

# L4: Implementation

INDUSTRY PRACTICES FOR APPLICATION OF COCLASS IN SOFTWARE



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# 1 Background, purpose and scope

## 1.1 Background

CoClass is a modern and web-based classification system that is developed to cover the construction sector's complete information need. CoClass builds on standard, science and proven experience since it is based on international standards (see Normative references section)

The vision is that CoClass shall lead to improved communication between the actors within the construction sector. The goal is that CoClass shall be used by all parties during all stages during the lifecycle of a construction complex from early stages to maintenance, operation and demolition. An investigation performed 2014 by Svensk Byggtjänst showed that deficient communication leads to increased spending of approximately 60 billion SEK within the construction sector. CoClass may contribute to the resolution of this problem when used fully through the whole lifecycle. In other words, there is a substantial potential for savings for the sector when using CoClass.

A strive is that CoClass successively will replace the current system for classification, BSAB 96. CoClass is adapted for digital modelling and will play an important role in the realization of the full potential with BIM (Building Information Modelling). CoClass includes definitions for objects, properties and activities through the whole lifecycle for both buildings and infrastructure. This will be the backbone for the communication through the construction, maintenance and operation, from idea to demolition.

## 1.2 Purpose of the project

One important component to achieve the potential of CoClass is that there exists support in the software systems that are used in different stages through the life cycle. This is vital for achieving a continuous flow of data through the processes thus reducing the risk of misunderstandings and disputes and errors. Adequate support in software will also significantly lower the thresholds for getting started.

To achieve this, it is required that the software which implements CoClass does this in a uniform way. The understanding of CoClass is not allowed to change just because different software systems are used in different parts of the lifecycle.

The purpose of this project is therefore to develop guidelines and recommendations for how CoClass shall be implemented in software.

**Primary purpose:**

- To develop an industry practice for software implementors on how to implement CoClass in a uniform way.

**Secondary purpose:**

- To provide an opportunity for software implementors and other actors in the construction sector to put forward requirements on functionality and content in CoClass.

**Tertiary purpose:**

- To achieve software implementations with built in support for CoClass so that CoClass users can include the use of CoClass as part of their information delivery specifications.

### 1.3 Purpose of this document

Based from the deliverables L1 (analysis of user needs) and L2 (Requirements analysis IT), this implementation specification report provides a specification for implementation of several test cases to be implemented (in WP4) and verified (in WP5).

## 2 Summary of previous work in the project

In work package 1, workshops with the aim to investigate user needs, were held together with user representatives. The results from this investigation of user needs is reported in (Project Industry practices for application of CoClass in software, 2019). In work package 2, the results from this investigation have been compiled into a requirements analysis together with requirements from the participating software providers to capture a representative set of requirements from a large group of stakeholders. In work package 3, each partner specified a set of test cases to implement with the aim to verify and validate their solutions against the requirements and user needs.

## 3 Implementation specification

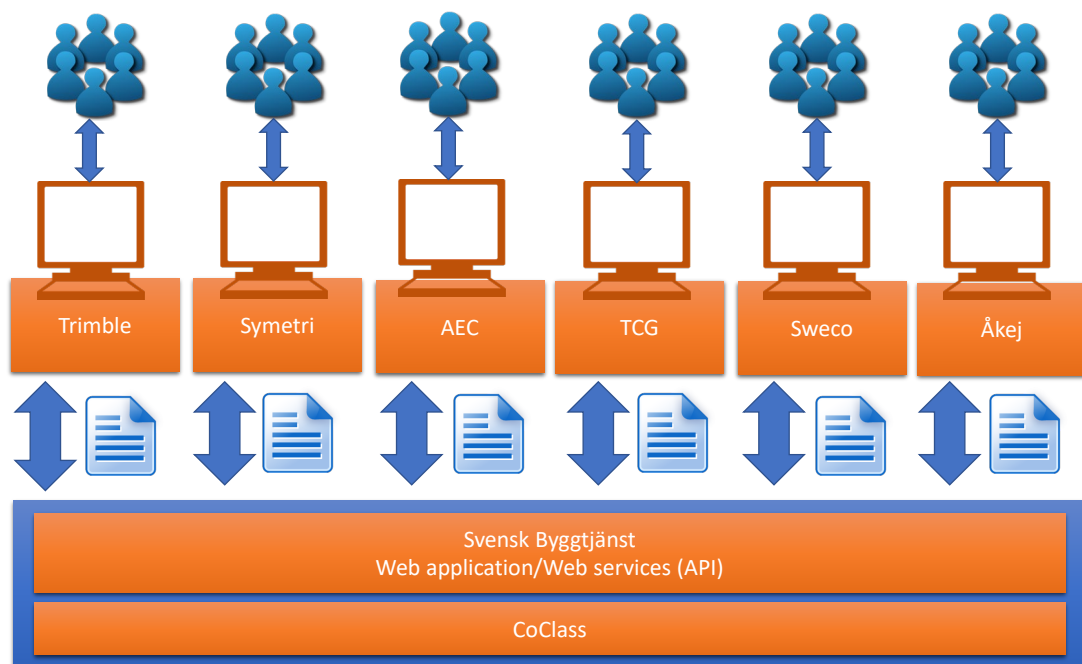
### 3.1 Principles and organization

Based on the requirements analysis, the implementation specification specifies several real cases to be implemented in software (in WP4) and verified (in WP5) by the project partners, including Svensk Byggtjänst.

The implementations are made in the respective software package provided by the project partners and shall cover important needs from their users regarding the use of CoClass.

The figure below gives an overview of the organization of the work:

- Each partner has some software supporting certain categories of users
- The software makes use of CoClass and the related web services
- Each partner has created an implementation specification (Work package 3) for one or more selected test scenarios
- Each test scenario is described by detailed steps including input, processing, output, requirements mapping and a method for verification and validation
- Each test scenario is implemented in the software



## 3.2 Description of the software packages

The table below gives an overview of the software packages chosen for the implementation and their dedicated market and area of use.

Partner	Software	Software market and area of use
<b>Trimble</b>	Trimble Novapoint & Trimble Quadri	Trimble Novapoint & Trimble Quadri is used for civil design, construction and maintenance of infrastructure projects. Mainly used by technical consultants but also contractors, municipalities and infrastructure owners.
<b>Symetri</b>	Naviate BIMeye Spine Anavitor	Construction and production.
<b>AEC</b>	Savoir & AEC PLUS Infra	The software can be used in all phases of the lifecycle of an infrastructure project. The software is primarily used by design engineers when working on designing a project this to deploy the right codes and also for quality checking deliverables and coding. The receiving client/asset owner can also use the software for example checking that requirements are fulfilled
<b>TCG</b>	Master Concept (Vendor: IDES AB)	Information and documentation masterdata hub for large property owners/ plant owners with technically more complex facilities e.g. nuclear plants, district heating plants, energy distribution, process industries, hospitals and large building complexes etc. Covering all information and documentation needed by all roles in the business processes from customer inquiries to maintenance and overhaul. Fully IEC/ISO 813 46-1, -2, -10 (KKS) and -12 (CoClass) compliant including multiple aspects, version handling, item and cost aggregation at any level in the hierarchy
<b>Sweco Position (Safe Software)</b>	FME Desktop 2019 & FME Server 2019	FME is an ETL-tool (extract, transform, load) and is widely used in the following industries: Airports & Aviation, Architecture, Engineering and Construction, Commercial, Defense and Aerospace, Emergency Services, Energy, Federal Government, Health Care, Local Government, Natural Resources, State Government, Telecommunications, Transportation and Utilities. FME can be, and is used, in all parts of the life cycle for data management, data validation, data extraction, data transformation and data load. The software can read and write over 400 different data formats/sources.
<b>Åkej</b>	Software using fi2xml classlist functionality	This is to transfer classification information to final storage in FM software
<b>Svensk Byggtjänst</b>	coclass.byggtjanst.se , including CoClass Studio web application and CoClass API	CoClass is the Swedish classification system for all built environments. The purpose of CoClass is that the model should be used by all parties throughout the construction work's life cycle - from the early stages to management and demolition. With CoClass, all parties have access to a common language with the same concepts and terminology

in all software and in all information deliveries. CoClass is a digital language that can be read by both man and machine.

### 3.3 Description of the test cases

The table below gives an overview of the test cases specified by the project partners.

Partner	Chosen scenario	Purpose/benefit of chosen scenario
<b>Trimble</b> <a href="#">Testcase</a>	Road Owner Nye Veier adopt CoClass for classification of assets	Nye Veier is a new CoClass customer that are eager to test out CoClass for classification of their assets
<b>Symetri</b> <a href="#">Testcase</a>	Transfer information from requirements to construction and production where the result can be verified and stored in FM.	The purpose is to make the information and their properties to the classified through the whole lifecycle. E.g. That you could verify the same component through the whole lifecycle. It shall be possible to verify objects and its properties at the different delivery milestones to make sure that a complete classification has been done at the last delivery.
<b>AEC</b> <a href="#">Testcase</a>	The Designer is working on design of an infrastructure project. The Designer have requirements to use CoClass. The designer needs to have all relevant CoClass codes for his discipline that are relevant for his project. The Designer access the codes and picks some relevant codes. When delivery to the client is to be done the Designer can check that the objects have the relevant coding. When Byggtjänst updates the CoClass to a new version the designer needs to update the project to that version. The designer needs to understand how the changes will be relevant and impact his project T	Using, quality checking and selecting, defining, updating and validating CoClass codes within a project.
<b>TCG</b> <a href="#">Testcase</a>	The test scenario was a new bridge incl the road up to a bridge and lightning along the road and on the bridge. The old bridge was dismantled. Thus achieving a continuous flow of information from planning to dismantling. An IFC model from Trafikverket was imported. Properties, documents and item specific software were linked to objects and articles. A preventive maintenance order was added. Resources, number of articles	A typical scenario for any contractor, property or infrastructure owner. The information model based on the Trafikverket standard, IEC 813 46-1, -2, 12 and Coclass naming standard. Implementing two aspects of the bridge, a constructive system (the bridge) and a functional system (the power network).

	and costs was added per object and aggregated upwards.	
<b>Sweco Position (Safe Software)</b> <a href="#">Testcase</a>	Semi-automatically set CoClass codes for objects in Revit files and tabular data format. The user can upload a Revit file or a file in a tabular format with objects that doesn't have any CoClass codes set. FME will read and interpret the information about the objects, make requests to the CoClass API, retrieve and transform the results and present it to the user for further handling.	To easy get suggestions of CoClass codes for existing data. This will hopefully speed up the implementation of CoClass at certain organizations.
<b>Åkej</b> <a href="#">Testcase</a>	When fi2xml software requires classlist verification CoClass API simulates and fi2 classlists so that these software can verify they do with other classes.	The purpose is to make the information and their properties to the classified through the whole lifecycle. E.g. That you could verify the same component through the whole lifecycle. It shall be possible to verify objects and its properties at the different delivery milestones to make sure that a complete classification has been done at the last delivery.
<b>Svensk Byggtjänst</b>	A developer creates a structure in CoClass Studio for use in future work in planning a construction. The developer shares the structure with one or more people in order for them to continue work. Alt 1: The persons that the structure is shared to downloads it and imports it in another tool to continue work. Alt 2: The persons that the structure is shared to uses another tool and imports the structure through the CoClass API to continue work.	Enables a developer to create a structure and share it to other people that needs to work with it. Enables one common data source for all to work with

General tests of Svensk Byggtjänst's CoClass API concerning authentication/authorization, requests and replies, error responses, documentation will be conducted implicit by those project partners that will use the CoClass-API.



### 3.4 Complete list of test cases and mapping of requirements

The complete list of all test cases that shall be conducted by the project parts can be found in the *Appendix - Complete list of test cases*. The following table summarize which test cases that belong to each project partner and which requirements that will be tested.

The mapping of tested requirements is made by the project parts separately, and is what they believe they have tested.

Partner	ID:s of test cases	Mapped requirements
<b>Trimble</b>	P1-01 to P2-09	F1, F2, F10, F21, F22, F32, F33, F39, F43, F55,1, F55,2, F68, F70, F72
<b>Symetri</b>	P6-01/P4-01 to P6-04/P2-04	F24, F54, IF24
<b>AEC</b>	P3-01 to P3-11	F21, F28-1, F28-2, F82, F17, IF10, IF16, IF18, IF20, IF27, IF29, IF35, IF37
<b>TCG</b>	P4-01 to P4-19	F1, F2, F3, F20, F22, F23, F26, F28, F32, F33, F39, F43, F44, F45, F46, F47, F49, F50, F53, F55, F58, F62, F68, F72, F73, F74, F76, F78, F79, F83, F84, F85, F86, F88, F89, F90, F91, F92, F94, F95, F96, IF1, IF8, IF9, IF10, IF11, IF16, IF18, IF20, IF32, IF33, IF35 F25
<b>Sweco Position (Safe Software)</b>	P5-01 to P5-02	F18, F19, IF21
<b>Åkej</b>	P6-01/P4-01 to P6-04/P2-04	F24, F54, IF24
<b>Svensk Byggtjänst</b>	P0-01 to P0-03	F1, F2 F12, F98, F99, IF37

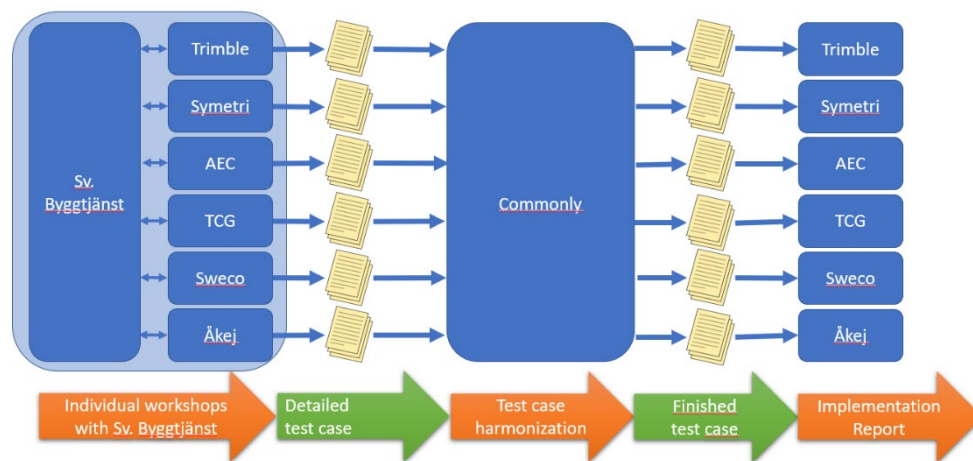
### 3.5 Test cases and lifecycle

The table below gives an overview on how the test cases map to the different stages in the lifecycle of built assets.

Life cycle stage	Trimble	Symetri	AEC	TCG	Sweco	Åkej	Sv. Byggtj.
<b>Planning</b>		x		x	x	x	x
<b>Design</b>	x	x	x	x	x	x	
<b>Construction</b>		x		x		x	
<b>Maintenance</b>	x	x		x		x	
<b>Operations</b>	x	x		x		x	
<b>Demolition</b>		x		x		x	

### 3.6 Implementation conclusions

The figure below explains the agreed process for implementation.



The implementation has been followed out in three steps

#### 3.6.1 Step 1 - Individual workshops with Sv. Byggtjänst

This step aims to detail the test cases for each project part to reach a level that is possible to implement and verify. To achieve a mutual understanding of the test case and the use of the CoClass services, individual workshops between Svensk Byggtjänst and each project part have been held by Trimble, Sweco Position AB, Symetri, ÅKEJ and TCG.

Each project part makes an Implementation in their systems

#### 3.6.2 Step 2 - Test case harmonization

This step was planned to reach a level of harmonization within the project regarding how the test case implements CoClass and also to achieve a minimum level of coverage of the desired functionality for the project as a whole.

Unfortunately, the project did not find time to complete this harmonization, which has resulted in everyone having implemented CoClass in different ways. Uncertainties regarding the publication of the new CoClass api may also have contributed to this. This harmonization will be part of the work for the Industry standard.

#### 3.6.3 Step 3 – Implementation and reporting

This step was performed separately for each participant

Some test cases have changed during the implementation, following an agile process. The implementations were documented and links to the documentation can be found in chapter 3.3

### 3.6.4 Observations from the implementation

These observations will be handled in the further work with the Industry standard, based on the severity of the issues.

Observation	Proposed action
<b>The API</b> is on a fine grained level which leads to a very “chatty” conversation between client and server.	Need to be able to download a table in one call. With the new API, there will be many calls to get the table.
<b>The API does not have the required performance, it took 5 min to download a table.</b> Good examples are lacking	More composite api calls? Server configuration? Create an open-source example project (e.g. Revit model) to show how CoClass will be implemented in a real project. Set up a real project that everyone can see how it is thought the whole process
<b>How should the user activate CoClass in the software? If a license is required then three-factor authentication would be beneficial so that the CoClass API itself can authorize the user.</b>	
<b>Later release of new API which made the development more difficult.</b> <b>Did not have access to new API</b>	
<b>API documentation shortcomings.</b> Especially regarding all ID concepts used: <b>categoryId, categoryClassId, childNodeId, id, valueListId, coClassVersionId, activityId, activityClassId, childId</b>	The API should be carefully documented to avoid any misunderstandings. An idea may be to document these IDs on the Coclasse website for each code so you understand how they are connected.
<b>The API and CoClass website should be harmonized so that the same concepts / words are used in both places. The risk is otherwise that the IT people and the business people have difficulty communicating needs between each other when using different concepts. This entails additional difficulties in implementing CoClass in an organization.</b> <b>--e.g. is called the top level Tables on the coclasse website (this part is not translated into English nor when you change language but you can guess that it should be called Tables) but in the API this level is called Root Categories.</b>	
It should be the same example of Swedish and English on coclasse website for all components	

<p>-- e.g. <a href="https://coclass.byggtjanst.se/classes/2/145/292370">https://coclass.byggtjanst.se/classes/2/145/292370</a> showing UCA Appliance Case has 16 examples of Swedish but only 5 examples of English.</p>	
<p><b>It should be possible to link to a page on the Coclass website and choose in the URL if you want to show it in English or Swedish. Now the user has to click on the language (which is a functionality that has become worse after the upgrade). If you have English-speaking customers you want to build a support directly in English without having to click to change language.</b></p>	
<p><b>Since it is not possible to search through the API, we have had to download CoClass locally to a database. This works if you work with a locked version of CoClass, but if you want "the latest" it must be possible to search through the API.</b></p>	
<p><b>We suggest that the API that CoClass offers should include a complete reference code and verify it and divide it into its constituents so that an identification as above must be made. Similarly, the API should also take all CoClass classification and all CoClass properties to build a complete reference code according to the regulations that the application calls through the API. If we have this routine then all kind of generic connection to environmental data will be possible!</b>  <b>Sample code:</b>  <b>BX:AAA.BV:AAA.FS:B#.KS:AD%10+004(Längd:4230;Bredd:250)</b></p>	
<p><b>The test scenario was a new bridge incl the road up to a bridge and lightning along the road and on the bridge. The old bridge was dismantled. Thus achieving a continuous flow of information from planning to dismantling. An IFC model from Trafikverket was imported. Properties, documents and item specific software were linked to objects and articles. A preventive maintenance order was added. Resources, number of articles and costs was added per object and aggregated upwards.</b></p>	
<p><b>A typical scenario for any entrepreneur, property or infrastructure owner.</b>  <b>The information model based on the Trafikverket standard, IEC 813 46-1, -2, 12 and Coclass naming standard. Implementing two aspects of the bridge, a constructive system (the bridge) and a functional system (the power network).</b></p>	

## 4 Normative references

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