HERE Technologies GuadalaHacks Student Hackathon

May 17 & 18 2025

About HERE Technologies

We make a unified live map designed for every moving vehicle

Using location technology to solve global challenges

- HERE Technologies is a location data and technology company that created the first digital map **40 years ago**.
- Today we are the world's leading location platform company with a global footprint across **52 countries.**
- We create and maintain a new type of map - a complete, accurate and easy-to-use digital representation of the physical world.

Prizes

1st place team: internships with HERE.

- **Potential start date:** Summer or Fall 2025 (Must be completed before end of 2025)
- **Duration:** 10-12 weeks
- **Hours:** 10-12 hours per week
- Option for remote or in-office (Leon)

2nd and 3rd place teams

- HERE Developer Blog posts

The Problem:

Automatically Correcting Spatial Validations

Project Overview

The road network is continuously evolving, and we aim to maintain up-to-date maps to enhance navigation and overall user experience.

HERE develops and maintains a robust set of validations to detect issues within the data.

- Based on a comprehensive set of rules
- Currently 3000+ validations
- Intended to reflect reality situations
- Cleaned before release
- Reviewed: fixed or labeled as “legal exceptions”

POI295

POI on Inside of Multi-Dig Road

Trigger: A Point of Interest (POI) feature is suspicious when located on the inside of Multiply Digitised roads.

Outcome scenarios:

1. No POI in reality
2. Incorrect POI location
3. Incorrect Multiply Digitised attribution
4. Legitimate Exception from the rule

Possible Scenarios (1/4)

Scenario #1: no POI in reality

No POI in reality:

- The POI feature is most likely outdated or has been moved.

OUTCOME:

Mark the feature for deletion

Possible Scenarios (2/4)

Scenario #2: POI placed on incorrect side of the road

Incorrect road matching:

- There is a POI in reality, but it has been associated to the wrong side of the road segment.

OUTCOME:

Update the POI record with a new associated Link

Possible Scenarios (3/4)

Scenario #3: Incorrect Multiply Digitised attribution

Incorrect road attribution:

- The POI is in the correct place, however the road segment was erroneously attributed as ‘Multiply Digitised = YES’

OUTCOME:

Update the Link feature’s MULTIDIGIT attribute to ‘N’

- See more about Multiply Digitised (MULTIDIGIT) coding in the *Navstreets Reference Guide (pg. 468-470)*.

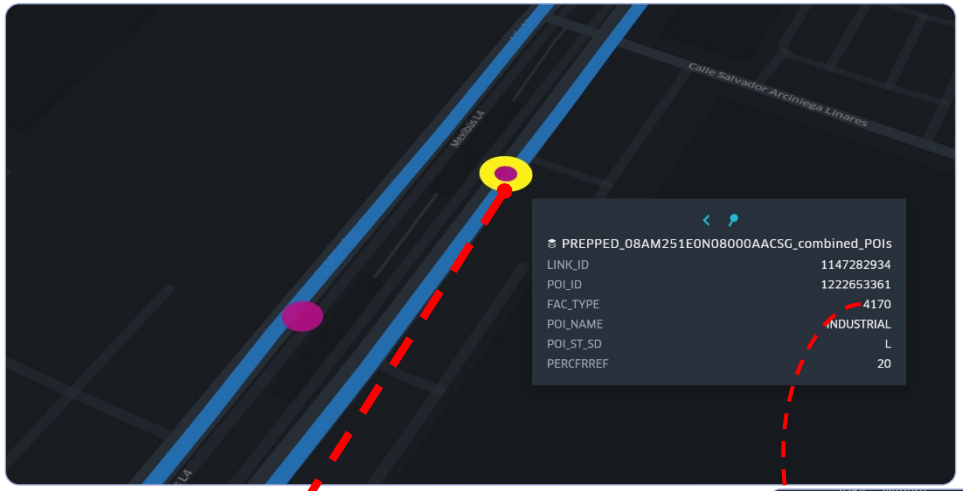
Possible Scenarios (4/4)

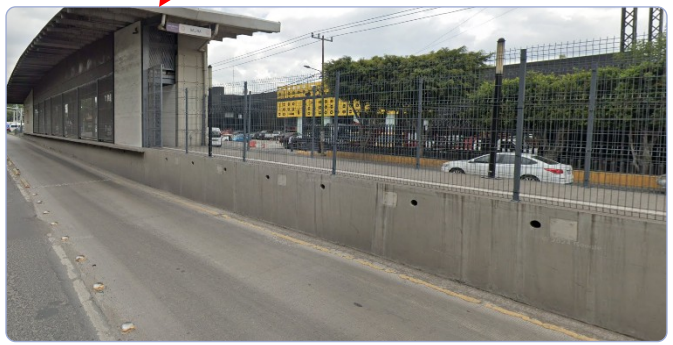
Legitimate Exception: correct location and confirmed existence

Valid exception from the rule:

- There is a POI in reality and its location within a multi-dig set of road links is correct

OUTCOME:
mark violation as 'Legitimate Exception' in the Validations dataset





3578	ATM
4013	Train Station
4100	Commuter Rail Station
4170	Bus Station
4444	Named Place
4482	Ferry Terminal
4493	Marina
4580	Public Sports Airport
4581	Airport
5000	Business Facility

POI Facility Type Codes

Dataset Characteristics

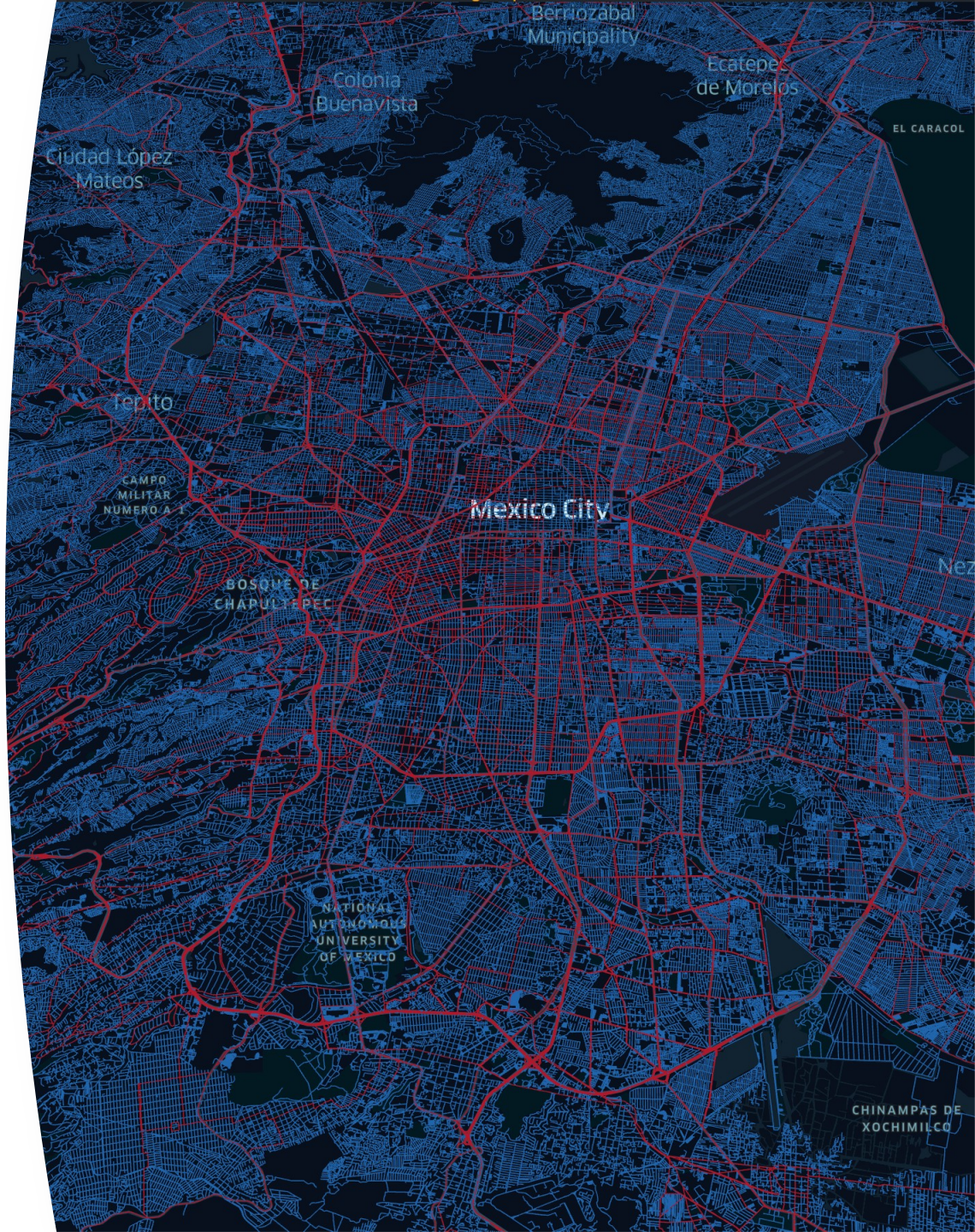
The provided data includes the Street Network and Places of Interest in parts of Mexico City and surrounding area. It also includes ***hidden errors...***

Included:

- Road Network Dataset (geometry, street type etc.)
- Points of Interest Dataset (restaurants, banks etc.)
- Satellite Imagery *(through the HERE REST APIs)*

Allowed:

- Open-source data (as reference, not as sole data source)



The Datasets

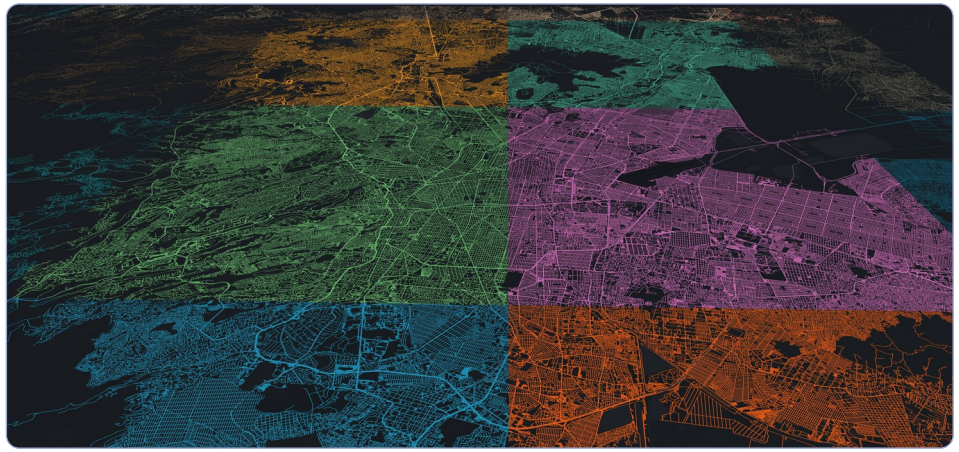
Street Network - Nav Dataset

Definition

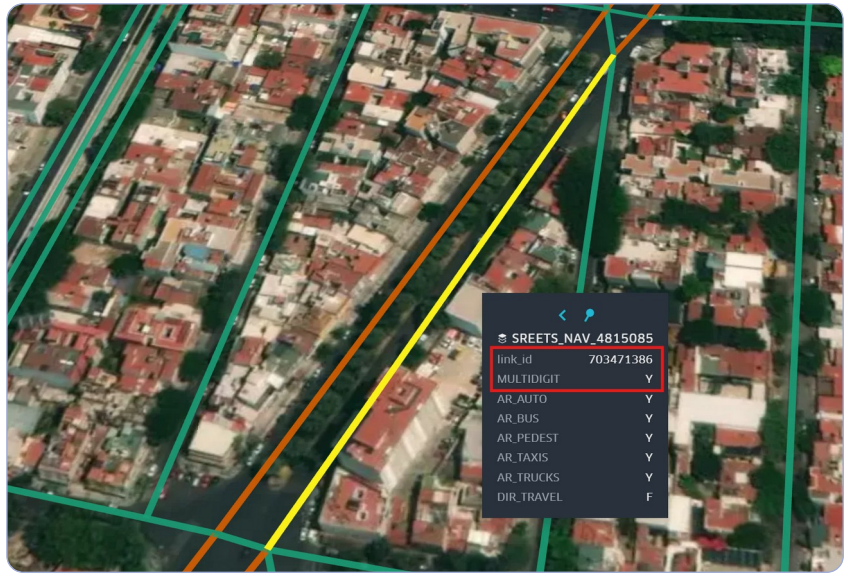
- The **Streets - Nav** dataset contains all roads plus Road Network features related to navigation such as direction of travel, dividers, lane counts etc.
- **Spatial Feature Type:** LineString

Location

- Geojson files can be found in the ‘STREETS_NAV’ folder.
- Data is split into 20 separate files for convenience.



20 ‘tiles’ of Street Network Data



‘link_id’ acts as the unique ID while other columns show relevant attribution of the feature.

The Datasets

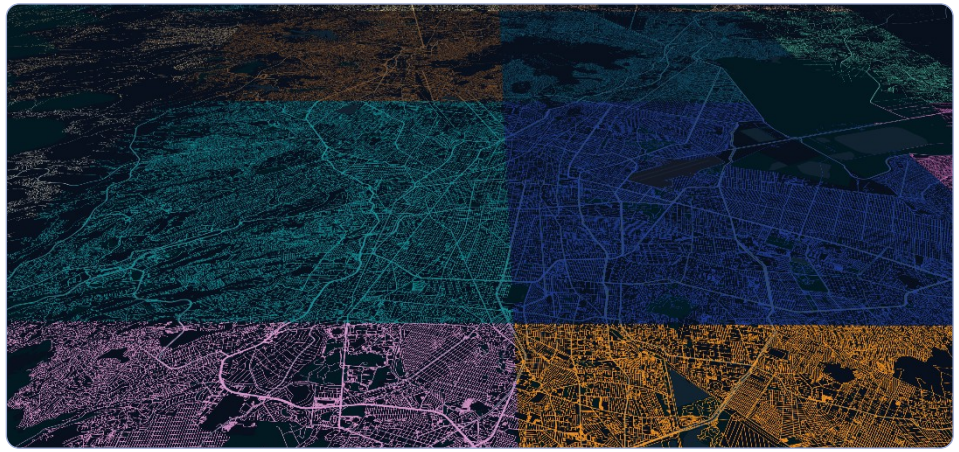
Street Network – Naming & Addressing Dataset

Definition

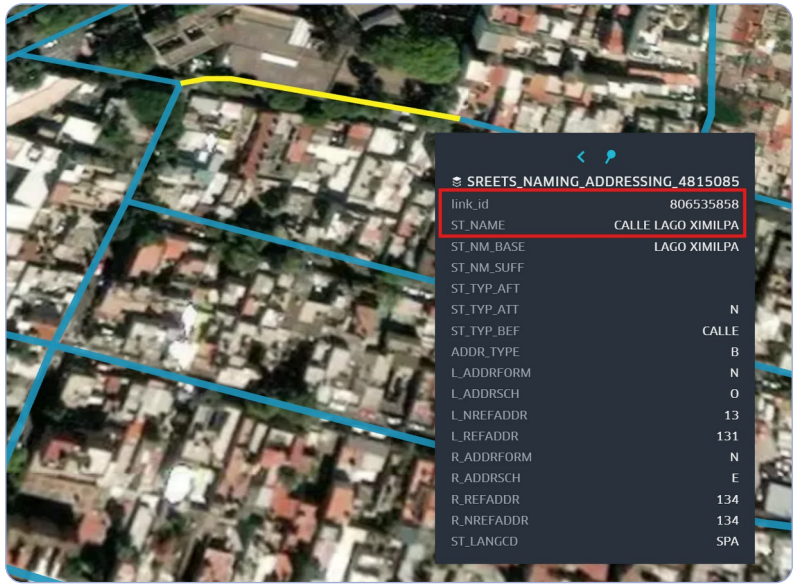
- The **Streets – Naming & Addressing** dataset contains all roads plus Road Network features related to naming and addressing.
- **Spatial Feature Type:** LineString

Location

- Geojson files can be found in the ‘STREETS_NAMING_ADDRESSING’ folder.
- Data is split into 20 separate files for convenience.



20 ‘tiles’ of Street Network Data



‘link_id’ acts as the unique ID while other columns show relevant attribution of the feature.

The Datasets

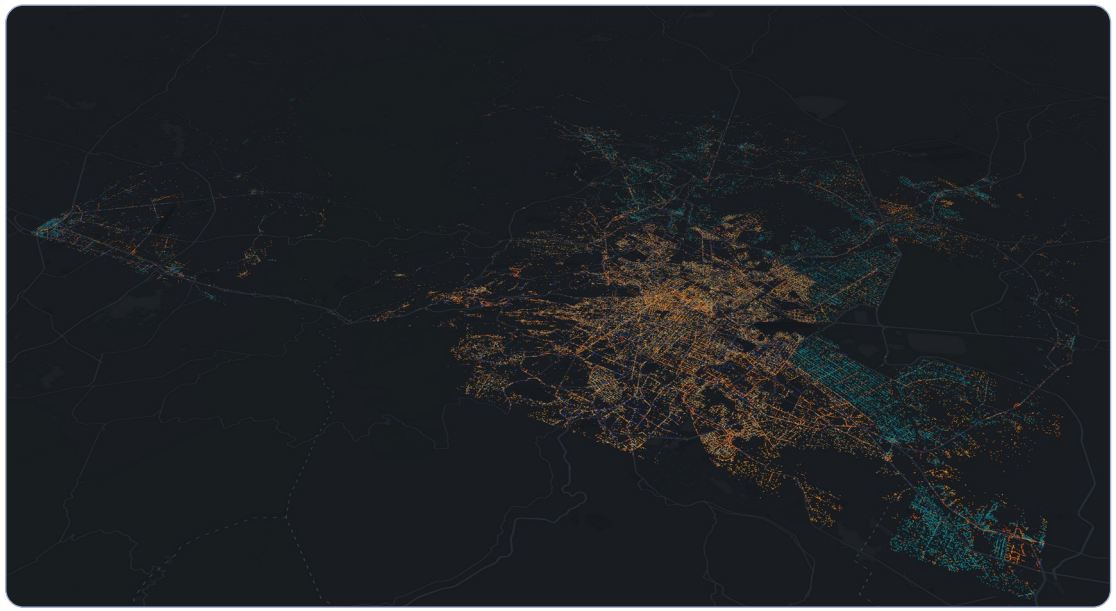
Places of Interest (POI) Dataset

Definition

- The **POI** dataset contains all Places of Interest features along with relevant attribution.
- Its **location is derived** by joining it with the Streets dataset and calculating its placement based on indicated distances.
- **Spatial Feature Type:** Point (but its geometry needs to be derived)

Location

- Geojson files can be found in the ‘POIs’ folder.
- Data is split into 20 separate files for convenience.



~190,000 POI records in the Mexico City area

‘POI_ID’ identifies a unique POI record

LINK_ID = associates POI with a street.
POI_ST_SD = side of street where the POI is located.

PERCREF = indicates the location of the POI on the link in terms of percent from the reference node.

The Datasets

Satellite Imagery (HERE REST API requests)

Definition

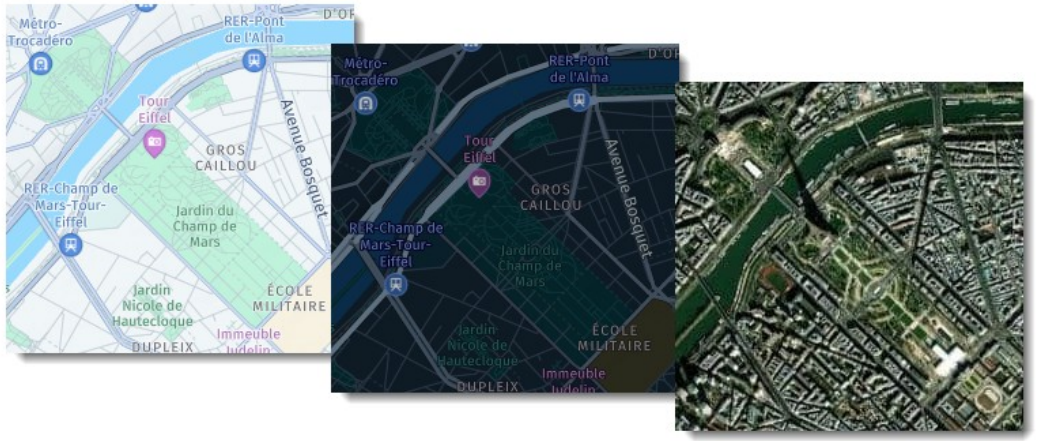
- The HERE Raster Tile API offers bitmap images with a resolution of either 256x256 or 512x512 pixels.
- Satellite imagery is one of the pre-defined response types that can be requested.

Location

- Available through REST API requests. Requires API Key (30k request for free in the Base Plan)

How to:

- Example python code snippet to request satellite imagery is provided in the docs.



HERE Raster Tile API style examples

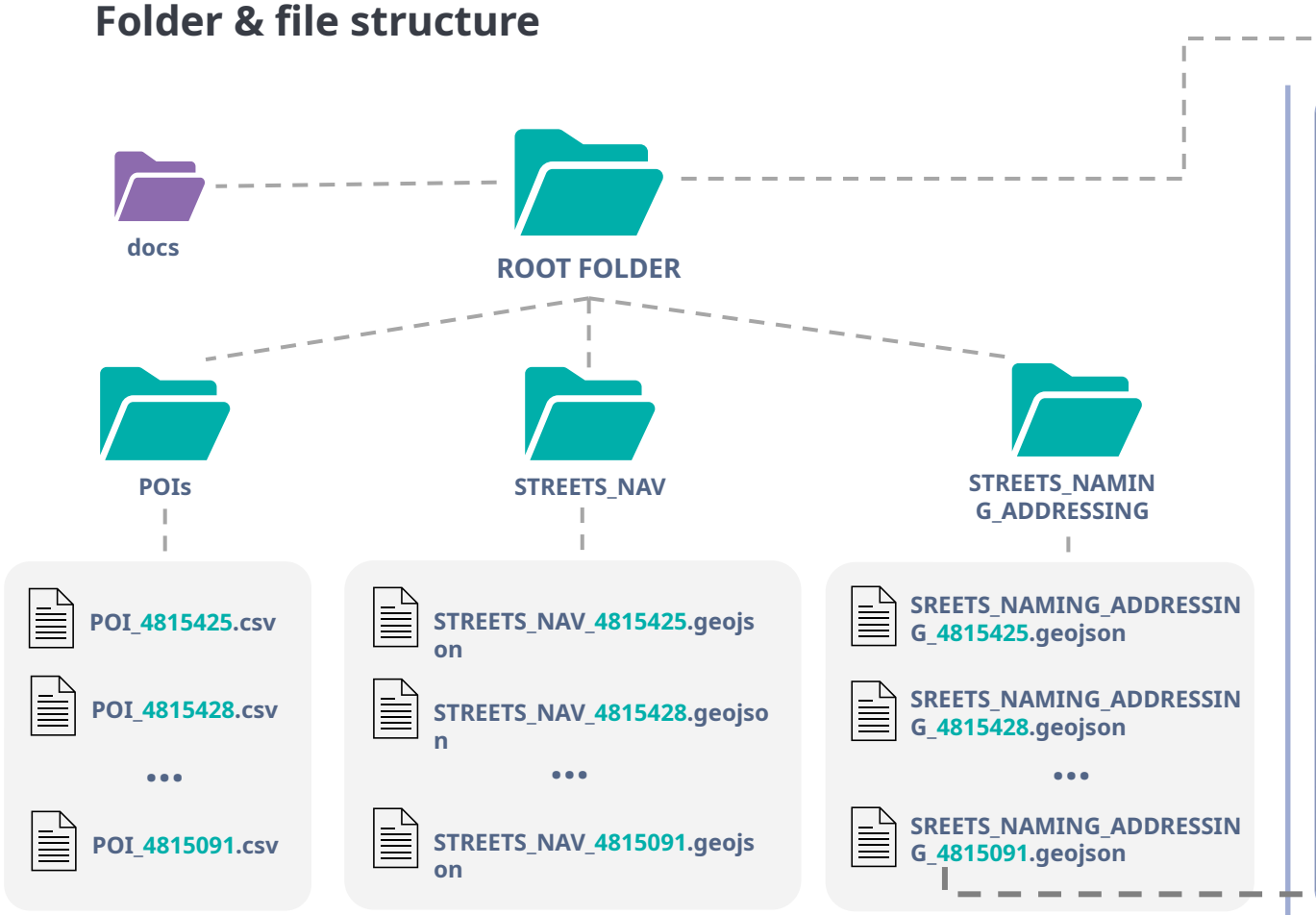
```python
def get_satellite_tile(lat,lon,zoom,tile_format,api_key):

    x,y =lat_lon_to_tile(lat, lon, zoom)


    # Construct the URL for the map tile API
    url = f'https://maps.hereapi.com/v3/base/mc/{zoom}/{x}/{y}/{tile_format}&style=satellite.day&size={tile_size}?apiKey={api_key}'

    # Make the request
    response = requests.get(url)

    # Check if the request was successful
    if response.status_code == 200:
        # Save the tile to a file
        with open(f'satellite_tile.{tile_format}', 'wb') as file:
            file.write(response.content)
        print('Tile saved successfully.')
    else:
        print(f'Failed to retrieve tile. Status code: {response.status_code}')

    bounds = get_tile_bounds(x,y, zoom)
    wkt_polygon = create_wkt_polygon(bounds)
    return wkt_polygon

############################################################
### EXECUTION
############################################################
# Define the parameters for the tile request
api_key = '<YOUR API KEY>'
latitude = 51.94347
longitude = 8.51692
zoom_level = 16  # Zoom level
tile_size = 512  # Tile size in pixels
tile_format = 'png'  # Tile format

# Execute request and save tile
wkt_bounds = get_satellite_tile(latitude,longitude,zoom_level,tile_format,api_key)
```

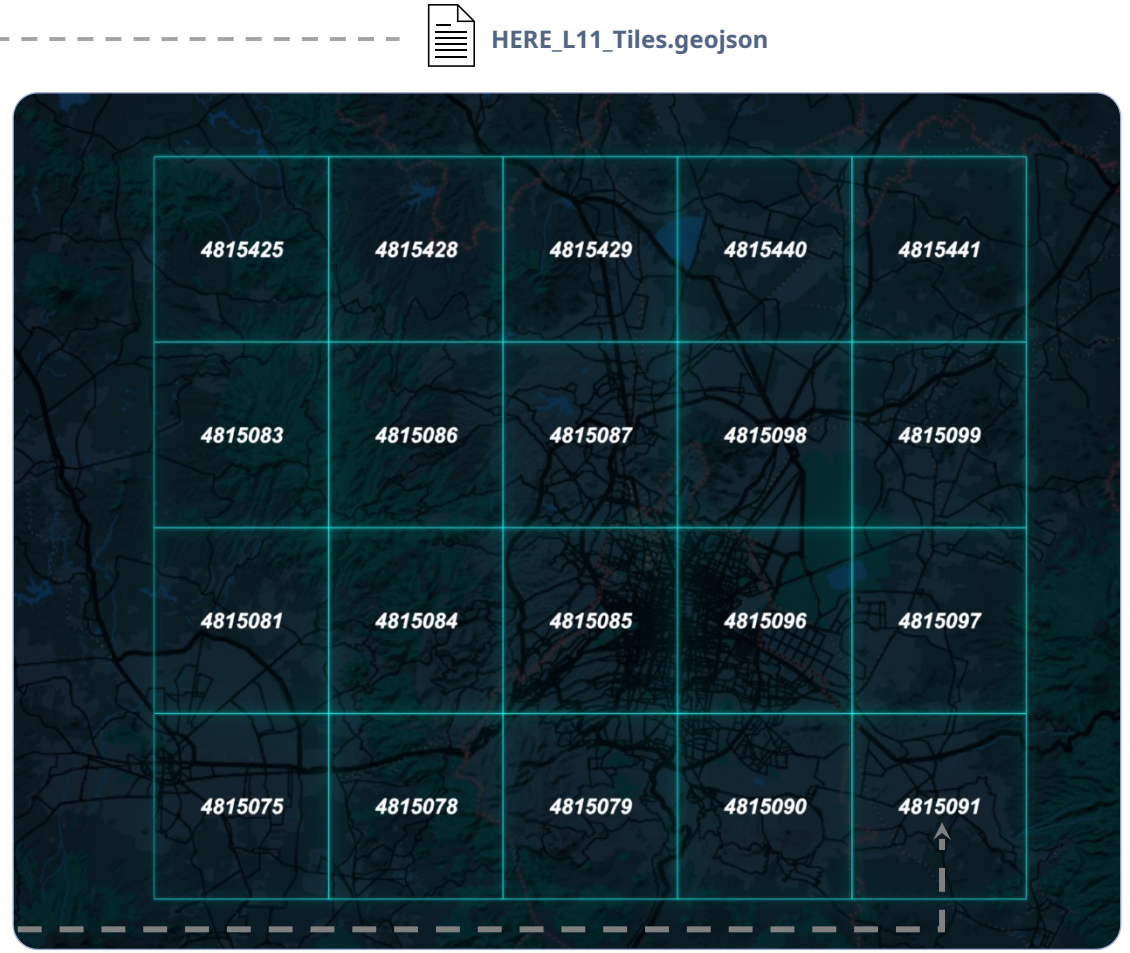
Provided python script

Output png image

The Datasets

Folder & file structure





Each Data Layer is split into 20 HERE Tiles for easier processing.

Critical Attributes (1/3)

Reference & Non-Reference Nodes of Links

HERE NAVSTREETS Reference Guide page 74

Definitions

- **The Reference Node** is the node with the lower latitude.
- If the latitudes of both end nodes are identical and their longitudes differ, the Reference Node is determined by the end node with the lower longitude.
- If, however, the latitudes and longitudes of both end nodes are identical but their Z-Levels are different, the Reference Node is determined by the end node with the lower Z-Level.

Navstreets feature type: Link

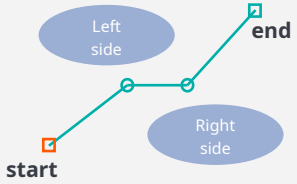
SHAPE POINTS = defines geometric curvature of the road

END NODES = last coord pairs at each ends

REFERENCE NODE = end node with the lower latitude **OR** lower longitude if lats are the same.*

**See additional rules in the Navstreets Guide*

The importance of the Reference Node



Side Orientation is established using the Reference Node and Non-Reference Nodes.

The Reference Node is located at the “beginning” of a link.

I.e.: the right side of a link is the side on the right when facing the Non-Reference Node.

CASES

Lat A < Lat B

Lat A = Lat B

Lon A < Lon B

Lat A = Lat B

Lon A = Lon B

Ref Node has the lower Z level (height)

REFERENCE NODE **NON-REFERENCE NODE**

Critical Attributes (2/3)

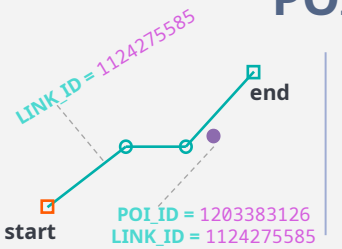
POI Road Side & Distance From Reference Node

HERE NAVSTREETS Reference Guide page 52

Definitions

- **Link ID (LINK_ID)** defines which Link the POI is associated to.
- **Percent From Reference Node (PERCFFREF)** is an attribute to a Point Of Interest (POI) and indicates the location of the POI on the link in terms of percent from the reference node.
- **Side (POI_ST_SD):** The side of the street the POI is located on.

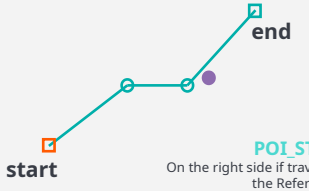
POIs are associated to Links



A POI feature's location needs to be defined based on its LINK ID (LINK_ID) association.

The LINK_ID attribute of a POI record identifies which Link it's associated to.

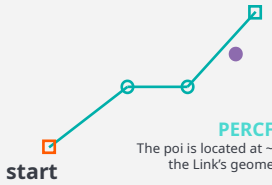
POIs are "placed" with the POI_ST_SD attribute



POI_ST_SD = R
On the right side if traveling along the link from the Reference Node.

POI_ST_SD = L
On the left side if traveling along the link from the Reference Node.

POI location is defined by the PERCFRREF attribute



PERCFFREF = 0.8
The poi is located at ~80% distance marker along the Link's geometry, from the Ref point

Percent From Reference indicates the location of the POI on the link in terms of percent from the reference node.

E.g.: a POI that is approximately at the mid distance point along the geometry has PERCFRREF = 0.5

Critical Attributes (3/3)

Multiply Digitised

HERE NAVSTREETS Reference Guide page 468

Definition:

- The Multiply Digitised attribute identifies links that are digitised with one line per direction of traffic instead of one line per road and using the rules listed below.

Usage:

- For wide roads a link is digitised for each direction of traffic (instead of for each road) in order to improve map matching of the car to the road map.
- The Multiply Digitised attribute identifies these opposing lanes of traffic when it is reasonable to represent them as a single line on displays and printed maps.

Conditions*:

- Meets distance thresholds between the two roadbeds
- Road is not a Ramp, Bi-directional or a Manoeure Link
- No heavy vegetation and the Street Name is the same on both sides

Multiply Digitised requirements not met
(heavy vegetation, large distance & different street names)

Multiply Digitised requirements are met

*Check Navstreets Guide for full list.

Expectations

Find a way to fix the data in automated fashion.

The expected outcome is a presentation on how we can help to resolve violations reported by a particular validation rule code without manual intervention.

Bonus opportunity

- **Goal**: Scale this solution for global use.
- **Challenge**: How to make this solution efficient across different countries and road systems.
- **Task**: Propose a **theoretical** approach to scale the model globally.
- **Extra Points**: Present a practical or innovative method for global scaling.

Additional Resources

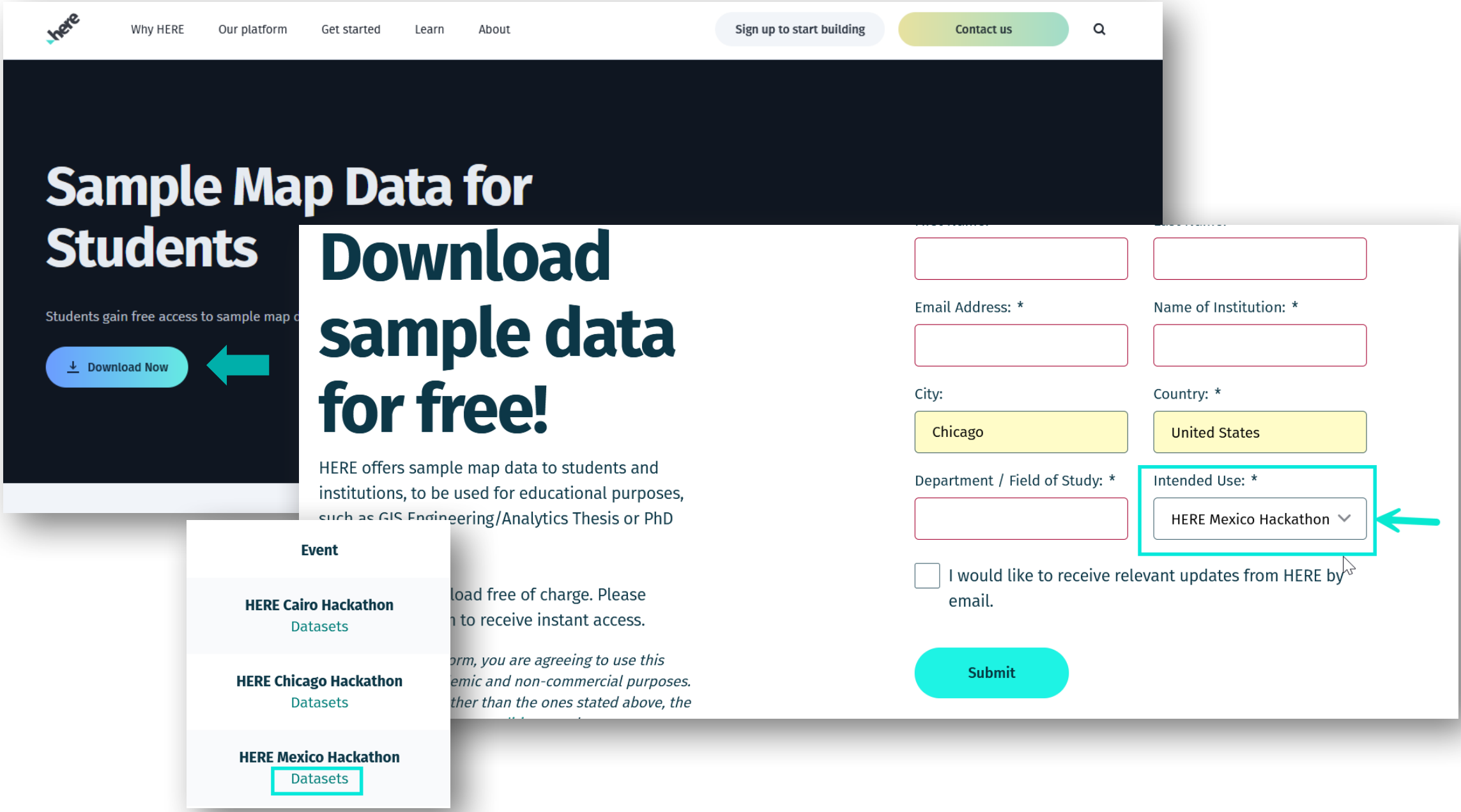
- Introduction to HERE Mapping Concepts: User Guide
- HERE Platform (free access available)
- HERE Rest API Information
- General HERE Documentation Search

Questions?

Chat via Teams

Email:
kelli.vogt@here.com
akos.magdo@here.com

Get Started: Download data


here
Why HERE
Our platform
Get started
Learn
About
Sign up to start building
Contact us
Sample Map Data for Students
Students gain free access to sample map
Download Now
Download sample data for free!
HERE offers sample map data to students and institutions, to be used for educational purposes, such as GIS Engineering/Analytics Thesis or PhD
load free of charge. Please
to receive instant access.
rm, you are agreeing to use this
emic and non-commercial purposes.
ther than the ones stated above, the
Email Address: *
Name of Institution: *
City:
Chicago
Country: *
United States
Department / Field of Study: *
Intended Use: *
HERE Mexico Hackathon
I would like to receive relevant updates from HERE by email.
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Event
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