OpenStreetMap Energy Shapefiles

Version 2.0 - 2019-03-07

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Version History and Copyright

Version	Created At	Changes
0.1	2012-01-14	Initial document
0.2	2013-07-02	update IDs to VARCHAR since they exceed 2^31-1
1.0	2016-09-14	introduce codes and feature classes which are already used by our other shape file products. Add attributes "material" and "design" to masts layer, add catenary masts to masts layer. Support new OSM tags which have been introduced recently: power=plant, generator:source, man_made=street_cabinet, location=*.
2.0	2019-03-07	Rewrite of layer structure, new codes for most feature classes, addition of various additional feature classes (portal, terminal) and fields. Removing all station_* feature classes and replacing them by plant_* feature classes. Split cable_distribution_c class into cable_distribution_c and power_street_cabinet. Add frequency, line and circuits field to powerlines layer. Rename all layers.

1 Preface

The OpenStreetMap (OSM) project (www.openstreetmap.org) has collected an enormous amount of free spatial data and the database is growing every day. Many people want to use this data for their own GIS projects but have been hindered by the use of a non-standard data format in the OSM project.

Geofabrik has pioneered a mapping from OSM features to a traditional GIS structure with their "OSM Data in Layered GIS Formats" specification. That specification covers most low-level aspects of OSM.

This document describes an additional mapping of detailed OSM structures concerning energy (electricity generation and distribution). There is a slight overlap between the specific mapping described here and the general "Layered GIS" mapping which covers basic aspects.

2 Introduction

2.1 Versions

This is no static document. New versions of this document are likely to appear from time to time. If the definition of layers or features is changed significantly, the layers will get new version identifiers.

Layer names will contain version numbers without the embedded dot.

2.2 Map datum

All coordinates are unprojected WGS84 (EPSG:4326).

2.3 Character encoding

All strings are encoded in UTF-8.

2.4 Attribute names

All attribute names are lower case and are less than 11 characters long so that they are not truncated in shapefiles.

2.5   Layers

In OSM there are no layers in the traditional GIS sense. All features are in one big coherent database. For the purpose of the mapping described in this document, the features stored in the OSM database are extracted into different layers depending on their type.

All layers defined in this document use the "osmen_" prefix for their names.

To allow for future changes of this document, the document version number is embedded in the layer names. So the "masts" layer in version 1.0 is called "osmen_masts_v10" in file names, WMS layers etc.

2.6   Common attributes

Most tables/shape files will have the following columns/attributes:

Attribute	PostGIS Type	Descriptiosteps/gis-roads-v06.pln
osm_id	VARCHAR (10)	OSM Id taken from the Id of this feature (node_id, way_id, or relation_id) in the OSM database. In case several features in the OSM database are joined into one feature, this is one of the Ids. This ID is not necessarily unique because one OSM object can result in several geometry objects. Also note that when doing shape file exports, this will be exported as a VARCHAR type since shape files don't support long integers.
lastchange	TIMESTAMP WITHOUT TIME ZONE	Last change of this feature. Comes from the OSM last_changed attribute. Reflects changes in the attributes of a feature; changes in the geometry will not necessarily change this.
code	SMALLINT (2 Bytes)	4 digit code (between 1000 and 9999) defining the feature class. The first one or two digits define the layer, the last two or three digits the class inside a layer.
fclass	VARCHAR(40)	Class name of this feature. This does not add any information that is not already in the "code" field but it is better readable.

The code and the combination of layer name and fclass always contains the same information.

2.7   Points, Linestrings and Areas

The availability of high-resolution aerial imagery has led to many features being recorded as areas (e.g. large substations and power plants), not points, in OpenStreetMap. You will, for example, often find them drawn as an area—but not always. This makes processing difficult because you have to cater for both types of these feature classes even if you are not interested in areas.

The Geofabrik shape files alleviate this problem by converting any area feature to a point, and adding it to the appropriate point layer. All point layers which are marked as having an "associated area layer" in this document work this way. They will have an extra "geomtype" column that has one of the three values "N" (=the feature stems from a node, or point, in OSM), "W" (=the feature stems from a way, a simple area, in OSM), or "R" (=the feature stems from a multipolygon relation in OSM). For these layers, there will be extra shape files with the name suffix "_a" containing the proper polygon and the name suffix "_l" containing the proper linestring.

So in case you are not interested in areas, you can just ignore the "geomtype" column in the point shape, and process everything normally. The automatic conversion of areas to points will make sure that you do not lose any information. If, however, you would like to process areas wherever they are available, then you should disregard the auto-converted objects of type "W" and "R" from the point shape, and additionally use the polygons from the _a shape and lines from the _l shape.

In the power domain, some features can be mapped as linestrings or points in OpenStreetMap, e.g. portals. As with areas, portals mapped as linestrings, will be contained in the point layer additionally (a sample point on the linestring geometry). The "geomtype" column will have the value "W" in this case.

Note that sometimes features are contained twice in the OSM database, once as point and once as area. If this happens, they will turn up twice in these layers.

2.8   Spillover Shape Files

When a certain layer becomes too large for one shape file (shape files are limited to 2 GB in size), it will automatically spill over into additional shape files. A shape file named "osmen_powerlines_v10_1.shp" will have spillover shape files names "osmen_powerlines_v10_2.shp", "osmen_powerlines_v10_3.shp" and so on.

3   Point Features

3.1   Masts and Transmission Towers ("power-masts")

Locations of masts and transmission towers.

This layer has an associated area layer (see section 2.7).

Additional attributes:

Attribute	PostGIS Type	Description	OSM Tags
ref	VARCHAR(100)	The reference number of this tower or pole as defined by the operator.	ref
operator	VARCHAR(100)	The name of the tower's operator.	operator
material	VARCHAR(100)	The main material of the mast. Common values are "wood", "metal", "concrete" and "steel". You can find more values at https://wiki.openstreetmap.org/wiki/Key:material	material
design	VARCHAR(100)	Design of power towers. See https://wiki.openstreetmap.org/wiki/Tag:power %3Dtower#Tower_design for details.	design

The following feature classes exist in this layer:

code	fclass	Description	OSM Tags
6801	tower	towers or pylons carrying high voltage electricity cables	power=tower

code	fclass	Description	OSM Tags
6802	pole	masts of low and medium voltage power lines	power=pole
6803	catenary_mast	Mast carrying catenary. You will find rather few objects of this class in the shape file because they are rarely mapped in OpenStreetMap (usually only if the mast carries a power line in addition to the catenary)	power=catenary_mast

4 Point and Area Features

4.1 Power Generators ("power-generators")

This layer contains all power generators.

This layer has an associated area layer (see section 2.7).

Unfortunately, there is no clear differenciation in the OSM data between "power generators" and "power plant" (the latter are often called "power stations" outside the OSM project). Many plants are tagged as generators. This applies a lot to photovoltaic plants on plain fields where a large facility is tagged as a single generator.

Additional attributes:

Attribute	PostGIS Type	Description	OSM Tags
operator	VARCHAR(100)	The name of the facility's operator.	operator
name	VARCHAR(100)	Name of this feature, like a street or place name.	name
ref	VARCHAR(48)	The reference number or other identifier of this facility as defined by the operator. Often used for wind turbines.	ref
source	VARCHAR(100)	Power source of the generator. Common values are "wind", "solar", "oil", "hydro", "gas", "coil", "biogas", "biomass" and "nuclear".	generator:source, power_source as fallback
gen_type	VARCHAR(100)	Generator type (e.g. "kaplan", "francis" or "pelton") to differenciate different types of generators using the same power source	generator:type
output	VARCHAR(100)	Electrical power rating of the generator. This is usually either "yes" (if the exact rating is unknown and it is only known that the generator put electric power out) or the power rate (e.g. "15 MW").	generator:output:electricity, plant:output:electricity as fallback
mfct	VARHCAR(48)	The manufacturer of this facility.	manufacturer
mfct_type	VARCHAR(48)	The make/model name as specified by the manufacturer. This is usually only tagged on wind turbines.	manufacturer:type

The following feature classes exist in this layer:

code	fclass	Description	OSM Tags
6410	generator	A power generator or a power station where the power source is not specified.	power=generator with none of the specifics below
6411	generator_nuclear	A nuclear power generator.	power=generator with generator:source=nuclear

code	fclass	Description	OSM Tags
6412	generator_solar	A solar power generator.	with generator:source=solar, generator:source=photovoltaic, power_source=solar or power_source=photovoltaic
6413	generator_fossil	A power generator burning fossil fuels.	with generator:source=* or power_source=* having one of the following values: oil, gas. coal
6414	generator_water	A hydroelectric power generator.	with generator:source=hydro or power_source=hydro
6415	generator_wind	A wind turbine.	with generator:source=wind or power_source=wind
6416	generator_bio	A power generator fueled with biomass or biogas.	with generator:source=biogas, generator:source=biogas, power_source=biomass or power_source= biomass
6510	plant	A power plant where the power source is not specified.	power=generator with none of the specifics below
6511	plant_nuclear	A nuclear power plant.	power=generator with generator:source=nuclear
6512	plant_solar	A solar power plant.	with generator:source=solar or power_source=photovoltaic
6513	plant_fossil	A power plant burning fossil fuels.	with generator:source=gas or coal
6514	plant_water	A hydroelectric power plant.	with generator:source=hydro or power_source=hydro

4.2 Power Plants ("power-plants")

This layer contains all power plants.

This layer has an associated area layer (see section 2.7).

Unfortunately, there is no clear differenciation in the OSM data between "power generators" and "power plant" (the latter are often called "power stations" outside the OSM project). Many plants are tagged as generators. This applies a lot to photovoltaic plants on plain fields where a large facility is tagged as a single generator.

Additional attributes:

Attribute	PostGIS Type	Description	OSM Tags
operator	VARCHAR(100)	The name of the facility's operator.	operator
name	VARCHAR(100)	Name of this feature, like a street or place name.	name
ref	VARCHAR(48)	The reference number or other identifier of this facility as defined by the operator.	ref
source	VARCHAR(100)	Power source of the generator. Common values are "wind", "solar", "oil", "hydro", "gas", "coil", "biogas", "biomass" and "nuclear".	plant:source; power_source and generator:source as fallback
gen_meth od	VARCHAR(100)	Generator type (e.g. "photovoltaic", "wind_turbine", "combustion", "run_of_the_river" or "fission") to differenciate subclasses of the power source	generator:method
output	VARCHAR(100)	Electrical power rating of the generator. This is usually either "yes" (if the exact rating is unknown and it is only known that the generator put electric power out) or the power rate (e.g. "15 MW").	plant:output:electricity , generator:output:elect ricity as fallback

The following feature classes exist in this layer:

code	fclass	Description	OSM Tags
6420	plant	A power plant where the power source is not specified.	power=plant with none of the specifics below
6421	plant_nuclear	A nuclear power plant.	power=plant with one of the following: plant:source=nuclear, power_source=nuclear, generator:source=nuclear
6422	plant_solar	A solar power plant.	with generator:source=solar, power_source=photovoltaic or plant:source=solar
6423	plant_fossil	A power plant burning fossil fuels.	with plant:source=*, power_source=* or generator:source=* having one of the following values: gas, oil, coal
6424	plant_water	A hydroelectric power plant.	with plant:source=hydro, power_source=hydro, generator:source= hydro
6425	plant_wind	A wind farm.	with plant:source=wind, power_source=wind, generator:source= wind
6426	plant_bio	A power plant burning with biomass or biogas.	with generator:source=biogas, generator:source=biogas, power_source=biomass or power_source= biomass

4.3 Power Substations ("power-substations")

This layer contains all power-distributing facilities.

This layer has an associated area layer (see section 2.7).

Additional attributes:

Attribute	PostGIS Type	Description	OSM Tags
operator	VARCHAR(100)	The name of the facility's operator.	operator
name	VARCHAR(100)	Name of this feature, like a street or place name.	name
ref	VARCHAR(48)	The reference number or other identifier of this facility as defined by the operator.	ref
voltage	VARCHAR(48)	The voltage rating of this facility.	voltage
frequency	VARCHAR(48)	The frequency rating of this facility.	frequency
type	VARCHAR(48)	Function of the substation. Common values are "transmission", "minor_distribution", "traction" and "industrial". See https://wiki.openstreetmap.org/wiki/Key:substation for details.	substation
location	VARCHAR(48)	Location and size of a substation. Common values are "underground", "outdoor", "indoor", "kiosk". See https://wiki.openstreetmap.org/wiki/Key:location for details.	location

The following feature classes exist in this layer:

code	fclass	Description	OSM Tags
6430	substation	A power substations or relay station.	power=substation; power=sub_station; power=station without power_source=* and generator:source=*
6424	cable_distribution_c	A cable_distribution_cabinet (sometimes called power box or feeder pillar) which can be found along streets.	power=cable_distribution_cabinet man_made=street_cabinet + street_cabinet=power

4.4 Power Transformers ("power-transformers")

This layer contains all power transformers.

This layer has an associated area layer (see section 2.7).

Additional attributes:

Attribute	PostGIS Type	Description	OSM Tags
operator	VARCHAR(100)	The name of the facility's operator.	operator
name	VARCHAR(100)	Name of this feature, like a street or place name.	name
ref	VARCHAR(48)	The reference number or other identifier of this facility as defined by the operator.	ref
voltage	VARCHAR(48)	The voltage rating of this transformer.	voltage
volt_prim	VARCHAR(48)	The voltage rating on the primary interface.	voltage:primary
volt_sec	VARCHAR(48)	The voltage rating on the secondary interface.	voltage:secondary
volt_tert	VARCHAR(48)	The voltage rating on the tertiary interface.	voltage:tertiary
frequency	VARCHAR(48)	The frequency rating of this transformer.	frequency
type	VARCHAR(48)	Function of the substation. Common values are "distribution", "generator", "auto" and "traction". See https://wiki.openstreetmap.org/wiki/Key:traction for details.	transformer
location	VARCHAR(48)	Location and size of a substation. Common values are "underground", "outdoor", "indoor", "kiosk". See https://wiki.openstreetmap.org/wiki/Tag:power %3Dtransformer#Location_values for details.	location

The following feature classes exist in this layer:

code	fclass	Description	OSM Tags
6441	transformer	A power transformer within a station or substation.	power=transformer

5 Point, Linestring and Areas Features

5.1 Facility details ("power-facility-details")

This layer contains facilities usually to be found in substations.

This layer has an associated area layer (see section 2.7).

Additional attributes:

Attribute	PostGIS Type	Description	OSM Tags
operator	VARCHAR(100)	The name of the facility's operator.	operator
ref	VARCHAR(48)	The reference number or other identifier of this facility as defined by the operator.	ref
voltage	VARCHAR(48)	The voltage rating of this feature (switchgears only).	voltage
frequency	VARCHAR(48)	The frequency rating of this facility (switchgears only).	frequency
height	INTEGER	The height above ground in metre (portals and terminals only).	height

The following feature classes exist in this layer:

code	fclass	Description	OSM Tags
6442	switchgear	A switchgear. This feature is mapped as area or as a point in OpenStreetMap.	power=switchgear
6443	portal	A power portal (a support composed of 2 or more vertical legs linked by horizontal crossarm supporting the cables). This feature is mapped as either a point or a linestring in OpenStreetMap.	power=portal
6444	terminal	A point where an overhead power link is attached to a building (usually a substation building). This feature exists as point only.	power=terminal

5.2 Other Power Features ("power-other")

This layer contains all power features which are mapped as points or areas in OpenStreetMap and do not fit into any other layer.

This layer has an associated area layer (see section 2.7).

Additional attributes:

Attribute	PostGIS Type	Description	OSM Tags
operator	VARCHAR(100)	The name of the facility's operator.	operator
name	VARCHAR(100)	Name of this feature, like a street or place name.	name
ref	VARCHAR(48)	The reference number or other identifier of this facility as defined by the operator.	ref
voltage	VARCHAR(48)	The voltage rating of this facility.	voltage
frequency	VARCHAR(48)	The frequency rating of this facility.	frequency

The following feature classes exist in this layer:

code	fclass	Description	OSM Tags
6450	power_street_cabinet	A street cabinet for the purpose of power distribution, e.g. containing fuses house connection lines. Some of them may host small substations.	man_made=street_cabinet + street_cabinet=power but without power=substation
6451	cable_distribution_c	A street cabinet for the purpose of power distribution, e.g. containing fuses house connection lines. These street cabinets do not host substations.	power=cable_distribution_cabinet

6 Line Features

6.1 Power Lines and Cables ("power-lines")

This layer has all power lines in OSM and their attributes, where known.

Additional attributes:

Attribute	PostGIS Type	Description	OSM Tags
operator	VARCHAR(100)	The name of the facility's operator.	operator
name	VARCHAR(100)	Name of this feature, like a street or place name.	name
voltage	VARCHAR(48)	The voltage rating of this line/cable.	voltage
frequency	VARCHAR(48)	The frequency rating of this line/cable .	frequency
cables	INTEGER	The number of cables carried in this power line	cables
circuits	INTEGER	The number of electric circuits of this power line.	circuits
location	VARCHAR(30)	Location of the cable. Common values are "underground", "overground", "indoor", "undersea", and "overhead".	location
wires	VARCHAR(25)	The type of wiring used (usually "single", "double", "triple" or "quad")	wires
line	VARCHAR(15)	Subclass for power lines (6600) in substation facilities (common values: bay, busbar). See https://wiki.openstreetmap.org/wiki/Tag:line%3Dbusbar and https://wiki.openstreetmap.org/wiki/Tag:line%3Dbay for details. For lines outside of substations, this field is usually null.	line

The following feature classes exist in this layer:

code	fclass	Description	OSM Tags
6600	line	A regular power line.	power=line
6601	minor_line	A smaller power line usually supported by poles, not masts.	power=minor_line
6611	cable	An underground or submarine power cable.	power=cable
6612	minor_cable	A smaller underground or submarine power cable.	power=minor_cable