







# Rapid & Reliable Building Assessment



WORLD BANK GROUP





## MEDICAL TRIAGE

The process of sorting people based on their need for immediate medical treatment as compared to their chance of benefiting from such care.



## HOUSING TRIAGE

The process of sorting housing units based on their need for immediate intervention and its associated economic and technical feasibility.

SE VENDE  
ESTA PROPIEDAD  
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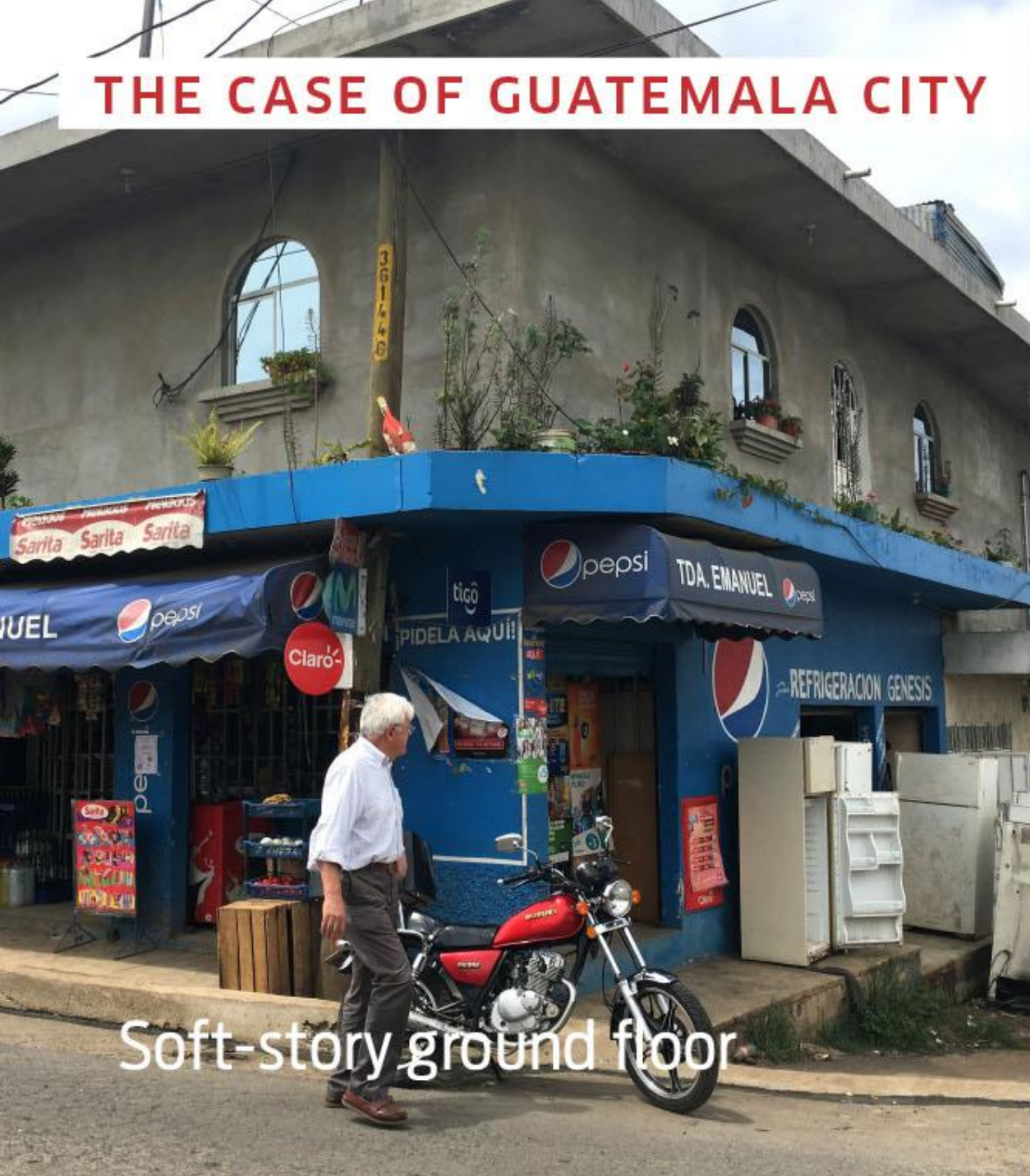
## SOFT-STORY BUILDINGS



School in Mexico City



# THE CASE OF GUATEMALA CITY



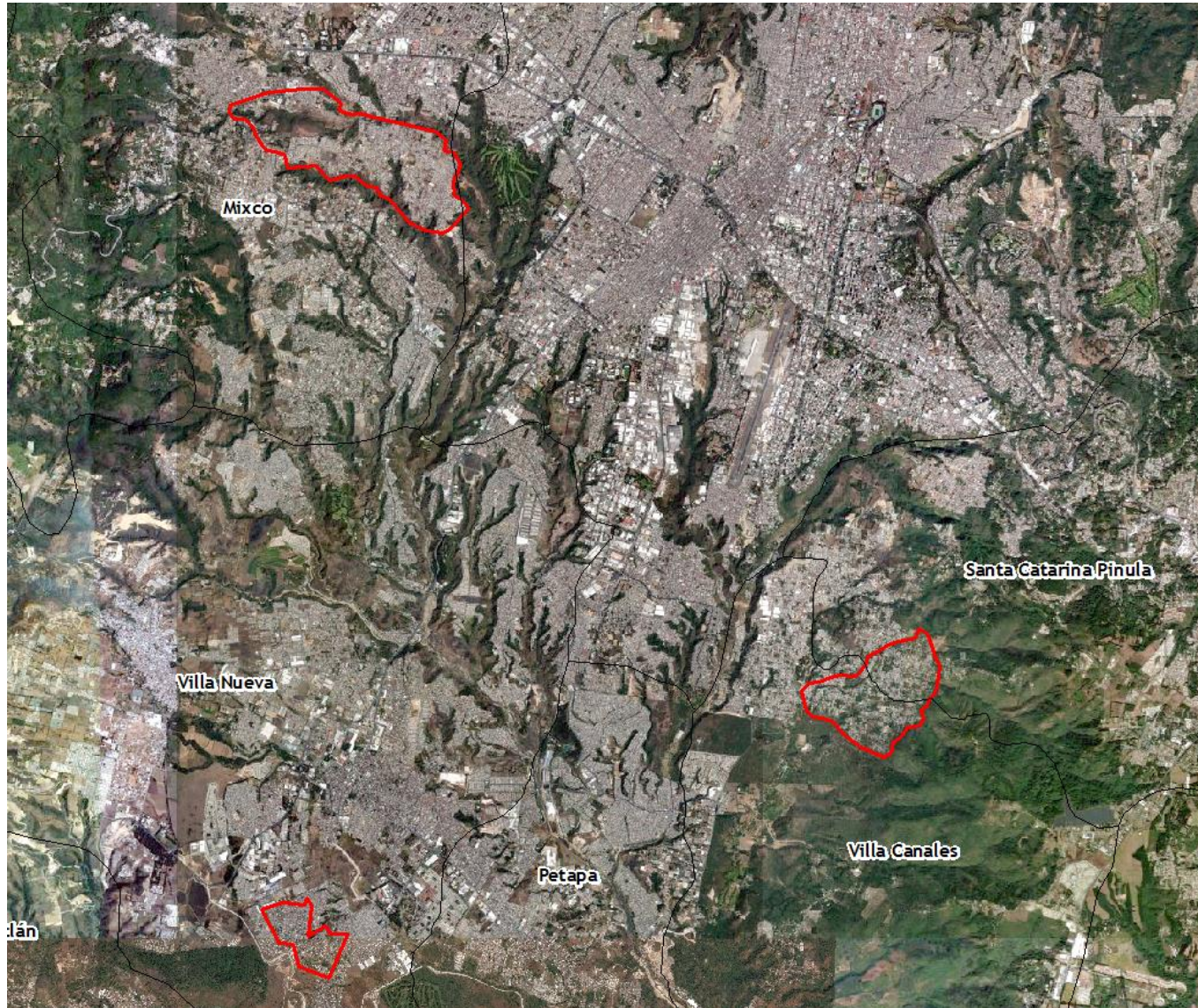
Soft-story ground floor



Steep slope



# Test sites: 3 Neighborhoods

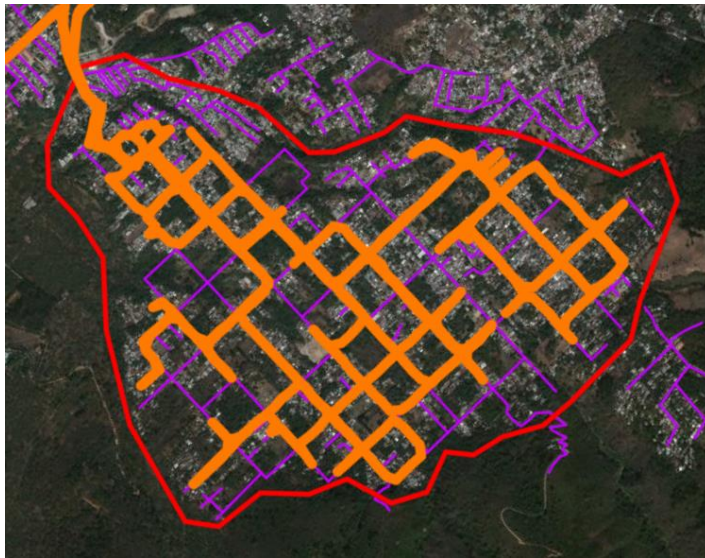
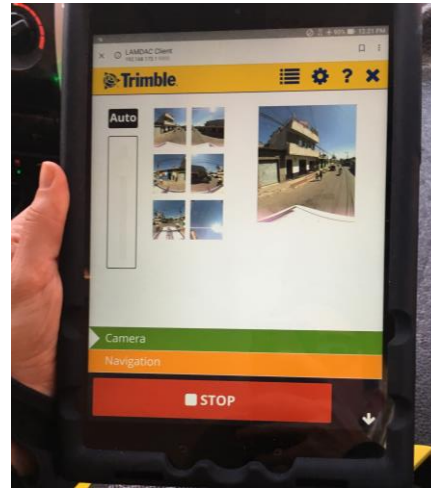


- **Mixco**
  - street view (26 km)
  - Drone (140 hectares)
  - BuildChange Surveys (123)
- **Villa Canales (El Porvenir)**
  - 31 km of streetview
  - MGCS Landuse maps (4,533 parcels, 11 months)
- **Villa Nueva**
  - 22 kms of streetview
  - BuildChange Surveys (11)

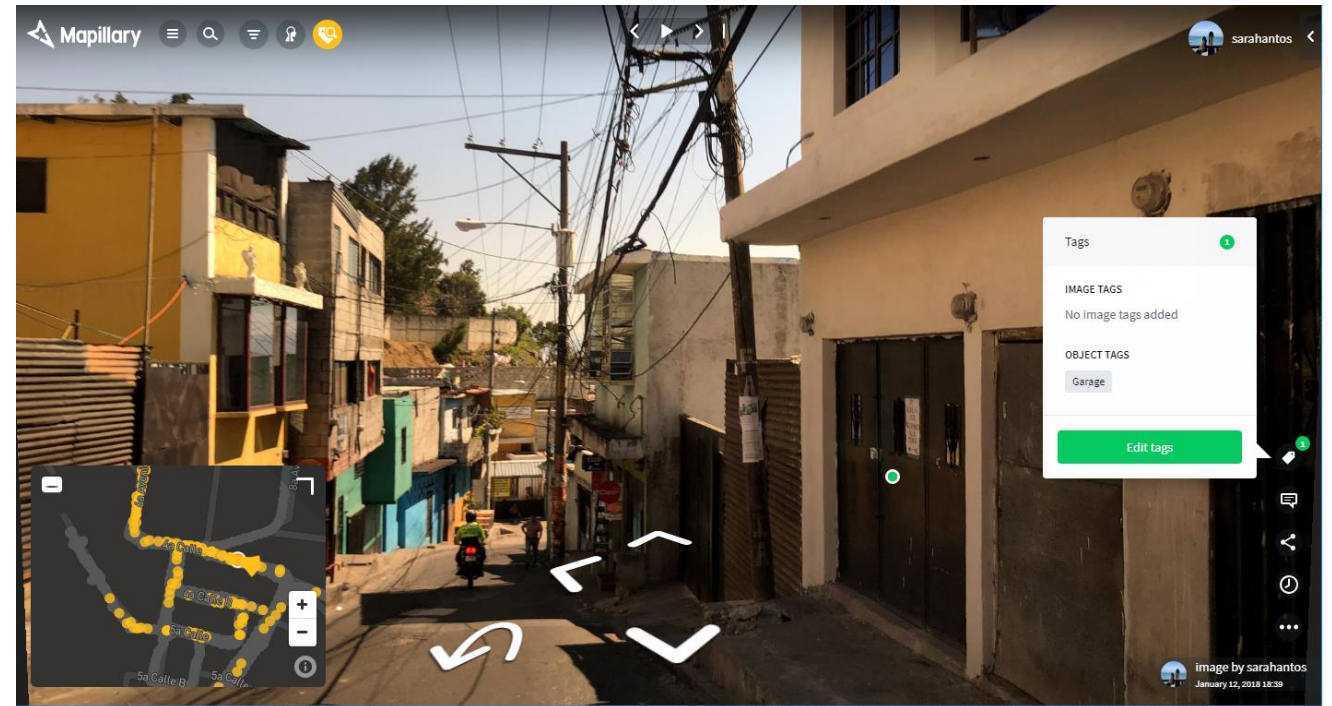


# Streetview

- Collected using a Trimble MX7 360 camera mounted on top of an SUV
- Uploaded to Mapillary platform for 'tagging'



Orange = Streets driven in El Porvenir





# Drone

- We flew a fixed wing drone over 140 hectares in Mixco
- From the drone images we automatically generated:
  - Elevation model, building surface model, rooftops













Digital Surface Model  
High : 38 meters  
Low : 0 meters

Two story building



One story building



Tall trees

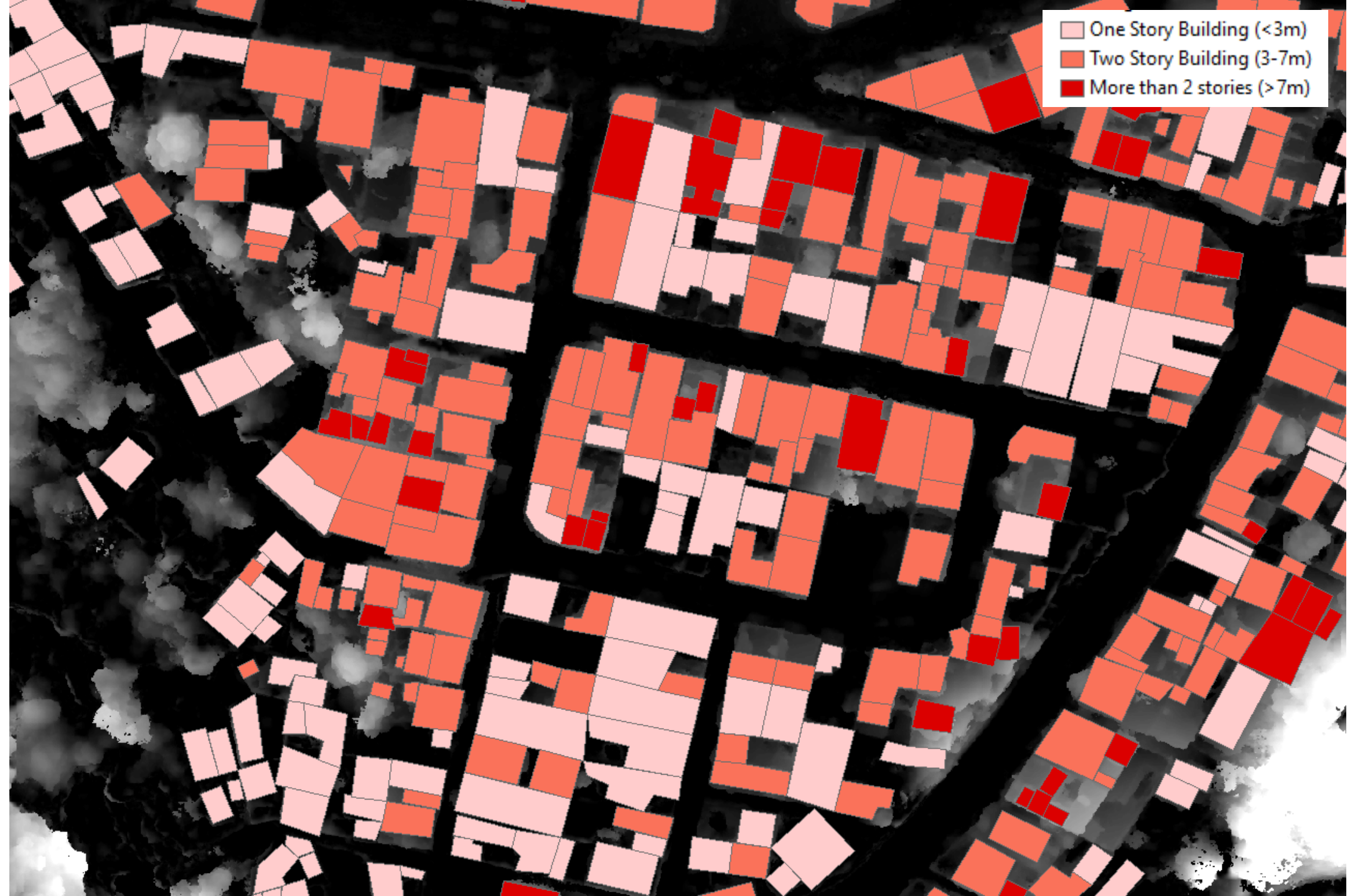
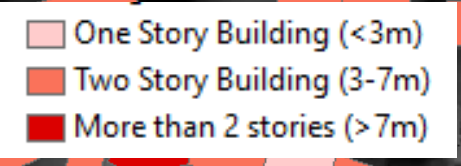




Calculate average pixel value (height) in each red polygon











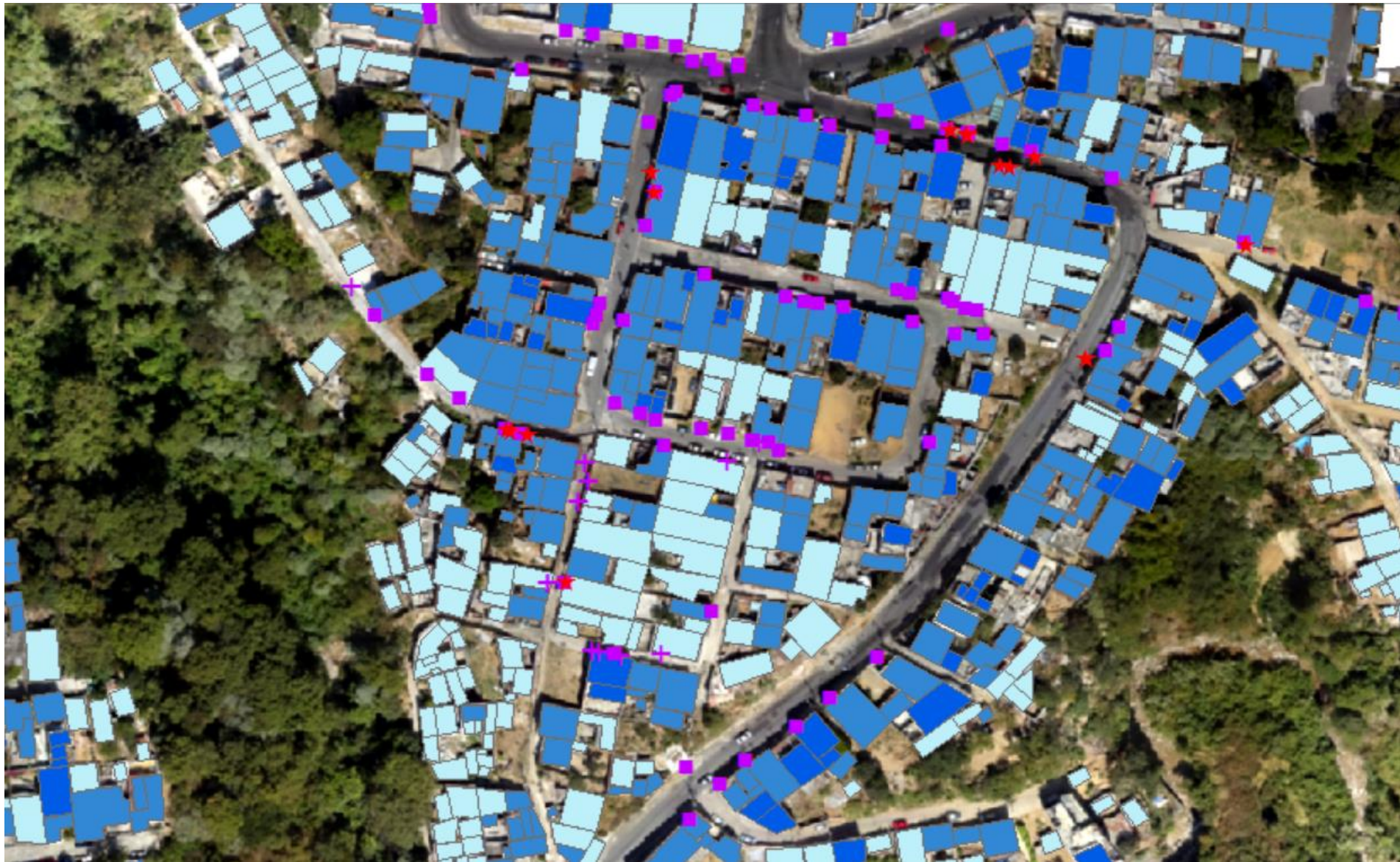


# Slope at scale





# Combine data from the drone with data from the street...



## Drone images..

- Single Story
- Two Story
- > Two Stories

## Street images..

- Logos/Signs
- Garage
- Large Window



# Possible Soft Story

Structures that are

- At least two stories high
- unconfined rooftops (corrugated metal)
- Built on a slope steeper less than 15 degrees

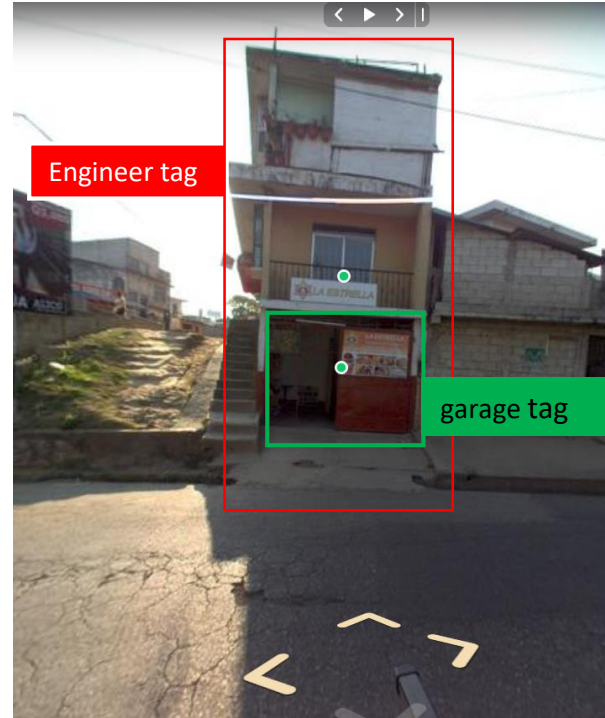
In this 100 hectares, there are 4,955 buildings - 503 of which should be evaluated for earthquake retrofitting



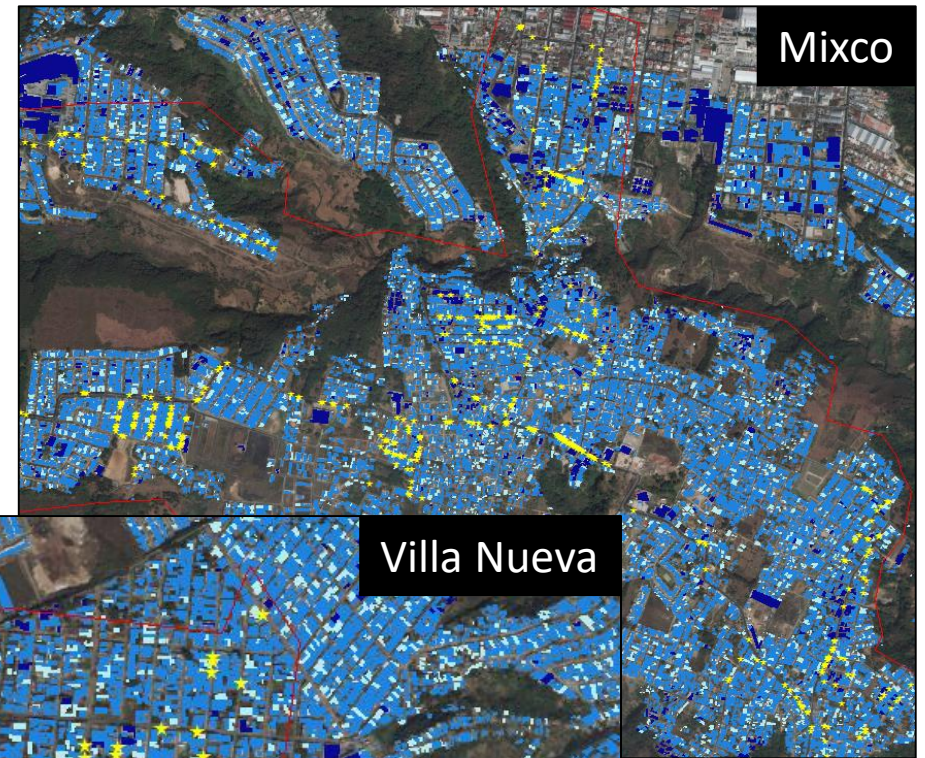


# Validation

Of the 560 structures identified by the structural engineers as being soft-story, more than 83% were identified as being at least two stories and having large garages from our approach.



Satellite derived footprint is calling this building 7.32 meters high, 3.4 meters wide and 20 meters deep



- single story
- two story
- >two story
- ★ garage tags



## THE RESULTS

For each building we have the following characteristics –the thresholds picked are up to the decision maker/expert.



Attribute table	
Slope (degrees)	5.467
First floor windows (count)	0
Garages (count)	1
Logo (count)	3
Tagged as Soft-story?	yes
Height of building (meters)	10.3
Risk level (1-5)	



# Conclusions

- This is a first pass-- a Triage approach, but it was inexpensive and successfully identified individual structures.
- It can reduce the number of units by 90% so engineers in the field only have to visit a fraction of the housing stock.
- We are now working to link the results to retrofitting projects – targeted investments and loans.

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- Resilient Housing Projects.
- Developing new markets for home insurance.
- Reforming housing subsidy or cash-transfer schemes.
- Connecting housing subsidies with microloans.
- Promoting expansion in consolidated areas and the creation of new housing for rental.
- Regularization of informal constructions.