Rijkswaterstaat
Ministry of Infrastructure and Water Management

Annual report Rijkswaterstaat 2017

Cover photo:
Secondary channel at Spiegelwaal near Lent

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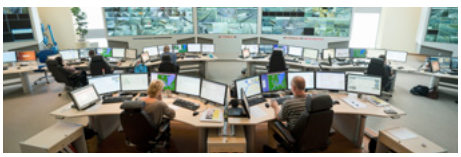
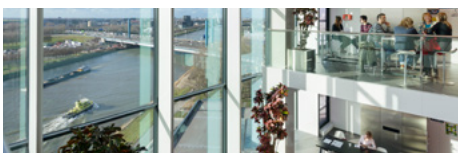




Rejuvenation, renewal, sustainability

Dutch society in 2017 was brimming with confidence and dynamism. The economy was expanding, and we were spending more, travelling more and moving more goods. Our lifestyles were also becoming more sustainable and increasingly data-driven.

How do you make the country safer, more liveable and more accessible in buoyant times like these? This annual report shows how Rijkswaterstaat goes about the job.

The way we work with nature, for example. Sand and silt are our favourite building materials. We use them to strengthen the coastline and dikes. And in the Markermeer we are even building a little island kingdom, with space for new nature.

In 2017 we also gave the rivers more room. We engaged with local residents in carrying out these projects. This is the approach we want to take to boost the quality of life. Together we can make this country safer and more attractive, with more room for nature.

Greater mobility also calls for sustainable solutions involving local residents. In 2017, 14 new sections of road were added to our road network. Each was carefully designed to fit into the landscape. We can now see the results at the Gaasperdammerweg. Here, the A9 motorway disappears beneath a beautiful urban park. Traffic flows more smoothly, and the city is greener, with more open spaces.

At the same time we are experimenting with smart technologies. They are helping us to keep traffic moving more smoothly. The same principle also applies to the waterways. In 2017, the Smart Shipping Challenge practical demonstration pointed us in the right direction. Autonomous ships will make the inland shipping sector safer, stronger and more sustainable.

But the most sustainable investment in infrastructure is in good maintenance. Up to 2028 we will be giving more than 80 older bridges and tunnels a thorough facelift. We will try to reduce any inconvenience to a minimum – in close consultation with local residents. And while we are working on maintenance, we will also be preparing our infrastructure for the future. With the latest technological innovations for autonomous cars and modern traffic management.

Rejuvenation, renewal and sustainability. These are the three words that characterise Rijkswaterstaat's strategy in these exciting, dynamic times. Every day, Rijkswaterstaat's 9,200 staff members work behind the scenes to keep the Netherlands safe, liveable and accessible. And for every job that needs to be done, they bring together the right parties: from the business sector, government, knowledge institutions, the general public and civil society.

Rijkswaterstaat's customer-oriented, partnership-driven working methods radiate from every page of this annual report. The picture it presents fills me with pride.

Michèle Blom,
director-general Rijkswaterstaat

1 2017 at a glance

Everyone in the Netherlands wants to live and work in safety behind the dikes and dunes. We want to travel safely and quickly to our destinations. And we want a constant supply of clean water in a country where quality of life is ensured. To achieve these objectives, Rijkswaterstaat had a budget of around 4.5 billion euros in 2017.

Working to ensure that the Netherlands is safe, liveable and accessible: that is Rijkswaterstaat's mission. Most of this country is below sea level. We make it safe by protecting it from flooding. We make it liveable for people and wildlife by carefully designing infrastructure to harmonise with the landscape. And we lay the basis for freedom of movement and prosperity by working on accessibility.

Accessibility by road

Volumes of traffic have been growing steadily since the end of the financial crisis in 2014. People are travelling longer distances more often and there are more goods vehicles on the road. So we'll probably be stuck in traffic jams for longer periods in the years to come. Journey times may increase by 28 per cent between 2017 and 2022. The third Rutte government is investing an extra 2 billion euros in infrastructure to keep the Netherlands on the move. Rijkswaterstaat wants to keep road traffic moving smoothly and safely by constructing additional motorway lanes and through better, smarter use of the roads and better maintenance.

Road construction projects

In the past few years, Rijkswaterstaat laid more than 700 kilometres of asphalt – not only additional lanes to widen busy motorways, but also new sections of road to fill in missing links or improve links in the existing road network. In 2017, we took 14 new sections of road into service and constructed 175 kilometres of additional motorway lanes. We also did the groundwork for projects that will tackle major bottlenecks in the road network in the years to come

The Tacitus Bridge on the River Waal at Ewijk

– starting with the Utrecht ring road, the Blankenburg link, the A13 and A16 near Rotterdam and the link between the A15 and the A12 at Bemmel. The third Rutte government wants to lay at least 1,000 kilometres of extra asphalt between now and 2031.

Facelift for old bridges and tunnels

Good maintenance promotes robust infrastructure and keeps the Netherlands on the move. Technical failure or malfunction leads to inconvenience, traffic jams, unsafe situations and economic losses, and must therefore be prevented. Rijkswaterstaat faces a huge challenge in the next few decades, when major maintenance work will need to be carried out. Many bridges and tunnels date from the '50s and '60s and are now approaching the end of their lifespan.

By 2028, at least 80 structures will need a thorough facelift. Rijkswaterstaat did the groundwork on 40 of them in 2017. In the South Holland region alone, 8 major structures will need major maintenance work. They include the Heinenoord Tunnel, the Haringvliet Bridge and the Van Brienenoord Bridge.

A decision on how to tackle the remaining 40 structures will be taken in 2018. From 2020, the government will raise the annual maintenance budget from 150 million to 350 million euros. Total costs of maintenance work are estimated at around 10.2 billion euros.

Future-proof infrastructure

Rijkswaterstaat will not only be giving bridges and tunnels a facelift. While carrying out this major maintenance work we'll also rejuvenate our infrastructure using smart new technologies that will prevent future malfunctions. And we'll be equipping our roads with the latest high-tech gadgetry to enable smart mobility and smart traffic management. We'll also be introducing other innovations to make our roads safer, more sustainable and more user-friendly.

Congestion plan for 2020

Under the Congestion Plan for 2020 banner, Rijkswaterstaat is also working on smart solutions to prevent traffic jams. For example, in the aftermath of incidents we're ensuring heavy goods vehicles are salvaged more quickly, we're deploying road inspectors at congestion hot spots and opening rush-hour lanes earlier in the day. By providing road users with better traffic information, we help them make smarter choices on the route they take, ensuring more reliable journey times. Under the Congestion Plan for 2020 banner, Rijkswaterstaat is also exploring new solutions for the 34 most urgent congestion hot spots.

Smart mobility

Smart technology is becoming increasingly important in ensuring smooth flows of traffic. Rijkswaterstaat is therefore experimenting with new forms of traffic management, intelligent transport systems and smart traffic information. And we are working with other government authorities,

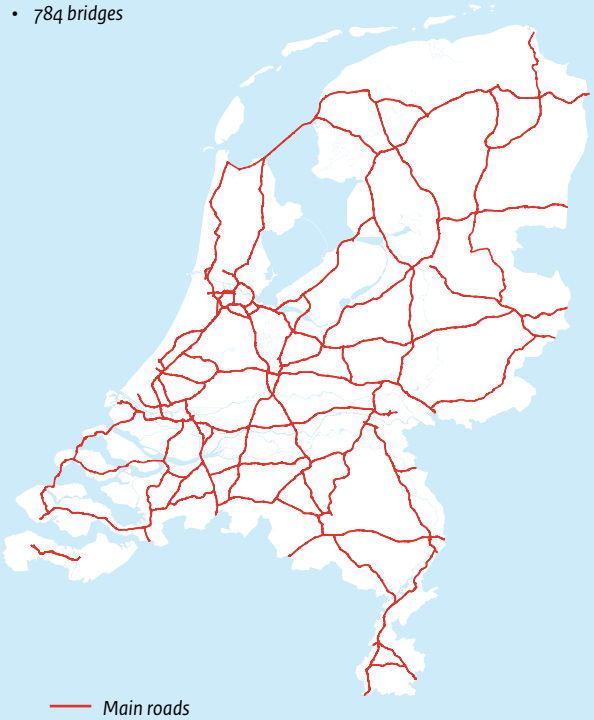
Main waterway network

- *3,437 kilometres of inland waterways*
- *3,646 kilometres of waterways in open waters*
- *91 locks*
- *130 lock chambers*
- *332 bridges*

Main waterways

Main road network

- *3,072 kilometres of motorways*
- *1,677 kilometres of access and exit roads and connecting roads*
- *2,900 viaducts*
- *49 wildlife crossings*
- *27 tunnels*
- *16 aqueducts*
- *784 bridges*



Main roads

market parties and knowledge institutions. This approach creates new opportunities to use our roads and waterways more efficiently, to improve services to road users, and to cut back CO_2 emissions from road traffic.

In February 2017, the government approved a bill encouraging experiments with autonomous vehicles – for example tests with goods and passenger vehicles driving in convoy on automatic pilot using data communications. The first of these tests will probably take place in early 2018. Rijkswaterstaat will act as facilitator.

Main waterway network

Transport by water is an environmentally friendly way of relieving congestion on the roads and railways, so the government wants to boost the inland shipping sector and make better use of the inland waterways as a goods transport network. Rijkswaterstaat is therefore making a major investment in the quality of the main waterway network. Many of the main waterways have been upgraded, widened and deepened in recent years. Locks have been enlarged and bridges reinforced and given greater clearances. Construction of the sea lock at Terneuzen began in 2017 and work on the Beatrix Locks and Eefde Lock was in full swing. In IJmuiden, work is still underway on a new sea lock. Once completed, it will be the largest in the world.

Rijkswaterstaat also wants to improve management of traffic flows on the shipping routes to the European hinterland. Our aim is smooth, safe, uninterrupted journeys. Traffic controllers in the traffic control centres are using an increasing array of new technologies to ensure smooth operation of locks and bridges and to provide vessels with useful traffic information. And to boost development of the shipping sector, Rijkswaterstaat organised the Smart Shipping Challenge in 2017 – a practical demonstration of smart, computerised navigation, operation, loading and unloading systems.

Main water system

Water will pose a major challenge in the decades to come. As a result of climate change and sea-level rise, the Netherlands will need additional protection, in terms of both water safety and water quality. Rijkswaterstaat is working to meet this challenge in the Delta Programme, and in other programmes including the Delta Plan on Freshwater Supply and the High Water Protection, River Maas and Room for the River programmes.

High water protection

The Delta Programme encompasses a whole new flood defence policy. The aim is not only to reduce the risk of flooding, but also to mitigate the possible impact of a water event. In early 2017 it was decided that the Netherlands' flood defences would need to meet new, tougher safety standards. Up to 2050, the water authorities and Rijkswaterstaat will work together to ensure that dikes, dunes and storm-surge barriers meet these new standards.

Main water system

- *90,191 km² of surface water*
- *35 kilometres of dunes*
- *154 kilometres of dikes and dams*
- *10 major dams*
- *5 storm-surge barriers*
- *Afsluitdijk and Houtribdijk*

Rijkswaterstaat mission

Rijkswaterstaat is the executive organisation that sustainably develops and manages the national infrastructure networks on behalf of the minister of and state secretary for Infrastructure and Water Management.

Rijkswaterstaat works on

- sustainable living environment
- protection against flooding
- sufficient clean water
- smooth and safe transport by road and water
- reliable and useful information

Social roles

Rijkswaterstaat manages and develops 3 main infrastructure networks in the Netherlands:

- the main road network
- the main waterway network
- the main water system

Rijkswaterstaat performs its day-to-day management tasks by fulfilling 3 social roles:

- a public-oriented network manager
- a leading project manager
- an effective crisis manager

Up to 2028 we will be strengthening more than 1,100 kilometres of dike and 256 locks and pumping stations in nearly 300 projects throughout the country. Apart from these 'hard' measures, Rijkswaterstaat and the water authorities are also exploring intelligent new ways of protecting the Netherlands from flooding and making it more climate-proof.

Room for the River

These days, high water protection entails much more than strong dikes. It also calls for climate-proof spatial planning, with room for water. In the past 11 years Rijkswaterstaat has worked to achieve this with the Room for the River Programme. In February 2017, the high-water channel between Veessen and Wapenveld was completed – one of more than 30 projects. And in November 2017, we achieved the high-water targets for the Grensmaas project in Limburg. The Maas is now safe from flooding over a length of 43 kilometres. By giving the rivers more room, the Dutch river basin has not only been made safer from flooding, but also more liveable and attractive.

Delta Plan on Freshwater Supply

Rijkswaterstaat is working to achieve a good chemical and ecological status for the Dutch surface waters. They need to meet the targets set out in the EU Water Framework Directive by 2027 at the latest. But this will call for a more effective, more systematic approach and closer cooperation. At the request of the House of Representatives, the Netherlands' water authorities developed a Delta Plan for water quality and freshwater. In our role as water authority for the national waters, Rijkswaterstaat will now tackle water quality across the board – at source, and in partnership with the other water authorities. This approach was fleshed out in 2017 in a new Administrative Agreement on Water, with tangible measures for the longer term.

Sustainability and quality of life

Rijkswaterstaat wants the Netherlands to be a clean, green, pleasant place to live for future generations too. That is why working on a sustainable environment is one of the keystones of our work. In 2017 we made an even firmer commitment to sustainable infrastructure, sustainable water management and a sustainable environment.

In 2017, too, Rijkswaterstaat identified achievement of a circular economy as a priority. Working with our partners in the construction process, we want to turn the Netherlands into a circular economy by 2050. We share knowledge and experience of sustainability more and more intensively. And in designing a lock, bridge or road, we now focus on whether it is sustainable and recyclable.

Within central government, Rijkswaterstaat leads the field in conserving energy and reducing CO_2 emissions. In the land and water areas we manage, we increasingly produce energy from wind, water, sun and even biomass. Rijkswaterstaat's ultimate aim is to achieve energy-neutral infrastructure by 2030.

2 Sustainable living environment

A liveable country, with sustainable accessibility and sustainable water management in which infrastructure is carefully designed to harmonise with the landscape. This is Rijkswaterstaat's ambition for the Netherlands. We work every day to achieve it, using a wide range of measures and innovative solutions and in close partnership with businesses, knowledge institutions and other government authorities.

A clean, liveable, naturally beautiful country for present and future generations. That is the sustainable country Rijkswaterstaat works every day to build by experimenting with new types of partnership and new technologies. We have three main ambitions.

By 2030 we want our infrastructure networks to be energy-neutral and our materials to be fully recyclable, with use of primary resources cut by at least 50 per cent. Our third ambition is sustainable area development.

Wind turbines along the Hartel Canal

Sustainable area development

Rijkswaterstaat works on sustainable area development by carefully designing infrastructure to harmonise with the landscape and the living environment. We engage with local residents, provincial and municipal authorities, water authorities, businesses and civil society organisations and actively involve them in our plans.

Area-based approach

Work on roads, dikes, bridges and tunnels has a direct impact on spatial planning. There are often many different interests at stake. Before starting work, Rijkswaterstaat charts the solutions that will yield the highest dividend in terms of quality of life for residents and other users. And we also look at how we can best work with provinces, municipalities, water authorities, private parties and the public to achieve common goals – both before and during the project. Working with all stakeholders, we choose and combine the various functions to create a safe, accessible area for living, working and spending leisure time.

A liveable river basin

The Room for the River projects are excellent examples of the area-based approach. By working on flood safety in the river basin, we have created many new areas of natural beauty and opportunities for leisure pursuits. In the Noordwaard and Overdiepse Polder we even built houses and farms on artificial mounds so that local residents could continue to live and work in these flood-prone areas.

Safer and more attractive

In 2017, Rijkswaterstaat looked back on 11 years of work on the Room for the River projects. A survey of more than 500 local residents showed that 82 per cent felt that their homes were now better protected from flooding than 10 or 20 years ago. Eighty-four per cent felt that the river basin had become more attractive in the past 10 years; 63 per cent felt that Room for the River had given the local economy a boost, and 82 per cent felt that the programme had encouraged more leisure activities in the area.

Sustainable roads

Sustainable spatial planning also calls for roads that harmonise with their environment. So, where necessary, Rijkswaterstaat constructs sections of road below ground level or, in urban areas, in tunnels. In the A9 Gaasperdammerweg project, we are working on a 3-kilometre long tunnel with a long park on top to link the various districts of Southeast Amsterdam (read also the story at page 16).

Sustainability is also key in constructing the Schiphol-Amsterdam-Almere corridor. In this project, we are installing higher noise barriers along most of the route, and surfacing the road with low-noise, double-layer very porous asphalt concrete. The A6 between Almere Havendreef and Almere Buiten-Oost will be the first energy self-sufficient motorway in the Netherlands.

Cooperation for healthy cities

City dwellers, too, are entitled to live, work and enjoy their leisure in a healthy environment. Working with the municipal authorities, knowledge institutions, businesses and civil society organisations, Rijkswaterstaat is exploring smart opportunities to make cities healthier, improve air quality and cut noise nuisance.

Sustainable cycle routes

Working with the Netherlands Organisation for Applied Scientific Research (TNO), Rijkswaterstaat has developed a handy little gadget for cyclists in the Eindhoven area. The gadget contains an air-quality sensor and a gps receiver enabling cyclists to measure and register air quality on their daily commute. In the future they will be able to use this information to choose the healthiest route through the city. Rijkswaterstaat is working with the municipal authorities of Rotterdam and Schiedam to improve and enlarge the crossings above and beneath the A13 and A20 motorways and link them to the local cycle-path network.

Climate-proof cities

Working with the cities of Zwolle, Enschede, Hengelo and Almelo, Rijkswaterstaat is studying ways of proofing urban areas against the impact of climate change. In Dordrecht, too, Rijkswaterstaat is looking into climate-proof development of open spaces, with roof gardens, parks below ground level and surface water flanked by nature areas. Measures like these will help cities cope with extreme heat, drought and flooding.

Sustainable city centre

A new city district is emerging behind Utrecht Central Station. Rijkswaterstaat is helping the municipal authorities to make this district sustainable, with a healthy combination of homes, workplaces, clean transport and leisure facilities. The city talked to residents and visitors, asking them to 'look beyond their horizons'. The feedback will be used as a basis for the municipal spatial development policy strategy. The talks were also the first in a series of consultations with local residents, which must lead to the completion of this new, sustainable district in the centre of Utrecht by 2030.

Circular economy through sustainable use of materials

Rijkswaterstaat is strongly committed to the circular economy. The challenge is to make all the material from the land and waters we manage part of the sustainable cycle and to reuse it.

Central government agencies want to cut their use of primary resources by at least 50 per cent by 2030. As the country's major client for civil and hydraulic engineering projects, Rijkswaterstaat can make the difference. We encourage our contractors to work with sustainable materials and to cooperate with us in developing sustainable new working methods.

Sustainable asphalt

Road surfacing and maintenance account for nearly a quarter (23 per cent) of Rijkswaterstaat's carbon footprint. Increasingly, therefore, we are using sustainable asphalt. It is produced at a relatively low temperature and emits 25 per cent less CO_2 than traditional asphalt. And it comprises around 60 per cent recycled material. On an increasing number of roads, the lifespan of existing asphalt is being extended using an asphalt rejuvenator. These roads need to be resurfaced less often, which radically cuts the costs of maintenance and reduces the impact on the environment.

Recyclable viaduct

In 2017, Rijkswaterstaat worked with a number of building contractors to design a recyclable viaduct. The viaduct is built up of modules, so that it can be disassembled without producing waste. It can be reduced to raw materials, which can be used to build a new structure. This viaduct shows that we can now build fully recyclable infrastructure. The design is a prototype with which we aim to challenge the market to come up with newer, better versions of recyclable structures. The viaduct will probably be built somewhere in the Netherlands in the next few years.

Trial with plastic harvester

Early 2017 marked completion of a trial in the North Sea with the Ocean Cleanup system. This innovative plan was devised by Dutch student Boyan Slat to clean up the plastic soup in the world's seas and to recycle the harvested material. The system comprises 100-metre-long barriers that float on the water and harvest the plastic so that it can be recycled. Rijkswaterstaat facilitated the trial by contributing 200,000 euros to the costs and providing a test site for the prototype 23 kilometres off the coast of Scheveningen.

The trial showed that in extreme weather conditions the floating barriers can become dislodged from their anchors in the seabed. Using this knowledge, Boyan is now developing smaller barriers attached to floating anchors. This is proving to be a less expensive, more practical solution, enabling more plastic to be harvested faster. Boyan is hoping to install the first functional prototype of this new design in the ocean in the spring of 2018.

Bio-based crash barrier

For the past three years, Rijkswaterstaat has been testing a crash barrier made from bioplastic combined with various fibres, including grass from roadside verges. Unlike the standard galvanised steel crash barriers, this barrier does not leak hazardous substances into the grass verge. After much testing and calculation, the design and composition of the material have now been improved. Rijkswaterstaat plans to carry out the first crash tests in late 2018. If these are successful, we hope to be able to install the new crash barriers along the roads in a few years' time.

Cardboard from grass

Rijkswaterstaat has also been exploring options for using the grass mowings from roadside verges and the banks of canals and rivers in the production of cardboard. In 2017, we carried out the first practical trials with harvesting, transporting, storing and processing the grass. The process has now been optimised and a special machine has been developed to process the fibres properly. This means that in the next few years, the grass from our roadside verges may well be transformed from waste into a raw material.

Energy and climate

Rijkswaterstaat wants to work on an energy-neutral basis, using energy from renewable sources. We are also encouraging and facilitating companies to generate energy in the land and water areas we manage.

Our aim is for the Dutch main road network, main waterway network and water system to be energy-neutral by 2030. Rijkswaterstaat manages many structures and areas of land and water on which sustainable energy can be generated – roadside verges, motorway intersections, noise barriers, sludge depots and the IJsselmeer, for example.

Hydroelectric, solar and wind energy

Rijkswaterstaat is enabling wind turbines to be installed on increasingly larger areas of the land and water it manages – along roads and waterways, on dikes and the Maasvlakte and in the North Sea. The 31 wind turbines in the Kreekraksluis wind farm in Zeeland generate enough energy to meet the needs of around 55,000 households. Hydroelectric power is being generated in the Maas at Linne and at Lith. And the waterfall

Sustainable asphalt reduces CO_2 emissions

produced by the lock in the Wilhelmina Canal in Tilburg generates energy for around 250 households. The five turbines installed in the tidal gullies in the Eastern Scheldt storm-surge barrier supply 1,000 households with electricity.

Energy self-sufficient

Rijkswaterstaat increasingly uses roads, waterways and structures to generate energy. New bridges and locks all generate energy themselves. The Ramspol Bridge at Kampen is the first energy self-sufficient moveable bridge in the world. Following this example, the Beatrix Lock and the lock at Terneuzen will also be made energy self-sufficient. Here, energy will be generated by the movement of the lock gates. A second, energy self-sufficient chamber is currently being added to Eefde Lock. Here, solar panels will be used to generate the energy needed to operate the lock.

Rijkswaterstaat also wants to make the Barrier Dam (the *Afsluitdijk*) energy self-sufficient in the near future. We are investigating whether the energy needed for the lighting and to operate the pumps can be generated in the near vicinity, on our own land.

Energy self-sufficient roads

In February, Rijkswaterstaat started work on the first energy self-sufficient motorway in the Netherlands. Using solar panels, the A6 between Almere Havendreef and Almere Buiten-Oost will generate energy to meet its own needs. A 13-kilometre-long section of this road is being widened, so that each carriageway will have four lanes. In constructing the road, fewer or recycled materials are being used, with lower CO_2 emissions.

Energy savings with led lighting

Rijkswaterstaat wants to consume a lot less energy. So in recent years we have gradually been introducing led lighting along the motorways. In 2016, it was installed on the Holendrecht-Maarssen section of the A2. This is the first multi-lane motorway in the world to use led lighting. We expect to save around 241,600 kWh a year on this section of road. Led lighting cuts CO_2 emissions by 62 per cent compared to traditional lighting.

Led lighting in the Benelux Tunnel has resulted in a 22 per cent reduction in energy consumption. Rijkswaterstaat is

Led lighting along the A44 motorway

also replacing the lights in light buoys, lighthouses and tunnels. Led lights not only save energy. As they last 10 to 15 times longer than conventional lights, they will also save about 1 million euros a year in maintenance costs.

Innovative noise barriers

Rijkswaterstaat is involved in the development of solar highways, innovative noise barriers that reduce noise and generate energy. The barriers are equipped on either side with solar panels and will be installed along the A50 between Sint-Oedenrode and the Paalgraven intersection. They will start to supply energy to a cooperative of local residents by December 2018 at the latest.

Circular design

Rijkswaterstaat is widening the A58 between Eindhoven and Tilburg from two to three lanes using a unique concept. The design is entirely circular – with innovative, sustainable vehicle and information technology, energy and construction. Rijkswaterstaat has pooled its resources with knowledge partners, other government authorities and market parties. To ensure partners' innovations are successful, a Living Lab has been set up to develop, test and monitor them in practice in and around the A58.

Energy-efficient pumping station in IJmuiden

The pumping station in IJmuiden is a major energy consumer. In 2017, Rijkswaterstaat devised a plan to reduce energy consumption by 8.5 per cent and to cut CO_2 emissions by 372 tonnes a year, saving more than 31,000 litres of diesel oil a year. Rijkswaterstaat wants to start implementing the plan in 2018.

Reducing the carbon footprint

Rijkswaterstaat wants to reduce the CO_2 emissions from its activities by 20 per cent by 2020. Compared to 2016, our CO_2 emissions have remained more or less stable, totalling around 119,000 tonnes in 2017. That is equivalent to the carbon footprint of around 29,000 households. Our CO_2 emissions have dropped by around 32 per cent since 2009, the year in which we started measuring them.

Most of our CO_2 emissions are caused by the electricity we use to light roads, tunnels and bridges and to operate pumping stations and locks. And our Government Shipping Company vessels are also responsible for causing a large percentage of the emissions through their use of fossil fuels.

Electric cars

Electric cars can help Rijkswaterstaat reduce its CO_2 emissions. At the end of 2017, we purchased 100 electric cars. They will replace 100 older diesel cars in our fleet in 2018. This will mean that 20 per cent of the cars in our fleet are electric, and we plan to expand the number to 750 by 2022, accounting for 75 per cent of our fleet. Our ultimate aim is an emission-free fleet by 2030. In time, Rijkswaterstaat also plans to use electricity generated by the solar panels on its office buildings and the wind turbines in the land and water areas it manages to charge the batteries of the cars in the fleet.

Government Shipping Company

Rijkswaterstaat's ships can play a major role in cutting CO_2 emissions. Deployment of the 110 Government Shipping Company vessels is responsible for 44 per cent of the Ministry of Infrastructure and Water Management's total emissions.

The 12 largest seagoing vessels now run partly (30 per cent) on biodiesel, which is made from recycled cooking oil. As a result, in 2017 CO_2 emissions were reduced by 9 per cent compared to 2016.

Multifunctional ships

In September 2017, Rijkswaterstaat commissioned three new multifunctional, energy-efficient ships. They are to replace four older ships that sailed on the larger inland waterways, the sea inlets and the Waddenzee. The new ships will be equipped with cleaner engines running where possible on batteries. Diesel fuel will only be used if the ships have to leave port quickly. And to keep environmental harm to a minimum, the engines will be equipped with an installation that purifies exhaust fumes. The first hybrid ship will come into service in 2018.

In 2018 Rijkswaterstaat will continue to work towards becoming an organisation that is energy- and climate-neutral. We will take firmer measures to save energy, use more renewable sources of energy (green, electricity and gas) and generate more of our own sustainable energy.

Schiphol-Amsterdam-Almere Corridor

‘The whining chainsaws made me feel sick’

Nel Wiersma | secretary of Kelbergen residents’ association

Sustainable living environment

In the Kelbergen district of Southeast Amsterdam, much-loved trees have made way for a mass of cables and pipes – a heart-breaking experience for many local residents. In close consultation with the residents' association, Rijkswaterstaat created new green spaces as quickly as possible afterwards. Nel Wiersma, secretary of the residents' association, looks back.

'Cables and pipes for a 3-kilometre long tunnel between Amsterdam-Utrecht and the Gaasp. That would mean felling over a hundred trees that had adorned our neighbourhood since 1972. Much-loved trees, most of them from the Floriade in the Amstel Park, the largest, busiest horticulture exhibition ever held. My first thought was that it would be a sorry sight and I hoped that we'd get enough trees and plants to compensate.'

'We couldn't stop the tunnel being built, but we wanted to keep our neighbourhood liveable, whatever the cost. We didn't want to be staring at a wide open space for the next few years. In consultation with Rijkswaterstaat we got fast-growing plants, evergreens and shrubs. And, with a view to the future, some slow-growing plants, too.'

From tree to bench

'Before the felling began, we painted sad faces on the trees and put candles around them. The whining of the chainsaws and the sound of the trees falling made me feel sick. Our friendly neighbourhood was turning into a cheerless building site. To brighten the place up till the area could be replanted, Rijkswaterstaat put down tubs of geraniums. That was quite a cheering sight. One of the residents was very attached to a particular tree that she could see from her kitchen window. Rijkswaterstaat asked her if they could make a bench from it. Contact between them was so friendly that the residents' association didn't need to mediate. The bench has been given a nice spot, at the junction in Kelbergen.'

Replanting postponed

'In the autumn of 2015, trees were replanted along the path behind my house. I now have a view of two young linden trees. Work along the Kelbergenpad was delayed, so replanting didn't start there until the late spring of 2016. Some of the trees and shrubs didn't take root in the spring and they died. That was a shame. And some of the trees in the third category, up to 6 metres high, couldn't be planted along the second section of the Kelbergenpad. The cables and pipes left them too little room to grow. That's why shrubs around 2 metres tall have been planted there, and some residents don't have such a nice view as before.'

> 'More flowers than ever before'

More colour than ever

'To make our neighbourhood more colourful, Rijkswaterstaat suggested planting bulbs – even in places where there'd been no flowers before the work started. We chose bulbs that flower consecutively. Now we have more flowers between April and July than ever before.'

'From 1 January 2017, responsibility for managing the green spaces was transferred to the borough authorities. We're sorry to say that since then, they've already carried out two replanting operations. The authorities said this was necessary because shrubs were too close together, and they couldn't mow the grass between them. And some trees that had been planted near houses would grow too high. It's a shame that the agency responsible for designing the green spaces and the borough authorities took too little account of factors like these at the planning stage. Fortunately, the trees will be replanted elsewhere, and smaller trees will be planted in their place.'

Not a single cross word

'When work along the water is completed, Rijkswaterstaat will plant another 10 trees. And then it will be back to normal after four hectic years in which a group of residents and myself regularly sat round the table with Rijkswaterstaat and borough representatives. We discussed every problem harmoniously. We didn't miss a single plan or alteration, and I don't think a single cross word ever passed between us. Looking back, I often think with amazement of the time I put into this project – calling on residents to voice their ideas and discuss them with us, attending meetings, giving residents feedback on them and writing letters on their behalf. But it was worth it.'

Green redevelopment in the Bijlmer

With the Schiphol-Amsterdam-Almere Corridor project, Rijkswaterstaat is improving traffic flow, journey times and quality of life. To lay the cables and pipes needed for construction of the Gaasperdammer Tunnel on the A9, we had to fell around 150 trees in the Kelbergen district. The borough authorities and Kelbergen residents' association gave Rijkswaterstaat their input on redeveloping the green spaces.

3 Protection against flooding

Living and working in a delta is something that the Dutch take for granted. But without all the dunes, dikes, dams and storm-surge barriers managed by Rijkswaterstaat, nearly 60 per cent of the country would be permanently under water or regularly inundated. These primary flood defences protect us from flooding by the sea and rivers.

The Netherlands is at risk of flooding from the major rivers, the lakes, the North Sea and the Waddenzee. Climate change poses an additional threat. Current climate scenarios indicate that by 2100 the sea level will rise by up to 85 centimetres. To make matters worse, the west of the Netherlands is subsiding and there is a greater risk of storm surges. We expect more extreme weather conditions with more and longer periods of rain. To protect the Netherlands against flooding now and in the future, Rijkswaterstaat is working with other water management authorities on a number of major programmes. They include the River Maas Programme, the Room for the River Programme and the High Water Protection Programme.

Trial closure of Maeslant storm-surge barrier

High water protection

The Delta Programme uses new safety standards for the primary flood defences. Since 2007, Rijkswaterstaat and the water authorities have been taking measures to strengthen them, with work on more than 3,500 kilometres of dikes, dams and dunes and 18 locks, barriers and pumping stations. In carrying out this work, we constantly seek innovative, sustainable and affordable solutions.

Beach nourishment

The sandy Dutch coast is a major defence protecting the north and west of the country from flooding. But wind and the strong current can carry the sand away or erode it. Every year, Rijkswaterstaat monitors whether the coastline is up to strength, and deposits sand at the locations where too much has disappeared. This operation is known as beach nourishment, and we carry it out on the beach or underwater just off the coast. In 2017, the Dutch coast was nourished with a total of 9.7 million cubic metres of sand. That is equivalent to around 6.5 times the content of the Kuip football stadium in Rotterdam.

Beach nourishment at Callantsoog, Domburg, Westkapelse Zeedijk, Heemskerk and North and South Schouwen Westkop was completed in 2017. Work at Southwest Ameland, Vlieland Stortemelk, Southwest Texel and Oostkapelle will continue into 2018.

Probes measure movement of sand and water

If we know exactly how sand and water move in tidal inlets, we should be able to plan and carry out beach nourishment operations much more effectively. Working with Deltares and three universities, Rijkswaterstaat is investigating whether and how this could be done. In late August 2017 we sank five underwater probes into the Borndiep between Ameland and Terschelling. These installations are 2.5 metres high and 3 metres wide and stand on three high legs. Using the probes, the researchers will chart the seabed, the currents and quantities of sand and sludge in the water. They will carry out measurements at both low and high tide in the waters between Ameland and Terschelling.

In 2018, we will carry out beach nourishment in the area to see whether the Borndiep is a suitable location, and to learn more about sand and currents in tidal inlets.

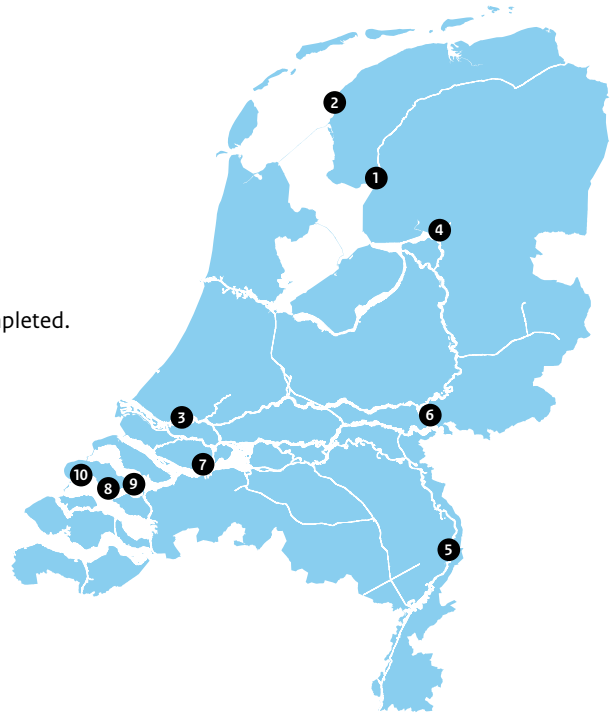
Dikes

Many of the dikes in the Netherlands need to be strengthened to meet the new safety requirements. However, the tried and tested method of raising and widening the dikes would be too demanding and costly, while the widened dikes would need extra space which is not always available. Rijkswaterstaat and the water authorities are therefore investigating other ways to strengthen them, for example by proofing them against the impact of waves breaking over the top. Though we may occasionally get wet feet, the dikes will still protect us against storm surges and strong waves.

Safe dike status

In 2017 10 projects under the High Water Protection Programme were completed. The following projects have achieved 'safe dike' status:

1. Lemsterhoek
2. Noorderhaven, Harlingen
3. Spuihaven, Schiedam
4. De Whaa sluicegate
5. 'Bij de Oude Gieterij' dike, Blerick
6. Pannerden / Loo
7. Strijensas
8. Flauwershaven / Borrendamme
9. Zuidhoek / Bruinisse coastal buffer zone
10. Burghsluis – Schelphoek



But because they don't give way, a catastrophic disaster is much less likely.

Barrier Dam

One of the dikes we are going to wave-proof is the Barrier Dam *(Afsluitdijk)*. To protect the Netherlands against flooding now and in the future, the 80-year-old dike will be strengthened and upgraded, with new sluices and pumps to drain off more water. The new, smart dike will generate energy and boost nature, the regional economy, recreation and tourism. In 2017, three consortiums submitted plans for this megaproject. In 2018, we will decide which of them will get the go-ahead to work on the Barrier Dam. The project will probably start at the end of the same year.

Tidying up the floodplains

At high water, when the river discharges into the floodplains, vegetation can form an obstacle, causing the water level, and the risk of flooding, to rise. In 2012, Rijkswaterstaat started tidying up the flood plains. Where the river flows fastest, we are clearing a total of 1,443 hectares of shrubs and trees. In 2017, we cut back 53 hectares of rough vegetation at around 20 locations. By the end of the year, we had cleared 68 per cent of the total planned at the start of the project, enormously improving flood safety. The rough vegetation has now been cleared from the floodplains of the Lower Rhine/River Lek, River Waal and River Maas. We expect to finish work in the floodplains of the River IJssel in 2018.

More professional dike inspections

Too much water can cause dikes to burst. But they can also burst through parching. During the prolonged dry periods in the summer of 2017, the dikes were inspected more frequently. Dike managers, Rijkswaterstaat inspectors and the water authorities are working more closely together to carry out dike inspections. And we are taking a more professional, more practical approach to them. In 2017 we developed courses for dike inspectors, including for people working for the building contractors who manage the dikes for us.

The inspectors also have a new instrument at their disposal, the Digispectie app. Using the app, they can record damage to the dike with a digital photograph that the app automatically links to the location. If at a later date the inspector takes another photograph, the app will compare it with the existing one to establish whether the situation has deteriorated.

Major disaster exercise around the river dikes

In the vulnerable river basin in the Central and Eastern Netherlands, we want to be well prepared for extremely high water levels. In September 2017, five water authorities, the emergency services, Rijkswaterstaat and the Ministry of Defence held a high-water disaster exercise in this area. 1,000 people worked day and night to check the 1,147 kilometres of river dike. On the ground, and from the water and the air, they traced the weak spots in the dikes. The Ministry of Defence supplied the army vehicles, and around 200 volunteers helped build the Kampen-Midden mobile flood barrier. This barrier protects the historic town centre of Kampen from flooding from the River IJssel.

More room for the rivers

In the past few centuries, the rivers in the Netherlands have had less and less room to move. They have been confined by ever higher dikes, behind which people built their homes. Due to soil subsidence, the land behind the dikes is sinking and the rivers have to drain off increasing volumes of water because of heavier, more frequent rainfall.

The government has taken measures to protect the river basin from flooding. Together, all these measures form the Room for the River Programme, which Rijkswaterstaat is implementing

with the water authorities, the provincial and municipal authorities, the general public and stakeholder organisations, with a total budget of more than 2 billion euros. The rivers have now been given more room at over 30 locations.

Safety and spatial quality

By implementing the Room for the River Programme, Rijkswaterstaat is increasing the discharge capacity of the Rhine and its distributaries from 15,000 to 16,000 cubic metres per second. Highest priority has been given to the safety of the four million people in the river basin, but nature, recreation and the economy will also benefit from the measures.

Three Room for the River projects were completed in 2017 – the extra excavation of the Millingerwaard floodplain, excavation of the Huissense Waarden floodplain and the Veessen-Wapenveld high-water channel.

Veessen-Wapenveld

After several years of work, the high-water channel between Veessen and Wapenveld was completed in February 2017. This was one of the last major Room for the River projects. The channel runs parallel to the River IJssel and was constructed between two new dikes. It is 8 kilometres long and between 550 and 1,500 metres wide.

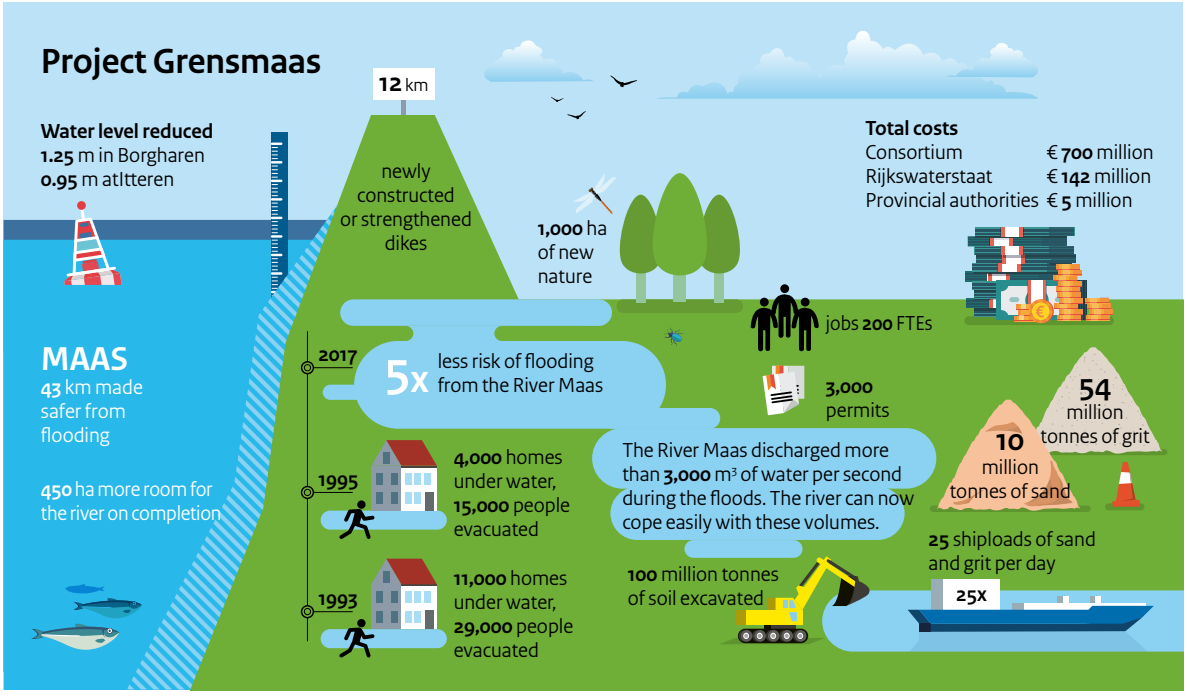
An innovative valve construction marks the inlet to the channel at Wapenveld. If water levels are extremely high and the valves are open, the channel drains off a huge quantity of water each second – enough to fill an Olympic-size swimming pool. Water levels in the River IJssel then drop by between 71 centimetres at Veessen and 5 centimetres in Zutphen, 35 kilometres upstream. This is the biggest drop, measured in centimetres, of all the Room for the River projects, guaranteeing the safety of local residents.

River Maas Programme

Floods in 1993 and 1995 were a wake-up call for the Netherlands: high-water protection along the River Maas was inadequate. The River Maas Programme was launched to improve the situation.

On 9 November 2017, Limburg celebrated achievement of the high-water safety targets for the Grensmaas project. The River Maas has been made safe from flooding along a stretch of 43 kilometres. Local residents are now protected against high-water levels occurring once every 250 years on average. The project also created 1,000 hectares of new nature areas along the River Maas in Limburg. And it paid for itself – with the grit excavated from the river bed.

In the past 10 years, the River Maas's channel has been widened, giving the river hundreds of hectares' more room, and more than 12 kilometres of dike have been strengthened. The river can now discharge up to 3,275 cubic metres of water per second between Maastricht and Echt-Susteren. The water level at Borgharen has dropped by 1.25 metres and at Itteren by 0.95 metres. Along the whole route, water levels have dropped by an average of 0.80 metres (read also the story at page 22).



River Maas Programme – Grensmaas project

‘A swirling mass of river water rushed through the streets’

Peter Schols | a resident of Itteren

Protection against flooding

After the floods of 1993 and 1995, the villages of Itteren and Borgharen are now safe thanks to the River Maas Programme. Peter Schols, a resident of Itteren, revisits those frightening times, and talks about the measures taken. 'I was amazed at how strong and decisive the Dutch government can be if everyone agrees on the same course of action,' he says.

Great fun

'When I was growing up, it was quite normal for water to cut my village off from Maastricht for a few weeks every year. For centuries, people living in Itteren had to cope with flooding from the River Maas. Nothing serious. We had to move the potatoes from the cellar because the groundwater levels rose. There was about 10 centimetres of water in the streets. Great fun for children. We didn't have to go to school, and we went from door to door collecting poles and drums so that we could build a raft. The water was sometimes a metre deep on the low-lying fields. We pushed ourselves along using a long pole. Until we fell in, and we were told off for coming home in wet clothes. Those were the days.'

Things went wrong in 1993

'But then came the 1993 floods. I was a member of the village council at the time. We always met if water levels were high. Just before Christmas things went wrong again; but this time we were summoned urgently to the crisis centre in Maastricht.'

'I felt like I'd arrived at a funeral. We were shown maps on which Rijkswaterstaat forecast how far each area would be submerged within a very short period of time. I was paralysed with fear. A friend from the village council saw on the map that his house would be standing in one and a half metres of water!'

Residents of Itteren underestimated the danger

'We had to relay the warnings we had received in Maastricht to Itteren and our neighbouring village of Borgharen. We drove through the streets in a loudspeaker van. We moved the cattle to a safe place. But many people weren't worried at all. Someone even came and complained about us using the loudspeakers at 10 o'clock in the evening. It wasn't until the next morning when people had listened to the news that they realised they were in danger. Then the telephone at the crisis centre in Itteren didn't stop ringing.'

'We drove through the streets in a loudspeaker van'

'It was mainly the people who had been born and bred in Itteren who thought that the water would drop as it always did. That's why many of them left their cars standing. And they didn't always follow our advice to evacuate, thinking that they had enough food and weren't going to abandon their homes. But when the banks burst, everything moved incredibly fast. In no time at all a swirling mass of river water, more than a metre and a half deep, rushed through the streets. It was terrifying.'

Emergency services

'I still think it's a miracle that we survived with just a few bumps and scratches and only material damage. That's thanks to the emergency services: central government, the municipal authorities, police, firefighters and the Technische Hilfswerke from Aachen in Germany. Through their expert handling of stressful situations, no major accidents occurred and hovercrafts and army vehicles provided us with the necessary bridgehead to Maastricht.'

Urgently needed

'A major flood like that occurs maybe once in 250 years. That's why a project costing millions of euros had never been a priority for a small village like ours. But the 1993 flood showed that it was urgently needed. Measures would be taken. But nobody expected that we would be hit by yet another flood two years later. If only the embankments had been strengthened before then ...'

Decisive government

'After that second major water event in 1995 I was amazed at how strong and decisive the Dutch government could be if everyone agreed on the same course of action. The same year, emergency measures were taken to strengthen the embankments at Itteren and Borgharen. In the period between 2008 and 2018 the Grensmaas was given far more room. At Borgharen it has been widened from 60 to 300 metres. I now feel completely safe.'

Grensmaas project

The River Maas Programme was launched after the major floods in 1993 and 1995. Within the Grensmaas project, the Grensmaas Consortium widened sections of the river bed, lowered the floodplain and strengthened the embankments. The surrounding area is not only five times safer than before, but 1,000 hectares of new nature areas are now developing. Work to create more room for the river at Itteren and Borgharen was completed in late 2017. But work on the River Maas will never be finished. Given the need to proof the river basin against climate change, more plans are in the making.

4 Sufficient clean water

We take it for granted that everyone in the Netherlands has sufficient clean water at their disposal. Households are not the only users of water. Shipping, industry and agriculture also depend on it, and so do plants and animals. Rijkswaterstaat works every day with its water management partners to ensure that there is sufficient clean water for every user.

Surface water must be clean enough to be processed for drinking and bathing. And it must also be healthy enough to provide a good habitat for plants and animals. So we are working with our water management partners to ensure clean, sustainable water systems in the Netherlands. Our aim is for surface water in the Netherlands to satisfy the requirements of the EU Water Framework Directive by 2027.

Clean and healthy water

Water policy has significantly improved the status of Dutch surface and ground water in recent decades. Most Dutch waters are clean enough to be turned into drinking water and for growing crops, watering livestock and bathing. But in some places, the water still doesn't meet the requirements.

The River Lek floodplain

Bathing water

In 2017, Rijkswaterstaat managed 232 open bathing water locations. During the season, we monitor the quality of the water for compliance with the Bathing Water Directive. The bathing water quality was poor at only one location in 2017, where geese proved to be the chief source of pollution. In the 2014 to 2017 period, the water at only 3 locations was 'poor', at 6 'sufficient', at 36 'good' and at 180 locations (80 per cent) 'excellent'.

Ecology

Surface water must not only be clean enough to be processed for drinking and bathing. It must also be healthy enough to provide a good habitat for plants and animals.

Ecological measures

The ecological status of the waters has improved considerably in recent decades. But in 2017, the spatial planning of the national waters was not yet good enough to ensure healthy habitats for all plants and animals. It takes some time for ecological measures to have an impact. And concentrations of chemical substances in the environment are still too high. Rijkswaterstaat is now seeking new ways of improving habitats for birds and fish – for example by creating more ecotone habitats between land and water. That contributes considerably to ecologically healthy water systems.

Dead trees for more life

Dead trees in rivers are underwater nurseries. They provide an ideal location for fish to spawn, hide from predators and mature. But much of the dead wood has been removed from the Dutch rivers in the past 100 years to prevent the risk of flooding and damage to ships and bridges.

To improve the habitat for plants and animals, Rijkswaterstaat has now sunk 74 entire trees at safe places in the Rivers IJssel and Lek and in the Lower Rhine. Twelve trees have now been fixed in the new secondary channel of the River Maas in the Hemelrijkse Waard in North Brabant, eight in a former branch of the river and four across the river in the Maasbommel channel.

Studies completed in 2017 show that the wood improves the quality of the water. And this is a relatively inexpensive measure that we can apply in constructing secondary channels or restructuring river banks. Rijkswaterstaat now wants to fix trees in major rivers like the River Waal and the River IJssel.

Fish passage in the Kleine Sluis at IJmuiden

Rijkswaterstaat has used an innovative method to create a fish passage in the Kleine Sluis at IJmuiden. A few adjustments to the position of the existing gates make it easier for fish to pass through the lock from the North Sea to the North Sea Canal and vice versa.

Other locks and sluices along the North Sea Canal will also be adapted in this way to enable fish to migrate. The fish passage in the Kleine Sluis at IJmuiden was taken into service in 2017.

Stededijk Polder

Up to 2017, a dike closed off Stededijk Polder near Dordrecht. Rijkswaterstaat constructed a system of channels linking the polder with the river through the Doode Kikvorschkil. A tidal freshwater nature area has emerged in which plants like the marsh marigold and animals like the beaver are very much at home. Rijkswaterstaat transferred management of the area to the municipal authorities of Dordrecht in December 2017. They will open the area to visitors.

De Zaag recreation area

In late 2017, Rijkswaterstaat put the finishing touches to De Zaag recreation area in Krimpen aan de Lek. Channels now run criss-cross through De Zaag – an island in the River Maas – and the Stormpoldervloedbos nature reserve. Water drains in and out of these channels to the ebb and flow of the tide. These two nature areas are located outside the dike and form oases in the heavily industrialised landscape.

The entrance to the area has been cleared of asbestos and restructured. Bicycle racks and a car park make the area more accessible to nature lovers. The jewel in the crown of this nature area is the steel beaver bridge, which draws visitors' attention to the tidal nature area, and gives them a view of the river and Rotterdam.

Salmon return to the River Geul and the River Maas

In the south of the Netherlands, an experiment is currently under way to return salmon to the River Geul and the River Maas. In May 2017, thousands of juvenile salmon were released into the Geul. In September, fish migration experts from the University of Namur caught 400 salmon to study them. The fish were healthy and had grown well. On the instructions of Rijkswaterstaat, transmitters were placed in 180 of these salmon. This will enable us to measure how many of them swim from the River Geul to the River Maas next spring on their way to the sea.

Flakkeese Sluice renovated

On 31 May 2017 work was completed on the renovation of the Flakkeese Sluice in the Grevelingen Dam. This sluice links the Grevelingenmeer with the Eastern Scheldt.
Six funnels have been installed in the sluice to allow water from the Eastern Scheldt to flow into the Grevelingenmeer, boosting the oxygen level in the lake. This means that wildlife that had disappeared due to a lack of oxygen can now return to the eastern section of the lake. The measure will also relieve the problem of stench from rotting aquatic plants. A Tidal Technology Centre has been set up near the sluice, where companies and institutions can install test units for trials with tidal energy generation.

Hemelrijkse Waard

In the last century, the river was canalised in many places for shipping, and its banks were strengthened with stone cladding. River wildlife declined through lack of shallow water.

On Monday 27 March 2017, the restructured Hemelrijkse Waard was officially opened in Oss. An agricultural area the size of around 450 football pitches has been turned into a new river wildlife area. Construction of a 3-kilometre-long channel along the River Maas has greatly enlarged the habitat for river wildlife. There is also less risk of flooding. Because the river has now been given more room, high-water levels are four to seven centimetres lower than before. Nature lovers can enjoy the area from a viewing platform and a path.

Marker Wadden

With the completion of the Houtribdijk between Enkhuizen and Lelystad in 1976, the Markermeer was closed off from the IJsselmeer. Since then, the ecological quality of the water has declined considerably. Working with nature conservation organisation Natuurmonumenten, Rijkswaterstaat is developing a new wet nature reserve – the Marker Wadden – in the Markermeer. This nature reserve will develop into an archipelago with lagoons, reed marshes and mudflats, greatly improving the quality of both the bed and the water in the Markermeer, and providing a healthy habitat for birds, fish and aquatic plants.

In March 2016, the contractor started work on the first island in the Marker Wadden, including an underwater landscape of around 300 hectares, using materials like silt, sand and clay. By 2017 the contours of the first island were clearly taking shape. In the breeding season, around 2,000 birds settled here. They included endangered species such as the little tern and the Kentish plover and a very special common tern.

The second and third islands were constructed in 2017 and the contours of the fourth and fifth islands began to emerge. The contractor will finish work on all five islands by the end of 2020. Up to then, sand nourishment will continue to prevent the islands subsiding.

For the construction of the Marker Wadden, Rijkswaterstaat entered into an alliance with Natuurmonumenten in 2014. In May 2017, the Ministry of Infrastructure and Water Management allocated an extra 1.5 million euros for research into the Marker Wadden. The aim is to gain more knowledge of building with nature. The first island will be open to the public in September 2018.

Maasbommel

A channel was also completed in the River Maas floodplain at Maasbommel in April 2017. The S-shaped channel is around 650 metres long and 100 metres wide and forms a good habitat for plants, fish and other animals native to this landscape. When water levels are normal, the channel lies isolated in the floodplain. But when the Maas reaches high-water mark, some of it will overflow into the channel, slightly lowering the level of the river. This will happen once a year on average.

River IJssel

In the past seven years, improvements have been introduced along 25 kilometres of the River IJssel. Secondary channels have been constructed between Dieren and Kampen and dead trees fixed in them. Stone cladding has also been removed from the embankments. The Vallei en Veluwe water authority, which carried out these measures for Rijkswaterstaat, finished work on the area in October 2017. Rijkswaterstaat and its partners will make further improvements to the quality of the water in the River IJssel in the next few years.

Progress with the EU Water Framework Directive

In 2017, the Dutch water management authorities completed the first stage of measures to implement the EU Water Framework Directive. The 302 planned measures have nearly all been implemented. Four measures have been moved to the second stage, and three measures proved to be unfeasible, in terms of either technology or procedure.

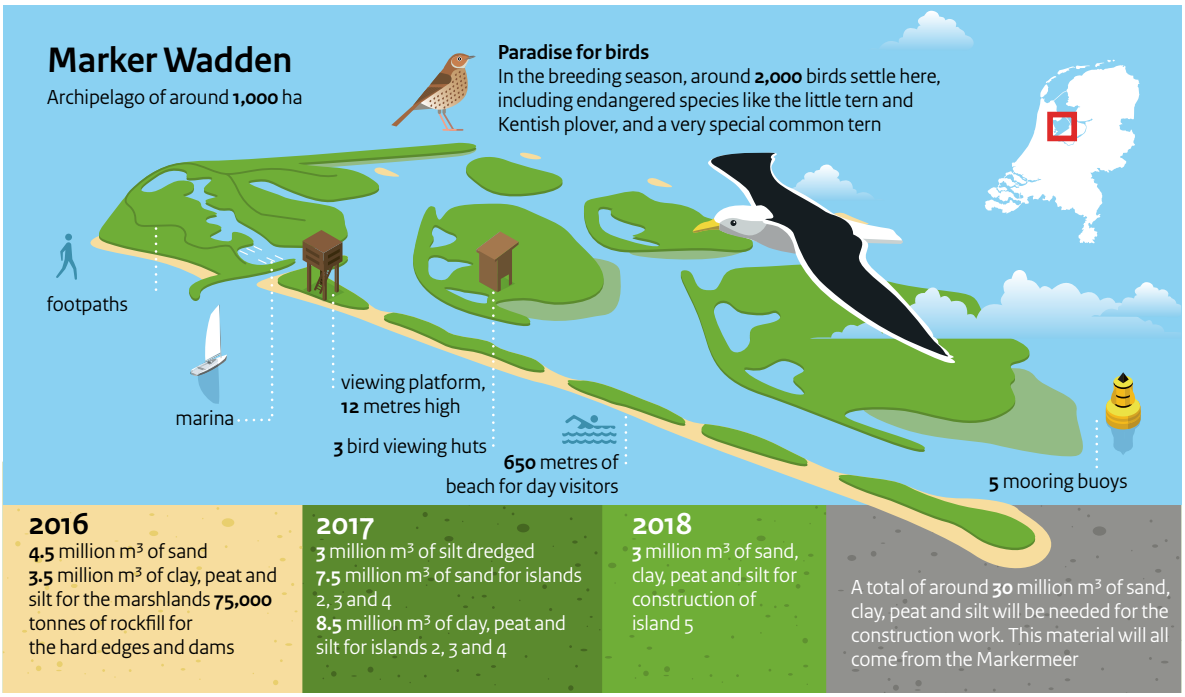
Measure	Target	Achieved
Channels and nature-friendly embankments	230 km	243 km
Lowering and excavating floodplains	2,545 ha	2,569 ha
Fish passages	51	55
Management and maintenance measures	65	64
Studies	50	50

First stage progress EU Water Framework Directive

Second stage

In 2017, implementation of the Directive entered its second stage. Measures will again be taken to construct shallow channels and nature-friendly embankments. The mouths of streams will also be reconstructed to enable fish to swim upstream.

But to achieve all the goals by 2027, we will need a more cohesive package of measures to tackle the Netherlands' water quality problems. For this reason, the main water management partners have been working more closely together since the end of 2016.



Waddenzee oil alert

‘In the wind, the oil spreads very quickly over the beach’

Sophia Dingenouts-Koops |
Rijkswaterstaat crisis manager

Sufficient and clean water

An oil spill in a vulnerable area like the Waddenzee and Frisian Islands would be an unimaginable disaster. This UNESCO World Heritage site is the habitat of tens of thousands of plant and bird species, some of them endangered. But for three days in early September things went very wrong. The area was threatened by straw, woodchips and colourants. Crisis manager Sophia Dingenouts-Koops was on the scene.

'Just imagine: two ships collide on the North Sea. One of them is severely damaged and thousands of litres of fuel oil leak every hour from a hole in the hull. The spill threatens the breeding ground of the common scoter on the island of Texel. We could tow the leaking ship to another location so that the oil would leak the other way. But unfortunately, it would then spill onto the coast at Den Helder, where hundreds of sunbathers are out on the beach.'

Day 1: difficult choices

'What do you do? Move the ship? Leave it where it is? That's a difficult decision. Even if you know exactly what the consequences are. That's why we do a 'dry' run on the first day, with the mayors of the Frisian Islands and their mainland colleagues. We put this dilemma and many other problems to them. Some decisions are very hard to take. But it's useful to get to know each other, and the interests that are at stake.'

Day 2: straw on the sea

'It's day 2 of the exercise and time to go to sea. We practise on the North Sea and in the deeper stretches of the Waddenzee. We create a large mock oil slick using biodegradable colourant and straw and try to clean them up as quickly as possible. Ships fitted with sweeping arms sweep the mess together and suck it up; other ships install a screen to prevent the slick from spreading. Coastguard helicopters and drones from Rijkswaterstaat keep the slick under surveillance to see if it's spreading.'

'At the same time, the regional crisis team practises by charting the impact on the environment. Based on projections issued by the National Water Management Centre, the crisis team examines how the oil slick will spread in the next few hours and whether it might spill onto the shore. Acting under great pressure, the team leader then has to decide what action to take. The more oil you clear up at sea, the less will spill onto the coast. And the faster you take preventive measures on the shore, the better you can protect it. So we have to be quick. It's very useful to practise working in a situation like this.'

> 'You can decide in advance how to respond in various conditions'

Day 3: protecting the shore

'The next stage is to try to prevent what's left of the oil slick reaching the shore. On day 3, we practise erecting dams along the coast. We have inflatable dams (oil screens) to prevent the oil polluting the shore, but we might use heaps of sand. That depends on the circumstances on the ground. You can bring in tractors to build a dam, but if you do that in the middle of a breeding ground, you do more harm than good. It's sometimes better to do nothing.'

'And conditions are sometimes against you. We experience that during the exercise. On day 3 there's so much wind that the tide comes in really fast, and we have to stop the work on the mudflats. And the special machine that cleans up the oil can't cope with the impact of the fast-rising tide. The woodchips we used that day to simulate the oil slick soon wash metres onto the beach. That's a good lesson. You can't control the weather, the tide or the current. But you can decide in advance how to respond in various conditions.'

Rakes and roboducks

'The last part of the exercise assumes the worst-case scenario: cleaning up the oil that has spilled onto the shore. It is gale force eight, and rain is pouring down, but more than 70 volunteers, following instructions from Ministry of Defence staff, work tirelessly on the beach with rakes and spades. They also practise catching a remote-controlled roboduck. It's a ridiculous sight – people chasing a fake bird – but it's based on reality. A real bird smeared with oil won't just sit and wait for you to catch it.'

Waddenzee oil alert

On 4, 5 and 6 September 2017, 200 people took part in an exercise to practise what they would do if there was an oil spill in or near the Waddenzee. Rijkswaterstaat, the State Forest Service and nature conservation organisations Natuurmonumenten and the Waddenvereniging, the Ministry of Defence and many local government authorities and other stakeholders worked together on this major simulation.

5 Smooth and safe transport by road

Road transport is the lifeblood of the Dutch economy. Optimal access to the economic centres is vital. Private motorists must also be able to reach their destinations safely and quickly. As the road authority and developer of the main road network, Rijkswaterstaat is committed to achieving these aims.

Every day around three million motorists take to the roads in the Netherlands. But not all roads are able to cope with the volume of traffic. This leads to traffic jams and much irritation among road users. But that's not all. According to TNO estimates, slow-moving or stationary goods vehicles cost the Dutch transport industry around 1.2 billion euros a year. Dutch transport policy therefore has two goals: reliable journey times and better accessibility.

The Vaanplein intersection near Rotterdam

Working on accessibility

Construction, utilisation measures, traffic management and good maintenance – these are key to keeping the Netherlands accessible. To eliminate traffic bottlenecks, Rijkswaterstaat is building new stretches of road and widening existing roads with additional lanes. We also want to make better use of existing capacity by working closely with market parties, public authorities and road authorities in the region. Traffic management plays an important role in keeping traffic moving and minimising congestion. Good maintenance is also essential for keeping the motorways reliable, accessible and safe.

More intensive use

In 2017, Dutch road users travelled 71.1 billion kilometres on the main road network, 1.6 per cent more than in 2016. More people took to the roads during the rush hour and in the daytime in particular.

Nevertheless, congestion (length x duration of traffic jams) dropped by 1.8 per cent in 2017 – to 11.4 million kilometre-minutes, because the traffic jams were spread more evenly across the road network than in 2016.

The main cause of congestion in 2017 was the growing use of the main road network, especially in the rush hour. Accidents and incidents were also a major cause. Journey times increased by 2.7 per cent in 2017, partly because road users spent more time in traffic jams.

Construction

Forecasts show that traffic will continue to grow between now and 2022. To cater for this growth, Rijkswaterstaat will continue to eliminate traffic bottlenecks. In 2017 we laid a total of 175 kilometres of asphalt – to widen roads, eliminate congestion hotspots and fill in missing links in the main road network.

A9 bypasses Badhoevedorp

As of April 2017, the A9 no longer runs through Badhoevedorp. Traffic now by-passes the village between the Badhoevedorp and Raasdorp intersections. The new, widened section of the A9 has three permanent lanes in each carriageway. Ten viaducts were constructed, including complex structures over the A4 and Schiphol railway line. The existing cloverleaf junction has been replaced, and a new slip road constructed for buses.

This project improves traffic flow in this busy region and quality of life in and around Badhoevedorp. The air is cleaner, and use of double-layer very porous asphalt concrete reduces noise. Work on the bypass started in late 2013. The project has now entered the following stage – demolition of the old motorway. This should be completed by February 2019 at the latest.

Road construction projects completed in 2017

- A *A1 Apeldoorn Zuid–Beekbergen*
- B *A6/A7 knooppunt Joure intersection*
- C *A50 Ewijk–Valburg*
- D *N31 Harlingen (crossing)*
- E *A1/A6 Diemen–Almere Havendreef (various)*
- F *A9 Holendrecht–Diemen (Holendrecht intersection)*
- G *A9 Badhoevedorp bypass*
- H *A58 Goes exit*

A50 Ewijk – Valburg

On an average weekday, 110,000 vehicles use the A50 between the Betuwe and Maas en Waal regions in Gelderland. The new section of the A50 between the Ewijk and Valburg intersections was opened in May 2017. Each carriageway now has four instead of three lanes, and the speed limit in both directions has been raised from 90 to 120 kilometres an hour. This has improved traffic flow and road safety in the region, making it more accessible. Before work started on the motorway, an additional bridge was constructed on the River Waal. The Tacitus Bridge now comprises two parts: the original bridge dating from 1976 and the new bridge, completed in 2013. The Ewijk and Valburg intersections have also been redesigned. Rijkswaterstaat has been working on this project since 2011.

Schiphol-Amsterdam-Almere Corridor

In June 2017, reconstruction work on the A1 at the Muiderberg intersection was completed. The intersection now has three lanes for traffic to the A6, and three for traffic on the A1. The reconstruction work is part of the road-widening operation between Schiphol, Amsterdam and Almere (SAA) – the biggest road construction project in the Netherlands in the 2012-2024 period. Through this project, Rijkswaterstaat aims to cut congestion in this region and keep the north of the Randstad conurbation accessible.

The project entails construction of additional lanes over a stretch of 63 kilometres on the A1, A6, A9 and A10 motorways, two tunnels, two major bridges and the largest aqueduct in the world, remodelling of five intersections and installation of around 100 other structures.

Smarter use of capacity of existing roads

Construction of additional lanes cannot accommodate all the extra traffic. More asphalt alone will not reduce congestion. Smarter use also needs to be made of the capacity of the existing infrastructure.

Better Use

Within the Better Use Programme, central government, the regional authorities and market parties are working together on tangible, assessable measures to make smarter use of existing infrastructure and reduce congestion in the 12 busiest urban regions. In 2017, the focus was on new types of signage and new travel information apps enabling people to reach their destinations faster.

Smart mobility

Smart mobility presents many opportunities to meet our growing transport needs safely and sustainably. At the Traffic Innovation Centre in Helmond, Rijkswaterstaat is experimenting with new forms of traffic management, autonomous cars and smart traffic information. And we sometimes come up with clever solutions in day-to-day practice. For example, an app is already being used to inform road users of the situation on the A58, where work is in progress. As soon as a road user approaches the roadworks, they receive a spoken message from the road traffic controller giving them alternative routes. We are using similar methods on the Schiphol-Amsterdam-Almere

Corridor and the A50, where maintenance work is in progress.

Amsterdam practical trials

Since 2014, Rijkswaterstaat has been working with its partners and with market parties and knowledge institutions on the latest technology to reduce congestion and make the roads safer and the air cleaner in the Amsterdam metropolitan region. Between 2015 and 2017, we tested innovative roadside and in-car technologies.

One of the trials took place during a series of sell-out concerts in the Amsterdam ArenA. Using electronic roadside panels and push messages on the social media, we informed concertgoers of the best route to take and the best place to park. Though the concert attracted thousands of visitors, it led to very few problems. Concertgoers who asked for advice on the best route to take were grateful for this service. Rijkswaterstaat devised new tests in 2017, linking travel, route and navigation advice, autonomous vehicles and real-time traffic management. Trials will probably start in 2019.

Traffic management

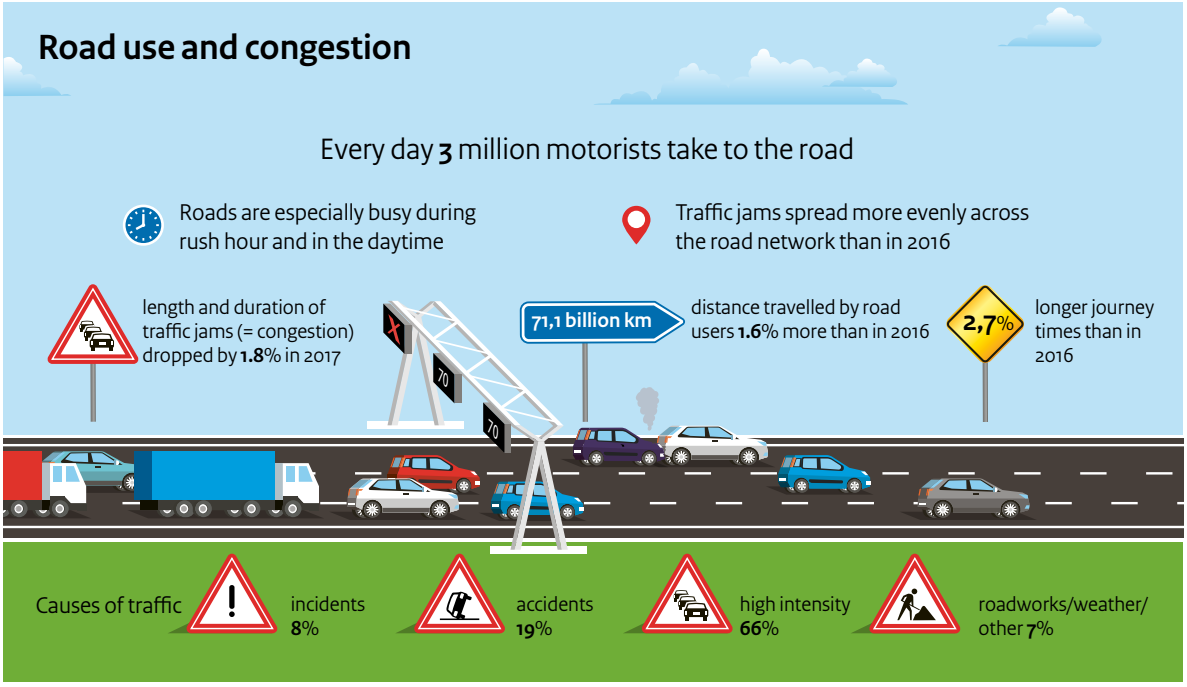
Rijkswaterstaat helps road users reach their destination smoothly and safely. Around 260 road inspectors patrol the motorways in their bright yellow vehicles. If an accident or incident occurs, they deal with the situation as quickly and safely as possible. They make sure that the emergency services – the ambulance and fire services and the police – can work in safety and that the rest of the traffic can pass safely and quickly.

Special enforcement officers

Since early 2017, some of Rijkswaterstaat's road inspectors have also held the status of special enforcement officer (BOA). They may draw up official reports of offences such as ignoring the overhead red crosses indicating a lane closure, or parking on the hard shoulder. As part of a trial, eight road inspectors in the Rotterdam region were given this status in early 2015. This proved to be a success and 50 more road inspectors were appointed as special enforcement officers in 2017.

Flashing blue lights and siren

In the past, it was often difficult for road inspectors to reach the scene of an incident on the motorway. In 2015, Rijkswaterstaat launched a trial in which 24 road inspectors were trained to drive vehicles with flashing blue lights and siren. The trial was a success. On average, the road inspectors arrived at the scene of an incident 20 per cent faster because road users made way for them. And they were safer, because they were more clearly visible and recognisable. In 2017 another 31 road inspectors received this special training. Ultimately, Rijkswaterstaat's aim is for all 260 road inspectors to drive vehicles with flashing blue lights. Since only the emergency services may use these vehicles, Rijkswaterstaat was officially given this status on 1 September 2017 (read also the story at page 36).



Management and maintenance

We all want to arrive at our destinations quickly and safely by the route we have planned. This calls for reliable, well-maintained roads, infrastructure and traffic management systems.

Minimising inconvenience

In 2006, it was agreed with parliament that roadworks should not account for more than 10 per cent of total congestion. At 3.6 per cent in 2017, the percentage of traffic jams caused by roadworks was far below the agreed norm.

The latest surveys again show that motorists are highly satisfied with Rijkswaterstaat. Eight out of 10 give us full marks for our work as manager of the national road network.

Facelift for the A10 westbound

The A10 westbound, the ring road to the west of Amsterdam, was given a thorough facelift between 24 July and 4 September 2017. The road cuts through a residential area, so noise nuisance has to be kept to a minimum. It has now been surfaced with low-noise asphalt, greatly reducing noise from the 124,000 vehicles that use it each day. The chief contractor has had a special machine designed for jobs like this. Since the machine can lay two layers of asphalt at once, the whole operation took 6 instead of 12 weeks, limiting inconvenience to road users.

In this project, 46,000 tonnes of old asphalt was removed, half of which was recycled, saving as much rubble as would fill 20 Olympic-size swimming pools. Drains were cleaned and enlarged in some places. The matrix panels above the road were serviced, and the 27 bridges and viaducts were regrouted.

Renovation of the Velser Tunnel

After nine months of renovation work, the Velser Tunnel was re-opened to traffic on the morning of 16 January 2017. The 60-year-old tunnel is the oldest motorway tunnel in the Netherlands, and was urgently in need of major maintenance work. Rijkswaterstaat installed a new ventilation system, new emergency exits and an up-to-the-minute digital control system.

The Velser Tunnel is an important link for traffic in North Holland. Now that it has been thoroughly renovated, traffic can continue to circulate smoothly and safely. In the past, heavy goods vehicles with high loads regularly got stuck in the tunnel, inconveniencing road users and causing damage. The tunnel's overhead clearance has therefore been raised by 12 centimetres, making it fit for service for many years to come.

Technical failure

Technical failure affected a striking number of Rijkswaterstaat's bridges, tunnels and rush-hour lanes in 2017. The new Botlek Bridge, the vertical-lift bridge over the River Maas on the A15 motorway, has been particularly prone to technical failure since it was opened in 2015. The complex IT systems used in these new structures have proved to be vulnerable. Technical failure in older structures was mainly caused by IT components reaching the end of their service life.

Rijkswaterstaat is working hard on solutions to make these operating systems less vulnerable. The Botlek Bridge is now far less prone to technical failure. The operating and surveillance systems of many bridges and tunnels are reaching the end of their service life. They will be replaced in the next few years by reliable new standard systems, which will first be installed and tested in the Wantij Bridge and the Heinenoord Tunnel.

Rejuvenation and renewal

Many tunnels, bridges and viaducts dating from the '50s and '60s onward need to be renovated or replaced in the coming years. Within the next 15 years, 25 bridges will need to be overhauled or strengthened, and more than 33 billion euros has been earmarked for this purpose up to 2031. Maintenance work will start in the South Holland region. To keep the region accessible, projects will be spread over a number of years. The IJssel Bridge (A12), the Van Brienenoord Bridge (A16) and the bridge over the River Rhine at Heteren (A50) will be the first structures to be tackled.

To guarantee safety, structures are carefully monitored. If a bridge is set to reach the end of its service life within five to eight years, Rijkswaterstaat starts the groundwork for renovation or replacement. We want to have enough time to harmonise the work with other construction and maintenance projects, including those of the provincial and municipal authorities, so that inconvenience can be kept to a minimum.

Winter maintenance

On Sunday 10 and Monday 11 December 2017, the Netherlands was hit by heavy snowfall. In the evening of 11 December traffic jams totalled between 1,500 to 2,000 kilometres. Yet the roads did not gridlock. Rijkswaterstaat worked with a total of 900 salt spreaders and snow ploughs and 1,200 people to keep the roads clear.

We have 350 snow ploughs at our disposal to clear the roads in wintry conditions. We have 56 salt storage depots throughout the Netherlands, along with salt spreaders and snow ploughs ready for winter to arrive. With this equipment, we can spread a preventive layer of salt on

Clearing icy roads with the Lavastorm

10,000 kilometres of road within two hours. That means every single motorway in the Netherlands, including slip roads and service stations.

Salt spreaders and snow ploughs

Ice formation on the road can cause serious problems. Ice often forms in places that are difficult for the salt spreaders to reach, because of stationary or slow-moving vehicles on the road. To keep roads ice-free, Rijkswaterstaat has four innovative salt spreaders at its disposal.

First we have our two Firestorms. These machines remove persistent ice sheets from the road by spraying them with a warm saline solution. The ice immediately begins to thaw, making the road easier to navigate. Our second salt spreader can be used in heavy snowfall where a traffic jam has formed. From the hard shoulder, it sprays salt beneath the vehicles, across the width of two lanes.

The Lavastorm removes sheets of ice using a combination of techniques: the heavy-duty snow plough on the front of the vehicle ploughs snow and loose sheets of ice onto the side of the road while rotating brushes clear the road of any remaining traces of snow. The ice sheet beneath is then sprayed with a warm saline solution.

Road safety

Road safety is one of this government's main priorities. The Netherlands wants its roads to continue to be among the safest in the world. However, the number of road deaths and casualties has been rising since 2007. In 2016, there were 629 deaths and 21,400 casualties on the Dutch roads. The minister of Infrastructure and Water Management is now working on the plans set out in the Road Safety Manifesto. She is also working on a new strategic plan for road safety, while measures are being taken to improve registration of road injuries. In 2018, roadside verges at 150 locations will be cleared of obstacles, and work on road safety will continue as part of the *Meer Veilig* (Greater Safety) programme. On the N36 national road, for example, measures target not only the infrastructure, but also motorists' conduct.

Information on road safety in 2017 was not yet available when this annual report was published.

Road inspectors get special enforcement officer status

‘My badge commands respect’

Richard Nijveen | road inspector and special enforcement officer for Rijkswaterstaat

Smooth and safe transport by road

Taking a break on the hard shoulder, disregarding flashing orange lights or ignoring the overhead red crosses indicating that a lane is closed – these are all very dangerous things to do on our increasingly hectic motorways. In the past, road inspector Richard Nijveen had no choice but to watch it all happen. But since his promotion to special enforcement officer, he can now take more targeted action to ensure that traffic flows smoothly and safely.

'That vehicle over there is stationary for no apparent reason. Ah, it's an Eastern European driver taking his compulsory break – but on the hard shoulder. For him it's the most normal thing in the world, but he's created a situation that's highly dangerous – for himself and other road users. In the past, all I could do was try to explain to these drivers why they weren't allowed to stop on the hard shoulder. No more than that. But now I use the telephone interpreting service to make sure my message comes across and, where necessary, I give the driver a fine. And I hand him a list of truck stops so that he can see where to take a nap safely.'

Fuel gauge

'The private car that stopped on the hard shoulder just now had run out of fuel. When I pointed out that the situation was dangerous, and told him why I had taken action, the driver responded respectfully. In the past, before I wore a special enforcement officer badge on my jacket, people often got very upset. I hope that in the future, motorists will take their fuel gauges more seriously. Because the number who don't tank up in time continues to amaze me. I start to feel nervous if I've only got enough fuel for another 60 kilometres.'

Flashing blue lights

'I've just had a phone call – there's been an accident. Flashing blue lights on, and away we go! That's good, I can see they're making way for me further up. It was quite different when I only had orange lights. My vehicle looked like a truck. Other road users weren't impressed. But now that I've got these blue lights, I'm usually at the scene of the accident at the same time as the emergency services and we can make the place safe to work in. Together we can then deal with the aftermath of the accident as smoothly and quickly as possible.'

> 'Unfortunately, many road users ignore rules and instructions'

Automatic pilot

'Someone has driven straight through the road block. When I stop the car and ask the driver why he did it, he says that he had to take this exit. I understand why. Many people drive as if they were on automatic pilot. It's quite logical. So if the situation requires them to do something different, it's difficult for them to take another route. But for me and my colleagues, it's important for road users to act on the information we provide, so that we can do our job properly.'

More and more hectic

'I can't help thinking about the thousand or more fines my colleagues and I handed out last year. Unfortunately, many road users ignore rules and instructions. And it's getting more and more hectic on our roads. Everyone knows it's dangerous to send text messages while you're driving, but it still happens. Special enforcement officers can't hand people tickets for texting and driving. That's a job for the police.'

Special enforcement officer

Growing traffic intensity and the irresponsible conduct of road users are creating more and more dangerous situations on our roads. To ensure that traffic continues to flow smoothly, around 50 Rijkswaterstaat road inspectors have been given the status of special enforcement officer in the past two years. This entitles them to stop cars, and to issue fines for offences such as ignoring the red crosses indicating that a motorway lane is closed, or stopping for no reason on the hard shoulder. An increasing number of road inspectors are entitled to use blue flashing lights and a siren, so they now arrive at the scene of motorway incidents 20 per cent faster on average. These developments make the work of road inspectors like Richard Nijveen much more effective.

6 Smooth and safe transport by water

Transport by water is of essential economic importance. Inland shipping is an environmentally-friendly alternative to road and rail transport. A large modern vessel can carry as much cargo as several hundred heavy goods vehicles. And the capacity of the inland waterway network is still far from fully used.

Construction

Larger ships are carrying more goods by water. In 2017, Rijkswaterstaat again invested actively and effectively in improving the capacity of the main waterway network.

Meppelerdiep Lock

On 25 October 2017, the first inland waterway vessel passed the new Meppelerdiep Lock. The lock has been converted so that it now has a double pair of gates and no longer forms a bottleneck for shipping. In the past, when water levels were extremely high or low, the lock had to close and vessels couldn't pass. Now shipping traffic can pass smoothly and

A steward helps recreational boaters in the Grevelingen Lock

safely between the Meppelerdiep and the Zwarte Water. The new lock is also wider and deeper, so that larger inland waterway vessels can reach the harbours at Zwartsluis and Meppel (read also the story at page 42).

Princess Beatrix Lock

In 2017, work started on expanding the monumental Princess Beatrix lock complex near Nieuwegein. A third chamber will be added and the Lek Canal widened so that shipping can pass the lock smoothly and safely far into the future. We will also be able to create more moorings for inland waterway vessels.

IJmuiden Sea Lock

In September 2016 work started in IJmuiden on construction of the world's largest sea lock. The new lock will be 70 metres wide, 500 metres long and 18 metres deep, and will replace the Noorder Lock, which is nearly 100 years old. It will ensure better access to the Port of Amsterdam for increasingly larger sea vessels. The new lock is expected to open to shipping in late 2019.

New lock at Terneuzen

For the next five years, Rijkswaterstaat will be working on a new lock at Terneuzen. Minister of Infrastructure and Water Management Cora van Nieuwenhuizen and her Flemish counterpart Ben Weyts officially launched the project on 13 November 2017. The first ship is expected to sail through the Port of Ghent's new front door in 2022. The project costs more than 900 million euros, and will largely be funded by Flanders.

Juliana Canal

Rijkswaterstaat is widening and deepening the Juliana Canal to enable navigation by class Vb vessels (large Rhine vessels) with a draught of 3.5 metres. However, work has had to be suspended due to rewetting of the land in the area. The contractor has now taken measures to prevent this happening. At the end of 2017, Rijkswaterstaat was still negotiating with the contractor on continuation of the work and the consequences for the planned opening of the newly widened canal.

Wilhelmina Canal

Rijkswaterstaat is working with the provincial authorities of North Brabant and the municipal authorities of Tilburg to widen the Wilhelmina Canal and construct a new lock III next to the existing lock. The new lock was completed in November 2016. Plans to demolish lock II were abandoned in 2017. To prevent problems with groundwater levels in the area near the lock, we decided not to demolish the lock but to enlarge it for class IV (Rhine-Herne Canal) vessels. We will know more about the design and planning of this project and about the tender procedure in the spring of 2018. For the time being, lock II will remain in service, although it is navigable for class II (Campine) vessels only.

Moorings along the River Waal

Rijkswaterstaat is working at several locations along the River Waal to increase and improve the number of overnight moorings for inland shipping. We are working on new overnight moorings at Lobith, and refurbished moorings were opened near Spijk in late 2017. These are now more easily accessible, and can also cater for larger vessels. The overnight moorings near Haaften are also being refurbished

Waterway traffic management

The Dutch waterways are becoming busier and busier. It is therefore becoming increasingly important to oversee and manage traffic flow on the entire waterway network. Rijkswaterstaat works to achieve this from its traffic control and operating centres.

Rijkswaterstaat has a fleet of 122 vessels, on which 270 people work. They patrol the waterways, carry out tests, measurements and fisheries-related studies, and mark shipping channels. And if an incident occurs, they are always on hand. Rijkswaterstaat also manages 12 traffic control centres, 91 lock complexes and 115 moveable bridges.

Rijkswaterstaat is working to professionalise traffic management on the water. The ultimate aim is nationwide corridor management, providing support, guidance and facilities to enable a smooth, safe passage along the main shipping corridors to the European hinterland.

Smart shipping

On 30 November 2017 Rijkswaterstaat, working with market parties and knowledge institutions in the maritime sector, organised the Smart Shipping Challenge. In this practical demonstration, the inland waterway vessel MCS Saluté sailed the Nieuwe Maas in Rotterdam, while the computer kept it on course. Another vessel collected information on course, route, current, wind and vessels in the vicinity enabling it to sail autonomously.

With experiments like these, the Netherlands wants to lead the field in smart shipping, i.e. smart, computerised navigation, operation, loading and unloading systems for ships. The development of smarter ships will boost the competitiveness of the shipping sector and improve safety on the water. Between 70 per cent and 80 per cent of accidents on the water are due to human error. New digital technology can also make ships more sustainable. The Smart Shipping Challenge was an appeal to the shipping sector to cooperate more closely with, for example, the automobile industry. The Ministry of Infrastructure and Water Management plans to amend shipping regulations so that new technologies can be tested on canals and rivers and at sea.

Lock stewards

For many recreational boaters, passing a lock is no simple matter. Large cargo ships and small pleasure boats have to manoeuvre together in a limited space. Once again therefore, Rijkswaterstaat decided to station stewards at a number of busy or complex locks during the 2017 summer season. A total of 60 stewards helped recreational users choose the right place in the lock chamber and enter and exit the lock. They also provided assistance in passing the lock, with instructions and information and by answering questions.

Crackdown to promote safe sailing

During the summer period, many recreational boaters break the navigating rules, intentionally or unintentionally. This can lead to dangerous situations on the water. For four days at the end of August 2017 Rijkswaterstaat cracked down on offenders on the lakes of Flevoland and the Princess Margriet Canal in Friesland. Using surveillance and rapid intervention craft, a water scooter and a helicopter we checked speed and position on the fairway and whether boaters were in possession of a boat licence and had the prescribed equipment on board. More than 450 inspections led to 180 warnings and 80 official reports, most of the latter for not using a lifeline, exceeding the speed limit and not being in possession of a boat licence. Many boaters were also taken to task for dangerous behaviour.

Management and maintenance

For smooth and safe use of the main waterway network, the waterways need to be navigable and well maintained.

New shipping routes on the North Sea

In the night of 31 May to 1 June 2017, the shipping routes to the south of Rotterdam and off the coast of Zeeland and Belgium were changed. This was a radical operation. To create the new routes, 12 new buoys had to be installed, 8 buoys had to be removed from the water and 9 buoys had to be replaced.

The new shipping routes are needed because wind farms are planned off the Dutch and Belgian coasts. The Netherlands and Belgium worked closely together to change the routes. The two countries also work together to improve access to the main ports, improve traffic flows to ports, and to achieve a single, uninterrupted waterway network reaching from France into Germany. At the same time, Rijkswaterstaat is working to improve the safety of shipping with pilot stations and anchorage along the southern part of the Dutch North Sea coast.

Zones for recreational craft

From a large, fast-moving ship, small slow-moving craft are often difficult to see. In 2017, Rijkswaterstaat demarcated special channels for recreational craft and smaller professional craft at the crossing between the Hollands Diep and the Dordsche Kil. This is a highly industrial area, with many professional craft carrying hazardous substances. To keep risks to a minimum, extra measures have been taken to ensure safety at the crossing.

Extra gate for the Volkerak Locks

In mid-August 2017, an extra, third gate was installed in the Volkerak Locks, Europe's largest and busiest inland waterway lock complex. The new gate will enable inland waterway traffic to circulate more smoothly, since passage through the lock will be faster, with shorter waiting times at peak hours. The third gate was installed in response to demand from the inland shipping sector. The Volkerak Locks are a crucial link between the port of Rotterdam, the Scheldt ports and the German hinterland. Around 115,000 commercial craft and 45,000 recreational craft pass the locks each year.

Eemshaven acquires a highway to the sea

In October 2016 work started on the expansion of the shipping channel from the North Sea to the Eemshaven and the ports of Delfzijl and Emden. The job was finished in December 2017 and ships with a draught of 14 metres are now able to reach the ports. Larger vessels now have better access to the Eemshaven.

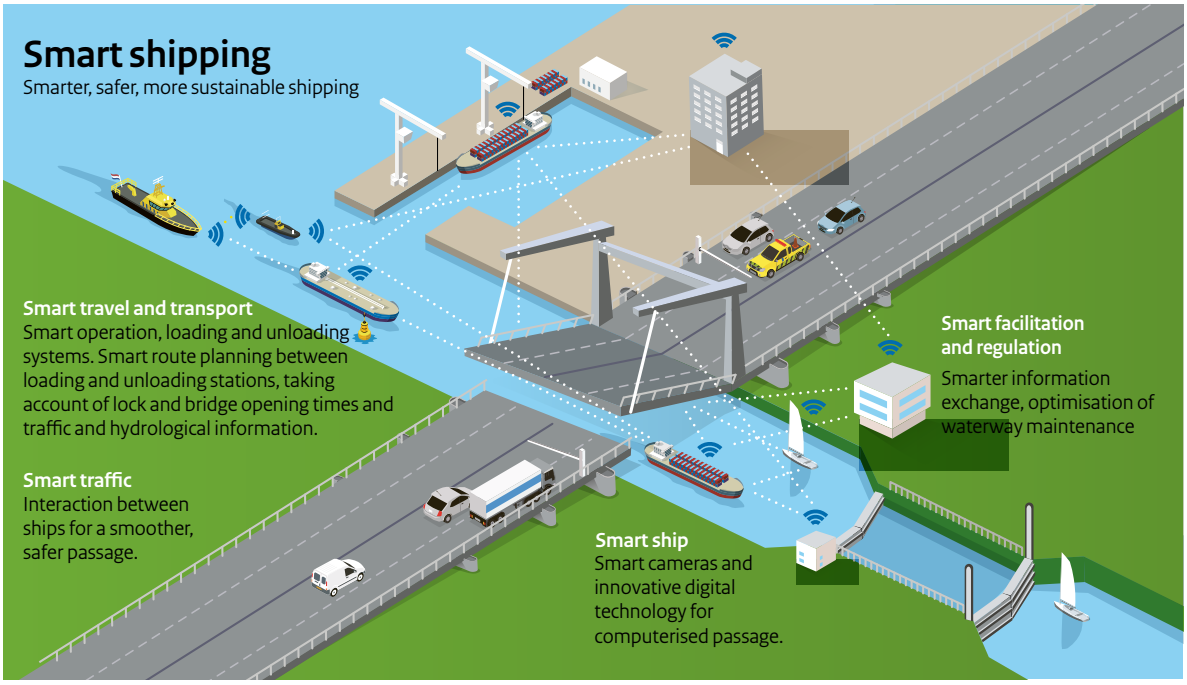
Dam at Grave restored

Dams enable Rijkswaterstaat to keep the water in the River Maas in Limburg at safe levels to navigate. On 29 December 2016, the dam at Grave was seriously damaged when an inland waterway vessel ran into it in thick fog. Part of the River Maas ran dry, and shipping between Sambeek and Grave was brought to a standstill for nearly a month.

In mid-January 2017, Rijkswaterstaat built a temporary dam from rubble. Behind it, we could then carry out repair work on the dam proper. In May and June, we repaired three of the five support beams, installed two new beams and re-installed 15 gates in the dam. We also strengthened the river bed beneath the dam. In mid-July 2017, we excavated the temporary dam. Since then, the dam at Grave has been fully operational once again.

Satisfied

A survey carried out in February 2017 by the water management authorities' platform *Water Ontmoet Water* (Water meets Water) showed that nearly 9 out of 10 users of the inland waterways are satisfied or highly satisfied with the way in which Rijkswaterstaat manages the waterways. Scores for the quality of the fairways were high, with 87 per cent of respondents expressing their satisfaction. Some recreational boaters felt that we should focus more on information provision, in particular on moorings and overnight moorings. Respondents also expressed some dissatisfaction at the remote operation of locks and bridges. We are now working on these issues.



New Meppelerdiep Lock

‘We can now rely on the new lock’

Henk Bonsink | owner of HEBO Maritiemservice

Smooth and safe transport by water

The new Meppelerdiep Lock has literally and figuratively opened doors for maritime service provider HEBO. When the flood barrier is closed at high or low water, ships can still sail smoothly and safely between the Meppelerdiep and Zwarte Water. HEBO owner Henk Bonsink talks about the miracle of Zwartsluis.

'It's October 2017, my wife, son and daughter are on board Catharina 10, the push barge that propels our two floating platforms, HEBO p6 and p7. From the lock-keeper's engine room I watch nervously as the 125-metre-long combination sails without a hitch into the new lock. The champagne flows. It's like a family celebration. Here I stand, an incredibly proud son of Zwartsluis. One of our ships first through the gate! It sends shivers of excitement down my spine.'

Blessing in disguise

'For three weeks in 1998, Zwartsluis was threatened by high water. To stop the land from flooding, the lock was closed for the entire period. No ships could get through. Businesses in the industrial zones of Kranerweerd, Meppel and Hoogeveen came to a standstill. You can imagine how much they lost. We were fortunate – HEBO had another job to do at that time. The nearby pumping station at Zedemuden was partly out of order, and we helped Rijkswaterstaat pump off the surplus water. If the pumping station had been fully operational, HEBO would also have suffered losses.'

Uncertain times

'The problem with the old lock was that you never knew when it was going to close, and that led to considerable uncertainty. I followed the weather forecast continually, and was in close contact with the lock-keeper. Even so, we sometimes loaded a ship and then found that the lock was closed. We had to-turn back again.'

Sill lowered

'The old lock sill was fairly shallow. At low water, it was always uncertain whether a fully loaded ship would pass the lock unscathed. The lock was also on the narrow side, so quite a few ships managed to wreak havoc as they passed through. There was one ship that had difficulty passing the lock gate because of the current and the various water levels. When it had finally managed to get through, the bridge-keeper closed the bridge to let the queue of waiting road traffic through. But the current was so strong that it took hold of the ship and pushed it back. The wheelhouse collided with the bridge and was flattened. That could have happened to us. Now that the lock is wider and has a deeper sill, we know that we can get through safely. That is quite a comforting thought, I can tell you.'

> 'I think it was a major feat that we had so few closures'

Reliable

'When the flood barrier is closed to protect the land from flooding, we can still sail through, thanks to the new lock. We recently had to transport a windmill to Morocco, but it was high water. In the past, we wouldn't have been able to deliver the windmill on time, and we would've lost the contract. In our sector, it's a crime not to deliver on time. Our company works by the clock, and we can now rely on the new lock. We can plan our transport operations without taking account of obstacles or the need for possible alternatives. So we are a reliable partner, and have grown as a result. And the new lock is wider, which is also a huge advantage. Now we can reach our depot with sea-going pontoons, which means we can transport larger loads.'

Feat

'It took nearly 12 years for the new lock to be built. That's not bad for such a huge operation. There was so much at stake that a whole lot of parties were involved in the public participation procedure – including the provincial authorities, shipping sector representatives and local residents. The procedure went very smoothly. If we didn't agree on a proposal, Rijkswaterstaat looked at other ways of approaching the project.'

'Work on the Meppelerdiep Lock took five years. I think it was a major feat that in all that time we were faced with so few closures. And they never lasted longer than a week, and sometimes just two days. They were always announced six months in advance, so that we could take account of them.'

New Meppelerdiep Lock

The Meppelerdiep Lock has been converted so that it now has a double pair of gates. And it has acquired a new function. Besides protecting the provinces of Drenthe and Overijssel from flooding, it now ensures smooth, safe passage of shipping between the Meppelerdiep and the Zwarte Water. The new lock is wider and deeper, so that larger inland waterway vessels can reach the harbours at Zwartsluis and Meppel. On 25 October 2017, HEBO Maritiemservice's Catharina 10, with two floating platforms, was the first inland waterway vessel to pass the new lock.

7 Reliable and useful information

Accurate and timely information is increasingly important for road and waterway users. They want information on traffic jams and diversions, and on water levels and the navigability of the waterways. Reliable and useful information is indispensable for user-friendly, efficient management of motorways, waterways and water systems.

Main water system

Rijkswaterstaat provides timely, reliable and useful information on water levels and on the quantity and quality of water. Our customers are all users of the main water system: water professionals and the public.

Water awareness

Too few people are aware of the work that goes into keeping the country dry and habitable. They are also poorly informed about the risk of flooding and what to do in an emergency. Rijkswaterstaat is committed to making the public more aware of water issues.

Traffic controllers at work in Velsen-Zuid traffic control centre

Barrier Dam icon

In the next few years, Rijkswaterstaat will be strengthening the Barrier Dam (*Afsluitdijk*). This dam is a powerful symbol for water management in the Netherlands and both central government and the region want to exploit its iconic function to the full. They want the Barrier Dam to serve as a showcase for Dutch hydraulic engineering, not only strengthening the dam's cultural and historical value but also raising public awareness of water issues.

In 2014 designer and innovator Daan Roosegaarde was called in to help. On 18 November 2017 three of his designs were opened to the public. The Barrier Dam has now acquired a permanent, futuristic gateway. In the dark, the 60 monumental towers on either side of the dam light up in the headlights of passing vehicles. A temporary design and innovation exhibition was held from 17 November 2017 to 21 January 2018. Exhibits included a kite that generates energy and leaves a strip of light in its wake and fluorescent algae projecting a future green landscape against the horizon.

Overstroomik.nl

To make the public more risk-aware and increase their self-reliance in the event of a major flood, Rijkswaterstaat developed the *Overstroom ik?* website and app a few years ago. Users can enter their postcode and see the maximum height the water can reach in their postcode district, the location of high buildings with a dry floor and the infrastructure that can be used as an escape route. In the event of a real crisis, the app and the website will direct the user to the emergency broadcaster.

Maeslant storm-surge barrier

The Maeslant and Hartel storm-surge barriers protect two million people in South Holland against storm surges from the sea. Before the annual storm season starts on 1 October, Rijkswaterstaat tests these flood defences to see whether they are still fully operational. This year's test closure on 9 September was also a festive occasion. In 2017, the Maeslant barrier was 20 years old. Visitors to the Keringhuis information centre could participate in activities based on the theme of flood protection, and take in an outdoor exhibition on water storage. They could experience what a flood is like and see what they themselves could do to keep their feet dry.

National water week

The government, drinking water companies and nature conservation organisations work every day to keep our water clean. But very few people know what this entails, and how they themselves can contribute. They could find out during the national water weeks, which were held in May and October 2017. Water museums and water purification plants opened their doors to the public and organised activities. In May, the main activity was counting fish. Many volunteers helped to chart the fish stocks, since these indicate how clean the water is. During both weeks, staff from the water sector also visited schools.

The national water weeks are an initiative of the Ministry of Infrastructure and Water Management, Rijkswaterstaat, drinking water suppliers Vewin, the Delta Programme, the water authorities, the provincial and municipal authorities and water companies.

Swimming warnings

In the summer of 2017 Rijkswaterstaat again issued warnings about the dangers of swimming in rivers and canals. Despite the ban on swimming in shipping channels and at bridges, locks and harbours, injuries and deaths occur every year. The currents in rivers, canals and whirlpools can be strong enough to pull swimmers underwater. Furthermore, the navigators of large vessels have difficulty spotting people in the water.

Bathing Water app

The Bathing Water app is a handy tool for open-water swimming enthusiasts. It was developed by the Association of Provincial Authorities, the Association of Regional Water Authorities and Rijkswaterstaat to inform the public about the quality and safety of official open-water bathing locations. With the aid of Google Maps, users can conveniently find local bathing locations, learn how safe they are and find out when the water was last tested. Routes can also be plotted to lakes and swimming pools. When the temperature rises above 25 degrees Celsius, the app issues a warning if there is a risk of blue-green algae. Safe bathing locations are also listed on *www.zwemwater.nl*.

Main waterway network

The Netherlands is Europe's water transport hub. Dutch waterways are among the busiest in the world. For smooth, safe and efficient use of the waterways, information is essential.

Customised waterway information

Information is essential to ensure traffic circulates smoothly and safely on the waterways. Waterway users need to know about currents, weather conditions and tides, dredging work and closures, for example. On *www.vaarweginformatie.nl* Rijkswaterstaat provides information that could be relevant to their journeys. Website users can set up their own free, personal account for information customised to their planned routes. The website also covers the inland waterways in countries popular with recreational boaters, like Germany and France.

Safe Boating

Safety on the waterways is a concern during the busy summer periods. Recreational boaters and commercial shippers are increasingly getting in each other's way. The Safe Boating campaign is therefore meeting the growing need for information about the risks on Dutch waterways.

The information is provided via social media and an app. Booklets and flyers are also handed out at trade fairs, harbours and locks and by rental companies and sailing schools. The project is an initiative by the Stichting Recreatietoervaart Nederland alliance, Rijkswaterstaat, the provincial authorities, port authorities, water sports associations and interest groups.

Main road network

Millions of people take to the Dutch motorways every day. Reliable, up-to-date information on hold-ups, diversions and maintenance work is crucial to keep the traffic moving.

Up-to-the-minute traffic information

Rijkswaterstaat's National Traffic Management and Information Centre (VCNL) supplies service providers such as the Royal Dutch Touring Club (ANWB) and TomTom satellite navigation with a constant stream of up-to-the-minute traffic information via the National Data Warehouse for Traffic Information. They in turn pass on the information to road users via the radio, internet, navigation systems and social media.

Road inspector Christian
@WIS_Christian • *26 feb.*

Wintry showers in the south of Limburg.
We've spread salt, and the salt spreaders are still in action. Drive carefully, keep your distance and adjust your speed.

Road inspectors on Twitter

Rijkswaterstaat makes systematic use of Twitter to inform users about lane closures due to maintenance work, diversions and emergency repairs. Road inspectors and mobile shipping traffic managers also use Twitter to share their experiences with thousands of followers as they work to ensure traffic circulates safely and smoothly.

Information panels above the motorway

Delays app

In January 2017, Rijkswaterstaat launched a free app with information on traffic delays. The app, *Rijkswaterstaat Actueel*, is linked to a new Twitter account, *@RWS_verkeer*. Together they provide road users with information on hold-ups on the motorways, roadworks and diversions, enabling them to plan their journeys and avoid delays. The app and the Twitter account also provide information on incident clearance on the main road network.

The app and Twitter account supplement existing information sources, like panels above and alongside the road and traffic information services. The app is downloadable from both App Store and Play Store.

Emergency telephones removed

As of 1 July 2017, the 3,300 emergency telephones have been removed from the Dutch motorways. The telephones in their iconic bright yellow pillars were the property of Rijkswaterstaat and gave direct access to the Royal Dutch Touring Club (ANWB) helpdesk. They are no longer needed, because nearly everyone now has a mobile phone. Removal of the emergency telephones presented Rijkswaterstaat with a good opportunity to provide the following tips on what to do in the event of a breakdown. Always make sure your mobile phone is charged, and that you have the number of your emergency roadside assistance provider at hand. In the event of an incident, go and stand behind the crash barrier, wearing your safety jacket, and phone for assistance as quickly as possible.

Most of the emergency telephones will be given a second life as charging points for electric vehicles or information panels.

Information and data

Information and data are becoming increasingly important factors in Rijkswaterstaat's work. Optimal provision of information and data enables us to respond more readily to the wishes of infrastructure users. Our aim is for everyone in the Netherlands to have real-time access to relevant information on developments on the roads and waterways.

We need information and data to monitor the condition of our infrastructure. We are making growing use of sensors to monitor the condition of road surfaces and dikes. We have already installed sensors in the moving components of the Prince Bernhard Lock. This enables us to prevent unexpected technical failure, plan maintenance work and keep consumption of energy and materials at the lock to a minimum (read also the story at page 48).

Preventive maintenance at the Prince Bernhard Lock in Tiel

‘No more unexpected technical malfunctions? Why not?’

Gilbert Westdorp | senior adviser Rijkswaterstaat

Reliable and useful information

Ships queueing for hours because of a defective lock. Long tailbacks because a bridge won't close. Rijkswaterstaat's Gilbert Westdorp dreams of a future with far fewer technical malfunctions and far less inconvenience to road and waterway users. Is this a pipedream? 'By monitoring with sensors we can do the right maintenance work precisely when it's needed. If we install sensors in all our structures, we'll be taking a huge step forward.'

Dream on

'Dream on, Gilbert.' That's probably what my colleagues first thought when I came up with this idea. Rijkswaterstaat manages hundreds of bridges, locks and dams that are more or less approaching the end of their service life and are increasingly showing signs of wear and tear. It will take years to renovate or replace them all. So reducing the number of technical malfunctions sounds like an impossible task.'

'But over a year ago I began to see some possibilities. At the time, I was in contact with a company that was able to detect the imminent failure of a compressor on an offshore installation by monitoring its energy consumption. We could do that too, I thought. And so we launched a trial at the Prince Bernhard Lock in Tiel. We're also investigating whether this new way of working should be introduced throughout Rijkswaterstaat.'

This is how it works

'If an installation starts using more or less energy than usual, there's a good chance that it's not working properly any more. By continually monitoring its energy consumption with sensors, you can see far earlier and with far more accuracy than with the human eye where maintenance work is needed. This means that you can not only deal with problems on time, but even prevent them happening. And you can carry out the work much more precisely. That means far less inconvenience for road and waterway users.'

Nothing to worry about, then?

'Back to the lock. On the morning of Friday 6 October 2017, things start to go wrong. On my screen I can see that a dehumidifier in one of the towers is using far less energy than usual. Though our maintenance engineer carried out his weekly inspection just a few days ago and saw nothing to worry about, I know there's something wrong.'

'We'll be faced with fewer unpleasant surprises'

'When the manager goes to have a look, he sees that the heating unit in the dehumidifier is broken, and that only the ventilators are working. This defect isn't going to cause an urgent problem, but it needs to be dealt with quickly. If the dehumidifier ceases to function, the lift installation might suffer serious damage as soon as the weather turns colder. In the worst-case scenario, the entire lock basin could break down. And that would lead to serious hold-ups for a long time to come.'

The approach works well

'The incident with the dehumidifier shows that the approach works well: we can detect defects at an early stage. That's a great advantage. If we equip all our structures with sensors in the next few years, we can see in time which components need to be repaired or replaced. And we'll be faced with fewer unpleasant surprises.'

Benefit to society

'The advantages are clear. We can carry out the right maintenance work at the right time, neither too late nor too early. And we can order the components we need on time. Preventive maintenance also saves money. But most important is the benefit to society. Fewer technical malfunctions mean less inconvenience for road and waterway users. When bridges and locks, whatever their age, operate as smoothly as water flowing from the tap, my dream will have come true.'

Maintenance work on the Prince Bernhard Lock

For optimal use of data in service provision, Rijkswaterstaat set up its own data lab in 2017. This team makes data accessible, safeguards its quality and links it to smart algorithms, which are then integrated into the normal work process. The sensors in the Prince Bernhard Lock are a good example of the team's work. Gilbert Westdorp, senior adviser at Rijkswaterstaat, took the initiative to launch the trial with preventive maintenance at the Prince Bernhard Lock.

8 Changes in the organisation

Rijkswaterstaat wants to respond flexibly and professionally to the challenges facing society today. That is the aim of Strategy 2020, our customer-driven organisational approach. Based on this strategy, our 9,200 staff members work together to keep the Netherlands safe, liveable and accessible.

The third Rutte government took office in 2017. The new coalition agreement addresses many major developments in the field of climate, transport, spatial planning, public participation, sustainability, technology and innovation, all of which affect society.

Five priorities

Society and its demands are changing ever more rapidly in all these areas. Rijkswaterstaat wants to respond to these changes more flexibly and more professionally. In 2017, we identified five priorities to indicate the direction in which our organisation will develop in the years to come. These priorities are a sustainable living environment, the Environment and Planning Act, replacement and renovation, smart mobility and information provision.

Sustainable living environment

Working on a sustainable, high-quality living environment touches on Rijkswaterstaat's every service and product. For this reason, we introduced a new Sustainability and Living Environment Programme in early 2017. The aim is to anchor sustainable working methods in all parts of our

View from the Rijkswaterstaat office along the Amsterdam-Rhine Canal

organisation and in our work processes. Rijkswaterstaat's aim is to develop as the executive organisation not only of the Ministry of Infrastructure and Water Management, but also of other central government agencies.

Environment and Planning Act

Working with the Environment and Planning Act, which will enter into force after 2019, is a tangible example of working on liveability and public participation. The new act will impact on the work of around 4,000 members of Rijkswaterstaat staff. It will enable government agencies to work together more efficiently and more actively on a sustainable living environment, driven by the needs of our customers. Rijkswaterstaat also wants to involve the general public and regional authorities more closely in developing the living environment – at both the preparatory stage and during implementation of projects.

Replacement and renovation

In the years to come, the Netherlands faces the biggest maintenance operation ever, when much of its infrastructure will need replacing or renovating. Keeping roads, bridges, tunnels and viaducts safe, reliable and accessible will have the highest priority in Rijkswaterstaat's work in the foreseeable future. We will need all the expertise at our disposal to prevent and limit inconvenience and disruption. Careful planning and programming will be crucial. Rijkswaterstaat will also have to work more closely with market parties, knowledge institutions and other government authorities to ensure that we have the high-quality staff and the knowledge and expertise we need, and to exploit opportunities for innovation and standardisation, so that we can meet this major challenge efficiently and affordably.

Smart mobility

Rijkswaterstaat wants to exploit opportunities for smart mobility to improve traffic management, manage roads more efficiently and provide services for road users. In the next few years, we plan to make our roadside systems smart-mobility-proof and work with a carefully thought-out, intelligent traffic management plan.

Information and data

Rijkswaterstaat also wants to make optimum use of online information provision, data and innovative technology. This will enable us to respond more adequately to the wishes of our users, with real-time customised travel information. And we will be able to fulfil our role as infrastructure and traffic manager more efficiently, computerise major structures and secure them against technical failure and hackers.

Transition and cooperation

To achieve the objectives of Strategy 2020, Rijkswaterstaat will need to undergo a transition in the next few years. In 2017 we started working with this new strategy on clear internal management structures and a clear distribution of

roles and tasks. We have strengthened management of the organisation by working on clear management decisions that can implement streamlined work processes. Rijkswaterstaat also wants to work on more unity within the organisation, even better internal cooperation and a culture of internal connectivity. In the next few years we will be actively investing in external cooperation with our counterpart infrastructure managers and other partners.

New work culture

Strategy 2020 calls on Rijkswaterstaat to make as few changes as possible to its organisational structure in the next few years and to reduce unnecessary internal regulation. The aim is to create a sense of calm within the organisation, enabling staff members to focus their talents, skills and attention on the services and products they provide for society. Expertise and the significance of our work for society play a central role. Staff members must each feel that they own their work, and that they have the freedom to do it as they see fit. In this way, Rijkswaterstaat will continue to be an attractive employer.

Capacity management

Ensuring that the right knowledge is available at the right place in the organisation is becoming an increasingly important task for Rijkswaterstaat. In 2017, the average age of our staff was 49. Within 10 years, 40 per cent of the current workforce will retire. At the same time, the labour market is becoming tighter. Each year, using strategic capacity management and a carefully thought-out labour market strategy, we determine what knowledge must be developed, strengthened or obtained to enable us to operate in the years to come.

Knowledge

In its knowledge strategy, Rijkswaterstaat has identified what knowledge and expertise the organisation itself must have in-house and what it can obtain from external knowledge parties. A targeted approach to mobility enables us to coordinate the recruitment, transfer and departure of staff and their knowledge. Specialist knowledge is pooled within internal core teams or programmes that operate across organisational units – knowledge of flood defences, sustainability or smart mobility, for example.

Partnership

Infrastructure- and environment-related challenges call for new research into the circular economy, climate and energy, use of space and ecology. In January 2017, Rijkswaterstaat entered into a partnership with Wageningen University & Research. In the next four years, the parties will work together on research and training – the latter through guest lectures, case histories, work experience placements and dissertations, for instance.

In-house knowledge

In the '90s, Rijkswaterstaat started contracting more and more of its work out to external market parties. This included designing. In early 2017, we set up our own Design Agency to take on a few design projects each year. This will enable us to keep our specialist knowledge up to date and, in putting projects out to tender, specify more clearly what we require of our contractors. We will also learn how to produce more reliable cost estimates, and to communicate more clearly with our contractors.

Rijkswaterstaat's Design Agency is set to work on three projects in 2017 – an integrated design for the flood defences at the IJmuiden locks, selective freshwater extraction at the same location and a pre-draft design for cement bridges on the Utrecht ring road.

Market Vision

Building projects are becoming increasingly complex and call for closer cooperation. A few years ago, Rijkswaterstaat took the initiative to develop a Market Vision, which was presented in early 2016. By 2020, builders in the Netherlands aim to excel in a vital sector that works in close partnership to ensure maximum added value for society.

The Market Vision invests in a new work and partnership culture, with a better understanding of each other's position and the willingness to share risks more fairly and exchange knowledge and information more openly. New-style partnerships ultimately lead to fewer rules and less red tape in contract award procedures, so transaction costs and the costs of failure can be reduced.

Implementation

The Market Vision is a joint product of Rijkswaterstaat, ProRail, Cemtral Government Real Estate Agency, sector organisations Bouwend Nederland, MKB INFRA, NLingenieurs, Vereniging van Waterbouwers, UNETO VNI and Astrin (Association of Traffic Industries in the Netherlands). All organisations have started embedding the Market Vision within their organisations.

In 2017, Rijkswaterstaat adapted its manual on system-oriented contract management to bring it into line with the Market Vision. And in many places in the organisation, staff members worked on pilot projects in which they entered into dialogue with market parties at an earlier stage – for example the A27 project at Houten-Hooipolder and the new tenders for the management, maintenance and operation of Rijkswaterstaat's fibre-optic network.

Rijkswaterstaat and market parties have developed a training course for staff members who want to encourage their organisation to work more closely in line with the

Market Vision. These staff members will also work on connectivity with other parties in the sector.

Awareness of the Market Vision has grown considerably since 2016. A survey of Rijkswaterstaat staff held in 2017 showed that 90 per cent had heard of it, while 81 per cent endorsed the need for it.

Stronger reputation

In 2017, the business community's confidence in Rijkswaterstaat proved to be higher than ever. Eighty per cent of the 282 partners taking part in a survey conducted by research agency Ipsos expressed confidence in Rijkswaterstaat. This figure was 69 per cent in 2015. Eighty per cent also found that Market Vision had led to improvements in the work process, while 56 per cent said that it made a positive contribution to the partnership.

Some parties are concerned that there is a brain drain at Rijkswaterstaat. The majority of our business partners (54 per cent) are pleased that Rijkswaterstaat takes sustainability on board. Fifty per cent of the market parties say that we are open to innovation, but a third say that, too often, Rijkswaterstaat ultimately chooses tried-and-tested technologies.

9 Summary annual accounts 2017

Statement of income and expenditure 2017

All amounts in thousands of euros	**31 - 12 - 2017**	**31 - 12 - 2016**
Income		
Income from parent ministry	2,212,833	2,235,181
Income from other ministries	38,677	40,224
Income from third parties	179,317	155,069
Provisions released	3,324	22,608
Extraordinary income	2,348	3,407
	2,436,499	2,456,489
Expenditure		
Management and maintenance costs	1,321,514	1,349,063
Other costs:		
Personnel costs	827,364	786,627
Equipment costs	203,768	204,661
Depreciation and amortisation	29,086	30,411
Interest expenses	3,707	4,041
Additions to provisions	12,449	7,112
Extraordinary expenses	10,728	217
	2,408,615	2,382,132
Net income and expenditure	**27,884**	**74,357**
Agency share of corporation tax	7,885	
Addition to Government Shipping Company reserve	8,305	10,269
Unallocated result	**11,694**	**64,088**

Balance sheet as at 31 December 2017 (before allocation of result)

All amounts in thousands of euros	31 - 12 - 2017		31 - 12 - 2016	
Assets				
Fixed assets				
Intangible fixed assets	2,973		5,551	
Tangible fixed assets	160,020		179,471	
Financial fixed assets	42,800		48,800	
		205,793		233,822
Current assets				
Debtors	35,936		36,478	
Other debtors, prepayments and accrued income	32,183		39,107	
		68,119		75,585
Liquid assets		676,570		601,934
MIRT projects				
Projects in progress		7,457,663		8,190,543
Total assets		**8,408,145**		**9,101,884**
Liabilities				
Capital and reserves				
Government Shipping Company reserve	42,463		41,147	
Operating reserve	79,994		48,413	
Unallocated result	11,694		64,088	
		134,151		153,648
Provisions		38,975		44,134
Long-term liabilities		100,090		124,502
Current liabilities				
Creditors	79,962		53,254	
Current liabilities to ministry	446			
Other creditors, accruals and deferred income	596,858		535,803	
		677,266		589,057
MIRT projects				
Deliverable projects		7,457,663		8,190,543
Total liabilities		**8,408,145**		**9,101,884**

Notes to the summary annual accounts

The summary annual accounts and notes are taken from Rijkswaterstaat's annual accounts for 2017. The annual accounts were compiled in accordance with Ministry of Finance regulations. An unqualified audit opinion was issued on them. Rijkswaterstaat's annual accounts form part of the Ministry of Infrastructure and Water Management's annual accounts.

The 2017 financial year was closed with a surplus.

Income from other ministries mainly comprises income received in respect of the Government Shipping Company.

Income from third parties largely consists of rents and leases paid for parcels managed by Rijkswaterstaat, compensation paid for damage caused by road or waterway users, income under the Water Act and income from services provided by the National Road Signage Agency.

Management and maintenance costs are charged by contractors and engineering firms.

Personnel costs consist of the cost of our own staff and of temporary staff hired in to carry out Rijkwaterstaat's core tasks.

Financial fixed assets comprise the debt falling due after more than one year receivable from the Ministry of Infrastructure and Water Management. The current portion is included under 'debtors'. The non-current portion will be paid off by the Ministry of Infrastructure and Water Management over 15 years as from 2009.

Projects in progress consists of direct production expenditure on current construction projects. Deliverable projects are recognised as a contra entry to the same amount.

Operational management

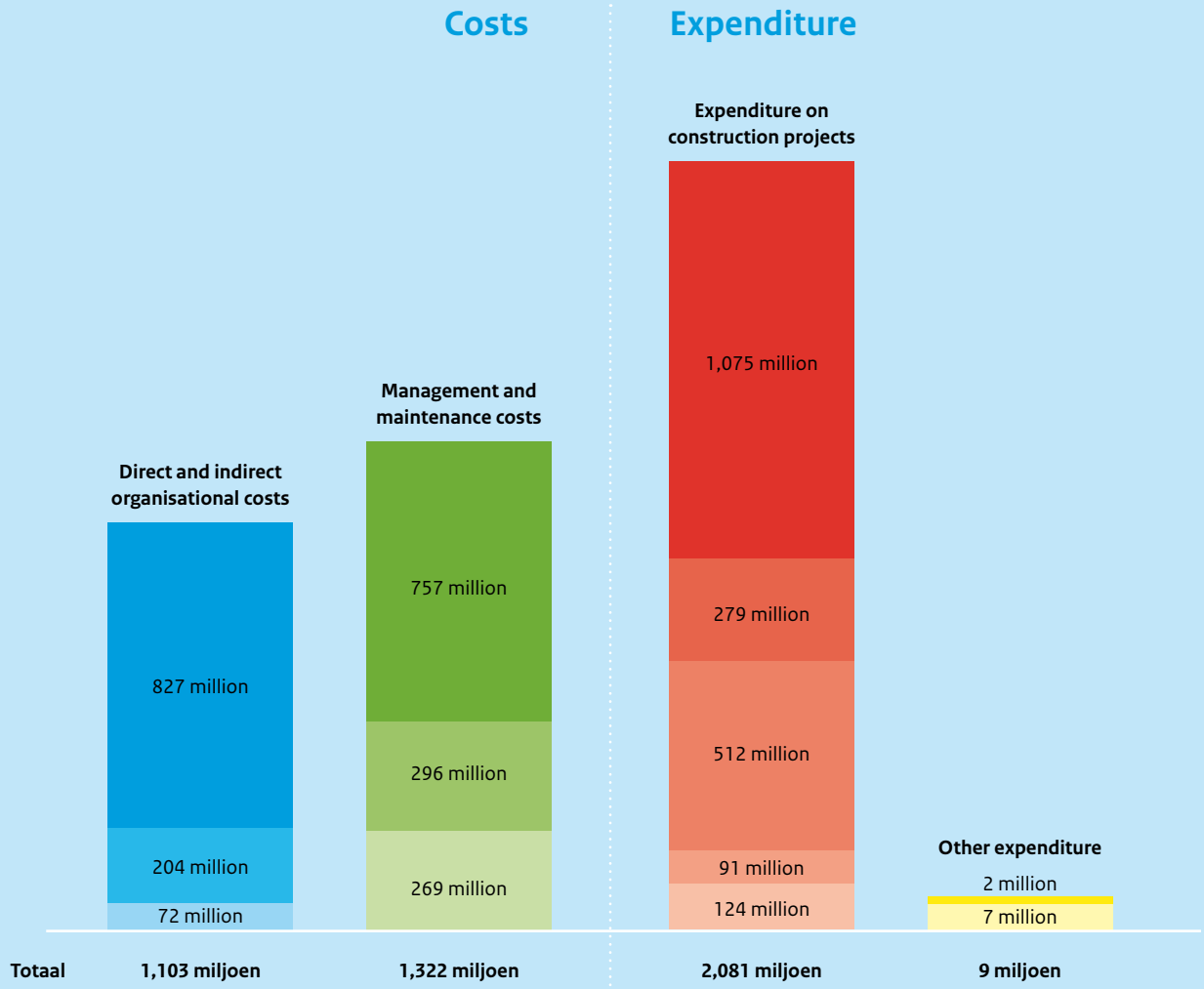
In 2017, under interministerial agreements on complying (in a demonstrable manner) with the Public Procurement Act, the market approach was assessed against the statutory requirements for the (independent) selection of suppliers. The outcome was positive. In 2018 further attention will be devoted to how the choice of procedure can be monitored in more systematic manner and what this requires in terms of ICT support and working methods.

In 2017 the contract management framework was modified; a distinction is now made between requirements for contracts with system-oriented contract management (SCB) and those without it. The HRM and training efforts required for this purpose were continued at the same level in 2017. This resulted in the ambitions set being achieved.

The Corporation Tax Liability (Public Enterprises) Modernisation Act entered into force on 1 January 2016. Agreements on related activities and responsibilities have been laid down in the Corporation Tax Framework of the Ministry of Infrastructure and Water Management. Rijkswaterstaat's activities have been charted and the results achieved have been determined as far as possible.

In 2017 Rijkswaterstaat paid 97 per cent of the 141,000 or so invoices it received on time, i.e. within 30 days, thus comfortably meeting the government-wide target of 95 per cent.

Rijkswaterstaat costs and expenditure 2017 *(total 4,5 billion euros)*



Direct and indirect organisational costs

- Personnel costs
- Material costs
- Other organisational costs

Management and maintenance costs
(including traffic management)

- Main highway network
- Main waterway network
- Main water systems

Expenditure on construction projects
(Infrastructure and Delta Fund)

- Main highway network
- Main waterway network
- Main water systems
- Megaproject
- Regional and local infrastructure

Other expenditure
(infrastructure/environment)

- Improvement of the living environment (GIS)
- Miscellaneous

All amounts in euros

Notes to costs and expenditure

As a departmental agency, Rijkswaterstaat concludes management and maintenance agreements with the Ministry of Infrastructure and Water Management. Rijkswaterstaat receives an agency fee for the work it performs, which also covers organisational costs. Rijkswaterstaat can make a profit or incur a loss on the agency fee. Rijkswaterstaat is also responsible for the construction and expansion of the main highways and waterways and the main water systems. The ministry funds the expenditure on these construction projects directly from the Infrastructure Fund and the Delta Fund. Rijkswaterstaat cannot make a profit or incur a loss on this expenditure.

Management and maintenance costs

The costs of managing and maintaining the land and waters for which Rijkswaterstaat is responsible, together with its organisational costs, are accounted for in this annual report and disclosed in the statement of income and expenditure. Management and maintenance costs consist of the cost of work by contractors on the main highways and waterways and the main water system, and the cost of traffic management (main highway and waterway network and) and water management (main water system). Network-wide costs are disclosed separately.

Direct and indirect organisational costs

Organisational costs are divided into personnel costs, equipment costs and other organisational costs.
Direct personnel and equipment costs relate principally to traffic and water management, management and maintenance, exploratory and planning studies, and the implementation of construction projects.
Indirect equipment costs include buildings and depreciation; indirect personnel costs include, for example, central administration and management support staff.

Expenditure on construction projects

Construction projects relate to building work on the main highways and waterways and the main water system. Like management and maintenance, this work is outsourced to third parties. Other costs incurred by Rijkswaterstaat for these projects (such as project management costs) form part of organisational costs and are accounted for in the agency's statement of income and expenditure.

Other expenditure

Chapter XII of the central government budget is the budget of the Ministry of Infrastructure and Water Management. Rijkswaterstaat accounts for expenditure on improving the living environment (the Noise Reduction Schiphol project (GIS)). This includes expenditure on the Schadeschap Luchthaven Schiphol (which handles claims for compensation) and expenditure on crisis management, for training courses (e.g. in crisis roles), evaluations and the Crisis Expert Team on the environment and drinking water.

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