The many worlds of OpenStreetMap

Alan McConchie
PhD Candidate, University of British Columbia
alan.mcconchie@geog.ubc.ca

URISA BC Seminar:
GIS Technology Showcase
Wednesday January 19, 2011

Outline of presentation

- Overview of OpenStreetMap
  - Origins
  - Data Model
  - User Interfaces
- Using OpenStreetMap
  - Quality control
  - Licensing
  - Examples
- Academic research on OSM
  - Quality and completeness
  - Contributors and motivations
  - Crowdsourcing, neogeography, and Volunteered Geographic Information (VGI)
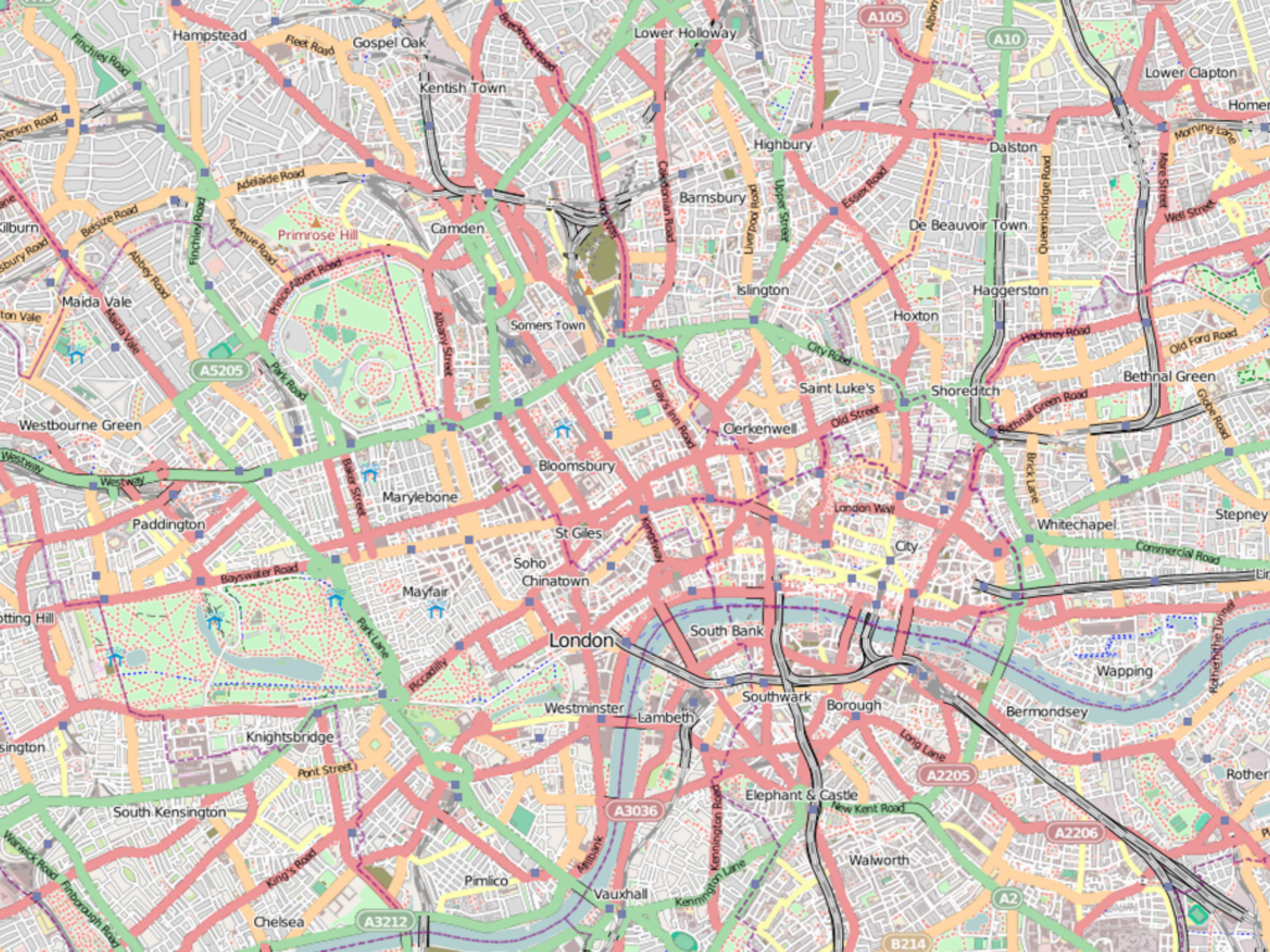
Origins of OpenStreetMap

- Started in 2004 in the UK
- Largely a response to high cost of Ordnance Survey data
- Map originally based on nothing but volunteers' GPS traces and notes

Image: Tom Carden and Steve Coast, 2005

OpenStreetMap today

- On-the-ground mapping still important
- Tracing from permitted satellite imagery
  - Yahoo!, now Bing Maps
- Mass imports of data
  - TIGER in the U.S.
  - AND in the Netherlands
  - and more…
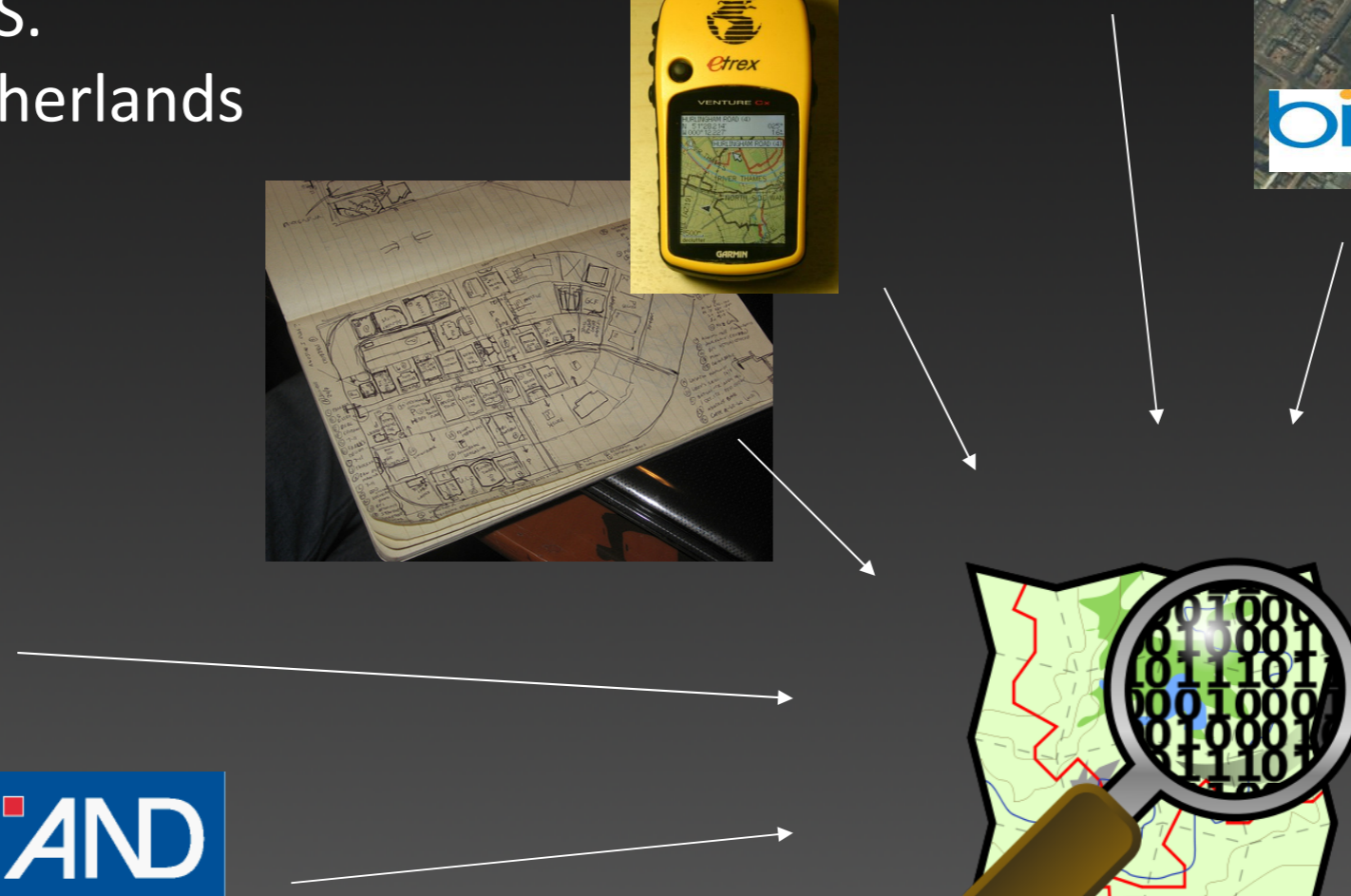
TIGER/Line
(U.S. Census Bureau)

Automobile
Navigation Data
(Netherlands)

OpenStreetMap

OpenStreetMap

◄ ► 🏠 + 🗺 http://www.openstreetmap.org/ ↻ 🔍▾

View | Edit | History | Export | GPS Traces | User Diaries

OpenStreetMap

The Free Wiki World Map

OpenStreetMap is a free editable map of the whole world. It is made by people like you.

OpenStreetMap allows you to view, edit and use geographical data in a collaborative way from anywhere on Earth.

OpenStreetMap's hosting is kindly supported by the UCL VR Centre and bytemark. Other supporters of the project are listed in the wiki.

Help & Wiki
Copyright & License
News blog
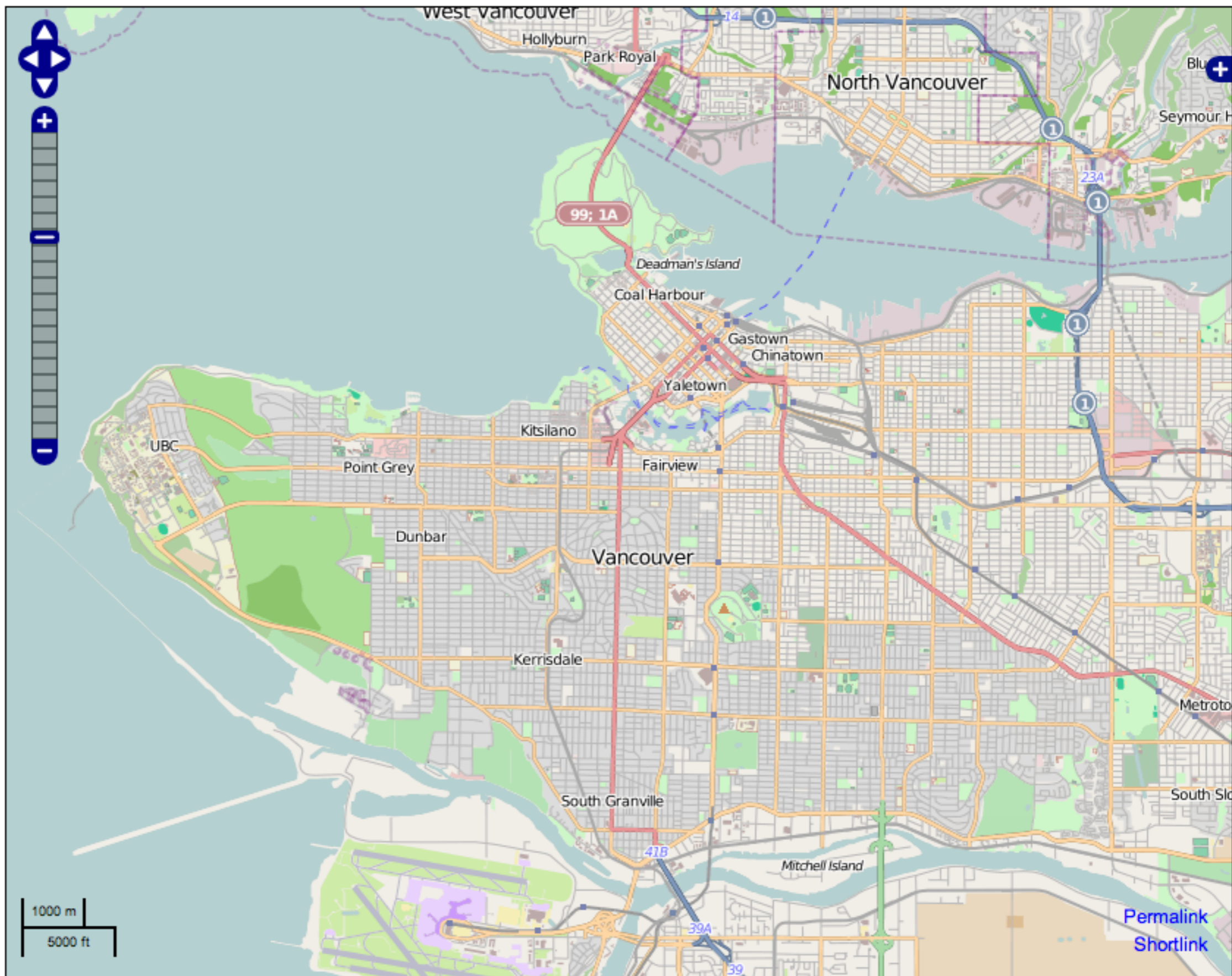**Shop**
Map key

Search   Where am I?

[   ] Go

examples: 'Alkmaar', 'Regent Street, Cambridge', 'CB2 5AQ', or 'post offices near Lünen' more examples...

Make a Donation

West Vancouver
Hollyburn
Park Royal
North Vancouver
Seymour H
Blu
14
1
99; 1A
23A
Deadman's Island
Coal Harbour
1
Gastown
Chinatown
Yaletown
Kitsilano
Fairview
UBC
Point Grey
1
Dunbar
Vancouver
1
Kerrisdale
Metroto
South Granville
South Slo
41B
Mitchell Island
39A
39

1000 m
5000 ft

Permalink
Shortlink

View | Edit | History | Export | GPS Traces | User Diaries

OpenStreetMap

The Free Wiki World Map

OpenStreetMap is a free editable map of the whole world. It is made by people like you.

OpenStreetMap allows you to view, edit and use geographical data in a collaborative way from anywhere on Earth.
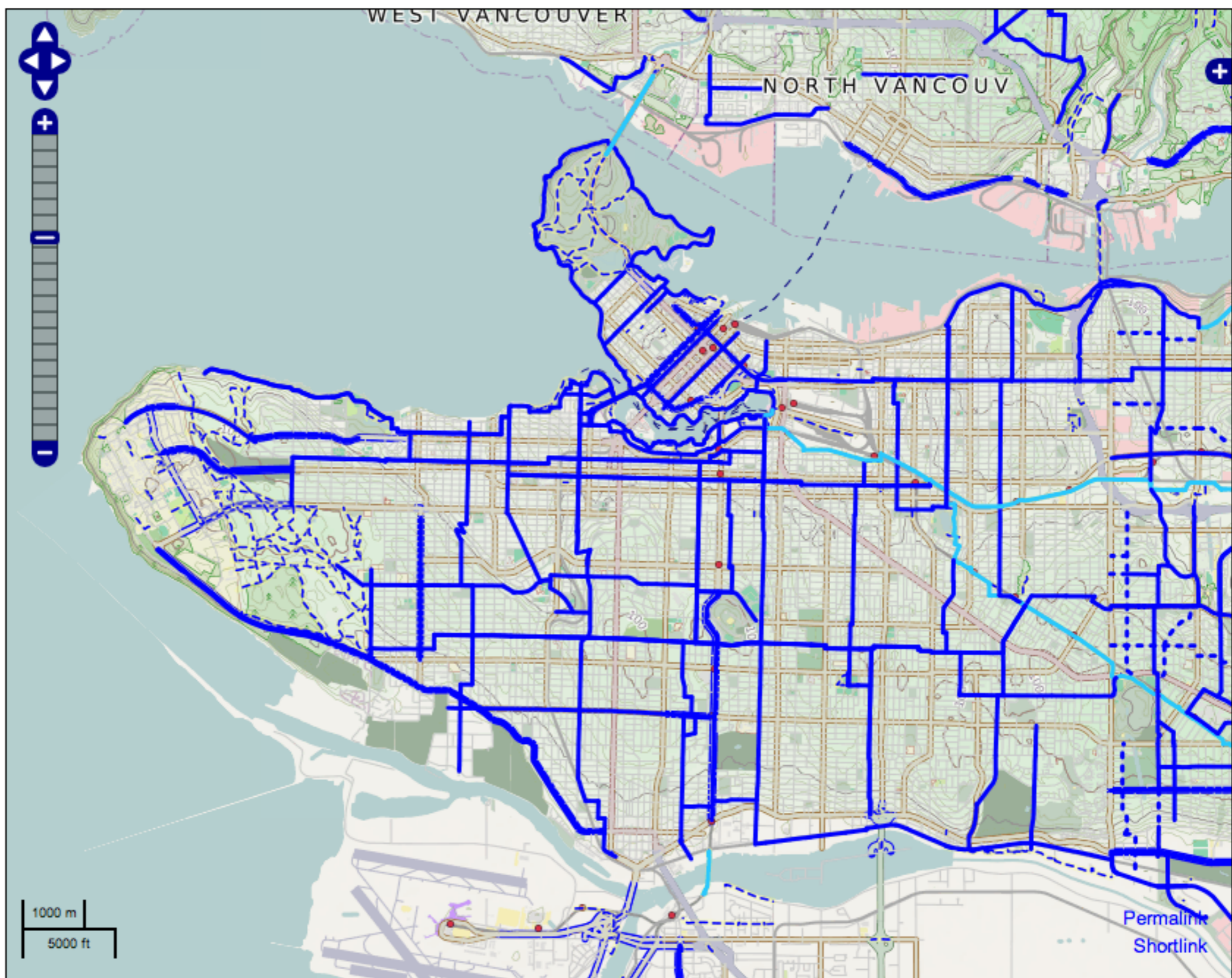
OpenStreetMap's hosting is kindly supported by the UCL VR Centre and bytemark. Other supporters of the project are listed in the wiki.

Help & Wiki
Copyright & License
News blog
Shop
Map key

Search   Where am I?

[   ] Go

examples: 'Alkmaar', 'Regent Street, Cambridge', 'CB2 5AQ', or 'post offices near Lünen'
more examples...

Make a Donation

WEST VANCOUVER

NORTH VANCOUV

1000 m
5000 ft

Permalink
Shortlink

OpenStreetMap

View Edit History Export GPS Traces User Diaries

OpenStreetMap

The Free Wiki World Map

Help Centre
Documentation
Copyright & License
Community Blogs
Foundation
Map Key

Search   Where am I?

[   ] Go

examples: 'Alkmaar', 'Regent Street,
Cambridge', 'CB2 5AQ', or 'post
offices near Lünen' more
examples...

Make a Donation

Marketplace IGA

Maitland Street

Dover

Hazel Street

Miller Avenue

Kemp Street

Kathleen Avenue

Nelson Avenue

Willingdon Avenue

Crystal Mall

Sussex Avenue

Hazel Street

Sussex Avenue

McMurray Avenue

Sanders Street

Beresford Avenue

McKay Avenue

Save on Foods

The Real Canadian Superstore

Metrotown

McMurray Avenue

Miller Avenue

Newto

Central Boulevard

T&T Supermarket

Metrotown Centre Mall

Metrotown

P

Nelson Avenue

London Drugs

Willingdon Avenue

Bennett Street

Bennett Street

Cassie Avenue

McKay Avenue

Silver Avenue

Beresford Street

Central Boulevard

Bonsor Avenue

Brief Street

Dunblane Avenue

Maywood Park

Telford Avenue

Dow Avenue

SkyTrain Expo Line/Millenium Line

Central Boulevard

Jubilee Avenue

McKay Avenue

Maywood Street

Silver Avenue

Sussex Avenue

100 m
200 ft

Permalink
Shortlink

OpenStreetMap Data Model

- Nodes

- Ways
  - Made of up directionally-linked nodes
  - Closed ways represent areas only if appropriately tagged

- Relations
  - Collections of ways or nodes
  - Can group ways into multipolygons (holes, discontiguous pieces, etc.)
  - Can describe relationship between objects (turn restrictions, for example)

- Tags
  - Key/value pairs applied to nodes, ways or relations

◄ ► 🏠 ＋ 🕸 http://www.openstreetmap.org/edit?editor=potlatch2&lat=49.22668&lon=-123.00052&zoom=16 ⟳ | Q▾ Google

The Free Wiki World Map

**Help Centre
Documentation
Copyright & License
Community Blogs
Foundation**

Search   Where am I?

[   ] Go

examples: 'Alkmaar', 'Regent Street,
Cambridge', 'CB2 5AQ', or 'post
offices near Lünen' more
examples...

Make a Donation

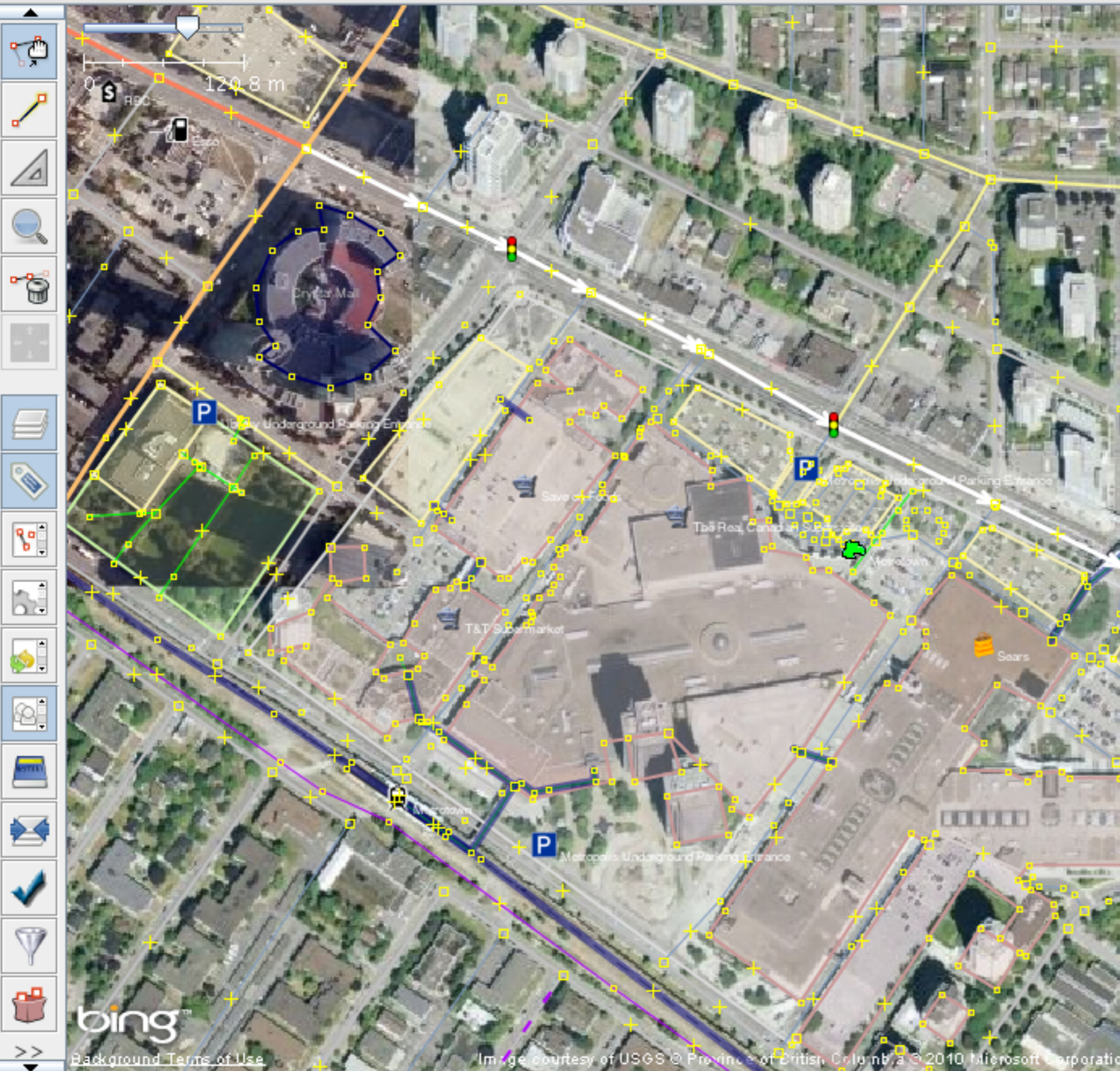**View**   **Edit**   **History**   **Export**   **GPS Traces**   **User Diaries**

Welcome, Alan | home | inbox (0) | logout

Background ▾   **Map Style** ▾   **GPS data** ▾   Undo Redo   Help **Options** 🖫 Save

Way: 35482458

Key	Value	
attribution	GeoBase®	⊗
geobase:acquisitio	GPS	⊗
geobase:datasetNa	NRN:British Colum	⊗
geobase:uuid	5312353ef51711d	⊗
highway	residential	⊗
is_in	Burnaby,British Co	⊗
lanes	2	⊗
name	Brief Street	⊗
source	Geobase_Import_2	⊗

Delete   **Add**

Relation	ID	Role

Remove from   **Add to**

Simple | Advanced   ⌐⌐   ☰

◄ |‖‖‖ | ►

Metrotown

Metrotown

Bennett Street

Brief Street

bing™

Background © 2010 GeoEye, © 2010 Microsoft
Corporation. Image courtesy of USGS. Province of
British Columbia, © 2010 DigitalGlobe.

Background terms of use

Java OpenStreetMap Editor

File   Edit   View   Tools   Presets   WMS   Audio   Help

Layers

- ✓ 👁 Data Layer 1
- 👁 Slippy Map

Properties: 4 / Memberships: 3

Highways / Streets / Primary

Key	Value
highway	primary
is_in	Burnaby, BC
name	Kingsway
ref	99A;1A

Member Of	Role	Posit...
restriction ("only_right_turn", 3 mem...	to	2
route ("Highway 1A", 112 members...		110
route ("Highway 99A", 83 members...		83

➕ Add   📝 Edit   🗑 Delete

1 Author

Author	# Objects	%
alexz	1	100%

Select   Show info

⊖ 49.2295023   ⊘ -123.0012131   (no object)   to toggle); Shift-Ctrl to rotate selected; or change selection

bing

Background Terms of Use   Image courtesy of USGS © Province of British Columbia © 2010 Microsoft Corporatio

OpenStreetMap editing interfaces

- Potlatch
  - Web-based editor
  - Written in Flash

- JOSM
  - Offline editor
  - Written in Java
  - Powerful plug-in architecture

- Other editors
  - Merkaartor (offline, similar to JOSM)
  - MapZen (online, similar to Potlatch)
  - Vespucci (Android)
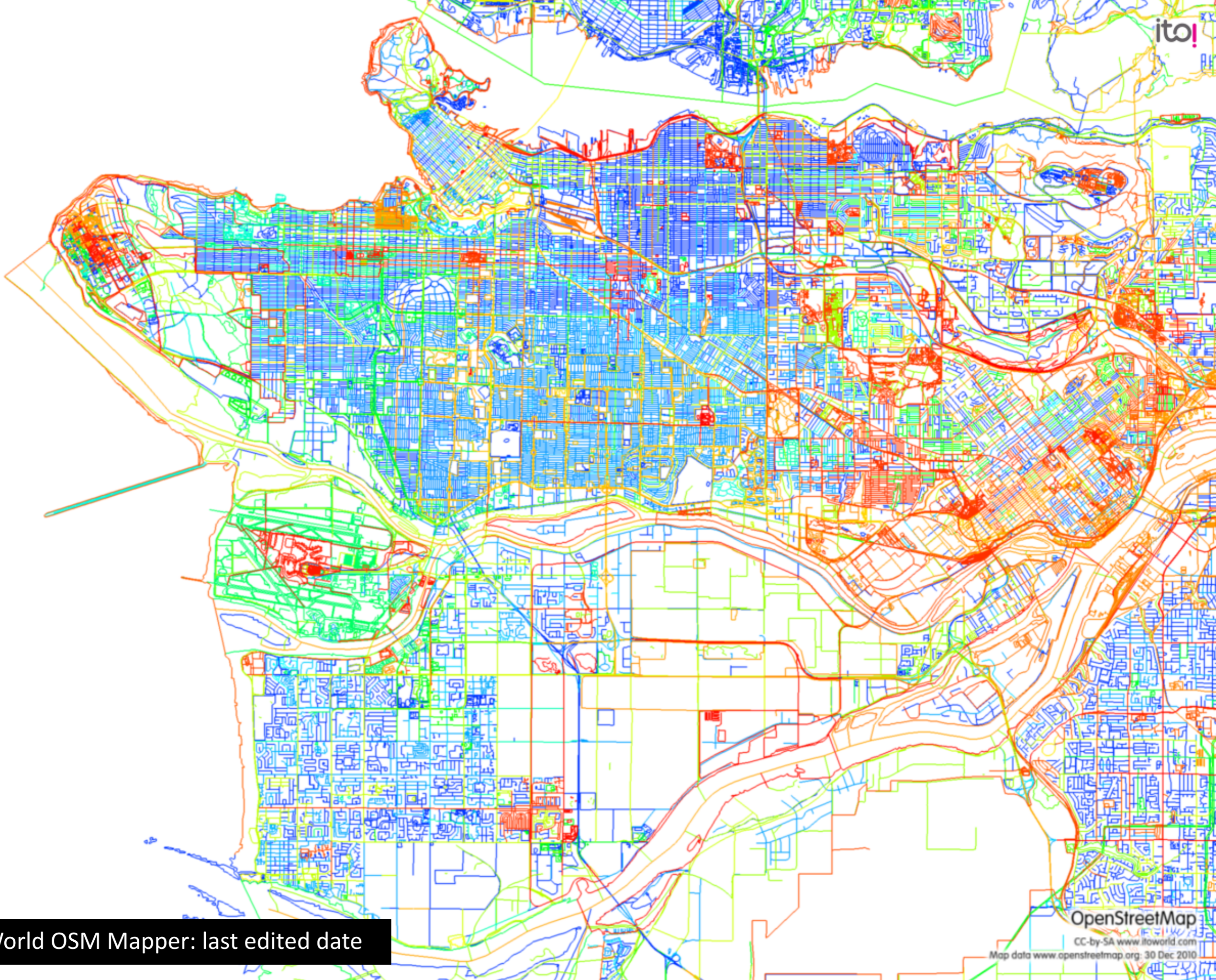 - MapZen POI Collector (iOS)

Using OpenStreetMap

- As an online basemap
    - With Google's API: easy to replace Google's map tiles with OSM tiles
    - With other APIs: OpenLayers, Mapstraction

- Create your own map tiles using a custom style
    - Online using CloudMade
    - Offline with Mapnik

- Getting the raw data
    - OSM's XML format: .osm
    - osm2shp, osm2pgsql
    - Download as shapefile from cloudmade.com, geofabrik.de

OpenStreetMap quality control

- Visualization tools
    - ITO World
    - TIGER edited
    - OpenStreetBugs
    - OSM Inspector
    - NoName layer

- Bots and scripts
    - Tools for reverting vandalism or newbie mistakes
    - Bots for large scale error fixes and updates
    - GeoRSS feeds to monitor changes in a bounding box

Dec 09
Feb 10
Apr 10
Jun 10
Jul 10
Sep 10
Nov 10
Dec 10

ITO World OSM Mapper: last edited date

OpenStreetMap
CC-by-SA www.itoworld.com
Map data www.openstreetmap.org: 30 Dec 2010

Legend:
- Adam Dunn
- alexz
- pnorman
- WBSKI
- mbiker
- klusark
- pdunn
- andrewpmk
- vcelier
- bri g
- LivingWithDragons
- adaviel
- gfish
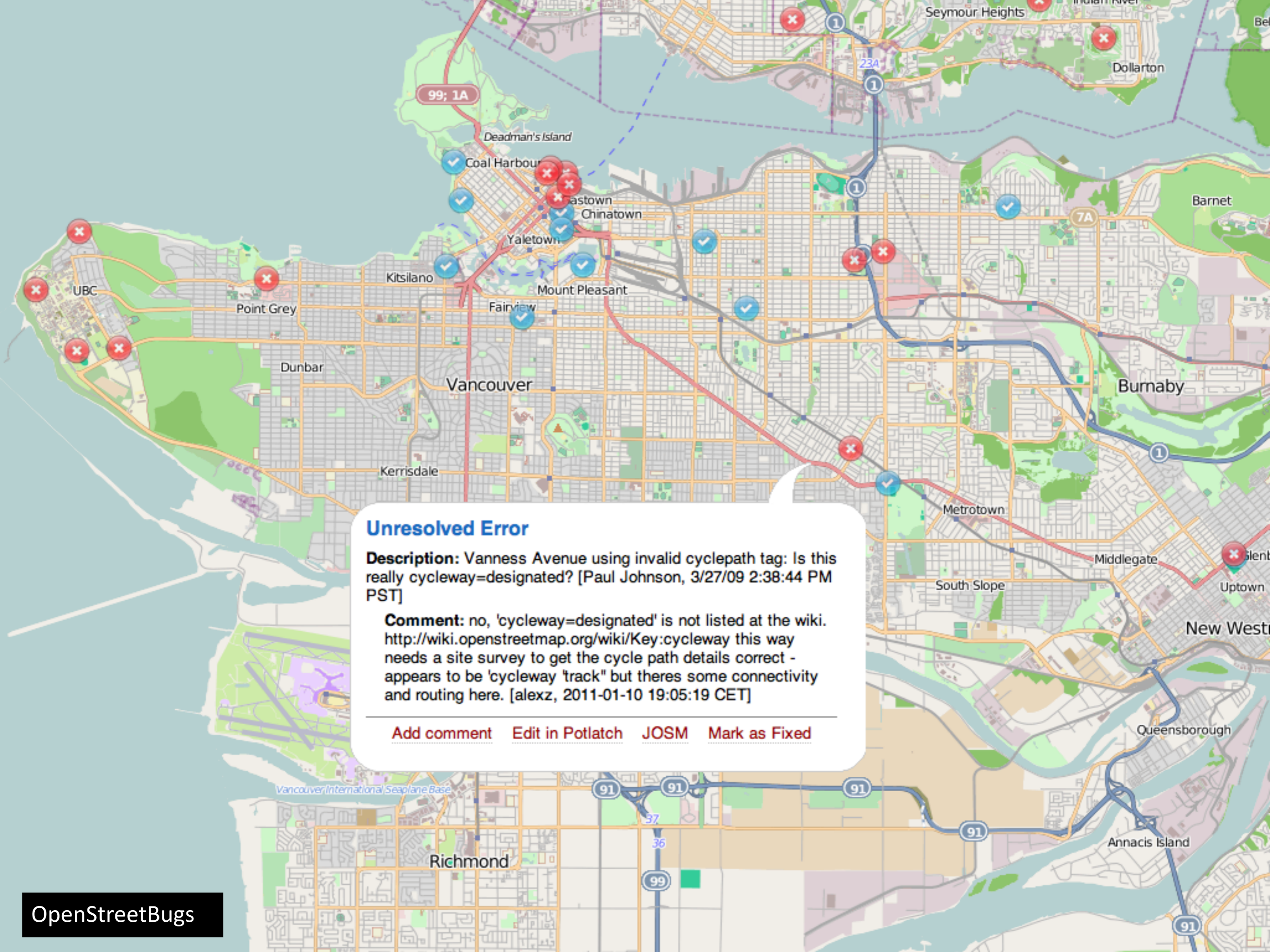- Paul Johnson
- ...130 others
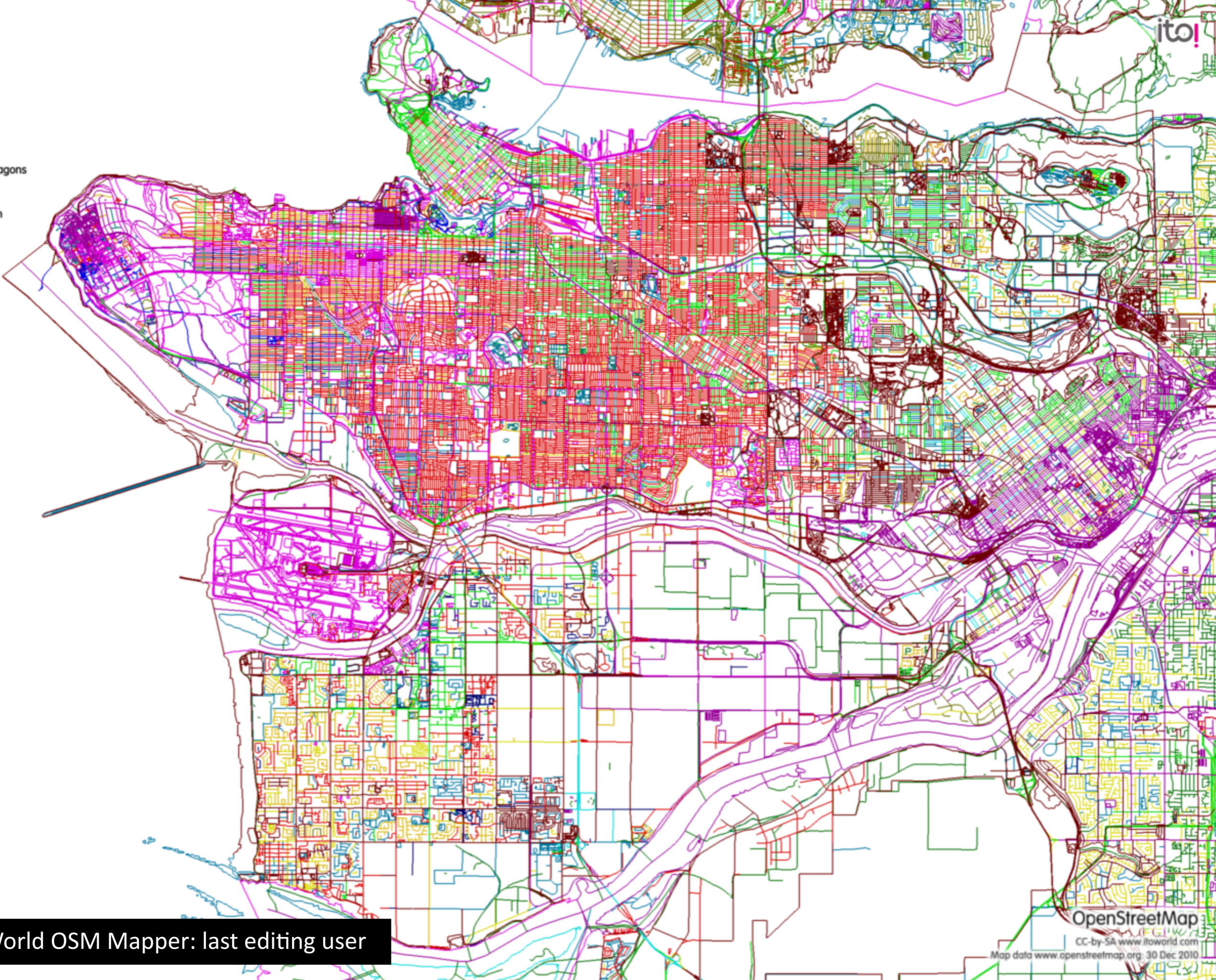
ITO World OSM Mapper: last editing user

OpenStreetMap
CC-by-SA www.itoworld.com
Map data www.openstreetmap.org: 30 Dec 2010

farm
industrial
reservoir
cemetery
retail
recreation_ground
commercial
allotments
residential
construction
forest
greenfield
wood
grass
...9 others
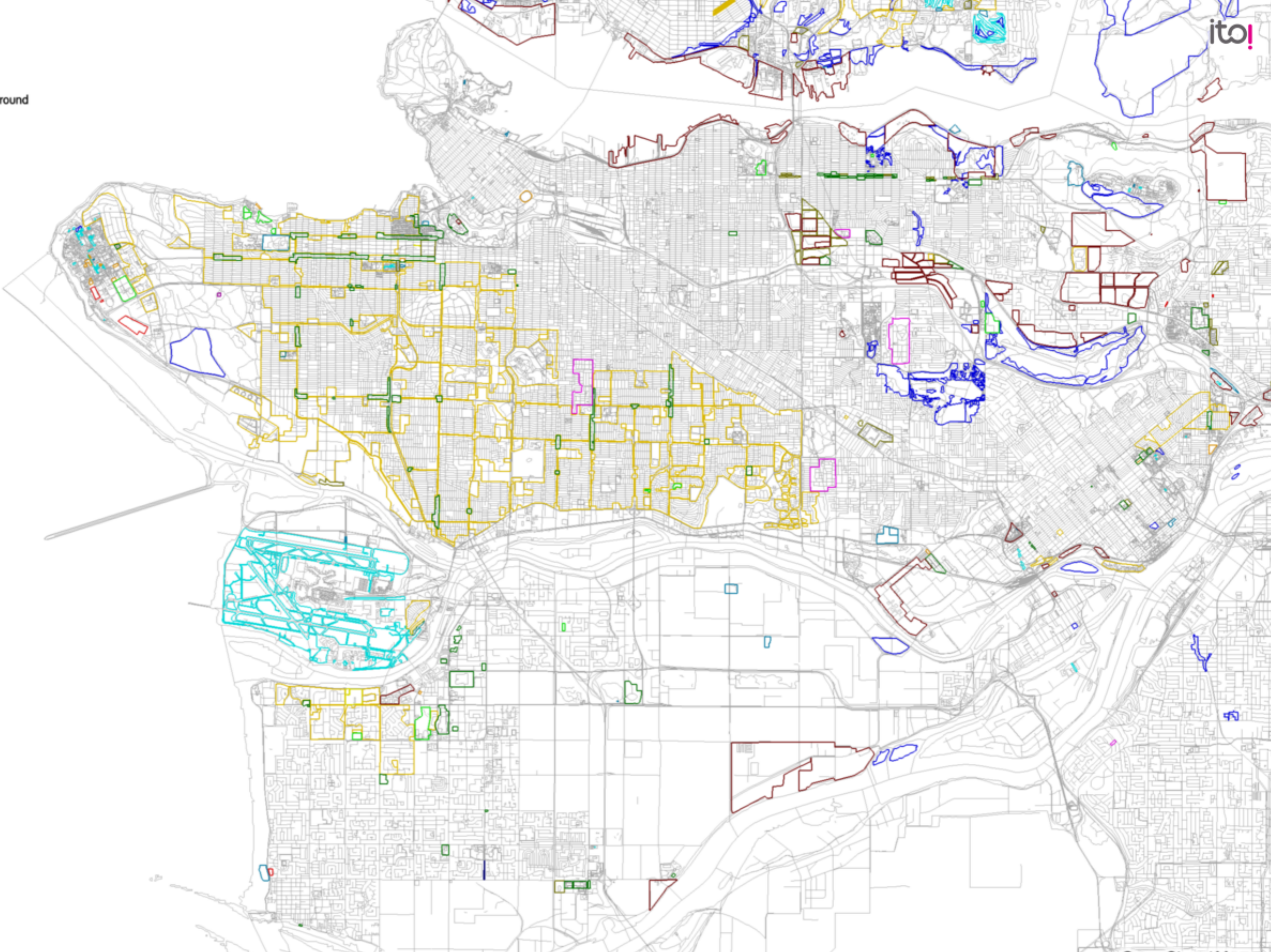
ITO World OSM Mapper: landuse tags

OpenStreetMap
CC-by-SA www.itoworld.com
Map data www.openstreetmap.org: 30 Dec 2010

Unresolved Error

Description: Vanness Avenue using invalid cyclepath tag: Is this really cycleway=designated? [Paul Johnson, 3/27/09 2:38:44 PM PST]

Comment: no, 'cycleway=designated' is not listed at the wiki. http://wiki.openstreetmap.org/wiki/Key:cycleway this way needs a site survey to get the cycle path details correct - appears to be 'cycleway 'track" but theres some connectivity and routing here. [alexz, 2011-01-10 19:05:19 CET]

Add comment   Edit in Potlatch   JOSM   Mark as Fixed
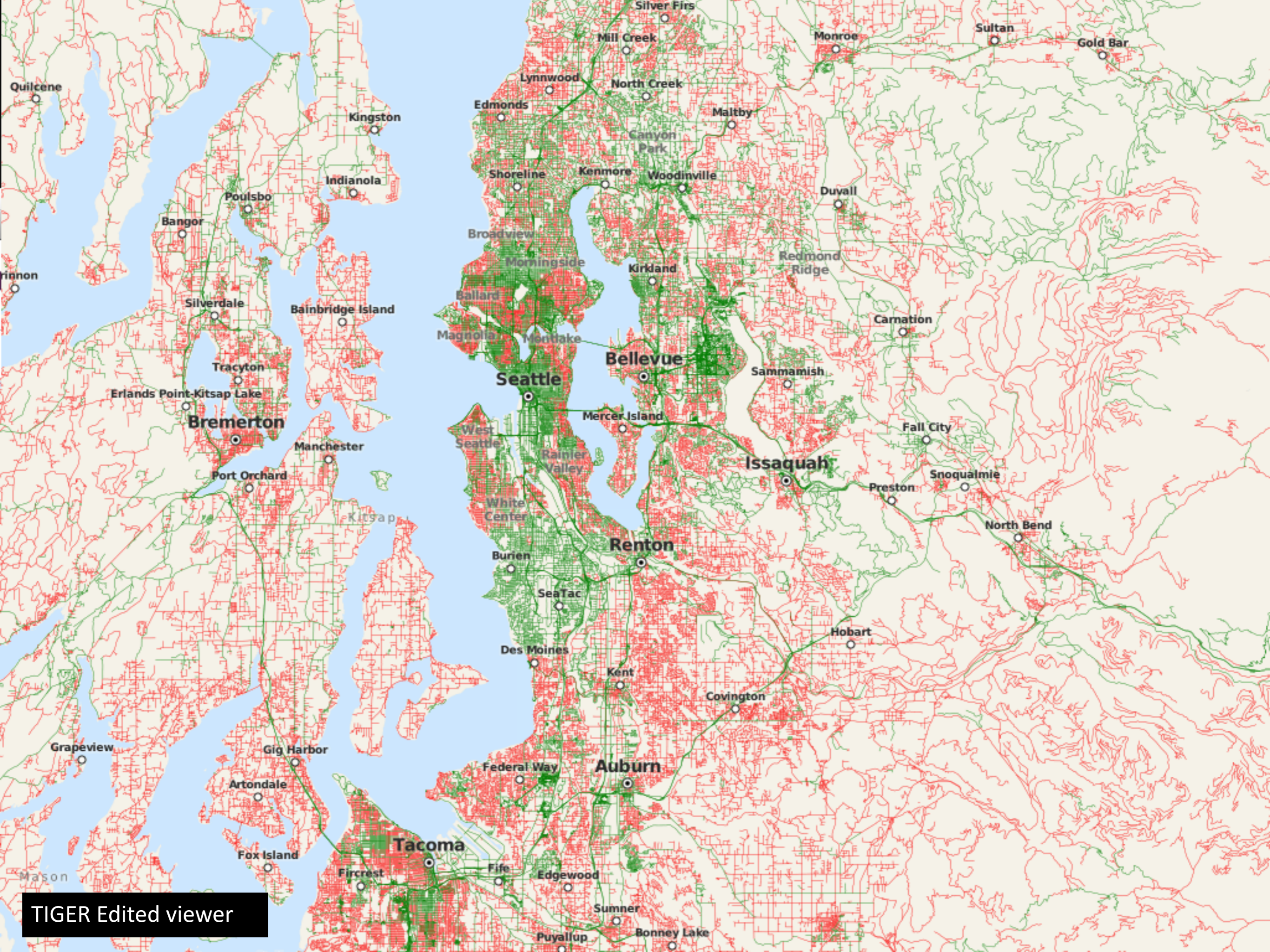
OpenStreetBugs

TIGER Edited viewer

OpenStreetMap license

- Current license: Creative Commons Attribution-ShareAlike 2.0

- Anyone using OSM data must credit "Map data © OpenStreetMap (and) contributors, CC-BY-SA"

- What you can do:
  - Use OSM data or maps in commercial products, if you credit OSM in a manner appropriate to the medium
  - If you modify or improve the data, these improvements must be available under CC-BY-SA (the share-alike clause)
  - If your product overlays data on top of OSM, and the layers are kept separate, your data does not need to be distributed under CC-BY-SA

- Note: This is not legal advice!

OpenStreetMap license: open questions

- Do the same rules apply both to map data and to rendered maps?

- What exactly constitutes a derived work?

- Is CC-BY-SA compatible with other free licenses (such as LGPL?)

- Do you have to credit each OSM contributor (impossible!) or just OSM as a whole?

OpenStreetMap license: future

- Proposed license: Open Database License (ODbL)

- Creative Commons license was designed for creative works such as images, audio, and text. It is not suited to a collective database.

- Under current CC-BY-SA...
  - ...contributors retain rights to their data, but license it under CC-BY-SA
- Under future ODbL...
  - ...contributors will waive all rights to individual contributions to the database. End users need only credit the database as a whole.

- Clarifies that share-alike applied only to the data, not to rendered maps or interactive applications

- Open question: what to do with data from contributors who do not agree to the new license?

See: http://wiki.openstreetmap.org/wiki/Open_Data_License_FAQ
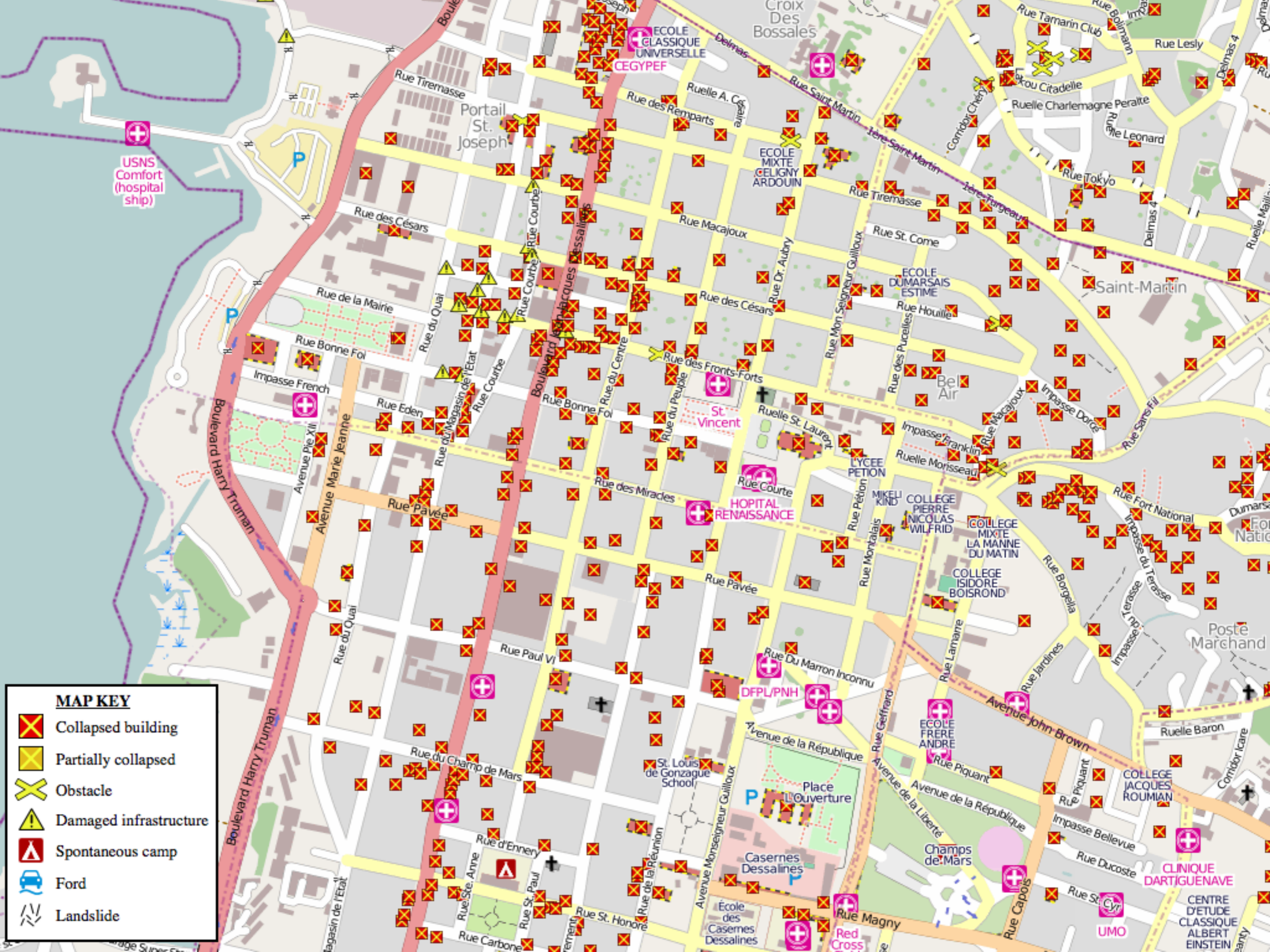
OpenStreetMap strengths

- Rapid turn-around
  - Instantaneous fixing of errors
  - Disaster response

- Mapping places ignored by other providers
  - Conflict zones mapped remotely
  - But volunteers also ignore many areas

- Micromapping
  - No limit to the amount of detail
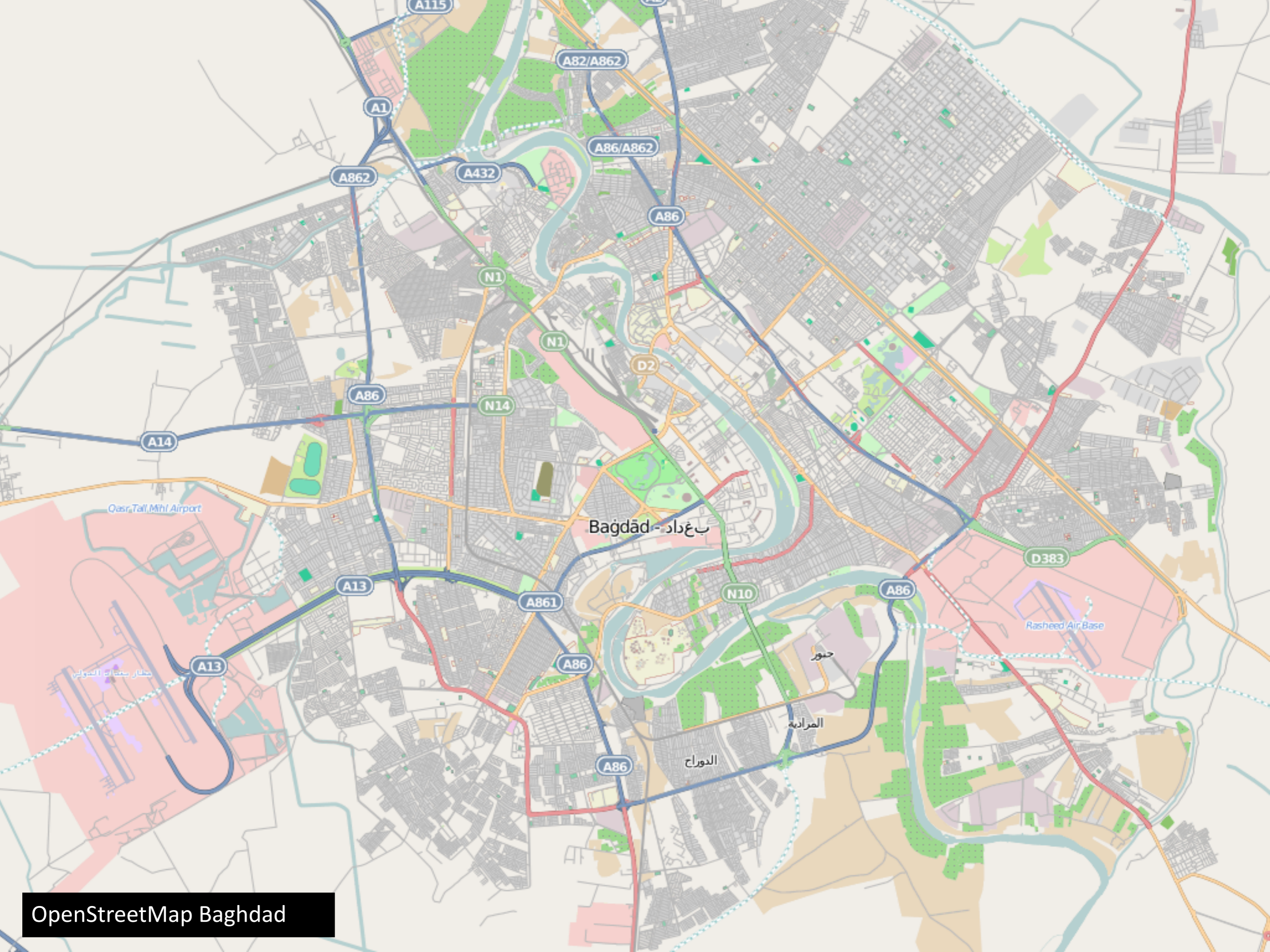 - But also highly uneven spatially

OpenStreetMap Haiti:

Pre-quake · Post-quake

MAP KEY

- Collapsed building
- Partially collapsed
- Obstacle
- Damaged infrastructure
- Spontaneous camp
- Ford
- Landslide

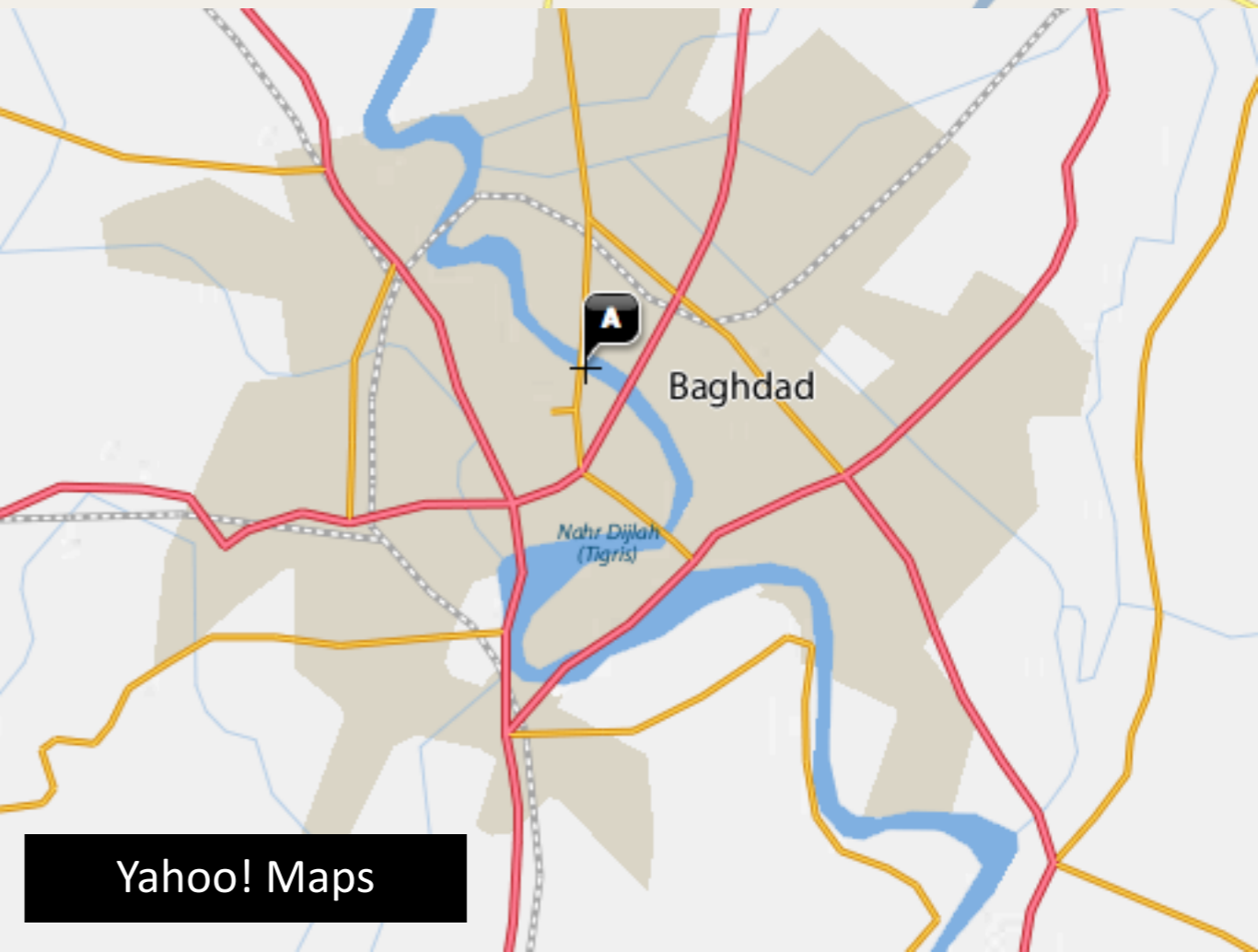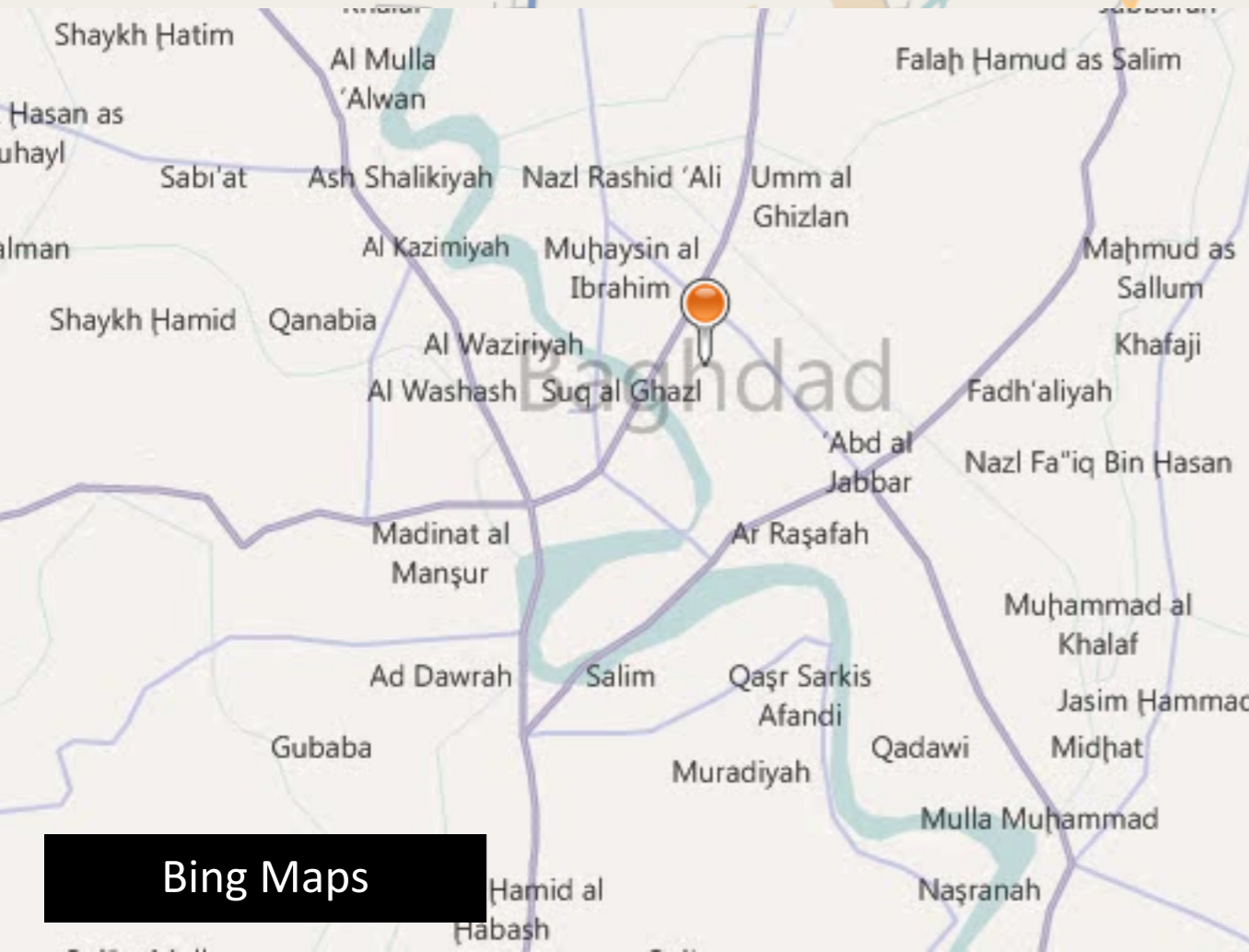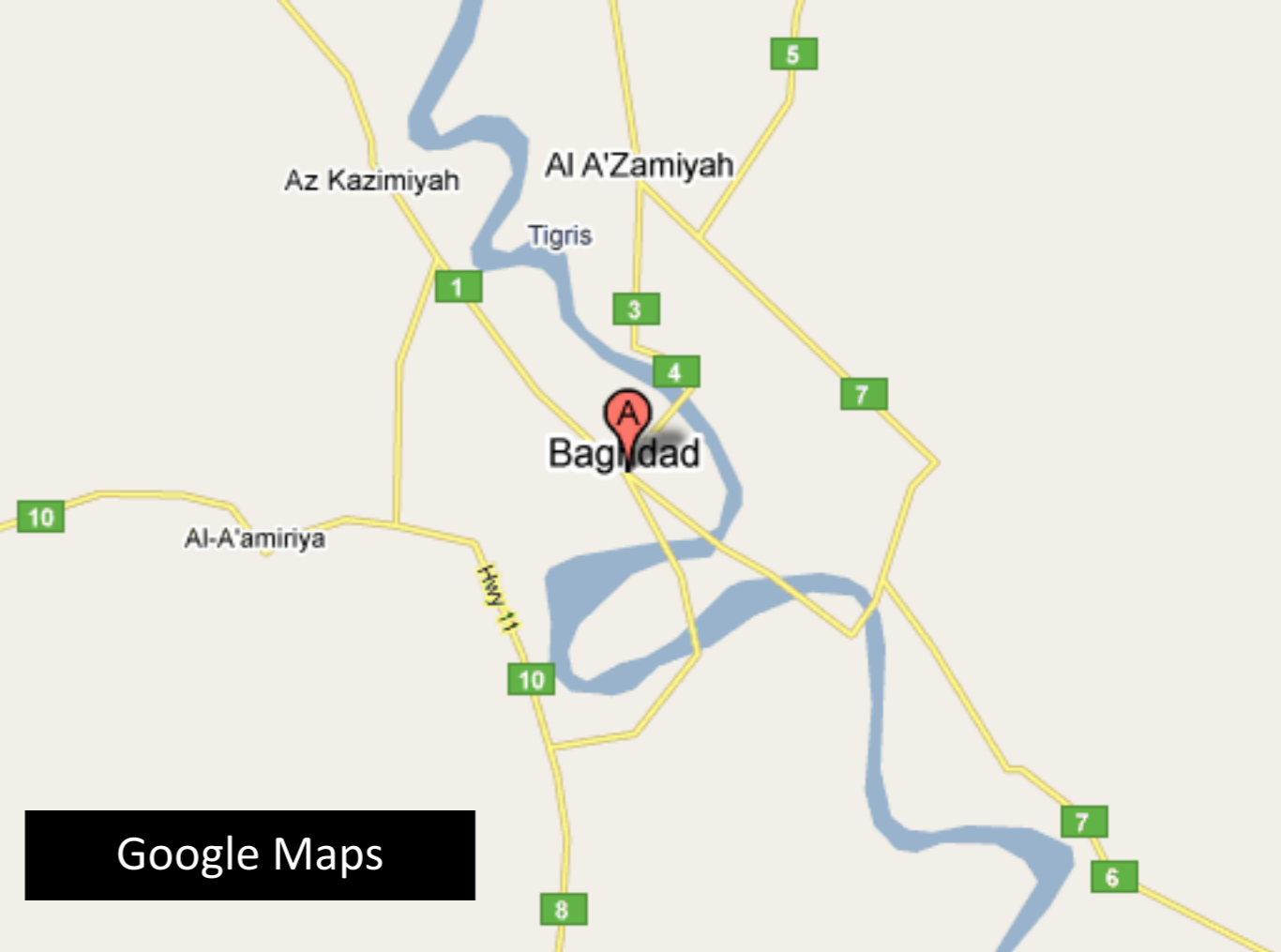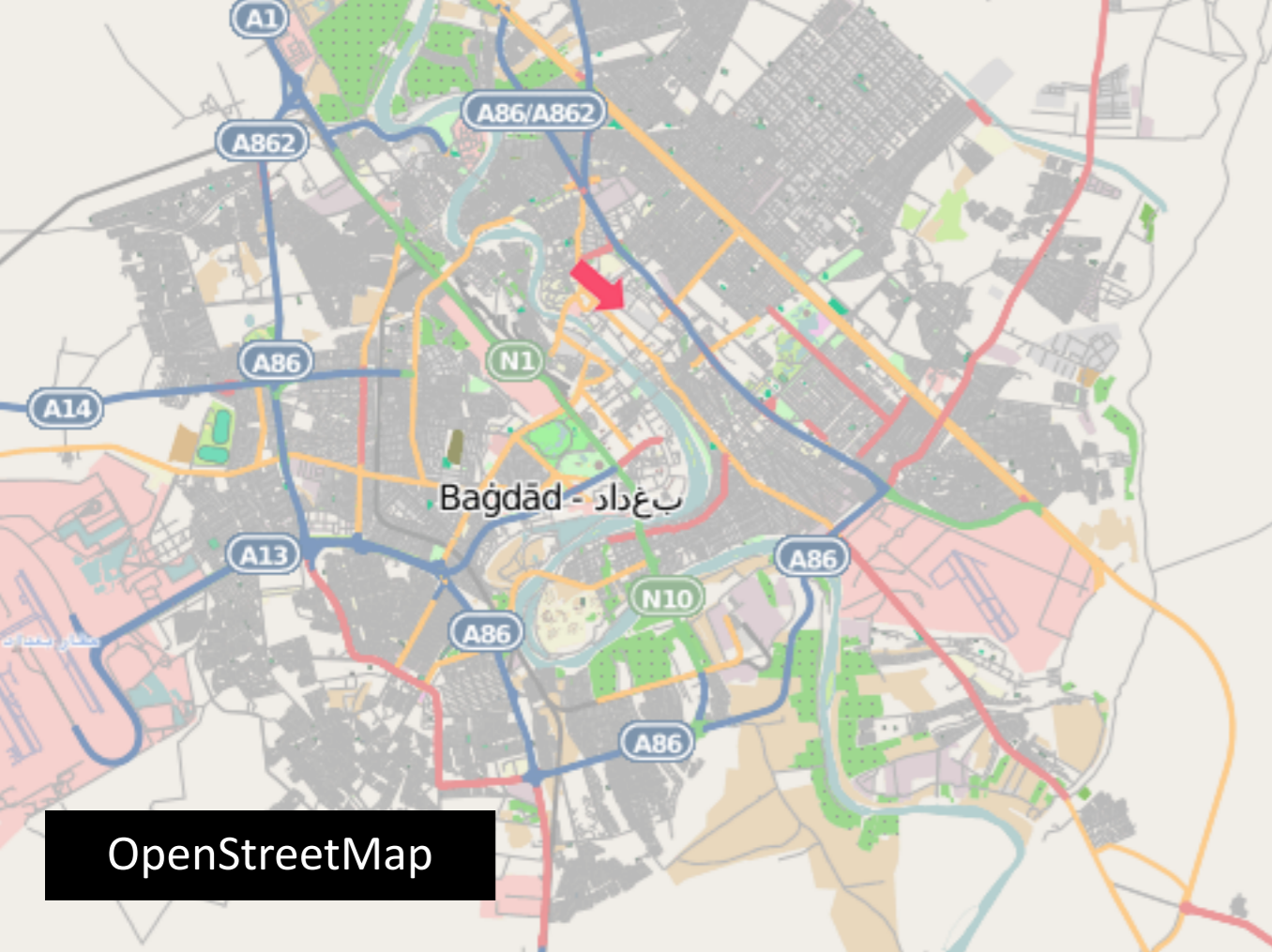USNS Comfort (hospital ship)

Portail St. Joseph

ECOLE CLASSIQUE UNIVERSELLE CEGYPEF

ECOLE MIXTE CELIGNY ARDOUIN

ECOLE DUMARSAIS ESTIME

Saint-Martin

Croix Des Bossales

St Vincent

HOPITAL RENAISSANCE

LYCEE PETION

MIKELI KIND

COLLEGE PIERRE NICOLAS WILFRID

COLLEGE MIXTE LA MANNE DU MATIN

COLLEGE ISIDORE BOISROND

Bel Air

DFPL/PNH

ECOLE FRERE ANDRE

St. Louis de Gonzague School

Place L'Ouverture

Champs de Mars

Casernes Dessalines

Ecole des Casernes Dessalines

Red Cross

UMO

CLINIQUE DARTIGUENAVE

COLLEGE JACQUES ROUMAIN

CENTRE D'ETUDE CLASSIQUE ALBERT EINSTEIN

Poste Marchand

Fort National

Streets
Boulevard Harry Truman, Boulevard Jean-Jacques Dessalines, Delmas, Rue Tiremasse, Rue des Remparts, Rue des Césars, Rue de la Mairie, Rue du Quai, Rue Courbe, Rue Bonne Foi, Impasse French, Rue Eden, Rue Pavée, Rue des Miracles, Rue Paul VI, Rue du Champ de Mars, Rue d'Ennery, Rue Ste. Anne, Rue St. Paul, Rue St. Honoré, Rue Carbone, Rue de la Réunion, Avenue Monseigneur Guilloux, Avenue de la République, Rue Geffrard, Rue Montalais, Rue Pétion, Rue du Peuple, Rue du Centre, Rue des Fronts-Forts, Rue Macajoux, Rue Dr. Audry, Rue St. Come, Rue Houlie, Rue des Pucelles, Rue Mon Seigneur Guilloux, Rue Saint Martin, 1ère Saint-Martin, Corridor Chery, Rue Tokyo, Ruelle Charlemagne Peralte, Ruelle Leonard, Rue Tamarin Club, Rue Bolmanin, Rue Lesly, Rue Fort National, Rue Borgella, Rue Lamarre, Rue Jardines, Rue Capois, Rue Ducoste, Rue Magny, Rue Piquant, Impasse Bellevue, Avenue John Brown, Ruelle Baron, Avenue de la Liberté, Avenue du Travail, Rue Du Marron Inconnu, Impasse Franklin, Ruelle Morisseau, Rue Sans Fil, Impasse Dorde, Ruelle St. Laurent, Avenue Pie XII, Avenue Marie Jeanne, Rue du Magasin de l'Etat, Pakou Citadelle, Delmas 4, Ruelle A. Cassaigne, Rue Ducoste, Ruelle Baron

OpenStreetMap Baghdad

Micromapping enclosures in the Berlin Zoo

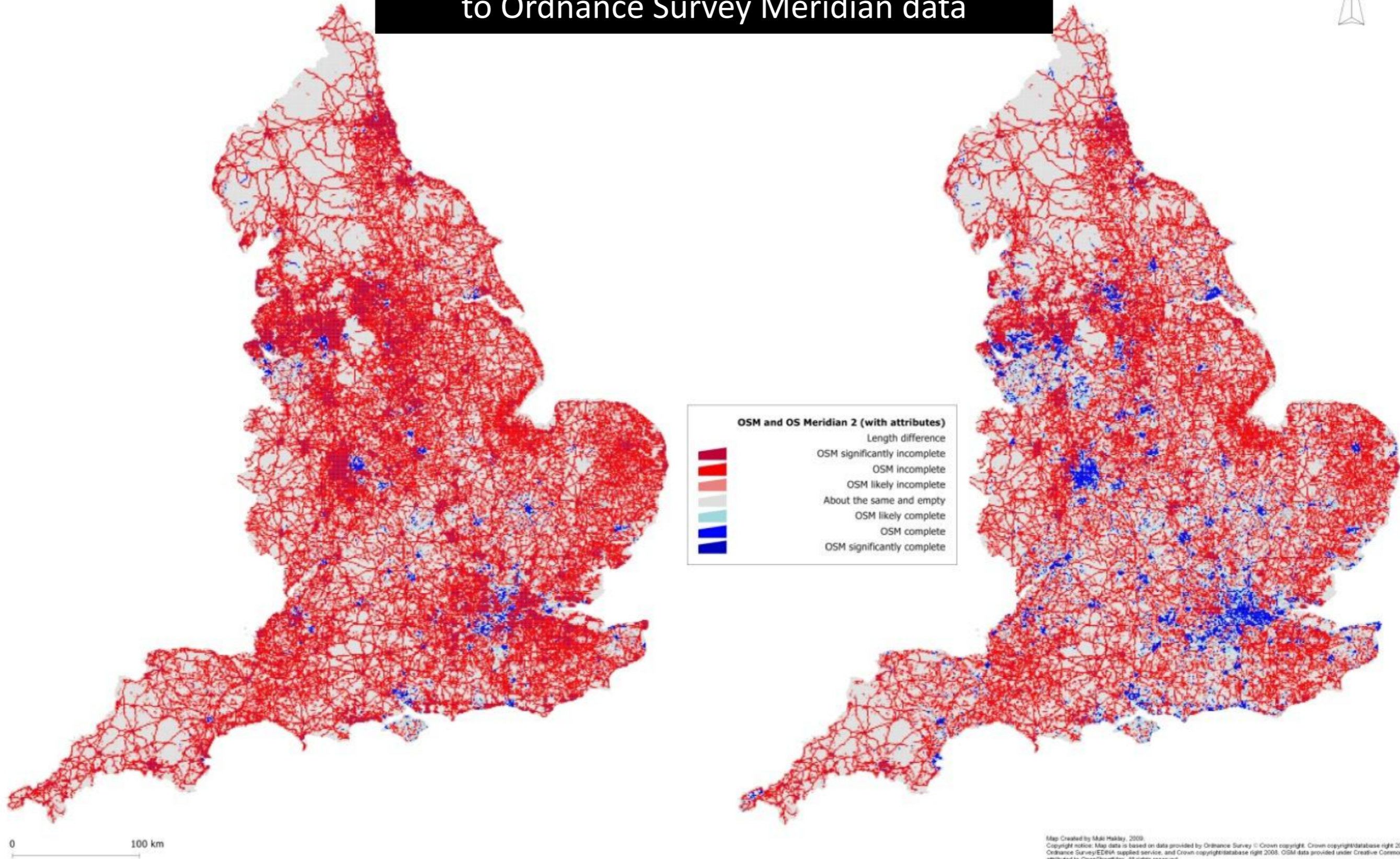Micromapping trees in Alameda de Cervantes park, Spain

Academic research on OpenStreetMap

- Quality and completeness
  - How spatially accurate are OSM features?
  - How much attribute data is missing?
  - Where is OSM more or less complete?
- Contributors and motivations
  - Who contributes?
  - How much?
  - What do they contribute?
  - Why do they do it?
- Crowdsourcing, neogeography, and Volunteered Geographic Information (VGI)
  - Experts vs amateurs
  - Trust and credibility
  - Privacy
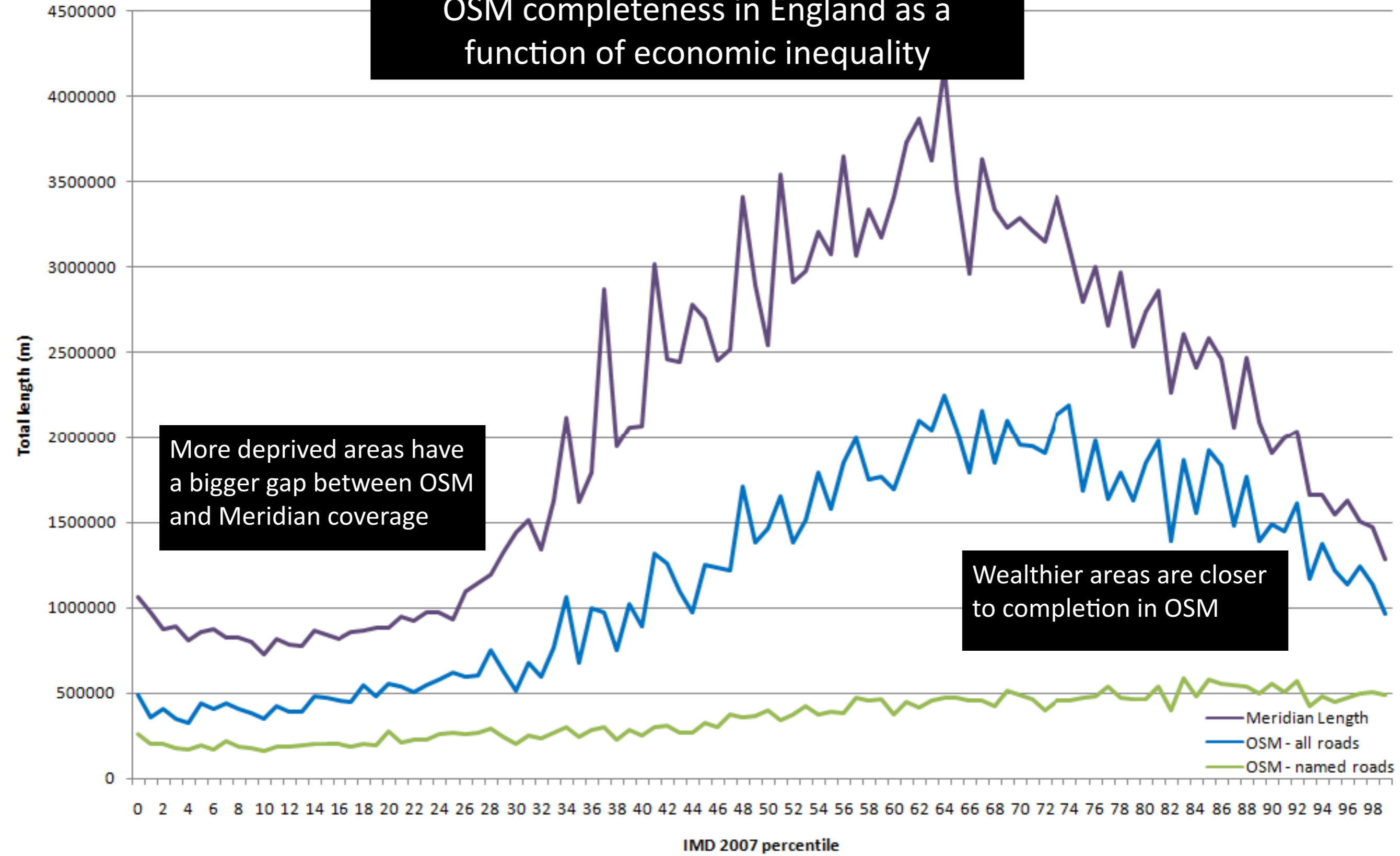 - etc...

March 2008

October 2009

OSM completeness in England as compared to Ordnance Survey Meridian data

OSM and OS Meridian 2 (with attributes)
Length difference
OSM significantly incomplete
OSM incomplete
OSM likely incomplete
About the same and empty
OSM likely complete
OSM complete
OSM significantly complete

0   100 km
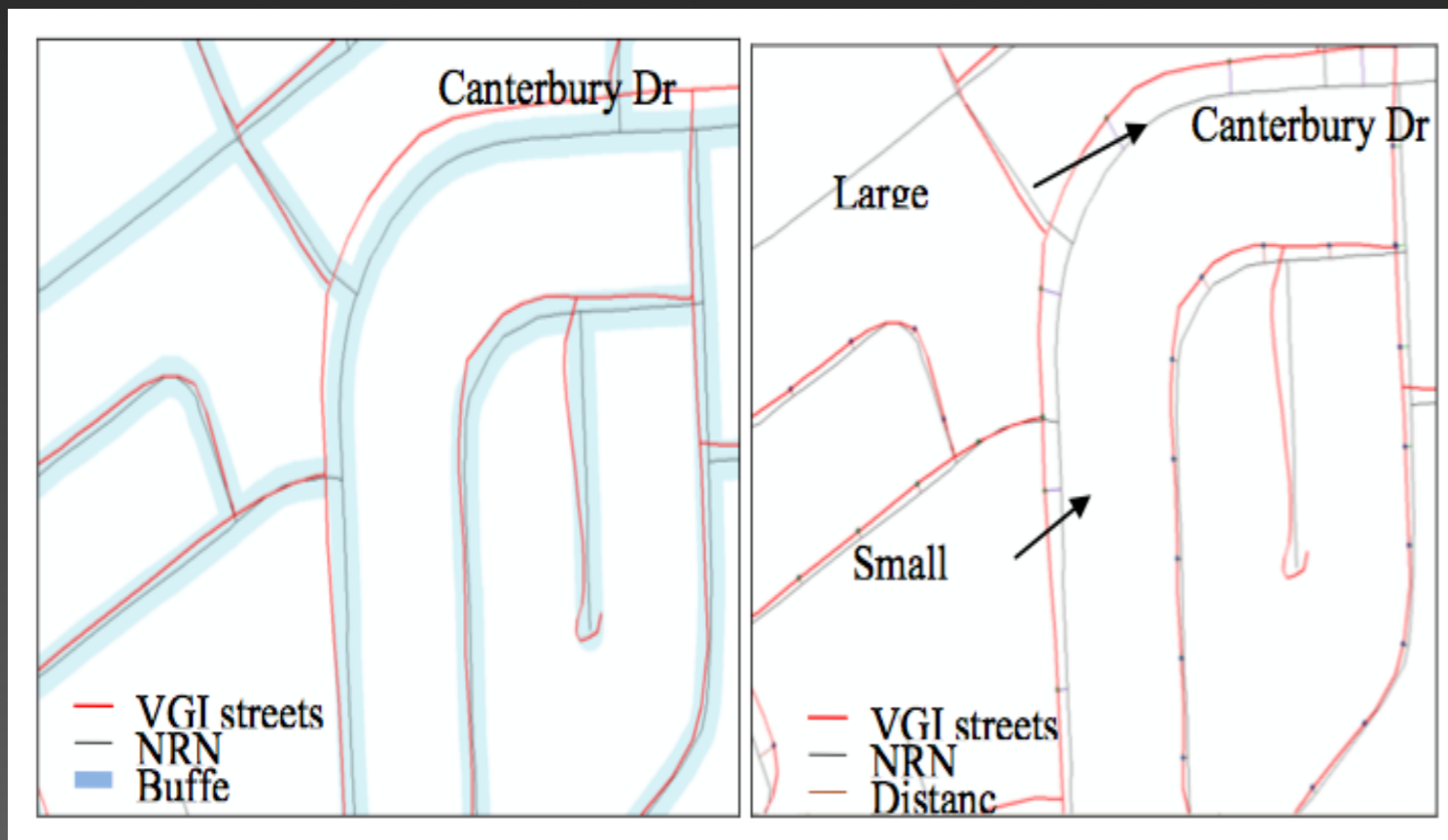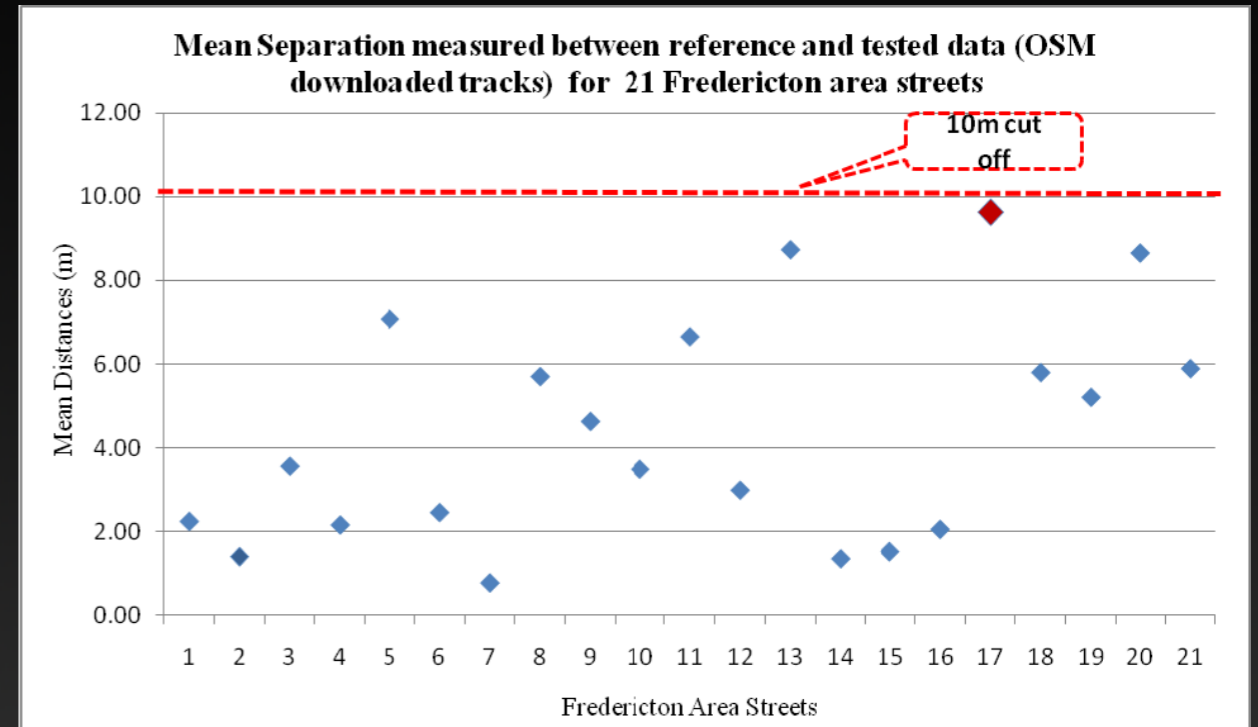
(Haklay 2009)

OSM completeness in England as a function of economic inequality

More deprived areas have a bigger gap between OSM and Meridian coverage

Wealthier areas are closer to completion in OSM

Meridian Length
OSM - all roads
OSM - named roads

Total length (m)

IMD 2007 percentile

(Haklay 2009; 2010)

OSM spatial accuracy in New Brunswick compared with National Road Network data

94% of the OSM road centerlines tested fall within 10m of NRN data, exceeding the required accuracy standards of the National Topographic Data Base (NTDB).

Mean Separation measured between reference and tested data (OSM downloaded tracks) for 21 Fredericton area streets

OpenStreetMap contributors and their motivations

- Over 300,000 registered users

- Contributions follow a power law or "long tail" distribution

Contribution of ways (current data) by contributor in the OpenStreetMap database

Notes:

50% of the way data is contributed by just 31 user accounts. 32% of this is the TIGER data import for the USA, the next major contributors are also significant data imports, such as the AND data for the Netherlands and coastline data.

This graph is created from current table data for ways only as of Dec 2009. The total number of ways being 38,369,213 with 51,806 unique contributor names.

- Key motivations:
  - Goal of the project, a "free wiki world map"
    - For their own needs, and out of altruism for others
  - Learning about geography
  - Instrumentality of local knowledge
    - Users feel their specific knowledge is essential to the success of the project

(Budhathoki 2010, Budhahthoki, Haklay and Nedovic-Budic 2010)
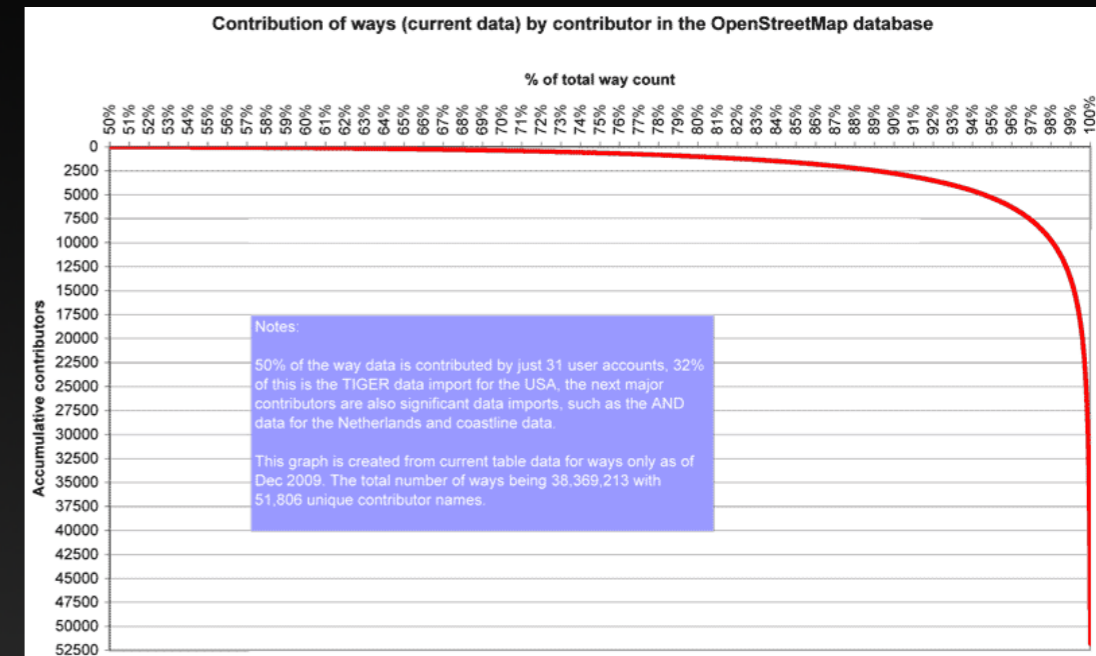
Volunteered Geographic Information and neogeography: some research trends

- Neogeographers and "paleogeographers"?
  - Is Expert/Novice the same as Professional/Amateur?
  - What do experts really know? What can amateurs usefully map?
  - How can we integrate VGI with "expert" data?
- Trust
  - How do VGI projects like OpenStreetMap govern themselves?
  - Can professionals judge the credibility of data by knowing something about the user who created it?
- Participation
  - How to encourage submission of VGI to official data sets?
  - Can participation be made more equal across space and across the population?
- Social implications
  - Privacy concerns
  - Exploitation of free labour

(Elwood 2009, Flanagin and Metzger 2008, Goodchild 2009, Tulloch 2008)

Further reading

Budhathoki, Nama. 2010. Participants' Motivations to Contribute Geographic Information in an Online Community. PhD thesis, University of Illinois.

Budhathoki, Nama, Muki Haklay, and Zorica Nedović-Budić. 2010. Who are the mappers and why do they map in OpenStreetMap? State of the Map U.S., Atlanta, GA, August 14.

Coleman, David J. 2010. The Potential and Early Limitations of Volunteered Geographic Information. Geomatica 64, no. 2: 209-219.

Elwood, Sarah. 2009. Geographic Information Science: new geovisualization technologies -- emerging questions and linkages with GIScience research. Progress in Human Geography 33, no. 2: 256-263.

Flanagin, Andrew, and Miriam Metzger. 2008. The credibility of volunteered geographic information. GeoJournal 72, no. 3: 137-148.

Goodchild, Michael. 2007. Citizens as sensors: the world of volunteered geography. GeoJournal 69, no. 4: 211-221.

--- 2009. NeoGeography and the nature of geographic expertise. Journal of Location Based Services 3, no. 2: 82.

Haklay, Muki. 2009. OpenStreetMap and Ordnance Survey Meridian 2 – Progress maps. Po Ve Sham - Muki Haklay's personal blog. November 14. http://povesham.wordpress.com/2009/11/14/openstreetmap-and-ordnance-survey-meridian-2-progress-maps/

--- 2010. How good is volunteered geographical information? A comparative study of OpenStreetMap and Ordnance Survey datasets. Environment and Planning B: Planning and Design 37, no. 4: 682-703.

Mooney, Peter, Padraig Corcoran, and Adam C. Winstanley. 2010. Towards quality metrics for OpenStreetMap. In Proceedings of the 18th SIGSPATIAL International Conference on Advances in Geographic Information Systems, 514–517. San Jose, CA: ACM.

Sabone, Botshelo. 2009. Assessing Alternative Technologies for Use of Volunteered Geographic Information in Authoritative Databases. Master's Thesis, University of New Brunswick.

Tulloch, David. 2008. Is VGI participation? From vernal pools to video games. GeoJournal 72, no. 3: 161-171.

alan.mcconchie@geog.ubc.ca