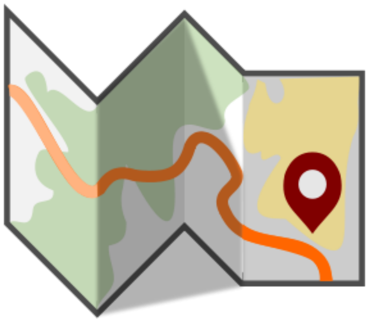
Calculating Line Lengths and Statistics

QGIS Tutorials and Tips



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計算線段的長度和統計資訊

(Unfinished) QGIS 內建的功能可以計算圖徵的幾何性質，像是長度、面積、周長等等。

內容說明

使用北美鐵路網的線段式 shapefile 來計算美國的鐵道總長度。

■■■■■■■

- 使用表達式選擇圖徵。
- 把圖層重新投影到專案的座標參考系統 (CRS) 上。
- 查閱某圖層中某個屬性的統計資訊。

取得資料

Natural Earth 上有屬於公領域資料的 `鐵路 <http://www.naturalearthdata.com/downloads/10m-cultural-vectors/railroads/>`_ 資料庫，`北美的部分 <http://www.naturalearthdata.com/http//www.naturalearthdata.com/dow nload/1

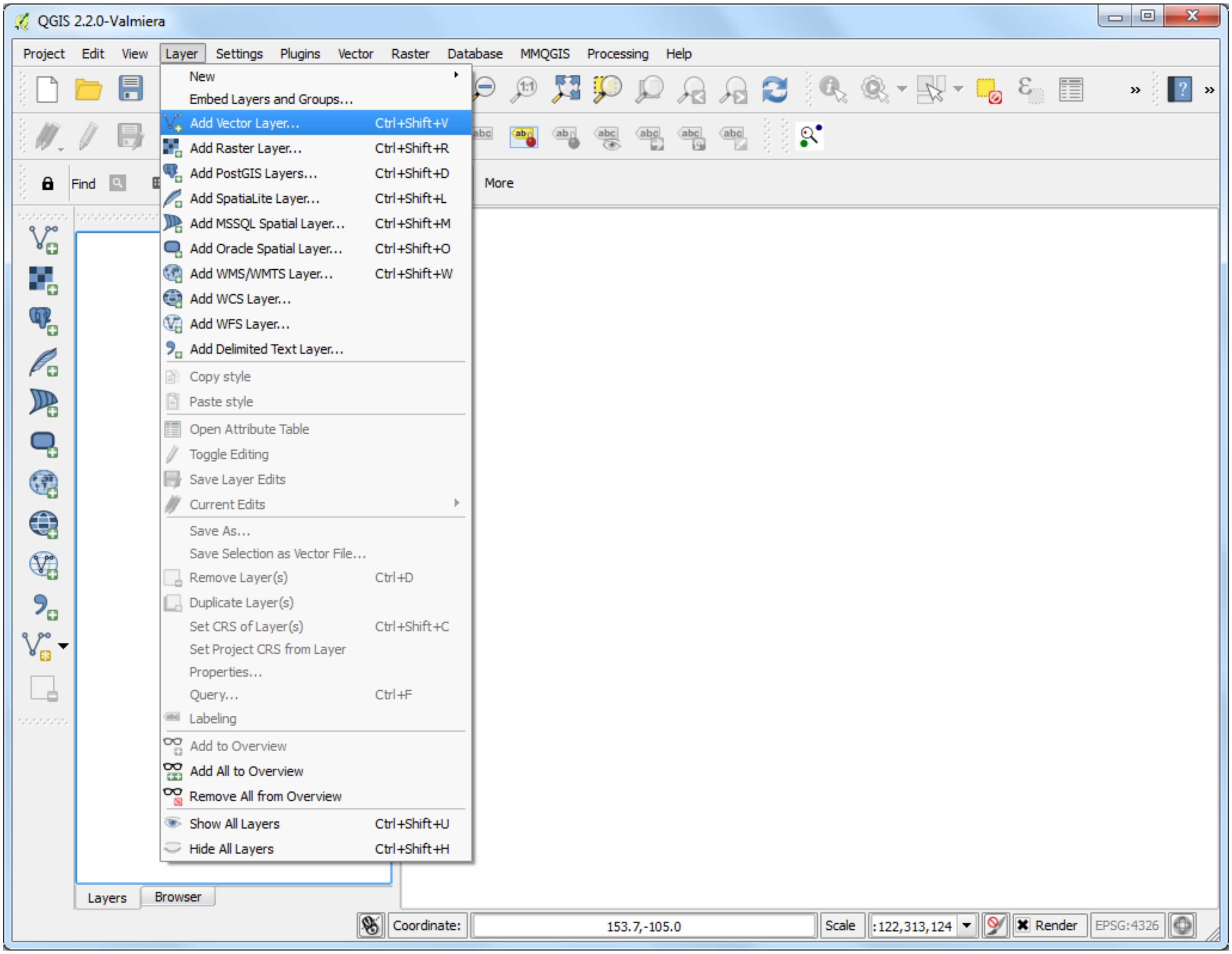
為了方便起見，你也可以直接用下面的連結下載：

ne_10m_railroads_north_america.zip

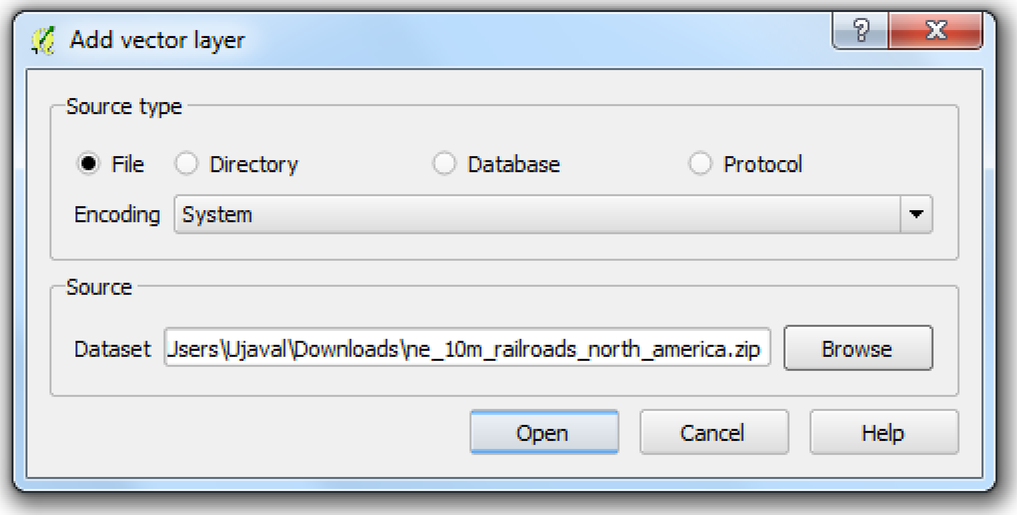
資料來源 [NATURALEARTH]

操作流程

1. 選擇 圖層 ‣ 加入向量圖層。


QGIS 2.2.0-Valmiera
Project Edit View Layer Settings Plugins Vector Raster Database MMQGIS Processing Help
New
Embed Layers and Groups...
Add Vector Layer... Ctrl+Shift+V
Add Raster Layer... Ctrl+Shift+R
Add PostGIS Layers... Ctrl+Shift+D
Add SpatiaLite Layer... Ctrl+Shift+L
Add MSSQL Spatial Layer... Ctrl+Shift+M
Add Oracle Spatial Layer... Ctrl+Shift+O
Add WMS/WMTS Layer... Ctrl+Shift+W
Add WCS Layer...
Add WFS Layer...
Add Delimited Text Layer...
Copy style
Paste style
Open Attribute Table
Toggle Editing
Save Layer Edits
Current Edits
Save As...
Save Selection as Vector File...
Remove Layer(s) Ctrl+D
Duplicate Layer(s)
Set CRS of Layer(s) Ctrl+Shift+C
Set Project CRS from Layer
Properties...
Query... Ctrl+F
Labeling
Add to Overview
Add All to Overview
Remove All from Overview
Show All Layers Ctrl+Shift+U
Hide All Layers Ctrl+Shift+H
Find
More
Layers
Browser
Coordinate: 153.7,-105.0
Scale :122,313,124
Render
EPSG:4326

2. 選擇 ***ne_10m_railroads_north_america.zip*** 並按下 確定。


Add vector layer
Open
Cancel
Help
Browse

Source type

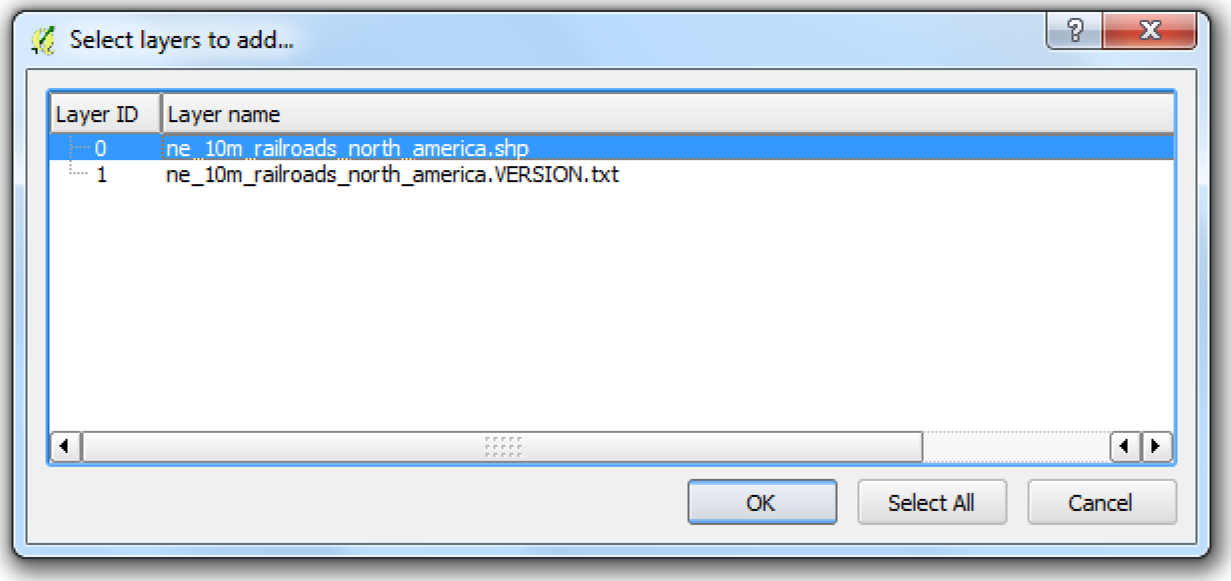
● File ○ Directory ○ Database ○ Protocol

Encoding: System

Source

Dataset: Jsers\Ujaval\Downloads\ne_10m_railroads_north_america.zip

3. 在 選擇加入的圖層... 對話框中，選擇 ***ne_10m_railroads_north_america.shp***。（譯註：較新的 QGIS 版本不會出現這個步驟）

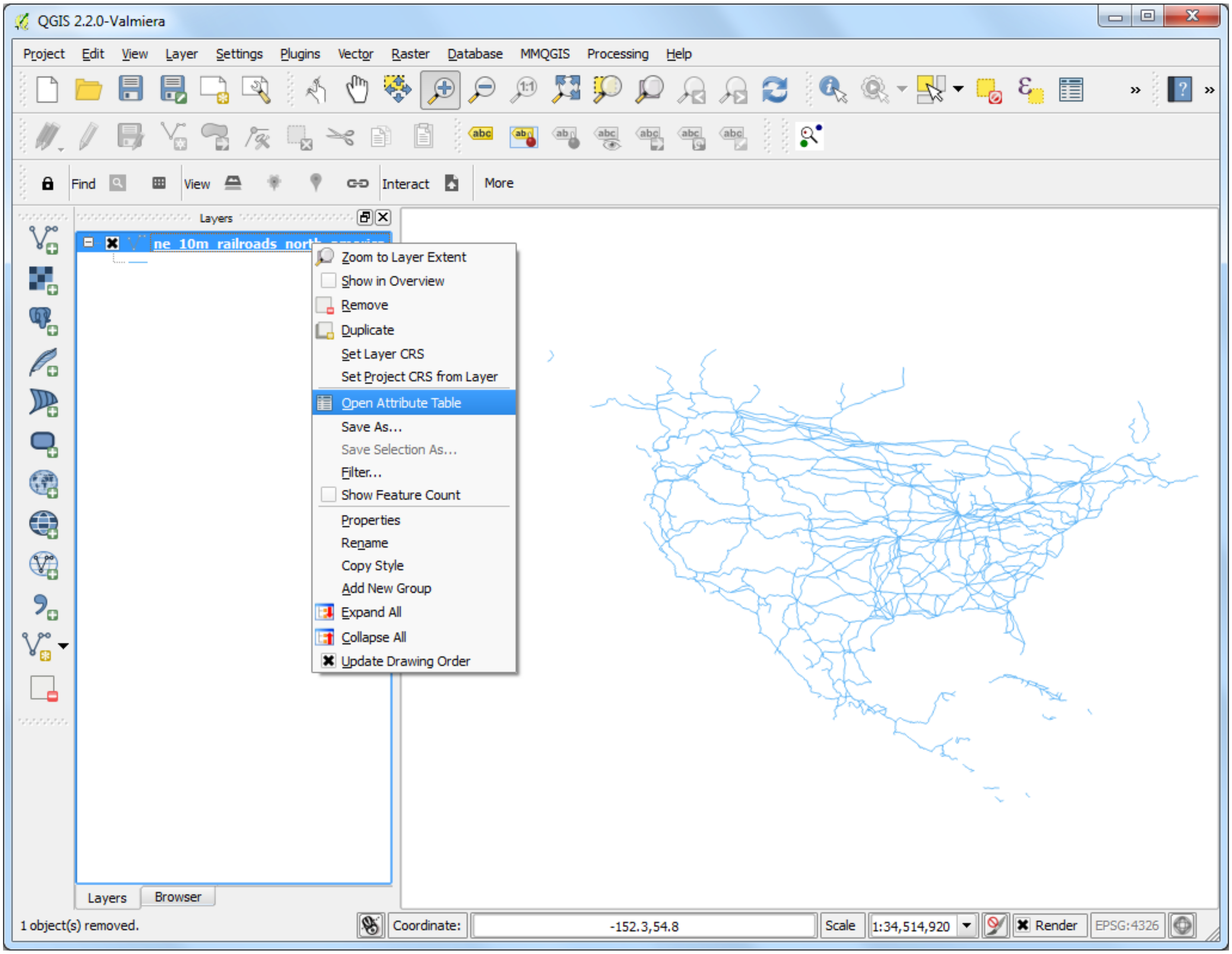


Select layers to add...

Layer ID	Layer name
0	ne_10m_railroads_north_america.shp
1	ne_10m_railroads_north_america.VERSION.txt

OK
Select All
Cancel

. 圖層載入後，會顯示所有北美的鐵道線段。我們的目標是只計算美國的鐵路長度，所以必須要先選擇那些位於美國境內的鐵路才行。以右鍵點選此圖層，:guilabel:` 開啟屬性表格。



QGIS 2.2.0-Valmiera

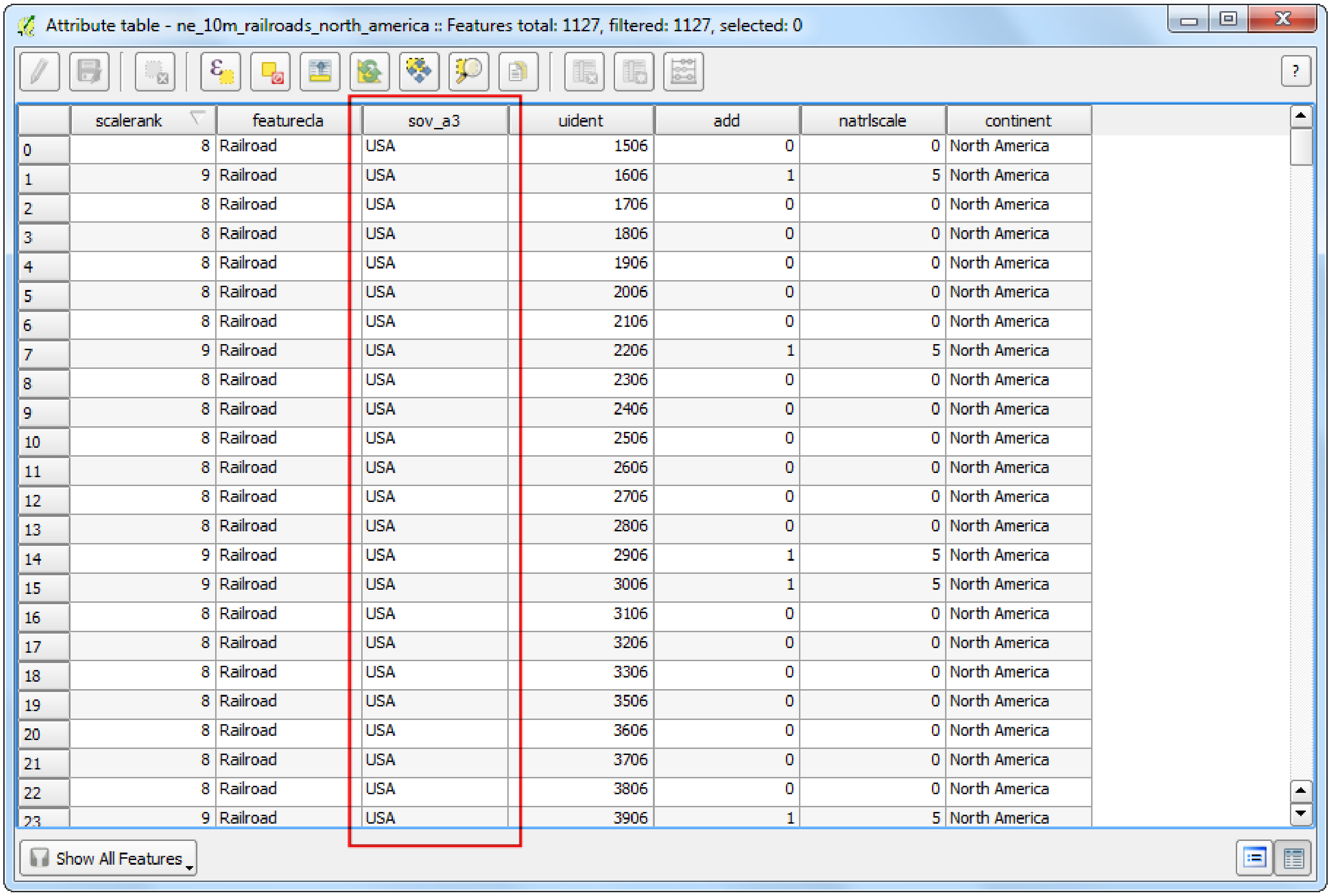
1 object(s) removed.

Coordinate: -152.3,54.8

Scale 1:34,514,920

Project
Edit
View
Layer
Settings
Plugins
Vector
Raster
Database
MMQGIS
Processing
Help
Find
View
Interact
More
Layers
ne_10m_railroads_nort
Zoom to Layer Extent
Show in Overview
Remove
Duplicate
Set Layer CRS
Set Project CRS from Layer
Open Attribute Table
Save As...
Save Selection As...
Filter...
Show Feature Count
Properties
Rename
Copy Style
Add New Group
Expand All
Collapse All
Update Drawing Order
Layers
Browser
Render
EPSG:4326

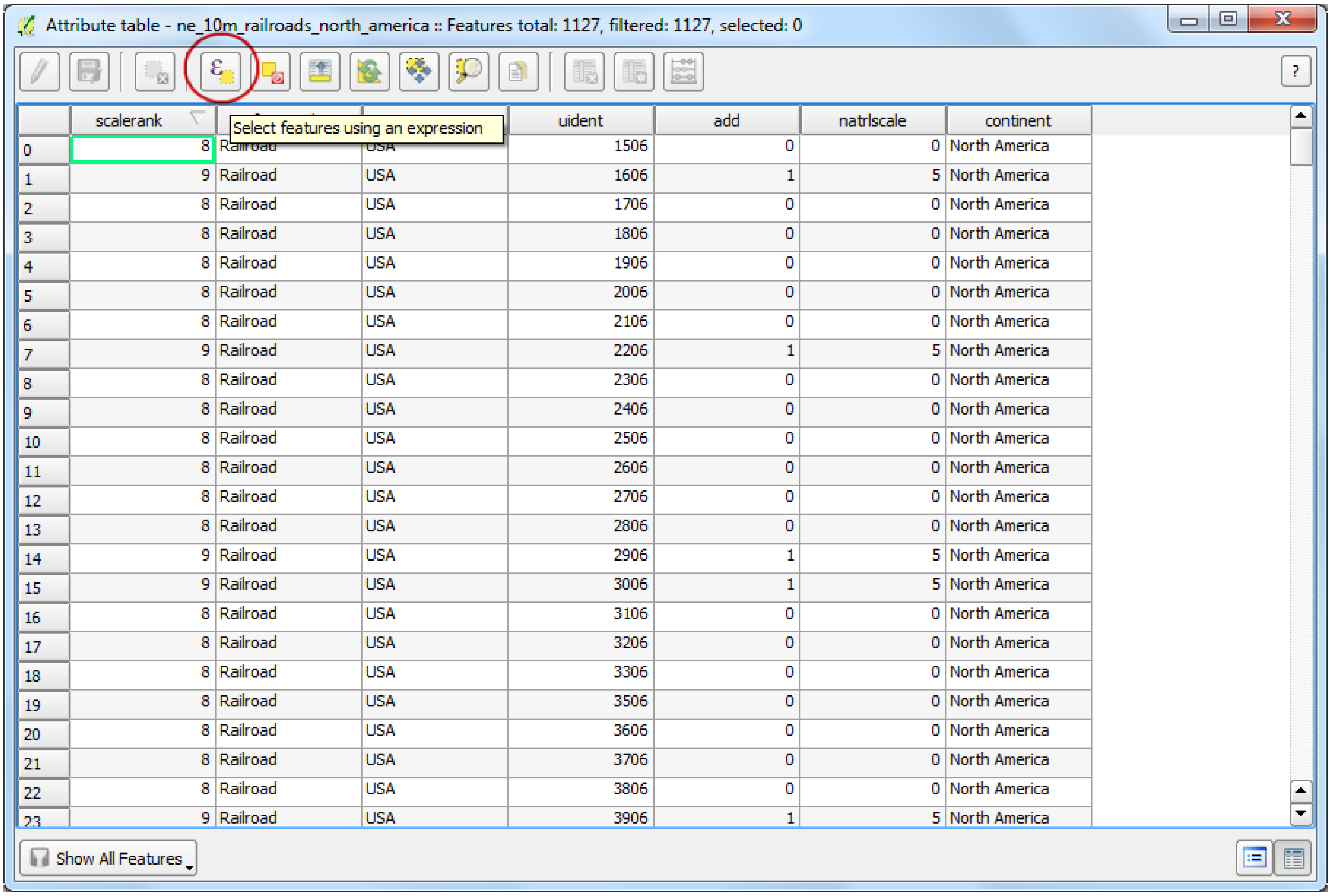
5. 這個圖層含有一個叫做 sov_a3 的屬性，其值使用三個英文字母來代表這段圖徵位在哪個城市。我們要利用這個屬性來選擇位於美國境內的鐵路。



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

	scalerank	featurecla	sov_a3	uident	add	natrlscale	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

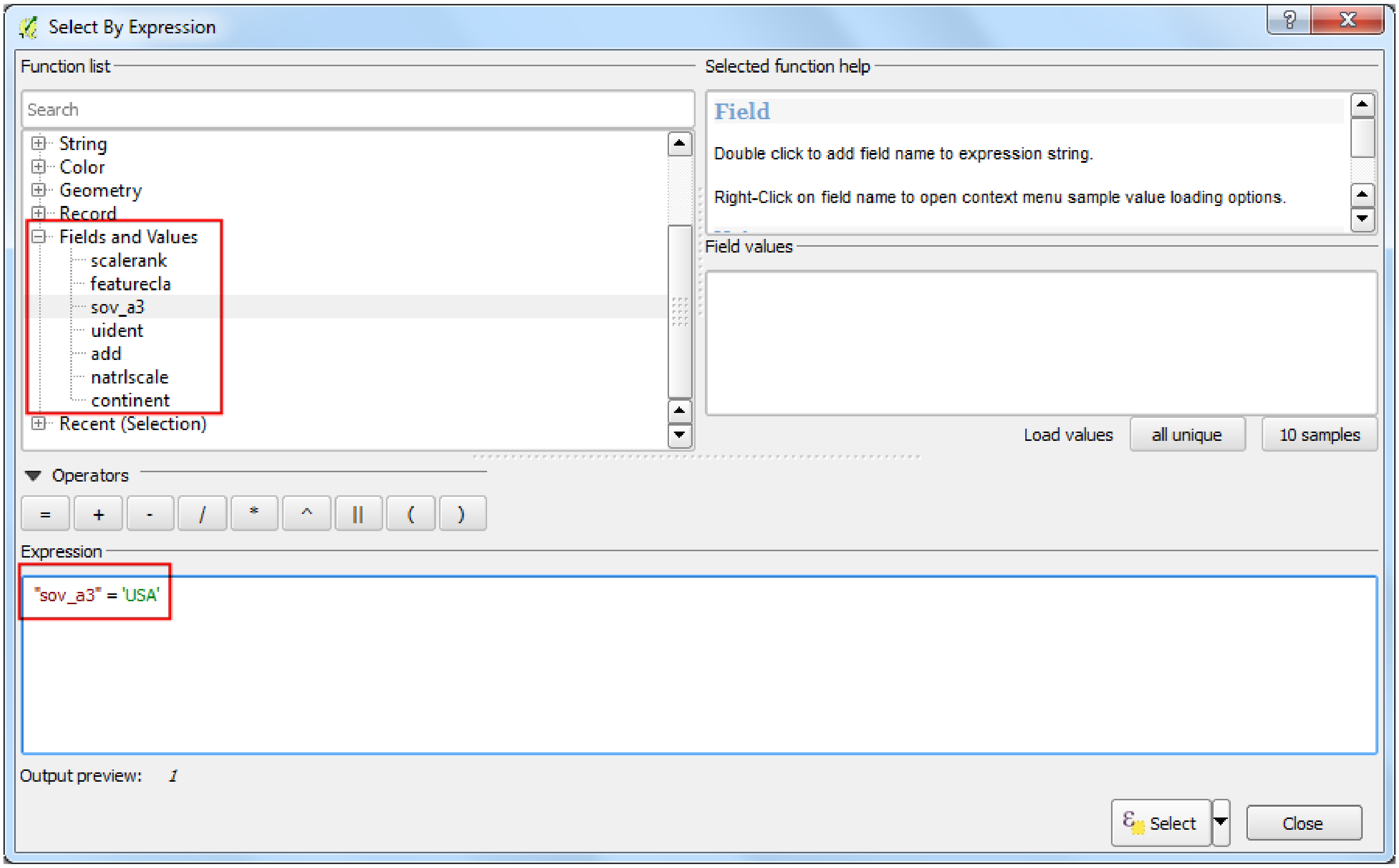
6. 在 屬性表格 視窗中按下 :guilabel:` 使用表示式選取圖徵 ` 的按鈕。



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

	scalerank			uident	add	natrlscale	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

7. 以表示式選取圖徵 的視窗出現後，在 函數列表 中的 欄位與值 的分類中找到 sov_a3 屬性，然後按兩下以加入到 表示式區中，補完這個表達式 ***"sov_a3" = 'USA'***，好了以後按下 選取 然後 關閉。


Select By Expression
Function list
Search
String
Color
Geometry
Record
Fields and Values
scalerank
featurecla
sov_a3
uident
add
natrlscale
continent
Recent (Selection)
Operators
=
+
-
/
*
^
||
(
)
Expression
Selected function help
Field values
Load values
all unique
10 samples
Select
Close

Field

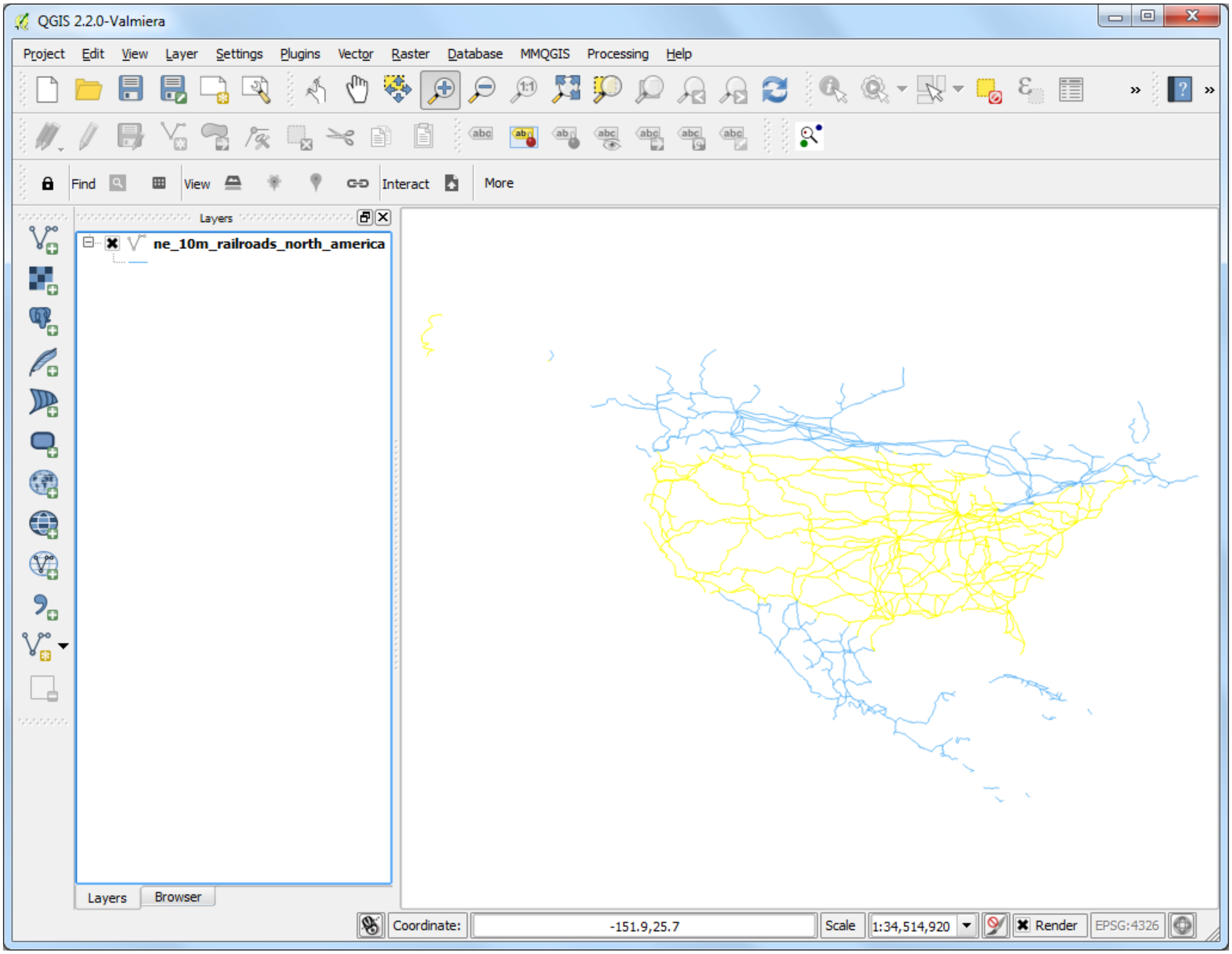
Double click to add field name to expression string.

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

```
"sov_a3" = 'USA'
```

Output preview: 1

8. 回到 QGIS 主視窗，現在在美國境內的線段都被選取，並標為黃色了。


QGIS 2.2.0-Valmiera
Project
Edit
View
Layer
Settings
Plugins
Vector
Raster
Database
MMQGIS
Processing
Help
Find
View
Interact
More
Layers
Layers
Browser

ne_10m_railroads_north_america

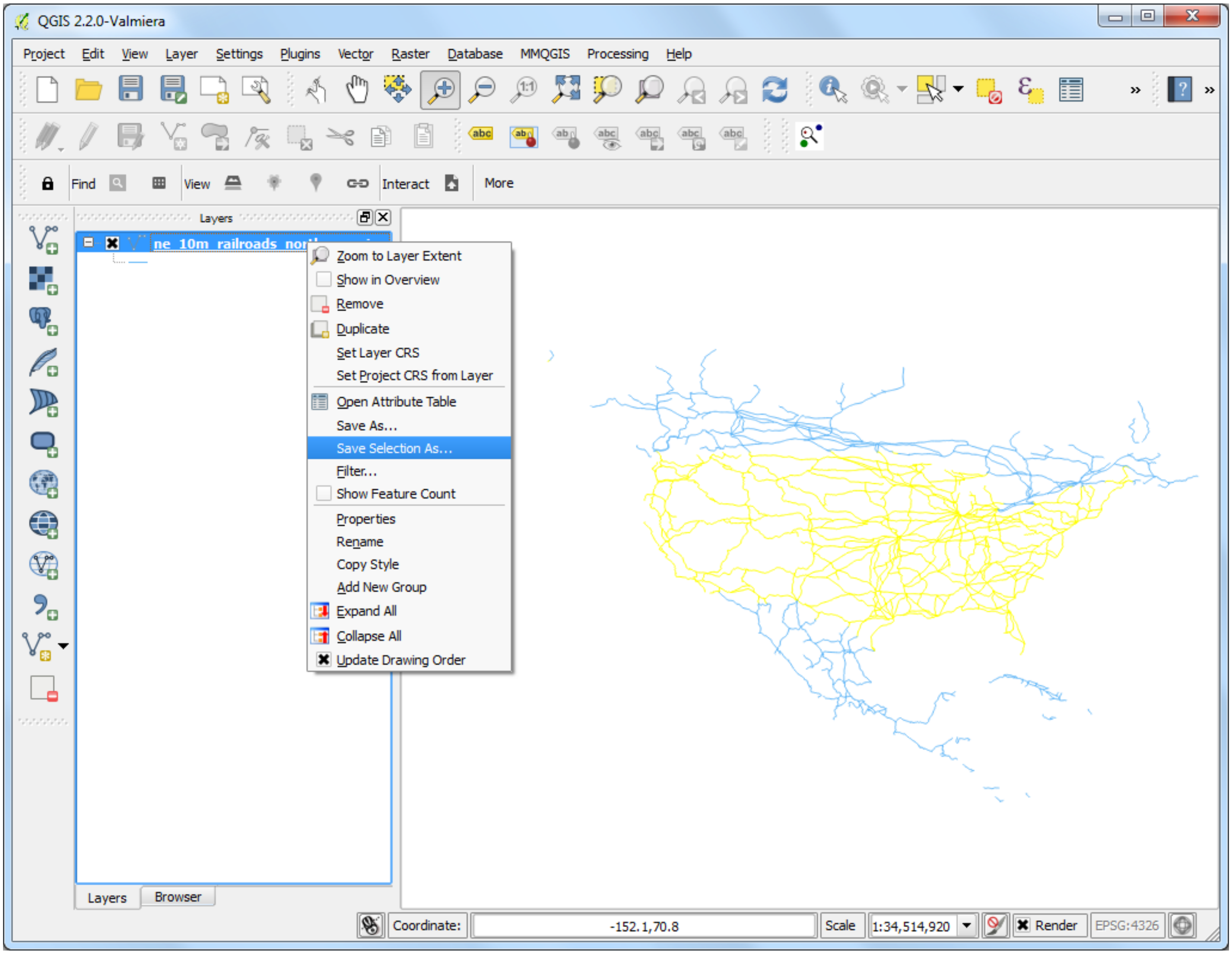
Coordinate: -151.9,25.7

Scale 1:34,514,920

☒ Render

EPSG:4326

9. 現在來把選取區域另存新檔吧。在 ***ne_10m_railroads_north_america*** 圖層上按右鍵然後選擇 儲存選取區域為 ... （或是 :guilabel:■■■...），


QGIS 2.2.0-Valmiera
Project Edit View Layer Settings Plugins Vector Raster Database MMQGIS Processing Help
Find View Interact More
Layers
ne_10m_railroads_nort
Zoom to Layer Extent
Show in Overview
Remove
Duplicate
Set Layer CRS
Set Project CRS from Layer
Open Attribute Table
Save As...
Save Selection As...
Filter...
Show Feature Count
Properties
Rename
Copy Style
Add New Group
Expand All
Collapse All
Update Drawing Order
Layers Browser
Render

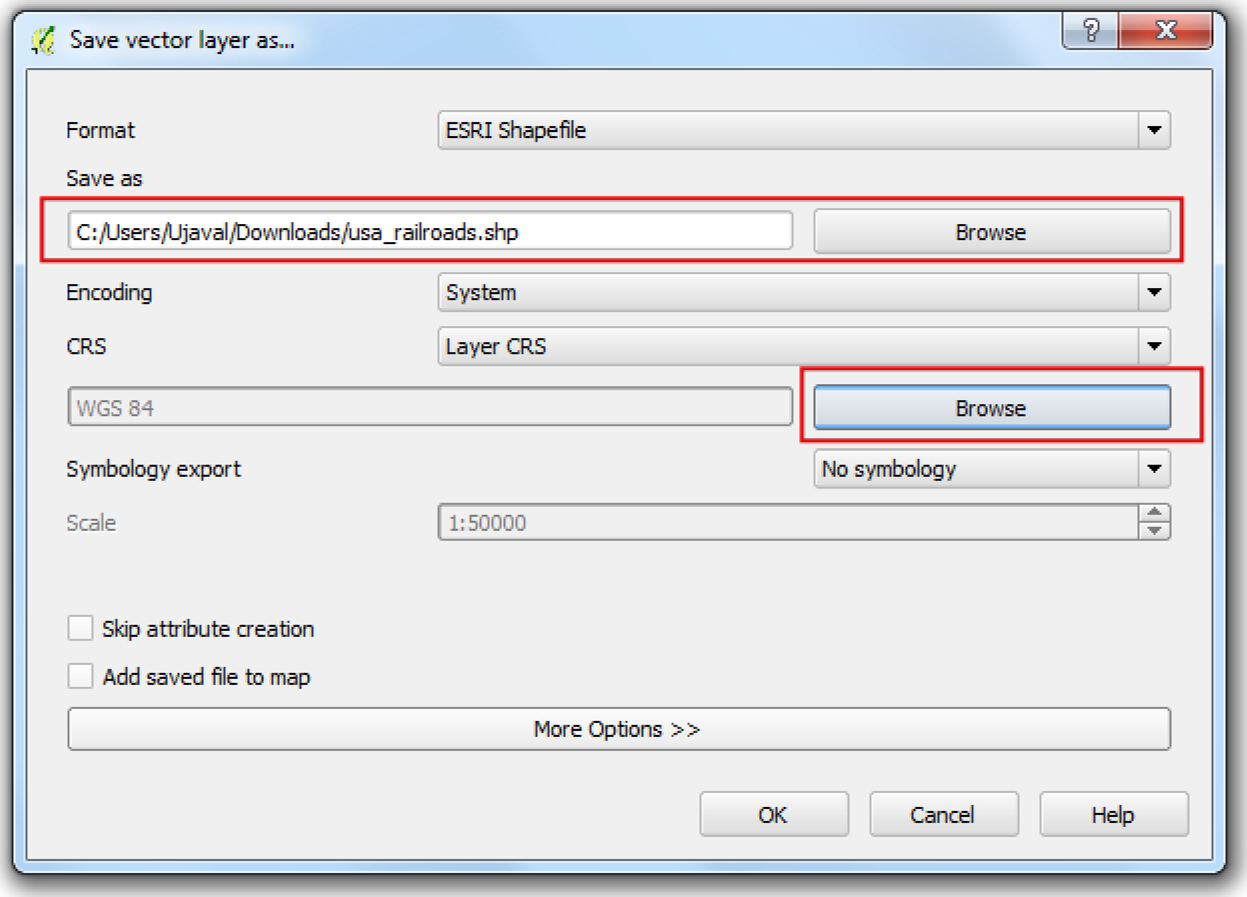
Coordinate: -152.1,70.8

Scale 1:34,514,920

EPSG:4326

10. 選擇 瀏覽 然後把輸出檔命名為 ***usa_railroads.shp***。這裡我們順便轉換一下圖層的 CRS，請按下在 CRS 旁邊的 瀏覽 圖示。

內建函數是使用圖層的座標參考系統 (CRS) 的預設單位來計算線段長度。因為 EPSG:4326 這
位，計算線段或面積的結果也會是 ** 角度 ** 或是 ** 平方度 **，以此作單位的數值其實並不實用。所以這裡必須要使用以 ** 公尺 ** 作為單位的專案座標參



Save vector layer as...

Format: ESRI Shapefile

Save as: C:/Users/Ujaval/Downloads/usa_railroads.shp

Encoding: System

CRS: Layer CRS

WGS 84

Symbology export: No symbology

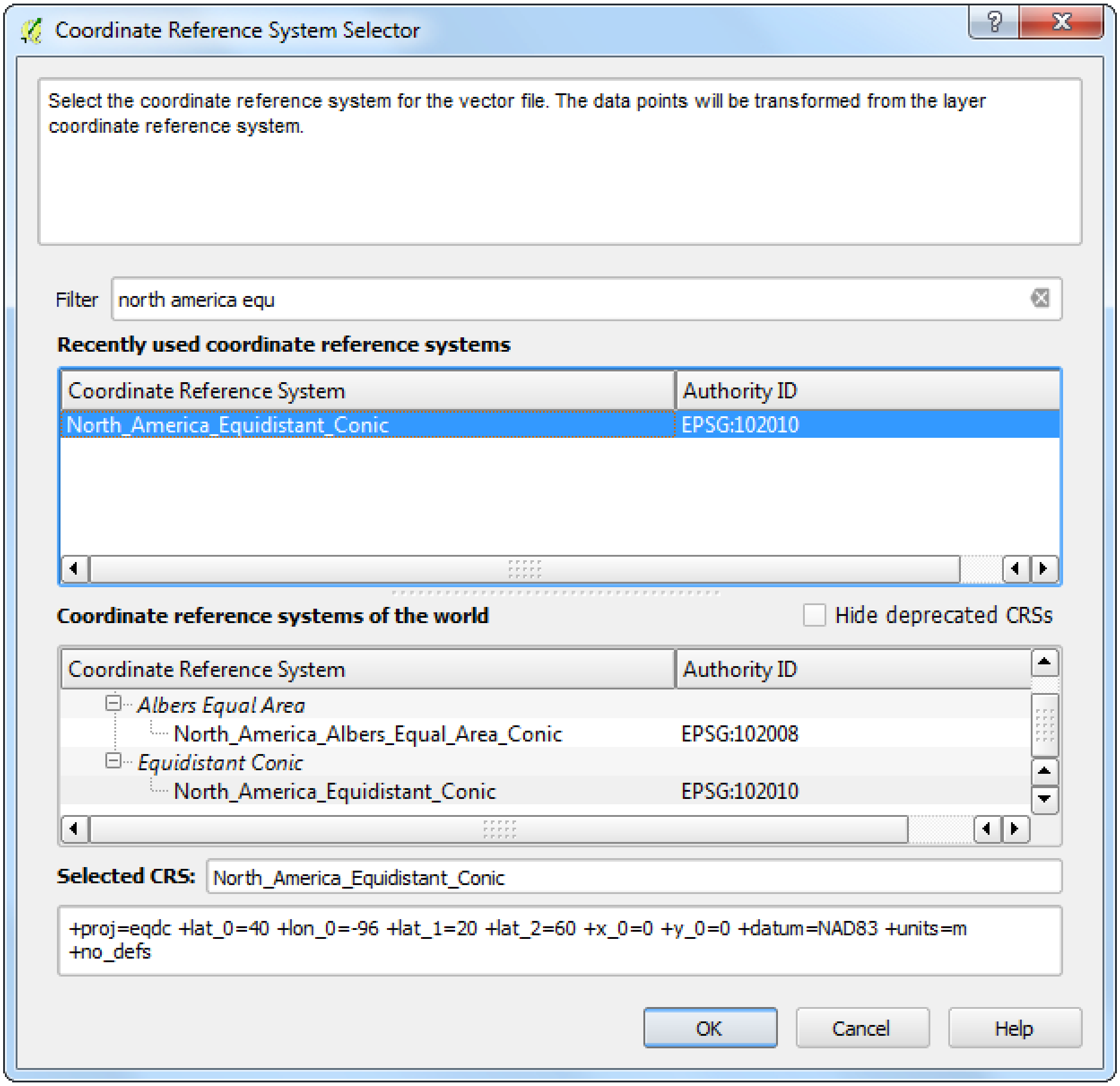
Scale: 1:50000

☐ Skip attribute creation

☐ Add saved file to map

Browse
Browse
More Options >>
OK
Cancel
Help

11. 因為我們是要計算長度，這裡來選一個等距離投影試試。在 過濾條件 欄位輸入 north america equ 後，底下的結果就會出現 North_America_Equidistant_Conic EPSG:102010，選擇它作為新的 CRS 之後，按下 :guilabel:` 確定。



Select the coordinate reference system for the vector file. The data points will be transformed from the layer coordinate reference system.

Filter: north america equ

Recently used coordinate reference systems

Coordinate Reference System	Authority ID
North_America_Equidistant_Conic	EPSG:102010

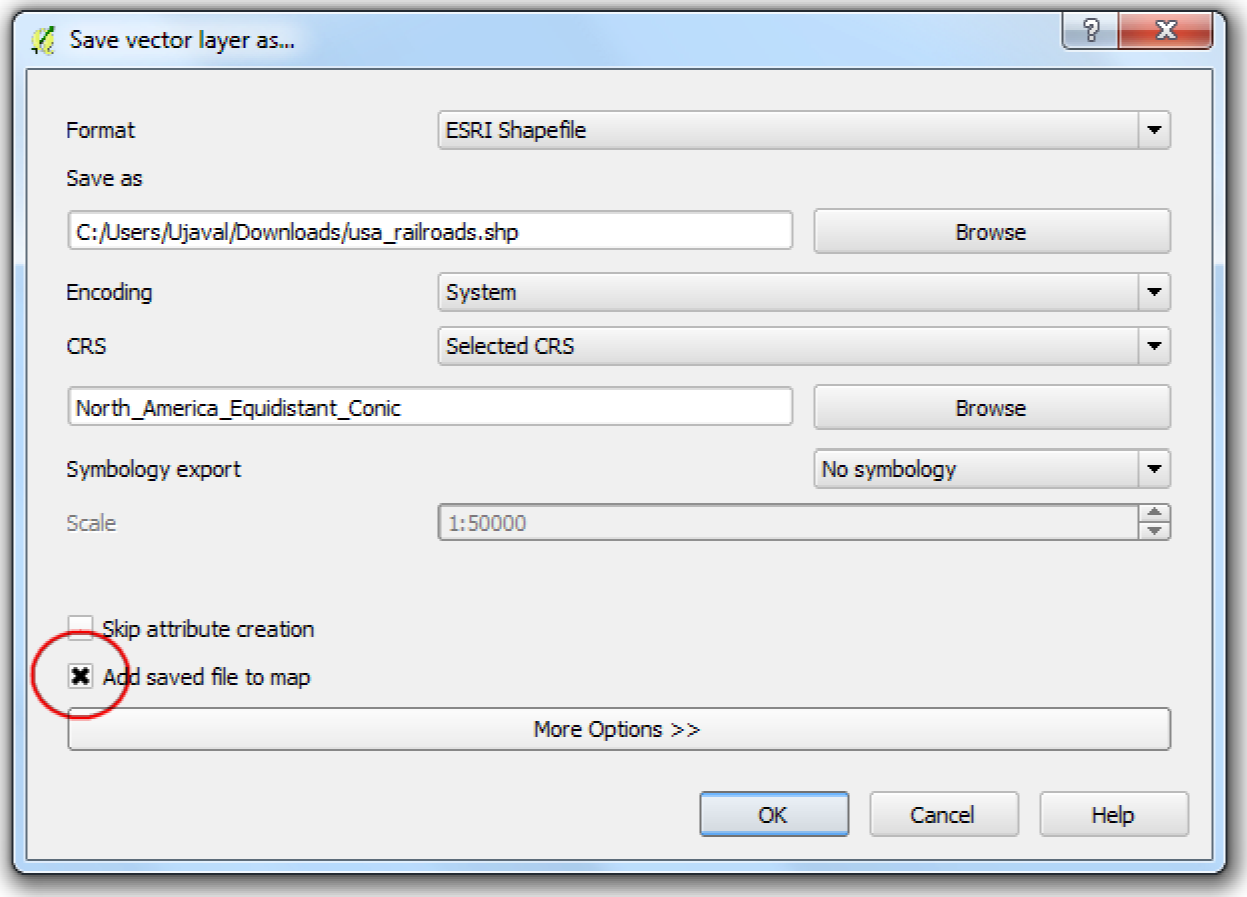
Coordinate reference systems of the world

Coordinate Reference System	Authority ID
Albers Equal Area	
North_America_Albers_Equal_Area_Conic	EPSG:102008
Equidistant Conic	
North_America_Equidistant_Conic	EPSG:102010

Selected CRS: North_America_Equidistant_Conic

```
+proj=eqdc +lat_0=40 +lon_0=-96 +lat_1=20 +lat_2=60 +x_0=0 +y_0=0 +datum=NAD83 +units=m
+no_defs
```

12. 回到剛才的 儲存向量圖層為 ... 視窗，勾選 加入儲存檔案至地圖中 ` （譯註：如果有 :guilabel: ` 儲存僅選取的圖徵，也應一併勾選），最後按下 確定。


Save vector layer as...
Browse
Browse
More Options >>
OK
Cancel
Help

Format: ESRI Shapefile

Save as: C:/Users/Ujaval/Downloads/usa_railroads.shp

Encoding: System

CRS: Selected CRS

North_America_Equidistant_Conic

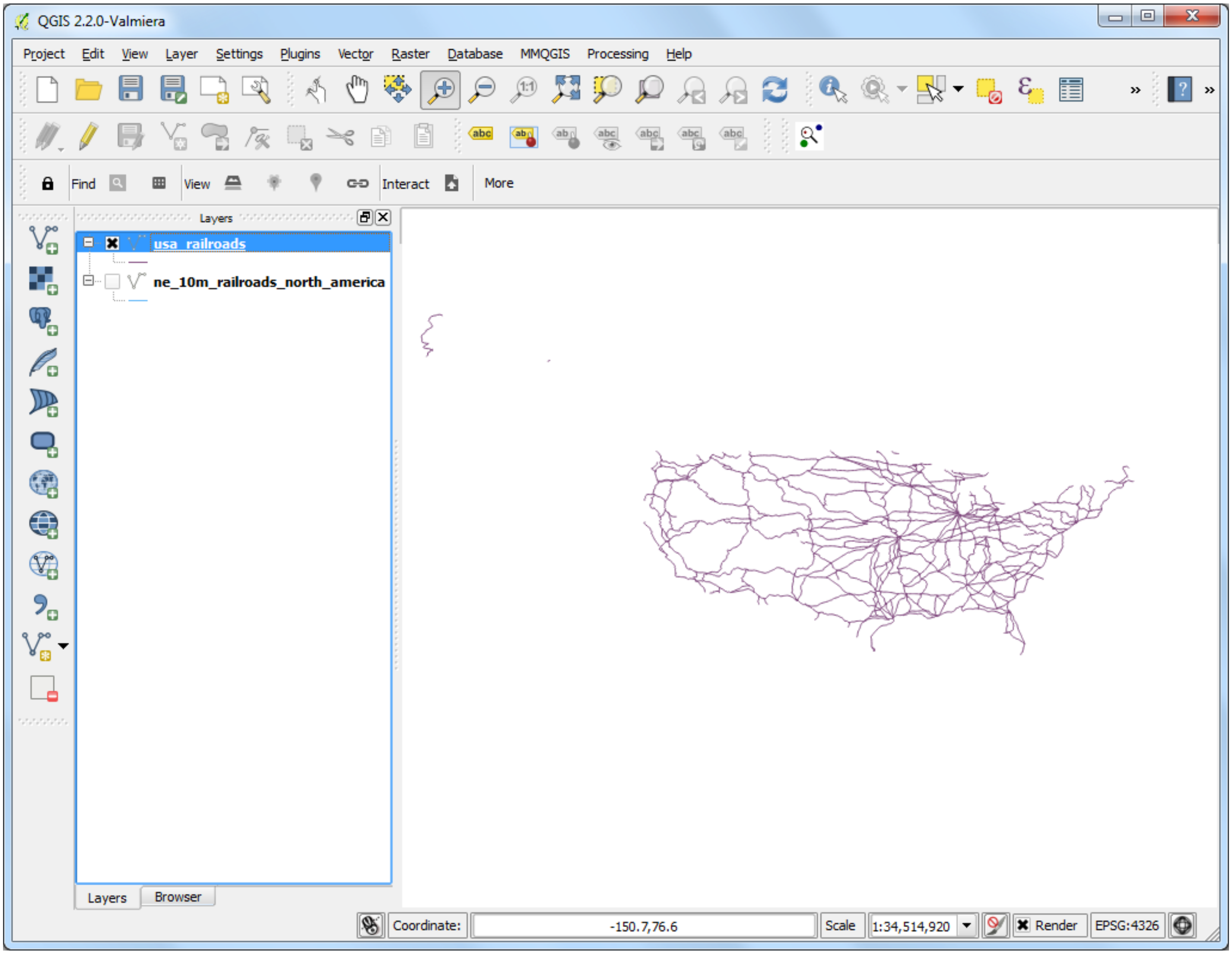
Symbology export: No symbology

Scale: 1:50000

☐ Skip attribute creation

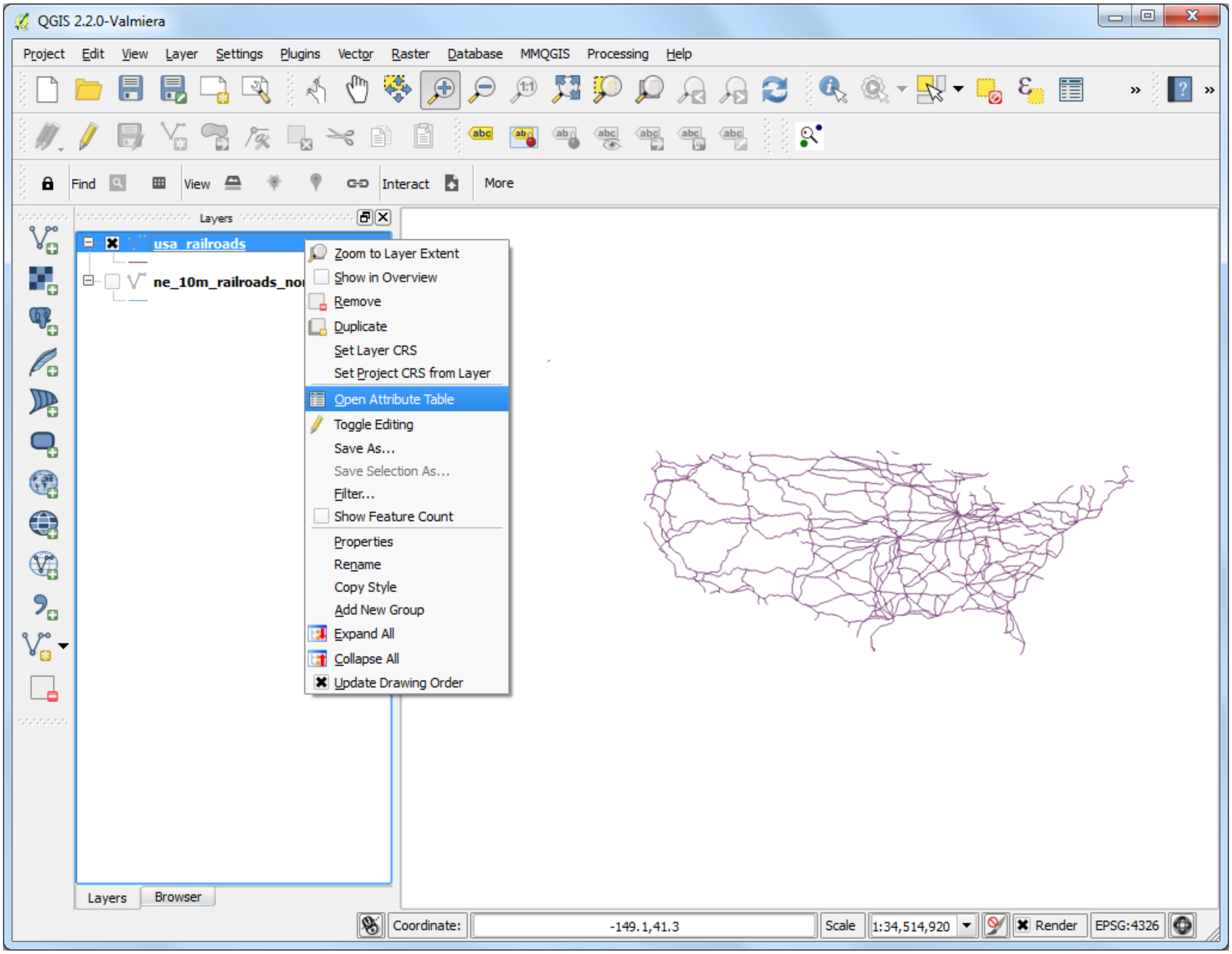
☒ Add saved file to map

13. 操作完成後，QGIS 中會出現叫做 ***usa_railroads*** 的新圖層。現在已經用不到舊圖層，可以取消 ***ne_10m_railroads_north_america*** 的勾選，把它隱藏起來了。

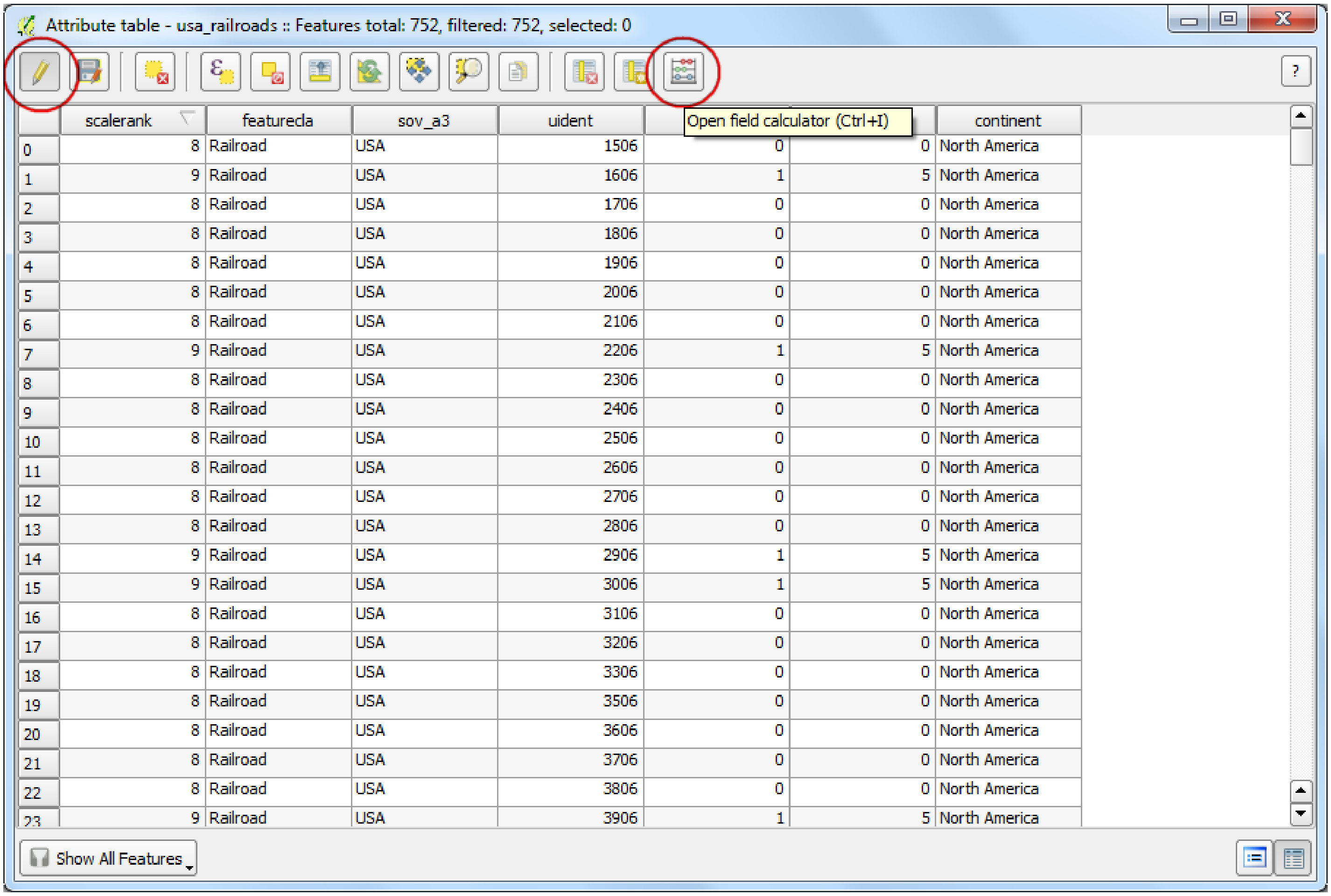

QGIS 2.2.0-Valmiera
Project
Edit
View
Layer
Settings
Plugins
Vector
Raster
Database
MMQGIS
Processing
Help
Find
View
Interact
More
Layers
usa_railroads
ne_10m_railroads_north_america
Layers
Browser
Render

Coordinate: -150.7,76.6
Scale 1:34,514,920
EPSG:4326

14. 在 ***usa_railroads*** 圖層上按右鍵，選擇 開啟屬性表格，

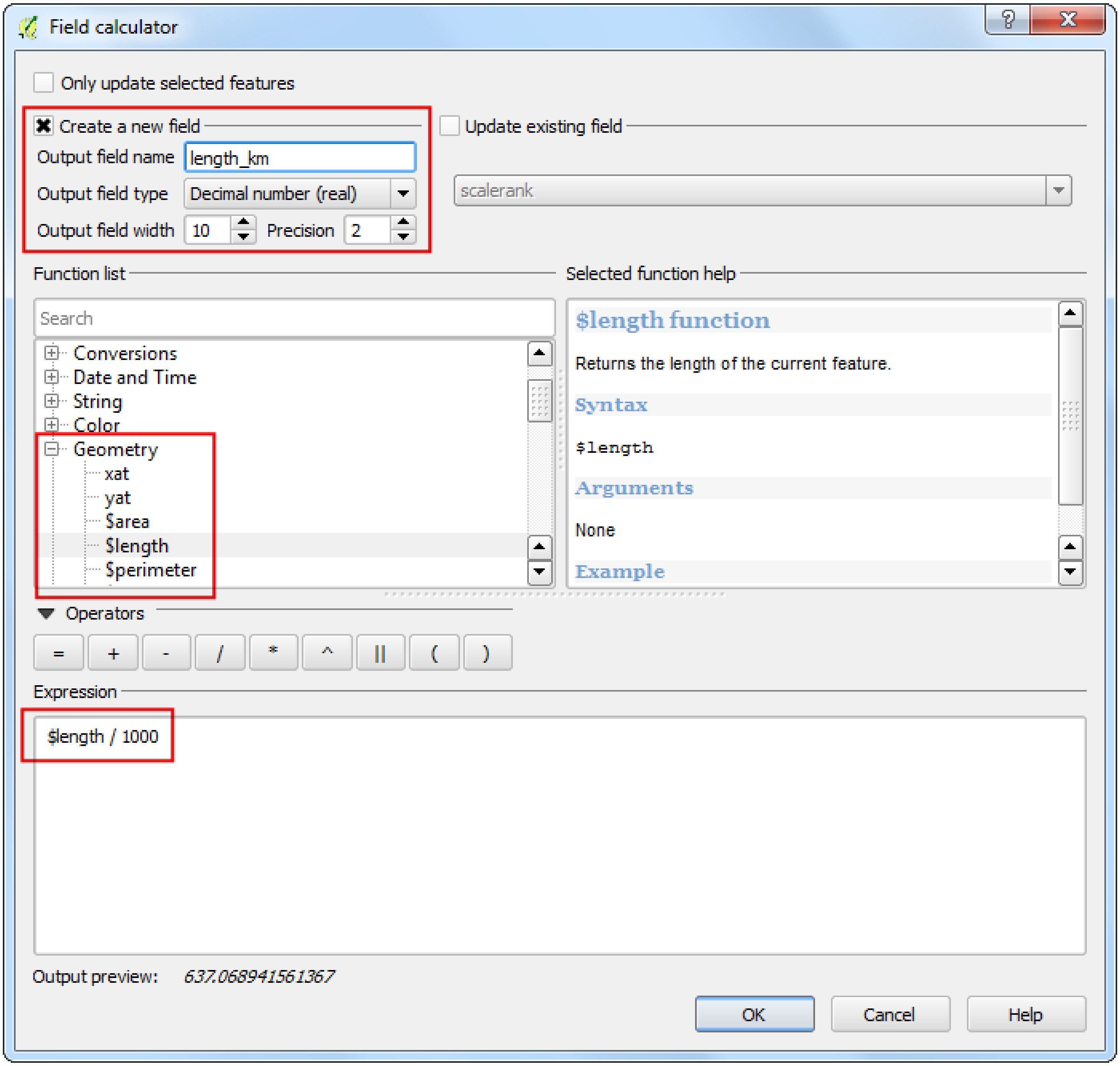

QGIS 2.2.0-Valmiera
Project Edit View Layer Settings Plugins Vector Raster Database MMQGIS Processing Help
Find View Interact More
Layers
usa_railroads
ne_10m_railroads_no
Zoom to Layer Extent
Show in Overview
Remove
Duplicate
Set Layer CRS
Set Project CRS from Layer
Open Attribute Table
Toggle Editing
Save As...
Save Selection As...
Filter...
Show Feature Count
Properties
Rename
Copy Style
Add New Group
Expand All
Collapse All
Update Drawing Order
Layers
Browser
Coordinate:
-149.1,41.3
Scale
1:34,514,920
Render
EPSG:4326

15. 接下來就來為所有圖徵新增一個長度的屬性看看。按下 切換編輯模式 鈕以進入編輯模式，在此模式中，按下 開啟欄位計算鈕。


Attribute table - usa_railroads :: Features total: 752, filtered: 752, selected: 0
Open field calculator (Ctrl+I)
?
Show All Features

	scalerank	featurecla	sov_a3	uident			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

16. 在 欄位計算器 中，先勾選 建立新欄位，在 輸出欄位名稱 中輸入 length_km，在 輸出欄位類別 中選擇 十進位數(實數)，精確度 調到 2，然後在底下的 函數列表 框中，找出位於 幾何欄位 分類中的 $length，並且點兩下以加入 表達式 區塊。因為我們想要以 ** 公里 ** 為單位但圖層的 CRS 使用 ** 公尺 ** 為單位，所以這裡公式要改成：***$length / 1000***。最後按下 確定。


Field calculator
Function list
Search
Conversions
Date and Time
String
Color
Geometry
xat
yat
$area
$length
$perimeter
Operators
=
+
-
/
*
^
||
(
)
OK
Cancel
Help

☐ Only update selected features

☒ Create a new field

Output field name: length_km

Output field type: Decimal number (real)

Output field width: 10 Precision: 2

☐ Update existing field

scalerank

Selected function help

$length function

Returns the length of the current feature.

Syntax

`$length`

Arguments

None

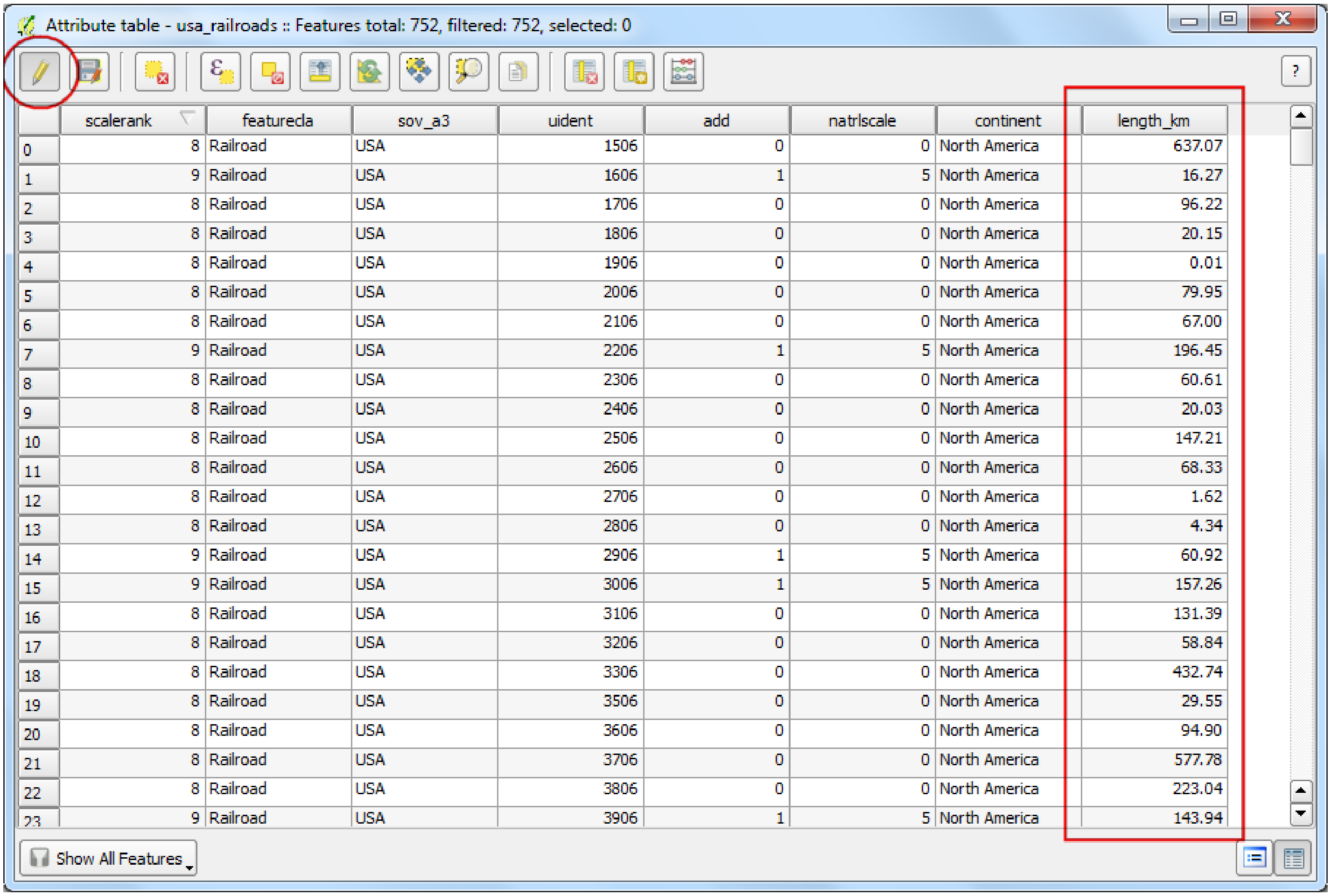
Example

Expression

`$length / 1000`

Output preview: *637.068941561367*

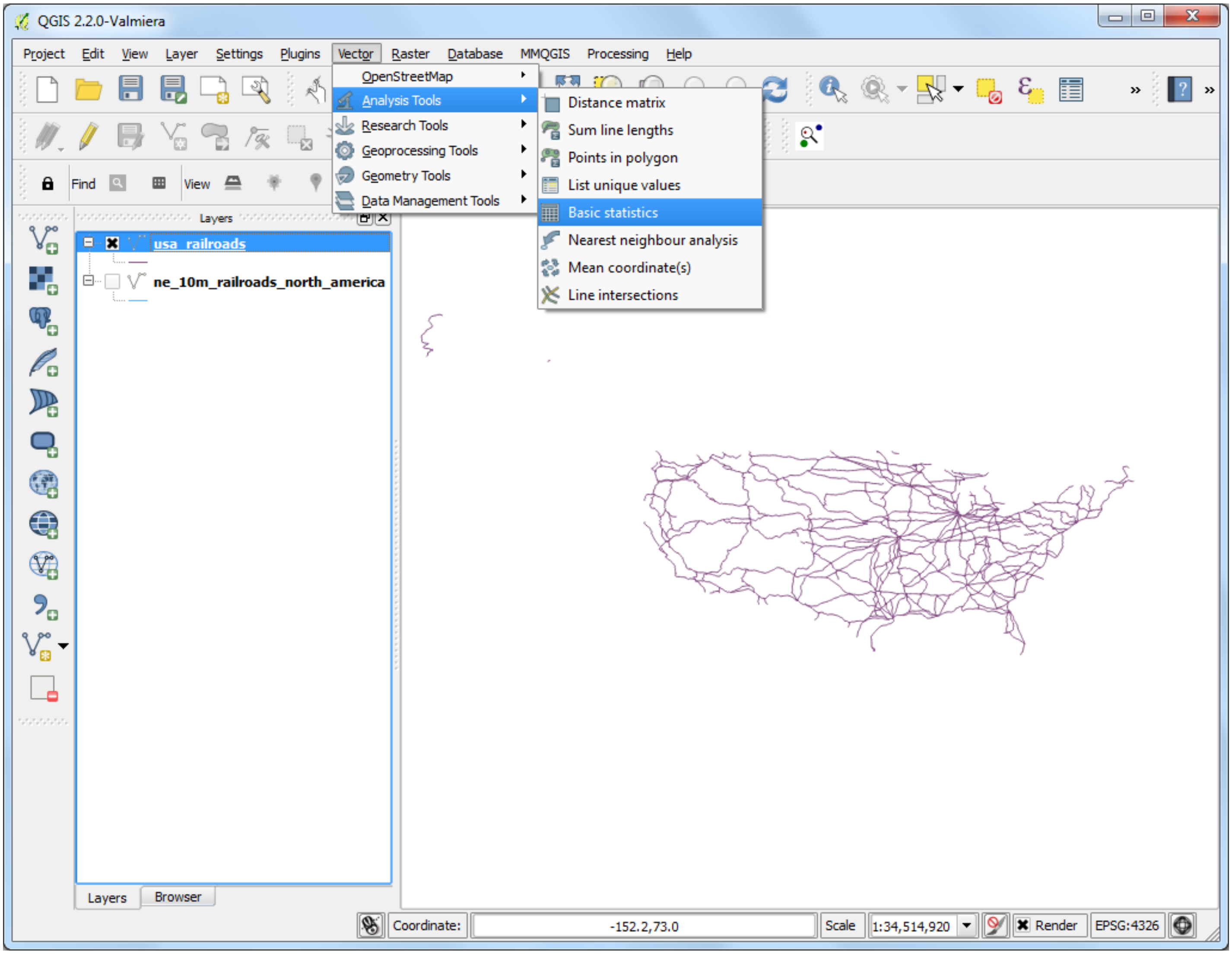
17. 回到 屬性表格，新的 length_km 屬性就會出現。再次按下 切換編輯模式 以儲存剛才所做的修改。



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

	scalerank	featurecla	sov_a3	uident	add	natrlscale	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

18. 現在每個線段都有自己個長度了，我們只需簡單的加總，就能知道全線段 ** 總長 **。選擇 向量 ‣ 分析工具 ‣ 基本統計，


QGIS 2.2.0-Valmiera
Project
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Help
OpenStreetMap
Analysis Tools
Research Tools
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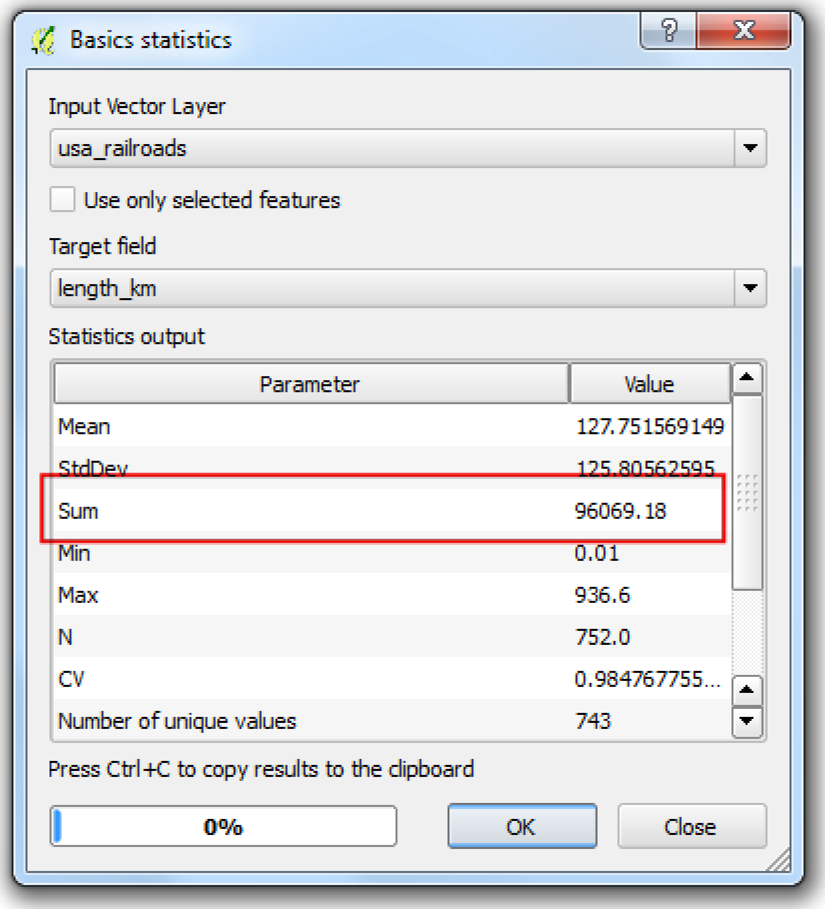
Geometry Tools
Data Management Tools
Distance matrix
Sum line lengths
Points in polygon
List unique values
Basic statistics
Nearest neighbour analysis
Mean coordinate(s)
Line intersections
Find
View
Layers
usa_railroads
ne_10m_railroads_north_america
Layers
Browser
Coordinate:
-152.2,73.0
Scale
1:34,514,920
Render
EPSG:4326

19. 然後在 輸入向量圖層 中選擇 ***usa_railroads***，在 目標欄位 中選擇 length_km。按下 確定 ` 後，就可以看到許多的統計資訊出現，其中的 :guilabel:` 總和 數值就是我們這次要找的鐵道總長度。

不同。實務上，線段、道路等長度一般會在製作資料庫時一併測量，並作為圖徵的其中一個屬性。本教學介紹的方法可以當作真實線段長度的近似估計，使



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