



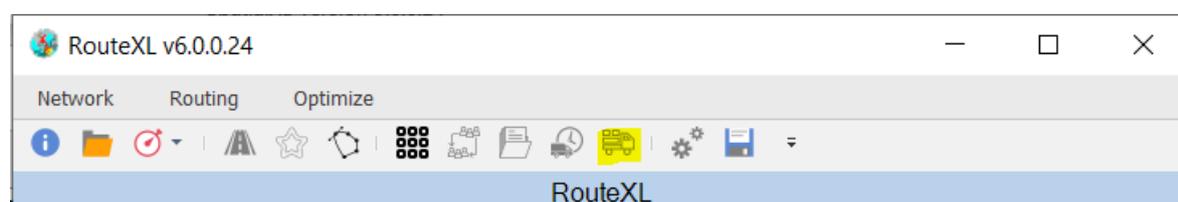
Quantitative Vehicle Routing

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Introduction

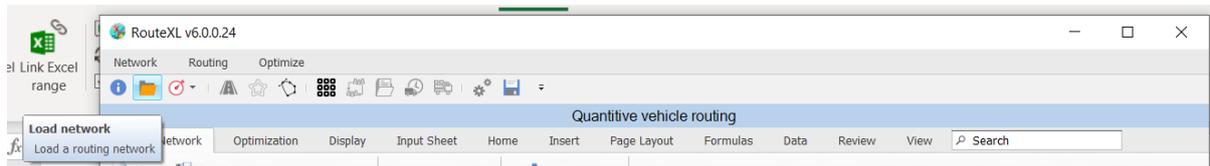
Quantitative Vehicle Routing is a feature in RouteXL where you can optimize vehicle delivery based on demands and capacities of vehicles.



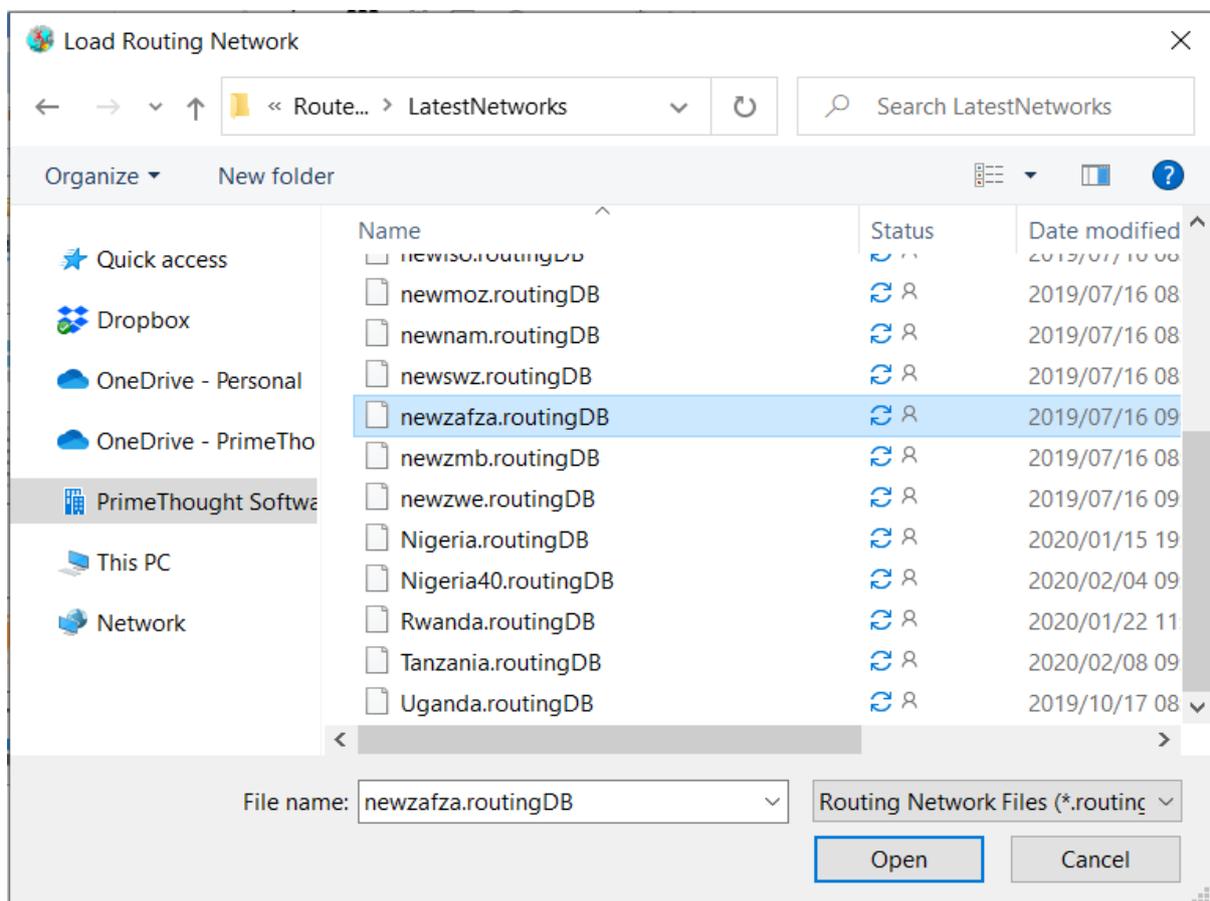
There is a sample Excel file available to download from our website that you can use and follow along with in the steps below: [QVR-Sample-Workbook.zip](#)

Loading The Road Network

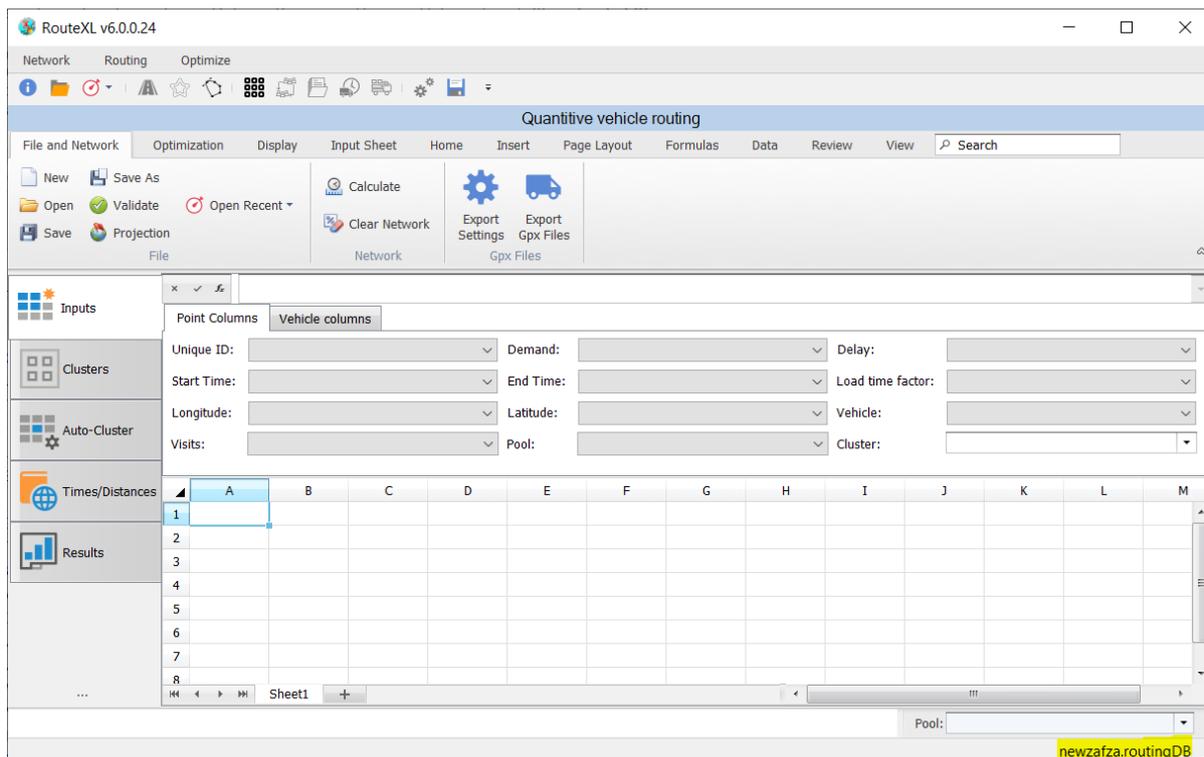
Load your Routing Network as the first step.



Browse to where your Routing Network is saved. In this example I'm loading the South African Routing Network.



You will see this loaded at the bottom right corner of your RouteXL window.



Setting Up Your Data

Point Columns

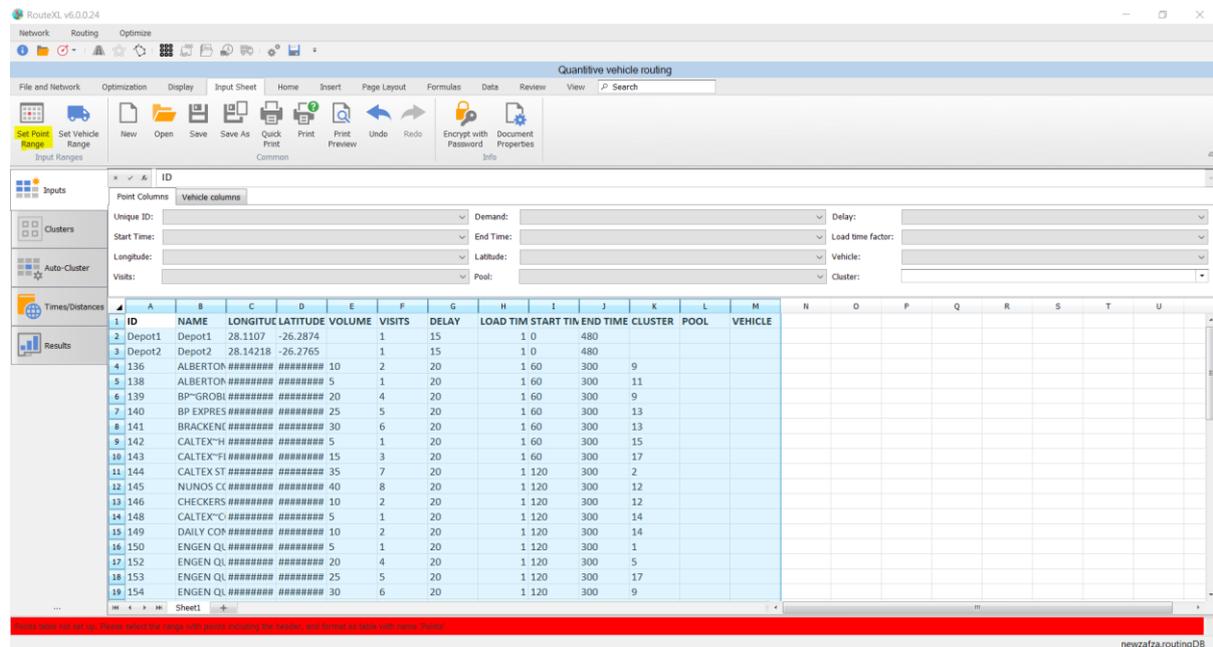
At this point you can copy and paste your point data (customer data) from a Microsoft Excel Sheet in the Point Columns sheet in QVR. (You can alternatively just create your sheet straight in QVR with changes if need be. It works just like Microsoft Excel.)

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	ID	NAME	LONGITUDE	LATITUDE	VOLUME	VISITS	DELAY	LOAD TIME FACTOR	START TIME	END TIME	CLUSTER	POOL	VEHICLE
2	Depot1	Depot1	28.11069522	-26.28741964		1	15		1 0	480			
3	Depot2	Depot2	28.14218193	-26.27654833		1	15		1 0	480			
4	136	ALBERTON HYPER LIQUOR	28.122200	-26.272800	10	2	20		1 60	300	9		
5	138	ALBERTON WHOLESALERS	28.122167	-26.270050	5	1	20		1 60	300	11		
6	139	BP**GROBLER SERVICE STATION	28.122770	-26.276130	20	4	20		1 60	300	9		
7	140	BP EXPRESS**RANDHART	28.194684	-26.337667	25	5	20		1 60	300	13		
8	141	BRACKENDOWNS LIQUOR STORE	28.194684	-26.337667	30	6	20		1 60	300	13		
9	142	CALTEX**HENNICO SERVICE STATION	28.124850	-26.260540	5	1	20		1 60	300	15		
10	143	CALTEX**FLORENTIA MOTORS	28.135400	-26.263000	15	3	20		1 60	300	17		
11	144	CALTEX STARMART**STAR SERVICES	28.112600	-26.340280	35	7	20		1 120	300	2		
12	145	NUNOS CONVENIENCE STORE	28.115820	-26.264900	40	8	20		1 120	300	12		
13	146	CHECKERS**ALBERTON CITY	28.112800	-26.254500	10	2	20		1 120	300	12		
14	148	CALTEX**COYS SERVICE STATION	28.126640	-26.263104	5	1	20		1 120	300	14		
15	149	DAILY CONVENIENCE STORE	28.127100	-26.261400	10	2	20		1 120	300	14		
16	150	ENGEN QUICK SHOP**BRACKENTEN MOTORS	28.086900	-26.321800	5	1	20		1 120	300	1		
17	152	ENGEN QUICK SHOP**JACQUELINE SERVICE STATION	28.115767	-26.296617	20	4	20		1 120	300	5		
18	153	ENGEN QUICK SHOP**KRITZINGER SERVICE STATION	28.147534	-26.264817	25	5	20		1 120	300	17		
19	154	ENGEN QUICK SHOP**NEW MARKET SERVICE STATION	28.122300	-26.272000	30	6	20		1 120	300	9		
20	155	ENGEN QUICK SHOP**NEW REDRUTH	28.127140	-26.272440	35	7	20		1 120	300	14		
21	156	ENGEN QUICK SHOP**VERWOERDPARK SERVICE STATION	28.144480	-26.273980	40	8	20		1 60	360	13		
22	157	ENGEN QUICK SHOP**VILLAGE MOTORS	28.106320	-26.309980	50	10	20		1 60	360	3		
23	158	SASOL DELIGHT**MEYERSDAL	28.091434	-26.289217	20	4	20		1 60	360	7		
24	159	FRIENDLY SUPERMARKET**RETSOS	28.117450	-26.296867	15	3	20		1 60	360	5		
25	160	HELENS CAFÉ	28.122300	-26.272800	45	9	20		1 60	360	9		
26	161	HOT SPOT LIQUOR	28.128100	-26.259200	10	2	20		1 60	360	15		
27	163	KWIKSPAR**MAYBERRY PARK	28.121930	-26.319390	20	4	20		1 180	360	2		
28	164	LIQUOR CITY BRACKENDOWNS	28.095660	-26.339550	35	7	20		1 180	360	1		

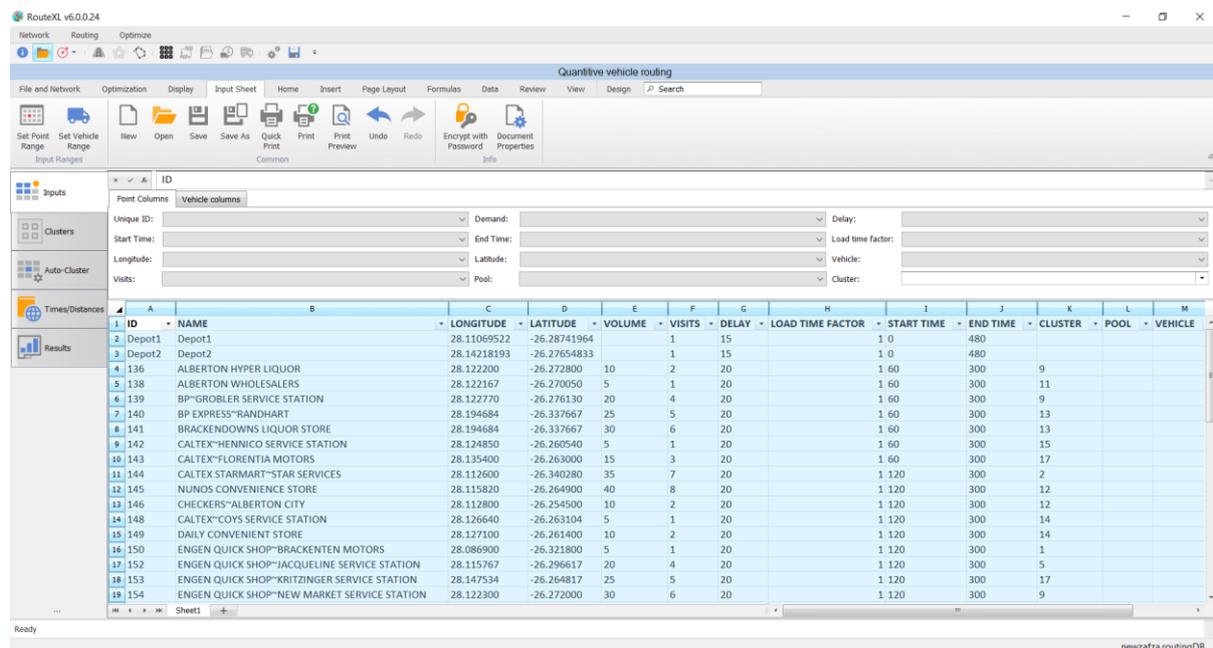
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(Ensure you have included your Depot/Warehouse etc in this sheet as well, see example above of Depot1 and Depot2.)

Before you do anything else you will need to Set Point Range, so it is identified in QVR. (You are usually prompted to do this anyway by viewing the red bar at the bottom of the window.)



Click Set Point Range.



Your Point Range is now set per the above screenshot.

You can also rename your Sheet1 if need be, by double clicking on it. I renamed my Sheet1 as Points to make it clearer for me.

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ID	NAME	LONGITUDE	LATITUDE	VOLUME	VISITS	DELAY	LOAD TIME FACTOR	START TIME	END TIME	CLUSTER	POOL	VEHICLE
2	Depot1	28.11069522	-26.28741964		1	15		1 0	480			
3	Depot2	28.14218193	-26.27654833		1	15		1 0	480			
4	136 ALBERTON HYPER LIQUOR	28.122200	-26.272800	10	2	20		1 60	300	9		
5	138 ALBERTON WHOLESALERS	28.122167	-26.270050	5	1	20		1 60	300	11		
6	139 BP*GROBLER SERVICE STATION	28.122770	-26.276130	20	4	20		1 60	300	9		
7	140 BP EXPRESS*RANDHART	28.194684	-26.337667	25	5	20		1 60	300	13		
8	141 BRACKENDOWNS LIQUOR STORE	28.194684	-26.337667	30	6	20		1 60	300	13		
9	142 CALTEX*HENNICO SERVICE STATION	28.124850	-26.260540	5	1	20		1 60	300	15		
10	143 CALTEX*FLORENTIA MOTORS	28.135400	-26.263000	15	3	20		1 60	300	17		
11	144 CALTEX STARMART*STAR SERVICES	28.112600	-26.340280	35	7	20		1 120	300	2		
12	145 NUNOS CONVENIENCE STORE	28.115820	-26.264900	40	8	20		1 120	300	12		
13	146 CHECKERS*ALBERTON CITY	28.112800	-26.254500	10	2	20		1 120	300	12		
14	148 CALTEX*COYS SERVICE STATION	28.126640	-26.263104	5	1	20		1 120	300	14		
15	149 DAILY CONVENIENT STORE	28.127100	-26.261400	10	2	20		1 120	300	14		
16	150 ENGEN QUICK SHOP*BRACKENTEN MOTORS	28.086900	-26.321800	5	1	20		1 120	300	1		
17	152 ENGEN QUICK SHOP*JACQUELINE SERVICE STATION	28.115767	-26.296617	20	4	20		1 120	300	5		
18	153 ENGEN QUICK SHOP*KRITZINGER SERVICE STATION	28.147534	-26.264817	25	5	20		1 120	300	17		
19	154 ENGEN QUICK SHOP*NEW MARKET SERVICE STATION	28.122300	-26.272000	30	6	20		1 120	300	9		

Now you will need to set up your Point Columns by clicking and selecting the appropriate field on the various dropdown arrows.

Point Columns Vehicle columns

Unique ID: Demand: Delay:

Start Time: End Time: Load time factor:

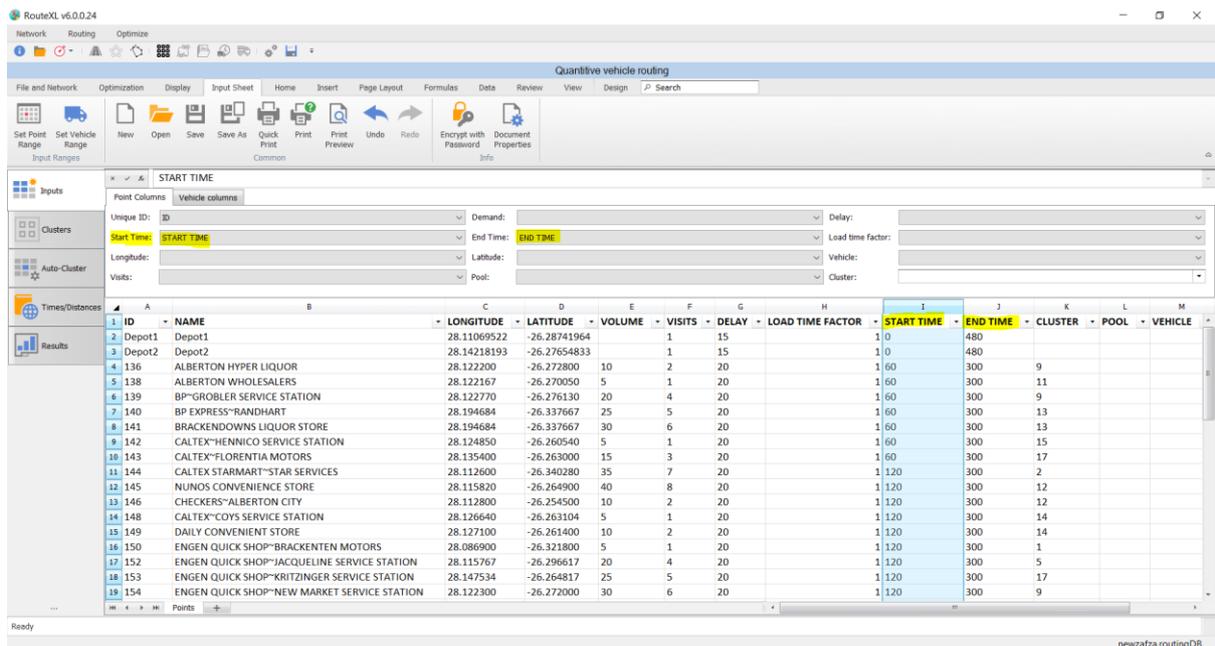
Longitude: Latitude: Vehicle:

Visits: Pool: Cluster:

ID	NAME	LONGITUDE	LATITUDE	VOLUME	VISITS	DELAY	LOAD TIME FACTOR	START TIME	END TIME	CLUSTER	POOL	VEHICLE
2	Depot1	28.11069522	-26.28741964		1	15		1 0	480			
3	Depot2	28.14218193	-26.27654833		1	15		1 0	480			
4	136 ALBERTON HYPER LIQUOR	28.122200	-26.272800	10	2	20		1 60	300	9		
5	138 ALBERTON WHOLESALERS	28.122167	-26.270050	5	1	20		1 60	300	11		
6	139 BP*GROBLER SERVICE STATION	28.122770	-26.276130	20	4	20		1 60	300	9		
7	140 BP EXPRESS*RANDHART	28.194684	-26.337667	25	5	20		1 60	300	13		
8	141 BRACKENDOWNS LIQUOR STORE	28.194684	-26.337667	30	6	20		1 60	300	13		
9	142 CALTEX*HENNICO SERVICE STATION	28.124850	-26.260540	5	1	20		1 60	300	15		
10	143 CALTEX*FLORENTIA MOTORS	28.135400	-26.263000	15	3	20		1 60	300	17		
11	144 CALTEX STARMART*STAR SERVICES	28.112600	-26.340280	35	7	20		1 120	300	2		
12	145 NUNOS CONVENIENCE STORE	28.115820	-26.264900	40	8	20		1 120	300	12		
13	146 CHECKERS*ALBERTON CITY	28.112800	-26.254500	10	2	20		1 120	300	12		
14	148 CALTEX*COYS SERVICE STATION	28.126640	-26.263104	5	1	20		1 120	300	14		
15	149 DAILY CONVENIENT STORE	28.127100	-26.261400	10	2	20		1 120	300	14		
16	150 ENGEN QUICK SHOP*BRACKENTEN MOTORS	28.086900	-26.321800	5	1	20		1 120	300	1		
17	152 ENGEN QUICK SHOP*JACQUELINE SERVICE STATION	28.115767	-26.296617	20	4	20		1 120	300	5		
18	153 ENGEN QUICK SHOP*KRITZINGER SERVICE STATION	28.147534	-26.264817	25	5	20		1 120	300	17		
19	154 ENGEN QUICK SHOP*NEW MARKET SERVICE STATION	28.122300	-26.272000	30	6	20		1 120	300	9		

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(The data in the ID column must have unique values otherwise you will get an error message. You can just change the cell to a unique value right then and there if that is the case.)



If you want to set various operating hours for your depots and customers, you will do this by having START TIME and END TIME columns and selecting these in the dropdown arrows as above.

(The way this works is in minutes. Let's assume 0 is your START TIME at your depots and 480 is the END TIME. This would mean your depots operate from 8am (You can assume 0 as any START TIME but I assumed it as 8am in this example) until 480 minutes later which is 4pm. This is the END TIME.

The customers in the example above work on the same principle. You will see some customers operate from 60 as the START TIME which is 60 minutes from 0. By assuming 8am is the START TIME, this would mean 60 minutes from it is 9am. And these customers would close at 300 minutes which would mean 1pm. That is the END TIME.)

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ID	NAME	LONGITUDE	LATITUDE	VOLUME	VISITS	DELAY	LOAD TIME FACTOR	START TIME	END TIME	CLUSTER	POOL	VEHICLE
1	Depot1	28.11069522	-26.28741964	1	15	1	1.0	480				
2	Depot2	28.14218193	-26.27654833	1	15	1	1.0	480				
4	136 ALBERTON HYPER LIQUOR	28.122200	-26.272800	10	2	20	1.60	300	9			
5	138 ALBERTON WHOLESALERS	28.122167	-26.270050	5	1	20	1.60	300	11			
6	139 BP GROBLER SERVICE STATION	28.122770	-26.276130	20	4	20	1.60	300	9			
7	140 BP EXPRESS RANDHART	28.194684	-26.337667	25	5	20	1.60	300	13			
8	141 BRACKENDOWNS LIQUOR STORE	28.194684	-26.337667	30	6	20	1.60	300	13			
9	142 CALTEX HENNICO SERVICE STATION	28.124850	-26.260540	5	1	20	1.60	300	15			
10	143 CALTEX FLORENTIA MOTORS	28.135400	-26.263000	15	3	20	1.60	300	17			
11	144 CALTEX STARMART STAR SERVICES	28.112600	-26.340280	35	7	20	1.120	300	2			
12	145 NUNOS CONVENIENCE STORE	28.115820	-26.264900	40	8	20	1.120	300	12			
13	146 CHECKERS ALBERTON CITY	28.112800	-26.254500	10	2	20	1.120	300	12			
14	148 CALTEX COYS SERVICE STATION	28.126640	-26.263104	5	1	20	1.120	300	14			
15	149 DAILY CONVENIENCE STORE	28.127100	-26.261400	10	2	20	1.120	300	14			
16	150 ENGEN QUICK SHOP BRACKENTEN MOTORS	28.086900	-26.321800	5	1	20	1.120	300	1			
17	152 ENGEN QUICK SHOP JACQUELINE SERVICE STATION	28.115767	-26.296617	20	4	20	1.120	300	5			
18	153 ENGEN QUICK SHOP KRITZINGER SERVICE STATION	28.147534	-26.264817	25	5	20	1.120	300	17			
19	154 ENGEN QUICK SHOP NEW MARKET SERVICE STATION	28.122300	-26.272000	30	6	20	1.120	300	9			

Set your LONGITUDE and LATITUDE per above.

ID	NAME	LONGITUDE	LATITUDE	VOLUME	VISITS	DELAY	LOAD TIME FACTOR	START TIME	END TIME	CLUSTER	POOL	VEHICLE
1	Depot1	28.11069522	-26.28741964	1	15	1	1.0	480				
2	Depot2	28.14218193	-26.27654833	1	15	1	1.0	480				
4	136 ALBERTON HYPER LIQUOR	28.122200	-26.272800	10	2	20	1.60	300	9			
5	138 ALBERTON WHOLESALERS	28.122167	-26.270050	5	1	20	1.60	300	11			
6	139 BP GROBLER SERVICE STATION	28.122770	-26.276130	20	4	20	1.60	300	9			
7	140 BP EXPRESS RANDHART	28.194684	-26.337667	25	5	20	1.60	300	13			
8	141 BRACKENDOWNS LIQUOR STORE	28.194684	-26.337667	30	6	20	1.60	300	13			
9	142 CALTEX HENNICO SERVICE STATION	28.124850	-26.260540	5	1	20	1.60	300	15			
10	143 CALTEX FLORENTIA MOTORS	28.135400	-26.263000	15	3	20	1.60	300	17			
11	144 CALTEX STARMART STAR SERVICES	28.112600	-26.340280	35	7	20	1.120	300	2			
12	145 NUNOS CONVENIENCE STORE	28.115820	-26.264900	40	8	20	1.120	300	12			
13	146 CHECKERS ALBERTON CITY	28.112800	-26.254500	10	2	20	1.120	300	12			
14	148 CALTEX COYS SERVICE STATION	28.126640	-26.263104	5	1	20	1.120	300	14			
15	149 DAILY CONVENIENCE STORE	28.127100	-26.261400	10	2	20	1.120	300	14			
16	150 ENGEN QUICK SHOP BRACKENTEN MOTORS	28.086900	-26.321800	5	1	20	1.120	300	1			
17	152 ENGEN QUICK SHOP JACQUELINE SERVICE STATION	28.115767	-26.296617	20	4	20	1.120	300	5			
18	153 ENGEN QUICK SHOP KRITZINGER SERVICE STATION	28.147534	-26.264817	25	5	20	1.120	300	17			
19	154 ENGEN QUICK SHOP NEW MARKET SERVICE STATION	28.122300	-26.272000	30	6	20	1.120	300	9			

If you have a 10-pallet truck for example and need to deliver 30 pallets to a customer, you wouldn't be able to do this in one visit. You would do this in 3 visits. That's where you can use a VISITS column and assign number of visits per screenshot above. (Note: As a default you always need to put a 1 by the Depots in your VISITS otherwise you won't get a solution.) This scenario we refer to as 'capacity-driven multi-visits'.

See the [Frequency-Driven Multi-Visits](#) section for information on how to precisely stagger your visits per a scheduled visit frequency.

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The screenshot shows the 'Quantitative vehicle routing' interface. In the 'Vehicle columns' tab, the 'Demand' dropdown is set to 'VOLUME'. The 'Results' table is displayed with the following columns: ID, NAME, LONGITUDE, LATITUDE, VOLUME, VISITS, DELAY, LOAD TIME FACTOR, START TIME, END TIME, CLUSTER, POOL, and VEHICLE. The 'VOLUME' column is highlighted in yellow.

ID	NAME	LONGITUDE	LATITUDE	VOLUME	VISITS	DELAY	LOAD TIME FACTOR	START TIME	END TIME	CLUSTER	POOL	VEHICLE
2	Depot1	28.11069522	-26.28741964		1	15		1 0	480			
3	Depot2	28.14218193	-26.27654833		1	15		1 0	480			
4	136 ALBERTON HYPER LIQUOR	28.122200	-26.272800	10	2	20	1 60	300	9			
5	138 ALBERTON WHOLESALERS	28.122167	-26.270050	5	1	20	1 60	300	11			
6	139 BP*GROBLER SERVICE STATION	28.122770	-26.276130	20	4	20	1 60	300	9			
7	140 BP EXPRESS*RANDHART	28.194684	-26.337667	25	5	20	1 60	300	13			
8	141 BRACKENDOWNS LIQUOR STORE	28.194684	-26.337667	30	6	20	1 60	300	13			
9	142 CALTEX*HENNICO SERVICE STATION	28.124850	-26.260540	5	1	20	1 60	300	15			
10	143 CALTEX*FLORENTIA MOTORS	28.135400	-26.263000	15	3	20	1 60	300	17			
11	144 CALTEX STARMART*STAR SERVICES	28.112600	-26.340280	35	7	20	1 120	300	2			
12	145 NUNOS CONVENIENCE STORE	28.115820	-26.264900	40	8	20	1 120	300	12			
13	146 CHECKERS*ALBERTON CITY	28.112800	-26.254500	10	2	20	1 120	300	12			
14	148 CALTEX*COYS SERVICE STATION	28.126640	-26.263104	5	1	20	1 120	300	14			
15	149 DAILY CONVENIENT STORE	28.127100	-26.261400	10	2	20	1 120	300	14			
16	150 ENGEN QUICK SHOP*BRACKENTEN MOTORS	28.086900	-26.321800	5	1	20	1 120	300	1			
17	152 ENGEN QUICK SHOP*JACQUELINE SERVICE STATION	28.115767	-26.296617	20	4	20	1 120	300	5			
18	153 ENGEN QUICK SHOP*KRITZINGER SERVICE STATION	28.147534	-26.264817	25	5	20	1 120	300	17			
19	154 ENGEN QUICK SHOP*MARKET SERVICE STATION	28.133300	-26.333000	30	6	30	1 120	300	6			

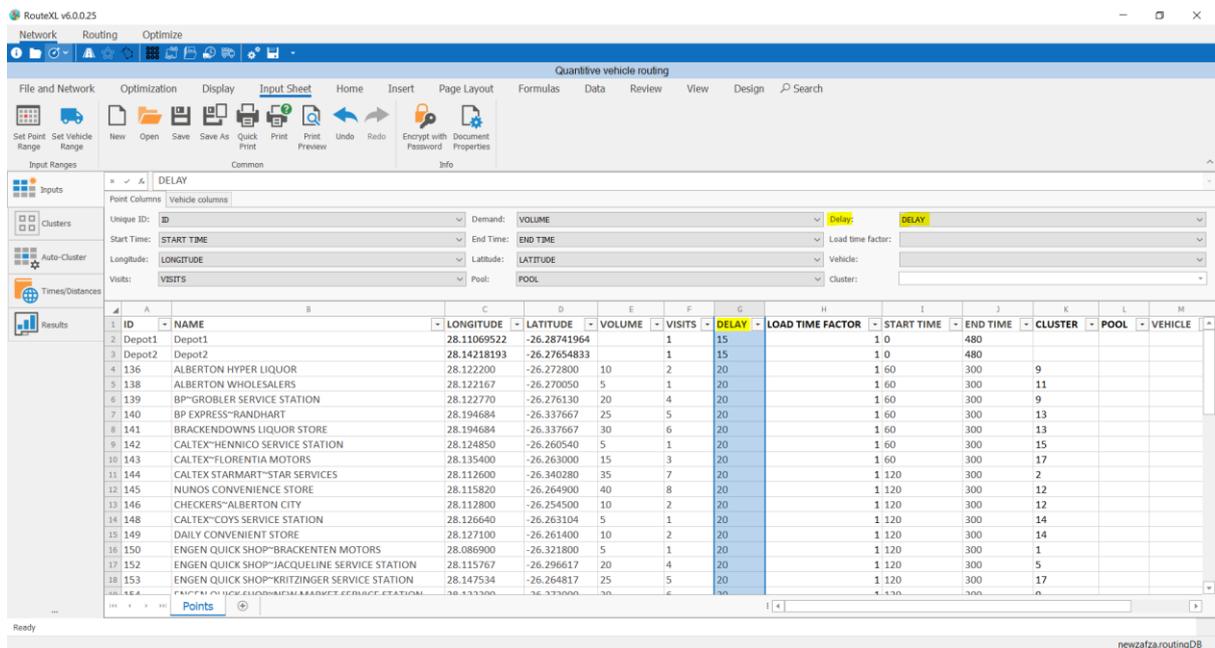
Set up your VOLUME column as above.

The screenshot shows the 'Quantitative vehicle routing' interface. In the 'Vehicle columns' tab, the 'Demand' dropdown is set to 'VOLUME' and the 'Pool' dropdown is set to 'POOL'. The 'Results' table is displayed with the same columns as the previous screenshot, but the 'POOL' column is highlighted in yellow.

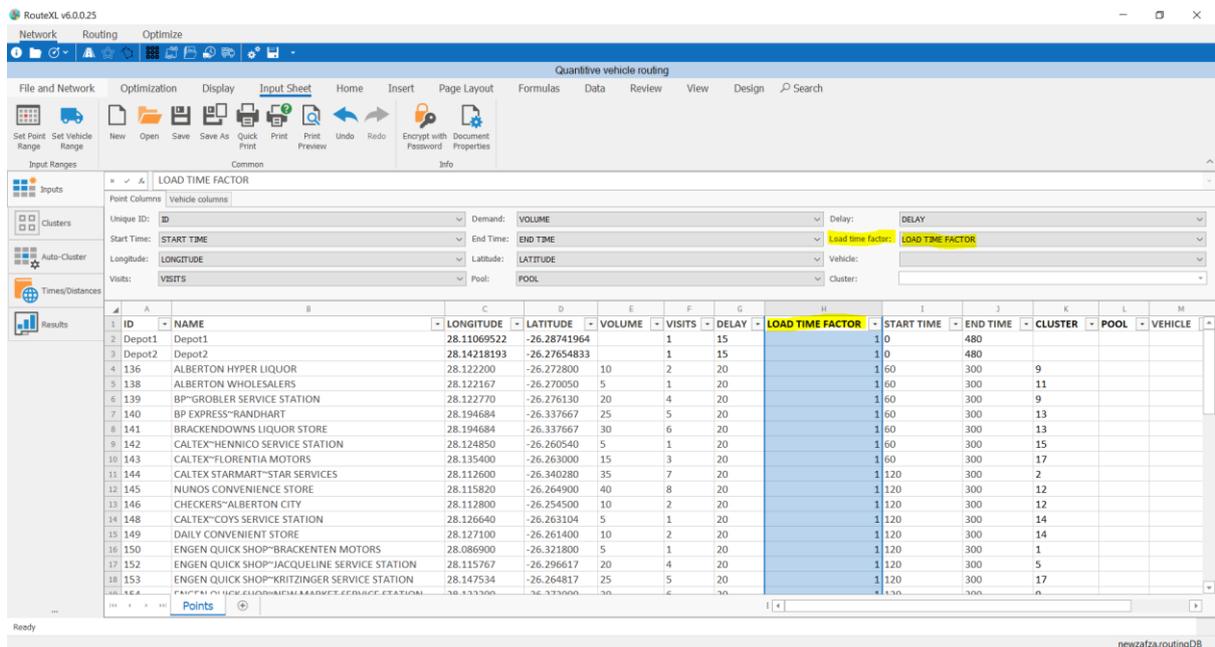
ID	NAME	LONGITUDE	LATITUDE	VOLUME	VISITS	DELAY	LOAD TIME FACTOR	START TIME	END TIME	CLUSTER	POOL	VEHICLE
2	Depot1	28.11069522	-26.28741964		1	15		1 0	480			
3	Depot2	28.14218193	-26.27654833		1	15		1 0	480			
4	136 ALBERTON HYPER LIQUOR	28.122200	-26.272800	10	2	20	1 60	300	9			
5	138 ALBERTON WHOLESALERS	28.122167	-26.270050	5	1	20	1 60	300	11			
6	139 BP*GROBLER SERVICE STATION	28.122770	-26.276130	20	4	20	1 60	300	9			
7	140 BP EXPRESS*RANDHART	28.194684	-26.337667	25	5	20	1 60	300	13			
8	141 BRACKENDOWNS LIQUOR STORE	28.194684	-26.337667	30	6	20	1 60	300	13			
9	142 CALTEX*HENNICO SERVICE STATION	28.124850	-26.260540	5	1	20	1 60	300	15			
10	143 CALTEX*FLORENTIA MOTORS	28.135400	-26.263000	15	3	20	1 60	300	17			
11	144 CALTEX STARMART*STAR SERVICES	28.112600	-26.340280	35	7	20	1 120	300	2			
12	145 NUNOS CONVENIENCE STORE	28.115820	-26.264900	40	8	20	1 120	300	12			
13	146 CHECKERS*ALBERTON CITY	28.112800	-26.254500	10	2	20	1 120	300	12			
14	148 CALTEX*COYS SERVICE STATION	28.126640	-26.263104	5	1	20	1 120	300	14			
15	149 DAILY CONVENIENT STORE	28.127100	-26.261400	10	2	20	1 120	300	14			
16	150 ENGEN QUICK SHOP*BRACKENTEN MOTORS	28.086900	-26.321800	5	1	20	1 120	300	1			
17	152 ENGEN QUICK SHOP*JACQUELINE SERVICE STATION	28.115767	-26.296617	20	4	20	1 120	300	5			
18	153 ENGEN QUICK SHOP*KRITZINGER SERVICE STATION	28.147534	-26.264817	25	5	20	1 120	300	17			
19	154 ENGEN QUICK SHOP*MARKET SERVICE STATION	28.133300	-26.333000	30	6	30	1 120	300	6			

Vehicle pools are set up in your Vehicle columns tab which will be described later. You can also set up a blank POOL column as above and when you get your results after a solution is run, the various pool/s will be populated here in your Points sheet.

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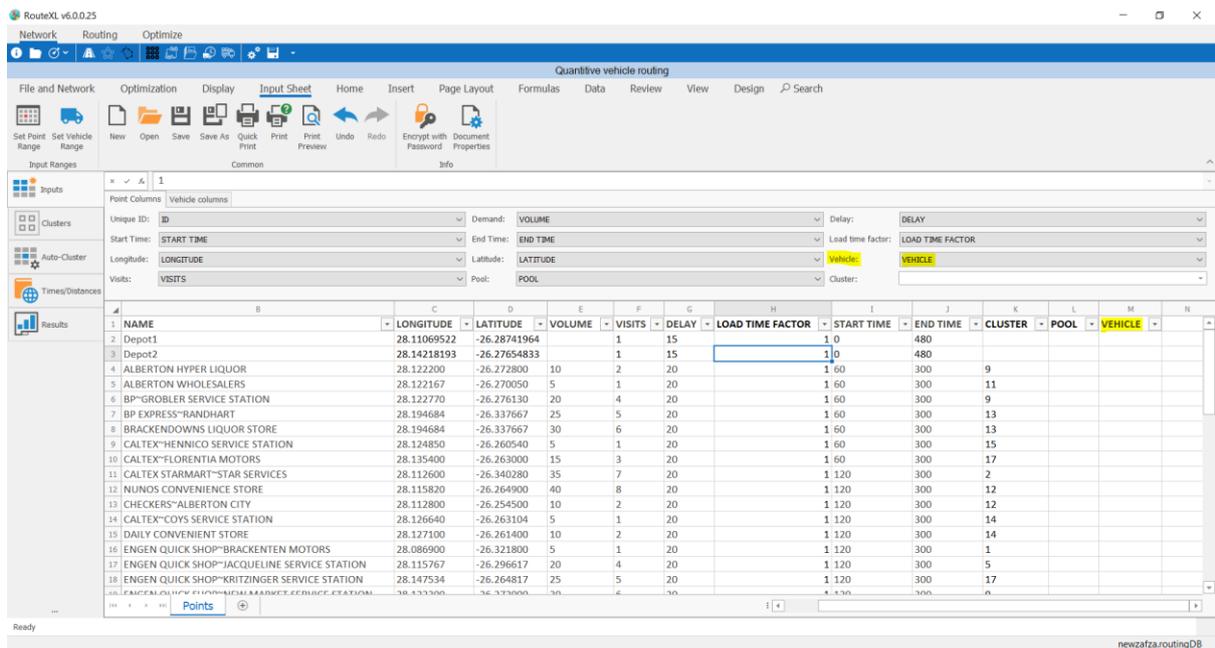


If there are any delays at your Depot/s and Customers because of loading/offloading etc you would set up your sheet as above. You can have various cells in this column blank if there aren't any delays at certain Customers or Depots.

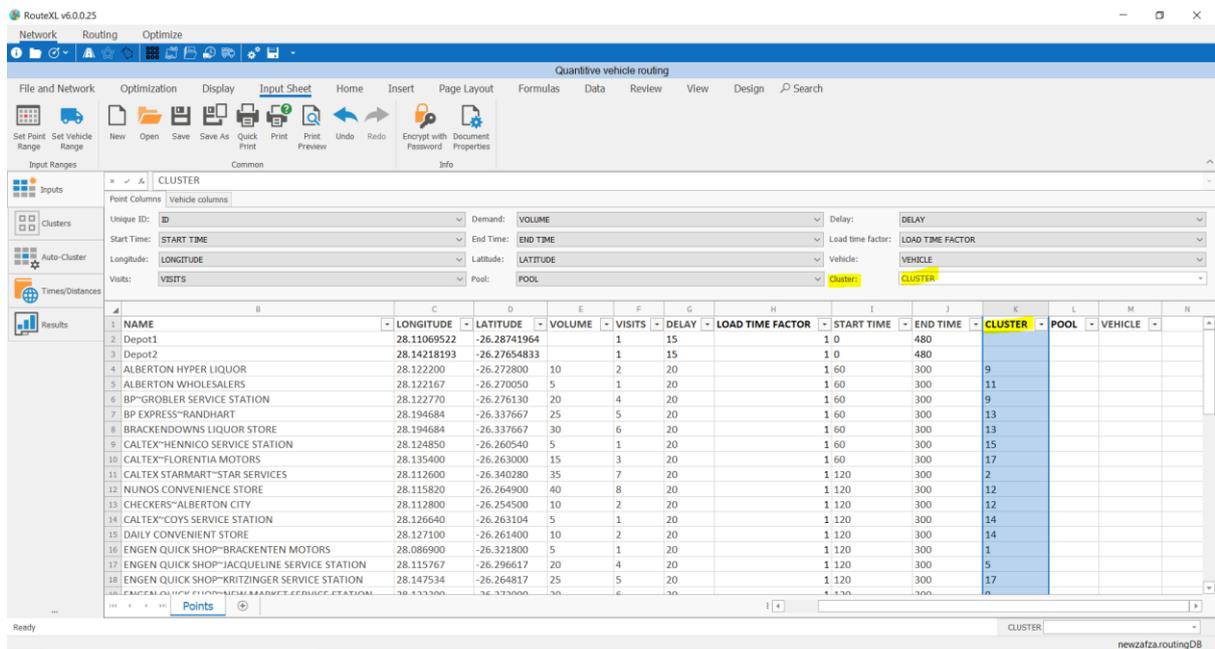


LOAD TIME FACTOR column can be used if there is a factor that needs to be changed for various customers/depots because of heavier loads etc. In the screenshot above I have set it at 1 which means no change. I can make the factor 2 which will double the load time.

QVR User Guide



Set up this blank column VEHICLE which will be populated with the vehicle used for each point after you run a solution and get results.



For an optimal solution you might want to cluster(group) your points so they can be visited by specific vehicle pools only. (Your vehicle pool can have one or more vehicles in it.)

In this case, you can cluster your points how you want to as I have above and set it up. (I used a SpatialXL tool to help me cluster my points before I copied and pasted my sheet in QVR.)

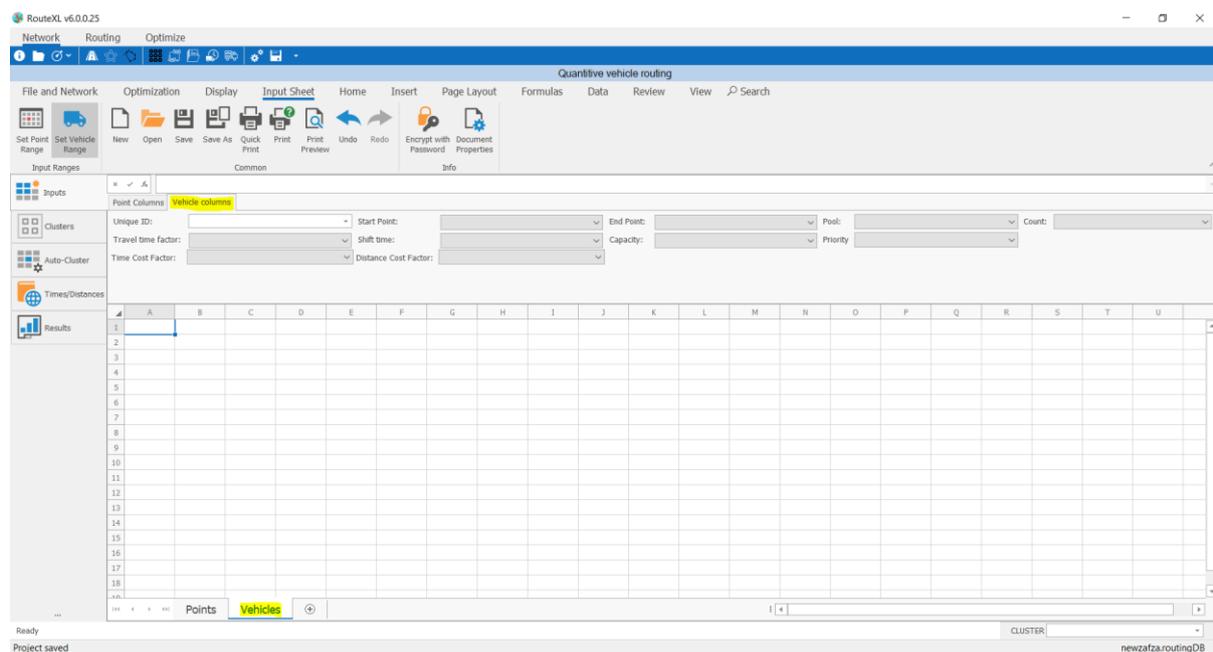
NOTE: You don't need to use or have all columns as I have set up above. It is just a demonstration of using each field. If you don't need to use a field for example VISITS, you just set it up as <None>.

Point Columns	Vehicle columns	
Unique ID:	ID	Demand:
Start Time:	START TIME	End Time:
Longitude:	LONGITUDE	Latitude:
Visits:	<None>	Pool:

Your Point Columns have been fully set up.

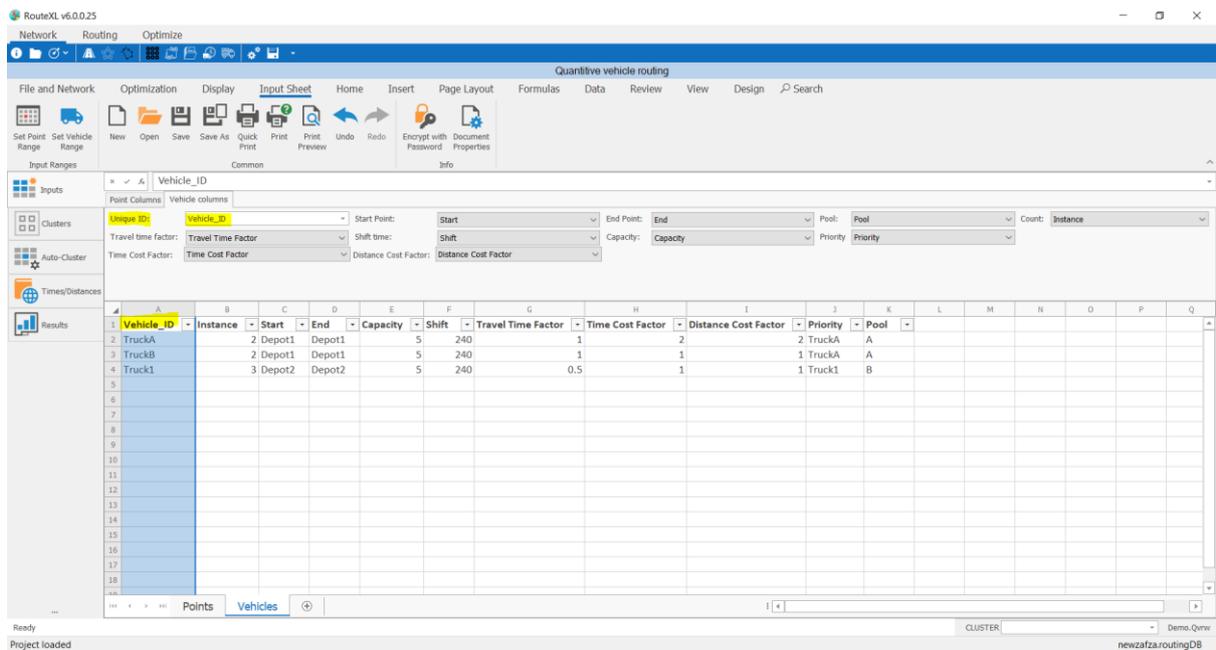
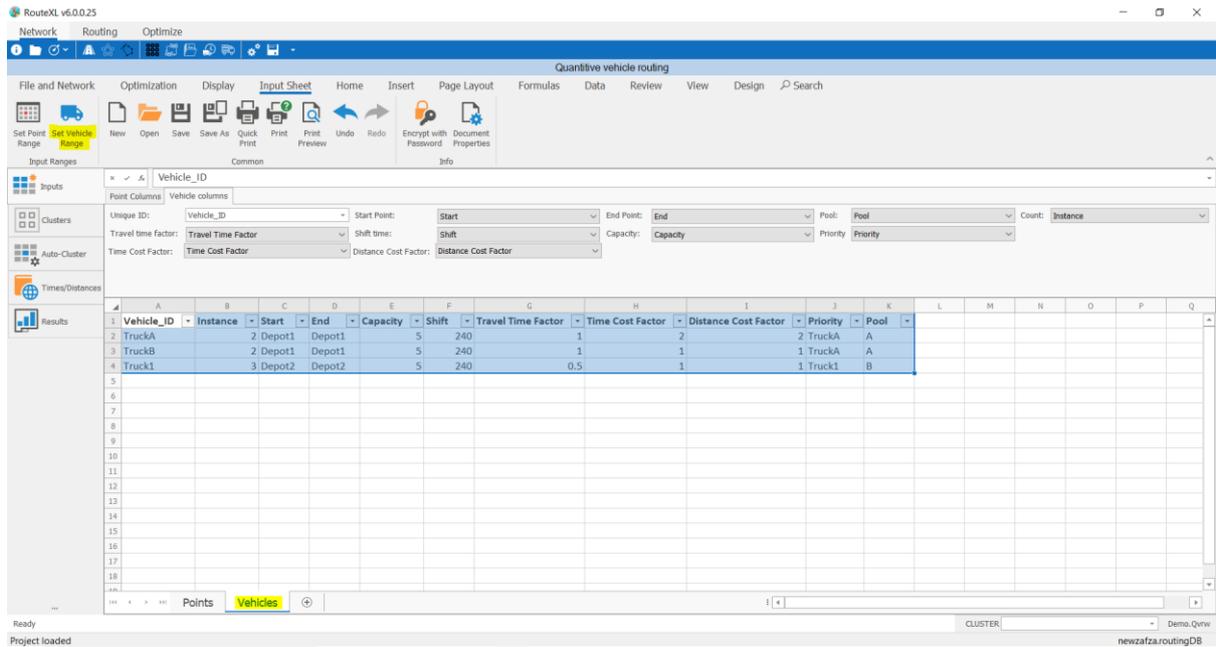
Vehicle Columns

Now we'll set up your Vehicle columns. I added a separate sheet called Vehicles to separate everything out. (You can have your Points and Vehicles on one sheet if you want. You just need to ensure you set your Point Range and Vehicle Range separately.)

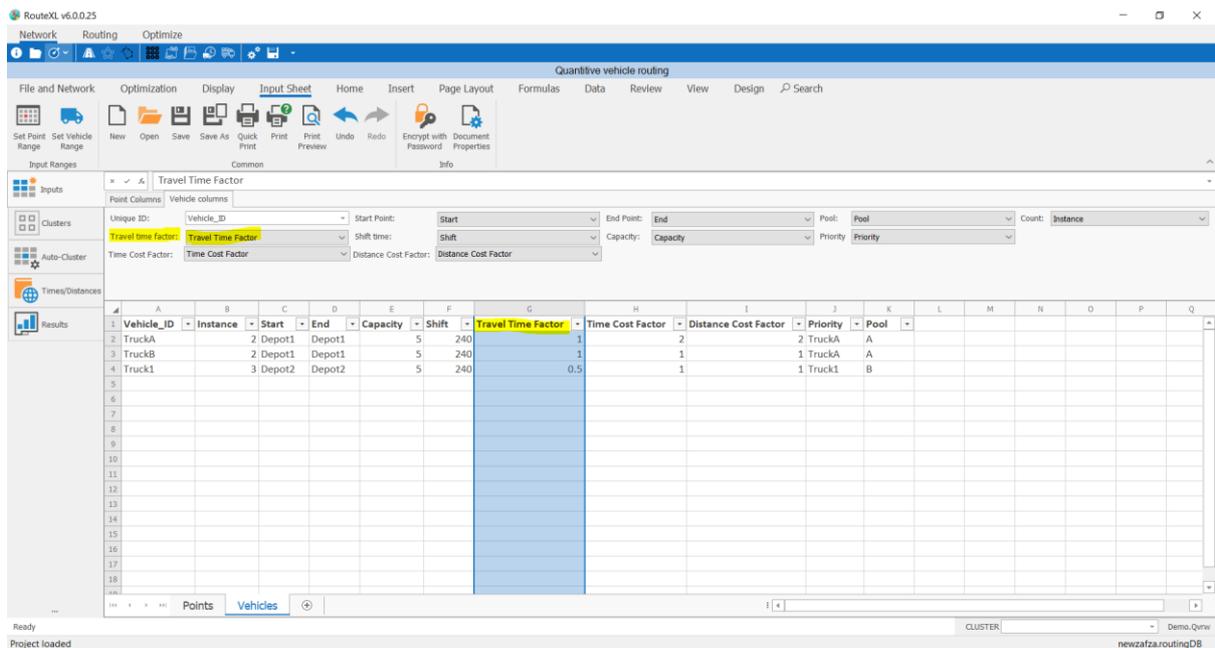


I have set up my vehicles here having specific fields which I'll be explaining. (Remember to Set Vehicle Range after inputting your data!)

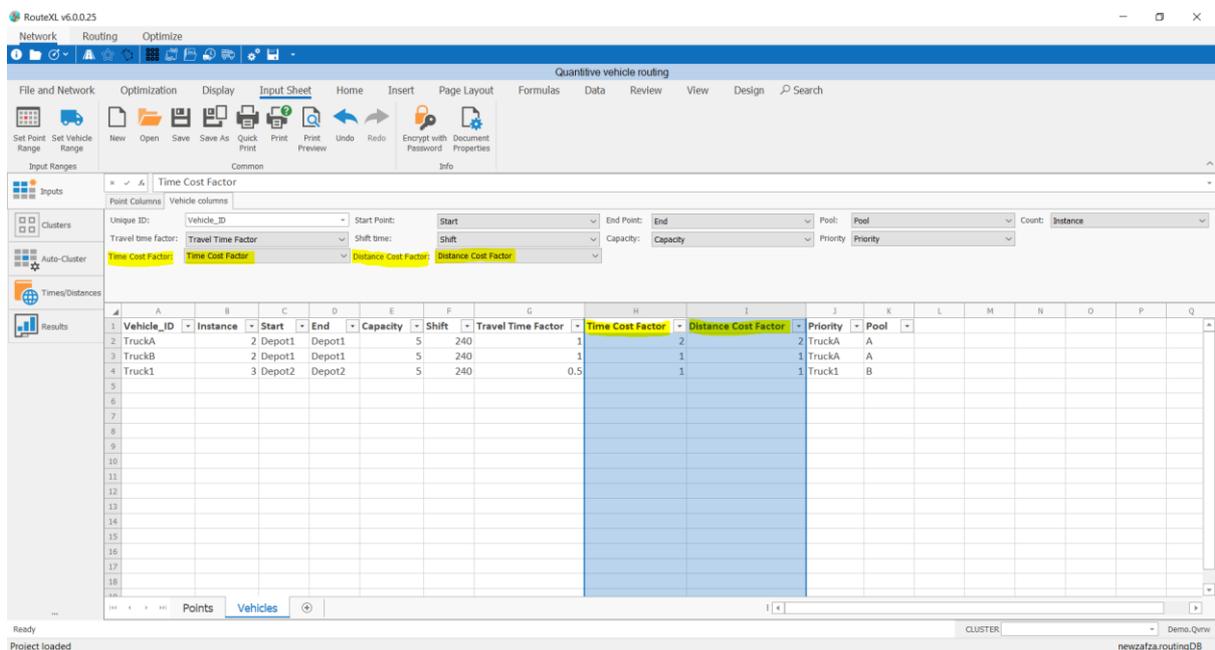
QVR User Guide



Set up Unique ID field by choosing Vehicle_ID. (Remember, these IDs need to be unique.)



If you are wanting to adjust the travel time for a truck you can input per the above screenshot. A factor of 1 means no change. A factor of 0.5 would mean your truck would travel half the speed compared to usual in the road network - Maybe the area where this truck is routing would make sense that the truck is slower travelling.



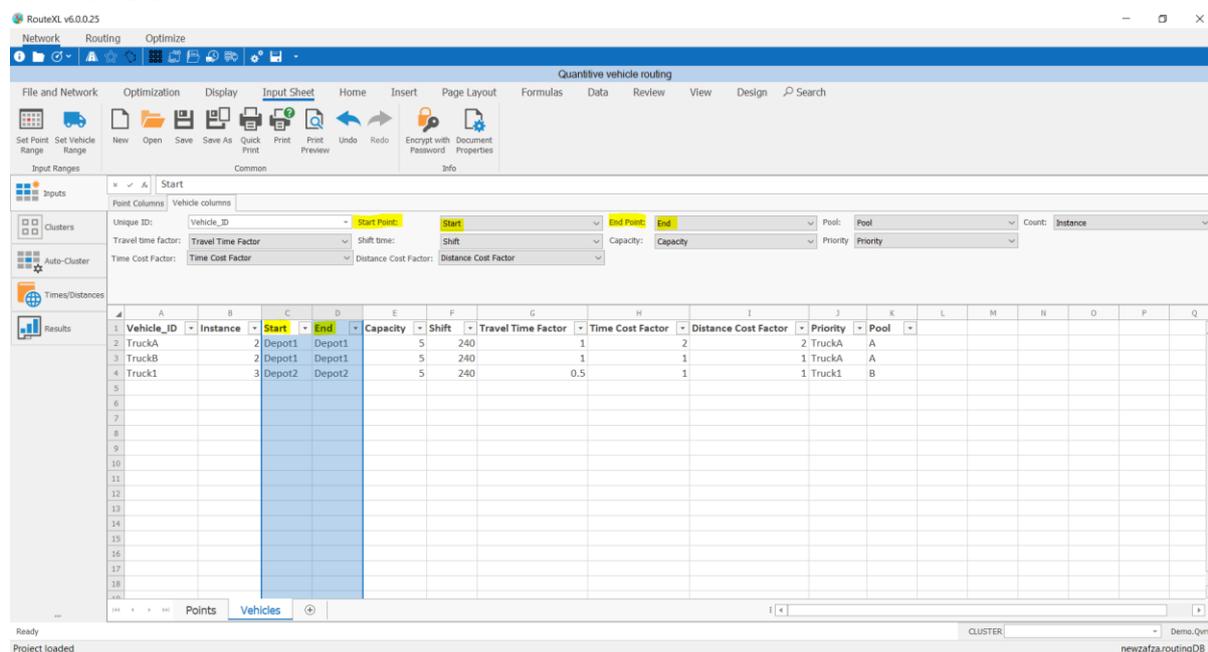
You might have a truck that costs you more in terms of cents per litre because it is a heavier truck, or it might cost you more the further distance it travels. Maybe you want the truck to travel slower and you don't care how long it takes because it will save you costs. There are various things that could affect these factors and you would want the most efficient solution.

As you can see above, there are factors of 1 and 2 in the Time Cost Factor column and the Distance Cost Factor column. This number can represent whatever cost unit you choose such as cents, dollars etc. It will essentially mean ‘1 or 2 cent/s per meter travelled’ for Distance Cost factor, or ‘1 or 2 cent/s per minute spent travelling’ for Time Cost Factor.

The time or distance unit the cost is per, depends on how your routing network was built. Normally, the routing network will be built on meters and minutes.

Both Time and Distance Cost Factor for TruckA is 2 but for TruckB it is 1.

This would mean TruckB would be forced to be used first when running a solution instead of TruckA in the pool. It is more cost efficient having only a factor of 1.



Set up your Start Point and End Point per screenshot above. This is where your trucks will start and end off in this example.

QVR User Guide

Quantitative vehicle routing

File and Network Optimization Display **Input Sheet** Home Insert Page Layout Formulas Data Review View Design Search

Set Point Set Vehicle Range Input Ranges

Inputs

Point Columns Vehicle columns

Unique ID: Vehicle_ID Start Point: Start End Point: End Pool: Pool Count: Instance

Travel time factor: Travel Time Factor Shift time: Shift Capacity: Capacity Priority: Priority

Time Cost Factor: Time Cost Factor Distance Cost Factor: Distance Cost Factor

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Vehicle_ID	Instance	Start	End	Capacity	Shift	Travel Time Factor	Time Cost Factor	Distance Cost Factor	Priority	Pool						
2	TruckA	2	Depot1	Depot1	5	240	1	2		2	TruckA	A					
3	TruckB	2	Depot1	Depot1	5	240	1	1		1	TruckA	A					
4	Truck1	3	Depot2	Depot2	5	240	0.5	1		1	Truck1	B					

Ready Project loaded CLUSTER Demo.Qvr newzafza.routingDB

Your Shift time is set up as above.

Quantitative vehicle routing

File and Network Optimization Display **Input Sheet** Home Insert Page Layout Formulas Data Review View Design Search

Set Point Set Vehicle Range Input Ranges

Inputs

Point Columns Vehicle columns

Unique ID: Vehicle_ID Start Point: Start End Point: End Pool: Pool Count: Instance

Travel time factor: Travel Time Factor Shift time: Capacity Capacity Priority: Priority

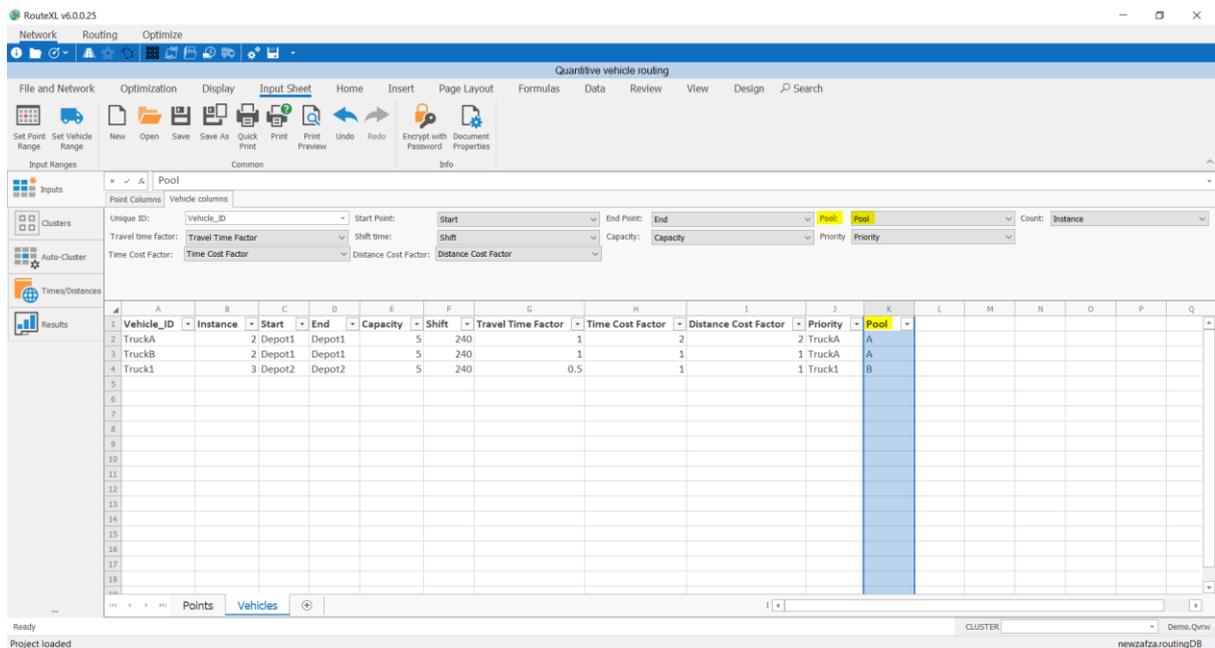
Time Cost Factor: Time Cost Factor Distance Cost Factor: Distance Cost Factor

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Vehicle_ID	Instance	Start	End	Capacity	Shift	Travel Time Factor	Time Cost Factor	Distance Cost Factor	Priority	Pool						
2	TruckA	2	Depot1	Depot1	5	240	1	2		2	TruckA	A					
3	TruckB	2	Depot1	Depot1	5	240	1	1		1	TruckA	A					
4	Truck1	3	Depot2	Depot2	5	240	0.5	1		1	Truck1	B					

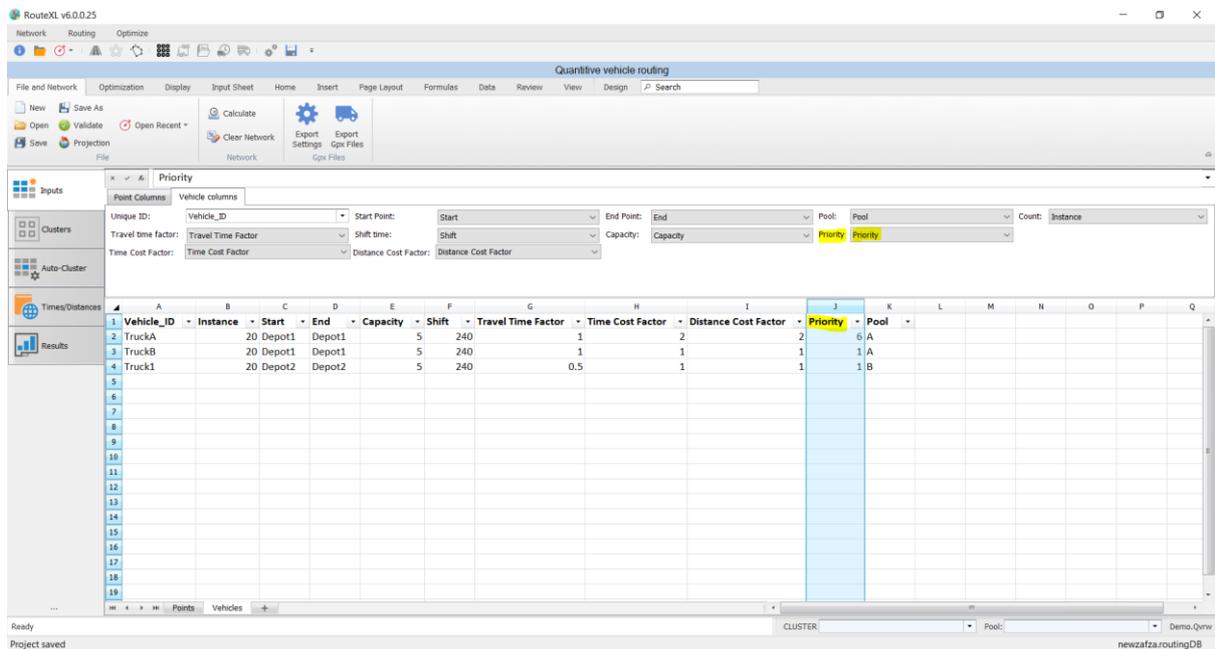
Ready Project loaded CLUSTER Demo.Qvr newzafza.routingDB

Your vehicle Capacity is set up as above.

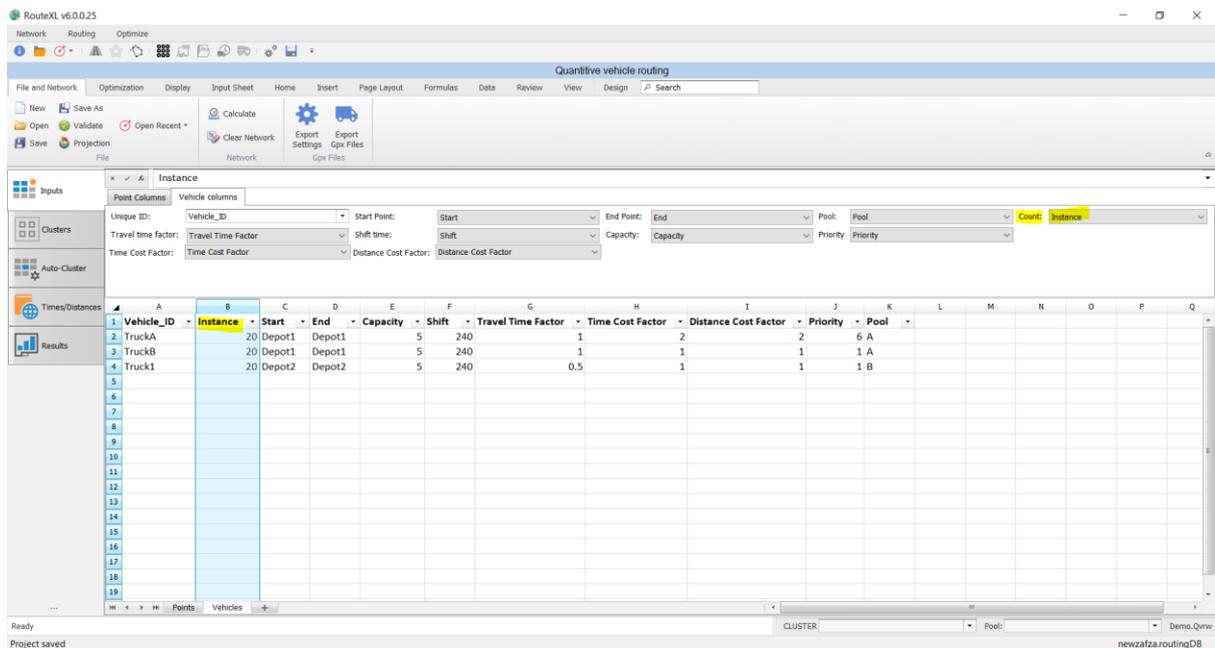
QVR User Guide



You can have one or more vehicles in a Pool as I have set up above. (Note: If you do have pools, you just need to ensure that you do have a cluster column as we already set up in the Points Column tab. See [Clusters](#) section on pool-cluster assignments.)



There is a Priority column that you can have set up as I did per the screenshot above. Higher priority vehicles get chosen first. In Pool A, TruckA has a priority of 6 and TruckB has a priority of 1, therefore TruckA will be used first.



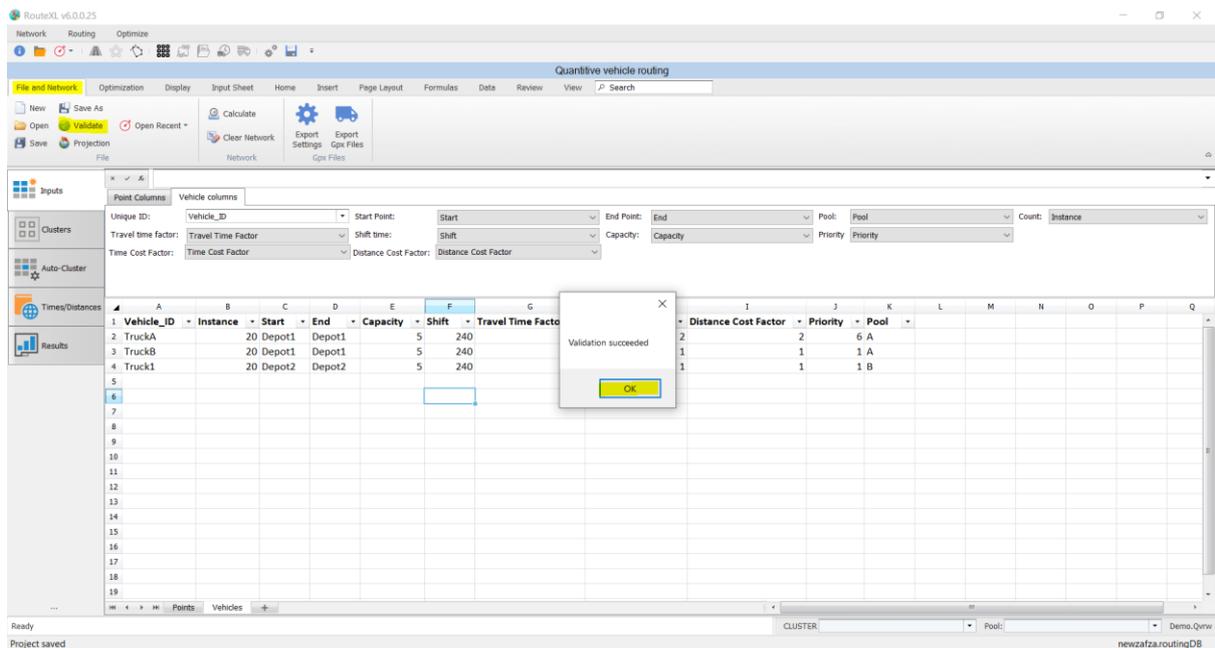
Setting up the column Count is useful if you have more than one instance of a vehicle/truck. For example, if a truck goes out and does what it needs to do and comes back to the depot and completes its shift that would be one instance.

If there were 3 instances of a truck then that is basically 3 shift times completed, therefore you would probably need 3 of those same trucks for that day. Or 3 shifts completed of the one truck over 3 days. This is a concept of how it works.

(Note: You can have many trips a day of a truck to and from the depot within its shift time and when that's complete that is still one instance. The Count field set up could also be used as the maximum number of trips a truck can do. It all depends on what solution you want to get out. It is very dynamic.)

Your Points Columns and Vehicle columns have been fully set up. (Note: Again, you don't need to use all fields. Just make sure if you don't have that field in your sheet or don't need to use it at this point, always select <None>. Don't leave the fields blank.)

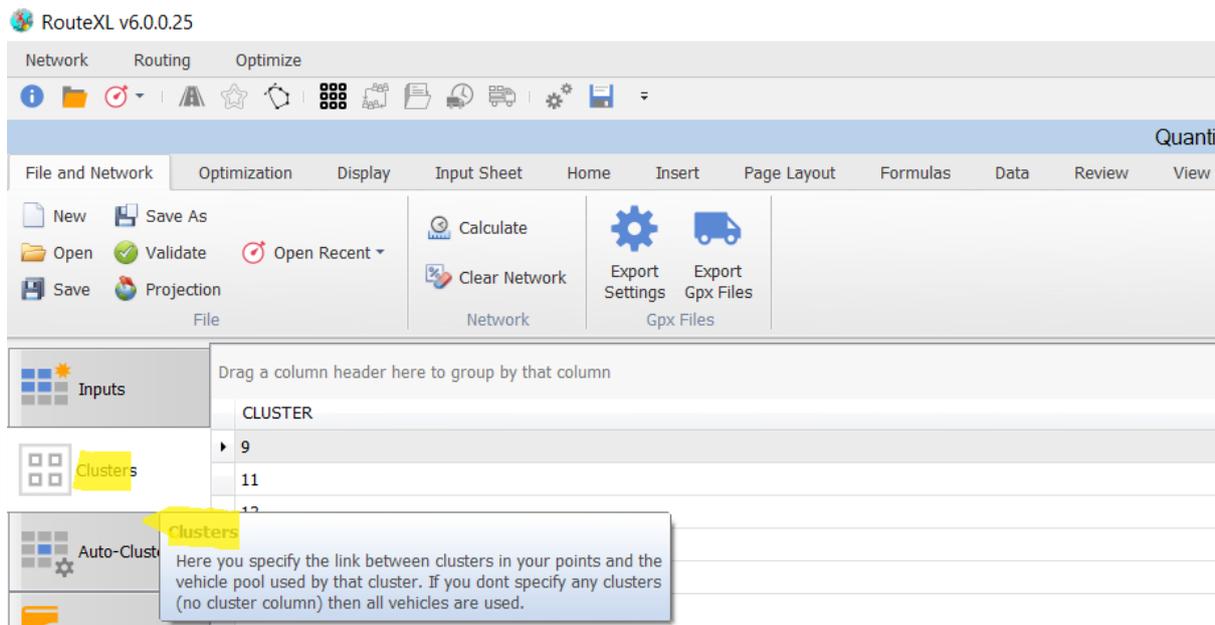
To validate your work to ensure everything is set up correctly in your Points and Vehicles sheet etc, select File and Network tab and click on Validate. If there is an error, you will be notified and can adjust your set up. If it succeeded it will notify you too as it did in my example below. Click OK.



Clusters

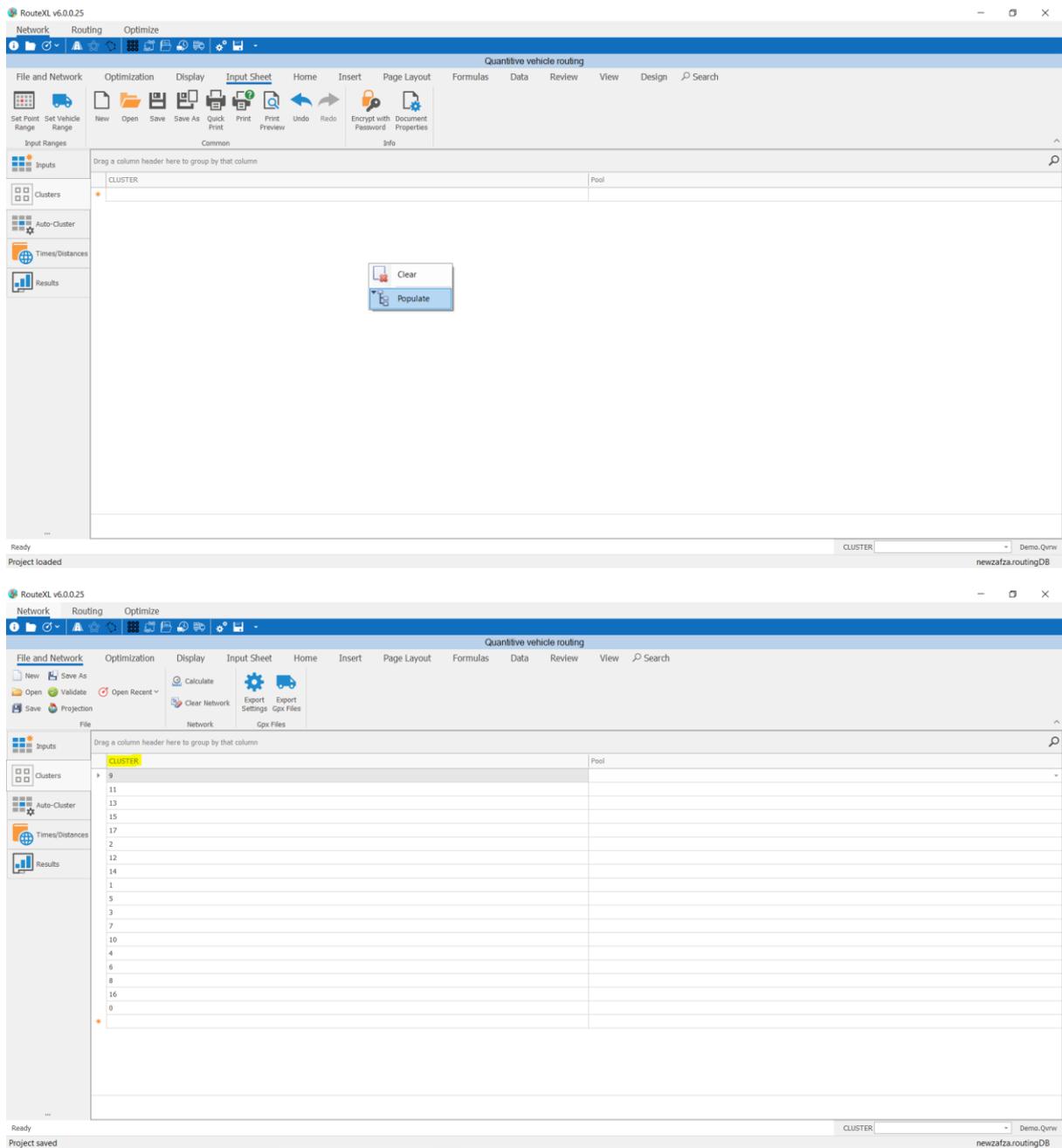
The idea is that you assign pool/s to clusters. For a certain cluster the vehicle/s in a pool assigned to it are only routed by those vehicles. A pool can also be assigned to one or more clusters at a time.

Therefore, you need to go to your Clusters tab and assign you pool/s to your cluster/s as the next step.

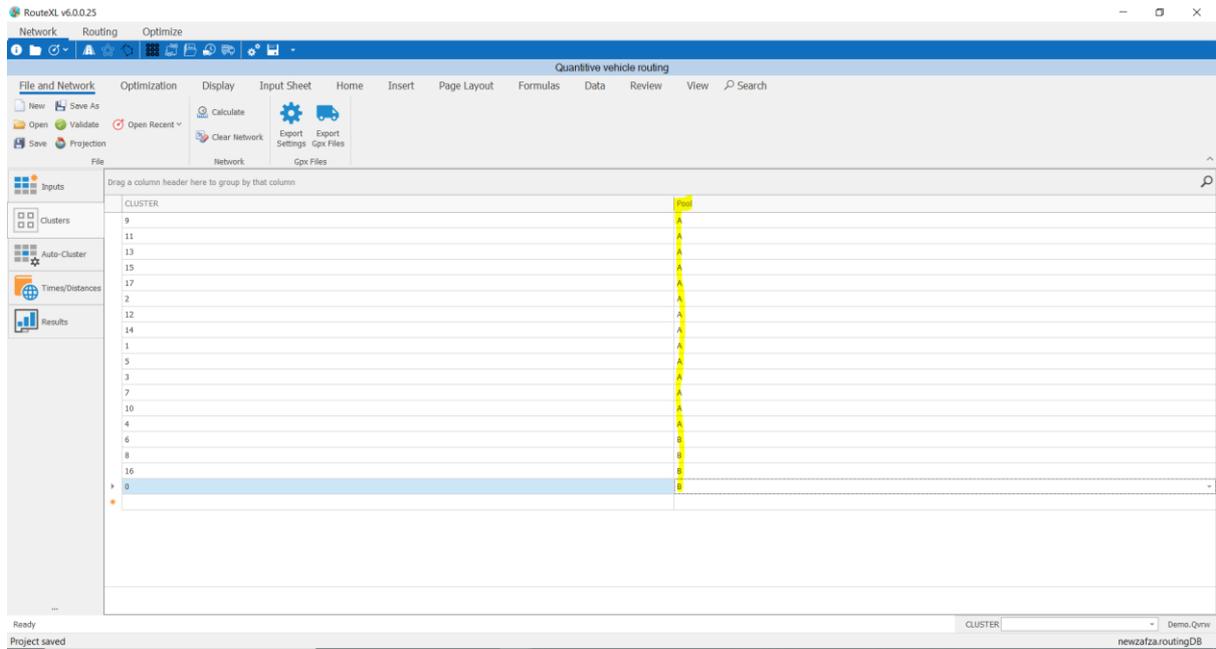


Right click in the area and select Populate. This will populate all your clusters.

QVR User Guide



Fill in your pools by typing it in exactly worded as in your Vehicles sheet. You could also copy and paste it in which will make it faster.

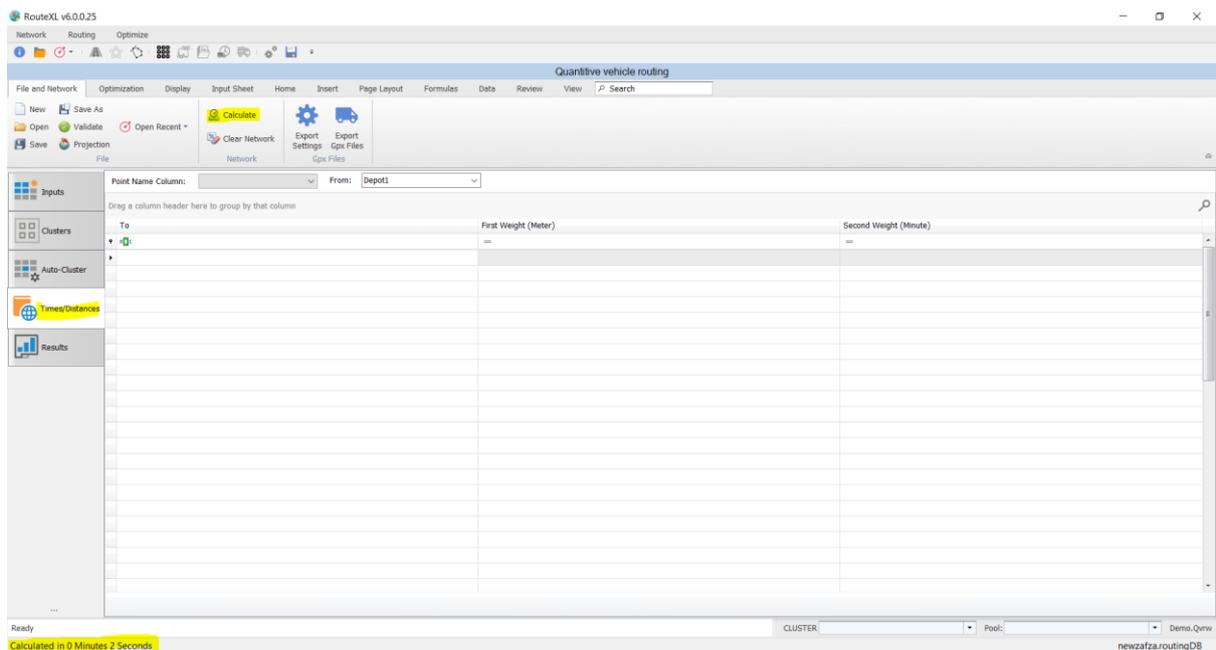


You are done with this set up in the Clusters tab.

Calculate Network (Times/Distances)

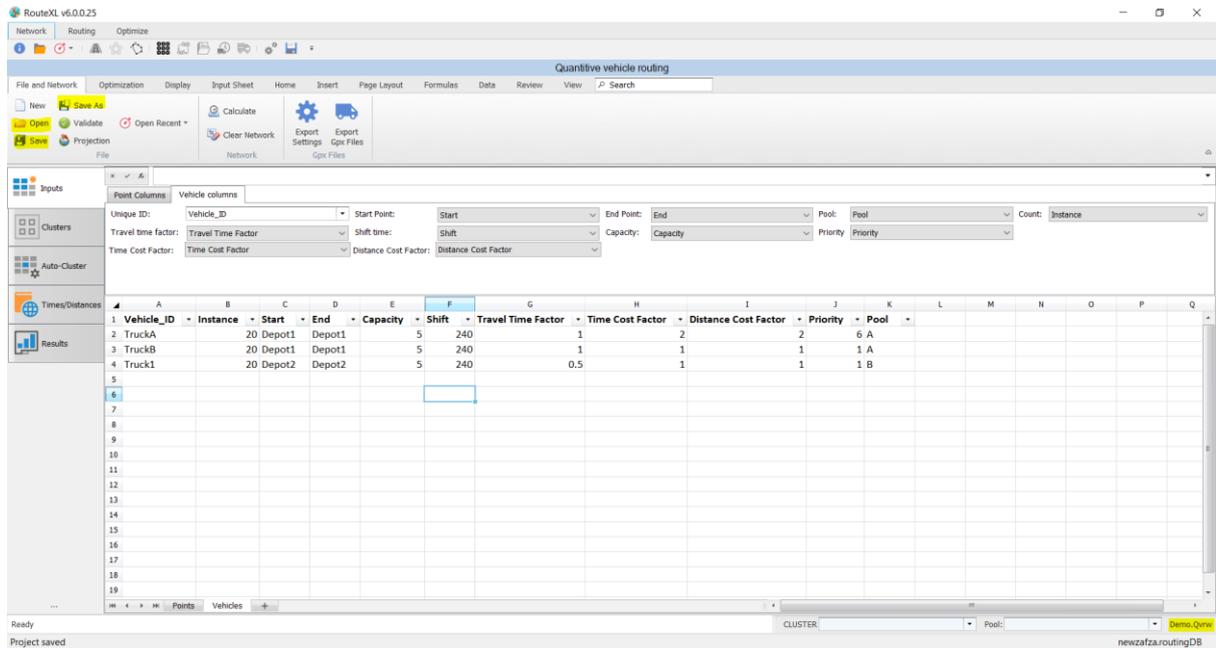
You need to Calculate your routing network now that you loaded earlier. Click on Calculate.

You will see that it has successfully calculated or is calculating by viewing the bottom left of your RouteXL window. You will automatically be taken to your Times/Distances tab when this is complete.



You should save your work now at this point, so you don't lose anything that you have set up including calculating your routing network.

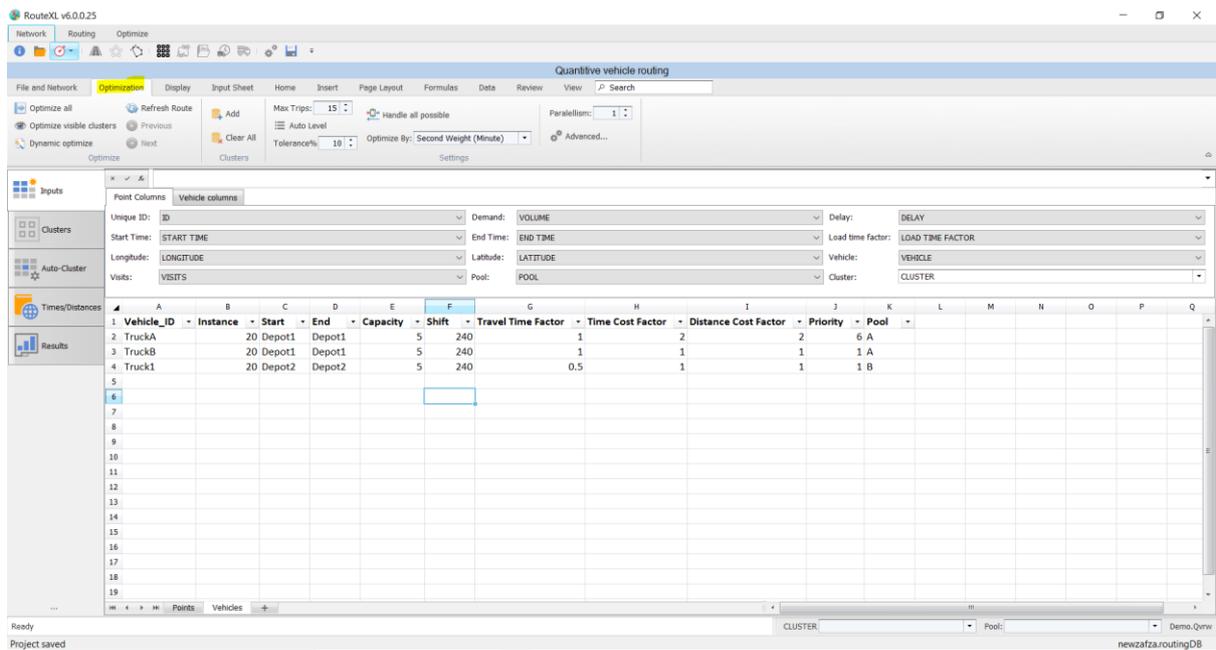
Save it in an appropriate location. You can then just load this project again at a later point. Your project is displayed at the bottom right hand corner of the RouteXL window.



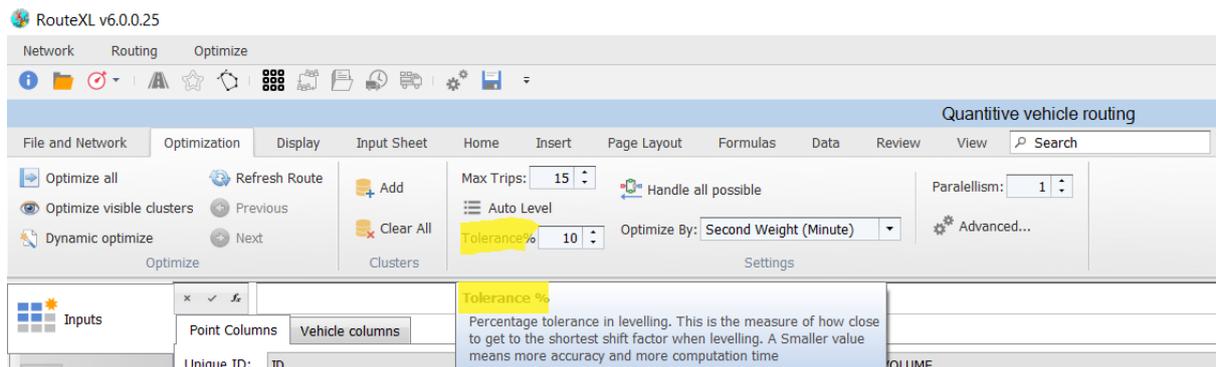
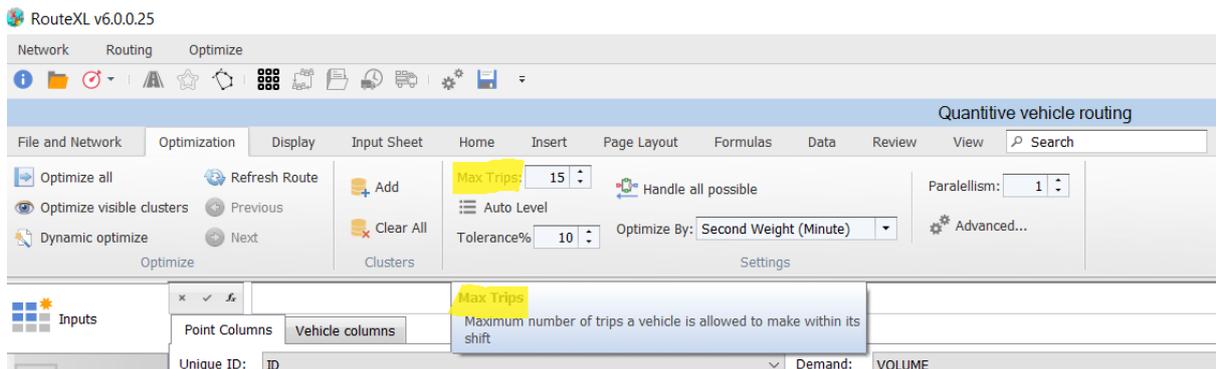
Optimization

Let's move onto the Optimization tab as you are now ready to do your routing based on your various parameters that have been set up.

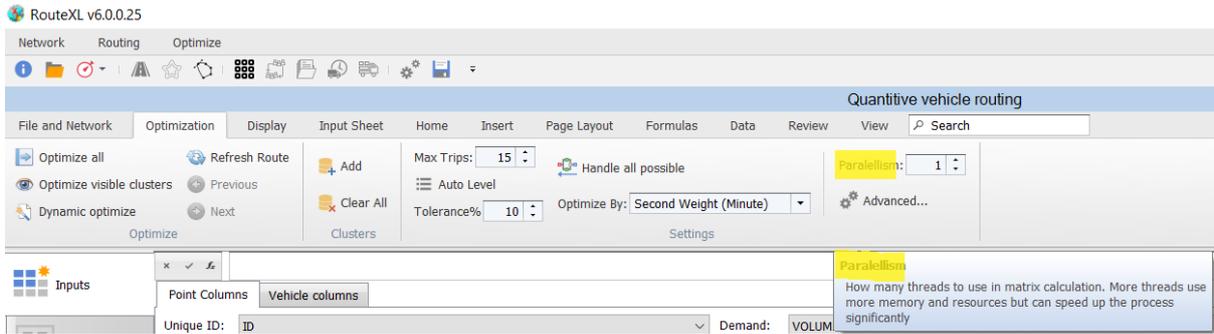
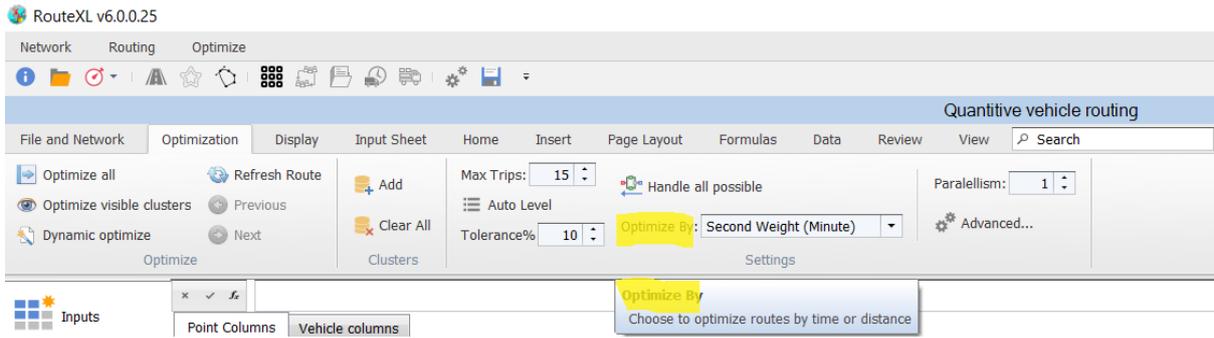
QVR User Guide



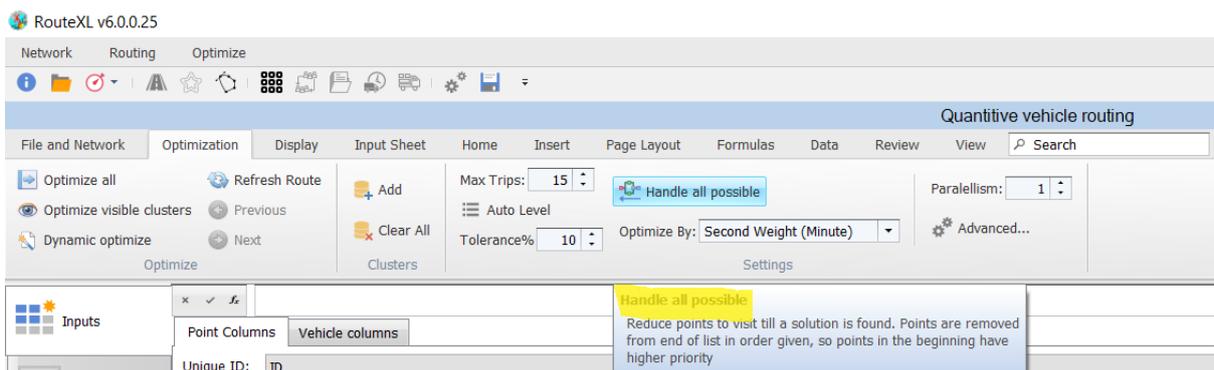
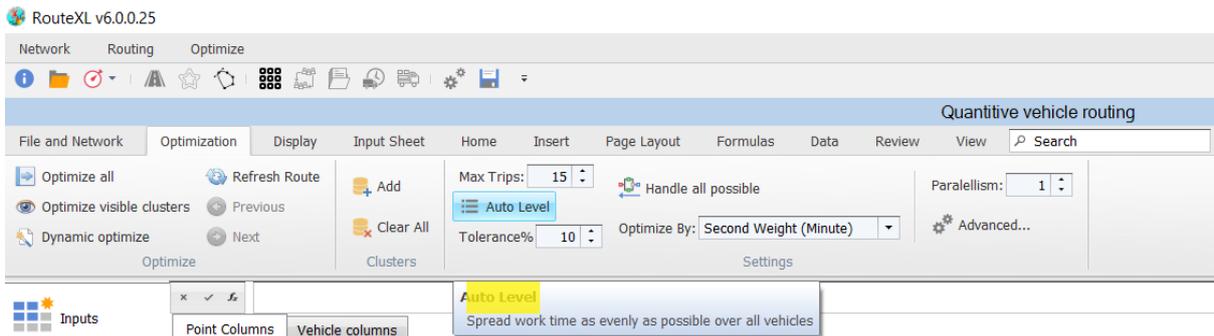
Below are screenshots of settings that are set at default with an explanation of each. You can adjust these based on what output you want from your routing solution.



QVR User Guide



If your Auto Level button is selected it will do the following, otherwise it is by default off.

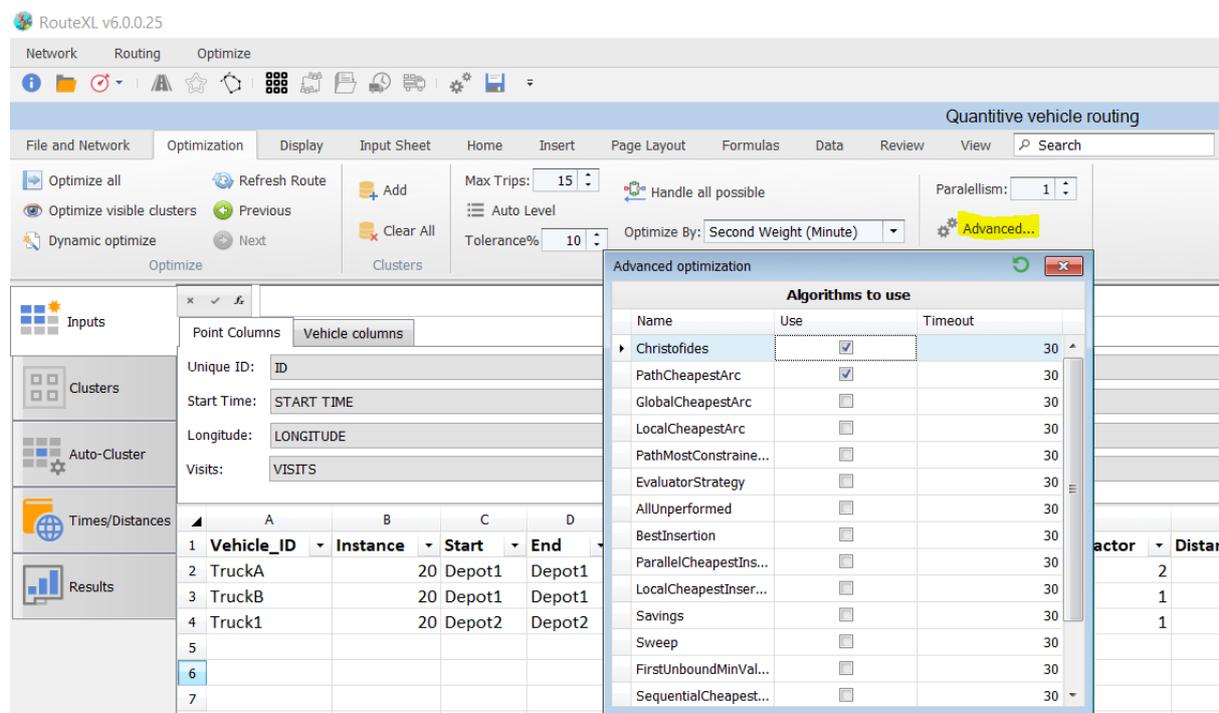


This button is by default off but can be selected if you are wanting a solution per the description of it. This is useful to have on if you have many points and want to get a solution for what you can in the meantime, instead of spending so long to find a solution and it failing with no results at all.

(Note: This process can take a while if the button is selected compared to running a normal solution. It also depends how many points you are routing. The more points the longer it will take.)

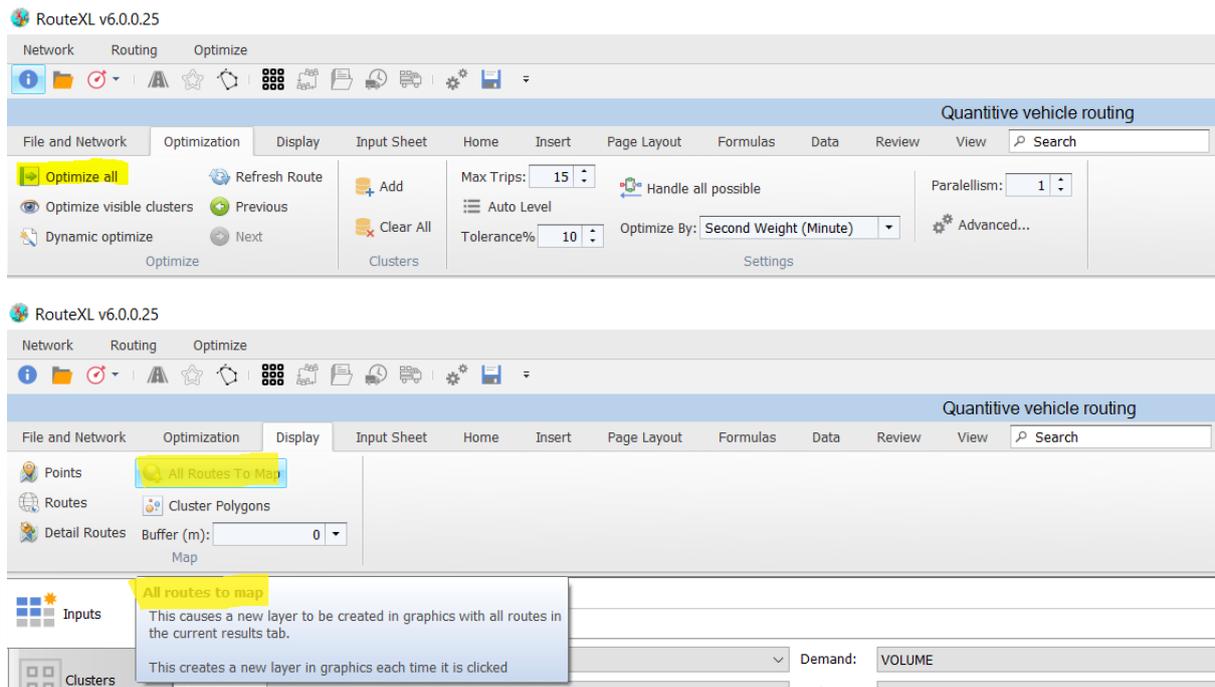
The next setting in the screenshot below is set at default. You would change it when you are routing a lot of points. In this case, you would use just Christofides and not PathCheapestArc. It is the best algorithm to use, and you would get a solution faster compared to using 2 algorithms at the same time. (You have a choice of many algorithms to use as well.)

You might also want to increase the Timeout. (It is measured in seconds and shows how long is needed to find or produce a solution) You would want it set higher when routing a lot of points so there is enough time to find and/or produce a solution with results.



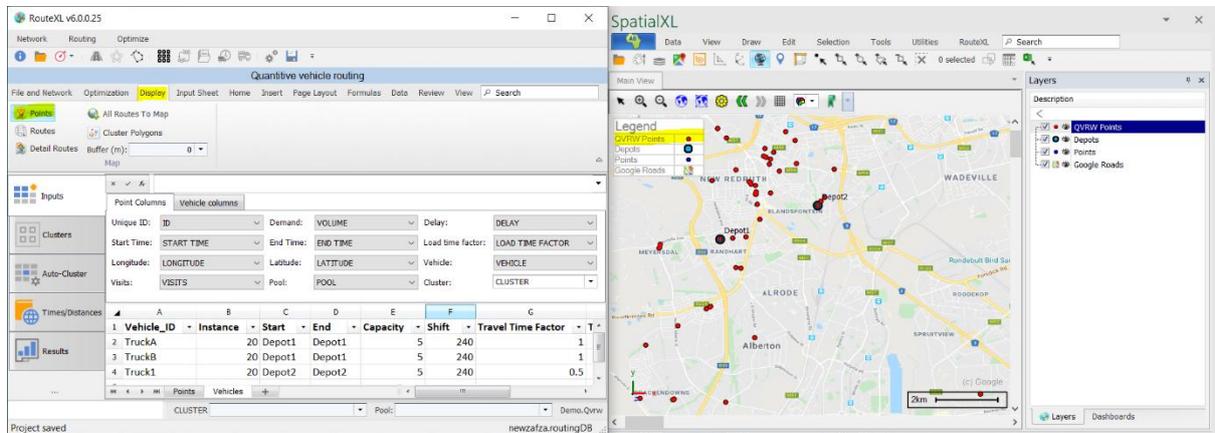
At this point you are ready to optimize your routes and get a solution and results out.

If you have set up Pools and Clusters which I have in this example, you would only need to use the button Optimize all to get an entire solution. You can export all your routes thereafter to your map.

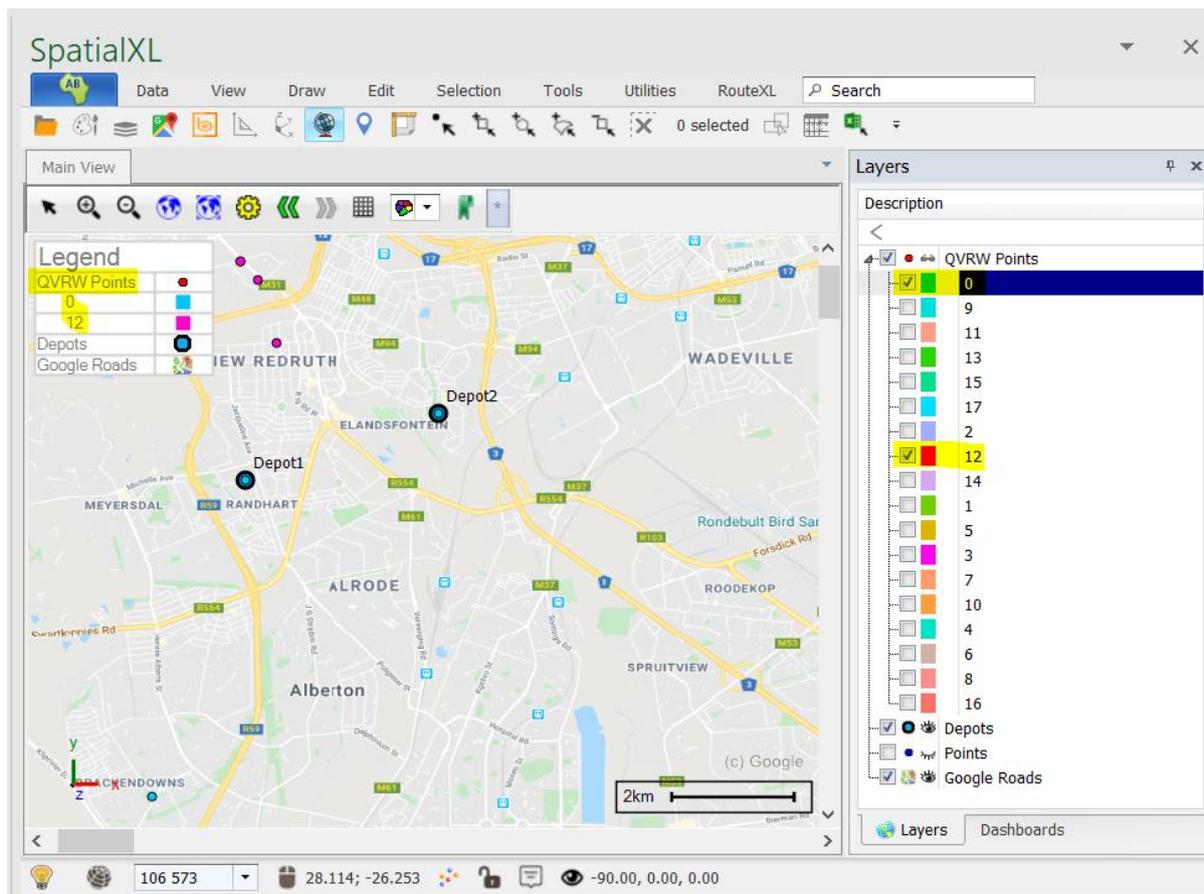


If you would only like to get a solution and results for a cluster or a certain number of clusters instead of all of them, you can do the following:

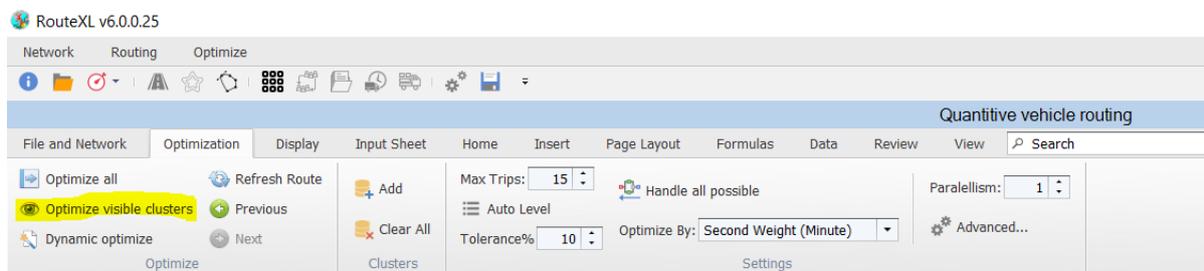
Go to your Display tab and select Points. All your points will be displayed on your map with QVRW Points layer created.



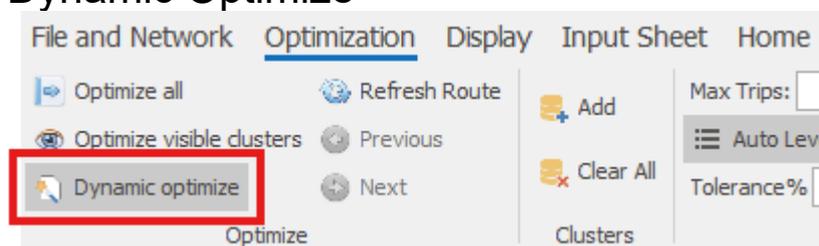
Create a colour theme on the column Cluster and select what clusters are visible on your map. Here is an example:



Go back to your RouteXL window and now select Optimize visible clusters which will do just that.



Dynamic Optimize



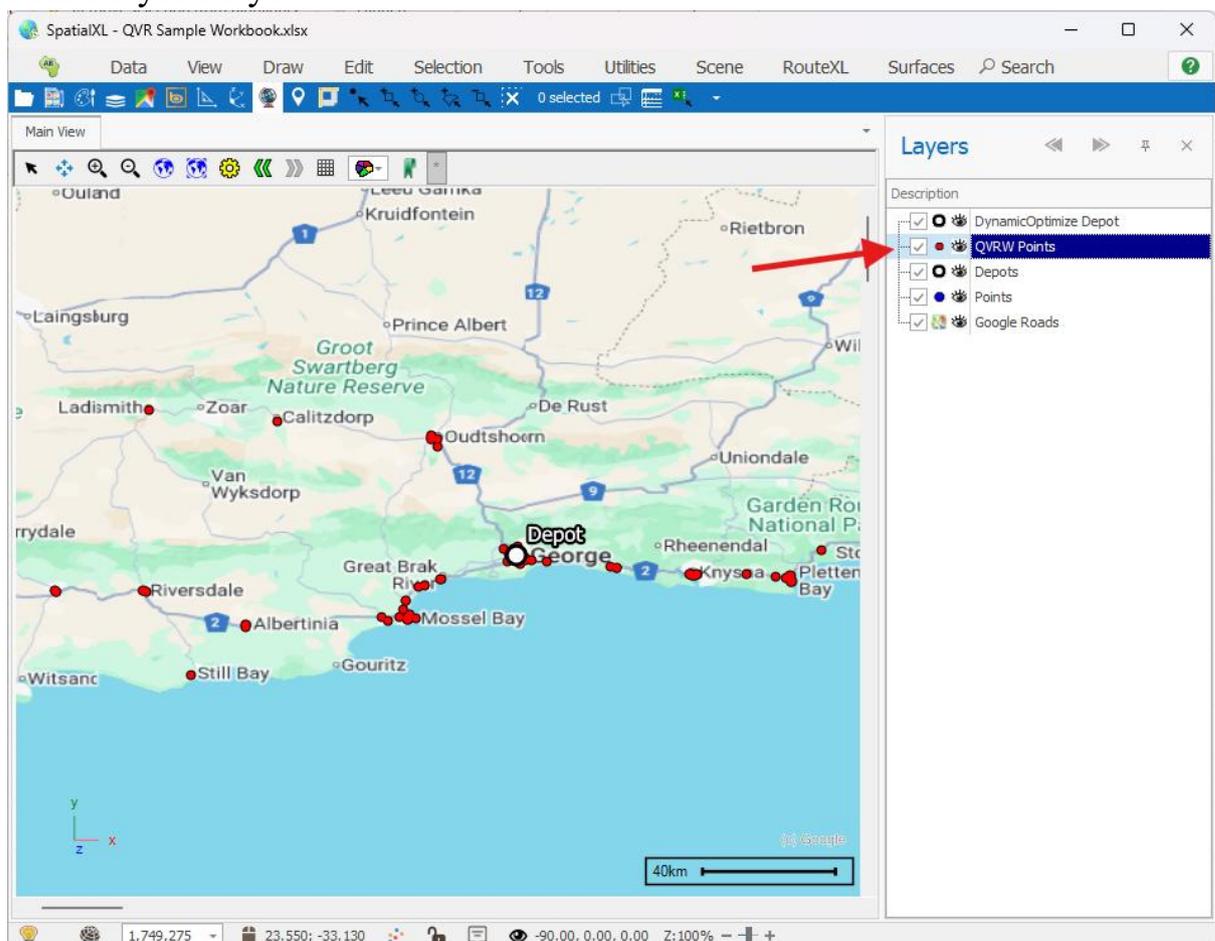
The Dynamic optimization button is used to dynamically route through selected points in graphics and display the results and optionally the routes.

As you select and deselect points in graphics when this mode is selected, the routes and results are updated automatically.

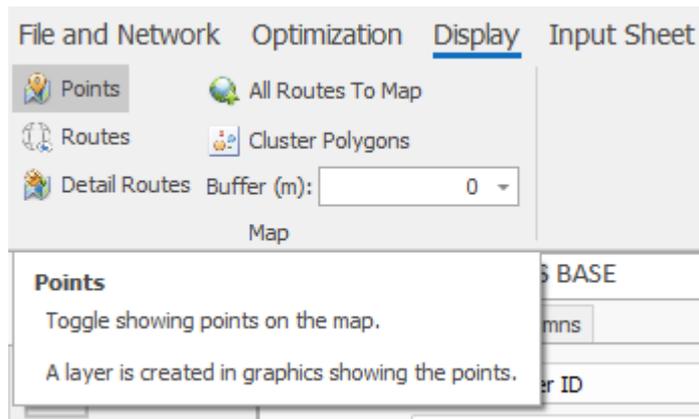
This option is used to design your routing clusters. The selected points can be added to a cluster using the “Add” option in the Clusters section.

Note: You can only use Dynamic optimize if you are not using Pools, otherwise you will get an error.

1. Set up your Dynamic Optimize project in QVR using the data from the appropriate worksheets in the [QVR-Sample-Workbook.zip](#)
2. Click “Dynamic optimization” button. This will automatically add a QVRW Points layer for you:

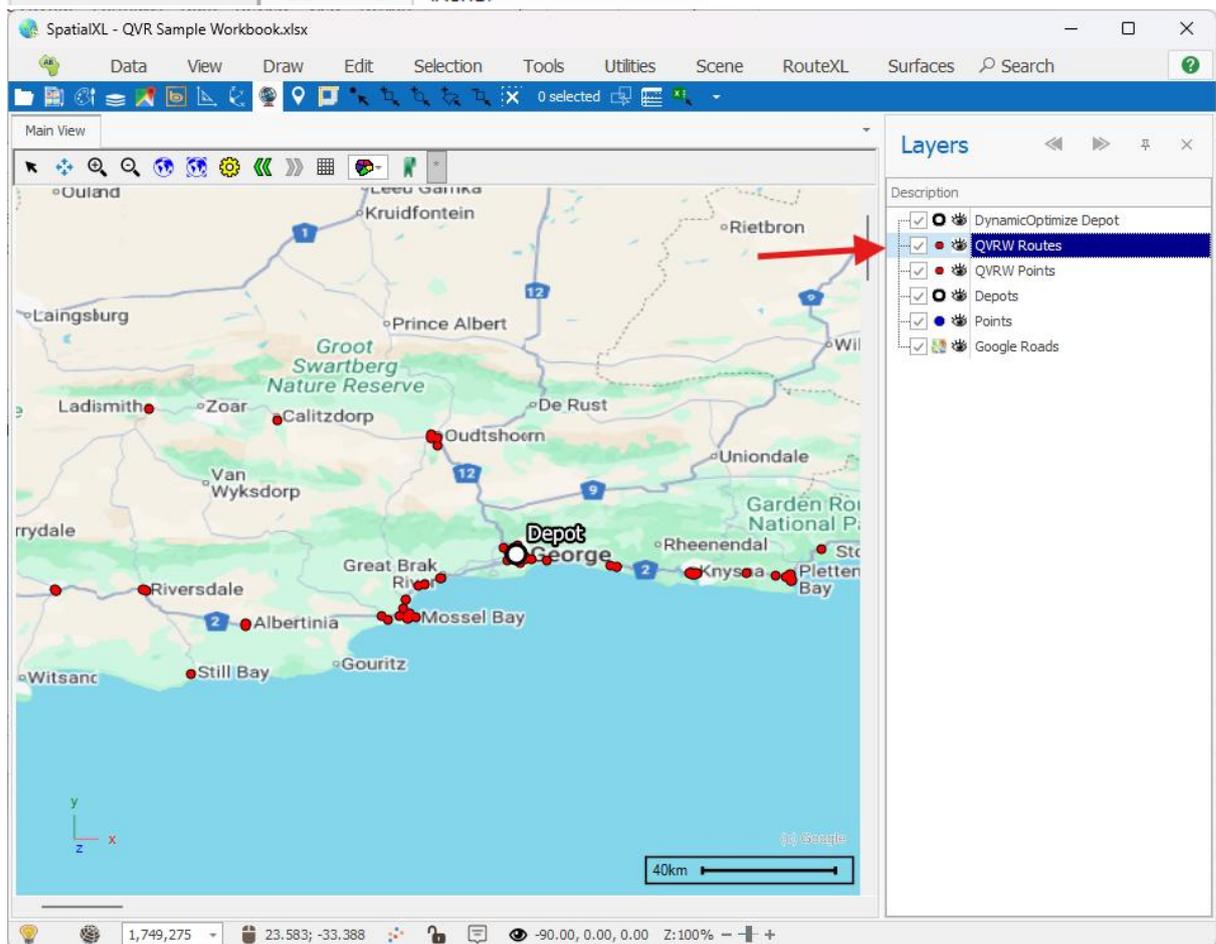
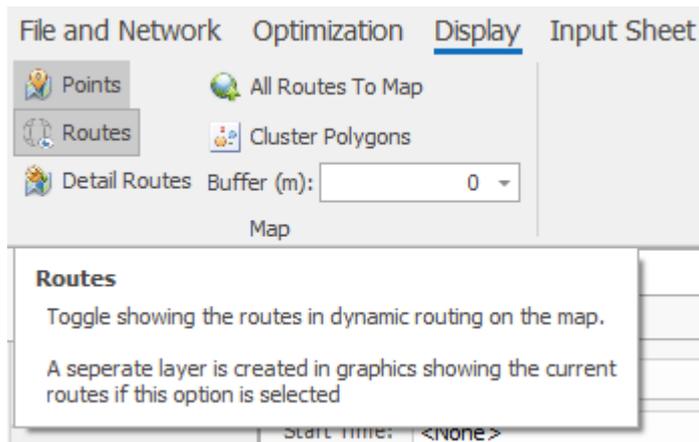


You can manually toggle on and off the Points layer by clicking the “Points” button in the Display tab:



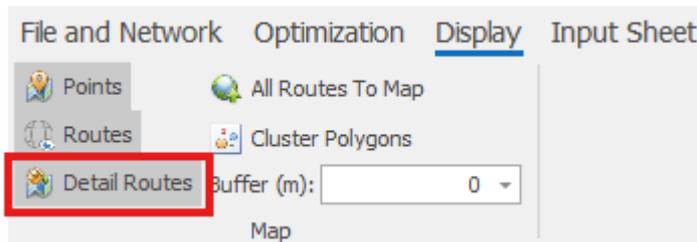
3. Display routes by clicking the “Routes” button in the Display tab. This will add a QVRW Routes layer for you in graphics.

This button is also a toggle that you can use to show/take away the route display layer in graphics.

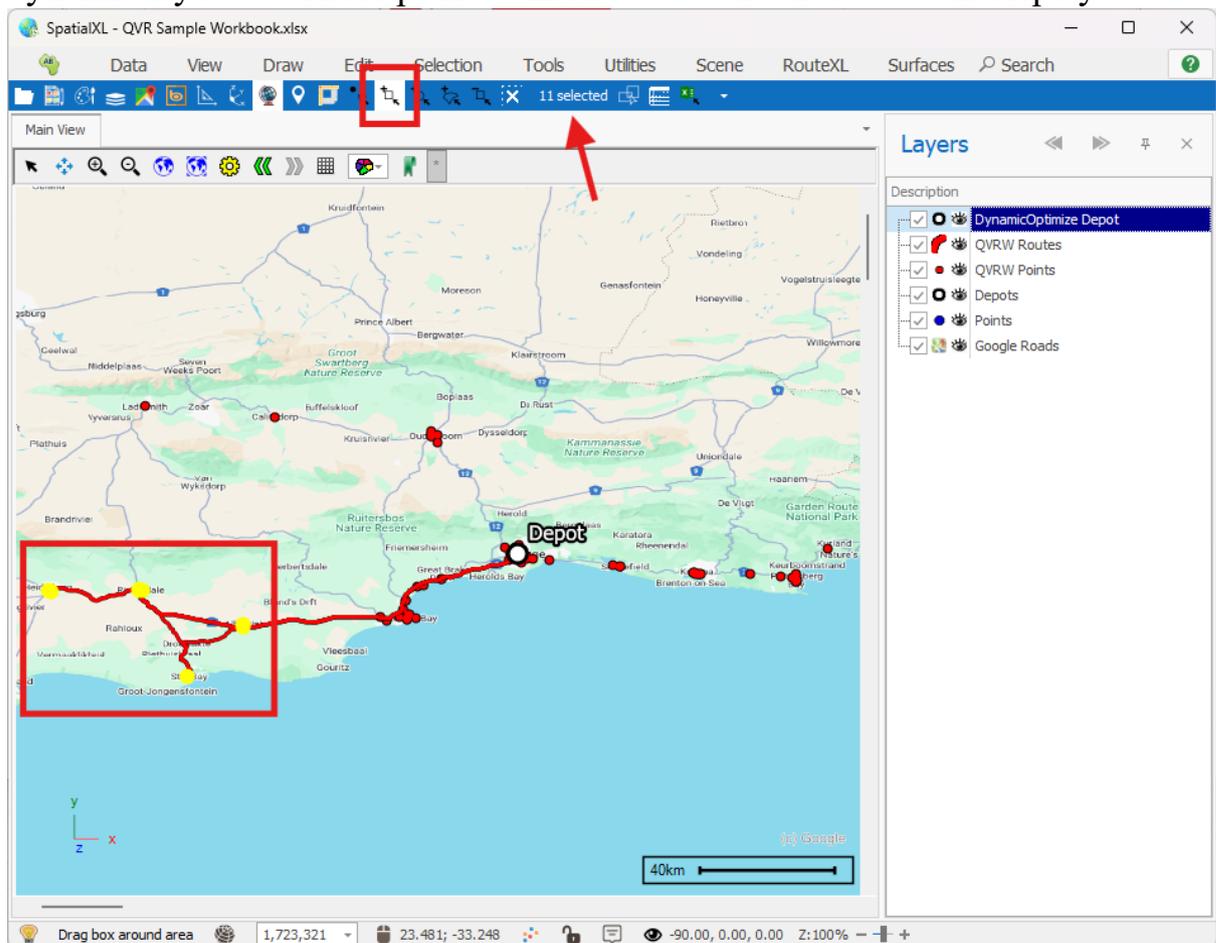


Use “Detail Routes” to toggle showing detailed routes on the map during dynamic routing. If this option is off only straight lines are drawn between points on a route.

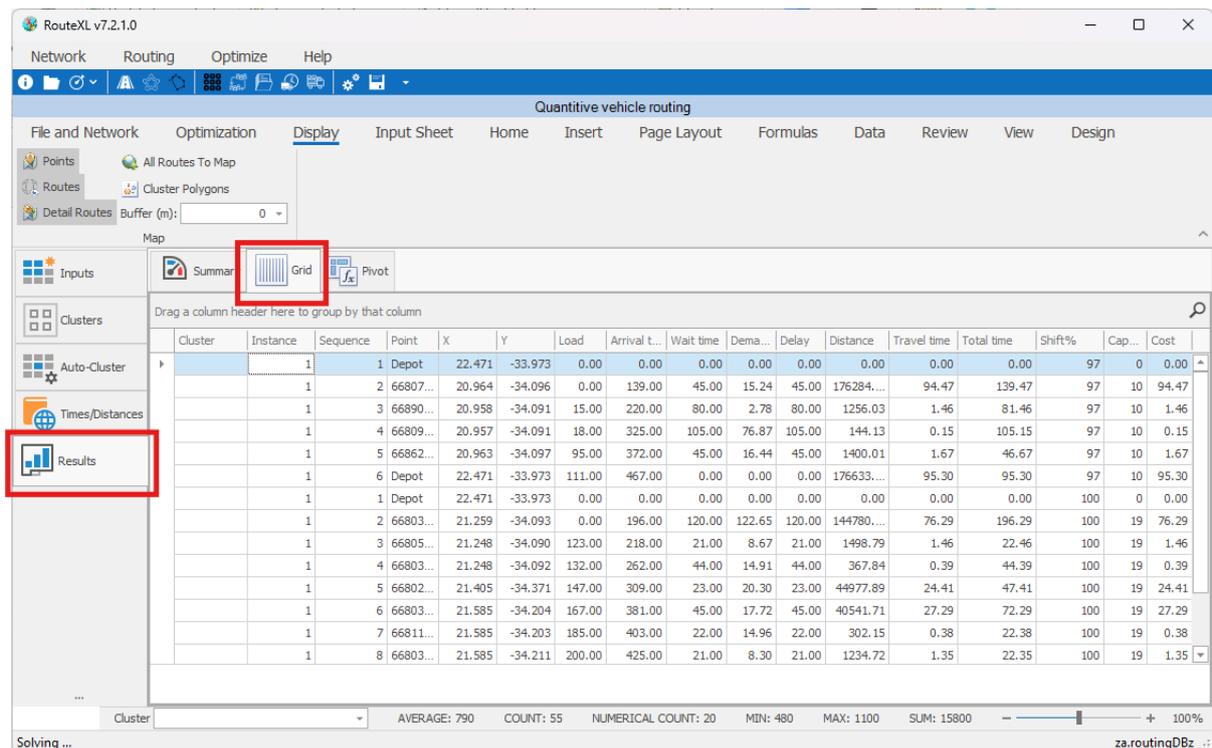
When this option is on, if the network has been created with detailed routes, these detailed routes are shown.



- Using one of the SpatialXL map selection tools, select the points you want to dynamically route. These points will be routed and the route will display:

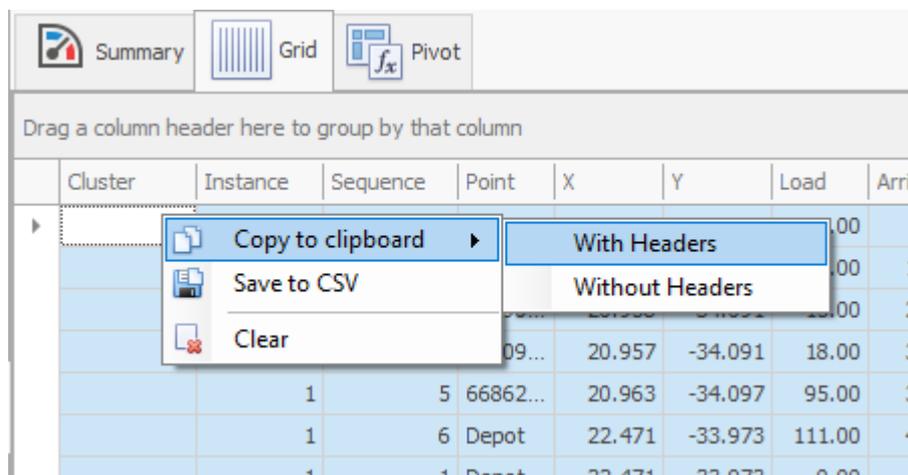


- Go to Results > Grid to view the routing results for the points you selected:



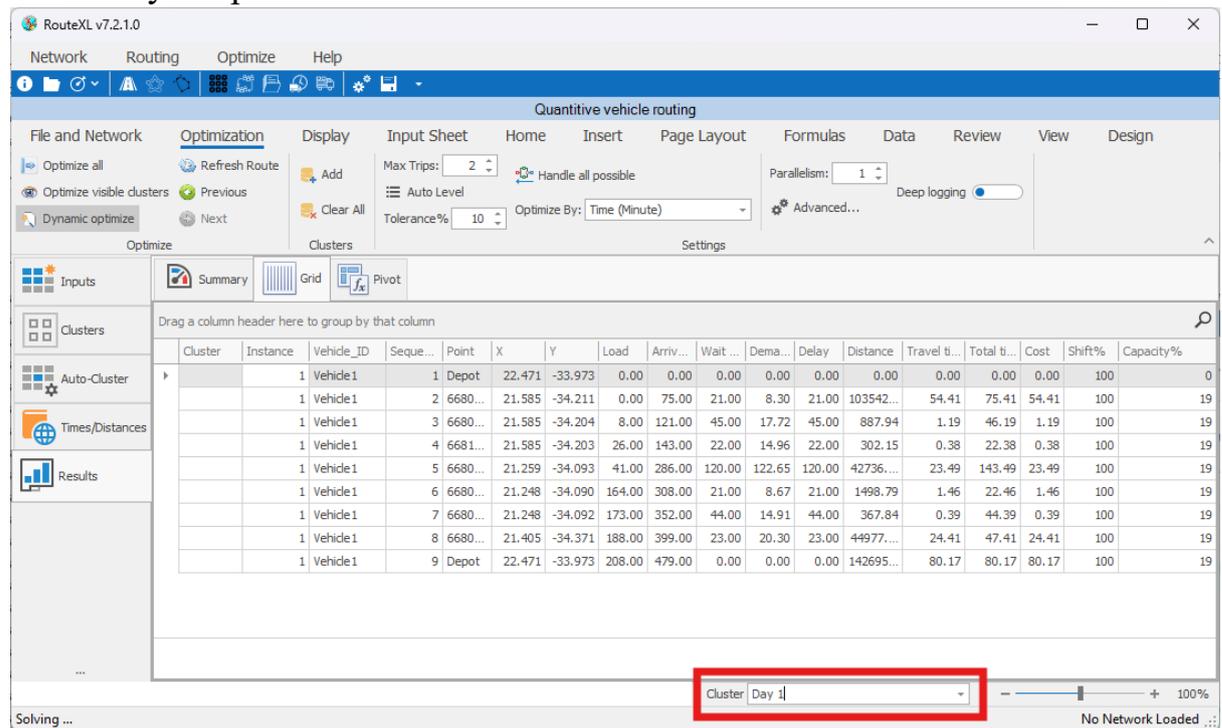
6. As you select and deselect points on the map the route display and results grid will update. If you want to save results from dynamic routing, you must copy out the results and paste them out, for example, into an Excel sheet:

{CTRL-A} to select all rows, then right click and select “Copy to clipboard”.

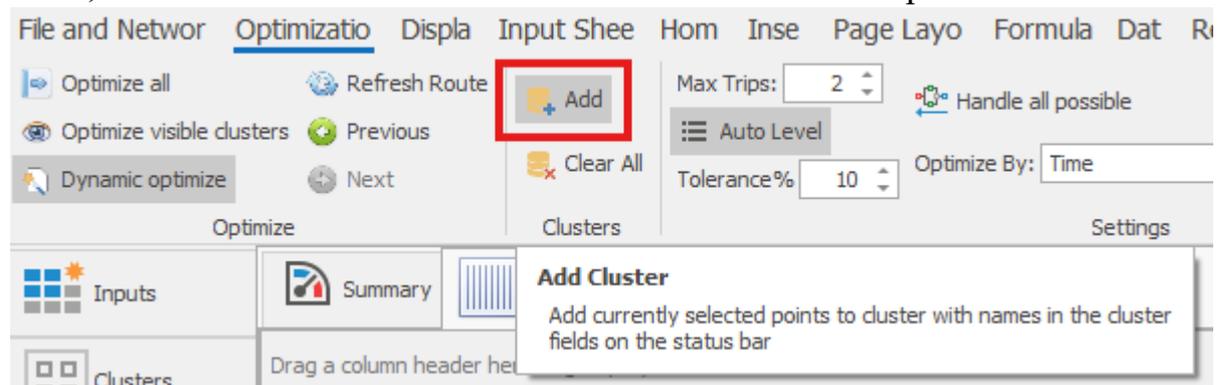


7. To add the selected points to a cluster, first, type in the cluster name in the cluster field at the bottom of the QVR window. This field will be named after whatever your cluster column in your input data is called. In this example my cluster field is called “Cluster” and I will type I a name based

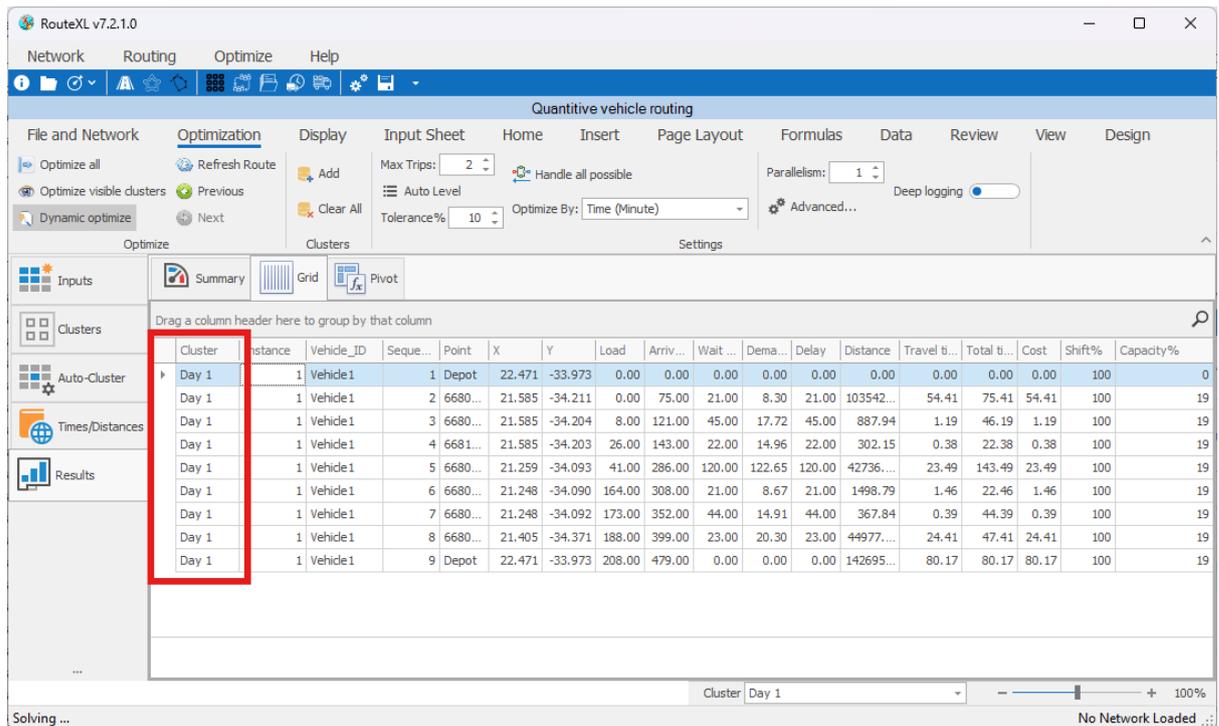
on the day the points should be visited.



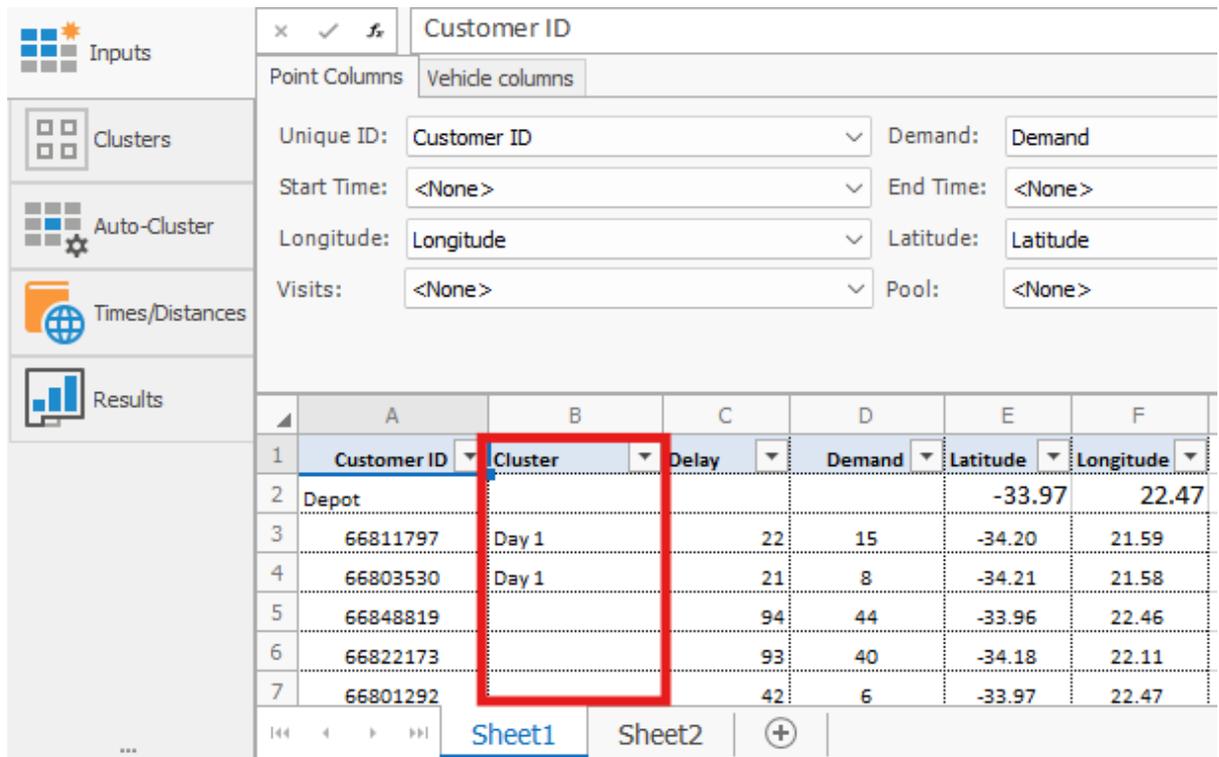
Then, click the “Add” button in the Cluster section of the Optimization tab:



The cluster will be assigned accordingly in your results in your previously blank cluster column:

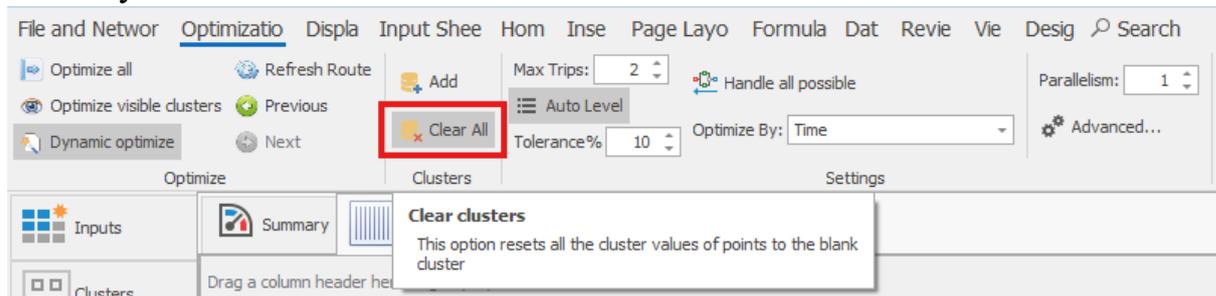


The cluster column in your input sheet will also update accordingly with the assigned cluster:

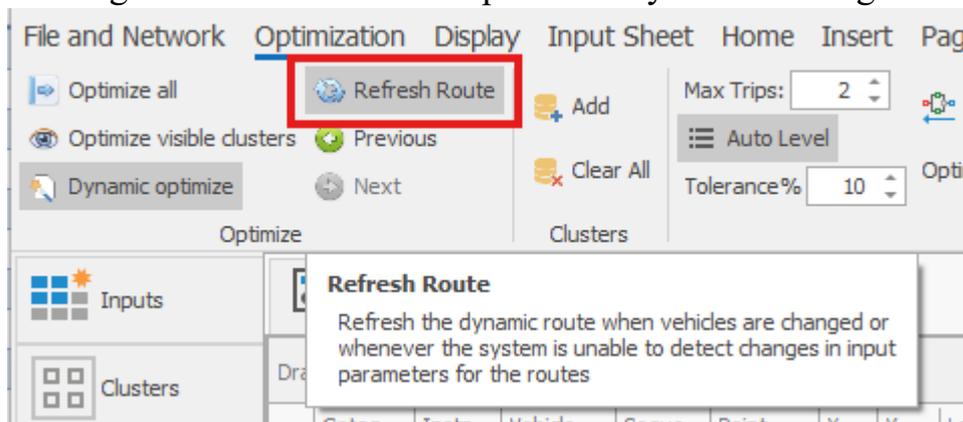


You can then continue selecting more points with Dynamic Optimize and assigning the clusters as above.

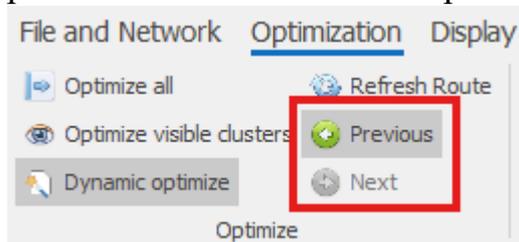
- The “Clear All” button will clear all cluster assignments of your points so that they have a blank cluster.



- When vehicles or any other input parameters in the Inputs tab are changed, clicking “Refresh Route” will update the dynamic routing results:



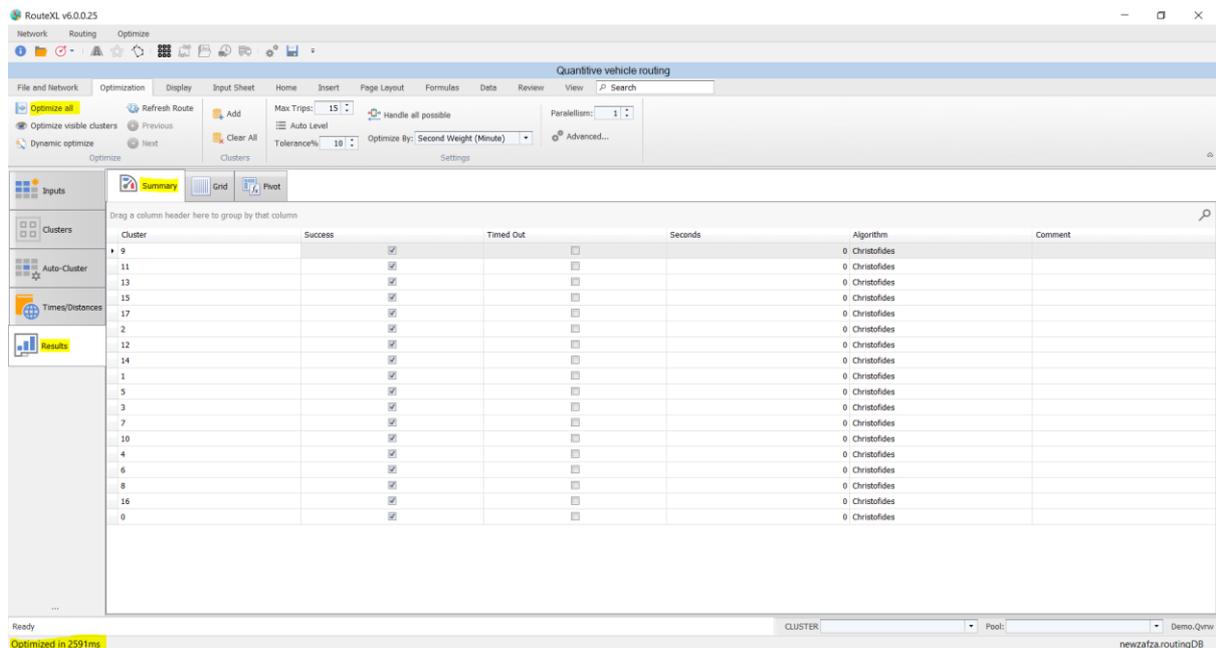
- The “Previous” and “Next” buttons can be selected to easily go back to the previous or next selection of points and show its route.



Results

Once you’ve chosen your way of optimization and run it to a solution, your results will be displayed in Results > Grid tab.

In my example I have Pools that have been assigned to Clusters, so I have used the “Optimize all” option. (Note: It is best to have Pools and Clusters set up, even if it just one Pool and one Cluster. You will have an additional tab next to Grid called Summary which shows whether you got a solution or not and adjust whatever is needed to get a solution. This saves time.)



You can see that a solution was found for all clusters by a tick in the Success column. If there was no success it wouldn't be ticked. The Timed Out column has nothing ticked on showing all clusters solved within the timeout set in the Advanced button described above. If there was no solution (because you have a lot of points in a cluster to solve) it may timeout before a solution is found. Timed Out would be ticked on. In this case you can just adjust your timeout to a higher number to allow enough time for a solution to be found and rerun.

The Seconds column shows how long it took for that Cluster to solve. The Comment column will display an error message against a cluster if there was no solution because of various reasons like capacity of the truck is too low to carry the volume needed to be delivered to a customer etc. You therefore can adjust your inputs and rerun the solution.

If your Comment column simply just reports No Solution against a cluster/s, it usually means that your Shift time is too low, or your number of Instances are too low. There could be other reasons so just ensure your inputs are 100% correct. You then need to rerun.

Your actual results are in the Grid tab.

Inputs

Clusters

Auto-Cluster

Times/Distances

Results

Summary

Grid

Pivot

Drag a column header here to group by that col

CLUSTER	Instance	Vehicle_ID	Sequer
9	1	TruckA	
9	1	TruckA	
9	1	TruckA	
9	2	TruckA	
9	2	TruckA	
9	2	TruckA	
9	3	TruckA	
9	3	TruckA	

Results

This tab shows the results of the optimization, if it succeeded.

There is one row for each visit of a vehicle to a point. They are in order of the vehicles route.

These results can be mapped or exported to Excel for further analysis

Summary

Grid

Pivot

Drag a column header here to group by that column

CLUSTER	Instance	Vehicle_ID	Sequence	Point	X	Y	Load	Arrival time	Wait time	Demand	Delay	Distance	Travel time	Total time	Shift%	Capacity%	Pool
9	1	TruckA	1	Depot1	28.111	-26.287	0.00	0.00	15.00	0.00	0.00	15.00	0.00	15.00	57	100	A
9	1	TruckA	2	187	28.124	-26.281	0.00	118.00	115.00	5.00	115.00	2199.47	3.18	118.18	57	100	A
9	1	TruckA	3	Depot1	28.111	-26.287	5.00	136.00	15.00	0.00	15.00	2186.39	3.19	18.19	57	100	A
9	2	TruckA	1	Depot1	28.111	-26.287	0.00	0.00	15.00	0.00	15.00	0.00	0.00	15.00	57	100	A
9	2	TruckA	2	187	28.124	-26.281	0.00	118.00	115.00	5.00	115.00	2199.47	3.18	118.18	57	100	A
9	2	TruckA	3	Depot1	28.111	-26.287	5.00	136.00	15.00	0.00	15.00	2186.39	3.19	18.19	57	100	A
9	3	TruckA	1	Depot1	28.111	-26.287	0.00	0.00	15.00	0.00	15.00	0.00	0.00	15.00	57	100	A
9	3	TruckA	2	187	28.124	-26.281	0.00	118.00	115.00	5.00	115.00	2199.47	3.18	118.18	57	100	A
9	3	TruckA	3	Depot1	28.111	-26.287	5.00	136.00	15.00	0.00	15.00	2186.39	3.19	18.19	57	100	A
9	4	TruckA	1	Depot1	28.111	-26.287	0.00	0.00	15.00	0.00	15.00	0.00	0.00	15.00	57	100	A
9	4	TruckA	2	187	28.124	-26.281	0.00	118.00	115.00	5.00	115.00	2199.47	3.18	118.18	57	100	A
9	4	TruckA	3	Depot1	28.111	-26.287	5.00	136.00	15.00	0.00	15.00	2186.39	3.19	18.19	57	100	A
9	5	TruckA	1	Depot1	28.111	-26.287	0.00	0.00	15.00	0.00	15.00	0.00	0.00	15.00	57	100	A
9	5	TruckA	2	187	28.124	-26.281	0.00	118.00	115.00	5.00	115.00	2199.47	3.18	118.18	57	100	A
9	5	TruckA	3	Depot1	28.111	-26.287	5.00	136.00	15.00	0.00	15.00	2186.39	3.19	18.19	57	100	A
9	1	TruckB	1	Depot1	28.111	-26.287	0.00	0.00	15.00	0.00	15.00	0.00	0.00	15.00	94	100	A
9	1	TruckB	2	154	28.122	-26.272	0.00	120.00	50.00	5.00	50.00	3057.19	3.63	53.63	94	100	A
9	1	TruckB	3	Depot1	28.111	-26.287	5.00	138.00	15.00	0.00	15.00	2890.24	3.46	18.46	94	100	A
9	1	TruckB	4	Depot1	28.111	-26.287	0.00	138.00	15.00	0.00	15.00	0.00	0.00	15.00	94	100	A
9	1	TruckB	5	160	28.122	-26.273	0.00	207.00	65.00	5.00	65.00	3057.19	3.72	68.72	94	100	A
9	1	TruckB	6	Depot1	28.111	-26.287	5.00	226.00	15.00	0.00	15.00	2890.24	3.55	18.55	94	100	A
9	2	TruckB	1	Depot1	28.111	-26.287	0.00	0.00	15.00	0.00	15.00	0.00	0.00	15.00	94	100	A

These results are self-explanatory by the column names. All your various parameters that have been set resulted in optimized delivery per above.

You can also group by columns to see you results clearer per the below:

Summary

Grid

Pivot

Drag a column header here to group by that column

CLUSTER	Instance	Vehicle_ID	Sequence	Point	X	Y	Load	Arrival time
9	1	TruckA		1 Depot1	28.111	-26.287	0.00	0.00

Instance	Sequence	Point	X	Y	Load	Arrival time	Wait time	Demand	Delay	Distance	Travel time	Total time	Shift%	Capacity%	Pool
CLUSTER: 0															
Vehicle_ID: Truck1															
1	1	Depot2	28,142	-26,277	0,00	0,00	15,00	0,00	15,00	0,00	0,00	15,00	15,00	68	100 B
1	2	188	28,096	-26,340	0,00	60,00	40,00	5,00	40,00	11255,04	7,15	47,15	68	100 B	
1	3	Depot2	28,142	-26,277	5,00	82,00	15,00	0,00	15,00	13189,54	6,83	21,83	68	100 B	
1	4	Depot2	28,142	-26,277	0,00	82,00	15,00	0,00	15,00	0,00	0,00	15,00	68	100 B	
1	5	188	28,096	-26,340	0,00	142,00	40,00	5,00	40,00	11255,04	7,15	47,15	68	100 B	
1	6	Depot2	28,142	-26,277	5,00	164,00	15,00	0,00	15,00	13189,54	6,83	21,83	68	100 B	
2	1	Depot2	28,142	-26,277	0,00	0,00	15,00	0,00	15,00	0,00	0,00	15,00	68	100 B	
2	2	188	28,096	-26,340	0,00	60,00	40,00	5,00	40,00	11255,04	7,15	47,15	68	100 B	
2	3	Depot2	28,142	-26,277	5,00	82,00	15,00	0,00	15,00	13189,54	6,83	21,83	68	100 B	
2	4	Depot2	28,142	-26,277	0,00	82,00	15,00	0,00	15,00	0,00	0,00	15,00	68	100 B	
2	5	188	28,096	-26,340	0,00	142,00	40,00	5,00	40,00	11255,04	7,15	47,15	68	100 B	
2	6	Depot2	28,142	-26,277	5,00	164,00	15,00	0,00	15,00	13189,54	6,83	21,83	68	100 B	
CLUSTER: 1															
CLUSTER: 10															
CLUSTER: 11															

Cost Column in Results

In QVR, there is a Cost column that comes through in the results grid indicating total cost for each segment of a trip based on the vehicle used.

Instance	Point	X	Y	Load	Arrival time	Wait time	Demand	Delay	Distance	Travel time	Total time	Cost	Shift%	Capacity%	Pool
1	Depot1	28,111	-26,287	0,00	0,00	15,00	0,00	15,00	0,00	0,00	15,00	0,00	56	100	A
1	187	28,124	-26,281	0,00	117,00	115,00	5,00	115,00	2158,60	2,25	117,25	4321,69	56	100	A
1	Depot1	28,111	-26,287	5,00	134,00	15,00	0,00	15,00	2164,10	2,24	17,24	4332,68	56	100	A
2	Depot1	28,111	-26,287	0,00	0,00	15,00	0,00	15,00	0,00	0,00	15,00	0,00	56	100	A
2	187	28,124	-26,281	0,00	117,00	115,00	5,00	115,00	2158,60	2,25	117,25	4321,69	56	100	A
2	Depot1	28,111	-26,287	5,00	134,00	15,00	0,00	15,00	2164,10	2,24	17,24	4332,68	56	100	A
3	Depot1	28,111	-26,287	0,00	0,00	15,00	0,00	15,00	0,00	0,00	15,00	0,00	56	100	A
3	187	28,124	-26,281	0,00	117,00	115,00	5,00	115,00	2158,60	2,25	117,25	4321,69	56	100	A
3	Depot1	28,111	-26,287	5,00	134,00	15,00	0,00	15,00	2164,10	2,24	17,24	4332,68	56	100	A
4	Depot1	28,111	-26,287	0,00	0,00	15,00	0,00	15,00	0,00	0,00	15,00	0,00	56	100	A
4	187	28,124	-26,281	0,00	117,00	115,00	5,00	115,00	2158,60	2,25	117,25	4321,69	56	100	A
4	Depot1	28,111	-26,287	5,00	134,00	15,00	0,00	15,00	2164,10	2,24	17,24	4332,68	56	100	A
5	Depot1	28,111	-26,287	0,00	0,00	15,00	0,00	15,00	0,00	0,00	15,00	0,00	56	100	A
5	187	28,124	-26,281	0,00	117,00	115,00	5,00	115,00	2158,60	2,25	117,25	4321,69	56	100	A
5	Depot1	28,111	-26,287	5,00	134,00	15,00	0,00	15,00	2164,10	2,24	17,24	4332,68	56	100	A
1	Depot1	28,111	-26,287	0,00	0,00	15,00	0,00	15,00	0,00	0,00	15,00	0,00	93	100	A
1	154	28,122	-26,272	0,00	120,00	50,00	5,00	50,00	3174,80	2,95	52,95	3177,75	93	100	A
1	Depot1	28,111	-26,287	5,00	138,00	15,00	0,00	15,00	2986,90	2,79	17,79	2989,69	93	100	A

This cost will be a total cost based on the figures you specify in the Distance Cost Factor and Time Cost Factor fields in your Vehicle tab of your input sheet.

Point Columns		Vehicle columns					
Unique ID:	Vehicle_ID	Start Point:	Start	End Point:	End	Pool:	Pool
Travel time factor:	Travel Time Factor	Shift time:	Shift	Capacity:	Capacity	Priority:	Priority
Time Cost Factor:	Time Cost Factor	Distance Cost Factor:	Distance Cost Factor	Type:	<None>		

	A	B	C	D	E	F	G	H	I	J	K
1	Vehicle_ID	Instance	Start	End	Capacity	Shift	Travel Time Factor	Time Cost Factor	Distance Cost Factor	Priority	Pool
2	TruckA	20	Depot1	Depot1	5	240		2	2	6	A
3	TruckB	20	Depot1	Depot1	5	240		1	1	1	A
4	Truck1	20	Depot2	Depot2	5	240	0.5	1	1	1	B

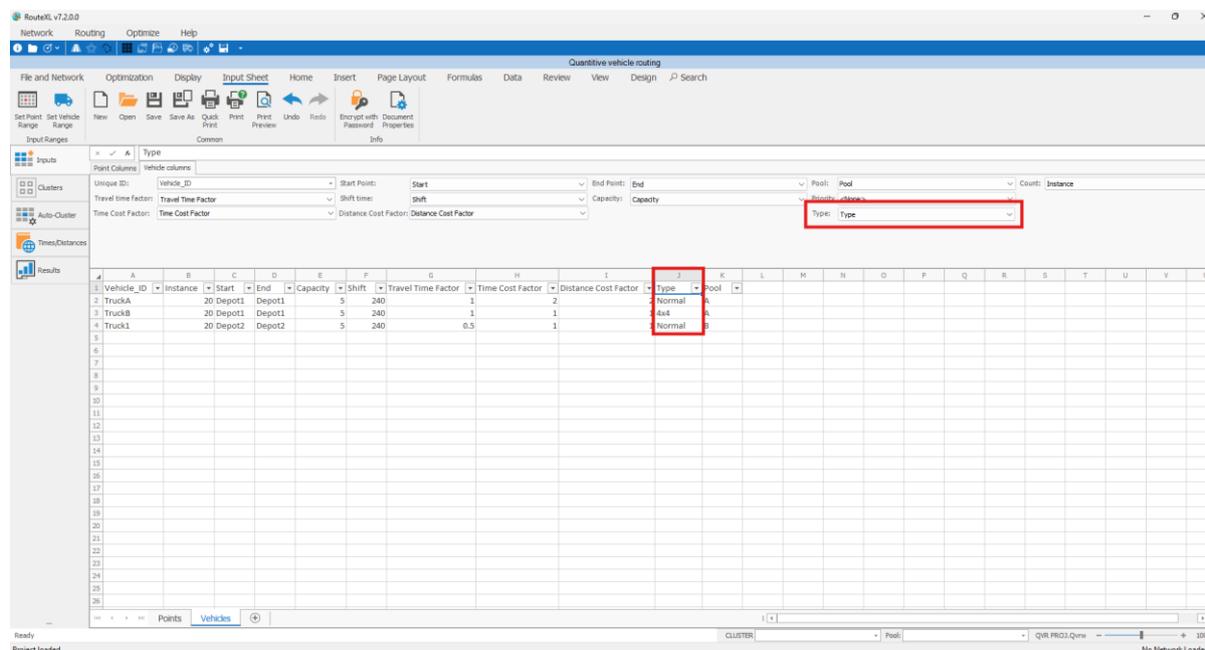
The cost unit is whatever you choose it to mean, such as dollars, per unit of time and distance that your routing network that you are using is built on.

For example, if I am using a routing network that is built on meters, and the cost unit I want to use is cents, then if I put a 1 in the Distance Cost Factor field of my vehicle input sheet, then this indicates a cost of 1 cent per 1 meter travelled.

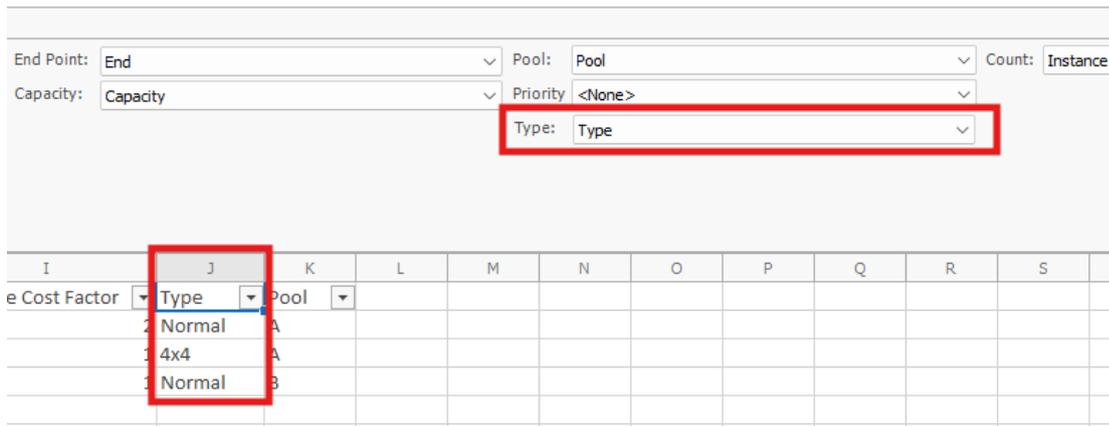
If the routing network I am using is built on time units of minutes, then if I put a 1 in the Time Cost Factor field of the vehicle input sheet then this indicates a cost of 1 cent for every minute spent travelling by the vehicle.

Allowed Vehicles and Type Columns

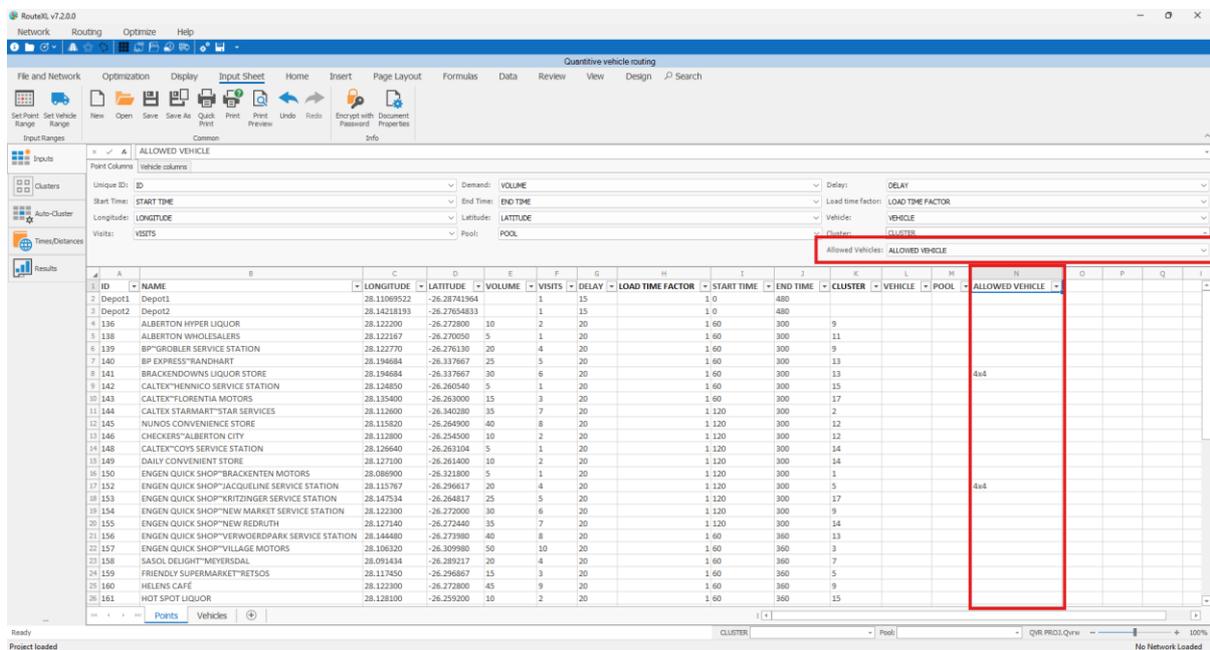
You can specify a vehicle as a specific type, for example, '4x4', for travelling to locations in rugged terrains. This is done using a 'Type' column in the Vehicle Columns tab.



QVR User Guide



Then, in your Point Columns tab, you will use an 'Allowed Vehicles' column to specify what type of vehicle *must* be used when visiting a certain point. If you leave any fields in this column blank, then that point can be visited by any vehicle.



Delay: DELAY

Load time factor: LOAD TIME FACTOR

Vehicle: VEHICLE

Cluster: CLUSTER

Allowed Vehicles: ALLOWED VEHICLE

	K	L	M	N
	CLUSTER	VEHICLE	POOL	ALLOWED VEHICLE
9				
11				
9				
13				
13			4x4	
15				
17				
2				
12				
12				
14				
14				
1				
5			4x4	
17				

Frequency-Driven Multi-Visits

You can precisely *stagger* visits to points that need to be visited multiple times over a certain period.

For example, you may want a point to be visited 4 times over a 4-week period, and you want each visit to be staggered into a different week.

Example: Here are route results where we have point 10006 that needed to be visited 4 times, staggered into separate weeks.

Instance	Vehicle	Sequence	Point	X	Y
1	Day5	6	100006	28.223	-26.161
1	Day9	17	100006	28.223	-26.161
1	Day11	4	100006	28.223	-26.161
1	Day17	18	100006	28.223	-26.161

Example Input: In your input, you simply set your “Visits” field to the column specifying the frequency of visits to the point:

QVR User Guide

Point Columns | Vehicle columns

Unique ID: Account | Demand: <None> | Delay: <None>

Start Time: <None> | End Time: <None> | Load time factor: <None>

Longitude: Longitude | Latitude: Latitude | Vehicle: Vehicle

Visits: Call Frequency | Pool: Pool | Cluster: | Allowed Vehicles: Allowed Vehicles

	A	B	C	D	E	G	H	I	J	K
1	Account	Latitude	Longitude	Call Frequency	Vehicle	Allowed Vehicles				
2	Depot	-25.99189278	28.09732065	1						
3	100001	-26.17	28.23	1						
4	100002	-26.17	28.21	2		w2/w4				
5	100003	-26.17	28.21	1						
6	100004	-26.17	28.22	1						
7	100005	-26.17	28.20	1						
8	100006	-26.16	28.22	4		w1/w2/w3/w4				
9	100007	-26.16	28.17	1						
10	100008	-26.16	28.21	1						
11	100009	-26.16	28.18	1						
12	100010	-26.16	28.18	1						
13	100011	-26.15	28.17	1						
14	100012	-26.15	28.17	1						
15	100013	-26.15	28.16	4		w1/w2/w3/w4				
16	100014	-26.15	28.19	1						
17	100015	-26.15	28.19	1						
18	100016	-26.15	28.18	1						
19	100017	-26.14	28.22	1						
20	100018	-26.14	28.15	2		w2/w4				
21	100019	-26.14	28.18	2		w2/w4				
22	100020	-26.13	28.15	2		w2/w4				

Then, in the Vehicles sheet, you have a vehicle representing each day of the period you are routing over. You then make a vehicle type representing each week using the Vehicles “Type” field:

QVR User Guide

Point Columns Vehicle columns

Unique ID: Vehicle Start Point: Start End Point: End Pool: <None> Count: Instance

Travel time factor: <None> Shift time: Shift Capacity: <None> Priority: <None>

Time Cost Factor: <None> Distance Cost Factor: <None> Type: Type

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Vehicle	Start	End	Shift	Instance	Type								
2	Day1	Depot	Depot		120	1 w1								
3	Day2	Depot	Depot		120	1 w1								
4	Day3	Depot	Depot		120	1 w1								
5	Day4	Depot	Depot		120	1 w1								
6	Day5	Depot	Depot		120	1 w1								
7	Day6	Depot	Depot		120	1 w2								
8	Day7	Depot	Depot		120	1 w2								
9	Day8	Depot	Depot		120	1 w2								
10	Day9	Depot	Depot		120	1 w2								
11	Day10	Depot	Depot		120	1 w2								
12	Day11	Depot	Depot		120	1 w3								
13	Day12	Depot	Depot		120	1 w3								
14	Day13	Depot	Depot		120	1 w3								
15	Day14	Depot	Depot		120	1 w3								
16	Day15	Depot	Depot		120	1 w3								
17	Day16	Depot	Depot		120	1 w4								
18	Day17	Depot	Depot		120	1 w4								
19	Day18	Depot	Depot		120	1 w4								
20	Day19	Depot	Depot		120	1 w4								
21	Day20	Depot	Depot		120	1 w4								

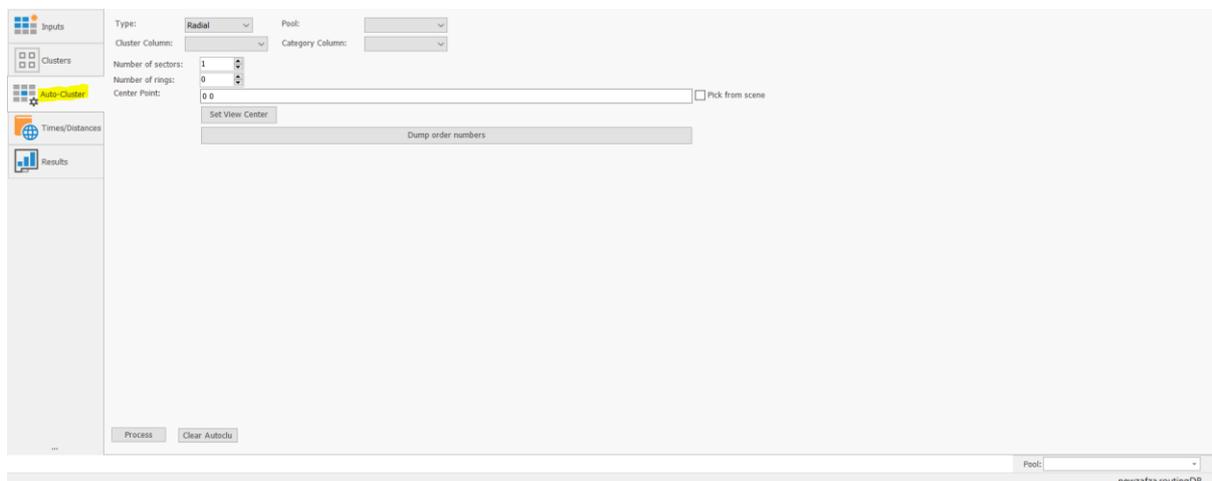
Finally, in the Points sheet you match up the vehicle types to each multi-visit point and enter in “w2/w4” etc. in the “Allowed Vehicles” field you set up:

Point Columns		Vehicle columns									
Unique ID:	Account	Demand:	<None>	Delay:	<None>						
Start Time:	<None>	End Time:	<None>	Load time factor:	<None>						
Longitude:	Longitude	Latitude:	Latitude	Vehicle:	Vehicle						
Visits:	Call Frequency	Pool:	Pool	Cluster:							
				Allowed Vehicles:		Allowed Vehicles					

	A	B	C	D	E	G	H	I	J	K
1	Account	Latitude	Longitude	Call Frequency	Vehicle	Allowed Vehicles				
2	Depot	-25.99189278	28.09732065		1					
3	100001	-26.17	28.23		1					
4	100002	-26.17	28.21		2	w2/w4				
5	100003	-26.17	28.21		1					
6	100004	-26.17	28.22		1					
7	100005	-26.17	28.20		1					
8	100006	-26.16	28.22		4	w1/w2/w3/w4				
9	100007	-26.16	28.17		1					
10	100008	-26.16	28.21		1					
11	100009	-26.16	28.18		1					
12	100010	-26.16	28.18		1					
13	100011	-26.15	28.17		1					
14	100012	-26.15	28.17		1					
15	100013	-26.15	28.16		4	w1/w2/w3/w4				
16	100014	-26.15	28.19		1					
17	100015	-26.15	28.19		1					
18	100016	-26.15	28.18		1					
19	100017	-26.14	28.22		1					
20	100018	-26.14	28.15		2	w2/w4				
21	100019	-26.14	28.18		2	w2/w4				
22	100020	-26.13	28.15		2	w2/w4				

Auto Cluster

There is an option of clustering your points radially using Auto-Cluster in QVR. In this case you need to set up a blank Cluster column in your Points sheet so your cluster numbers can populate there. The number of clusters created depends on your Shift Time in your Vehicles sheet. The shorter the shift time the more clusters will be created that fits the shift time. (I used 60 min as an example)



Then set up your fields as below:

Inputs Clusters Auto-Cluster Times/Distances

Type: Radial Pool:

Cluster Column: Cluster Auto cluster type Category Column:

Number of sectors: 0

Number of rings: 1

Center Point: 0 0

Set View Center

Inputs Clusters

Type: Radial Pool: A

Cluster Column: Cluster Cluster column to set with autocluster values Category Column: <None>

Number of sectors: 0

Number of rings: 1

Inputs Clusters Auto-Cluster

Type: Radial Pool: A Pool to use in autocluster calculation

Cluster Column: Cluster Category Column: <None>

Number of sectors: 0

Number of rings: 1

Center Point: 0 0

Inputs Clusters Auto-Cluster

Type: Radial Pool: A

Cluster Column: Cluster Category Column: <None> Column to use to autocluster in categories

Number of sectors: 0

Number of rings: 1

Center Point: 0 0

Inputs Clusters Auto-Cluster

Type: Radial Pool: A

Cluster Column: Cluster Category Column: <None>

Number of sectors: 0 Number of sectors in first circle

Number of rings: 1

Center Point: 0 0

(This as a default works well. You can adjust as necessary)

Inputs Clusters Auto-Cluster

Type: Radial Pool: A

Cluster Column: Cluster Category Column: <None>

Number of sectors: 0

Number of rings: 1 Number of rings, first circle is counted as a ring

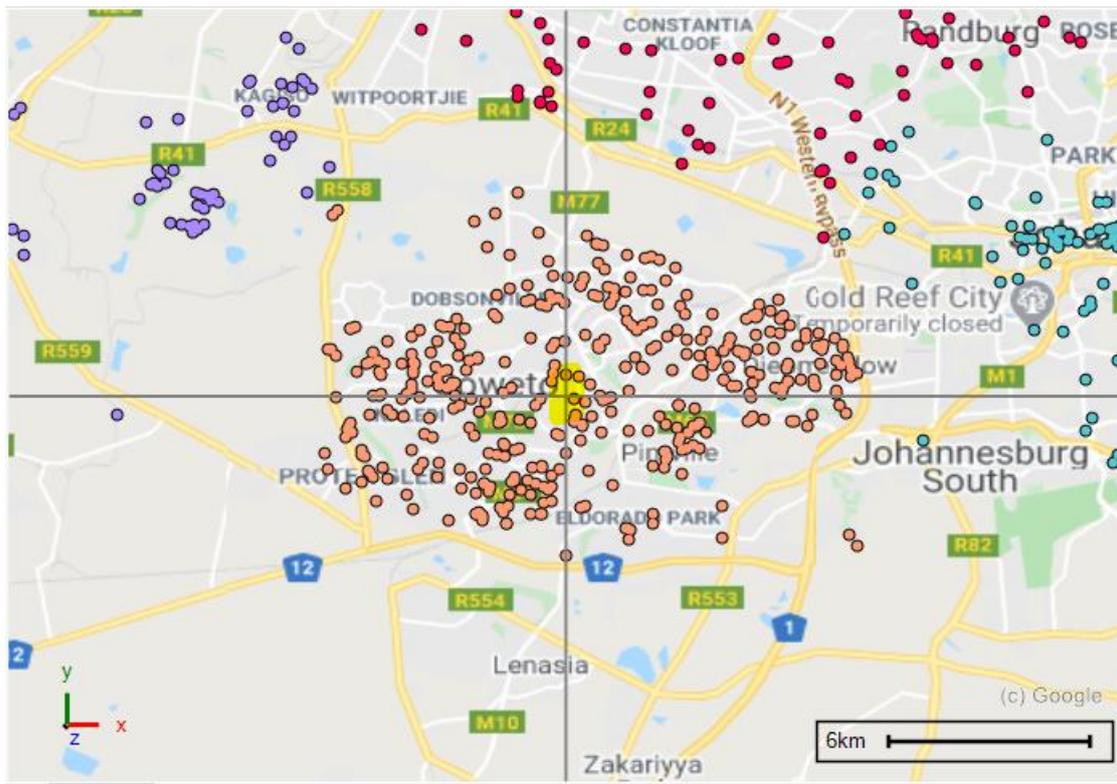
Center Point: 2

Set View Center

(This as a default works well. You can adjust as necessary)

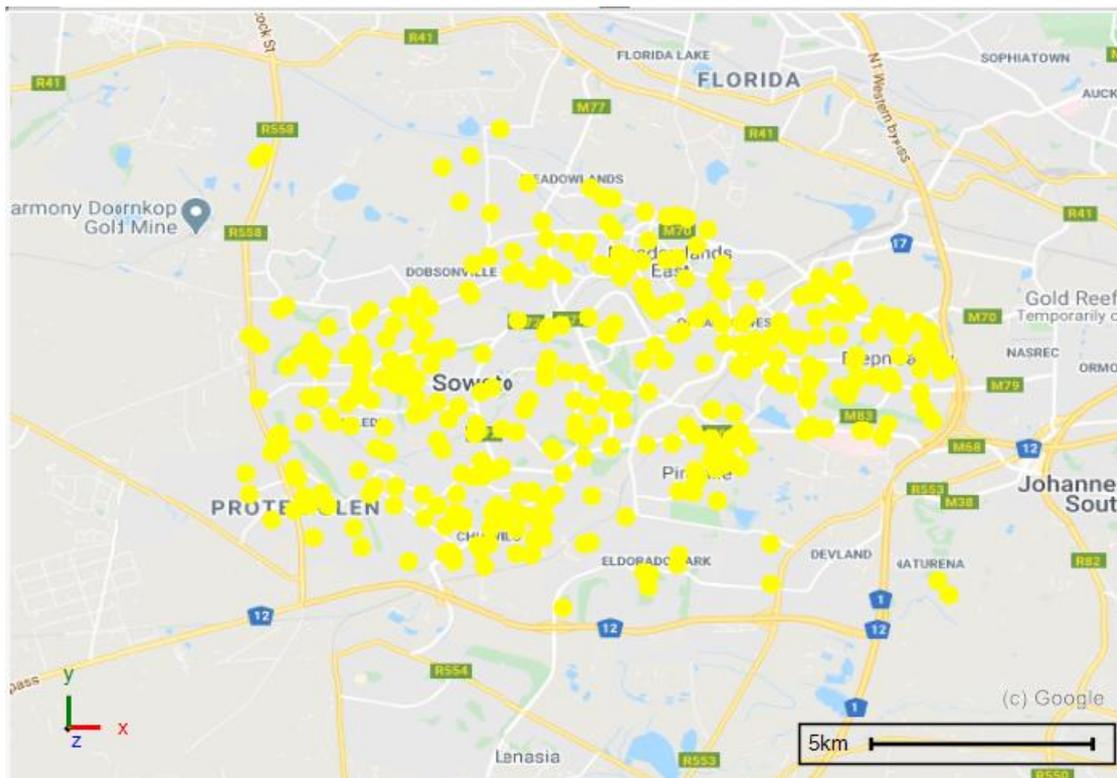
	Type: Radial	Pool: A
	Cluster Column: Cluster	Category Column: <None>
	Number of sectors: 0	Number of rings: 1
	Center Point: 27.874739682766 -26.2513312554667	<input type="checkbox"/> Pick from scene
	<input type="button" value="Set View Center"/>	Centre point coordinates

	Type: Radial	Pool: A
	Cluster Column: Cluster	Category Column: <None>
	Number of sectors: 0	Number of rings: 1
	Center Point: 27.874739682766 -26.2513312554667	
	<input type="button" value="Set View Center"/>	Set the active view center to this center point. Clicking twice toggles crosshair display



(You would usually have your crosshair centred where your depot would be.)

Go to your Display tab and select Points. (A QVRW Points layer will be added.)
Use a selection tool and select the points on your map you are wanting to radially cluster.



Click on Process. You will see at the bottom left of your window when it is complete.

Inputs

Clusters

Auto-Cluster

Times/Distances

Results

Type: Radial Pool: A

Cluster Column: Cluster Category Column: <None>

Number of sectors: 0

Number of rings: 1

Center Point: 27.8756982809901 -26.2518105545787 Pick from scene

Set View Center

Dump order numbers

Process Clear Autoclu

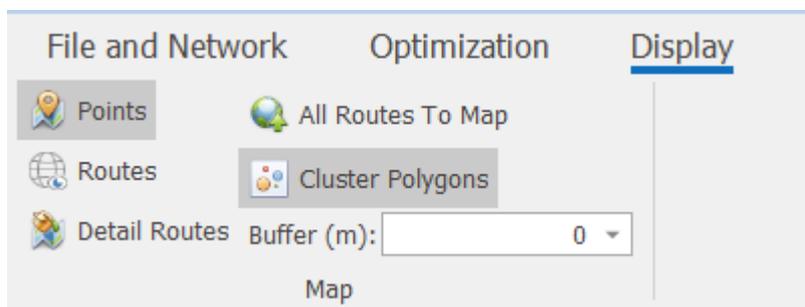
Cluster

Autocluster complete

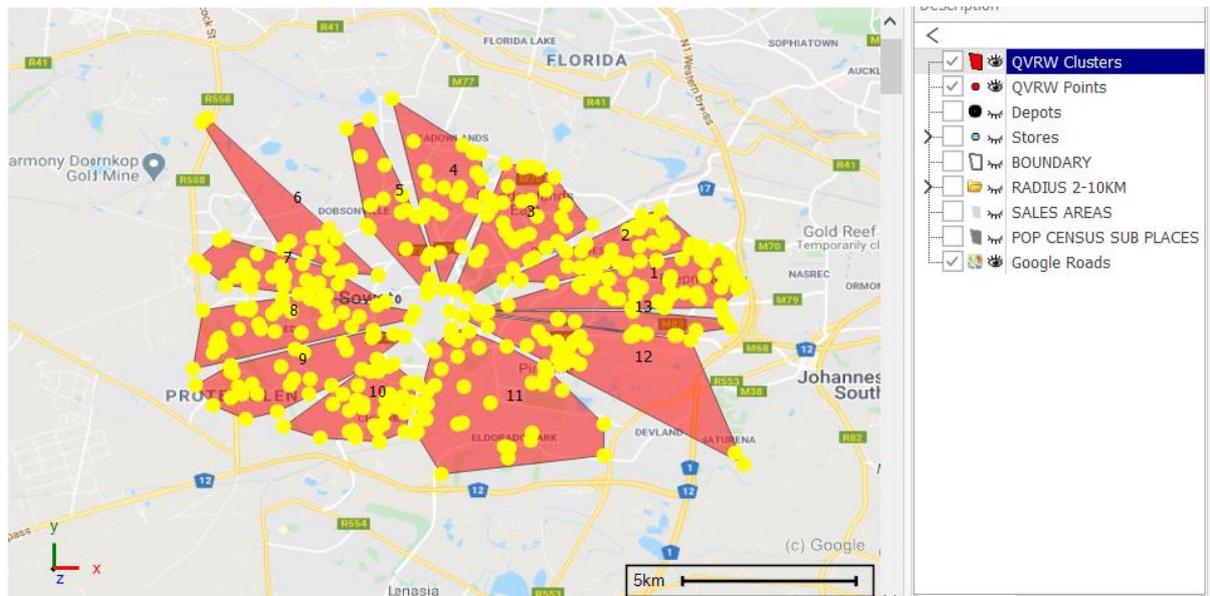
Your cluster numbers are populated in your Cluster column in your Points sheet.

	W	X	Y	Z	AA	AB	A
1	Cluster						
2	11						
3	11						
4	11						
5	11						
6	11						
7	11						
8	11						
9	11						
10	11						
11	11						
12	11						
13	11						
14	9						
15	6						
16	13						
17	9						
18	2						
19	5						

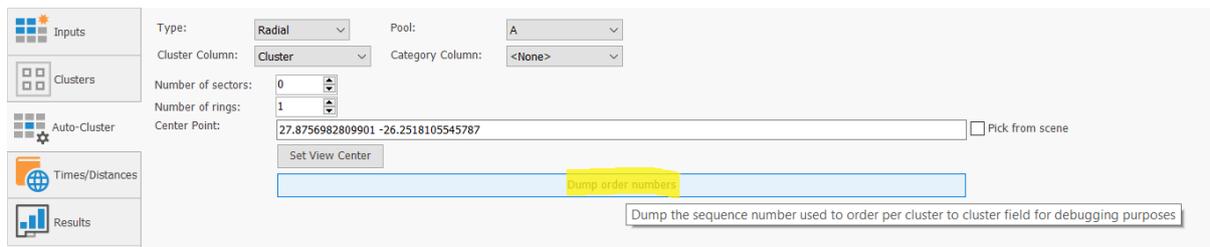
Click on Cluster Polygons in your Display tab to see your polygons drawn on your map.



A QVRW Clusters layer will be added where you can view your data etc. 13 clusters were drawn in this example.



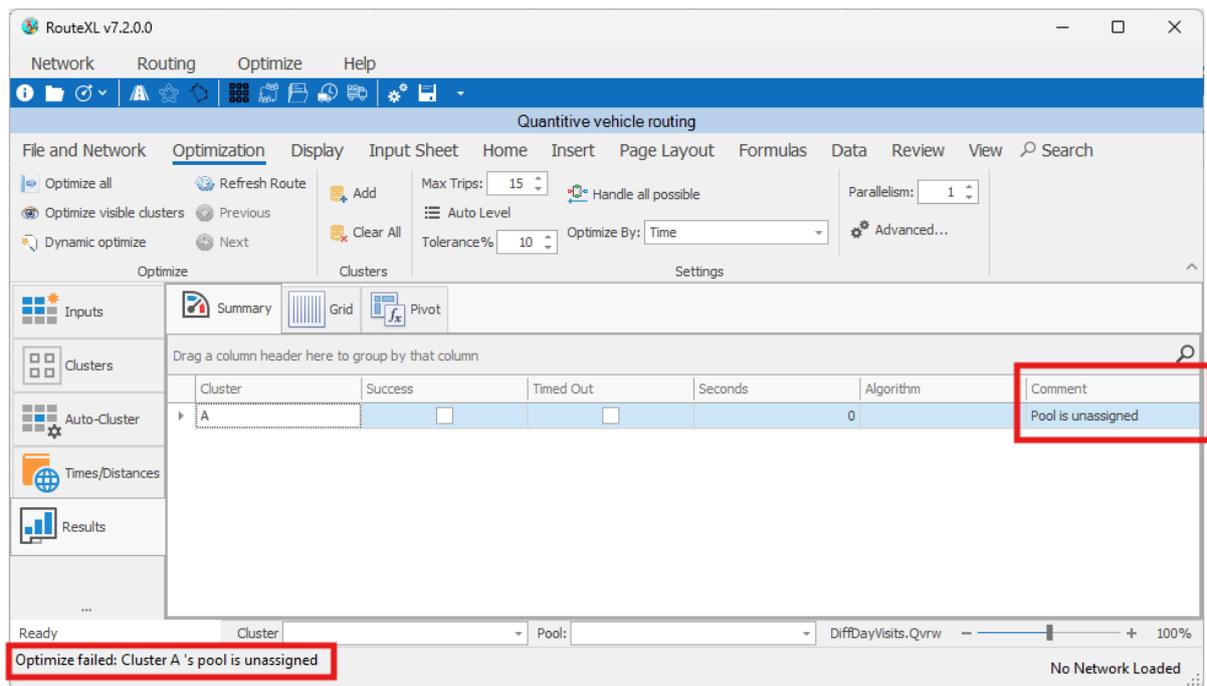
There is also an option of Dumping order numbers if that is needed.



Troubleshooting

QVR Route Optimization Fail

If an optimization fails, you will see a message indicating the reason in the Comment column of the Results Summary tab. The status bar at the bottom left of the window gives full details:

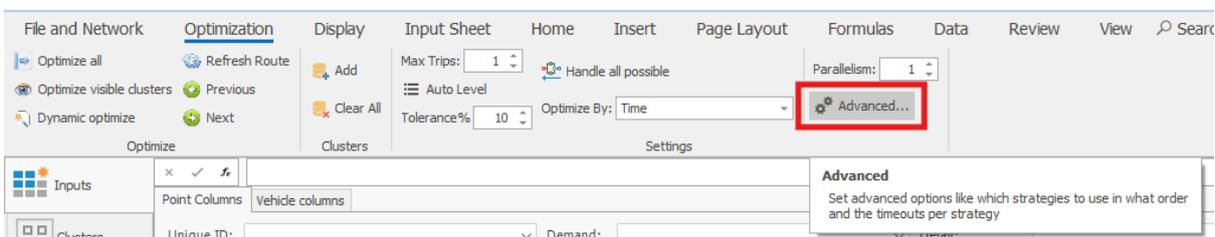


Most of the time this message will tell you clearly what needs to be fixed, such as not enough shift time to get a solution or that you need to assign your pools to your clusters etc.

Below is a list of failure messages you could get that may not be as clear, along with explanations.

RoutingFailTimeout: Ran out of time trying to find any solution. In the case of timeout, extending the timeout or adding more algorithms could help.

Go to the Optimization tab>Settings group>Advanced button and set the timeout next to your algorithms to a greater number and/or add more algorithms.



RoutingInvalid: Some parameters are incorrect. (Usually, the front end will pick this up at validation stage.)

RoutingInfeasible: No solution given the input parameters.

RoutingFail: Unable to find a solution but a solution is probably possible.

In the case of RoutingFail, adding more algorithms (Optimization tab>Settings group>Advanced button) could help in getting a solution.

QVR Log

In the case of any error, please provide PrimeThought with the QVR log and send it to Support@PrimeThought.biz.

The QVR log can be found here on your machine: C:\Users\

Support



T: +27871354351

support@primethought.biz - primethought.biz

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