Beirut Community Streets

Participatory design solutions and a pedestrian impact analysis model to improve walkability in blast-affected neighborhoods.

2022–2023

City Form Lab

AMERICAN UNIVERSITY OF BEIRUT

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Contents

Summary

In response to the Beirut Blast of 2020, the MIT City Form Lab and researchers from the Civil Engineering Department of the American University of Beirut have explored walkability improvements in the blast- affected neighborhoods. The research team assembled detailed data about Beirut's built environment and land-use patterns, and used these data to develop a model of pedestrian activity in the city center for morning, lunch, and evening peak travel periods. We conducted pedestrian counts in Beirut to calibrate the model and ensure that the estimated volumes of foot-traffic correspond to the actual levels of foot-traffic on city streets during different times of the day.

Using this model as a basis for explaining pedestrian activity in the city, we convened a stakeholder workshop with community groups, civil society leaders, academics and professionals at the American University of Beirut in June 2022 to identify important challenges to walkability in the blast-affected neighborhoods, and to propose improvements and urban design interventions. A wide range of proposals from the workshop were then synthesized into six actionable scenarios by the research team. We used the pedestrian flow model to test how each of the suggested interventions would affect pedestrian accessibility to different daily destinations and restructure pedestrian flows on city streets, desirably increasing walking trips in the city. This helped the team identify the most effective strategies for improving walkability in the blast-affected neighborhoods with reasonably cost-effective interventions.

The project demonstrates how a digital model of pedestrian flows can be used to inform design and policy decisions to shape the built environment around pedestrian needs. While quantitative analysis of mobility flows has been commonplace for vehicular traffic models for decades—informing traffic regulations, development permitting, and infrastructure investments—analogous approaches to non-motorized mobility have not been commonly used so far. Beyond the six scenario proposals, the pedestrian activity model developed in this study can be used in Beirut to analyze the benefits and costs of different future urban design and infrastructure improvements to the pedestrian realm in the future.


COSCO SHIPPING
CMA CGM
EVERGREEN

Context

In August 2020, the largest civil explosion on record caused almost immeasurable damage around Beirut's Port, leaving no building, street or community in its vicinity unaffected. Many buildings were severely damaged and entire streets in the nearby neighbourhoods of Karantina, Gemmayzeh, and Mar Mikhael left in rubble, disrupting community networks and leaving the businesses that served them in debris. A large number of buildings were left uninhabitable, many businesses closed and have yet to re-open, and the added impact of the COVID-19 pandemic has been felt with restrictions on open spaces.

The blast of 2020 also added to pre-existing urban planning and public space challenges in Beirut. The Lebanese capital on the Mediterranean coast has all the critical prerequisites to make it a highly walkable city: it has a great climate, the city is dense, with a diverse and mixed land-use pattern, and many small businesses line city streets. Yet, due to complex challenges, Beirut has largely failed to deliver walkable streets with safe and comfortable sidewalks. Many streets lack proper sidewalks; where sidewalks do exist, they are often narrow, or blocked by cars and other obstructions. Crossing busy roadways can be a frightening experience with no pedestrian signals and safety islands in many places; and a lack of trees and shading make the thermal comfort a real challenge for pedestrians. The city's current mostly informal public transportation system is inadequate for pedestrians on longer journeys between neighbourhoods. and the high increases in fuel making travel by motor vehicle unaffordable for many.

(Left page) Beirut blast location as seen from Karantina Neighborhood

Overview of Beirut Context

Areas of Interest for Project

1 Hamra Neighborhood
2 American University of Beirut Campus
3 Karantina Neighborhood
4 Mar Mikhael Neighborhood
5 Port of Beirut
6 Site of Port Explosion
7 Gemmayzeh Neighborhood
8 Jeitaoui Neighborhood

Study Area


7
9
4
5
3
8

Existing Conditions for Pedestrians

Even before the blast, Beirut's pedestrian infrastructure was still underdeveloped in many parts of the city. The photos on the right depict a range of common issues, indicating conditions that present major and minor challenges, as well as acceptable qualities.

- Major Challenges
- Minor Challenges
- Acceptable

a Difficult and complex intersection with low visibility for traffic and pedestrians

b Side pavement for private use, requiring pedestrian to use the roadway

c Pedestrian bridge over highway challenging for disabled, inconvenient, and low visibility

d Large intersections near retail areas are difficult to cross due to high traffic

e Obstacles on narrow pavement

f Obstacles and cars parked along side of street

g No walkway with parked cars requiring pedestrians to walk into traffic

h Obstacles on narrow pavement requiring pedestrians to walk around

i High-traffic intersection with inadequate crosswalks

j Uneven and narraw sidewalk widths

k Narrow sidewalk width but with bollards to prevent cars parking over and trees for shade

l Adquate sidewalk area with trees for shade, but with cars parked over

m Alleyway stairs connecting difficult terrain with railings but lacking benches

n Adequate sidewalk widths and bollards with trees for shading

o Wide sidewalk promenade with benches along scenic area


i

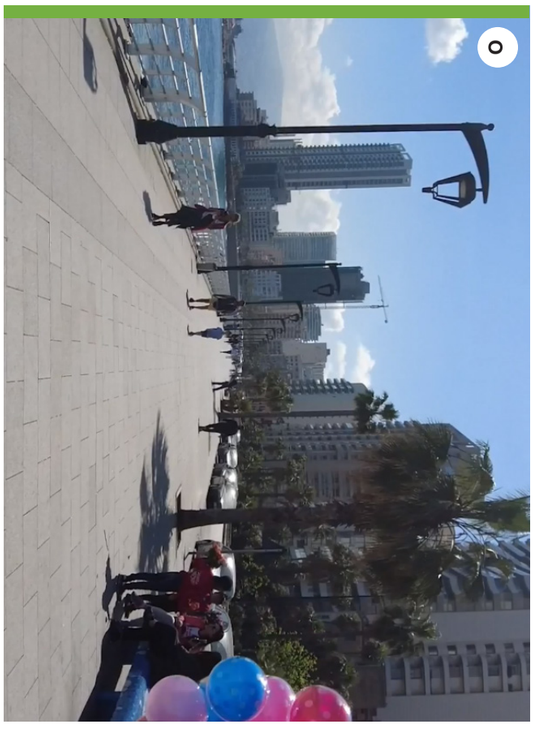

h


g


l


k


j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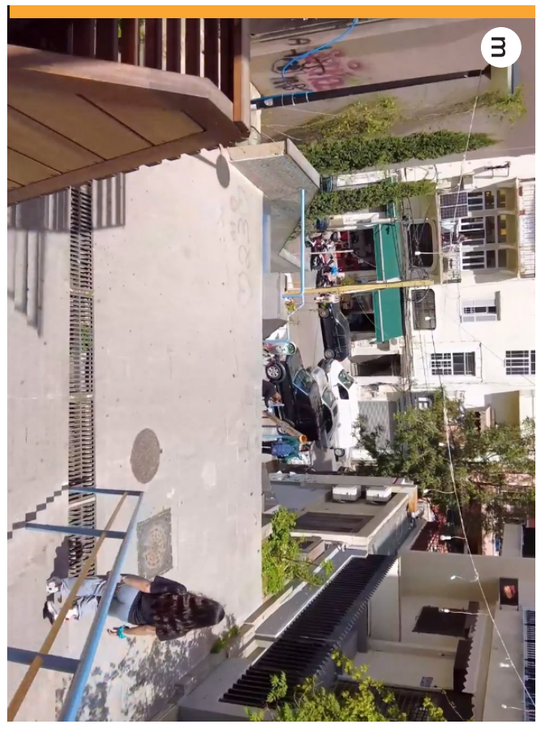

m

Map of Modeled Pedestrian Flows from Homes to Schools
Pedestrian Flows (Uncalibrated)

Map of Modeled Pedestrian Flows from Homes to Parks
Pedestrian Flows (Uncalibrated)

Map of Modeled Pedestrian Flows from Homes to Street Commerce
Pedestrian Flows (Uncalibrated)

Map of Modeled Pedestrian Flows from Street Commerce to Street Commerce
Pedestrian Flows (Uncalibrated)

Map of Modeled Pedestrian Flows from Jobs to Buses
Pedestrian Flows (Uncalibrated)

Map of Modeled Pedestrian Flows from Jobs to Worship Places
Pedestrian Flows (Uncalibrated)

Pedestrian Flow Modeling

We use Urban Network Analysis tools to model pedestrian trips in the area and optimise the selection of improvements. First, we model potential pedestrian trips between various origin-destination pairs, such as journeys from homes to jobs, homes to parks, homes to commercial establishments and so on. Second, given that existing data is fragmented and incomplete, we collected pedestrian counts on the street to calibrate the models. This results in estimated flows that match observed foot-traffic on selected streets, while also providing a more expansive estimate of pedestrian flows on all streets in the area during peak travel periods in the morning, lunch-time and evening.

The maps on the following pages illustrate modeled pedestrian flows to and from a variety of origin and destination types such as homes, jobs, schools, parks, and other potential origin-destination pairs from which a more comprehensive model of pedestrian flows can be made.

(Right page) Examples of pedestrian flow modeling from various origins and destinations

Key for maps on next page

Street Network

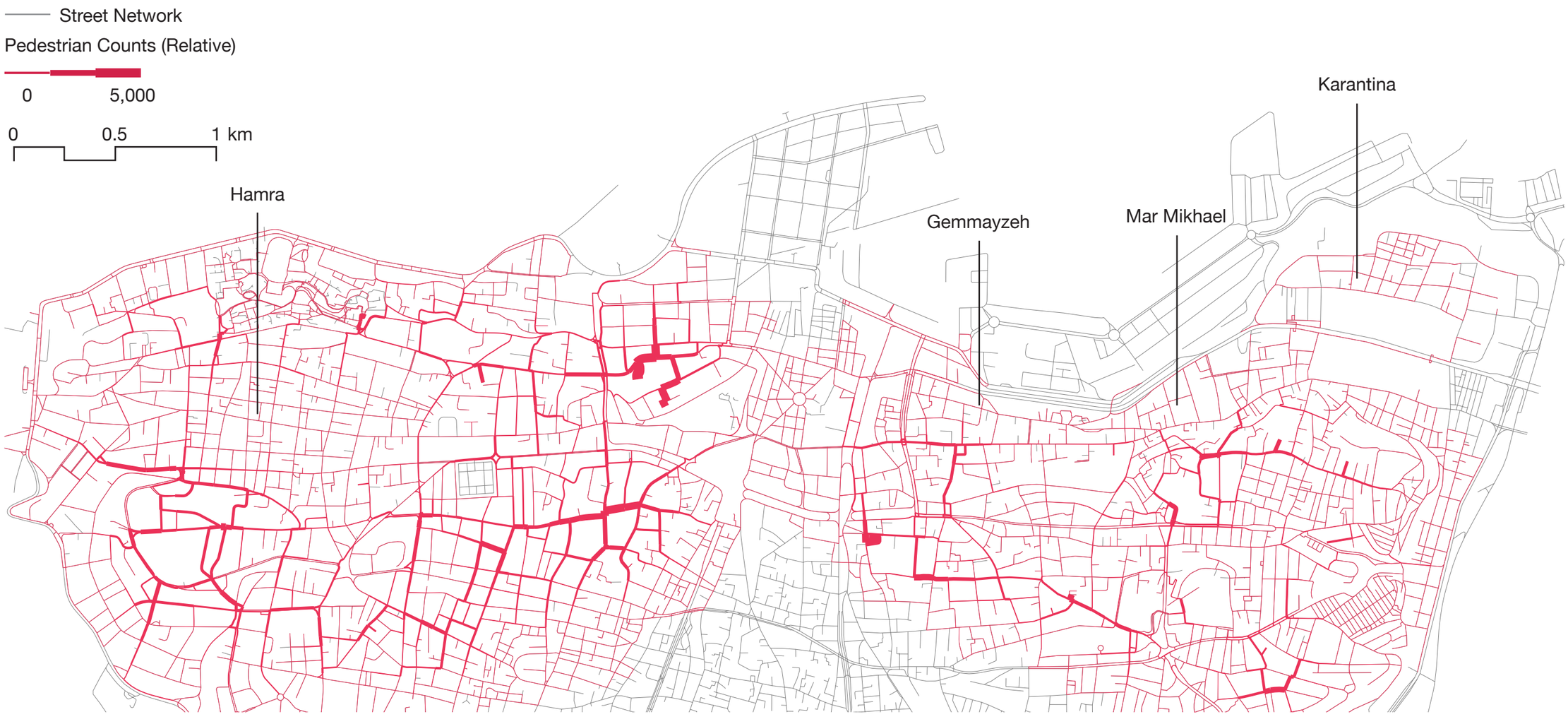
0 0.5 1 km

Example Pedestrian Flows
Homes to School

The map below illustrates pedestrian flows from homes to schools with thicker lines showing higher estimated volumes.

(Above) Pedestrian path in AUB Campus

Map of Modeled Pedestrian Flows from Homes to Schools



Example Pedestrian Flows
Retail to Retail

The map below illustrates pedestrian flows from retail to retail (such as a store on a commercial street) with thicker lines showing higher estimated volumes.

(Above) A sidewalk with retail activities near Jesuit Park

Map of Modeled Pedestrian Flows from Retail to Retail

Street Network

Pedestrian Counts (Relative)

0 100

0 0.5 1 km

Hamra

Gemmayzeh

Mar Mikhael

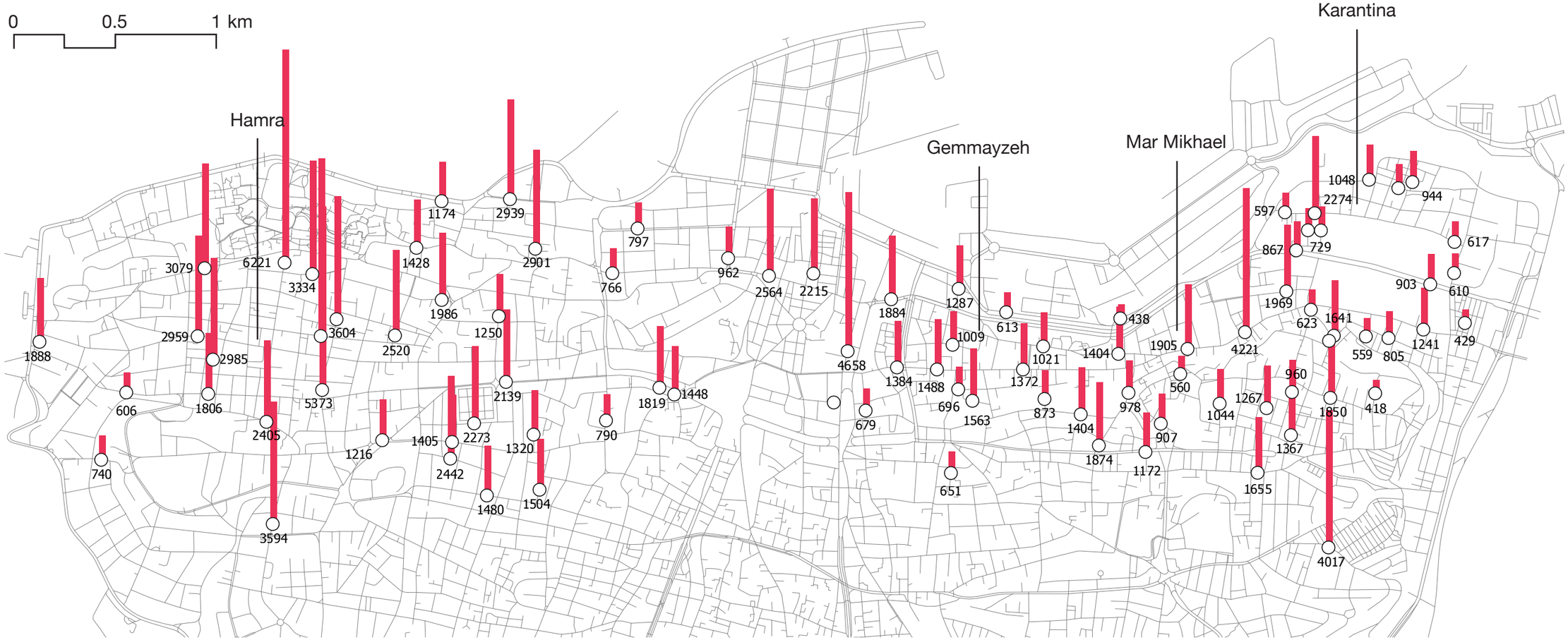
Karantina

Observed Pedestrian Counts

Counters were used to record observed pedestrian counts within peak hours in the AM, Noon, and PM travel times on weekdays. Modeled pedestrian flows are calibrated to these observed pedestrian counts.

Map of Pedestrian Counts at Weekday AM Peak Time

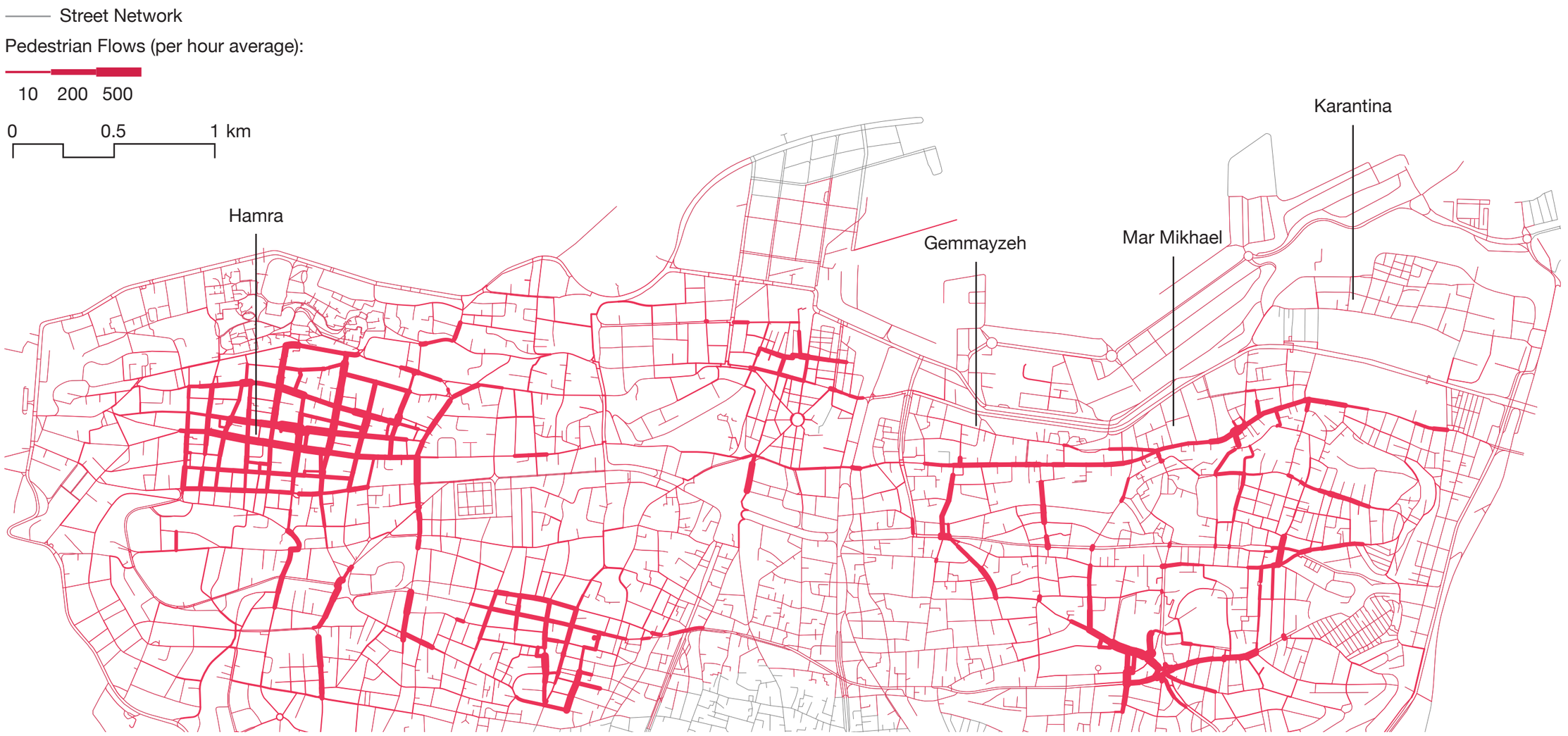
Street Network
Counter Location
Pedestrian Counts (AM peak counts)



Total Pedestrian Flows

This map illustrates the aggregate modeled pedestrian flows composed of all of the flows modeled between different origin and destination pairs.

Map of Modeled Pedestrian Flows at Weekday PM Peak Time



Beirut Community Streets Proposals

Having built a model of pedestrian flows for central Beirut, we convened a stakeholder workshop with community groups, civil society leaders, and professionals at the American University of Beirut to identify important challenges to walkability in these neighbourhoods, and to propose improvements and future urban design interventions.

Based on these assessments, the project team chose specific short-term tactical interventions that would immediately improve key walking routes in the area with minimal costs, such as improving sidewalks and pedestrian bridges along Charles Helou Highway to make them safer, more accessible, and open to surrounding neighbourhoods.

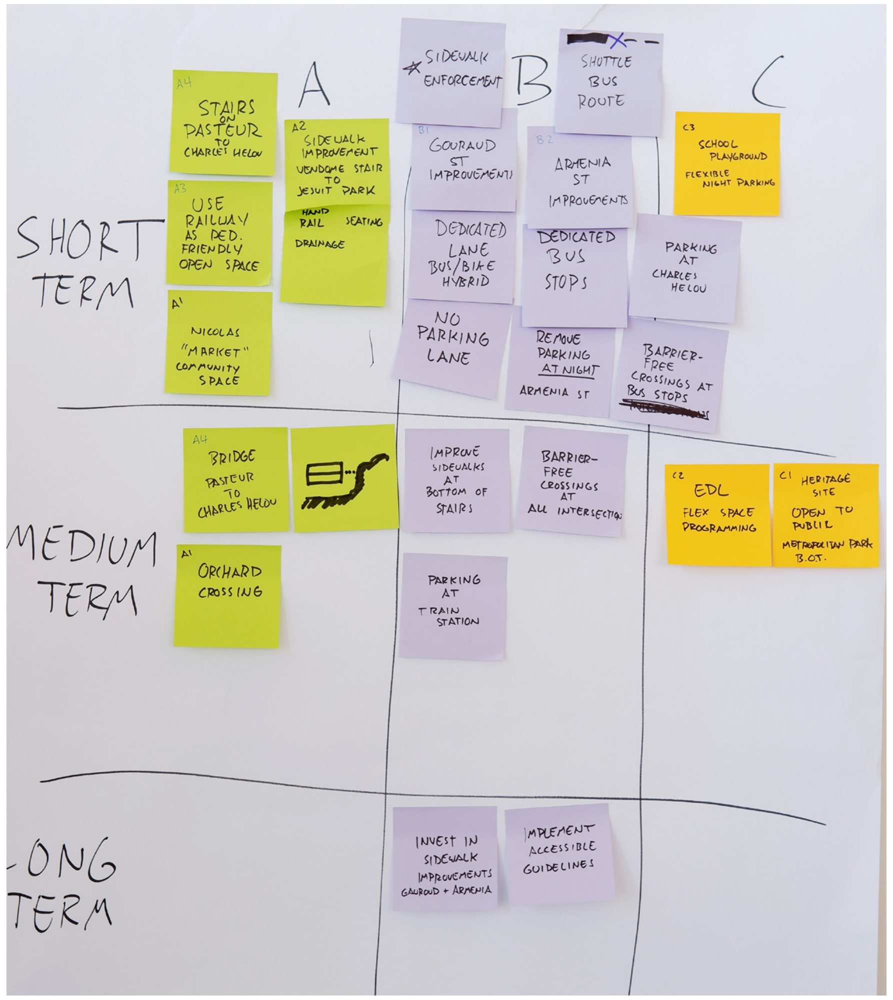
We also propose a more pedestrian friendly intersection between George Haddad and Gouraud street by introducing a raised intersection, improved signalized traffic, dedicated bus lanes, and more greenary.

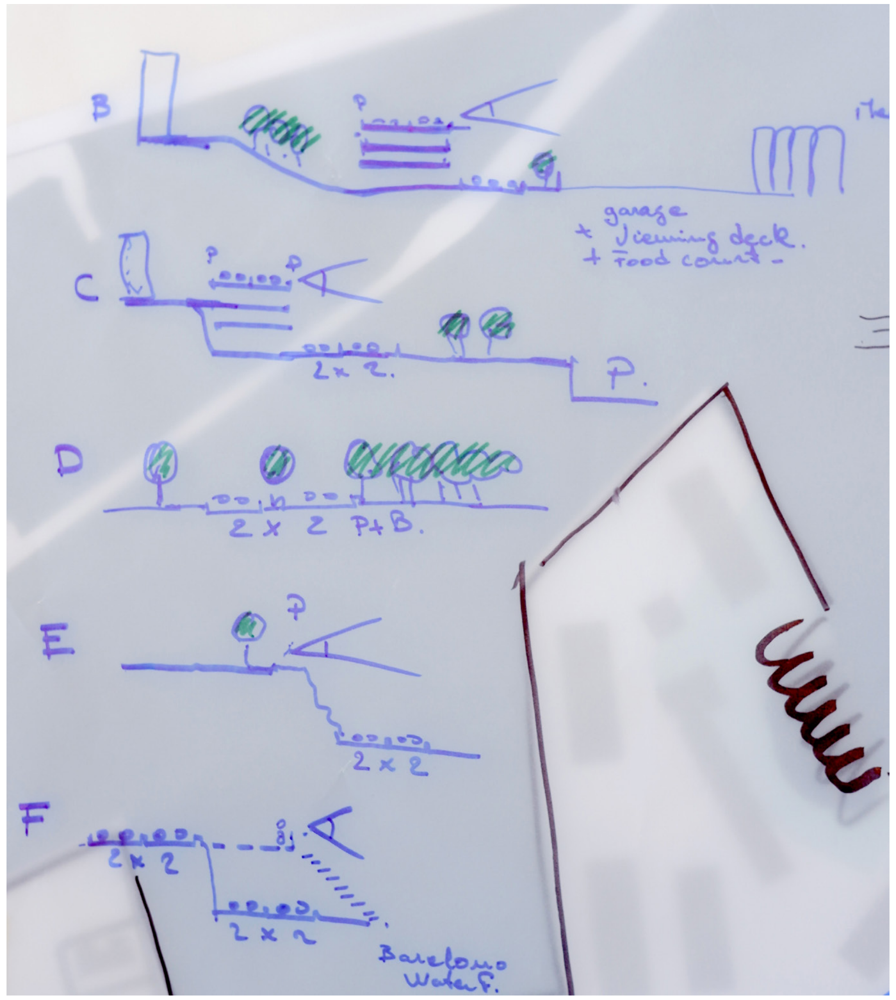
A longer-term strategy can also build on these tactical interventions, such as an even bolder vision that considers large capital projects, such as turning the Charles Helou Highway into a more humane urban boulevard, or establishing a new city park around the Gemmayzeh train station.

We used the pedestrian flow model to test how the suggested changes and interventions within each scenario would affect pedestrian accessibility to different daily destinations, and how these interventions would restructure the distribution of pedestrian flows on city streets, desirably increasing pedestrian journeys in the city.

(Left page) Teams discuss their proposed interventions and present to the workshop audience at American University of Beirut


1 KARANTINA
2 CHARLES HELOU
3 GOURAUD-ARMENIA
4 MAR MAROUN - NKOULA
5 HIKMEH - MUSTASHFA
6 JEITAOUI


A
B
C
SHORT TERM
MEDIUM TERM
ONG TERM
STAIRS PASTEUR TO CHARLES HELOU
SIDEWALK ENFORCEMENT
SHUTTLE BUS ROUTE
SCHOOL PLAYGROUND
USE RAILWAY AS DED. FRIENDLY OPEN SPACE
GOURAUD ST IMPROVEMENT
ARMENIA ST IMPROVEMENTS
DEDICATED LANE BUS/BIKE HYBRID
DEDICATED BUS STOPS
PARKING AT CHARLES HELOU
NO PARKING LANE
REMOVE PARKING AT NIGHT
BARRIER-FREE CROSSINGS AT BUS STOPS
BRIDGE PASTEUR TO CHARLES HELOU
ORCHARD CROSSING
EDL FLEX SPACE PROGRAMMING
PARKING AT TRAIN STATION
INVEST IN SIDEWALK IMPROVEMENTS
IMPLEMENT ACCESSIBLE GUIDELINES


B
C
D
E
F
2 x 2
2 x 2 P+B.
garage + viewing deck. + Food court -

Proposals

The workshop identified numerous pedestrian walkability interventions, which were then organized into a series of scenarios to better visualize and evaluate the impact of each intervention set. These scenarios are loosely classified as short-term and long-term proposals, with the latter typically corresponding to higher scenario numbers.

Scenario 1: Implement basic pedestrian mobility improvements, such as a 30 km/h speed limit, intersection upgrades, and pedestrian bridge enhancements.

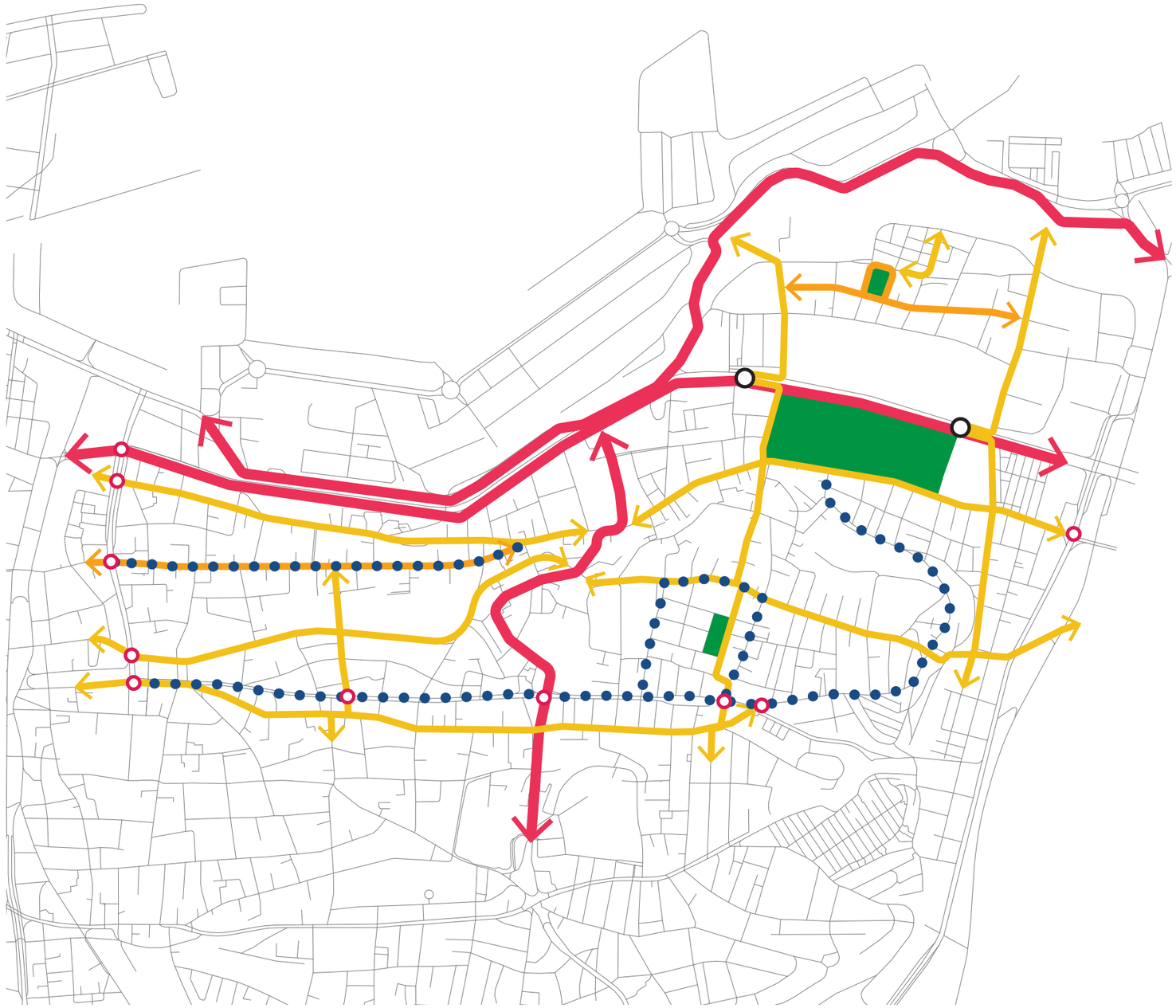
Scenario 2: Enhance walkability by building upon Scenario 1 and adding wider sidewalks, greenery, urban furniture, and increased amenities.

Scenario 3: Integrate a shuttle loop into Scenario 2's enhanced walkability features.

Scenario 4: Reopen closed parks and introduce a new park in Karantina, in addition to the enhancements from Scenario 2.

Scenario 5: Focus on street pedestrianization and the Fouad Boutros corridor improvements, while incorporating Scenario 4's park updates.

Scenario 6: Transform Charles Helou into an urban boulevard, create a Karantina pedestrian promenade, and open Mar Mikhael Station Park, while building on Scenario 5's improvements.



(Left page) Examples of team sketches and proposals at the workshop at American University of Beirut

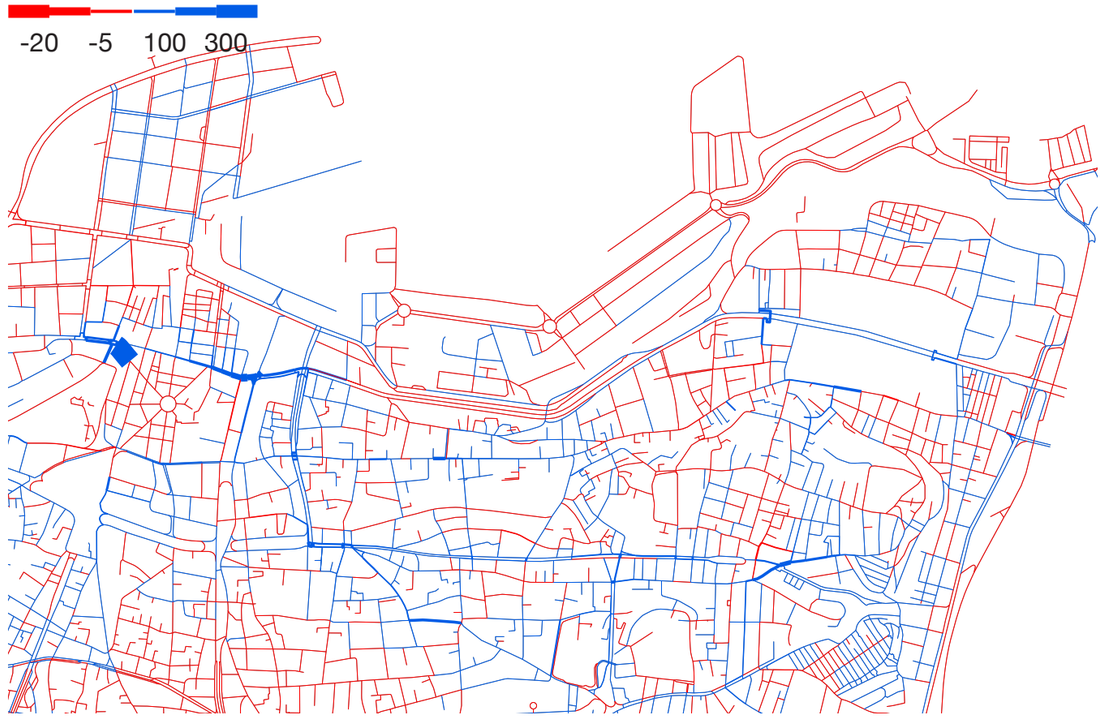
Overview of Scenarios

The maps presented here use blue to indicate areas where a specific urban design scenario increases foot traffic on streets, while red highlights areas where pedestrian activity decreases due to the introduction of new destinations or improved streets attracting pedestrians away from certain areas.

These models serve as valuable tools, offering metrics and visualizations that effectively communicate community priorities to technical experts and decision-makers. They illustrate the advantages of targeted urban design interventions, such as enhancing street safety and accessibility, expanding ground floor retail space, or improving public transit access.

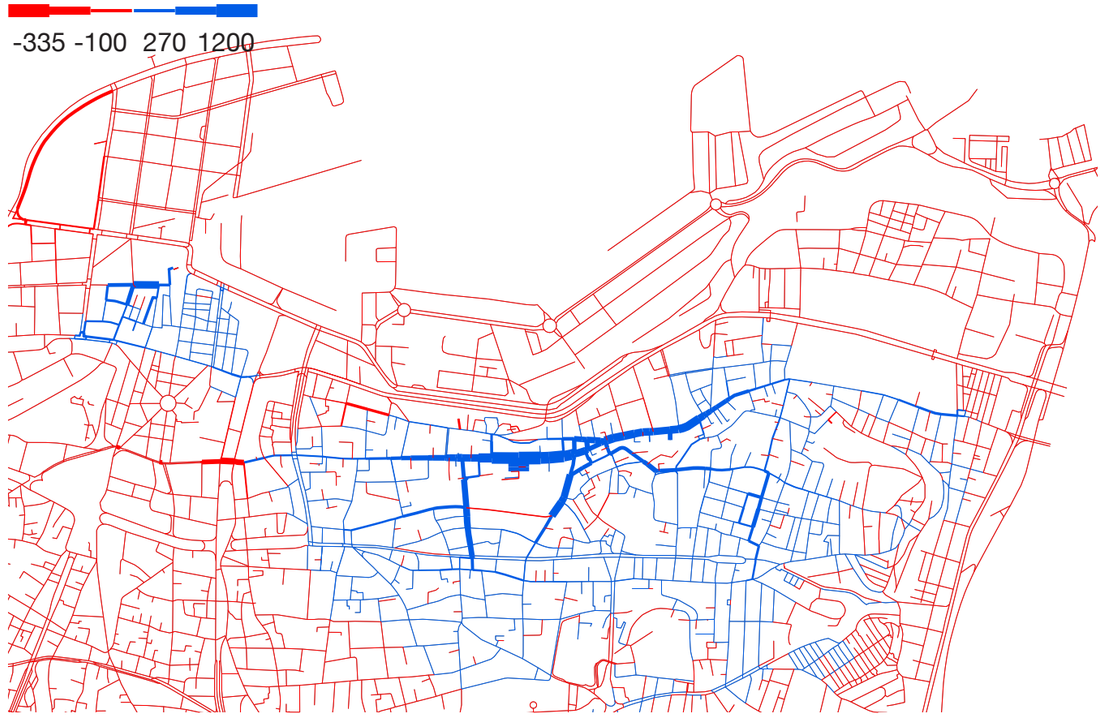
Map of Pedestrian Volume Changes from Baseline to Scenario 1

Pedestrian Flow Change



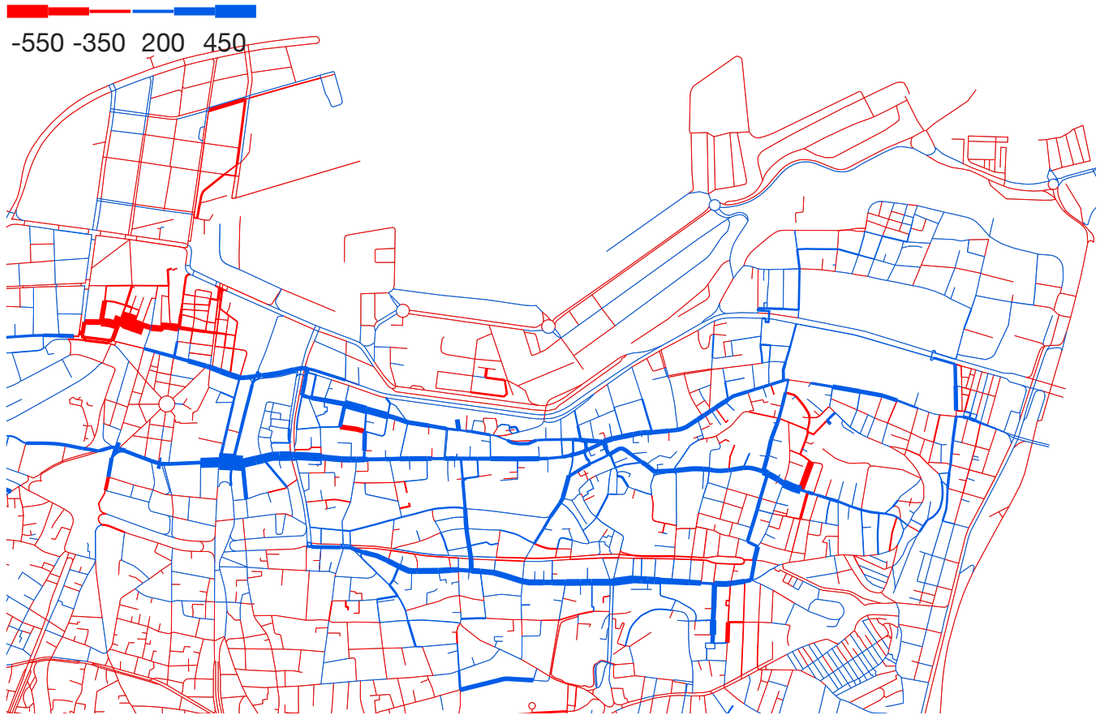
Map of Pedestrian Volume Changes from Scenario 3 to Scenario 4

Pedestrian Flow Change



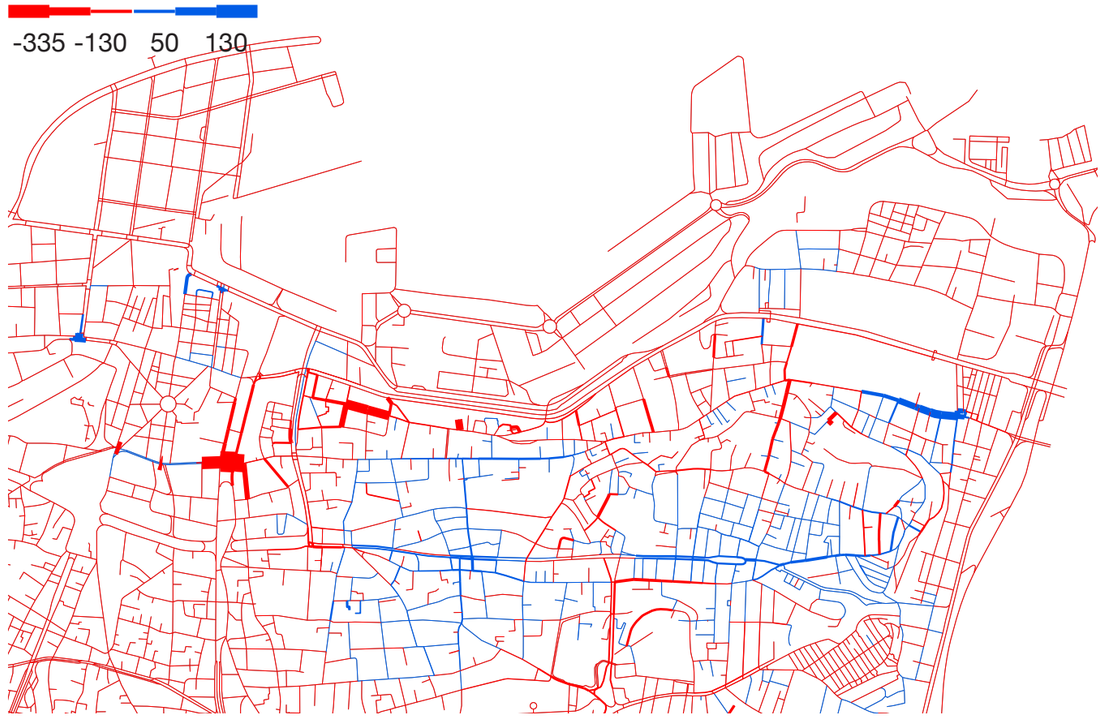
Map of Pedestrian Volume Changes from Scenario 1 to Scenario 2

Pedestrian Flow Change



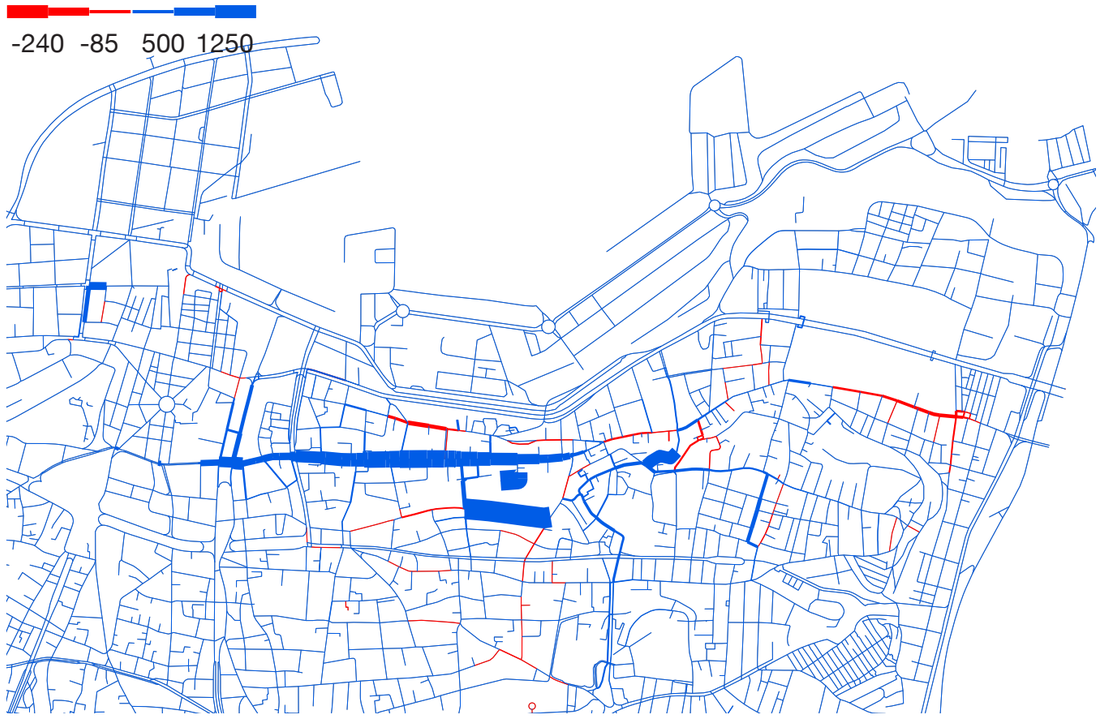
Map of Pedestrian Volume Changes from Scenario 2 to Scenario 3

Pedestrian Flow Change



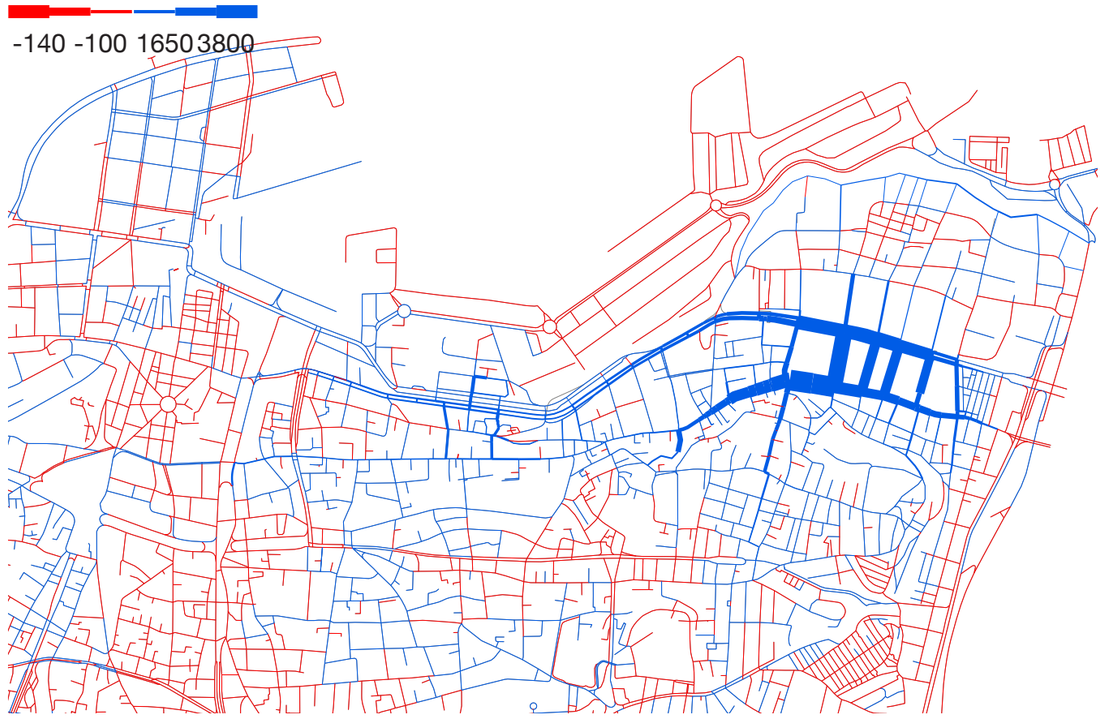
Map of Pedestrian Volume Changes from Scenario 4 to Scenario 5

Pedestrian Flow Change



Map of Pedestrian Volume Changes from Scenario 2 to Scenario 3

Pedestrian Flow Change



Example from Scenario 1

Pedestrian Overpass at Charles Helou Highway

Scenario 1: Implement basic pedestrian mobility improvements, such as a 30 km/h speed limit, intersection upgrades, and pedestrian bridge enhancements.

Pedestrian Bridge Enhancements

Intersection Upgrades

Proposal Location

Existing Streetscape at Charles Helou Pedestrian Overpass

a Challenging and inconvenient pedestrian overpass

b Narrow sidewalk at the side of fast traffic

c Use of side of road blocking bus pickup

d Obstruction along neighborhood side of road


a
b
c
SERRURE
COFFRE FORT
PORTE BLINDÉE
WU
Western Union

Example from Scenario 1

Pedestrian Overpass at Charles Helou Highway

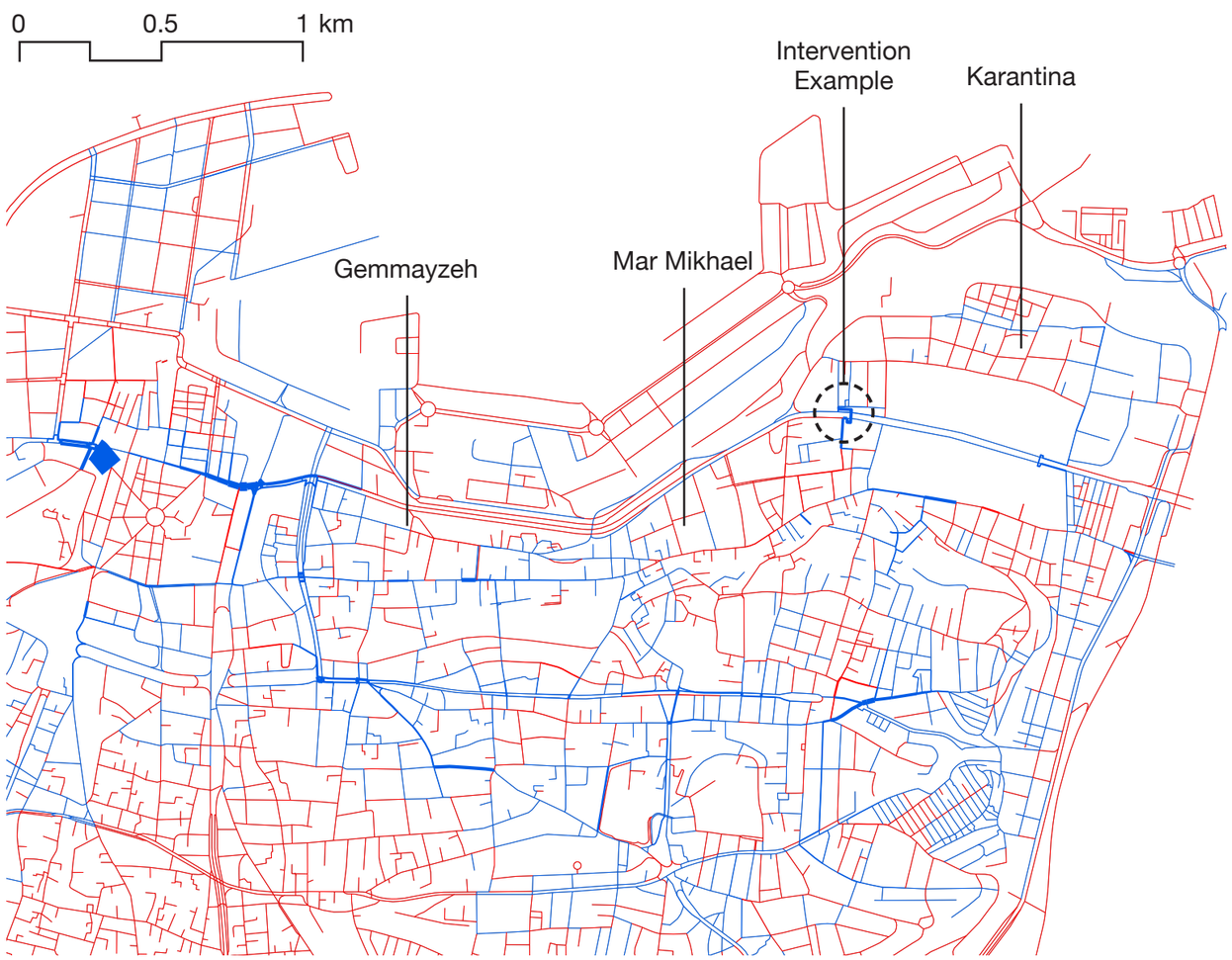
Post-intervention Pedestrian Flows

Street Network

Pedestrian Flow Change

-20 -5 100 300

0 0.5 1 km



Proposed Intervention at Charles Helou Pedestrian Overpass

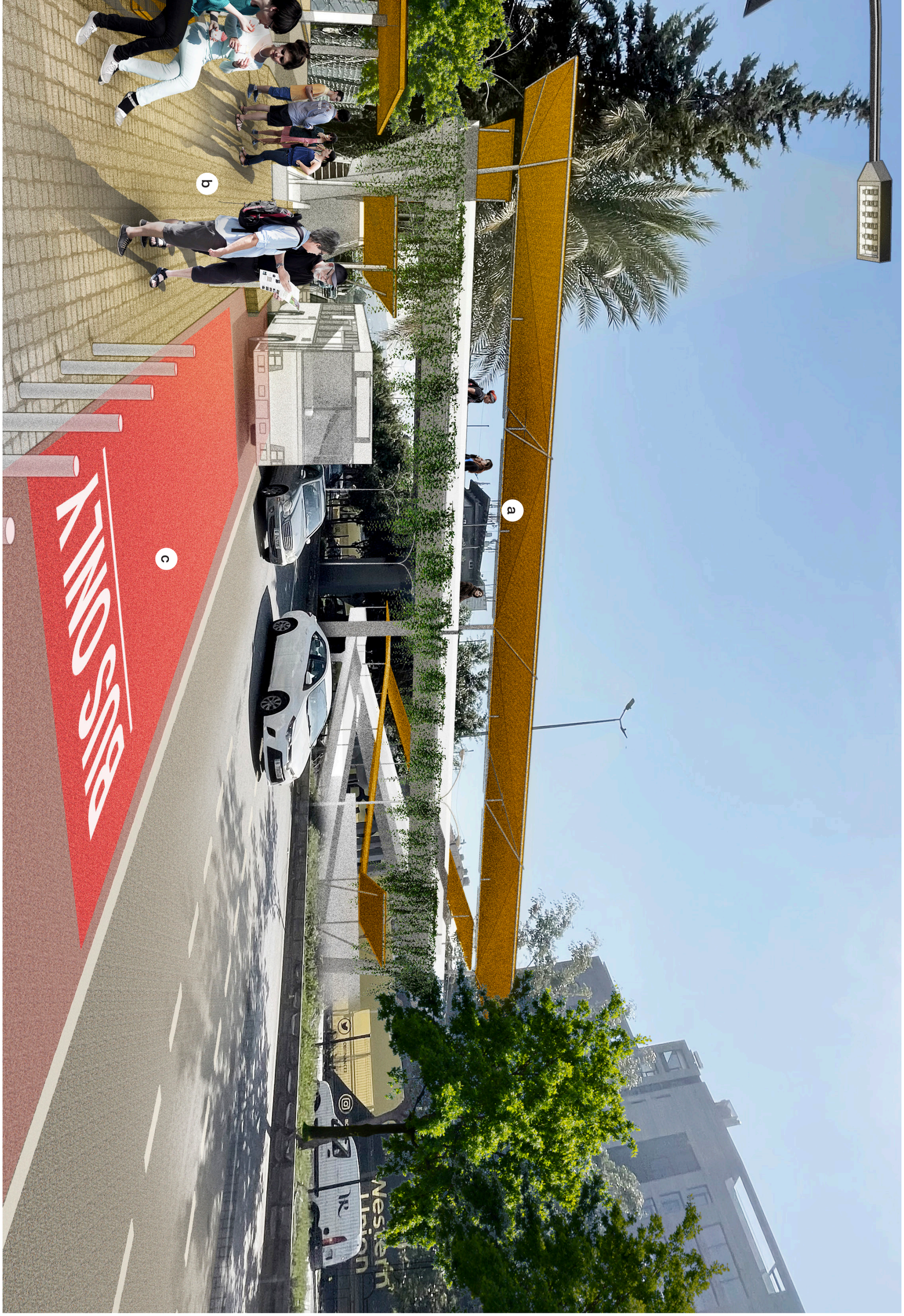
a Redesigned pedestrian overpass for wheelchair ramps, covered bridge, and more visibility for safety.

b Widen sidewalk

c Paint area on side of road for designated bus pickup and bollards along sidewalk

d Covered bus waiting area

e Clearing of obstruction and added pedestrian crosswalk into adjacent neighborhood


a
b
c
Western Union

Example from Scenario 2

Pedestrianize Intersection at Goroud Street and Armenia Street

Scenario 2: Enhance walkability by building upon Scenario 1 and adding wider sidewalks, greenery, urban furniture, and increased amenities.

Sidewalk Improvements

Proposal Location

Existing Streetscape at Gouraud Street and Armenia Street

a Poor pedestrian infrastructure and lack of accessible features

b Wide streets with no clearly marked areas for pedestrian crossing

c Extensive car parking taking over much of the sides of the street

d Lack of outward engagement between storefronts and streetscape


a
b
c
d

Example from Scenario 2

Pedestrianize Intersection at Gouraud Street and Armenia Street

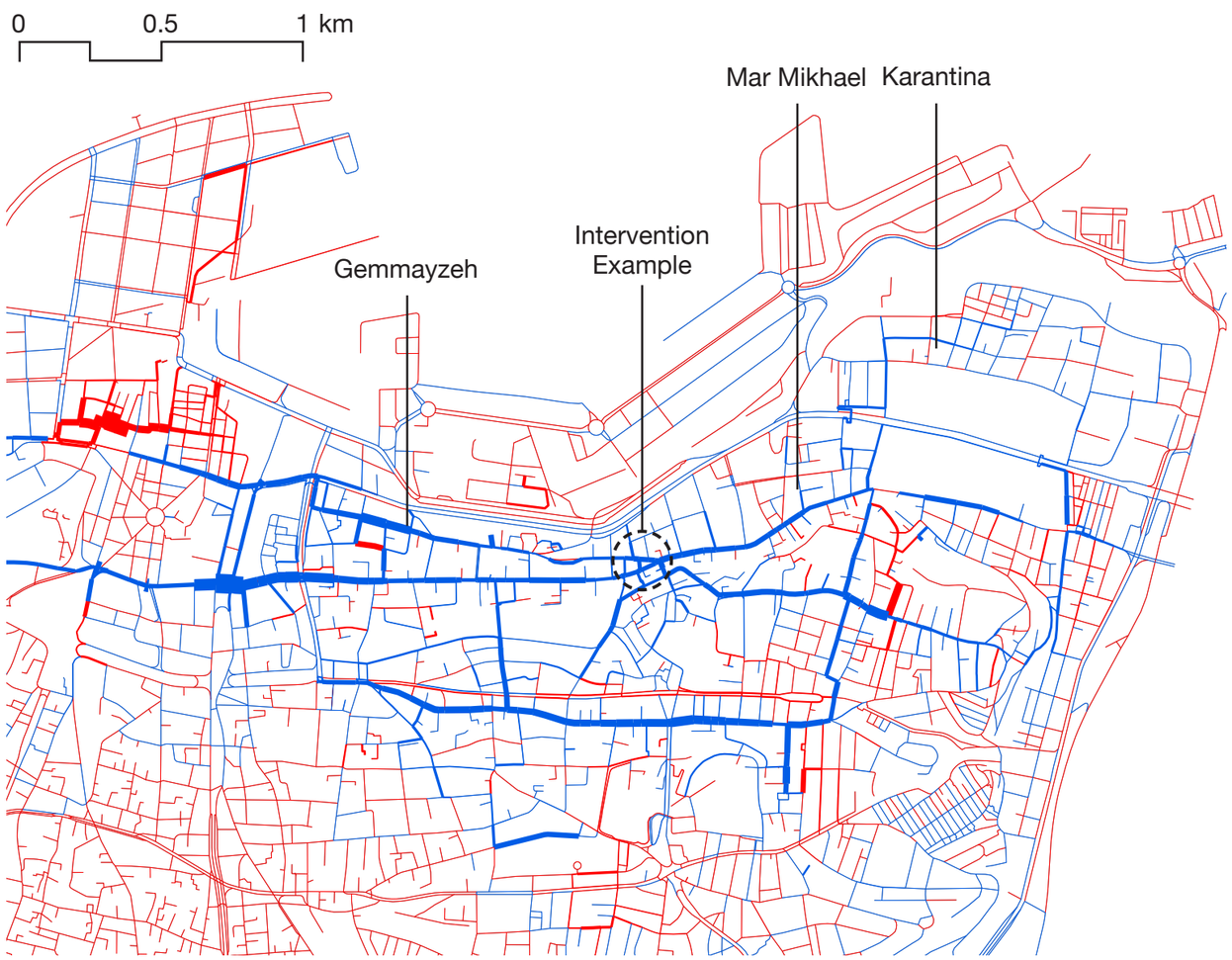
Post-intervention Pedestrian Flows

Street Network

Pedestrian Flow Change

-550 -350 200 450

0 0.5 1 km



Proposed Intervention at Gouraud Street and Armenia Street

a Create plaza for seating and greater pedestrian accessibility

b Add speed table or raised intersection for pedestrian crossing and safety

c Extend sidewalk width and add baulistrades or planters to protect edge from car parking

d Create designated parking spaces

e Promote greater outward engagement between pedestrian realm and storefronts


a
b
c
c
d
e

Example from Scenario 3

Pedestrian Intersection at George Haddad Road and Add Shuttle Loop

Scenario 3: Integrate a shuttle loop into Scenario 2's enhanced walkability features.

Sidewalk Improvements

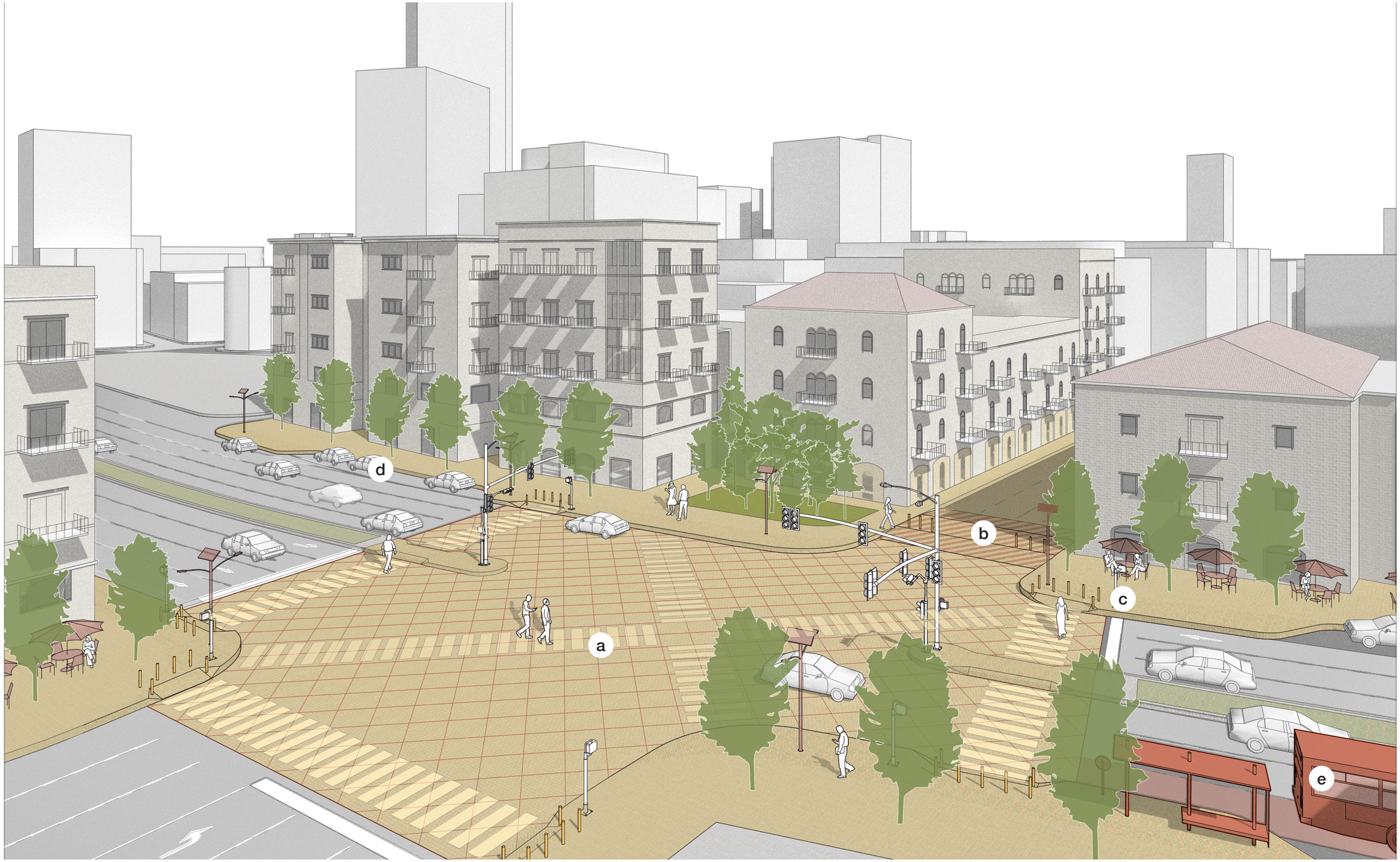
New Shuttle Loop

Proposal Location

Existing Streetscape at George Haddad Intersection

a Unfriendly and dangerously long pedestrian crossings

b Wide roadways and limited sidewalks



Proposed Intervention at George Haddad Intersection

a Paint intersection to articulate special zone for pedestrian crossing

b Create raised crosswalk for pedestrian safety and balustrades to prevent non-emergency vehicles from entering

c Extend sidewalk width and add baulistrades or planters to protect edge from car parking

d Create designated parking spaces

e Create shuttle loop to bring pedestrians around commercial areas on Armenia and Gouraud Streets

Example from Scenarios 4 and 5

Pedestrianize Streetscape around Karantina Park

Existing Streetscape at Charles Helou Highway and Karantina (Left)

a Karantina Park is closed to the public

b Charles Helou Highway presents a major barrier between Karantina and other neighborhoods

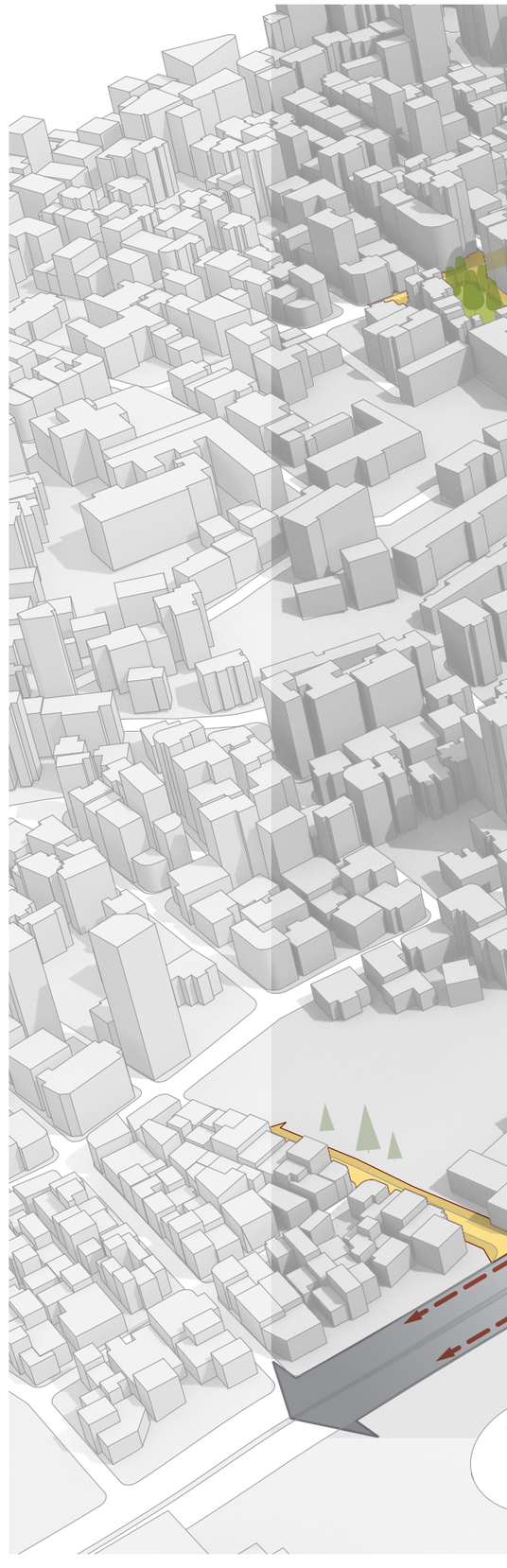
Proposed Interventions at Charles Helou Highway and Karantina (Right)

a Open up Karantina Park for the public

b Pedestrianize Senegal Street around Karantina Park

c Create pedestrian improvements around Karantina neighbrohood with wider sidewalks and street trees

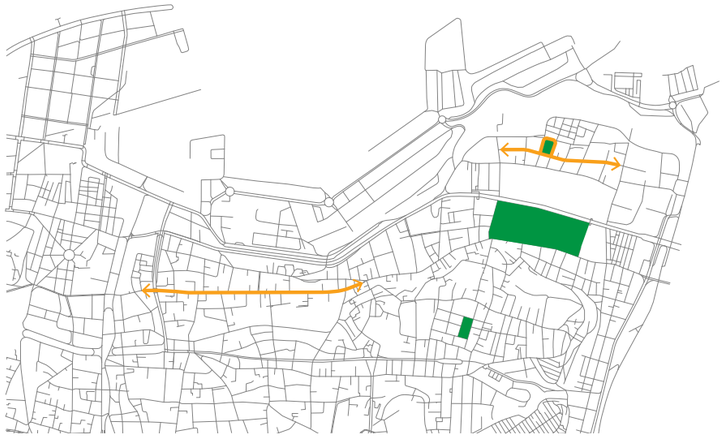
d Redesign pedestrian overpass over Charles Helou Highway with bus line connection (see scenario 1)



Proposal Location

Reopen Closed Parks

Street Pedestrianization



Scenario 4: Reopen closed parks and introduce a new park in Karantina, in addition to the enhancements from Scenario 2.

Scenario 5: Focus on street pedestrianization and the Fouad Boutros corridor improvements, while incorporating Scenario 4's park updates.


CHARLES HELOU
a
b
c
d

Example from Scenario 6

“Boulevardize” Charles Helou Highway and Create Integrated Parkscape

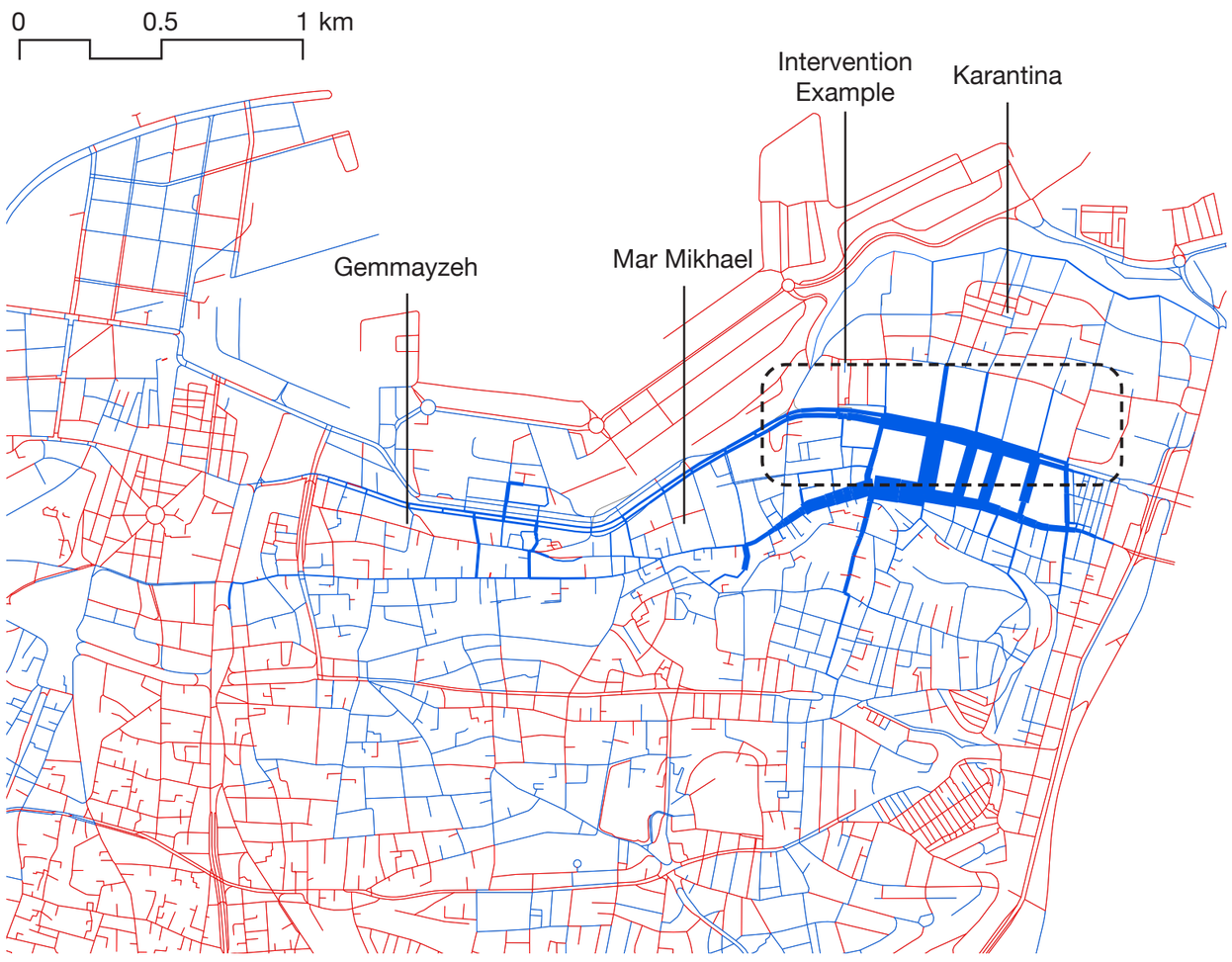
Post-intervention Pedestrian Flows

Street Network

Pedestrian Flow Change

-140 -100 1650 3800

0 0.5 1 km



Existing Streetscape at Charles Helou Pedestrian Overpass

a Open up Karantina Park for the public (see scenario 4)

b Pedestrianize Senegal Street around Karantina Park (see scenario 5)

c Create pedestrian improvements around Karantina neighbrohood with wider sidewalks and street trees (see scenario 5)

d Turn Charles Helou Highway into a boulevard with adequate pedestrian improvements including increased sidewalk widths, signalized crossing areas, street trees, and painted bus areas

e Create Mar Mikhael Station Park as a connective park between the new boulevard and Karantina neighborhood and other neighborhoods


a
b
c
d
e

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