

2017-2020

PROGRESS

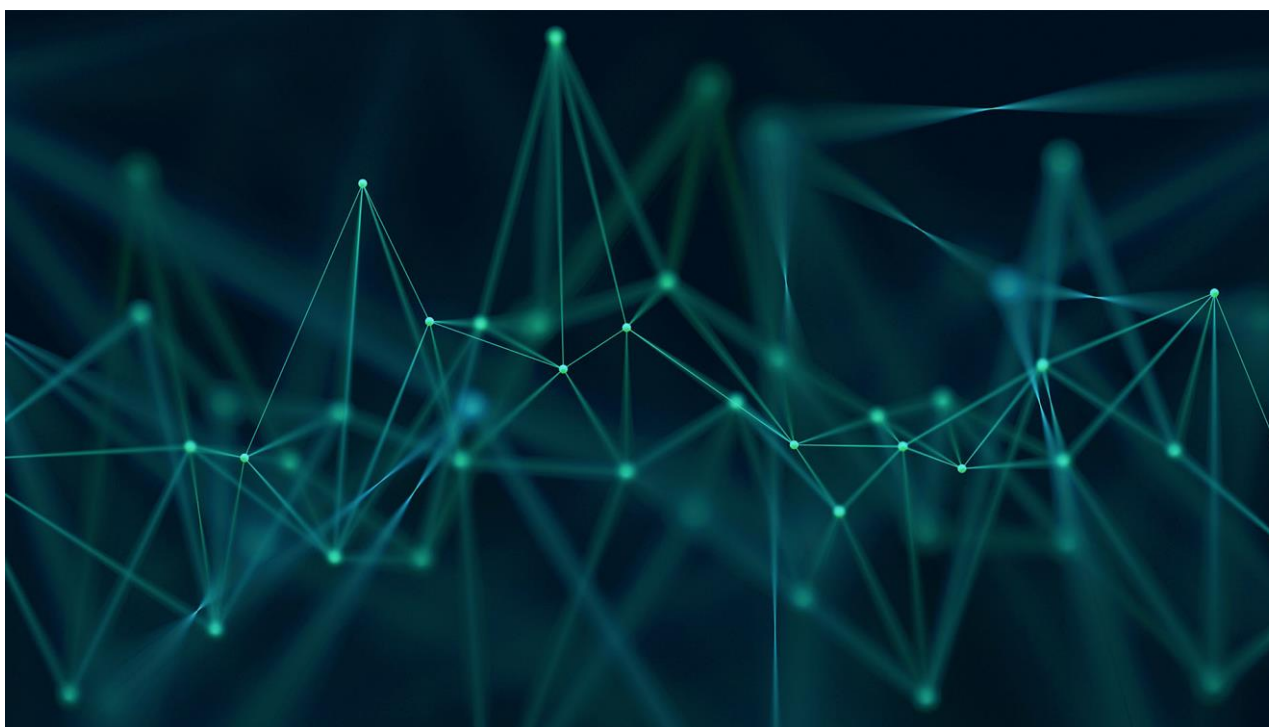
PROVISIONS FOR GREATER REUSE OF STEEL STRUCTURES

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Prototype information sharing portal

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Deliverable: D8.3 Prototype information sharing portal

Confidentiality: Public

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Executive summary

The aim of Task 8.3 was to develop a prototype website portal for sharing information about the reuse of steel-framed SSBs and their constituent components. The portal will provide information and guidance (from earlier WPs and particularly the Design Guide D6.1) but will focus on systems to trade steel buildings and products. In terms of the functionality of the portal, it has been developed to address both:

- Reuse today scenario, i.e. a traditional 'sell-buy' exchange but devoted specifically to reclaimed structural steel and steel-based envelope products from existing buildings
- Development of a database of new structural steel in newly constructed buildings, i.e. facilitating future deconstruction and reuse.

As set out in the proposal, the structure of the website was organised as shown in Figure A.

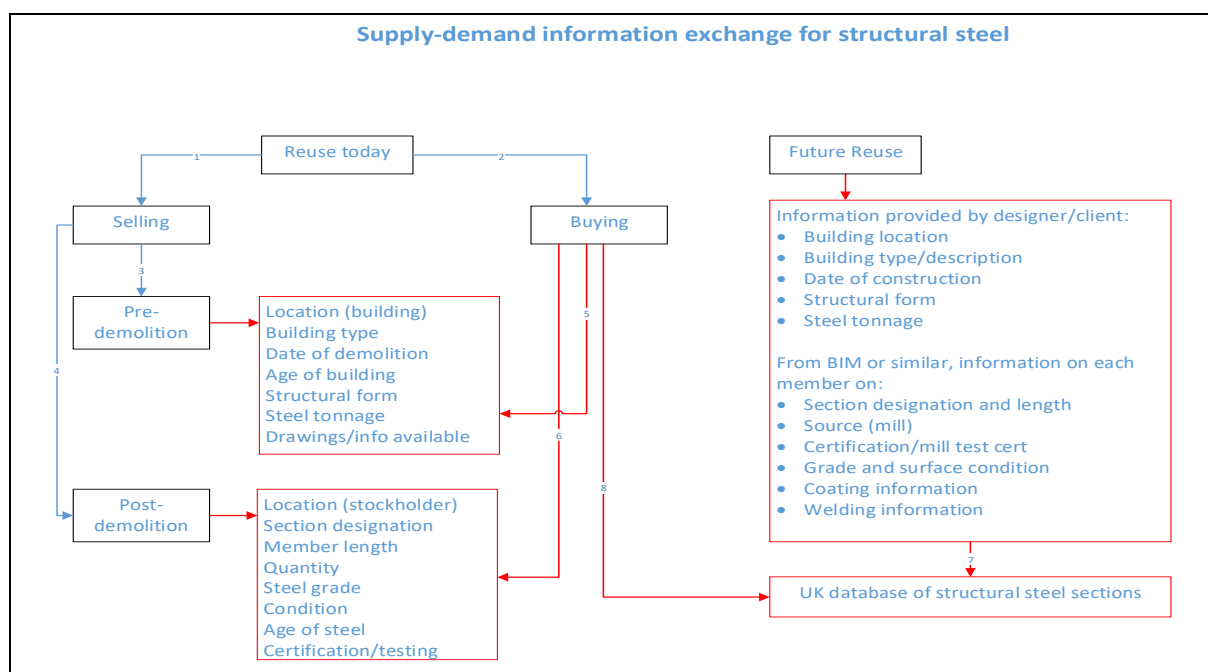


Figure A Framework of the prototype steel reuse portal

The prototype website was developed by SCI. During the first reporting period, the website was developed by an SCI website developer however, he left SCI in 2019 and was not replaced. To complete development of the prototype website, SCI subcontracted a UK IT development company (IceBlue) with whom SCI has recent experience of developing software and websites. The prototype website is currently hosted on an IceBlue staging server.

Although the website was intended to include all product groups within the scope of PROGRESS, the prototype development has focussed on hot-rolled, primary structural sections and on single-storey buildings.

Table A describes the different scenarios shown in Figure A. Screenshots from the prototype are used to illustrate the website functionality.

Table A Information exchange scenarios and actors

Scenario	Selling ¹	Actor	Buying ¹	Actor	Notes
Reuse today, i.e. existing buildings	1	Building owner/Demolition contractor	2	Client/designer	
Pre-demolition	3	Building owner/Demolition contractor	5	Client/designer	General building information to link buyer and seller. More detailed information by negotiation
Post-demolition	4	Stockholder/Demolition contractor	6	Client/designer	Scenario in which either the entire building structure or an inventory of the structural elements are offered for sale
Future reuse, i.e. facilitating future reuse	7	Client/Demolition contractor	8	Client/designer	Future scenario where BIM information is uploaded to a database to enable future reuse.

¹ Refer to the number shown in Figure A

Pre-demolition - Route 3/5 (see Figure A)

For this scenario it is assumed that, for most buildings, insufficiently detailed information is available, pre-demolition, to enable designers to plan for the reuse of the steel in sufficient detail. Information exchange therefore is limited to basic project/building information. The building information is posted (most likely) by the building owner or demolition contractor and if the building is likely to be of interest for reuse, the designer can make contact with the demolition contractor or building owner directly to discuss the potential for reuse in greater detail. This could include a more detailed pre-demolition audit and/or a review of existing design information and drawings, if these are available, or a more intrusive survey and testing.

Post-demolition - Route 4/6 (see Figure A)

This scenario assumes that the building has been deconstructed with a view to reusing the reclaimed members, i.e. care has been taken to deconstruct the building carefully with a view to preserving the structural steel members. Post-demolition, more information is more readily available, for example, section designation, length, etc. If testing is required, the results should also be made available.

For small-scale listings, information on individual elements can be uploaded manually using simple drop-down menus; as is the case for the current prototype. For larger inventories/databases, such as those held by stockists that currently trade in reclaimed sections, a means of uploading data (web service) to the website automatically would need to be developed.

Figure B shows the search facility to find buildings potentially available for reuse. The user inserts a postcode and search radius and selects either the 'pre-demolition' or 'post-demolition' scenario. Available buildings are shown on a map and are listed (left of screen). Clicking on 'more details' brings up further details about the building or the available sections depending on the scenario

selected. All website users are able to search on the website but to list projects or to make contact with sellers, users are required to register and logon to the website.

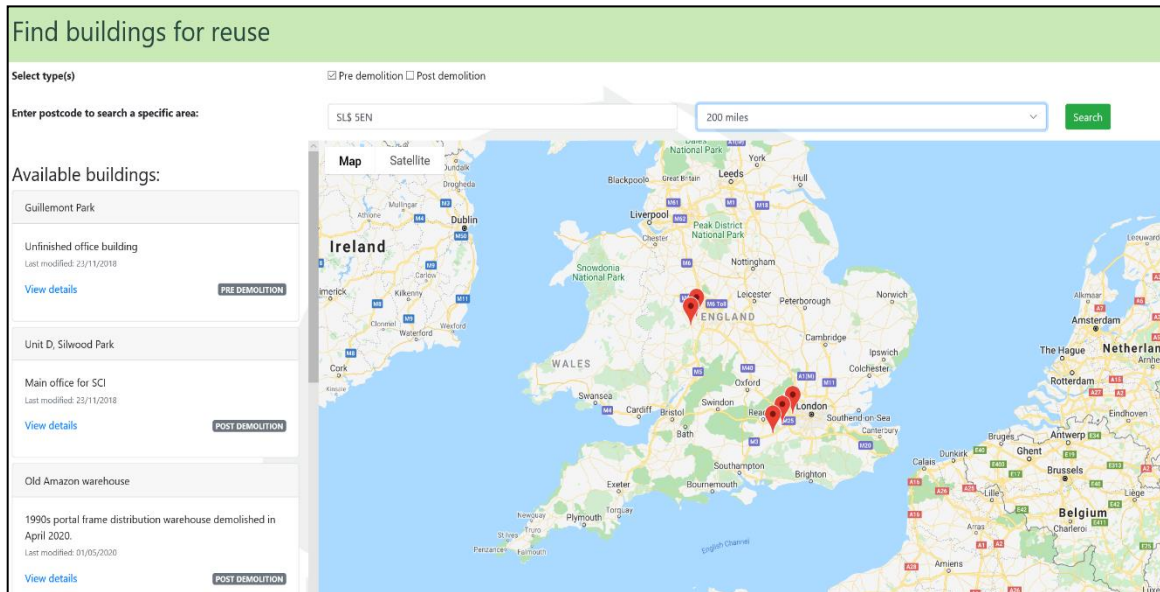


Figure B Search facility to find a steel building available for reuse

Figure C shows the building details returned for the pre-demolition scenario. Location details are provided together with details of the building including:

- Age of building
- Scheduled demolition date
- Size of building
- Overview of section sizes, grade, sub-grade, etc.
- Contact details to enquire about the building (only available to registered users).

Figure D shows the results returned for the post-demolition scenario. In addition to the project description and the location of the building/sections, an inventory of the available sections including their size, length, grade and quantity is provided. Contact information is available to registered users of the web site.

Project: NTS building, Thirsk

Project description
 dss
Address
 120 Eldmire Lane,
 Thirsk,
 Yorkshire,
 YO7 3HE,
 United Kingdom

Project details

Building type
 Industrial

Scheduled demolition date
 31/05/2055

Age of building
 1984

Structural form
 Portal frame

Condition of steel structure

Number of bays
 2

External column spacing
 7.50

Column section range
 0

Rafter section range
 0

Steel Grade
 S275

Steelwork coating
 Shot-blasted

Is the steel structure CE marked?
 True

Info regarding CE marking

PRE DEMOLITION



Number of storeys
 0 storeys

Footprint of building
 0.00 x 0.00 m

Gross floor area
 11700 m²

Estimate of steel tonnage
 0 tonnes

Height of building
 11.00 m

Width of bay
 30.00 m

Internal column spacing
 7.50

Column section size
 0

Rafter section size
 0

Steel Subgrade
 J0

Roof pitch
 3 degrees

Are building drawings/information available?
 Yes

Other information

Figure C Pre-demolition project details

Project: Old Amazon warehouse

Project description
 1990s portal frame distribution warehouse demolished in April 2020.

Address
 Hayes,
 West Drayton,
 Berkshire,
 UB7 9FN,
 United Kingdom

POST DEMOLITION



Steel member inventory

Section designation	Length	Steel grade	Quantity
Columns (UC)s 356 x 406 x 1299	12.00m	S275	23
Beam (UB)s 254 x 146 x 43	6.00m	S355	12
1016 x 305 x 584	5.00m	S235	0

Figure D Post-demolition details

Alternatively, users can search the database of available reclaimed sections using the search facility shown in Figure E. Users input the following search criteria:

- Section type; currently UB, UC, PFC
- Postcode and search radius
- Section size from a dropdown menu of standard section sizes.

Note that the functionality to search for a range of section sizes has not yet been implemented in the prototype website.

Available sections are listed and clicking on 'view details' returns the information shown in Figure F.

Figure E Search functionality for a specific section

Section Designation	Grade	Length	Quantity
UKB 356x127x33	S355	-1m	24
UKB 305x165x40	S355	-1m	16
UB 406x140x46	S355	-1m	8
UKB 406x140x46	S355	-1m	8
UB 610x305x149	S355	-1m	4
UB 610x229x125	S355	-1m	3
UC 203x203x46	S355	-1m	13

Figure F Returned results for a search for a specific section size

Future reuse - Route 7/8

This scenario relates to future reuse, i.e. enabling reuse of steel structures in the future. By capturing detailed information on buildings constructed today, this information will enable buildings to be refurbished or extended and potentially reused in the future. Data fields relate to:

- Building or project information, and
- Elemental information.

Project information is inputted manually and elemental or product information is provided to the portal via uploaded IFC files. The whole building structural models are held confidentially and securely until such point as they either due to be refurbished, structurally extended or when they are scheduled for demolition. At this time, the project/building information becomes searchable (as described in Figure B) and the elemental information will be placed in the database of reclaimed sections and searchable as shown in Figure E.

For the purpose of testing this functionality of the prototype website, a number of IFC models of steel SSBs have been provided by UK steelwork contractors to SCI – see Figure G which shows two examples.

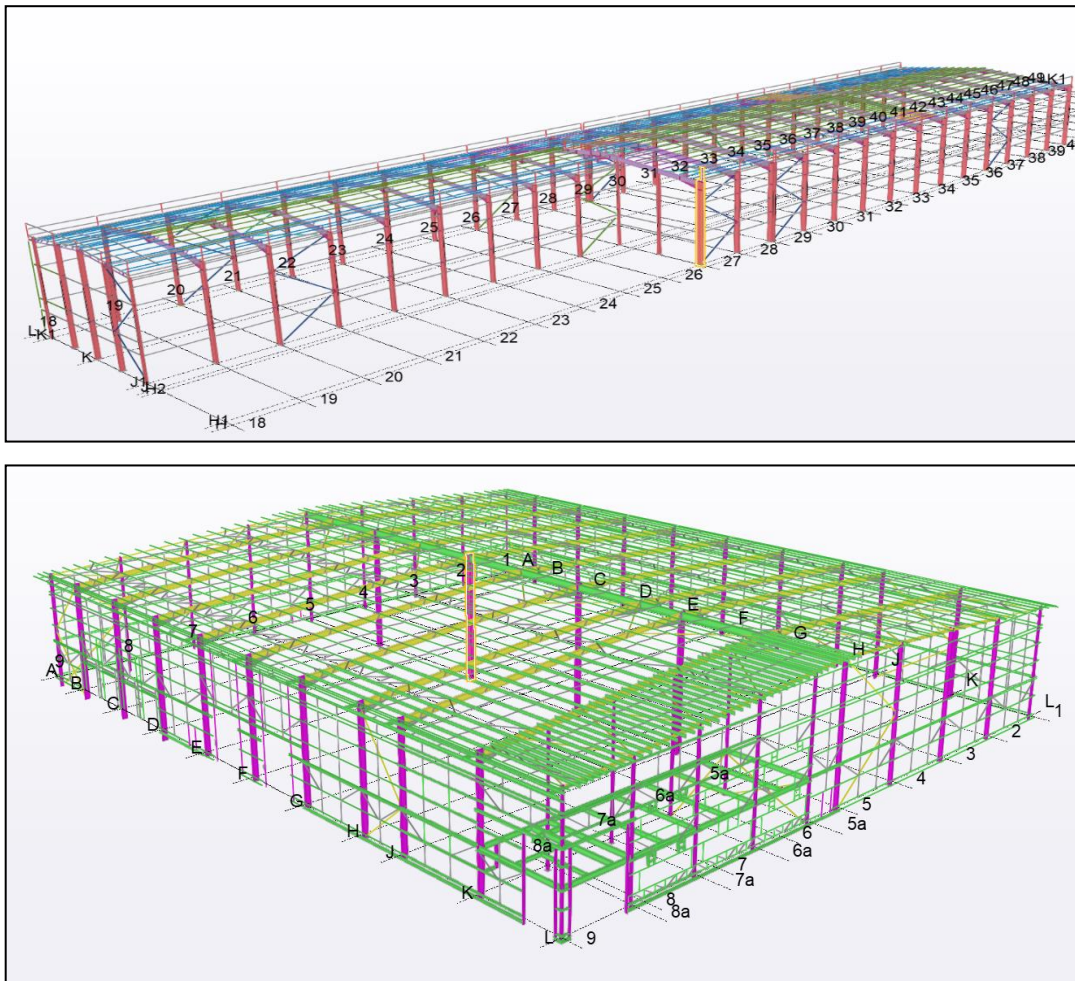


Figure G IFC files of single-storey, steel structures (models viewed using Tekla BIMsight)

Within the prototype, coding has been written to search through the IFC files and automatically select the elemental information and store this information in a searchable database. Figure H visualises this process using a screenshot for a UB 457 x 152 x 52 beam obtained from Tekla BIMsight. As shown, the section size, length, grade, sub-grade and weight are captured and stored in the database. Note that the example IFC files used during testing of the prototype, are in the format provided by the steelwork contractor. Although they contain the most important product information, it is recommended that a larger dataset is specified for the IFC file. This could include, for example, the mill certificate (or reference or link to this) and environmental information, for example in the form of an environmental product declaration (EPD).

One other challenge in automating the process of searching IFC files is the precise formatting of the product descriptions. For example, for section size, different steelwork contractors use either UB 457 x 152 x 52 or UB 457 * 152 * 52 similarly the way/format that the steel grade and sub-grade are recorded in the IFC file can vary. All of the IFC files tested within the prototype so far have been provided by UK steelwork contractors. This difficulty is likely to be greater with the inclusion of IFC files from other countries and other languages and reinforces the need for a clear standard on what information to include in the IFC model and the precise formatting of that information.

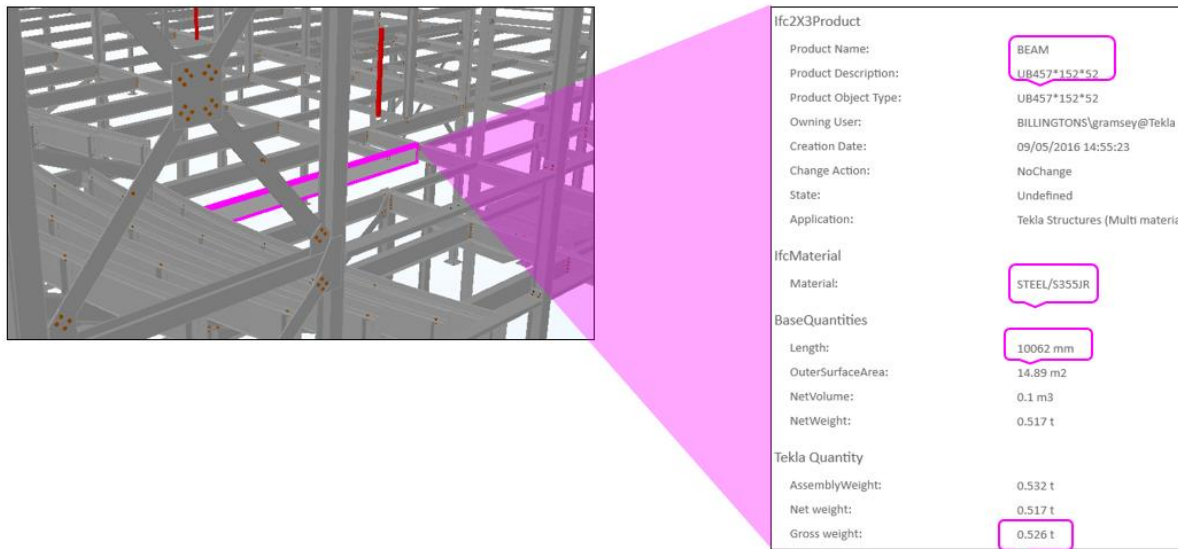


Figure H Elemental information extracted from IFC file

Summary and next steps

A prototype website for facilitating current reuse, i.e. of existing buildings, and future reuse has been developed and tested using example SSB projects. The scope of the prototype has been limited at this stage to primary structural steel elements however, the structure and functionality of the website can be easily extended to other structural steel products, including secondary steel elements and cladding products.

More work is required to take the prototype to a publicly available, fully functioning website however it is strongly recommended that this is done since no such material exchange is currently available providing the level of detail required to safely and cost effectively reuse reclaimed primary structural steelwork. Collating and securely storing structural models of new SSB is a very cost effective way of facilitating future reuse since these models are already routinely generated by European steelwork contractors and therefore generating these IFC files requires no additional effort or cost. Further work is however required to ensure the confidentiality of stored models and also to ensure that there are no security concerns for building owners particularly for some building types.