Effective Winter Highway Maintenance through Application of Partnering Concept

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Abstract—In many countries winter road maintenance is outsourced to private contractors. Selecting appropriate contract for performance of winter highway maintenance and implementing it in an efficient way is then very important for both results and costs. Writing contracts concerning winter road maintenance is however difficult as weather conditions are hard to describe in an exact way and as what is rational to do in a certain situation, depends on expected future conditions. Problems during recent harsh winters in Sweden have clearly illustrated this. The study argues, with reference both to theoretical and empirical studies, that a partnering concept can improve efficiency in outsourced winter road maintenance. A detailed model of how partnering can be implemented is presented for winter road maintenance contracts together with systems for information supply such as International Roughness Index – surface unevenness measurement and Road Weather Information System.

Keywords— Construction Contract; Partnering; Performance Contract; Strategic Alliance; Winter Maintenance Contract

I. INTRODUCTION

The need of improving inter-organisational cooperation in construction industry has been current discussion during several decades in most European countries and Northern America due to lack of trust and high level of conflicts in this sector. Although, several standardised set of practices and guidelines in this context has emerged and issued to facilitate implementation of collaborative contracting, the construction sector is still perceived as an industry with low level of trust and confidence and high level of conflicts.

Construction, operation and maintenance of the Swedish road and railway network had been the responsibility of former Swedish Road Administration and Swedish Railway Administration as two independent authorities during several decades.

For a long time, the operation and maintenance of these infrastructures traditionally used to be performed in-house by these agencies. Step by step the activities have been outsourced and today almost all construction and maintenance activities are performed by private contractors. This development is described more in detail in [1].

In order to create a more effective and unified infrastructure authority, according to a decision made by the Swedish government, the two agencies were merged with each other on 1th of April 2010 to build the new Swedish Transport Administration (STA) that currently is responsible for the construction, operation and maintenance of all state owned roads and railways.

A. Objective and Method

The main objective of the current study is to investigate and find out the possibilities for application of partnering concept to the winter maintenance contract. The study was conducted by a literature review followed by semi-structured interviews and a questionnaire survey across Sweden, and among countries that have similar climate to Sweden. Based on this a model for implementation of partnering in maintenance contracts is presented.

B. Structure of the Article

The article is organised in six sections. Section Two discusses how the partnering concept has been implemented in different countries with a focus on Europe. A theoretical perspective of the partnering concept is presented in Section Three. Section Four is description and analysis of some empirical investigations concerning application of partnering concept in some projects and Section Five deals with the proposal of the study for improving the performance based contract concerning winter road maintenance through application of partnering concept. Conclusion and recommendation are appeared in Section Six which is the final section of the article.

II. PARTNERING IN AN INTERNATIONAL PERSPECTIVE

Partnering as a different concept of collaboration between clients and contractors was developed in the U.S. during the late 80’s, mainly by public sector clients in the defence sector. The purpose was to get stakeholders in the sector to work together instead of engaging in confrontations [2]. Partnering was first applied to a dam project in 1988 and a road construction project in 1991 in the U.S. with good results in both projects [3].

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After introduction of partnering and successful results in the U.S. it has been used and become a successful concept in other countries like Great Britain and Denmark [4].

A. Great Britain

In the middle of 90’s, as a result of a series of high-profile investigations of the shortcomings of traditional procurement, the British government started close collaboration with the industry and introduced partnering to counteract the inability of the British construction industry that was unable to fulfil the requirements that client organisations demanded due to economically adverse development within construction industry [2, 5, 6]. Partnering is now used in Great Britain in most contracts which are financed by state funds.

B. Denmark

In 1997, the Danish government based on the British experience in using partnering contract, took the initiative to develop partnering in the construction industry due to negative basic feature in the construction industry that a series of investigations had pointed to. Already 1998, a number of partnering contracts were signed in different areas, and in 2000 a number of industry stakeholders were involved for development of a common industry practice. In 2004, partnering projects represented approximately 15% of all the project volumes in the Danish construction industry, a proportion that is still growing. In Denmark, partnering is now well established within road maintenance and an industry practice has been developed [7].

C. Norway

In the early 90’s it was found and then desired that competitive bidding within the Norwegian construction industry needed to be enhanced and strengthened. Due to this desire, during 1996 and 1999 a research and development program was implemented with the theme Interaction in Construction Process.

The objective of the research program was to find the new ways for implementation of construction projects that would be flexible and easier to change in the later stages. Thirteen pilot projects were performed within the research program. In six of these projects, new organisational forms were examined. According to the final report of the program, the experience gained from the performed projects had mostly been good, and emphasising good governance, mutual understanding, trust and cooperation as key characteristics of the project [2, 8]. In recent years some Norwegian contractors and clients jointly developed new working methods. The approach is based on turnkey projects with early procurement where great emphasis is placed on building confidence and team-building.

D. Sweden

Lack of trust, high costs and quality problems were discussed intensely in the early 2000’s and partnering was seen as one way to solve these problems [9]. The introduction was however slow as legal costs were not seen as very high, and that the parties in most cases could solve the problems themselves [10].

The former Swedish Railway Administration (now part of the Swedish Transport Administration) was first in public sector to test partnering in operation and maintenance activities even if many were sceptical [11]. The situation in the former Swedish Road Administration (now part of the Swedish Transport Administration) was somewhat different because the administration had already divided the whole country into several maintenance areas and all the operation and maintenance works were contracted through competitive bidding (still similar). On the central level there were however several development projects reported in [12] and [13]. The authority used the term “extended cooperation” instead of “partnering”. This did not lead to a more structured use of partnering and it is not an official part of current contracts. The result in [12] was that even though the parties were satisfied it was difficult to prove clear effects. Partnering was also tested in bridge maintenance project reported in [14]. In Section Four some examples of partnering on the municipal level are presented.

One difference compared to other countries is that one of the largest construction companies in Sweden [15] early adopted partnering as a central part of the firm’s business model. This was applied in both private and public sector concepts. The company expresses:

“We avoid the traditional model in which different actors are in the construction process for a limited time. Partnering is everyone's skill to take advantage of and everybody works together in the project from start to the end” [15].

They underline that partnering should increase efficiency but that it presupposes complete honesty and openness. The company had earlier been convicted as a leader in a cartel and fined 200 million Swedish Kronor (SEK) and a new management team wanted to completely change the image of the company.

III. THEORETICAL PERSPECTIVES

A. Introduction

Construction and maintenance works can be contracted in different ways. The traditional form in Sweden [16] is the Design-Bid-Build model, with a combination of fixed-price and unit-price contract. For larger projects it is more common with

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Design-Build contracts where the contractor also is responsible for the detailed design. Typically there is a risk-sharing arrangement related to an estimated cost. There are a number of different sub-categories and combinations of these, but that is not important for the current article.

Maintenance contracts have in recent years moved in the direction of functional contracts and/or contracts where the client stipulates a number of characteristics that an object should have (see [14] for evaluation of an experiment with this type of contract). Formally there are however no difference between construction and maintenance according to [17].

As argued in [12] partnering should not be seen as an alternative form of procurement in contrast to the Design-Bid-Build or Design-Build model. Instead, partnering is a way to organise the implementation of any type of procurement contract. Therefore advantages and disadvantages of the different procurement types will not be discussed here.

B. The Interpretation of Partnering

Partnering has generally been defined as a form of collaborative relationship between clients and contractors. Reference [12] describes partnering as a combination of highly defined practices and rather abstract concept such as trust and collaboration. Reference [18] states that there are three key factors for all types of partnering projects: common goals, common activities and joint/open economy. Reference [8] states that in order to achieve the minimum requirements for a partnering project, the key factors should be developed i.e. every factor should comprise at least three sub-factors to be called a partnering project and suggest that common goals in a partnering agreement should have the following composition [19, 20]:

- The project should be run as a unified project organisation
- All parties in the project organisation should start cooperating in the early stages
- Partnering declaration and agreement must show that all parties are willing to run the project together
- There should be transparency with the right team and employees

In order to succeed in joint activities in a partnering contract the following composition should be taken into consideration:

- Workshops should be started and be continuous, work teams should be created
- Continuous improvement should be taken into considered. Quick and easy decisions promote cooperation and results
- Partnering organisations should have a conflict resolution steps model i.e. a common conflict resolution system should be developed
- A joint risk management should be developed

Similar to other partnering advocates, [2]'s approach to partnering in the construction process is to achieve better procurement, better cooperation through increased confidence between/among parties, better management of conflict, increased effectiveness and economic efficiency as the goal.

In order to achieve better procurement, a client can decide what a partnering project should involve in a particular project but he/she can preliminary refer to a partnering pattern a so-called partnering flower [12] in his/her procurement specification, and then determine the approach of the cooperation through consultation with stakeholders [3].

What a partnering pattern or flower might include, appears in [12]'s proposal. Reference [12] has also found two properties in a partnering collaboration namely; common goals and, trust and mutual understanding, which is the core of a partnering pattern or flower as shown in Fig. 1.
According to [21] partnering has four basic dimensions namely: width, depth, intensity and duration. As [21] claims, explicitly discussion of these dimensions can make it easier to find the way to implement partnering and achieving cooperation in a project. The dimension width in this context implies that how many and which actors may be involved in partnering, the dimension depth concerns the amount of different skilled staff that will participate in a partnering agreement, intensity is the third dimension in a partnering agreement and the intensity of cooperation is strengthened by cooperative procurement procedures [21] and concerning duration, [22] concludes that the duration of construction projects is normally long, often more than a year, making it possible to build trust-based relationships within single projects. Reference [21] states that the duration of collaboration also depends on when a partner is procured and for how long he/she is involved in the project.

C. Theoretical Explanations

The logic of different types of contracts has been discussed from a general theoretical perspective in [23]. They [23] point out that a “principal” that wants to have something accomplished can, firstly, try to write a rather detailed contract with penalty clauses and then monitor the “agent”.

A second alternative is to write a more open “relational contract” and then fill in the blanks in the contract sequentially as more information becomes available. Incentives for good behaviour are then created by either promises of future contracts or by using an agreed conflict resolution mechanism or both. Sometimes these open relational contracts are called partnering contracts. An example is when firms are organised as partnerships. Reference [23] analyses how these partnerships form their internal rules in a way that creates strong incentives for each partner to cooperate to strengthen the reputation of the company.

Reference [12] analysed partnering in maintenance contracts and found that there was a combination of partnering and very detailed contracts. In his theoretical analysis the question was why the parties chose this combination of detailed contracts and partnering. The hypothesis presented was that during a 3-5 years contract there will always be new information and circumstances that make it rational to change the contract and a partnering structure makes such adjustments easier.

Even a rather detailed contract will include terms that will be difficult to interpret in certain specific situations and the partnering structure can make it easier to “fill out” these unclear parts in a way that is acceptable to both parties. As will be argued later, this role of the partnering structure makes it very suitable for winter maintenance contracts as weather conditions and optimal measures in specific situations are difficult to determine.

D. Comparison between Traditional and Partnering Contract

What typically characterises a traditional project and a partnering project is shown in Table I.

<table>
<thead>
<tr>
<th>Traditional project</th>
<th>Partnering Projects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transactional business</td>
<td>Process with client orientation</td>
</tr>
<tr>
<td>Tender / competition</td>
<td>Competitive selection / partner selection</td>
</tr>
<tr>
<td>Sub-optimisation</td>
<td>Transparency and coordination</td>
</tr>
<tr>
<td>Evaluation of tenders / negotiation</td>
<td>Fast start and workshops</td>
</tr>
<tr>
<td>Predetermined solutions</td>
<td>Opportunities and creativity, new thinking, common goals and trust</td>
</tr>
<tr>
<td>Control / conflict</td>
<td>Collaboration of participants - effective process</td>
</tr>
<tr>
<td>Much duplication of work</td>
<td>Open Books</td>
</tr>
<tr>
<td>Uncertainty, hidden economy</td>
<td>Reducing costs – solving problems quickly</td>
</tr>
<tr>
<td>Additional invoices and additional work</td>
<td>Learning of each other</td>
</tr>
<tr>
<td>Bad experience feedback</td>
<td>Interaction with the confidence and trust</td>
</tr>
</tbody>
</table>

Furthermore, the differences between traditional project and partnering project in today’s society can be distinguished by identifying and listing of the pros and cons in partnering projects. Some of the advantages and disadvantages of partnering that may be mentioned are shown in Table II.

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common solutions - reducing costs and implementation time</td>
<td>Less price pressure</td>
</tr>
<tr>
<td>It provides good and lasting relations</td>
<td>Not applicable in all projects</td>
</tr>
<tr>
<td>Common goals and incentives provide “win-win” for everyone in the project and creates the “Teamwork”</td>
<td>But not all people</td>
</tr>
<tr>
<td>Minimizes disputes</td>
<td>Requires extra meeting time and bureaucracy</td>
</tr>
</tbody>
</table>
E. Criticism of Partnering

Some criticism is expressed that there is no clear definition of partnering, or if it is possible to define it as a strategic alliance. There is another criticism to partnering [24] that the term partnering is so diffuse that it can be applied to any good relationship at any time. In order to make partnering functional [8] all parties in the project must be willing to constantly have the entire project in mind. Loyalty Problems can be arisen if each participant in the project has own individual goals for the project instead of having the common aims for the project and finally a satisfied client. According to [10] it is not always necessary to show the correct costs in open books i.e. a contractor can allocate the costs over the accounts he wants, and the open books can be misleading and counter-confidence. In addition, the close relationships within a partnering collaboration influence priorities and make it extra sensitive to resolve conflicts.

In other words, when open books are used in partnering it just happens that the owner of the books is also entitled not to disclose any more than what suits him/her in the books [10]. Of course, open book does not mean full access to how various costs are broken down e.g. it is easy for a contractor to charge a certain amount of administrative work from one project to the detriment of a partnering project in his books. Another problem according to [24] may occur with partnering is the application of the Act on Public Procurement (the Swedish law of public procurement since 1992). If a party is a public sector, contracts cannot be established in the same way according to the Act that says, each procurement must be performed separately, therefore a contract cannot be established for more projects simultaneously.

IV. EMPIRICAL INVESTIGATIONS

A. Domestic Questionnaire Survey

In order to explore if a partnering concept has been applied or is currently used in (winter) maintenance contract an electronic questionnaire survey was constructed. The questionnaire was divided into four sections with different themes. The questionnaire consisted of questions with both multiple choice answers and with open-ended answers and place for comments as well. One of the themes concerned the partnering concept, based on the participants’ experience e.g. if their current contract has any requirement for partnering or extended collaboration between client and contractor and if yes, how they experience partnering or extended collaboration in the work as client/contractor. 23 of 41 participants responded to the questions. 31.6% responded that they use partnering in the contract (Fig. 2).

![Partnering or extended collaboration in the contracts](image)

Even if partnering is mentioned in some contracts, some clients state that so far they have not seen any tested/tried working methods with partnering somewhere else. Some other clients state that they have not seen more than marginal effects of this work method. Thus they do not use partnering as a requirement in the contract. Some clients state that they do not see partnering as something necessary to offer contractors. Some respondents state that they actually do not use the terms partnering or extended collaboration partly because they themselves have developed their own concept of consultation or collaboration. This concept is included in the contract and used widely in different maintenance contracts during the contract period. A couple of participants in the survey believe that it is always good to have close collaboration because of the common goals but we should not forget that every part has different roles.

B. International Questionnaire Survey: Benchmarking

Similar to the domestic survey, an electronic questionnaire that was targeted to (winter) maintenance contract in cold climate was designed and sent to Road and Transport Administrations in 12 selected countries (Canada/Ontario, Finland, Norway, Iceland, Denmark, Estonia, Lithuania, Latvia, England, Austria, Japan and USA/Washington DC).

The questionnaire was divided into four sections with different themes among other things the partnering concept. The response rate after two reminders was 58% (7 road agencies) which is acceptable for this type of investigation.
Partnership and its application in contract in order to eliminate or minimise possible conflicts between client and contractor is a relatively new phenomenon. In this connection the participants in the survey were asked about the level of their familiarity with the phenomenon partnering in contract. Six of seven participating Road Administrations responded to the question. As Fig. 3 shows, 50% of the respondents i.e. Canada (MTO), Iceland (ICRA) and Lithuania (LRA) are hardly familiar with partnering in the contract, 33.3% i.e. Finland (FTA) and Estonia (ERA) are rather familiar, only 16.7% i.e. Denmark (DRD) is very familiar with this phenomenon.

When asking if there is any formal requirement for partnering in their current road maintenance contract, four of seven respondents response that there is not any formal requirement for partnering, only DRD and LRA have formal requirements for partnering in contract (Fig. 4).

Two (FTA, MTO) of four respondents state that although the current contract does not cover partnering there is always some kind of cooperation and communication between parties during the contract period. MTO states that their contract is designed in such manner that the contracts are looked upon as partnership for service delivery regardless of summer or winter activities and measures.

When asking about the respondents own opinion about partnering regardless of the current contract’s consideration for it, all the seven responding Road Administrations are totally agree with the statement “partnering between client and contractor can affect the performed work positively” and two of the respondents believe that partnering leads to increased joint-responsibilities (DRD) and partnering, collaboration, teamwork and mutual understanding always generate positive results (ERA) (Fig. 5).
C. Case Studies

In order to use new contract forms to stimulate innovation and using partnering concept in forthcoming contracts for winter infrastructure maintenance, the study has also involved, followed and analysed and evaluated three recent construction projects with different degree of complexity, which were procured and performed through application of partnering concept by three different client organisations in Swedish public sector. All the projects were of maintenance character.

The projects were performed in three different cities in Sweden, namely; Gothenburg, Eskilstuna and Norrköping as shown in Table III (one SEK – Swedish Kronor is approximately equal to 0.11 €).

<table>
<thead>
<tr>
<th>Project Location</th>
<th>Contract type</th>
<th>Sort of Work</th>
<th>Scope of project</th>
<th>Work duration (month)</th>
<th>Tender (contract) price ~MSEK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gothenburg</td>
<td>General contract</td>
<td>Renewal of damaged Asphalt</td>
<td>151000 m² Asphalt 6200 m Curb</td>
<td>16</td>
<td>13.30</td>
</tr>
<tr>
<td>Eskilstuna</td>
<td>Performance Contract</td>
<td>Reconstruction of Municipal roads</td>
<td>15400 m²</td>
<td>18</td>
<td>31.00</td>
</tr>
<tr>
<td>Norrköping</td>
<td>General contract</td>
<td>Reconstruction of bypass roads</td>
<td>High complex Scope</td>
<td>16</td>
<td>90.00</td>
</tr>
</tbody>
</table>

1) Gothenburg Project (G) (Gothenburg Municipality – Traffic Office):

The main purpose of following and documenting this project has been to demonstrate the differences between the collaboration form partnering and traditional procurement form (in this case; general contract) and the new situations and problems and benefits that may arise.

The project, named Asphalt coating/surfacing maintenance stage 1:2008 in the city of Gothenburg, began in January 2008 and was completed in May 2009. There was a general contract with the functional requirements i.e. appropriate quality which included corrective maintenance (asphalt renewal) of 45 municipal roads and streets, approximately 50000 m² thin layers surfacing, 90000 m² conventional surfacing. Approximately 11000 m² walkway and adjustment of approximately 6200 m curb. Tender (contract) price was 13.30 million SEK. In early stage of the tender and before the closing day for tenders an information meeting was held. Everyone who had taken the procurement-specification documents was invited. They received information about partnering and could ask questions. All information including questions and answers were collected after the meeting and sent to those who had taken the inquiry-specification documents. Each tenderer was asked to write in the tender document if he/she was willing to run the project with the collaboration form partnering, but no tender points were given for previous experience in other partnering projects. The project began with a workshop by initiation of the contractor who had been awarded the contract. Participants from both the procurement phase and the execution phase were represented in the workshop and it was led by an external partnering leader. During the workshop project-specific data were blended with exercises in order to form a partnering organisation with a strong team spirit. Through group exercises, common project-goals were developed and a partnering declaration was drafted. Risks of the project were identified, preventive measures were discussed and subsequently a conflict resolution methodology was established.

The project was organised in a steering committee, a collaboration group and construction management group consisting of partners (project managers, construction managers and site managers) from the client and the contractor or from any of them appointed consultant. A simplified design was carried out before the project would be started. To define possible incentives at the initial workshop and try/test them in the project was included in the project. Otherwise bill of quantities were regulated according to the documents. The daily work was managed by the contractor’s site manager along with the client’s construction manager. With the increased collaboration in the project, the contact between them increased too. The first thing that was done was to prepare sample-streets that would be the basis for incentives. The project has been run by continued close contact between the construction manager and site manager. Decision paths have been short and straightforward. Arising problems were handled quickly and efficiently. According to the client, they have strived to optimise solutions rather than following the basic design. The right quality (functional requirements) has been in focus throughout the project. At the end of the project, representatives of the client and the contractor gathered in a finishing workshop. There was reconciliation with the identified risks, and also to the project-objectives [7].

Follow-up and evaluation of the project at the final workshop showed that, it was a very good goal achievement.

Three important factors can be pointed out which contributed to the success of the Gothenburg project by partnering as follow:
• Information meeting in connection with the bidding to ensure tenderers’ understanding of what partnering means for the project. It is important as long as partnering is an unusual form of work
• Initial workshop where the group feeling is strengthened makes the contacts in the project simplified
• When everybody can express his/her opinion freely regardless to the formal structures or surrounding’s expectations, gives a faster and better problem solving where everybody also dare discuss and try new solutions with shared responsibility

2) Eskilstuna Project (E) (Eskilstuna Municipality – Traffic office):

In this project named Reconstruction of Church Street (Kyrkogatan), Eskilstuna municipality decided in autumn 2007 to advance the reconstruction of Church Street (kyrkogatan), due to a new building construction in the district would be completed in 2009. An investigation was performed on the basis of consultations in the municipal technical office in November 2007. The rebuilding of this municipal road took a total time of 18 months for the design, procurement and construction. Two winter periods were also included in the schedule, which reduced the effectiveness of the reconstruction work. Essential to meet the short project period was to design and build simultaneously. To obtain a high quality reconstruction with limited budget and schedule, the municipality chose to implement the reconstruction work by partnering collaboration. The idea was that the municipality along with a procured contractor would plan, design and build to a large extent in parallel processes, thereby reduce project duration by about 40 per cent.

The project Church Street (Kyrkogatan) in Eskilstuna began in January 2008 and was completed in May 30, 2009 with an official opening ceremony. The project, which was a performance contract, was divided into two parts, the first of which involved planning and design, and the other continued design and construction. The work encompassed approximately 15,400 m² of road, bike paths, and walkways, parking areas, park and square surfaces. Tender price consisted of an overall budget of 28.8 million SEK. The project’s overall scale was about 31 million SEK and also included external orders.

In this project there was a steering committee which basically served as a board of the project. It has indicated a main targeting and has continuously followed up the goals and targets. All steering committee meetings have been documented and available to all involved in the project. The project’s external partnering leaders have also taken note of the documentation. Each party has also appointed a representative in the steering committee.

The project was basically performed on a cost-plus contract basis with the economic framework and timeframe. During the project, no model for economic incentives had been discussed. The task was to adapt the project to the financial framework.

Similar to the project G, in the early tender stage, before the closing date, an information meeting was held. All those who had received the inquiry-specification documents were invited. They received information about partnering and got to ask questions. All information including questions and answers were collected after the meeting and sent to those who had already taken the procurement-specification documents. The contract with its inquiry was perceived as clearly. There were clear criteria for all requested materials. Almost the entire tender was based on partnering specific selection criteria i.e. non-monetary parameters. Even evaluation model was clearly described and easy to understand and follow. No appeal of the award was made.

The contractor, who had won the contract, began with a joint start-up workshop where participants from both the design phase and construction phase were represented, including information officer and quality manager. The workshop was led by an external partnering leader. During the workshop the project-specific data were blended with exercises in order to form a partnering organisation with a strong team spirit. Through group exercises, common project goals were developed and a partnering declaration was drafted. Risks of the project were identified, preventive measures were discussed and subsequently a conflict resolution methodology was established.

As previously mentioned, the project was divided into two parts. Part I covered the planning and design and Part II continued design and construction simultaneously. Part II was a continuation of Part I, the parties considered that the cooperation in the design stage worked well. In Part I, unit price-lists for personnel, machinery and vehicles were determined. Even the client’s personnel was priced and billed to the project because it would be cost-neutral to use internal or external staff. Even the contractor’s add-ons on invoices were established before the project would be passed into Part II. All invoices were put in the client’s financial system.

As the client stated at the end of the project, this project has laid the groundwork for many rewarding lessons. Basically partnering collaboration has worked very well in the project. A common desire to implement the best project and a good climate of cooperation with purposeful demands for improvements gave active employees and simplifications. Only with a close and trusting cooperation between the client and the contractor, it was possible to compress the schedule by allowing the design and running the construction work simultaneously. According to both the client and the contractor, partnering cooperation in this project resulted in more understanding of each other’s problems, which ultimately led to a better quality of the performed work and better economy for all parties [7].

3) Norrköping Project (N) (Norrköping Municipality – Traffic Office):

This project included reconstruction of the existing bypass road in Norrköping and contained a number of complex parts,
such as conversion from two-lane to four-lane road, lowering of a road about 6-7 meters and the construction of four new bridges. It was precisely because of the project’s high level of complexity that partnering collaboration model was selected.

The project began with planning in spring 2007 and the contractor was selected in summer 2007 and it was completed in October 2008. The project was a general contract with design responsibility for bridges. The contract price was about 90 million SEK. The project had three partners; the Municipality of Norrköping, STA and the already procured contractor and carried out by partnering collaboration. Norrköping Municipality was the client and financed half of the project and ran it. STA financed up the remaining half and was represented in steering group. In addition to the steering group, there was a collaboration group and a construction management group consisting of stakeholders from the client and the contractor or from any of them appointed consultant. The project was conducted with target price with incentives, without indexation. The target price had been split into a fixed and a variable component.

The goal of collaboration form was to optimise resources and thereby create a better result. The tender evaluation focused on the soft parameters. Client’s ambition with the selection of collaboration form was to achieve the following goals:

- Project cost within budget
- Cooperation and trust is created and developed between all parties involved throughout the project
- Maximise the benefits of investments
- Build for the long term management and low operating costs
- Minimise disturbance to the environment during construction with regard to safety
- Zero accidents
- Zero accidents attributed to reconstruction during the construction period
- Schedule to be held
- Zero error when audits

The project was started with a meeting with the contractor for delivery from the designer to the contractor and followed with a start-up workshop with the core group. The workshop included representatives of the municipality, STA, contractor and consultant who had designed the project.

The remuneration form in the project was a combination of cost-plus contract with target cost and a certain fixed fee component and incentives. Upper or lower boundary of the target cost was divided equally between the contractor and the client. The contractor used a computerised system for cost tracking. The client had full insight into project accounts, known as open books, and possibility to access to information in real time. The reported costs would be equal to net prices with visible discounts. Each month, a cost-reconciliation from actual (spent) cost at reconciliation time, assessment of remaining works and the outcome from the beginning of the project would be implemented. Quarterly, a follow-up and prognosis would be performed where the entire cost-structure including the calculation of incentive outcomes were presented.

The project has been able to accomplish a ten per cent saving that was shared equally between client and contractor.

Some of the reasons that the project worked fine can be ranked as follow:

- The open and relevant financial reporting
- Common incentive
- Suggestions for improvement from all parts of the organisation
- Less unnecessary talk and quick decisions

What that was less good in the project can be ranked as follow:

- Too few partnering meetings
- Cooperation with the STA in Borlänge (the location of STA’s headquarter)
- Information and structure in the workplace
- Difficulty getting out messages to professional workers

This project was nominated and awarded the yearly prise for best Swedish construction project in 2008 by Swedish Renewal in the Civil Work Industry. The prise is the industry’s own quality award given to a project that best combines collaboration and creative solutions to get more facility for the money. The project was complicated but successful and was completed on time while the final budget was almost ten per cent less than the calculated i.e. about eight million SEK [7].

V. PROPOSAL TO THE APPLICATION OF PARTNERING CONCEPT IN WINTER HIGHWAY MAINTENANCE CONTRACT

A. Introduction

The Swedish road network has been divided into 115 geographic areas, so-called maintenance areas only covering the state
roads. A maintenance area in average comprises between 700 and 1000 kilometres roads. All the operation and maintenance works are contracted through competitive bidding. A routine maintenance package contract, called Basic Operation and Maintenance Package (“Grundpaket Drift” in Swedish, GPD”) is procured area-wise. The contractor for each maintenance area is selected on a price – and quality basis. The contract-awarded contractors are responsible for year-round-maintenance of the roads belonging to the area. The duration of the contracts vary from 3 to 6 years with an option to extend the contract in one to two more years (1+1 year). The contracts primarily consist of short-term measures aimed to keep the roads open for traffic accessibility. The main tasks are maintenance of gravel roads and paved roads, repair of minor road surface damages and potholes, maintenance of rest areas, replacement of damaged road signs and clearing and haymaking of road embankments [14, 25].

Winter maintenance which is a part of the year-round-maintenance comprises those tasks that must be performed during winter season (1st October- 30th April) to ensure the road traffic safety for users during winter. The main tasks for winter maintenance are snow ploughing, de-icing, salting, sanding and cleaning the traffic signs from snow [25] and doing precise maintenance for problematic targets.

B. Winter Maintenance – Why Partnering Is Especially Relevant

As discussed above in the theoretical section partnering can be implemented through different types of contracts. The traditional theoretical view of partnering is that it is part of an open relational contract where there are few details in the contracts and where the parties step by step make decision about details within the framework of the partnering contracts. An important observation in [12] was that partnering in the context of Swedish maintenance contracts was not like this. Instead there was a detailed contract as a base, but the partnering concept meant that adjustments and changes in the contract could be made when e.g. new information was available.

Starting from a detailed contract partnering can be important for several different reasons. The first is that it might be difficult to describe the conditions in the contract with enough detail. In reality there might be situations that are difficult to classify and then partnering is a way to decide what to do in these situation. A second situation is where it is clear what the contract stipulates but circumstances indicate that it is not rational to carry out in the specific situation that occurs. Instead of following the contract the parties agree to do something else. A third related situation is that unexpected events, e.g. new information about the consequence of a certain situation, leads to changes in the evaluation of the importance of different task and the client wants to adjust the priorities. A fourth situation is when during the contract period new products come on the market and where it is not clear whether these products have good enough qualities or where the new product might lead to changes in priorities. In all these situations a partnering concept could lead to a more efficient use of resources and make renegotiations easier.

Our view is that winter maintenance fulfils all these characteristics. Weather conditions and the conditions of the road are difficult to describe in a complete and easily observed way. As expected weather conditions affect what is rational to do at a certain point in time, this also creates situations where it is difficult to know what is rational to do. Both technical development, new scientific results, new environmental demands and new chemicals have also affected winter maintenance.

C. A Possible Partnering Structure

It is always difficult to know how a proposed organisation form will work in practice so the framework below should be tested in one or two maintenance areas somewhere in Sweden in order to evaluate the costs and benefits of the new models. The discussion only focuses on the winter maintenance part of the contract or on a situation where there is a separate winter maintenance contract.

The basic ideas in the models are described in Fig. 6 and Fig. 7 where Model 1 in Fig. 6 only focuses on winter road maintenance while Model 2 in Fig. 7 includes all road maintenance as winter maintenance is often procured as part of a broader maintenance contract. The models should be interpreted as follows:

- Seasonal winter road maintenance planning by the client organisation
- Selection of skilled contractors in winter road maintenance area
- Invitation of the selected contractors to a workshop meeting in order to introduce and inform the contractors that the winter maintenance will be performed by application of partnering concept
- Procuring the winter maintenance project according to the Swedish act on public procurement
- Final selection of the contractor that accepts partnering concept in the contract
- Starting a so-called winter maintenance project organisation that involves all the parties both from client and contractor i.e. the contractor that is awarded the contract
- Starting different work groups a so-called team building
- Performing the tasks during the winter season
International Roughness Index (IRI) as presented in Fig. 6 and Fig. 7 is an assistive technology for measuring the unevenness of the road surface. Information about the road surface unevenness helps winter maintenance contractors how to plan and perform winter maintenance tasks on those parts of roads that have not been measured before winter, based on the measuring results of major unevenness on the road surface.

Road Weather Information System (RWIS) that is also presented in the Fig. 6 and Fig. 7 is an important assistive technology to help contractors get information about road weather conditions e.g. road surface slipperiness. Supplying information from these two assistive technologies is normally performed according to two separate contracts. In a partnering contract both IRI and RWIS contractors should be presented in the partnering project organisation with a close cooperation with the other involved parties in the winter maintenance project organisation.

This proposal model in winter road maintenance can be successful only with a good communication, close and trusting cooperation between all parties involved in the (yearly) winter road maintenance project. It should also be remembered that whole the partnering application process should be covered by partnering pattern as a framework to ensure success of the project both technically and financially.
VI. CONCLUSION

In a situation where (winter) road maintenance is procured from private contractors, procurement methods, contract forms and implementation of contract have crucial importance. Winter maintenance raises a number of challenges from a contracting perspective as weather conditions are hard to describe precisely, and as the measures taken will depend on expected future weather conditions. In all longer maintenance contracts there is a need to adjust to new information and new technologies.

In this article the concepts and general experiences of contracting in the construction sector have been described. With this as background a detailed model for how partnering can be implemented for (winter) road maintenance contracts is proposed. In order to develop the model, future testing in the field is necessary. The model also points out the importance of systems for providing the decision-makers with up-to-date information through IRI-measurement and RWIS.
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