

Calculating Line Lengths and Statistics

QGIS Tutorials and Tips



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Calculating Line Lengths and Statistics

QGIS has built-in functions to calculate various properties based on the geometry of the feature - such as length, area, perimeter etc. This tutorial will show how to use **Field Calculator** to add a column with a value representing length of each feature.

Overview of the task

We will use a polyline shapefile of railroads in North America and try to determine the total length of railroads in the United States.

Other skills you will learn

- Using expressions to select features.
- Re-projecting a layer from Geographic to Projected Coordinate Reference System(CRS).
- Viewing statistics for values of an attribute in a layer.

Get the data

[Natural Earth](#) has a public domain railroads dataset. Download the [North America supplement](#) zip file from the portal.

Data Source [NATURALEARTH]

Procedure

1. Go to *Layer* ■ *Add Vector Layer*.



2. Browse to the `ne_10m_railroads_north_america.zip` file and click OK.



3. In the *Select layers to add...* dialog, choose `ne_10m_railroads_north_america.shp` layer.



- Once the layer is loaded, you will notice that the layer has lines representing railroads for all of North America. Since we want to calculate line lengths only for United States railroads, we need to select the lines that fall in the United States. Right-click on the layer and select *Open Attribute Table*.



5. The layer has an attribute called `sov_a3`. This is the 3 letter code for the country that a particular feature falls in. We can use the value of this attribute to select features that are in USA.



Attribute table - ne_10m_railroads_north_america :: Features total: 1127, filtered: 1127, selected: 0

| | scalerank | featuredc | sov_a3 | uident | add | natrscale | continent |
|----|-----------|-----------|--------|--------|-----|-----------|---------------|
| 0 | 8 | Railroad | USA | 1506 | 0 | 0 | North America |
| 1 | 9 | Railroad | USA | 1606 | 1 | 5 | North America |
| 2 | 8 | Railroad | USA | 1706 | 0 | 0 | North America |
| 3 | 8 | Railroad | USA | 1806 | 0 | 0 | North America |
| 4 | 8 | Railroad | USA | 1906 | 0 | 0 | North America |
| 5 | 8 | Railroad | USA | 2006 | 0 | 0 | North America |
| 6 | 8 | Railroad | USA | 2106 | 0 | 0 | North America |
| 7 | 9 | Railroad | USA | 2206 | 1 | 5 | North America |
| 8 | 8 | Railroad | USA | 2306 | 0 | 0 | North America |
| 9 | 8 | Railroad | USA | 2406 | 0 | 0 | North America |
| 10 | 8 | Railroad | USA | 2506 | 0 | 0 | North America |
| 11 | 8 | Railroad | USA | 2606 | 0 | 0 | North America |
| 12 | 8 | Railroad | USA | 2706 | 0 | 0 | North America |
| 13 | 8 | Railroad | USA | 2806 | 0 | 0 | North America |
| 14 | 9 | Railroad | USA | 2906 | 1 | 5 | North America |
| 15 | 9 | Railroad | USA | 3006 | 1 | 5 | North America |
| 16 | 8 | Railroad | USA | 3106 | 0 | 0 | North America |
| 17 | 8 | Railroad | USA | 3206 | 0 | 0 | North America |
| 18 | 8 | Railroad | USA | 3306 | 0 | 0 | North America |
| 19 | 8 | Railroad | USA | 3506 | 0 | 0 | North America |
| 20 | 8 | Railroad | USA | 3606 | 0 | 0 | North America |
| 21 | 8 | Railroad | USA | 3706 | 0 | 0 | North America |
| 22 | 8 | Railroad | USA | 3806 | 0 | 0 | North America |
| 23 | 9 | Railroad | USA | 3906 | 1 | 5 | North America |

Show All Features

6. In the *Attribute Table* window, click the *Select features using an expression* button.

Attribute table - ne_10m_railroads_north_america :: Features total: 1127, filtered: 1127, selected: 0

Select features using an expression

| | scalerank | | uident | add | natrscale | continent |
|----|-----------|----------|--------|------|-----------|-----------------|
| 0 | 8 | Railroad | USA | 1506 | 0 | 0 North America |
| 1 | 9 | Railroad | USA | 1606 | 1 | 5 North America |
| 2 | 8 | Railroad | USA | 1706 | 0 | 0 North America |
| 3 | 8 | Railroad | USA | 1806 | 0 | 0 North America |
| 4 | 8 | Railroad | USA | 1906 | 0 | 0 North America |
| 5 | 8 | Railroad | USA | 2006 | 0 | 0 North America |
| 6 | 8 | Railroad | USA | 2106 | 0 | 0 North America |
| 7 | 9 | Railroad | USA | 2206 | 1 | 5 North America |
| 8 | 8 | Railroad | USA | 2306 | 0 | 0 North America |
| 9 | 8 | Railroad | USA | 2406 | 0 | 0 North America |
| 10 | 8 | Railroad | USA | 2506 | 0 | 0 North America |
| 11 | 8 | Railroad | USA | 2606 | 0 | 0 North America |
| 12 | 8 | Railroad | USA | 2706 | 0 | 0 North America |
| 13 | 8 | Railroad | USA | 2806 | 0 | 0 North America |
| 14 | 9 | Railroad | USA | 2906 | 1 | 5 North America |
| 15 | 9 | Railroad | USA | 3006 | 1 | 5 North America |
| 16 | 8 | Railroad | USA | 3106 | 0 | 0 North America |
| 17 | 8 | Railroad | USA | 3206 | 0 | 0 North America |
| 18 | 8 | Railroad | USA | 3306 | 0 | 0 North America |
| 19 | 8 | Railroad | USA | 3506 | 0 | 0 North America |
| 20 | 8 | Railroad | USA | 3606 | 0 | 0 North America |
| 21 | 8 | Railroad | USA | 3706 | 0 | 0 North America |
| 22 | 8 | Railroad | USA | 3806 | 0 | 0 North America |
| 23 | 9 | Railroad | USA | 3906 | 1 | 5 North America |

Show All Features

7. A new dialog *Select By Expression* will open. Find the attribute *sov_a3* under *Fields and Values* in the *Functions list* section. Double-click on it to add it to the *Expression* text area. Complete the expression by typing in "*sov_a3*" = 'USA'. Click *Select* followed by *Close*.

Select By Expression

Function list

Search

- String
- Color
- Geometry
- Record
- Fields and Values
 - scalerank
 - featurecla
 - sov_a3
 - uident
 - add
 - natrscale
 - continent
- Recent (Selection)

Selected function help

Field

Double click to add field name to expression string.

Right-Click on field name to open context menu sample value loading options.

Field values

Load values all unique 10 samples

Operators

= + - / * ^ || ()

Expression

"sov_a3" = 'USA'

Output preview: 1

Select Close

8. Back in the main QGIS window, you will see that all lines that fall in USA are selected and appear in yellow.



9. Now let's save our selection to a new shapefile. Right-click on the ne_10m_railroads_north_america layer and select *Save Selection As....*



10. Click *Browse* and name the output file as `usa_railroads.shp`. We also want to change the CRS of the layer. Click on *Browse* next to *CRS*.

Note

The built-in functions that use a feature's geometry for calculation use the units of the layer's CRS. Geographic Coordinate Reference System(CRS) such as *EPSG:4326* have **degrees** as units - so the length of the feature would be in **degrees** and area in **square degrees** - which is meaningless. You need to use a Projected Coordinate Reference System with units of **meters** or **feet** to perform such calculations.



11. Since we are interested in calculating length, let's select an equidistance projection. Type *north america equ* in the *Filter* search box. In the results pane below, select *North_America_Equidistant_Conic EPSG:102010* as the CRS. Click *OK*.



12. In the *Save vector layer as...* dialog, check the *Add saved file to map* and click *OK*.



13. Once the export process finishes, you will see a new layer `usa_railroads` loaded in QGIS. You can uncheck the box next to `ne_10m_railroads_north_america` layer to turn it off as we don't need it anymore.



14. Right-click on the `usa_railroads` layer and select *Open Attribute Table*.



15. Now it is time to add a column with length of each feature. Put the layer in editing mode by clicking on the *Toggle editing* button. Once in editing mode, click the *Open field calculator* button.

Attribute table - usa_railroads :: Features total: 752, filtered: 752, selected: 0



| | scalerank | featuredata | sov_a3 | uident | | continent |
|----|-----------|-------------|--------|--------|---|---------------|
| 0 | 8 | Railroad | USA | 1506 | 0 | North America |
| 1 | 9 | Railroad | USA | 1606 | 1 | North America |
| 2 | 8 | Railroad | USA | 1706 | 0 | North America |
| 3 | 8 | Railroad | USA | 1806 | 0 | North America |
| 4 | 8 | Railroad | USA | 1906 | 0 | North America |
| 5 | 8 | Railroad | USA | 2006 | 0 | North America |
| 6 | 8 | Railroad | USA | 2106 | 0 | North America |
| 7 | 9 | Railroad | USA | 2206 | 1 | North America |
| 8 | 8 | Railroad | USA | 2306 | 0 | North America |
| 9 | 8 | Railroad | USA | 2406 | 0 | North America |
| 10 | 8 | Railroad | USA | 2506 | 0 | North America |
| 11 | 8 | Railroad | USA | 2606 | 0 | North America |
| 12 | 8 | Railroad | USA | 2706 | 0 | North America |
| 13 | 8 | Railroad | USA | 2806 | 0 | North America |
| 14 | 9 | Railroad | USA | 2906 | 1 | North America |
| 15 | 9 | Railroad | USA | 3006 | 1 | North America |
| 16 | 8 | Railroad | USA | 3106 | 0 | North America |
| 17 | 8 | Railroad | USA | 3206 | 0 | North America |
| 18 | 8 | Railroad | USA | 3306 | 0 | North America |
| 19 | 8 | Railroad | USA | 3506 | 0 | North America |
| 20 | 8 | Railroad | USA | 3606 | 0 | North America |
| 21 | 8 | Railroad | USA | 3706 | 0 | North America |
| 22 | 8 | Railroad | USA | 3806 | 0 | North America |
| 23 | 9 | Railroad | USA | 3906 | 1 | North America |

Show All Features

16. In the *Field Calculator*, check *Create a new field*. Enter **length_km** as the *Output field name*. Choose **Decimal number (real)** as the *Output field type*. Change the output *Precision* to **2**. In the *Function list* panel, find the *\$length* under *Geometry*. Double-click it to add it to the *Expression*. Complete the expression as `$length / 1000` because our layer CRS is in **meters** unit and we want the output in **km**. Click **OK**.



17. Back in *Attribute Table*, you will see a new column *length_km* appear. Click the *Toggle editing* button to save the changes to the attribute table.

Attribute table - usa_railroads :: Features total: 752, filtered: 752, selected: 0



| | scalerank | featurecla | sov_a3 | uident | add | natrscale | continent | length_km |
|----|-----------|------------|--------|--------|-----|-----------|---------------|-----------|
| 0 | 8 | Railroad | USA | 1506 | 0 | 0 | North America | 637.07 |
| 1 | 9 | Railroad | USA | 1606 | 1 | 5 | North America | 16.27 |
| 2 | 8 | Railroad | USA | 1706 | 0 | 0 | North America | 96.22 |
| 3 | 8 | Railroad | USA | 1806 | 0 | 0 | North America | 20.15 |
| 4 | 8 | Railroad | USA | 1906 | 0 | 0 | North America | 0.01 |
| 5 | 8 | Railroad | USA | 2006 | 0 | 0 | North America | 79.95 |
| 6 | 8 | Railroad | USA | 2106 | 0 | 0 | North America | 67.00 |
| 7 | 9 | Railroad | USA | 2206 | 1 | 5 | North America | 196.45 |
| 8 | 8 | Railroad | USA | 2306 | 0 | 0 | North America | 60.61 |
| 9 | 8 | Railroad | USA | 2406 | 0 | 0 | North America | 20.03 |
| 10 | 8 | Railroad | USA | 2506 | 0 | 0 | North America | 147.21 |
| 11 | 8 | Railroad | USA | 2606 | 0 | 0 | North America | 68.33 |
| 12 | 8 | Railroad | USA | 2706 | 0 | 0 | North America | 1.62 |
| 13 | 8 | Railroad | USA | 2806 | 0 | 0 | North America | 4.34 |
| 14 | 9 | Railroad | USA | 2906 | 1 | 5 | North America | 60.92 |
| 15 | 9 | Railroad | USA | 3006 | 1 | 5 | North America | 157.26 |
| 16 | 8 | Railroad | USA | 3106 | 0 | 0 | North America | 131.39 |
| 17 | 8 | Railroad | USA | 3206 | 0 | 0 | North America | 58.84 |
| 18 | 8 | Railroad | USA | 3306 | 0 | 0 | North America | 432.74 |
| 19 | 8 | Railroad | USA | 3506 | 0 | 0 | North America | 29.55 |
| 20 | 8 | Railroad | USA | 3606 | 0 | 0 | North America | 94.90 |
| 21 | 8 | Railroad | USA | 3706 | 0 | 0 | North America | 577.78 |
| 22 | 8 | Railroad | USA | 3806 | 0 | 0 | North America | 223.04 |
| 23 | 9 | Railroad | USA | 3906 | 1 | 5 | North America | 143.94 |

Show All Features

18. Now that we have length of each individual line in our layer, we can easily add it all up and find the **Total** length. Go to **Vector** ■ **Analysis Tools** ■ **Basic Statistics**.



19. Select the *Input Vector layer* as `usa_railroads`. Choose the *Target field* as `length_km` and click *OK*. You will see various statistics appear. The *Sum* value is the total length of the railroads that we are looking to find.

Note

This answer will vary slightly if a different projection is chosen. In practice, line lengths for roads and other linear features are measured on the ground and provided as attributes to the dataset. This method works in absence of such attribute and as an approximation of actual line lengths.

Basics statistics

Input Vector Layer
usa_railroads

☐ Use only selected features

Target field
length_km

Statistics output

| Parameter | Value |
|-------------------------|----------------|
| Mean | 127.751569149 |
| StdDev | 125.80562595 |
| Sum | 96069.18 |
| Min | 0.01 |
| Max | 936.6 |
| N | 752.0 |
| CV | 0.984767755... |
| Number of unique values | 743 |

Press Ctrl+C to copy results to the clipboard

0% OK Close