
The Forth Bridge (United Kingdom) No 1485

Official name as proposed by the State Party

The Forth Bridge

Location

Estuary of the River Forth
Fife (north end) and Edinburgh City (south end)
Scotland

Brief description

The railway bridge over the River Forth estuary in Scotland is the world's longest multi-span cantilever bridge. It opened in 1890 and still operates today as an important passenger and freight rail bridge. More than 2.5 km long, this large-scale structure was designed and built using advanced civil engineering design principles and construction methods. Its distinctive industrial aesthetic is the result of a forthright, unadorned display of its structural elements. Innovative in its concept, design, materials, and scale, the Forth Bridge represents a milestone in the history of bridge construction.

Category of property

In terms of categories of cultural property set out in Article I of the 1972 World Heritage Convention, this is a *monument*.

1 Basic data

Included in the Tentative List

27 January 2012

International Assistance from the World Heritage Fund for preparing the Nomination

None

Date received by the World Heritage Centre

29 January 2014

Background

This is a new nomination.

Consultations

ICOMOS consulted several independent experts and the International Committee for the Conservation of the Industrial Heritage (TICCIH).

Technical Evaluation Mission

An ICOMOS technical evaluation mission visited the property from 1 to 3 October 2014.

Additional information requested and received from the State Party

A letter was sent by ICOMOS to the State Party on 17 September 2014 to request further information about the relationship of the setting to the nominated property, and the delineation of that setting; the decision not to create a buffer zone specifically for the nominated property; the nature of the Forth Bridge's new technologies, design principles and construction, its innovations in design and concept, and its influence on practice and construction; the changes to the bridge made over time; the interrelationships between the Forth Bridges Forum, Forth Bridge World Heritage Nomination Steering Group, and Forth Bridge Partnership Management Agreement Group; the nominated property's owner, Network Rail; and the current status of the draft Property Management Plan for the nominated property.

The State Party replied on 24 October 2014, sending additional documentation, and supplementary information was provided to the technical evaluation mission on 4 October 2014, all of which has been taken into account in this evaluation.

A second letter was sent to the State Party on 17 December 2014, requesting further information on the proposed *de facto* buffer zone; key viewsheds and views of the bridge; the composition and roles of the bodies managing and monitoring the property; the presumption against construction of wind turbines; and an interpretation and tourism plan. The State Party replied on 26 February 2015, sending additional documentation that has been taken into account in this evaluation.

Date of ICOMOS approval of this report

12 March 2015

2 The property

Description

The nominated property, which covers 7.5 ha, is a cantilever trussed bridge that spans the estuary (Firth) of the River Forth in eastern Scotland, linking Fife to Edinburgh by railway. The structure of the bridge, which is 2,529 m long from escarpment to escarpment, takes the form of three double-cantilever towers, with cantilever arms to each side. The towers rise 110 m above their granite pier foundations, and the cantilever arms each project 207 m from the towers, linked together by two suspended spans, each 107 m long. The two spans formed by the three towers are therefore each 521 m wide (for 28 years the greatest span in the world). The central cantilevered sections of the bridge are continued at each end by steel approach viaducts sitting on tall granite piers. The superstructure is distributed both above and below the deck, thereby reducing the steelwork's apparent bulk.

This large-scale engineering work is comprised of about 54,000 tons of mild steel used as main compression struts of rolled steel plate riveted into 4-m diameter tubes, and lighter spans used in tension. Mild steel was a relatively

new material in the 1880s. Its use on such a large-scale project was innovative, and helped to bolster mild steel's reputation. Because of its propensity to rust, the exposed steel is protected by paint (a distinctive red colour for the Forth Bridge) to prevent structural decay from corrosion.

History and development

John Fowler and Benjamin Baker started design of the Forth Bridge in 1880. A £1.6-million contract for its construction was awarded by the Forth Bridge Railway Company on 21 December 1882 to a partnership that became Tancred, Arrol & Co. The primary challenges in the bridge's design and construction were geographical (creating clear spans of unprecedented length), logistical (managing a volume of masonry and steel that exceeded any single bridge before or since), technical (exploiting a relatively new material, mild steel), and aesthetic (creating a functional and economical structure that was both truthful in expression and visually appealing).

There were two phases to the construction of the bridge. The first, from 1882 to 1885, focused on the substructure, including sinking the caissons and constructing the foundations and piers on which the upper structure of the bridge sits. The second, from 1886 to 1889, focused on the superstructure, including erecting the three cantilever towers and the approach viaducts. About 4,600 men were employed at the peak of construction; 73 died. The bridge was completed on 15 November 1889, successfully tested in January 1890, and officially opened on 4 March 1890.

Alterations undertaken since 1890 include strengthening the deck trough that carries trains in 1913, installing floodlighting in the 1990s, and adding a walkway around the Jubilee Tower in 2012. Painting the steelwork with a red oxide paint was a more-or-less continuous process until very recently. Modern cup-head bolts are now often used in repairs to mimic the original rivets.

The Forth Bridge has been in continuous use since 1890, and remains an important part of the United Kingdom and Scottish railway networks. Care and maintenance of the bridge declined significantly during the final years of state ownership (1947-1993). Its present owner, Network Rail, completed a 10-year, £130-million restoration of the bridge in 2011, including stripping all the steelwork down to bare metal and repainting it with a longer-lasting glass-flake epoxy system developed for the offshore oil and gas industry. In addition, a few smaller angle sections that had suffered significant corrosion were replaced in-kind during the restoration programme. The bridge is estimated to retain about 99.5 percent of its original steelwork.

3 Justification for inscription, integrity and authenticity

Comparative analysis

The State Party presents a comparative analysis of bridges within a geo-cultural area it defines as global, in respect of the international nature of large-scale engineering works in the late 19th century. Comparisons

are made to large bridges on the basis of their construction material (with a focus on mild steel), form, and span. The State Party makes particular reference to the thematic study *Context for World Heritage Bridges*, prepared by Eric DeLony in 1996 for the International Committee for the Conservation of the Industrial Heritage (TICCIH) and ICOMOS. This study concludes that only three cantilever bridges might have the potential to demonstrate Outstanding Universal Value: the Forth Bridge; the Poughkeepsie Bridge (1886-1899) in New York State, United States of America; and the Quebec Bridge (1903-1919) in Quebec, Canada. The study notes that the steel Forth Bridge, "*perhaps the world's greatest cantilever,*" was "*the crowning achievement of the material during the 19th century.*"

Comparisons are also made to the four properties already on the World Heritage List where a bridge is the principal focus for inscription: Mehmed Paša Sokolović Bridge in Višegrad (Bosnia and Herzegovina, 2007, (ii), (iv)); Old Bridge Area of the Old City of Mostar (Bosnia and Herzegovina, 2005, (vi)); Ironbridge Gorge (United Kingdom, 1986, (i), (ii), (iv), (vi)); and Vizcaya Bridge (Spain, 2006, (i), (ii)). With the possible exception of the latter, none are comparable in a meaningful way.

Comparisons are likewise made to bridges that are components of larger properties already on the World Heritage List, the most relevant of which is the Luiz I Bridge in Oporto, Portugal (1885) (Historic Centre of Oporto (Portugal, 1996, (iv)). While it is the largest wrought-iron span in the world, the Luiz I Bridge does not figure in the justification for inscription on the World Heritage List, which focuses on Oporto's urban fabric and its many historic buildings. And, finally, comparisons are made to the three large bridges that are on the Tentative Lists: the Puente de Occidente wire-cable suspension bridge in Medellin, Colombia; the lattice-truss Malleco Viaduct in Chile; and the now-demolished bowstring-arch Yenisei River Railway Bridge in Krasnoyarsk, Russian Federation.

ICOMOS considers that the State Party has adequately demonstrated that long-span bridges represent a class of monument that is not currently well represented on the World Heritage List. The State Party's analysis shows that there is room on the List for the nominated property, and that there are few similar properties that could be nominated.

ICOMOS considers that the comparative analysis justifies consideration of this property for the World Heritage List.

Justification of Outstanding Universal Value

The nominated property is considered by the State Party to be of Outstanding Universal Value as a cultural property for the following reasons:

- The Forth Bridge's steel-built cantilever design, devoid of decoration, is an aesthetic achievement of tremendous grace.
- Its design represents a unique level of creative genius in conquering a scale and depth of natural barrier that had never before been overcome.
- In civil engineering, it was a crucible for the application of new design principles and new construction methods.
- It exerted great influence on civil engineering practice the world over, and is an icon to engineers world-wide.
- It is a potent symbol of the railway age, part of the revolution in transport and communications that represents a significant stage in human history.
- It is a unique milestone in the evolution of bridge and other steel construction, innovative in its design, concept, materials, and enormous scale.
- It marks a landmark event in the application of science to architecture that profoundly influenced humankind in ways not limited to bridge building.

ICOMOS considers that this justification is generally appropriate: the Forth Bridge, an extraordinary and impressive milestone in the history of bridge construction, is innovative in its concept, design, materials, and enormous scale; it was designed and built using advanced civil engineering design principles and construction methods; and it possesses a distinctive industrial aesthetic that is the result of a forthright, unadorned display of its structural elements. ICOMOS considers, however, that its direct influence has not been demonstrated; rather than being the prototype for subsequent structures, it was the culmination of a typology, a single outstanding example scarcely repeated but widely admired as an engineering wonder of the world.

Integrity and authenticity

Integrity

ICOMOS considers that the nominated property contains all the elements necessary to express the property's Outstanding Universal Value, that it is of adequate size to ensure the complete representation of the features and processes that convey the property's significance, and that it does not suffer from adverse effects of development or neglect. ICOMOS also considers that a logical and scientific basis has been presented for the selection of the area being nominated – though being limited to the bridge itself, it is the smallest conceivable, and justifiable, area for this engineering work. ICOMOS concurs with the State Party that the Forth Bridge is in an excellent state of conservation after completion of its 10-year restoration in 2011, and that the risk from decay or neglect is small for the foreseeable future.

Authenticity

ICOMOS considers that the links between the potential Outstanding Universal Value of the nominated property and its attributes are truthfully expressed, and that the

attributes fully convey the value of the nominated property. In particular, the nominated property is fully authentic in its form and design, which are virtually unaltered; in its materials and substance, which have undergone only minimal changes; and in its use and function, which have continued as originally intended. The use of traditional hot rivets is a subject worth investigating for selected and highly visible repairs of the Forth Bridge in the future.

In conclusion, ICOMOS considers that the conditions of integrity and authenticity have been met.

Criteria under which inscription is proposed

The property is nominated on the basis of cultural criteria (i), (ii), and (iv).

Criterion (i): *represent a masterpiece of human creative genius;*

This criterion is justified by the State Party on the grounds that the Forth Bridge is an aesthetic triumph in its avoidance of decoration and yet an achievement of tremendous grace for something so solid. Its steel-built cantilever design represents a unique level of new human creative genius in conquering a scale and depth of natural barrier that had never before been overcome by man.

ICOMOS considers that the Forth Bridge is a creative masterpiece because of its distinctive industrial aesthetic, which is the result of a forthright, unadorned display of its massive functional structural elements. ICOMOS considers, however, that the point concerning the creative genius required to conquer a natural barrier could be applied to most large-scale bridges that are the first at their respective locations.

ICOMOS considers that this criterion has been justified.

Criterion (ii): *exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;*

This criterion is justified by the State Party on the grounds that the Forth Bridge was a crucible for the application to civil engineering of new design principles and new construction methods. It was at that time the most-visited and best-documented construction project in the world. It therefore exerted great influence on civil engineering practice the world-over and is an icon to engineers world-wide.

ICOMOS considers that the Forth Bridge is notable for the design principles and construction methods employed during its erection, including innovative approaches related to wind loading, thermal changes, hydraulic machinery, and the organization of the construction effort, but that an important interchange of human values over a span of time or within a cultural area of the world has not yet been demonstrated.

ICOMOS considers that this criterion has not been justified.

Criterion (iv): *be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;*

This criterion is justified by the State Party on the grounds that the Forth Bridge represents a significant stage in human history, namely the revolution in transport and communications. The railway age, of which it is a potent symbol, was made possible by, and influenced the speed and connectivity of, the industrial revolution. The bridge forms a unique milestone in the evolution of bridge and other steel construction, is innovative in its design, its concept, its materials and in its enormous scale. It marks a landmark event in the application of science to architecture that went on to profoundly influence mankind in ways not limited to bridge-building.

ICOMOS considers that the Forth Bridge is an outstanding and unique milestone in the evolution of bridge design and construction during the period when railways came to dominate long-distance land travel, innovative in its concept, in its use of mild steel, and in its enormous scale. ICOMOS considers, however, that the bridge's global importance as a symbol of the railway age, and/or its influence on humanity beyond bridge-building, have not been adequately demonstrated.

ICOMOS considers that this criterion has been justified.

In conclusion, ICOMOS considers that the nominated property meets criteria (i) and (iv) and the conditions of authenticity and integrity.

Description of the attributes

The Outstanding Universal Value of The Forth Bridge is expressed in its massive, unadorned structure comprised of granite piers supporting a superstructure of mild steel rolled plate riveted into tubes used in compression and lighter spans used in tension, all painted a distinctive red colour, and in its clear spans of unprecedented length. The bridge's visual impact on the setting, and its continuing use, are also contributing attributes.

4 Factors affecting the property

There is little development pressure possible within this very tightly delimited property. Potential threats to the proposed Outstanding Universal Value of the nominated property identified by the State Party include the creation of visitor access structures and the possible future electrification of the railway. One option for visitor access envisions a visitor centre with a glass ceiling underneath the bridge, and lifts to carry passengers up the eastern face of the Fife Tower to a viewing platform at the top.

Such visitor access is currently at the pre-application stage. Detailed designs of proposed buildings, lifts, walkways, and associated infrastructure for "the Forth Bridge Experience" have yet to be prepared by Network Rail, and no formal proposals have been submitted.

Development pressures outside the nominated property but in its vicinity could include a significant increase in the number of visitors to both Queensferry and North Queensferry; heightened pressure on existing services and infrastructure, including roads and public transport; potentially detrimental alterations or additions to properties immediately adjacent to the bridge; destruction of valuable features and views around the bridge in response to pressure from development; influence on the value of property in the neighbourhoods close to the bridge; increased demand for development in the setting of the bridge; and wind turbines.

The new Queensferry Crossing cable-stayed road bridge that is currently under construction approximately 1 km to the west of the nominated property is due to open in 2016. Between this bridge and the nominated Forth Bridge is the Forth Road Bridge, a suspension bridge built in 1964 and a Category 'A' listed building. It will become a dedicated public transportation corridor for buses, cyclists, and pedestrians after the new road bridge is opened. These two very large bridges are close to the nominated property, but not so close as to have a negative impact on its proposed Outstanding Universal Value.

No severe environmental pressures are mentioned. Disaster risk management will be addressed through the Property Management Plan. The State Party notes a concern in the bridgehead communities that any increases in visitor numbers will need to be managed appropriately.

ICOMOS considers that there are no immediate threats to the property itself, but that there are potential threats outside the property related to possible increases in the number of visitors and developments in the setting. ICOMOS recommends developing, as part of the Property Management Plan and in full consultation with residents, an interpretation and tourism plan associated with the value of the nominated property. It should consider strategies that avoid overwhelming North Queensferry and Queensferry, such as remote parking, shuttle systems, and alternatives to automobile travel. If a visitor centre is formally proposed, it should be submitted at the earliest possibility to the World Heritage Centre for review, in accordance with paragraph 172 of the *Operational Guidelines*. ICOMOS further considers that a clearer presumption against the construction of wind turbines within the key viewsheds of the bridge should be made in the appropriate planning instruments and Property Management Plan.

5 Protection, conservation and management

Boundaries of the nominated property and buffer zone

The boundaries of the nominated property are defined by the single contract that was let in 1882 for the construction of the masonry and steel elements of the Forth Bridge, as represented in the original contract drawings. In physical terms, the nominated property is limited to the stone and steel-built elements of the 2,529-m-long bridge itself, from escarpment to escarpment. It includes the cantilever piers it stands on, and the caissons set into the water to support the central pier, but not the submerged rock of Inchgarvie Island or the rock in North Queensferry on which the two other piers stand. The embankments and cuttings connecting the bridge to the rest of the rail network are not included within the proposed boundaries, nor are the islands or the marine portions of the Firth of Forth itself.

No “buffer zone” for the purpose of protecting the nominated property from wider threats has been specifically created for this nomination. The State Party contends that the nominated property is adequately protected through the local planning system and, in particular, through the suite of existing designation systems (both cultural and natural). These are supported by detailed analyses of views and viewsheds undertaken in support of this nomination. These analyses (which have no status in relation to planning controls) allow planning authorities to take into consideration in their decision-making the protection of views identified as being of value.

The State Party proposed in October 2014 that the Conservation Areas at each end of the bridge designated under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997, combined with the suite of other existing cultural and natural heritage designations, collectively comprise a *de facto* buffer zone (“Bridgehead Zone”). The State Party further advised on 26 February 2015 that this aggregation of planning designations will also include the marine area of the estuary (which in the nomination dossier had been omitted), and that marine protection will also be included in an updated version of actions contained within the Property Management Plan and coordinated with the key viewsheds. These revisions have been initiated and will be completed by the end of 2015. The estimated total area of the proposed polygonal Bridgehead Zone, including the relevant marine area, is 1,233 ha, about 40 percent of which is on land.

ICOMOS considers that the boundaries of the nominated property are adequate, and that boundaries of the *de facto* buffer zone, as revised in February 2015 to include the relevant marine area of the estuary, are also adequate. A limited number of key viewsheds and views of the bridge should also be selected and included in the appropriate planning instruments and management plan, with the objective of ensuring their protection.

Ownership

The nominated property is owned and managed by Network Rail Limited, a public sector arm’s-length body of the Department for Transport.

Protection

The Forth Bridge is listed at Category ‘A’ as a “building of special architectural or historic interest” under City of Edinburgh Council, Edinburgh Burgh HBNUM: 40370 Item No: 30 QF; and Fife Council, Inverkeithing Parish HBNUM 9977 Item No: 6. This listing, given effect in 1973, gives the nominated property the highest level of statutory protection for a structure that is in use.

Any changes that affect the special interest of the bridge require the consent of both City of Edinburgh and Fife councils, with advice in certain circumstances from Historic Scotland on behalf of Scottish Ministers. Directions for planning authorities with regard to listed buildings are set out in the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997, as amended.

ICOMOS notes that the setting of a World Heritage property in Scotland is protected under the 2014 Scottish Planning Policy, wherein the planning authority must protect and preserve the Outstanding Universal Value.

ICOMOS considers that the legal protection in place, with the inclusion of the relevant marine area of the estuary in the *de facto* buffer zone and the safeguarding of key viewsheds and views of the bridge, is adequate.

Conservation

The nominated property has been documented and will be digitally mapped and scanned in 2015. Its present state of conservation is good, and active conservation measures include regular inspections: effectively, one-sixth of the bridge is inspected visually by Network Rail each year. There is no discernible threat to its continued use. The draft Management Plan identifies actions to further protect and enhance the condition of the historic fabric. The conservation measures are appropriate to conserve the nominated property’s value, authenticity, and integrity. Funding for maintenance and conservation work has been identified by the State Party, and the work is carried out by persons with the appropriate level of skill and expertise. There are no urgent issues following the recent 10-year restoration project.

ICOMOS considers that the state of conservation of the property is good, and that the conservation measures adopted are effective.

Management

Management structures and processes, including traditional management processes

Management of the nominated property is currently the responsibility of its owner, Network Rail. In the event the Forth Bridge is inscribed on the World Heritage List, a Partnership Management Agreement will be implemented

as one of the first actions of the draft Property Management Plan. It involves the members of the Forth Bridge World Heritage Nomination Steering Group (a subgroup of the Forth Bridges Forum) that have statutory planning functions, including Network Rail, Historic Scotland, Fife Council, and City of Edinburgh Council. The role of the Forth Bridge Partnership Management Agreement Group will be to protect the property's Outstanding Universal Value while helping it continue as an operating structure.

Policy framework: management plans and arrangements, including visitor management and presentation

A draft Property Management Plan for the nominated property is included with the nomination dossier. Now operational, its prioritized six-year action plan began in 2014. In addition to benchmark information, the Plan includes the Statement of Outstanding Universal Value; statutory duties of main bodies and other existing management arrangements; operation of heritage protection measures and land use planning; a summary of pressures and threats and opportunities for change or improvements; means of implementing the Plan, and measures by which it will be monitored.

The Town and Country Planning (Scotland) Act 1997 and The Planning etc. (Scotland) Act 2006 (which modifies and amends many of the 1997 provisions) provide the legal framework for local planning policy. They act as the primary legislation guiding planning and development in Scotland. Edinburgh and Fife Local Development Plans – the local interpretations of regional and national planning policy – are both expected to be completed in 2015; the Fife version is intended to include policy specifically directed at protecting the context of the Forth Bridge. Both Local Development Plans will be linked to the two relevant Conservation Area designations.

Concerning visitor management, there is currently no public pedestrian access to the bridge, and no means of counting individual visitors. The number of people who experience and interact with the bridge in their daily lives, however, is very large, as up to 200 passenger trains cross the rail bridge every day. The State Party has outlined some possible initiatives to manage visitors, including creating new visitor facilities and presentation experiences. Current resources, including staffing levels, expertise, and training, appear to be adequate. Network Rail is currently committed to approximately £1 million per year over the next five years for ongoing care and maintenance of the bridge structure. Risk management will be addressed through the Property Management Plan.

Involvement of the local communities

Local communities have been involved in the development of the nomination and the Property Management Plan, and the Fife and Edinburgh city councils have formally agreed to support the nomination.

ICOMOS considers that the management system for the property is adequate. ICOMOS recommends that various improvements initiated by the State Party, as outlined in February 2015, be completed, including clarifying the institutionalization of the current Steering Group; formally incorporating World Heritage into the remit of the Forth Bridge Partnership Management Agreement Group; and developing an interpretation and tourism plan as part of the Property Management Plan.

6 Monitoring

Monitoring the condition of the nominated property is part of Network Rail's mandated maintenance programme, and the results are recorded in its Civil Asset Register and electronic Reporting System, which is tailored to the maintenance and monitoring needs of the bridge. Network Rail also has an asset management plan. The nomination dossier includes four key indicators: two make reference to the Buildings at Risk Register; one to the enhancement of, or harm to, key views by foliage or new development; and one to train tickets sold to North Queensferry and Dalmeny. ICOMOS considers these key indicators, as well as their periodicity, to be vague. The key indicators should relate more directly to the attributes that convey potential Outstanding Universal Value (that is, to more than just the physical condition of the bridge), to ensure that these attributes are protected, conserved, and managed in order to sustain that value. The key indicators do not express a benchmark that indicates a desired state of conservation.

ICOMOS considers that the proposed key indicators should be more specific and relate more directly to the attributes that convey potential Outstanding Universal Value.

7 Conclusions

ICOMOS considers that the Outstanding Universal Value of the nominated property has been demonstrated. The Forth Bridge represents an extraordinary milestone in the history of bridge construction, notable for its enormous scale, its innovative use of materials, its advanced design principles and construction methods, and its distinctive industrial aesthetic. The relevant attributes conveying the Outstanding Universal Value of the nominated property are included within its boundaries. The nominated property is in a good state of conservation, and has the highest level of protection at the national level. Its *de facto* buffer zone, as proposed in October 2014 and revised in February 2015 to include the relevant marine area, is adequate. Key viewsheds and views of the bridge should be safeguarded, including from wind turbine construction. The management system for the property, while adequate, will benefit from the organizational clarifications that have been initiated, and the Property Management Plan should include an interpretation and tourism plan.

8 Recommendations

Recommendations with respect to inscription

ICOMOS recommends that The Forth Bridge, United Kingdom, be inscribed on the World Heritage List on the basis of **criteria (i) and (iv)**.

Recommended Statement of Outstanding Universal Value

Brief synthesis

The Forth Bridge, which spans the estuary (Firth) of the River Forth in eastern Scotland to link Fife to Edinburgh by railway, is at 2,529 m long the world's longest multi-span cantilever bridge. It opened in 1890 and continues to operate as an important passenger and freight rail bridge. This enormous structure, with its distinctive industrial aesthetic and striking red colour, was conceived and built using advanced civil engineering design principles and construction methods. Innovative in design, materials, and scale, the Forth Bridge is an extraordinary and impressive milestone in bridge design and construction during the period when railways came to dominate long-distance land travel.

This large-scale engineering work's appearance is the result of a forthright, unadorned display of its structural elements. It is comprised of about 54,000 tons of mild steel plate rolled and riveted into 4-m diameter tubes used in compression, and lighter steel spans used in tension. The use of mild steel, a relatively new material in the 1880s, on such a large-scale project was innovative, and helped to bolster its reputation. The superstructure of the bridge takes the form of three double-cantilever towers rising 110 m above their granite pier foundations, with cantilever arms to each side. The cantilever arms each project 207 m from the towers and are linked together by two suspended spans, each 107 m long. The resulting 521-m spans formed by the three towers were individually the longest in the world for 28 years, and remain collectively the longest in a multi-span cantilever bridge. The Forth Bridge is the culmination of its typology, scarcely repeated but widely admired as an engineering wonder of the world.

Criterion (i): The Forth Bridge is a masterpiece of creative genius because of its distinctive industrial aesthetic, which is the result of a forthright, unadorned display of its massive, functional structural elements.

Criterion (iv): The Forth Bridge is an extraordinary and impressive milestone in the evolution of bridge design and construction during the period when railways came to dominate long-distance land travel, innovative in its concept, its use of mild steel, and its enormous scale.

Integrity

The property contains all the elements necessary to express the Outstanding Universal Value of The Forth Bridge, including granite piers and steel superstructure. The 7.5-ha property is of adequate size to ensure the

complete representation of the features and processes that convey the property's significance, and it does not suffer from adverse effects of development or neglect.

Authenticity

The Forth Bridge is fully authentic in form and design, which are virtually unaltered; materials and substance, which have undergone only minimal changes; and use and function, which have continued as originally intended. The links between the Outstanding Universal Value of the bridge and its attributes are therefore truthfully expressed, and the attributes fully convey the value of the property.

Management and protection requirements

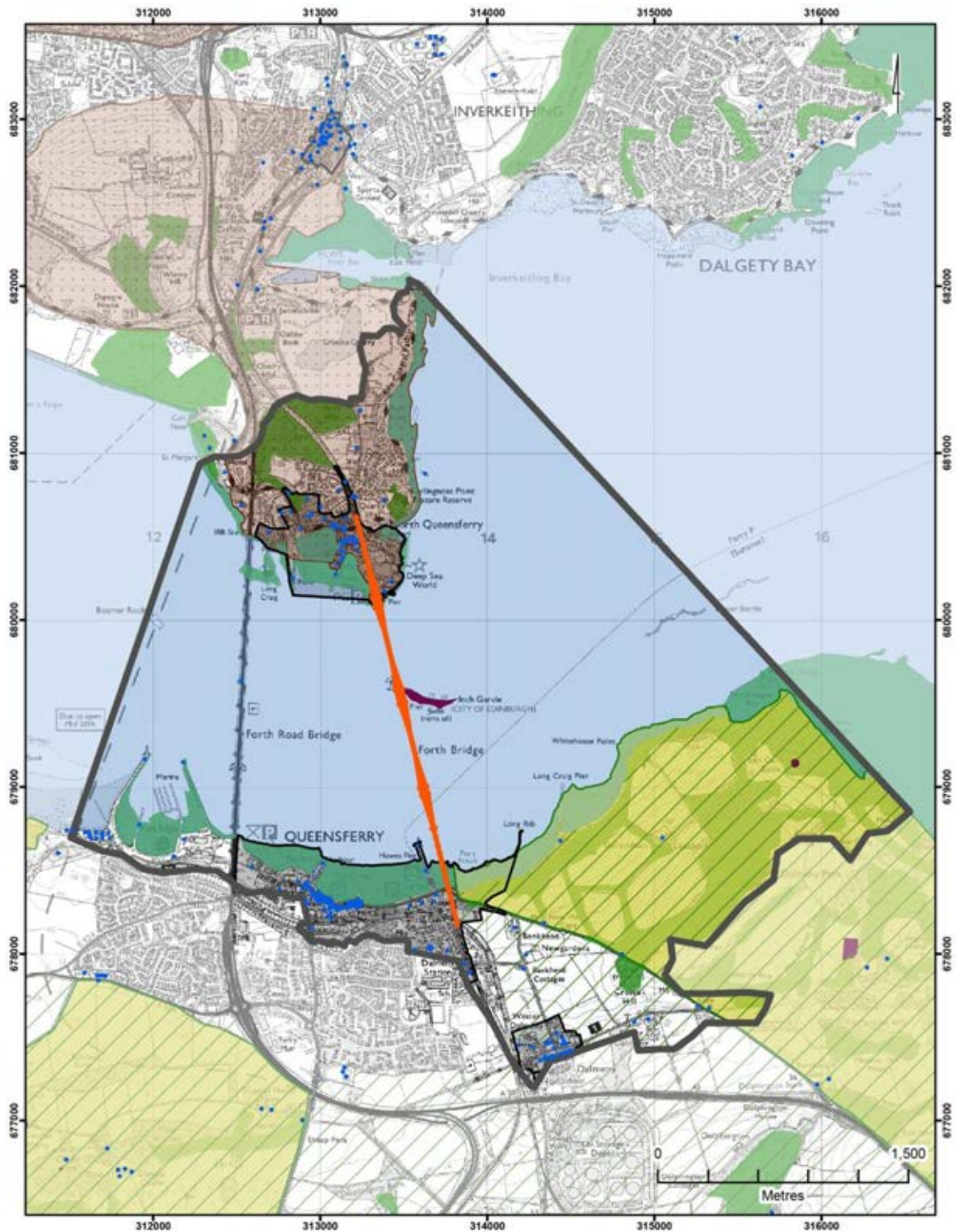
The Forth Bridge is listed at Category 'A' as a building of special architectural or historic interest, giving the property the highest level of statutory protection. Its immediate surroundings are also protected by means of a suite of cultural and natural heritage designations. Owned by Network Rail Limited, the property will be managed in accordance with a Property Management Plan by the bodies that have a statutory planning function. The Forth Bridges Forum partnership has been established to ensure that local stakeholders' interests remain at the core of the management of the Forth bridges.

Specific long-term expectations related to key issues include maintenance of strong community support, broadening understanding in the context of world bridges, attention to developments within key views, risk management, and inspiring others.

Additional recommendations

ICOMOS recommends that the State Party give consideration to the following:

- Creating key indicators that are more specific and relate more directly to the attributes that convey potential Outstanding Universal Value;
- Extending the Property Management Plan to include an interpretation and tourism plan;
- Submitting to the World Heritage Centre, by 1 December 2016, a report on the selection of key viewsheds and views of the bridge for inclusion in the appropriate planning instruments and management plan, along with an analysis of their effectiveness in ensuring the protection of these key viewsheds and views, for examination by the World Heritage Committee at its 41st session in 2017;
- Submitting plans for any proposed visitor centre at the earliest possibility to the World Heritage Centre for review, in accordance with paragraph 172 of the *Operational Guidelines for the Implementation of the World Heritage Convention*.

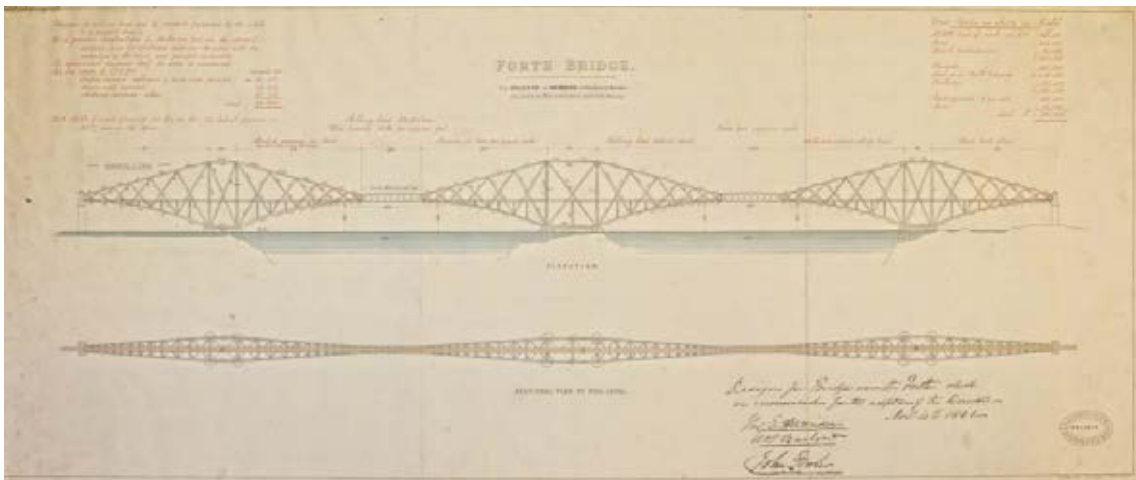


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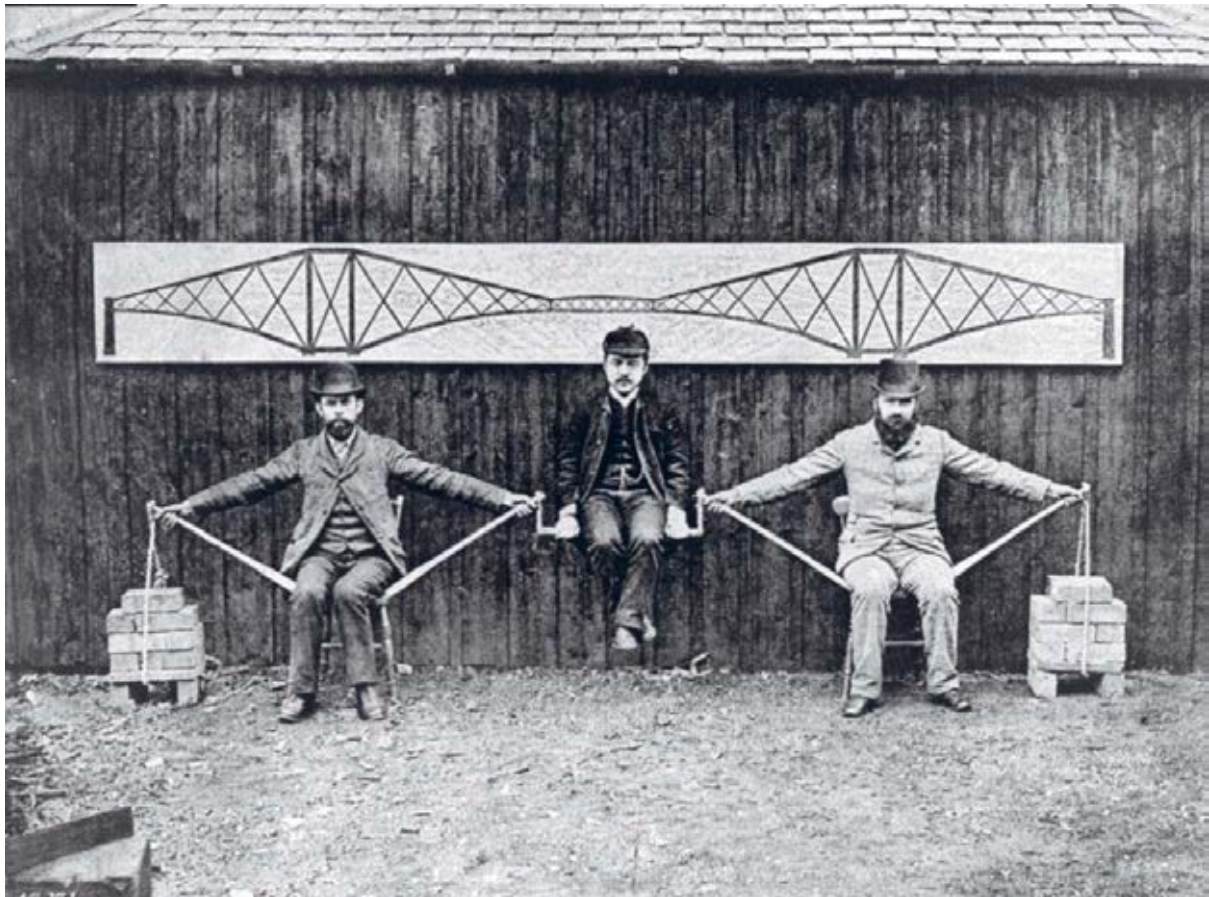
Title:		Key	
The Forth Bridge: Bridgehead Zone		Nominated Property	Listed Building
Bridgehead Zone Boundary		Scheduled Monument	Natural Heritage Protected Sites
Scale: 1 : 30,000 @ A4		Inventory Battlefield	Marine Planning Area
Projection: British National Grid		Conservation Area	Green Belt
		Gardens and Designed Landscape	



Map showing the boundaries of the nominated property



Drawing of the Forth Bridge signed by Mr. Barlow, Sir Fowler, and Mr. Harrison (1881)



The human cantilever



Photograph showing progress of the Queensferry main tower



Forth Bridge from South Queensferry



View of the Forth Bridge from South Queensferry

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An ICOMOS technical evaluation mission visited the property from 1 to 3 October 2014.

Additional information requested and received from the State Party

A letter was sent by ICOMOS to the State Party on 17 September 2014 to request further information about the relationship of the setting to the nominated property, and the delineation of that setting; the decision not to create a buffer zone specifically for the nominated property; the nature of the Forth Bridge's new technologies, design principles and construction, its innovations in design and concept, and its influence on practice and construction; the changes to the bridge made over time; the interrelationships between the Forth Bridges Forum, Forth Bridge World Heritage Nomination Steering Group, and Forth Bridge Partnership Management Agreement Group; the nominated property's owner, Network Rail; and the current status of the draft Property Management Plan for the nominated property.

The State Party replied on 24 October 2014, sending additional documentation, and supplementary information was provided to the technical evaluation mission on 4 October 2014, all of which has been taken into account in this evaluation.

A second letter was sent to the State Party on 17 December 2014, requesting further information on the proposed *de facto* buffer zone; key viewsheds and views of the bridge; the composition and roles of the bodies managing and monitoring the property; the presumption against construction of wind turbines; and an interpretation and tourism plan. The State Party replied on 26 February 2015, sending additional documentation that has been taken into account in this evaluation.

Date of ICOMOS approval of this report

12 March 2015

2 The property

Description

The nominated property, which covers 7.5 ha, is a cantilever trussed bridge that spans the estuary (Firth) of the River Forth in eastern Scotland, linking Fife to Edinburgh by railway. The structure of the bridge, which is 2,529 m long from escarpment to escarpment, takes the form of three double-cantilever towers, with cantilever arms to each side. The towers rise 110 m above their granite pier foundations, and the cantilever arms each project 207 m from the towers, linked together by two suspended spans, each 107 m long. The two spans formed by the three towers are therefore each 521 m wide (for 28 years the greatest span in the world). The central cantilevered sections of the bridge are continued at each end by steel approach viaducts sitting on tall granite piers. The superstructure is distributed both above and below the deck, thereby reducing the steelwork's apparent bulk.

This large-scale engineering work is comprised of about 54,000 tons of mild steel used as main compression struts of rolled steel plate riveted into 4-m diameter tubes, and lighter spans used in tension. Mild steel was a relatively

new material in the 1880s. Its use on such a large-scale project was innovative, and helped to bolster mild steel's reputation. Because of its propensity to rust, the exposed steel is protected by paint (a distinctive red colour for the Forth Bridge) to prevent structural decay from corrosion.

History and development

John Fowler and Benjamin Baker started design of the Forth Bridge in 1880. A £1.6-million contract for its construction was awarded by the Forth Bridge Railway Company on 21 December 1882 to a partnership that became Tancred, Arrol & Co. The primary challenges in the bridge's design and construction were geographical (creating clear spans of unprecedented length), logistical (managing a volume of masonry and steel that exceeded any single bridge before or since), technical (exploiting a relatively new material, mild steel), and aesthetic (creating a functional and economical structure that was both truthful in expression and visually appealing).

There were two phases to the construction of the bridge. The first, from 1882 to 1885, focused on the substructure, including sinking the caissons and constructing the foundations and piers on which the upper structure of the bridge sits. The second, from 1886 to 1889, focused on the superstructure, including erecting the three cantilever towers and the approach viaducts. About 4,600 men were employed at the peak of construction; 73 died. The bridge was completed on 15 November 1889, successfully tested in January 1890, and officially opened on 4 March 1890.

Alterations undertaken since 1890 include strengthening the deck trough that carries trains in 1913, installing floodlighting in the 1990s, and adding a walkway around the Jubilee Tower in 2012. Painting the steelwork with a red oxide paint was a more-or-less continuous process until very recently. Modern cup-head bolts are now often used in repairs to mimic the original rivets.

The Forth Bridge has been in continuous use since 1890, and remains an important part of the United Kingdom and Scottish railway networks. Care and maintenance of the bridge declined significantly during the final years of state ownership (1947-1993). Its present owner, Network Rail, completed a 10-year, £130-million restoration of the bridge in 2011, including stripping all the steelwork down to bare metal and repainting it with a longer-lasting glass-flake epoxy system developed for the offshore oil and gas industry. In addition, a few smaller angle sections that had suffered significant corrosion were replaced in-kind during the restoration programme. The bridge is estimated to retain about 99.5 percent of its original steelwork.

3 Justification for inscription, integrity and authenticity

Comparative analysis

The State Party presents a comparative analysis of bridges within a geo-cultural area it defines as global, in respect of the international nature of large-scale engineering works in the late 19th century. Comparisons

are made to large bridges on the basis of their construction material (with a focus on mild steel), form, and span. The State Party makes particular reference to the thematic study *Context for World Heritage Bridges*, prepared by Eric DeLony in 1996 for the International Committee for the Conservation of the Industrial Heritage (TICCIH) and ICOMOS. This study concludes that only three cantilever bridges might have the potential to demonstrate Outstanding Universal Value: the Forth Bridge; the Poughkeepsie Bridge (1886-1899) in New York State, United States of America; and the Quebec Bridge (1903-1919) in Quebec, Canada. The study notes that the steel Forth Bridge, "*perhaps the world's greatest cantilever,*" was "*the crowning achievement of the material during the 19th century.*"

Comparisons are also made to the four properties already on the World Heritage List where a bridge is the principal focus for inscription: Mehmed Paša Sokolović Bridge in Višegrad (Bosnia and Herzegovina, 2007, (ii), (iv)); Old Bridge Area of the Old City of Mostar (Bosnia and Herzegovina, 2005, (vi)); Ironbridge Gorge (United Kingdom, 1986, (i), (ii), (iv), (vi)); and Vizcaya Bridge (Spain, 2006, (i), (ii)). With the possible exception of the latter, none are comparable in a meaningful way.

Comparisons are likewise made to bridges that are components of larger properties already on the World Heritage List, the most relevant of which is the Luiz I Bridge in Oporto, Portugal (1885) (Historic Centre of Oporto (Portugal, 1996, (iv)). While it is the largest wrought-iron span in the world, the Luiz I Bridge does not figure in the justification for inscription on the World Heritage List, which focuses on Oporto's urban fabric and its many historic buildings. And, finally, comparisons are made to the three large bridges that are on the Tentative Lists: the Puente de Occidente wire-cable suspension bridge in Medellin, Colombia; the lattice-truss Malleco Viaduct in Chile; and the now-demolished bowstring-arch Yenisei River Railway Bridge in Krasnoyarsk, Russian Federation.

ICOMOS considers that the State Party has adequately demonstrated that long-span bridges represent a class of monument that is not currently well represented on the World Heritage List. The State Party's analysis shows that there is room on the List for the nominated property, and that there are few similar properties that could be nominated.

ICOMOS considers that the comparative analysis justifies consideration of this property for the World Heritage List.

Justification of Outstanding Universal Value

The nominated property is considered by the State Party to be of Outstanding Universal Value as a cultural property for the following reasons:

- The Forth Bridge's steel-built cantilever design, devoid of decoration, is an aesthetic achievement of tremendous grace.
- Its design represents a unique level of creative genius in conquering a scale and depth of natural barrier that had never before been overcome.
- In civil engineering, it was a crucible for the application of new design principles and new construction methods.
- It exerted great influence on civil engineering practice the world over, and is an icon to engineers world-wide.
- It is a potent symbol of the railway age, part of the revolution in transport and communications that represents a significant stage in human history.
- It is a unique milestone in the evolution of bridge and other steel construction, innovative in its design, concept, materials, and enormous scale.
- It marks a landmark event in the application of science to architecture that profoundly influenced humankind in ways not limited to bridge building.

ICOMOS considers that this justification is generally appropriate: the Forth Bridge, an extraordinary and impressive milestone in the history of bridge construction, is innovative in its concept, design, materials, and enormous scale; it was designed and built using advanced civil engineering design principles and construction methods; and it possesses a distinctive industrial aesthetic that is the result of a forthright, unadorned display of its structural elements. ICOMOS considers, however, that its direct influence has not been demonstrated; rather than being the prototype for subsequent structures, it was the culmination of a typology, a single outstanding example scarcely repeated but widely admired as an engineering wonder of the world.

Integrity and authenticity

Integrity

ICOMOS considers that the nominated property contains all the elements necessary to express the property's Outstanding Universal Value, that it is of adequate size to ensure the complete representation of the features and processes that convey the property's significance, and that it does not suffer from adverse effects of development or neglect. ICOMOS also considers that a logical and scientific basis has been presented for the selection of the area being nominated – though being limited to the bridge itself, it is the smallest conceivable, and justifiable, area for this engineering work. ICOMOS concurs with the State Party that the Forth Bridge is in an excellent state of conservation after completion of its 10-year restoration in 2011, and that the risk from decay or neglect is small for the foreseeable future.

Authenticity

ICOMOS considers that the links between the potential Outstanding Universal Value of the nominated property and its attributes are truthfully expressed, and that the

attributes fully convey the value of the nominated property. In particular, the nominated property is fully authentic in its form and design, which are virtually unaltered; in its materials and substance, which have undergone only minimal changes; and in its use and function, which have continued as originally intended. The use of traditional hot rivets is a subject worth investigating for selected and highly visible repairs of the Forth Bridge in the future.

In conclusion, ICOMOS considers that the conditions of integrity and authenticity have been met.

Criteria under which inscription is proposed

The property is nominated on the basis of cultural criteria (i), (ii), and (iv).

Criterion (i): *represent a masterpiece of human creative genius;*

This criterion is justified by the State Party on the grounds that the Forth Bridge is an aesthetic triumph in its avoidance of decoration and yet an achievement of tremendous grace for something so solid. Its steel-built cantilever design represents a unique level of new human creative genius in conquering a scale and depth of natural barrier that had never before been overcome by man.

ICOMOS considers that the Forth Bridge is a creative masterpiece because of its distinctive industrial aesthetic, which is the result of a forthright, unadorned display of its massive functional structural elements. ICOMOS considers, however, that the point concerning the creative genius required to conquer a natural barrier could be applied to most large-scale bridges that are the first at their respective locations.

ICOMOS considers that this criterion has been justified.

Criterion (ii): *exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town-planning or landscape design;*

This criterion is justified by the State Party on the grounds that the Forth Bridge was a crucible for the application to civil engineering of new design principles and new construction methods. It was at that time the most-visited and best-documented construction project in the world. It therefore exerted great influence on civil engineering practice the world-over and is an icon to engineers world-wide.

ICOMOS considers that the Forth Bridge is notable for the design principles and construction methods employed during its erection, including innovative approaches related to wind loading, thermal changes, hydraulic machinery, and the organization of the construction effort, but that an important interchange of human values over a span of time or within a cultural area of the world has not yet been demonstrated.

ICOMOS considers that this criterion has not been justified.

Criterion (iv): *be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history;*

This criterion is justified by the State Party on the grounds that the Forth Bridge represents a significant stage in human history, namely the revolution in transport and communications. The railway age, of which it is a potent symbol, was made possible by, and influenced the speed and connectivity of, the industrial revolution. The bridge forms a unique milestone in the evolution of bridge and other steel construction, is innovative in its design, its concept, its materials and in its enormous scale. It marks a landmark event in the application of science to architecture that went on to profoundly influence mankind in ways not limited to bridge-building.

ICOMOS considers that the Forth Bridge is an outstanding and unique milestone in the evolution of bridge design and construction during the period when railways came to dominate long-distance land travel, innovative in its concept, in its use of mild steel, and in its enormous scale. ICOMOS considers, however, that the bridge's global importance as a symbol of the railway age, and/or its influence on humanity beyond bridge-building, have not been adequately demonstrated.

ICOMOS considers that this criterion has been justified.

In conclusion, ICOMOS considers that the nominated property meets criteria (i) and (iv) and the conditions of authenticity and integrity.

Description of the attributes

The Outstanding Universal Value of The Forth Bridge is expressed in its massive, unadorned structure comprised of granite piers supporting a superstructure of mild steel rolled plate riveted into tubes used in compression and lighter spans used in tension, all painted a distinctive red colour, and in its clear spans of unprecedented length. The bridge's visual impact on the setting, and its continuing use, are also contributing attributes.

4 Factors affecting the property

There is little development pressure possible within this very tightly delimited property. Potential threats to the proposed Outstanding Universal Value of the nominated property identified by the State Party include the creation of visitor access structures and the possible future electrification of the railway. One option for visitor access envisions a visitor centre with a glass ceiling underneath the bridge, and lifts to carry passengers up the eastern face of the Fife Tower to a viewing platform at the top.

Such visitor access is currently at the pre-application stage. Detailed designs of proposed buildings, lifts, walkways, and associated infrastructure for "the Forth Bridge Experience" have yet to be prepared by Network Rail, and no formal proposals have been submitted.

Development pressures outside the nominated property but in its vicinity could include a significant increase in the number of visitors to both Queensferry and North Queensferry; heightened pressure on existing services and infrastructure, including roads and public transport; potentially detrimental alterations or additions to properties immediately adjacent to the bridge; destruction of valuable features and views around the bridge in response to pressure from development; influence on the value of property in the neighbourhoods close to the bridge; increased demand for development in the setting of the bridge; and wind turbines.

The new Queensferry Crossing cable-stayed road bridge that is currently under construction approximately 1 km to the west of the nominated property is due to open in 2016. Between this bridge and the nominated Forth Bridge is the Forth Road Bridge, a suspension bridge built in 1964 and a Category 'A' listed building. It will become a dedicated public transportation corridor for buses, cyclists, and pedestrians after the new road bridge is opened. These two very large bridges are close to the nominated property, but not so close as to have a negative impact on its proposed Outstanding Universal Value.

No severe environmental pressures are mentioned. Disaster risk management will be addressed through the Property Management Plan. The State Party notes a concern in the bridgehead communities that any increases in visitor numbers will need to be managed appropriately.

ICOMOS considers that there are no immediate threats to the property itself, but that there are potential threats outside the property related to possible increases in the number of visitors and developments in the setting. ICOMOS recommends developing, as part of the Property Management Plan and in full consultation with residents, an interpretation and tourism plan associated with the value of the nominated property. It should consider strategies that avoid overwhelming North Queensferry and Queensferry, such as remote parking, shuttle systems, and alternatives to automobile travel. If a visitor centre is formally proposed, it should be submitted at the earliest possibility to the World Heritage Centre for review, in accordance with paragraph 172 of the *Operational Guidelines*. ICOMOS further considers that a clearer presumption against the construction of wind turbines within the key viewsheds of the bridge should be made in the appropriate planning instruments and Property Management Plan.

5 Protection, conservation and management

Boundaries of the nominated property and buffer zone

The boundaries of the nominated property are defined by the single contract that was let in 1882 for the construction of the masonry and steel elements of the Forth Bridge, as represented in the original contract drawings. In physical terms, the nominated property is limited to the stone and steel-built elements of the 2,529-m-long bridge itself, from escarpment to escarpment. It includes the cantilever piers it stands on, and the caissons set into the water to support the central pier, but not the submerged rock of Inchgarvie Island or the rock in North Queensferry on which the two other piers stand. The embankments and cuttings connecting the bridge to the rest of the rail network are not included within the proposed boundaries, nor are the islands or the marine portions of the Firth of Forth itself.

No “buffer zone” for the purpose of protecting the nominated property from wider threats has been specifically created for this nomination. The State Party contends that the nominated property is adequately protected through the local planning system and, in particular, through the suite of existing designation systems (both cultural and natural). These are supported by detailed analyses of views and viewsheds undertaken in support of this nomination. These analyses (which have no status in relation to planning controls) allow planning authorities to take into consideration in their decision-making the protection of views identified as being of value.

The State Party proposed in October 2014 that the Conservation Areas at each end of the bridge designated under the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997, combined with the suite of other existing cultural and natural heritage designations, collectively comprise a *de facto* buffer zone (“Bridgehead Zone”). The State Party further advised on 26 February 2015 that this aggregation of planning designations will also include the marine area of the estuary (which in the nomination dossier had been omitted), and that marine protection will also be included in an updated version of actions contained within the Property Management Plan and coordinated with the key viewsheds. These revisions have been initiated and will be completed by the end of 2015. The estimated total area of the proposed polygonal Bridgehead Zone, including the relevant marine area, is 1,233 ha, about 40 percent of which is on land.

ICOMOS considers that the boundaries of the nominated property are adequate, and that boundaries of the *de facto* buffer zone, as revised in February 2015 to include the relevant marine area of the estuary, are also adequate. A limited number of key viewsheds and views of the bridge should also be selected and included in the appropriate planning instruments and management plan, with the objective of ensuring their protection.

Ownership

The nominated property is owned and managed by Network Rail Limited, a public sector arm’s-length body of the Department for Transport.

Protection

The Forth Bridge is listed at Category ‘A’ as a “building of special architectural or historic interest” under City of Edinburgh Council, Edinburgh Burgh HBNUM: 40370 Item No: 30 QF; and Fife Council, Inverkeithing Parish HBNUM 9977 Item No: 6. This listing, given effect in 1973, gives the nominated property the highest level of statutory protection for a structure that is in use.

Any changes that affect the special interest of the bridge require the consent of both City of Edinburgh and Fife councils, with advice in certain circumstances from Historic Scotland on behalf of Scottish Ministers. Directions for planning authorities with regard to listed buildings are set out in the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997, as amended.

ICOMOS notes that the setting of a World Heritage property in Scotland is protected under the 2014 Scottish Planning Policy, wherein the planning authority must protect and preserve the Outstanding Universal Value.

ICOMOS considers that the legal protection in place, with the inclusion of the relevant marine area of the estuary in the *de facto* buffer zone and the safeguarding of key viewsheds and views of the bridge, is adequate.

Conservation

The nominated property has been documented and will be digitally mapped and scanned in 2015. Its present state of conservation is good, and active conservation measures include regular inspections: effectively, one-sixth of the bridge is inspected visually by Network Rail each year. There is no discernible threat to its continued use. The draft Management Plan identifies actions to further protect and enhance the condition of the historic fabric. The conservation measures are appropriate to conserve the nominated property’s value, authenticity, and integrity. Funding for maintenance and conservation work has been identified by the State Party, and the work is carried out by persons with the appropriate level of skill and expertise. There are no urgent issues following the recent 10-year restoration project.

ICOMOS considers that the state of conservation of the property is good, and that the conservation measures adopted are effective.

Management

Management structures and processes, including traditional management processes

Management of the nominated property is currently the responsibility of its owner, Network Rail. In the event the Forth Bridge is inscribed on the World Heritage List, a Partnership Management Agreement will be implemented

as one of the first actions of the draft Property Management Plan. It involves the members of the Forth Bridge World Heritage Nomination Steering Group (a subgroup of the Forth Bridges Forum) that have statutory planning functions, including Network Rail, Historic Scotland, Fife Council, and City of Edinburgh Council. The role of the Forth Bridge Partnership Management Agreement Group will be to protect the property's Outstanding Universal Value while helping it continue as an operating structure.

Policy framework: management plans and arrangements, including visitor management and presentation

A draft Property Management Plan for the nominated property is included with the nomination dossier. Now operational, its prioritized six-year action plan began in 2014. In addition to benchmark information, the Plan includes the Statement of Outstanding Universal Value; statutory duties of main bodies and other existing management arrangements; operation of heritage protection measures and land use planning; a summary of pressures and threats and opportunities for change or improvements; means of implementing the Plan, and measures by which it will be monitored.

The Town and Country Planning (Scotland) Act 1997 and The Planning etc. (Scotland) Act 2006 (which modifies and amends many of the 1997 provisions) provide the legal framework for local planning policy. They act as the primary legislation guiding planning and development in Scotland. Edinburgh and Fife Local Development Plans – the local interpretations of regional and national planning policy – are both expected to be completed in 2015; the Fife version is intended to include policy specifically directed at protecting the context of the Forth Bridge. Both Local Development Plans will be linked to the two relevant Conservation Area designations.

Concerning visitor management, there is currently no public pedestrian access to the bridge, and no means of counting individual visitors. The number of people who experience and interact with the bridge in their daily lives, however, is very large, as up to 200 passenger trains cross the rail bridge every day. The State Party has outlined some possible initiatives to manage visitors, including creating new visitor facilities and presentation experiences. Current resources, including staffing levels, expertise, and training, appear to be adequate. Network Rail is currently committed to approximately £1 million per year over the next five years for ongoing care and maintenance of the bridge structure. Risk management will be addressed through the Property Management Plan.

Involvement of the local communities

Local communities have been involved in the development of the nomination and the Property Management Plan, and the Fife and Edinburgh city councils have formally agreed to support the nomination.

ICOMOS considers that the management system for the property is adequate. ICOMOS recommends that various improvements initiated by the State Party, as outlined in February 2015, be completed, including clarifying the institutionalization of the current Steering Group; formally incorporating World Heritage into the remit of the Forth Bridge Partnership Management Agreement Group; and developing an interpretation and tourism plan as part of the Property Management Plan.

6 Monitoring

Monitoring the condition of the nominated property is part of Network Rail's mandated maintenance programme, and the results are recorded in its Civil Asset Register and electronic Reporting System, which is tailored to the maintenance and monitoring needs of the bridge. Network Rail also has an asset management plan. The nomination dossier includes four key indicators: two make reference to the Buildings at Risk Register; one to the enhancement of, or harm to, key views by foliage or new development; and one to train tickets sold to North Queensferry and Dalmeny. ICOMOS considers these key indicators, as well as their periodicity, to be vague. The key indicators should relate more directly to the attributes that convey potential Outstanding Universal Value (that is, to more than just the physical condition of the bridge), to ensure that these attributes are protected, conserved, and managed in order to sustain that value. The key indicators do not express a benchmark that indicates a desired state of conservation.

ICOMOS considers that the proposed key indicators should be more specific and relate more directly to the attributes that convey potential Outstanding Universal Value.

7 Conclusions

ICOMOS considers that the Outstanding Universal Value of the nominated property has been demonstrated. The Forth Bridge represents an extraordinary milestone in the history of bridge construction, notable for its enormous scale, its innovative use of materials, its advanced design principles and construction methods, and its distinctive industrial aesthetic. The relevant attributes conveying the Outstanding Universal Value of the nominated property are included within its boundaries. The nominated property is in a good state of conservation, and has the highest level of protection at the national level. Its *de facto* buffer zone, as proposed in October 2014 and revised in February 2015 to include the relevant marine area, is adequate. Key viewsheds and views of the bridge should be safeguarded, including from wind turbine construction. The management system for the property, while adequate, will benefit from the organizational clarifications that have been initiated, and the Property Management Plan should include an interpretation and tourism plan.

8 Recommendations

Recommendations with respect to inscription

ICOMOS recommends that The Forth Bridge, United Kingdom, be inscribed on the World Heritage List on the basis of **criteria (i) and (iv)**.

Recommended Statement of Outstanding Universal Value

Brief synthesis

The Forth Bridge, which spans the estuary (Firth) of the River Forth in eastern Scotland to link Fife to Edinburgh by railway, is at 2,529 m long the world's longest multi-span cantilever bridge. It opened in 1890 and continues to operate as an important passenger and freight rail bridge. This enormous structure, with its distinctive industrial aesthetic and striking red colour, was conceived and built using advanced civil engineering design principles and construction methods. Innovative in design, materials, and scale, the Forth Bridge is an extraordinary and impressive milestone in bridge design and construction during the period when railways came to dominate long-distance land travel.

This large-scale engineering work's appearance is the result of a forthright, unadorned display of its structural elements. It is comprised of about 54,000 tons of mild steel plate rolled and riveted into 4-m diameter tubes used in compression, and lighter steel spans used in tension. The use of mild steel, a relatively new material in the 1880s, on such a large-scale project was innovative, and helped to bolster its reputation. The superstructure of the bridge takes the form of three double-cantilever towers rising 110 m above their granite pier foundations, with cantilever arms to each side. The cantilever arms each project 207 m from the towers and are linked together by two suspended spans, each 107 m long. The resulting 521-m spans formed by the three towers were individually the longest in the world for 28 years, and remain collectively the longest in a multi-span cantilever bridge. The Forth Bridge is the culmination of its typology, scarcely repeated but widely admired as an engineering wonder of the world.

Criterion (i): The Forth Bridge is a masterpiece of creative genius because of its distinctive industrial aesthetic, which is the result of a forthright, unadorned display of its massive, functional structural elements.

Criterion (iv): The Forth Bridge is an extraordinary and impressive milestone in the evolution of bridge design and construction during the period when railways came to dominate long-distance land travel, innovative in its concept, its use of mild steel, and its enormous scale.

Integrity

The property contains all the elements necessary to express the Outstanding Universal Value of The Forth Bridge, including granite piers and steel superstructure. The 7.5-ha property is of adequate size to ensure the

complete representation of the features and processes that convey the property's significance, and it does not suffer from adverse effects of development or neglect.

Authenticity

The Forth Bridge is fully authentic in form and design, which are virtually unaltered; materials and substance, which have undergone only minimal changes; and use and function, which have continued as originally intended. The links between the Outstanding Universal Value of the bridge and its attributes are therefore truthfully expressed, and the attributes fully convey the value of the property.

Management and protection requirements

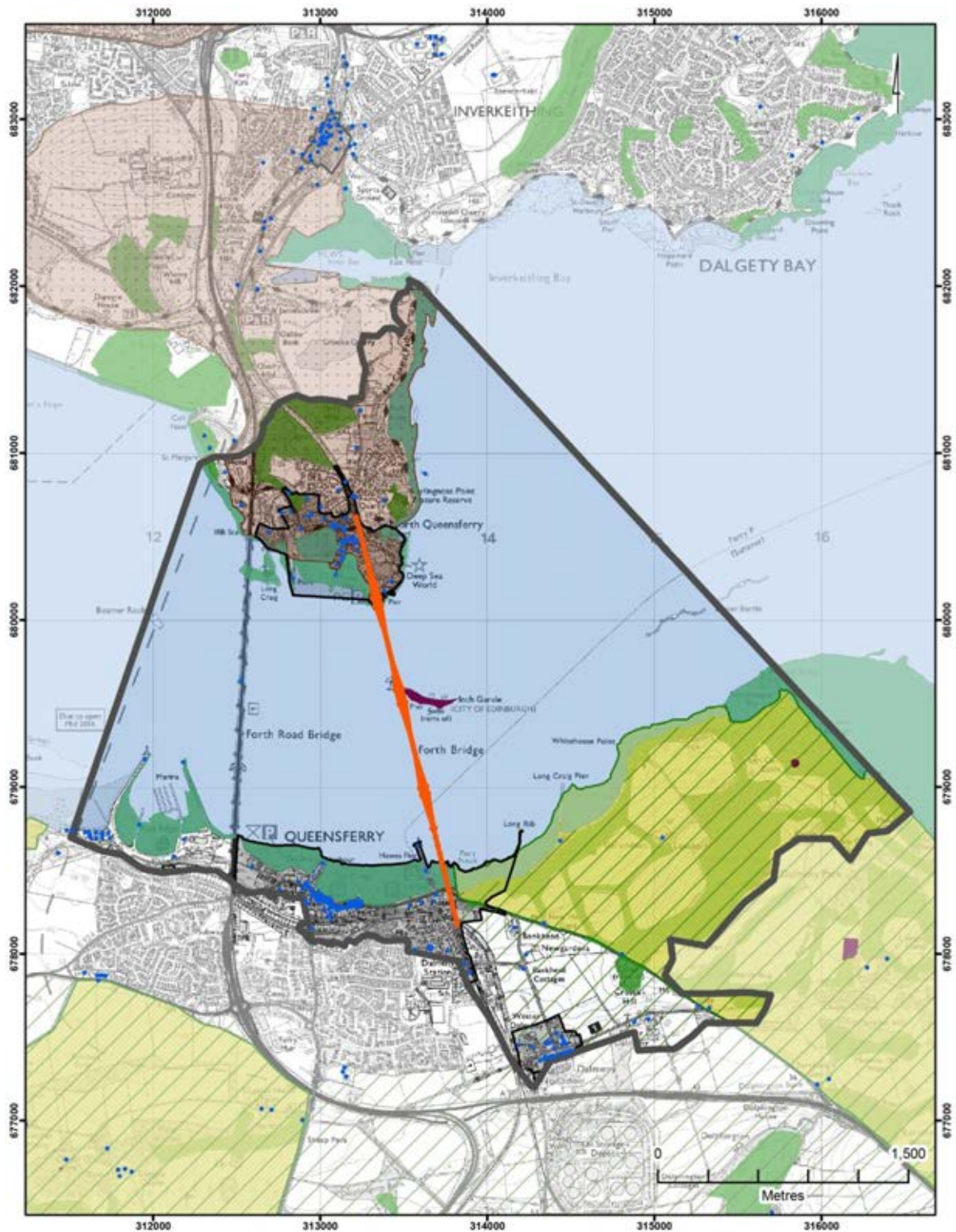
The Forth Bridge is listed at Category 'A' as a building of special architectural or historic interest, giving the property the highest level of statutory protection. Its immediate surroundings are also protected by means of a suite of cultural and natural heritage designations. Owned by Network Rail Limited, the property will be managed in accordance with a Property Management Plan by the bodies that have a statutory planning function. The Forth Bridges Forum partnership has been established to ensure that local stakeholders' interests remain at the core of the management of the Forth bridges.

Specific long-term expectations related to key issues include maintenance of strong community support, broadening understanding in the context of world bridges, attention to developments within key views, risk management, and inspiring others.

Additional recommendations

ICOMOS recommends that the State Party give consideration to the following:

- Creating key indicators that are more specific and relate more directly to the attributes that convey potential Outstanding Universal Value;
- Extending the Property Management Plan to include an interpretation and tourism plan;
- Submitting to the World Heritage Centre, by 1 December 2016, a report on the selection of key viewsheds and views of the bridge for inclusion in the appropriate planning instruments and management plan, along with an analysis of their effectiveness in ensuring the protection of these key viewsheds and views, for examination by the World Heritage Committee at its 41st session in 2017;
- Submitting plans for any proposed visitor centre at the earliest possibility to the World Heritage Centre for review, in accordance with paragraph 172 of the *Operational Guidelines for the Implementation of the World Heritage Convention*.

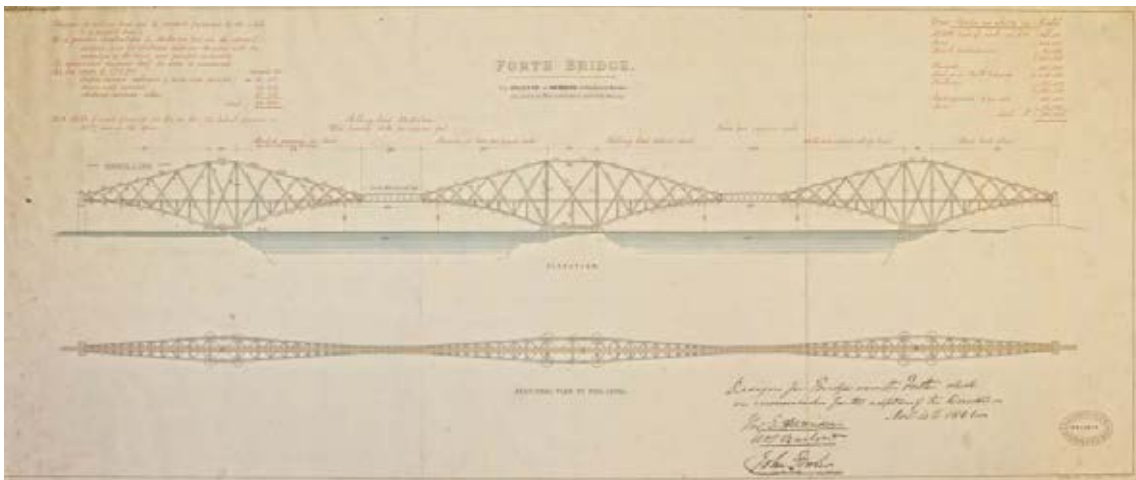


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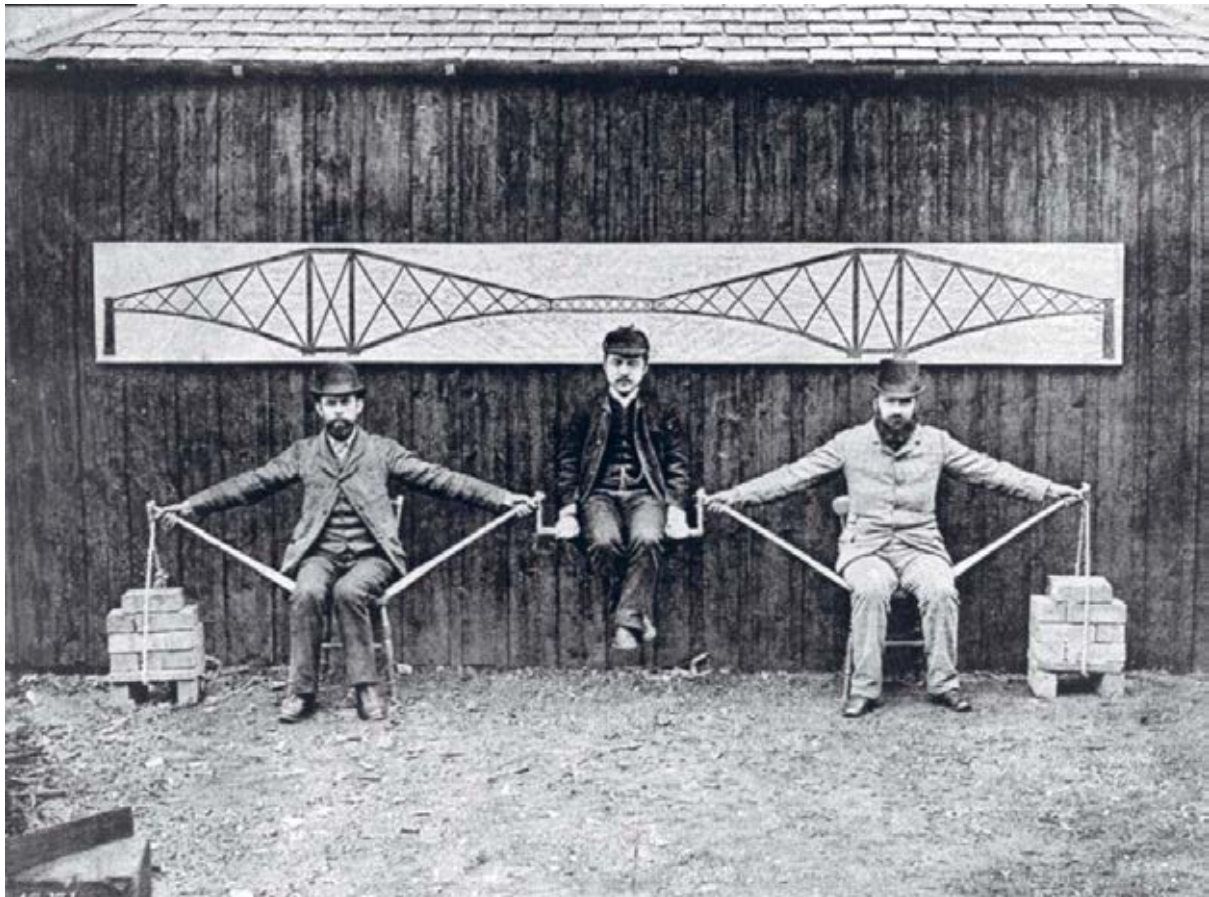
Title: The Forth Bridge: Bridgehead Zone	Key	● Listed Building
Scale: 1 : 30,000 @ A4	▭ Bridgehead Zone Boundary	■ Scheduled Monument
Projection: British National Grid	▭ Inventory Battlefield	■ Natural Heritage Protected Sites
	▭ Conservation Area	▭ Marine Planning Area
	▭ Gardens and Designed Landscape	▭ Green Belt



Map showing the boundaries of the nominated property



Drawing of the Forth Bridge signed by Mr. Barlow, Sir Fowler, and Mr. Harrison (1881)



The human cantilever



Photograph showing progress of the Queensferry main tower



Forth Bridge from South Queensferry



View of the Forth Bridge from South Queensferry

Le pont du Forth (Royaume-Uni) No 1485

Nom officiel du bien tel que proposé par l'État partie

Le pont du Forth

Lieu

Estuaire du fleuve Forth

Fife (extrémité nord) et ville d'Édimbourg (extrémité sud)
Écosse

Brève description

Ce pont ferroviaire enjambant l'estuaire du fleuve Forth, en Écosse, est le plus long pont cantilever à travées multiples du monde. Ouvert en 1890, il fonctionne encore aujourd'hui et reste un important pont ferroviaire pour le transport des passagers et des marchandises. Cette structure de grande envergure, longue de plus de 2,5 km, a été élaborée et réalisée grâce à des principes de conception et des méthodes de construction de pointe du génie civil. Son esthétique industrielle caractéristique résulte de la présentation franche et dépouillée de ses éléments structurels. Le pont du Forth, novateur dans son concept, son style, ses matériaux et son envergure, marque une étape importante dans l'histoire de la construction des ponts.

Catégorie de bien

En termes de catégories de biens culturels, telles qu'elles sont définies à l'article premier de la Convention du patrimoine mondial de 1972, il s'agit d'un *monument*.

1 Identification

Inclus dans la liste indicative

27 janvier 2012

Assistance internationale au titre du Fonds du patrimoine mondial pour la préparation de la proposition d'inscription

Aucune

Date de réception par le Centre du patrimoine mondial

29 janvier 2014

Antécédents

Il s'agit d'une nouvelle proposition d'inscription.

Consultations

L'ICOMOS a consulté plusieurs experts indépendants et le Comité international pour la conservation du patrimoine industriel (TICCIH).

Mission d'évaluation technique

Une mission d'évaluation technique de l'ICOMOS s'est rendue sur le bien du 1er au 3 octobre 2014.

Information complémentaire reçue par l'ICOMOS

L'ICOMOS a envoyé une lettre à l'État partie le 17 septembre 2014 pour lui demander des informations complémentaires sur la relation entre l'environnement et le bien proposé pour inscription, et la délimitation de cet environnement ; la décision de ne pas créer de zone tampon spécifiquement pour le bien proposé pour inscription ; la nature des nouvelles technologies du pont du Forth, de ses principes de conception et de construction, de ses innovations en matière de style et de concept, et son influence sur la pratique et la construction ; les changements apportés au pont au fil du temps ; les corrélations entre le Forth Bridges Forum, le Forth Bridge World Heritage Nomination Steering Group, et le Forth Bridge Partnership Management Agreement Group ; le propriétaire du bien proposé pour inscription, Network Rail ; et le statut actuel de l'avant-projet de plan de gestion du bien proposé pour inscription.

L'État partie a répondu le 24 octobre 2014, en envoyant une documentation complémentaire, et des informations supplémentaires ont été fournies à la mission d'évaluation technique le 4 octobre 2014, dont il est tenu compte dans la présente évaluation.

Une deuxième lettre a été envoyée à l'État partie le 17 décembre 2014, demandant des informations supplémentaires sur ce qui est *de facto* la zone tampon proposée ; les principaux cônes de vision et vues du pont ; la composition et le rôle des organismes gérant le bien et assurant son suivi ; la présomption contre la construction d'éoliennes ; et un plan d'interprétation et de tourisme. L'État partie a répondu le 26 février 2015, en envoyant une documentation complémentaire, dont il est tenu compte dans la présente évaluation.

Date d'approbation de l'évaluation par l'ICOMOS

12 mars 2015

2 Le bien

Description

Le bien proposé pour inscription, couvrant 7,5 hectares, est un pont cantilever à treillis qui enjambe l'estuaire (Firth) du fleuve Forth, dans l'est de l'Écosse, et relie le Fife et Édimbourg par voie ferrée. La structure du pont, qui mesure 2 529 m de long, d'un escarpement à l'autre, prend la forme de trois tours à double cantilever, avec des bras en porte-à-faux de chaque côté. Ces tours s'élèvent à 110 m au-dessus des fondations de leurs piles en granit, et chacun des bras en porte-à-faux dépasse de 207 m par rapport aux tours, reliées par deux travées suspendues, de 107 m de long chacune. Les deux travées formées par les trois tours font donc 521 m de large chacune (pendant 28 ans, la plus grande portée au monde). Les sections en porte-à-faux centrales du pont sont prolongées à chaque extrémité par des viaducs d'approche en acier, reposant

sur de hautes piles de granit. La superstructure est distribuée au-dessus et en dessous du pont, réduisant ainsi le volume apparent de la charpente d'acier.

Cet ouvrage de génie civil de grande envergure fait appel à environ 54 000 tonnes d'acier doux, utilisé sous forme d'entretoises principales en plaques d'acier laminé rivetées sur des tubes de 4 m de diamètre, et de travées plus légères utilisées en traction. L'acier doux était un matériau relativement nouveau dans les années 1880. Son utilisation dans un projet d'une telle envergure était novatrice, et a contribué à renforcer la réputation de l'acier doux. Du fait de sa propension à rouiller, l'acier exposé est protégé par de la peinture (d'un rouge caractéristique dans le cas du pont du Forth), pour prévenir la dégradation structurelle due à la corrosion.

Histoire et développement

John Fowler et Benjamin Baker ont entamé la conception du pont du Forth en 1880. Un contrat de 1,6 million de livres pour sa construction fut passé par la Forth Bridge Railway Company le 21 décembre 1882 avec un partenariat qui devint Tancred, Arrol & Co. Les défis principaux posés par la conception et la construction du pont étaient géographiques (créer des portées libres d'une longueur sans précédent), logistiques (gérer un volume de maçonnerie et d'acier qui surpassait celui de tous les ponts construits antérieurement, ou depuis), techniques (exploiter un matériau relativement nouveau, l'acier doux), et esthétiques (créer une structure fonctionnelle et économique à la fois honnête dans son expression et visuellement attrayante).

La construction du pont s'est déroulée en deux phases. La première, de 1882 à 1885, s'est focalisée sur l'infrastructure, notamment l'immersion des caissons et la construction des fondations et piles sur lesquelles repose la structure supérieure du pont. La deuxième phase, de 1886 à 1889, s'est concentrée sur la superstructure, notamment l'édification des trois tours cantilever et des viaducs d'approche. Environ 4 600 hommes étaient employés au plus fort de la construction ; 73 d'entre eux trouvèrent la mort. Le pont fut achevé le 15 novembre 1889, testé avec succès en janvier 1890, et ouvert officiellement le 4 mars 1890.

Les modifications entreprises depuis 1890 comprennent le renforcement de l'auge à ballast qui supporte les trains en 1913, l'installation d'un éclairage par projecteurs dans les années 1990, et l'ajout d'une passerelle autour de la Jubilee Tower, en 2012. Peindre la charpente d'acier d'une couleur rouille a été un processus plus ou moins continu jusqu'à très récemment. Des boulons à tête bombée sont désormais souvent employés dans les réparations pour imiter les rivets d'origine.

Le pont du Forth a été utilisé sans interruption depuis 1890, et reste un élément important du réseau ferroviaire du Royaume-Uni et d'Écosse. La conservation et l'entretien du pont ont décliné de façon significative au cours des dernières années de la propriété d'État (1947-1993). Le propriétaire actuel du pont, Network Rail, a

achevé une restauration qui aura duré dix ans, et coûté 130 millions de livres, en 2011, comprenant le décapage à nu de toute la charpente d'acier, qui a été repeinte avec un système époxy à écailles de verre, plus durable, mis au point pour l'industrie du pétrole et du gaz offshore. En outre, quelques cornières plus petites, qui avaient subi une corrosion importante, ont été remplacées à l'identique durant le programme de restauration. On estime que le pont a conservé environ 99,5 pour cent de sa charpente d'acier d'origine.

3 Justification de l'inscription, intégrité et authenticité

Analyse comparative

L'État partie présente une analyse comparative des ponts au sein d'une zone géoculturelle qu'il définit comme mondiale, eu égard à la nature internationale des ouvrages de génie civil de grande envergure à la fin du XIXe siècle. Des comparaisons sont faites avec des grands ponts, sur la base de leurs matériaux de construction (en se concentrant sur l'acier doux), de leur forme et de leur portée. L'État partie fait particulièrement référence à l'étude thématique *Context for World Heritage Bridges*, préparée par Eric DeLony en 1996 pour le Comité international pour la conservation du patrimoine industriel (TICCIH) et l'ICOMOS. Cette étude conclut que trois ponts cantilever seulement pourraient avoir le potentiel nécessaire pour démontrer une valeur universelle exceptionnelle : le pont du Forth ; le pont de Poughkeepsie (1886-1899), dans l'État de New York, États-Unis d'Amérique ; et le pont de Québec (1903-1919), au Québec, Canada. L'étude note que le pont du Forth en acier, « peut-être le plus impressionnant cantilever du monde », a marqué « la réussite suprême de ce matériau au XIXe siècle ».

Des comparaisons sont également faites avec les quatre biens déjà inscrits sur la Liste du patrimoine mondial où un pont est le motif principal de l'inscription : le Pont Mehmed Pacha Sokolović de Višegrad (Bosnie-Herzégovine, 2007, (ii), (iv)) ; le Quartier du Vieux pont de la vieille ville de Mostar (Bosnie-Herzégovine, 2005, (vi)) ; la Gorge d'Ironbridge (Royaume-Uni, 1986, (i), (ii), (iv), (vi)) ; et le Pont Vizcaya (Espagne, 2006, (i), (ii)). À l'exception possible de ce dernier pont, aucun n'est comparable de façon significative.

Des comparaisons sont également faites avec des ponts faisant partie de biens plus grands déjà inscrits sur la Liste du patrimoine mondial, dont le plus pertinent est le pont Louis Ier à Porto, Portugal (1885) (Centre historique de Porto (Portugal, 1996, (iv))). S'il constitue la plus grande portée en fer forgé au monde, le pont Louis Ier ne figure pas dans la justification de l'inscription sur la Liste du patrimoine mondial, qui se concentre sur le tissu urbain de Porto et ses nombreux bâtiments historiques. Et, finalement, des comparaisons sont faites avec les trois grands ponts qui se trouvent sur les listes indicatives : le pont de l'Occident, un pont suspendu de Medellín, en Colombie ; le viaduc en treillis

du Malleco, au Chili ; et le pont ferroviaire bow string du lenisseï, aujourd'hui démolì, à Krasnoïarsk, Fédération de Russie.

L'ICOMOS considère que l'État partie a démontré de manière convaincante que les ponts de grande portée représentent une classe de monuments qui n'est pas bien représentée actuellement sur la Liste du patrimoine mondial. L'analyse de l'État partie montre qu'il y a de la place sur la Liste pour le bien proposé pour inscription, et qu'il existe peu de biens similaires qui puissent être proposés.

L'ICOMOS considère que l'analyse comparative justifie d'envisager l'inscription de ce bien sur la Liste du patrimoine mondial.

Justification de la valeur universelle exceptionnelle

Le bien proposé pour inscription est considéré par l'État partie comme ayant une valeur universelle exceptionnelle en tant que bien culturel pour les raisons suivantes :

- Le pont du Forth, construction de type cantilever en acier, sans aucune décoration, est une réussite esthétique d'une formidable élégance.
- Sa conception représente un niveau unique de génie créateur surmontant l'ampleur et la profondeur d'une barrière naturelle qui n'avait jamais été franchie auparavant.
- En matière de génie civil, il s'agissait d'un défi pour l'application de nouveaux principes de conception et de nouvelles méthodes de construction.
- Il a exercé une grande influence sur les pratiques du génie civil dans le monde entier, et est une icône pour les ingénieurs à l'échelle mondiale.
- Il constitue un symbole puissant de l'ère ferroviaire, dans le cadre de la révolution des transports et des communications, qui représente une période significative de l'histoire humaine.
- C'est un jalon unique dans l'évolution des ponts et autres constructions en acier, novateur dans son style, son concept, ses matériaux et son énorme envergure.
- Il marque une étape cruciale dans l'application de la science à l'architecture, qui a profondément influencé l'humanité d'une manière qui ne se limite pas à la construction des ponts.

L'ICOMOS considère que, de manière générale, cette justification est appropriée : le pont du Forth, jalon extraordinaire et impressionnant dans l'histoire de la construction des ponts, est novateur dans son concept, son style, ses matériaux et son envergure énorme ; il a été conçu et bâti à l'aide de principes de conception et de méthodes de construction de pointe du génie civil ; et il possède une esthétique industrielle caractéristique qui résulte de la présentation franche et dépouillée de ses éléments structurels. Cependant, l'ICOMOS considère que son influence directe n'a pas été démontrée ; plutôt que d'être le prototype de structures ultérieures, il était

l'aboutissement d'une typologie, un exemple singulier exceptionnel, quasiment jamais répété, mais largement admiré comme une merveille du monde en matière d'ingénierie.

Intégrité et authenticité

Intégrité

L'ICOMOS considère que le bien proposé pour inscription contient tous les éléments nécessaires pour exprimer sa valeur universelle exceptionnelle, qu'il est de taille suffisante pour garantir la représentation complète des caractéristiques et procédés traduisant l'importance du bien, et qu'il ne souffre pas d'effets négatifs dus au développement ou au manque d'entretien. L'ICOMOS considère également qu'une base logique et scientifique a été présentée pour la sélection de la zone proposée pour inscription – bien que limitée au pont lui-même, c'est la zone la plus petite envisageable, et justifiable, pour cet ouvrage de génie civil. L'ICOMOS est d'accord avec l'État partie pour dire que le pont du Forth est dans un excellent état de conservation après l'achèvement de sa restauration sur une période de dix ans en 2011, et que le risque de dégradation ou de manque d'entretien est faible dans un avenir proche.

Authenticité

L'ICOMOS considère que les liens entre la valeur universelle exceptionnelle potentielle du bien proposé pour inscription et ses attributs sont exprimés fidèlement, et que les attributs traduisent pleinement la valeur du bien proposé pour inscription. En particulier, le bien proposé pour inscription est parfaitement authentique dans sa forme et sa conception, qui sont pratiquement inchangées ; dans ses matériaux et sa substance, qui n'ont subi que des changements minimes ; et dans son usage et sa fonction, qui se sont perpétués comme il était prévu à l'origine. L'emploi de rivets à chaud traditionnels est une option qui mérite d'être étudiée pour certaines réparations très visibles du pont du Forth à l'avenir.

En conclusion, l'ICOMOS considère que les conditions d'intégrité et d'authenticité sont remplies.

Critères selon lesquels l'inscription est proposée

Le bien est proposé pour inscription sur la base des critères culturels (i), (ii) et (iv).

Critère (i) : représenter un chef-d'œuvre du génie créateur humain ;

Ce critère est justifié par l'État partie au motif que le pont du Forth est un triomphe esthétique dans sa façon d'éviter toute décoration, et pourtant une réussite d'une élégance formidable pour un ouvrage aussi massif. Sa construction en acier de type cantilever représente un niveau unique de génie créateur humain novateur, surmontant l'ampleur et la profondeur d'une barrière naturelle qui n'avait jamais été franchie auparavant par l'homme.

L'ICOMOS considère que le pont du Forth est un chef-d'œuvre du génie créateur du fait de son esthétique industrielle caractéristique, qui résulte d'une présentation franche, dépouillée de ses éléments structurels fonctionnels massifs. L'ICOMOS considère cependant que le point concernant le génie créateur humain requis pour conquérir une barrière naturelle pourrait s'appliquer à la plupart des ponts de grande taille qui sont les premiers à leurs emplacements respectifs.

L'ICOMOS considère que ce critère a été justifié.

Critère (ii) : *témoigner d'un échange d'influences considérable pendant une période donnée ou dans une aire culturelle déterminée, sur le développement de l'architecture ou de la technologie, des arts monumentaux, de la planification des villes ou de la création de paysages ;*

Ce critère est justifié par l'État partie au motif que le pont du Forth, en matière de génie civil, représentait un défi pour l'application de nouveaux principes de conception et de nouvelles méthodes de construction. Il était à l'époque le projet de construction le plus visité et le mieux documenté au monde. Il a donc exercé une grande influence sur les pratiques du génie civil dans le monde entier et est une icône pour les ingénieurs à l'échelle mondiale.

L'ICOMOS considère que le pont du Forth est remarquable par les principes de conception et les méthodes de construction employés au cours de son édification, notamment les approches innovantes liées à la charge exercée par le vent, aux changements thermiques, au matériel hydraulique et à l'organisation de l'effort de construction, mais qu'un échange d'influences considérable pendant une période donnée ou dans une aire culturelle déterminée n'a pas encore été démontré.

L'ICOMOS considère que ce critère n'a pas été justifié.

Critère (iv) : *offrir un exemple éminent d'un type de construction ou d'ensemble architectural ou technologique ou de paysage illustrant une période ou des périodes significative(s) de l'histoire humaine ;*

Ce critère est justifié par l'État partie au motif que le pont du Forth représente une période significative de l'histoire humaine, à savoir la révolution dans les transports et les communications. L'ère ferroviaire, dont il est un symbole puissant, a été rendue possible par la révolution industrielle, et en a influencé la vitesse et la connectivité. Le pont constitue un jalon unique dans l'évolution de la construction des ponts et autres ouvrages en acier, il est innovant dans son style, son concept, ses matériaux et dans son énorme envergure. Il marque une étape cruciale dans l'application de la science à l'architecture, qui a continué d'influencer profondément l'humanité d'une manière qui ne se limite pas à la construction des ponts.

L'ICOMOS considère que le pont du Forth est un jalon exceptionnel et unique dans l'évolution de la conception et la construction des ponts durant la période où les lignes de chemins de fer en sont venues à dominer les voyages longue distance par voie terrestre, qu'il est innovant par son concept, son emploi de l'acier doux et son énorme envergure. L'ICOMOS considère cependant que l'importance planétaire du pont en tant que symbole de l'ère ferroviaire, et/ou son influence sur l'humanité au-delà de la construction des ponts, n'ont pas été démontrées de façon appropriée.

L'ICOMOS considère que ce critère a été justifié.

En conclusion, l'ICOMOS considère que le bien proposé pour inscription remplit les conditions d'intégrité et d'authenticité, répond aux critères (i) et (iv).

Description des attributs de la valeur universelle exceptionnelle

La valeur universelle exceptionnelle du pont du Forth est exprimée par sa structure massive, sans ornement, qui comprend des piles en granit soutenant une superstructure de plaques laminées en acier doux rivetées sur des tubes utilisés en compression et des travées plus légères utilisées en traction, le tout peint d'une couleur rouge caractéristique, et par ses portées libres d'une longueur sans précédent. L'impact visuel du pont sur l'environnement, et son utilisation continue, font également partie des attributs.

4 Facteurs affectant le bien

Il y a peu de pressions dues au développement possibles dans le cadre de ce bien très étroitement délimité. Les menaces potentielles pesant sur la valeur universelle exceptionnelle proposée du bien, identifiées par l'État partie, comprennent la création de structures pour l'accès des visiteurs et l'éventuelle électrification future de la voie ferrée. Une option pour l'accès des visiteurs envisage un centre d'accueil des visiteurs avec un plafond en verre sous le pont, et des ascenseurs pour faire monter les passagers par la façade est de la tour du Fife jusqu'à une plateforme d'observation au sommet. Ce type d'accès des visiteurs est actuellement dans une phase préalable à la demande d'agrément. Les projets détaillés des bâtiments, ascenseurs, passerelles et infrastructures associées proposés pour la « Forth Bridge Experience » n'ont pas encore été préparés par Network Rail, et aucune proposition officielle n'a été soumise.

Les pressions dues au développement en dehors du bien proposé pour inscription, mais dans ses environs, pourraient comprendre une augmentation significative du nombre de visiteurs, à la fois à Queensferry et à North Queensferry ; des pressions accrues sur les services et infrastructures existants, notamment les routes et les transports publics ; les modifications ou ajouts potentiellement nuisibles apportés aux propriétés dans le voisinage immédiat du pont ; la destruction de

caractéristiques et de vues de valeur autour du pont en réponse à des pressions dues au développement ; l'influence sur la valeur des propriétés dans les quartiers proches du pont ; une demande accrue de développement dans l'environnement du pont ; et des éoliennes.

Le Queensferry Crossing, nouveau pont routier à haubans, qui est actuellement en construction à environ 1 km à l'ouest du bien proposé pour inscription, doit ouvrir en 2016. Entre ce pont et le pont du Forth proposé pour inscription se trouve le Forth Road Bridge (pont autoroutier du Forth), un pont suspendu construit en 1964 et édifice classé en catégorie « A ». Il deviendra un couloir de transport public réservé aux bus, aux cyclistes et aux piétons quand le nouveau pont routier aura ouvert. Ces deux très grands ponts sont proches du bien proposé pour inscription, mais pas au point d'avoir un impact négatif sur sa valeur universelle exceptionnelle proposée.

Aucune contrainte grave liée à l'environnement n'est mentionnée. La gestion des risques de catastrophe sera assurée par le plan de gestion du bien. L'État partie note une inquiétude au sein des communautés en tête de pont concernant toute augmentation du nombre de visiteurs qui devra être gérée de façon appropriée.

L'ICOMOS considère qu'il n'existe aucune menace immédiate pesant sur le bien lui-même, mais qu'il y a des menaces potentielles en dehors du bien, liées aux accroissements possibles du nombre de visiteurs et aux développements dans l'environnement. L'ICOMOS recommande de développer, dans le cadre du plan de gestion du bien et en pleine consultation avec les résidents, un plan d'interprétation et de tourisme associé à la valeur du bien proposé pour inscription. Ce plan devrait envisager des stratégies qui évitent de submerger North Queensferry et Queensferry, tels que des parkings éloignés, des systèmes de navettes et des alternatives aux déplacements en voiture. Si un centre d'accueil des visiteurs est officiellement proposé, il devrait être soumis le plus tôt possible au Centre du patrimoine mondial pour être examiné, selon le paragraphe 172 des *Orientations*. L'ICOMOS considère également qu'une présomption plus claire contre la construction d'éoliennes à l'intérieur des cônes de vision essentiels du pont devrait figurer dans les instruments de planification appropriés et le plan de gestion du bien.

5 Protection, conservation et gestion

Délimitations du bien proposé pour inscription et de la zone tampon

Les délimitations du bien proposé pour inscription sont définies par le contrat unique qui a été passé en 1882 pour la construction de la maçonnerie et des éléments en acier du pont du Forth, telles qu'elles sont représentées dans les dessins contractuels d'origine. En termes physiques, le bien proposé pour inscription se limite aux éléments en pierre et en acier du pont lui-même, long de

2 529 m, d'escarpement à escarpement. Il comprend les piles cantilever sur lesquelles le pont repose, et les caissons installés dans l'eau pour supporter la pile centrale, mais pas les rochers immergés de l'île d'Inchgarvie ni les rochers de North Queensferry sur lesquels les deux autres piles se dressent. Les talus et déblais raccordant le pont au reste du réseau ferroviaire ne sont pas compris dans les délimitations proposées, pas plus que les îles ou les parties marines du Firth of Forth lui-même.

Aucune « zone tampon » destinée à protéger le bien proposé pour inscription contre des menaces plus larges n'a été spécifiquement créée pour cette proposition. L'État partie soutient que le bien proposé pour inscription est protégé de façon appropriée par le système de planification local et, en particulier, par l'ensemble de systèmes de classement (culturel et naturel) existants. Ces derniers sont appuyés par des analyses détaillées des vues et cônes de vision, entreprises pour soutenir de cette proposition d'inscription. Ces analyses, qui n'ont aucun statut en ce qui concerne les mécanismes de contrôle de planification, permettent aux autorités de planification de prendre en considération, dans leurs prises de décision, la protection des vues qui ont été identifiées comme ayant de la valeur.

L'État partie a proposé en octobre 2014 que les zones de conservation à chaque extrémité du pont, désignées par la loi sur la planification (bâtiments et zones de conservation répertoriés) (Écosse) de 1997, combinées avec l'ensemble des autres classements en tant que patrimoine culturel et naturel existants, constituent collectivement une zone tampon *de facto* (« Zone de tête de pont »). L'État partie a également indiqué le 26 février 2015 que cet ensemble de désignations de planification comprendra aussi la zone marine de l'estuaire (qui avait été omise dans le dossier de proposition d'inscription), et que la protection marine sera également incluse dans une version actualisée des actions contenues dans le plan de gestion du bien et coordonnée avec les cônes de vision essentiels. Ces révisions ont été amorcées, et seront achevées à la fin de l'année 2015. La surface totale estimée de la zone polygonale de tête de pont proposée, qui comprend les zones marines concernées, couvre 1 233 hectares, dont 40 pour cent environ sur terre.

L'ICOMOS considère que les délimitations du bien proposé pour inscription sont appropriées, et que les délimitations de la zone tampon *de facto*, telles qu'elles ont été révisées en février 2015 pour inclure la zone marine concernée de l'estuaire, sont également appropriées. Un nombre limité de vues et de cônes de vision essentiels du pont devrait également être sélectionné et inclus dans les instruments de planification appropriés et le plan de gestion, avec pour objectif d'assurer leur protection.

Droit de propriété

Le bien proposé pour inscription est la propriété de, et est géré par Network Rail Limited, un organisme indépendant du ministère des Transports au sein du secteur public.

Protection

Le pont du Forth est classé en catégorie « A », en tant que « construction d'intérêt architectural ou historique particulier », par le City of Edinburgh Council, Edinburgh Burgh HBNUM : 40370 Item No : 30 QF; et le Fife Council, Inverkeithing Parish HBNUM 9977 Item No : 6. Ce classement, qui a pris effet en 1973, donne au bien proposé pour inscription le plus haut degré de protection statutaire pour une structure en service.

Toutes les modifications affectant l'intérêt particulier que présente le pont nécessitent l'accord des deux conseils de la Ville d'Édimbourg et de Fife, avec l'avis, dans certaines circonstances, de Historic Scotland au nom des ministres écossais. Les instructions destinées aux autorités chargées de la planification en ce qui concerne les bâtiments classés sont exposées dans la loi sur la planification (bâtiments et zones de conservation répertoriés) de 1997, telle qu'amendée.

L'ICOMOS note que l'environnement d'un bien du patrimoine mondial en Écosse est protégé par la politique écossaise de planification de 2014, selon laquelle l'autorité chargée de la planification doit protéger et préserver la valeur universelle exceptionnelle.

L'ICOMOS considère que la protection légale en place, avec l'inclusion de la zone marine concernée de l'estuaire dans la zone tampon *de facto*, et la sauvegarde des vues et cônes de vision essentiels du pont, est appropriée.

Conservation

Le bien proposé pour inscription a été documenté et sera cartographié et scanné numériquement en 2015. Son état actuel de conservation est bon, et les mesures de conservation mises en place comprennent des inspections régulières : en pratique, un sixième du pont est inspecté visuellement par Network Rail chaque année. Il n'y a aucune menace discernable pesant sur la poursuite de son usage. L'avant-projet de plan de gestion identifie des mesures pour protéger davantage et améliorer l'état du tissu historique. Les mesures de conservation sont appropriées pour conserver la valeur, l'authenticité et l'intégrité du bien proposé pour inscription. Le financement des travaux d'entretien et de conservation a été identifié par l'État partie, et ces travaux sont effectués par des personnes possédant le niveau de qualification et d'expertise approprié. Il n'y a aucun problème urgent suite au récent projet de restauration mené sur dix ans.

L'ICOMOS considère que l'état de conservation du bien est bon, et que les mesures de conservation adoptées sont efficaces.

Gestion

Structures et processus de gestion, y compris les processus de gestion traditionnels

La gestion du bien proposé pour inscription est actuellement placée sous la responsabilité de son propriétaire, Network Rail. Au cas où le pont serait inscrit sur la Liste du patrimoine mondial, l'une des premières mesures de l'avant-projet de plan de gestion du bien sera de mettre en œuvre un accord de gestion en partenariat. Cet accord fait appel aux membres du Forth Bridge World Heritage Nomination Steering Group (un sous-groupe du Forth Bridges Forum), qui ont des fonctions de planification statutaires, dont Network Rail, Historic Scotland, le Conseil de Fife et le Conseil de la Ville d'Édimbourg. Le rôle du Forth Bridge Partnership Management Agreement Group sera de protéger la valeur universelle exceptionnelle du bien, tout en l'aidant à perdurer en tant que structure en fonctionnement.

Cadre de référence : plans et mesures de gestion, y compris la gestion des visiteurs et la présentation

Le dossier de proposition d'inscription comprend un avant-projet de plan de gestion du bien proposé pour inscription. Désormais opérationnel, son plan d'action sur six ans, auquel la priorité a été donnée, a débuté en 2014. Outre des informations de référence, le plan inclut la déclaration de valeur universelle exceptionnelle ; les responsabilités statutaires des principaux organismes et autres mesures de gestion existantes ; la mise en œuvre des mesures de protection du patrimoine et de l'aménagement du territoire ; un résumé des pressions et menaces, et des opportunités de changements ou d'améliorations ; les moyens pour mettre en œuvre le plan, et les mesures qui serviront à son suivi.

La loi d'aménagement du territoire rural et urbain (Écosse) de 1997 et la loi de planification (Écosse) de 2006 (qui modifie et amende bon nombre des dispositions de 1997) fournissent le cadre légal de la politique de planification locale. Ces lois font office de législation principale guidant la planification et le développement en Écosse. Les plans de développement local d'Édimbourg et du Fife – des interprétations locales de la politique de planification régionale et nationale – doivent tous deux être achevés en 2015 ; la version du Fife devrait comporter une politique spécifiquement destinée à protéger le contexte du pont du Forth. Les deux plans de développement local seront liés aux deux désignations des zones de conservation correspondantes.

En ce qui concerne la gestion des visiteurs, il n'y a pas actuellement d'accès public piétonnier au pont, et aucun moyen de comptabiliser les visiteurs individuels. Le nombre de personnes qui fréquentent le pont dans leur vie quotidienne, cependant, est très élevé, car jusqu'à 200 trains de passagers traversent le pont ferroviaire chaque jour. L'État partie a exposé les initiatives envisageables pour gérer les visiteurs, comme la création de nouvelles installations leur étant destinées et des expériences de présentation. Les ressources actuelles, y

compris le niveau des effectifs, l'expertise et la formation, semblent être appropriées. Network Rail est actuellement engagé à hauteur d'environ 1 million de livres par an, pendant les cinq prochaines années, pour les travaux d'entretien courants de la structure du pont. La gestion des risques sera traitée via le plan de gestion du bien.

Implication des communautés locales

Les communautés locales ont été impliquées dans l'élaboration de la proposition d'inscription et du plan de gestion du bien, et les conseils de Fife et de la Ville d'Édimbourg ont officiellement accepté de soutenir la proposition d'inscription.

L'ICOMOS considère que le système de gestion du bien est approprié. L'ICOMOS recommande que les diverses améliorations amorcées par l'État partie, telles qu'elles ont été exposées en février 2015, soient achevées, y compris la clarification concernant l'institutionnalisation de l'actuel Groupe directeur (Steering Group) ; d'intégrer officiellement le patrimoine mondial dans les attributions du Forth Bridge Partnership Management Agreement Group ; et de développer un plan d'interprétation et de tourisme dans le cadre du plan de gestion du bien.

6 Suivi

Le suivi de l'état du bien proposé pour inscription fait partie du programme d'entretien obligatoire de Network Rail, et les résultats sont consignés dans son registre des biens civils et son système de rapport électronique, qui est adapté aux besoins d'entretien et de suivi du pont. Network Rail possède également un plan de gestion des biens. Le dossier de proposition d'inscription comprend quatre indicateurs clés : deux font référence au registre des bâtiments en péril ; un autre à la mise en valeur des vues essentielles, ou leur détérioration par la végétation ou de nouveaux développements ; et un dernier aux billets de train vendus à North Queensferry et Dalmeny. L'ICOMOS considère que ces indicateurs clés, de même que leur périodicité, sont vagues. Les indicateurs clés devraient être plus directement reliés aux attributs qui traduisent la valeur universelle exceptionnelle potentielle (c'est-à-dire ne pas se limiter à l'état physique du pont), pour garantir que ces attributs soient protégés, conservés et gérés afin de soutenir cette valeur. Les indicateurs clés n'énoncent pas une référence qui indique un état de conservation souhaité.

L'ICOMOS considère que les indicateurs clés proposés devraient être plus spécifiques et reliés plus directement aux attributs qui traduisent la valeur universelle exceptionnelle potentielle.

7 Conclusions

L'ICOMOS considère que la valeur universelle exceptionnelle du bien proposé pour inscription a été démontrée. Le pont du Forth constitue un jalon extraordinaire dans l'histoire de la construction des ponts, remarquable par son énorme envergure, par son emploi innovant des matériaux, par ses principes de conception et ses méthodes de construction de pointe, et son esthétique industrielle caractéristique. Les attributs pertinents traduisant la valeur universelle exceptionnelle du bien proposé pour inscription sont inclus dans ses délimitations. Le bien proposé pour inscription est dans un bon état de conservation, et bénéficie du plus haut degré de protection au niveau national. Sa zone tampon *de facto*, telle qu'elle a été proposée en octobre 2014 et révisée en février 2015 pour inclure la zone marine concernée, est appropriée. Les vues et cônes de vision essentiels du pont devraient être sauvegardés, y compris face à la construction d'éoliennes. Le système de gestion du bien, même s'il est approprié, bénéficiera des clarifications organisationnelles qui ont été entamées, et le plan de gestion du bien devrait comprendre un plan d'interprétation et de tourisme.

8 Recommandations

Recommandations concernant l'inscription

L'ICOMOS recommande que le pont du Forth, Royaume-Uni, soit inscrit sur la Liste du patrimoine mondial sur la base des **critères (i) et (iv)**.

Déclaration de valeur universelle exceptionnelle recommandée

Brève synthèse

Le pont du Forth, qui enjambe l'estuaire (Firth) du fleuve Forth, dans l'est de l'Écosse, pour relier le Fife à Édimbourg par voie ferrée est, avec sa longueur de 2 529 m, le plus long pont cantilever à travées multiples du monde. Ouvert en 1890, il fonctionne encore aujourd'hui et reste un important pont ferroviaire pour le transport des passagers et des marchandises. Cette énorme structure, avec son esthétique industrielle caractéristique et sa couleur rouge frappante, a été élaborée et réalisée grâce à des principes de conception et des méthodes de construction de pointe du génie civil. Le pont du Forth, novateur dans son style, ses matériaux et son envergure, marque un jalon extraordinaire et impressionnant dans la conception et la construction des ponts durant la période où les lignes de chemins de fer en sont venues à dominer les voyages longue distance par voie terrestre.

L'apparence de cet ouvrage de génie civil de grande envergure résulte de la présentation franche et dépouillée de ses éléments structurels. Le pont fait appel à environ 54 000 tonnes de plaques d'acier doux laminé rivetées sur des tubes de 4 m de diamètre utilisés en compression, et à des travées en acier plus légères utilisées en traction.

L'emploi de l'acier doux, matériau relativement nouveau dans les années 1880, pour un projet d'une telle envergure, était novateur, et a contribué à renforcer la réputation de ce matériau. La superstructure du pont prend la forme de trois tours à double cantilever, s'élevant à 110 m au-dessus des fondations de leurs piles en granit, avec des bras en porte-à-faux de chaque côté. Chacun des bras cantilever dépasse de 207 m par rapport aux tours, et ils sont reliés par deux travées suspendues, de 107 m de long chacune. Les travées de 521 m qui en résultent, formées par les trois tours, ont été individuellement les plus longues du monde pendant vingt-huit ans, et restent collectivement les plus longues dans un pont cantilever à travées multiples. Le pont du Forth est l'aboutissement de sa typologie, quasiment jamais répété, mais largement admiré comme une merveille du monde en matière d'ingénierie.

Critère (i) : Le pont du Forth est un chef-d'œuvre du génie créateur du fait de son esthétique industrielle caractéristique, qui résulte d'une présentation franche, dépouillée de ses éléments structurels fonctionnels massifs.

Critère (iv) : Le pont du Forth constitue un jalon extraordinaire et impressionnant dans l'évolution de la conception et de la construction des ponts, durant la période où les lignes de chemins de fer en sont venues à dominer les voyages longue distance par voie terrestre, innovant dans son concept, son emploi de l'acier doux et son énorme envergure.

Intégrité

Le bien proposé pour inscription contient tous les éléments nécessaires pour exprimer la valeur universelle exceptionnelle du pont du Forth, y compris les piles en granit et la superstructure en acier. Le bien de 7,5 hectares est de taille suffisante pour garantir la représentation complète des caractéristiques et procédés traduisant l'importance du bien, et il ne souffre pas d'effets négatifs dus au développement ou au manque d'entretien.

Authenticité

Le pont du Forth est parfaitement authentique dans sa forme et sa conception, qui sont pratiquement inchangées ; dans ses matériaux et sa substance, qui n'ont subi que des changements minimes ; et dans son usage et sa fonction, qui se sont perpétués comme il était prévu à l'origine. Les liens entre la valeur universelle exceptionnelle du pont et ses attributs sont donc exprimés fidèlement, et les attributs traduisent pleinement la valeur du bien proposé pour inscription.

Mesures de gestion et de protection

Le pont du Forth est classé en catégorie « A », en tant que construction d'intérêt architectural ou historique particulier, ce qui donne au bien proposé pour inscription le plus haut degré de protection statutaire. Ses environs immédiats sont également protégés par le biais d'un ensemble de classements au patrimoine culturel et

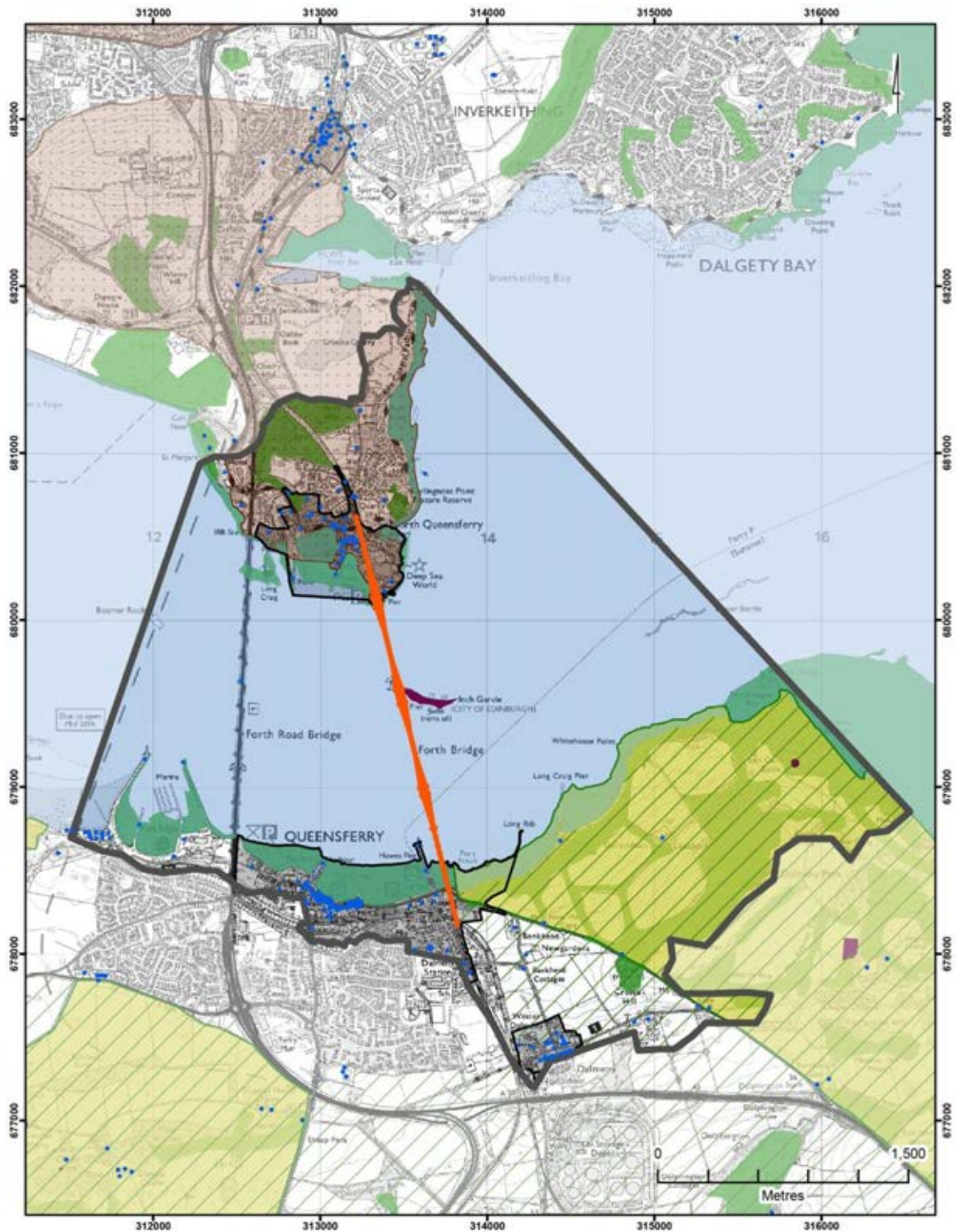
naturel. Propriété de Network Rail Limited, le bien sera géré conformément à un plan de gestion du bien par les organismes qui ont une fonction de planification statutaire. Le partenariat du Forth Bridges Forum a été établi pour garantir que les intérêts des parties prenantes locales restent au cœur de la gestion des ponts du Forth.

Parmi les attentes spécifiques à long terme, liées à des questions cruciales, figurent le maintien d'un fort soutien des communautés, une meilleure compréhension dans le contexte des ponts dans le monde, l'attention portée aux développements au sein des vues essentielles, la gestion des risques, et d'autres retombées qui s'en inspirent.

Recommandations complémentaires

L'ICOMOS recommande que l'État partie prenne en considération les points suivants :

- créer des indicateurs clés plus spécifiques et plus directement reliés aux attributs traduisant la valeur universelle exceptionnelle potentielle ;
- étendre le plan de gestion du bien pour inclure un plan d'interprétation et de tourisme ;
- soumettre au Centre du patrimoine mondial, d'ici au 1er décembre 2016, un rapport sur la sélection des vues et cônes de vision essentiels du pont, pour inclusion dans les instruments de planification appropriés et le plan de gestion, avec une analyse de leur efficacité pour assurer la protection de ces vues et cônes de vision essentiels, pour examen par le Comité du patrimoine mondial lors de sa 41e session en 2017 ;
- soumettre des plans pour toute proposition de centre d'accueil des visiteurs le plus tôt possible au Centre du patrimoine mondial pour examen, conformément au paragraphe 172 des *Orientations devant guider la mise en œuvre de la Convention du patrimoine mondial*.



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Title:
The Forth Bridge: Bridgehead Zone

Scale:
1 : 30,000 @ A4

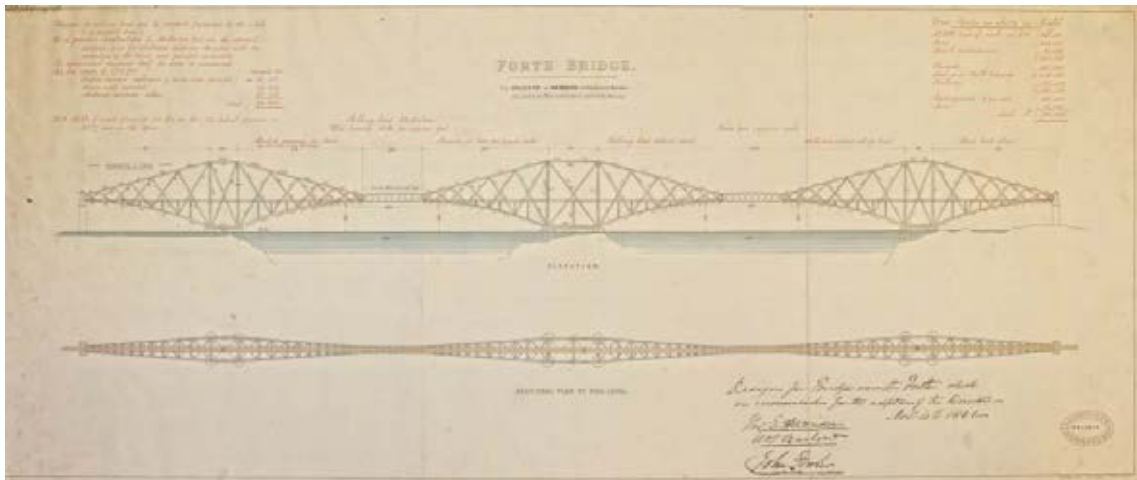
Projection:
British National Grid

Key

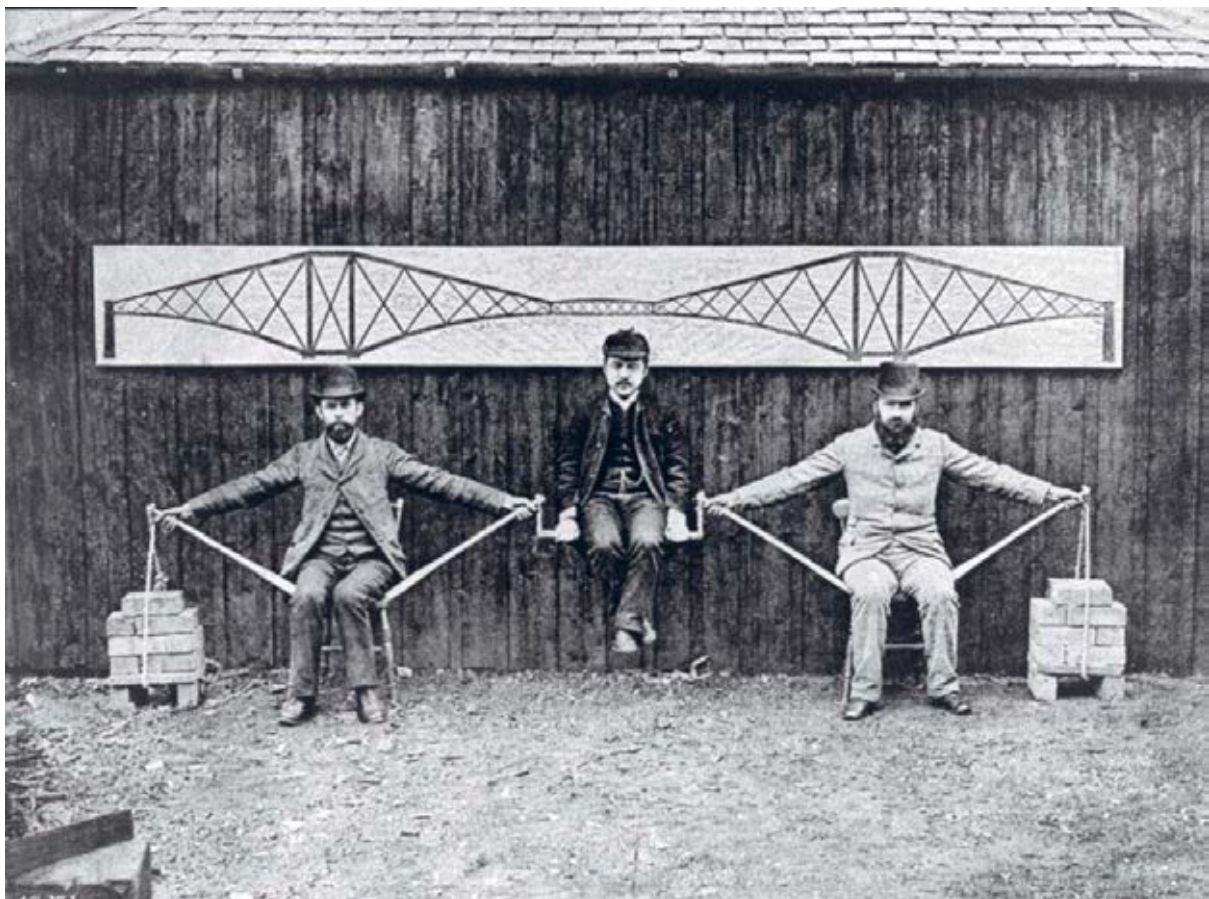
Nominated Property	Listed Building
Bridgehead Zone Boundary	Scheduled Monument
Inventory Battlefield	Natural Heritage Protected Sites
Conservation Area	Marine Planning Area
Gardens and Designed Landscape	Green Belt



Plan indiquant les délimitations du bien proposé pour inscription



Dessin du projet du pont du Forth signé par M. Barlow, Sir Fowler et M. Harrison (1881)



Cantilever humain



Photographie de la construction du pont (1887)



Vue du pont du Forth depuis South Queensferry



Vue du pont du Forth depuis South Queensferry