

# Model for information provision in the tender process

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**ABSTRACT:** This paper presents a model for information provision during the tender process for integrated projects. In the theoretical framework six aspects of information provision are identified: the choice of the client to obtain information, the obligation of the UAV-GC, completeness, correctness, usability and conformity of information. These six aspects are examined in four case studies. The context of these cases is the renovation of moveable bridges which are contracted by the general terms and conditions of the Dutch UAV-GC. By means of a cross-case method the results of the cases are analysed, which shows that all the aspects influence the information provision. Based on the outcome of the analysis, considerations of information provision are formulated. The proposed model for information provision aims to explain some of the problems and risks associated with the type and amount of the provided information during the tender process.

**Key words:** Information aspects, risk, considerations of information provision, model, renovation of moveable bridge, UAV-GC, Netherlands

## 1 INTRODUCTION

During the tender process of construction projects information and documents are provided to tenderers. Such tender documents contain information about the requirements and wishes of the client to help tenderers to submit their bids. In many cases, however the information provided leads to problems especially in renovation projects where an UAV-GC contract is used. An UAV-GC contract is a Dutch contract that contains the general terms and conditions for integrated contracts, such as Design and Build or Design, Build and Maintain. In the Netherlands, many of the moveable bridges are built in the 60's and 70's of the previous century. To guarantee safety of the users and to meet the current requirements, many of these bridges require renovation. These renovations are mainly contracted using the UAV-GC in order to allow the tenderers to use their knowledge to come with innovative and optimized design and construction time. Since the use of UAV-GC contract in renovation projects is still in its early stages of development, several problems related to information provision has been encountered. One of these problems is, that the provided information is not always the right information that the tenderers need to submit their bids. Due to the difference between the provided and required information, disagreements between the client and contractor about the information exchange often arise. To minimize such conflicts the information provision process in the tender phase need to be analysed. In this paper, a model for information provision is proposed as a guideline for the process of information provision during the preparation of the contract. By considering the required information provision, the client would become aware of the choices and consequences needed to be made

in the process of information provision. The first step to develop the model of information provision is through identifying the aspects of information provision through literature review.

## 2 THEORETICAL FRAMEWORK

### 2.1 Renovation

The word 'renovation' is often confused with other terms like maintenance, reconstruction or restauration. The difference between those types of interventions are associated with the intensity of the work (Schraven et al., 2011). In this paper, the definition of Nielsen et al. (2016) will be adopted because it refers to renovation as a general term for improvements of the performance of existing bridges, ranging from middle to major interventions. The intervention in this case should lead to extension of the functional and technical lifetime.

Comparing with new construction projects, renovation projects face some challenges. According to Mitropoulos et al. (2002) these challenges include 1) the physical constraints due to the existing construction, like the limited space for new components or the structural strength of the existing construction, 2) the limited access to the work area and 3) the high uncertainty regarding conditions of the construction. These uncertainties are caused by the absence of as-built drawings, or even the absence of the original drawings.

Klatte et al. (2009) mention that renovation activities of today mainly depend on the decisions made in the past, like decision about the investment, design procedures, choice of materials or construction methods. Also, choices for a bridge's requirements are crucial for fulfilling societal needs, not only at present, but also in the future.

## 2.2 Information provision

Information provision during the tender process has its aim to inform the tenderers about the design and specification of what the client wants to achieve. The provided information is the basis for tenderers to submit their bids. The clearer the tender documentation, the easier it will be for a contractor to estimate his costs. On the other hand poor quality of tender documents can lead to inaccurate estimates, higher (risk) margins in bids, claims and disputes (Laryea, 2011). It can be concluded that documents containing the provided information, have significant influence on the tender and the construction process. In his publication Laryea (2011) suggested six recommendations for clients to adopt and to improve the quality of the tender documents. This includes for the client to describe the specification clearly, not to assume that the tenderers know what the client wants, to tell the tenderers what is required, not to change your mind, allow a realistic tender period and be clear about risk sharing.

## 2.3 Information provision and the UAV-GC

One of the general terms in the UAV-GC contract refers to the obligation to provide information to the tenderers (§3, sect. 1 of the UAV-GC). It says the following: *‘The client shall ensure that the contractor is timely provided with all the information that the client has at his disposal, so far as the provision is necessary to enable the contractor to realize the work and the long-term maintenance in accordance with the agreement’*. This obligation can be represented as a decision tree as shown in Fig. 1. It shows that the client is obligated to provide information only when a) it is necessary, b) the client has the information at his disposal and c) it cannot be made available by other means. In particular the first point leads to problems, because it is often difficult for the client to decide on what information is necessary for a tenderer to carry out the project (CROW, 2005).

The obligation specified in the UAV-GC to provide information, creates expectations by the tenderers to be completely informed about all the elements of the work. Because of this, they will submit their bids as if they have all the information required but in reality this is not always the case (Broesterhuizen, 2015). Information provision is often limited because the client is responsible for all the information he provides (§ 3, sect. 2 of the UAV-GC), regardless whether it is necessary information or not.

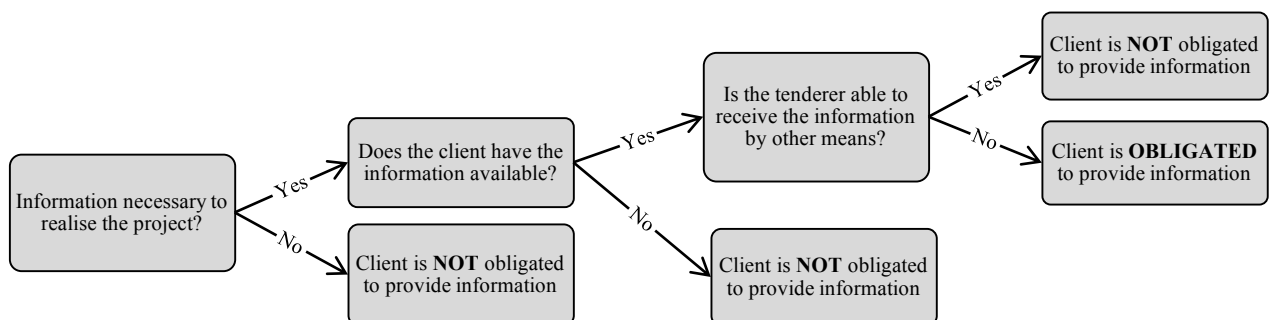


Fig. 1 Obligation to provide information according to the UAV-GC

## 2.4 The relationship between information provision, project requirements and risks

Fig. 2 shows the relationships between information provision, project requirements and risks. These triangular relationships influence the completeness of the tender documents. Each of the relations will be explained in the following sections.

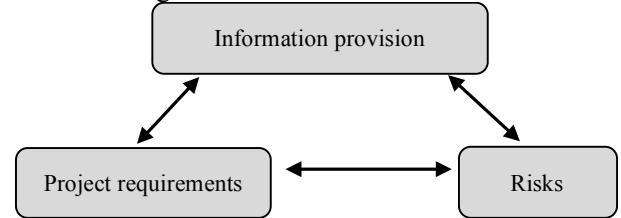


Fig. 2 Relationship information provision, requirements and risks

### 2.4.1 Information provision and project requirements

Fig. 2 indicates that information provision and project requirements influences each other. In a situation where a client requests a partial replacement of an element in a bridge, then it may be not relevant to provide maintenance reports. Otherwise when there is a renovation-requirement, tenderers need to know what the current condition of the element is and how it is maintained. These different types of requirements demand different amount and type of information.

#### 2.4.1.1 Specification of an UAV-GC contract

Since the projects examined and analysed in this paper are all contracted using the UAV-GC, it is important to understand how requirements are specified in this type of contract. The specification of an UAV-GC contract contains the project requirements, but in some cases the contract could also include a design. The specification exists of two parts, one part with the product-requirements and the other part with the process-requirements (CROW, 2016). Both the product- and process-requirements are provided to increase the probability that the system to be build, is on a sufficient level and according to the wishes and requirements of the client (Davis et al., 2004). The requirements of an UAV-GC contract are functionally specified. This means that there is space for more than one solution. The tenderers have through the functionally specified requirements the responsibility for the design and the possibility to implement innovations and optimizations.

Also, it is important to be aware with what interest a certain requirement is formulated, which risks are managed and the need of the requirement (Pianoo, 2016).

#### 2.4.2 *Information provision and risks*

Information provision is also a consideration in context of risk management (Rijkswaterstaat, 2011). The provided information should be of such a degree that tenderers will be able to submit a bid with a limited risk level. In the context of risks, the client should make conscious considerations about which information should be provided and which not. Also, the relevance of the information should be taken into consideration and whether such information would limit the contractor to find broad choices of possible solutions. When the client provides more information than required, tenderers may miss important information because they are not able to analyze all the information provided. It is also possible that the information contradicts each other. Eventually the completeness of information influences the level of risks for both the client and the contractor. Although it is impossible to exclude risks and uncertainties, however it can be minimized through extensive information provision and project definition (Molenaar et al., 2000).

##### 2.4.2.1 *The blurred line between risk and uncertainty in relation to information*

According to the literature review, Samson et al. (2009) indicated that there is a certain relation between risk and uncertainty. A distinction can be made between the two whether they are the same or not, if they are depending one another and which one is dependent on the other. Many of the reviewed literature agreed that risk depends on uncertainty. Knight (1921) makes the distinction between risk and uncertainty by whether it is possible to quantify uncertainty or not, risk is quantifiable uncertainty. The difference between risk and uncertainty in relation to information provision will be further explained in the following example.

In construction projects, there is always the possibility of the presence of unexploded ordnance. The level of information provision can lead to uncertainty or risks. If no investigation is carried out about the presence of unexploded ordnance, there is an uncertainty about such presence and the risk will be borne by the market. When there is some certainty about the presence of unexploded ordnance, but unclear to which extent, a risk will be borne by the contractor about the extent of the unexploded ordnance. If the number of unexploded ordnance is explicitly given, the risk will then be borne by the client because there could be more unexploded ordnance than indicated in the contract. This example shows the influence of information and investigation on the degree uncertainty and risks.

#### 2.4.3 *Specification and risks*

In the paragraph about the specification of an UAV-GC contract, it is already mentioned that risks can be managed

by the formulation of requirements. By specifying the requirements in a risk driven process, it would be possible to integrate risk management in formulating the specification. Asnar et al. (2010) agreed that because of this process, risk mitigating measurements becomes an integrated part of the specification. By analysing the risks along with the needs of the client, risk-based criteria may be included in the requirements.

### 3 ASPECTS OF INFORMATION PROVISION

In the previous sections, different aspects of information provision are already mentioned, like the obligation of provision and the responsibility for completeness and correctness of the provided information. Furthermore, the choice of the client to obtain information, the degree of usability of the information and the conformity of documents and requirements are the other aspects of information provision.

#### 3.1 *Choice of client to obtain information*

The choice of the client largely determines the level of information that will be obtained before the tender. The client's choice can be two-fold. On one hand, the client seeks to obtain and provide as much information as possible or does not, in which case may lead to a minimum of information provision.

#### 3.2 *Obligation of the UAV-GC*

As mentioned in section 2.3 the obligation to provide information follows from the general terms and conditions of the UAV-GC. When the information is necessary, it is in possession of the client and it cannot be obtained by other means, then the client is obligated to provide the information. Further, according to the UAV-GC, the client is responsible for the correctness of the content of the provided information. There is only one exception for this responsibility, however the contractor has the duty to warn when the information is incorrect. If the contractor fails to do so, the contractor will then be responsible for the consequences of the incorrect information. (Bruggeman et al., 2007).

#### 3.3 *Completeness of information*

With the completeness of information is meant that the information content should be of such a degree, that the tenderers are able to submit their bids. Incomplete information provision may be caused by incorrect or not relevant contents. It is even possible that the information is not available at the moment of tendering (Huith et al., 2016). For the completeness of the information provision, information should be obtained by further investigation. To which extent information should be gathered depends on the cost benefit ratio of the investigation to minimize high costs and risks. The intensity of investigation and the level of risks that will be minimized can be variable as in the example of the unexploded ordnance. So, the completeness of information provision will depend on the level of risks the client will transfer to the contractor.

### 3.4 Correctness of information

Correctness of information is another important aspect to be considered during information provision. According to the UAV-GC the client is responsible for the information provided. This means that the client is responsible for the correctness of the information. The correctness of the information may depend on the actuality and source of the information (Jansen, 2001). When a client is not sure about the correctness of the available information, the information will not be provided or is provided as indication, which implies that the client is not responsible for the content of the information.

### 3.5 Usability of information

Information provided to the tenderers can sometimes only be used for specific goals or is limited because of its status. The usability of information depends on the nature and the meaning of the information (Boonstra, 2013; van Dijk, 2013). The nature of information here refers to the kind of information and status of the information (required or informative). The meaning of information indicates that the information relates to a specific component of the structure, which is suitable for a specific purpose. To clarify the nature and meaning of information to tenderers, a client may state attention points to the provided information.

### 3.6 Conformity of information

Another aspect of information provision is the conformity of information. The client is also responsible for conformity between the documents and/ or requirements. Conflicting and contradicting information can lead to uncertainties as to what is required. It is also possible that documents are not in line with each other. In the UAV-GC contract, a clause to deal with this should be included, in case documents or requirements are contradictory (Huith et al., 2016).

## 4 RESEARCH METHOD

Literature review shows that there are six aspects of information provision; choice of client to obtain information, obligation of the UAV-GC, completeness, correctness, usability, and conformity of information.

To develop the model for information provision, these aspects are examined using case studies. For this examination, four cases are analysed, where moveable bridges are renovated according to the general terms and conditions of the UAV-GC. The data from the cases are collected by analysing the contracts and projects' documents and using interviews. In each case different parties are interviewed, representing the client, contractor and contract advisors of the client from Witteveen+Bos. The data are collected using a semi-structured approach. The case studies are cross-case analysed using the theoretical aspects as mentioned above. By means of this analysis, considerations of information provision are identified. These considerations have led to the

development of a concept model for information provision which was then validated by several contract advisors from Witteveen+Bos. The objective of the final proposed model of information provision, is to guide the client when considering the level of information to be provided in the tender phase and the possible risks associated with the choices made.

## 5 CASE STUDIES

In this study four case projects which involve renovations of removable bridges contracted using the UAV-GC are examined in terms of problems related to information provision.

The role of Witteveen+Bos in each of the four projects is different. In the projects Aalsmeerderbruggen A and B, and Konigin Julianabrug, Witteveen+Bos' role was to prepare the contracts following their win to do so. For the other two projects, the Ringbrug and Markneserbrug, Witteveen+Bos was invited to prepare the contract, without a tender process. For all four projects Witteveen+Bos has acted as an advisor, which represents the interest of the client.

### 5.1 Aalsmeerderbruggen A and B

The Aalsmeerderbruggen A and B are two bascule bridges, which were constructed in 1933 and 1969. The renovation activities mainly involve the preservation of the steel structure and replacing of the electrical systems. In the tender documents, it was mentioned that the client did not want to conduct additional investigation to obtain extra information. The client chose for that because the client wanted to leave it to the expertise of the contractors to investigate the damage to the bridge and choose the right renovation method.

In the tender documents, points of attention are stated in some informative documents. These points of attention stated for example that 'the given volumes and unit prices are outdated and may deviate from the actual situation' and that 'the recommendations in the study concern an indication of a possible solution and that the contractor is free to choose another solution, as long as the requirements are met'.

Because of the choice of the client not to carry out full investigation of the state of the bridge, an assessment of the requirements and available information and the possible risks and uncertainties associated with the lack of all required information, is performed. Each requirement is analysed to see whether there is enough information to process the requirement in a bid and which risks may arise from the requirements or the information. Because of this assessment, an investigation is conducted to determine if the steel structure is contaminated with lead. The uncertainty related to the presence of lead will influence the manageability of the project.

The available maintenance reports, which are two to three years old, gave an indication of the kind of damages and its severity, but not the overall extent and location of the

damages. If tenderers prepared their bid solely based on these reports, they would have submitted their bids on outdated information. In order to reduce the discrepancy between the reports and the actual situation, the tenderers were invited for an inspection of the local situation of the bridge. In this way, the tenderers got a better view of the condition of the Aalsmeerderbruggen A and B. The old maintenance reports are also provided, because decisions about the scope of activities are mainly based on these reports.

In the construction period, the structural safety was at stake because of the material loss due to sandblasting of the steel structure. This risk was known to the client, but is estimated as minimal during the preparation of the tender period. To carry out appropriate measures, an inspection is conducted by Witteveen+Bos. The additional activities led to delays and additional costs.

### 5.2 *Ringbrug*

The Ringbrug is a drawbridge with two counterbalances on each side of the bridge. The main renovation activities required were the replacement of the moveable bridge deck and electrical installations in addition to several minor revisions.

During the tender an inspection was organised for the tenderers, to inform them about the local situation and the condition of the bridge. In the request for information, tenderers inquired about the relation between the drawings and the calculations, since the drawings are required and the calculations are only informative. The ambiguity about what the contractor should design and calculate had led to two disagreements, after the project was awarded.

The first disagreement arose due to the application of the ROK (Design Directives for civil infrastructure constructions of Rijkswaterstaat, division of the Dutch Ministry). The ROK demands a certain detail level for a developed design. The developed design, which was provided by the client, should, according to the contract, be further developed and did not meet the requirements of the ROK. The contractor did not further detail the design, but constructed the bridge according to the provided design.

The second disagreement between the contractor and the client was related to the previous issue, because the design and calculations were not of the same detail level. The detail level of the design suggested a further level of the calculations than implemented. In the request for information it was mentioned that the design was based on the calculations. The calculations indicate the basis and design choices, on which the client has developed the design. Because of this the contractor assumed that what was drawn in the design was supported by the calculation and did not further calculate what already was designed. Due to the non-conformity of the design and calculations, some important calculations were not made.

A third point of disagreement was the inspection reports.

The client had asked Witteveen+Bos to conduct a feasibility study for construction alternatives. For this feasibility study, an inspection of the Ringbrug was conducted to gain knowledge about the lifetime of the bridge and its components. Some bridge components were not relevant for the feasibility study, and therefore were not inspected. That meant that not all components of the bridge were examined, which was not mentioned in the report of the study. Because of this, the contractor did not know that some components should be renovated. The contractor expected that all components which should be renovated/ replaced are mentioned in the inspection report, which was not the case.

### 5.3 *Koningin Julianabrug*

The Koningin Julianabrug is a bascule bridge, which went into service in the late 50's. The renovation activities consisted mainly of the replacement of the moveable bridge deck, the operating mechanism and the control unit. Also, the bascule basement was renovated.

In the tender for preparing the contract, the client provided a list of investigations that needed to be conducted by the engineering consultancy. The list should have been examined for its completeness. It was drafted by the client and was based on the risks and uncertainties the client expected, after analysing the project.

During the construction tender, an inspection for the tenderers was held and there were three requests for information. Because of those requests, additional information was provided and many inquiries were answered. One of the inquiry was related to the usability of one of the documents, it is unclear what the objective of the document was.

One of the tender documents was the concept design. The contractor was required to develop the technical design, and verify it. The main risk associated within the project was the integration of a new operational mechanism in the existing bascule basement. During the verification, the designed push-pull connection of the operational mechanism did not fit in the existing situation. According to the requirements, it should have been longer than was specified in the concept design. Therefore, the design needed to be redeveloped and the entire bascule basement needed to be adjusted.

In the contract, there was uncertainty about the condition and structural strength of the frontwall of the bridge. This was because the investigation of the frontwall could only be examined when the bridge was not operating. Because of this there was a lack of information during the tender process. During the construction period the investigation took place, to examine the condition and structural strength of the frontwall of the bridge. The outcomes were worse than anticipated from the limited available information.

### 5.4 *Marknesserbrug*

The Marknesserbrug is a drawbridge with a counterbalance. It was constructed in 1952, according to

the needs of that time. In order to meet the current needs and requirements, the moveable part of the bridge deck, operating mechanism and electrical system needed to be replaced and extended maintenance was required to be performed.

In the tender process five contractors were invited to submit a bid. Because of the limited engineering and construction time, and the risks involved, three contractors were unwilling to submit a bid. The client cancelled the tender and started a new tender process, where again the same five contractors were invited. Some of the concerns expressed during the first tender process were addressed, but still too many risks still existed and because of that the contractors were again unwilling to submit a bid. For the third attempt, an open procedure was chosen, so many contractors could submit their bids. Eventually the project was awarded a half year later than planned.

In the tender process of the Marknesserbrug an inspection was organised and two requests for information were submitted. Particularly in the second request, tenderers requested for information about the superstructure and the operational mechanism of the bridge, but this information was not available to the client.

There were also inquiries about the responsibility for the basic information, like the integration of a new operational mechanism in the existing superstructure. The client indicated that he was responsible for the provided documents, also for the correctness of the information contained in them.

After the contract was awarded, the contractor stated that he needed more information. By means of a request for modification, the contractor wanted to conduct an investigation. The contractor requested that the design should be verified through disassembling and measuring the existing superstructure. Witteveen+Bos indicated that disassembling was not necessary for measuring the existing structure and that if the existing situation was found to be worse than described in the contract, the necessary actions would be arranged with the client.

Similar debate was conducted regarding the reinforcement. The contractor wanted to verify the assumptions, which were based on a study of the reinforcement configuration of the bridge deck. The same applied to this situation concerning the superstructure. If the existing situation is found to be worse than stated in the contract, the necessary actions will be arranged with the client.

Due to these disagreements between the client and the contractor the contract is terminated.

## 6 ANALYSIS OF CASE STUDIES

The results of the four case studies are analysed according to the aspects of the theoretical framework. Because, the obligation of the UAV-GC to provide information is the basis for information provision in the contract, the cases are not analysed according to this aspect. The results are

analysed according to the aspects: choice of the client to obtain information, completeness, correctness, usability and conformity of information.

### 6.1 *Choice of the client to obtain information*

In section 3.1 it was mentioned that it is up to the client to determine the level of information that is obtained or provided. The client can conduct investigation to obtain extra information or not, in which case may lead to shortage in the information provided.

The client of the Aalsmeerderbruggen A and B believed that additional investigation was not necessary, because changes will occur during the process. This choice had led to a stagnation in the construction period as well as additional requests for modification.

The client of Koningin Julianabrug initially intended to provide more information. This intention was indicated in the tender documents during the preparation of the contract whereby a list of investigations was planned. The list did not lead to disagreements between the client and the contractor, but the added value of some of those investigations was in doubt.

In the Ringbrug and Marknesserbrug projects, nothing was mentioned about the choice of the client, there were also no specific problems encountered.

It can be concluded that the choice of the client of how much information should be obtained and provided very much influences the occurrence of disagreements and problems with the contractor during the contract. The client can be open to obtain additional information or be reserved about this issue. Minimum information may lead to risks for the contractor and possible debates, disagreements and requests for modification. On the other hand, provision of too much information does not seem to affect these issues or the progress of the project.

### 6.2 *Completeness of information*

The completeness of the information related mainly to the available information. It also affects the requirements of the client and the level of acceptable risks, as is described in section 2.4 and Fig. 2.

It was mentioned earlier that in the Aalsmeerderbruggen A and B project an assessment was performed to find out if there was enough information provided for the tenderers to submit their bids. From that assessment, it can be deduced that Witteveen+Bos was aware of shortage in the information provided. The assessment has led to a study to determine if the protection of the steel structure was polluted. The assessment showed that the cost of the study in relation to its benefit, conformation of the presence of lead, was worth the effort.

Mitropoulos et al. (2002) have mentioned that renovation projects face challenges due to the high uncertainty regarding conditions of the construction. This uncertainty was identified in the Aalsmeerderbruggen A and B project. It was agreed that information about the condition of the bridge was missing which has led to uncertainties and risks to the contractor. The condition of components

was worse than initially assumed based on the maintenance reports. It is notable that there were no inquiries or requests for information because the condition was identified using the investigation. It can be assumed that tenders used the provided information as it was and accepted the uncertainty and risks associated with it.

The client of the Koning Julianabrug project prescribed an extensive list of investigations in the tender for preparing the contract. The list needed to be examined for completeness and based on that examination, it can be concluded that the client emphasis was mainly on obtaining the required information. This is also supported by the large amount of additional information provided during the request for information. From this it was noted that in the first instance some information was missing.

The investigation for determining the condition and structural strength of the frontwall of the Koningin Julianabrug, took place when the bridge was out of operation time. The client was not able to inform the tenderers completely about the condition, but by stating that the investigation had to be carried out when the bridge is not operating, the tenderers become aware of the uncertainty. In their research, Huith et al. (2016) stated that it is not always possible to possess all the information at the moment of tendering. The investigation in the case of this project could not be performed due to the limited access to the structure, this is one of the problems of renovation projects according to Mitropoulos et al. (2002).

In the Marknesserbrug, the provided information did not match the required information tenderers need for submitting a bid. This was apparent by the fact that twice a selective tender procedure was cancelled because the parties realised that there were too many risks. The provided information should be of such a degree that tenderers submit a bid with a limited risk level (Rijkswaterstaat, 2011). Witteveen+Bos should have mentioned to the client that more information was needed than provided and hence was required to be collected in order to reduce the uncertainties and risks. Evidence about the shortage of information was supported by the many requests for information during the third tender procedure. This was also confirmed during the discussion with the contractor.

In general, incompleteness of the information will lead to problems before and after awarding of the tender. Additionally, the completeness of the information is influenced by various factors such as the choice of the client to provide more information or not, the requirements, and the risks and uncertainties. In some cases, it is not possible to ensure complete information because it cannot be obtained due to the inaccessibility to the structure as stated by Mitropoulos et al. (2002)

### *6.3 Correctness of information*

The general terms and conditions of the UAV-GC

mention that the client is responsible for the content of the information. This means that the client is responsible for the correctness of the information. In three project cases, problems arose due to incorrectness of the information. The consequences of these problems mainly appeared after the project was awarded to the contractor.

In the Aalsmeerderbruggen A and B project, the correctness of the two to three years old maintenance reports was doubtful. This was because in the tender documents it was mentioned that an inspection was organised to minimize the discrepancy between the reports and the actual condition of the Aalsmeerderbruggen A and B. The inspection indicated that the information in the reports was not up to date and did not reflect the actual condition. If such discrepancy was not mentioned by the client, tenderers would have based their bid on incorrect information. This confirms that up to date documents can determine the correctness of information, as indicated by Jansen (2001).

The incorrect information has led to problems in the Koningin Julianabrug project. The operating mechanism was designed on a detailed level, however the verification of the design, by the contractor, showed that the designed operational mechanism did not fit in the existing bascule basement, because the designed push-pull connection, should have been longer according to the specification. It can be concluded that the information provided was incorrect, which led to delay during the engineering period. There were many requests for modification, and extension to the construction period.

The responsibility for the correctness was discussed in the request for information in the Marknesserbrug project. This was highlighted in a question about who is responsible for the provided information when it is discovered to be wrong. In answering this question, it was indicated that the client takes the responsible for all the provided information, independent of its status. This is consistent with what is stipulated in the general terms and conditions of the UAV-GC §3 sect. 2 (CROW, 2005).

It can be concluded that incorrectness of information will lead to various problems. Hence it will influence what and how much information the client chooses to provide. In the Aalsmeerderbruggen A and B, and Marknesserbrug projects disagreements were prevented, through mentioning the basis of the information.

A disagreement about the information in the Koningin Julianabrug project could have been prevented, if there were more details on the bridge operational mechanism. If such details were available, the client would have known that the push-pull connection will not fit. The necessary elements to fit it in the existing bascule basement, would then have been included in the tender. Also, if the push-pull connection was not already designed, the tenderers could have made their own design as part of their bids. Depending on how detailed the tenderers design would be, it would have been possible to discover that the push-pull connection will not fit.

#### 6.4 Usability of information

As indicated in the theoretical framework, the usability depends on the nature and meaning of the information. Because of this, it is important to find out the kind and the status of the information, and to which component it belongs. Extra remarks and explanations may also help to clarify the usability of the information.

Such remarks and attention points were used in some of the informative documents of the Aalsmeerderbruggen A and B project. Because of that extra information, tenderers were able to prepare their bids. In one of the attention points it was mentioned that the recommendations provided should be an indication of a possible solution and that the tenderers are free to use other solutions. Because of this, tenderers are aware of the role and value of the recommendations in the documents. The added value of attention points for the usability of the documents is also mentioned by van Dijk (2013).

One of the tender documents in the Ringbrug project was an inspection report, which shows the outcome of the feasibility study for the construction alternatives. However, this was not mentioned to the tenderers as an attention point. Tenderers expected that the inspection report reflected the condition of all components that require renovation based on the contract. However, the document contained only the components which are relevant for considering the alternatives. Hence the information in the report did not serve the objective of the information provision. This is also indicated by Broesterhuizen (2015) who mentioned that tenderers usually expect to be completely informed, but that the reality is somewhat different.

In the request for information in the Koningin Julianabrug project, a question was asked about the status and reason for one of the provided document. It was not clear to the tenderer what the usability of the document is. Through the introduction of attention points about the usability of documents, it makes it clearer to tenderers what the nature and meaning of the documents are.

This is also supported by Boonstra (2013); van Dijk (2013), who agreed that the usability of information depends on the nature and the meaning of the information. The usability of information also influences the consideration of the client to provide the information.

#### 6.5 Conformity of information

Conformity means the alignment between documents and/or requirements intended. When documents contradict with each other, they will lead to confusion to tenderers. Therefore, it is important that documents and/or requirements are mutually congruent.

This aspect was observed and led to problems in the Ringbrug project. In this project, there were two problems caused by non-conformity. The first one concerns non-conformity between the ROK and the developed design. A discussion point was raised about what should be designed and what already is designed. According to the

contractor, he had to design more than it was expected according to the contract.

The other discussion occurred because the design is not aligned with the calculations. The level of the design suggests the need further detailed level of the design, than that was implemented. It can be stated that the design and the calculations should agree with each other since in the request for information it was mentioned that the calculations are the basis for the provided drawings.

These two discussions show that non-conformity between documents can result in confusion and eventually problems to the contractor. Non-conformity of information can also influence the choice of the client to provide information or otherwise.

### 7 MODEL FOR INFORMATION PROVISION

In the theoretical framework, five aspects of information provision for integrated contracts are identified.

- Choice of client to obtain information;
- Obligation of the UAV-GC;
- Completeness of information;
- Correctness of information;
- Usability of information;
- Conformity of information.

From the analysed cases, it was possible to show that these aspects, with exception to the obligation of the UAV-GC, had led to problems during the tender and construction periods.

#### 7.1 Considerations of information provision

Information provision generally begins with the question: which information is available and is this sufficient for tenderers to use to prepare a bid? This question raises several other considerations to the client when deciding to whether obtain and provide some of the information. The identified aspects are used in helping make such considerations.

##### 7.1.1 Is the available information sufficient?

At the start of a project the client has already some information available. The amount of available information should be examined to check whether it is enough to use by tenderers to submit a bid, without a bearing to much risks.

In the Aalsmeerderbruggen A and B project such an examination is performed. It shows that the requirements and risks play a role major in deciding if available information is sufficient or not. This is also described in section 2.4 by showing that there is a triangular relationship between information provision, project requirements and risks.

Besides requirements and risks, the nature of the project has also influence on such consideration. In this study, a limited number of bridge renovation projects are analysed. In bridge renovation, information about the condition of the bridge is important for tenderers to prepare their bids. In addition, the project's goals and risk allocation within the contract are the other two factors



which influence the level of information provided. The influence of risk allocation on the consideration, is also mentioned by Laryea (2011).

Even when the available information is considered to be sufficient, it is the decision of the client whether to provide the information or not. If on the other hand the information is not sufficient, the client will need to obtain more information.

#### *7.1.2 Is it possible to obtain information?*

In cases where there is insufficient information, the client should obtain the information required whenever possible. In the Koningin Julianabrug project however it was not possible initially to obtain the required information, because the bridge inspection could only be performed when the bridge is out of operation time. Because of this, the client was required to inform the tenderers what information was missing in order for the tenderers to take that in consideration with his allocation of risks.

It is not always possible to obtain all the information in advance of the tender, see Huith et al. (2016). In the Koningin Julianabrug project this was because some components of the bridge were not accessible to obtain the required information. The components were not accessible because the bridge should be out of operation time or some part(s) of the bridge need to be demolished first. This is a typical problem in renovation projects as indicated by Mitropoulos et al. (2002).

#### *7.1.3 Will the client obtain the required information?*

The consideration that the client obtains information, depends on the choice of the client. In the Aalsmeerderbruggen A and B, and the Koningin Julianabrug projects, the choice of the client is emphatically present.

The client of the Aalsmeerderbruggen A and B project chose in the first instance not to obtain information. However, an assessment was then conducted to indicate the high risks associated with the lack of information and a further investigation showed that the uncertainty regarding the presence of polluting substances will very negatively influence the manageability of the project. This example shows that the choice of the client can be influenced if more information is provided.

The client of the Koningin Julianabrug project decided to obtain more information, which was apparent from the tender documents. Because of this choice enough information was obtained and provided.

The two projects show that the choice of the client plays a major role in the possibility to obtain information. Once the information is available, the client should then decide whether to provide it in the tender dossier or not.

#### *7.1.4 Will the client provide the information?*

If the information is available the client needs to decide whether to provide this information or not.

The availability of information is one of the three criteria

regarding the obligation to provide information according to the UAV-GC contract. If the information is necessary to prepare the bid and the tender is not able to acquire this information by other means, the client is obligated to provide the information (see also Fig. 1). If one of these criteria is not applicable, the client is not obligated to provide the information.

The client is responsible for the content of the provided information (§3 sect. 2, UAV-GC). Because of this responsibility, the client may be reluctant to provide the information. The three aspects (correctness, usability and conformity) identified in the theoretical framework and confirmed by the cases, will affect the consideration of the client to provide information or not. If the client decides to provide the information he will carry the responsibility of the risks in case the information is not correct, not usable or does not match with other information. These aspects can be used by the client as a justification for not providing the information.

#### *7.2 Validation of considerations and concept model*

The considerations of information provision and a concept version of the model were validated through a meeting with contract advisors from Witteveen+Bos. During the meeting the considerations and, the readability and the applicability of the concept model were discussed. During the meeting, it was mentioned that there is no clear begin and end to the model, also one loop in the model was missing. For the assessing the first consideration, the project goals and contract strategy should be clear. Using the contract strategy one can consider if the available information is sufficient or not. It was also mentioned that it will be difficult to decide if the information is sufficient, because it will depend on the degree of risk the client is willing to take.

The advisors mentioned that the possibility to obtain information will be influenced by the technical and physical constraints. Also, the risk perception of the client influences the third consideration ‘will the client obtain the required information?’.

The concept version was adjusted to include assessment of risk allocation. A loop was added to assess if the risk profile, as a result of the allocation, is acceptable according to the contract strategy. During the validation, it was also mentioned that the model is applicable for all types of integrated projects where the general terms and conditions of the UAV-GC are used, and not just for renovation projects.

#### *7.3 Model for information provision*

The model for information provision begins with the identification of the project goals and the related contract strategy. Based on this, one can consider if the available information is sufficient or not. If it is not sufficient, one should consider if it is possible to obtain the missing information. In renovation projects, it is not always possible to obtain some of the information, because of technical and physical inspection constraints. If this is the

case, only partial information will be available. This of course may have risk consequences. In case it is possible to obtain all the required information, the client should consider if this is desirable. As part of this consideration, the cost-benefit ratio for choosing to obtain information and minimize the risks, has a major role. If the client decides not to obtain the information, higher uncertainties and possible risks will be retained. The final consideration concerns the choice of the client to provide the information. One of the factors of this consideration is the general term of the UAV-GC about the obligation to provide information (§3, sect. 1). If the information is necessary and not possible to acquire by other means, the client is obligated to provide the information (see Fig. 1). Also, the client needs to decide to provide the information if the correctness, usability or conformity of the information are uncertain. In this case, risks need to be taken into consideration. The risks associated with the difficulty of obtaining the required information, not

willing to obtain information, or not willing to provide information, should be allocated to the party which is able to manage them best. This allocation will determine the risk profiles for both the client and contractor. Based on the risk profile, the client can examine if the information provision and the corresponding risk allocation is according to the desired contract strategy. The model assists in the decisions of information provision because it guides the user to make distinctions between the obligated information provision, partial information provision and sufficient information provision. It also helps the client to way up the risks in case information is not possible to obtain information, not willing to obtain information, or not willing to provide information. With such awareness, the client can allocate the risks to the party which is able to manage them the best. Hereby the client can determine if the information provision lead to an acceptable risk profile, according to the contract strategy.

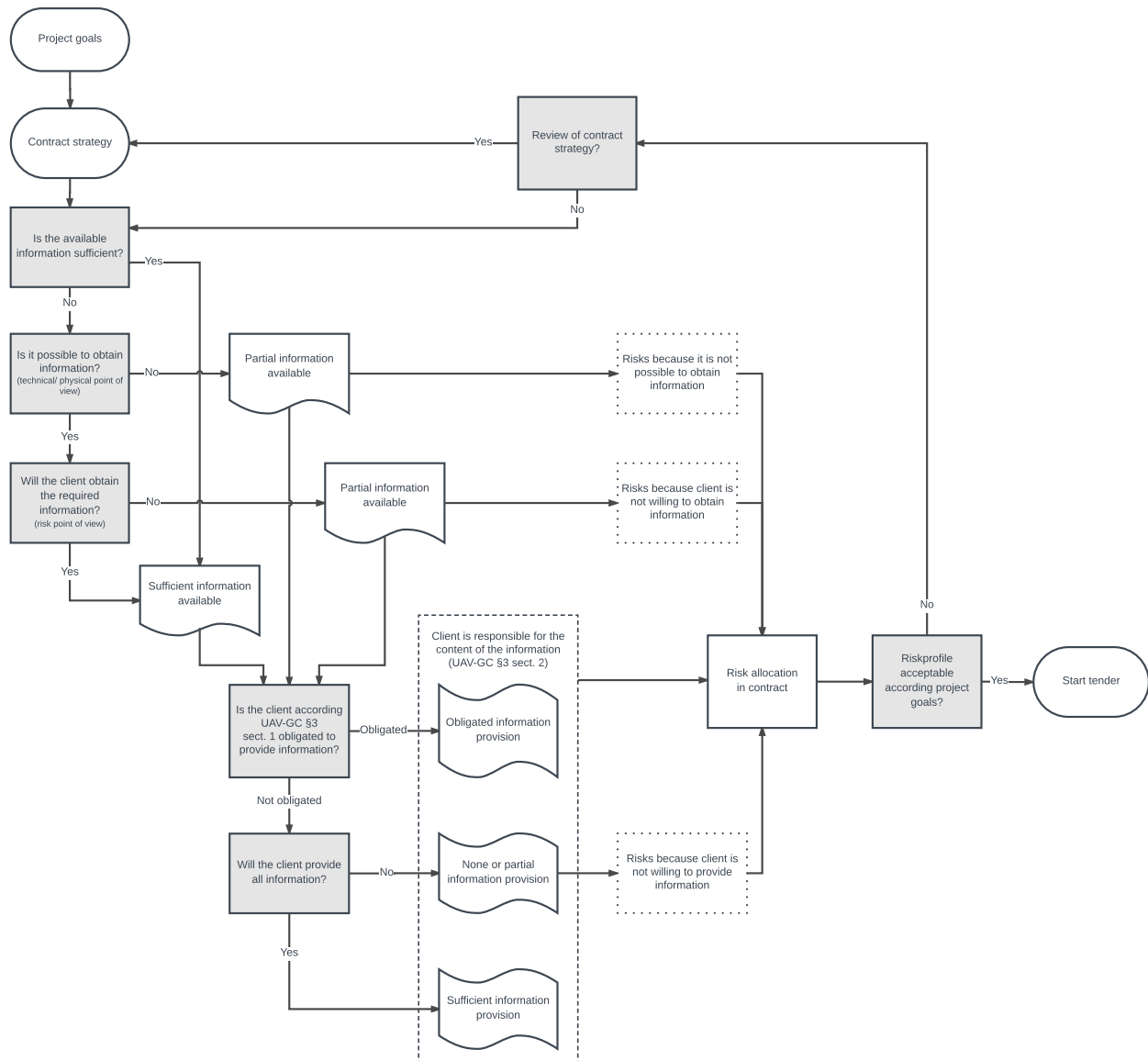


Fig. 3 Model for information provision

## 8 DISCUSSION

The model for information provision shows the different considerations of information provision. Comparing this with the considerations of the obligation of the UAV-GC to provide information, as shown in Fig. 1, it is striking that in the UAV-GC model nothing is mentioned about obtaining information. It is especially remarkable that even when it is agreed that the information is necessary but not in possession of the client, the client has no obligation to obtain the information.

Another striking point is that in the UAV-GC nothing is mentioned about the completeness of the provided information. The completeness of information cannot be obligated if the client is not obligated to obtain information when necessary. It shows that in the absence of an obligation to provide sufficient information there is also absence of an obligation to obtain the required information. This means that a client can choose to provide insufficient information.

The authors of the UAV-GC are aware of the limited obligation to provide information. This is stated in the memo for a revision of the UAV-GC. They agree that the obligation of information provision should be clearer and expanded. To include that the client should have an obligation to obtain the required information, that is necessary to realise the project.

Literature indicates that there are few challenges related to renovation projects, see for example Mitropoulos et al. (2002). The challenges that were identified in the case studies include the physical constraints due to the existing structure, the limited access to the work area and the high uncertainty regarding conditions of the construction. This raises the question whether the use of an integrated contract such as UAV-GC, an appropriated choice is for renovation projects.

## 9 CONCLUSION

In general, the analysis of the case projects has shown that information provision may lead to problems during the tender and construction phases.

The problems are related to aspects of information provision that already have been identified during the literature study. The analysis of the case studies shows that all these aspects influence the information provision in one way or another and hence considerations of their consequences need to be made during the preparation of the information provision in the tender phase.

Based on the considerations and the aspects, a model for information provision is developed. The developed model for information provision will guide the user of the model to consider the information provision and risks associated with it.

When applied, the model will lead to a risk profile, depending on the provided information. Using this risk profile, it can be examined if the information provision

and the corresponding risk allocation is in line with the desired contract strategy.

To minimize the difference between the provided and required information, it is recommended to identify criteria which are of influence on the first consideration, 'Is the available information sufficient?'.

## 10 REFERENCES

- Asnar, Y., Giorgini, P., & Mylopoulos, J. (2010). Goal-driven risk assessment in requirements engineering. *Requirements Engineering*, 16(2), 101-116. doi:10.1007/s00766-010-0112-x
- Boonstra, W. (2013). UAV-GC werken: Hoe informatieverstrekking kan leiden tot meerwerk.
- Broesterhuizen, A. (2015). UAV-gc: (On)bekend maakt (on)bemind. *Cobouw Juridisch*, 147.
- Bruggeman, E. M., Chao-Duivis, M. A. B., & Koning, A. Z. R. (2007). *Praktijkboek contracteren in de bouw*. 's-Gravenhage: Instituut voor Bouwrecht.
- CROW. (2005). *UAV-GC 2005: Model Basisovereenkomst en Toelichting*.
- CROW. (2016). *Model Vraagspecificatie - UAV-GC 2005 met toelichting*.
- Davis, A. M., & Zowghi, D. (2004). Good requirements practices are neither necessary nor sufficient. *Requirements Engineering*, 11(1), 1-3. doi:10.1007/s00766-004-0206-4
- Huith, G. J., & Rijckevorsel, M. R. v. (2016). Informatieverstrekking, de achilleshiel van de UAV-GC 2005. *Tijdschrift voor Bouwrecht*, 4(52).
- Jansen, C. E. C. (2001). *Totstandkoming en inhoud van design & construct-contracten voor complexe infrastructurele projecten*. Deventer: Kluwer.
- Klatter, L., Vrouwenvelder, T., & van Noortwijk, J. M. (2009). Societal and reliability aspects of bridge management in the Netherlands. *Structure and Infrastructure Engineering*, 5(1), 11-24. doi:10.1080/15732470701322743
- Knight, F. (1921). *Risk, Uncertainty and Profit*.
- Laryea, S. (2011). Quality of tender documents: case studies from the UK. *Construction Management and Economics*, 29(3), 275-286. doi:10.1080/01446193.2010.540019
- Mitropoulos, P., & Howell, G. A. (2002). Renovation Projects: Design Process Problems and Improvement Mechanisms. *Journal of Management in Engineering*, 18(4), 179-185. doi:10.1061/(asce)0742-597x(2002)18:4(179)
- Molenaar, K., Vanegas, J. A., & Martinez, H. (2000). Appropriate Risk Allocation in Design-Build RFPs. 1083-1092. doi:10.1061/40475(278)117
- Nielsen, A. N., Jensen, R. L., Larsen, T. S., & Nissen, S. B. (2016). Early stage decision support for sustainable building renovation – A review. *Building and Environment*, 103, 165-181. doi:10.1016/j.buildenv.2016.04.009
- Pianoo. (2016). Vraagspecificatie in de GWW. Retrieved from <https://www.pianoo.nl/markten/gww/inkopen-gww/vraagspecificaties-in-gww>
- Rijkswaterstaat. (2011). Ter beschikking stellen van informatie

- bij UAV-GC contracten (versie 2). 10.
- Samson, S., Reneke, J. A., & Wiecek, M. M. (2009). A review of different perspectives on uncertainty and risk and an alternative modeling paradigm. *Reliability Engineering & System Safety*, 94(2), 558-567. doi:10.1016/j.ress.2008.06.004
- Schraven, D., Hartmann, A., & Dewulf, G. (2011). Effectiveness of infrastructure asset management: challenges for public agencies. *Built Environment Project and Asset Management*, 1(1), 61-74. doi:10.1108/20441241111143786
- van Dijk, E. W. J. (2013). Kroniek rechtspraak UAV-GC. *Tijdschrift voor Bouwrecht*, 1(7).