michael kloos planning and heritage consultancy

FINAL REPORT

HERITAGE IMPACT ASSESSMENT (HIA) OF THE " PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANDBROGATEN" ON THE WORLD HERITAGE PROPERTY BRYGGEN IN BERGEN


photo: Philipp Tebart/ mkphc

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Colophone

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Content

ABSTRACT

Background and Working Process

Bergen developed a Green Strategy with the overall goal to support sustainable urban development and to develop into a fossil free municipality. This strategy promotes zero growth in vehicle traffic and decrease of traffic by at least 20 % from 2013 to 2030.

In this context, the Bybanen light-rail network, opened in 2010, functions as the backbone of the city's future sustainable public transport system as it is meant to link the different parts of the city together. Three Bybanen lines are currently in operation and a fourth one is planned to be opened in November 2022. To extend this network, Bergen Municipality plans currently a fifth light-rail line which is meant to link Åsane, located in the north of Bergen, to the city centre.

Partly, this planned light-rail extension is planned to be located in the immediate proximity to the World Heritage Property *Bryggen*. Bryggen, located in Bergen's city centre, was inscribed in 1979 in the World Heritage List as a type of northern "fondaco", unequalled in the world, where the structures have remained within the cityscape and perpetuate the memory of one of the oldest large trading ports of Northern Europe.

Regarding this background, a Heritage Impact Assessment (henceforth: HIA) has been commissioned in 2020 by *Byantikvaren*, representing the Municipality of Bergen, so as to evaluate positive and negative impacts of the planned Bybanen light-rail extension on the World Heritage property Bryggen.

In this context, a first HIA PRELIMINARY REPORT was submitted to Bergen Municipality on 16 October 2020 and a supplemented HIA PRELIMINARY REPORT was submitted to Bergen Municipality on 30 September 2021.

Objective and methods of this HIA REPORT

Regarding this background and working process, the objective of this HIA report is to evaluate from an independent perspective the impacts and risks of the modified design proposal of the planned PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN on the OUV of the World Heritage property Bryggen. Both positive and negative impacts are to be assessed. In case of negative impacts and risks recommendations are to be provided how to mitigate such negative effects.

Throughout the assessment, this FINAL HIA REPORT PLANFORSLAGET distinguishes

- Impact Assessment (Chapter 5)
- Risk Assessment (Chapter 6)

This separation is necessary because not all direct impacts on the structure of World Heritage property Bryggen are known at present. Therefore, the assessment grades here potential risks.

Throughout the PRELIMINARY HIA REPORTS, the magnitude and severity of positive and negative impacts of the planned Bybanen light-rail on the World Heritage property Bryggen was assessed in line with the *2011 ICOMOS Guidance for Heritage Impact Assessment for Cultural World Heritage Properties*. According to this 2011 ICOMOS Guidance, impacts were graded on a score of 'no change' to 'major change'. The latter grade indicates a very severe impairment of the OUV.

The *2011 ICOMOS Guidance for Heritage Impact Assessment for Cultural World Heritage Properties* was updated in 2022. According to the new *Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context 202*2 impacts are to be evaluated in four categories, the grading "very large positive / very large negative" does not exist. In order to make the assessment carried out throughout this FINAL HIA REPORT PLANFORSLAGET comparable to the ones carried out earlier, it was decided to apply the assessment table suggested in the ICOMOS Guidance 2011. Otherwise, the methods applied throughout this FINAL HIA REPORT PLANFORSLAGET follow the 2022 *Guidance and Toolkit for Heritage Impact Assessments.*

Results

The assessment lead to the following results:

Impact Assessment:

Concerning the ***functional impact on quantity of traffic of vehicles and noise (number of cars, bus, light rail and cycling)*** the planned removal of car and bus traffic (or reduction of bus traffic at Torget respectively) and the planned coherent urban design have a positive impact on the continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout. Similarly, the quality of the public spaces is improved. However, the implementation of light rail traffic will have negative impacts due to the length and height of light rail cars, as well as the frequency of light rail traffic. In total, functional impacts are graded **slight / moderate positive**. At Øvregaten, the impact of the planned removal of car traffic and the constant number of public transport buses is assessed as **moderate positive**.

- Concerning the ***functional impact on walkability and accessibility of World Heritage property Bryggen*** (Torget, Bryggen Quay) the planned removal of buses and cars, the coherent new urban design with lighting plan Torget – Bryggen and with priority for pedestrians and cyclists, as well as the planned new light rail stops are assessed as **moderate positive.** At Finnegården, where the Quay is very narrow, the relation of the Hanseatic Office with its quay is compromised due the high frequency of Bybanen traffic combined with the length and height of Bybanen cars the impact on walkability and accessibility was assessed as **moderate negative**. At Øvregaten, the planned light rail stop at Sandbrogaten providing access to Mariakirke and Bergenhus area was assessed as **large positive**.
- With regard to ***functional barriers*** the impacts at Torget were assessed as moderate positive due to the coherent new urban design improving the quality of public spaces, the removal of car traffic, the reduction of bus traffic while the high frequency of Bybanen traffic combined with the length and height of Bybanen cars has a negative impact. In total, the impact was assessed as **moderate positive**. Also at Finnegården, the coherent new urban design with priority for pedestrians and cyclists improves quality and use of public spaces. But functional barriers appear due to the planned cycle paths combined with tram track in the immediate vicinity of the entrance of Hanseatic Museum, leading to an assessment in total as **moderate negative**. At Bryggen Quay, the new coherent urban design improves the quality and use of the urban space. Barrier effects during large festivities can be avoided due to turns around of Bybanen at Sandbrogaten and Kaigaten. However, due to the length, height and frequency of light rail cars, barrier effects appear compromising the maintained built structure of the Hanseatic Quarters and their relation to the quay, leading to an assessment of **moderate negative** in total. At Øvregaten, the removal of car traffic reduces existing barrier effects and strengthens the relation between Bryggen and medieval wooden Bergen. However, there are conflicts with tourist buses here leading to an assessment of **slight positive** in total.
- With regard to visual impacts, the coherent new urban design without high-voltage line and masts will ameliorate the public space and urban quality. However, the length, height and frequency of light rail traffic causes negative visual impacts. This is especially true for the iconic view of Bryggen from Strandkaien, where the upgraded public spaces cannot be seen, thus leading to a **large negative** impact. The night view from Strandkaien was assessed as **moderate negative** as the new lighting system, balancing and sharpening the contour of illuminated Bryggen which can still be perceived as one coherent property, is assessed as **moderate negative**. Similarly, visual impacts are assessed as **moderate negative** from all other viewpoints.

Risk Assessment:

- At *Finnegården*, where a concrete basin around the foundations has been established potential impacts due to groundwater changes have been assessed as **slight negative**.
- At *Bryggen Quay*, a stabilizing pile wall is meant to minimise risks due to groundwater changes. But archaeologic surveys are not yet completed and potential risks due to vibrations caused by operational activities of Bybanen cars are still to be investigated. Consequently, remaining risks are assessed as **large negative** (Note: These remaining risks also exist at Bryggen Quay at Finnegården).

- At *Øvregaten* heavy traffic might increase during constructions, but the load bearing capacity has been already investigated and considered as adequate. Potential risks due to vibrations caused by operational activities are still to investigated. Consequently, the impact has been assessed as **moderate negative**.
- At *Sandbrogaten / Sandbrogaten Tunnel* archaeological surveys on cultural layers of very high value are not yet completed. Ground investigations for Sandbrogaten tunnel show very low permeable bedrock, there is a risk for leakage and changes in the groundwater levels without mitigation methods. A larger pit will be required during the construction phase and potential risks due to operational activities are still to investigated. Consequently, potential risks have been assessed as **large negative**.
- With regard to potential impacts due to sea water rise and flooding, the planned establishment of a pile wall was assessed as **slight positive**.

General conclusions

As a general conclusion, the Bybanen light-rail (daylight option) has both beneficial and adverse consequences for the World Heritage property Bryggen. Considerable work has been done to reduce the adverse consequences and enhance the more beneficial ones. **None of the assessed impacts were assessed as very large negative (=loss of OUV). Consequently, the following recommendations address the reduction of large negative impacts, as well as the protection of the setting and to ensure the support of central management goals of the World Heritage property.**

In this context, it has to be noted that the indicated **large negative visual impacts due to the length, height and frequency of Bybanen cars from viewpoint Strandkaien cannot be reduced** as all possible mitigation measures were already applied. However, this large negative impact will not appear during large festivities when Bybanen will turn around at Sandbrogaten and Kaigaten.

Consequently, the planned removal of high-voltage line and masts is considered as absolutely necessary to safeguard the iconic view of Bryggen from Strandkaien which then can still be enjoyed when Bryggen Quay is closed for Bybanen traffic.

Recommendations

Recommendation 1: Monitoring risks for groundwater-balance and archaeological deposits at Sandbrogaten and Bryggen Quay

The impact assessment carried out throughout this report showed that large risks are existing at Sandbrogaten and Bryggen Quay regarding the structural integrity of these archaeological deposits. Moreover, the construction of the tunnel at Sandbrogaten could cause large risks with regard to the groundwater balance.

Consequently, it is recommended to

►DEVELOP a coordinated risk management program which clearly shows that risks for archaeologic deposits and especially for groundwater balance at both Bryggen Quay and Sandbrogaten can be eliminated during constructions and permanent phase.

► ESTABLISH a coordinated monitoring plan along the light rail project including all relevant stakeholders, coordinated by Riksantikvaren.

Recommendation 2: Definition of a Buffer Zone for the World Heritage property Bryggen

Bergen Municipality has done considerable work to provide a solid basis for the definition of the future buffer zone in recent years so that the planning process to define its boundaries can be started.

Consequently, it is recommended to

►DEVELOP further the buffer zone concept in close cooperation with the stakeholders

►ESTABLISH a permanent coordination mechanism between the stakeholders to ensure the understanding of the World Heritage value and the implementation of the buffer zone measures and recommendations (e.g. an extended Fagrådet / Council of specialists)

►INVESTIGATE and clarify the potential advantages and disadvantages of the Bybanen project for the management of the World Heritage property to develop supporting and mitigation measures.

►GENERATE as soon as possible a map showing all attributes related to World Heritage property Bryggen, identify important sightlines from and to the World Heritage property, as well as between the mapped attributes, identify both threats and potentials in this area and define boundaries of the potential World Heritage buffer zone on this basis.

►CLARIFY how the potential buffer zone can be protected with legislative instruments

Recommendation 3: Development a visitor management strategy for the World Heritage Bryggen and its buffer zone

Generally, it can be stated that much effort has been taken by Municipality of Bergen as well as other stakeholders in the city to make tourism more sustainable. Yet, it is not clear how the Bybanen light-rail concept at Bryggen supports these efforts. The Trafikkplan sentrum[1], aims at car free inner city and thereby contributes to creating a viable and attractive urban environment in the centre of Bergen. However, it stays unclear how Bybanen affects other types of mobility, such as cruise ship mass tourism and tourist buses with a special focus on the values of the World Heritage property Bryggen and its buffer zone.

Consequently, it is recommended to

►DEVELOP a comprehensive mobility strategy for the World Heritage property Bryggen and its buffer zone which provides clear guidance for a sustainable visitor management

►IDENTIFY how Bybanen and soft road users will affect mobility in Bryggen and the above-mentioned challenges respectively (e.g. reduction of numbers of tourists).

►CLARIFY in this concept how numbers of tourist buses at Bryggen are planned to be reduced and where parkings for tourist buses are going to be provided.

►INTEGRATE in this concept aspects such as

- Goods transport
- Accessibility for the disabled
- Space and routing for pedestrians and cyclists
- Development of the Vågen harbour and the quays for private and commercial maritime activities
- Implement monitoring tools for visitor and mobility mapping

Recommendation 4: Refine Safety Concept for public spaces at Hanseatic Museum and Bryggen Quay

In general, the visualizations provided in this report show that the cohesive design approach in front of Bryggen and the Hanseatic Museum improves the quality of the public spaces in front of World Heritage property Bryggen. However, this design varies from Bybanen's general design manual requirements for marking of safety zones with a standard "white lining". Besides, applications for approval of changes from standard road design requirements have still to be approved.

Consequently, it is recommended to

►SHOW clearly how the safety concept avoids possible safety risks between the various traffic modes (Bybanen light-rail, cyclists, scooters, and especially pedestrians) are avoided during day- and night times.

►SHOW clearly how the safety concept is managing security of large tourist groups on Bryggen Quay and at Hanseatic Museum.

►INFORM all stakeholders thoroughly about this safety concept.

[1] Miljøløftet (26 April 2022): Trafikkplan sentrum. Temaplan for trafikksystemet i det sentrale byområdet I Bergen

PART I BACKGROUND

1 Background, Working Process and Objective of this Heritage Impact Assessment

1.1 Background

Norway currently follows a zero-growth policy with regard to carbon emissions for large cities. Growth of passenger traffic should be covered by public transport, cycling and walking, while carbon emissions caused by motorised traffic should be reduced to a minimum extent. Consequently, Bergen, the region capital of Vestland County and the second largest city in Norway, developed a Green Strategy with the overall goal to support sustainable urban development and to develop into a fossil free municipality. This strategy promotes zero growth in vehicle traffic and decrease of traffic by at least 20 % from 2013 to 2030. With the aim to achieve this national zero growth policy, «Miljøløftet» was formed as a collaboration between the national government (The Norwegian Public Roads Administration and others), Vestland county, Bergen and its surrounding municipalities.

Bergen is located in a mountainous region (“the city between the mountains”). For hundreds of years, the sea was the most important transport route to and from the city. This changed rapidly when Bergen was first connected by train to the east of the country and later, during the 20th century, car traffic arrived. Bergen, which at first had developed as a compact city around the harbour area, developed quickly into suburbanised region connected mainly by motorised traffic.

In this context, the Bybanen light-rail network, opened in 2010, functions as the backbone of the city’s future sustainable public transport system as it is meant to link the different parts of the city together. One Bybanen line is currently in operation and a second one is planned to be opened in November 2022. To extend this network, Bergen Municipality plans currently a third light-rail line which is meant to link Åsane, located in the north of Bergen, to the city centre.

Fig. 1.1a/b: Bergen, seen from Ulriken, and City Map of Handberg showing Bergen in 1864 (Fylkeskomune)

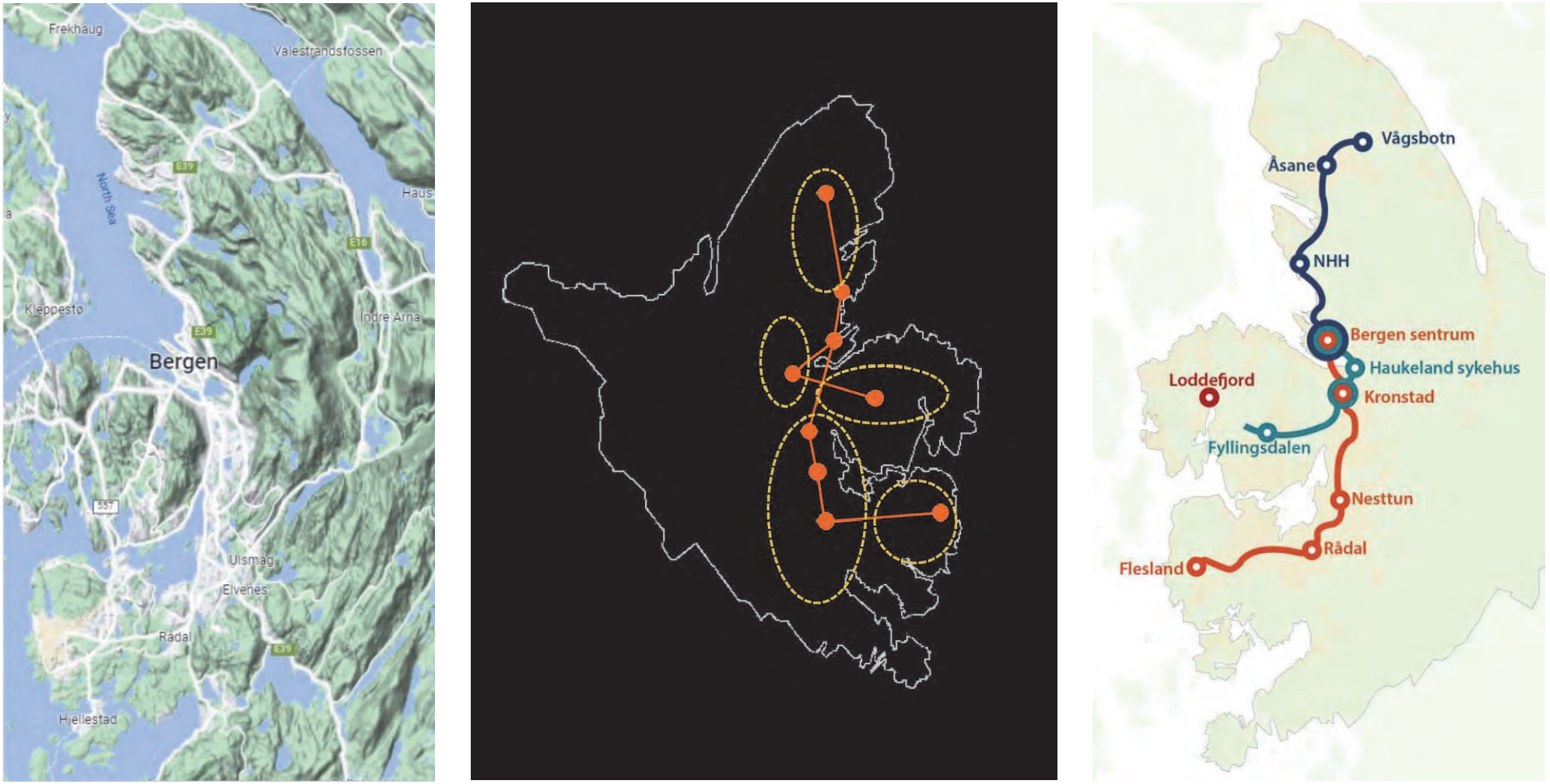


Fig. 1.2: Bergen is today a city with a high commuter level, Bybanenen is meant to strengthen a sustainable public transport strategy (Fylkeskomune)

Fig. 1.3: Bryggen and its setting, seen from Strandkaien @ Philipp Tebart/mkphc

Partly, this planned light-rail extension is planned to be located in the immediate proximity to the World Heritage Property *Bryggen*. Bryggen, located in Bergen's city centre, was inscribed in 1979 in the World Heritage List as a type of northern "fondaco", unequalled in the world, where the structures have remained within the cityscape and perpetuate the memory of one of the oldest large trading ports of Northern Europe. Bryggen Quay witnessed transformations throughout history. But the setting of the WH-property in its medieval cityscape and the medieval cityscape as such are still well preserved and fully understandable and should therefore not be disrupted.

1.2 Working Process

Regarding this background, a Heritage Impact Assessment (henceforth: HIA) has been commissioned in 2020 by *Byantikvaren*, representing the Municipality of Bergen, so as to evaluate positive and negative impacts of the planned Bybanen light-rail extension on the World Heritage property Bryggen.

In this context, a first HIA PRELIMINARY REPORT, carried out by *michael kloos planning and heritage consultancy (henceforth: mkphc),* was submitted to Bergen Municipality on 16 October 2020. This HIA led to the result that partly large and very large negative impacts on the Outstanding Universal Value (henceforth: OUV) of the World Heritage property Bryggen have to be expected.

Consequently, main recommendations of HIA Preliminary Report were to:

- further develop the planned Bybanen Light-Rail Extension (day option)
- develop an alternative tunnel option in parallel
- assess and compare both options concerning their potential impact on the OUV of World Heritage property Bryggen;

Bergen Municipality decided to follow these recommendations and developed an alternative tunnel option while the day option was modified in parallel. Afterwards, a supplemented HIA RELIMINARY REPORT was submitted to Bergen Municipality on 30 September 2021 to compare both alternative options concerning their functional, visual and structural impacts and risks on the OUV of the World Heritage property Bryggen.

This supplemented HIA RELIMINARY REPORT stated that both the modified day-option and the planned tunnel option would generate positive and negative impacts and risks concerning the OUV of the World Heritage property Bryggen. However, the two options would have completely different impacts on the OUV of the World Heritage property:

- The *day option* could cause large functional deficits at the Hanseatic Museum and large to moderate negative functional and visual impacts on Bryggen

Quay due to the length and the frequency of the light-rail-cars and the introduction of new elements such as masts for a high-voltage-line. Besides, construction works might cause large negative structural impacts at Sandbrogaten and Bryggen Quay, though after its placement the planned pile wall at Bryggen Quay might have positive effects concerning the protection against flooding and changes of groundwater level.

- The *tunnel option* could cause mainly large uncertainties concerning its structural impact as it would entail residual risks concerning groundwater subsidence under the World Heritage property. As the tunnel is irreversible, this risk can only be mitigated to a certain extent by infiltration and other groundwater stabilizing measures. Thus, it requires an active and continuous risk monitoring process including identification of further risk-reducing measures. Moreover, both planned tunnel entrances at Øvregaten would cause the need to demolish buildings and to work in the immediate vicinity of archaeological layers. At Mariakirken, which is an important World Heritage attribute, this was considered as a very large uncertainty making it necessary to relocate this planned entrance.

Overall, the day option was therefore considered a safer solution for the World Heritage property considering the large structural risks in the present tunnel option. At the same time, it was also stated clearly that the potential large negative impacts and risks caused by the day option also would have to be mitigated to a maximum extent prior to the realisation of the project.

Following the discussions of a hearing process taking place in autumn 2021, Bergen Municipality decided to stop the further development of the tunnel version and to modify the planned day light version (henceforth: PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN) so as to further reduce its negative impacts. In the meeting on 15 December 2021 Bergen City Council adopted the daylight route through the city centre as the basis for further zoning plan work. The City Council will consider the plan proposal and submit it for public consultation (November 2022 – December 2022). After consultation, comments will be processed, the plan adjusted, and sent for a second reading and decision in Bergen City Council in the spring of 2023.

1.3 Conclusion: Objective of this HIA Report

Regarding this background and working process, the objective of this HIA report is to evaluate from an independent perspective the impacts and risks of the modified design proposal of the planned PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN on the Outstanding Universal Value (henceforth: OUV) of the World Heritage property Bryggen. Both positive and negative impacts are to be assessed. In case of negative impacts and risks recommendations are to be provided how to mitigate such negative effects.

Consequently, this FINAL HIA REPORT “PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN” (henceforth short: FINAL HIA REPORT PLANFORSLAGET) is meant to serve as a basis for the hearing process planned by the Bergen Municipality between October 2022 and March 2023. The intention is to use the inputs gained throughout this hearing process in order to compile a *FULL HIA UNESCO* REPORT “PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN”, which is planned to be submitted to the World Heritage Committee after the hearing process.

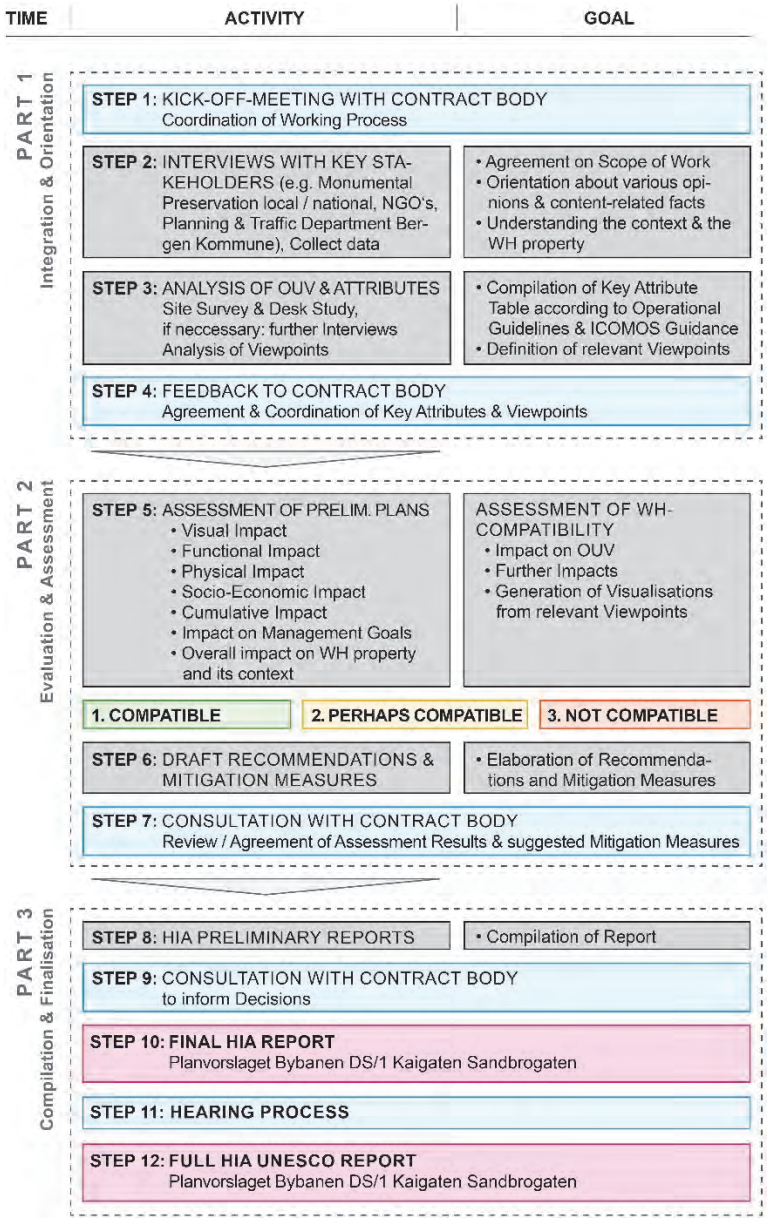


Fig. 1.4: Process of HIA REPORT

Photo of the current state date: 27.07.2020 location: N 60.398022 E 5.321308

Current state: During normal summer seasons, the quay is crowded by Bergen's inhabitants, visitors and a large number of cruising ship tourists. The quay has outdoor cafés and pubs, located on a wooden deck. Further, the historic port area is characterised by smaller leisure boats mooring along the quay. But the image of the harbour changes every day, liners and larger boats connected to both the navy, cruise tourism and petroleum activities are also mooring here. Bryggen Quay is accessible for cars and bus traffic.

Fig. 1.5: Overview from tower of Clarion Hotel

Planning state BYBANEN DS/1 KAIGATEN-SANBROGATEN 2021 (SUPPLEMENTED PRELIMINARY REPORT): Car and bus traffic has been removed, local buses go over Øvregaten. Bybanen traffic and a cycle path on either side of the track is planned on Bryggen Quay. A more coherent urban design is foreseen at Bryggen Quay, with cobblestones of different hues and textures. Bybanen is planned to be implemented with high-voltage line and masts. Bybanen frequency is planned with cars every 3 minutes in peak times with 40 light rail sets in both directions. A cycle path is planned on either side of light rail track. Bybanen can turn around at the stops in Sandbrogaten and Kaigaten / Bystasjonen so as to support events such as tall ship gatherings and the National Day on May 17, which bring a high number of visitors to Bryggen. (*As a consequence of the recommendations of the first preliminary report, Bergen Municipality decided to develop an alternative tunnel option in parallel. However, following the discussions of a hearing process taking place in autumn 2021, Bergen Municipality decided to stop the further development of the tunnel version and to modify the planned day light version so as to further reduce its negative impacts.)*

Planning state 2022 (PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN): Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery. The coherent urban design approach of Bryggen Quay has been detailed. A new lighting plan is foreseen at Fynnegården – Bryggen. Bybanen is now planned without high-voltage line and masts on Bryggen Quay. Solutions for foundations for the light rail track have been detailed.

The three illustrations show Bryggen Quay from Clarion Tower to provide an overview about the various planning states of Bybanen DS 1 Torget-Sandbrogaten. These visualisations are not assessed as the accessibility of the viewpoint is only possible via the Hotel Clarion.

2 Methods

2.1 Preliminary Remarks Concerning Methods of HIA 2

Regarding the above-mentioned background and working process, this FINAL HIA REPORT PLANFORSLAGET is based on the methods set out in the PRELIMINARY HIA REPORTS submitted earlier to Bergen Municipality. Hence, the results of the various analytical steps carried out throughout those PRELIMINARY HIA REPORTS form the starting point for the assessment of the consequences of the planned "PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN" with regard to the Outstanding Universal Value (henceforth: OUV) of the World Heritage property Bryggen.

In general, it is important to note that this FINAL HIA REPORT PLANFORSLAGET intends not to compare the impacts of the planned "PLANFORSLAG BYBANEN DS/1 KAIGATEN-SANBROGATEN" with its earlier states. Rather, the intention is to provide a transparent assessment of positive and negative impacts and risks of the current planned PLANFORSLAG BYBANEN DS/1 KAIGATEN-SANBROGATEN on the OUV of the World Heritage property Bryggen so as to deliver a reliable basis to inform both the upcoming hearing process in Bergen and the UNESCO World Heritage Committee.

2.2 Outstanding Universal Value, (Key) Attributes and Impact Assessment

Being included on the World Heritage List means that a heritage place has been formally recognized as having 'Outstanding Universal Value' (OUV). The concept of OUV, together with the conditions for its authenticity and integrity, underpins the World Heritage Convention, and all activities associated with properties on the List, including impact assessment (Figure 2.1). Each property on the List has a Statement of Outstanding Universal Value which summarizes the justification for the inscription of the property on the World Heritage List, and serves as a baseline for the universally recognized and accepted heritage/conservation values of that place.

Fig. 2.1: The three pillars of Outstandoing Universal Value (© UNESCO, ICCROM, ICOMOS and IUCN)

Hence, the OUV of the World Heritage property Bryggen, serving as the starting point of the PRELIMINARY HIA REPORTS, will also be used as the basis for this FINAL HIA REPORT PLANFORSLAGET. An analysis of the OUV forms the starting point of this FINAL HIA REPORT PLANFORSLAGET (cf. Chapter 3).

UNESCO and its advisory bodies ICCROM, ICOMOS and IUCN recently published a new toolkit for Heritage Impact Assessments.[2] Similar to earlier HIA manuals this publication stresses the need to identify the so-called "attributes"[3] that contribute the OUV of a World Heritage property. Consequently, it is the main goal to assesses as to whether the proposed plan will significantly affect these attributes[4].

[2] UNESCO, ICCROM, ICOMOS and IUCN (2022): Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context

[3] For further explanation of attributes pls. see: UNESCO, ICCROM, ICOMOS and IUCN (2022): Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context, p.56, or the glossary provided in the appendix in this report.

[4] UNESCO, ICCROM, ICOMOS and IUCN (2022): Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context, p. 25

According to the new toolkit, “an impact is the interaction of a proposed action with an attribute of the World Heritage property, and this can take either positive or negative forms – biophysical, social, cultural, economic, health, visual, etc. All relevant impacts should be considered, including those on intangible attributes which are reflected in physical elements of the property”[5].

Figure 6.8. The impact on a historic urban environment created by sound and vibration from a proposed action. An impact is the interaction of the proposed action with an attribute of the World Heritage property. In this example, the vibration from a proposed action may have an impact on the buildings and weaken their structural stability. Where these buildings are an attribute of the World Heritage property, this would lead to a loss of Outstanding Universal Value.

Fig. 2.1: Relation of attributes and impacts (©UNESCO, ICCROM, ICOMOS, IUCN)

Accordingly, throughout the PRELIMINARY HIA REPORTS an analysis was carried out concerning the relevant (key)attributes contributing to the OUV of the World Heritage property. Consequently, this analytical step will also be the starting point of this FINAL HIA REPORT PLANFORSLAGET. The analysis of the OUV and relevant attributes is documented in Chapter 3. Positive and negative impacts on the OUV of the World Heritage property Bryggen caused by the planned “PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN” will be assessed on this basis.

2.3 Data Sources and generation of visualizations

Bergen Municipality delivered the following data for this FINAL HIA REPORT PLANFORSLAGET:

- Digital 3D environmental model
- Detailed information about planned “PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN”, including information about the planned modifications of the planned railway tracks, public spaces surrounding the World Heritage property Bryggen and the light-rail cars (without pantographs)
- 3D model of light-rail cars
- 2D Plans including further data were used to generate a full 3D model throughout this FINAL HIA REPORT PLANFORSLAGET

Besides structural and functional impacts, the assessment of the positive and negative visual impacts plays an important role throughout FINAL HIA REPORT PLANFORSLAGET. Consequently, visualisations are relevant in this context. Based on the above-mentioned data as well as geo-referenced digital photographs used in PRELIMINARY HIA REPORTS, a complete 3D model was generated by *mkphc*. This 3D model was superimposed with GPS-related digital photographs to generate the visualisations.

[5] UNESCO, ICCROM, ICOMOS and IUCN (2022): Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context, p. 40

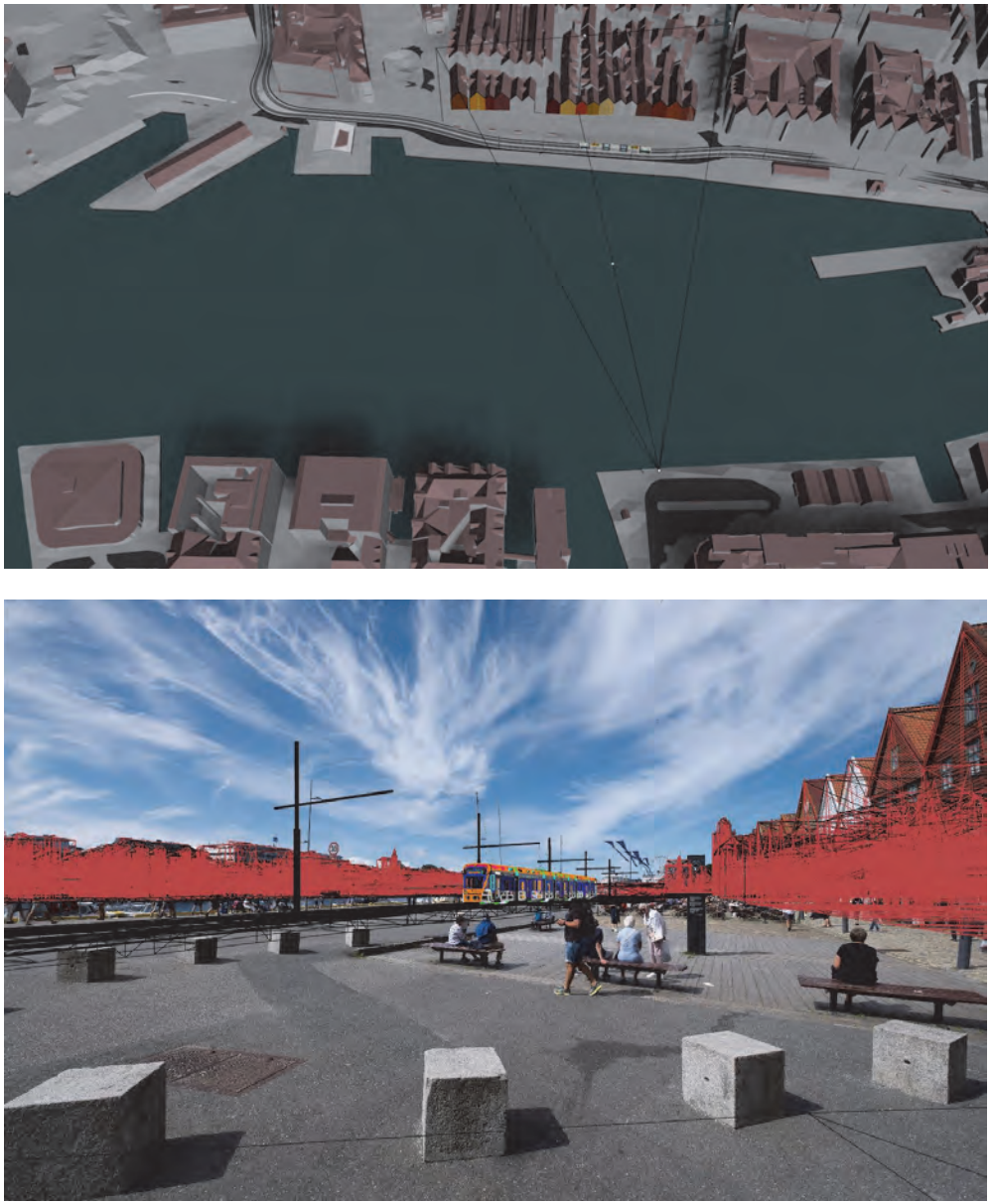


Fig. 2.2: Generation of visualizations. 3D model superimposed with digital photographs. (@mkphc)

2.4 Viewpoints

Related to the identification of World Heritage attributes a set of relevant viewpoints and view corridors with cultural and historical relevance has been defined throughout the PRELIMINARY HIA REPORTS to visualise the planned Bybanen project. The first Preliminary Report provided an overview about the impacts on all of those visual relationships. Throughout the supplemented PRELIMINARY HIA REPORT dated 30 September 2021 the documented viewpoints were reduced. Only viewpoints with a critical negative visual impact on the World Heritage property Bryggen had been assessed at this state. Consequently, for the visualisations of the planned “PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN” the same viewpoints will be used again.

Fig. 2.3: Viewpoints and view corridors with cultural and historical importance assessed throughout the first Preliminary Report. Viewpoints indicated in white were no longer used in the second HIA PRELIMNARY REPORT, as no negative impact had been assessed. (@Google Earth Pro / mkphc)

2.5 Grading – Magnitude of Impact

Throughout the PRELIMINARY HIA REPORTS, the magnitude and severity of positive and negative effects of the planned Bybanen light-rail on the World Heritage property Bryggen was assessed in line with the *2011 ICOMOS Guidance for Heritage Impact Assessment for Cultural World Heritage Properties*. According to this 2011 ICOMOS Guidance, impacts were graded on a score of 'no change' to 'major change'. The latter grade indicates a very severe impairment of the OUV.

According to the *2011 ICOMOS Guidance for Heritage Impact Assessment for Cultural World Heritage Properties* the magnitude of the positive and negative impacts was evaluated in five categories, graded according to the following colour spectrum for the sake of clarity:

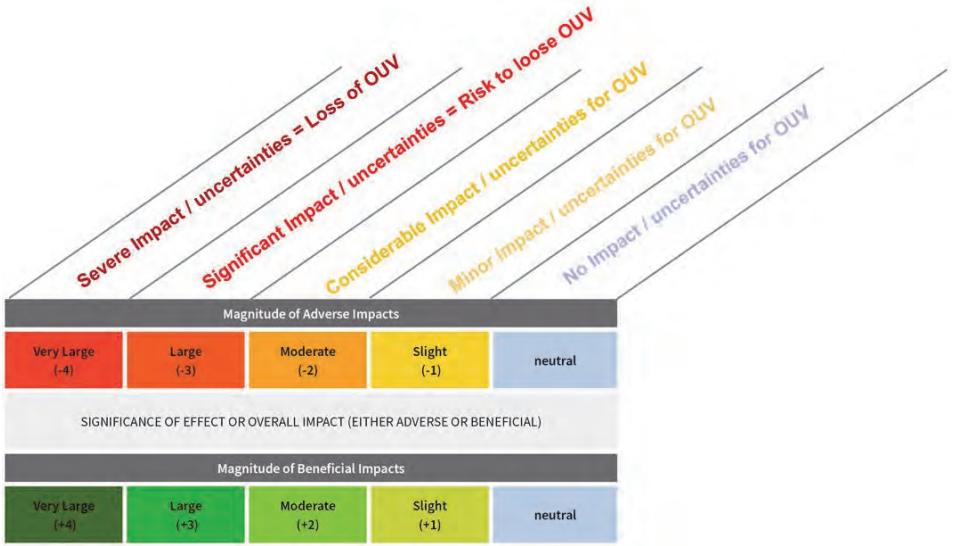


Fig.. 2.4: Positive and negative evaluation grades: (Original table from the 2011 ICOMOS Guidance)

In this context, it must be noted that the upgraded *Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context 2022* suggests a grading in assessments which slightly differs from the assessment table displayed in Fig. 2.4. According to this new toolkit impacts are to be evaluated in four categories, the grading "very large positive / very large negative" does not exist. However, in order to make the assessment carried out throughout this FINAL HIA REPORT PLANFORSLAGET comparable to the ones carried out earlier it was decided to apply the assessment table suggested in the ICOMOS Guidance 2011 (s. Fig. 2.4).

When assessing the impacts, it must be taken in account that the significance of individual attributes is closely linked to the assessment scale. A relatively slight change has major effects if the cultural heritage value of the attribute concerned can be rated as "large" or "very large".

2.6 Definition of Impact Assessment and Risk Assessment

Regarding the assessment of the planned "PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN", it has to be noted that not all impacts can be graded equally. While visual and functional impacts of the planned project on its environment can be visualised and graded accordingly, potential indirect and cumulative impacts on cultural layers or the hydrology and groundwater level of the World Heritage property Bryggen cannot be fully foreseen at this point of time.

Accordingly, similar to the earlier Preliminary Report also this FINAL HIA REPORT PLANFORSLAGET distinguishes between impacts and risks. In this context, it has to be noted that several reports on potential risks have been commissioned by Bybanen Group / Miljøløftet . However, in contrast to these risk reports, this FINAL HIA REPORT PLANFORSLAGET will assess risks with regard to potential positive and negative impacts on the OUV of the World Heritage property Bryggen. In this context, it has to be noted that even slight or moderate remaining risks have to be graded as a large negative impact since the OUV of the World Heritage property could be affected negatively due to those risks.

2.7 Conclusion: Methodological Steps of FINAL HIA REPORT PLANFORSLAGET

Regarding the inscription criteria mentioned in the *Retrospective Statement of Outstanding Universal Value*, the *Values* and *Attributes* defined here (cf. Chapter 3), the framework set out in the *2011 ICOMOS Guidance for Heritage Impact Assessments for Cultural World Heritage Properties,* as well as the *Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context 2022,* this FINAL HIA REPORT PLANFORSLAGET consists of five different parts:

PART I_BACKGROUND

1. Background, task and objective
2. Methods

PART II_ANALYSIS

3. Bryggen World Heritage: Historic Description, RSOUV, Attributes, Context and wider setting, Protection and Management
4. Background and description of planned Bybanen project: PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN

PART III_ASSESSMENT

5. **Impact Assessment:**
   Functional Integrity (Impact on reduction number of car and bus traffic and noise, Impact on walkability and accessibility, Impact on functional barriers
   Visual Integrity (Impact on potential visual barrier effect),
6. **Risk Assessment:**
   Structural Integrity: (Ground Water Changes and direct impacts on built and archaeological heritage due to loss, vibrations, noise)

PART IV_ CONCLUSIONS & RECOMMENDATIONS

7. Conclusion and Recommendations

PART V APPENDIX

8. Background information and sources

PART II ANALYSIS

3 Bryggen World Heritage

3.1 Short historic overview

3.1.1 Bergen Trade Harbour

The favourable harbour conditions in Vågen are considered a main reason why Bergen already in the Middle Ages developed into an important Northern European trading and shipping port. In 1350 The Hanseatic League established their office in Bryggen and dominated international trade for 400 years.

The oldest parts of Vågen harbour settlements were established along the east side of Vågen, below Mariakirken and the lower half of Sandbrogaten by the ancient lake Veisan. Archaeological evidence shows that by year 1000 the width of Vågen harbour was double in comparison to today.

Bergen had a central position as military, administrative, political, and religious centre in Norway for several hundred years. The Bergenhus Fortress is one of the oldest preserved fortresses in Norway. The context of the Hanseatic League related to the Norwegian king, the church and the city are still visible by the relation between landmarks of Bergenhus fortress, the churches, and ruins of the townhall. Mariakirken is one of the oldest in Norway and became the Hansa League's church. [6]

The main features of medieval Bergen city development and urban life were centered around Vågen harbour where building plots, streets and public spaces are oriented towards the harbour to facilitate easy access to each merchant's quay. Access to the harbour was important and already in 1276, the City Council established the public spaces "allmenninger". They secured everybody's right to access to the sea and to common areas and they are still readable in present Bergen. By Bryggen the Dreggsallmenningen between Mariakirken and the quay can be traced to the year 1100 and Nikolaiallmenningen to 1276 [7]

All main communication was by maritime routes and there were only a few access roads by land. One of them, Øvregaten is Bergen's oldest street and in the Middle Ages it was also the city's main street. The medieval wooden Bergen settlements were above and below Øvregaten and Bergen artisans and merchants lived here. The City Council Act from 1276 names several of medieval churches along Øvregaten, especially Mariakirken, highlighting the importance of the area. Over 1000 years the stretch and character of Øvregaten has changed in connection with fires, changes in built structures and urban layout. Consequently, under the current street there may be archaeological traces of different structures, linked to buildings, churches or other institutions. [8]

Fig. 3.1: Perspective of Bergen 1740. @ marcus.uib, ubb-bs-fo-01052

[6] Verdensarvsstedet Bryggen. Forvaltningsplan 2021-2022©Bergen kommune

[7] Ersland, G.A The Hanse and Bryggen in Bergen – creating cultural heritage. 2019

[8] Øvregaten-Trafikkbelastning og kulturlag.BN-DS1-008.

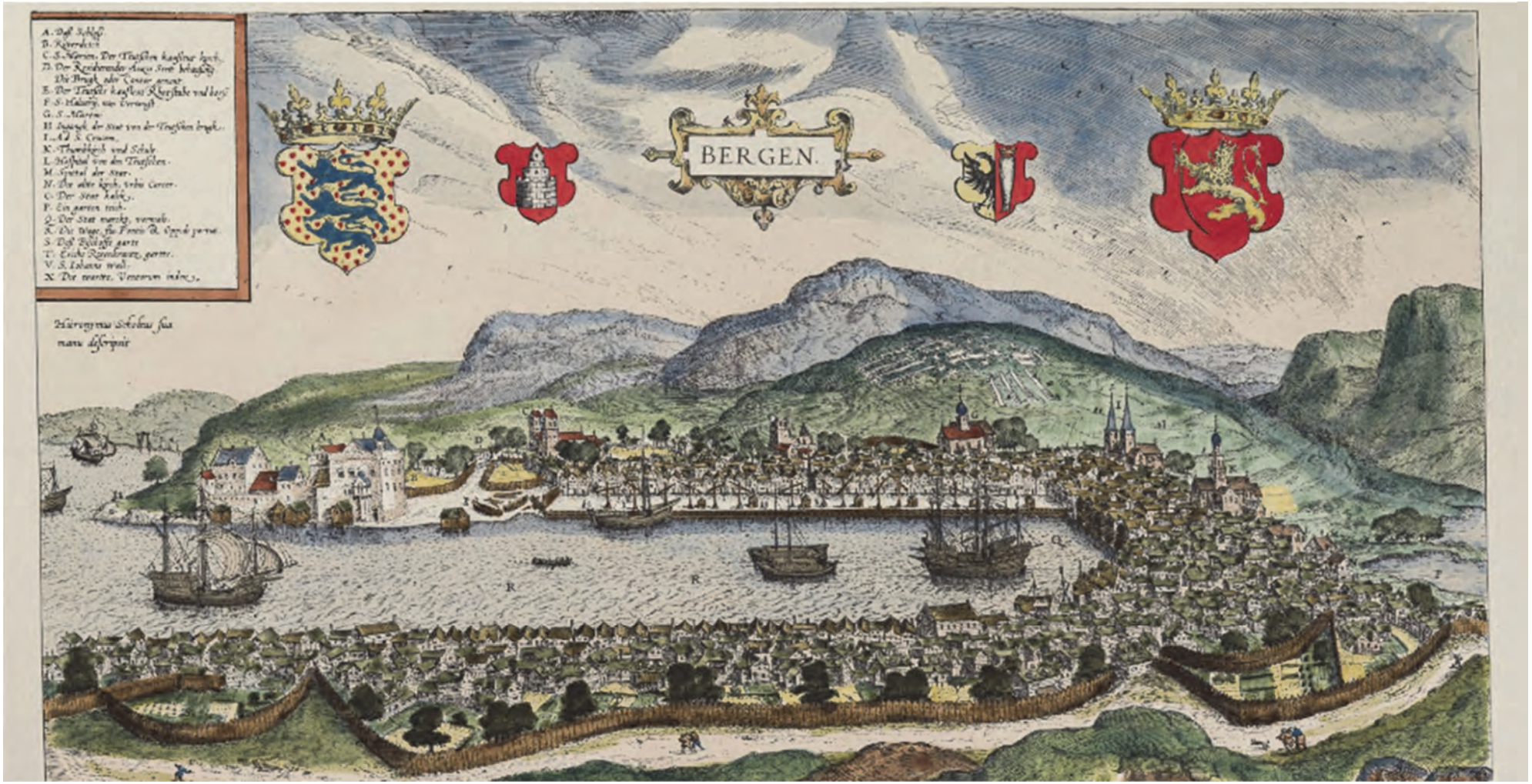


Fig. 3.2: Bergen in 1581. Hieronimus Scholeus 1581© marcus.uib, ubb-bs-fo-0137-002

3.1.2 Bryggen Hanseatic Office

The Hanseatic League established the “Hanseatic Office” in Bergen in 1350. The Hanseatic merchants gradually acquired ownership of Bryggen and controlled the trade in stock fish from Northern Norway through privileges granted by the Norwegian king. The Hanseatic Office at Bryggen was one of four; London, Bruges, Novgorod. Bryggen is the only one where the whole building structure can still be experienced.

The Hanseatic tradition followed up on the built structure of the medieval Bergen harbour. Although the Hanseatic merchants owned the houses in Bryggen, the ownership of the plots and tenements was controlled by Norwegian magnates or ecclesiastical institutions. In 1754 the Hanseatic Office was closed and replaced by a Norwegian Office which most of the German merchants joined.

Today's buildings at Bryggen were mainly rebuilt after the great fire in 1702. The southern part of the original Bryggen structures was demolished around 1900 and replaced with new brick buildings. Only half of the Finnegården tenement, now Hanseatic Museum, was conserved. The buildings at Bryggen stand on thick layers of building debris and waste after several hundred years of human activity. The excavations have shown that under the buildings that stand today there are in some places over 10 previous construction phases in cultural layers up to 10 meters thick.[9]

The compact medieval building structure at Bryggen has been preserved, with long rows of houses organized in single and double yards along narrow passages down to the quays and Vågen. The passages served as transport arteries between the quay and the warehouses, while the need for transporting goods from the quay was filled by the “allmenninger”. This structure has been the form for the building pattern and regulation both at Bryggen and the whole Vågen harbour. Bryggen World Heritage property contains all the functional and structural elements of a Hanseatic Office with its representative waterfront, trade and storage facilities, social functions and “cabbage gardens” in the back. The remaining buildings illustrate the daily life of trading and social life in German Hanseatic community.

Fig. 3:3 Hanseatic Office 1768. J.J. Reichbom, Prospect av Handels Contoiret udi Bergen © Byarkivet

[9] Miljøløftet september 2022. Planbeskrivelse Delstrekning1, Kaigaten- Sandbrogaten. Plan-ID 65800000

Fig. 3.4: Hanseatic quarters between the harbour and Øvregaten 1870 © Marcus.uib, Knut Knudssen , ubb-kk-2127-0158

Fig. 3.5: Bryggen 1890 © ubb-bs-ok-07175

3.1.3 Bryggen Quay

In Middle Ages the quay, called *"bryggene"* gave the name to Bryggen. It has maintained its position in Bergen harbour and today the quay front of Bryggen has become an iconic image of Bergen.

The Hanseatic League followed Bergen's medieval urban pattern, and each trading house had its own part of the quay with private stalls and rocker booms for loading. The quay in front of Bryggen was not publicly accessible until late 1800s when the private quays were purchased by the Port Authority.[10]

The quay remained mainly unchanged from the period after the fire in 1702 until 1899. The increasing trade activity at Bryggen with larger vessels led to the need to expand the quays. In 1901, when the southern part of Bryggen was demolished, a new quay was

[10] Miljøløftet september 2022. Planbeskrivelse Delstrekning1, Kaigaten- Sandbrogaten. Plan-ID 65800000

completed from Torget to Nikolaikirken. In 1920 the new quay was also extended in front of the northern part of the quay. The harbour sheds had been demolished but the existing harbour shed, Skur 11, is from 1906.

Fig. 3.6: Bryggen from Torget 1870 © marcus.uib, Marcus Selmer, ubb-s-133

Fig. 3.7: Bryggen quay 1914 © Olaf Andreas Svanøe. Ubb-bros-00744

3.2 Retrospective Statement of Outstanding Universal Value (RSOUV)

World Heritage property Bryggen was inscribed under criterion (iii) in 1979 in the World Heritage List. Yet, at this point of time no Statement of Outstanding Universal Value (SOUV) with a description of the values and attributes of the World Heritage property was required. Hence, the Retrospective Statement of Outstanding Universal Value (RSOUV), adopted by the World Heritage Committee in 2013, serves as the formal starting point of this FINAL HIA REPORT PLANFORSLAGET.

Following, important attributes (attributes: how can we see those values if we visit the place?) expressing the OUV of World Heritage Bryggen, are displayed in italic letter. Important values (values: why is this heritage place special?) are underlined.

Brief synthesis

Bryggen is a *historic harbour district in Bergen*, one of North Europe's oldest port cities on the west coast of Norway which was established as a *centre for trade by the 12th century*. In 1350 the Hanseatic League established a *"Hanseatic Office"* in Bergen. They gradually acquired ownership of Bryggen and controlled the trade in stockfish from Northern Norway through privileges granted by the Crown. The Hanseatic League established a total of four overseas Hanseatic Offices, Bryggen being the only one preserved today.

Bryggen has been damaged by a number of fires through the centuries and has been rebuilt after every fire, closely following the previous property structure and plan as well as building techniques. Bryggen's appearance today stems from the time after the fire in 1702. *The buildings are made of wood in keeping with vernacular building traditions. The original compact medieval urban structure is preserved with its long narrow rows of buildings facing the harbour, separated by narrow wooden passages*. Today, some 62 buildings remain of this former townscape and these contain sufficient elements to demonstrate how this colony of bachelor German merchants lived and worked, and illustrate the use of space in the district. It is characterized by the *construction of buildings along the narrow passages running parallel to the docks*. The urban units are *rows of two- to three-storey buildings* signified by the medieval name "gård". They have *gabled facades towards the harbour and lie on either one or*

both sides of the narrow passages that have the functions of a private courtyard. The houses are built in a combination of traditional timber log construction, and galleries with column and beam construction with horizontal wooden panel cladding. The *roofs have original brick tiling or sheets*, a result of fast repairs after an explosion during World War II. Towards the back of the gård, there are *small fireproof warehouses or storerooms (kjellere) built of stone, for protection of special goods and valuables against fire*. This repetitive structure was adapted to the living conditions of the Hanseatic trading post. The German merchants took up winter residence in the small individual wooden houses and the storerooms were used as individual or collective warehouses. A true colony, Bryggen enjoyed quasi-extraterritoriality which continued beyond the departure of the Hanseatic merchants until the creation of a Norwegian trading post in 1754, on the impetus of fishermen and ship owners of German origin. *Today, Bryggen is a significant part of the historic wooden city of Bergen*.

Criterion (iii): Bryggen bears the traces of social organization and illustrates the use of space in a quarter of Hanseatic merchants that dates back to the 14th century. It is a type of northern "fondaco", unequalled in the world, *where the structures have remained within the cityscape* and perpetuate the memory of one of the oldest large trading ports of Northern Europe.

Integrity

Only around a quarter of the original buildings that existed in Bryggen remained after demolitions at the turn of the 19th century and several fires in the 1950s; the property is comprised of these remaining buildings. *Notwithstanding, the medieval urban structure is maintained and the buildings include all elements necessary to demonstrate how Bryggen functioned: offices and dwellings at the front, warehouses in the midsection and assembly rooms ("Schøtstuer"), kitchen facilities and fireproof stone cellars at the back.*

Bryggen can be experienced as an entity within a larger harmonious urban landscape. It is connected more closely to the areas of small wooden dwellings beyond Bryggen and in the medieval city centre than to the larger 20th century buildings in its close proximity.

The risk of fire, excessive numbers of visitors as well as global climate changes with more extreme weather and possibly higher sea levels are some of the potential risks Bryggen faces today.

Authenticity

The Hanseatic period at Bryggen ended long ago, but the Hanseatic heritage is documented through buildings, archives and artefacts which are well preserved for posterity. There are also series of architectural surveys of the buildings from 1900 onwards.

The preservation of the buildings commenced on a larger scale in the 1960s and had made major progress by 1979, the year of inscription on the World Heritage List. Some buildings at the back were moved in 1965 to create an open area for fire emergencies, but no further changes have been made to the urban structure since. The solutions and methods chosen have been well documented, and limiting the replacement of original materials has been an objective. Bryggen is built of wood, which is subject to rot, insect attack and ageing. Since 2000, there has been an increased focus on maintaining original methods and building materials in the restoration, with careful consideration given to the choice of material, paint, plugs,nails, etc. and the use of original tools as far as possible.

As the activity at Bryggen decreased after 1900, the buildings became derelict. However, from the 1960s the former trading in stockfish and commodities was gradually replaced by small arts and crafts businesses. An increase in the number of visitors has led to the establishment of restaurants and tourist businesses. This has resulted in inevitable changes in the spirit of the place, particularly along the front facades, whereas the atmosphere of the Hanseatic period can still be sensed in the more secluded area further back.

Tab. 3.1: Retrospective Statement of Outstanding Universal Value (Emphasizes added by the authors)

3.3 Attributes sustaining the OUV

3.3.1 HIA Assessment Area

According to the Guidance and Toolkit for Impact Assessments assessing any impact on World Heritage and its OUV, positive or negative, of changes to the property or its setting, "requires an understanding of the **attributes** that contribute to the OUV of the **World Heritage property** and its other heritage/conservation values, within its boundary, buffer and **wider setting**, which may then mean that the scope of the assessment should be extended to include the relevant geographical, ecological and landscape areas around the **heritage**, while also considering the direct, indirect and **cumulative impacts** (Figure 4.3)"[11].

Hence, a wider setting is necessary for assessing the integrity of the property in this HIA REPORT PLANFORSLAGET. Accordingly, the scope of this Heritage Impact Assessment includes the inscribed property and the area proposed in the World Heritage property buffer zone strategy proposal (2022, Fig. 3.1)[12]. Since the visual, associative and functional aspects of the World Heritage property in the context of medieval Bergen and the Vågen harbour testimony of the medieval cityscape and seascape still can be perceived, the proposed area encompasses the present medieval city in its natural setting and the seascape of Vågen as perceived by maritime travellers since medieval times.

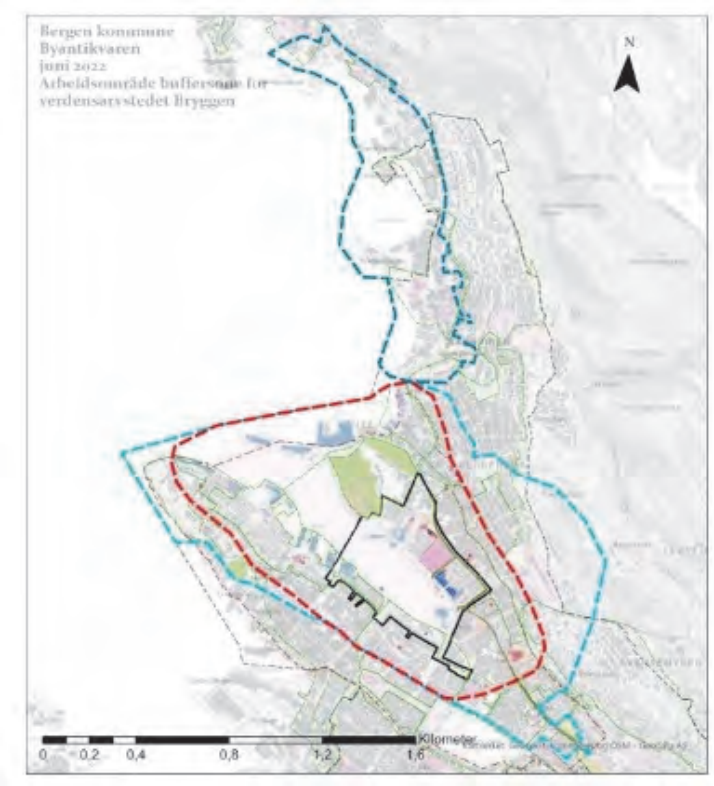


Fig. 3.1: Working area for future buffer zone (Bergen kommune)

[11] UNESCO, ICCROM, ICOMOS and IUCN (2022): Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context, p. 22 (Emphasize in original document)

[12] Byantikvaren (2022): Overview topics in the Management Plan for Bryggen with relevance for the buffer zone / KUVA

3.3.2 Key themes, key attributes and attributes considered in FINAL HIA REPORT PLANFORSLAGET

This HIA assessment has built on the justification of the OUV for the World Heritage property Bryggen with focus of how the proposed Bybanen project could be considered having main potential positive and / or negative impacts.

HIA builds on the key issues identified in the Management Plan for Bryggen (2021-2025)

- Harbour quarters and early trading port
- The Hanseatic testimony
- Building tradition

For an understanding of the Outstanding Universal Value the following two themes, related to 5 key attributes, are considered.

CONTEXT AND SETTING: BERGEN HANSEATIC TRADING PORT
1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout
2_Continued visual and functional setting of Bryggen in living Vågen harbour
3_Cultural layers of medieval Bergen

THE HANSEATIC TESTIMONY: BRYGGEN HANSEATIC OFFICE
4_Maintained built structure of the Hanseatic quarters and its quay
5_Story telling: Testimony of the Hanseatic League and the Hanseatic way of life

The following table summarises key themes, key attributes and attributes relevant for this FINAL HIA REORT PLANFORSLAGET:

THE WORLD HERITAGE PROPERTY BRYGGEN IN BERGEN - ATTRIBUTES SUSTAINING THE OUV			
LEVEL OF RECOGNITION **World Heritage**	**VALUE** **World Heritage Outstanding Universal Value (OUV)**	**KEY ATTRIBUTES**	**ATTRIBUTES**
CONTEXT AND SETTING: BERGEN HANSEATIC TRADING PORT			
Criteria (iii) Retrospective Statement of Outstanding Universal Value (RSOUV) 2013	*...it is a type of northern "fondaco" unequalled in the world where the structures have remained within the cityscape and perpetuate the memory of one of the oldest large trading ports of Northern Europe* *Bryggen can be experienced as an entity within a larger harmonious urban landscape*	**1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar**	• Medieval wooden Bergen on the slopes above Øvregaten and in Vågsbunnen • Bergen medieval maritime and land communication routes • Access by sea: Bergenhus / Festningskaien, Nordnes, Skuteviken • Access by land: Øvregaten, Vågsbunnen • Public spaces and access roads / allmenningar: • Dreggsallmenningen, Vertlidsallmenningen Nikolaikirkeallmenningen, Finnegårdsgaten, Bryggesporden, Torget, Vågsallmenningen • Landmarks for the religious, social, and political context of Hanseatic office: Mariakirken, Bergenhus castle, Holmen, Håkonshallen, Rosenkrantztower
		2_Continued visual and functional setting of Bryggen in living Vågen harbour	• Topography of Vågen harbour and views in / out • Trade and maritime activities in Vågen harbour • Quays, Dramshuset, sheds 7,8,11 • Bradbenken, Tollboden
		3_Cultural layers of medieval Bergen	• Cultural layers under Hanseatic quarters and quay, Sandbrogaten and Bergenhus • Underwater archeology in Vågen

LEVEL OF RECOGNITION World Heritage	VALUE World Heritage Outstanding Universal Value (OUV)	KEY ATTRIBUTES	ATTRIBUTES
THE HANSEATIC TESTIMONY: BRYGGEN HANSEATIC OFFICE			
Criteria (iii) RSOUV 2013	*Bryggen bears the traces of the social organization and illustrates the use of space in a quarter of Hanseatic merchants that dates back to 14th century.* *The medieval urban structure is maintained and the buildings include all elements necessary to demonstrate how Bryggen functioned* *… the atmosphere of the Hanseatic period can still be sensed in the more secluded area in the back*	**4_Maintained built structure of the Hanseatic quarters and its relation with the quay**	• Medieval built structure with long plots facing their quay; offices and dwellings in the front, passages, warehouses in the midsection and assembly rooms, kitchen facilities, storerooms and kitchen gardens in the back towards Øvregaten
	Hanseatic heritage is documented through buildings, archives and artifacts which are well preserved for posterity	**5_Story telling: Testimony of the Hanseatic League and the Hanseatic way of life**	• Use of building conservation practices based on in-depth knowledge and research on Bryggen buildings • Maintained ownership structure and small crafts and commercial activities • Hanseatic Museum and its activities • Festivities and events with historical narrative • Documentation in literature and research (UNESCO Memory of the World nomination)

3.4 Protection and Management

The following Chapter provides an overview about stakeholders, current issues, as well as the management policy with regard to the World Heritage property Bryggen.[13]

3.4.1 National World Heritage policies

World Heritage policy is part of Norway's overall environmental policy, which the Ministry of Climate and Environment is responsible for coordinating. The Ministry's subordinate directorates, the Directorate for Cultural Heritage, and the Norwegian Environment Agency, are the most important executive agencies in the world heritage work.

In guidelines for the management of World Heritage sites "*Future with a foothold – cultural heritage policy"*[14] to the Storting (Parliament) a national World Heritage policy was adopted. This has been followed up in "*New goals in cultural heritage policy*"[15]. Emphasis is on the transfer of relevant experience from World Heritage management to other cultural heritage management as a basis for sustainable social development.

3.4.2 Legal protection

In a national legal context, World Heritage is protected through the guidelines issued in plans in accordance with the Planning and Building Act and protection under special legislation such as the Cultural Heritage Act.

Bryggen World Heritage with its cultural layers is listed by the Norwegian Cultural Heritage Act which provides the strongest protection of the archaeological and built heritage in Norway. Bryggen is also protected by the Norwegian planning and building act and buildings and the archaeological layers are listed under the Cultural Heritage Act. A protection plan was adopted in 2006 for the proposed buffer zone in Vågen area.

At the national level, the Directorate for Cultural Heritage is a government agency under the Ministry of Climate and Environment and responsible for implementation of the Cultural Heritage Act. The Directorate for cultural heritage has the right to file an official objection to proposed plans that it considers to be contrary to national cultural interests.

The regional level, Vestland County is responsible managing cultural resources by the Cultural Heritage Act. The County has the right to file an official objection to proposed plans that it considers to be contrary to cultural heritage interests.

Bergen city has a cultural heritage management office with expertise in cultural heritage conservation and management; Agency for Cultural Heritage Management (Byantikvaren). The main tool for managing cultural heritage at the local level is the Planning and Building Act.

3.4.3 World Heritage management coordination

Bergen municipality, Vestland County and Directorate for Cultural Heritage are involved in the management of Bryggen World Heritage. They are represented in in World Heritage Council of Bryggen which has the overall political responsibility. A council of specialists (Fagrådet)has been established as an advisory body to the World Heritage council. The owners, university of Bergen, the museums, visit Bergen and Friends of Bryggen are also represented in the council of specialists. A World Heritage coordinator is the focal point for the site.

<u>Owners</u>

- *Stiftelsen Bryggen* is the largest private owner with responsibility for 38 buildings at Bryggen. It is a non-profit association established 1962. Stiftelsen has its own staff with restoration craftsmen, carpenters, caretakers, technicians and architects. Its activities include hands-on training, research and dissemination of knowledge about Bryggen built heritage and history.
- *Bryggen private owners association* is an association of seven owners who together own 23 buildings. Its aim is to safeguard the private landowners' interests, be a consultative body for matters concerning Bryggen and be a discussion and action forum for being a landowner at Bryggen.

[13] Forvaltningsplan Verdensarvsstedet Bryggen 2021-2025©Bergen kommune

[14] Report No. 35(2012-2013)

[15] Report No. 16 (2019-2020)

- *Bergen municipality* owns Finnegården and part of the ground. The Agency for Construction and Real Estate at the City Council's Department of Finance, Business and Real Estate is the property manager.

Other stakeholders

- *City Museum*, Museum Vest; the Hanseatic Museum
- *Friends of Bryggen, "Bryggens Venner"*, a public association with focus on the preservation of Bryggen and dissemination of knowledge of Bryggen

3.4.4 Bryggen World Heritage management plan 2021-2025[16]

Bryggen World Heritage Management Plan sets out the following goals:

Vision

The vision for the World Heritage Site Bryggen is:

In 2030, Bryggen is a good example of how the outstanding universal values for a world cultural monument are secured and strengthened, in parallel with Bryggen developing as part of the city centre in Bergen in an environmentally, socially, and economically sustainable way. Bryggen has a significant number of jobs that stem from world heritage. The world heritage status and the environmental and cultural qualities associated with Bryggen as an attraction and cultural monument are important for the identity of people of Bergen, Western Norway and the Norwegian population. Knowledge of the world heritage, and what it represents, creates interest and understanding of history, anchors in the present and expectation of the future, and underpins the recognition of the world heritage's place in the global community.

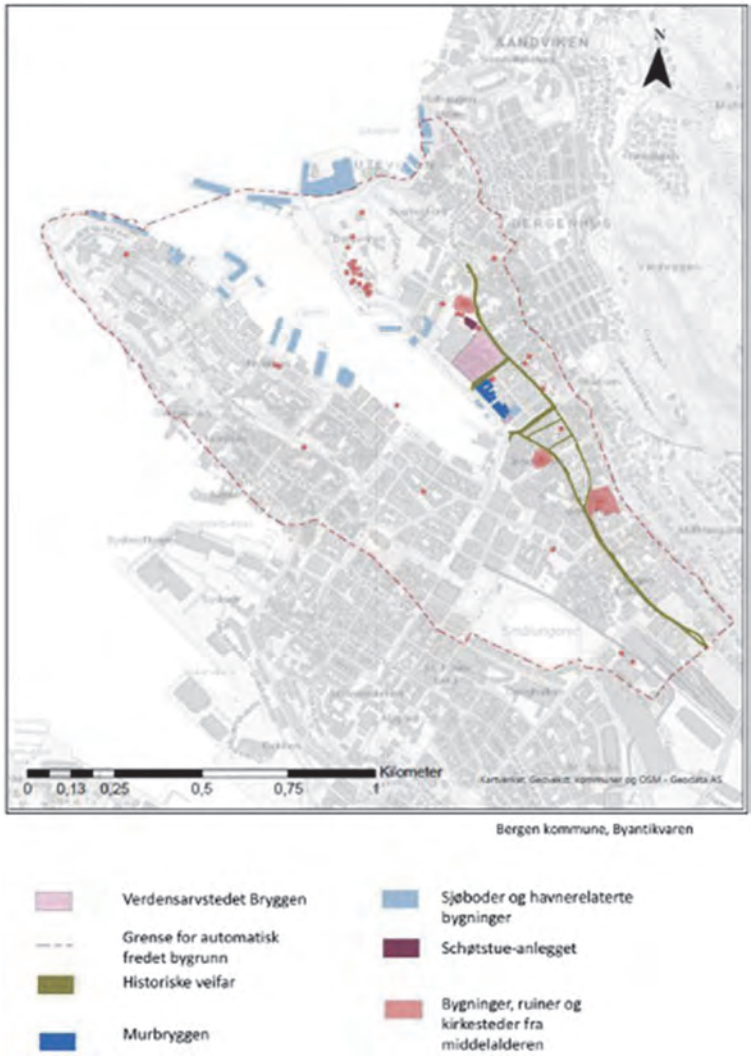


Fig. 3.2: Forvaltningsplan Bryggen 2021-2025

[16] FORVALTNINGSPLAN 2021-2025 | VERDENSARVSTEDET BRYGGEN

Visitor management goals

Bergen is certified as sustainable visitor goal and sustainable and comprehensive visitor management is in place. The World Heritage Centre has been established.

A facilitation that ensures management of the number of organized groups traveling within World Heritage Site has been established and authorisation scheme for guiding/dissemination within the World Heritage Site is in place. Cooperation has been developed between owners, tenants, destination companies, tourism companies and world heritage management to provide safe and good experiences to visitors and protect world heritage values.

Goals for value creation and business development

The World Heritage values that Bryggen represents are central to local value creation in tourism, trade, traditional crafts, handicrafts, and culture-based industries. Bryggen will be a hub for experiences and value creation throughout the year, which strengthens the story of the Hanseatic League and the experience of port and commercial quarters and Bryggen's belonging and place in the city landscape. This includes to arrange and plan for physical events that take up the historical narrative throughout the year. The furnishing, signage, lighting and design of the front areas, from the quay front to Bryggen's facades, will be done according to a comprehensive plan that strengthens the outstanding values of the World Heritage.

3.4.5 Management challenges [17]

Inter alia, the following challenges for the management are mentioned in the Management Plan:

Subsidence damage and ground conditions

Today, 47 monitoring wells have been installed at Bryggen, to document conservation status in the form of groundwater level and water chemistry. Together with sentence measurements, the monitoring provides a basis for assessing trends in terms of conservation conditions for the cultural layers. Securing groundwater and monitoring the groundwater situation are key issues.

Water and wastewater

Stormwater management at Bryggen is important in order to stabilise groundwater levels, ensure good conservation conditions for the cultural layers and to avoid subsidence damage to the buildings. Stormwater must be diverted away from the buildings, in parallel with ensuring that the groundwater level fluctuates naturally over the day and over the seasons. Water intake lines must be secured in relation to use and to well-functioning extinguishing systems.

Sea level rise, flooding and extreme weather

Springtide has always been a challenge for the buildings in front of Bryggen. In 2007, check valves for wastewater were established, after wastewater and wastewater had been separated. The purpose is that seawater will not penetrate the sewage system and provide storage in the sewer lines in the buildings at Bryggen. In connection with storm surges, waves can hit the quayside in front of Bryggen. Dreggekaien is lower and often stands under water during storm surges. The restoration works, as they are planned, aim to get the buildings positioned at a level so that the risk of damage from storm surges is small.

Use of Bryggen quay

During the summer season, parts of the quay front are occupied by outdoor seating. Besides the temporary furnishings associated with outdoor seating, there is some furnishing in the south (benches, stucco stones). Bus sheds, benches and boards have also been erected at the bus pocket.

Visitor pressure

Tourism and an increasing number of visitors are a challenge for Bryggen. Bryggen is, together with Fløyen and the Fish Market, the places in Bergen that are visited the most by tourists. This leads to a large gathering of people within three small areas in Bergen city center. During the summer months, there have occasionally been calls for mass tourism and great visitor pressure on Bryggen's front areas and into the passages at Bryggen. At its peak, up to 36,000 visitors have been registered in a day. Large crowds of tourists, queues and noise can provide an unedifying experience of the World Heritage

[17] In selection, related to HIA recommendations

for visitors. This causes great wear and tear on the building stock and can pose an increased risk of fire and make evacuation difficult. A large part of the commercial and commercial activity at Bryggen today depends on visiting tourists.

A comprehensive study of visitor management at Bryggen is perceived as both desirable and appropriate. VisitBergen is working to get Bergen certified as a sustainable destination. As part of this work, an action plan is being drawn up to be adopted by the City of Bergen. World Heritage values and securing them are key issues. VisitBergen will prepare an action plan for visitor management based on in a vulnerability analysis. The goal is to spread traffic, improve infrastructure to minimize burden from large groups, and to incorporate measures to create good attitudes towards social responsibility and promote good guest behavior.

Activities and use of Bryggen

Bryggen, and especially the front area, is perceived as Bergen's main stage and frequently used for small and large events. It is mainly the front area, the roadway and the quay that are then used for events; Tall Ships Races, Hanseatic Days, Cycling World Championships and Torgdag. The actors at Bryggen also have joint events to highlight Bryggen as a destination for a more local audience. This applies, among other things, to the cultural heritage festival "Ruins, holes and other secrets" under the auspices of the Children's Culture House, which in 2019 was held for the 10th time, and which showcases visible and invisible sports after the past. "Christmas at Bryggen" is another event originating from the tenant, and which has become a tradition. Several of today's events have historical links to the Hanseatic era and to the city's position as a trading venue, and can thus help strengthen knowledge and dissemination of world heritage and its narrative.

3.4.6 The Hanseatic museum vision and objectives[18]

The Hanseatic Museum will reopen in 2026 after a closure for building restauration. The museum celebrates 150 years anniversary in 2022. The Hanseatic Museum will convey the entire Hanseatic history of Bergen, set in an international context, and the use of the outdoor area with various activities. The traces and stories of the Hanseatic League are more than the Hanseatic Museum; the Hanseatic quarters, assembly rooms, Mariakirken, the ruins of Katharina Hospital, the wine cellar and Dramshusen's shed, among others. These traces of the Hanseatic League will be an important initiative in the dissemination offer to increase understanding of history and the city's development.

3.4.7 Management of the setting ; proposed buffer zone

The first Management Plan (Forvaltningsplan) for Bryggen in 2005 was developed in the same timeframe as the zoning plan “Vågen, kaiene og Bryggen” which is still valid. It was elaborated as a plan for a buffer zone around the World Heritage site and he two plans were meant to support each other.[19]

Fig. 3.3: Zoning plan Vågen, kaiene og Bryggen, adopted 2006 and still valid. The plan boundary was the suggestion for a bufferzone (Bergen kommune)

[18] Visjonsdokument for det Hanseatiska Museum. January 2022

[19] Byantikvaren (2022): Follow-up on Recommendatins Concerning Integrated Management of the World Heritage Given in the Preliminary Reports 1 & 2

However, due to a decision of the World Heritage Committee dating from 2019 requesting to extend the suggested buffer zone this proposal for a buffer zone was referred:

> Having examined Documents WHC 19/43.COM/8B.Add and WHC 19/43.COM/INF. 8B1 Add,
>
> Refers the proposed buffer zone for Bryggen/Norway back to the State Party in order to allow it to:
>
> - Extend the buffer zone to include a wider area in the northeast part of the property, as it could prevent urban pressure the World Heritage property; or to provide a clear and solid rationale for the exclusion of this area,
> - Undertaker a Heritage Impact Assessment regarding the future tram track that will pass the buffer zone, to assess the potential impact on Bryggen's Outstanding Universal Value.

Since then, Bergen Municipality initiated further activities. A revision of the Management Plan was started up in 2019, finalised in 2021 and adopted by Bergen City Council in 20220[21]. Inter alia, the need to define a buffer zone for World Heritage property Bryggen is mentioned here. Bergen City Council also recognized the implementation of tasks assigned to the City of Bergen in the Management Plan, including initial work on the buffer zone.

Further, a Strategic Cultural Heritage Strategy was adopted in 2019[22], a Cultural Environment Plan (Kulturmiljøplan for Bergen 2021-2025[23]) was adopted in 2021, a Strategy for Architecture was adopted in 2019 and a strategy for walkability 2020-2030 was adopted by Bergen City Council in 2020. Finally, through the approved Management Plan for Bryggen, Bergen Municipality commissioned the Agency for Cultural Heritage Management (Byantikvaren) to prepare a proposal to define the boundaries of the buffer zone with the goal to achieve an approval by the World Heritage Committee. Following, a "Pre-Project Buffer Zone for the World Heritage Site Bryggen"[24] was started with the goal to prepare a strategic plan to

- ensure good protection of the area around the World Heritage Site Bryggen so that Bryggen's outstanding universal values (OUV) are not weakened or negatively affected by any measures in the area.
- ensure a positive development of the area that will strengthen Bryggens OUV.
- create predictability for everyone involved and contribute to increased understanding of what Bryggen's World Heritage values mean locally, regionally, nationally and internationally.
- create an important basis for formalising protection and providing guidelines for development opportunities through consideration zones and provisions in the land-use plan.
- facilitate the participation and involvement of citizens in the protection of world heritage values.

In this context, the Agency for Cultural Heritage Management (Byantikvaren) has defined a working area for the future buffer zone, which will be used as investigation area for this HIA REPORT PLANFOSLAGET (Fig. 3.3). As part of the planning of the work on the buffer zone, also a coordination group has been established consisting of the heads of the Planning and Building Administration, the Agency for Urban Environment, the Climate Agency, Bergen Water', the City Architect and the Directorate for Cultural Heritage.[25]

[20] Verdensarvstedet Bryggen. Forvaltningsplan 2021-2025

[21] Verdensarvstedet Bryggen. Forvaltningsplan 2021-2025

[22] Byantikvaren (2019): Kulturminnestrategi. Identiteit med særpreg. Kulturminneplan for Bergen. Del 1 Kulturminnestrategi 2019-23

[23] Byantikvaren (2022): Kulturmiljøplan for Bergen 2021-2025

[24] Byantikvaren (2022): Forprosjekt Buffersone for Verdensarvstedet Bryggen (Pre- Project Buffer Zone for the World Heritage Site Bryggen)

[25] Byantikvaren (2022): Overview topics in the Management Plan for Bryggen with relevance for the buffer zone / KUVA

3.4.8 Climate change challenges and rising sea level

Severe threats from climate change and rise of sea level are planned to be handled in the Master Plan for waste water and water environment 2019 – 2028. In the long term, adverse effects as a result of sea level rise are planned to be limited by establishing barriers at the entrance to Vågen and Store Lungegårdsvann, possibly in Damsgårdssundet at Puddefjordsbroen. The speed of climate changes will determine when it is necessary to build the barriers, but planning of the barriers should start in this Master plan period (2019 – 2028).

Fig. 3.4: Locations for potential barriers set out in the Master Plan for waste water and water environment 2019 – 2028: (Bergen kommune)

3.4.9 Cruise ship strategy 2016-2020

The cruise strategy for Bergen 2016 – 2020 addresses the sustainable development of cruise tourism. Port of Bergen is Norway's largest cruise port.[26] During the pandemic, the Port of Bergen, VisitBergen and several partners also developed a plan for more sustainable cruise tourism in Bergen[27]. Bergen City Council decided in May 2022 that a maximum of 8.000 cruise ship passengers daily will be accepted in the future, and that the number of cruise ships per day will be reduced to three. In collaboration with the Port of Bergen, efforts will be made to ensure that one of the cruise ships is mooring in Jekteviken on days with three ships in the harbour. Four ships will only be accepted if electrical power can be provided from the shore. According to Bergen City Council, all cruise ships mooring at Bergen should be able to connect to shore power, this should be a mandatory requirement by 2026 at the latest. To support this, Bergen harbour built the world's largest onshore power supply system, which can supply three cruise vessels with shore power simultaneously. [28] Additionally, Bergen also plans to introduce requirements for zero emissions to air and sea, from the port and entry, as well as for cruise ships. Regulations and an introduction date as prepared by the Norwegian Maritime Directorate for the World Heritage fjords.

3.4.10 Sea front strategy [29]

The sea front strategy sets out frameworks and guidelines at an overall level for the development of marine areas. Good links between the existing urban structure and the sea front must be clarified, and a principle with a continuous promenade with associated urban spaces has been proposed to connect areas together. The Sea Front strategy aims to manage cultural heritage in a better way and ensure that Bergen is further developed as a green, compact walking city.

[26] https://bergenhavn.no/en/cruise-en/

[27] Amland (April 2021): Håndtering av Cruiseshippassasjerer til Bergen etter Covid 19 Pandemien

[28] https://bergenhavn.no/en/cruise-en/

[29] Strategi for sjøfronten i Bergen sentrale deler https://www.bergen.kommune.no/api/rest/filer/V326015

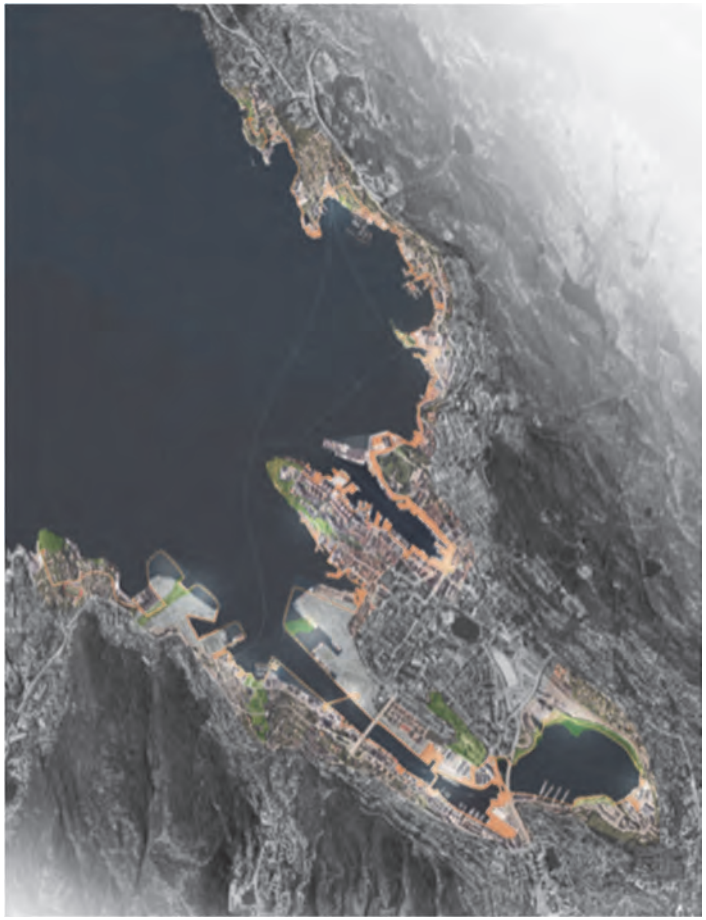


Fig. 3.5: Sea front strategy Bergen @Bergen commune

3.5 Conclusion: Relevant Aspects to be addressed in FINAL HIA REPORT PLANFORSLAGET

The analysis provided in Chapter 3 shows clearly that World Heritage property Bryggen is a complex site, where issues on several scales are interfering. Also the planned PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN will interfere with these aspects. For this FINAL HIA REPORT PLANFORSLAGET, the following aspects will be relevant:

- Main qualities that World Heritage Property Bryggen are related closely to its setting, Bryggen's former medieval context is still fully understandable. As a result, the assessment of the impact of PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN will be related to this context though the planned project covers only a part of this area.

- Management challenges, such as visitor management or environmental issues, have been clearly set out in the Management Plan. Similarly, PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN will affect the management of World Heritage Bryggen. Consequently, this FINAL HIA REPORT PLANFOSLAGET intends to clarify how Bryggen's World Heritage management might be affected by this plan.

- Various stakeholders are involved into management of World Heritage Bryggen. Throughout the HIA process, the intention was to inform relevant stakeholders about the planned Bybanen project. Similarly, also this FINAL HIA REPORT PLANFORSLAGET intends to provide transparent information for the upcoming hearing process.

4 Planned Bybanen Light-Rail Project

4.1 Background

Bergen, second largest city in Norway with 286.930 inhabitants, is a city between the mountains, which is both an asset and a challenge in connecting the different parts of the city together. Bergen is also the regional capital of the Vestland county and a commuter hub from the surrounding municipalities. Bergen is today a city with a high commuter level. The Bybanen light- rail network, opened in 2010, functions as the backbone of Bergen's sustainable public transport system connecting the different parts of the city together.

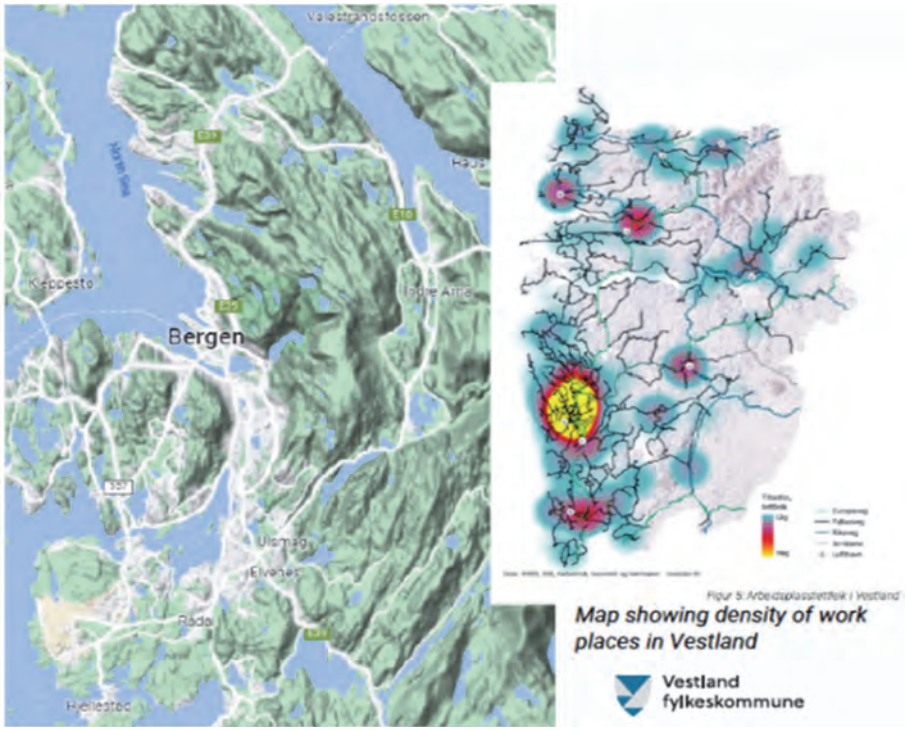


Fig 4:1 Map of Bergen and density of workplaces in Vestland (©Vestland Fylkeskommune)

The national strategy of zero growth policy for the large cities is the basis of Miljøløftet, the collaboration between Bergen, Vestland County, the surrounding municipalities, and the Norwegian Public Roads Administration. It includes goals for transition to low- and zero growth, reduction of car traffic, promote bicycle, pedestrian and collective traffic and an environment friendly urban development, reduction of carbon dioxide emissions and local pollution and promote accessibility and effective utilization of transport capacity. Bybanen light-rail system is considered important to achieve this strategy.

4.2 Bergen city traffic plan 2022[30]

A proposal for a new traffic plan for the city centre has been presented in September 2022 and is currently on hearing and expected to be approved by the City Council in autumn 2022. The main objective is to establish zones that can be accessed only from the main road system outside the city centre. Only buses, taxi, deliver vehicles and cyclists can access and go through the historic city centre. A crucial starting point to implement the plan and to achieve a car free city centre is the extension of Floyfjelltunnelen, located in the east of Bergen.

Closing Bryggen and Torget for traffic has been a political goal since the 1990s. The car free centre can be implemented through the Bergen city traffic plan without the proposed Bybanen stretch along Bryggen.[31] Improvement of connectivity will however not be ensured with this measure, as the capacity of the bus system is limited.

[30] Miljøløftet september 2022. Planbeskrivelse Delstrekning1, Kaigaten- Sandbrogaten. Plan-ID 65800000

[31] Bergen kommune (16.06.2022): Fagnotat Traffikplan Centrum

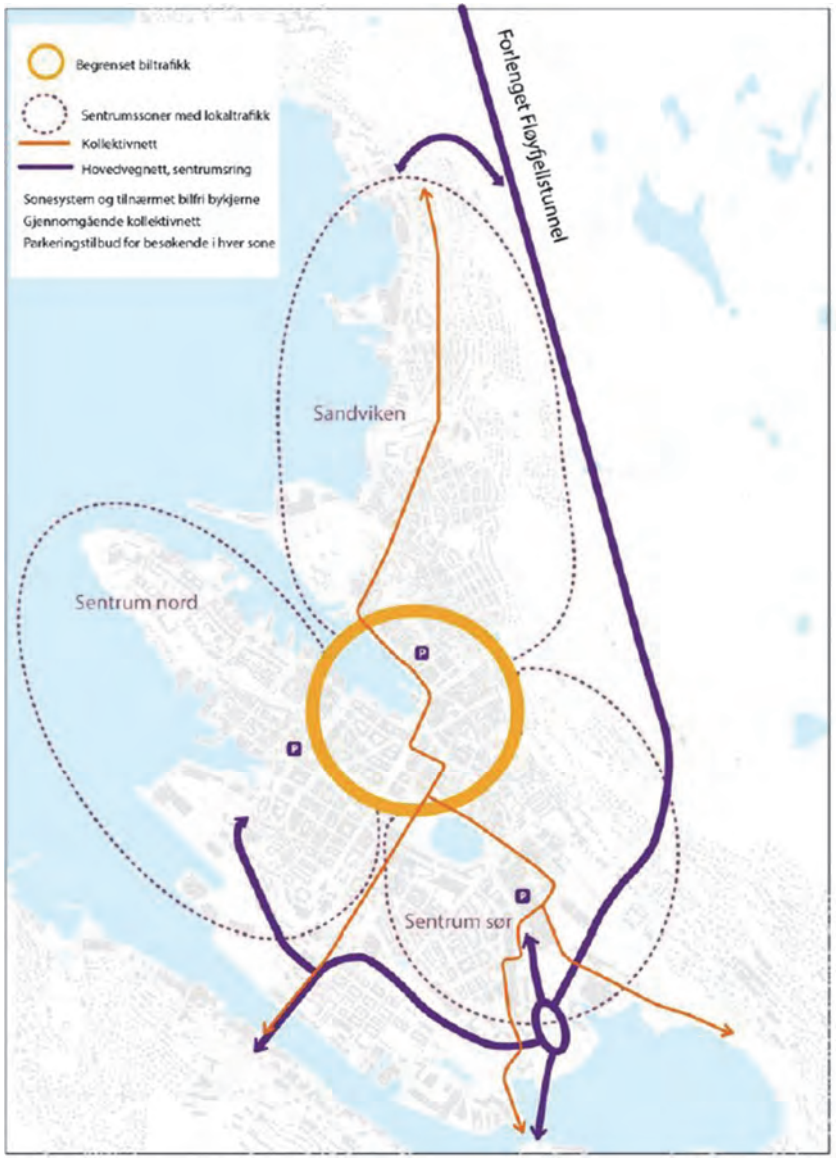


Fig. 4.2: Traffic plan and city centre September 2020: (© Miljøløftet/ Bergen commune)

4.2.1 Changes in traffic volume

Changes of traffic volumes in the new traffic plan show a reduction in annual average daily traffic over Bryggen, Torget and through Øvregaten in the alternative 2. This alternative is the preferred alternative in the proposal. An alternative 1 has also been developed, where some car traffic can pass through Torget (not Bryggen), and which will increase the annual average daily traffic through Øvregaten with 1000 vehicles. The alternative 1 is proposed to be a preliminary phase but Vestland county, amongst others, propose to go directly to alternative 2.

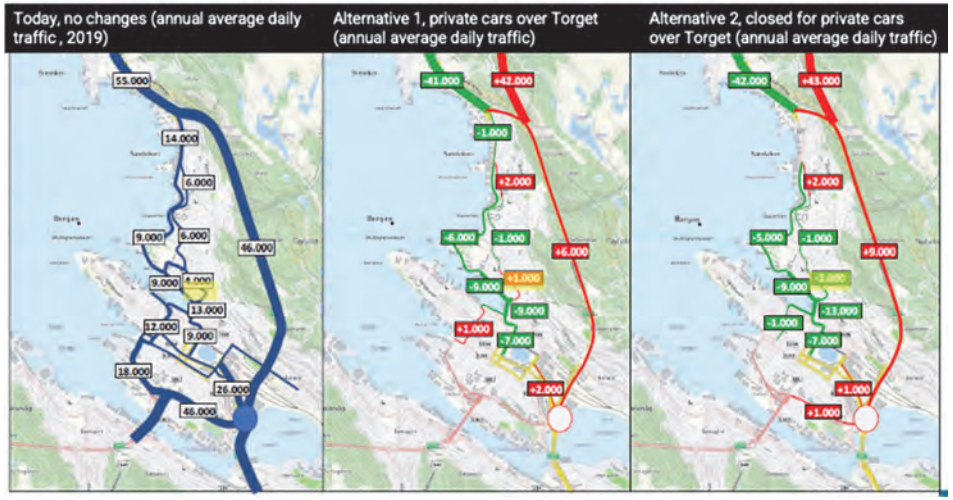


Fig. 4.3: Expected change in traffic (© Vestland fylkeskommune)

For phase 2 it is planned that,

- Torget will carry Bybanen, bus, delivery, cyclists, taxi
- Bryggen Quay will carry Bybanen, delivery and cyclists
- Øvregaten will carry bus, delivery, cyclists, taxi

4.2.2 Cycle strategy in Bergen 2019 – 2030

An increase of travels by bicycle is a key-part of the strategy to reduce traffic growth. In 2030 10 % of all travels in Bergen shall be done by cycle and 20 % of all travels in the expanded city centre shall be done by cycle. In parallel to the Bybanen a high-quality cycle-path network along the full length of the light rail tracks has been built and in the extension of Bybanen to Åsane the cycle route will continue through the city centre and to Åsane.

4.2.3 Local buses

The new routing of the local buses from city centre to Sandviken will go through Øvregaten. The stops are at Torget and Mariakirken. The frequency of the buses is 18 buses/h which is almost the situation today. The decrease of traffic on Øvregaten will regard the number of cars.

Øvregaten is considered Bergen's oldest medieval street and the main access road to Bergen and closely linked to the World Heritage property and Mariakirken. In Phase 2 there will be a reduction of total traffic with the same number of buses as today, but no car traffic. During the construction period heavy traffic can go through Øvregaten. The results of the survey indicate that the street has a good carrying capacity without reinforcement. However, repairs may be necessary when the construction phase is over, as well as minor changes to the design where curb stops for buses are established.

4.3 Bybanen light rail project DS1 Kaigaten – Sandbrogaten

Three Bybanen lines are currently in operation and a fourth one is planned to be opened in November 2022. To extend this network northwards, a fifth light-rail line is currently planned to link Åsane to the city centre.

The Bybanen Light Rail project has the goal to contribute to the improvements in the city centre and for Bryggen by following measures:

- Follow-up on objectives in planning for Vågen, the quays and Bryggen
- Reduction of car traffic, and no private cars along Bryggen
- Maintaining access to the city centre in the event of major traffic incidents
- Serving the historic centre, also in exceptional situations and at large events
- Strengthening business
- Improving conditions for pedestrians and cyclists
- Regeneration of urban spaces
- Regulation of tourist buses and tourist traffic
- Reduced noise, dust and air pollution
- Creating a flooding and storm wave barrier

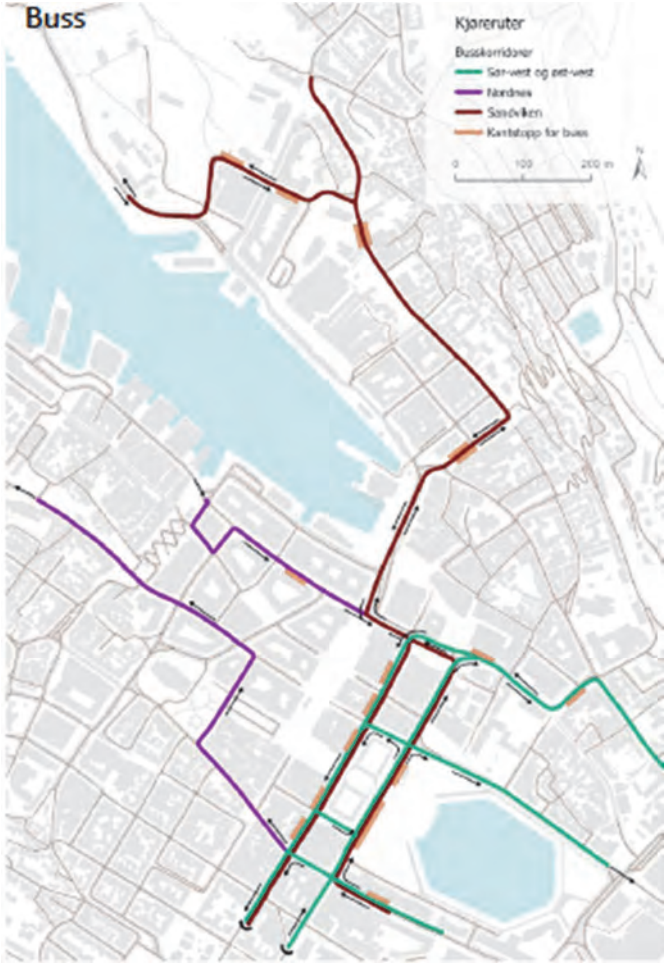


Fig. 4.5: Local bus route over Øvregaten to Sandviken (© Bergen kommune)

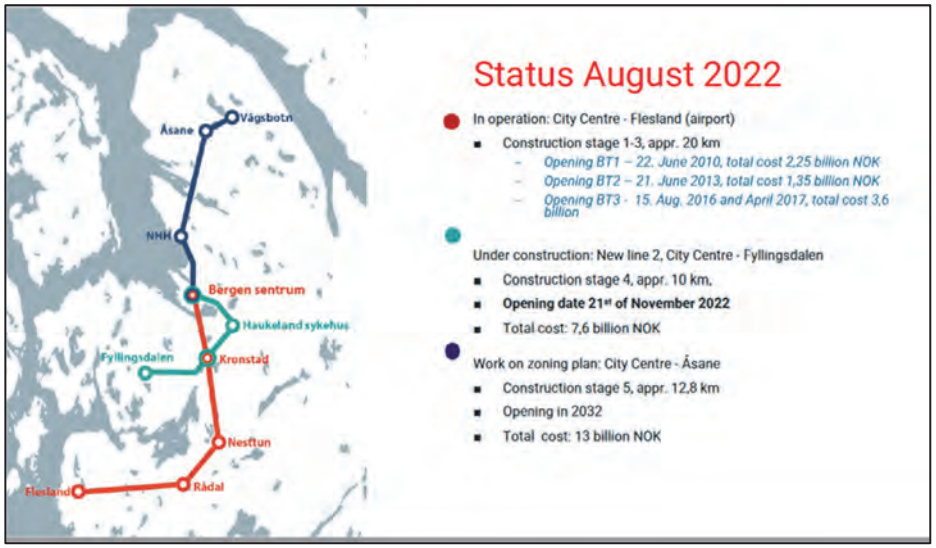


Fig. 4.5: Bybanen 2022 and planned extensions (© Vestland fylkeskommune)

4.3.1 Roles and responsibilities

Bergen municipality is responsible for the zoning plan for Bybanen in close collaboration with Vestland County and the Norwegian public roads authority.

- *Bergen City Council* approves the plan
- *Vestland County Council* is the highest political authority in areas of regional planning, culture, roads, and public transport. It is responsible for public transport in Bergen, hence builds, operates, and owns the Bybanen. The Vestland County Council can object to the plan if the plan has negative impacts on areas the County is responsible for as cultural heritage, public transport and roads.
- *Norwegian Public Roads Administration* is responsible for national and EU roads, road users. It is not a political level; the administration can object to the plan.

4.4 Development of Bybanen options

4.3.2 Planning process

The planning process for Bybanen to Åsane has been ongoing since 2011. Phase 1 included the Plan Program and Environmental Impact Assessment and routing alternatives. The Environmental impact assessment was submitted to public hearing in 2013, and Bergen City Council adopted the routing for Bybanen through the city centre in 2016.

Phase 2 for the light rail project comprises the zoning plan process, where a sketch phase has first been carried out. A tunnel alternative was compared with the present-day alternative, and Bergen City Council in the meeting of 15 December 2021 adopted the route through the city centre as the basis for further zoning plan work. Work on the tunnel alternative was stopped.

The City Council will consider the plan proposal and submit it for public consultation in the autumn of 2022. After consultation, comments will be processed, the plan will be adjusted and sent for a second reading and decision in Bergen City Council in the spring or 2023.

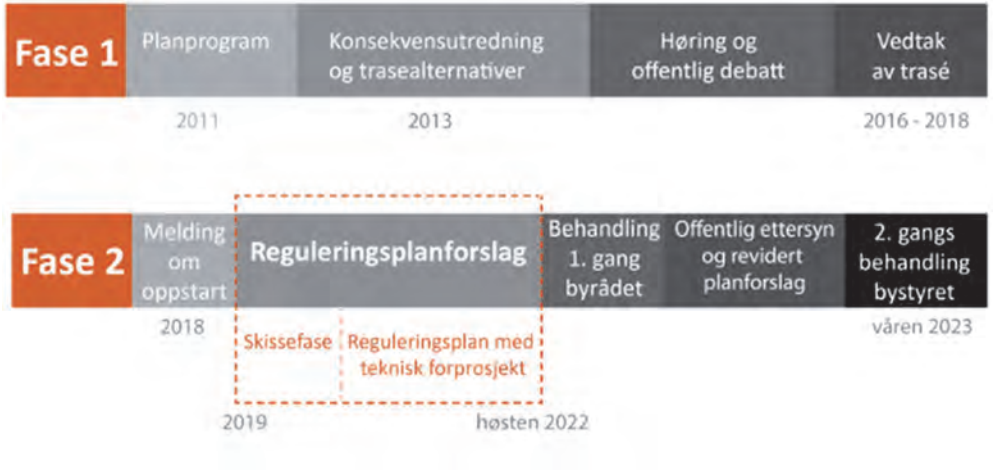


Fig. 4.6: Bybanen planning process (© Bergen kommune)

4.3.3 Heritage impact assessments Phase 1 and 2

In 2019 the World Heritage Committee (43.COM) stated that a Heritage Impact Assessment should be undertaken *"regarding the future track that will pass in the buffer zone, to assess the potential impact on Bryggen's Outstanding Universal Value".*

The Heritage Impact Assessment for the World Heritage Property Bryggen has been done in two phases. Phase 1 resulted in two preliminary HIA reports with recommendations for further development of the Bybanen project in the draft phase. These were Preliminary HIA report October 2020 and a supplementary Preliminary HIA report related to the comparison of the "day" and "tunnel" alternatives in September 2021. This current HIA assesses the present plan proposal.

The HIA recommendations from Phase 1 (October 2020) inter alia emphasized the following:

- Minimize visual effect of a catenary system, minimize raising of the ground level and work towards a landscape design that visually connects the World Heritage site with Vågen.
- Rearrange tracks to gain extra distance to Hanseatic Museum/ Finnegården.
- Minimize traffic along Bryggen and in Øvregaten and seek sustainable solutions for tourist traffic.
- Show possible solutions and potential positive impacts for underground cultural heritage regarding groundwater, vibrations, noise, and flood prevention for the World Heritage site.

As a follow-up to the HIA preliminary recommendations from October 2020 the local bus routing was shifted to Øvregaten, the height of the track in front of Bergen was lowered, the design of the Bryggen quay was detailed, among others.

Furthermore, the follow-up to the recommendations in HIA from September 2021 included that overhead cables were removed along Bryggen, the lighting plan and detailed design for Torget and Bryggen urban spaces was upgraded. Technical solutions regarding cultural layers conservation and groundwater stability at Bryggen quay and Sandbrogaten were developed further.

Fig. 4.7: HIA preliminary reports (©mkphc)

4.4 Bybanen project DS1/ Kaigaten – Sandbrogaten

The light rail route is planned through the historic centre along Kaigaten, Christie's gate, Småstrandgaten, Nedre Torgallmenningen, Torget, Bryggen and Sandbrogaten. On this section, Bybanen will have three stops: Kaigaten, Torget and Sandbrogaten. In Sandbrogaten Bybanen will continue into a tunnel. Bicycle lanes are planned along the light rail track on Finnegården and Bryggen quay and continue along the coast to Sandviken.

The planned frequency of Bybanen is 3 minutes in rush hours with 40 light rail sets (both directions). Today a total of 100-120 buses (both directions) in rush hours pass Bryggen.

Fig. 4.8: Bybanen DS1 section from Kaigaten to Sandbrogaten @Bergen kommune

Fig. 4.9: Walking routes and urban spaces in and around World Heritage (©Bergenkommune)

4.4.1 Accessibility and walkability in the Bryggen area

The planned Bybanen will provide direct access to Bryggen with Bybanen from different parts of Bergen region. Bybanen stops are at Torget and Sandbrogaten. These are on walking distance from the World Heritage property. There will be a local bus stop at Mariakirken in Øvregaten. The planned stop at Sandbrogaten will also facilitate access to Bergenhus and Koengen.

Fig. 4.10: Walking distances 200-400-600 meter from Bybanen stops (©Bergen kommune)

4.4.2 Urban design proposal Torget – Bryggen

The project area for the design "Mot Vågen" encompasses the public space of Bryggen and Torget, as well as parts of Dreggsallmenningen, Nikolaikirkeallmenningen, Vertlidsallmenningen and Vågsallmenningen.

Fig. 4.11: Design "Mot Vågen" (© Mot Vågen)

The design principle developed by Agency of Urban Environment and "Mot Vågen" project group aims at creating living urban spaces and establish a coherent and well-designed city-floor along Bryggen and Torget, which is made possible by the light rail day option.

4.4.3 Bicycle route along Bryggen

Along Torget cycling will be in mixed traffic with cyclists given priority. From Torget along Finnegården and Bryggen quay the bicycle lanes are on each side of the light rail continuing along the waterfront through Skuteviken and Sandviken.

Fig 4.12: Bryggen quay design proposal (© Mot Vågen)

4.4.4 Safety

The proposed solution for increased pedestrian safety is having a cycle lane on each side of Bybanen, together with speed-moderating design. Both light rail, cyclists, and other traffic has a low speed. Consideration has been given to the design of pedestrian crossings to ensure that these are wide and appropriately placed across the light rail tracks and cycle paths. In Nikolaikirkeallmenning, local parking is proposed to be removed to provide more space for pedestrians. Parking for disabled is located south and north of Bryggen.

As a part of a mitigating measure a specific solution of marking the safety zone has been applied to the historic quay between Bryggesporden and Dreggekaien. Important crossings are marked as a pedestrian area and sightlines marked in the urban floor. The solution is intended to ensure that both cyclists and pedestrians clearly understand which areas are specially adapted for them, to avoid conflicts between the various users. This solution differs from Bybanen design manual requirement for marking of the safety zone with a standard "white lining" and therefore the Regional Directorate of Public Roads needs to approve the solution. Applications for approval of changes from standard road design requirements are submitted.

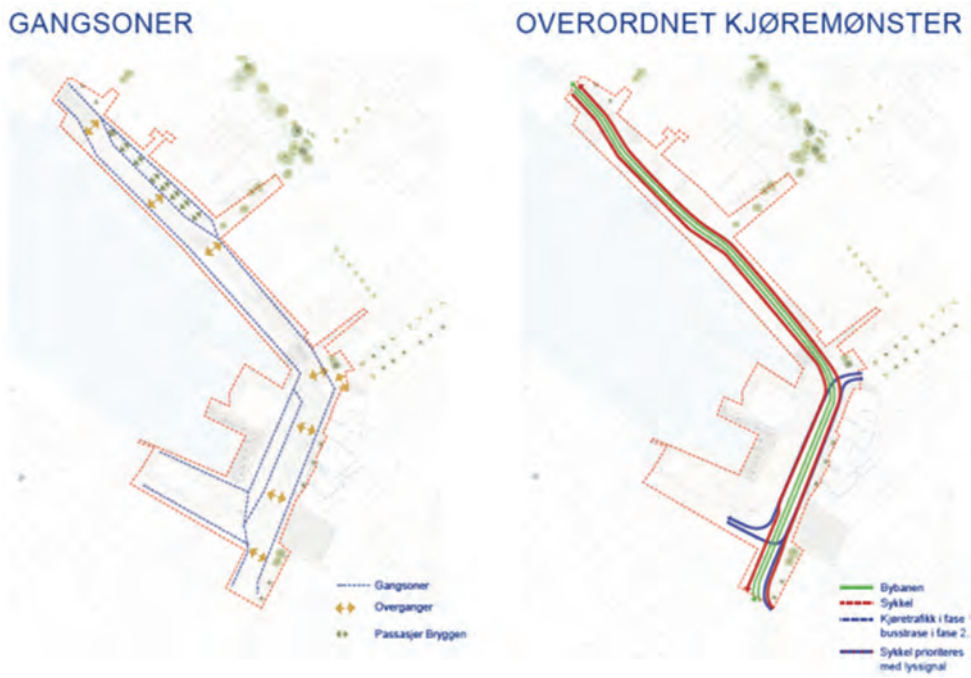


Fig. 4.13: Walking zones passages and traffic pattern (© Mot Vågen)

4.4.5 Lighting concept and lighting masts

There will be no masts for overhead power lines along Bryggen quay. Between the stops at Torget and Sandbrogaten the Bybanen will operate on battery power. Consequently, there will be only lighting poles on the quay.

The lighting principle on Bryggen includes functional lighting for security with 12 m lighting poles along the light rail track and Bryggen quay front buildings lighting with 3.2 m shielded masts. The lighting will be complemented with private owners lighting of their shops and restaurants. The zoning plan proposal contains provisions for the exact location of lighting masts and their design.

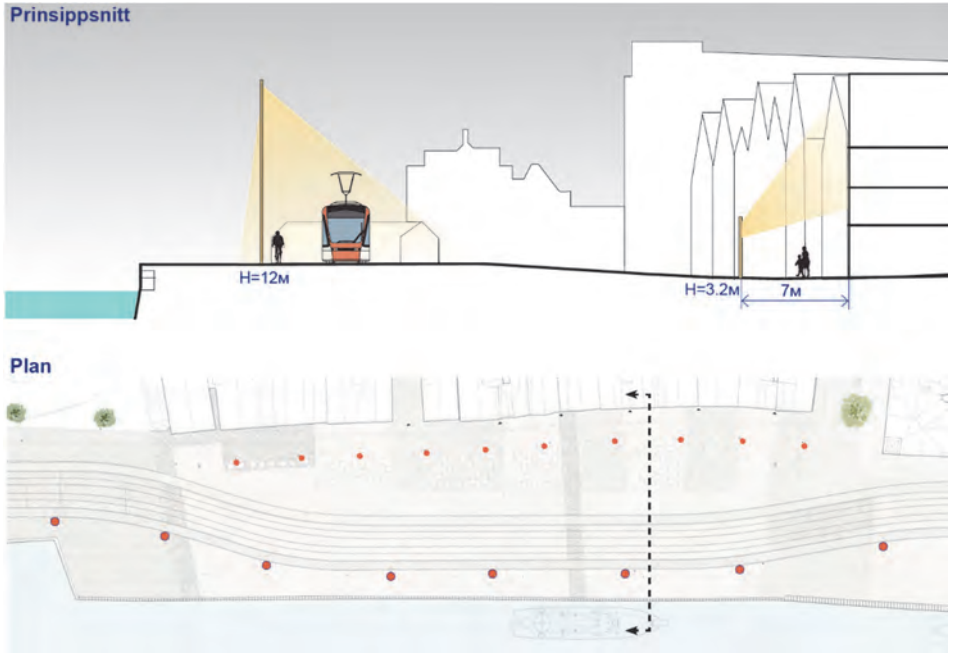


Fig. 4.14a/b: Lighting design (@ Mot Vågen)

4.4.6 Bryggen Quay

The overall design measures for the Bryggen Quay include a cohesive surface treatment with cobblestones in various formats, hues, and textures. The view from inside Bryggen is designed to allow for a good visual contact with Vågen. Crossings are marked as a pedestrian area and sightlines are marked in the pavement.

The urban floor is divided into four zones:

- Pedestrian zones: Surface treatment ensuring universal accessibility
- Bicycle zone: Bike friendly surface treatment. Double row of stone pavement on each side.
- Light rail track: Re-used stone with less bike friendly surface.
- Activity and furniture zone: Varying fields of stone demarking the zone. The meeting between differing pavement stones marks the positions of the passages

4.4.7 Use of Bryggen during events

Bryggen is accommodating events, tall ship gatherings, national celebrations, and smaller events throughout the year. Events such as the National Day on May 17, and the Tall Ships Race are examples of important days which bring a high number of visitors to Bryggen. The light rail over Bryggen manages these specific days by ensuring that Bybanen can turn around at the stops in Sandbrogaten and Kaigaten/ Bystasjonen. The urban design concept accommodates both large events and smaller flexible ones on Torget and Bryggen.

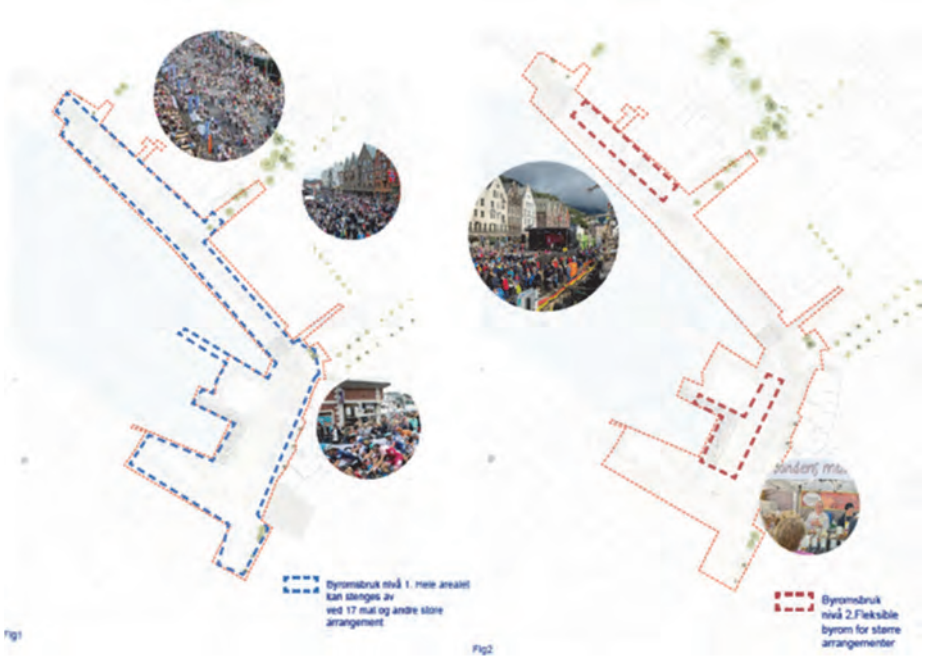


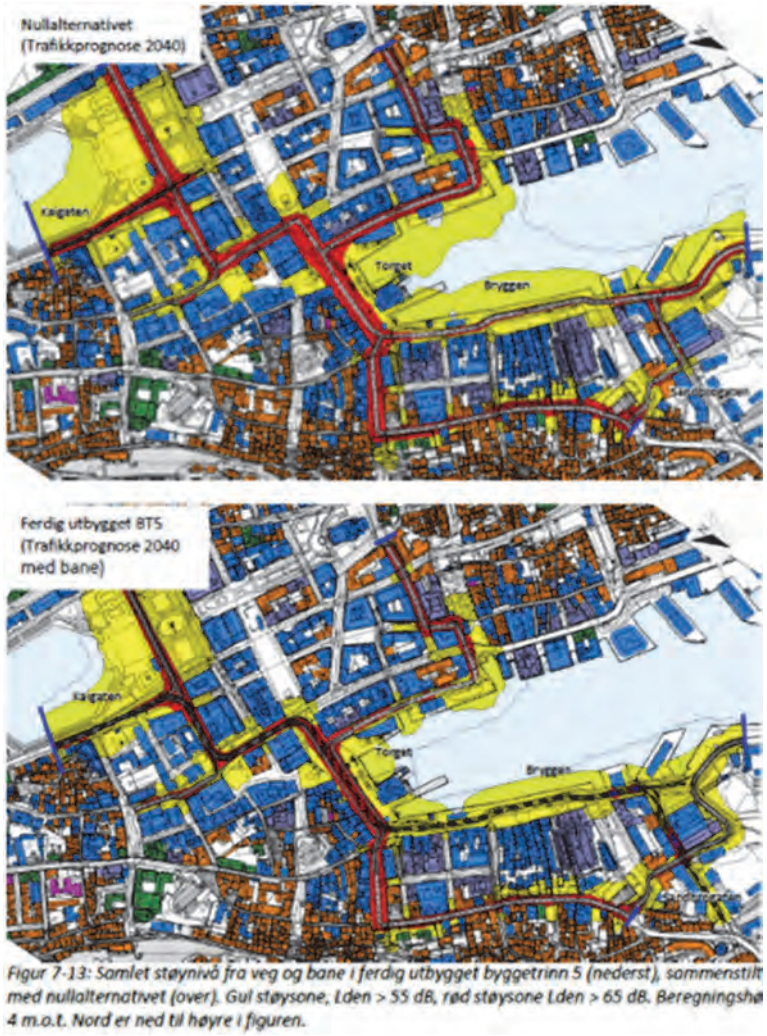
Fig. 4.15: Urban spaces for large and flexible arrangements @ Mot Vågen

4.4.8 Goods Delivery and emergency vehicle access

Car lanes will be removed, and only light rail and cycling lanes will be allowed along the quay, with exception of delivery vehicles which will have their own zone and time window. These vehicles will partially drive in the light rail track, and partially in the pedestrian zone along Bryggen.

4.4.9 Noise

After the finalisation of the Bybanen construction works the noise level is expected to be slightly lower as today with the exception at western part of Øvre Dreggsallmenningen and Bradbenken which will have the traffic that goes on Sandbrogaten. At Bryggen the noise level at the building fronts will be reduced between 3 to 7-8 dB to then 57-58 dB.



Figur 7-13: Samlet støynivå fra veg og bane i ferdig utbygget byggetrinn 5 (nederst), sammenstilt med nullalternativet (over). Gul støysone, Lden > 55 dB, rød støysone Lden > 65 dB. Beregningshø 4 m.o.t. Nord er ned til høyre i figuren.

Fig. 4.16 Noise analysis from 0 alternative and road and light rail in traffic forecast 2040
© Norconsult asplan viak

[32]Miljøløftet 2022 Miljøløftet september 2022. Planbeskrivelse Delstrekning1, Kaigaten- Sandbrogaten. Plan-ID 65800000

4.4.10 Vibration

A vibration assessment is proposed to be done with a more detailed basis for assessing vibrations in sensitive areas such as Bryggen, Sandbrogaten and Øvregaten. The ground conditions along the stretch are unfavorable regarding vibrations and the tresholds for vibrations can be exceeded without mitigation measures.[32]

4.4.11 Construction works of the light rail on Bryggen quay

The ground conditions and cultural layers of Bryggen quay are varied and not yet fully mapped. An archaeological survey will be completed in autumn 2022, and current research about the historical evidence of the building stages of the Bryggen Quay has recently been presented [33]

Fig.4.17: *Map from 1885 with today's quay line is marked and the light rail track is shown with bicycle lanes. ©asplan viak NO-DS1_033*

[33] Skivenes,A. juni 2022: En Sang om Mudder og Bakfyll, Tyskebryggekaiens forlangelse 100 år etten. Stiftelsen Bryggen.

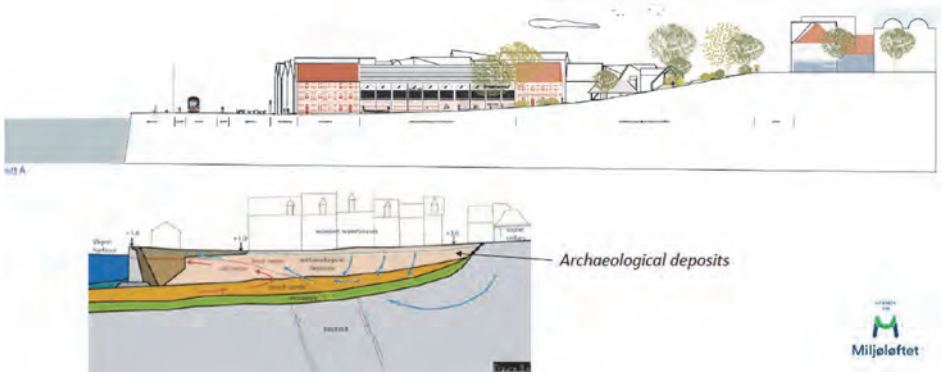


Fig. 4.18: Foundation of the light rail tracks and relocation of underground infrastructure along Bryggen @Miljøløftet

The principle of the construction of the light rail is to limit the construction works to the newer masses outside the 1800 quay as they are defined in the project.

- Track foundations will be 1 meter deep.
- New underground infrastructure, 3-4 meters deep, on the outside of the tracks along the quay.
- The construction method for the track foundations is done by wet excavation, which avoids groundwater lowering
- The establishment of a stabilizing pile wall (10 – 14 m deep) of a row of adjoining piles on the inside of the ditch. In the detailed design phase, the pile wall will be designed to slow down the supply of oxygen, and sulphates to some degree, to cultural layers and bulwarks under the buildings.

Fig. 4.19: The new ditch for infrastructure (left) and planned pile wall along Bryggen Quay (© Norconsult asplan viak)

The pile wall is expected lead to less weathering of cultural layers, somewhat higher groundwater levels on the inside of the pile, and less variation in the groundwater level in front of Bryggen as a result of high and low tides. A dense pile wall does not stop the exchange between groundwater and seawater, but limits movement in the highest water layers. The proposed building method is planned to ensure a stable ground water level throughout the building period. It also aims at achieving a permanent effect of stabilisation of the groundwater meaning reduced oxygen caused by flooding, tidal water and drainage through the quay.

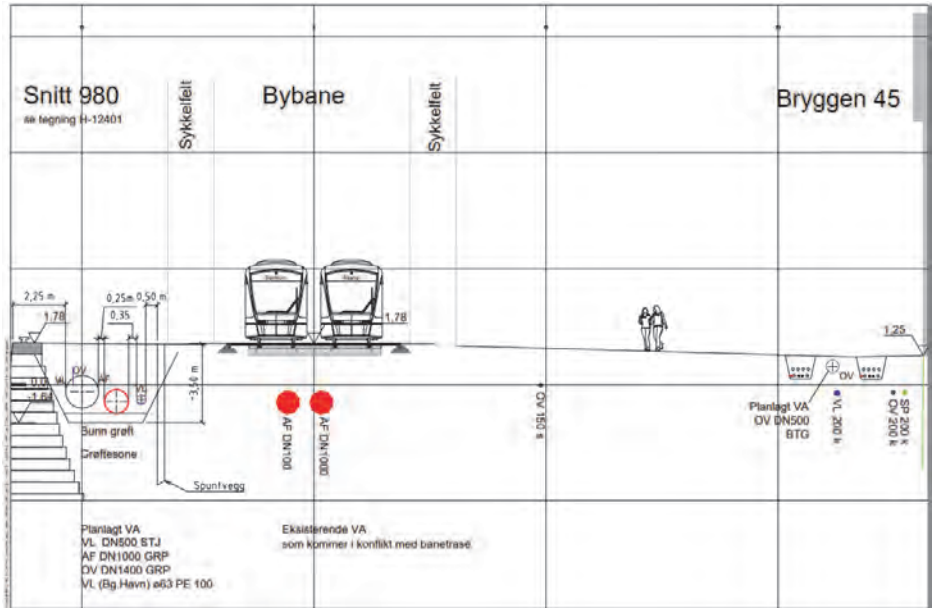


Fig. 4.20: Planned pile wall at Bryggen (Bryggen 45)© Bergen commune

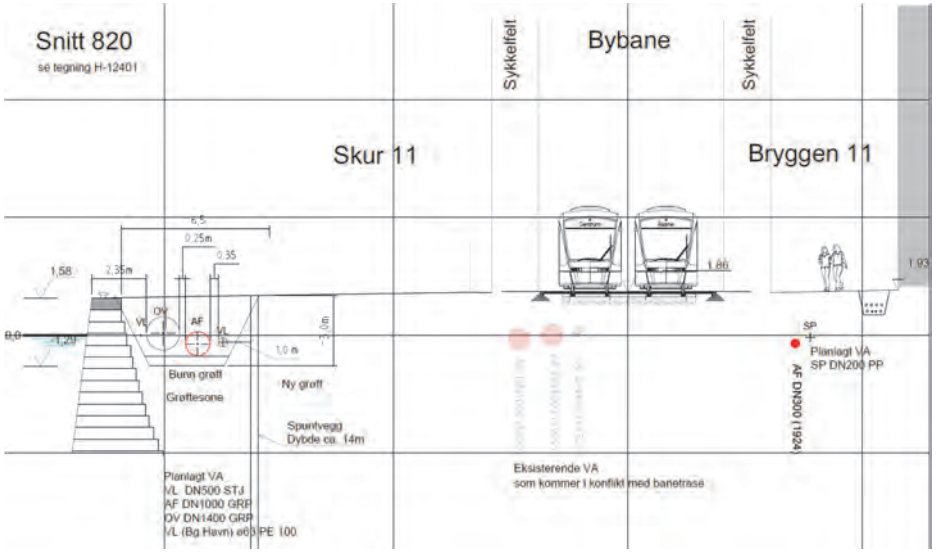


Fig. 4.21: Situation at Finnegården with tracks and a pile wall © Bergen kommune

4.4.12 Sandbrogaten

The cultural layers at Sandbrogaten and in adjacent areas of Koengen are assessed to be the oldest in Bergen and of very high value. Groundwater levels are relatively low. This results in poor conservation conditions for organic culture layers. The groundwater situation in Sandbrogaten must be seen in the context of Koengen, where the cultural layers are also very valuable.

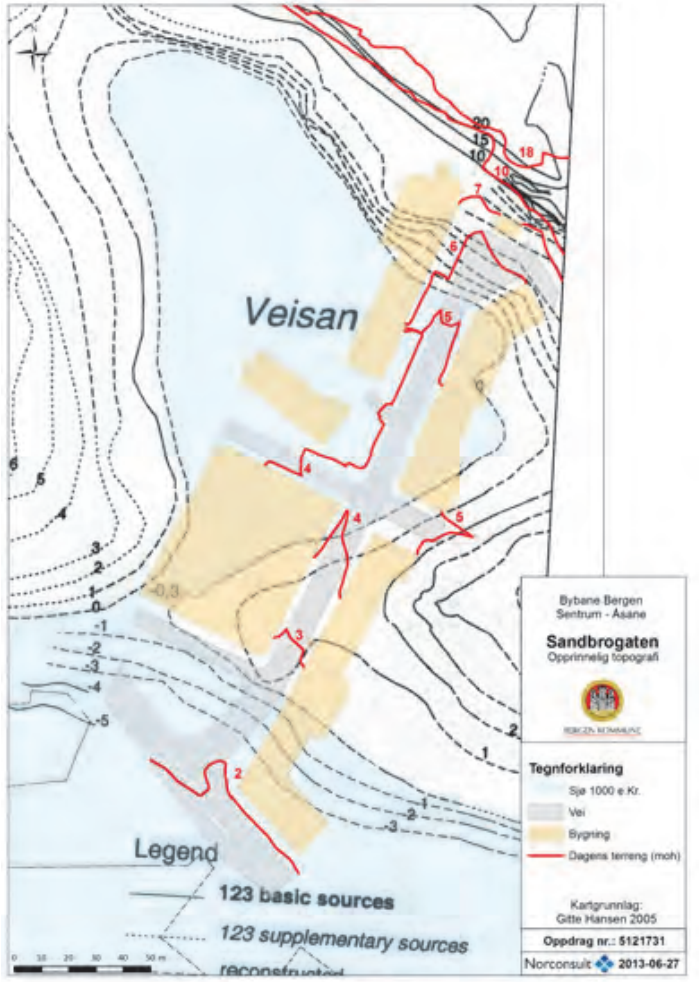


Fig 4.22: Medieval topography and today's Sandbrogaten @Norconsult

Archaeological investigations with drillings will be finalized in the autumn 2022. Organic cultural layers are expected to be 1.4 -1.5 meters below the surface. It is recommended that new infrastructure be established shallowly, and thresholds and seals be established that prevent unwanted drainage.

Bybanen tracks are proposed to be laid above the cultural layers and primarily in existing ditches.

- The light rail track is planned on a basin with a maximum depth of 1 meter below surface, filled up with lighter masses.
- The light rail construction together with the trams is not predicted to increase load on Sandbrogaten compared with today's situation. New underground infrastructure is proposed to be laid primarily in existing ditches.

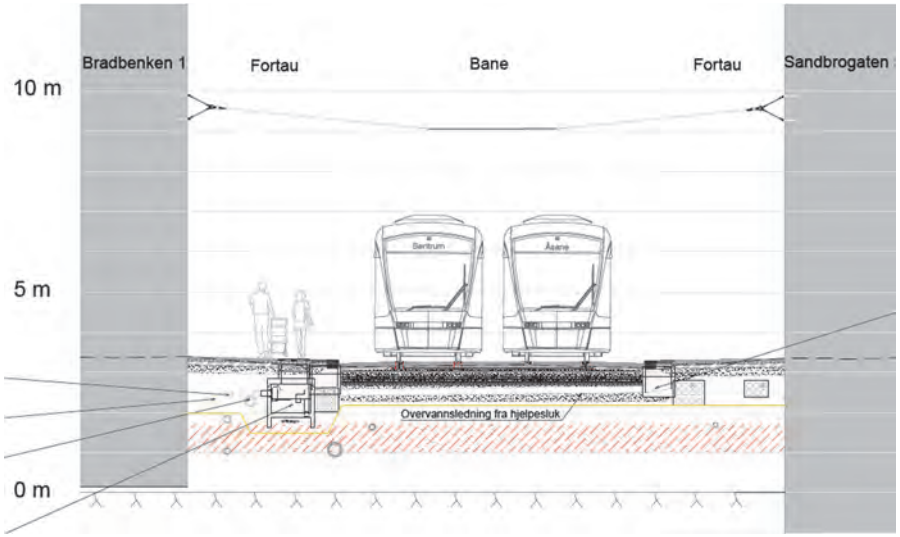


Fig 4.23: *Section at Sandbrogaten . Red markings are cultural layers. © Bergen kommune*

4.4.13 Bybanen construction works

The construction time of Bybanen DS 1 Kaigaten - Sandbrogaten is estimated to be eight years. In the first phases underground infrastructure is built, taking about 1-2 years along Bryggen. In the last phases the surface with tracks and paving is built, taking about 1 year along Bryggen.

Principles for the construction phase is to construct the different areas in steps

- Frist step is to divert traffic away from Bryggen and Torget
- Second step to refurnish infrastructure at the edge of Bryggen and at Torget
- Third step re-establish the street to secure traffic during the joining of the separate tunnels of the extended Fløyfjell tunnel
- Forth step to divert traffic again and establish the surface and the rails
- Opening of the light rail

The establishment of a tunnel at Sandbrogaten will also require a larger construction pit during the construction phase, which will not only have a major impact on the cultural environment in Sandbrogaten and Kroken, but also Bergenhus Fortress, especially in relation to noise and dust during the construction phase.

The area at Koengen railway site is planned to be used as a construction area throughout the light -rail building period. The site is part of the protected Bergenhus fortress area and borders a park which is widely used for recreation and events.

When the Bybanen is in operation, no negative consequences are foreseen for cultural heritage or the use of the site for activities. The construction phase may have special effects on the environment and those who live or work daily in or near the construction site. These can be mass heavy transport by road and sea, rerouted roads, cycle paths, bus stops and walkways and driving access. Quay areas along Bryggen will be closed for periods and may temporarily interfere with historical legibility.

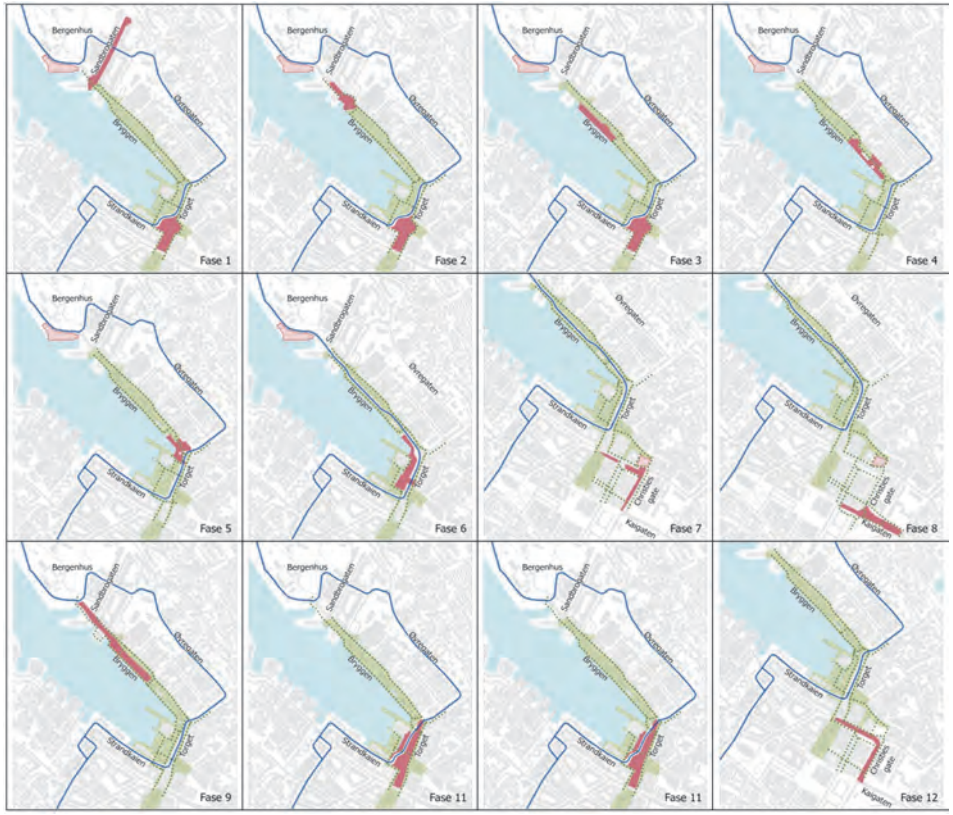


Fig. 4.24: Bybanen construction phases ©Bergen kommune

4.5 Conclusion: Relevant aspects to be addressed in the HIA

With regard to the OUV of the World Heritage property and the (key)attributes expressing this OUV identified in Chapter 3, the following aspects related PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN must be taken in account in the assessment:

FUNCTIONAL INTEGRITY:

- Potential impact on quantity of traffic vehicles and noise (number of cars, bus, light rail and cycling traffic)
- Potential impact on walkability and accessibility
- Potential impact on functional barriers

VISUAL INTEGRITY

- Potential impact of planned transformations on Bryggen / Bryggen Quay / Vågen Harbour

STRUCTURAL INTEGRITY

- Ground water changes and their potential impact on built structures and cultural layers

As already stated in Chapter 2.6, it has to be noted regarding the assessment of the planned “PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN” that not all impacts can be graded equally. While visual and functional impacts of the planned project on its environment can be visualised and graded accordingly, potential indirect and cumulative impacts on cultural layers or hydrology and the groundwater level of the World Heritage property Bryggen cannot be fully foreseen at this point of time.

Accordingly, similar to the earlier Preliminary Report, this FINAL HIA REPORT PLANFORSLAGET distinguishes between impacts and risks.

5 Impact Assessment

5.1 Functional Analysis – Methods

The first step of the impact assessment is an evaluation of the functional impacts to be expected to the OUV of the World Heritage property Bryggen.

The following main principles of the future traffic development are relevant for the assessment:

- The authors of this HIA Report were informed that phase 2 of «Trafikkplan sentrum» will be directly implemented. According to phase 2 of this plan, car traffic through the city centre will be removed. Extension of Fløyfjellstunnel is crucial for implementation of this plan.
- Reduction of bus traffic (from 100-120 buses / hour to 18 buses / hour) at Torget. Stop for local buses at Torget.
- Coherent new urban design along Bryggen Quay, including a new lighting plan.
- Removal of bus and car traffic at Bryggen Quay.
- Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery.
- Bryggen Quay frequented by Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions.
- Buses will use routing via Øvregaten. There will be 18 buses in each direction in peak hours in Øvregaten (approx. the same amount than today).
- Concept how to prevent tourist buses from entering Øvregaten is not yet finalised.

Fig. 5.2 Traffic main principles according to Traffic Plan Phase 2 (© Bergen Municipality)

5.1.1 Identified potential impacts

The assessment will be graded according to the (key)attributes identified in chapter 3. According to the facts compiled throughout Chapter 3 and 4, the following elements of proposed action related to PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN were identified with regard to the (key)attributes of the World Heritage property (Irrelevant key attributes are not indicated here):

"PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN"						
(KEY) ATTRIBUTES	**IDENTIFICATION OF ELEMENTS OF PROPOSED ACTION RELEVANT FOR FUNCTIONAL INTEGRITY OF BRYGGEN**					
Functional Impact: *quantity of traffic vehicles and noise (number of cars, bus, light rail and cycling traffic)*	***Elements of proposed action***					
Torget KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	Removal of car traffic (The goal of a car free Bergen centre can be achieved without the Bybanen track DS1 over Bryggen. Grading is dependent on implementation of "Traffikplan sentrum", phase 2).	Reduction of bus traffic (from 100-120 buses / hour to 18 buses / hour)	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions.	Planned light-rail stop at Torget Stop for local buses at Torget	Along Torget cycling will be in mixed traffic with cyclists given priority.	
Finnegården KA4 Maintained built structure of the Hanseatic quarters and its quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	Removal of car and bus traffic	Coherent new urban design along Bryggen Quay	Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery.	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions close to entrance Hanseatic Museum.		
Bryggen Quay KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its quay	Coherent new urban design along Bryggen Quay	Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery.	Removal of car and bus traffic.	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction on Bryggen quay.	Slight noise reduction (3.8 db)	
Øvregaten KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	Removal of car traffic	Buses will use routing via Øvregaten No. of public transport buses stays approx. the same (18 buses / h rush hours) (->"Traffikplan sentrum", phase 2).	Concept how to prevent tourist buses from entering Øvregaten is not yet finalised			

(KEY) ATTRIBUTES	IDENTIFICATION OF ELEMENTS OF PROPOSED ACTION RELEVANT FOR FUNCTIONAL INTEGRITY OF BRYGGEN					
Functional Impact: *Impact on walkability and accessibility of WH property Bryggen*	***Elements of proposed action***					
Torget KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen	Removal of car traffic	Reduction of bus traffic (from 100-120 buses / hour to 18 buses / hour)	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions.	Planned light-rail stop at Torget	Along Torget cycling will be in mixed traffic with cyclists given priority.
Finnegården KA4_Maintained built structure of the Hanseatic quarters and its quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen	Removal of bus and car traffic	Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery.			
Bryggen Quay KA4_Maintained built structure of the Hanseatic quarters and its quay	Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen	Removal of bus and car traffic	Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery.as goods delivery.			
Øvregaten KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	Planned light-rail stop at Sandbrogaten	Local buses will use routing via Øvregaten, bus stop at Mariakirke				

(KEY) ATTRIBUTES	IDENTIFICATION OF ELEMENTS OF PROPOSED ACTION RELEVANT FOR FUNCTIONAL INTEGRITY OF BRYGGEN					
Functional Impact: *Impact on functional barriers*	***Elements of proposed action***					
Torget KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen	Removal of car traffic	Reduction of bus traffic (from 100-120 buses / hour to 18 buses / hour)	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions.	Planned light-rail stop at Torget	Along Torget cycling will be in mixed traffic with cyclists given priority.
Finnegården KA4_Maintained built structure of the Hanseatic quarters and its quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen	Removal of bus and car traffic	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction with cycling path on either side of light rail track.	Planned light-rail stop at Torget		
Bryggen Quay KA4_Maintained built structure of the Hanseatic quarters and its quay	Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen	Removal of bus and car traffic	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction with cycling path on either side of light rail track.	Bybanen can turn around at the stops in Sandbrogaten and Kaigaten / Bystasjonen so as to support events such as tall ship gatherings and the National Day on May 17, which bring a high number of visitors to WH Bryggen.		
Øvregaten KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	Removal of car traffic	Buses will use routing via Øvregaten Number of public transport buses stays approx. the same (18 buses / h rush hours) (This is dependent on implementation of "Traffikplan sentrum", phase 2).	Concept for parking and through-traffic due to tourist buses is not finalised.			

5.1.2 Assessment of impacts on functional integrity

The above-mentioned identified elements of proposed action related to PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN lead to the following assessment:

Elements of proposed action "PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN"	**Attributes / key attributes in WH property and its setting**	**Description of potential impact on (Key) Attributes**	
Functional Impact: ***quantity of traffic vehicles and noise (number of cars, bus, light rail and cycling traffic)***			
• Removal of car traffic • (The goal of a car free Bergen centre can be achieved without the Bybanen track DS1 over Bryggen. Grading is dependent on implementation of "Traffikplan sentrum", phase 2). • Reduction of bus traffic (from 100-120 buses / hour to 18 buses / hour) • Introduction of light rail traffic. Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions. • Planned light-rail stop at Torget • Stop for local buses at Torget • Along Torget cycling will be in mixed traffic with cyclists given priority.	**Torget** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	• Coherent new urban design along the streetscape in Torget, to improve priority for pedestrians and cyclists, improves quality of public space • Removal of car traffic and reduction of bus traffic improves quality of public space • High frequency of Bybanen traffic combined with the length of Bybanen cars has a negative impact on the quality of public space	
• Removal of car and bus traffic • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery. • Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction close to entrance Hanseatic Museum.	**Finnegården** KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	• Coherent new urban design along Bryggen Quay, to improve priority for pedestrians and cyclists, improves quality of public space. • Removal of car traffic and reduction of bus traffic improves quality of public space • High frequency of Bybanen traffic combined with the length of Bybanen cars has a negative impact on the quality of public space, especially because it is close to entrance Hanseatic Museum and the quay is narrow here	
• Coherent new urban design along Bryggen Quay • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery. • Removal of car and bus traffic. • Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction on Bryggen quay. • Slight noise reduction (3.8 db)	**Bryggen Quay** KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Coherent new urban design along Bryggen Quay, to improve priority for pedestrians and cyclists, improves quality and use of public space and improves relation between Hanseatic Office and its quay. • Removal of car traffic and bus traffic improves quality and use of public space and improves relation between Hanseatic Office and its quay. • High frequency of Bybanen traffic combined with the length of Bybanen cars has a negative impact on the quality and use of public space and relation between Hanseatic Office and its quay. • Slight noise reduction has a positive impact on the quality of public space.	
• Removal of car traffic • Buses will use routing via Øvregaten • Number of public transport buses stays approx. the same (18 buses /h rush hours) • (This is dependent on implementation of "Traffikplan sentrum", phase 2). • Concept how to prevent tourist buses from entering Øvregaten is not yet ready • Bybaneen stop at Sandbrogaten	**Øvregaten** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	• Removal of car traffic has a positive impact on public space and relation between Bryggen and medieval wooden Bergen	

	Frequency of action	Duration of action	Reversibility of action	Longevity of change to attribute	Impact on attribute	Quality of change to the attribute	Evaluation of impact
	continuous	long-term	reversible	permanent	moderate	positive	**moderate positive impact (+2)**
	continuous	long-term	reversible	permanent	slight	positive	**slight positive impact (+1)**
	continuous	long-term	reversible	permanent	moderate	positive	**moderate positive impact (+2)**
	continuous	long-term	reversible	permanent	moderate	positive	**moderate positive impact (+2)**

Functional Impact: *Impact on walkability and accessibility of WH property Bryggen*		
• Coherent new urban design along Torget with new lighting plan Torget – Bryggen • Planned light-rail stop at Torget • Planned bus stop at Torget • Along Torget cycling will be in mixed traffic with cyclists given priority. • New lighting plan Torget – Bryggen	**Torget** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	• Coherent new urban design, with priority for pedestrians and cyclists, improves quality and use of public space. • Bybanen light rail with stop at Torget provides enhanced accessibility from the Bergen area to Bryggen.
• Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen • Removal of buses and cars • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery	**Finnegården** KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	• Light rail stop at Torget provides for accessibility for pedestrians to Hanseatic Museum • High frequency of Bybanen traffic combined with the length of Bybanen cars has a negative impact on relation of Hanseatic Office with its quay, especially because it is close to entrance of Hanseatic Museum and the quay is narrow here.
• Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen • Removal of buses and cars • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery.as goods delivery. • Light Rail stops at Torget and Sandbrogaten	**Bryggen Quay** KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• New light-rail stops at Torget improves accessibility from Bergen area • New light-rail stop at Sandbrogaten has due to long walking distance of approx. 500m only limited potential to improve accessibility of Bryggen Quay • Coherent new urban design, with priority for pedestrians and cyclists, improves quality and use of public space.
• Planned light-rail stop at Sandbrogaten • Local buses will use routing via Øvregaten, bus stop at Mariakirke	**Øvregaten** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	• Light-rail stop at Sandbrogaten improves accessibility of Øvregaten, Mariakirke, Bergenhus area

	continuous	long-term	reversible	permanent	moderate	positive	**moderate positive impact (+2)**
	continuous	long-term	reversible	permanent	moderate	negative	**moderate negative impact (-2)**
	continuous	long-term	reversible	permanent	moderate	positive	**moderate positive impact (+2)**
	continuous	long-term	reversible	permanent	large	positive	**large positive impact (+3)**

Impact on functional barriers		
• Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen • Removal of car traffic • Reduction of bus traffic (from 100-120 buses / hour to 18 buses / hour) • Introduction of light rail traffic. Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction. • Planned light-rail stop at Torget • Along Torget cycling will be in mixed traffic with cyclists given priority.	**Torget** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	• Coherent new urban design, with priority for pedestrians and cyclists, improves quality and use of public space. • Removal of car traffic and reduction of bus traffic reduces barrier effects and supports use of public space • High frequency of Bybanen traffic combined with the length of Bybanen cars generates barrier effects and has a negative impact on the use of public space
• Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen • Removal of car and bus traffic • Introduction of light rail traffic. Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction with cycling path on either side of light rail track. • Planned light-rail stop at Torget	**Finnegården** KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Coherent new urban design, with priority for pedestrians and cyclists, improves quality and use of public space. • Barrier effect due to cycle track combined with tram track in immediate vicinity of entrance Hanseatic Museum
• Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen • Removal of car and bus traffic • Introduction of light rail traffic. Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction with cycling path on either side of light rail track. • Bybanen can turn around at the stops in Sandbrogaten and Kaigaten / Bystasjonen so as to support events such as tall ship gatherings and the National Day on May 17, which bring a high number of visitors to WH Bryggen.	**Bryggen Quay** KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Coherent new urban design improves quality and use of public space. • Barrier effect for pedestrians due to cycle track combined with tram track • No barrier effect during festivities
• Removal of car traffic • Buses will use routing via Øvregaten • Number of public transport buses stays approx.. the same (18 buses /h rush hours) • (This is dependent on implementation of “Traffikplan sentrum”, phase 2). • Concept for parking and through-traffic buses due to tourist buses is not finalised.	**Øvregaten** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	• Removal of car traffic has a reduces existing barrier effects and strengthens relation between Bryggen and medieval wooden Bergen • Conflicts with tourist bus traffic at Øvregaten

	continuous	long-term	reversible	permanent	moderate	positive	moderate positive impact (+2)
	continuous	long-term	reversible	permanent	moderate	negative	moderate negative impact (-2)
	continuous	long-term	reversible	permanent	moderate	positive	moderate negative impact (-2)
	continuous	long-term	reversible	permanent	moderate	positive	moderate positive impact (+2)

5.2 Visual Analysis – Methods

The second step of the assessment is an evaluation of the visual impacts to be expected to the OUV of the World Heritage property Bryggen. The assessment will be graded according to the (key)attributes identified in chapter 3. Irrelevant attributes will be indicated in the assessment tables and will not be integrated in the assessment.

5.2.1 Viewpoints relevant to the assessment

The evaluation focuses on visualizing the project in Bergen's historic urban space. Since it is usually perceived when moving (pedestrian or road traffic), the visualizations show single images from relevant viewpoints within the urban space. All of those viewpoints are accessible for the public. In addition, a visualization was created from Clarion Hotel to provide an overview about the plan (Fig. 5.3). As this viewpoint is normally not accessible for the public, this visualization will not be graded.

Referring to the analysis carried out in the PRELIMINARY HIA REPORTS visualisations were created in the following places:

- 1B: Strandkaien (day- and nightview)
- 2: Bryggesporden
- 3: Bryggen Nikolaikirkeallemenningen
- 4: Inside Bryggen
- 6B: Dreggekaien

The aerial view (Fig. 5.2) shows the documented viewpoints and view corridors.

It is important to notice that not all viewpoints of PRELIMINARY REPORT 1 will be displayed as this HIA REPORT concentrates on visualisations of visual relationships which have been earlier graded as large or very large negative.

5.2.2 Existing impairments

Considering the preceding analysis, the assessment of the impacts of the planned "PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN" on the OUV of the World Heritage property Bryggen has to take in account existing impairments due to earlier developments. As a consequence, the evaluation tables documented below contain an assessment of the current state and the expected future state in each case.

5.2.3 Identified potential impacts

The following table provides an overview about elements of "PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN" which might cause impacts on the visual integrity of the World Heritage property Bryggen and its immediate surroundings and will be assed concerning their consequence for the attributes of the World Heritage property Bryggen.

5.2.4 Conditions of assessment

When the digital photographs were taken, traffic rates were lower than normal on Bryggen Quay due to the Covid situation and due to a test period were Torget was closed for traffic. For this reason, less vehicles appear on the visualizations than under normal conditions.

"PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN"						
(KEY) ATTRIBUTES	**IDENTIFICATION OF ELEMENTS OF PROPOSED ACTION RELEVANT FOR VISUAL IMPACTS**					
View from Strandkaien to Bryggen 1a_Strandkaien (Day and night view) KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	Removal of car and bus traffic. (This is dependent on implementation of "Traffik-plan sentrum", phase 2)	Coherent new urban design without high-voltage line masts and with new lighting plan at Fynnegården – Bryggen	Bryggen area will accommo-date light rail, cyclists and pedestrians, as well as goods delivery			Bybanen can turn around at the stops in Sandbrogaten and Kaigaten / Bystasjonen so as to support events such as tall ship gatherings and the National Day on May 17, which bring a high number of visitors to WH Bryggen
Finnegården Viewpoint Bryggesporden KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_ Maintained built structure of the Hanseatic quarters and its relation to the quay KA5_Testimony of the Hanse-atic League and the Hanseatic way of life	Coherent new urban design without high-voltage line masts at Fynnegården – Bryggen	Removal of car and bus traffic	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions.	Cycle path on either side of light rail track.		
Bryggen Quay Viewpoint Bryggen / Nikolaikirkeallmenningen KA2_Continued visual and func-tional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	Coherent new urban design without high-voltage line masts Cycle path on either side of light rail track	Removal of car and bus traffic	Bryggen area will accommo-date light rail, cyclists and pedestrians, as well as goods delivery	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions	Cycle path on either side of light rail track	Bybanen can turn around at the stops in Sandbrogaten and Kaigaten / Bystasjonen so as to support events such as tall ship gatherings and the National Day on May 17, which bring a high number of visitors to WH Bryggen

(KEY) ATTRIBUTES	IDENTIFICATION OF ELEMENTS OF PROPOSED ACTION RELEVANT FOR VISUAL IMPACTS					
Bryggen Quay **Viewpoint Bellgården inside** KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	Coherent new urban design without high-voltage line masts	Removal of car and bus traffic	Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions.	Cycle path on either side of light rail track	
Bryggen Quay **Viewpoint Dreggekaien** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	Coherent new urban design without high-voltage line masts	Removal of car and bus traffic	Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery	Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions	Cycle path on either side of light rail track	Bybanen can turn around at the stops in Sandbrogaten and Kaigaten / Bystasjonen so as to support events such as tall ship gatherings and the National Day on May 17, which bring a high number of visitors to WH Bryggen

5.2.5 Documentation of the Visualisations

Fig. 5.2: Viewpoints Map and selected Visualizations (@Google Earth / mkphc)

VIEWPOINT 1B STRANDKAIEN - *SITUATION*

The image shows reduced traffic due to a traffic experiment with the temporary closure of Torget and the Covid 19 situation at the time of recording

Panorama photo of the current state date: 25.07.2020 location: N 60.395605 E 5.320996

Situation: The visually striking view of the Bryggen warehouses from across Vågen harbour is an iconic view, showing the continued visual and structural relation of Bryggen within Bergen's medieval cityscape and urban layout, Bryggen's continued visual and functional setting in living Vågen Harbour, and the maintained built structure of the Hanseatic quarters and its quay.

Despite more recent housing block developments in the background and the changes of use of the quay the setting of medieval Hanseatic Office maintained its integrity in the seascape and cityscape of Bergen and it is still possible to enjoy the vista to Bryggen and its setting.

1581 Joachim Scholeus (@Bergen Byarkiv / Minimap with VP 1B (@ Google Earth /mkphc)

VIEWPOINT 1B STRANDKAIEN - *VISUALIZATION*

Strandkaien - original photo of current state

Strandkaien - visualization of project status 2022

VIEWPOINT 1B STRANDKAIEN - *ASSESSMENT*

Current state: During normal summer seasons, the quay is crowded by Bergen's inhabitants, visitors and a large number of cruising ship tourists. The quay has outdoor cafés and pubs. Further, the historic port area is characterised by smaller leisure boats mooring along the quay. But the image of the harbour changes every day, liners and larger boats connected to both the navy, cruise tourism and petroleum activities are also mooring here.

Assessment: Removal of car and bus traffic is beneficial and removal of high-voltage line and masts are beneficial. Due to their length and height the planned Bybanen Light-Rail Extension is visually dominant to the quay. As light rail set will pass on peak hours every three minutes, it is still possible to understand the relation between Bryggen and its setting, but the light rail accentuates a visual barrier effect between the Hanseatic Office, Bryggen quay and Vågen harbour, thus significantly transforming the visual and functional setting of Bryggen in Vågen harbour.

original photo date: 25.07.2020 location: N 60.395605 E 5.320996

photomontage

KEY THEMES		OUV KEY ATTRIBUTES	current state	HIA 2022
CONTEXT AND SETTING: BERGEN HASEATIC TRADING PORT	1	KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout	slight (-1)	large (-3)
	2	KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour	moderate (-2)	moderate (-2)
	3	KA3_Cultural layers of medieval Bergen	irrelevant	irrelevant
TESTIMONY OF HANSEATIC LEAGUE / WAY OF LIFE	4	KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	moderate (-2)	large (-3)
	5	KA5_Testimony of the Hanseatic League and the Hanseatic way of life	irrelevant	irrelevant
VP 1B - TOTAL			**moderate (-1.6)**	**large (-2.6)**

VIEWPOINT 1C STRANDKAIEN NIGHT VIEW - *SITUATION*

The image shows reduced traffic due to a traffic experiment with the temporary closure of Torget and the Covid 19 situation at the time of recording

Panorama photo of the current state date: 28.07.2020 location: N 60.395563 E 5.321150

Situation: Similar to the daytime view, also the night view of the Bryggen warehouses from across Vågen harbour is an iconic view of Bergen, showing the continued visual and structural relation of Bryggen within Bergen's medieval cityscape and urban layout, Bryggen's continued visual and functional setting in living Vågen Harbour, and the maintained built structure of the Hanseatic quarters and its quay. Despite more recent housing block developments in the background and the changes of use of the quay the setting of medieval Hanseatic Office maintained its integrity in the seascape and cityscape of Bergen and it is still possible to enjoy the vista to Bryggen and its setting.

photo: *Philipp Tebart / mkphc*

Hanseatic Office 1768. J.J. Reichbom “ Prospect av Handels Contoiret udi Bergen © Byarkivet/ Minimap with VP 1C (@ Google Earth /mkphc)

VIEWPOINT 1C STRANDKAIEN NIGHT VIEW - *VISUALIZATION*

Strandkaien night view - original photo of current state

Strandkaien night view - visualization of project status 2022

VIEWPOINT 1C STRANDKAIEN NIGHT VIEW - *ASSESSMENT*

Current state: During normal summer seasons, the quay is crowded by a large number of leisure boats mooring along the quay. The existing lighting is focusing on Bryggen, but some of the warehouses are lighted more intensively than others, thus creating an imbalanced overall impression.

Assessment: Removal of car and bus traffic is beneficial. Due to their length, height, frequency and the existing mirror effect the planned Bybanen Light-Rail Extension is visually dominant to the quay. As light rail cars will pass on peak hours every three minutes, it is still possible to understand the relation between Bryggen and its setting when no cars are present, but the light rail accentuates a visual barrier effect between the Hanseatic Office, Bryggen quay and Vågen harbour. The new lighting concept, balancing and sharpening the contour of illuminated Bryggen which now still can be perceived as one coherent property, is beneficial.

original photo date: 28.07.2020 location: N 60.395563 E 5.321150

photomontage

KEY THEMES		OUV KEY ATTRIBUTES	current state	HIA 2022
CONTEXT AND SETTING: BERGEN HASEATIC TRADING PORT	1	KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout	slight (-1)	moderate (-2)
	2	KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour	moderate (-2)	moderate (-2)
	3	KA3_Cultural layers of medieval Bergen	irrelevant	irrelevant
TESTIMONY OF HANSEATIC LEAGUE / WAY OF LIFE	4	KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	moderate (-2)	large (-3)
	5	KA5_Testimony of the Hanseatic League and the Hanseatic way of life	irrelevant	irrelevant
VP 1C - TOTAL			**moderate (-1.6)**	**moderate (-2.3)**

VIEWPOINT 2 BRYGGESPORDEN - *SITUATION*

The image shows reduced traffic due to a traffic experiment with the temporary closure of Torget and the Covid 19 situation at the time of recording

Panorama photo of the current state date: 25.07.2020 location: N 60.395458 E 5.326206

Situation: Although disturbed by ongoing car and bus traffic, the present view allows to identify the attributes of the World Heritage property and its setting; Finnegården – Hansa Museum, the Bryggen warehouses and quay, the Vågen harbour and the King's castle in the background. The harbour shed (Kur 11) is a listed building which represents the numerous harbour sheds which were on Bryggen quay.

1895 / 1900 Andreas Svanøe (@ marcus.uib.no)/ Minimap with VP 2 (@Google Earth /mkphc)

VIEWPOINT 2 BRYGGESPORDEN - *VISUALIZATION*

Bryggesporden - original photo of current state

Bryggesporden - visualization of project status 2022

VIEWPOINT 2 BRYGGESPORDEN - *ASSESSMENT*

Current state: The historic relation of Finnegården and its quay is difficult to perceive even apart from the ongoing works. The entrance to Hansa Museum is often crowded by museum visitors as well as other tourists stopping by. Due to the present traffic hub the public space is fragmented by car and bus traffic, pedestrian crossings, bus stops and a number of traffic signals.

Assessment: Removal of car traffic and the reduction of bus traffic are beneficial for the relation of the Hanseatic Office with its quay. The coherent new urban design without high voltage line and masts of the traffic area and the adjoining Finnegårdsgaten / Vertlidsallmenning will ameliorate the public space and the urban quality.

However, the understanding of the visual and functional relation of Finnegården with the medieval Bergen, Vågen Harbour and Bryggen quay will be compromised by the height, length and high frequency of light rail cars, as well as the light rail track very close to Finnegården.

original photo date: 25.07.2020 location: N 60.395458 E 5.326206

photomontage

KEY THEMES		OUV KEY ATTRIBUTES	current state	HIA 2022
CONTEXT AND SETTING: BERGEN HASEATIC TRADING PORT	1	KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout	irrelevant	irrelevant
	2	KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour	moderate (-2)	moderate (-2)
	3	KA3_Cultural layers of medieval Bergen	irrelevant	irrelevant
TESTIMONY OF HANSEATIC LEAGUE / WAY OF LIFE	4	KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	large (-3)	large (-3)
	5	KA5_Testimony of the Hanseatic League and the Hanseatic way of life	moderate (-2)	moderate (-2)
VP 2 - TOTAL			**moderate (-2.3)**	**moderate (-2.3)**

VIEWPOINT 3B BRYGGEN - *SITUATION*

The image shows reduced traffic due to a traffic experiment with the temporary closure of Torget and the Covid 19 situation at the time of recording

Panorama photo of the current state date: 25.07.2020 location: N 60.396751 E 5.324018

Situation: The pedestrian view along the Bryggen quay and towards the Vågen harbour encompasses the key attributes of the World Heritage property and illustrates the function and position of the Hanseatic League in Bergen.

photo: *Philipp Tebart / mkphc*

1860 /69 Knud Knudsen (© marcus.uib.no)/ Minimap with VP 3B (@ Google Earth /mkphc)

VIEWPOINT 3B BRYGGEN- *VISUALIZATION*

Bryggen - original photo of current state

Bryggen - visualization of project status 2022

VIEWPOINT 3B BRYGGEN - *ASSESSMENT*

Current state: The character of a harbour quay is compromised by the throughfare traffic and fragmented tourism facilities in high season. Despite the changes of the Bryggen quay over time, the relation between the Hanseatic Office, the quay and harbour can still be experienced.

Assessment: Removal of car and bus traffic are beneficial for the relation of the Hanseatic Office with its quay and the concept of the planned coherent new urban design with less fragmentation of the public space and without high-voltage line and masts is beneficial. Bryggen Quay can still accommodate large festivities.

The length and the height and frequency of light rail traffic, the of the light-rail-cars disturbs the already compromised visual and functional relation between the Hanseatic Office built structure, its quay and Vågen harbour.

original photo date: 25.07.2020 location: N 60.396751 E 5.324018

photomontage

KEY THEMES		OUV KEY ATTRIBUTES	current state	HIA 2022
CONTEXT AND SETTING: BERGEN HASEATIC TRADING PORT	1	KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout	moderate (-2)	moderate (-2)
	2	KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour	moderate (-2)	moderate (-2)
	3	KA3_Cultural layers of medieval Bergen	irrelevant	irrelevant
TESTIMONY OF HANSEATIC LEAGUE / WAY OF LIFE	4	KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	moderate (-2)	moderate (-2)
	5	KA5_Testimony of the Hanseatic League and the Hanseatic way of life	large (-3)	large (-3)
VP 3B - TOTAL			**moderate (-2.3)**	**moderate (-2.3)**

VIEWPOINT 4 BELLGÅRDEN INSIDE - *SITUATION*

The image shows reduced traffic due to a traffic experiment with the temporary closure of Torget and the Covid 19 situation at the time of recording

Panorama photo of the current state date: 25.07.2020 location: N 60.396751 E 5.324018

Situation: The views from inside Bryggen out towards the Bryggen quay and Vågen harbour illustrate the daily life in the trading post. The close visual and functional linkage between the quay, the offices and warehouses testimony of the Hanseatic League and the Hanseatic way of life.

photo: *Philipp Tebart / mkphc*

Bryggen 1918 -39 (@ marcus.uib.no)/ Minimap with VP 4 (@Google Earth /mkphc)

VIEWPOINT 4 BELLGÅRDEN INSIDE - *VISUALIZATION*

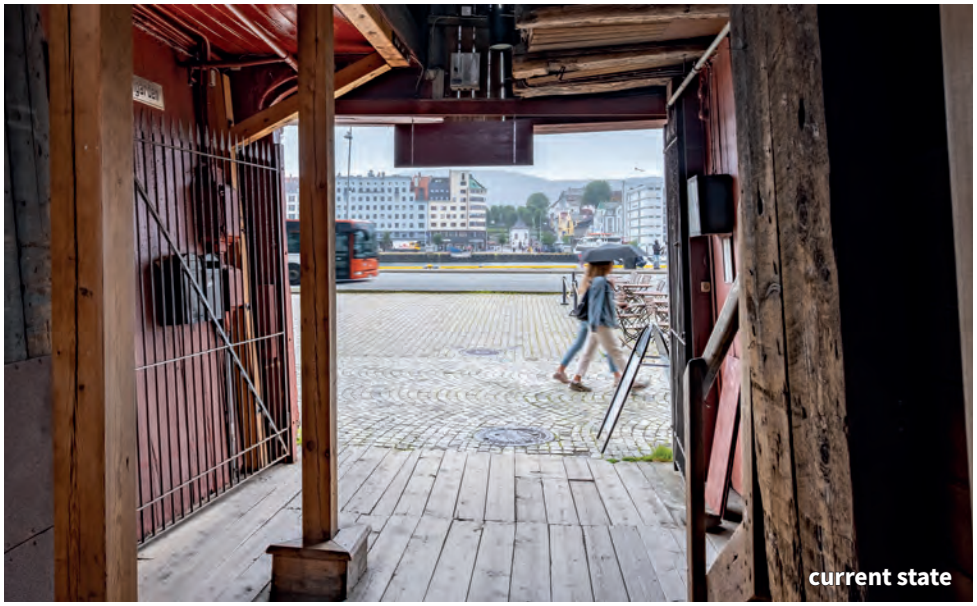
Bellgården Inside - original photo of current state

Bellgården Inside - visualization of project status 2022

VIEWPOINT 4 BELLGÅRDEN INSIDE - *ASSESSMENT*

Current state: Under normal conditions the view towards the quay and Vågen harbour is impaired by existing traffic and street furniture, but the continued visual and functional setting of Bryggen in living Vågen harbour can still be experienced.

Assessment: Removal of car and bus traffic are beneficial for the relation of the Hanseatic Office with its quay. The coherent urban design of the quay without high-voltage line and masts will improve the overall quality of Bryggen Quay. The view towards Vågen harbour and relation of Hanseatic Office built structure with its quay and Vågen harbour respectively is obstructed due to the height, length and frequency of the light-rail-cars and high frequency of light-rail-traffic. Large Bybanen cars compromise spirit and feeling of the testimony of the Hanseatic League, Witness of the Hanseatic way of life.



original photo date: 25.07.2020 location: N 60.396751 E 5.324018

photomontage

KEY THEMES		OUV KEY ATTRIBUTES	current state	HIA 2022
CONTEXT AND SETTING: BERGEN HASEATIC TRADING PORT	1	KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout	irrelevant	irrelevant
	2	KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour	moderate (-2)	moderate (-2)
	3	KA3_Cultural layers of medieval Bergen	irrelevant	irrelevant
TESTIMONY OF HANSEATIC LEAGUE / WAY OF LIFE	4	KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	moderate (-2)	large (-3)
	5	KA5_Testimony of the Hanseatic League and the Hanseatic way of life	moderate (-2)	moderate (-2)
VP 4 - TOTAL			**moderate (-2)**	**moderate (-2.3)**

VIEWPOINT 6 DREGGEKAIEN - *SITUATION*

The image shows reduced traffic due to a traffic experiment with the temporary closure of Torget and the Covid 19 situation at the time of recording

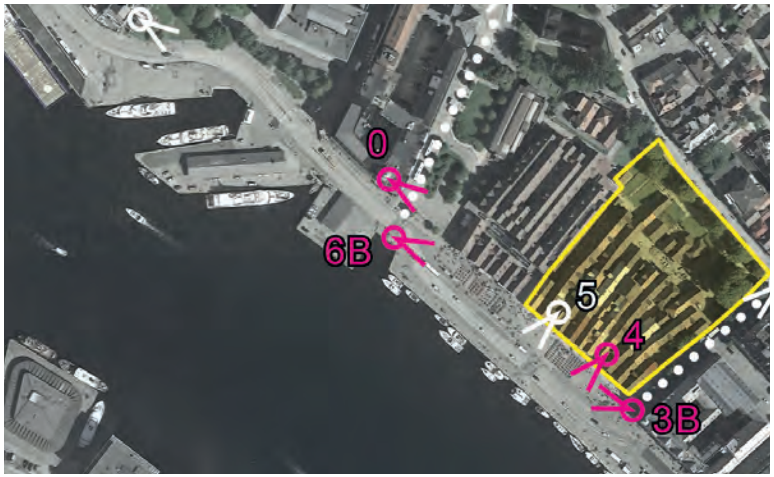
Panorama photo of the current state date: 25.07.2020 location: N 60.397728 E 5.321482

Situation: The view along the Bryggen quay towards the medieval centre of Bergen with Korskirken, Torget, Vågen harbour and the natural setting with mountains allows to enjoy the continued visual and structural relation of Bryggen with Bergen's medieval cityscape and urban layout. It also illustrates the important position of the Hanseatic Office in Bergen and the visual and functional setting of Bryggen in living Vågen Harbour.

(At the time of recording of the panorama, the road was closed to all traffic. In the original photo for comparison with the visualization see following pages), buses are shown as examples to illustrate the traffic in the initial state.)

photo: *Philipp Tebart / mkphc*

JFLDreierBryggen1817.jpg (@ https://commons.wikimedia.org/wiki/File)/ Minimap with VP 4 (@ Google Earth /mkphc)



VIEWPOINT 6 DREGGEKAIEN - *VISUALIZATION*

Dreggekaien - original photo of current state

Dreggekaien - visualization of project status 2022

VIEWPOINT 6 DREGGEKAIEN - *ASSESSMENT*

Current state: The view allows to understand the setting of the World Heritage property in Bergen's medieval urban landscape. The public space is fragmented and degraded by the existing street, bus stops, as well as other elements such as signage, outdoor cafés and terraces along the waterfront buildings.

Assessment: Removal of car and bus traffic are beneficial for the relation of the Hanseatic Office with its quay. The concept of the planned coherent urban design with less fragmentation of the public space, without car and bus traffic and without high-voltage line and masts, will improve the overall quality of the urban design of Bryggen Quay and supports the understanding of the relationship between Bryggen and Vågen Harbour. Bryggen Quay can still accommodate large festivities.

Due to their length, height and frequency the light-rail-cars generate a visual barrier effect between Bryggen's built structure and the Vågen harbour. The planned combination of a light rail track with a cycle path might increase the separation of the quay.

original photo date: 25.07.2020 location: N 60.397728 E 5.321482

photomontage

KEY THEMES		OUV KEY ATTRIBUTES	current state	HIA 2022
CONTEXT AND SETTING: BERGEN HASEATIC TRADING PORT	1	KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout	moderate (-2)	moderate (-2)
	2	KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour	moderate (-2)	moderate (-2)
	3	KA3_Cultural layers of medieval Bergen	irrelevant	irrelevant
TESTIMONY OF HANSEATIC LEAGUE / WAY OF LIFE	4	KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	large (-3)	large (-3)
	5	KA5_Testimony of the Hanseatic League and the Hanseatic way of life	irrelevant	irrelevant
VP 6 - TOTAL			**moderate (-2.3)**	**moderate (-2.3)**

5.2.6 Assessments of impacts on visual integrity

Elements of proposed action "PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN"	Attributes / key attributes in WH property and its setting	Description of potential impact on (Key) Attributes	
Visual Impact			
• Removal of car and bus traffic. (This is dependent on implementation of "Traffikplan sentrum", phase 2). • Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery.	**View from Strandkaien to Bryggen 1b_Strandkaien (Day view)** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Removal of car and bus traffic is beneficial. • Removal of high-voltage line and masts is beneficial. • Due to the large length, height and frequency of Bybanen cars visual barrier effect increases in total, thus significantly transforming the visual and functional setting of Bryggen in Vågen harbour.	
• Removal of car and bus traffic. (This is dependent on implementation of "Traffikplan sentrum", phase 2). • Coherent new urban design along Torget with new lighting plan at Fynnegården – Bryggen • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery.	**View from Strandkaien to Bryggen 1c_Strandkaien (night view)** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Removal of car and bus traffic is beneficial. • Visual barrier effect due to length, height and frequency of Bybanen cars. • Due to the new lighting concept Bryggen can still be perceived as one coherent property.	
• Coherent new urban design without high-voltage line masts at Fynnegården – Bryggen • Removal of car and bus traffic • Introduction of light rail traffic. Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction. • Cycle path on either side of light rail track.	**Finnegården** **Viewpoint 2 Bryggesporden** KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	• Removal of car traffic and the reduction of bus traffic are beneficial for the relation of the Hanseatic Office with its quay. • The redesign of the traffic area, including removal of bus stop, and the coherent new urban design at Finnegården, will ameliorate the public space and the urban quality. • The understanding of the visual relation of Finnegården with medieval Bergen, Vågen harbour and Bryggen quay will be compromised by the length, height and frequency of light rail cars very close to Finnegården	
• Coherent new urban design without high-voltage line masts • Removal of car and bus traffic • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery. • Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction. • Cycle path on either side of light rail track • Bybanen can turn around at the stops in Sandbrogaten and Kaigaten / Bystasjonen so as to support events such as tall ship gatherings and the National Day on May 17, which bring a high number of visitors to WH Bryggen.	**Bryggen Quay** **Viewpoint 3B Bryggen / Nikolaikirkeallmenningen** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	• Removal of car and bus traffic are beneficial for the relation of the Hanseatic Office with its quay. • Coherent new urban design without high-voltage line masts • will ameliorate the public space and the urban quality. • Length, height and frequency of Bybanen cars generates visual barrier effect concerning relation of Hanseatic Office built structure with its quay and Vågen harbour • Bryggen Quay can still accommodate large festivities	

	Frequency of action	Duration of action	Reversibility of action	Longevity of change to attribute	Impact on attribute	Quality of change to the attribute	Evaluation of impact
	continuous	temporary	reversible	long-term	large	negative	large negative (-2.6)
	continuous	temporary	reversible	long-term	moderate	negative	moderate negative (-2.3)
	continuous	temporary	reversible	long-term	moderate	negative	moderate negative (-2.3)
	continuous	temporary	reversible	long-term	moderate	negative	moderate negative (-2.3)

Visual Impact			
• Coherent new urban design without high-voltage line masts • Removal of car and bus traffic • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery. • Bybanen cars every 3 minutes in peak times with 40 light rail sets in both direction. • Cycle path on either side of light rail track	**Bryggen Quay** **Viewpoint 4 Bellgården inside** KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay KA5_Testimony of the Hanseatic League and the Hanseatic way of life	• Removal of car and bus traffic are beneficial for the relation of the Hanseatic Office with its quay. • Coherent new urban design without high-voltage line masts • will ameliorate the public space and the urban quality. • Length, height and frequency of Bybanen cars generates visual barrier effect concerning relation of Hanseatic Office built structure with its quay and Vågen harbour • Large Bybanen cars compromise spirit and feeling of testimony of the Hanseatic League, Witness of the Hanseatic way of life	
• Coherent new urban design without high-voltage line masts • Removal of car and bus traffic • Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery. • Bybanen cars every 3 minutes in peak times with 40 light rail sets in both directions. • Cycle path on either side of the light rail track • Bybanen can turn around at the stops in Sandbrogaten and Kaigaten / Bystasjonen so as to support events such as tall ship gatherings and the National Day on May 17, which bring a high number of visitors to WH Bryggen.	**Bryggen Quay** **Viewpoint 6 Dreggekaien** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar KA2_Continued visual and functional setting of Bryggen in living Vågen Harbour KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Removal of car and bus traffic are beneficial for the relation of the Hanseatic Office with its quay. • Coherent new urban design without high-voltage line masts supports visual relation of Bryggen with medieval Bergen and will ameliorate the public space and the urban quality. • Length, height and frequency of Bybanen cars generates visual barrier effect concerning relation of Hanseatic Office built structure with its quay and Vågen harbour • Bryggen Quay can still accommodate large festivities	

	continuous	temporary	reversible	long-term	moderate	negative	**moderate negative (-2.3)**
	continuous	temporary	reversible	long-term	moderate	negative	**moderate negative (-2.3)**

5.3 Summary of key results of impact assessment

In conclusion, the impact assessment leads to the following key results:

- Concerning the functional integrity of attributes of World Heritage property Bryggen (Torget, Finnegården, Bryggen Quay) the length, height and frequency of light rail cars cause negative impacts, especially for the relation of the Hanseatic Office with its quay. These negative impacts can partly be compensated by the planned removal of car and bus traffic (or significant reduction of bus traffic at Torget respectively) and the coherent new urban design without high-voltage line and masts. Overall, impacts on the functional integrity of World Heritage Bryggen will vary from slight positive to moderate positive.

- At Øvregaten, the planned removal of car traffic and the same number of buses than today will cause a large positive impact on the functional integrity of World Heritage property Bryggen.

- When seen from far away (Strandkaien), due to their length, height and frequency the Bybanen light rail cars cause **large negative impacts** on the visual integrity (day view). Due to the planned new lighting system the night view shows **moderate negative impacts**.

- When seen from nearby, the negative impacts on the visual integrity of Bryggen Quay due to the length, height and frequency of light-rail-cars are partly compensated by the planned coherent new urban design without high-voltage line and masts. Hence, there will be a **moderate negative** visual barrier effect on Bryggen Quay.

6 Risk Assessment

Chapter 6 will assess the risks concerning the structural integrity of World Heritage property Bryggen.

In this context, it has to be noted that several reports on potential risks have already been commissioned by Bybanen Group / Miljøløftet during the planning process (especially: Norconsult / asplan viak: Risikoanalyse – Risiko for skade på kulturmiljø, kulturminner, bygg eller infrastruktur). In contrast to these risk reports, this FINAL HIA REPORT PLANFORSLAGET will assess risks with regard to potential positive and negative impacts on the OUV of the World Heritage property Bryggen. Remaining uncertainties have to be graded as a large negative impact since the OUV of the World Heritage property could be affected negatively.

According to the facts compiled throughout Chapter 3 and 4, the following potential structural risks related to PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN were identified with regard to the attributes of the World Heritage property:

- Risks for changes in the groundwater conditions
- Risks for degradation of archaeological deposits
- Risks for cultural layers due to planned construction works at Bryggen Quay and Sandbrogaten / Sandbrogaten tunnel

6.1.1 Finnegården

At Finnegården / Hanseatic Museum the solution for the stabilisation of the foundations of Finnegården is considered sufficient to mitigate the structural risk for building foundations.

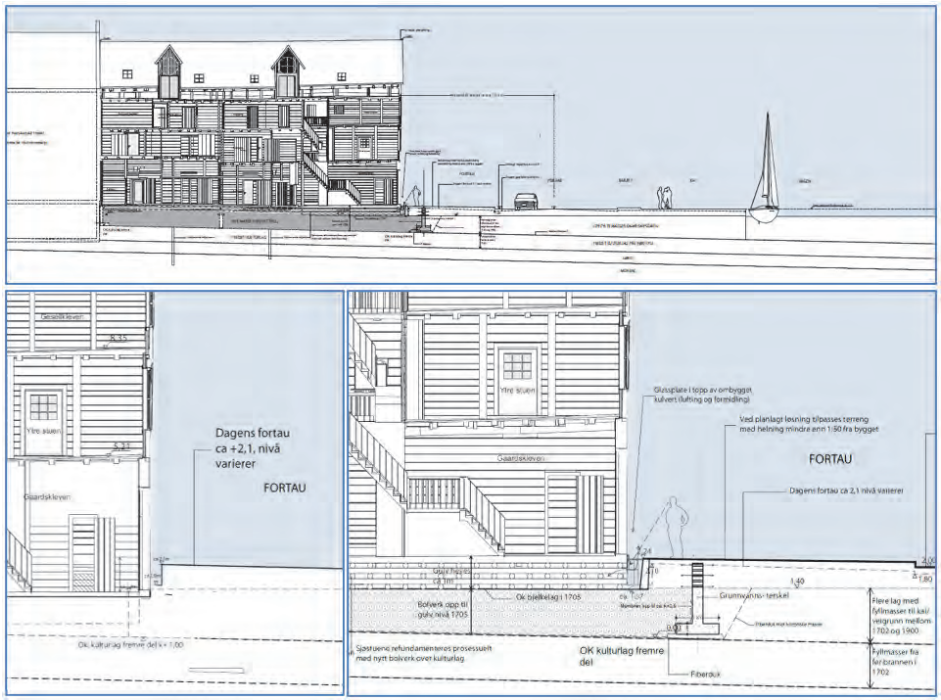


Fig. 6.1: Stabilisation of foundations at Finnegården / Bryggen Quay (@Norconsult / asplan viak)

6.1.2 Bryggen Quay

The ground conditions and cultural layers of Bryggen quay are varied and not yet fully mapped. An archaeological survey will be completed in autumn 2022, and current research about the historical evidence of the building stages of the Bryggen Quay has recently been presented [34]

[34] Skivenes,A. 2022

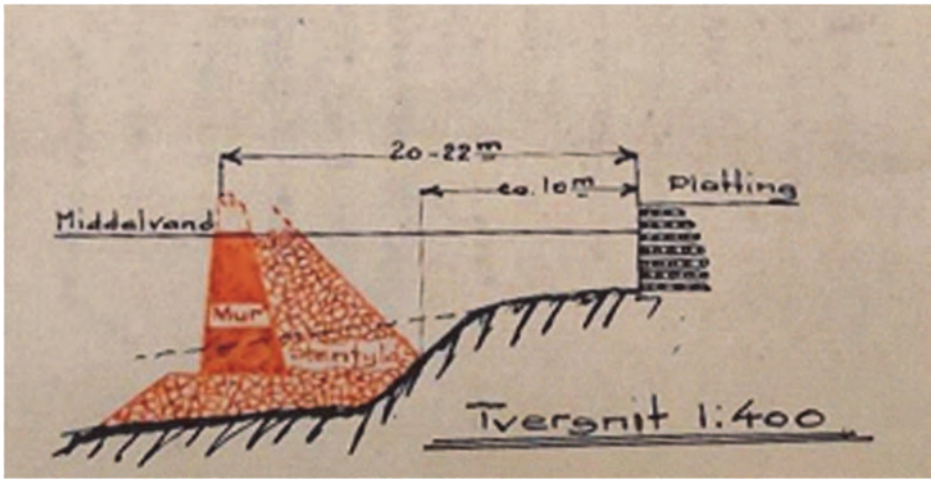


Fig 6:2: Bryggen Quay cultural layers (© Skivenes.A . 2022)

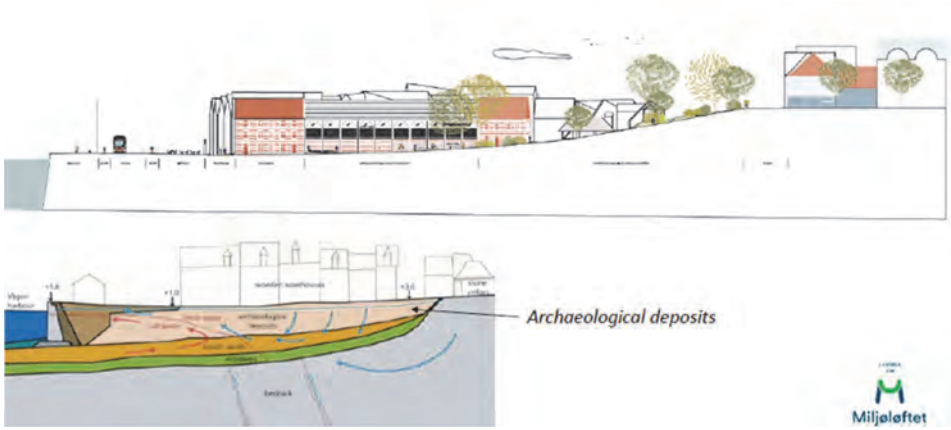


Fig 6:3: Bryggen Quay cultural layers (© Norconsult / asplan viak)

The planned construction of the light rail foresees the following measures:

- Track foundations will be 1 meter deep.
- New underground infrastructure, 3-4 meters deep, on the outside of the tracks along the quay. The trench for new infrastructure is being established along the quayside, outside the pile wall. It is not planned to be dug deeper than what has previously been excavated, to avoid negative effects on cultural layers, when upgrading infrastructure.
- The construction method for the track foundations is done by wet excavation to avoid groundwater lowering.
- The establishment of a stabilizing pile wall (10 – 14 m deep) of a row of adjoining piles on the inside of the ditch. In the detailed design phase, the pile wall will be designed to slow down the supply of oxygen, and sulphates to some degree, to cultural layers and bulwarks under the buildings.
- Construction activities are planned to be realised in smaller construction zones in order to minimise risks of groundwater lowering.

The proposed building method is suggested to ensure a stable ground water level throughout the building period. It also aims at achieving a permanent effect of stabilisation of the groundwater meaning reduced oxygen caused by flooding, tidal water and drainage through the quay.

6.1.3 Sandbrogaten

The cultural layers at Sandbrogaten and in adjacent areas of Koengen are assessed by Riksantikvaren to be the oldest in Bergen and of very high value. Medieval findings are expected at very shallow depths, from 1.3 meters, below today's ground level.

Archaeological investigations with drillings will be finalized in the autumn 2022.

Bybanen tracks are proposed to be laid above the shallow cultural layers. To avoid risks, the following measures are foreseen:

- The light rail track is planned on a basin with a maximum depth of 1 meter below surface, filled up with lighter masses.
- The light rail construction together with the trams is not predicted to increase load on Sandbrogaten compared with today's situation.
- It is planned to place new infrastructure shallowly. Thresholds and seals are planned to be established that prevent unwanted drainage. New underground infrastructure is proposed to be laid primarily in existing ditches.

6.1.4 Sandbrogaten tunnel

The ground investigations show very low permeable bedrock. There is a risk for leakage and changes in the groundwater levels without mitigation methods[35].

6.1.5 Bybanen construction works

The construction time of Bybanen DS 1 Kaigaten - Sandbrogaten is estimated to be eight years. In the first phases underground infrastructure is built, taking about 1-2 years along Bryggen. In the last phases the surface with tracks and paving is built, taking about 1 year along Bryggen.

The construction time of Bybanen DS 1 Kaigaten - Sandbrogaten is estimated to be eight years. The establishment of a tunnel at Sandbrogaten will also require a larger construction pit during the construction phase, which will not only have a major impact on the cultural environment in Sandbrogaten and Kroken, but also Bergenhus Fortress, especially in relation to noise and dust during the construction phase.

The area at Koengen railway site is planned to be used as a construction area throughout the light -rail building period. The site is part of the protected Bergenhus fortress area and borders a park which is widely used for recreation and events.

At Øvregaten, more heavy traffic might appear during construction activities. Investigations show that the load bearing capacity of Øvregaten is sufficient to avoid damage.

6.1.6 Identified potential risks

The assessment will be graded according to the (key)attributes identified in chapter 3. Irrelevant key attributes are not indicated in the assessment tables. According to the facts compiled throughout Chapter 3 and 4, the following potential risks related to PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN were identified with regard to the attributes of the World Heritage property:

[35] DeBeer

6.1.7 Identification of potential impacts on structural integrity

"PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN"						
(KEY) ATTRIBUTES	**IDENTIFICATION OF ELEMENTS OF PROPOSED ACTION RELEVANT FOR STRUCTURAL INTEGRITY OF WORLD HERITAGE PROPERTY OF BRYGGEN**					
Structural Impact:	***Elements of proposed action***					
Finnegården KA3_Cultural layers of medieval Bergen	Track foundations will be 1 meter deep	Replacement of existing infrastructure in the same ditch, 3-4 meters deep, on the outside of the tracks along the quay		Construction method for the track foundations is done by wet excavation	Foundation of new lighting poles	Potential risks of vibrations due to operational activities: (Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery)
Bryggen Quay KA3_Cultural layers of medieval Bergen	Track foundations will be 1 meter deep	Replacement of existing infrastructure in the same ditch, 3-4 meters deep, on the outside of the tracks along the quay	Construction of a stabilizing pile wall (10 – 14 m deep)	Construction method for the track foundations is done by wet excavation to avoid groundwater lowering	Foundation of new lighting poles	Potential risks of vibrations due to operational activities: (Bryggen area will accommodate light rail, cyclists and pedestrians, as well as goods delivery)
Øvregaten KA3_Cultural layers of medieval Bergen	Possible heavy traffic during construction activities	Number of tourist bus traffic not yet defined				
Sandbrogaten KA3_Cultural layers of medieval Bergen	The light rail track is planned on a basin with a maximum depth of 1 meter below surface, filled up with lighter masses	The light rail construction together with the trams is not predicted to increase load on Sandbrogaten compared with today's situation	New infrastructure will be established shallowly and is proposed to be laid primarily in existing ditches. Thresholds and seals that prevent unwanted drainage	Koengen railway site is planned to be used as a construction area throughout the light -rail building period	The construction of a tunnel at Sandbrogaten will require a larger pit during the construction phase, which might not only have a major impact on the cultural environment in Sandbrogaten, but also Bergenhus Fortress, especially in relation to heavy traffic, noise, dust, vibrations during the construction phase.	

6.1.8 Assessment of impacts on functional integrity

The above-mentioned identified factors lead to the following assessment:

Elements of proposed action "PLANFORSLAGET BYBANEN DS/1 KAIGATEN-SANBROGATEN"	Attributes / key attributes in WH property and its setting	Description of potential impact on (Key) Attributes	
Structural Impact: (groundwater changes and cultural layers) due to construction activities			
• Track foundations will be 1 meter deep. • New underground infrastructure, 3-4 meters deep, on the outside of the tracks along the quay. • Track foundation is done by wet excavation • Establishment of a stabilizing pile wall (10 – 14 m deep) • Construction activities in smaller construction zones.	**Finnegården** KA3_Cultural layers of medieval Bergen KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Construction of a concrete basin around the foundations prevents potential changes of the groundwater level.	
• Track foundations will be 1 meter deep. • New underground infrastructure, 3-4 meters deep, on the outside of the tracks along the quay. • Track foundation is done by wet excavation • Establishment of a stabilizing pile wall (10 – 14 m deep) • Construction activities in smaller construction zones.	**Bryggen Quay** KA3_Cultural layers of medieval Bergen KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Impact on cultural layers unknown as archaeological surveys on Bryggen Quay are not yet completed (NOTE: This applies also for Bryggen Quay at Finnegarden) • Maintained built structure might be compromised by groundwater changes. • Potential risks of vibrations due to operational activities still to be investigated. (NOTE: This applies also for Bryggen Quay at Finnegarden)	
• Removal of car traffic • More heavy traffic during construction period • Concept how to prevent tourist buses from entering Øvregaten is not yet ready	**Øvregaten** KA1_Continued visual and structural relation of Bryggen with Bergen medieval cityscape and urban layout, public spaces and access roads / allmenningar	• Increase of heavy traffic during constructions might lead to damages at Øvregaten and Mariakirken though load bearing capacities are expected to be adequate. • Potential risks of vibrations due to operational activities still to be investigated.	
• Light rail track planned on a basin with a maximum depth of 1 meter below surface, filled up with lighter masses. • Light rail construction together with the trams is not predicted to increase load on Sandbrogaten compared with today's situation. • Shallow new infrastructure. Thresholds and seals to prevent unwanted drainage. New underground infrastructure is proposed to be laid primarily in existing ditches. • Construction pit during the construction phase of tunnel at Sandbrogaten	**Sandbrogaten / Sandbrogaten tunnel opening** KA3_Cultural layers of medieval Bergen	• Archaeological surveys on cultural layers of very high value at Sandbrogaten are not yet completed. • Ground investigations for Sandbrogaten tunnel show very low permeable bedrock and there is a risk for leakage and changes in the groundwater levels without mitigation methods. • Construction of a tunnel at Sandbrogaten will also require a larger construction pit during the construction phase. • Potential risks of vibrations due to operational activities still to be investigated.	
Structural Impact: (sea water rise and flooding)			
• Establishment of a stabilizing pile wall	**Bryggen Quay** KA4_Maintained built structure of the Hanseatic quarters and its relation to the quay	• Establishment of pile wall might have positive impacts on flooding mitigation	

	Frequency of action	Duration of action	Reversibility of action	Longevity of change to attribute	Impact on attribute	Quality of change to the attribute	Evaluation of impact
	continuous	long-term	irreversible	permanent	slight	negative	slight negative impact (-1)
	continuous	long-term	irreversible	permanent	large	negative	large negative impact (-3)
	continuous	long-term	irreversible	permanent	moderate	negative	moderate negative impact (-2)
	continuous	long-term	irreversible	permanent	large	negative	large negative impact (-3)
	continuous	long-term	reversible	permanent	slight	positive	slight positive impact (+1)

PART IV FINAL CONCLUSIONS AND RECOMMENDATIONS

7 Conclusions and Recommendations

As a general conclusion, the Bybanen light-rail (daylight option) has both beneficial and adverse consequences for the World Heritage property Bryggen. Considerable work has been done to reduce the adverse consequences and enhance the more beneficial ones. **None of the assessed impacts were assessed as very large negative (=loss of OUV). Consequently, the following recommendations address the reduction of large negative impacts, as well as the protection of the setting and to ensure the support of central management goals of the World Heritage property.**

In this context, it has to be noted that the indicated **large negative visual impacts due to the length, height and frequency of Bybanen cars from viewpoint Strandkaien cannot be reduced** as all possible mitigation measures were already applied. However, this large negative impact will not appear during large festivities when Bybanen will turn around at Sandbrogaten and Kaigaten.

Consequently, the planned removal of high-voltage line and masts is considered as absolutely necessary to safeguard the iconic view of Bryggen from Strandkaien which then can still be enjoyed when Bryggen Quay is closed for Bybanen traffic.

7.1 Recommendation 1: Monitoring risks for groundwater-balance and archaeological deposits at Sandbrogaten and Bryggen Quay

According to the Riksantikvaren the area between southern part Sandbrogaten, Mariakirken and Bergenhus is considered to contain the oldest and most important archaeological deposits in Bergen. Medieval findings are expected at very shallow depths, from 1.3 meters, below today's ground level.

The planned Bybanen track construction has been further detailed to avoid disturbance of the cultural layers. However, the archaeological surveys are not yet completed and there are large risks even during the construction of the light rail, especially at Sandbrogaten tunnel opening. These may have an impact on the groundwater level in a larger area.

At Bryggen quay, the situation is partly similar. The ground conditions and cultural layers are not fully mapped and the present survey is not yet finished. There has also been recent research presented by Stiftelsen Bryggen pointing out the need for an updated in-depth survey about the historical ground conditions of Bryggen quay which must be assessed. A mitigation programme for flooding events should be done.

Consequently, further investigations are needed:

- Updated investigations on risks for structural, hydrogeological and cultural layers on Bryggen Quay and Sandbrogaten
- Finalising the archaeological surveys on Bryggen Quay and Sandbrogaten area
- Establishment of coordinated monitoring and risk control management programs
- Developing a coordinated monitoring plan for the construction period

The impact assessment carried out throughout this report showed that large risks are existing at Sandbrogaten regarding the structural integrity of these archaeological deposits. Moreover, the construction of the tunnel at Sandbrogaten could cause large risks with regard to the groundwater balance. Consequently, it is recommended to

►DEVELOP a coordinated risk management program which clearly shows that risks for archaeologic deposits and especially for groundwater balance at both Bryggen quay Sandbrogaten can be eliminated during construction and permanent phase.

► ESTABLISH a coordinated monitoring plan along the light rail project including all relevant stakeholders, coordinated by Riksantikvaren.

7.2 Recommendation 2: Definition of a Buffer Zone for the World Heritage property Bryggen

The analysis of the OUV carried out throughout this HIA showed clearly that the OUV and the attributes expressing the OUV of World Heritage property Bryggen are closely related to the entire Vågen area and its surroundings. In this context, it is a huge potential that the medieval landscape of Bryggen and its harbour are still largely intact and fully understandable up until nowadays (cf. Chapter 3).

For this reason, both HIA Preliminary Reports emphasised the need for integrated management of the Vågen area (HIA Preliminary Report October 2020) as well the need to define a buffer zone for the World Heritage property Bryggen which considers the entire Vågen area (HIA Preliminary Report September 2021).

Bergen Municipality has already prepared investigations concerning a concept for the buffer zone.

- A first Management Plan (Forvaltningsplan) for Bryggen was first adopted in 2005. This Management Plan was developed in the same timeframe as the zoning plan "Vågen, kaiene og Bryggen" which is still valid and was elaborated as a plan for a buffer zone around the World Heritage site. The two plans were meant to support each other.36 However, due to a decision of the World Heritage Committee dating from 2019 (WHC 19/43.COM/8B.Add and WHC 19/43.COM/INF. 8B1 Add) requesting to extend the suggested buffer zone this proposal for a buffer zone was referred.

Since then, Bergen Municipality initiated further activities, including

- A revision of the Management Plan was started up in 2019, finalised in 2021 and adopted by Bergen City Council in 202[37][38]. Inter alia, the need to define a buffer zone for World Heritage property Bryggen is mentioned here.
- Further, a Strategic Cultural Heritage Strategy was adopted in 2019[39], a Cultural Environment Plan (Kulturmiljøplan for Bergen 2021-2025[40]) was adopted in 2021, a Strategy for Architecture was adopted in 2019 and a strategy for walkability 2020-2030 was adopted by Bergen City Council in 2020.
- Bergen Municipality commissioned the Directorate for Cultural Heritage (Byantikvaren) to prepare a "Pre- Project Buffer Zone for the World Heritage Site Bryggen"[41] was started with the goal to prepare a strategic plan. The Directorate for Cultural Heritage (Byantikvaren) has defined a working area for the future buffer zone.

As part of this work on the buffer zone, also a coordination group has been established consisting of the heads of the Planning and Building Administration, the Agency for Urban Environment, the Climate Agency, Bergen Vann', the City Architect and the Directorate for Cultural Heritage.[42]

In conclusion, it can be stated that a solid basis for the definition of the future of the buffer zone has been established in recent years so that the planning process to define its boundaries can be started.

Consequently, it is recommended to

►DEVELOP further the buffer zone concept in close cooperation with the stakeholders

►ESTABLISH a permanent coordination mechanism between the stakeholders to ensure the understanding of the World Heritage value and the implementation of the buffer zone measures and recommendations (e.g. an extended Fagrådet / Council of specialists)

[36] Byantikvaren (2022): Follow-up on Recommendations Concerning Integrated Management of the World Heritage Given in the Preliminary Reports 1 & 2

[37] Verdensarvstedet Bryggen. Forvaltningsplan 2021-2025

[38] Verdensarvstedet Bryggen. Forvaltningsplan 2021-2025

[39] Byantikvaren (2019): Kulturminnestrategi. Identiteit med særpreg. Kulturminneplan for Bergen. Del 1 Kulturminnestrategi 2019-23

[40] Byantikvaren (2022): Kulturmiljøplan for Bergen 2021-2025

[41] Byantikvaren (2022): Forprosjekt Buffersone for Verdensarvstedet Bryggen (Pre- Project Buffer Zone for the World Heritage Site Bryggen)

[42] Byantikvaren (2022): Overview topics in the Management Plan for Bryggen with relevance for the buffer zone / KUVA

►INVESTIGATE and clarify the potential advantages and disadvantages of the Bybanen project for the management of the World Heritage property to develop supporting and mitigation measures.

►GENERATE as soon as possible a map showing all attributes related to World Heritage property Bryggen, identify important sightlines from and to the World Heritage property, as well as between the mapped attributes, identify both threats and potentials in this area and define boundaries of the potential World Heritage buffer zone on this basis.

►CLARIFY how the potential buffer zone can be protected with legislative instruments

7.3 Recommendation 3: Development a visitor management strategy for the World Heritage Bryggen and its buffer zone

The Bryggen World Heritage Management Plan states that "Tourism and increasing numbers of visitors are a challenge for the Bryggen World Heritage Site."

The World Heritage Management Plan, identifies the following challenges[43]:

- Large numbers of tourists, queues and noise can impair the experience of world heritage
- Great wear and tear on the building mass
- Risk in an evacuation situation
- Great dependence on tourism for traders and other actors at Bryggen

These challenges for a sustainable visitor management have been addressed by Bergen Municipality and VisitBergen, among others. A destination strategy[44] and a separate action plan[45] for sustainable tourism management have been developed recently. A first concept of removing tourist buses from the city centre has been commissioned.[46]

The Port of Bergen is Norway's largest cruise port.[47] During the pandemic, the Port of Bergen, VisitBergen and several partners also developed a plan for more sustainable cruise tourism in Bergen[48]. Bergen City Council decided in May 2022 that a maximum of 8.000 cruise ship passengers daily will be accepted in the future, and that the number of cruise ships per day will be reduced to three. According to Bergen City Council, all cruise ships mooring at Bergen should be able to connect to shore power, this should be a mandatory requirement by 2026 at the latest. To support this, Bergen harbour built the world's largest onshore power supply system, which can supply three cruise vessels with shore power simultaneously.[49] Additionally, Bergen also plans to introduce requirements for zero emissions to air and sea, from the port and entry, as well as for cruise ships. Regulations and a introduction date as prepared by the Norwegian Maritime Directorate for the World Heritage fjords.

Additionally, the Traffic Plan for the City Centre is currently in the consultation process. The traffic plan includes issues regarding the introduction of light-rail in the city centre, and accessibility and visitor management questions with the overall aim of a walkable city.

In short, it can be stated that a much effort has been taken by Municipality of Bergen as well as other stakeholders in the city to make tourism more sustainable. Yet, it is not clear how the Bybanen light-rail concept at Bryggen supports these efforts. The Trafikkplan sentrum[50], aims at car free inner city and thereby contributes to creating a viable and attractive urban environment in the centre of Bergen. However, it stays unclear how Bybanen affects other types of mobility, such as cruise ship mass tourism and tourist buses with a

[43] Verdensarvstedet Bryggen. Forvaltningsplan 2021-2025

[44] VisitBergen (date unknown): Destinasjonsstrategi for en bærekraftig reiselivsontvikling i Bergen

[45] VisitBergen (date unknown): Handlingsplan for en bærekraftig reiselivsontvikling i Bergen

[46] Asplan Viak (15.05.2020): Turbussparkering i Bergen commune

[47] https://bergenhavn.no/en/cruise-en/

[48] Amland (April 2021): Håndtering av Cruiseshippassasjerer til Bergen etter Covid 19 Pandemien

[49] https://bergenhavn.no/en/cruise-en/

[50] Miljøløftet (26 April 2022): Trafikkplan sentrum. Temaplan for trafikksystemet i det sentrale byområdet I Bergen

special focus on the values of the World Heritage property Bryggen and its buffer zone.

Consequently, it is recommended to

►DEVELOP a comprehensive mobility strategy for the World Heritage property Bryggen and its buffer zone which provides clear guidance for a sustainable visitor management.

►IDENTIFY how Bybanen and soft road users will affect mobility in Bryggen and the above-mentioned challenges respectively (e.g. reduction of numbers of tourists).

►CLARIFY in this concept how numbers of tourist buses at Bryggen are planned to be reduced and where parkings for tourist buses are going to be provided.

►INTEGRATE in this concept aspects such as

- Goods transport
- Accessibility for the disabled
- Space and routing for pedestrians and cyclists
- Development of the Vågen harbour and the quays for private and commercial maritime activities
- Implement monitoring tools for visitor and mobility mapping

7.4 Recommendation 4: Broad information about Safety Concept for public spaces at Hanseatic Museum and Bryggen Quay

The overall design and upgrade of the urban spaces along Bryggen and Torget is meant to include the light rail and main cycle route into a cohesive surface treatment with cobblestones in various formats, hues and textures so as to highlight Bryggen and Torget as independent urban spaces. Further detailing of the urban spaces in front of the World Heritage property Bryggen and the Hanseatic Museum has been elaborated and the design of the light rail route along Bryggen has been modified so as to integrate it into the city floor while the lighting concept intends to ensure a safe and attractive seafront at night.

The bicycle lanes planned on each side of the light rail line along Bryggen are designed to be visually perceived as part of one large urban space, the quay in front of Bryggen. At the same time, by the use of materials and marking of the safety zones it is intended to make it visible and understandable where the light rail route is. Cycle lanes and pedestrian zones are conceived as a design that provides sufficient visual clarity to define where the various users have their place in the urban space. In parallel, the view from Bryggen is further developed to secure good visual contact with Vågen. Important crossings are marked as a pedestrian area, and sightlines preserved in the furnishing of the urban space. This solution intends to ensure that both cyclists and pedestrians clearly understand which areas are specially adapted for them, to avoid conflicts between the various users.

In general, the visualizations provided in this report show that this cohesive design approach in front of Bryggen and the Hanseatic Museum improves the quality of the public spaces in front of World Heritage property Bryggen. However, this design varies from Bybanen's general design manual requirements for marking of safety zones with a standard "white lining". Besides, applications for changes from standard road design requirements have still to be approved.

Consequently, it is recommended to

►SHOW clearly how the safety concept avoids possible safety risks between the various traffic modes (Bybanen light-rail, cyclists, scooters, and especially pedestrians) are avoided during day- and night times.

►SHOW clearly how the safety concept is managing security of large tourist groups on Bryggen Quay and at Hanseatic Museum.

►INFORM all stakeholders thoroughly about this safety concept.

PART VI APPENDIX

8 Background Information and Sources

8.1 World Heritage Convention

UNESCO-World Heritage properties are protected under the *World Heritage Convention* ("*Convention concerning the Protection of the World Cultural and Natural Heritage*"[51]. The World Heritage Convention that took effect in 1972 is an international agreement between the *State Parties* and the United Nations. The objective of the World Heritage Convention is to identify, protect and use the most important natural and cultural heritage of mankind for intercultural mediation. World Heritage properties are inscribed on the *World Heritage List* to protect them for future generations.

Pursuant to the World Heritage Convention, the *State Parties* are responsible for the protection and sustainable development of the World Heritage properties. According to Article 4 of the World Heritage Convention, "each State Party recognizes that the duty of ensuring the identification, protection conservation, presentation and transmission to future generations of the cultural and natural heritage referred to in Articles 1 and 2 and situated on its territory, belongs primarily to that State".

The protection and sustainable development of the UNESCO World Heritage property *Historic Centre of Vienna* must therefore be ensured by the Austrian State Party that joined the World Heritage Convention in 1992. For this purpose, the internationally applicable guidelines must be observed, in particular the various charters on the implementation of the World Heritage Convention and the so-called *Operational Guidelines* serving to implement the World Heritage Convention.[52] Based on the Austrian legal situation, it must therefore be ensured that the internationally applicable requirements of the *Operational Guidelines* are implemented.

8.2 Outstanding Universal Value (OUV)

The inscription of World Heritage properties on the World Heritage List depends on their *Outstanding Universal Value* (OUV). The concept of the *Outstanding Universal Value in the* World Heritage Convention and its implementation stands for all UNESCO World Heritage properties in all regions of the planet. After inscription on the UNESCO World Heritage List, the *Outstanding Universal Value* is set in stone and must not be impaired.[53] The *Outstanding Universal Value* is therefore the central point of reference for all activities within the UNESCO World Heritage property.

8.3 Selection Criteria

Cultural and natural sites whose *Outstanding Universal Value* is acknowledged by the World Heritage Committee and its advisory organisations *ICOMOS International*, *IUCN* and *ICCROM* are inscribed on the World Heritage List using specific criteria. These criteria are defined in the internationally applicable guidelines for World Heritage properties, the *Operational Guidelines*. Six different criteria (criteria (i) – (iv)) exist for World Cultural Heritage Sites like the *Historic Centre of Vienna*. After a State Party to the World Heritage Convention has nominated a site for inscription on the World Heritage List, the *UNESCO World Heritage Committee* decides whether:

- at least one of these criteria applies, so that the *Outstanding Universal Value* of a site and therefore its inscription on the *UNESCO World Heritage List* is justified (*Operational Guidelines*, paragraph 77),
- any potential World Heritage property also meets the criteria of *Integrity* and *Authenticity*,

[51] UNESCO (1972): *Convention Concerning the Protection of the World Cultural Heritage*

[52] UNESCO World Heritage Centre: *The Operational Guidelines for the Implementation of the World Heritage Convention,* Paris 2017. The *Operational Guidelines* are updated in regular intervals. This Assessment is based on the Operational Guidelines 2017.

[53] The *Operational Guidelines* define the *OUV* as follows: "Outstanding Universal Value means cultural and/or natural significance which is so exceptional as to transcend national boundaries and to be of common importance for present and future generations of all humanity. As such, the permanent protection of this heritage is of the highest importance to the international community as a whole. The Committee defines the criteria for the inscription of properties on the World Heritage List." See: UNESCO World Heritage Centre: *The Operational Guidelines for the Implementation of the World Heritage Convention,* Paris 2017

- any potential World Heritage property has an adequate *system for its protection and management* (Operational Guidelines, paragraph 78).

These so-called *conditional criteria* are summarised in compact form for all World Heritage properties in a *Statement of Outstanding Universal Value* (SoOUV). For any World Heritage properties that were inscribed on the World Heritage List without a SoOUV (which has been the case for Vienna), a so-called *Retrospective Statement of Outstanding Universal Value (RSoOUV)* is prepared. The *RSOUV* must always be considered in compliance with the information provided in the nomination file, and cannot be applied in isolation.

Therefore, the selection criteria determined in the *RSOUV* for the World Heritage property *Historic Centre of Vienna* are the starting point of this *Heritage Impact Assessment*, because these criteria must be maintained by all means and must not be impaired.

8.4 Heritage Impact Assessment (HIA)

Heritage Impact Assessments have been required by the *UNESCO World Heritage Committee* and its advisory organisation *IUCN* (Natural World Heritage Sites) and *ICOMOS* (World Cultural Heritage Sites) for some years in order to evaluate and assess transformations in the World Heritage properties and consequences for the *Outstanding Universal Value*. A major reason for such requirement of *Heritage Impact Assessments* is that they explicitly take account of the particularities of the system of values of World Heritage properties, in particular the *Outstanding Universal Value,* and the Selection Criteria, respectively.

In contrast to *Strategic Environmental Assessments* (*SEA*) and *Environmental Impact Assessments (EIA*), *Heritage Impact Assessments* have currently not been planned under EU law. The realisation of *Heritage Impact Assessments* and the implementation of the resulting recommendations is therefore done on a voluntary basis and usually falls under the responsibility of the individual State Parties.

ICOMOS International established applicable guidelines for the performance of *Heritage Impact Assessments* in World Cultural Heritage Sites, the so-called *ICOMOS Guidance on Heritage Impact Assessments for Cultural World Heritage Properties 2011*[54]. This guidance was updated by the advisory bodies ICCROM, ICOMOS and IUCN in 2022[55] .

8.5 Attributes (source: UNESCO, ICCROM, ICOMOS and IUCN (2022): Guidance and Toolkit for Heritage Impact Assessments in a World Heritage Context)

Attributes are the elements of a heritage place which convey its heritage/conservation values and enable an understanding of those values. They can be physical qualities, material fabric and other tangible features, but can also be intangible aspects such as processes, social arrangements or cultural practices, as well as associations and relationships which are reflected in physical elements of the property.

For cultural heritage places, they can be buildings or other built structures and their forms, materials, design, uses and functions but also urban layouts, agricultural processes, religious ceremonies, building techniques, visual relationships and spiritual connections. For natural properties, they can be specific landscape features, areas of habitat, flagship species, aspects relating to environmental quality (such as intactness, high/pristine environmental quality), scale and naturalness of habitats, and size and viability of wildlife populations.

Attributes, and the interactions between them, should be the focus of protection, conservation and management actions.

The term ‘attributes’ is particularly used for World Heritage properties and a clear understanding of the attributes that convey their Outstanding Universal value is critical for their long-term protection. The spatial distribution of those attributes and respective protection requirements should inform the boundary of the property and other management actions.

[54] http://openarchive.icomos.org/266/1/ICOMOS_Heritage_Impact_Assessment_2010.pdf

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8.7 Abbreviations

HIA: Heritage Impact Assessment

ICOMOS: International Council of Monuments and Sites

OUV: Outstanding Universal Value

SOUV: Statement of Outstanding Universal Value

RSOUV: Retrospective Statement of Outstanding Universal Value

UNESCO: United Nations Educational, Scientific and Cultural Organization

WHC: UNESCO-World Heritage Centre, Paris