

buildingSMART International (2022)

404-DESIGN BUILDINGS Design for Buildings using openBIM



nKkOperv

Department for Education: Gen Zero

Entrant details

Role or Job Title on the Project | Director

Employer

| Bond Bryan Digital Ltd

Employer Role | Other

Are you or your employer a member of buildingSMART? | No

Entry details

Entry Details

By checking this box I understand and acknowledge that this awards program is to assess information about openBIM, and that openBIM is not only about the use of solutions. openBIM is about setting up an environment where every party in a team can work in the optimal way ("how they prefer") without putting limitations on others.

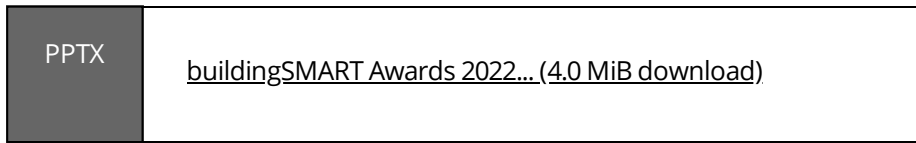
It is about freedom to take control over your data and workflows, while keeping that freedom for others as well. Full use of open standards is not mandatory for this mission.

Website | <https://www.genzero.co.uk/>

Location

2 theoretical school designs in the United Kingdom on an urban and rural site. Sites to develop the theoretical designs are based on sites in Birmingham, West Midlands, UK (Urban Site) and Crawley, West Sussex, UK (Rural Site).

Submitting Party and Stakeholder Logos (compiled into one .ppt/pptx file for upload)



Entry Description

The Gen Zero project is a research and development project involving the design of two schools, one on an urban site and one on a rural site, to look at the delivery of new ultra-low carbon building standards for schools. This project looked to use BIM and best practice information management to support specifically the carbon assessment and determine the cost uplift for designing these schools.

For the Gen Zero project Bond Bryan Digital (Information Manager) were initially engaged by the Department for Education (DfE) through the Centre for Digital Built Britain (CDBB), to develop a set of client information management resources.

Bond Bryan Digital (Information Manager) developed the information requirements collaboratively with the DfE, which included developing and documenting exchange information requirements to support the use-cases of carbon analysis, coordination, quantification (to support cost analysis), visualisation, linking to cloud-based specifications and data for transfer to the operational phase (using COBie) to support the management of the buildings post-handover.

The information management resources were developed in full alignment with the UK BIM Framework including the ISO 19650 suite of standards in advance of any of the designers being appointed to the scheme. This provided the opportunity to set the project up for success from the very outset and truly follow a compliant ISO 19650 process throughout.

Whilst there was an assumption that designers would all be using the same authoring tool at the outset of the project, the information requirements were developed fully around open standards. Requirements were documented using the IFC2x3 schema (ISO16739:2005). This was supplemented with additional properties required by the COBie schema and then further enhanced with additional client specific requirements.

The use of classification references was important and this included Uniclass 2015 as the primary classification as well as NRM1 (to support quantification and costing) and a bespoke classification to allow the DfE to define and assess spatial design information. This was all captured within the structure of IFC.

All information requirements were documented in an Information Management Platform (IMP), which was a combination of technology solutions including Notion, Airtable and Whimsical. Collectively this approach was referred to as the project's 'Information Hub'. The Information Hub integrated with other cloud-based technology, such as 3D Repo (cloud-based model viewer) and links to other technology used on the project (e.g., Asite as the project's common data environment).

Bond Bryan Digital's work also involved developing processes to support the design team tender process and carrying out capability and capacity assessments of each prospective designer using online forms and reports. This process included an assessment related to the use of open standards. One key aspect of this was that the assessment was only scored in terms of actually completing the form. Authors were encouraged to answer truthfully in order to understand where support would be required (particularly around the use of IFC and COBie), and this helped when delivering the project.

On the appointment of the designers, Bond Bryan Digital supported the team to develop the appointment resources, including a BIM Execution Plan, Detailed Responsibility Matrix and Master Information Delivery Plan. These lead appointed party information management resources were then included within the Information Hub directly alongside the DfE's information management resources. This provided a single location for all the resources to be stored, accessed and managed throughout the life of the project.

This project (as an R&D project) was unusual to 'standard' ISO 19650 projects as Bond Bryan Digital supported both the appointing party (DfE) and lead appointed party (Mott McDonald). This approach led to a more collaborative approach and provided the DfE with a better understanding of progress of the information delivery throughout the life of the project.

The use of open standards as part of the DfE's Exchange Information Requirements meant that the best designers could be selected to deliver the project irrespective of their software selection. This resulted in the selection of a design team that were using four different authoring tools. These were Graphisoft Archicad (architecture), Autodesk Revit (building services, catering, civil engineering, and FF&E), Nemetschek Vectorworks (landscape architecture) and Bentley OpenBuildings Designer (structural engineer).

The use of four different authoring tools meant that a consistent openBIM approach was critical across all tools to provide data that could support the required purposes set out in the client's requirements. Bond Bryan Digital directly supported the design team by providing guidance and support as well as mapping and template files to support the delivery. Bond Bryan Digital worked collaboratively with the designers to address issues with information exchange throughout the commission.

Bond Bryan Digital have built up extensive knowledge of robust processes using both Autodesk Revit and Graphisoft Archicad to deliver IFC-SPF (Industry Foundation Classes-STEP Physical File) aligned to exchange information requirements over the years. However, more trial-and-error processes were required with Nemetschek Vectorworks and Bentley OpenBuildings Designer but the team largely managed to make these solutions work, working collaboratively to solve issues. There were some issues that couldn't be fully resolved during the project (although some solutions were found later) but none of these materially affected the information required to meet the purposes for this project.

As a research and development project, much of the information management scope emerged as the project evolved. As a result, Bond Bryan Digital services included the collation of federated data for carbon analysis to import into the cloud-based carbon assessment solution (One Click LCA) and supporting the exchange of information for quantification (iTWO costX). A key tool was the use of Solibri as a tool to validate the data requirements to support these processes.

At each information exchange, Bond Bryan Digital produced federated models using the IFC-SPF models, this allowed the delivered data to be checked against the requirements and because both sets of data were structured using IFC this could be checked using automated rulesets. Since COBie is a subset of the IFC schema, this data could be extracted and exported as a spreadsheet and information management assurance reports were produced.

What stage of completion is the entry content representing? | Design Development

Stakeholder Statements

Department for Education (Client) - "The use of open standards for the Gen Zero project demonstrated that the Department for Education's purposes could be satisfied for this specific project. This has given the confidence to further integrate more of this approach to all future projects with the knowledge that the data requirements can be delivered irrespective of the authoring tools. This therefore allows the delivery of best value to continue for all projects by allowing the best teams to be selected."

Bond Bryan Digital (Information Management) - "This project truly showcases what is possible when teams are selected not based on their software choices. The most important thing to make projects work is genuine collaboration between the individual organisations involved in the day-to-day delivery of the project and a commitment to the same goal. By setting out the information requirements before designers were appointed and following this up with a kick-off meeting very early on it was possible to get all organisations driving in a single direction built around the need to work with each other irrespective of the tools selected."

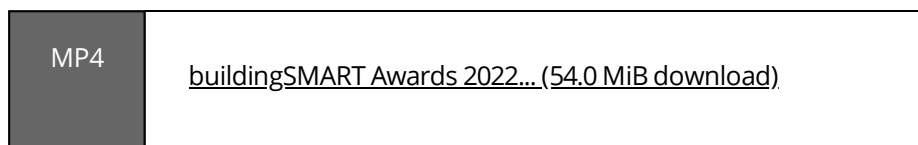
Lyall Bills & Young (Architect) - "The decision to require an openBIM workflow allowed each designer to choose the right tool for them: the architectural model was produced using Graphisoft Archicad while other designers used other software packages more appropriate to their needs. The coordination of seven disciplines was successful thanks to the openBIM workflow and the efforts of a great team. The openBIM approach was key to allow the client to find the right design team,

basing the selection on design and technical expertise rather than on the use of a particular software. The use of IFCs widened the range of available specialized software for thermal simulations, carbon analysis, cost analysis, visualization etc."

Cundall (Building Services) - "The openBIM standard allowed multiple project stakeholders to effectively exchange model information without proprietary software format conversion. This allowed the project team to develop their models using software package of their choice, avoiding software version compatibility issues and allowed for greater opportunities to use the model data for other purposes. The Client benefited from the approach that does not favour any software format, thus improving model maintainability via future openBIM upgrades that do not require proprietary software."

Smith and Wallwork (Civil and Structural Engineering) - "Smith and Wallwork have always faced the same question on every project 'You use Bentley? Don't you use Revit?', with Gen Zero and openBIM that was never a question or an issue to any of the design team. We gained valuable experience from this project which has helped shape how we work now, the benefits of the project and the openBIM method of working will be far-reaching for Smith and Wallwork. It's prompted us to look at other software knowing that the information that the IFC schema can support is more than sufficient. It was a great effort from all of those involved in the project who delivered such a fantastic project."

Upload a 2 minute video to show the scope of the entry.



openBIM Claim

Detailed description of openBIM used on the project or initiative

The project was initially to be a short research and development (R&D) project and there was an assumption that designers would all be using the same authoring tool for simplicity of delivery. A set of information requirements were developed fully built around open standards. Using an open approach is beneficial to support similar processes across many projects (and improve them over time) which are adapted around the edges to suit each client's needs. This approach though is also designed to allow the client to select the best supply chain, irrespective of their tool choices.

For the Department for Education (DfE) as a government body it is important that open standards are used and promoted wherever possible. It was important that the project could ultimately be a valuable case study that would allow any project teams in the future to follow, not just those using a specific tool. As it turned out the DfE did select their preferred designers and this meant that 4 different authoring tools needed to be used on the project. Whilst this was an added challenge this actually meant the project was more fun to see if the team could work collaboratively to deliver across so many tools!

Importantly, a significant part of the approach to Gen Zero was subsequently incorporated into the DfE's information management resources for their subsequent £7billion construction framework launched in late 2021. Of course, like Gen Zero these resources have been fully aligned to the use of open standards to allow the best teams to be selected and deliver best value across all school projects.

This particular project has been invaluable to explore new and untested workflows. For example the team learnt how to develop a workflow for linking specifications effectively to models, how to create a workflow to support carbon analysis and explored data visualisation using a cloud-based database. Much of this was not in the original scope but because we had such an excellent dataset it allowed the team to explore additional items within the fee allowance. This approach has allowed the team to explain to other clients some of the benefits that can be realised by using open standards using actual examples from a project.

A project like this was not without its challenges and there were issues with some of the tools used on the project (not just authoring). These issues were reported directly back to the various vendors in order that improvements can be made for any future projects using open standards.

Ultimately though the approach to Building Information Modelling (BIM) and Information Management led to the project delivering information to support the purposes that had been defined in the brief.

"We were able to innovate using openBIM."

Bond Bryan Digital's Information Hub (referred to as an Information Management Platform - see Attachment Link) was developed as a live site to fully document the information requirements around open standards. This includes a database of requirements fully aligned to the IFC Schema. This approach ensured a robust approach to information requirements that left no room for ambiguity when it came to delivery. This then supported a robust delivery process that is repeatable, reusable and reliable. This approach has now evolved since we completed this project and will now allow us to develop this approach where Acceptance Criteria (as required by ISO 19650) can be documented and then automatically generate model validation in checking tools like Solibri or other similar tools.

The project was also innovative because we are not aware of anyone attempting to deliver data for carbon analysis from 4 different authoring tools. The use of so many authoring tools is still challenging even for processes that are well documented such as COBie. So developing an approach for data to support carbon analysis presented additional challenges to understand what was required and then developing a workflow that would allow the various authoring tools to generate the same output.

Additionally, the team developed an approach to provide cloud-based specifications for some of the designers using the Information Hub concept, adding no cost to the project or for designers, while satisfying the client's brief. This solution allowed a direct connection between the 3-dimensional models and the detailed specification for each product.

openBIM methods used

- ✓ IFC 2x3
- ✓ COBie

Have you used bSDD to add additional extensions on top of IFC?

No

Were there other regional or open standards used other than those listed above?

Uniclass 2015, New Rules of Measurement - NRM1.

Uniclass 2015 was key to supporting the COBie, carbon analysis and linking to cloud-based specification requirements.

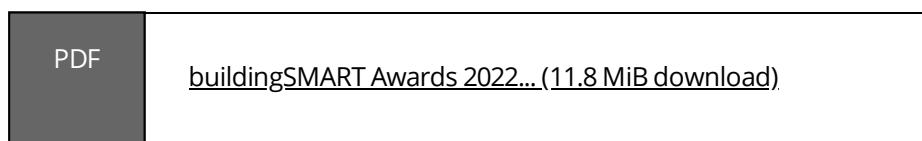
NRM1 was used to support both the carbon analysis and quantification (to support cost analysis) workflows. NRM1 was also included in the COBie delivery to allow useful data visualisation to be tested.

Note: Additional client specific categorisation was used to supplement the above standardised classifications and categorisations.

Level of Collaboration

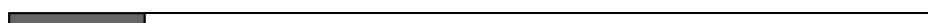
- ✓ One domain in two or more organizations

Information Requirements



openBIM Evidence

Software Ecosystem Map



PDF

[buildingSMART Awards 2022... \(1.2 MiB download\)](#)

Process Maps

PDF

[buildingSMART Awards 2022... \(819 KiB download\)](#)

openBIM Data Metrics Summary

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Additional openBIM Supporting Evidence

PDF

[buildingSMART Awards 2022... \(127.0 MiB download\)](#)

Lessons Learned

- Robust exchange information requirements established at outset (and before appointment) have provided rigorous framework for designers to tender and deliver against
- An openBIM approach has allowed the DfE to select designers based on their design abilities rather than their software choices
- An openBIM approach has successfully demonstrated that the purposes identified can be satisfied by multiple authoring tools
- Successfully demonstrated how Area/Room Data Sheets can be generated using an IFC-SPF workflow and compared against the DfE data library (i.e. brief vs actual)
- IFC-SPF models have supported robust quantification/cost reporting - still some work to do to perfect the specific quantities required but this project has progressed knowledge in this area
- IFC-SPF models have supported the required carbon analysis - it is clear that a more defined set of requirements could be developed to support this use case/purpose to make this workflow more consistent across many clients/projects.
- IFC-SPF models can be successfully linked to cloud-based specifications - files can be opened in any IFC compliant tool and access the specification accordingly - most challenges though were around the need to have open access to each clause as the links meant logging in to view each clause which is somewhat painful.
- Alignment to national and industry standards wherever possible mean approach is repeatable across any client or project type
- Robust information requirements established at outset have meant validation of requirements is robust
- Education around use of Uniclass 2015 has led to DfE engaging with NBS to include updates specific to School (and subsequently Further Education) projects
- Project has helped inform the information management resources developed for both the DfE Technical Advisory Services and DfE Construction Framework 2021 (which is a £7billion framework delivered over 5 years)

"We were able to identify where we need openBIM to develop further."

As a team we recognise the implementation of BCF (BIM Collaboration Format) would have aided the communication of geometrical issues although this was more to do with the speed of the delivery rather than because it was not recognised as valuable.

Issues we came across using IFC2x3 related to data associated to Building Element Parts to support the carbon analysis workflow. The workflow and data could have been improved by implementing the IFC4 schema.

Improvements could be made to the IFC schema in how carbon analysis data is delivered in a more standardised way. Ideally there would be a more defined set of data to satisfy this specific purpose as a lot of the work on the project was trial and error and relied on software specific requirements rather than against a defined schema that the carbon analysis tools align to.

Upload .ifc file(s) or other technical files to support validation of the research results.

<https://service.usbim.com/link/62ac494317de4eeef5f865fc>

Share any instructions for accessing the .ifc or other technical files for review.

All files for download (Files can only be accessed through modern web browsers. Note: Internet Explorer will NOT work):

<https://bondbryandigital.notion.site/buildingSMART-Awards-2022-IFC-SPF-7bdd0b17e8184ea7afa2b8cff5fbab5c>

Use Cases

BIM Uses were defined on the project | ✓

BIM Uses formed an integral part to how the project was delivered | ✓

I agree to be contacted for more information about the project BIM uses outside of this awards program. | ✓

Documentation on use case(s) as a single file upload

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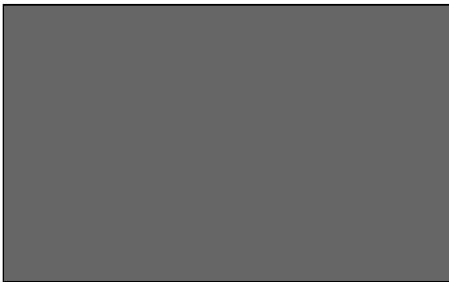
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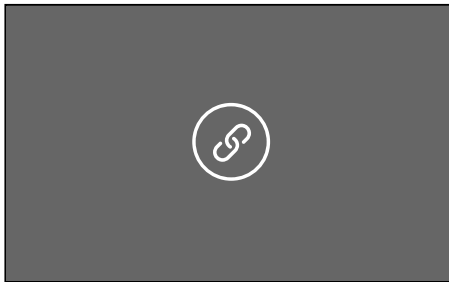
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