THE UNIVERSITY OF HONG KONG: THESIS ABSTRACT 2025

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PORTRAIT PHOTO:

TITLE:

AI-Generated Design for Yau Ma Tei's Aging Residential Buildings

KEYWORDS: *(maximum 5)*

AI, urban renewal, form generation, heritage preservation, community engagement

WHAT: *(100-200 words)*

This thesis investigates AI-generated form design for the adaptive reuse of Yau Ma Tei's aging residential buildings, specifically tong lau, which are historic tenement structures integral to the district's cultural identity near Temple Street Market.

Facing demolition risks due to intense urban renewal pressures, these buildings contribute to Hong Kong's housing shortages. The project employs AI tools to meticulously analyze Yau Ma Tei's urban context, including building conditions and community needs, which base on these analysis, AI tools is once again utilized to generate innovative, modular architectural forms. These forms are optimized for spatial efficiency and community sensitivity, ensuring designs resonate with the district's character while blend with modern approach.

Furthermore, the thesis proposes context-aware solutions that incorporate with community engagement. Residents' suggestions could be potentially collected through participatory platforms, allowing their voices to merge with AI to shape the renewal process. By integrating advanced AI-driven methods, the study contributes to Hong Kong's urban renewal discourse, offering scalable strategies for revitalizing aging districts. It explores how AI can transform dilapidated structures into dynamic, inclusive spaces, preserving Yau Ma Tei's unique identity while addressing pressing urban challenges in a rapidly evolving city.

WHY: *(100-200 words)*

Yau Ma Tei's tong lau, cherished cultural landmarks near Temple Street Market, face existential threats from urban renewal prioritizing commercial development over heritage and community needs. This thesis is significant for leveraging AI tools to craft sustainable, community-driven designs that address Hong Kong's acute housing crisis while preserving community engagement.

By generating context-informed forms by AI, the project ensures designs to be rooted in Yau Ma Tei's dense urban fabric and social dynamics, reflecting its culture. It advances architectural innovation by seamlessly integrating AI into urban renewal, offering scalable solutions for aging districts across Hong Kong. The approach fosters inclusive redevelopment, aligning with the city's need for equitable and community sensitive urban planning.

Key aims include:

- *Develop housing solutions through generative AI tools to address urban renewal challenges in an innovative way. While testing out AI contemporary capacity in architectural project development*
- *Preserve the architectural identity of Yau Ma Tei's tong lau while emerge with modern features*
- *Engage communities through participatory visualization platforms to ensure resident input.*

This thesis positions Yau Ma Tei as a model for a sensitive urban renewal, contributing to Hong Kong's broader urban policy goals while leveraging the current technological trend of AI.

HOW: *(100-200 words)*

The thesis utilizes AI tools for context analysis, form generation, and optimization, with a potential to develop an AI agent (Python-based) to streamline workflows. Urban data, including Yau Ma Tei's building conditions from URA reports, and community feedback to define precise design parameters, such as living environment and communal spaces.

Image generative tools like Midjourney or Stable Diffusion generates modular, community sensitive forms, which are converted into 3D meshes using Open3D for modelling. These designs are further refined with tolls such as Grasshopper, employing the Ladybug plugin to optimize for density, sunlight exposure, and sustainability, ensuring alignment with urban renewal goals.

The methodology integrates with potential supervisors specializing in digital design or urbanism, ensuring robust, context-aware outcomes. The project also allow a testing

ground for using AI agent, a chained set of automated AI tools, on design innovation. This structured approach ensures the creation of innovative, community-sensitive designs that contribute to Yau Ma Tei's sustainable and inclusive urban transformation.

LOCATION OF PROJECT: (100 words)

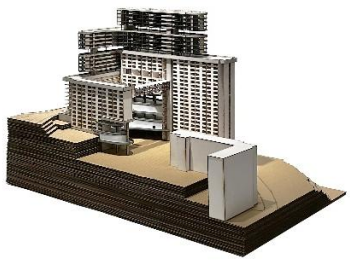
Yau Ma Tei, Hong Kong, centered on aging tong lau near Temple Street Market, aligns with government policies accelerating urban renewal from 2025 to 2028. The Urban Renewal Authority's initiatives, including the 2025 Design Ideas Competition and Sai Yee Street project, prioritize redeveloping aging buildings, enhancing housing supply, and preserving cultural heritage. Yau Ma Tei's dense urban fabric, vibrant market culture, and ongoing renewal efforts make it an ideal site for testing AI-driven adaptive reuse. This project addresses housing shortages and community needs, supporting Hong Kong's vision for sustainable, inclusive redevelopment in historically significant districts.

OUTPUT: (100-200 words)

The thesis prioritizes physical models and detailed drawings, including axonometric drawings, sections, and plans, showcasing modular, heritage-sensitive designs for Yau Ma Tei's tong lau that blend cultural aesthetics with modern functionality. A giant diagram illustrates the AI-driven design methodology, highlighting the workflow from context analysis to optimization. Secondary outputs include context-driven diagrams visualizing urban analysis and community sentiment (via pandas/NLP), alongside renderings or videos depicting different scenarios and potentially incorporate pre-rendered VR walkthroughs (Unity) for community engagement, integrating AI-generated forms with Yau Ma Tei's market imagery. These deliverables would not only exhibits the final design through visual communication but also showcase the design methodology utilizing multiple AI tools in a diagrammatic way.

REFERENCES:

Reference Project 1
Design through Discussion with AI


Description
"Design through Discussion with AI," developed for HKU's ARCH7081 Design 11 in 2024-25, explores AI's potential in architectural design by enhancing communal spaces at Wah Fu Estate, Hong Kong. Situated at 8 Waterfall Bay Road, Pok Fu Lam, this 1967 public housing estate features U-shaped slab and twin-tower blocks, designed for ventilation and density. The project, subtitled "Communal Space Enhancement," uses ChatGPT to analyze issues like poor light, ventilation, and privacy in inward-facing units, proposing solutions through iterative AI-human dialogue. MidJourney generates diagrammatic visuals, blending strategies like vertical breaks, organic terraces, and sky bridges with existing structures. Lightweight steel framing and concrete columns support upward extensions, adding affordable family and premium units to

meet Hong Kong's housing demands. Massing models and solar analyses refine designs, ensuring light penetration and airflow. The project fosters community interaction via open platforms, integrating programs like gardens and cultural spaces. Outputs include 3D models, plans, and diagrams, showcasing a modernist estate revitalized through AI-driven, context-sensitive interventions, offering a model for urban renewal.

Reference Project 2
The Bamboo Wonderland

Description
The Bamboo Wonderland, developed for HKU's ARCH7082 Design 12 in 2024-25, reimagines a multi-storey bamboo community center in Bali, Indonesia, fusing artificial intelligence (AI) and augmented reality (AR) with local craftsmanship. Located in Bali's lush context, the project leverages Midjourney AI to generate organic, biomorphic forms—featuring interwoven bamboo arches, V-columns, and grid shell roofs—inspiring a fluid, extroverted structure. Grasshopper scripts optimize parametric designs for structural efficiency, while AR headsets using Fologram technology guide precise bamboo assembly, enhancing construction accessibility. The design process iterates between AI-generated images, physical sketch models, and digital refinements, creating a community hub with performance spaces, multi-purpose areas, and offices. Natural light and ventilation permeate the open, curved interior, blending Bali's environmental harmony with modern functionality. The final 1:20 model, plans, and sectional drawings showcase a vibrant, community-oriented space, while AR simulations offer immersive stakeholder engagement. This project exemplifies innovative architectural workflows, merging AI-driven form-finding with traditional materials, offering a scalable model for sustainable, culturally resonant design, relevant to global and local contexts.

Reference Project 3
The Peony House Renovation

Description
The Peony House Renovation, located at 36-46 Tai Kok Tsui Road, Kowloon, reimagines a 15-storey tong lau amidst Tai Kok Tsui's evolving urban fabric, where old tenement buildings contrast with modern podium towers like HSBC Center and Florient Rise. This project, developed for HKU's ARCH4080 Design 8 in 2022-23, addresses urban density, limited sunlight, and enclosed living conditions through strategic interventions. By analyzing site context—solar patterns, street dynamics, and programmatic needs—the design liberates ground-floor circulation with public tunnels and opens corridors for light and ventilation. Modular residential units, ranging from 182 to 620 sq ft, are reconfigured, with upward extensions supported by reinforced lift cores and trusses, blending heritage aesthetics with modern functionality. The renovated Peony House introduces communal platforms, pixelated facades, and a porous urban interface, fostering civic engagement and recreational spaces within a dense "urban jungle." Through iterative massing studies and analytical models, the project balances historical preservation with contemporary living demands, offering a model for adaptive reuse that enhances Tai Kok Tsui's community vitality and architectural identity.