buildingSMART International (2022)
425-FM Facilities Management using openBIM

Wellington Railway Station Façade Condition Assessment

PYqlJZxw

Entrant details

Role or Job Title on the Project	Digital Engineer
Employer	
Aurecon	
Employer Role	Architecture or Engineering Company
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.	✓

Location

Wellington, New Zealand.

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

PPTX	Aurecon-Kiwirail.pptx (42 KiB download)

Entry Description

Aurecon was tasked to provide an interface and dataset to Kiwirail and a heritage architect to conduct a condition assessment on some tiles on the Wellington Railway Station Façades – of which there are 5,562. In addition, a visual report or model to present this data was required to enable an opportunity to detect trends of damage. The Wellington Railway station is a neoclassical building, constructed from a steel substructure, with reinforced concrete slabs and panels, with brick cladding. Underneath most window casings are the panels of terracotta tiles in different states of condition, which is the subject of this project. Blender3D was chosen early to receive condition data as the model generator, which was anticipated to be able to connect to Blender's internal rendering tools to provide these insights through python scripting and access to materials and lighting systems. Due to the number of tiles, a novel approach to data entry and automation was required.

The production of the model was divided into numerous phases as follows.

Phase 1: Preparation of a web project with high-quality images, referenced to a location-based tagging structure governed by a spatial hierarchy (Façade orientation, level, panel, and tile position, and tile type), as well as predefined drop down lists, such as damage types and severity. Additionally, 'replication' options are built in, such as the number of tiles affected in each direction adjacent and the number, as well as options for whether the replication might be linear, area-based, or diagonal. This project provided remote access to the heritage architecture organisation to navigate through the volume of panels, placing pushpins on damaged areas.

Phase 2: The encoding of the tagging structure to and data tables provide the simple insertion points and orientations for replicating the tile types to instances, with the right parameters to receive damage types and severity levels.

Phase 3: The accumulation & processing of the data from within the model, referencing the outputs from BIM360 issues to generated visual insights in the form of Façade renders and colour legends.

Points of innovation

1. 'Computational' thinking in the configuration of BIM360 locations, issue types and replication options that were anticipated to be used by digital model data structures. This enabled a temporal 'future proofing' which provided ultimate automation through data standardisation.
2. The connection of the locational data to the model via CSV files and python scripting, enabled the generation of BIM elements, with correct tagging and naming standard to be regenerated and injected with data with the click of a button.
3. Asset information thinking, in the form of a lean approach to damage as assets, enabling the focus of the condition assessment team to be on only capturing the data necessary, rather than being daunted by the number of tiles: 5,562.

The project output is believed to be futureproofed as a demonstration of connecting structured data to building elements which may be used throughout time, especially in relation to emerging facilities management practices for those that already exist. Computational thinking and openBIM enables the perpetual storage of asset information and enables condition to be recorded against assets that may be computationally and retrospectively tagged according to rigorous location hierarchies.

What stage of completion is the entry content representing?	Substantial Completion

Stakeholder Statements

This project enabled an assessment of the Wellington Railway Station Façade tiles where potential fall risks due to their age and design. This project provided the ability to successfully conduct a virtual assessment during the Covid pandemic, and for our Heritage Architect to review the spatial layouts provided by Aurecon to better understand the relative risks for the damage types identified.

Simone Hadley - General Manager Facilities, KiwiRail

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

MP4	AureconKiwirail_bsiAwards... (12.1 MiB download)

openBIM Claim

Detailed description of openBIM used on the project or initiative

The project utilised openBIM in the form of the BlenderBIM addon, complimented by python. A sophisticated asset 'tagging' system was created to read the tag of the IFC spatial container for a panel of tiles, concatenating the column row and type of the tile as the later portion of the element tag. This happened in the same step as the programmatic creation of the geometric element itself, through the use of a tile 'type' object (IFCBuildingElement), shifted and rotated into place according to the position of the tile's spatial container in a CSV file. Replication of tiles was also possible within the spatial container through the addition of a column count variable, making the number of tiles along the length of a panel adapt according to different positions on the façade.

The tagging standard then allowed the connection for tile elements to receive damage information via python, through an additional csv which was exported as a report from the BIM60 issues module. Additional sophistication was built in the form of the damage replication type already mentioned, enabling the heritage architect to collect adjacent rows and columns of tiles, with a linear, diagonal or area pattern via simple integer fields in BIM360, which was required to be mapped to the tagging standard to ensure the correct collection of tiles for the particular damage issue. The use of IFC as a receiving schema and the python connectors provided by this early version of BlenderBIM meant that a high degree of automation was achieved, leading to these approximate metrics:

· 2,449 damage issues rather than an assessment of 5,562 individual tiles.

· Elimination of approximately 80 hours of manual elevation creation, reading tables and shading individual tiles according to severity and damage type.

· Ability to accumulate a programmatically produced bill of materials based on severity level, eliminating the requirement for manual counting and error openness.

· Ability to provide additional legibility via overlaying tile models with reality capture model.

Once this data had been aggregated, a script to perform colourations based on both severity and damage type was run to affect materials and render outputs. Cameras were configured on a façade-by-façade basis, as well as a script to accumulate the number of tiles in severity groups and generate a report for damage triage and any procurement necessary. Sophisticated scripting was required to determine numerous logical rules, such as the requirement to chose the highest damage severity for a tile, as different damage issues can affect more than one tile. With this process the team was able to provide insights on a large volume of assets in timely fashion.

openBIM methods used	✓ IFC 4
Have you used bSDD to add additional extensions on top of IFC?	No

openBIM Evidence

Software Ecosystem Map

PDF	Wellington Railway Statio... (76 KiB download)

Process Maps

PDF	Wellington Railway Statio... (100 KiB download)

openBIM Data Metrics Summary

PDF	Data metrics.pdf (51 KiB download)

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

https://docs.b360.autodesk.com/projects/64c7d842-f4f3-4daf-b30a-211ee4ed227f/folders/urn:adsk.wipprod:fs.folder:co.4bGtrk_ZTHykGtX_WjK1LQ/detail/viewer/items/urn:adsk.wipprod:dr

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

Please email matt.randell@aurecongroup.com to enable permissions for access to the IFC model.

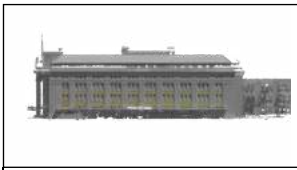
Use Cases

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

Log in to awards.buildingsmart.org to see complete entry attachments.

Type of attachment
Image

North.png 7.9 MiB



Type of attachment
Image

East.png 7.9 MiB

Type of attachment
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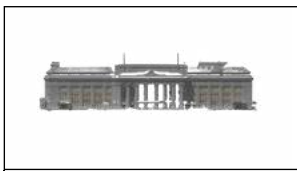
NorthWest.png 7.9 MiB



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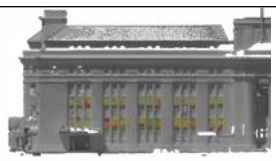
South.png 7.9 MiB

Type of attachment
Image

SouthEast.png 7.9 MiB



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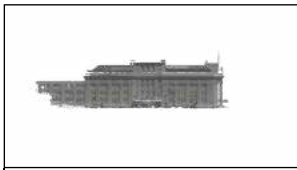
SouthWest.png 7.9 MiB



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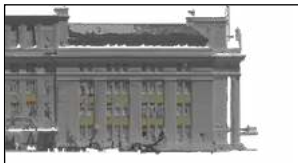
Type of attachment
Image

West-North.png 7.9 MiB



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West-South.png 7.9 MiB

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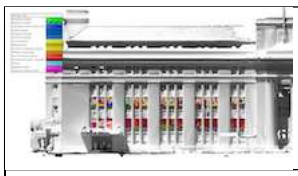
Image

Slide4.jpg 267 KiB



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South-West-Exp... 2.1 MiB

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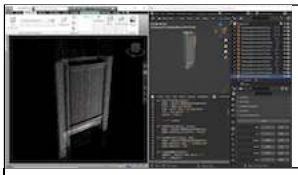

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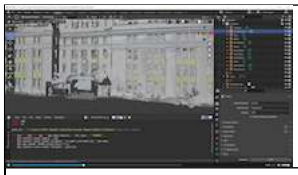

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Issue.png 798 KiB	Model.png 978 KiB	ModelOverlay.png 1.2 MiB