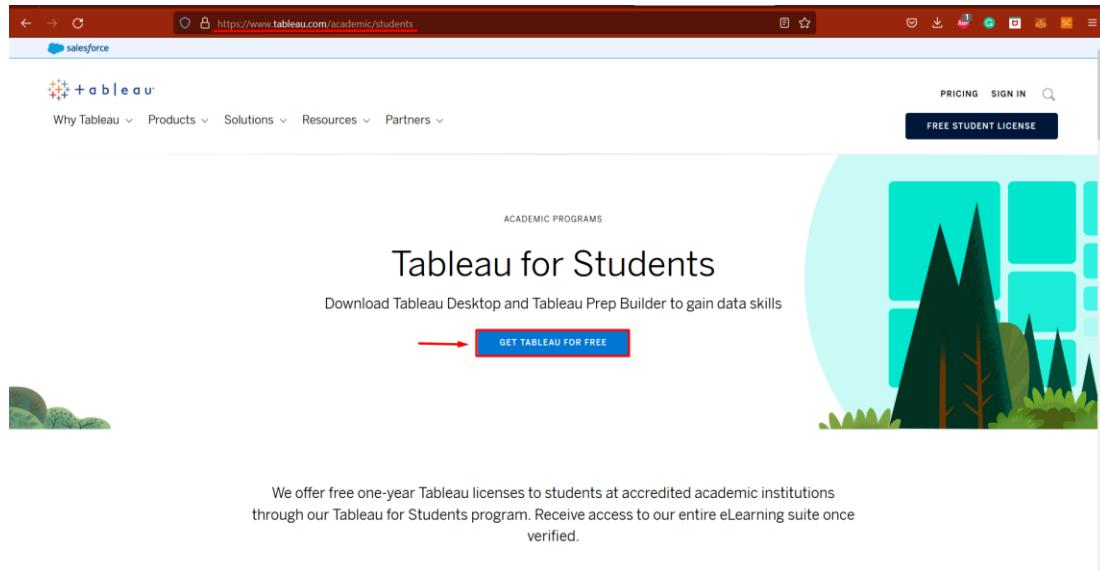


Module 3 Project**TABLE OF CONTENTS**

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I. Installing Tableau Desktop

For this project, we would need to install Tableau for exploring and analyzing our data. We head over to the Tableau official website where we can download Tableau for Students, <https://www.tableau.com/academic/students>. Click on **GET TABLEAU FOR FREE**.



A prompt will appear asking to complete a form to confirm your eligibility. Input the required information then click on **VERIFY STUDENT STATUS**.

A screenshot of a web browser showing the Tableau student license application form. The page has a dark background with a green bird illustration on the left. At the top, there is a message "You're almost there!" and a link "Are you an instructor? Visit tableau.com/teaching to request your license.". Below this, there is a section titled "Personal information" with fields for "Legal First Name*" (Alyssa Mae), "Legal Last Name*" (Pepito), "Email*" (ammpepito@mymail.mapua.edu.ph), "Confirm Email*" (ammpepito@mymail.mapua.edu.ph), and "Date of birth*" (July 14, 2001). There is also a note: "Students at accredited academic institutions worldwide are eligible for a free one-year license to activate Tableau Desktop and Tableau Prep. Complete the form below to confirm your eligibility and unlock your new free license. You must be 16 years of age or older to request a license." A link "How does verifying work?" is also present.

Email*
ammpepito@mymail.mapua.edu.ph

Confirm Email*
ammpepito@mymail.mapua.edu.ph

Date of birth*
July 14 2001

School Information
School Name*
Mapua University (Intramuros, Manila)

Anticipated Graduation Year*
August 2023

How will you be using your Tableau license?*
Learning as a part of a course

VERIFY STUDENT STATUS

We offer free one-year Tableau licenses to students and recent graduates through our Tableau for Students program. [Are you an instructor?](#) Visit [tableau.com/teaching](#) to request your license.

Information entered into this web form will be used for verification purposes. The information will be shared with Tableau. All use of Tableau products must comply with United States export control and economic sanction laws. [Tableau Privacy Policy](#)

Verification services powered by SheerID. [SheerID FAQs](#)

Sign into your school's web portal to get a Tableau product key.

SIGN IN

FREE STUDENT LICENSE

Verify using your school credentials

Please sign in to your school's web portal. It will open in a new tab.

Tableau for Students

Download Tableau Desktop and Tableau Prep Builder to gain data skills

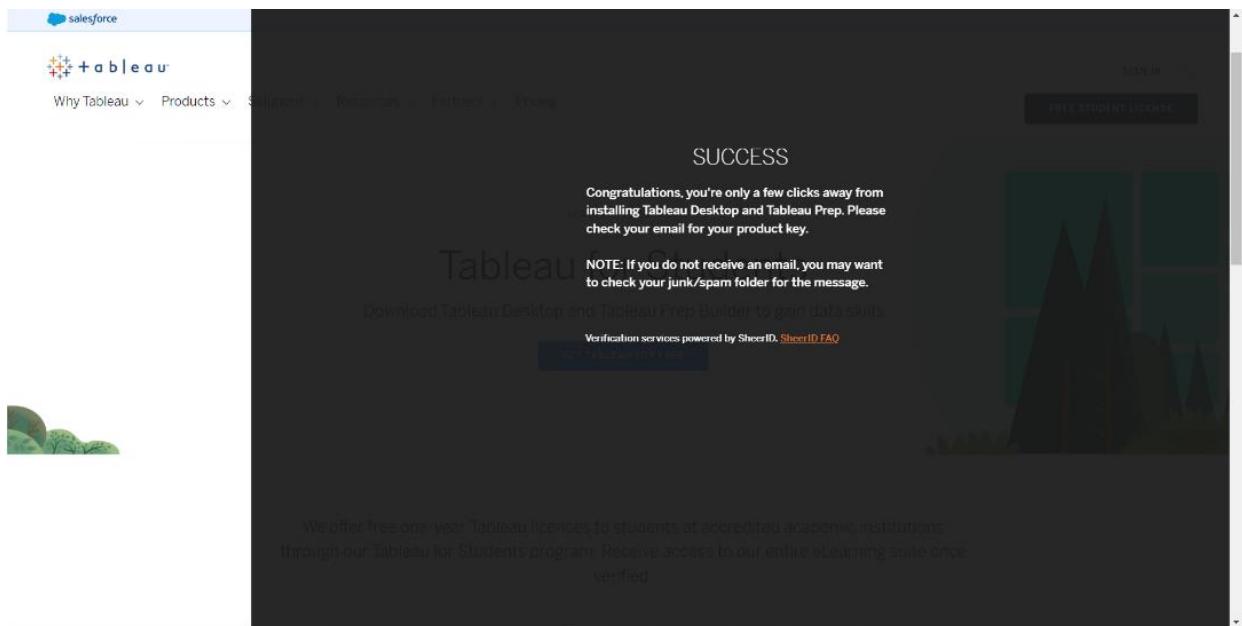
Sign in to my school

By clicking, I consent to processing my information for the purpose of verifying my eligibility as described within the [\[CompanyName\] Privacy Policy](#). I understand that my information will be shared with Tableau. Your information will be transferred to the United States and will be treated according to SheerID's privacy policy.

We offer free one-year Tableau licenses to students and recent graduates through our Tableau for Students program. [Are you an instructor?](#) Visit [tableau.com/teaching](#) to request your license.

Verification services powered by SheerID. [SheerID FAQs](#)

After successfully signing in, it will prompt you to check your email for the product key.



The email should look like the image below. Take note of your product key and click on **Download Tableau Desktop**.

Your Tableau Desktop Product Key is Enclosed

Some content in this message has been blocked because the sender isn't in your Safe senders list.
[I trust content from verify@sheerid.com.](#) | [Show blocked content](#)

SV SheerID Verification (On Behalf of Tableau) <Verify@SheerID.com>
To: ALYSSA MAE M. PEPITO
Wed 2/2/2022 12:37 AM

You don't often get email from verify@sheerid.com. [Learn why this is important](#)

Hi Alyssa Mae,

Please retain this email for your records. You will need the product key and instructions enclosed.

Welcome to Tableau for Students! Your academic license now includes Tableau Desktop, Tableau Prep, and eLearning for free.

The product key below can be used to activate both [Tableau Desktop](#) and [Tableau Prep](#) on two separate computers, Windows or Mac. This key will expire in one year.

- [Download Tableau Desktop](#)
- [Download Tableau Prep](#)
- Activate with your product key: **TCAD-F917-5E60-0369-E4A5**
- If you're receiving the error "product key is invalid" visit the [knowledge base page](#) to resolve your issue.

Get started with free eLearning online self-paced courses:

The link will direct you to this webpage from Tableau. Fill in the required fields and click on **DOWNLOAD FREE TRIAL**.

Tableau Desktop: Start your free 14-day trial

Almost there!

It only takes 15 seconds to fill out. If you're already registered, [sign in](#).

First Name
Alyssa Mae

Last Name
Pepito

Business E-mail
ammpepito@mymail.mapua.edu.ph

Organization
Mapúa University

Company Size
201 - 10,000 employees

Department
IT

Job Role
Student

Country/Region
Philippines

Phone
+63 966 931 8206

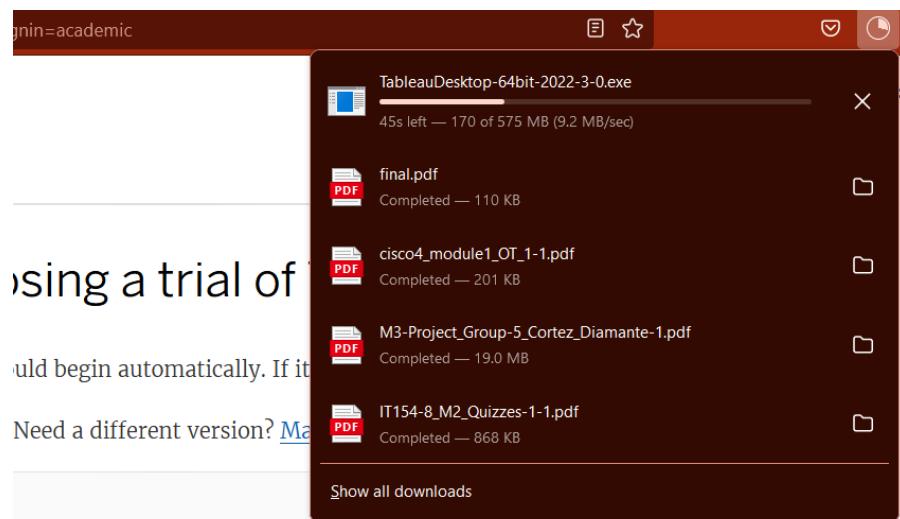
Yes, I would like to receive marketing communications regarding Salesforce products, services, and events. I can unsubscribe at any time.

By registering, you confirm that you agree to the processing of your personal data by Salesforce as described in the [Privacy Statement](#).

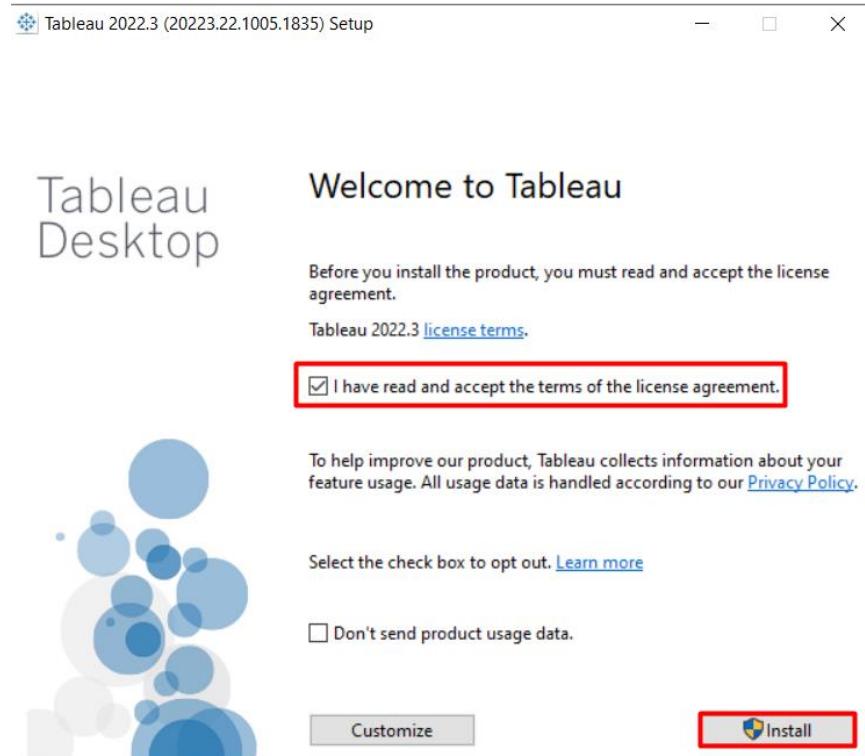
 [DOWNLOAD FREE TRIAL](#)

WE RESPECT YOUR PRIVACY | HAVING TROUBLE? STUDENT OR TEACHER? GET A FREE 1-YEAR LICENSE. LEARN

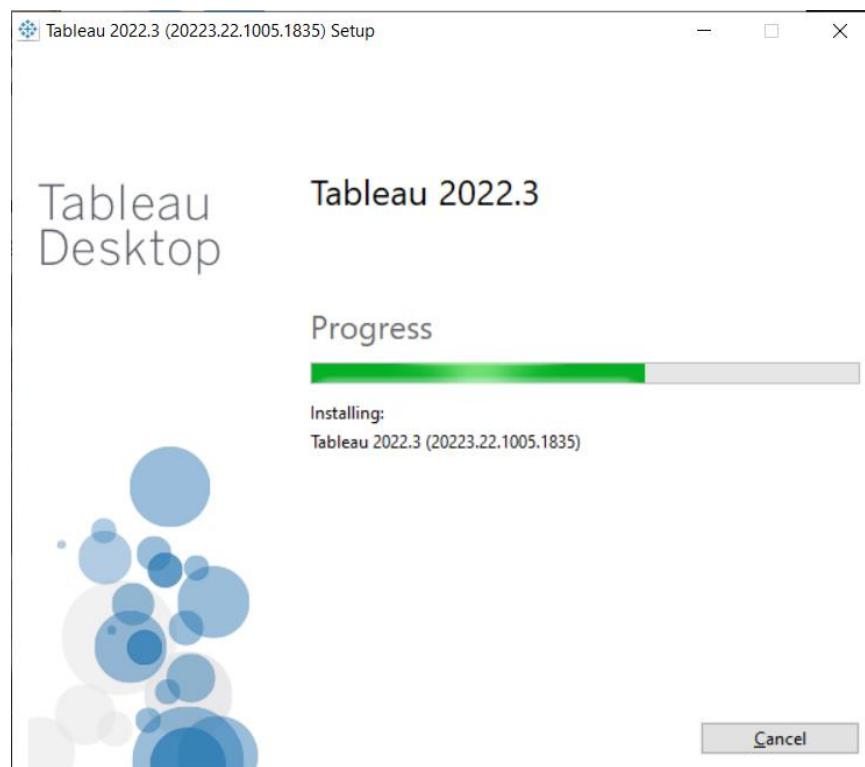
Tableau will then start downloading. Wait for it to finish and then click on it.



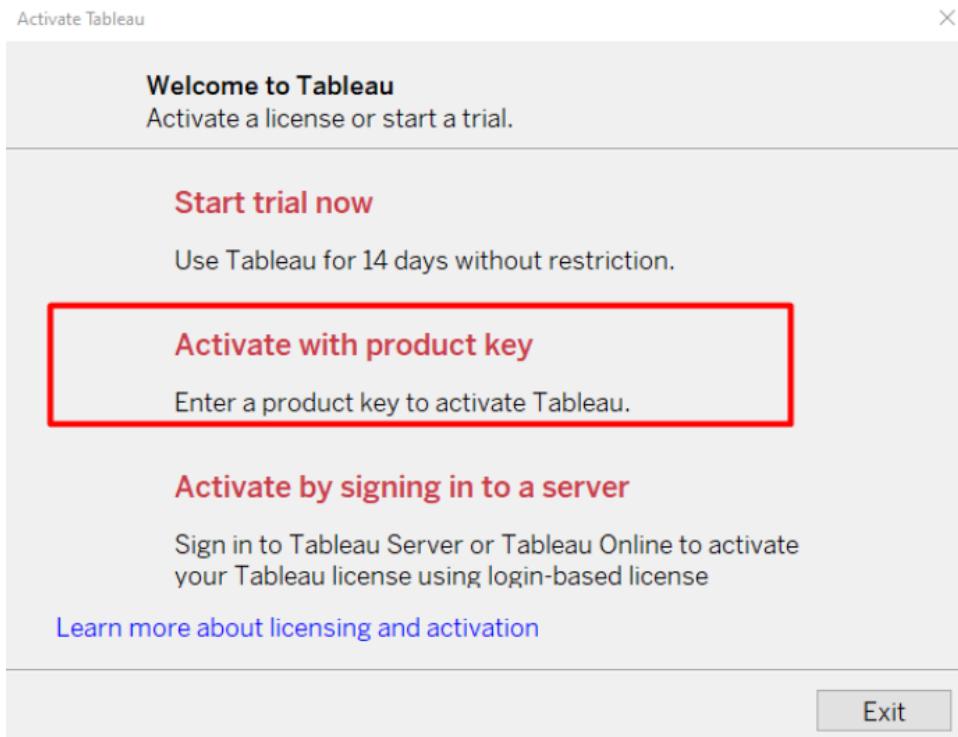
The Tableau wizard setup will open. Check mark the box next to the “I have read and accept the terms of the license agreement.” and then click on **Install**.



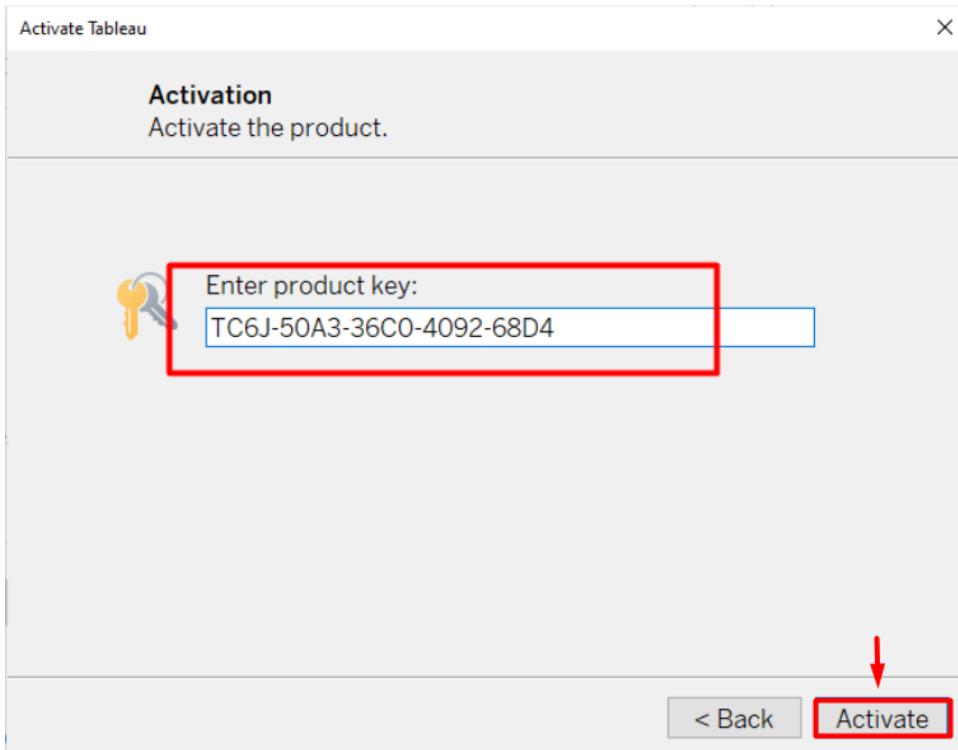
Now we must wait for Tableau to install.



After installation, it will prompt you to activate a license or start a trial. Here we must click on **Activate with product key**.



Then input your product key here and click on Activate.



If successfully activated, it will prompt you to register. Fill out the required fields and then click on **Register**.

Activate Tableau

 **Registration**
Complete all fields for the registered user.

First Name Alyssa Mae	Last Name Pepito	Organization Mapua University
Email alyssamaepp2@gmail.com		
Country/Region Philippines	State/Province	Company Size 201 - 10,000 employees

Yes, I would like to receive marketing communications regarding Salesforce products, services, and events. I can unsubscribe at any time.

By registering you confirm that you agree to the processing of your personal data as described in the [Salesforce Privacy Statement](#)

Register

Once registration is complete click on **Continue**.

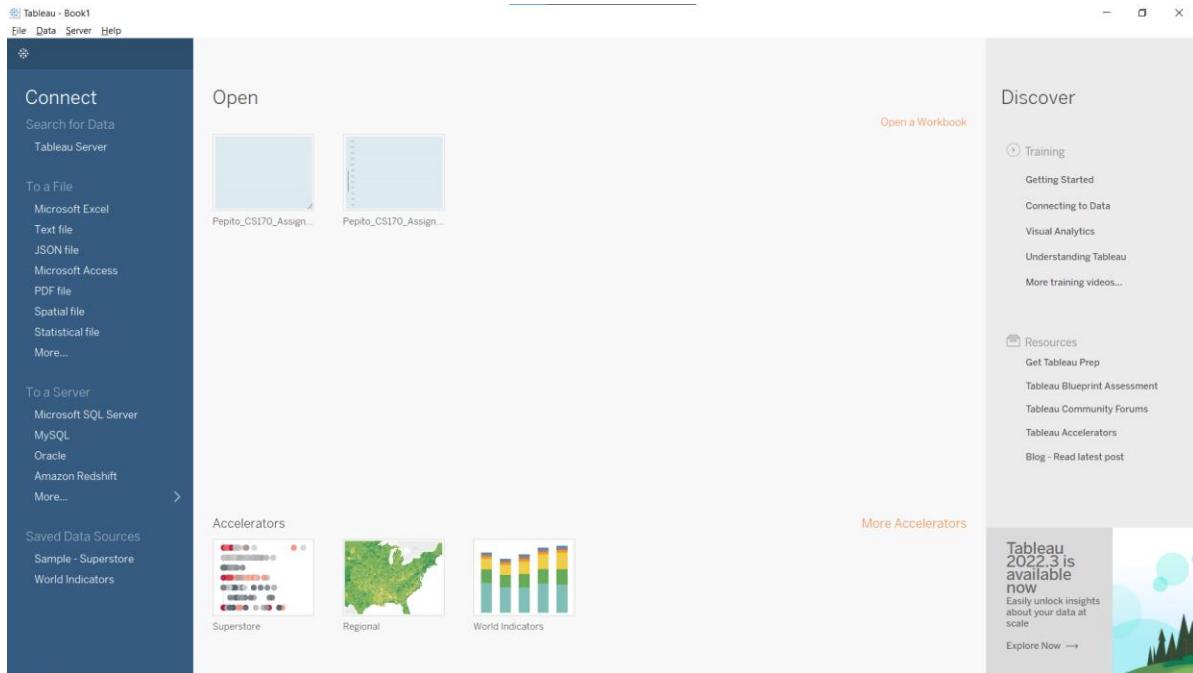
Activate Tableau

 **Registration**
Start using the product.

 Registration completed.

Continue

Tableau is now ready for use.



II. Downloading and installing the Cassandra ODBC Driver

Before establishing a connection between Apache Cassandra and Tableau, the [Cassandra ODBC Driver](#) should be downloaded first.

The landing page for the CData Cassandra ODBC Driver. At the top, there's a navigation bar with 'cdata' logo, 'Platform', 'Solutions', 'Connectors', 'Support', 'Resources', 'Company', 'Search', and 'Chat'. The main title is 'Cassandra ODBC Driver' with the subtitle 'Read, Write, and Update Cassandra through ODBC'. It says 'Easily connect live Apache Cassandra data with BI, ETL, Reporting, & Custom Apps.' Below this are two orange buttons: 'Download' and 'Buy Now'. A link 'Other Technologies →' is also present. On the right side, there's a large graphic featuring a stylized eye icon with the word 'cassandra' underneath it, set against a blue background with abstract data visualization elements. At the bottom, a box contains the text: 'The Apache Cassandra ODBC Driver is a powerful tool that allows you to connect with live data from Apache Cassandra NoSQL database, directly from any applications that support ODBC connectivity. Access Cassandra data like you would a database - read, write, and update NoSQL tables through a standard ODBC Driver interface.'

Select *Download Trial* to download the driver without paying any fees.

The screenshot shows the CData Software website. At the top, there's a navigation bar with links for Platform, Solutions, Connectors, Support, Resources, and Company. To the right of the navigation are search and chat icons. Below the navigation, there's a row of icons for various connectors: ODBC, JDBC, ADO.NET, Python, SSIS, Excel, Power BI, Tableau, CMQLETS, Firedac, Sync, Docs, Free Trial, and Buy Now. The main content area is titled "ODBC Driver Download:" and features a sub-section for "Cassandra ODBC Driver". It includes a screenshot of the software interface, a brief description, and download buttons for Windows, Mac, and Unix. The "Windows" button is highlighted in blue.

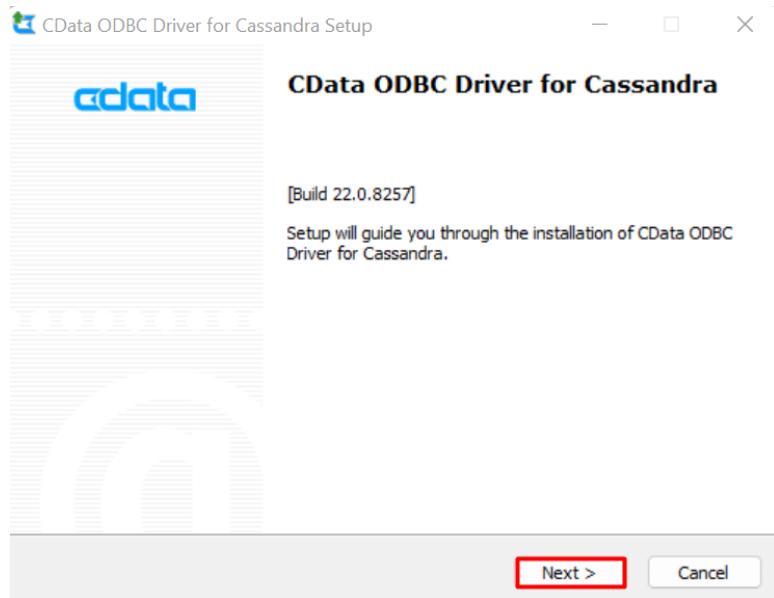
Enter an appropriate answer to the required field, then click *Download* to download the driver.

The screenshot shows the "CData Software - Downloads" page for the Cassandra ODBC Driver. It has a header with links for Platform, Solutions, Connectors, Support, Resources, and Company, along with search and chat icons. The main section is titled "Download Cassandra ODBC Driver". It contains a form with fields for "Company Email*" (with the value "datagatheringcs171@gmail.com" highlighted by a red border), Name, Phone Number, Job Title, and Company. Below the form is a section for "Primary Interests" with checkboxes for BI & Analytics, ETL / Data Integration, Linked Servers / Data Virtualization, Internal App Dev, Commercial App Dev, and Other. A red arrow points to the "Download" button at the bottom of the form.

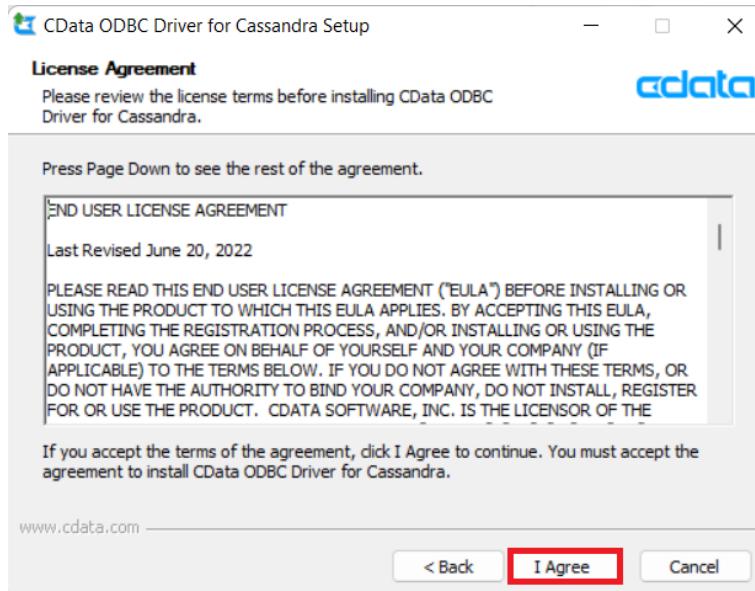
An executable (.exe) file should begin downloading.

The screenshot shows the CData website with the URL <https://www.cdata.com/Products/ODBC/Cassandra/>. The page title is "Download - Cassandra ODBC Driver". A message says "Your download of Cassandra ODBC Driver will begin in a moment. If it doesn't initiate, please [click here](#) to try again." Below this, a note says "If you are unable to download the .EXE installer due to proxy configuration, please [click here to download with an alternate file extension \(.ex\)](#). After download, please change the file extension to .EXE and run the self-extracting executable to continue with installation." A "Special Offers!" section is present with links to follow on LinkedIn and Twitter. At the bottom, there's a download progress bar with a red box around the file name "CassandraODBCDr....exe".

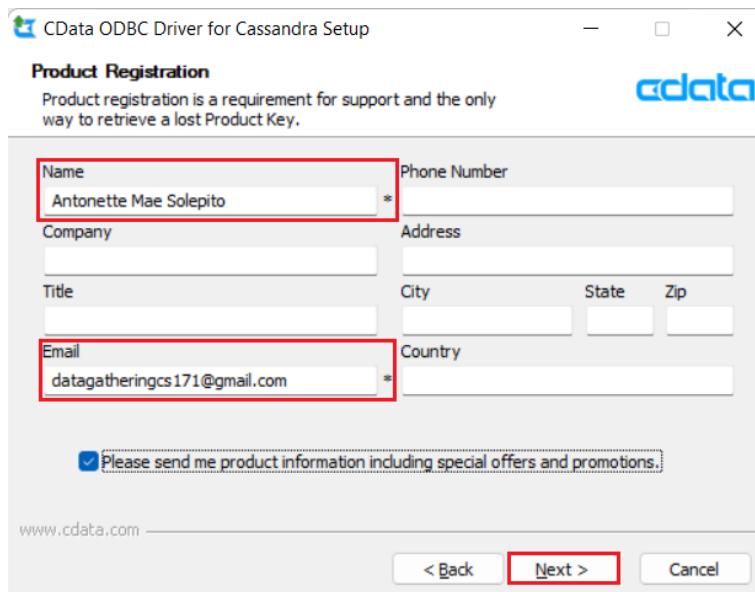
Double-click on the file to open it and follow the setup guide to install CData ODBC Driver for Cassandra. Click *Next >*.



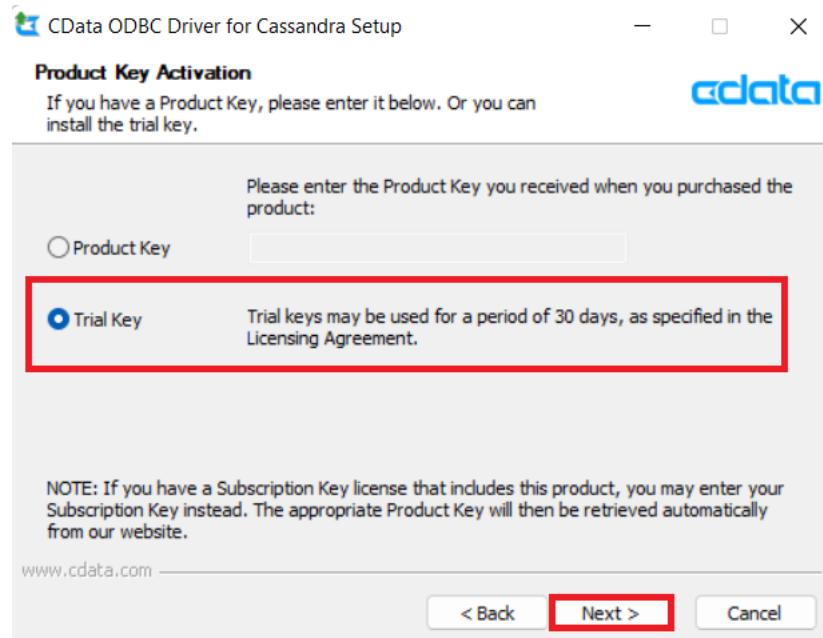
To agree with Cassandra ODBC Driver's Terms and Agreement, click *I Agree*.



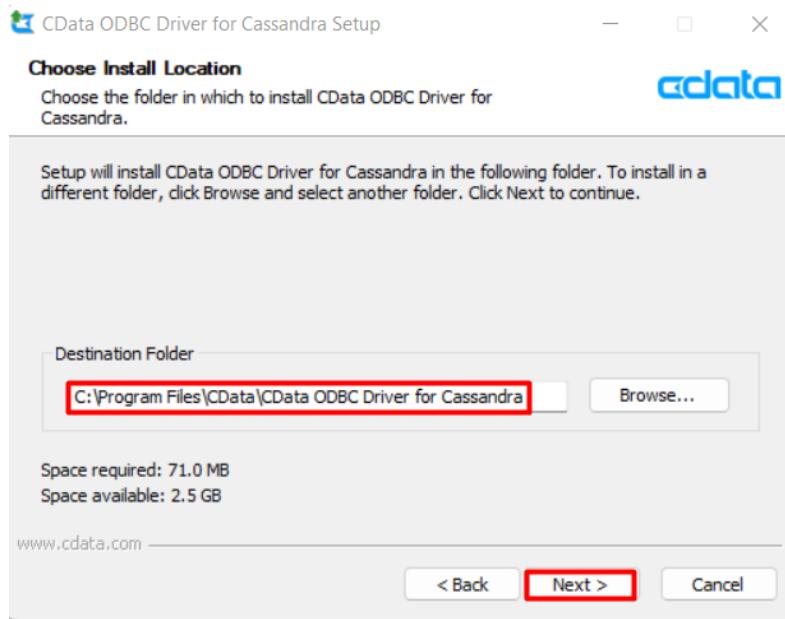
Populate the required fields. For this example, we used the following credentials to complete this step. Click *Next >*.



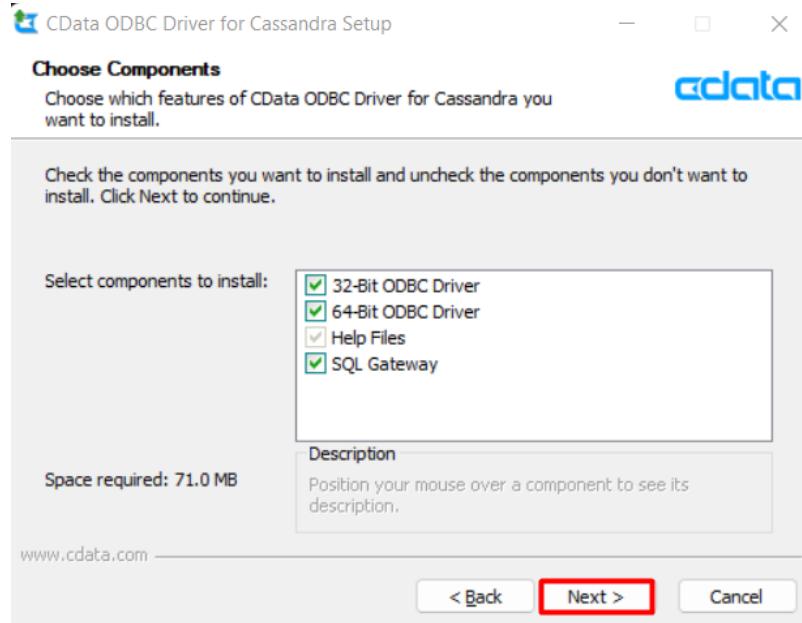
Since the driver was previously selected as a trial download, select the “Trial Key” option to proceed. Click *Next >*.



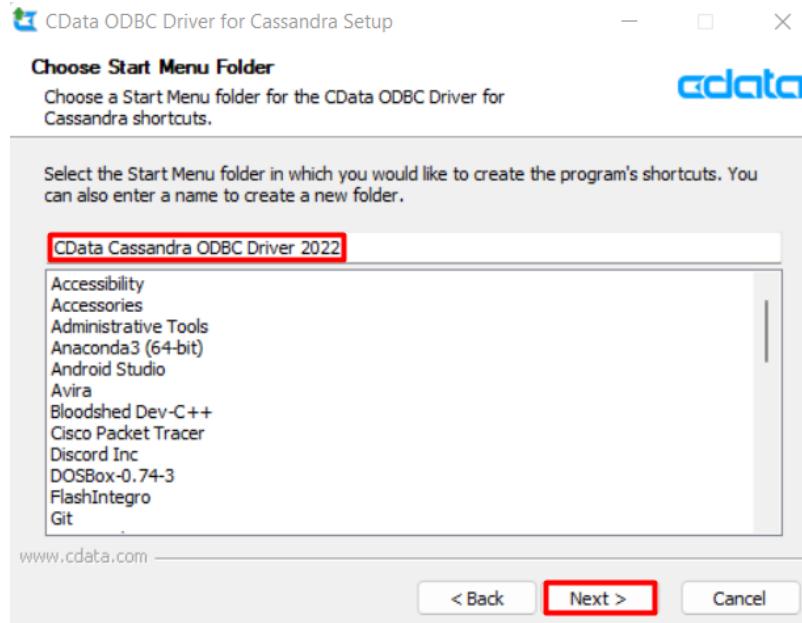
Specify the directory in which the Driver’s folder is to be located, then click *Next >*.



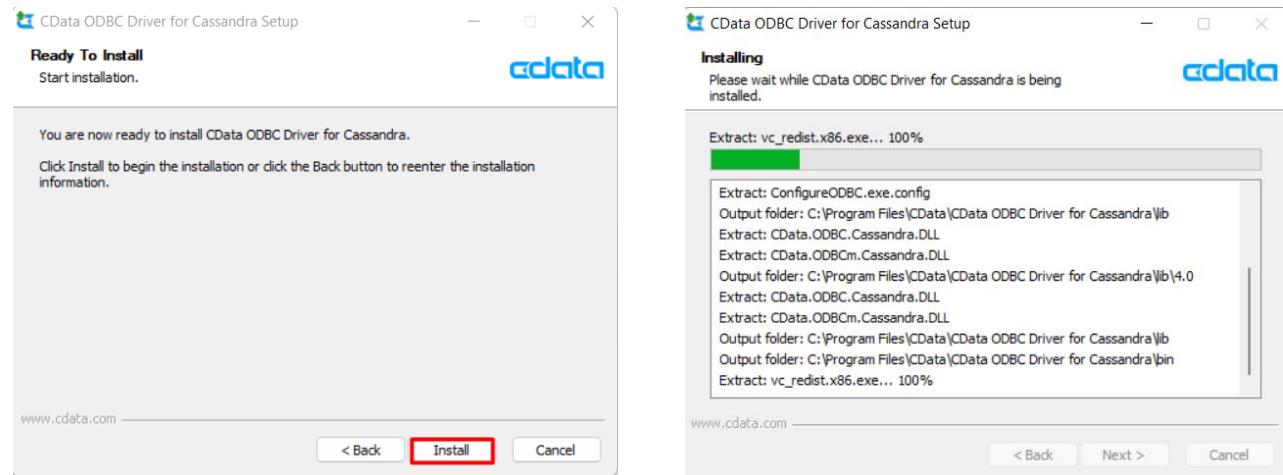
Select all the required components to install. In this example, all components were selected to ensure that all possible components will be available when needed. Then, click *Next >*.



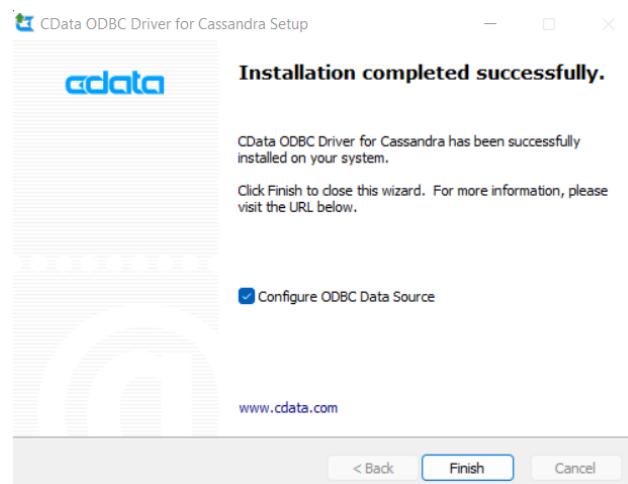
Then, select the folder that was created for the CData ODBC Driver as the Start Menu folder. Click *Next >*.



Click *Install* to begin installing the driver.

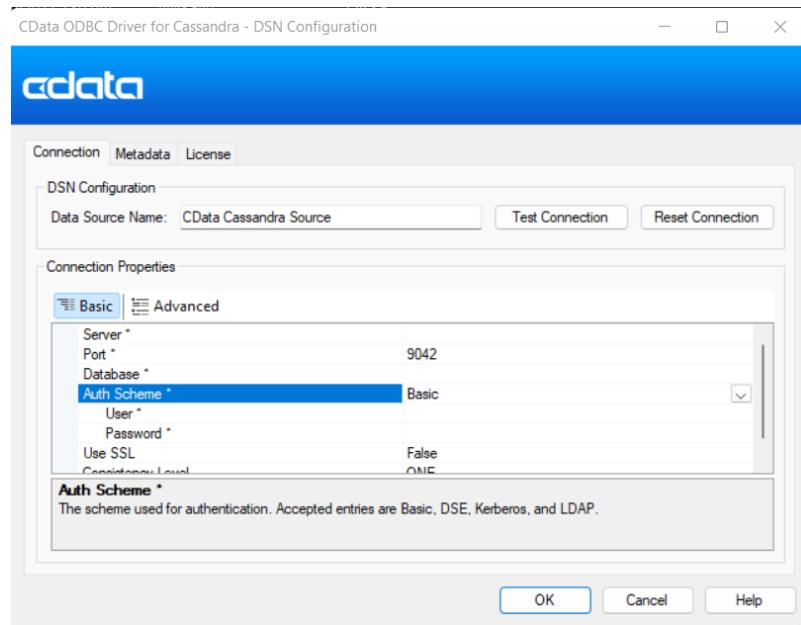


Once the installation is complete, click *Finish*.



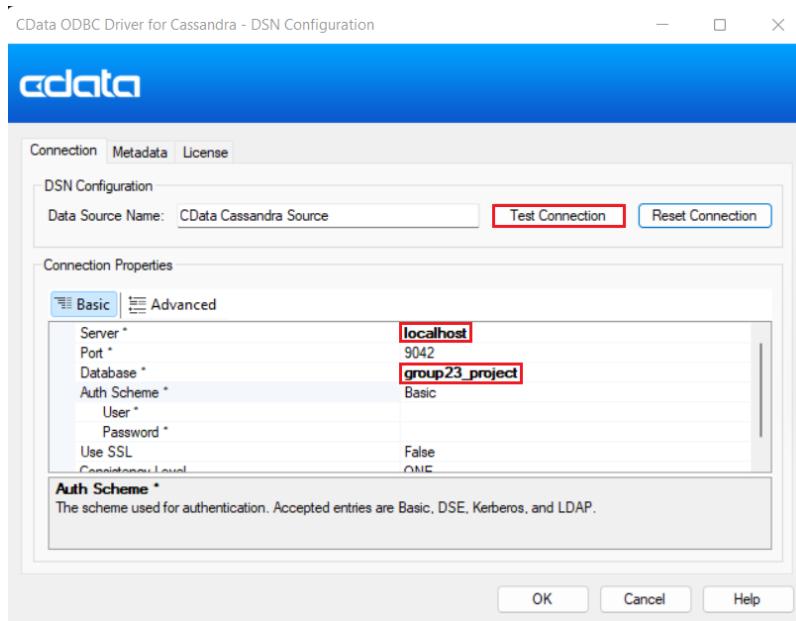
III. Connecting Apache Cassandra to Tableau

The *CData ODBC Driver for Cassandra – DSN Configuration* window should appear after clicking *Finish*.

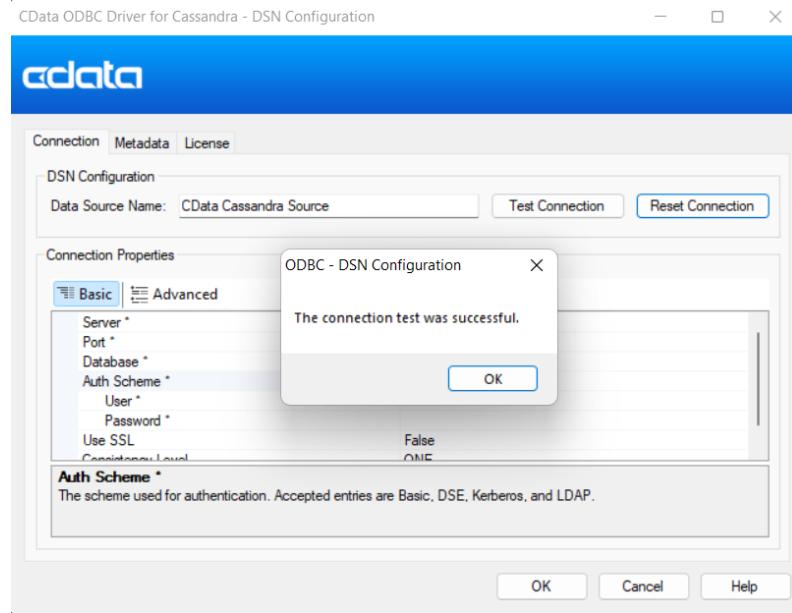


Populate all the necessary fields within the *Connection Properties* section of the window, then click *Test Connection* to verify the connectivity of the Cassandra database.

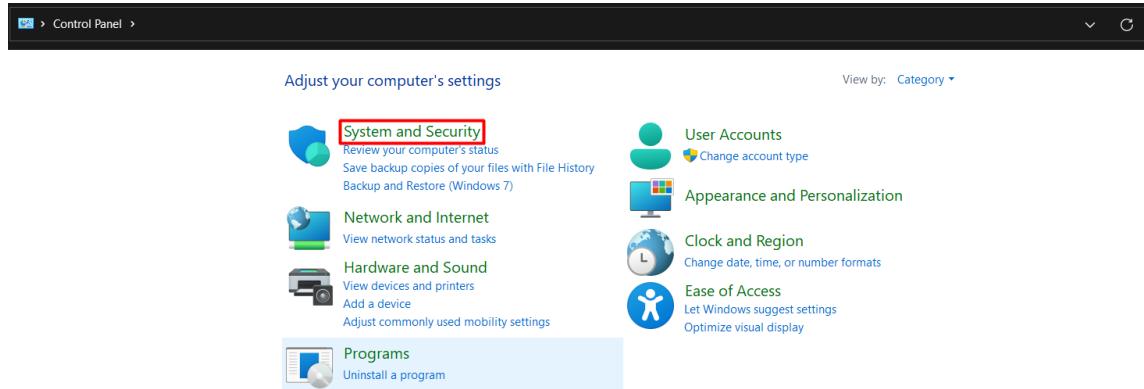
Note: Before testing the connection, ensure that **Cassandra** and **cqlsh** are running on the command prompt terminal.



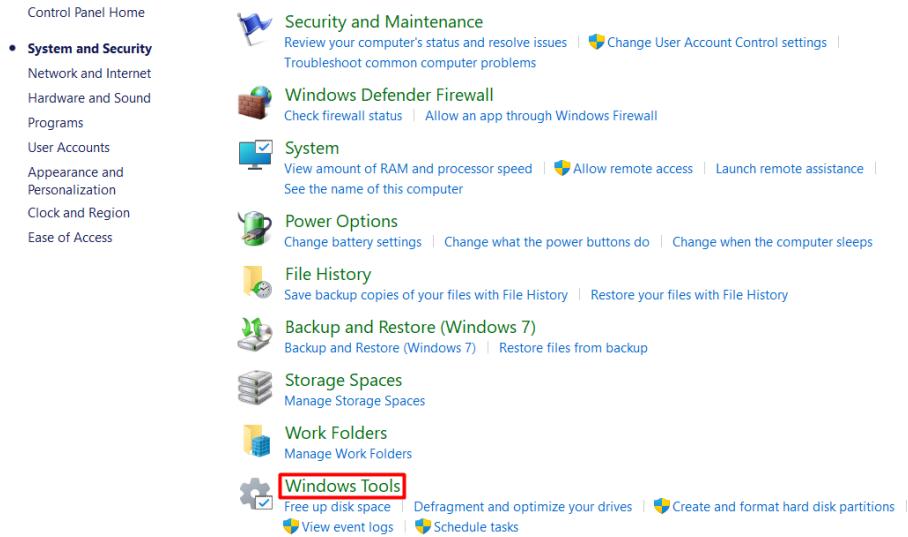
The following dialog should appear to verify that the connection test was successful.



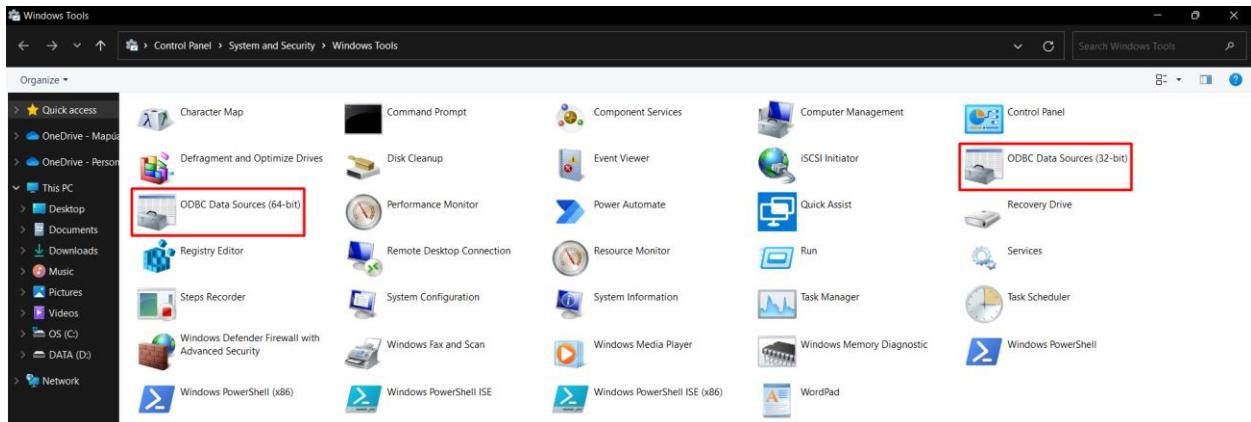
Alternatively, if you prefer to specify the connection properties later, you can access the ODBC Data Source Administrator by going to *Control Panel > System and Security > Windows Tools > ODBC Data Sources (64-bit)*.



Control Panel window

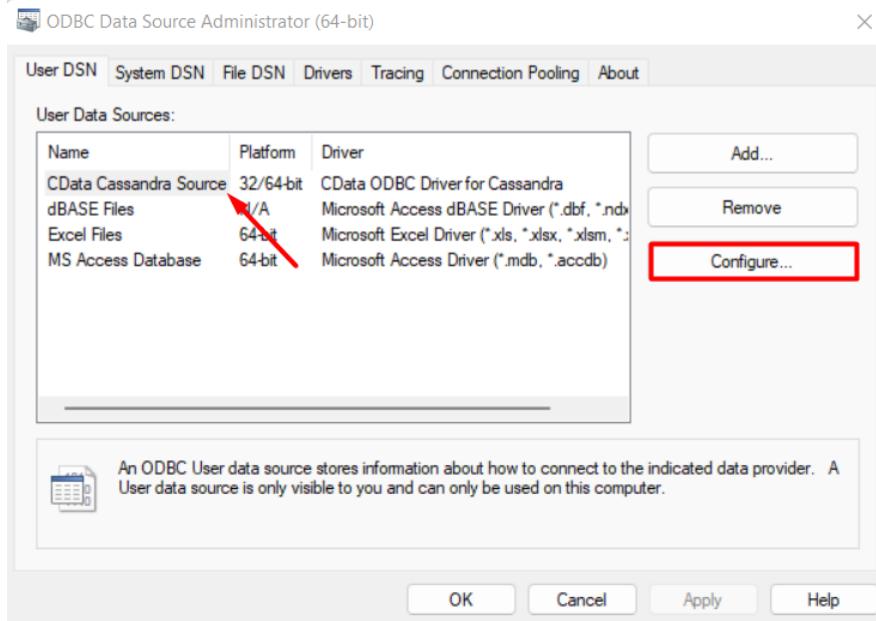


System and Security window

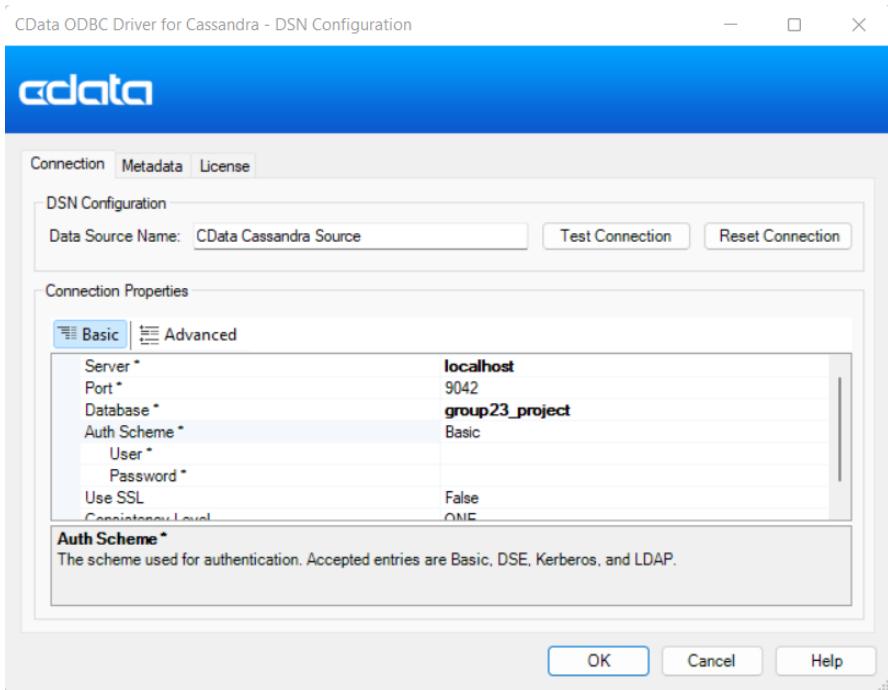


Windows Tools window

The following window should appear. Before selecting the *Configure..* button, ensure that the selected User Data Source is the CData Cassandra Source.

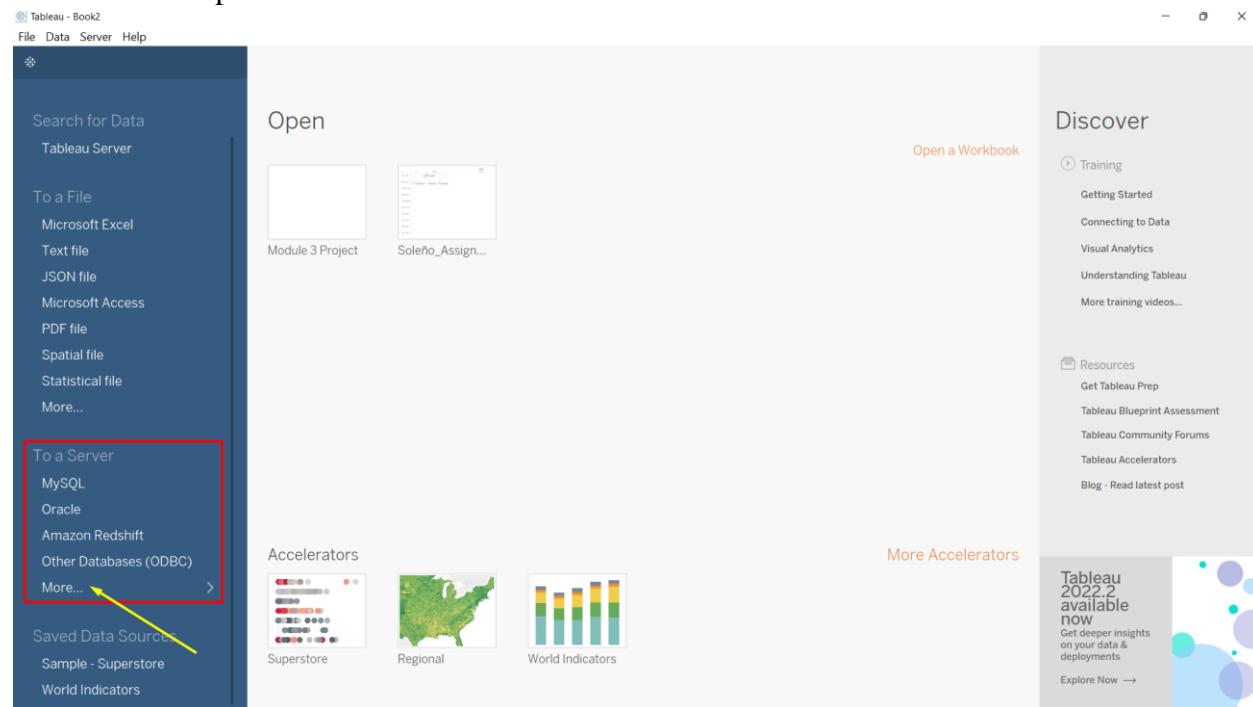


Clicking the *Configure...* button should redirect you to the following window.

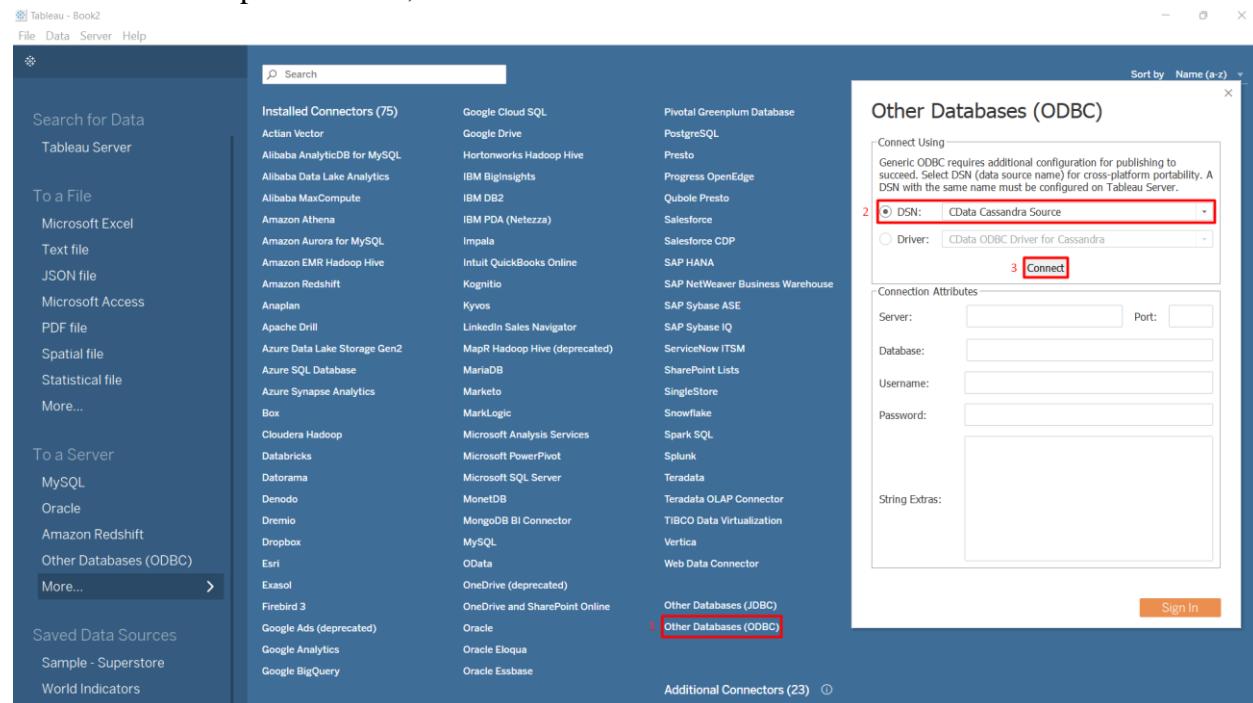


IV. Importing the CCTV_counts table into Tableau Desktop

Now that a connection between Apache Cassandra and Tableau has been established, open Tableau Desktop and select *More...* under *To a Server*.



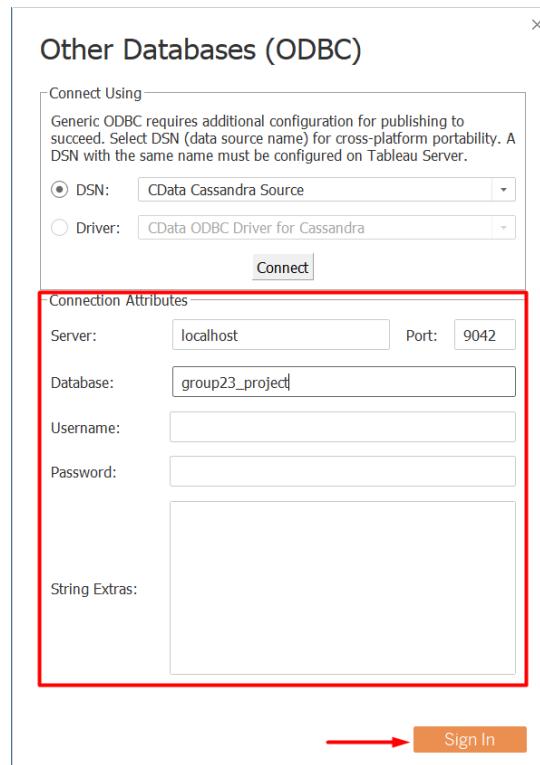
Then, select *Other Databases (ODBC)* to configure which Data Source Name (DSN) to use to connect Tableau to the Cassandra database. First, select the option *DSN: CData Cassandra Source* on the dropdown menu, then click *Connect*.



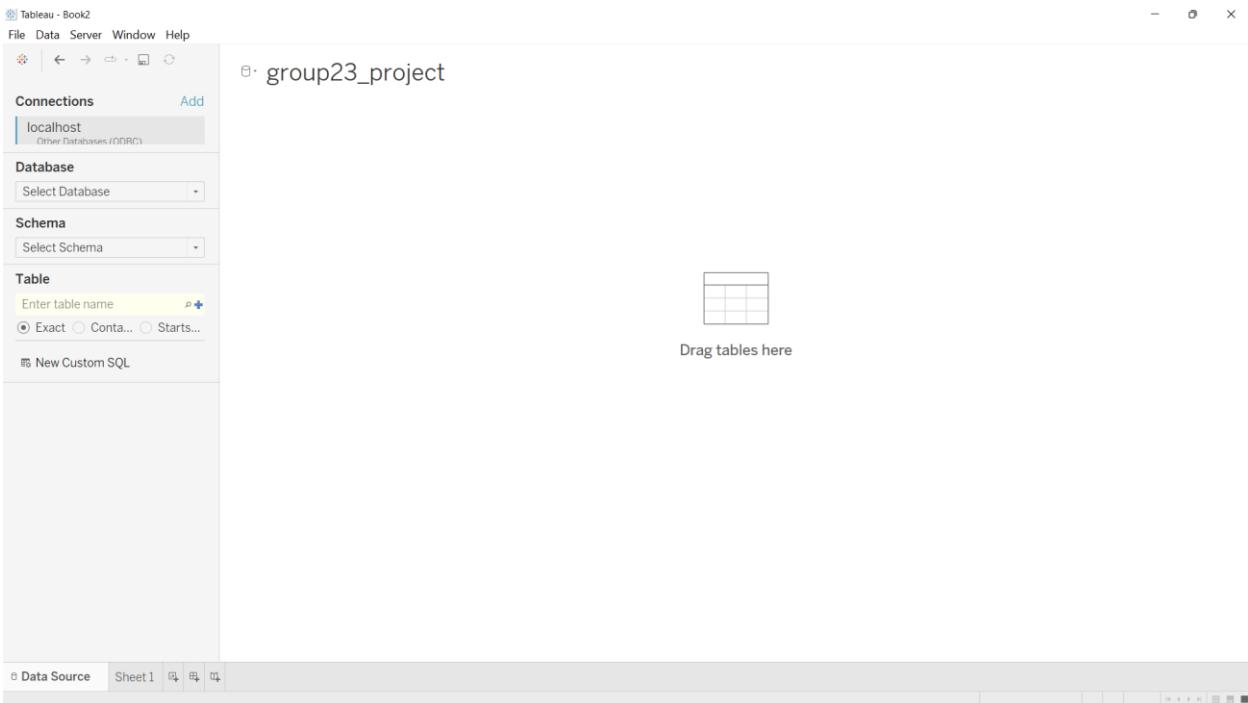
After clicking the *Connect* button, the *Connection Attributes* panel will be available. To connect Tableau to the Cassandra database, the following were specified for each corresponding text label:

Server: localhost
Port: 9042
Database: group23_project

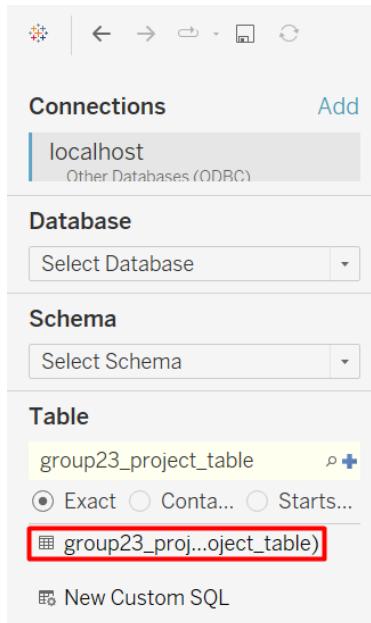
Click *Sign In* once done.



The following window should appear after clicking the *Sign In* button.



Now, go to the *Table* panel and enter the table name **group23_project_table** in the corresponding text field. The table should appear above *New Custom SQL*, as indicated.



To import the data to Tableau, drag the Cassandra table to the workspace on the right side of the window.

The screenshot shows the Tableau Data Source interface. On the left, under the 'Table' section, the 'group23_project_table' is selected. A red arrow points from this selection towards the main workspace area on the right, which is labeled 'Drag tables here'. The workspace area contains a small grid icon.

Dragging the selected table should yield the following output. Next, click *Update Automatically* to enable the live streaming of data from Cassandra automatically.

The screenshot shows the Tableau Data Source interface with the 'group23_project_table' worksheet open. In the bottom right corner of the workspace, there is a red box highlighting the 'Update Automatically' button. The workspace displays a table with the following data:

Name	Timeuuid Id	Type	Physical Table	Remote ...
group23_project_table	Abc	Timeuuid Id	group23_project_table	timeuuid_id
	Abc	Bike	group23_project_table	bike
	Abc	Bus	group23_project_table	bus

The contents of the Cassandra table should appear in the area where the two *Update* buttons were previously present.

The screenshot shows the Tableau Data Source interface. On the left, the 'Connections' sidebar is open, showing a connection to 'localhost' (Other Databases (ODBC)). The main workspace displays a table named 'group23_project_table' with 13 fields and 23509 rows. A red box highlights the data grid, which contains the following data:

Timeuuid Id	Bike	Bus	Car	Date Saved	Jeepney	Lgu
1664525944.38	3	1	4	09/30/2022	2	1200
1664524567.29	1	0	0	09/30/2022	1	1200
1664522890.93	1	1	3	09/30/2022	2	1200
1664524657.75	4	1	3	09/30/2022	0	1200
1664523824.43	3	0	0	09/30/2022	1	1200
1664523174.64	4	2	0	09/30/2022	1	1200
1664525006.1	2	1	0	09/30/2022	0	1200

Now, if you select the Sheet with the prompt *Go to Worksheet*, the following dialog box will appear:

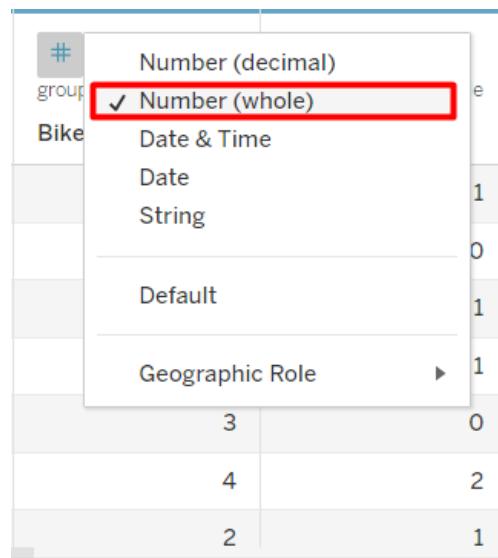


The dialog box explains that Tableau has identified certain limitations from the ODBC data source, one of which is the incapability to detect the table's data types upon importing. To work around this, we manually identified each data value according to their appropriate data type by doing the following steps.

First, select the data value that requires adjusting.

Abc group23_project_table	Abc group23_project_table	# group23_project_table	# group23_project_table	Date group23_project_table	# group23_project_table	# group23_project_table	Abc group2
Timeuuid Id	Bike	Bus	Car	Date Saved	Jeepney	Lgu C	
1664525944.38	3		1	4	30/09/2022		2 1200
166452456729	1		0	0	30/09/2022		1 1200
1664522890.93	1		1	3	30/09/2022		2 1200
1664524657.75	4		1	3	30/09/2022		0 1200
1664523824.43	3		0	0	30/09/2022		1 1200
1664523174.64	4		2	0	30/09/2022		1 1200
1664525006.1	2		1	0	30/09/2022		0 1200

Then, click on the data type label (*Abc*) and select the appropriate data type. Since the column *Bike* contains whole numbers, select *Number (whole)* on the menu.



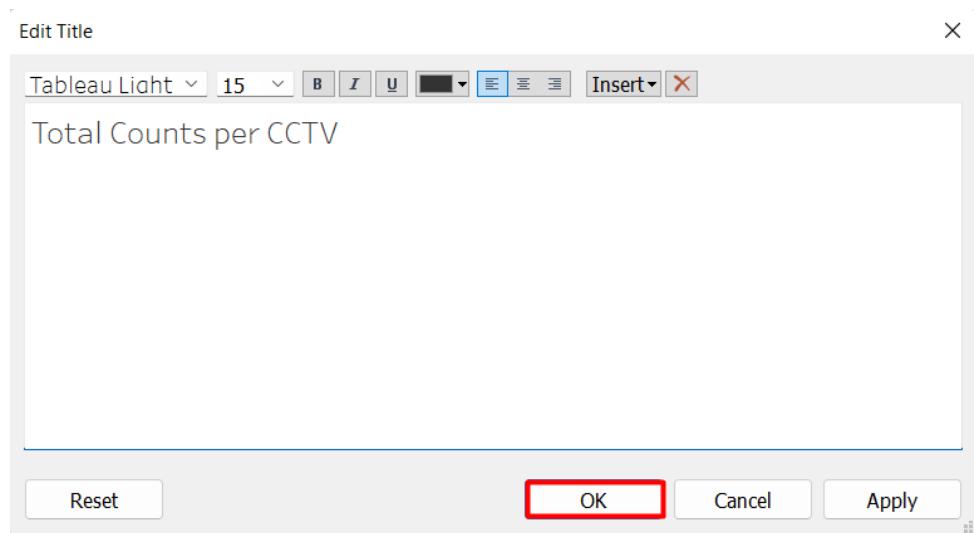
Apply the steps mentioned above to the rest of the other data values that need to be changed to their appropriate data types. The final table should contain a varied list of data values of different types, as indicated in the figure below.

group23_project_table														100	rows	Table Details
>	Abc group23_project_table	# group23_project_table	Tryke													
Timeuuid Id	Bike	Bus	Car	Date Saved	Jeepney	Lgu Code	Others	Sensor Id	Time Saved	Total	Truck					
1664525944.38	3	1	4	30/09/2022		2	1200	sensor_05	16:19:04	13	1	0				
166452456729	1	0	0	30/09/2022		1	1200	sensor_02	15:56:07	6	1	2				
1664522890.93	1	1	3	30/09/2022		2	1200	sensor_05	15:28:10	7	0	0				
1664524657.75	4	1	3	30/09/2022		0	1200	sensor_08	15:57:37	14	2	2				
1664523824.43	3	0	0	30/09/2022		1	1200	sensor_03	15:43:44	8	2	0				
1664523174.64	4	2	0	30/09/2022		1	1200	sensor_02	15:32:54	9	2	0				
1664525006.1	2	1	0	30/09/2022		0	1200	sensor_04	16:03:26	8	9	9				

V. Creating the Two Main Worksheets: Total Counts per CCTV and Vehicle Counts per CCTV

Since the first requirement states that the first two pages of the project should contain all the data captured by the CCTV, two types of data visualization charts were created: *Total Counts per CCTV* and *Vehicle Counts per CCTV*.

To create the *Total Counts per CCTV* data visualization chart, first name the Sheet as *Total Counts per CCTV* by right-clicking on the Sheet title and selecting **Edit title**. Name the Sheet as *Total Counts per CCTV*, then click “OK” to apply the changes and to close the dialog box.



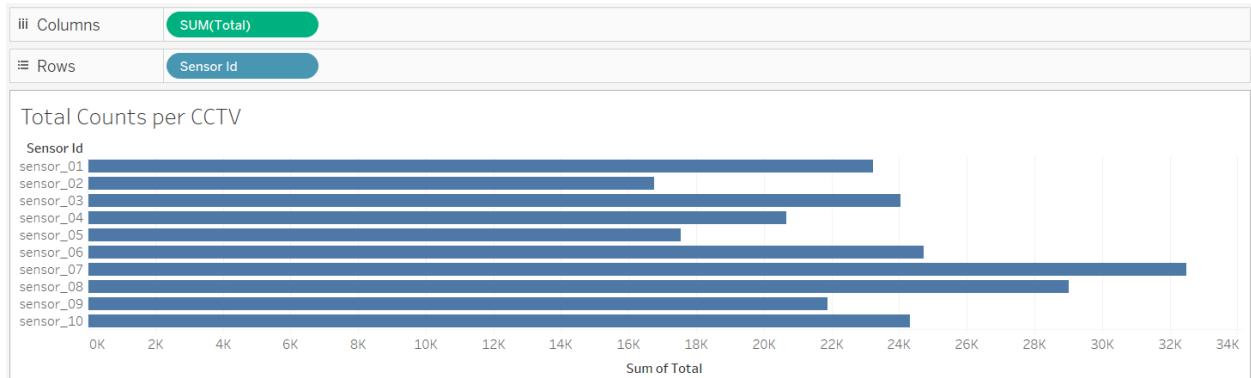
Next, drag table *Sensor Id* to the *Rows* pane and *Total* to the *Columns* pane, as shown in the figure below. The view should automatically produce a table visualization as these changes are made.

The screenshot shows the Tableau Data Editor interface. In the top navigation bar, 'Data' is selected. The 'Rows' pane contains the 'Sensor Id' field, and the 'Columns' pane contains the 'Total' field. The main workspace displays a table titled 'Total Counts per CCTV'. The table has columns labeled 0 through 20. The first row shows the headers: Sensor Id, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20. Subsequent rows list sensor IDs from sensor_01 to sensor_10, each corresponding to a row of 'Abc' values across the columns. On the left sidebar, under 'Tables', there is a list of various data sources and measures. Under 'Parameters', there is a 'Drill Down of Incomin...' option.

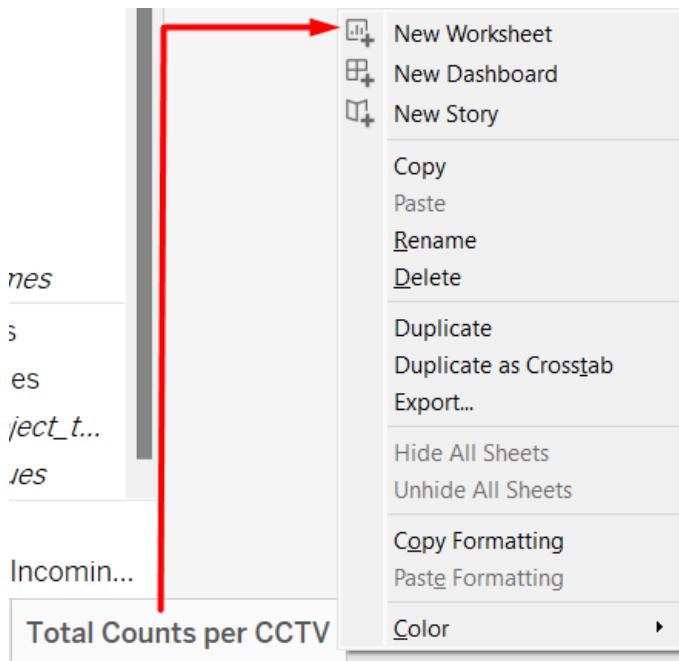
Then, right click on Total > Measure > Sum.

This screenshot shows a context menu for the 'Total' column in the Tableau visualization. The 'Measure' option is selected, and a sub-menu is displayed with the following options: Average, Median (requires extract), Count, Count (Distinct), Minimum, Maximum, Percentile (requires extract), Std. Dev, Std. Dev (Pop.), Variance, and Variance (Pop.). The 'Sum' option is also visible in the list.

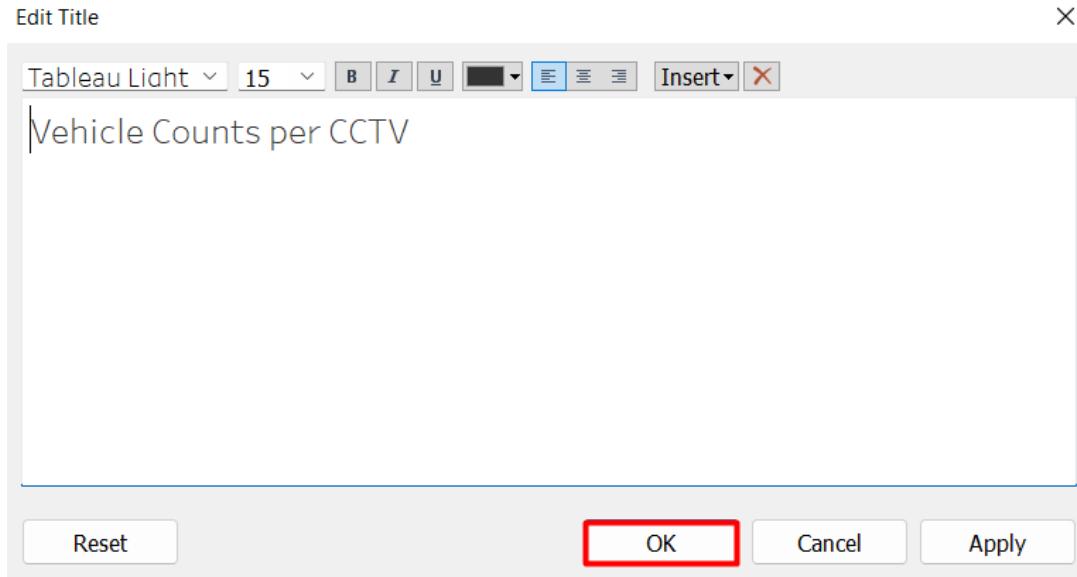
A bar graph should automatically appear.



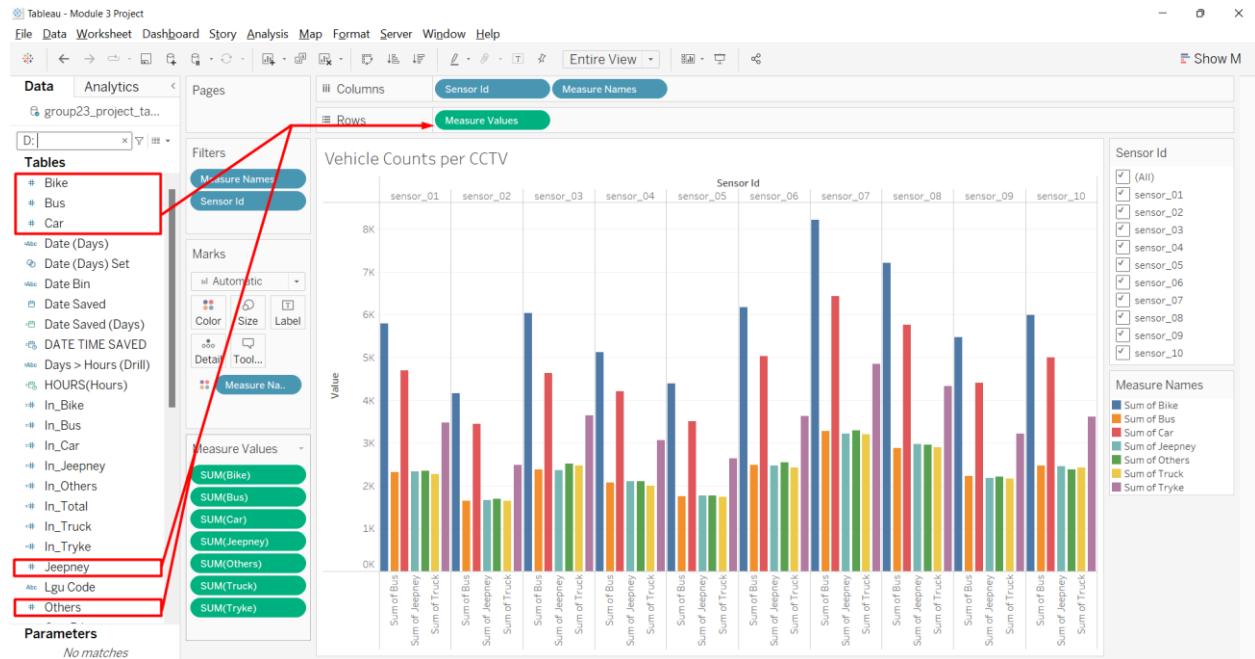
Next, create a new Worksheet entitled *Vehicle Counts per CCTV* by right clicking on the current worksheet and selecting *New Worksheet*.

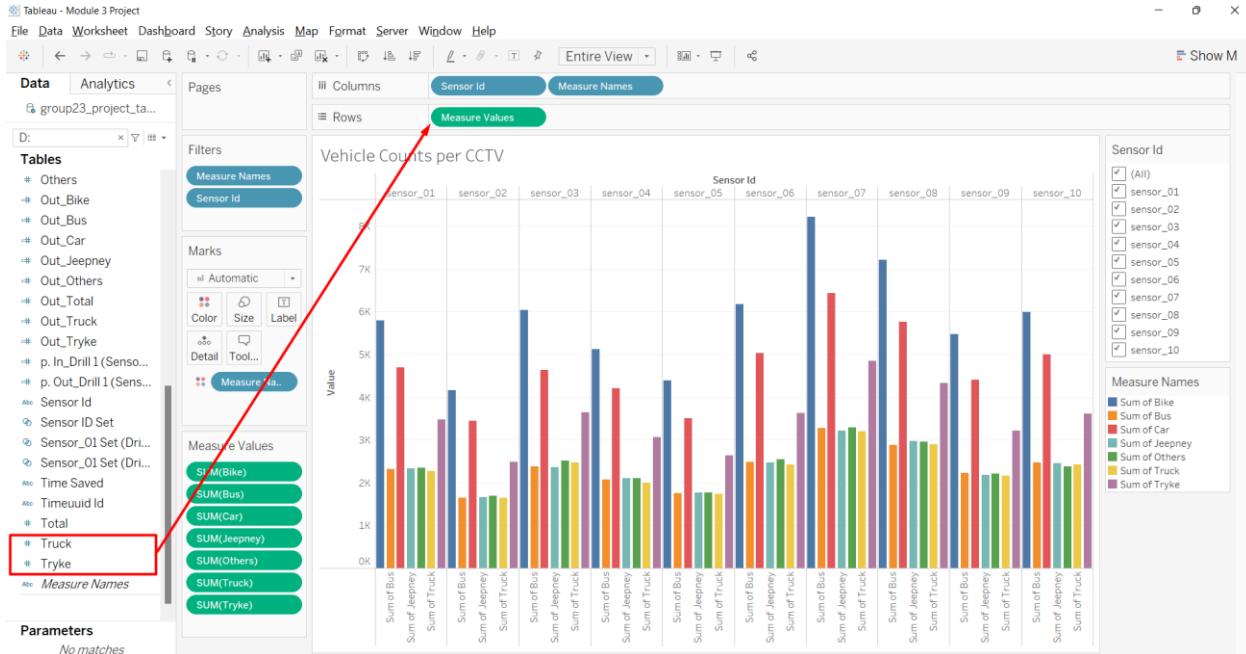


Edit the title of the Sheet and name the Sheet as *Vehicle Counts per CCTV*, like how the previous worksheet's title was edited. Click “OK” to apply changes and to close the dialog box.

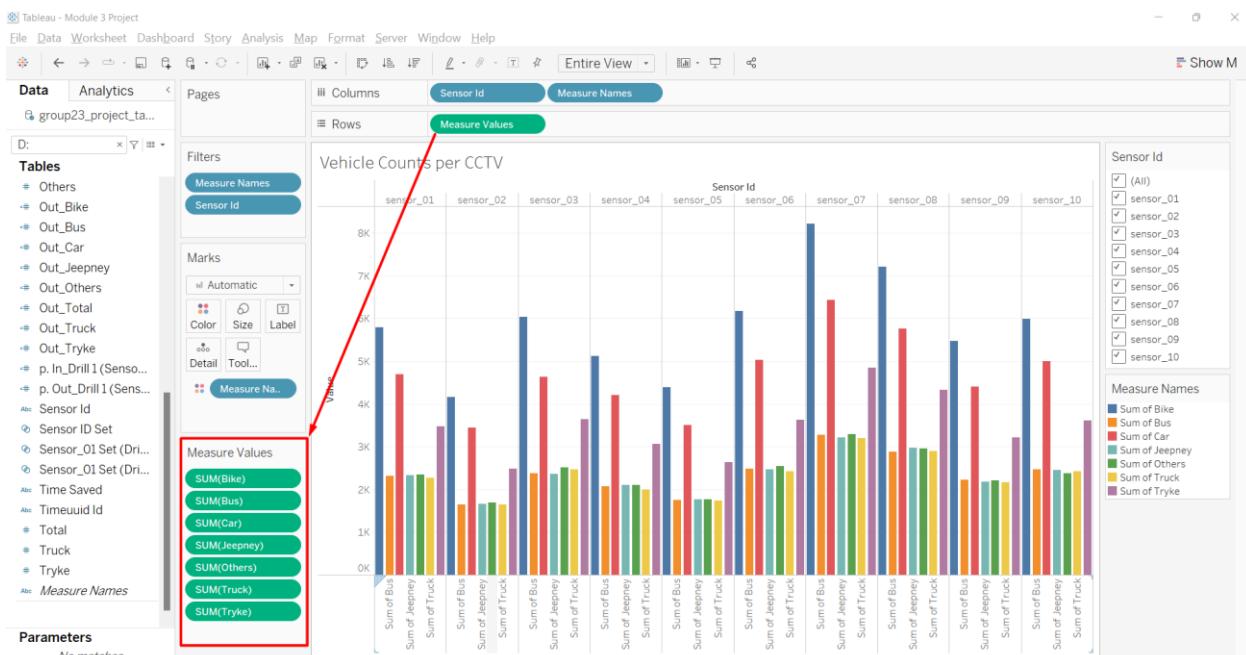


To represent the relationship between each CCTV and the type of vehicles each CCTV captured, we created a visualization that represented the sums of each vehicle type per sensor ID. First, we dragged the values *Bike*, *Bus*, *Car*, *Jeepney*, *Others*, *Truck*, and *Tryke* to the Rows field and set each of these values as Sum Measures.



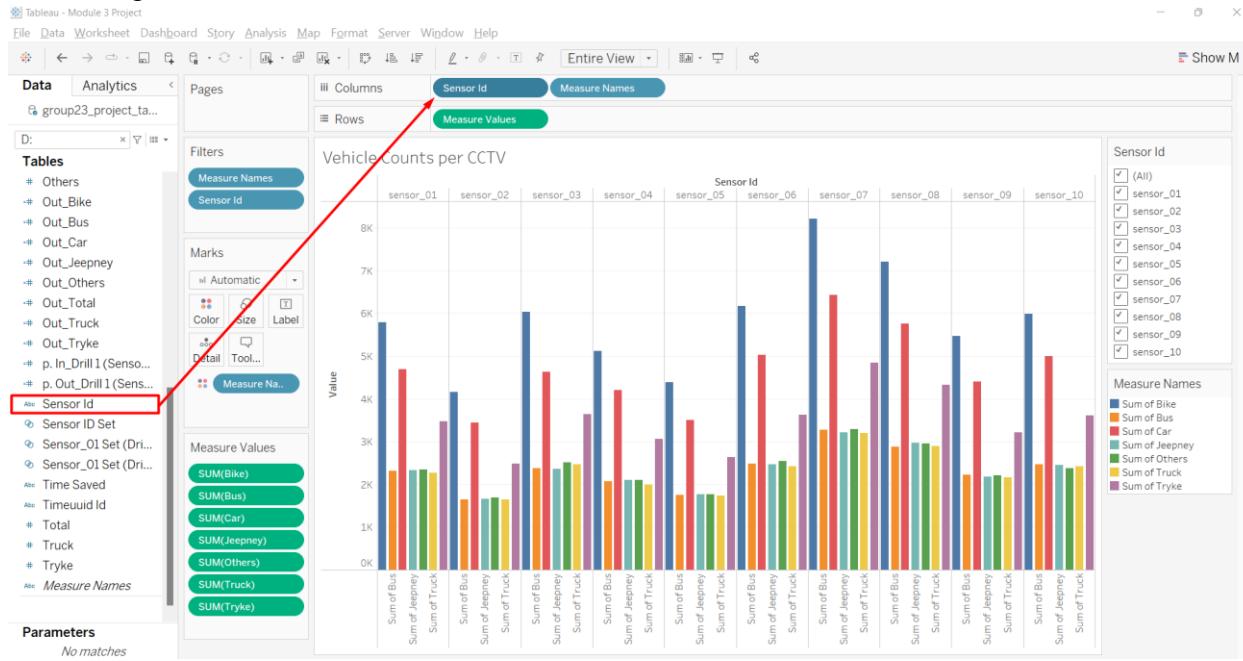


Values Bike, Bus, Car, Jeepney, Others, Truck, and Tryke Being Dragged to Rows

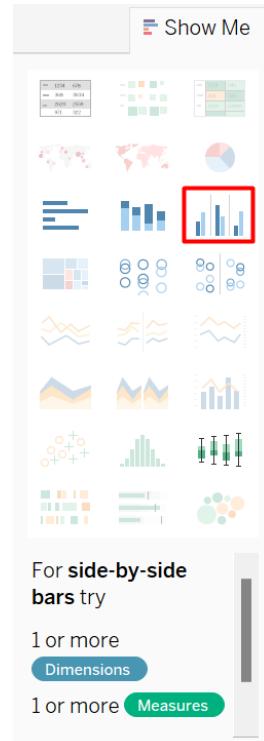


Row Values are Converted to Sum Measure Values

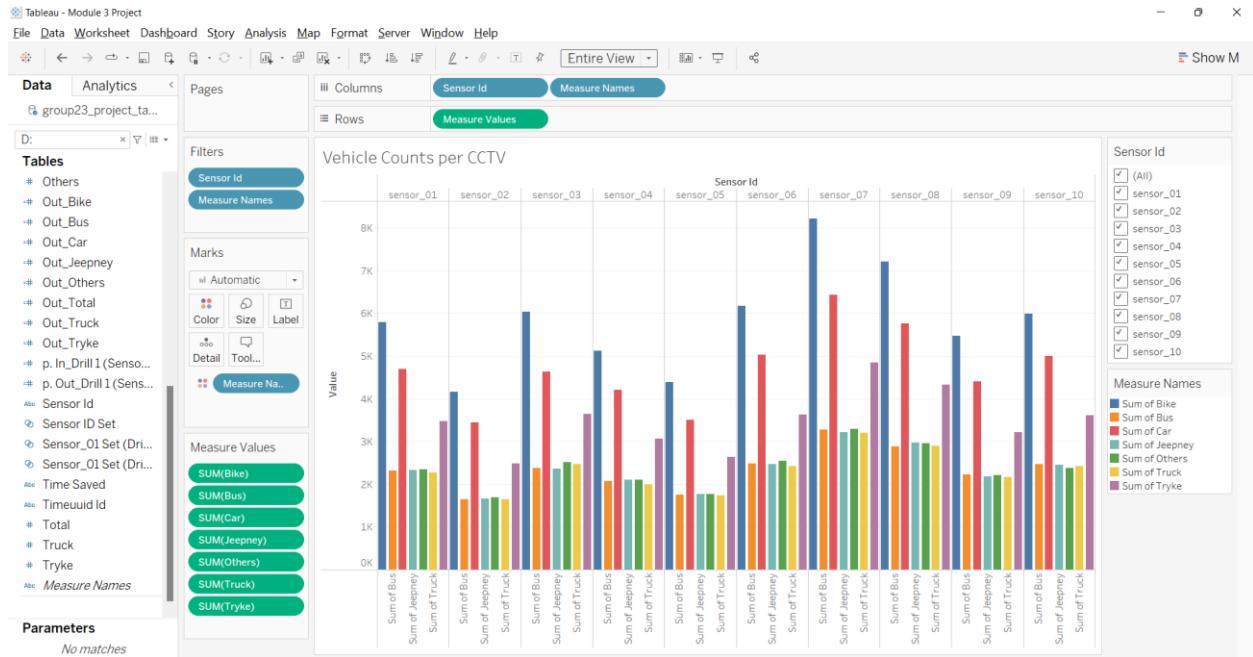
Then, drag *Sensor Id* to the Column field.



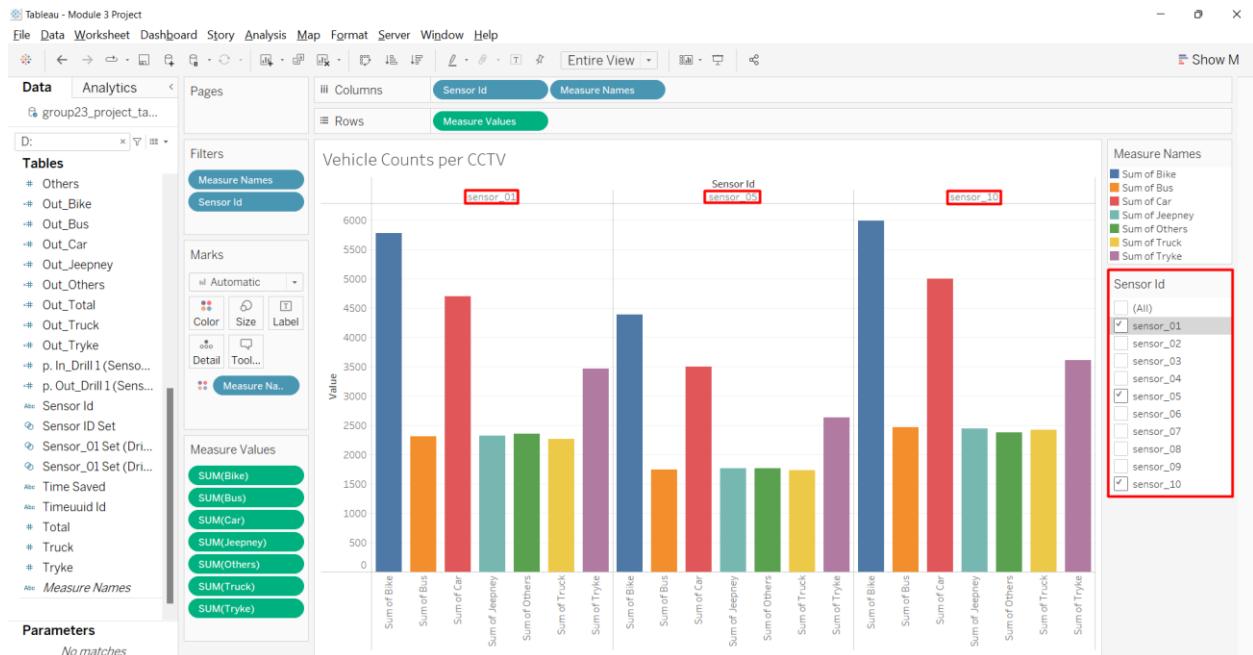
Next, select *Show Me* and choose **side-by-side bars** to change the data visualization as such.



The data should be represented as such, with each Sensor Id column containing the total of each vehicle type captured by the corresponding CCTV.



To view the data more closely, we included a filter section for the *Sensor Id* value at the right side of the window. This section will allow the user to view the data per sensor ID within the same data visualization more comprehensibly.



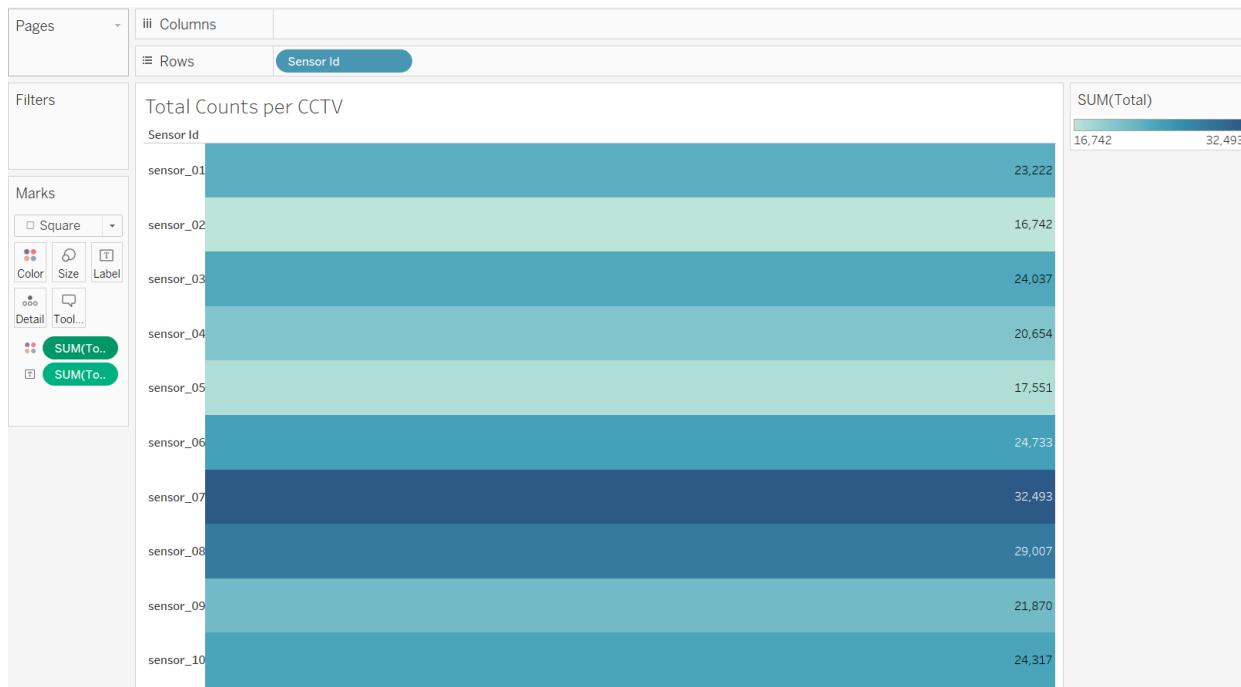
*To change the visualization of data, select *Show Me* and choose the preferred visualization type. In this project, we chose the **highlight tables** to represent our data for *Total Counts per CCTV* differently, as indicated. Then, we selected *Entire View* on the dropdown menu to allow the data visualization to occupy the entire workspace.

The image shows the Tableau 'Show Me' interface on the left, displaying various visualization options like maps, bar charts, and pie charts. A red box highlights the 'Highlight Table' icon. To the right is a screenshot of a Tableau visualization titled 'Total Counts per CCTV'. This visualization is a table with two columns: 'Sensor Id' and 'Total Counts'. The data is as follows:

Sensor Id	Total Counts
sensor_01	23,222
sensor_02	16,742
sensor_03	24,037
sensor_04	20,654
sensor_05	17,551
sensor_06	24,733
sensor_07	32,493
sensor_08	29,007
sensor_09	21,870
sensor_10	24,317

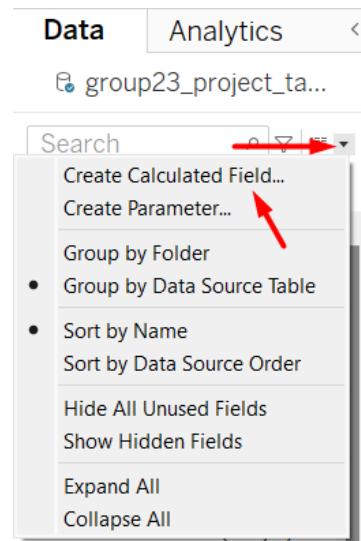
Below the visualization is a screenshot of the Tableau interface showing the 'Entire View' dropdown menu. An arrow points to the 'Entire View' option, which is highlighted.

Our final data visualization for *Total Counts per CCTV* should look like the following screenshot.



VI. Implementing Drill Through from Vehicle Counts per CCTV to Total Incoming and Outgoing Vehicles

Before implementing the drill through from *Vehicle Counts per CCTV*, a worksheet containing the total counts in and out per vehicle type should be created. To do this, first create calculated fields for each incoming and outgoing vehicle.



Using the *Total* counts value as an example, the following equations were formulated to determine the values for the Total Incoming Vehicles and Total Outgoing Vehicles.

$$\begin{aligned} \text{In_Total} &= \text{FLOOR}([\text{Total}]/2) \\ \text{Out_Total} &= [\text{Total}] - \text{In_Total} \end{aligned}$$

A screenshot of the calculated field editor in Power BI. It shows two fields side-by-side. The left field is labeled 'In_Total' with the formula 'FLOOR([Total]/2)' below it. The right field is labeled 'Out_Total' with the formula '[Total] - [In_Total]' below it. Both fields have a red border around them. At the bottom, there are two status bars: 'The calculation is valid.' and '11 Dependencies' with 'Apply' and 'OK' buttons, followed by another set for 'Out_Total'.

The calculation is valid.

11 Dependencies

Apply

OK

The calculation is valid.

7 Dependencies

Apply

OK

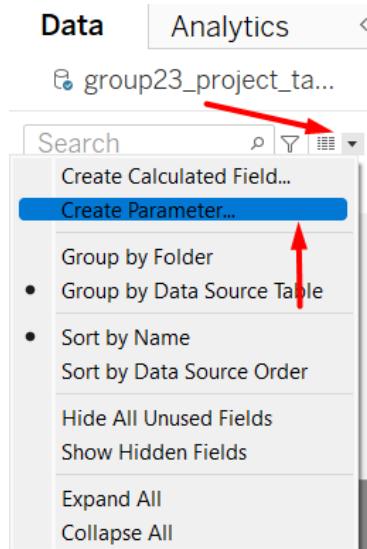
After applying these equations to the other values, the Tables pane should look like the figure below.

The screenshot shows the Data pane of a software application. At the top, there are tabs for "Data" and "Analytics". Below the tabs, the title "group23_project_ta..." is visible. A search bar and a filter icon are present. The main area is titled "Tables" and lists various tables. Some tables are highlighted with colored borders: a red border surrounds the "In" tables (In_Bus, In_Car, In_Jeepney, In_Others, In_Total, In_Truck, In_Tryke), and a blue border surrounds the "Out" tables (Out_Bike, Out_Bus, Out_Car, Out_Jeepney, Out_Others, Out_Total, Out_Truck, Out_Tryke). Other tables listed include "Jeepney", "Lgu Code", "Others", and several tables with "p." prefixes followed by sensor names.

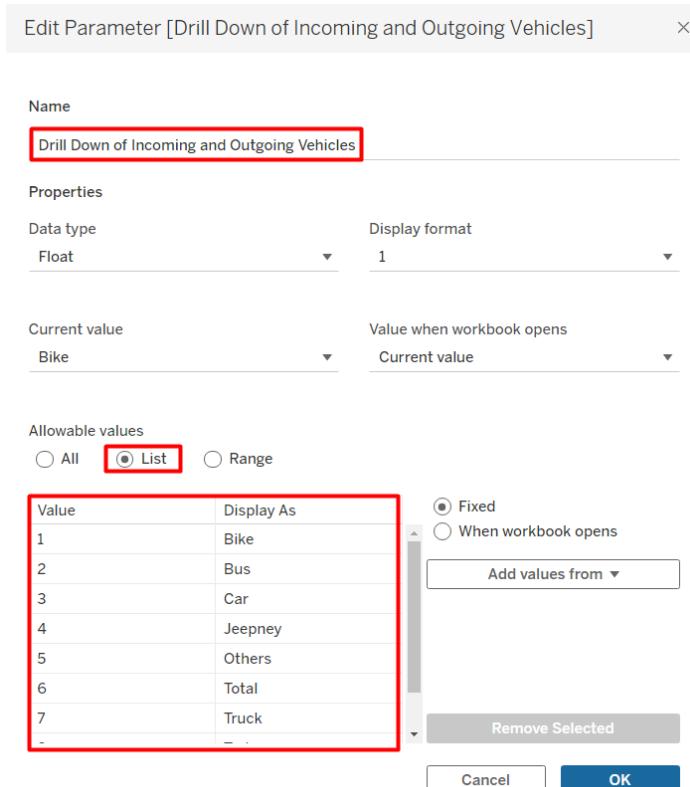
Table Type	Table Name
In	In_Bus
In	In_Car
In	In_Jeepney
In	In_Others
In	In_Total
In	In_Truck
In	In_Tryke
Out	Out_Bike
Out	Out_Bus
Out	Out_Car
Out	Out_Jeepney
Out	Out_Others
Out	Out_Total
Out	Out_Truck
Out	Out_Tryke
p.	p. In_Drill 1(Senso...)
p.	p. Out_Drill 1(Sens...
Abc	Sensor Id
Q	Sensor ID Set

To create the data visualization of these newly created values in terms of sensor ID, create a parameter entitled *Drill Down of Incoming and Outgoing Vehicles*. This feature will enable the user to switch between the data visualizations of different vehicle types within the same worksheet.

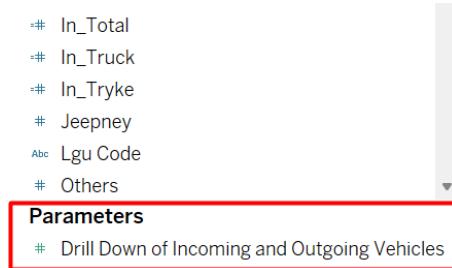
To create a parameter, select the drop-down arrow on the Data pane and select *Create Parameter*....



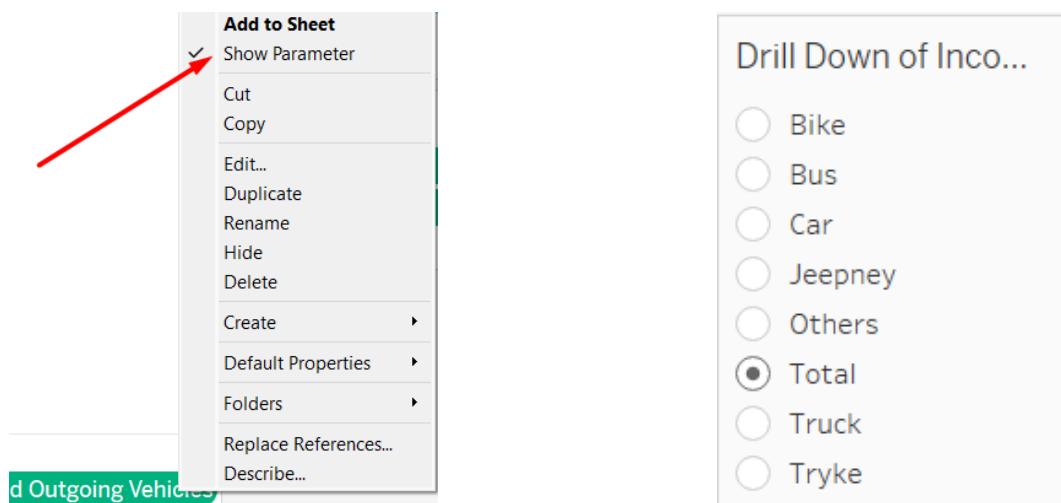
Then, populate the dialog box with the necessary information, as shown in the figure below.



A new parameter should now appear on the left side of the screen under **Parameters**, as indicated below.

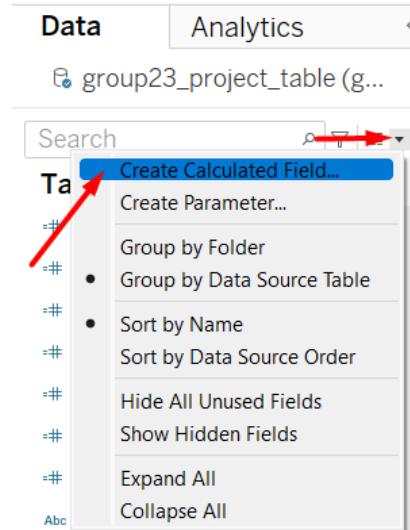


Now, to create the feature that will allow the user to switch between vehicle types, right click on the newly created parameter and check *Show Parameter*. Clicking this option will enable the parameter to appear on the right-hand side of the screen, where a selection of the different vehicle types will be available to the user.



The next step is to create another calculated field that contains the drill down conditions of the *Drill Down of Incoming and Outgoing Vehicles* parameter. This calculated field will contain a CASE statement that will enable the making selections feature of the parameter. (Note that two calculated fields need to be created to portray the values of vehicles coming in and going out.)

To create the calculated field, select the drop-down arrow on the Data pane and select *Create Calculated Field....*



Then, add the following code into the *p. In_Vehicles* and *Out_Vehicles* calculated field, respectively.

```
CASE [Drill Down of Incoming and Outgoing Vehicles]
WHEN 1 THEN [In_Bike]
WHEN 2 THEN [In_Bus]
WHEN 3 THEN [In_Car]
WHEN 4 THEN [In_Jeepney]
WHEN 5 THEN [In_Others]
WHEN 6 THEN [In_Total]
WHEN 7 THEN [In_Truck]
WHEN 8 THEN [In_Tryke]
END

CASE [Drill Down of Incoming and Outgoing Vehicles]
WHEN 1 THEN [Out_Bike]
WHEN 2 THEN [Out_Bus]
WHEN 3 THEN [Out_Car]
WHEN 4 THEN [Out_Jeepney]
WHEN 5 THEN [Out_Others]
WHEN 6 THEN [Out_Total]
WHEN 7 THEN [Out_Truck]
WHEN 8 THEN [Out_Tryke]
END
```

p. In_Vehicles

```
CASE [Drill Down of Incoming and Outgoing Vehicles]
WHEN 1 THEN [In_Bike]
WHEN 2 THEN [In_Bus]
WHEN 3 THEN [In_Car]
WHEN 4 THEN [In_Jeepney]
WHEN 5 THEN [In_Others]
WHEN 6 THEN [In_Total]
WHEN 7 THEN [In_Truck]
WHEN 8 THEN [In_Tryke]
```

The calculation is valid. 2 Dependencies

p. Out_Vehicles

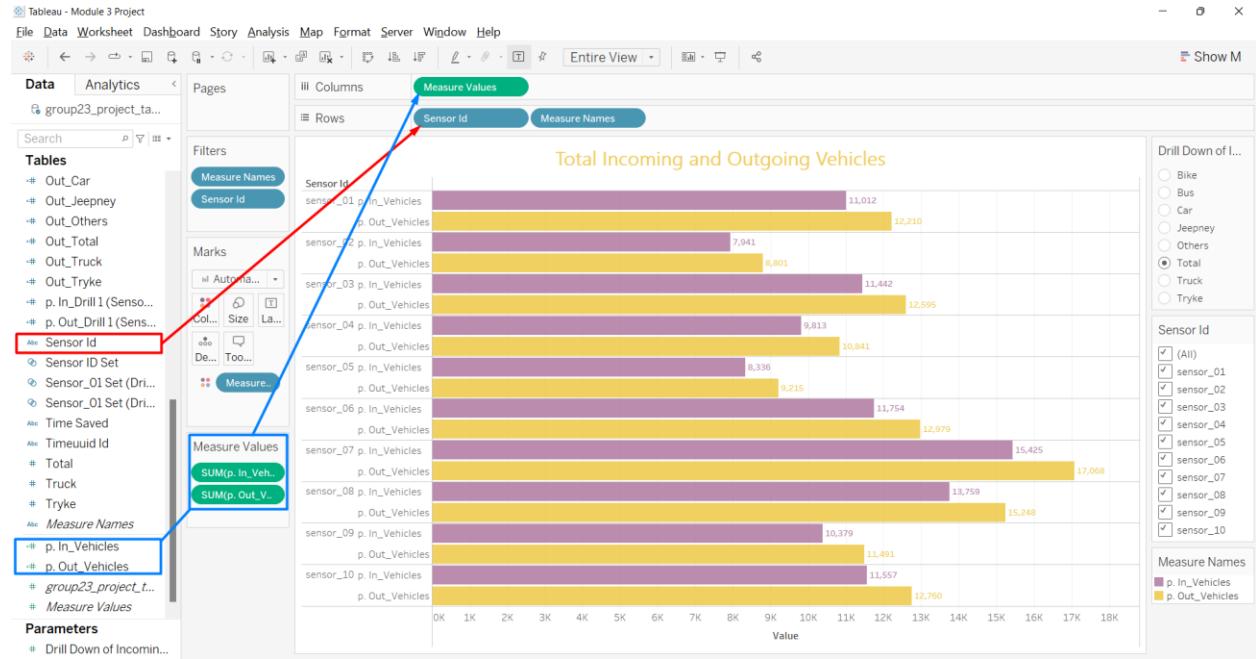
```
CASE [Drill Down of Incoming and Outgoing Vehicles]
WHEN 1 THEN [Out_Bike]
WHEN 2 THEN [Out_Bus]
WHEN 3 THEN [Out_Car]
WHEN 4 THEN [Out_Jeepney]
WHEN 5 THEN [Out_Others]
WHEN 6 THEN [Out_Total]
WHEN 7 THEN [Out_Truck]
WHEN 8 THEN [Out_Tryke]
```

The calculation is valid. 2 Dependencies

These newly created calculated fields should appear on the bottom, left side of the screen as Measure Values.

```
-# p. In_Vehicles
-# p. Out_Vehicles
# group23_project_table ...
# Measure Values
```

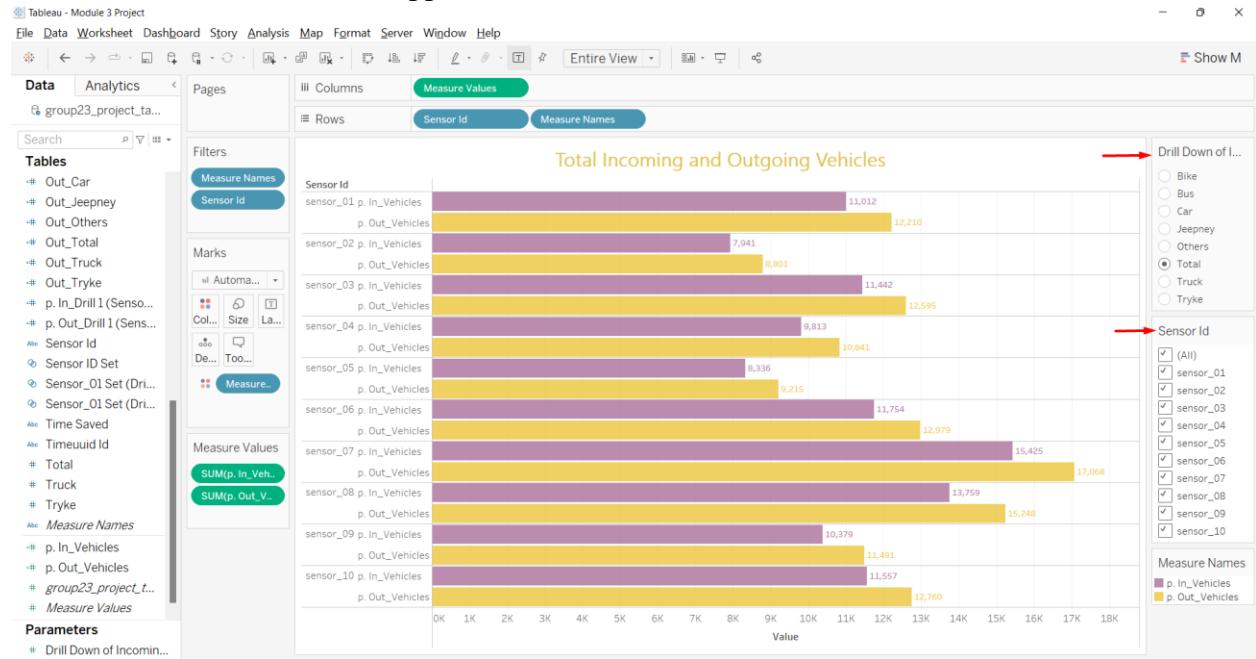
Now that the data is ready, drag the *Sensor ID* table value to the Rows field and the *p. In_Vehicles* and *p. Out_Vehicles* to the Columns field. Make sure to change the Measure of the column values to Sum so that their sum values may be used to visualize the data accordingly.



Next, go to **Show Me > side-by-side bars** icon to change the type of data visualization.

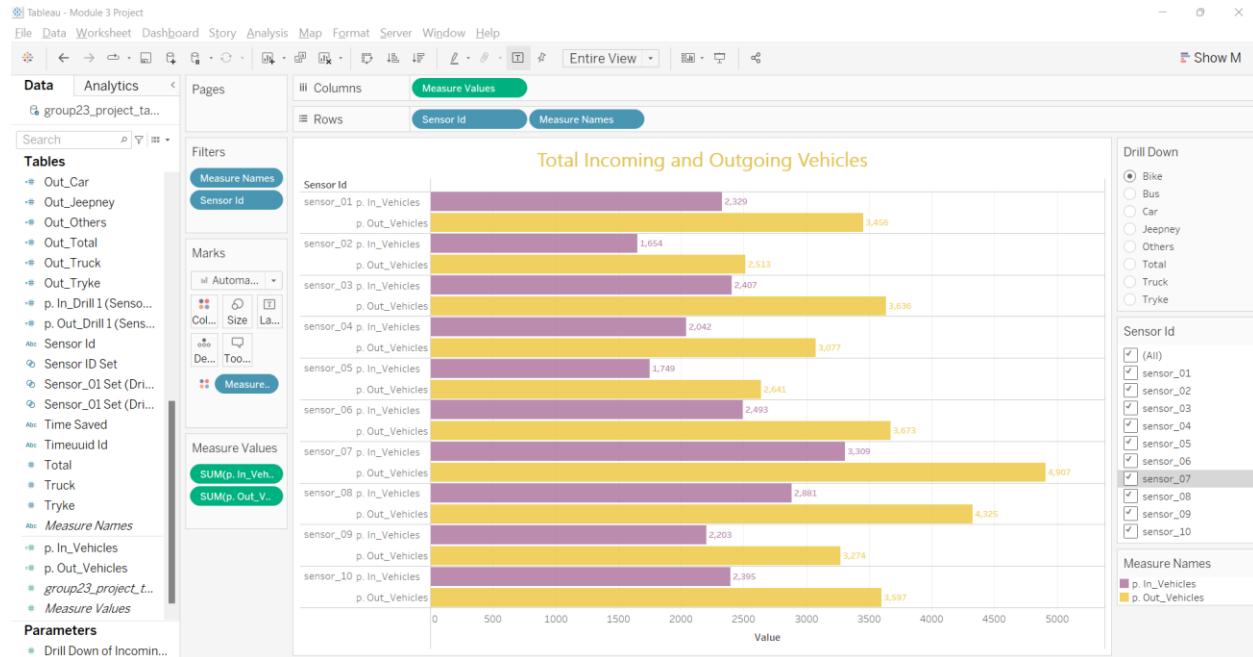


The data visualization should appear like the screenshot below.

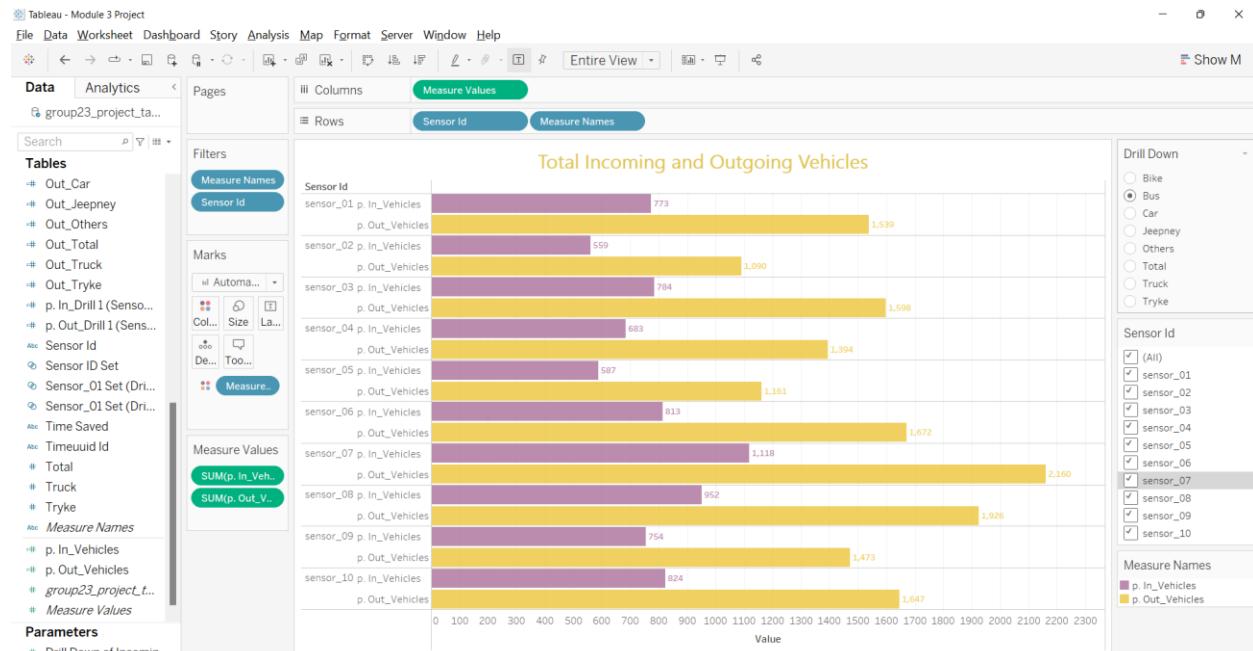


If the parameters were implemented correctly, the user should be able to switch through the different vehicle types using the *Drill Down* parameter on the upper right side of the view. The data values may also be viewed in terms of selected sensor IDs by using the filter on the lower right side of the view.

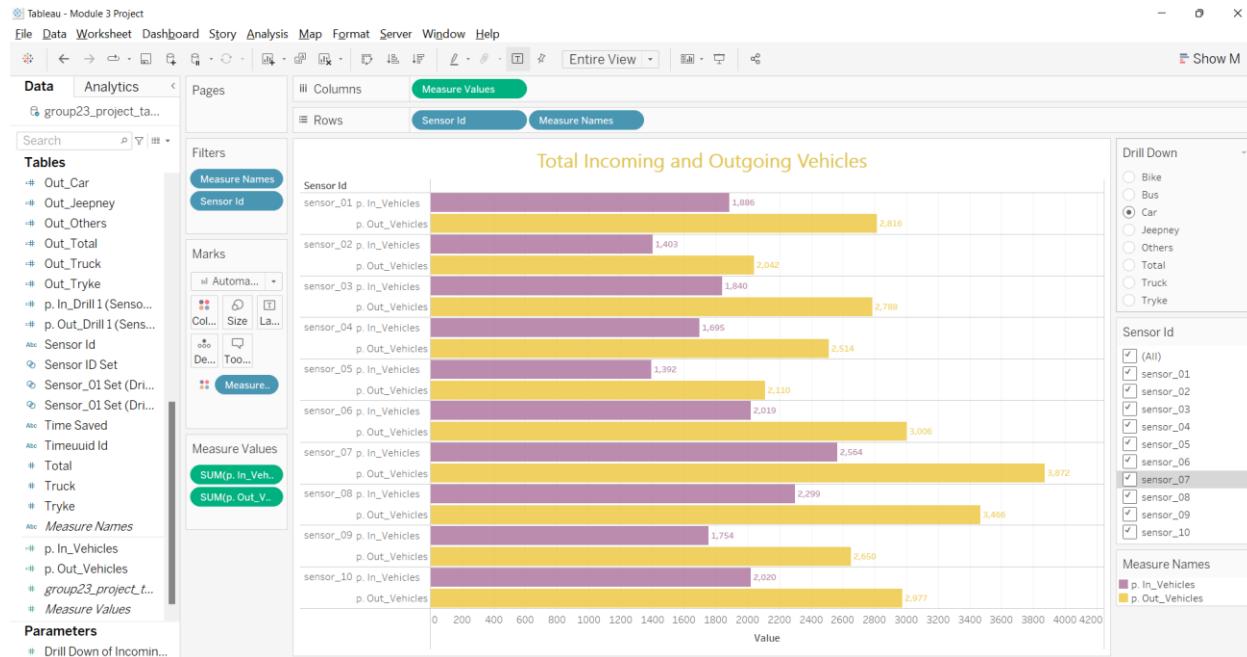
The images below show each data visualization of the sum of each type of vehicle coming in and out per CCTV.



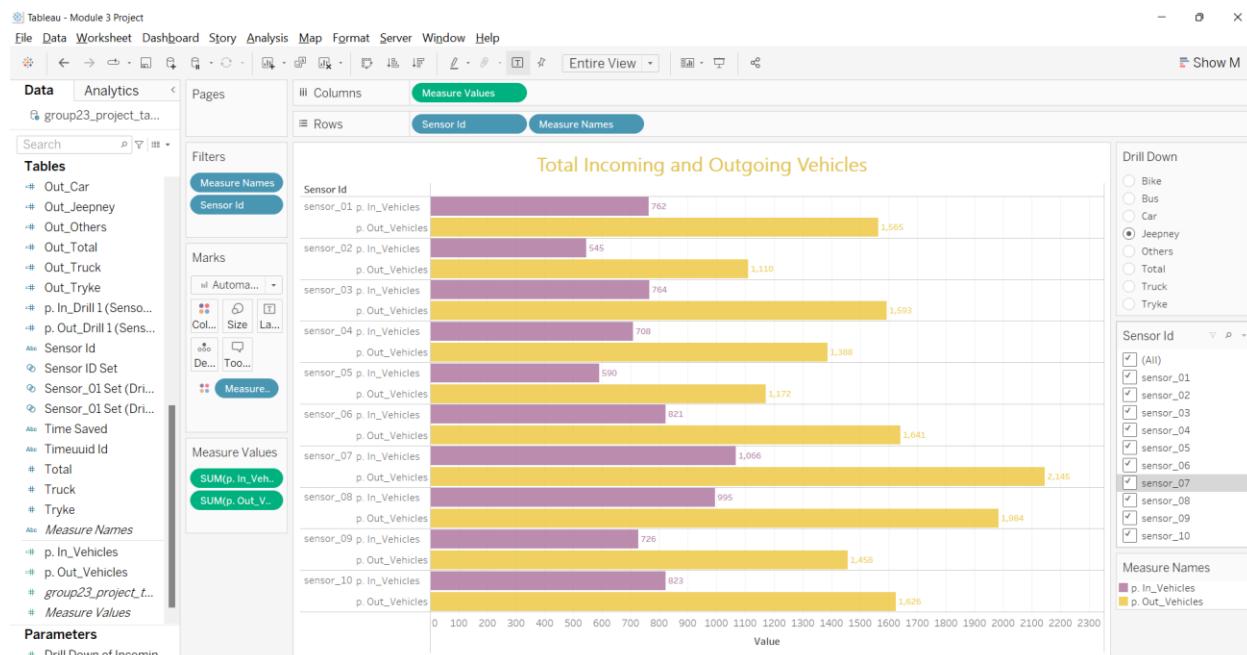
Bike



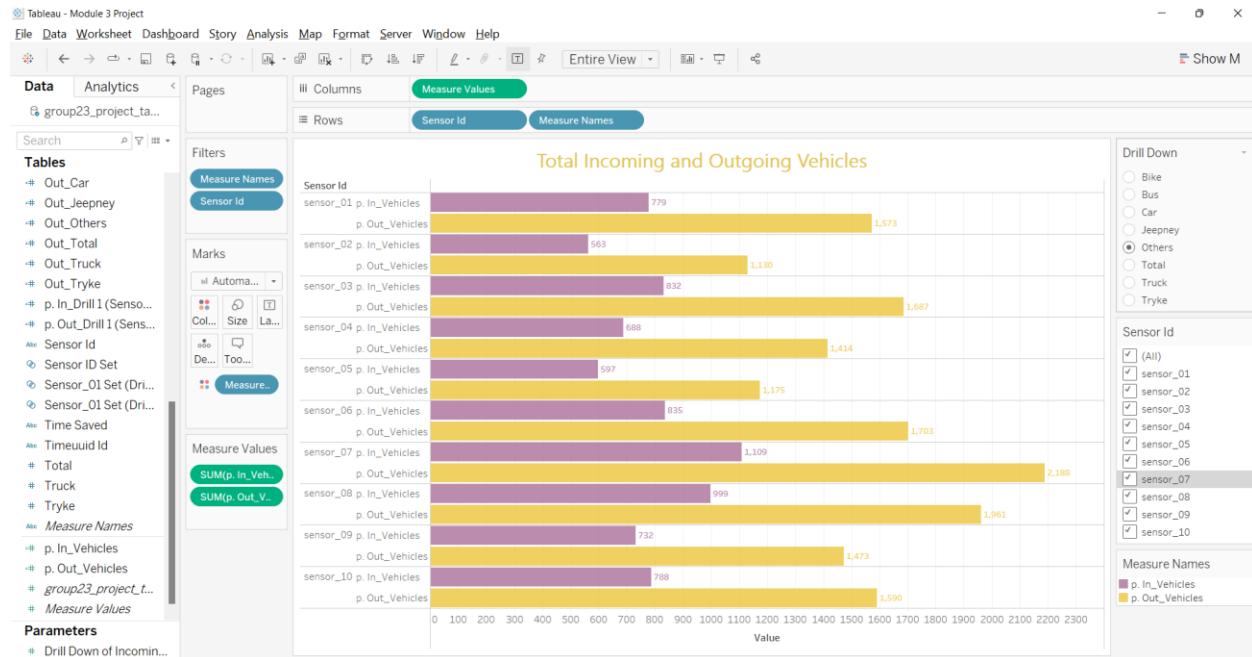
Bus



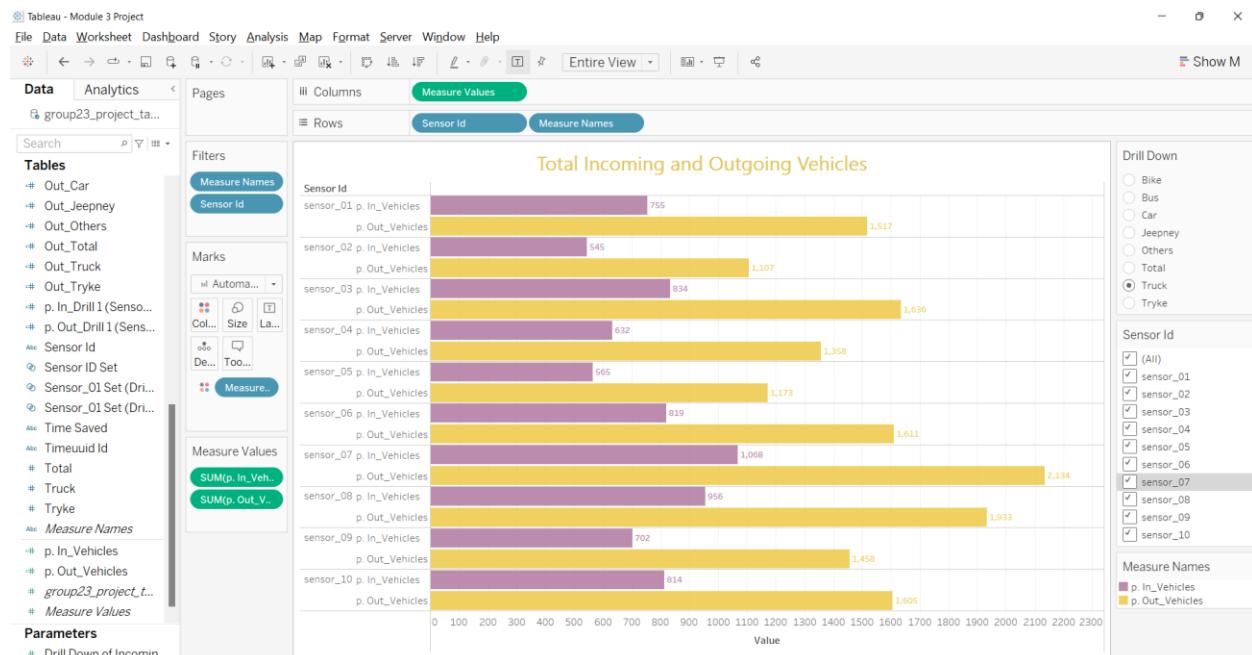
Car



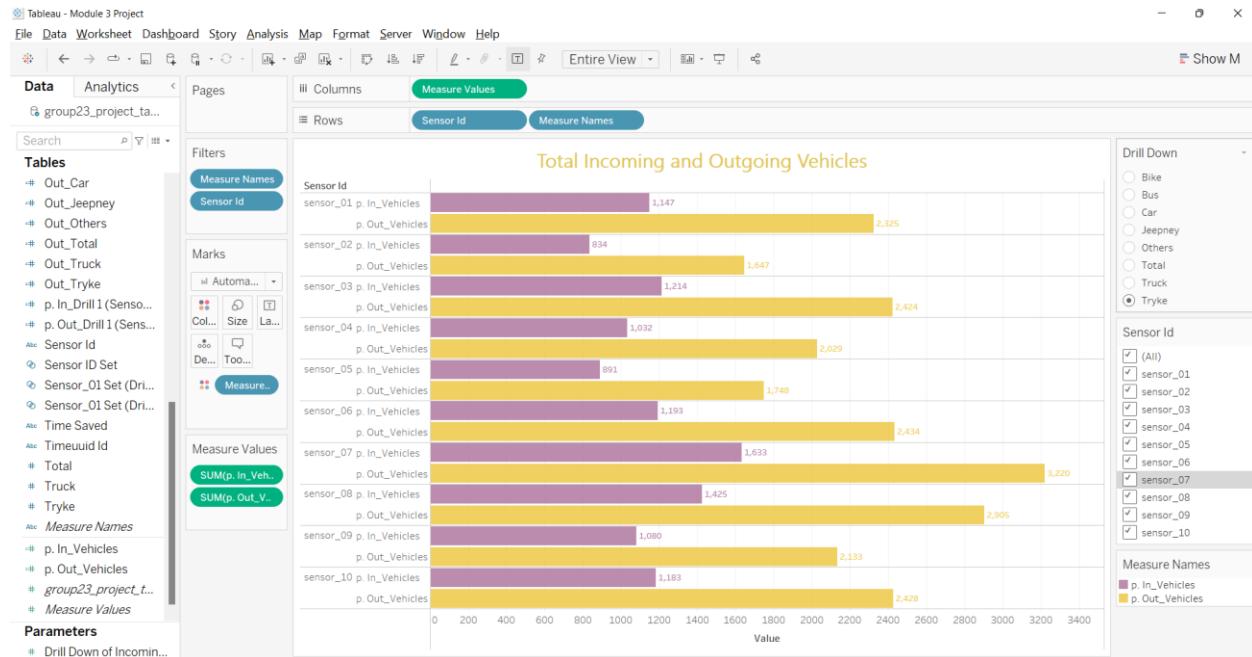
Jeepney



Others

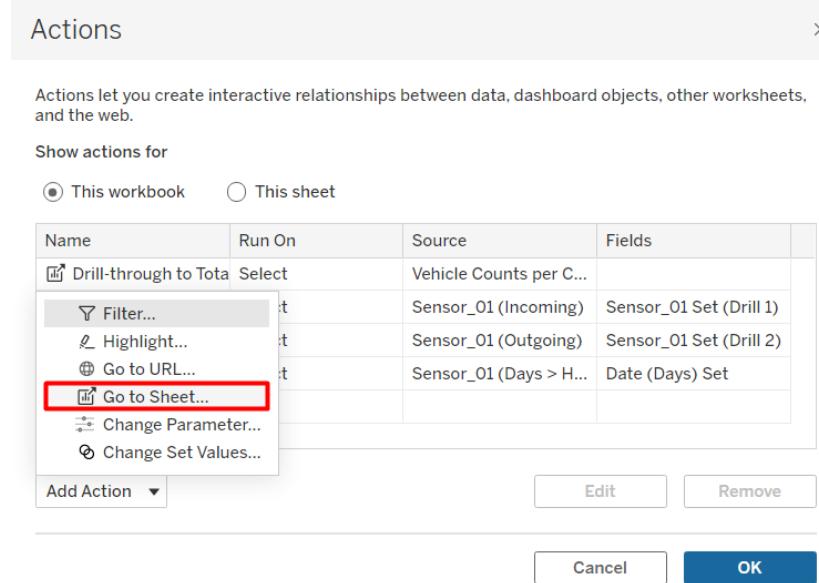


Truck

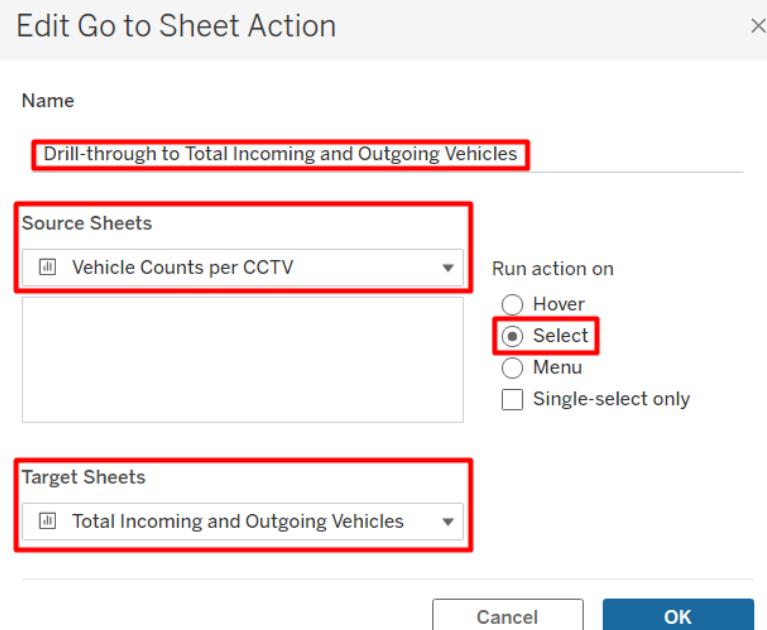


Tryke

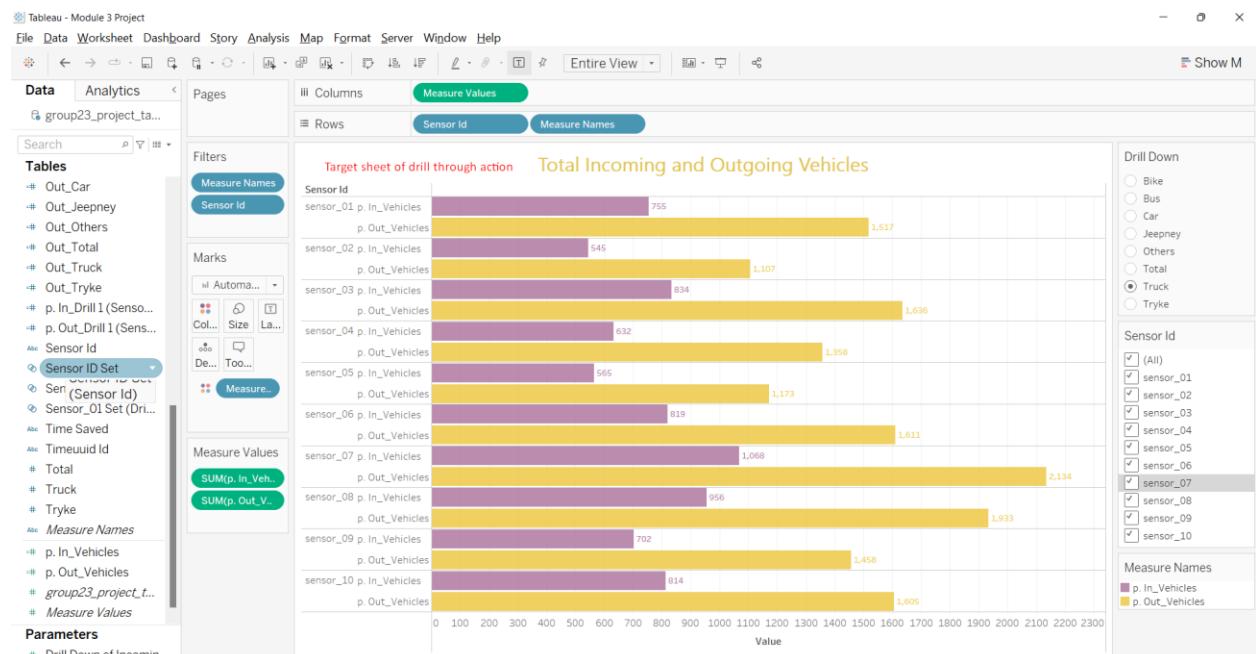
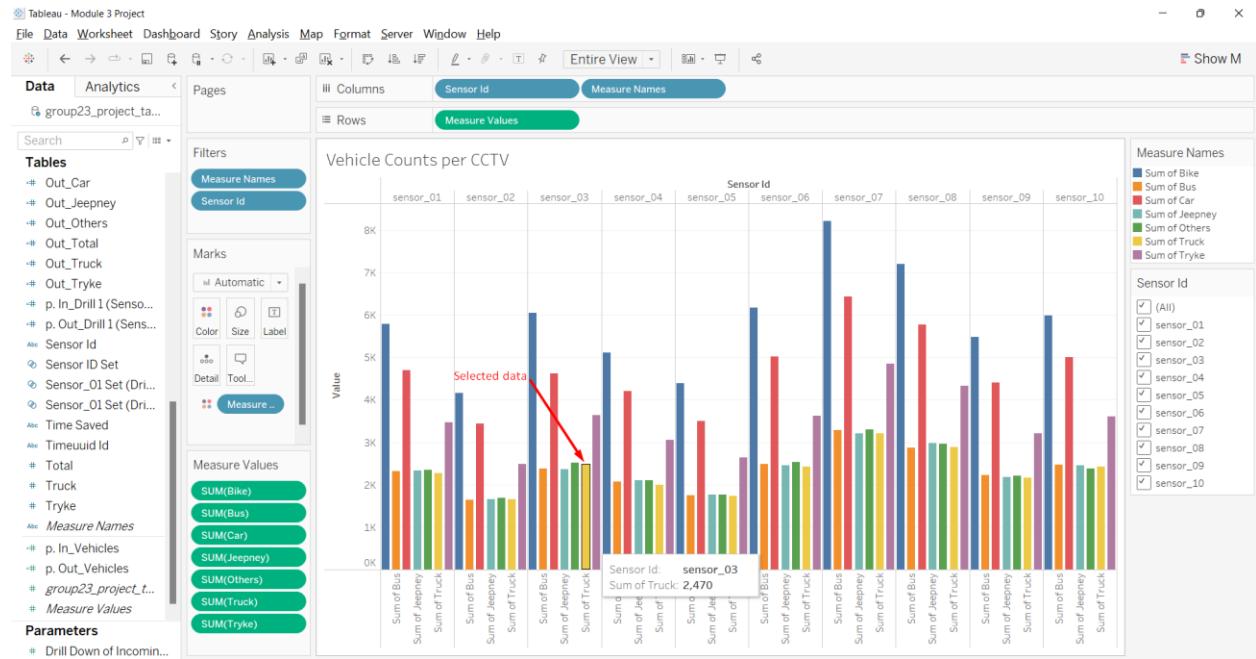
Now that a target page has been created for the drill through from *Vehicle Counts per CCTV* to *Total Incoming and Outgoing Vehicles*, the drill through action may now be implemented. First, return to *Vehicle Counts per CCTV* and go to **Worksheet > Actions > Add Action > Go to Sheet...** to create an action that will perform the drill through from one worksheet to another.



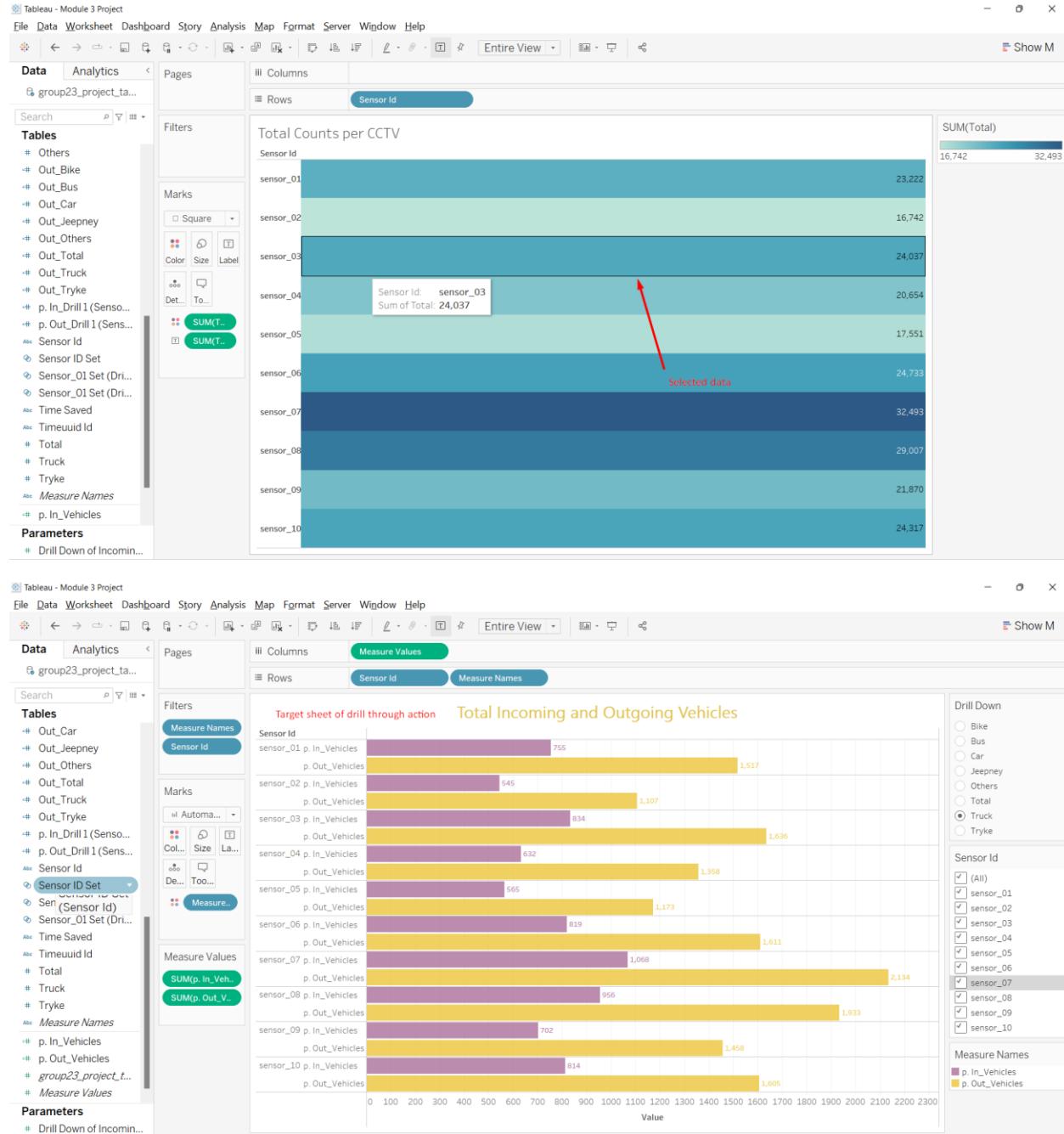
Then, name the Go to Sheet Action as “Drill-through to Total Incoming and Outgoing Vehicles” and set the **Source Sheets** as the current worksheet and the **Target Sheets** as *Total Incoming and Outgoing Vehicles*. In this project, we ran this drill through action on “Select.” Click “OK” to save.



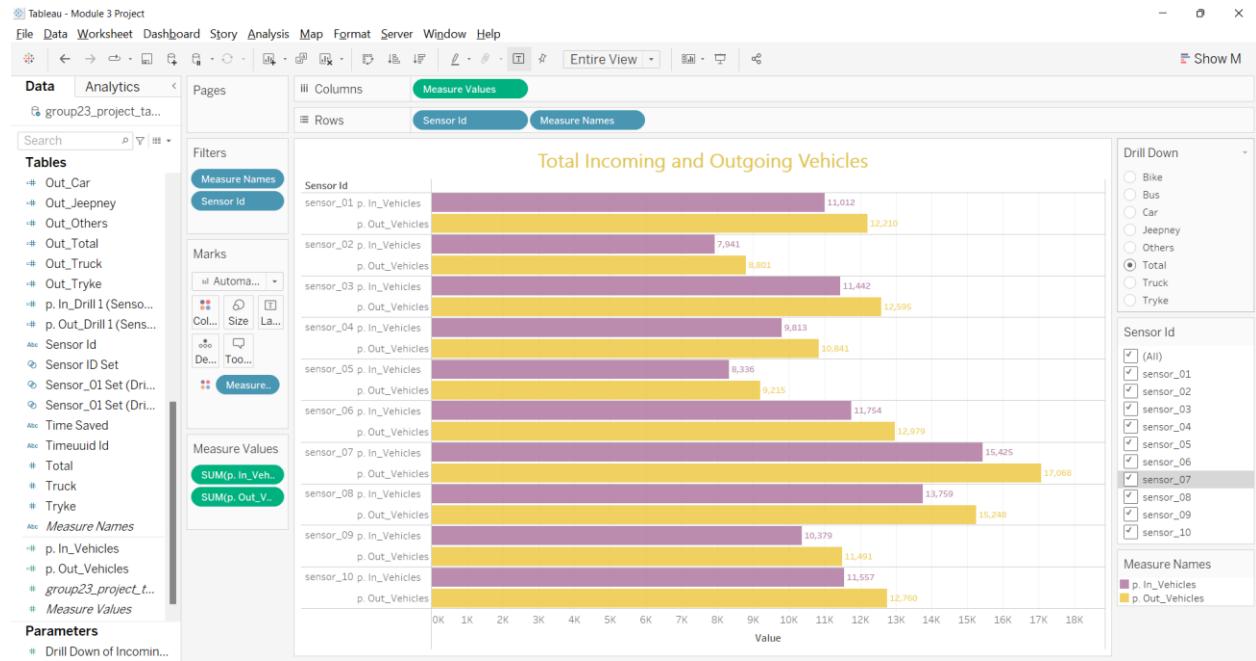
Now, return to the main window and select on any data on the data visualization. Doing so should allow the user to drill through to the specified target sheet called *Total Incoming and Outgoing Vehicles*.



The same drill through action was also applied to *Total Counts per CCTV* and *Total Incoming and Outgoing Vehicles*, where the source sheet is the former and the target sheet is the latter.



The worksheet *Total Incoming and Outgoing Vehicles* is the third page of the project, which also contains a data visualization of each CCTV's total incoming vehicle count and total outgoing vehicle count.



Total

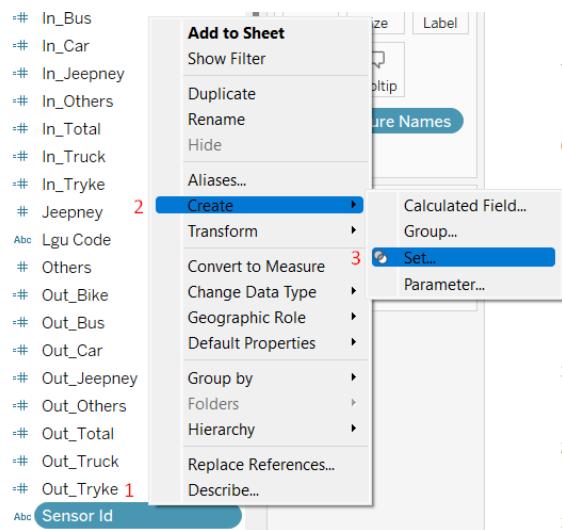
VII. Implementing Drill Down from Total Incoming and Outgoing Vehicles Captured by Each Sensor per Day to Hours

To begin the implementation of the drill down from the total incoming and outgoing vehicles captured by each sensor per day to hours, two sets should be created: *Sensor ID Set* and *Date (Days) Set*. The *Sensor ID Set* will be derived from the *Sensor Id* Table value, and the *Date (Days) Set* will be derived from the custom date created from the Date Saved Table value.

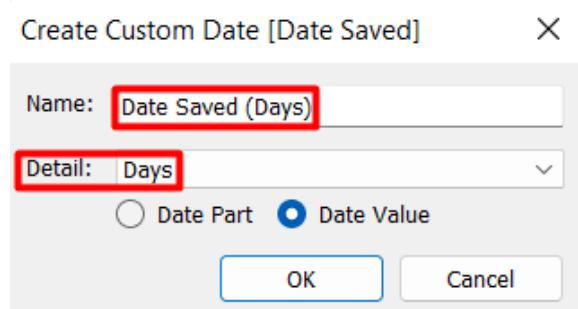
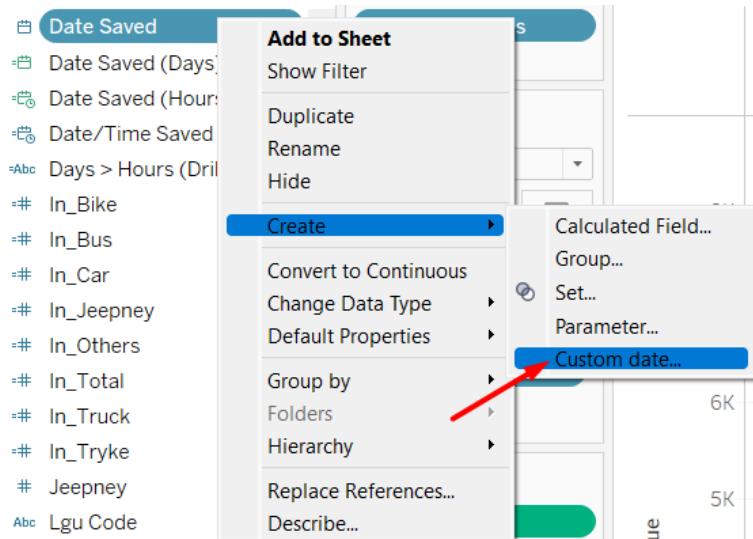
⌚ Date (Days) Set

⌚ Sensor ID Set

First, the *Sensor ID Set* must be created from the *Sensor Id* value. To create a set from a given value, select the **value (Sensor Id) > Create > Set....**



Then, create a *Custom date...* from *Date Saved (Detail > Days)* and label it as **Date Saved (Days)**. This creates the first level of hierarchy for the drill down from days to hours.



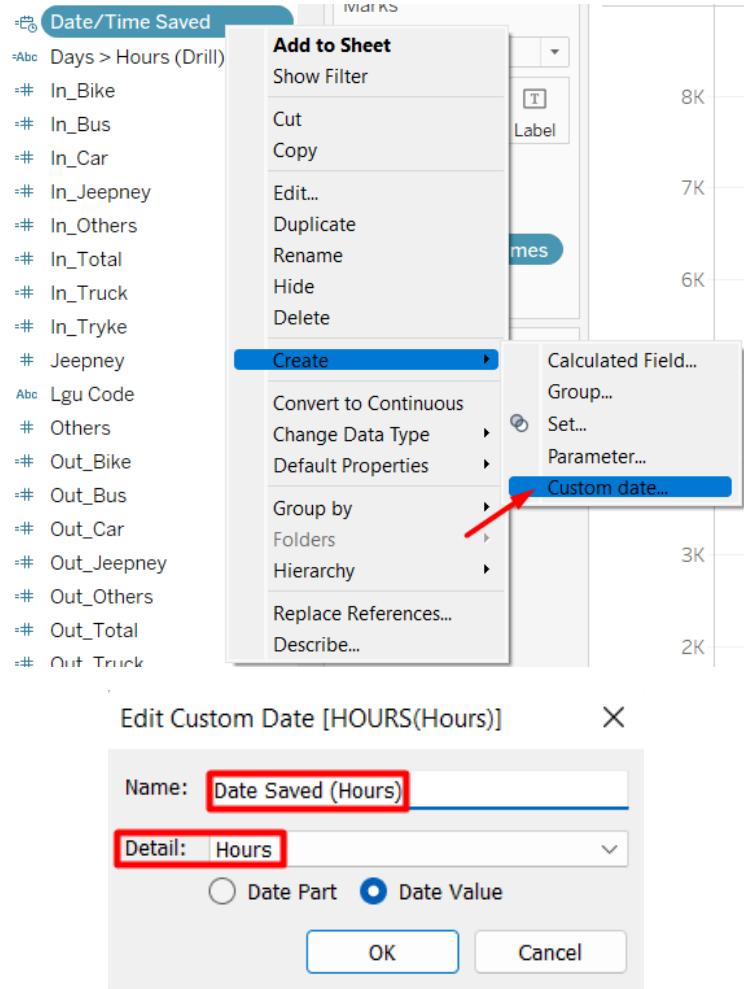
Since the drill down is from days to hours, another custom date must be created for the second level of hierarchy for the drill down (hours). Instead of deriving a custom date from *Date Saved*, a custom date from a [new calculated field](#) should be created: *Date/Time Saved*. This calculated field will display both the date and time of each sensor ID specified in the data visualization.

```

Date/Time Saved
DATETIME(STR([Date Saved]) + ' ' + [Time Saved])
The calculation is valid. 6 Dependencies ▾ Apply OK

```

This new custom date should be named **Date Saved (Hours)** (*Detail > Hours*).



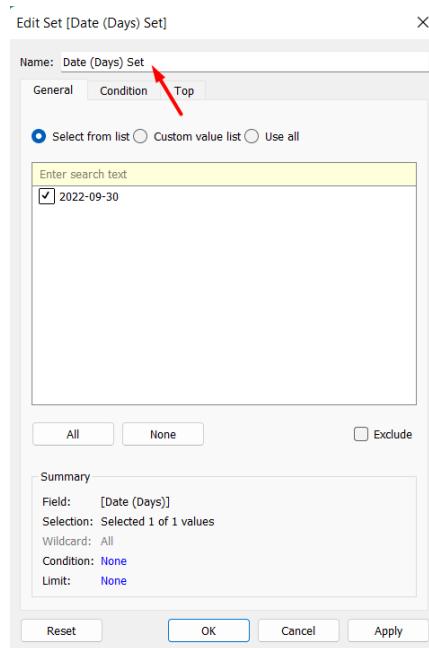
Lastly, create a calculated field named *Date Bin* that will convert the custom date *Date Saved (Hours)* to a string. This step will ensure that the custom date for hours will be accessed as a string by Tableau later.

```
STR([Date Saved (Hours)])
```

The calculation is valid. 4 Dependencies ▾ Apply OK

Now that those prerequisites have been created, a drill down from Days to Hours can be created.

First, derive the *Date (Days) set* from the custom date *Date Saved (Days)*.



Then, create a calculated field called *Date (Days)* for the *Date (Days) set* by inserting the following code into the calculated field:

```
STR([Date Saved (Days)])
```



Next, create another calculated field called *Days > Hours (Drill)* and insert the following code:

```
IF [Date (Days) Set]
THEN [Date Bin]
ELSE [Date (Days)]
END
```

This code will determine the path the Action will take, such that if the user selects date data on the visualization, Tableau will call *Date Bin* to “drill down” the date value to hours by returning

a string type of *Date Saved (hours)*). If the selected data portrays a non-date value, then Tableau will return the custom date, *Date (Days)*, and a drill down will not occur.

Days > Hours (Drill)

X

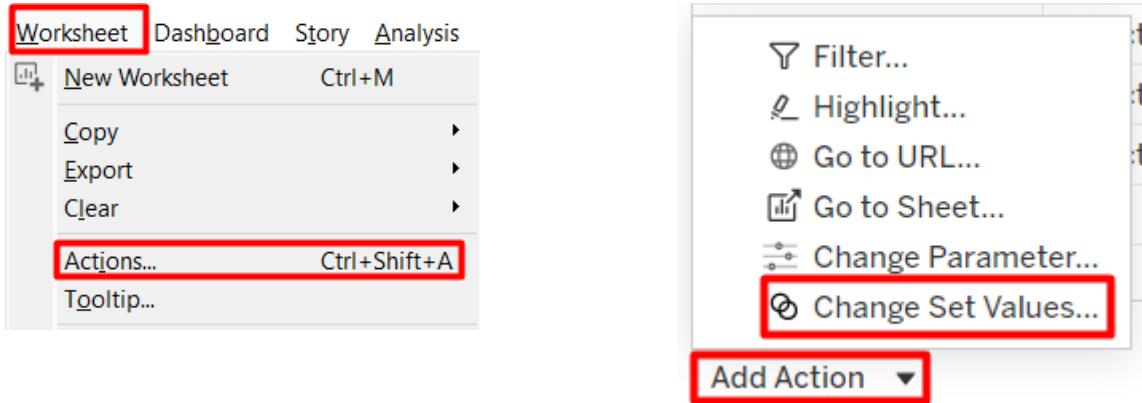
```
IF [Date (Days) Set]
THEN [Date Bin]
ELSE [Date (Days)]
END
```

▶

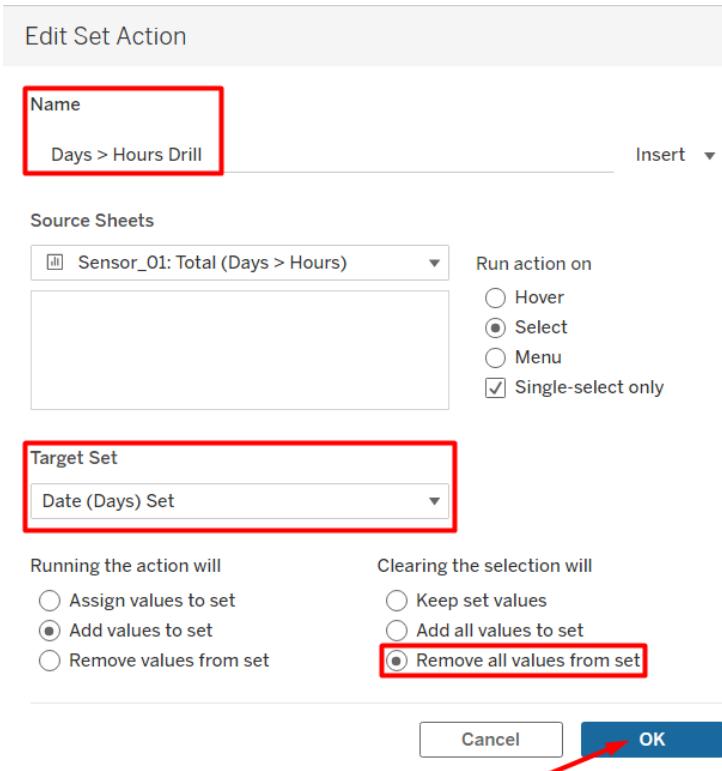
The calculation is valid.3 Dependencies ▾

ApplyOK

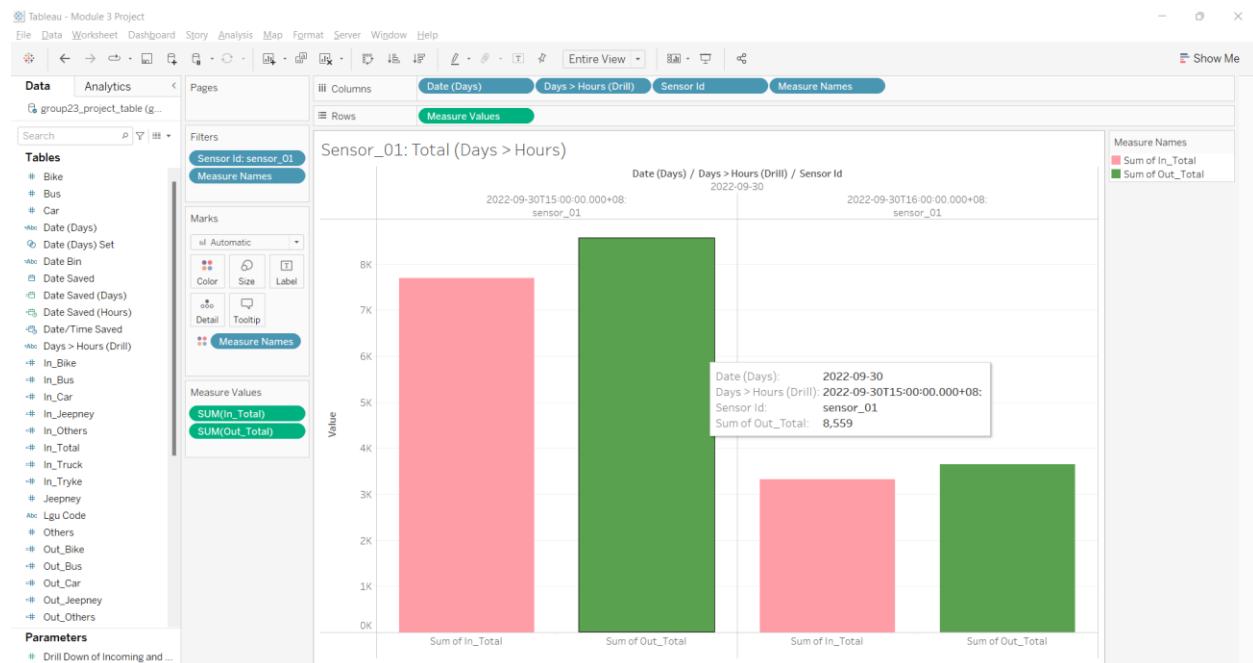
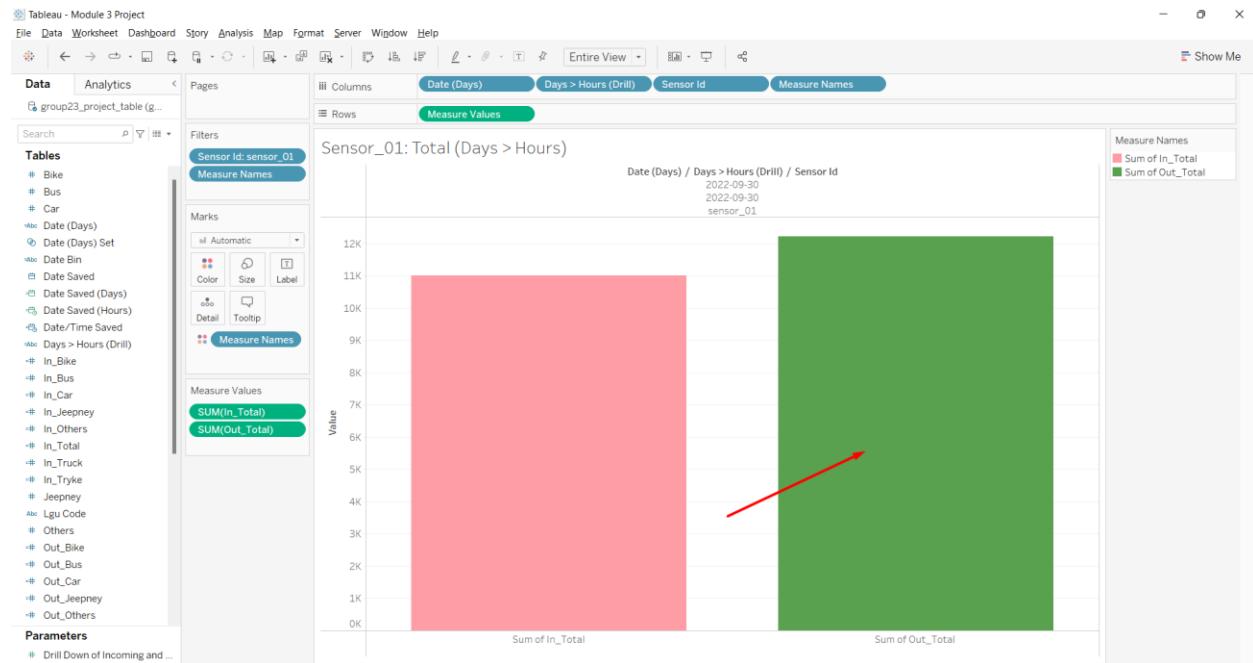
The last step in enabling a drill down between values is to add the action that will drill down the current worksheet to the specified set. To do this, go to **Worksheet > Actions.. > Add Action > Change Set Values....**



Set the Target Set to *Date (Days) Set* and choose *Remove all values from set* under *Clearing the section will*. In this project, we named this action as “Days > Hours Drill.” Click *OK*.



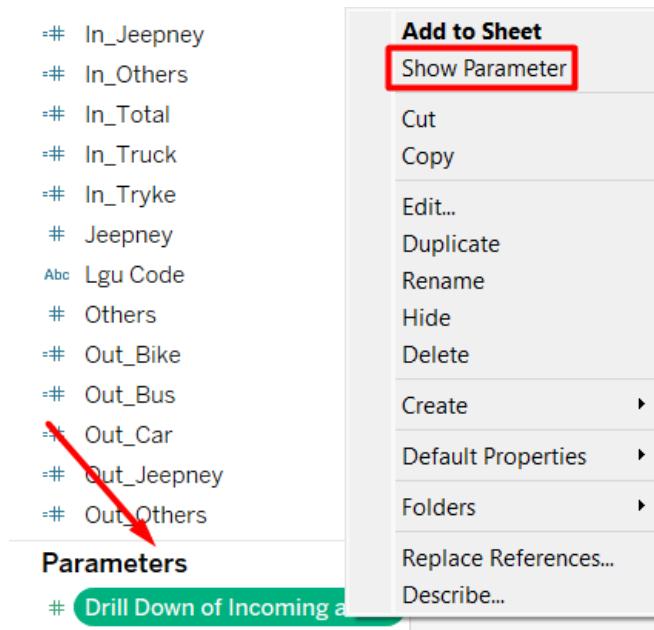
If all configurations were made correctly, the drill down feature of the current worksheet should be enabled when the user clicks on a date value, as shown in the figures below.



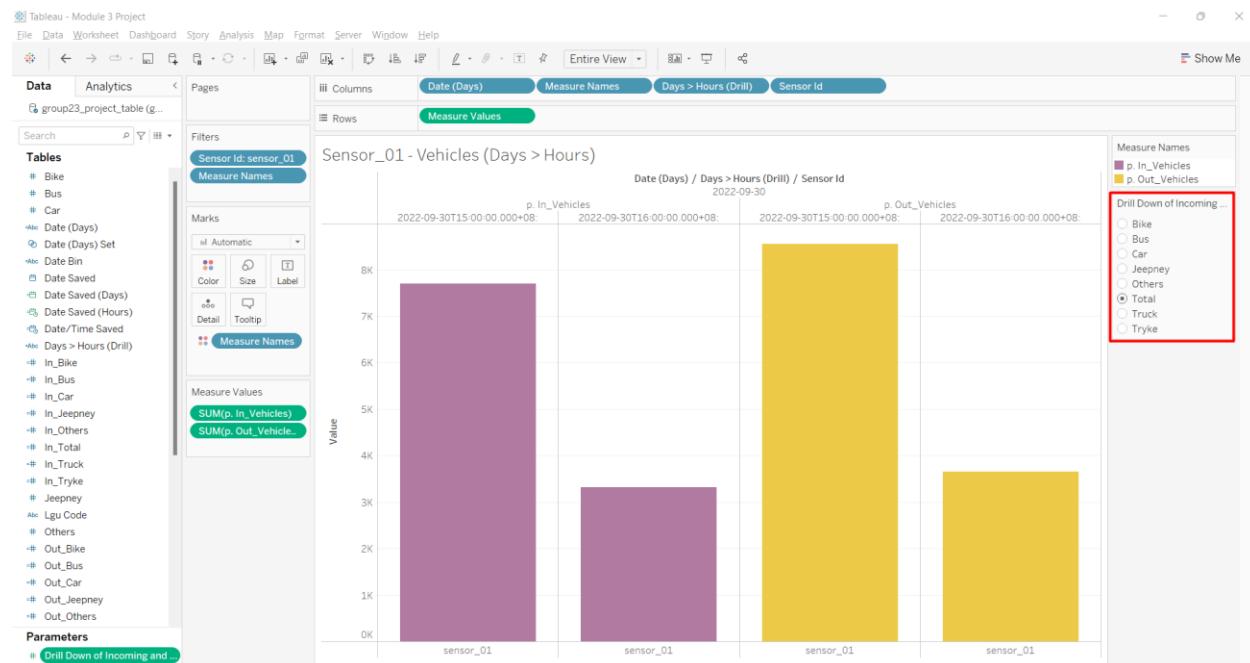
Note: Only one date was identified from the Cassandra table; hence, only one date was visualized by Tableau.

VIII. Implementing Drill Down from Individual Incoming and Outgoing Vehicles Captured by Each Sensor per Day to Hours

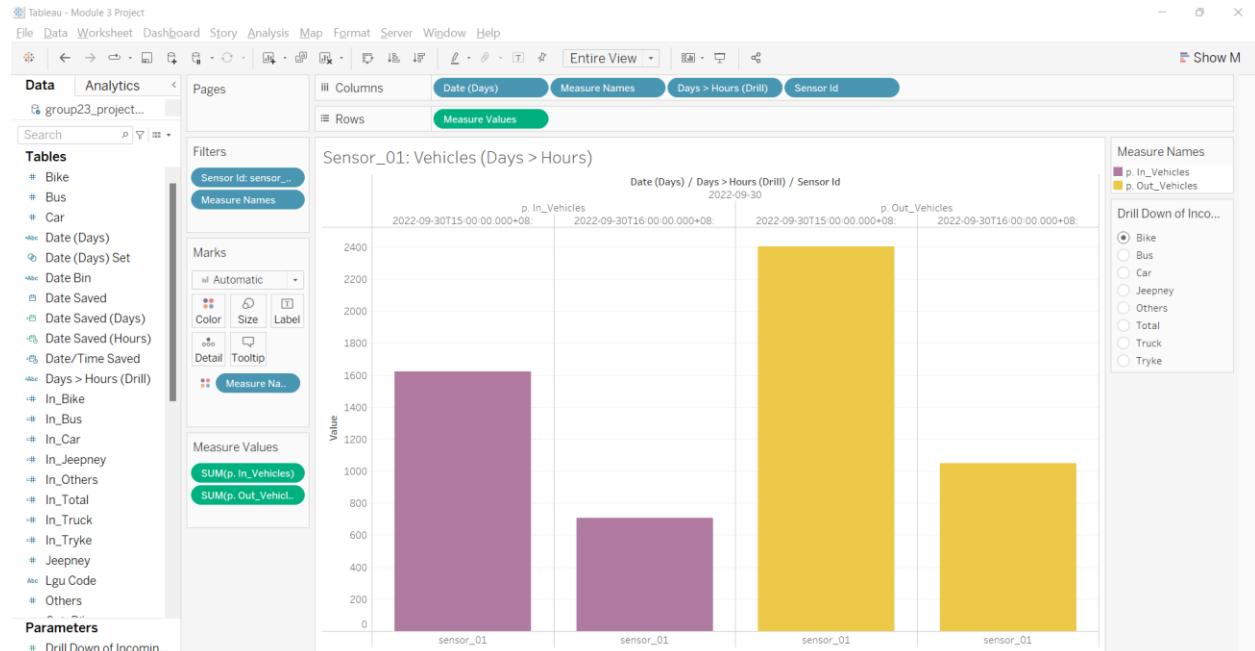
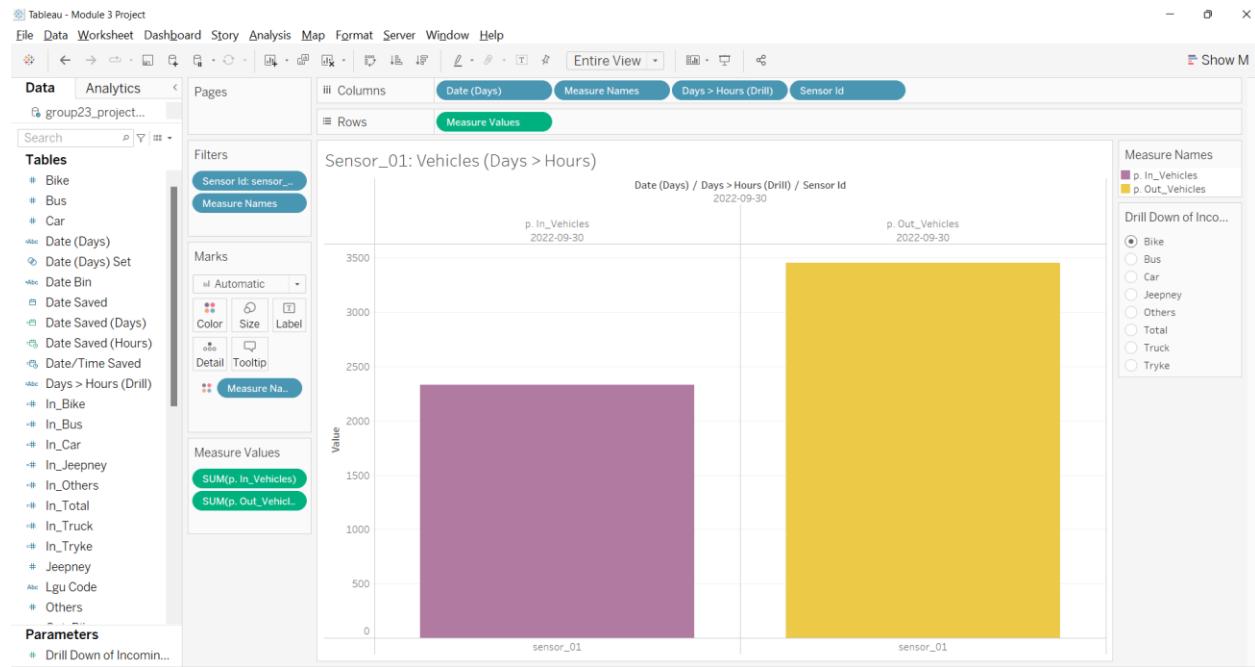
To implement a drill down from days to hours per incoming and outgoing vehicles, follow the steps from the previous step and enable the *Drill Down of Incoming and Outgoing Vehicles* parameter on the bottom left of the window.



Doing so should enable (or show) a feature (parameter) that will allow the user to choose among the different vehicles. This selection of different vehicles will be located on the upper right corner of the window, as shown below.

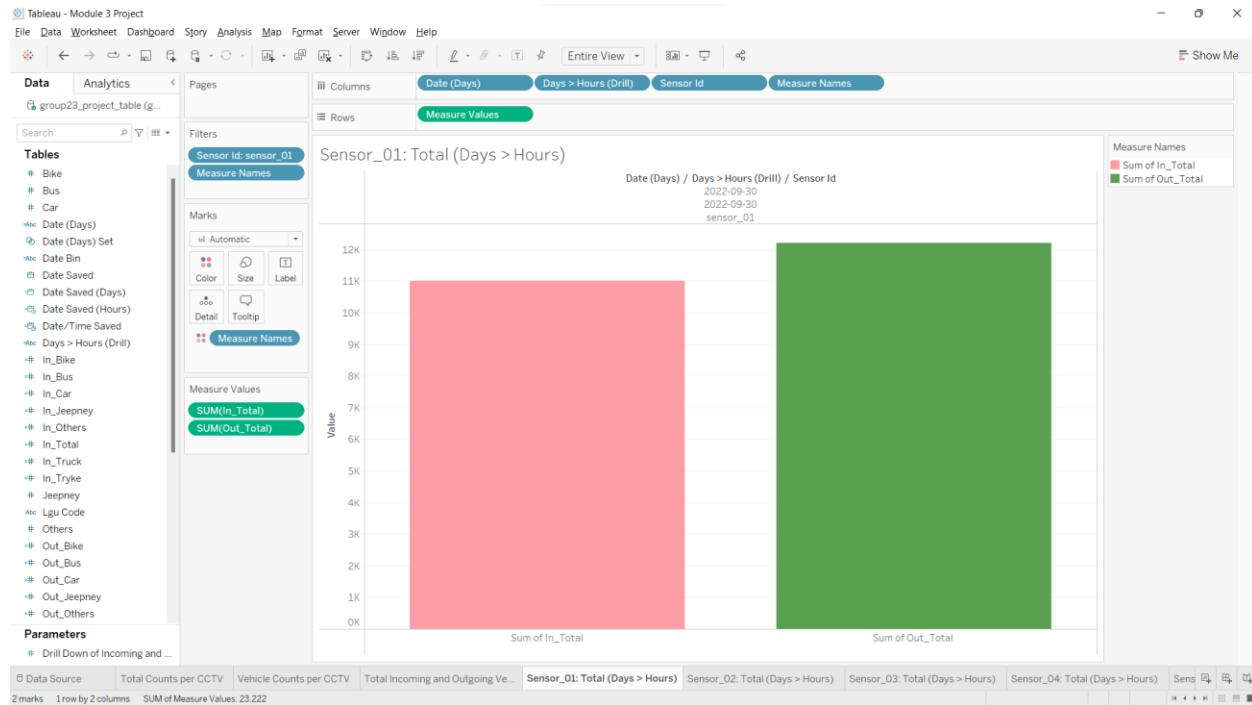


If all configurations were made correctly, the drill down feature of the current worksheet should be enabled when the user clicks on a date value, as shown in the figures below.

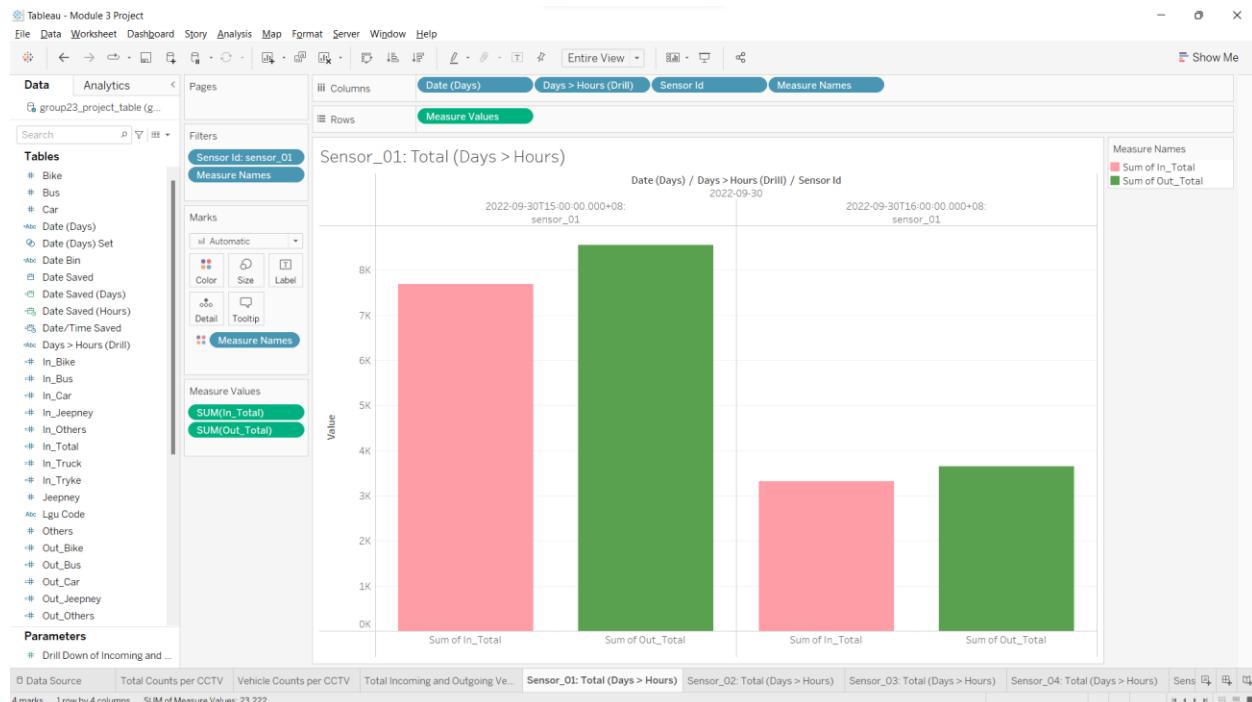


Since there are ten different sensors capturing various incoming and outgoing vehicles, both drill down processes, **Total Incoming and Outgoing Vehicles (Days to Hours)** and **Individual Incoming and Outgoing Vehicles (Days to Hours)**, were duplicated nine times to represent the nine other sensors.

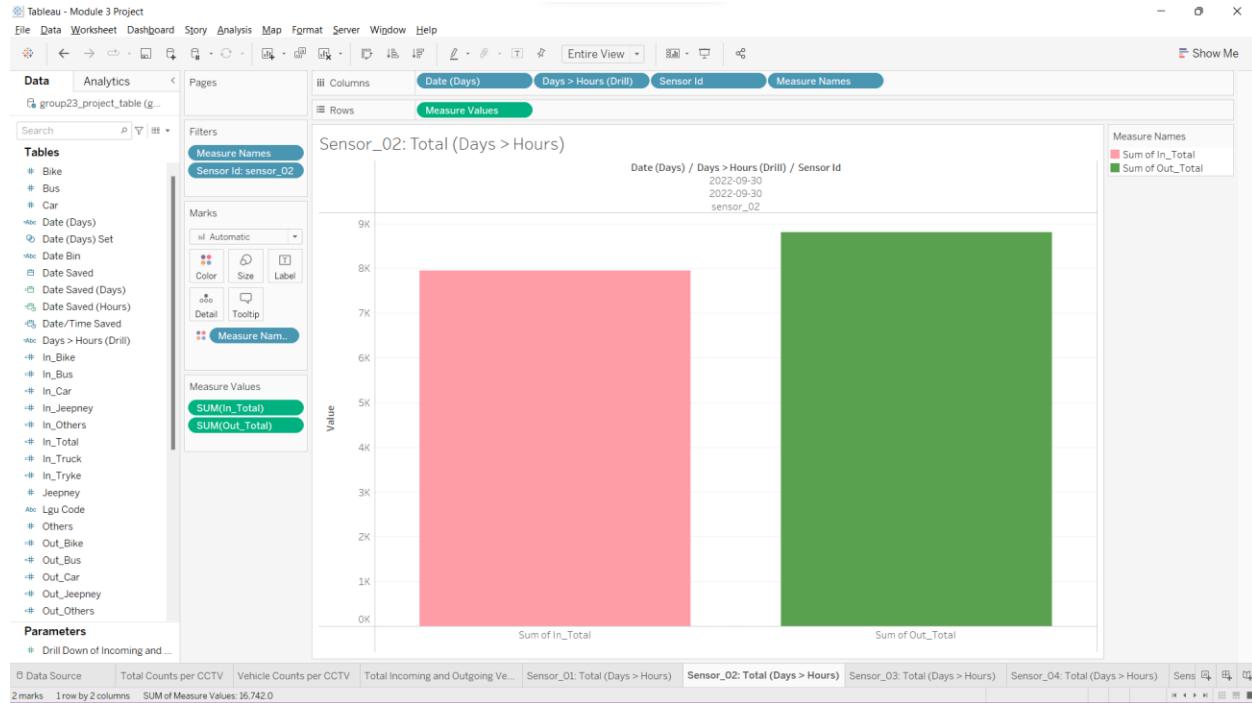
Total Incoming and Outgoing Vehicles (Days to Hours) Drill Down



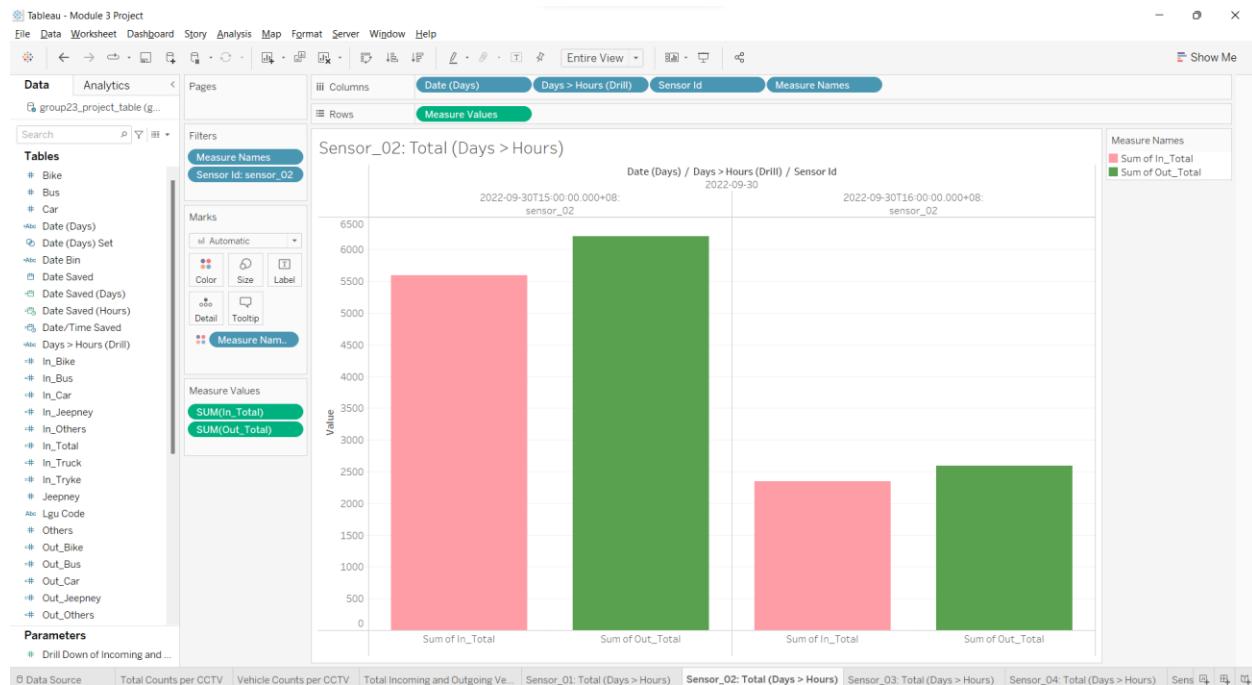
Sensor_01



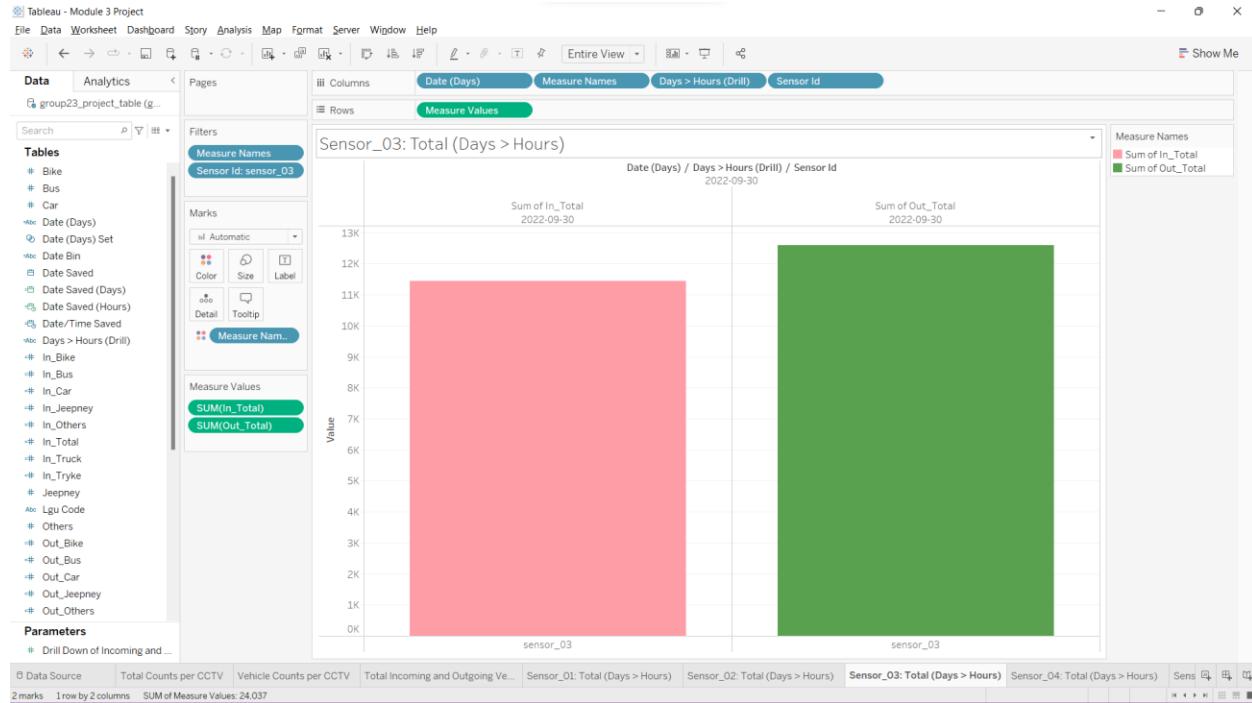
Sensor_01 (Drill Down)



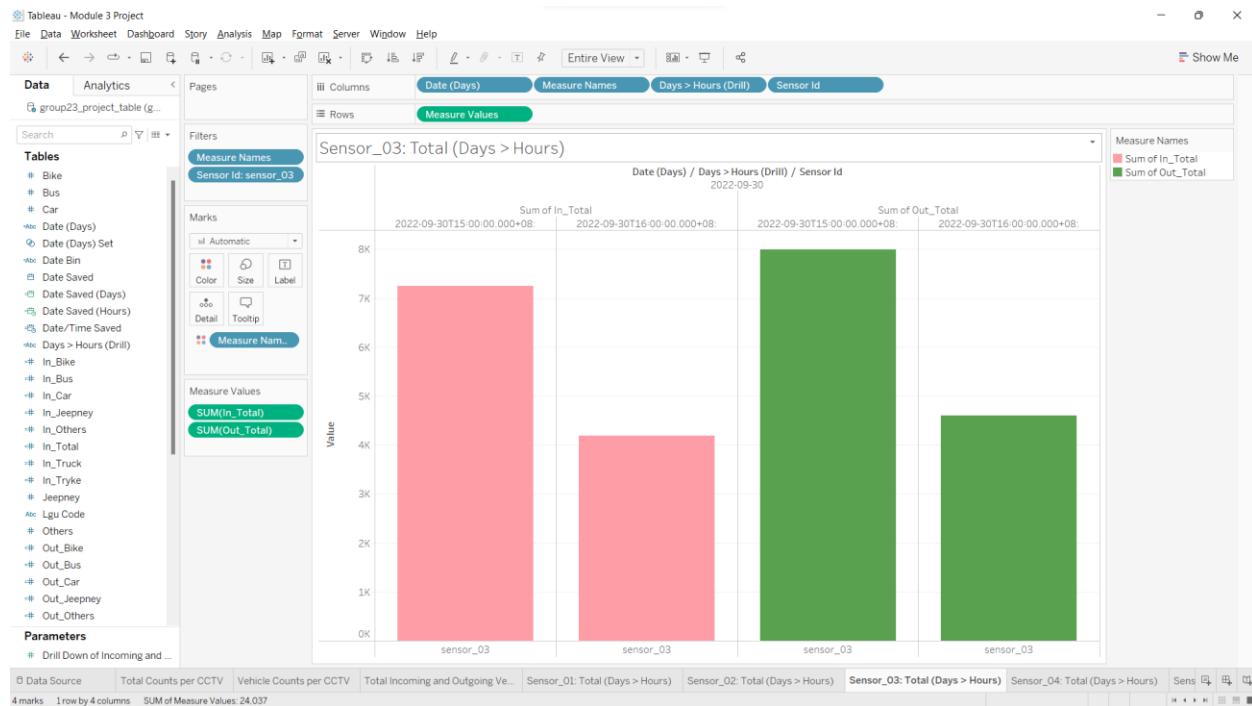
Sensor_02



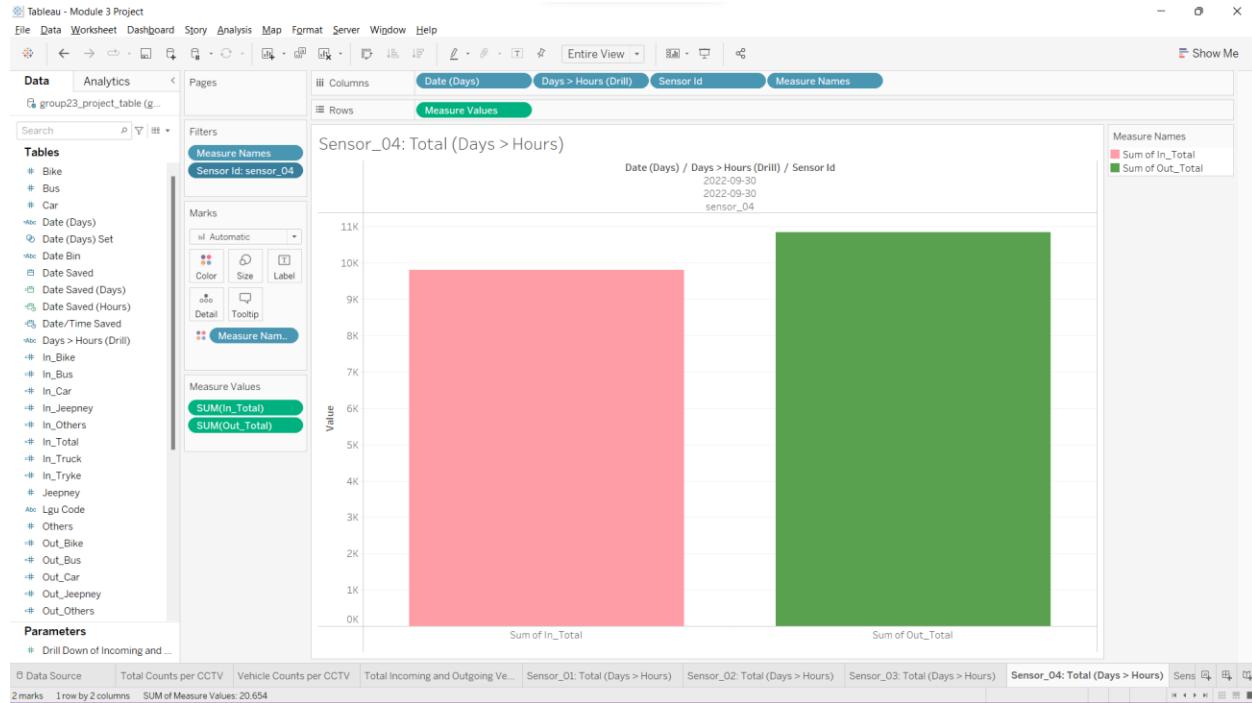
Sensor_02 (Drill Down)



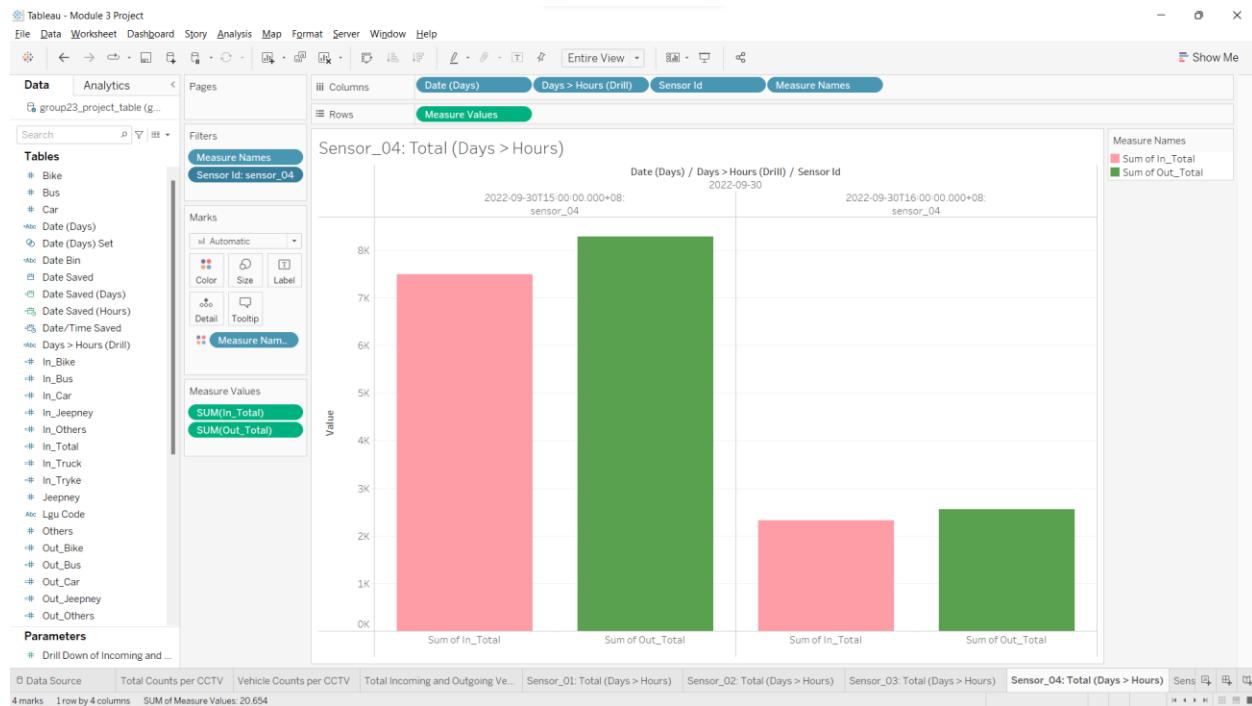
Sensor_03



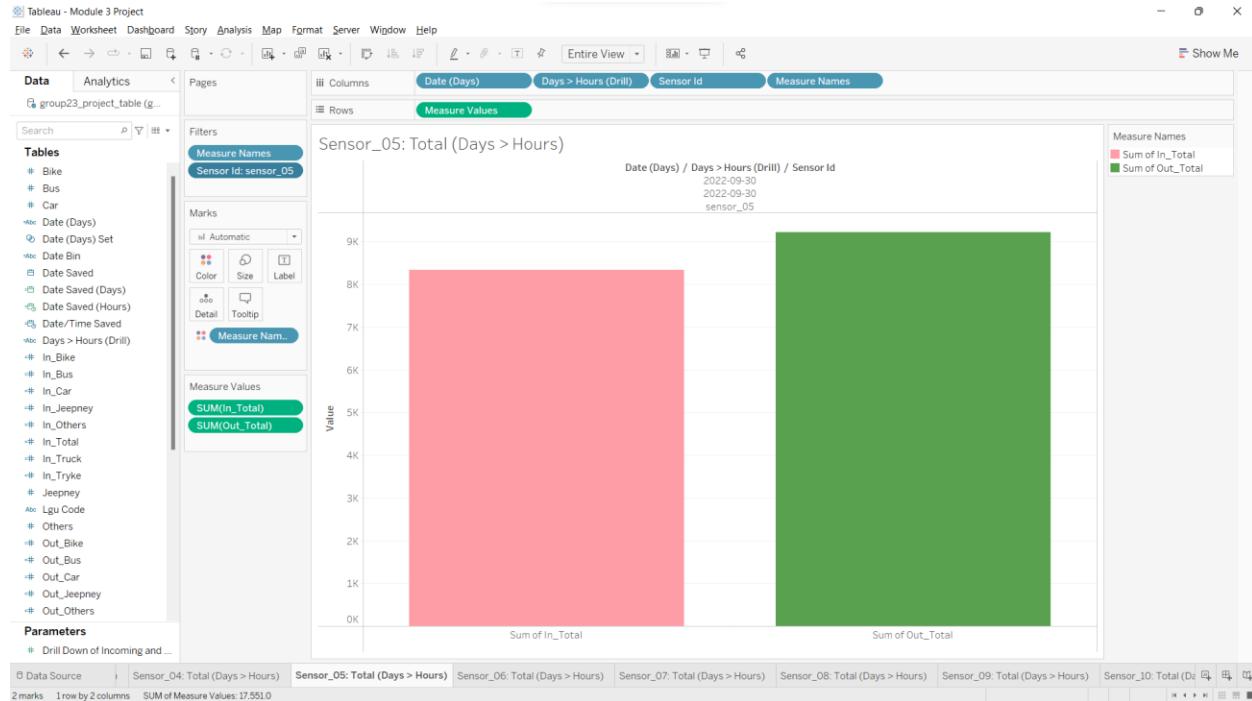
Sensor_03 (Drill Down)



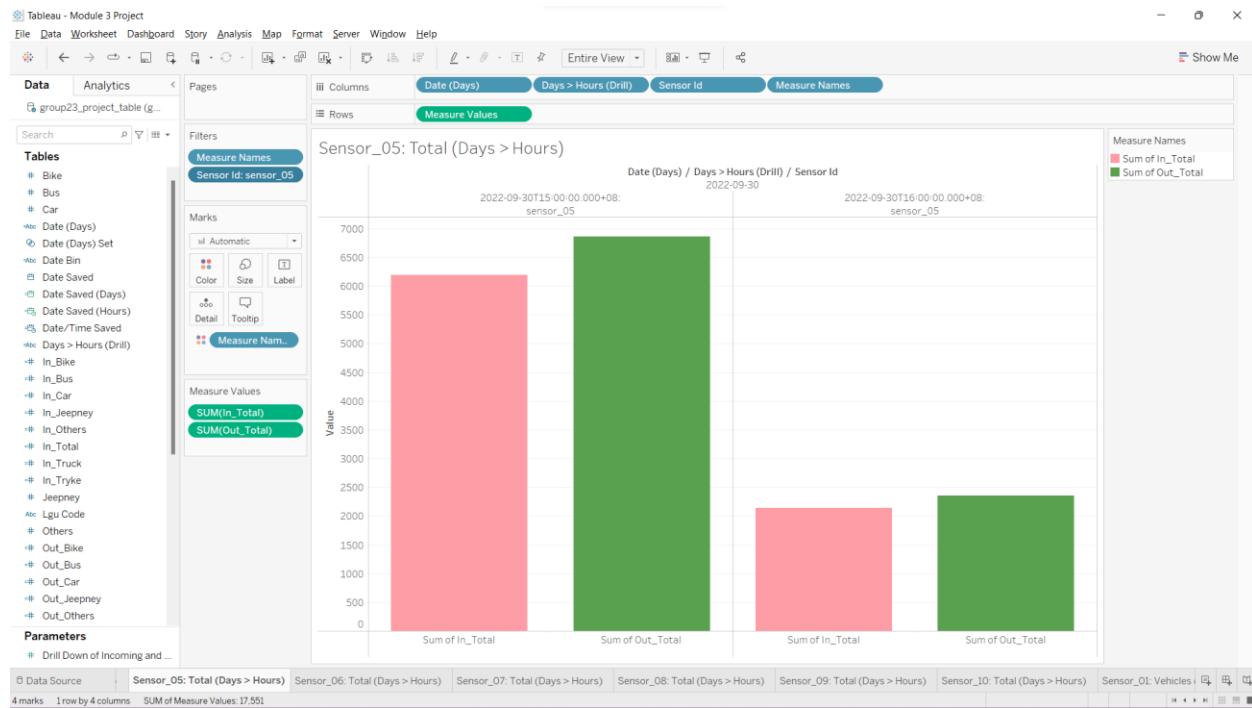
Sensor_04



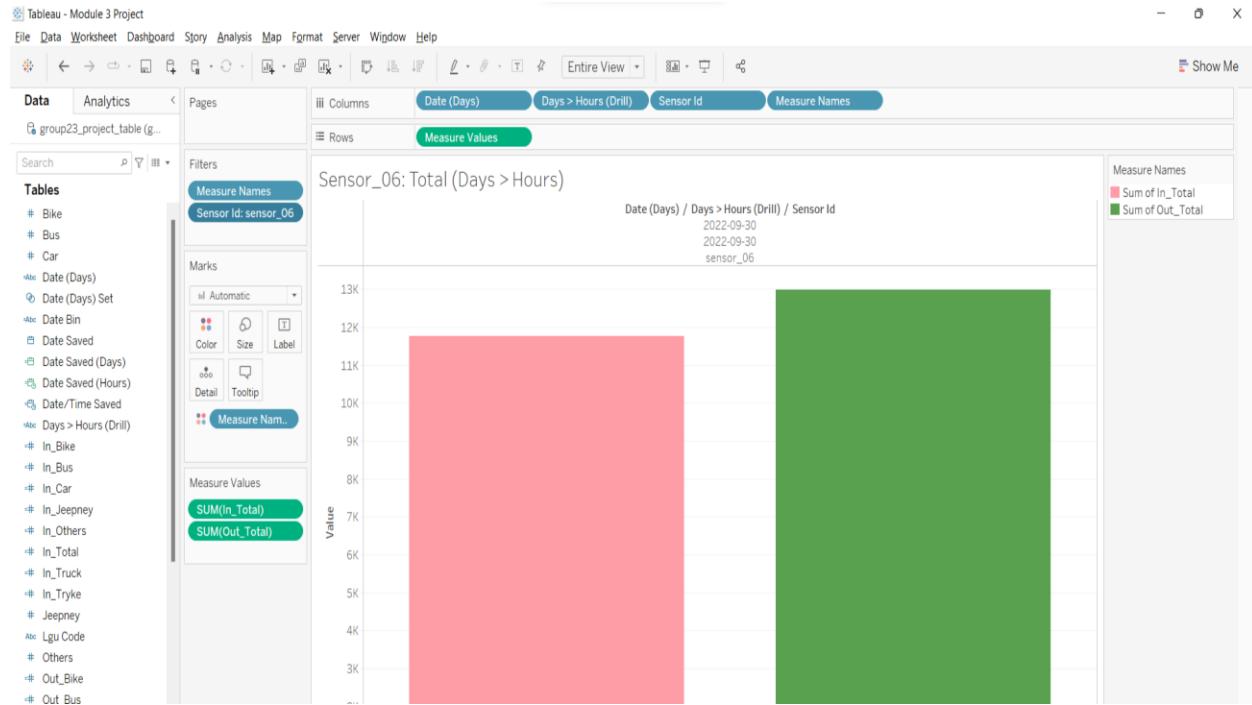
Sensor_04 (Drill Down)



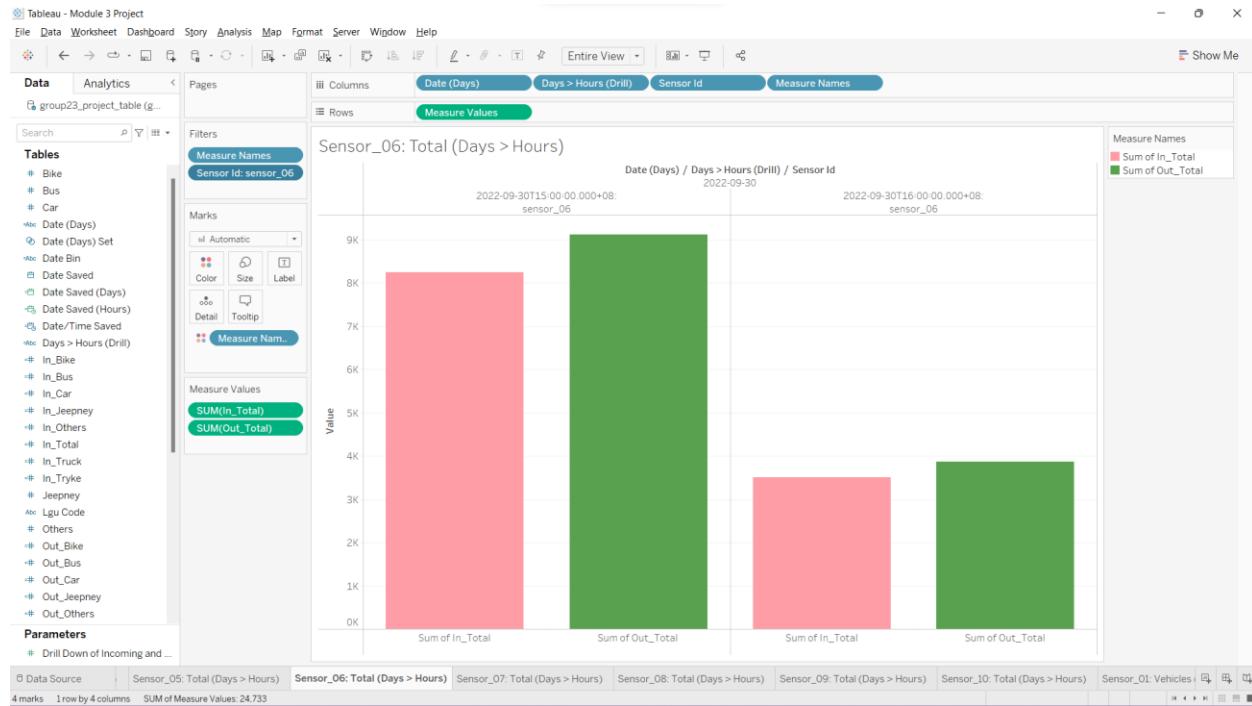
Sensor_05



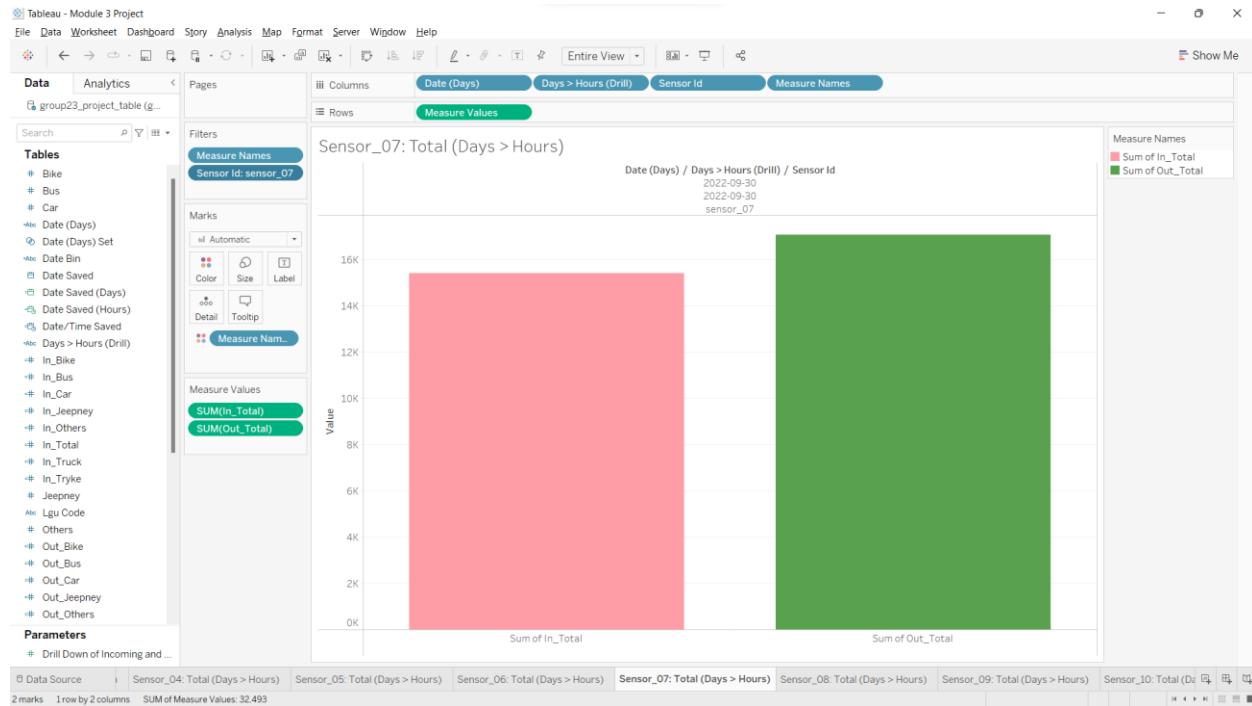
Sensor_05 (Drill Down)



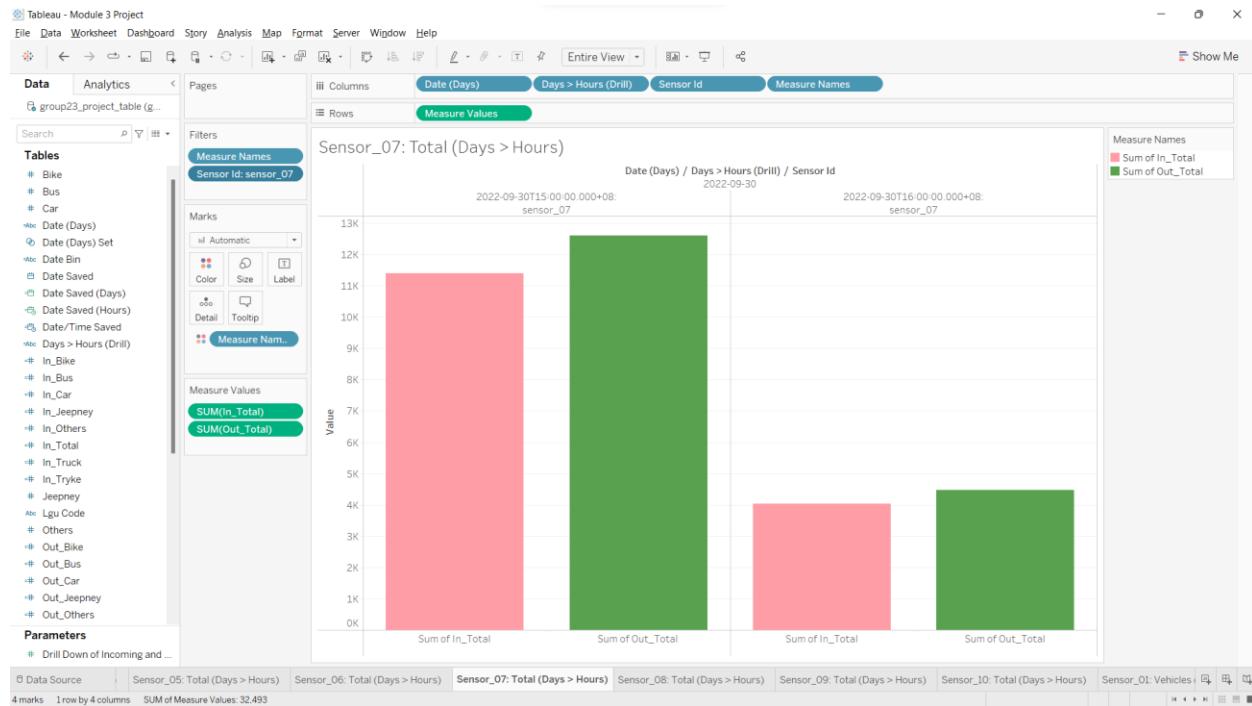
Sensor_06



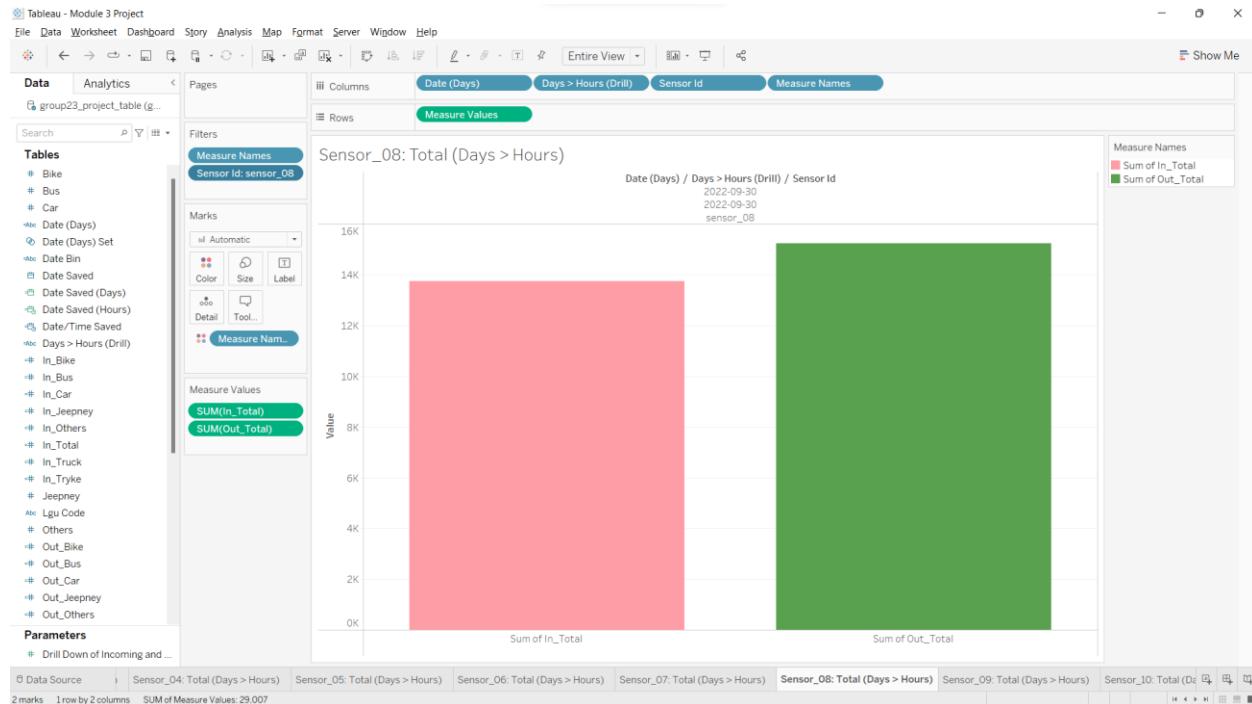
Sensor_06 (Drill Down)



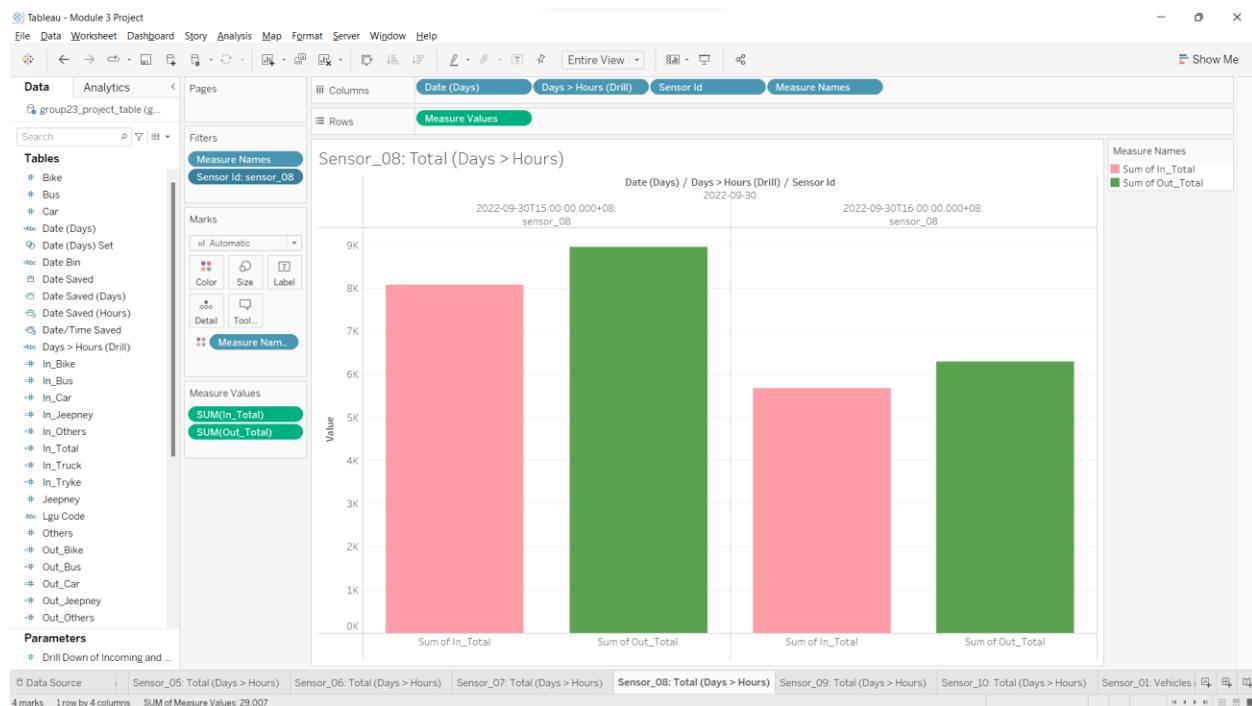
Sensor_07



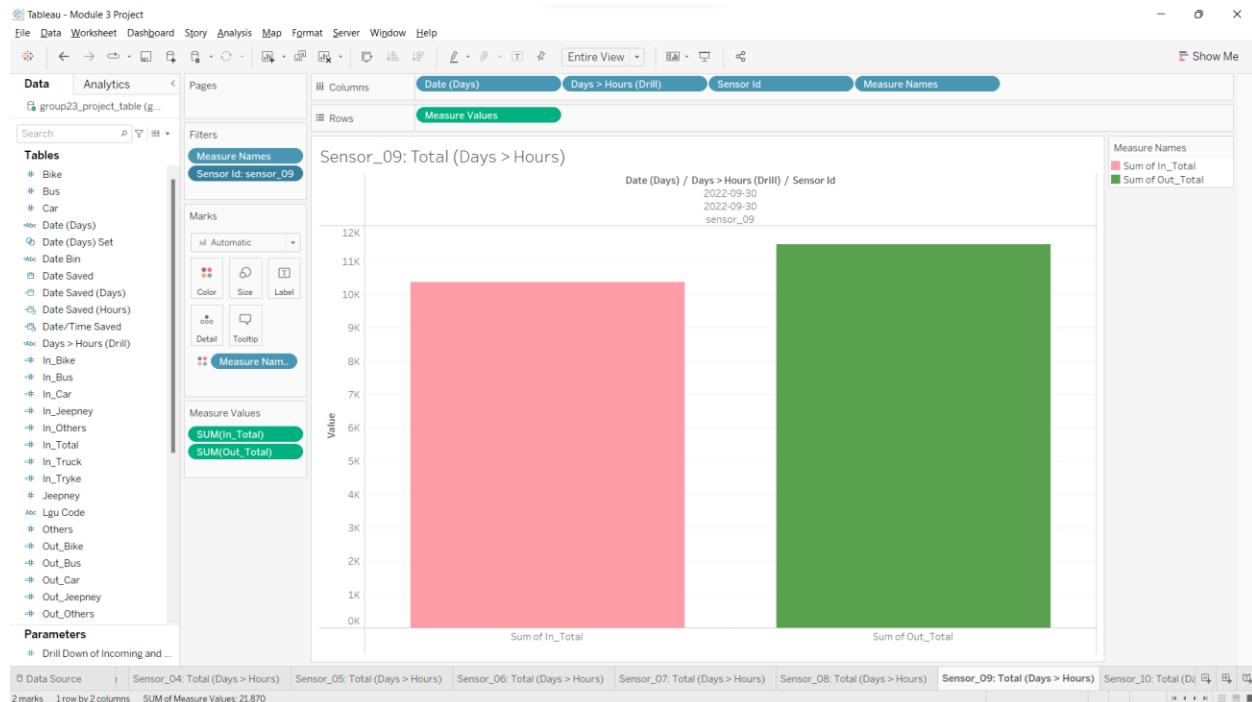
Sensor_07 (Drill Down)



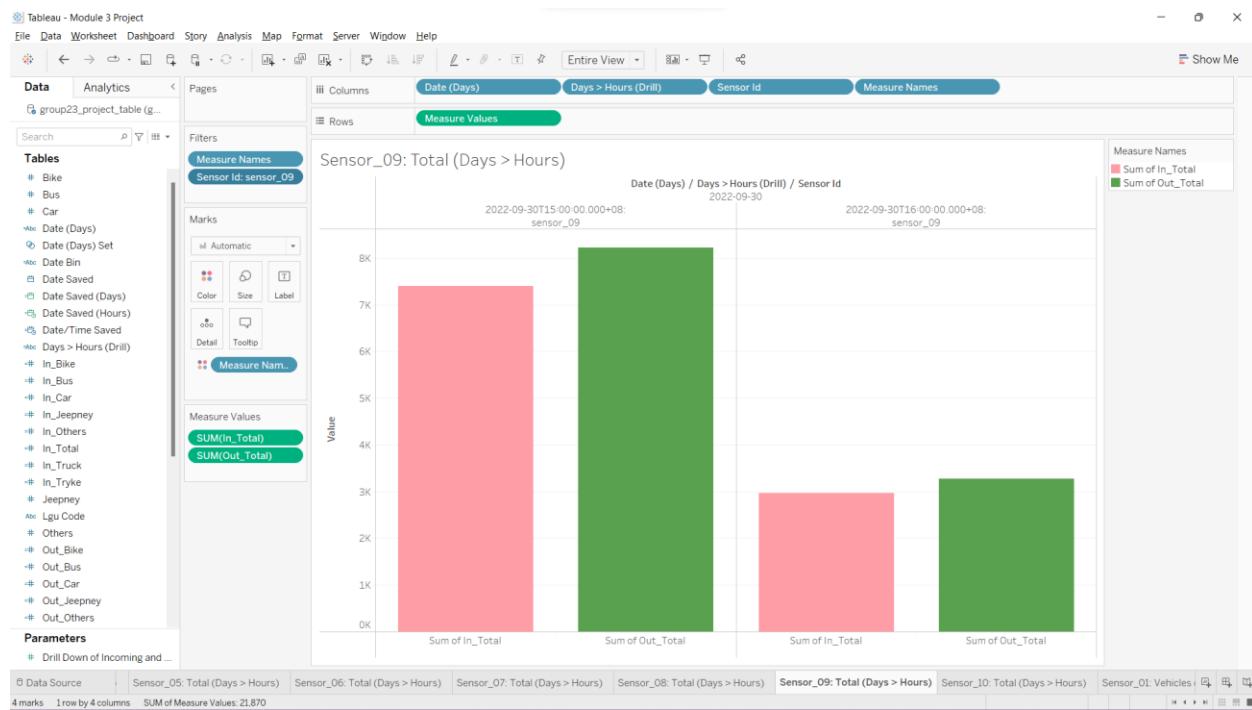
Sensor_08



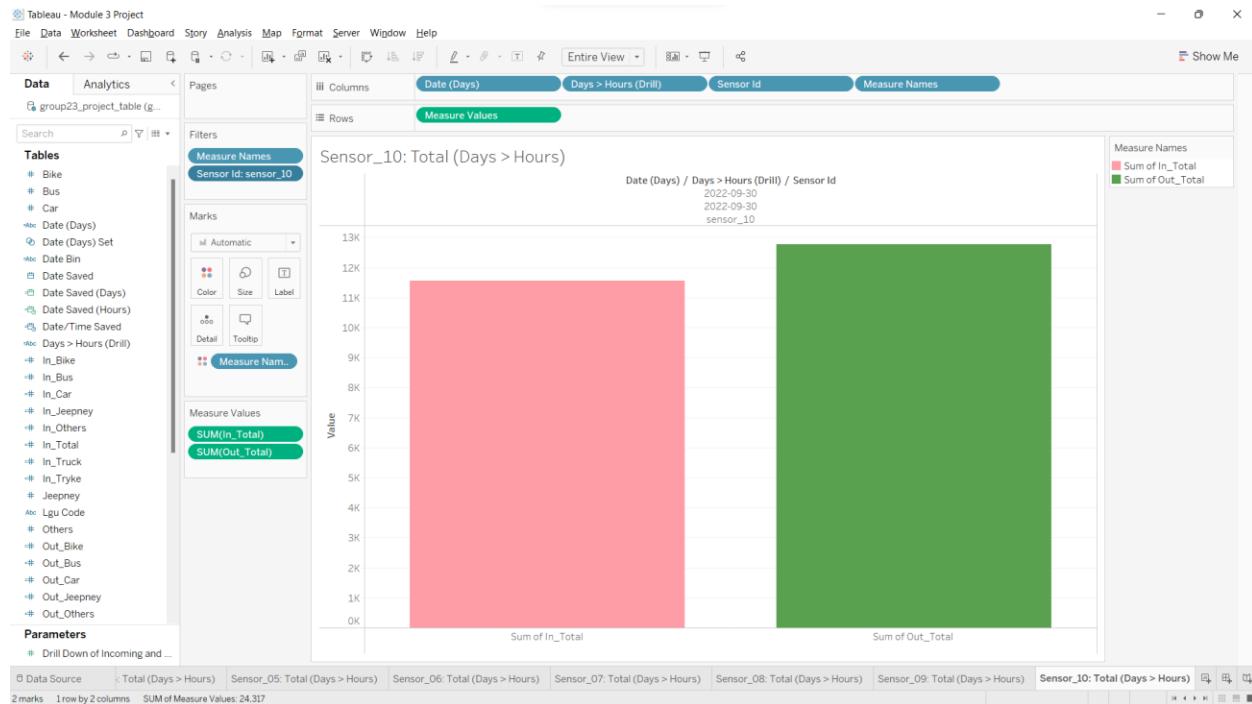
Sensor_08 (Drill Down)



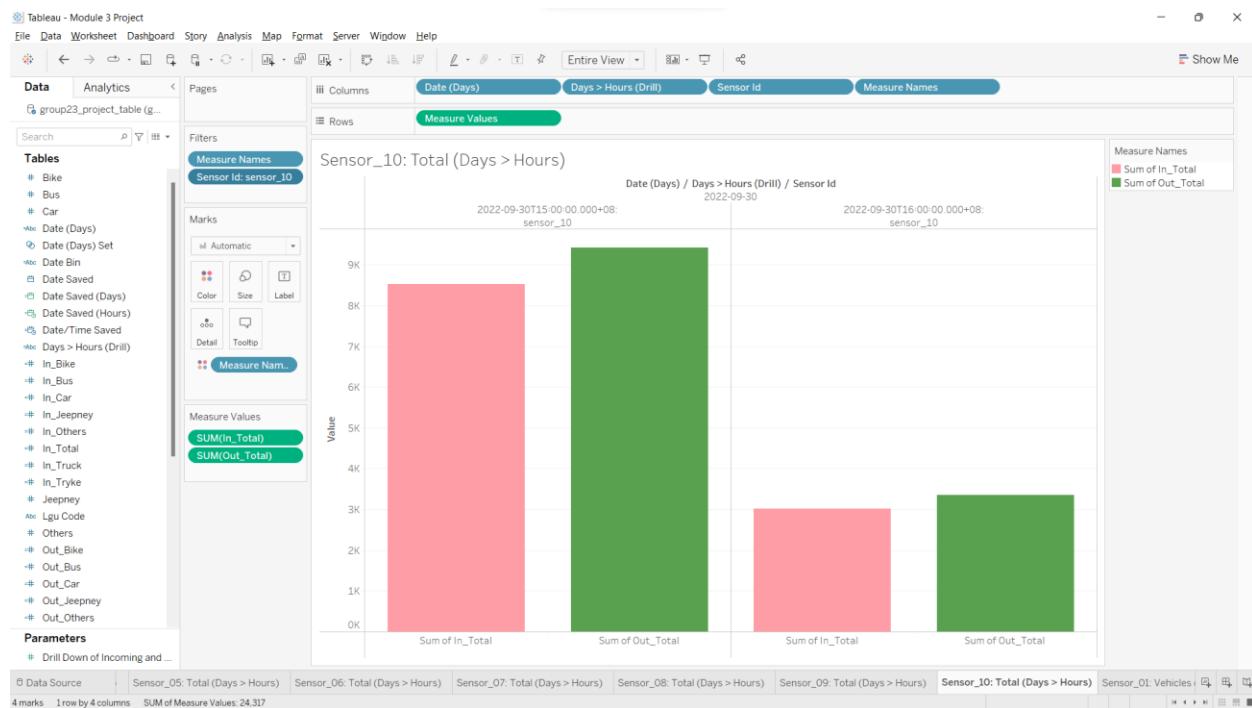
Sensor_09



Sensor_09 (Drill Down)



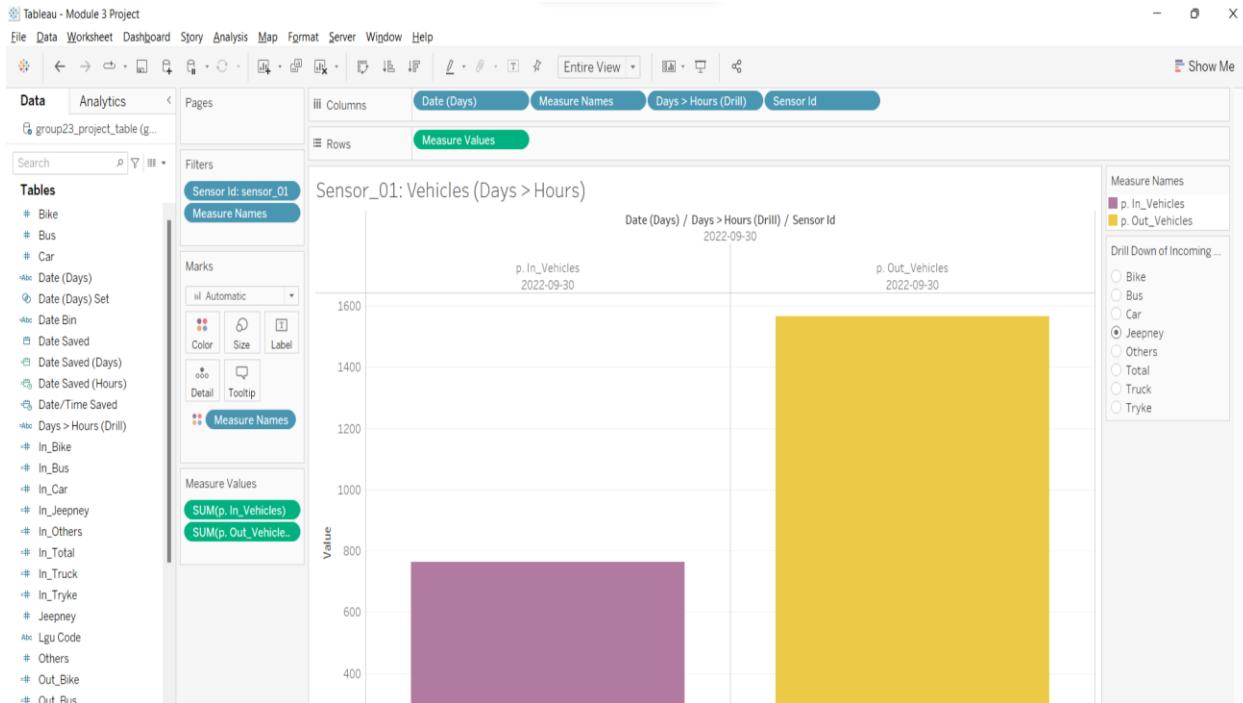
Sensor_10



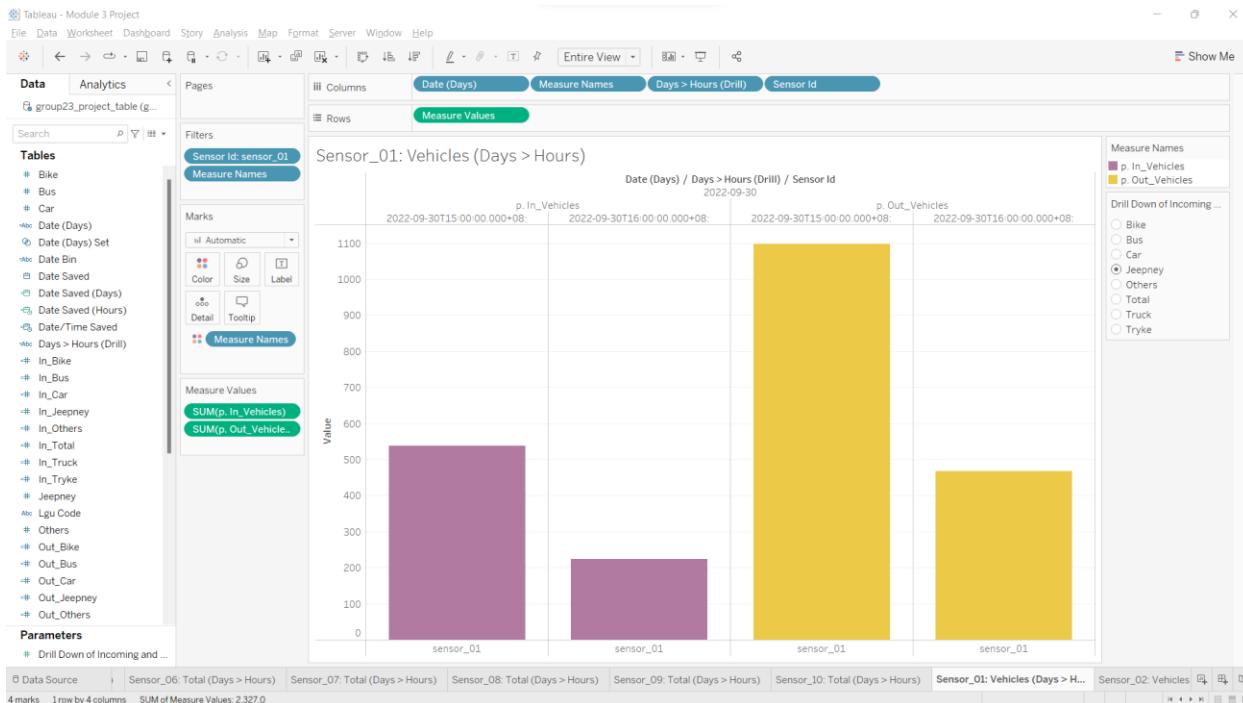
Sensor_10 (Drill Down)

Individual Incoming and Outgoing Vehicles (Days to Hours) Drill Down

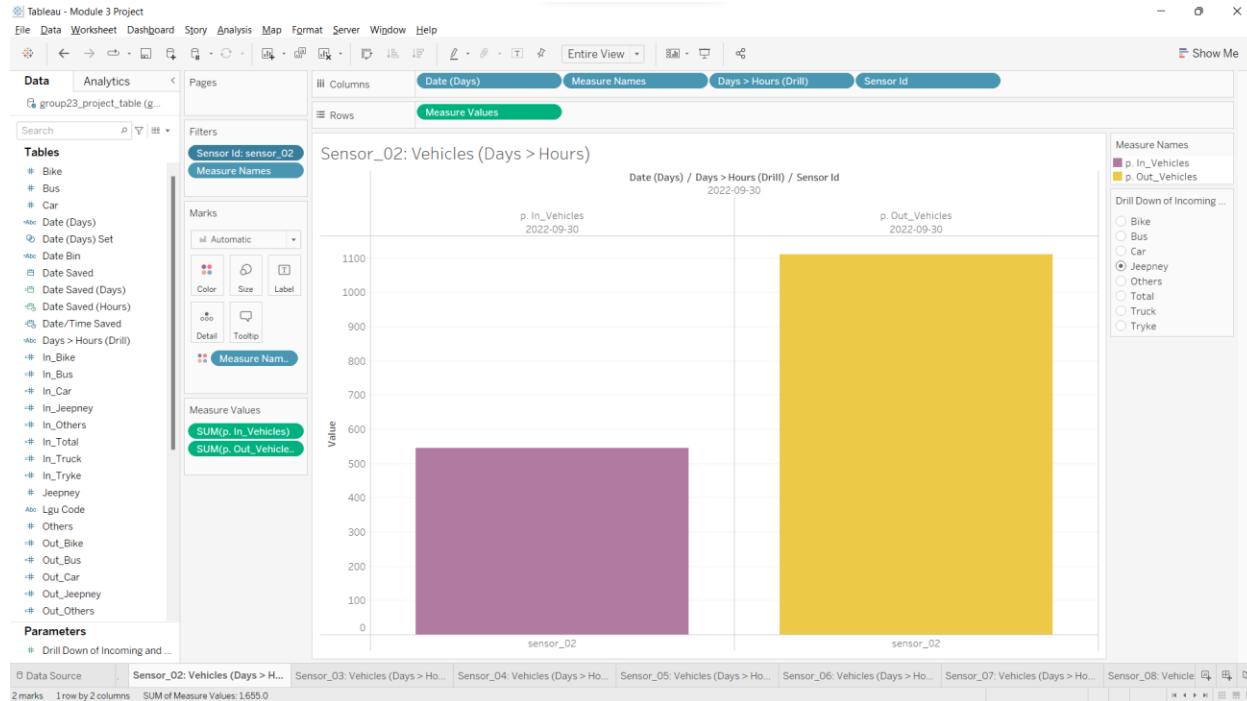
Jeepney



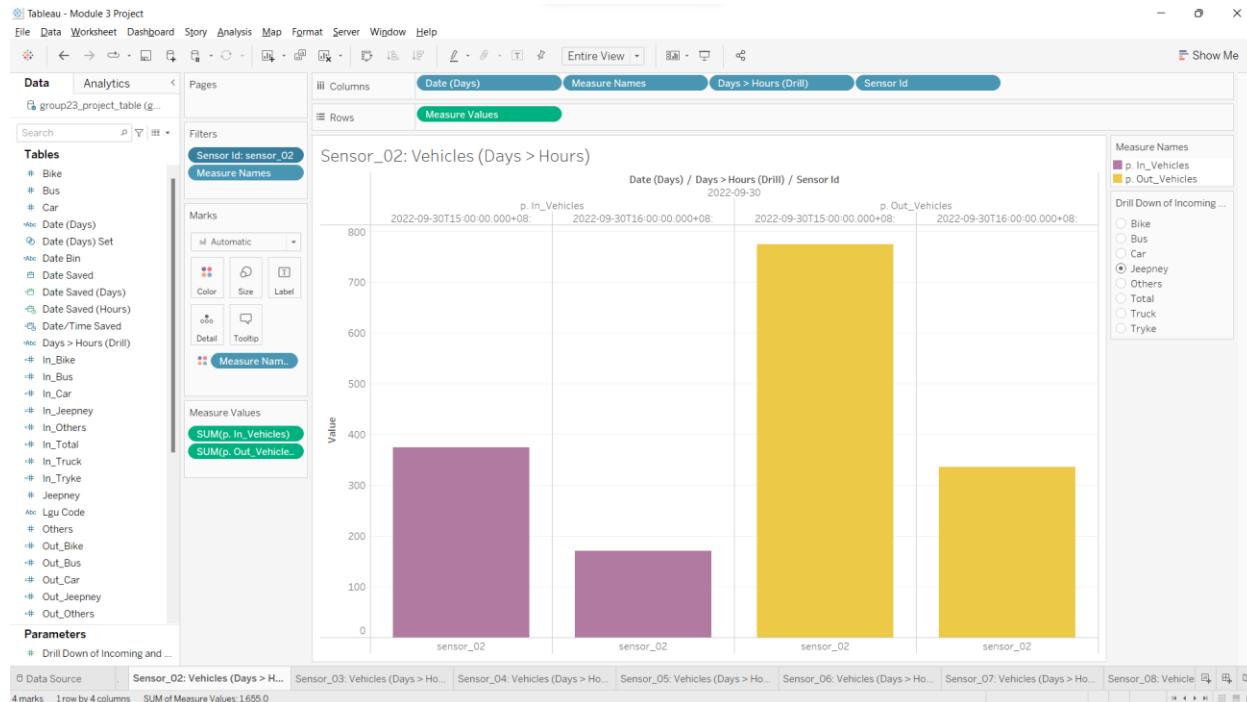
Sensor_01



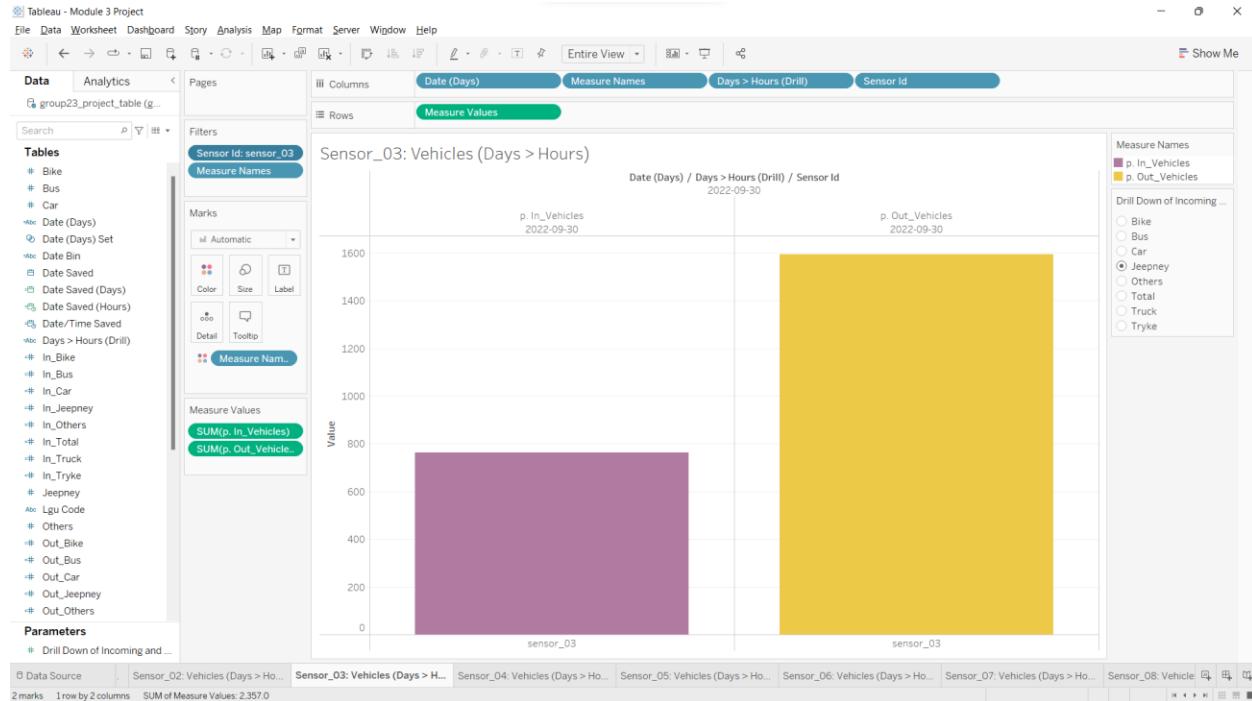
Sensor_01 (Drill Down)



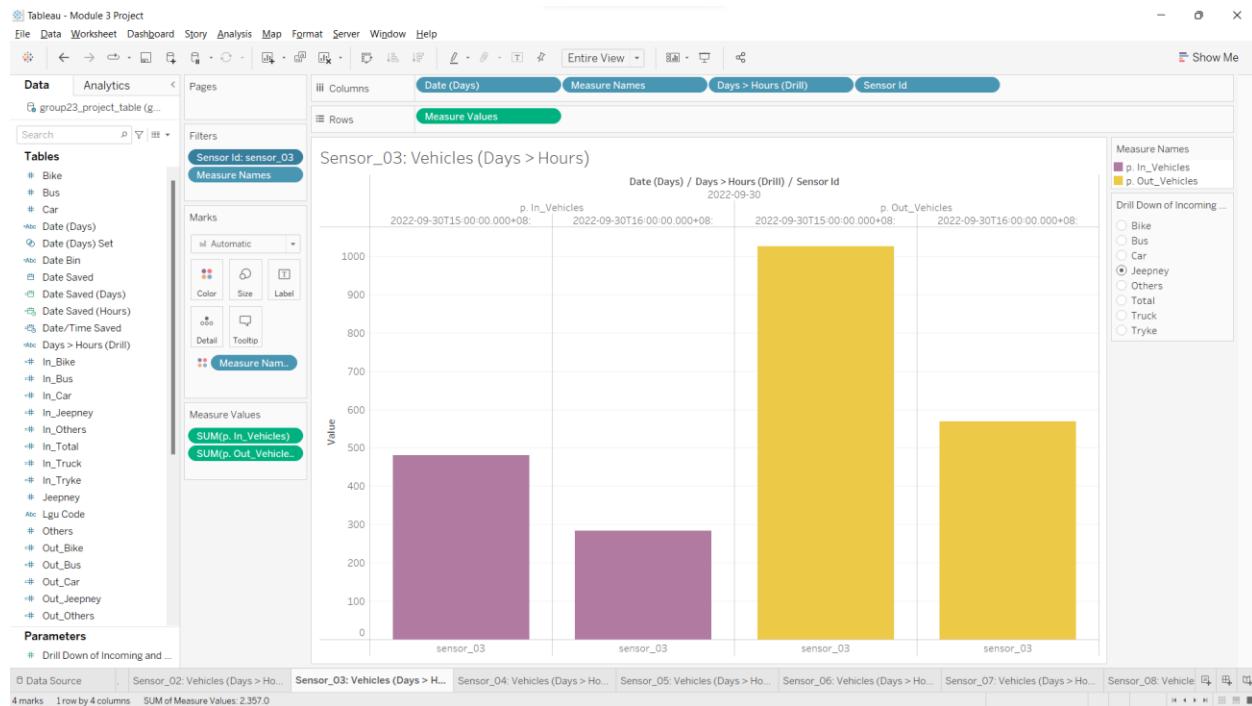
Sensor_02



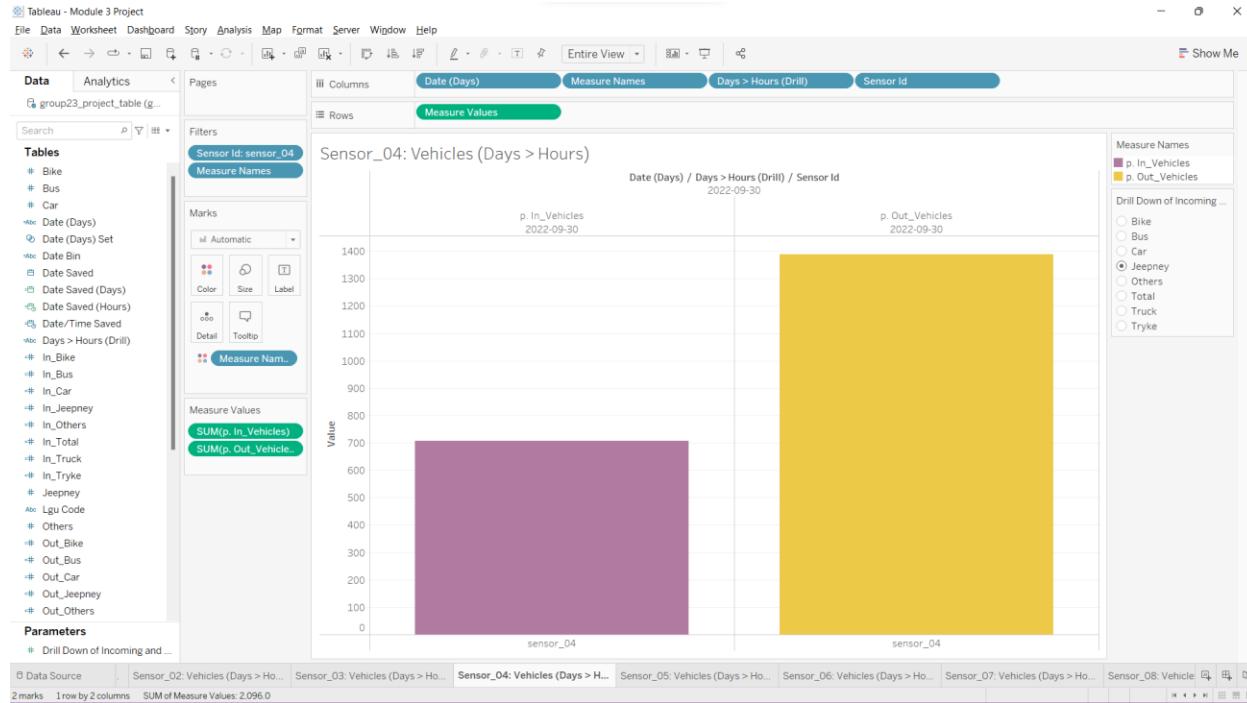
Sensor_02 (Drill Down)



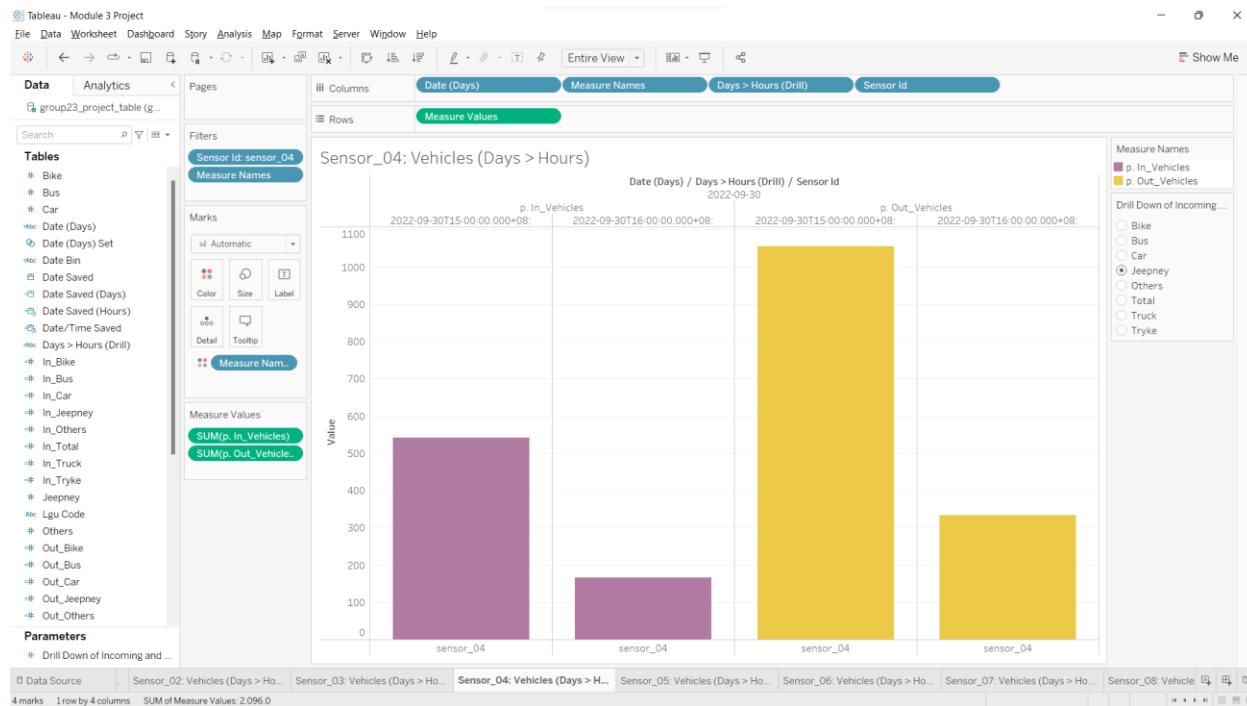
Sensor_03



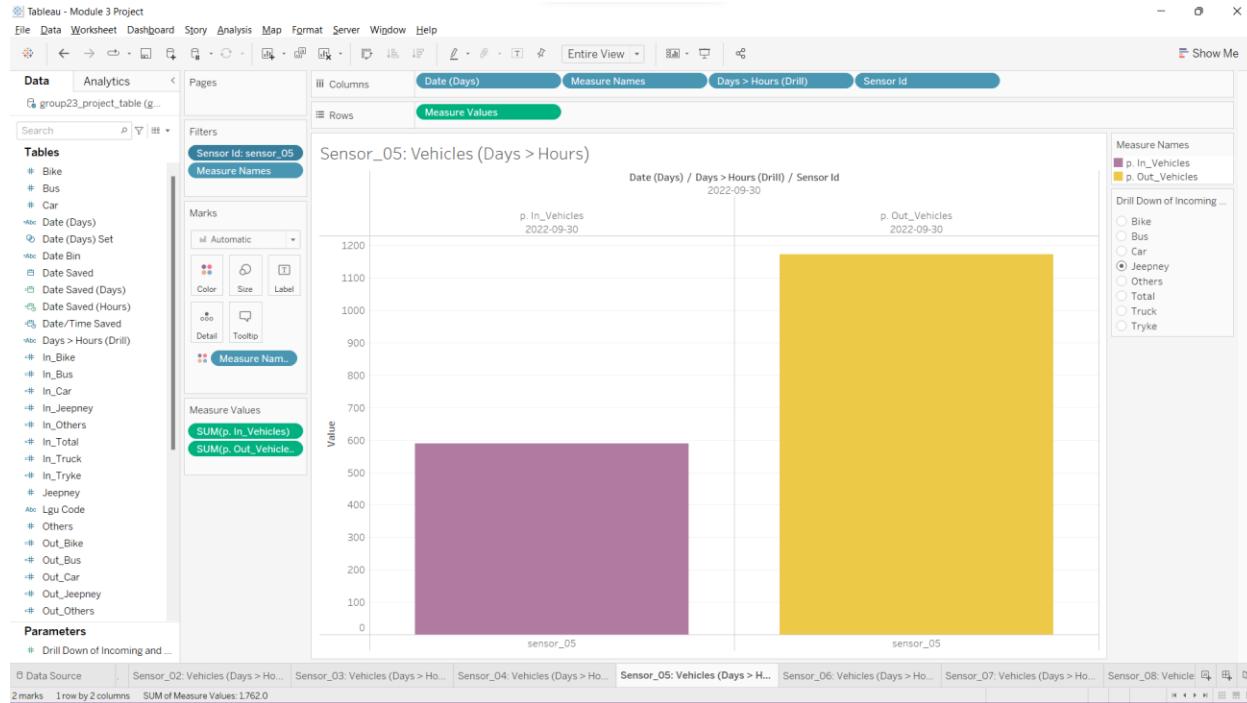
Sensor_03 (Drill Down)



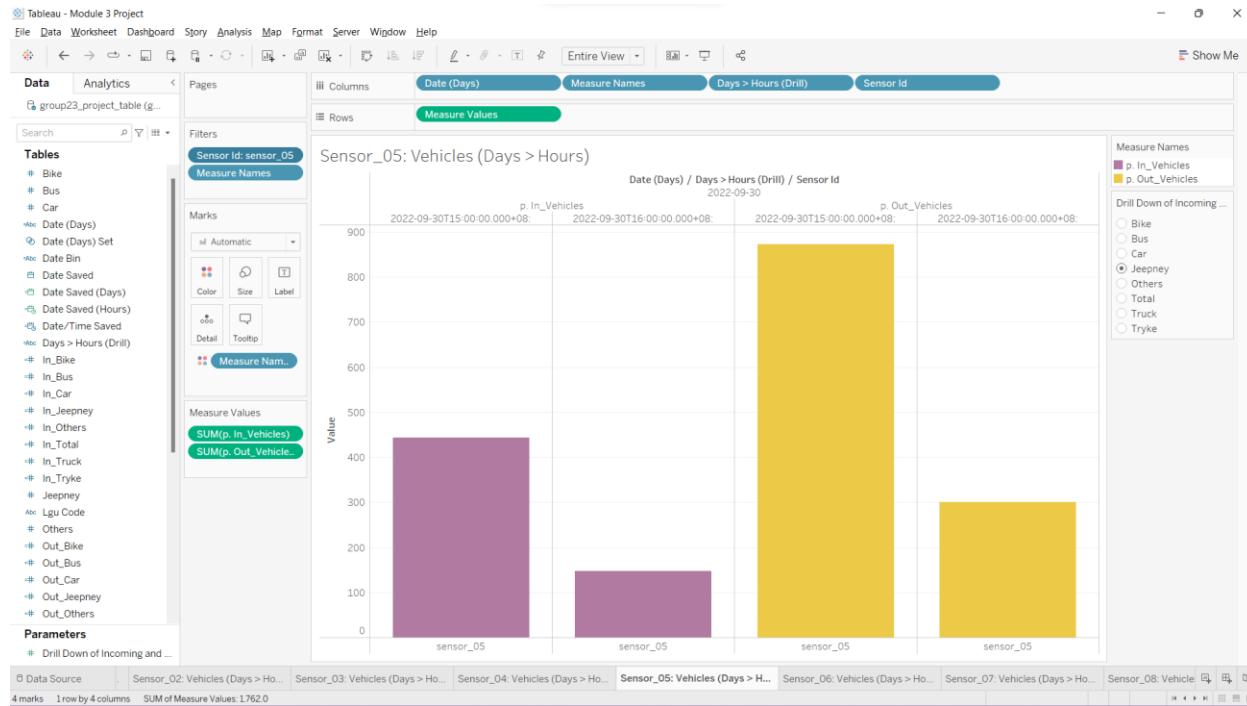
Sensor_04



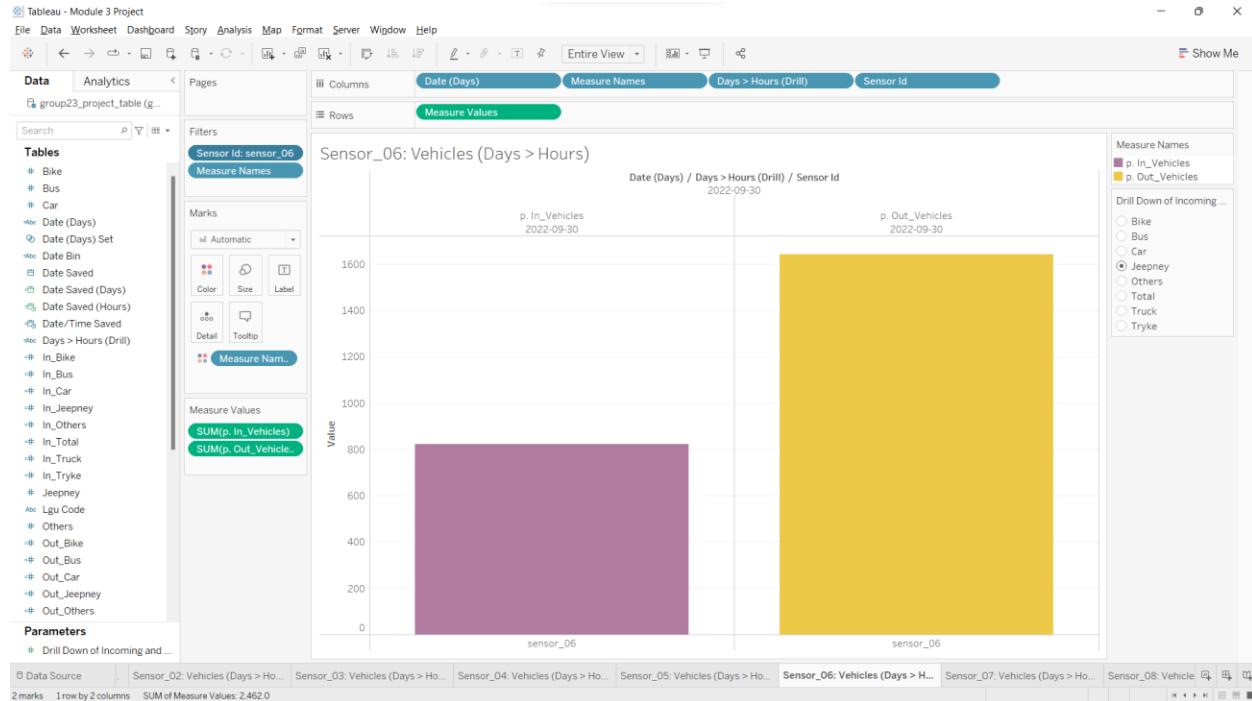
Sensor_04 (Drill Down)



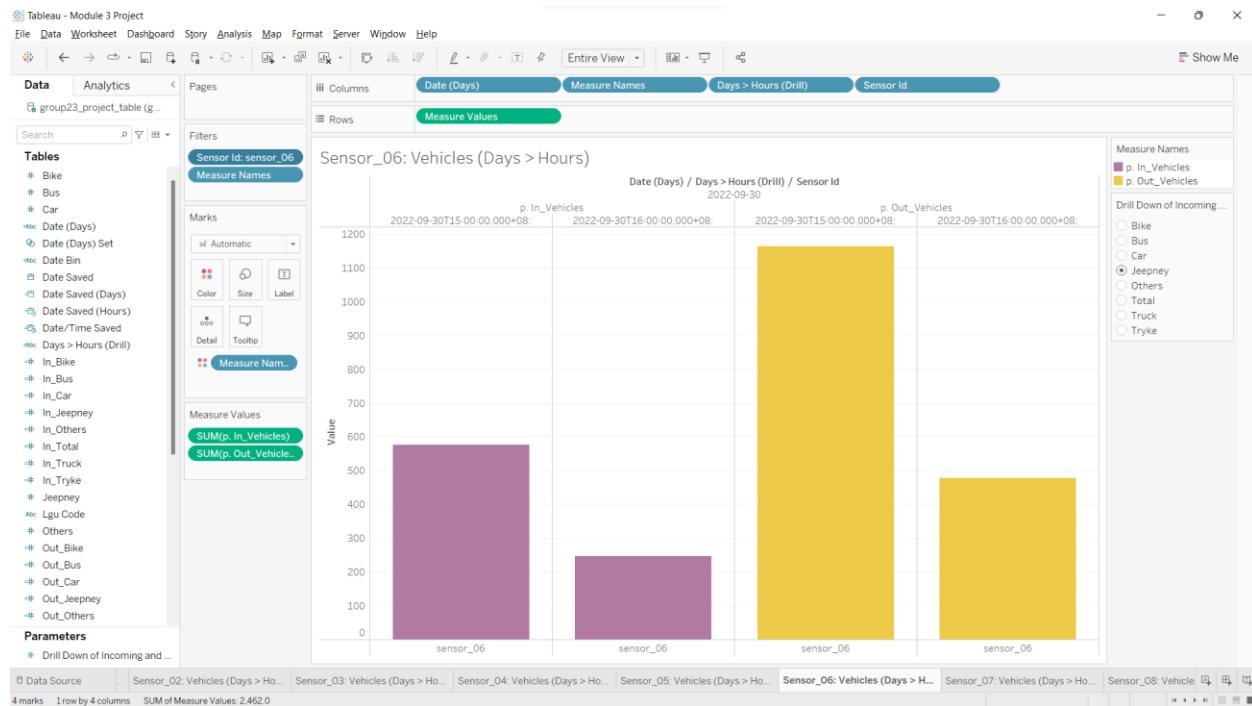
Sensor_05



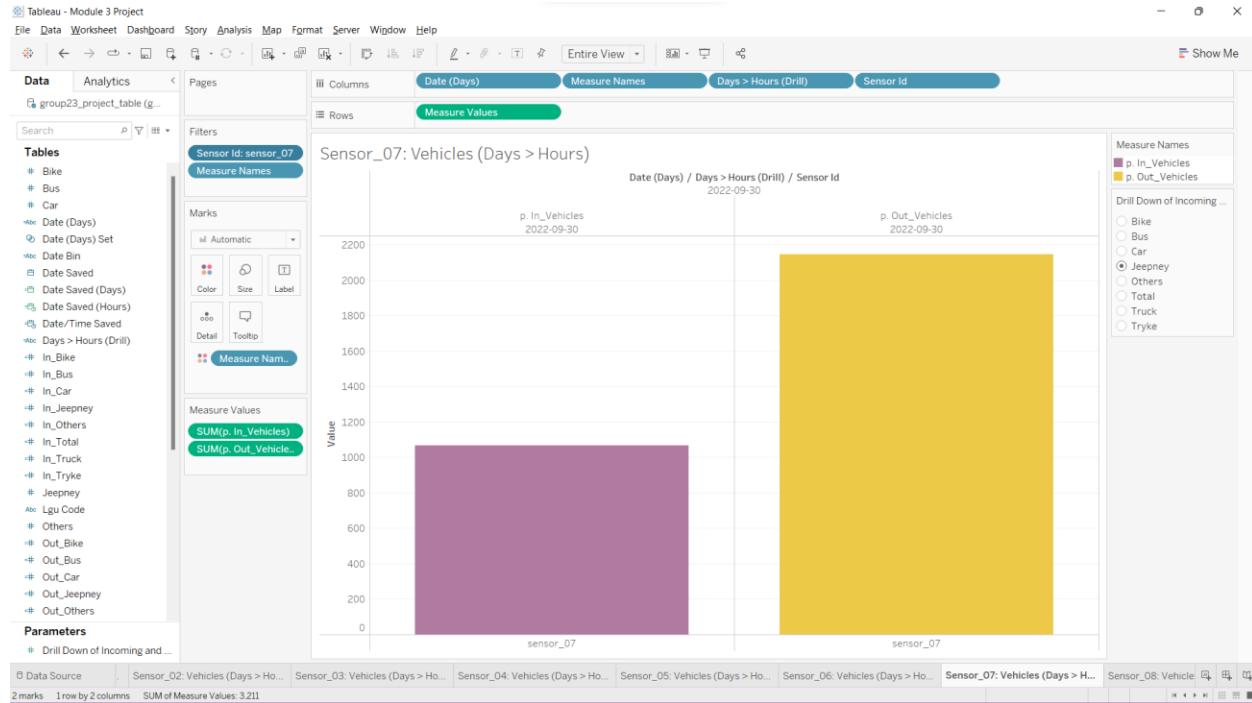
Sensor_05 (Drill Down)



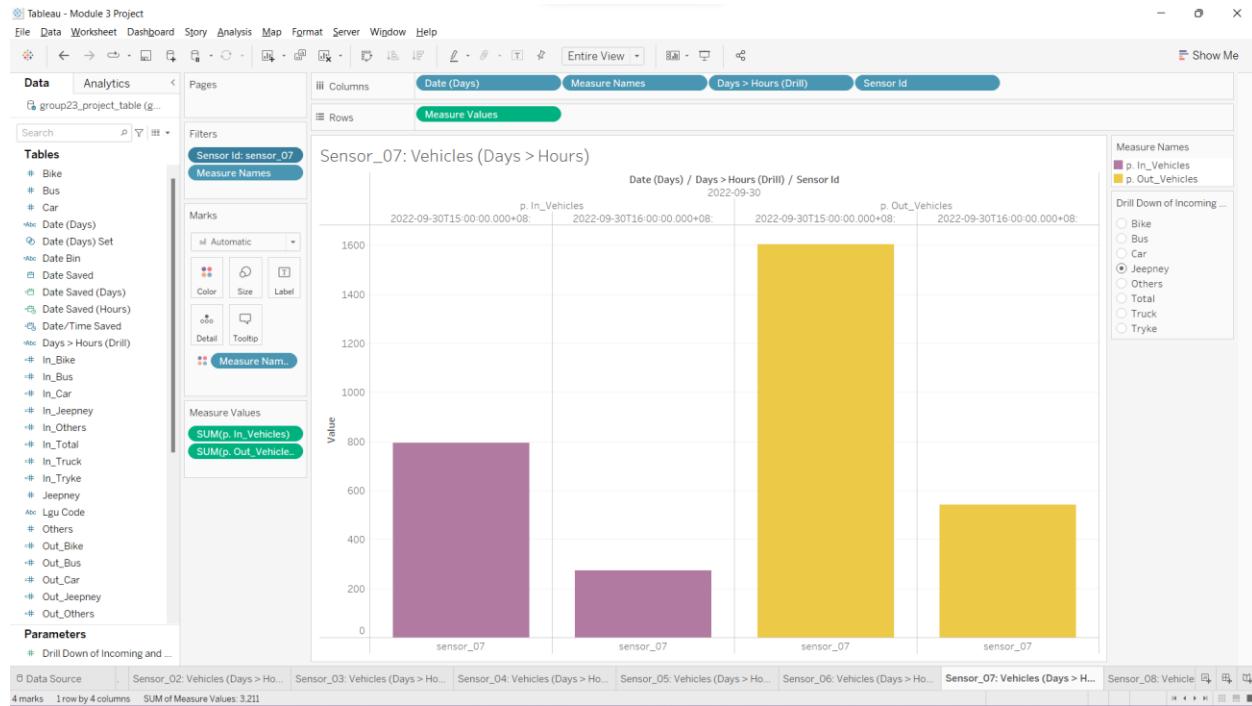
Sensor_06



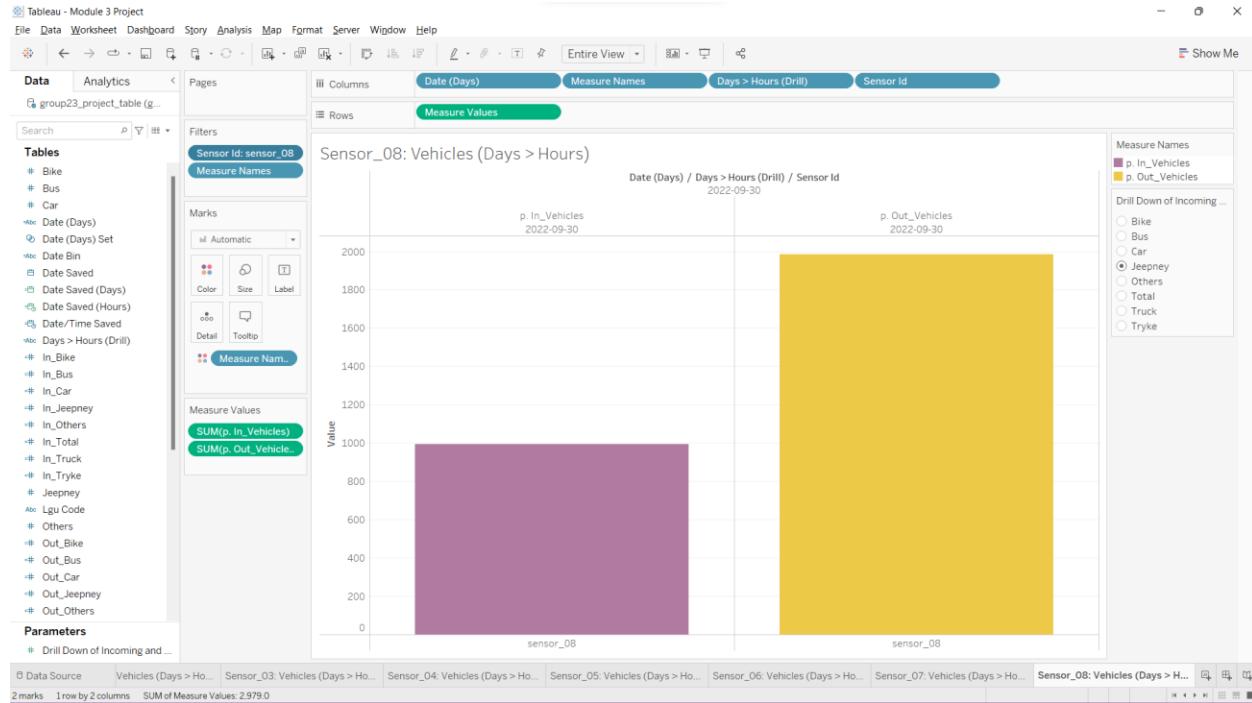
Sensor_06 (Drill Down)



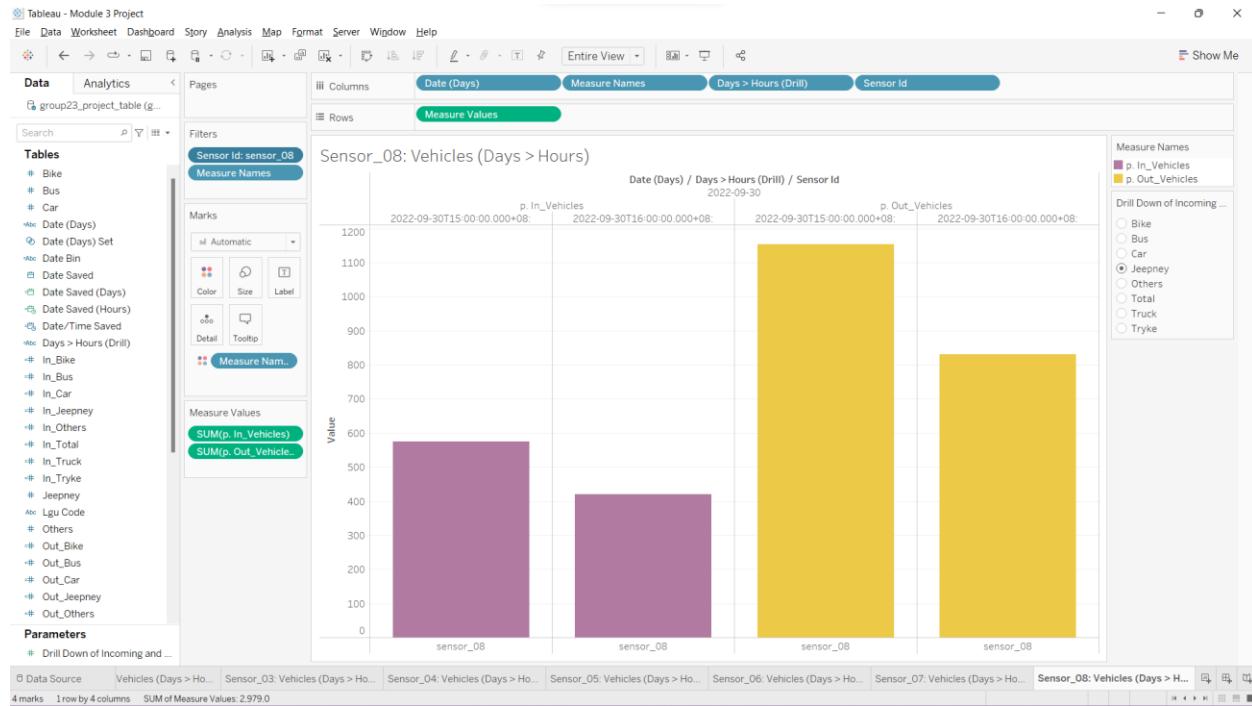
Sensor_07



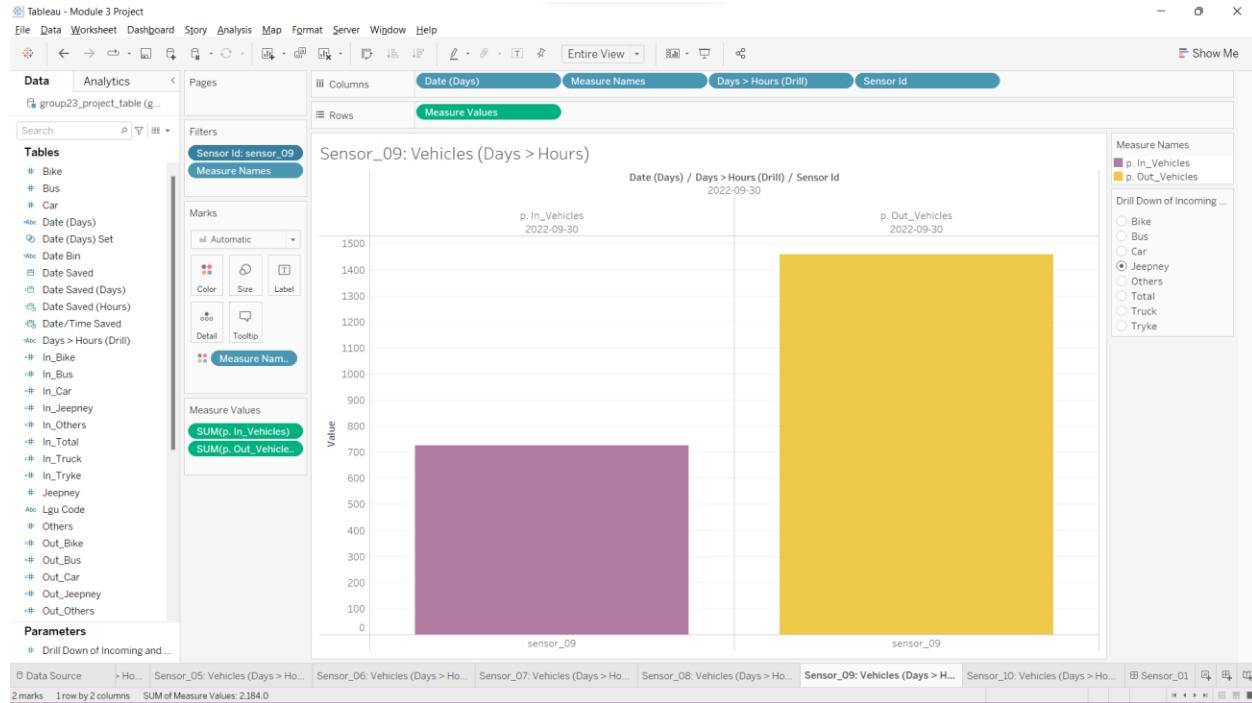
Sensor_07 (Drill Down)



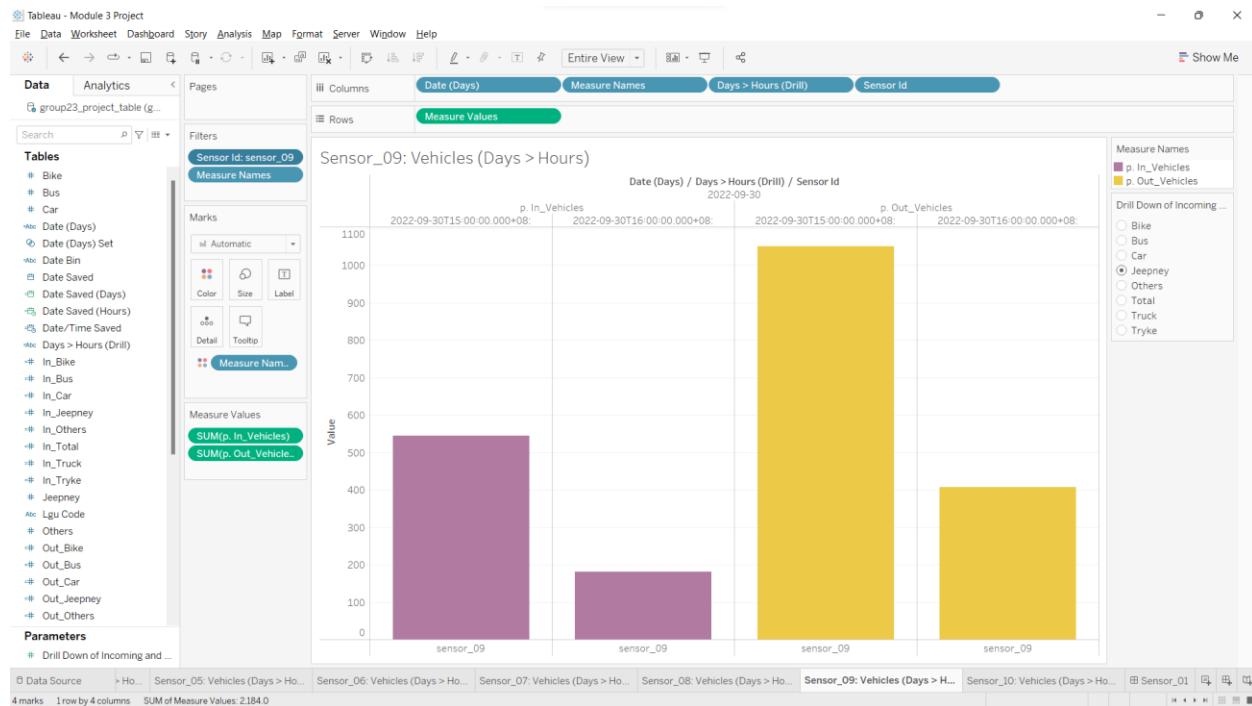
Sensor_08



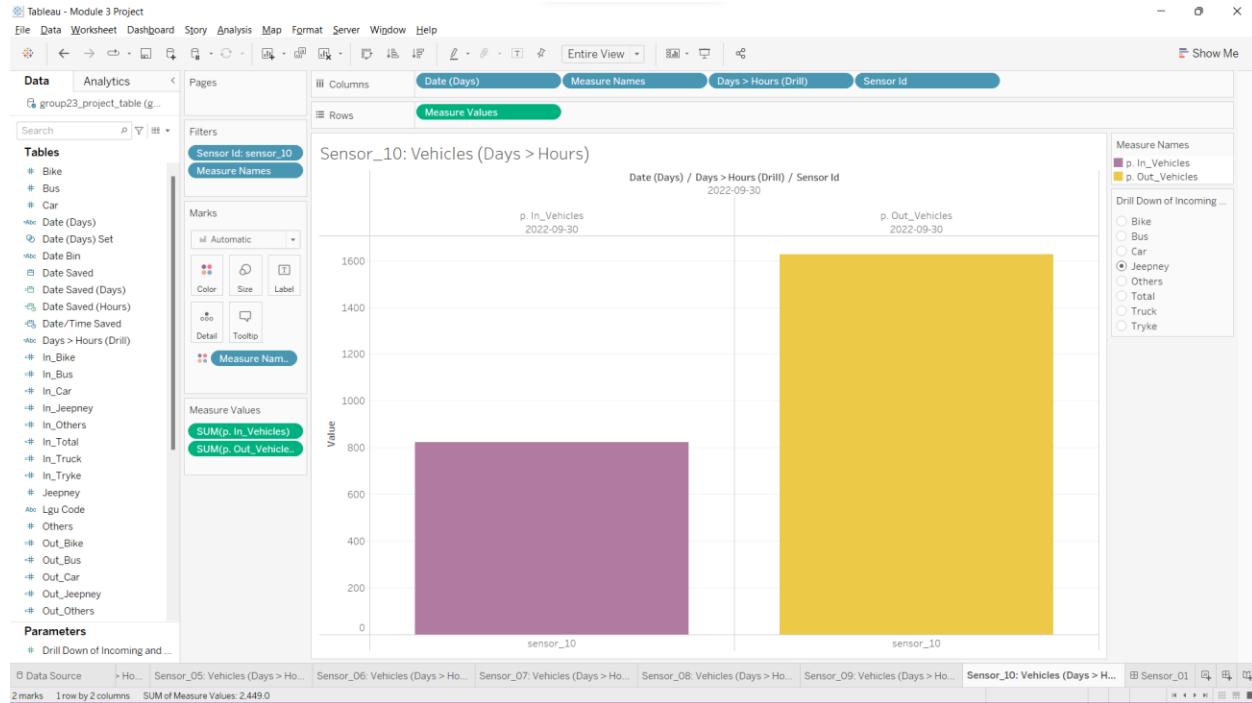
Sensor_08 (Drill Down)



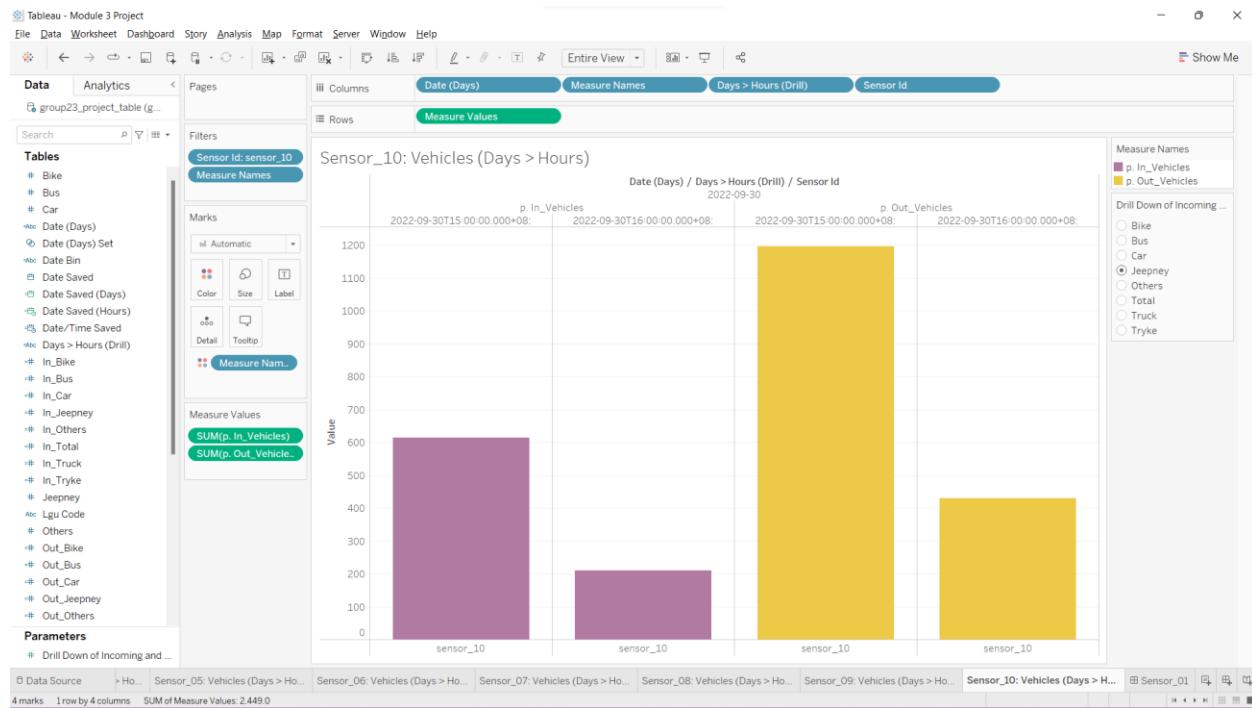
Sensor_09



Sensor_09 (Drill Down)



Sensor_10



Sensor_10 (Drill Down)

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- Smoak, A. B. (2018, December 17). *Using Set Actions in Tableau to Drill into Data* [Video]. YouTube. Retrieved from <https://www.youtube.com/watch?v=tpYUfR6wkC4&feature=youtu.be>
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