Using Experts' Knowledge to Identify Deterioration Factors of Dutch Highways

Construction Management and Engineering

Master Thesis

2014-2015

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GRADUATION YEAR
2014 - 2015
COLLOQUIUM DATE
14-07-2015

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EXECUTIVE SUMMARY

Infrastructural contractors are facing the challenge that they need to increase their understanding about long-term pavement performances. It is, however, unclear which data is relevant to collect to increase the understanding about long-term pavement performance. The goal for this research states: *to outline the data that is needed to gain understanding about pavement performance by identifying the factors that influence abnormal deterioration*. The leading research question states as follows: *What data is needed for infrastructural contractors to gain understanding about abnormal deterioration behaviour of flexible pavements?*

This study has emerged because of changes in the construction industry. New procurement strategies and new forms of contracts necessitate a change in contractors' acting. Changing procurement strategies imply that the Dutch government is outsourcing tasks and responsibilities to the market parties by means of so called Performance Based Contracts (PBC). Rijkswaterstaat is using DBFM contracts as a form of PBC to transfer the responsibilities for design, construction, financing and maintenance of an infrastructural object to one private entity. With contractors as an important party within this private entity, they are confronted with new tasks, responsibilities, and risks for long periods of time. For DBFM projects, the maintenance periods can go up to 30 years. In a DBFM project, contractors are panelised or rewarded based on the performance of the infrastructural object they design, construct and maintain. The increased risks and responsibilities work as an incentive for contractors to deliver higher quality products and to optimise their operational processes. However, long-term responsibilities reach beyond the experience domain of the contractors. To stay competitive and to be able to cope with the increased risks and responsibilities which are being transferred to the contractors, they need better understanding about long-term pavement performance.

Better understanding about pavement performance refers to the ability to make accurate predictions of pavement deterioration behaviour. DBFM contracts are mostly applied for highway projects with a PAC or 2L-PAC top layer. Therefore, better understanding about the performances of these pavement types is essential for contractors. The exact lifespan of PAC and 2L-PAC is not known, and the distribution in lifespan is indistinct. Six major categories can be used to describe the reasons for unpredictable pavement performance: structure, environment, traffic, construction, maintenance, and material properties. These six categories contain a large number of factors which cause the deviating lifespans of pavements. In addition, complex interactions between deterioration factors make pavement performance prediction a difficult matter.

Although there are models that cope with predicting pavement performance, accurate predictions are still difficult to make and are often based on experience. Road agencies often use performance models to predict pavement performance. Performance models are models which contain statistical representations of damage developments based on condition surveys to estimate the remaining life of pavements. Little to no variables are taken into account in these models. Performance prediction models are more advanced prediction models than performance models and also take variables into account. Performance prediction models can make accurate performance predictions, but data about important influential variables is missing, while inclusions of the most influential variables is essential for accurate predictions. The effects of deterioration factors on the lifespan of pavements are not well understood, and the current available databases do not satisfy this need. Therefore, it is important to gain understanding about the effects of the most important pavement deterioration factors, so that the accuracy of prediction models can be optimised. Current databases and performance models are not sufficient to comply with contractors' needs and current performance prediction models lack data to make accurate predictions.

Data about the most important deterioration factors is, thus, needed to increase understanding about pavement performance.

Because of the limited knowledge about the effects of conditions and variables on the lifespan of pavements, this study identified and ranked relevant deterioration factors for PAC and 2L-PAC top layers in the Netherlands. A specific study that focuses on the Netherlands was needed, because different countries often cope with different conditions that determines the performance of roads. In addition, the Netherlands is one of a few countries were PAC pavements are extensively applied. 73 unique deterioration factors were identified and ranked by experts; 37 for the construction phase and 36 for the lifespan phase. Factors that were scored above a value of 0.4 are considered worthwhile to monitor. 45 unique factors were scored higher than 0.4; 26 for the construction phase and 19 for the lifespan phase.

Construction conditions have a great influence on pavement deterioration. For PAC, 61 per cent of the factors which have a score higher than 0.4 are construction factors, and for 2L-PAC, 65 per cent of the factors which have a score higher than 0.4 are construction factors. Most deterioration factors in the construction phase are controllable, meaning they can be avoided or minimised by human interventions. This means that unpredictable pavement behaviour is for a large share a result of human failure or actions during construction. It is, therefore, worthwhile to put effort in eliminating the deterioration factors which have a score higher than 0.4. In addition, it is worthwhile to take notice of the higher scored factors, and document these conditions when one wants to be able to explain unexpected deterioration symptoms.

The highest scored factors that occur during the lifespan of pavements are often of a local and incidental nature. This means that their occurrence is incidental and their impact is high but on a small surface. Maintenance work to repair consequential damages is, therefore, more local and less rigorous than maintenance work for damages that are a result of factors that have a more structural nature, such as climate and traffic factors. Deterioration factors which occur during the lifespan of pavements and which were scored higher than 0.4, for both PAC and 2L-PAC, are considered worthwhile to monitor. In addition, climate and traffic factors are scored relatively low (mostly below the threshold), but they are considered worthwhile to monitor. Despite their low scores, most traffic and climate factors are considered important, because of their structural nature. Most of these factors are affecting the whole pavement surface and can be reoccurring. Besides monitoring the factors which are scored higher than 0.4, it is also worthwhile to put effort in monitoring traffic and climate factors which are scored higher than 0.2 for both PAC and 2L-PAC.

This study has created a first understanding about the effects of factors that influence abnormal deterioration of Dutch highways during construction and lifespan. This knowledge may be used to adjust initial performance expectations when a certain factor is observed. In addition, when structurally collecting data and documenting deterioration factors, the occurrence probability of certain factors can be predicted more and more precise, and unexpected deterioration can be traced back to its underlying cause. Further, empirical evidence can be created when data about deterioration factors is linked to performance data. Finally, when performance data and data about deterioration factors are obtained, the reliability of performance prediction models can be improved, and the overall understanding about long-term pavement performance can be enhanced.

MANAGEMENT SAMENVATTING

Infrastructurele aannemers worden geconfronteerd met de uitdaging dat ze hun kennis over lange termijn prestaties van wegen dienen te verbeteren. Het is echter onduidelijk welke data nodig en relevant is om te verzamelen waarmee het begrijpen van lange termijn gedrag vergroot kan worden. Het doel van dit onderzoek is als volgt: *het inzichtelijk maken van de data die nodig is om de kennis over het gedrag van wegen te verbeteren door de factoren die abnormale degradatie beïnvloeden te identificeren*. De onderzoeksvraag is als volgt: *Welke data is nodig voor infrastructurele aannemers om kennis over het abnormale degradatiegedrag van asfaltwegen te vergroten?*

Dit onderzoek is ontstaan door veranderingen in de bouwindustrie. Nieuwe aanbestedingsstrategieën en nieuwe contractvormen eisen een verandering in de operationele strategieën van aannemers. Deze veranderende aanbestedingsstrategieën houden in dat de Nederlandse overheid taken en verantwoordelijkheden uitbesteedt aan marktpartijen door middel van prestatiecontracten. Rijkswaterstaat gebruikt DBFM contracten om de verantwoordelijkheid voor het ontwerp, bouw, financiering en onderhoud te weerleggen naar één private entiteit. Met de aannemer als belangrijke partij in deze private entiteit worden zij geconfronteerd met nieuwe taken, verantwoordelijkheden en risico's voor lange perioden. In DBFM contracten kan de onderhoudsperiode oplopen tot 30 jaar. In DBFM projecten worden aannemers op het presteren van het infrastructurele object dat zij hebben ontworpen, gebouwd en onderhouden gestraft of beloond. De verhoogde risico's en verantwoordelijkheden fungeren als stimulans voor de aannemer om een hogere kwaliteit van producten op te leveren en om hun operationele processen te optimaliseren. Lange termijn verantwoordelijkheden reiken echter buiten het ervaringsdomein van aannemers. Om concurrerend te blijven en om te kunnen omgaan met de verhoogde risico's en verantwoordelijkheden, moeten aannemers hun kennis over lange termijn prestaties van wegen verbeteren.

Met het beter begrijpen van wegprestaties wordt bedoeld het vermogen om accurate voorspellingen over het degradatiegedrag van wegen te maken. DBFM contracten worden doorgaans toegepast op snelwegen waarop een ZOAB of 2L-ZOAB deklaag is toegepast. Daarom is het beter begrijpen van het degradatiegedrag van deze type wegen essentieel voor aannemers. De exacte levensduur van ZOAB en 2L-ZOAB is onbekend en de spreiding in levensduur is onduidelijk. Zes belangrijke categorieën kunnen gebruikt worden om het onvoorspelbare gedrag van wegen te verklaren: constructie, omgeving en klimaat, verkeer, bouwproces en materiaaleigenschappen. Onder deze zes categorieën vallen een groot aantal factoren die de afwijkende levensduur van wegen veroorzaken. Daarnaast is er een complexe interactie tussen factoren aanwezig, waardoor het voorspellen van wegprestaties een moeilijke kwestie is.

Hoewel er modellen zijn die zich bezighouden met het voorspellen van het degradatiegedrag, is het nog altijd moeilijk om accurate voorspellingen te maken en daarnaast worden voorspellingen veelal gebaseerd op ervaringen. Wegbeheerders gebruiken vaak prestatiemodellen om het gedrag van wegen te voorspellen. Prestatiemodellen zijn modellen om de resterende levensduur van wegen te voorspellen. Deze modellen bevatten statistische representaties van schadeontwikkelingen, ze zijn gebaseerd op inspecties en nemen weinig tot geen variabelen in acht. Prestatievoorspelmodellen zijn meer geavanceerde voorspelmodellen dan de prestatiemodellen en nemen variabelen in acht. Prestatievoorspelmodellen kunnen accurate prestatievoorspellingen maken, maar data over belangrijke invloedsvariabelen is niet beschikbaar, terwijl het meenemen van dergelijke variabelen essentieel is voor accurate voorspellingen. De effecten van degradatiefactoren op de levensduur van wegen worden niet goed begrepen en huidige databasen zijn niet toereikend. Daarom is het belangrijk om meer kennis te verkrijgen over de effecten van de meest belangrijke degradatiefactoren, zodat de precisie van voorspelmodellen kan worden

geoptimaliseerd. Huidige databasen en prestatiemodellen zijn niet toereikend om te voorzien in de behoeftes van de aannemers en huidige prestatievoorspelmodellen hebben niet genoeg data om accurate voorspellingen te genereren. Data over de meeste belangrijke degradatiefactoren is dus nodig om de kennis over de prestaties van wegen te verbeteren.

Omdat er beperkte kennis is over de effecten van condities en variabelen op de levensduur van wegen, focust dit onderzoek op het identificeren en scoren van relevante degradatiefactoren voor ZOAB en 2L-ZOAB in Nederland. Een onderzoek dat focust op Nederlandse snelwegen was nodig, omdat andere landen te maken hebben met verschillende condities die het gedrag van wegen bepalen. Daarnaast is Nederland één van de weinige landen waar ZOAB deklagen op grote schaal zijn toegepast. Experts hebben zijn 73 unieke factoren geïdentificeerd; 37 voor de uitvoeringsfase en 36 voor de levensduurfase. De factoren die boven de drempelwaarde van 0.4 hebben gescoord, worden beschouwd als waardevol om te monitoren. 45 unieke factoren hebben een score hoger dan 0.4; 26 voor de uitvoeringsfase en 19 voor de levensduurfase.

Uitvoeringscondities hebben een grote invloed op wegdegradatie. Voor ZOAB zijn 61 procent van de factoren die hoger zijn gescoord dan 0.4 uitvoeringsfactoren. Voor 2L-ZOAB zijn 65 procent van de factoren die hoger zijn gescoord dan 0.4 uitvoeringsfactoren. De meeste factoren die voorkomen in de uitvoering zijn controleerbaar. Menselijke interventies kunnen deze factoren dus minimaliseren of elimineren. Dit betekent dat onvoorspelbaar degradatiegedrag voor een groot gedeelte een resultaat is van menselijke acties en falen tijdens de uitvoering. Het is daarom waardevol om moeite te steken in het elimineren van de degradatiefactoren die hoger hebben gescoord dan 0.4. Daarnaast is het waardevol om voorkomende degradatiefactoren op te merken en te documenteren, zodat onverklaarbare en onverwachte degradatie kan worden verklaard.

De hoogst gescoorde factoren van de levensduur fase zijn vaak van lokale en incidentele aard. Dit betekent dat ze incidenteel voorkomen en een hoge impact hebben op een klein oppervlak. Werkzaamheden om gevolgschade te repareren is dan ook meer lokaal en minder rigoureus dan werkzaamheden voor schades die het gevolg zijn van factoren met een meer structurele aard. Degradatiefactoren die tijdens de levensduur voorkomen en die een hogere score hebben dan 0.4 worden beschouwd als waardevol om te monitoren. Daarnaast worden ook klimaat- en verkeersfactoren beschouwd als waardevol om te monitoren, hoewel deze factoren grotendeels onder de grenswaarde zijn gescoord. Ondanks de relatief lage score worden deze factoren als belangrijk gezien, omdat ze van structurele aard zijn. De meeste klimaat- en verkeersfactoren hebben invloed op het gehele wegoppervlak en kunnen terugkerend zijn. Naast het monitoren van de factoren die hoger gescoord zijn dan 0.4 is het ook waardevol om klimaat- en verkeersfactoren te monitoren die hoger gescoord zijn dan 0.2 voor zowel ZOAB als 2L-ZOAB.

Dit onderzoek heeft een eerste inzicht gecreëerd in het begrijpen van de effecten van degradatiefactoren die voorkomen tijdens de uitvoering en levensduur van Nederlandse snelwegen. Deze kennis kan bijdragen aan het bijstellen van initiële prestatieverwachtingen wanneer een van deze factoren wordt waargenomen. Daarnaast kan het structureel verzamelen en documenteren van degradatiefactoren bijdragen aan het voorspellen van de kans dat dergelijke factoren voorkomen. Onverwacht degradatiegedrag kan terug worden geredeneerd naar de onderliggende oorzaak wanneer deze data beschikbaar is. Verder kan empirisch bewijs gegenereerd worden wanneer data over degradatiefactoren gelinkt wordt aan prestatiedata. Tot slot kan prestatiedata en data over degradatiefactoren de betrouwbaarheid van prestatievoorspelmodellen vergroten en kan zo het algemeen begrijpen van lange termijn degradatiegedrag worden vergroot.

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1.1.1 Problem Description

Infrastructural contractors are facing the challenge that they need to increase their understanding about long-term pavement performances. Competitive tendering and the rise of contracts with a performance component have let that contractors need more accurate understanding about the behaviour of pavement objects. Performance Based Contracting has created a gap between the market demands (long warranty and maintenance periods) and the knowledge of contractors about their pavement assets. The current market demand reaches beyond the experience of contractors, and there is little data at hand that can be used to increase the understanding of long-term pavement performance. It is unclear which data is relevant to collect to increase the understanding about pavement performance.

1.1.2 Problem Statement

Followed by the problem definition, the following problem statement was defined for this study:

Contractors lack understanding about long-term pavement performances in order to cope with increased risks and responsibilities.

1.1.3 Research Questions

For this study, one research question was composed with six sub-questions. The main research question is as follows:

What data is needed for infrastructural contractors to gain understanding about abnormal deterioration behaviour of flexible pavements?

The main research question was split into several sub-questions each covering a single topic. The sub-questions are formulated as follows:

1. *What are the consequences of changed procurement conditions in the infrastructure industry for contractors?*
2. *What makes pavement performance unpredictable?*
3. *How is currently dealt with predicting pavement performance?*
4. *What factors cause abnormal deterioration of PAC and 2L-PAC during construction?*
5. *What factors cause abnormal deterioration of PAC and 2L-PAC during their lifespan?*
6. *What is, according to experts, the severity of deterioration factors on pavement deterioration?*

1.1.4 Research Objective

The following research objective is leading in this study:

To outline the data that is needed to gain understanding about pavement performance by identifying the factors that influence abnormal deterioration.

1.1.5 Scope of this Research

Although infrastructural contractors deal with a wide variety of infrastructural assets, for this study, the focus is on asphalt pavements and factors that influence these pavements' lifespan. Different assets are subjected to different deterioration factors during its lifespan making the scope too broad to cover all assets in this study. In addition, asphalt pavements cover a large part and most critical parts of the Dutch road network. For contractors, it is most interesting to increase their understanding about pavements on national highways. Therefore, this study focuses on highways in the Netherlands. The following statement is leading in this study: *Factors that influence deterioration of asphalt pavements are worthwhile to monitor.*

The focus will be on the factors which occur during construction and during the lifetime of pavements. It is not the intention to develop a tool that enables contractors to improve their understanding about pavements. The intention of this study is to identify the most influential deterioration factors.

1.1.6 Expected Results

This study provides a list of factors which have a negative effect on the performance of two pavement types (PAC and 2L-PAC) and which occur during construction and during the lifespan. The identified factors are ranked to its severity on pavement deterioration by experts. The most influential factors will be highlighted. Factors that are perceived as most important by experts, i.e. the ones with a score above a certain threshold, will most likely be representative for data that is worthwhile to collect for one who wants to understand actual pavement performance.

1.1.7 Relevance of this Study

This study is closely related to innovative contracting and new technological innovations, such as performance-contracting, Data science and Wireless Sensor Networks. Infrastructure is an important part of the built environment and is essential for the economy of nations, regions and cities. Safe and fast transport of people and goods, protection and proper drainage of water, and a reliable supply of energy are essential for the functioning of any economy and society. To guarantee this now and in the future, proper management and maintenance of overhead- and underground infrastructure are of great importance. Pavement, as a significant part of infrastructure, thus needs great care. With contract- and technological innovations, opportunities arise to increase quality of pavement management.

1.1.8 Research Overview

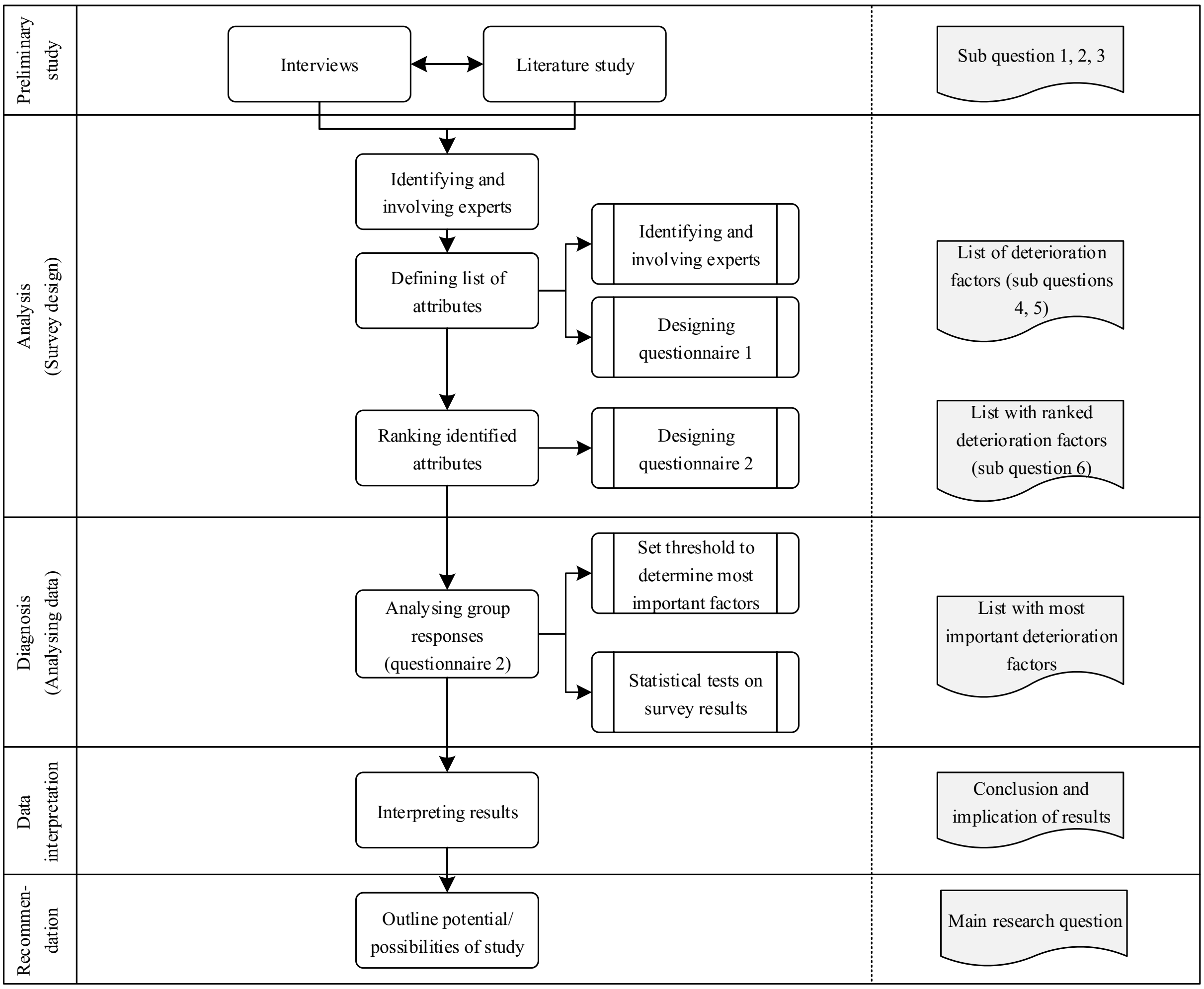

Figure 1: Research overview.

1.2 Thesis Outline

In chapter two, the glossary can be found. Chapter three presents the theoretical background of this study. Five main topics are discussed in this chapter: 1) the context of the literature study; 2) changes in the construction industry and the consequences for contractors; 3) theory about the structure and behaviour of asphalt pavements; 4) contractors' needs and the current dealing with pavement performance predictions; 5) the scope of this study. Chapter four presents the research model of this study. First an introduction and theoretical background about the used method is presented. Second, the application of the model in this study is discussed. Third, the analysis of the results are presented. Finally, an interpretation of the survey results is given, and recommendations for future actions and future research are provided. Chapter five closes this thesis with a conclusion.

CHAPTER 2, GLOSSARY

Term	Definition (as used in this thesis)
Abnormal deterioration	Physical degradation of pavement which deviates from reasonable expectations.
Asphalt concrete	A mixture of crushed stone, sand, and filler, bounded by bitumen.
Asphalt pavement	A pavement type which is usually built up from three layers: a base layer, a binder layer, and a top layer. The top layer is made of asphalt concrete.
Client	A party which outsources the design, construction, financing, or maintenance of a public infrastructural object.
Commissionee	A private entity which takes responsibility to design, build, finance, and maintenance an infrastructural object, also called Special Purpose Vehicle.
Commissioning party	A party which outsources the design, construction, financing, and maintenance of a public infrastructural object.
Compacting	Exert force on asphalt concrete to make it denser; compress.
Consensus	The level to which a group of people agree to each other.
Construction phase	The timeframe where the actual construction of an object takes place.
Contractor	Private company which constructs infrastructural objects for a client.
Crisp value (S_j)	Expert group opinion.
Damage symptom	A physical expression of damage, e.g. ravelling or cracking.
DBFM	A contract form where the design, construction, financing, and maintenance is outsourced to one private entity.
Defuzzification	The process of converting experts' opinions into one single number (crisp value).
Delphi Method	A research method that draws upon knowledge, experience and expertise of a group of experts in a systematic manner.
Deterioration behaviour	The development of pavement deterioration over time.
Deterioration factor	A factor that cause pavement deterioration.

Double Layer Porous Asphalt Concrete, 2L-PAC	A gap-grade asphalt mixture based on PAC, but with two (instead of one) open layers with different air void content.
Expert	A person with comprehensive experience and knowledge about a given subject.
Flexible pavement	Asphalt concrete pavement which is usually built up from three layers: a base layer, a binder layer, and a top layer.
Fuzzy Delphi Method	A research method that draws upon knowledge, experience and expertise of a group of experts in a systematic manner and with the use of fuzzy numbers.
Fuzzy number	Converted rankings to a scale from 0 to 1. Fuzzy number is a number which takes uncertainty of a general number into account.
Input parameter	Variable that is used by performance prediction models.
Lifespan phase	The timeframe where an object, in final state, is used for its initial purpose.
Maximum value (Fuzzy Delphi)	The maximum effect of a given factor.
Minimal value (Fuzzy Delphi)	The minimal effect of a given factor.
Optimal value (Fuzzy Delphi)	The most probable effect of a given factor.
Pavement deterioration	Physical degradation of pavement.
Pavement failure	The moment in time that an asphalt pavement drops below a certain predefined technical requirement.
Pavement Management System, PMS	A system to help road agencies in making informed decisions about maintenance.
Pavement performance	The physical condition of a pavement over time.
Paving	Applying the asphalt concrete layer of a pavement structure.
Performance Based Contract, PBC	Integrated long-term contracts where the contractor is assessed on the performances of an (infrastructural) object for which they are responsible.
Performance model	A model, which contains statistical representations of damage developments based on condition surveys to estimate the remaining life of pavements.
Performance prediction model	Advanced model to predict pavement performance.
Porous Asphalt Concrete, PAC	A gap-graded asphalt mixture with a minimum air void content of 20 per cent after compaction.

Procurement	A way in which bodies governed by public law buy what they need for their activities, e.g. infrastructural objects.
Ravelling	The damage formed when mineral aggregate is forced out of the road surface.
Rijkswaterstaat	The executive agency of the Ministry of Infrastructure and Environment in the Netherlands. Rijkswaterstaat operates and develops the main road and waterway networks on behalf of the ministry.
Road	A small strip of ground within a landscape, which is specifically used by- and prepared for traffic.
Road network	Interconnecting roads that represent a system of roads for an area or country.
SHRP-NL	Strategic Highway Research Program – Netherlands. A research program to improve knowledge about the long-term performance of flexible pavements.
Special Purpose Vehicle	A private entity which takes responsibility to design, build, finance, and maintenance an infrastructural object, also called commissionnee.
Tender	A way in which bodies governed by public law buy what they need for their activities, e.g. infrastructural objects.
Threshold	A minimal value that has to be reached.
Top Layer	The upper layer of an asphalt pavement which is visible in a pavement’s final state and on which physical contact is made by traffic.
Triangular fuzzy number	A fuzzy number represented with three point range (min., opt., max.)
Viscosity	The state of being thick, sticky, and semifluid in consistency due to internal friction.
WINFRABASE	A database with data about pavement performance and conditions.

CHAPTER 3, THEORETICAL BACKGROUND

Abstract

This study has emerged because of changes in the construction industry. New procurement strategies and new forms of contracts necessitate a change in contractors' acting. This study has outlined the consequences of changing procurement strategies from the Dutch government for infrastructural/road projects. Changing procurement strategies imply that the Dutch government is outsourcing tasks and responsibilities to the market parties by means of so called performance based contracts. This dilemma is approached from contractors' perspective, because they are confronted with new tasks and responsibilities for long periods of time. The new tasks and responsibilities are an incentive for contractors to increase the knowledge about pavement performance. The responsible party for the long-term functioning of roads needs to increase their understanding about the actual long-term performances. Contractors do, however, not have enough experience and understanding of long-term pavement performance. The current market demand reaches beyond the experience domain of the contractors. A large amount of factors and complex interactions between factors affect pavement performance which make predicting pavement performance a difficult matter. In addition, prediction models that cope with the dilemma of performance predictions are lacking data to create reliable input parameters. The factors that influence pavement deterioration are not well understood and data about these factors is lacking. Better understanding about the factors that influence pavement deterioration is needed for contractors to increase the understanding of long-term pavement performance. Factors that explain abnormal pavement deterioration should be identified. Understanding these factors is needed so one can expand its knowledge domain and better cope with the new tasks and responsibilities that come with Performance Based Contracting.

3.1 Introduction; Context of Study

Throughout the years, an extensive road network has been developed around the world and became an important part of the built environment. The Netherlands has one of the most advanced dense road network in the world. With 138.641 km public roads, the road network is as good as complete. The main activity in road construction has shifted from constructing new roads to reconstructing, widening and maintaining the current network (CROW, 2010). The Dutch main road network can be divided in three main classes: national roads/highways (5.242 km), provincial roads (7.749 km), and other roads/municipal and Water Board roads (125.650 km) (CBS, 2014). Nowadays, roads are mainly made of asphalt concrete, so called flexible pavements. The Netherlands knows three main types of top layers for these flexible pavements: Dense Asphalt Concrete (DAC), Porous Asphalt Concrete (PAC), and Stone Mastic Asphalt (SMA). The focus of this study is on PAC for reasons which are explained further on in this thesis. PAC was first utilised as a surface wearing course in 1972 in order to promote safety aspects during wet weather conditions. Although road safety aspects were initially considered to be of overruling importance when deciding to apply porous asphalt wearing courses, the favourable noise-reduction characteristics of this material have led to its more widespread use in the 1980s (van der Zwan , et al., 1990).

Transportation networks in particular are needed to enable modern economies to create wealth and employment (Hertogh & Westerveld, 2010). In the Netherlands, the share of domestic freight transport that travels over roads covers approximately 80 per cent. The share of international freight transport covers almost 43 per cent. Nowadays, the degree of which transport over roads is possible is essential for the development and functioning of any national economy. Banerjee et al. (2012) state that the transportation infrastructure of a country is the key for growth and development for both social and commercial purposes.

Commercial-, standard-, and public transport are all strongly dependent on the condition of the road network. Proper maintenance of the network is, therefore, of great social and economic importance. It is the road authority's accountability to keep the pavement infrastructure save and efficient so that availability for social and commercial purposes is optimal. However, due to changes in procurement strategies, the responsibility for the management of the Dutch road network shifts more towards the private sector.

3.2 A Changing Industry; Consequences of Performance Based Contracting

In order to provide efficient and effective road networks, in many countries, the public sector is responsible for infrastructure. In the Netherlands, Rijkswaterstaat is the executive agency of the Ministry of Infrastructure and Environment. This means that Rijkswaterstaat operates and develops the main road and waterway networks on behalf of the ministry. In recent years, Rijkswaterstaat has searched for ways to decrease their contribution and to pass on certain risks and responsibilities to the private sector.

Procurement strategies in the Dutch construction industry are changing. For a long time now, a trend towards integrated long-term contracts can be recognised in most western countries (Lenferink, et al., 2013; Ministerie van Financiën, 2008; Pietroforte & Miller, 2002). Integrated long-term contracts are mainly known as Public Private Partnerships (PPP), or as termed by the World Bank: Performance Based Contracts (PBC) (Haas, et al., 2011). Where previously the responsibility for design, financing and maintenance planning of a project was with the client, now these tasks are becoming more and more the responsibility of private parties that enter into a construction project. In PPP/PBC, the role of the client has become very limited. The largest client of infrastructural projects in the Netherlands is the Ministry of Infrastructure and Environment; Rijkswaterstaat. Formerly, as in many other countries, Rijkswaterstaat would develop their plans in detail; they controlled the planning procedure from the beginning to the end, from agenda-setting and explorative studies to management and maintenance of delivered infrastructure (Arts, 2007; van den Brink, 2009). Nowadays, they minimise their contribution to plan development, preconditioning and agreements with the surroundings, and then hand over the work to the market parties (Rijkswaterstaat, n.d.).

3.2.1 Performance Based Contracting in Infrastructure Construction

In the literature, there are discussed different forms and categories of PBC, e.g.: Public Outsourcing; Design and Build; Design Build & Maintain; Franchising; Partnering; Joint Ventures. Even privatisation is sometimes seen as a form of PBC/PPP (Ferlie, et al., 2007; Geddes, 2005; Grimsey & Lewis, 2007). In this chapter, the focus is on PBC's with a Design Build Finance & Maintenance (DBFM) aspect, because infrastructural PBC projects are mostly tendered as DBFM by Rijkswaterstaat. In addition, the long-term maintenance aspect of the DBFM model requires contractors of infrastructural projects to rethink their operational strategies.

Currently, DBFM contracts are the standard for large, complex infrastructural projects on national level in the Netherlands (Eggers & Startup, 2006; Lenferink, et al., 2013). DBFM contracts are a mean for the client (called a commissioning party) to receive better value for money, i.e. to achieve higher quality products with the same budget, or the same quality with a smaller budget (Commitee Ruding, 2008; Ministerie van Financiën, 2008; Wijsman, et al., 2011). In 2012, the Dutch Ministry of Finance calculated that for using a DBFM contract the project value has to be at least 60 million euros (Ministerie van Financiën, 2014). After the 60 million threshold, the benefits (value for money) of using a DBFM outweigh the transaction costs that are associated with the contract form (Ministerie van Financiën, 2014).

In the DBFM model, a commissioning party outsource the design, construction, financing and maintenance of a public infrastructural object to one private entity (called the commissionee or Special Purpose Vehicle). With a DBFM, the financing of the project has to be carried by the private commissionee, while the funding has to be carried by the public commissioning party. Here, financing refers to the origin of the financial means to realise a project, while funding refers to who ultimately is bearing the costs of the investments (Commitee Ruding, 2008). Because the commissionee needs to finance the DBFM project, a consortium has to be formed with a party who is able to control the financial aspects; who will provide the financial means. The consortium of the commissionee is also often formed with other specialists, such as project management-, consultancy- and engineering-firms. Figure 2 shows a typical structure the relationship between the involved parties in a Dutch infrastructural DBFM project.

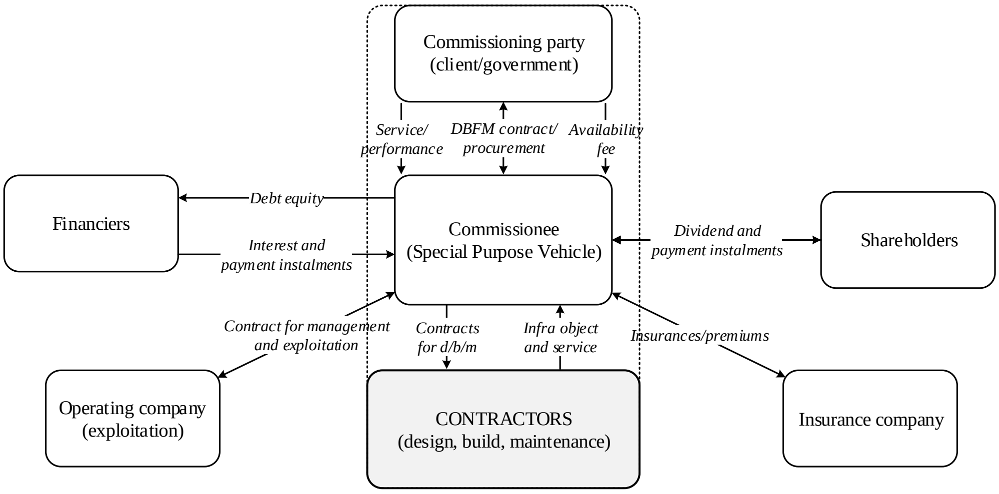

Figure 2: Typical DBFM structure for Dutch infrastructure project (Commitee Ruding, 2008).

The basic principle of DBFM is to transfer long-term risks and responsibilities to a private party which is considered best capable of controlling them (Allen, 2003; Leahy, 2005). Generally, the contractor is seen as having the best control of the risks associated with quality and performance of the project (Thompson, et al., 2002). Therefore, this thesis refers to and focuses on the contractor when discussing transferred risks and responsibilities. For the commissioning party/client, the rationale behind transferring the risks is to get best value for money, i.e. build and maintain the infrastructure asset in the most economic and efficient manner (Eversdijk & Korsten, 2009; HM Treasury, 2011; Ministerie van Financiën, 2014). The World Bank reports extensively about costs savings as well as a variety of other benefits that have resulted by using PBC for road assets. In the Netherlands, costs savings should be 30 to 40 per cent according to the World Bank (Stankevich, et al., 2009). There is, however, no empirical evidence that DBFM creates a financial added value for the commissioning party (Eversdijk & Korsten, 2009). However, it is believed that the added value of tendering infrastructural projects as a DBFM is in the expectation that the contractor delivers a smarter design, because they have to maintain the object for a long period after construction. The responsibility period for contractors can stretch up to 30 year, thus, low quality work could lead to higher maintenance costs for the contractor and vice versa.

In a DBFM, the private consortium aims for the best solutions for the whole lifecycle of the object to ensure adequate (financial) return on investment. While in general, the public sector/commissioning party aims for a societal return on investment. A social return on investment is the extent to which societal needs are satisfied (Bult-Spiering, 2003). A social return can be measured by the performance of a road, e.g. the amount of availability. Therefore, performance indicators are specified which the contractor is required to meet when delivering maintenance services (Stankevich, et al., 2009). During the maintenance phase, the contractor provides a service over the lifecycle of the asset. The contractor can be rewarded or penalised based on the performance/functioning of the asset. In the DBFM model, the income of the contracting party is based on measured outputs. For roads, this often means the availability of roads (Rijkswaterstaat, 2014; Stankevich, et al., 2009). For instance, the availability of a road lane; if an asset is only partially available because of maintenance activities, the responsible party (contractor) receives less money/income. Thus, in the DBFM model, individual maintenance activities are not rewarded, but the overall performance of the asset determines the income of the contractor. This reasoning should be an incentive to produce higher quality, and thus better functioning of governmental assets (Lenferink, et al., 2013). For contractors to stay competitive and to achieve an adequate return on investments, they have to adopt a long-term lifecycle approach.

3.2.2 Consequences of DBFM from Contractors' Perspective

The shift from traditional contracting to a form of contracting with maintenance periods up to 30 years has an impact on the operational strategies of contractors. Contractors have to aim for a 'lifecycle-approach' when tendering for a project. This means that the operational performance of the asset has to be efficient for the whole contract period, because they are assessed on the overall performance of the constructed object. This new reasoning makes it interesting to look at the dilemma of increased risks and responsibilities from contractors' perspective.

With PBC, the commissioning party aims for a better functioning product, however, the contractors are the ones who are confronted with more responsibilities and process tasks. The responsibility for significant risks shifts from clients to contractors, and therefore, contractors are confronted with any quality shortcomings in the infrastructural objects they design, construct, and maintain. As a result, contractors are triggered to reduce any shortcomings in their product and to act more strategically throughout the whole process; from tender to maintenance. Contractors should have control over their processes and assets to be competitive in tendering and to be successful in their operations.

PBC has little impact on the technical requirements of an infrastructural project, meaning that the same objects have to be constructed by the same market parties as in conventional contracts. However, contractors get more freedom, and thus, can benefit if they deliver high quality products with low maintenance costs and high availability. As a result of long-term contracts, contractors are thus facing technical challenges, such as designing and constructing objects with low maintenance costs, and estimating the reparation and maintenance costs for periods up to 30 years.

At this point in time, it is questionable if the contractor is the party who is best capable of controlling the long-term risks and responsibilities that come with an infrastructural project, because long-term thinking is beyond the experience domain of contractors. With conventional contract forms, contractors had the responsibility (warranty obligations) of road assets for periods of +/- 3 to 7 years. With DBFM, the performances of road assets are the responsibility of contractors for periods up to 30 years. Thus, more responsibilities for longer periods of time are transferred to contractors. Although it is questionable if contractors are, on the short term, the ones who have the most knowledge to control the risks associated with maintaining and operating roads for periods up to 30 years, it also provides new opportunities and challenges for contractors. With clients outsourcing the responsibility for design, construction and maintenance, additional consequences for the market parties are more freedom in interpretation of the contract and in defining operational strategies. Contractors experience the pressures of new types of competition, but at the same time, acknowledge the opportunity to distinguish themselves from their competitors (Bijleveld, 2015). There is more freedom to design, construct and maintain the described object to own preferences and expertise. Performance Based Contracts often empower contractors to choose the materials, construction processes, and maintenance processes. With these developments, contractors have to opportunity to develop certain expertise, deploy innovative products and increase understanding about the products they make.

3.2.3 Summary of the Used Literature

In previous paragraph, 17 main studies were taken into account about the changing pavement industry and the consequences of changing procurement strategies. The selected studies were published between 2002 and 2014. The following categories were the main subjects in chapter 3.2: '*new contracts; changing market conditions'*, '*defining DBFM*', '*consequences and benefits of DBFM*', and '*shift of risks and responsibilities*'. Table 1 shows the topics and the authors who wrote about a topic.

Table 1: Concept centric representation of used literature for consequences of changing procurement strategies.

Main categories	Scientific articles
New contracts; changing market conditions	Arts, 2007; Leahy, 2005; Lenferink, et al., 2013; Ministerie van Financiën, 2008; Pietroforte & Miller, 2002; van den Brink, 2009; Wijsman, et al., 2011.
Defining DBFM	Eggers & Startup, 2006; Ferlie, et al., 2007; Geddes, 2005; Grimsey & Lewis, 2007; Haas, et al., 2011; Lenferink, et al., 2013.
Consequences and benefits DBFM	Eversdijk & Korsten, 2009; HM Treasury, 2011; Lenferink, et al., 2013; Ministerie van Financiën, 2014; Stankevich, et al., 2009; Thompson, et al., 2002; Wijsman, et al., 2011.
Shift of risks and responsibilities	Allen, 2003; Leahy, 2005; Thompson, et al., 2002; Stankevich, et al., 2009.

3.3 Structure and Behaviour of Roads

As described in previous paragraphs, procurement strategies are changing in the construction sector, and therefore, contractors have to adapt. Contractors need control over their assets and processes. Shortcomings in the eventual product have to be minimised, so that they will not be confronted with unexpected costs because of abnormal deterioration. An important aspect is optimising the predictability of the objects that have to be delivered. Unpredictable deterioration behaviour is extremely transverse for contractors. Maintenance strategies cannot be optimised and predictions of future performances can hardly be made. As a result, budgets are not accurate, and anticipating on deterioration is hard. Hence, a competitive advantage is missed.

In this study, the focus is on how contractors can increase the predictability of road performances. Roads in the Netherlands are mainly made of asphalt concrete. Therefore, to better understand the content of this thesis, an overview of the substance is provided in the following paragraph. In addition, the causes of unpredictable deterioration behaviour is discussed in this chapter.

3.3.1 The Composition of Asphalt Concrete Pavements

Without going into detail about the structural and material properties, a short introduction about asphalt pavements will be given to provide a better understanding of this subject.

The elements and dimensions of a road structure are based on requirements, design principles and precondition. Flexible pavement structures are usually built up from three layers: a base layer, a binder layer, and a top layer. Each layer may be subdivided in a number of sub-layers, but not every structure consists of the same structural layers. This strongly depends on the usage conditions and geographic conditions. A typical asphalt concrete road structure can be divided in the following sub-layers: top layer; binder course and bituminous base; base or foundation; sub-base layer and improved subgrade layer. Figure 3 shows a typical pavement structure in the Netherlands.

The top layer, or wearing course, is made of asphalt concrete. It is this layer that is visible in final state and on which physical contact is made by traffic. The top layer is directly exposed to stresses from climate and traffic (Suo & Wong, 2009). Therefore, this layer has to comply with high standards, such as skid resistance, visibility, texture, evenness, strength, resistance to atmospheric and chemical influences, water drainage, and deformation resistance. These high requirements make the top layer relatively the most expensive layer in the structure (CROW, 2010). The top layer is made of asphalt concrete. Asphalt concrete is a mixture of crushed stone, sand, and filler, bounded by bitumen. In the Netherlands, three main types of top layers are applied: Dense Asphalt Concrete (DAC; Dutch: DAB), Porous Asphalt Concrete (PAC; Dutch: ZOAB), and Stone Mastic Asphalt (SMA). The difference between these layers is defined by the percentages and types of crushed stone, sand, filler, and bitumen and air voids in the mixture.

The binder course and bituminous base are made from asphalt concrete and are situated between the non-bituminous base and the top layer. The binder layer is the last layer before the final top layer is applied. This layer serves as anchor for the top layer, and therefore, has to have the highest degree of evenness, because variations in the top layer are unacceptable. In addition, this layer needs to transfer shear stresses from the top layer to the base layers.

The base, or foundation, consists of unbound or bound materials. Unbound materials are, for example, crushed stone, slag, or recycled demolition debris. Bound materials are the same materials as used in unbound base but stabilised with cement or bitumen. The base layer has a structural role for the structure and serves as construction platform.

The sub-base layer and improved subgrade layer are important layers of a flexible pavement structure in the Netherlands. For countries with a natural ‘rock-base’, this layer is less important. Requirements for these base layers are thickness, strength and density, drainage capacity and frost resistance. The strength and density of this layer is of major importance for the durability of the entire structure. Insufficient bearing capacity will result in premature deterioration. The stability of this layer is very important when no base layer is applied.

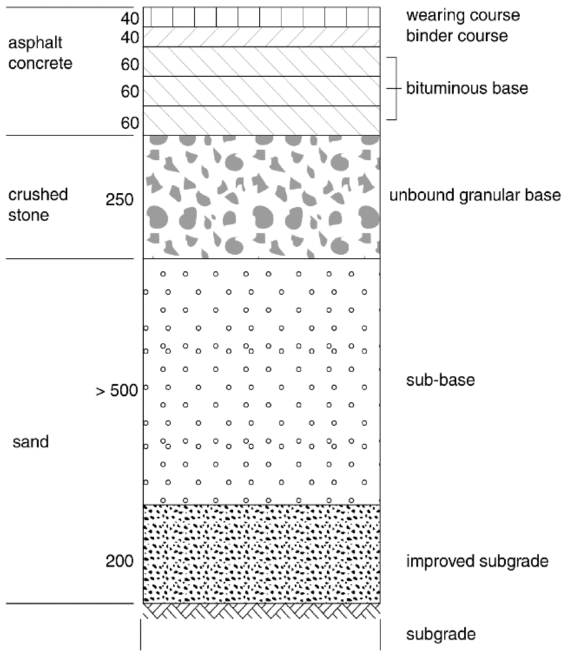

Figure 3: Representative pavement structure of a primary road in the Netherlands (Molenaar, 2004).

3.3.2 Porous Asphalt Concrete Pavements in the Netherlands

As mentioned above, there are a large amount and variety of asphalt concrete pavements on the Dutch road network. This study focuses on Porous Asphalt Concrete (PAC) top layers. Today, more than 90 per cent of the top layers of highways in the Netherlands are surfaced with PAC (Mo, 2010), and the goal is to reach 100 per cent. Two types of porous asphalt concrete are used for highways in the Netherlands: traditional Porous Asphalt Concrete (PAC) and Two-Layer PAC (2L-PAC). The traditional single layer PAC is a gap-graded asphalt mixture with a minimum air void content of 20 per cent after compaction. The air voids allow surface water to quickly penetrate and drain through the PAC layer. This offers significant reduction of splash and spray and improved visibility. In addition, the open structure of the surface reduces the noise level produced by rolling tires. These are the main reasons why PAC is extensively applied in the Netherlands (Mo, 2010; Suo & Wong, 2009; Uzun & Terzi, 2012; Yilmaz, et al., 2011). The double layer of 2L-PAC offers an even better reduction in traffic noise than the conventional single layer PAC (Molenaar, et al., 2006).

The drawbacks of PAC are the high construction and maintenance costs. The construction costs of PAC are 21 per cent higher than those of DAC, and its maintenance costs are 83 per cent higher than those of DAC. For 2L-PAC, the costs are even higher (see Table 2).

This study focuses on PAC because of its large scale presence on highways, and because the high costs bring more risks associated with the construction and maintenance of this asphalt type. Additionally, because of the costs of PAC, the size and complexity of highway projects, these projects are most likely to reach the 60 million euro limit that is set by Rijkswaterstaat to tender it as a DBFM project. This means that projects with long-term maintenance obligations for contractors are most likely highways with a PAC top layer. For this very reason, this study focuses on PAC (traditional PAC and 2L-PAC).

Table 2: Average construction and maintenance costs for DAC and PAC top layers (Morgan, 2008).

Top layer variant	Average construction costs (€/m2)	Annual average maintenance costs (€/m2)	Net present value (30 years) (€/m²)
DAC	19	1.18	30
PAC	23	2.16	50
2L-PAC	27	3.07	63

3.3.3 Causes of (Un)predictable Deterioration Behaviour of Porous Asphalt

The performance of asphalt pavements is often unpredictable (Liu, et al., 2011). Compared to more dense asphalt types, PAC does not last long and has a large variety in its lifespan. Porous asphalt concrete has an average lifespan of 12 years, but the variability in lifespan is 4 to 16 years, this can be seen in Figure 4 (Miradi, et al., 2009). Research of Mo (2010) states that the average lifespan of porous asphalt on the slow lanes of Dutch highways is currently about 10 to 12 years, while Huurman (2007) states that the lifespan is approximately 10 to 15 years. The exact lifespan is thus not known, but also the distribution in lifespan is indistinct.

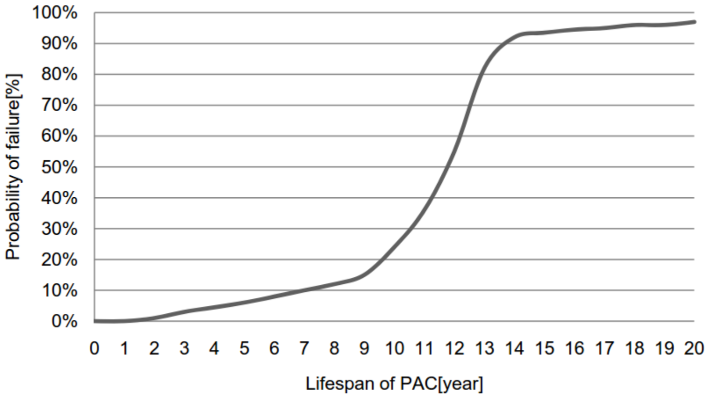

Figure 4: Cumulative lifespan distribution (Miradi, 2009).

The lifespan and causes of its wide deviations are not well understood. For pavements, the moment and definition of failure is fuzzy. The moment of failure cannot be defined the same as it is done for e.g. electronic products or structural components of bridges and buildings. A collapse of road pavements does not occur in the developed world, because most roads are in a proper condition as a result of good design, construction, and maintenance (Miradi, 2009). In addition, pavements do not really fail, because even though a road is severely damaged, transportation will almost always remain possible (CROW, 2007). Pavement failure is not an abrupt point of breaking, but it is usually a gradual process of deterioration. Therefore, pavement failure can be defined as the moment in time that a pavement drops below a predefined technical requirement (CROW, 2007). Table 3 gives a representation of such requirements. The lifespan of PAC top layers is mostly determined by its sensitiveness to ravelling. Ravelling is the most important damage symptom for PAC as it is normative for PAC's lifespan.

Table 3: Guiding requirements for the classification of damage severity of highway (Rijkswaterstaat, Dienst Weg- en Waterbouwkunde, 2002).

Damage symptom	Damage categorisation		
	Light Damage	Moderate Damage	Severe Damage
Ravelling	6-10%	11-20%	> 20%
Transverse cracking	width: < 3mm height: < 2mm	width: < 3mm height: < 2mm	width: < 3mm height: < 2mm
Longitudinal cracking	width: < 3mm height: < 2mm	width: < 3mm height: < 2mm	width: < 3mm height: < 2mm
Alligator cracking	cracks not connected	cracks connected w/o loose elements	cracks connected with loose elements
Transverse unevenness	< 14mm	15 – 17mm	> 18mm
Longitudinal unevenness	< 2.5	2.6-3.4	> 3.5
Skid resistance	> 0.45/100m	0.38 – 0.44/100m	< 0.37/100m
Cross slope	> 1.6%	1.1-1.5%	< 1%

Pavement failure is often open to interpretation, e.g. the severity of ravelling is dependent on the interpretation of the person that inspects the road's condition. In addition, pavements have multiple modes of failure (see Table 3), e.g. failure is when the criteria for skid resistance does not comply with its requirements anymore, or when the noise reduction dives below the requirements. One can speak of pavement failure when just one technical requirement is not met due to deterioration, which is why the failure of pavement is not always due to the same damage symptom. This makes the moment and definition of pavement failure fuzzy.

It is hard to define the actual performances of flexible pavements throughout their lifecycle due to a variety of variables and factors that have an influence. There is an unknown risk of failure associated with any pavement due to this variability of different factors. This results in unexpected and sudden pavement deterioration (Anastasopoulos, et al., 2009; Schlotjes, et al., 2011). In addition, it is known that failure is almost never caused by one specific underlying factor, but deterioration of a pavement is associated with a complex interaction of factors (George, 2000). This complicates the task of diagnosing the cause of failure and adds elements of uncertainty to prediction (Schlotjes, et al., 2011). A combination of circumstances and occurring deterioration factors makes the nature of pavement deterioration complex. The unpredictability, variety in lifespan and short lifespan of PAC pavements are highly undesirable. They not only cause increased maintenance costs, but also results in extensive traffic delays due to maintenance work on the very busy highways (Meerkerk, et al., 2006). With PBC, negative consequences for contractors do not only come from high maintenance costs, but delayed traffic is often a performance indicator on which penalties are applied.

Figure 5 gives a representation of the interaction of factors that affect pavement performance. George (2000) and Saba et al. (2006) categorised the variables that are known to affect pavement performance under major categories as can be seen in Table 4. A combination of George's (2000) and Saba's (2006) categorisations is used to describe the unpredictable deterioration behaviour of pavements.

Table 4: Major categories of explanatory variables for pavement deterioration behaviour.

Categories	(George, 2000)	(Saba, et al., 2006)
Structure		x
Environment	x	x
Traffic Loading	x	x
Construction		x
Maintenance	x	x
Material Properties	x	

First, the pavement structure highly determines the deterioration rate. Of course, some factors that are grouped under ‘structure’ have a logical effect on the deterioration behaviour. For instance, when one applies a thin top layer, he should not be surprised if its lifespan is relativity short. However, the unpredictability of pavements in this category is mostly determined by the material properties. The material of which flexible pavements are made is highly unpredictable in its real-life behaviour. The bitumen in asphalt concrete is a highly viscous liquid or semi-solid form of petroleum. The deformability of the material is strongly dependent on the type of bitumen, the temperature, the loading time and the stresses on the material. At high temperatures, bitumen becomes thin and liquid, and when it cools down it becomes solid. If asphalt concrete is hot, it can easily be applied as a flat solid layer. After compaction and cooling, the material becomes hard with a high bearing capacity. When stressed for short periods, asphalt behaves elastic, but with long stress periods it behaves plastic (viscous) (CROW, 2010). The viscous material property makes asphalt concrete an ideal material for road construction, but these properties make it also hard to determine the long-term performances of roads. The exact deformability is impossible to fully understand due to its complexity of interaction with other factors, such as loading and environment.

Second, environmental and traffic factors occur during the lifecycle of roads. During its lifecycle, pavements are under continues influence of variables which influence the deterioration rate, such as traffic loads, utilisation and weather (Golabi, et al., 1982; Panthi, et al., 2008; Tarawneh & Sarireh, 2013). These variables affect the viscosity, but the variability also make wear and tear unpredictable as it is not possible for one to determine on forehand how much and to what degree different variables will occur. In spite of an enormous effort that has been made in the pavement engineering field, it is still very hard to make accurate and precise predictions of pavement life due the unpredictability and variability of influential factors during its lifecycle (Saba, et al., 2006). It is, for example, very difficult to predict many factors that influence the pavement performance, especially for periods up to 30 years. It is hard, if not impossible, to anticipate for future climate and traffic conditions. Unusual hot summers, cold winters, wet springs etc. cannot be predicted, and traffic forecasts are mostly unreliable. An increasing traffic intensity causes, for example, a faster wear of the pavements, which asks for a different frequency of road maintenance (Huerne, 2004).

Third, the overall quality of roads, and therewith its eventual performances, is highly determined by the performed construction and maintenance activities. These factors influence the overall quality of the pavement, and therewith the durability and predictability. During construction, factors occur which influence eventual pavement performance, such as the quality of the mixture composition and the production conditions of the mixture, but also the condition and quality during the actual construction of the pavement. Maintenance factors, such as the frequency, timing and treatment type, also have an effect on a pavement’s performances. The major part of the literature deals with pavement failure from a material perspective and continuously research is done by contractors, meaning that the negative effects of mixture and production conditions are rather well understood. The lifetime of PAC wearing courses is for 65 per cent controlled by the mixture composition, while other factors, such as traffic and climate, have a relative influence of about 35 per cent (Meerkerk, et al., 2006). However, limited attention has been given to on-site construction processes (Bijleveld, 2015). More and more it is believed that the lifetime of PAC and its variation are strongly influenced by the construction process (Molenaar, et al., 2006).

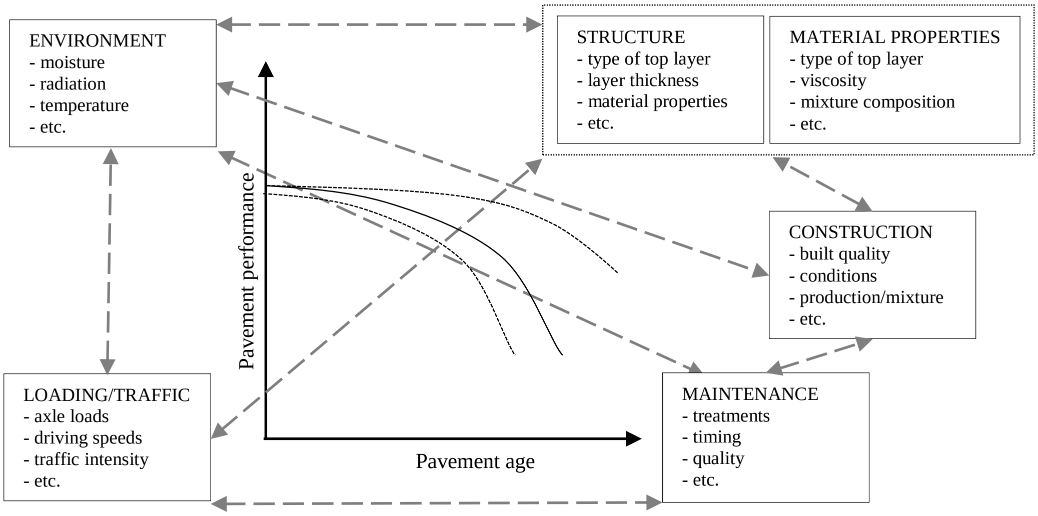

Figure 5: Representation of interacting factors affecting pavement performance (George, 2000; Saba, et al., 2006).

3.3.4 Understanding Pavement Deterioration Behaviour

Because of the complex nature of the pavement failure and the complexity of the influential factors which lead to deterioration, it is quite hard to measure the correct mode of failure and to predict the exact moment of failure. Besides predicting pavement deterioration behaviour, it can also be very difficult to trace back pavement failure to its causes. Tracing back damage symptoms to its causes is hard if the understanding of the factors that cause deterioration is insufficient. The complexity may lead to overlooked failure mechanisms, but also to maintenance which may not address the underlying cause. Additionally, understanding deterioration behaviour is necessary to apply the appropriate maintenance at the right time (Schlotjes, et al., 2011). Budgets and maintenance strategies cannot be optimised if one does not know how the asset will deteriorate in the future. Thus, for efficient and effective maintenance, one needs to understand pavement failure and its causes. With PBC, this is becoming more and more an issue for the contractors. If contractors are able to optimise their understanding about pavement performances and the causes of sudden and unexpected deterioration, the deviations in lifespan may be minimised, budget and maintenance strategies can be optimised, and failure symptoms may be traced back to their causes.

This paragraphs showed that a large variety of factors influence the eventual performance of flexible pavements, making it hard to understand and predict actual pavement performance over longer periods of time. For one to better understand pavement performance, the effects of factors that influence pavement deterioration need to be better understood.

3.3.5 Summary of the Used Literature

In the previous paragraph, 18 main articles were used to explain the structure and behaviour of asphalt roads. One article was published in the year 1982, and the other 17 articles were published between 2006 and 2015. The following categories were the main subjects in chapter 3.3: '*benefits of PAC and 2L-PAC*', '*unpredictability of pavements*', '*lifespan of asphalt pavements*', and '*influential factors*'. Table 5 shows the topics and the authors who wrote about a topic.

Table 5: Concept centric representation of used literature for the structure and behaviour of roads.

Main categories	Scientific articles
Benefits of PAC and 2L-PAC	Mo, 2010; Morgan, 2008; Suo & Wong, 2009; Uzun & Terzi, 2012; Yilmaz, et al., 2011.
Unpredictability of pavements	Anastasopoulos, et al., 2009; George, 2000; Huerne, 2004; Liu, et al., 2011; Saba, et al., 2006; Schlotjes, et al., 2011.
Lifespan of asphalt pavements	Huurman, 2007; Miradi, et al., 2009; Miradi, 2009; Mo, 2010.
Influential factors	Bijleveld, 2015; Golabi, et al., 1982; Meerkerk, et al., 2006; Molenaar, et al., 2006; Panthi, et al., 2008; Tarawneh & Sarireh, 2013.

3.4 Dealing with Predicting Pavement Performance

3.4.1 The Need for Understanding Pavement Performance from Contractors' Perspective

The lifespan of pavements is not well understood (Anastasopoulos, et al., 2009). There is little knowledge about the long-term performances of pavement assets and about how severe different variables cause abnormal pavement deterioration. In previous paragraph, reasons for unpredictable pavement behaviour were discussed. Because of the long-term responsibilities, it is important for contractors to increase their understanding about the long-term performances of these assets. Knowing how pavement will behave in the future let contractors improve their operational processes. Understanding pavement deterioration behaviour is important for efficient (maintenance) management of road infrastructure to make rational budget- and resource allocations, or for adequate activity planning and project prioritisation. In addition, pavement performance prediction is needed for establishing and designing the necessary corrective actions, such as maintenance and rehabilitation (Saba, et al., 2006).

Contractors need to be able to make sensible judgements in the tender-phase about the expected long-term performances of the object they are going to design, construct and maintain. The more precise they are able to estimate future deterioration behaviour, the more precise the maintenance strategy can be defined and the more precise budgets can be made. Being able to make accurate predictions is important to ensure a positive return on investment, minimise risks, attract investors, and to stay competitive. Data about historical projects can provide initial estimation grounds for new projects. Such data may be subtracted from performance models as further described in chapter 3.4.2 and 3.4.4.

In addition, contractors need to be able to correct their first estimates based on what was actually designed and constructed, and what happens during the lifespan of the pavement. In order to understand the real-life performance of an asset, the true conditions have to be taken into account. This means that factors which influence deterioration behaviour, and which occur during construction and the lifespan of pavements, have to be taken into account when making predictions (Miradi, 2009). One must be able to apply a 'correction' for construction conditions and deviating conditions that occur during the lifespan. When outliers are monitored, one can adjust the expectations of pavement performances. Eventually, this can mean that maintenance planning has to be adjusted. Models that comply with these needs are, for instance, performance prediction models as further described in chapter 3.4.3. In addition, performance data together with data of production, construction, and lifecycle can be used to understand pavement deterioration behaviour and to understand the correlations between cause and effect. Contractors need to be able to trace sudden failure of the asset back to its cause. This can only be done if the factors are well documented. Unexpected pavement failure can then be linked to the conditions that have influenced deterioration. No models but proper documentation of all deviating conditions is essential to comply with this need.

3.4.2 Pavement Management Systems and Performance Models

As mentioned before, formerly, Rijkswaterstaat developed their plans in detail; they controlled the planning procedure from the beginning to the end, from agenda-setting and explorative studies to management and maintenance of delivered infrastructure (Arts, 2007; van den Brink, 2009). Many of these responsibilities are shifting towards contractors, however, the goals and needs of Rijkswaterstaat are different than those of contractors that enter a PBC. For example, for maintenance planning, the goal of Rijkswaterstaat is to find how much maintenance work can be done within the available budget (Panthi, et al., 2008). The goal of contractors, however, has become to find how much investment is required to execute the work that meets the requirements as described in the performance-based contracts before they bid on the job (Panthi, et al., 2008). For maintenance planning, governmental agencies use an asset management approach, and for that, pavement management systems (PMS) are available (Dewan, 2004). A PMS helps in making informed decisions enabling the maintenance of the network in a serviceable and safe condition at a minimum cost to both the agency and the road users (George, 2000). A PMS is based on the inventory of the pavement network and includes information about the pavements, such as type, location and size of sections, number of traffic lanes, functional classification, and section conditions, e.g., type of distresses, roughness, and deflections. When it comes to predicting pavement performance, a PMS uses analytical tools or statistical methods to assist agencies in the decision-making procedure to maintain pavements in serviceable and functional conditions throughout their life (Bianchini & Bandini, 2010). Table 6 shows the goal, needed data, and how the PMS can be applied.

For behavioural predictions, the Dutch CROW pavement management system uses a condition survey system in which the extent and severity of the different damage types is monitored by surveyors. The results of the surveys were used as input for performance models to predict the remaining life (CROW, 2011). In the Netherlands, the performance models are derived from the SHRP-NL research program which is further explained in chapter 3.4.4. Performance models contain statistical representations of damage developments, i.e. they give statistical representations of the expected remaining lifespan. These performance models use the age of the pavement surface and the observed amount of deterioration as input, but do not take into account the effect of many other variables, such as the traffic, asphalt quality, climate conditions, etc. (CROW, 2011; Miradi, 2009). Using pavement management systems might be good to be used for planning purposes by Rijkswaterstaat, but it does not contribute in actually understanding pavement deterioration. General predictions about the remaining life are possible, but there is still no understanding about the causes of the deterioration, let alone abnormal deterioration. Thus, optimising uncertainty and unpredictability is not possible. The system is insufficient for making accurate predictions or to determine which measures should be taken to extend the average pavement life and to reduce the variation there-in (Miradi, 2009). It can be argued that contractors need more reliable models than the performance models of pavement management systems. For contractors to limit the risks, i.e. keeping the costs within reasonable limits, they need more understanding about actual pavement performances and the causes of deterioration. Contractors should be able to make predictions about pavement performance in an early stage, while performance models, as used in PMS, only allow one to predict pavement performance based on observed performances. A prediction model should, therefore, be a function of the most influential variables, e.g.: *Future pavement performance = f (condition, material properties, traffic factors, climate factors)* (George, 2000; Miradi, 2009).

3.4.3 Performance Prediction Models

More in line with contractors' needs are performance prediction models that have been proposed over the years. These models also deal with the dilemma of predicting pavement performance, but take more variables into account. Table 6 shows the goal, data elements, and how performance prediction models can be applied. Several researchers (George, 2000; Haas, 2003; Prozzi & Madanat, 2003) grouped the performance prediction models into three classes which indicate their basis as follows:

- Empirical Models: These models do not necessarily portray the theoretical mechanisms of the pavement response and are developed from measured/observed data. Empirical models are useful in situations where the theoretical mechanisms are not well understood (George, 2000).
- Mechanistic-Empirical Models: These models are developed based on mechanistic responses complemented by empirical distress relations. The form of the model and the variables included are generally based on theoretical knowledge, but the coefficients are determined from regression analysis for which measured data is employed (George, 2000).
- Probabilistic/Subjective Models: Here the experience is captured in a formalised or structured way; it allows utilisation of both the judgments of experienced individuals and measured data to quantify mathematical models (George, 2000).

The models as described above often focus on predicting a certain mode of failure, e.g. ravelling or cracking, and the input of these models is often limited. As can be seen in Table 6, the prediction models need to include many data elements. However, most models do not take into account important factors, such as material properties, traffic loads, and climate, while the models should contain most influential variables known to effect pavement performance (George, 2000). Consideration of factors affecting pavement performance should be an important and essential part of any performance measurement system (Fallah-Fini, et al., 2009). The lack of variable inclusion means that the lifespan which is predicted can have a significant error margin (Miradi, 2009). Miradi (2009) concludes that no model uses a wide variety of input variables, and it is not determined whether the used variables are the most important ones to use as input.

Variable selection has not received enough attention in research despite its importance for the quality of prediction models. Inclusion of variables, an adequate database, reliable data, and sufficient amount of data are requirements that need to be satisfied when creating accurate prediction models (George, 2000). Once accurate data about influential variables is available, much can be obtained from data using intelligent techniques, resulting in very accurate predictions and analysis (Miradi, 2009). Despite the type of prediction model, it is thus important to choose those input variables that are expected to have a maximum influence on the output. Thus, to improve the quality of any prediction model, one should identify the most important variables that affect pavement performance and collect data about these variable so that reliable and accurate input parameters can be created.

Table 6: Comparison between Pavement Management System and Performance Prediction Model (George, 2000).

	Pavement Management System	Performance Prediction Model
Goal	Improve the efficiency of the decision making, expand its scope, provide feedback about the consequences of decisions, and ensure consistency of decisions made at different levels within an organisation.	Predict future pavement deterioration based on the present pavement condition, deterioration factors, and the effect of maintenance.
Data elements	- Inventory - Condition - Traffic - Historical data	- Adequate database - Reliable data - Sufficient amount of data - Causal factors: pavement structure, age, traffic loads, and environmental variables - Function form of the model - Statistical criteria - Boundary conditions
Applied for	- Planning - Budgeting - Scheduling - Performance evaluation - Performance research	- Planning - Programming - Budgeting.

3.4.4 Available Pavement Performance Datasets

Momentarily, there is little data at hand that can be used to increase the understanding about pavement performance, i.e. little data is at hand to increase the accuracy of predictions and to understand deterioration causes. In the Netherlands, the most complete datasets are SHRP-NL and WINFRABASE. Only Dutch databases are examined, because different countries often cope with different conditions that determines the deterioration behaviour of roads, such as geographic conditions, soil types, construction methods, and usage conditions (Cuelho, et al., 2006). Furthermore, only a few countries have extensively applied PAC for their pavements (Miradi, 2009).

The Strategic Highway Research Program in the Netherlands (SHRP-NL) is a 10 years research program conducted from 1990 until 2000. The goal of the program was to improve knowledge about the long-term performance of flexible pavements. The program collected performance data of a comprehensive set of 250 test sections in the Netherlands of which 34 were PAC sections of 300 m (17 per cent). The performance models and database contain the development of damage types on the test sections. The condition of the test sections was periodically determined by means of visual condition surveys by trained surveyors. The performance models that directly result of the research program are statistical representations of damage development based on condition surveys (CROW, 2002). The SHRP-NL performance models can be used to predict certain damage development, i.e. data about past performances/damage developments of the measured test sections can be used to predict future performances on similar road types. Therefore, data from the SHRP-NL is used for pavement management systems, such as the CROW PMS. However, it is less useful for one who wants to make accurate predictions and who wants to understand the cause of pavement deterioration. The SHRP-NL database does contain some information about variables that influence deterioration, however, data about influential variables is very limited, e.g. it does not contain information on annual rainfall, solar radiation, or working conditions during construction, while all these variables can have an influence on the actual performance of the pavement. The traffic data and growth rate is badly documented in the SHRP-NL dataset, and the available climate data only contains average values (Miradi, 2009). The SHRP-NL data is, thus, lean with respect to including variables that affect pavement deterioration. In addition, today 2L-PAC plays an important role and is applied very often. The SHRP-NL does not take into account 2L-PAC, while it is not known if 2L-PAC performs the same as traditional PAC.

WINFRABASE is a similar type of database as SHRP-NL. WINFRABASE uses, in addition to visual condition surveys, laser measurements. Subjective and biased inspections are, therefore, ruled out. For each 100m section of a highway, a number of variables are recorded, such as the location of the section, date of the measurements, and the severity of the damage. WINFRABASE does not use test sections, but keeps getting supplemented with data from laser measurements. Therefore, the sample size of WINFRABASE is larger than SHRP-NL. The drawbacks are the same as the SHRP-NL, i.e. no data about variables that cause deterioration is included.

Table 7 shows a comparison between the contents of SHRP-NL and WINFRABASE. It examined if the databases contain information about the most important variables that are needed to make accurate predictions, i.e. if they contain information about the major categories according to George (2000) and Saba, et al. (2006). In addition, it is examined whether the databases contain information about PAC and 2L-PAC. In Table 7, shows that SHRP-NL does not contain any data about 2L-PAC, and data about influential factors/variables is very limited. Further, the data in SHRP-NL is old and maybe even outdated. Table 7 shows that, even though WINFRABASE contains data about 2L-PAC, it does not contain any data about influential variables. In addition, there has to be mentioned that WINFRABASE data is collected less structured.

Table 7: Contents overview of databases.

Data content	SHRP-NL	WINFRABASE
Period of data	10 years continuously (1990-2000)	Year of maintenance (ongoing)
PAC included	Yes	Yes
2L-PAC included	No	Yes
Performance/Condition data	Yes	Yes
Structure/Material properties	Yes	No
Environment/Climate data	Limited	No
Loading/Traffic data	Limited	No
Construction conditions	No	No
Maintenance data	No	No

The available databases do not provide the needed data to maximise the accuracy of prediction models. More data is needed to better understand and predict the performance of pavements. Because the long maintenance and warranty periods is rather new for contractors, making long-term predictions reaches out of their knowledge. Currently predictions, such as maintenance or budget predictions, are mainly expert driven in contractors' environment. Thus, there is a knowledge gap between contractors' knowledge about long-term pavement performance and the market demand of long-term responsibilities (up to 30 years). The expertise is not there yet, and thus, contractors need to increase their ability to make accurate behavioural analyses to stay competitive. Current databases are not sufficient to comply with contractors' needs. Especially, data about factors that influence pavement deterioration is insufficient in the available databases, while such data is needed for prediction models to make accurate predictions about the lifespan (George, 2000). In addition, data about factors that cause pavement deterioration is needed to comply with other needs, such as tracing back deterioration symptoms to its causes. It is, therefore, important for one to collect data about important factors that affect pavement deterioration. Thus, it is important to obtain data about those factors that have a large influence on the deterioration behaviour of flexible pavements. When such data is obtained, one can increase the understanding of pavement performance, and more precise and reliable predictions can be made.

3.4.5 Technological Opportunities to Collect Data

From the discussion so far, it is obvious that contractors need better understanding about the factors that influence pavement deterioration. They need understanding about deterioration causes so that the overall predictability of flexible pavements can be increased and damage symptoms can be explained. It can be concluded that, in order to better understand pavement deterioration, one must collect data about these pavements. Damage symptoms can only be explained when the cause of it is documented, and damage can only be predicted when prediction models use reliable parameters. Without accurate data for input parameters, the reliability of any model is questionable. The current databases are not sufficient. One can conclude that new and more accurate data has to be obtained. However, collecting field data for pavement performance modelling is a costly and time consuming effort. It is, therefore, desirable that at least some qualitative understanding exists about the factors that influence pavement performance before data collecting starts. Otherwise essential data might not be collected while unnecessary data is (Miradi, 2009).

Nowadays, new technologies make it increasingly easy to monitor, collect, store, view and analyse large amounts of data. An inevitable trend is the increasing technocratic nature of society. In this technocratic age of the internet, pervasive networks and rapid progress in technologies, one might expect contractors to embrace the new ICT opportunities to enhance performance and understanding. In reality, however, the construction process is still largely carried out without high-tech instruments to monitor key parameters during the process and adoption of new technologies is slow (Bijleveld, 2015). The DBFM contracts offer more freedom in the execution of the work. This means that contractors are free to install sensors to obtain the needed data. Technologies to monitor, visualise, and map construction processes, and to monitor conditions during pavement lifespan are becoming increasingly available (Bijleveld, 2015; Kaare, et al., 2012).

3.5 Scope of this Study; Filling the Research Gap

Contractors do not collect data specifically to enhance the reliability of performance and deterioration models or to adjust performance expectations. As mentioned before, there is little knowledge in contractors’ environment about the long-term performance of pavement assets. However, as contractors are the ones who have increased responsibilities for longer periods of time as a result of performance based contracting, it can be argued that they need to collect data in order to improve their knowledge and operational strategies.

To better understand the failure mechanism of pavements, it is thus important to understand the factors that affect pavement deterioration. Besides lack of data for prediction models, the unpredictability of pavement deterioration has several other causes; the material is unpredictable, the quality of production and construction varies, and roads are under a variety of stresses during their lifespan (Bijleveld, 2015; Meerkerk, et al., 2006; Panthi, et al., 2008).

The major part of the literature deals with pavement failure from a material perspective (Bijleveld, 2015). Mixture and production optimisation are well researched. However, limited attention is given to on-site construction processes (Bijleveld, 2015). Further, the exact influences of factors that cause roads to deteriorate during their lifetime are not well understood in contractors’ environment. Therefore, this study focuses on identifying those factors that affect pavement deterioration which occur during construction and lifespan of roads. Mixture and production qualities are left out of the scope of this study, because it is believed that these factors are better understood, while factors that occur during construction and lifespan have received less attention (Bijleveld, 2015).

It may be obvious that mixture, production and construction conditions affect the quality, and therewith, the durability and predictability of the final product. It is assumed that by improving the quality of the final product, deviations in lifespan could be minimised, and thus, the predictability maximised. Thus, knowledge about factors that cause deterioration can contribute to produce higher quality products. This study, however, only outlines the factors that cause abnormal pavement deterioration with the goal improve the possibilities to predict pavement deterioration behaviour. In addition to mixture, production and construction quality, it is important to focus on factors that occur during the actual lifespan of pavement. Monitoring these factors let contractors adjust their expectations about pavement performance and act on the new expectations. For example, the deterioration rate of pavements can accelerate when there are outliers in factors that influence pavement deterioration. By monitoring these factors, one can adjust their maintenance planning to the most optimal point in time. In addition, with knowledge about these factors, contractors can also trace back abnormal deterioration to its cause.

3.5.1 Final Remarks

It is time for contractors to monitor and collect data about pavement performance and about factors that influence pavement deterioration, so they can enhance their ability to predict and steer pavement behaviour and to react on the market changes now and in the future. It is, however, still unclear which data exactly needs to be collected to better explain the deterioration behaviour of pavements. Here the question rises; what data should contractors collect? Based on the discussion in previous paragraphs, this study aims to identify those factors that influence pavement deterioration which occur during construction and lifespan. In addition, this study aims to classify the factors to their significance on pavement deterioration.

Based on this section, the following statement is leading in this study: *"Factors that significantly influence abnormal deterioration of asphalt pavements are worthwhile to monitor"*. In this study, the focus is on on-site construction conditions and conditions during the lifespan of the pavement. The complex interaction of factors are not taken into account as this matter is too complex to understand without sufficient data. In the following chapters, the individual underlying factors that influence deterioration are identified and scored to significance. An outline of these factors should give contractors insight in the factors that are worthwhile to monitor if they want to increase the knowledge about real-life pavement performance.

CHAPTER 4, RESEARCH MODEL

Abstract

Pavement deterioration is a serious problem for countries around the world, this is no different for the Netherlands. Current market conditions are an incentive for contractors to increase their knowledge about pavement deterioration. This study aims to identify and rank all relevant deterioration factors which occur during the construction and lifespan of PAC and 2L-PAC pavements in the Netherlands. This was done by means of experts' opinions, and for that the Fuzzy Delphi principle is employed. Two questionnaires were designed and distributed among pavement experts in order to 1) identify all relevant factors, and 2) rank each factor to its significance on deterioration. After defining an initial list of factors, 22 experts from a variety of disciplines identified and ranked a total of 73 deterioration factors; 37 for the construction phase and 36 for the lifespan phase. Each expert ranked each factor 3 times (minimal value, optimal value, and maximum value) for PAC and 2L-PAC. A seven-point scale was used which was represented in years of deterioration (1 = '*no effect'*, 2 = '*0 to -1 year'*, …, 7 = '> *-5 years'*). After setting a threshold to highlight the most important factors, 45 unique factors were retained. The study is helpful in highlighting the causes of abnormal pavement deterioration in the Netherlands, so that consequential actions can be taken, such as avoiding and improving certain conditions and collecting data to enhance understanding about the effects of pavement deterioration factors.

4.1 Introduction; Exploiting Experts' Knowledge to Identify Deterioration Factors

4.1.1 Problem Description

In the construction industry, decisions are mainly based on individual and collective knowledge of construction professionals. In addition, prediction models are lacking data to make sensible judgement about future pavement performance. Contractors should start with collecting data about factors that influence pavement performance to increase knowledge about pavement deterioration behaviour. There is little data at hand, and therefore, there is no starting point to set up such program. One should identify which factors have most influence on pavement performance as collecting field data for pavement performance modelling is a costly and time consuming effort. At least some qualitative understanding about the factors influencing performance should exist before data collecting starts. Otherwise essential data might not be collected while unnecessary data is (Miradi, 2009). This study contributes to solving this problem by identifying, structuring, and ranking the most relevant factors that cause pavement deterioration.

Because no data is available to substantiate models and decisions, this study used a methodology that exploits the knowledge of experts. Experts were used to identify and rank the factors that influence pavement deterioration which occur in the construction and lifespan phase. To do so, the Fuzzy Delphi research method was employed. Despite over half a century of Delphi applications in scientific and academic research, there are still many ambiguities about this technique (Habibi, et al., 2015). Therefore, the following paragraph provides a short introduction about the methodological background, and why this method was employed to identify the factors that influence pavement performance. Finally, in chapter 4.2 the Fuzzy Delphi Method is applied, in chapter 4.3 the results are described, and in chapter 4.4 the interpretation of the results is given.

For this chapter, 18 main articles were used to explain the method and its interpretation as used for this study. There is a wide range of the publishing year (1967 – 2015). The older articles are concerning the initial development of the Delphi method. Newer articles are about the application of defuzzification. The main articles which were used in this chapter have wrote about several main concepts. Table 8 shows seven concepts which were used for the discussion and application of the Fuzzy Delphi research method.

Table 8: Concept matrix of used literature for discussion and application of the Fuzzy Delphi method.

Article		Concept							
Author	Year	Original Delphi method	Applicability of Delphi	Delphi Modifications	Why Fuzzy Delphi	Fuzzy Delphi process	Fuzzy Delphi Requirements	De-fuzzification	Concensus calculation
Adler & Ziglio	1996		x				x		
Chen	2014							x	
Chou, et al.	2011							x	
Christie & barela	2005								x
Coates	1975		x						
Delbecq, et al.	1975	x			x	x	x		
Ding,	2008							x	
Giannarou & Zervas	2014								x
Glumac, et al.	2012				x	x	x		
Gupta & Clarke	1996	x	x						
Habibi, et al.	2015					x		x	
Helmer	1967								x
Hsu & Chen	1996			x					
Ishikawa, et al.	1993			x					
Kittel-Limerick	2005								x
Murray, et al.	1985			x					
Noorderhaven	1995			x	x				
Rowe, et al.	1991		x		x		x		
Schmidt	1997					x			
Schmidt, et al.	2001					x	x		
Wang, et al.	2009							x	
Zhang & Xing	2010							x	

4.1.2 Methodological Background of the Fuzzy Delphi Research Methodology

The Fuzzy Delphi Method is derived from the traditional Delphi method and fuzzy set theory. It is a communication technique to gain information in a structured way, mainly based on a weighting system obtained from a panel of experts. Numerous researchers contributed to the origin of the Fuzzy Delhi Method (Hsu & Chen, 1996; Ishikawa, et al., 1993; Murray, et al., 1985; Noorderhaven, 1995). In its original form, the Delphi method is a long-range forecasting technique that elicits, refines, and draws upon the collective opinion and expertise of a panel of experts (Gupta & Clarke, 1996). The Delphi method does not provide conclusions from a huge database where statistical sample represents random population, but it is a decision support tool that draws on experts who have thorough knowledge about the specific topic (Glumac, et al., 2012). It is a group process which utilises written responses as opposed to bring individual opinions together (Delbecq, et al., 1975).

The traditional Delphi method questionnaires has tendency that both questions and answers are vague. The human factor that is present in evaluating the importance of a certain attribute makes the evaluation uncertain. This is the fuzziness or vagueness resulting from the lack of definite distinction. Using a proper method is crucial to create a clear overview of the attributes that are relevant to the topic (Glumac, et al., 2012). There is a notable problem to solve the fuzziness in expert consensus in group decision making. Murray et al. (1985) first proposed the application of fuzzy theory to the Delphi method. Further, Ishikawa et al. (1993) used the maximum-minimum method together with cumulative frequency distribution and fuzzy scoring to compile the experts' opinions into fuzzy numbers. The expert prediction interval value was then used to derive the fuzzy numbers, resulting in the

Fuzzy Delphi Method. Noorderhaven (1995) indicates that applying the Fuzzy Delphi Method to group decision can solve the fuzziness of common understanding of experts' opinions.

By drawing upon the current knowledge of experts, Fuzzy Delphi provides a more updated exchange of scientific or technical information than a literature study (Delbecq, et al., 1975). The method mainly exists of a series of questionnaires which are used to ask experts to their individual knowledge or opinion. The use of individual questionnaires ensures anonymity and allows each expert to freely express their beliefs without feeling pressured by dominant individuals or their professional environment (Adler & Ziglio, 1996; Gupta & Clarke, 1996; Habibi, et al., 2015; Rowe, et al., 1991). Group thinking of qualified experts assures the validity of the collected data. Group thinking means that each participant's opinion will be individually and anonymously collected and subsequently merged into one group opinion. The potential of combining individual knowledge (group thinking) will be at least as great as, and more usually greater than, that of any particular individual within that set (Rowe, et al., 1991).

4.1.3 Why the Fuzzy Delphi Method is employed

The Delphi technique draws upon knowledge, experience and expertise of a group of experts in a systematic manner (Adler & Ziglio, 1996). Using a methodology that uses experts' knowledge is a logical step as there is little data and literature at hand that deals with the dilemma of this study. Thorough knowledge about the topic is needed to make sensible judgements. Therefore, using a random population of people to interview or fill out a questionnaire was ruled out. Interviewing individuals is also not possible in terms of experts' time and group arrangement, therefore, questionnaires in a Delphi survey was used to collect data. More quantitative approaches is, at this point in time, hard as the data is not there yet. Delphi is a technique to be used when no adequate models exist upon which some statistical prediction or judgment might be based or perhaps even in situations where historical, economic, or technical data is just too costly to obtain (Adler & Ziglio, 1996; Coates, 1975; Gupta & Clarke, 1996; Rowe, et al., 1991). The main criterion for Delphi's employment is the indispensability of judgmental information, which may arise in cases where no historical data exists, or when such data is inappropriate[1] (Rowe, et al., 1991). In this study, a slightly modified version of the Fuzzy Delphi Method was employed to identify, structure, and rank the factors that cause abnormal pavement deterioration.

4.2 Research Model and Survey Design

The Fuzzy Delphi Method was used to rationalise factors that influence the deterioration of pavements by exploiting experts' knowledge. In a structured way, a panel of experts was used to identify all relevant factors. Consequently, the same panel was used to score these factors to the significance of their impact. Thus, the panel was used to identify and rank factors that cause abnormal pavement deterioration. The Fuzzy Delphi procedure can be divided in three stages: 1) identifying experts; 2) brainstorming; 3) ranking (Glumac, et al., 2012; Schmidt, et al., 2001; Schmidt, 1997). In Table 9 each stage is shortly explained. The following paragraphs show the steps that were undertaken together with the results that were gathered.

[1] That is, new influencing factors are expected that are not incorporated in the past data.

Table 9: Fuzzy Delphi research process (Glumac, et al., 2012; Schmidt, et al., 2001; Schmidt, 1997).

Phase	Task
1. Identifying Experts	- Identify relevant disciplines, organisations, literature - Create expert panel; involve experts
2. Brainstorming	- Set up pre-defined attribute list with literature - Create and distribute questionnaire in which participants are asked for their view on attributes - Collect, clear, and merge results and create final list of attributes
3. Ranking	- Create and distribute questionnaire to rank list of attributes - Collect results and calculate group opinion o Convert rankings into overall fuzzy numbers by using the triangular fuzzy number o Defuzzification o Set up threshold

4.2.1 Identifying and Involving Experts

Flexible pavement expertise is a niche in the Netherlands, and therefore, there can be spoken of a certain scarcity in flexible pavement experts. The first challenge was, therefore, to identify and involve enough experts. Fuzzy Delphi Method uses a limited number of experts compared to classical Delphi and other research methods. Literature suggests that involvement of ten to fifteen experts from homogeneous group may yield sufficient results (Delbecq, et al., 1975). There are four requirements for 'expertise': knowledge and experience with the topic, capacity and willingness to participate, sufficient time to participate, and effective communication skills (Adler & Ziglio, 1996). Delbecq et al. (1975) describe that a relevant panel can be identified by addressing different disciplines, organisations and literature. The involved experts must be able to give a sensible judgement about the causes and effects of deterioration factors, and therefore, thorough knowledge about the topic is needed. Contractors are one of the important parties in road and highways sector; study and design, construction, and maintenance and operation. So their vision for road sector is reputable and taken in consideration in development process for the sector (Tarawneh & Sarireh, 2013). Therefore, a large group of construction professionals were involved. In addition, there was searched for experienced asphalt pavement experts from a variety of disciplines (academic professionals and clients/operators). To increase trust and motivation, participants were asked on forehand to participate in the study and were contacted individually via phone or e-mail. The experts were briefed about the goal of the study and were asked for their commitment to fill out a number of questionnaires.

Employees of a variety of (pavement) construction companies were contacted. Only employees of Heijmans responded or agreed to cooperate. Although there was no variety in company selection, a variety in professions was reached. 16 construction professionals of Heijmans agreed to participate. Several researchers from Delft University of Technology (TUD) and from TNO (Dutch Organisation for Applied Scientific Research) were contacted. Two researchers agreed to participate: one Associate Professor of Road Engineering (TUD) and one research advisor of road engineering (TNO). Last, pavement experts who work for road operators were contacted. Two pavement experts within Rijkswaterstaat, one pavement expert of a municipality and one pavement expert within a province agreed to commit to the study. Appendix A shows an overview of the participant's organisations, relevant experiences, and degree of participation.

4.2.2 Defining List of Attributes (Questionnaire 1)

The second step refers to the brainstorm phase as also applied in the classical Delphi method (Delbecq, et al., 1975; Schmidt, et al., 2001). The goal of this step was to identify relevant factors that have to be ranked in a later stage. To do this, a questionnaire was distributed among the experts who agreed upon participating in this study.

The main goal of this questionnaire was, thus, to identify all relevant factors that cause abnormal pavement deterioration which occur in the construction and lifespan phase. First, a predefined list of deterioration factors was derived from literature. The reason to create an initial list was to predefine the abstraction level on which participants should add missing factors (Schmidt, et al., 2001). Pavement deterioration can be approached from a very detailed level or a much more generic level. This will determine the eventual outcome and usability of the results. In this study, there was searched for a rather detailed level; deterioration factors. Some examples as initial predefined factors served, therefore, as guidelines for the participants. The predefined list was kept as limited as possible, because participants must be able to think freely around the subject without being forced too much into a specific mind-set. The openness of questionnaire 1 ensures that participants felt free to add factors of which they believe are relevant regardless what the literature or common sense says.

The predefined list was transformed into a fillable PDF form in which participants were asked to delete, validate, or add factors to those that were already on the list. The questionnaire contained two sections; one for factors that occur during the construction phase and one for factors that occur during the lifespan phase. To maximise the chance of unearthing all relevant factors, participants were able to submit as many factors as possible in this phase (Schmidt, 1997). Additionally, it was tried to use questionnaire 1 to retrieve some additional information. Participants were asked to select the pavement types (out of 4 options) on which the named factors had an effect. Further, they were asked to select the damage symptoms (out of 8 options) that occur as a result of the named factors. Questionnaire 1 was distributed to the experts that agreed upon participating in this study. The response rate was 100 per cent (N=20). An example of questionnaire 1 can be seen in Appendix B.

A total of 178 factors were identified by the experts. 107 for the construction phase and 71 for the lifespan phase. Most factors were mentioned multiple times and over time, no new factors were mentioned. Therefore, it can be concluded that saturation was reached. Discussion with several experts did lead to disqualifying factors, but not to adding new factors. However, consulting literature on the completeness of the list resulted in adding one additional factor in the lifespan phase; '*rainfall*' (Fairweather & Yeaman, 2014). As for the additional part of questionnaire 1, it was seen that the complexity of the subject made checking the pavement types that are affected, and damage symptoms that resulted from the factors was not unambiguously. For instance, experts mentioned that certain factors had an influence on all road types or resulted in multiple damage symptoms, however, the severity varies for different types of roads or damage symptoms. Some experts checked all options, while others checked only the ones on which the named factor has the most severe effect. Thus, no reliable data was obtained from this part of questionnaire 1. However, as this part was meant to retrieve additional information, the overall study was not jeopardised, and input for questionnaire 2 was successfully obtained.

In order to structure and to reduce the large number of factors, all double answers were merged. Some factors had a different description with the same meaning. For example, '*rain during construction*' may be considered the same as '*wet subsurface during paving*' as rain causes a wet subsurface, making the effect on deterioration the same. These doublings were tracked down and later discussed with experts, and if necessary, cleared from the list. In total, 73 unique factors were obtained from questionnaire 1; 37 for the construction phase and 36 for the lifespan phase. The list of remaining factors were clustered into six categories for the construction phase and into five categories for the lifespan phase (see Table 10), so they can be meaningfully ranked in the next phase (Schmidt, 1997).

Table 10: Clustering of identified factors.

Construction phase		Identified factors	Lifespan phase		Identified factors
1.	Processing temperature	5	1.	Climate	6
2.	Base layer	9	2.	Loads	9
3.	Transportation	2	3.	Pollution	9
4.	Paving	15	4.	Soil/base layer	3
5.	Compaction	4	5.	Other	9
6.	Other	2			
	Total:	*37*		*Total:*	*36*

4.2.3 Ranking Identified Attributes (Questionnaire 2)

With the narrowed and cleared results of questionnaire 1, a second questionnaire was presented back to the experts in which they needed to rank the identified factors to their deterioration severity on asphalt pavements. As stated before, this study focuses on two types of asphalt pavements; PAC and 2L-PAC. Therefore, the goal of the second questionnaire was to identify how severe PAC and 2L-PAC deteriorate when exposed to the factors as identified in questionnaire 1.

It was decided to create two separate questionnaires; one to rank factors that occur during construction and one to rank the factors that occur during the lifespan of pavements. There were two reasons to split the initial list of questionnaire 1 into two lists: 1) it was felt that the expertise of some participants was leaning towards one of the two aspects. To create a more homogeneous group and to get more reliable results, participants were confronted with questions which are within their own field of expertise. The pertinence of question scenarios must depend upon the relevance of the expertise of the panellists; “sensible” questions are only sensible to panellists if they lie within their general realm of knowledge (Rowe, et al., 1991). 2) The final attribute-list of questionnaire 1 contained 73 factors, multiplying this with two pavement types (PAC and 2L-PAC) means that each participant needed to rank 146 factors. This was considered too intensive and demotivating for the participants. Schmidt et al. (2001) suggest that in the narrowing phase, the target number of final attributes is 20-23. In regard of coming closer to this target number, and thus to preserve the participants from filling out an endless amount of questions, the list was split up. The target of desired number of factors was not reached as the questionnaires contained respectively 37 and 36 factors. However, no factors were left out, because the goal of the study was to identify and score all relevant factors. Each factor was considered relevant and valuable until proven otherwise.

Within questionnaire 2, each identified factor had to be ranked in a range from its minimum value to its maximum value with in between an optimal/most probable value (see Figure 6). For the ranking in this study, there was made use of three values (creating triangular fuzzy numbers); participants were asked to provide a minimum, optimal and maximum value (see Figure 6). The three values can be expressed as follows: Minimum (a) is the minimal value/effect of a factor, i.e. the minimal shortening in lifespan that can occur as a result of factor x. Optimal (b) is the most probable value, i.e. the most probable shortening in lifespan as a result of factor x. Maximum (c) is the maximal value/effect of factor, i.e. the maximal shortening in lifespan that can occur as a result of factor x. It was believed that asking four values to create trapezoidal fuzzy numbers (minimum (a), optimal lower bound (b), optimal upper bound (c), and maximum (d)) would make the questionnaire too confusing and would not provide more valuable data. A trapezoidal fuzzy number is a triangular fuzzy number if *b* = *c* (Bansal, 2011).

By using a range in ranking the severity of each factor, there can be better dealt with the uncertainty around this particular subject. Much more data is obtained compared to using a ranking without the range. How the distribution of the range/fuzziness is expressed is not known. It was expected that there is no standard distribution of the minimum, maximum and optimal value and that the differences can be very wide. Therefore, experts were asked to provide the range of each factor in contrary to using a standard range. The usage of a range made the questionnaire more open to the experts' experience during different cases and interpretation of other relevant conditions. This was needed because the severity of a factor is not defined as there is little to no empirical evidence. For example, the severity of a factor can be ranked higher by someone who has experienced this factor as severe and relevant, while someone else's experience tells otherwise. In addition, the effect of a certain factor does not always express the same due to unexplainable reasons or interacting conditions. To summarise the tasks of participants, participating experts needed to rank each given factor that causes abnormal pavement deterioration within a range (three values). In addition, they were asked to do this for two different pavement types; PAC and 2l-PAC.

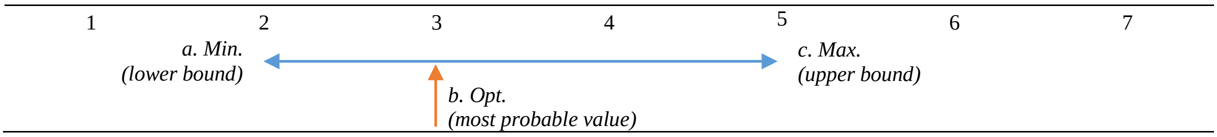

Figure 6: Representation of Fuzzy Delphi (triangular fuzzy number) principle.

Figure 7 shows a representation of a question in questionnaire 2. It can be seen that the factors had to be ranked on a scale from 1 to 7. Linguistic variables were used to give meaning to the seven points. In this study, the linguistic variable was the years of shortening in lifespan of pavements. All values were taken from a term set that contains the set of acceptable values ('*no effect', 'little effect', …, 'medium effect', …, 'extreme effect'*). The reason to use a scale with the linguistic variable '*shortening in lifespan*' was because it is difficult to define seven points into acceptable values which will be understood by participants. It was expected that it would be more tactile for participants if they could reflect the severity to a shortening of the lifespan in years. Therefore, this study used a '*shortening in lifespan*' as term set. The used term set T = {0 years, 0 to -1 years, …, -4 to -5 years, > -5 years} can be seen in Figure 7. Reason to use a seven-point scale instead of a five- or ten-point scale was because 0 to > -5 years can be evenly distributed over a seven-point scale, while keeping a range of 1 year in each answer, e.g. -1 to -2 years. Discussion with experts showed that a range of one year was the desired level of detail, nor was there reason to go further than '> *-5*' years as this is very exceptional to happen in real life. An example of questionnaire 2 can be seen in Appendix C.

What is the effect of '*factor x*' on the lifespan of the following two pavement types?								
		1 No effect	*2* 0 to -1 yr	*3* -1 to -2 yr	*4* -2 to -3 yr	*5* -3 to -4 yr	*6* -4 to -5 yr	*7* > -5 yr
Minimum effect	PAC			×				
	2L-PAC		×					
Maximum effect	PAC					×		
	2L-PAC				×			
Optimal effect	PAC				×			
	2L-PAC			×				

Figure 7: Representation of ranking factors in questionnaire 2.

After a pre-test with two experts and two none-experts, questionnaire 2 was distributed among all experts divided over two groups. Some participants were considered capable of filling out both questionnaires and were therefore asked to do so. 17 experts received the questionnaire for the construction phase and 21 experts received the questionnaire for the lifespan phase. The response rate for the construction phase condition was 88.2 per cent (N = 15) and for the lifespan condition 61.9 per cent (N = 13). Some experts who participated in the first questionnaire and agreed upon participating in the second questionnaire did not respond or could not respond due to holidays or illness. Literature (Delbecq, et al., 1975) suggest that 10-15 participants from a homogenous group should may yield reliable results. Therefore, the number of participants was sufficient.

Finally, the consensus of the ranked factors needed to be calculated. A common practice to measure consensus does not exist (Giannarou & Zervas, 2014). The criteria for consensus can be determined by either the evaluator alone or with stakeholder input (Christie & Barela, 2005). There are studies that measure the consensus through frequency distribution, standard deviation or the interquartile range. Criteria for measure consensus always contains a certain percentage of respondents that are within a specified distance, which could be the mean, standard deviation, or interquartile range. For example, Christie and Barela (2005) propose that at least 75 per cent of experts' responses should fall between two points above and two points below the mean. When using the standard deviation to measure consensus, it should be less than 1.5 (Christie & Barela, 2005) or less than 2.5 (Kittell-Limerick, 2005). If enough experts scored within the specified distance from the mean, consensus has been reached. The 75 per cent of consensus can also set on 50 per cent or 100 per cent (Helmer, 1967). In this study, consensus is measured by using Christie and Barela's (2005) method, meaning that experts' responses should fall between two points above and two points below the mean.

4.3 Analysis of Survey Results

After identifying relevant factors (questionnaire 1) and ranking the identified factors (questionnaire 2), the final evaluation of each factor had to be calculated. Each factor was ranked three times by each participant; minimum, optimal and maximum. The minimum is the lower bound (a), the optimal is the most probable value (b), and the maximum is the upper bound (c).

In this study, a total of 73 factors were ranked (construction phase N = 37; lifespan phase N = 36) by different experts (N = 19). 15 experts' opinions were gathered to determine the importance of factors that occur during construction, and 13 experts' opinions were gathered to determine the importance of factors that occur during the lifespan of asphalt pavements. Table 11 shows a part of the results that are gathered with questionnaire

2 for factors that occur during construction. It shows the rankings (minimum, optimal and maximum) of the factors on a seven-point scale (1 = '*no effect'*, 2 = '*0 to -1 year'*, …, 7 = '*> -5 years'*) by the experts. The dataset with seven-point scale for the construction can be found in Appendix D and for the lifespan phase in Appendix E.

Table 11: Indication of gathered experts' opinions with seven-point scale for factors during construction.

		Expert 1	Expert 2	Expert 3	Expert ….	Expert 15
Factor 1	pac	(1;2;3)	(2;3;5)	(1;3;5)	(…;…;…)	(3;3;7)
	2lpac	(2;2;4)	(3;4;6)	(2;3;6)	(…;…;…)	(3;3;7)
Factor 2	pac	(3;3;4)	(1;3;4)	(1;3;5)	(…;…;…)	(4;5;7)
	2lpac	(3;4;5)	(2;3;5)	(2;3;6)	(…;…;…)	(4;5;7)
Factor 3	pac	(1;1;1)	(1;2;3)	(1;1;2)	(…;…;…)	(2;3;3)
	2lpac	(1;1;1)	(2;2;4)	(1;1;2)	(…;…;…)	(2;3;3)
Factor …	pac	(…;…;…)	(…;…;…)	(…;…;…)	(…;…;…)	(…;…;…)
	2lpac	(…;…;…)	(…;…;…)	(…;…;…)	(…;…;…)	(…;…;…)
Factor 37	pac	(2;2;3)	(1;2;3)	(2;5;7)	(…;…;…)	(3;4;5)
	2lpac	(2;2;3)	(1;2;3)	(2;5;7)	(…;…;…)	(3;4;5)

Note: 1 = 0 years, 2 = 0 to -1 years, 3 = -1 to -2 years, 4 = -2 to -3 years, 5 = -3 to -4 years, 6 = -4 to -5 years, 7 = > -5 years.

Since a seven-point scale with linguistic values was used, it was not possible to do calculations yet. In Fuzzy Delphi Method, an appropriate fuzzy spectrum should be developed for the fuzzification of respondents' linguistic expressions. In this study, participants had to rank the minimum, optimal and maximum value instead of only one value. This lead to a modified method to create fuzzy numbers, because in most studies, experts had to rank once and then a fuzzy spectrum is used. For example, if an expert ranked a factor with a '*5*' on a seven-point scale, the triangular fuzzy number is 0.5, 0.75, 0.9. As mentioned before, in this study, experts had to rank three values (minimum, optimal and maximum) to gather more data. Therefore, each minimum, optimal and maximum value had to be converted into fuzzy numbers. This was based on the method as proposed by Chen (2000). The scaling values for fuzzy numbers of a seven-point scale is shown in Table 12. For example, when an expert ranked '*factor x*' with a '*5*' (i.e. '*-3 to -4 years*'), the fuzzy number is '*0.7*'. The opinions (minimum, optimal and maximum) of all experts were converted into the fuzzy numbers of Chen (2000). Table 13 shows a part of the fuzzified results that are gathered with questionnaire 2 for factors that occur during construction. The complete dataset with fuzzified results for the construction phase can be found in Appendix F and for the lifespan phase in Appendix G. The three values (minimum, optimal and maximum) represent the triangular fuzzy number of a factor by each expert: ($\tilde{w}_{ij} = a_{ij} + b_{ij} + c_{ij}$). For example, expert 1 ranked factor 1 on PAC at 1 (min), 2 (opt), and 3 (max). Converting this into the scaling values results in: 0 (min), 0.1 (opt), 0.3 (max). In Table 13 this is represented as (0;0.1;0.3).

Table 12: Scaling values for fuzzy numbers of seven-point scale (according to Chen (2000)).

1	2	3	4	5	6	7
0 years	0 to -1 years	-1 to -2 years	-2 to -3 years	-3 to -4 years	-4 to -5 years	> -5 years
0	0.1	0.3	0.5	0.7	0.9	1

Table 13: Fuzzification of linguistic expressions for factors during construction.

		Expert 1	Expert 2	Expert 3	Expert ….	Expert 15
Factor 1	pac	(0;0.1;0.3)	(0.1;0.3;0.7)	(0;0.3;0.7)	(…;…;…)	(0.3;0.3;1)
	2lpac	(0.1;0.1;0.5)	(0.3;0.5;0.9)	(0.1;0.3;0.9)	(…;…;…)	(0.3;0.3;1)
Factor 2	pac	(0.3;0.3;0.5)	(0;0.3;0.5)	(0;0.3;0.7)	(…;…;…)	(0.5;0.7;1)
	2lpac	(0.3;0.5;0.7)	(0.1;0.3;0.7)	(0.1;0.3;0.9)	(…;…;…)	(0.5;0.7;1)
Factor 3	pac	(0;0;0)	(0;0.1;0.3)	(0;0;0.1)	(…;…;…)	(0.1;0.3;0.3)
	2lpac	(0;0;0)	(0.1;0.1;0.5)	(0;0;0.1)	(…;…;…)	(0.1;0.3;0.3)
Factor …	pac	(…;…;…)	(…;…;…)	(…;…;…)	(…;…;…)	(…;…;…)
	2lpac	(…;…;…)	(…;…;…)	(…;…;…)	(…;…;…)	(…;…;…)
Factor 37	pac	(0.1;0.1;0.3)	(0;0.1;0.3)	(0.1;0.7;1)	(…;…;…)	(0.3;0.5;0.7)
	2lpac	(0.1;0.1;0.3)	(0;0.1;0.3)	(0.1;0.7;1)	(…;…;…)	(0.3;0.5;0.7)

Before the aggregated results of experts' opinions could be calculated, the overall values of each factor of all experts needed to be calculated. There are different methods that can be used for fuzzy aggregation and defuzzification of calculated values (Habibi, et al., 2015). In this study, the following equation was used to calculate the triangular fuzzy number for each factor: $\widetilde{w}_j = a_j + b_j + c_j$ where: $a_j = \min_j\{a_{ij}\}$, $b_j = \frac{1}{n}\sum_{i=1}^{n} b_{ij}$, $c_j = \max_j\{c_{ij}\}$ (Chen, 2014). The calculated results are shown in Table 14 under opinion's mean as 'a_j; b_j; c_j'.

After getting the overall triangular fuzzy numbers of each factor, it was necessary to convert these triangular fuzzy numbers into a single number, called defuzzification. Defuzzification is needed because fuzzy numbers cannot be ranked since they are not crisp values. In this study, the graded mean integration representation method, proposed by Chen and Hsieh as cited in Chou et al. (2011), was used to rank the final ratings (crisp values). The following simple equation was used for the defuzzification of opinions' means to rank the final ratings: $S_j = \frac{a_j+4b_j+c_j}{6}$ (Ding, 2008; Wang, et al., 2009; Zhang & Xing, 2010). This defuzzification equation weighs the optimal value (b) four times heavier than the minimum (a) and maximum value (c). This is needed because the most probable value is most valuable for the purpose of this study. The crisp values, i.e. the final calculated scores, are partially shown in Table 14. All the crisp values can be seen in Appendix H.

A screening threshold was set up to highlight the most important deterioration factors. Since there is no standard for setting the threshold, the index was based on the needs of the concerning study (Hsu, as cited in Chen, (2014)). Based on experts' suggestions and because all the identified factors already have a negative effect, the screening threshold was set relatively low at 0.4. In addition, it was seen that 0.4 provides a balance between the retained and rejected factors; 0.3 resulted in retaining almost all factors, and 0.5 resulted in rejecting almost all factors. When the crisp value was larger than 0.4, the factor was retained; otherwise, it was rejected. The retained and rejected factors can partially be seen in Table 14. All the factors ranked from highest to lowest crisp value (S_j) can be seen in Appendix I.

Table 14: Defuzzification results of aggregated experts' value for construction phase.

		Opinion's mean	Crisp value (S_j)	Result
Factor 1	pac	(0;0.42;1)	0.447	retained
	2lpac	(0;0.46;1)	0.473	retained
Factor 2	pac	(0;0.4;1)	0.433	retained
	2lpac	(0;0.44;1)	0.460	retained
Factor 3	pac	(0;0.16;0.9)	0.257	rejected
	2lpac	(0;0.16;0.9)	0.257	rejected
Factor ….	pac	(…;…;…)	(…)	(…)
	2lpac	(…;…;…)	(…)	(…)
Factor 37	pac	(0;0.306;1)	0.371	rejected
	2lpac	(0;0.36;1)	0.407	retained

Since the threshold was set on 0.4, there were retained 45 unique factors (construction phase N = 26; lifespan phase N = 19). Table 15 shows the amount of retained factors for both construction and lifespan phase as well as PAC and 2L-PAC. Note that factors that apply to PAC can also apply to 2L-PAC and vice versa. All the retained factors together with their crisp values can be seen in Table 16 (for the construction phase) and Table 17 (for the lifespan phase). A graphical representation of the scores of all factors is shown in Figure 8 for the construction phase and in Figure 9 for the lifespan phase. The horizontal dotted line represents the threshold of 0.4. The x-axis shows the concerning factors and the y-axis shows the deterioration in years in the same scale as it was presented to the experts in the questionnaires.

Table 15: Overview of the total number of retained factors.

	Total factors construction phase	Retained factors construction phase	Total factors lifespan phase	Retained factors lifespan phase
Pac	37	19	36	15
2lpac	37	26	36	19

Table 16: Overview of the retained factors of the construction phase with the calculated crisp value.

Deterioration factors during construction		(S_j) PAC	(S_j) 2L-PAC
Category 1: Processing Temperature			
Factor 1	Abnormal onset temperature of mixture	0.447	0.473
Factor 2	Inadequate cooling curve (too fast)	0.433	0.460
Factor 4	Abnormal temperature consistency of mixture	0.420	0.447
Category 2: Base Layer			
Factor 6	Polluted subsurface before paving	0.438	0.469
Factor 8	Poor adhesive coating	0.447	0.447
Factor 9	Poor millwork of subsurface	N.A.	0.429
Factor 10	Too low temperature of subsurface	N.A.	0.407
Factor 12	Foundation too small	N.A.	0.407
Factor 13	Deviating stiffness of foundation	0.424	0.438
Factor 14	Insufficient carrying capacity of subsurface	0.456	0.473
Category 3: Transportation			
Factor 15	Varying homogeneity of mixture when applied	0.416	0.460
Factor 16	Segregation of the mixture	0.469	0.487
Category 4: Paving			
Factor 18	Paver made a stopping point (discontinuity)	0.447	0.478
Factor 21	Paver was insufficiently pre-heated	0.402	0.447
Factor 23	Too thin constructed pavement layer	N.A.	0.424
Factor 26	Paving warm asphalt against cold asphalt w/o joint heaters	0.464	0.500
Factor 27	Asphalt joint constructed in wheel track of traffic	0.576	0.602
Factor 28	Joints situated above one another	0.451	0.464
Factor 29	Manually raking asphalt at joints	N.A.	0.420
Factor 30	Paving with a widened paver w/o extending the worms	0.411	0.464
Category 5: Compaction			
Factor 32	Excessive compaction	0.469	0.478
Factor 33	Compacted with too low temperature of asphalt (too late)	0.561	0.597
Factor 34	Wrong wheel roller used for compaction	0.527	0.544
Factor 35	Unequally compaction	0.433	0.462
Category 6: Other			
Factor 36	Base-layer was abnormally loaded, e.g. traffic loads	N.A.	0.402
Factor 37	Pavement was to early opened up for traffic (insufficient strength)	N.A.	0.407

Note: N.A. means Not Applicable, i.e. value did not reach threshold.

Table 17: Overview of the retained factors of the lifespan phase with the calculated crisp value.

Deterioration factors during lifespan		(S_j) PAC	(S_j) 2L-PAC
Category 2: Traffic			
Factor 10	Increase of wringing traffic	0.531	0.567
Factor 12	Tight curve in road, e.g. cloverleaf loop	0.556	0.597
Category 3: Pollution			
Factor 16	Polluted road surface	0.401	0.428
Factor 18	Insufficient drainage capabilities	0.428	0.469
Factor 19	Grass ingrowth in the redress- or emergency lane.	N.A.	0.423
Factor 20	Loose stones on road because of ravelling	N.A.	0.418
Factor 22	Cadaver on road surface	0.438	0.469
Factor 23	Oil on road surface	0.594	0.614
Factor 24	Gasoline on road surface	0.521	0.526
Category 4: Soil/Base Layer			
Factor 25	Unequal residual subsidence in soil base/subgrade	0.423	0.433
Factor 26	Weak soil base/subgrade below widened lane	0.506	0.517
Factor 27	Groundwater level too high	0.464	0.495
Category 5: Other			
Factor 28	Steel wheel roller over existing pavement	0.567	0.587
Factor 29	Misuse of road surface, e.g. snowplough	0.526	0.551
Factor 30	Cleaning of pavement surface with rotating steel wire brush	N.A.	0.418
Factor 31	Removed linings with water blasting	0.459	0.485
Factor 33	Collapsed bituminous joints	0.533	0.578
Factor 34	Mechanical/scratch damage lengthwise	0.408	0.438
Factor 36	Difference in age between road segments widthwise	N.A.	0.413

Note: N.A. means Not Applicable, i.e. value did not reach threshold.

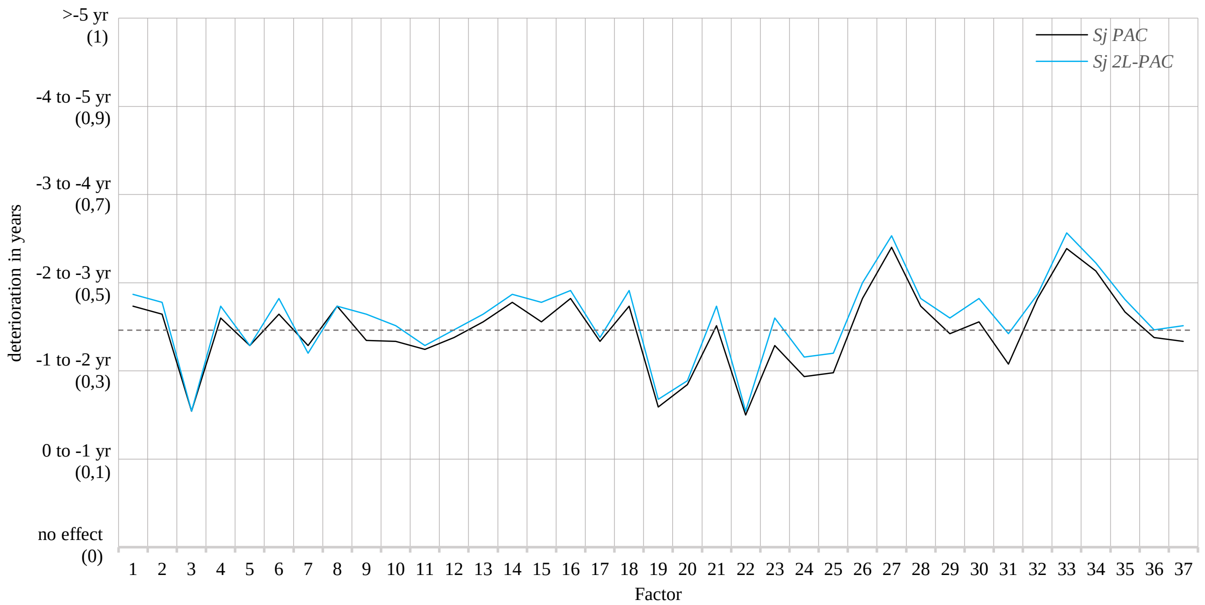

Figure 8: S_j values (collective experts' opinions) for each individual factor during construction.

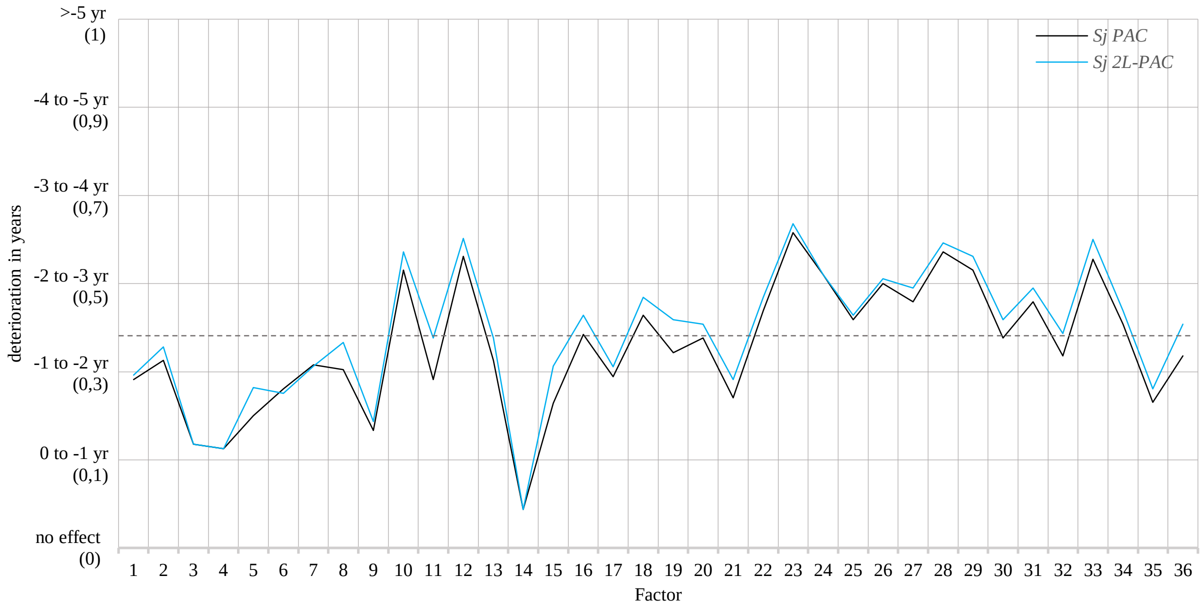

Figure 9: S_j values (collective experts' opinions) for each individual factor during lifespan.

Further, the range of each factor was examined, i.e. the difference between the minimal and optimal, and between the maximum and optimal ranking. An exceptional high maximum or minimal value compared to the optimal value might indicate that these factors are worthwhile to focus on. Therefore, a graph is plotted which shows the mean values of the experts' rankings. Figure 10 and Figure 11 show the mean collective experts' opinions for each individual factor, each ranking (min., opt., and max.), and for both PAC and 2L-PAC. The x-axis shows the concerning factors and the y-axis shows the deterioration in years in the same scale as it was presented to the experts in the questionnaires.

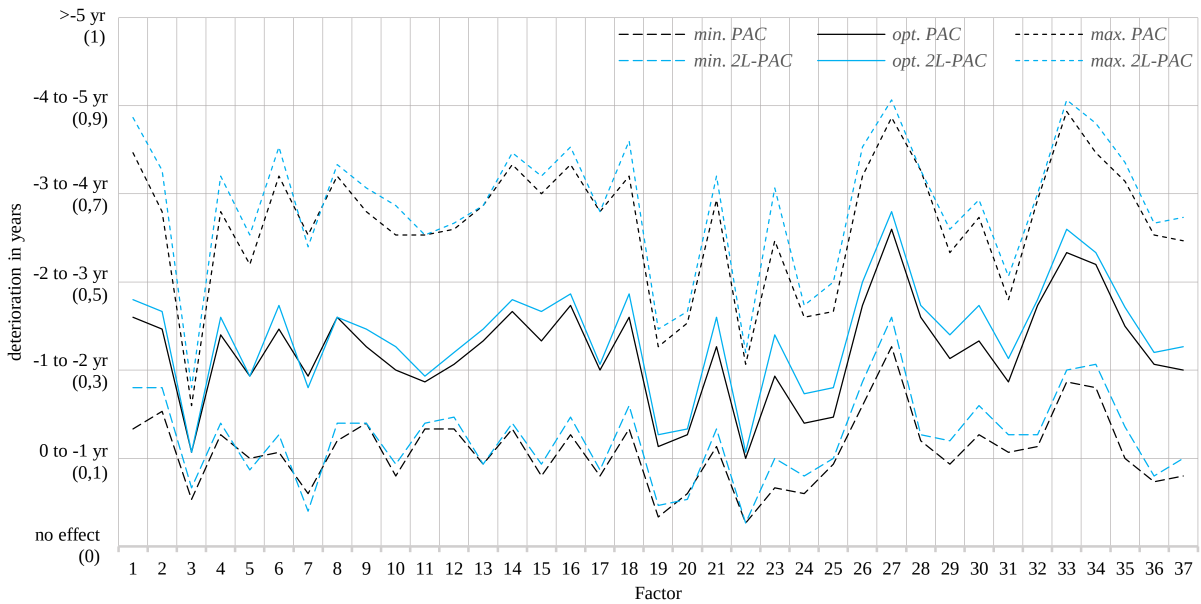

Figure 10: Mean values (min., opt., max.) of PAC compared to 2L-PAC, construction phase.

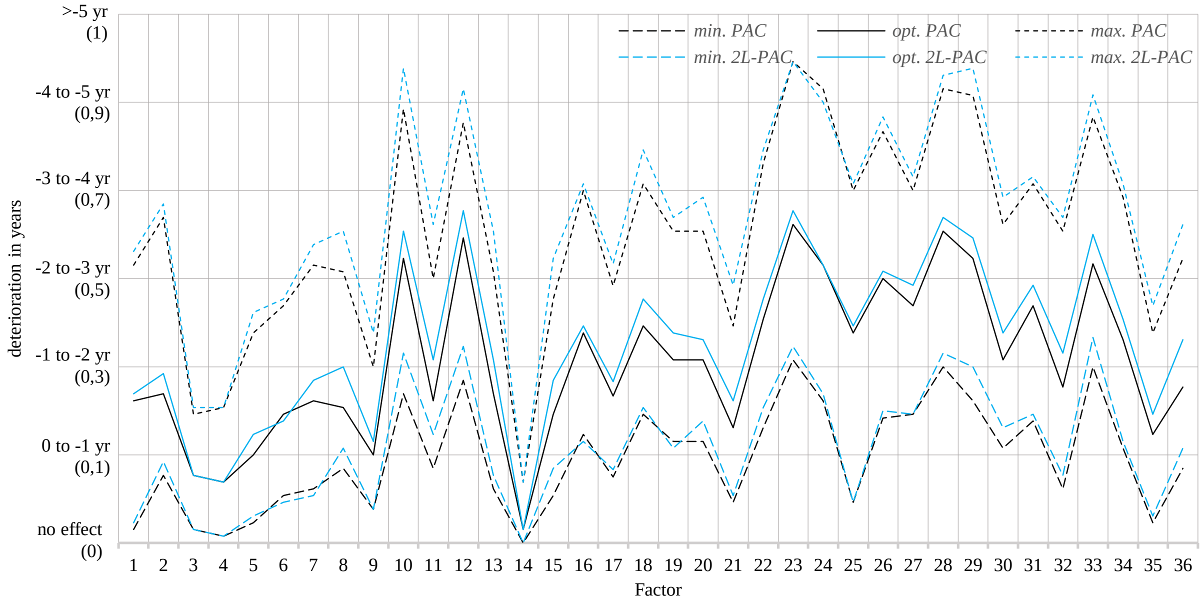

Figure 11: Mean values (min., opt., max.) of PAC compared to 2L-PAC, lifespan phase.

A screening threshold was set up to highlight the factors with the widest distribution, meaning the highest value for $b_j - a_j$ and $c_j - b_j$, where: $a_j = \frac{1}{n}\sum_{i=1}^{n} a_{ij}$, $b_j = \frac{1}{n}\sum_{i=1}^{n} b_{ij}$, $c_j = \frac{1}{n}\sum_{i=1}^{n} c_{ij}$. The threshold for $b_j - a_j$ and $c_j - b_j$ was set at 0.3. Table 18 and Table 19 show the retained factors with their distribution range. Table 18 shows that 12 factors have a higher range than 0.3 for the construction phase, and Table 19 shows that 14 factors have a range higher than 0.3 for the lifespan phase.

Table 18: Retained factors with range > 0.3, construction phase.

	$b_j - a_j$ PAC	$b_j - a_j$ 2L-PAC	$c_j - b_j$ PAC	$c_j - b_j$ 2L-PAC
Factor 1	N.A.	N.A.	0.340	0.380
Factor 6	N.A.	N.A.	0.307	0.320
Factor 8	N.A.	N.A.	N.A.	0.313
Factor 9	N.A.	N.A.	0.307	0.313
Factor 14	N.A.	N.A.	0.307	0.307
Factor 15	N.A.	0.327	0.313	N.A.
Factor 17	N.A.	N.A.	0.327	0.313
Factor 18	N.A.	N.A.	0.313	0.340
Factor 21	N.A.	N.A.	0.313	N.A.
Factor 23	N.A.	N.A.	N.A.	0.313
Factor 33	N.A.	0.320	N.A.	N.A.
Factor 35	N.A.	N.A.	0.321	0.314

Note: N.A. means Not Applicable, i.e. value did not reach threshold.

Table 19: Retained factors with range > 0.3, lifespan phase.

	$b_j - a_j$ PAC	$b_j - a_j$ 2L-PAC	$c_j - b_j$ PAC	$c_j - b_j$ 2L-PAC
Factor 1	N.A.	N.A.	0.308	0.323
Factor 2	N.A.	N.A.	0.385	0.369
Factor 7	N.A.	N.A.	N.A.	0.308
Factor 10	N.A.	N.A.	N.A.	0.315
Factor 12	0.308	N.A.	N.A.	N.A.
Factor 16	N.A.	N.A.	0.323	0.315
Factor 18	N.A.	N.A.	0.308	0.308
Factor 22	N.A.	N.A.	0.331	0.308
Factor 23	0.308	0.308	0.315	N.A.
Factor 24	N.A.	N.A.	0.338	0.308
Factor 25	0.331	0.308	0.308	N.A.
Factor 29	N.A.	N.A.	0.323	0.338
Factor 32	N.A.	N.A.	0.338	N.A.
Factor 34	N.A.	N.A.	0.315	N.A.

Note: N.A. means Not Applicable, i.e. value did not reach threshold.

In this study, consensus was measured by using Christie and Barela's (2005) method, meaning that experts' responses should fall between two points above and two points below the mean. Since in this study the scale was converted into a scale from 0 to 1, some adjustments were made. This led that the responses should fall between 0.2 points above and 0.2 points below the mean instead of two points above and two points below the mean (($\Delta S_j \leq 0.2$) = consensus, ($\Delta S_j > 0.2$) = no consensus). The consensus criterion was set on 70 per cent which was determined by the evaluator. To check the level of consensus among experts, first the S_j value ($s_j = \frac{a_j + 4b_j + c_j}{6}$) was calculated for each factor and each expert. Then the percentage of experts' rankings that fall within the consensus boundary were calculated. Results show that 14 unique factors (PAC: N = 14; 2L-PAC: N = 8) which occur during the construction reach a consensus level of more than 70 per cent. There were 18 unique factors (PAC: N = 14; 2L-PAC: N = 12) which occur during the lifespan that reached a consensus level of more than 70 per cent. All factors with their consensus level can be seen in Appendix J.

Based on the results where $S_j > 0.4$, a couple of statistical analysis have been conducted to get further insight in the meaning of the collected data. To test if there was a difference between the two pavement types (PAC and 2L-PAC) for all factors which occur during the construction and lifespan phase, an independent samples t-test was done twice. The first test concerns the construction phase. The independent variable is the pavement type (PAC vs 2L-PAC) and the dependent variable is the collected score. Results show that the factors that occur during construction are scored equal for both pavement types (PAC: $M = 0.46$, $SD = 0.05$; 2L-PAC: $M = 0.46$, $SD = 0.05$). The difference in scores are, thus, not significant; $t\ (43) = 0.49$, $p = .62$. The second test concerns the lifespan phase. Once again an independent samples t-test was done where the pavement type is the independent variable (PAC vs 2L-PAC) and the collected score the dependent variable. Results show that the factors are substantially equal for both pavement types (PAC: $M = 0.49$, $SD = 0.06$; 2L-PAC: $M = 0.50$, $SD = 0.07$). The observed statistical differences are not significant; $t\ (32) = 0.25$, $p = .80$.

Besides the differences between pavement types, it was also interesting to examine the difference between the two phases (construction and lifespan) for the two pavement types (PAC and 2L-PAC). An independent samples t-test is conducted twice. The first test concerns the pavement type PAC in which the independent variable is the phase (construction vs lifespan) and the collected scores is the dependent variable. Results show that the factors from the lifespan phase (*M* = 0.49, *SD* = 0.06) are ranked higher than those from the construction phase (*M* = 0.46, *SD* = 0.05) when the pavement type PAC is present. The differences are, however, not significant; *t* (32) = 1.74, *p* = .09. The second independent samples t-test concerns the pavement type 2L-PAC in which the independent variable is again the phase (construction vs lifespan) and the collected score is the dependent variable. Results show that the factors from the lifespan phase (*M* = 0.50, *SD* = 0.07) are again ranked higher than those from the construction phase (*M* = 0.46, *SD* = 0.05) when the pavement type 2L-PAC is present. The differences are, however, again not significant; *t* (43) = 1.74, *p* = .089.

The results, as described above, where $S_j > 0.4$, show no significant difference between the factors that occur during the two phases nor between the factors that apply to PAC vs the factors that apply to 2L-PAC. Therefore, the differences between the scores of all factors were analysed by means of an independent samples t-test. Thus, in this test also the rejected factors were taken into account. Again, the phase is the independent variable and the collected scores the dependent variable. Factors that occur during construction (*M* = 0.41, *SD* = 0.08) are scored higher than factors that occur during the lifespan (*M* = 0.38, *SD* = 0.13). The results are, however, not significant; *t* (144) = 1.58, *p* = .12.

In addition, the differences between PAC and 2L-PAC of each individual factor for both construction and lifespan phase were examined. This was done by using the collective experts' opinions for each individual factor. By conducting an independent samples t-test no statistical differences between PAC and 2L-PAC were found for none of the factors. Figure 8 shows a graphical presentation of collective experts' opinions (S_j) for each factor that occurs during construction. Figure 9 represents the factors that occur during the lifespan of pavements. The differences between PAC and 2L-PAC in both construction and lifespan phase are very small.

Last, in order to measure if there was a bias of Heijmans employees, the experts who ranked the factors during the lifespan were divided in two groups: external experts[2] (N = 4) and Heijmans experts (N = 9). For this, the S_j value had to be calculated for each expert. Then, 73 independent samples t-test were conducted, where the independent variable is the group (extern vs Heijmans) and the dependent variable is the S_j value. Results show that 15 factors are ranked significantly higher by Heijmans experts than external experts, and four factors are scored significantly higher by external experts than Heijmans experts (Table 20).

Table 20: Difference between ranking of Heijmans experts and external experts.

	Factors where Heijmans experts ranked significantly higher	Factors where external experts ranked significantly higher
PAC	1, 2, 5, 7, 8, 13, 17, 20, 34, 36	/
2L-PAC	1, 2, 5, 8, 17	10, 30, 32, 35

4.4 Discussion and Implications

In this study, the factors that influence abnormal asphalt pavement deterioration were identified, because contractors need better understanding about these factors to enhance their knowledge about long-term pavement performance. The research question is as follow: "*What data is needed for infrastructural contractors to gain understanding about abnormal deterioration behaviour of flexible pavements*?"

To answer the research question, the Fuzzy Delphi method was employed. A panel of pavement experts was used to identify the most relevant factors that influence pavement deterioration which occur during the

[2] External experts are all involved experts who are not employed by construction company Heijmans.

construction and lifespan of roads. Consequently, the same experts were used to rank the identified factors to their severity on deterioration. Each identified factor was ranked in a range from its minimum value to its maximum value with in between an optimal/most probable value.

This paragraph discusses the results from previous paragraph in dept. First, the methodological limitations are discussed. Further, the results are interpreted and recommendations about future actions and research are provided. Overall, this paragraph gives an overview of the practical interpretation and usability of the results.

4.4.1 Methodological Limitations

The factors that influence pavement deterioration is a complex matter. The Fuzzy Delphi was used to deal with this complexity. The complexity of pavement deterioration and the openness to interpretation could make the questions ambiguous to experts' interpretation. The range that was used in the Fuzzy Delphi (min, opt, max) could minimise this ambiguity, but still leaves the questions open to interpretation. The questions were open to interpretation of the experts, so they could link the severity of factors to their experience during different cases and how they believe the factors interact with other factors. This means that the results will never be an absolute truth, but a first approximation of this truth.

The group consensus is for a large number of factors below the threshold of 70 per cent and 14 of those even score below 50 per cent (see Appendix J). This could be explained by the complexity of the subject making the interpretation different to each expert. In addition, it is possible that there is overall little knowledge about the effects of deterioration factors. However, this is unfortunate for the usability of the results of this study, it also indicates that data about these factors is needed in order to make sensible judgements about the effect of the identified factors on pavement performance. The low level of consensus ratifies the belief of the need to start collect data about the factors that influence pavement performance. Creating more consensus for this study was not possible because of time constraints and willingness of experts. Another iteration of the questionnaire would further lower experts' motivation.

The experts who participated were distributed among a couple of organisations. Employees from construction company Heijmans forms the biggest expert group (N = 16). Although it was successful to attract Heijmans employees from a wide variety of jobs/disciplines, there is still a risk for blindness and biased opinions as they all work for the same company. For the lifespan phase, the difference between the rankings of Heijmans experts (N = 9) and other experts (N = 4) was calculated. For 19 out of 73 factors, there was found a significant difference between the two expert groups. This means that a small difference was measured which could be interpreted that there is little to no bias of Heijmans experts compared to other experts. It is, however, still not measurable if Heijmans experts would show a bias compared to experts from other construction companies, because Heijmans is the only involved company. In addition, a possible bias in the construction phase was not measurable, because there were no other experts involved besides Heijmans experts.

4.4.2 Interpretation of the Results

The results of this study show that a panel of pavement experts identified 73 unique factors; 37 for the construction phase and 36 for the lifespan phase. After setting up a threshold to highlight the most important deterioration factors, 45 unique factors were retained; 26 for the construction phase and 19 for the lifespan phase. A couple of discussion points have to be mentioned about these results.

For the construction phase, the retained factors ($S_j > 0.4$) are evenly distributed among six clusters: processing temperature, base layer, transportation, paving, compaction, other. The factors that are grouped under the compaction category are all retained which could indicate that the compaction process has an important share in the overall quality and lifespan of pavements. In addition, processing temperature factors are considered important by expert. This is a logical outcome as compaction factors are directly related to the temperatures of the mixture. Further, there are no notable remarks to be made for the construction phase, because all categories have a couple of factors which are considered important. It can be concluded that deviating conditions during construction highly affect the overall lifespan of pavements. For PAC, 61 per cent of the factors which have a score higher than 0.4 are construction factors, and for 2L-PAC 65 per cent of the factors which have a score higher than 0.4 are construction factors. The results are in line with the statement of Molenaar et al. (2006) who stated that the lifespan of PAC is strongly influenced by the construction process. It is, therefore, worthwhile to put effort in eliminating the deterioration factors which have a score higher than 0.4. Most of the factors that occur during construction are a result of human actions or human failure, meaning that most of the factors which cause abnormal pavement deterioration can be controlled (avoided or minimised). Besides controlling these deviating construction conditions and errors, it is also necessary to take notice of the higher scored factors and document these conditions when one wants to be able to explain unexpected deterioration symptoms. For instance, documentation is essential for linking unexpected deterioration to the factor that caused the deterioration.

For the lifespan phase, it is notable that factors, such as climate and traffic, are often uncontrollable, which means that their occurrence is uncontrollable and no human intervention can change their occurrence. It is interesting to see that these uncontrollable factors are scored relatively low. There are no retained factors ($S_j > 0.4$) in the environment category and only two in the traffic category. The retained traffic factors are both related to an increase of wringing traffic. However wringing traffic occurs seldom, it is important to take notice of these factors when they occur. For instance, when PAC or 2L-PAC is applied on a cloverleaf loop, one can expect a significant decrease in lifespan compared to straight road sections. Another example of wringing traffic is when traffic is temporarily redirected to another lane due to accidents or maintenance. Further, it is noteworthy that climate and traffic factors are scored relatively low, while climate and traffic factors are often named in literature as one of the key factors that determine pavement deterioration (George, 2000; Saba, et al., 2006; Tarawneh & Sarireh, 2013). Thus, although traffic and climate factors determine pavement deterioration, experts believe that abnormal traffic or climate conditions, such as an increase of traffic intensity or cold weather, are just minimally responsible for a reduction in lifespan of porous asphalt pavements. For environment factors, it has to be noted that there was asked for the effect of a certain climate condition for the period of one year or season. Climate conditions could reoccur annually and may, therefore, be of greater influence over the whole a pavement's lifespan. A final note is that climate and traffic factors are of the most structural nature among all factors, which means that these factors are continuously present or reoccurring, and affecting a large pavement surface compared to other factors which are of a more incidental and local nature.

Based on the remarks before, it can be concluded that climate and traffic factors are important factors which are worthwhile to monitor. Despite their low scores, they are considered important, because of their structural nature. It is, thus, worthwhile to put effort in monitoring traffic and climate factors. However, five factors are scored extremely low ($S_j < 0.2$), making them negligible for further use or study; '*cold nights*', '*rainfall*', '*summer heat*', '*temporal increase in traffic weight*', and '*increase in driving speed*'. The factor rainfall was manually added based on literature (Fairweather & Yeaman, 2014). Fairweather and Yeaman (2014) conducted an experiment in Australia and concluded that rain has a negative effect on pavement deterioration. However, experts ranked rain relatively low (S_j (PAC) = 0.173; S_j (2L-PAC) = 0.173) in this study. This could imply that the pavement types PAC and 2L-PAC are more resistant to the negative effects of rainfall than the one used in the study of Fairweather and Yeaman (2014). In addition, the extremeness of rainfall in the Netherlands is probably of a much milder severity than the cyclonic depressions which occur Australia. This also implies that it is difficult to rely on existing studies conducted in different countries, because different countries often cope with different conditions that determines the performance of roads (Cuelho, et al., 2006).

Further, it is noteworthy that the highest scored factors that occur during the lifespan of pavements are often of a local and incidental nature. For instance, the factors '*cadaver on road surface*', and '*mechanical/scratch damage lengthwise*', are scored relatively high, but only have a very local impact. This implies that their occurrence is incidental and their impact is high but on a small surface. Maintenance work to repair consequential damages is, therefore, more local and less rigorous than maintenance work for damages that are a result of factors that have a more structural nature, such as climate and traffic factors. Deterioration factors which occur during the lifespan of pavements and which were scored higher than 0.4 are worthwhile to monitor.

A final observation concerns that 2L-PAC is more sensitive to deterioration factors than traditional PAC in both construction phase and in the lifespan phase. It is interesting to see that more factors are scored above the threshold ($S_j > 0.4$) for 2L-PAC than for PAC. Taking into account all factors, it is notable that 2L-PAC scores slightly higher than PAC for a vast majority of the factors (N = 61). Three factors are scored slightly lower for 2L-PAC and nine factors are scored identical. Although the differences between PAC and 2L-PAC are not significant, the fact that 2L-PAC is scored higher could still indicate that 2L-PAC is more sensitive to deterioration as a result of deviating conditions during construction and lifespan. Monitoring PAC and 2L-PAC to collect empirical evidence should provide better understanding of the differences between the two top layers.

This study provides a first indication of the severity of the factors that influence pavement deterioration behaviour. Based on previous discussion, it is concluded that the following factors are important to monitor: 1) all factors that have a higher value than 0.4 for both PAC and 2L-PAC and for both construction and lifespan phase (see Appendix I); 2) all traffic and environment factors that have a higher value than 0.2 (see Appendix H).

4.4.3 Recommended Future Actions for Contractors

As concluded in paragraph 4.4.2, contractors should start with collecting data about pavement deterioration factors which experts scored higher than 0.4. In addition, data about climate and traffic factors should be obtained (see paragraph 4.4.2). When such data is obtained, the reliability of performance prediction models can be improved, and the overall understanding about long-term pavement performance can be improved.

With the responsibility over roads for periods up to 30 years, contractors basically have roads under their responsibility which can be used as their own test sections. Without using these roads solely as test sections, long-term responsibilities offer possibilities to obtain empirical data about the performances of these roads. During the lifetime of roads, contractors are freer to collect data by using techniques, such as sensor networks, to monitor the pavement conditions and circumstances. Most relevant traffic and climate conditions can be monitored using techniques, such as sensor networks (Kaare, et al., 2012). When measuring climate and traffic conditions, contractors can adjust their expectations when outliers are observed. In addition, by collecting climate and traffic data together with performance data, empirical evidence can be gathered to create more reliable input parameters for performance prediction models.

Although climate and traffic factors have a notable effect on abnormal pavement deterioration, other factors also severely affect pavement deterioration during the lifespan. Techniques, such as sensor networks, are for these factors not applicable as they mainly cause deterioration on a more local scale, or they are hard to measure from distance. For the remaining factors, contractors should take notice of them by means of inspections and structural documentation. Because most factors are of an incidental nature, e.g. '*cadaver on road*', remote monitoring is impossible. For the short term, inspections are needed to take notice of deterioration factors. When incidental deterioration factors are structurally monitored and stored in a database, one can improve the estimation of the probability of occurrence, because the sample sizes will keep increasing. For contractors, this is relevant for making predictions about what to expect throughout the contract period before they start on the job. This way, budgets, resources and maintenance strategies can be optimised. In addition, structural documentation of all relevant deterioration factors during the lifespan is needed so performance expectations can be adjusted. For example, when one observes a '*failed joint*', then one can expect the lifespan of the pavement on that particular location to be shortened with +/- 3.5 to 4.5 years. For the middle long term, data about deterioration factors can help contractors in explaining unexpected damage symptoms. This is, for instance, relevant for contractors who wants to understand the cause of deterioration, or who needs to prove the cause of deterioration, e.g. towards clients. For the long term, empirical evidence may be created when such documentation is linked to performance data of the pavements on which deterioration factors were present. Data about damage development is already collected by contractors by means of visual inspections or laser measurements. However, this data can specifically be used to improve performance models and to generate empirical evidence about the effects of deviating conditions. Continuously collecting and storing performance data at a central locations has the potential to create a more reliable database than the current available ones.

In addition, contractors should monitor deterioration factors that occur during construction. Technologies to monitor construction processes are becoming increasingly available (Bijleveld, 2015). Data about deterioration factors during construction should be collected in a 'logbook' manner. Meaning all deviating conditions which occur during construction have to be structurally recorded in one central place. For the short term, recording and structuring construction conditions can help contractors adjust their performance expectations. When deviating conditions are perceived during construction, one can adjust their expectations. For example, when an unavoidable error was made during construction, the deterioration rate of the pavement may increase. One should not be surprised if the lifespan is disappointing when the top layer was applied in adverse weather conditions, or if the finisher drives at a too high speed and if the number of rollers is too little to obtain the right degree of compaction (Meerkerk, et al., 2006). Results of this study contribute in understanding the effect of such errors made during construction. For instance, when the initial temperature of the mixture was too low during construction, one can expect the lifespan of the pavement to be shortened with +/- 1.5 to 2.5 years. For the middle long term, the data can help contractors in explaining unexpected damage symptoms. Meaning that when a road deteriorates in an abnormal rate, or damage symptoms occur, one may link the deterioration to its cause as it was documented during construction. Again, this is, for instance, relevant for contractors who wants to understand the cause of deterioration, or who wants to prove the cause of deterioration, e.g. towards clients. For the long term, structurally collecting data about deviating conditions during construction together with performance data can help in creating empirical evidence of the effect of those deviating construction conditions.

4.4.4 Recommendations for Future Research

This study gives an overview of the most important pavement deterioration factors which occur during construction and lifespan of PAC and 2L-PAC top layers. However, because of the complexity of pavement deterioration factors, it is also worthwhile to examine the interacting effects of deterioration factors. For instance, it is conceivable that traffic conditions do not have much effect on pavement deterioration, but a combined action of traffic and climate conditions may intensify the influence of these factors. This is especially valid in relation to the age of PAC, e.g. a combination of freeze-thaw cycles and rainfall have quite some effect on ravelling of old, brittle PAC and much less effect on ravelling of rather new PAC. Understanding the interaction between deterioration factors is, thus, needed to fully understand pavement deterioration and the exact influence of deterioration factors. Such interactions could be researched by using experts' opinions, or by gathering performance data and data about influential factors. With enough data, correlations between deterioration factors and damage symptoms may be made. However, a long timeframe is needed to gather enough data to make such correlations visible.

Further, research for the opportunities and possibilities of data collection, storage, analysing and visualising is necessary. Data collection possibilities, such as wireless sensor networks or technologies to monitor construction processes, is rather new in contractors' environment and, therefore, deserves attention to outline realistic implementation possibilities. For instance, much could be obtained when the data is structurally collected for analytical purposes. Infrastructure asset data is typically identified, associated with, or referenced by their geographic locations and spatial relationships. Therefore, a GIS offers possibilities for contractors to support their asset management processes. Further, the collected data has to be converted into useful input parameters to be used in performance prediction models. Research is needed to determine the exact data needs of such models. Finally, for practical purposes, it is interesting to study the financial feasibility of collecting data about pavement deterioration factors.

Finally, future research is needed about data preparation. Raw data about factors that influence pavement performance is not directly applicable. Data cleaning, data scaling, and variable selection is needed before raw data can be used as input for performance prediction models.

CHAPTER 5, CONCLUSION

This final chapter gives an overview of the scientific and societal relevance of this study. In addition, this chapter highlights the conclusions that have led to answering the research questions which were leading for this study.

New governmental procurement strategies necessitate a change in contractors' acting. Rijkswaterstaat is using DBFM contracts to transfer the responsibilities for design, construction, financing and maintenance of an infrastructural object to one private entity. With contractors as an important party within this private entity, they are, thus, confronted with new tasks, responsibilities, and risks for long periods of time. For DBFM projects, the maintenance periods can go up to 30 years. In a DBFM project, contractors are panelised or rewarded based on the performance of the infrastructural object they design, construct and maintain. The risks and responsibilities work as an incentive for contractors to deliver higher quality products and to optimise their operational processes. However, long-term responsibilities reach beyond the experience domain of the contractors. Thus, to stay competitive and be able to cope with the increased risks and responsibilities, they need better understanding about long-term pavement performance.

Better understanding about pavement performance refers to the ability to make accurate predictions of pavement deterioration behaviour. DBFM contracts are mostly applied for projects where a PAC or 2L-PAC top layer is applied. Therefore, better understanding about the performances of these pavement types is essential for contractors. The exact lifespan of PAC and 2L-PAC is not known, and the distribution in lifespan is indistinct. Six major categories can be used to describe the reasons for unpredictable pavement performance: structure, environment, traffic, construction, maintenance, and material properties. These six categories contain a large number of factors which cause the deviating lifespans of pavements. In addition, complex interactions between deterioration factors make pavement performance prediction a difficult matter.

Although there are models that cope with predicting pavement performance, accurate predictions are still difficult to make and are often based on experience. Road agencies often use performance models to predict pavement performance, but little to no variables are taken into account in these models. Performance prediction models are more advanced prediction models than performance models and also take variables into account. Performance prediction models can make accurate performance predictions, but data about important influential variables is missing, while inclusions of the most influential variables is essential for accurate predictions. The effects of deterioration factors on the lifespan of pavements are not well understood, and the current available databases do not satisfy this need. Therefore, it is important to gain understanding about the effects of the most important pavement deterioration factors, so that the accuracy of prediction models can be optimised. Data about the most important deterioration factors is, thus, needed to increase understanding about pavement performance.

Because of the limited knowledge about the effects of conditions and variables on the lifespan of pavements, this study identified and ranked relevant deterioration factors for PAC and 2L-PAC top layers in the Netherlands. A specific study that focuses on the Netherlands was needed, because different countries often cope with different conditions that determines the performance of roads, such as geographic conditions, soil types, construction methods, and usage conditions. 73 unique deterioration factors were identified and ranked by experts; 37 for the construction phase and 36 for the lifespan phase. For the construction phase, 26 unique factors are considered worthwhile to monitor[3], and 19 factors are considered worthwhile to monitor[3] for the lifespan phase.

[3] Meaning a higher score than 0.4

Construction conditions have a great influence on pavement deterioration. For PAC, 61 per cent of the factors which have a high score[4] are construction factors, and for 2L-PAC 65 per cent of the factors which have a high score[4] are construction factors. Most deterioration factors in the construction phase are controllable, meaning they can be avoided or minimised by human interventions. This means that unpredictable pavement behaviour is for a large share a result of human failure or actions during construction. It is, therefore, worthwhile to put effort in eliminating the deterioration factors which have a high score[4]. In addition, it is worthwhile to take notice of the higher scored factors and document these conditions when one wants to be able to explain unexpected deterioration symptoms.

The highest scored factors that occur during the lifespan of pavements are often of a local and incidental nature. This means that their occurrence is incidental and their impact is high but on a small surface. Maintenance work to repair consequential damages is, therefore, more local and less rigorous than maintenance work for damages that are a result of factors that have a more structural nature, such as climate and traffic factors. Deterioration factors which occur during the lifespan of pavements and which have a high score[4] for both PAC and 2L-PAC are considered worthwhile to monitor. In addition, climate and traffic factors are scored relatively low (mostly below the threshold), but they are considered worthwhile to monitor. Despite their low scores, most traffic and climate factors are considered important, because of their structural nature. Most of these factors are affecting the whole pavement surface and can be reoccurring. Besides monitoring the factors which have a high score[4], it is also worthwhile to put effort in monitoring traffic and climate factors which are scored higher than 0.2 for both PAC and 2L-PAC.

This study identified and highlighted the most important causes of abnormal pavement deterioration in the Netherlands, so that consequential actions can be taken, such as avoiding and improving certain conditions, and collecting data to enhance understanding about the effects of pavement deterioration factors. A first understanding is created about the effect of factors that influence abnormal deterioration of Dutch highways during construction and lifespan. This understanding is relevant, because momentarily, the lifespan of highway pavements and their deviations are not well understood in the scientific fields and construction industry. Optimising pavement performance is important and relevant, because commercial-, standard-, and public transport are all strongly dependent on the condition of the Dutch highways. A good functioning road network is, therefore, of great social and economic importance.

A logical step for further research is to examine the feasibility and possibilities of collecting data about the deterioration factors as identified in this study. In addition, it is interesting to study the effects of interacting deterioration factors, so the full spectrum of deterioration factors can be understood. Finally, research for data cleaning, data scaling, and variable selection is needed before raw data can be used as input for performance prediction models.

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[4] Meaning a higher score than 0.4

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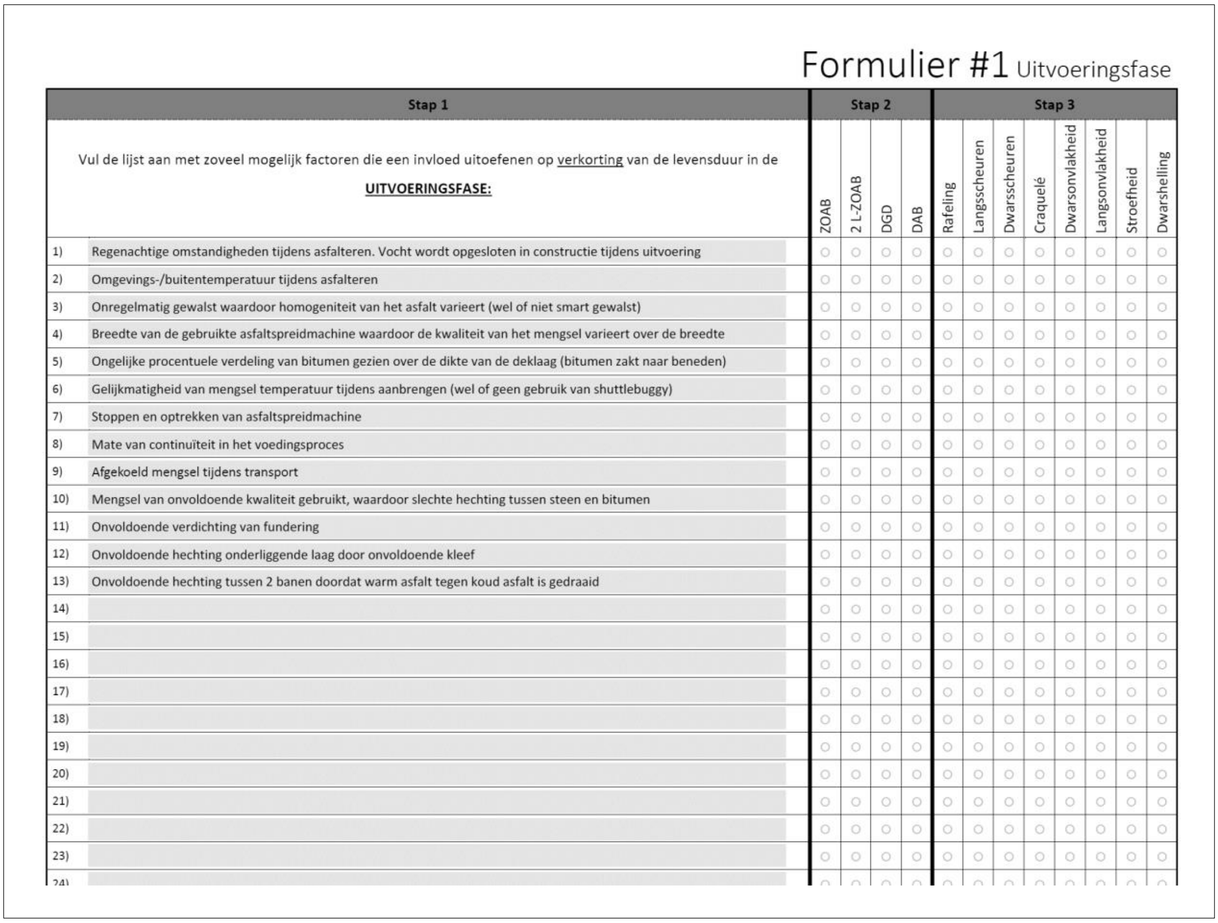
APPENDICES

Appendix A Involved Experts

Table 21: Overview of the participant's organisations, relevant experiences, and degree of participation.

ID	Organisation	Relevant experience	Questionnaire 1	Questionnaire 2 (construction phase)	Questionnaire 2 (lifespan phase)
1.	Heijmans	Experienced project and construction manager pavements.	x	x	/
2.	Heijmans	Experienced project manager pavements.	x	x	x
3.	Province	Pavement Specialist at a Dutch province (22 years). Numerous of working groups (CROW and other). Previously 13 years head of improvements at Rijkswaterstaat.	x	/	x
4.	Heijmans	Chief/head technologist.	x	x	/
5.	TNO	Advisor pavement research. Former advisor and laboratory project manager at Rijkswaterstaat.	x	/	/
6.	Heijmans	Project manager. Former project coordinator and construction manager or infrastructure and pavement projects.	x	x	x
7.	Heijmans	Innovation manager pavements. Prominent pavement specialist in the Netherlands. Involved in numerous scientific pavement studies.	x	x	x
8.	Heijmans	Technologist.	x	x	/
9.	Municipality	43 years in road construction of which 31 years with a municipality. Functions: financial budgeting, pavement advice, supervision, maintenance management.	x	/	x
10.	Heijmans	Project manager pavement projects. Former asphalt coordinator.	x	x	/
11.	Rijkswaterstaat	Senior advisor. Pavement specialists and involved in numerous scientific studies (incl. PAC studies).	x	/	/
12.	Heijmans	Project advisor pavements. Former project manager and construction manager.	x	x	/
13.	Heijmans	Chief/head technologist.	x	x	/
14.	TUD	Associate professor at Delft University of Technology, faculty Civil Engineering and Geosciences, department Road and Railway Engineering.	x	x	x
15.	Heijmans	Project manager pavement projects.	/	x	x
16.	Heijmans	Chief/head technologist.	x	/	/
17.	Heijmans	Senior pavement advisor.	x	x	x
18.	Heijmans	Innovation manager pavements. Former chief/head technologist.	x	x	x
19.	Heijmans	xx. Deals with damage reports and interventions of pavements during lifespan. Former construction manager.	x	x	x
20.	Heijmans	Experienced project manager.	x	x	/
21.	Rijkswaterstaat	Senior Advisor Material Technology. 36 years employed at Rijkswaterstaat of which 20 as years as asphalt pavement specialist. Involved in innovation projects regarding PAC.	x	/	x
22.	Heijmans	Senior pavement advisor.	/	/	x
		Total:	20	15	13

Appendix B Questionnaire 1



Formulier #1 Uitvoeringsfase

Stap 1		Stap 2				Stap 3							
Vul de lijst aan met zoveel mogelijk factoren die een invloed uitoefenen op verkorting van de levensduur in de **UITVOERINGSFASE:**		ZOAB	2 L-ZOAB	DGD	DAB	Rafeling	Langsscheuren	Dwarsscheuren	Craquelé	Dwarsonvlakheid	Langsonvlakheid	Stroefheid	Dwarshelling
1)	Regenachtige omstandigheden tijdens asfalteren. Vocht wordt opgesloten in constructie tijdens uitvoering	○	○	○	○	○	○	○	○	○	○	○	○
2)	Omgevings-/buitentemperatuur tijdens asfalteren	○	○	○	○	○	○	○	○	○	○	○	○
3)	Onregelmatig gewalst waardoor homogeniteit van het asfalt varieert (wel of niet smart gewalst)	○	○	○	○	○	○	○	○	○	○	○	○
4)	Breedte van de gebruikte asfaltspreidmachine waardoor de kwaliteit van het mengsel varieert over de breedte	○	○	○	○	○	○	○	○	○	○	○	○
5)	Ongelijke procentuele verdeling van bitumen gezien over de dikte van de deklaag (bitumen zakt naar beneden)	○	○	○	○	○	○	○	○	○	○	○	○
6)	Gelijkmatigheid van mengsel temperatuur tijdens aanbrengen (wel of geen gebruik van shuttlebuggy)	○	○	○	○	○	○	○	○	○	○	○	○
7)	Stoppen en optrekken van asfaltspreidmachine	○	○	○	○	○	○	○	○	○	○	○	○
8)	Mate van continuïteit in het voedingsproces	○	○	○	○	○	○	○	○	○	○	○	○
9)	Afgekoeld mengsel tijdens transport	○	○	○	○	○	○	○	○	○	○	○	○
10)	Mengsel van onvoldoende kwaliteit gebruikt, waardoor slechte hechting tussen steen en bitumen	○	○	○	○	○	○	○	○	○	○	○	○
11)	Onvoldoende verdichting van fundering	○	○	○	○	○	○	○	○	○	○	○	○
12)	Onvoldoende hechting onderliggende laag door onvoldoende kleef	○	○	○	○	○	○	○	○	○	○	○	○
13)	Onvoldoende hechting tussen 2 banen doordat warm asfalt tegen koud asfalt is gedraaid	○	○	○	○	○	○	○	○	○	○	○	○
14)		○	○	○	○	○	○	○	○	○	○	○	○
15)		○	○	○	○	○	○	○	○	○	○	○	○
16)		○	○	○	○	○	○	○	○	○	○	○	○
17)		○	○	○	○	○	○	○	○	○	○	○	○
18)		○	○	○	○	○	○	○	○	○	○	○	○
19)		○	○	○	○	○	○	○	○	○	○	○	○
20)		○	○	○	○	○	○	○	○	○	○	○	○
21)		○	○	○	○	○	○	○	○	○	○	○	○
22)		○	○	○	○	○	○	○	○	○	○	○	○
23)		○	○	○	○	○	○	○	○	○	○	○	○
24)		○	○	○	○	○	○	○	○	○	○	○	○

Figure 12: Representation of questionnaire 1.

Appendix C Questionnaire 2

ONDERWERP: Temperatuur ondergrond

VRAAG 10 context: Er is geasfalteerd op een ondergrond met een erg lage temperatuur. **Geef hieronder een inschatting van het uiteindelijk effect wanneer de ondergrond een erg lage temperatuur had tijdens het asfalteren.**

Vraag 10a: Wat is het **minimale** effect op de levensduur van onderstaande deklagen als de ondergrond een te lage temperatuur had?

ZOAB:

geen effect	0 tot -1 jr	-1 tot -2 jr	-2 tot -3 jr	-3 tot -4 jr	-4 tot -5 jr	>-5 jr

Twee-laags ZOAB:

geen effect	0 tot -1 jr	-1 tot -2 jr	-2 tot -3 jr	-3 tot -4 jr	-4 tot -5 jr	>-5 jr

Vraag 10b: Wat is het **maximale** effect op de levensduur van onderstaande deklagen als de ondergrond een te lage temperatuur had?

ZOAB:

geen effect	0 tot -1 jr	-1 tot -2 jr	-2 tot -3 jr	-3 tot -4 jr	-4 tot -5 jr	>-5 jr

Twee-laags ZOAB:

geen effect	0 tot -1 jr	-1 tot -2 jr	-2 tot -3 jr	-3 tot -4 jr	-4 tot -5 jr	>-5 jr

Vraag 10c: Wat is het **gemiddelde** effect op de levensduur van onderstaande deklagen als de ondergrond een te lage temperatuur had?

ZOAB:

geen effect	0 tot -1 jr	-1 tot -2 jr	-2 tot -3 jr	-3 tot -4 jr	-4 tot -5 jr	>-5 jr

Twee-laags ZOAB:

geen effect	0 tot -1 jr	-1 tot -2 jr	-2 tot -3 jr	-3 tot -4 jr	-4 tot -5 jr	>-5 jr

Figure 13: Representation of questionnaire 2.

Participant remarks:

The following remarks were made by participants on questionnaire 2:

- There is data to reflect the estimations to;
- Questions concern the effect of a single factor (no interaction) making it difficult to comprehend.

Appendix D Dataset with Seven-Point Scale for Construction Phase

			expert_1				expert_2				expert_4			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	1	2	3	(1;2;3)	2	3	5	(2;3;5)	1	3	5	(1;3;5)
		2l-zoab	2	2	4	(2;2;4)	3	4	6	(3;4;6)	2	3	6	(2;3;6)
factor_2	afkoeling_snel	zoab	3	3	4	(3;3;4)	1	3	4	(1;3;4)	1	3	5	(1;3;5)
		2l-zoab	3	4	5	(3;4;5)	2	3	5	(2;3;5)	2	3	6	(2;3;6)
factor_3	afkoeling_langz	zoab	1	1	1	(1;1;1)	1	2	3	(1;2;3)	1	1	2	(1;1;2)
		2l-zoab	1	1	1	(1;1;1)	2	2	4	(2;2;4)	1	1	2	(1;1;2)
factor_4	temp_const	zoab	2	3	4	(2;3;4)	2	2	4	(2;2;4)	2	3	4	(2;3;4)
		2l-zoab	3	3	4	(3;3;4)	2	3	5	(2;3;5)	3	4	5	(3;4;5)
factor_5	regen	zoab	2	3	3	(2;3;3)	2	3	5	(2;3;5)	2	2	4	(2;2;4)
		2l-zoab	3	3	4	(3;3;4)	2	3	5	(2;3;5)	2	3	4	(2;3;4)
factor_6	vervuiling_ondergr	zoab	1	4	5	(1;4;5)	2	3	6	(2;3;6)	2	3	5	(2;3;5)
		2l-zoab	1	4	4	(1;4;4)	2	3	6	(2;3;6)	2	3	5	(2;3;5)
factor_7	vochting_ondergr	zoab	1	3	4	(1;3;4)	2	3	5	(2;3;5)	2	3	4	(2;3;4)
		2l-zoab	1	3	4	(1;3;4)	2	3	5	(2;3;5)	2	3	4	(2;3;4)
factor_8	kleef_ondergr	zoab	2	3	5	(2;3;5)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
		2l-zoab	2	3	5	(2;3;5)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
factor_9	freeskwal	zoab	3	4	5	(3;4;5)	3	3	5	(3;3;5)	2	3	5	(2;3;5)
		2l-zoab	3	4	5	(3;4;5)	3	4	6	(3;4;6)	2	3	5	(2;3;5)
factor_10	temp_ondergr	zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	2	3	5	(2;3;5)
		2l-zoab	2	3	4	(2;3;4)	1	3	4	(1;3;4)	2	4	6	(2;4;6)
factor_11	verdicht_klank	zoab	4	4	5	(4;4;5)	3	3	5	(3;3;5)	1	1	2	(1;1;2)
		2l-zoab	4	4	5	(4;4;5)	3	3	5	(3;3;5)	1	1	2	(1;1;2)
factor_12	fundering_smal	zoab	3	3	4	(3;3;4)	3	4	6	(3;4;6)	1	1	2	(1;1;2)
		2l-zoab	3	3	4	(3;3;4)	3	4	6	(3;4;6)	1	1	2	(1;1;2)
factor_13	fundering_stijf	zoab	2	3	5	(2;3;5)	2	4	5	(2;4;5)	1	2	4	(1;2;4)
		2l-zoab	2	3	5	(2;3;5)	2	4	5	(2;4;5)	1	2	4	(1;2;4)
factor_14	draagkracht_onder	zoab	2	3	4	(2;3;4)	2	4	5	(2;4;5)	1	2	3	(1;2;3)
		2l-zoab	2	3	4	(2;3;4)	2	4	5	(2;4;5)	1	2	3	(1;2;3)
factor_15	varierende_homog.	zoab	1	4	6	(1;4;6)	2	3	5	(2;3;5)	1	4	5	(1;4;5)
		2l-zoab	1	4	6	(1;4;6)	2	4	5	(2;4;5)	1	5	6	(1;5;6)
factor_16	ontmenging	zoab	2	4	6	(2;4;6)	3	4	6	(3;4;6)	2	4	6	(2;4;6)
		2l-zoab	2	4	6	(2;4;6)	3	5	6	(3;5;6)	2	4	7	(2;4;7)
factor_17	rijsnelheid_hoog	zoab	3	4	6	(3;4;6)	1	2	3	(1;2;3)	1	3	4	(1;3;4)
		2l-zoab	3	4	6	(3;4;6)	1	2	3	(1;2;3)	1	4	5	(1;4;5)
factor_18	continuiteit_machine	zoab	2	3	4	(2;3;4)	3	3	5	(3;3;5)	2	4	6	(2;4;6)
		2l-zoab	2	3	4	(2;3;4)	4	4	6	(4;4;6)	2	4	7	(2;4;7)
factor_19	aanstoten_machine	zoab	1	1	2	(1;1;2)	2	3	3	(2;3;3)	1	1	2	(1;1;2)
		2l-zoab	1	1	2	(1;1;2)	3	3	4	(3;3;4)	1	1	2	(1;1;2)
factor_20	instelling_hoogte_mach	zoab	2	2	3	(2;2;3)	1	1	3	(1;1;3)	1	2	3	(1;2;3)
		2l-zoab	2	2	3	(2;2;3)	1	2	3	(1;2;3)	1	2	4	(1;2;4)
factor_21	voorverwarm_mach	zoab	2	3	4	(2;3;4)	2	2	3	(2;2;3)	1	3	4	(1;3;4)
		2l-zoab	2	3	4	(2;3;4)	3	3	4	(3;3;4)	1	4	5	(1;4;5)
factor_22	dik_asfalt	zoab	1	2	3	(1;2;3)	1	3	4	(1;3;4)	1	2	2	(1;2;2)
		2l-zoab	1	2	3	(1;2;3)	1	4	5	(1;4;5)	1	2	2	(1;2;2)
factor_23	dun_asfalt	zoab	1	3	4	(1;3;4)	1	2	4	(1;2;4)	1	2	2	(1;2;2)
		2l-zoab	1	3	4	(1;3;4)	1	3	5	(1;3;5)	2	4	5	(2;4;5)
factor_24	breedte_machine	zoab	2	3	4	(2;3;4)	2	2	4	(2;2;4)	1	2	3	(1;2;3)
		2l-zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	2	3	4	(2;3;4)
factor_25	warm_koud_metnaad	zoab	2	2	3	(2;2;3)	3	3	4	(3;3;4)	2	4	5	(2;4;5)
		2l-zoab	2	2	3	(2;2;3)	3	4	5	(3;4;5)	2	5	6	(2;5;6)
factor_26	warm_koud_zonder	zoab	3	3	5	(3;3;5)	3	4	5	(3;4;5)	3	5	6	(3;5;6)
		2l-zoab	3	3	5	(3;3;5)	4	5	6	(4;5;6)	4	6	7	(4;6;7)
factor_27	asfaltnaad_wielspoor	zoab	2	3	4	(2;3;4)	3	5	6	(3;5;6)	3	6	7	(3;6;7)
		2l-zoab	2	3	4	(2;3;4)	4	6	7	(4;6;7)	4	6	7	(4;6;7)
factor_28	nadenplan_verkeerd	zoab	3	3	5	(3;3;5)	2	2	4	(2;2;4)	3	6	7	(3;6;7)
		2l-zoab	3	3	5	(3;3;5)	2	2	4	(2;2;4)	4	6	7	(4;6;7)
factor_29	terugharken_asfalt	zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	2	5	7	(2;5;7)
		2l-zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	3	6	7	(3;6;7)
factor_30	geen_wormen	zoab	3	4	5	(3;4;5)	3	3	5	(3;3;5)	2	4	6	(2;4;6)
		2l-zoab	3	4	5	(3;4;5)	4	4	5	(4;4;5)	4	6	7	(4;6;7)
factor_31	faseerd_aanbrengen	zoab	2	2	3	(2;2;3)	2	3	4	(2;3;4)	2	5	6	(2;5;6)
		2l-zoab	2	2	3	(2;2;3)	3	4	5	(3;4;5)	3	6	7	(3;6;7)
factor_32	walsinzet_hoog	zoab	2	3	4	(2;3;4)	1	3	4	(1;3;4)	1	2	3	(1;2;3)
		2l-zoab	2	3	4	(2;3;4)	1	3	4	(1;3;4)	1	2	3	(1;2;3)
factor_33	laat_walsen	zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	2	5	7	(2;5;7)
		2l-zoab	2	4	5	(2;4;5)	2	4	5	(2;4;5)	2	5	7	(2;5;7)
factor_34	verkeerd_wals	zoab	3	3	4	(3;3;4)	1	2	3	(1;2;3)	2	5	7	(2;5;7)
		2l-zoab	3	3	4	(3;3;4)	2	3	4	(2;3;4)	2	5	7	(2;5;7)
factor_35	ongelijk_wals	zoab	3	3	4	(3;3;4)	2	3	4	(2;3;4)	1	4	6	(1;4;6)
		2l-zoab	3	3	4	(3;3;4)	3	3	4	(3;3;4)	2	5	7	(2;5;7)
factor_36	belaste_ondergr	zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	2	5	7	(2;5;7)
		2l-zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	2	5	7	(2;5;7)
factor_37	vroegtijdig_belast	zoab	2	2	3	(2;2;3)	1	2	3	(1;2;3)	2	5	7	(2;5;7)
		2l-zoab	2	2	3	(2;2;3)	1	2	3	(1;2;3)	2	5	7	(2;5;7)

			expert_6				expert_7				expert_8			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	2	3	5	(2;3;5)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
		2l-zoab	3	3	6	(3;3;6)	3	4	5	(3;4;5)	3	4	6	(3;4;6)
factor_2	afkoeling_snel	zoab	3	3	4	(3;3;4)	2	2	3	(2;2;3)	3	4	5	(3;4;5)
		2l-zoab	4	4	6	(4;4;6)	2	4	5	(2;4;5)	3	4	5	(3;4;5)
factor_3	afkoeling_langz	zoab	2	3	4	(2;3;4)	2	2	2	(2;2;2)	1	1	1	(1;1;1)
		2l-zoab	3	4	6	(3;4;6)	2	2	3	(2;2;3)	1	1	1	(1;1;1)
factor_4	temp_const	zoab	1	2	3	(1;2;3)	2	3	4	(2;3;4)	3	4	5	(3;4;5)
		2l-zoab	1	2	4	(1;2;4)	3	4	6	(3;4;6)	2	4	5	(2;4;5)
factor_5	regen	zoab	1	1	2	(1;1;2)	1	2	3	(1;2;3)	2	2	3	(2;2;3)
		2l-zoab	1	1	2	(1;1;2)	1	3	5	(1;3;5)	2	2	3	(2;2;3)
factor_6	vervuiling_ondergr	zoab	3	4	5	(3;4;5)	1	1	2	(1;1;2)	1	1	2	(1;1;2)
		2l-zoab	3	4	6	(3;4;6)	1	2	3	(1;2;3)	1	1	2	(1;1;2)
factor_7	vochting_ondergr	zoab	1	1	2	(1;1;2)	1	1	2	(1;1;2)	1	1	1	(1;1;1)
		2l-zoab	1	1	2	(1;1;2)	1	1	2	(1;1;2)	1	1	1	(1;1;1)
factor_8	kleef_ondergr	zoab	3	4	6	(3;4;6)	1	2	3	(1;2;3)	1	2	2	(1;2;2)
		2l-zoab	4	4	7	(4;4;7)	1	2	3	(1;2;3)	1	2	2	(1;2;2)
factor_9	freeskwal	zoab	3	4	6	(3;4;6)	2	2	3	(2;2;3)	2	2	2	(2;2;2)
		2l-zoab	4	4	7	(4;4;7)	3	3	5	(3;3;5)	1	2	2	(1;2;2)
factor_10	temp_ondergr	zoab	2	2	3	(2;2;3)	2	2	3	(2;2;3)	2	3	4	(2;3;4)
		2l-zoab	2	2	4	(2;2;4)	2	3	4	(2;3;4)	2	3	4	(2;3;4)
factor_11	verdicht_klank	zoab	2	2	4	(2;2;4)	2	2	3	(2;2;3)	3	3	4	(3;3;4)
		2l-zoab	2	2	5	(2;2;5)	2	2	3	(2;2;3)	3	3	4	(3;3;4)
factor_12	fundering_smal	zoab	3	4	7	(3;4;7)	1	1	2	(1;1;2)	4	5	6	(4;5;6)
		2l-zoab	4	4	7	(4;4;7)	1	2	3	(1;2;3)	4	5	6	(4;5;6)
factor_13	fundering_stijf	zoab	3	5	6	(3;5;6)	1	1	2	(1;1;2)	3	5	7	(3;5;7)
		2l-zoab	4	5	7	(4;5;7)	1	2	3	(1;2;3)	2	5	6	(2;5;6)
factor_14	draagkracht_onder	zoab	1	2	4	(1;2;4)	2	3	3	(2;3;3)	3	4	5	(3;4;5)
		2l-zoab	1	3	5	(1;3;5)	3	4	4	(3;4;4)	3	4	5	(3;4;5)
factor_15	varierende_homog.	zoab	2	3	5	(2;3;5)	2	2	3	(2;2;3)	1	3	4	(1;3;4)
		2l-zoab	2	3	5	(2;3;5)	3	4	5	(3;4;5)	2	4	4	(2;4;4)
factor_16	ontmenging	zoab	4	5	7	(4;5;7)	2	2	3	(2;2;3)	1	3	4	(1;3;4)
		2l-zoab	5	5	7	(5;5;7)	3	3	5	(3;3;5)	2	3	4	(2;3;4)
factor_17	rijsnelheid_hoog	zoab	3	4	7	(3;4;7)	1	1	2	(1;1;2)	1	2	3	(1;2;3)
		2l-zoab	4	4	7	(4;4;7)	1	1	2	(1;1;2)	1	2	3	(1;2;3)
factor_18	continuiteit_machine	zoab	2	4	5	(2;4;5)	2	2	3	(2;2;3)	2	4	5	(2;4;5)
		2l-zoab	2	4	6	(2;4;6)	4	4	6	(4;4;6)	2	4	5	(2;4;5)
factor_19	aanstoten_machine	zoab	1	1	3	(1;1;3)	1	1	2	(1;1;2)	1	1	1	(1;1;1)
		2l-zoab	1	2	4	(1;2;4)	2	2	3	(2;2;3)	1	1	1	(1;1;1)
factor_20	instelling_hoogte_mach	zoab	1	2	4	(1;2;4)	2	2	3	(2;2;3)	1	1	1	(1;1;1)
		2l-zoab	1	2	5	(1;2;5)	2	2	3	(2;2;3)	1	1	1	(1;1;1)
factor_21	voorverwarm_mach	zoab	3	3	7	(3;3;7)	1	2	2	(1;2;2)	1	2	3	(1;2;3)
		2l-zoab	4	4	7	(4;4;7)	2	3	3	(2;3;3)	1	2	3	(1;2;3)
factor_22	dik_asfalt	zoab	1	2	5	(1;2;5)	1	1	2	(1;1;2)	1	1	1	(1;1;1)
		2l-zoab	1	2	6	(1;2;6)	1	1	2	(1;1;2)	1	1	1	(1;1;1)
factor_23	dun_asfalt	zoab	2	3	5	(2;3;5)	2	3	3	(2;3;3)	1	1	1	(1;1;1)
		2l-zoab	3	3	6	(3;3;6)	3	4	5	(3;4;5)	1	1	1	(1;1;1)
factor_24	breedte_machine	zoab	3	3	6	(3;3;6)	1	1	2	(1;1;2)	1	2	2	(1;2;2)
		2l-zoab	4	4	6	(4;4;6)	1	2	3	(1;2;3)	1	2	2	(1;2;2)
factor_25	warm_koud_metnaad	zoab	2	3	5	(2;3;5)	2	2	3	(2;2;3)	2	2	3	(2;2;3)
		2l-zoab	2	4	6	(2;4;6)	3	4	5	(3;4;5)	2	2	3	(2;2;3)
factor_26	warm_koud_zonder	zoab	2	3	6	(2;3;6)	3	3	4	(3;3;4)	2	3	4	(2;3;4)
		2l-zoab	3	3	7	(3;3;7)	4	4	5	(4;4;5)	2	3	4	(2;3;4)
factor_27	asfaltnaad_wielspoor	zoab	2	2	5	(2;2;5)	2	3	4	(2;3;4)	1	2	3	(1;2;3)
		2l-zoab	3	3	5	(3;3;5)	4	4	6	(4;4;6)	1	2	3	(1;2;3)
factor_28	nadenplan_verkeerd	zoab	1	2	4	(1;2;4)	1	1	2	(1;1;2)	1	2	2	(1;2;2)
		2l-zoab	1	3	4	(1;3;4)	2	2	3	(2;2;3)	1	2	2	(1;2;2)
factor_29	terugharken_asfalt	zoab	3	4	7	(3;4;7)	2	2	3	(2;2;3)	1	2	2	(1;2;2)
		2l-zoab	4	5	7	(4;5;7)	3	3	5	(3;3;5)	1	2	2	(1;2;2)
factor_30	geen_wormen	zoab	4	4	7	(4;4;7)	2	3	3	(2;3;3)	1	2	3	(1;2;3)
		2l-zoab	5	5	7	(5;5;7)	3	4	5	(3;4;5)	1	2	3	(1;2;3)
factor_31	faseerd_aanbrengen	zoab	2	3	4	(2;3;4)	3	3	4	(3;3;4)	1	2	3	(1;2;3)
		2l-zoab	2	3	4	(2;3;4)	4	5	6	(4;5;6)	1	2	3	(1;2;3)
factor_32	walsinzet_hoog	zoab	1	3	6	(1;3;6)	3	4	5	(3;4;5)	2	4	5	(2;4;5)
		2l-zoab	1	4	6	(1;4;6)	5	5	6	(5;5;6)	2	3	5	(2;3;5)
factor_33	laat_walsen	zoab	4	4	7	(4;4;7)	3	4	5	(3;4;5)	3	4	5	(3;4;5)
		2l-zoab	5	5	7	(5;5;7)	5	5	6	(5;5;6)	2	3	4	(2;3;4)
factor_34	verkeerd_wals	zoab	4	5	6	(4;5;6)	2	3	3	(2;3;3)	1	2	3	(1;2;3)
		2l-zoab	5	5	7	(5;5;7)	3	4	5	(3;4;5)	1	2	3	(1;2;3)
factor_35	ongelijk_wals	zoab	3	3	7	(3;3;7)	2	3	4	(2;3;4)	1	3	4	(1;3;4)
		2l-zoab	4	4	7	(4;4;7)	4	4	6	(4;4;6)	2	3	4	(2;3;4)
factor_36	belaste_ondergr	zoab	2	4	6	(2;4;6)	1	1	1	(1;1;1)	1	1	1	(1;1;1)
		2l-zoab	3	5	7	(3;5;7)	1	2	2	(1;2;2)	1	1	1	(1;1;1)
factor_37	vroegtijdig_belast	zoab	1	2	5	(1;2;5)	2	2	2	(2;2;2)	1	1	1	(1;1;1)
		2l-zoab	1	3	6	(1;3;6)	3	3	4	(3;3;4)	1	1	1	(1;1;1)

			expert_10				expert_12				expert_13			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	2	4	7	(2;4;7)
		2l-zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	2	4	6	(2;4;6)
factor_2	afkoeling_snel	zoab	3	4	5	(3;4;5)	2	3	3	(2;3;3)	2	4	6	(2;4;6)
		2l-zoab	3	4	5	(3;4;5)	2	2	3	(2;2;3)	2	4	5	(2;4;5)
factor_3	afkoeling_langz	zoab	1	1	1	(1;1;1)	1	1	1	(1;1;1)	2	4	5	(2;4;5)
		2l-zoab	1	1	1	(1;1;1)	1	1	1	(1;1;1)	2	3	4	(2;3;4)
factor_4	temp_const	zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	2	4	5	(2;4;5)
		2l-zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	2	3	4	(2;3;4)
factor_5	regen	zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	3	5	5	(3;5;5)
		2l-zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	4	5	6	(4;5;6)
factor_6	vervuiling_ondergr	zoab	3	4	5	(3;4;5)	3	4	5	(3;4;5)	3	5	7	(3;5;7)
		2l-zoab	3	4	5	(3;4;5)	3	4	5	(3;4;5)	3	5	7	(3;5;7)
factor_7	vochting_ondergr	zoab	1	5	6	(1;5;6)	1	3	5	(1;3;5)	4	5	6	(4;5;6)
		2l-zoab	1	5	6	(1;5;6)	1	2	4	(1;2;4)	2	4	4	(2;4;4)
factor_8	kleef_ondergr	zoab	4	5	7	(4;5;7)	2	3	5	(2;3;5)	4	5	7	(4;5;7)
		2l-zoab	4	5	7	(4;5;7)	2	3	5	(2;3;5)	3	4	5	(3;4;5)
factor_9	freeskwal	zoab	2	4	6	(2;4;6)	2	3	4	(2;3;4)	4	5	6	(4;5;6)
		2l-zoab	2	4	6	(2;4;6)	2	3	4	(2;3;4)	3	5	6	(3;5;6)
factor_10	temp_ondergr	zoab	1	3	6	(1;3;6)	1	2	3	(1;2;3)	2	4	6	(2;4;6)
		2l-zoab	1	3	6	(1;3;6)	1	2	2	(1;2;2)	2	3	5	(2;3;5)
factor_11	verdicht_klank	zoab	2	3	6	(2;3;6)	3	4	5	(3;4;5)	3	4	6	(3;4;6)
		2l-zoab	2	3	6	(2;3;6)	3	4	5	(3;4;5)	3	4	6	(3;4;6)
factor_12	fundering_smal	zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	5	5	6	(5;5;6)
		2l-zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	5	5	6	(5;5;6)
factor_13	fundering_stijf	zoab	2	4	6	(2;4;6)	2	4	5	(2;4;5)	2	5	7	(2;5;7)
		2l-zoab	2	4	6	(2;4;6)	2	4	5	(2;4;5)	2	5	7	(2;5;7)
factor_14	draagkracht_onder	zoab	4	5	6	(4;5;6)	3	4	5	(3;4;5)	3	4	6	(3;4;6)
		2l-zoab	4	5	6	(4;5;6)	3	4	5	(3;4;5)	3	4	6	(3;4;6)
factor_15	varierende_homog.	zoab	2	4	6	(2;4;6)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
		2l-zoab	2	4	6	(2;4;6)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
factor_16	ontmenging	zoab	2	4	6	(2;4;6)	2	3	4	(2;3;4)	2	3	3	(2;3;3)
		2l-zoab	2	4	6	(2;4;6)	2	3	4	(2;3;4)	2	3	3	(2;3;3)
factor_17	rijsnelheid_hoog	zoab	2	3	4	(2;3;4)	3	4	5	(3;4;5)	2	3	5	(2;3;5)
		2l-zoab	2	3	4	(2;3;4)	3	4	5	(3;4;5)	2	3	5	(2;3;5)
factor_18	continuiteit_machine	zoab	2	3	6	(2;3;6)	3	4	5	(3;4;5)	2	3	4	(2;3;4)
		2l-zoab	2	3	6	(2;3;6)	3	4	5	(3;4;5)	2	3	4	(2;3;4)
factor_19	aanstoten_machine	zoab	1	2	3	(1;2;3)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
		2l-zoab	1	2	3	(1;2;3)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
factor_20	instelling_hoogte_mach	zoab	1	1	1	(1;1;1)	1	1	1	(1;1;1)	3	4	5	(3;4;5)
		2l-zoab	1	1	1	(1;1;1)	1	2	2	(1;2;2)	3	4	5	(3;4;5)
factor_21	voorverwarm_mach	zoab	2	4	6	(2;4;6)	2	3	4	(2;3;4)	2	4	6	(2;4;6)
		2l-zoab	2	4	6	(2;4;6)	2	3	4	(2;3;4)	2	4	6	(2;4;6)
factor_22	dik_asfalt	zoab	1	1	1	(1;1;1)	2	3	4	(2;3;4)	2	2	3	(2;2;3)
		2l-zoab	1	1	1	(1;1;1)	2	3	4	(2;3;4)	2	2	3	(2;2;3)
factor_23	dun_asfalt	zoab	2	3	6	(2;3;6)	2	3	4	(2;3;4)	3	5	6	(3;5;6)
		2l-zoab	2	3	6	(2;3;6)	2	3	4	(2;3;4)	3	5	6	(3;5;6)
factor_24	breedte_machine	zoab	1	1	1	(1;1;1)	1	2	3	(1;2;3)	3	5	6	(3;5;6)
		2l-zoab	1	1	1	(1;1;1)	1	2	3	(1;2;3)	3	5	6	(3;5;6)
factor_25	warm_koud_metnaad	zoab	2	3	4	(2;3;4)	1	1	2	(1;1;2)	2	3	4	(2;3;4)
		2l-zoab	2	3	4	(2;3;4)	1	1	2	(1;1;2)	2	3	4	(2;3;4)
factor_26	warm_koud_zonder	zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	3	5	6	(3;5;6)
		2l-zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	3	5	6	(3;5;6)
factor_27	asfaltnaad_wielspoor	zoab	4	5	6	(4;5;6)	3	4	5	(3;4;5)	4	6	7	(4;6;7)
		2l-zoab	4	5	6	(4;5;6)	3	4	5	(3;4;5)	4	6	7	(4;6;7)
factor_28	nadenplan_verkeerd	zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	4	5	6	(4;5;6)
		2l-zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	4	5	6	(4;5;6)
factor_29	terugharken_asfalt	zoab	2	2	3	(2;2;3)	1	2	3	(1;2;3)	3	4	5	(3;4;5)
		2l-zoab	2	2	3	(2;2;3)	1	2	3	(1;2;3)	3	4	5	(3;4;5)
factor_30	geen_wormen	zoab	1	2	3	(1;2;3)	2	3	4	(2;3;4)	3	5	6	(3;5;6)
		2l-zoab	1	2	3	(1;2;3)	2	3	4	(2;3;4)	3	5	6	(3;5;6)
factor_31	faseerd_aanbrengen	zoab	3	4	5	(3;4;5)	1	1	2	(1;1;2)	2	3	4	(2;3;4)
		2l-zoab	3	4	5	(3;4;5)	1	1	2	(1;1;2)	2	3	4	(2;3;4)
factor_32	walsinzet_hoog	zoab	2	3	4	(2;3;4)	2	4	6	(2;4;6)	3	5	6	(3;5;6)
		2l-zoab	2	3	4	(2;3;4)	2	4	6	(2;4;6)	3	4	5	(3;4;5)
factor_33	laat_walsen	zoab	4	5	6	(4;5;6)	3	4	5	(3;4;5)	4	5	6	(4;5;6)
		2l-zoab	4	5	6	(4;5;6)	3	4	5	(3;4;5)	3	4	5	(3;4;5)
factor_34	verkeerd_wals	zoab	3	4	5	(3;4;5)	3	5	6	(3;5;6)	3	4	6	(3;4;6)
		2l-zoab	3	4	5	(3;4;5)	3	4	6	(3;4;6)	3	4	6	(3;4;6)
factor_35	ongelijk_wals	zoab	2	3	4	(2;3;4)	1	3	5	(1;3;5)	3	5	6	(3;5;6)
		2l-zoab	2	3	4	(2;3;4)	1	3	5	(1;3;5)	2	4	5	(2;4;5)
factor_36	belaste_ondergr	zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	2	5	6	(2;5;6)
		2l-zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	2	5	6	(2;5;6)
factor_37	vroegtijdig_belast	zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	2	4	5	(2;4;5)
		2l-zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	2	4	5	(2;4;5)

			expert_14				expert_15				expert_17			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	2	4	7	(2;4;7)	4	6	7	(4;6;7)	4	5	7	(4;5;7)
		2l-zoab	2	4	7	(2;4;7)	5	6	7	(5;6;7)	3	4	7	(3;4;7)
factor_2	afkoeling_snel	zoab	1	1	4	(1;1;4)	4	6	7	(4;6;7)	4	5	7	(4;5;7)
		2l-zoab	1	1	4	(1;1;4)	5	6	7	(5;6;7)	3	4	7	(3;4;7)
factor_3	afkoeling_langz	zoab	1	1	1	(1;1;1)	3	4	5	(3;4;5)	1	2	3	(1;2;3)
		2l-zoab	1	1	1	(1;1;1)	3	4	5	(3;4;5)	1	2	3	(1;2;3)
factor_4	temp_const	zoab	2	4	7	(2;4;7)	2	4	6	(2;4;6)	3	4	7	(3;4;7)
		2l-zoab	2	4	7	(2;4;7)	2	4	6	(2;4;6)	2	3	7	(2;3;7)
factor_5	regen	zoab	2	5	7	(2;5;7)	2	4	6	(2;4;6)	5	6	7	(5;6;7)
		2l-zoab	2	5	7	(2;5;7)	2	4	7	(2;4;7)	1	4	6	(1;4;6)
factor_6	vervuiling_ondergr	zoab	2	5	7	(2;5;7)	1	4	6	(1;4;6)	2	3	7	(2;3;7)
		2l-zoab	2	5	7	(2;5;7)	1	4	6	(1;4;6)	2	3	7	(2;3;7)
factor_7	vochting_ondergr	zoab	2	4	6	(2;4;6)	1	4	7	(1;4;7)	2	4	7	(2;4;7)
		2l-zoab	2	4	6	(2;4;6)	1	4	7	(1;4;7)	1	3	6	(1;3;6)
factor_8	kleef_ondergr	zoab	2	4	6	(2;4;6)	1	4	7	(1;4;7)	2	5	7	(2;5;7)
		2l-zoab	2	4	6	(2;4;6)	2	4	7	(2;4;7)	1	3	6	(1;3;6)
factor_9	freeskwal	zoab	1	2	3	(1;2;3)	1	2	4	(1;2;4)	2	3	6	(2;3;6)
		2l-zoab	1	2	3	(1;2;3)	1	3	4	(1;3;4)	2	3	6	(2;3;6)
factor_10	temp_ondergr	zoab	1	1	4	(1;1;4)	1	4	6	(1;4;6)	2	3	4	(2;3;4)
		2l-zoab	1	1	4	(1;1;4)	1	4	6	(1;4;6)	2	3	4	(2;3;4)
factor_11	verdicht_klank	zoab	2	4	7	(2;4;7)	2	4	7	(2;4;7)	1	1	3	(1;1;3)
		2l-zoab	2	4	6	(2;4;6)	3	5	7	(3;5;7)	1	1	3	(1;1;3)
factor_12	fundering_smal	zoab	1	4	7	(1;4;7)	2	4	7	(2;4;7)	1	1	1	(1;1;1)
		2l-zoab	1	4	7	(1;4;7)	3	5	7	(3;5;7)	1	1	1	(1;1;1)
factor_13	fundering_stijf	zoab	1	1	1	(1;1;1)	2	4	7	(2;4;7)	1	1	1	(1;1;1)
		2l-zoab	1	1	1	(1;1;1)	3	5	7	(3;5;7)	1	1	1	(1;1;1)
factor_14	draagkracht_onder	zoab	1	5	7	(1;5;7)	2	4	7	(2;4;7)	1	2	6	(1;2;6)
		2l-zoab	1	5	7	(1;5;7)	2	4	7	(2;4;7)	1	2	6	(1;2;6)
factor_15	varierende_homog.	zoab	2	5	7	(2;5;7)	1	4	6	(1;4;6)	3	4	7	(3;4;7)
		2l-zoab	2	5	7	(2;5;7)	1	4	6	(1;4;6)	3	4	7	(3;4;7)
factor_16	ontmenging	zoab	2	5	7	(2;5;7)	2	4	7	(2;4;7)	3	5	7	(3;5;7)
		2l-zoab	2	5	7	(2;5;7)	2	4	7	(2;4;7)	3	5	7	(3;5;7)
factor_17	rijsnelheid_hoog	zoab	1	3	4	(1;3;4)	2	4	7	(2;4;7)	1	2	7	(1;2;7)
		2l-zoab	1	3	4	(1;3;4)	2	4	7	(2;4;7)	1	2	7	(1;2;7)
factor_18	continuiteit_machine	zoab	2	3	5	(2;3;5)	2	4	6	(2;4;6)	1	4	6	(1;4;6)
		2l-zoab	2	3	5	(2;3;5)	2	4	6	(2;4;6)	1	4	6	(1;4;6)
factor_19	aanstoten_machine	zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	1	4	6	(1;4;6)
		2l-zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	1	4	6	(1;4;6)
factor_20	instelling_hoogte_mach	zoab	2	3	4	(2;3;4)	1	4	6	(1;4;6)	1	2	7	(1;2;7)
		2l-zoab	2	3	4	(2;3;4)	1	4	6	(1;4;6)	1	2	7	(1;2;7)
factor_21	voorverwarm_mach	zoab	2	3	5	(2;3;5)	1	3	5	(1;3;5)	2	3	6	(2;3;6)
		2l-zoab	2	4	6	(2;4;6)	1	3	5	(1;3;5)	2	3	6	(2;3;6)
factor_22	dik_asfalt	zoab	1	2	3	(1;2;3)	1	3	6	(1;3;6)	1	1	1	(1;1;1)
		2l-zoab	1	2	3	(1;2;3)	1	3	6	(1;3;6)	1	1	1	(1;1;1)
factor_23	dun_asfalt	zoab	1	2	3	(1;2;3)	1	4	7	(1;4;7)	1	3	6	(1;3;6)
		2l-zoab	1	2	3	(1;2;3)	1	4	7	(1;4;7)	2	5	7	(2;5;7)
factor_24	breedte_machine	zoab	2	4	7	(2;4;7)	1	3	5	(1;3;5)	1	2	3	(1;2;3)
		2l-zoab	3	5	7	(3;5;7)	1	3	5	(1;3;5)	1	2	3	(1;2;3)
factor_25	warm_koud_metnaad	zoab	1	1	1	(1;1;1)	2	4	7	(2;4;7)	1	1	3	(1;1;3)
		2l-zoab	1	1	1	(1;1;1)	2	4	7	(2;4;7)	1	1	3	(1;1;3)
factor_26	warm_koud_zonder	zoab	1	3	6	(1;3;6)	3	5	7	(3;5;7)	2	4	7	(2;4;7)
		2l-zoab	1	4	7	(1;4;7)	3	5	7	(3;5;7)	2	4	7	(2;4;7)
factor_27	asfaltnaad_wielspoor	zoab	3	5	7	(3;5;7)	2	5	7	(2;5;7)	6	7	7	(6;7;7)
		2l-zoab	3	5	7	(3;5;7)	2	5	7	(2;5;7)	6	7	7	(6;7;7)
factor_28	nadenplan_verkeerd	zoab	2	5	7	(2;5;7)	2	5	7	(2;5;7)	1	3	7	(1;3;7)
		2l-zoab	2	5	7	(2;5;7)	2	5	7	(2;5;7)	1	3	7	(1;3;7)
factor_29	terugharken_asfalt	zoab	1	2	3	(1;2;3)	1	4	6	(1;4;6)	1	2	3	(1;2;3)
		2l-zoab	1	2	3	(1;2;3)	1	4	6	(1;4;6)	1	2	3	(1;2;3)
factor_30	geen_wormen	zoab	3	5	7	(3;5;7)	1	3	5	(1;3;5)	1	2	3	(1;2;3)
		2l-zoab	3	6	7	(3;6;7)	1	3	5	(1;3;5)	1	2	3	(1;2;3)
factor_31	faseerd_aanbrengen	zoab	1	1	1	(1;1;1)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
		2l-zoab	1	1	1	(1;1;1)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
factor_32	walsinzet_hoog	zoab	1	1	1	(1;1;1)	2	4	6	(2;4;6)	3	6	7	(3;6;7)
		2l-zoab	1	1	1	(1;1;1)	2	5	7	(2;5;7)	3	6	7	(3;6;7)
factor_33	laat_walsen	zoab	2	4	7	(2;4;7)	2	4	6	(2;4;6)	2	5	7	(2;5;7)
		2l-zoab	2	5	7	(2;5;7)	2	4	6	(2;4;6)	2	5	7	(2;5;7)
factor_34	verkeerd_wals	zoab	3	6	7	(3;6;7)	2	4	6	(2;4;6)	3	4	6	(3;4;6)
		2l-zoab	3	6	7	(3;6;7)	2	4	6	(2;4;6)	3	4	6	(3;4;6)
factor_35	ongelijk_wals	zoab	2	4	6	(2;4;6)	1	3	5	(1;3;5)	1	3	5	(1;3;5)
		2l-zoab	2	4	6	(2;4;6)	1	4	6	(1;4;6)	1	3	5	(1;3;5)
factor_36	belaste_ondergr	zoab	2	4	7	(2;4;7)	1	3	6	(1;3;6)	1	3	7	(1;3;7)
		2l-zoab	2	4	7	(2;4;7)	1	3	6	(1;3;6)	1	3	7	(1;3;7)
factor_37	vroegtijdig_belast	zoab	2	3	5	(2;3;5)	2	4	7	(2;4;7)	1	3	5	(1;3;5)
		2l-zoab	2	3	5	(2;3;5)	3	5	7	(3;5;7)	1	3	5	(1;3;5)

			expert_18				expert_19				expert_20			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	3	5	6	(3;5;6)	3	4	6	(3;4;6)	3	3	7	(3;3;7)
		2l-zoab	4	6	7	(4;6;7)	3	4	6	(3;4;6)	3	3	7	(3;3;7)
factor_2	afkoeling_snel	zoab	2	2	3	(2;2;3)	3	4	5	(3;4;5)	4	5	7	(4;5;7)
		2l-zoab	3	3	4	(3;3;4)	3	4	5	(3;4;5)	4	5	7	(4;5;7)
factor_3	afkoeling_langz	zoab	1	1	1	(1;1;1)	3	4	6	(3;4;6)	2	3	3	(2;3;3)
		2l-zoab	1	1	1	(1;1;1)	3	4	6	(3;4;6)	2	3	3	(2;3;3)
factor_4	temp_const	zoab	3	4	5	(3;4;5)	1	3	4	(1;3;4)	5	5	6	(5;5;6)
		2l-zoab	4	6	7	(4;6;7)	1	3	4	(1;3;4)	5	5	6	(5;5;6)
factor_5	regen	zoab	1	1	2	(1;1;2)	1	2	4	(1;2;4)	2	2	4	(2;2;4)
		2l-zoab	1	1	3	(1;1;3)	1	2	4	(1;2;4)	2	2	4	(2;2;4)
factor_6	vervuiling_ondergr	zoab	2	3	3	(2;3;3)	2	4	6	(2;4;6)	3	4	7	(3;4;7)
		2l-zoab	5	6	7	(5;6;7)	2	4	6	(2;4;6)	3	4	7	(3;4;7)
factor_7	vochting_ondergr	zoab	1	2	4	(1;2;4)	1	2	4	(1;2;4)	3	3	5	(3;3;5)
		2l-zoab	1	3	6	(1;3;6)	1	2	4	(1;2;4)	3	3	5	(3;3;5)
factor_8	kleef_ondergr	zoab	2	3	3	(2;3;3)	3	5	7	(3;5;7)	2	3	4	(2;3;4)
		2l-zoab	5	6	7	(5;6;7)	3	5	7	(3;5;7)	2	3	4	(2;3;4)
factor_9	freeskwal	zoab	3	4	5	(3;4;5)	2	4	6	(2;4;6)	4	4	6	(4;4;6)
		2l-zoab	3	4	5	(3;4;5)	2	4	6	(2;4;6)	4	4	6	(4;4;6)
factor_10	temp_ondergr	zoab	3	4	4	(3;4;4)	1	4	6	(1;4;6)	4	5	7	(4;5;7)
		2l-zoab	5	6	7	(5;6;7)	1	4	6	(1;4;6)	4	5	7	(4;5;7)
factor_11	verdicht_klank	zoab	1	1	1	(1;1;1)	1	2	3	(1;2;3)	5	5	7	(5;5;7)
		2l-zoab	1	1	1	(1;1;1)	1	2	3	(1;2;3)	5	5	7	(5;5;7)
factor_12	fundering_smal	zoab	1	1	1	(1;1;1)	2	3	5	(2;3;5)	4	4	7	(4;4;7)
		2l-zoab	1	1	1	(1;1;1)	2	3	5	(2;3;5)	4	4	7	(4;4;7)
factor_13	fundering_stijf	zoab	3	4	6	(3;4;6)	1	4	6	(1;4;6)	3	3	5	(3;3;5)
		2l-zoab	2	4	5	(2;4;5)	1	4	6	(1;4;6)	3	3	5	(3;3;5)
factor_14	draagkracht_onder	zoab	3	4	5	(3;4;5)	2	4	7	(2;4;7)	5	5	7	(5;5;7)
		2l-zoab	3	4	5	(3;4;5)	2	4	7	(2;4;7)	5	5	7	(5;5;7)
factor_15	varierende_homog.	zoab	1	1	1	(1;1;1)	2	4	7	(2;4;7)	3	3	4	(3;3;4)
		2l-zoab	1	1	1	(1;1;1)	2	4	7	(2;4;7)	3	3	4	(3;3;4)
factor_16	ontmenging	zoab	1	1	1	(1;1;1)	3	5	7	(3;5;7)	3	4	6	(3;4;6)
		2l-zoab	1	1	1	(1;1;1)	3	5	7	(3;5;7)	3	4	6	(3;4;6)
factor_17	rijsnelheid_hoog	zoab	2	3	5	(2;3;5)	2	5	7	(2;5;7)	2	2	3	(2;2;3)
		2l-zoab	2	3	4	(2;3;4)	2	5	7	(2;5;7)	2	2	3	(2;2;3)
factor_18	continuiteit_machine	zoab	5	6	7	(5;6;7)	2	4	5	(2;4;5)	3	3	6	(3;3;6)
		2l-zoab	6	7	7	(6;7;7)	2	4	5	(2;4;5)	3	3	6	(3;3;6)
factor_19	aanstoten_machine	zoab	1	2	3	(1;2;3)	1	2	3	(1;2;3)	2	2	3	(2;2;3)
		2l-zoab	1	2	3	(1;2;3)	1	2	3	(1;2;3)	2	2	3	(2;2;3)
factor_20	instelling_hoogte_mach	zoab	3	4	5	(3;4;5)	2	3	4	(2;3;4)	2	2	3	(2;2;3)
		2l-zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	2	2	3	(2;2;3)
factor_21	voorverwarm_mach	zoab	5	6	7	(5;6;7)	2	4	5	(2;4;5)	4	4	7	(4;4;7)
		2l-zoab	5	6	7	(5;6;7)	2	4	5	(2;4;5)	4	4	7	(4;4;7)
factor_22	dik_asfalt	zoab	1	1	2	(1;1;2)	2	4	6	(2;4;6)	2	2	3	(2;2;3)
		2l-zoab	1	1	2	(1;1;2)	2	4	6	(2;4;6)	2	2	3	(2;2;3)
factor_23	dun_asfalt	zoab	3	4	6	(3;4;6)	2	4	6	(2;4;6)	2	2	4	(2;2;4)
		2l-zoab	4	5	7	(4;5;7)	2	4	6	(2;4;6)	2	2	4	(2;2;4)
factor_24	breedte_machine	zoab	1	1	1	(1;1;1)	2	3	5	(2;3;5)	2	2	2	(2;2;2)
		2l-zoab	1	1	1	(1;1;1)	2	3	5	(2;3;5)	2	2	2	(2;2;2)
factor_25	warm_koud_metnaad	zoab	2	2	2	(2;2;2)	2	3	5	(2;3;5)	3	3	4	(3;3;4)
		2l-zoab	2	2	2	(2;2;2)	2	3	5	(2;3;5)	3	3	4	(3;3;4)
factor_26	warm_koud_zonder	zoab	4	4	4	(4;4;4)	3	4	5	(3;4;5)	3	4	5	(3;4;5)
		2l-zoab	4	4	4	(4;4;4)	3	4	5	(3;4;5)	3	4	5	(3;4;5)
factor_27	asfaltnaad_wielspoor	zoab	5	6	7	(5;6;7)	3	4	6	(3;4;6)	6	6	7	(6;6;7)
		2l-zoab	5	6	7	(5;6;7)	3	4	6	(3;4;6)	6	6	7	(6;6;7)
factor_28	nadenplan_verkeerd	zoab	3	4	6	(3;4;6)	2	4	6	(2;4;6)	5	6	7	(5;6;7)
		2l-zoab	2	4	5	(2;4;5)	2	4	6	(2;4;6)	5	6	7	(5;6;7)
factor_29	terugharken_asfalt	zoab	3	4	5	(3;4;5)	2	4	5	(2;4;5)	4	5	6	(4;5;6)
		2l-zoab	4	5	7	(4;5;7)	2	4	5	(2;4;5)	4	5	6	(4;5;6)
factor_30	geen_wormen	zoab	2	2	3	(2;2;3)	2	3	5	(2;3;5)	4	5	6	(4;5;6)
		2l-zoab	2	2	3	(2;2;3)	2	3	5	(2;3;5)	4	5	6	(4;5;6)
factor_31	faseerd_aanbrengen	zoab	4	4	4	(4;4;4)	3	4	6	(3;4;6)	3	4	5	(3;4;5)
		2l-zoab	4	4	4	(4;4;4)	3	4	6	(3;4;6)	3	4	5	(3;4;5)
factor_32	walsinzet_hoog	zoab	2	3	3	(2;3;3)	2	5	7	(2;5;7)	5	6	7	(5;6;7)
		2l-zoab	2	3	3	(2;3;3)	2	5	7	(2;5;7)	5	6	7	(5;6;7)
factor_33	laat_walsen	zoab	3	5	6	(3;5;6)	2	4	7	(2;4;7)	5	6	7	(5;6;7)
		2l-zoab	4	6	7	(4;6;7)	2	4	7	(2;4;7)	5	6	7	(5;6;7)
factor_34	verkeerd_wals	zoab	4	5	6	(4;5;6)	3	5	7	(3;5;7)	5	6	7	(5;6;7)
		2l-zoab	5	6	7	(5;6;7)	3	5	7	(3;5;7)	5	6	7	(5;6;7)
factor_35	ongelijk_wals	zoab				(;;)	2	4	6	(2;4;6)	4	5	6	(4;5;6)
		2l-zoab				(;;)	2	4	6	(2;4;6)	4	5	6	(4;5;6)
factor_36	belaste_ondergr	zoab	1	1	1	(1;1;1)	2	4	6	(2;4;6)	3	3	4	(3;3;4)
		2l-zoab	1	1	1	(1;1;1)	2	4	6	(2;4;6)	3	3	4	(3;3;4)
factor_37	vroegtijdig_belast	zoab	2	4	6	(2;4;6)	2	3	5	(2;3;5)	3	4	5	(3;4;5)
		2l-zoab	3	5	7	(3;5;7)	2	3	5	(2;3;5)	3	4	5	(3;4;5)

Appendix E Dataset with Seven-Point Scale for Lifespan Phase

			expert_2				expert_3				expert_6			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	1	3	6	(1;3;6)
		2l-zoab	3	4	5	(3;4;5)	1	2	3	(1;2;3)	1	4	6	(1;4;6)
factor_2	regen+vorst	zoab	2	4	5	(2;4;5)	1	1	1	(1;1;1)	3	3	6	(3;3;6)
		2l-zoab	3	5	6	(3;5;6)	1	1	1	(1;1;1)	4	4	6	(4;4;6)
factor_3	koude_nachten	zoab	1	1	2	(1;1;2)	1	1	1	(1;1;1)	2	3	5	(2;3;5)
		2l-zoab	1	1	2	(1;1;2)	1	1	1	(1;1;1)	2	3	5	(2;3;5)
factor_4	regen	zoab	1	2	3	(1;2;3)	1	1	1	(1;1;1)	2	3	4	(2;3;4)
		2l-zoab	1	2	3	(1;2;3)	1	1	1	(1;1;1)	2	3	4	(2;3;4)
factor_5	zomerhitte	zoab	1	2	3	(1;2;3)	1	1	2	(1;1;2)	2	3	5	(2;3;5)
		2l-zoab	1	2	3	(1;2;3)	1	1	2	(1;1;2)	2	3	5	(2;3;5)
factor_6	uv-straling	zoab	2	3	4	(2;3;4)	2	2	3	(2;2;3)	1	3	5	(1;3;5)
		2l-zoab	2	3	4	(2;3;4)	2	2	3	(2;2;3)	1	3	5	(1;3;5)
factor_7	struct_toename_verkeer	zoab	2	2	4	(2;2;4)	2	2	3	(2;2;3)	1	3	5	(1;3;5)
		2l-zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	1	3	5	(1;3;5)
factor_8	struct_zwaarder_verkeer	zoab	2	3	4	(2;3;4)	2	2	3	(2;2;3)	3	3	7	(3;3;7)
		2l-zoab	3	4	5	(3;4;5)	2	3	4	(2;3;4)	3	3	7	(3;3;7)
factor_9	tijdel_zwaarder_verkeer	zoab	1	2	3	(1;2;3)	1	1	2	(1;1;2)	2	2	4	(2;2;4)
		2l-zoab	1	2	4	(1;2;4)	1	2	3	(1;2;3)	2	2	4	(2;2;4)
factor_10	struct_wringend_verkeer	zoab	3	4	6	(3;4;6)	2	6	7	(2;6;7)	3	3	6	(3;3;6)
		2l-zoab	4	5	7	(4;5;7)	3	7	7	(3;7;7)	3	3	7	(3;3;7)
factor_11	tijdel_wringend_verkeer	zoab	2	3	5	(2;3;5)	2	2	3	(2;2;3)	3	3	6	(3;3;6)
		2l-zoab	2	3	6	(2;3;6)	3	3	4	(3;3;4)	3	3	7	(3;3;7)
factor_12	krappe_bochten	zoab	2	4	5	(2;4;5)	3	3	4	(3;3;4)	1	3	5	(1;3;5)
		2l-zoab	2	5	6	(2;5;6)	4	4	5	(4;4;5)	1	3	5	(1;3;5)
factor_13	files	zoab	2	2	4	(2;2;4)	1	2	3	(1;2;3)	1	2	4	(1;2;4)
		2l-zoab	2	2	4	(2;2;4)	2	3	4	(2;3;4)	1	2	4	(1;2;4)
factor_14	verhoging_snelheid	zoab	1	1	1	(1;1;1)	1	1	1	(1;1;1)	1	1	2	(1;1;2)
		2l-zoab	1	1	1	(1;1;1)	1	1	1	(1;1;1)	1	1	2	(1;1;2)
factor_15	ov_versporing	zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	3	3	5	(3;3;5)
		2l-zoab	2	3	4	(2;3;4)	3	4	5	(3;4;5)	4	4	6	(4;4;6)
factor_16	verontreiniging	zoab	2	3	5	(2;3;5)	2	3	5	(2;3;5)	3	3	6	(3;3;6)
		2l-zoab	3	4	6	(3;4;6)	2	4	6	(2;4;6)	3	4	7	(3;4;7)
factor_17	bomen	zoab	2	2	3	(2;2;3)	2	2	3	(2;2;3)	1	2	3	(1;2;3)
		2l-zoab	2	2	3	(2;2;3)	2	2	3	(2;2;3)	1	2	3	(1;2;3)
factor_18	ov_afwatering	zoab	2	3	5	(2;3;5)	4	6	7	(4;6;7)	3	3	6	(3;3;6)
		2l-zoab	3	4	6	(3;4;6)	4	6	7	(4;6;7)	3	4	7	(3;4;7)
factor_19	gras_ingroei	zoab	2	2	3	(2;2;3)	3	4	5	(3;4;5)	3	3	6	(3;3;6)
		2l-zoab	2	3	4	(2;3;4)	3	4	5	(3;4;5)	3	4	7	(3;4;7)
factor_20	stenen/rafeling	zoab	3	4	6	(3;4;6)	2	3	4	(2;3;4)	3	4	6	(3;4;6)
		2l-zoab	4	5	7	(4;5;7)	3	4	5	(3;4;5)	4	5	7	(4;5;7)
factor_21	strooizout	zoab	2	2	3	(2;2;3)	1	1	1	(1;1;1)	1	3	4	(1;3;4)
		2l-zoab	2	3	4	(2;3;4)	1	1	1	(1;1;1)	1	3	5	(1;3;5)
factor_22	kadaver	zoab	2	2	4	(2;2;4)	2	3	5	(2;3;5)	4	5	7	(4;5;7)
		2l-zoab	2	3	4	(2;3;4)	2	3	5	(2;3;5)	5	6	7	(5;6;7)
factor_23	olie	zoab	3	5	6	(3;5;6)	5	5	7	(5;5;7)	4	6	7	(4;6;7)
		2l-zoab	3	5	6	(3;5;6)	5	5	7	(5;5;7)	5	6	7	(5;6;7)
factor_24	benzine	zoab	3	5	6	(3;5;6)	5	5	7	(5;5;7)	4	5	7	(4;5;7)
		2l-zoab	3	5	6	(3;5;6)	5	5	7	(5;5;7)	5	6	7	(5;6;7)
factor_25	restzettingen	zoab	2	3	5	(2;3;5)	3	5	7	(3;5;7)	1	4	5	(1;4;5)
		2l-zoab	2	4	5	(2;4;5)	3	5	7	(3;5;7)	1	5	7	(1;5;7)
factor_26	slappe_ondergrond	zoab	4	5	7	(4;5;7)	5	6	7	(5;6;7)	3	5	6	(3;5;6)
		2l-zoab	4	5	7	(4;5;7)	5	6	7	(5;6;7)	3	5	7	(3;5;7)
factor_27	hoog_grondwater	zoab	4	5	6	(4;5;6)	6	7	7	(6;7;7)	3	5	7	(3;5;7)
		2l-zoab	4	5	6	(4;5;6)	6	7	7	(6;7;7)	3	6	7	(3;6;7)
factor_28	wallschade	zoab	3	5	6	(3;5;6)	6	7	7	(6;7;7)	4	5	7	(4;5;7)
		2l-zoab	3	5	6	(3;5;6)	6	7	7	(6;7;7)	5	5	7	(5;5;7)
factor_29	oneigenlijk_gebruik	zoab	3	5	7	(3;5;7)	4	6	7	(4;6;7)	3	4	7	(3;4;7)
		2l-zoab	3	5	7	(3;5;7)	5	7	7	(5;7;7)	4	5	7	(4;5;7)
factor_30	reinigen_borstel	zoab	3	3	5	(3;3;5)	5	6	7	(5;6;7)	1	3	4	(1;3;4)
		2l-zoab	3	3	5	(3;3;5)	6	7	7	(6;7;7)	1	3	5	(1;3;5)
factor_31	verwijderde_markering	zoab	2	3	5	(2;3;5)	3	6	7	(3;6;7)	4	5	7	(4;5;7)
		2l-zoab	2	3	5	(2;3;5)	4	7	7	(4;7;7)	5	6	7	(5;6;7)
factor_32	detectielus	zoab	2	3	5	(2;3;5)	2	4	5	(2;4;5)	1	3	7	(1;3;7)
		2l-zoab	2	3	5	(2;3;5)	3	5	6	(3;5;6)	1	4	7	(1;4;7)
factor_33	bezweken_voeg	zoab	3	4	5	(3;4;5)	6	7	7	(6;7;7)	3	4	7	(3;4;7)
		2l-zoab	3	4	5	(3;4;5)	7	7	7	(7;7;7)	4	5	7	(4;5;7)
factor_34	krasschade	zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	4	5	7	(4;5;7)
		2l-zoab	2	3	4	(2;3;4)	3	4	5	(3;4;5)	5	5	7	(5;5;7)
factor_35	langshelling	zoab	1	1	3	(1;1;3)	2	3	5	(2;3;5)	1	2	2	(1;2;2)
		2l-zoab	1	1	3	(1;1;3)	3	4	6	(3;4;6)	1	2	2	(1;2;2)
factor_36	verschil_ouderdom	zoab	1	2	3	(1;2;3)	1	2	2	(1;2;2)	3	4	7	(3;4;7)
		2l-zoab	1	2	3	(1;2;3)	1	3	3	(1;3;3)	4	5	7	(4;5;7)

			expert_7				expert_9				expert_12			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	2	3	4	(2;3;4)	1	2	4	(1;2;4)	1	4	5	(1;4;5)
		2l-zoab	2	3	5	(2;3;5)	1	2	4	(1;2;4)	1	3	4	(1;3;4)
factor_2	regen+vorst	zoab	3	3	4	(3;3;4)	1	2	3	(1;2;3)	3	4	6	(3;4;6)
		2l-zoab	4	4	5	(4;4;5)	1	2	3	(1;2;3)	2	3	5	(2;3;5)
factor_3	koude_nachten	zoab	2	3	3	(2;3;3)	1	2	3	(1;2;3)	1	2	3	(1;2;3)
		2l-zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	1	2	3	(1;2;3)
factor_4	regen	zoab	1	2	2	(1;2;2)	1	2	3	(1;2;3)	1	1	1	(1;1;1)
		2l-zoab	1	2	2	(1;2;2)	1	2	3	(1;2;3)	1	1	1	(1;1;1)
factor_5	zomerhitte	zoab	1	1	2	(1;1;2)	1	2	3	(1;2;3)	2	3	5	(2;3;5)
		2l-zoab	1	1	2	(1;1;2)	1	2	3	(1;2;3)	2	3	5	(2;3;5)
factor_6	uv-straling	zoab	1	2	2	(1;2;2)	1	2	3	(1;2;3)	3	4	6	(3;4;6)
		2l-zoab	1	2	3	(1;2;3)	1	2	3	(1;2;3)	3	3	6	(3;3;6)
factor_7	struct_toename_verkeer	zoab	1	2	3	(1;2;3)	1	2	3	(1;2;3)	3	4	7	(3;4;7)
		2l-zoab	2	3	5	(2;3;5)	1	2	3	(1;2;3)	2	3	6	(2;3;6)
factor_8	struct_zwaarder_verkeer	zoab	2	2	3	(2;2;3)	1	1	2	(1;1;2)	2	4	7	(2;4;7)
		2l-zoab	3	3	4	(3;3;4)	2	2	3	(2;2;3)	2	4	7	(2;4;7)
factor_9	tijdel_zwaarder_verkeer	zoab	1	2	3	(1;2;3)	1	1	1	(1;1;1)	1	3	5	(1;3;5)
		2l-zoab	1	2	4	(1;2;4)	1	1	2	(1;1;2)	1	3	5	(1;3;5)
factor_10	struct_wringend_verkeer	zoab	3	4	4	(3;4;4)	1	3	4	(1;3;4)	2	4	7	(2;4;7)
		2l-zoab	4	5	7	(4;5;7)	2	4	5	(2;4;5)	2	3	7	(2;3;7)
factor_11	tijdel_wringend_verkeer	zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	2	4	6	(2;4;6)
		2l-zoab	4	5	6	(4;5;6)	1	3	4	(1;3;4)	2	4	6	(2;4;6)
factor_12	krappe_bochten	zoab	3	4	5	(3;4;5)	2	2	3	(2;2;3)	2	4	6	(2;4;6)
		2l-zoab	4	5	7	(4;5;7)	3	3	4	(3;3;4)	2	4	6	(2;4;6)
factor_13	files	zoab	2	4	5	(2;4;5)	1	2	3	(1;2;3)	2	4	5	(2;4;5)
		2l-zoab	3	5	7	(3;5;7)	1	3	4	(1;3;4)	2	3	5	(2;3;5)
factor_14	verhoging_snelheid	zoab	1	1	2	(1;1;2)	1	1	1	(1;1;1)	1	1	1	(1;1;1)
		2l-zoab	1	1	2	(1;1;2)	1	1	1	(1;1;1)	1	1	1	(1;1;1)
factor_15	ov_versporing	zoab	1	2	3	(1;2;3)	1	2	3	(1;2;3)	2	4	5	(2;4;5)
		2l-zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
factor_16	verontreiniging	zoab	3	4	6	(3;4;6)	2	3	4	(2;3;4)	3	4	6	(3;4;6)
		2l-zoab	3	3	4	(3;3;4)	3	4	5	(3;4;5)	2	3	5	(2;3;5)
factor_17	bomen	zoab	3	4	4	(3;4;4)	2	3	4	(2;3;4)	2	4	6	(2;4;6)
		2l-zoab	4	5	6	(4;5;6)	2	3	4	(2;3;4)	2	4	6	(2;4;6)
factor_18	ov_afwatering	zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	3	4	6	(3;4;6)
		2l-zoab	4	4	7	(4;4;7)	2	4	5	(2;4;5)	2	4	5	(2;4;5)
factor_19	gras_ingroei	zoab	3	4	6	(3;4;6)	2	3	4	(2;3;4)	2	4	6	(2;4;6)
		2l-zoab	3	4	4	(3;4;4)	2	4	5	(2;4;5)	2	4	6	(2;4;6)
factor_20	stenen/rafeling	zoab	3	4	5	(3;4;5)	2	3	5	(2;3;5)	3	5	7	(3;5;7)
		2l-zoab	4	5	7	(4;5;7)	2	4	6	(2;4;6)	3	4	7	(3;4;7)
factor_21	strooizout	zoab	1	2	2	(1;2;2)	1	2	3	(1;2;3)	2	4	6	(2;4;6)
		2l-zoab	2	3	4	(2;3;4)	1	3	4	(1;3;4)	2	4	6	(2;4;6)
factor_22	kadaver	zoab	3	4	5	(3;4;5)	2	3	4	(2;3;4)	3	4	6	(3;4;6)
		2l-zoab	4	5	7	(4;5;7)	2	3	4	(2;3;4)	3	3	6	(3;3;6)
factor_23	olie	zoab	4	6	7	(4;6;7)	2	3	5	(2;3;5)	2	4	6	(2;4;6)
		2l-zoab	5	6	6	(5;6;6)	2	3	5	(2;3;5)	2	4	6	(2;4;6)
factor_24	benzine	zoab	4	6	7	(4;6;7)	2	3	4	(2;3;4)	2	4	5	(2;4;5)
		2l-zoab	5	6	6	(5;6;6)	2	3	4	(2;3;4)	2	3	5	(2;3;5)
factor_25	restzettingen	zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	2	4	6	(2;4;6)
		2l-zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	2	4	6	(2;4;6)
factor_26	slappe_ondergrond	zoab	2	2	3	(2;2;3)				(;;)	2	5	7	(2;5;7)
		2l-zoab	3	3	4	(3;3;4)				(;;)	2	5	7	(2;5;7)
factor_27	hoog_grondwater	zoab	1	2	3	(1;2;3)	3	4	7	(3;4;7)	3	4	5	(3;4;5)
		2l-zoab	1	3	4	(1;3;4)	3	4	7	(3;4;7)	3	4	5	(3;4;5)
factor_28	wallschade	zoab	3	5	5	(3;5;5)	2	3	5	(2;3;5)	2	4	5	(2;4;5)
		2l-zoab	4	6	7	(4;6;7)	2	3	5	(2;3;5)	2	4	5	(2;4;5)
factor_29	oneigenlijk_gebruik	zoab	3	4	5	(3;4;5)	2	3	4	(2;3;4)	2	5	7	(2;5;7)
		2l-zoab	5	5	7	(5;5;7)	3	4	5	(3;4;5)	2	4	7	(2;4;7)
factor_30	reinigen_borstel	zoab	2	3	4	(2;3;4)	2	3	4	(2;3;4)	3	4	6	(3;4;6)
		2l-zoab	4	4	6	(4;4;6)	3	4	5	(3;4;5)	2	4	5	(2;4;5)
factor_31	verwijderde_markering	zoab	3	4	5	(3;4;5)	2	3	4	(2;3;4)	3	4	5	(3;4;5)
		2l-zoab	3	4	5	(3;4;5)	2	3	4	(2;3;4)	3	4	5	(3;4;5)
factor_32	detectielus	zoab	1	2	3	(1;2;3)	2	3	4	(2;3;4)	2	3	4	(2;3;4)
		2l-zoab	1	2	3	(1;2;3)	3	4	5	(3;4;5)	2	3	4	(2;3;4)
factor_33	bezweken_voeg	zoab	3	4	5	(3;4;5)	2	3	4	(2;3;4)	2	4	6	(2;4;6)
		2l-zoab	4	5	6	(4;5;6)	3	4	5	(3;4;5)	2	4	6	(2;4;6)
factor_34	krasschade	zoab	3	4	5	(3;4;5)	2	3	4	(2;3;4)	2	4	6	(2;4;6)
		2l-zoab	2	3	4	(2;3;4)	3	4	5	(3;4;5)	2	4	6	(2;4;6)
factor_35	langshelling	zoab	1	2	3	(1;2;3)	2	3	5	(2;3;5)	2	4	6	(2;4;6)
		2l-zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	2	4	6	(2;4;6)
factor_36	verschil_ouderdom	zoab	3	3	5	(3;3;5)	2	3	5	(2;3;5)	3	4	6	(3;4;6)
		2l-zoab	4	5	7	(4;5;7)	3	4	6	(3;4;6)	2	4	5	(2;4;5)

			expert_14				expert_15				expert_17			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	1	2	3	(1;2;3)	1	4	6	(1;4;6)	1	2	4	(1;2;4)
		2l-zoab	1	2	3	(1;2;3)	1	4	6	(1;4;6)	1	2	4	(1;2;4)
factor_2	regen+vorst	zoab	2	3	6	(2;3;6)	2	3	7	(2;3;7)	1	2	7	(1;2;7)
		2l-zoab	2	3	6	(2;3;6)	2	4	7	(2;4;7)	1	2	7	(1;2;7)
factor_3	koude_nachten	zoab	1	2	3	(1;2;3)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
		2l-zoab	1	2	3	(1;2;3)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
factor_4	regen	zoab	1	2	3	(1;2;3)	1	3	5	(1;3;5)	1	1	3	(1;1;3)
		2l-zoab	1	2	3	(1;2;3)	1	3	5	(1;3;5)	1	1	3	(1;1;3)
factor_5	zomerhitte	zoab	1	2	4	(1;2;4)	1	3	6	(1;3;6)	1	1	1	(1;1;1)
		2l-zoab	1	2	4	(1;2;4)	1	4	7	(1;4;7)	1	1	1	(1;1;1)
factor_6	uv-straling	zoab	2	3	5	(2;3;5)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
		2l-zoab	2	4	6	(2;4;6)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
factor_7	struct_toename_verkeer	zoab	2	3	4	(2;3;4)	1	3	5	(1;3;5)	1	2	5	(1;2;5)
		2l-zoab	2	4	5	(2;4;5)	1	3	5	(1;3;5)	1	3	6	(1;3;6)
factor_8	struct_zwaarder_verkeer	zoab	2	3	4	(2;3;4)	1	2	4	(1;2;4)	1	1	2	(1;1;2)
		2l-zoab	2	3	4	(2;3;4)	1	3	5	(1;3;5)	1	1	2	(1;1;2)
factor_9	tijdel_zwaarder_verkeer	zoab	2	3	4	(2;3;4)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
		2l-zoab	2	4	5	(2;4;5)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
factor_10	struct_wringend_verkeer	zoab	3	5	7	(3;5;7)	1	3	5	(1;3;5)	3	4	7	(3;4;7)
		2l-zoab	4	6	7	(4;6;7)	1	3	5	(1;3;5)	3	4	7	(3;4;7)
factor_11	tijdel_wringend_verkeer	zoab	2	3	5	(2;3;5)	1	2	3	(1;2;3)	1	1	2	(1;1;2)
		2l-zoab	2	4	6	(2;4;6)	1	2	3	(1;2;3)	1	1	2	(1;1;2)
factor_12	krappe_bochten	zoab	4	7	7	(4;7;7)	2	3	5	(2;3;5)	3	6	7	(3;6;7)
		2l-zoab	5	7	7	(5;7;7)	2	3	5	(2;3;5)	3	6	7	(3;6;7)
factor_13	files	zoab	2	3	5	(2;3;5)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
		2l-zoab	2	4	6	(2;4;6)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
factor_14	verhoging_snelheid	zoab	1	1	2	(1;1;2)	1	2	3	(1;2;3)	1	1	1	(1;1;1)
		2l-zoab	1	1	2	(1;1;2)	1	2	3	(1;2;3)	1	1	1	(1;1;1)
factor_15	ov_versporing	zoab	1	2	3	(1;2;3)	1	2	4	(1;2;4)	1	2	4	(1;2;4)
		2l-zoab	1	3	4	(1;3;4)	1	2	4	(1;2;4)	1	2	4	(1;2;4)
factor_16	verontreiniging	zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	3	4	6	(3;4;6)
		2l-zoab	2	4	5	(2;4;5)	1	2	3	(1;2;3)	3	4	6	(3;4;6)
factor_17	bomen	zoab	1	2	4	(1;2;4)	1	2	3	(1;2;3)	2	3	6	(2;3;6)
		2l-zoab	1	3	5	(1;3;5)	1	2	3	(1;2;3)	2	3	6	(2;3;6)
factor_18	ov_afwatering	zoab	2	3	4	(2;3;4)	1	2	4	(1;2;4)	3	4	7	(3;4;7)
		2l-zoab	2	4	5	(2;4;5)	1	2	4	(1;2;4)	3	4	7	(3;4;7)
factor_19	gras_ingroei	zoab	2	3	4	(2;3;4)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
		2l-zoab	2	4	5	(2;4;5)	1	4	6	(1;4;6)	1	1	1	(1;1;1)
factor_20	stenen/rafeling	zoab	2	3	4	(2;3;4)	1	2	4	(1;2;4)	2	3	4	(2;3;4)
		2l-zoab	2	3	4	(2;3;4)	1	2	4	(1;2;4)	2	3	4	(2;3;4)
factor_21	strooizout	zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	1	1	3	(1;1;3)
		2l-zoab	2	3	4	(2;3;4)	1	2	3	(1;2;3)	1	1	3	(1;1;3)
factor_22	kadaver	zoab	1	2	4	(1;2;4)	1	4	6	(1;4;6)	1	2	3	(1;2;3)
		2l-zoab	1	2	4	(1;2;4)	1	4	6	(1;4;6)	1	2	3	(1;2;3)
factor_23	olie	zoab	2	4	7	(2;4;7)	2	4	5	(2;4;5)	2	3	6	(2;3;6)
		2l-zoab	2	4	7	(2;4;7)	2	5	6	(2;5;6)	2	3	6	(2;3;6)
factor_24	benzine	zoab	2	4	7	(2;4;7)	2	4	7	(2;4;7)	2	3	6	(2;3;6)
		2l-zoab	2	4	7	(2;4;7)	2	4	7	(2;4;7)	2	3	6	(2;3;6)
factor_25	restzettingen	zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	1	1	1	(1;1;1)
		2l-zoab	1	2	3	(1;2;3)	2	4	6	(2;4;6)	1	1	1	(1;1;1)
factor_26	slappe_ondergrond	zoab	2	4	7	(2;4;7)	2	5	7	(2;5;7)	1	1	1	(1;1;1)
		2l-zoab	2	4	7	(2;4;7)	2	5	7	(2;5;7)	1	1	1	(1;1;1)
factor_27	hoog_grondwater	zoab	1	1	2	(1;1;2)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
		2l-zoab	1	1	2	(1;1;2)	1	3	5	(1;3;5)	1	1	1	(1;1;1)
factor_28	wallschade	zoab	2	3	7	(2;3;7)	1	3	6	(1;3;6)	2	4	6	(2;4;6)
		2l-zoab	2	3	7	(2;3;7)	1	3	6	(1;3;6)	2	4	6	(2;4;6)
factor_29	oneigenlijk_gebruik	zoab	1	4	7	(1;4;7)	1	3	5	(1;3;5)	2	4	7	(2;4;7)
		2l-zoab	1	4	7	(1;4;7)	1	3	5	(1;3;5)	2	4	7	(2;4;7)
factor_30	reinigen_borstel	zoab	1	3	7	(1;3;7)	1	2	4	(1;2;4)	2	3	4	(2;3;4)
		2l-zoab	1	4	7	(1;4;7)	1	2	4	(1;2;4)	2	3	4	(2;3;4)
factor_31	verwijderde_markering	zoab	1	2	4	(1;2;4)	2	3	5	(2;3;5)	2	3	4	(2;3;4)
		2l-zoab	1	3	5	(1;3;5)	2	3	5	(2;3;5)	2	3	4	(2;3;4)
factor_32	detectielus	zoab	1	3	7	(1;3;7)	2	2	3	(2;2;3)	1	2	3	(1;2;3)
		2l-zoab	1	4	7	(1;4;7)	2	2	3	(2;2;3)	1	2	3	(1;2;3)
factor_33	bezweken_voeg	zoab				(;;)	2	2	4	(2;2;4)	2	4	7	(2;4;7)
		2l-zoab				(;;)	2	2	4	(2;2;4)	2	4	7	(2;4;7)
factor_34	krasschade	zoab	1	2	4	(1;2;4)	1	3	5	(1;3;5)	2	3	4	(2;3;4)
		2l-zoab	1	3	5	(1;3;5)	1	3	5	(1;3;5)	2	3	4	(2;3;4)
factor_35	langshelling	zoab	1	2	3	(1;2;3)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
		2l-zoab	1	3	4	(1;3;4)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
factor_36	verschil_ouderdom	zoab	1	2	4	(1;2;4)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
		2l-zoab	1	3	5	(1;3;5)	1	2	4	(1;2;4)	1	1	1	(1;1;1)

			expert_18				expert_19				expert_21			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	1	2	5	(1;2;5)	1	3	5	(1;3;5)	1	2	2	(1;2;2)
		2l-zoab	1	2	5	(1;2;5)	1	3	5	(1;3;5)	1	2	3	(1;2;3)
factor_2	regen+vorst	zoab	1	3	6	(1;3;6)	2	3	5	(2;3;5)	1	2	2	(1;2;2)
		2l-zoab	1	3	6	(1;3;6)	2	3	5	(2;3;5)	1	2	3	(1;2;3)
factor_3	koude_nachten	zoab	1	1	1	(1;1;1)	1	1	1	(1;1;1)	1	1	1	(1;1;1)
		2l-zoab	1	1	1	(1;1;1)	1	1	1	(1;1;1)	1	1	1	(1;1;1)
factor_4	regen	zoab	1	1	1	(1;1;1)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
		2l-zoab	1	1	1	(1;1;1)	1	2	4	(1;2;4)	1	1	1	(1;1;1)
factor_5	zomerhitte	zoab	2	2	3	(2;2;3)	1	3	6	(1;3;6)	1	1	1	(1;1;1)
		2l-zoab	3	4	5	(3;4;5)	1	3	6	(1;3;6)	1	1	1	(1;1;1)
factor_6	uv-straling	zoab	3	3	4	(3;3;4)	1	3	5	(1;3;5)	1	1	2	(1;1;2)
		2l-zoab	2	2	3	(2;2;3)	1	3	5	(1;3;5)	1	1	2	(1;1;2)
factor_7	struct_toename_verkeer	zoab	3	3	4	(3;3;4)	1	4	6	(1;4;6)	1	1	1	(1;1;1)
		2l-zoab	2	2	3	(2;2;3)	1	4	6	(1;4;6)	1	1	1	(1;1;1)
factor_8	struct_zwaarder_verkeer	zoab	2	2	3	(2;2;3)	3	5	7	(3;5;7)	1	2	3	(1;2;3)
		2l-zoab	2	2	3	(2;2;3)	3	5	7	(3;5;7)	1	3	4	(1;3;4)
factor_9	tijdel_zwaarder_verkeer	zoab	2	2	3	(2;2;3)	2	3	4	(2;3;4)	1	1	1	(1;1;1)
		2l-zoab	2	2	3	(2;2;3)	2	3	4	(2;3;4)	1	1	1	(1;1;1)
factor_10	struct_wringend_verkeer	zoab	6	6	7	(6;6;7)	3	4	6	(3;4;6)	2	4	5	(2;4;5)
		2l-zoab	6	6	7	(6;6;7)	3	4	6	(3;4;6)	3	5	6	(3;5;6)
factor_11	tijdel_wringend_verkeer	zoab	4	4	5	(4;4;5)	2	3	4	(2;3;4)	1	2	3	(1;2;3)
		2l-zoab	4	4	5	(4;4;5)	2	3	4	(2;3;4)	2	3	4	(2;3;4)
factor_12	krappe_bochten	zoab	6	6	7	(6;6;7)	3	6	7	(3;6;7)	4	5	7	(4;5;7)
		2l-zoab	6	6	7	(6;6;7)	3	6	7	(3;6;7)	5	6	7	(5;6;7)
factor_13	files	zoab	5	6	7	(5;6;7)	1	2	4	(1;2;4)	1	2	4	(1;2;4)
		2l-zoab	5	6	7	(5;6;7)	1	2	4	(1;2;4)	1	3	4	(1;3;4)
factor_14	verhoging_snelheid	zoab	1	1	2	(1;1;2)	1	2	3	(1;2;3)	1	1	1	(1;1;1)
		2l-zoab	1	1	2	(1;1;2)	1	2	3	(1;2;3)	1	1	1	(1;1;1)
factor_15	ov_versporing	zoab	2	2	3	(2;2;3)	1	2	4	(1;2;4)	1	2	3	(1;2;3)
		2l-zoab	2	2	3	(2;2;3)	1	2	4	(1;2;4)	1	3	4	(1;3;4)
factor_16	verontreiniging	zoab	4	5	6	(4;5;6)	1	3	5	(1;3;5)	1	3	4	(1;3;4)
		2l-zoab	3	4	5	(3;4;5)	1	3	5	(1;3;5)	1	4	6	(1;4;6)
factor_17	bomen	zoab				(;;)	2	3	5	(2;3;5)	1	1	1	(1;1;1)
		2l-zoab				(;;)	2	3	5	(2;3;5)	1	1	1	(1;1;1)
factor_18	ov_afwatering	zoab	4	5	6	(4;5;6)	2	3	5	(2;3;5)	2	3	4	(2;3;4)
		2l-zoab	3	4	5	(3;4;5)	2	3	5	(2;3;5)	2	3	4	(2;3;4)
factor_19	gras_ingroei	zoab	4	5	6	(4;5;6)	2	3	6	(2;3;6)	1	2	3	(1;2;3)
		2l-zoab	3	4	5	(3;4;5)	2	3	6	(2;3;6)	1	2	3	(1;2;3)
factor_20	stenen/rafeling	zoab	2	2	3	(2;2;3)	2	3	5	(2;3;5)	1	1	2	(1;1;2)
		2l-zoab	1	1	2	(1;1;2)	2	3	5	(2;3;5)	1	1	2	(1;1;2)
factor_21	strooizout	zoab	3	3	4	(3;3;4)	2	3	6	(2;3;6)	1	2	3	(1;2;3)
		2l-zoab	3	3	4	(3;3;4)	2	3	6	(2;3;6)	1	3	4	(1;3;4)
factor_22	kadaver	zoab	5	6	7	(5;6;7)	2	3	5	(2;3;5)	2	4	7	(2;4;7)
		2l-zoab	6	6	7	(6;6;7)	2	3	5	(2;3;5)	2	5	7	(2;5;7)
factor_23	olie	zoab	7	7	7	(7;7;7)	3	5	7	(3;5;7)	2	4	7	(2;4;7)
		2l-zoab	7	7	7	(7;7;7)	3	5	7	(3;5;7)	2	5	7	(2;5;7)
factor_24	benzine	zoab	2	2	3	(2;2;3)	3	5	7	(3;5;7)	1	4	7	(1;4;7)
		2l-zoab	1	1	2	(1;1;2)	3	5	7	(3;5;7)	1	5	7	(1;5;7)
factor_25	restzettingen	zoab	1	4	6	(1;4;6)	1	2	4	(1;2;4)	1	4	6	(1;4;6)
		2l-zoab	1	3	5	(1;3;5)	1	2	4	(1;2;4)	1	4	6	(1;4;6)
factor_26	slappe_ondergrond	zoab	3	4	5	(3;4;5)	3	5	7	(3;5;7)	1	4	7	(1;4;7)
		2l-zoab	3	4	5	(3;4;5)	3	5	7	(3;5;7)	1	4	7	(1;4;7)
factor_27	hoog_grondwater	zoab	3	4	5	(3;4;5)	2	4	5	(2;4;5)	1	4	5	(1;4;5)
		2l-zoab	3	4	5	(3;4;5)	2	4	5	(2;4;5)	1	5	6	(1;5;6)
factor_28	wallschade	zoab	5	6	7	(5;6;7)	3	5	6	(3;5;6)	4	5	7	(4;5;7)
		2l-zoab	5	6	7	(5;6;7)	3	5	6	(3;5;6)	4	6	7	(4;6;7)
factor_29	oneigenlijk_gebruik	zoab	6	7	7	(6;7;7)	3	4	6	(3;4;6)	2	3	4	(2;3;4)
		2l-zoab	6	7	7	(6;7;7)	3	4	6	(3;4;6)	2	3	5	(2;3;5)
factor_30	reinigen_borstel	zoab	1	1	2	(1;1;2)	2	3	5	(2;3;5)	1	2	2	(1;2;2)
		2l-zoab	1	1	2	(1;1;2)	2	3	5	(2;3;5)	1	2	3	(1;2;3)
factor_31	verwijderde_markering	zoab	4	5	6	(4;5;6)	1	3	4	(1;3;4)	1	3	4	(1;3;4)
		2l-zoab	3	4	5	(3;4;5)	1	3	4	(1;3;4)	1	4	5	(1;4;5)
factor_32	detectielus	zoab	2	2	3	(2;2;3)	2	3	5	(2;3;5)	1	2	4	(1;2;4)
		2l-zoab	2	2	3	(2;2;3)	2	3	5	(2;3;5)	1	3	4	(1;3;4)
factor_33	bezweken_voeg	zoab	5	6	7	(5;6;7)	3	4	6	(3;4;6)	2	4	5	(2;4;5)
		2l-zoab	5	6	7	(5;6;7)	3	4	6	(3;4;6)	2	5	6	(2;5;6)
factor_34	krasschade	zoab	4	5	6	(4;5;6)	1	3	6	(1;3;6)	1	2	4	(1;2;4)
		2l-zoab	3	4	5	(3;4;5)	1	3	6	(1;3;6)	1	4	5	(1;4;5)
factor_35	langshelling	zoab	1	2	3	(1;2;3)	1	2	3	(1;2;3)	1	2	2	(1;2;2)
		2l-zoab	1	2	3	(1;2;3)	1	2	3	(1;2;3)	1	2	3	(1;2;3)
factor_36	verschil_ouderdom	zoab	2	3	4	(2;3;4)	3	4	6	(3;4;6)	1	2	3	(1;2;3)
		2l-zoab	2	3	4	(2;3;4)	3	4	6	(3;4;6)	2	3	4	(2;3;4)

			expert_22			
			min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	1	2	3	(1;2;3)
		2l-zoab	1	2	3	(1;2;3)
factor_2	regen+vorst	zoab	1	2	3	(1;2;3)
		2l-zoab	1	2	3	(1;2;3)
factor_3	koude_nachten	zoab	1	2	3	(1;2;3)
		2l-zoab	1	2	3	(1;2;3)
factor_4	regen	zoab	1	1	2	(1;1;2)
		2l-zoab	1	1	2	(1;1;2)
factor_5	zomerhitte	zoab	1	2	3	(1;2;3)
		2l-zoab	1	2	3	(1;2;3)
factor_6	uv-straling	zoab	1	3	4	(1;3;4)
		2l-zoab	1	3	4	(1;3;4)
factor_7	struct_toename_verkeer	zoab	2	3	4	(2;3;4)
		2l-zoab	2	3	4	(2;3;4)
factor_8	struct_zwaarder_verkeer	zoab	2	3	4	(2;3;4)
		2l-zoab	2	3	4	(2;3;4)
factor_9	tijdel_zwaarder_verkeer	zoab	2	2	3	(2;2;3)
		2l-zoab	2	2	3	(2;2;3)
factor_10	struct_wringend_verkeer	zoab	3	5	6	(3;5;6)
		2l-zoab	3	4	5	(3;4;5)
factor_11	tijdel_wringend_verkeer	zoab	1	2	3	(1;2;3)
		2l-zoab	2	2	3	(2;2;3)
factor_12	krappe_bochten	zoab	2	5	7	(2;5;7)
		2l-zoab	2	4	7	(2;4;7)
factor_13	files	zoab	1	3	4	(1;3;4)
		2l-zoab	1	4	5	(1;4;5)
factor_14	verhoging_snelheid	zoab	1	1	2	(1;1;2)
		2l-zoab	1	1	2	(1;1;2)
factor_15	ov_versporing	zoab	2	3	4	(2;3;4)
		2l-zoab	2	3	4	(2;3;4)
factor_16	verontreiniging	zoab	2	4	5	(2;4;5)
		2l-zoab	1	2	3	(1;2;3)
factor_17	bomen	zoab	2	4	5	(2;4;5)
		2l-zoab	2	4	5	(2;4;5)
factor_18	ov_afwatering	zoab	2	3	4	(2;3;4)
		2l-zoab	2	3	4	(2;3;4)
factor_19	gras_ingroei	zoab	2	3	4	(2;3;4)
		2l-zoab	2	3	4	(2;3;4)
factor_20	stenen/rafeling	zoab	2	3	4	(2;3;4)
		2l-zoab	2	3	4	(2;3;4)
factor_21	strooizout	zoab	1	2	3	(1;2;3)
		2l-zoab	1	2	3	(1;2;3)
factor_22	kadaver	zoab	2	4	6	(2;4;6)
		2l-zoab	2	4	6	(2;4;6)
factor_23	olie	zoab	2	4	7	(2;4;7)
		2l-zoab	2	4	7	(2;4;7)
factor_24	benzine	zoab	2	4	7	(2;4;7)
		2l-zoab	2	4	7	(2;4;7)
factor_25	restzettingen	zoab	1	5	7	(1;5;7)
		2l-zoab	1	5	7	(1;5;7)
factor_26	slappe_ondergrond	zoab	1	2	4	(1;2;4)
		2l-zoab	1	2	4	(1;2;4)
factor_27	hoog_grondwater	zoab	3	4	7	(3;4;7)
		2l-zoab	3	4	7	(3;4;7)
factor_28	wallschade	zoab	2	4	6	(2;4;6)
		2l-zoab	2	4	6	(2;4;6)
factor_29	oneigenlijk_gebruik	zoab	2	3	6	(2;3;6)
		2l-zoab	2	3	6	(2;3;6)
factor_30	reinigen_borstel	zoab	3	4	6	(3;4;6)
		2l-zoab	3	4	6	(3;4;6)
factor_31	verwijderde_markering	zoab	3	4	6	(3;4;6)
		2l-zoab	3	4	6	(3;4;6)
factor_32	detectielus	zoab	2	4	6	(2;4;6)
		2l-zoab	2	4	6	(2;4;6)
factor_33	bezweken_voeg	zoab	3	4	7	(3;4;7)
		2l-zoab	3	4	7	(3;4;7)
factor_34	krasschade	zoab	2	3	5	(2;3;5)
		2l-zoab	2	3	5	(2;3;5)
factor_35	langshelling	zoab	1	3	4	(1;3;4)
		2l-zoab	1	3	4	(1;3;4)
factor_36	verschil_ouderdom	zoab	2	4	5	(2;4;5)
		2l-zoab	2	4	5	(2;4;5)

Appendix F Dataset with Fuzzified Results for Construction Phase

			expert_1				expert_2				expert_4			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,3	0,7	(0;0,3;0,7)
		2l-zoab	0,1	0,1	0,5	(0,1;0,1;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,9	(0,1;0,3;0,9)
factor_2	afkoeling_snel	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0,3	0,5	(0;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,9	(0,1;0,3;0,9)
factor_3	afkoeling_langz	zoab	0	0	0	(0;0;0)	0	0,1	0,3	(0;0,1;0,3)	0	0	0,1	(0;0;0,1)
		2l-zoab	0	0	0	(0;0;0)	0,1	0,1	0,5	(0,1;0,1;0,5)	0	0	0,1	(0;0;0,1)
factor_4	temp_const	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,5	(0,1;0,1;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_5	regen	zoab	0,1	0,3	0,3	(0,1;0,3;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,1	0,5	(0,1;0,1;0,5)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_6	vervuiling_ondergr	zoab	0	0,5	0,7	(0;0,5;0,7)	0,1	0,3	0,9	(0,1;0,3;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0	0,5	0,5	(0;0,5;0,5)	0,1	0,3	0,9	(0,1;0,3;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_7	vochting_ondergr	zoab	0	0,3	0,5	(0;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_8	kleef_ondergr	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_9	freeskwal	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,3	0,7	(0,3;0,3;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_10	temp_ondergr	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,5	(0;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_11	verdicht_klank	zoab	0,5	0,5	0,7	(0,5;0,5;0,7)	0,3	0,3	0,7	(0,3;0,3;0,7)	0	0	0,1	(0;0;0,1)
		2l-zoab	0,5	0,5	0,7	(0,5;0,5;0,7)	0,3	0,3	0,7	(0,3;0,3;0,7)	0	0	0,1	(0;0;0,1)
factor_12	fundering_smal	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0	0,1	(0;0;0,1)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0	0,1	(0;0;0,1)
factor_13	fundering_stijf	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,1	0,5	(0;0,1;0,5)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,1	0,5	(0;0,1;0,5)
factor_14	draagkracht_onder	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_15	varierende_homog.	zoab	0	0,5	0,9	(0;0,5;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,5	0,7	(0;0,5;0,7)
		2l-zoab	0	0,5	0,9	(0;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,7	0,9	(0;0,7;0,9)
factor_16	ontmenging	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,7	0,9	(0,3;0,7;0,9)	0,1	0,5	1	(0,1;0,5;1)
factor_17	rijsnelheid_hoog	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)	0	0,5	0,7	(0;0,5;0,7)
factor_18	continuiteit_machine	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,3	0,7	(0,3;0,3;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,5	0,5	0,9	(0,5;0,5;0,9)	0,1	0,5	1	(0,1;0,5;1)
factor_19	aanstoten_machine	zoab	0	0	0,1	(0;0;0,1)	0,1	0,3	0,3	(0,1;0,3;0,3)	0	0	0,1	(0;0;0,1)
		2l-zoab	0	0	0,1	(0;0;0,1)	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0	0,1	(0;0;0,1)
factor_20	instelling_hoogte_mach	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0	0,3	(0;0;0,3)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,5	(0;0,1;0,5)
factor_21	voorverwarm_mach	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0,5	0,7	(0;0,5;0,7)
factor_22	dik_asfalt	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,5	(0;0,3;0,5)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,5	0,7	(0;0,5;0,7)	0	0,1	0,1	(0;0,1;0,1)
factor_23	dun_asfalt	zoab	0	0,3	0,5	(0;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)
factor_24	breedte_machine	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,5	(0,1;0,1;0,5)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_25	warm_koud_metnaad	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,7	0,9	(0,1;0,7;0,9)
factor_26	warm_koud_zonder	zoab	0,3	0,3	0,7	(0,3;0,3;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,7	0,9	(0,3;0,7;0,9)
		2l-zoab	0,3	0,3	0,7	(0,3;0,3;0,7)	0,5	0,7	0,9	(0,5;0,7;0,9)	0,5	0,9	1	(0,5;0,9;1)
factor_27	asfaltnaad_wielspoor	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,7	0,9	(0,3;0,7;0,9)	0,3	0,9	1	(0,3;0,9;1)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,5	0,9	1	(0,5;0,9;1)	0,5	0,9	1	(0,5;0,9;1)
factor_28	nadenplan_verkeerd	zoab	0,3	0,3	0,7	(0,3;0,3;0,7)	0,1	0,1	0,5	(0,1;0,1;0,5)	0,3	0,9	1	(0,3;0,9;1)
		2l-zoab	0,3	0,3	0,7	(0,3;0,3;0,7)	0,1	0,1	0,5	(0,1;0,1;0,5)	0,5	0,9	1	(0,5;0,9;1)
factor_29	terugharken_asfalt	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,9	1	(0,3;0,9;1)
factor_30	geen_wormen	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,3	0,7	(0,3;0,3;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,5	0,5	0,7	(0,5;0,5;0,7)	0,5	0,9	1	(0,5;0,9;1)
factor_31	faseerd_aanbrengen	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,7	0,9	(0,1;0,7;0,9)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,9	1	(0,3;0,9;1)
factor_32	walsinzet_hoog	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,5	(0;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,5	(0;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)
factor_33	laat_walsen	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,7	1	(0,1;0,7;1)
factor_34	verkeerd_wals	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,7	1	(0,1;0,7;1)
factor_35	ongelijk_wals	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,5	0,9	(0;0,5;0,9)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,7	1	(0,1;0,7;1)
factor_36	belaste_ondergr	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,7	1	(0,1;0,7;1)
factor_37	vroegtijdig_belast	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,7	1	(0,1;0,7;1)

			expert_6				expert_7				expert_8			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0,3	0,3	0,9	(0,3;0,3;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,9	(0,3;0,5;0,9)
factor_2	afkoeling_snel	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0,5	0,5	0,9	(0,5;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_3	afkoeling_langz	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,1	(0,1;0,1;0,1)	0	0	0	(0;0;0)
		2l-zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0	0	(0;0;0)
factor_4	temp_const	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0	0,1	0,5	(0;0,1;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)
factor_5	regen	zoab	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,1	0,3	(0,1;0,1;0,3)
		2l-zoab	0	0	0,1	(0;0;0,1)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)
factor_6	vervuiling_ondergr	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0	0,1	(0;0;0,1)	0	0	0,1	(0;0;0,1)
		2l-zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)	0	0	0,1	(0;0;0,1)
factor_7	vochting_ondergr	zoab	0	0	0,1	(0;0;0,1)	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)
		2l-zoab	0	0	0,1	(0;0;0,1)	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)
factor_8	kleef_ondergr	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0,5	0,5	1	(0,5;0,5;1)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,1	(0;0,1;0,1)
factor_9	freeskwal	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,1	0,1	(0,1;0,1;0,1)
		2l-zoab	0,5	0,5	1	(0,5;0,5;1)	0,3	0,3	0,7	(0,3;0,3;0,7)	0	0,1	0,1	(0;0,1;0,1)
factor_10	temp_ondergr	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,1	0,1	0,5	(0,1;0,1;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_11	verdicht_klank	zoab	0,1	0,1	0,5	(0,1;0,1;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,3	0,5	(0,3;0,3;0,5)
		2l-zoab	0,1	0,1	0,7	(0,1;0,1;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,3	0,5	(0,3;0,3;0,5)
factor_12	fundering_smal	zoab	0,3	0,5	1	(0,3;0,5;1)	0	0	0,1	(0;0;0,1)	0,5	0,7	0,9	(0,5;0,7;0,9)
		2l-zoab	0,5	0,5	1	(0,5;0,5;1)	0	0,1	0,3	(0;0,1;0,3)	0,5	0,7	0,9	(0,5;0,7;0,9)
factor_13	fundering_stijf	zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0	0	0,1	(0;0;0,1)	0,3	0,7	1	(0,3;0,7;1)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,7	0,9	(0,1;0,7;0,9)
factor_14	draagkracht_onder	zoab	0	0,1	0,5	(0;0,1;0,5)	0,1	0,3	0,3	(0,1;0,3;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0	0,3	0,7	(0;0,3;0,7)	0,3	0,5	0,5	(0,3;0,5;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_15	varierende_homog.	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,5	(0,1;0,5;0,5)
factor_16	ontmenging	zoab	0,5	0,7	1	(0,5;0,7;1)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,7	0,7	1	(0,7;0,7;1)	0,3	0,3	0,7	(0,3;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_17	rijsnelheid_hoog	zoab	0,3	0,5	1	(0,3;0,5;1)	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,5	0,5	1	(0,5;0,5;1)	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)
factor_18	continuiteit_machine	zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,5	0,5	0,9	(0,5;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)
factor_19	aanstoten_machine	zoab	0	0	0,3	(0;0;0,3)	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)
		2l-zoab	0	0,1	0,5	(0;0,1;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0	0	(0;0;0)
factor_20	instelling_hoogte_mach	zoab	0	0,1	0,5	(0;0,1;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0	0	(0;0;0)
		2l-zoab	0	0,1	0,7	(0;0,1;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0	0	(0;0;0)
factor_21	voorverwarm_mach	zoab	0,3	0,3	1	(0,3;0,3;1)	0	0,1	0,1	(0;0,1;0,1)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,5	0,5	1	(0,5;0,5;1)	0,1	0,3	0,3	(0,1;0,3;0,3)	0	0,1	0,3	(0;0,1;0,3)
factor_22	dik_asfalt	zoab	0	0,1	0,7	(0;0,1;0,7)	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)
		2l-zoab	0	0,1	0,9	(0;0,1;0,9)	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)
factor_23	dun_asfalt	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,3	(0,1;0,3;0,3)	0	0	0	(0;0;0)
		2l-zoab	0,3	0,3	0,9	(0,3;0,3;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0	0	(0;0;0)
factor_24	breedte_machine	zoab	0,3	0,3	0,9	(0,3;0,3;0,9)	0	0	0,1	(0;0;0,1)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0,5	0,5	0,9	(0,5;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,1	(0;0,1;0,1)
factor_25	warm_koud_metnaad	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,1	0,3	(0,1;0,1;0,3)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)
factor_26	warm_koud_zonder	zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,3	0,3	1	(0,3;0,3;1)	0,5	0,5	0,7	(0,5;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_27	asfaltnaad_wielspoor	zoab	0,1	0,1	0,7	(0,1;0,1;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,3	0,3	0,7	(0,3;0,3;0,7)	0,5	0,5	0,9	(0,5;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)
factor_28	nadenplan_verkeerd	zoab	0	0,1	0,5	(0;0,1;0,5)	0	0	0,1	(0;0;0,1)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,1	(0;0,1;0,1)
factor_29	terugharken_asfalt	zoab	0,3	0,5	1	(0,3;0,5;1)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,3	0,3	0,7	(0,3;0,3;0,7)	0	0,1	0,1	(0;0,1;0,1)
factor_30	geen_wormen	zoab	0,5	0,5	1	(0,5;0,5;1)	0,1	0,3	0,3	(0,1;0,3;0,3)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,7	0,7	1	(0,7;0,7;1)	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_31	faseerd_aanbrengen	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,5	0,7	0,9	(0,5;0,7;0,9)	0	0,1	0,3	(0;0,1;0,3)
factor_32	walsinzet_hoog	zoab	0	0,3	0,9	(0;0,3;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0	0,5	0,9	(0;0,5;0,9)	0,7	0,7	0,9	(0,7;0,7;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_33	laat_walsen	zoab	0,5	0,5	1	(0,5;0,5;1)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0,7	0,7	1	(0,7;0,7;1)	0,7	0,7	0,9	(0,7;0,7;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_34	verkeerd_wals	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,1	0,3	0,3	(0,1;0,3;0,3)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,7	0,7	1	(0,7;0,7;1)	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_35	ongelijk_wals	zoab	0,3	0,3	1	(0,3;0,3;1)	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,5	0,5	1	(0,5;0,5;1)	0,5	0,5	0,9	(0,5;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_36	belaste_ondergr	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0	0	(0;0;0)	0	0	0	(0;0;0)
		2l-zoab	0,3	0,7	1	(0,3;0,7;1)	0	0,1	0,1	(0;0,1;0,1)	0	0	0	(0;0;0)
factor_37	vroegtijdig_belast	zoab	0	0,1	0,7	(0;0,1;0,7)	0,1	0,1	0,1	(0,1;0,1;0,1)	0	0	0	(0;0;0)
		2l-zoab	0	0,3	0,9	(0;0,3;0,9)	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0	0	(0;0;0)

			expert_10				expert_12				expert_13			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_2	afkoeling_snel	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,3	(0,1;0,3;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,5	0,7	(0,1;0,5;0,7)
factor_3	afkoeling_langz	zoab	0	0	0	(0;0;0)	0	0	0	(0;0;0)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0	0	0	(0;0;0)	0	0	0	(0;0;0)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_4	temp_const	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_5	regen	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,7	0,7	(0,3;0,7;0,7)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,5	0,7	0,9	(0,5;0,7;0,9)
factor_6	vervuiling_ondergr	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,7	1	(0,3;0,7;1)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,7	1	(0,3;0,7;1)
factor_7	vochting_ondergr	zoab	0	0,7	0,9	(0;0,7;0,9)	0	0,3	0,7	(0;0,3;0,7)	0,5	0,7	0,9	(0,5;0,7;0,9)
		2l-zoab	0	0,7	0,9	(0;0,7;0,9)	0	0,1	0,5	(0;0,1;0,5)	0,1	0,5	0,5	(0,1;0,5;0,5)
factor_8	kleef_ondergr	zoab	0,5	0,7	1	(0,5;0,7;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_9	freeskwal	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,5	0,7	0,9	(0,5;0,7;0,9)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,7	0,9	(0,3;0,7;0,9)
factor_10	temp_ondergr	zoab	0	0,3	0,9	(0;0,3;0,9)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0	0,3	0,9	(0;0,3;0,9)	0	0,1	0,1	(0;0,1;0,1)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_11	verdicht_klank	zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,9	(0,3;0,5;0,9)
factor_12	fundering_smal	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,7	0,7	0,9	(0,7;0,7;0,9)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,7	0,7	0,9	(0,7;0,7;0,9)
factor_13	fundering_stijf	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,7	1	(0,1;0,7;1)
factor_14	draagkracht_onder	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,9	(0,3;0,5;0,9)
factor_15	varierende_homog.	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_16	ontmenging	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,3	(0,1;0,3;0,3)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,3	(0,1;0,3;0,3)
factor_17	rijsnelheid_hoog	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_18	continuiteit_machine	zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_19	aanstoten_machine	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_20	instelling_hoogte_mach	zoab	0	0	0	(0;0;0)	0	0	0	(0;0;0)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0	0	0	(0;0;0)	0	0,1	0,1	(0;0,1;0,1)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_21	voorverwarm_mach	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_22	dik_asfalt	zoab	0	0	0	(0;0;0)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)
		2l-zoab	0	0	0	(0;0;0)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)
factor_23	dun_asfalt	zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,7	0,9	(0,3;0,7;0,9)
		2l-zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,7	0,9	(0,3;0,7;0,9)
factor_24	breedte_machine	zoab	0	0	0	(0;0;0)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,7	0,9	(0,3;0,7;0,9)
		2l-zoab	0	0	0	(0;0;0)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,7	0,9	(0,3;0,7;0,9)
factor_25	warm_koud_metnaad	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0	0,1	(0;0;0,1)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0	0,1	(0;0;0,1)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_26	warm_koud_zonder	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,7	0,9	(0,3;0,7;0,9)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,7	0,9	(0,3;0,7;0,9)
factor_27	asfaltnaad_wielspoor	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,5	0,9	1	(0,5;0,9;1)
		2l-zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,5	0,9	1	(0,5;0,9;1)
factor_28	nadenplan_verkeerd	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,5	0,7	0,9	(0,5;0,7;0,9)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,5	0,7	0,9	(0,5;0,7;0,9)
factor_29	terugharken_asfalt	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_30	geen_wormen	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,7	0,9	(0,3;0,7;0,9)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,7	0,9	(0,3;0,7;0,9)
factor_31	faseerd_aanbrengen	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0	0,1	(0;0;0,1)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0	0,1	(0;0;0,1)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_32	walsinzet_hoog	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,7	0,9	(0,3;0,7;0,9)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_33	laat_walsen	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,5	0,7	0,9	(0,5;0,7;0,9)
		2l-zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_34	verkeerd_wals	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,7	0,9	(0,3;0,7;0,9)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,3	0,5	0,9	(0,3;0,5;0,9)
factor_35	ongelijk_wals	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)	0,3	0,7	0,9	(0,3;0,7;0,9)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)
factor_36	belaste_ondergr	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,7	0,9	(0,1;0,7;0,9)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,7	0,9	(0,1;0,7;0,9)
factor_37	vroegtijdig_belast	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,7	(0,1;0,5;0,7)

			expert_14				expert_15				expert_17			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	0,1	0,5	1	(0,1;0,5;1)	0,5	0,9	1	(0,5;0,9;1)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0,7	0,9	1	(0,7;0,9;1)	0,3	0,5	1	(0,3;0,5;1)
factor_2	afkoeling_snel	zoab	0	0	0,5	(0;0;0,5)	0,5	0,9	1	(0,5;0,9;1)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0	0	0,5	(0;0;0,5)	0,7	0,9	1	(0,7;0,9;1)	0,3	0,5	1	(0,3;0,5;1)
factor_3	afkoeling_langz	zoab	0	0	0	(0;0;0)	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0	0	0	(0;0;0)	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_4	temp_const	zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	1	(0,1;0,3;1)
factor_5	regen	zoab	0,1	0,7	1	(0,1;0,7;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,7	0,9	1	(0,7;0,9;1)
		2l-zoab	0,1	0,7	1	(0,1;0,7;1)	0,1	0,5	1	(0,1;0,5;1)	0	0,5	0,9	(0;0,5;0,9)
factor_6	vervuiling_ondergr	zoab	0,1	0,7	1	(0,1;0,7;1)	0	0,5	0,9	(0;0,5;0,9)	0,1	0,3	1	(0,1;0,3;1)
		2l-zoab	0,1	0,7	1	(0,1;0,7;1)	0	0,5	0,9	(0;0,5;0,9)	0,1	0,3	1	(0,1;0,3;1)
factor_7	vochting_ondergr	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,5	1	(0;0,5;1)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,5	1	(0;0,5;1)	0	0,3	0,9	(0;0,3;0,9)
factor_8	kleef_ondergr	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,5	1	(0;0,5;1)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,5	1	(0,1;0,5;1)	0	0,3	0,9	(0;0,3;0,9)
factor_9	freeskwal	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,5	(0;0,1;0,5)	0,1	0,3	0,9	(0,1;0,3;0,9)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,5	(0;0,3;0,5)	0,1	0,3	0,9	(0,1;0,3;0,9)
factor_10	temp_ondergr	zoab	0	0	0,5	(0;0;0,5)	0	0,5	0,9	(0;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0	0	0,5	(0;0;0,5)	0	0,5	0,9	(0;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_11	verdicht_klank	zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,5	1	(0,1;0,5;1)	0	0	0,3	(0;0;0,3)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,7	1	(0,3;0,7;1)	0	0	0,3	(0;0;0,3)
factor_12	fundering_smal	zoab	0	0,5	1	(0;0,5;1)	0,1	0,5	1	(0,1;0,5;1)	0	0	0	(0;0;0)
		2l-zoab	0	0,5	1	(0;0,5;1)	0,3	0,7	1	(0,3;0,7;1)	0	0	0	(0;0;0)
factor_13	fundering_stijf	zoab	0	0	0	(0;0;0)	0,1	0,5	1	(0,1;0,5;1)	0	0	0	(0;0;0)
		2l-zoab	0	0	0	(0;0;0)	0,3	0,7	1	(0,3;0,7;1)	0	0	0	(0;0;0)
factor_14	draagkracht_onder	zoab	0	0,7	1	(0;0,7;1)	0,1	0,5	1	(0,1;0,5;1)	0	0,1	0,9	(0;0,1;0,9)
		2l-zoab	0	0,7	1	(0;0,7;1)	0,1	0,5	1	(0,1;0,5;1)	0	0,1	0,9	(0;0,1;0,9)
factor_15	varierende_homog.	zoab	0,1	0,7	1	(0,1;0,7;1)	0	0,5	0,9	(0;0,5;0,9)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0,1	0,7	1	(0,1;0,7;1)	0	0,5	0,9	(0;0,5;0,9)	0,3	0,5	1	(0,3;0,5;1)
factor_16	ontmenging	zoab	0,1	0,7	1	(0,1;0,7;1)	0,1	0,5	1	(0,1;0,5;1)	0,3	0,7	1	(0,3;0,7;1)
		2l-zoab	0,1	0,7	1	(0,1;0,7;1)	0,1	0,5	1	(0,1;0,5;1)	0,3	0,7	1	(0,3;0,7;1)
factor_17	rijsnelheid_hoog	zoab	0	0,3	0,5	(0;0,3;0,5)	0,1	0,5	1	(0,1;0,5;1)	0	0,1	1	(0;0,1;1)
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0,1	0,5	1	(0,1;0,5;1)	0	0,1	1	(0;0,1;1)
factor_18	continuiteit_machine	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,5	0,9	(0;0,5;0,9)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,5	0,9	(0;0,5;0,9)
factor_19	aanstoten_machine	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,5	0,9	(0;0,5;0,9)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,5	0,9	(0;0,5;0,9)
factor_20	instelling_hoogte_mach	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,5	0,9	(0;0,5;0,9)	0	0,1	1	(0;0,1;1)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,5	0,9	(0;0,5;0,9)	0	0,1	1	(0;0,1;1)
factor_21	voorverwarm_mach	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,3	0,9	(0,1;0,3;0,9)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,3	0,9	(0,1;0,3;0,9)
factor_22	dik_asfalt	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,9	(0;0,3;0,9)	0	0	0	(0;0;0)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,9	(0;0,3;0,9)	0	0	0	(0;0;0)
factor_23	dun_asfalt	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,5	1	(0;0,5;1)	0	0,3	0,9	(0;0,3;0,9)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,5	1	(0;0,5;1)	0,1	0,7	1	(0,1;0,7;1)
factor_24	breedte_machine	zoab	0,1	0,5	1	(0,1;0,5;1)	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,3	0,7	1	(0,3;0,7;1)	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_25	warm_koud_metnaad	zoab	0	0	0	(0;0;0)	0,1	0,5	1	(0,1;0,5;1)	0	0	0,3	(0;0;0,3)
		2l-zoab	0	0	0	(0;0;0)	0,1	0,5	1	(0,1;0,5;1)	0	0	0,3	(0;0;0,3)
factor_26	warm_koud_zonder	zoab	0	0,3	0,9	(0;0,3;0,9)	0,3	0,7	1	(0,3;0,7;1)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab	0	0,5	1	(0;0,5;1)	0,3	0,7	1	(0,3;0,7;1)	0,1	0,5	1	(0,1;0,5;1)
factor_27	asfaltnaad_wielspoor	zoab	0,3	0,7	1	(0,3;0,7;1)	0,1	0,7	1	(0,1;0,7;1)	0,9	1	1	(0,9;1;1)
		2l-zoab	0,3	0,7	1	(0,3;0,7;1)	0,1	0,7	1	(0,1;0,7;1)	0,9	1	1	(0,9;1;1)
factor_28	nadenplan_verkeerd	zoab	0,1	0,7	1	(0,1;0,7;1)	0,1	0,7	1	(0,1;0,7;1)	0	0,3	1	(0;0,3;1)
		2l-zoab	0,1	0,7	1	(0,1;0,7;1)	0,1	0,7	1	(0,1;0,7;1)	0	0,3	1	(0;0,3;1)
factor_29	terugharken_asfalt	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,5	0,9	(0;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,5	0,9	(0;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)
factor_30	geen_wormen	zoab	0,3	0,7	1	(0,3;0,7;1)	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,3	0,9	1	(0,3;0,9;1)	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_31	faseerd_aanbrengen	zoab	0	0	0	(0;0;0)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
		2l-zoab	0	0	0	(0;0;0)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
factor_32	walsinzet_hoog	zoab	0	0	0	(0;0;0)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,9	1	(0,3;0,9;1)
		2l-zoab	0	0	0	(0;0;0)	0,1	0,7	1	(0,1;0,7;1)	0,3	0,9	1	(0,3;0,9;1)
factor_33	laat_walsen	zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,1	0,7	1	(0,1;0,7;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,7	1	(0,1;0,7;1)
factor_34	verkeerd_wals	zoab	0,3	0,9	1	(0,3;0,9;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,3	0,9	1	(0,3;0,9;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	0,9	(0,3;0,5;0,9)
factor_35	ongelijk_wals	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,3	0,7	(0;0,3;0,7)	0	0,3	0,7	(0;0,3;0,7)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,5	0,9	(0;0,5;0,9)	0	0,3	0,7	(0;0,3;0,7)
factor_36	belaste_ondergr	zoab	0,1	0,5	1	(0,1;0,5;1)	0	0,3	0,9	(0;0,3;0,9)	0	0,3	1	(0;0,3;1)
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0	0,3	0,9	(0;0,3;0,9)	0	0,3	1	(0;0,3;1)
factor_37	vroegtijdig_belast	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	1	(0,1;0,5;1)	0	0,3	0,7	(0;0,3;0,7)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,7	1	(0,3;0,7;1)	0	0,3	0,7	(0;0,3;0,7)

			expert_18				expert_19				expert_20			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		``	opt (b)	max (c)	
factor_1	aanvangstemp	zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,3	0,3	1	(0,3;0,3;1)
		2l-zoab	0,5	0,9	1	(0,5;0,9;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,3	0,3	1	(0,3;0,3;1)
factor_2	afkoeling_snel	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,5	0,7	1	(0,5;0,7;1)
factor_3	afkoeling_langz	zoab	0	0	0	(0;0;0)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,3	(0,1;0,3;0,3)
		2l-zoab	0	0	0	(0;0;0)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,3	(0,1;0,3;0,3)
factor_4	temp_const	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,3	0,5	(0;0,3;0,5)	0,7	0,7	0,9	(0,7;0,7;0,9)
		2l-zoab	0,5	0,9	1	(0,5;0,9;1)	0	0,3	0,5	(0;0,3;0,5)	0,7	0,7	0,9	(0,7;0,7;0,9)
factor_5	regen	zoab	0	0	0,1	(0;0;0,1)	0	0,1	0,5	(0;0,1;0,5)	0,1	0,1	0,5	(0,1;0,1;0,5)
		2l-zoab	0	0	0,3	(0;0;0,3)	0	0,1	0,5	(0;0,1;0,5)	0,1	0,1	0,5	(0,1;0,1;0,5)
factor_6	vervuiling_ondergr	zoab	0,1	0,3	0,3	(0,1;0,3;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	1	(0,3;0,5;1)
factor_7	vochting_ondergr	zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,5	(0;0,1;0,5)	0,3	0,3	0,7	(0,3;0,3;0,7)
		2l-zoab	0	0,3	0,9	(0;0,3;0,9)	0	0,1	0,5	(0;0,1;0,5)	0,3	0,3	0,7	(0,3;0,3;0,7)
factor_8	kleef_ondergr	zoab	0,1	0,3	0,3	(0,1;0,3;0,3)	0,3	0,7	1	(0,3;0,7;1)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0,3	0,7	1	(0,3;0,7;1)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_9	freeskwal	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,5	0,5	0,9	(0,5;0,5;0,9)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,5	0,5	0,9	(0,5;0,5;0,9)
factor_10	temp_ondergr	zoab	0,3	0,5	0,5	(0,3;0,5;0,5)	0	0,5	0,9	(0;0,5;0,9)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0	0,5	0,9	(0;0,5;0,9)	0,5	0,7	1	(0,5;0,7;1)
factor_11	verdicht_klank	zoab	0	0	0	(0;0;0)	0	0,1	0,3	(0;0,1;0,3)	0,7	0,7	1	(0,7;0,7;1)
		2l-zoab	0	0	0	(0;0;0)	0	0,1	0,3	(0;0,1;0,3)	0,7	0,7	1	(0,7;0,7;1)
factor_12	fundering_smal	zoab	0	0	0	(0;0;0)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,5	0,5	1	(0,5;0,5;1)
		2l-zoab	0	0	0	(0;0;0)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,5	0,5	1	(0,5;0,5;1)
factor_13	fundering_stijf	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0,5	0,9	(0;0,5;0,9)	0,3	0,3	0,7	(0,3;0,3;0,7)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,5	0,9	(0;0,5;0,9)	0,3	0,3	0,7	(0,3;0,3;0,7)
factor_14	draagkracht_onder	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	1	(0,1;0,5;1)	0,7	0,7	1	(0,7;0,7;1)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	1	(0,1;0,5;1)	0,7	0,7	1	(0,7;0,7;1)
factor_15	varierende_homog.	zoab	0	0	0	(0;0;0)	0,1	0,5	1	(0,1;0,5;1)	0,3	0,3	0,5	(0,3;0,3;0,5)
		2l-zoab	0	0	0	(0;0;0)	0,1	0,5	1	(0,1;0,5;1)	0,3	0,3	0,5	(0,3;0,3;0,5)
factor_16	ontmenging	zoab	0	0	0	(0;0;0)	0,3	0,7	1	(0,3;0,7;1)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0	0	0	(0;0;0)	0,3	0,7	1	(0,3;0,7;1)	0,3	0,5	0,9	(0,3;0,5;0,9)
factor_17	rijsnelheid_hoog	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,7	1	(0,1;0,7;1)	0,1	0,1	0,3	(0,1;0,1;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,7	1	(0,1;0,7;1)	0,1	0,1	0,3	(0,1;0,1;0,3)
factor_18	continuiteit_machine	zoab	0,7	0,9	1	(0,7;0,9;1)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,3	0,3	0,9	(0,3;0,3;0,9)
		2l-zoab	0,9	1	1	(0,9;1;1)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,3	0,3	0,9	(0,3;0,3;0,9)
factor_19	aanstoten_machine	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,1	0,3	(0,1;0,1;0,3)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,1	0,3	(0,1;0,1;0,3)
factor_20	instelling_hoogte_mach	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)
factor_21	voorverwarm_mach	zoab	0,7	0,9	1	(0,7;0,9;1)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,5	0,5	1	(0,5;0,5;1)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,5	0,5	1	(0,5;0,5;1)
factor_22	dik_asfalt	zoab	0	0	0,1	(0;0;0,1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,1	0,3	(0,1;0,1;0,3)
		2l-zoab	0	0	0,1	(0;0;0,1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,1	0,3	(0,1;0,1;0,3)
factor_23	dun_asfalt	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,1	0,5	(0,1;0,1;0,5)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,1	0,5	(0,1;0,1;0,5)
factor_24	breedte_machine	zoab	0	0	0	(0;0;0)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,1	0,1	(0,1;0,1;0,1)
		2l-zoab	0	0	0	(0;0;0)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,1	0,1	(0,1;0,1;0,1)
factor_25	warm_koud_metnaad	zoab	0,1	0,1	0,1	(0,1;0,1;0,1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,3	0,5	(0,3;0,3;0,5)
		2l-zoab	0,1	0,1	0,1	(0,1;0,1;0,1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,3	0,5	(0,3;0,3;0,5)
factor_26	warm_koud_zonder	zoab	0,5	0,5	0,5	(0,5;0,5;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0,5	0,5	0,5	(0,5;0,5;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_27	asfaltnaad_wielspoor	zoab	0,7	0,9	1	(0,7;0,9;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,9	0,9	1	(0,9;0,9;1)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,9	0,9	1	(0,9;0,9;1)
factor_28	nadenplan_verkeerd	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,7	0,9	1	(0,7;0,9;1)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,7	0,9	1	(0,7;0,9;1)
factor_29	terugharken_asfalt	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,5	0,7	0,9	(0,5;0,7;0,9)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,5	0,7	0,9	(0,5;0,7;0,9)
factor_30	geen_wormen	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,5	0,7	0,9	(0,5;0,7;0,9)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,5	0,7	0,9	(0,5;0,7;0,9)
factor_31	faseerd_aanbrengen	zoab	0,5	0,5	0,5	(0,5;0,5;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0,5	0,5	0,5	(0,5;0,5;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_32	walsinzet_hoog	zoab	0,1	0,3	0,3	(0,1;0,3;0,3)	0,1	0,7	1	(0,1;0,7;1)	0,7	0,9	1	(0,7;0,9;1)
		2l-zoab	0,1	0,3	0,3	(0,1;0,3;0,3)	0,1	0,7	1	(0,1;0,7;1)	0,7	0,9	1	(0,7;0,9;1)
factor_33	laat_walsen	zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,1	0,5	1	(0,1;0,5;1)	0,7	0,9	1	(0,7;0,9;1)
		2l-zoab	0,5	0,9	1	(0,5;0,9;1)	0,1	0,5	1	(0,1;0,5;1)	0,7	0,9	1	(0,7;0,9;1)
factor_34	verkeerd_wals	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,3	0,7	1	(0,3;0,7;1)	0,7	0,9	1	(0,7;0,9;1)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0,3	0,7	1	(0,3;0,7;1)	0,7	0,9	1	(0,7;0,9;1)
factor_35	ongelijk_wals	zoab					0,1	0,5	0,9	(0,1;0,5;0,9)	0,5	0,7	0,9	(0,5;0,7;0,9)
		2l-zoab					0,1	0,5	0,9	(0,1;0,5;0,9)	0,5	0,7	0,9	(0,5;0,7;0,9)
factor_36	belaste_ondergr	zoab	0	0	0	(0;0;0)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,3	0,5	(0,3;0,3;0,5)
		2l-zoab	0	0	0	(0;0;0)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,3	0,5	(0,3;0,3;0,5)
factor_37	vroegtijdig_belast	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0,3	0,7	1	(0,3;0,7;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,5	0,7	(0,3;0,5;0,7)

			$\min_j\{a_{ij}\}$	$\frac{1}{n}\sum_{i=1}^{n} b_{ij}$	$\max_j\{c_{ij}\}$	$\frac{a_j + 4b_j + c_j}{6}$	RESULT
factor_1	aanvangstemp	zoab	0,0	0,4	1,0	0,447	retained
		2l-zoab	0,0	0,5	1,0	0,473	retained
factor_2	afkoeling_snel	zoab	0,0	0,4	1,0	0,433	retained
		2l-zoab	0,0	0,4	1,0	0,460	retained
factor_3	afkoeling_langz	zoab	0,0	0,2	0,9	0,257	rejected
		2l-zoab	0,0	0,2	0,9	0,257	rejected
factor_4	temp_const	zoab	0,0	0,4	1,0	0,420	retained
		2l-zoab	0,0	0,4	1,0	0,447	retained
factor_5	regen	zoab	0,0	0,3	1,0	0,367	rejected
		2l-zoab	0,0	0,3	1,0	0,367	rejected
factor_6	vervuiling_ondergr	zoab	0,0	0,4	1,0	0,438	retained
		2l-zoab	0,0	0,5	1,0	0,469	retained
factor_7	vochting_ondergr	zoab	0,0	0,3	1,0	0,371	rejected
		2l-zoab	0,0	0,3	1,0	0,353	rejected
factor_8	kleef_ondergr	zoab	0,0	0,4	1,0	0,447	retained
		2l-zoab	0,0	0,4	1,0	0,447	retained
factor_9	freeskwal	zoab	0,0	0,4	0,9	0,386	rejected
		2l-zoab	0,0	0,4	1,0	0,429	retained
factor_10	temp_ondergr	zoab	0,0	0,3	1,0	0,371	rejected
		2l-zoab	0,0	0,4	1,0	0,407	retained
factor_11	verdicht_klank	zoab	0,0	0,3	1,0	0,362	rejected
		2l-zoab	0,0	0,3	1,0	0,371	rejected
factor_12	fundering_smal	zoab	0,0	0,3	1,0	0,393	rejected
		2l-zoab	0,0	0,4	1,0	0,407	retained
factor_13	fundering_stijf	zoab	0,0	0,4	1,0	0,424	retained
		2l-zoab	0,0	0,4	1,0	0,438	retained
factor_14	draagkracht_onder	zoab	0,0	0,4	1,0	0,456	retained
		2l-zoab	0,0	0,5	1,0	0,473	retained
factor_15	varierende_homog.	zoab	0,0	0,4	1,0	0,416	retained
		2l-zoab	0,0	0,4	1,0	0,460	retained
factor_16	ontmenging	zoab	0,0	0,5	1,0	0,469	retained
		2l-zoab	0,0	0,5	1,0	0,487	retained
factor_17	rijsnelheid_hoog	zoab	0,0	0,3	1,0	0,371	rejected
		2l-zoab	0,0	0,3	1,0	0,380	rejected
factor_18	continuiteit_machine	zoab	0,0	0,4	1,0	0,447	retained
		2l-zoab	0,0	0,5	1,0	0,478	retained
factor_19	aanstoten_machine	zoab	0,0	0,2	0,9	0,257	rejected
		2l-zoab	0,0	0,2	0,9	0,266	rejected
factor_20	instelling_hoogte_mach	zoab	0,0	0,2	1,0	0,287	rejected
		2l-zoab	0,0	0,2	1,0	0,287	rejected
factor_21	voorverwarm_mach	zoab	0,0	0,4	1,0	0,402	retained
		2l-zoab	0,0	0,4	1,0	0,447	retained
factor_22	dik_asfalt	zoab	0,0	0,1	0,9	0,239	rejected
		2l-zoab	0,0	0,1	0,9	0,248	rejected
factor_23	dun_asfalt	zoab	0,0	0,3	1,0	0,362	rejected
		2l-zoab	0,0	0,4	1,0	0,424	retained
factor_24	breedte_machine	zoab	0,0	0,2	1,0	0,300	rejected
		2l-zoab	0,0	0,3	1,0	0,340	rejected
factor_25	warm_koud_metnaad	zoab	0,0	0,2	1,0	0,309	rejected
		2l-zoab	0,0	0,3	1,0	0,353	rejected
factor_26	warm_koud_zonder	zoab	0,0	0,4	1,0	0,464	retained
		2l-zoab	0,0	0,5	1,0	0,500	retained
factor_27	asfaltnaad_wielspoor	zoab	0,0	0,6	1,0	0,576	retained
		2l-zoab	0,0	0,7	1,0	0,602	retained
factor_28	nadenplan_verkeerd	zoab	0,0	0,4	1,0	0,451	retained
		2l-zoab	0,0	0,4	1,0	0,464	retained
factor_29	terugharken_asfalt	zoab	0,0	0,3	1,0	0,384	rejected
		2l-zoab	0,0	0,4	1,0	0,420	retained
factor_30	geen_wormen	zoab	0,0	0,4	1,0	0,411	retained
		2l-zoab	0,0	0,4	1,0	0,464	retained
factor_31	faseerd_aanbrengen	zoab	0,0	0,3	0,9	0,346	rejected
		2l-zoab	0,0	0,3	1,0	0,398	rejected
factor_32	walsinzet_hoog	zoab	0,0	0,5	1,0	0,469	retained
		2l-zoab	0,0	0,5	1,0	0,478	retained
factor_33	laat_walsen	zoab	0,1	0,6	1,0	0,561	retained
		2l-zoab	0,1	0,6	1,0	0,597	retained
factor_34	verkeerd_wals	zoab	0,0	0,5	1,0	0,527	retained
		2l-zoab	0,0	0,6	1,0	0,544	retained
factor_35	ongelijk_wals	zoab	0,0	0,4	1,0	0,433	retained
		2l-zoab	0,0	0,4	1,0	0,462	retained
factor_36	belaste_ondergr	zoab	0,0	0,3	1,0	0,389	rejected
		2l-zoab	0,0	0,4	1,0	0,402	retained
factor_37	vroegtijdig_belast	zoab	0,0	0,3	1,0	0,371	rejected
		2l-zoab	0,0	0,4	1,0	0,407	retained

Appendix G Dataset with Fuzzified Results for Lifespan Phase

			expert_2				expert_3				expert_6			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,9	(0;0,3;0,9)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0	0,5	0,9	(0;0,5;0,9)
factor_2	regen+vorst	zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0	0	(0;0;0)	0,3	0,3	0,9	(0,3;0,3;0,9)
		2l-zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0	0	0	(0;0;0)	0,5	0,5	0,9	(0,5;0,5;0,9)
factor_3	koude_nachten	zoab	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_4	regen	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_5	zomerhitte	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0	0,1	(0;0;0,1)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0	0,1	(0;0;0,1)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_6	uv-straling	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,3	0,7	(0;0,3;0,7)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,3	0,7	(0;0,3;0,7)
factor_7	struct_toename_verkeer	zoab	0,1	0,1	0,5	(0,1;0,1;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,3	0,7	(0;0,3;0,7)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)
factor_8	struct_zwaarder_verkeer	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,3	1	(0,3;0,3;1)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,3	1	(0,3;0,3;1)
factor_9	tijdel_zwaarder_verkeer	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0	0,1	(0;0;0,1)	0,1	0,1	0,5	(0,1;0,1;0,5)
		2l-zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,1	0,5	(0,1;0,1;0,5)
factor_10	struct_wringend_verkeer	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,9	1	(0,1;0,9;1)	0,3	0,3	0,9	(0,3;0,3;0,9)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,3	1	1	(0,3;1;1)	0,3	0,3	1	(0,3;0,3;1)
factor_11	tijdel_wringend_verkeer	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,3	0,9	(0,3;0,3;0,9)
		2l-zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,3	0,3	0,5	(0,3;0,3;0,5)	0,3	0,3	1	(0,3;0,3;1)
factor_12	krappe_bochten	zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)
		2l-zoab	0,1	0,7	0,9	(0,1;0,7;0,9)	0,5	0,5	0,7	(0,5;0,5;0,7)	0	0,3	0,7	(0;0,3;0,7)
factor_13	files	zoab	0,1	0,1	0,5	(0,1;0,1;0,5)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,5	(0;0,1;0,5)
		2l-zoab	0,1	0,1	0,5	(0,1;0,1;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)
factor_14	verhoging_snelheid	zoab	0	0	0	(0;0;0)	0	0	0	(0;0;0)	0	0	0,1	(0;0;0,1)
		2l-zoab	0	0	0	(0;0;0)	0	0	0	(0;0;0)	0	0	0,1	(0;0;0,1)
factor_15	ov_versporing	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,3	0,7	(0,3;0,3;0,7)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,5	0,5	0,9	(0,5;0,5;0,9)
factor_16	verontreiniging	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,3	0,9	(0,3;0,3;0,9)
		2l-zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	1	(0,3;0,5;1)
factor_17	bomen	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)
factor_18	ov_afwatering	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,5	0,9	1	(0,5;0,9;1)	0,3	0,3	0,9	(0,3;0,3;0,9)
		2l-zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,5	0,9	1	(0,5;0,9;1)	0,3	0,5	1	(0,3;0,5;1)
factor_19	gras_ingroei	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,3	0,9	(0,3;0,3;0,9)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,5	1	(0,3;0,5;1)
factor_20	stenen/rafeling	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,5	0,7	1	(0,5;0,7;1)
factor_21	strooizout	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0	0	(0;0;0)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0	0	(0;0;0)	0	0,3	0,7	(0;0,3;0,7)
factor_22	kadaver	zoab	0,1	0,1	0,5	(0,1;0,1;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,7	0,9	1	(0,7;0,9;1)
factor_23	olie	zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,7	0,7	1	(0,7;0,7;1)	0,5	0,9	1	(0,5;0,9;1)
		2l-zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,7	0,7	1	(0,7;0,7;1)	0,7	0,9	1	(0,7;0,9;1)
factor_24	benzine	zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,7	0,7	1	(0,7;0,7;1)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,7	0,7	1	(0,7;0,7;1)	0,7	0,9	1	(0,7;0,9;1)
factor_25	restzettingen	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,7	1	(0,3;0,7;1)	0	0,5	0,7	(0;0,5;0,7)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,3	0,7	1	(0,3;0,7;1)	0	0,7	1	(0;0,7;1)
factor_26	slappe_ondergrond	zoab	0,5	0,7	1	(0,5;0,7;1)	0,7	0,9	1	(0,7;0,9;1)	0,3	0,7	0,9	(0,3;0,7;0,9)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,7	0,9	1	(0,7;0,9;1)	0,3	0,7	1	(0,3;0,7;1)
factor_27	hoog_grondwater	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,9	1	1	(0,9;1;1)	0,3	0,7	1	(0,3;0,7;1)
		2l-zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,9	1	1	(0,9;1;1)	0,3	0,9	1	(0,3;0,9;1)
factor_28	wallschade	zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,9	1	1	(0,9;1;1)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,9	1	1	(0,9;1;1)	0,7	0,7	1	(0,7;0,7;1)
factor_29	oneigenlijk_gebruik	zoab	0,3	0,7	1	(0,3;0,7;1)	0,5	0,9	1	(0,5;0,9;1)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0,3	0,7	1	(0,3;0,7;1)	0,7	1	1	(0,7;1;1)	0,5	0,7	1	(0,5;0,7;1)
factor_30	reinigen_borstel	zoab	0,3	0,3	0,7	(0,3;0,3;0,7)	0,7	0,9	1	(0,7;0,9;1)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,3	0,3	0,7	(0,3;0,3;0,7)	0,9	1	1	(0,9;1;1)	0	0,3	0,7	(0;0,3;0,7)
factor_31	verwijderde_markering	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,9	1	(0,3;0,9;1)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,5	1	1	(0,5;1;1)	0,7	0,9	1	(0,7;0,9;1)
factor_32	detectielus	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,3	1	(0;0,3;1)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,7	0,9	(0,3;0,7;0,9)	0	0,5	1	(0;0,5;1)
factor_33	bezweken_voeg	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,9	1	1	(0,9;1;1)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	1	1	1	(1;1;1)	0,5	0,7	1	(0,5;0,7;1)
factor_34	krasschade	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,7	0,7	1	(0,7;0,7;1)
factor_35	langshelling	zoab	0	0	0,3	(0;0;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0	0	0,3	(0;0;0,3)	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0,1	0,1	(0;0,1;0,1)
factor_36	verschil_ouderdom	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,1	(0;0,1;0,1)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,3	(0;0,3;0,3)	0,5	0,7	1	(0,5;0,7;1)

			expert_7				expert_9				expert_12			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)	0	0,5	0,7	(0;0,5;0,7)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,5	(0;0,1;0,5)	0	0,3	0,5	(0;0,3;0,5)
factor_2	regen+vorst	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,5	0,5	0,7	(0,5;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_3	koude_nachten	zoab	0,1	0,3	0,3	(0,1;0,3;0,3)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)
factor_4	regen	zoab	0	0,1	0,1	(0;0,1;0,1)	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)
		2l-zoab	0	0,1	0,1	(0;0,1;0,1)	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)
factor_5	zomerhitte	zoab	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)
		2l-zoab	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_6	uv-straling	zoab	0	0,1	0,1	(0;0,1;0,1)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,3	0,9	(0,3;0,3;0,9)
factor_7	struct_toename_verkeer	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,9	(0,1;0,3;0,9)
factor_8	struct_zwaarder_verkeer	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0	0,1	(0;0;0,1)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,5	1	(0,1;0,5;1)
factor_9	tijdel_zwaarder_verkeer	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)	0	0,3	0,7	(0;0,3;0,7)
		2l-zoab	0	0,1	0,5	(0;0,1;0,5)	0	0	0,1	(0;0;0,1)	0	0,3	0,7	(0;0,3;0,7)
factor_10	struct_wringend_verkeer	zoab	0,3	0,5	0,5	(0,3;0,5;0,5)	0	0,3	0,5	(0;0,3;0,5)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,3	1	(0,1;0,3;1)
factor_11	tijdel_wringend_verkeer	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0	0,3	0,5	(0;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_12	krappe_bochten	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_13	files	zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,3	0,7	1	(0,3;0,7;1)	0	0,3	0,5	(0;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_14	verhoging_snelheid	zoab	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)	0	0	0	(0;0;0)
		2l-zoab	0	0	0,1	(0;0;0,1)	0	0	0	(0;0;0)	0	0	0	(0;0;0)
factor_15	ov_versporing	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_16	verontreiniging	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_17	bomen	zoab	0,3	0,5	0,5	(0,3;0,5;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_18	ov_afwatering	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,5	0,5	1	(0,5;0,5;1)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)
factor_19	gras_ingroei	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,3	0,5	0,5	(0,3;0,5;0,5)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_20	stenen/rafeling	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,7	1	(0,3;0,7;1)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,3	0,5	1	(0,3;0,5;1)
factor_21	strooizout	zoab	0	0,1	0,1	(0;0,1;0,1)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,5	(0;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_22	kadaver	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,3	0,9	(0,3;0,3;0,9)
factor_23	olie	zoab	0,5	0,9	1	(0,5;0,9;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,7	0,9	0,9	(0,7;0,9;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_24	benzine	zoab	0,5	0,9	1	(0,5;0,9;1)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,7	0,9	0,9	(0,7;0,9;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_25	restzettingen	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_26	slappe_ondergrond	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)				(;;)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)				(;;)	0,1	0,7	1	(0,1;0,7;1)
factor_27	hoog_grondwater	zoab	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	1	(0,3;0,5;1)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0,3	0,5	1	(0,3;0,5;1)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_28	wallschade	zoab	0,3	0,7	0,7	(0,3;0,7;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,5	0,9	1	(0,5;0,9;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)
factor_29	oneigenlijk_gebruik	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,7	1	(0,1;0,7;1)
		2l-zoab	0,7	0,7	1	(0,7;0,7;1)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	1	(0,1;0,5;1)
factor_30	reinigen_borstel	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,5	0,5	0,9	(0,5;0,5;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)
factor_31	verwijderde_markering	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)
factor_32	detectielus	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_33	bezweken_voeg	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_34	krasschade	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_35	langshelling	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_36	verschil_ouderdom	zoab	0,3	0,3	0,7	(0,3;0,3;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,5	0,7	1	(0,5;0,7;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)

			expert_14				expert_15				expert_17			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,5	0,9	(0;0,5;0,9)	0	0,1	0,5	(0;0,1;0,5)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,5	0,9	(0;0,5;0,9)	0	0,1	0,5	(0;0,1;0,5)
factor_2	regen+vorst	zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,1	0,3	1	(0,1;0,3;1)	0	0,1	1	(0;0,1;1)
		2l-zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,1	0,5	1	(0,1;0,5;1)	0	0,1	1	(0;0,1;1)
factor_3	koude_nachten	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
factor_4	regen	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,7	(0;0,3;0,7)	0	0	0,3	(0;0;0,3)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,3	0,7	(0;0,3;0,7)	0	0	0,3	(0;0;0,3)
factor_5	zomerhitte	zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,3	0,9	(0;0,3;0,9)	0	0	0	(0;0;0)
		2l-zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,5	1	(0;0,5;1)	0	0	0	(0;0;0)
factor_6	uv-straling	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
factor_7	struct_toename_verkeer	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,7	(0;0,1;0,7)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,3	0,7	(0;0,3;0,7)	0	0,3	0,9	(0;0,3;0,9)
factor_8	struct_zwaarder_verkeer	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)	0	0	0,1	(0;0;0,1)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)	0	0	0,1	(0;0;0,1)
factor_9	tijdel_zwaarder_verkeer	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
factor_10	struct_wringend_verkeer	zoab	0,3	0,7	1	(0,3;0,7;1)	0	0,3	0,7	(0;0,3;0,7)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0,5	0,9	1	(0,5;0,9;1)	0	0,3	0,7	(0;0,3;0,7)	0,3	0,5	1	(0,3;0,5;1)
factor_11	tijdel_wringend_verkeer	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)	0	0	0,1	(0;0;0,1)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)	0	0	0,1	(0;0;0,1)
factor_12	krappe_bochten	zoab	0,5	1	1	(0,5;1;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,9	1	(0,3;0,9;1)
		2l-zoab	0,7	1	1	(0,7;1;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,3	0,9	1	(0,3;0,9;1)
factor_13	files	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
factor_14	verhoging_snelheid	zoab	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)
		2l-zoab	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)
factor_15	ov_versporing	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,5	(0;0,1;0,5)
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,5	(0;0,1;0,5)
factor_16	verontreiniging	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	0,9	(0,3;0,5;0,9)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,3	0,5	0,9	(0,3;0,5;0,9)
factor_17	bomen	zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,9	(0,1;0,3;0,9)
		2l-zoab	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)	0,1	0,3	0,9	(0,1;0,3;0,9)
factor_18	ov_afwatering	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)	0,3	0,5	1	(0,3;0,5;1)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,1	0,5	(0;0,1;0,5)	0,3	0,5	1	(0,3;0,5;1)
factor_19	gras_ingroei	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,5	0,9	(0;0,5;0,9)	0	0	0	(0;0;0)
factor_20	stenen/rafeling	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_21	strooizout	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0	0	0,3	(0;0;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)	0	0	0,3	(0;0;0,3)
factor_22	kadaver	zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,5	0,9	(0;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,5	0,9	(0;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)
factor_23	olie	zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,5	0,7	(0,1;0,5;0,7)	0,1	0,3	0,9	(0,1;0,3;0,9)
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,7	0,9	(0,1;0,7;0,9)	0,1	0,3	0,9	(0,1;0,3;0,9)
factor_24	benzine	zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,5	1	(0,1;0,5;1)	0,1	0,3	0,9	(0,1;0,3;0,9)
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,5	1	(0,1;0,5;1)	0,1	0,3	0,9	(0,1;0,3;0,9)
factor_25	restzettingen	zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0	0	(0;0;0)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,1	0,5	0,9	(0,1;0,5;0,9)	0	0	0	(0;0;0)
factor_26	slappe_ondergrond	zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,7	1	(0,1;0,7;1)	0	0	0	(0;0;0)
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,7	1	(0,1;0,7;1)	0	0	0	(0;0;0)
factor_27	hoog_grondwater	zoab	0	0	0,1	(0;0;0,1)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
		2l-zoab	0	0	0,1	(0;0;0,1)	0	0,3	0,7	(0;0,3;0,7)	0	0	0	(0;0;0)
factor_28	wallschade	zoab	0,1	0,3	1	(0,1;0,3;1)	0	0,3	0,9	(0;0,3;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)
		2l-zoab	0,1	0,3	1	(0,1;0,3;1)	0	0,3	0,9	(0;0,3;0,9)	0,1	0,5	0,9	(0,1;0,5;0,9)
factor_29	oneigenlijk_gebruik	zoab	0	0,5	1	(0;0,5;1)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab	0	0,5	1	(0;0,5;1)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,5	1	(0,1;0,5;1)
factor_30	reinigen_borstel	zoab	0	0,3	1	(0;0,3;1)	0	0,1	0,5	(0;0,1;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0	0,5	1	(0;0,5;1)	0	0,1	0,5	(0;0,1;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_31	verwijderde_markering	zoab	0	0,1	0,5	(0;0,1;0,5)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0	0,3	0,7	(0;0,3;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_32	detectielus	zoab	0	0,3	1	(0;0,3;1)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0	0,5	1	(0;0,5;1)	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)
factor_33	bezweken_voeg	zoab				(;;)	0,1	0,1	0,5	(0,1;0,1;0,5)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab				(;;)	0,1	0,1	0,5	(0,1;0,1;0,5)	0,1	0,5	1	(0,1;0,5;1)
factor_34	krasschade	zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0	0,3	0,7	(0;0,3;0,7)	0	0,3	0,7	(0;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_35	langshelling	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
factor_36	verschil_ouderdom	zoab	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
		2l-zoab	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)

			expert_18				expert_19				expert_21			
			min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)		min (a)	opt (b)	max (c)	
factor_1	vorst-dooi_periode	zoab	0	0,1	0,7	(0;0,1;0,7)	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0	0,1	0,7	(0;0,1;0,7)	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_2	regen+vorst	zoab	0	0,3	0,9	(0;0,3;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0	0,3	0,9	(0;0,3;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_3	koude_nachten	zoab	0	0	0	(0;0;0)	0	0	0	(0;0;0)	0	0	0	(0;0;0)
		2l-zoab	0	0	0	(0;0;0)	0	0	0	(0;0;0)	0	0	0	(0;0;0)
factor_4	regen	zoab	0	0	0	(0;0;0)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
		2l-zoab	0	0	0	(0;0;0)	0	0,1	0,5	(0;0,1;0,5)	0	0	0	(0;0;0)
factor_5	zomerhitte	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,3	0,9	(0;0,3;0,9)	0	0	0	(0;0;0)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,3	0,9	(0;0,3;0,9)	0	0	0	(0;0;0)
factor_6	uv-straling	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0,3	0,7	(0;0,3;0,7)	0	0	0,1	(0;0;0,1)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,3	0,7	(0;0,3;0,7)	0	0	0,1	(0;0;0,1)
factor_7	struct_toename_verkeer	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0	0,5	0,9	(0;0,5;0,9)	0	0	0	(0;0;0)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,5	0,9	(0;0,5;0,9)	0	0	0	(0;0;0)
factor_8	struct_zwaarder_verkeer	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,7	1	(0,3;0,7;1)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,7	1	(0,3;0,7;1)	0	0,3	0,5	(0;0,3;0,5)
factor_9	tijdel_zwaarder_verkeer	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0	0	(0;0;0)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0	0	(0;0;0)
factor_10	struct_wringend_verkeer	zoab	0,9	0,9	1	(0,9;0,9;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,9	0,9	1	(0,9;0,9;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,3	0,7	0,9	(0,3;0,7;0,9)
factor_11	tijdel_wringend_verkeer	zoab	0,5	0,5	0,7	(0,5;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,5	0,5	0,7	(0,5;0,5;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_12	krappe_bochten	zoab	0,9	0,9	1	(0,9;0,9;1)	0,3	0,9	1	(0,3;0,9;1)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,9	0,9	1	(0,9;0,9;1)	0,3	0,9	1	(0,3;0,9;1)	0,7	0,9	1	(0,7;0,9;1)
factor_13	files	zoab	0,7	0,9	1	(0,7;0,9;1)	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,5	(0;0,1;0,5)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0	0,1	0,5	(0;0,1;0,5)	0	0,3	0,5	(0;0,3;0,5)
factor_14	verhoging_snelheid	zoab	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)
		2l-zoab	0	0	0,1	(0;0;0,1)	0	0,1	0,3	(0;0,1;0,3)	0	0	0	(0;0;0)
factor_15	ov_versporing	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,5	(0;0,1;0,5)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0	0,1	0,5	(0;0,1;0,5)	0	0,3	0,5	(0;0,3;0,5)
factor_16	verontreiniging	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0	0,3	0,7	(0;0,3;0,7)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,3	0,7	(0;0,3;0,7)	0	0,5	0,9	(0;0,5;0,9)
factor_17	bomen	zoab				(;;)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0	0	(0;0;0)
		2l-zoab				(;;)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0	0	(0;0;0)
factor_18	ov_afwatering	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,3	0,5	(0,1;0,3;0,5)
factor_19	gras_ingroei	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0,1	0,3	0,9	(0,1;0,3;0,9)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,3	0,9	(0,1;0,3;0,9)	0	0,1	0,3	(0;0,1;0,3)
factor_20	stenen/rafeling	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0	0,1	(0;0;0,1)
		2l-zoab	0	0	0,1	(0;0;0,1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0	0,1	(0;0;0,1)
factor_21	strooizout	zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,3	0,9	(0,1;0,3;0,9)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,3	0,3	0,5	(0,3;0,3;0,5)	0,1	0,3	0,9	(0,1;0,3;0,9)	0	0,3	0,5	(0;0,3;0,5)
factor_22	kadaver	zoab	0,7	0,9	1	(0,7;0,9;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab	0,9	0,9	1	(0,9;0,9;1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0,1	0,7	1	(0,1;0,7;1)
factor_23	olie	zoab	1	1	1	(1;1;1)	0,3	0,7	1	(0,3;0,7;1)	0,1	0,5	1	(0,1;0,5;1)
		2l-zoab	1	1	1	(1;1;1)	0,3	0,7	1	(0,3;0,7;1)	0,1	0,7	1	(0,1;0,7;1)
factor_24	benzine	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,3	0,7	1	(0,3;0,7;1)	0	0,5	1	(0;0,5;1)
		2l-zoab	0	0	0,1	(0;0;0,1)	0,3	0,7	1	(0,3;0,7;1)	0	0,7	1	(0;0,7;1)
factor_25	restzettingen	zoab	0	0,5	0,9	(0;0,5;0,9)	0	0,1	0,5	(0;0,1;0,5)	0	0,5	0,9	(0;0,5;0,9)
		2l-zoab	0	0,3	0,7	(0;0,3;0,7)	0	0,1	0,5	(0;0,1;0,5)	0	0,5	0,9	(0;0,5;0,9)
factor_26	slappe_ondergrond	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,7	1	(0,3;0,7;1)	0	0,5	1	(0;0,5;1)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,3	0,7	1	(0,3;0,7;1)	0	0,5	1	(0;0,5;1)
factor_27	hoog_grondwater	zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,5	0,7	(0;0,5;0,7)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,1	0,5	0,7	(0,1;0,5;0,7)	0	0,7	0,9	(0;0,7;0,9)
factor_28	wallschade	zoab	0,7	0,9	1	(0,7;0,9;1)	0,3	0,7	0,9	(0,3;0,7;0,9)	0,5	0,7	1	(0,5;0,7;1)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0,3	0,7	0,9	(0,3;0,7;0,9)	0,5	0,9	1	(0,5;0,9;1)
factor_29	oneigenlijk_gebruik	zoab	0,9	1	1	(0,9;1;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)
		2l-zoab	0,9	1	1	(0,9;1;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,7	(0,1;0,3;0,7)
factor_30	reinigen_borstel	zoab	0	0	0,1	(0;0;0,1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0	0	0,1	(0;0;0,1)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,3	(0;0,1;0,3)
factor_31	verwijderde_markering	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0	0,3	0,5	(0;0,3;0,5)	0	0,3	0,5	(0;0,3;0,5)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,3	0,5	(0;0,3;0,5)	0	0,5	0,7	(0;0,5;0,7)
factor_32	detectielus	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,1	0,5	(0;0,1;0,5)
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,1	0,3	0,7	(0,1;0,3;0,7)	0	0,3	0,5	(0;0,3;0,5)
factor_33	bezweken_voeg	zoab	0,7	0,9	1	(0,7;0,9;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,5	0,7	(0,1;0,5;0,7)
		2l-zoab	0,7	0,9	1	(0,7;0,9;1)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,7	0,9	(0,1;0,7;0,9)
factor_34	krasschade	zoab	0,5	0,7	0,9	(0,5;0,7;0,9)	0	0,3	0,9	(0;0,3;0,9)	0	0,1	0,5	(0;0,1;0,5)
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0	0,3	0,9	(0;0,3;0,9)	0	0,5	0,7	(0;0,5;0,7)
factor_35	langshelling	zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,1	(0;0,1;0,1)
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)	0	0,1	0,3	(0;0,1;0,3)
factor_36	verschil_ouderdom	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)	0	0,1	0,3	(0;0,1;0,3)
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,3	0,5	0,9	(0,3;0,5;0,9)	0,1	0,3	0,5	(0,1;0,3;0,5)

			expert_22				$\min_j\{a_{ij}\}$	$\frac{1}{n}\sum_{i=1}^{n} b_{ij}$	$\max_j\{c_{ij}\}$	$\frac{a_j + 4b_j + c_j}{6}$	RESULT
			min (a)	opt (b)	max (c)						
factor_1	vorst-dooi_periode	zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,2	0,9	0,299	rejected
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,2	0,9	0,309	rejected
factor_2	regen+vorst	zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,2	1,0	0,331	rejected
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,3	1,0	0,362	rejected
factor_3	koude_nachten	zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,1	0,7	0,183	rejected
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,1	0,7	0,183	rejected
factor_4	regen	zoab	0	0	0,1	(0;0;0,1)	0,0	0,1	0,7	0,173	rejected
		2l-zoab	0	0	0,1	(0;0;0,1)	0,0	0,1	0,7	0,173	rejected
factor_5	zomerhitte	zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,1	0,9	0,237	rejected
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,2	1,0	0,285	rejected
factor_6	uv-straling	zoab	0	0,3	0,5	(0;0,3;0,5)	0,0	0,2	0,9	0,288	rejected
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0,0	0,2	0,9	0,278	rejected
factor_7	struct_toename_verkeer	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,2	1,0	0,321	rejected
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,3	0,9	0,335	rejected
factor_8	struct_zwaarder_verkeer	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,2	1,0	0,315	rejected
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,3	1,0	0,372	rejected
factor_9	tijdel_zwaarder_verkeer	zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,0	0,1	0,7	0,204	rejected
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,0	0,2	0,7	0,219	rejected
factor_10	struct_wringend_verkeer	zoab	0,3	0,7	0,9	(0,3;0,7;0,9)	0,0	0,5	1,0	0,531	retained
		2l-zoab	0,3	0,5	0,7	(0,3;0,5;0,7)	0,0	0,6	1,0	0,567	retained
factor_11	tijdel_wringend_verkeer	zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,2	0,9	0,304	rejected
		2l-zoab	0,1	0,1	0,3	(0,1;0,1;0,3)	0,0	0,3	1,0	0,382	rejected
factor_12	krappe_bochten	zoab	0,1	0,7	1	(0,1;0,7;1)	0,0	0,6	1,0	0,556	retained
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0,0	0,6	1,0	0,597	retained
factor_13	files	zoab	0	0,3	0,5	(0;0,3;0,5)	0,0	0,2	1,0	0,331	rejected
		2l-zoab	0	0,5	0,7	(0;0,5;0,7)	0,0	0,3	1,0	0,382	rejected
factor_14	verhoging_snelheid	zoab	0	0	0,1	(0;0;0,1)	0,0	0,0	0,3	0,060	rejected
		2l-zoab	0	0	0,1	(0;0;0,1)	0,0	0,0	0,3	0,060	rejected
factor_15	ov_versporing	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,2	0,7	0,245	rejected
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,3	0,9	0,329	rejected
factor_16	verontreiniging	zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,0	0,4	0,9	0,401	retained
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,4	1,0	0,428	retained
factor_17	bomen	zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,0	0,2	0,9	0,311	rejected
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,0	0,3	0,9	0,333	rejected
factor_18	ov_afwatering	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,4	1,0	0,428	retained
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,5	1,0	0,469	retained
factor_19	gras_ingroei	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,3	0,9	0,365	rejected
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,4	1,0	0,423	retained
factor_20	stenen/rafeling	zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,3	1,0	0,382	rejected
		2l-zoab	0,1	0,3	0,5	(0,1;0,3;0,5)	0,0	0,4	1,0	0,418	retained
factor_21	strooizout	zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,2	0,9	0,268	rejected
		2l-zoab	0	0,1	0,3	(0;0,1;0,3)	0,0	0,2	0,9	0,309	rejected
factor_22	kadaver	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,0	0,4	1,0	0,438	retained
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,0	0,5	1,0	0,469	retained
factor_23	olie	zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,6	1,0	0,594	retained
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0,1	0,6	1,0	0,614	retained
factor_24	benzine	zoab	0,1	0,5	1	(0,1;0,5;1)	0,0	0,5	1,0	0,521	retained
		2l-zoab	0,1	0,5	1	(0,1;0,5;1)	0,0	0,5	1,0	0,526	retained
factor_25	restzettingen	zoab	0	0,7	1	(0;0,7;1)	0,0	0,4	1,0	0,423	retained
		2l-zoab	0	0,7	1	(0;0,7;1)	0,0	0,4	1,0	0,433	retained
factor_26	slappe_ondergrond	zoab	0	0,1	0,5	(0;0,1;0,5)	0,0	0,5	1,0	0,506	retained
		2l-zoab	0	0,1	0,5	(0;0,1;0,5)	0,0	0,5	1,0	0,517	retained
factor_27	hoog_grondwater	zoab	0,3	0,5	1	(0,3;0,5;1)	0,0	0,4	1,0	0,464	retained
		2l-zoab	0,3	0,5	1	(0,3;0,5;1)	0,0	0,5	1,0	0,495	retained
factor_28	wallschade	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,0	0,6	1,0	0,567	retained
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,0	0,6	1,0	0,587	retained
factor_29	oneigenlijk_gebruik	zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,0	0,5	1,0	0,526	retained
		2l-zoab	0,1	0,3	0,9	(0,1;0,3;0,9)	0,0	0,6	1,0	0,551	retained
factor_30	reinigen_borstel	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,0	0,3	1,0	0,382	rejected
		2l-zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,0	0,4	1,0	0,418	retained
factor_31	verwijderde_markering	zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,0	0,4	1,0	0,459	retained
		2l-zoab	0,3	0,5	0,9	(0,3;0,5;0,9)	0,0	0,5	1,0	0,485	retained
factor_32	detectielus	zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,0	0,3	1,0	0,336	rejected
		2l-zoab	0,1	0,5	0,9	(0,1;0,5;0,9)	0,0	0,3	1,0	0,387	rejected
factor_33	bezweken_voeg	zoab	0,3	0,5	1	(0,3;0,5;1)	0,1	0,5	1,0	0,533	retained
		2l-zoab	0,3	0,5	1	(0,3;0,5;1)	0,1	0,6	1,0	0,578	retained
factor_34	krasschade	zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,0	0,4	1,0	0,408	retained
		2l-zoab	0,1	0,3	0,7	(0,1;0,3;0,7)	0,0	0,4	1,0	0,438	retained
factor_35	langshelling	zoab	0	0,3	0,5	(0;0,3;0,5)	0,0	0,2	0,9	0,258	rejected
		2l-zoab	0	0,3	0,5	(0;0,3;0,5)	0,0	0,2	0,9	0,288	rejected
factor_36	verschil_ouderdom	zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,0	0,3	1,0	0,341	rejected
		2l-zoab	0,1	0,5	0,7	(0,1;0,5;0,7)	0,0	0,4	1,0	0,413	retained

Appendix H Deterioration Factors Categorised

Table 22: All deterioration factors during construction sorted by category.

Deterioration Factors During Construction		(S_j) PAC	(S_j) 2L-PAC
Category 1: Processing Temperature			
Factor 1	Abnormal onset temperature of mixture	0,447	0,473
Factor 2	Inadequate cooling curve (too fast)	0,433	0,460
Factor 3	Inadequate cooling curve (too slow)	0,257	0,257
Factor 4	Abnormal temperature consistency of mixture	0,420	0,447
Category 2: Base Layer			
Factor 5	Rainfall during paving	0,367	0,367
Factor 6	Polluted subsurface before paving	0,438	0,469
Factor 7	Base-layer insufficient dry / moisture on base-layer	0,371	0,353
Factor 8	Poor adhesive coating	0,447	0,447
Factor 9	Poor millwork of subsurface	0,386	0,429
Factor 10	Too low temperature of subsurface	0,371	0,407
Factor 11	Insufficient compaction of sub-base	0,362	0,371
Factor 12	Foundation too small	0,393	0,407
Factor 13	Deviating stiffness of foundation	0,424	0,438
Factor 14	Insufficient carrying capacity of subsurface	0,456	0,473
Category 3: Transportation			
Factor 15	Varying homogeneity of mixture when applied	0,416	0,460
Factor 16	Segregation of the mixture	0,469	0,487
Category 4: Paving			
Factor 17	Too high driving speed of paver	0,371	0,380
Factor 18	Paver made a stopping point (discontinuity)	0,447	0,478
Factor 19	Truck bumping into paver	0,257	0,266
Factor 20	Insufficient height adjustment of paver	0,287	0,287
Factor 21	Paver was insufficiently pre-heated	0,402	0,447
Factor 22	Too thick constructed top layer	0,239	0,248
Factor 23	Too thin constructed top layer	0,362	0,424
Factor 24	Use of a wide paver (e.g. full width of roadway)	0,300	0,340
Factor 25	Paving warm asphalt against cold asphalt with joint heaters	0,309	0,353
Factor 26	Paving warm asphalt against cold asphalt w/o joint heaters	0,464	0,500
Factor 27	Asphalt joint constructed in wheel track of traffic	0,576	0,602
Factor 28	Joints situated above one another	0,451	0,464
Factor 29	Manually raking asphalt at joints	0,384	0,420
Factor 30	Paving with a widened paver w/o extending the worms	0,411	0,464
Factor 31	Paving applied in two stages widthwise	0,346	0,398
Category 5: Compaction			
Factor 32	Excessive compaction	0,469	0,478
Factor 33	Compacted with too low temperature of asphalt (too late)	0,561	0,597
Factor 34	Wrong wheel roller used for compaction	0,527	0,544
Factor 35	Unequally compaction	0,433	0,462
Category 6: Other			
Factor 36	Sub-layer was abnormally loaded, e.g. traffic loads	0,389	0,402
Factor 37	Pavement was to early opened up for traffic (insufficient strength)	0,371	0,407

Table 23: All deterioration factors during lifespan sorted by category.

Deterioration Factors During Lifespan		(S_j) PAC	(S_j) 2L-PAC
Category 1: Climate			
Factor 1	Frost-thawing cycles (1 year)	0,240	0,258
Factor 2	Rainfall combined with frost (1 year)	0,286	0,327
Factor 3	Cold nights (1 year)	0,108	0,110
Factor 4	Rainfall (1 year)	0,097	0,097
Factor 5	Summer heat (1 season)	0,156	0,196
Factor 6	UV-radiation (1 year)	0,224	0,214
Category 2: Traffic			
Factor 7	Structural increase in traffic intensity	0,255	0,291
Factor 8	Structural increase in traffic weight	0,247	0,326
Factor 9	Temporal increase in traffic weight	0,147	0,174
Factor 10	Structural increase of wringing traffic	0,547	0,609
Factor 11	Temporal increase of wringing traffic	0,255	0,346
Factor 12	Tight curve in road, e.g. cloverleaf loop	0,571	0,636
Factor 13	Increase in breaking, stationary, slow driving traffic (traffic jams)	0,264	0,333
Factor 14	Increase of driving speed	0,024	0,024
Factor 15	Poor driving alignment (cars drive in each other's tracks)	0,214	0,288
Category 3: Pollution			
Factor 16	Polluted road surface	0,396	0,406
Factor 17	Trees on side of pavement	0,257	0,290
Factor 18	Insufficient drainage capabilities	0,412	0,465
Factor 19	Grass ingrowth in the redress- or emergency lane.	0,344	0,386
Factor 20	Loose stones on road because of ravelling	0,340	0,394
Factor 21	Use of road salt (1 year)	0,194	0,251
Factor 22	Cadaver on road surface	0,426	0,468
Factor 23	Oil on road surface	0,617	0,644
Factor 24	Gasoline on road surface	0,537	0,542
Category 4: Soil/Base Layer			
Factor 25	Unequal residual subsidence in soil base/subgrade	0,381	0,392
Factor 26	Weak soil base/subgrade below widened lane	0,504	0,522
Factor 27	Groundwater level too high	0,449	0,485
Category 5: Other			
Factor 28	Steel wheel roller over existing pavement	0,600	0,629
Factor 29	Misuse of road surface, e.g. snowplough	0,542	0,590
Factor 30	Cleaning of pavement surface with rotating steel wire brush	0,342	0,396
Factor 31	Removed linings with water blasting	0,442	0,473
Factor 32	Presence of a detection loop	0,278	0,340
Factor 33	Collapsed bituminous joints	0,538	0,600
Factor 34	Mechanical/scratch damage lengthwise	0,378	0,417
Factor 35	Longitudinal slope in road	0,176	0,219
Factor 36	Difference in age between road segments widthwise	0,285	0,374

Appendix I Deterioration Factors Ranked from Highest to Lowest

Table 24: All deterioration factors for PAC ranked from highest to lowest S_j value (aggregated experts' opinions).

Deterioration Factors			(S_j) PAC
1.	L, factor 23	Oil on road surface	0,617
2.	L, factor 28	Steel wheel roller over existing pavement	0,600
3.	C, factor 27	Asphalt joint constructed in wheel track of traffic	0,576
4.	L, factor 12	Tight curve in road, e.g. cloverleaf loop	0,571
5.	C, factor 33	Compacted with too low temperature of asphalt (too late)	0,561
6.	L, factor 10	Structural increase of wringing traffic	0,547
7.	L, factor 29	Misuse of road surface, e.g. snowplough	0,542
8.	L, factor 33	Collapsed bituminous joints	0,538
9.	L, factor 24	Gasoline on road surface	0,537
10.	C, factor 34	Wrong wheel roller used for compaction	0,527
11.	L, factor 26	Weak soil base/subgrade below widened lane	0,504
12.	C, factor 16	Segregation of the mixture	0,469
13.	C, factor 32	Excessive compaction	0,469
14.	C, factor 26	Paving warm asphalt against cold asphalt w/o joint heaters	0,464
15.	C, factor 14	Insufficient carrying capacity of subsurface	0,456
16.	C, factor 28	Joints situated above one another	0,451
17.	L, factor 27	Groundwater level too high	0,449
18.	C, factor 1	Abnormal onset temperature of mixture	0,447
19.	C, factor 8	Poor adhesive coating	0,447
20.	C, factor 18	Paver made a stopping point (discontinuity)	0,447
21.	L, factor 31	Removed linings with water blasting	0,442
22.	C, factor 6	Polluted subsurface before paving	0,438
23.	C, factor 2	Inadequate cooling curve (too fast)	0,433
24.	C, factor 35	Unequally compaction	0,433
25.	L, factor 22	Cadaver on road surface	0,426
26.	C, factor 13	Deviating stiffness of foundation	0,424
27.	C, factor 4	Abnormal temperature consistency of mixture	0,420
28.	C, factor 15	Varying homogeneity of mixture when applied	0,416
29.	L, factor 18	Insufficient drainage capabilities	0,412
30.	C, factor 30	Paving with a widened paver w/o extending the worms	0,411
31.	C, factor 21	Paver was insufficiently pre-heated	0,402
32.	L, factor 16	Polluted road surface	0,396
33.	C, factor 12	Foundation too small	0,393
34.	C, factor 36	Sub-layer was abnormally loaded, e.g. traffic loads	0,389
35.	C, factor 9	Poor millwork of subsurface	0,386
36.	C, factor 29	Manually raking asphalt at joints	0,384
37.	L, factor 25	Unequal residual subsidence in soil base/subgrade	0,381
38.	L, factor 34	Mechanical/scratch damage lengthwise	0,378
39.	C, factor 7	Base-layer insufficient dry / moisture	0,371
40.	C, factor 10	Too low temperature of subsurface	0,371
41.	C, factor 17	Too high driving speed of paver	0,371
42.	C, factor 37	Pavement was to early opened up for traffic (insufficient strength)	0,371
43.	C, factor 5	Rainfall during paving	0,367
44.	C, factor 11	Insufficient compaction of sub-base	0,362
45.	C, factor 23	Too thin constructed top layer	0,362

46.	C, factor 31	Paving applied in two stages widthwise	0,346
47.	L, factor 19	Grass ingrowth in the redress- or emergency lane.	0,344
48.	L, factor 30	Cleaning of pavement surface with rotating steel wire brush	0,342
49.	L, factor 20	Loose stones on road because of ravelling	0,340
50.	C, factor 25	Paving warm asphalt against cold asphalt with joint heaters	0,309
51.	C, factor 24	Use of a wide paver (e.g. full width of roadway)	0,300
52.	C, factor 20	Insufficient height adjustment of paver	0,287
53.	L, factor 2	Rainfall combined with frost (1 year)	0,286*
54.	L, factor 36	Difference in age between road segments widthwise	0,285
55.	L, factor 32	Presence of a detection loop	0,278
56.	L, factor 13	Increase in breaking, stationary, slow driving traffic (traffic jams)	0,264*
57.	L, factor 17	Trees on side of pavement	0,257
58.	C, factor 3	Inadequate cooling curve (too slow)	0,257
59.	C, factor 19	Truck bumping into paver	0,257
60.	L, factor 11	Temporal increase of wringing traffic	0,255*
61.	L, factor 7	Structural increase in traffic intensity	0,255*
62.	L, factor 8	Structural increase in traffic weight	0,247*
63.	L, factor 1	Frost-thawing cycles (1 year)	0,240*
64.	C, factor 22	Too thick constructed top layer	0,239
65.	L, factor 6	UV-radiation (1 year)	0,224*
66.	L, factor 15	Poor driving alignment (cars drive in each other's tracks)	0,214*
67.	L, factor 21	Use of road salt (1 year)	0,194
68.	L, factor 35	Longitudinal slope in road	0,176
69.	L, factor 5	Summer heat (1 season)	0,156
70.	L, factor 9	Temporal increase in traffic weight	0,147
71.	L, factor 3	Cold nights (1 year)	0,108
72.	L, factor 4	Rainfall (1 year)	0,097
73.	L, factor 14	Increase of driving speed	0,024

Notes: *1. C = factors that occur during construction, L = factors that occur during lifespan; 2) dotted line.*
2. Dotted line represents the threshold to highlight the most important factors.
*3. * = retained factors with a ranking below 0.4.*

Table 25: All deterioration factors for 2L-PAC ranked from highest to lowest S_j value (aggregated experts' opinions).

Deterioration Factors			(S_j) 2L-PAC
1.	L, factor 23	Oil on road surface	0,644
2.	L, factor 12	Tight curve in road, e.g. cloverleaf loop	0,636
3.	L, factor 28	Steel wheel roller over existing pavement	0,629
4.	L, factor 10	Structural increase of wringing traffic	0,609
5.	C, factor 27	Asphalt joint constructed in wheel track of traffic	0,602
6.	L, factor 33	Collapsed bituminous joints	0,600
7.	C, factor 33	Compacted with too low temperature of asphalt (too late)	0,597
8.	L, factor 29	Misuse of road surface, e.g. snowplough	0,590
9.	C, factor 34	Wrong wheel roller used for compaction	0,544
10.	L, factor 24	Gasoline on road surface	0,542
11.	L, factor 26	Weak soil base/subgrade below widened lane	0,522
12.	C, factor 26	Paving warm asphalt against cold asphalt w/o joint heaters	0,500
13.	C, factor 16	Segregation of the mixture	0,487
14.	L, factor 27	Groundwater level too high	0,485
15.	C, factor 32	Excessive compaction	0,478
16.	C, factor 18	Paver made a stopping point (discontinuity)	0,478
17.	C, factor 1	Abnormal onset temperature of mixture	0,473
18.	C, factor 14	Insufficient carrying capacity of subsurface	0,473
19.	L, factor 31	Removed linings with water blasting	0,473
20.	C, factor 6	Polluted subsurface before paving	0,469
21.	L, factor 22	Cadaver on road surface	0,468
22.	L, factor 18	Insufficient drainage capabilities	0,465
23.	C, factor 28	Joints situated above one another	0,464
24.	C, factor 30	Paving with a widened paver w/o extending the worms	0,464
25.	C, factor 35	Unequally compaction	0,462
26.	C, factor 2	Inadequate cooling curve (too fast)	0,460
27.	C, factor 15	Varying homogeneity of mixture when applied	0,460
28.	C, factor 4	Abnormal temperature consistency of mixture	0,447
29.	C, factor 8	Poor adhesive coating	0,447
30.	C, factor 21	Paver was insufficiently pre-heated	0,447
31.	C, factor 13	Deviating stiffness of foundation	0,438
32.	C, factor 9	Poor millwork of subsurface	0,429
33.	C, factor 23	Too thin constructed top layer	0,424
34.	C, factor 29	Manually raking asphalt at joints	0,420
35.	L, factor 34	Mechanical/scratch damage lengthwise	0,417
36.	C, factor 10	Too low temperature of subsurface	0,407
37.	C, factor 12	Foundation too small	0,407
38.	C, factor 37	Pavement was to early opened up for traffic (insufficient strength)	0,407
39.	L, factor 16	Polluted road surface	0,406
40.	C, factor 36	Sub-layer was abnormally loaded, e.g. traffic loads	0,402
41.	C, factor 31	Paving applied in two stages widthwise	0,398
42.	L, factor 30	Cleaning of pavement surface with rotating steel wire brush	0,396
43.	L, factor 20	Loose stones on road because of ravelling	0,394
44.	L, factor 25	Unequal residual subsidence in soil base/subgrade	0,392
45.	L, factor 19	Grass ingrowth in the redress- or emergency lane.	0,386
46.	C, factor 17	Too high driving speed of paver	0,380
47.	L, factor 36	Difference in age between road segments widthwise	0,374

48.	C, factor 11	Insufficient compaction of sub-base	0,371
49.	C, factor 5	Rainfall during paving	0,367
50.	C, factor 7	Base-layer insufficient dry / moisture	0,353
51.	C, factor 25	Paving warm asphalt against cold asphalt with joint heaters	0,353
52.	L, factor 11	Temporal increase of wringing traffic	0,346*
53.	C, factor 24	Use of a wide paver (e.g. roadway wide)	0,340
54.	L, factor 32	Presence of a detection loop	0,340
55.	L, factor 13	Increase in breaking, stationary, slow driving traffic (traffic jams)	0,333*
56.	L, factor 2	Rainfall combined with frost (1 year)	0,327*
57.	L, factor 8	Structural increase in traffic weight	0,326*
58.	L, factor 7	Structural increase in traffic intensity	0,291*
59.	L, factor 17	Trees on side of pavement	0,290
60.	L, factor 15	Poor driving alignment (cars drive in each other's tracks)	0,288*
61.	C, factor 20	Insufficient height adjustment of paver	0,287
62.	C, factor 19	Truck bumping into paver	0,266
63.	L, factor 1	Frost-thawing cycles (1 year)	0,258*
64.	C, factor 3	Inadequate cooling curve (too slow)	0,257
65.	L, factor 21	Use of road salt (1 year)	0,251
66.	C, factor 22	Too thick constructed top layer	0,248
67.	L, factor 35	Longitudinal slope in road	0,219
68.	L, factor 6	UV-radiation (1 year)	0,214*
69.	L, factor 5	Summer heat (1 season)	0,196
70.	L, factor 9	Temporal increase in traffic weight	0,174
71.	L, factor 3	Cold nights (1 year)	0,110
72.	L, factor 4	Rainfall (1 year)	0,097
73.	L, factor 14	Increase of driving speed	0,024

Note: *1. C = factors that occur during construction, L = factors that occur during lifespan.*
2. Dotted line represents the threshold to highlight the most important factors.
*3. * = retained factors with a ranking below 0.4.*

Appendix J Consensus Levels of all Factors

Table 26: Level of consensus for factors in construction phase.

Factor	Pavement type	Group Consensus level	Consensus per expert														
			1	2	4	6	7	8	10	12	13	14	15	17	18	19	20
1	pac	67%	/	x	x	x	x	x	x	/	x	x	/	/	/	x	x
	2l-pac	73%	/	x	x	x	x	x	x	/	x	x	/	x	/	x	x
2	pac	60%	x	x	x	x	/	x	x	x	x	/	/	/	/	x	/
	2l-pac	73%	x	x	x	x	x	x	x	/	x	/	/	x	x	x	/
3	pac	33%	/	x	/	x	x	/	/	/	/	/	/	x	/	/	x
	2l-pac	33%	/	x	/	/	x	/	/	/	x	/	/	x	/	/	x
4	pac	73%	x	/	x	/	x	x	x	/	x	x	x	x	x	x	/
	2l-pac	73%	x	x	x	/	x	x	x	/	x	x	x	x	/	x	/
5	pac	40%	x	x	x	/	/	/	x	/	/	/	x	/	/	/	x
	2l-pac	53%	x	x	x	/	x	/	x	/	/	/	x	x	/	/	x
6	pac	73%	x	x	x	x	/	/	x	x	/	/	x	x	x	x	x
	2l-pac	73%	x	x	x	x	/	/	x	x	/	x	x	x	/	x	x
7	pac	53%	x	x	x	/	/	/	/	x	/	x	x	x	/	/	x
	2l-pac	60%	x	x	x	/	/	/	/	/	x	x	x	x	x	/	x
8	pac	60%	x	x	x	x	/	/	/	x	/	x	x	/	x	/	x
	2l-pac	67%	x	x	x	x	/	/	/	x	x	x	x	x	/	/	x
9	pac	67%	x	x	x	x	/	/	x	x	/	/	/	x	x	x	x
	2l-pac	80%	x	x	x	x	x	/	x	x	/	/	x	x	x	x	x
10	pac	60%	x	/	x	/	/	x	x	/	x	/	x	x	x	x	/
	2l-pac	67%	x	x	x	/	x	x	x	/	x	/	x	x	/	x	/
11	pac	60%	x	x	/	x	/	x	x	x	x	x	x	/	/	/	/
	2l-pac	53%	x	x	/	x	/	x	x	x	x	x	/	/	/	/	/
12	pac	60%	x	x	/	x	/	/	x	x	/	x	x	/	/	x	x
	2l-pac	53%	x	x	/	x	/	/	x	x	/	x	/	/	/	x	x
13	pac	53%	x	x	/	/	/	/	x	x	/	/	x	/	x	x	x
	2l-pac	53%	x	x	/	/	/	x	x	x	/	/	/	/	x	x	x
14	pac	67%	x	x	/	/	x	x	/	x	x	x	x	/	x	x	/
	2l-pac	73%	x	x	/	x	x	x	/	x	x	x	x	/	x	x	/
15	pac	80%	x	x	x	x	/	x	x	x	x	/	x	x	/	x	x
	2l-pac	93%	x	x	x	x	x	x	x	x	x	x	x	x	/	x	x
16	pac	60%	x	x	x	/	/	x	x	x	/	x	x	/	/	/	x
	2l-pac	80%	x	x	x	/	x	x	x	x	/	x	x	x	/	x	x
17	pac	67%	x	/	x	x	/	/	x	x	x	x	x	x	x	/	/
	2l-pac	60%	x	/	x	/	/	/	x	x	x	x	x	x	x	/	/
18	pac	87%	x	x	x	x	/	x	x	x	x	x	x	x	/	x	x
	2l-pac	93%	x	x	x	x	x	x	x	x	x	x	x	x	/	x	x
19	pac	53%	/	x	/	/	/	/	x	x	x	x	/	/	x	x	x
	2l-pac	67%	/	x	/	x	x	/	x	x	x	x	/	/	x	x	x
20	pac	60%	x	/	x	x	x	/	/	/	/	x	x	x	/	x	x
	2l-pac	73%	x	x	x	x	x	/	/	/	/	x	x	x	x	x	x
21	pac	73%	x	/	x	x	/	/	x	x	x	x	x	x	/	x	x
	2l-pac	87%	x	x	x	x	x	/	x	x	x	x	x	x	/	x	x
22	pac	60%	x	x	x	x	/	/	/	x	x	x	x	/	/	/	x
	2l-pac	53%	x	/	x	x	/	/	/	x	x	x	x	/	/	/	x

23	pac	67%	x	/	/	x	x	/	x	x	/	/	x	x	x	x	x
	2l-pac	60%	x	x	x	x	x	/	x	x	/	/	x	/	/	x	/
24	pac	60%	x	x	x	x	/	/	/	x	/	/	x	x	/	x	x
	2l-pac	33%	x	x	x	/	/	/	/	/	/	/	x	/	/	x	/
25	pac	67%	x	x	x	x	x	x	x	/	x	/	/	/	/	x	x
	2l-pac	53%	/	x	/	x	x	/	x	/	x	/	x	/	/	x	x
26	pac	73%	x	x	/	x	x	x	x	/	/	x	/	x	x	x	x
	2l-pac	87%	x	x	/	x	x	x	x	/	x	x	x	x	x	x	x
27	pac	40%	/	x	/	/	/	/	x	x	/	x	x	/	/	x	/
	2l-pac	40%	/	/	/	/	x	/	x	x	/	x	x	/	/	x	/
28	pac	47%	x	/	/	/	/	/	/	x	/	x	x	x	x	x	/
	2l-pac	53%	x	/	/	x	/	/	/	x	/	x	x	x	x	x	/
29	pac	40%	x	/	/	x	/	/	/	/	x	/	x	/	x	x	/
	2l-pac	33%	x	/	/	/	x	/	/	/	x	/	x	/	/	x	/
30	pac	53%	x	x	x	x	x	/	/	x	/	/	x	/	/	x	/
	2l-pac	40%	x	x	/	/	x	/	/	x	/	/	x	/	/	x	/
31	pac	60%	/	x	/	x	x	/	x	/	x	/	x	/	x	x	x
	2l-pac	53%	/	x	/	x	/	/	x	/	x	/	x	/	x	x	x
32	pac	67%	x	x	/	x	x	x	x	x	x	/	x	/	/	x	/
	2l-pac	60%	x	x	/	x	/	x	x	x	x	/	x	/	/	x	/
33	pac	80%	/	/	x	x	x	x	x	x	x	x	x	x	x	x	/
	2l-pac	80%	x	x	x	x	x	/	x	x	x	x	x	x	/	x	/
34	pac	67%	x	/	x	x	/	/	x	x	x	/	x	x	x	x	/
	2l-pac	53%	/	/	x	/	x	/	x	x	x	/	x	x	/	x	/
35	pac	80%	x	x	x	x	x	x	x	x	/	x	x	x	/	x	/
	2l-pac	87%	x	x	x	x	x	x	x	x	x	x	x	x	/	x	/
36	pac	60%	x	/	/	x	/	/	x	x	/	x	x	x	/	x	x
	2l-pac	53%	x	/	/	/	/	/	x	x	/	x	x	x	/	x	x
37	pac	67%	/	/	/	x	/	/	x	x	x	x	x	x	x	x	x
	2l-pac	60%	/	/	/	x	x	/	x	x	x	x	/	x	/	x	x

Note: x = within consensus range ($\Delta S_j \leq 0.2$), / = outside consensus range ($\Delta S_j > 0.2$).

Table 27: Level of consensus for factors in lifespan phase.

Factor	Pavement type	Group Consensus level	Consensus per expert												
			2	3	6	7	9	12	14	15	17	18	19	21	22
1	pac	92%	x	x	x	x	x	x	x	/	x	x	x	x	x
	2l-pac	77%	/	x	/	x	x	x	x	/	x	x	x	x	x
2	pac	77%	x	/	x	x	x	/	x	x	x	x	x	/	x
	2l-pac	62%	/	/	/	/	x	x	x	/	x	x	x	x	x
3	pac	77%	x	x	/	/	x	x	x	/	x	x	x	x	x
	2l-pac	77%	x	x	/	/	x	x	x	/	x	x	x	x	x
4	pac	92%	x	x	x	x	x	x	x	/	x	x	x	x	x
	2l-pac	92%	x	x	x	x	x	x	x	/	x	x	x	x	x
5	pac	69%	x	/	x	/	x	x	x	x	/	x	x	/	x
	2l-pac	69%	x	/	x	/	x	x	x	x	/	x	x	/	x
6	pac	77%	x	x	x	x	x	/	x	x	/	x	x	/	x
	2l-pac	77%	x	x	x	x	x	x	/	x	/	x	x	/	x
7	pac	62%	/	/	x	/	/	x	x	x	x	x	x	/	x
	2l-pac	77%	x	x	x	x	/	x	x	x	x	/	x	/	x
8	pac	46%	x	/	x	/	/	x	x	/	/	/	x	/	x
	2l-pac	38%	x	/	x	x	/	x	/	/	/	/	x	/	/
9	pac	69%	x	/	x	x	/	x	x	x	/	x	x	/	x
	2l-pac	69%	x	x	x	x	/	x	/	x	/	x	x	/	x
10	pac	77%	x	x	x	x	/	x	x	/	x	/	x	x	x
	2l-pac	54%	x	/	/	x	x	/	/	/	x	/	x	x	x
11	pac	85%	x	x	x	x	x	x	x	x	/	/	x	x	x
	2l-pac	69%	x	x	x	/	x	x	x	/	/	x	x	x	/
12	pac	46%	/	/	/	/	/	/	x	/	x	x	x	x	x
	2l-pac	46%	/	/	/	x	/	/	x	/	x	x	x	x	/
13	pac	85%	x	x	x	x	x	x	x	x	/	/	x	x	x
	2l-pac	69%	x	x	x	/	x	x	/	x	/	/	x	x	x
14	pac	100%	x	x	x	x	x	x	x	x	x	x	x	x	x
	2l-pac	100%	x	x	x	x	x	x	x	x	x	x	x	x	x
15	pac	85%	x	x	/	x	x	/	x	x	x	x	x	x	x
	2l-pac	85%	x	/	/	x	x	x	x	x	x	x	x	x	x
16	pac	85%	x	x	x	x	x	x	x	/	x	/	x	x	x
	2l-pac	85%	x	x	x	x	x	x	x	/	x	x	x	x	/
17	pac	62%	x	x	x	/	x	/	x	x	x	/	x	/	/
	2l-pac	62%	x	x	x	/	x	/	x	x	x	/	x	/	/
18	pac	77%	x	/	x	x	x	x	x	/	x	/	x	x	x
	2l-pac	77%	x	/	x	/	x	x	x	/	x	x	x	x	x
19	pac	69%	/	x	x	x	x	x	x	x	/	/	x	/	x
	2l-pac	77%	x	x	/	x	x	x	x	x	/	x	x	/	x
20	pac	62%	/	x	/	/	x	/	x	x	x	x	x	/	x
	2l-pac	38%	/	/	/	/	/	/	x	x	x	/	x	/	x
21	pac	46%	x	/	x	/	/	x	x	/	/	x	x	/	/
	2l-pac	69%	x	/	x	x	x	x	x	/	/	x	x	x	/
22	pac	62%	/	x	/	x	x	x	/	x	/	/	x	x	x
	2l-pac	62%	x	x	/	/	x	x	/	x	/	/	x	x	x
23	pac	62%	x	x	x	x	/	/	x	/	/	/	x	x	x
	2l-pac	54%	x	x	x	x	/	/	/	x	/	/	x	x	/

24	pac	77%	x	x	x	/	/	x	x	x	x	/	x	x	x
	2l-pac	62%	x	x	/	/	/	/	x	x	x	/	x	x	x
25	pac	38%	x	/	x	x	/	/	x	/	/	/	x	/	/
	2l-pac	31%	/	/	/	x	/	/	x	/	/	x	x	/	/
26	pac	62%	x	/	x	/	/	x	x	x	/	x	x	x	/
	2l-pac	62%	x	/	x	/	/	x	x	x	/	x	x	x	/
27	pac	54%	/	/	/	/	x	x	/	x	/	x	x	x	x
	2l-pac	54%	/	/	/	/	x	x	/	x	/	x	x	x	x
28	pac	46%	x	/	x	x	/	/	/	/	/	x	x	x	/
	2l-pac	46%	x	/	x	x	/	/	/	/	/	x	x	x	/
29	pac	54%	x	/	x	x	/	x	x	/	x	/	x	/	/
	2l-pac	62%	x	/	x	x	x	x	x	/	x	/	x	/	/
30	pac	69%	x	/	x	x	x	/	x	x	x	/	x	x	/
	2l-pac	46%	x	/	x	/	/	/	/	x	x	/	x	x	/
31	pac	69%	x	/	/	x	x	x	/	x	x	/	x	x	x
	2l-pac	85%	x	/	/	x	x	x	x	x	x	x	x	x	x
32	pac	92%	x	x	x	x	x	x	x	x	x	x	x	x	/
	2l-pac	62%	x	/	/	x	/	x	/	x	x	x	x	x	/
33	pac	62%	x	/	x	x	/	x	/	/	x	/	x	x	x
	2l-pac	69%	x	/	x	x	x	x	/	/	x	/	x	x	x
34	pac	69%	x	x	/	x	x	x	/	x	x	/	x	/	x
	2l-pac	92%	x	x	/	x	x	x	x	x	x	x	x	x	x
35	pac	77%	x	/	x	x	/	/	x	x	x	x	x	x	x
	2l-pac	77%	x	/	x	x	/	/	x	x	x	x	x	x	x
36	pac	54%	/	/	x	x	x	x	/	/	/	x	x	/	x
	2l-pac	54%	/	/	/	/	x	x	x	/	/	x	x	x	x

Note: x = within consensus range ($\Delta S_j \leq 0.2$), / = outside consensus range ($\Delta S_j > 0.2$).

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