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## BEST4ROAD

# Country-specific reports on road maintenance procurement

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## 1 Introduction

The trans-national research programme “**Call 2014: Asset Management and Maintenance**” was launched by the Conference of European Directors of Roads (CEDR). CEDR is an organisation which brings together the road directors of 25 European countries. The aim of CEDR is to contribute to the development of road engineering as part of an integrated transport system under the social, economic and environmental aspects of sustainability and to promote co-operation between the National Road Administrations (NRA).

The participating NRAs in this Call are Belgium-Flanders, Finland, Germany, Ireland, Norway, the Netherlands, Sweden, United Kingdom and Austria. As in previous collaborative research programmes, the participating members have established a Programme Executive Board (PEB) made up of experts in the topics to be covered. The research budget is jointly provided by the NRAs who provide participants to the PEB as listed above.

BEST4ROAD is a two years project aiming at the development of best practice guidelines and tools for the efficient procurement of road maintenance in a changing world. Based on a comprehensive and integrative framework for maintenance procurement, the project will bring together the extensive, yet scattered procurement knowledge and experiences at National Road Authorities (NRAs) in 9 countries including the US and Australia. It will determine the lessons learnt at the NRAs and based on that will develop a number of hands-on tools and step-by-step guidance for procuring road maintenance taking current and future challenges of NRAs into account.

The benefit of the BEST4ROAD project for NRAs lies in the integration of an in-depth study and comparison of maintenance procurement practices in different countries with the development of tools and guidelines that can be easily implemented and used at NRAs. This will allow NRAs to learn from their peers and at the same time improve their maintenance procurement practices to get prepared for future challenges such as staff turnover and shrinking budgets.

The BEST4ROAD project consists of seven work packages (WP):

- WP1 – Comparison of maintenance procurement practices
- WP2 – Maintenance procurement strategies and maintenance efficiency
- WP3 – Quick scan method for risk in maintenance procurement
- WP4 – Competence profiles and transition processes
- WP5 – Best practice guidelines
- WP6 – Dissemination and demonstration
- WP7 – Project management

The main objective of WP1 is to study, scan and compare maintenance procurement practices in 9 countries and identify commonalities and differences in terms of driving factors for maintenance procurement practices, effects of maintenance procurement practices on road quality and maintenance costs, and risks experienced with current maintenance procurement practices and how they are managed.

This report presents a summary of country-specific practices in road maintenance procurement of the 9 countries (NRAs).

## 2 Maintenance procurement framework

The main focus of the BEST4ROAD project is *maintenance procurement* that is defined as all activities and decisions necessary for a NRA to acquire maintenance services for road infrastructure from supplying contractors. Maintenance procurement goes beyond the sole purchasing function of an organisation and covers the entire process from the identification of maintenance requirements to the management of maintenance contracts.

*Maintenance* as the procurement object involves all activities during the life cycle of road infrastructure assets intended to retain the assets in, or bring them to, a state in which they can perform the required function considered necessary to deliver a defined service. In the BEST4ROAD project two main maintenance tasks are distinguished: *operational tasks* and *management tasks*.

Through operational tasks the actual physical maintenance work is carried out (*doing*). They are divided into: regular maintenance and rehabilitation. *Regular maintenance* involves all activities that are of a repetitive nature and are executed in short-term intervals. The activities are often small in terms of resource demand and aim at retaining the condition of road assets rather than bringing them to an increased performance level. Typical regular maintenance activities include cutting grass, cleaning drainages, winter maintenance activities and small pavement repairs. In some countries, this type of maintenance is categorized as regular or periodic maintenance. *Rehabilitation* is carried out in long, non-repetitive intervals, and involves a larger amount of work, and aims at enhancing the service life of a road asset or improving its performance. Typical rehabilitation activities include pavement resurfacing. In some countries, this maintenance is categorized as variable maintenance.

Maintenance is also understood as a cyclical process where the actual operational work is preceded by supporting management tasks such as *monitoring* (including inspecting of road assets and predicting of road performance) and *planning* (including developing maintenance strategies and planning maintenance work).

In order to study and compare maintenance procurement across different countries, a comprehensive framework is used consisting of the following procurement components and aspects:<sup>1</sup>

**Maintenance procurement context:** relates to the drivers that can explain the development towards certain maintenance procurement practices and the appropriateness of these practices for achieving intended maintenance outcomes.

**Maintenance procurement practices:** relate to past, current and future practices of NRAs in different countries in terms of procuring road maintenance.

**Maintenance procurement outcomes:** relates to the consequences of procurement maintenance practices for the effectiveness and efficiency of road maintenance.

**Maintenance procurement competences:** relates to the required skills and capabilities at NRAs to procure road maintenance.

In addition, for each NRA the used contract types (discrete, framework and integrated) are presented according to Figure 1. The example in Figure 1 represents the German discrete contracts (GE discrete) and shows that separate contracts (blue boxes) are in place for the rehabilitation of different assets and that only the operational activities (*doing*) are covered by

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<sup>1</sup> A detailed description of the framework aspects can be found in the report for deliverable 1.1 of the project.

the contracts. This provides an easy way to compare the content of the maintenance contracts in different countries<sup>2</sup>.

Type of maintenance		Type of asset					
Task	Activity	Build assets			Installed assets		
Rehabilitation	Plan						
Rehabilitation	Monitor						
Rehabilitation	Do rehab						
<i>Regular maintenance</i>	<i>Do regular</i>						
<i>Regular maintenance</i>	<i>Monitor</i>						
<i>Regular maintenance</i>	<i>Plan</i>						

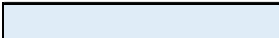
 single contract with full responsibility

Figure 1 Content of maintenance contracts (example)

<sup>2</sup> For the more comprehensive comparison see report for deliverable 1.3 of the project.



## 3 Country-specific reports

### 3.1 The Netherlands – Dutch Roads and Waterways Agency

The following sections focus on the Dutch Roads and Waterways Agency (Rijkswaterstaat, RWS). The information was collected via interviews and documents<sup>3</sup>.

#### 3.1.1 Context

Rijkswaterstaat (RWS) is the executive authority of the Ministry of Infrastructure and the Environment, responsible for the Dutch main road network, the main waterway network, the main water systems, and the environment in which they are located. RWS facilitates smooth and safe flow of traffic, keeps the national water system safe, clean, user-friendly and protects the Netherlands against flooding. RWS is organized into 7 regional departments and 6 central departments. Under each region there are 3 to 4 districts.

The Netherlands has one of the world's densest road network. The state road network of the Netherlands consists of about 3,000 km of motorways, 1,400 km of access, exit and connecting roads, 2,750 viaducts, 13 ecoducts, 22 tunnels and 750 bridges. Additionally, there are 6,500 km of provincial roads and 119,000 km of municipal roads, which are managed by decentralized authorities.

The weather conditions divide the year into summer and winter periods. The average summer temperature is 17 °C and winter temperature is approximately 5 °C. The average summer precipitation is 65 mm/month in the summer and 75 mm/month in the winter. For this reason, the Dutch road system is unique in its reliance on porous asphalt (this type of asphalt is characterized by a high percentage of interconnected voids in the top layer of the pavement). The Dutch road network is now constructed with 90% porous asphalt and 10% regular asphalt.

The first corporate procurement strategy so called "Market unless" was published in July 2004 for the period 2004-2008. RWS was the last organisation within the Ministry of Transport that in 2006 became officially an autonomous administrative authority. The new procurement strategy for the period 2004-2008 was also seen as a way to break with the old system of drawing up agreements between contractors, by making contractor selection less predictable, increasing the distance between the government authority and contractors and promoting more innovation in the sector. A second procurement strategy was prepared for the period 2008-2012.

The following contract types will be reviewed:

- Discrete contracts for rehabilitation (Engineering and Construct), **NL discrete**
- Framework contracts for rehabilitation (Variable Maintenance Contracts), **NL framework**

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<sup>3</sup> 10 interviews were conducted with RWS employees and market parties. At RWS top specialists in market strategy and in pavement materials and structures, as well as internal technical advisors were interviewed. The market parties interviewed included contractors, consultants and research organisations. Documents studied include annual reports, contract documents, professional presentations, and audit reports (see also References).

- Integrated contracts for regular maintenance (Performance Based Contracts), **NL integrated**

### 3.1.2 Procurement Practices

#### Discrete contracts for rehabilitation of single and multiple assets

Discrete contracts (Engineering & Construct) are primarily intended for rehabilitation of existing road assets including bridge components, asphalt pavements and steel structures (Figure 2). The contract duration is marked by the beginning and the end of the works. The contracts are discipline-oriented. Contract sizes are decided along the organisational limits. The goal is to keep increasing their geographic scale, by integrating many traditional contracting units (i.e. bridge) into a single contract, which means that several assets will be integrated in one contract. The payment mechanism is lump sum.

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>				
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				


 single contract with full responsibility

Figure 2 Content of maintenance contract NL discrete

All contracts are awarded on the basis of the Most Economically Advantageous Tender approach. The price/quality ratio used for selection is 40% to 60%.

The formal relationship ends immediately after the project is delivered. However, contractors do offer a guarantee that can vary per subcomponent between five to ten years. For asphalt, the standard guarantee period is now seven years, but experts suggest that problems may actually show up around the eighth year.

The contracts have become the standard for the delivery of rehabilitation operational maintenance activities since 2007. The advantages are: a) the responsibility and implementation risks are carried (partly) by the contractor, b) the client retains a relatively large impact on the design and c) the client can steer and control the process on the basis of general technical assumptions or based on a preliminary design, and d) the client retains great flexibility to make adjustments. The main disadvantage may be that changes in the scope of the contract could be costly.

#### Framework contracts for rehabilitation of multiple assets

Framework contracts for rehabilitation (Variable Maintenance Contracts) include operational and management activities. The contractor is not only responsible for carrying out the work, but also for determining the maintenance actions required and coordinating the work with stakeholders. Activities that could be included are life lengthening work (e.g. minor asphalt repair), works with a short time frame (e.g. winter damage repair), drafting plans for traffic measures, coordinating stakeholders in an area, or obtaining permits (Figure 3).

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab		
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		

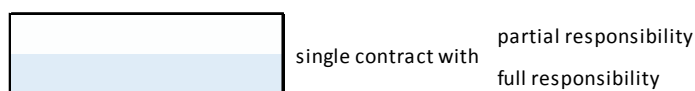


Figure 3 Content of maintenance contract NL framework

The contract has a duration of 2 years with the possibility of two, one year extensions if the contractor delivers good performance. For certain materials and types of work, a unit price is established. RWS then issues annually a list of work to be done. Based on that list, and the rates as agreed in the tender, a work package proposal is submitted. Upon acceptance of this proposal, the contractor carries out the work. Meanwhile, contractors can propose to carry out a number of special tasks, which include major rehabilitation works.

According to RWS this type of contract was more a transition type of contract just to lengthen the life of roads.

### Integrated contracts for regular maintenance of multiple assets

Integrated contracts for regular maintenance (Performance-based contracts) combine several regular maintenance activities and assets under one contract where the level of the service is defined by RWS. They are district-wide contracts and cover nearly all road assets within a district such as gutters, verges, asphalt, bridges, viaducts, lining, rest areas and signs and operational and management maintenance activities. Operational activities ensure daily functioning and durability of the asset system and risk control. Management activities support the functioning and performance of the asset system and control the impact of external factors, such as weather-related events. They include the monitoring of risks, exchange of data and information with RWS and maintaining a record of activities. Not included in the contracts, however, are winter maintenance (e.g. snow removal), graffiti removal and traffic systems and technical installations. Also, incident management does not fall under the responsibility of the contractor (Figure 4).

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab		
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		

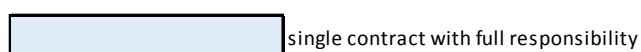


Figure 4 Content of maintenance contract NL integrated

The contract duration is 5 years with the possibility of two, one year extensions. Payments are lump sum and made on a monthly basis. Additionally, extra activities are paid directly. Deductions from these monthly payments take place based on the number of failures affecting the functionality of the system, the number of reparation activities realized and related response times (i.e. the time it takes the contractor to repair these failures). RWS also grants bonuses to contractors if they exceed certain key performance indicators.

Contractors are preselected based on their capabilities (prequalification). Tender evaluation is based on a price-quality ratio that varies between 40% and 60%. The evaluation criteria are: process control asset management or way of working of the contractor – which includes reliable actual and complete data of assets; the levels of functionality and response times guaranteed, and CO2-reduction objectives. Using these criteria, the tendering amount is converted to a fictive tendering amount, using discount rates that depend on the quality grade achieved per criteria. As an example, the ambition level for CO2 can reduce the tendering amount up to 5%.

The contractor is responsible for meeting all pre-set requirements. RWS wishes to remain at a distance and focuses on evaluating the functioning to the contractors' quality management system. What is called the system-focused contract control (SCB) is an approach that makes use of the information gathered by contractors in their own project management system to randomly test quality of the contractor's work. Kind and frequency of test depends on the contract specifications and the associated risk profile. In case of deviations it is the contractor' responsibility to make the necessary corrections in the bookkeeping and the physical system. Meanwhile it is the responsibility of RWS to: (a) confirm the information received from the contractor and let him know if deviations have been found, (b) test again after contractor has performed corrective measures and (c) if the problem has not yet been solved penalize him.

These contracts have been used since 2004 and currently the 3<sup>rd</sup> generation is applied. Based on the experience accumulated since 2004 and the feedback of market players, a standard contract has evolved leading to fewer errors and further reduction of transaction costs.

### 3.1.3 Procurement Outcomes

In general, the tight price competition combined with the recent crisis in the construction sector keep cost at low level, but this intensified competition may also result in poor results or legal procedures. Especially if contractors are eager to get the work, they offer extremely low prices and no (quality) criteria helps in making quality a deciding factor for the selection. As a consequence of this, (i) the winner is not able to use good material, knowledge and people and (ii) contractors do not want to lose money, so they will find a way to gain or claim extra work.

Particularly for E&C contracts guarantees are used to counteract such situations, but often they are not monitored and enforced. In addition, setting the term for guarantees requires a more thorough consideration (e.g. how long does a well-constructed asphalt layer last). As an example, the guarantee for asphalt is now fixed for 7 years (the lowest in the range) without considering the causes for poor performance that could be avoided by the contractor. A combination of the term with tender criteria and /or significant bonuses (now bonuses too low) could improve the quality delivered by the contractors. It seems that functional requirements and lab tests as only proof are not sufficient to create incentives for contractors to deliver good quality and do their best in laying the mixes.

The results achieved with the VOC contracts are also mixed. Contractors could not make very well underpinned proposals and incorrect measures and/or materials were proposed. To some extent RWS accounts the little or limited technical expertise in engineering, for instance in the design of structural measures, as the reason for this. Moreover, the technical

advisors of RWS in the region were not involved as much as they should have been. Contracts were drafted and managed by accountants and lawyers that know more about management than about engineering. The market parties were also not always very well qualified. Partly based on this experience a clear distinction between life lengthening works and regular maintenance works that bring the asset to its initial condition is proposed for the next contract generation.

### 3.1.4 Procurement Competences

At RWS the provision of appropriate incentives (bonuses and deductions) is seen as an important contractual competence. Such incentives should be gradual, punishing bad performance not automatically and sending contractors to bankruptcy because of a small mistake or inconvenient weather circumstances. To design incentives that are gradual and not make it a binary choice for contractors (gamble) remains challenging.

Contracting authorities also need to be able to develop smart tender criteria that could make quality a dominant factor. Here, Systems Engineering is a good method to draft functional requirements instead of technical specifications. Nevertheless, it does require technical knowledge and specialization in a certain area to be able to realistically assess the costs for a certain performance level and quality (e.g. useful life, days to construct or lay down the asphalt layers, what is under the influence of contractor and what not). This helps in determining the length of the guarantees, as well as the number of bonuses. Technical knowledge is also crucial to establish realistic estimation of construction times taking into account also weather conditions and to develop functional requirements (not only technical specifications). Although legal and other skills are also necessary in a contract team, a focus solely on the quality of the process without technical knowledge may result in the wrong product being built even though the whole process has the highest quality. If technical knowledge is lacking (i) contracts cannot be set up in the right way, (ii) it is not known what to ask, (iii) discussions with the market are difficult, and (iv) projects with different risk profiles cannot be assessed.

10 years ago, RWS implemented the "Market unless" vision. This vision meant that the default choice was to outsource tasks and transfer more responsibilities and freedom to the market, unless there were important project specific and strategic risks for not doing so. In concrete terms, this meant to move from Design-Bid-Build to Design-Build contracts as default. All in all, this process resulted in a lot of technical knowledge being lost. Years later and due to a number of negative experiences the agency realizes that changes have to be made and knowledge levels need to rise. As a result, since 2010 they have started the so called "knowledge path" to analyse the areas where knowledge is needed, what type of knowledge is required and how to source it.

### 3.1.5 Lessons Learnt

Based on the experiences made with different types of maintenance contracts main lessons learned are:

- RWS is becoming more careful with the risk assigned to the private sector and aiming for incentives and ways to manage important risks together. An example of a risk that RWS tries to manage together with the contractors is the risk of permits, as RWS is better in dealing with other decentralized governments. Additionally, for unforeseen aspects (e.g. underground/soil conditions) RWS is becoming more careful to assign them to the private sector. In order to prevent contractors to speculate on those risks, as they often price these risks not taking into consideration the full economic consequences, only those risks contractors can price and manage should be assigned to them.

- A better balance between bonuses and deductions is required and aimed at. 10 years ago, RWS mostly used the malus side leading to a not very constructive relationship. Deductions should not be that large -in case of minor faults/mistakes- that they break the whole relationship; but that contractors do feel the incentive to do their best.
- For all types of contract, it is necessary to reduce the gap in language and understanding between the contract people writing the contracts, and the technical groups working with the contracts.
- Due to the complexity of projects it is necessary to take into account many more aspects and stakeholders and bring together more disciplines in project teams including engineering, public management, communication, economics and ICT experts.
- A too much focus on the quality of the process and not the quality of the product can lead to functionally deficient products. A good understanding is needed of what a certain product should do and how to measure the fulfilment of the functional requirements.
- Financial incentives should be complemented with other types of incentives. The challenge of financial incentives is that, even with bonuses (and given the large market competition) the bonus is taken into account in the price offered and then actually it becomes per se a negative incentive (deduction).
- When evaluating tenders, the weight to price should be lowered to make quality a deciding and differentiating factor.

## **3.2 Belgium – Flemish Agency for Roads and Traffic**

The following sections focus on the Flemish Agency for Roads and Traffic (Agentschap Wegen en Verkeer (FAWV)) and its responsibilities for road maintenance and its procurement across the Flemish region of Belgium. The information was collected via interviews and documents<sup>4</sup>.

### **3.2.1 Context**

The Flemish Agency for Roads and Traffic (FAWV) is responsible for achieving safe, seamless and sustainable mobility for all road users in Flanders. FAWV has a Service Level Agreement with the Flemish Ministry of Mobility and Public Works, with the Department of Mobility and Public Works. Other regions in Belgium besides the Flemish are Brussels and Walloon. There is limited cooperation on a regular basis between the road agencies of these three regions. Cooperation may happen only on a project basis and if coordination is necessary.

The agency is organized in 6 regional departments and three central departments. The three central departments are: 1) Planning and Coordination, 2) Expertise Centre Traffic and Telematics (EVT), and 3) Road Engineering. Each regional division has 4 to 5 districts, summing up altogether 23 districts.

Territorial divisions are responsible for drafting and managing the maintenance contracts. Each of the 5 provinces is responsible for the design, construction and improvement of roads and bridges. Meanwhile the regional department of Electromechanics and Telematics is responsible for project study, management and operation of electrical, electromechanical and telematics equipment along regional roads, waterways and rivers, ports and regional airports. The agency has in total 1,500 employees and 70 of them work for the central department of Planning and Coordination.

FAWV is responsible for 1,764 km of highways, 11,817 km of secondary roads, 133,340 km of regional roads and 7,600 km of cycling paths and 60 traffic tunnels. They are responsible for all bridges in the Flemish region, also for the ones that connect with the local roads. In such cases FAWV is responsible for the structural strength of the bridge and the local authority for the road pavement.

The weather conditions divide the year into summer and winter periods. The average summer temperature is 21 °C and winter temperature is approximately 3 °C. The average summer precipitation is 78 mm/month in the summer and 65mm/month in the winter.

The procurement strategy for road maintenance of FAWV is rather traditional and has been hardly changed. The agency's personnel carry out all inspection, monitoring, maintenance planning and contract management tasks. Regular operational maintenance activities are 100% outsourced. However, FAWV does the maintenance and operational tasks that are required after accidents or emergency situations. Rehabilitation tasks are outsourced via traditional Design-Bid-Build contracts.

Due to the budgetary cuts required in the next years it is also expected that FAWV will outsource more and more of the tasks realized now by own personnel.

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<sup>4</sup> In Belgium two in depth interviews were carried out with the Director of Investments and Operations, Department Planning and Coordination within the Flemish Road Administration. Documents studied include annual reports, contract documents and technical guidelines (see also References).

The following contract types will be reviewed:

- Discrete contracts for rehabilitation single assets, **BE discrete**
- Framework contracts for regular maintenance of built assets, **BE b-framework**
- Framework contracts for regular maintenance and rehabilitation of installed assets, **BE i-framework**

### 3.2.2 Procurement Practices

#### Discrete contracts for rehabilitation of single assets

Discrete contracts (Design-Bid-Build) are primarily intended for rehabilitation of existing road assets including asphalt renovation of lanes and hard shoulders or rebuilding of foundations (Figure 5). These contracts are also being used for the replacement and renovation of bridge components. The contract duration is marked by the beginning and the end of the works.

Discrete contracts are discipline-oriented and intervention-related contracts, which means that not many phases of the life cycle or different assets and tasks are integrated. The design is worked out by the FAWV own engineers and only in some cases is this outsourced to an engineering consultancy firm. Even in the last case, FAWV prepares and carries out the tendering process.

Accordingly, the contracts are prescriptive, based on technical specifications (e.g. including the choice of materials) and the selection is based on price. The standard technical specifications are drafted by FAWV and they are continuously renewed by introducing a number of errata, based on the findings from their practical application. Examples of these standards are the types of “tests” that are required from the contractor.

Even though the payment mechanism is lump sum, in practice the contracts include a number of costing posts.

Type of maintenance		Type of asset			
Task	Activity	Build assets			Installed assets
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>				
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				


 single contract with full responsibility

Figure 5 Content of maintenance contract BE discrete

The formal relationship ends immediately after the project is delivered. However, contractors do offer a guarantee that can vary per subcomponent between five to ten years. For asphalt, the standard guarantee period is now seven years, but experts suggest that problems may actually show up around the eighth year.

The contracts have been the standard for the delivery of rehabilitation activities since 2007. Meanwhile a number of key bottlenecks and missing links of the infrastructure network are being tendered as PPP contracts within the VIA-Invest program.

The perceived advantage of the contracts is the level of control that can be kept by FAWV and the expectation that costs are lower due to lower overhead costs of the contractor and



tendering and contracting costs for the agency.

### Framework contracts for regular maintenance of built assets

The FAWV procures regular maintenance for built assets by making use of framework contracts related to interventions or disciplines (Figure 6). This means that 10 different contracts are tendered in a district to cover 10 different types of tasks, activities or services, for example maintenance of pavements and maintenance of bridges. Contractor selection is based on unit prices. These contracts have a duration of 1 year with the possibility to renew 3 times and 4 years as maximum total length. They cover a specific task within a road district, which is ca. 300 km and combine in some cases motorways and regional roads.

Contractors receive requests by FAWV and following up on that they are paid based on a list of agreed unit prices. The FAWV has a number of road supervisors per district who are specialized in a particular discipline and accordingly supervise and manage on average 10 contracts per district.

The rationale behind this contract is that each task requires different types of expertise and therefore a different contractor would be the most suitable. While FAWV is now working on developing standard contracts that by combining a couple of task will reduce the number of contracts to 4 or 5 per district instead of the current 10; the regional departments are not very keen in bundling too many different tasks together and the expectation is that costs will raise as contractors will have to organize themselves differently and increase their overhead by having a project manager or main contractor. Also, overall contract costs are then expected to raise.

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab		
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		


 single contract with full responsibility

Figure 6 Content of maintenance contract BE b-framework

### Framework contracts for regular maintenance and rehabilitation of installed assets

Framework contracts also focus on single regular maintenance and rehabilitation activities for the following types of assets: electro mechanic assets, traffic lights and public lighting (Figure 7). These contracts have a duration of four years and as they are discipline oriented, there is one contract per regional department and per discipline. In other words, the contracts cover a larger geographical scale than regular maintenance contracts for pavements. They also involve in some cases besides regular maintenance activities, rehabilitation or small capital investment activities.

The payment mechanism is based on completed work units and sometimes a small availability amount coupled to more regular small maintenance activities. The expected quality is described in the contract and there are no penalties or bonuses. Before the contract is tendered FAWV prepares an estimation of the expected number of work units per year. This expected quantity is indicated to the contractors but does not translate in a legal guarantee of the amount of work to be realized.

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab		
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		


 single contract with full responsibility

Figure 7 Content of maintenance contract BE i-framework

Because of their volume, the contracts are usually prepared under the European public tendering process for services. Potential contractors have to prove their qualification within the tendering process. Bids undergo a formal review and the contractor's qualifications are checked. The evaluation of all bids, which meet the minimum criteria, is solely based on the price. No negotiation is possible, just clarification of specific aspects.

### 3.2.3 Procurement Outcomes

The procurement strategy of the FAWV has kept rather stable for the last one to two decades. Accordingly, an evaluation of procurement outcomes follows a different logic than for the rest of the cases, where many changes have been introduced.

FAWV own impression is that by keeping direct control and following a procurement strategy when their own personnel is closely involved in design, tendering, project and contract management, they have been able to keep transaction costs of the agency and overhead costs of contractors low. Also, according to our interviews and a press release of FAWV in 2015; the quality of the roads has improved for the last 7 years.

### 3.2.4 Procurement Competences

Very different than in neighbouring countries and coherent with their current traditional procurement strategy, FAWV places a strong emphasis on the importance of technical and civil engineering expertise. They carry out monodisciplinary works and contracts are short-term, standardized and based on technical specifications. Relational and contractual competences are less developed but also probably less required.

For most contracts applies that smaller adjustments can be discussed between client and contractor. In case of significant changes in the social environment or policy options or a change in financial engagement of the government, the contract can be re-negotiated.

In case of a dispute, a commission will be established whose members are appointed by the Flemish parliament, including two members of the Flemish government.

Although in the last decades there has not been a significant loss of expertise due to organisational changes, having enough technical expertise in house to be able to keep in control appears to be a concern of the agency. FAWV has actively tried to recruit young engineers and increase its attractiveness as work place through a number of activities. The agency also undertakes a knowledge management program where, for example, the upcoming need of bridge inspections plays an important role.

### 3.2.5 Lessons Learnt

Based on the experiences made with different types of maintenance contracts main lessons learned are:

- The contracting of engineering services turns out to be more challenging than first expected. Different options have been tried such as to pay a percentage of the amount to be tendered, based on an hourly rate or even using a lump sum; without much success.
- For the proper management and control of maintenance contracts it is crucial to have technical knowledge based on hands on experience in house.

### 3.3 Germany – State Road Authorities

The next section is based on information from six different organised states as representative examples out of the 16 German states and from one public private partnership concessionaire involved in maintenance procurement. The information was collected via interviews and documents<sup>5</sup>.

#### 3.3.1 Context

The maintenance procurement in Germany is performed by state and county administrations. Additionally, there are a few public private partnership projects including maintenance services. The organisational processes usually differ regarding rehabilitation and regarding regular maintenance.

The total length of federal, state and county road network is about 230,400 km. 12,900 km are federal highways with dual carriageways. Most of the road network are primary, secondary and regional roads (39,400 km federal, 86,200 km state and 91,900 km county roads), in some cases with dual carriageways.

The weather conditions divide the year into summer and winter periods. The average summer temperature is 12 °C and the average winter temperature is close to 0 °C. Germany has two different climate types and is dominated by warm, humid continental climate and it has also areas with oceanic climate.

There are at least two different administrative schemes regarding responsibility for type of maintenance on the specific type of roads in use:

- state road authorities (nine states) respectively state enterprises (five states) responsible for rehabilitation and regular maintenance on federal, state and all or part of the county road networks in a state and
- state road authorities responsible for the rehabilitation on federal and state roads and county road authorities responsible for the rehabilitation on their county roads as well as for the regular maintenance on the federal, state and county road network in their county (two states).

The tendering processes for road maintenance are supported by a handbook with criteria and forms published by the Federal Ministry of Transport and Digital Infrastructure.

Since the 1980s procurement of maintenance activities has increased and substituted administrative organised work. At the end of the 1990s public private partnership contracts were introduced, but still the road length managed under these contracts is less than 1 % of the whole road network. As there is an increasing proportion of maintenance measures performed by contractors, a market for these services with numerous contractors has developed.

The main types of contracts in use are discrete contracts and framework contracts. A few integrated contracts have been tested in pilot projects.

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<sup>5</sup> Interviews were conducted in two counties of Baden-Württemberg, in the state road authorities of Hesse and Lower Saxony, in the state enterprise of Saarland, in one county of Saxony, with the organizational consultants of the Thuringia road authority and at Via Solutions Southwest the concessionaire for a 60 km section of the federal motorway A5. Documents studied include annual reports, contract documents and technical guidelines (see also References).

The following contract types will be reviewed:

- Discrete contracts for rehabilitation, **GE discrete**
- Framework contracts for regular maintenance, **GE framework**
- Integrated contracts for regular maintenance, **GE integrated**

### 3.3.2 Procurement Practices

#### Discrete contracts for rehabilitation of single assets

Discrete contracts usually focus on one project and one kind of service (Figure 8). Planning and monitoring is done by the road authority. The contractor gets a lump sum contract for each task to perform. In some cases, the lane closure has to be planned and organised by the contractor. Nevertheless, the lane closure is usually added by a third party in charge of the road authority or the contractor, and the layout for lane closures has to be approved by the traffic authority, which is a different division than the road authority.

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>				
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				


 single contract with full responsibility

Figure 8 Content of maintenance contract GE discrete

The contract duration is related to the completion of the specific project. The payment mechanism is based on unit prices and a predefined schedule. The expected quality is described in the contract or given by technical regulations. There are no penalties but sometimes bonuses used for earlier completion.

Depending on their volume contracts are prepared under national or European public tendering processes for constructions or services. Potential contractors have to prove their qualification in a first phase of the tendering process. There is a pre-selection register to skip this step but only a few contractors are registered. Bids undergo a formal review. Apart from the price the evaluation is usually based on some additional technical criteria. No negotiation is possible, just clarification of specific aspects.

The progress of work is monitored by the administration. The quality evaluation is usually conducted by a third-party institute. Changes of unit prices are only applicable in case the work site description was not accurate. The number of required work units has to differ from the agreed number by more than 10 %.

#### Framework contracts for regular maintenance of single assets

Framework contracts focus on single regular maintenance activities like cutting bushes or filling potholes and have a duration of three to five years (Figure 9). Depending on the contract duration the road authority sometimes provides technical equipment (e.g. winter service contracts). The lane closure is planned by the road authority and the layout becomes part of the framework contract. The contractor in charge usually sets up the lane closure. The payment mechanism is based on completed work units and sometimes a small availability

fee. The expected quality is described in the contract and there are no penalties or bonuses.

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>				
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				


 single contract with full responsibility

Figure 9 Content of maintenance contract GE framework

Because of their volume framework contracts are usually prepared under the European public tendering process for services. Potential contractors have to prove their qualification within the tendering process. Bids undergo a formal review and the contractor's qualifications are checked. The evaluation of all bids, which meet the minimum criteria, is solely based on the price. No negotiation is possible, just clarification of specific aspects.

While the contract is active the administration calls for specific workloads. There is no quality evaluation as the payment criteria is, 'work is done' or 'work is not done'. If the number of accounted work units differs from the agreed number, the price can be negotiated. With construction services for negotiation the difference has to be higher than 10 %, with other services a limit has to be agreed upon in the contract.

### Integrated contracts for regular maintenance of multiple assets

As integrated contracts are still in a pilot phase the few contracts tested are slightly different:

In Lower Saxony, an integrated maintenance contract was tested (2004-2007) containing every asset and every operational regular maintenance activity. The planning and monitoring was done by the road authority calling the contractor for each maintenance activity.

In Hesse, an integrated contract was tested (2007-2010), where the contractor was in charge for all management (planning and monitoring) and operational maintenance activities. The contract was performance-based and the road authority was checking randomly the result of work (Figure 9).

In 2002 Thuringia adapted a contract design with separate contracts for specific services e.g. green keeping or winter service, but for each service all management and operational activities are combined.

These contracts are prepared under European public tendering processes. Potential contractors have to prove their qualification in a first phase of the tendering process. Bids undergo a formal review and an evaluation with price and technical aspects as criteria. Often there is a last phase of an officially monitored negotiation process reducing the number of bidding companies.

Depending on the contract design road authorities just randomly check the result of work in their road network or have a monitoring division, which calls the contractor to perform defined tasks. The payment mechanisms were tested, too. There are contracts with constant monthly payments and contracts with unit prices related to the amount of performed tasks. In case of unit prices there has to be an estimation of work load within the tendering process. But as there are no regulations on that, the consequence in case the work load does not occur or is significantly higher during the contract period has to be negotiated in each single case.

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab		
Regular maintenance	Do regular		
Regular maintenance	Monitor		
Regular maintenance	Plan		

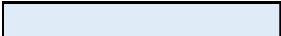
 single contract with full responsibility

Figure 10 Content of maintenance contract GE integrated (Hesse)

### 3.3.3 Procurement Outcomes

The technical requirements in *discrete contracts* are mainly set by the technical regulations causing a tight price competition. Because of missing incentives in the payment mechanism and an often missing enforcement of the requirements, this competition has become worse in the last years resulting in poor quality. For road authorities, the contract type seems easy to handle but often leads to additional negotiation about the amount of payment. The contract type is not attractive for contractors and forces them into a poor relationship with the public partner.

Because of the close local relationship between contractor, road authority and customer respectively public participation, results of *framework contracts* are usually of good quality. Road authorities can control budgets up to a certain point and if not, it is usually because of political influences. For road authorities, the estimation of work load is a challenge and has to be compensated with a sound relationship with the contractors. For contractors, the maintenance services are a good addition to their core business. There have to be local, related industries, though. Otherwise it is nearly impossible to find contractors for framework maintenance contracts.

With *integrated contracts*, the results are strongly related to the contract design, especially monitoring process and payment mechanism. In the Lower Saxony project, the road authority was responsible for the monitoring and had to call the contractor. The contractor was paid by each performed maintenance activity. This developed into a negative partnership where the employees of the responsible road authority wanted to prove they were cheaper and the private contractor was satisfied being paid by unit prices. The project budget was overdrawn.

In the Hesse project, the road authority checked randomly and the contractor had to perform the whole process of planning, monitoring and doing within a fixed monthly payment. Whenever the road authority reduced the number of random inspections the quality decreased. During the project both partners found a sound collaboration, but overall the effort for inspection in addition to the monthly payments lead to higher costs than with the in-house execution of operational road maintenance.

In Thuringia, the contract design was successful as the road authority dispensed their capacities to the market (as a company) and stopped the competition between administration employees and contractors. Later it turned out to be a problem in those regions, where the number of comparable businesses is not sufficient. To improve the contract design different maintenance services were combined in one contract creating a year-round work load for the potential contractor. However, in this kind of regions the former public company – nowadays owned by private companies – is still the only maintenance contractor.

### 3.3.4 Procurement Competences

*Discrete contracts* are easy to handle as soon as they are designed correctly. Even though discrete contracts focus on specific projects the contract design is comparable and the contracts are copied from maintenance measure to maintenance measure. Low contractual competence is needed and relational competence can focus on managing the contract. The market is very open and companies work in different regions.

Technical requirements are closely related to the applying regulations and are often mandatory. Nevertheless, they have to be adapted to the specific project and they need to be monitored and enforced. If not, this leads to poor quality especially if there is no work site monitoring by the road authority. Knowledge transfer within the projects is little in both directions. The exchange of information and experiences is limited to the committees working on the technical regulations.

*Framework contracts* are designed to reduce the number of different contracts and the contract changes needed. The difficulty lies in estimating the work load for the contractor during the contract life time and in finding arrangements in case the occurring work load does not fit into the work load estimation. Mainly local companies offer their services and usually these maintenance contracts are not their core business. Contractual and relational competences are essential to find suitable regulations and payment mechanisms and to keep the market interested in maintenance contracts for the road authority.

Technical requirements are mainly derived from experiences of road authorities as many of the services were performed in-house before. Nevertheless, knowledge transfer is little as the contractors have been active in comparable services before, too. As contractors are local and have local employees their motivation and the delivered quality is often very good. Most of them are not used to work in a trafficked environment and setting up lane closures is new for them. In case the road authority is not monitoring, assisting and enforcing correct closure layouts, this aspect can reduce traffic safety and lead to some kind of trouble in contracts.

*Integrated contracts* are relatively new in Germany and usually very complex. Road authorities need external contractual and relational competences to design these contract types, to perform the tendering process and to manage the contract during its application. As there is no market for this kind of contracts by now, high relational competence is mandatory in the whole process.

Even though the technical requirements for each task are the same as in discrete and framework contracts, a suitable description and regulation of the monitoring processes have to be added. This is new for both partners, road authority and contractors. Monitoring processes in combination with the payment mechanism are decisive for success and failure of the mentioned pilot projects.

### 3.3.5 Lessons Learnt

Based on the experiences made with different types of maintenance contracts main lessons learned are:

- The discrete contract is the traditional contract form. It is accepted by all parties and well known. The framework form of contract is well known, too, but preferred by road authorities. Technical provisions and availability proportion of payment have to be carefully adapted to regional markets and climate conditions. Both contract types lead to an average quality and do not encourage innovations.
- Employees of road authorities are used to framework contracts linked to regular maintenance activities and discrete contracts linked to rehabilitation activities. Depending on their work experience - usually maintenance responsibility is divided into different divisions - they are familiar with one or both of these contract types.



- Market monitoring and contractor networking is not set up systematically.
- As the expertise is not kept and not passed on to the next person in charge, the competence of a road authority depends on the number of employees. Especially in county administrations sometimes there is just one person in charge for maintenance issues and if this person leaves, the knowledge is lost.
- In state organisations, there are several persons in charge of maintenance issues, which facilitates keeping expertise and retaining knowledge in-house.

### 3.4 United Kingdom – Highway England

The following sections focus on the newly formed Highways England (HE). The information was collected via interviews and documents<sup>6</sup>.

#### 3.4.1 Context

The former Highways Agency (HA) was created as an executive agency in 1994 and became a government-owned company with the name Highways England (HE) in 2015.

HE with its 3,600 employees looks after the important national routes (motorways and major A roads). More specifically, HE looks after around 7,000 km (motorway and trunk roads). Moreover, HE is responsible for barriers, technology assets and signs, embankments and earthworks (ca. 12,000 km), and bridges/build structures (ca. 18,500 pcs). The HE is also responsible for over 150,000 technology assets and signs.

The weather conditions divide the year into summer and winter periods. The average summer temperature is 17 °C and winter temperature is approximately 6.5 °C. The average summer precipitation is 63 mm/month in the summer and 83 mm/month in the winter.

Highway England is split into 7 offices (Dorking, Bedford, Leeds, Manchester, Birmingham, Bristol and Exeter) around the country and has a yearly maintenance budget of around £390m for major improvements and around £370m for maintaining the road network. HE is conducting over 950 maintenance interventions and over 2,900 km of resurfacing activities a year to ensure that 4 m drivers a day (over 140 bn vehicle kilometres yearly) can safely travel the roads.

Corporate social responsibility (CSR) and sustainability issues have attracted increasing attention in the last years with multiple publications and guidelines being issued by HE (also in corporation with the Environment authority). Over 24% of HE's annual budget is spent on SMEs. Future objectives of HE include a focus on driving value for money (Vfm) and further increasing confidence in delivery and sustainability of the services offered by HE.

The following contract types will be reviewed:

- Discrete contracts for rehabilitation of single assets, **UK discrete**
- Integrating contracts for regular maintenance and rehabilitation of multiple assets, **UK integrated**
- Framework contracts for regular maintenance of single assets, **UK framework**

#### 3.4.2 Procurement Practices

##### Discrete contracts for rehabilitation of single assets

Discrete contracts are primarily intended for specific maintenance works required on existing road networks. These contracts are mainly deployed for rehabilitation of existing road assets and are used, for instance, for existing components of bridges, for asphalt pavements and for steel structures (Figure 11). The contract terms are marked by the beginning and the end of

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<sup>6</sup> Interviews were conducted with employees from Highways England including senior advisor and head of asset delivery. Documents studied include, but are not limited to, annual reports, contract documents, professional presentations, and audit reports (see also references for some key documents).

the works and the quite formal relationship ends immediately after the project is delivered. However, contractors do offer a guarantee for a certain period depending on the asset and subcomponents in question. The contracts will be used to procure requirements which are beyond the scope of framework agreements or more integrated contracts, and are specific to a particular requirement. Contract sizes are decided along the organisational limits or road authority districts. All contracts are awarded on the basis of value for money approach (Vfm) (including cost implications) and includes provisions such as a standardized risk allocation between the contracting authority and the contractor.

Type of maintenance		Type of asset					
Task	Activity	Build assets			Installed assets		
Rehabilitation	Plan						
Rehabilitation	Monitor						
Rehabilitation	Do rehab						
<i>Regular maintenance</i>	<i>Do regular</i>						
<i>Regular maintenance</i>	<i>Monitor</i>						
<i>Regular maintenance</i>	<i>Plan</i>						


 single contract with full responsibility

Figure 11 Content of maintenance contract UK discrete

### Integrated contracts for regular maintenance and rehabilitation for multiple assets

HE has been procuring integrated maintenance services based on performance specifications since its inception as Highways Agency in 1994. In other words, the integration of maintenance services and rehabilitation schemes makes the supplier fully responsible for the provision of high-performing infrastructure assets and networks. HE (and its predecessor HA) has always been reliant on external suppliers/contractors and HE has contracted out planning and execution of maintenance work and integrated most of its regular maintenance and small rehabilitations in performance-based contracts (PBCs). These contracts specify mainly the outcome (i.e. performance) to be achieved in order to meet contractually specified targets. The contractor is then responsible to manage the asset in a way that ensures that these contractually specified performance targets are met.

Type of maintenance		Type of asset					
Task	Activity	Build assets			Installed assets		
Rehabilitation	Plan						
Rehabilitation	Monitor						
Rehabilitation	Do rehab						
<i>Regular maintenance</i>	<i>Do regular</i>						
<i>Regular maintenance</i>	<i>Monitor</i>						
<i>Regular maintenance</i>	<i>Plan</i>						

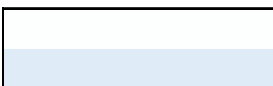
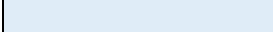
 single contract with partial responsibility  
 single contract with full responsibility

Figure 12 Content of maintenance contract UK integrated

Initially, HA (predecessor of HE) worked with two types of supplier organisations: the managing agent (MA) and the term maintenance supplier (TMC). The MA worked directly for the HA and was responsible for planning and designing maintenance work for all road

infrastructure as well as the supervision of the TMC. The TMC performed all maintenance work such as regular, cyclical and winter maintenance and small rehabilitation works up to £250 000. In 2001, HA combined MA and TMC to form a prime contractor role, the managing agent contractor (MAC). Under this structure, one supplier was responsible for delivering front-line maintenance services for all road assets in a particular area including rehabilitation schemes of up to £500 000. In 2005, the HA increased the limit for rehabilitation schemes to £2m. A prime contractor was subsequently responsible for all maintenance services and rehabilitation schemes for a specific road network.

In 2012, the MAC was replaced by the 'Asset Support Contract' (ASC) which includes maintenance work as well as materials in accordance with the contract. The ASC was set up to provide value across the road network to deliver capital works and maintenance activities. An ASC includes regular and rehabilitation activities across multiple assets. Outcomes and used materials must meet the requirements set out in the contract and contracts are normally let for five years with an option to extend by up to two more years depending upon performance. Annual spend on each contract runs into tens of millions of pounds. ASCs are linked to incentivised continual improvements and the supplier/contractor is expected to ensure transparency through all tiers of its supply chain. Moreover, the contractor is expected to operate as an integrated team with Highways England staff to support best delivery and ensure value for money targets.

Approximately 50% of maintenance activities are governed by ASCs and 6 ASCs are let at the moment. While the contract was successful in what it was set out to do in that it did reduce spending (around 25% when compared to previous spends), HE reported that there were multiple issues around the way the network looked and how it was poorly maintained. These contracts were managed in a more adversarial relationship mode to further drive cost cuttings as the main objective to be achieved by the contractors. In late 2015, HE issued a statement that in the East Midlands the ASC approach is being scrapped (as the contract documentation was found to be flawed) in favour of a more traditional approach that separates design contracts from regular maintenance work and construction. In what appears to be a return to the traditional way of doing things, design, regular maintenance and construction work will be separated into different contracts. HE expects that this change will bring back control and oversight in house.

### **Framework contracts for regular maintenance of single assets**

The contract portfolio further includes framework contracts that are used to procure regular maintenance including winter maintenance and emergency repairs (Figure 13). The advantages of framework contracts are flexibility and access to the most appropriate firms depending on the specific need. A framework has advantages if contracts are awarded regularly to the market. In a framework agreement, the element of competition is maintained, while transaction costs and tendering times are reduced compared to a European tender organized separately each time. HE is interested to achieve early contractor involvement in all of their contracts to ensure cost minimisation with predesigned quality specifications. Timeframes can vary from a few months to around 2 years with a possibility for an extension.

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>				
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				


 single contract with full responsibility

Figure 13 Content of maintenance contract UK framework

### 3.4.3 Procurement Outcomes

HE draws out the advantages of discrete contracts as follows: i) the responsibility and implementation risks are carried (partly) by the contractor which helps to transfer risks (at least to a certain degree) away from HE; ii) HE retains a relatively large impact on the design (which is important to keep control over project specifics and characteristics and also to ensure value for money is actually being achieved); iii) HE can steer and control the process on the basis of general technical assumptions (assuming that sufficient technical knowledge is present at the NRA or support via external consultants would need to be hired) or based on a preliminary design; and iv) HE retains great flexibility to make adjustments (this is especially vital with longer term projects in which some degree of flexibility is needed to address either internal changes within HE or changes in the wider HE environment (e.g. industry changes; different demand pattern). The main disadvantage drawn out by HE is that possible changes in the scope of the contract might be costly and life-cycle issues (with regards to the asset and possible maintenance services) are not really taken into account to a degree that would be the case for more integrated contracts.

Integrated contracts consider the whole life-cycle and asset management activities of an asset. This will help to ensure effectiveness and efficiency in terms of, for instance, risk management, innovation and incentives. Thus, these types of contracts are quite often linked to incentivised continuous improvement and suppliers are expected to operate as an integrated team with the authority to support best delivery.

In the past, integrated contracts could be often described as being onerous contracts to manage with a large number of scheduled items, and reliance on work orders. More recent contracts adopt some of the key characteristics of performance-based contracts such as fewer specifications for works/schedules and an emphasis on performance which needs to be achieved by the contractor.

The asset support contract integrates regular maintenance and rehabilitation activities for multiple assets (basically covering a road network in a particular region) under a fixed lump-sum contract for up to a 10-year timeframe. As a consequence, many risks were assumed by the contractor and HE plays more of a supervisory role. With this development, HE slowly lost control of planning, prioritising and implementing activities of asset maintenance. In-house competences were partly lost and the ability to respond to shifting priorities and ensuring flexibility to react to unplanned incidents became much more difficult (without a full set of relevant competences in-house).

However, while cost savings were substantial, expected and desired performance outcomes were not always achieved. This was due to missing competences to achieve true integration

at the contractor. At the same time, HE had limited control to manage required maintenance outcomes. Renegotiations and conflicts between HE and its contractors occurred. In order to be able to confidently report on asset performance and maintenance costs, supportive systems and processes (e.g. management maintenance information system) needed to be put in place. In the near future, HE is looking at managing contracts more closely and splitting works into multiple contracts. Also, interviewees stated that as HE gains relevant competences and knowledge of particular assets, certain procurement activities and the intelligence/decision making may be brought back in-house.

### 3.4.4 Procurement Competences

With the adoption of the Asset Support Contract, changes of procurement practices were required from both HE and from contractor staff. Required competences needed to be developed and further honed over time. This set of competences included a wide range of requirements such as the ability of the contractor to perform to contractual requirements and to the contractual administration levels needed by HE. HE interviewees stressed that the HE is still more of an 'engineering organisations' which is now moving towards a more commercial outlook, thus further developing relevant contractual and relational competences within their procurement team.

The operational technical knowledge of HE staff in road maintenance and traditional contract management had to be supplemented with knowledge in quality management, process auditing, and relationship management skills. At the same time, by transferring asset management and road maintenance responsibilities to the contractor, HE diminished its operational technical knowledge base to appropriately manage the contracts and remain an informed client.

Important contractual competences are required when designing incentives (bonuses and specially deductions). Relational competences are mainly based on trustworthiness and information exchange between individuals (from HE and contractor). Information exchange is based on regular work meetings and building up cooperative relationships with contractors. Asset management competences are necessary as well as the technical understanding behind it to be able to steer contracts and meet required targets. An example of technical knowledge required is the knowledge of the life-time of different materials. Moreover, determining the length of the guarantees and the amount of bonuses requires to know how much a certain level of quality and any additional level of quality cost; and how much influence a contractor has on the performance delivered.

Technical competences related to the various assets and maintenance services are needed, in order to, for instance, write tendering documents, evaluate bids, negotiate and monitor contracts. Legal competences are also necessary in a contract team, but not without technical expertise, if what you are buying is a technical item/engineering asset. A focus solely on the quality of the process without technical knowledge may result in the wrong product being built even though the whole process has the highest quality. With a drive to ensure value for money considerations at HE, commercial management competences that include the capture and analysis of costs for maintenance activities and the implementation of a cost performance regime to focus on the achievement of commercial targets needed to be developed. Although HE offers staff some formal training programmes, a structured approach to upskill staff to deal with the complexity of current and future contracts is not in place.

### 3.4.5 Lessons Learnt

Based on the experiences made with different types of maintenance contracts main lessons learned are:

- Fully integrated contracts with performance specifications and long-term contract

duration do not necessarily result in value-for-money oriented decisions by the contractor. NRA oversight and a strong supervisory role is needed to drive true value-for-money (and not just cost cuttings).

- Forge stronger relationships/partnership approaches with contractors to realise joint cost minimisation, drive value for money considerations and aim to reduce waste.
- Asset management knowledge should be developed and retained (not just technical knowledge but also relationship management knowledge) at the NRA (consider, for instance, the use of project champions and internal databases).
- Emphasis on creating effective integrated project teams (IPTs) to further align each other's expectations (NRA and contractor), get to know each other's roles and responsibilities, and share knowledge.
- Emphasis on appropriate risk management (risk transfer) and incentive approaches within the contract.
- Integrated contracts require time for the contractor to settle in, develop relevant knowledge, and build effective working relationships with the NRA.
- HE needs to build (mainly contractual and relational) capabilities to specify service quality and incentives so that the contractor is able to comply with its requirements.
- HE recognises that they need to take more ownership of investment decisions and increase intelligence on local factors that influence where work is most needed.
- For all types of contracts, it is necessary to bridge the gap in language and understanding between the contract managers/legal team and technical managers (NRAs do require technical and legal competences and further training is needed to hone these competences).
- Move away from price as a key decision criterion to include wider measurements (including quality, but consider issues with its measurement) to drive true value for money.

## 3.5 United States - Virginia Department of Transportation

The next sections focus on the Virginia Department of Transportation (VDOT) as one of the 52 state departments of transportations in the United States. The information was collected via interviews and documents<sup>7</sup>.

### 3.5.1 Context

The origin of the Virginia Department of Transportation (VDOT) dates back to 1906 when the first State Highway Commission was established. Since then, VDOT has been in charge of maintaining, operating and managing the state system of roads and highways in Virginia, that is today approx. 93,300 km. The road network includes ca. 1,770 km of interstate highways, ca. 13,000 km of primary roads, and ca. 77,700 km of secondary roads. VDOT is also responsible for ca. 12,000 bridges, 2 mountain tunnels, 4 underwater crossing, and 41 rest areas. The traffic intensity varies from 30 AADT in rural regions to 135,000 AADT in urban regions.

The climate can be either humid subtropical or humid continental with an average summer temperature of 24°C and an average winter temperature of 2.2°C. Extreme weather events like blizzards and hurricanes are occurring regularly.

In 2015 VDOT had 7,500 employees of which 3,000 were involved in road maintenance. Operational and administrative tasks are organized around a central office in Richmond and 9 district offices. The districts are further divided into 31 residences consisting of 1-4 counties. The road and highway maintenance budget absorbs a large portion of the department's total spending each year. In 2016 the total maintenance budget is US\$5.3bn from which ca. US\$500m is spent for pavements and ca. \$300m for bridges.

Since the 1990's VDOT has faced a drastic downsizing from 14,000 to 7,500 employees and has entered into contracts with the private sector to deliver many maintenance and operations related projects and services. At VDOT, outsourcing can occur either through traditional contracting with private suppliers or through the Public Private Transportation Act of 1995 (PPTA) which is the legislative framework enabling VDOT to have agreements with private entities for the development and/or operation of transportation facilities. In addition, in 2006 the Chapter 782 of the Acts of Assembly passed requiring all interstate maintenance to be outsourced by July 2009.

VDOT has a number of different contract types in place from which the following will be reviewed:

- Integrated contracts for regular maintenance of multiple assets, **US integrated**
- Discrete contracts for regular maintenance and rehabilitation, **US discrete**
- Framework contracts for regular maintenance, **US framework**

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<sup>7</sup> Interviews with 13 VDOT employees from the central department in Richmond and four VDOT districts were conducted including district managers, maintenance managers, contract managers, and maintenance supervisors. Documents studied include annual reports, contract documents, professional presentations, and audit reports (see also References).



## 3.5.2 Procurement Practices

### Integrated contracts for regular maintenance

Three months after the PPTA was passed, in October 1995, a private contractor submitted an unsolicited proposal for the entire maintenance of interstate assets. In December 1996, the first integrated contract, "Comprehensive Agreement for Interstate Highway Asset Management Services," was let. It covered a number of Virginia's interstate highways (I-77, I-81, I-95, and I-381) with a total length of 250 mi (402 km). The contractor was not only responsible for the maintenance of all assets (e.g. pavement, bridges, road equipment), but was also required to carry out incident management and snow and ice removal services. The lump-sum contract had a total fee of \$131.6million and a duration of 5 years with an option of renewal for one more term. In 2001 the contract was renewed for five more years.

With the legislative mandate to outsource all interstate maintenance until 2009 VDOT started in 2006 to put out Turnkey Asset Management Service (TAMS) contracts. Compared to the first integrated contract they did not include any rehabilitation (e.g. pavement resurfacing, bridge deck overlays), only regular maintenance work (e.g. mowing, litter removal, surface repair), incident management, snow removal, and emergency response were covered. In addition, instead of having a large geographical scope, contracts for 13 smaller segments of the interstate highway were let. The contractual segments lay within the boundaries of the nine districts and had a length between 10 - 170 mi (16-270 km). The contract lump-sum fees of the first series of TAMS varied between US\$1.5-\$3million.

The duration of the TAMS was 5 years with two successive two-years renewal options. Tender proposals consist of the technical proposal and the bid price which are separately assessed. The technical proposal is evaluated first and includes, amongst others, a description of the organisational structure, a quality management plan, a maintenance operation plan, and an emergency operation and incident management plan. If it does not meet a minimum score of 75 points (out of 100), the bid price envelope will not be opened. The contract is awarded to the lowest bidder that passes the evaluation of the technical proposal.

TAMS is a performance-based contract describing the performance expected from the assets, rather than specifying the materials or methods to be used. Performance is evaluated by two means: (i) the Maintenance Rating Program (MRP) and (ii) the Daily Timeliness Requirements (DTR). The MRP evaluates whether or not specified asset items meet the contractually required minimum service or maintenance condition. For example, concrete barriers are required to be safe and structurally sound which is achieved if the barriers are free of vegetation, no damage is exceeding 25% of joint and 25% of the barrier face. Due to the large number of assets VDOT assesses the performance of the interstate corridor by sampling tenth of a mile sections, inspecting every asset within the tenth of a mile sections, and evaluating the asset against the contractual performance criteria. Within an asset group (e.g. traffic assets) all assets (e.g. signs, lighting, guardrail) have to meet a minimum performance rating (e.g. 70%) and for all asset groups a minimum performance rating is set as well (e.g. 90%). The rating scores will drive the payment. If the contractor does not gain the minimum scores, deduction over the next three months of its payment is taken. This kind of evaluation is done at least twice a year. Besides the assessment of the asset performance the contractor is also evaluated in terms of timeliness. The DTR ask the contractor to react on certain deficiencies (e.g. potholes) and events (e.g. washout) within a prescribed time. For example, the contractor is required to complete repairs on concrete barriers within thirty days of notification or discovery. For missing time limits the contractor gets penalized by a day deduction until the repair work is done.

With the renewal of TAMS emergency response and snow removal were pulled out and the ownership of the decisions went back to VDOT. In addition, a new generation of integrated

contracts were launched as Bundled Interstate Maintenance Service (BIMS) contracts that not only excluded a couple of services but also introduced a stricter quality control system. The number of inspected tenth of a mile sections increased from 5% to 15% and the minimum performance rating scores were adjusted. Instead of five years, the BIMS are let for only three years with three two-years renewal options. The annual value of the 9 BIMS contracts currently in place is approximately US\$34 million.

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>				
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				


 single contract with full responsibility

Figure 14 Content of maintenance contract US integrated

### Discrete and framework contracts for regular maintenance and rehabilitation of single assets

From 2012 onwards 6 out of 14 TAMS have not been renewed and the responsibility for the management of the maintenance work has gone back to the districts. Because of the legal requirement to outsource any interstate maintenance the districts use discrete contracts (Figure 15), Special Advertisement and Award Process (SAAP), and framework contracts (Figure 16, Regular Advertisement and Award Process (RAAP), for the operational maintenance activities of road structures and equipment. SAAP and RAAP are unit price contracts let for any maintenance work outside TAMS/BIMS including pavement resurfacing, bridge painting, deck repair and replacement, superstructure and substructure repair, bridge inspection, guardrail upgrades and replacements, and signals, electronic sign installations, mowing, and roadside maintenance. They use task-related performance specifications (e.g. number of equipment needed) and the fulfilment of the contractual requirements are directly controlled by VDOT.

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>				
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				

 single contract with full responsibility

Figure 15 Content of maintenance contract US discrete

Type of maintenance		Type of asset					
Task	Activity	Build assets			Installed assets		
Rehabilitation	Plan						
Rehabilitation	Monitor						
Rehabilitation	Do rehab						
<i>Regular maintenance</i>	<i>Do regular</i>						
<i>Regular maintenance</i>	<i>Monitor</i>						
<i>Regular maintenance</i>	<i>Plan</i>						


 single contract with full responsibility

Figure 16 Content of maintenance contract US framework

### 3.5.3 Procurement Outcomes

The introduction of bundled, integrated contracts was a logical consequence of a drastic downsizing of VDOT staff, since the number of employees for monitoring and managing the contracts could be decreased. Instead of coordinating and managing numerous contracts, only one prime contractor became responsible for maintenance activities along the interstate.

At the beginning VDOT followed a very comprehensive approach by integrating all maintenance activities in one contract. Although the first contract had a total duration of 10 years, VDOT realized that the contractor did not make substantial capital investments to improve road quality. The contract duration appeared to be too short to set sufficient incentives for the contractor to adopt a more long-term view. With the next generation of integrated contracts (TAMS) the rehabilitation activities were pulled out. The lack of long-term thinking persisted with the new contract generation in terms of a rather reactive maintenance strategy reducing the effort to what is absolutely needed to fulfil contract requirements than a preventive maintenance strategy optimizing the effort to what is beneficial for the life-cycle performance of the assets.

What remained in the contract was ice and snow removal that during the term of this new contract generation let to a number of service disruptions due to some blizzards. In other words, contractors were not prepared to handle heavy winter conditions. They did not price in the risk of such extreme weather events. Since it was not acceptable for VDOT to get unavailable roads and road users caught in snow, the third generation of integrated contracts did not include ice and snow removal. This activity is now procured through a framework contract, but with the possibility for VDOT to bring in additional resources when needed.

The issue of being flexible in unforeseen situations let also to the transformation of performance-based activities into requirement-based activities such as mowing, litter removal, and roadway sweeping. Instead of asking a lump-sum price for delivering a certain performance VDOT asked the contractor to provide a unit price for conducting these activities. VDOT also gains flexibility with its numerous framework (on-call) contracts but they come with a downside. If contractors regard the amount of actual work to be executed as very uncertain, bid prices can go up and the number of bidders can drop.

Another outcome of the first generation of task-integrating contracts is related to the quality control system installed by VDOT. This system defines the quality level of the road assets, the way of assessing the delivered quality, and the penalties for not providing the desired quality. From the perspective of VDOT the initial quality control system had some shortcomings in terms of quality assessment and contractor incentives that could lead to an unsatisfactory road quality. As a consequence, the new quality control system increases the number of assets that need to pass the required quality level. It also increases the number of

randomly selected tenth of mile sections for quality assessment and applies higher penalties for not achieving the required quality level.

The experiences with the TAMS/BIMS contracts suggest management effort as a decisive criterion for the cost-benefit ratio of these contracts. In urban areas, the effort to manage multiple contracts in an environment with high traffic volumes, many different stakeholders, numerous damage claims, and limited maintenance windows appears to be considerable. As an additional consequence, conducted maintenance is rather corrective with less possibilities for preventive maintenance optimization. A reduced management effort gained with TAMS/BIMS is thus seen to outweigh a possible loss in prioritization and optimization and justify the integration of maintenance tasks and assets. From a VDOT district perspective the management effort in rural areas can decrease to a point where integrated contracts are no longer cost-effective compared to an in-house management of several single contracts. At the same time, a rural environment offers greater freedom for the preventive optimization of the road network which represented an additional rationale for the de-bundling of TAMS in some of VDOT's districts. However, management effort does not only depend on contextual aspects but is also influenced by contractors' compliance with contract requirements. It appeared that the maintenance procurement through the TAMS contracts was not sufficient enough to stimulate every contractor to deliver the work within the required time. Extra effort was needed for documentation and discussions escalated to higher management levels to get work done. If the additional effort relates to the prime contractor of an integrated contract it serves as an argument for de-bundling. If it concerns a contractor of single maintenance activities, integration is regarded as means to transfer the management effort to the prime contractor.

### 3.5.4 Procurement Competences

From the perspective of VDOT a good mix of competences and people is needed to deliver and manage outsourced road maintenance. This includes a program manager that can interlink authority policy, procurement procedures, and maintenance processes, a contract manager that has a decent understanding of maintenance procurement and processes, and a road supervisor that has a strong background in incident management and maintenance work. Moreover, it is expected that in the future more data and information will be available supporting maintenance planning. The development of competences in collecting and analysing appropriate data and information is seen to be vital.

For VDOT technical operational skills are the basis for any type of contract. Many of the contract managers are former construction inspectors, highway foremen or highway superintendents and are regarded as very competent from a technical point of view. Over the years these people have gained an in-depth understanding of road maintenance practices that helps them to manage and evaluate the work a contractor is doing. They are able to recognize the criticality of situations on the road and take appropriate decisions to prevent either any serious safety event or major traffic disruptions. In addition, they know the local road network with its peculiarities and stakeholders. Knowing maintenance work with the associated costs and time needed is also seen to be beneficial to assess whether submitted tenders can be put into practice.

The first integrated contract also revealed that the transfer of responsibilities and tasks to the private sector over a longer period may lead to the loss of certain operational technical skills at the public side and may make the reversion to former practices difficult. This includes the development of a different skill set of employees particularly in terms of monitoring the work delivered by the contractor. It seems also difficult to attract younger people to work in road maintenance. VDOT also works with temporary employees that allows them to train people on the job and hire them later on.

Although a higher skill level (including relational skills) is expected when it comes to

integrated contracts, the technical operational side of it is seen to be key. Here, a number of still self-performed maintenance and management activities on the local roads seem to prevent the authority from the erosion of its basic technical operational skill level. Strong technical operational skills are also required from the contractor and VDOT expects that 30% of the maintenance work is carried out with in-house staff of the contractor. In addition, contractors need to provide training certificates for the staff depending on the work.

### 3.5.5 Lessons Learnt

The long history of VDOT as state authority responsible for the maintenance, operation and management of Virginia's road infrastructure has contributed to the accumulation of extensive managerial and operational knowledge and experiences. Over the last two decades VDOT has witnessed a strong downsizing accompanied with the requirement to outsource maintenance work and asset management services. To some extent downsizing and outsourcing contributed to the loss of operational technical expertise.

The outsourcing trajectory started with a comprehensively integrated contract and continued with the successive unbundling of maintenance activities and responsibilities. One of the main reasons for this is that VDOT perceived a loss of core responsibilities and control. This became evident in case of emergency response and snow removal. From the VDOT perspective a contractor is not able to be responsive to any incident without pricing itself out of the market. As a consequence, the authority should keep decision responsibility for rather unlikely incidents with a high impact on road users and should even possess own capabilities to respond adequately. Some of the districts were even dissatisfied with the outcomes of the integrated contracts under the responsibility of the contractor and put themselves back in the position of coordinating and managing the maintenance activities for the interstate assets.

Road maintenance is mainly outsourced for the interstates. Many maintenance activities for the subordinated road network are conducted by VDOT's own staff. Many of the management positions are taken by people who climbed within the organisation and bring hands-on maintenance knowledge with them. For VDOT these people represent the backbone of an effective maintenance procurement.

Based on the experiences with different types of maintenance contracts main lessons learnt for VDOT are:

- Management responsibility for uncertain but high risk events like blizzards should remain within the NRA.
- It cannot be expected that an integrated contract with a duration less than 10 years motivates a contractor to follow a preventive maintenance strategy.
- Integrated, bundled contracts should make use of hybrid performance specifications (task-related/asset-related) and mixed payment mechanisms (unit price/lump sum) to retain flexibility and control.
- Integrated contracts are appropriate for urban areas with high traffic intensity, since it is difficult to do the required maintenance within the available time, and handle the high administrative work load stemming from the coordination of maintenance activities and third parties.
- Discrete or framework contracts are more appropriate for rural area with low traffic intensity, since the road authority might be able to bear the administrative work load and put itself in the position of applying preventive maintenance measures.
- High quality levels in combination with a representative quality assessment scheme and high penalties will increase the contractor's compliance with the contractual requirements.

- Operational technical knowledge and experience is an essential basis for managing maintenance contracts.

## 3.6 Australia - Main Roads Western Australia

The following sections focus on Main Roads Western Australia (MRWA) one of the seven state departments of transportation in Australia. The information was collected via interviews and documents<sup>8</sup>.

### 3.6.1 Context

Main Roads Western Australia (MRWA) is responsible for the planning, building and maintaining of more than 18,400 km of highway and state roads and 1,000 bridges in Western Australia the largest state covering almost one-third of the entire land mass in Australia or 2.5m km<sup>2</sup>.

The geographically spread road network is exposed to different climate zones. The climate ranges from tropical north regions having high temperatures and humidity and distinct wet and dry seasons, over the central desert regions with extremely hot day time temperatures and generally cold night temperatures, to the southern regions having warm and dry summers and mild and wet winters.

In 2015, MRWA had 1,030 employees and spent A\$250m on road maintenance. MRWA has a central office located in Perth and 8 regional offices.

In 1993, the Western Australian State Government introduced a Competitive Tendering and Contracting policy striving for greater competition in the delivery of public services. In 1995 MRWA developed and published its Best Roads Blueprint, a government approved reform that aimed at transforming MRWA from a provider and builder of roads to a manager of the road network. Although even prior to the reform a part of the maintenance activities was provided by private sector suppliers, the aim was to outsource up to 100% of the urban operational construction and maintenance activities and up to 70% of the rural operational construction and maintenance activities to the private sector. At same time, staff numbers were to reduce from 1,662 to 1,000 by the year 2000.

The following contract types will be reviewed:

- Integrated contracts for regular maintenance and rehabilitation of multiple assets, **AUS integrated**

MRWA uses also discrete and framework contracts.

### 3.6.2 Procurement practices

#### Integrated contracts for regular maintenance and rehabilitation

In 1996 MRWA started outsourcing road maintenance with a number of so called Term Maintenance Contracts (TMC) that based on unit price mechanisms procured maintenance work for ca 7000 km of the road network in two MRWA regions. From the seven awarded contracts with a duration of three years four went to private sector suppliers and three stayed within MRWA putting their own day labour crews in the role of the contractor. A private sector consultant was engaged as superintendent identifying defects and issuing work orders on the

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<sup>8</sup> Interviews with 5 MRWA employees from the central department in Perth and the MRWA district in Bunbury were conducted including contract managers, district managers, and technical managers. Documents studied include annual reports, contract documents, professional presentations, and audit reports (see also References).

contractor and a contract manager at MRWA served as linking pin between regional manager and superintendent.

Based on the experiences with this first generation of maintenance contracts and driven by an increased political pressure to outsource, in 1998 MRWA set out to introduce eight Term Network Contracts (TNC) each covering the entire MRWA regional road network. These fully integrated, lump sum contracts asked the contractor to do routine and non-routine (e.g. regular and rehabilitation) operational and managerial maintenance activities for all road structures and equipment. More specifically, the contractor was responsible for:

- rehabilitation work for values up to A\$1.5m,
- resurfacing and resealing of pavements,
- maintenance and installation of signs, lighting and line markings,
- maintenance and rehabilitation of bridges and structures,
- maintenance and rehabilitation of drainage systems,
- collection and management of asset inventory data,
- emergency response for incidents such as oil spills, major traffic accidents and traffic control for bush fires,
- responding to customer enquiries, complaints and feedback.

For five of the eight TNC's MRWA mainly specified asset-related performance requirements for a road network (for the other three contracts a combination of task-related performance requirements for the on-road work and asset-related performance for the off-road work was applied). The contractor was responsible for planning, programming and executing the necessary work to meet the requirements.

Asset-related requirements included specifications of surface texture and surface skid resistance as safety-related requirements and rutting and roughness specifications as user cost-related requirements. Asset condition profiles were used to present the desired cumulative frequency distribution of pavement condition parameters including worst and target profiles the contractor had to comply with. The former needed to be exceeded at any time during the contract and the latter had to be achieved at the end of the contract period. By annually measuring pavement conditions MRWA compared the required with the measured profiles and a payment adjustment was linked to these measurements.

Other performance specifications included the allowable level and extent of occurring defects on pavements or road furniture such as potholes, height of grass, or presence of litter. It also covered the response times to repair defects and in case of emergency situations. More general performance indicators related to specific areas such as asset management, safety, customer relationships, and environmental compliance. There was the possibility for the contractor to receive a bonus if exceeding target performance levels and deductions in case of not meeting performance requirements. A small contract administration team superintended the contract and monitored and audited the contractor's performance.

The contract had a duration of 10 years with the intention to stimulate the contractor to be innovative. The evaluation of tenders was based on price and non-price criteria.

As a result of renegotiating some of the TNC's a new generation of integrated contracts emerged in 2010. These Integrated Service Arrangements (ISA) adopt relationship-based contracting principles that include the combination of systems and people from public and private sector, a non-adversarial, collaborative decision-making approach, an open-book approach, development and retaining of core knowledge and skills, and the support for investment in innovation. Under this contract model public and private parties are working as



a team delivering the following services (Figure 17):

- Road network operations including providing safe and efficient access to the network and managing incidents
- Operational asset management
- Maintenance work including network/asset inspections and regular and rehabilitation activities
- Capital work up to A\$3m including safety or geometry improvements
- Project and contract management for projects undertaken by MRWA

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab		
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		

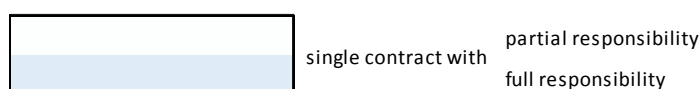


Figure 17 Content of maintenance contract AUS integrated

The contractor co-locates at the premise of MRWA under a unified governance and management structure describing the functions and activities to be fulfilled by Main Roads and the contractor. The ISA is a cost-plus fee contract that allows the contractors to get reimbursed of their direct costs, plus a fee comprised of corporate overhead and profit. The fee can be adjusted depending on the contractor’s performance. A proportion of the fee can be paid by MRWA to reward outstanding performance or has to be paid by the contractor if performance does not meet the agreed standards. A number of key performance indicators are used to determine the pain/gain scheme. At the beginning, these indicators were mainly related to the practices and processes of the contractor and whether these were in place such as safety management, traffic management or asset management plans. Later on, they were replaced or complemented by indicators measuring the work value (unit rates for maintenance tasks) to be used as internal benchmark and comparator between contracts.

The original term of the ISA is 5 years with the possibility to extend the contract on an ongoing basis as long as the contractor delivers the desired performance.

### 3.6.3 Procurement outcomes

The TMC’s as first step towards maintenance outsourcing at MRWA were rather unsuccessful mainly because of the superintended function that was outsourced to a private sector consultant. Besides the administrative burden created by numerous work orders to be handled, the superintendent lacked the regional network knowledge that would have allowed him to plan and optimize the work.

The TNC’s represented a major shift for MRWA in the way of delivering road maintenance. By integrating regular and rehabilitation activities for multiple assets under a fixed lump sum contract for 10 years many risks were assumed by the contractor and MRWA were put in a hands-off role. As a consequence, with the TNC’s MRWA lost control of planning, prioritizing

and implementation of asset maintenance activities that limits its ability to respond to shifting priorities and its flexibility to react to unplanned incidents. Moreover, the integration between maintaining, improving and upgrading road performance dissolved.

At the same time, the expected and desired performance outcomes could not be achieved. To some extent this related to the inexperience of the contractors with this type of contracts and the insufficient data available on asset conditions leading to some under-pricing of contracts. Combined with shortcomings in the demarcation of assets, the monitoring of asset conditions, the payment structure and the reward and penalty scheme this led to a limited effort of the contractors to deliver the agreed outcomes. For example, the measurement of pavement conditions appeared to be unreliable and thus not suited for managing the contract. Instead of taking a 10-year perspective and resurfacing entire road sections at the beginning of the contract, the contractor applied local repairs within its annual payment scheme. It was particularly this short-term view of the contractor that was stimulated by the TNC.

As contracts progressed, many minor issues on the work to be done escalated causing disputes between MRWA and the contractors that put some of the contractors under considerable business pressure in meeting MRWA requirements. As a result, a number of contracts were renegotiated and finally delivered under an alliance-style arrangement with a greater involvement of MRWA in determining required maintenance activities, thus reducing the risk of costly adversarial situations.

The ISA built on these renegotiated arrangements and fully adopted relationship-based contracting principles. With a cost-plus fee reimbursement, it brought flexibility back in the now joint decision-making between MRWA and contractor. It enabled MRWA staff to manage uncertainties and adjust to changes based on network operation priorities and stakeholder needs.

The unified governance and management structure clearly defined roles and responsibilities but whether positions were filled with MRWA or contractor people slightly differed between region. Although key middle management positions were taken by MRWA staff, administrative and operational management functions were also allocated to contractors depending on the availability of suitable persons. This led to a situation where decisions on resourcing were not clearly assigned and two different commercial models interfere.

As a consequence, the integrated team structures (on average 40% contractor staff involved in regions) combined with the cost-plus fee payment led to the perception at MRWA corporate level that the ISAs could not proof to deliver value for money through the consistent and regular capture and reporting of actual costs aligned to work performed by location, type, quantity or period.

In order to be able to report on asset performance and maintenance costs, supportive systems and processes (e.g. management maintenance information system) should be in place. At the beginning, the development of these systems and processes was left to the regions with little support and guidance from the central office. This resulted in inefficient systems and numerous processes increasing the administrative burden and costs. Currently, standardized systems are being introduced by the central office.

Besides the commercial perspective of MRWA's corporate management, the regional management believes that the flexibility of a cost-plus fee arrangement combined with the knowledge of the contractor crews working in the regions can lead to cost-effective solutions that cannot be necessarily achieved with separately contracted work. However, it is not felt that the ISAs delivered innovative solutions but rather incremental improvements of the operational maintenance work. This includes the perception that key performance indicators particularly used at the beginning were not sufficiently important or challenging enough to drive contractor performance and reward performance improvement. Nevertheless, there is the impression that the condition of the network has improved under the ISA even though

funding has not changed much over the years.

### 3.6.4 Procurement competences

The comprehensive change of the procurement practice with the TNC's required from MRWA staff and from contractor staff a different skill set that took considerable time to be developed. This set of skills ranged from the ability of the contractors to perform to their contractual requirements through to the contractual administration levels that were required by MRWA. The operational technical knowledge of MRWA staff in road maintenance and traditional contract management had to be supplemented with knowledge in quality management, process auditing and surveillance, and communication and relationship management skills. At the same time, by transferring asset management and road maintenance responsibilities to the contractor MRWA (partly) lost its operational technical knowledge and expertise to appropriately manage the contracts and remain an informed client. However, it appeared that not many of former MRWA maintenance staff either transferred to positions within the contractor organisations. The contractors generally had to rely on their own internal staff that had to acquire the required knowledge and skills by themselves.

With the ISA, a contractual model was implemented that allowed MRWA to re-build their asset management capabilities. This included an improved knowledge on the condition and performance of the network, but also the implementation of a consistent framework related to roles and functions of MRWA and contractor. The ISA put more emphasis on the relational capabilities of both MRWA and contractors. However, the frequent turnover of employees in more rural regions did not support the development of these capabilities.

The lack of evidence for the ISA's value of money pointed to the development of commercial management capabilities that include the capture and analysis of costs for maintenance activities and the implementation of a cost performance regime to focus on the achievement of commercial targets.

By using framework contracts with specialist contractors for line marking, traffic management and surfacing, some assurance for future work was created and, through this, a wider industry capability and capacity enhancement was facilitated. That seems particularly important for small, local specialists that depend on continuous work orders. From the MRWA perspective, special knowledge on the design, building and maintenance of engineering structures should be located and retained at the agency, on the one hand, to absorb possible opportunistic behaviour of contractors and, on the other hand, to deal with regional network peculiarities in a cost-effective manner. However, as an outsourcing consequence, this special expertise and the broad technical understanding at MRWA developed through in-house cross-functional training have been slowly fading away and have been mainly replaced by general and project management knowledge. It is even apprehended that the private sector cannot fully compensate for this knowledge loss.

### 3.6.5 Lessons learned

Since 1996 MRWA has outsourced road maintenance and moved to fully integrated contracts covering regular maintenance and rehabilitation of entire road networks. With the first two generations of these contracts, MRWA also outsourced maintenance planning and prioritization and, by doing so, lost some of its flexibility and control of road performance. Unsatisfied with the outcome of these contracts and to gain back its role as an involved and informed client, MRWA introduced relationship-based contracting principles with the third contract generation while keeping the degree of task and asset integration. This trajectory of outsourcing road maintenance at MRWA provided a number of lessons learnt:

- Fully integrated, lump sum contracts with asset-related performance specifications and a contract duration of 10 years do not result in cost effective life-cycle oriented

decisions of the contractor.

- Asset management knowledge should be developed and retained at the NRA.
- Relationship-based contracts offer flexibility in decision-making but require commercial knowledge at the NRA to prove the contracts' value-for-money.
- Uniform, centrally-coordinated maintenance management systems are needed to develop commercial and asset management knowledge and allow the comparison of outcomes of different contracts.
- Integrated contracts require time for the contractor to settle in, in order to create a new organisation, develop local network knowledge, use unfamiliar systems and processes, and build effective working relationships with the NRA.
- Outsourcing of road maintenance still requires from the NRA a broader technical understanding to interact with the contractor and to be responsive to regional characteristics.
- Special engineering knowledge should be retained at the NRA, since the private sector does not necessarily provide this knowledge.

Based on the experiences made so far, MRWA is currently preparing the next generation of maintenance contract to be commissioned in 2017. Particularly the perception of getting not the sufficient value for money with the ISA has triggered a change towards a functional separation of contracts. It is intended to let more state-wide contracts for the planned maintenance of different type of assets (e.g. roads, bridges, line marking) and regional-based contracts for the unplanned maintenance on the network. The former will use a lump-sum payment mechanism whereas the latter will be based on unit prices. At the same time, it is planned to introduce more clear-cut responsibilities lying maintenance planning back in the hands of MRWA and leaving its execution to the contractor. Co-location and daily coordination are intended to be kept as benefits from the ISAs.

### 3.7 Finland – Finnish Transportation Authority

The following sections focus on the Finnish Transportation Authority (FTA). The information was collected via interviews and documents<sup>9</sup>.

#### 3.7.1 Context

The total length of the state road network in Finland is 78,000 km (ca 52,000 km of paved roads, 13,000 km are main roads and 700 km are dual carriageways) and includes 11,600 bridges, 3,200 culverts and other assets such as ferry landing stages, road signs, guiding signs, road barriers, bus shelters, road telematics systems and monitoring equipment.

The weather conditions divide the year into summer and winter periods. The average summer temperature is 16 / 12°C (south/north) and winter temperature is -4 / -13°C (south/north). The number of frost days is 110 – 190 days.

In the year 2000, FTA was liberalized by dividing its activities in two separate organisations, a new road authority responsible for the open tendering procedure and other administrative duties, and a new company responsible for the actual maintenance business. In 2010, the current FTA was established as a central organisation to manage the entire transportation sector including road, rail and waterways. At the same time, 9 regional state organisations were created, called "ELY-centres", to manage the yearly maintenance contracts with steering and funding functions from the FTA.

The following contract types will be reviewed:

- Discrete contracts for rehabilitation of single assets, **FI discrete**
- Integrated contracts for regular maintenance of multiple assets, **FI m-integrated**
- Integrated contracts for regular maintenance and rehabilitation of pavements, **FI p-integrated**
- Framework contracts for regular maintenance and rehabilitation of pavements, **FI framework**

#### 3.7.2 Procurement practices

The main types of contracts in use in Finland are discrete contracts and integrated contracts.

##### Discrete contracts for rehabilitation of single assets

Discrete contracts are usually regional or site-specific contracts for rehabilitation of structures or equipment. FTA with ELY-centres executes approximately one hundred maintenance contracts of this type annually (Figure 18).

A discrete contract includes labour time and materials. Performance specifications are quality-related. The payment mechanism is dependent on completed work amounts, indices and a predefined schedule. Penalty schemes are based on quality; if the delivered outcome is below the standards. Bonuses are used occasionally.

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<sup>9</sup> Interviews with two FTA employees from the central department and four employees from regional Centre for Economic Development, Transport and the Environment were conducted including maintenance managers and contract managers. Documents studied include annual reports, contract documents, and professional presentations (see also References).

FTA monitors the market and develops contract requirements. Usually potential contractors are pre-selected based on their qualifications. Tender evaluation is conducted in two phases. First, a check is performed to confirm that contractors meet the minimum requirements. Second, a price comparison is made between all contractors who meet the minimum criteria. Negotiation opportunities are minimal. This traditional contract form is accepted by all parties and well known.

Contracts of this type have formal management procedures, with the contractor responsible for quality assessment. Change management is based on unit prices for changes and dispute resolution is conducted via negotiations.

Discrete contracts allow for a lean contract management role based on monitoring work site outcomes and approvals of minor changes. The contractor is responsible for all operational tasks. Deviations to the contract price are low (approximately under 5 %). This contract type is especially predictable when the work site plan is accurate.

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>				
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				


 single contract with full responsibility

Figure 18 Content of maintenance contract FI discrete

### Integrated contracts for regular maintenance of multiple assets

The integrated contract for regular maintenance is typically a five-year contract applied to monitor, plan, and conduct regular maintenance activities for all FTA asset types (pavement, gravel roads, pedestrian and bicycle ways, bridges, green areas, road signs, railings, cleaning, drainage) (Figure 19). In addition to this, the contractor is also responsible for certain authoritative and official supervisory tasks. FTA with ELY-centres executes approximately 80 concurrent maintenance contracts of this type, with approximately 13-19 new contracts annually.

Integrated contracts include labour time and materials. Performance specifications are intervention- and service-related. The payment mechanism is a hybrid of lump-sum based services and some activities based on unit prices with a pre-defined payment schedule. An incentive scheme may be based on quality assessment and controls performed by FTA. Bonuses are used to improve certain maintenance outcomes (max 2% of project value), based on a subjective evaluation.

Regular maintenance contracts are developed continuously based on the changing needs of FTA. The FTA presents a draft of each contract design before the beginning of the tendering process to allow contractors to have the possibility to express their comments. Providers are preselected based on their capabilities (prequalification). Tender evaluation is performed in a phased manner based on a ratio of quality and price in that order. Price evaluation is conducted only for those contractors which meet the minimum quality demands. This contract type is well known.

Regular maintenance contracts are evaluated with KPI's according to the quality specifications. Regular project meetings are the formal communication platform, while the

daily need for mutual agreements about details are conducted by phone and email. Changes are executed when within the contract scope; otherwise, changes may be postponed until the next contract cycle. Dispute resolution is almost always conducted by arbitration negotiations. Difficult disputes, which occur very infrequently, are handled in court.

Over time, contractors' operations models have changed, and therefore, program management models also require changes to contracts. For example, the tendency for a prime contractor to hire many sub-contractors requires a different management process than the traditional single-contractor relationship.

Regular maintenance contract combines several maintenance activities and assets under one contract where the level of the service is defined by the authority. The contractor reports performed actions while the authority's project manager monitors the outcomes. Because of the complexity of the contract, changes during the contract period are difficult. The budget predictability is good (when there is no need for additional works), price level is low due to intense price competition.

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab		Signs
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		


 single contract with full responsibility

Figure 19 Content of maintenance contract FI m-integrated

### Integrating contracts for regular maintenance and rehabilitation of single assets

The integrated contract for regular maintenance and rehabilitation of single assets (service contract) is an area- or road-specific contracts with a duration of 10 to 15 years. The contract integrates monitoring, planning, and executing of regular maintenance and rehabilitation of pavements or road markings leaving only the quality control to the authority (Figure 20). FTA has executed approximately 5 maintenance contracts of this type in a pilot phase.

Contracts of this type include labour time and materials. Performance specifications are based on road condition. The payment mechanism is on an annual basis, as a scheduled lump sum payment with an indexed correction. The incentive scheme is based on functional quality, providing contractors the freedom to organize all activities according to the requirements for the entire contract period. Penalties are used. Bonus payments are not used.

In the pilot contracts, the tendering process was performed collaboratively between contractors and FTA experts. The prequalified contractors submitted a total price to meet the contract requirements over the contract period. Tender evaluation was based on price. At this stage, the tendering process is laborious for all parties.

The contracts are thoroughly reported in detail by the contractor. Regular project meetings are the formal communication. During the long contract period, the contract management seeks yearly regulars which are easy to follow annually. Changes are executed within the contract scope; however, this can result in undesirable challenges during long contract periods without clear mechanisms to resolve disputes. If project managers cannot agree on a particular matter, problem-solving moves to higher level directors. Disputes are typically

resolved by arbitration negotiations.

The contracts allow the contractor to exercise his full expertise and are easy to manage. However, due to the long contract period, a certain need for more flexibility exists. Both budget and outcome are very predictable for a long period.

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan		Pavements	Road markings	
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
Regular maintenance	Do regular				
Regular maintenance	Monitor				
Regular maintenance	Plan				

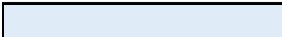
 single contract with full responsibility

Figure 20 Content of maintenance contract FI p-integrated

### Framework contracts for regular maintenance of pavements

Framework contracts for pavements are typically regional or area-wide contracts with a duration of 1 to 5 years and are based on partnering principles (partnering contract). The contracts are applied to monitor, plan and conduct regular maintenance on pavements, drainage or road structures (Figure 21). FTA is developing this maintenance contract type, and has executed approximately 10 contracts to date.

This contract type is used when more flexibility is needed than, for example, what a lump sum contract can provide. It is used mainly in low volume roads where performance indicators cannot be used as contract specifications. Typically, contractors also provide short term planning. This contract type leaves all technical choices to the contractor (within the guidelines of the performance specifications and standards). FTA receives information about implemented actions for asset management purposes at the end of the season.

The contractor can suggest products irrespective of total costs or maintenance efficiency. It is the authority's responsibility to choose the most cost-effective maintenance method when ordering or approving maintenance plans.

This contract includes labour time and materials. Performance specifications are task-related and problems are addressed as they are detected. The payment mechanism is based on unit prices and is applied to implemented work quantities. Incentive schemes for this contract type are minimal, as a standard of quality is required to be met.

The contracts make use of contractor's knowledge to improve maintenance efficiency and outsource the authority's workload. During the tendering process, prequalified contractors submit unit prices for different products, weighted by theoretical amounts, in a price competition. Experiences with this contract type have been good.

The contracts are applied with performance monitoring and re-evaluation is performed as the warranty period is ending. Change management is usually easy, because the prices are known and products that are not included in the tendering process can be priced by negotiation. Large changes in work volume can lead to disputes. If project managers cannot agree on a matter, problem-solving moves to higher level directors. Disputes are typically resolved by arbitration negotiation.



Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
<i>Regular maintenance</i>	<i>Do regular</i>		Pavem.		
<i>Regular maintenance</i>	<i>Monitor</i>				
<i>Regular maintenance</i>	<i>Plan</i>				


 single contract with full responsibility

Figure 21 Content of maintenance contract FI framework

The contracts are flexible, easy to adjust and provide an easy way for knowledge transfer. As a part of the partnership, contractors can ease authority's workload. Predictability is very good.

### 3.7.3 Procurement outcomes

In general, discrete contracts show an intense price competition that keeps costs to a low level. Minimum quality demands are typically met on time. The contractor can concentrate on conducting the agreed work without any additional responsibilities. However, the intense competition encourages contractors to test the limits of quality tolerance rather than to offer ways to improve technical quality or work methods. Innovations are authority-driven and usually related to quality specifications or contract structure. In this contract type, the contractor will naturally tend to lower cost solutions. The normal warranty time is two or three years. However, expected material life-cycles can exceed this period resulting in long term quality risks for the authority.

Integrated contracts provide the authority the possibility to share the work load with the contractor and benefit from the contractor's full expertise. Contract costs have been low due to existing market competition and the provided quality meets specifications.

Integrated contracts for regular maintenance provide good overall quality. The contractor aims to fulfil contract specifications and, occasionally, introduce new innovations. Authorities have limited resources to develop contract structure but small changes are nonetheless introduced annually. Future contract structures emphasis on automatic quality measurements and implementing new technologies. This type of contract is very important for stakeholders (e.g. winter maintenance). Risk allocation is defined by the authority. Long contract periods balance risks (e.g. winter maintenance). Due to short warranty periods, it is essential that quality control measures are properly followed during the contract period.

Integrated contracts for pavements provide well-reported quality in a given contract area for long periods. Efficiency is the contractors' internal business concern and provides the possibility for testing of new methods and innovations within the technical standards. Quality specifications are defined by the authority, as stakeholder satisfaction is ultimately the authority's responsibility. Risk allocation is designed in the contract; cost indexes and responsibility for road structures lies with the authority while the overall cost is the responsibility of the contractors.

Framework contracts for pavements are based on the authority's stipulated quality specifications and negotiations with the contractor. The contractor can (and should) propose innovative solutions and products as part of the partnership. Stakeholders are made a primary focus when work sites and actions are planned and chosen. In this relationship, the authority assumes long term risks (e.g. asset level of service) and the contractor assumes

technical risks (e.g. quality of performed works).

### 3.7.4 Procurement competences

Discrete contracts are commonly used and their understanding is very good because they have been in place for a long time. They are easy to implement and the budget is predictable. Information exchange is based on regular work meetings and the level of cooperation depends on the project manager. Good technical competence of the authority staff is necessary because they plan the tasks and chooses used methodologies and technologies. FTA's Asset Management System provides the framework and templates for information needs. The authority has its own expert network for discussions/learning. Contractors have common training programs (e.g. asphalt workers). For knowledge capture and transfer, the FTA's and ELY Centre procurement specialists meet a few times a year and exchange experiences, or participate in so-called "learning by doing" activities.

Integrated contracts for regular maintenance have been in use for a long time and the procurement model is familiar to both FTA and the contractors. Changes in personnel may result in more discussions about previously established working practices. The same contract model is used in all contracts and the general contract terms are developed at the national level; however, local adjustments to contracts are necessary. Daily communication for mutual agreements about details is needed. Third party cooperation is conducted through the Infra Contractor Association. The contract is dependent on trustworthiness and long term commitment. Information exchange is based on regular meetings, phone and email. More often, extranet systems designed to coordinate these activities are in use, typically provided by the FTA. Members of both parties are expected to actively communicate with one another. Disputes can be normally solved by project managers. Escalated disputes normally move up the company hierarchy. The contract is developed in cooperation with Infra Contractor Association, including contract documents and quality requirements. The authority's project managers receive internal training. For knowledge capture and transfer, the regional maintenance managers meet 5-6 times per year. Documents and instructions are updated on a regular base. Contractors have their own in-house training and this training is kept strictly internal. There is a recognized need to provide more "hands on" training to sub-contractors to improve their knowledge and level of quality of services performed.

Integrated contracts for pavements is a new contract type. Generally, a good understanding of the contract exists, but caused different interpretations during the contract period. The contracts have been a learning process, especially for contractors. They require close cooperation and communication between the authority and the contractor because of new responsibilities given to the contractor. Therefore, a mutual understanding about new roles and practices between contracting parties is mandatory. This contract type knows a comprehensive, formal reporting task as well as informal discussions. Decision making is conducted during the work season. Conflicts are agreed by negotiation. There is no precedent model for difficult disputes. Knowledge capture and transfer methods are under development. Reports and studies of the pilot project are not complete.

The use of framework contracts for pavements has increased significantly in recent years. Generally, a good understanding of the contract exists, but a full understanding of the partnership principles underlying this contract has been difficult in some cases. The contract is designed for open discussion and the opinions of both parties must be heard. Success, thus, depends greatly on project managers. The outcome is further dependent upon how information is shared between parties. Informal discussions and decision making are conducted during the work season. ICT -systems are provided for real-time monitoring. Conflicts are agreed by negotiation, providing a reasonable solution for all parties.

### 3.7.5 Lessons Learned

Based on the experiences with different types of maintenance contracts main lessons learnt are:

- Traditionally used contracts are easy to design and manage.
- A mechanism to control costs and more easily handle contract change orders is needed.
- Integrated contracts for pavements maximize the use of contractors' expertise.
- The operational method of conducting regular maintenance contracts has changed from sole-provider of works to subcontracting.
- Procurement documents remain mostly unmodified from year to year; however, small continuous customisations are executed.
- Third party forums for communication haven proved to be a good way to strengthen mutual understanding.
- Partnering has proved to be a great way to limit risks and provide flexibility for the use of resources.

The procurement of maintenance services will shift towards longer and more extensive contracts including broader service terms and they are more and more based on functional requirements. These types of maintenance service contracts will provide new business opportunities and improved productivity for contractors and, in addition, new innovations and cost effective solutions for authority. The objective is also to encourage contractors to provide high quality service for road users.

### 3.8 Norway – Norwegian Public Road Administration

The following sections focus on the Norwegian Public Road Administration (NPRA). The information was collected via interviews and documents<sup>10</sup>.

#### 3.8.1 Context

The state road network managed by the NPRA consists of 10,500 km of main roads (riksveger) and 45,000 km of regional roads (fylkesveger). Approximately 500 km roads are dual carriageways. Before 2010 there were about 27,000 km of main roads, but almost 17,000 km of these were reclassified as regional roads. The main roads are owned and financed by the national government, while regional roads are owned and financed by 18 regions. Municipal roads (39,000 km) are owned, financed and managed by the municipalities.

The weather conditions divide the year into summer and winter periods. The average summer temperature is 16 / 12°C (south/north) and winter temperature is +2 / -4°C (south/north). The number of days when temperatures are below 0°C (length of winter) is 110 – 190 days.

In 2003, the state-owned road enterprise Mesta AS took over the NPRA's operational activities for regular maintenance. Many maintenance activities had been put out for tender also before 2003, but from 2003 all remaining maintenance (incl. winter maintenance) was tendered out gradually over a transition period until August 31<sup>st</sup> 2006.

In 1.1.2016 started a new state-owned road enterprise, Nye Veier AS (<http://www.nyeveier.no/>), to plan, build and maintain selected important road sections (at this moment five pcs.). The idea behind the new road company is to create a lean and efficient organisation to provide holistic and cost-efficient development and maintenance of main roads.

The following contract types will be reviewed:

- Discrete contracts for rehabilitation of single assets, **NO discrete**
- Integrated contracts for regular maintenance, **NO integrated**

#### 3.8.2 Procurement practices

##### Discrete contracts for rehabilitation of single assets

Discrete contracts are usually regional or site-specific contracts for rehabilitation of pavements or structures (Figure 22). NPRA executes approximately eighty contracts for pavements annually with an average budget of €3m.

This contract type includes labour time and materials. Performance specifications are quality-related. The payment mechanism is dependent on completed work amounts, indices and a predefined schedule. Penalty schemes are based on quality; if the delivered outcome is below the standards. Bonuses are used to improve quality (e.g. use of thermographic camera, low temperature asphalt).

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<sup>10</sup> Interviews with three NPRA employees from the central department were conducted including maintenance managers and contract managers. Documents studied include annual reports, contract documents, and professional presentations (see also References).

NPRA develops contract requirements with branch organisations. Tender evaluation is conducted in two phases. First, a check is performed to confirm that contractors meet the minimum requirements regarding technical, financial and competence issues. Second, a price comparison is made between all contractors who meet the minimum requirements. There are no negotiation opportunities. This traditional contract type is accepted by all parties, risk allocation is known and the process is well known.

Contracts of this type have formal management procedures. The authority conducts quality testing and have in-house personnel on site. Change management (object details and additional work sites) is based on unit prices for changes. Dispute resolution is seldom needed. In case of dispute cooperation meetings are held, where leaders from both sides participate. If agreement is not reached, the contract describes a scheme where an external third-party expert is engaged to give advice on how the conflict may be resolved. It is voluntary for both parties to accept any suggested solutions. If agreement is not reached the matter then has to be decided in the judiciary system. Discrete contracts provide lean contract management; namely, monitoring work site outcomes and approvals of minor changes. The contractor is responsible for all operational tasks. This contract type is very predictable when the work site plan is accurate. Same persons are involved regularly in the procurement process.

Type of maintenance		Type of asset					
Task	Activity	Build assets			Installed assets		
Rehabilitation	Plan						
Rehabilitation	Monitor						
Rehabilitation	Do rehab						
<i>Regular maintenance</i>	<i>Do regular</i>						
<i>Regular maintenance</i>	<i>Monitor</i>						
<i>Regular maintenance</i>	<i>Plan</i>						


 single contract with full responsibility

Figure 22 Content of maintenance contract NO discrete

### Integrated contracts for regular maintenance of multiple assets

Integrated contracts for regular maintenance are usually area wide five-year contracts (with option for 1 year extension) including the monitoring, planning and conducting of regular maintenance for all of NPRA's asset types (pavement, gravel roads, pedestrian and bicycle ways, bridges, green areas, road signs, rails, cleaning, drainage) (Figure 23). NPRA has about 100 maintenance contracts of this type, the length of maintained road network is between 400 to 800 km in each contract. Usually the contracts contain both main and regional roads. The NPRA's goal is to maintain the roads with the focus on transport routes minimizing the administrative borders. The main contractors can have only two levels of subcontractors.

Performance specifications are intervention- and service-related. The payment mechanism is a hybrid of lump-sum based services and some activities based on unit prices with a pre-defined payment schedule. Price-indices compiled by *Statistics Norway (SSB)* are used to compensate for changes in price level, thereby reducing part of the cost related risks during the contract period. Deviation from contract requirements may result in economic penalties for the contractor.

The contracts are continuously developed. The contracts contain requirements regarding environmental factors, e.g. which chemicals that may be used (where and when), and in some cases, describe specific areas where use of salt for de-icing is prohibited because of

environmental factors. The contract type is well known.

The contracts are monitored with NPRA’s online system for contract management. Regular project meetings are the formal communication platform. NPRA has usually two in-house persons working for each contract, project manager and technician for sample testing and quality monitoring. In some cases, these personnel also have other tasks, so not all their time is used on these contracts alone. Ideally, this should not be the case.

When an extreme weather situation occurs in a contract area and the contractor is unable to keep the level of performance which is defined in the contract, the contract requires this to be reported immediately to NPRA. The NPRA then decides whether reduced level of service is allowed (provided that all resources specified in the quality plan are on duty) or if extra resources beyond this level will be called out. Extra payment will come only if the client is ordering extra resources.

According to the contract regulations, the parties are required to attend a so called “Cooperation meeting” every 3-months during the first year of the contract, and then biannually the following years, or whenever one of the parties in the contract requires this. In addition to the people normally in charge of handling the contract, the management level above the same people are required to attend. The purpose of such meetings is to strengthen the cooperation, and in addition, to solve conflicts which may exist.

In all contracts, there are schemes for dispute resolution. During the period after signing the contract and before the contract works starts up, the parties are required to name an “expert” to be called upon if a dispute which cannot be solved through a “cooperation meeting”, arises. This expert will define a solution which is believed to be correct according to the contract specifications. The parties are free to accept this solution, or bring the conflict to the courts. Normal range for cost adjustments are within 15 % of contract price.

The over 100 contracts means that there are about 20 contracts let every year. Extending the contract periods suggests that there are too many contracts to manage. A focus on contractor’s performance might be more beneficial. Small contract size provides opportunities for small contractors to participate in the tendering process. In recent years trials with smaller area contracts with greater client (NPRA) involvement (management) have been carried out in different parts of Norway. These contracts have mainly been implemented in areas where there has been weaker competition for traditional contracts, and has been designed to encourage smaller, local contractors to participate in the competition. This has led to more competition than for earlier contracts.

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab		Signs
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		


 single contract with full responsibility

Figure 23 Content of maintenance contract NO integrated

### 3.8.3 Procurement outcomes

The discrete contracts are performed according to the detailed specifications defined by the

authority and outcomes generally meet the five-year warranty time and expectations. Minimum quality demands are typically met on time. The contractor follows the specifications and no innovations are introduced. The authority has tendency to increase penalty regulation over the years.

NPRA has tried a few long-term pavement projects on high volume road to introduce the possibility for contractor to optimize the action cycles caused by rutting. The general opinion is that the contractors give more emphasis on quality on these performance-based contracts than on the traditional method-based contracts with detailed technical specification. The way they were designed the final economic settlement was usually not done until 4-7 years after the work was completed. This, together with other factors led to the termination of any new contracts of this type. Among the factors was a general view expressed by many contractors about the risk being too high for them.

Integrated contract costs have been on same level for last four years and the trend has been decreasing based on the competition on the market. The results from the road user evaluations have been improving a little over the years.

NPRA would like to encourage development and innovation in each contract and it is possible to include a R&D part the contract, although the current funding is much smaller than 20 years ago.

### **3.8.4 Procurement competences**

Discrete contracts have been in use for a long time and the procurement model is familiar to both authority and contractors. NPRA maintains contract templates and the procurement process is partly electronic, providing less possibilities for errors and simplifies the administrative process.

The contracts are monitored by NPRA's regional staff. The authority is present during the work and the contracts meetings are held every 14<sup>th</sup> day within a standard agenda.

A good in-house/internal knowledge over the technical details is demanded, because the authority provides the detailed technical specifications. The NPRA currently provides all needed support systems for effective asset management. Every region has its own technical department equipped with measurement devices, laboratory etc. Currently very little external consultancy is used for technical questions. Competence is maintained through an internal expert network and co-operation with research institutes. The procurement experts from NPRA and regions meet four times per year and exchange their experiences, basic policy is learning by doing. Yearly technology meetings are also arranged for expertise exchange.

Integrated contracts for regular maintenance have been in use for a long time and the procurement model is familiar to both the authority and the contractors. The same contract model is used for all contracts and the general contract terms are developed at the national level.

The NPRA's electronic communication portal is well used with all contracts and it is well accepted way to communicate and document the contractual issues. Attitudes vary a lot over different contracts and there are different experiences within the authority. Every contract has two times per year a co-operation meeting where both parties evaluate works done during the previous time period.

Since 2012, there has been an emphasis that workers are trained properly and possess the necessary level of competence associated with the work they perform. This is an integral part of the responsibility of a contractor which perform according to the requirements of ISO 9001. Winter maintenance is the most important tasks of integrated contracts, and previously it was observed that many drivers performing this type of work, did not possess the necessary level of competence. This acknowledgement led to a project where the NPRA in cooperation with

the Swedish Trafikverket developed common requirements of competence for this type of work. The Norwegian and Swedish authorities also cooperate in defining questions suited for multiple-choice tests related to winter maintenance. This has led to common contract requirements in both countries for drivers who are responsible for winter maintenance. In Norway, the requirements state that all drivers must pass a test to validate the competence associated with winter maintenance. The NPRA has published a text book (manual) and presentations to be used for training. The responsibility to provide sufficient training and competent workers, is placed on the contractor. The NPRA has assumed responsibility to arrange PC based multiple-choice tests to verify the theoretical competence. The NPRA also pays a bonus for each work hour performed by people who participates in vocational training offered by the public-school system. This scheme with bonus apply to all contracts that NPRA enter.

The NPRA's internal technical sections in regions providing currently the main part of the in-house technical competence. However, the NPRA's development funding has been diminishing during the past years and it is difficult for thee NPRA to steer development done in different regions.

On the contractor side some technical shortages occur randomly (e.g. there exists some problems to follow the performance specification for skid resistance) , emphasising the need for continuous training.

### 3.8.5 Lessons learnt

Based on the experiences with different types of maintenance contracts main lessons learnt are:

- It is challenging to maintain good quality standards on regular maintenance contracts over the years, costs are well managed.
- There is a need for continuous training for maintenance personnel.
- There is a need to measure with standardised methods the outcomes of lump sum pavement contracts.
- NPRA believes that the contractors can invest to develop their competence and technological capacities with the long term integrated performance-based contracts.
- Authority costs have been relatively at the same level for the discrete contracts.
- Contractors are using other pavement methodologies in long term contracts than contract where NPRA is defining the specifications in details.
- Long term integrated contracts provide better work quality for pavements than normal discrete contracts.
- Knowledge shortages can occur in regular maintenance contracts when personnel or contractor changes.
- The authority should be able to transfer existing maintenance data to new contractors.
- Extra emphasis should be given to the communication practices between authority and contractor on personal level.
- Quality issues are difficult to evaluate in tenders if the economic factors get the main role.
- Similar monitoring and quality assessment methods should be used nationwide.
- Small contractors have difficulties to tender for regular maintenance contract.



- There exists very little freedom of action for the authority in case the contractor does not meet the required outcomes.

### 3.9 Sweden – *Swedisch Transport Administration*

The following sections focus on the Swedish Transport Administration (STA). The information was collected via interviews and documents<sup>11</sup>.

#### 3.9.1 Context

The total length of the road network is 98,500 km (ca 76,500 km of paved roads, 26,400 km are main roads and 2,650 km have two carriageways).

The weather conditions divide the year into summer and winter periods. The average summer temperature is 16 / 12°C (south/north) and winter temperature is -4 / -13°C (south/north). Number of day's temperature below 0°C (length of winter) is 110 – 190 days.

In the year 1990, the liberalization process started and production was separated from administration. The political opinion was that in-house competences could be outsourced and that contractors would provide maintenance expertise. In 2008, the state enterprise was privatized and in 2010 the current STA was created by combining the road and railway administrations.

In 1990's, the public road network was divided into 235 maintenance areas. Currently, there are 115 regular maintenance areas with a goal to reduce this number below 100.

The following contract types will be reviewed:

- Discrete contracts for rehabilitation of single assets, **SE discrete**
- Integrated contracts for regular maintenance of multiple assets, **SE m-integrated**
- Integrated contracts for pavements, **SE p-integrated**

#### 3.9.2 Procurement practices

##### Discrete contracts for rehabilitation of single assets

Discrete contracts are usually regional or site-specific contracts for rehabilitation of pavements and structures from which about 70 % are related to pavement rehabilitation (Figure 24). They provide lean contract management and possibility to approve minor changes. The contractor is responsible for all operational tasks. This contract type is very predictable when the work site plan is accurate.

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<sup>11</sup> Interviews with four STA employees from the central department were conducted including maintenance managers and contract managers. Documents studied include annual reports, contract documents, and professional presentations (see also References).

Type of maintenance		Type of asset			
Task	Activity	Build assets		Installed assets	
Rehabilitation	Plan				
Rehabilitation	Monitor				
Rehabilitation	Do rehab				
Regular maintenance	Do regular				
Regular maintenance	Monitor				
Regular maintenance	Plan				


 single contract with full responsibility

Figure 24 Content of maintenance contract SE discrete

### Integrated contracts for regular maintenance

Integrated contracts for regular maintenance are usually geographically based, four year contracts (with option for 1 or 2 year extension) applied to monitor, plan and conduct regular maintenance activities for all of STA's asset types (pavement, gravel roads, pedestrian and bicycle lanes, bridges, green areas, road signs, rails, cleaning, drainage) (Figure 25). STA has about 115 maintenance contracts of this type, signing on about 20 new contracts annually.

This contract type includes work and materials. Performance specifications are intervention and service related. The payment mechanism has two parts: a fixed price and a variable price. The variable price is based on unit prices and results from the weather maintenance model developed by STA over the years (VädErs). This model uses historical geographic weather data and several sub models. The contractor gets the model and data from the subscriber and performs the analysis according to a fixed methodology.

Incentive schemes are based on quality assessments and third-party controls. Bonuses play a minor role. The basic incentive is the possibility of extending the contract period in case of good performance. However, a premature termination of contracts is currently too difficult.

The contracts are developed continuously. STA has a specialized unit for market studies (BDA; ByggDriftAnläggning) having regular meetings with the main contractors. Providers are preselected based on their capabilities (prequalification). Tender evaluation has two phases; quality based acceptance and price competition for qualified contractors. The contract type is well known. The STA has the possibility to award any proposal, if the total benefits are obvious.

The contracts are conducted with the use of the VädErs model, mobile reporting (MPI, mobile inrapportering från plogbilar) and KPI's according to the quality specifications. Third party quality control is performed over the whole network. Regular project meetings are the formal communication platform and daily needs for mutual agreements about details are conducted by phone and email. Changes are executed within the contract scope. Dispute resolution is conducted by arbitration negotiations according to the mutually developed third party process "FIA (Utökad samverkan på anläggningsbranschen)" with "Svensk Byggtjänst ltd" organisation.

The contracts combine several maintenance activities and assets under one contract where the service level is defined by the authority based on the road user expectations. The aim in these contracts has been a fair share of the risk, especially the weather-related risk (VädErs). In addition, a principle exists that the authority assumes responsibility for "unforeseen" issues. STA has developed the understanding over network and maintenance needs based on the outcomes from previous contracts. Price level is low due to tough price competition. Contract predictability is good because the weather risk is managed according to

the VādDers model and a contract maximum price is stipulated.

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan		
Rehabilitation	Monitor		
Rehabilitation	Do rehab	pavements	Signs
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		

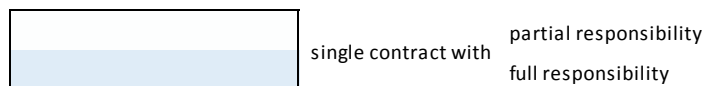


Figure 25 Content of maintenance contract SE m-integrated

### Integrated contracts for pavements

Integrated contracts (service contracts) are also used for rehabilitation and regular maintenance of pavements. They are road-specific and have a duration of seven years. The authority defines the quality requirements for pavement surface condition and the contractor has complete responsibility for the actions (Figure 26). STA has also introduced a new type of contract for longer periods of 13 years. The contractor is responsible for maintaining a specified level of quality for the duration of the contract period. The payment mechanism is lump sum paid on a yearly basis.

The contracts are tendered in two phases: qualification of the company and then, accepted companies submit a price proposal to meet the contract requirements over the contract period. Tender evaluation is based on price. The contracts have a predefined, well-functioning annual monitoring process. Disputes occur seldom and are typically resolved by arbitration negotiation.

The authority expresses the quality requirements in terms of technical specifications for the road and materials used. The contractor can use its knowledge to meet the requirements in the most economical way.

Type of maintenance		Type of asset	
Task	Activity	Build assets	Installed assets
Rehabilitation	Plan	Pavements	
Rehabilitation	Monitor		
Rehabilitation	Do rehab		
<i>Regular maintenance</i>	<i>Do regular</i>		
<i>Regular maintenance</i>	<i>Monitor</i>		
<i>Regular maintenance</i>	<i>Plan</i>		

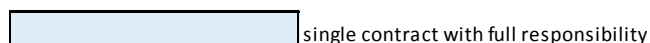


Figure 26 Content of maintenance contract SE p-integrated

### 3.9.3 Procurement outcomes

Discrete contracts are performed according to the quality specifications defined by the authority and the outcomes generally meet the expectations. Minimum quality demands are

typically met on time. The contractor can concentrate on conducting the agreed work without any additional responsibilities. Contract costs are decreasing due to existing market competition while the provided quality continues to meet specifications.

Integrated contracts for regular maintenance provide good overall quality and the road users have been generally satisfied. The condition of assets is carefully reviewed during the beginning and end of the contract period. Innovations are introduced, including technical developments (e.g. from dry salt to liquid fluid applications) and more timely and precise actions.

Integrated contracts for rehabilitation of pavements have been found to provide good quality under the long guarantee (contract) period. A longer contract period (13 years, in pilot phase) gives contractors the possibility to adjust the volume of production according to annual market demands.

### 3.9.4 Procurement competences

Discrete contracts follow the Finnish experiences in terms of contractual, relational and technical competences. Contract understanding is very good because it has been in use for a long time. It is easy to implement and the budget is predictable.

Integrated contracts for regular maintenance have been in use for almost 30 years and the procurement model is familiar to both authority and contractors. They need daily communication for mutual agreements about details. The co-operation is a learning process under the contract period. However, the aim is that the co-operation should be similar between contracts and should not be personified in contract areas. The five regional authorities have regular internal meetings to process actual issues. The STA has developed principles and documentation for co-operation between contract actors, road users and the public (Samverkan). The workforce faces a generation change and training for new personnel is needed. Differences among contractors are considerable in different parts of the country in terms of competences. Regions with low population density, large distances also have fewer actors to provide maintenance tasks.

Integrated contracts for regular maintenance require training certificates for all personnel since 2014. Training courses are provided for internal and external persons by STA's "Trafik skola" ([www.trafikverksskolan.se](http://www.trafikverksskolan.se)). For example, all drivers must pass a computer based test. These certificates are also accepted for Norwegian maintenance contracts as a result of co-operation between STA and NPRA. For knowledge capture and transfer, regional maintenance managers meet once a year. The need to maintain and increase knowledge in regular maintenance activities is noted.

Integrated contracts for rehabilitation of pavements are commonly used and accepted. The contract templates and principles for performance specifications exist and are in use. Contract model is clear and well understood. The authority's representative should have experience and knowledge to act in conflict situations. Contractors are not required to possess training certificates. The STA has its own internal specialist group to develop the pavement contracts. Contractors also have their own internal training programmes. The "Asfaltskola" (Education institute which arranges courses for the pavement branch) is arranging training courses for its member workers.

### 3.9.5 Lessons learnt

Based on the experiences with different types of maintenance contracts main lessons learnt are:

- Risk should not be transferred if the receiving party is not capable of handling it.
- Contracts should not be dependent upon individuals and their qualifications to co-

operate.

- R&D needs public funding to develop maintenance outcomes. The R&D interest of contractors is different from the interest of the agency.
- Misused or poor incentives can create undesirable practices.
- Generation shift is ongoing on both authority and contractor side.
- Mutual contract design throughout the country results in good transparency for the market.
- The possibility exists for synergy with local municipalities to gain savings in long-term contracts in terms of facilities, scale and materials.
- Small contractors lack knowledge and resources to participate in large, integrated contracts.
- Local circumstances should be taken into account for all contracts.
- The economic structure should be simple. Currently, contracts are complex and cumbersome to manage.
- There is a need to coordinate with other contracts in the same area (bridges, lighting, traffic signals etc.).

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