

Honorable Mentions

COMPANY
Hong Kong Housing Authority,
HKSAR Government

PROJECT
Innovative Use of Computational Design -
A Public Housing Design Perspective

LOCATION
Hong Kong

TYPE
Public Housing Development

SCHEDULED TIME OF COMPLETION
On-going

Innovative Use of Computational Design - A Public Housing Design Perspective



About Hong Kong Housing Authority, HKSAR Government

The Hong Kong Housing Authority (HA) is a statutory body established in 1973 under the Housing Ordinance to provide subsidised public rental housing to low-income families, and to help low to middle-income families gain access to subsidised home ownership. The Housing Department is the executive arm of the HA to help the Government achieve its policy objective on public housing.

BIM PARTNERS

Advanced Construction Information Development Limited

Andrew Lee King Fun & Associates Architects Limited

isBIM Limited

Aggressive Construction Company Limited

AUTODESK PRODUCTS USED

Autodesk® 3ds Max®

Autodesk® BIM 360®

Autodesk® CFD

Autodesk® Civil 3D®

Autodesk® Dynamo

Autodesk® Revit®

Autodesk® Fusion 360®

Generative Design in Autodesk® Revit®

Project Description

HA demonstrated that computational and generative design (GD) technologies could be innovatively applied to resolve complex design problems from architecture planning, structural and landscape architectural design to construction planning:

1. GD for pile supported foundation design
2. GD for paving design and tile-cut patterning
3. Computational design with solar and wind simulations for trellis
4. GD for design of directory signage in modularised panels
5. Computational view assessment tools for domestic blocks
6. Automatic clash-free MEP services routing design

Project Challenges

It was challenging for designers to script the design goal and logic into the GD software, along with various parameters such as spatial requirements (e.g. pile/pave-block size, spacing), analysis methods (e.g. structural analysis) and cost constraints (e.g. total pile/pave-block cost).

There was also limited choice of software that could produce accurate analysis results (e.g. structural, wind, thermal comforts, etc.) but also interoperate seamlessly with BIM or GD software in the trellis and signage design.

Solutions for challenges

After extensive research, study and making reference to the design of some as-built public housing projects, design goal and logic were scripted with Dynamo in various design scenarios for trial runs, and finally generated the optimised design layout for piles and paving units.

Further, through applying appropriate analysis softwares such as Autodesk CFD and Fusion 360, the optimised performance of trellis design and multiple design solutions for supporting frame of signage panels could be respectively evaluated and generated.

How does BIM benefit the project?

The application of computational or GD technologies attained following benefits as illustrated in the aforementioned design examples:

1. Automatically generated optimal pile layouts which maximised utilisation of pile capacity thus minimised pile cost
2. Reduced wastage of paving units and promoted reuse of cut tiles within site
3. Balanced sun-shade percentage and maximised thermal comforts in trellis design
4. Combined modularised signage panels and structural design requirements to create directional function
5. Provided quantitative view assessment data to assist Architects to make informed design decisions for building dispositions and orientations
6. Automatically generated clash-free services routing design of all MEP trades

Better with BIM

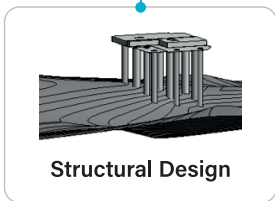
Apart from benefits in terms of design quality, efficiency and accuracy, the use of computational technologies empowered HA and our counter-parties to expand skill sets in the latest trend of design practice and digitalised the design and construction workflow.

The evolving paradigm of human-computer collaboration helped accomplish the holistic goal of sustainability in public housing development and probably a wider ecosystem in construction field. Unlocking the creative power of artificial intelligence in BIM would not make humans redundant, rather design professions could focus more on human and practical engagements to create a better and more sustainable environment.

Generative / Computational Design



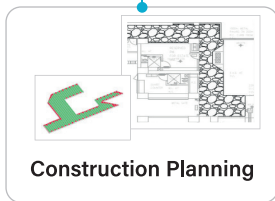
Architectural Design



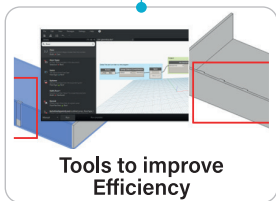
Structural Design



Landscape Design



Construction Planning



Tools to improve Efficiency

Overview of computational or generative design applications
Image Courtesy of Hong Kong Housing Authority, HKSAR Government

GD for pile supported foundation design

Adaptive grid system for generating pile design layouts and the output results of GD for pile layout design
Image Courtesy of Hong Kong Housing Authority, HKSAR Government

GD for design of directory signage in modularised panels

Computational design and manufacturing workflow for modularised signage panels
Image Courtesy of Hong Kong Housing Authority, HKSAR Government