the asset;
- Building greater understanding between our Operational and Maintenance staff to educate them on the requirements and safety benefits of effective seasonal management initiatives, e.g. vegetation clearance;

- We will implement a programme of strategic briefings delivered at key times in the year prior to seasonal change to ensure all Operational Staff are aware of seasonal working instructions;
- We will review the effectiveness of localised weather stations on the route and identify any geographic areas that have poor coverage with a view to further installation of this equipment;
- Use of failure data to risk assess track circuits and build a case for further fitment of Remote Condition Monitoring (RCM) in high risk areas.

Platform - Train interface

We will work with our rail partners to remove the risk of passengers falling between train and platform and slips, trips and falls of passengers on station platforms by:

- Seeking innovative ways to communicate the safety risk to passengers so that they better understand this risk and are able to contribute toward the solution;
- Identify stations where the stepping distance between platform edge and train is excessive and look at what we can easily do to reduce the problem;
- Identifying solutions using the combination of infrastructure improvements and operational controls to reduce the risk so far as is reasonably practicable;
- Work with our rail partners to better understand the demographics of use at particular stations (e.g. high number of elderly/disabled users). So that we can better develop the right response to mitigate the risk.

Signals Passed at Danger

We will maintain the strategy of reducing the risk of Category A Signal Passed at Danger (SPAD) by ensuring signals are correctly placed and sighted, line side vegetation is managed to maintain visibility, and sighting inspections are carried out consistently and that Train Operating Company (TOC)/Freight Operating Company (FOC) customers are continually engaged with ourselves in actively monitoring the effectiveness of all signals across the Route. Specifically we will:

- Actively promote and seek funding for signal renewal schemes on the Route and look for opportunities to improve the asset;
- Deliver the five-year rolling Signal Risk Assessment plan for the route and ensure that detailed assessments are completed within twelve-weeks of identifying high risk signals and the necessary mitigation is actioned;
- We will have suitable representation at the various project stages of all new re-signalling schemes that affect the route and ensure that the principle of safety by design is embraced by the project teams;
- We will maintain a list of multi-SPAD signals on the route and risk-manage these effectively;
- We will actively continue with replacement of existing signal heads with LED light-engine replacement of filament lamps, or full LED signal head conversion where appropriate. We will refurbish and replace signal back boards to enhance signal visibility where beneficial;
- We will maintain historical data of signals encroached by vegetation ensuring persistent offenders have maximum sighting achievable through fitment of signal sighting plates to infrastructure and management of line side vegetation.

What will success look like?

Our aim is to make the greatest contribution towards Network Rail's overall improvement in safety, and to realise the vision for everyone to return home safely every day. We aim to be the model route and to lead the business in achieving nationwide objectives by sharing with the other routes: our learning, successes and safety improvements to the benefit of Network Rail as a whole.

Sustainability development improvement plan

The Route is focused on change and we have a culture of pushing for higher levels of safety, reliability and transparency, as well as better value for money for our customers and stakeholders. Sustainable development will be at the heart of this as it supports these values and is integral to the long term success of the company and the railways. Ultimately, we are seeking a safer, more reliable railway, with greater capacity and efficiency that contributes towards a thriving, low-carbon economy with better connections between people and jobs.

The Sustainable Development Vision:

A railway fit for the future

We believe that good management of our economic, social and environmental impacts is key to maintaining a strong and prosperous business. We will drive efficiency, build trust and create long term value for our stakeholders.

Key SD Priorities

- Safety and Wellbeing;
- Communities;
- Accessibility and inclusivity;
- Employees;
- Energy and Resources;
- Environmental Protection;
- Climate Change Adaptation;
- Buildings and land.

Safety and wellbeing

Our vision for safety is unequivocal: we want everyone to return home safely, every day. That includes passengers, members of the public and our workforce, whether directly employed or working on contract. To implement that vision, a separate but complementary strategy establishes strategic objectives and sets out where we will focus.

Communities

Through the corporate community investment programme we seek to support and understand better our stakeholder community. This helps connect the communities we serve, particularly our lineside neighbours and those that live near the railways with our employees. It enables communities to engage with railway investment, our employees and our charitable support supporting wider social benefits of rail.

Accessibility and inclusivity

We understand the important social role played by public transport. Public transport has a key role to play in improving accessibility for all individuals, thereby minimising social exclusion and enhancing social cohesion. The railway we build, therefore, must provide accessible and inclusive provision for all people, especially those with reduced mobility, the disabled, the elderly, families with young children, and the young children themselves, lower income residents, those without cars, and those living in economically deprived areas.

Employees

Our vision is to build a high performance culture throughout the Route. To do this we need engaged employees with the freedom to innovate and the confidence to challenge when we need to improve or do things differently. Evidence tells us that engaged employees are essential to creating a culture of high performance – particularly around safety. The better the engagement, the more likely that employees will increase their discretionary efforts, take fewer sick days and ultimately contribute to delivering enhanced services.

Energy

The Government has set a target to reduce emissions of CO₂ by 80% over the period 1990 to 2050. Our contribution to achieving this target will be through a combination of energy efficiency and low-carbon procurement strategies. New train technology such as regenerative braking and energy metering enables us to become more energy efficient. The efficient use of energy also has significant financial benefits.

Resources

The natural environment has a finite resource base, and it is essential that we use these resources sustainably. In addition, commodity prices vary considerably adding unanticipated costs to our business. It therefore makes good business sense to be efficient in the way we use resources, be innovative in our use of sustainable materials, and wherever possible turn any waste product into a commodity.

Environmental protection

Our interaction with the natural environment is considerable. Protecting the environment in the course of our operations is both a legal obligation and the sign of a responsible business. Preventing pollution and environmental damage also makes us more efficient. As we enhance our infrastructure we will seek to minimise our impact on the natural environment.

Climate change adaptation

Our infrastructure is a valuable asset for Great Britain and we are committed to making our network and our operations resilient to future changes in the climate. The Stern Review on the Economics of Climate Change set out the importance of adapting infrastructure and operations to the changes in climate expected over the next 50 years. The review concluded that the costs incurred now were likely to be significantly less than costs incurred in the future.

Buildings

In addition to our new buildings programme, we are custodians of 40,000 buildings and structures across our network. The average age of our building assets is 125 years old. We are committed to managing our buildings sustainably enhancing where we can its economic and social value. The built environment underpins economic growth and delivering this investment in a sustainable way is key to our success.

Land

Our 20,000 miles of infrastructure pass through both urban and rural areas of land (rail corridors) and we also have substantial land holdings including those associated with our maintenance depots, engineering works and offices. We are committed to managing our land sustainably, enhancing ecological diversity where we can, and increasing its economic and social value.

Outstanding value

Our output objective is to deliver outstanding value for money to taxpayers, customers and funders. In addition to finding more efficient ways of working which will enable us to return cash to the Government, we will also ensure the investment in our infrastructure represents outstanding value for money.

CP5

The Route's approach to sustainable development currently is transactional and is based on achieving compliance with Network Rail's standards in turn meeting our legal obligations. This work will continue however, in order to achieve our aim we must take a more transformation approach.

Route Performance and Capability Improvement Plan

This section summarises the projects, actions and initiatives aimed at delivering Sussex Route's performance targets in the remainder of CP4 and across CP5. It looks at the capacity and capability improvements for both passenger and freight, and the key project to achieve this.

Sussex Route performance summary

Performance in Control Period 4 has been mixed on this highly congested route. Although traffic growth has been much higher than forecast in CP4 plans, asset reliability has improved during 2011/12, with a general reduction of incidents. However, Delay Minutes have increased and PPM is behind target.

Route infrastructure performance has been supported by the introduction of **Remote Condition Monitoring (RCM)** for critical assets. Further roll-out will take place during 2013. The Route has recently introduced **conductor rail heating** at critical locations to improve traction power to rolling stock in cold weather. There have been some significant performance impacting events in CP4, despite the improvements in asset reliability – a **burst water main** at South Croydon resulted in an embankment slip; a **power cable theft** at South Bermondsey and **emergency engineering** work in Balcombe Tunnel. For the remainder of CP4, there will need to be a continued focus on asset reliability, seasonal preparation, cost effective mitigation for external events, and close working with Train Operators, particularly in the context of the start of Thameslink Key Output 2 build phase.

Performance Outputs

The route performance outputs for the end of CP4 and through CP5 are provided in the following graphs. These figures should be considered as the first draft performance deliverables for Sussex (rather than targets) and are subject to more detailed work to be undertaken when the CP5 Joint Performance Improvement Plans are formulated and final outputs are agreed both internally and externally for Network Rail as a whole.

Figure 3.1: Annual Delay Minutes for Sussex: Actual/Forecast v Target

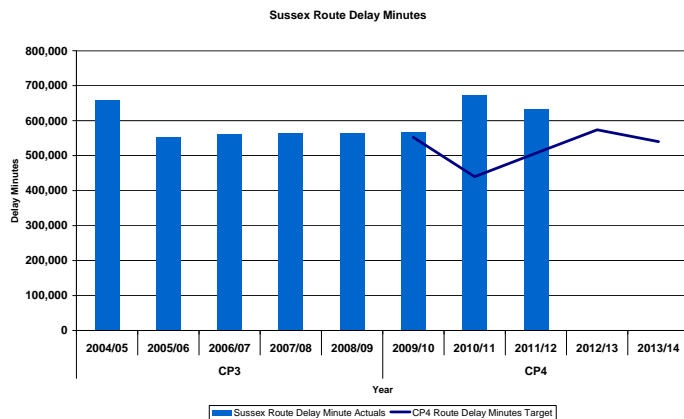


Figure 3.2: PPM MAA for Southern: Actual/Forecast v Target

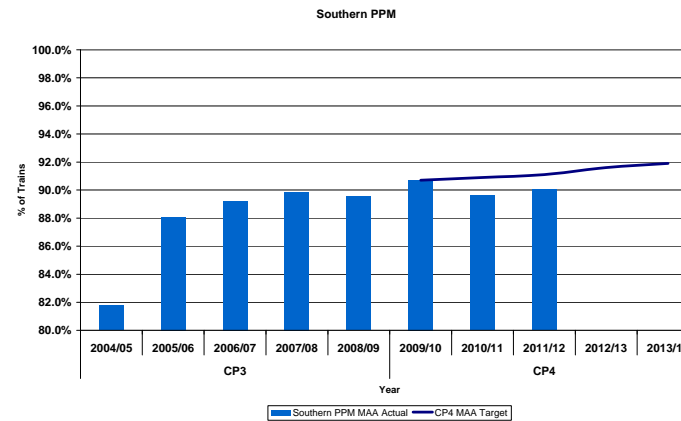
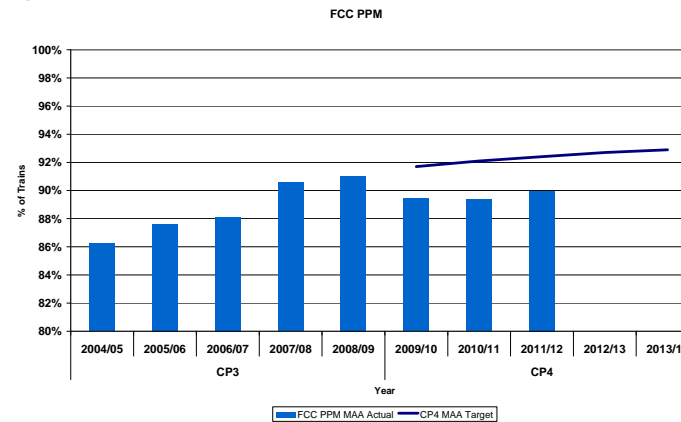


Figure 3.3: PPM MAA for First Capital Connect: Actual/Forecast v Target



Delivering CP4 performance

During the early stages of performance planning for 2012/13 the routes were asked to put together a two year performance plan, including a two year Joint Performance Improvement Plan (JPIP) for each lead Train Operating Company.

JPIPs

The shift away from one year plans recognised that, with two years left in Control Period 4, and with the industry failing to meet some of its regulatory targets, a plan was needed to make sure that these shortfalls in performance were identified and robust plans were put in place to recover. The JPIPs, known as the 'Base', are the corner stone of an industry performance plan supplemented by the nationally held 'Base +' and 'Base ++' programmes. The industry performance plan is the direct response to the shortfalls in current performance and has been put in place to ensure that regulatory targets are met by the end of the Control Period.

Sussex Route has found it challenging to meet the targets anticipated in the CP4 delivery plan and Southern Railways Long Term Performance Plan. Route delay minutes, Southern Railways Public Performance Measure (PPM) and Southern Railways Cancellation and Significant Lateness (CaSL) have all fallen short of targets.

There have been a number of contributory factors including an underestimation of traffic growth in the CP4 plan, a rise in delay per incident even though incidents generally are falling, severe external impacts such as the winter weather impacts in 2009/10 and 2010/11 and a rise in fatalities and trespass. There has also been a general rise in sub-threshold delay.

There have been several key signalling renewals taking place in CP4: Victoria relocking, Gatwick Airport relocking, Arun Valley re-signalling and East Sussex resignalling which will contribute to maintaining performance and reducing incidents in late CP4 and CP5.

Other planned initiatives, expected to give benefits in CP4 include service recovery improvements from the joint control team, improved train crew marshalling at London Victoria, suicide prevention programme (particularly at Selhurst and Streatham Common), timetable improvements, motorised hook switch installation (reducing disruptive impact of emergency isolations) and the ongoing roll out of Remote Condition Monitoring (RCM) for critical assets.

There are also a number of asset initiatives that are designed to strengthen service delivery capability, and protect performance, during the Thameslink K02 build phase, particularly the diversionary route via Herne Hill for First Capital Connect Services.

Fleet performance is ahead of target for both incidents and delay minutes and is considered to be an example of best practice for data quality and asset knowledge and management. However, the impact of incidents, when they happen, has increased and will require continued focus to the end of CP4.

Sussex Route targets

Due to the CP4 challenges, it was agreed with Southern Railway in March 2012, that the 2012 to 2014 Joint Performance Improvement Plan (JPIP) would deviate from the CP4 delivery plan performance targets. Instead, more realistic targets were agreed in the JPIP for CP4 exit although given lower than expected performance in 2012/13 to date, the provisional JPIP targets for 2013/14 and thus CP4 exit are to be fully reviewed as part of the development of the 2013-15 JPIP. Detailed performance planning and target setting for 2013/14 is underway.

The targets set for Sussex are still very challenging, due to the removal of capacity at London Bridge from 2013, due to Thameslink Key Output 2, but ultimately considered to be deliverable.

For Sussex Route and Southern Railways. the agreed targets for the remaining years of Control Period 4 are shown in the table below:

KPI	2011/12 result	CP4 exit LTPP	CP4 exit JPIP	Variance
Sussex Route delay minutes	639,542	364,000	542,815	49.1%
All Network Rail on Southern delay minutes	624,636	368,600	540,220	46.6%
Southern PPM Moving Annual Average (MAA)	90%	91.9%	91%	0.9%
Southern CaSL MAA	2.8%	2.1%	2.5%	0.4%

Note: CP4 exit JPIP targets are provisional and are likely to change as part of the development of the 2013 – 15 JPIP. Detailed performance planning and target setting for 2013/14 is underway.

The **Route Performance Team** will monitor and track delivery against plan through a set structure. This structure, consisting of a series of strategic and tactical meetings, as well as a daily performance conference allows the tracking of on-going delivery as well as providing new schemes, projects and risks that the Performance Team can quantify and add into the Performance Plan throughout the year making it a 'live' process.

This process has been supplemented by a **Route Performance Project Manager**, as an extra resource for the Route to help ensure delivery of the performance plans through the use of project management skills and techniques.

The commissioning of the new **Performance Action Tracker (IPAT)** will also give the Route greater management and control over the benefit schemes and risks in the performance plans.

Delivering CP5 performance

Performance during CP5 will be heavily affected by a large programme of investment on the Sussex Route. This will provide significant long term benefit to all rail stakeholders, but in the short term will pose a number of challenges and adds significant risk to performance delivery. There will be particular impact from Thameslink K02 capacity restrictions in the London Bridge area throughout CP5.

Given the ongoing challenge to deliver the CP4 plan and that CP5 is expected to bring significant passenger growth, CP5 planning has used the JPIP CP4 exit targets as the base case for CP5 performance planning, to ensure that deliverable targets are established.

The overall strategy for CP5 will be to maintain above CP4 exit levels of performance to mitigate the predicted risks. This will be a considerable challenge, due to the significant volume of enhancement work during the control period, forecast passenger and traffic growth and uncertainties created by changes in franchising arrangements.

CP5 Performance Risks

There will be a number of performance risks in CP5, which come in five categories:

- The impact of enhancement works;
- The impact of asset condition and reliability;
- The impact of refranchising and timetable change;
- More generic risks, such as externally-caused incidents and weather;
- Passenger growth on a congested network.

The scale of the impact of major infrastructure changes at both London Bridge and Victoria stations is summarised below:

- From December 2012, there will only be six terminating platforms available at London Bridge. In the peak, train platform occupation will need to be actively managed to meet the timetable. In the event of operational/infrastructure issues during the peak there will no capacity to divert London Victoria services to London Bridge;
- From May 2013, diverse route capacity in the London Victoria area is reduced with the Atlantic lines connection to London Victoria removed at Battersea Park (Platforms 1&2); enabling platform extension works;
- From December 2014 to Jan 2018, all cross London First Capital Connect (FCC) services to and from the Brighton Main Line (BML) will be diverted via Herne Hill and Tulse Hill. There will be no route available via London Bridge. Therefore, in the event of operational/infrastructure issues between Tulse Hill and London Blackfriars, there will be no diversionary route. Only if there are issues at Tulse Hill (East Croydon via Crystal Palace) will there be the potential to divert services via Streatham Common and vice versa.

As a result of these operational restrictions, contingency plans are currently being developed between the Routes and Train Operators to identify the most appropriate recovery actions during an incident and provide the best available service accordingly.

The performance impact of Thameslink works at London Bridge has been modelled and will need to be factored into the detailed CP5 performance planning and contingency planning. Other enhancement works on the Route including re-signalling and platform extensions also have the potential to impact on performance.

The Sussex Route has delivered improved asset reliability, measured by incident count, in recent years. Nevertheless, the infrastructure on Sussex dates predominantly from the 1970s and 1980s and the renewal rates in CP4 and CP5 will not result in a step change improvement in the used age of the infrastructure. As a consequence, particularly with the further introduction of lengthened trains throughout the control period, asset performance will continue to be a challenge, and incidents causing significant disruption are likely to continue. Achieving asset reliability sufficient to support the enhanced cross-city Thameslink timetable from 2018 will require innovations including Remote Condition Monitoring (RCM), night time inspection and the roll out of risk based maintenance.

Thameslink refranchising, when the process re-starts, will ultimately lead to the amalgamation of the existing South-Central and Thameslink franchises at some point in CP5. There will undoubtedly be changes including rolling stock and timetables but, it is to be hoped, these will provide an opportunity to build further resilience into the services delivered. Changes outside of assumptions made for CP5 planning will be subject to the proposed industry change control processes.

The Sussex Route will continue to face challenges such as fatalities, trespass, cable theft and the impact of weather and seasons and the Route has included expenditure in CP5 to mitigate against the likelihood and impact of these external risks.

CP5 Performance Opportunities

Focus on performance improvement opportunities will be needed to counter the impact of performance risk. A number of opportunities will be available in CP5.

Following completion at the end of CP4, the remodelling of Gatwick Airport and resignalling schemes on the Arun Valley and East Sussex routes will create additional capacity, and, crucially, more flexibility in terms of layouts and signalling during disruption. Reductions in reactionary delay are therefore anticipated. Similar reductions will also result from the various smaller signalling enhancements planned, such as the removal of approach control signalling at some locations, as well as from the delivery of the extra Platform 0 at Redhill. Longer suburban trains may also assist with reduction of sub-threshold delay, which is a considerable challenge on the Route due to passenger crowding and general congestion.

From a point in CP5, there will be one principal operator on the Route, as opposed to the two operators who utilise the Brighton Mainline today. This change could generate greater opportunities for Alliancing and joint working with the new Train Operator. Key opportunities will include more common approaches to incident and train service management during disruption and a wider range of alliancing. Such opportunities are, at this stage, speculative, and will emerge in greater detail during the control period – however they will come too late to be factored in any detail in CP5 performance.

During CP4, RCM is being installed across the Sussex Route, and is contributing to a reduction in incidents by providing better information of assets that are failing or have failed. Technicians dedicated to studying RCM outputs and optimising response team deployment are now in place in Sussex Route Control. As the rolling implementation programme continues, further benefits from RCM are expected. With greater experience, the Route's ability to make the most of RCM for performance improvement purposes should increase.

Sussex Route Performance Delivery Strategy

The Sussex Route will focus **on incident prevention** first and foremost, but when incidents do happen the route will focus hard on managing those incidents to **minimise impact** to the network and the fare paying customer.

The route will be applying a **whole-life asset management approach** to incident prevention. This will mean closer working between the route team and our customers. We will make best use of our resources and knowledge in order to deliver reliable infrastructure. We will continue to monitor safety, compliance and performance weekly to reduce the risk of asset failure and performance damaging incidents.

A **risk based approach** to reliability will continue to be applied during CP5 acknowledging that there are key 'golden' assets which are crucial to performance delivery. Where considered necessary, the route will employ an enhanced regime above and beyond set standards for these assets.

When incidents do occur, the route will continue to look at how it can best respond in order to minimise the impact on the train service. We will continue to minimise primary delay using a risk based approach to incident response.

We will continue to **proactively manage service recovery** through the use of the agreed contingency plans, as well as proactively monitoring ongoing events on other routes. We work with adjacent routes to minimise imported/exported delay via co-ordinated service management.

Involvement of Lead Train Operator

We have worked with our lead train operator Southern Railway to formulate the CP5 performance plan. It should be noted that the Southern Railway franchise is due to end in April 2015 and the First Capital Connect franchise is due to end in September 2013. The re-franchising process is subject to the current reviews under-way and it is likely that plans and dates could alter.

The December 2018 timetable change, following completion of Thameslink K02 is dependent on infrastructure changes, the re-franchising process and the procurement and implementation of new rolling stock.

The assumptions below are Network Rail's view based on information available:

- 2013/14 JPIP targets set in 2012/13 are delivered as planned
- Traffic growth on each Strategic Route Section (SRS) is as set out in the SBP
- Changes outside of core assumptions are subject to industry change control processes

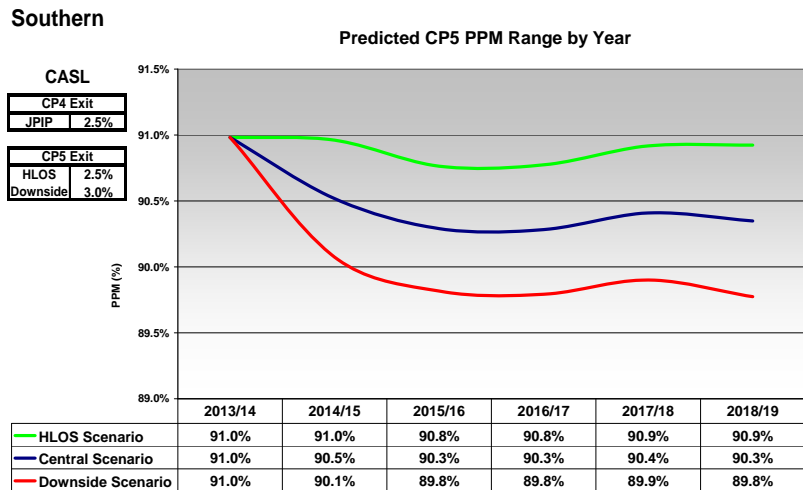
CP5 Performance Deliverables

A PPM & CASL trajectory has been produced showing each year of CP5 for each individual Train Operator (TOC) which operates on the Route. These trajectories have been produced using the assumptions which are a mix of national and route level assumptions. Trajectories have been shared with the current TOCs and wider rail industry. The main drivers behind each individual trajectory have been included for added information. Note that achieving the CP5 year 1 result is dependent on the level of performance delivered during 2013/14, the CP4 exit year. Detailed performance planning and target setting for 2013/14 is underway.

The graphs show the CP5 PPM range with the CASL CP5 exit range noted in the table on the left. The ranges are based on:

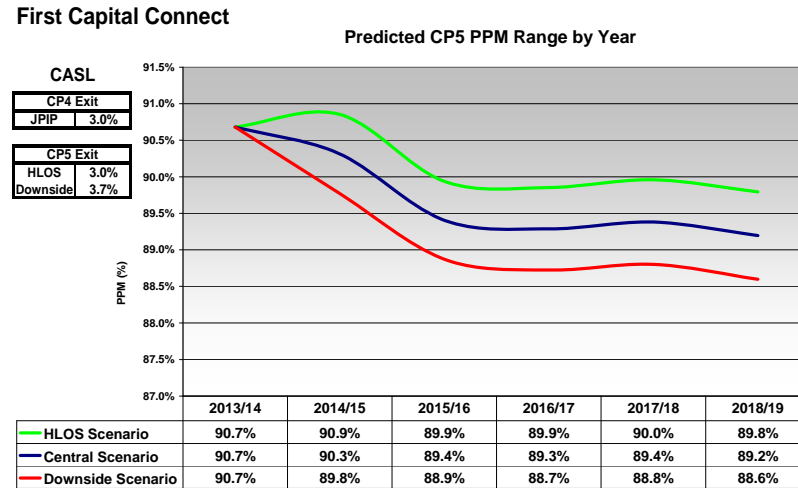
- An HLOS scenario based on achieving exit-CP4 targets and impact of change at the low end of estimates (green line). Equates to 25 per cent confidence.
- A central scenario based on achieving exit-CP4 targets and impact of change at the mid-range of estimates (blue line). Equates to 50 per cent confidence.
- A downside scenario based on achieving exit-CP4 targets but the impact of change is at the high end of estimates (red line). Equates to 75 per cent confidence.

Figure 3.4: CP5 PPM Range Forecast for Southern



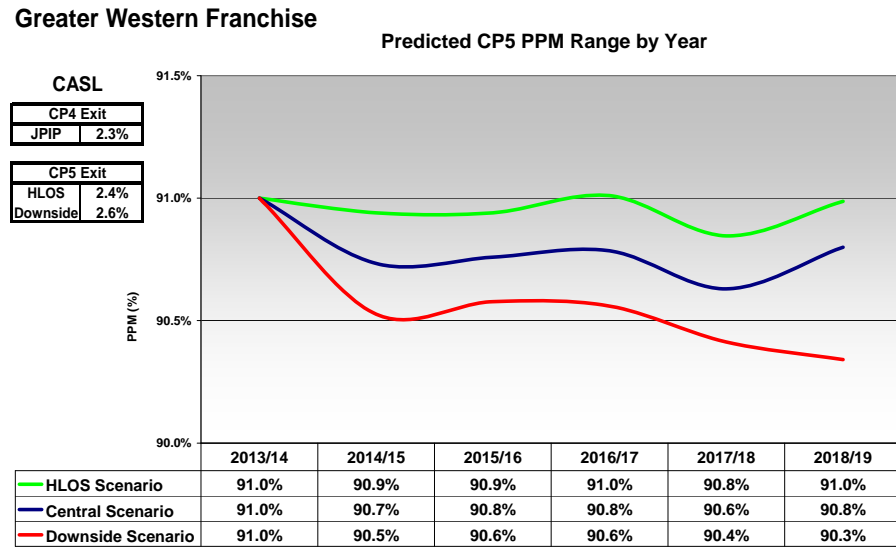
- Large impact from Thameslink capacity restrictions in London Bridge area throughout CP5
- Dip expected in Dec 2018 as the new Thameslink timetable is introduced which increases congestion and interaction between service groups.
- Gatwick remodelling and Arun valley re-signalling benefits will be realised in 2014/15.
- Levels of confidence for these scenarios and additional forecasts are as set out in the National performance plan summary.

Figure 3.5: CP5 PPM Range Forecast for First Capital Connect



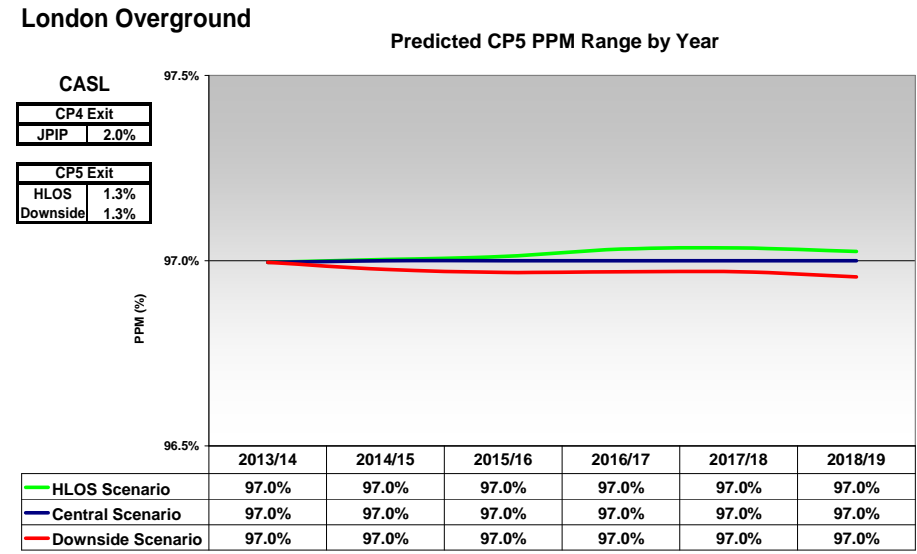
- Expected dip in performance due to Thameslink London Bridge capacity restrictions during build phase
- The December 2018 timetable could impact performance due to anticipated large increases in traffic and interaction of additional service groups.
- Levels of confidence for these scenarios and additional forecasts are as set out in the National performance plan summary.

Figure 3.6: CP5 PPM Range Forecast for Greater Western



- Performance affected by large volume of projects including Reading and Crossrail, mainline re-signalling, electrification and introduction of new trains and additional services.
- Benefits will accrue as these projects are completed by 2018/19 but introduction of Crossrail services increases risk due to large additional traffic and interaction of new service groups.
- Levels of confidence for these scenarios and additional forecasts are as set out in the National performance plan summary.

Figure 3.7: CP5 PPM Range Forecast for LOROL



- Flat line trajectory due to no major investment and current excellent levels of performance.
- There is an anticipated large growth in traffic with the introduction of new East London Line services from December 2012, but this is not predicted to adversely affect performance.
- Levels of confidence for these scenarios and additional forecasts are as set out in the National performance plan summary.

Capacity and capability improvement plan

An assessment of the capacity and capability of the Sussex Route was carried out, in consultation with passenger and freight train operators, as part of the development of the Route Utilisation Strategies (RUS). The Sussex RUS, established in the summer of 2010, covers the BML, the Arun Valley, the East and West Coastways and the outer suburban routes within Sussex.

The South London RUS, established in summer 2008, covers the inner suburban lines and services in Sussex; namely slow line services via the West London Line (WLL), Norbury, Hackbridge, Streatham Hill, Sydenham and Tulse Hill to Victoria and London Bridge.

In July 2011, the London and South East RUS, was published. This RUS covered the whole of the London and South East area including the whole of the Sussex Route area. Demand forecasts were updated but there were no changes to the recommendations of the 2010 Sussex RUS and the 2008 South London RUS, which were all upheld.

The Network RUS, which incorporates a number of national work streams, also affects the Plan for the route, particularly the electrification strategy. The Network RUS consists of:

- Scenarios and Long distance forecasts – established August 2009;
- Electrification strategy – established December 2009;
- Stations – established October 2011;
- Rolling Stock – established November 2011;
- Alternative Solutions – Draft for Consultation published September 2012.

There are a number of other strategies that this Plan aligns with, including the Strategic Freight Network (SFN) which predicts freight growth to 2019 and 2030, and identifies a network of core and diversionary routes to allow more and longer freight trains to operate.

The integration of these strategies is key to the development of each route, as collectively they deliver the requirements for both passenger and freight demand in the future. The specification of capacity and capability requirements for the Route was updated in the Network Specification 2012 – Sussex Route and the supporting Route Specifications.

Route Context

The Brighton Main Line

The Brighton Main Line (BML) links Brighton, Gatwick Airport, and East Croydon with London Bridge/Thameslink core, Clapham Junction and London Victoria. The line is principally a commuter railway serving a range of commuter towns between these locations including Haywards Heath & Redhill. At the southern end of the route, as well as serving Brighton, routes connect from the West and East Coastway providing direct services from towns such as Littlehampton, Worthing, Hove, Lewes, and Eastbourne to London. Airport traffic to/from Gatwick Airport and leisure traffic to/from coastal locations provide the other key flows on the BML.

The line is an important freight route for the delivery of aggregates into the South East of England with heavily used terminals at Purley, Crawley and Ardingly. DB Schenker, Freightliner Heavy Haul and GB Railfreight all operate services on the BML at present.

The BML is a four track railway from Three Bridges northwards, where the routes from Horsham and the Arun Valley converge. Slow lines diverge via Redhill and rejoin the Fast lines south of Purley. Between East Croydon and both London termini four track railways exist to support the additional suburban traffic on these sections.

The Sussex Suburban Network

The Sussex inner Suburban Network provides a metro frequency service between London Victoria/London Bridge and the inner and outer suburban areas of south London that in most cases do not have tube links.

On the London Victoria side the key inner suburban routes diverge at Balham, with services operating to and from Sutton, Epsom and Dorking, Streatham Hill and Crystal Palace and West Croydon/East Croydon/Wallington. From London Bridge inner suburban services operate to and from Sydenham and Crystal Palace, and to the Croydon area, Beckenham and the Wimbledon Loop via Tulse Hill.

The outer suburban network provides services (usually at a lower frequency) between London Victoria/London Bridge and branches to East Grinstead, Tattenham Corner, Caterham, Redhill/Reigate and Oxted/Uckfield (from London Bridge only).

The Sussex suburban network is operated by Southern into the central London terminals of London Bridge and London Victoria. First Capital Connect operate services to/from the Wimbledon loop and the BML via Tulse Hill into the Thameslink core. London Overground Rail Operations Limited (Lorol) operate services from West Croydon, Crystal Palace and Clapham Junction to Highbury & Islington via the East London Line (ELL).

The Arun Valley Line

The Arun Valley provides a direct link from the West Coastway towns of Chichester, Littlehampton and Bognor Regis to London Victoria and London Bridge via Horsham. The line diverges from the West Coastway at Arundel and serves a number of small to medium sized towns between there and Horsham. From Horsham two routes into London are available, Arun Valley services taking the Sussex Route via Crawley and Three Bridges or via Leatherhead. The line is an important long distance commuter railway as well as attracting leisure and diversionary traffic.

All services on the Arun valley line are operated by Southern.

The West Coastway

The West Coastway line serves the highly populated coastline between Brighton and Portsmouth, serving major towns such as Hove, Worthing, Littlehampton, Bognor Regis (by way of a branch from Barnham) Chichester and Havant (where the boundary with the Wessex Route is met). Services extend beyond this point to Portsmouth Harbour and Southampton Central.

The route is characterised by short hop journeys between the towns along the line of route rather than long distance trips and the service patterns reflect this demand with even the fastest services between Southampton Central/Portsmouth Harbour and Brighton calling at many locations in between.

All services on the West Coastway (within Sussex Route boundaries) are operated by Southern, with the exception of a small number of trains per day operated by First Great Western (FGW) between Brighton and the West of England.

The East Coastway

The East Coastway line service links Brighton with Lewes, Eastbourne, Newhaven and Bexhill. The boundary with the Kent route is reached at Collington but services continue to Hastings, Ore and in some cases Ashford International. Southern operate all services on the route.

The Coastway route caters for two key commuter flows, passengers from Eastbourne, Lewes and other smaller stations on the line travelling to/from London via Keymer Junction, and more local commuters travelling to/from Brighton.

Leisure traffic is substantial, particularly in the summer months and the opening of the new Brighton and Hove Albion football stadium at Falmer has generated large flows on the western end of the route on match days.

West London Line

The West London Line runs from Clapham Junction (with connections from the suburban lines to/from East Croydon) via a number of stations in West London to Shepherd's Bush and thence to the West Coast Main Line or the North London Line (NLL) at Willesden Junction.

Through services from the Sussex Route area to the West Coast Main Line operate on this route in the shape of East Croydon to Watford Junction and Milton Keynes Central services operated by Southern. Southern also operate a number of peak only shuttle services between Clapham Junction and Shepherd's Bush. The rest of the service on the WLL is provided by LOROL, who operate a metro frequency service between Clapham Junction and the NLL at Willesden Junction.

The WLL is also the busiest freight line within the Sussex Route area, being the only line that is both W9 gauge cleared and electrified between the South east of England and the rest of the UK. DB Schenker, Freightliner, GB Railfreight, Direct Rail Services and Colas all use the line.

Demand and Capacity – Key Passenger markets and traffic flows

The Brighton Main Line (BML) and outer suburban branches

The London and South East RUS projects significant growth in the outer commuter markets over the next 20 years, 37 per cent to London Victoria and 83 per cent to London Bridge during the high-peak hour. It is important to note that growth on main line and outer suburban services is predicted to be significantly higher than growth in the inner suburban area. This is linked to the feasibility of further housing development and population growth in the inner suburban area versus the development plans that exist in the outer suburban area and on the BML.

Current crowding on the BML is very train specific. Significant levels of standing exist as far out as Haywards Heath in the morning peak, but tend to occur on either London Bridge bound services (which will be relieved by Thameslink KO2 in 2018) or Brighton Main line services to Victoria which offer interchange at Clapham Junction.

On outer suburban services, standing of 30 to 75 people per carriage can take place as far out as Purley Oaks on Caterham and Tattenham services. Crowding on the East Grinstead and Uckfield routes has been substantially relieved by the East Grinstead 12 car project delivered in December 2011. A small number of specific Uckfield peak services remain overcrowded but this is due to the availability of diesel rolling stock, not the capability of the infrastructure to handle longer trains.

Sussex Inner Suburban

The London and South East RUS predicts relatively modest growth on the inner suburban routes over the next 20 years, with 6 per cent growth predicted to London Victoria and 25 per cent to London Bridge in the high peak. There will remain a need to keep these projections under review. In the decade 1998-2008 it was not unusual for the 20 year growth projection to London Victoria to be met in the space of 1-2 years as demand boomed on the suburban services. Whilst growth has slowed markedly since the recession, the impact of 10 car lengthening may well stimulate further growth.

Growth on ELL services is expected to be 132 per cent over the 20 years to 2031.

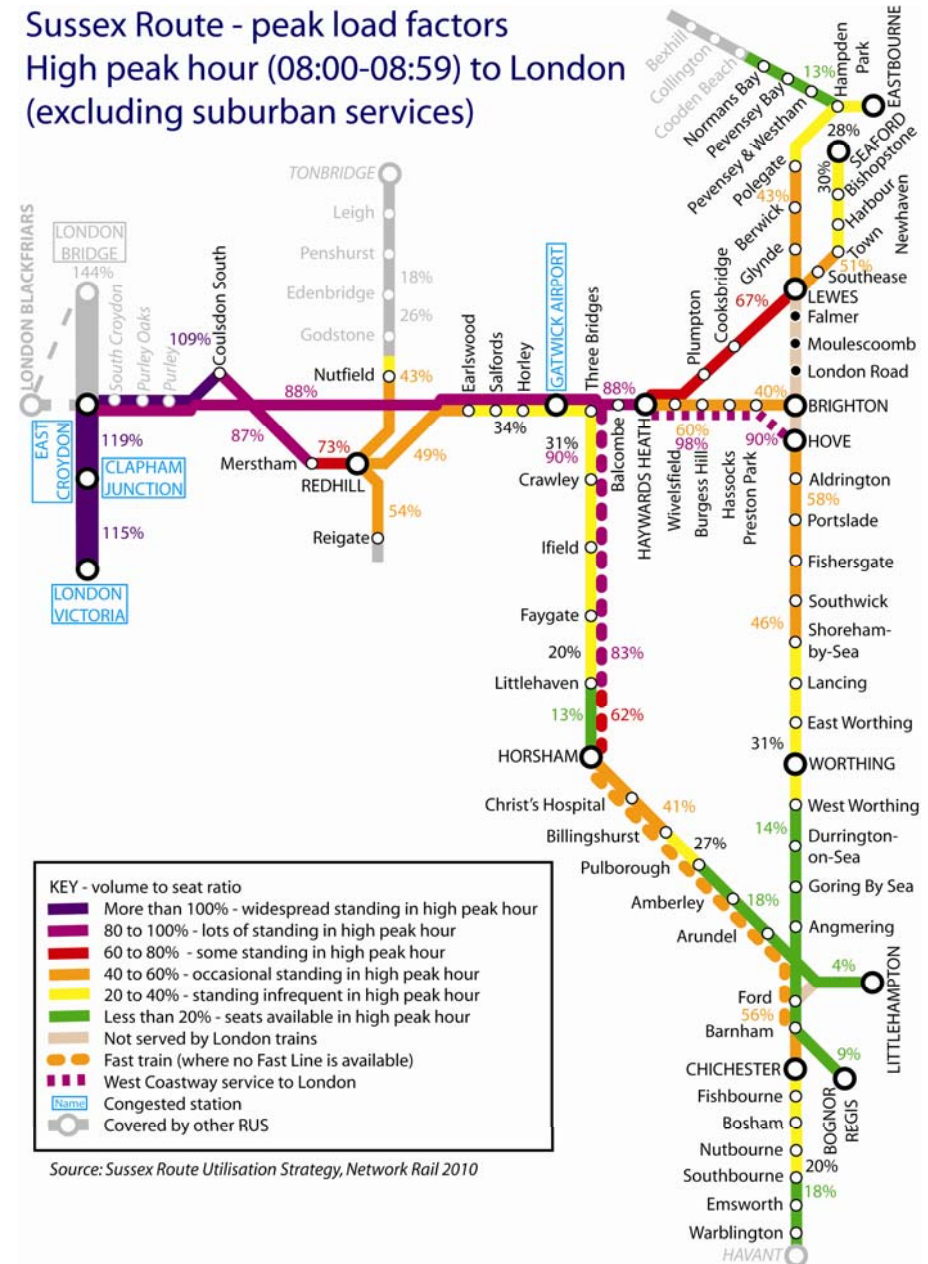
Current crowding levels during the high peak hours on the inner suburban routes are very route and time specific. London Victoria services via Clapham Junction tend to reach significant levels of crowding – 40 to 75 standing per carriage from Balham inwards. Crowding on suburban services into London Bridge has been substantially relieved by the Sydenham slow line 10-car project) and the opening of the ELL Phase 1 in 2009. As a result both Southern and LOROL services are currently providing ample capacity on this route.

West London Line

The WLL is a unique sub market within the inner suburban area, where growth is expected to rapidly outpace that of other services. The London and South East RUS predicts 109 per cent peak passenger growth to 2031.

This is against a backdrop of significant overcrowding of Southern services from East Croydon and Clapham Junction onto the WLL during the peak with 50-100 standing per carriage on some peak services north of Clapham Junction.

Sussex Route - peak load factors High peak hour (08:00-08:59) to London (excluding suburban services)



Source: Sussex Route Utilisation Strategy, Network Rail 2010

Demand and Capacity: Freight

Whilst there are relatively low levels of freight traffic originating within Sussex a number of important traffic flows transit through and to the Route.

Of the flows destined to/originating in the Route, foremost is the movement of aggregates (predominantly stone and sand) from the Mendips/Leicestershire/North Kent into terminals at Purley, Crawley, Ardingly, Battersea and Chichester. Typically between one and three trains per day for each terminal operate. In addition, occasional aggregates trains use the terminal at Salfords north of Gatwick and a weekly train of ash from an incinerator at Newhaven commenced in 2011 to Brentford. Flows of aggregate into Newhaven from Acton are likely to start shortly.

Aside from these flows that operate to/from destinations on the Route, there are a number of key flows that transit the route. Foremost of these is Channel Tunnel traffic to/from the Midlands/North West/Great Western traversing the WLL and which also regularly uses the Channel Tunnel diversionary route via Tonbridge – Redhill and the BML slow lines to reach the WLL at Clapham Junction.

It is not expected that the frequency of these flows will alter significantly in the near future; some incremental growth may be accommodated through lengthening existing services. As noted above an additional path to/from Newhaven was introduced in 2011.

There is also a possibility that during CP5 freight traffic (waste) may commence from Warnham and use the Horsham – Dorking line, which does not presently see freight traffic.

Sufficient capacity exists in the current timetable for the Channel Tunnel diversions detailed above. Current take up of paths means there is ample capacity for growth. This is true of the WLL also where on average a timetable an hour in each direction is currently utilised – but significant additional paths are available in the off-peak as and when required. The growth in intermodal traffic alluded to in the national forecasts is predominately related to the Haven Ports and Southampton and is therefore unlikely to drive large growth over current traffic levels on the West London Line.

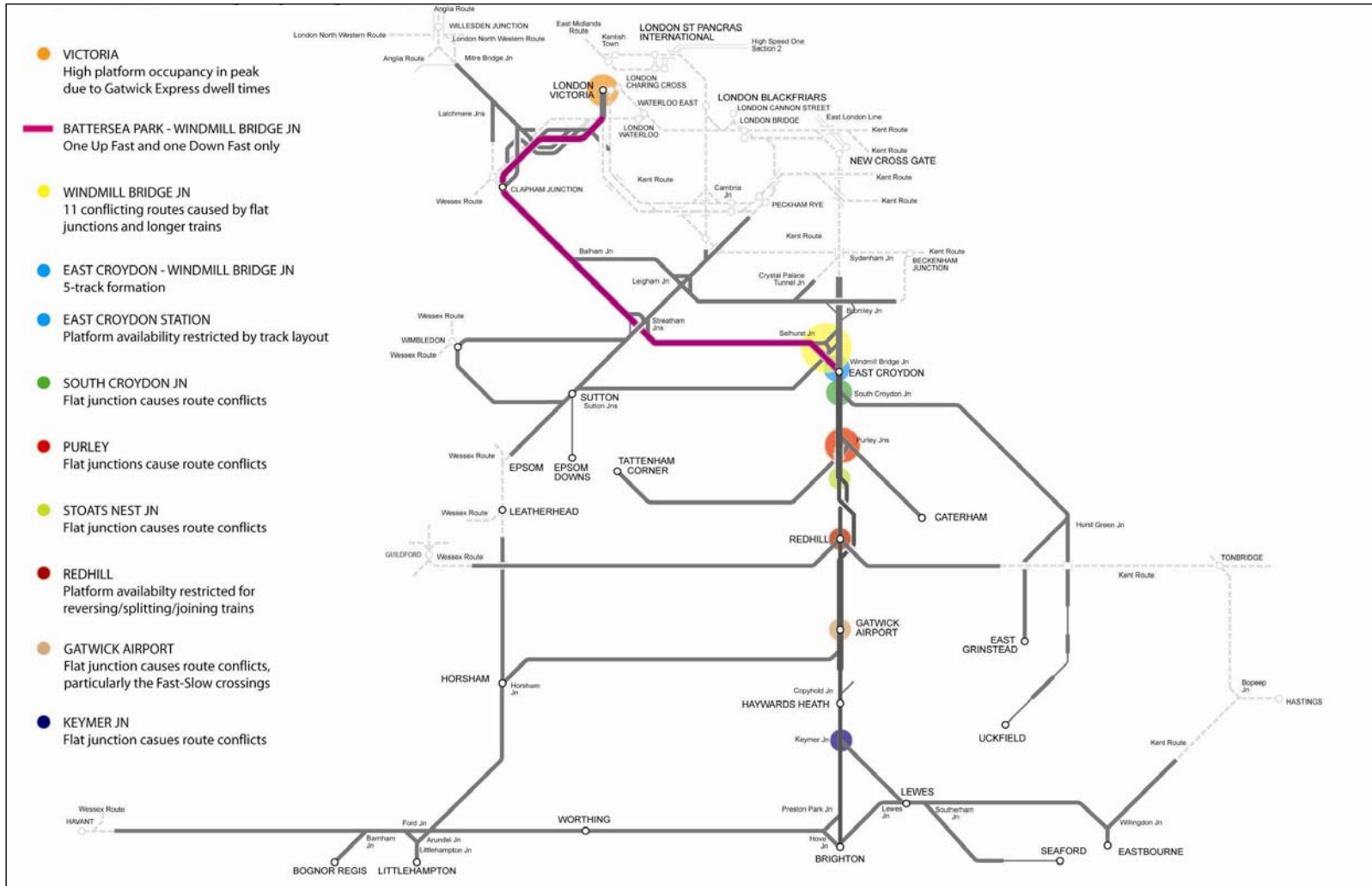
Current infrastructure capability and capacity

The principal infrastructure characteristics in terms of capacity and capability of the Sussex Route were analysed as part of the South London, Sussex and London and South East RUS and updated and published in the 2011 Route Specifications.

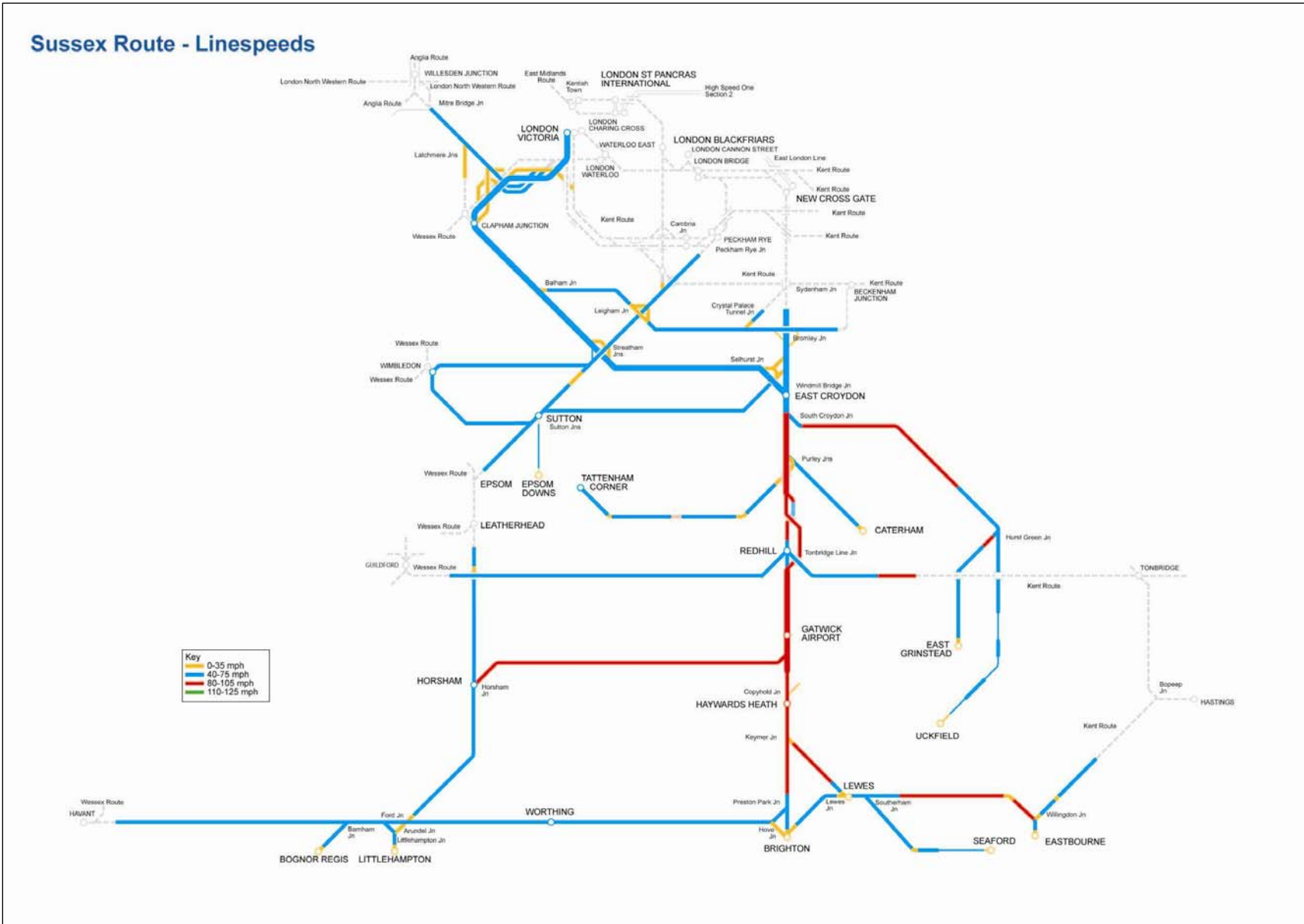
A graphic summary is included over the next few pages. Starting with figure 3.9 charting the Key capacity constraints on the route, followed by a series of maps summarising key capability measures on the Route.

Capacity

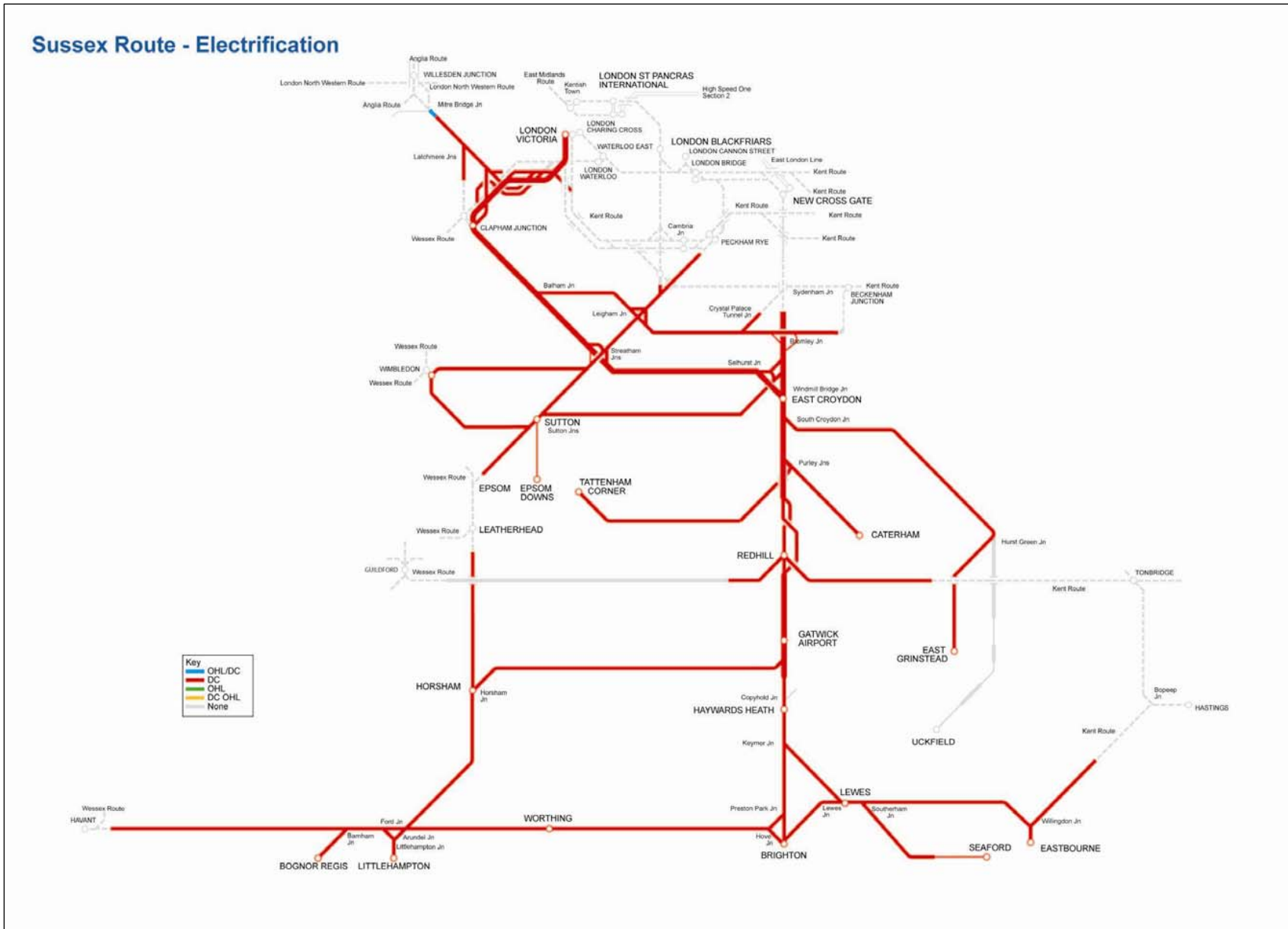
Sussex Route – Key capacity constraints



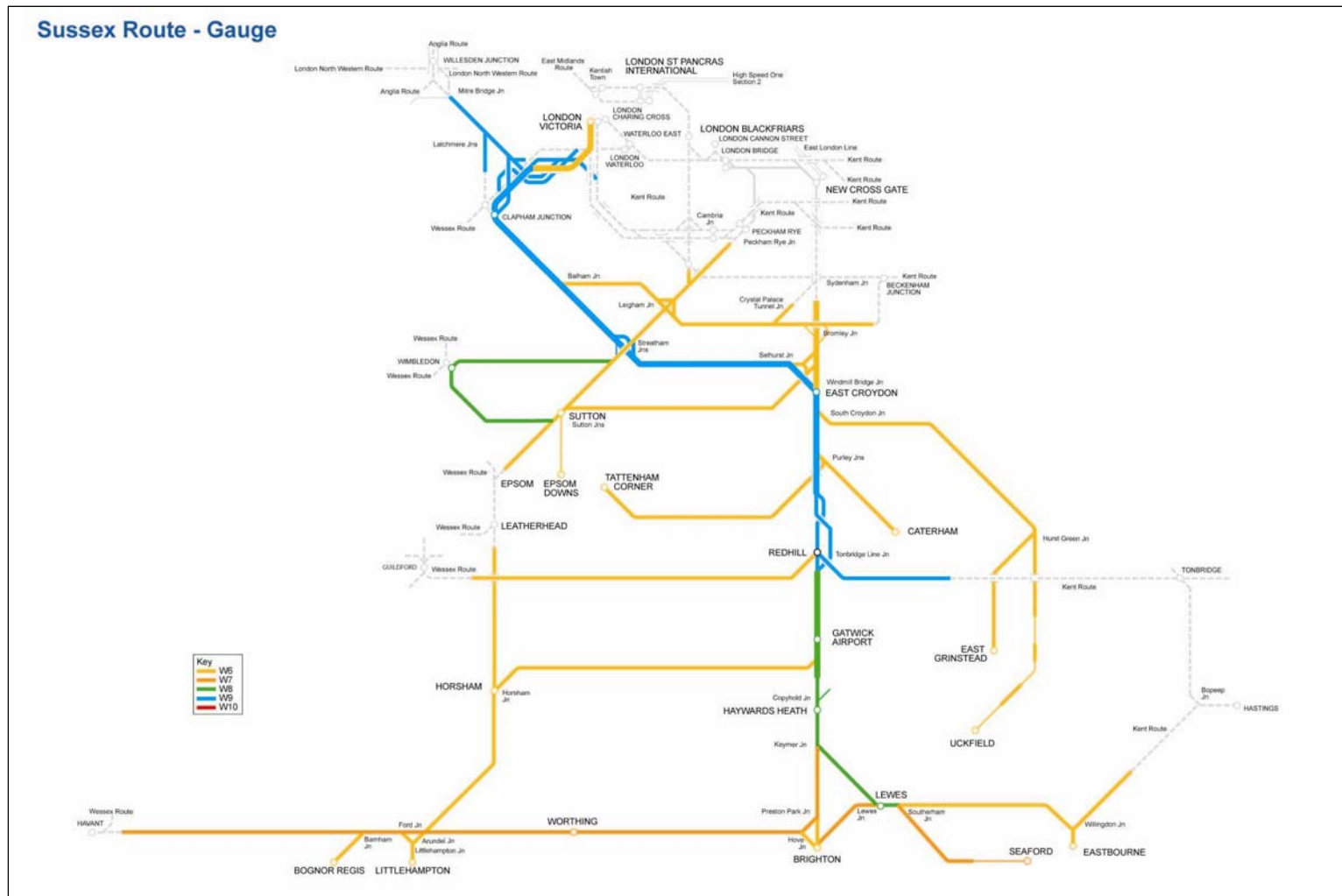
Current Linespeeds on the Sussex Route



The types of electrification on the Sussex Route



Gauging abilities on the Sussex Route



As part of the Infrastructure Capability Programme a number of Network Changes to Route Availability and Gauge, which may affect some of the detail of these maps, has been issued for consultation. Details of the Network Changes being consulted and those that have been established can be found on the Network Rail website.

Current capability is shown in the Network Rail Sectional Appendix.

The target numbers of arriving passengers to be accommodated in the morning peak is shown below. The load factor is defined as the number of passengers carried on a train as a percentage of the design capacity of the train (including seats and standing allowances).

Planned investment to improve capacity and capability in CP4 (2009-14)

As part of the CP4 Delivery Plan, Network Rail committed to a series of capacity improvements to meet the HLOS targets outlined above. These were primarily based on South London and Sussex RUS recommendations for train lengthening on inner and outer suburban services and became commitments within the Southern franchise when it was relet during 2009. The majority of work from Network Rail's point of view has involved lengthening platforms and associated signalling and track alterations.

Sussex Route will by the end of the control period have comfortably exceeded the metric targets set by the DfT for London Victoria in the CP4 HLOS. London Bridge/London Blackfriars will remain short of target due to the delay (versus expected delivery time scale at the start of CP4) in the procurement of Thameslink rolling stock. Despite this delay the infrastructure required to meet the London Bridge/London Blackfriars metric has been completed by Network Rail against target.

Service Changes and Projects in CP4 to meet the capacity challenge

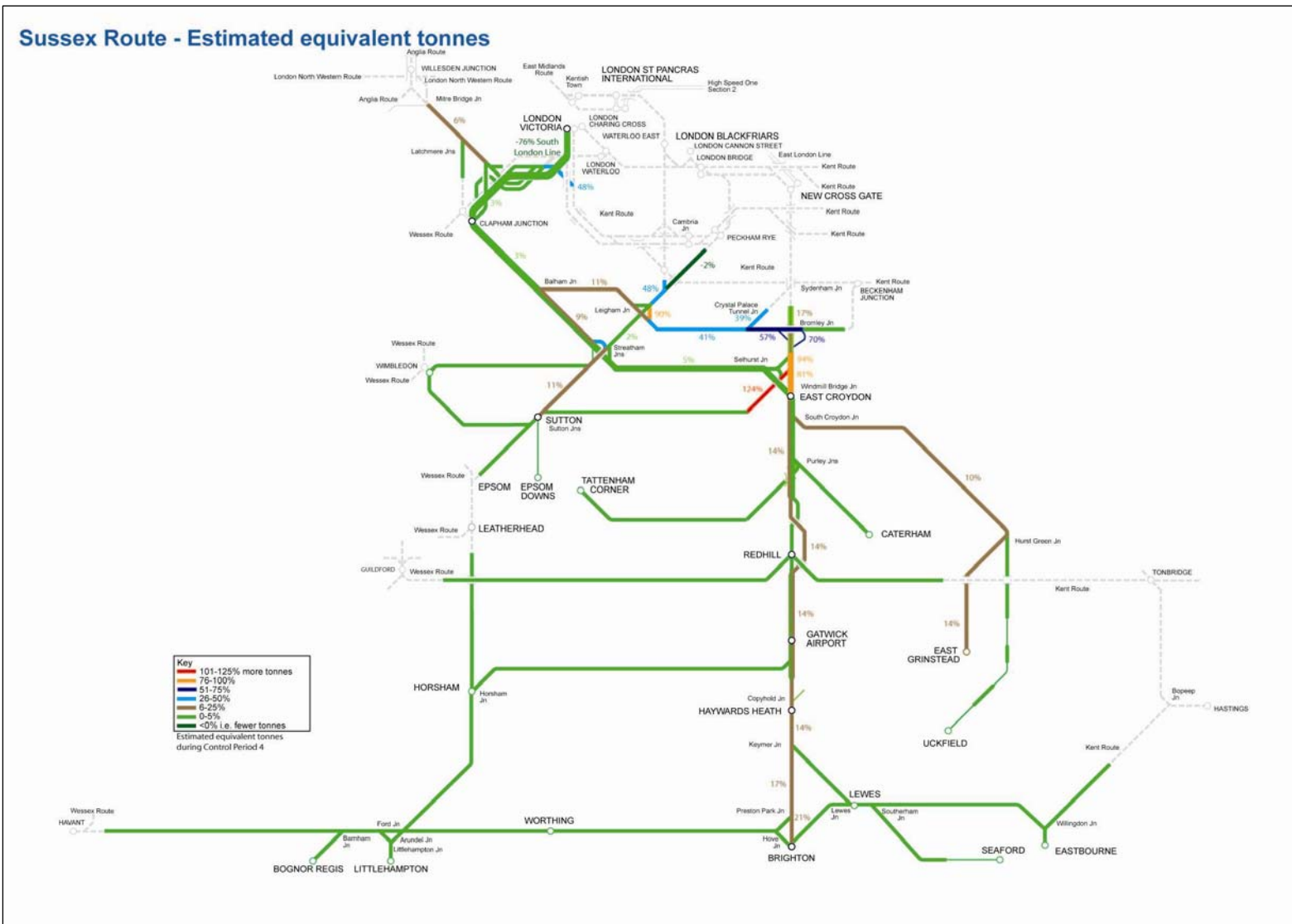
Whilst the HLOS metrics analysis above is a useful fixed measure as to how the Route is performing against regulatory targets, it is of limited use to the Asset Managers and those responsible for maintaining the route, in understanding changes to usage of the Sussex Route over the course of CP4.

The Train length and service frequency table (below) captures all significant changes to train lengths and service frequency on routes into London as a timeline in CP4. The map below the table outlines the estimated impact of all of these changes route section by route section on the equivalent tonnage to be accommodated on the Route in CP4.

Train length and service frequency changes in CP4 on the Sussex Route

Date	Service Change	Routes Affected on Sussex
Dec 2009	Introduction of 4 tph West Croydon – ELL core services (4 car 378) Introduction of 4 tph Crystal Palace – ELL core services (4-car 378)	West Croydon, Gloucester Road Junction, Norwood Junction, Sydenham, New Cross Gate Crystal Palace, Sydenham, New Cross Gate
Dec 2009, 2010 timetable changes	Strengthening or 1 or 2 high-peak Horsham <> London Bridge services 8 – 10/12-car (377 units)	Horsham – Three Bridges – East Croydon – London Bridge
Dec 2011 timetable change	Implementation of Thameslink Key Output 1. 2 trains in each peak Brighton – Bedford, 12-car 377 instead of 8-car – includes contra peak workings (in each peak)	Brighton – Three Bridges – East Croydon – London Bridge/Tulse Hill/ Elephant and Castle
Dec 2011 timetable change	6 trains in high peak 10 car instead of 8-car on Sydenham slow lines (Norwood Junction to London Bridge). Class 377 units	West Croydon/Norwood Junction – London Bridge via Sydenham
Dec 2011 timetable change	4 trains in high peak hour 8 to 12-car East Grinstead <> London Bridge/ London Victoria (2tph each). Some minor shoulder peak strengthening also	East Grinstead – South Croydon – Norwood Junction – London Bridge East Grinstead – South Croydon – Norwood Junction – London Victoria
Dec 2012	South London Line service withdrawal. 2tph removed London Victoria – Battersea Park – Atlantic lines – Denmark Hill – South Bermondsey – London Bridge	London Victoria – Battersea Park – Atlantic line – Denmark Hill – South Bermondsey – London Bridge
Dec 2012	Reduction of Southern high peak operation into London Bridge low level from 30 tph to 24 tph. Services removed include 2 tph South London line service above, plus probably 1 x Uckfield terminates East Croydon, 1 x Sydenham slow line service	East Croydon – Norwood Junction – London Bridge
Dec 2012	2 Up morning peak Purley to London Bridge services to operate at 10 rather than 8-car	Purley – East Croydon – Norwood Junction – London Bridge
Dec 2012	1 additional peak WLL service between Clapham Junction and Watford Junction. 4-car 377	Clapham Junction – Shepherd's Bush – Watford Junction
Dec 2013	2 Down evening peak London Bridge to Purley service to operate at 10 rather than 8-car	Purley – East Croydon – Norwood Junction – London Bridge
Dec 2013	14 high peak 8-car-suburban services between the Sussex suburban route/Balham and London Victoria to operate at 10 rather than 8-car. Some shoulder peak lengthening in addition	Horsham – Epsom – Hackbridge – Balham – Victoria Sutton – Wallington – Norbury – Balham – Victoria London Bridge – Crystal Palace – Streatham Hill – Balham – London Victoria

Tonnage abilities on the Sussex Route



In addition to the train lengthening and service change proposals outlined for CP4, there are a number of other schemes summarised below which have been/are being delivered in CP4 on the Sussex Route in order to increase capacity and improve journey times and performance.

A full list of schemes is listed in full elsewhere in this report; the list below is the most significant interventions only.

Gatwick Airport track layout and additional Platform 7

This scheme reduces the number of conflicting moves between the fast and slow lines. It will provide additional platform capacity on the fast line side of the station. It will also provide sufficient platform capacity on the slow line side for a future second Gatwick Airport to Reading service in CP5.

North Pole turn back

This scheme allowed an additional Southern shuttle service to operate on the WLL from May 2009.

Falmer signalling headways

This scheme will reduce the signalling headways in the Moulsecoomb and Falmer area. It will help to improve performance and journey times and may allow additional services on match days at the new Brighton and Hove Albion football stadium in Falmer.

Arun Valley resignalling

This scheme will reduce the signalling headways on the route as an enhancement on the back of the signalling renewal. It will also improve performance as set out in the Sussex RUS.

East Sussex resignalling

This will involve a series of linespeed improvements on the back of the planned signalling renewals project. It will help reduce the through Ashford International to Brighton journey times.

Proposed investment to improve capacity and capability in CP5

The Route Plan has previously outlined the RUS predictions for demand growth on the BML, suburban routes and the WLL over the next 20 years. Major steps have and will be taken in CP4 to address much of this growth. In particular the inner suburban train lengthening programme will eradicate most crowding in the inner suburban area. The outer suburban train lengthening (East Grinstead and Purley) in CP4 will take significant steps to reduce crowding on main line services from East Croydon inwards.

The key challenges in CP5 will therefore be crowding on the WLL and remaining crowding on main line services. We have set out the service changes that will address these issues in CP5 and alongside these interventions the relevant Network Rail projects that are designed to facilitate the service changes.

Passenger services on the Sussex Route operated by Southern, FCC and FGW are all in the process of being re-franchised with new franchises in place between 2013 and 2015. For this reason the anticipated service changes detailed below are only Network Rail's current expectation and they do not currently represent TOC commitments.

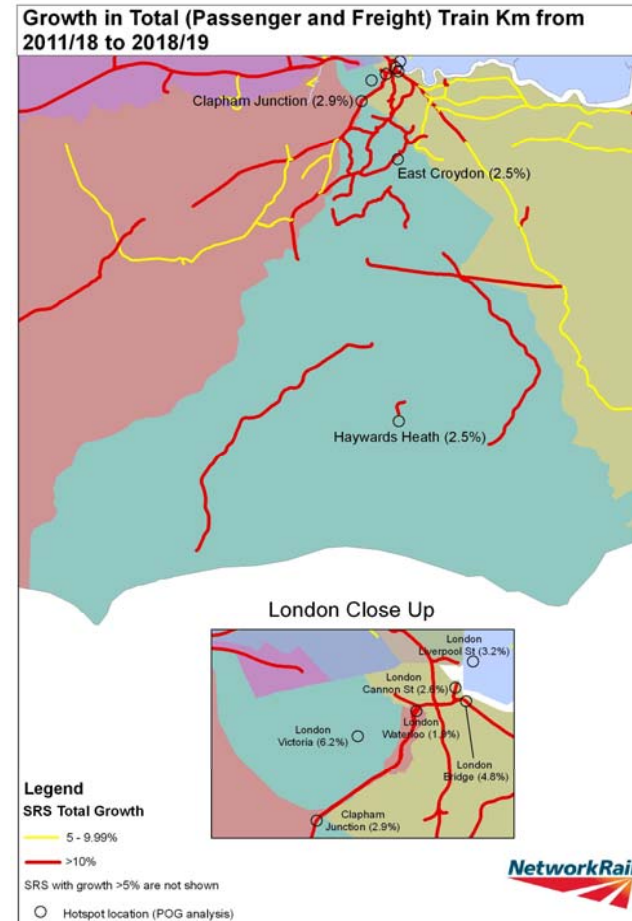
How the individual projects contribute to the HLOS are detailed outside of this Route Plan document.

Other Infrastructure interventions on route

HLOS specified projects

- SE018 London Victoria station passenger capacity improvements
- SE010 Norwood Junction Platform 6&7 Turnback
- DP021 South London HV traction power upgrade

Route performance hotspot graphic – growth in total (passenger and freight) train km from 2011/12 to 2018/19



Proposed investment to improve capacity and capability in CP5 (2014-19)

Date	Service Change	Associated Project	Route affected
May 2014	8-car Southern operations on WLL. 4 or 5 peak diagrams only	8-car platform lengthening and associated signalling alterations at Clapham Junction	East Croydon-Norbury-Clapham Junction – Shepherds Bush – Watford Junction
December 2014	Diversion of Brighton – Thameslink core services via Tulse Hill and Elephant and Castle (4tph)	Reliability strengthening work on Tulse Hill Route Norwood Junction Platforms 6 and 7 reversible scheme	East Croydon – Streatham Common – Streatham – Tulse Hill – Elephant and Castle. Norwood Junction – Crystal palace – Tulse Hill – Elephant and Castle
CP5 Date to be determined	Redhill – London Victoria high-peak services – remaining short formed strengthened 8 to 12-car (2 trains per peak)	Redhill Platform 0	Redhill – East Croydon – London Victoria
CP5 Date to be determined	1 x additional peak path Redhill corridor to London Victoria	Redhill Platform 0	Redhill – East Croydon – London Victoria
CP5 Date to be determined	Extension of 2nd train Reading train in most hours from Redhill to Gatwick Airport	Redhill Platform 0	Redhill – Gatwick Airport
CP5 Date to be determined	Strengthening of peak Uckfield line services to 8-car (and possibly 10-car in the longer term)	None for 8-car. Platform lengthening on Uckfield branch for 10-car	Uckfield – Hurst Green – South Croydon – Norwood Junction – London Bridge
CP5 Date to be determined	N/A	Victoria Station concourse decongestion works	N/A
CP5 Date to be determined	N/A	Wimbledon Dispersal Bridge (linking Sussex Route platform 10 and Tramlink with Wessex suburban platforms)	N/A
December 2018	Phased introduction of Thameslink Key Output 2 timetable. 4 trains per hour Brighton – Bedford throughout the peak at 12-car via London Bridge. Horsham/East Grinstead/Three Bridges/Caterham/Tattenham <->London Bridge services all extended through Thameslink core	Thameslink London Bridge works and associated power supply works on the Sussex Route	Brighton – Haywards Heath – East Croydon – London Bridge

CP6 and beyond

Network Strategy and Planning and the Route are currently developing a longer term plan for the BML, based on a two pronged approach:

- Making best use of the opportunities presented in CP6 by Three Bridges resignalling to de-conflict several key junctions on the Sussex Route including potentially; Keymer Junction, Stoats Nest Junction and East Croydon Junction (Windmill Bridge), plus reviewing CP6 options at London Victoria.
- Working with Transport for London (TfL) on longer term strategy for new cross-London links.

The key constraints on the route are well understood and the challenge is providing the right infrastructure to enable, in the long term, additional peak paths all the way through to central London. Further information on the plans being developed will be set out during 2013.

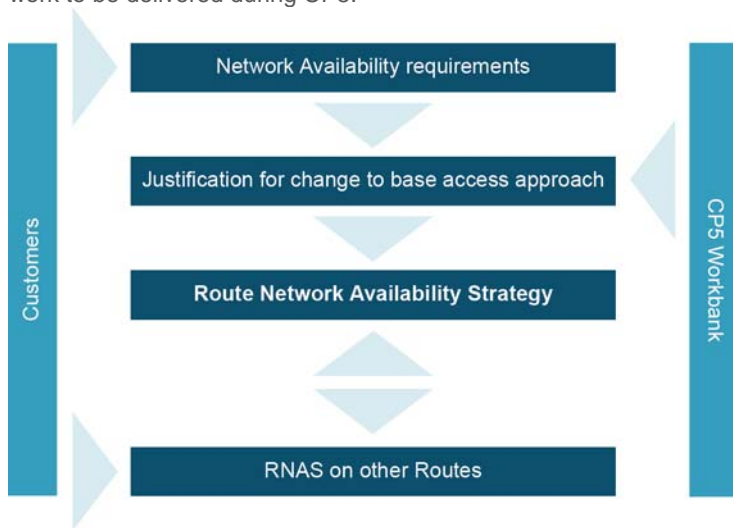
The Route will support Network Strategy and Planning in their discussions with the DfT to determine and then developed in CP5 those identified CP6 enhancement projects. It is understood that these feasibility workstreams will be funded from the centrally held CP6 Development Fund.

Sussex Route Network Availability Strategy

The Sussex Route serves a diverse set of markets ranging from long distance leisure and business travel and shorter distance commuter travel into London. The route is also of vital importance to freight, particularly as a diversionary route for Channel Tunnel freight services. The 'availability strategy' has been developed to align with the Route Output specification which is detailed in the 'Route Performance and Capability Improvement' section of this Route Plan.

Process

Network availability is about striking the right balance between when passengers wish to travel and when the infrastructure needs to be maintained, renewed and enhanced in order to maximise net industry value and revenue. The main drivers are customer requirements and the work to be delivered during CP5.



To develop a CP5 strategy for network availability the Route has been in dialogue with customers and across relevant teams within Network Rail. For inter-route operators the Route are co-ordinating access principles with other Network Rail routes. The approach adopted in CP4 provides the starting position for this.

The Sussex Route Network Availability Strategy (RNAS) has been and will continue to be reviewed and executed in line with the Kent, Wessex, Western and East Midland's strategies to maintain consistency at the route boundaries and for our customers. It will also be reviewed together with the Kent and Wessex route strategies at the South East Programme Delivery Group (SE PDG).

Key routes and flows

In support of embedding network availability, the industry prioritised a number of key flows at the start of CP4 as part of a Route Categorisation initiative. For passenger routes, this was based on those flows carrying high numbers of passengers between important conurbations. A number of strategic national freight flows were also identified. The key routes identified for the Sussex Route are in Figure 4.2.

Figure 4.2 Route Categorisation and key routes identified in CP4

Passenger routes	Freight routes
London Victoria – Brighton London Bridge – East Croydon Bedford – Brighton	Dollands Moor – Wembley via Redhill and the West London Line

Passengers travelling between the key intermediate stations on the passenger routes are not to be transferred onto buses unless absolutely necessary and where trains are diverted the aim is to limit increases in planned journey time to 25-30 per cent. For freight, the route seeks to provide a through route from origin to destination, making best use of alternative routes.

Following consultation with Sussex Route customers, the most important end-to-end flows for network availability for CP5 have been confirmed and are listed in figures 4.3 and 4.4.

Figure 4.4 Key freight routes

Operation	Strategic freight route
Freight	Channel tunnel freight services are sometimes diverted via Redhill (Diesel traction only when diverting via Redhill)

The priority for the network availability strategy is to protect these key flows, so far as it is practical to do so. For the key passenger routes, this means limiting the increase in journey times when considering the available options, such as diversionary routes, if the normal route is blocked. The strategic freight flow identified above is taken from the national freight network availability plan, and the need to ensure a suitable through route, utilising appropriate diversions, remains the overriding concern.

In terms of change from CP4 to CP5 it is the fact that the quantum of key routes and flows identified through consultation has increased. This increase places additional constraints around the maintenance, renewals and enhancement activities during CP5 and thus the efficiency opportunities.

Figure 4.3 Key passenger flows

Operator	Key routes	Important intermediate stations
Southern Railway	London Bridge – East Croydon	East Croydon
	London Victoria – Brighton	Clapham Junction, East Croydon, Gatwick Airport, Haywards Heath
	London Bridge – Horsham	East Croydon, Purley, Redhill, Gatwick Airport, Three Bridges, Crawley
	London Victoria – Littlehampton	East Croydon, Gatwick Airport, Haywards Heath, Hove, Worthing
	London Victoria – Eastbourne	East Croydon, Gatwick Airport, Haywards Heath, Lewes, Eastbourne, Bexhill
	London Victoria – Portsmouth	East Croydon, Gatwick Airport, Three Bridges, Crawley, Horsham, Chichester
	London Victoria – Dorking	Clapham Junction, Sutton, Epsom
	London Victoria – East Grinstead	Clapham Junction, Oxted
	London Victoria – Sutton	Clapham Junction, Balham, Streatham Common, Streatham Hill, West Croydon
	Brighton – Ashford International	Lewes, Eastbourne, Bexhill, Hastings, Rye
First Capital Connect	Brighton – Portsmouth Harbour	Hove, Shoreham, Worthing, Littlehampton, Bognor Regis, Chichester
	Bedford – Brighton	Luton, St. Albans, London St. Pancras International, London Blackfriars, East Croydon, Gatwick Airport, Haywards Heath
LOROL	London Blackfriars – Sutton	Wimbledon, Carshalton
	Highbury & Islington – West Croydon	
	Highbury & Islington – Crystal Palace	
	Willesden Junction – Clapham Junction	

Customer priorities and expectations

In terms of service requirements for network availability, the table below highlights additional requirements that have been identified with customers and key stakeholders for CP5.

Specific service aspirations for CP5

Operator	Service aspirations
Southern Railway	<ul style="list-style-type: none"> • Protection of key flow between London and Brighton • Increased service levels on Sundays
First Capital Connect	<ul style="list-style-type: none"> • 'Core' available at all times, except for 0145 to 0715 on Sunday mornings • Fulfil suppressed demand for an overnight service between Three Bridges and Brighton
LOROL	<ul style="list-style-type: none"> • Increased service levels on Sundays
FGW	<ul style="list-style-type: none"> • Protection of key flows
Freight	<ul style="list-style-type: none"> • Planning of access restrictions co-ordinated across Network Rail routes

Network availability strategy and Access

The Sussex Route network availability strategy for CP5 is based on the key routes and access principles that have been agreed with our customers for CP5. For the key passenger routes and freight flows identified, tables have been developed to establish the outcomes for network availability that the industry will aim to deliver. This includes the specific access principles for major works, and any exceptions to the normal agreed approach.

The Sussex network availability strategy is based on the acceptance that Sussex Route is now realistically at capacity given the volume of trains and performance capability. In the absence of a compliant diversionary route, and in order to protect performance and existing services, availability should broadly remain at the levels at which they are at the end of this control period.

Given the high anticipated volume of Switch & Crossing renewals on Sussex Route in CP5, together with Thameslink Key Output 2 at London Bridge and other enhancements, there will continue to be significant disruptive access required. The Route are working with the Train Operating Companies (TOCs) to establish where alternative access strategies can be used (for instance midweek night track renewals); however early indications of this discussion show that this is more likely to be possible on the secondary routes away from the Brighton Main Line.

The flexibility provided by signalling schemes should enable alternative access options on some routes (for example bi-directional working); however the extent that this can be exploited has yet to be determined.

Enablers of availability

Several projects will be delivered in CP4 to support the access strategy on the Sussex Route in CP5

- At present there is no compliant diversionary route for the Brighton Mainline.
- The Arun Valley resignalling scheme will assist in making the Arun Valley a more compliant diversionary route.
- Balcombe to Copyhold Junction bi-directional signalling upgrade will allow trains to operate on this section of the Brighton Mainline during engineering works, where currently this is not possible.
- East Sussex Coastway resignalling will improve the capability, capacity and reliability of the East Coastway.
- The Sussex possession strategy meeting discusses future engineering access requirements, challenges work plans where appropriate and seeks alternative solutions that minimise the level of disruption experienced by passengers.

Anticipated CP5 initiatives that will support future network availability include Redhill Platform-0, Brighton and Lewes headway reduction scheme, West Croydon Track remodelling and Norwood Junction re-instatement of Platform 7. A full list of projects is detailed within this Route Plan and the Sussex RNAS.

Thameslink Key Output 2 resilience work bank has been approved by the Department for Transport (DfT) and instructed to Sussex Route for delivery in CP4 in readiness for robust divergence routes at the start of CP5.

The Sussex Route Asset Management Plan (RAMP) brings together the inspection, maintenance and renewal interventions for each asset discipline. The RAMP allows the opportunity to establish the most appropriate approach to asset interventions to deliver the required outputs for the minimum whole life, whole system cost.

The volumes of work contained within the RAMP will inform the view for CP5 works, as will the planned enhancement works. The works are captured on a multi-disciplinary time-chainage chart allowing works to be integrated to reduce the impact on availability levels in CP5.

Access principles for key passenger and strategic freight routes

The Sussex network availability strategy for CP5 is based on the 'key routes' and 'access principles' that are being agreed with our customers for CP5. For the key passenger routes and freight flows identified, tables will be developed to establish the outcomes for network availability that the industry will aim to deliver. This includes the specific access principles for major works, and any exceptions to the normal agreed approach.

Further details on the justification for the network availability strategy on key routes and the general access patterns on Sussex route for maintenance, renewals, enhancements and major projects for CP5 can be found in the Sussex RNAS.

Operations Plan

This section considers how the Sussex Route will deliver its operational plans, including signalling migration initiatives, European Rail Traffic Management System changes to electrical control, and heritage considerations the Route has in respect of its signal box inheritance.

CP4 and CP5 delivery

CP4 Delivery

At the end of CP4 there will be two signalling schemes that will have an impact on the Sussex Route for headcount reduction. The first – Arun Valley due to be delivered in October 2013 will see a direct saving of 14 signalling staff, with control being transferred to the existing Three Bridges Area Signalling Centre (ASC). The second, East Sussex will see the closure of 5 signal boxes and 1 gate box on the Route with a reduction of 28 signalling staff – there will be 6 positions created to operate the new workstation, so an overall saving of 22 signalling staff.

In November 2013 there will be a further reduction of 5 relief signalling staff and 1 Local Operations Manager following a review of the roles and responsibilities due to the 2 resignalling schemes.

In February 2014 Plumpton gate box will close which will result in a further reduction of 5 signalling staff.

CP5 Delivery

The Operating expenditure and efficiency forecasts can be found detailed within the final section of this plan. Additional costs will be incurred in CP5 due to the migration of signalling panels from London Bridge [Kent Route] to the Three Bridges ROC.

Some enabling elements of the strategy have been deployed in CP4 providing the capability to accelerate renewals investments to successfully reduce Operating Expenditure (OPEX) costs.

Rail Operating Centre (ROC)

The Sussex ROC at Three Bridges will be constructed by late 2012, and the first workstation will be operational in 2013 (East Sussex). Figures 5.1 and 5.2 show how control of the route will be consolidated into a lower number of workstations with an increased average span of control.

Currently in 2011/12, 6,792 Signalling Equivalent Units (SEUs) are controlled from 46 panels/signalboxes, giving an average of 111 SEUs per panel/signalbox. At the end of CP7, 6,690 SEUs will be controlled by 21 workstations, with an average of 319 SEUs per workstation.

Based on current analysis, the Three Bridges ROC will be the only signal boxes that will remain at the end of CP7. This is on the assumption that Bognor Regis Signal Box is decommissioned at the end of CP5 as detailed in this Route Plan The Sussex ROC plan for CP4 to CP6 is presented overleaf.

Figure 5.1 – Sussex ROC Signalling Equivalent Units (SEUs) per workstation

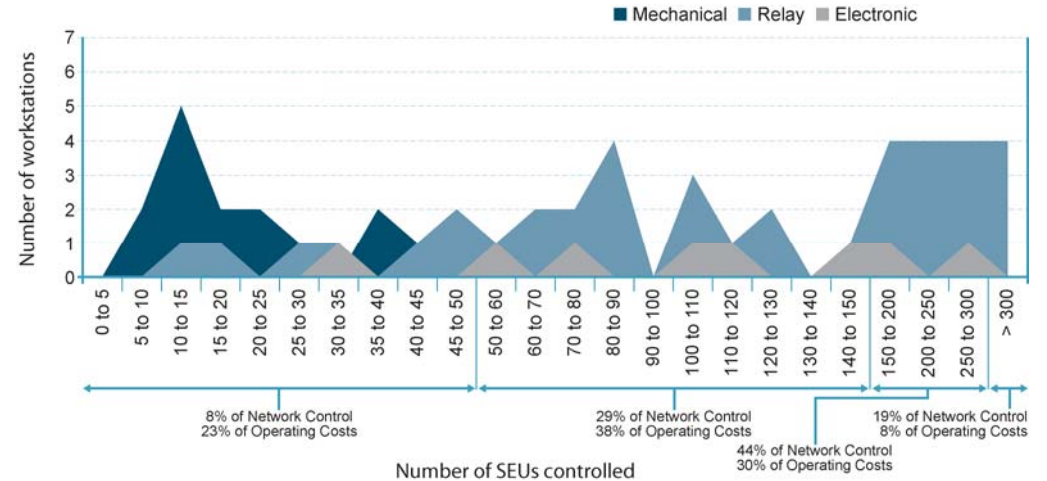
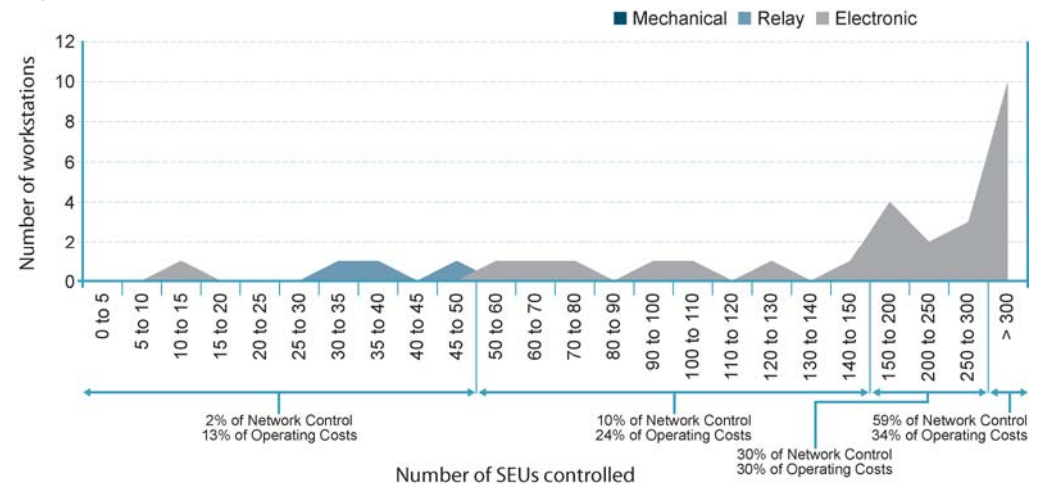


Figure 5.2 – Sussex ROC SEUs per workstation – End of CP7



Signalling migration synopsis

The Three Bridges ROC is currently being constructed. The ROC Migration Plan (Figure 5.3 and 5.4) details the resignalling and recontrol schemes resulting in migration to the ROC.

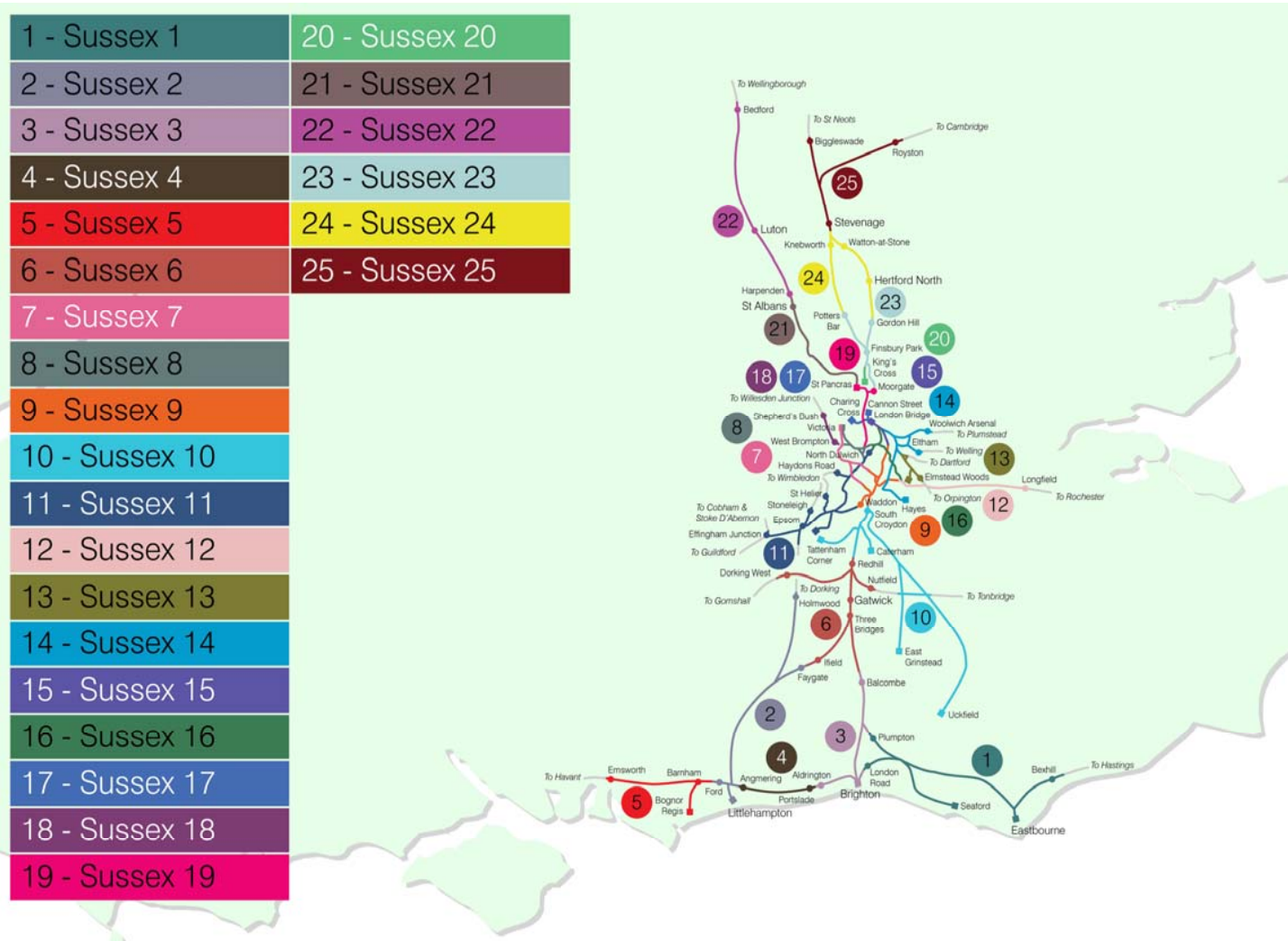
With the exception of some schemes (Arun Valley and East Sussex Coast) in 2013, the majority of activity takes place from 2015 to 2020. In 2015 schemes in Arundel, Lewes and Newhaven and West Sussex Coast result in 267 SEUs transferring, with 180 SEUs from Victoria part transferring in 2016. The most activity takes place in 2017 and 2018, with 1,084 SEUs transferring from Three Bridges Signal Box (SB) over these two years and an additional 217 SEUs from Victoria Signalling Control Centre (SCC) transferring in 2018. A further 473 SEUs transfer from Three Bridges Signal Box and 341 transfer from Victoria SCC in 2019 and 2020 respectively.

Figure 5.3 – ROC Migration Plan (Sussex)

Recontrol Year	Programme/Project Name	Signal Box and * where over multiple years
2012	Level Crossing Renewals [to Three Bridges Area Signalling Centre (ASC)]	Littlehaven Crossing Gated Box (XGB)
2013	Arun Valley (to Three Bridges ASC)	Amberley SB; Billingshurst SB; Pulborough SB
	East Sussex Coast (to Sussex ROC)	Berwick SB; Eastbourne SB Hampden Park SB; Pevensey & Polegate SB
2014	Level Crossing Renewals (to Three Bridges ASC)	Plumpton XGB
2015	Arundel (to Sussex ROC)	Arundel SB
	Lewes & Newhaven (Sussex ROC)	Lewes SB; Newhaven Harbour SB Newhaven Town SB
	Victoria (Sussex ROC)	Victoria SCC (Clapham)*
2016	West Sussex Coast (Sussex ROC)	Barnham SC Littlehampton SB
	West Sussex Coast (Sussex ROC)	Lancing SB
2016	Three Bridges (Sussex ROC)	London Bridge SB*
2017	Three Bridges (Sussex ROC)	Lovers Walk Depot Panel Three Bridges SB*
2017	Level Crossing Renewals (to Three Bridges ASC)	Whyteleafe XGB
2018	Three Bridges (Sussex ROC)	Three Bridges SB*
	Victoria (Sussex ROC)	Victoria SCC (Clapham)*
2019	Reigate (Sussex ROC)	Reigate SB
	Bognor Regis (Sussex ROC)	Bognor Regis SB
	Three Bridges (Sussex ROC)	Three Bridges SB*
2020	WLL (Sussex ROC)	Victoria SCC (Clapham)
	Victoria (Sussex ROC)	Victoria SCC (Clapham)*
	Oxted (Sussex ROC)	Oxted SB
2022	Three Bridges (Sussex ROC)	Selhurst Depot Panel
2023	West Coast (Sussex ROC)	Chichester SB
2040	Dorking (Wessex ROC)	Dorking SB

Sussex ROC – Signalling Migration Map

Figure 5.4 – Map showing each resignalling scheme that will migrate into Sussex ROC

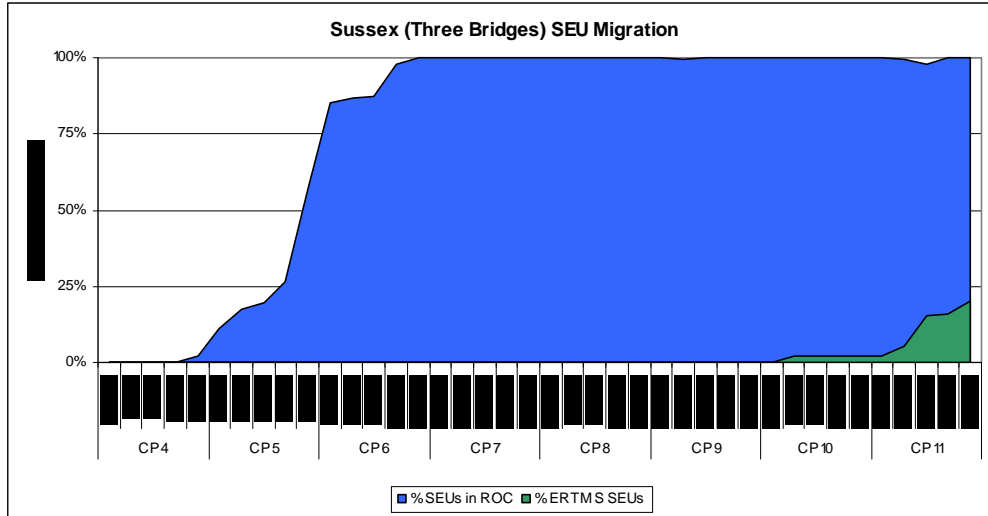


Note – workstation 22 (excluding W Hampstead) recontrolled to Derby ROC; workstation 23, 24 and 25 recontrolled to York ROC (excluding Kings Cross)

ERTMS on the Sussex Route

Conversion of SEUs for compatibility with European Rail Traffic Management System (ERTMS) on the Sussex Route commences in 2039/40 – see Figure 5.5.

Figure 5.5 – Sussex ROC SEU Mitigation



	CP4	CP5	CP6	CP7	CP8	CP9	CP10	CP11
% ERTMS SEUs	0%	0%	0%	0%	0%	0%	2%	20%
% SEUs in ROC	2%	57%	100%	100%	100%	100%	100%	100%

Electrical control

All existing electrical control supervisory systems are due for replacement by 2022. Within the existing 13 Electrical Control Rooms (ECR), the Route has 16 different control systems, none of which has a back up capability. The national strategy is mapped out in the overarching strategic business plan; for Sussex the electrical control will be relocated to the Three Bridges ROC – the relocation of which has been built into the Route plan.

Heritage considerations

Network Rail currently has over 800 signal boxes. The Operating Strategy will over time render an increasing number of them redundant. A nationally coherent route strategy needs to be developed to manage these assets, to avoid redundant structures remaining a liability to the company, and to comply with Network Rail's sustainability policy.

Many of the signal boxes are of interest to preservation societies and over 90 boxes are listed buildings – imposing legal requirements for Infrastructure Maintenance. To address these issues the National Operations team are liaising with listing bodies, the National Railway Museum, the Heritage Railway Association and Network Rail colleagues. These discussions are being informed by a comprehensive register of signal boxes which is currently being validated by the Routes.

English Heritage is also conducting a national review of all signal boxes, and their report (expected in March 2013) may lead to recommendations revising the current listed signal boxes' records.

Heritage railway on the Sussex Route

There are currently five listed signal boxes on the Sussex Route, three of which have no signalling use. These are listed in Figure 5.6. There are two further boxes which have no signalling use.

Additionally, there are eleven signalling locations which are scheduled for closure within the next three years, including some listed locations. A suitable strategy regarding either future use or demolition of these boxes will need to be developed.

Figure 5.6 – Listed signal boxes on the Sussex Route

Box Name	Current Closure Date	Status	Date Built	Listed Status	Notes	Suggested Actions
Billingshurst	2013	Operational	1876	Grade 2 Listed	None	Create action plan prior to closure
Crawley	Closed	Other use	1877	Grade 2 Listed	Leased to Crawley SB Preservation Society	None
Holmwood	Closed	Out of Use	1877	Grade 2 Listed	None	TBC
Horsham	Closed	Out of Use	1938	Grade 2 Listed	None	TBC
Plumpton	2013	Operational	1891	Grade 2 Listed	Gate Box	Create Action plan prior to closure

Key

- Immediate action required (next two years)
- No action currently required
- White Unknown

Asset Management Plan

Strategic overview

The infrastructure in Sussex, although not unreliable in the context of national reliability, is not reliable enough for the very busy timetabled operations and the increasing numbers of passengers carried each day. The CP5 plan has been designed to improve the reliability of key infrastructure, with the main renewals being on the strategically important Brighton main line.

The heavy workload in CP5 will be undertaken with the backdrop of normally difficult access and the remodelling of London Bridge station and track layout between 2014 and 2017.



Gatwick Express

The renewals work banks for the Sussex Route have been thoroughly reviewed across the asset base in order to ensure that the Route Plan represents a balance of schemes to meet a number of different requirements ranging from the increased loading on the asset from more frequent longer trains to addressing aged equipment condition, and reliability strengthening. In preparing this section the Route Asset Manager's (RAM's) have jointly considered the impacts of these requirements on the route for CP5 and have subsequently identified eight goals which attempt to address these requirements, realise the delivery of forecast efficiencies, create sustainable infrastructure reliability and an operating environment where less intervention is needed. The RAM's goals are summarised as follows:

- They will work together with Enhancements, Infrastructure Projects (IP) and the customer to develop an integrated approach to the workbanks and enhancement portfolio to create opportunities to integrate schemes, maximise efficient use of access and develop programmes of work which not only can be effectively managed, but also attract the right level of supply chain engagement and delivery;
- They will continue to embrace novel and intelligent infrastructure on critical assets in the form of remote condition monitoring (signalling & E&P assets), on train track monitoring/recording, MCB-OD level crossings and "plug and play" signalling solutions. This will enable Infrastructure Maintenance to continue to develop and apply their risk based intervention delivery driving both efficiency and reducing the exposure of front line staff to the operating environment during peak service periods;
- They will proactively meet the challenges of the Thameslink Key Output 2 scheme and renew, refurbish and build resilience into the diverging routes (Tulse Hill and Herne Hill) in readiness for the three year closure of the lower level platforms at London Bridge station;
- They will support the train lengthening (8 to 10-car and 10 to 12-car consists) and increase in train frequency by investing in the renewal of critical assets which directly impact on train performance and ride quality with particular focus on the Brighton Main Line (BML) including:
 - Switches & Crossing signalling assets at key junctions, including resignalling & recontrol;
 - Plain line renewals & refurbishment of aged rail & components;
 - DC switch-gear mitigation issues under n-1 conditions.
- They will make significant investment in aged assets addressing previous underfunding on major structures (Shoreham and Thorndell viaducts), and signalling interlockings (Sutton and Newhaven Harbour) which are reaching the end of their operational life and are at risk of becoming unreliable;
- The RAM (Signalling), will accelerate a number of planned resignalling schemes from CP6 into CP5 enabling them to be included in the migration plan for recontrol in the new Three Bridges Rail Operating Centre (ROC). We also plan to deliver resignalling schemes, in readiness for migration into the ROC, enabling part or fully renewal of up to 37 level crossings, enhancing safety for users across the route. This will be in addition to six other level crossing renewal schemes planned to address aged condition;
- They will make significant investment during the first three years of CP5 to enable a 20 minute window of robust infrastructure to be established to mitigate the risk of train delay being imported into the Thameslink core route, in readiness for the 2017/18 Thameslink Franchise;
- The RAM (Buildings), will continue to work collaboratively with the Franchise Station Operators to integrate their work banks and establish the most effective and efficient delivery strategies.

Route information



Freight train near Gatwick.

Table 6.1

Route Planning Segment Characteristics			
Delivery Units	2	Level Crossings	232
Route km	518	Sussex Stations	153
Track km	1,220	Bridges	1,721
Electrified lines km	1,073	Soil Cuttings (100m lengths)	1,845
No of Tracks (Majority and Range)	Combination of four and two tracks	Embankments (100m lengths)	3,214
S&C units	1,044	Rock Cuttings (100m lengths)	386
Signal Interlockings	54		
Critical Line side Buildings	390	A – National hubs	3
Light Maintenance Depots	8	B – Regional hubs	3
		C – Important feeders	25
Operational Buildings		D – Medium-sized staffed	41
Maintenance Delivery Unit	29	E – Small staffed	67
National Delivery Services (NDS)	1	F – Small unstaffed	45
Network Operations	30	Managed Stations	1
Critical Line side Buildings	269	Franchised Stations – FCC	12
Non-critical line side buildings	419	Franchised Stations – LOROL	10
Other (redundant buildings)	62	Franchise Stations – Southern	158
		Franchise Stations – FGW	3

Track

Route Context for the Track Asset

The used life of the track infrastructure in Sussex has accelerated in recent years due to the large increase in services operating on the network. The CP5 plan has been designed to improve the maintainability and availability of key pieces of track infrastructure, particularly on the Brighton main line. This work will contribute to the sustainability of the CP4 exit performance on Sussex.

The Sussex Route is a 'Spine and rib' route with the Brighton Main Line (London Victoria to Brighton) as the spine and a series of suburban routes forming the ribs. A characteristic of this type of railway system is the limited availability of a diversionary route in order to facilitate track interventions on the Route.

The BML is classified as critically Band 2 and is therefore the focus of the Route's track renewals programme in CP5. The remaining parts of the Route are classified within critically Bands 3 to 5.



Delivery Plan for CP4

During the final year of CP4 the Route will see the complete renewal of Stoats Nest Junction on the Brighton Main Line and 18km of plain line renewal across the route; these renewals have been targeted due to asset condition.

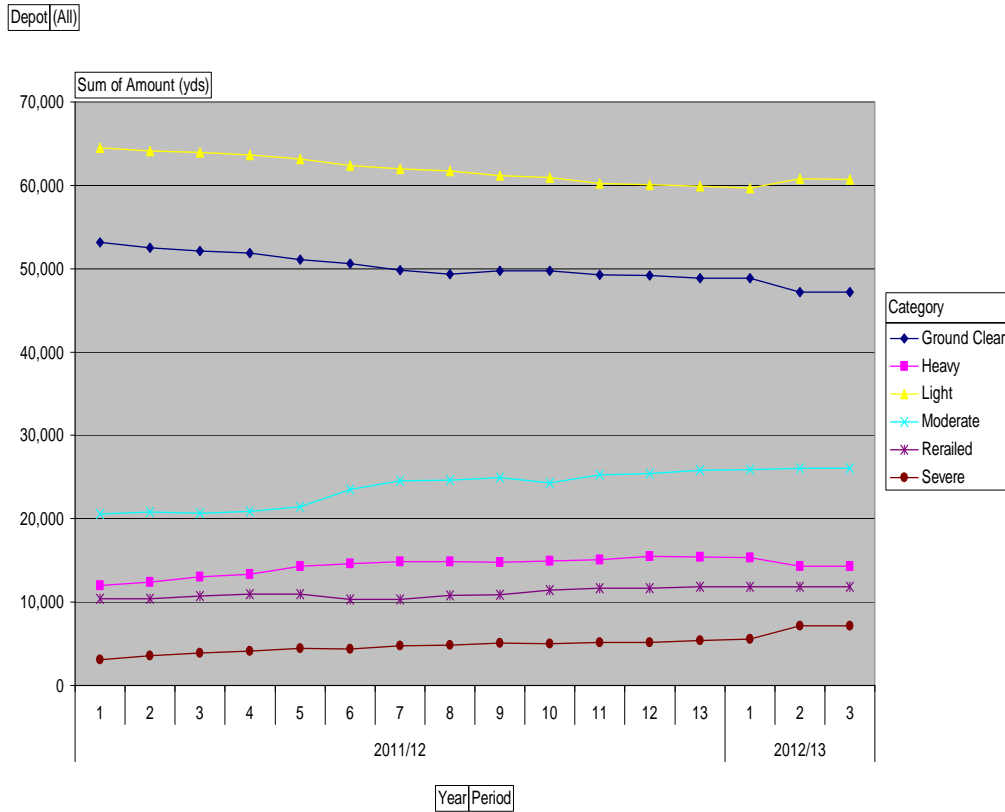
Additional strengthening works will be undertaken on the Thameslink Key Output 2 diversionary route between Windmill Bridge Junction and Herne Hill, the works will reinforce the asset to provide the required level of reliability throughout the three year diversionary period commencing in December 2014. These works include major S&C refurbishment at Norwood Junction, Bromley Junction and Tulse Hill and the complete rerailing of Crystal Palace Tunnel.

A new access point at West Norwood will enable basic visual track inspections to be undertaken during darkness as daytime access will be limited. Key to resilience on the Route will be the successful full renewal of West Norwood Junction, planned for 2012/13.

A significant impact on track asset reliability in CP4 has been an increasing volume of rail defects within Rolling Contact Fatigue (RCF) sites that require the imposition of an Emergency Speed Restriction (ESR) and removal within 36 hrs to 7 days. At year three of CP4 a more focused strategy of targeted rerailing in known RCF sites commenced and is planned to continue for the remainder of CP4. This will deliver 25.5 miles through maintainer delivered track renewals over the two years remaining of CP4.

Current analysis shows, that despite significant volumes (11km through 2011/12 and 55.5km in 2010/11 and 2009/10) of re-railing, there is no reduction in the overall amount of RCF across the Route. Throughout CP5 it is planned to deliver 60km of re-railing in addition to the volumes captured within conventional plain line renewal and S&C renewal. This volume is necessary to greatly reduce the amount of severe and heavy RCF across the route and is presented in the accompanying chart (Figure 6.1).

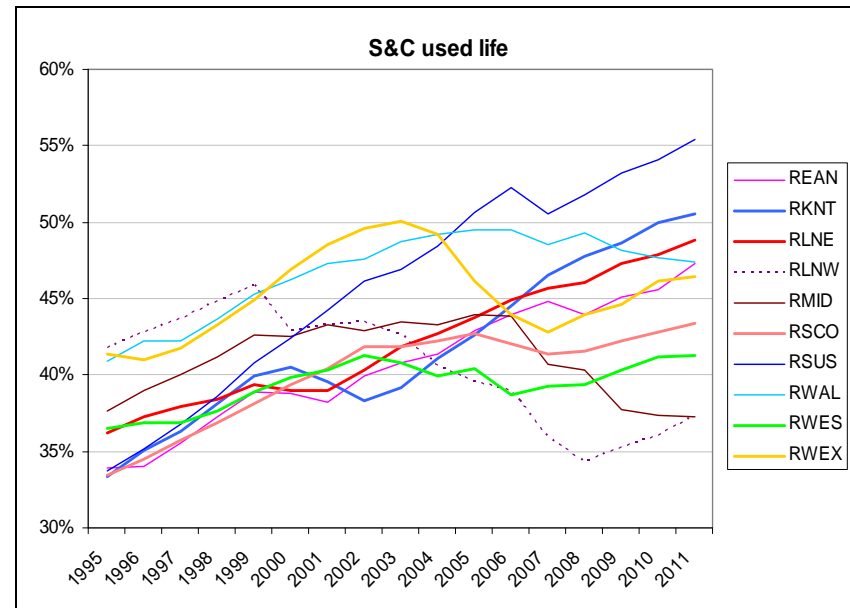
Figure 6.1 – Route RCF Volumes



Additionally from year four of CP4 there is a focus on the targeted removal of 3M type defects (which are non-actionable defects that need to be re-tested ultrasonically) within RCF sites that, if left untreated will propagate to more serious rail defects. It is the intention to carry both strategies forward into CP5.

During year three of CP4 work commenced on the route to improve gauge variations within the moveable parts of S&C units to improve asset reliability. It is envisaged that these works will continue for the remainder of this control period and into CP5. Delivery has been targeted for a further 90 point ends during the remainder of CP4 and a further 180 point ends through CP5. Where applicable this work will be included for both medium and heavy refurbishment programmes. As shown in the Figure 6.2 below significant investment is required in the Route's S&C in order to address not only the increase tonnage and operational demand presented by more frequent train services and longer train consists, but also to address the aged condition of the asset especially when compared to other routes.

Figure 6.2 – S&C Used Life by Route



Output Objectives

Network Rail have set out to the Office of Rail Regulation our planned asset output measures for robustness and sustainability for CP5. At present the forecasts for the Route are being developed for those currently being used. The remaining renewals and refurbishment work in CP4 is designed to reverse the adverse reliability trend that started in 2012/13 and the work currently planned in CP5 will enable the Route to sustain its CP4 exit performance.

Key Local Issues

In terms of track asset management the key local issues stem from the limited availability to access the asset. This is principally due to two key points, firstly the limited diversionary routes for the BML services and secondly the intensity of the usage of the Sussex Route. The Route contains 700 miles of track which influences 16.6 per cent of national PPM.

For the final year of CP4 and through CP5 the Thameslink Key Output 2 works (London Bridge and Bermondsey Dive Under) has a profound impact of the Route constraining track renewals works in Sussex. The Route through the South Eastern Programme Delivery Group is actively co-ordinating work so availability to the network is maximised.

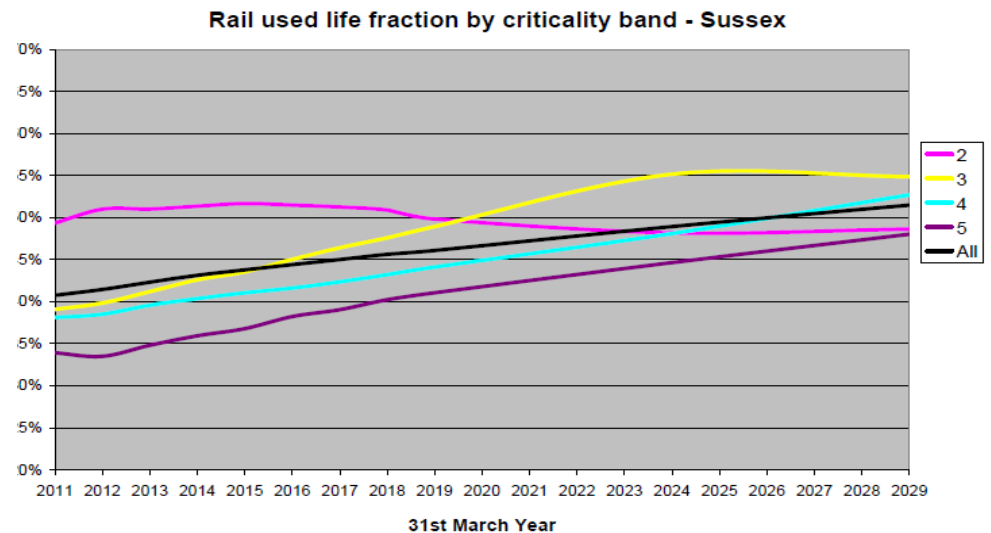
In line with the Track asset policy complete renewals have been targeted to Criticality Band 2 track which for the Sussex Route translates to the Brighton Main Line and East Croydon to London Bridge. This has created a local challenge in respect of volume of track access required to deliver this volume of works particularly the aging timber bearer S&C layouts on the Brighton Main Line.

Summary of Activity and work profile in CP5 Brighton Main Line (Criticality Band 2)

The Brighton main lines were largely converted from jointed track to continuous welded rail in the late 1960s and early 1970s. There are however still a significant number of junctions on the mainline that were renewed as part of the Brighton main line resignalling project between 1979 & 1981, this has left a legacy of switches and crossings founded on aging timber bearers and life expired ballast. There is also a proportion of plain line track that is overdue for half life ballast replacement.

Rail life is currently around 40 per cent (on average of rail life) and the age will increase to around 43 per cent by the end of CP4 (see figure 6.3). Rail defects have been the principle cause of rail replacement and the Route continues to have Rolling Contact Fatigue (RCF) which in many cases results in the need for some of the newer rail being replaced early. Root cause analysis will be conducted by using the Track Ex model to identify the principal causes of RCF propagation and create action plans to deal with it. The action plans will be reviewed against whole system whole life costs to find the best balance between OPEX and Capital Expenditure (CAPEX) spend for rail management. Rail management is thought to offer one of the best examples where an increase in OPEX spend (tamping and rail head grinding) could result in a reduction in overall expenditure.

Figure 6.3 – Rail Used Life



Throughout CP5 a significant volume of the 60km of modelled IIP volume for rerailling will be predominantly focused in two areas. The continued removal of RCF sites and the removal of pre-1976 rail on the London end of the BML between Earlswood Junction and London Victoria.

In line with the Track Asset Policy S&C timber age will be reduced by complete renewal at the following key junctions:

- Battersea Park Junction (in deliverable packages over CP5);
- Clapham Junction Ladder;
- Selhurst;
- Norwood Junction;
- Purley;
- Earlswood South Junction;
- Balcombe Tunnel Junction;
- Haywards Heath South Junction;
- Keymer Junction.

The renewal of Norwood Junction S&C will need to be undertaken towards the end of CP5 due to the limited access in the earlier years and the increased volume of traffic as a result of the implementation of the Thameslink diversionary route.

Additional S&C timber age reduction will be achieved by heavy refurbishment, predominately at the terminal junctions located at each end of the BML.

For plain line the predominant method for life expired ballast and component replacement will be by complete track renewal in line with the track asset policy. In addition it is envisaged that half life ballast replacement will be targeted by the use of ground penetrating radar data.

Drainage renewal and refurbishment will be targeted towards known problem areas at the following locations:

- Clapham Junction Platform 13;
- Clapham Junction to Balham (Fast Lines);
- Merstham Tunnel to Merstham;
- Salfords to Horley (Slow Lines);
- Horley to Gatwick Airport (Fast Lines).

Thameslink (Criticality Band 2)

The future single Thameslink franchise in 2017/18 will contribute to approximately 16 per cent (Sussex contribution) of the national Planned Performance Measure (PPM) and to ensure continued reliability it is essential to create a ring of high performing assets within a 20 minute window of the Thameslink core. For the Sussex Route, the critical junctions are:

- Norwood Junction – will be targeted for renewal in 2017/18;
- Windmill Bridge Junction, East & South Croydon – resilience works will be undertaken at these locations by heavy refurbishment in years one and two of CP5 on 21 units of S&C;
- Stoats Nest Junction – planned for complete renewal 2013/14.

Remainder of the Route (Criticality Band 3 to 5)

The aim during CP5 will be to further reduce the volume of pre 1976 rail. In line with the track asset policy there will be targeted medium and heavy refurbishment of both plain line and S&C assets. This work will include completion of suitable half life ballast renewal locations where appropriate. Refurbishment of S&C will be considered for both the condition of an asset and its performance. Opportunity will be taken to correct any gauge through the moveable length of S&C as this is now recognised as a key requirement for high performing assets.

The key junctions in criticality bands 3 to 5 are:

- Horsham;
- Arundel Junction;
- Lewes.

Throughout CP5 the track element of level crossings will be managed by refurbishment in line with the track asset policy. Refurbishment will be prioritised towards CCTV/Automatic Half Height (AHB) crossing types equating to approx. 25 per cent of crossings on the route. Integrated planning, using time/chainage plans will enable signalling and track works delivery to be co-ordinated. See Route Delivery Strategy.

Variations to application of policy

The Route will deal with all track in accordance with the track policy. Exceptions will include life expired, obsolete track in a condition or form where life extension is not possible or does not represent best whole life cost. Any exceptions will be subject to a peer review for validation and agreement to deviate from the policy.

The majority of the volumes planned for CP5 are in line with the Head of Asset Management (HAM) amended IIP volumes issued in October 2011 with the exceptions of conventional plain line renewals – complete track replacement (TRAX). This volume has been increased to allow for those volumes that will not be achieved through high output activities. Also the volume of S&C unit full renewal has been increased to be prepared for the traffic volume increase through Norwood Junction.

During the course of the SBP development the central asset management team determined that Sussex would need a further 5.8 km of high performance (HP) rail over CP5 in preparation for the introduction of the Thameslink services in 2018. This has been incorporated in the Sussex Route plan.

Delivery Synergies, Opportunities and Efficiencies

The RAM (Track) will be working together with the other RAM's to populate time/chainage plans, representing each of the sixteen Strategic Route Sections (SRS), with their workbank's in order to analyse and identify opportunities to package/bundle work by year, geographical area, discipline or as multidiscipline scopes, and thus in turn identify a number of delivery strategies to suit the Route, delivery agents (Maintenance, Franchise, Infrastructure Projects), supply chain, customers and stakeholders. A draft extract of this plan can be seen in the deliverability, data and assumptions section.

To date potential opportunities for efficiencies have been identified in the following areas:

- Implementation of Plain Line Pattern Recognition (PLPR) reducing the numbers of maintenance staff required to undertake basic visual inspections;
- Maximising working time within possessions by the utilisation of single line working across the route;
- On Track Machine (OTM) only possessions to improve productivity due to faster set up times;
- Agreement of a Route works delivery team to deliver a bigger volume of work in the same possession time. This will also seek to drive smoother route wide working resulting in less "peak & trough" Maintenance Delivery Unit (MDU) work plans;
- The utilisation of cascaded materials where appropriate for maintenance/renewals on criticality bands 3 to 5 routes rather than installing new.

- Greater use of the C21 Train Borne Grinder for better increased productivity and rail life; this will improve rail profiles and thus reducing the propagation of RCF;
- Recover S&C units from planned complete renewal sites. It is envisaged to recover serviceable S&C units from both Balham and Stoats Nest Junction renewals and other S&C renewals throughout CP5 and to cascade Route wide. Each location will be assessed for suitability of recoverable S&C units;
- Increased volumes for both S&C and plain line weld repairs; embedding the use of BV1000 weld repairs through Maintenance rather than undertaking crossing replacement and similarly 'inbed' railhead replacement for 3M type defects.

It should be noted that whilst the Route fully supports the national aspiration for increased track renewal efficiencies for CP5 by the movement of a percentage of S&C and plain line renewals to midweek nights, current Company Standards and operational restrictions overlaid on a compact Sussex Route will severely restrict these opportunities. The Route will endeavour to assist in negotiations for longer mid week night track access and support the Southeast track delivery teams in consultation for the necessary company standards amendments for working adjacent to open lines.

Signalling

Route Context for the Signalling Asset

On the Sussex Route 90 per cent of the signalling interlockings are over 25 years old (see figure 6.4). The two main signalling centres; Victoria Area Signalling Centre (ASC) and Three Bridges ASC finished commissioning in 1982 and 1984 respectively. Because of this there is a high level of condition led resignalling during the later part of CP4 and through CP5. There is a wide and varied asset type, ranging from mechanical equipment and open block signalling to the latest computer based interlocking systems (Westlock and Smartlock) and digital track circuits.

The majority of the Sussex Route is conventional colour light signalling with track circuit block and a summary of the predominant track circuit and point operating mechanisms is set out below. The relay based (geographical and free-wired) interlockings are approaching the end of their nominal life, these being the GEC Geographical Circuitry 'B' (GCB) Interlocking(s) serving the Victoria ASC area and the Westinghouse Geographical Circuitry (GCA) & British Rail standard Route Relay Interlocking (RRI) Interlocking(s) mainly serving Three Bridges ASC. The 17 interlockings on the BML are all relay based and of three main types (GCA, GCB and RRI) were all installed between 1976 and 1984.

The geographical relay interlockings are not reliable enough for the intensively used railway operated at present and are a regular cause of delay at the London end of the Sussex Route.

The signalling renewals plan in CP5 has been created in accordance with national asset policy and is designed to deal with condition led risks to safety and performance and using the opportunity to re-control to the new ROC at Three Bridges. The resulting asset base will be more reliable, more efficient to maintain and operate.

Figure 6.4 – Interlocking age of the BML

	%
■ Post 1983	6
■ Pre 1983	94



CP4 Delivery Plan

To provide a robust signalling infrastructure during the Thameslink Key Output 2 diversionary route the following works are planned:

- Between Crystal Palace & Tulse Hill – replace 50 track circuit impedance bonds/rail connections;
- Tulse Hill – upgrade point battery rectifier;
- East Croydon and Tulse Hill via both Streatham & Norwood Junction, including Crystal Palace tunnel – replacement of all 136 incandescent SL35 lamps with LED SL35 replacement modules;
- Crystal Palace, Tulse Hill, Norwood Jct & Streatham Jct – Remote Condition Monitoring (RCM) 11 additional point ends and 43 tracks circuits;
- Crystal Palace tunnel – Change 600 critical relays, and convert VC361 non standard HW point machine to Clamp Locks;
- Crystal Palace tunnel – Change 600 critical relays, and convert VC361 non standard HW point machine to Clamp Locks.

Other major CP4 work

- Victoria interlocking relocking – replace both Victoria Central & Eastern interlocking with a Solid State Interlocking (SSI) CBI Smartlock, this is due to wiring degradation;
- Gatwick Airport interlocking relocking – replace Gatwick Airport interlocking as part of the station remodeling;
- Arun Valley resignalling – replace three mechanical signal boxes with an SSI CBI Smartlock;
- East Sussex resignalling – replaces six mechanical signal boxes with SSI.

Output Objectives

Network Rail have set out to the Office of Rail Regulation our planned asset output measures for robustness and sustainability for CP5. At present the forecasts for the Route are being developed for those currently being used.

Key local issues and lessons learnt in CP4

Gatwick Airport, Arun Valley & East Sussex resignalling schemes will all increase the amount of signalling equivalent units (SEUs) to give greater capacity and seven day railway benefits. The London Victoria scheme is a condition led renewal of the interlocking and has been brought forward to avoid clashing with the Thameslink Key Output 2 works.

The Route has invested significant time and resources into these major schemes during CP4; and will working with the train operators and other stakeholders to refine the project scope and determine the optimum delivery strategy.

There were many technical issues associated with the proposal to use axle counter technology for the Arun Valley scheme whilst recontrolling to Three Bridges ROC. Now that these issues have been resolved it will be more straightforward (and therefore less costly) to convert track circuits to axle counters in future schemes. The technical gains will permit the installation and commissioning of axle counters alongside traditional track circuited track sections.

The Sussex Route has also managed to get Proceed on Site (POS) signals into the scope for the Gatwick Airport redevelopment project and this will give significant performance improvements under degraded working. The use of POS will be written into the specification for the major renewals during CP5 where appropriate.

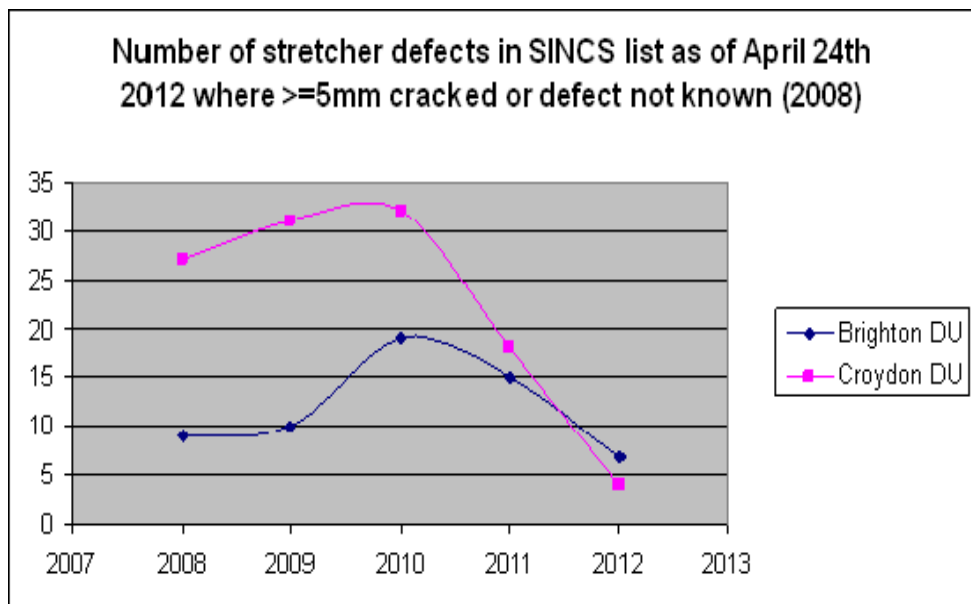
The Arun Valley resignalling project delivers signalling renewal and Network Operating Strategy (NOS) objectives which are achieved by the renewal of life expired and non-compliant (open block) signalling equipment.

The Route will also reduce signalling headways in the Moulsecoomb and Falmer area by installing one additional signal section on the down line and one on the up. This will improve performance and journey times and may allow additional services on match days (Falmer station serves the Brighton and Hove Albion football stadium).

During year three of CP4 work commenced on the Route to improve gauge variations and subsequent reliability within the moveable parts of S&C units. It is envisaged that these works will continue for the remainder of this control period and into CP5. Delivery has been targeted for 90 point ends during the remainder of CP4 and a further 180 point ends through CP5. Where applicable this work will be included for both medium and heavy refurbishment programmes.

During CP4 cracked stretcher bars in S&C were at a record high. A great deal of work has been done using the outputs from the Standard NR/L3/TRK1202 inspections and by installing modified resistors to HW point machines. This has led to a significant reduction in broken stretcher bars. Further benefits will be gained through the use of back to back gauging at S&C, taking action on the outputs of 1202 inspections and further rolling out the resistor modification to HW machines.

Figure 6.5 – Stretcher defects in the Signalling Incident System (SINCS)



In CP4 there have been many issues with STS relays produced by STS Signals Ltd, although these are now resolved the Route will still continue in CP5 to use pro-active relay testing to try and predict/prevent future failures.

Summary of activity and work profile for CP5 Brighton Mainline (Criticality Band 2)

The Route plans to replace all of the 228 reed track circuits left on the BML between Windmill Bridge Junction and Brighton; including removing the Insulated Rail Joint (IRJ), and replacing with Axle counters or TI21 joint less track circuits. By removing the IRJs the Route can also remove many of the associated impedance bonds. This then removes two major potential failure points and saves the ongoing maintenance costs. Also, by removing the impedance bonds, the reliability and resistance of the DC traction return paths are improved through the reduction of cabled rail to impedance bonding.

The Route plans to undertake a number of resignalling, recontrolling schemes and interventions on critical assets to address aged asset condition as follows:

Resignalling

- Streatham, and Balham resignalling schemes

These schemes will allow significant performance improvements by replacing the existing signalling equipment in these areas with a modern equivalent, these renewals are primarily condition led with the wiring in a poor condition. They will also include immunisation for 25kV AC providing future roofing for any changes to the traction power supply system.

Re-locking

- Clapham Junction relock and recontrolling scheme

This scheme will allow a reduction in signalling system and power supply failures as the interlocking will be replaced in full.

Finally the Route plans the replacement of six TDM69 systems at Selhurst, Norwood Junction, South Croydon, Purley, Stoats Nest Junction and East Croydon. This is required as the current Time Division Multiplex (TDM) does not have sufficient capacity to cope with the current and increased train services operating on the BML under system failure conditions.

Critical Assets

Due to the lack of major resignalling schemes in the Sussex Route the population of HW machines is in excess of 20 years old with some point machines being in excess of 30 years old. Clamp locks on the route have an average age of in excess of 10 years. The route has started using the Point Decision Support Tool that helps prioritise point operation replacement.

Certain key point ends and track circuits have been identified as critical assets; this totals 31 point ends and 73 track circuits. The criteria for determining critical point ends is those point ends that if fail would require more than two signals to be cautioned in either direction, have the highest point operations in a day and have a category recognised as 'high' traffic tonnage per day. From these criteria the following locations were identified as critical:

- London Victoria;
- Battersea;
- Pouparts Junction;
- Balham;
- Streatham;
- Falcon Junction;
- Windmill Bridge Junction;
- Selhurst;
- East Croydon;
- Norwood Fork Junction.

Track circuits use the same criteria as points, e.g. if they fail it would require more than two signals to be cautioned in either direction. Additionally any track circuits through points that are listed as critical are also automatically added to the critical track circuits list. 73 critical track circuits have been located between Windmill Bridge Junction and Clayton Tunnel. All the assets listed as critical will have RCM fitted where available for that asset type and be renewed to the latest specification.

Thameslink (Criticality Band 2)

The future single Thameslink franchise in 2017/18 will contribute to approximately 16 per cent of the national PPM and to ensure continued reliability it is essential to create a ring of high performing assets within a 20 minute window of the Thameslink core.

To align and integrate with the plans for the track asset, signalling will renew/upgrade the selected point operating mechanisms at Norwood Junction, Windmill Bridge Junction, East and South Croydon and all point mechanisms at Stoats Nest Junction as follows:

- Stoats Nest Junction to be renewed 2013/14;
- Windmill Bridge Junction and East Croydon heavy S&C refurbishment which will deliver the required reliability;
- Norwood Junction, North Junction to be renewed 2017/18.

Remainder of the Route (Criticality Band 3 to 5)

Significant condition led recontrol/resignalling

Full resignalling at Tulse Hill, Sutton and Newhaven Harbour, will allow significant performance improvements as all the signalling in these areas will be replaced with a modern equivalent.

Relocking of Wimbledon, Lewes and Arundel will reduce the incidents associated with signalling system and power supply failures as the respective interlockings will be replaced in full.

Significant NOS led resignalling

The resignalling and closure of Bognor, Littlehampton and Reigate signal boxes.

Asset enhancement

Many benefits will be realised through the use of 'plug and play' and light weight structures, summarised as follows:

- increased levels of factory acceptance testing, reduced signalling testing/installation times on site, reduced possessions/construction time and reduced commissioning times at complex junctions;
- less exposure to incidents/accidents by reducing trackside working hours for signalling staff/contractors during maintenance and faulting activities;
- lower levels of working at height, as lightweight signals will be lowered to ground level for maintenance.

Safety Improvement Work bank

Implementation and Disconnection Links

The implementation of disconnection links to point operating equipment will continue throughout CP5. This will help meet Signal Maintenance Specification part A04 more easily when technicians have to move the points by hand when not working within a possession.

Implementation of Proceed On Sight (POS) signals

The implementation of proceed on sight signals will be considered where possible as part the CP5 resignalling schemes.

Signals Passed at Danger

The Route will maintain the strategy of reducing the risk of Category A Signal Passed At Danger (SPAD). For further details see Route Safety Improvement Plan.

Level Crossings

See specific section below within this Route Asset Management Plan.

Remote Condition Monitoring

The Sussex Route will implement the Route Condition Monitoring (RCM) policy for new assets and where practicable on existing assets. The Route believes that through the implementation of remote condition monitoring technologies, maintenance and other stakeholders will fundamentally change their relationship with the asset. The repeated subjective assessment by an individual will no longer form the baseline for maintenance and renewal. This will be replaced where appropriate with a system recording standardised and measurable data sets that accurately reflect asset condition. Manual intervention by a skilled and experienced individual will enhance the automated data collection where necessary. This data will track asset condition and be the driver of cost effective and appropriate intervention at the optimum time applicable to the individual asset.

The Sussex Route has successfully implemented Phase 1 & 2 of the national RCM rollout programme. These phases covered the installation of 432 points, 278 track circuits and 5 Earth Leakage Detection (ELD) 650v Bender units.

Front Line Efficiency Benefits of RCM

The planned efficiency benefits are as follows:

- Immediate identification of impending failure modes will reduce mean time to repair and improve work planning;
- Time-to-failure data can be used to better prioritise and organise preventative maintenance;
- Identification of critical wear out failures can be used to better plan renewals, optimise provision of spares and lower whole-lifecycle costs;

- A more reliable system will help staff to accept Points Condition Monitoring (PCM) as a useful tool, increasing employee engagement, resulting in all alarms being actioned, leading to fewer failures. Tranche 3 is currently being implemented and planned to be completed in March 2013;
- Fewer track visits, resulting in increased staff safety.

To maximise the opportunities to realise these benefits the Route is currently undertaking the Phase 3 rollout to increase the number of assets fitted with RCM. The Route will be getting an extra 145 points, 452 track circuits (ccts), 40 ELD 650v Bender units and 64 point heaters. The RCM roll out coverage is presented in Figures 6.6 – 6.8. and show the status of RCM following the completion of Tranche 3 in March 2013.

Figure 6.6 – Rollout of points Remote Condition Monitoring

■ Non-fitted	630
■ Planned to fit RCM	145
■ RCM fitted	432



Figure 6.7 – Rollout of track circuits Remote Condition Monitoring

■ Non-fitted	1,867
■ Planned to fit RCM	452
■ RCM fitted	278



Figure 6.8 – Rollout of RCM Insulation Remote Condition Monitoring

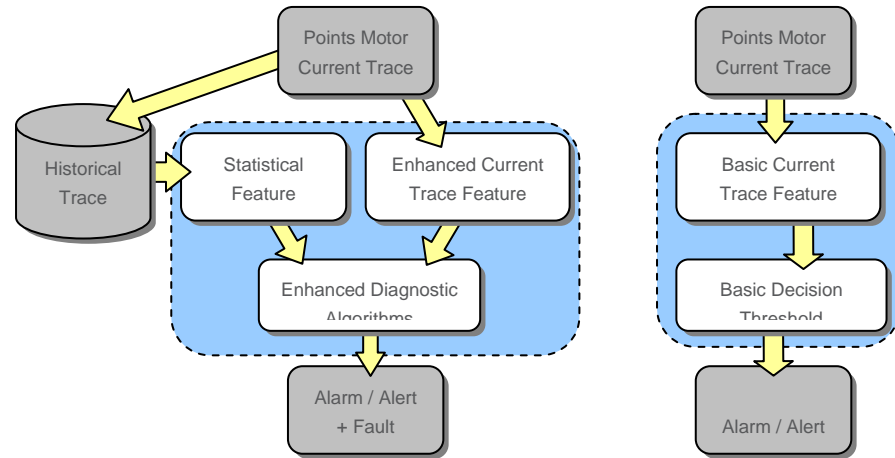
■ Plan to fit RCM	47
■ RCM fitted	17
■ Monitored by ECRO	8



Note: RCM Insulation Monitoring is earth leakage detection (Bender units)

RCM Next Steps

The aim of the project is to develop an ‘intelligent’ PCM system. It is envisaged that this system will be configured as shown in the diagram below (shown on the left hand side of the graphic). It should be noted that there are key differences between this system compared to the existing PCM system (shown on the right hand side). The existing system, as presently implemented, looks at two preselected features and compares them to a user defined threshold (that may or may not have been derived manually from historical data). If either of these features are exceeded an alarm or alert message is generated, dependent on the level by which the feature is exceeded.



The enhanced system (shown on the left hand side) will make use of not only the most recent current trace, but historical trace data from the same point end and other similar point ends in the global population. All of this data will be run through various statistical models and feature extraction processes. The output will be a health assessment indicating the present state of the points. In the event that a developing fault is detected an alert or alarm will be raised and a simple prognostic assessment indicating likely time to failure will be generated. In the case of gradual failures, the asset will re-alert the appropriate persons when the asset has degraded further. The new enhanced system should be implemented towards the end of CP4.

Delivery Synergies, Opportunities and Efficiencies

The RAM (Signalling) is working together with the other Sussex RAM's and Infrastructure Projects to populate time/chainage plans, representing each of the sixteen Strategic Route Sections (SRS), with their work banks in order to analyse and identify opportunities to package/bundle work by year, geographical area, discipline or as multidiscipline scopes, and thus in turn identify a number of delivery strategies to suit the Route, delivery agents (Maintenance, Franchise, IP), supply chain, customers and stakeholders.

To date opportunities for efficiencies have been identified in the following areas:

- Scope efficiencies;
- Further implementation of Reliability Operational Signalling Equipment (ROSE) realising a reduction in the numbers of maintenance visits required to be undertaken;
- The use of "Plug and Play" technology and light weight signals;
- Measures agreed with Infrastructure Projects (IP) to realise further efficiencies by using the in-house Signalling Design Group (SDG) for GRIP1 to 4;
- Route signalling resource funded to support re-signalling projects within IP programmes and projects;
- IP to drive early participation of supply chain, Route, Competent Independent Person and Train Operating Company (TOC) in GRIP 1 to 4 to "freeze" outputs before Invitation To Tender (ITT) and Contract award (GRIP 6 to 8);
- Signalling uses the National Framework contracts that are committed to delivering a 16 per cent efficiency by the end of CP5.

Compliance with Signal Asset Policies

All signalling renewals will be compliant with signalling asset policy, however there are a number of risks which are detailed further within this section.

90 per cent of the Signalling Route Relay Interlockings (RRI) on the Sussex area are over 25 years old, with many now approaching or exceeding 35 years old. During CP4 there has been a change in asset policy; historically the high usage areas on Sussex would be resignalled when they were between 25 and 35 years old. Now we are life extending many of the interlocking areas instead. This generally involves renewal of the interlocking with a CBI and replacement of the outside equipment over a 20 to 25 year period.

The Route has worked with the central asset management to amend asset policies to improve whole life asset costs. An example of this is as follows:

In-bearer Clamp Locks (IBCL) with Hy-drive

Although the merits of IBCL are clear there are issues of safety, whole life cost, skills and competency to be fully explored and consolidated into the policy decision making process with safety being the highest priority. The Mean Time Between Failures (MTBF) of the IBCL is currently two years. If an HW point machine was utilised the installation costs would be less and the MTBF is currently 6.1 years. Therefore, the Route have asked for a derogation in order to use HW machines in places where performance is critical and a failure would involve degraded working that would import risk. The Route has recently received several site specific derogations for HW2000 machines to be used where appropriate.

Risks

During CP4 there has been a change in asset policy; historically the high usage areas on Sussex Route would be resignalled when they were between 25 and 35 years old. Now asset policy is to life extend many of the interlocking areas instead, where their condition indicates renewal is necessary and leave other parts of the signalling system unchanged. This brings benefits as it maximises the use of available funding and reduces the overall impact on the business during renewal. However, there is a risk that the outside equipment degrades at a much higher rate than expected, i.e. wiring degradation of external location cases. This could lead to unexpected calls on expenditure, increased right side failures and in several cases degraded working where equipment might need to be taken out of service for a period of time. Additionally installations where this type of approach is taken historically require a greater retention for the levels of maintenance as many parts of the total system are extremely old in technological terms; what is left is generally a unique hybrid system of SSI and RRI.

The amount of work planned for Sussex during CP5 is substantial; as such this will be a challenge for both Network Rail and our suppliers to deliver this volume of work within the timescales that are required.

With the increased renewals volumes not only for the signalling but all the other disciplines comes a risk to performance. With this amount of work that is mainly constrained to limited possessions there are likely to be extended pressures on performance due to the risk of errors and overruns during that work.

The Route plan includes upgrade of all level crossings with an ALCRM score of 1, 2 and 3 that are part of a recontrol with MCB-OD. Reference should be made to the Level Crossing section in this plan for further details

Geotechnical assets (Earthworks)

Route Context for the Geotechnical Asset

Earthwork assets fall into three categories: Embankments, Soil Cuttings and Rock Cuttings, each of which is broken into 5 chain lengths (100m) for the purpose of condition monitoring by examination. There are 3,214 No 5 chain lengths of embankments, 1,845 No 5 chain lengths of soils cuttings 386 No 5 chain lengths of rock cuttings. These assets date from the original construction of the railway. A small percentage of these assets have been repaired since the time of construction.

The distribution of the earthworks is determined by the topography, which, in turn, is a function of the underlying geology. Sussex Routes fall within an area of gently folded strata, known as the Wealden Anticline, which comprises weak clay layers (London Clay, Gault Clay and Weald Clay) separated by harder rocky layers (Chalk and sandstones). Typically, the clay areas form the lower ground over which the railway passes on embankments, whilst the rocky layers form the higher ground through which the railway passes in cuttings, e.g., the deep cuttings through the Chalk escarpments of the North and South Downs.

The earthworks within the predominantly clay areas are more susceptible to the weathering processes and adverse effects of vegetation, whereas those within the more rocky formations tend to require less remedial attention. However, even these are suffering from the ravages of time (>150 yrs) and cannot be renewed by reprofiling because of boundary constraints imposed at the time of construction.

The delivery plan for the final year of CP4 comprises the netting and stabilisation works at Hooley Cutting on the Redhill lines (RED2), a number of reactive earthworks remediation schemes on the Brighton main line (VTB3) and a programme of improvements to both soil and rock cuttings which are being facilitated by the National Earthworks Risk Reduction Programme (NERRP) delivery plan for the final year for CP4.

Output objectives

The principal output objective is to ensure that the overall asset base does not deteriorate.

Hooley cutting has required significant expenditure over previous control periods including the current £9 million project. No major expenditure is expected during CP5 and no allowance has been made for this. However, if Hooley Cutting were to deteriorate at a greater level than expected then further expenditure would be required. There are no other local geo-tech factors within Sussex Route that are out of the norm.

The work bank aligns with policy in terms of refurbishment and maintenance; details on the activity volumes can be found in the Deliverability, Data and Assumptions section of this plan. However, some renewal sites may require intervention at an earlier stage of deterioration as a result of the examination and evaluation process. Specifically a rock cutting at Brighton requires the renewal/installation of sprayed concrete facing.

The maintenance volumes are broadly in line with the modelled target; which is aligned to the earthworks policy. This difference has been justified by the Route and has been agreed with the Head of Asset Management (Civil – Geotech).

The Route submission is a base plan and does not include any efficiency or performance enhancements beyond that detailed below.

Efficiency Plans

There are five business efficiency cases which have been developed for the Civils plan; the principal CP5 efficiency identified is in the areas of Tendering, Procurement and Contract Management to which the Route will continue to support the Project Delivery Team achieve.

Structures

Route Context for Structures Assets

The primary aim of the Sussex Route structures CP5 plan is to deal with a number of large structures whose condition and capabilities are below those required by standards and/or licence obligations. The Route also requires a higher spend level on metallic bridges, a number of which have required traffic restrictions recently. The requirement to reverse the trend in condition and capability will take longer than CP5 and in Sussex it is anticipated that this will not be in a comfortable position before the end of CP7 at current rates of spend.

The structures assets comprise largely of underline, intersection (rail over rail), overline, and side of line bridges, footbridges, viaducts and culverts. The bridge stock is largely constructed from wrought iron/steel and/or masonry with a few more modern concrete or steel and concrete structures. The key drivers for structures work items are generally capability, condition, safety and serviceability.

The overall affect of structures on performance is normally between 2 to 4 per cent of overall Route delay minutes and the usual cause of structures related delay minutes is due to bridge strikes by road vehicles. There are no significant plans for performance driven structures schemes and a further contribution to performance improvement will be achieved largely by good housekeeping with respect to bridge strike mitigation and better asset management avoiding unplanned disruption.



Ouse Valley Viaduct

CP4 Delivery Plan

The final year of CP4 is dominated by the strengthening and refurbishment work at Chelsea River Bridge on the West London Line and the reconstruction of three weak underline bridges between North Dulwich and Tulse Hill stations. These four structures are all 'discrepancy' bridges, where a commitment has been made to the Office of Rail Regulation (ORR) that they will be strengthened or reconstructed within CP4. Strengthening, refurbishment and partial reconstruction of Goat House Bridge (London end of Norwood Junction station) will also take place during 2013/14 – this work is largely funded by Transport for London (TfL)/The London Borough of Croydon; this scheme is part of the ongoing Bridgeguard 3 programme and will replace a timber parapet with a full containment parapet as well as strengthening the carriageway and footpaths.

Output Objectives

The work bank for Structures assets in the Sussex Route, both over-bridges and under-bridges is a legacy of decades of under investment stretching back to the days of British Rail. The Route objective is to exit CP5 with an asset condition which is no worse than that at the end of CP4.

From a long term perspective the Route is in the early stages of the development of a strategic plan for structures beyond CP5 which will establish a sustainable state for the asset so that future generations are not left with increased renewals requirements due to insufficient maintenance or renewals today.

Key Local issues

There are circa 627 underline/intersection structures; of these 308 are metallic or partially metallic. This is a very high percentage of metallic structures – a significant factor for the Route as they generally require significantly higher expenditure than masonry structures. A data analysis of known dates has shown that 85-90 per cent of the metallic bridge stock dates from 1861 to 1910. The age profile of the under-bridge stock in the Sussex Route is of major significance; there is recent experience in the South East of serviceability issues associated with old structures resulting in emergency speed/traffic restrictions prior to temporary repair works and ultimately renewal.

Not all old metallic structures require renewal, for example the Sussex CP5 Route Plan includes for the replacement of the timber cross girders on the 4 span Arun River Bridge at Pulborough, which is a 1861 wrought iron structure and it is anticipated that this structure will remain in service for many more years. However many of the older shorter span metallic structures will require renewal in the medium to long term.

There are 16 planned underline bridge renewals for the Sussex CP5 Route Plan, significantly above previous control periods which was typically between 1 and 8 structures. The Route is actively addressing the ageing profile of the Sussex underline bridge stock to avoid further traffic restrictions, emergency speed restriction or in the worst case closure to traffic pending installation of a temporary bridge.

CP5 Delivery Plan and Work Profile

The CP5 Structures expenditure plan is aligned to maintaining the current railway on a minimum whole-life cost basis. The impact of key national investments and HLOS has no effect on the Route work profile.

During CP5 a large proportion of the spend will be focused on a few large underline structures, which are under strength and require either renewal or strengthening and refurbishment as well as addressing a few significant overline structures.

As a consequence of the necessary significant expenditure on a few structures in CP5 the Route will be focused on establishing business cases to align the asset intervention with the age profile of the underline bridge stock. This will enable the Route to efficiently manage from a 'whole-life cost' perspective so that those metallic structures can be kept serviceable for the medium to long term while managing the decline up to the point of renewal of those that cannot. Within this context we will review the appropriateness of applying an asset policy of painting many bridges and managing by the Bridge condition monitoring index.

The Route plan includes the start a programme of relining of brick culverts on all routes irrespective of route criticality. The brick culverts date from the construction of the railway and where they are "non man entry" due to their size, it is not possible to maintain them. Much of the culvert stock on the Route has exceeded the theoretical point at which they should have been relined/renewed. The programme for this work is in the early stages of development to focus on the high priority sites to avoid adverse operational consequences.

Much of the CP5 plan is driven by the need to address under strength underline bridges resulting in both superstructure (and some sub and superstructure) renewals as well as a continuation of strengthening works and associated repair and refurbishment work. The 16-span Shoreham Viaduct over the Adur estuary and Mitre Bridge, which carries the West London Line over the Western mainline and Old Oak/North Pole depots will be strengthened and refurbished. The overline bridge stock will continue to require heavy expenditure in part due to the national Bridgeguard 3 programme as well as the need to address condition issues.

Efficiency Plans

There are five Business Efficiency Cases which have been developed for Civils; the principal CP5 efficiency identified is in the areas of Tendering, Procurement and Contract Management to which the Route will continue to support the Project Delivery Team achieve.

Buildings

Route Context for Buildings Assets

Stations are the rail industry's shop window and during CP4 the Sussex Route has worked closely with its industry partners to improve the station environment for passengers and other users. This philosophy of collaboration will continue through CP5 with the aim of maintaining station assets to acceptable levels of condition and where funding is available, further improving the station environment.



Platform 8 – Brighton Station

Detailed below is a summary of the age, condition and performance of the Buildings Portfolio.

Stations

The station portfolio is critical to service provision and directly used by many millions of people. They are among the most complex of our buildings and demand the greatest level of expenditure and management time. The assets were mostly constructed in the Victorian and Edwardian periods, with further construction work carried out during the inter-war and post war periods. The age of the assets and the diverse design and construction practices that were used throughout these periods brings with it asset management challenges. A number of our stations are listed or situated within conservation areas which incur a 'Heritage Factor' not simply on cost but on duration, design and construction techniques. Through CP4 our intervention strategy has been to maintain station assets at 'steady state' in line with regulatory targets.

Light Maintenance Depots (LMDs)

There are eight LMDs within the Sussex Route of which seven are leased to Southern Railway on a 25 year full repairing lease. The one remaining depot Stewarts Lane is critical to the servicing, maintenance and repair of rolling stock that supports the Gatwick Express operating fleet. Typically, an LMD contains items of plant such as cranes, jacks, wheel lathes, carriage washers, tanking and refuelling facilities. A major roof renewal at Stewarts Lane has been identified in CP4 for delivery in CP5.

Line Side Buildings

The line side building portfolio is made up of critical (housing operational equipment) and non critical buildings (stores/huts etc). There are no regulatory targets for line side buildings. Asset condition is established through an annual inspection and planned preventative maintenance programme which enables the asset steward to identify repair and renewals work on a prioritised basis. Through inspection we have identified the need to implement an accelerated roof renewal programme to critical lineside buildings in CP5.

Maintenance Delivery Unit (MDU) and National Delivery Services (NDS) Depots

MDU and NDS depots have developed according to the type of work carried out at each location they include a diverse range of type and size of facilities. CP4 funding has enabled a 'steady state' to be maintained. Future requirements are subject to maintenance delivery unit geographical delivery strategies therefore, CP5 funding requirements have been kept at steady state.

Table 6.2 – Stations & LMD Portfolio

Stations & Light Maintenance Depots	Number of Assets
A – National hubs	3
B – Regional hubs	3
C – Important feeders	25
D – Medium-sized staffed	41
E – Small (staffed)	67
F – Small (unstaffed)	45
Managed Stations (Victoria)	1
Franchised Stations – FCC	12
Franchised Stations – LOROL	10
Franchise Stations – Southern	158
Franchise stations – FGW	3
Light Maintenance Depots	8
Total	192

Table 6.3 – Operations Buildings

Operational Buildings	Number of Assets
MDU	29
NDS	1
Network Operations (Signal Boxes/ECR)	30
Critical Line side Buildings	269
Non Critical Lineside	419
Other (redundant buildings)	62
Total	688

Delivery Plan for final year of CP4

The CP4 Buildings scope is actively managed, taking advantage of any super efficiencies by reinvesting back in the infrastructure; key schemes to be delivered are listed below.

- Three Bridges station platform renewals;
- Reedham station platform and footbridge renewals;
- Kingswood station platform and footbridge renewals;
- North Dulwich station footbridge renewal.

Development of the 2013/14 programme is in line with targets and for those schemes that are track possession dependent, a delivery strategy has been identified.

Station Condition

Station condition is measured using the Station Stewardship Measure (SSM) reported as 'M17' in the Annual Return. The condition of our stations is steadily improving across all station categories. This is due to a combination of factors, including:

- Improved station surveying: more accurate capture of asset remaining life and risk data;
- Effective asset stewardship supported by robust decision making tools;
- Cumulative beneficial effect of CP4 customer focused enhancement projects (National Station Improvement Programme (NSIP) etc.);
- Integrated Station Planning (ISP).

LMD Condition

Stewarts Lane LMD is the only depot where we have maintenance and renewal responsibility and although there is currently no regulatory condition measure our strategy is to maintain at steady state in line with stations.

Table 6.3 – Current Station and LMD Condition Measures

Station Category	Asset Stewardship Measures	
	CP3 Exit*	Sep 12
A	2.33	2.38
B	2.42	2.28
C	2.49	2.52
D	2.53	2.56
E	2.54	2.43
F	2.54	2.52
LMD	2.52	2.44

*Regulatory output targets for CP4

Key local issues influencing the plan

There are no route specific factors impacting on the application of buildings asset policy however, the proposed new Thameslink franchise may impact on the programming of renewals once we have visibility of the franchise operator's franchise commitments.

Summary of CP5 Work Activity

Effective application of buildings policies has enabled the RAM (Buildings) to understand the condition of the assets, the associated risks and appropriate application of interventions at the correct intervals to sustain condition in CP5. The chosen interventions are programmed to deliver lowest whole-life cost solutions which are based on three intervention modes; renew, refurbish and maintain.

The following activity was used to refine identified asset interventions:

- Prioritising assets by Percentage Asset Remaining Life (PARL) & Asset Risk Scores (ARS) and applying policy interventions;
- Using asset knowledge to drive decision making;
- Directing interventions to high safety and performance issues;
- Taking account of customer imperatives;
- Identifying opportunities/synergies for renewals by reviewing the integrated station plan;
- Considering heritage issues;
- Reviewing and prioritising outputs of electrical test inspection reports (These reports provide the basis of the Mechanical & Electrical CP5 work bank rather than Operational Property Asset System (OPAS) data);
- Prioritising results of structures assessment reports.

Variations to application of policy

The Sussex Route buildings asset work bank has been developed to ensure there are no variations to the national buildings policy.

CP5 Work profile

The base plan volumes and work profile in the final year of CP4 and CP5 are broadly an equal mix of interventions across the buildings asset type. The work profile peaks in the second year of CP5 due to planned major roof expenditure to the concourse roof at London Victoria station, which accounts for 21 per cent of the plan value.

It should be noted that maintenance delivered minor works and planned preventative maintenance are subject to ongoing efficiency initiatives such as integrated working with Station Franchise Operators therefore funding will be allocated by the RAM to the most efficient delivery route.

In terms of the buildings portfolio enhancements schemes delivered in the final year of CP4 and CP5, e.g. reconstruction of London Blackfriars station and the FTN GSMR programme have imported an additional cost into the Route Plan principally in the area of planned preventative maintenance.

The HLOS published in July 2012 in terms of Building Asset Management provides opportunity to invest renewals expenditure alongside HLOS Access for All and Station Improvement expenditure. The Route is actively looking at opportunities to integrate the works at identified locations.

Additionally the HLOS identifies a number of Enhancement Funds; the Route has identified through dialogue with Southern Railway and First Capital Connect 12 locations (see Table 6.4) where the stepping distances are sub-standard. The locations are listed below with an indication of costs – these sit outside the Sussex Route CP5 expenditure plans, however the Route will seek to identify funds to address these locations.

Table 6.4 – Sub-standard platform stepping distances identified for enhancement funding

Station	Location
Arundel	Platform 1
Birkbeck	Platform 1
Carshalton Beeches	Platform 1 and 2
East Croydon	Platform 2
Ifield	Platform 1
South Croydon	Platform 3, 4 and 5
Sutton	Platform 3
Waddon	Platform 2
Wandsworth Common	Platform 2
West Norwood	Platform 2
Tulse Hill	Platform 1
Elephant & Castle	Platform 3

In terms of volumes of work, the CP5 base plan has developed to incorporate the following additional items:

- Intervention/expenditure for LMD and lineside buildings determined from recent RAM inspections;
- Output from RAM site reviews to verify the Initial Industry Plan (IIP) modelled outputs; where required adjustments have been made to the proposed intervention strategy in line with Buildings policy.

The Route building portfolio expenditure profile has been developed using national efficiency business cases across the whole of the CP5 plan with Route tailoring of assumptions to reflect the unique circumstances.

The national efficiency business cases are:

- improved asset system;
- innovation and policy improvement;
- procurement methods/systems;
- work planning;
- reduced project management overheads;
- improved working windows;
- procurement packaging;
- reduce contracts overheads.

Electrification and Plant (E&P)

Route Context for Electrification and Plant Assets

Power supply capacity and certainty of supply is essential to the very busy and challenging timetable operated in the Sussex Route, particularly on the Brighton main line. The CP5 plan aims to deal with resilience and known system weaknesses that have become apparent in recent years with the introduction of new and additional rolling stock to the Route. This resilience and certainty of supply will be essential to cope with the introduction of the full Thameslink services proposed towards the end of the Control Period.



33kV outdoor HV raft

Key asset groups, condition and renewal proposals

The Route is predominately electrified with a third rail DC system dating from the early 1900s; with a small section of 25kV over-head electrification in the Mitre Bridge area at the northern end of the West London Line (WLL). While there has been some increase in equipment volumes during Control Period 3 and 4, arising from enhancement schemes to support newer and longer rolling stock, this has been of a piecemeal nature, and much of the Route's

electrification equipment dates from the time of its last renewal, some of which was in the 1950s, with a large quantity of DC switchgear dating from the 1970s.

The E&P assets are separated into three key categories as follows:

Third Rail

In line with current asset policy, there has been little renewal of third rail, with some sections remaining in service to this day from the earliest installations on the Route.

The third rail system comprises approximately 1,073 single track kilometres of conductor rail (varying between 100lb/yard and 150lb/yard in weight), with just over half of this of a welded construction, and the remainder fishplate jointed. Sections of conductor rail are connected together electrically, or to the DC traction switchgear, by hook switches and track feeder cabling distributed around the on track area, however changes in train service operation over the past decade have increased the loading on the DC track cabling to such an extent that it has begun failing in certain locations.

Measures are in place to focus on these particular assets – the current CP5 E&P policy requires hook switches which are used in routine planned isolations to be replaced with track isolation switches, while reinforcement measures are being undertaken to manage the risk of track cable failure.

Appreciable quantities of the Route's conductor rail system are of the smallest (100lb/yard) cross section – including along the heavily loaded Brighton main line. This, in combination with the historical practice of fishplated jointing across smaller conductor rail cross-section types, poses a particular risk for train service disruption in the event of overheating/failure and the older (pre 1957) types have become increasingly problematic. With the introduction of the 2018 Thameslink Key Output 2 timetable services, such system weaknesses are likely to become exacerbated, with a resultant increasing risk of train service disruption. To this end, the current programme of conductor rail replacement with a larger cross-section, along with joint welding in place of fishplating, requires to be extended into CP5 to lower this risk. Replacing smaller types of conductor rail with the 150lb/yard variety also has the benefit of improving the overall energy efficiency of the DC electrification system.

Distribution

The portfolio comprises of just under one hundred traction substations and switching stations, containing around 400 High Voltage Circuit Breakers (HV CBs), connected by approximately 550km of HV cabling of both oil-filled and cross linked polyethylene types. In combination, there are seven power transformers, and just over 100 transformer/rectifier sets between these substations. The traction substations and Track Paralleling Huts contain just over 800 DC circuit breakers with significant numbers dating from the 1950s and 1970s.

The distribution system is designed such that an outage of a single item of equipment will not prevent normal timetabled train service operation (called N-1). Due to increasing load and cycling arising from the newer and longer rolling stock over CP3 and 4 the rating and protection setting capacity headroom on the equipment has been eroded. On certain sections this headroom is no longer available and the equipment could exceed its design rating without reduced power operation of the rolling stock, thereby impacting on timetabled operations. Proposals are made in the CP5 plan to address such system weaknesses, and restore the necessary headroom. It is particularly important that this weakness is addressed before the introduction of the full Thameslink services and at present this work is not in the Thameslink project scope of work.

Other than the above, little renewal/refurbishment of traction switchgear is proposed in the control period, applying the requirements of the E&P asset policy, and assuming the standard cyclic maintenance activities ensure the asset performance levels can be maintained at a suitable level throughout the control period.

A sub-asset of the distribution portfolio (Supervisory Control and Data Acquisition (SCADA)) comprises items which enable the remote control/indication of the traction equipment in substations and Track Paralleling (TP) Huts. The out based remote termination units which connect to Brighton Electrical Control Room (ECR) are reaching the end of their serviceable life, and the workbank aims to replace a proportion of these in CP5. The plan is to liberate sufficient spares to keep the remainder functional until their replacement in CP6.

Plant

This portfolio is extensive in both breadth and quantities, including over 1,000 heated point ends, three principal supply points, 75 signalling power supplies, over 1,500 signalling power cables, Distribution Network Operator (DNO) intakes, lighting installations, and non-traction High Voltage (HV) Circuit Breakers (CBs) in several locations.

The asset age profile across the route is varied, and while most types are performing in accordance with their age and required maintenance intervention periodicities, a number of them require renewal within the Period due to condition and/or poor performance including a number of points heating installations, and certain non-traction HV CBs.

Knowledge of the condition and degradation rate of signalling power distribution cabling has historically tended towards being dated, however this will improve markedly with the introduction of in-situ equipment for “live” insulation (remote condition) monitoring before the end of CP4.

The performance of the points heating asset base has varied with both the degree of blown snow accumulating at the point ends, and the design of certain switches/crossings – some of which prevent the effective heating of the tips when combined with cartridge heaters. The proposed plans for CP5 aim to mitigate these issues in order to improve system resilience against external influences. Added to this is the fitting of Remote Condition Monitoring to points heating installations currently, to better identify quickly when heating issues arise, and these

RCM units will also be renewed where necessary as the points heating installations are themselves renewed.

Output objectives

Presently, there are five output objectives to achieve at the end of CP4 for E&P, of which four relate to Asset Stewardship Index targets. These are:

- M13 – AC traction Distribution Systems – 2.81;
- M14 – DC Traction Distribution Systems – 1.77;
- M15 – AC Contact System Condition – 1.6 (national);
- M16 – DC Contact System Condition – 1.93

And Traction Power Supply Failures causing train delays >10 mins – 41.

Network Rail have set out to the Office of Rail Regulation our planned asset output measures for robustness and sustainability for CP5. At present the forecasts for the Route are being developed for those currently being used

Delivery plan for the final year of CP4

A number of E&P projects will be delivering works in 2013/2014 on the Sussex Route, including:

Renewals of:

- Points heating at several sites;
- Rectifier/transformers at six sites.

Along with enhancement works for the Thameslink Key Output 2 deliverables which will achieve staged completion during 2013/14 and into 2014/15.

Summary of activity in CP5

The detail below describes the key E&P work elements necessary to maintain the end of CP4 output objectives, and in compliance with the current E&P CP5 policy. The profile of this workbank is generally balanced across CP5, except where efficiencies are better achieved through combining works in discrete portions of the period, and in combination with other Routes where appropriate.

Brighton Mainline (Criticality Band 2)

The key renewals involve:

- Partial or complete DC switchgear at twelve sites, of which eleven are due to overloading issues under N-1 conditions;
- Around 6km of HV feeder cabling renewal;
- Renewal of short lengths of conductor rail, totalling around 20km, in small lengths over the length of the BML.

Thameslink (Criticality Band 2)

For the future single Thameslink franchise in 2017/18, to ensure continued reliability, it is essential to create a ring of high performing assets within a 20 minute window of the Thameslink core. For E&P the following works are planned to increase reliability both within this core, and along the main line towards Brighton:

- Adding HV switchgear to two substations, and transformer/rectifier units to four substations;
- Renewing some, or all, of the DC switchgear at six locations;
- Renewal of 100lb/yard conductor rail and/or welding of fishplated joints in various locations.

Remainder of the Route (Criticality Band 3 to 5)

- Renewal of 100lb/yard conductor rail and/or heavy refurbishment in various locations;
- HV cable renewals in two locations.

Furthermore, the Network Rail – Network Strategy and Planning have created a workbank specifically to address the balance of works necessary to fulfil the HLOS requirements.

Delivery Synergies, Opportunities and Efficiencies

The RAM (E&P) has worked together with the other Sussex RAM's to identify opportunities for programme optimisation – packaging/bundling aspects of the workbank by year, geographical area, discipline or as multidiscipline scopes, and thus in turn identify a number of delivery strategies to suit the Route, delivery agents (Maintenance, Franchise, IP), supply chain, customers and stakeholders. This is detailed further in the Route Delivery Strategy.

As the Sussex Route and other southern routes lead on the national electrification strategy, there is significant potential for the Sussex Route to be actively involved in the following activities:

- Standardise specifications and designs using industry norms, allowing off the shelf equipment and materials to be purchased – preferably in conjunction with other Routes to maximise purchasing leverage;
- Greater use of Network Rail in-house designers, standardise installation techniques, and utilisation of in-house delivery;
- Centrally stored equipment and components, providing security, inventory control and 'just in time logistics' as they are required on site;
- Use outputs from time/chainage plans to develop sufficient work volumes and support local supply chain and Maintenance capability and competency to delivery some works, e.g. conductor rail relaying and cable laying.

Safer and Faster Isolations

The Route is developing proposals to deliver a step change in both safety and efficiency on DC third rail electrified lines. The proposals for implementation during CP5 and CP6 will introduce new infrastructure and processes to improve the taking of conductor rail isolations by significantly increasing the number of remotely operated devices employed. As well as reducing the time taken to implement an isolation, it will reduce the direct person interface with the third rail by removing staff and contractors from avoidable contact with electrical equipment and exposure to the operational railway.

The Route has undertaken a review of where these devices offer best benefit and an outline scope has been produced. Further work will be undertaken to refine the scope, costs and programme between now and the end of CP4.

The proposals will provide:

- Remotely operated Negative Short Circuiting Devices (NSCDs) to replace/reduce the need to deploy manually fitted short circuiting straps;
- Remotely operated Controlled Track Switches (CTS) to replace manually operated hookswitches.

These will be primarily deployed on multi track high usage sections where line occupation is at a premium, time taken to establish the isolation is critical and requires staff having to access open lines.

The NSCDs will also improve the management of emergency switch off during running line incidents enabling the affected area to be quickly contained.

In addition, the number of conductor rail mounted manually operated hookswitches will be reduced replacing units with trackside disconnectors (TDs) which remove the need to expose staff to train movement hazards.

This with process changes which can be deployed where all lines are normally blocked and isolated for engineering access (primarily two track railway) will again reduce the number of staff exposed to electrical and railway hazards and reduce the time taken to undertake isolations.

Telecoms

Reliability issues and lesson learnt from CP4

The Telecommunications assets/services present on the route are categorised into three main groups:

- Network Services;
- Railway Operational Telecommunications;
- Station Information Security Systems (SISS).

Reliability Issues (Network Services)

Network services on the route are provided by a mixture of legacy transmission, Fixed Telecoms Network (FTN) Infrastructure with some moderate use of leased services. Legacy transmission is currently present in a variety of forms. The systems support the majority of the transmission requirements on the Route and will be migrated to FTN where applicable. Some systems are being migrated as part of the delivery of projects such as Arun Valley resignalling and East Sussex coast re-signalling.

The FTN infrastructure for the Route is part of the Completion Area 11 package of the FTN project. Build is complete and final commissioning/handover activities are in progress. Migration activities will be ongoing to transfer operational services. The legacy transmission systems hold a number of risks due to the general age profile and the availability of some components to support faulting and maintenance.

Knowledge of the telecoms system is good and in the main spares are available. There is a potential for equipment cards etc. to become obsolete. The legacy systems are approaching the end of their operational life with some minor supportability issues. The FTN system is part of a new build and the system has a high level of supportability. The migration of circuits to the FTN system will facilitate the continuation of network services and reduce the reliance on leased services such as BT and Level 3 (formally Global Crossing). The FTN project may not achieve complete migration for the remaining life of the project therefore this activity will become the responsibility of Network Rail Telecoms. The national SCADA project is installing an independent fibre network there is the potential for network integration in areas that have not been covered by the FTN project to support the migration of legacy systems.

The performance and reliability of the network service will be significantly improved with the ongoing migration from legacy based transmissions systems to the FTN. It should be noted that the copper network has not been wholly renewed by the FTN project any shortfalls where copper infrastructure is required will be managed between Network Rail Telecoms (NRT) and Maintenance.

The age profile of the transmission asset will reduce with the ongoing installation of FTN infrastructure and the removal of the legacy systems.

Reliability Issues Operational Services

Telephony

Operational telephony is predominately provided at the following locations – Three Bridges via a Siemens Hi-Com, this will be superseded by the implementation of a modern system in to the new Three Bridges ROC; however there will be a requirement to support this system until full migration in to the new ROC is complete. London Victoria signalling centre is located at Clapham Junction the central control equipment is being renewed with a Northgate Call Touch Interface and an MX-ONE switch, (commissioning will be complete September 2012), this will leave the five remote nodes still to be renewed (Ericsson MD110) in CP5.

Electrical Control for the route is provided from two locations, Brighton and Selhurst, the operational telephony is provided via Kestrel KDX300 system, new screens have been provided at both sites to maintain supportability until relocation in to Three Bridges ROC.

The concentrators at the following locations are considered to be critical to the operation of the route and thus identified as 'Critical Assets';

- Three Bridges Concentrator;
- Victoria Signalling Centre Concentrator;
- Brighton Concentrator;
- Selhurst Concentrator.

The age profile of the operational telephone concentrator asset will remain static for the large concentrators and increase very slightly for the small concentrators although a number of small concentrators will be removed as part of the Arun Valley project.

Voice Recording

All operational voice communications via both telephone and radio are recorded. There is no planned full scale renewal of voice recording facilities. These assets will be maintained, faulted and renewed by the maintainer in line with asset policy on an on-going basis.

The voice recorders are being managed as part of a maintenance renewal so the age profile will remain static.

Operational Radio

Operational Radio services are provided by Cab Secure Radio (CSR) and National Radio Network (NRN). GSM-R infrastructure is in the process of being installed/commissioned. Full implementation is dependent on the completion of the radio units within the fleet. Currently the proposed date is May 2014. This will form one of the primary changes in the operational Telecoms asset.

The age profile of the existing operational radio asset will reduce with the implementation of GSM-R and the ongoing decommissioning of CSR/NRN asset later in the control period will reduce the age profile further still.

Crossing Communications

Automatic Half Barrier (AHB) crossings are present on the route and these are provisioned with Whitley Public Emergency Telephone System (PETS) technology. There are 25 crossings in total with this system in place.

The age profile of PETS systems will remain broadly static.

Driver Only Operation Closed Circuit Television (DOO CCTV)

DOO CCTV currently exists at 35 stations with various car stop configurations such as 4, 4/6/8 and 8/10/12. The platform extension project will add to these numbers with either new car stops or additional cameras and monitors. There may also be additional systems for guard dispatch installed as part of this project; such is the case at Billingshurst. All of these systems have colour cameras either post mounted or suspended from station canopies, all monitors are of a TFT (Thin Film Transistor) type with the majority being 15 inch portrait style.

Driver Only Operation, Mirrors

There are 29 stations on the route that have DOO mirrors; these assets are maintained by E&P.

The age profile of the DOO asset base (mirrors/CCTV) will reduce due to the ongoing renewals.

Cable Troughing

Line side cable troughing is in place throughout the route. There is a mix of GLT (Ground Level Troughing) and raised GRP (Glass re-enforced plastic) the route is in generally good condition. Access to the route can be hindered by excessive ballast especially after track renewals, heavy vegetation also adds to the problem.

The age profile of the cable route is going to increase and much of this will be dependent on external influences, i.e. track work, geotechnical etc.

Reliability Issues Station Information and Security Services (SISS)

Customer Information Systems (CIS) are present at all of the stations located on the route. Systems are a mixture of LED, TFT and CRT display technology. Security CCTV systems are present at all of the stations. The significant use of CRT display technology throughout the systems are being addressed through NSIP, train operator funded projects and Network Rail Telecoms funded projects from CP4 through to CP5 as the CRT technology is completely obsolete with only moderate refurbishment opportunity still available. The majority of the CIS element of the SISS asset is either at or approaching its end of life report. The Security CCTV element of the SISS asset has no renewal activities planned. Alterations to the system have been undertaken by enhancement projects and or by the train operator.

The Department for Transport (DfT) are currently negotiating future changes to asset responsibility for SISS assets when new franchises are awarded. SISS assets may therefore be handed over to the franchise Operator and responsibility in terms of ownership, faulting, maintenance, repair and renewal will reside with the train operator.

The lack of clarity SISS organisational responsibilities has led to potential inefficiencies in the management of the asset base and the ongoing renewals and enhancements undertaken by both Network Rail and the associated train operator primarily associated with the responsibility of ownership.

Significant works have been undertaken to ratify this position with all stakeholders and a new company process has been created and rolled out nationally. Going forward into CP5 clearer understanding and identification of roles and responsibilities such as Asset Owner and Asset Steward are clearly defined. Renewals of station based equipment such as SISS and Driver Only Operation (DOO) will build on the successes of existing work banks to improve the co-ordination with NSIP, Access for All and other enhancements works to deliver efficiencies.

The age profile of the SISS asset will increase slightly. There are issues to be understood with regards to ownership of the assets and how the age profile is broken down.

Asset Enhancement

One of the key Telecoms enhancements that will be delivered in CP5 will be the renewal of the traditional PETS Systems with a new variant known as KETS. The new variation takes away the requirement for remote power supplies and associated equipment reducing maintenance and faulting activities. A plan has been developed to renew the oldest units and nine new systems will be rolled out between 2015-17.

Safety Improvement

The key safety improvements that will be undertaken during CP5 as part of the renewals and enhancements are associated with the location of equipment. Where practicable assets such as DOO Monitors and lineside equipment will be placed in a green zone environment. The asset management team will be working with FTN/GSMR to learn lessons from the earlier CP4 installations and improve access and the location of equipment. DOO works will start in 2017 and the asset management team will be working with FTN to deliver improvements from the start of CP5.

Compliance with asset Policy

The renewals within the current CP5 submission are in line with the Telecoms Asset Policy and no requirement to vary from this has been identified.

Variations between Modelled IIP & Sussex Route Plan (CP5)

There are currently no deviations identified between the IIP and the Sussex Route Plan.

Route Identified Risks

Risk	Location	Mitigation
Current NOS plan not being met resulting in current telephone systems to remain in operation longer than expected.	Brighton ECR	Procurement of spare screens through minor works submissions.
Current NOS plan not being met resulting in current telephone systems to remain in operation longer than expected.	Selhurst ECR	Procurement of spare screens through minor works submissions.
Legacy copper cable not being replaced by FTN project.	Route wide	Maintenance activities to life extend further or replacement by either future projects with a requirement to use the network or replacement by NRT.

Level Crossings

During CP5 the Route plans to undertake the measures to reduce our level crossing risks, reliability and performance as identified in the respective sections of this plan.

In addition we plan to undertake the following Level Crossing works in CP5:

- Convert Yapton AHB into an MCB-OD, due to the safety issues that are currently requiring a 20 mph speed restriction;
- Renew or part renew 30 crossings as part of the recontrol to the ROC;
- 3 AHBs are being upgraded with additional associated signal protection as part of the recontrol/resignalling works. These are not condition led but required following ALCRM assessments which resulted in collected risk scores of 1 or 2. These assessments have been triggered by the NOS recontrol schemes in the CP5 plan.

55 per cent of the Route's level crossings will be affected by the risk control measures planned to be implemented in CP5. Where practicable the Route will endeavour to align level crossing refurbishment with signalling work.

MCB-OD

The Manually Controlled Barrier Obstacle Detection (MCB-OD) level crossing technology is a fully automated system requiring no intervention from the signaller in normal operations. As a standalone level crossing scheme or as part of a re-signalling, MCB-OD provides a re-control opportunity for locally controlled crossings.

The technology has been successfully trialled on an operational crossing at Filey and is approved for use across the network. It should however be noted that the MCB-OD element of re-control currently carries a number of significant financial risks as the Radar equipment is currently not yet fully approved.

An outline list of proposed CP4 and CP5 and also a list of MCB-OD schemes are shown on the following tables.

Figure 6.9 – The MCB-OD sites that commission on the Sussex Route in CP4 and CP5

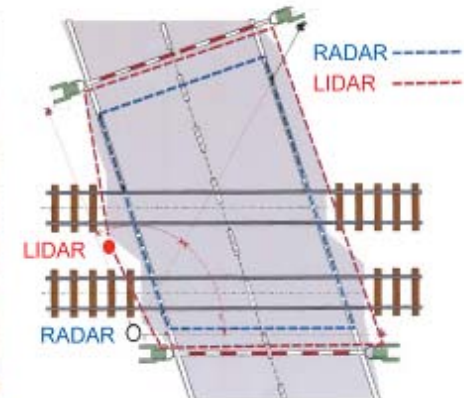
Level Crossing	Operational Date	Type
Ford CCTV	31/12/16	MCB-OD (Conv)
Lyminster CCTV	31/12/16	MCB-OD (Conv)
Woodgate CCTV	31/12/16	MCB-OD
Ripe AHB	30/09/13	MCB-OD
Adversane AHB	31/3/14	MCB-OD
Billingshurst – (Station Road) MCB	31/03/14	MCB-OD
Angmering CCTV	31/12/16	MCB-OD
Ferring CCTV	31/12/16	MCB-OD (Conv)
Goring CCTV	31/12/16	MCB-OD (Conv)
Lancing CCTV	31/12/16	MCB-OD (Conv)
Roundstone CCTV	31/12/17	MCB-OD (Conv)
Shoreham East (Ham Road) CCTV	31/12/16	MCB-OD (Conv)
Shoreham-by-Sea (Buckingham Road) CCTV	31/12/16	MCB-OD (Conv)
Cooksbridge CCTV	31/12/15	MCB-OD (Conv)
Littlehaven (Rusper Road) MGW	31/12/17	MCB-OD (Conv)
Beach Road MCBR	31/12/15	MCB-OD (Conv)
Newhaven Harbour MCBR	31/12/15	MCB-OD
Newhaven Town MCBR	31/12/15	MCB-OD (Conv)
Pevensey MCB	31/03/13	MCB-OD
Wallsend CCTV	31/12/13	MCB-OD
Plumpton MGW	31/12/13	MCB-OD
Polegate MCB	31/12/13	MCB-OD
Wilmington AHB	31/03/14	MCB-OD
Betchworth CCTV	30/10/18	MCB-OD
Reigate MCB	30/10/18	MCB-OD (Conv)
Crawley (High Street) CCTV	31/12/17	MCB-OD
Crawley (Horsham Road) CCTV	31/12/17	MCB-OD

Level Crossing	Operational Date	Type
Keymer CCTV	31/12/17	MCB-OD
Parsonage Road AHB	31/12/17	MCB-OD
Eastfields Road CCTV	31/1/15	MCB-OD
Whyteleafe CCTV	31/12/16	MCB-OD
Whyteleafe South CCTV	31/12/16	MCB-OD
Berwick MCB	30/09/13	MCB-OD
Toddington AHB	01/04/16	MCB-OD
Yapton AHB	01/04/16	MCB-OD
Parsonage Road AHB	31/12/17	MCB-OD

Figure 6.10 – The MCB-OD sites that commission on the Sussex Route in CP6 and beyond

Level Crossing	Operational Date	Type
Selmeston AHB	01/01/28	MCB-OD
Pevensey Sluice AHB	02/08/27	MCB-OD
Betchworth CCTV	31/12/19	MCB-OD

Figure 6.11 – MCB-OD Radar (top), Lidar (bottom left) and the area of obstacle detection provided by both



Additionally the following sites will have CCTV provision as part of the recontrol during the remainder of CP4 and through CP5.

- Hampden Park (Mountfield Road) MCB;
- Portslade CCTV;
- West Worthing CCTV;
- Worthing (South Farm Road) CCTV;
- Havensmouth (Normans Bay).

Drainage assets

Drainage assets (civils)

Drainage assets fall into two categories: Track and Off Track, each of which is broken down into drainage systems. Each system comprises an outfall and various components which convey water to the outfall. For simplification, these are listed below as nodes (catch pits and ditch end-points, etc) and connectors (pipes, ditches, culverts, etc).

Sussex Route comprises:

Asset Category	No. of Components
Track Nodes	6,300 (nr. of)
Off-Track Nodes	3,100 (nr. of)
Track Connectors	126,684 (metres length)
Off-Track Connectors	112,315 (metres length)

Some of these assets date from the original construction of the railway and are approaching the end of their serviceable life. A percentage of these assets, particularly the track drainage, have been renewed since the time of original construction. However, these are subject to deterioration at varying rates.

Delivery plan for the final year for CP4

The delivery plan for the final year of CP4 comprises installation of an interim solution to flooding around the Haywards Heath Tunnel on the Brighton main line (VTB3) and detailed design for the permanent solution. In addition, a number of planned and reactive drainage minor works schemes across the Route and programme of refurbishment of cutting crest drains.

Output objectives

There are no KPIs for drainage in CP5 at present.

Key local issues

A particular local issue is flooding around the Haywards Heath Tunnel area, including the need to install flood alleviation associated with an outside party inflow to the country end of the tunnel. The tunnel has required expenditure over previous control periods and it is planned that a permanent solution is delivered during CP5.

Some tunnel drains running through the six-foot are generally in poor condition through age of asset, lack of funding and access allowing for a maintenance regime and indiscriminate track renewal practices under CP3. The renewal of tunnel drainage at Haywards Heath, Crowborough and Bletchingly tunnels requires significant capital expenditure at these locations.

Variations to application of policy

There are no variations to the emerging drainage policy, although there are challenges with respect to the OPEX provision to ensure that the drainage system is maintained in a serviceable condition by the delivery units.

CP5 work profile

There is a significant spend at several locations namely Haywards Heath, Bletchingly and Crowborough Tunnels as well as drainage minor works and drainage work associated with earthwork refurbishment schemes (reinstatement of crest and toe drains, installation of counterfort drains).

The CP5 Structures expenditure plan is aligned to maintaining the current railway on a minimum whole-life cost basis. The impact of key national investments and HLOS has no effect on the work profile.

During CP5, the major proportion of the spend is planned for the first years, in order to address flooding and track quality issues at a few key locations.

Drainage assets (Track)

Drainage Delivery for final year of CP4

Extensive drainage renewal between Crawley and Horsham Road Level crossing of some 1km in length, this will alleviate the formation and track geometry problems in conjunction with the planned track renewal later in the control period. In addition, a number of planned and reactive drainage minor works schemes across the Route.

Key local issues

Now that the Drainage surveys have been completed across the Route this has highlighted a very large volume of poor or marginally functioning drains which will have to be renewed on a prioritised basis throughout the control period and into Control Period 6 (CP6).

Variations to application of policy

There are no variations to the emerging drainage policy, although there are concerns with respect to the OPEX provision to ensure that the drainage system is maintained in a serviceable condition by the delivery units.

CP5 Work Profile

The CP5 track drainage work bank is predominantly on Criticality Bands three to five at some 24 locations. There majority of works is to renew systems where there is not only large number of breaks but old clay pipe systems. Works will also be targeted at reinstating ditches and culvert renewal.

Maintenance

Maintenance is delivered on the Sussex Route by two self-contained Delivery Units based in Croydon and Brighton. Each Delivery Unit has separate discipline depots of track, signalling, Electrification and Plant, along with a Works Delivery section for capital works. The maintenance delivery plan for the remainder of CP4 includes principally carrying out maintenance scheduled tasks and work arising with the volumes of work agreed by the RAMs. This schedule of work along with additional performance plans form the position of the CP4 exit. Within the key workstreams of note is the first tranche of Remote Condition Monitoring applied to signalling assets. The lessons in its use will aid its further roll out in CP5.

Additionally, the Sussex Route Maintenance team will be delivering the Thameslink KO2 resilience work bank during CP4. The content of this work is twofold; firstly to improve reliability of the strengthened assets on the key diversionary route. Secondly, between December 2014 to December 2017 the provision of maintenance cover to minimise the response times associated with asset failures and external incidents, e.g. bridge strikes, trespass and vandalism, point failures etc. on the key diversionary route.



Leaf Buster in action at Glynde.

Key local issues which have influenced the CP4 and CP5 delivery plans include:

- 20 min window for the Thameslink core route, i.e. critical assets/junctions 20 mins from the Thameslink core route needing enhanced maintenance and component renewal to ensure presentation of trains at the core on time;
- Increase in traffic usage through CP4 into CP5 (15 per cent increase in average tonnage with some sections of the Sussex Route seeing as much as 77 per cent increase);
- Density of signalling per Route mile;
- Quantum of flat junctions on the Route;
- Age of the Route's operational assets specifically, track, signalling and E&P fish plated (100 and 106lb/yard) conductor rail;
- Availability to undertake works in week day night possessions has reduced by an average of 30 per cent in CP4;
- Increase in volume of rail with severe RCF (400 per cent increase in CP4);
- Increase in the number of actionable rail defects of over 50 per cent in CP4.

Summary of activity in CP5

During CP5 maintenance will be delivered on the Sussex Route in just one route wide Delivery Unit. This Delivery Unit will have out based staff, mobile and vehicle based. The field systems will enable remote access to all systems through appropriate mobile computers and the Orbis workstreams. This will give for a more efficient workforce with information and knowledge as required on site. Generally the Route maintenance activities will become more risk based and the actual amount of maintenance work will aim to be reduced. The maintenance activities will be developed in the context of asset maintenance policies and the Route Safety Improvement Plan (RSIP). This influences maintenance activities in a number of areas principally to reduce the amount of time spent on the track carrying out maintenance work and reducing the manual aspects through automation. Detailed below is a summary of initiatives to support a strategy to reduce the amount of access required from end of CP4 through CP5:

- New signalling equipment to be located further than three metres from the track where possible to eliminate the requirement for access to carry out maintenance work;
- Reliability Centred Maintenance (RCM) will drive less inspection/maintenance volumes and so less access. Train borne monitoring including plain line pattern recognition, track quality and conductor rail measuring will significantly reduce the need for access and will allow remote inspection methods;
- In addition the use of the Mobile Flash Butt Welder (MFBW) (on average eight minutes a weld including stressing compared with currently approximately two hours per weld) will reduce the amount of access required for rail replacement, not to mention better weld quality and so the reduction of possible broken rails at welds. With the MFBW the

manual handling and exposure to risk is removed. However there is the need for more access points for the MFBW to gain access to all locations.

With the further innovation of negative short circuiting devices which replace earthing straps there is a systematic operation which reduces human error, risk exposure, and also reduces the number of staff required on site. Negative short circuiting devices are a significant safety improvement. Also they significantly improve working time in possessions with the consequent significant increase in productivity and efficiency.

Variances to application of Policy

The basis of remote condition monitoring essentially removes the need for cyclical maintenance and to enable reliability centred and risk based maintenance there are significant standard changes required including at a basic principle level. Also there is a requirement for Rule Book changes to give more efficient possession and isolation processes along with the use of short circuiting devices. Help is required from Central Services to assist in rule book and standard changes including principle changes.

There will be benefits from CP5 signalling schemes with light weight structures and maintenance, to enable the associated policy changes.

There will be some areas of work load increase. This may be volume driven, or may be due to work previously undertaken externally by contractors for renewals. Simple renewals and other core railway work including refurbishment will be carried out in house by the maintenance team. There will be volume increase due to asset increased numbers for things like the GSM-R Network

CP5 work Profile

The Route has implemented the first three phases of Signalling Remote Condition Monitoring during CP4 and has found the result beneficial. Specifically the Route has observed a number of results which have included an increase in the number of pre-failure interventions which reduce the performance delays experienced by trains. In terms of expenditure and resource the impacts have been limited as each early warning still requires attendance and intervention by the response team although it is easier to identify the cause of the fault, meaning a saving on materials, as the wholesale replacement of equipment is not required.

Looking forward into CP5 the main strategy to improve reliability is the full implementation and use of remote condition monitoring on signalling critical assets providing 100 per cent RCM coverage with some E&P coverage [See Signalling and E&P Asset Management for further detail on rollout during CP4 and CP5]. This in conjunction with the use of 'flight engineers' to monitor and drive the monitoring systems, advise what work is required and to enable a strategy of 'predict and prevent' failures. The progression of this strategy will then lead toward intelligent proactive maintenance. There will be a reduction in cyclical maintenance which will be replaced by risk based reliability centred maintenance work. This will require changes to standards and policies. As well as remote condition monitoring of critical assets, train borne

monitoring on specialist and passenger trains will be required to be extensive and the Route will work with HQ to develop and help realise these plans. This will include track quality measurements, conductor rail monitoring and plain line pattern recognition.

The CP5 Route Plan for maintenance is supported by a number of national and local efficiencies which are outlined below:

The track efficiencies are to be achieved through higher productivity of new on track machines reducing number of shifts required, e.g. B66, use of technology (MFBW) and standardisation of processes. The national efficiencies are agreed in principle although there were some adjustments over national volumes, reducing the percentage efficiency and large variations in the unit rates which have reduced the efficiencies;

Signalling & Telecoms national efficiencies were generally agreed but due to the plan not to fit lightweight structures until half way through CP5 there is a consequent reduction in the assumed efficiency. The LED signals will assist with work load reduction and working at height, however there was some concern on national savings at the beginning of the control period due to data collection;

There are a number of local efficiencies proposed. The first is achieved through a reduction to one Maintenance Delivery Unit and the efficiencies in direct headcount that this brings. Also other efficiencies are had by following the Sussex Maintenance Vision through home/site start, rationalising depots, creating of a 24/7 super depot at Three Bridges and multi disciplinary intervention teams and field systems. In addition other opportunities include the development and training of the works delivery teams to deliver further renewals and enhancements work.

Faster isolations and possessions through the use of negative short circuit devices and methodology is a key work stream when successfully implemented will make significant improvements to maintenance and renewals productivity and efficiency.

Red Zone Working

The Route has outlined its position on Workforce Safety within the Route Safety Improvement Plan. Specifically the Route seeks to maximise the use of Green Zone working, currently the Route Maintenance team undertakes on average 54 per cent in Green Zone. Principally the Red Zone working is in the areas of Track (production/inspection), S&T production, and E&P Conductor Rail inspection.

Within the Route Plan allowance has been made for additional Lookout Operated Warning Systems (LOWs) and the associated training. The LOWs system will be implemented where appropriate; for the purposes of the Route Plan it has been assumed to be used in the following situations:

- at night time;
- within 200 metres of a junction or Switch & Crossing;
- Line Speed >100mph;
- Moving worksites.

Enhancements

The route enhancement plans are detailed within the Route Performance and Capability Improvement Plan

Summarised below is the route's long term vision for our significant stations, these include London Victoria, East Croydon and London Blackfriars.

London Victoria:

Summarised below are extracts from the London Victoria masterplan:

- De-cluttered concourse with a mezzanine level for shops;
- Existing facilities to be improved, layout to be amended into more logical arrangement;
- Improve the rail air deck car park to create either a significantly improved entrance or new property development.

London Blackfriars:

- The route vision is embodied within the brand new station that has been constructed as part of Thameslink Key Output 1.

East Croydon:

- A new station with a larger concourse and new platforms (with basic facilities) to respond to the forecast passenger growth between 2008 and 2022 of 22 per cent;
- New footbridge giving improved access to the shopping centres, offices and hotels. This will be delivered in Christmas 2012.



East Croydon Station Footbridge – November 2012.

Deliverability, data and assumptions

This section summaries the key output, activities, expenditure, risks and assumptions behind the Sussex Route Plan.

Delivery Strategy for the CP5 plan

The Route strategic targets for CP5 in terms of service delivery, sustainability and efficiency require a step change in the management of risk, how we engage with our customers and stakeholders in the planning, procurement and delivery of work.

The volume of work to be delivered on the Route set against a backdrop of traffic growth through CP5 and efficiency targets requires a step change in approach to the way work is planned and delivered to make the maximum use of access to the railway to complete works efficiently and safely. The devolved Route structure provides the opportunity to coordinate the CP5 work bank across all asset types and to work with our customers and stakeholders to develop an integrated plan.

The Route Plan has developed a consideration of outputs and operational performance as described in the Route Output Specification along with the efficiency challenges over Control Period 5. The Route has consulted with both internal and external stakeholders to determine the appropriate asset management interventions, unit rates and appropriate levels of efficiency given the unique characteristics of Sussex.

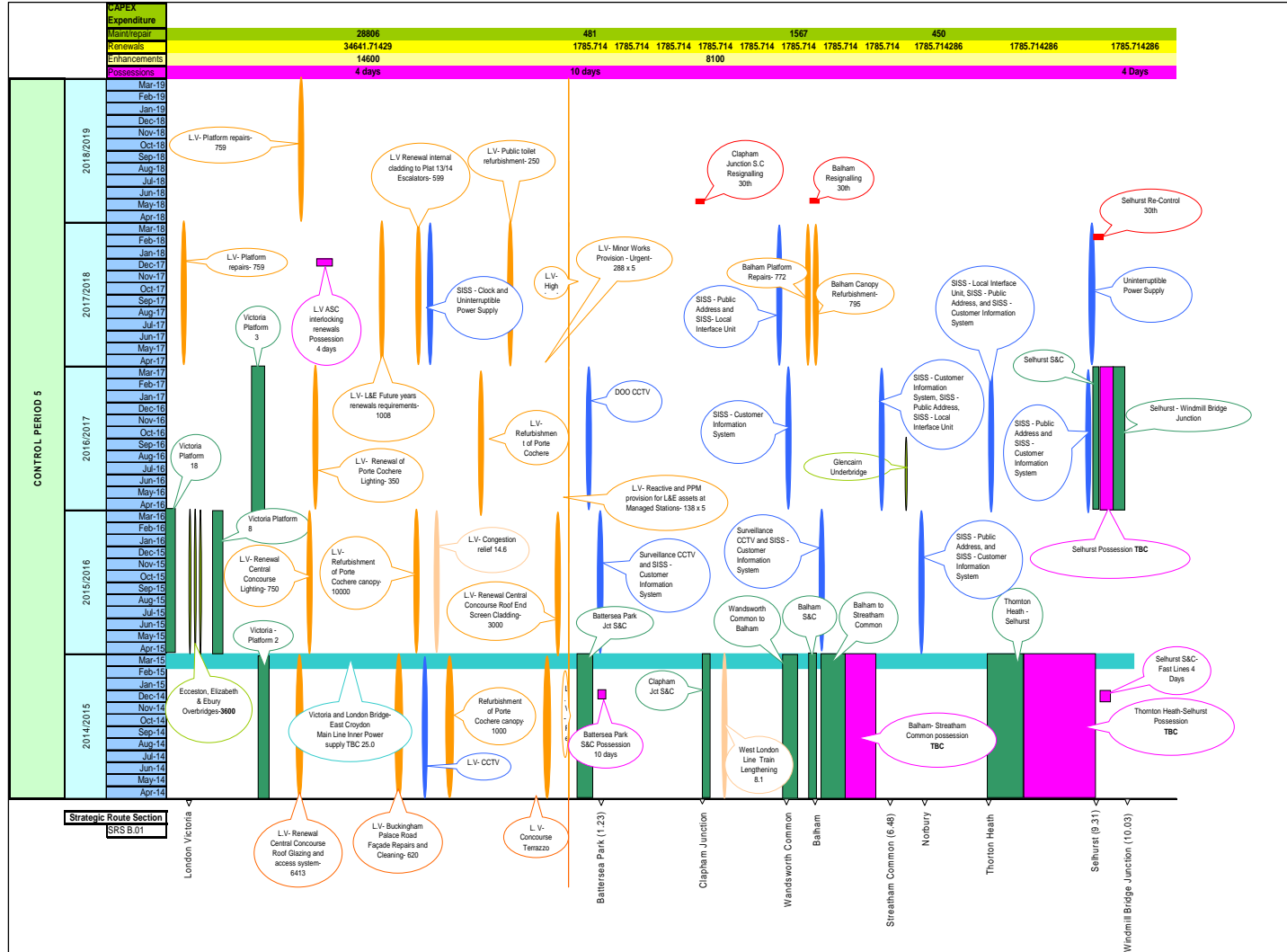
Detailed within this section are the strategic themes (see list below) and expenditure plan which underpin the Route delivery plan for CP5.

- Integrated planning;
- Risk Management & Assurance;
- Assumptions;
- Capability of our People;
- Value and Growth;
- Customer service and customer satisfaction.

Integrated planning

The Route's intent is to determine the most cost effective and efficient way of delivering its renewal workbank and enhancement portfolio along with the maintenance volumes where appropriate. The Route has commenced integrated planning for CP5 with our customers,

stakeholders and delivery partners (predominantly Network Rail Infrastructure Projects) – it has been captured in the form of time/chainage plan (see extract below).



The integrated plan will allow the Route with our delivery partners to determine across asset types and geographical areas the most efficient procurement strategy and delivery programme to minimise the impact on the availability and performance of the Route.

Working with our Infrastructure Projects (principal delivery partner) four key areas have been identified to improve efficiency as part the integrated planning initiative:

- Improving specification to ensure client requirements are clearly defined;
- Programming management/packing work across asset types and geographical areas to ensure work volume is maximised and undertaken safely;
- Tripartite Agreements between involving the Route, Infrastructure Projects and key customers/stakeholders (support non-standard access strategy);
- Advance funding for renewal work bank development to enable early development of schemes with appropriate involvement from the supply chain, customers and stakeholders.

Risk Management and Assurance

The Route approach to risk management and assurance is detailed within the Route Safety Improvement Plan. The key strategic risks/opportunities within this plan are:

- Efficiency business cases which underpin the efficient expenditure prove to be incorrect;
- Industrial relations associated with organisational change;
- Changes to the UK/World economy which result in price escalation;
- Increase in traffic use beyond that which has been modelled and included within this plan;
- Reactive asset intervention as a consequence of a lack of long term sustainable asset renewals – especially relevant to the Route structures portfolio which may mean that the Bridge Condition Monitoring Index (BCMI) worsens over the control period.

Assumptions

Detailed below are key strategic assumptions which frame this plan:

- Supply chain is able to deliver the CP5 work bank as currently planned;
- The Route is able to access and perform works at stations and on the infrastructure under a safety regime which is no more restrictive than 2012/13;
- The current national plan for migrating signalling and electrical control to the Three Bridges ROC is robust and will be delivered as stated in this plan;
- CP4 outputs will be delivered as planned and not roll over in CP5;
- Enhancement schemes will be delivered as planned in CP5 – this is especially relevant for the Thameslink KO2 programme;
- The Route Plan captures current capital and operational expenditure and may be subject to change.

People and Culture

Sussex Route is committed to developing and up-skilling its employees to achieve the Route goals. The following current areas of focus include:

- Succession planning for key roles such as RMD, RMD direct reports and their direct reports;

- Managing and deploying employee talent throughout the Route to maximise individual performance levels and grow internal talent pipelines for key roles;
- A range of approaches have been undertaken utilising newly employed apprentices and young people on the Track & Train programme providing short-term work experience opportunities to new graduates seeking work;
- A further key aspect of the Route's approach is supporting all line management employees to deliver the people and performance strategy and seeking to widen resourcing activity to recognise the contribution of diverse opinions and inclusive behaviours for the future.

Sussex Route seeks to partner with our Train Operating companies and currently have established joint secondment arrangements between Network Rail and Southern. Sussex Route and Network Rail seek to explore the opportunities for further joint people activities to benefit the industry.

Value and Growth

In 2011 the Route set up a 'Value & Growth' (V&G) team to focus on delivering business efficiencies with both our rail partners, and other rail industry stakeholders in response to specific recommendations highlighted in the Industry wide McNulty review. The work stream of this V&G team will seek to both implement synergies (where they exist), and also to grow the income base to allow the Route a choice to either return Financial Value Added to the wider industry or to reinvest within the Network.

The Route has a business plan for CP4 that outlines the commitments and which is based on working with others, both within the business and within the broader stakeholder community, to deliver efficiencies for the wider Industry.

The V&G team has committed to generate net benefits of circa £0.5 million p.a. up to the end of CP4. For the CP5 Route Plan it is assumed that the same level of net benefit or profit will be generated by utilising the same V&G team staff resource.

The success of the V&G team relies on the continued creation of ideas and initiatives by each of the following functions:

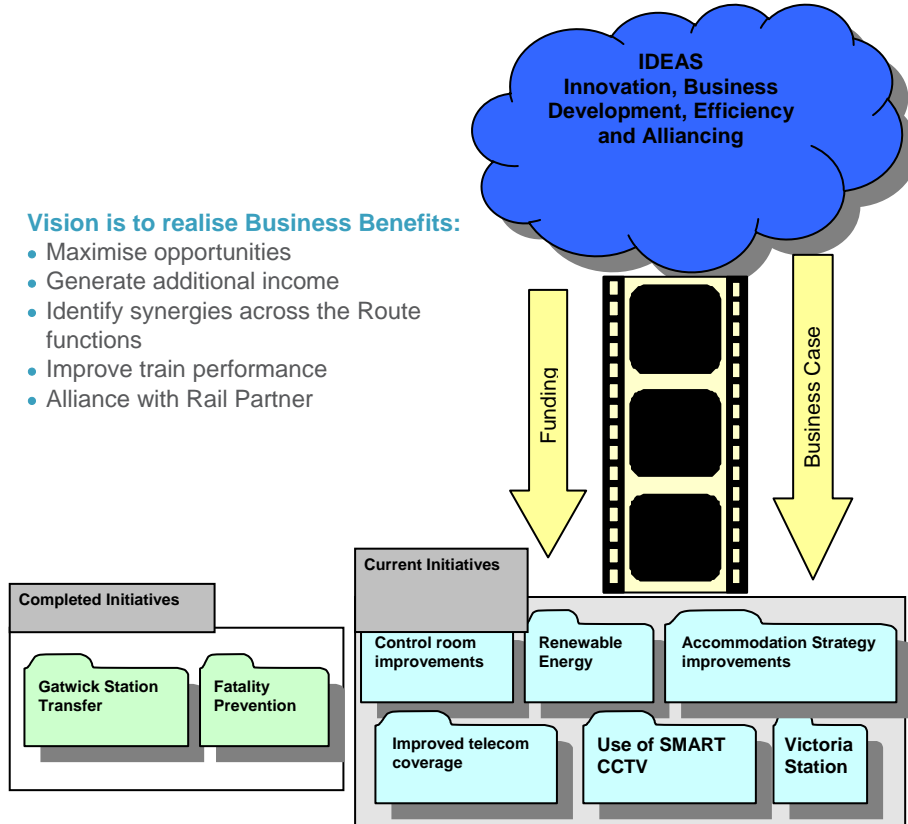
- Asset Management;
- Maintenance;
- Operations;
- Performance; and
- Safety.

Also it is assumed that the V&G team will act as a focal point to manage the Business Change programme between the centre and Route that satisfy the criteria of providing value and growth.

Since the middle of 2011 the V&G team has worked on a number of "schemes" to maximise opportunities and generate income for the business and also the wider Rail Industry.

The process and approach by the team is to gather ideas for developing the business, delivering efficiencies and realising business and Rail Industry benefits.

The diagram below shows in diagrammatic form the process and approach adopted by the V&G team to create and realise business benefits.



The V&G Workbank

Detailed below are the completed and current initiatives the V&G team are planning to deliver in CP4 and into CP5. Ongoing business planning continues to identify additional schemes to be delivered in CP5.

In CP5 the V&G team are targeting financial and non financial net benefits of approximately £0.5 million p.a.

Customer service and customer satisfaction

The Sussex Route aims to deliver train paths, the timetable and train movements that ensure safe performance but which also meets the needs of our customers. Our ultimate goal is to deliver a high level of customer satisfaction and advocacy for the service we offer.

The Route is fully committed to maintaining and improving the close relationships that have been built with our customers and to focus our improvement in the areas that make a difference to them through the development of more aligned objectives. CP5 will present the Route with a new challenge as the Thameslink franchise commences in 2015.

We will continue to meet with customers on a regular basis to better understand opportunities for enhancing levels of satisfaction and driving down industry cost whilst also improving the way in which we work together through mechanisms such as devolution and Alliancing. The Route will endeavour to expand on the innovative work done during CP4 and deliver enhanced service delivery, safety and value for money with the new Thameslink franchisee.

The annual customer satisfaction survey is our key measure of customer satisfaction. The main drivers of customer satisfaction on the Sussex Route are performance delivery, asset reliability, demonstrable effective joint working, and consistent communication. The Route aims to address each of these through effective annual customer satisfaction action planning, its Alliance work streams and other areas of this Route Plan.

Capacity Data

Detailed below are capacity data tables for the Route which are derived from the High Level Output Specification (HLOS) published in July 2012.

High Level Output Specification (HLOS) route or city: London Bridge (Sussex Routes)

	AM 3 hour peak			AM 1 hour peak		
	Forecast demand in 2013-14	Extra demand to be met by		Forecast demand in 2013-14	Extra demand to be met by	
		2018-19	Demand to be met by 2018-19		2018-19	Demand to be met by 2018-19
Number of passengers*	45,300	24,600	69,900	23,500	11,800	35,300

	AM 3 hour peak			AM 1 hour peak		
	Passenger vehicle arrivals	Number of seats	Total passenger capacity**	Passenger vehicle arrivals	Number of seats	Total passenger capacity*
Forecast capacity at end of Control Period 4	563	36,700	55,500	262	16,900	25,500
Additional capacity enabled by the plan	128	2,900	34,400	42	1,000	11,500
Forecast capacity at end of Control Period 5	691	39,600	89,900	304	17,900	37,000

High Level Output Specification (HLOS) route or city: London Victoria (Southern)

	AM 3 hour peak			AM 1 hour peak		
	Forecast demand in 2013-14	Extra demand to be met by		Forecast demand in 2013-14	Extra demand to be met by	
		2018-19	Demand to be met by 2018-19		2018-19	Demand to be met by 2018-19
Number of passengers*	47,700	6,700	54,400	23,200	1,300	24,500

	AM 3 hour peak			AM 1 hour peak		
	Passenger vehicle arrivals	Number of seats	Total passenger capacity**	Passenger vehicle arrivals	Number of seats	Total passenger capacity*
Forecast capacity at end of Control Period 4	723	46,000	66,600	323	20,600	30,000
Additional capacity enabled by the plan	23	1,500	2,300	21	1,300	2,100
Forecast capacity at end of Control Period 5	746	47,500	68,900	344	21,900	32,100

* Number of passengers as specified in the HLOS

** Total passenger capacity includes an additional allowance for standing on short journeys of 20 minutes or less

For further information please refer to the passenger capacity plan supporting document.

Expenditure plan

This section details the proposed Route expenditure plans and activity volumes for CP5.

Detailed below is the efficient expenditure plan for the route operations team. The cost to operate the Route during CP5 reduces primarily as a consequence of the long term operating strategy of which the dominate factor is the migration of signalling control to the new Three Bridges ROC. The renewal activity volumes for CP5 has been developed by the individual Route Asset Managers (RAM) using top-down modelling and bottom up work bank development using their detailed local asset knowledge and the application of national asset policies. Minor variances by discipline evident across routes are as the consequence of the individual RAM flexing activity volumes to suit local structural factors and conditions.

CP5 Renewals efficiencies summary

Efficiencies	FY15	FY16	FY17	FY18	FY19
Track	0%	3%	6%	9%	13%
Signalling	4%	8%	12%	16%	21%
Civils	2%	5%	8%	12%	15%
Buildings	10%	14%	16%	17%	17%
Electrification	9%	15%	19%	22%	22%
Telecoms	3%	6%	9%	12%	15%
Plant	8%	15%	17%	20%	20%

CP5 Operations expenditure

£m (12/13 prices)	2014/15	2015/16	2016/17	2017/18	2018/19	CP5 Total
Signaller	24.2	23.7	23.3	22.1	21.1	114.5
Non-Signaller	4.1	3.9	3.2	3.5	4.0	18.6

Summary of CP5 Maintenance expenditure

£m (12/13 prices)	2014/15	2015/16	2016/17	2017/18	2018/19	CP5 Total
Maintenance Function Controllable Costs	37.4	36.4	33.8	32.6	31.4	171.5
RAM Function Controllable Costs	1.1	1.0	1.0	1.0	1.0	5.1
CEFA element of RAM Function Controllable Costs	2.8	2.8	2.6	2.6	2.3	13.0

Renewals	FY15	FY16	FY17	FY18	FY19	CP5
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Renewals	FY15	FY16	FY17	FY18	FY19	CP5
Total: 12/13 prices	165.6	175.5	144.2	144.9	119.0	749.2
Track	25.3	29.3	29.6	22.8	32.4	139.4
Plain line	13.4	12.5	14.4	14.4	14.0	68.7
Refurbishment	3.0	2.9	2.8	2.7	2.7	14.1
S&C	4.4	9.6	8.2	1.6	11.7	35.5
Drainage	1.2	1.2	1.2	1.1	1.1	5.8
Fencing	0.9	0.9	0.8	0.8	0.8	4.2
Other off-track	2.4	2.3	2.2	2.2	2.1	11.2
Signalling	40.3	38.1	35.8	49.0	31.1	194.3
Conventional resignalling	22.4	10.1	10.5	19.0	10.0	72.0
Level crossings	1.7	5.4	10.7	6.5	1.7	25.9
Minor works/life extension	8.8	10.2	6.5	6.1	7.0	38.6
Control centres		4.3				4.3
National projects	0.4	0.4	0.4	0.4	0.4	2.1
Resignalling (partial)	6.3	5.5	5.4	14.9	11.4	43.5
Traffic Management		1.7	1.7	1.6		5.0
Signalling Other	0.6	0.6	0.6	0.6	0.6	2.9
Civils	21.0	20.6	21.9	21.0	19.4	103.9
Underbridges	10.3	10.2	11.8	11.3	10.0	53.7
Major structures	0.1	0.1	0.1	0.1	0.1	0.5
Overbridges	1.3	1.2	1.2	1.2	1.1	6.0
Tunnels	0.6	0.6	0.6	0.6	0.5	3.0
Civils Other Assets	1.2	1.2	1.1	1.1	1.0	5.6
<i>Culverts</i>	<i>0.3</i>	<i>0.3</i>	<i>0.3</i>	<i>0.3</i>	<i>0.3</i>	<i>1.5</i>
<i>Footbridges other assets</i>	<i>0.5</i>	<i>0.5</i>	<i>0.5</i>	<i>0.5</i>	<i>0.5</i>	<i>2.5</i>
<i>Retaining walls</i>	<i>0.3</i>	<i>0.3</i>	<i>0.3</i>	<i>0.3</i>	<i>0.3</i>	<i>1.6</i>
Earthworks	5.4	5.2	5.1	5.0	4.8	25.5
Civils Other	2.1	2.0	1.9	1.9	1.8	9.7

Renewals	FY15	FY16	FY17	FY18	FY19	CP5
Buildings	26.3	46.8	21.6	18.7	11.1	124.5
Managed Stations	9.5	24.5	4.9	2.5	1.6	42.9
Franchised Stations	11.4	17.5	14.2	13.8	7.1	63.9
Depots	3.6	3.2	0.8	0.8	0.8	9.4
Lineside Buildings	1.9	1.6	1.8	1.6	1.6	8.3
Electrification	21.9	10.3	8.8	8.1	5.9	54.9
Conductor rail	3.6	2.5	2.4	2.0	1.9	12.4
DC distribution	15.2	6.5	5.4	5.2	3.0	35.3
SCADA	2.4	0.8	0.4	0.4	0.4	4.5
Electrification Other	0.6	0.6	0.6	0.5	0.5	2.8
Telecoms	7.2	8.9	8.4	5.2	2.7	32.4
Station I&S	5.8	7.0	5.3	3.3	1.3	22.7
Operational	1.5	1.9	3.1	1.9	1.4	9.7
Plant & Machinery	10.0	5.7	4.8	4.9	2.9	28.4
Fixed Plant	9.4	5.1	3.9	4.2	2.1	24.6
Intelligent Infrastructure	0.6	0.5	1.0	0.8	0.9	3.8
Other Renewals	13.6	15.8	13.3	15.2	13.5	71.4
Property	5.7	7.9	5.4	7.2	5.6	31.8
Isolation	7.9	7.9	7.9	7.9	7.9	39.6

Volumes

Track	FY15	FY16	FY17	FY18	FY19	CP5
Plain Line Conventional						
Steel relay (km)						
Complete Trax (km)	12	11	10	11	11	55
Rail renewal (km)	15	15	15	15	15	75
Single rail (km)	2	2	2	2	2	10
Heavy refurb (km)	6	9	20	20	20	75
Plain Line High Output						
ABC (km)						
Rail Sleeper Relay (km)						
Heavy refurb (km)						
Plain Line Refurbishment						
Heavy refurb (km)	1	1	1	1	1	5
Medium – concrete (km)	2	2	2	2	2	10
Medium – other (km)	9	9	9	9	9	45
Switches & Crossings						
Abandonment (#)	3	3	3	3	3	15
Full (#)	8	19	17	3	27	74
S&C refurbishment						
Heavy refurb (km)	15	15	15	15	15	75
Medium refurb (km)	21	21	21	21	21	105

Signalling	FY15	FY16	FY17	FY18	FY19	CP5
Conventional (SEUs)						
	73	111			184	369
ERTMS (equ SEUs)						
Level Crossings (#)						
MCB (#)						
MCB-CCTV (#)				3		3
ABC (#)						
AHB (#)					1	1
AOC (#)						
Obstacle detection (#)	1	1	6	4	1	13
MCB-OD(#)		3	7	2	1	13
MSL/MWL (#)						
Partial Conventional						
		74	3	12	71	161
Targeted component						
	7	28	8	6	36	84
Modular Resignalling						
Other SLC						
Civils						
	FY15	FY16	FY17	FY18	FY19	CP5
Underbridges (sq m)	2,358	2,403	2,873	2,873	2,627	13,133
Major Structures (sq m)	–	–	–	–	–	–
Overbridges (sq m)	333	333	333	333	333	1,665
Bridgeguard 3 (sq m)						
Tunnels (sq m)	1,085	1,085	1,085	1,085	1,085	5,427
Culverts (sq m)	40	40	40	40	40	202
Footbridges (sq m)	112	112	112	112	112	562
Coastal/Estuary Defences (m)	–	–	–	–	–	–
Retaining Walls (sq m)	95	95	95	95	95	476
Earthworks (5 chain-length)	138	138	138	138	138	690

Buildings	FY15	FY16	FY17	FY18	FY19	CP5
Franchised Stations						
Footbridge (m ²)	252	305	349	820	160	1,886
Train Shed (m ²)		5,533	3,900	1,595		11,028
Canopy (m ²)	2,520	2,520		885	194	6,119
Platform (m ²)	3,490	12,441	7,335	15,521	5,065	43,852
Building (m ²)						
Managed Stations						
Footbridge (m ²)						
Train Shed (m ²)	4,368	6,417		4,368	10,600	25,753
Canopy (m ²)			1,049			1,049
Platform (m ²)				5,500	5,500	11,000
Building (m ²)	4,732	1,498	1,498	3,702	1,498	12,928
Electrification						
Overhead Line						
OLE Re-wiring (wire runs)						
OLE Campaign changes (wire runs)						
Mid-life refurbishments						
Structure renewals						
Conductor rail (km)	12	7	7	2	1	29
AC distribution						
HV switchgear (#)						
GSP transformers (#)						
GSP cable (km)						
Booster transformers (#)						
DC distribution	122	76	72	72	52	393
HV switchgear (#)	15					15
HV cables (km)	24	5				29
LV switchgear (#)	31	19	20	20		90
LV cables (km)	52	52	52	52	52	259
Transformer/Rectifiers (#)						

Telecoms	FY15	FY16	FY17	FY18	FY19	CP5
CIS	47	76	74	47		243
Public address	776	41	407	146	129	1,500
CCTV	250	544	438	238	50	1,521
Clocks			36			36
Operational telecoms						
Large Concentrators						
Small Concentrators						
Driver-only operation CCTV				31		31
Cables & Routes						
PETS			1			1
Voice recorders						
HMI Large (#)		12				12
HMI Small (#)						
Legacy Radio						
GSM-R (#)						
Power (#)						