Life Cycle information exchange (LCie): Product Inspection

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BACKGROUND

Quality Control and Quality Assurance inspections documented on paper or in relational database applications have been common place for since the use of computers for construction management. As a result of the distribution of computing power and ubiquitous nature of computer networks, there are an increasing number of commercial and corporate tools used capture information about the inspection and status of materials, products, and equipment.

BUSINESS CASE

The effective resolution of issues identified during design and construction today rely on the use of common information platforms for all project participants. This requirement results in higher costs for all parties since each party is forced to change technology stacks across projects. The benefit of a common framework for the exchange of issues will result in each party being able to streamline their own business software and processes because the exchange of information to others can be relied upon.

EXAMPLE CONTRACT CLAUSE

The contractor shall provide electronic quality control inspections reports to the owner in the format specified by the Product Inspection stage of the LCie specification. Software selected by the contractor to support the resolution of quality control and quality assurance issues shall be self-certified to consume and produce LCie Product Inspection transactions.

ORGANIZATION

The buildingSMART international Information Delivery Manual process identifies information exchanges according to the table shown below. Use this table to determine if this information exchange applies to your area of responsibility for a given project.

Code	Phase	Used
0	Portfolio requirements	
1	Conception of need	
2	Outline feasibility	
3	Substantive feasibility	
4	Outline conceptual design	
5	Full conceptual design	
6	Coordinated design and procurement	
7	Production information	
8	Construction	✓
9	Operation and maintenance	
10	Disposal	

The buildingSMART alliance classifies information exchanges according to a number of different classification tables, called OmniClass, provided by the Construction Specification Institute. In addition to OmniClass references to the subject exchange, the buildingSMART alliance provides an overall business activity diagram node referenced in the table below.

LCie Worksheet	OmniClass Table 31 Phase	OmniClass Table 34 Actors	OmniClass Table 32 Services	Activity Node Tree
Product Inspection	**31-40 40 91 17** Evaluation Phase	**34-35 14 00** Contractor	**32-21 17 00** Constructing	**4.34** Inspect and Approve Work

EXCHANGES

The sections below describe the inputs required to apply this information exchange. The processing that is accomplished to process these inputs, and the resulting outputs that should be expected as a result of performing this information exchange. This information exchange can be characterized as a "transactional" update of the as-built construction building model. A general description of the requirements for transactional exchanges is found in the LCie Overview (URL).

Inputs

Product Inspection requires the user authentication and project authorization wrappers described in the LCie Overview (URL). In addition, the information below is the minimum data set that will be processed; however, additional worksheets may be provided by the creator of the COBie file. Please note that additional worksheets may be needed to produce a proper ifc file.

- Issue worksheet.
- Attribute worksheet.
- (Optional) Document worksheet.

The following table summarizes the expected content in the COBie file. Referenced rows are for informational purposes and should not be changed. New rows require the addition of new row items to the designated worksheet. Updated rows require the addition of information to an existing row item. It may also be appropriate to add a new row item to a worksheet as part of an update. Optional rows are not required but will be processed if provided.

Key: Referenced Rows= Y or – (not reqd.)
New Rows= Y or – (not reqd.)
Updated Rows = Y or – (not reqd.)
Optional Rows = Y or – (not reqd.)

Worksheet	Referenced Rows	New Rows	Updated Rows	Optional Rows
Facility	Y	-	-	-
Floor	-	-	-	-
Space	-	-	-	-
Zone	-	-	-	-
Type	Y	-	-	-
Component	Y	-	-	-
System	-	-	-	-
Spare	-	-	-	-
Resource	-	-	-	-
Job	-	-	-	-
Document	-	-	-	Y
Attribute	-	-	Y	-
Connection	Y	-	-	-
Coordinate	Y	-	-	-
Issue	-	Y	-	-

Processing

The capture of this transactional information may be seen as a type of building information survey where the appropriate portion of the building information is requested to generate a data entry form, the user completes that form, and the information is returned to update the building information.

Preparation of building information template

The first stage is the preparation of a template data set from the current building information. Implementation of the template information may be accomplished through specific software solutions using appropriate menus. To create realistic examples, bimServices demonstration scripts automatically create COBie spreadsheets containing the minimum set of information needed to provide the required BIM sub-set.

- Select current project from building information database
- Select specific product type from current project
- Select specific product component from current product type
- Generate product inspection data entry form
- Provide product inspection data entry form

Building information capture

The second stage is the captured of the required new information in the data entry form. As with step one this would be expected to be accomplished within proprietary software solutions. To provide a realistic example the COBie file provided in the first step may be used to:

- Access product inspection data entry form
- Provide required attribute data
- Provide required issue data
- (Optional) Provide document data

Building information transmission and processing

The final stage is the transmission and processing of that information by the target information system. For this specific information exchange the following steps are required. To provide a realistic example the completed COBie building information survey form is used as the input artifact that updates the model.

- Access product inspection data entry form
- Provide user credential information (if needed)
- Provide required attribute data
- Provide required issue data
- (Optional) Provide document data
- Send information to the building information server

Processing information sent to the building information server will require the following steps.

- User authentication
- User authorization
- Checking file compliance with COBie
- Checking file compliance with LCie exchange requirements
- Checking the requested transaction with targeted information
- Backing-up prior building information
- Identification of matching component
- Updating attribute data
- Updating issue data
- Updating document data

- (Optional) Completion of the transaction and reporting

Output

There are two types of outputs created with this transaction. The first is the creation of the product installation form. This output may be shown on a screen as part of an information system or may be produced as a standalone template file, as is accomplished with the bimServices engine.

The second outputs are files that demonstrate proper processing of the submitted information. The following reports would be expected:

- Incoming file compliance with COBie
- Incoming file compliance with information exchange requirements (identification of optional data)
- Verification of mapping to target model
- Results of completing the transactions
- Comparison of prior and current model states.

Follow On

The following processes are expected to occur after or concurrently with this process:

- Other product inspection reports
- Product Type Parts

EXAMPLES

The LCie project has two example projects, a duplex apartment and a medical clinic. For each example project, a product inspection COBie file has been created. The type, component, document, attribute, coordinate, and connection worksheets in each product insoection file have been completed in accordance with the COBie instruction worksheet. The product inspection files for both example projects can be found below.

Duplex Apartment

- Example 1:
  - Input:
    - Prior building model (DuplexApartment_ProductInspection_ Doors--Door-3_before)
    - Exported template for Product Inspection (URL)
    - Completed template for Product Inspection (DuplexApartment_ProductInspection_ Doors--Door-3)
  - Output:
    - Incoming file compliance with COBie
    - Incoming file compliance with exchange requirements (identification of optional data)
    - Verification of mapping to target model
    - Results of completing the transactions
    - Comparison of prior and current model states.

Medical Clinic

- Example 1:
  - Input:
    - Prior building model (MedicalClinic_ProductInspection_ Door-2A12_before)
    - Exported template for Product Inspection (URL)

        - Completed template for Product Inspection (MedicalClinic_ProductInspection_ Door-2A12)
    - Output:
        - Incoming file compliance with COBie
        - Incoming file compliance with exchange requirements (identification of optional data)
        - Verification of mapping to target model
        - Results of completing the transactions
        - Comparison of prior and current model states.

Software Implementation Guidance

SCRIPTED PROCESS

To recreate the example files identified in this information exchange documentation the bimServices engine was used based on information from two projects a Duplex Apartment building and a Clinic building. The following batch file was used to process the appropriate files through the bimServices engine.

```
echo off
set a0=ProductInspection
rem Replace %1 with MedicalClinic or DuplexApartment
set a1=%1
rem  Replace %2 with appropriate component name
set a2=%2

call goCI           %a1% %a0%_%a2%
call goMerge2       %a1% %a0% %a2%
call goIC           %a1% %a0%_%a2%

time /t
```

Figure 1 doProductInspection batch file