

Building materials and construction

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Chapter 14

Building Materials and Construction: Constructing a Quality of Life



Frank Veraart

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Abstract Catastrophes and new societal ambitions energized the huge construction effort undertaken between 1910 and 1970. The floods of 1917 and 1953 led to enormous investments in coastal defences. The government also undertook major investments in the construction of roadways and other infrastructural works. New building codes, damage incurred during the Second World War and population growth incited new housing construction on a colossal scale. Demand for building materials grew apace.

The need for wood and mineral subsoil resources transformed nature and landscapes in the Netherlands and at foreign sites. Dutch forestry practices were rationalised. Imports from the Baltic regions by and large met the Dutch demand for wood. But the creation of monocultures and production forests in these regions reduced local biodiversity. Gravel and marl were mined above all in the province of Limburg. That led to tensions with local stakeholders. Gravel extraction transformed the floodplains of the Meuse into a lake landscape. It led directly to the Excavation Law, the first environmental law in the area of land-use. After 1970, regulations concerning land-use and new landscape values would regularly inspire conflicts in the national supply of building materials (see Chap. 19).

This chapter is written by Frank Veraart with contributions by Harry Lintsen.

Keywords Construction · Housing construction · Coastal defences · Infrastructure · Building materials · Wood · Iron · Minerals · Cement · Concrete · Gravel · Limburg · Land-use

14.1 Could the Flood Disaster Have Been Prevented?

1953. The night of January 31st to February 1st. A northwest wind roared across the North Sea at hurricane force. The storm had already lasted for hours. An enormous mass of water was being driven at great speed in the direction of the southwest Netherlands. Around midnight it was supposed to be low tide, but the waters had not retreated. Quite the contrary, the waters continued to rise and looked ominous; it was black and full of driftwood. The next high-tide was a super high-tide.

(That afternoon...) you saw masses of water charging from afar over the Oosterscheldt. It was magnificent, magnificent! We stood there thrilled by the tremendous power of nature.

as the soldier Jo Leune and his girlfriend Suus Priem from Stavenisse later recalled.¹ The majority of the population was not really worried. Many people were visiting or at a party, as was normal for Saturday night. The floods of 1906 and 1916 survived only as the vague memory of an older generation. Toward the end of the war Walcheren had been flooded. But that had been done on purpose to support the Allied invasion of the continent. In this night it was certainly exceptionally heavy weather, but here and there measures had been taken and flood-boards erected. That would suffice.

Several hours after midnight the Dutch delta was transformed into an unimaginable pandemonium. In some places sirens had wailed or church bells chimed. In many places there had been no warning at all. The dikes burst at more than 150 places. Around 140,000 hectares of land were flooded. 1835 people lost their lives. Thousands of head of cattle were drowned. Nearly 50,000 buildings were destroyed or damaged. The economic damage was estimated at about 700 million euros (at current prices equivalent to more than 10 billion euros).

God had shown his hand, according to the deeply pious part of the inhabitants of Zeeland. In the book *In the Grip of the Water Wolf*, published in response to the disaster, it was written:

God saw the work of man...and they did what was evil in His eyes. They loved money and power...and violence ruled in the streets... Then He used His right and he chastised us, so that the whole of humanity should learn that love is more than violence.²

¹Cited and translated from: K. Slager, *De ramp: Een reconstructie: 200 ooggetuigen over de watersnood van 1953* (Goes 1992), 15.

²C. Baardman, *In de greep van de waterwolf* (Den Haag, 1953), 171.

Others emphasized the mystical power of nature. Nature surprised humans time and again. Humans might think they had conquered nature with their modern technologies. But that was a misconception.

But we must ask: Is this perception accurate? Had the Netherlands no inkling of these kinds of extraordinary natural phenomena in 1953? Was there no knowledge of the consequences of the unusual circumstances that had presented themselves? A day after the disaster of February 1st, 1953 an emotional engineer wrote:

Natural disasters! But our civil engineers already knew beforehand where these 'natural disasters' would strike. They warned in reports and expert advice about the dikes that were too low and too weak...³

He pointed to research undertaken by the Research Unit of the Estuaries, Tidal Rivers and Coasts of the Dutch Agency for Public Works and Water Management, *Rijkswaterstaat*. The research unit was set up in 1929. During the 20 years prior to the flood disaster an average of 50 persons per year worked on the problem of the delta region, that is, about 1000 person-years in total. Old conceptions made way for new theories and traditional rules of thumb were abandoned. Endless measurements and soundings were taken and registered. New instruments and new approaches like the application of statistical methods and factor analysis of storm surges were introduced.⁴ The investigations arrived at a clear conclusion. The delta region was a kind of time-bomb and vulnerable to big threats. Draconic measures would be needed to turn the tide.

But even with all this knowledge the disaster could not have been prevented. New approaches take time to penetrate into the domain of policy and politics. During the Second World War the Netherlands was occupied with other matters. Designing and constructing a new coastline would require gigantic investments, investments that were unthinkable from a social perspective during the Depression and post-war reconstruction.

'Calamities produce policy' is an oft-cited saying in civil engineering circles. After the disaster things moved quickly, among other things because the plans were already prepared. The disaster took place on February 1 1953. On the 21st of that month the Delta Commission was sworn in. Between 1953 and 1955 the commission published five fundamental and radical reports. In 1955 it proposed a Delta Law that was ratified by parliament in 1958. By then the *Rijkswaterstaat* had already been long at work.

The vulnerable delta is one of the fundamental aspects of well-being and sustainability in the Netherlands. The well-being monitor of Statistics Netherlands (CBS) lacks an indicator to reference this issue. This is hardly surprising because the set of indicators we use in this study conforms to international guidelines. A specifically Dutch issue like the flood-prone situation cannot be coupled to one of these

³R. Verloren van Themaat, 'Watersnood 1953', *De Ingenieur* 65(1953), nr. 6, A 56.

⁴P.J. Wemelsfelder, 'Wetmatigheden in het optreden van stormvloed', *De Ingenieur* (1939), B, nr. 31 and J. van Veen, *Te verwachten stormvloed op de benedenrivieren* (internal report, Rijkswaterstaat, directie Benedenrivieren, afdeling Studiedienst, 1939).

indicators. But for the Netherlands it is an ancient and crucial issue. This was the case in the twentieth century and it will remain the case for future generations.

14.2 Well-being, Vulnerability and Liveability

In addition to the vulnerable delta, poverty was one of the biggest determinants of well-being and sustainability in the past. Despite the positive developments at the end of the nineteenth century, the differences among living conditions of the various segments of the population were still very large. The unemployed and low-paid workers lived in hovels, while industrialists, bankers and other well-off prominent citizens fitted their opulent dwellings with modern delights like bathrooms, electric illumination and telephones. Public housing demanded significant improvement. In addition, population growth also demanded a continual growth in welfare. This in turn required growth in business and in transport, energy and communications infrastructures.

The further elaboration of the infrastructures, the defences against flooding and the construction of liveable housing for the poor dominated the enormous construction agenda of the twentieth century. This effort had far-reaching consequences for the quality of life and for natural capital in the Netherlands and abroad. The effects on natural capital had two dimensions, a spatial and a material. Construction of housing, roads, utility buildings and urban layout had implications for the use of space. In the course of the twentieth century it proved necessary to reflect ever more profoundly on the division and utilisation of the country's limited surface area. It was also impossible to build without a supply of materials. Millions of kilos of wood, bricks, concrete and steel found their way to construction sites. Between 1910 and 1970 building materials were among the biggest material flows in the Dutch economy (see Tables 12.5 and 12.8).

In this section we briefly describe the water management and infrastructural developments. To an important degree these were extensions of nineteenth century policy. Subsequently we shift our focus to public housing construction for the poor and to urban development. After that the supply side of the enormous building effort demands our attention. Where did the raw materials come from? What influences did this have on changes in the environment and the landscape?

14.2.1 *Safe Behind the Dikes*

The closure and reclamation of the Zuiderzee (1919–1969) and the Delta Works (1956–1998) were the calling cards of Dutch civil engineering. After the reclamation of the Haarlemmermeer using the world's biggest steam engine, plans were made, starting in the mid-nineteenth century, for the next step: the reclamation of an entire sea. The first proposals still seemed like fantasies, but in 1886 liberal circles

founded a Zuiderzee Association that began to develop concrete plans. The young engineer Cornelis Lely authored the various technical reports published by the association. In 1891 Lely left the association to become Minister of Public Works, Trade and Industry. During his first and second terms as minister nothing came of the Zuiderzee plans. In 1913 he accepted a third term, but only on condition that now a decision would be taken in favour of closure and reclamation.

The outbreak of the First World War again threatened the plans. Though the Netherlands succeeded in remaining neutral, the war in the surrounding countries nonetheless caused material and food shortages. The storm surge and floods of 1916 that affected the region of the Zuiderzee caused local food shortages. This not only put the food situation squarely on the agenda but also provided an important impulse for the Zuiderzee plans.

Together with the Delta Works these were the dizzying heights of Dutch hydraulic engineering in the twentieth century. The works confirmed the image of the Netherlands as a nation of dike-builders. Dike-builders who with perseverance and investments had wrested land from the sea and who, after completing the Delta Works, could resist the sea as well.

14.2.2 *New Roads and the Unification of the Netherlands*

At the turn of the century the Netherlands was a patchwork of loosely connected regions. During the twentieth century these were stitched together by various infrastructures, that reduced time needed for travelling, communications and hauling goods. Important infrastructural works included the construction of canals, the improvement of the rivers and the building of road, energy and communications networks.⁵ In the twentieth century the Netherlands was a colossal ‘work in progress.’⁶ The country was literally smothered in networks of conduits, pipes, rails, asphalt and electromagnetic waves. Every bit of the Netherlands, wet or dry, was eventually connected up with a larger whole. Links among households, farms and factories were established throughout the country. Intentionally or not, the material infrastructures thus became an important medium of the ‘unification of the Netherlands,’ the socio-spatial integration of regions and communities within the national territory.⁷

They also contributed to economic growth and the growth of well-being. Networks were built up and broken up again or partially lost their function. The

⁵Erik B.A. van der Vleuten, ‘De materiële eenwording van Nederland,’ in *Techniek in Nederland in de twintigste eeuw - Techniek en modernisering, balans van de twintigste eeuw*, by Johan W. Schot et al., VII (Zutphen: Walburg Pers, 2003), 42–73.

⁶A. van der Woud, ‘Stad en land: Werk in uitvoering,’ in D. Fokkema and F. Grijzenhout, *Nederlandse Cultuur in Europese Context* (Den Haag 2004).

⁷H. Knippenberg and B. de Pater, *De eenwording van Nederland: Schaalvergroting en integratie sinds 1800* (Nijmegen 1988).

nineteenth century telegraph network lost some of its functions to the telephone network as it unfolded into a national and international network in the twentieth century. The local gas networks suffered competition from the electricity networks, that were ultimately organized at a provincial level. The railway trunk network branched out after 1880 with connections to numerous ‘secondary’ local rail networks and inter-local tramways. There were also ‘tertiary’ municipal tramway networks. Around 1930 there were about 6500 km of railways and tramways. Large portions were later torn up.

The network that made the largest claims on space and spatial planning was the road and highway network. The ANWB, founded in 1883 as an organisation for cyclists, developed into one of the most important advocates of improvements to the road infrastructure. In 1920 this organisation, together with the Royal Institute of Engineers (KIVI), organised the First Netherlands Road Congress. The congress accelerated the road improvement program that was already underway. Additional consultations between the government and interest groups led to a national road plan by 1924, a plan that was ratified by parliament in 1928.⁸

In the 1930s ideas about roads exclusively for motorised traffic gained currency. The national road plan, especially in the western part of the country, gradually became a plan of limited access highways. The ANWB, the KIVI and other organisations saw the highway as an alternative and successor to the railways. Construction of the first highway between The Hague and Utrecht began in 1934 and took 5 years. Other sections followed.⁹ After 1958, bowing to popular pressure, the Minister of Transport and Public Works increased the pace of highway construction. Between 1950 and 1970 the total length of the highways grew from about 100 to a 1000 km. In 1970 all the roads in the Netherlands taken together had a collective length of 77,000 kilometres.¹⁰

The investments in communications, energy and road infrastructure contributed to the spread of industries throughout the country. The textile factories in Brabant and Twente were heavily dependent on their connections to the maritime ports in the western part of the country. Coal from the Limburg mines was able to fuel the Dutch economy only after this region had been opened up by the canalisation of the river Meuse and railroad connections. The development of infrastructures fostered industrialisation throughout the Netherlands.

Building of infrastructures and industrialisation contributed significantly to improving the quality of life. That had been demonstrated unequivocally in the nineteenth century. At the beginning of the twentieth century there was still a yawning gap between rich and poor. Part of the elite was of the opinion that the poor should have more of a share in the increase in well-being. This focused attention on another aspect of the building agenda, the construction of public housing.

⁸G. Mom and R. Filarski, *Van transport naar mobiliteit: De mobiliteitsexplosie (1895–2005)* (Zutphen 2008), 173–201.

⁹Mom and Filarski, *Van transport naar mobiliteit*, 197.

¹⁰Mom and Filarski, *Van transport naar mobiliteit*, 314–317.

14.3 Living and Quality of Life in the City

We cannot say in the abstract: this or that is a good habitation; that depends entirely on the situation in a given municipality. When one hears, for example, that people live in a house made of turf, then this sounds very miserable to a city-dweller, but I have seen such turf houses that I would far prefer to some rooms in one of the big apartment buildings in the big cities, where one lives between stone walls, but where one loses all freedom...where outside of one's room there is no single domain in which one is one's own boss. In a dwelling on the heath, even if it is made of turf, one is just as well protected from cold or heat; one is one's own boss and is not bothered by neighbours, piano-players and such.¹¹

The quality of dwellings, argued the parliamentarian for the Christian Historical Union (CHU), squire A.F. de Savornin Lohman, in 1901 in the Second Chamber deliberations on the new housing bill, was subjective. Reports on housing conditions in the Netherlands had produced a clear image of the hovels and miserable workers' dwellings. But opinions diverged on what was to count as good housing.

Inspired by and based on foreign examples, Dutch Hygienist groups in the societal midfield had developed ideas about daylight and ventilation and about sanitary, cooking and sleeping facilities. At the end of the nineteenth century they themselves set an example with the construction of workers' housing. At the political level the right approach remained up for grabs. Liberal and confessional politicians feared that the demands made on housing would infringe the rights of landlords and that housing would become unaffordable for the poor. The social-liberal cabinet led by N.G. Pierson resolved the debate by introducing the Housing Law of 1901.

14.3.1 *The Housing Law and Housing Construction*

The Housing Law aimed at the elimination of hovels and the improvement of the quality of dwellings. Starting with the census of 1899 information on housing had been gathered with each census. This revealed that more than half the dwellings had only one or two rooms, a statistic that provided an estimate of the proportion of hovels in the total housing supply. The housing statistics of various cities over a number of years showed the effect of the Housing Law. In a half century the number of one and two room dwellings declined sharply (Table 14.1).

Eliminating the hovels was work for the municipalities. Municipal inspectors made an inventory of the many workers' homes in order to be able to advise on the housing situation. The residents of these homes regarded the members of the commission with mixed feelings. For them, a declaration that their homes were uninhabitable meant eviction or higher rent. The prominent socialist member of Amsterdam's city council, F.M. Wibaut, member of the Public Health Commission from 1907 to 1914, noted a typical reaction:

¹¹ Handelingen Tweede kamer 1900–1901, 'Wettelijke bepalingen betreffende de volkshuisvesting', 60ste Vergadering – 15 Maart 1901, 1218.

Table 14.1 Development of the number of rooms per dwelling as a percentage of the total number of dwellings in different cities

		Number of rooms per dwelling (in %)				
		1	2	3	4	5 and more
Amsterdam	1900	19.1	25.7	22.4	23.6	9.2
	1930	10.2	8.9	17.5	26.4	37.1
	1947	0.6	3.1	15.2	32.5	48.5
	1956	0.6	3.2	15.3	31.6	49.4
Rotterdam	1900	20.1	41.1	16.8	14.3	7.7
	1930	5.3	12.8	15.7	21.7	44.5
	1947	0.3	3.4	8.9	27.5	59.9
	1956	0.3	3.0	10.2	31.5	55.0
Groningen	1900	34.8	31.7	12.0	11.2	10.4
	1930	6.8	16.4	16.6	16.4	43.8
	1956	1.1	5.3	11.5	18.3	63.9
Nijmegen	1900	15.0	32.3	16.8	16.1	19.7
	1930	1.9	6.7	10.6	13.6	67.2
	1956	0.0	1.9	6.1	13.8	78.2
Tilburg	1900	2.5	37.5	31.9	19.8	8.3
	1930	0.7	4.5	12.2	22.1	60.5
	1956	0.0	1.1	9.7	10.5	78.7
Maastricht	1900	31.2	32.6	12.4	11.4	12.5
	1930	7.8	18.2	17.5	15.9	40.6
	1956	0.5	3.0	7.0	11.1	78.4
Enschede	1900	7.5	38.3	23.6	20.0	10.5
	1930	1.6	4.0	6.1	10.8	77.5
	1956	0.0	0.4	5.1	11.1	83.4
Emmen	1900	80.0	13.2	3.6	2.5	0.7
	1930	31.6	25.9	15.0	10.0	17.5
	1956	3.1	11.2	14.8	16.2	54.7

Data from 'Uitkomsten der Woningstatistiek' behorende bij Volkstellingen 1899/'Woningtelling en Gezinsstatistiek' behorende bij Volkstelling 1930/'Volkstelling annex woningtelling' 1947/'Algemene Woningtelling' 1956

Source: NIWI- KNAW/CBS (www.volkstelling.nl)

Gosh, sir, just let us live here. I'm sixty-four. Was born here in this cellar. My husband is sixty-six and for him it's alright too. Never a doctor. If we want fresh air we have the street. Brought up twelve children here. Figuring out sleeping places was a real puzzle. But it went fine... It was a good family. All of them married. Two dead, all of them healthy.¹²

In their reactions the residents reflected the arguments of the commission members about health, light and fresh air. The focus on living conditions meant that decisions were made about and for the lowest classes. The supervisors and elite champions of workers' housing were mocked and were known among the hovel-dwellers paradoxically enough as 'poor-people-rejectors.'¹³

¹²F.M. Wibaut, *Levensbouw, memoires*, Querido, Amsterdam, 1936, cited in Egbert Ottens, 'Ik moet naar een kleinere woning omzien want mijn gezin wordt te groot', *125 Jaar Sociale Woningbouw in Amsterdam* (Amsterdam 1985), 22.

¹³Ottens, 'Ik moet naar een kleinere woning omzien want mijn gezin wordt te groot'.

The Housing Law compelled municipalities to establish a department of building and dwelling inspection and to formulate building codes. Construction plans that satisfied legal demands were financially supported by the national government. The law took account of local differences. The law's implementation took a long time, among other things due to the time it took to formulate local building codes and the guarantees against misuse of state financing, the lengthy debates on the proper rents for subsidized dwellings, the discussion about the role and recognition of building societies and the delaying tactics of powerful landlords.

In 1904 the national government published the first 'guidelines' that provided a point of departure for state financing. In subsequent years ministerial letters and new guidelines in 1927 ensured harmonisation of the building codes.¹⁴ This enabled the national government to be specific about the quality of workers' housing. Alcoves were forbidden and separate rooms for cooking, sleeping and toilet facilities became mandatory. Every dwelling had to have an outside space. The toilet in the dwelling was not allowed to open into the kitchen. Bedrooms had to have a window.¹⁵ The admission of air and light became the new adage, with the typical Dutch '*doorzonwoning*' - a house equipped with large glass panes front and back so as to admit sunlight both morning and afternoon - as the characteristic outcome. The minimum surface area of a dwelling was originally fixed at 30 m². In 1920 this was upgraded to 40 m². The average size of Dutch dwellings in that year was 47 m².¹⁶ The national average dwelling size increased starting in the 1950s to 109 m² in 1970. The surface area differed according to the type of housing; the surface area of non-subsidized dwellings grew especially rapidly in the 1960s (Table 14.2).¹⁷

Subsidies were granted to recognized housing corporations. In order to streamline discussions among municipalities, the national government, and housing corporations, a Housing Council was established in 1913 in which the certified housing corporations united themselves.¹⁸ During the First World War, housing construction ground to a halt. Construction workers and materials were scarce. The government eased the restrictions on loans for housing construction and framed a Housing Shortage Law. This mandated municipalities to support housing corporations or take housing construction into their own hands. Many municipalities adopted the latter course and set up their own housing agency or housing firm. In 1917 munic-

¹⁴N. de Vreeze, (Ed.), *65 miljoen woningen: 100 jaar Woningwet en wooncultuur in Nederland* (Rotterdam 2001), 105–111.

¹⁵J. Huisman et al., *Honderd jaar wonen in Nederland, 1900–2000* (Rotterdam 2000), 16.

¹⁶Vreeze, *65 miljoen woningen*, 107; Huisman et al., *Honderd jaar wonen in Nederland, 1900–2000*, p. 25. For more detailed analyses of the development of dwelling size in the city of Groningen see: A.M.L. Diepen, 'Spatial Aspects of Housing,' in *Green Households? Domestic Consumers, Environment and Sustainability*, ed. Klaas Jan Noorman and Ton Schoot Uiterkamp (London 1998), 105–7.

¹⁷L.A. Bruggeman, 'Kwalitatieve woningdocumentatie (KWD) 1948–1970: Enkele kwaliteit-aspecten van de nieuwbouw van woningen over de afgelopen 30 Jaar,' kwalitatieve woningdocumentatie (Zoetermeer 1981), Table V.

¹⁸Wouter Beekers, *Het bewoonbare land: Geschiedenis van de volkshuisvestingsbeweging in Nederland* (Amsterdam 2012), 107–33.

Table 14.2 Development of dwelling size in the Netherlands: average surface area in m²

	Housing law housing			Unsubsidized housing			Total new housing ^a		
	One-family homes	Multi-family homes	Average	One-family homes	Multi-family Homes	Average	One-family homes	Multi-family homes	Average
1948	56	50	55						
1950	56	46	53						
1952	54	44	49						
1954	55	47	51						
1956	58	50	54						
1958	58	50	54						
1960	57	49	53						
1962	57	51	54	70	56	66	62	52	58
1964	60	52	57	68	59	66	63	54	60
1966	67	60	63	75	66	73	69	60	66
1968	66	59	63	85	62	82	72	58	68
1970	69	59	65	89	57	85	75	55	69
1972	70	58	66	90	56	88	78	54	72
1974	67	52	63	95	66	93	78	52	72
1976	67	53	64	100	60	98	80	52	74

The average surface area is the sum of the surface areas of the kitchen, living room, and bedrooms
^aHousing Law, Unsubsidized, and Premium dwellings

Source: Bruggeman, L.A. "Kwalitatieve Woningdocumentatie (KWD) 1948–1970, Enkele Kwaliteitsaspecten van de Nieuwbouw van Woningen over de Afgelopen 30 Jaar." (Zoetermeer 1981), tabel V

palities also acquired the right to appropriate housing corporations.¹⁹ Despite the long start-up phase and difficult circumstances, between 1901 and 1918 the housing corporations built, with government support, more than 50,000 dwellings. The number of corporations rose from 400 in 1914 to 1300 in 1920.²⁰ This made corporative building the most important force in housing construction in this period.

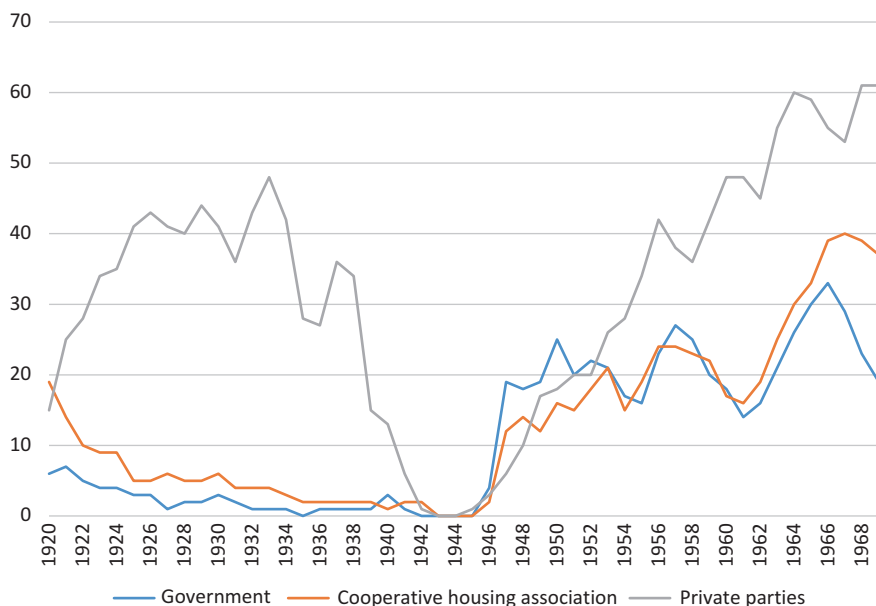
After the First World War the national government took stock of its position, reduced subsidies and coupled them to slum clearance. Housing corporations and municipalities saw this about-face as a death blow to the Housing Law and protested fiercely. Exerting themselves, they plumbed alternative sources of financing and in this way managed to triple the production of new homes between 1918 and 1940.²¹ In the total housing production the share of corporative housing construction declined to 10 or 20%.

The production of new housing by housing corporations and private parties grew from about 20,000 dwellings per year around 1900 to 30,000 just before the out-

¹⁹Beekers, *Het bewoonbare land*, 135–142.

²⁰P. Ekkers, *Van volkshuisvesting naar woonbeleid* (Den Haag 2006), 63.

²¹Beekers, *Het bewoonbare land*, 172.



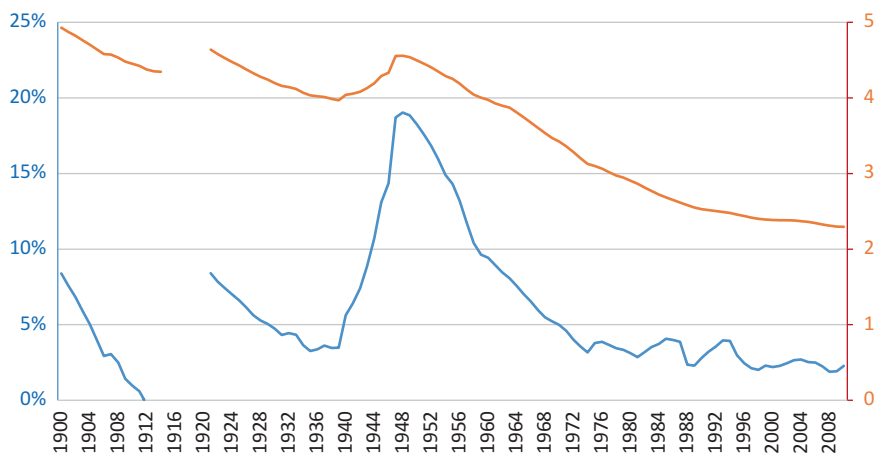
Graph 14.1 Housing production by the government, housing construction corporations and private parties 1920–1970

Source: CBS – Historie bouwnijverheid vanaf 1899

break of the First World War. In the interbellum housing production increased further to about 50,000 dwellings around 1930, after which it declined to a bit more than 30,000 per year. After the Second World War the Ministry of Public Housing and Reconstruction assumed responsibility for housing construction. The number of new dwellings per year rose from 50,000 per year in the early 1950s to more than 150,000 in the early 1970s. (See Graph 14.1)

These building efforts brought the average number of occupants per dwelling down from five around 1900 to four on the eve of the Second World War. After the war the number of occupants per dwelling climbed again until another decline set in during the 1960s. At the end of the 1970s the figure was three occupants per dwelling.

Throughout the twentieth century there was a shortage of dwellings in relation to the number of households. In 1900 the shortage amounted to 100,000 dwellings for 1.1 million households (9% housing shortage). Housing construction reduced this shortage up to the First World War, but due to production cutbacks and an increase in the number of households the shortage again increased to more than 130,000 dwellings in the early 1920s (8% housing shortage). After that there was a decline until the Second World War. War damage, a moratorium on construction during the war, shortages of materials and the post-war increase in the number of households forced the housing shortage up to a half million dwellings for 2.6 million households (20% housing shortage) at the end of the 1940s. For the second time in the twentieth century public housing became a core priority of the national state. The



Graph 14.2 Percentage of households without a dwelling and average number of occupants per dwelling in the Netherlands, 1900–2010

Source: CBS - processing of data regarding number of dwellings, households and inhabitants by author

enormous housing production of the 1950s and 1960s once again reduced the housing shortage to about 150,000 dwellings (4% housing shortage). With these building efforts the government succeeded in limiting the housing shortage in the post-war years. But even after the 1970s some 3% of the households still did not have its own dwelling (Graph 14.2).

The focus of attention of building contractors, housing corporations and the government gradually changed. From slum clearance, attention shifted to fighting the housing shortage. The Housing Law explicitly defined the minimum requirements for a Dutch dwelling. The massive share of one and two-room dwellings had assuredly been reduced but without any palpable increase in the size of dwellings. With the stipulation of minimal requirements housing shortage became the new name for a shortage of quality dwellings. Housing shortage shaped the building activities of post-war ministers of reconstruction and public housing. In view of the unheard-of production of more than 123,000 dwellings in 1969, the Minister of Public Housing and Spatial Planning, W.F. Schut, felt able to announce the end of the housing shortage.²² It seemed that the worst of it was indeed over. However, the end of the housing shortage was announced time and again simply because it persisted, albeit at a lower level than before.

With the shift of attention from the quality of dwellings to the struggle against the housing shortage, more effort was put into the production of new dwellings. Elimination of the hovels and slum clearance became secondary issues. New housing construction was situated in the urban peripheries, satellite towns, and so-called 'growth cores.' The fixation on new construction meant that in the 1960s portions of the old cities were still deteriorating into slums. An investigation by the Commission

²² 'Opheffing van woningnood schuift steeds verder op' in *De Waarheid*, 14 januari 1969, 1 en 4.

Table 14.3 Number of rooms per dwelling 1899–1971

	Dwellings	With 1 room	With 2 rooms	With 3 rooms	With 4 rooms	With 5 rooms	With 6 or more rooms
	x1000	%	%	%	%	%	%
1899	1091	28.3	30.7	17.6	15.3	15.3	8.1
1909	1237	18.7	29.2	20.0	21.3	21.3	10.8
1920	1366
1930	1824	7.4	14.5	16.3	18.3	18.2	25.3
1947	2117	2.2	8.2	11.4	17.8	24.0	36.4
1956	2546	0.9	4.5	10.4	17.9	28.4	37.9
1971	3873	0.2	1.5	7.9	16.6	38.0	35.9

Source: CBS – Historie bouwnijverheid vanaf 1899

for Slum Clearance and Redevelopment of the Ministry of Public Housing revealed that in 1957 approximately 6% of the housing supply, or 145,450 dwellings, consisted of hovels. The provinces of North and South Holland topped the list with respectively 30,000 and 29,650 hovels. The housing problem was thus far from solved, but it assumed an entirely different aspect in the 1960s. In the statistics the improvements in housing quality became increasingly visible in the growth of the number of rooms per dwelling (see Table 14.3).

The pauperization of the cities was intensified by the growing suburbanisation of the 1960s. By means of redevelopment and ‘city formation’ according to modernist principles, city governments tried to maintain their inner cities as economically viable centres.²³ Growing welfare was responsible for the flight of families with increased purchasing power from the cities. New sustainability issues around residency came to the fore, because, where were these people to live? With this, the housing question and urban development after the Second World War acquired an emphatically spatial dimension.

14.3.2 Expanding Cities 1900–1970

The growth of the cities was governed by two different spatial dynamics. In the first place it was about urban density: how many inhabitants are there per square kilometre? This was closely related to the housing developments just described. A second spatial aspect concerns the expansion of cities and their infrastructures into the countryside. How much land was used for the city and for the infrastructures that connected the cities to each other? Both these spatial aspects were consequential for deliberations about how to use the territory of the Netherlands, for the food supply, industrial development, nature and residence patterns.

²³ H. De Liagre Böhl, *Steden in de steigers: Stadsvernieuwing in Nederland 1970–1990* (Amsterdam 2012), 17.

Table 14.4 Ten cities with the highest population density on January 1, 1850, 1900, 1950 and 2000 (inhabitants per km²)

1850		1900		1950		2000	
× 1000		× 1000		× 1000		× 1000	
Leiden	21.4	Amsterdam	22.0	The Hague	8.5	The Hague	6.5
Amsterdam	13.5	Maastricht	14.4	Utrecht	7.6	Voorburg	6.2
Rotterdam	11.9	Vlaardingen	9.2	Leiden	7.2	Leiden	5.3
Maastricht	10.6	Schoonhoven	9.1	Haarlem	6.3	Haarlem	5.0
Schoonhoven	5.1	The Hague	8.5	Voorburg	5.7	Maassluis	4.4
Breda	4.2	Breda	7.5	Amsterdam	5.3	Amsterdam	4.4
Vlaardingen	4.2	Haarlam	7.1	Groningen	5.3	Cappelle aan den IJssel	4.4
Gouda	4.2	Leiden	6.6	Urk	4.9	Gouda	4.2
Haarlem	4.1	Enschede	6.4	Rotterdam	4.4	Schiedam	4.1
Delft	3.5	Rotterdam	6.1	Bussum	4.4	Bussum	3.8

Remark: The population density depends on the surface area of the municipality. Due to the redrawing of municipal boundaries in the second half of the twentieth century the population density of a number of cities declined. If the population density is expressed as the number of inhabitants in a radius of 25 km, The Hague, Rotterdam and Amsterdam are the cities with the highest population density

Source: P. Ekamper, R. van der Erf and N. van der Gaag, *Bevolkingsatlas van Nederland, Demografische Ontwikkeling van 1850 tot Heden*, (Den Haag 2003), 43–49

Limited housing space and a limited surface area due to city walls and moats made nineteenth century cities very densely populated. This situation was basically the same in 1900 (Table 14.4).²⁴ After changes to the Fortress Law in 1874, the utility and necessity for city walls had disappeared and urban expansion became possible. The national government forced the cities to formulate detailed expansion plans as a condition for acquiring the formerly military zones. This marked the starting point of a more structured approach to urban development, one shaped by the city government in consultation with experts and interested parties. The new urban space on and around the old walls was devoted to the elaboration of traffic and transport possibilities and new utilities like gasworks and electrical power plants. Many railway stations came to be located in the late nineteenth century expansions of the city, just outside the old defensive works.²⁵

The new international ideas about light, air and space, previously applied to the design of dwellings, also seized the imaginations of urban planners. Dutch urban planners were influenced by German handbooks. Around the turn of the century international congresses in London (1906), Vienna (1908), Düsseldorf (1913) and Ghent (1913) contributed to the spread of ideas and knowledge amongst urban planners.²⁶

²⁴P. Ekamper, R. van der Erf and N. van der Gaag, *Bevolkingsatlas van Nederland: Demografische ontwikkeling van 1850 tot heden* (Den Haag 2003), 42.

²⁵L. de Klerk, *De modernisering van de stad 1850–1914: De opkomst van planmatige stadsontwikkeling in Nederland* (Rotterdam 2008), 198–227.

²⁶De Klerk, *De modernisering van de stad 1850–1914: De opkomst van planmatige stadsontwikkeling in Nederland*, 274–289.

The first nineteenth-century city parks like Rotterdam's Maaspark (1853) and Amsterdam's Vondelpark (1865) had become green enclaves surrounded by densely built up neighbourhoods. In the eyes of the improvers of housing conditions these parks were too small. Toward the end of the century they developed a new vision for parks: in addition to offering a touch of nature, they should also provide space for sports and games.²⁷ Renowned architects, naturalists and politicians like J. Kruseman, H.P. Berlage, J. van Hasselt, D. Hudig, C.A. den Tex en Jac.P. Thijsse testified as members of Amsterdam's Housing Council in 1909 that

'parks, green areas and sport facilities are an absolute necessity for every single neighbourhood. Where they have once been established their zoning may never be changed into that of building plots again.'²⁸

In 1908 the Housing Law was amended to allow a zoning specification of 'park'; by 1921 it had become embedded in the law. With the parks, nature was brought into the city. In 1908 Rotterdam's city government pronounced that parks served to compensate the working population for 'the lack of rural, dust-free pedestrian routes and attractive spots.' A year later the director of Rotterdam's municipal public works, G.J. Jongh, presented his plans for parks in the Blijdorpolder and around the Kralingen Lake. The latter consisted of a terrain of 315 hectares the plans for which included not only a park and woods, but also athletic fields, ponds and playgrounds as well as plots for villas and allotment gardens. The cost was estimated at 7.7 million guilders, but according to the director it would result in 'a kind of natural monument, that would be of lasting value to future generations.'²⁹

Around the turn of the century, architects and urban planners in Germany and Great Britain developed ideas for so-called garden cities. In these types of urban expansions there was more room for greenery and private gardens. Socially conscious housing corporations embraced the garden city concept and implemented it in the Netherlands. In the more generous use of residential space they saw possibilities for elevating the working masses. With the aid of architects like H.P. Berlage (Amsterdam and Utrecht), C.J. van Eesteren (Amsterdam), M.J. Granpré Molière (Rotterdam) and W.M. Dudok (The Hague) housing corporations realized garden city neighbourhoods, villages and districts on the outskirts of the large cities. Even middle-sized cities like Hilversum and Apeldoorn were developed according to these concepts. In the expanding industrial cities big firms established new garden towns, like the garden village 't Lansink developed by the Stork company in Hengelo or garden village Heyplaat developed by the Rotterdam Drydock Company as well as the Philipsdorp and Drentsdorp, built by the Philips company in Eindhoven. In the mining region of the (Catholic) province of Limburg the project to curtail the 'socialist threat' and a Catholic parochial structure went hand in hand with the creation of a village structure in the mining colonies, developed by the Catholic housing construction corporations.³⁰

²⁷ K. Bosma et al., *Bouwen in Nederland, 600–2000* (Zwolle 2007), 586.

²⁸ J. Kruseman (secretary), *Rapport over de Amsterdamsche parken en plantsoenen*, commission consisting of H.P. Berlage, J. van Hasselt, D. Hudig, J. Kruseman, C.A. den Tex and Jac.P. Thijsse, *Amsterdamsche Woningraad*, 1909, cited in Klerk, *De Modernisering van de Stad 1850–1914*, 219.

²⁹ Bosma et al., *Bouwen in Nederland, 600–2000*, 595–97.

³⁰ W. Rutten, 'Een archipel van koloniën: Wonen in de mijnstreek,' in A. Knotter, *Mijnwerkers in Limburg: Een sociale geschiedenis* (Nijmegen 2013), 432.

The point of departure for both the creation of new city parks as well as the garden city concept was to bring the joys of nature closer to the urban population. Nature was seen as the counterpart of the urban and as the purveyor of healthy air, rest and space for relaxation. But the paradoxical result of these developments was that the spatial footprint per urban household increased, with the consequence that the cities laid an ever-increasing claim on space, a development that proceeded at the cost of the landscapes surrounding the cities.

During the interbellum, urban expansion plans were aimed not only at the city, but more and more pointedly at the surroundings as well. The national road plan designed by engineers in the 1930s was the occasion for the first spatial reconnaissance of the Netherlands as a whole. Urban planners developed ideas for a National Plan ‘that indicates the land-use of the Dutch territory and that aims to promote the harmonious development of the surface of our country along pre-determined lines’ in the words of the urban planner F. Bakker-Schut in 1937.³¹ During the German occupation these centralistic spatial planning ideas acquired an institutional grounding in the State Service for the National Plan, established in 1941. The service was mandated to develop national plans for different facets of the ordering of the national territory. This included planned spaces for nature, traffic, built-up areas, agriculture and industry. By way of preparation, the service made lists of areas of special scientific or landscape significance and compelled municipalities to report land transactions and activities in those areas.

This centralist approach came under fire from lower levels of government that wanted to retain their municipal development plans and their regional structure plans. After the war, ideas about central planning and the rule of expertise acquired wider currency. In the economic sphere this was visible in the founding of the Central Planning Office in 1945. National plans in the domain of spatial planning first appeared in the form of a Building Plan and an Industrialization Memorandum in 1949. According to this memorandum the best chances for economic recovery were to be found in the large cities in the west and in the industrial regions of Twente, Brabant and South Limburg. The accompanying Building Plan described how the still scarce building materials should be distributed among these regions.³²

In 1956, the spatial planners at the State Service for the National Plan assessed the effects of existing policy in a report entitled *The West...and the rest of the Netherlands*. It described the exodus from Zeeland, Limburg and the northern provinces. The study provided the impetus for a first government memorandum on spatial planning, that appeared in 1961. The document aimed at ‘a balanced development of our country as a whole.’ The plan anticipated a redistribution of economic activities, thanks to which the boundaries between ‘the west’ and ‘the rest of the Netherlands’ would become more vague.

The policy of regional economic stimulation proved to be a success, not least thanks to economic developments in the 1960s. In the middle of that decade the

³¹F. Bakker Schut cited in H. van der Cammen and L. de Klerk, *Ruimtelijke ordening: Van grachtengordel tot vinex-wijk* (Utrecht 2003), 157.

³²Cammen and de Klerk, *Ruimtelijke ordening*, 207.

CBS calculated that with this kind of growth in the economy and in welfare the population would number about 20 million by the year 2000. The population of the 'Randstad' (the horseshoe-shaped urban cluster in the western part of the country) would grow from 5.5 to 9 million inhabitants. These predictions caused much consternation and precipitated a flood of regional and national plans. In response to the different ideas, the government published its second spatial planning memorandum in 1966, with concern for a broad quality of life.

'Our country has entered a phase in which more than in the past the government and society must take to heart a concern for the maintenance of a good living environment.'

The spatial plans opted for so-called 'bundled de-concentration,' an effort to spread suburbanisation to smaller centres in urban zones around the big cities. The metropolitan district became the new spatial unit for planning.³³ The plan reserved a remarkable amount of space for nature and recreational landscapes. The spatial planners expected that increasing leisure time would lead to 'a recognition of the creative possibilities of the natural environment.' In these spatial plans nature thus acquired a new, specifically recreational function.³⁴

The implementation of the memorandum was institutionally supported by the Law on Spatial Planning enacted in 1965. This law defined the frameworks for the different planning levels of municipality, provinces and national state. Following the subsidiarity principle - decentralize what can be decentralized - the centre of gravity of planning came to rest with the municipalities. With their zoning plans they shaped the local space. The provincial regional plans harmonized the supra-municipal functions of the region. National plans described zones for housing, working, agriculture, recreation and nature. In addition the law provided for harmonisation of procedures for permissions and protests at all levels.³⁵

This spatial policy was in part responsible for steering Dutch urban development away from the kind of dense metropolitan spatiality characteristic of London or Paris. In the Netherlands population growth was spread out over many cities that were closely tied together by roads and railroads.

The urban density in the centres of the old cities stood at about 150–200 dwellings per hectare around 1970. Post-war outskirts had densities of 75 dwellings per hectare and in smaller settlements the housing density stood at about 25–30 dwellings per hectare.³⁶ Urban and infrastructural development claimed ever more space in the course of the twentieth century. Between 1900 and 1970 this increased from 2 to 6% of the national surface area.

The planning of space had originated around the planning of national infrastructures like roads and canals. Subsequently attention shifted to a fair distribution of economic development throughout the country. In the 1960s the idea took hold that space was becoming a scarce commodity. It became necessary to think about how

³³ Cammen and de Klerk, *Ruimtelijke ordening*, 208–215.

³⁴ H. Meyer, *De staat van de delta: Waterwerken, stadsontwikkeling en natievorming in Nederland* (Nijmegen: Van Tilt 2016), 132.

³⁵ Cammen and Klerk, *Ruimtelijke ordening*, 177–78.

³⁶ Verstedelijingsnota 1976.

to apportion space among the various needs and desires of society. In spatial terms, improvements in housing quality and in material prosperity tended to be made at the cost of heath meadows and sand drifts. These fell prey to urbanization, agriculture and forestry (Figure and Table 13.1).

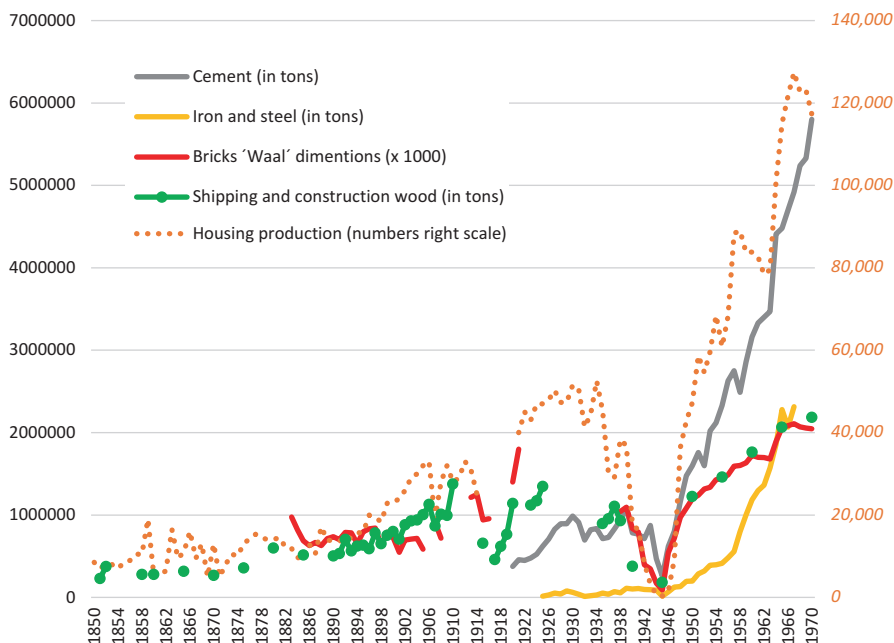
14.4 The Demand for Building Supplies and Construction Materials

The construction of infrastructures and housing had not only a spatial, but also a material dimension. Building activities were responsible for an enormous increase in the use of building materials. Where did these enormous quantities of building materials come from? Which societal organisations shaped the procurement and production of the building materials that made housing construction and urban development possible? How did the procurement and production of these materials influence changes in natural capital domestically and abroad?

Clay, sand, gravel, bulk ceramics (including bricks and roof tiles), stone and wood were the dominant materials in 1913. In 1970 construction materials were also part of the sizeable material flows. Concrete, concrete products and cement had relegated the role of clay and clay products to a second place. Together with raw metals and chemical products they formed a broad spectrum of material flows within the industrialised society of the Netherlands.

The use of building materials and activities in the sphere of public housing exhibited a parallel upward development (Graph 14.3). Though building materials were not used exclusively for housing construction, the large scale of this activity shaped the demand. In addition to the increasing use of classic building materials like wood and bricks, the use of concrete and later steel became ever more prominent. These developments were the result of the application of new building methods and changing use of materials. An increasing proportion of construction work - especially after the Second World War - was carried out in concrete, composed of cement, sand and gravel.

Only a portion of the necessary building materials were produced in the Netherlands. The domestic production of building materials consisted around 1900 above all of clay products like bricks for buildings and streets, and roof tiles. During the 1920s this was supplemented by domestic production of cement at the marl pits near Maastricht and of steel at the Hoogovens in IJmuiden. With the increasing use of concrete, domestic production of gravel also increased sharply. The extraction of clay, marl and gravel had, above all, local implications for the immediate surroundings. This was not the case with imported building materials, like wood, iron and a portion of the cement. These influenced natural capitals elsewhere. The First World War made the dependence on these materials painfully clear. This had diverse consequences for construction in the Netherlands and the development of the domestic building materials industry.



Graph 14.3 Utilization of wood, bricks, cement, iron and housing production in the Netherlands, 1850–1970

Source: wood – trade statistics for various years; G.B. Janssen, *Baksteenfabrikage in Nederland, 1850–1920* (Zutphen 1987); J.A. de Jonge, *De Industrialisatie in Nederland Tussen 1850 en 1914* (Nijmegen 1976), 497–501; Joh. de Vries, *Hoogovens IJmuiden, 1918–1968, Ontstaan En Groei van een Basisindustrie* (Amsterdam 1968); J.C.A. Everwijn, *Beschrijving van Handel en Nijverheid in Nederland* ('s Gravenhage 1912)

14.4.1 Wood Production and Resources from Foreign Forests

Prior to the First World War the Dutch building sector was heavily dependent on imports. Resources like wood, cement and iron were found elsewhere. What was the origin of these raw materials and how were they processed in the Netherlands?

Among the most common traditional building materials was wood. But for a long time the Netherlands had little (remaining) forest. Forest acreage in 1900 amounted to a bit less than 268,000 hectares, about 8–9% of the country's total surface area. This was 0.05 hectare of forest per inhabitant. This made the Netherlands, together with Great Britain (3.9% forest cover and 0.03 ha/inhabitant) and Denmark (6.3% forest cover and 0.10 ha/inhabitant) one of the least forested countries of Europe.³⁷

Since the mid-nineteenth century forest acreage was on the increase again in connection with projects to reclaim the wastelands; the sand drifts and heathlands

³⁷Data CBS – statistics land use and A.G. Malcom, *De houthandel van Nederland* (Rotterdam 1930), 13.

(see previous chapter). Private and public organizations like the Heidemij (1888) and the State Forest Service (*Staatsbosbeheer* 1899) coordinated the planting of new forest. At its founding the State Forest Service had assumed responsibility for 2000 hectares of forest and more than 10,000 hectares of so-called wastelands. Making these lands profitable was in fact the main purpose of this organisation.³⁸ Nature conservationists and the ANWB tourist organisation also welcomed the cultivation of new forest by the state. Together with a number of foresters they advocated the planting of a natural forest with a variety of hardwoods and pines. Their plea fell on receptive ears and this resulted in a program to plant not only fir trees on the sand grounds, but also Douglas spars, the Corsican pine and various kinds of larches. The second director of the State Forest Service, E.D. van Dissel, appointed in 1902, himself anchored concern for ‘natural’ re-forestation in the organization’s DNA. From 1907 until his retirement in 1937, in addition to his leadership of the Forest Service, he was also a board member of the Association for Natural Monuments. This meant that from very early on the executive of the Forest Service had an opening to nature and to natural forests.

The chief activity, however, was still the creation of forests for wood production and the improvement of the soil. Only at extremely unique locations did the service abstain from planting new forest in order to preserve special natural landscapes.³⁹

In 1910 a bit more than half of the Dutch forests consisted of various species of softwoods. For the rest they were composed of 20% oak forest, 8% other hardwoods, 5% reeds and wicker, and 13% other coppice wood. The most important building applications were in carpentry, railroad ties and beams for shoring up mineshafts.⁴⁰ Domestic wood production was limited in relation to the demand for wood, but not unimportant. This became clear during the First World War as imports of wood and coal were throttled. Wood prices soared and people took to the woods in search of alternative fuels. Associations devoted to nature, heritage and tourism applied to the government to take measures to protect the forests and natural beauty. In 1917 the government submitted an emergency law to appease the persistent complaints about increasing logging activities and illicit forays to gather firewood.⁴¹ The law prohibited the chopping of wood in forests of unusual natural beauty, in immature forests and where damage to the wood supply might be expected. The State Forest Service was mandated to issue permits. In 1922 the emergency law was transformed into a permanent one. This was intended to protect forests against plagues, diseases and fire, as well as illegal logging.⁴²

³⁸ M. Coesèl, J. Schaminée and L. van Duuren (2007), *De natuur als bondgenoot: De wereld van Heimans en Thijssse in historisch perspectief* (Zeist 2007), 164–67.

³⁹ J. Buis and J.P. Verkaik, *Staatsbosbeheer 100 jaar: Werken aan groen Nederland*, ed. Fred Dijs (Utrecht 1999), 11–49.

⁴⁰ J.C.A. Everwijn, *Beschrijving van handel en nijverheid in Nederland* (Den Haag 1912), 208.

⁴¹ There had been proposals as early as 1908 and 1912 for a forestry law, especially with a view to preventing plant diseases, plagues and fire. The associated violations of private property had prevented adoption.

⁴² Buis, Verkaik and Dijs, *Staatsbosbeheer 100 jaar*, 51–69.

During the Second World War the Dutch wood supply suffered considerable attrition. The German occupiers forcibly requisitioned more than 4.7 million cubic metres of wood from the Dutch forests. During the so-called ‘Hunger Winter’ of 1944–45, another million cubic metres of firewood disappeared. The annual pre-war wood production of 550,000 cubic metres more than doubled during the war years. In order to satisfy an acute post-war demand for mining wood, permission was granted by the Allied authorities after the war to chop wood in German forests near the border.⁴³ The appraisal of the exact war damage took until 1950. It then transpired that 55,000 hectares (13%) of the Dutch forest acreage had been lost during the war.⁴⁴

After the war, rational approaches gained the upper hand in forestry, just as they had in the broader agricultural sector. Foresters saw it as their obligation to create new forest as quickly as possible in order to satisfy the demand for wood. This was an opening for agrarian, rational and business-economic approaches. Increasing the profitability of forest production was now informed by academic research, as it had long been in the traditional wood producing countries.⁴⁵ It led to an increase of production forests characterized by monocultures, a lack of biodiversity and vulnerability to diseases.

In the end, Dutch wood consumption relied heavily on foreign imports. This was a long-standing tradition. Since the late middle ages wood had been imported via the big rivers and across the sea. By the end of the nineteenth century the famous *Höllander Holzfluss* (Dutch wood-raft) trade with its enormous wood rafts floating down the Rhine, had come to an end. Around 1900 only 1% of the Dutch wood supply (about 10,000 tons) came to Dutch wood vendors via this route.⁴⁶ The decline was an example of ecological over-exploitation causing the demise of a commodity flow. The pirating of the forests around Württemberg on the shores of the high Rhine was stimulated by the increasing demand from the river’s lower reaches, in the industrialising Ruhr and the export to the Netherlands.⁴⁷ Nineteenth century deforestation in Germany led to a focus on *Nachhaltigkeit* (sustainability) in forest management. There was extensive debate on how this might be achieved. Foresters and wood merchants saw sustainability above all in terms of optimization of the production cycle.⁴⁸

In the twentieth century, Dutch wood imports came primarily from the Baltic countries. For the Netherlands, Russia had been the most important source before the First World War; thereafter Sweden and Finland became the main suppliers.

⁴³Up to 1948 the State Forestry Service had been able to recover 550,000 cubic metres of wood from German forests. This was about the annual growth of the Dutch forests and equivalent to 8 years of timber cutting in the 1930s.

⁴⁴Buis, Verkaik and Dijks, *Staatsbosbeheer 100 jaar*, 91–94.

⁴⁵Buis, Verkaik and Dijks, *Staatsbosbeheer 100 jaar*, 100–112.

⁴⁶R. Stenvert, *Kerckappen in Nederland, 1800–1970* (Zwolle 2013), 52–53.

⁴⁷J. Buis, *Holland houtland: Een geschiedenis van het Nederlandse bos* (Amsterdam 1993), 139–40.

⁴⁸J. Radkau, *Holz - Wie ein Naturstoff geschichte schreibt* (München 2012), 229–42.

Table 14.5 Import of wood according to country of origin 1905, 1930, 1962 en 1970 (in kton)

	1905	1930			1962		1970	
	Timber	Timber	Mining wood	Poles	Wood, shaped or simply worked	Poles, pilings, posts & other wood in the rough	Wood, shaped or simply worked	Poles, pilings, posts & other wood in the rough
Russia/ USSR	1,060,944	388,739	29,288	23,132	313,873		108,464	
Latvia		128,715		4063				
Estonia		22,745		158				
Finland		316,952	28,302	427	639,317	15,832	326,691	1557
Sweden	302,496	222,733	2500	10,002	918,055	8082	659,312	19,394
Norway	70,050			1293	7760	2411	7516	1334
Poland		74,393	19,091	7788	28,756		20,606	
Germany	195,694	128,924	85,534	74,572				
GDR					92,762	6964	120,630	37,992
DDR					19,980		20,840	
Belgium	73,524	12,702	3830	11,050	45,828	92,243	27,225	110,500
France			246	242	90,983	917	60,755	313
Austria	13,264				61,529	359	46,143	179
Czechoslovakia			34	384	143,459	76	72,348	72
USA	313,456				19,256		19,172	
Canada					29,588		3400	
Total (world)	2,209,049	1,463,515	168,895	134,288	2,599,020	127,149	1,740,521	172,822

Source: CBS – Jaarstatistiek Handel 1905, 1930 (www.historisch.cbs.nl) en UN Comtrade Database (comtrade.un.org)

(Table 14.5). In the late 1920s the Netherlands was the most important export market for the Finnish wood industry after Great Britain.⁴⁹ In this period the wood trade constituted 90% of Finnish exports. Under the influence of scientific research and Darwinist conceptions, German forestry practices were further developed in Finland. Soil Forestry was optimized thanks to botanic knowledge and new methods of production. Dense monoculture forests were the ideal in which the Finnish forestry authorities and the industrial foresters found common cause. In this context, ‘sustainable forestry’ was redefined as the maximisation of a theoretical growth potential of a particular soil type. The approach consisted of razing contiguous parcels of forest and replanting. Other kinds of forestry like selective felling were discouraged by regulations.

After the Second World War the demand for wood increased even more. In Finland this resulted in further intensification of forest production. By means of

⁴⁹Malcom, *De houthandel van Nederland*, 21.

draining high moors, fertilizing the forests and improving access to the forests for men and machines, the wood yield per hectare was further increased.⁵⁰

In this way, the growing demand for wood from the Netherlands, among others, did not lead to deforestation in the wood-producing countries. But it did have serious repercussions in these regions. The industrialisation of forestry in the twentieth century led to extended forests in monoculture. The original forest was transformed into much younger production forests. This had far-reaching consequences for the decline of local biodiversity, not only because of the monoculture in these woods, but also because of the disappearance of a variegated landscape.⁵¹

The domestically produced wood and the overwhelming share of imported wood was further processed in the Netherlands in sawmills and carpentry shops and in the furniture industry. In 1913 Zaandam was the largest wood import harbour on the European continent. Fifty percent of the Dutch wood import was unloaded here. The supply of wood changed as a result of the foreign industrialisation of forestry. Wooden beams - roughly sawn trunks - were gradually replaced by already sawn wood. For the exporting firms this meant more value added to the export product. In addition, ships could be more efficiently loaded with sawn wood. Waste products like sawdust, pulp and cellulose became raw materials for the paper industry that emerged in the forestry countries.⁵²

14.4.2 *Steel and Cement: Vacillating Support for Basic Industries*

In 1898 the Society for the Promotion of Factory and Trade Industry presented plans for a national steel-foundry. A blast furnace facility would stimulate the development of Dutch shipyards, machine builders and construction firms.⁵³ In 1913 the board of the Society for Industry (*Maatschappij van Nijverheid*) appointed a commission to explore the expansion of cement production.⁵⁴ Dutch neutrality and the troubled supply of materials and resources during the First World War provided a new context for both plans. More than ever before, the Netherlands was thrown back upon its own resources. What would happen to trade after the war? Would not the combatant nations first look to their own needs when it came to raw materials? In an exploration of the post-war situation, the Delft professor I.P. de Vooy's definitely saw chances for a leading position for the Netherlands if rapid measures could be taken

⁵⁰J. Kotilainen and T. Rytteri, 'Transformation of forest policy in Finland since the nineteenth century,' *Journal of Historical Geography* 37 (2011): 429–39.

⁵¹T. Myllyntaus and T. Mattila, 'Decline or increase? The stading Timber stock in Finland 1800–1997,' *Ecological Economics* 41 (2002): 271–88.

⁵²P.J. Middelhoven, *Hout en trouw: De geschiedenis van een familiebedrijf de wed. stadlander en middelhoven H = houthandel te Zaandam* (Zaandijk 1975), 55.

⁵³J. de Vries, *Hoogovens IJmuiden, 1918–1968* (Amsterdam 1968), 23–29.

⁵⁴A. Heerding, *Cement in Nederland* (IJmuiden 1971), 72–75.

to invest in industrial and infrastructural activities. But he had doubts about the 'general feeling regarding the big technical-economic, and thus above all national, problems.' He referred to the Zuiderzee Works, the electrification of the country, the founding of a national cement industry, steel plants and rolling mills, exploitation of subsoil assets, the industrialisation of the Dutch East Indies and the expansion of domestic road and waterway networks.⁵⁵ De Vooy was enthusiastic about a Dutch steel foundry. The state was obliged to support this project financially:

We have started to exploit our coal fields... But for years now the lack of blast furnaces has kept just as many engineers busy as the reclamation of the Zuiderzee... Both stimulate the creative urge to provide for the future by undertaking a large enterprise.⁵⁶

Prohibitions on export of iron and steel products to the Netherlands by both England and Germany placed the plans for a Dutch blast furnace facility in an entirely new light. Under the leadership of the chairman for the state commission for the distribution of iron and steel, the engineer-entrepreneur H.J.E. Wenckebach, plans were developed during the war for the founding of an iron and steel plant. In the plans for the facility Wenckebach not only included the production of iron and steel, but also the exploitation of other material flows like the production of cokes gas and cement using blast-furnace slag. By early 1917 the plans were ripe for financial negotiations with firms and banks. The latter particularly insisted on financial participation by the state. After tough negotiations and parliamentary debates, the Government Gazette of July 1918 was able to announce state financing for the blast furnace facility.⁵⁷ A lobbying effort by the metalworking industry had been able to convince the banks and the government to risk an investment of 11.3 million euros (160 million euros at current value) for the blast furnace facility. The government guaranteed 30% of the investment.

In 1919 the first harbours were excavated at the site of the future blast furnaces in IJmuiden. In 1920 the site was connected to the Haarlem-Uitgeest railway line and construction was started on the first blast furnace. On January 22, 1924 the first blast furnace was ignited and the production of Dutch raw iron and steel could begin.

Considerably more effort was needed to establish a national cement industry. There had been some modest attempts to mine marl and establish a cement factory.⁵⁸ In 1919 the government installed a commission to study the chalk and cement problem. This commission charged the Government Service for Exploration of Subsoil Resources (*Rijksopsporingsdienst van Delfstoffen*) with investigating the commercial feasibility of mining chalk in Limburg.⁵⁹ In 1921 the commission published a provisional report recommending a state-run cement factory. But it was critical of

⁵⁵A. Heerding, *Cement in Nederland* (IJmuiden 1971), 72–75; I.P. de Vooy, 'De economische taak van den ingenieur na den oorlog' in *De Ingenieur* 32 (1917), nr 33, 597–611, (quote p. 600).

⁵⁶I. P. de Vooy, 'Het hoogovenplan' in *De Ingenieur* 33 (1918), nr 14, 243–244.

⁵⁷J.J. Dankers and J. Verheul, *Hoogovens 1945–1993: Van staalbedrijf tot twee-metalenconcern* (Den Haag 1993), 19–32.; Heerding, *Cement in Nederland*, 85.

⁵⁸Heerding, *Cement in Nederland*, 60–69; A. Nieste, *Van mergel tot cement: 70 jaar ENCI, 1926–1996* (Maastricht 1996), 17–25.

⁵⁹Heerding, *Cement in Nederland*, 71–93.

the quality of the raw materials in the Limburg subsoil, despite successful experiments during the war.⁶⁰ During the economic recession of the early 1920s the possibility of financing by the government also receded from view. The debate had a welcome side-effect. In response to the proposed exploration, foreign cement vendors lowered their prices in the Netherlands, aiming to undermine the founding of a domestic cement factory.

During the interbellum, Belgium developed into an important cement-exporting country, with a share of world trade amounting to 17–26%. In the Netherlands, cement cartels and suppliers from Belgium, Germany, England, France, Switzerland and Austria and even Poland fought for a share of the Dutch market. In 1925, during this battle for a market share, a Belgian-Swiss consortium applied for permission to set up the First Netherlands Cement Industry (ENCI) at the Sint Pietersberg in Maastricht.

The establishment of the cement factory and the mining of marl in an open pit was not uncontested. The Natural History Fellowship in Limburg protested vehemently. The polemic issued in a petition against a permit for the ENCI, a situation that brought the question before parliament. In subsequent negotiations the factory reached agreements with the city and the local planning board, but the Ministry of Education, Arts and Sciences kept making additional demands. This led to revision and modification of the permit, such that a number of historically valuable ruins were protected and a wooded hillside of the Sint Pietersberg was retained in order to partly hide the unsightly excavation. The permit was finally issued in 1925. In January 1927 construction on the factory commenced and in 1928 the first cement oven was fired up.⁶¹

With the founding of the ENCI the Netherlands became less dependent on the import of cement. The locally produced cement was used to make cement mortar, but chiefly for concrete. After the Second World War concrete became a favourite building material. Between 1958 and 1970, concrete production rose from 460,000 to 6.6 million cubic metres. Relative to the total national surface area, Dutch use of concrete in this period exceeded that of Belgium and Germany. In 1970 53% of the concrete was used for housing construction, 36% in utility construction, 8% in hydraulic engineering and 3% for road construction.⁶²

The increasing demand for concrete had consequences for the Dutch landscape at those locations where marl and so-called additive materials like gravel and sand were found. In addition, ENCI was among the industries with the highest level of carbon dioxide emissions. That was also the case for the Hoogovens. In the final decades of the twentieth century this point became an element in discussions about sustainability. The transformations in the landscape had become an item on the societal agenda much earlier.

⁶⁰Quote from 1924 by Prof. J.A. Van der Kloes, founder of Dutch cement testing, cited in Heerding, *Cement in Nederland*, 65.

⁶¹Heerding, *Cement in Nederland*, 91–105; Nieste, *Van mergel tot cement*, 28–29.

⁶²A.A. van der Vlist, *Tussen cement, zand en grind... en beton: 50 jaar betonmortelindustrie in Nederland, 1948–1998* (Driebergen 1998).

14.4.3 *Gravel Pits and Marl Quarries, What Is Lost?*

The discussion about the ENCI pit flared up again in 1948 after new proposals to expand the excavations. Once again local administrators and the company stood on opposite sides of the fence. Municipal, provincial and national advisements by the State Service for the National Plan, founded in 1941, hindered further expansion of the pit. In 1946 this agency had pronounced the Sint Pietersberg to be a protected nature zone. Local cultural and conservationist interests appeared to be blocking the expansion.

As an alternative for ENCI's expansion plans, the State Service for the National Plan developed the 'Valley Plan.' This was a proposal to excavate portions of the Margraten Plateau near the town of Sibbe, nine kilometres northeast of the ENCI pit. ENCI had also studied this location during the war, but had concluded that such a relocation was not economically feasible. In 1948 new negotiations about the extension of the existing permits took place among ENCI, provincial authorities and representatives from the Ministries of Reconstruction and of Education, Culture and Science. After long and difficult negotiations, the 'Valley Plan' was dismissed. What followed was a new expanded 60 year concession at the existing location with an annual ceiling of 600,000 tons. Permission was also given to excavate the wall created earlier between the Meuse and the pit so that the factory could expand further. By way of compensation, terrain to the west of the pit would be spared and there would be an investigation into the cultural history of those marl caves that were to succumb to the excavation. Finally a plan would be developed concerning the condition of the pit after marl mining had been terminated.⁶³

The discussions about the conditions for granting a permit were unusual for the time. The duration and acerbic quality of the debate were probably due to the proximity of the city of Maastricht and the historical role of the Sint Pietersberg. In addition, the deliberations were shaped by chance occurrences and local, sometimes even individual interests. The controversy around the excavations was above all a local problem. The huge demand for cement made it into a national interest.

The intensive building efforts relating to post-war reconstruction and the struggle against the housing shortage brought the procurement of building materials and their coordination more forcefully into the national political arena. This became clear in relation to the delving of gravel - next to cement a second important raw material for making concrete. In the flat countryside and close to rivers, gravel pits quickly became lakes, resulting in loss of land and effects on water management. Prior to the turn of the century the use of the land was the business of the owners. From the mid-nineteenth century on, gravel mining in the rivers was controlled by the need for permits and by rules policed by the *Rijkswaterstaat*. In the early twen-

⁶³ Nieste, *Van mergel tot cement*, 45–64.

tieth century new hydrological insights placed ever more restrictions on gravel mining in the rivers themselves. The gravel industry shifted its activities to the floodplains and to sites in close proximity to the rivers.⁶⁴

In 1950, in view of the enormous demand for materials, the Minister of Reconstruction and Public Housing concluded that the existing regulations for sand and gravel extraction were inadequate. He proposed to make the State Service for the National Plan responsible for coordinating the winning of sand and gravel. In the course of parliamentary debates, a few parliamentarians pointed out that decisions about sand and gravel extraction addressed not only a material question, but that recreational and natural values had to be taken into consideration as well. But the plans were above all economically motivated: in the words of the responsible minister, ‘as concerns this sand winning, its costs (may) not be so high as to force the land prices for public housing to rise to intolerable levels’.⁶⁵

In 1951, in response to the proposed changes, the Minister of Transport and Public Works appointed an inter-ministerial commission to investigate the question of sand and gravel extraction.⁶⁶ In February 1953, only a few days after the flood disaster in the southwest Netherlands, the Communist newspaper *De Waarheid* reported on clay and sand pits in the river area near Culemborg:

Agricultural land is being exported with permission from the government. While in the southwest of our country, thousands are fighting for every centimetre of land that can be salvaged from the sea, while in the reclamation of the Zuiderzee 17,000 to 18,000 guilders are spent in order to wrest a hectare of land from the sea, at Culemborg 78 hectares of floodplains have been sold in order to be excavated. This is an inestimable loss for our country. This concerns excellent river clay, one of the most fertile soil types that we have.⁶⁷

The owner of this land had sold it to an excavating company that exported to Belgium. But everything had been done quite legally. National, provincial and regional authorities were stalemated. The *Waarheid's* true interest was the tenant farmers who were being driven from their fields by landowners and dealers in sand in what they called a ‘capitalist chaos.’ The paper pinned its hopes on ‘engineering circles’ who would propose a national sand mining plan in which sand would be mined at one central location. Opponents of these plans pointed to the differences in

⁶⁴H. van Heiningen, *Diepers en Delters: Geschiedenis van de zand en grindbaggers* (Zutphen 1991), 259–322.

⁶⁵Minister cited by parliamentarian Ten Hagen in *Handelingen der Tweede Kamer 1950–1951*, 30^{ste} Vergadering, 7 December 1950, 812.

⁶⁶*Handelingen der Tweede Kamer 1951–1952*, Kamerstuk Tweede Kamer 1950–1951 kamerstuknummer 1900 IX A ondernummer 15, Memorie van Antwoord, Rijksbegroting voor het dienstjaar 1951 (Wederopbouw en Volkshuisvesting), 18–19; *Handelingen der Tweede Kamer*, Algemene Beschouwingen, Bijlage A Tweede Kamer, Rijksbegroting van het dienstjaar 1951, 1900 IX B (Verkeer en Waterstaat), V 202, 50.

⁶⁷‘Met toestemming van regering worden cultuurgronden geëxporteerd’ in *De Waarheid*, Februari 14, 1953, 3; ‘Kostbare kleilaag afgegraven omdat Belgen zand willen’ in *De Waarheid*, May 16, 1953, 4.

sand qualities and the special properties of river sand and gravel. According to the paper such a decision ‘could best be left to the engineers. They have no ‘mushy’ plans in their head.’⁶⁸

The reports of the excavations at Culemborg led to parliamentary questions being put to the Minister of Transport and Public Works about possibly putting a stop to the gravel mining there. In view of the existing legal framework, the minister regarded this as impossible. He added that new statutes were in the making.⁶⁹ After this, discussions about excavations flared up repeatedly in response to new planned mining announcements and rumours.

After gravel mining had been relocated to the floodplains, the province of Limburg had become the most important supplier of gravel. In 1938, in order to acquire a say in the mining activities, the province formulated an ‘ordinance against the infringement of natural beauty by excavating or digging in the ground.’ Halfway through the 1950s the provincial authorities modified the ordinance to require refilling of the gravel pits. The gravel companies rejected this as an impossible demand due to the lack of sufficient material with which to refill the pits. The province threatened to take the matter to court and with that the debate once again moved to parliament.

In 1958 parliament asked the Minister of Agriculture to formulate a standpoint regarding the loss of agricultural land to gravel mining along the Meuse. The minister determined that gravel mining was undertaken haphazardly and that due to combined sand mining much more land was dug up than anticipated. In view of the scarcity of arable land he ordered an investigation into the economic rationality of gravel mining at a national level. At the same time he expressed a preference for refilling the gravel pits, with the costs being borne by the gravel vendors. According to the minister this would imply a reduction of profits made by gravel miners by 10–30% and a price hike for concrete of 1–3%.⁷⁰ The Catholic Peoples’ Party (KVP) parliamentarian W.J. Drosen welcomed this idea, though he remained critical of the strictly economic approach to the gravel mining:

I assume that gravel mining, from a national economic point of view, is a necessity, but that doesn’t give the nation the right to totally mutilate the Limburg countryside for the future. The modern excavating and dredging machines snatch about 50 hectares of superior acreage from the shores of the broad river Meuse each year, creating enormous disorderly holes up to and soon around the village centres. In order to prevent the destruction of an old and beautiful landscape, the costs of refilling should not be weighed on an analytical balance, but the Netherlands should say: Beloved Limburg, we need your gravel for our construc-

⁶⁸ ‘Ingenieurskringen voor nationaal zandwinningsplan’ in *De Waarheid*, May 28, 1953, 3.

⁶⁹ *Aanhangsel tot het Verslag van de Handelingen der Tweede Kamer*, Deel III, Zitting 1952–1953, nr. 3043, 3069.

⁷⁰ *Verslag van de Handelingen der Tweede Kamer*, Zitting 1957–1958, nr. 4900, ‘Rijksbegroting voor het Dienstjaar 1958, Hoofdstuk XI, Landbouw Visserij en Voedselvoorziening, voorlopig verslag’, nr 11, 20; *Verslag van de Handelingen der Tweede Kamer*, Zitting 1957–1958, nr. 4900 ‘Rijksbegroting voor het Dienstjaar 1958, Hoofdstuk XI, Landbouw Visserij en Voedselvoorziening, Memorie van antwoord’, 37.

tions, but we want to repair your damage, even if that means that concrete will become a few percent more expensive.⁷¹

Fearing a possible stagnation of the gravel supply, the Ministry of Reconstruction and Public Housing initiated mediation between the province and the gravel dredgers. These negotiations led to a levy on gravel which could be used to fill up the pits. The levy of 0.20 euro per ton of gravel and 0.11 euro per ton of sand was enacted in August 1958. The agreement also compelled the gravel dredgers to hand over the empty pits to the province. Using the funds from the levies that were collected in a so-called gravel fund, the province would then take responsibility for filling up the pits and restoring them to agricultural use.⁷²

The provincial authorities settled on mine rock as suitable fill material. The first trials were undertaken after talks with the State Mines in 1959.⁷³ These proved successful and in the 1960s hundreds of tons of mine rock were used to fill up the gravel pits. In 1968 more than 4.5 million tons of mine rock was processed, enough to restore 475 hectares of land. In that year the contract was upgraded to an annual bulk of 3.5 million tons. This was partly made possible by excavating the mine rock hill at the Maurits State Mine, which incidentally made it possible to expand the chemical plants located on the mine site. With this mass of stones another 200 hectares of gravel pits could be refilled.⁷⁴

In 1961, after more than a decade of negotiations by various political interests in inter-ministerial and provincial commissions, no less than six ministers submitted a proposal to parliament for a Law on Subsoil Excavations (*Ontgrondingswet*).⁷⁵ Parliament insisted on strong ties with the Ministry of Public Housing. Parliamentarians also advocated harmonisation with the law on spatial planning that was then in preparation.⁷⁶ The new law was published on October 27th 1965. It harmonised the different provincial regulations. As part of an application for a digging concession, the sand and gravel mining industry was now obliged to submit plans for re-use, accompanied by financial underpinnings. The execution of the permits became a provincial task and was to be aligned with the provincial regional

⁷¹ *Verslag van de Handelingen der Tweede Kamer*, Zitting 1957–1958, 29 session 11 December 1957, 3437.

⁷² Province of Limburg, 'De afronding van het grindfonds', appendix to Letter Provinciale State van Limburg, 4 oktober 2005, onderwerp: Afronding ontgrondingsfonds (via web: <http://portal.prvlimburg.nl/psonline/> accessed 16-8-2012); H.B. Kramer, 'De grintwinning in Midden-Limburg: Een evaluatie van alternatieve winningsgebieden,' *Tijdschrift Voor Economische En Sociale Geografie*. 58, nr mei/juni (1967), 113–125.

⁷³ Soil mechanics reports by T.H. Huizinga in 1942 had proven the suitability of these materials for dikes and banks.

⁷⁴ 'Afgraving steenberg Maurits levert materiaal voor vulling van 200 ha grindgaten in Midden-Limburg' in *Nieuws van de Staatsmijnen*, Oktober 25 1968, 8.

⁷⁵ *Handelingen der Tweede Kamer*, Zitting 1960–1961, 'Regeling omtrent ontgrondingen (Ontgrondingswet), Memorie van Toelichting', nr 6338.

⁷⁶ The law on spatial planning entered into force in June 1961.

plans.⁷⁷ The incorporation of the proposals into provincial regulation took another few years. While discussions and provincial planning continued, the Law on Subsoil Excavations silently came into force on September 1, 1971.⁷⁸

The nature of the discussion gradually changed. Acquisition of materials, water management and agrarian interests had motivated the law, but the creation of recreational areas now also became a growing consideration.⁷⁹ This became visible at the presentation of the regional plan for gravel mining locations by the Limburg provincial authorities in 1969. In the ensuing discussion new actors came to the fore. At the behest of municipalities along the Meuse River, H.B. Kramer, a geographer at the Catholic University of Nijmegen, had executed an economic cost-benefit analysis of the provincial proposals. On the basis of these - for that time modern - calculations, he was able to propose an economically viable alternative in which the gravel pits along the Meuse would be transformed into an 'international' centre for aquatic sports. This could produce new economic activity, certainly desirable in view of the immanent closure of the mines. Kramer concluded that filling in the gravel pits and restoration of the agrarian function had become less relevant in view of agricultural developments in a European context. The cost-benefit analysis revealed the economic advantages of continued gravel mining along the Meuse and the transformation of the region into a zone for aquatic sports with 'international allure.'⁸⁰

The provincial council was receptive to these arguments and consulted the tourist organisation ANWB and the Royal Dutch Yachting Association (KNWV). In 1971 these organisations published a voluminous joint report exploring the possibilities for aquatic sports in the gravel pits. According to both organisations there were good chances for this region that in the past had only very limited possibilities for waterborne recreation. The proximity of Germany was regarded in this connection as an extra plus. The gravel pits as new nature zones with unique economic possibilities would support the economic development of the region.⁸¹

After 1970 contracts for gravel mining in Panheel were signed by the gravel mining companies and the province. The agreements also included a twenty-year moratorium on gravel mining outside of the planned zone.⁸² The 1970s were the high water mark for gravel dredging in Limburg. The activities were not without consequences. Gravel hunger transformed the landscape around Roermond and at many places along the Meuse.

⁷⁷The figures are mentioned in: *Tweede Kamer zitting 1963–1964* no. 6338, 'Memorie van Antwoord, Regelen omtrent ontgrondingen (Ontgrondingenwet), Wijziging van de onteigeningswet: Wijziging en aanvulling van de Rivierenwet', Submitted 20 april 1964, 2.

⁷⁸*Handelingen der Tweede Kamer, Zitting 1973–1974*, 'Aanhangsel tot het verslag van de Handelingen der Tweede Kamer', Vragen nr 840, 1681; P. Ike, *De planning van ontgrondingen* (Groningen 2000), 31–41.

⁷⁹*Handelingen der Eerste Kamer, Zitting 1965–1966*, 'Regeling omtrent ontgrondingen (Ontgrondingwet), etc.' 3^e vergadering 5 oktober 1965, 23.

⁸⁰Kramer, 'De grintwinning in Midden-Limburg'.

⁸¹ANWB en KNWV, 'Grintgaten in Limburg' (Den Haag 1971).

⁸²Kramer, 'De grintwinning in Midden-Limburg'.

14.5 The State, Construction and Well-being

Since time immemorial, construction consisted of short supply and command chains among purveyors of raw materials, builders and clients. Building materials were transported directly to the construction site, as in the case of sand for raising the ground level, or processed and then transported to the construction site, as in the case of clay and bricks. In a geographic sense there was often a long supply chain. Many construction materials, for example wood and stone, had to be imported. For the rest, the construction site was a node for the supply of various materials, including wood, mortars and stone. It also resembled a network because the construction site gathered a variety of trades like carpenters, bricklayers and excavation workers who processed these materials.

In the twentieth century the supply chains for mineral substances (construction and building materials) became more and more complex, just like those of bio-materials (agriculture and foods) and fossil substances (energy and plastics). New chains were added, among others those of steel, with new links like the processing of steel in metal products, machines and constructions. Supply chains thus became longer and more differentiated. New actors concerned themselves with the supply chains. The networks around specific links became more ramified. The fundamental dynamic of the supply chains was the increasing size of the enormous flows of materials. This caused tensions and problems in the chain and its environment.

With respect to the issue of well-being and sustainability the role of the state in the construction supply chain was crucial. From the beginning of this period the state was a new and dominant actor. The Housing Law of 1904 gave it directive powers over the construction of public housing. In subsequent decades the state defined the quality of dwellings for the poor and on that basis financially supported housing construction. Together with housing corporations and municipalities it achieved a significant improvement in public housing construction, one of the big issues in quality of life in this period.

The influence of the state extended to other supply chains as well. The First World War had made it clear what the international embargo on raw materials like wood, cement and steel meant for the Netherlands. The same confrontation followed in the Second World War. During both wars the state did its best to allocate flows of materials. Post-war reconstruction also demanded government steering in order to prevent a descent into chaos.

During peacetime, the state made efforts to diminish the vulnerability of material flows, among other things by creating the prerequisites for a more independent position vis a vis foreign suppliers. After the First World War it co-financed the iron and steel plant Hoogovens, which reduced Dutch dependency on foreign suppliers to 5% of the total market. Dependency on foreign suppliers of natural stone (in particular marl for making cement) decreased: imports declined from 100% in 1913 to 68% in 1970. Dependency on foreign gravel also decreased: imports declined from 67% in 1913 to 47% in 1970 (Table 12.8). It should be noted that the latter develop-

ments were the result of initiatives by private entrepreneurs. Nonetheless here too the state played an important role. It intervened in local conflicts around the extraction of raw materials in order to guarantee a stable supply. The Excavation Law of 1971 became the legal framework within which the state, the provinces and other parties would solve conflicts in the future.

The local conflicts and state interventions had to do with the interests of raw materials extraction, agriculture, recreation and landscape. In the 1920s landscape conservation became an issue in the marl excavations in Maastricht. Later, during gravel dredging, priorities shifted from agrarian interests to that of recreation and landscape conservation. Limburg became the territory in which national and local interests were weighed in the balance. Landscapes were sacrificed for the material needs of housing, utility buildings, roads and the Delta Works. Zeeland was wrested from the sea while Roermond changed into a centre for aquatic recreation, a win-win situation for safety and the economy.

Ultimately the state was also confronted with the consequences of the construction agenda in this period. The expanding cities and the building of infrastructures infringed increasingly on the available space. That provided fertile soil for conflicts. It was the first time that politicians and national policy makers had the feeling that, in an incoherent fashion, the Netherlands was becoming 'full' of buildings and constructions. Residential quality, the human environment, economic capital and natural capital had to be weighed in claims on space. The Law on Spatial Planning of 1965 created the legal framework in which discussions on well-being and sustainability were to be carried on.

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