
ings Bank
food court

Motivation

1

Can we quantify walkability?

obility AWARDS

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Powered by Data-Driven People

Motivation

1

Can we quantify walkability?

2

How do we leverage this to determine what street interventions LGU should prioritize?

obility AWARDS

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INTRODUCING

Hakbang

Policy Simulation Tool for LGU Sidewalk Interventions

Team Hippothesis
Eltagonde, Germar, Yunque | Ateneo de Manila University

Scores walkability based on street design

+

Compares routes for different types of pedestrians

=

Main Feature

Simulates and compares different LGU interventions

obility AWARDS

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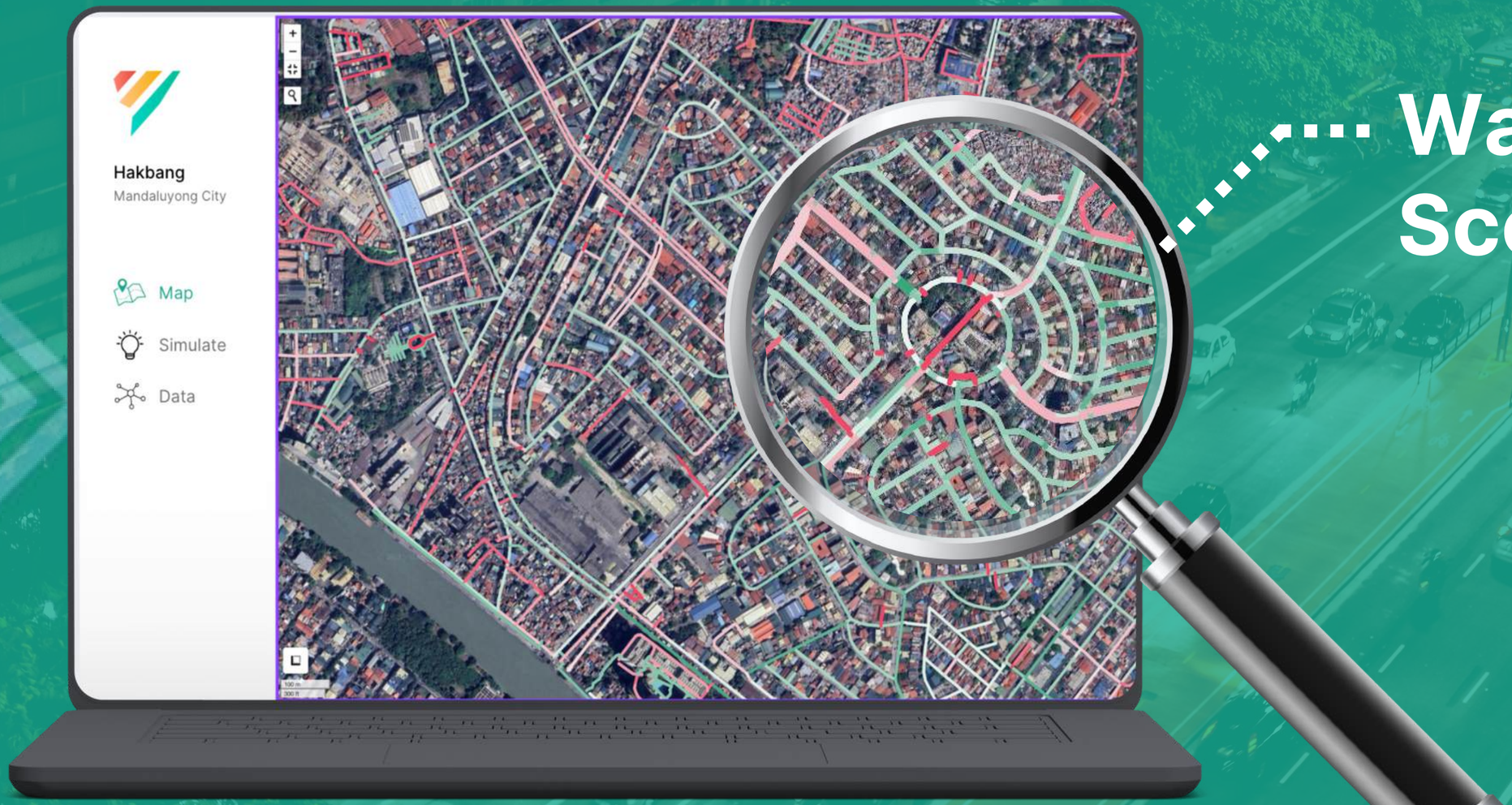
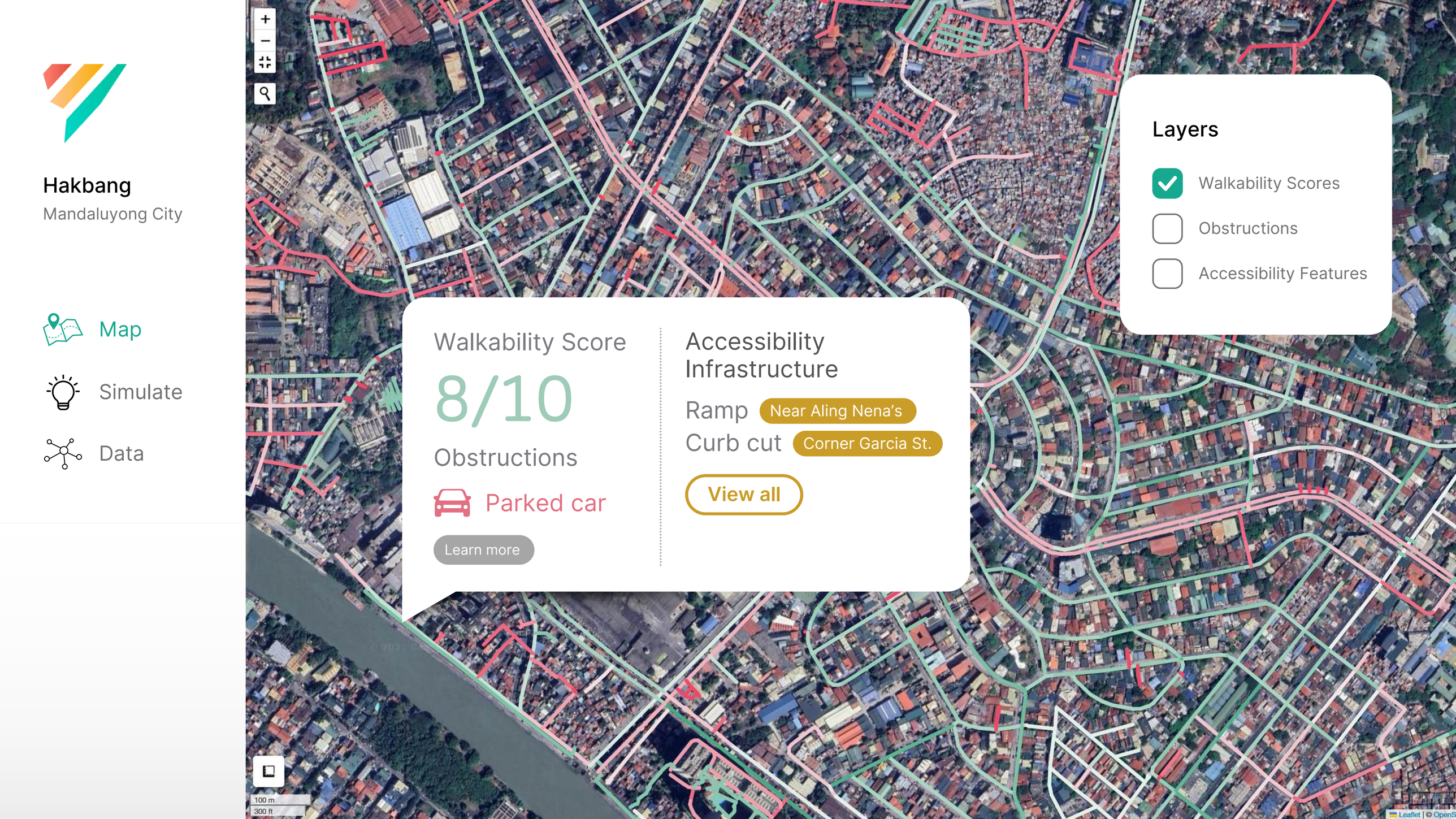


Walkability Score


Hakbang
Mandaluyong City
Map
Simulate
Data
Layers
Walkability Scores
Obstructions
Accessibility Features
Walkability Score
8/10
Obstructions
Parked car
Learn more
Accessibility Infrastructure
Ramp
Near Aling Nena's
Curb cut
Corner Garcia St.
View all
100 m
300 ft
Leaflet | © Open

Scoring Model

Safety	Mobility	Accessibility of crossings	Equity	Ease
1. curb to curb width 2. width of buffer zone 3. no. of through lanes 4. vertical protection of sidewalk 5. speed limit	1. sidewalk width 2. no. of sidewalk discontinuities 3. slope of sidewalk 4. sidewalk obstructions	1. sidewalk elevation 2. at-grade crosswalk 3. curb cuts 4. for footbridges, is there a ramp or elevator	1. tactile paving 2. braille and auditory signages 3. ramps	1. percent of sidewalk with shade 2. foliage 3. no. of sitting places 4. land use mix 5. no. of PUV stops 6. evening lights

Boongaling et al. (2021); Cervania et al. (2025)

Relative Discomfort

Relative Distance or “Circuity”

Compare the route for kinds of pedestrians

Work commuter	Leisure commuter
Shorter route	Longer route
Less walkable	More walkable

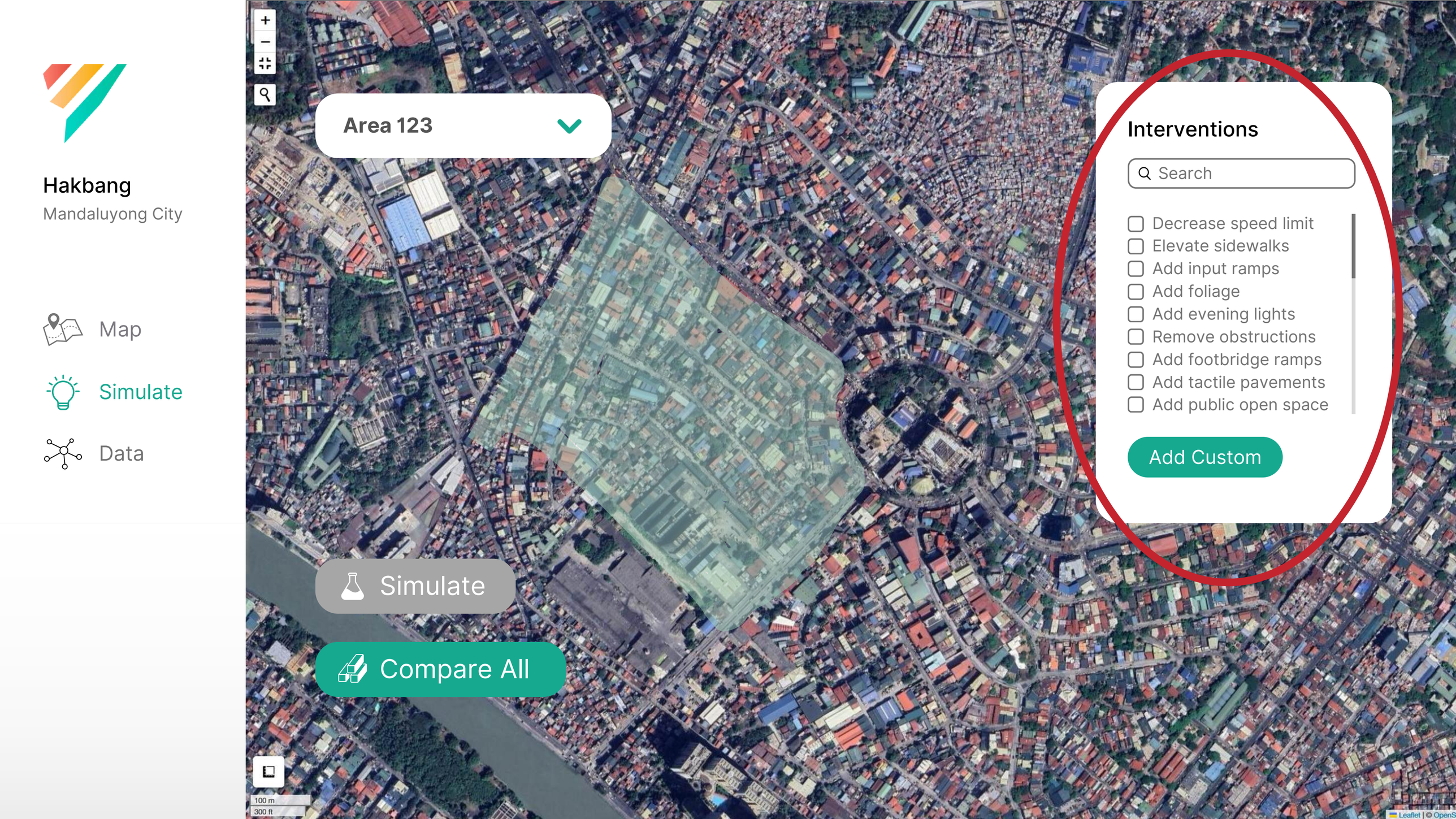
Reggiani et al. (2022)

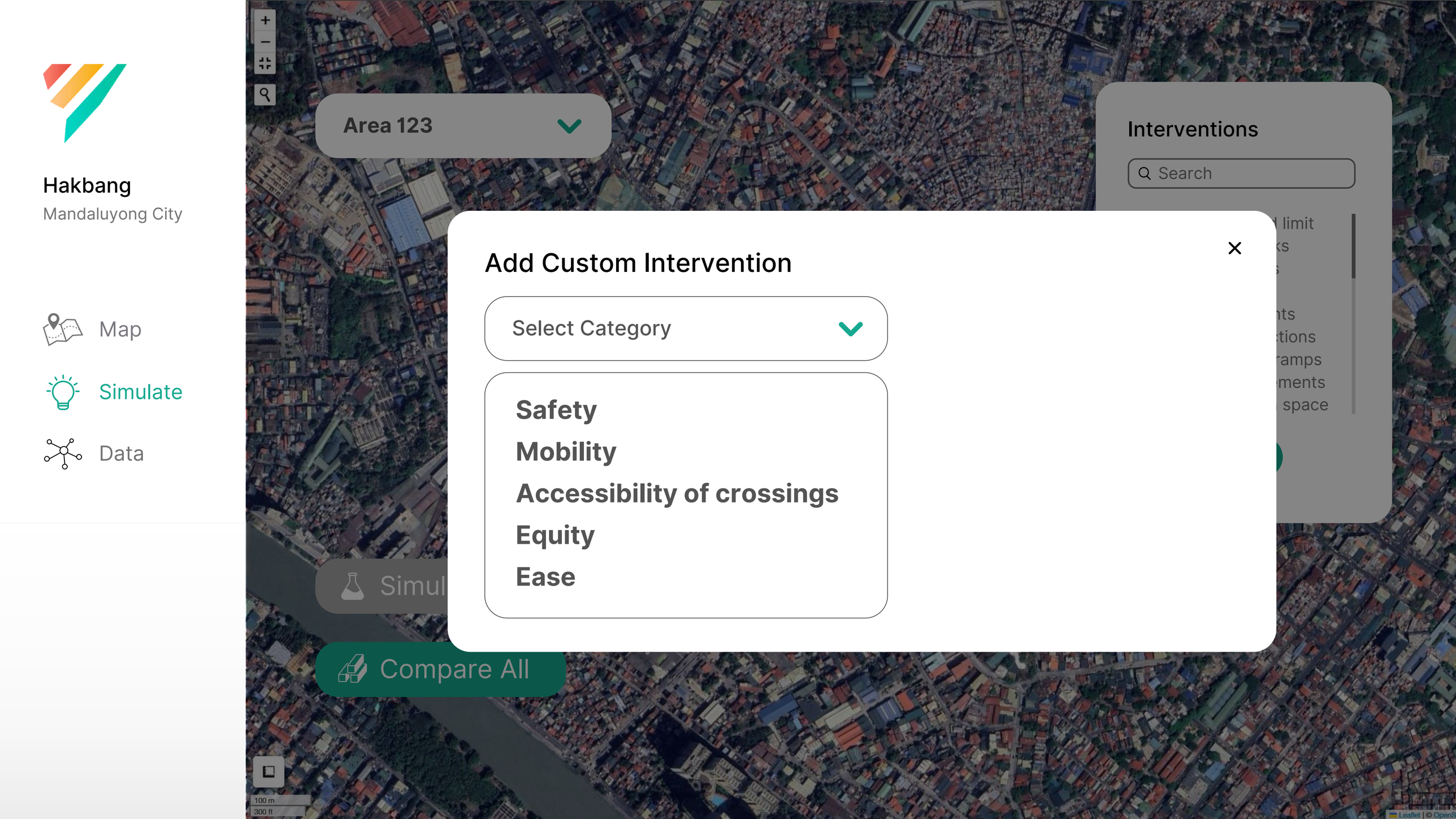
HAKBANG'S CORE

Simulate the impact of changing street design on walkability

HAKBANG'S CORE

Let LGUs **mathematically determine** how much changing street design improves walkability


Hakbang
Mandaluyong City
Map
Simulate
Data
Area 123
Interventions
Search
Decrease speed limit
Elevate sidewalks
Add input ramps
Add foliage
Add evening lights
Remove obstructions
Add footbridge ramps
Add tactile pavements
Add public open space
Add Custom
Simulate
Compare All
100 m
300 ft
Leaflet | © Open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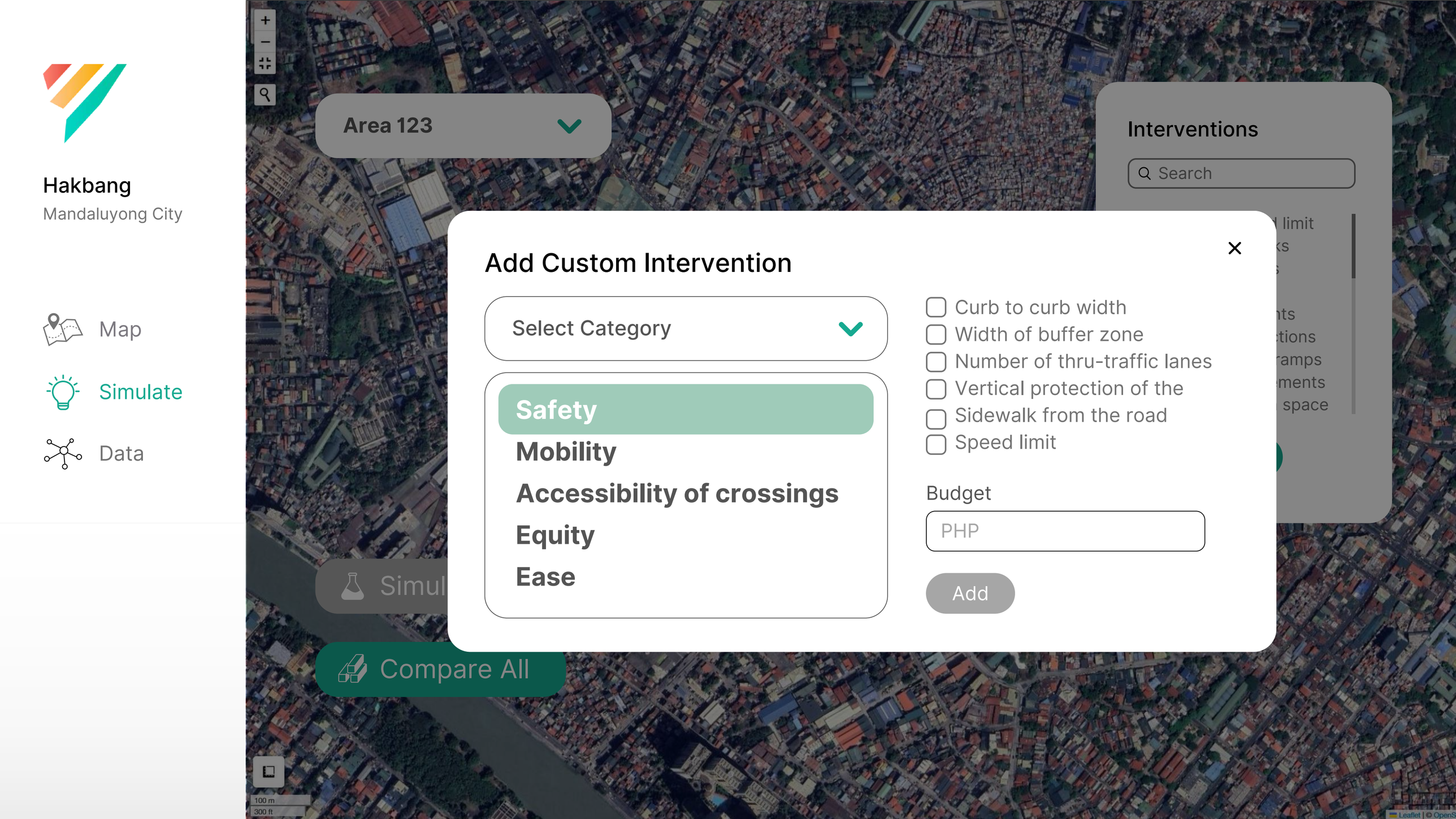
Safety
Mobility
Accessibility of crossings
Equity
Ease
Compare All
100 m
300 ft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Mandaluyong City
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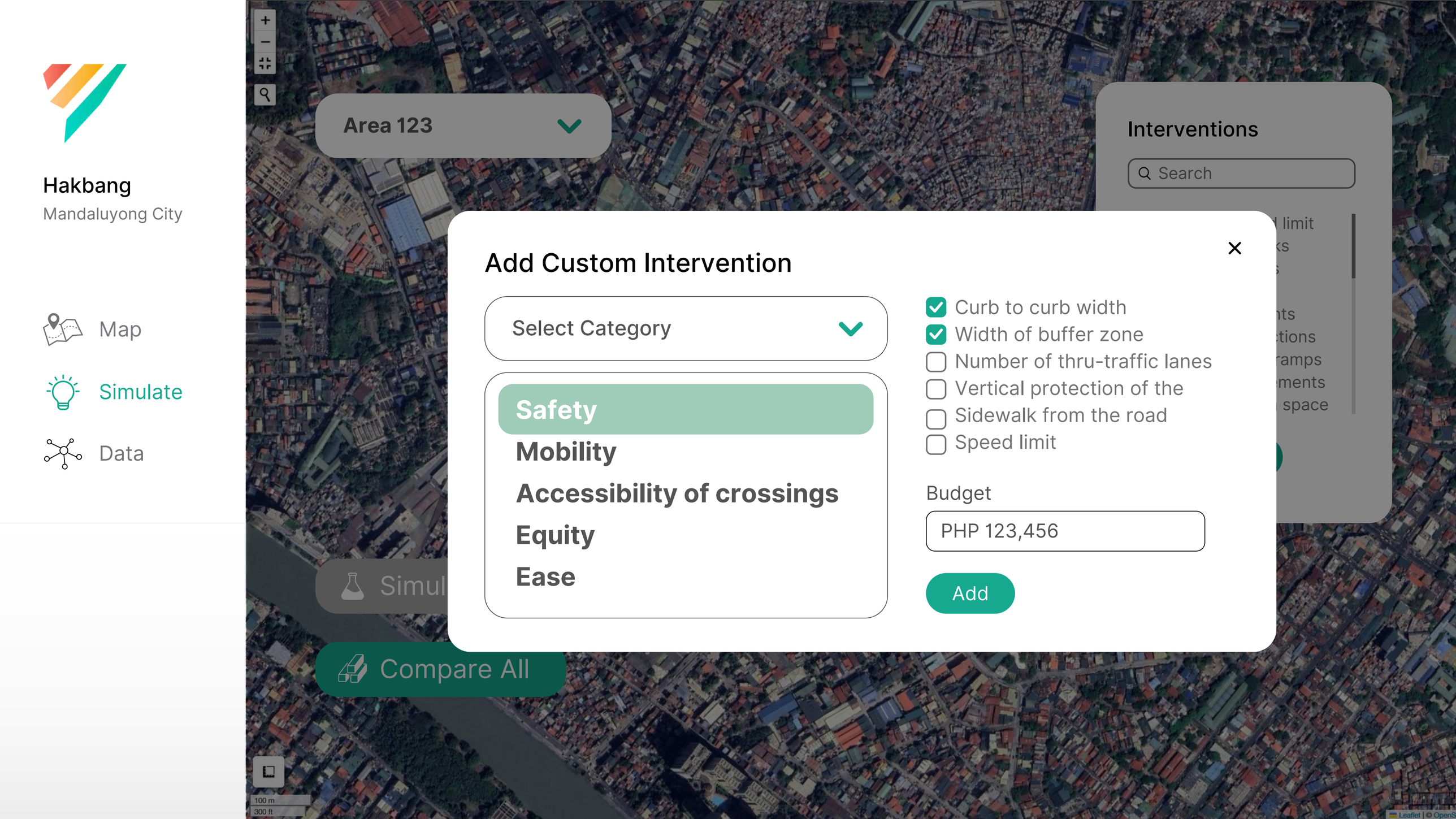
Simulate
Data
Area 123
Interventions
Search
Add Custom Intervention
Select Category
Safety
Mobility
Accessibility of crossings
Equity
Ease
Curb to curb width
Width of buffer zone
Number of thru-traffic lanes
Vertical protection of the
Sidewalk from the road
Speed limit
Budget
PHP
Add
Compare All
100 m
300 ft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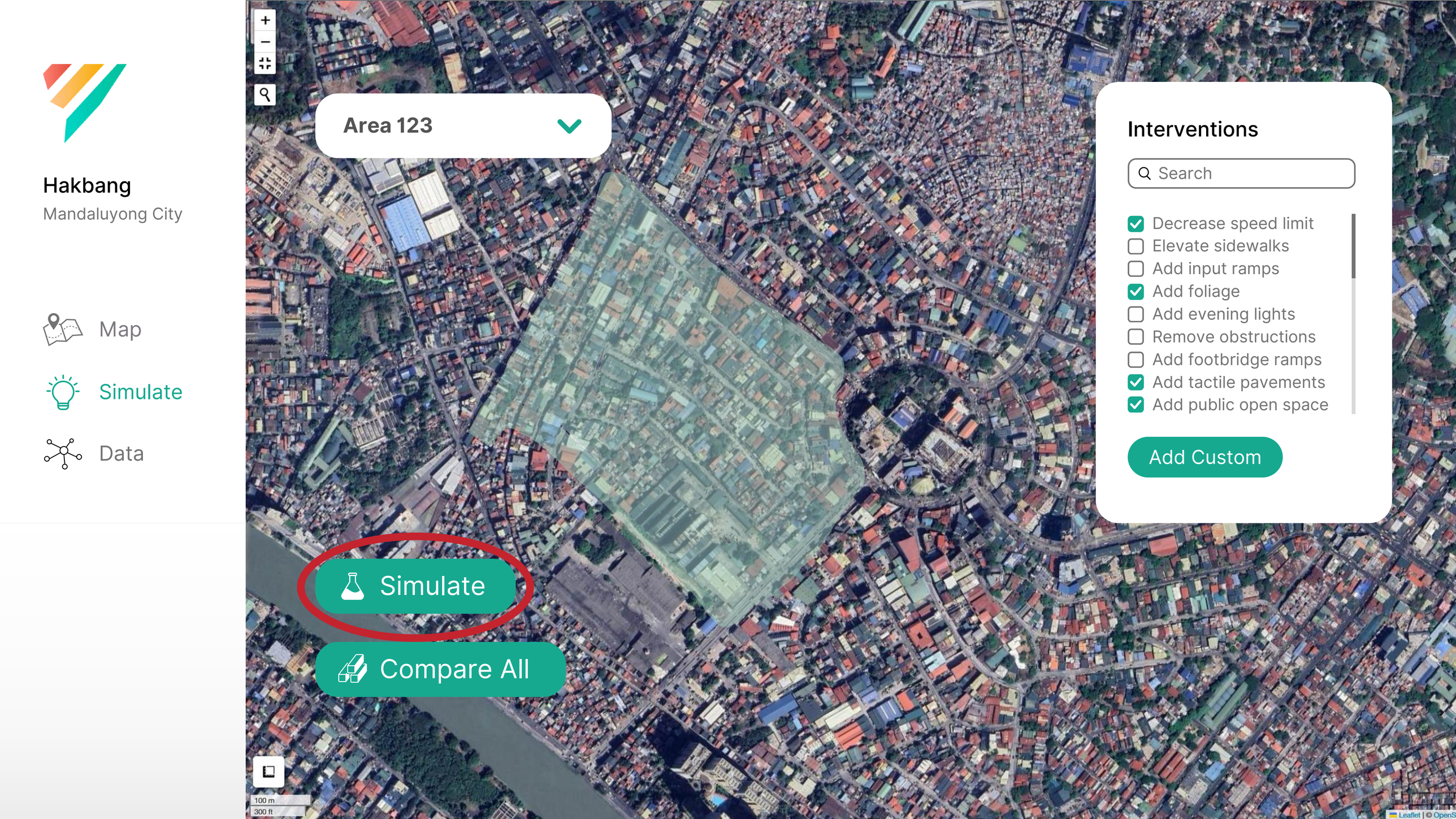
Hakbang
Mandaluyong City
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Add public open space
Add Custom
Simulate
Compare All
100 m
300 ft
Leaflet | © Open

Hakbang
Mandaluyong City

Map
Simulate
Data

Barangay Plainview

Back

Summary

New Walkability Score
9/10 ↑ 2 points

Required Budget
PHP 1.23M

Walkability Score

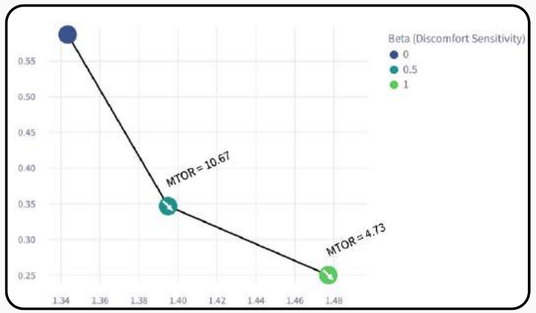
Walkability | Accessibility

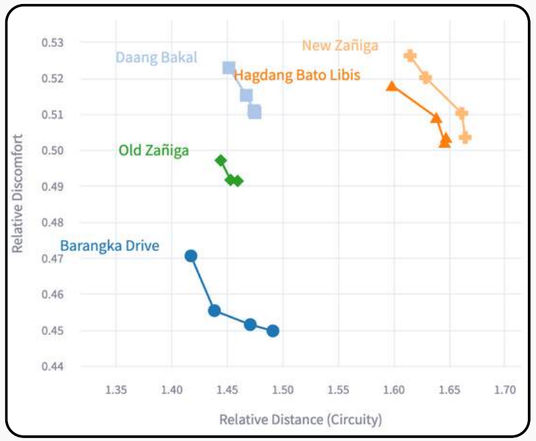
Before Intervention

After Intervention

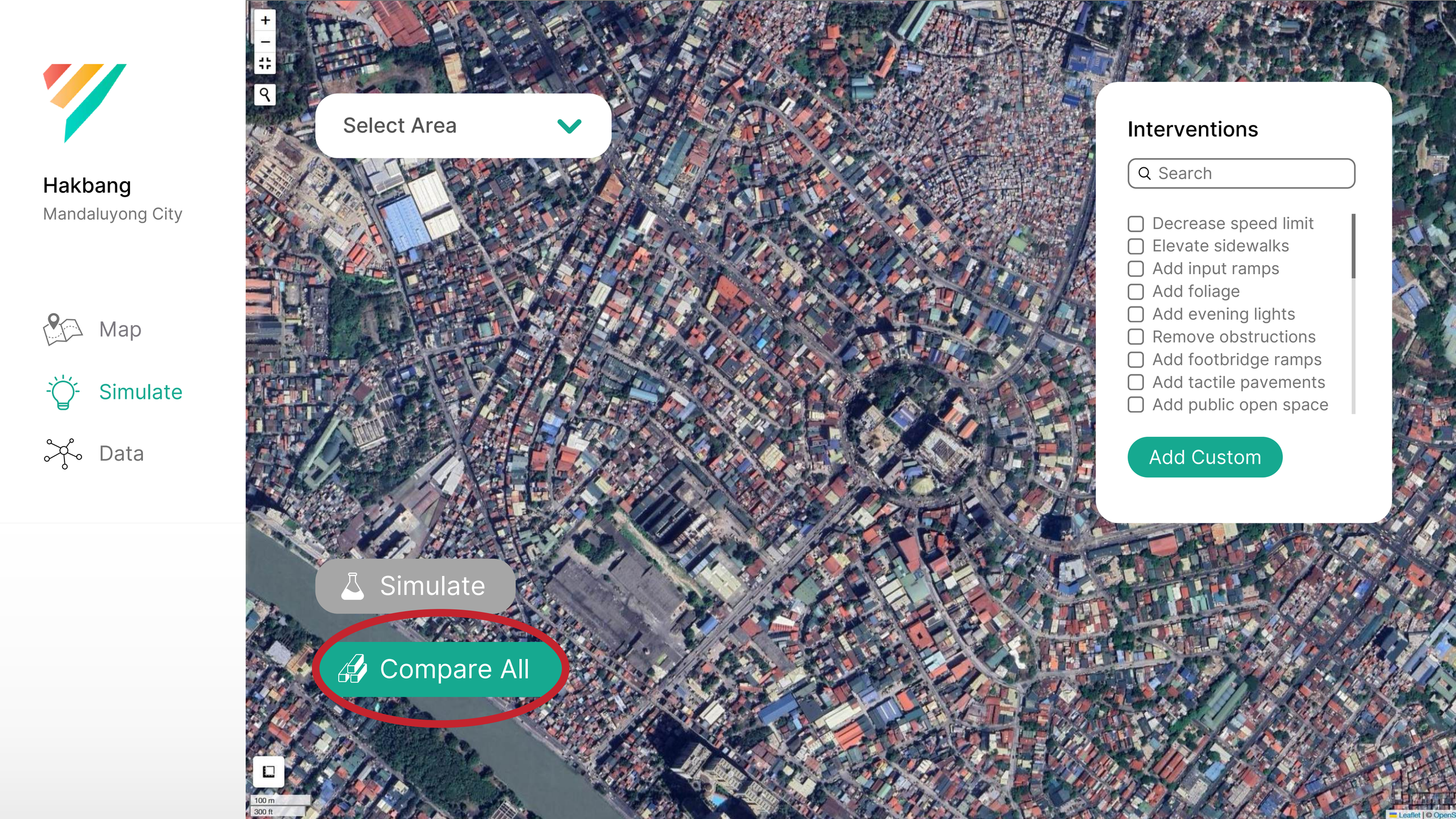
Walkability Curve

Learn more





View Budget Breakdown


Hakbang
Mandaluyong City
Map
Simulate
Data
Select Area
Interventions
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Decrease speed limit
Elevate sidewalks
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Add foliage
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Add public open space
Add Custom
Simulate
Compare All
100 m
300 ft
Leaflet | © Open

Hakbang
Mandaluyong City

Map
Simulate
Data

Intervention Comparison

Back

Summary

Best Score-to-cost Ratio

Decrease speed limit

This program has a score-to-cost ratio of 0.86

Highest Score

Add tactile pavements

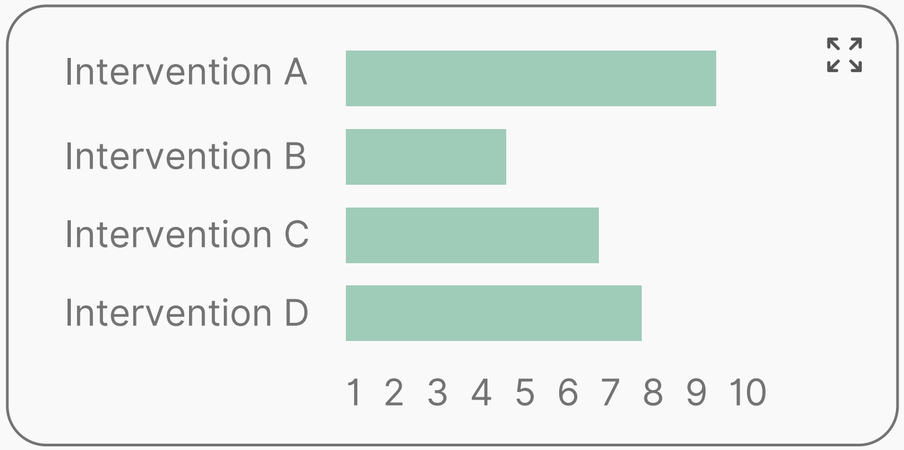
Lowest Cost

Add foliage

Learn more

Data Visualization

Walkability Score | Cost



Intervention Results

Filter by

Sort by

Intervention	Score	Budget
Decrease speed limit	9	PHP 1.2M
Elevate sidewalks	8	PHP 3.4M
Add input ramps	7	PHP 5.6M
Add foliage	6	PHP 7.8M
Add evening lights	5	PHP 9.0M
Remove obstructions	4	PHP 10.0M

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WHY SHOULD LGUs CARE?

Hakbang establishes **priorities**.

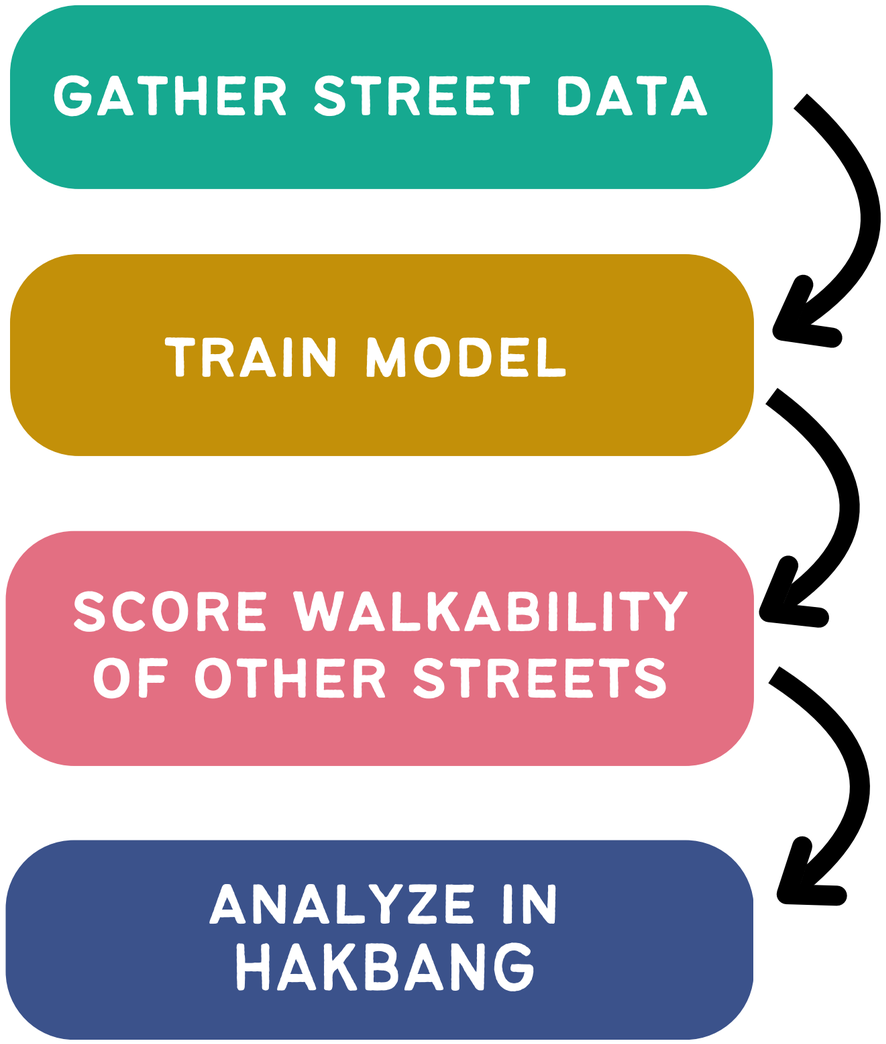
Given limited budgets, how do LGUs choose the best intervention?

Using HAKBANG, we choose the intervention that maximizes improvements to walkability

In short, Hakbang turns data into **actionable** policy recommendations.

Methodology

How would an LGU implement HAKBANG?



Overview

GATHER STREET DATA

TRAIN MODEL

SCORE WALKABILITY OF OTHER STREETS

ANALYZE IN HAKBANG

STREET TAGGING USING APP

LGU directs team to collect data from a small area.

Goal: measurements about street design

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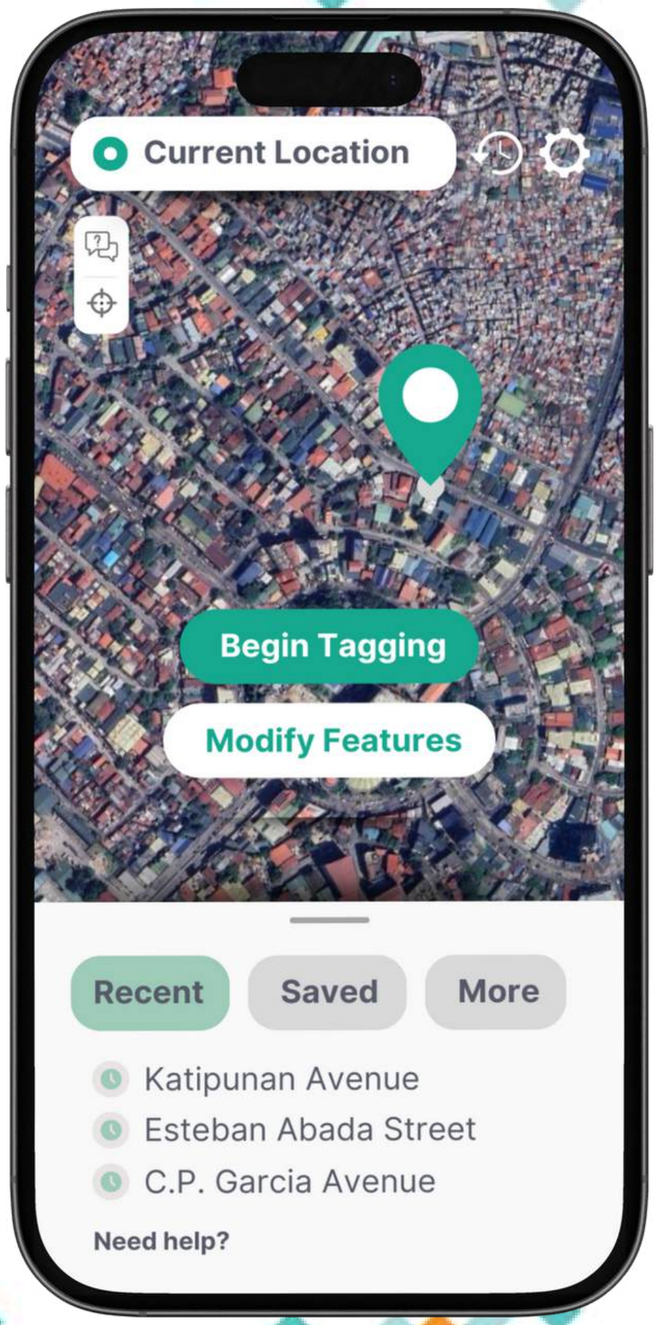
Overview

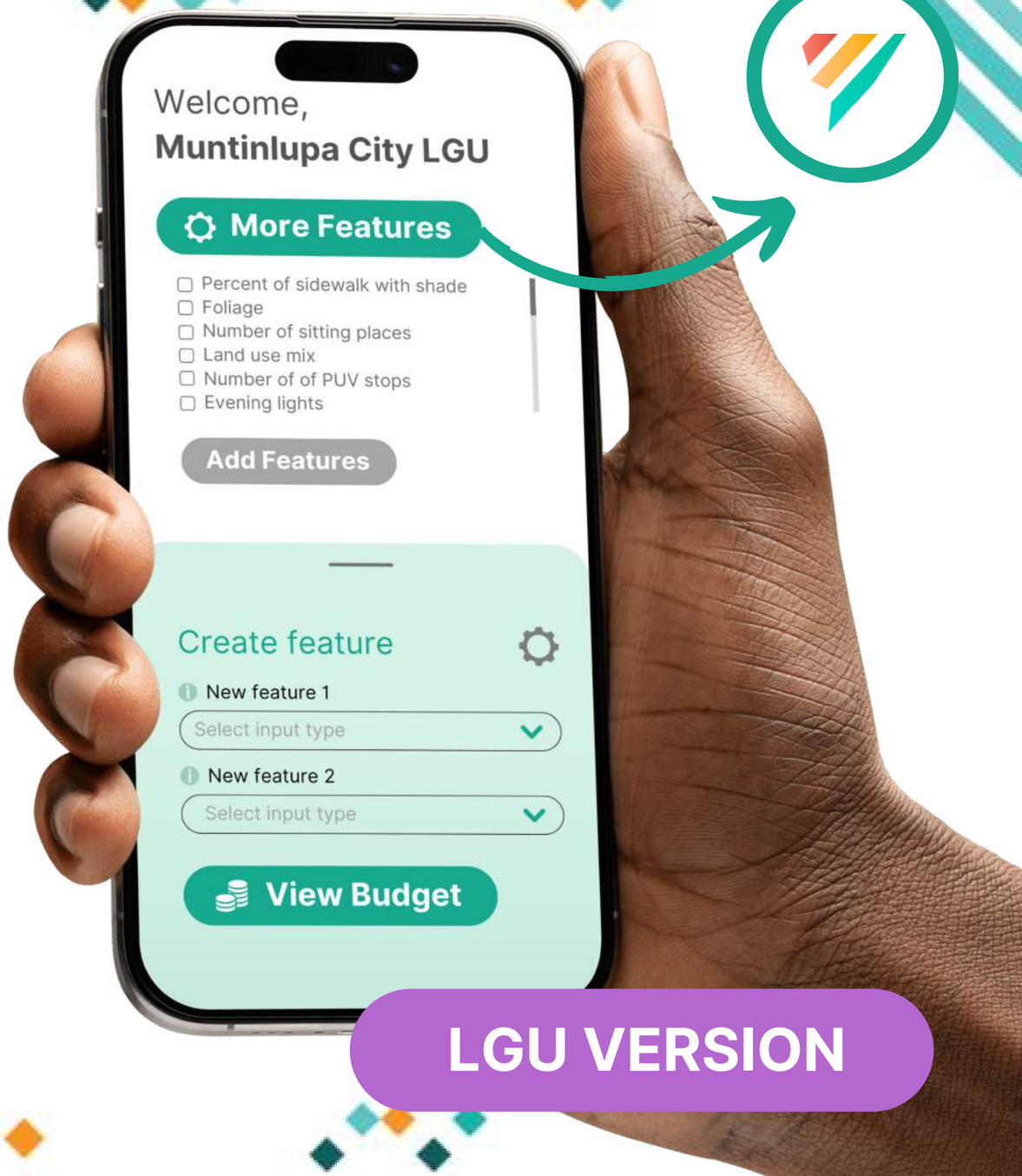
GATHER STREET DATA

TRAIN MODEL

SCORE WALKABILITY OF OTHER STREETS

ANALYZE IN HAKBANG





LGU VERSION

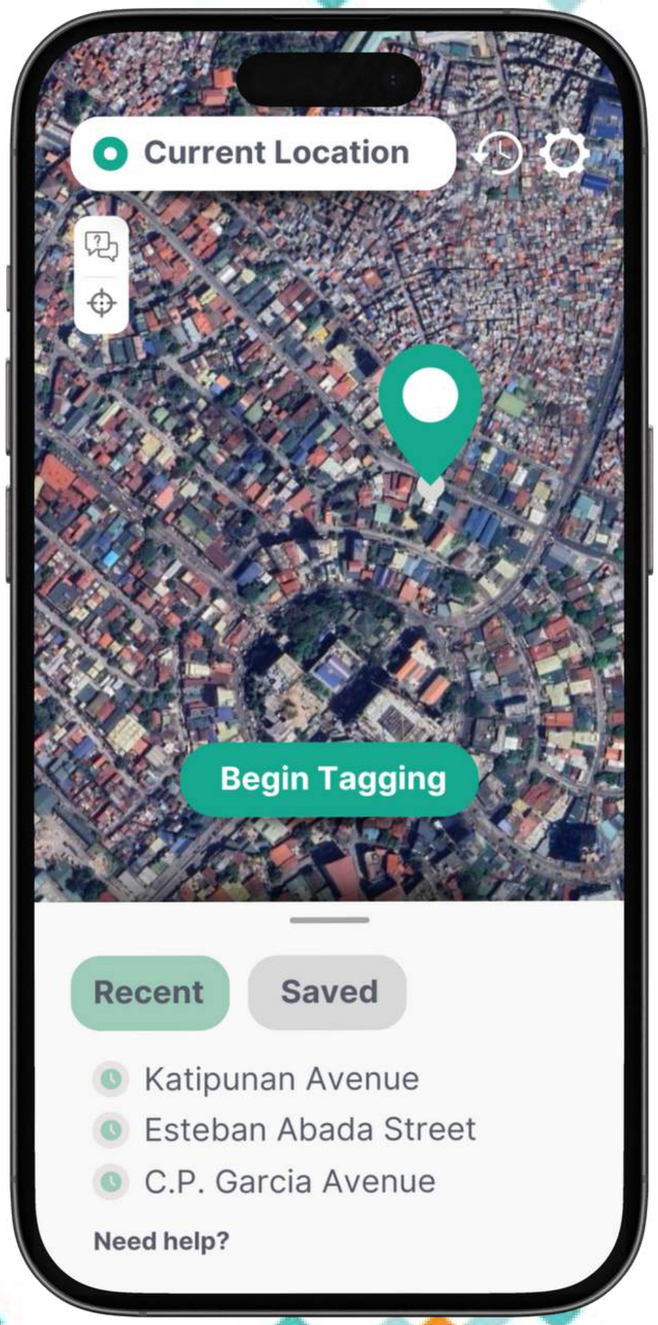
Overview

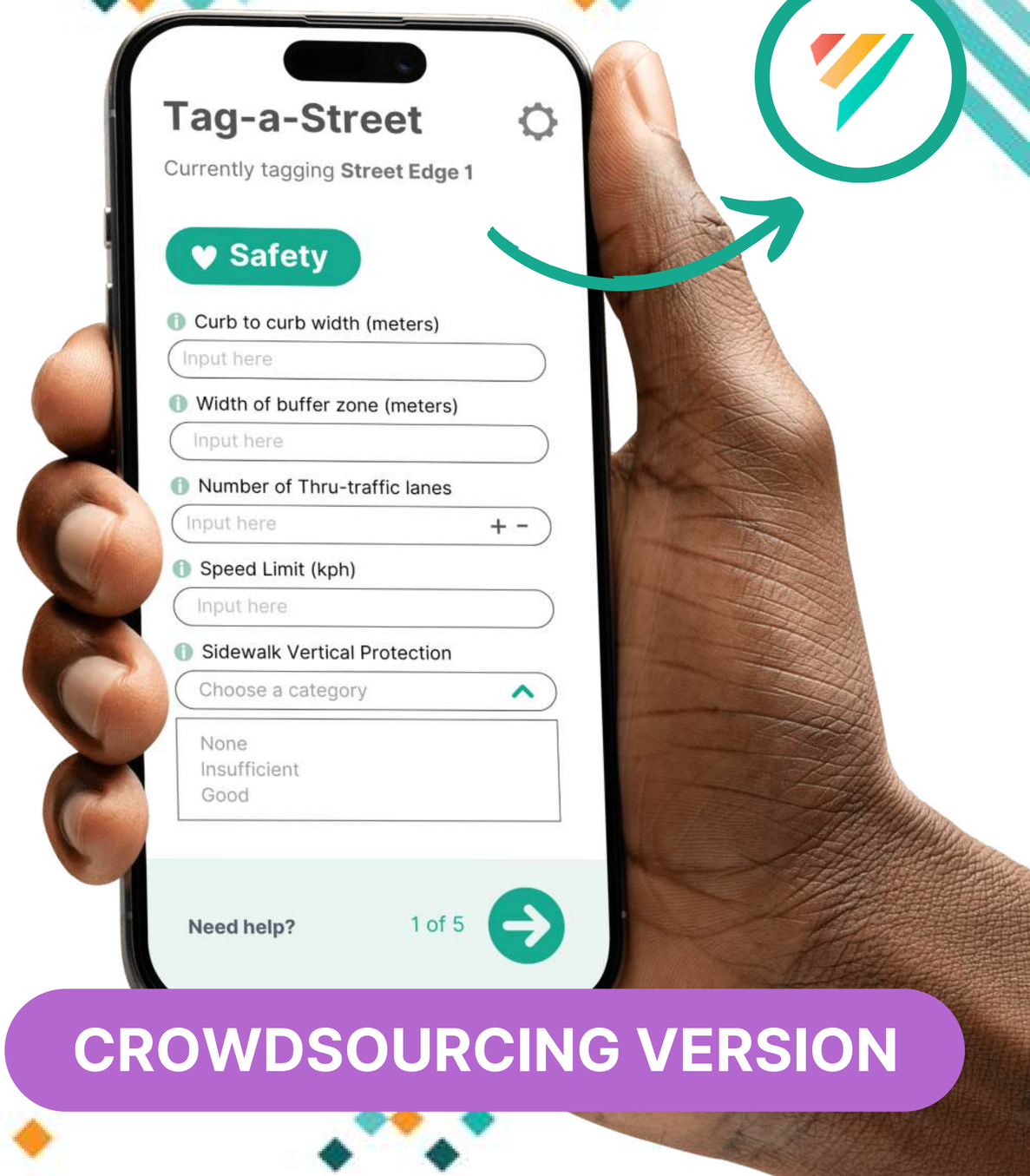
GATHER STREET DATA

TRAIN MODEL

SCORE WALKABILITY OF OTHER STREETS

ANALYZE IN HAKBANG





CROWDSOURCING VERSION

Overview

GATHER STREET DATA

TRAIN MODEL

SCORE WALKABILITY OF OTHER STREETS

ANALYZE IN HAKBANG

STREET TAGGING USING APP

LGU directs team to collect data from a small area.

Goal: measurements about street design

PEDESTRIAN SURVEY

Survey local residents.

Goal: walkability scores from human perception

Overview

GATHER STREET DATA

TRAIN MODEL

SCORE WALKABILITY OF OTHER STREETS

ANALYZE IN HAKBANG

STREET TAGGING USING APP

LGU directs team to collect data from a small area.

Goal: measurements about street design

PEDESTRIAN SURVEY

Survey local residents.

Goal: walkability scores from human perception

Train a model to **predict walkability scores** from street design.

Overview

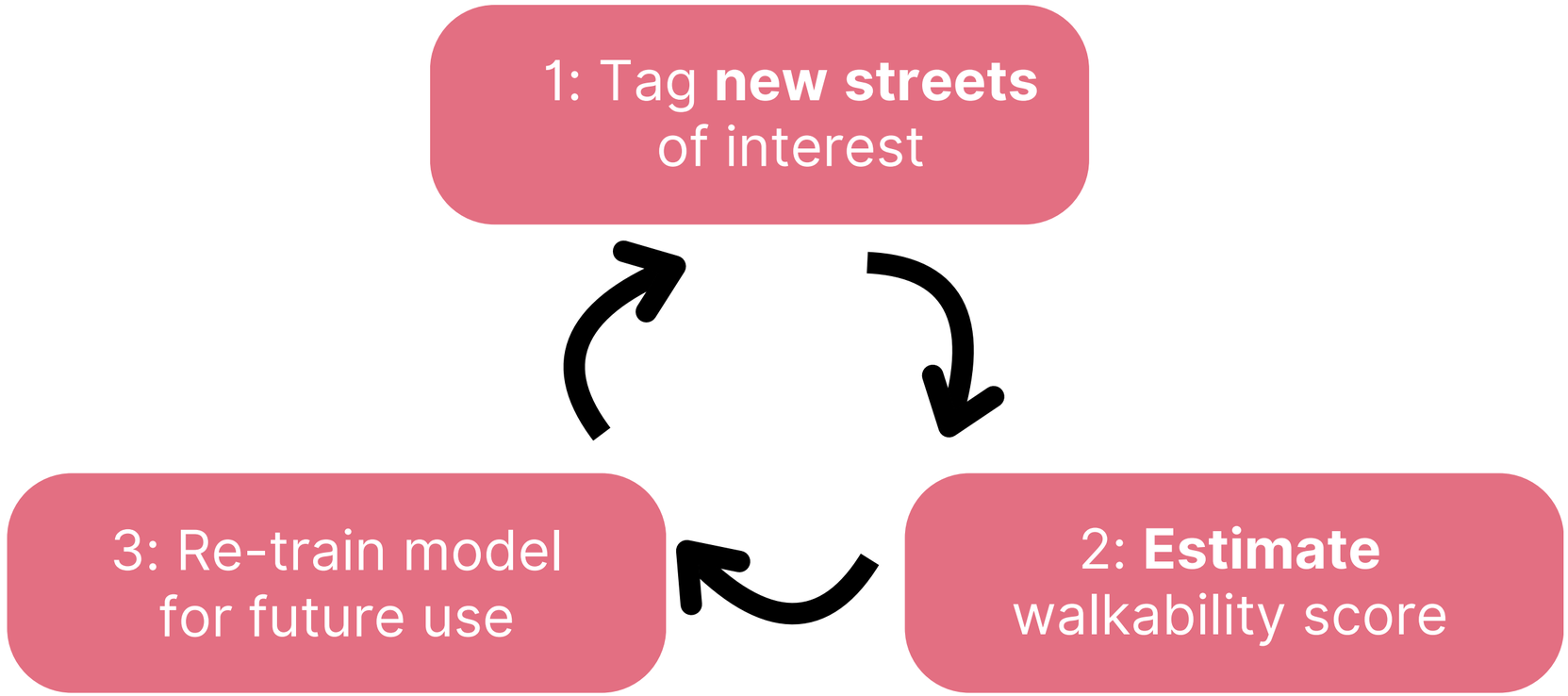
GATHER STREET DATA

TRAIN MODEL

SCORE WALKABILITY OF OTHER STREETS

ANALYZE IN HAKBANG

Cycle of Improvement



Overview

GATHER STREET DATA

TRAIN MODEL

SCORE WALKABILITY OF OTHER STREETS

ANALYZE IN HAKBANG

Infrastructural data from street-tagging

Predicted walkability scores

OpenStreetMap pedestrian network

KPIs and Validation Plan

Hakbang is already feasible and scalable. But we can **do better**.

Validation Plan

Compare before and after pedestrian volumes.

Look at ongoing pedestrian surveys to see if interventions increase walkability scores.

KPIs

- Model Accuracy
- Pedestrian Volume
- Street Coverage
- Use in Project Proposals

SMART Goals + Expansion Timeline

YEAR ONE

Implement pilot testing with 1 LGU to launch walkability assessments for at least 50 streets.

YEAR TWO

Build a machine learning model with at least 90% accuracy for scoring walkability.

YEAR THREE

Establish a sustainable data collection framework by partnering with 2 LGUs and 3 NGOs, and incorporating crowdsourcing initiatives.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Let’s move forward
one *Hakbang* at a time.

References Used

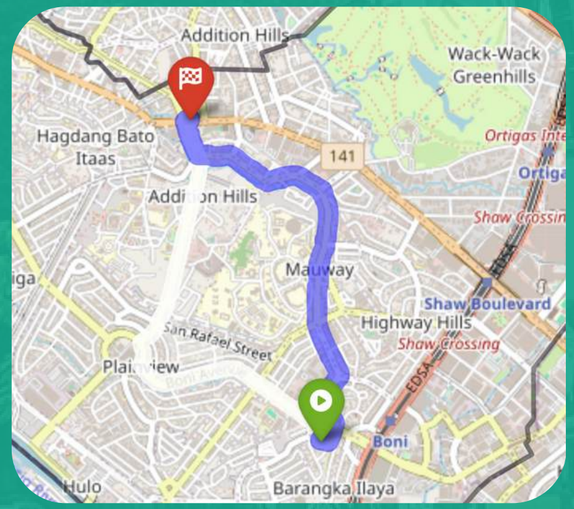
[1] Boongaling, C.G.K., Luna, D.A. & Samantela, S.S. (2022). Developing a street level walkability index in the Philippines using 3D photogrammetry modeling from drone surveys. *GeoJournal 87*, 3341–3364. https://doi.org/10.1007/s10708-021-10441-2

[2] Cervania, B.A., Dingalsan, G., Go, J.C., Wu, D.D., & Roquel, K.I.D. (2025). Integrating intersectional needs of Filipinos of different ages, disabilities, and socioeconomic classes for inclusive sidewalk design. *Asian Transport Studies 11,* 100156. https://doi.org/10.1016/j.eastsj.2024.100156

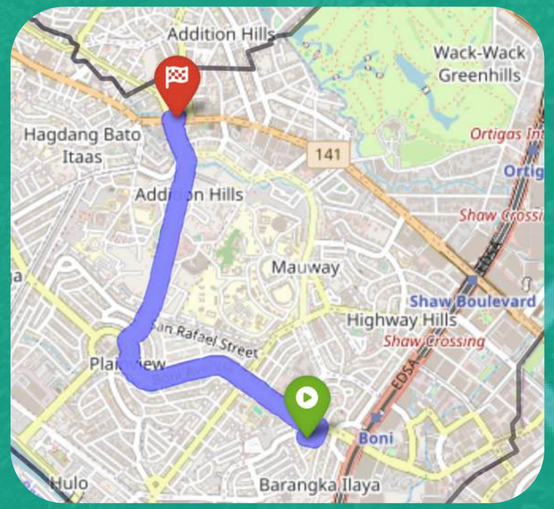
[3] Krambeck, H., & Shah, J. (2006). The global walkability index: talk the talk and walk the walk [Master's thesis, Massachusetts Institute of Technology].

[4] Reggiani, G., van Oijen, T., Hamedmoghadam, H. et al. (2022) Understanding bikeability: a methodology to assess urban networks. *Transportation 49*, 897–925. https://doi.org/10.1007/s11116-021-10198-0

For every level of sensitivity, the most likely route that a pedestrian will take is found by using the A* algorithm to minimize the cost of traversing the path.
Cost is given by [Distance + (Sensitivity x Discomfort)].



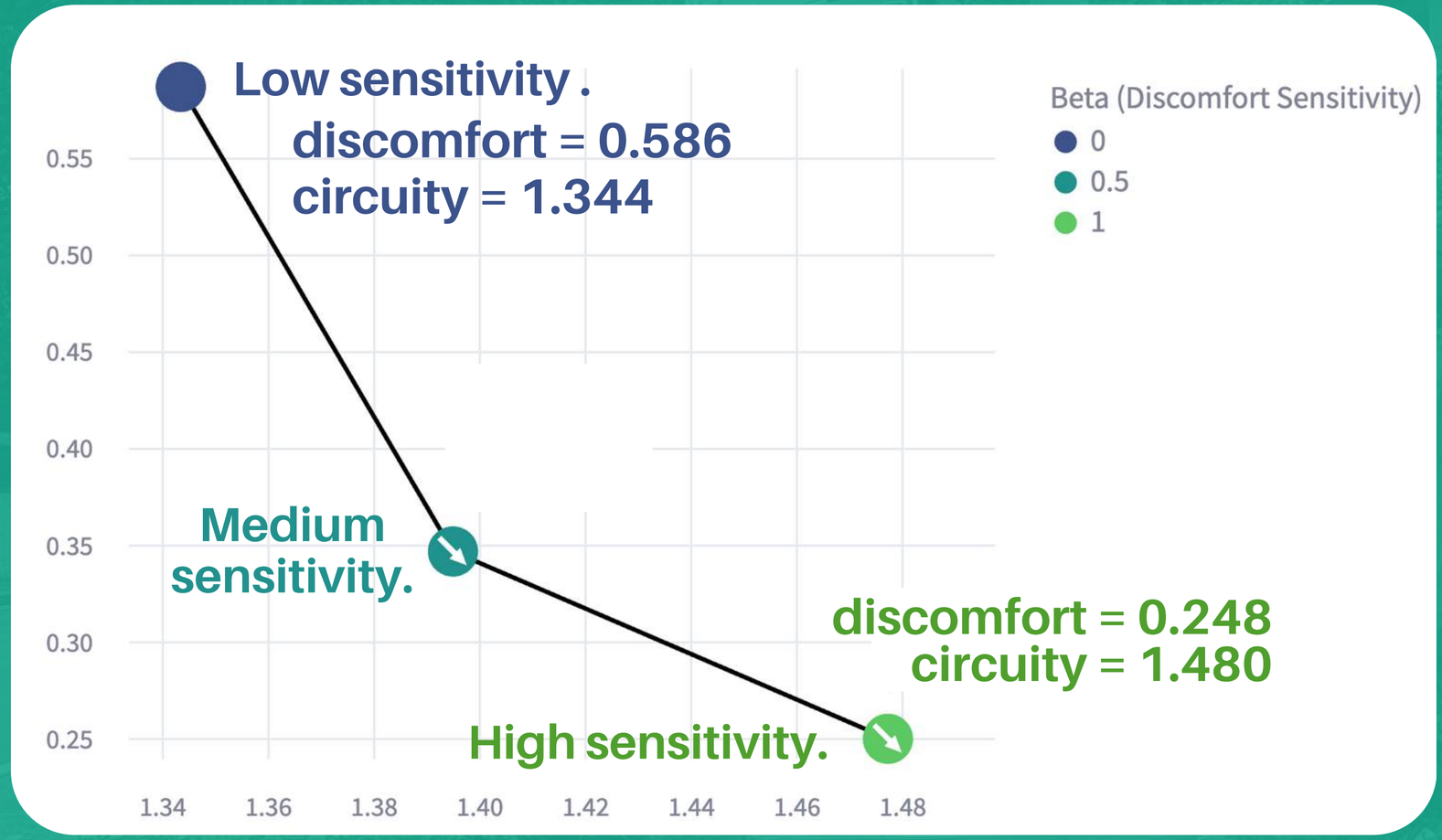
Low sensitivity (shortest route)



High sensitivity (detour)

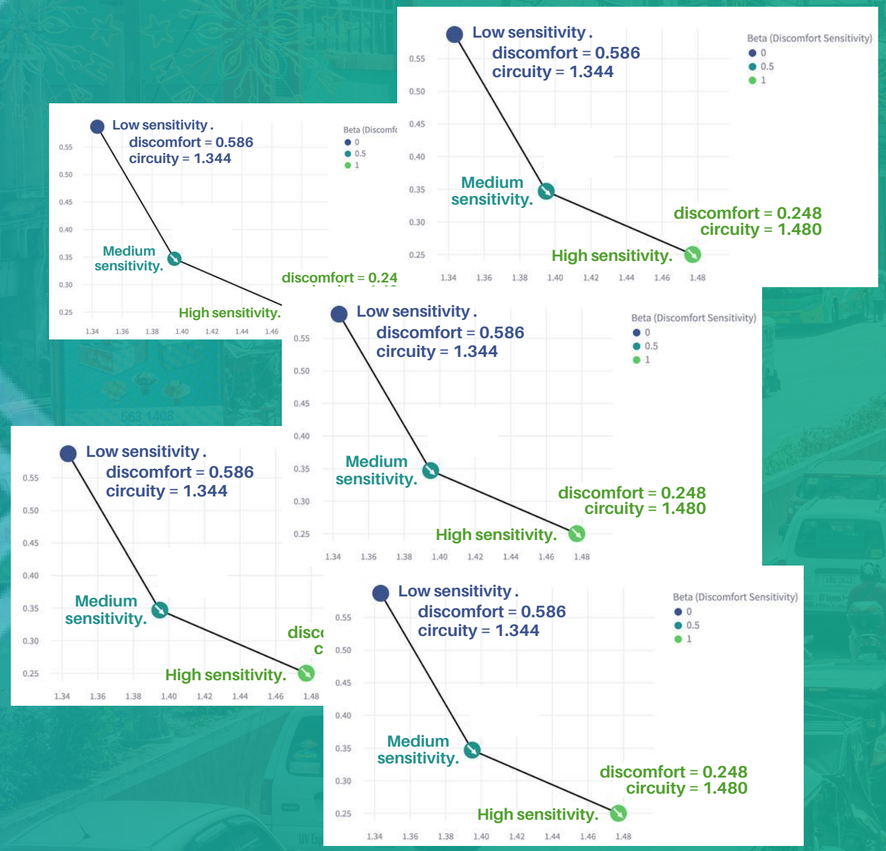
Relative Distance/ "Circuity":	**1.344**	**vs.**	**1.480**
Relative Discomfort:	**0.586**		**0.248**

The discomfort and distance for each level of sensitivity is graphed to form a walkability curve.



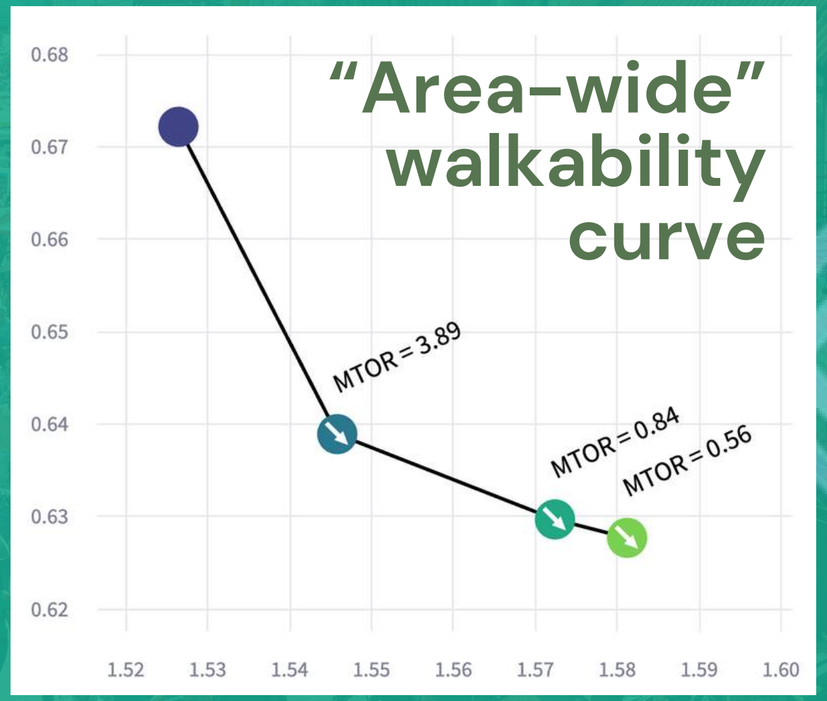
Relative Discomfort

Relative Distance or “Circuity”



Curves for different origins and destinations

Expected Value* for all origins and destinations in an area



EXAMPLE: CURVE FOR 1 BARANGAY (BRGKA. ILAYA)

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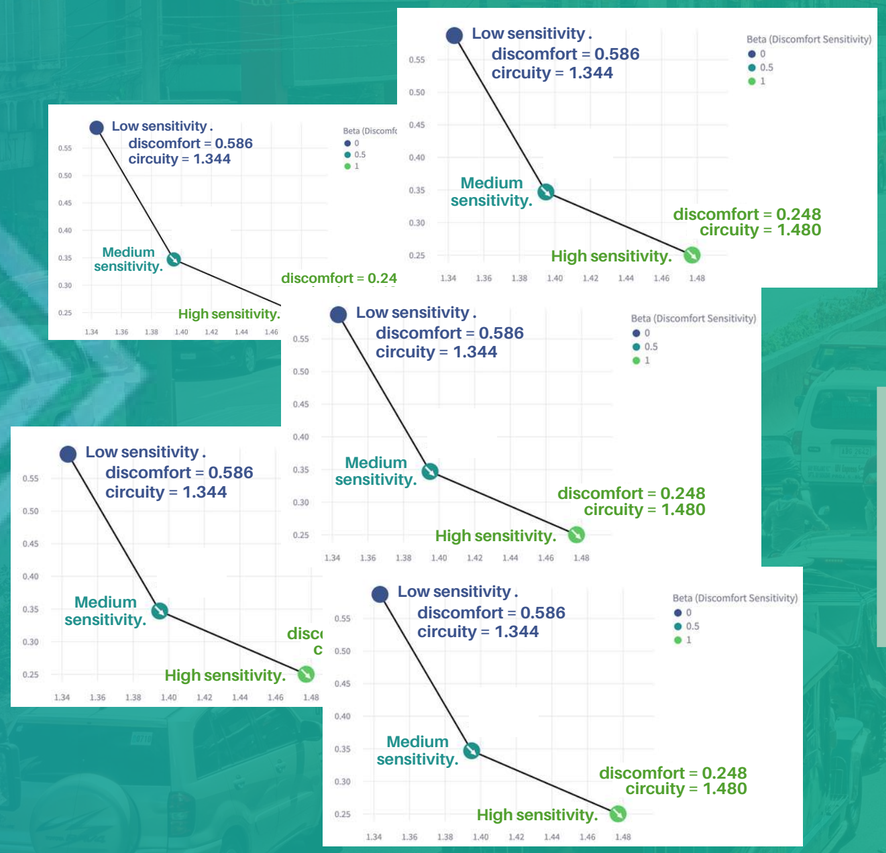
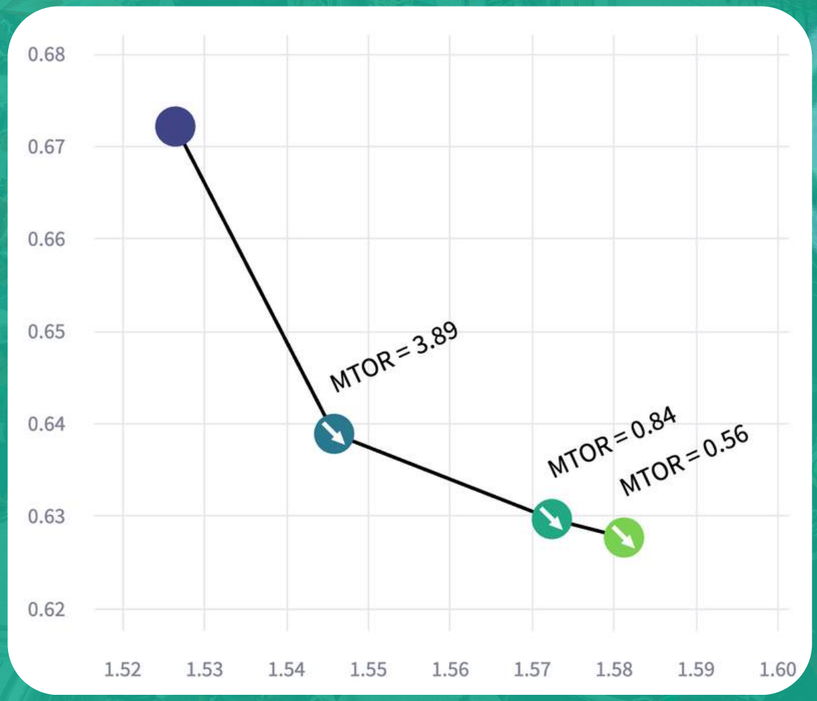


Expected Value* for all origins and destinations in an area

*Based on estimation of *demand* for cycling or walking.

"How likely is it that someone needs to travel to/from each place?"



Demand Estimation

OpenStreetMap (OSM) data
- Point of Interest (POI) data: amenities, buildings, land use
- Intersection density (higher implies more demand)

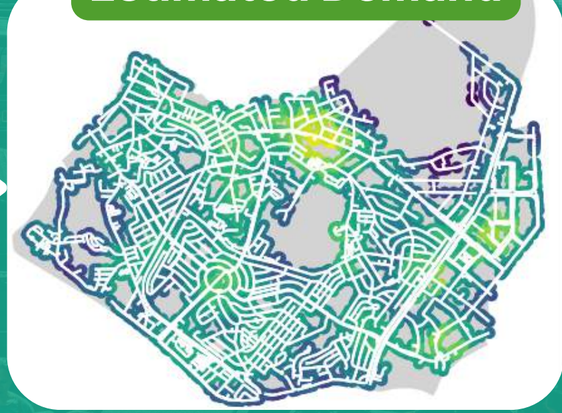
Population density data
- Obtained from Data for Good at Meta (2022)

Intersection density

Land use mix

Population density

Estimated Demand



These components are based on USA EPA (2021) and Frank et al. (2009).

Demand Estimation

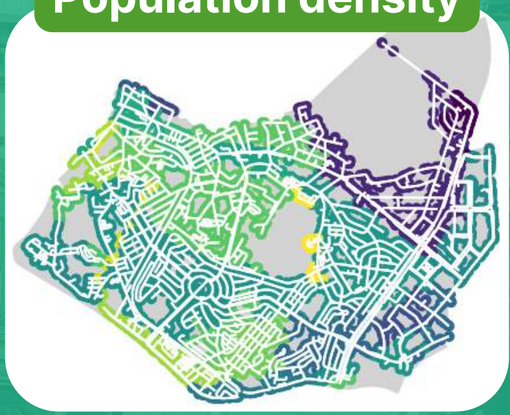
Purpose: **To ensure the relevance of our metrics**.

Certain routes in the city should matter less to our metrics because fewer people actually need to use them.

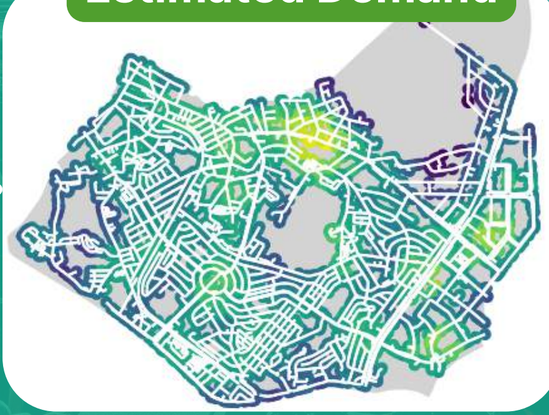
Intersection density

Land use mix

Population density

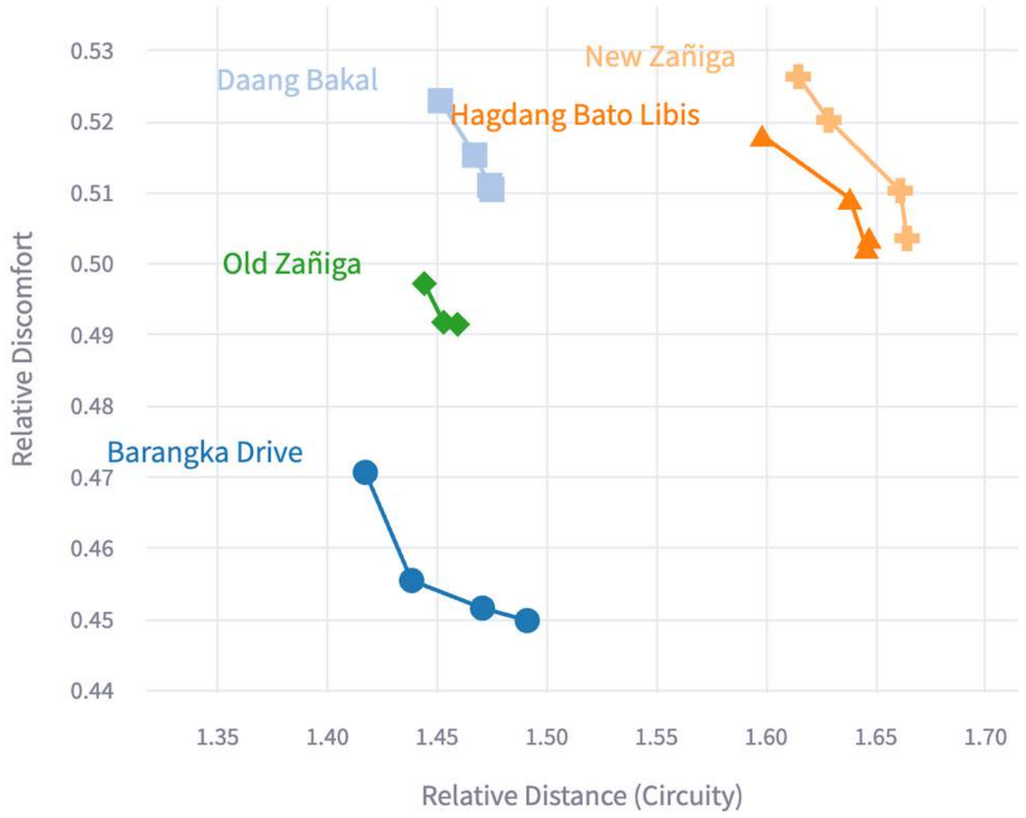


Estimated Demand



Comparing curves for different areas

EXAMPLE: CURVES FOR 5 BARANGAYS



Closer to the **bottom left** is ideal. (Lower discomfort *and* circuity.)

This plot is easy to interpret: Barangka Drive (blue) is most cyclist-friendly for within-barangay trips.

This shows that the app can be extended in the future to compare entire cities.