

VISI: A Methodology to Standardise Communications in Civil Engineering

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Summary

Parties collaborating on infrastructure projects in the civil engineering industry have expressed their need to use common starting points for information transfer and communication. The VISI project examined what type of starting points are required for the design and construction of infrastructure, proposing a framework of agreements that is based on the DEMO organisational theory. The framework describes the process on the dividing lines of identified roles. The responsibilities of each role are determined, including the required communication. The framework was elaborated for the following fields of application: design, contracting, and testing/acceptance. The result is currently being tested in the sector, and the first results of the trial demonstrate that the framework offers effective support for organising the collaboration and specifying the communication structure.

1. Introduction

VISI is the name of a project. It is also an acronym of ‘Voorwaarden scheppen voor Invoering Standaardisatie ICT in de GWW-sector’, in English ‘Creating conditions for introducing standardisation of information & communication technology in civil engineering’. Its objective is to develop a generic model for digital communication, which will enable partners in large-scale and complex infrastructure development schemes to organise communication and co-operation in a flexible way. It is expected that this in turn will significantly reduce costs and the run time of development schemes.

Representatives of many parties in the civil engineering industry are participating in the project: local and national authorities, engineering firms, contractors, associations, research institutes and IT companies are all working together to improve communications within civil engineering.

2. A new vision of standardisation in communication

2.1 What is required for improved communication?

Three inventories were executed within the context of the VISI project to determine which agreements on communication may yield benefits for the civil engineering sector. Each inventory was based on different objectives and perspectives.

The first inventory, which focused on an extensive study of existing literature, showed that few provisions are made for communication in co-operative projects in the civil engineering industry. Starting points are available only for the traditional communication modes (standard specifications).

The second inventory, which involved a study of communication in co-operative projects in other sectors, demonstrated that other industries have already started standardising communication within projects. They concentrate on improving information exchange by entering into agreements regarding the data of the product that needs to be developed. It is recommended that a common process and information model be conceived within the civil engineering industry. A model that will allow parties to determine the responsibilities (roles) in the field of communication and products is clearly required.

The third inventory, a study on the actual situation in two large-scale infrastructure projects, showed that the lack of structured communication is one of the main bottlenecks. This study yielded a generic model for structuring communications within the framework of infrastructure projects.



Within the civil engineering sector, this model is considered an important tool to map the responsibilities within the project organisation and in the field of communications.

Requirements for improved communication

The inventories resulted in the insight that generally applicable agreements on communication need to be based on three perspectives, to wit at which moment (process), by whom (role), and what (information content). These three perspectives result in a coherent whole. The agreements must be independent of parties or the collaboration concept. By offering agreements in the form of templates, they can be modified to fit specific situations.

2.2 Starting points for agreements on communication

Communication and information

The VISI project distinguishes between communication and information. The communication process relates to reaching agreements between two or more parties, for instance delivering the design of a viaduct. The information process is supportive and serves to transfer the required information in a uniform, timely, and clear manner to the various parties involved. Communication occurs before, after and during the execution of a commission. Information processes support the communication by rendering data accessible. For adequate ICT support, the main issues need to be transparent. It must be clear who is communicating, when and on what. The concept of transaction gives meaning to these aspects.

The communication concepts used in this chapter are based on the DEMO (Dynamic Essential Modelling of Organisations) concept, which was developed by J.L.G. Dietz at the TU Delft. For a more extensive description of the method and its concepts, please refer to *DEMO Modelling Handbook*, ref. [1].

Transaction: building block for communication

The transaction is the building block for communication. A transaction exists if two parties agree that something needs to be done, for instance building a viaduct. Communication is clarified in three different ways from the perspective of the transaction.

Process

Communication can be considered a process, which comprises three phases: commission, execution, and acceptance. The parties involved are the initiator and the executor.

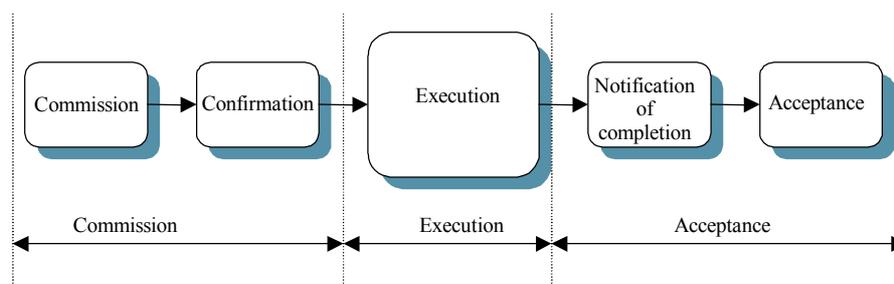


Fig. 1 Three phases can be distinguished in an agreement.

Division of roles

The second way in which communication is considered from the transaction perspective is the division of roles. Who is communicating? In infrastructure projects, it is not uncommon for parties to change roles. When visualising communication at the level of the parties, it is possible to deduce an unambiguous line. This is why the responsibilities and competencies of roles are described at the level of the transaction. This description is not associated with the organisation and the chosen co-operation concept. Thus, a generic picture of communication emerges.

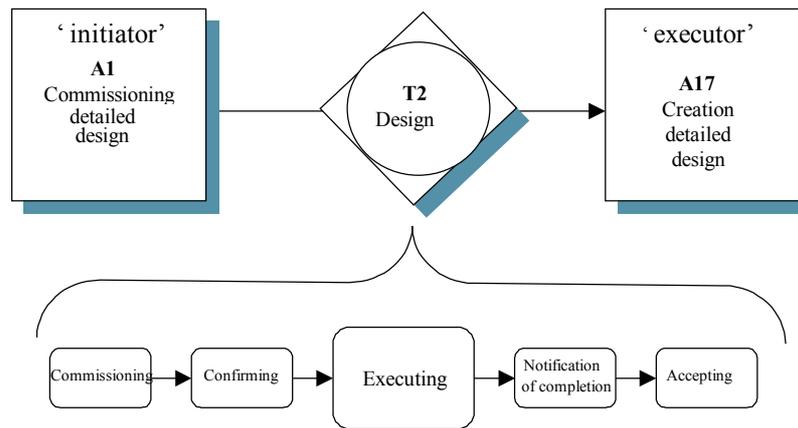


Fig. 2 Two roles are involved in a transaction, the initiator and the executor

Information content

The third aspect of a transaction is the information content, i.e. ‘What do the parties communicate about?’ Before a project is initialised, it is important that all relevant information is clearly defined. This is necessary for good communication, but it is also a prerequisite for organising the digital information arrangements.

2.3 The construction project as a network of agreements

The analysis of projects in actual practice showed that a generic picture can be determined for roles and transactions in infrastructure projects. Fig. 3 represents a diagram that distinguishes 13 transactions, such as acquiring ground, delivering the total design, delivering design alternatives, and construction of the structure. For the actual application in projects, further detailing will be required in the form of a decomposition over multiple levels. Thus, it will be possible to define more recognisable transactions, roles and messages and specify information and communication characteristics.

The following system cores can be distinguished in this global representation.

- S0 Initiating
- S1 Commissioning (executor on behalf of initiator)
- S2 Designing
- S3 Site developing
- S4 Constructing
- S5 Maintaining
- S6 Exploiting
- S7 Funding
- S8 Site acquisition
- S9 Regulating
- S10 Consulting
- S11 Testing/accepting
- S12 Contracting
- S13 Creating public acceptance

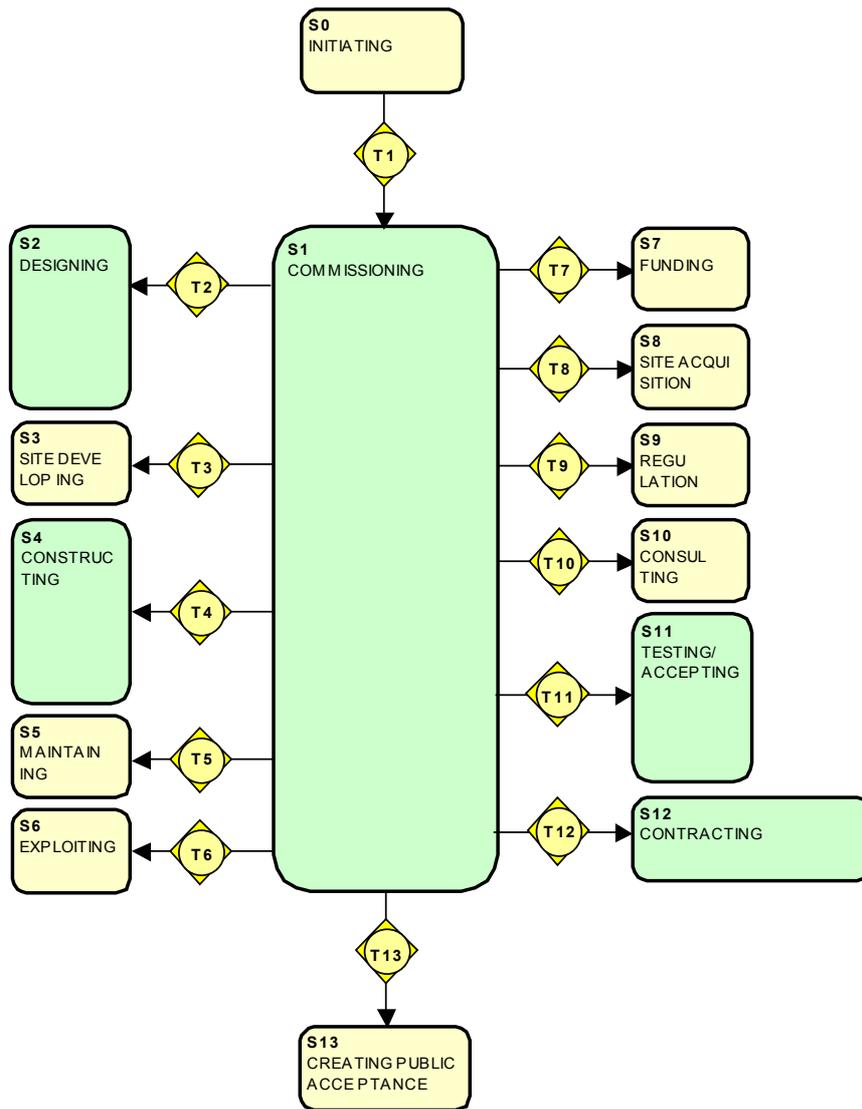


Fig. 3 Global diagram of roles and transactions (interaction diagram)

The following characteristics are involved:

- Definition of roles
- Associated tasks and responsibilities
- Required initial information per transaction
- Supporting steering and management information
- Technical and organisational prerequisites, including agreements on order and procedures
- Deliverable results, including type of information and method of acceptance

For optimal communication in projects, it is desirable that a priori agreements are reached in relation to the elaboration of these aspects. Especially for the elaboration at lower levels, where more than one hundred different (standard) transactions can sometimes be distinguished within one single project, this results in a complex network of agreements.

The decomposition and definition of transactions follow from the generic civil engineering building process and are unrelated to the co-operation concept. In fact, the elaboration of the project organisation follows from the assignment of the roles associated with the transactions to parties.

The parties determine how the roles will be divided. This may involve any number of considerations, such as:

- Knowledge and facilities of the organisation;
- Experience gleaned from previous projects;

- Contractual considerations;
- Risk assessment;
- Trusted/permanent project partners.

From the perspective of optimal communication, an attractive option would be to limit the number of formal boundaries (or the number of legal parties) to a minimum, such as in the alliance model or Turnkey. In this strategy, there will be fewer limitations in the communication between the various roles and a more open communication will emerge.

3. Elaboration of the VISI framework

3.1 Elaboration

On the basis of the findings, it was decided to elaborate the VISI framework. It was developed for the following fields of application: design, contracting, and testing/acceptance. The first step involved elaborating the scheme of roles and transactions. Fifty roles and transactions were distinguished in all. Twenty of these were specified in detail. Fig. 4 shows part of the diagram of roles and transactions.

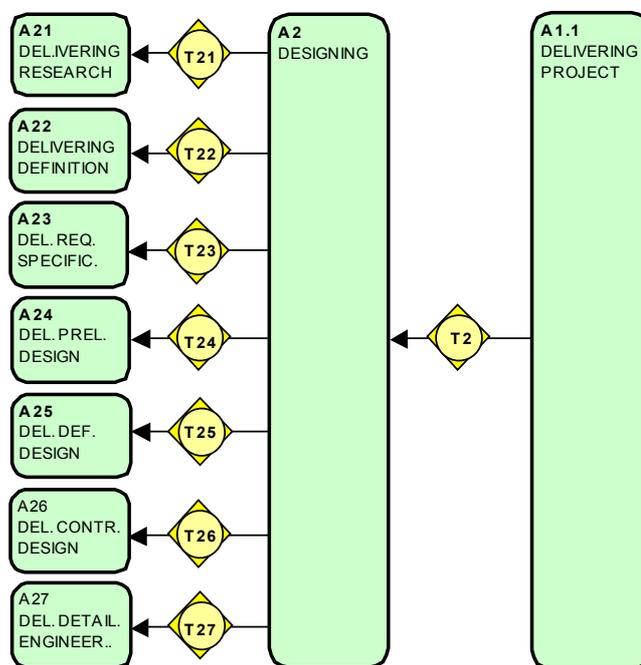


Fig. 4 Diagram of roles and transactions for the field of application 'Design'

- A21 – Delivering research
- A22 – Delivering definition
- A23 – Delivering requirements specification
- A24 – Delivering preliminary design
- A25 – Delivering definitive design
- A26 – Delivering contract design
- A27 – Delivering detailed engineering
- A2 – Designing
- A1 – Delivering project

Furthermore, the elaboration involved specifying the definitions of roles and drafting a transaction diagram for each transaction, see fig. 5. The transaction diagram describes the purpose of the transaction and distinguishes a number of parts of the transaction, such as commissioning, execution, etc. It also shows which messages are associated with the transaction and what function they have in the various sub-transactions. An arrow shows who sends the message and who is the recipient.

To complete the transaction schemes, the various messages were elaborated. This means that the content of data elements was specified for each message. And finally, all data elements were incorporated in a data model

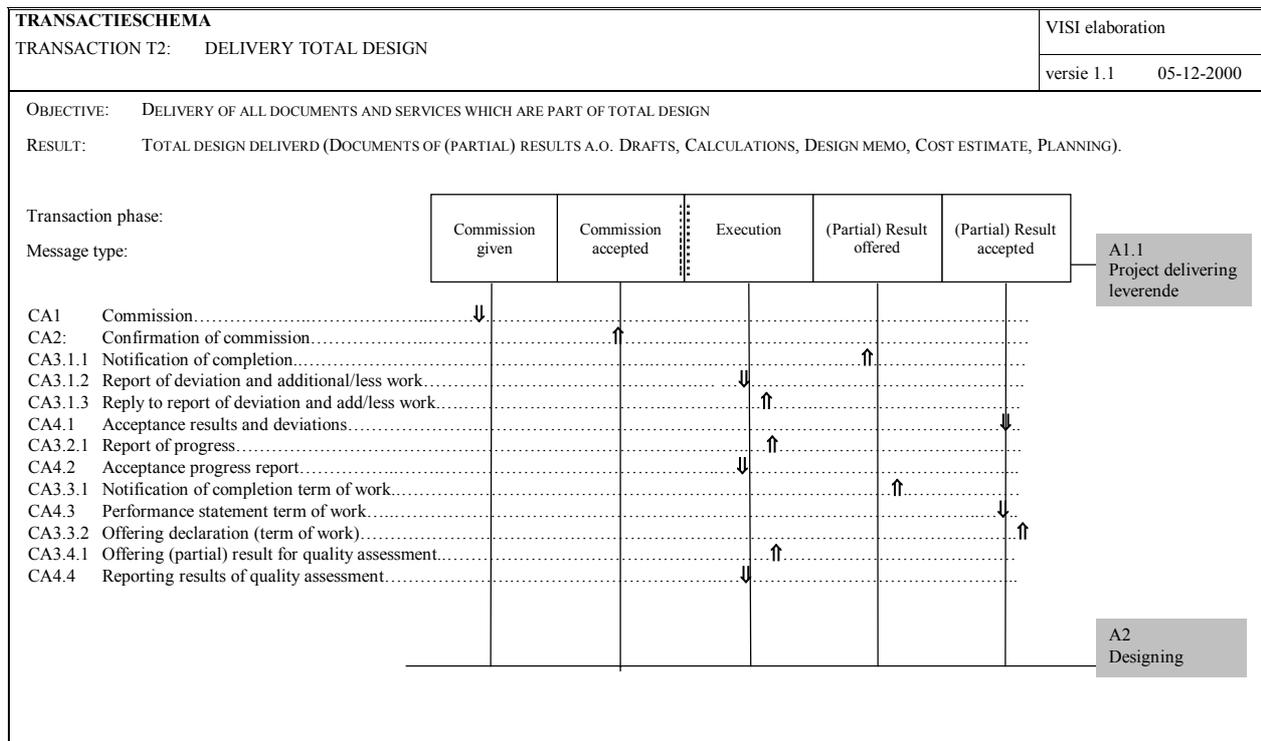


Fig. 5 Sample transaction diagram

3.2 Testing

The elaboration led to the release of the first version of the VISI framework. This version is now tested in a number of real-life projects, which means that project managers of infrastructure projects use the framework as a tool in their projects. The first results are encouraging, since the framework is found to offer effective support in organising the co-operation within the project and specifying the communication structure.

4. Discussion and conclusions

A framework of agreements was proposed to support communication in infrastructure projects. The framework is based on roles, transactions, transaction diagrams, messages, and data elements. Project managers confirm the value yielded by the framework when organising co-operation and arranging communication.

The DEMO organisation theory was used as a starting point in the creation of the VISI framework. This theory comprises models to determine time dependencies and information dependencies. These models have not yet been elaborated in the VISI framework, but are expected to yield great value for information management and project progress control. Further research is required to achieve implementation.

The success of the VISI framework depends on the degree in which it can be supported digitally. Parties in the industry must be capable of translating the content of the VISI framework to a project-specific application in a simple and straightforward manner. An umbrella model description is required to do so. Further research is required in this field.

[1] Reijswoud, V.E. van, Dietz, J.L.G., *DEMO Modelling Handbook: Volume 1*. Being printed. (download http://www.demo.tudelft.nl/demo_hbook.pdf)