



AI-PLANNING TOOLKIT DEVELOPMENT

APRIL 2024
CPAA ANNUAL CONFERENCE

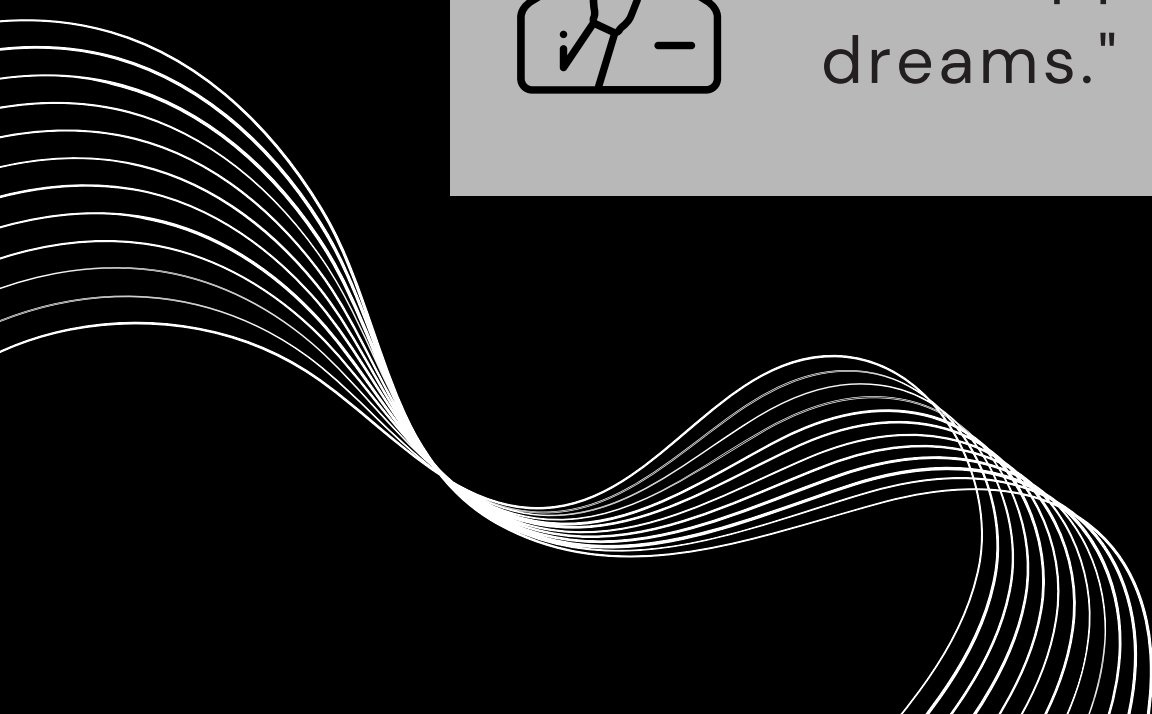
JIMMY HU



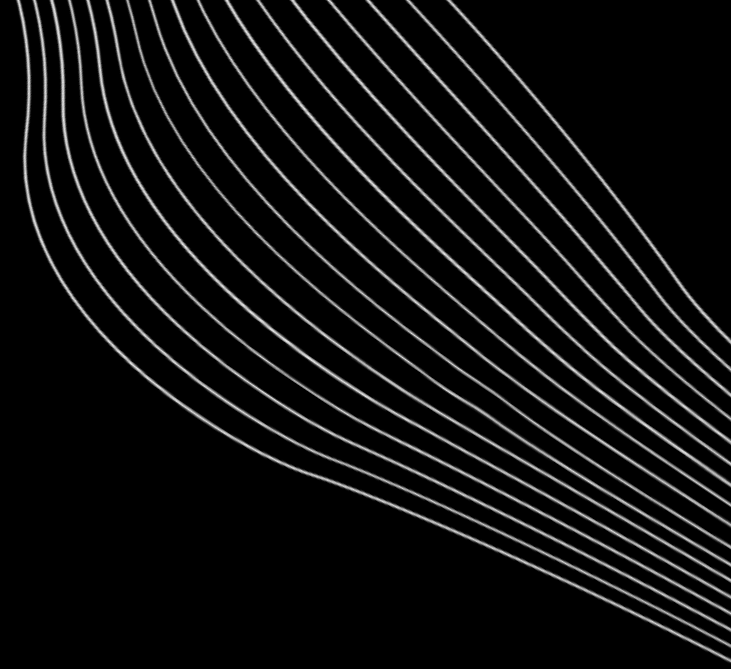
UAlberta MURP Candidate 2024
Project Lead - NAIOP RE Challenge
Project Lead - LAA for Brookfield Res.
Planning Student - City of Kamloops




"Visioning is my definition of planning.
It's mapping tomorrow's city from today's
dreams."



CONTENT



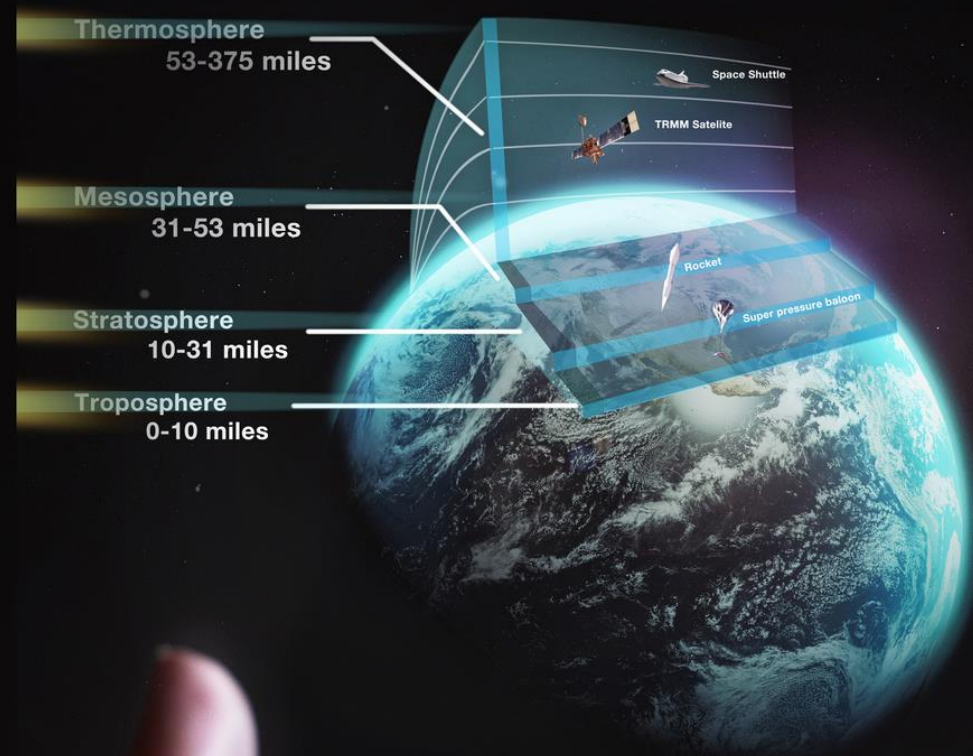
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- 01* INTRODUCTION
 - 02* PLANNING TOOLS
 - 03* AI FRAMEWORK
 - 04* AI-ASSISTED
 - 05* AI-AUGMENTED
 - 06* AI-AUTOMATED
 - 07* AI-AUTONOMIZED
 - 08* RECOMMENDATIONS

What is AI?

- ARTIFICIAL INTELLIGENCE?
- CHATGPT? OPENAI?
- MIDJOURNEY? SORA?

A dark blue, semi-transparent globe is centered in the background. Overlaid on the globe are numerous white icons representing various concepts: a smartphone, a classical building, a wallet, a document, a Bitcoin symbol, a hand holding a coin, a briefcase with a Euro symbol, a piggy bank, a calculator, a Euro symbol, a plus-minus sign, a dollar symbol, and a smartphone. In the center of the globe, the letters 'AI' are written in a large, bold, white sans-serif font.

AI



Introduction

UNDERSTAND SPECIFICATIONS

Difference in AI-models

Not so different from what we are using

AI CLASSIFICATION

Types of AI

The emergence of artificial superintelligence will change humanity, but it's not happening soon. Here are the types of AI leading up to that new reality.

Reactive AI

- Good for simple classification and pattern recognition tasks
- Great for scenarios with known parameters; faster calculation
- Incapable of dealing with imperfect information or requiring historical understanding

Limited memory

- Able to use historical data to make predictions
- Capable of complex tasks, but still vulnerable to outliers or adversarial examples
- This is the current state of AI, and some say we have hit a wall

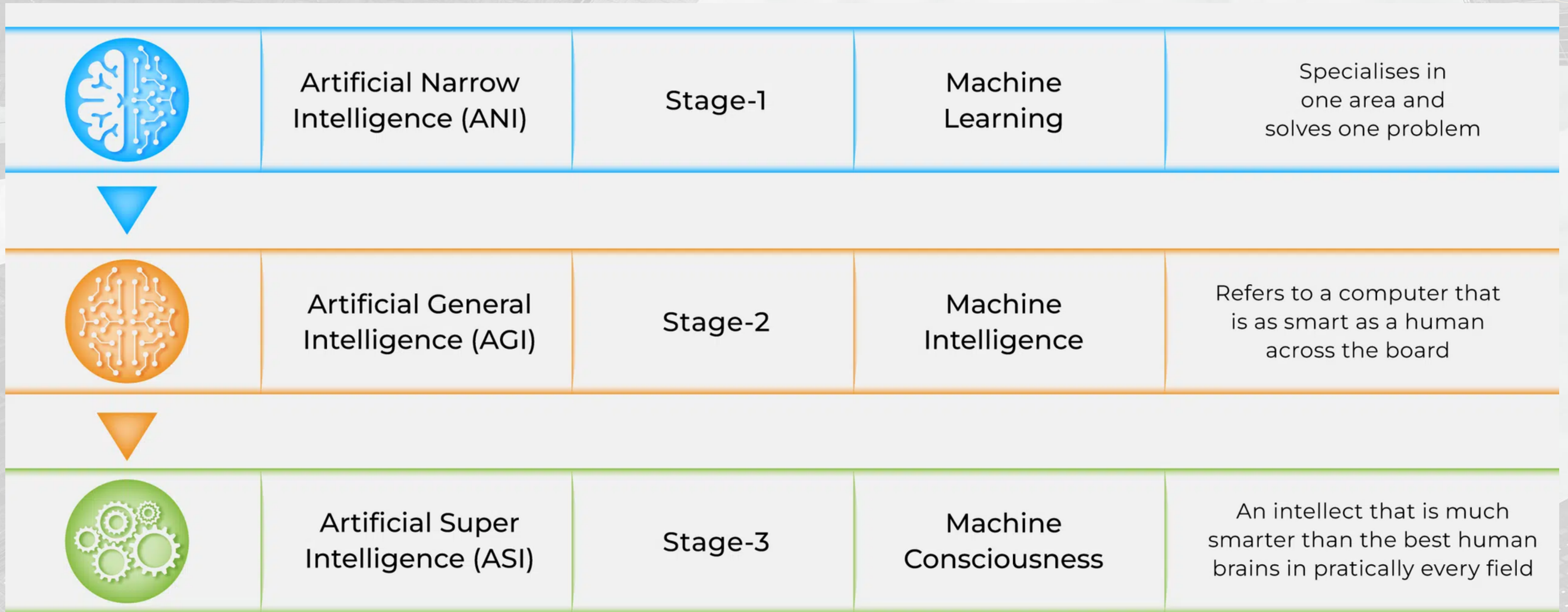
Theory of mind

- Able to understand human motives and reasoning; can deliver personal experience to everyone based on their motives and needs
- Able to learn with fewer examples because it understands motive and intent
- Considered the next milestone for AI's evolution

Self-aware

- Human-level intelligence that can bypass our intelligence
- Considered a long-shot goal

THREE TYPES OF ARTIFICIAL INTELLIGENCE



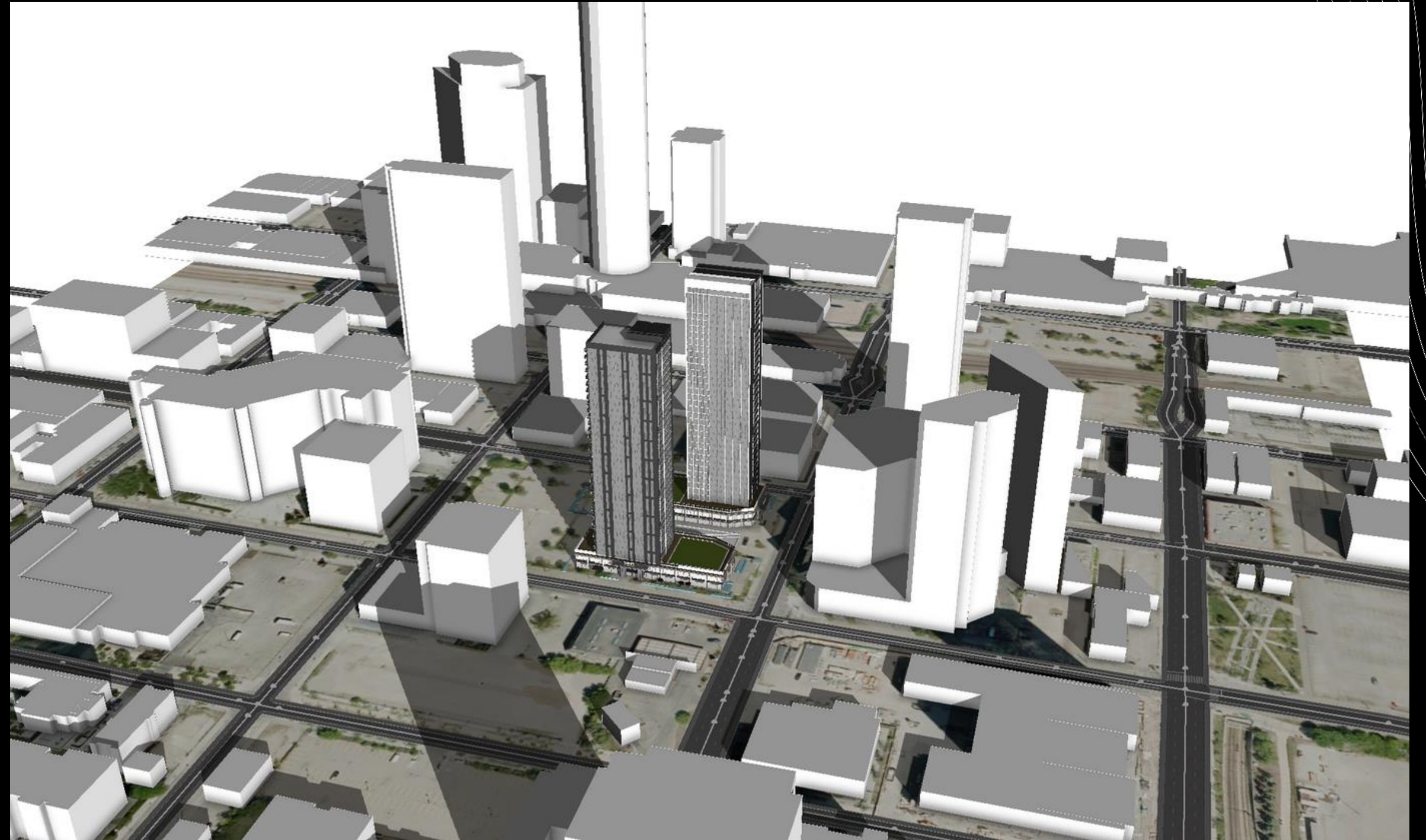


CURRENT TOOLS

Know what we have before we start the journey

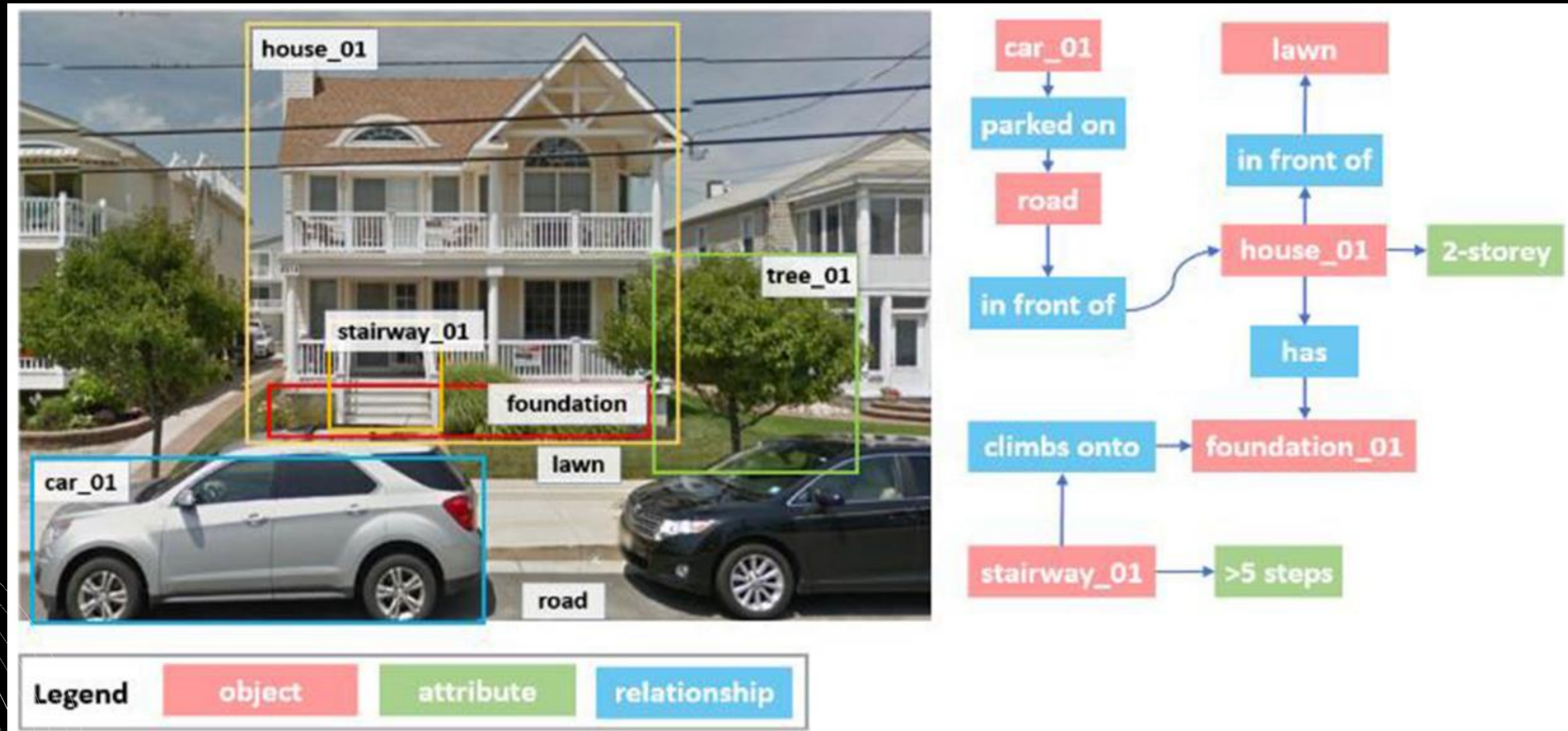
CityEngine

- “Digital Twin” City
- Scenario Planning



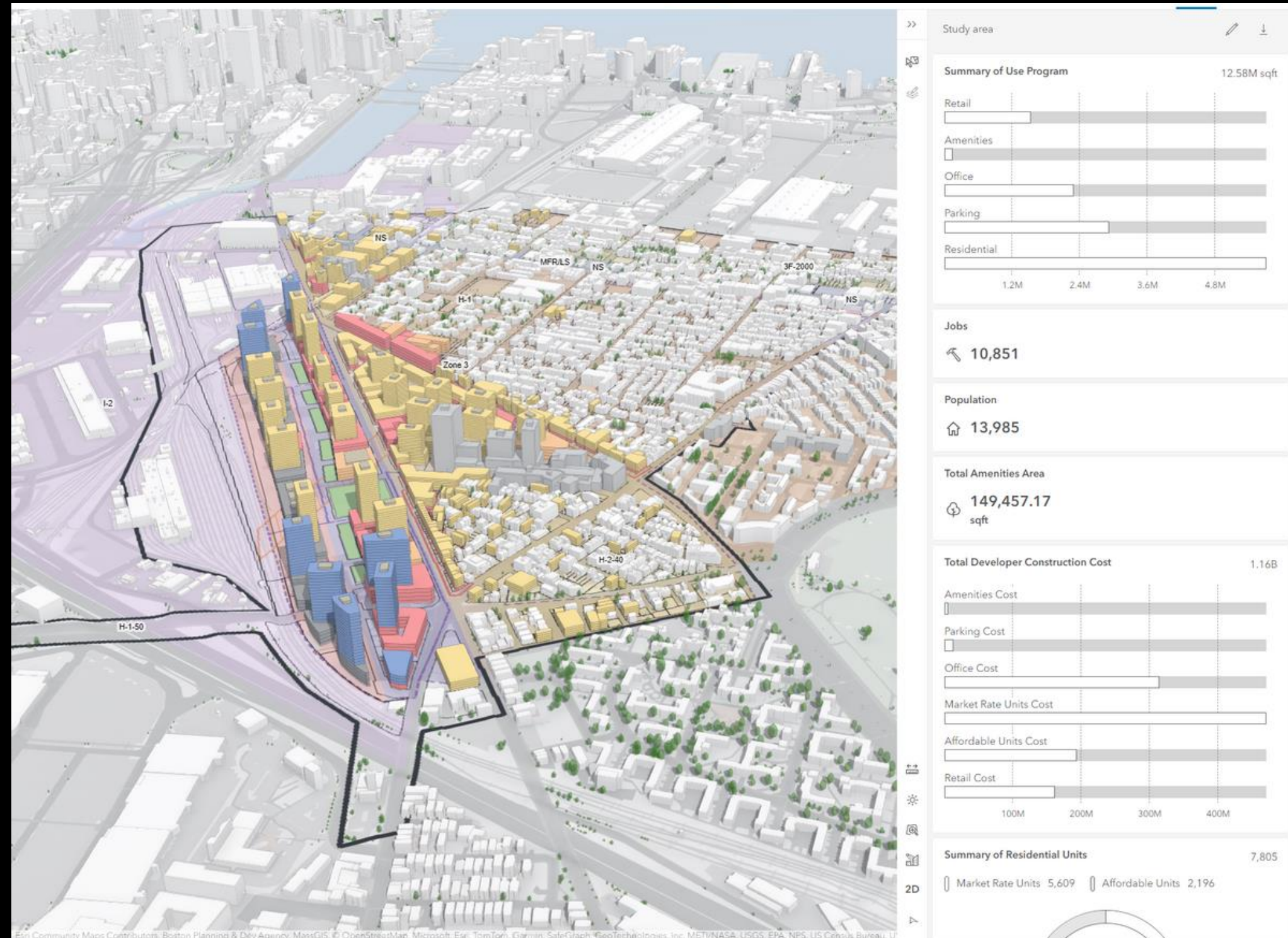
Machine Learning Model

- Understanding BIM through ML
- Construct Urban Land data



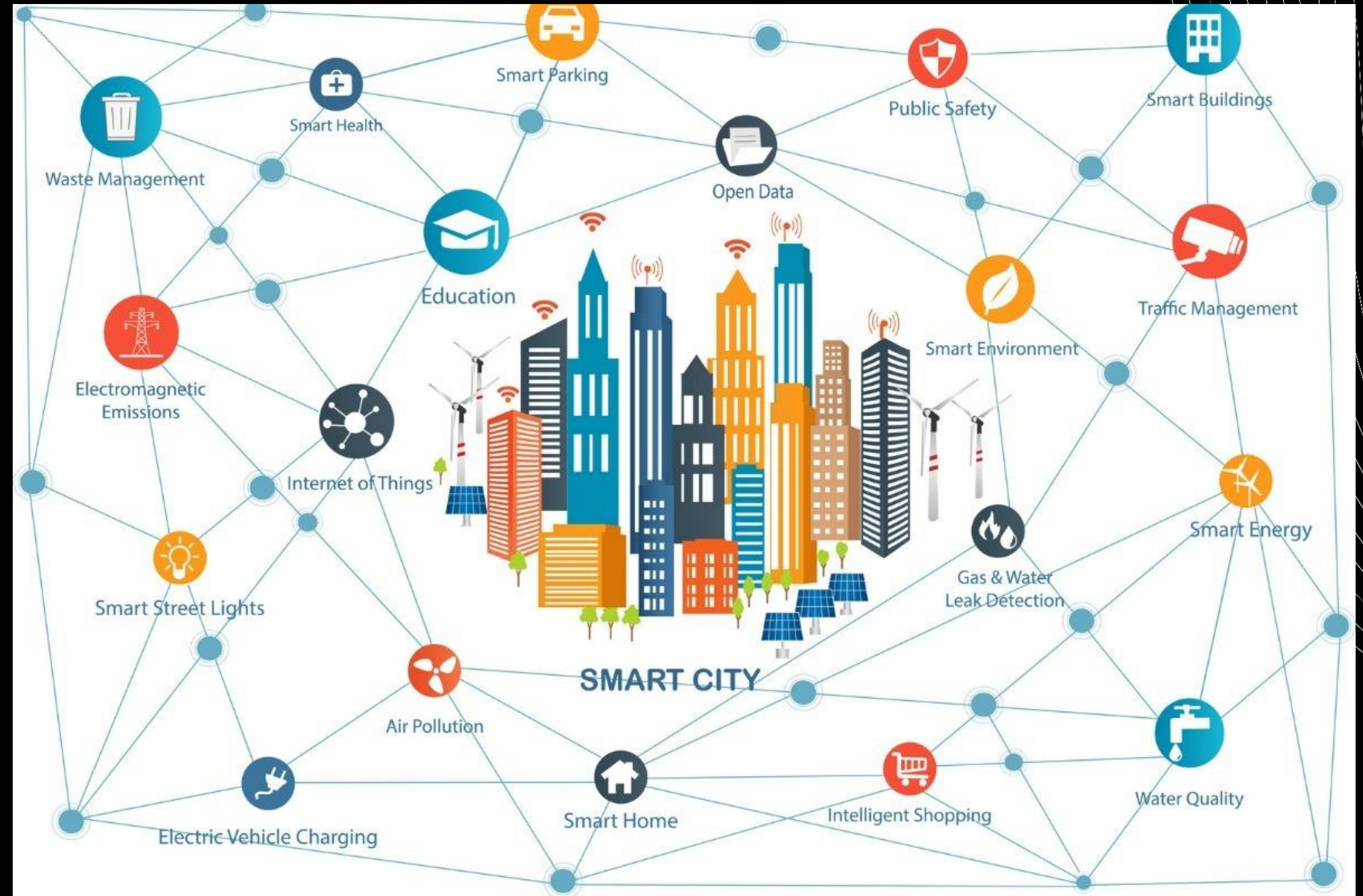
ArcGIS Urban

- Interactive 3D GIS
- Scenario Planning



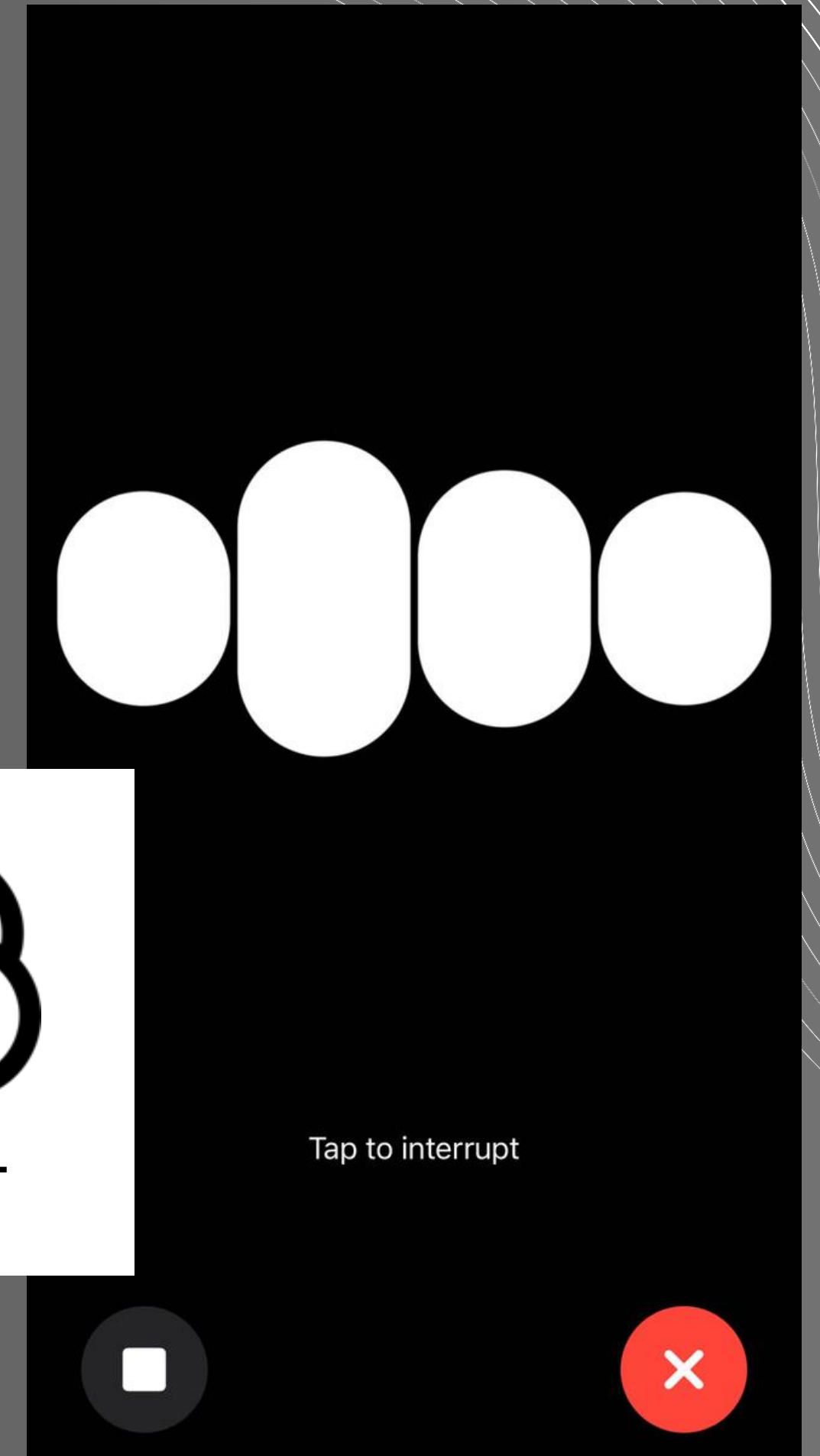
Large Urban Data

- Population data
- Land Use data
- Employment Data
- Road Data
- License Plate Readers
- Google Street View Images
- Air Pollution Data
- Mobile Locational Data
- Utility Usage Data
- Crime Occurrence Data
- Transportation Data
- Infrastructure servicing data
- BIM data



ChatGPT

- Virtual Assistance
- Language Process ability
- Tailored Modeling



AI-Planning Framework

AI-Assisted

- Prepare & Support
- Planner in the loop

AI-Augmented

- Identify, Forecast & Simulate
- Planners on the loop

AI-Automated

- Make plans based on Planner's goals
- Planners on the loop

AI-Autonomized

- Make plans by self-learning and decision making algorithms
- Planners out of the loop

CURRENT PRACTICES

City of Kelowna

Adopting virtual assistant that minimize planners' time on phone calls with realtors and developers

City of Edmonton

Automated Permitting system for deck, garage, to Single Family Detached and Semi-Detached

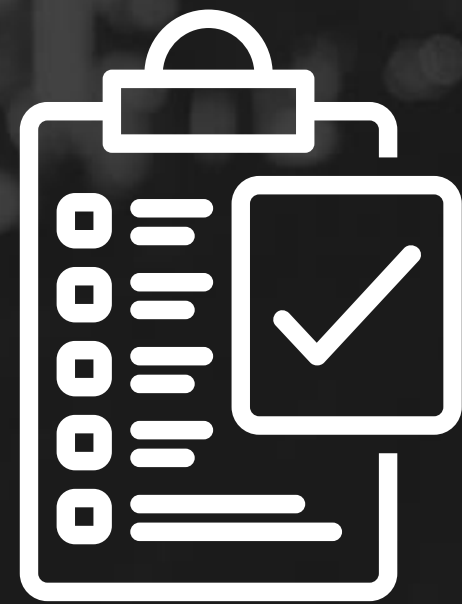
City of Toronto

Adopting pilot programs for AI-led smart traffic management system



AI-ASSISTED

PLANNING



Policy Guidance



“Digital Twin” City

Edmonton Planner

The RS (Small Scale Residential) zone under Edmonton's Zoning Bylaw 20001 allows for various types of small scale residential developments, such as detached, attached, and multi-unit housing up to three stories in height. It also includes limited opportunities for community and commercial development to serve local residents. Here are the specific design requirements and regulations for developments in the RS zone:

Setbacks

- **Front Setback:** A minimum front setback of 4.5 meters is required.
- **Rear Setback:** The minimum rear setback required is 10.0 meters.
- **Interior Side Setback:** Minimum interior side setback is 1.2 meters, and 1.5 meters if row housing or multi-unit housing faces an interior or flanking side lot line.
- **Flanking Side Setback:** A minimum of 1.2 meters is required, and 2.0 meters if the main entrance of a principal dwelling faces a flanking side lot line.

Building Height and Space Between Buildings

- **Maximum Height:** Buildings can have a maximum height of 10.5 meters.
- **Building Length:** The maximum length of any building should not exceed 30.0 meters.
- **Minimum Distance Between Buildings:** For rear detached garages, the minimum distance between the garage and the principal dwelling, except for backyard housing on the same site, is 3.0 meters.

Site and Building Regulations

- **Site Coverage:** Maximum site coverage is 45% of the lot. This can be increased by 2% to accommodate a single-storey unenclosed front porch, historic buildings that are retained, or developments where supportive housing or at least 20% of dwellings comply with inclusive design requirements.

Design Regulations

- **Building Design:** Facades facing a street or with a total length greater than 20 meters must use two or more design techniques to reduce massing and enhance visual interest. This includes variations in rooflines, material finishes, and architectural features such as windows and balconies.
- **Entrance Design:** Main entrances for ground-oriented dwellings and non-residential uses must face the front or flanking side lot line. Multi-unit housing should have entrances facing a street or an internal courtyard visible from the street. Sliding patio doors cannot serve as main entrances.

RS Zone Request

Zoning Bylaw 20001 – COE

Specification in:

- Setbacks
- Buildings Height and Space between Buildings
- Site and Building Regulations
- Design Regulations

POWERED BY OPENAI

Policy Guidance

The screenshot displays the ChatGPT interface. On the left is a sidebar with a list of chat titles, including 'RS Zone Regulations Summary', 'Total Property Valuation Calculation', and 'Thursday Date: April 19'. The main area shows a chat with the user asking about single-family detached zoning in Edmonton. ChatGPT responds with a detailed overview of the city's zoning changes, including the 'Energy Mix' in 2018 and the 'Strong Towns' initiative in 2020. The chat ends with a partially visible sentence: 'These reforms aim to foster a more vibrant, inclusive, and economically sustainable ●'.

You
Tell me about single family detached zoning in Edmonton.

ChatGPT
Edmonton has been actively revising its zoning regulations to address housing needs and promote more sustainable urban growth. Historically, the city had single-family detached zoning, which limited residential areas to only single-family detached homes. However, recent changes have shifted this focus significantly.

In 2018, Edmonton began a transformative shift in its zoning policies by allowing duplexes and semi-detached homes across all residential zones, moving away from strictly single-family detached zoning ([The Energy Mix](#)). This was part of a broader effort to increase density and diversify housing options in response to growing demand and land scarcity concerns.

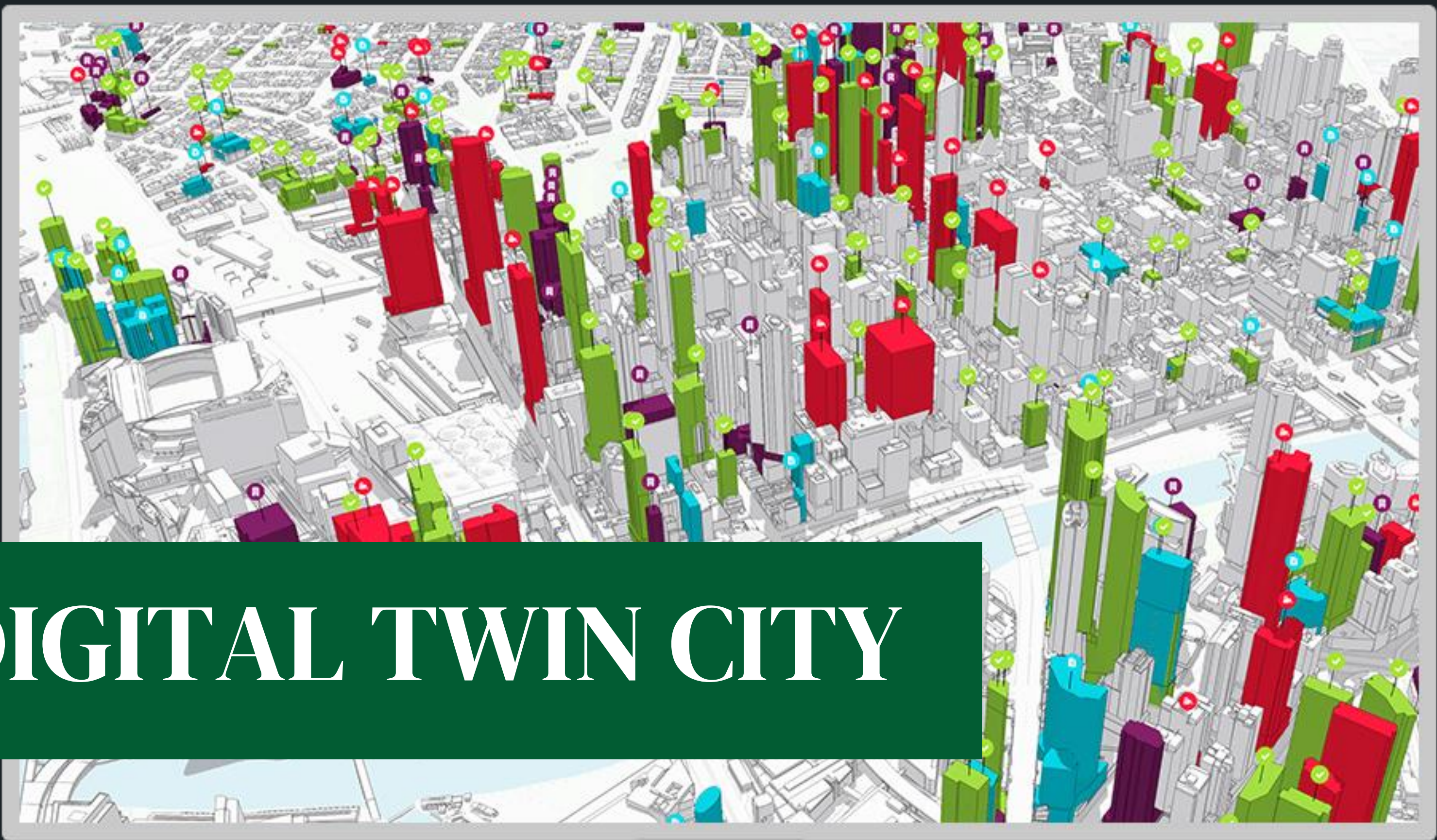
By 2020, Edmonton had further advanced its urban planning by eliminating parking minimums for new developments, thereby reducing costs and promoting more efficient use of space. The city also passed a new City Plan that called for 50% of all new development to be infill, effectively ending the exclusive single-family zoning and enabling a variety of housing types within existing urban areas ([Strong Towns](#)).

These changes are part of a comprehensive effort by the city to support infill development, which utilizes existing infrastructure and services and reduces the economic and environmental impacts of suburban sprawl. The revised zoning bylaw, which took effect in January 2024, allows for more housing types and has reduced the number of administrative zones within the city from 46 to 24, simplifying the development process and encouraging more mixed-use and multi-story developments ([Strong Towns](#)).

These reforms aim to foster a more vibrant, inclusive, and economically sustainable ●

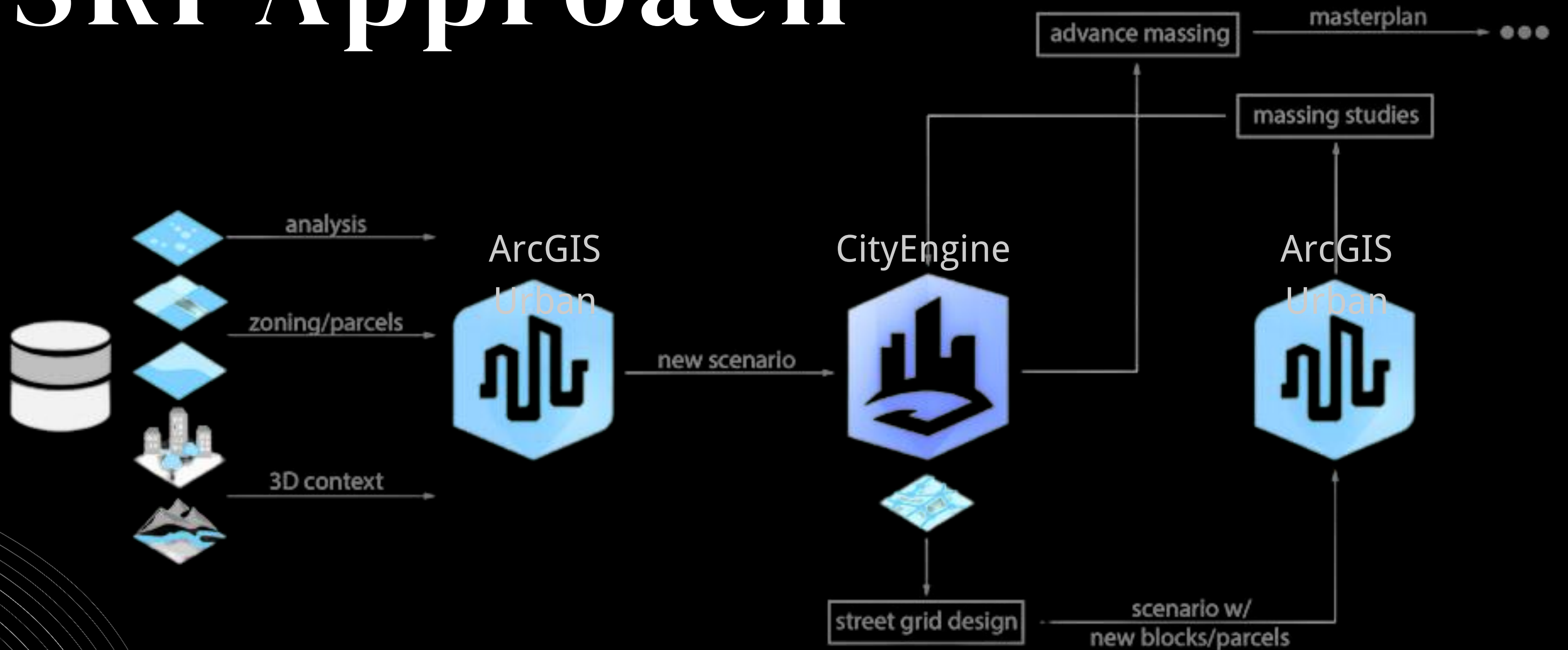
Message ChatGPT...

ChatGPT can make mistakes. Consider checking important information.

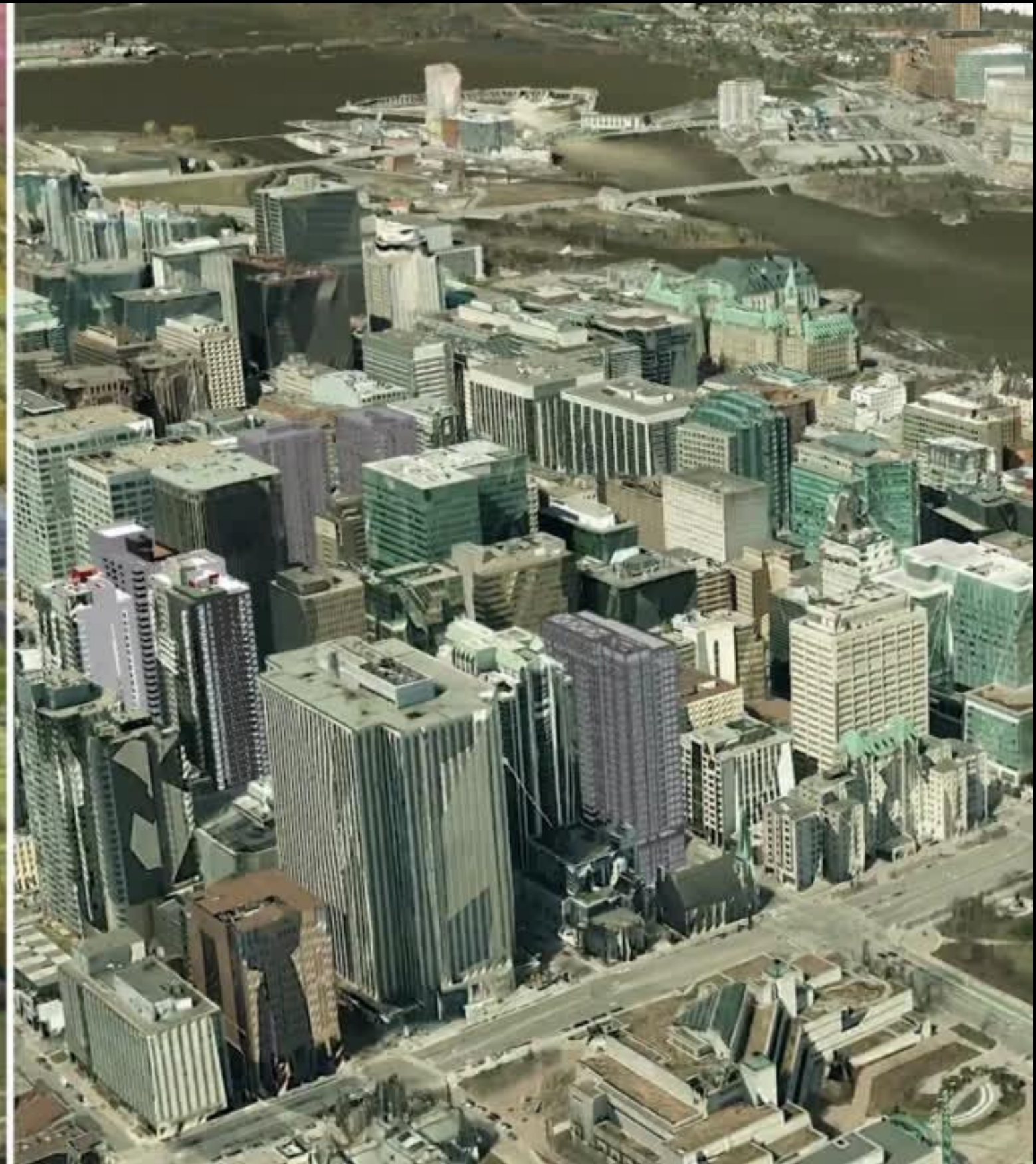


DIGITAL TWIN CITY

“Digital Twin” ESRI Approach



Digital Twin Ottawa

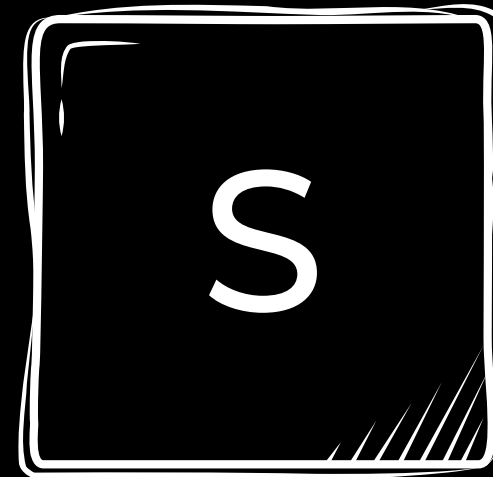


SWOT ANALYSIS

DIGITAL TWINCITY

Strength

Scenario Planning
3D Visualization & interaction
Visualize developments interactions

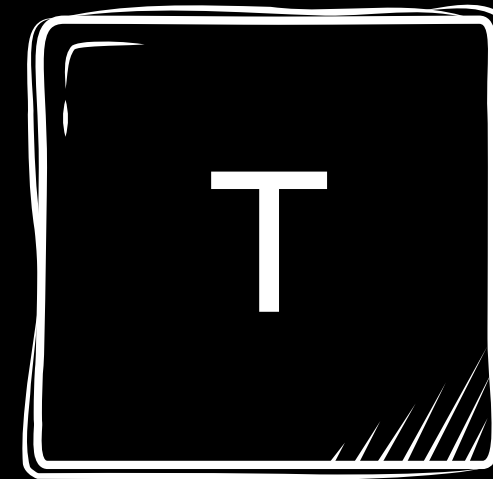
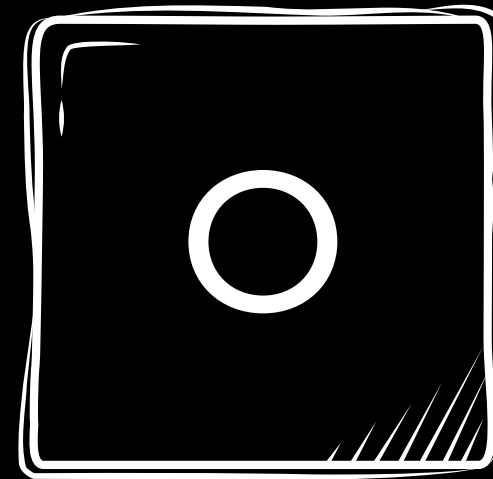


Opportunities

Data Transparency
Urban Data Construction
Explore Urban potentials

Weakness

Complexity on Updating
Staff & User Training



Threats

Certain urban data
collection
Additional Complexity

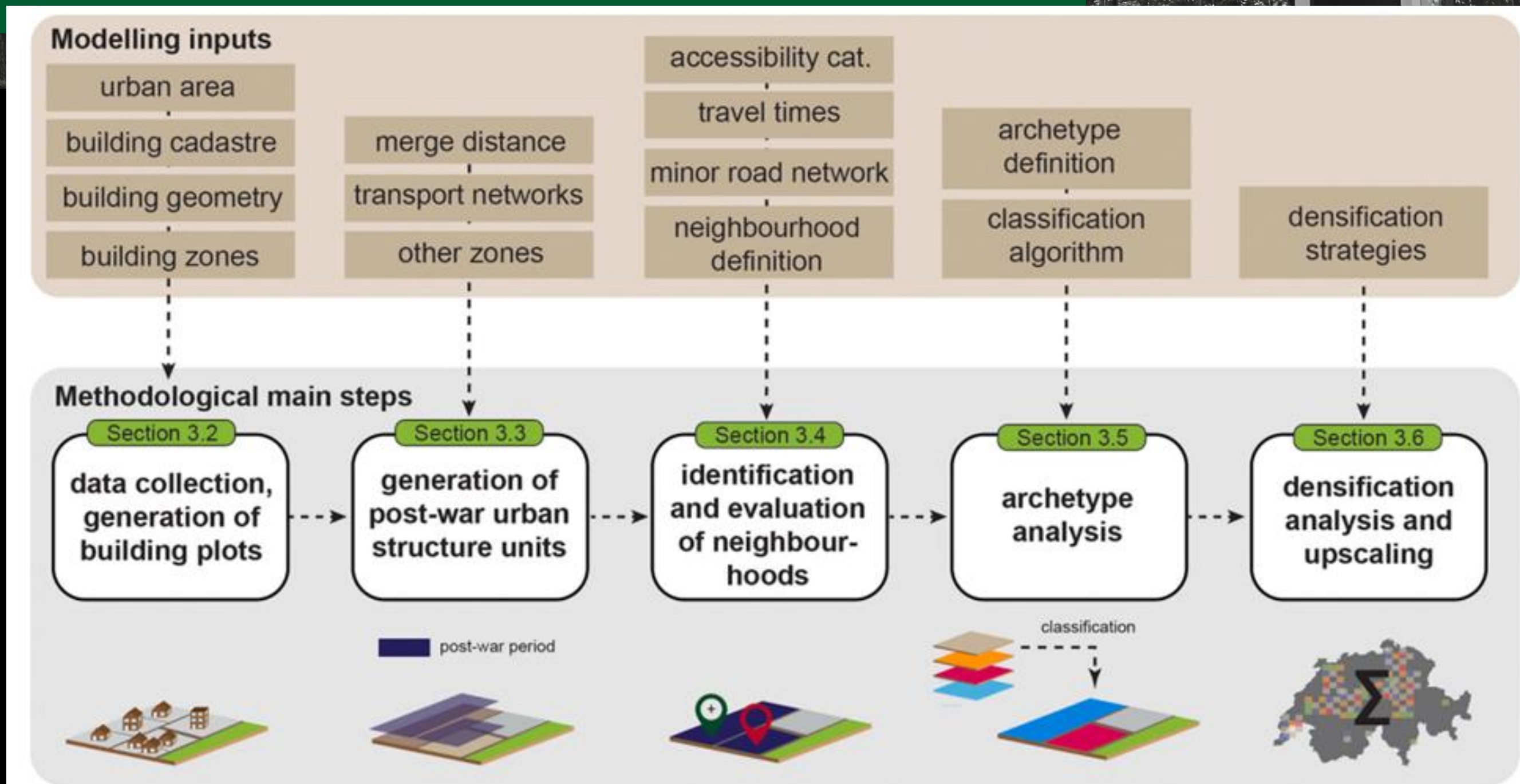
AI-AUGMENTED

PLANNING

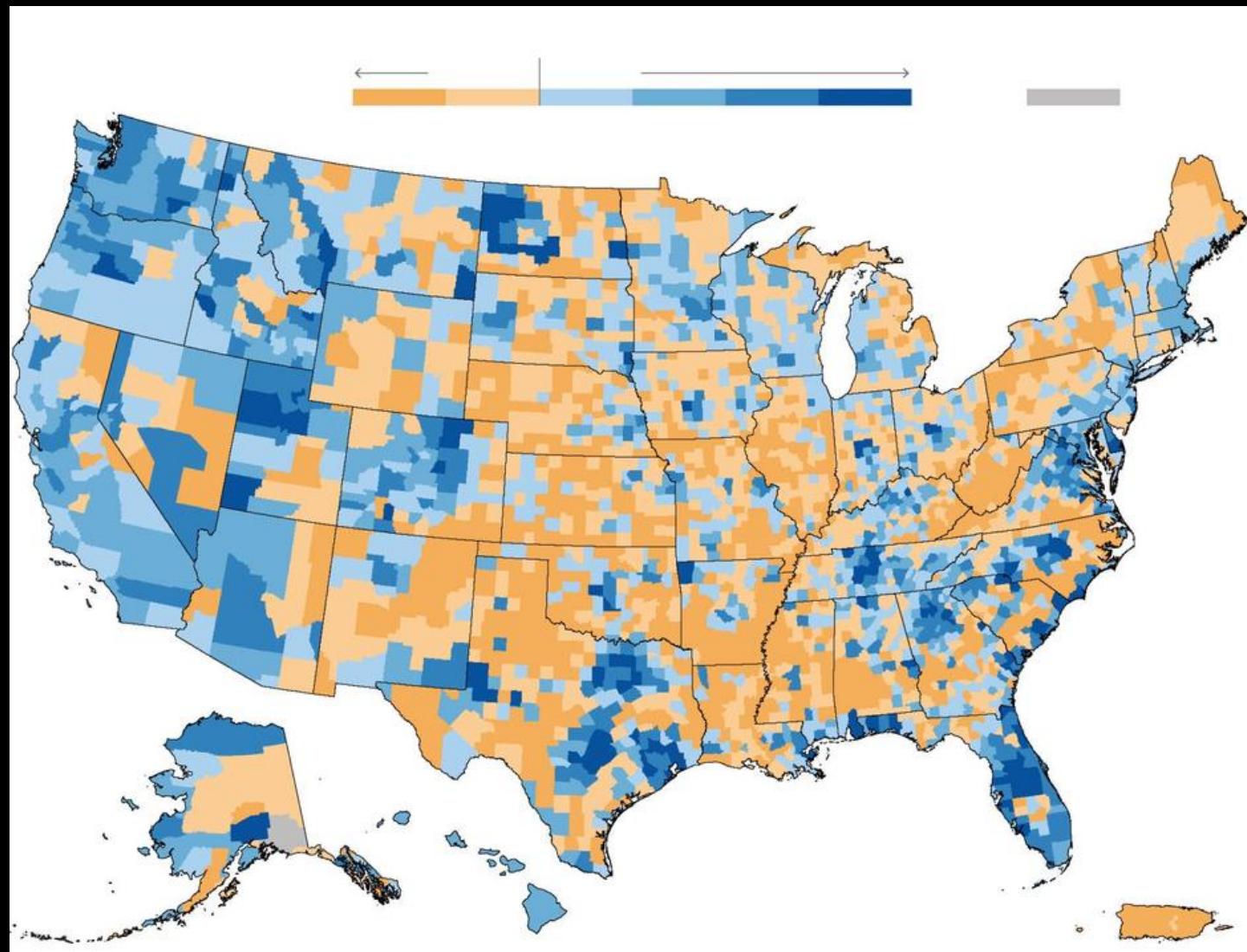


Densification

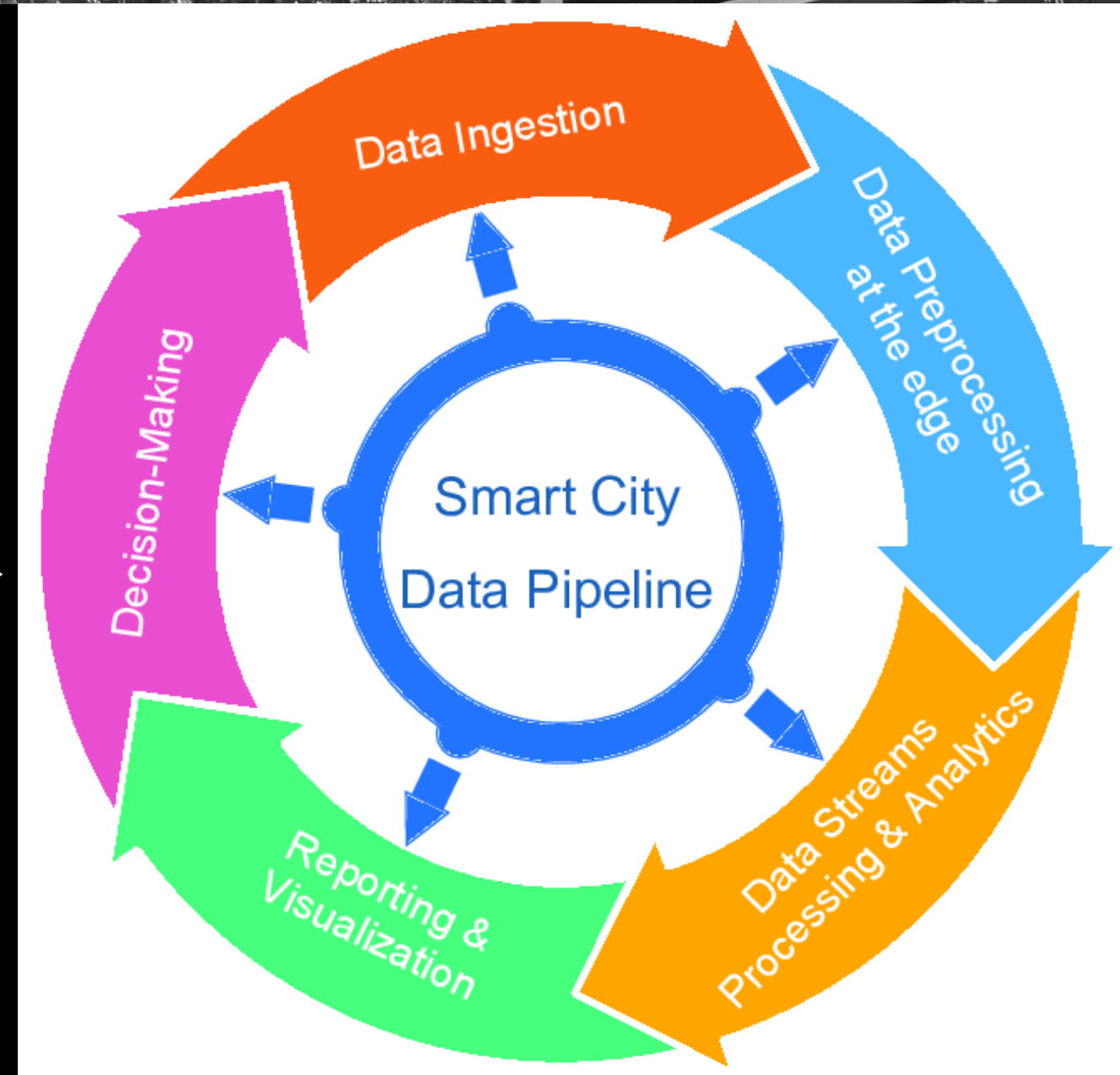
DENSIFICATION PROJECTION



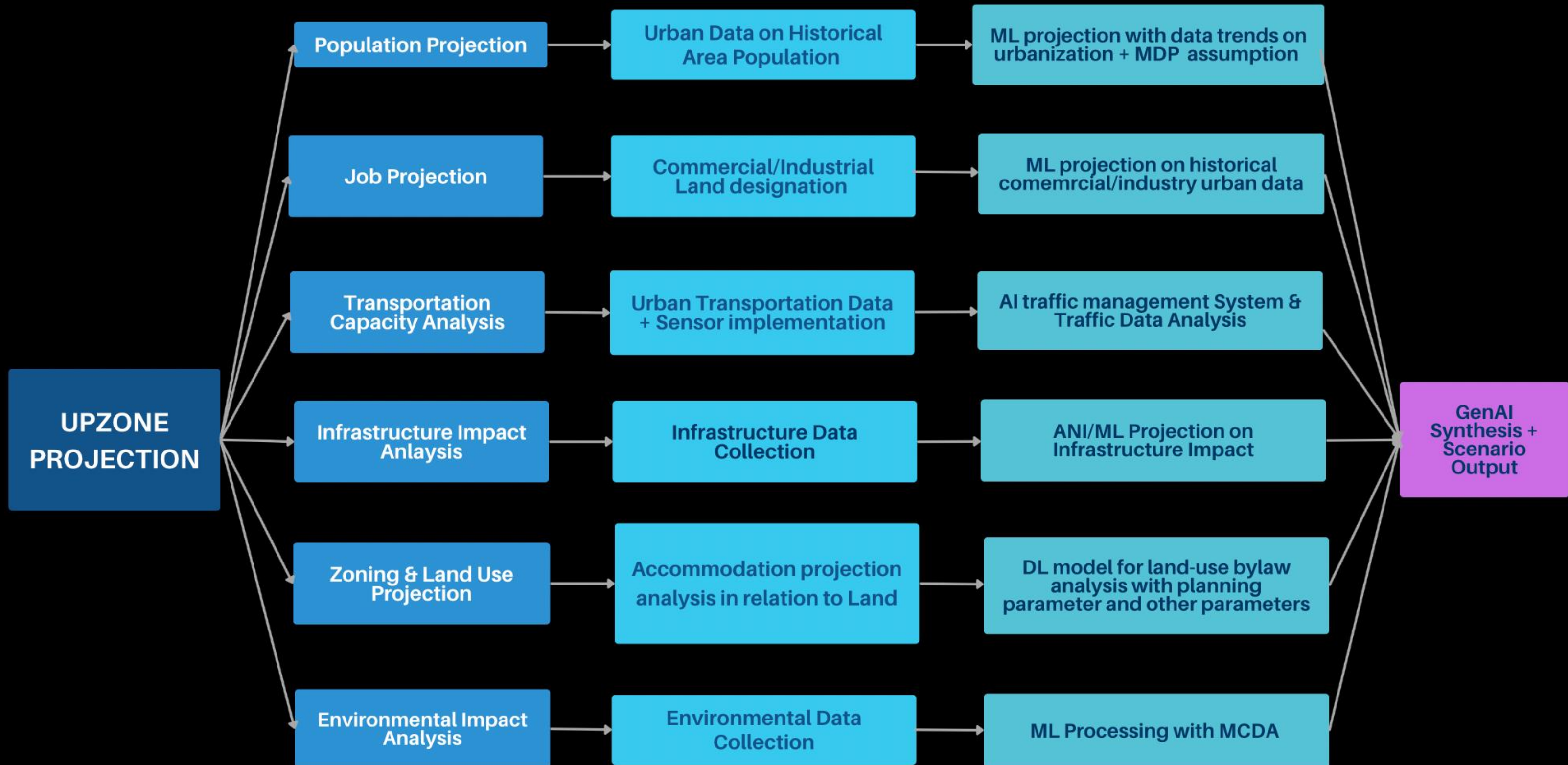
AI DENSIFICATION PROJECTION



**AI-GIS Multi-Criteria
Decision Model**



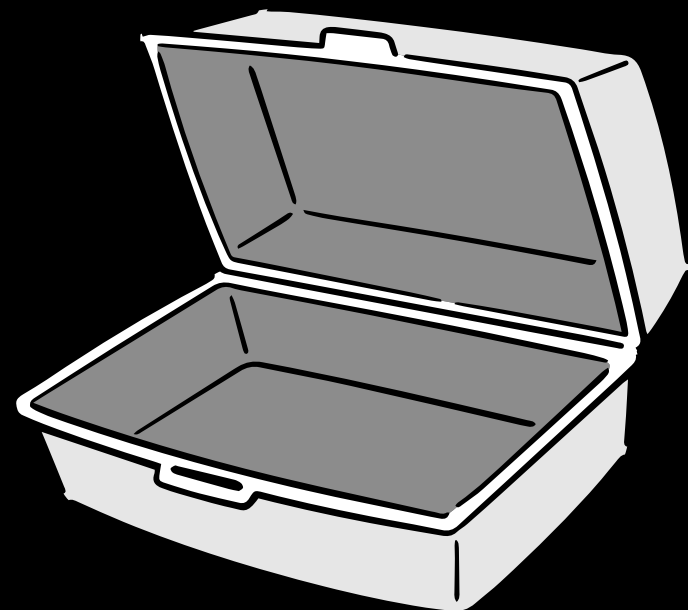
UPZONE PROJECTION



AI LIMITATIONS

Machine Learning

Learn from Mistakes



Deep Learning

Learn from Mistakes



AI-AUTOMATED

PLANNING

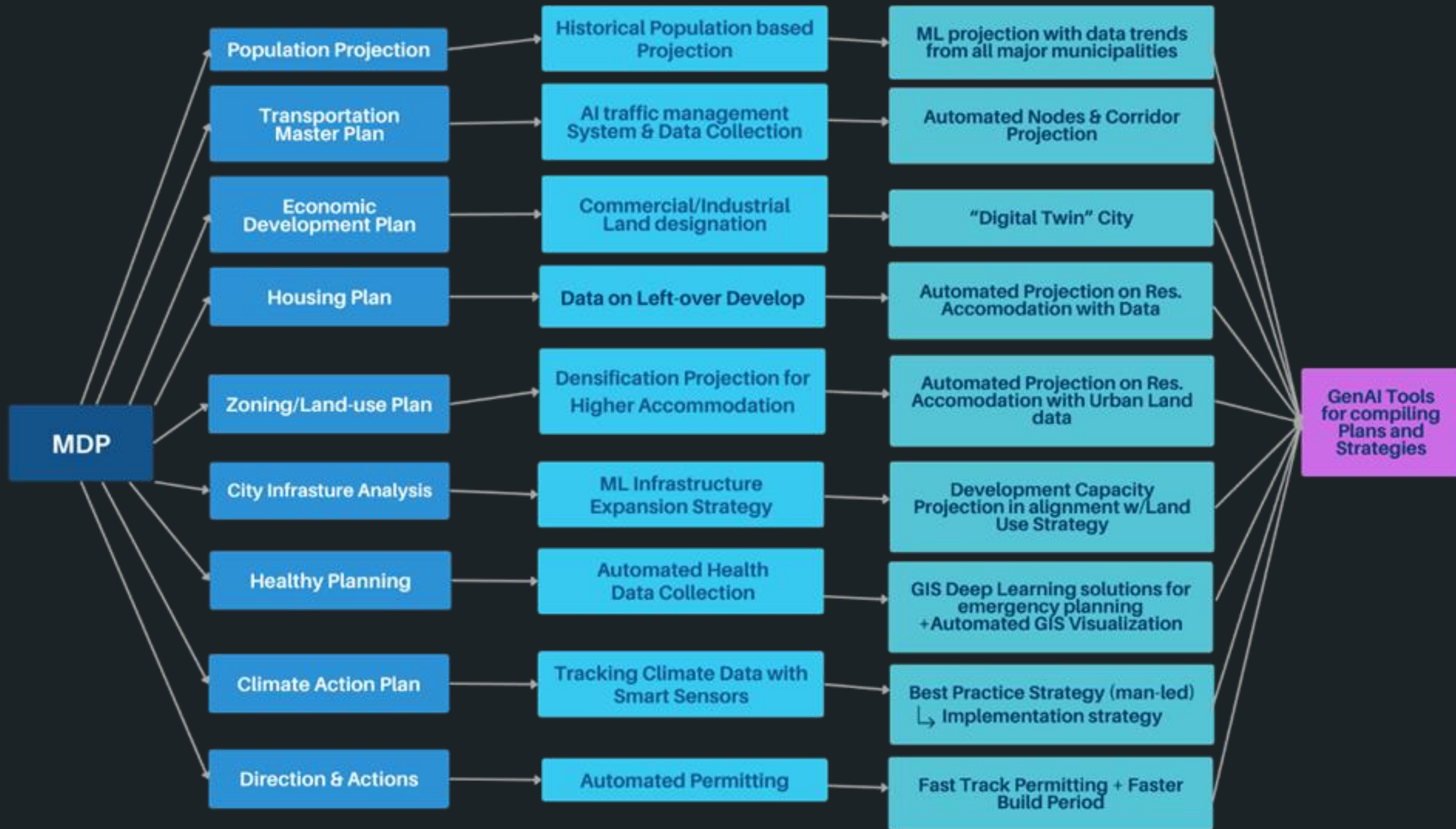


AI Plan Generation

AI-PLAN GENERATION

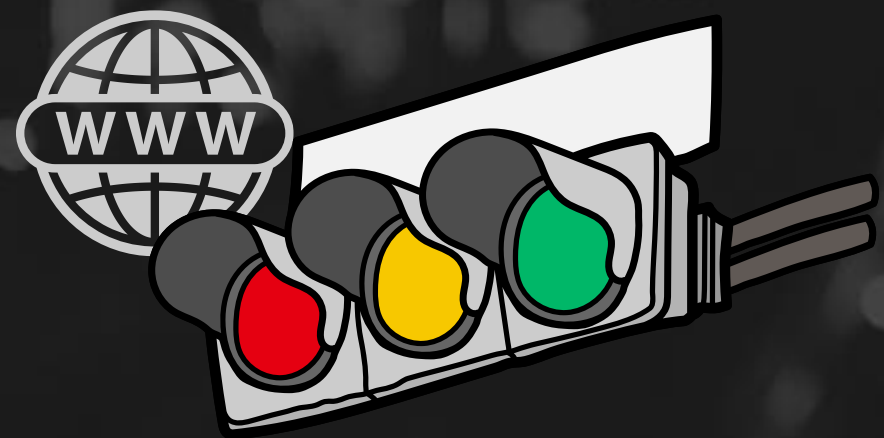
“All subsector of the plan needs big urban data, and machine processed tools”

“AGI Adoption”

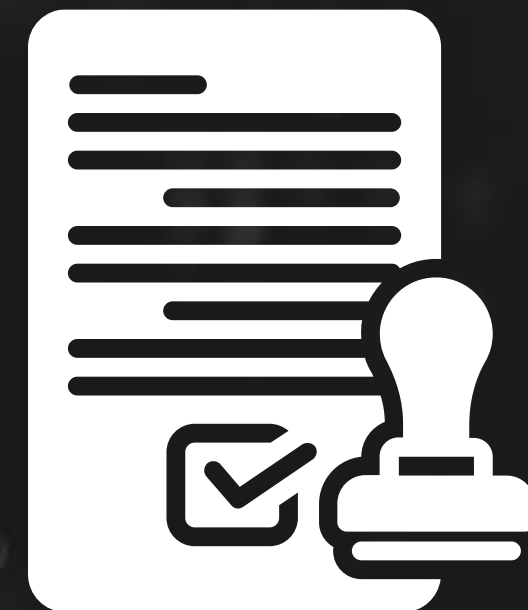


AI-AUTONOMIZED

PLANNING



Smart Traffic



**Fast Track
DP/Subdivision
Permitting Process**



SMART TRAFFIC

Online Traffic Signals

SMART MANAGEMENT

AI-Sensors & AI-Management

181.7 H

VEHICLE DELAY
REDUCTION

93.4 H

PEDESTRIAN DELAY
REDUCTION

2.8 TONNES

CARBON DIOXIDE
REDUCTION

\$ 6,371

TOTAL ECONOMIC VALUE
SAVED

5

Intersections

AT UBC-CAMPUS FOR 2
WEEKS

PERMITS

SUBDIVISION

Zoning Verification

Design Drawings with location, dimension, boundaries

Proximity to nearby utility, boundaries of shore, sewage, wells (existing & proposed)

DEVELOPMENT

Zoning Verification

ASP, NSP alignments

CITY OF EDMONTON APPROACH

AUTOMATED DP DESIGN

ONLINE SUBMISSION

Ensure details come in Digitally. Developers need to submit design specification to assist model processing

MACHINE LEARNING MODEL

Based on Big Urban Dataset. Any mistakes could be altered on the spot and prevent mistakes of future.

TAILORED MODEL APPROACH

This ML permitting tool is designed to work with local zoning bylaws and local design guidelines.

RECOMMENDATION

ASSESSING CURRENT CAPACITY



POLICY GUIDANCE

QUERY PLANS & GUIDELINES

LLM Interpretation

LOW COST

LLM extension plug-in

Public IT support would suffice

MINIMAL RISK

ChatGPT accuracy and precision could be tested prior to adoption

DIGITAL TWIN

VISUALIZATION OF PLANS

3D interactive plan

Population, Job projection

Developable and Zoning parameters

SCENARIO PLANNING

Zoning Interpretation

Subdivision requirements

HIGH COST & TRAINING

Need lots IT support & Huge upfront cost

Parameter mod - Skillset development

DP PERMITTING

ML PERMITTING MODEL

Low computational power requirement

Instant Delivery

Human Oversight

CONSTRUCT URBAN DATABASE

Build urban dataset for future

Future AGI adoption

HIGH COSTS

Need IT support

SMART TRAFFIC MANAGEMENT SYSTEM

CONSTRUCT URBAN DATABASE

Build transportation data for future AGI
adoption

ESG INITIATIVES

GHG emission reduction

Time Saving

Faster transportation access

URBAN DATA COLLECTION

Legality concern on data collection

Community push back

DENSIFICATION

LARGE URBAN DATA UTILIZATION

Combined ML and GAN to process large urban dataset for planning purpose

SKILLSET ADOPTION

Planners need to adopt some level of coding skillset to make modification. Planner needs to understand urban land models.

DATA & MODEL INTEGRITY

'Gray box' approach. Planners can check model integrity with IT, but complexity would lead to high cost.

GenAI-Plan

PLANNERS CAN RELAX

Combine models on models on models on models on models on models on models on models

SKILLSET ADOPTION

Planners need to adopt coding skillset to make modification

DATA & MODEL INTEGRITY

Complete 'blackbox' approach as Planners cannot modify or check parameters.

The Futures of Decision-Making in Planning

How will planners do their work when AI and politics intersect? Illustrations by A. Richard Allen

AI capabilities have massively improved. Many planning tasks can be done by this technology, including data-based decision-making.

SCENARIO D AI IS THE PLANNING DIRECTOR

AI is taking over decision-making, as no consensus can be found due to political polarization and societal division.



SCENARIO A ALL IN FAVOR SAY "AI"

AI is everyone's new coworker. Planners, together with the community, collaborate with AI to make the right decisions for the future of the community.



SCENARIO C GOING NOWHERE FAST

No one wants to or can make decisions. Societal division and political polarization bring everything to a halt.



SCENARIO B DEMOCRACY RULES

Planners are consensus builders working with the community to make human-centered decisions jointly. Civilized discourse is possible in a united community.



Lack of trust in AI and ethical concerns have prevented most planners from using this technology.

Political polarization and societal division have worsened as parties grow more at odds on policy issues.

Political polarization and societal division have been declining, making community consensus easier to achieve.

Powered by  OpenAI

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12-31

THANK YOU

FOR LISTENING

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