



ORACLE

Perform Spatial Analysis with Oracle Spatial Studio

November 2023, Version 1.0
Copyright © 2023, Oracle and/or its affiliates
Public

Purpose Statement

This paper provides in-depth insights into the capabilities and features of Oracle Spatial Studio. The primary audience includes developers and technical professionals seeking practical information about leveraging Oracle's spatial functionalities without the need for extensive coding. Focused on the key benefits, features, and application development with Spatial Studio, this paper equips developers with the knowledge and tools necessary to harness scalable and high-performance spatial data storage, processing, and analysis capabilities within Oracle Database. Whether they're working with Oracle Cloud Infrastructure (OCI) or Oracle Autonomous Database, this paper aims to empower developers with a step-by-step understanding of setting up and using Spatial Studio, facilitating self-service spatial analysis and visualization for diverse applications.

Disclaimer

This document in any form, software or printed matter, contains proprietary information that is the exclusive property of Oracle. Your access to and use of this confidential material is subject to the terms and conditions of your Oracle software license and service agreement, which has been executed and with which you agree to comply. This document and information contained herein may not be disclosed, copied, reproduced or distributed to anyone outside Oracle without prior written consent of Oracle. This document is not part of your license agreement nor can it be incorporated into any contractual agreement with Oracle or its subsidiaries or affiliates.

This document is for informational purposes only and is intended solely to assist you in planning for the implementation and upgrade of the product features described. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, timing, and pricing of any features or functionality described in this document remains at the sole discretion of Oracle. Due to the nature of the product architecture, it may not be possible to safely include all features described in this document without risking significant destabilization of the code.

Table of Contents

Introduction	4
Key Benefits of Oracle Spatial Functionality	4
Features of Spatial Studio	5
No-Code Spatial Analysis and Mapping with Oracle Spatial Studio	6
Accessing Spatial Studio	7
Working with Datasets	11
Working in a Project	15
Getting Started Resources	19
Conclusion	20

Introduction

Oracle is committed to reshaping the way that people perceive and use data. Our focus on spatial analysis involves understanding interactions based on geographic relationships and addressing queries related to the locations of people, assets, and resources. These spatial insights empower better customer service, workforce optimization, site selection for retail and distribution centers, assessment of sales and marketing campaigns, and more.

Oracle's spatial offerings provide developers, database professionals, and analysts with a comprehensive suite of spatial data management, analytics, and visualization tools. This suite integrates spatial analysis and mapping into applications on data management infrastructures such as Oracle Database and Oracle Exadata. The advanced technologies of Oracle Cloud and Oracle Autonomous Database, the industry's exclusive self-driving, self-securing, and self-repairing database, are readily available for spatial applications.

As described in this paper, Oracle Database's spatial features provide scalable and high-performance storage, processing, and analysis capabilities for both basic and advanced spatial data types. A significant portion of the paper is dedicated to explaining the practical aspects of working with datasets within the Oracle Spatial Studio environment. From loading spatial and nonspatial data to preparing datasets through geocoding and indexing, the paper offers insights into managing and optimizing datasets. By focusing on the setup of Spatial Studio and hands-on interaction with datasets, this paper equips developers with actionable knowledge to leverage Oracle's spatial functionalities effectively. The step-by-step guidance ensures that developers can implement Spatial Studio seamlessly, harnessing its capabilities for spatial analysis and visualization in their applications.

This paper is based on an Oracle LiveLabs workshop that covers certain aspects of Oracle's spatial offerings, and addresses limited offerings by Oracle. Access to the workshop is provided in the "Getting Started Resources" section of this paper.

Key Benefits of Oracle Spatial Functionality

Oracle Spatial Studio provides access to the spatial functionalities of Oracle Database without the need for coding. Traditionally, using these capabilities required coding expertise or reliance on third-party tools. Spatial Studio enables users to generate and distribute spatial analyses and interactive web maps through user-friendly graphical interfaces, eliminating the complexities associated with coding or external applications.

The ability to establish connections between information by using location-based criteria, such as spatial proximity and containment, proves advantageous across various scenarios. In instances in which no predefined key links store locations to a warehouse, Spatial Studio helps to determine such relationships based on proximity. Similarly, when there's no preexisting association between store locations and regions, such as tax regions, Spatial Studio helps to establish relationships based on containment.

Additionally, Spatial Studio facilitates location-based analytics, which summarizes information based on proximity. For example, you could analyze losses attributed to tornadoes within a specific distance from a location. Instead of conducting these analyses in a separate system, you can use the inherent spatial features of Autonomous Database for seamless integration and enhanced efficiency.

Oracle's spatial functionalities are integrated into Oracle's unified database, an integral component of the information technology platform for Oracle Cloud, on-premises, and big data implementations. Developers can incorporate these capabilities into their solutions through contemporary development frameworks. Spatial applications created with Oracle benefit from the advantages of Oracle Database, encompassing superior performance, scalability, and security features. They can also use the robust processing power and bandwidth of Oracle Exadata Database Machine. Oracle's spatial features are endorsed by a variety of tools, enterprise applications, and prominent vendors. Across diverse sectors such as mapping agencies, transportation, utilities, telecommunications, insurance, energy, and financial services, global enterprises of significant scale rely on Oracle for their spatial processing requirements.

Features of Spatial Studio

Spatial Studio boasts a robust set of features designed to enhance the accessibility, preparation, analysis, and visualization of spatial data. Users can access and prepare spatial and nonspatial data that resides in Oracle Database. The platform facilitates the loading of data from standard formats and allows for the preparation of nonspatial data through geocoding addresses or indexing latitude/longitude columns. Additionally, Spatial Studio supports precaching of large datasets, which optimizes data retrieval. For analysis and visualization, the platform provides drag-and-drop map visualizations, data-driven styling, and the ability to perform intricate spatial analyses. The platform also supports the sharing of analysis results, which fosters collaboration and insights across teams.

Spatial Studio functions with spatial data stored in Oracle Database, encompassing the tables and views that contain Oracle's geometry data type. This data can consist of preexisting spatial data or nonspatial data, which can be transformed into spatial data by using Spatial Studio to associate geometries with attributes.

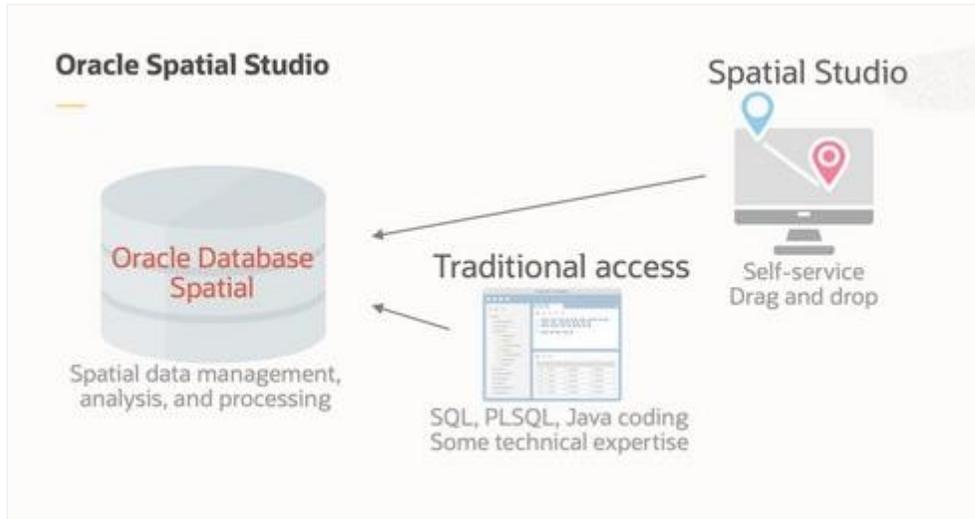
The user-centric features of Spatial Studio can be summarized as follows:

- **Access and prepare spatial data**
 - Access spatial and nonspatial data in Oracle Database
 - Load data from common formats
 - Prepare nonspatial data by geocoding addresses or indexing latitude/longitude columns
 - Precache large datasets
- **Analyze and visualize spatial data**
 - Use drag-and-drop map visualizations
 - Use data-driven styling
 - Perform spatial analyses
 - Share results

Following are the key aspects of the Spatial Studio features. The points highlighted in bold are covered in the LiveLabs workshop that this paper is based on.

- Spatial object type for vector data, spatial index type, and hundreds of spatial operators and functions
- Comprehensive support for coordinate systems and transformations
- **GeoRaster support for georeferenced imagery and gridded data**
- 3D data model, with native support for 3D geometries, surfaces, and LiDAR point clouds
- Support for OGC and ISO geospatial standards: Web Feature Service, Web Service/Tile Service, Web Coverage Service, and Web Catalog Service
- Geocoding and routing engines
- Topology data model and linear referencing system
- Network data model to represent graphs and networks in link and node tables
- JSON support for spatial data access, REST APIs
- **Location data enrichment API with geographic hierarchy and place names dataset**

- Spatial index and partitioning
- **Map visualization of geographic data**
- Location tracking server



No-Code Spatial Analysis and Mapping with Oracle Spatial Studio

Analysts using Oracle Database and Autonomous Database can now conduct spatial analysis and mapping without the need to write any code. Spatial Studio is a self-service, visual, and code-free map canvas and spatial analysis tool. The results of these analyses can be incorporated into applications, made accessible through REST services, published as web pages, or transferred to Oracle Analytics Cloud.

This section explores the features of Spatial Studio for self-service spatial analysis and visualization. By creating a workflow, you learn about the Oracle Spatial capabilities that cover the following attributes:

- Loading spatial data
- Visualizing spatial data
- Performing spatial analysis

To get started, you need access to an Oracle Cloud Infrastructure (OCI) tenancy. If you don't have an OCI tenancy created already, set one up by using the instructions in [Get an Oracle.com Account](#). You also need to install Oracle Spatial Studio. For options, see [Getting Started with Oracle Spatial Studio](#).

Alternatively, you can register on [Oracle LiveLabs](#) to access the [Introduction to Oracle Spatial Studio](#) workshop.

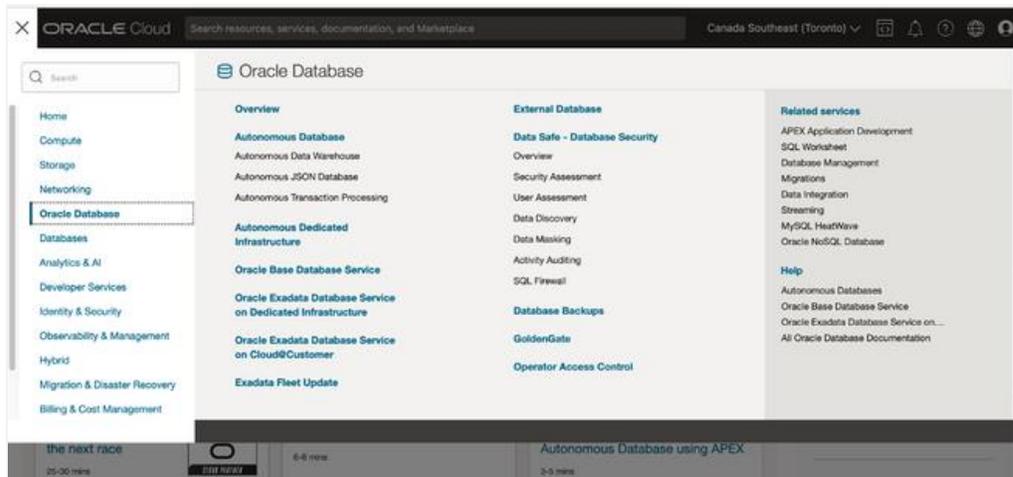
Accessing Spatial Studio

You access Spatial Studio by getting the credentials in OCI, logging in to Spatial Studio, and then setting up the metadata schema and service level.

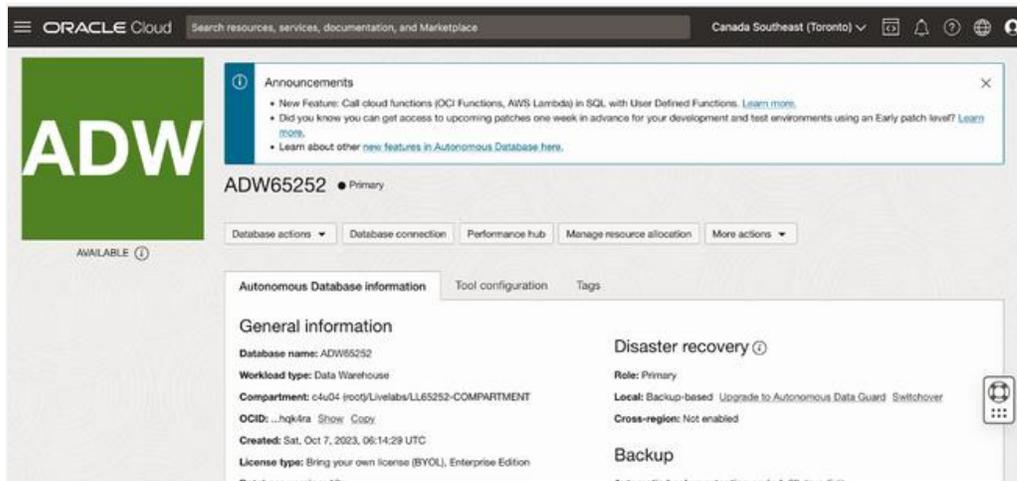
Get Credentials in OCI

1. Sign in to the Oracle Cloud Console by using your cloud username and password.
2. From the navigation menu, select **Oracle Database** and then select **Autonomous Database**.

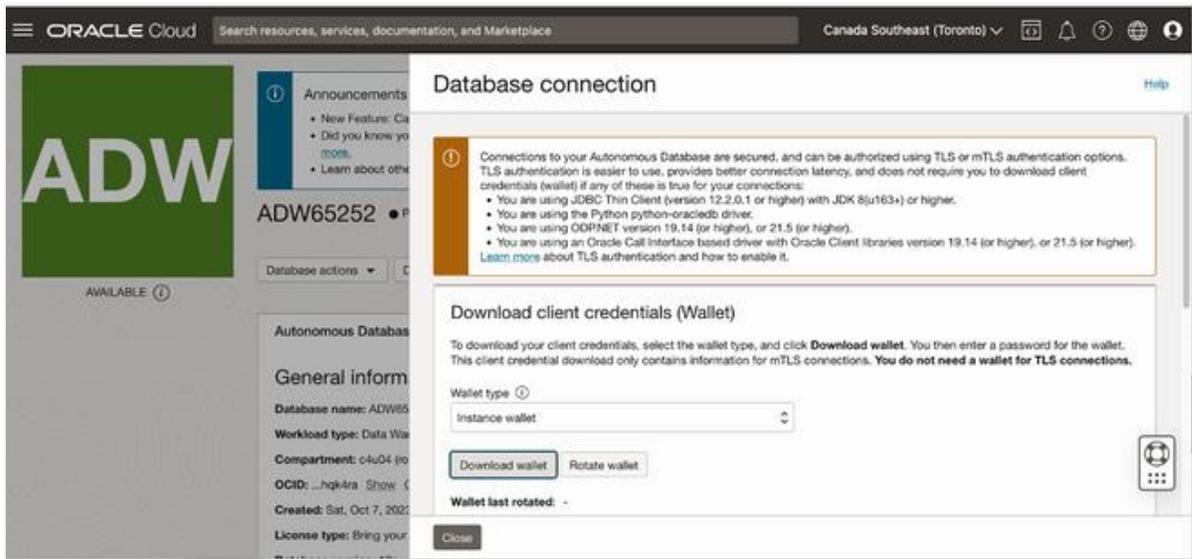
If you already have an autonomous database created in your OCI tenancy, then you can use the same database. If you are using Oracle LiveLabs workshop environment, then the database is already provisioned for you.



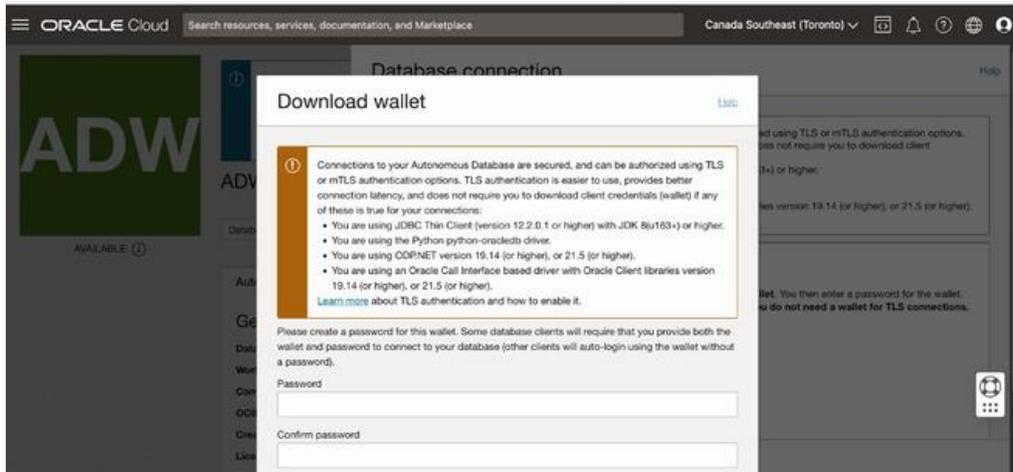
3. Select the database that you want to use.



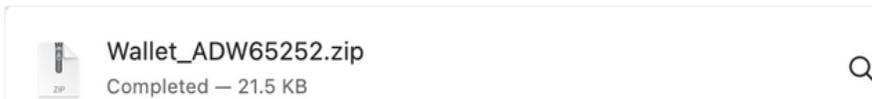
4. Select **Database connection** and then select **Download wallet**.



5. When prompted for a wallet password, enter any string (this password will not be used).



6. Save the wallet zip file to a convenient location on your laptop. You use it in the next section.



Log In to Spatial Studio

To log in to Spatial Studio, you use the Spatial Studio IP address. You can get the Spatial IP address information from the Login Info page of the LiveLabs workshop in the instance provisioned column, or in your OCI tenancy if you have installed Spatial Studio.

1. Open a new tab in your browser and go to `https://<your_spatial_studio_IP_address>:4040/spatialstudio`.

For example, if your Spatial Studio IP address is 111.111.11.111, then you would go to `https://111.111.11.111:4040/spatialstudio`.

Because of the absence of a signed SSL certificate in your Spatial Studio instance, a browser-specific security warning is displayed. You can accept the risk and continue to the site. Note that in a production environment, a configured certificate would prevent such warnings from occurring.

2. Click **Accept the Risk and Continue**.
3. Log in with the credentials provided in the LiveLabs workshop, or with your own credentials for Spatial Studio.

When you initially log in to Spatial Studio, you're prompted to input database connection details for the metadata repository.

4. Select **Oracle Autonomous Database** and then click **Next**.

5. Drag the previously downloaded wallet file to the **Upload Wallet** area, or upload it, and then click **OK**.

Set Up the Metadata Schema and Service Level

1. When prompted for Autonomous Database connection information, enter your credentials or the credentials provided in the LiveLabs workshop, and select the medium service level (or the service level of your choice).

Specify metadata schema details

User
studio_repo

Password
.....

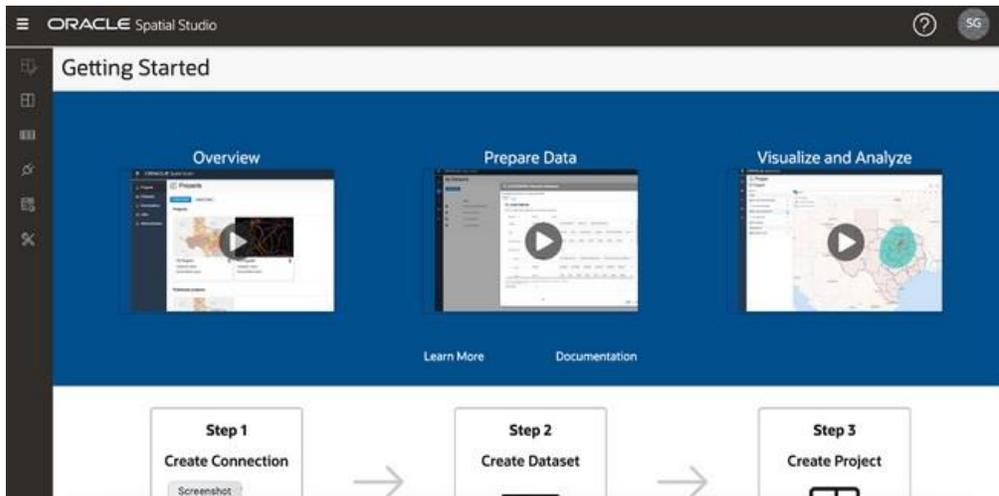
Service
adw65252_medium

Proxy Host

Proxy Port

Validating connection Cancel

When Spatial Studio opens, the first-time login is complete.



Working with Datasets

Spatial Studio functions with the data housed in Oracle Databases. Within Spatial Studio, you engage with *datasets*, which are references to database tables and views accessed through database connections. You can assign datasets user-friendly names to enhance their self-descriptive nature beyond the underlying database table or view name.

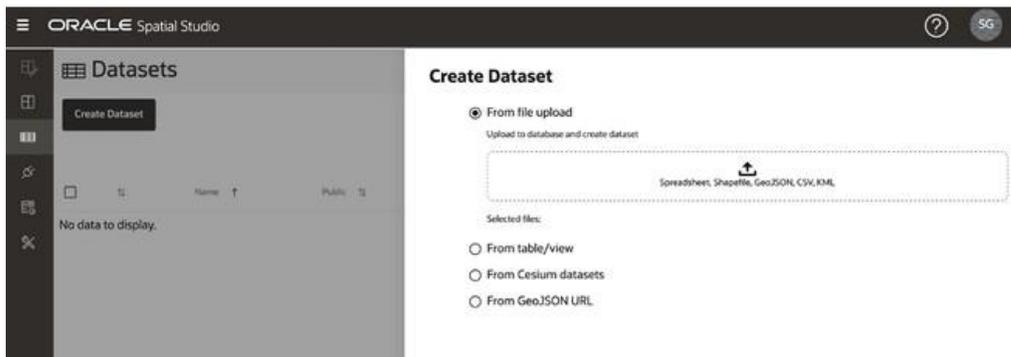
Often, users need to incorporate data from diverse sources. To facilitate this, Spatial Studio enables you to import data from standard formats into Oracle Database. These formats include the two most prevalent formats for spatial data exchange: shapefiles and GeoJSON files. This section guides you through the steps of loading spatial data in these formats using Spatial Studio.

Note: Spatial Studio also accommodates the loading of spreadsheet data. However, this necessitates additional preparation to extract geometries from spatial attributes like addresses (address geocoding) and latitude/longitude coordinates (coordinate indexing).

Create a Dataset from a GeoJSON File

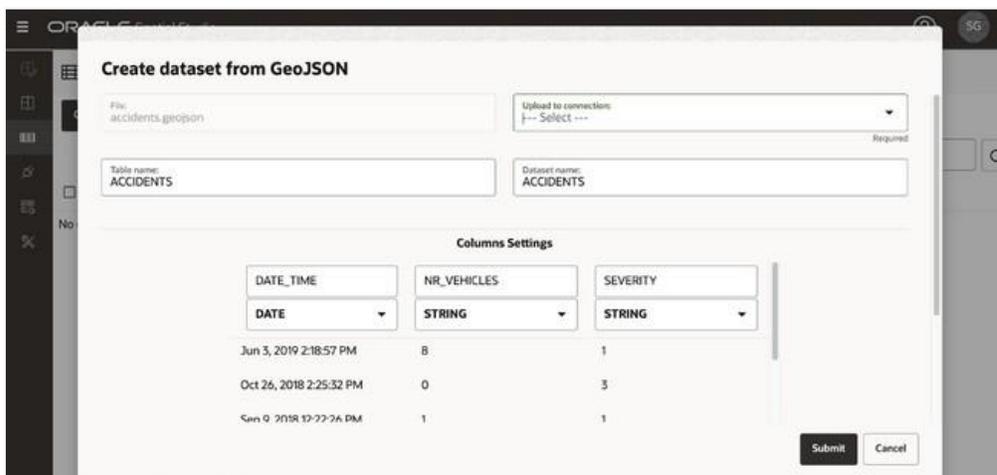
Use a GeoJSON file to create a dataset in Spatial Studio, and assign a key column.

1. In Spatial Studio, navigate to the **Datasets** page, and then click **Create Dataset**.



2. Drag a GeoJSON file that you want to use to the upload area. You can also click in the upload area and navigate to the file.

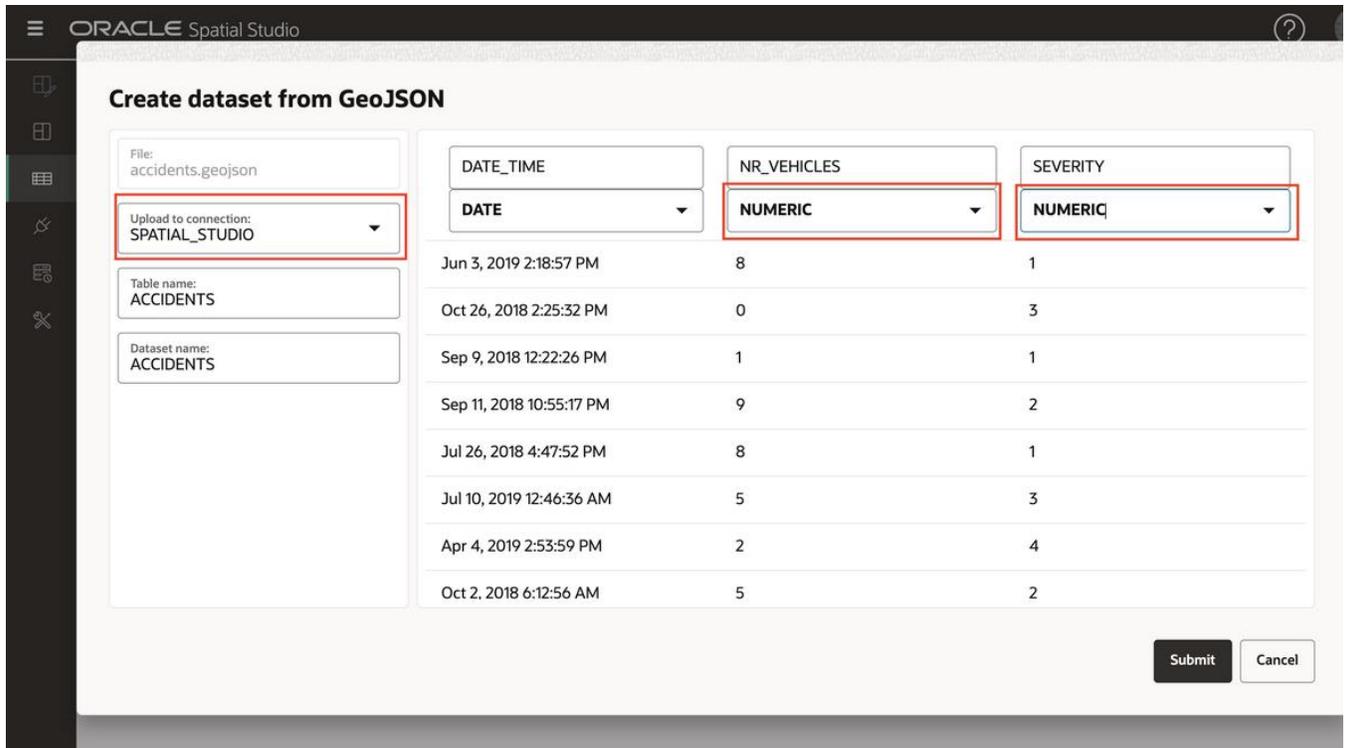
Information from the dataset is displayed.



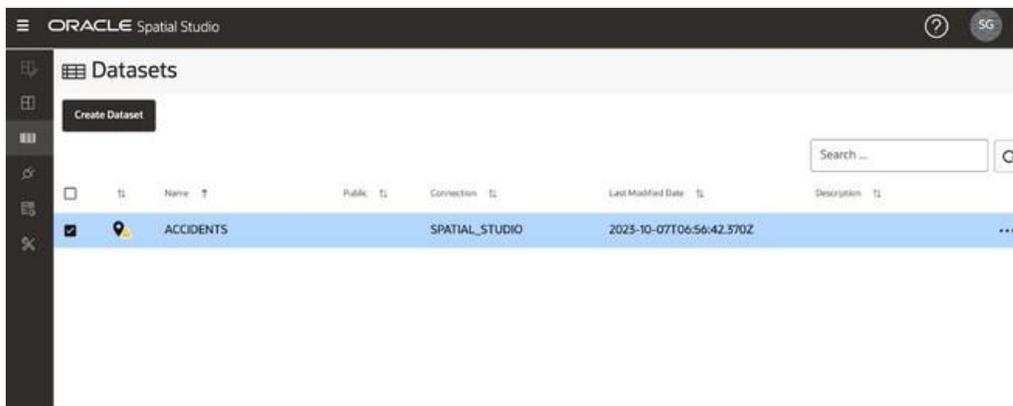
3. Select the destination connection for this upload.

In this example, we're using the SPATIAL_STUDIO connection (the Spatial Studio metadata repository), but in a production scenario, you would have other connections for such business data, separate from the metadata repository.

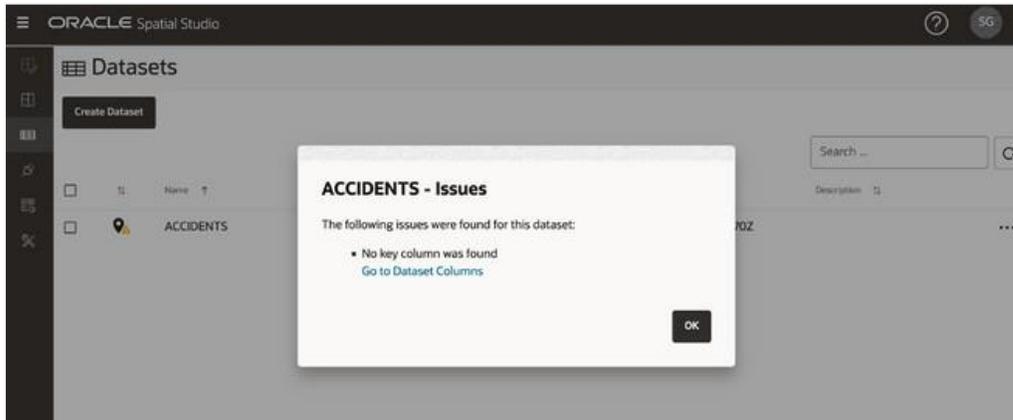
4. Set the data types for NR_VEHICLES and SEVERITY to NUMERIC. Then, click **Submit** to initiate the upload.



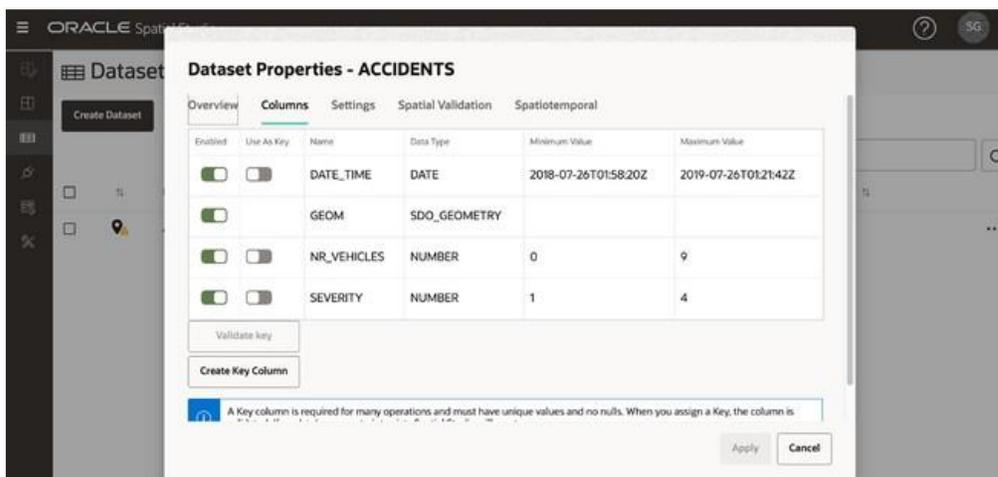
The uploaded dataset is listed with a small warning icon to indicate that a preparation step is needed. In this case, you need to add a dataset key. Although this key isn't needed for basic mapping, it is needed for analyses later.



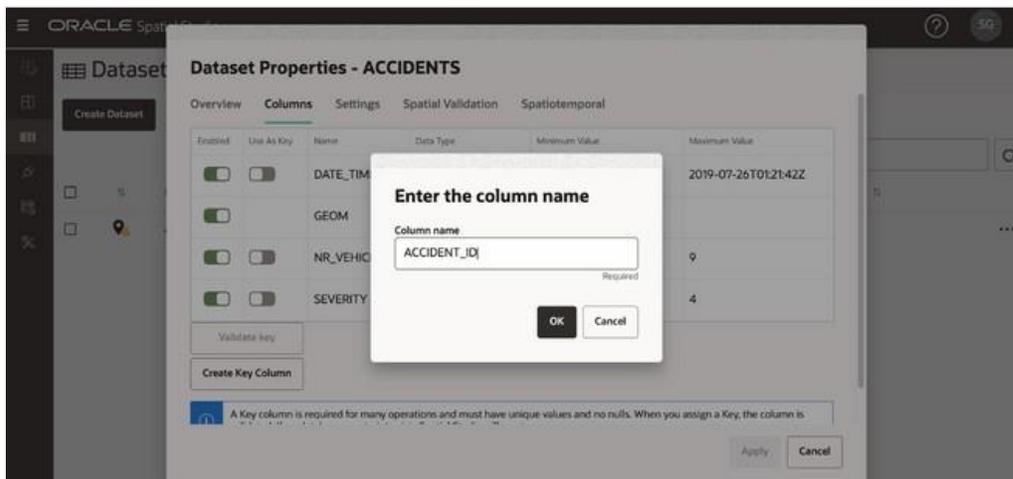
- Click the warning icon and then click **Go to Dataset Columns**.



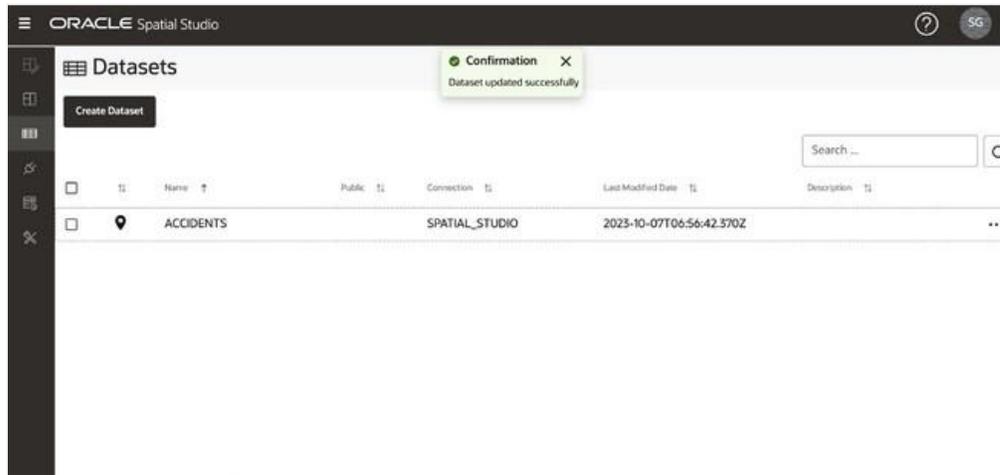
The dataset properties page is displayed.



- Assign a unique identifier as a key. If a unique identifier is not present, then you can create one by clicking **Create Key Column** and entering a column name.



After you assign a key, the dataset is updated.

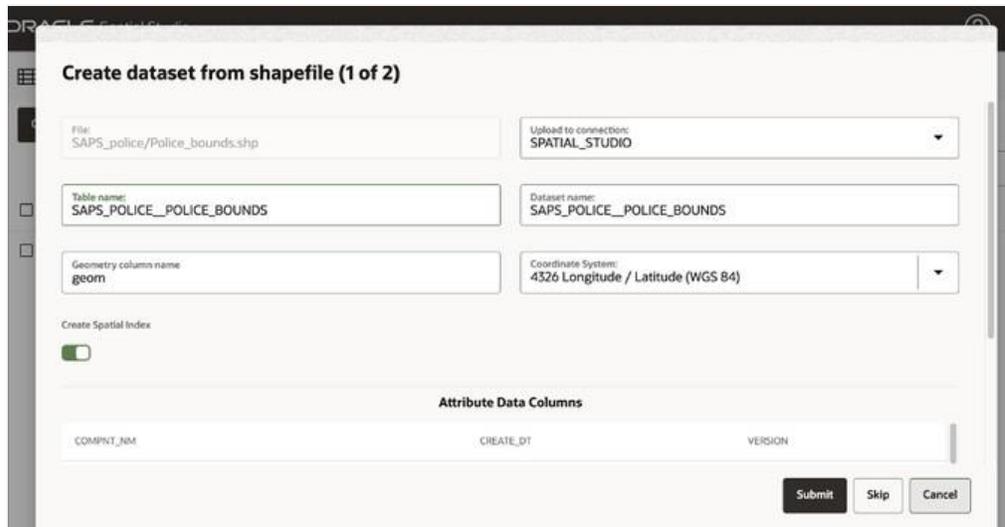


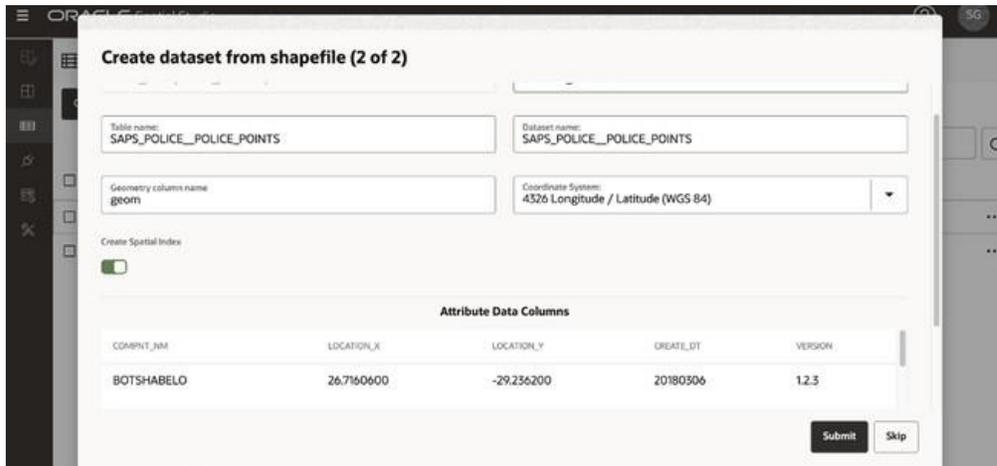
Create Datasets from a Shapefile

Shapefiles play a crucial role in Spatial Studio because they are a common and widely used format for exchanging spatial data. A shapefile is a popular geospatial vector data format that contains both geometry and attribute data. By loading shapefiles into Spatial Studio, you can seamlessly integrate spatial information into your analyses, visualizations, and mapping activities within the application.

1. Navigate to the **Datasets** page, and then click **Create Dataset**.
2. Drag a spatial data file that you want to use to the upload area.

Spatial Studio extracts the shapefiles from the file and processes them individually as separate datasets.

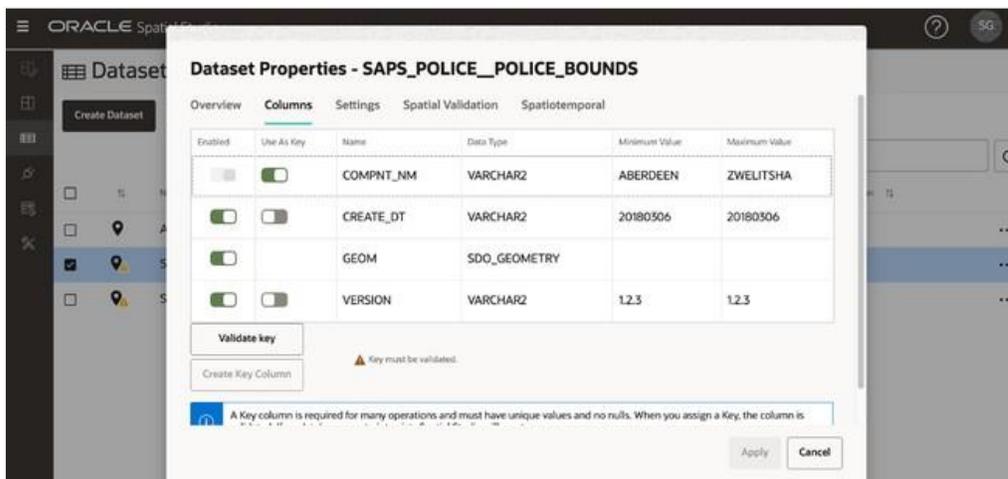




3. Click **Submit** for each dataset.

The uploaded datasets are listed with a small warning icon to indicate that a preparation step is needed. In this case, there's an existing unique column to use as the key.

4. Click the warning icon for the datasets and then click **Go to Dataset Columns**.
5. Select **Use As Key** for the column to use as the key (in this example, the column is the COMPNT_NAME column), click **Validate key**, and then click **Apply**.



All datasets are ready for mapping and spatial analysis.

Working in a Project

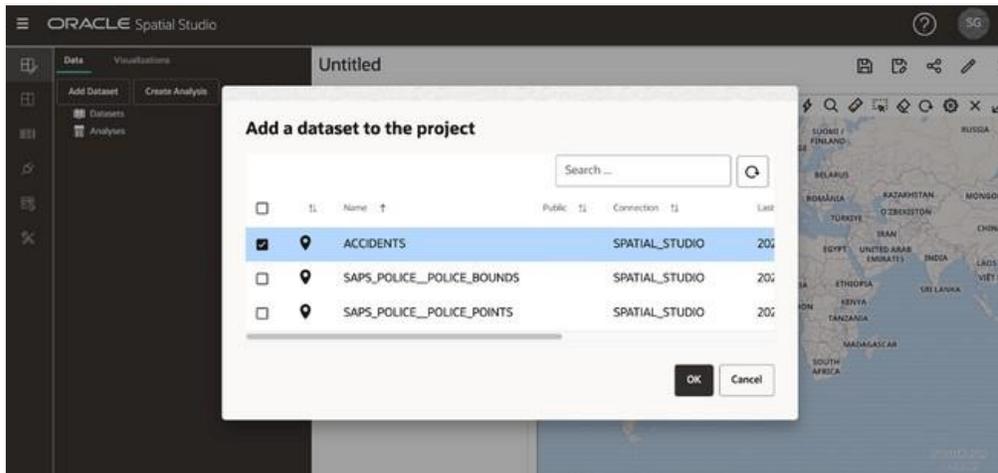
Within Spatial Studio, a *project* serves as the workspace for visualizing and analyzing data. You can save projects, and you have the option of publishing them to share insights and results with others. This section guides you through the process of creating, saving, and working in a project.

Create a Project

1. In Spatial Studio, navigate to the **Projects** page, click **Create Project**, and create the project.

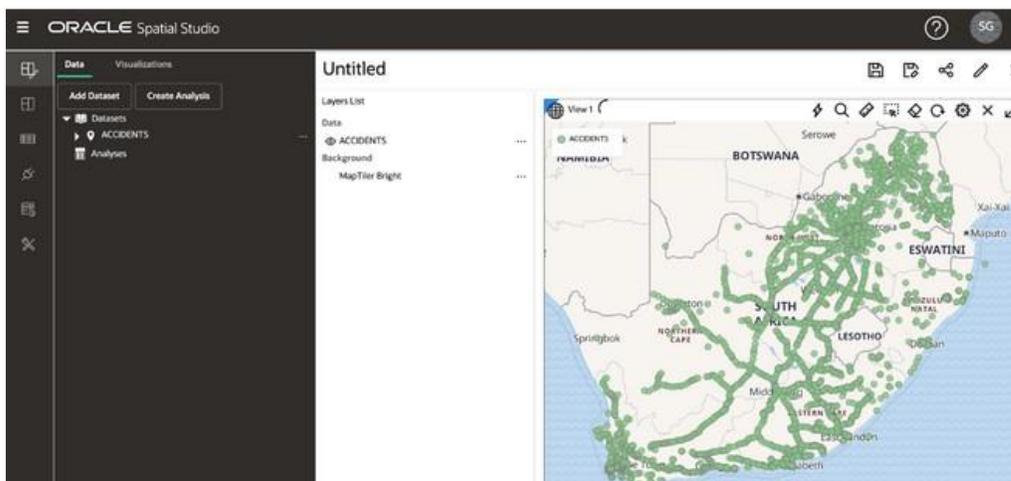


2. In the project, click **Add Dataset**, select the datasets to add to the project, and then click **OK**.



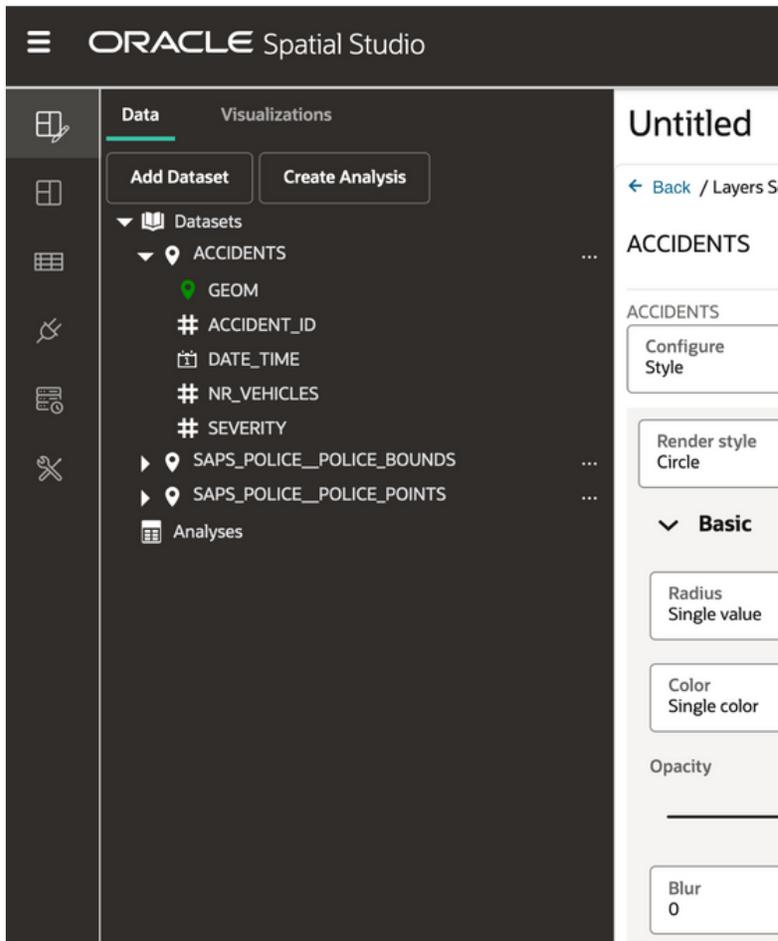
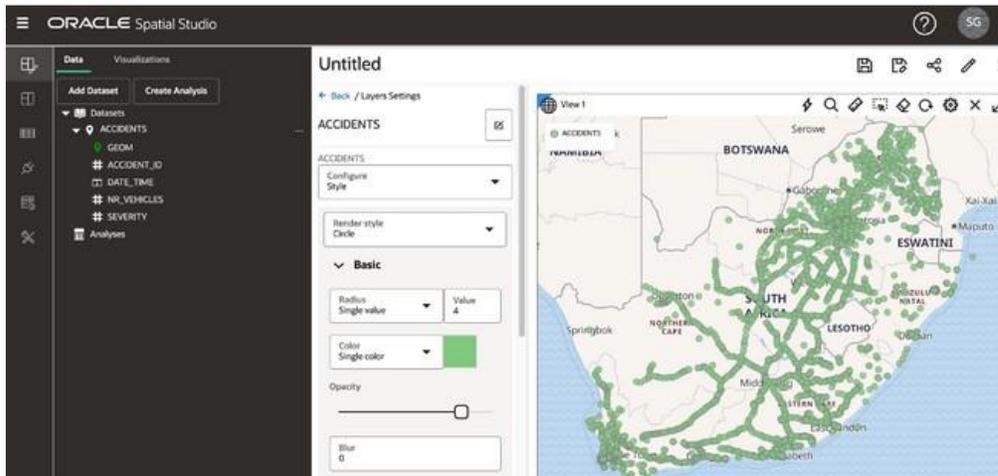
3. Drag the dataset onto the map to create a map layer.

You can optionally configure map settings, including a label, navigation control widget, scale bar and legend. Click the gear icon to access map settings.



- In the **Layers List** panel, click the action menu for the dataset and select **Settings**.

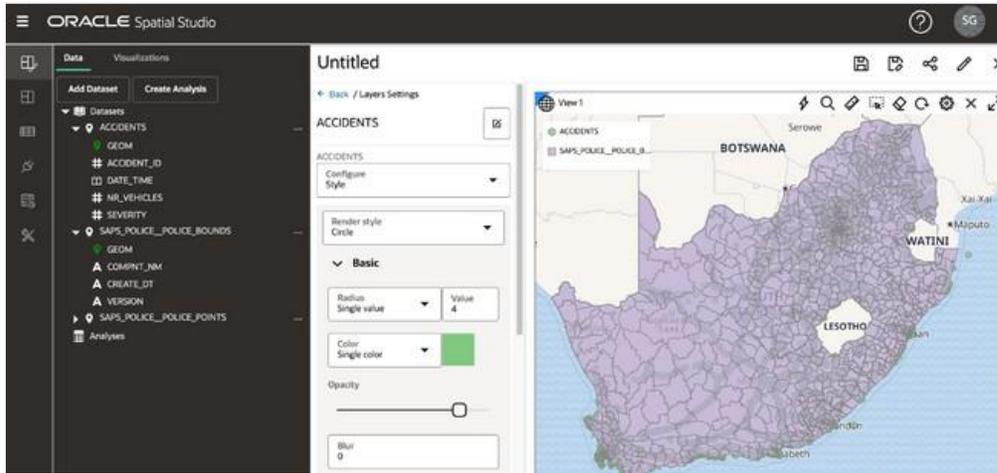
From here you control the layer display and interactivity settings.



Add Multiple Datasets

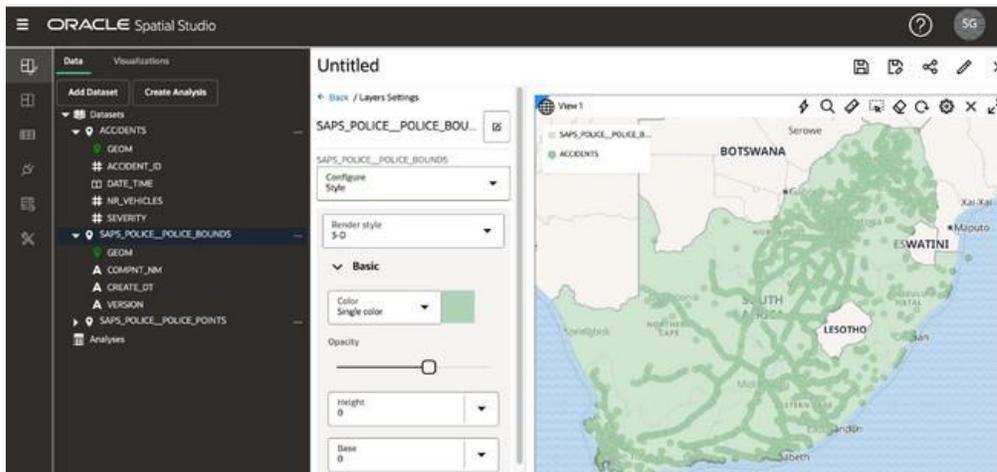
Add more datasets to create more layers.

1. Click **Add Dataset** at the top of the project's **Data** tab.
2. Select two previously uploaded datasets, and click **OK**.



3. Drag the second dataset from the **Data** tab onto the map, click the dataset layer's action menu, select **Settings**, and then update the radius, color, opacity, and any other settings. Then, click the **Back** link at the top of the **Layer Settings** panel.

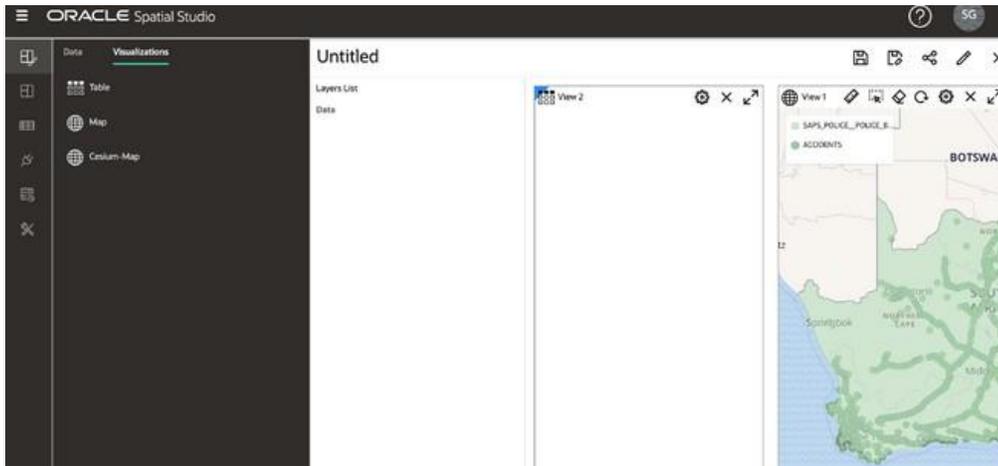
As layers are added to the map, they're rendered on top of the existing layers.



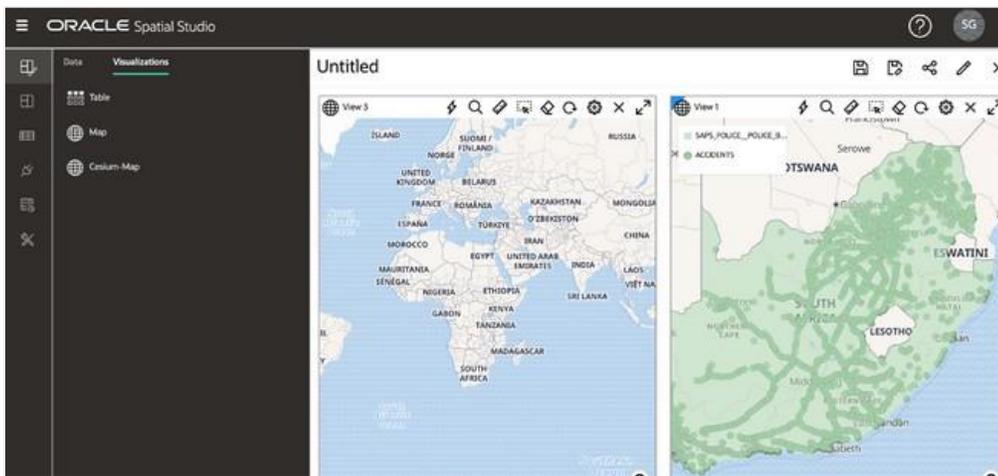
Add Visualizations

Spatial Studio lets you display your datasets as maps and tables.

To add visualizations, click the **Visualizations** tab in the project and then drag **Table** to the edge of the existing map view. A grey bar appears when the table can be dropped.



Try the other visualization options: Map and Cesium Map.



Getting Started Resources

See the following resources to get started with Oracle Spatial Studio and other spatial features.

Product page: [Spatial Database](#)

Blog posts

- [Track data through space & time with Autonomous Database, Spatial Studio](#)
- [Announcing Oracle Spatial Studio 23.1](#)
- [Oracle Spatial and Graph posts](#)
- [Oracle Graph posts](#)

LiveLab workshops

- [Introduction to Oracle Spatial Studio](#)
- [Simplify Microservices with Converged Oracle Database workshop](#)

Create an account on OCI: [Get an Oracle.com Account](#)

Conclusion

Oracle's spatial offerings are an integral part of the unified Oracle database, providing developers and analysts with access to location intelligence analytics and mapping services. This inclusion empowers geographic information system (GIS) professionals to efficiently implement sophisticated geospatial applications. With Oracle Autonomous Database and Oracle Database, organizations gain the capability to handle diverse geospatial data types, run a myriad of spatial analytics, and use interactive map visualization tools. This robust spatial feature set facilitates the deployment of advanced geospatial applications for comprehensive location-based insights.

Connect with us

Call +1.800.ORACLE1 or visit [oracle.com](https://www.oracle.com). Outside North America, find your local office at [oracle.com/contact](https://www.oracle.com/contact).

 blogs.oracle.com

 facebook.com/oracle

 twitter.com/oracle

Copyright © 2023, Oracle and/or its affiliates. This document is provided for information purposes only, and the contents hereof are subject to change without notice. This document is not warranted to be error-free, nor subject to any other warranties or conditions, whether expressed orally or implied in law, including implied warranties and conditions of merchantability or fitness for a particular purpose. We specifically disclaim any liability with respect to this document, and no contractual obligations are formed either directly or indirectly by this document. This document may not be reproduced or transmitted in any form or by any means, electronic or mechanical, for any purpose, without our prior written permission.

Oracle, Java, MySQL, and NetSuite are registered trademarks of Oracle and/or its affiliates. Other names may be trademarks of their respective owners.

Intel and Intel Inside are trademarks or registered trademarks of Intel Corporation. All SPARC trademarks are used under license and are trademarks or registered trademarks of SPARC International, Inc. AMD, Epyc, and the AMD logo are trademarks or registered trademarks of Advanced Micro Devices. UNIX is a registered trademark of The Open Group.

Perform Spatial Analysis with Oracle Spatial Studio

Author: Divit Gupta

Contributing author: Paul Parkinson