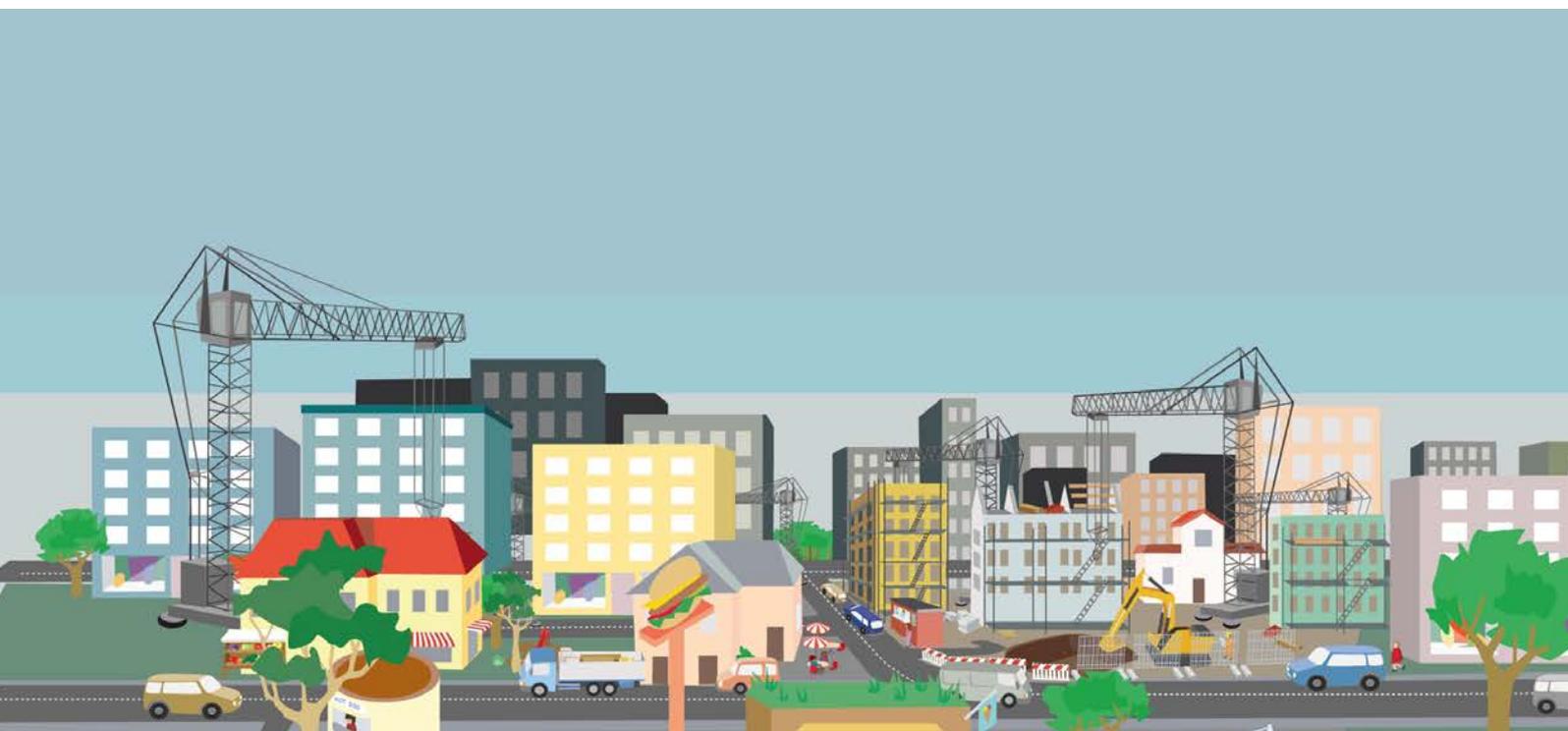


WP4: Smart Governance

Deliverable 4.3: Policy instruments

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1. Introduction

1.1 About MIMIC

The purpose of *MIMIC – Minimizing impact of construction material flows in cities: Innovation co-creation* is to demonstrate how Smart Governance concepts can be used in construction and city planning processes to facilitate and support logistics to, from, and on urban construction sites – to improve mobility and reduce congestion, thereby reducing the negative impact of construction sites on the surrounding community. The SMART Governance Concept as described here integrates several different aspects:

- 1) A description of possible construction logistics scenarios and strategies (D1.1) (Fredriksson *et al.*, 2020) to increase knowledge of construction logistics,
- 2) A construction logistics serious game (D1.3) (Bergström *et al.*, 2020) and stakeholder analysis (D1.4) (Brusselaers *et al.*, 2019, Brusselaers *et al.*, 2021) to identify needs and facilitate discussions on the evaluation of impact of construction activities,
- 3) An impact assessment framework to evaluate the environmental, economic, and social performance of on-site and off-site construction logistics scenarios (D2.1 and D2.2) (Brusselaers *et al.*, 2020),
- 4) Simulation and optimisation models to evaluate construction logistics scenarios (D3.1 and D3.2) (Fredriksson, Nolz and Seragiotta, 2021),
- 5) A policy framework to set logistic requirements in the early planning process (D4.3).

The Smart Governance Concept 1.0, developed under the previous CIVIC project, was a first attempt to support the inclusion of construction logistics planning in construction project planning on a city level. Building on the Smart Governance Concept 1.0 and its evaluation (D4.1), this deliverable aims at developing and testing the Smart Governance Concept 2.0 within the scope of the MIMIC project.

1.2 Goal and scope

This report is a deliverable (D4.3) in the MIMIC project, under WP4, Task 4.3. The aim of WP4 is:

- test the Smart Governance Concept 1.0 developed under the previous CIVIC project with an attempt to include construction logistics planning in city level planning (Task 4.1 Testing of Smart Governance Concept 1.0),
- develop and test Smart Governance Concept 2.0 based on the tools developed in MIMIC project (Task 4.2 Testing of Smart Governance Concept 2.0)
- define design criteria, and policy and legal framework requirements, allowing testing and implementation of the SMART Governance Concept of construction logistics (Task 4.3 Legal framework and policy making).

The main aim of this report is to design policy and legal framework requirements which support the implementation of the Smart Governance Concept of construction logistics. In addition, the report gives an overview of the legal and political status at strategic, tactical, and operational levels, from each partner country in MIMIC.

The methodology used in this study is based on literature review and practical knowledge of the existing legal frameworks in Norway, Sweden, and Belgium. After this introduction chapter, Chapter 2 through Chapter 4 give detailed descriptions of the current legal and political status in Norway, Sweden, and Belgium, respectively. Chapter 5 provides some examples from each country. Chapter 6 provides recommendations for approaches to create awareness and have an impact on legal and policy development.

2. Status of legal and policy framework in Norway

2.1 Introduction

There are three levels of government in Norway. The first is the State, consisting of the Storting (the Parliament), second level consists of the eleven counties, and the third is the 356 municipalities. The counties comprise the regional level, while the municipalities make up the local government level. The state level has the judicial branch and the legal framework, where relevant ministries for construction logistics are the Ministry of the Environment, the Ministry of Local Government and Modernization, and the Ministry of Transportation. In addition, the State is represented at the regional level by the County Governor. The County Governor's office is important for supervising and controlling the implementation of state regulations at the Local Government level, e.g., supervising and organising the implementation of GHG emission reduction measures. The municipality is responsible for local-level administration (planning and building authorities). From a logistic perspective, the legal framework at the state level can achieve higher ambitions when working at the scale of the regional (county) and local (municipal) requirements for transport and logistics associated with construction sites. Tabel 2.1 gives an overview of relevant acts and guidelines at different Norwegian public administration levels to address construction logistics issues.

Tabel 2.1 Acts and guidelines at different public administration level in Norway. Orange (State level), blue (county level) and green (municipality level). All three can influence on each other. How strong the color indicates where it has the most impact

Public administration levels Acts and guidelines	State	County/Regional	Municipality/local
The Plan and Building Act			
The Building Code			
Coordinated area and transport planning - state guidelines			
The Climate Change Act			
The Pollution Control Act			
National Transport Plan			
Regional climate plan			

Municipalities climate and/or energy plans			
Municipality master plan			
Municipality zoning plan			
Public procurement			

In Norway, political movement towards more green solutions opens for implementations of construction logistic solutions demonstrated in MIMIC project. There are several activities to achieve higher ambition levels in regional and local requirements for construction sites, including transport and construction logistics activities. At the municipal level, from both political and administrative perspectives, it is important to have public development projects be good pilot projects and role models.

At the state level, the existing legal framework should be revised in order to increase the ambition levels in regional and local requirements for transport and logistics associated with construction sites.

Table 2.2 gives an overview of the legal and political framework at different public administration levels.

Table 2.2 An overview of legal and political framework in Norway

Acts and guidelines / Public administration levels	Strategic	Tactical	Operational
State	The acts with building codes	The ministries' and directorates' work towards counties, municipalities, and partly actors/stakeholders	The ministries' and directorates' work towards counties, municipalities, and partly actors/stakeholders
Regional	The regional plans	Regional planning with requirements, and inter-municipal planning	Practical work towards municipalities, inputs to zoning plan and building applications, and appeal against decisions

Local	The municipal sub-plan. Political guidelines and strategies approved in city councils	Municipal planning at general level down to zoning plans	Practical work to fulfil municipal planning, towards actors
Other actors	- Expert advice/ taking part in policy development (white papers etc) - Voting	- Lobbying	- Fulfillment of legal, regional and local requirements through planning, project applications and construction works

We have chosen to separate the political framework and the legal framework in this report, although they may sometimes overlap. By legal framework we refer to the absolute requirements that must be followed in all planning decision at all three government levels. The planning and building act and the building code are examples of legal frameworks. By political framework, we mean guidelines that all planning must follow, that do not necessarily have absolute requirements, but rather overarching goals. One such goal is becoming a low-carbon society by 2050. Furthermore, we expect to develop recommendations for approaches to create awareness and have an impact on legal and policy development.

2.2 State level

2.2.1 The Planning and Building Act (PBL)

The Planning and Building Act (PBL) is the main act for provisions on the planning and regulation of land use and construction in Norway. The PBL currently has no specific requirements related to fossil-free or emission-free construction sites, transport, or other construction logistic activities. Paragraph 29-8 of the PBL (Waste management) provides requirements for proper waste management. This provision applies to measures under Chapter 20, targeting to "satisfy requirements for proper waste management in or pursuant to the Act". The Ministry of Local Government and Modernisation (KMD) provides detailed regulations on waste management, including documentation on waste management. Furthermore, the law states that the Ministry (KMD) provides "*regulations for the protection of the environment, including natural diversity, in the placement and design of measures*" (Planning and Building Act, § 28-8 and § 29-10).

2.2.2 The building code (TEK)

The current Norwegian building code (TEK17) focus on construction waste reduction through a series of specific requirements (e.g., waste planning, assessment of reuse and recycling, and local sorting). Requirements for greenhouse gas (GHG) emission reductions from construction sites, transport, and other construction logistics activities, are not expressed in the building regulations. Proposals for changes in TEK17 are currently out for public consultation, where GHG emission requirements are to be included but only for materials. Chapter 9 of TEK17 "*External*

*environment*¹ describes how the construction industry is influential in achieving national goals, including obtaining conscious use of materials, and reduction of waste generated by construction. The entire chapter 9 of TEK17 is relevant to the choice of products and materials, and to environmental impact on the environment. *"The rules in Chapter 9 of the Regulations include provisions on health and environmentally hazardous substances in building products, basic pollution, natural diversity, handling of construction waste and particulate emissions from wood-burning stoves"* (TEK17, Chapter 9). § 9-1 states that *"Buildings shall be designed, constructed, operated and demolished in a manner that entails the least possible strain on natural resources and the external environment. The construction waste must be handled accordingly and the amount of waste over the life cycle of the structure is limited to a minimum"*.

Building construction products must be suitable for reuse and material recycling. Further, TEK17 states that *"Products must be selected for buildings suitable for reuse and material recycling"* (TEK 17, 9.5 second section). Chapter 14 "Energy" stipulates requirements for energy solutions, insulation, and energy efficiency in buildings, but presents no specific requirements for construction sites, transport, and other construction logistics activities. Chapter 12 also mentions building layouts, where Section 12.1 states *"Construction works shall have a layout adapted to the construction works' function"*.

2.2.3 The Climate Change Act

The Climate Change Act is an act related to Norway's climate targets – aiming to "promote the implementation of Norway's climate targets as part of the transition to a low-emission society by 2050" (Ministry of Climate and Environment section 1, page 1) . The Climate Act stipulates that it applies to emissions and absorption of greenhouse gases that Norway has committed to through the Paris Agreement, and sets targets for limiting GHG emissions in 2030, with a reduction of at least 55% from the 1990 reference year (section 3). The Act describes the targets of becoming a low-carbon society by 2050, and has an overall target of promoting openness and public debate on the status, direction, and progress of the ambition. Further, the Climate Change Act endorses cooperation with the EU community to obtain the goals of the climate targets set in, or pursuant to, this law.

2.2.4 National strategy on green circular economy

The Norwegian government has developed a strategy for a green circular economy (Ministry of Climate and Environment, 2021). The ambition is to make Norway a pioneer in the development of a green circular economy through active development of policy instruments both nationally and in cooperation with the EU, for framework conditions that ensure the basis for value creation and green competitiveness in Norway.

The strategy is a combination of different strategies that could help lead Norway toward a green circular economy. For construction sites, transport, and construction logistics associated activities, the government will make arrangements for fossil-free construction site requirements by 2025, with public construction sites leading the way. The government recently presented an action plan for fossil-free construction sites in the transport sector. One measure here is a pilot project for fossil-free and emission-free construction sites under the auspices of the Ministry of

¹ [Regulations on technical requirements for construction works \(TEK17\) \(dibk.no\)](https://dibk.no)

Transport's agencies and activities. Enova (an energy enterprise owned by the Norwegian government) has its own initiative to support innovative pilot projects that will develop and test new technologies, solutions, and business models that facilitate fossil-free / emission-free construction sites. Enova also subsidises purchase of electric machinery. State support enables municipalities to bear the additional financial cost of buying construction services performed with emission-free machines, though still this is in the pilot phase (Ministry of Climate and the Environment 06/2021).

2.2.5 The Pollution Control Act

The purpose of the Pollution Control Act is to protect the outdoor environment against pollution and reduce existing pollution, to reduce the quantity of waste, and promote better waste management (MCE, 2019, section 1). The law aims to ensure a sound environmental quality, and facilitates for recycling of materials within environmentally, resource efficiently, and economically sound limits. The Act also applies to pollution from transport, unless other laws have specific provisions, such as pollution from the individual means of transport, see section 5. The Pollution Authority may issue regulations on boundary values and prohibitions related to certain aspects (e.g., substances, noise, vibration, etc.), as well as when, where, and how such requirements shall apply.

2.2.6 National Transport Plan (NTP) and state guidelines

The National Transport Plan (NTP) is the political transport strategy for the next 12 years, aiming for a better and safer transport system with lower environmental impacts (Norwegian Ministry of Transport and Communication, 2018). Target figures for zero emission vehicles are specified in the NTP for 2018-2029 (White paper 33, 2017). Furthermore, in the decision to increase the marked requirement for biofuels to road traffic, an increase of 20% was added in 2020.

Achieving transport-related environmental and climate goals requires coordination between actors, and active and long-term use of many of the instruments and measures described in the catalog of measures². The Planning and Building Act from 2009 (PBL stipulates that state guidelines for environmentally oriented and coordinated area and transport planning (SAT) shall be taken into account in public planning at all levels, and in sector planning governed by other laws than PBL.^[OB:OB]In the transport area, the National Transport Plan (NTP) also provides concrete guidelines through financial and organizational instruments for coordination

2.3 County level

County level is the regional people-governed level of government in Norway. The county municipality has administrative and service-producing tasks within a county, and subject to political control, with the county council as the supreme body. The tasks that the county municipalities take care of are largely determined and regulated by state legislation. The county council is elected directly by the county's inhabitants every four years, by municipal and county council elections.

² <https://www.tiltak.no/>

The county municipality also has a practical role as an advisor for smaller municipalities that have limited capacity and knowledge. The county municipality can also submit objections and inputs to the municipality's zoning plans and building applications.

The regional climate plan will represent the county level ambitions for climate change. An example is in Vestland county, which has ambitions to achieve emission-free construction sites (see Section 5.1.3) and the goal to become a zero-emission society.

2.4 Municipal level

The municipal level has a planning hierarchy with the municipal masterplan at the top, followed by a master plan, and then zoning plans (see Figure 2.1). These plans are governed by the Plan and Building Act and the building code. Municipality master plan and zoning plan combined with public procurement is the most important instrument to secure emission-free construction sites with focus on transport and logistics.

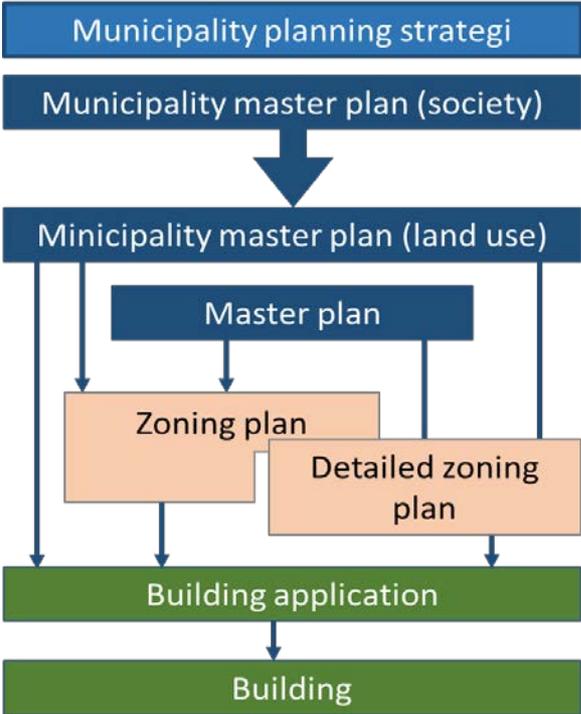


Figure 2.1 Municipal planning hierarchy (regjeringen.no/reguleringsplanveileder)

The Norwegian Environment Agency points out that municipalities and businesses can work together in setting requirements to suppliers to obtain fossil-free or emission-free construction sites (Miljødirektoratet, 2019). By setting emission reduction requirements through fossil-free / emission-free construction sites, the greater the pressure on the suppliers to develop and make available low or zero emission technology, machinery, and other solutions. Decisions to demand low or zero emission construction sites can be anchored in the municipalities' climate and energy plans, decisions in the individual construction project, municipal plans and sector plans, and other relevant policy instruments and guidelines. It is nevertheless at the regulatory level that important provisions for the relevant construction project are decided. A review of the Planning and Building Act and the building code shows no specific requirements related to fossil-free or emission-free

construction sites. Public plans cannot demand higher ambitions than the minimum requirements given in the building code (TEK).

2.4.1 Public procurement

The public sector purchases goods, services and construction work for about NOK 520 billion annually. All procurements are subject to the regulations. The regulations must ensure that the money is utilized in the best possible way, and that the purchases contribute to a competitive business life³. (Annskaffelser.no)

Oslo municipality has been using fossil-free / emission-free construction strategies to address challenges and needs of projects in order to achieve environmental goals and ambitions. Oslobygg, a local government entity in Oslo responsible for municipal buildings, has been one of the frontrunners in developing and realising emission-free construction through their procurement procedures. On the regional and local authority level, there are two important bylaws from the City Council of Oslo in 2019: 1091/19 (Oslo kommune, 2019a) and 1123/19 (Oslo kommune, 2019b) that indirectly describe the scope and approach for the work on efficient and sustainable construction logistics in municipal procurements related to construction.

The bylaw 1091/19 mainly focuses on the municipal procurement of services within the construction process in particular (Figure 2).

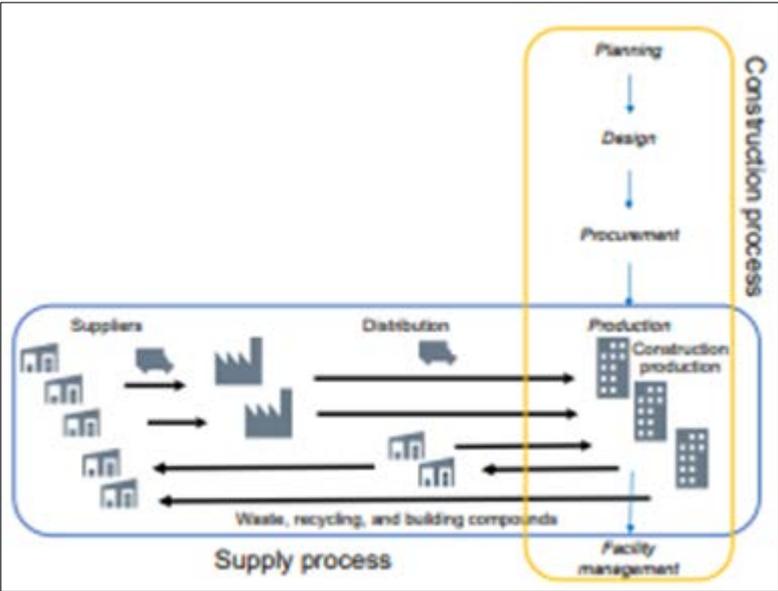


Figure 2.2 The interface between construction process and supply process (adopted from (Thunberg and Fredriksson, 2018)

It clearly states that Oslo will set demanding standard requirements for environmental performance, either as minimum requirements, or by rewarding the contractors in the evaluation criteria of the competition. For instance, biofuels (fossil-free) is a minimum requirement, with higher rewards given to contractors that offer electric or other emission-free solutions. The primary scope is GHG emissions reduction related to construction machinery used in services associated to construction site activities. The policy also includes GHG emission reduction from

³ Annskaffelser.no

the transport of materials and waste to and from construction site, with an aim of emission-free emphasising GHG emissions reduction from construction machinery and transport of mass and waste, focusing (primarily) on technology shift (towards emission-free) rather than optimum construction logistics as the main target.

The bylaw 1123/19 mainly focus on the supply process (Figure 2.2). According to the bylaw 1123/19, all service and goods procurements of the city of Oslo should include requirements or (ambitious) procurement criteria that promotes energy efficient driving, good planning, and route optimisation of transports to reduce emissions and traffic. The scope of the bylaw 1123/19 is therefore focused on GHG emissions reduction from supply process (transport and traffic) and, focusing (primarily) on technology shift (towards emission-free) rather than optimum construction logistics as the main target. There is also a new upcoming new strategy on sustainable and reduced resource utilisation 2020-2023 focusing on 1) Green procurement and reduced consumption in the municipality, 2) facilitating collaboration and supporting actors beyond municipalities, 3) Knowledge and communication, and 4) strengthening and creating green workplaces (Oslo kommune, 2020a). This facilitates measures that support the development of circular construction, focusing mainly on reuse of building materials, but also on waste reduction.

3. Status of legal and policy framework in Sweden

3.1 Introduction

Across Europe we are experiencing a strong urbanization trend where people are moving to cities for work and leisure activities. Sweden is one of the countries where this trend is at its strongest. In fact, in 2014, 85.8 per cent of the Swedish population were living in urban areas, a figure that is predicted to rise to 90.3 per cent by 2050.

Similar to Norway, Sweden has three levels of government. First, the state level with Riksdagen (the Parliament), second, the regional level with county municipalities and third the local level with the municipalities.

The state level has the legal framework, regulatory bodies, and to some extent the investment obligation. Relevant ministries, directorates, and administrations for construction logistics are the National Board of Housing, Building and Planning (Boverket), Ministry of the Environment, Ministry of Infrastructure, the Swedish Transport Administration, the Swedish Maritime Administration, and the Swedish Air Traffic Administration (LFV). The administration bodies also act as large-scale developers within their respective responsibilities, meaning that they impact how construction and construction logistics are carried out in a more direct way.

The state level is represented at the regional level by the County Governor who oversees and controls the implementation of state regulations at the regional level, as well as administrative courts such as the Land and Environmental courts which enforce the state legislation at the regional level. Finally, at the regional level (inter-regional level), the County Administrative Boards lead the regional work on reduced environmental impact and energy transitions.

The municipalities hold a planning monopoly in Sweden (local government), meaning that all development planning and zoning is under the control of the municipal departments (e.g., planning, building, and traffic departments). This means that regulations can differ from municipality to municipality.

Construction projects in major urban areas, with a dense population and limited space for additional transport operations, call for new solutions in terms of transport as well as for managing consolidation and coordination of construction material deliveries. Like in Norway there is a high degree of activities at the municipal level, including many good pilot projects. At the state and regional levels there is to some extent a need for changes in the legal framework for the construction sites, transport, and logistics associated with the construction sites (state level) as well as more awareness regarding the impacts that construction and construction logistics have (state and regional levels).

Table 3.1 An overview of legal and political framework in Sweden

Public administration levels Acts and guidelines	Strategic	Tactical	Operational
State	The acts with building codes, climate acts and policies, waste ordinance, and national transport plan, etc.	The ministries' and directorates' work towards counties, municipalities, and partly actors/ stakeholders Hold the national interest and investment option	The ministries' and directorates' work towards counties, municipalities, and partly actors/ stakeholders Hold the national interest and investment option Adds to statistical knowledge and monitoring of e.g., climate goals
Regional	Regional plans and guidelines Regional climate goals Regional administrative court proceedings and rulings	Regional planning with requirements, and inter-municipal planning Permits for earth and rock mass excavation, waterway usage, etc.	Practical work towards municipalities, inputs to zoning plan and building applications, appeal against decisions Requirements for e.g., hospital development and public transport system works Permit inspections

Local	Municipal comprehensive/zoning plan (MCP) Political guidelines and strategies approved in city councils	Municipal detailed development plan (DDP) Local traffic regulations Local environmental and climate goals	Practical work to fulfil municipal planning Enforcement of regulations Municipal housing and infrastructure projects (acting as developers) Monitoring and follow-up of local regulations and guidelines
Other actors (Developer conglomerates, Unions, State-owned companies, research financiers, etc.)	Expert advice/taking part in policy development (white papers, etc.) Lobbying Research financing	Lobbying Research and development projects and applications	Fulfilment of legal, regional and local requirements through planning Research and development projects and applications

3.2 State level

Several laws, acts, regulations, and guidelines stipulated at the Swedish state level apply to construction and construction logistics. These are outlined in the following chapter.

3.2.1 Planning and Building Act (SFS 2010:900)

Similar to the Norwegian Planning and Building Act, the Swedish counterpart is the main act for provisions on the planning and regulation of land use and construction in Sweden. The Swedish Planning and Building Act contains provisions on the planning of land and water areas and on the construction itself, including technical provisions on a higher level. Detailed technical provisions are instead detailed under the Building Regulations (BBR). The purpose of the act is to promote societal progress with equal opportunities for proper living conditions and a clean and sustainable habitat. It does not, however, detail regulations for the protection of the environment, only that planning and building for societal progress should adhere to the related legislation for reduced environmental and climate impact.

3.2.2 Planning and Building Ordinance (SFS 2011:338)

The Planning and Building Ordinance complements the Planning and Building Act by regulated how planning is communicated from the regional and municipal level towards the state and vice versa (ch. 2). The ordinance further details and provides guidance of design aspects of buildings, e.g., technical design requirements in terms of fabrication, load factors, safety, and accessibility but also the physical design in terms of shape, form, and colour. Furthermore, the ordinance gives guidance for permits for civil engineering works other than buildings (ch. 6).

3.2.3 Building Regulations (BBR)

The Building Regulations (BBR) contain the mandatory provisions and general recommendations related to the Planning and Building Act (2010:900) and the Planning and Building Ordinance (2011:338). The BBR specifies all technical requirements of buildings (e.g., accessibility, room height, load safety factors, etc.) that need to be considered in the design of a building. It also contains provisions and recommendations for the building during its lifetime on hygiene, health, and environment (ch. 6), noise protection (ch. 7), safety in use (ch.8), and energy conservation (ch. 9).

3.2.4 The Swedish Climate Act (SFS 2017:720)

The Swedish Climate Act stipulates the governments work with the Climate Policy Framework and what responsibilities and obligations the government has in updating and evaluating the policies. Amongst other things, the Swedish Climate Act stipulates that the government must present an action plan for the Swedish climate impact work every four years (§5).

3.2.5 Swedish Climate Policy Framework

As stipulated in the Swedish Climate Act (2017:720), the Swedish government has to present an action plan for the Swedish climate impact work. This policy framework is related to the climate targets set up by the government, based on the EU climate targets. The policy framework aims to create order and stability in climate policy and provide business and society with long-term conditions to implement the transition needed to address the challenge of climate change (Swedish Government, 2021). Four points are highlighted by the Swedish Government (2021);

1. By 2045, Sweden is to have zero net emissions of greenhouse gases into the atmosphere, meaning that GHG emissions from activities in Sweden should be at least 85% lower than in 1990. After 2045 Sweden should achieve negative emissions, meaning that the amount of greenhouse gas emitted is less than what can be reduced through the natural eco-cycle or through supplementary measures.
2. By 2030, emissions from domestic transport are to be reduced by at least 70% compared with 2010.
3. By 2030, emissions in Sweden in the sectors covered by the EU Effort Sharing Regulation should be at least 63% lower than in 1990.
4. By 2040, emissions in Sweden in the sectors covered by the EU Effort Sharing Regulation should be at least 75% lower than in 1990.

3.2.6 The Swedish Environmental Code (SFS 1998:808)

The purpose of the Swedish Environmental Code (SEC) is to promote sustainable development. The SEC focuses on, amongst other things, the management of land and water, nature

conservation, protection of flora and fauna, environmentally hazardous activities, water operations, genetic engineering, chemical products, and waste management (The Swedish Environmental Protection Agency, 2017). As such it concerns both construction operations as well as construction logistics.

The SEC applies to all persons and operators who undertake activities or measures which could cause negative impacts on human health or the environment, i.e., activities or measures that can have an impact on the fulfilment of the objectives of the SEC. The SEC provides a basic framework and does not specify emission limits, nor does it go into detail on how to balance differing goals and interests (The Swedish Environmental Protection Agency, 2017). The more detailed provisions are specified in governmental ordinances or regulations issued by government agencies.

3.2.7 Waste Ordinance (SFS 2011:927)

The Swedish Waste Ordinance builds on the EU Waste Framework (2008/98/EC) and details what is considered as waste. The ordinance stipulates how different waste materials are to be managed, while Appendix 4 contains the waste catalogue of Sweden. In general, hazardous waste is subject to stricter regulations in its collection, transport, storage, and disposal than other types of waste materials (e.g., paper, glass, etc.).

3.2.8 National Transport Plan

The National Transport Plan is the Swedish government's political strategy for transport. The transport plan stipulates that greenhouse gas emissions from domestic transport, excluding domestic aviation, will be reduced by at least 70% by 2030 compared with 2010. This is to be achieved through fulfilling the overarching goal of building a resilient and accessible transport system for all Swedish transport system users. This goal is in turn divided into two overarching goals, a *functional goal* and a *consideration goal*.

The functional goal includes the design and development of the transport system to provide everyone with basic accessibility with good quality and usability. The consideration goal focusses on achieving a safe transport system where no one is killed or seriously injured, as well as achieving sustainable transportation in terms of reduced environmental impacts and attainment of climate goals.

3.3 Regional level

The regional level has to adhere to the national laws, acts, regulations, and guidelines. Partly, the work of the regional level authorities is to adapt these regulatory measures and set regional counterparts from their own context. The region can also act as a developer, predominantly when it comes to public works, such as hospital construction or for the public transport system. An example of the region as developer in hospital projects is given in section 5.2.1. Two main bodies are of interest on the regional level; the County Administrative Board (CAB) and the Regional Administrative Courts.

3.3.1 County Administrative Board (CAB)

The County Administrative Board (CAB) leads the regional work with the energy transition and the reduction of climate impacts, and acts as coordinator for regional efforts to reduce GHG

emissions, speed up energy streamlining, and increase the proportion of renewable energy. The different CABs provide their subsequent municipalities, industry actors, and authorities support related to these issues through arenas for collaboration and knowledge, as well as financial support. Additionally, CABs are responsible for developing regional energy and climate strategies that are aligned with the national goals. These strategies are developed in collaboration with other actors such as the municipalities and industry actors. The CABs are also responsible for issuing permits for earth and rock mass excavation and waterway usage.

3.3.2 Regional Administrative Courts

There are a number of regional administrative courts relating to transport, construction, and construction logistics throughout Sweden through the five Swedish *land and environmental courts*. These courts have a larger regional uptake than the individual county regions, but have judicial cover of all the Swedish regions between them. In these courts, cases related to land and environment (e.g., land use, transport conflicts, water pollution, etc.) are decided when conflicts arise between industry actors and municipalities and/or county administrative boards. If a ruling is appealed, the case can be brought forth the *Land and environmental court of arbitration*. Rulings in the arbitration court can lead to precedents that will allow for faster and more efficient rulings in the regional administrative courts in later cases.

3.4 Municipal level

Municipalities hold the planning monopoly in Sweden, meaning that they are the ones that can affect what is built and where, aided by the Planning and Building Act, the Planning and Building Ordinance, and BBR as well as the national climate policy, the regional climate policies, and the municipalities' own climate policies. All municipalities have an administrative department responsible for the development within the municipality. What is built is stipulated first in an overarching *municipal comprehensive/zoning plan* (MCP) which sets the long-term plan for the municipality's growth and secondly in the *detailed development plan* (DDP). The DDP is (relatively) fixed once it is adopted, whereas the MCP is subject to change for a longer time-span. These plans will impact construction as well construction logistics efforts within the municipality, regardless if the development is undertaken by public or private actors.

Additionally, the municipalities also have an administrative department responsible for traffic and transport within the municipality, and can to some extent regulate how the municipal transport system is managed. Local traffic regulations can be in effect and impact how construction logistics can be carried out. Examples of such traffic regulations are environmental zones (Stockholm, Gothenburg, Malmö), congestion charges (Stockholm, Gothenburg), size and weight limitations (Stockholm, Gothenburg, Malmö, Uppsala, Norrköping) to name a few. These local traffic regulations have the potential to align the national emission goals with local initiatives.

The municipal level can also act as developer (i.e., housing projects, infrastructure projects). In this role, the municipality can act to increase the awareness of construction logistics and also set requirements for how the construction logistics within a specific project are carried out. An example of a municipal development company's construction logistics strategy work is given in section 5.2.2.

4. Status of legal and policy framework in Belgium

4.1 Introduction

Brussels, with a total population of 1.2 million inhabitants (UN, 2020), accounts for approximately 120,000 construction sites in the regional public space annually (SPRB, 2018). Macro-economically, the Belgian construction sector represents 6% of Belgium's GDP, which corresponds to an annual turnover of about 36 billion euros. At the same time, the sector accounts for more than 275,000 jobs, employing close to 7% of the working population in more than 127,000 companies (21.2% of all companies in Belgium). Although construction represents one of the largest economical industries, often little attention is paid to the logistical costs and nuisances caused during construction activities (NBB, 2019; StatBel, 2020; FOD Economie, 2021; Construction Confederation, 2019). The macroeconomic figures therefore also cascade to the sector's logistics activities and the costs incurred on microeconomic level. Construction logistics (CL) is said to represent 17.5-20% of all urban traffic in the Brussels Region (Brussels Mobility, 2008 & 2016).

The highest transport external costs on the political agenda are air pollution, climate change, traffic safety, and congestion, as also highlighted in the Brussels Mobility and Logistics Plan (Brussels Mobility, 2020). Omnipresent is the notion that these external effects should be a mitigating element across all future logistics scenarios implemented in the sector and are planned to be enforced in future tendering and policy regulations. The city development agency has stated that it will adjust future tendering procedures to be stricter in the construction logistics handling. This could come in the form of an environmental score for air pollution, climate change, congestion, traffic safety etc. While such enforcements will initially go along with a price increase, it is also expected to reduce overall construction-related costs upon and after completion of the construction site.

Table 4.1 gives an overview of legal and political framework at different public administration levels in Belgium.

Table 4.1 An overview of legal and political framework in Belgium

Public administration levels Acts and guidelines	Strategic	Tactical	Operational
State	Overarching national environmental targets derived from EU directives, which are under the supervision of the regions. Per kilometre charge for road vehicles >3.5t (interregional	Overarching national environmental targets derived from EU directives, which are under the supervision of the regions.	Currently, bottom-up communication with operational stakeholders is very scarce unless in stakeholder workshops or pilot projects such as MIMIC and BCCC

	agreement but under regional authority)		
Regional	BCR's government / approves ordinances and plans Perspective.brussels (SAU) / Master Plans, Particular Land Use Plans	Urban.brussels / planning permissions (via CoBAT) Brussels Environment / environmental permits (via CoBAT and an ordinance) CityDev	Brussels Mobility / OSIRIS Port of Brussels
Local		Municipalities: in charge of delivering planning permissions for projects which don't need urban.brussels' approval. They also deliver environmental permits for class 2 projects.	Police
Other actors			Construction (con)federation(s) Contractors and construction firms

4.2 State level

4.2.1 National environmental targets

Belgium (and by extension Brussels) aims to meet environmental targets by reducing the impact of mobility on the environment by achieving a 35% reduction in GHG emissions by 2030, as compared to 2005. This overarching guideline thus sets emission targets on the national level, derived from EU directives. This and other targets are updated according to EU directives (e.g., the Green Deal or Fit for 55 package will impose a scaled-up climate ambition effort towards a 55% reduction by 2030). However, the rules are not enforced on the national level, as the decision-making power cascades most often down onto the regional level and its 3 autonomous regions (Flanders, Wallonia, and the Brussels-Capital Region). This is also the case for transport-related departments, such as environment, transport and mobility, land use etc.

4.2.2 Transport and environment

With regards to Environmental affairs, the emission inventory for national pollution reporting is managed by the regions, and by 3 regional agencies (Flanders Environment Agency in Flanders, Environnement Wallonie in Wallonia, and Brussels Environment) and 1 interregional agency (Belgian Interregional Environment Agency IRCEL - CELINE). Further air pollution mitigation implementations are under regional policy as well. Currently, although officially under regional supervision, one state-wide interregional agreement is in place to address transport-related

externalities (air pollution, climate change, and congestion in particular), which comes under the form of a per-kilometre charge. This taxation is mandatory for road vehicles with a maximal authorized mass higher than 3.5t (Macharis, Brusselsaers & Mommens, 2019) and is applicable in the entire Belgian territory and on the entire Brussels-Capital Region's road network. It is enforced by GPS-based units and supervised by ViaPass. In parallel, discussions are held on how to address externalities from passenger cars with other policy levers, e.g., a diesel ban or per-kilometre charge. Only rail freight transport, which has been fully liberalised since the beginning of 2007, is supervised on the federal level by the Federal Public Service Mobility and Transport (*FOD Mobiliteit en Vervoer*).

The three autonomous regions thus set their own targets. Some agencies are governed on the federal level (such as finance, military, justice, social security, internal, and foreign affairs) but are less directly relevant for the construction logistics sector.

4.3 Regional level

As highlighted above, the three autonomous regions (Flanders, Brussels, and Wallonia) each have the authority to create, develop, and enforce transport and environment-related policies. This also means there are often 3 agencies in charge of one subject, when compared with the federal level. This is the case for transport and mobility: the Flemish Department of Mobility and Public Works (MOW), Brussels Mobility, and SPW Wallonie Mobilité.

At the intersection of mobility, construction logistics, and the environment, the main governing authorities in the Brussels-Capital Region (BCR) are the BCR Government, perspective.brussels, urban.brussels, Brussels Environment, Brussels Mobility, and the Port of Brussels.

4.3.1 Land-use and urban planning

The BCR's Government approves land-use planning as well as the Brussels Planning Code (CoBAT) with requirements about planning permissions and environmental permits. The Flemish and Walloon government develop this in their respective regions.

Perspective.brussels is the regional land-use planning agency. It has an impact on the development of new neighbourhoods for instance through legal tools such as Particular Land Use Plans (Plans Particuliers d'Affectation des Sols) and Master Plans (Plan d'Aménagement Directeur). All those plans are approved by the BCR's Government. Perspective.brussels works in consultation with the Société d'Aménagement Urbain (SAU) and collaborates with all actors involved in spatial planning and in the statistical and socio-economic analysis of the Brussels Region. At the same time, they aim for a cooperation agreement between the three regions of the country, together with SPW Territoire in Wallonia and the Department of Environment (Departement Omgeving) in Flanders.

Urban.brussels is the regional agency in charge of delivering planning permissions for projects subject to an impact assessment, or for projects led by other administrations according to the Brussels planning Code (CoBAT). Urban.brussels also delivers mixed permits (when a planning permission is asked at urban.brussels and an environmental permit at Brussels Environment for the same project).

Brussels Environment is the regional agency in charge of the environment. Its tasks include delivering environmental permits for class 1A, 1B and to projects led by another administration, according to the Ordinance on environmental permits. The Port of Brussels supports worksites willing to use waterways to deliver construction materials. They notably provide an expert who can help companies to plan deliveries by the waterways. Finally, Brussels Mobility manages the OSIRIS system for work sites having an impact on regional road. Those worksites require an approval before being able to start the worksite to ensure coordination between worksites and avoid excessive burden on the main road network. The OSIRIS system is one of the tools of the Worksite Coordination Committee (which is compulsory only for projects with an impact on regional road network). The Flemish and Walloon counterparts are respectively OVAM (Public Waste Agency of Flanders) as well as the VMM (Flemish Environment Agency), and SPW Agriculture, Ressources naturelles et Environnement.

4.3.2 Sustainable Mobility and Logistics Plan

One of the major schemes affecting construction logistics in Brussels is the Good Move Mobility and Logistics Plan. Good Move is the Regional Mobility Plan for the Brussels-Capital Region. Approved in 2020 by the Brussels Government, it defines the main policy guidelines in the field of mobility and logistics. This includes measures to contain air pollution levels, as well as targets towards more safety and space for every road user by refurbishing certain road sections.

Currently two separate measures are in place in the Brussels-Capital Region (BCR) to reduce or contain negative externalities, in particular for air pollution levels. A first one is the kilometre charge, which is mandatory for road vehicles with a maximal authorized mass higher than 3.5t (Macharis, Brusselaers & Mommens, 2019) and is applicable on the entire BCR road network. The second one is the Low Emission Zone (LEZ) and is only applicable to vehicles with combustion engines and a maximal authorized mass of less than 3.5t, with little differentiation between prices between vehicle EURO standards. The LEZ are implemented and maintained on the regional and municipal level.

Specifically for Flanders, the Flemish Air Policy Plan 2030 (*Vlaams Luchtbeleidsplan 2030*) was approved by the Flemish Government on 25 October 2019 (VR 2019 2510 MED.0359/2). This plan contains objectives for the medium (2030) and long (2050) term, as well as a comprehensive package of measures to tackle air of measures to tackle air pollution in Flanders and, in so doing, further reduce the impact of air pollution on health and the environment.

4.3.3 Federations and confederations

(Con)federations on the regional level (Confédération Wallonie/Bruxelles/Vlaanderen) developed logistics management tools for construction professionals and public decision-makers (permits). These are however tailored to the regulations of the region.

4.4 Municipal level

It is important to stress the complexity of the numerous actors involved and complex policy structures, particularly in the assessment of urban or inter-urban construction logistics in Brussels. Each of Brussels 19 municipalities has its own and unique administration and legislation regarding mobility and logistics planning.

Municipalities are responsible for projects with small expected impacts. They are in charge of delivering planning permissions for projects which don't need the approval of urban.brussels. They also deliver environmental permits for class 2 projects.

Municipalities are also responsible for the local road network. As road manager, they can reserve space for a construction site for instance. The Police take an active role in the Brussels Worksite Coordination Committee and are in charge of enforcing its prescriptions as well as the good use of public space.

5. Example projects

This section provides example projects from Norway, Sweden and Belgium, where legal and policy framework related to construction logistics are planned and/or implemented.

5.1 Norway

In Norway, during planning of construction and related construction logistic activities, the local planning authorities cannot set ambitions that imply requirements that are stricter than legal requirements (Venås *et al.*, 2020). However, public building owners use their purchasing power as a strategic tool to set ambitions and requirements in their public procurement procedures. The city of Oslo has been a leader in this area by setting ambitious requirements in the tenders and drive the market to develop fossil and emission-free solutions.

Six more of Norway's biggest cities, Bergen, Trondheim, Stavanger, Kristiansand, Tromsø, and Drammen, followed Oslo setting similar goals. The seven cities, including Oslo, have signed a declaration on a joint emission-free municipal construction industry (Bellona Europa, 2021). The declaration states that their municipal building and construction activities must be emission-free by 2025, while all construction and civil engineering activities in the cities must be emission-free by 2030 (Figure 5.1).



Figure 5.1 Targets of six Norwegian cities for setting requirements in reaching emission-free construction cities. Adopted from (Bellona Europa, 2021).

The following sub-sections give examples of fossil and emission-free construction site activities from Oslo municipality, Trondheim municipality, and Vestland county.

5.1.1 Oslo municipality

The construction site activities in Oslo accounted to up to 7% of the city's total GHG emissions, without including the emissions from transport of goods and people to and from construction sites (C40 Knowledge, 2020). In order to decarbonise on-site construction activities, Oslo Municipality sets requirements for fossil-free (since 2017) and emission-free (from 2020) construction sites, and has had several pilots for testing different types of fossil-free and electrical machines, both cable-connected and battery-powered. Market dialogue has been used as a tool to set ambitious but achievable requirements and initiate the market and several innovative research projects toward developing fossil and/or emission-free solutions (e.g., Emission-free construction sites - Utslippsfrie byggeplasser pre-project (Fufa, 2018; Fufa *et al.*, 2018), and the Zero emission digger (ZED) (Wiik *et al.*, 2020)). This resulted in the development of a number of electric driven alternatives machineries for excavators, loaders, dumpers, vibrators, cement mixers, drilling rigs, and other equipment offered by manufacturers such as Nasta and Volvo (Bellona Europa, 2020).

The municipality also incentivised the use of electric technologies through the tender criteria for Oslo's construction sites. In the pilot project for emission-free construction site under the auspices of Oslo Municipality in Olav Vs gate, requirements were set for all the machines used on the construction site to run on electricity. The project is described as "the world's first emission-free construction site". When the construction contract was announced, the municipality had a conscious strategy for electricity supply to the construction site. The municipality chose to provide electricity with sufficient voltage, placement of a transformer and financing of electricity for the construction site. This was deliberate, both to prevent errors and to use free electricity as an asset to get offers / tenders for the project.



Figure 5.2 The first fossil-free nursery school (Lia barnehage, left) and the first emission-free construction site (Olav Vs gate, right) in Norway. Source: SINTEF

The city of Oslo has also opened up for testing zero emission zones in urban areas, where only emission-free (electric or hydrogen driven) vehicles are allowed (Oslo kommune, 2021). This can greatly affect logistics and other construction site activities within the zero emission zones.

5.1.2 Trondheim municipality

The GHG emissions from construction machinery make up a large part of the direct GHG emissions in Trondheim municipality. The municipality wants to use its role as a developer to reduce these emissions. They received subsidies to enter into a dialogue with the market and

identify opportunities to replace traditional diesel and propane operation with climate-friendly alternatives (Miljødirektoratet, 2019).

Through its municipal sub-plan for energy and climate, Trondheim has set a goal to reduce direct emissions by 10% by 2020 and 80% by 2030, compared to 1991 levels. Dialogue conferences have been held with the supplier market. Through the conferences, the municipality (as the client) has discussed directly with the industry about opportunities and challenges with fossil-free construction machinery, fossil-free transport to / from the construction site, rigging and operations, including emission-free heating and drying.

The municipality has implemented the requirement for a fossil-free construction site by giving priorities to emission-free solutions, if available, in all major construction projects. In the long run, the goal is to achieve emission-free construction sites. The most demanding thing so far has been to find feasible requirements for emission cuts from transport to and from the construction site. In practice, it is difficult to demand that the transport of goods from, for example, Oslo to Trondheim be completely emission-free, as the transport often takes place with trailers in regular traffic and with other assignments on the return.



Figure 5.3: Trondheim Torg, Fossil-free construction site. Source: Trondheim Municipality

5.1.3 Vestland county

Bergen municipality and several other large public developers are joining forces on a joint initiative in Vestland county, with an ambition to achieve emission-free construction sites (Kilapartnere, 2020). Bergen municipality is one of the large developers in the region with an ambition of emission-free construction sites by 2025. In Bergen municipality alone, construction machineries accounts for 13% of the total GHG emissions (BKK, 2020). Noise and air pollution are other negative side effects from the construction activities. Today, construction sites mostly use fossil energy. Bergen municipality and other developers from Vestland county aim not only to set emission-free construction site requirements but also help to make emission-free solutions accessible through market dialogue and various support schemes.

The municipality, together with a number of other public developers, has now notified the suppliers that there will be ambitious but realistic requirements for emission reductions. Bergen municipality and Eviny are working on two emission-free construction site pilot projects (Figure 5.4).



Figure 5.4. Bergen Municipality and Eviny have two pilots for emission-free construction sites. Illustration: Eviny

5.2 Sweden

The state level sets the legal requirements that construction projects and construction logistics need to adhere to, but they have very little impact on *how* construction logistics are carried out. This is instead left up to the developers and contractors to decide. As such, construction logistics in Sweden are approached primarily from a project, program, or portfolio perspective by the developers, contractors, or municipalities.

5.2.1 Helsingborgs hospital

The Helsingborg hospital has undergone a large-scale renovation project combined with the construction of new care buildings and a parking garage. The Swedish regional councils (regions) are responsible for hospitals and healthcare, and as such, the region of Skåne had to keep the hospital operational during the project. To ensure that hospital operations could continue during the project, the regional council employed a construction management (CM) company to manage the site and the material and resource deliveries. As the hospital is located in the busy city centre, the CM company opted for a checkpoint solution with a planning system for all delivery bookings and a waiting area for lorries outside of the city.

To give the CM company enough power to manage the site as well as all delivery activities, the region included the CM company in the projects management team and gave them their own budget and mandate to enforce any regulations related to construction logistics in the project and on site. However, as their mandate was only for the project, there have been issues in

coordinating regional and local council road and construction works adjacent to the hospital project with what happens on site. Nevertheless, the Helsingborg hospital case shows that when introducing a construction logistic solution (CLS), it is important to consider where in the organizational hierarchy the CLS is located as this will signal actual and perceived mandate to enforce the regulations set for construction logistics within the construction project. Due to its position within the project organization and the dedicated own budget, the CM company had a comparatively easier journey to get all stakeholders onboard with the CLS. The main issues encountered in Helsingborg were that at the same time as the (regional) hospital project was running, the municipality had smaller infrastructure projects performed adjacent to this large-scale project and the access roads of the site. Ideally, the municipality would have postponed their infrastructure projects until the hospital project was completed.

5.2.2 Älvstranden Utveckling

In Gothenburg, the municipal development company Älvstranden Utveckling has identified a need to work more strategically and efficiently with issues related to construction logistics. There are several reasons for this, but a main reason is that all Älvstranden Utveckling's projects are surrounded by the existing city and river, and are located close to other ongoing projects. Additionally, the climate issue and the fact that the construction phase must contribute to reducing greenhouse gas emissions is another reason. The construction phase today accounts for almost half of a building's total CO₂ emissions, of which transport during the construction phase accounts for 6 - 10%. As part of the MIMIC project, Älvstranden Utveckling has developed a construction logistics strategy.

The main goal of the strategy is to contribute to the goal of reducing GHG emissions 50% by 2025. The construction logistics contribution to this goal is estimated at 3 - 5% of the 50%. In order to be able to realize the objectives above, Älvstrand Utveckling demands that all their projects have an action plan for construction logistics, regardless of size. These construction logistics action plans must be approved before any projects are started. As part of the strategy, Älvstranden Utveckling gives suggestions for possible services and setups to use within their projects as well as checklists to guide the projects towards suitable construction logistics setups. What determines which setups are suitable solutions in the specific project can be, for example, the project's geographical location, size, proximity to other projects, and more.

5.3 Belgium

5.3.1 Brussels Construction Consolidation Centre (BCCC)

In Brussels, the Brussels Construction Consolidation Centre (BCCC) aims to provide Brussels construction sites with a logistical platform for the consolidation of material deliveries. This project aims to test the operation of such a construction consolidation centre, but also its digital solution, while measuring the societal impacts (mobility, economic, environmental and social). The BCCC has been operational since the end of 2019 and experiments have been conducted with different partners such as material suppliers and contractors.



Figure 5.3. Brussels Construction Consolidation Centre with deliveries of construction materials by barge at the Port of Brussels. Illustration: Shiplt © 2020.

The experimentation of the consolidation centre initially focused on the transport of palletisable materials (concrete blocks, insulation, facade bricks, bags of plates, etc.). Although the focus was initially on supplying large construction sites in the Brussels Region, the practice highlighted the multitude of situations to which the BCCC was able to respond. First of all, in terms of clients, this type of solution could be just as relevant for material suppliers (to improve their services), for construction companies (to set up specific logistics for one or more sites), and for real estate developers (to facilitate the reuse of materials, for example). From an operational point of view, a whole series of experiments of different natures could then be tested: deliveries to large building sites; deliveries of joinery to several large sites; deliveries to infrastructure sites; deliveries of prefabricated elements; provision of storage space managed by a company itself; reverse logistics, and re-use for a large construction site; deliveries to smaller sites using vans; etc.

An element to be highlighted is BCCC's ability to receive goods by water. In just over a year, 21 barges have come to supply the centre with various materials, with each barge corresponding to 50 fewer lorries on the roads. The BCCC shows that the modal shift from road to inland waterway transport significantly reduces overall transport external costs.

The environmental costs that could be avoided by using alternative modes of transport, taking trucks from the road and avoiding half-empty trucks delivering to site, are obvious if the manufacturing company is located close to the waterway. Although trucks are still top of mind in Belgium, initiatives guide construction sites in identifying suppliers close to waterways, and how to include clauses into tender documents and asking for options for environment-friendly solutions. In this way, these services aim to provide a transparent view on (a) the total logistics cost and (b) the service levels of using the waterways. The construction logistics decision-making, comparing different logistics solutions and taking into consideration all points of view, should be conducted in order to evaluate both the cost perspective and the added value services that e.g., a CCC (Construction Consolidation Centre) can provide, as to highlight potential benefits and drawbacks to construction sites and the different actor groups.

6. Conclusions and recommendations

6.1 Conclusions

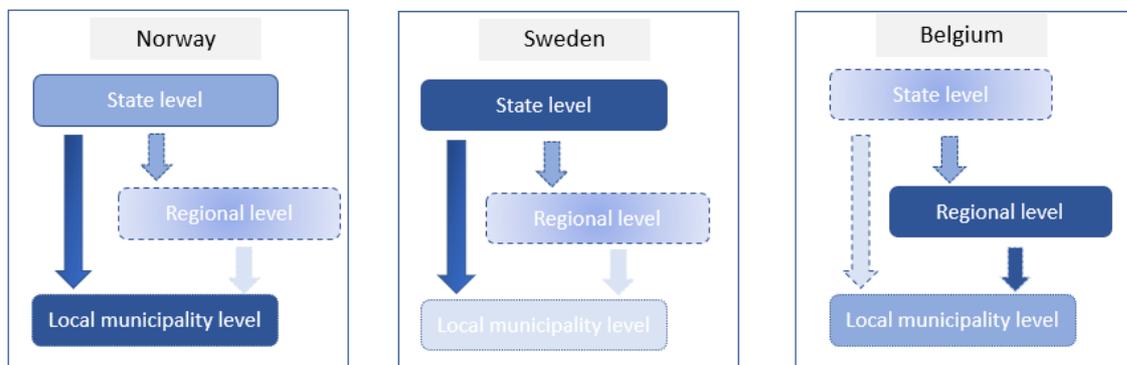
In **Norway**, there are activities to achieve fossil-free and emission-free construction site ambitions, at municipal level, both on political, administrative and in municipal property management. Whilst there are limited but growing activities to incorporate fossil-free end emission-free transport and other construction logistic activities. On-going activities highlight the importance of having public development projects as good pilots and role models. The decisions to demand climate-friendly construction sites can be anchored in the municipalities' climate and energy plans, decisions in the individual construction project, municipal plans and sector plans, and other relevant policy instruments and guidelines. It is nevertheless at the regulatory level that important provisions for the relevant construction project are decided. These plans are governed by the Planning and Building Act and the building code. Municipal master plans and zoning plans combined with public procurement are the most important instruments to secure emission-free construction sites with a focus on transport and other logistic activities. The review of the legal framework demonstrates that few legal requirements have been incorporated that build on the authorities' ambitions to achieve a comprehensive reduction in GHG emissions in Norway. Until such legislative changes are in place, it is up to the builders and other commissioners, as well as all actors in the construction process, to describe the level of emission reduction ambitions.

In **Sweden** there are plenty of laws and regulations stipulated at the state level that affect how construction and construction logistics are carried out at the local level. What the review of the legal framework in Sweden shows is that to some extent, these laws and regulations are interconnected (e.g., the Planning and Building Act, the Planning and Building Ordinance, and the Building Regulations), but at the same time they are interconnected in different legal “blocks” that impact each other without necessarily complementing each other (e.g., building regulations and the Climate Policy Framework). At the same time, it is on the local level that these regulations need to be operationalized, which means that municipalities interpret the legal frameworks and set regulations for the local level. Thus, the local ambitions may not be fully aligned with the national ambitions. Here, the state level could do more to address construction and construction logistics, and as a first step, the state level should take responsibility for these questions within the projects that are in fact commissioned by the state to ensure that they are setting a good example. However, there are upcoming amendments to (amongst other directives) the Building Regulations that will connect the construction legislation more closely to the environmental and climate focussed legislations, thus giving more transparency on an overarching national level.

In **Belgium**, the different regulatory bodies cause a suboptimal logistics pattern. Because the different autonomous regions of Flanders, the Brussels-Capital Region, and Wallonia each have their own jurisdiction, each of these regions enforce different prices and regulations. This is especially noticeable for soil and waste flows, where construction companies are encouraged to remove and transport soil and rubble to different locations based on the rules and prices in order. Specifically for construction (logistics) companies, there is a need for a clear top-down scope definition from the strategic to the operational level. This precise description of the rules to follow should be set at the Strategic level, so that construction companies can define logistics scenarios within this scope. However, more bottom-up communication between actors could lead to realistic guidance from the government to implement more sustainable alternatives. Additionally, in the

case of a CCC, a consolidation centre and a digital platform are not enough on their own. A good management of the construction site supply process must be put in place, both from the point of view of material suppliers (producers and traders) and construction contractors (general contractors and subcontractors).

Figure 6.1 shows a comparison between Norway, Sweden, and Belgium. In Norway, there are many plans and strategies at the state level but few absolute requirements. It is the municipality in Norway that is leading the way and giving good examples for construction sites and other logistic activities. In Sweden there are plenty of laws and regulations stipulated at the state level that affects how construction and construction logistics are carried out on the local level. The problem has been that the municipalities have not used the opportunity to take the lead in the same way as in Norway. In Belgium, as opposed to the Nordic countries, the rules are not enforced at the national level, as the decision-making power cascades most often down onto the regional level. Municipalities are responsible only for projects with smaller impacts.



Figur 6.1: Status of legal and policy framework at state, regional and municipal level in Norway, Sweden and Belgium. The colour intensity shows the level of importance, where the darker shade of blue, the more important the level has in the decision-making process.

6.2 Policy recommendations

Based on the findings from this study, the following recommendations are given for policy makers, municipalities and other interested actors to strengthen the policy framework and improve the environmental performance of construction logistics. These recommendations are presented at each of the three hierarchical levels.

State level

- Focus on reducing emissions by:
 - Setting mandatory targets;
 - Requiring data gathering to follow up on the targets;
 - Setting good examples for working towards reduced climate impact by utilizing construction logistics setups in state commissioned projects.
- Support cost reduction through incentives and subsidies:
 - Provide and stimulate the required infrastructure (e.g., electricity, hydrogen, transport machinery, waterways etc.) for new markets.
- Align legislation to be complementary:

- Identify tradeoffs and synergies between different requirements, legislations, strategies, and guidelines.

Regional level

- Increase awareness at a political level:
 - Enable and enhance good cooperation with municipalities concerning emission reduction measures;
 - Ensure that court rulings in the administrative courts are elevated to the state level to be able to set legal precedence in e.g., water and environment courts (typical for Sweden).
 - Set clear objective-based incentives to allow for competitiveness across regions and states
- Develop regional climate plans and transport strategies

Local level

- Increase awareness at a political level by:
 - Increase testing in pilot projects, follow-up of the ambitions and update processes based on knowledge gained;
 - Clarifying and unifying the role(s), mandates and legislations of different municipal administrations to allow for more consolidated views of the division(s) of responsibility amongst them (e.g., building regulations, traffic management, environmental concerns, etc.);
 - Set clear objective-based incentives to allow for competitiveness across regions and states
- Aim for high activity and high ambitions in the tendering, procurement and building processes:
 - Focus on testing solutions and generate ambition to contribute to research.

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