

BACKGROUND INFORMATION

CUSTOMER City of Helsinki, Urban Environment Division

OBJECT OF THE PLANNING

A climate-smart planning process that compared regular and climate-smart construction practices was included in the planning of Hämeentie street renovation located in Arabia district. The street section covers about a two-kilometre road between Toukola and Vanhakaupunki, and it represents the densely built street environment that is typical in Helsinki. During the renovations, the street area will be repaired, the pedestrian and cycling conditions improved and the municipal technology in the area renewed.

PLANNING VALUES

Hämeentie street and construction planning:
€371,000

Emission calculation and climate-smart reviews:
€36,000



City of Helsinki Media Bank / Kimmo Brandt

Climate-smart street renovation as a goal

The objective of the planning process was to come up with the best possible technical solution for renovating the street, which would also consider the overall climate impacts. In accordance with the goals of City of Helsinki's cycling traffic development programme, an aim is to improve cycling conditions in the area, and one-way cycling lanes will be built on the street. Building the cycling lanes requires widening the street areas which, in turn, will affect the parking spaces and bus stops along the street. The tramline along Hämeentie will remain as before. At the same time, water maintenance and district heating and cooling networks will be renewed, and the street area's outdoor lighting will be modernised to meet today's demands and requirements. The intention is to conduct the area's storm waters to Vanhankaupunginlahti in the future, so separating wastewater and storm water into different networks was also reviewed.

A carbon footprint calculation that takes into account emissions generated during construction (including the production and transport of building materials and the emissions of installation/the work being carried out) was included in the planning work to highlight the renovations' key climate impacts. Combining the assessment of climate impacts as part of the planning allowed the comparison of regular construction procedures with resource-smart options and illustration of the emissions generated by the different planning solutions. This also revealed the emission reduction potential of utilising recycled materials and implementing a low-emission worksite. In addition to greenhouse gas emissions, the cost-effects of the proposed solutions were reviewed.

Even though the objective of the emission calculation and the climate-smart review was to review the major emission sources of this particular street renovation project and find out how they could be changed, the review is also a way to achieve similar advantages in future projects. The Hämeentie review is a learning platform for including the assessment of climate impacts a natural part of the planning process instead of keeping the carbon footprint calculation as a separate project. The recommendations are applicable to other, similar projects and will thus support the promotion of circular economy more extensively. Additionally, a further objective is to gather more information about the emissions of the alternative planning solutions to support the decision-making process.

Comprehensive competence through cooperation

The planning work was ordered by the City of Helsinki's Traffic and Street Planning. An extensive group of the City's representatives, for example from the units for foundation engineering and park and green area design, as well as some external parties, such as Helsinki Region Environmental Services Authority's water maintenance unit, HSL and Helen, took part in the project group. Within the City organisation, the project manager, an environmental specialist of the Development Services, the experts of the Canemure project and the City's mass coordinator took part in the climate-smart survey. The planning, the emission calculation guiding it and the resource-smart reviews were implemented by Ramboll in accordance with the City's guidelines.

The engagement of different parties in the planning process is important, as they bring the know-how of their special fields to the work and offer data to support climate-smart solutions. A review that takes climate impacts into account is still a new thing, and the projects allow the related competence in all organisations participating in the work to grow.

Many ways to cut down on the carbon footprint

A major part of infrastructure projects' carbon footprint comes from their emission-intensive construction materials as well as the large amounts of soil and rock matter transported. The City of Helsinki works determinedly to decrease the emissions of infrastructure construction, and various ways to mitigate emissions have already been identified. Information about the climate effects of infrastructure construction is needed to make sustainable, low-emission solutions.

Emission calculation is one way of producing concrete information to support the planning process. In Helsinki, emission calculations have been conducted for the Iso Roobertinkatu renovations, and the construction projects of Kivikko interchange and Alakivenpuisto, for example. In the previous infrastructure projects the emission calculations were mainly carried out after the construction. In Hämeentie project, the climate-smart review helped guide the planning, and solutions were made based on the emission calculation.

Significant developments have also taken place in mass coordination, and, in recent years, Helsinki has even become a forerunner of recycling soil masses. The purpose of mass coordination is to look for new purposes of use for the excavated soil, aggregates and building materials generated through the City's own construction projects. When these materials are utilised in areas nearby, the amount of waste taken to landfill, the demand for new soil and the emissions caused by transport all decrease.

The emissions of infrastructure construction will also be taken into account in procurements to consider the climate perspective and circular economy. The climate-smart review of Hämeentie as a part of street renovation planning is one of the cases of the Towards Carbon Neutral Municipalities (Canemure) project, which strive to make various procurements as low-carbon as possible. The project is also piloting the suitability of carbon footprint calculation as a factor steering procurements. The objective is to achieve successful cases as examples and to produce applicable tools to support the City's carbon neutrality actions.

The emissions from the construction stage were considered during the planning stage

With regard to steering the planning, the climate-smart review was correctly timed, as its implementation and objectives were brought up in the very first planning meeting. However, it was assessed that its impact options would be limited in the densely built, street environment when compared to, for example, a new construction site.

The planning work's climate-smart review focused on the recycling and reuse of structural layers, rock materials and asphalt, the utilisation of recycled planting matter in the street's green areas and the energy form used in work machinery. Additionally, the environmental impacts of separating waste water and storm waters, the climate burden of the trunk water pipes' material options, the effect of traffic arrangements during the project on traffic emissions and the impact of the planning solutions on the maintenance emissions were assessed in their own separate reviews.

The emission calculation focused on the construction stage, as it is the most significant stage in infrastructure construction's lifecycle emissions. The emission calculation following the standards of the CEN/TC 350 standard package was based on the quantities of building elements processed during the preliminary planning stage. Additionally, the work carried out and transport journeys were set to follow the policies applied in Helsinki. The reviewed solutions that took climate impacts into account as well as possible were compared to the usually implemented option (i.e. the 'worst-case scenario') in the project's emission and cost calculations.

The planning progressed in good cooperation with experts specialising in the subject. The climate perspective was included in all planning meetings, where the matters in which emission cuts could be achieved were also presented. Further reviews were carried out, when necessary, and the process was refined. This allowed for the highlighting of climate and cost impacts alongside the technologically best solutions. The planning stage took a little more than a year in total.

Better solutions for construction

From the perspective of both climate and costs, the most notable benefit in infrastructure construction can be achieved through the recycling and reuse of demolished soil and rock matter that usually ends up as waste. In Hämeentie, too, the most opportune emission and cost savings can be achieved through reusing the soil, bottom and surface structures. The recycling of reusable materials constitutes over 60 % of the emission deductions and most of these will be generated by reutilising the milled asphalt pavement (22 %). Even though milling does increase the amount of emissions somewhat, compared to removing asphalt in pieces, it makes reuse the old asphalt material as crushed matter for new asphalt more efficient. The objective is to reuse the asphalt and other materials demolished in the street section on site and in other City construction works, as applicable.

The development work the City has already carried out is considered in the planning, for example in the recycling of rock materials and by utilising the recycled planting matter refined in the Kivikko processing area. The demolished rock materials will be sorted on site for interim storage, which improves its utilisation in Hämeentie and other contract construction sites. A mixed-colour paving is favoured in the designs for Hämeentie, which makes reusing natural stone easier. Due to the dense street environment, interim storage will be located outside the area. About a fifth of the emissions deductions are achieved by shortening the transport distances and utilising the City's interim storages.

The fifth of the emission deductions is made by using alternative energy sources for work machinery and heavy transport vehicles. In the emission calculations the comparisons of the emission impacts were carried out between traditional diesel, biodiesel, electricity and green electricity. If the worksite is to be fossil-free, so that 80% of the energy is generated with renewable diesel and 20% with green electricity, the emissions caused by the worksite operations would be 89% smaller than those of a regular project.

A preliminary review of traffic arrangements during the work process was also carried out for the first time during the planning work. Avoiding unnecessarily prolonging the work process during stages where driving distances and the risk of congestion increase when the street is closed and tram traffic has been interrupted is the most essential part in mitigating climate impacts. Additionally, the smoothness of service and maintenance traffic is improved when designing the street structures to reduce the emissions of operations.

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Not all planning options could be reviewed in Hämeentie and some available measures were left unutilised. Natural processing of storm waters in the area or adding trees to the street as carbon sinks could not be applied in Hämeentie worksite. Also utilising recycled materials – such as crushed concrete and bottom ash – in earthworks was not possible due to the network of pipes and cables that fill the street structure.

Climate-smart construction secured through contract documents

The climate-smart review facilitated the presentation of measures that help decrease the emissions of Hämeentie street renovation. Not all climate and recycling goals can be adequately covered during the planning stages. This is why it is important to record the goals in the contract documents, which allows for the planning and securing of the implementation of the objectives and resource-smart solutions during construction together with the contractor. For the construction contract's tendering process, it should also be considered how the requirements established will be monitored during contract phase.

It is recommended that the following climate-smart measures identified in the review be entered in this project's contract documents:

- ▼ The current asphalt will be removed by milling it instead of excavating it in pieces.
- ▼ The masses from excavation operations and the demolished paving materials will be sorted and transported in the City's interim storage.
- ▼ The structural layer material demolished from the street will be utilised as a final filling material.
- ▼ Crushed asphalt will be utilised in the new asphalt material.
- ▼ Natural stone found in the demolished paving material will be reused in the work process, and concrete stones will be used for the City's other projects.
- ▼ Instead of planting matter procured from external suppliers, planting matter products developed by the City from its own surplus soil will be used.
- ▼ The traffic arrangements during construction will be taken into account when designing the worksite (i.e. the emission impacts will be considered when phasing the construction).
- ▼ Instead of using fossil diesel, 80% of energy used will come from renewable diesel and 20% from green electricity.*

*Helsinki is committed to the goals related to emission standards and energy sources of construction machinery and heavy transport vehicles in the Green Deal agreement of emission-free worksites. The City of Helsinki's valid procurement criteria (following the Green Deal agreement) for low-emission infrastructure worksite will be applied to the Hämeentie construction phase.

Climate impacts cannot be avoided

A number of needs and demands are always coordinated simultaneously in planning, and sometimes the different perspectives clash with each other. However, most climate-smart options are more affordable than regular solutions, both with regard to their emissions and their costs. Most resource-smart measures identified and recommended in the review could be included in the plans when striving towards the technical best solution. On the other hand, it was not always possible to implement the best possible option regarding climate impacts.

Steel lattice towers were chosen instead of the lower-emission conical steel columns or wooden pylons, as they were best suited to the area's cityscape. Similar lattice towers are already used as shared-use pylons in the area. Additionally, lattice towers are versatile in use, allowing for the integration of signposts, for example. Furthermore, when choosing the material for the main water line's trunk pipe, steel was chosen instead of lower-emission cast iron. Using a steel pipe was decided on due to previous experiences and the street section's characteristics.

Several trees on the street will have to be removed due to inadequate room for their roots and the changes to the street area. This will decrease the carbon sinks in the area. However, it also allows for improving the growth conditions of larger trees with greater climate advantages by changing their growth bed, for example. Green vegetation can be added to the dense streetscape with vines that will utilise the lattice towers used for street lighting as their growth support.

Resource-smart choices bring emission cuts and lower prices

By following the recommendations of the resource-smart solutions for the Hämeentie street renovation, the City of Helsinki can save an estimated 308,000 kg of CO₂e. This option cuts the emissions by about 27% compared to the total emissions of regular building sites. Additionally, this would total more than one third in cost savings, totalling EUR 910,000, which can be achieved through recycling and reusing materials, in particular.

The resource-smart review showed that utilisation of recycled materials, mass coordination, reserving interim storage places and the energy source of work machinery need to be linked both to the planning and then, later, to the project's procurement process. Based on the results, the emission and cost-savings will be notable in the project itself, but the results realised cannot be assessed until after the project has been completed. Implementing the emission calculation and the climate-smart review increased the planning costs by around 10%, which is a small addition compared to the cost savings achieved in construction. It is likely that the costs of the review will decrease further in the future, as these kinds of reviews become more common and will be carried out more often.

In addition to reviewing the climate impacts during construction, planning can have a more extensive effect on the emissions generated by the area's use, servicing and maintenance. When the area is in use, these actions have some significant climate impacts, but there is little information available on them, and further reviews on the subject are needed. The review also offered new information about the carbon footprint of the separation of storm water from other wastewater. The separation achieves positive climate impacts, as the nitrogen load arriving at the wastewater treatment plant decreases, reducing the amount of energy needed for the wastewater treatment process.

From the planning table to the worksite

Well planned is half done, and the goal is to introduce the recommendations of the resource-smart option to the tendering process of the contract and the construction in full. The resource-smart alternative will give realistic guidelines for the contract work's implementation, as the characteristics and potential challenges of the street section have been taken into account already at the planning table, when reviewing the options with best climate impacts. As extensive reuse as possible was one planning goal, but the true potential of, for example, structural layers in reutilisation will only be specified during the contract phase's quality reviews.

The contract phase will offer experience of implementing the recommendation and, for example, introducing the criteria for low-emission worksites. In addition to these recommendations, it would be interesting to review other matters during the contract phase, such as the utilisation potential of low temperature asphalt. The construction phase's timing will be specified later, as the detailed city plan of Arabia factory district and its construction, which will also effect the street renovation project, are specified further. However, the possible changes to the detailed plan were considered in the plans, for example with regard to traffic arrangements, and the climate-smart street renovation can be implemented despite the potential changes to detailed plans.

More climate-smart design in Helsinki

The Hämeentie climate-smart review is linked to the City's other development and the intention is to also apply its results to future projects. The review of a resource-smart alternative produced information about the climate impacts and costs of the planned measures. Its aim was to further promote circular construction in infrastructure construction. Know-how is accumulated gradually, and valuable data to support smarter choices can also be collected through, for example, development projects and pilot sites in the future.

In addition to the climate-smart solution, the Hämeentie case helped make the utilisation of carbon footprint calculation more concretely part of the City's planning process. What we learned from the project will allow us to connect the consideration of climate impacts more closely with the City's infrastructure construction. Considering the City's other development work, a resource-smart review is a sensible approach, both with regard to the environment and the project costs, and it is important to make the emission and cost savings achieved visible.

From a wider perspective, utilising the results of the Hämeentie case will also mean developing the city's guidelines and reviewing the document templates in order to take the significant climate and environmental impacts into account. Furthermore, it is necessary to facilitate internal dialogue within city about the subject and aim to systematically introduce new operating methods to ensure that sustainability and accountability perspectives are always included in planning.

Sharing the knowledge

A climate-smart review is easy to carry out in connection with planning building and infrastructure construction, as long as the review can be linked as a part of the process early enough and when real dialogue about the options is allowed in the planning progresses, for example as a fixed part of the planning meetings' agenda. Emission and cost calculation produce the necessary data to support decision-making.

The method, results and solution of the Hämeentie review can be directly applied to similar planning processes of dense street environments. However, it needs to be noted that only a limited range of measures could be applied to this renovation project. Additionally, including a carbon footprint calculation is not necessary in all street projects, if the site's characteristic emission sources and central methods to reduce emissions can be proven otherwise.



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