German Centre for
Rail Traffic Research at the

Federal Railway Authority

Reports
of the German Centre
for Rail Traffic Research

Report 23 (2022)

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Reports of the German Centre for Rail Traffic Research,
Report 23 (2022)
Project Number 2020-6-U-1210

Development of a specification sheet for the programming of a web-based information system for building materials

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by
Andreas Zamostny, Sebastian Schaarschmidt, Patrick Markus, Christina Freise
Schlange, Zamostny & Co. GmbH

On behalf of the German Centre for Rail Traffic Research at the Federal Railway Authority

Imprint

PUBLISHER
German Centre for Rail Traffic Research

August-Bebel-Straße 10
D-01219 Dresden

www.dzsf.bund.de

EXECUTION OF THE STUDY
Schlange, Zamostny & Co. GmbH

Große Bergstraße 219
22767 Hamburg

CONCLUSION OF THE STUDY
December 2021

EDITOR
German Centre for Rail Transport Research (DZSF)
Gina Elisa Bode, Dr. Sabrina Michael, Research Unit Environment and Sustainable Mobility

PUBLICATION AS PDF
https://www.dzsf.bund.de/Forschungsergebnisse/Forschungsberichte

ISSN 2629-7973

doi: 10.48755/dzsf.220004.05

Dresden, May 2022

This study was funded by the German Federal Ministry for Digital and Transport (BMDV) in the context of the BMDV Network of Experts.

The BMDV Network of Experts is the cross-modal research format in the BMDV's departmental research. In 2016, seven departmental research institutions and specialist authorities of the Federal Ministry for Digital and Transport (BMDV) joined forces to form a network under the guiding principle of "Knowledge - Ability - Action".

The aim is to research urgent transport issues of the future in a number of areas, including climate change, environmental protection, ageing infrastructure and digitalisation, renewable energies and transport economic analyses, and to enable a resilient and environmentally friendly design of transport modes through innovation.

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Abstract

In order to be able to better evaluate and take into account the environmental properties of building materials in future construction projects in the infrastructure sector, a specification sheet for an internal information system for public authorities and an exemplary prototype were developed within this research project. Furthermore, a thorough legal evaluation of possible conditions and obstacles for the implementation of such an information system was carried out. In addition, an argumentation and planning aid for the development and establishment of the outlined information system was developed. The results of the two work packages of the research project are briefly explained below.

The first work package included the preparation of a legal report describing the legal framework conditions of the envisaged information system for research purposes and answering the question of whether its realization is recommendable from a legal point of view. The result is that there are no fundamental legal objections to the examined facts, i.e. the model structure developed within the framework of the preliminary project "Needs and Stakeholder Analysis". This applies to both an intra-agency system and an external system.

The second work package of this research project comprised a requirements analysis, which was also based on the preliminary project "Needs and Stakeholder Analysis" and the model structure developed in it. The result is an agreed upon specification sheet with functional and technical criteria. In addition, the cause and objective of the information system were defined. The cause for the outlined information system is to offer a database solution that provides reliable and up-to-date information on emissions and immissions caused by buildings and structures. The objective is to enable federal authorities under the technical and legal supervision of the Federal Ministry for Digital and Transport to use the information system to improve their assessment of the environmental impacts of building materials and products. The system is also intended to facilitate the exchange of knowledge between authorities, for example by making research reports accessible.

Furthermore, a specification sheet based on the model structure of the requirements analysis with functional and non-functional requirements in MS Word format was created. The requirements of the specification sheet describe in detail the front-end of the information system, as well as non-functional requirements. In total, the specification sheet comprises 602 requirements in seven categories: Basic Structure, User, Output, Input, Data Contribution, Customization and Non-Functional Requirements. Also the identification of potential developers and hosts was part of the work package, the creation of an implementation catalogue and the derivation of recommendations for a public system. Approximately 21 months are estimated for the development and implementation of the information system.

The prototype of the information system, also part of the second work package, was developed based on the specification sheet and the model structure of the requirements analysis using MS Excel. The prototype illustrates the functionality of the information system, especially on the output level. The input level was also considered during the development, but was only illustrated as an example. All four information levels of the requirements analysis are represented in the prototype and created with exemplary data for the product groups epoxy resin paints and cement.

1 Introduction

Making transport and infrastructure environmentally compatible is a central concern of the BMDV Network of Experts. For this reason, a comprehensive information system is to be developed and established in the "Building Materials Assessment" section of the BMDV Network of Experts, which will simplify and standardize approval procedures for civil engineering building materials in the individual higher federal authorities and create a reliable data basis for construction- and building-related emissions and immissions. In addition, the information system should help to consider and evaluate the emission release and the environmental behavior of building materials in BMDV construction projects more effectively.

The study consists of two work packages, in which a thorough legal evaluation and assessment (including suggested solutions) of possible conditions and obstacles for the implementation of a web-based information system for building materials by federal authorities was prepared. In addition, a specification sheet for the information system was prepared, which can serve as a basis for the final implementation and programming of the information system.

Furthermore, based on the results of the first two work packages, a model structure for a web-based authority internal information system was developed. The information system is to be structured according to the four possibilities for the level of detail of the data it contains, as shown in Figure 1.

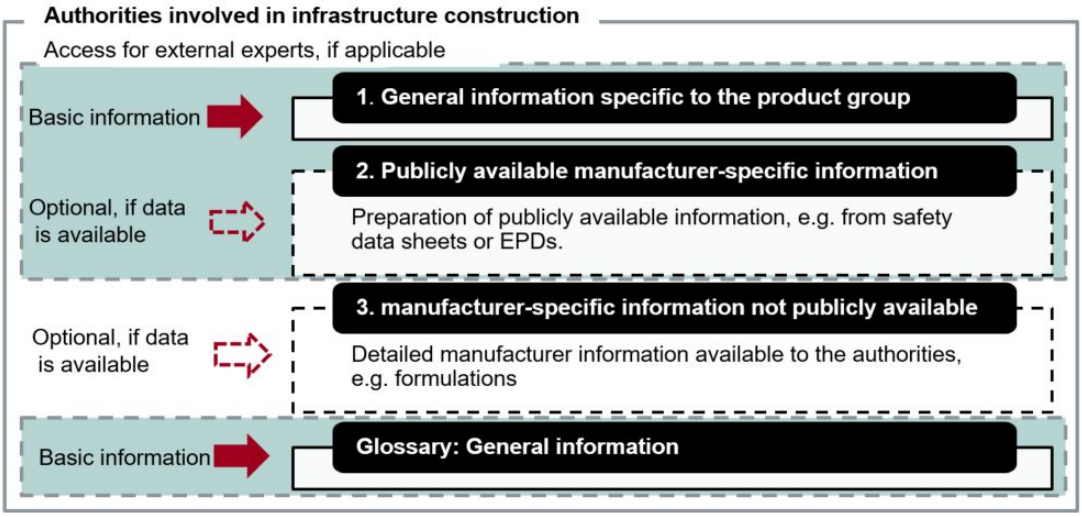

Figure 1: Levels of the model structure of the information system

The public authority information system is to be developed in a modular way so that the addition of (partial) access to the data on the first and second level for experts (planners and architects' offices) can be enabled at a later stage and the information system can be supplemented with further modules, for example to support contract award processes.

The aim of the project was to develop an argumentation and planning tool for the development and establishment of an information system for construction- and building-related emissions and immissions. The information system should initially focus on the transport sectors rail, road and waterway and the building material groups corrosion protection, geosynthetics, galvanic anodes and concrete. However, a subsequent extension to all quantitatively relevant building materials in the BMDV's area of responsibility is planned and should be taken into account in the design of the system to be created. The content of the information system should include data on construction- and building-related emissions, (eco)toxicity,

exposure and release scenarios, substance-specific dispersion potentials, as well as information on the durability and the associated duration of use (incl. dismantling and disposal) of the building materials/building products.

The information system should help to better consider and evaluate the emission release and environmental behavior of building materials in BMDV construction projects. The results of the present research project provide an argumentation and planning aid for the development and establishment of the information system outlined above.

2 Methodology

The project consisted of two work packages. In work package 1 (WP1), legal questions were answered in an expert assessment, while in work package 2 (WP2), a specification sheet was designed and drawn up, and further elements of a substantiated argumentation and planning aid were developed.

2.1 Work Package 1: Legal evaluation

The aim of the legal evaluation is to present the conditions that must be considered in the development of the information system. It is intended to support the further process of decision-making for the implementation of such an information system. The subject of the assessment is the model structure that was developed within the framework of the needs and stakeholder analysis. The assessment was carried out for both an authority-internal information system and a public information system. In the latter case, it is assumed that external users can only obtain information, but not enter it.

Two lawyers were commissioned to prepare the legal evaluation:

- Mr. Michael Vogelsang of Riverside Rechtsanwälte, Mauritz Depken Vogelsang Scharninghausen Reichelt Partnerschaft mbB, Hamburg on questions of public law;
- Mr. Dr. Sebastian Heep of PLANIT // LEGAL Rechtsanwaltsgesellschaft mbH, Hamburg on questions of IT, copyright and data protection law.

The following overview describes the structure of the legal assessment. Detailed results and the core questions can be found in the detailed results report and the legal assessments in the appendix.

A. Assessment „Authority internal system“

I. Legal requirements for building materials in general

II. Barriers and impulses for the "whether" of a national information system

1. Requirements under European law
2. Parliamentary reservation
3. Competences

III. Design of a national information system

1. European and national requirements for information and warning by public authorities
2. Freedom of information law
3. Legal protection
4. Copyright law
5. Data protection and IT security law

B. Assessment "public system”

I. Legal examination and presentation of any additions and/or deviations from the explanations and findings under "A. Internal public authority system" in the case of a public system.

II. In addition: examination of the applicability and any requirements of the Online Access Act.

In the first phase of application, the planned information system is intended to serve as an internal research platform for the authorities. Therefore, the focus of the legal evaluation was related to this use case. Should the information system also be used for tenders in the future, aspects of public procurement law would have to be examined in addition, along the lines of the situation envisaged in that case.

2.2 Work Package 2: Preparation of a specification sheet

Work package 2 "Preparation of a specification sheet for programming an information system for evaluating the environmental properties of building materials" started with the requirements analysis. In an online meeting with potential users from federal authorities, information on the integration and use of the system was obtained and functional and non-functional requirements for the system were identified.

Based on the above-mentioned working meeting, criteria for evaluating the user feedback were developed and the feedback from the users was afterwards evaluated. Furthermore, discussions were held with IT managers from federal authorities on non-functional and technical requirements in order to draw up a list of specific requirements.

Based on the requirements analysis, version 1.0 of the specification sheet was developed, in which the central functionalities are highlighted and described. Findings and recommendations from the legal opinions (WP 1) were incorporated into the specification sheet. This version was handed over to the contracting authority for examination and review and adapted to formal requirements. Following the review, a coordination workshop was held with the contracting authority to discuss comments and change requests. Based on the coordination workshop, the specification sheet was adapted to version 1.1.

Also within the scope of the work package "Preparation of a specification sheet", a selection of other information systems of public authorities was examined with regard to the developers and hosters of the respective system.

Based on the development and establishment plan drawn up as part of the "needs and stakeholder analysis", both an implementation plan including a draft timetable with the necessary work steps for the software programming/implementation and the desired results were developed. The implementation catalogue developed in this way is outlined for two options – establishment with specification sheet or via agile project management. In addition, recommendations for a public information system were developed based on the findings from the previous steps.

After drafting the specification sheet, a prototype of the system was developed, which visualizes and reflects the internal structure of the planned information system and on which the essential functions can be tested. The prototype was developed in MS Excel and primarily represents the output level.

3 Results of the legal evaluations

The legal evaluations are organized into a total of three main topics: Legal requirements for building materials in general, barriers and impulses for the "whether" of a national information system, and the design of a national information system.

As it can be seen in the legal evaluations in the appendix, there are no fundamental legal objections to the outlined information system and the system can be implemented. This applies to both an agency internal and an external system.

Neither legal requirements for building materials in general, barriers for the implementation of a national information system nor legal and European legal requirements fundamentally prevent the implementation of an information system. Likewise, copyright law and data protection and IT security law do not represent a barrier for the system.

4 Results of the requirement analysis

The model structure for an information system developed as part of the research project "Needs and stakeholder analysis for the establishment of an information system for the assessment of the environmental properties of building materials" (see Figure 1) formed the basis for the requirements analysis. The requirements contained in the model structure were written down and, if necessary, supplemented in such a way that implementation by a software developer could be examined.

Based on the detailed specification sheet several open questions emerged, which were discussed in a workshop with the project team of the BMDV Network of Experts. In addition to the open points on the requirements, the reason for and the objective of the information system were also discussed during this meeting (see chapter 1).

Building on the existing structure, an online workshop was conducted with a total of 25 potential users from various national authorities, industry and state authorities in order to derive additional requirements. Furthermore, non-functional and IT-technical requirements were discussed with IT managers from federal authorities as well as the ITZBund. In this discussion, the possibilities for developing the system with the ITZBund were also explained:

1. The ITZBund takes over the tender for the development, the process monitoring and quality control, the commissioning as well as the hosting.

2. The responsible authority carries out the tender and process control. The ITZBund takes over the hosting of the information platform. The operation and further development of the platform is ensured by the responsible authority (Infrastructure as a Service).

The ITZBund also offers consulting services to accompany the tender process.

The ITZBund can be commissioned directly without a tender via the IT planning tool IT-PLUTO. However, the development of the information system can not be carried out by the ITZBund itself, so that a call for tenders must be taken into account in the time planning in any case. According to the ITZBund, at least one year should be planned for the tender, which may have to be carried out throughout Europe. In addition, the ITZBund has given a rough cost estimate for the implementation of the information system of 2.5 to 3 million euros. A more precise determination of the potential costs for the implementation of the information system is not possible at this point in time, as this depends, among other things, on the final design of the system as well as the chosen establishment plan and hosting option.

The requirements gathered through the interviews were first collected and categorized together with all other identified requirements in an Excel file. A total of 602 requirements were collected, which are divided into the seven requirement categories shown in Figure 2 (see Chapter 5). These requirements also include a detailed description of the output and input levels of the information system.

5 Specification sheet

Based on the model structure and MS Excel list presented in Chapter 4 "Results of the requirements analysis" (see also Figure 1), functional and non-functional requirements were transferred into a Word format. In the course of drawing up the specifications, the ITZBund template was taken into account both formally and content-wise and incorporated in all chapters accordingly to account for the possibility of the system being hosted by the ITZBund. However, some of the elements of the ITZBund template can only be created once the responsibilities for operation have been clarified, e.g. for target business processes.

The requirements of the specification sheet describe in detail the front-end of the information system, as well as relevant non-functional requirements.

5.1 Identification of software solutions and software developers

For the identification of software providers, an online research was conducted. First, the information systems already identified in a previous research for detailed assessment were reviewed. For the providers Inies, Ökobaudat, STARS and WECOBIS both developers and hosting provider were identified.

In addition to researching the developers for the already known information systems, other public systems were researched for which developers and hosting providers could be identified. A total of five further public systems could be identified this way (WISIA, Onkogendatenbank, onDEA, IGS - Information System for Hazardous Substances, Stipendienlotse).

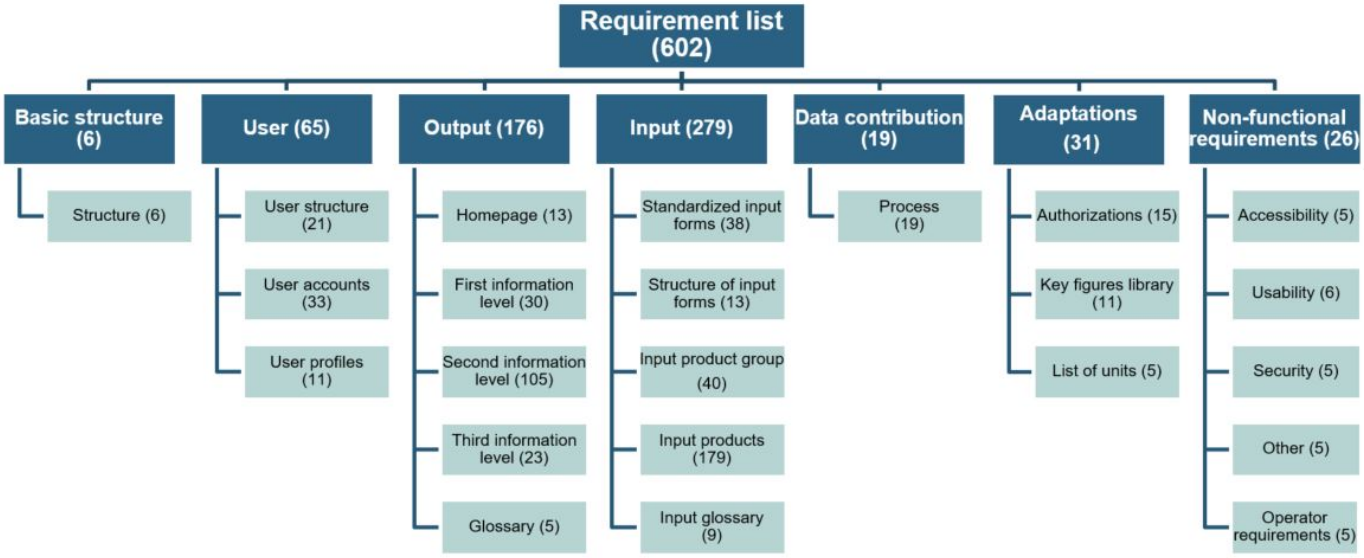

Figure 2: Overview of the requirement categories for the information system

5.2 Implementation catalog

Two options were evaluated for the implementation of the information system. Implementation by means of a detailed specification sheet or agile project management.

The implementation catalogs developed are examples based on information from discussions with various users, such as the ITZBund. The catalogs represent an approximate time schedule, which is, however, influenced in particular by the tender duration and the time availability of the software developer.

In total, this exemplary time planning estimates an approximate time horizon of 19 months until go-live (soft-launch). In addition, it is assumed that the finalization and acceptance of the system, as well as the initial data entry and user training, will take a further 2-3 months, so that a total of approx. 21 months is estimated for the implementation of the information system. This period should be planned for both implementation with the help of a specification sheet as well as with agile project management. Following this period, the system must be further maintained, updated and supported. This work step runs through the entire active time of the system.

The development of the information system with the help of a specification sheet can be divided into a total of 11 work steps.

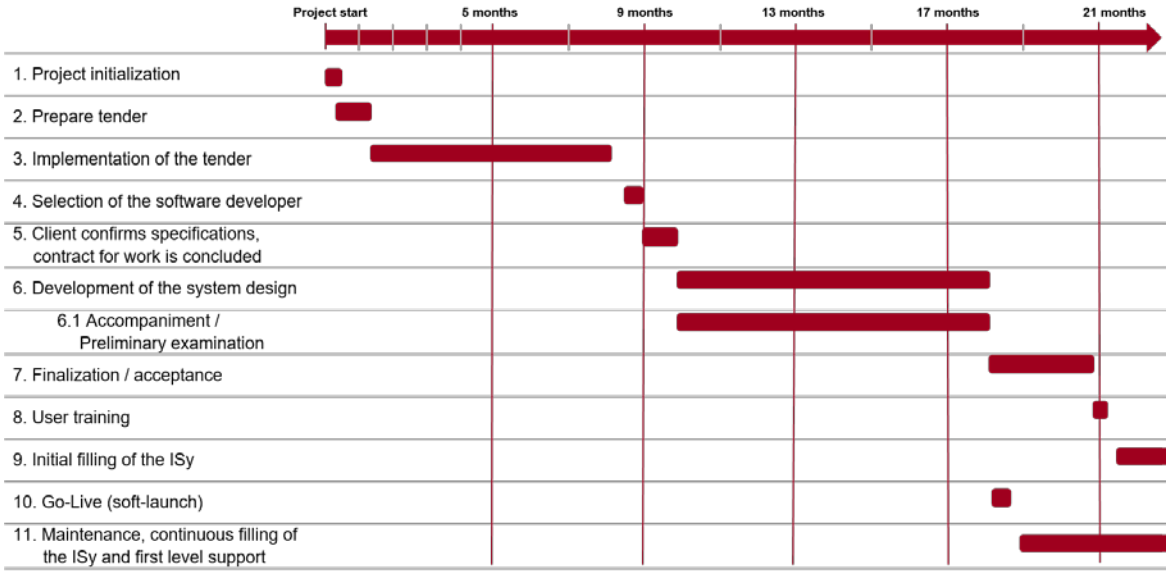

Figure 3: Development and establishment plan (specification sheet)

The development of the information system with the help of agile project management can be divided into 9 work steps. The first steps (1., 2., 3. and 4.) and those after the soft-launch of the system are similar to the establishment of a system with a specification sheet. The main difference of agile project management is the development and acceptance of the system. The development of the system would not be based on an already predefined specification, but in smaller work packages and sub-steps (outlined by the dotted line at work step 5). The services are processed in small packages and coordinated, finalized and accepted directly together with the contractor.

Figure 4: Development and establishment plan (agile project management)

For the outlined information system, recommendations and, if necessary, implications for a public system should be considered in all work steps. Corresponding recommendations were taken into account in both the prototype and the specification sheet. In addition, the legal evaluations have also considered implications and possible restrictions for opening the information system to a public system. There are no fundamental reservations against opening the system to persons outside the federal authorities. The more detailed explanations are presented in the legal evaluations in the appendix.

6 Prototype of the information system

The prototype of the information system was developed on the basis of the specification sheet and the model structure (see Figure 1) using MS Excel software.

The aim of the prototype is to illustrate the functioning of the information system by means of exemplary data, especially on the output level. The input level was also considered during the development, but is only presented as an example.

Four information levels are demonstrated in the prototype:

1. general product group-specific information,
2. publicly available manufacturer-specific information,
3. non-publicly available manufacturer-specific information, as well as
4. the glossary.

For the prototype, exemplary data for the product groups epoxy resin paints and cements were researched, prepared and entered. One product per product group was created. The products demonstrate the functionality of the prototype with two different examples.

In addition, elements of a public system were considered, but not yet implemented in a functional way.

7 Conclusion

Within the framework of the project "Development of a specification sheet", it was again confirmed that a national information system for the assessment of the environmental impact of building materials and building products is useful and necessary and that no fundamental legal restrictions exist. This applies to both an autority-internal and an agency-external system.

A comprehensive specification sheet with a focus on functional requirements was drawn up for the information system, which can serve as the basis for a tender for both implementation by means of a specification sheet and agile project management. The specification sheet is based on a detailed requirements analysis with the consultation of potential users and IT managers from the higher authorities involved, as well as supplementary results from the preliminary project "needs and stakeholder analysis". The specification sheet maps the four information levels developed in the model structure of the preliminary project. These levels are: (1) product group level (product group-specific data), (2) publicly accessible information at manufacturer/product level (manufacturer-specific data), (3) detailed, non-public information at manufacturer/product level (manufacturer-specific data) and (4) comprehensive information in the form of a glossary.

Based on the specification sheet, a functional prototype was developed, which in particular represents the output level of the system. Aspects of the input level were outlined as examples. The prototype represents the envisaged structure of the system and can be used as addition to the specification sheet for the tenders for the software development.

Furthermore, an implementation catalogue for the development of the system was created and outlined with results and responsibilities as examples. This catalogue can be the starting point for the project planning of the software development.

The planned information system has significant advantages over the current status quo. For the first time, it will enable the central collection and provision of information and data for the assessment of the environmental compatibility of building products and structures in infrastructure construction. Furthermore, due to the planned explanations and the glossary function, the information system is suitable for experts such as toxicologists as well as for non-specialists and increase the number of potential users. Furthermore, the planned modular structure of the information system allows for extensions and the possibility of setting up interfaces with other databases or information platforms. Lastly, the results report, as well as the specification sheet and prototype, consider requirements for a public system.

8 Outlook

The specification sheet describes the elements of a user-oriented and feasible information system. The next step is to decide whether the information system should be realized and in which area of responsibility it should be established. In doing so, it should be kept in mind from which organizations employees are to be appointed as contributors, validators and administrators. For the development, the formation of a cross-organizational working group should be considered, which in the next step carries out the project initialization and the definition of a project plan. The next important step is the preparation of the tender. For this, it is again important whether the programming should be done by means of specification sheet or agile project management. The information system was planned in a modular way so that it can be adapted and expanded in the future.

List of figures