Co-sponsored by

ICG Infrastructure Client Group

National Infrastructure & Service Transformation Authority

The Green Construction Board

Delivered by

Built Environment Connective



London's Thames Crossings

This is one of 15 case studies informing the Infrastructure Systems Review. It forms part of the evidence base for systems change in the built environment.

System: Cross-river transport.

Systems contribution and value: Proposes development from existing investment approaches, in which repairs and maintenance are coordinated between numerous custodians, to a fuller system approach that supports them in protecting cross-river connectivity, efficiency and resilience.

Author
Mark Enzer

Contributors
Isabel Coman
Garry Sterrit
Jennifer Tolson

Summary

London's Thames crossings are a critical part of the capital's transport, economic and social infrastructure. They connect communities, support public transport, enable freight and servicing, provide walking and cycling links, and help London's road and public transport networks operate as a whole. This case study considers the crossings within Greater London as a connected system, rather than a set of separate bridges, tunnels, ferries and rail links.

Ownership and maintenance responsibility for non-rail river crossings is split between TfL, the City Bridge Foundation and the London boroughs. Each owner assesses crossing investment alongside its wider infrastructure and organisational needs.

This is a reasonable approach, but priorities set separately may not fully reflect dependencies and benefits across the crossings system. Incorporating a wider system view into each owner's assessment could inform its investment priorities.

Many of the crossings are ageing assets requiring significant investment to maintain safe operation. Several, including Vauxhall bridge, Rotherhithe tunnel and Blackwall tunnel, are already closed or restricted, with further restrictions possible. However, for some owners, the cost of works can be substantially greater than the funding available through existing budgets and funding programmes. The amount of national funding available for London is expected to be insufficient for the scale of the maintenance and repair backlog.

Building on the longstanding pan-London bridge prioritisation approach developed by the boroughs and TfL through the London Bridges Engineering Group (LoBEG), a whole-system view would connect asset condition, usage, bus routes, active travel, freight, accessibility, resilience, ownership and funding. It would help owners assess how individual crossings contribute to connectivity across the portfolio.

A systems approach can help prioritise investment, reduce disruption, manage restrictions transparently, and strengthen the case for long-term funding.

The wider lesson is that system-wide outcomes can depend on assets owned and managed by different organisations, so realising system value depends on owners working together.



There are 58 river crossings, 28 for rail (plus one proposed) and 30 non-rail.

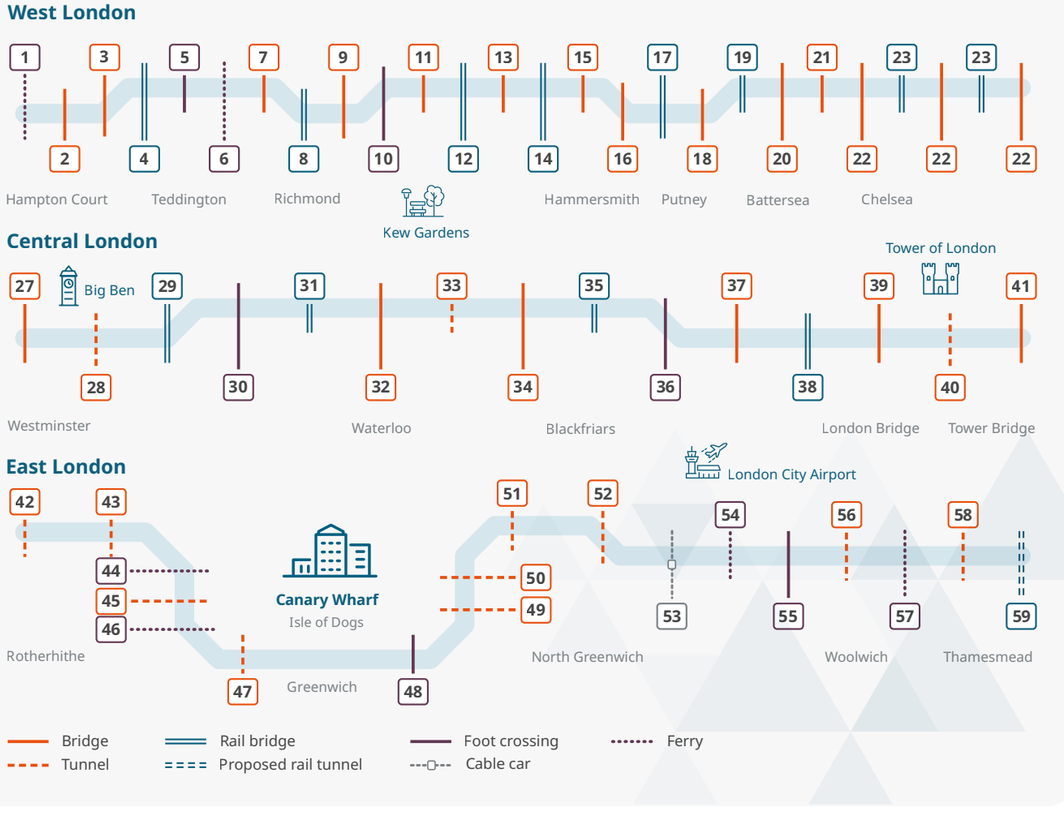
A systems approach can help prioritise investment, reduce disruption, manage restrictions transparently, and strengthen the case for long-term funding.

Disclaimer. It should be noted that this case study is a thought piece exploring how systems thinking could be applied to London's Thames crossings to support investment cases and improve overall benefits. It reflects the author's views and is not a policy position of TfL, the London boroughs, the City Bridge Foundation or LoBEG. The author thanks TfL for providing insights and background on the management of Thames crossings. The London boroughs, LoBEG and the City Bridge Foundation were not consulted in developing this paper.

Scope

This study covers London's Thames crossings as a connected system within Greater London. It includes road bridges and tunnels, pedestrian and cycling crossings, ferries, and relevant public transport crossings where these affect cross-river connectivity. The primary focus is on non-rail structures, reflecting TfL's traffic authority role, but the wider modal context is included because road, bus, rail, ferry, walking and cycling operate as one mobility system.

Figure 1: London's Thames crossings — spatial and modal portfolio





Hammersmith Bridge is one of several currently closed or restricted crossings.

The geographical scope covers west, central and east London. There is substantial variation in crossing density, modal choice, charging, accessibility and restrictions. West London has 23 crossings, central London has 18 and east London has 17. However, the mix and usability of those crossings differ markedly by mode (road, bus, rail, ferry, walking and cycling) and user group.

This case study is exploratory. It considers how systems thinking could help inform cross-boundary infrastructure challenges in a city like London, building on existing collaboration between crossing owners. It examines how the system is governed, funded, maintained and prioritised, and how a fuller portfolio view could improve outcomes.

The key stakeholders include TfL, London boroughs, the City Bridge Foundation, LoBEG, DfT, transport users, public transport operators, freight and servicing operators, local communities and businesses.

The systemic challenge is that a strategic London-wide network depends on assets owned, funded and maintained by many different organisations. The case study therefore focuses on how owners can steward the portfolio, rather than on the engineering design of individual assets.

Outcomes

London's Thames crossings are intended to support safe, reliable and inclusive movement across the river. They enable people, goods and services to move between communities, employment centres and strategic destinations. The desired outcomes are wider than transport connectivity alone. They include economic productivity, enabled by efficient freight, logistics and mobility, active travel, access to jobs, education, leisure and services, reduced severance, resilience to asset failure, and good value from existing infrastructure.

Actual outcomes vary significantly across the system. Central and west London have relatively dense crossing provision, with multiple bridges, rail links, walking and cycling routes, and many cross-river bus routes. East London has fewer practical choices, particularly for buses and active travel. There are approximately 52 cross-river bus routes in west London and 58 in central London, but only three in east London, despite continuing growth and development pressures. There are also constraints on cross-river movement in east London, including limited operating hours, lift availability at foot tunnels and restrictions affecting pedestrians, cyclists, vans and HGVs.

The condition and availability of existing crossings are major determinants of system outcomes. Several crossings are already closed or restricted, including Vauxhall Bridge, Hammersmith Bridge, Albert Bridge, Rotherhithe Tunnel and Woolwich Foot Tunnel. These limitations affect the wider movement system, not only the individual structures concerned. A closure or restriction displaces traffic, bus operations, walking, cycling and freight onto alternative crossings, increasing pressure elsewhere and reducing network resilience.

Access to cross-river movement is uneven. Where crossings are unavailable, restricted or have limited operating hours, some users face longer journeys or fewer practical choices.

The evidence base for systems change London's Thames Crossings

The central systems insight is that cross-river connectivity is an emergent property of the portfolio. It cannot be understood by assessing each structure in isolation.

This particularly affects pedestrians, cyclists, bus users, disabled users and people without access to a private car. These constraints are particularly important in east London, where there are fewer practical choices and some crossings have constraints on access or use.

The economic outcomes are affected by funding constraints and by how fully decisions reflect impacts across the network. When crossings become restricted or unreliable, the costs appear as delay, diversion, reduced network capacity, increased operating costs, lost productivity and increased risk of emergency interventions.

The outcome gap is therefore not simply a shortage of crossings or poor condition in individual assets. It is the difference between the safe, reliable, accessible and resilient connectivity that London needs and the connectivity that the whole system delivers in practice. Closing that gap requires owners to work together to understand system performance and the distribution of benefits across London; and to use that understanding to inform their own investment and operational decisions.

Systems

London's crossings are parts of a wider movement system of physical, organisational and digital elements. The physical system includes walking and cycling links, connecting roads, transport interchanges, and bus and rail services. Assets differ in capacity, condition, accessibility, charging, opening hours and modal use. Their performance affects local streets, freight and public transport reliability, emergency access and the resilience of surrounding networks.

Organisational responsibilities are distributed. Responsibility for ownership, maintenance, funding and operation is split between TfL, boroughs, the City Bridge Foundation and other bodies. These arrangements reflect the history and particular circumstances of individual crossings, but do not necessarily take a joined-up view of the system as a whole, and organisations may have competing priorities. Each owner makes decisions within its own duties and budgets, while the consequences of closure or restriction are felt across London's wider transport and economic system.

In several cases, the scale and cost of maintaining and renewing river crossings can exceed funding available to asset owners, creating challenges in bringing forward timely interventions and increasing the risk of unplanned restrictions or closures. Any crossing, whoever owns it, can become a London-wide resilience issue if its closure displaces buses, freight and general traffic onto other crossings.

The digital and information system is well established and continuing to develop. TfL and the boroughs share data on condition, usage, restrictions and traffic volumes, and work together through LoBEG, while the Thames River Crossings Group coordinates works and shares knowledge across crossing owners. The value of this information can be maximised by using it more fully as part of a portfolio view, connecting condition data with service performance, accessibility, modal capacity, economic impact, development need and network resilience.

The main leverage point is therefore not a single crossing. It is how each owner's investment priorities reflect the wider crossings system alongside its other infrastructure needs. A systems approach makes visible the interdependencies between asset condition, modal choice, growth, equity and resilience. It helps identify where a relatively modest intervention could prevent wider disruption, where maintenance should be prioritised because of network criticality, and where new or improved crossings could unlock wider benefits.

The central systems insight is that cross-river connectivity is an emergent property of the portfolio. It cannot be understood by assessing each structure in isolation. Better outcomes can come from further developing existing approaches, including LoBEG's pan-London prioritisation of borough bridge investment, so that each crossing is assessed by its contribution to wider network performance, while ownership responsibilities remain distributed.

Economic assessment

The economic case for applying a systems approach to London's Thames crossings is not simply that more funding is needed. Consistent with Green Book principles, the rationale for intervention rests on the coordination challenge created by distributed responsibilities, namely that asset-level decisions may not fully reflect costs and benefits across the wider transport network. A systems approach could improve investment decisions by making these impacts visible and directing funding towards interventions that deliver the greatest overall public value.

Crossings are owned and funded by TfL, boroughs and the City Bridge Foundation. Each makes reasonable decisions within its own responsibilities and funding constraints, but those decisions may not fully reflect wider network impacts. Costs borne by transport users, operators, businesses, communities and other parts of the network may therefore not be fully reflected in decisions about individual assets.

The baseline of continuing current arrangements includes constrained funding and increasing risk to service performance. Several crossings are already closed or restricted, reducing the capacity and resilience of the cross-river movement system. The consequences include longer journeys, traffic diversions, bus disruption, reduced freight reliability, poorer access to jobs and services, lost productivity, pressure on neighbouring crossings and increased risk of emergency intervention. The economic value of a portfolio view lies in considering these wider effects alongside structural condition when setting priorities.



The Thames cable car was constructed to improve cross-river connectivity for pedestrians in east London.

The scale of the funding challenge is already evident across London's Thames crossings and makes better prioritisation especially important. Vauxhall Bridge, which is currently subject to an 18t weight restriction, illustrates the growing investment pressures associated with ageing assets. The national £1 billion Structures Fund may help, but it is open to highway authorities across the country and is expected to be heavily oversubscribed.

A systems approach could enable investment to be prioritised according to whole-network criticality and the consequences of closure. Its primary value lies in improving decision-making by bringing together evidence on asset condition, network performance, accessibility, resilience, economic activity and user impacts. This enables decisionmakers to compare investment scenarios and direct scarce resources towards the highest value interventions.

The available evidence identifies the relevant types of cost and benefit but does not yet quantify the economic value of a portfolio view. It therefore provides a clear qualitative case for a systems approach, while further work is required to establish the magnitude of potential benefits. This requires estimating the avoided costs of closure and restriction, including journey-time losses, bus operating impacts, freight delays, emergency works, carbon impacts, accessibility losses and effects on local economies. It should also compare planned preventative investment with reactive intervention after failure. This would turn the qualitative case for stewardship into a quantified investment case.

In summary, the economic proposition is that a systems approach can improve the allocation of scarce funding by reflecting costs and benefits that asset-level decisions may overlook, and by helping each owner weigh crossing investment against its wider infrastructure needs with a fuller understanding of network-wide outcomes.

The outcome gap is not simply a shortage of crossings or poor condition in individual assets. It is the difference between the safe, reliable, accessible and resilient connectivity that London needs and the connectivity that the whole system delivers in practice.

Systemic assessment

London's crossings show that system value can depend on assets owned by many different bodies. Crossings are owned, funded and maintained separately, but their performance affects movement, economic activity and resilience across the capital. The body responsible for a structure may not have the resources or remit to account fully for the wider consequences of closure or restriction.

The resulting challenge is not simply the level of investment in individual assets. It is how fully each owner's investment assessment reflects network-wide consequences alongside its wider infrastructure needs when funding is constrained. Existing pan-London prioritisation of borough bridges provides a foundation. A fuller system view can help owners identify crossings whose closure would impose substantial costs beyond the owner's boundary or whose benefits are widely distributed.

There is also an equity and place issue. Crossing provision and accessibility vary across London. East London has fewer practical bus and active travel options, while some existing crossings are constrained by operating hours, lift availability or user restrictions. The number of crossings does not always reflect the connectivity the system provides.

The transferable lesson is that distributed ownership requires system stewardship across organisational boundaries. For nationally significant urban systems, shared evidence and common prioritisation criteria are needed to assess system-wide value. Owners need to work together, with appropriate funding, to address risks and investment needs that none can resolve alone. Better outcomes per pound depend not only on engineering, but on decisionmaking that connects asset condition and investment to service outcomes, user impacts and network resilience.

Interventions

The interventions suggested in this case study are primarily governance, coordination, data and investment-planning interventions. TfL supports the Thames River Crossings Group, which coordinates works, reduces disruption, shares knowledge and supports crossing owners. TfL and the boroughs work closely through LoBEG and share bridge data, including information on condition, usage, restrictions, traffic volumes and related metrics. Since 1999, LoBEG has also used a pan-London framework to prioritise TfL funding for major strengthening and refurbishment of borough bridges, using agreed criteria. These arrangements already take a road system view of bridge investment and coordinate works across crossings. Their value could be extended by drawing on a wider range of system evidence.

Further interventions could include developing a stronger case to government for long-term investment, using the planned 'State of the City' focus on river crossings; testing investment scenarios ranging from timely intervention to continuing restrictions; and developing existing prioritisation further to reflect criticality, modal function, accessibility and resilience alongside condition and usage.

Building on existing arrangements, crossing owners could use shared evidence and agreed criteria to identify collective priorities, inform their own investment decisions, coordinate interventions, monitor outcomes and address risks that no single owner can resolve, while each retains responsibility for its own assets.

The potential output is a clearer, shared, evidence-led view of investment priorities across London's river crossings. The potential system impact is to reduce the risk of unplanned closures, improve transparency about trade-offs, inform investment priorities, and protect cross-river connectivity for buses, freight, walking, cycling and general traffic.

Recommendations

London's Thames crossings could benefit from being considered as a connected infrastructure portfolio. The following actions are suggested:

- **Build on the existing pan-London prioritisation framework developed by LoBEG**, extending it to reflect system performance, modal function, accessibility, resilience, economic impact and consequences of closure.
- **Develop a Thames Crossings portfolio plan owned jointly by crossing owners**. It should cover condition, restrictions, usage, bus impacts, freight impacts, constraints on active travel, growth pressures, investment scenarios and quantified costs of closure and restriction, to inform each owner's priorities alongside its wider infrastructure needs.
- **Reflect system-wide value in investment cases**. Government should recognise that some locally owned crossings have London-wide and nationally significant value. Future investment cases should compare planned preventative maintenance with the costs of delay, diversion, emergency intervention and reduced service performance.
- **Strengthen collaboration between crossing owners**, building on the Thames River Crossings Group, LoBEG and the State of the City report, so that owners share evidence, identify collective priorities, inform their own investment decisions, coordinate interventions, monitor outcomes and address risks that no single owner can resolve.
- **Prioritise equity and place outcomes**, especially in east London, where practical cross-river choices for buses and active travel are more limited, and where reliable and accessible connectivity is needed to support growth.
- **Provide sustainable funding for strategically important crossings**, recognising that they support economic activity, housing growth and connectivity across London.

The wider national lesson is that ageing infrastructure portfolios need system stewardship. Asset condition data is necessary but not sufficient. Decisionmakers need to understand how individual assets contribute to service outcomes, network resilience and long-term public value.

References

London Assembly Transport Committee (2021) – London's river crossings: bridging the Thames – used for evidence on ownership and distributed responsibility of Thames crossings, variations in connectivity and access across London, the impacts of crossing closures and restrictions on network resilience.

National Engineering Policy Centre, Reviving our ageing infrastructure (2025) – used for wider evidence on infrastructure stewardship, the distinction between asset condition and system health, long-term financing, shared data, and coordination across organisational boundaries.

London Bridges Engineering Group: pan-London bridge prioritisation process – used for evidence on existing collaborative prioritisation of bridge investment.

Co-sponsored by

The Infrastructure Client Group brings together UK economic infrastructure clients in partnership with government and industry. The ICG's key purpose is to lead the acceleration of improvement and alignment in the delivery and development of UK infrastructure, for the benefit of society, the economy and the environment. It is sponsored by the Institution of Civil Engineers.
bit.ly/ICG_01

The National Infrastructure and Service Transformation Authority unites long-term strategy with best practice project delivery, to transform the performance of UK major projects and programmes. It gives ministers the levers they need to drive growth. NISTA is a joint unit at the heart of government, reporting to both HM Treasury and Cabinet Office.
bit.ly/NISTA_01

The Green Construction Board is the sustainability arm of the Construction Leadership Council. It brings together government and industry to drive net zero, biodiversity enhancement and resource efficiency across the built environment, helping shape policy and industry practice.
bit.ly/GCB_01

Delivered by

The Built Environment Connective is a public good organisation that brings people together to turn systems thinking into coordinated, lasting change. It connects system thinkers across government, industry, academia and civil society.
be-connective.com

Supported by

The Institution of Civil Engineers (ICE) is the home of infrastructure. It is a professional institution with 95,000 members and over 200 years of history. It qualifies civil and infrastructure engineers, promotes lifelong learning, and provides trusted, impartial, expert advice to decision makers. Its vision is a world where infrastructure enables people and planet to thrive. Its global membership designs, builds, and maintains trustworthy and sustainable infrastructure.
ice.org.uk