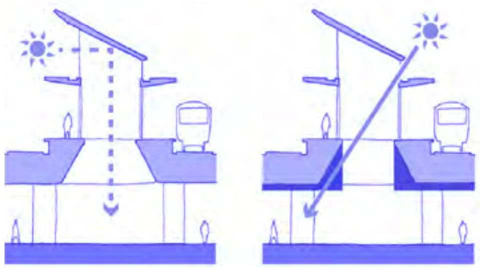
LONDON BRIDGE STATION

GRIMSHAW

Location	London, UK	**Project Partner/Lead**	Andrew Byrne, Mark Middleton
Completion	2018	**Project team**	Grimshaw, Arcadis/WSP JV, Maynard, Donald Insall Associates, MFD
Client	Network Rail		
Contractor	Costain, Skanska, Balfour Beatty, NG Bailey		



SUSTAINABILITY AND REGENERATIVE DESIGN CASE STUDY

The redevelopment of London Bridge station was one of the most complex and ambitious rail station redevelopments in the UK, including complex multi-staged infrastructure realignment and the complete rebuild of London Bridge station while maintaining operations.

The scheme has sustainability as a driving factor in both design and construction, introducing strategies such as geothermal piles and natural ventilation that are unusual for such a large public space.

Aerial View ↑

London Bridge station is the linchpin of the Thameslink Programme which links Brighton and Ashford to Cambridge, Peterborough, and Bedford, through central London. The development was driven by the need for Network Rail (NR) to increase the number of through-trains accommodated at the station and to meet the anticipated growth in passenger numbers from 56mppa to 96mppa. To accommodate this growth the scheme creates a grand new street-level concourse, providing new entrances on two nearby streets.

The sustainable design approach relied on close collaboration between the client, design team and construction partner, in order to understand opportunities, risks and agree targets that were realistic and measurable. A primary goal was to implement passive measures, ensuring the concourse is filled with natural, glare-free north light, and natural ventilation and cooling, which filters through the canopies that protect the platforms above. Secondary drivers include active energy-efficient measures such as lighting controls, geothermal energy piles and intelligent escalator/ lift controls.

Above all, Network Rail committed to implement sustainability into the construction of the programme. This was manifested in the Thameslink Programme Sustainable Design and Construction Strategy. The document set out sustainability objectives with several targets under each objective, one of which was to achieve a CEEQUAL Excellent award for the project.

Operational Carbon:
An early stage energy and carbon analysis identified the key energy-consuming systems and processes within the station. An options appraisal proposed a range of operational energy-saving measures, which were investigated in terms of feasibility, energy cost savings and carbon emission reduction. The selected measures include:

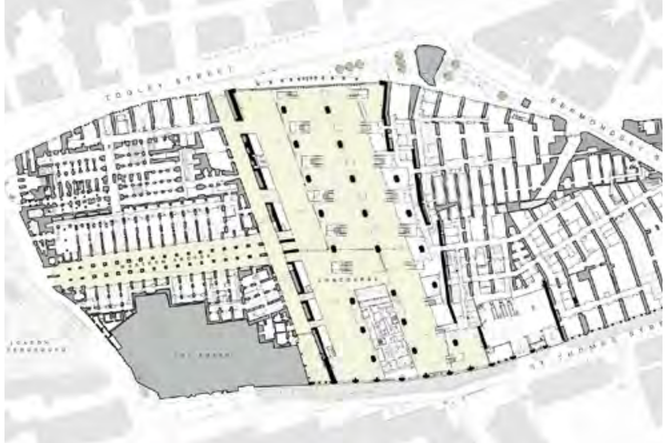
- Optimised access to natural daylight in the concourse and on the platforms, while preventing risk for solar overheating.
- High performance building envelope providing solar shading.
- Natural ventilation and free cooling to the concourse, as well as the station accommodation.
- Lighting strategy including efficient fixtures, integration with natural daylight potential and best practice controls.
- Efficient escalator and lift equipment and optimised controls, which in some cases required challenging NR standard specifications.
- Highly efficient supply of cooling via condensing loops.
- Ground-source heating and cooling in the form of a series of energy piles feeding into the condensing loop of the retail spaces.

Embodied Carbon:
Embodied energy and carbon impact of the materials and components proposed for the station were investigated in detail as part of a project lifecycle energy and carbon analysis. This identified the key contributors to the overall carbon footprint and focused attentions on lower impact options.

The reuse of the existing Victorian structure maintained significant heritage value, enhanced the surrounding streetscapes and urban realm and created a substantial saving in the project's embodied carbon. The use of other recycled materials throughout the project, such as recycled steel, further reduced the project's embodied carbon.

Social Impact:
The overall upgrading of the existing station and its increased capacity supports the uptake of sustainable public transport, encouraging commuters to avoid car travel. The upgraded station also promotes walking, being carefully designed to consider the interaction between the various modes, including rail passengers walking to the bus station, London Underground and surrounding streets.

The principal contractor was also committed to ensuring engagement with the local community and their supply chain, providing skills and employment and opportunities for local business in order to leave a social legacy beyond the project completion. Community volunteer days, work placements with local schools, training opportunities for jobless residents and working with local charities are just some examples of the extended engagements London Bridge undertook throughout Southwark and their work to maintain a diverse workforce.



Street level plan showing reuse of the existing Victorian brick viaducts into concourse and retail spaces ↑

View of Western Arcade towards London Underground ↑

Key Sustainability Facts

PROJECT SITE
Brownfield (Existing Operational Station)

OPERATIONAL ENERGY [REGULATED ONLY]

> Annual Energy Savings During Construction (kWh) = 1,290,601 kWh*
> Annual Operational Energy Savings (kWh) = 1,260,038 kWh*
> Annual operation carbon savings = 396 tCO2e
** The station annual energy use in operation baseline was estimated at 8532Mwh or 3,990(CO2 tonnes) per annum.*
> Energy/fuel types: Gas + electricity [grid] + on-site renewables [Geothermal Piles]

EMBODIED ENERGY/CARBON

> Overall construction carbon reduction of project = 1,687 tCO2e
> Overall embodied carbon reduction = 8,354 tCO2e

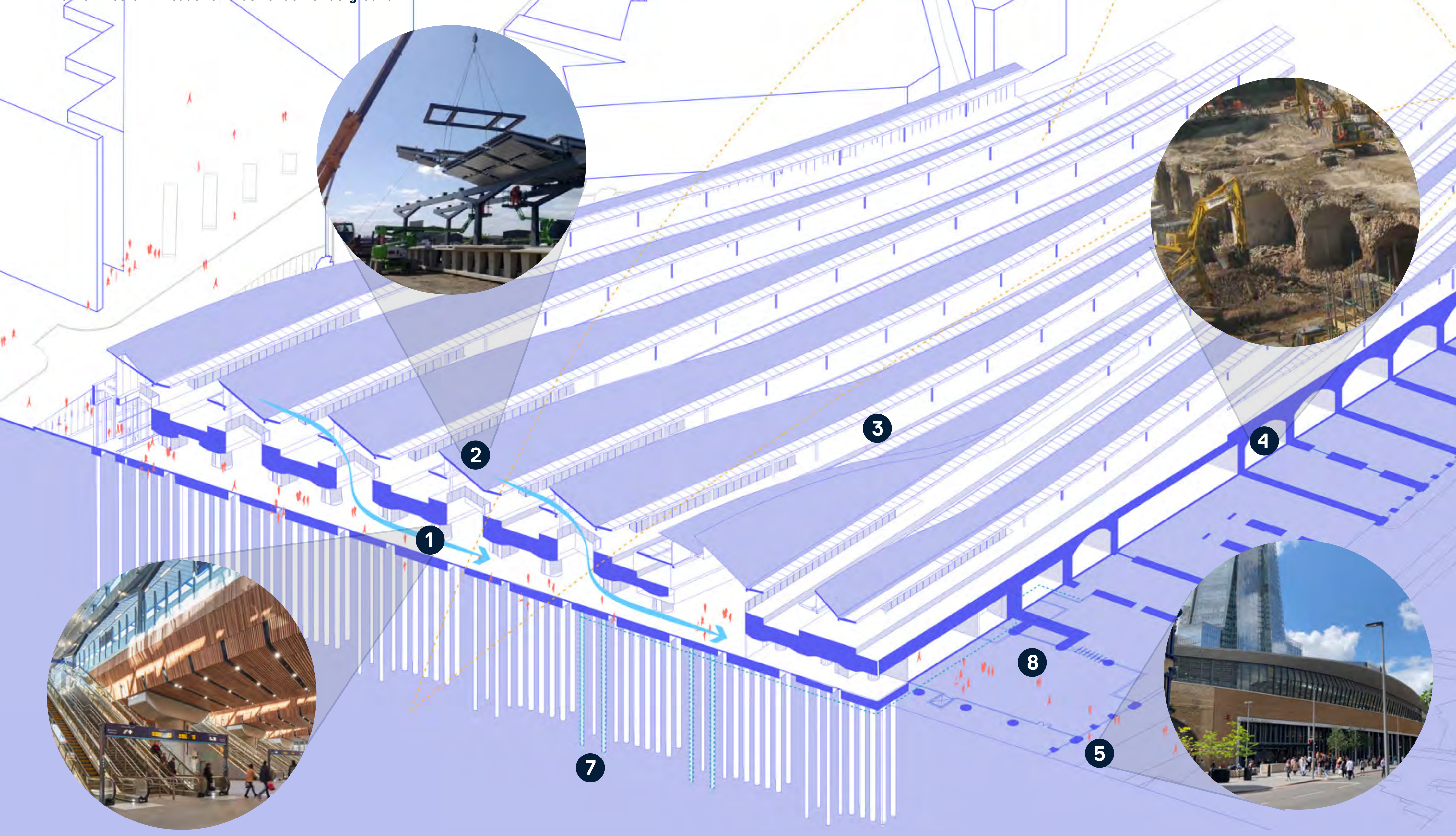
WATER USE AND DRAINAGE
The specification of low-flow/time-automatic/electronic sensor fixtures supported water conservation within the building.

Alignment with UN Sustainable Development Goals

SDG 3 GOOD HEALTH AND WELL-BEING
Design encouraging of mass transit use and is integrated into pedestrian-friendly public realm, designed/configured to provide convenient intermodal connections, promoting walking.

SDG 8 GOOD JOBS AND ECONOMIC GROWTH
New and improved services provide broader access within the metropolitan area between housing and places of work and education.

SDG 11 SUSTAINABLE CITIES AND COMMUNITIES
The station acts as an economic catalyst in the heart of an existing transit-oriented city centre, as an alternative to urban sprawl.



1. **Comfort / natural daylight and ventilation –** The naturally ventilated concourse does not require heating or air conditioning and allows for good levels of natural daylighting, resulting in significant energy savings. The design target of the station was not to exceed external temperatures by more than 5 degrees and the station's ventilation was determined to be enough for this criterion to be met throughout the next century. Overheating was further reduced through a dual-layered platform awning to limit the effect of radiant heat from exposed roof surfaces to platform occupants. The designed geometry of platform canopies also ensured the concourse could be top-lit, filled with natural glare-free northlight.

2. **Prefabrication –** The use of prefabrication across the project canopies, façades and cladding provided an inherent cost, energy and time saving in the reducing of interface with other trades; an improved quality associated with the working environment; a reduction in defects, rework, revisits and labour. Factory assembly allowed the roof, soffit and cable containment to be installed at ground level. This reduced the need to work at height; required fewer deliveries to site; reduced crane lifts, logistics and traffic management; reduced impacts on local communities, and; improved materials management and waste minimisation. It also provided the ability to mock-up, test, inspect and amend the product prior to delivery.

3. **Sustainable construction materials –** A Materials Use Plan was created to enable the sourcing of environmentally and ethically friendly materials while reducing the usage of unsustainable materials. Recycled materials contributed to lowering the project's embodied carbon. For example, by producing reinforced steel with a 98% recycled content, the project reduced the embodied carbon content of the top ten materials used by 15.6% against the industry standard baseline. Where possible construction materials were locally sourced, with 87% of deliveries to site from within 35 miles.

4. **Heritage and reuse –** A significant carbon saving was achieved through the decision to adapt and reuse 52% of the existing Victorian brick viaducts to accommodate the station's operational infrastructure, which included plant rooms, station storage and staff offices.

5. **Enhanced urban realm and ecology –** By enhancing the new station entrance on Tooley Street, a new urban realm was created. This acts as a primary orientation and dwell zone for both customers and members of the public as they make their way to onward travel. The urban realm completes the juxtaposition of the 'More London' development on the north side of Tooley Street, which has brought a welcome integration of both hard and soft landscaping and the addition of mature London plane trees.

6. **Growing sustainable transport –** The increased capacity of the station results in estimated savings of 24 million kg of CO2 per annum from the modal shift towards new and improved rail services. This is the equivalent to the energy use of 10 office buildings the size of the Shard.

7. **Geothermal piles –** Geothermal piles provides a continuous, reliable and sustainable energy source. These piles generate 126 tonnes per year in carbon savings for the operational station, delivering a 6.1% carbon reduction. They provide ground-source heating and cooling in the form of a series of chillers which feed into the main condensing loop of the retail spaces.

8. **Low-energy fixtures –** The station integrates a number of low-energy fixtures into its design. Intelligent control escalators allow reduced energy use during station off-peak hours and have annual savings of 36.46 tCO2e. DALI controlled LED lighting in the station concourse provides annual CO2e savings of around 235t. The inclusion of other active energy-efficient measures in the final build include high efficiency heat recovery, efficient air and water distribution and efficient control gear systems for lifts.