Railway Mapping at OpenStreetMap

Michael Reichert (Nakaner)

Brussels
24 September 2016
Outline

1. Tagging
   - Tracks
   - Stations
   - Stations
   - Signals
   - Train Protection

2. Mapping by Foot or Bicycle

3. Mapping by Train

4. Numbers

5. Community
railway=rail/tram/*
other types: light_rail, subway, monorail, funicular
Please always add gauge=<value in mm>!
rack=yes/abt/locher/*
electrified=contact_line/rail/..., voltage=<value in Volt>, frequency=<value in Hz>/0
railway:preferred_direction=forward/backward/both
Tagging Tracks

The lifecycle:

- railway=disused + disused=rail/tram/*
- or railway=disused + disused:railway=rail/tram/*
- abandoned: tracks missing, ballast already there
- construction: under construction
Tagging Tracks

Always disputed

railway=dismantled

railway=proposed
Tagging
Tracks

railway=razed
Tagging Tracks

- **usage=main/branch/industrial/military/test** – usage of the railway line
- **service=siding/spur/crossover/yard** – minor tracks in station

Railways
Michael Reichert (Nakaner)

Tagging
Tracks
Stations
Signals
Train Protection

Mapping by
Foot or Bicycle
Mapping by
Train
Numbers
Community
Tagging
Stations
Tagging

Stations

Railways
Michael Reichert (Nakaner)

Tagging
Tracks
Stations
Signals
Train Protection

Mapping by
Foot or Bicycle
Mapping by Train
Numbers
Community

railway = station
name = Newton
train = yes

public_transport = station
name = Newton

landuse = railway

building=train_station
Stations can be asymmetric. This happens quite often.
Basic signal tags:

- railway=signal
- railway:signal:direction=forward/backward/both
- railway:signal:position=left/right/bridge/in_track/catenary
- ref=*
Tagging
Signals

34 signal types
main

distant
combined

minor
shunting
crossing

electricity
speed_limit
...

railway:signal:<type> =
<country>-<operator/ruleset>:<name>

Example: railway:signal:main = DE-ESO:hp
Tagging
Signals

34 signal types
main         minor         electricity
distant      shunting      speed_limit
combined     crossing      ...

railway:signal:<type> =
   <country>-<operator/ruleset>:<name>

Example: railway:signal:main = DE-ESO:hp

railway:signal:<type>:form =
   light/semaphore/sign

Example: railway:signal:main:form = light
34 signal types
- main
- distant
- combined
- minor
- shunting
- crossing
- electricity
- speed_limit
- ...
Tagging
Signals

34 signal types
main
  minor
distant
  shunting
combined
  crossing
electricity
  speed_limit

railway:signal:<type> =
  <country>-<operator/ruleset>:<name>

Example: railway:signal:main = DE-ESO:hp

railway:signal:<type>:form = light/semaphore/sign

Example: railway:signal:main:form = light

railway:signal:<type>:states = [list]

Example: railway:signal:main:states = DE-ESO:hp0;DE-ESO:hp1

railway:signal:<type>:height = normal/dwarf
## Taggings
### Signals

<table>
<thead>
<tr>
<th>Country</th>
<th>Tagging</th>
<th>OpenRailwayMap</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany DB</td>
<td>full</td>
<td>few signals left</td>
</tr>
<tr>
<td>German trams</td>
<td>partially</td>
<td>similar to tagging</td>
</tr>
<tr>
<td>Austria</td>
<td>full</td>
<td>important signals</td>
</tr>
<tr>
<td>Finnland</td>
<td>full</td>
<td>some signals</td>
</tr>
<tr>
<td>Switzerland</td>
<td>draft</td>
<td>no</td>
</tr>
<tr>
<td>UK</td>
<td>early draft</td>
<td>no</td>
</tr>
</tbody>
</table>
Tagging
Train Protection

Railways
Michael Reichert (Nakaner)

Tagging
Tracks
Stations
Signals
Train Protection

Mapping by
Foot or
Bicycle
Mapping by
Train
Numbers
Community
country-specific topic

- railway:pzb=yes/no for German PZB system
- railway:lzb=yes/no for German LZB
- railway:etc=1/2/3/4 for European Train Control System
- railway:*=yes/no/*
Tagging
Train Protection

country-specific topic
railway:pzb=yes/no for German PZB system
railway:lzb=yes/no for German LZB
railway:etcς=yes/1/2/3 for European Train Control System
railway:*=yes/no/*

- unlimited number of keys
- impossible to tag "no train protection"
- tagging system needs rework
Tagging
Train Protection

- country-specific topic
- railway:pzb=yes/no for German PZB system
- railway:lzb=yes/no for German LZB
- railway:etcs=yes/1/2/3 for European Train Control System
- railway:*=yes/no/*
- unlimited number of keys
- impossible to tag ”no train protection”
- tagging system needs rework
Mapping
Overview

- by foot or bicycle
- by train
  - taking notes
  - GPS waypoints with notes
  - geotagged photos
  - videos (with and without geotagging)
- Bing, Mapbox Aerial and other imagery sources
- photos published on forums by railway fans (ask them beforehand!)
- open data (data.deutschebahn.com) if license is compatible
Mapping by Foot or Bicycle
Mapping by Foot or Bicycle

Railways

Michael Reichert (Nakaner)

Tagging
- Tracks
- Stations
- Signals
- Train Protection

Mapping by Foot or Bicycle

Mapping by Train

Numbers

Community
Mapping by Foot or Bicycle
- GPS signal is weak
- prefer a GPS+GLONASS receiver
- find the best location inside the train
### Mapping by Train

**GPS Signal Strength**


<table>
<thead>
<tr>
<th>Bezeichnung</th>
<th>Baureihe(n)</th>
<th>Einsatz</th>
<th>Empfänger</th>
<th>Position</th>
<th>Empfang (0-5)</th>
<th>Anmerkung</th>
<th>Eintragender/Datum</th>
</tr>
</thead>
<tbody>
<tr>
<td>611</td>
<td>RB, RE, IRE</td>
<td></td>
<td>Samsung Galaxy S5</td>
<td>Faltenbalg am Wagenübergang</td>
<td>4</td>
<td>Garmin Dakota 20 etwas schlechter wegen fehlendem GLONASS</td>
<td>--Nakaner (talk) 19:32, 18 April 2016 (UTC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Samsung Galaxy S5</td>
<td>Einstiegstüren hinter dem Führerstand</td>
<td>2</td>
<td></td>
<td>--Nakaner (talk) 19:32, 18 April 2016 (UTC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Samsung Galaxy S5</td>
<td>andere Stellen im Zug</td>
<td>0</td>
<td></td>
<td>--Nakaner (talk) 19:32, 18 April 2016 (UTC)</td>
</tr>
<tr>
<td>&quot;RegioSwinger&quot;</td>
<td>612</td>
<td>RE, IRE</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>kein Empfang außer am Fenster des Zugführers</td>
<td>--Nils 13:51, 12 July 2007 (BST)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Samsung Galaxy S5, Garmin Dakota 20</td>
<td>an vielen Stellen im Zug</td>
<td>3-5</td>
<td>allgemein gut geeignetes Mappingfahrzeug, Erfahrung aus mehreren Fahrten</td>
<td>--Nakaner (talk) 19:39, 18 April 2016 (UTC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Garmin eTrex HCx, Garmin Dakota 20</td>
<td>direkt am Fenster der Einstiegstür neben Zugspitze/end</td>
<td>2</td>
<td>empfindlicher Empfänger erforderlich (bei Garmin eTrex Vista/Legend auf das H im Namen achten!), GPS-Fix vor Einstieg sehr empfohlen</td>
<td>--gypakk, --Nakaner (talk) 10:07, 28 July 2014 (UTC)</td>
</tr>
</tbody>
</table>
Mapping by Train
Photo Mapping

photo mapping ... through the drivers cab
Mapping by Train
Photo Mapping

photo mapping ... through the rear drivers cab
photo mapping ... at the left window
video mapping ... at the left windows
video mapping . . . at the left windows
Mapping by Train
Video Mapping

InterCity train, 200 kph, 2 frames/second
extracted frames using ffmpeg, geotagging with
github.com/Nakaner/mapillary_tools/tree/float-seconds
Mapping by Train
Video Mapping

local train, 120 kph, 4 frames/second
extracted frames using ffmpeg, geotagging with
github.com/Nakaner/mapillary_tools/tree/float-seconds
Mapping by Train
Lessons Learned

- cameras with optical zoom are better
- Don’t zoom in too much.
- Use right/left side windows only as a replacement.
- Avoid filming against the sun!
- dirty windows
- GPS logging!
- extract 4 frames per second – always
- Wear an OSM T-shirt and people will ask you less often.
Mapping

Railways
Michael Reichert (Nakaner)

Tagging
Tracks
Stations
Signals
Train Protection

Mapping by
Foot or Bicycle
Train Numbers
Community
Some Numbers

- world-wide:
  - 78,779 nodes with railway=signal
  - 76,693 nodes with railway:signal:direction=*
  - 39,102 nodes with railway=milestone

- Germany yesterday (November 2015 in brackets):
  - 48,163 signals total
  - 10,987 main signals properly tagged (7,917)
  - 9,766 distant signals properly tagged (4,758)
  - 3,828 combined signals properly tagged (2,605)
Some Numbers

- world-wide:
  - 78,779 nodes with railway=signal
  - 76,693 nodes with railway:signal:direction=* 
  - 39,102 nodes with railway=milestone

- Germany yesterday (November 2015 in brackets):
  - 48,163 signals total
  - 10,987 main signals properly tagged (7,917)
  - 9,766 distant signals properly tagged (4,758)
  - 3,828 combined signals properly tagged (2,605)
  - 27,365 milestones properly tagged
  - 81,591 km railway track in total (81,235)
  - 29,730 km track with speed limit information (26,415)
  - 49,467 railway=switch (35,398)
  - 12,913 of them have ref=* (10,240)
Some Numbers

- world-wide:
  - 78,779 nodes with railway=signal
  - 76,693 nodes with railway:signal:direction=* 
  - 39,102 nodes with railway=milestone 

- Germany yesterday (November 2015 in brackets):
  - 48,163 signals total
  - 10,987 main signals properly tagged (7,917)
  - 9,766 distant signals properly tagged (4,758)
  - 3,828 combined signals properly tagged (2,605)
  - 27,365 milestones properly tagged 
  - 81,591 km railway track in total (81,235)
  - 29,730 km track with speed limit information (26,415)
  - 49,467 railway=switch (35,398)
  - 12,913 of them have ref=* (10,240)
Community

- dominated by Germans in terms of contributors, data and rendering
- Wiki documentation: OpenRailwayMap/Tagging
- Mapping tricks at OSM wiki:
  DE:OpenRailwayMap/Tutorial (only German)
- Mailing list: http://lists.openrailwaymap.org/
- IRC irc.oftc.net, #openrailwaymap
Credits

- slide 5: image by Niklas Bildhauer, Flickr, CC-BY-SA 2.0
- slide 7: image by Sebastian Terfloth, CC-BY-SA 2.5
- slide 10: image by Christian Liebscher, CC-BY-SA 4.0
- slide 17: image by Mapillary, CC-BY-SA
- slide 30: image by Ferres, CC-BY-SA
- slide 24: map rendering CC-BY-SA 2.0
- all maps are made of OSM data
Railways
Michael Reichert (Nakaner)

Tagging
Tracks
Stations
Stations
Signals
Train Protection

Mapping by
Foot or
Bicycle

Mapping by
Train
Numbers

Community