Bristol LRT

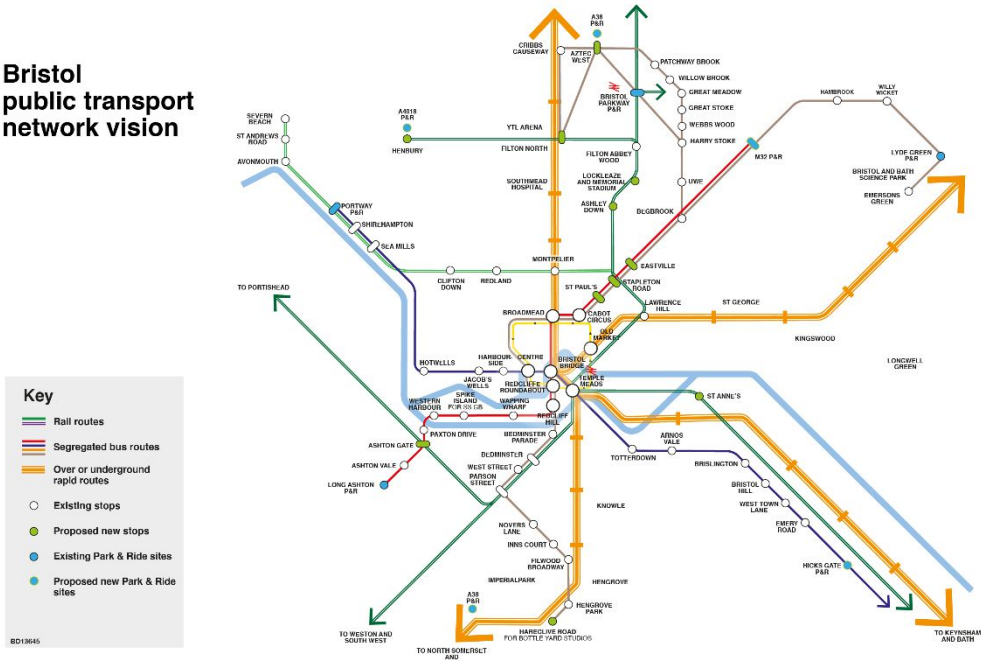
Trackwork Concept Proposal

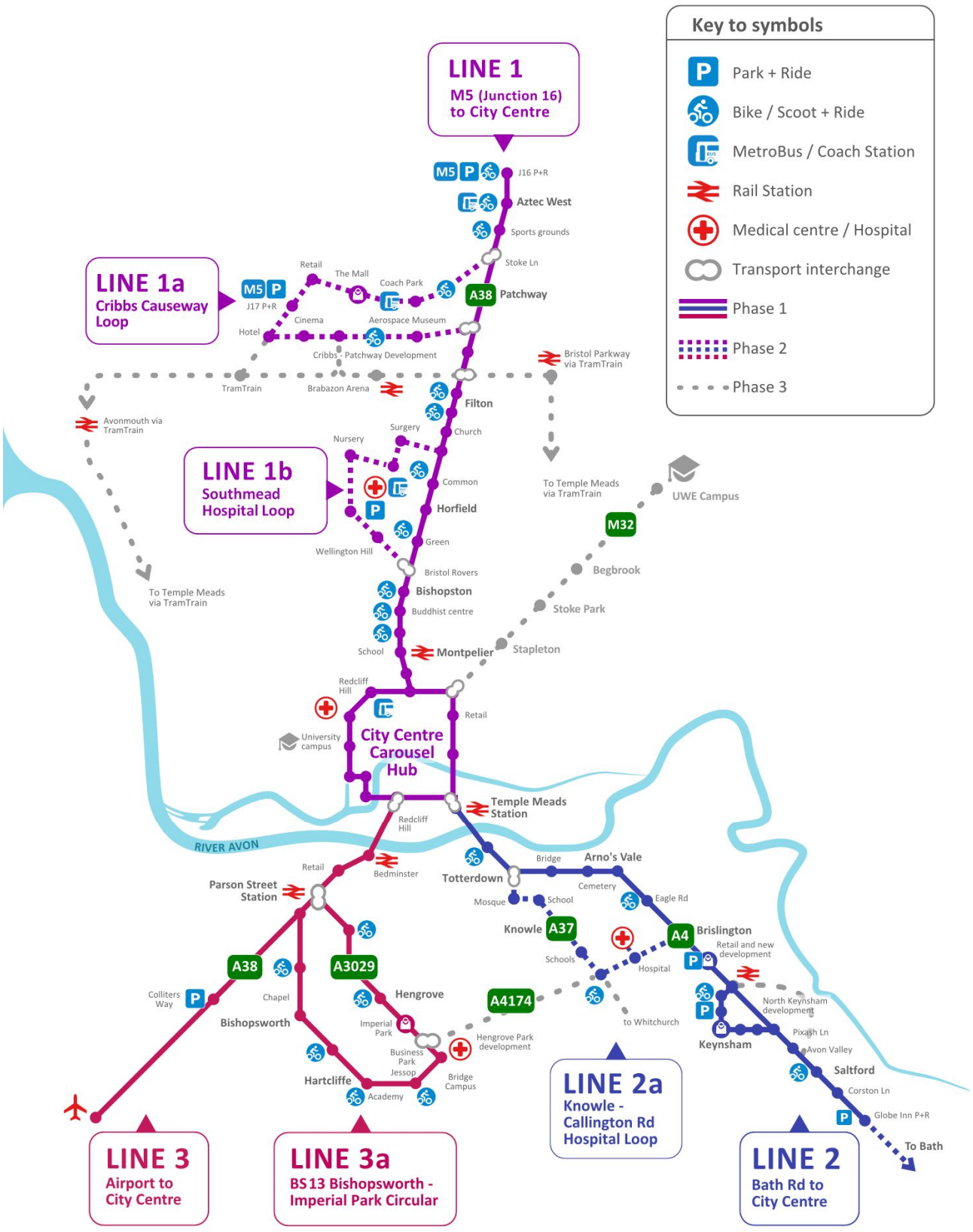
STECONFER

GLOBAL RAIL INFRASTRUCTURE

Contents

The Integrated Scheme





About Us

HEADQUARTERS:
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STECONFER is a global railway construction company with a **skilled** and **experienced workforce** and a plant equipment fleet for **Trackwork**, **Overhead Catenary (and Light rail)**, **Signalling** and other rail-based systems.

The company's 20+ years' experience is consistently based on core values of:

- **Safety** for our team, our customers, partners, and clients.
- **Client focussed** value propositions.
- Technical **competence** and high-quality standards.
- **Adaptability** to local cultures, customs, and **social responsibility.**
- Passion for **Equality** and **Diversity.**
- **Environmentally** conscious and caring.

STECONFER is qualified, willing, and able to provide comprehensive solutions to the market and all its clients regarding the **system** installation and maintenance of:

- **Tramway** and **LRT**
- **Metro** and **MRT**
- **Heavy Rail Infrastructures**

Local Company

Although part of a larger Global Group based in Lisbon, Portugal, Steconfer has a fully registered (11146299) standalone company in the UK. **Steconfer Rail Ltd** has been registered since 2018, with its own Quality & Management System compliant to and verified by RISQS (registration no. 6683) with its registered office at **International House, Mosley Street, Manchester, M2 3HZ.**

Examples of Similar Project Experience

LUAS CROSS CITY LINE

Ireland

Construction of 13,3 km of single track including OLE installation, from which, 5,2 km of embedded on street track on the city center.

EXTENSION OF THE BLACKPOOL TRAMWAY

United Kingdom

Construction of the track and OLE for the extension of the existing tramway on the city center, from North Pier to central Station. First project in the UK

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KAOHSIUNG LRT

Taiwan

Track works for:
- 11 km of embedded track;
- Intersection with 29 crossings;
- Supply and Installation of 8 crossovers on the main line and 15 turnouts on the depot.
- Installation of IRJ's.

LUAS DUBLIN LIGHT RAIL

Ireland

Design, construction, testing&comm - 18 km concreted, plinth, ballasted track (tunnels, viaducts, segregated/shared with road traffic track), including the OLE installation

SWEDEN
- **LUND LRT** – OLE Works
- **RINGON DEPOT LRT** – Track and OLE Works

NORWAY
- **BERGEN LRT** – Track Works

ISRAEL
- JERUSALEM LRT - Track Works
- PORT HADAROM

What We Can Do for Bristol LRT

Whereas we can provide trackwork, power distribution and signalling systems we believe that the concept for Bristol is to have, and benefit from the environmental sustainability and technical advantage of a 21st century *Ultra Light Self Powered Tram* System. This means that Bristol would not require a lineside traction power supply system in the form of a Third Rail, or Overhead Line System. Although our area of expertise does include Overhead Line installation, we do have experience of delivering this type of forward-looking transit solution having worked with, partnered, and built a successful relationship with the Global Leader in terms of Self Powered Tram Systems. It therefore would be our privilege to limit our potential scope of supply to the installation of the trackwork, including the preparation and construction of the track bed.

The scope of works to which this concept proposal relates can be summarised as follows:

- Confirmation of formation level
- Stabilisation base (C8 / C10)
- Setting and fixing of reinforcement

- First pour concrete.
- Track works incl. embedded & encapsulated, slab, or ballast.
- Second Pour including Shoulders (where required)
- Surface finish – paved / concrete / pigmented concrete / asphalt / cobbles / grass.
- Cable Ducting & Road, Track & Stop Drainage

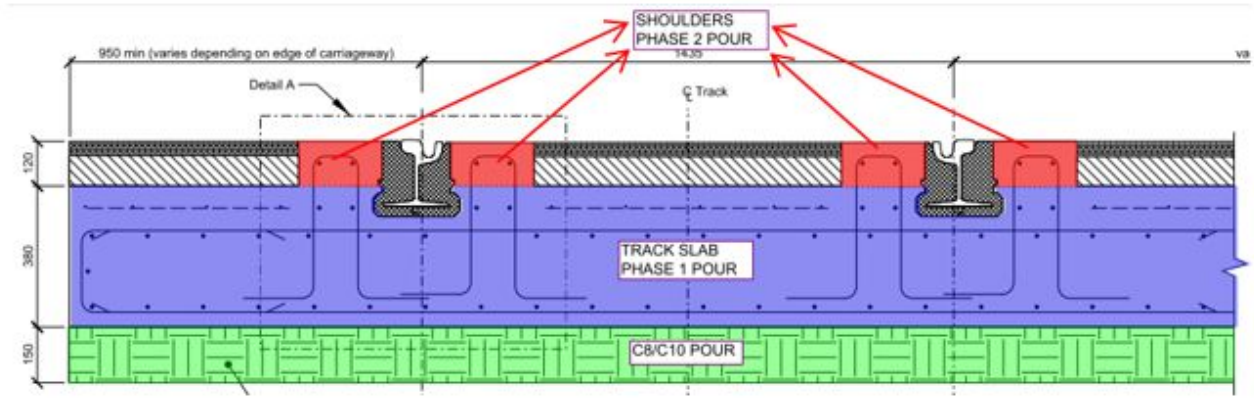
All stages of installation are preceded and followed by a detailed survey using the latest available digital and laser surveying equipment to assure line and levels are always maintained to exacting tolerances.

Designing for Successful Track Delivery & Systems Integration

Delivery of Quality and Safety managed efficient construction starts at the Design stage, but preferably even earlier. Understanding, then capturing all of the actual requirements of the scheme, challenging them and resolving them one at a time is one of the most important elements of a successful construction scheme. This will be done in conjunction with our construction specialists, multi-faceted design team, the other package contractors (Highways in particular), TfGB, BCC, WECA as part of the *Joint Local Transport Strategy*. Solving problems on paper and gaining consensus and approval before commencement allows considered and efficient procurement, confidence in the program, reduced disruption through efficient construction, and provides transparency to all stakeholders, including the public. Collaboration at these early coordination stages facilitates and allows collaboration without conflict during the delivery phase, which will contribute to an efficient and successful project.

Track Construction

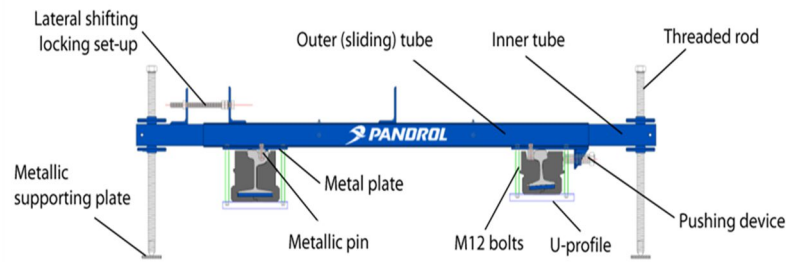
Our ‘typical’ method of track construction is to build the system on a shallow foundation. This can reduce disruption caused by the necessity of diverting buried infrastructure services if a track construction method is chosen which relies on a deeper foundation, which of course we would advise against. There are other methods available, including “drop in slabs” utilising a similar shallow foundation.



The slab is set at a depth of 500mm from finished rail level with allowance for a 150mm C8/10 blinding layer as a working platform. The choice of structural concrete for blinding is made to allow for construction traffic after an appropriate curing time and to provide sufficient strength for anchoring the props required to guarantee rail alignment.

As with the most light rail systems the rail can be encapsulated to counteract the effects of stray current. Sophisticated rail setting jigs allow for a top-down method of construction whereby the rails are suspended at their finished alignment to very exacting tolerances.

Shared section of track with finished shoulders prior to asphalting



Typical Rail Positioning Jig

Double Track Section – rails set with positioning jigs.

Structural C40/50 concrete is poured to a finished level 120mm below the finished rail level. Our specialised track surveyor ensures the alignment is within the construction tolerances to design and will submit a pre-pour report to the client prior to all pours. Additionally, the track surveyor will be present during the pouring process to ensure there no negative effects on the set alignment caused by weather conditions or from the concreting process. This initial pour is referred to as the track slab pour and is sufficient to embed the rails and allow the jigs to be removed.

The remaining 120mm is finished with either asphalt / pigmented concrete / cobbles / block paviors or even grass depending on the designated operation of the highway in any given area. If the area allows for vehicular traffic in addition to the tram the finish will usually be asphalt with concrete shoulders either side of the rail and encapsulation of a width of 225mm. When the area is segregated from other traffic the finish can be anything to suit or "tie-in" with the local environment, or architect's wishes. Where concrete is used with an exposed aggregate finish, it is our preference to add filaments to the finishing concrete to protect against freeze thaw action and chipping. This is particularly important in shared areas where the road/rail interface at the shoulder can be a constant source of problems if such filaments are not added.

Set track prior to concrete and surface finish.

Completed section of shared and segregated track.

Completed track section with block paving.

Following the completion of the second stage pour the track surveyor completes a post pour alignment including the relative overlap with the adjoining section. A sophisticated track trolley with data logger will be used to conduct an uniform survey of the entire track at the end of each phase of the project.

Typical Working Tolerances

Parameter	Description	As-constructed Tolerances
Vertical alignment	Absolute variation from design value	+/- 5mm
Vertical alignment	Relative on 3m base No versine shall be of opposite sign to the design versine	+/- 3mm
Horizontal Alignment	Absolute variation from design value	+/- 5mm
Horizontal Alignment	Difference between consecutive versines on overlapping 10m chords from designed geometry for curves up to 200m radius	+/- 3mm

Horizontal Alignment	Difference between consecutive versines on overlapping 20m chords from designed geometry for curves greater than 200m radius. No versine shall be of opposite sign to the designed versine	+/- 3mm
Cross Level (including cant)	Permissible variation from design cross level or cant (one rail relative to the other – not absolute)	+/- 2mm
Twist	Maximum rate of change of cross level over a 3m length (mm / 3m) (including design twist for cant application)	12mm/1:250
Gauge	Plain line (variation from 1435mm nominal gauge)	+/-2mm
Gauge	S&C (variation from nominal gauge for plain line)	+/-1mm
Gauge	Rate of variation in gauge over any 2m length in plain line	Not > 2mm

Parameter	Description	As-constructed Tolerances
Vertical deflection under load	Vertical deflection at any point on the rail under maximum permissible load	1.5mm
Vertical deflection under load	Vertical axis of the rail	+/- 0.5mm

Typical Rail Installation Tolerances

Typical Construction Tolerances

A Preliminary Budget

Bristol LRT

Embedded Trackwork - Cost Estimate

Date: 16/06/2021
Revision: 0

Line		Line 1	Line 2	Line 3	Depot?
Route		M5 to City Centre inc Ring	Bath Road to Globe Inn	City Centre to Airport	
Approximate Route Length (km)		19	20	15	4
Double Track (Assumed)		Yes (Exc Ring)	Yes	Yes	No
Single Track Length (km)		**34**	**40**	**30**	**4**
	Unit				
Concrete Paved Track (Est.)	km	**17.00**	**20.00**	**15.00**	**0.00**
Asphalt Paved Track (Est.)	km	**17.00**	**20.00**	**15.00**	**0.00**
Ballast Track (Est.)	km	**0.00**	**0.00**	**0.00**	**4.00**
Turnouts (Est.)	No	**12**	**16**	**12**	**20**
Double Crossover (Est.)	No	**4**	**6**	**4**	**1**
Budget Price Total	£	**96,049,252.00**	**114,064,579.00**	**85,261,064.00**	**10,399,416.00**
Budget Price per Single Track km	£	**2,824,978.00**	**2,851,614.48**	**2,842,035.47**	**2,599,854.00**

The table above is for preliminary indication purposes only and provides an outline cost budget for the trackwork inclusive of all materials, plant and labour required to complete the works to specification for each individual line.

At this stage route lengths, double or single track, turnout and cross over requirements are pure “estimates” and of course are subject to route and alignment design.

Costs would be reviewed and refined at tender stage, and scale efficiencies can be incorporated should multiple lines be chosen for project execution.

The cost of utility diversions (if required) implementation of traffic management plans, and / or temporary access routes are not included within this outline cost budget.