

OSM Highway Modeling

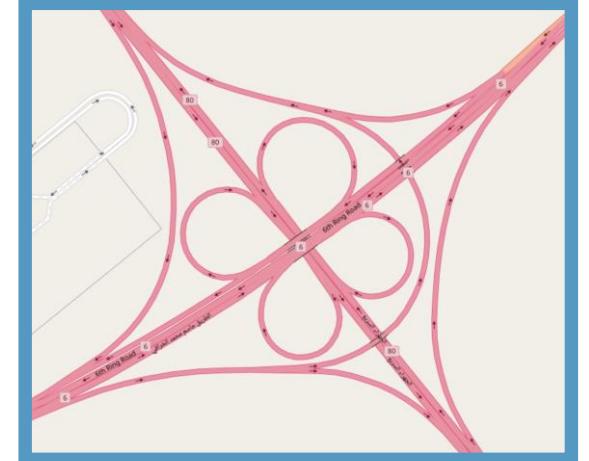
Introduction

July 2018

What are highways?

Introduction

What are highways?



Any road or route that connects two locations

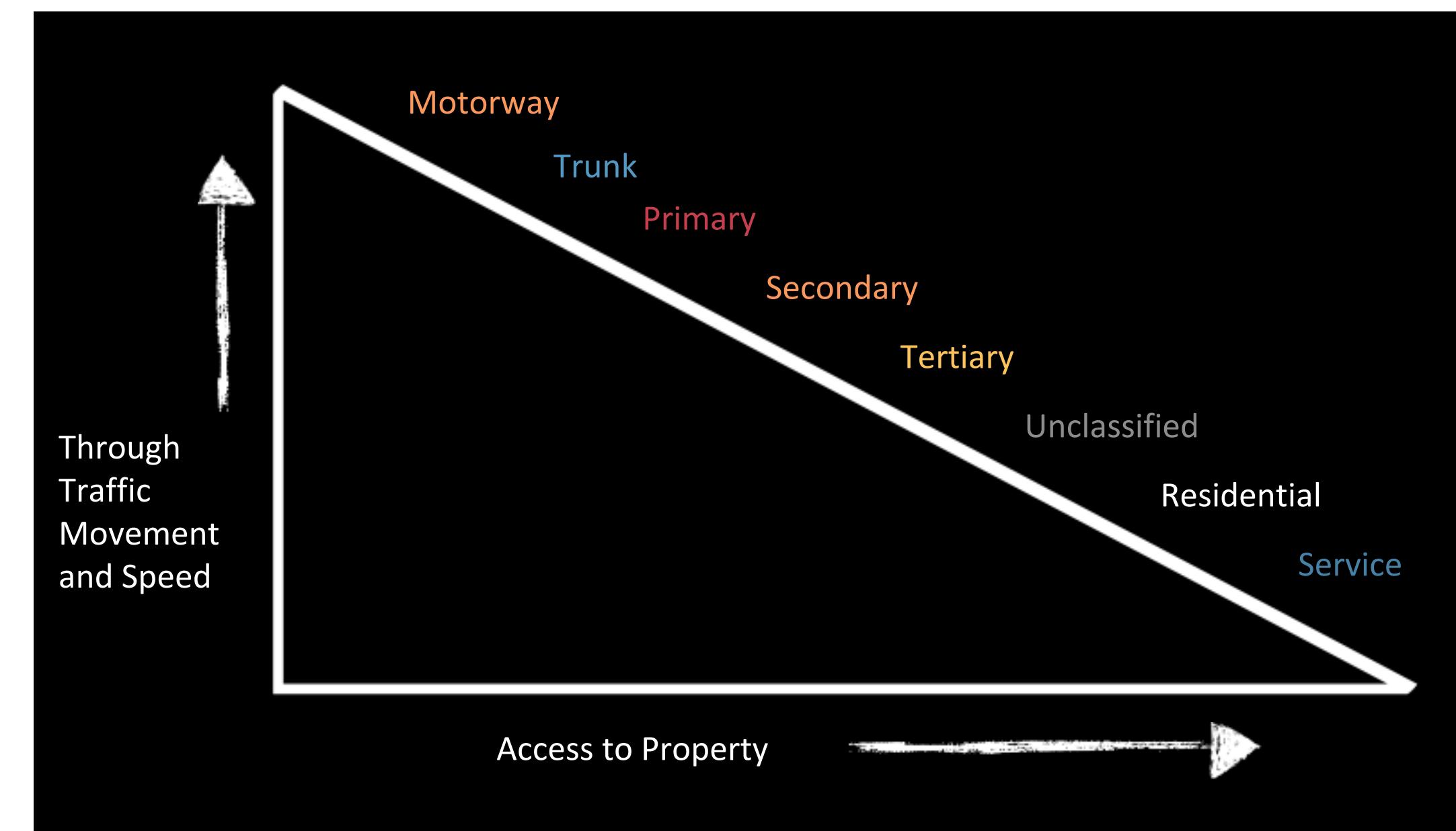
- OpenStreetMap's "highway" classification system is a hierarchy-based system
- The system allows us to define a road's importance in the overall city or national network

Use multiple data sources to determine highway priority:

- Imagery (alignment, highway size, destinations, traffic)
- GPS tracks (alignment, density of traffic, direction of traffic)

Highway Resources:

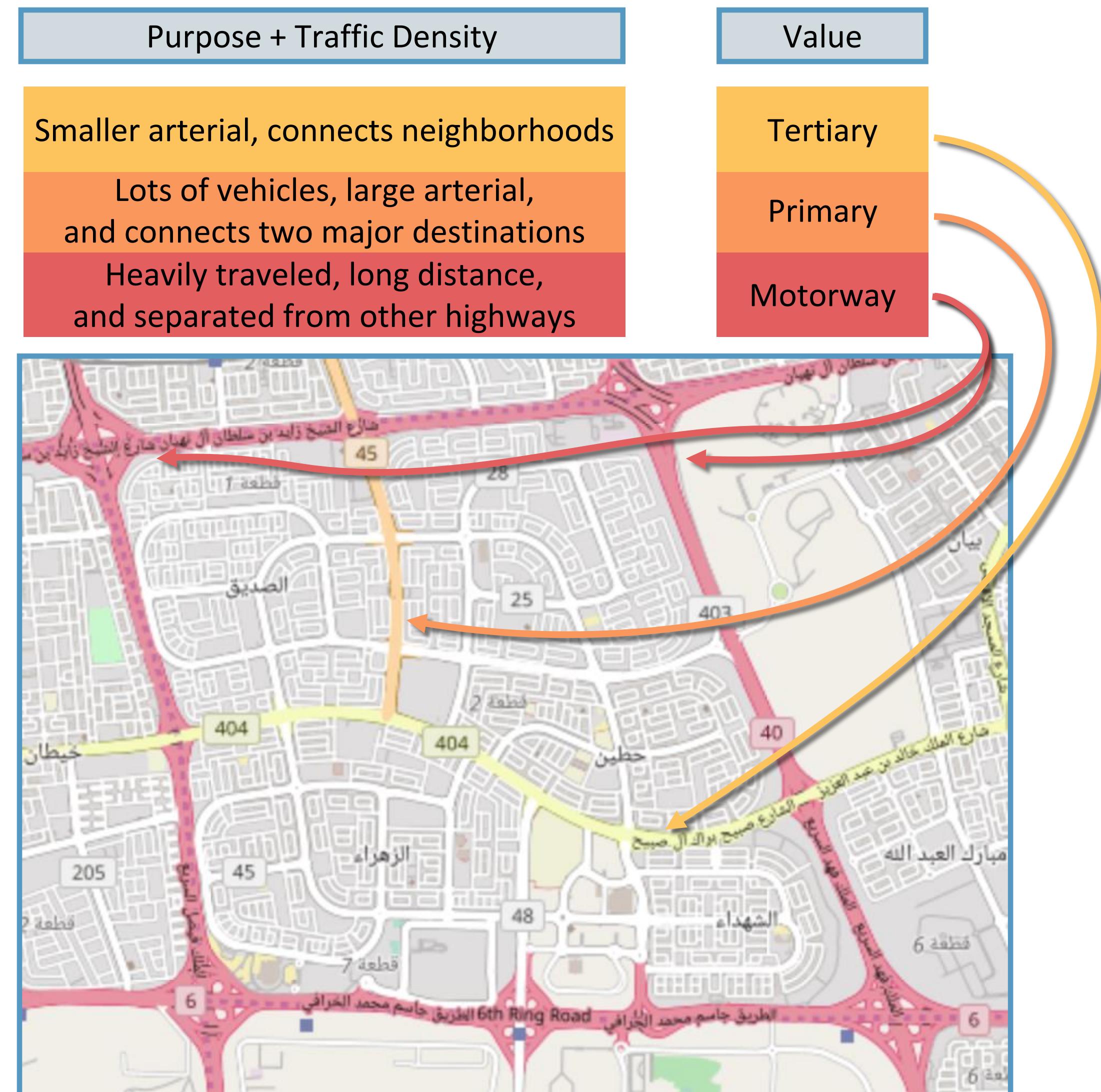
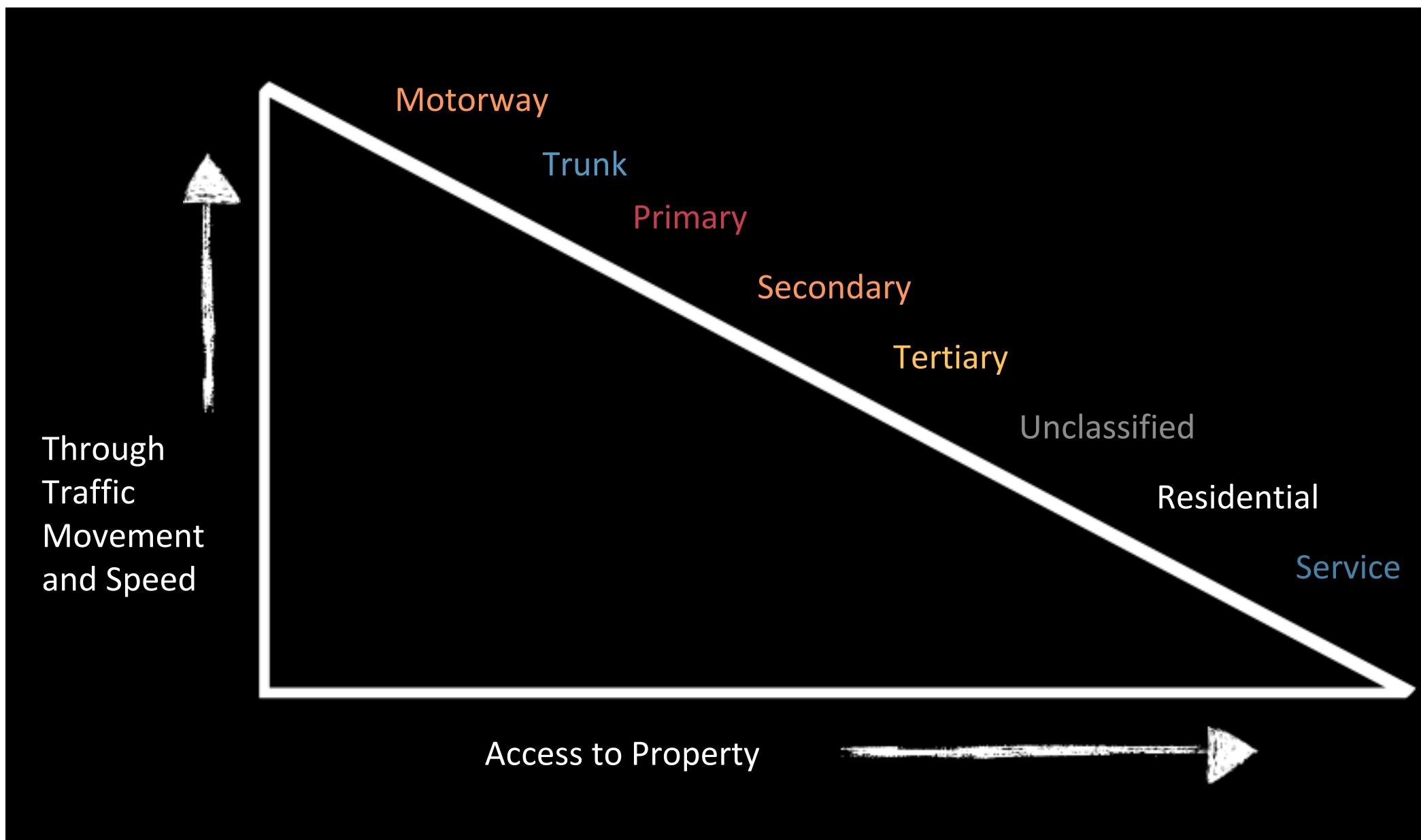
<http://wiki.openstreetmap.org/wiki/Key:highway>
http://wiki.openstreetmap.org/wiki/Australian_Tagging_Guidelines



Introduction

Highway Hierarchy

- Defined by the OSM community
- Some guidelines can be vague
- Based on purpose and traffic density
- Ranges from a multi-lane Motorway down to farm Track



Highway Classifications

Highway Hierarchy

High Classification

Often the largest road in a region/city; lots of traffic density (GPS tracks); long distance or destinations with high importance

Motorway

Trunk

Primary

Medium Classification

Connects larger neighborhoods or towns; decent amount of traffic (GPS tracks)

Secondary

Tertiary

Unclassified

Low Classification

The smallest roads in a region/city; low traffic density (GPS tracks); often serving minor facilities or houses

Residential

Service

Track

Highway Classifications

High Classification Routes

Highway Classifications

High Classification Routes

Motorway - Controlled Access (same in all OSM countries)

- The most important highway(s) in a country
- Not required for every country to have a motorway
- Accessed via controlled entry/exit points like highway ramps or interchanges
- No at-grade intersections
- Tunnels & Bridges to avoid intersections

Motorway Resources:

- <http://wiki.openstreetmap.org/wiki/Tag:highway%3Dmotorway>



England, Europe



Senegal, Africa

Highway Classifications

High Classification Routes

Trunk - Limited Access (varies in OSM countries)

- The most important highway in a country
- Nearly every country has at least one trunk highway
- Accessed via a mixture of at-grade & grade-separated intersections
- Depending on the country, a Trunk might:
 - Have the same features as a Motorway
 - Be a large, decently maintained unpaved road



France, Europe

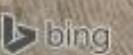
Trunk Highway Resources:

- <http://wiki.openstreetmap.org/wiki/Tag:highway%3Dtrunk>

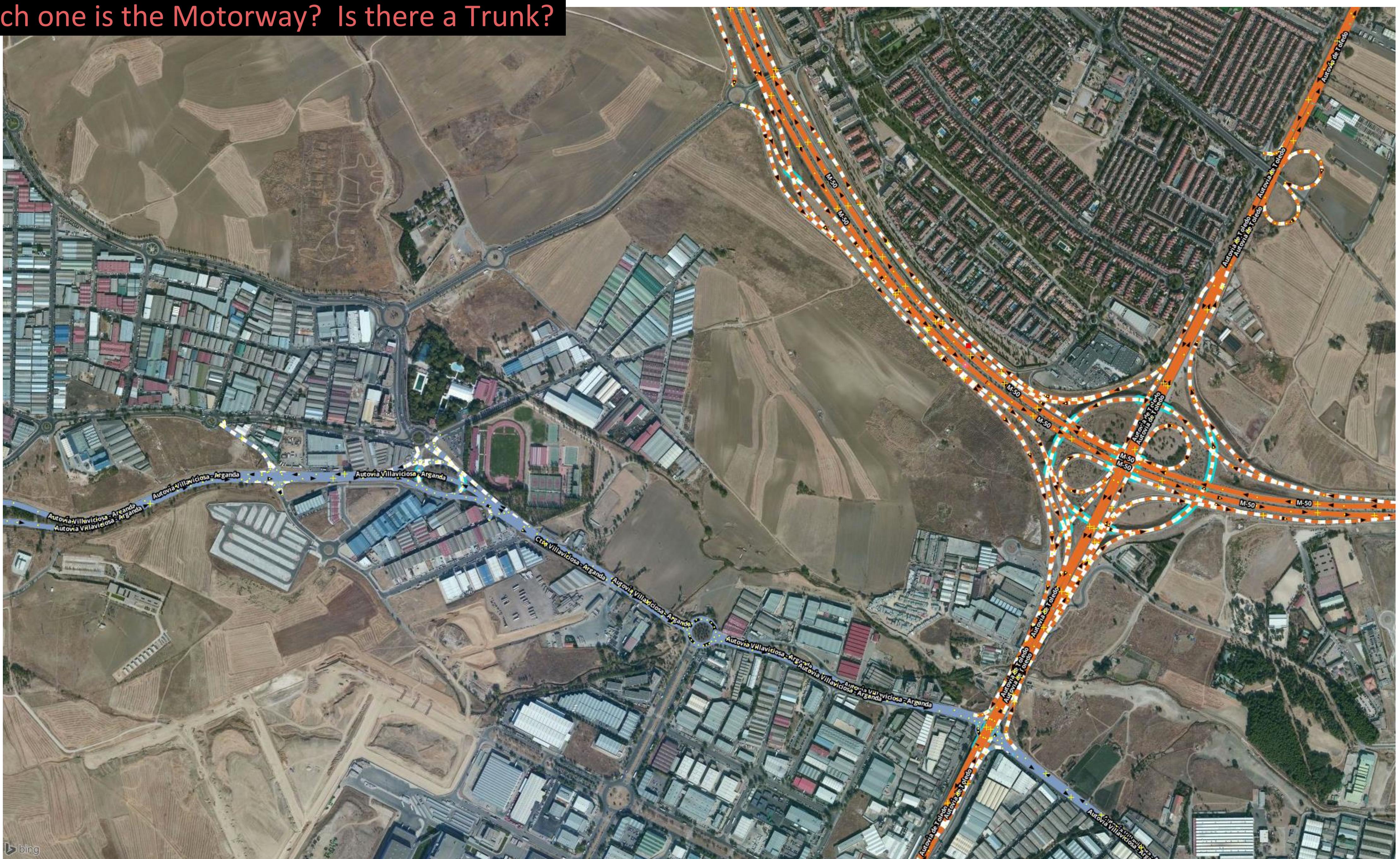


Uganda, Africa

Which one is the Motorway? Is there a Trunk?



Which one is the Motorway? Is there a Trunk?



Highway Classifications

High Classification Routes

Primary - Major regional highway or primary urban arterial

- Main road type in a country's overall road network
- Purpose:
 - Connects larger cities
 - Connects Trunk/Motorway within a city
- Supports higher speeds and densities than Secondary/Tertiary
- Might be grade-separated in more developed nations

Primary Highway Resources:

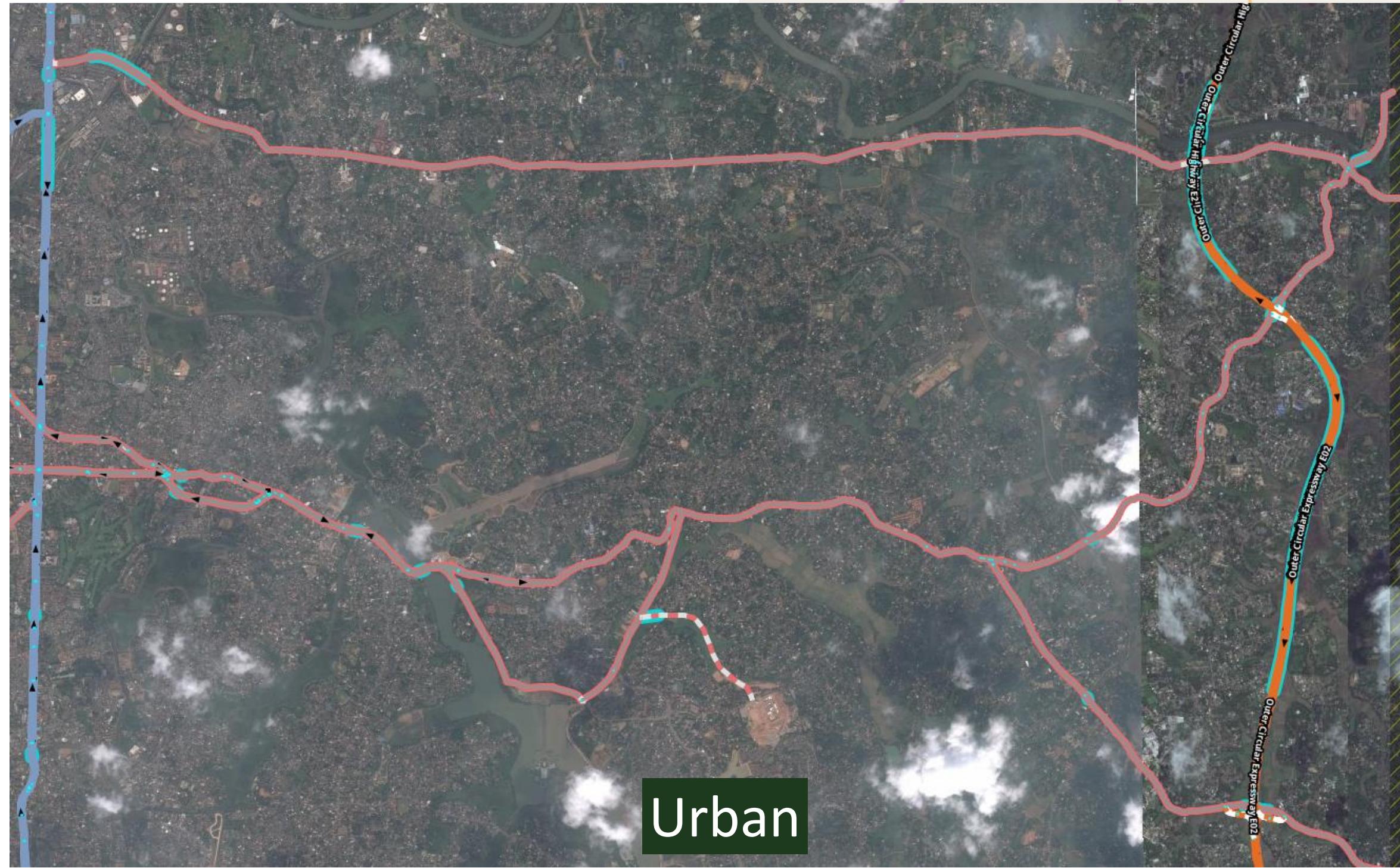
[- wiki.openstreetmap.org/wiki/Tag:highway=primary](https://wiki.openstreetmap.org/wiki/Tag:highway=primary)



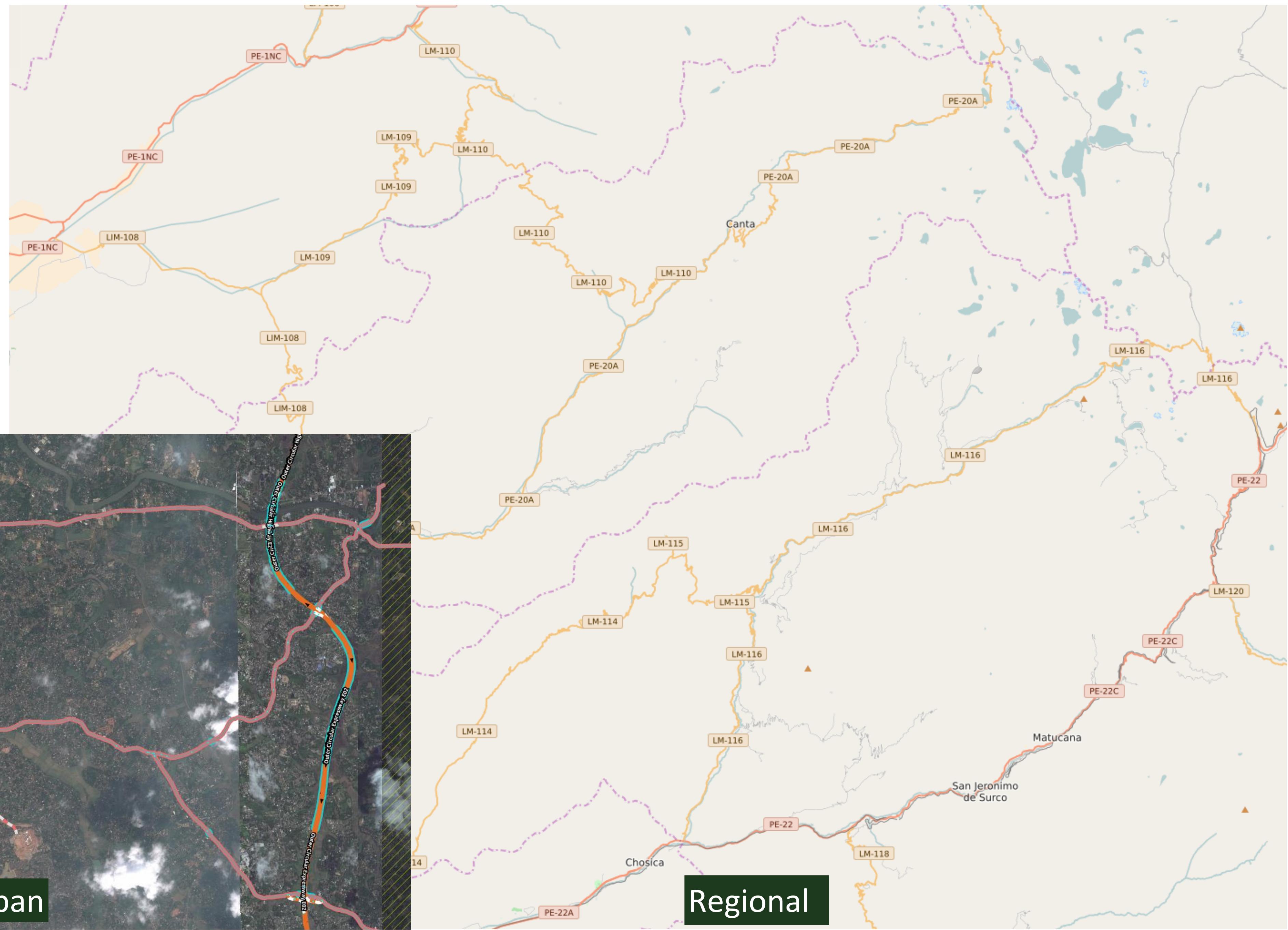
Chile, S. America



D.R. Congo, Africa



Urban



Regional

Medium Classification Routes

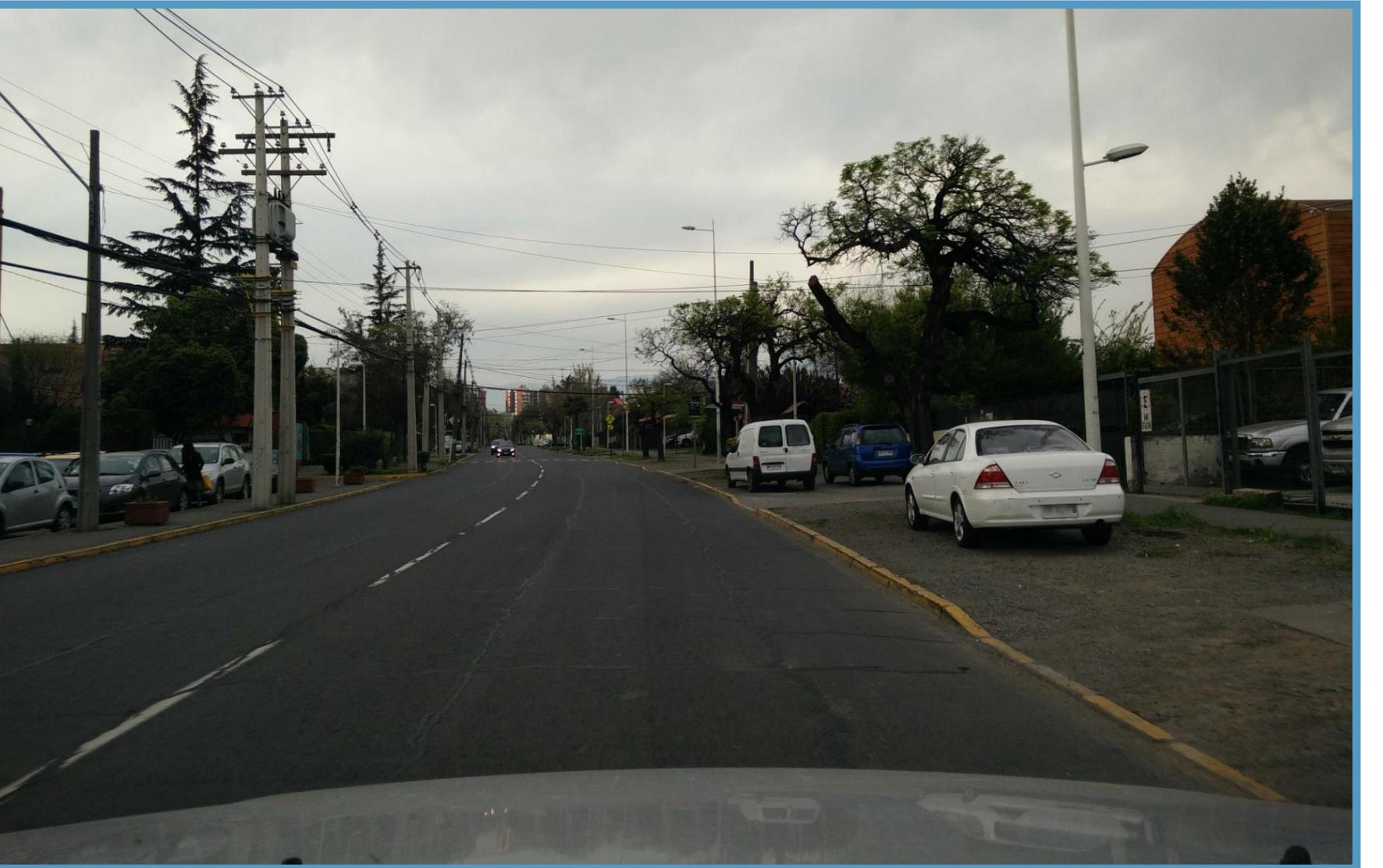
Highway Classifications

Medium Classification Routes

Secondary - Major urban arterial or regional highway

- Purpose:

- Connects smaller towns & hamlets
- Provides an arterial through a city; less traffic/smaller road than Primary but more than Tertiary
- Connects multiple neighborhoods



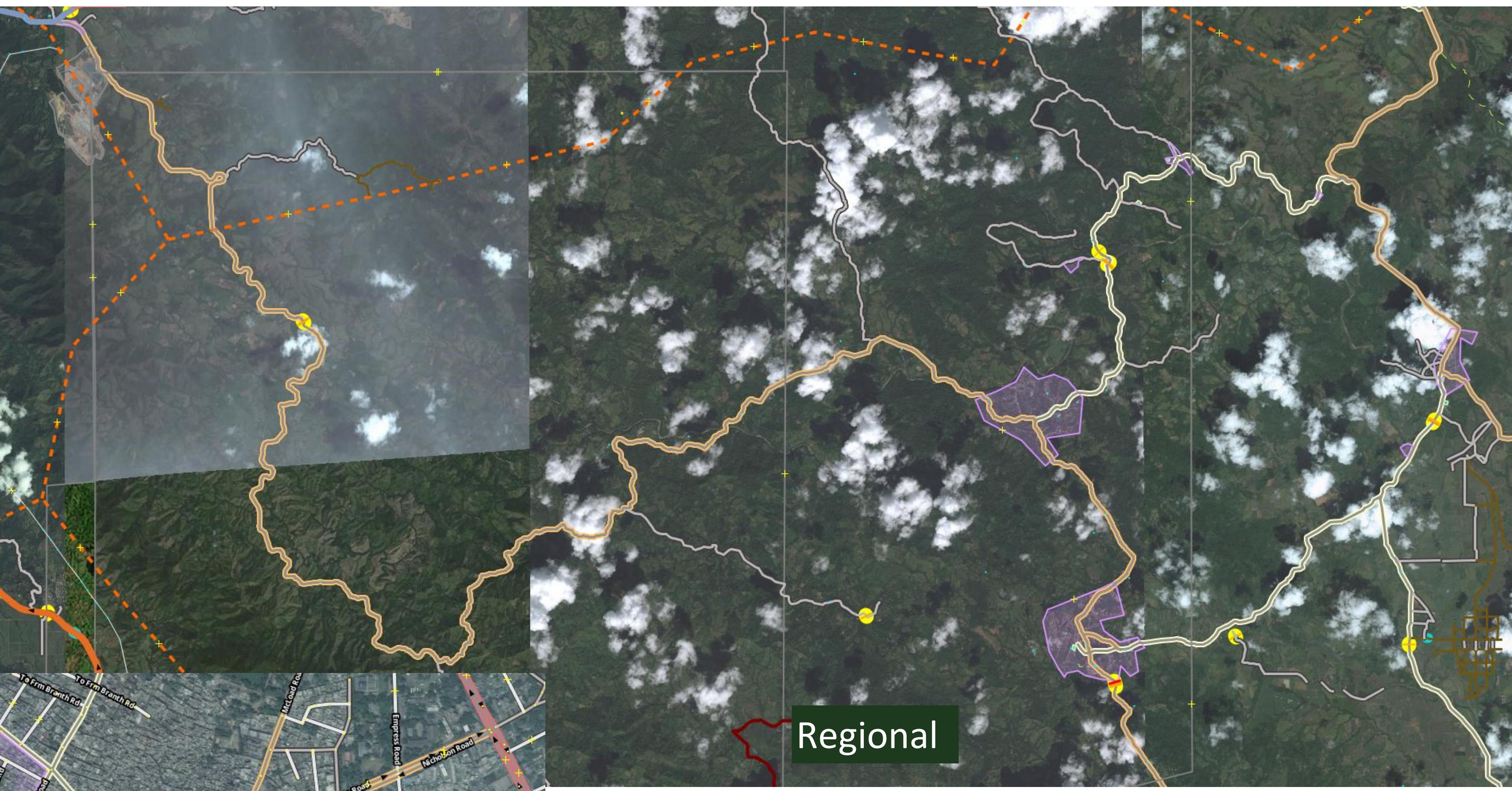
Chile, S. America



Uganda, Africa

Secondary Highway Resources:

- <http://wiki.openstreetmap.org/wiki/Tag:highway%3Dsecondary>



Highway Classifications

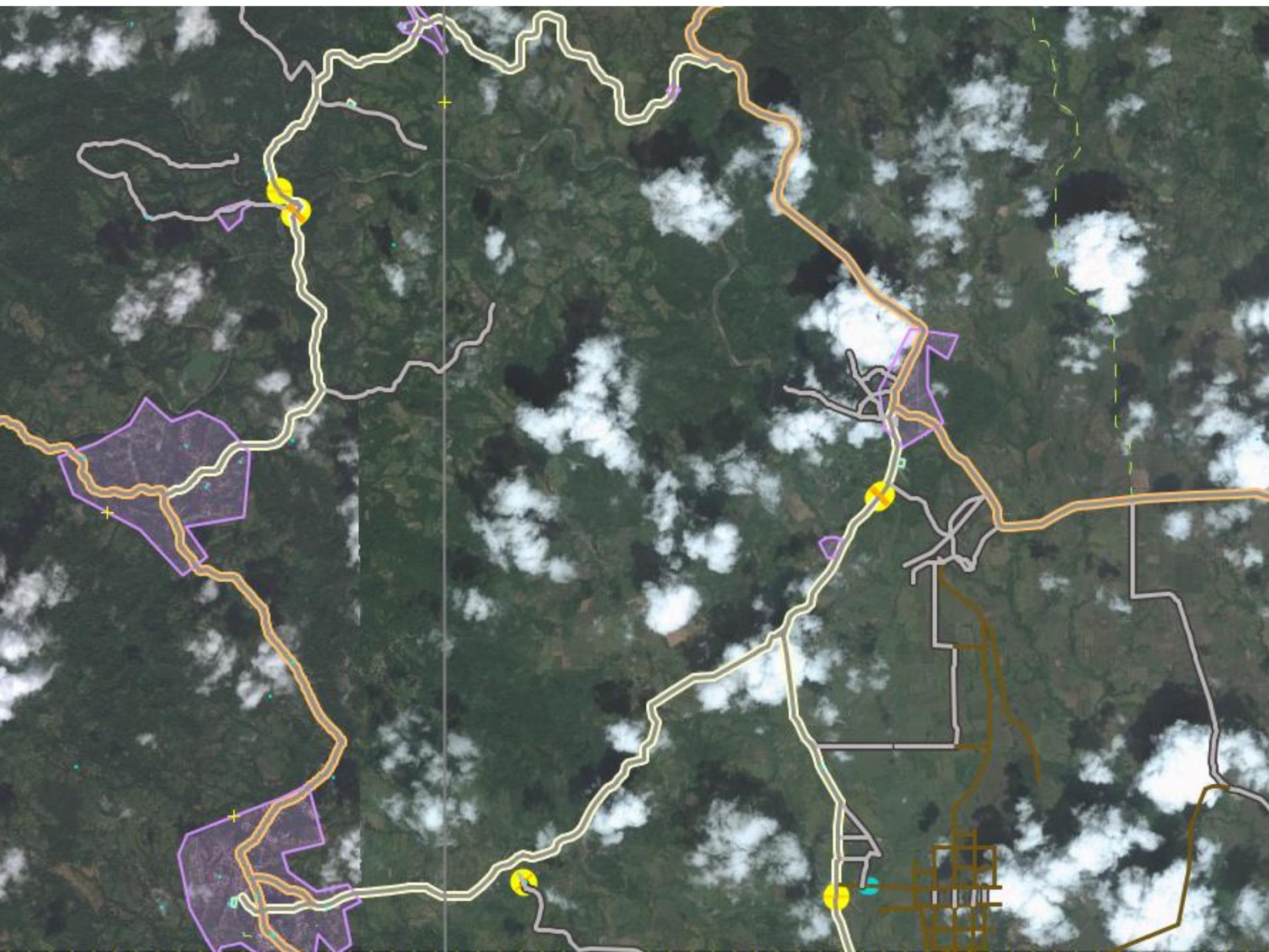
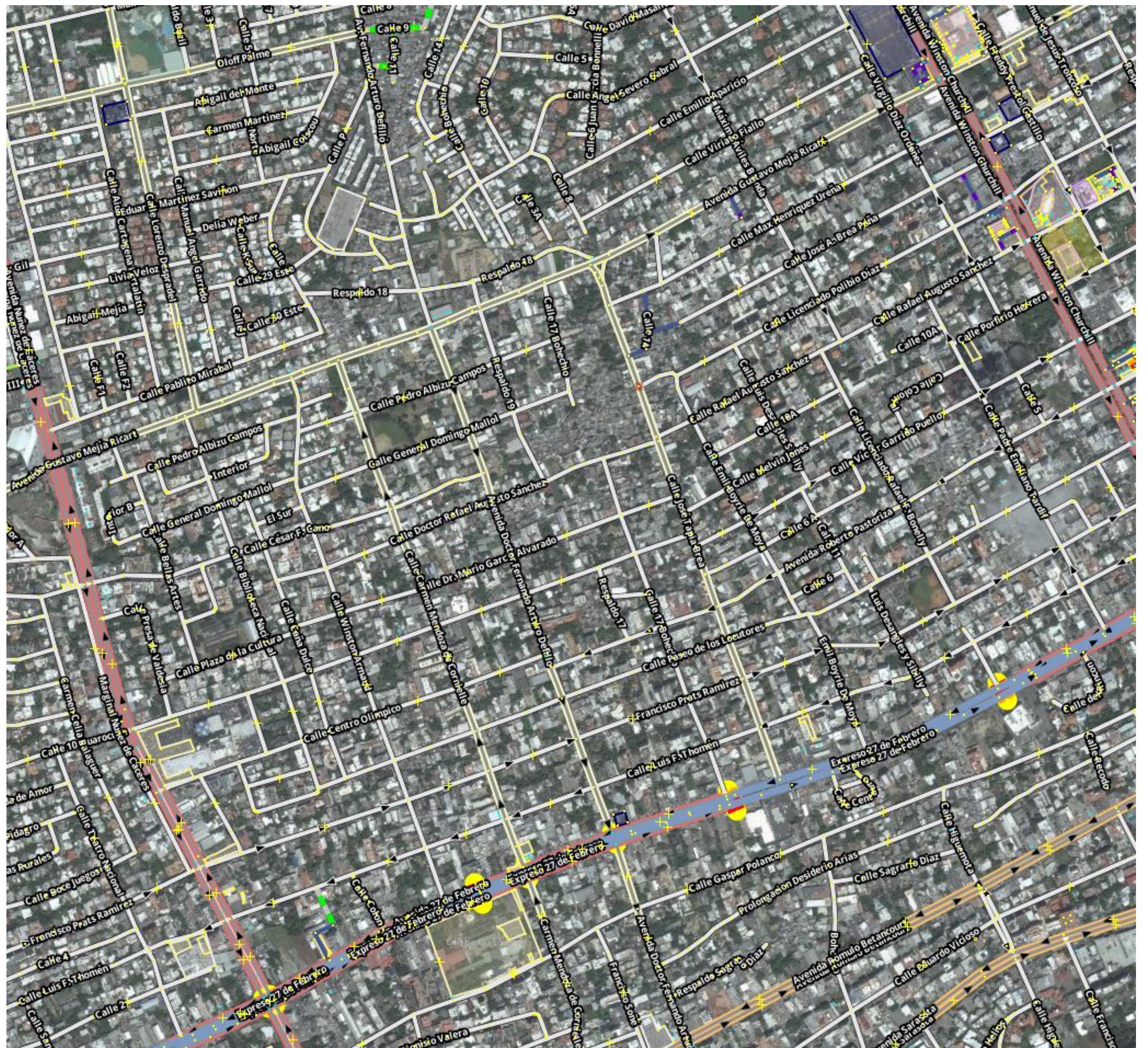
Medium Classification Routes

Tertiary highway - minor arterial or high-traffic country road

- Purpose:
 - Minor arterial routes in cities
 - Connects neighborhoods
 - Used to connect small cities and villages
 - Lower traffic than Secondary
- Easily confused with Secondary and Unclassified

Tertiary Highway Resources:

- <http://wiki.openstreetmap.org/wiki/Tag:highway%3Dtertiary>



Highway Classifications

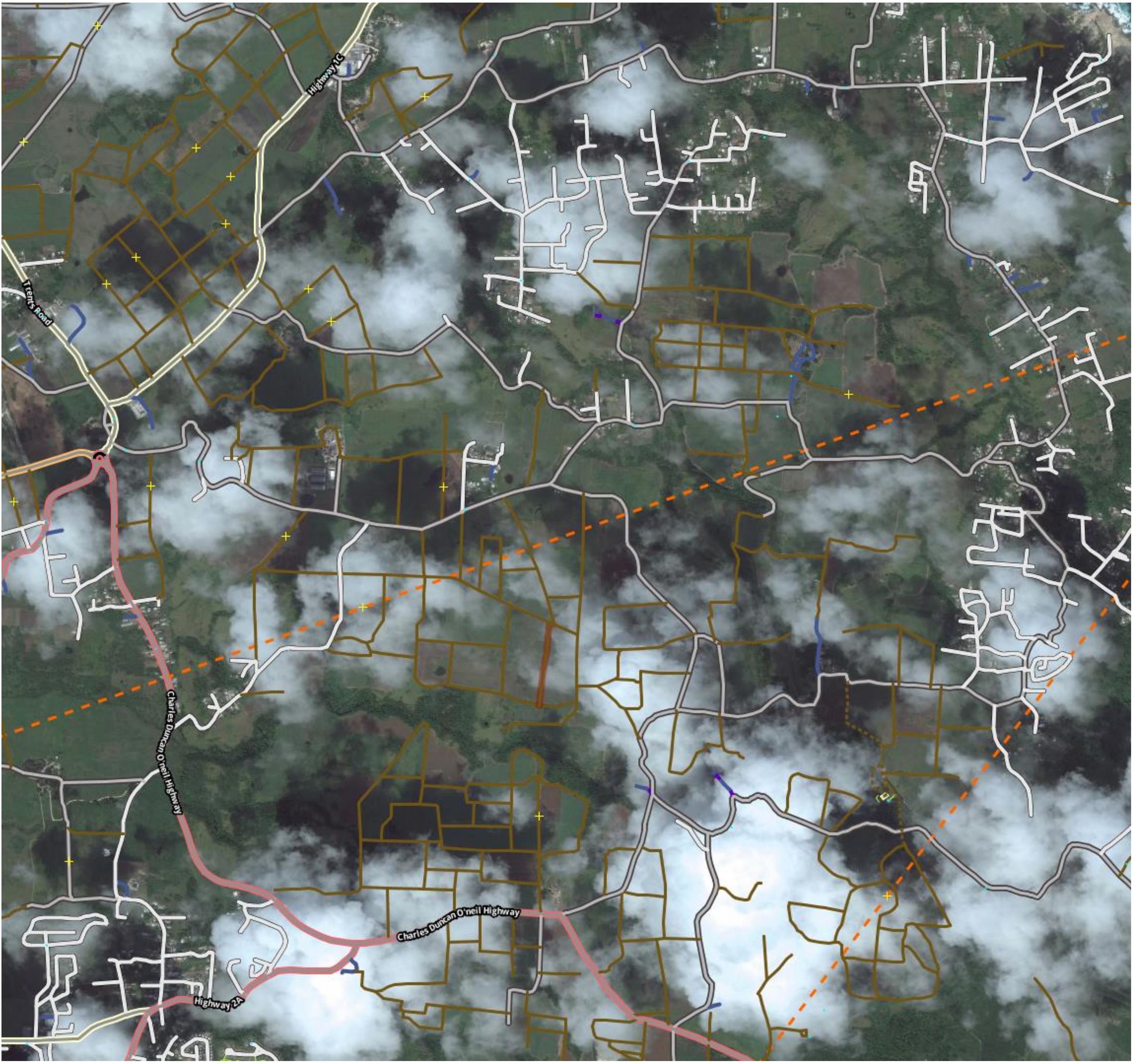
Medium Classification Routes

Unclassified - Local arterial or country road

- Purpose:
 - When road is less important to a network than Tertiary
 - More traffic than surrounding Residential roads
 - In a neighborhood, used as an arterial to route traffic *through* a neighborhood to a higher priority road
 - Outside a town, used to connect small towns or disconnected neighborhoods
- Part of the interconnecting routing grid

Unclassified Highway Resources:

- <http://wiki.openstreetmap.org/wiki/Tag:highway%3Dunclassified>



Low Classification Routes

Highway Classifications

Low Classification Routes

Residential - Provides passage to housing

- Leads to a residential area or a group of housing
- Can result in a dead-end road

Residential Road Resources:

- <http://wiki.openstreetmap.org/wiki/Tag:highway%3Dresidential>



Highway Classifications

Low Classification Routes

Service - Non-residential roads

- Purpose:
 - Driveways
 - parking lots
 - Alleys
 - Industrial parks
- Defined by service=* tag
 - =driveway
 - =alley

Service Road Resources:

- <http://wiki.openstreetmap.org/wiki/Tag:highway%3Dservice>



Highway Classifications

Highway Links

Links - An exclusive way that provides access between two mainline road segments

- Mainline = primary flow of traffic
- Usage:
 - Exclusive, physically separated turns
 - Highway ramps
 - U-turns
- Can be bi-directional, but typically one-way

Highway Link Resources:

- http://wiki.openstreetmap.org/wiki/Highway_link

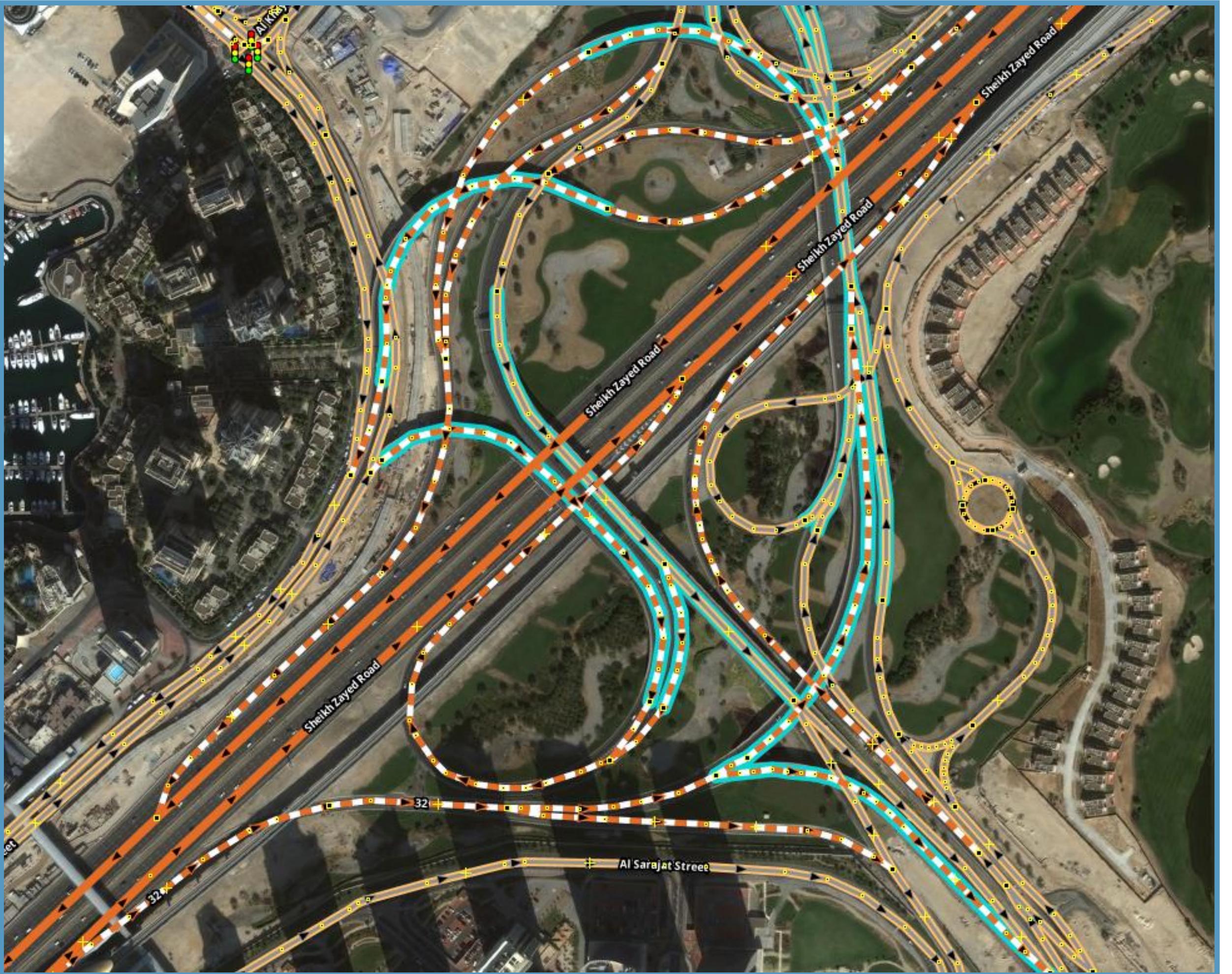
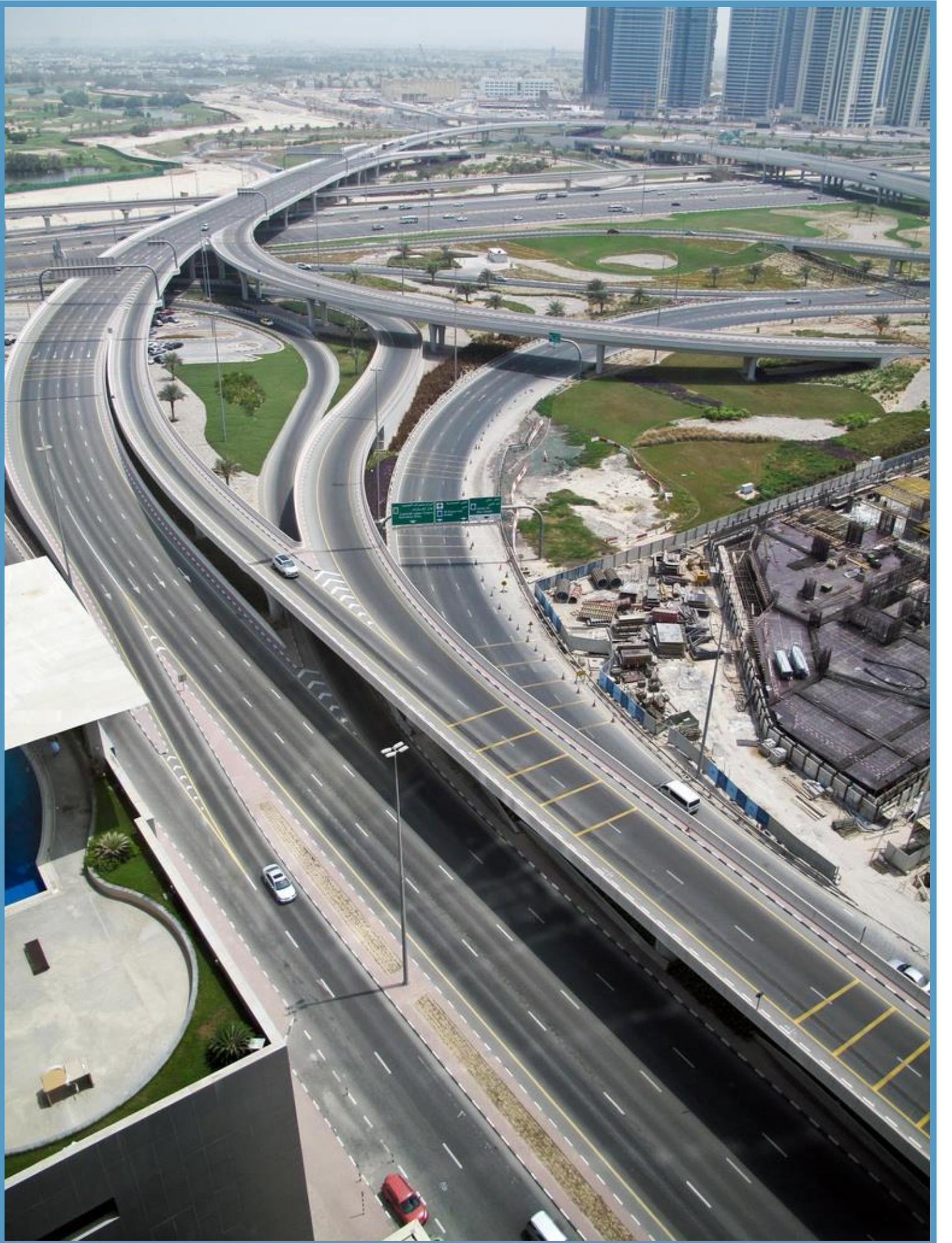


Physically separated turn



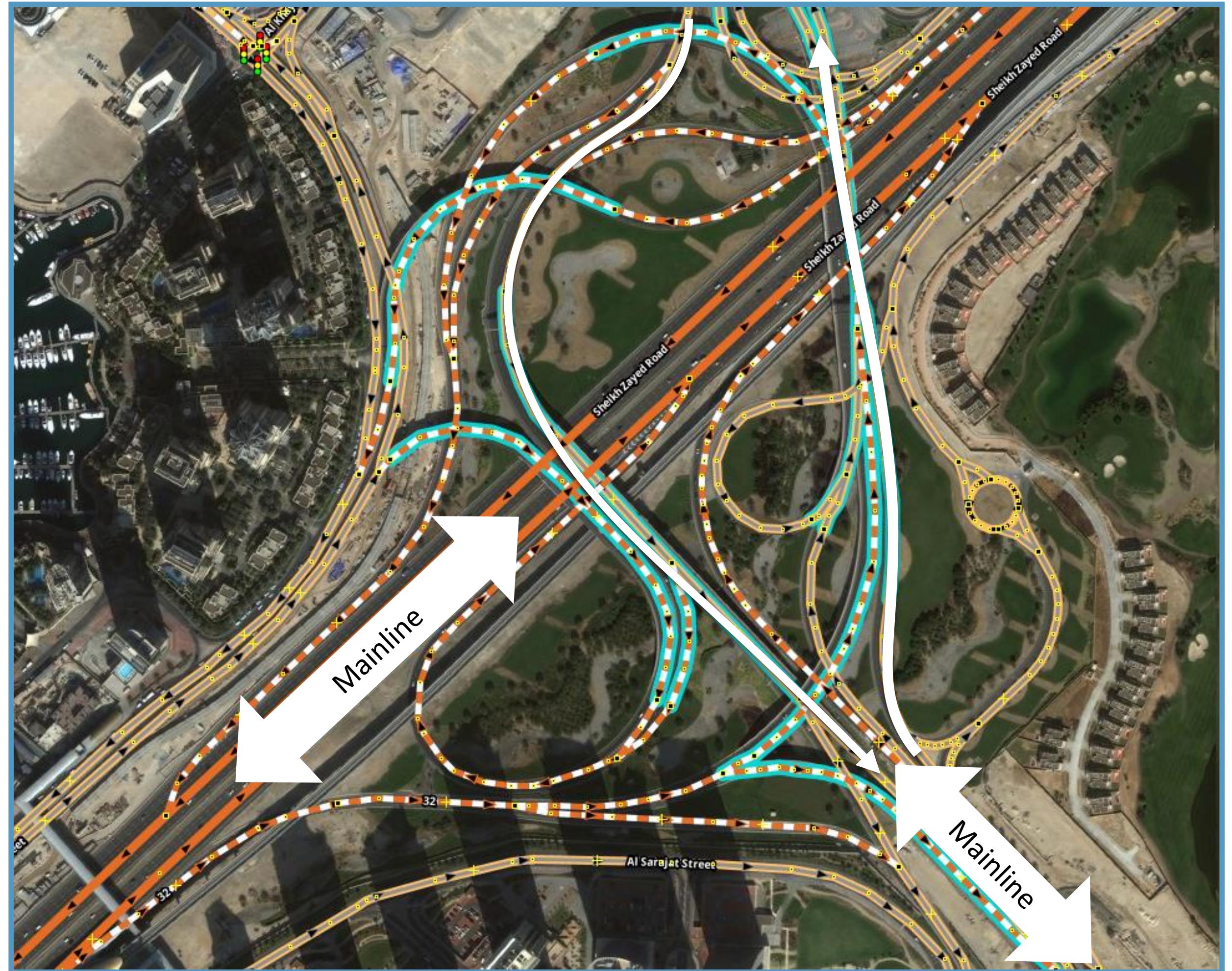
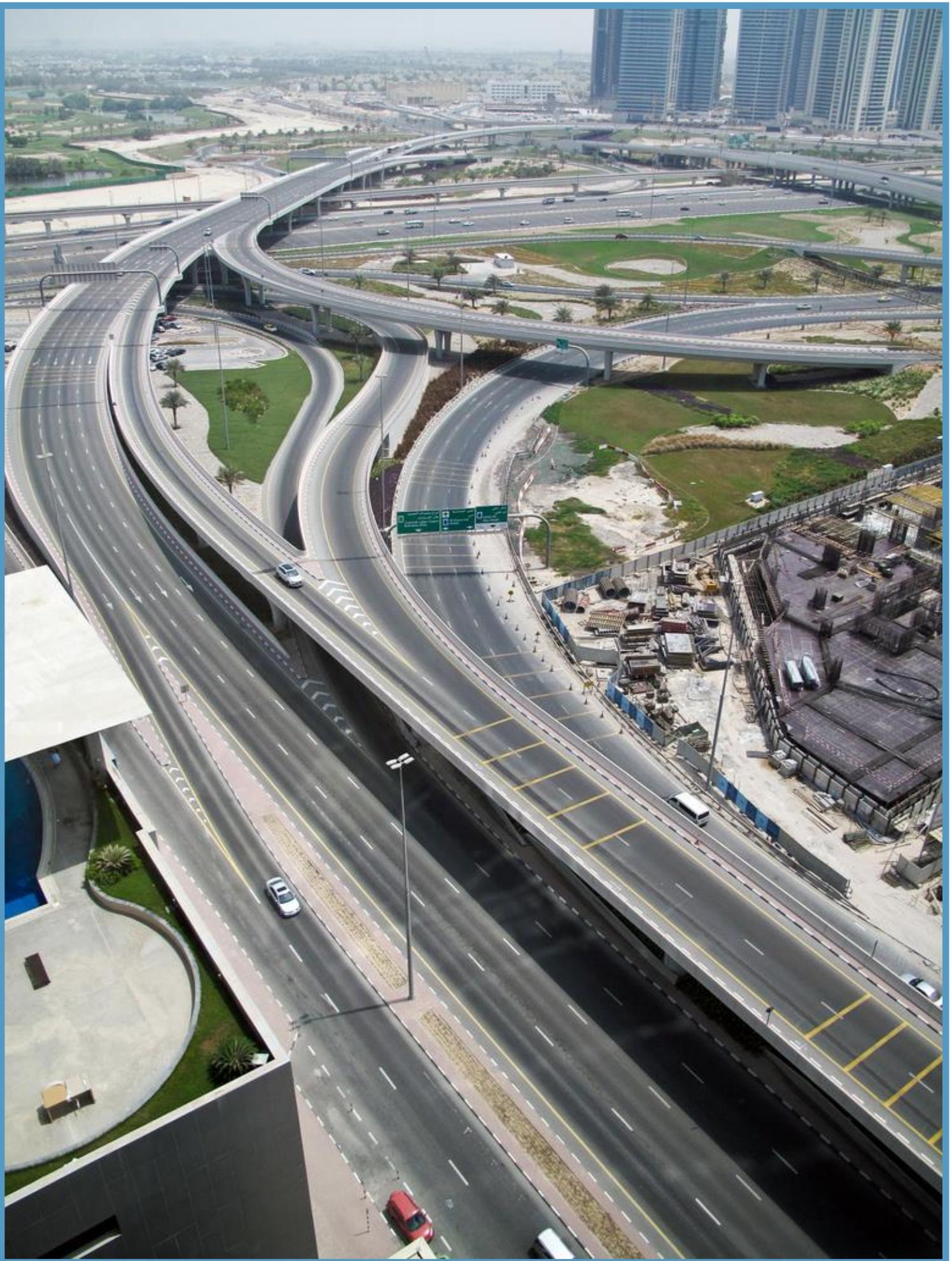
Highway Classifications

Highway Links - Ramps



Highway Classifications

Highway Links - Ramps



Highway Modeling

Highway Modeling

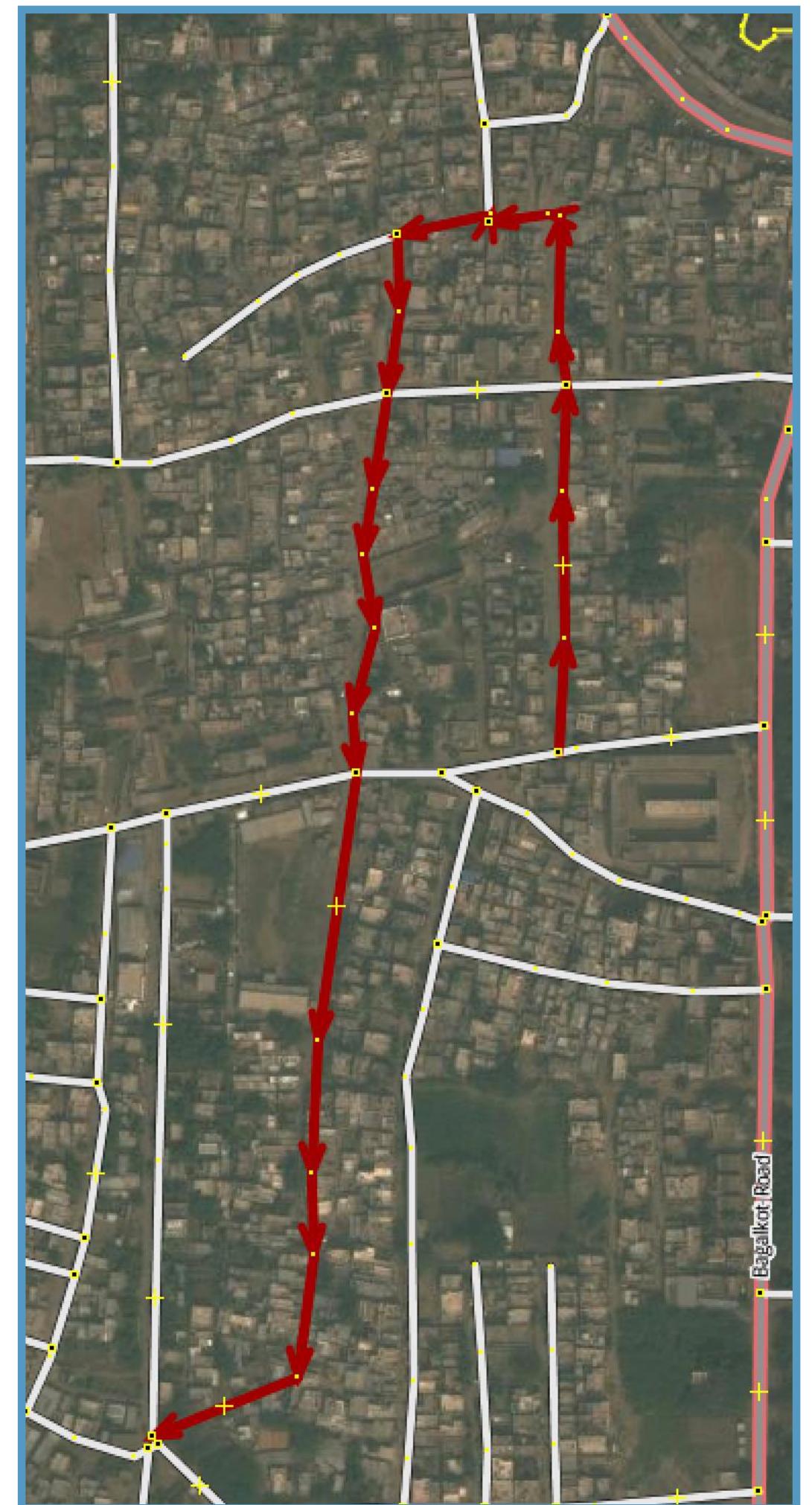
Objectives

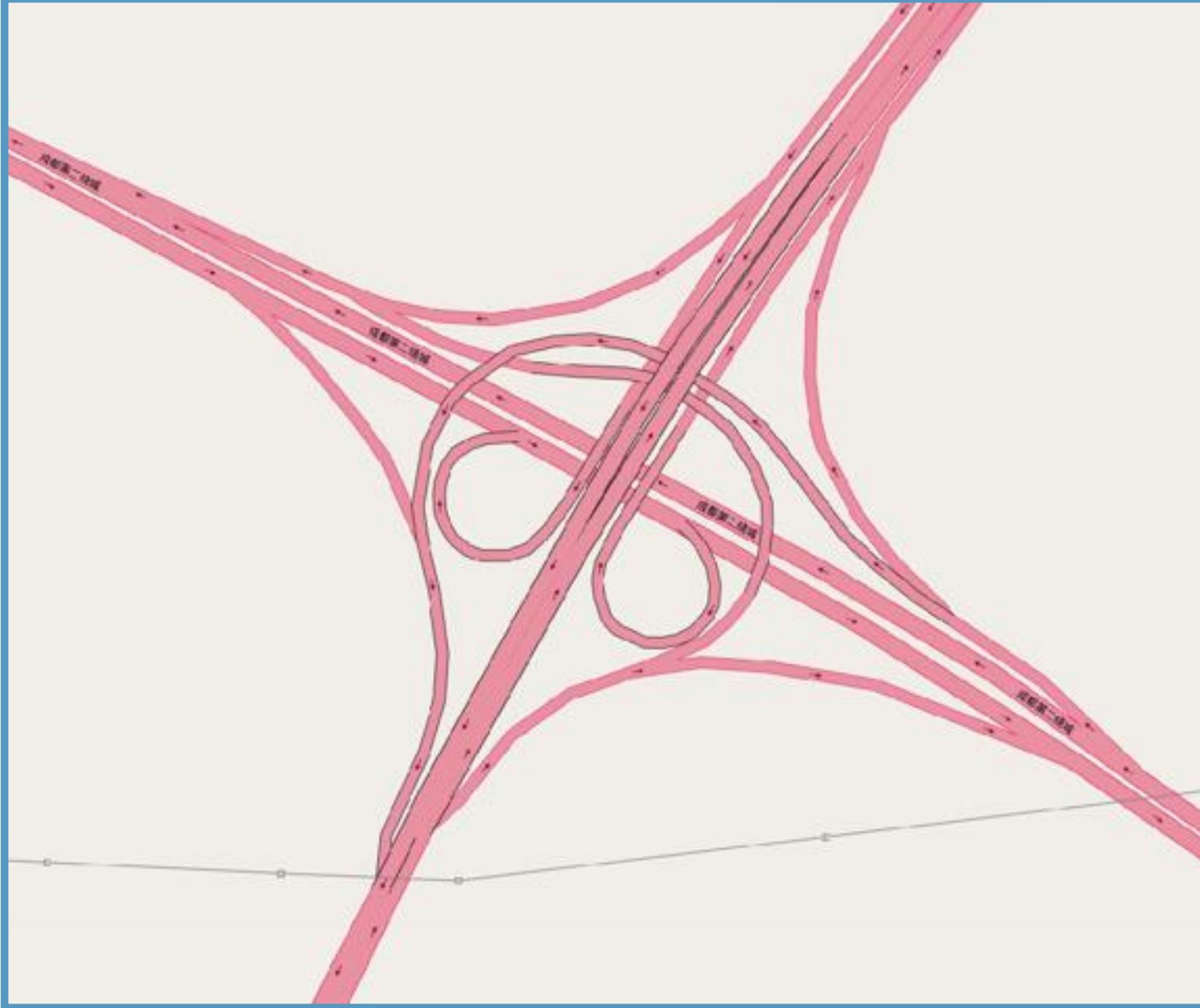
- Goal:
 - Match OSM data to best sources
 - Improve quality of road network
- Align highways using:
 - Imagery
 - GPS tracks
 - Public sources, i.e. Mapillary
- Should you align it?
 - >5-10m offset - **Align!**
- Add any missing highways and associated tags
- Continuous Roads - **Fix!**
 - Split highways if they are too circuitous
 - road names typically change at street corners



Misaligned Road

Continuous Road





Highway Modeling

Layers

Layers - How features *stack* in relation to each other

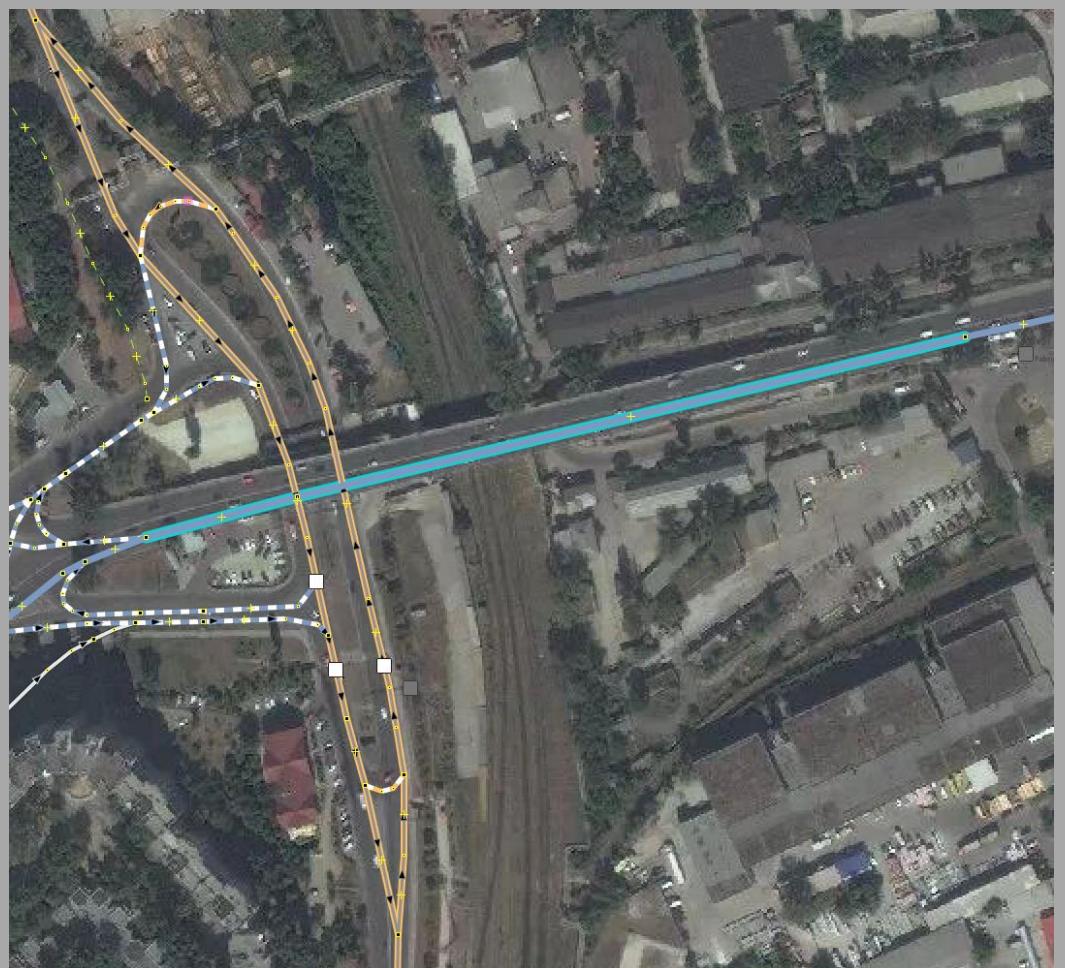
- Abstract value between 5 & 5; zero is inferred
- Usage:
 - Bridges
 - Tunnels
 - Waterways (i.e. Culverts)
- Do not confuse with:
 - Layers used in other programs which group similar features
 - Elevation values

Feature Layering Resources:

- <http://wiki.openstreetmap.org/wiki/Key:layer>

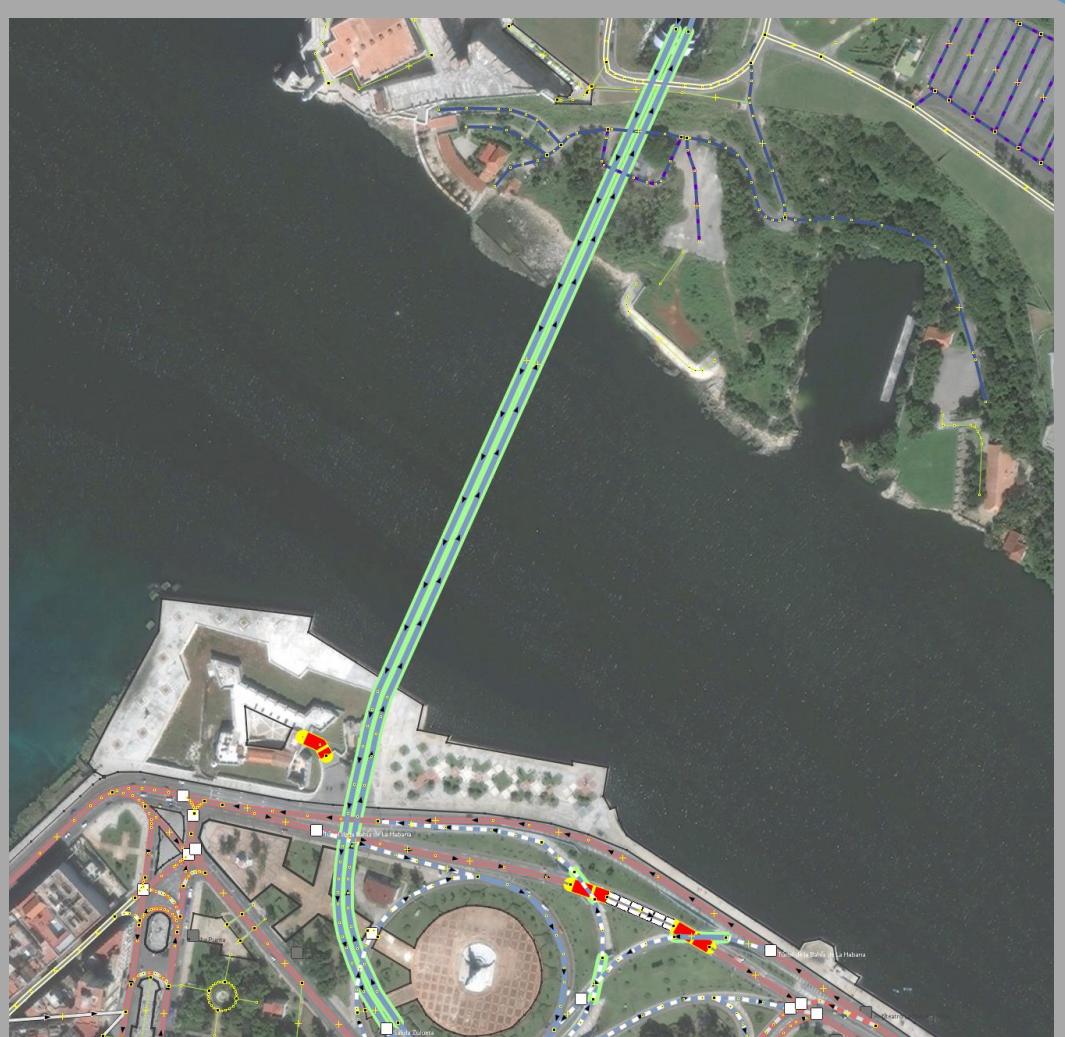
Bridges

REQUIRED VALUE:
1 to 5



Tunnels

REQUIRED VALUE:
-1 to -5



Highway Modeling

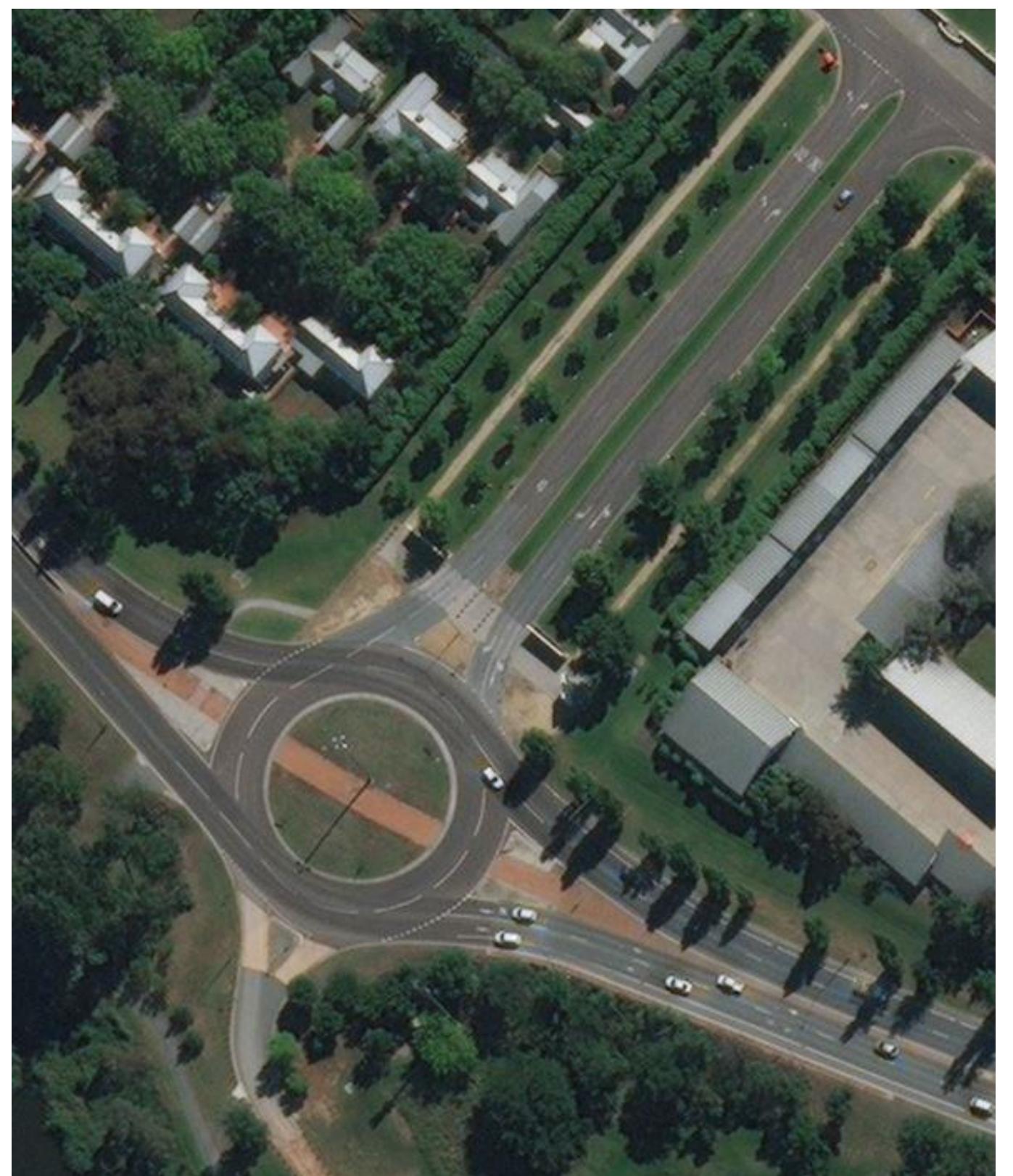
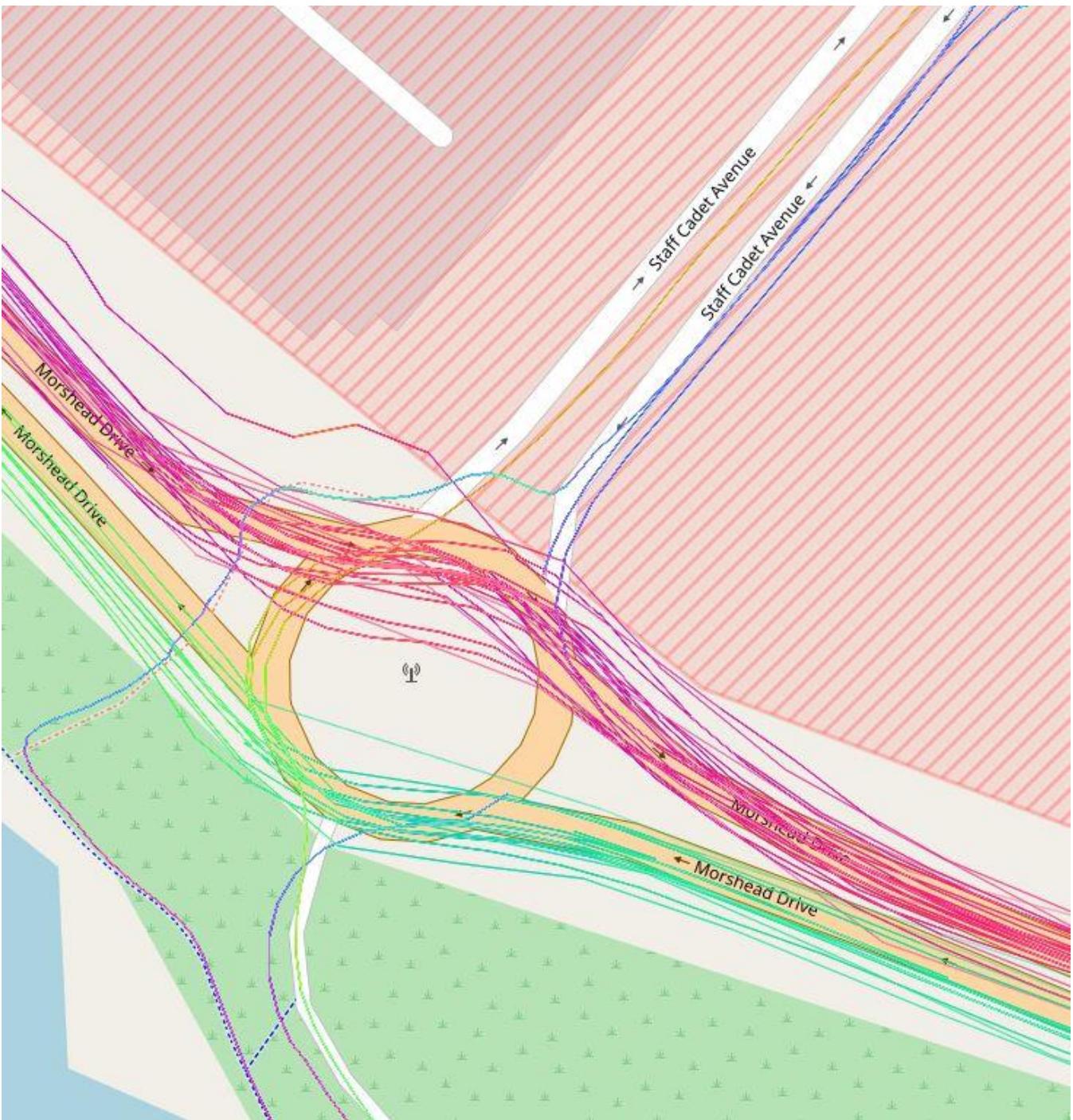
One-way Roads

Certain features only allow for one direction of traffic

- Roundabouts
- One-way Roads
- Most Highway Links

Remember

- Look for cars and road markings in imagery
- Check directional GPS tracks
- Aim for newest imagery/GPS tracks since direction may have changed



Highway Modeling

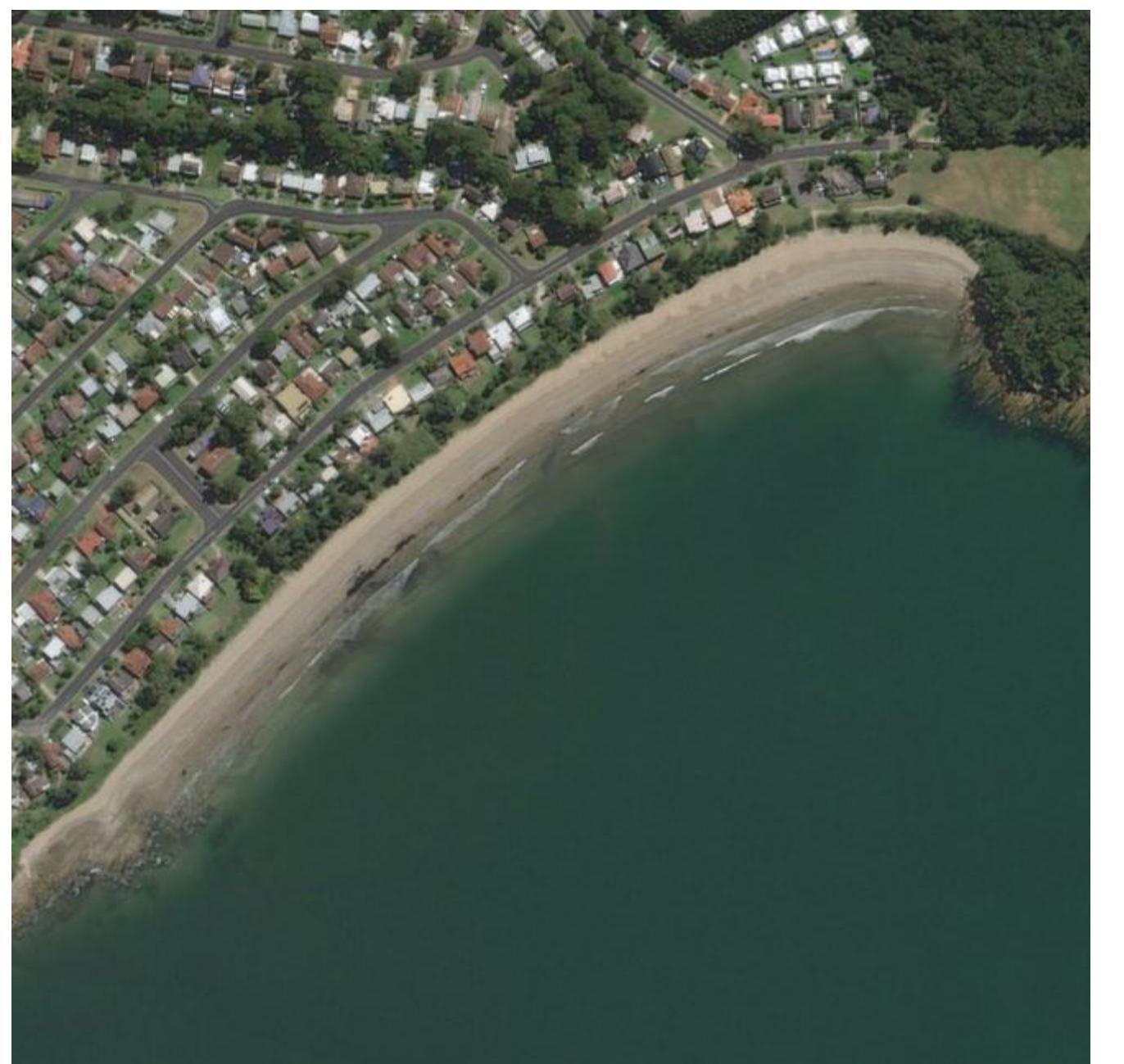
Obscured Imagery/Low Resolution

The world is a dynamic place, which can make capturing imagery difficult

- Clouds may block view
- Lack of funding for high resolution imagery in some areas



- Check all imagery layers:
 - Bing, Digital Globe, and MapBox
 - OpenAerialImagery
- Use GPS tracks if available
 - Best source for seeing the route of traffic if there is poor quality imagery



Highway Modeling

Geometry Kinks

- Sharp kinks in highway features:
 - Create routing issues
 - Example of poor quality cartography
- Add nodes around corners to smooth road

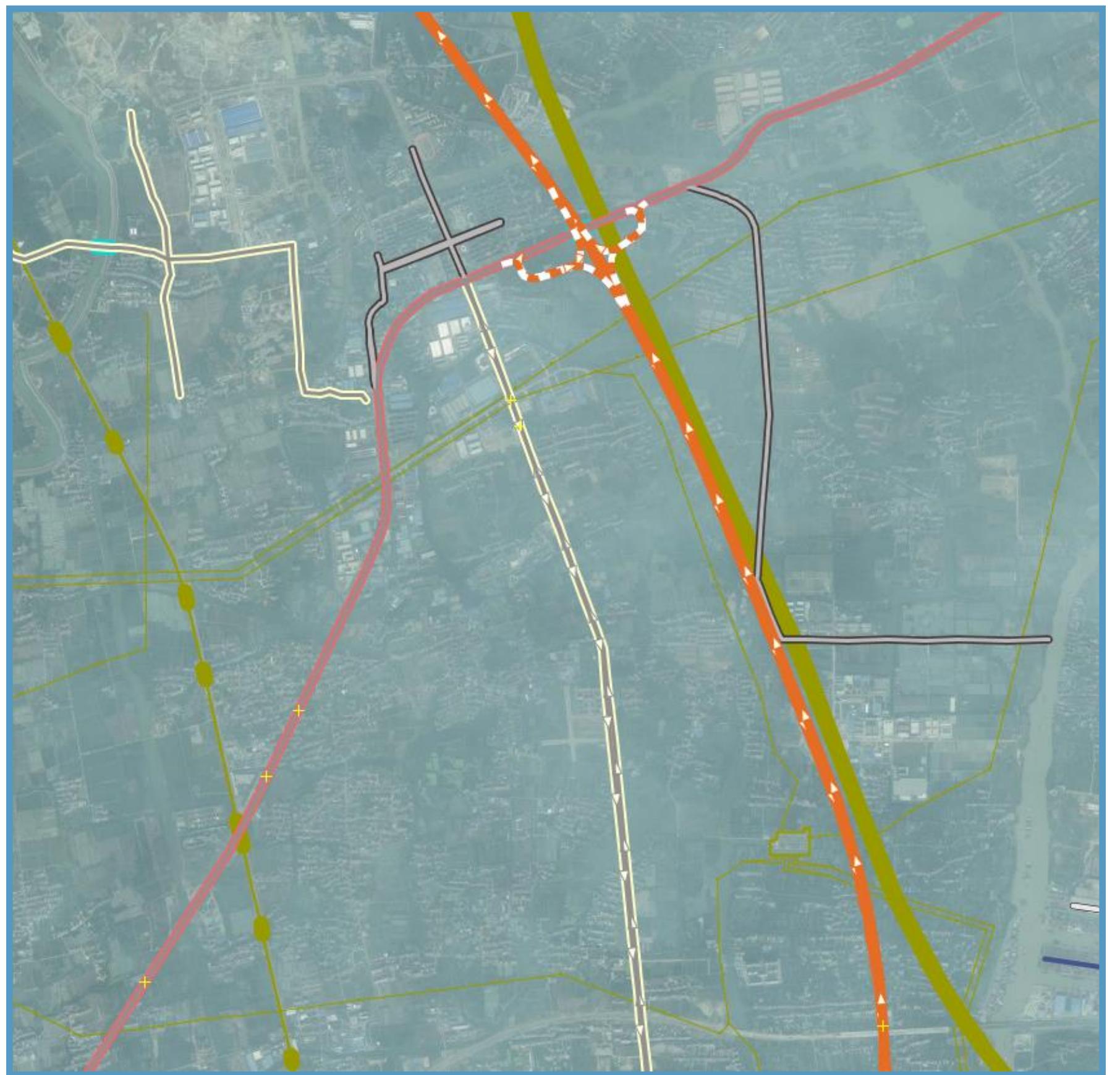


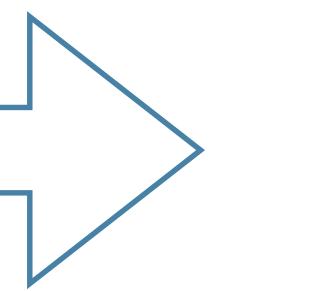
All of these corners do not accurately represent the road.

Highway Modeling

Adding Missing Roads

- Goals:
 - Create **network continuity** across OSM country data
 - Add valuable roads and connections
 - Finish what other users have started
 - Open roads which finished construction
- Make sure that a road is supported by imagery or GPS tracks
- In cases of limited time, only add highways if they provide critical access to a community or improve the connectivity of an area





Highway Modeling

Unsupported Highways

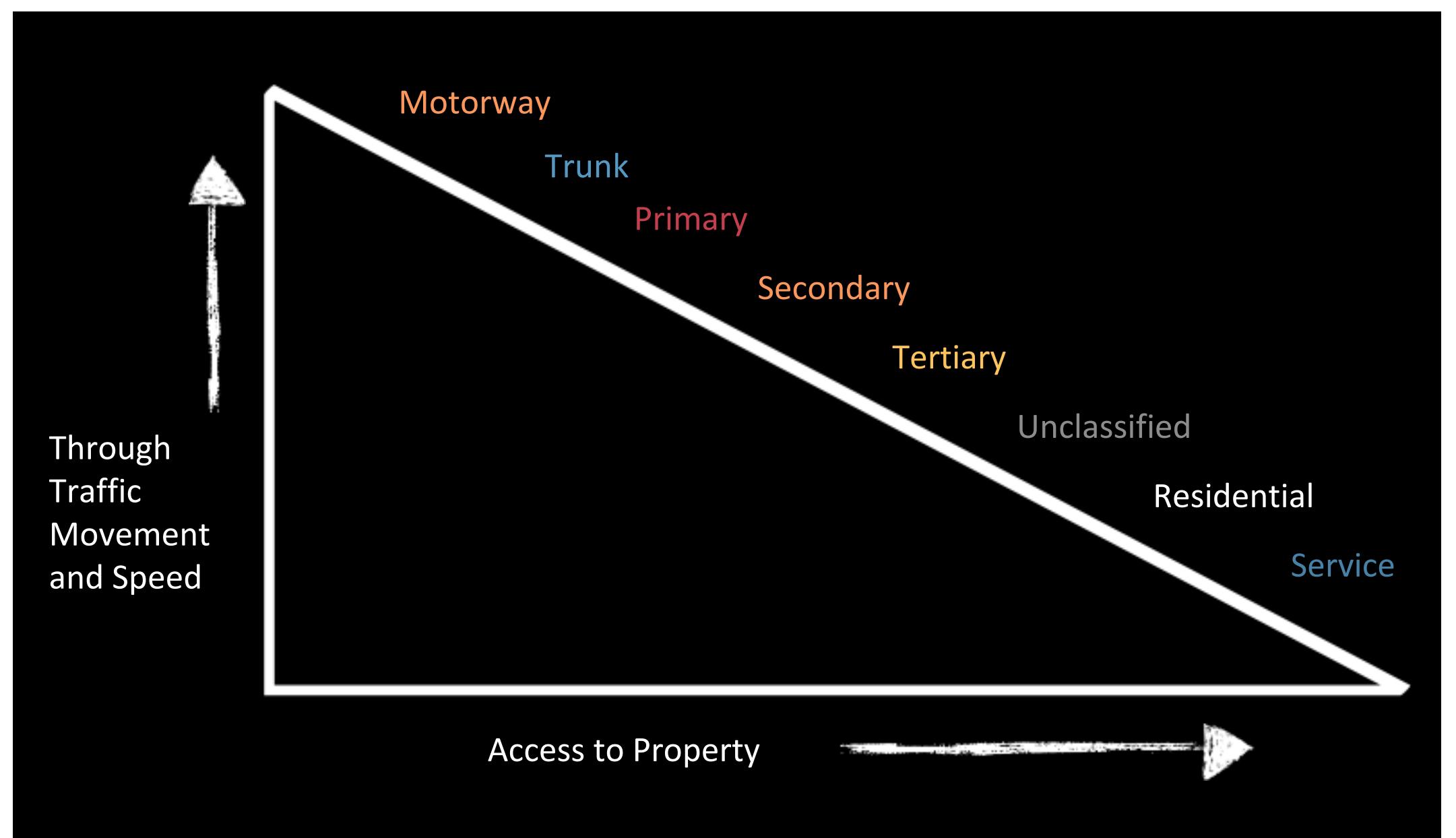
Occasionally we find highways with no proof of their existence in imagery or GPS tracks

- Research and verify road does not exist before removing
 - If feature has a name, research the name
 - Check other imagery layers
 - Review changeset comments for the feature
- Sometimes they are proposed or under construction highways
 - If verified by reliable and recent resource, change feature to “highway = construction” or “highway = proposed”
 - Cite source in your changeset comment
 - If unable to verify construction with reliable source but feature may exist, leave feature alone

Review

Thoughts and Tips

- Focus on making logical networks that users can understand and navigate
- Check OSM Wiki for guidelines
- View the area farther zoomed out
 - Look at the network as a whole
 - Analyze road's main purpose
- Links can get complicated, ask for advice if needed
- Check all your sources
 - Different imagery
 - GPS tracks
 - Online research for new construction



Highway Classification Hierarchy

Motorway

Trunk

Primary

Secondary

Tertiary

Unclassified

Residential

Service

Track