

A study of the future for concrete bridge construction in Sweden



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ABSTRACT

The construction industry in Sweden has been considered to have a clear potential for a development to a higher degree of industrialization and efficiency. Despite the availability of new techniques for concrete bridge construction, the tradition of constructing in-situ with old methods is still the dominating construction method. To be able to describe, interpret and give an explanation to this phenomenon, this paper will investigate why new techniques are not commonly used. A comprehensive survey has been conducted and the results show that rules and norms, conservatism, and poor collaboration are some of the reasons for slow development.

Key words: Bridge construction, development, prefabrication, survey, future.

1. INTRODUCTION

The research project is studying how an industrialized process could benefit concrete bridge construction. The project starts by mapping the potential for prefabrication and industrialized methods and after, a development of new bridge parts and industrialized methods will be preformed. The pace of development for the construction industry is relatively slow compare to manufacturing industries [1] and reasons for that are under discussion during the last decade [2-3]. It is clear that the demand for lower production costs, faster construction time and better quality has increased over the last years. All kinds of partly or totally prefabricated bridge concepts are used frequently abroad, but in Sweden these kind of concepts are very rare. Prefabrication is a large part of industrialized construction, but you have to consider the whole process, from design to maintenance, to be able to get great benefits of an industrialized process. Prefabrication meant not only complete element that are mounted together at situ, but also left formwork that are designed to be a permanent structure and reinforcements that are prefabricated into cages or rebar carpets and mounted into the formwork [4, 5]. The question can be raised, what major forces are working against a development of the construction industry in general and especially the bridge building?"

A large survey with almost 70 respondents will form the foundation for this research. The respondents of the survey include contactors, suppliers, consultants and representatives from the Swedish Transport Administration, which in most cases are the client. Interviews and document studies will complement the survey to highlight the advantages and disadvantages of using more industrialized construction techniques. The interviews were semi-structured face to face-interviews, which according to [6] are defined as interviews with the aim to collect description from the informants' world, in order to be able to interpret the described phenomenon. The used documents are not produced to benefit the research, which makes them perfect as a rich and ready source of information, [7].

2. REASONS FOR LOW DEVELOPMENT SPEED

According to the survey, bridge construction industry is united in the fact that the efficiency has to increase in the future. Almost 80% of the total respondents are answering that they totally agree and 15% answer that they partly agree on the question; "Do you think that bridge construction need to be more efficient?" By creating an Ishikawa diagram (fishbone) of the reasons for low development speed, it is easy to systematically review factors from the survey that affect or contribute to hindering the development of the bridge construction.

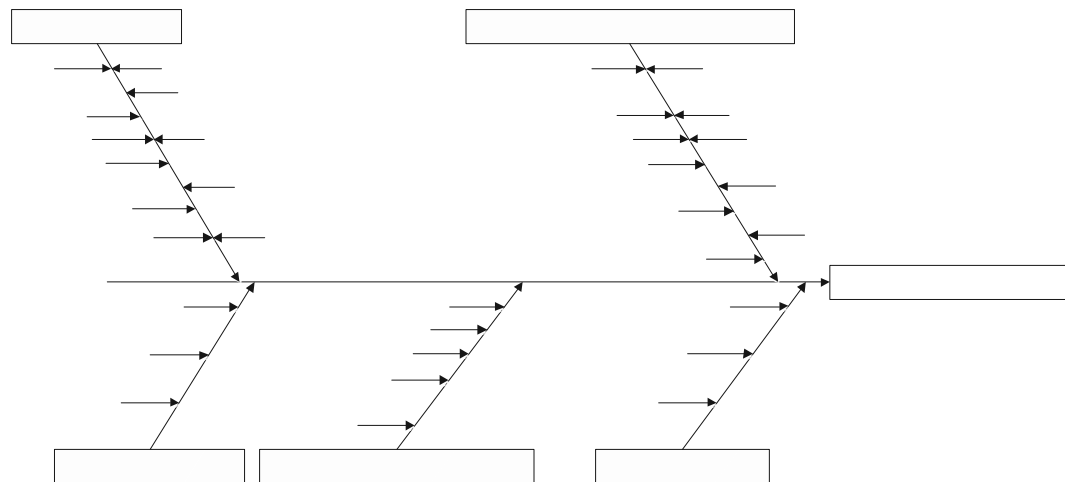


Figure 1 – Reasons for low development speed (The number in brackets behind each reason is the number of respondents)

The reasons are divided into five main categories, see Figure 1, and behind each reason and category are assigned the number of respondents. Behind each main category is also visible the percentage of the total number of respondents who are placed in this category. Some causes are difficult to put into a category, but since these causes have only one respondent each, the result is not dependent on where those are located. Some respondents have mentioned several reasons for this phenomenon which is why the total amount of answers is larger than the number of respondents.

The first category, *client*, could be divided into three groups, rules and norms, contract forms and the reviewing process. The rules are conservative and favour site-built bridges, prefabricated concepts are difficult to be approved. The most common contract forms do not allow contractors and other actors to be involved early in projects but when the design is already completed.

Client (27) 31%
 Conservative rules and norms (12)
 Contract forms (3)
 Buyer problems (2)
 High aesthetics demands (1)
 Quality demands (1)
 Constantly changing standards (1)
 No incentives for efficiency (1)

Unfavourable few pla
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Thoughts that the industry is unique, each project is unique and that every workplace is different from the last are reflecting the *climate prevailing in the industry*. Because of this attitude, constructing the whole bridge in-situ is more common than using more industrialized concepts. According to [9], there is no research showing that the products and processes within the construction industry are more unique than in other industries. The largest factor within this category is that there are very few actors who can compete for major contracts, therefore the major contractors have no reason to change their methods and practices, because they are earning money anyway.

Contractors seem to be reluctant to change and in the previous section several reasons for that are stated. The contractors seem to be comfortable and only perform what provided documents require. One respondent summarized this category by the following remark:

“The major contractors are not interested; it is the same guys as before. The big contractors do not want prefabrication because then the competition is increasing; any contractor can build prefabrication, site casting+road+coating and so on can usually only the heavyweights do.”

Widespread conservatism among *actors in general* seems to be a major problem. According to [8], there are no research showing that people within this industry are more conservative than other, but people often use this as an excuse to defend the currently existing work methods and unsatisfactory conditions. [8] are pointing out four major hindrances for a faster development of construction industry in Sweden, the first is about that actors are trying to convince the public that it is not possible to work smarter. The other hindrances are according to [8]; customer focus, but still not ..., improvement often results in increased administration and construction sector's structure prevents development.

The category *materials/product* is very intertwined with the claim that each product is unique and therefore it is almost impossible to build prefabricated bridges. This argument is not sustainable because we do not have to go far beyond our Swedish border to find countries where prefabricated bridges are the obvious choice. Over 80% of all built bridges in the Netherlands consist of prefabricated concrete. 53% of all respondents think that a combination of in-situ construction and prefabricated elements is the future for bridge construction. Noticeable is that consultants and contractors have a slightly more negative attitude against prefabricated elements than the clients. The superstructure or parts of it (bridge deck and edge beams) seems to be the parts that actors want prefabricated. Figure 2 highlight the most important factors of bridges construction and which concept that is most suitable for the situation.

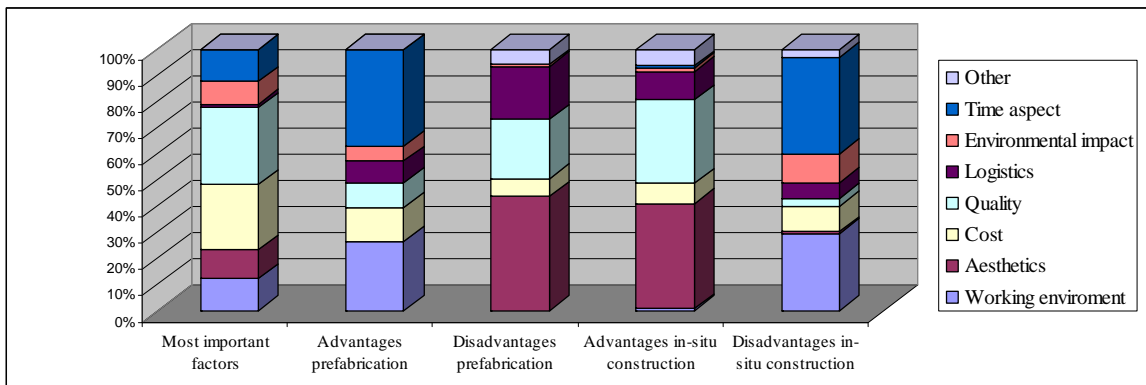


Figure 2 – Advantages and disadvantages of different construction methods

It is very important that bridges can be constructed with good quality as cheap as possible. Prefabricated bridges includes according to this survey, worse quality than in-situ constructed bridges, but to a cheaper price. A small study of inspection reports from the Swedish Transport Administration, [9], shows that there are no specific quality issues that can be linked to prefabricated bridges.

3. WHAT TO DO ABOUT THE PROBLEM

To address the problem of low efficiency growth, it is according to the survey the client organization which primarily has to change. Changes in rules and norms, and better contract forms with functional requirements need to become more common. More turnkey projects with functional requirements will lead to an earlier involvement of contractors and suppliers. According to [10], this lead to a faster development process and that the project team will be alerted to potential downstream problems in an earlier stage when these are easier and faster to fix. Meanwhile, the entire industry has to become more open and take better advantage of the knowledge and experience that already exists, to be able to develop improved products, whether it is built on site, prefabricated or a combination of the two different techniques.

4. DISCUSSION

Further investigations need to be done to verify this research and during autumn 2011, a workshop with people from the different actors will be performed to discuss the results from the survey. A journal paper containing more results from the survey and the workshop will hopefully be published during autumn 2011 this conference paper is a very brief summary of the result.

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