"Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining" (No. 1484)

Screening report as part of a Heritage Impact Assessment process for a new train station in the Buffer Zone of the Shuseikan component part (Area 2 / Component 2-1).

1. Introduction

This document is prepared as a screening report as part of a Heritage Impact Assessment process ("Screening") for the construction of a new JR station planned for the Buffer Zone adjacent to Shuseikan (Area 2 / Component 2-1), one of the 23 components of the World Heritage " Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining ".

As noted in the state of conservation report[1] submitted to the World Heritage Centre in December 2020, the construction of a new train station was believed to be unlikely to have a direct, negative impact on the Outstanding Universal Value (OUV) of the component site. In response to the ICOMOS Technical Review sent from the World Heritage Centre in October 2021, a thorough analysis was conducted of the detailed design of the train station and its potential impact on the OUV of the property and the surrounding environment of Shuseikan. This document presents the results of the analysis.

The screening phase has resulted in modifications to the design proposal and the final proposal as presented here will have no adverse impact on OUV. It will have positive impacts for community and visitor use, traffic reduction, and sustainable development, including easier access to the site as part of wider strategic initiatives to support the Shuseikan World Heritage component. The assessment recognizes that the location of the proposed train station avoids potential archaeological heritage in the Buffer Zone which is related to the Shuseikan period, that it is already a road-rail transportation corridor, and that the station is minimal in size and height, its design is simple and unobtrusive, and its colors are subdued. It will also not affect the important views from within the property. As a result, it was determined that a further detailed Heritage Impact Assessment (HIA) is not necessary.

The following section explains (1) Location of the project, (2) Purpose of the project, (3) Key Information from existing plans, and (4) Main entity of screening, etc.

(1)Location of the project

Shuseikan - a component part of the Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining". World Heritage property is located in Kagoshima-shi, Kagoshima Prefecture. The train station that is the subject of this screening report will be constructed in the buffer zone to the south of the heritage site (see Figures 1, 2, 3).

[1] Available for download from the following URL (in Japanese):https://www.cas.go.jp/jp/sangyousekaiisan/seikaiisan_houkoku/201217.html

Figure 1. Location of Shuseikan (Area 2 / component site 2-1)

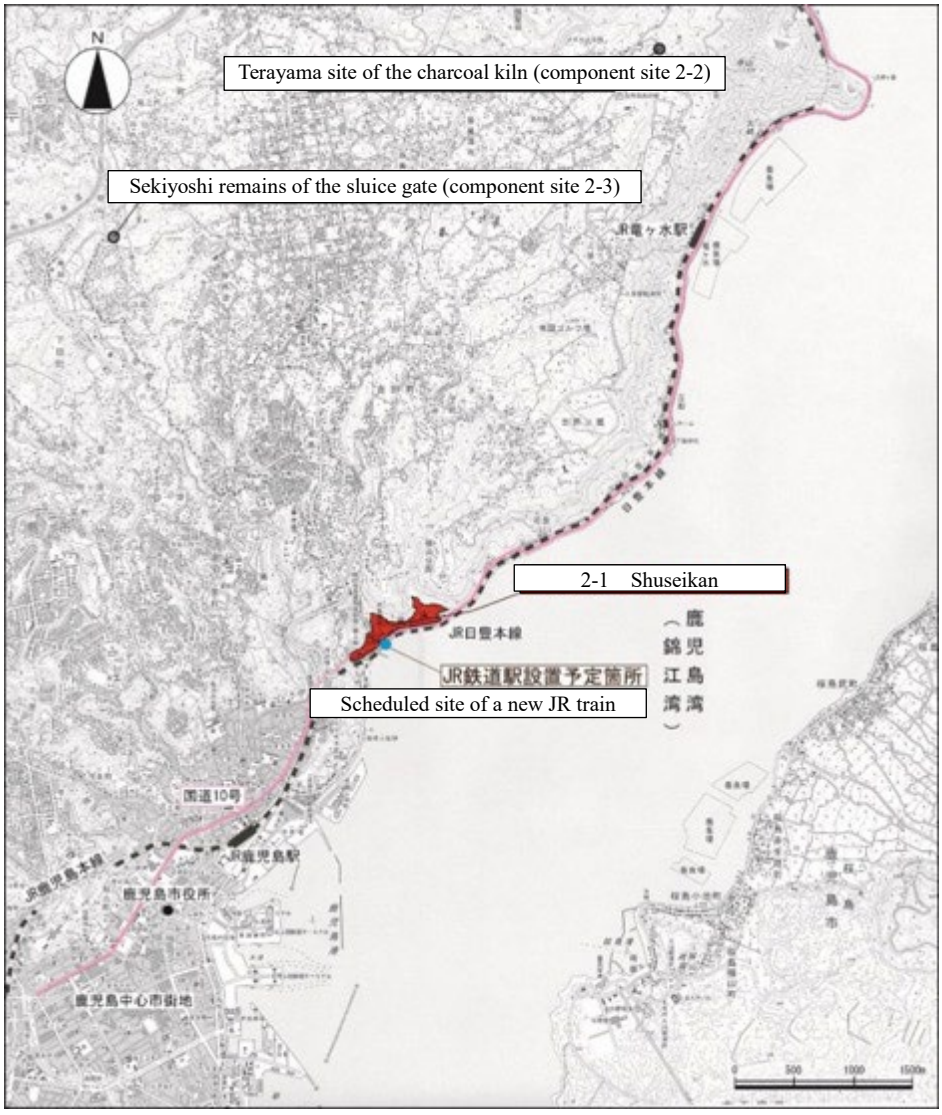


Figure 2. Location of Shuseikan (component site 2-1) in Area 2

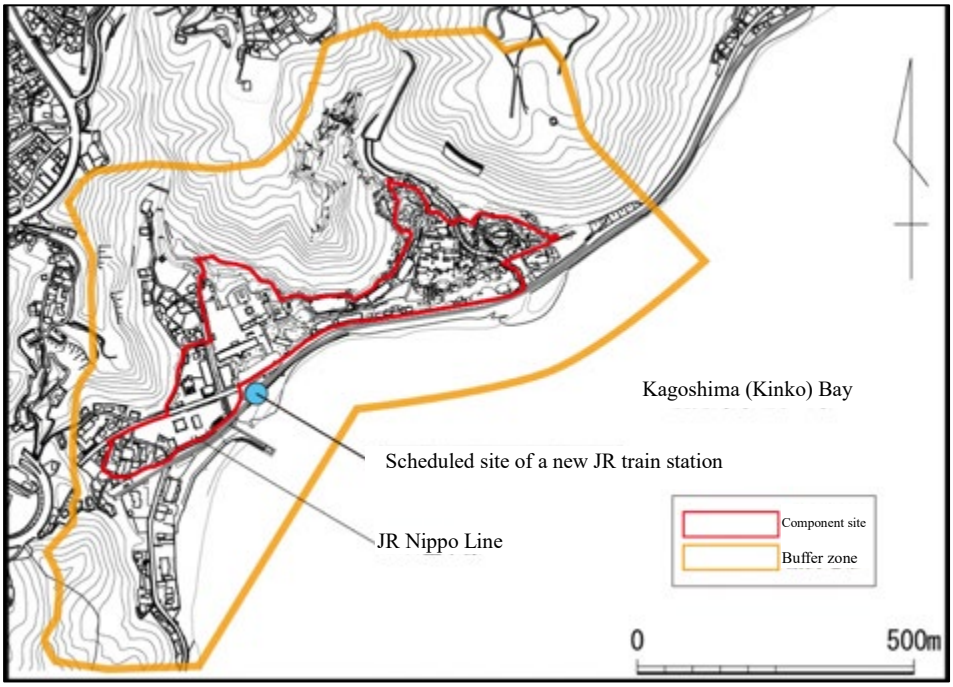


Figure 3. Shuseikan (component site 2-1) and its buffer zone

(2)Purpose of the project

The train station is to be built on the JR Nippo Line that passes through part of the buffer zone in the south of the component site. The New Iso Station Construction Council, which is the main project entity, is currently examining the project in consultations with the railway operator and the national agencies related to heritage conservation.

The project aims to utilize the existing railway as the principal means of access to the component site. The diversion of car-based visitors to railway access will allow a car parking area within the Property to be removed and enable the investigation of this area and the potential conservation and presentation of any underground remains related to the historical operation of the Shuseikan industrial complex. Furthermore, the project aims to improve the component site's interpretation by, for instance, creating a more direct access route to the component site including the Foreign Engineer's Residence.

The JR Nippo Line fulfills the important role of connecting major cities in Kyushu and promoting their economies, industries, cultures, and tourism. The construction of the new train station will enable on-time and speedy access to Shuseikan.

(3)Key Information from existing plans

Statements on the planned train station from key existing plans are as follows.

① Conservation Management Plan (Chapter 5, Part 6 (5) Response to Visitor Pressure)

> The Iso area experiences a parking space shortage during peak tourism seasons. Due to its topographical restrictions, however, expanding its parking space is difficult. This necessitates measures to control visits by cars and to reduce temporary congestion. …
> Going forward, comprehensive research will be conducted to examine transport access and to implement concrete measures. Such research will examine issues such as enhancement to access from Kagoshima Station to inside the component site, allocation of functions with the area around Kagoshima Station, an increase in the existing public and tourist bus services, and the needs and possibility of building a new train station in the Iso area.

② Repair and Public Usage Plan (Chapter 2, Part 2, 9 (2) Request to Build a New Train Station in the Iso Area)

> … In particular, road users will unlikely accept the traffic congestion deterioration on National Route No. 10 and on the Kamihonmachi-Iso municipal road which would result from the longer shutting time of the railway crossings. It was hence considered necessary to examine traffic plans linked to a National Route No. 10 bypass, with an eye on a long-term vision.

③ Total Traffic Environment Plan for the Conservation of the World Heritage in the Iso Area

> Cars and buses are the main means to visit the Iso area. Due to the area's geographic and topographical restrictions, however, increasing the area's parking capacity is impossible. This situation is not favorable for the conservation of the site, visitor safety, visitor traffic lines, and site interpretation. In fact, overwhelmed parking capacity has in the past led to situations that could potentially have a negative impact on the attributes representing the site's OUV. In response to this, countermeasures have been taken such as a park-and-ride trial and an increase in sightseeing circular bus services. These measures, however, have not resolved the problems.
> Against this backdrop, attention has been turned to *railway*, which did not exist at the time Shuseikan was conducting businesses but is currently functioning as part of important urban infrastructure. Building a new station in the area will facilitate a shift from cars to railway as the means of transport, thereby solving problems caused by the parking space shortage.

The Total Traffic Environment Plan for the Conservation of the World Heritage in the Iso Area defines its vision for the area's traffic environment as follows: maintain the World Heritage site and its surrounding environment in good condition into the future and strive to improve their values and attraction and the environment for visitors. To realize this vision, the Plan has established the following five basic policies: 1. Conserve remains and landscapes and uncover their values; 2. Change the means of transport; 3. Improve visitor traffic lines; 4. Improve the environment for visitors; and 5. Secure alternative routes. These policies will be acted on in phases from a long-term viewpoint.
The construction of a new train station, which is the subject of this screening as part of a Heritage Impact Assessment process, falls under basic policy 2. Change to the means of transport which will result from the construction of a new train station will help conserve remains and reduce parking within the World Heritage property. This will eventually help achieve basic policy 1, which aims to research remains which are thought to exist in the areas used as parking space within the site. It will also contribute to basic policy 3 as the new station will become another basis for site interpretation.

④ Station Building Concept (determined by the New Iso Station Construction Council on May 13, 2022)

Station building concept: "**Station that gently connects with history, nature and people**"
"History": World cultural heritage, historic remains
"Nature": Natural environment such as Sakurajima, Kagoshima (Kinko) Bay, and Isoyama Park
"People": Tourists, residents, workers in related facilities
"Gently connects": Improve, represent, and not damage the values of the world heritage and historic remains; able to use safely
The use of "*to*" in the Japanese sentence is designed to express mutual co-dependence instead of highlighting a specific main character.

Matters to pay attention as the basis of the concept
1. Appearance of the station building that takes into account the views and landscapes
2. Station construction work that does not have a negative impact on the conservation of historic remains [outside the World Heritage property]
3. Display of traffic lines to help improve visitors' understanding of the site
4. Ensuring visitor safety and convenience

(4)Main entity of screening, etc.

The main entity of the train station construction project is the New Iso Station Construction Council that consists of local economic organizations, Kagoshima Prefecture, and Kagoshima City. Kagoshima City functions as the Council's secretariat. Being the main entity of the station front square development project, Kagoshima City also organizes overall information including those on the train station and liaises with relevant organizations.

Accordingly, Kagoshima City has compiled the matters related to the project's potential impact on World Heritage, conducted an HIA screening process, and summarized the results in this report. Input has also been provided by international World Heritage advisors.

2. Train Station Facilities Subject to HIA Screening

(1) Overview

The intended location and size of the new train station are currently as below.

- Location: An area in the site of the existing Kagoshima municipal road along the Kagoshima (Kinko) Bay in the buffer zone to the south of the component site. (Proposed layout plan [Figure 4])
- Number of platforms: 1　Total length: 92.0 m
- Railway track: Use the current track.
- Station front square area: 660 sqm

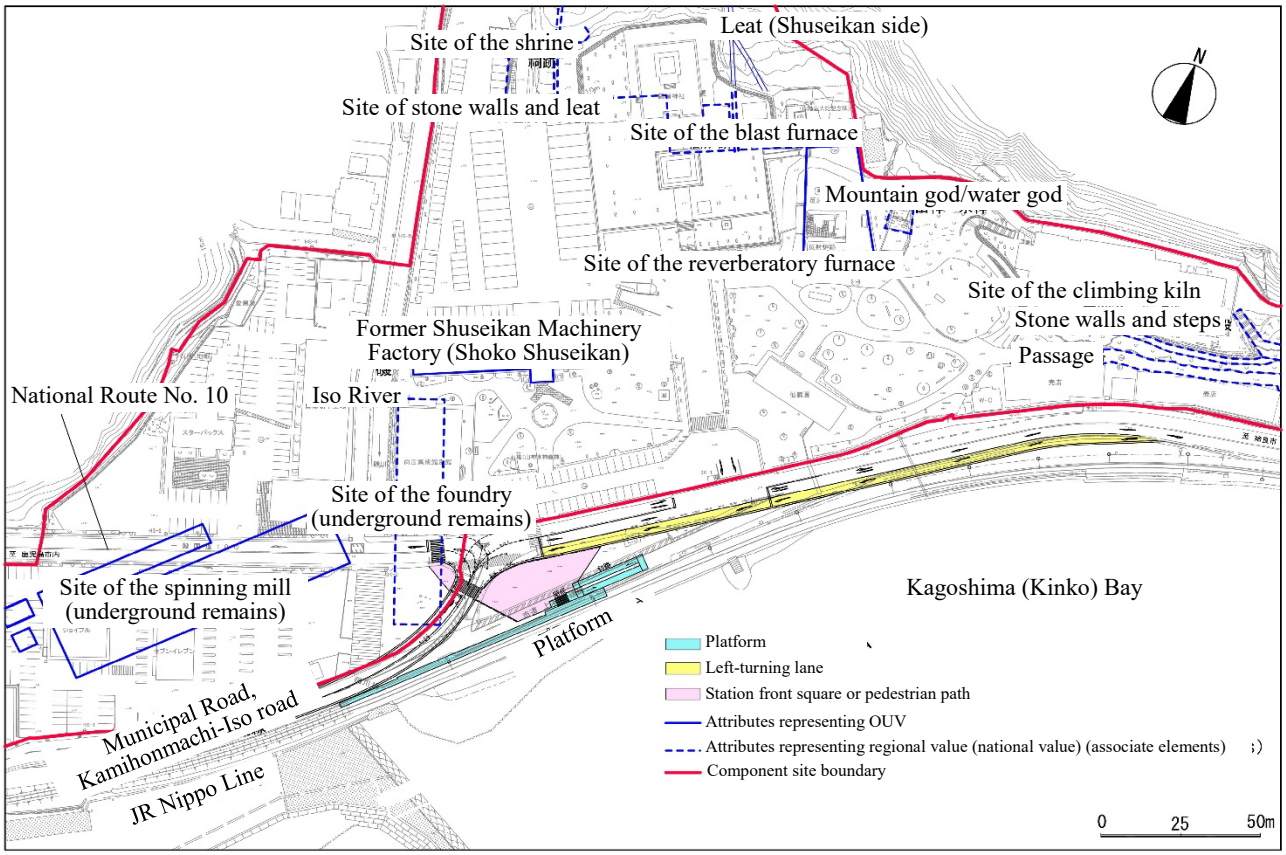


Figure 4. Layout plan for the train station platform and station front square (proposal)

(2) Chronicle

Table 1 below shows a chronicle related to the train station proposal.

July 2015	"Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining" including Shuseikan was inscribed on the World Heritage List
August 2016	The local neighborhood association and others submitted to the Kagoshima City council a petition requesting the establishment of a council for the construction of a new JR Iso station
September 2016	Economic groups and others submitted a request to the Kagoshima City council to establish a council to construct a new JR Iso station
March 2017	Kagoshima City established the New JR Iso Station Exploratory Investigation Council
August 2017	Consulted with the Agency for Cultural Affairs and Cabinet Secretariat on the exploratory investigation of a new Iso station
March 2018	Prepared the Repair and Public Usage Plan of the Shuseikan site
June 2018	The Kagoshima Association of Corporate Executives' Kagoshima revitalization committee

	announced its recommendation, “Toward promptly constructing a new JR Iso station”
August 2018	The local neighborhood association and others submitted to Kagoshima City a request to promptly construct a new JR Iso station
January 2019	Reported to the Agency for Cultural Affairs and Cabinet Secretariat on the results of the examination conducted to this point, future plans, and so on
July 2019	Reported to the Agency for Cultural Affairs regarding future plans and so on
May 2020	Established the New Iso Station Construction Council with participation of economic groups, Kagoshima Prefecture, and Kagoshima City
December 2020	Submitted a state of conservation report pursuant to Article 172 of the *Operational Guidelines for the Implementation of the World Heritage Convention*
October 2021	Received the ICOMOS Technical Review
August 2022	Discussions at the first session of the Expert Committee on the Development and Usage of Shuseikan in FY2022
September 2022	Opinion hearings at the 13th session of the Industrial Heritage Expert Committee (including Working Properties)
October 2022	Interviews with members of the "Expert Committee on Industrial Heritage Including Operational Assets" regarding the contents of the HIA screening process

Table 1 Chronicle related to the train station proposal

(3) Current challenges

The train station and station front square are to be created in the buffer zone of the World Heritage site. Due to their proximity to the inscribed area, their locations need to factor in their potential impact on the OUV and attributes representing the OUV, and on the associated remains of national or regional significance.

It is also required to consider the impact on the landscape from the areas that visitors to the World Heritage site will actually experience.

Meanwhile, there is not much latitude in terms of the train station site because the current railway track faces the ocean and the location considered for the new station is constrained by the ocean and a nearby tunnel. Despite this situation, it is necessary to produce ideas to meet the required functions of the train station.

Many of the local residents and economic groups have requested the construction of a new train station to improve the convenience of and safety for residents and visitors.

3. Heritage Value

(1) Statement of Outstanding Universal Value (SOUV)

The following is an excerpt from the "Brief synthesis" at the beginning of the "Statement of Outstanding Universal Value" adopted by the 35th session of the World Heritage Committee when it inscribed the "Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining" as World Heritage.

> A series of industrial heritage sites, focused mainly on the Kyushu-Yamaguchi region of south-west of Japan, represent the first successful transfer of industrialization from the West to a non-Western nation. … The sites in the series reflect the three phases of this rapid industrialization achieved over a short space of just over fifty years between 1850s and 1910.
> The first phase in the pre-Meiji Bakumatsu isolation period, at the end of the Shogun era in the 1850s and early 1860s, was a period of experimentation in iron making and shipbuilding. …
> The second phase from the 1860s accelerated by the new Meiji Era, involved the importation of Western technology and the expertise to operate it; while the third and final phase in the late Meiji period (between 1890 to 1910), was full-blown local industrialization achieved with newly-acquired Japanese expertise and through the active adaptation of Western technology to best suit Japanese and social traditions, on Japan's own terms. …
> Collectively the 23 components are an outstanding reflection of the way Japan moved from a clan based society to a major industrial society with innovative approaches to adapting western technology in response to local needs and profoundly influenced the wider development of East Asia.
> After 1910, many sites later became fully fledged industrial complexes, some of which are still in operation or are part of operational sites.

(2) Characteristics of OUV and positioning of Shuseikan

The characteristics of the OUV stated in the "Brief synthesis" consist of the following two points:

The 23 components collectively show:

- a process of rapid development through three phases for each of the three industries; and
- a process of qualitative change that transformed Japan into a major industrial society and influenced the wider development of East Asia.

Based on the above two characteristics, Shuseikan belongs to the themes of iron and steel and shipbuilding among the three industries. In terms of phases, while the contribution of Shuseikan to iron and steel belongs to the first phase, which was a period of experimentation, shipbuilding at Shuseikan belongs to the first phase as well as the second phase, which was a period of direct introduction of western technology and the initial period of industrialization. It is therefore an essential component site justifying the OUV of the "Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining."

(3) Attributes that represent Shuseikan's contribution to OUV

The Conservation Management Plan for the site identifies the following as the attributes of values that represent Shuseikan's contribution to OUV: Site and remains of: the Reverberatory Furnace; the blast furnace; Former Shuseikan Machinery Factory; Kagoshima Spinning Mill; Foreign Engineers' Residence; the Sekiyoshi sluice gate of the Yoshino water leat, and the Terayama Charcoal Kiln. The Plan also notes related attributes of other industrial developments of national and regional significance, such as the glassware and ceramics factory and steam engine research institute. All these attributes together constituted the Shuseikan Project. The Sengan-en villa of the Shimadzu family and related Daimyo garden are closely related to the Shuseikan Project, are of national significance, and are within the Property.

(4)Conservation measures for the buffer zone

The buffer zone conservation measures described in the Conservation Management Plan are as follows.

① Conditions of the buffer zone that are to be maintained (benchmark of regulation and protection)
The Shuseikan component site in the Iso Area is framed by rugged forested land on its inland side, and by the waters of Kagoshima (Kinko) Bay to the south-east. The natural beauty of these dominant landscape features determined the location of Sengan-en, and hence of the site for the Shuseikan industrial developments. The regulation of the buffer zone will ensure the maintenance of the natural qualities and visual beauty of this traditional setting.
The Shuseikan component site area commands a magnificent view of Sakurajima and the distant shores of Kagoshima (Kinko) Bay, which form the distant setting for Shuseikan. This distant setting is not included in the buffer zone, but is nonetheless protected through the Natural Parks Act.

② Regulation and protection policy and overall plan in the buffer zone
In order to maintain the condition described in ① above, and hence protect the heritage values of the related component sites, appropriate buffer zone boundaries have been determined and protection measures described in Chapter 4 put in place.
Activities within the buffer zones will be regulated and controlled by the Natural Parks Act, River Act, City Planning Act, Landscapes Act, and municipal ordinances based on them, as well as the Act on the Regulation of Housing Land Development.

4. HIA Screening of Proposed New Train Station

(1) Presentation of the basic framework of the screening process

In conducting the HIA screening, the *Total Traffic Environment Plan for the Conservation of the World Heritage in the Iso Area* required "sufficient consideration of the location, structure, and landscaping to minimize impacts on the landscape." Based on this requirement, a basic framework was established consisting of the points in (i) to (iii) below.

(i) Determining the best location for the train station

The screening compared the potential impact of the construction of a new station in different locations.

1) Impact on attributes

Given the proximity of all of the potential station sites to the Property or Buffer Zone, the screening evaluated the degree of impact of each location on the aboveground and underground historical remains that are attributes representing the OUV.

2) Access to the attributes

The screening evaluated the degree to which each location had a potential impact on access to the attributes, given that the change in the means of transport of visitors would change visitor flow patterns.

3) Impact on the surrounding setting (views and landscapes)

The screening evaluated the degree of each of the potential station's impacts on views and landscapes from viewing spots, as these relate to the appreciation of the property and its OUV.

4) Impact on associated remains – regional and national significance but not OUV

The screening evaluated the degree of impact of each potential station location on the associated remains of national or regional significance.

5) Functions of the train station

The screening evaluated whether there was any problem with the functioning of each potential site as a train station and entry point to the Property.

(ii) Determining the most appropriate platform structure

The screening compared various options for the platform's structure.

1) Impact on associated remains – regional and national significance but not OUV

Given the potential negative impact of the platform's structure and construction work on the associated remains of national or regional significance, the screening evaluated the degree of such impact.

2) Structure of the train station

The screening evaluated different degrees of safety of the train station depending on whether the train station was constructed as a permanent or temporary structure.

(iii) Determining an appropriate visual appearance for the proposed station

(iii)-1 Analysis of platform roof designs

The screening compared the impact of different platform roof designs.

1) Impact on the attributes and setting (views and landscapes)

Given the potential negative impact of the construction of a new train station on views and landscapes from viewing spots, the screening evaluated the degree of such impact for different types of platform roofs.

2) Functional requirements of the train station

The screening evaluated different impacts of different types of platform roofs on the proposed functions of the train station (hence assessing the practical feasibility of options).

(iii)-2 Analysis of the wall cladding of the platform

The screening compared the potential impact of the appearance of the platform.

1) Impact on the OUV

Potential negative visual impacts of various options on OUV were evaluated regarding the platform's wall materials.

2) Impact on associated remains – regional and national significance but not OUV

The screening evaluated potential impacts of different construction methods of the platform and wall cladding on any associated remains of national or regional significance.

3) Impact on the attributes and setting (views and landscapes)

The potential impact of the platform's wall cladding on the surrounding environment and the outlook landscape was evaluated.

(iii)-3 Analysis of the station front square

The screening assessed the impact of different designs for the station front square.

1) Impact on the attributes and setting (views and landscapes)

The screening evaluated the potential impacts of different designs of the station front square on the surrounding environment including the natural environment.

2) Impact on associated remains – regional and national significance but not OUV

The screening evaluated potential impacts of different types of construction work of a new station front square on any associated remains of national or regional significance.

(2) Result of the analysis of the potential location of the train station

Because of the proximity of the existing railway line to the Property and the sea, there were only three potential locations for the proposed railway station. Based on the basic framework for the HIA screening consisting of five issues shown in (1) (i) above, the three locations were compared, analyzed, and individually evaluated. As a result, a proposal was adopted to build a train station in the buffer zone adjacent to the Shoko Shuseikan Museum (hereinafter, the "Proposed Location" [Figure 5]).

This decision was made because the train station in the Proposed Location would be farthest from the Property and hence would not have any direct negative impact on the attributes representing the OUV. In addition, if the construction of a new train station changes the visitor's preferred means of transport, this will improve access to the property and better conserve Shuseikan, part of which has been used as permanent and temporary peak-visit parking space. The subsequent ability to reduce the areas used for parking will enable ground investigations that are likely to bring to light further remains potentially contributing to OUV. Furthermore, it will create an improved access route to the Foreign Engineer's Residence, which is an attribute of OUV, generating a positive outcome for site interpretation.

The potential visual impact of the Proposed Location has been assessed, and by careful selection of the platform and minimalist shelter design, negative impacts on OUV have been avoided.

Test excavations of the proposed location of the station front square have indicated the presence of associated remains of national and regional significance. However, this is not directly related to the OUV. The proposed design of the station front square requires no ground disturbance, so these remains will not be disturbed and can be accessed for research in future. The results of the exploratory survey of the proposed station front square site are outlined in attachment 1.

In the Proposed Location, achieving a minimum distance from the railway tunnel at the western end of the Shuseikan foreshore for safe operations, securing a sufficient length of the platform, and accommodating various security facilities will be possible. It will therefore satisfy the functional requirements for a train station. The analysis of potential station locations is outlined in attachment 2

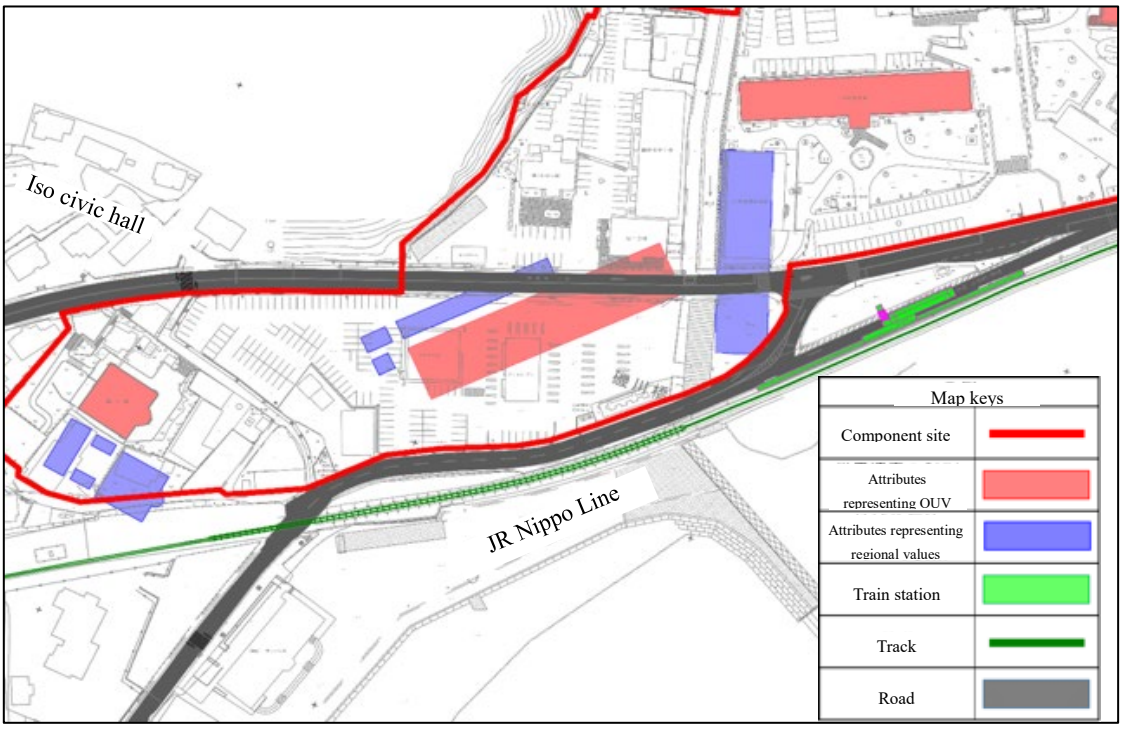


Figure 5. Proposal to build a train station in front of Shoko Shuseikan Museum

(3) Result of the analysis of the structure of the platform

Based on the basic framework for the HIA screening consisting of two items shown in (1) (ii) above, multiple options for the design of the platform structure were compared, analyzed, and evaluated. As a result, a proposal was adopted to build a platform in a gate-shaped culvert structure (hereinafter, the "Proposed Structure" [Figure 6]).

This decision was made because the impact on the surrounding associated remains (not related to OUV) could be mitigated.

The proposed structure will reduce the scope of construction and eliminate the need for temporary earth retaining structures impacting the ground. Furthermore, the amount of concrete required on site can be minimized, thereby reducing the number of construction vehicles traveling in the vicinity and potentially impacting related underground remains of national or regional significance found at the proposed station front square site.

This type of structure has been previously used for train stations and ensures safety as a passenger facility.

The platform will be built as a permanent structure and an analysis of its structure is outlined in attachment 3.

Since the height of this platform is the same as the existing seawall installed on the bay side across the railway track from the proposed station, there is no impact on the surrounding landscape by the platform.

Figure 6. Example of a Platform built using a gate-type culvert structure (Proposed Structure)

(4)Result of the analysis of platform roof options

Based on the basic framework for the HIA screening consisting of two items shown in (1) (iii)-1 above, multiple types of platform roofs were compared, analyzed, and evaluated. As a result, a proposal was adopted to use a flat platform roof with Galvalume sheets (hereinafter, the “Proposed Roof” [Figure 8]).

This decision was made because this roof type would best minimize any obstruction of views and landscapes. In the photomontage based on the view from in front of the Former Shuseikan Machinery Factory, the train station does not obstruct the view of Sakurajima and Kagoshima Bay, so the impact on the landscape is negligible. From the main viewpoint of Senganen Garden, the train station does not have any impact on the scenery because it is not visible.

Furthermore, the thickness of the "Proposed Roof" was reduced and the walls around the ticket gates were eliminated in order to give more consideration to the landscape. In addition, by concealing beams, electrical wiring, etc. in the roof space, the station was made simpler. The station platform will provide a slightly elevated view point of both the Shuseikan complex and the view across the harbor to Sakurajima that is not available anywhere else, while not itself obstructing any other views.

The color scheme will be chosen from the following three options taking into account harmonization with the surrounding landscape: dark brown (10YR2/1), dark grey (10YR3/0.5), and galvanized steel treated with phosphoric acid. A final decision will be made in an assessment on site using samples of the colours.

The option of having no roof was assessed, but it was rejected as the shelter would be needed to provide protection from ash given the frequent minor eruptions of Sakurajima, the fierce sunlight in summer, and heavy rain. A similar problem would arise if the shelter roof was moved back over the front square instead of being over the platform itself, especially for users with mobility problems. The analysis of the platform roof is outlined in attachment 4.

Figure 7. View from in front of the Former Shuseikan Machinery Factory (current condition)

Figure 8.Photomontage from in front of the Former Shuseikan Machinery Factory (**Proposed Roofs**)

(5)Result of the analysis of options for the cladding of the walls of the platform

Based on the basic framework for the HIA screening consisting of the five items shown in (1) (iii)-2 above, multiple types of outer walls were compared, analyzed, and evaluated. As a result, a proposal was adopted to create platform outer walls by affixing steel plates (hereafter the "proposed outer walls").

The reason for this is that by finishing the exterior of the platform with steel plates, the train station can be finished as a simple modern structure, and the impact on the OUV can be avoided by clearly differentiating it from the attributes that contribute to the OUV.

Many of the buildings that comprise the Shuseikan project, as well as other historical buildings and historic sites, are composed of stone formed by volcanic eruptions. In contrast, finishing the exterior walls of the platform with steel plates can create a clear difference between the train station and the attributes that contribute to the OUV, thus avoiding any impact on the OUV.

In addition, since the steel plates in question are to be affixed to the exterior of the platform, there will be no impact on related archaeological sites of national or regional significance found at the proposed station front square site. The analysis of options for the cladding of the walls of the platform is summarized in Attachment 5.

(6)Result of the analysis of the station front square design options

Based on the basic framework for the HIA screening consisting of two items shown in (1) (iii)-3 above, multiple ideas for the station front square were compared, analyzed, and evaluated. As a result, a proposal was adopted to create a station front square as part of a garden (hereinafter, the “Proposed Square” [Figure 9]).

The reason for this is to promote the use of the railroad station and to avoid impact on related archaeological sites of national and regional significance that exist underground.

The proposed plaza is based on the image of a garden with a view of the azure sea of Kinko Bay and the majestic Sakurajima, which is a characteristic of the Senganen Garden. The slope in the square in front of the station was designed with curved lines so that it would be a passageway to the station as well as a passageway in the garden. In addition, as the station front square is located in the buffer zone of the World Heritage site, it was designed to be a simple square for the sole purpose of user traffic, with only facilities that function as a passageway, in order to reduce any potential negative impact on the view of the landscape. This is an effort to encourage the use of the train station, to promote traffic diversion, to reduce parking on the property, which is the goal of the project, and to increase the potential for preservation and public access to the underground remains associated with the OUV underneath parking areas.

Furthermore, there will be no vehicles entering the station front square, and since the facility will be used only by pedestrians, there will be no negative impact on related archaeological sites of national or regional significance that exist underground. In addition, since the proposed plaza will only involve fill but no excavation, there will be no impact from the construction on underground remains. The analysis of the station front square is outlined in attachment 6.

Figure 9. Photomontage of the station front square (Proposed Square)

5. Management Process of Consensus Formation Among Concerned Parties

(1) Iso Station Exploratory Investigation Council

Discussions on the potential construction of a new train station and its challenges began at the examination council established by Kagoshima City in April 2017 which consisted of experts on heritage conservation, economic organizations, transportation organizations, railway operator (JR), Shimadzu Ltd. (component site owner), the Ministry of Land, Infrastructure, Transport and Tourism, Kagoshima Prefecture, and the local neighborhood association. During the fiscal years 2017 and 2018, deliberations of multiple proposals took place from the viewpoints of the layout plan of the platform and station front square, modification plan of the surrounding road, impact on the road traffic, component site, and their surrounding landscape, and cost performance. In this process, opinions were widely sought from relevant administrative organs, experts, citizens, and so on.

(2) New Iso Station Construction Council

In addition to local economic organizations, Kagoshima Prefecture and Kagoshima City participate in the New Iso Station Construction Council, which is the main entity for the construction of a new train station. The sections in which Kagoshima Prefecture and Kagoshima City take part include those in charge of heritage conservation. The Council therefore discusses the conservation of heritage as well.

Going forward, the Council will continue sharing information and having discussions with Shimadzu Ltd. (component site owner), Kagoshima Prefecture, Kagoshima City, the railway operator, the Ministry of Land, Infrastructure, Transport and Tourism, and traffic managers, in the process of discussing the construction of a new train station in stages at the Shuseikan Conservation Council (see (3)) for the World Heritage, “Sites of Japan’s Meiji Industrial Revolution.”

(3) Shuseikan Conservation Council

In the management system of the World Heritage "Sites of Japan’s Meiji Industrial Revolution," a Management and Conservation Council has been established for each district based on the "General Policy and Framework for Management and Conservation of the Sites of Japan’s Meiji Industrial Revolution: Iron and Steel, Shipbuilding, and Coal Mining. In Area 2, the "Shuseikan Area Management and Conservation Council" has also been established, and the Council reviewed and decided on the "Overall Transportation Environment Plan for World Heritage Conservation in the Iso Area" prepared by Kagoshima City. The Council also approved the design of the railroad station and station square in this HIA screening phase.

(4)Expert Committee

In compiling this report, under the guidance and advice of the Cabinet Secretariat and the Agency for Cultural Affairs, the "Committee of Experts on the Development and Utilization of the Shuseikan Area" established by Kagoshima City discussed and examined the issue from a expert standpoint, and also sought advice from the "Expert Council on Industrial Heritage, including Operational Assets" established by the Cabinet Secretariat.

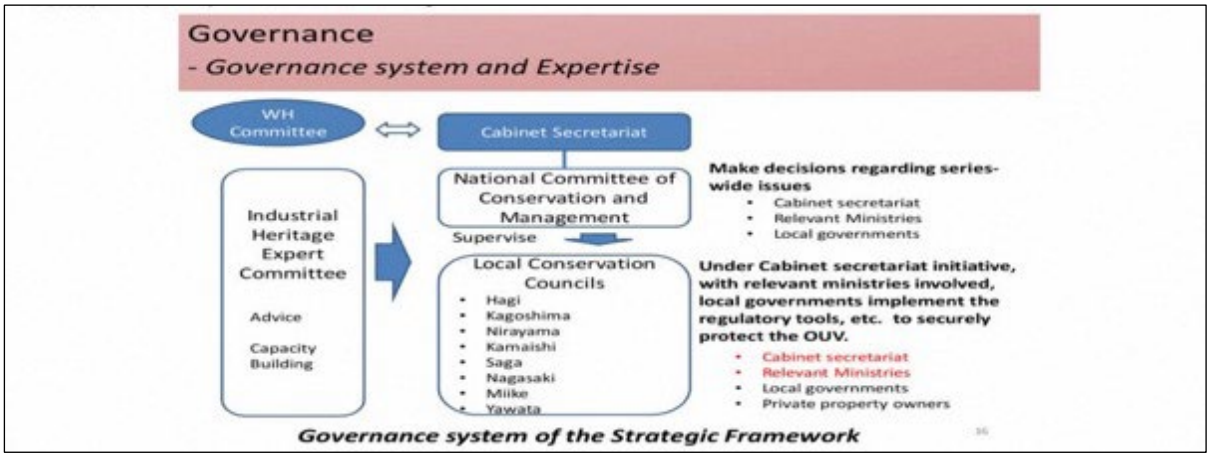


Figure 10. Governance system stipulated in the Strategic Framework

6. Conclusion

The proposed JR train station to be built in the buffer zone adjacent to Shuseikan, one of the 23 component sites of the World Heritage, "Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining," will provide a new and sustainable strategic means of visitor transport to the site. The diversion of car-based visitors to railway access will allow a car parking area within the Property to be removed and enable the investigation, conservation, and potential presentation of underground remains related to the operation of the Shuseikan industrial complex. Furthermore, by creating a more direct access route to the Foreign Engineer's Residence, which is an attribute of OUV, the train station will have a positive impact on visitor flow and the interpretation of the site.

Positioning the train station in the buffer zone adjacent to the Shoko Shuseikan Museum places it at the furthest point from the property that is possible, which together with the design solutions will ensure that the train station will not have any impact on the attributes of OUV or the appreciation of the property.

On the other hand, excavations on land near the proposed station site have confirmed the presence of an archaeological site of national and regional significance. However, this archaeological site is not directly related to the OUV. In addition, this site will become a station front square and will only be used by pedestrians. Therefore, there will be no impact on the archaeological site.

In addition, a new train station will not adversely affect the view and landscape of Sakurajima and Kagoshima Bay from in front of the Former Shuseikan Machinery Factory.

The construction of the platform in a portal culvert will reduce the impact on related archaeological sites of national and regional significance, and the use of steel plates for the outer wall of the platform will avoid any impact on the OUV.

Furthermore, the station front square will be designed to resemble a garden and constructed an embankment to promote the use of the railroad station and avoid impact on related archaeological sites of national and regional significance.

As stated above, the construction of a new train station will improve the convenience for visitors to the World Heritage property and have benefits for the interpretation of components of the site and the flow of visitors. The new train station, in removing a car park area within the property, will also enable conservation of elements potentially reflecting OUV, and their presentation to visitors.

The remains confirmed during excavation in May 2022 under the site name "Former Shuseikan" are the remains of ground consolidation (jigyo), which are traces of ground improvement work, and the building assumed to be above it is highly likely to have been a "warehouse (built around 1872).

1 Overview of Excavation Survey

Survey site: 9685-5, Yoshino-cho (planned station front square development site *outside the scope of national historic sites (components))

Purpose of the survey: To determine in advance whether or not the construction of the train station and ancillary works will have a negative impact on the underground remains and their condition.

Survey period: May 16 - May 31, 2022

Survey scale: 2m (length) x 8m (width) = 16m2

Type of Remains: Ground consolidation remains (traces of foundation work associated with construction (jigyo))
*The total shape and scale have not been confirmed.

Depth from ground surface: 0.6 to 0.8 m

Mentoring Assistant: Professor Yoshiro Watanabe, Faculty of Law, Kagoshima University (Archaeology) (5/26)
Agency for Cultural Affairs, Cabinet Secretariat (7/20), Shuseikan District Development and Utilization Expert Committee (8/5)

2 Future handling

Based on the guidance and advice of experts and the government, etc., we request that the entities involved in each project related to the construction of a new train station (Iso-New Station Establishment Council, Kagoshima National Highway Office, City Road Construction Division, etc.) promote the project, taking the following into consideration.

- The site is not included in the scope of the National Historic Site, but the site must have the same value as a National Historic Site.
- The "value equivalent to that of a national historic site" consists of the ground consolidation remains (jigyo) that indicate the site of a "warehouse" associated with the Shuseikan project, and the said remains should be preserved on the site.
- Further information on the "warehouse" site should be collected through excavation and other means.

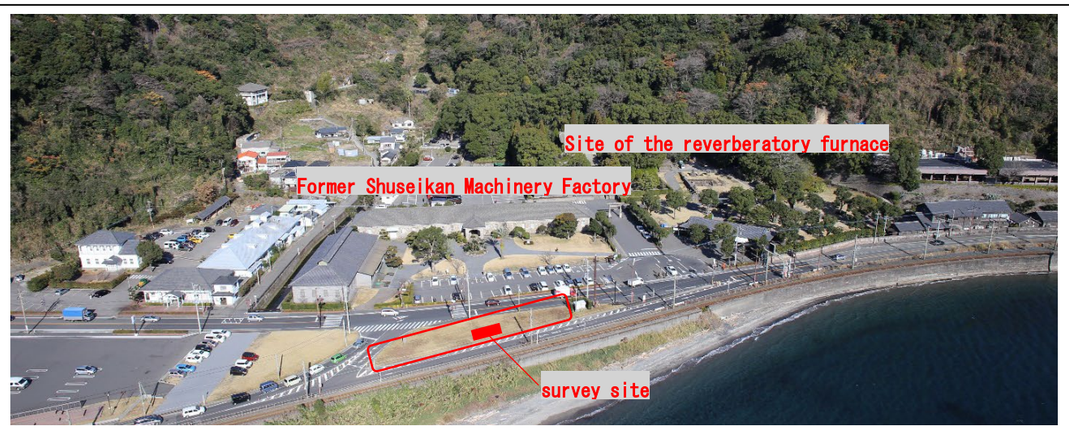
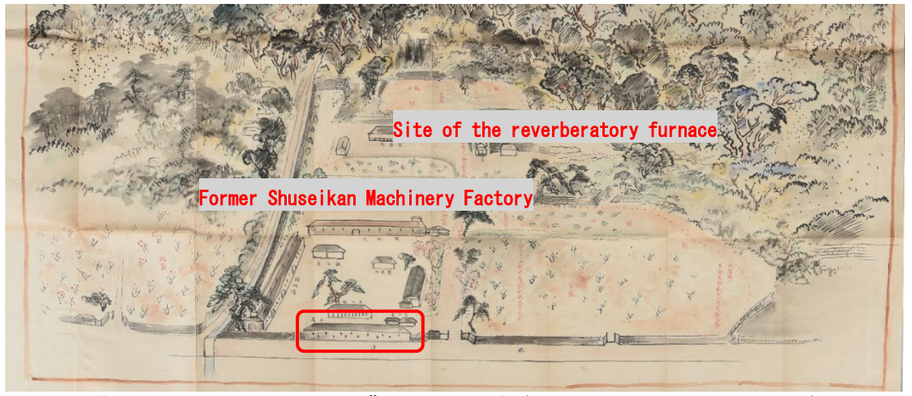


Photo 1: Distant view of the surveyed area (planned station front square: red line) and the excavation site (from the southeast)

Photo 2: Photograph of the complete excavation status during the 2022 excavation (from the southwest)



Map of the Shuseikan area" before 1915 (Shoko Shuseikan collection)
*The red line indicates a warehouse.

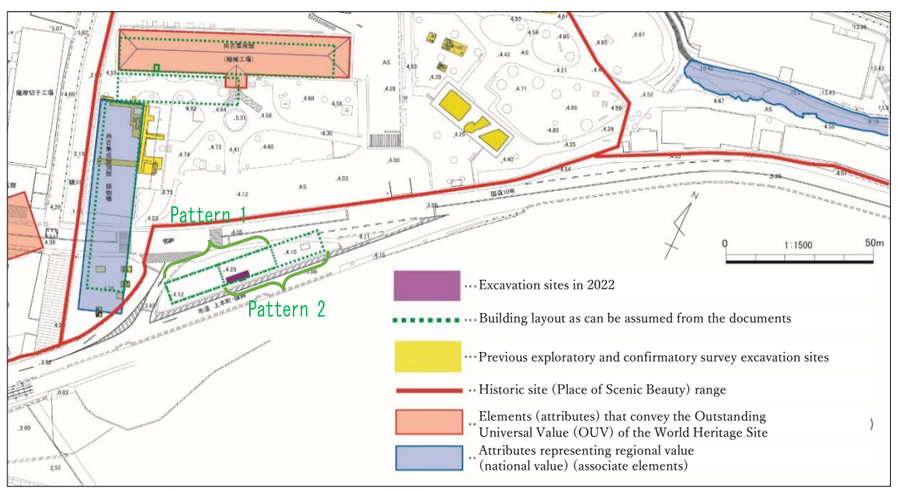
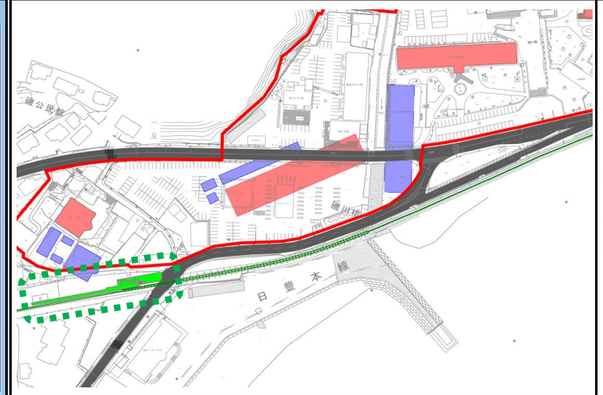
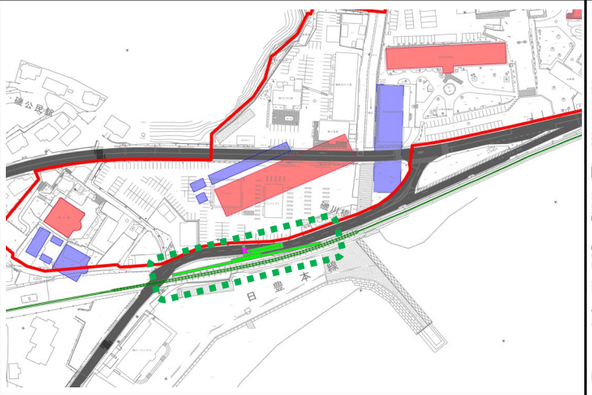
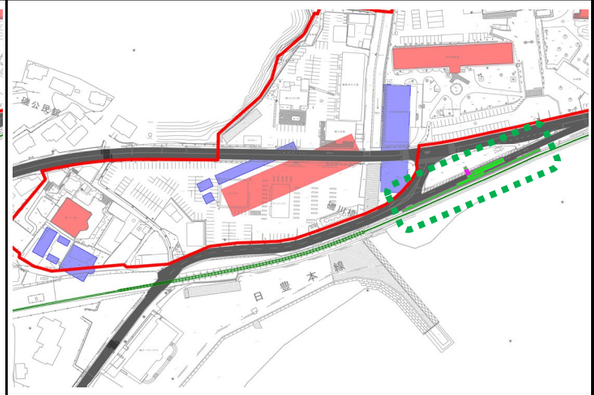


Figure: Map of the excavation site in 2022 (purple area) and the assumed building layout

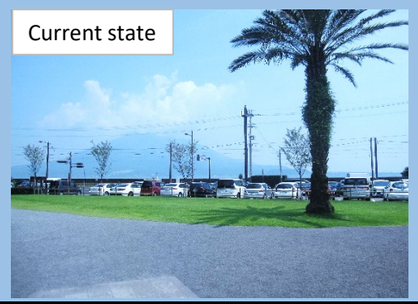
Screening comparison table (Determing the best location for the train station).

Potential plans / Basic information & comparison items	Plan 1	Plan 2	Plan 3
Railway station location	**Between Iso Kaido road crossing and tunnel**	**In front of Kagoshima Spinning Mill**	**In front of Shoko Shuseikan Museum**
Railway station specifications	**Track: single track Platform length: 70 m Train cars: up to 3 cars**	**Track: single track Platform length: 92 m Train cars: up to 4 cars**	**Track: single track Platform length: 92 m Train cars: up to 4 cars**
Proposed development site			
Assessment items — 1. Impact on attributes	The station will be built near the remains of the former Kagoshima foreign engineer's residence (Ijinkan). This is unlikely to have a direct impact on the resources due to limited space for developing a station square.	The station will be distantly located from the components, but the station square will be built within the property of the World Heritage site.	There is no direct impact as both the station and the station square will be distantly located from the components.
Assessment items — 2. Access to attributes	The addition of a railway will result in a transport mode shift and will improve access to attributes. Shuseikan is used as temporary parking during peak season, so a railway will help preserve the site. At the same time, this allows to excavate potential heritage resources that may be buried under the temporary parking area. The establishment of an access route to Ijinkan, which is one of the component sites, has a positive impact on the WHS interpretation.	Same as on the left.	Same as on the left.
Assessment items — 3. Impact on the surrounding setting (views and landscapes)	The train station would intrude into the view from the constituent assets, the Former Shuseikan Machinery Factory and Foreign Engineer's Residence, and may have an impact on the view of the landscape. However, the proposed roof design would reduce that impact.	Same as on the left.	Same as on the left.
Assessment items — 4. Impact on associated sites	Associated sites exist in the surrounding area of the railway station. However, there is no direct adverse impact on them since a station square cannot be built in the area concerned. The construction work may have an adverse impact.	There is no adverse impact since there are no associated sites in the vicinity of the area where the station will be built.	Preliminary excavations revealed that there are related heritage sites in the proposed station front square site that are not directly related to the OUV, but are important to the national or regional significance. However, the proposed design of the station front square does not require excavation, thus reducing the impact on the archaeological sites.
Assessment items — 5.Functions of the train station	Plan 1 has function problems. Trains have poor visibility of the platform because the station is located close to a tunnel. There is no space for setting up railroad signals on the premises. The problem cannot be solved as space is limited.	The platform can be easily seen from the train, and the platform length is sufficient. There are no function problems.	Same as on the left.
Impact assessment — **Individual assessment**	The construction of the new station has no impact on the attributes of the site. A new railway station improves access to the attributes and allows to preserve components as well as expose potential heritage resources. It has a positive impact on the WHS interpretation. However, the station's function presents problems, such as poor visibility and the inability to set up railway signals. They pose a threat to passenger safety, and the facility fails to function as a station. Impact on attributes: Good Access to attributes: Good Impact on the surrounding setting: Fair Impact on associated sites: Fair Station function: Poor	A new station improves access to the attributes and allows to preserve components as well as expose potential heritage resources. It has a positive impact on the WHS interpretation. However, the station is close to the World Heritage property area, and the square in front of the station will be within the said area. The location of the station may have an adverse impact on the landscape. Impact on attributes: Poor Access to attributes: Good Impact on the surrounding setting: Fair Impact on associated sites: Good Station function: Good	There will be no impact on the attributes due to the establishment of the train station and station front square. The establishment of the train station will improve accessibility to the site and preserve its attributes. There will also be a positive impact on the Interpretation. However, there is a potential impact on the related heritage of national or regional significance that is present in the proposed station front square. Impact on attributes: Good Access to attributes: Good Impact on the surrounding setting: Fair Impact on associated sites: Fair Station function: Good
Overall assessment	**Poor**	**Poor**	**Good**

Screening comparison table (Determining the most appropriate platform structure).

Basic information & comparison items \ Potential plans	Plan 1			Plan 2			Plan 3		
Platform structure	**Gravity platform**			**Box culvert**			**Iron frame (temporary structure)**		
Reference image of platform									
Assessment items — 1. Impact on associated remains	- Temporary sheet pile earth retaining walls are required to protect the track ballast during excavation, and the vibration caused by the press-in and extraction of the sheet piles may have a negative impact on related archaeological sites of national or regional significance located in the proposed station front square area. - This type of platform requires greater volume of concrete than box culvert platforms, which would result in frequent traffic of agitator vehicles and may have a negative impact on related archaeological sites of national or regional significance located at the proposed station front square site.			- Box culvert platforms do not require temporary earth retaining walls to protect the track ballast during foundation excavation, since the excavation area is smaller than gravity platforms. Therefore, there will be no impact on associated archaeological sites of national or regional significance located in the proposed station front square. - This type of platform requires less concreate than gravity thus, negative impacts on associated archaeological sites of national or regional significance located in the proposed station front square can be mitigated.			- Same as on the left - It is a simple structure, but requires vehicles for transporting iron frames. It also needs crane trucks for assembling the parts.Therefore, the project may have a negative impact on related archaeological sites of national or regional significance located in the proposed station front square site.		
Assessment items — 2. Structure of the tran station	Safety is guaranteed as a passenger facility since many railway stations use this structure.			Same as on the left.			Safety is not guaranteed as a passenger facility since it is a temporary structure. It may collapse during an earthquake or a storm. The station will be dismantled and will cease to operate as a station if underground heritage resources are to be exposed.		
Impact assessment — **Individual assessment**	Vibration caused by the press-in and extraction of sheet piles and vehicle traffic could have a negative impact on associated archaeological sites of national and regional significance located on the proposed station front square site. However, it is credible as a train station and ensures passenger safety.	Impact on associated sites	Poor	There is less adverse impact on the sites than gravity platforms. It is credible as a train station and ensures passenger safety.	Impact on associated sites	Fair	It has least adverse impact on the sites. However, it lacks credibility as a passenger facility due to its temporary structure. The station will be dismantled and will cease to function as a station if underground heritage resources are to be exposed.	Impact on associated sites	Good
		Station structure	Good		Station structure	Good		Station structure	Poor
Overall assessment	**Fair**			**Good**			**Poor**		

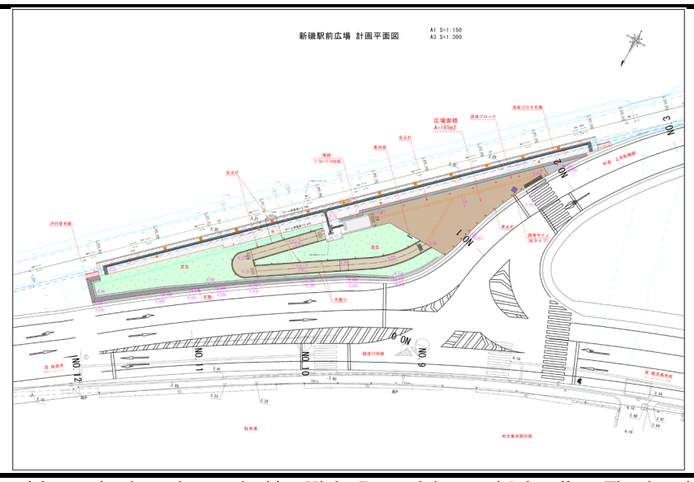
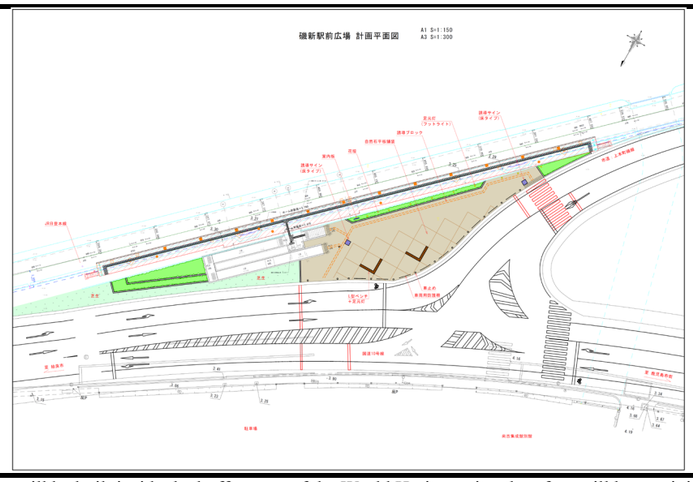
Screening comparison table (Analysis of platform roof designs).

Basic information & comparison items \ Potential plans		Plan 1			Plan 2			Plan 3			Plan 4		
General description of platform shelter		**Roof material: galvalume (folded plates) Pillars and beams: iron frame Color: 10YR2/1**			**Roof material: galvalume (flat plates) Pillars and beams: iron frame Color: 10YR2/1**			**The shelter of plan 2 is located at the station square and not on the platform.**			**No shelter**		
Photomontage from in front of the Former Shuseikan Machinery Factory													
Assessment items	1. Impact on the surrounding setting (views and landscapes)	In the view from in front of the Former Shuseikan Machinery Factory, an attribute that contributes to the OUV, the train station does not overlap with Sakurajima, and the impact of the new train station on the scenic view is minimal. Due to the thickest roof among the proposed roofs and the walled ticket gate, obstruction to the view is the largest. In addition, since this proposal does not install panels in the roof space, beams supporting the roof, electrical wiring, etc. would be exposed in the space inside the station.			As with Plan 1, the view from in front of the Former Shuseikan Machinery Factory shows that the impact of the new train station on the view of the landscape is minimal. The area that obstructs the view is reduced compared to Plan 1 due to the reduced thickness of the roof and the elimination of the wall around the ticket gate. In addition, this proposal also makes the space inside the station simpler by installing panels on the back side of the roof and concealing the beams supporting the roof and the electrical wiring, thereby taking into consideration the scenic view for station users.			The roof will be the same as in Plan 2, but the open space in front of the station front square will be lower than the platform, further reducing the impact on the view of the landscape. However, since the roof will be moved to the Sakurajima side, it will overlap Sakurajima more than Proposals 1 and 2.			Since no roof will be installed, there will be no impact on the scenic view.		
	2. Functional requirements of the train station	The shelter protects passengers from Sakurajima's volcanic ash falls, rain, and sunlight.			Same as on the left.			The shelter protects passengers from Sakurajima's volcanic ash falls, rain, and sunlight. However, wheelchair users need to go through the ticket gate well in advance of the train's arrival time since the shelter and the ticket gate will be separated. There will be a slope connecting the shelter and the ticket gate. As a result, they will be exposed to volcanic ash falls, rain, and sunlight during their waiting time.			Passengers will be exposed to volcanic ash falls, rain, and sunlight. Direct sunlight during the summer is especially dangerous.		
Impact assessment	**Individual assessment**	In terms of views from the site, the impact of the new train station is minor, but obstruction to the view is the largest due to the thickest roof and the wall around the ticket gate. However, the roof will protect users from ash fall, etc.	Impact on the surrounding setting	Fair	Plan 2 uses a lighter roofing material than plan 1, and a panel is added at the back to hide the beams, etc. This reduces the adverse impact on the landscape. The roof protects passengers from volcanic ash falls, etc.	Impact on the surrounding setting	Fair	The height of the shelter is lower than plan 2. This reduces the adverse impact on the landscape. However, it will be inconvenient for some users.	Impact on the surrounding setting	Fair	Plan 4 has the least adverse impact on the landscape because there is no shelter. However, this plan cannot protect passengers from volcanic ash falls, etc. Direct sunlight during the summer is especially dangerous.	Impact on the surrounding setting	Fair
			Station structure	Good		Station structure	Good		Station structure	Good		Station structure	Good
	Overall assessment	**Fair**			**Good**			**Fair**			**Poor**		

Screening comparison table (Analysis of the wall cladding of the platform).

Potential plans / Basic information & comparison items		Plan 1			Plan 2			Plan 3			Plan 4			Plan 5		
Platform exterior walls		**Stone slabs (natural stones formed by volcanic eruption)**			**Cement boards (design finish)**			**Steel wall panels (Galvanized steel treated with phosphoric acid)**			**Security fences**			**No entry fences & greenery**		
Reference image of platform exterior walls																
Impact assessment	1. Impact on the OUV	Because some of the attributes contributing to the OUV are masonry buildings, the masonry finish on the exterior of the platform could affect the appreciation of OUV if some people confuse what is genuinely heritage.			Concrete slabs, which did not exist in the historical period, are used, but the surface is hammered to make the surface finish, which could be mistaken for stone slabs, which could affect the OUV, as on the left.			The use of steel plates that are not related to the attributes that contribute to the OUV will lead to the train station being finished as a modern workpiece, and the difference from the attributes will be obvious. Therefore, it will not affect the OUV.			The use of off-limits fences, which are not related to the attributes that contribute to OUV, will not affect OUV as in Plan 3.			Same as on the left.		
	2. Impact on associated remains	Since the stone slabs are simply attached to the platform, no excavation or other work is required. Therefore, there will be no impact on related archaeological sites of national or regional significance that exist on the proposed station front square site.			Same as on the left.			Same as on the left.			Although it is necessary to install a foundation for the security fence, the scope of construction is small and will not affect related archaeological sites of national or regional significance that exist in the proposed station front square site.			Same as on the left.		
	3. Impact on the surrounding setting (views and landscapes)	Since it will be made up to the same height as the platform, it will be the same height as the existing sea wall behind it. Therefore, there will be no obstruction to the landscape, and there will be no impact on the views and landscapes.			Same as on the left.			Same as on the left.			Since only the secutiry fence will be installed, the inner space of the platform will not change from its bare state. Since this station is planned to be unmanned, trash and weeds in the inner space will be visible to users and may affect the view and landscapes.			In contrast to Proposal 4, greening will reduce the impact on the scenic view. However, since this station is planned to be unmanned, day-to-day maintenance is difficult, and if the plants die, the situation could be similar to Plan 4.		
Impact assessment	**Individual assessment**	The use of the same stone material as the site attributes may have an impact on the OUV because the train station could be mistaken for an attribute. There are no other impacts to the associated remains or landscape.	Impact on the OUV	Fair	Reduced impact on OUV compared to Plan 1. There are no other impacts to associated remains or landscaping.	Impact on the OUV	Fair	The use of steel plates will have no impact on the OUV because the difference between the train station and the attributes will be obvious. No other impact on the associated remains or landscape.	Impact on the OUV	Good	As with Plan 3, there would be no impact to OUV and no impact to associated remains. However, weeds and debris entering the platform inner space would enter the landscape and could impact the view.	Impact on the OUV	Good	In contrast to Proposal 4, greening can reduce the impact on the scenic view. However, if daily maintenance is difficult and greening cannot be maintained, the situation would be the same as Plan 4.	Impact on the OUV	Good
			Impact on associated remains	Good		Impact on associated remains	Good		Impact on associated remains	Good		Impact on associated remains	Good		Impact on associated remains	Good
			Impact on the surrounding setting	Good		Impact on the surrounding setting	Good		Impact on the surrounding setting	Good		Impact on the surrounding setting	Poor		Impact on the surrounding setting	Poor
	Overall assessment	**Poor**			**Fair**			**Good**			**Poor**			**Poor**		

Screening comparison table (Analysis of the station front square).

Basic information & comparison items \ Potential plans		Plan 1			Plan 2		
Reference image of station front square							
Proposed development plan of station front square							
Assessment items	1. Impact on the attributes and setting (views and landscapes)	This plan envisions a simple garden overlooking Kinko Bay and the grand Sakurajima. The slope in the square has a curved design. This acts as a passage to the station. The square will be built inside the buffer zone of the World Heritage site, therefore features a simple design intended for only people to pass through and is equipped with a facility that only serves as a passage to avoid disturbing the surrounding landscape. The height of the station front square will be less than the height of the platform and less than the existing sea wall behind it, so the existing landscape will not be disturbed.			The square will be built inside the buffer zone of the World Heritage site, therefore will have minimum function to avoid disturbing the surrounding landscape. The ground alone will be covered with greenery, and the slope will be built as a general concrete structure to keep to a bare minimum. As a result, this creates an open space. The height of the station front square will be less than the height of the platform and less than the existing sea wall behind it, so the existing landscape will not be further disturbed.		
	2. Impact on associated remains	The station front square itself will be a facility for human use only, with no vehicular access, so there will be no impact on related archaeological sites of national or regional significance that exist underground. In addition, since the square will be constructed with fill, there will be no impact on related archaeological sites of national or regional significance.			The station front square itself will be a facility for human use only, with no vehicular access, so there will be no impact on related archaeological sites of national or regional significance that exist underground. However, excavation and other construction work will be required to install the concrete structures that make up the ramp, which may affect archaeological sites of national or regional significance.		
Impact assessment	**Individual assessment**	The height of the station front square will be less than the height of the platform, and therefore, there will be no impact on the landscape. In addition, since the station front square will be composed of embankment, there will be no impact on the associated remains that exist underground.	Impact on the attributes and setting	Good	In contrast to Plan 1, there is a potential impact on an associated remains because the foundation of the structure comprising the ramp would have to be placed in the ground.	Impact on the attributes and setting	Good
			Impact on associated remains	Good		Impact on associated remains	Poor
	Overall assessment	**Good**			**Poor**		

Report on the Kosuge Slip Dock Preservation and Maintenance Work

1 Current status of Kosuge Slip Dock

(1) Introduction

Kosuge Slip Dock, which is one of the constituent assets of the World Cultural Heritage Sites of Japan's Meiji Industrial Revolution Iron and Steel, Shipbuilding and Coal Mining, will be preserved and maintained based on the CMP.

The attributes that contribute to the OUV of the Kosuge Slip Dock are the elements of intact masonry-faced quays, wharfs and slip dock elements including rails and the brick and timber hauling hut containing original winch, steam engine and boiler .These should be conserved properly.

In 2018, we conducted a seismic diagnosis of the hauling hut, and found that the hauling hut lacked adequate aseismic performance, and that countermeasure construction was necessary. This report presents the results of the diagnosis and the review process of countermeasure construction methods based on the results of the diagnosis. This process paid careful regard to the OUV of the site and the potential impacts of the proposed works, in order to address significant conservation issues as well as protect OUV.

During the study, we held several discussions with the Agency for Cultural Affairs, the Cabinet Secretariat, Nagasaki Prefecture/City, and domestic experts.

Figure-1 Location map of Kosuge Slip Dock

(2) Earthquake risk

The hauling hut (brick wall) was built in 1868, so it was not built according to the modern seismic design concept.

Nagasaki Prefecture is an area with a low possibility of a large-scale earthquake even in Japan, which is an earthquake-prone country. However, according to the Earthquake Hazard Station (National Research Institute for Earth Science and Disaster Resilience), as shown in Table 1, even in the vicinity of the Kosuge Slip Dock, there is a 69.5% probability of seismic intensity 5-lower or higher in the next 30 years, and for seismic intensity 5-upper or higher the probability is 29.2%, for seismic intensity 6-lower or more the probability is 9.6%, and for seismic intensity 6-strong (large-scale earthquake) or more, the probability is 2.5%.

Therefore, it is possible that the hauling hut, which is an attribute that contributes to OUV, may collapse and, in the process, damage the boiler and hauling machinery inside the building when an earthquake occurs, so it is necessary to improve earthquake resistance.

Table-1 Probability of possible earthquakes in the next 30 years near the site of Kosuge Slip Dock

	Earthquake intensity	Situation of shaking	Probability
	Seismic intensity 5 lower or more	Unsecured furniture may move, and unstable items may topple over.	69.5%
	Seismic intensity 5 upper or more	Brick walls that are not reinforced may collapse.	29.2%
	Seismic intensity 6 lower or more	In wooden buildings with low earthquake resistance, roof tiles may fall and the building may tilt. Some fall.	9.6%
large-scale earthquake	Seismic intensity 6 upper or more	Wooden buildings with low earthquake resistance tend to lean or collapse.	2.5%

(3) Setting seismic performance targets

Historically, there are countless buildings that have collapsed due to earthquakes, and many buildings have been damaged by earthquakes in recent years. Therefore, we conducted a seismic diagnosis of the hauling hut and confirmed its seismic performance.

In examining the seismic diagnosis and the seismic performance targets for the hauling hut, we examined the level that would be the minimum necessary intervention from the viewpoint of preserving the value of the World Heritage Site. The examination was conducted based on the Agency for Cultural Affairs' "Important Cultural Properties (Buildings) Earthquake Resistance Diagnosis Guideline" and implementation guidelines.

In order to protect the hauling hut and the hauling machinery inside the building, which are attributes that contribute to OUV, it is necessary to prevent the hauling hut from collapsing. Therefore, the level of restoration as a Cultural property building (recoverable level), which may collapse in the event of the largest possible earthquake, in Table 2 is not sufficient.

For this reason, the level was set so that it would not collapse in the event of the largest possible earthquake (safety assurance level).

Note that "the largest possible earthquake" means the largest possible earthquake on the site of a building. Based on the earthquake risk mentioned above, a large-scale earthquake with a seismic intensity of upper 6 or higher is assumed.

Table 2 Required level of seismic performance
for cultural property buildings

	level		explanation
	high	Function maintenance level	A level that can maintain functions in the assumed largest earthquake
adoption		Safety assurance level	A level that does not collapse in the assumed largest earthquake.
	low	Restorable level	A level that collapse in the assumed largest earthquake, but can be restored as a cultural property building. (When judging that the main cultural property value will not be lost even if the cultural property building collapses.)

(4) Seismic diagnosis result

As a result of conducting a seismic diagnosis, it was found that the brick walls of the hauling hut were likely to be deformed greatly when force was applied during a large earthquake. In particular, it was found that the brick walls on the south and north sides are likely to be damaged due to extensive deformation during a large-scale earthquake.

Figure 2 shows an example of analysis results of seismic diagnosis.

It shows the amount of deformation when a seismic force is applied in the X direction. The parts shown in red and yellow show particularly large deformation, and it can be seen that the risk of deformation is high for the brick walls on the south and north sides. It was diagnosed that there is a high possibility that this deformation will spread to the entire building and lead to damage.

The main reasons why the hauling hut is likely to be severely damaged during an earthquake are that the structure is masonry and that it has a large opening on the west side, with damage especially likely in the brick walls on the south and north sides. It is thought that the original structural problem such as the fact that force is easily applied is a major factor.

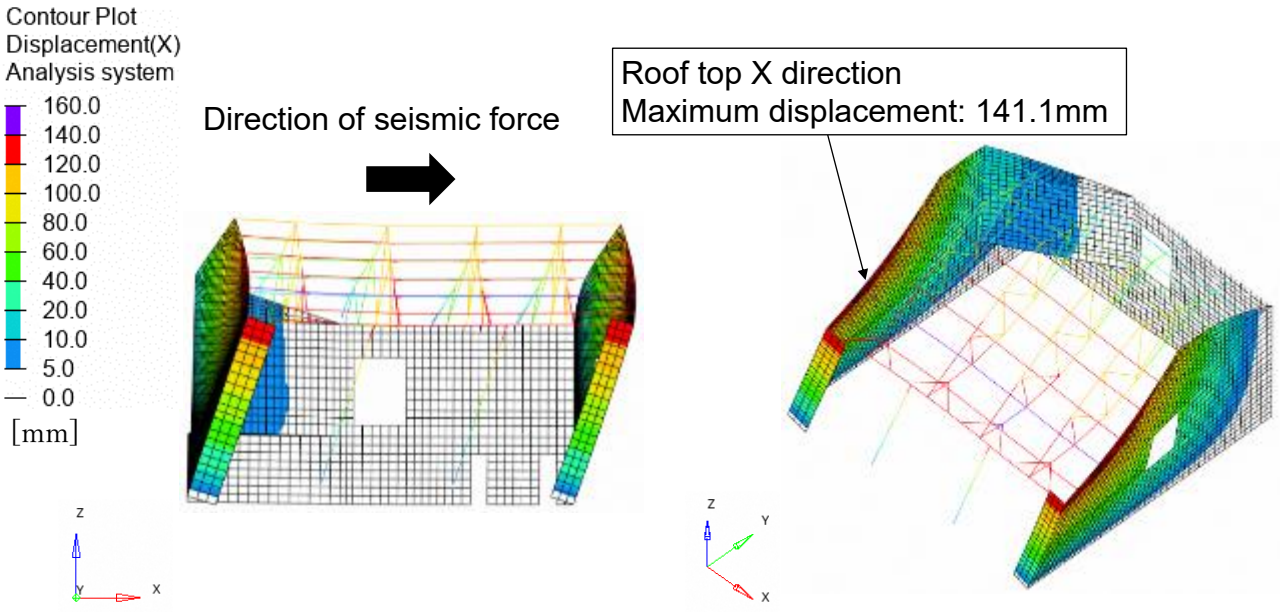


Figure-2 Deformation state during an earthquake
(in the case of the X direction)

(5) Impact on attributes contributing to OUV and necessity of countermeasure construction

As mentioned above, the hauling hut has been diagnosed as being potentially severely damaged during large earthquakes, and should an earthquake occur, the hauling hut, an attribute that contributes to OUV, may collapse. Also, collapsing brick walls, pillars, beams, etc. of buildings may cause significant damage to the hauling machinery (steam engines, boilers, etc.), which are also attributes.

In order to prevent adverse impacts on attributes that contribute to OUV, it was decided that it was necessary to take measures including seismic reinforcement.

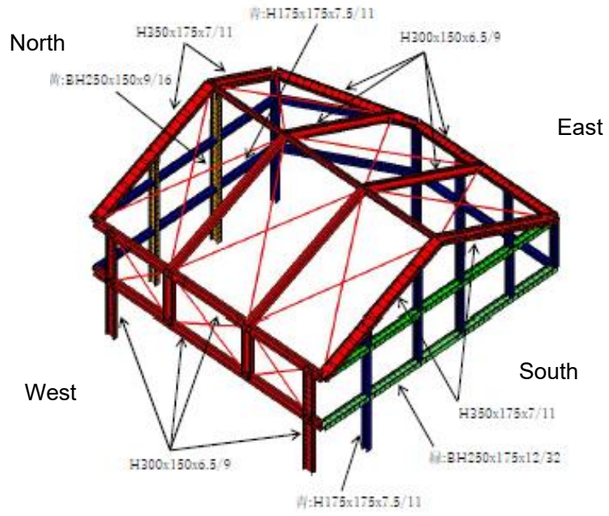
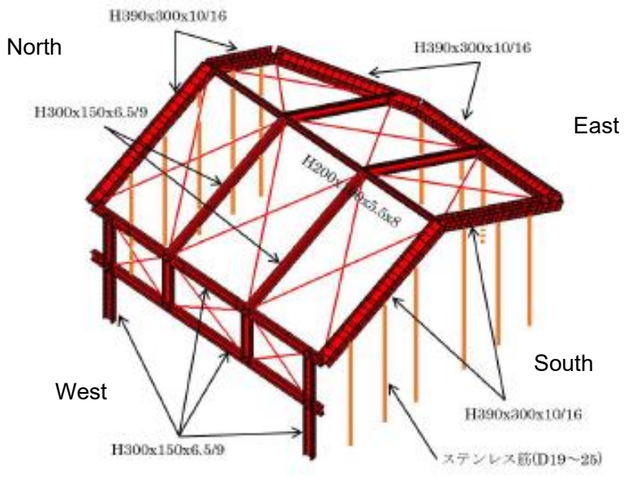
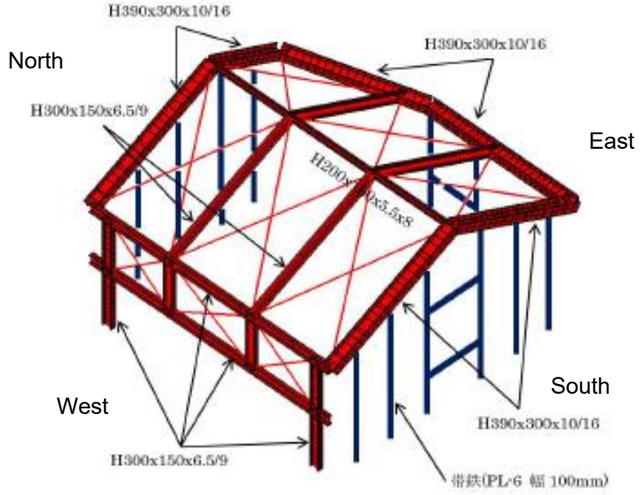
2 Consideration of countermeasures

(1) Seismic reinforcement

① Comparative examination of construction plans

As a reinforcement method to meet the seismic performance target "safety assurance level", three plans were considerd: Plan A: Reinforce the inside of the hut with a steel frame; Plan B: Plan to insert stainless steel bars into the brick wall; and Plan C: Wrapping steel bands around the inside and outside of the hut to reinforce it. In the study, we compared the impact on attributes that contribute to OUV, reversibility, and visual impact (Table 3).

Table-3 Comparison of reinforcement construction methods

	Plan A (reinforcing the inside of the hut with a full steel frame)		Plan B (inserting stainless steel bars into the brick wall)		Plan C (reinforcing the inside and outside of the hut with a band)	
Reinforcement plan image					
Reinforcement policy	A plan to receive the seismic force in the out-of-plane direction with a reinforced steel frame. A steel frame suppresses the deformation of bricks and prevents the bricks from bending and breaking. The out-of-plane bending strength of the brick wall is borne only in the horizontal direction, and the force is transferred to the steel frame.		By inserting stainless steel bars into the brick wall to add tensile strength, the bending strength of the brick wall is increased.		The bending strength of the brick wall body itself is increased by sandwiching the brick wall with steel straps to add tensile strength.	
Supplement	The steel frame members and bricks are joined with Post-constructed anchors. Since it is difficult to reinforce the boiler side (southern inner wall surface), partial damage will occur, but the steel frame will prevent total collapse.		Use D19-25 stainless steel. In order to insert the rebar, it is necessary to drill a hole approximately 50 to 70 mm in diameter from the top of the brick.		The band iron is 100mm wide and 6mm thick. In order to insert the through bolt, it is necessary to drill a hole with a diameter of 20 mm. Similar to plan A, there is a possibility that the inner wall of the boiler will be partially damaged.	
Visual impact	○	The exterior is almost unchanged, but the steel frame is exposed inside.	◎	The exterior and interior are unchanged.	△	Belt iron materials are exposed both in the exterior and interior.
Reversibility	○	The steel frame is relatively easy to remove, but the Post-constructed anchor remains inside the brick wall.	△	The inserted stainless steel bar cannot be pulled out.	○	Removing the strap material is relatively easy, but the inserted bolt cannot be pulled out.
Reinforcing effect	△	Since there are places where the brick walls themselves cannot be reinforced, there is a high possibility that the bricks will be partially damaged.	○	It is possible to increase the tensile strength by inserting stainless steel bars.	○	It is possible to increase the tensile strength by using a steel band material.
Impact on attributes	○	The area affected by the anchor on the brick wall is about 0.32m2 in surface area and about 0.06m3 in volume, and the area affected by grout injection is about 18.75m2 in surface area. There is also an impact on the boiler remains due to the installation of the foundation.	△	The range of impact on the brick wall by inserting the stainless steel bar is 0.02m2 in surface area and 0.11m3 in volume.	○	The area affected by bolt insertion on the brick wall is about 0.13m2 in surface area and about 0.05m3 in volume, and the area affected by grouting is about 12.83m2 in surface area.
Construction problems	Increase the number of the Post- constructed anchors.		It is necessary to confirm the effectiveness of the construction method for konnyaku bricks by conducting bending tests, etc.		It is difficult to attach steel straps to the inner wall of the boiler, and it is necessary to install only the outer wall with post-constructed anchors.	
Common subject matter	Regarding the tensile strength of the Post-construction anchor, a strength test has been conducted with konnyaku bricks of the same age as the hoisting machine shed on the premises of Mitsubishi Heavy Industries.					

Plan A: Reinforcing the inside of the hut with a steel frame

In plan A, it is necessary to join the steel frame and the brick wall, but it is possible to limit the impact on the bricks by, for example, placing the connections in the center of the mortar joints, and the effect on the appearance can be almost eliminated, so it is adopted.

However, since the steel frame is exposed inside, we examined how to reduce the size of the steel frame in consideration of the appearance of the interior.

Plan B: Inserting stainless steel bars into the brick wall

Plan B does not show reinforcement on the outside and inside from a design standpoint, but because it is necessary to drill holes in the important konnyaku bricks and insert reinforcing materials inside the brick wall, there is a lot of brick loss.

For OUV, it is important that the attributes remain in their original form. This also impacts on National significance, as this is the oldest European-style brick building surviving in Japan. Hence Plan B was not adopted because the impact on the bricks through drilling and insertion of the bars is too great.

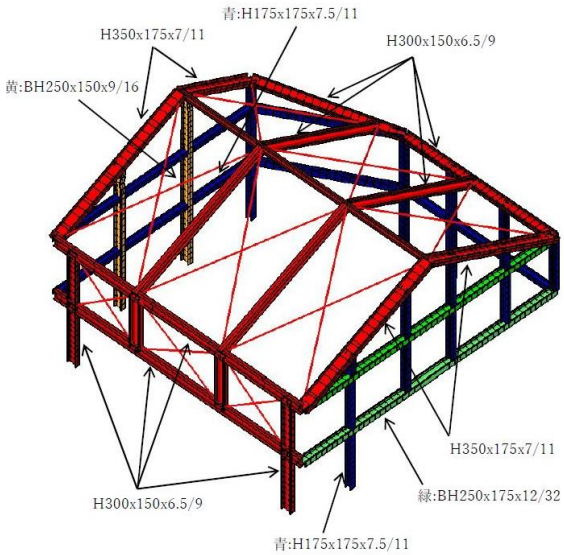
Plan C: Reinforcing the inside and outside of the hut with a band

In Plan C it would be necessary to attach steel belts to the outside and inside of the hut, and since the iron plates are visible on the exterior and interior, it has a significant impact on the appearance of the building, so it was not adopted.

② Examination of reducing the steel frame of plan A

The original design was re-examined, and it was determined that lighter steel members would provide the necessary degree of seismic performance. As a result it was assessed that the minimum necessary size of the steel frame could be reduced from the original 300 mm wide (red), to 244 mm wide (green).

Initial plan



Final draft

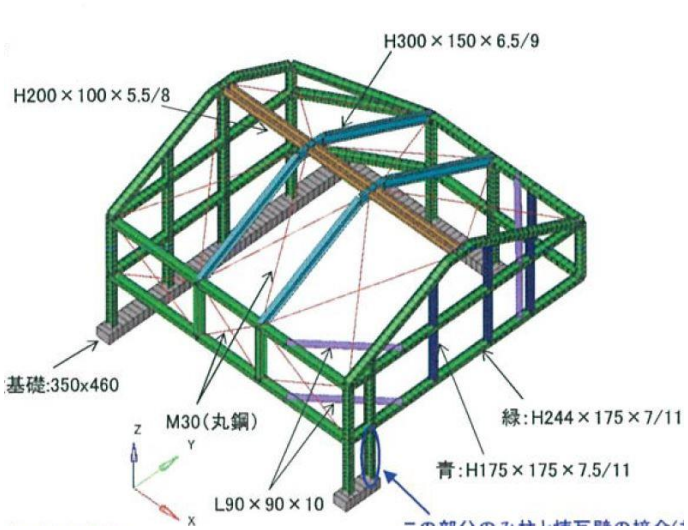


Figure-3 Reinforcing steel frame size comparison

It has been confirmed that the deformation that leads to damage during an earthquake can be suppressed if the seismic reinforcement of Plan A is carried out.

Figure 4 shows an example of analysis results after seismic reinforcement.

Before reinforcement, when seismic force was applied in the X direction, the brick walls on the south and north sides were shown in red and yellow, indicating that they would deform greatly. However, after seismic reinforcement, it is shown in blue even at the maximum, and it is confirmed that the reinforcement can suppress deformation due to a large earthquake.

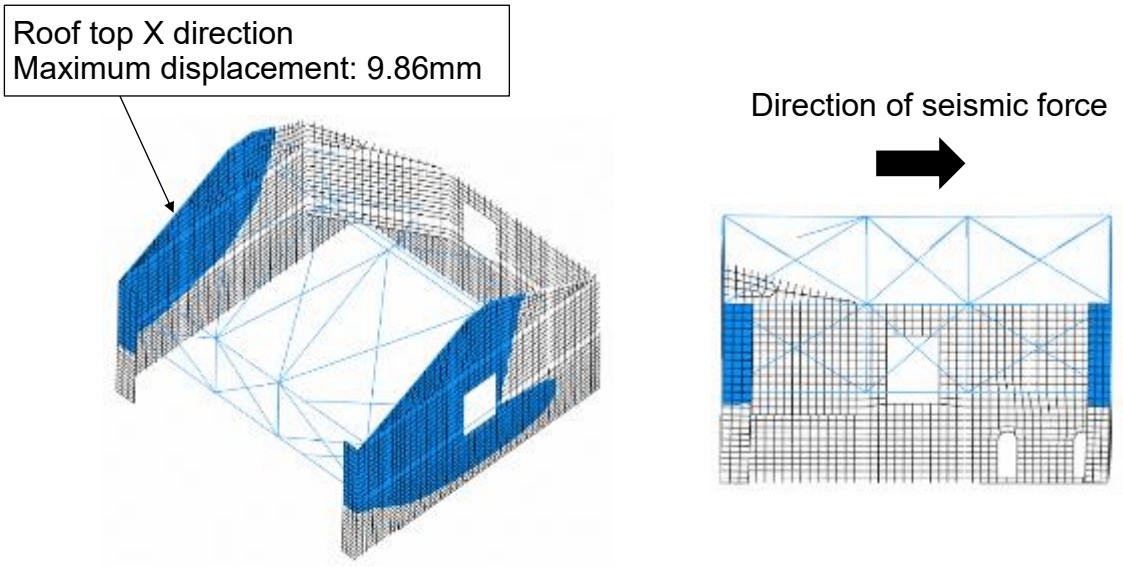
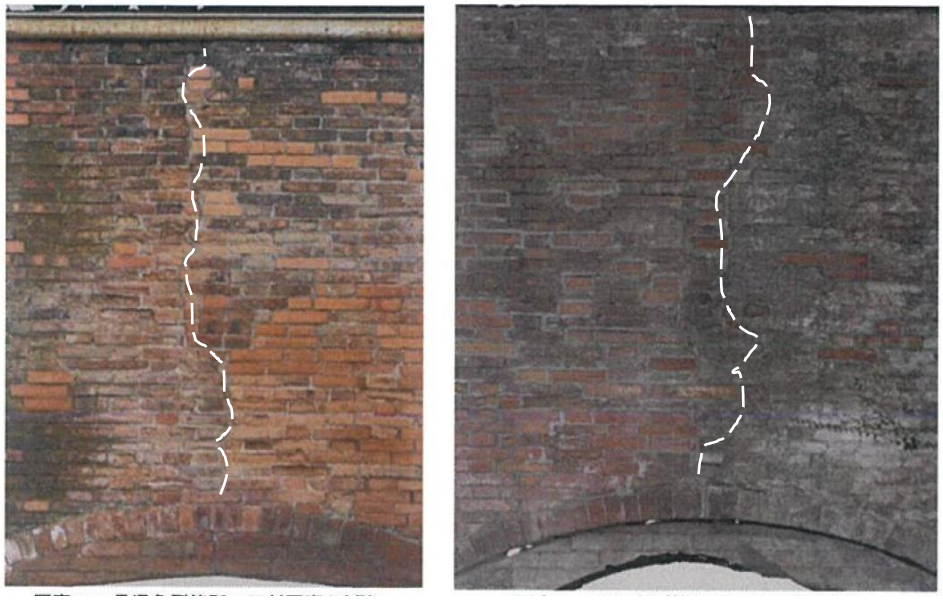


Figure-4 Deformation during an earthquake after seismic reinforcement (X direction)

⑵ Repairing cracks in brick walls (countermeasures against penetrating cracks in the outer wall on the east side)

Since the seismic diagnosis is performed on the assumption that the walls are all sound, if there are cracks in the existing walls, they will need to be repaired. If repairs are not carried out, the force will not be evenly distributed to the wall during an earthquake, and there is a possibility that the brick wall will collapse.

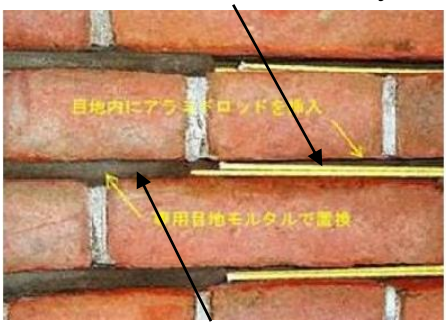
In determining the repair method, we compared three plans: plan a (injection method of filling cracks), plan b (inserting reinforced aramid rods), and plan c (partially re-laying bricks).



external crack　　internal cracks

Figure-5 Current condition of the east face of the brick wall

Table-4 Comparison of crack repair methods

	Plan a	Plan b
Method	Crack injection method Inject inorganic injection material	Insert aramid rod into existing joint
Construction method image	 Example of reinforced concrete wall	Insert an aramid rod into the joint  Replace with dedicated joint mortar
Construction method overview	The cracked part is sealed so that the injection material does not leak, and an inorganic filler such as fine particle polymer cement is injected from the injection jig installed in the joint part.	By removing the existing joint mortar near the crack (only the horizontal joint that is perpendicular to the crack) and inserting a straight aramid rod with a diameter of about 2.7 mm, the integrity of the bricks on both sides of the crack is secured.

Plan a (Injection method of cracked material)

By adding an inorganic filler similar to the existing joint filler to the cracked part, the gap can be filled and the crack can be eliminated. However, there is a possibility that the filler will enter into gaps other than the cracks, making it difficult to construct and causing unnecessary effects, so it was not adopted.

Plan b (Aramid rod reinforcement)

Insert an aramid rod into the joint to prevent the crack from spreading further. Although some of the brick jointing mortar will be lost, the brick itself will not be affected, and construction is possible. In order to stop cracks, plan b was adopted.

Plan c (Partial re-laying of bricks)

The original brick walls are one of the attributes, and unnecessary dismantling and re-laying of the brick work is not desirable, and impacts on authenticity. It was judged that this would impair the value of the World Heritage site and was rejected.

⑶ Drainage measures

There are places inside and outside the hut where rainwater and groundwater accumulate, affecting the brick walls, gears inside the pit, and boiler preservation, which are attributes that contribute to OUV. Therefore, it is necessary to control external drainage and prevent ingress of water into the hauling hut. Water ingress occurs from multiple directions, and the cause is not yet clearly understood. Therefore, we considered a step-by-step approach to draniage control to clarify and possibly solve the problem in the least intrusive way.

It has been confirmed that one of the routes of water ingress is flowing in from the south side of the hauling hut. Therefore, first, measures to prevent water ingress outside the building were examined.

Figure 6 shows the current accumulated water condition of the hauling hut.

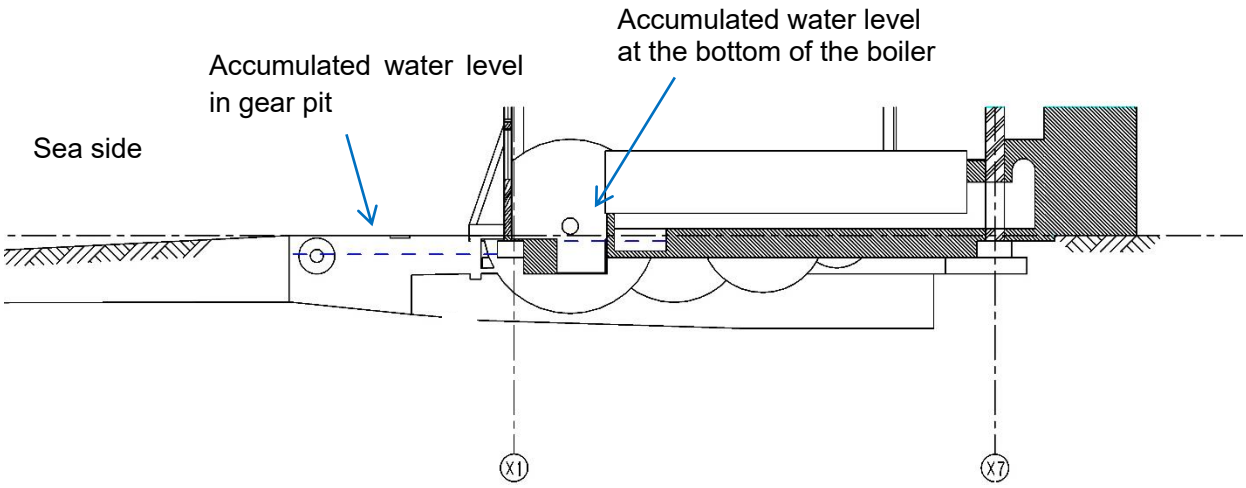


Figure-6 Current accumulated water situation in the hauling hut

After the consideration of several options to directly drain the internal engine pit, it was decided to first improve external drainage, and monitor if that work reduced or stopped the flow of water into the hauling hut, particularly from the southern side.

If water ingress into the building continues, then options to drain the internal engine pit will be considered. These options may involve drilling drainage pipes through original fabric, so all options to avoid such intervention will be tested and monitored.

The currently proposed works are as follows: On the south side of the hauling hut a drainage pipe would be laid in a drainage ditch that guides water above the level of the existing foundations and the drainage pipe is extended in the direction of the sea. The location of the drainage pipe adjacent to the hut wall

and down the slip way to the sea will be decided and constructed after archaeological testing and supervision to confirm that there would be no impact on the underground remains.

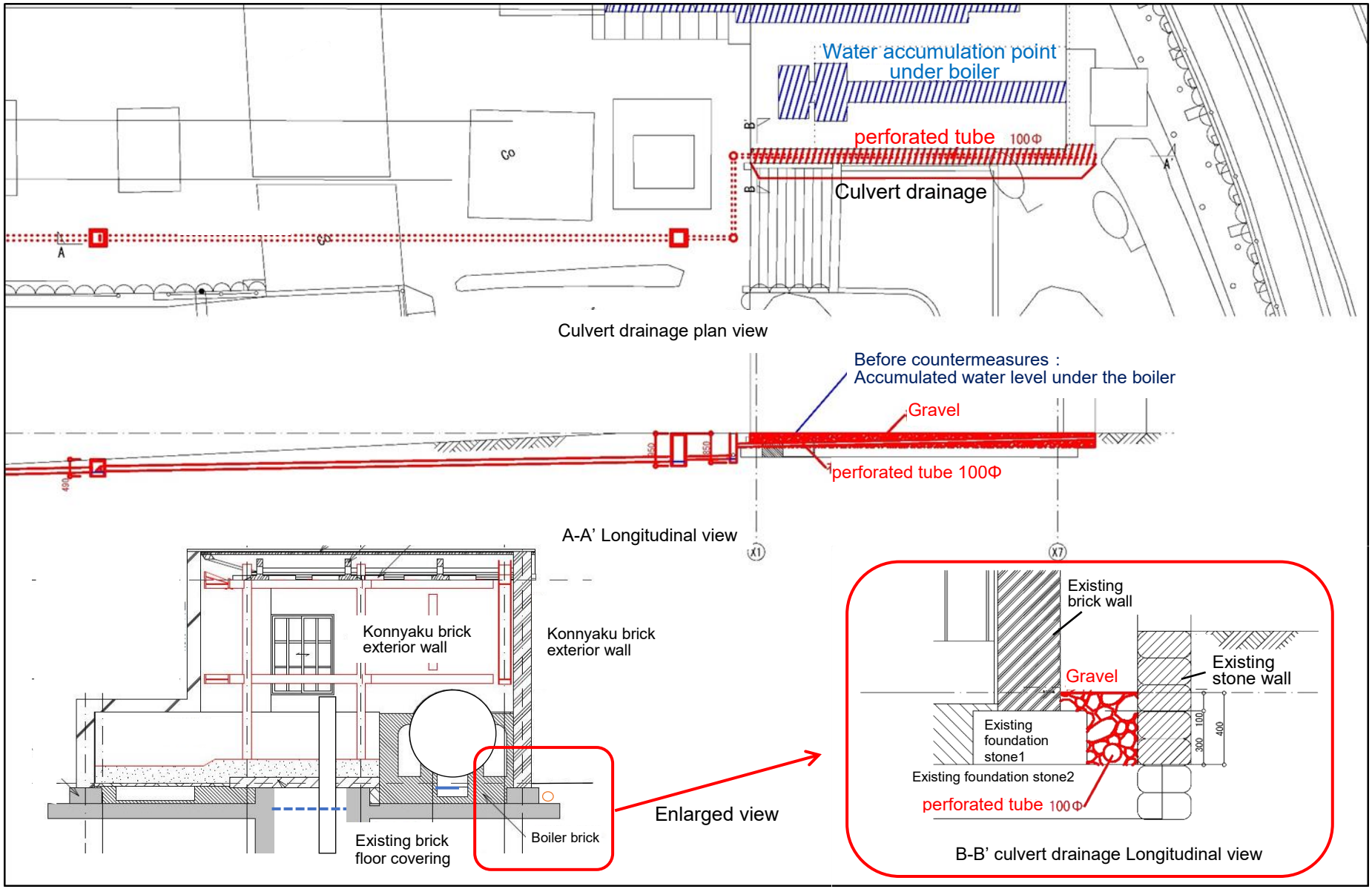


Figure-7 Drainage measures to be implemented this time

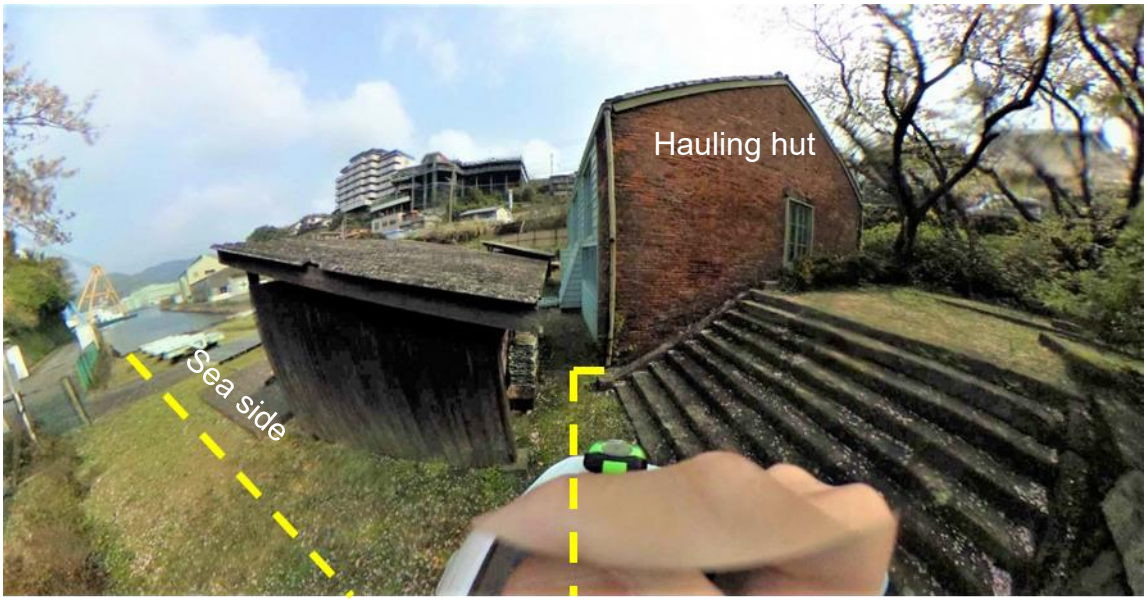


Figure-8 Drainage route

3 Assessment of impact on OUV by seismic reinforcement

The design of the proposed works has been undertaken in parallel with the screening process. The heritage values of the site have informed the design, and there has been an iterative process seeking to both address significant conservation issues as well as protect OUV. As demonstrated in this report, various options have been considered in order to determine the best possible conservation outcome, including the minimization of impacts. The process has also involved external expert review.

By implementing the necessary seismic reinforcement, it is possible to prevent damage to the boiler and the hauling machinery due to the collapse of the hauling hut, which is one of the attributes. And the adverse impact on OUV can be avoided.

The new seismic reinforcement will be a very visible new element inside the haulage hut, and efforts have been made to minimise that impact. It should also be noted this work is reversible, should circumstances or superior and less visible reinforcement techniques become available.

In addition, when considering the construction method, as mentioned above, in order to keep the impact on OUV to a minimum, we considered the optimal option from multiple options.

4 Phased drainage measures and monitoring

The drainage measures to be implemented this time will be implemented by selecting the minimum necessary measures that do not affect the remains, and the effects of these measures will be continuously monitored.

If further measures are required as a result of monitoring, coordinate with relevant organizations as necessary and consider measures to avoid impacts on OUV.

5 Construction schedule (planned)

Component	Element	Counterplan	2022	2023	2024
Hauling hut	Hauling hut	Drainage			Monitoring Consider the next measures depending on the situation
		Seismic reinforcement	Scheduled for December		
		Brick coservation	Scheduled for December		Consider the next measures depending on the situation
		Fire protection measures			
Hauling machinery	Boiler, Steam engine, Machine, Pits, Chain	Preservation work			Preparation/Consideration
Slip dock	Rail	Preservation work			Preparation/Consideration
	Ship cradle	Preservation work			
	Ground	Preservation work			Preparation/Consideration
Masonry work remains	Masonry-faced quays	Preservation work			Preparation/Consideration

Revetment construction work at Hashima Coal Mine (Area 6/Component Part 6-7)

Overview

The Hashima Coal Mine, which is one of the World Heritage Sites of Japan's Meiji Industrial Revolution Iron and Steel, Shipbuilding and Coal Mining, will be stabilised and restored based on the "Restoration and Public Utilization Plan" over a period of 30 years from 2018. Maintenance will be carried out at the same time. In the restoration process, priority will be given to protection and conservation of components which are attributes of OUV, such as early revetment remnants and coal production facilities, and physical improvement methods will be taken in stages. The revetment that circles the island and protects the reclaimed land within it from typhoon damage is the top priority, as if the revetment fails the island is at severe risk of substantial damage.

Nagasaki City has so far conducted a survey of the current state of the revetment on Hashima Island, simulated the wave power of the sea area, prioritized the most at-risk setions, and has developed a design for the stabilisation of the revetment, and plans to start construction work in 2023. This document describes the research results and design policy so far. By stabilising the revetment, it will be possible to preserve the remains of coal production facilities from the Meiji era, which are an attribute of OUV, together the Meiji sections of the revetment itself, over the long term. The design policy is being studied with advice from related organizations such as the Ministry of Land, Infrastructure, Transport and Tourism and the Port and Airport Research Institute, a research institute under the jurisdiction of the government.

It is planned to stabilise two small sections of the revetment from late 2023 until 2024 which are in urgent need of attention. The remaining parts of the revetment will be stabilised after 2024 over a period which is likely to take some years.

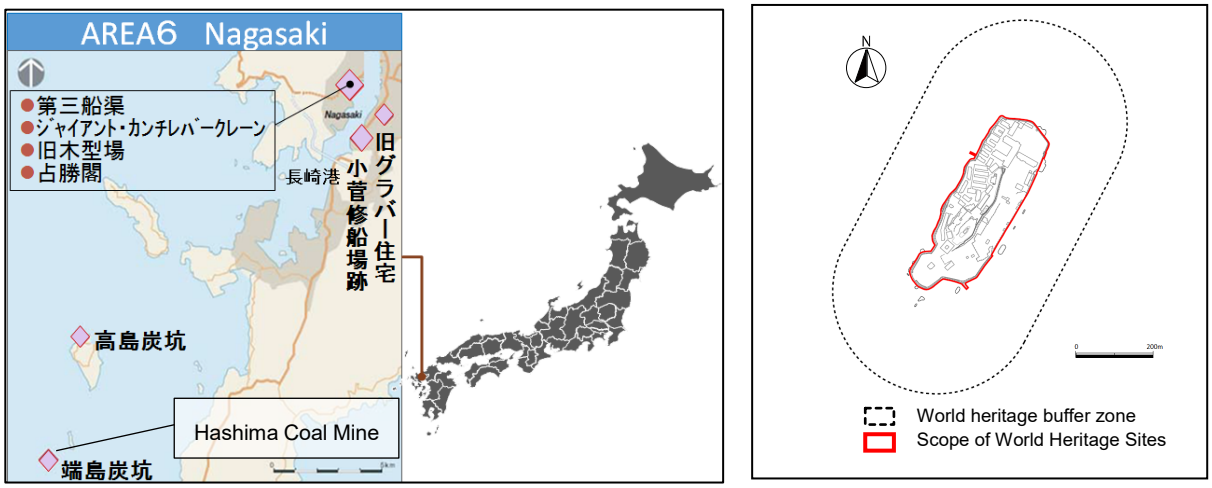


Figure-1 Asset location and planning scope

1 Current status of Hashima revetment

(1) Introduction

Hashima Coal Mine is surrounded by a revetment of about 1.2 km around the island. 48 years have passed since the coal mine closed in 1974 and the island became uninhabited. Reinforced concrete structures on the island and the revetments facing the sea are exposed to the harsh natural environment, including frequent violent typhoons, and have deteriorated to a considerable extent.

The revetment of Hashima protects the remains of the island from high waves and protects the island itself from erosion and collapse. However, since maintenance has not been done for several decades after the coal mine closed, serious deterioration such as cracks in the revetment and hollowing of the foundation have been confirmed, and recent typhoons have become more powerful and the island is threatened by heavy rain, as a result of climate change.

Figure-2 Hashima during a typhoon approaches

The photo below shows Building No. 70 (former Hashima Elementary and Junior High School) on the north side of the island, where the revetment was destroyed by a typhoon in 1991 (Fig. 3). When the revetment collapsed, the earth and sand from the foundation of Building No. 70 flowed out of the island, exposing the foundation piles of the building that were supposed to be buried in the ground, creating a very dangerous situation. In 2018, Nagasaki City carried out emergency construction such as submerged concrete filling, and the situation is now stable (Fig. 4). If such a situation arises again, it could lead to major damage to the island

itself.

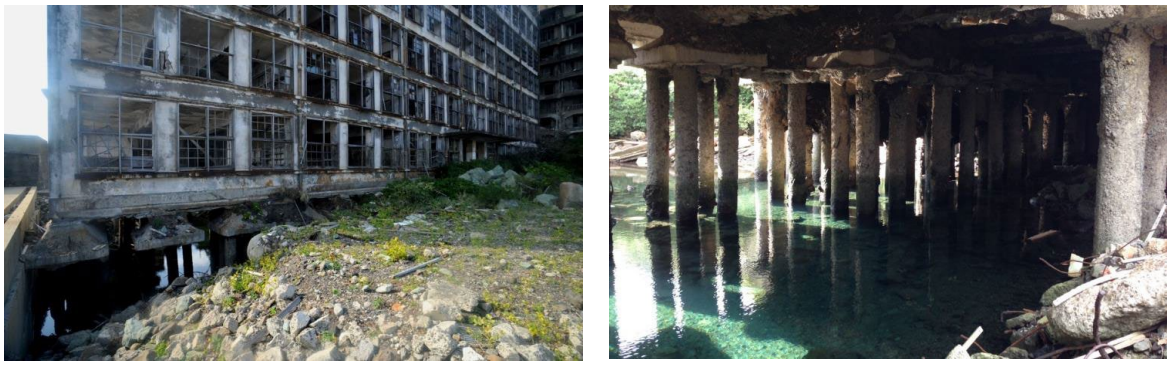


Figure-3 Pictures after the 1991 typhoon destroyed the revetment

Figure-4 Photographs before and after the emergency construction of the damaged area in 1991

For this reason, in order to avoid impacts on OUV, based on the results of a survey of the current state of revetments conducted in fiscal 2021, we decided to implement measures with a high degree of urgency due to particularly significant deterioration. We would like to implement countermeasure construction in two places.

Below, we report on the results of the survey of the current state of the revetment and the review process of the proposed countermeasures.

⑵ Revetment condition survey overview

Surveys of the current condition of revetments were conducted in 2015, 2016, and 2021.

Structural calculations were carried out in 2015 and 2016 to determine whether the protruding part of the revetment could withstand waves. As a result, it was found that 80% of the entire revetment could collapse due to the largest wave that could occur in 30 years (Fig. 5).

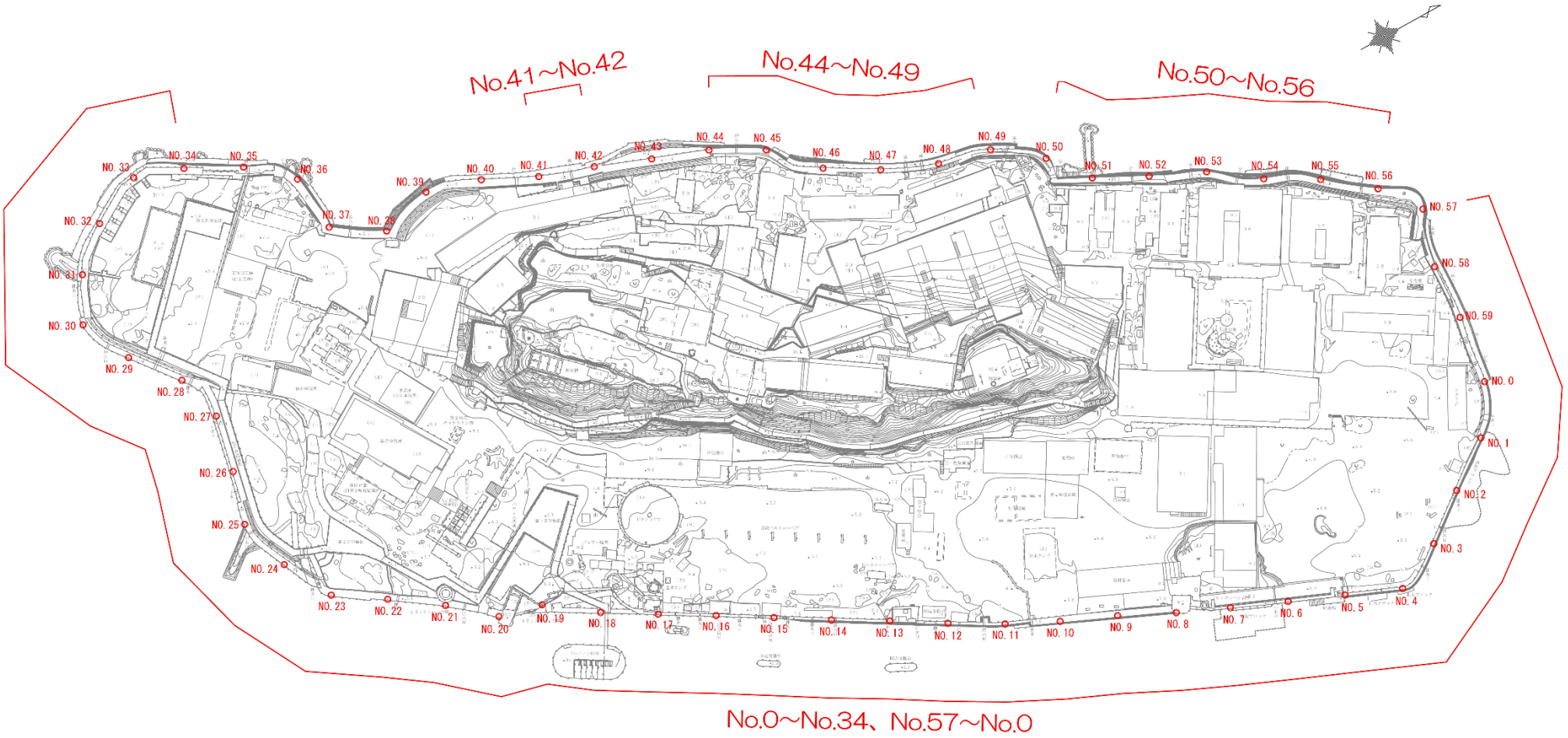


Figure-5 Area with insufficient strength of revetment overhang

In 2021, we investigated the state of deterioration of the revetment based on the inspection items and evaluation criteria created by applying various inspection standards (Table 1).

The survey was divided into 60 spans, with each span approximately 20m long (Fig. 6). The contents of the survey are as follows.

① Onshore visual inspection

The side and crown of the revetment on the land side were visually inspected for damage, and the damage was recorded in diagrams and photographs.

② Maritime visual inspection (inspection by drone)

A drone was used to photograph the sides and crown of the revetment on the sea side, and the damage status was investigated by analyzing the photographs and recorded in the damage diagrams.

③ Dive visual inspection

The base of the levee body of the revetment was visually inspected by divers to investigate the damage status, and the damage diagrams and photographs were recorded.

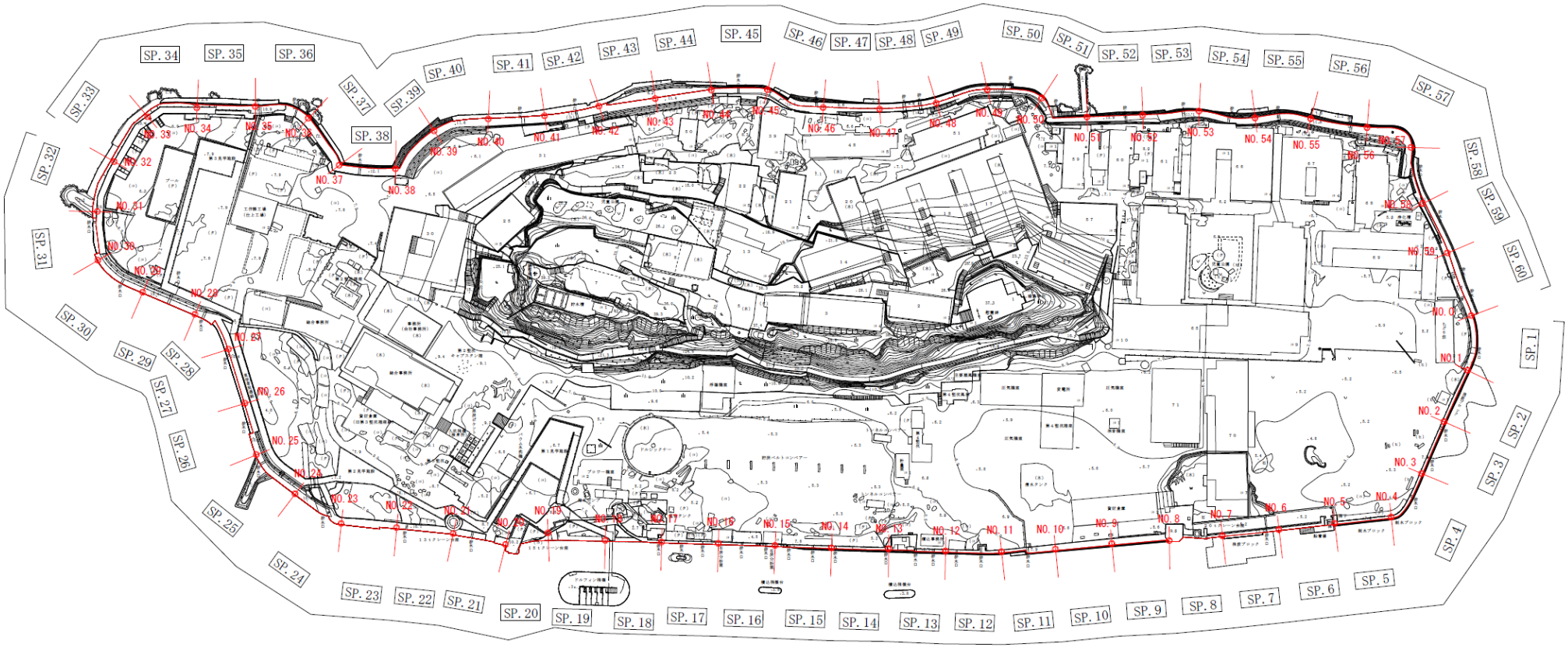


Figure-6 Hashima Revetment Section Map

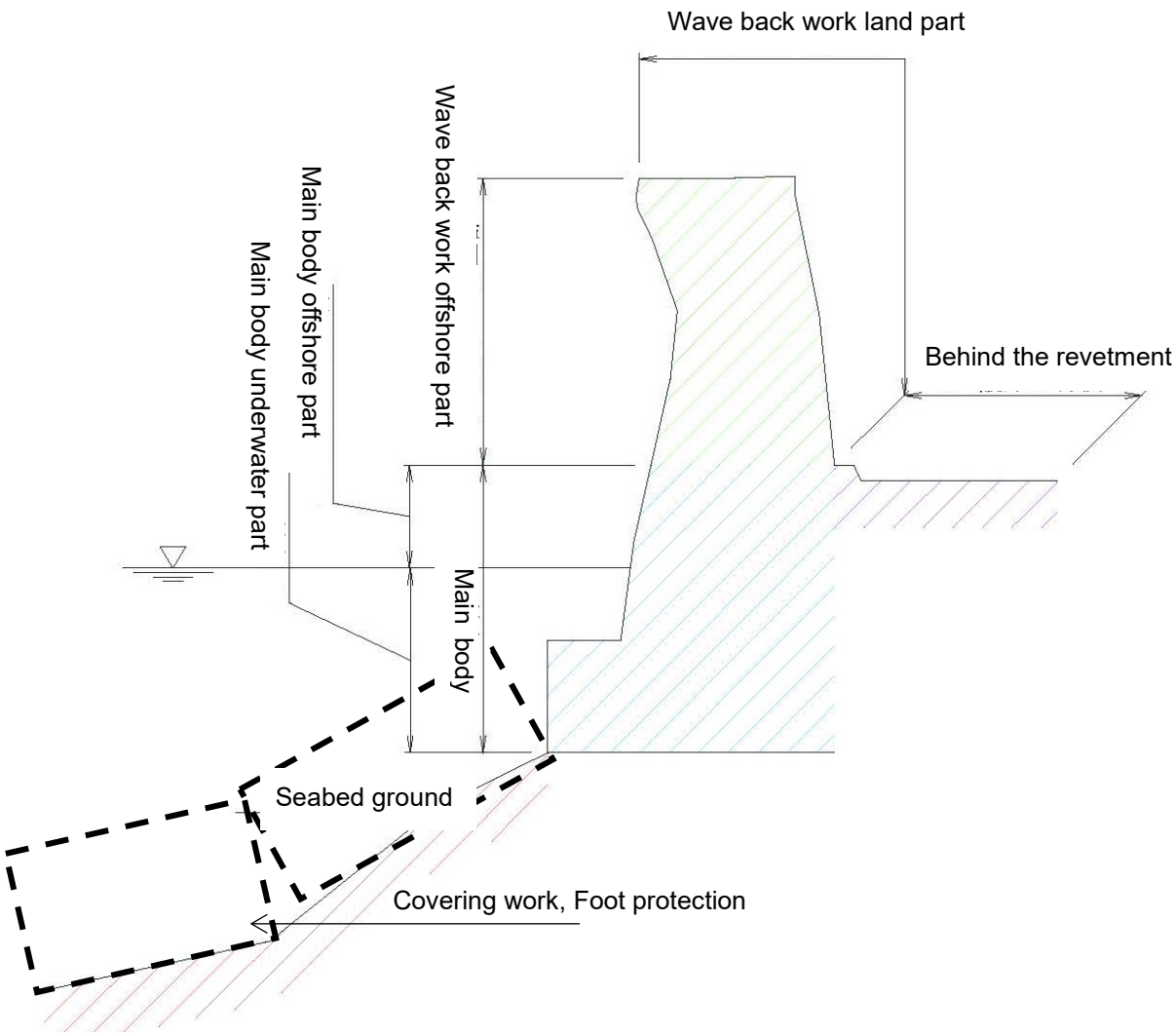


Figure-7 Diagnosis item division chart

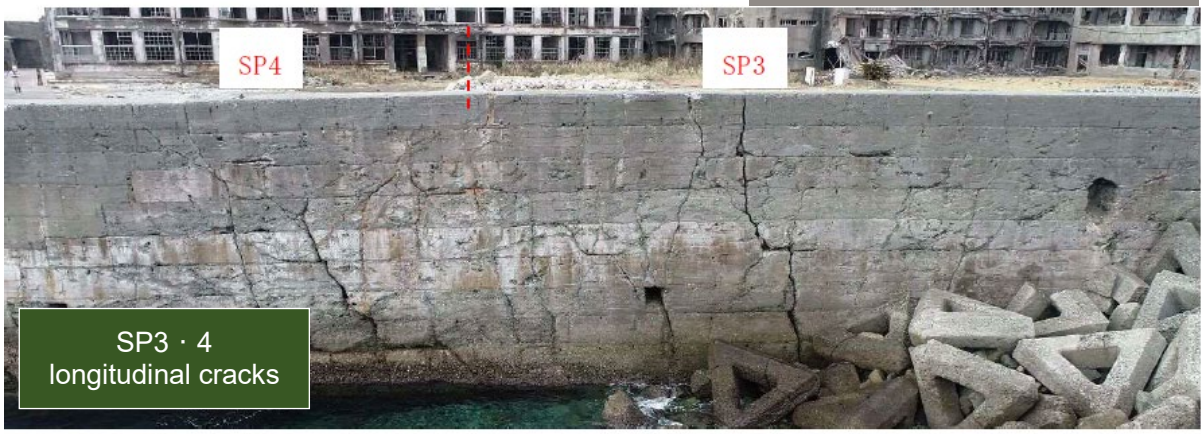
Table-1 List of inspection items and evaluation criteria

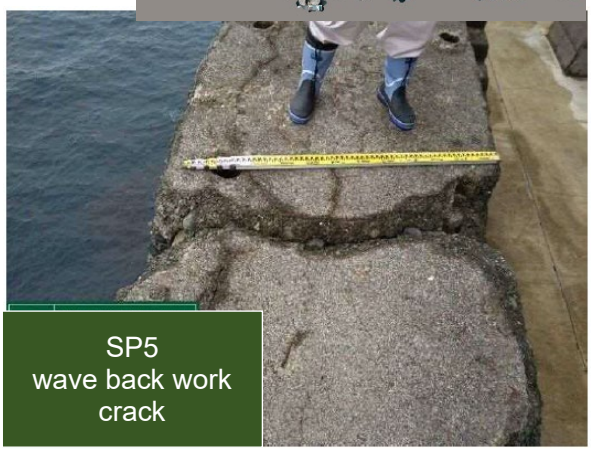
style	Classify -cation	Inspection diagnosis items		Inspection method		Evaluation criteria
General	I	Movement throughout the entire facility		Visual inspection (including measurement with tape measure, etc. Same below) ·Amount of movement	a	There is a gap of 20 cm or more between adjacent spans.
						There is normal deformation that impairs performance.
					b	Deformation of the normal line is observed.
						There is a gap of about 10 to 20 cm between adjacent spans.
					c	Otherwise, there is a gap of less than 10 cm between adjacent spans.
					d	No deformation.
		Subsidence of entire facility		Visual inspection · Revetment subsidence	a	Significant subsidence (about 1 m) can be confirmed visually.
					b	There is a step of several tens of centimeters between adjacent spans.
					c	There is a step of several centimeters between adjacent spans.
					d	No deformation.
		Behind the revetment/levee or body of the revetment	Sinking. suck out	Visual inspection (places where subsidence, depression, joint displacement, etc. have occurred) · The condition behind the revetment · Open joints and misalignment	a	Sediment is flowing out behind the revetment/levee or from the revetment itself.
						The ground behind the revetment/levee or the main body of the levee has subsided.
					b	There are significant openings and gaps in revetment joints.
					c	There are slight openings and gaps in revetment joints.
					d	No deformation.
		Wave back work	Concrete deterioration/ damage (For unreinforced concrete)	Visual inspection · Cracks, damage, defects · Signs of deterioration, etc.	a	There are indications that sediment is washed away from penetrating cracks.
						There is a defect of 10% or more in area ratio to the member surface.
					b	There is a defect of less than 10% in area ratio to the member surface.
					c	Although there are penetrating cracks, there is no sign of soil washout.
						There is a non-penetrating crack with a width of 1 cm or more.
					d	No deformation.
	II	Main body (gravity type) (underwater part)	Concrete deterioration/ damage (For unreinforced concrete)	Visual inspection · Cracks, damage, defects · Signs of deterioration, etc.	a	There are defects to the extent that they affect the performance of the breakwater.
					b	There is a crack with a width of 1 cm or more. There is a small defect.
					c	There are cracks less than 1 cm wide
					d	No deformation.
detail	I	main body (gravity type) (underwater part)	Concrete deterioration/damage	Diving survey · Cracks, peeling, damage, defects · Rebars exposure · Signs of deterioration, etc.	a	There are holes, cracks, or defects that allow the filling material to flow out.
						Extensive rebars are exposed.
					b	There are cracks with a width of about 3 mm in multiple directions.
					c	There is a crack with a width of about 3 mm in one direction.
						Rebars are exposed locally.
					d	No deformation.
		Foundation	Movement, subsidence, damage	Diving survey · Protrusion to the front, inclination, subsidence · Joint misalignment, steps · Concrete damage	a	Foundation is lost or damaged. Extensive movement or subsidence.
						There are large gaps and steps in the joints.
					b	Minor displacement or subsidence in foundations.
						There are small gaps and steps in the joints.
					c	---
					d	No deformation.
		Seabed ground	Scouring, sedimentation	Diving survey, bathymetric survey · Ups and downs of the sea floor · Is it a scouring trend or a sedimentation trend?	a	There is scouring with a depth of 1m or more in front of the slope of the rubble mound.
						As a result of scouring, the impact on the mound, etc. and the main body of the levee can be seen.
					b	There is scouring with a depth of 0.5m or more and less than 1m in front of the slope of the rubble mound.
					c	There is scouring or sedimentation less than 0.5m deep.
					d	No deformation.
	II	Covering work	Movement, scattering, subsidence	Diving survey, leveling · Deformation of slopes, shoulders, buttocks, etc. · The movement and scattering of stones and blocks	a	There is movement, scattering or subsidence with a damage rate of 5% or more.
					b	There is movement, scattering or subsidence with a damage rate of less than 1-5%.
					c	There is movement, scattering or subsidence with a damage rate of less than 1%.
					d	No deformation.
		Foot protection	Movement, scattering, subsidence	Diving survey, leveling · Deformation of slopes, shoulders, buttocks, etc. · The movement and scattering of stones and blocks	a	There is movement, scattering, or subsidence over a wide area of 50% or more of the inspection unit length.
					b	There is movement and scattering in the range of 10 to 50% or more of the inspection unit length.
					c	There is movement and scattering within a range of less than 10% of the inspection unit length.
					d	No deformation.

⑶ Revetment deterioration survey results

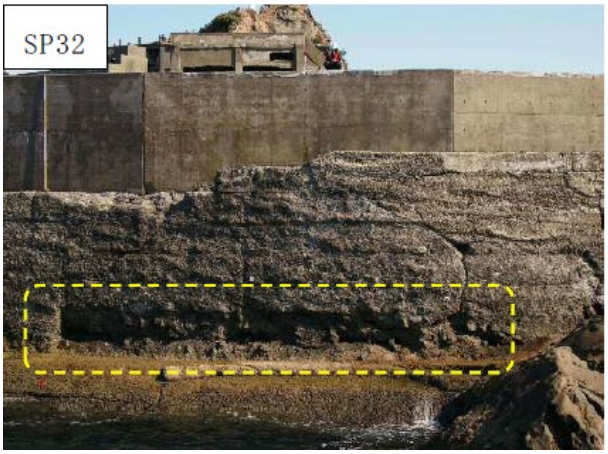
As a result of the investigation, the following deterioration conditions were confirmed.

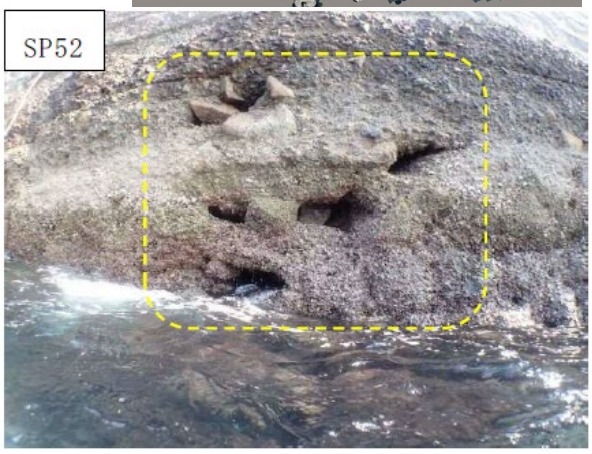
① Cracks of 10 mm or more in the revetment (Longitudinal cracks, penetrating cracks)





② Defect of revetment





③ Sediment runoff and subsidence behind the revetment


SP5
behind
the revetment
subsidence


SP4
behind
the revetment
subsidence


SP36
behind
the revetment
sediment runoff

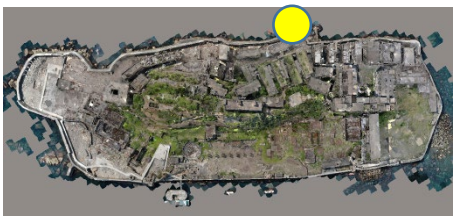

SP57
behind
the revetment
sediment runoff

④ Hollowing behind the revetment

SP53
wave back work
cavity

SP58
wave back work
cavity

⑤ Collapsing/collapse of revetment (Concrete part that was reinforced in the past separated and collapsed)

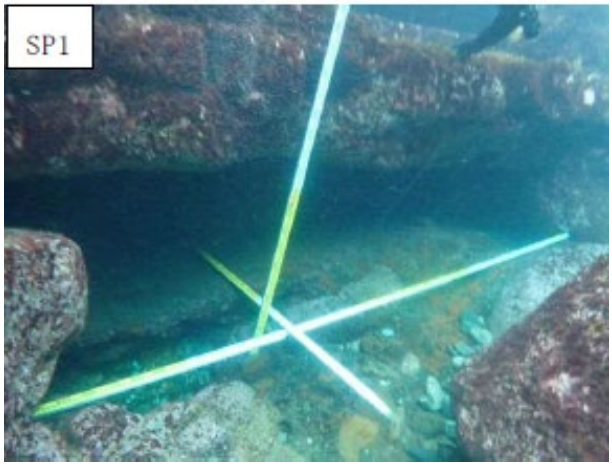


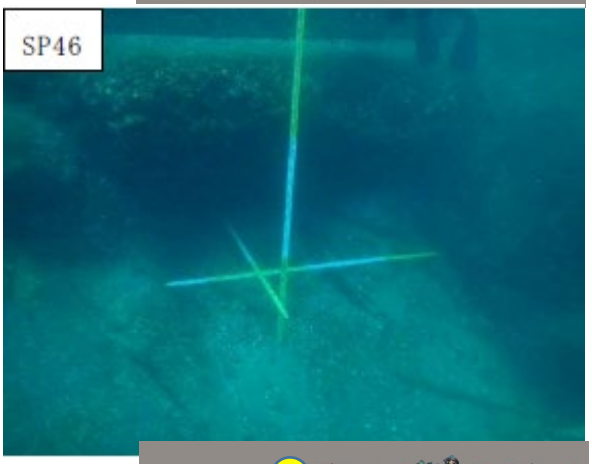
⑥Inclination, opening, and movement of the revetment
(The original masonry revetment was reinforced with concrete in the past, and the revetment has separated, and the bank body is leaning toward the land.)

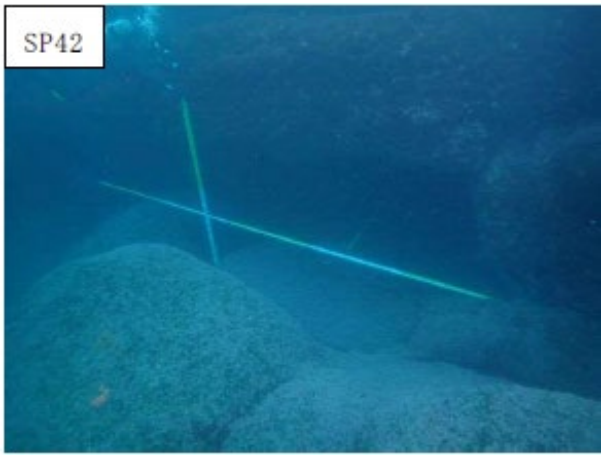
SP58
wave back work
Open joints

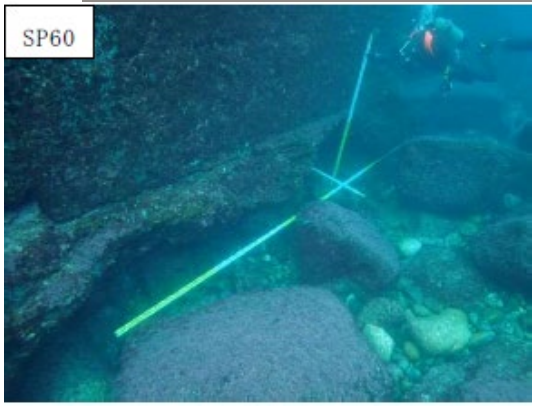
SP58
wave back work
Open joints

⑦Hollowing of the base of the revetment









(4) Maintenance priority

For each span (SP.1 to SP.60), based on "Table-1 List of inspection items and evaluation criteria", an evaluation of the state of revetment deterioration was undertaken and an overall priority was determined.

Based on the priority of maintenance and conservation, the areas judged to require the highest priority maintenance in FY2023 are listed in Figure 8.

The construction sites for FY2023 will be selected from the high-priority A-rank and B1-rank sites. However, SP.4, SP.56, and SP.58 out of the four A-ranked locations require additional ground surveys and a re-examination of the reinforcement cross-section according to the ground structure, before conservation work is possible. On the other hand, work on SP.12 (B1 rank) and SP.49 (A rank) can start in FY2023. Especially in SP.49, penetrating cracks have occurred in the revetment, and the reinforced concrete wall has collapsed. There is also a cavity (5m wide, 2.3m high, 3.2m deep, etc.) at the base of the bank (Fig. 9). Also, in SP.12, two cavities at the foundation of the revetment are connected at the back, reaching 5m at the deepest point (Fig.10). Since both SP.12 and SP.49 are in a critical situation, there is an urgent need to deal with them. SP.50 is also ranked A, but in Hashima, where the weather conditions are harsh, the weather conditions differ between the east and west sides of the island. For the purpose of grasping the impact of, and confirming the extent to which construction can be carried out at one time, we have selected one location each from the east and west sides, and SP.50 is not included in the construction locations for 2023.

Table-2 Criteria for maintenance priority

rank	priority	situation	
A	Highest priority	Locations where B1 and multiple deterioration are observed	
B	Second highest priority	**B 1**	A hollowing of the foundation of the levee with a depth of 3.0 m or more was observed, and the hollowing of the foundation of the levee may have caused the ground behind the levee to subside.
		B 2	Locations where cavities of 1.0m to 3.0m in depth were found in the base of the revetment.
		B 3	Locations where cavities were found in the base of the revetment with a depth of less than 1.0m.
C	3rd highest priority	The back of the revetment is scoured by overtopping waves. Due to this scouring, the back ground tends to subside, and the lower edge of the covering concrete is floating.	
D	4th highest priority	Places that do not correspond to the above	

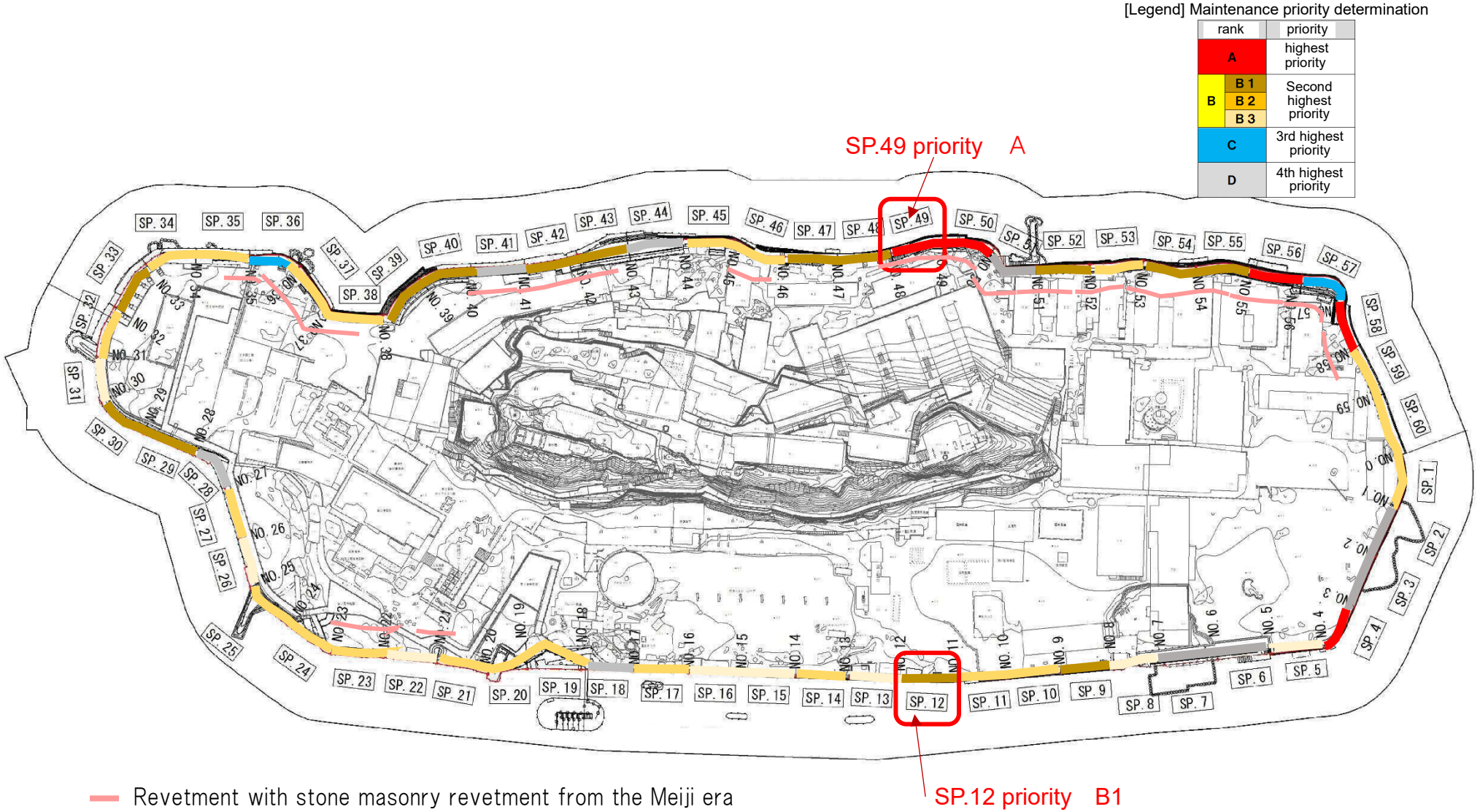


Figure-8 Maintenance priority judgment chart and selected areas for maintenance in 2023

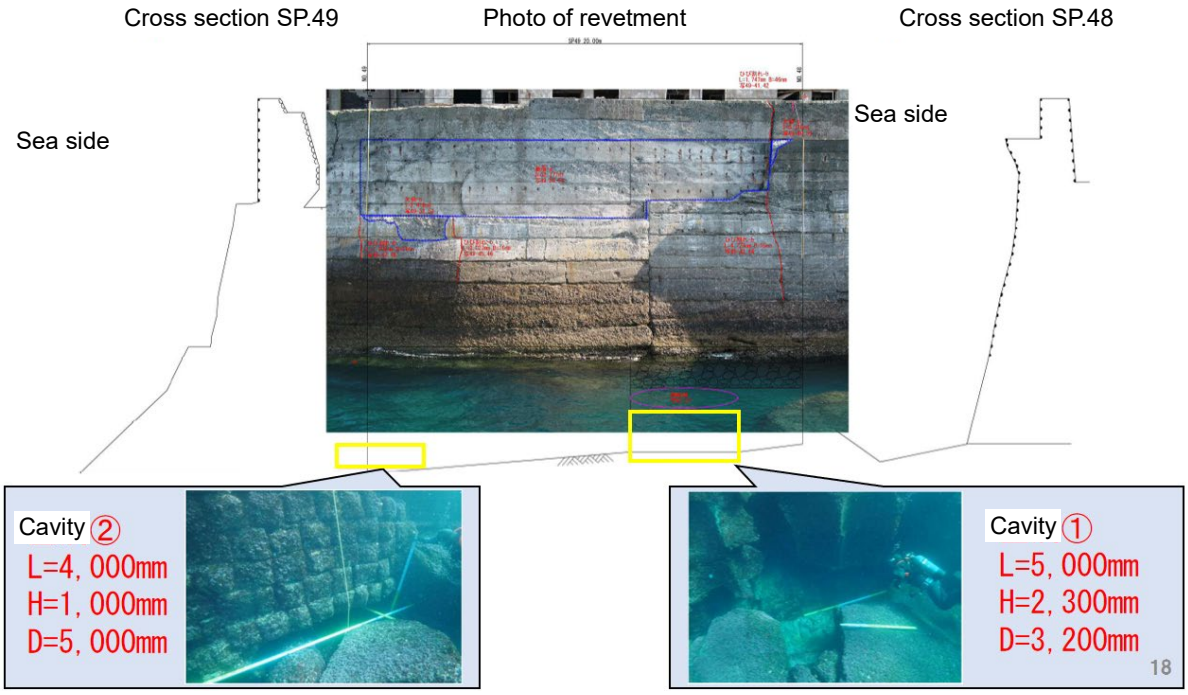


Figure-9 Locations scheduled for maintenance work in 2023 (SP.49, priority A)

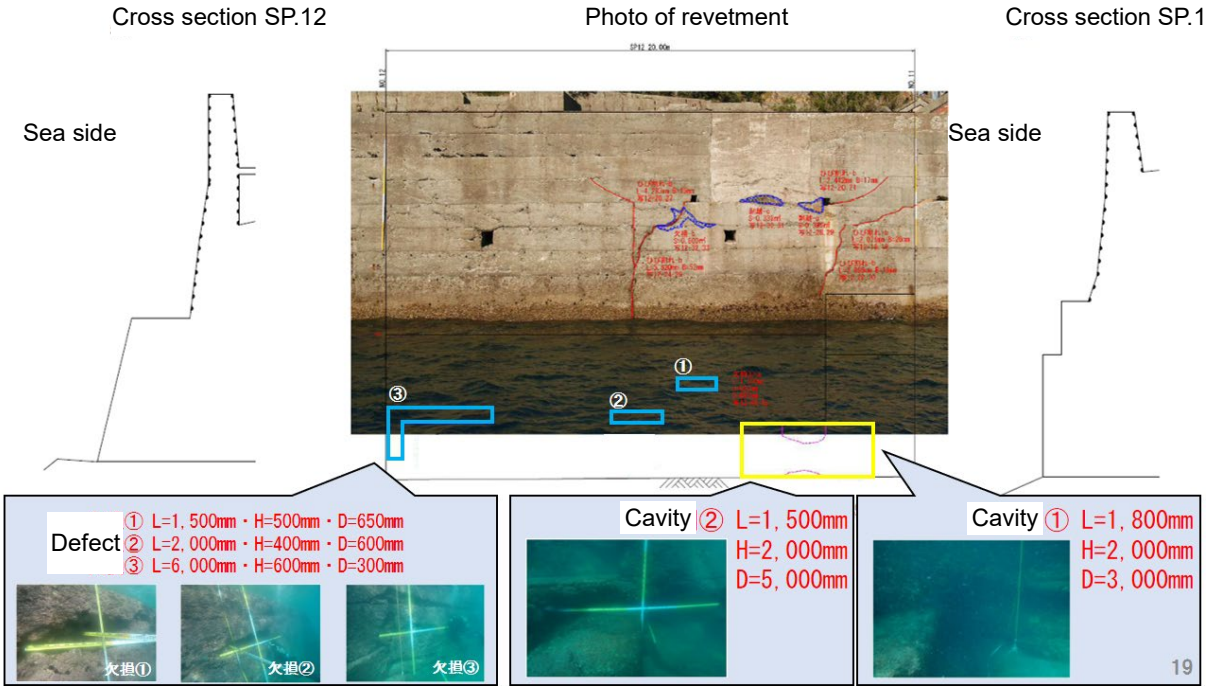


Figure-10 Locations scheduled for maintenance work in 2023 (SP.12, priority B1)

2. Factor analysis (mechanisms of revetment damage)

In considering countermeasures, we analyzed the mechanism of revetment damage.

We believe that there are two main factors in the leading to damage to the revetment: "Destabilization of revetment (Factor A)" and "Decreased strength of the revetment (Factor B)." Revetment collapse due to each factor, and then wave action directly on the remains on the island, may lead to the destruction of the revetment. The following diagrams explain the mechanisms of revetment damage, the countermeasure construction method considered (Fig. 11), and the details of the two mechanisms (Figs. 12 and 13).

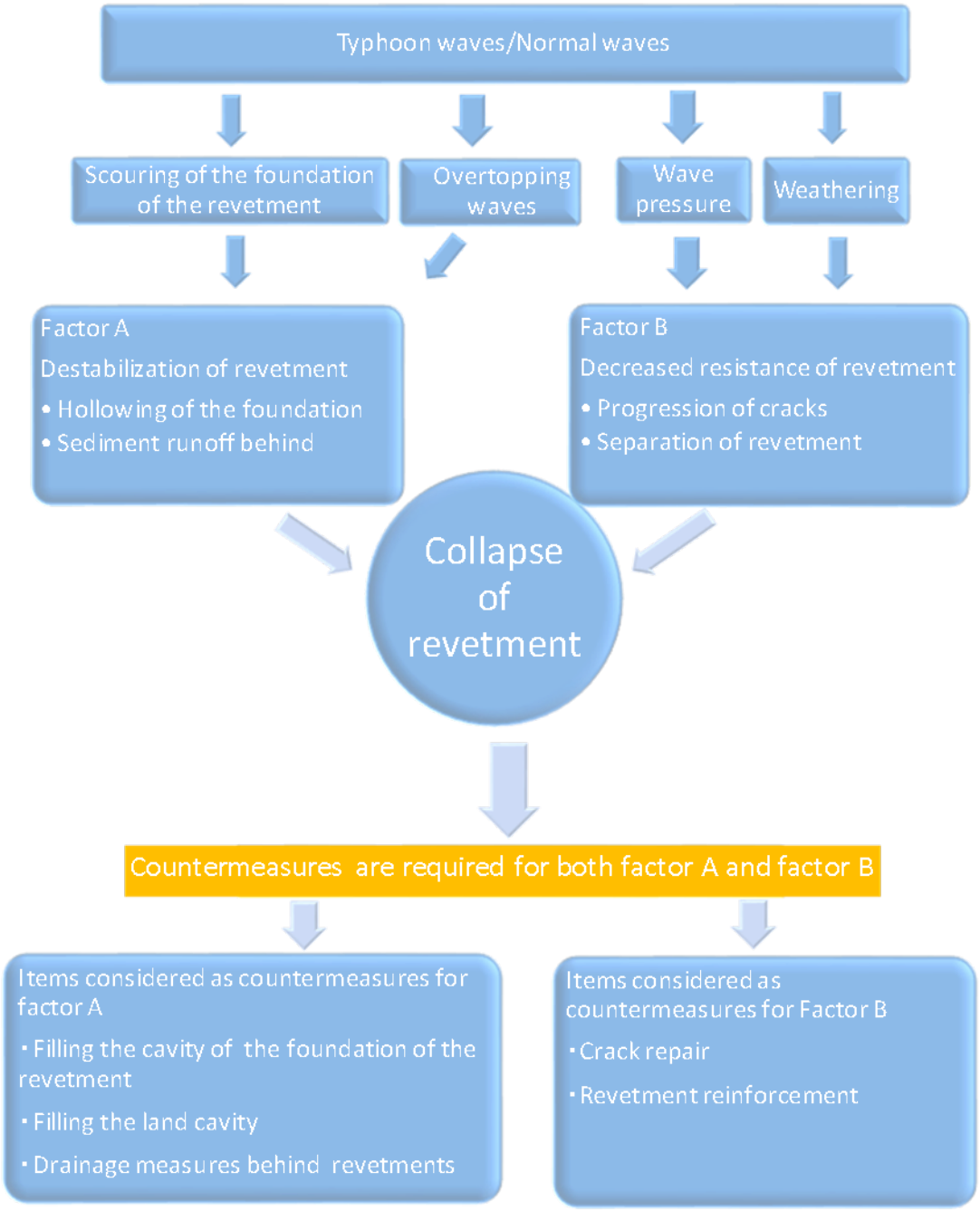


Figure-11 Mechanism of bank protection collapse and flow of countermeasure construction method

Factor A Destabilization of revetment

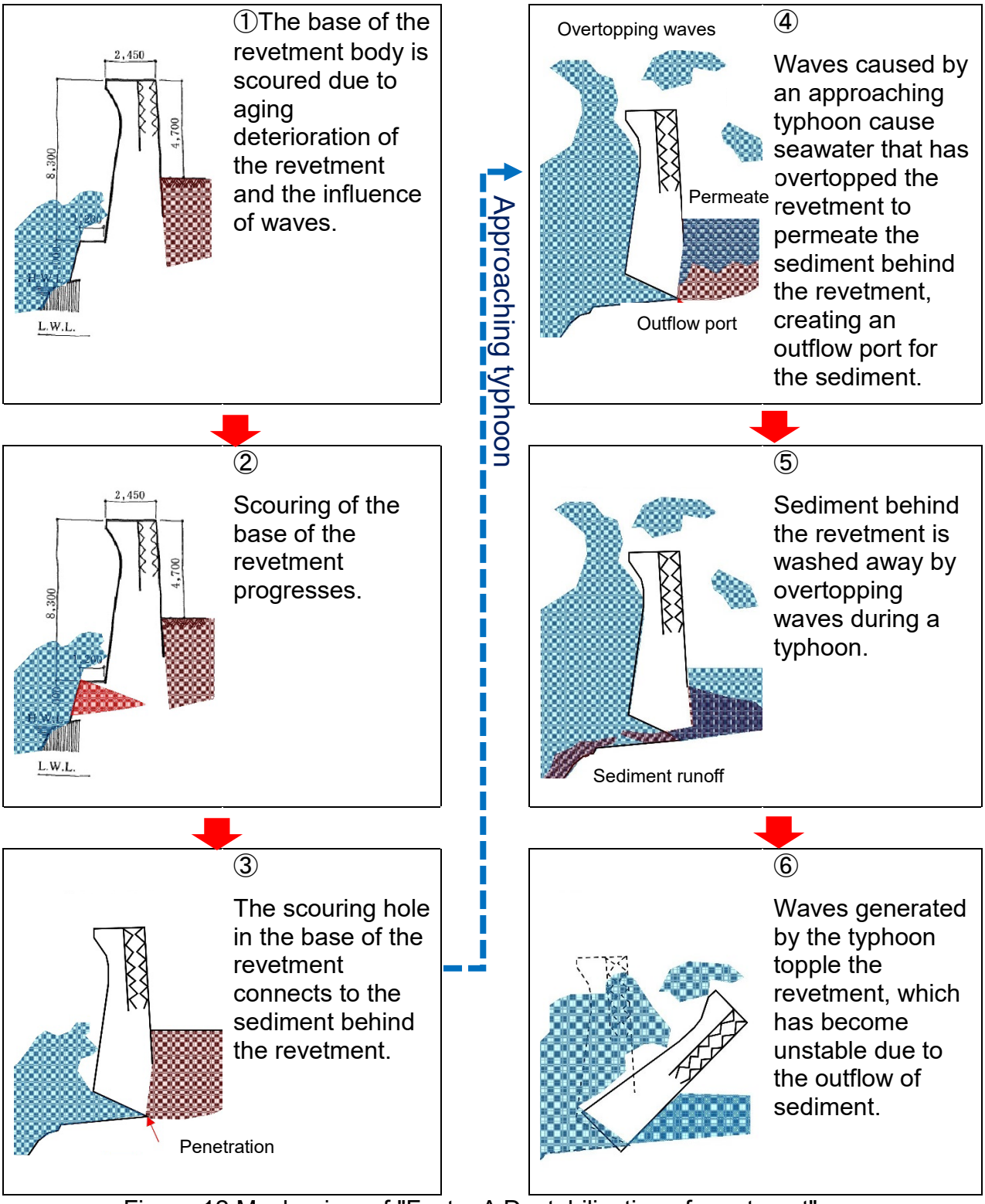


Figure-12 Mechanism of "Factor A Destabilization of revetment"

Factor B Decreased resistance of revetment

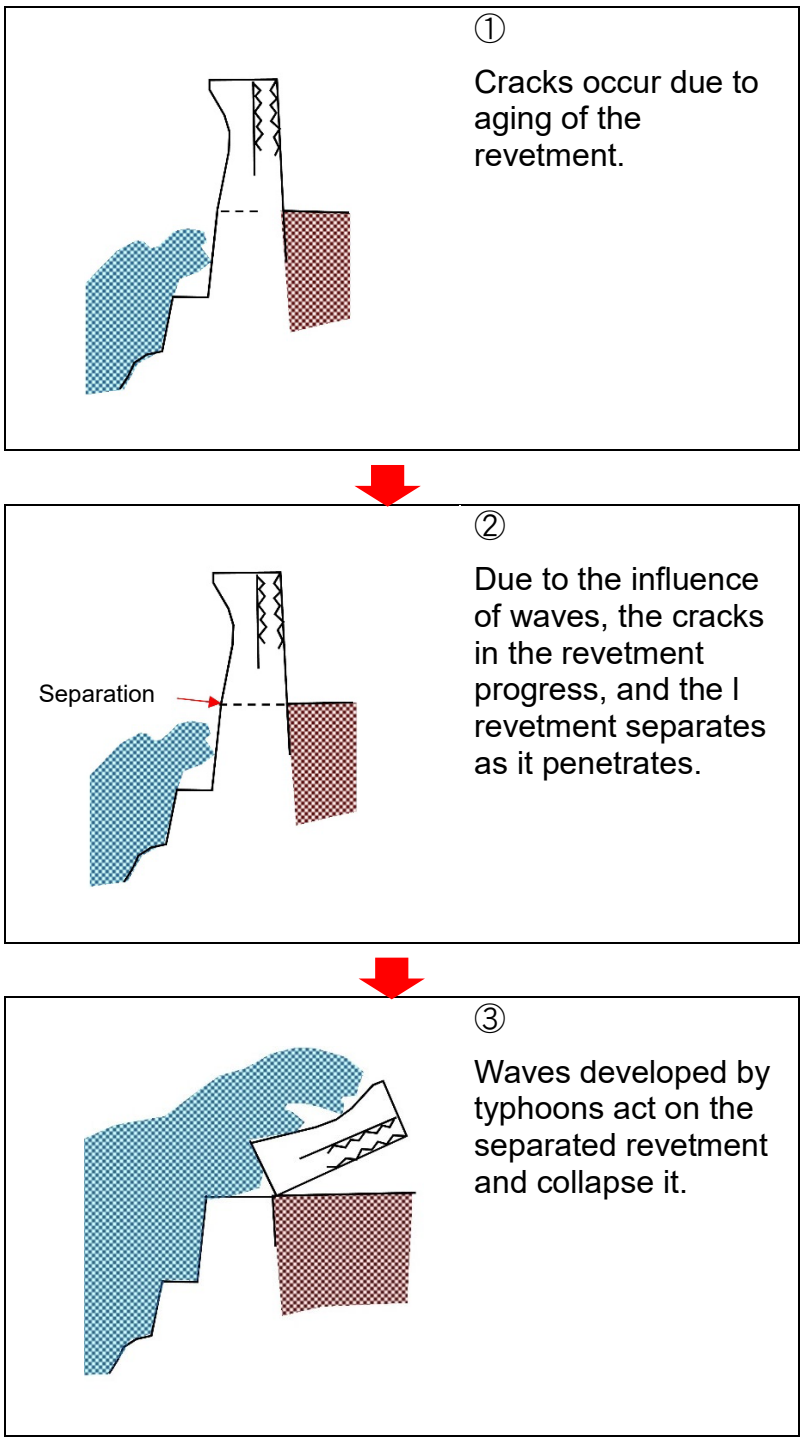


Figure-13 Mechanism of "Factor B Decrease in strength of revetment"

3 Consideration of countermeasures

Based on the results of "2 Factor analysis", we considered measures according to the factors. In examining the proposed countermeasures, we considered not to damage the current landscape. The review process for repair and reinforcement is shown below.

Consideration of countermeasures against [Factor A: Destabilization of revetment]

(1) Cavity filling and drainage measures behind revetments

The repair method for cavities is to inject the filler into cavities. And after a comparative study of fillers, the revetment foundation cavity and the land cavity were divided into cases and examined.

(a) Examination of filler

As for fillers, "cement bentonite", "plastic grout material (parfait grout)", and "High-flow, non-shrinking grout material for cement-based filling" were compared in terms of workability, environmental impact, and cost. (Table-3).

Table-3 Filler comparison table

Item	Cement bentonite	Plastic grout material (parfait grout)	High-flow, non-shrinking grout material for cement-based filling
Image			
Overview	A method of drilling an injection port and press-fitting it with a mortar pump.	A method of drilling an inlet and pressing it in with a grout pump.	A method of drilling an injection port and press-fitting it with a mortar pump.
Workability	It separates easily in the sea and cannot be filled into cavities and narrow gaps. The pumpable distance is about 50m.	It is difficult to separate in the sea and can be filled into cavities and narrow gaps. The pumpable distance is about 400m.	It is difficult to separate in the sea and can be filled into cavities and narrow gaps. The pumpable distance is about 100m. It is a factory production and cannot be constructed on remote islands away from the factory.

Environmental impact	It easily dissolves in water, and if leaked, it will deteriorate the water quality.	It does not dissolve in water and does not adversely affect the environment.	It does not dissolve in water and does not adversely affect the environment.
Cost	Material unit price ¥20,000/m3	Material unit price ¥24,000 /m3 ～¥30,000/m3	Material unit price ¥90,000 /m3

From the above, "Plastic grout material (parfait grout) " is possible to pump it over a wide area, it is difficult to separate in the sea, it is possible to fill cavities and narrow gaps, and it is a filler that does not dissolve in water and does not have an adverse effect on the environment. It was selected. In terms of cost, "cement bentonite" is superior, but it is not selected because it easily dissolves in water and may adversely affect the sea area of Hashima, which is a good fishing ground. " High-flow, non-shrinking grout material for cement-based filling " is not adopted because it is expensive and cannot be applied on remote islands far from the factory.

(b) Method of filling the cavity of the foundation of the revetment

Concerning the cavity of the foundation of the revetment, due to the following problems and construction restrictions, we will adopt underwater inseparable concrete that is difficult to separate in the sea and can be filled into cavities and narrow gaps.

・Emergency countermeasures are required as the revetment is unstable.
・The same strength as the revetment is required.
・There is concern about sediment runoff behind the site.
・There are good fishing grounds in the surrounding area.

(c) Filling method for the land cavity behind revetments and drainage measures behind revetments

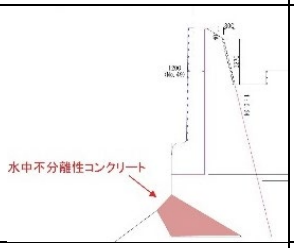
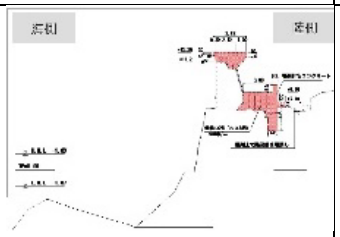
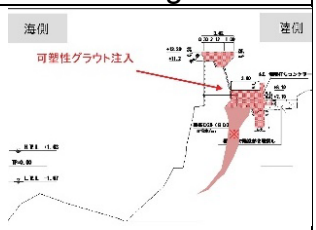
For the land cavity, the construction method will be selected based on whether or not the cavity penetrates the revetment body foundation and then there is a sign that the earth and sand are being sucked out (Table 4).

If there is no sign of soil being sucked out, cover with cast-in-place concrete to cope with scouring caused by overtopping waves. At that time, it is necessary to remove unnecessary rubble, etc., and confirm that there is no risk of the cavity reaching deep and sucking out earth and sand.

At the same time, as a countermeasure against sediment runoff, the overtopping area behind the revetment will be covered with concrete, and drainage ditches will be developed according to the amount of overtopping waves so that the overtopping seawater can be discharged quickly. The drain to be constructed will be connected to the outlet of the existing revetment.

If signs of sediment being sucked out from the levee body foundation cavity are observed, it is necessary to fill the levee body foundation and the through-cavity. Therefore, a method of injecting plastic grout, which can be used to fill cavities and narrow gaps, is adopted.

Table-4 Cavity filling method classification table

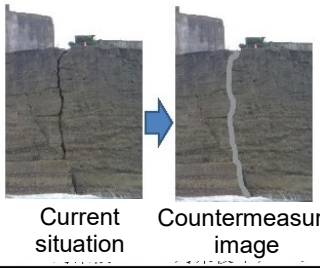
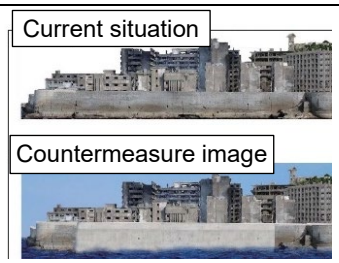
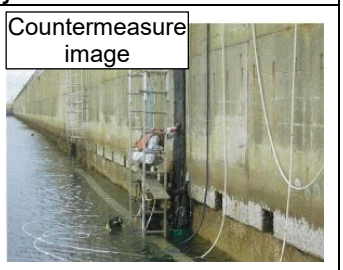
Place	Revetment foundation cavity	Land cavity	
Construction method	Underwater inseparable concrete	Cast-in-place concrete	Plastic grout injection
Suck out	-	No suck out	Sucking out
Image			
Overview	A construction method in which a special concrete with high inseparability in water and high fluidity is poured into the revetment foundation cavity.	Cast-in-place concrete will be placed in places where the back of the revetment has been scoured by overtopping waves and has sunk significantly. A drainage ditch will be developed according to the amount of overtopping waves, and it will be connected to the drainage outlet of the existing revetment.	Inject plastic grout to the places where the back of the revetment is scoured by overtopping waves and where signs of suction from the revetment foundation cavity are seen.
Workability	・Since the material itself does not separate, there are few restrictions on the construction method and construction conditions, and the total cost can be reduced by simplifying the construction and shortening the construction period.	・If there is no construction yard in the back, it will be cast on the sea using a work boat or by on-site kneading.	・If there is no construction yard in the back, it will be cast on the sea using a work boat or by on-site kneading.

(2) Crack repair

We considered three options for repairing cracks: (a) filling cracks, (b) covering with concrete, and (c) installing rubber joint material.

In the study, a comparative study was conducted from the perspectives of impact on landscape, workability, and maintainability (Table 5).

Table-5 Crack repair method comparison table

Construction plan	(a) filling cracks	(b)covering with concrete	(c) installing rubber joint material.
Image			
Construction method overview	A method of filling cracks with an epoxy resin-based filler.	A construction method in which new concrete is added to the sea side of the existing revetment and integrated.	A construction method in which a rubber joint material is installed in front of the revetment.
Scenery	The scenery does not change much.	Since the existing revetment is concrete, the landscape will not change significantly.	The appearance is bad because rubber joints stand out.
Workability	It is necessary to install scaffolding, but construction is difficult because it is constantly affected by waves.	Similar to (a), construction is difficult. If there is a yard on the inner side of the island, construction by land machinery is possible.	Similar to (a), construction is difficult. Temporary construction is required depending on the location.
Maintenance	Repair required every 10 years	No maintenance required	Need to replace when rubber deteriorates
Remarks	It is possible to prevent sediment runoff, but it does not restore strength.	Contributes to sediment runoff prevention and strength recovery.	It is possible to prevent sediment runoff, but it does not restore strength.

From Table 5, "(a) filling cracks" is not adopted because maintenance is required every 10 years and it does not recover the strength of the revetment.

Regarding "(c) installing rubber joint material ", it is not adopted because it has a minor visual impact as the rubber joint material stands out and it is necessary to replace the rubber when it deteriorates.

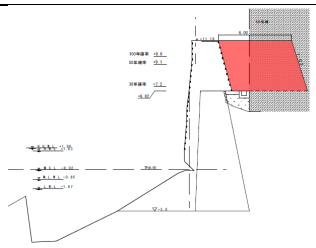
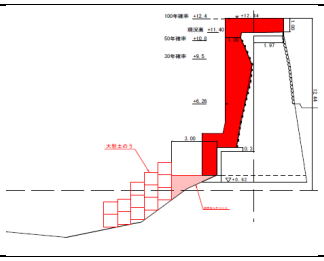
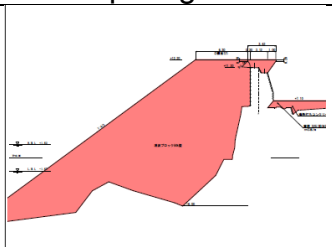
Regarding "(b) covering with concrete", since the original revetment is concrete, it has almost no impact on the landscape, does not require maintenance, and increases the strength of the revetment itself. Since it is in line with the current state of the revetment, it is adopted as the most suitable plan to protect the island itself, including the stone revetment of the Meiji period, from erosion and collapse.

(3) Revetment reinforcement

Three options were considered for the reinforcement method of the revetment main body: reinforcing the land side with concrete, reinforcing the sea side with concrete, and installing wave-dissipating blocks.

In the study, we conducted a comparative study in terms of impact on the remains, impact on the scenery, workability, and cost (Table 6).

Table-6 Reinforcement method review table

Construction plan	(a) reinforcing the land side with concrete	(b) reinforcing the sea side with concrete	(c) installing wave-dissipating blocks
Standard cross section			
Construction method overview	・ A construction method in which concrete is placed on the inner side of the protruding part to reinforce it. ・ The width of the concrete should be more than 6m in order for the protrusion to be safe against the action of waves.	・ A construction method that protects and reinforces existing concrete with tension concrete. Shear strength is also considered. ・ It counteracts the action of the waves with a spur.	・ A construction method that attenuates and dissipates wave energy by installing wave-dissipating blocks in front of the revetment.
Impact on remains	Since there are remains of coal production facilities in many places behind the revetment, reinforcement with a concrete width of 6 m or more is not possible because it would physically interfere.	No effect	No effect
Scenery	The appearance from the sea side does not change, but the scenery from the inside of the island changes greatly.	The appearance from the sea side does not change much because the existing revetment is also made of concrete. The scenery from inside the island remains the same.	The appearance from the sea side changes greatly.
Workability	On-site kneading on the	Construction is	Construction is difficult

	island can be done without being affected by waves, but a yard is required.	difficult because it is affected by waves, but it can be constructed by temporary work such as temporary installation of wave-dissipating blocks at the construction site. Repairs such as filling cracks are not required.	due to the influence of waves. Depending on the size of the wave-dissipating block, it may be difficult to procure a work boat with the necessary construction capacity, and a block production yard is required.
Cost	-	¥3,300,000/m	¥6,200,000/m

From Table 6, "(a) reinforcing the land side with concrete " is a structure that can withstand friction, but the thickness of the concrete is 6m or more depending on the location. It is physically impossible to implement because it interferes with the remains.

Regarding "(c) installing wave-dissipating blocks", it is excellent in that it is not necessary to directly modify the revetment, but in order to attenuate and dissipate wave energy, it is necessary to stack blocks up to the height of the crest of the revetment. There is a large change in the appearance from the sea side, which has a lot of impact on the landscape, and the cost is enormous, so it is not adopted.

Regarding "(b) reinforcing the sea side with concrete ", there is no impact on the remains of the production facility, and since the sea side, which was originally covered with concrete, is reinforced, there is little impact on the landscape, and the above-mentioned crack repair function.

Based on the above, "(b) reinforcing the sea side with concrete " will be adopted.

(4) Decided construction method/Evaluating the impact on attributes that contribute to OUV

As described above, we have conducted repeated studies to prevent the collapse of the revetment, which could have an adverse impact on the Meiji-era masonry revetment and the remains of coal production facilities, which are attributes that contribute to OUV, as well as the physical impact on the landscape and remains on the island. Considering this, we decided on a construction method that requires the minimum necessary intervention. The construction method (Table-7) and the construction cross section (Fig. 14) that summarizes the decision method are as follows.

Table-7 Decision construction method

Damaged area	Adopted construction method
Crack	Cover with concrete
Land cavity (with suction)	Plastic grout injection
Land cavity (without suction)	Cast-in-place concrete
Revetment foundation cavity	Underwater inseparable concrete
Revetment(reinforcement)	Cover with concrete
Sediment runoff behind the revetment	Drainage improvement + Cast-in-place concrete

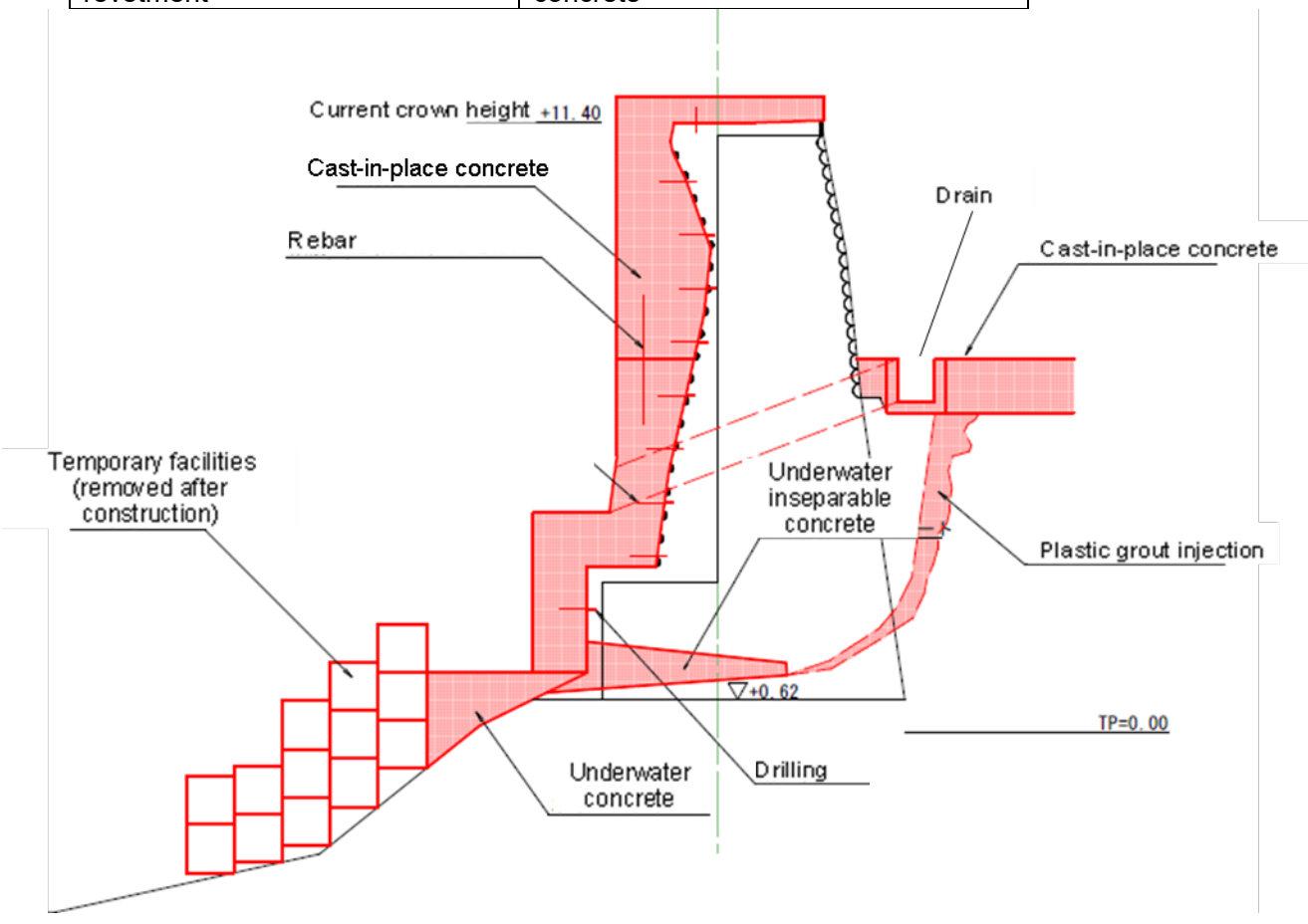


Figure-14 Basic cross section of revetment design

Reinforcement of the seawall by the above method can avoid the adverse impact of damage to the Meiji period masonry revetment and coal production facility remains, which are attributes that contribute to OUV, due to the collapse of the seawall, which has been a concern.

This study was conducted in line with the screening process. In order to realize both the conservation work of the Hashima revetment and the OUV, we

have repeatedly considered. As shown in this report, we considered the best of several alternatives to determine the best possible maintenance method, including minimizing OUV impact. This study was conducted with the advice of an external expert.

The primary attribute potentially impacted by the proposed works is the Meiji-era sections of revetment. When fully implemented, the works will stabilise the revetment which includes these sections, thereby conserving them in situ. The post-Meiji external face of the revetment, facing the sea, will be obscured where the new reinforcement wall is installed. This will have a limited visual impact, especially until the new concrete weathers. However, in time, it is likely to present a sympathetic finish which will not be noticed.

4 Construction plan

(1) Construction implementation plan for 2023

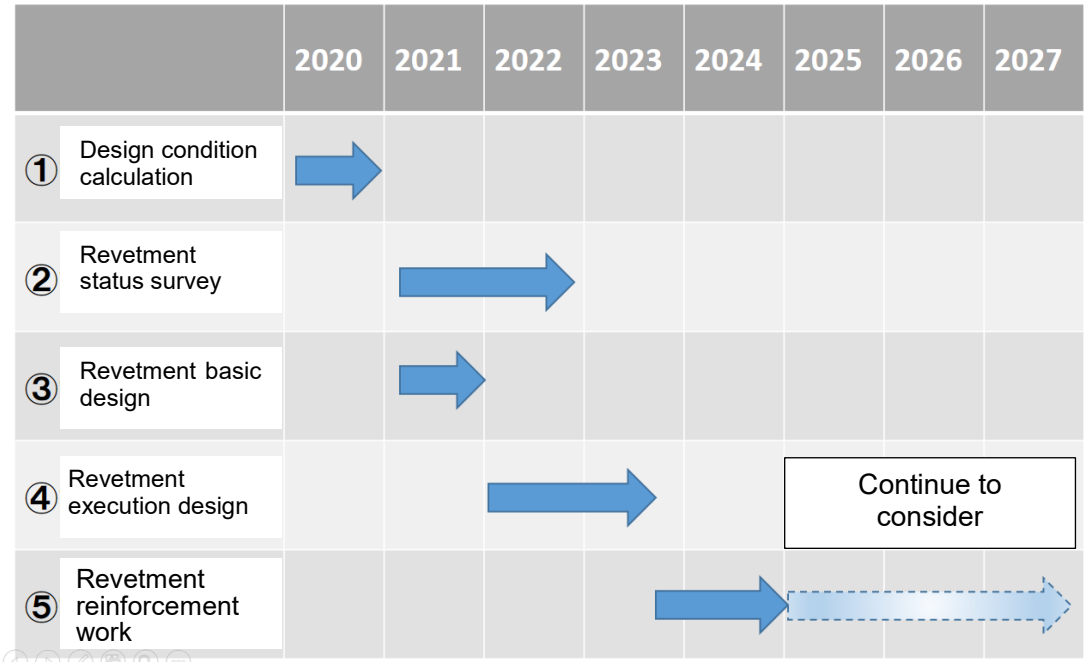
Detailed blueprints and construction plans are currently being prepared for two of the highest priority locations. They are scheduled to be completed around the fall of 2023. Therefore, we plan to start construction by the end of fiscal 2023.

(2) How to preserve and maintain revetments after 2024

As can be seen from the results of the survey of the current state of the revetments mentioned above, there are sections of revetments that are in a serious state of deterioration other than the two locations where construction is scheduled to start in 2023.

Based on the status of the construction work to be carried out in FY2023, we will continue to plan for the appropriate preservation and maintenance of other revetment.

Table-8 Implementation status and future plans for revetment development on Hashima



PROGRESS STATUS OF PROJECT PROPOSAL CONCERNING THE IMPERIAL STEEL WORKS

PROJECT PROPOSAL FOR THE IMPERIAL STEEL WORKS, COMPONENT PART OF THE "SITES OF JAPAN'S MEIJI INDUSTRIAL REVOLUTION: IRON AND STEEL, SHIPBUILDING AND COAL MINING"

PREFACE

The purpose of this report is to give an update on the project proposal reported in 2021 for the Imperial Steel Works, a component part of the "*Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining*." That report dealt with three buildings , however implementation of the plan to use the Head Office Building as a visitor facility, and the final planning for the implementation of seismic strengthening and conservation works at the Repair Workshop are as yet not finalised, and will be reported on in subsequent years as works are proposed. The seismic strengthening of the Former Forge Shop and related conservation works are proposed to commence in the next year, and this project is the subject of this report.

The Former Forge Shop project has been subject of a process over a number of years that has looked at the need for seismic reinforcement, the contribution of the Former Forge Shop as an attribute of OUV, and potential impacts of the works options on OUV and how to avoid or minimise them. It was, in effect, screening as part of an HIA process, amounting to a tailored HIA within the meaning of the 2022 *UNESCO/ICOMOS Guidance and Toolkit for Impact Assessment in a World Heritage Context*, that worked to refine the proposal to the point where a full HIA was not required. The process, which avoids or mitigates any adverse impact on the Outstanding Universal Value of the property, is summarised here and is submitted to the World Heritage Committee in response to the ICOMOS technical review provided by the World Heritage Centre in October 2021, in accordance with the Operational Guidelines, Paragraph 172.

1. PROJECT PROGRESS STATUS – FORMER FORGE SHOP

1.1 Contribution to OUV

The Former Forge Shop is one of the buildings that is an attribute of the Imperial Steel Works, Yawata, the first fully integrated steel works to be built successfully in Asia. The Imperial Steel Works group of three buildings, of which the Former Forge Shop is one, comprises one of the 23 component parts of the World Heritage "Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining."

The Imperial Steel Works at Yawata relates to the "iron and steel" aspects of this industrial revolution. Steelmaking took place in these facilities at the time Japan was emerging as an industrial nation in the last stage of its ongoing industrial revolution.

The management plans indicates that the Former Forge Shop:

> ‘Reflects one of the original functions of the steelworks, the original foundry function, necessary to the autonomous development of the steelworks, and the subsequent adaptation for materials testing. While its structure has been changed over time, the core building can still be recognized, and the changes it demonstrates echo the continuing expansion and refinement of the steelworks, and the adaptation of transferred technology to meet evolving local needs for these component parts make clear their contribution to the Outstanding Universal Value (OUV) of the property.’

1.2 Context of report – as a response to the ICOMOS Technical Review October 2021.
The October 2021 ICOMOS Technical Review states that:

> The proposed seismic reinforcement of the Former Forge Shop and Repair Shop was reported by the State Party in February 2019. This latest report states that the design will minimize impacts as much as possible and that exterior improvement works will be synchronized with the seismic reinforcement work. However, information on the extent and detail of this work was not provided, and it is advised that the State Party submits these details to the World Heritage Centre.

This report provides that additional detail.

1.3 Project description

The structure of the building, with steel frames supporting un-reinforced slag-brick wall panels (made in the steel works), combined with large window areas, makes it prone to earthquake damage. Earlier earthquake damage has resulted in the replacement of the metal roof and the collapse of the eastern slag-brick wall, it being replaced in 2005 with metal cladding. These facilities were found to have inadequate seismic performance in deterioration surveys in FY2014, building surveys in FY2016, and aseismic diagnosis in FY2017. Seismic strengthening design work was carried out in FY2018 based on these studies. Based on the seismic analysis, and the necessity of minimising potential impact on the building as an attribute of OUV, the seismic strengthening has been designed to support the building while reducing intervention in the existing building fabric as far as is feasible. Even with the degree of seismic strengthening proposed, a severe earthquake may still result in the collapse of some slag-brick wall panels, but the main structure will likely be protected allowing for reconstruction of any damaged cladding.

The proposed seismic strengthening framework is to be built free-standing within the building, rather than replacing or duplicating original building elements, and will be connected to the existing structure only at two points on each existing steel wall frame and to the roof trusses to provide stability. The design places the main supporting columns parallel to, but stepped back from the existing steel frames of the original building. The design has been modified to limit the number of columns needed, and the rhythm of the original frame location will be repeated, leaving the space between frames open. Beams link the new columns to a pair of steel ring beams circling the building at two heights, these in turn being tied to the original frames by way of clamp connections that limit intervention on the original fabric. Concrete foundations for the new columns are to be positioned inside the building so as not to disturb the original foundations and wall bases. Building the new foundation will require excavation of sections of the floor area, and tests have been done to devise a method of removing the encaustic ceramic tiles, that form the floor finish of the 1917 testing laboratory, without damaging the tiles, enabling their re-laying once the foundations have been laid. Visible disturbance will then be limited to the points where the new columns penetrate the floor. The

design of the seismic strengthening frame ensures that no reinforcing members cross window spaces or modify the raised clerestory on the roof.

A brick dividing wall separates the tile-floored test laboratory space at the eastern end of the building from the storage area to the west. The lower level of this wall is original to the 1917 reconfiguration of the building, while the upper section is an asbestos-containing post-1935 extension. Laying foundations and positioning columns at the point of level change between the two sections of the building will require removal of the asbestos-containing upper wall, which will not be replaced, and deconstruction of part of the lower wall to allow for the seismic strengthening work to proceed. The lower wall sections will be reconstructed after work is completed, maintaining the sense of enclosure of the testing laboratory space.

The steel frame members located around the wooden window frames and slag-brick walls have corroded at several points. The exterior steel surfaces of the frames have rusted because of exposure to wind and rain for many years. Rainwater has penetrated into the gaps between the steel frame and slag-bricks, or between the steel frame and wooden fittings, and steel corrosion progressed on the inside as well. Wooden window frames have heavily deformed at three spots on the north side, probably because the supporting steel frame members around the wooden windows could not withstand the effects of strong winds, such as typhoons, and have also lost strength progressively due to thinning caused by corrosion. The steel frame members exposed on the exterior walls will be cleaned and painted with anticorrosive coating, and any gaps filled with watertight seal and grout. This work will minimise any strength reduction due to corrosion thinning. The more heavily corroded steel frame will be replaced with new components.

The weight of the slag-brick wall on the wooden window frames, which has contributed to the deformation issues, will be supported by the beams of the new internal steel frame structure. This will prevent the deformation and collapse of the wall due to the strength reduction of the original steel frames, and will protect against earthquake-induced loads and movement.

1.4 Associated conservation works

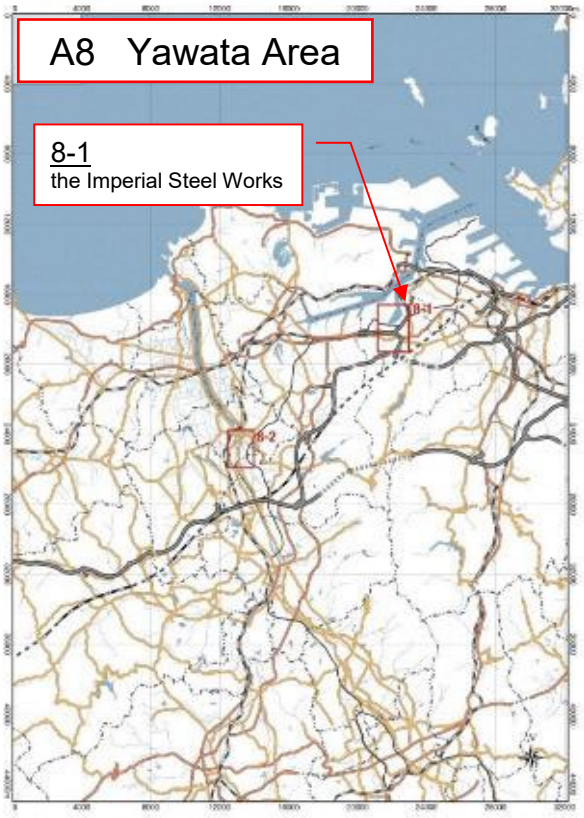
The archives of the Nippon Steel Corporation's Imperial Steel Works, currently housed in the building, will be relocated to a secure archival facility within the steelworks for their ongoing protection.

When the seismic strengthening frame is in position, a range of conservation works will then be able to be undertaken:

- The tile floor will be repaired as described above.
- The window frames will be repaired or elements replaced where beyond repair with elements of the same design. Exposed and corroded steel frame and window members will be treated or replaced if beyond viable use.
- The slag-brick wall panels, most of which are cement rendered, will be gently cleaned, repointed as needed and stabilised, but without removing the patina that characterises the industrial nature of the building.
- Door entries that require enlarging to enable the seismic works to take place will be reconstructed to their original configuration.

- External piping, gutters and downpipes, and conduit frames will be cleaned and stabilised, and repaired if still operational, to maintain the historic visual character of the façades, and to ensure effective roof drainage.
- The existing roof and east end-wall metal cladding, replaced after earthquake damage in 2005, are in good condition and will be maintained.

Former Forge Shop (view of west side)



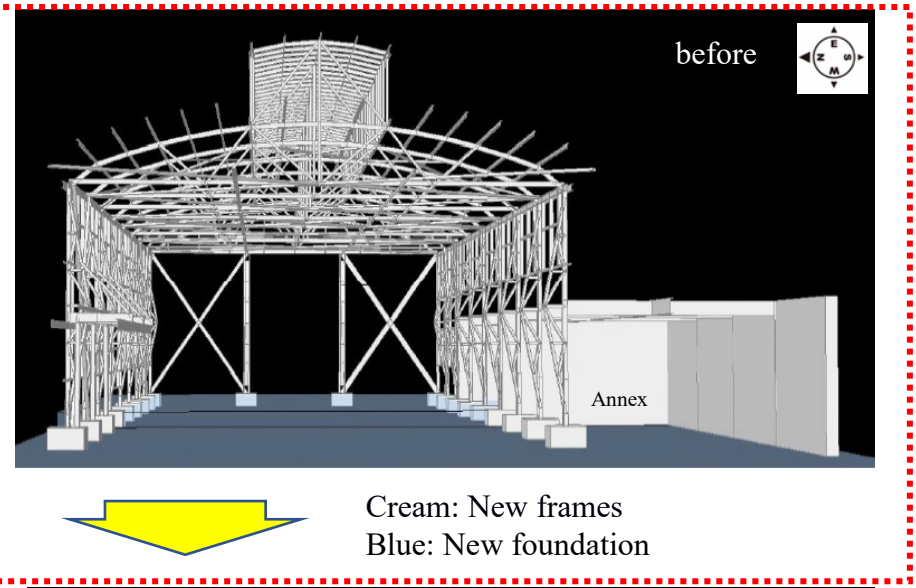
2. Images of proposed seismic reinforcement method

2.1 Image of conservation (west → east)

A. Current status photo

This facility has been in use as an archive of historical documents and other materials created during the operation of the steelworks. Reinforcing it in compliance with the current safe specifications would require doubling the number of steel columns for reinforcement, leaving space only in the central portion. Future use, as yet to be decided, must take into account the smaller floor space available.

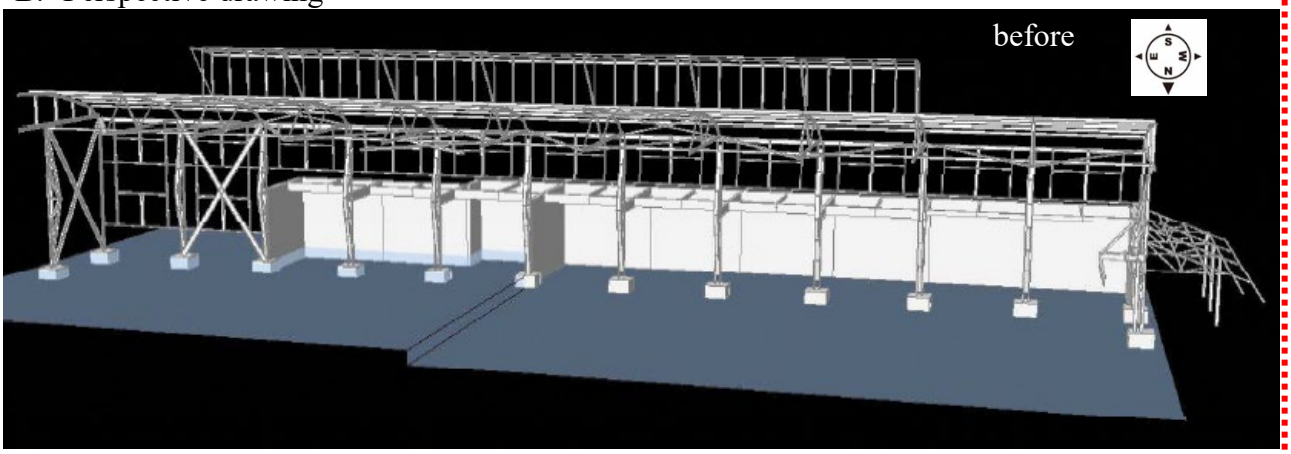
B. Perspective drawing



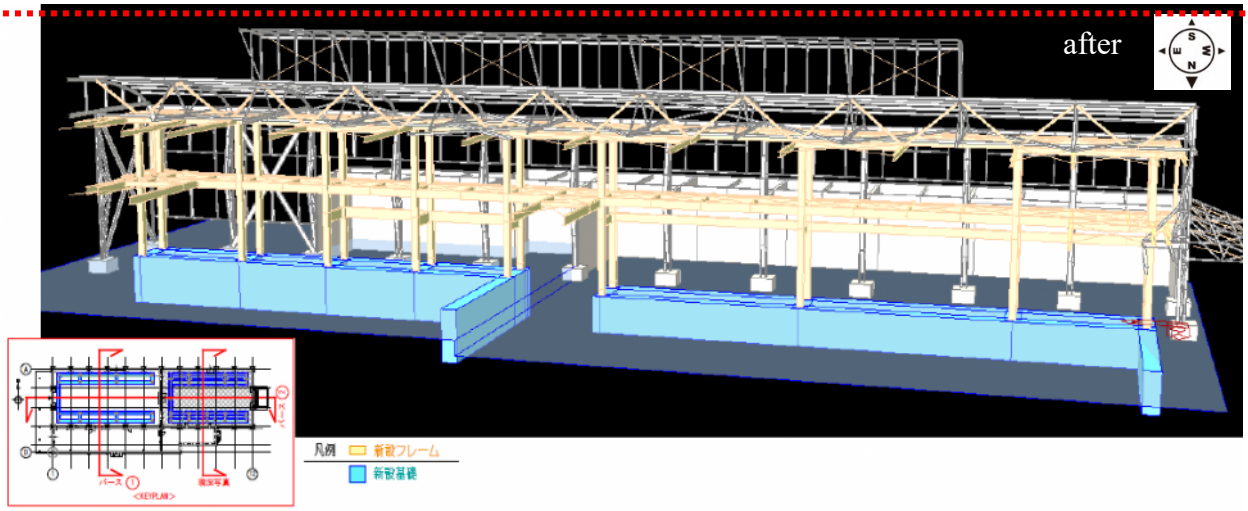
2.2) Image of conservation (north → south)

A. Current status photo

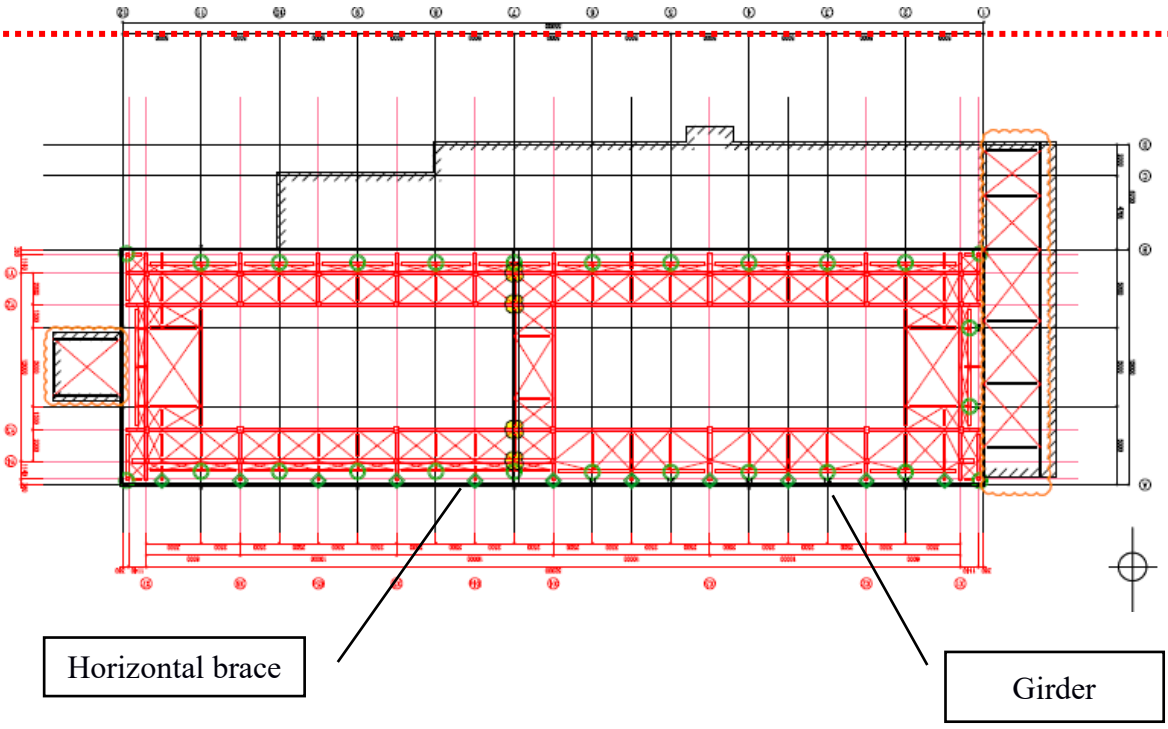
B. Perspective drawing

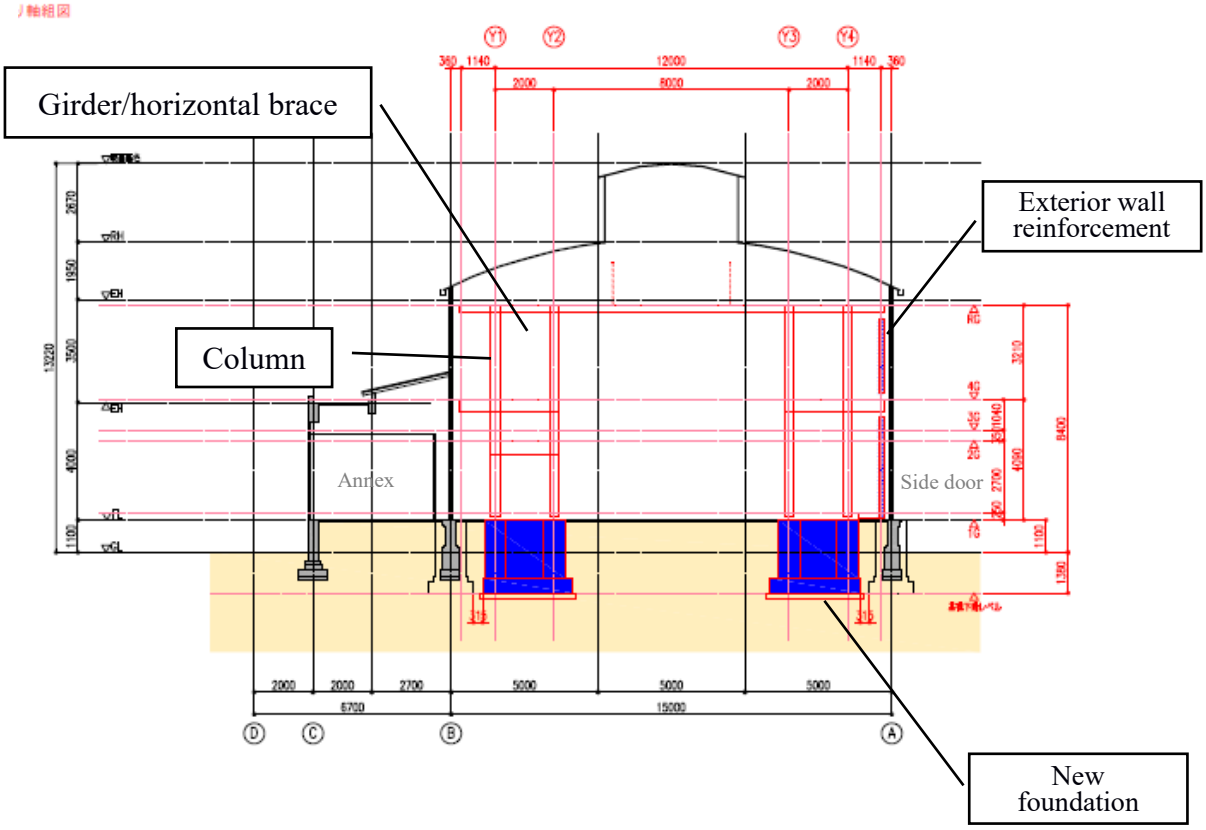


Cream: New frames
Blue: New foundation



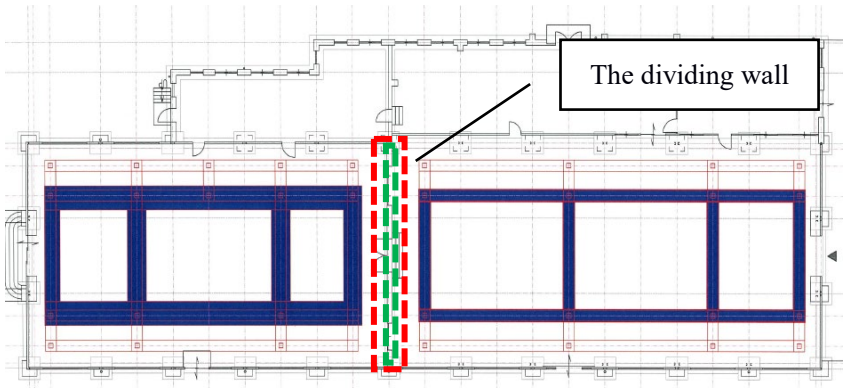
2.3 Working drawing

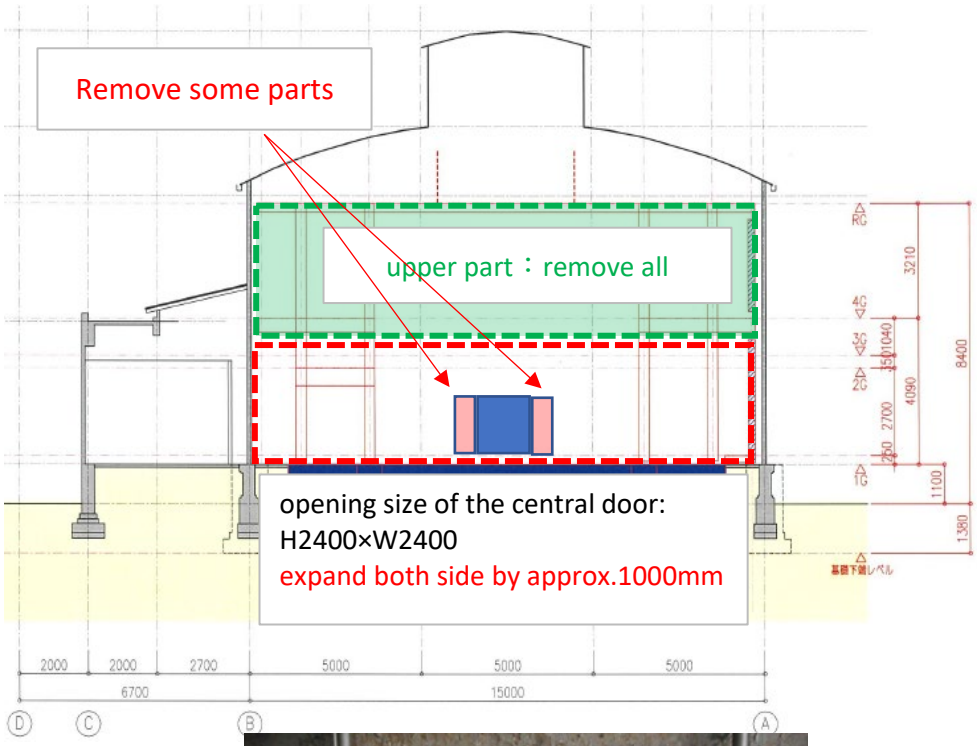




Note: Red for new reinforcing members and blue for new foundation

2.4 The dividing wall



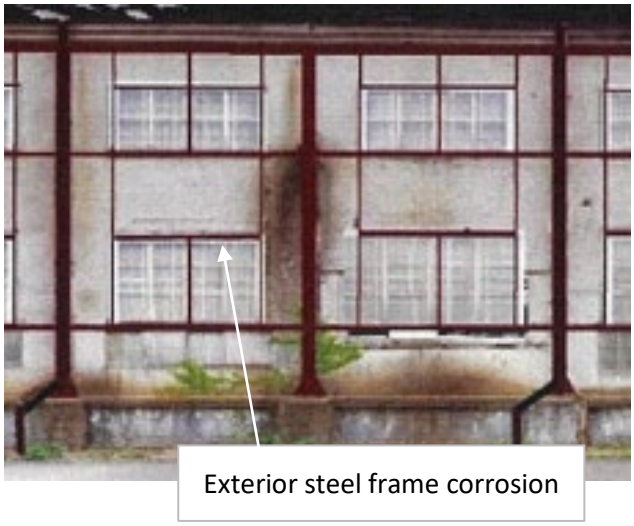


Remove some sections temporarily, then rebuilt after seismic reinforcing works

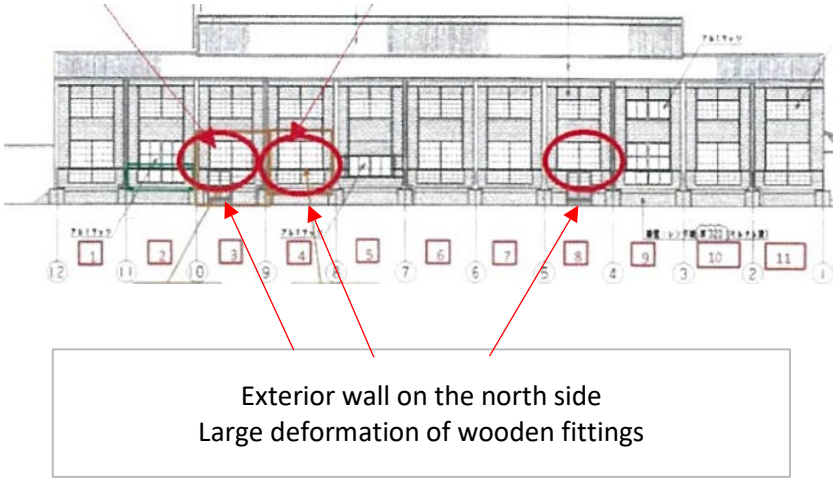
2.5 The exterior wall reinforcement

2.5-1 Current deterioration

A. Overall deterioration of the exterior walls



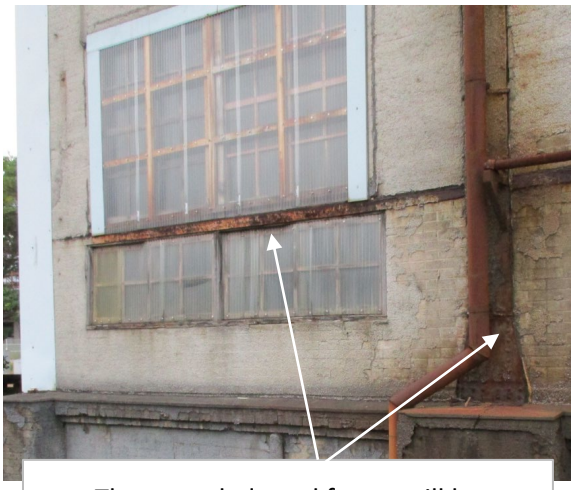
B. Partial deterioration of exterior wall



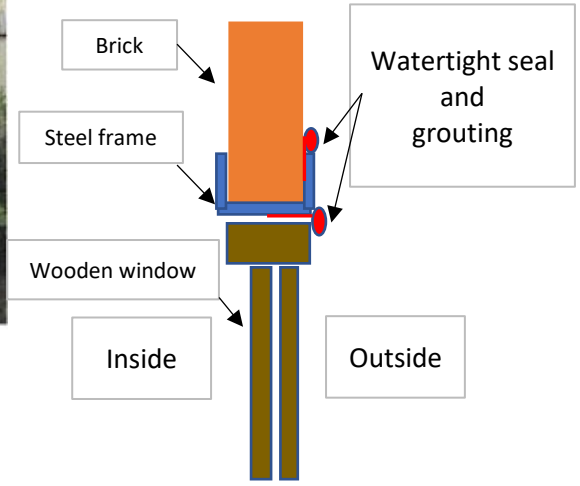
2.5-2 The Exterior wall reinforcement

Before

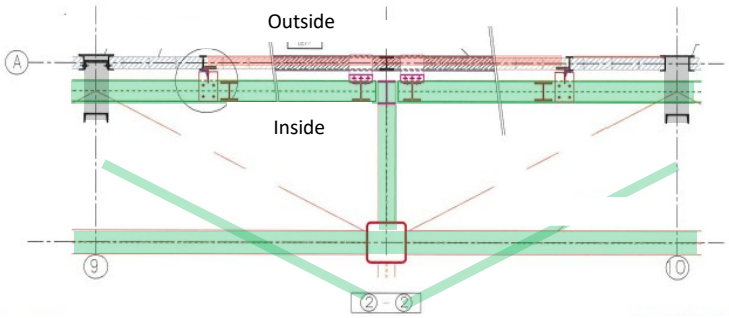
After anticorrosive coating



The corroded steel frame will be painted.



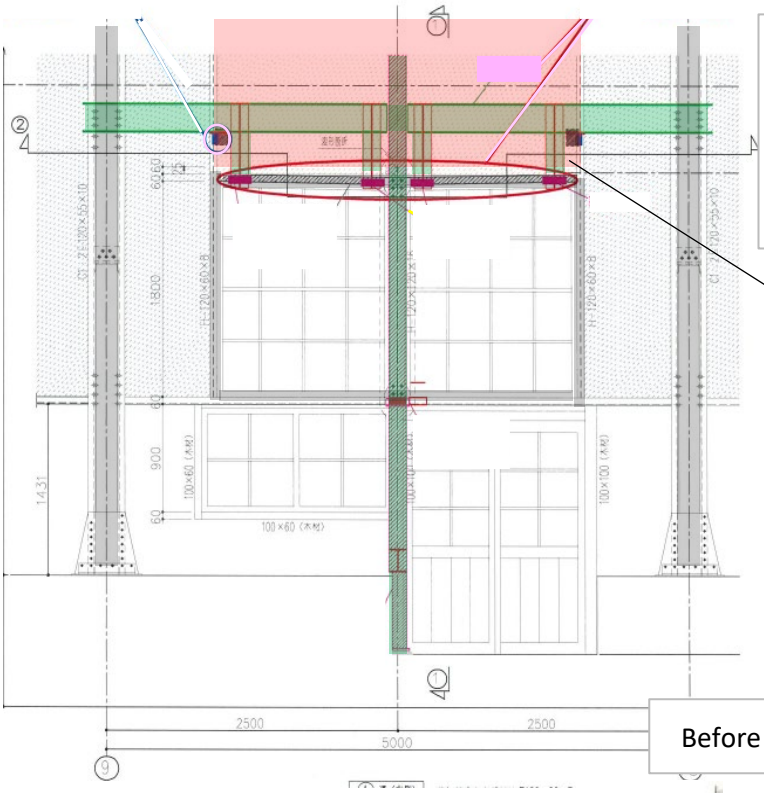
Red parts：All upper slag-brick wall will be reinforced.



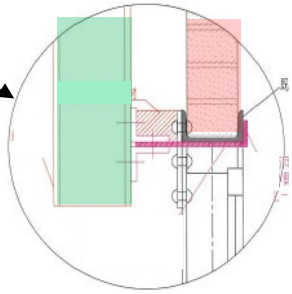
Red ：upper slag-brick wall

Green：new steel frames

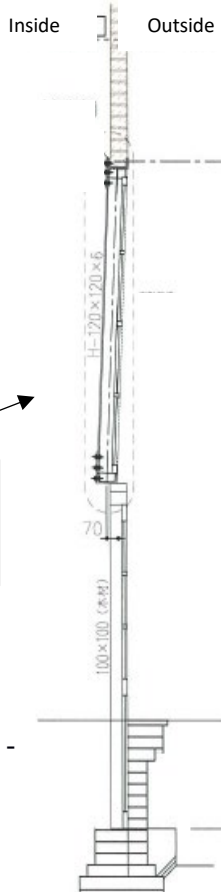
gray：existing steel frames



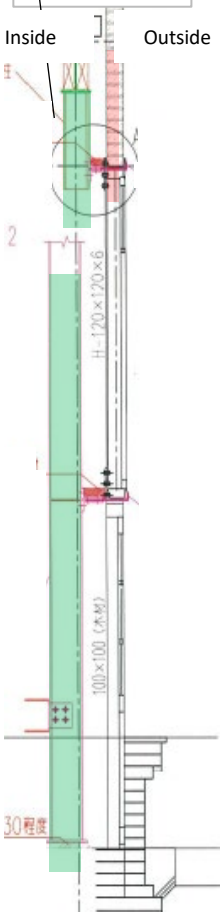
Detail of supporting part
The lower part of the brick wall will be supported at four points by a new steel frame.



Before



After



Heavily deformed wooden fitting

3. Consultation processes

Conservation and management of the buildings of the Imperial Steel Works are carried out in cooperation with stakeholders, based on the *General Principles and Strategic Framework for Conservation and Management* formulated by the Cabinet Secretariat. Nippon Steel Corporation, the owner of the property, drew up policies and plans in consultation with experts, and having obtained approval of the Yawata Local Conservation Council (Kitakyushu City and Nakama City, Cabinet Secretariat, etc.), reported the project proposal to the World Heritage Centre jointly with Kitakyushu City and Nakama City ("the municipalities"). Work was begun following an ICOMOS technical review provided by the Centre. Thereafter, the detailed specifications were decided while consulting with experts on engineering matters involved in the actual design work. As the design work proceeded, progress reports were submitted for approval to the Yawata Local Conservation Council. The reporting and approval process with these institutions will continue as the conservation work is carried out.

Representatives of these institutions, as well as of the owner, Nippon Steel Corporation, are also members of the planning group responsible for drafting this project proposal.

4. Further considerations

The current use of the Forge Shop is to store the archives related to the use of the Imperial Steel Works. The building is no longer regarded as suitable for the environmentally controlled conservation of these archives, and they are to be removed to another more suitable repository within the steelworks. The later lightweight partitioned rooms within the building that stored the collection will be removed, but the annex building to the south that also contained archives will be retained.

Future use: The seismic strengthening frame introduces more columns into the interior of the Forge Shop, reducing the area of floorspace available for effective use. It is unlikely that the building could be used for operations related to the steelworks production and maintenance. The consideration of future uses continues, and will be better able to be ascertained when the seismic works has been completed and the range of potential uses explored. Public interpretation in the future is a possibility, but at present is not feasible given the ongoing industrial operations surrounding the building. Until a new use is determined the building will be maintained in its stable, post-seismic-works conserved condition.

5. Assessment of potential impact on OUV

The extent of the seismic strengthening work is substantial, however its design has been aimed at avoiding or minimising its potential impacts on OUV. The seismic strengthening framework is to be located free-standing within the building, and connected to it at the absolute minimum number of points, and in a way that minimises intervention in the original fabric. The building's walls and roof will remain intact and be very little impacted by the work, and the seismic strengthening will not be visible from outside the building, where most visitors will experience it.

The floor area will be impacted by the necessity to excavate new foundations for the seismic strengthening framework. The building site had no former use, so the only possible archaeological remains relate to the construction of the Forge Shop itself. The excavation of the foundation trenches will follow archaeological testing and where necessary supervision. The extent of the impact will be minimised by creating slit trenches for the foundations, and

mitigated by carefully removing and relaying the encaustic ceramic tiles that make up the floor finish of the eastern half of the building. In the western half the floor is concrete that will be taken back to a similar finish.

The new columns and beams of the framework will be very evident within the building, but the overall scale of the interior space will still be visible, and in fact be made more visible with the removal of the lightweight partitioned rooms that currently fill half the space at floor level. The wall separating the eastern and western sections of the building, and defining the space of the testing laboratory established after 1917, will be retained and any sections deconstructed to enable works to take place will be reconstructed. The later upper section, which is of little significance in the industrial history of the building and contains asbestos, will not be replaced.

The conservation work on the building walls and windows will ensure the protection and ongoing survival of the structural elements, but will be subtle so as to retain the industrial character of the building, which is viewed in association with the adjacent Repair Workshop, and it will stand in contrast to the high-status and commercial rather than industrial character of the First Head Office building across the street.

It is assessed that the proposed seismic strengthening works and associated building conservation works will have minimal impact on OUV, and where it does these will be mitigated (as in the case of floor penetrations). The proposed works will ensure the conservation of the integrity and authenticity of the building and will enhance its presentation to the visitor as a cared-for element of the Imperial Steel Works contributing to the OUV of the *Sites of Japan's Meiji Industrial Revolution.* The seismic strengthening works are also reversible if superior options become available in future years.