

# Chapter 9

## Building Materials and Construction: The Four Building Challenges



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**Abstract** The chapter analyses the radical changes in the supply chain of building materials and construction between 1850 and 1910. It investigates the consequences for the four building challenges in this period: public hygiene, public housing, the struggle against water and the development of road infrastructure.

The hygienists succeeded in getting the issue of urban pollution due to faeces and other organic waste on the societal agenda. Despite this, the effect of the movement on the health of the poor and workers in this period was still minimal. Realising the hygienist program demanded firm municipal policy and large investments. Moreover there was exuberant debate on the nature of the measures to be taken.

Public housing too became a significant political issue thanks to the efforts of the progressive bourgeoisie and socially conscious entrepreneurs. The most important result was the passing of the Housing Law of 1901, that provided the future framework for the condemnation, dispossession and improvement of dwellings.

In the field of water management, the government public works agency (Rijkswaterstaat), intensified its struggle against regularly recurring river floods. An impressive program of river normalisation was carried out under its leadership.

Successive governments would devote much attention to infrastructure with the aim of improving welfare, reinforcing the position of the maritime harbours and improving the accessibility of remote regions. The construction of a network of canals and railways guaranteed the spatial integration of the Netherlands and had far-reaching consequences for the modernisation of the economy.

**Keywords** Construction · Hygienists · Public hygiene · Public housing · Housing Law · River improvements · Infrastructure · Railways

## 9.1 The Filthy Hole<sup>1</sup>

In 1864 Jacob van Niftrik, raised in the Ooipolder near Nijmegen, moved to Amsterdam. He went to work there as an engineer in the municipal Public Works Department. The first thing that struck him was how filthy the capital city was. The streets were muddy and the gutters clogged. Garbage accumulated around waste bins. The canals were repositories of waste. During walks taken to acquaint himself with the city he noticed ‘in many neighbourhoods how pestilential the emanations from that garbage were.’ It smelled in alleyways and side-streets, the canals reeked abominably and those approaching the many cellar dwellings and houses on inner courtyards were greeted by sour-smelling rotten air. In the course of an inspection, the effusion from ‘The Hole’ between the *Nieuwe Zijds Voorburgwal* and the *Kalverstraat* literally robbed him of consciousness. The neophyte municipal engineer was overwhelmed by the rotten air that drifted out of the dwellings and had to be taken to the broad canal behind the houses to be revived by his colleagues.

Amsterdam was no exception. The other Dutch cities also smelled and were filthy. But there was a difference between the cities in the low Netherlands, where due to the nature of the water the situation was worse, and the cities in the high Netherlands. (see Chap. 4). The issue of the filthy city has two interesting aspects. First, the conditions giving rise to the complaints were as old as the hills. Cities in the past had always been dirty, at least by present-day standards. Contemporaries once in a while complained and when even by contemporary standards things got out of hand, measures were sometime taken. But why did the number of complaints increase in the second half of the nineteenth century? In the second place it is striking that the cities were barely capable of improving the sanitary situation. Despite a permanent stream of alarming publications and chronic debate, for a long time after 1850 little seemed to improve. Was the issue so complicated? Where was the opposition?

From a contemporary perspective public health long remained an unimportant aspect of quality of life, though it certainly became so in the second half of the nineteenth century. It thus became incorporated in the great building challenges in the context of well-being. In our broad definition of well-being, health and human capital are important aspects of the quality of life and sustainable development. A hygienic city is a contributing factor to both. This is connected to another important building challenge, namely public housing. Public health demands sanitary facilities in dwellings. At the time, the dwellings of the poor and workers were not amenable to such facilities. A large part of the population lived in slums, sheds and hovels, that not only failed to satisfy the new hygienic norms, but also violated any number of other new emerging norms.

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<sup>1</sup>The introduction is based on: H.W. Lintsen, *Made in Holland: Een techniekgeschiedenis van Nederland [1800–2000]* (Zutphen 2005), 55–56; H. Buiten, *Riool, rails en asfalt: 80 jaar straatruimte in vier Nederlandse steden*, (dissertation Technical University Eindhoven 2005), 153–155; I. Jager, *Hoofdstad in gebreke: Manoeuvreren met publieke werken in Amsterdam, 1851–1901* (Rotterdam 2002).

In earlier chapters we noted two other large building challenges from the perspective of well-being: the struggle against water and the improvement of infrastructure. The Dutch delta was a vulnerable region. The land was threatened from all sides by water: the sea, enclosed waters and the rivers. In the struggle against water the rivers appeared to be the most immanent threat at the time. River floods had afflicted successive generations prior to 1850. In the 1850s and subsequent decades the issue would be joined and dealt with. Whence this sudden vigour and ambition and with what consequences? Improving infrastructure had already been a government priority under King William I. And under liberal domination the government continued to concern itself intensively with infrastructure. Proper infrastructure was seen to be essential to transportation, trade and national welfare. To what did this basic orientation lead?

In this chapter the four building challenges— in relation to the issue of poverty — provide a framework for further analysis.

## 9.2 Working on a Hygienic City<sup>2</sup>

In the first half of the nineteenth century, various reports had put the issues of public hygiene and health on the agenda, but only in an incidental way. It was the hygienists who after 1850 were the first to bring this issue to the attention of the public and who regularly succeeded in getting the problem onto the political agendas of municipalities and the national state. They were young physicians generally employed at a medical service for the poor, run by a municipality or one of the many churches.<sup>3</sup> They earned little and worked hard. Their work was barely acknowledged. In any case, the status of physicians was not in general very high. Cholera epidemics only made things worse. In the face of this disease, the profession appeared powerless. It is hardly surprising that the hygienists were in search of a new orientation for the profession of physician.<sup>4</sup>

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<sup>2</sup>This section is based on: E. Houwaart, 'Medische statistiek', in: H.W. Lintsen, et al. (eds.), *Geschiedenis van de techniek in de negentiende eeuw* (Zutphen 1993), volume 3, 19–45; H. van Zon, 'Openbare hygiëne', in: H.W. Lintsen, et al. (eds.), *Geschiedenis van de techniek in de negentiende eeuw* (Zutphen 1993), volume 3, 47–79; E. Houwaart, 'Professionalisering en staatsvorming', in: H.W. Lintsen, et al. (eds.), *Geschiedenis van de techniek in de negentiende eeuw* (Zutphen 1993), volume 3, 81–92; H. Buiten, *Riool, rails en asfalt: 80 jaar straatruoer in vier Nederlandse steden* (dissertation Technische Universiteit Eindhoven, 2005); E. Houwaart, *De hygiënisten: Artsen, staat en volksgezondheid in Nederland, 1840–1890* (dissertation Groningen 1991); H.W. Lintsen, *Wat is techniek? Een geschiedenis van menselijke secreten en discrete technieken* (Inaugural lecture TUE, 1992); H. van Zon, *Een zeer onfrisse geschiedenis: Studies over niet-industriële vervuiling in Nederland, 1850–1920* (dissertation Groningen 1986).

<sup>3</sup>Houwaart, 'Medische statistiek', 27–30.

<sup>4</sup>Physicians (including the hygienists) wanted not only to define a new practice for the profession of medicine but also to improve its position. With the aid of the Netherlands Society for the Promotion of Medicine (1849), for example, they succeeded in reducing the number of physicians per 100,000 inhabitants from 79 in 1850 to 41 in 1890 and thereby improving their financial position.

They derived inspiration from abroad. Progressive physicians in France, England and Germany saw themselves as the 'advocates of the poor.' It was their task to accurately chart and analyse abuses. They felt compelled to search for correlations among the number of ill, the spread of diseases, anatomical pathologies and the chemical composition of water, soil and air. Public health had to be expressed in figures describing age, sex, birth, death, illness, height, weight, nutrition etc. A scientific, statistical approach would be the basis of a new science, namely the science of public health, and of a new perspective on health, namely the maintenance of public health. Substandard hygienic circumstances were the evil genius of poor public health. The solution for hygienic problems lay in sewer systems, pure drinking water and other new technologies. In addition, it was important that the government, in particular the municipalities, acknowledged public hygiene as a governmental task, for which means and personnel had to be made available.

The constitutional reforms of 1848 gave the hygienists the chance to manifest themselves.<sup>5</sup> Physicians acquired voting rights. They became involved in elections for parliament, the provincial estates and the municipal councils. Some of them entered local and national politics. The hygienists also took steps to set up health boards that began to concern themselves with municipal governance. At the same time the hygienic program of this emancipated group of physicians began to enjoy increasing support. The movement became broader and began to include citizens, politicians, entrepreneurs and engineers. During and after the 1870s the issue became part of a more encompassing problem, the so-called 'social question,' that also included poverty, public housing and the question of labour.

That said, the effect of the hygienic movement on the health of the poor and the workers remained negligible in the nineteenth century.<sup>6</sup> The hygienic program required bold municipal policy and big investments. For this reason support for these policies among the bourgeoisie, politicians and administrators long remained far from sufficient. Municipal finances were inadequate. Consciousness of a public health problem and public health policy was limited. Two additional factors also played a role.<sup>7</sup>

First, for a long time there was no consensus among politicians and administrators about the exact causes of poor public health and of epidemic diseases, for example the cholera that caused so much commotion in 1848, 1853, 1859 and 1866.<sup>8</sup> Were these contagious diseases, that is to say, diseases spread by contacts from person to person? This perspective led to quarantine measures, the isolation of the ill and the disinfecting of dwellings. Were epidemics associated with so-called miasmas? This referred to particles in the air that made people sick. The *mal'aria*, literally bad air, that prevailed in the low Netherlands, was attributed to this cause.

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<sup>5</sup>Houwaart, 'Professionalisering en staatsvorming', 84–85 and Houwaart, 'Medische statistiek', 28.

<sup>6</sup>Van Zon, 'Openbare hygiëne', 47–49.

<sup>7</sup>Lintsen, *Made in Holland*, 58–64.

<sup>8</sup>Houwaart, 'Medische statistiek', 25–26.

This perspective emphasized the necessity of fresh air, sunlight and much space. Others, again, pointed to causes like spoiled food, polluted soil or a profligate life-style. Drinking water too counted as a potential source of infection. Research in London during the cholera epidemic of 1853 had pointed to infected drinking water as the most important vehicle for the spread of the disease. Investigations like these influenced the debate in the Netherlands. The hygienists pointed to practices with faeces and polluted water as important (but not sole) causes of poor public health. Confusion reigned.

A second factor was that there was no consensus – in particular within the broad hygienist movement – about the solution for the problem. The hygienists were united in emphasising the importance of a supply of reliable and pure drinking water. They supported plans for drilling new and modern wells that became the dominant practice in the 1860s and they advocated the construction of piped water systems whose numbers increased rapidly from the 1880s on.<sup>9</sup> They also concurred in supporting plans to set up sanitation departments, to flush urban canals, fill in ditches and lay underground sewers. But they were quite at odds about the proper approach to the disposal of faeces.

There were three options: the barrel system, the Liernur system and the flushing system with a water closet.<sup>10</sup> The barrel system, introduced for example in Delft in 1871, consisted of the placing of toilet barrels in dwellings. A (municipal or private) enterprise regularly collected the barrels and processed the faeces into manure to sell to farmers. The Liernur system – invented by a Dutch officer of the army engineer corps, C. Liernur, was based on the transport of faeces from dwellings to large underground tanks through vacuum pipes. Manure was collected from the tanks and transported to farmers and garden farmers by small boats. The vacuum was produced with steam engines. Leiden (1871), Dordrecht (1873) and Amsterdam (1879) performed large-scale experiments with this system. The flushing system with water closets consisted of a system of sewers that was coupled to the public drinking water supply. For a long time the hygienic movement was unable to settle on the one best solution among these alternatives.

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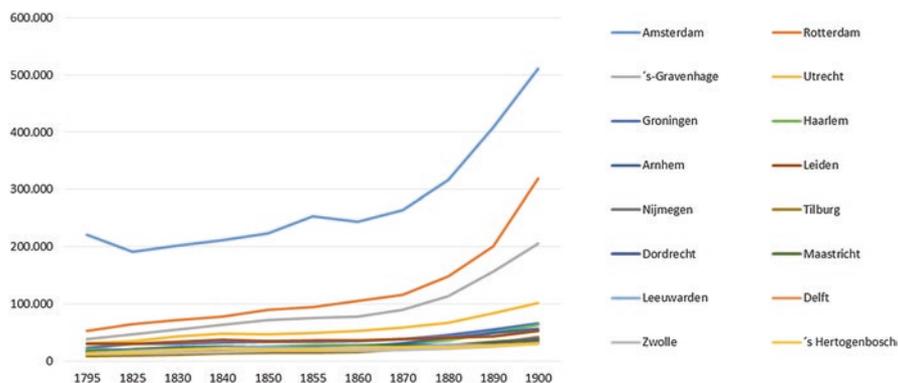
<sup>9</sup>Modern wells were drilled with a new method developed by the American Norton during the American Civil War. He drilled for potable water with an extensible telescopic tube fitted with a steel point with openings. This technology made it possible to drill to great depth at low costs. In the Hague, the city government together with the *Association for the Improvement of the Health Situation in The Hague*, a local association of hygienists, used this machine to install more than 25 public pumps that delivered water that was much more trustworthy than that in other wells. Lintsen, *Made in Holland*, 63.

<sup>10</sup>Van Zon, 'Openbare hygiëne', 62–77.

### 9.3 Striving for Public Housing<sup>11</sup>

As we saw above, in 1854 a commission of the Royal Institute of Engineers was among the first to address the issue of the housing of the poor and the workers. After that the Institute preserved a long silence on this point despite the miserable situation in the slums that the commission had reported. The Institute would develop into a conservative, liberal fortress that barely addressed the social question and that oriented itself above all to technology and the applied sciences. Despite this, the engineering world would be confronted with public housing by another route, namely via the municipal Public Works Departments, that employed engineers, architects and other technical professionals. Niftrik was one of them and also one of the engineers that developed ambitious plans. But one thing they did not do was to improve public housing.

Big cities, namely Amsterdam, Rotterdam, The Hague and Utrecht faced the challenge of accommodating their rapidly growing populations (Graph 9.1). Public works had a crucial role to play. They produced plans for urban development. Municipalities were in principle empowered to steer this development. Legislation was certainly inadequate, but they could get a lot done on the basis of building codes, land-use ordinances, the granting of concessions and the Public Nuisance Act.<sup>12</sup> Despite this, little was accomplished on this front. The question was whether



**Graph 9.1** Growth of the big cities in the Netherlands, 1795–1900

Remark: Cities with a population greater than 30,000 in the year 1900 count as ‘big’ cities

Sources: *Statistisch Jaarboek*, various years. F.W. van Voorden. *Schakels in stedenbouw; een model voor analyse van de ontwikkeling van de ruimtelijke kwaliteiten van de 19<sup>de</sup>-eeuwse stadsuitbreidingen op grond van een onderzoek in Gelderse steden* (Zutphen 1983)

<sup>11</sup>This section is based on: L. de Klerk, *De modernisering van de stad: De opkomst van de planmatige ontwikkeling in Nederland 1850–1914* (Rotterdam 2008); A. van der Woud, *Koninkrijk vol sloppen. Achterbuurten en vuil in de negentiende eeuw* (Amsterdam 2010); Buijter, *Riool, rails en asphalt*.

<sup>12</sup>De Klerk, *De modernisering van de stad*, 168.

**Table 9.1** Municipal expenditures in guilders per capita of population, 1862–1907 (three year running average)

	1862	1877	1892	1907	1907 Cities	1907 Countryside
General Administration	1.50	1.23	1.44	1.97	2.72	1.44
Public Safety		1.07	1.77	1.77	3.27	0.72
Public Works	1.95	3.44	3.17	8.70	17.17	2.69
Education	1.00	2.38	3.78	5.14	7.71	2.69
Poor relief	0.98	0.97	1.22	1.69	2.74	0.94
Interest and amortisation	0.83	2.33	3.39	4.06	8.16	1.16
Investments		0.65	0.28	1.68	3.29	0.54
Other	0.75	0.21	0.48	0.66	1.22	0.26
Unknown	0.65					
TOTAL	7.57	12.27	15.43	25.64	46.27	10.81

Source: H. Knippenberg and B. de Pater, *De eenwording van Nederland* (Nijmegen 1988), 162 and 164

urban development should be determined by the market or by government.<sup>13</sup> The former approach was dominant until the end of the nineteenth century. And municipal finances also played a role. Municipalities had lost important sources of revenue due to the abolition of local taxes. At the same time they acquired new responsibilities, among other things in the area of education. Expenditures for Public Works that increased strongly after 1870, were continuously under pressure (Table 9.1).

The ambitious plans produced by departments of Public Works supplied much fuel for debates in municipal councils and among the broad public. They were regularly voted down or radically altered. The consequence was a fragmented policy.<sup>14</sup> The projects that survived were related to infrastructure (adaptation of water management, building new roads, connecting up to the railway network, building harbours) and public hygiene (laying down sewers, flushing the canals, filling in drainage ditches).<sup>15</sup> Building houses was considered to be a task for the market. An answer to the question of public housing thus had to be provided by private initiative.

One of the responses of private initiative was the so-called ‘revolution’ building, made possible by a new ‘revolutionary’ method of market oriented financing.<sup>16</sup> In this approach a land-developer bought up land in a particular area of a city and divided it up into parcels. He then sold the parcels to housing contractors, who took out a loan at a mortgage bank with as security the ground and the building plans. The bank provided the loan in installments after each phase of the building process (delivery of the land, driving of the first pile, etc.). That meant fast-paced construction due to the cost of interest and the fact that various parties needed to be paid – which also meant that the building materials became a kind of afterthought. The

<sup>13</sup>De Klerk, *De modernisering van de stad*, 269.

<sup>14</sup>De Klerk speaks of chaotic planning. De Klerk, *De modernisering van de stad*, 194.

<sup>15</sup>Buiter, *Riool, rails en asfalt*, 43–60; 106–119; 145–167.

<sup>16</sup>De Klerk, *De modernisering van de stad*, 238–239.

approach provided a record number of dwellings in a brief period of time for cities that were bursting at the seams, like Amsterdam (the Pijp and the Kinkerneighbourhoods), The Hague (the Schilderswijk) and Rotterdam (the Oude Westen). But the soundness of the buildings often left much to be desired. Building materials and construction were sometimes of inferior quality even to the extent that buildings sometimes collapsed. Even though the quality might not differ very much in comparison with the existing housing of the poor and workers, the dwellings drew heavy fire from hygienists and health commissions. The houses were too close together, lacked an adequate drainage system for faeces and often consisted of only one room, in which the occupants also cooked and slept.

That things could be otherwise was demonstrated by several socially engaged entrepreneurs. Gerard Adriaan Heineken, for example, had a series of dwellings built for his workers in the Pijp that had separate kitchens and small gardens. They were designed by the architect Gosschalk. Both men were members of ‘Citizen’s Duty’ (*Burgerplicht*), a progressive-liberal political party in Amsterdam. Similar entrepreneurial initiatives were seen in other parts of the country as well. A famous example was the Agneten Park in Delft, built in the 1880s at the behest of Jacob Cornelis van Marken, director of the Dutch Yeast and Methylated Spirits Factory (*Nederlandsche Gist- en Spiritusfabriek*).<sup>17</sup> A number of his workers and higher personnel lived there. The firm also boasted a number of other social projects like a system of profit-sharing, an association building and an employee’s council for consultation. In this way the entrepreneurs sought to encourage loyalty among their employees, to exhibit their involvement in the social question, and to project an image of themselves as progressive, modern businessmen.<sup>18</sup>

An entirely different kind of initiative was undertaken by socially responsible members of the upper classes. An example was the Jordaan Building Company Inc., set up in 1896 by social-liberals like the architect Jan van der Pek and the writer Helena Mercier. The company was an experiment intended to investigate whether the construction of affordable workers’ housing on the basis of hygienic norms was possible. The experiment concerned one-room dwellings with sufficient daylight, a separate kitchen and a toilet. A housing inspector, inevitably female, collected the rent and checked to see if the occupants obeyed the rent contract, didn’t hang the washing up in the room and kept the house clean. In practice it turned out that the homes were too expensive for many of the working-class families.

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<sup>17</sup>E. Nijhof and A. van den Berg, *Het menselijk kapitaal: Sociaal ondernemersbeleid in Nederland* (Amsterdam 2012), 121.

<sup>18</sup>This section is based on: A. Bosch and G.P. van de Ven, ‘Rivierverbetering’, in: H.W. Lintsen et al. (eds.), *Geschiedenis van de techniek in Nederland: De wording van een moderne samenleving* (Zutphen 1993), volume II, 95–102; A. van Heezik, *Strijd om de rivieren: Tweehonderd jaar rivierenbeleid in Nederland* (dissertation Technische Universiteit Delft 2005); G.P. van de Ven (ed.), *Leefbaar laagland: Geschiedenis van de waterbeheersing en landaanwinning in Nederland* (Utrecht 2003); A. Bosch and W. van der Ham, with H.W. Lintsen, *Twee eeuwen Rijkswaterstaat, 1798–1998* (Zaltbommel 1998); A. Bosch, *Om de macht over het water: De nationale waterstaatsdienst tussen staat en samenleving, 1798–1849* (Zaltbommel 2000) and Lintsen, *Made in Holland*, 95–101.

The experiment in the Jordaan deeply influenced the debate on public housing in the 1890s. Socially responsible housing construction appeared to be possible only when supported by subsidies and legislation. The debate acquired momentum after a report on this issue by the Society for the Common Good (*Maatschappij tot Nut van 't Algemeen*), written by the social-liberal and lawyer Jan Kruseman, one of the founders of the Jordaan Building Company Inc. Inspired by this report, the progressive-liberal cabinet Pierson (1897–1901) submitted a proposal for a Habitation Act that was ratified by parliament in 1901. The act provided a framework for condemning dwellings and for dispossessing and improving them. It defined the role of municipalities in public housing and established the basic rules for providing subsidies for socially responsible housing construction. The issue of public housing had acquired entirely new dynamics.

#### 9.4 The Improvement of the Rivers<sup>19</sup>

In the twentieth century, public hygiene and public housing would become one of the administrative tasks of municipalities. Municipal governments had already had some experience in the area of public hygiene. This had yet to happen in the case of public housing. The crucial importance of a tradition of policy-making and implementation of governmental tasks can be appreciated in the case of another building challenge for well-being in the second half of the nineteenth century: the problem of the rivers.

The Dutch lived in a vulnerable delta. They experienced that particularly in the polders, where flooding and high water were regular occurrences, in the coastal zones that were from time to time harassed by storm surges and in the regions of the big rivers where successive generations experienced serious flooding. The struggle against water in the polders and against storm surges was above all a task for the water boards and especially the large regionally consolidated water boards (*hoogheemraadschappen*). They were able to manage high water thanks to the introduction of steam-powered pumping stations that enabled them to exercise much better control of water levels in the polders. They combatted storm surges by building dikes, a strategy that in the nineteenth century was codified into a well-organized body of knowledge and resulted in a complete system of defensive works.<sup>20</sup> The rivers were the responsibility of the water boards and the national government. The scale of the problem was such that it had even been fundamental for the process of state formation and the founding of the *Rijkswaterstaat*, the national hydraulic and public works agency, in 1798.

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<sup>19</sup>This section is based on: Bosch and van de Ven, 'Rivierverbetering', 95–102; van Heezik, *Strijd om de rivieren*; van de Ven, *Leefbaar laagland*; Bosch and van der Ham, with Lintsen (ed.), *Twee eeuwen Rijkswaterstaat 1798–1998*; Bosch, *Om de macht over het water* and Lintsen, *Made in Holland*, 95–101.

<sup>20</sup>Van de Ven (ed.), *Leefbaar Laagland*, 210.

The national government thus had a long tradition in caring for the rivers. This governmental task was uncontroversial. However, there was a problem: prior to 1850 the government and the Rijkswaterstaat had been singularly unsuccessful in combatting river floods. A certain indecisiveness caused in part by a controversy about how to come to grips with the problem lay at the bottom of this malaise. This came to an end in the 1850s.

In 1850 the leadership of the Rijkswaterstaat published a short and lucid report proposing a strategy for river improvement.<sup>21</sup> They rejected the concept of floodways, which could draw off an excess of river water along temporary alternative channels, and argued for the regulation and normalisation of the rivers, that is, the creation of a river with a bedding as straight as possible, of normalised dimensions and with a sizable opening to the sea. The report was a synthesis of ideas and foreign experiences accumulated over the preceding period. It came at a point in time that, thanks to the victory of the liberals in 1848, a new wind was blowing through the political landscape. And after the national treasury had also found its feet again, the government and parliament provided large sums of money. This made it possible to work on river improvements continually over a long period of time. For years there had been great pressure from an industrialising Germany that wanted better access to the sea. In Germany itself, massive efforts had already significantly improved the navigability of rivers. The Germans now demanded action from the Dutch.

A gigantic program was launched, one in which the Netherlands would invest hundreds of millions of guilders of tax revenues and to which successive generations of engineers, foremen, contractors, polder workers and other labourers would contribute. Rijkswaterstaat was in charge and occupied itself chiefly with the river beds. The water boards continued to concern themselves with the dikes, as they had done for centuries. In the end the entire river region would be transformed. Shores were rebuilt and consolidated with groynes and longitudinal embankments, meanders straightened and the river beddings widened. Secondary channels were eliminated by joining islands and sandbanks to the shores. New river mouths were created. Dikes were heightened, their width increased and their slopes rendered less steep, the outside faces reinforced with basalt and the floodplains cleared.

At the end of this period hundreds of groynes and lateral dams had been constructed along the Waal, Nether-Rhine and Lek. At a number of places, meanders had been eliminated, the one at Wijk bij Duurstede taking 6 years. The New Merwede, a new Rhine river opening to the Hollands Diep had been in the works for 35 years and still the river was of inadequate depth. In 1896, after 33 years, Rotterdam had a new opening to the sea of the required dimensions, the New Waterway. The Meuse and the Waal (main branch of the Rhine in the Netherlands) had been separated and the Meuse provided with its own mouth, the Bergsche Maas (1883–1904). Extensive dredging was carried out, in particular after 1875. All this was possible only for a state that had the necessary organisational and financial prowess. Modern technology also played a crucial, if not decisive, role. Dredging machines, sand suction dredgers and bucket-excavators, all powered by steam, had made the large-scale works possible.

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<sup>21</sup> Bosch and van de Ven, 'Rivierverbetering', 122–123.

Originally, safety had been the motivation for the river works. The rivers had first and foremost to be able to handle large volumes of water and ice. Subsequently attention shifted to navigability: achieving and maintaining a certain depth in the rivers and estuaries. In time it became normal usage to speak of the rivers as ‘shipping channels.’ Hence, the river works contributed in two ways to the positive development of well-being. The Netherlands would be considerably less vulnerable to ice jams and high water, while the rivers, as natural capital, functioned more effectively in transport and the economy.

## 9.5 The Infrastructural Revolution<sup>22</sup>

The development of infrastructure was also an age-old governmental responsibility. King William I had invested heavily in this domain. This continued under the new constitutional regime. Successive cabinets would devote considerable attention to infrastructure. And just as had been the case during William I’s reign, the most important arguments for state intervention were the advancement of national welfare, the consolidation of the position of the maritime harbours and the improvement of access to cities and the countryside. But there was an important difference. Decision-making on the large projects took considerably more time after 1850 than in the previous period (Table 9.2).

In regard to infrastructural projects, the government and politicians were as usual approached by countless lobbyists: farmers’ organisations, chambers of commerce, water boards, cities, private individuals and a diversity of interest groups. But King William I usually came to quick decisions, while governments and parliaments within the democratic order were busy evaluating interests, achieving compromises and coming to decisions. In this period some of the plans never made it across the finish line, or if they did, only after lengthy debates. For example, in 1849 an engineer of the Rijkswaterstaat published a two-volume work in which he proposed to drain and reclaim the Zuiderzee, the Frisian Wadden Sea and the Lauwerszee. He regarded the ‘present point in time’ eminently suited to realise his plans because of the ‘new political life’ and ‘the simplified state administration.’<sup>23</sup> This idea would be followed by numerous plans for the total or partial reclamation of the Zuiderzee. Governments and parliament regularly returned to this question. Still, it would take until 1918 – after serious flooding in North Holland in 1916 – before a law mandating the closure and partial reclamation was adopted.

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<sup>22</sup>This section is based on: G. Mom and R. Filarski, *Van transport naar mobiliteit: De transport-revolutie [1800–1900]* (Zutphen 2008); A.J. Veenendaal, ‘Spoorwegen’, in: H.W. Lintsen et al. (eds.), *Geschiedenis van de techniek in Nederland: De wording van een moderne samenleving* (Zutphen 1993), volume II, 129–163 and Lintsen, *Made in Holland*, 193–212.

<sup>23</sup>B.P.G. van Diggelen, *De Zuiderzee, de Friesche Wadden en de Lauwerszee, hare bedijking en droogmaking* (Zwolle 1849).

**Table 9.2** Lead times (excluding execution) of large projects, 1813–1918 (in years)

Project	Law	Lead time
<b>Period 1813–1815</b>		
Great North Holland Canal	1819	7
Keulse Waterway	1821	4
Zuid-Willems Waterway	1822	7
Canal Brugge-Oostende	1822	5
Zederik canal	1824	6
Canal Gent-Terneuzen	1825	8
Reclamation Haarlemmermeer	1837	2
<b>Period 1850–1918</b>		
North Sea Canal	1863	14
New Waterway	1863	10
Merwede Canal	1881	14
Relocation Meuse mouth	1883	23
Closure Zuiderzee/Polders	1918	50

Remark: Lead time is the time from the moment that the responsible administration adds the project to its agenda to the start of the actual execution. The year indicates the point in time that the project is mandated by law. In that same year (or soon thereafter) the actual work is generally started

Source: H.W. Lintsen and M.L. ten Horn-van Nispen, 'Grote infrastructuurprojecten als belangenstrijd: niets nieuws onder de zon?', in: *Grote infrastructuurprojecten: inzichten en aandachtspunten, achtergrondstudies ten behoeve van de Tijdelijke Commissie Infrastructuurprojecten* (Den Haag 2004), 36–45

The national government was the decisive factor in the development of a national infrastructure after 1850.<sup>24</sup> After 1860 it took the construction of a national railway network to hand, after private initiative had failed to do so. In 1863 it committed itself to major works to improve maritime access to Rotterdam and Amsterdam: the execution by the state of the New Waterway and its subsidising of the North Sea Canal. In addition a number of other important canals were dug. From 1894 on, the national government also developed a subsidy system for a nationwide network of local narrow-gauge steam tramways.

An important factor was also that the state could count on popular support.<sup>25</sup> To be sure, there were heated discussions about the role of the state, the contribution of private enterprise, the design of the networks, the losers in policy making and so forth; nonetheless users, local administrators, chambers of commerce, the press and public opinion all in principle favoured a good national infrastructure. Transport companies eagerly used the new roads, canals, railways and tramways. Travellers were enthusiastic and chose the means of transport that promised the shortest travel

<sup>24</sup>Mom and Filarski, *Van transport naar mobiliteit*, 403–404.

<sup>25</sup>Mom and Filarski, *Van transport naar mobiliteit*, 404–405.

**Table 9.3** Passenger transport. Development of speed and transport costs, 1850–1900

Means of transport	Speed (km/hour)		Transport costs (cents/km)	
	1850	1890–1900	1850	1890–1900
Tow barge	7	–	2.5	
Stage coach/omnibus on paved road	10–12	?	7.2–8.6	3.6–7.5
Steamship	10–15	10–15	2.3–3.0	1.0–1.5
Steam Railway	30–35	45–55	2.4–2.6	1.7–1.9
Steam Tram		12–14		1.75–3.0

Source: R. Filarski and G. Mom, *Van transport naar mobiliteit. De transportrevolutie [1800–1900]* (Zutphen 2008), 402

**Table 9.4** Freight transport: Development of speed and transport costs, 1850–1900

Means of transport	Type of transport	Transport costs (cent/tonxkm)	
		1850	1890–1900
Maritime shipping		0.4–1.0	0.1–0.4
Inland shipping	Domestic shipping	1–4	0.4–1.0
	Rhine upstream	4.6	0.6–1.3
	Rhine downstream	2.0	0.3–0.5
	Small rivers in eastern Netherlands	9–14	
Horse and wagon	Unpaved road	28–35	
	Paved road	12–19	
Steam railway		6.3	1.8–1.9
Tram			ca.5

Source: R. Filarski and G. Mom, *Van transport naar mobiliteit. De transportrevolutie [1800–1900]* (Zutphen 2008), 403

time. Passenger transport had increased in speed and decreased in cost (Table 9.3). The costs of freight transport had also declined (Table 9.4).

## 9.6 The Balance

From a present-day perspective on well-being, the Netherlands faced four building challenges: public hygiene, public housing, water management and transportation infrastructure. At the time, the latter two were also acknowledged to be important building challenges and had been the responsibility of the state since the founding of the Kingdom (in 1815). The two former challenges were manoeuvred onto the political agenda by the ‘societal midfield’ (in particular the hygienists) and increasingly came to be seen as construction agendas for municipalities. Results were mixed.

Public Works departments of municipalities, particularly in the low Netherlands, regularly initiated construction of hygienic facilities (sewers, flushing of canals) and entrepreneurs were active in public housing (‘revolution’ building). But municipali-

ties were incapable of formulating coherent policy in these areas. After the Law on Municipalities of 1851, they had to reinvent themselves before they could assume tasks in the domain of public hygiene, urban development and public housing and before they could provide the necessary means. Municipal governments were goaded into action by public opinion, social movements and a rapidly growing urban population. The financial situation proved an impediment. Many municipalities attempted to surmount their financial limitations by establishing a municipal gasworks (instead of granting concessions to a private firm) in order to generate extra income. A crucial factor was also that the national government created a legal framework for public health and public housing in order to legitimate, record and support municipal action.

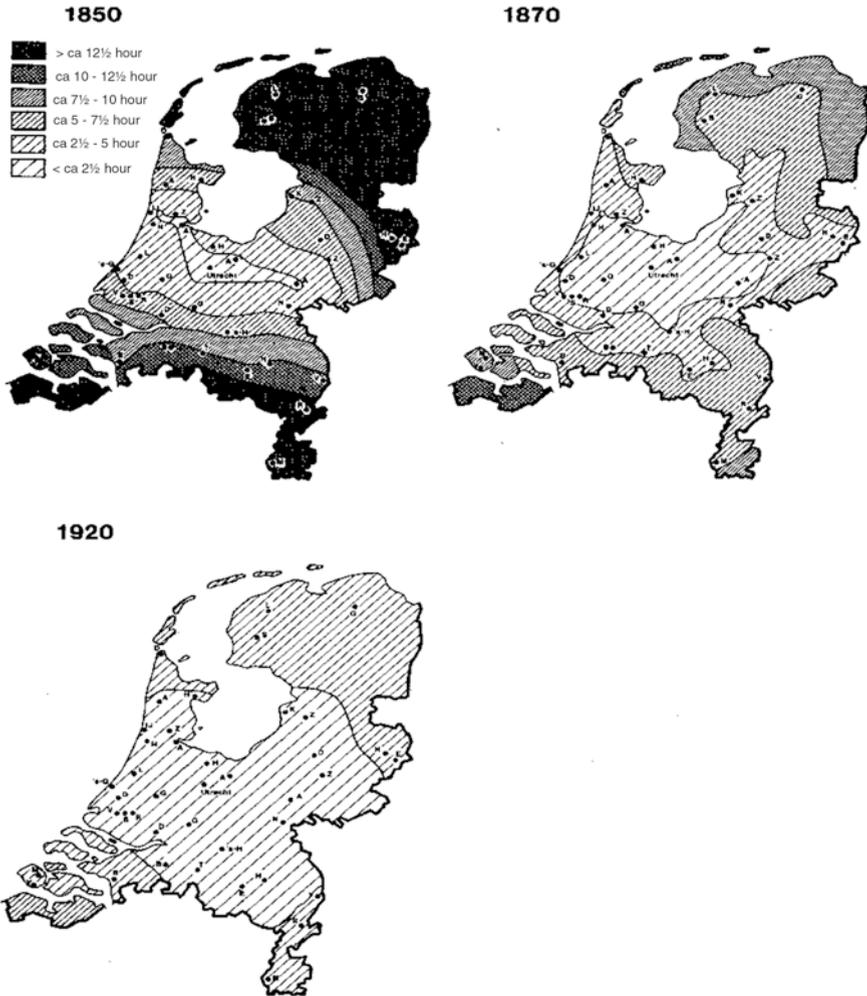
The national government had a better track record with its building challenges than the municipalities. Its struggle against water had made the region of the large rivers much safer. Flooding as a result of ice jams ravaged the river region one more time in the nineteenth century, but that was in 1861 when the normalisation project had only just been initiated. In the twentieth century, high river stages due to excessive rainfall and melting snow would once again overtax the rivers. For the first time in 1926 with extensive flooding as a consequence and – after a long period of relative calm – in 1993 when large parts of Limburg were flooded and in 1995 with a mass-evacuation of population from the river region as levees threatened to break. The national state also realised major works in the area of transport infrastructure and under its leadership coherent networks were created. This had two kinds of effects in relationship to well-being.

In the nineteenth century the Netherlands long remained ‘an archipelago of regions and societies.’ Until the 1860s large parts of the Netherlands were poorly accessible, barely opened up and inhabited by isolated and autonomous social communities. To be sure, the country was formally a unified state with a national legal system, but by no means a country characterised by a certain degree of economic, mental and cultural unification.<sup>26</sup> Every region had its own dialect, costume, products, dishes and local time.

In the first place, the transportation infrastructures enabled spatial integration and were an important prerequisite for the state formation of the Netherlands. Travel times, for example, decreased dramatically between 1850 and 1920. With the exception of Zeeuws Vlaanderen, the entire country could be reached from Utrecht within 5 h (Fig. 9.1). People and goods could circulate faster, ideas spread more quickly and social networks extend over greater distances. This was of course also abetted by the rise of newspapers, the telegraph and the telephone. New ideas about poverty, health, housing and labour penetrated more quickly into the furthest corners of the Netherlands. The activities of political parties, unions, health commissions acquired a broader reach. It was easier to mobilise social and occupational groups. Health became public health and housing became public housing. Both became a problem for the nation and hence also of the state.

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<sup>26</sup>H. Knippenberg and B. de Pater, *De eenwording van Nederland* (Nijmegen 1990).



**Fig. 9.1** Area in the Netherlands in 1850, 1870 and 1920 accessible from Utrecht within a given time

Source: A.J. Thurkow, J.D.H. Harten, H. Knippenberg et al., 'Bewoningsgeschiedenis', *Atlas van Nederland* (Den Haag 1984), part 2. See also: H. Knippenberg and B. de Pater, *De eenwording van Nederland* (Nijmegen 1990), 57

In the second place, spatial integration had far-reaching consequences for the modernisation of the economy. The modern economy was heavily dependent on scale, mass and speed. A key technology like steam could only develop on the basis of larger-scale production than was customary with existing technologies; it demanded a faster supply of raw materials and required larger markets. The opening up of the countryside, providing access to urban markets and making connections

with foreign regions were important factors in this connection. Roads, canals, rivers, railways and local light rail made them possible.

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