



Interstate Operations and Enhancement Program (IOEP) Tool Guidebook

www.vdotplanning.com/ioep

Version 2025.01

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Background

Program (IOEP) aims to improve safety, reliability, and traffic flow along interstate corridors in the Commonwealth by developing and funding both operational and capital improvements.

Historically, the analysis workflows for IOEP were developed by an external contractor, requiring VDOT planners to follow a series of complex, manual steps using Microsoft Excel. Even after attending an 8-hour training seminar, it typically takes planners an average of two weeks to complete an analysis for a selected interstate route. This process, heavily reliant on Excel and manual effort, often introduces the risk of biased or inconsistent results, especially for more advanced analyses.

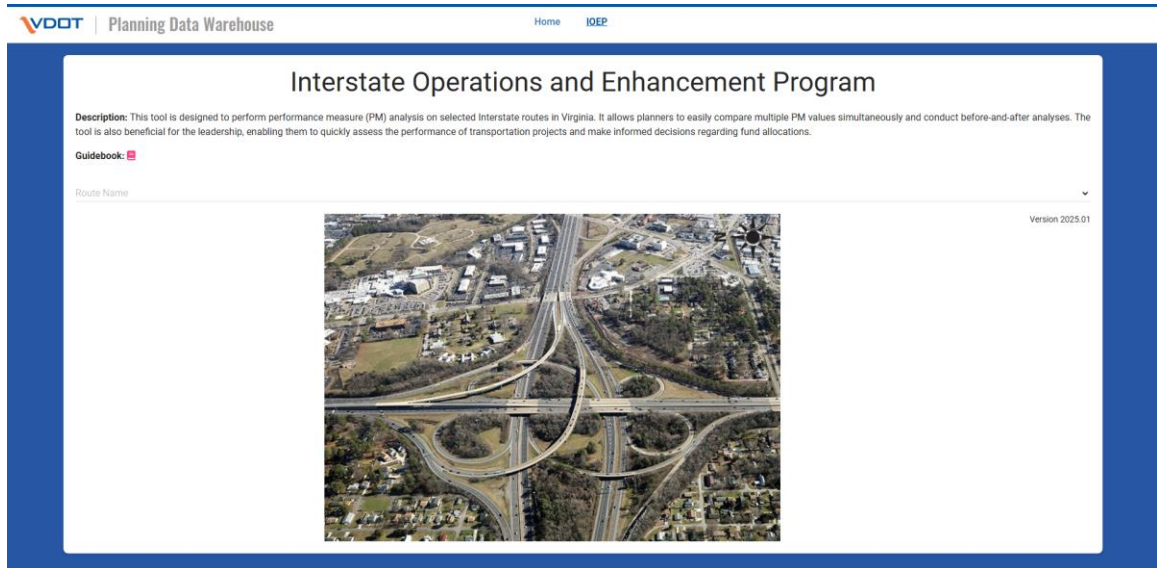
To address these challenges, VDOT's Transportation and Mobility Planning Division (TMPD) has proposed the development of a web-based application, the IOEP tool. The key objectives of this tool are:

- Offering an intuitive map interface to search, explore, and query geo-referenced data such as Interstate highways, crashes, and travel delays across multiple datasets simultaneously.
- Enabling users to conduct IOEP analyses more easily and efficiently, with the ability to export results.
- Automating workflows to maintain the IOEP database with regular data updates.
- Ensuring accessibility from any location.
- Creating a platform that supports informed decision-making and collaboration with planning partners, facilitating project development and advancement through the SMART portal.

Getting Started

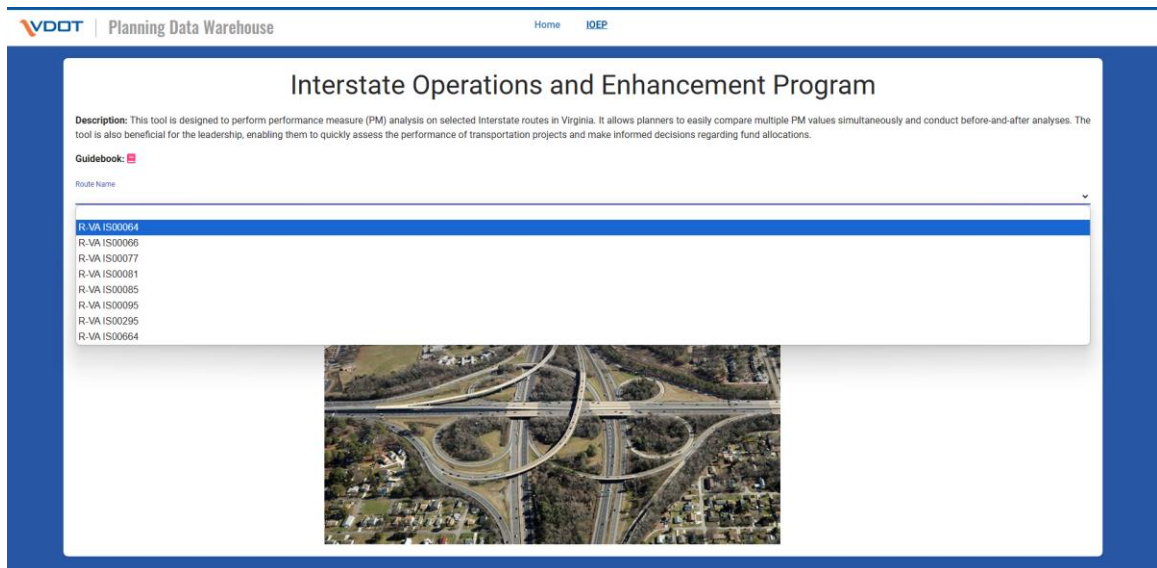
Basic Steps of conducting an Interstate Operations and Enhancement Program (IOEP) analysis

Step 1. Visit the IOEP Tool Homepage, <https://vdotplanning.com/ioep>.



The screenshot shows the homepage of the IOEP Tool. At the top left is the VDOT logo and "Planning Data Warehouse". At the top right are "Home" and "IOEP" links. The main heading is "Interstate Operations and Enhancement Program". Below this is a description: "Description: This tool is designed to perform performance measure (PM) analysis on selected Interstate routes in Virginia. It allows planners to easily compare multiple PM values simultaneously and conduct before-and-after analyses. The tool is also beneficial for the leadership, enabling them to quickly assess the performance of transportation projects and make informed decisions regarding fund allocations." There is a "Guidebook" link with a red icon. Below the description is a "Route Name" input field. To the right of the input field is a "Version 2025.01" label. In the center of the page is a large aerial photograph of a complex highway interchange with multiple overpasses and ramps.

Step 2. Select an Interstate Route. (e.g., R-VA IS00064)



The screenshot shows the IOEP Tool interface with a dropdown menu open for route selection. The dropdown list contains the following options: "R-VA IS00064", "R-VA IS00066", "R-VA IS00077", "R-VA IS00081", "R-VA IS00085", "R-VA IS00095", "R-VA IS00295", and "R-VA IS00664". The "R-VA IS00064" option is highlighted in blue. The rest of the page content, including the VDOT logo, navigation links, description, and the aerial photograph of the highway interchange, remains visible in the background.

Step 3. Select a Performance Measure under “Config Analysis” panel. (e.g., EPDO)

The screenshot shows the VDOT Planning Data Warehouse interface. At the top, the route name is "R-VA IS00064" and the milepost range is "from: 0 to 301". The "CONFIG ANALYSIS" tab is selected. Under the "Configuration" section, the "Select Performance Measure" dropdown menu is open, showing options: EPDO (highlighted), EPDO Rate, PHD, and IPHD. Below the dropdown is a satellite map of the project area. A "TOGGLE CHART" button is visible at the bottom left. A "Project Status" legend is located in the bottom right corner of the map area, with categories: Construction Started (yellow square), Construction Completed (blue square), and Planned Construction (grey square).

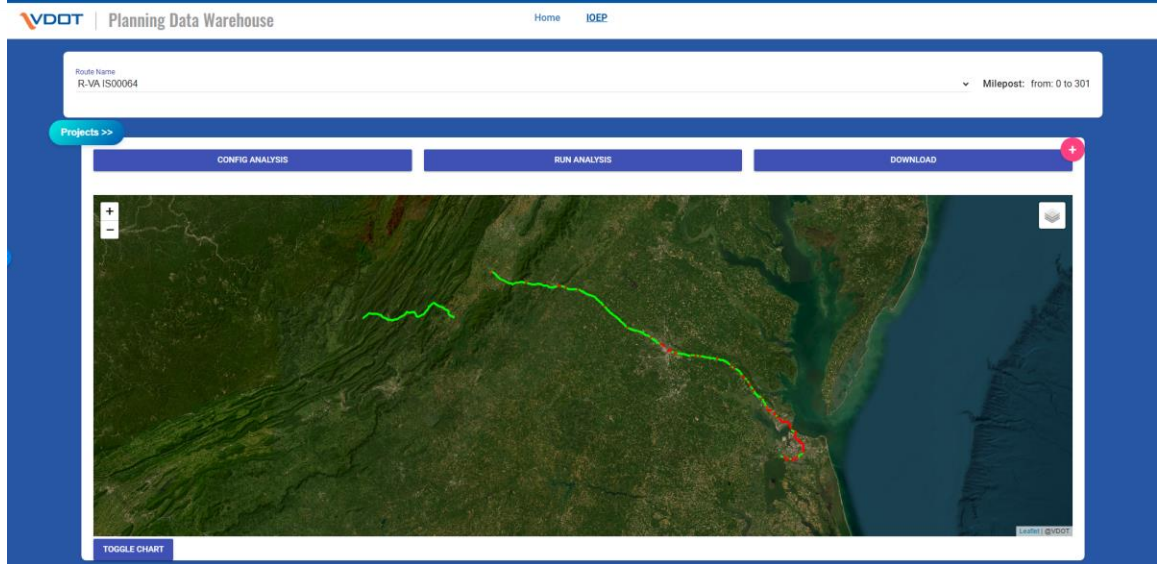
Step 4. Configure parameters including “From Year”, “To Year”, “Factor Weight”.

The screenshot shows the VDOT Planning Data Warehouse interface with the configuration parameters set. The route name is "R-VA IS00064" and the milepost range is "from: 0 to 301". The "CONFIG ANALYSIS" tab is selected. Under the "Configuration" section, the "Select Performance Measure" dropdown is set to "EPDO". The "From Year" dropdown is set to "2019" and the "To Year" dropdown is set to "2023". There is a "Milepost" section with a "+ Add another milepost range" button. Below that is a "Factor Weight" table:

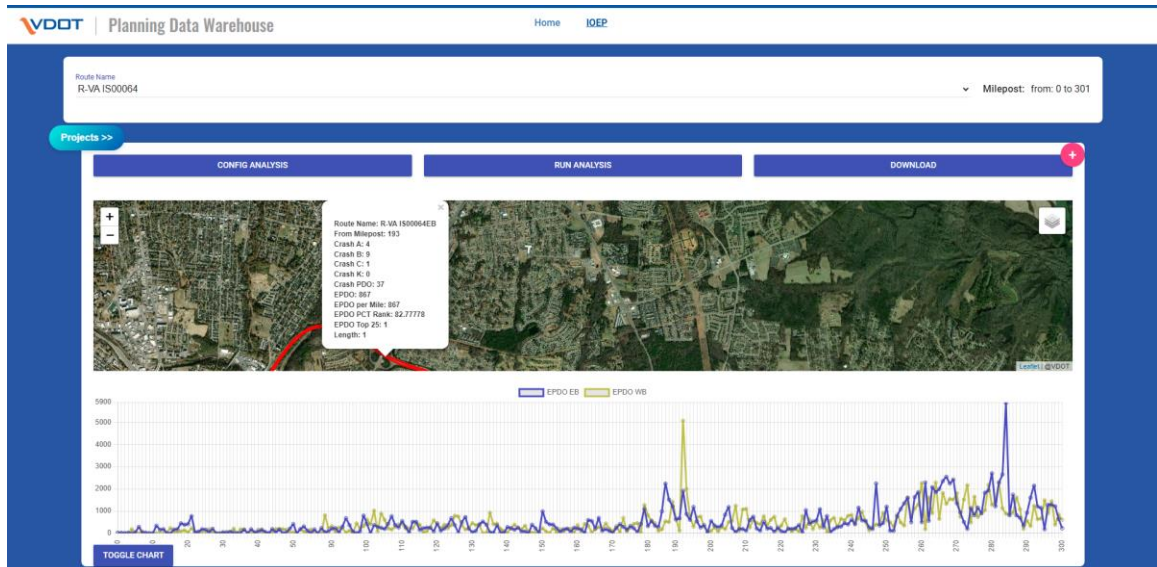
K	A	B	C	PDO
100	100	20	10	1

A "TOGGLE CHART" button is visible at the bottom left.

Step 5. Click “Run Analysis”, then analytic results are displayed on the map.



Step 6. Explore Analytic Results by Clicking any Interstate Segment and click “Toggle Chart” button.



Note: There are four types of performance measure: Equivalent Property Damage Only (EPDO), EPDO Rate, Person Hourly Delay (PHD), and Incident Person Hourly Delay (IPHD).

Step 7. Click “Download” button to export CSV tables.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Route Name	From Milepost	Length	A Crash Count	B Crash Count	C Crash Count	K Crash Count	PDO Crash Count	EPDO	EPDO per Mile	EPDO Percent Rank	EPDO Top 25	EPDO Rate	EPDO Rate Percent Rank	EPDO Rate Top 25	
2	R-VA IS00064WB	0	1	0	1	0	0	3	23	23	9.444445	0	53.639637	5.9259257	0	
3	R-VA IS00064EB	0	1	0	1	0	0	3	23	23	9.444445	0	294.05804	27.407408	0	
4	R-VA IS00064EB	1	1	0	1	0	0	2	22	22	8.703704	0	278.21936	25.555555	0	
5	R-VA IS00064WB	1	1	0	0	0	0	3	3	3	1.2962962	0	8.107356	0.9259259	0	
6	R-VA IS00064WB	2	1	0	1	0	0	2	22	22	8.703704	0	269.3276	24.814816	0	
7	R-VA IS00064EB	2	1	0	0	0	0	0	0	0	0	0	0	0	0	
8	R-VA IS00064EB	3	1	0	1	0	0	7	27	27	11.666667	0	325.16858	29.444445	0	
9	R-VA IS00064WB	3	1	0	0	0	0	0	0	0	0	0	0	0	0	
10	R-VA IS00064EB	4	1	0	0	0	0	2	2	2	0.7407407	0	24.086563	2.7777777	0	
11	R-VA IS00064WB	4	1	1	1	0	0	2	182	182	32.407406	0	2228.913	93.14815	1	
12	R-VA IS00064EB	5	1	0	2	0	0	5	45	45	18.111111	0	541.94763	40.925926	0	
13	R-VA IS00064WB	5	1	0	0	0	0	3	3	3	1.2962962	0	36.740326	4.4444447	0	
14	R-VA IS00064EB	6	1	1	5	1	0	18	288	288	50.74074	0	3468.465	98.333336	1	
15	R-VA IS00064WB	6	1	0	0	0	0	1	1	1	0.5555556	0	12.246775	1.4814814	0	
16	R-VA IS00064WB	7	1	0	4	0	0	6	86	86	23.888889	0	223.92853	22.222221	0	
17	R-VA IS00064EB	7	1	0	1	0	0	6	26	26	10.555555	0	317.14526	28.333334	0	
18	R-VA IS00064EB	8	1	0	1	0	0	4	24	24	10	0	293.4373	27.222221	0	
19	R-VA IS00064WB	8	1	0	1	0	0	0	20	20	7.962963	0	44.570496	5.3703704	0	
20	R-VA IS00064EB	9	1	0	0	0	0	7	7	7	3.8888888	0	85.58587	10.185185	0	
21	R-VA IS00064WB	9	1	0	0	0	0	7	7	7	3.8888888	0	15.599673	1.8518518	0	
22	R-VA IS00064WB	10	1	0	0	0	0	5	5	5	2.9629629	0	40.408455	4.814815	0	
23	R-VA IS00064EB	10	1	0	0	0	0	7	7	7	3.8888888	0	77.601234	8.703704	0	

Features and Functions

1. How to filter by Mileposts?

Users can include partial corridors in one analysis by filtering by mileposts.

1-1. At step 4, under the “Config Analysis” panel, click “+Add another milepost range” button.

VDOT | Planning Data Warehouse Home IOEP

Route Name: R-VA IS00064 Milepost: from: 0 to 301 Version 1.0

CONFIG ANALYSIS RUN ANALYSIS DOWNLOAD

Configuration

Select Performance Measure: EPDO

From Year: 2018 To Year: 2022

Milepost

Start Milepost - through - End Milepost Remove

+ Add another milepost range

Factor Weight

K	A	B	C	PDO
100	100	20	10	1

1-2. Fill milepost partials to be included. Note: milepost ranges (highlighted) can be referred.

VDOT | Planning Data Warehouse Home IOEP

Route Name: R-VA IS00064 Milepost: from: 0 to 301 Version 1.0

CONFIG ANALYSIS RUN ANALYSIS DOWNLOAD

Configuration

Select Performance Measure: EPDO

From Year: 2018 To Year: 2022

Milepost

0 - through - 50 Remove

100 - through - 150 Remove

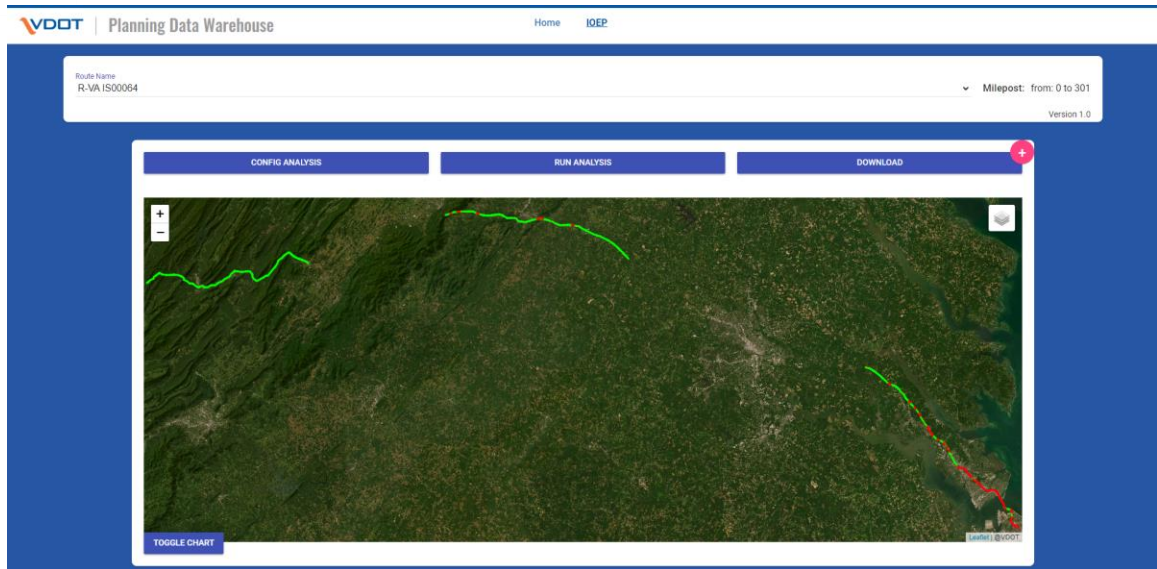
220 - through - 280 Remove

+ Add another milepost range

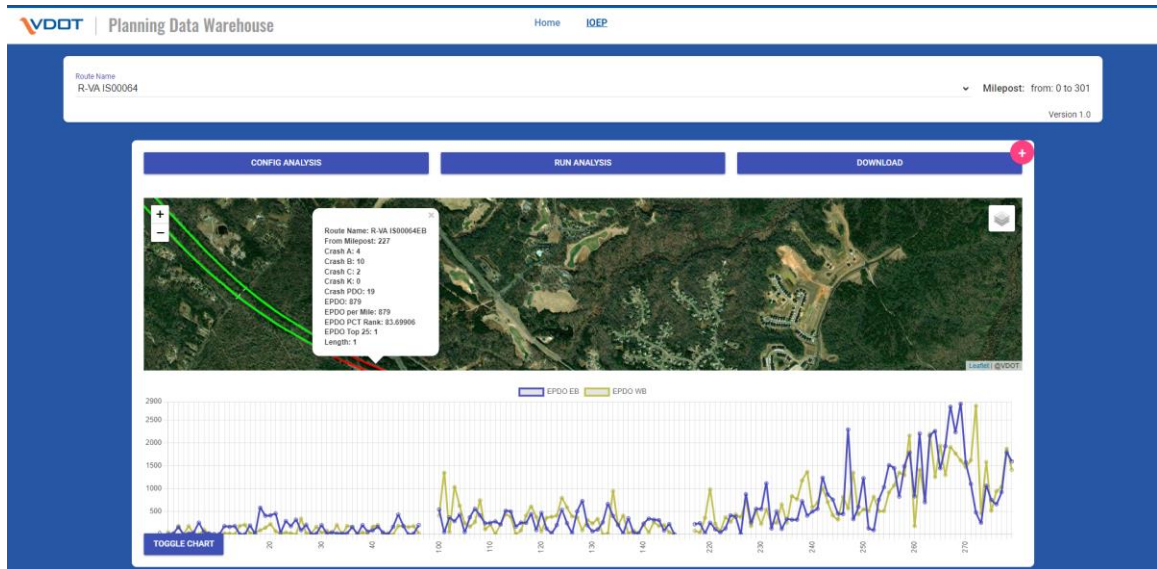
Factor Weight

K	A	B	C	PDO
100	100	20	10	1

1-3. Click “Run Analysis”.



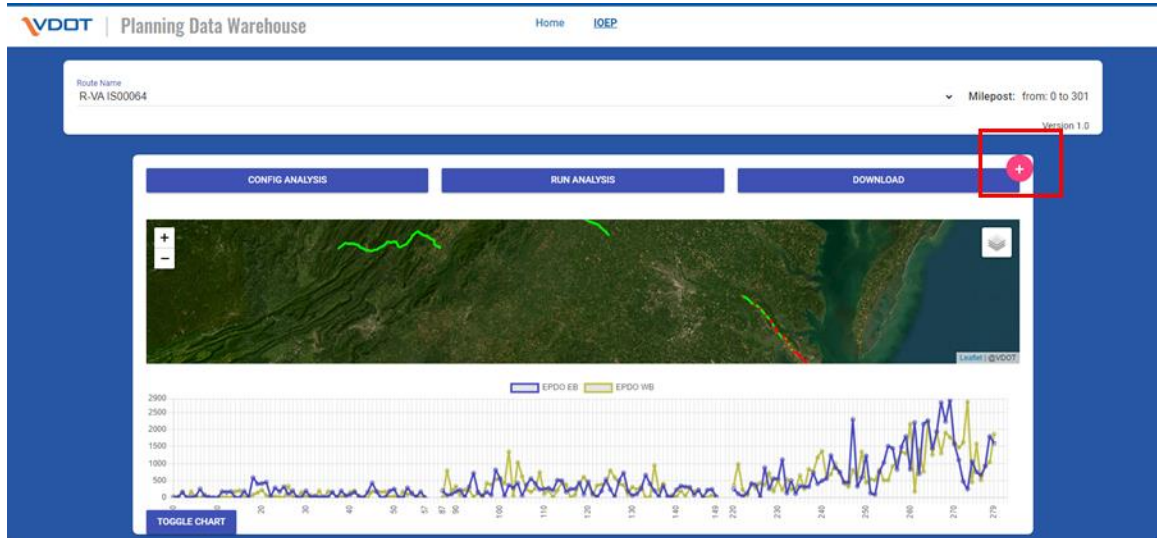
1-4. Click “Toggle Chart” button and explore the analytic results on the map.



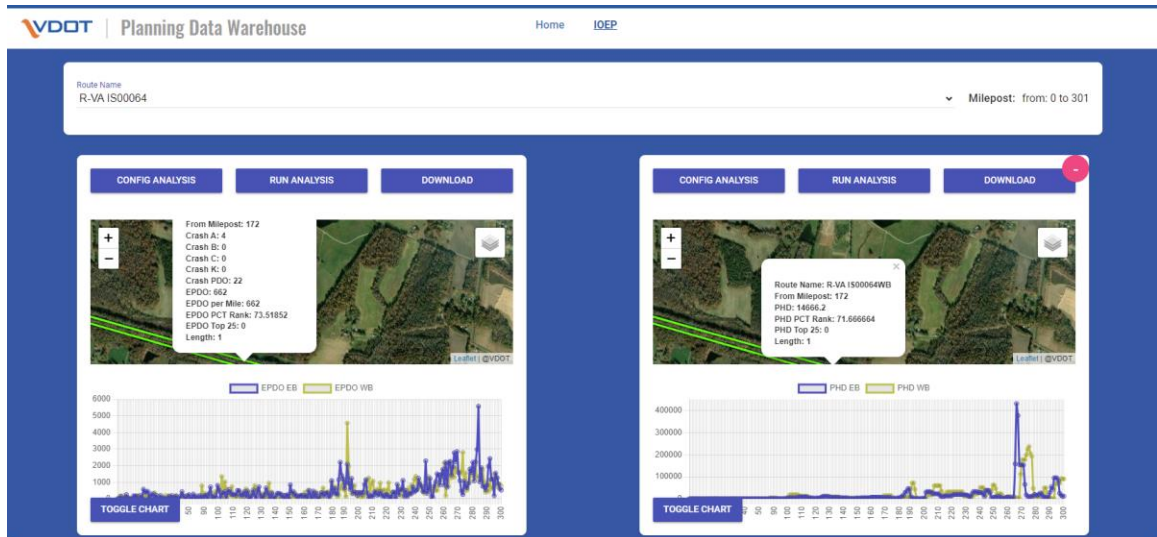
2. How to use Twin-Maps?

Users can have two side-by-side maps and simultaneously conduct multiple analysis.

2-1. After Step 6, click the “+” button (highlighted).



2-2. Follow Step 3~7 for the second map. (e.g., PHD, 2018~2022)

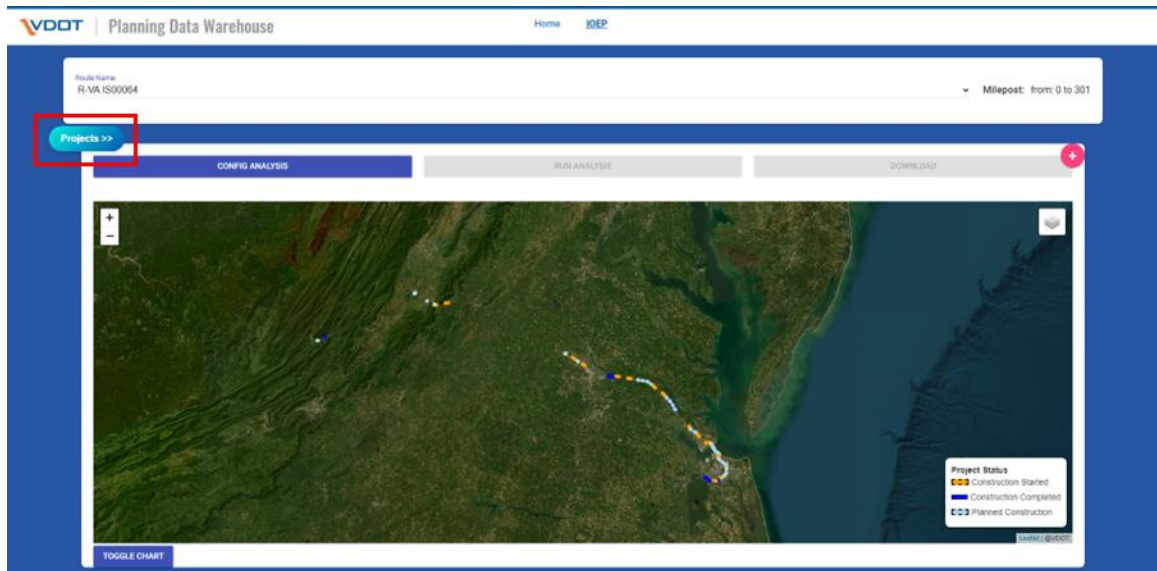


Note: Twin-maps are associated by sharing the same boundary.

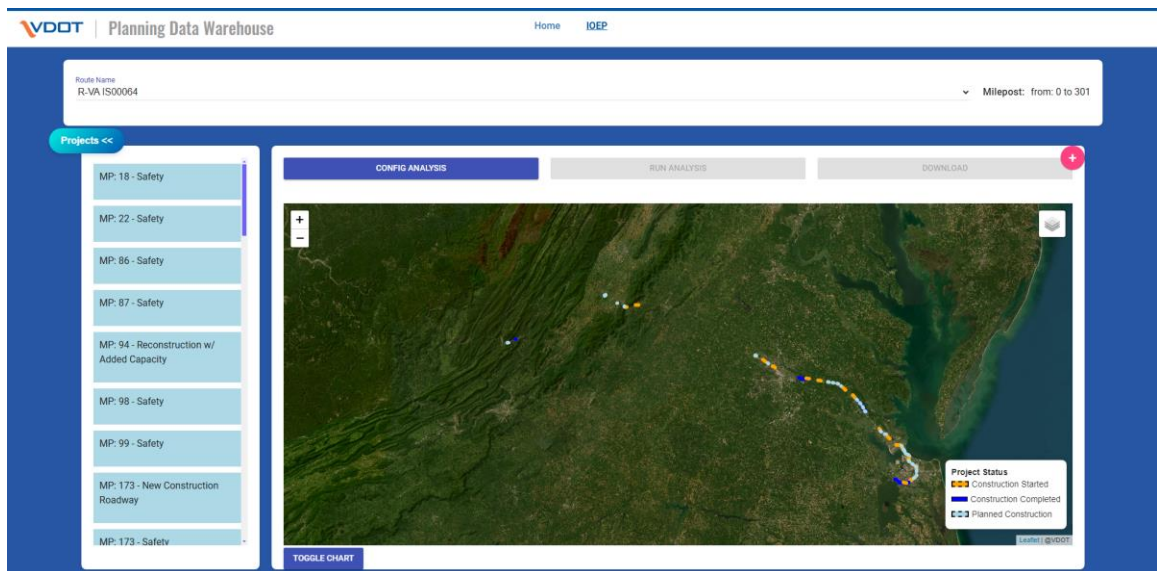
3. Transportation Project Layer

Existing/funded transportation projects are added to the map as a reference. Locations with funded projects can be excluded from future funding plans.

3-1. After Step 2, click the “Projects” button (highlighted).



3-2. A list of projects will be displayed in the sidebar. Then click any of the project item.



3-3. Detailed attributes will be displayed. Use the “PREVIOUS” and “NEXT” button to navigate between projects.

VDOT | Planning Data Warehouse

Home IOEP

Route Name: R-VA IS00064 Milepost: from: 0 to 301

Projects <<

Project 4 - UPC: 120397

Status: AWARDED
 District: Staunton
 Milepost From: 87 - To: 88
 Scope of Work: Safety
 Construction Start Date: 11/9/2023
 Construction End Date: 3/6/2025
 Project Purpose: Install high-friction surface pavement I-64 EB - NB I-61 Exit 221 to EB I-64.
 Project Description: #64CIP I-64 EB INSTALL HIGH FRICTION SURFACE PAVEMENT
 Total Estimate: 349924

--- Back

--- PREVIOUS NEXT ---

CONFIG ANALYSIS RUN ANALYSIS DOWNLOAD

TOGGLE CHART

Project Status
 Construction Started
 Construction Completed
 Planned Construction

3-4. If “Back” button is clicked, the sidebar will go back to display the list of projects.

VDOT | Planning Data Warehouse

Home IOEP

Route Name: R-VA IS00064 Milepost: from: 0 to 301

Projects <<

Project 4 - UPC: 120397

Status: AWARDED
 District: Staunton
 Milepost From: 87 - To: 88
 Scope of Work: Safety
 Construction Start Date: 11/9/2023
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 Total Estimate: 349924

--- Back

--- PREVIOUS NEXT ---

CONFIG ANALYSIS RUN ANALYSIS DOWNLOAD

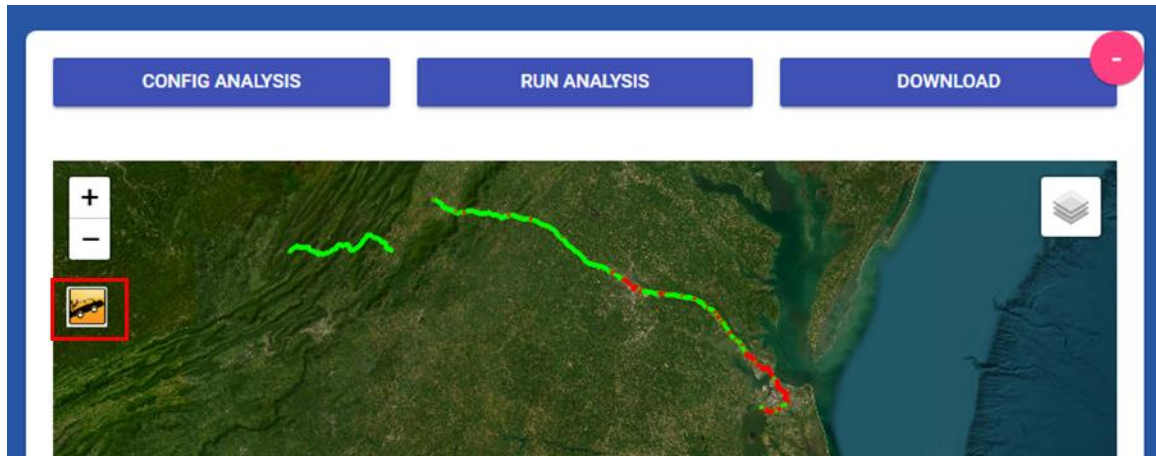
TOGGLE CHART

Project Status
 Construction Started
 Construction Completed
 Planned Construction

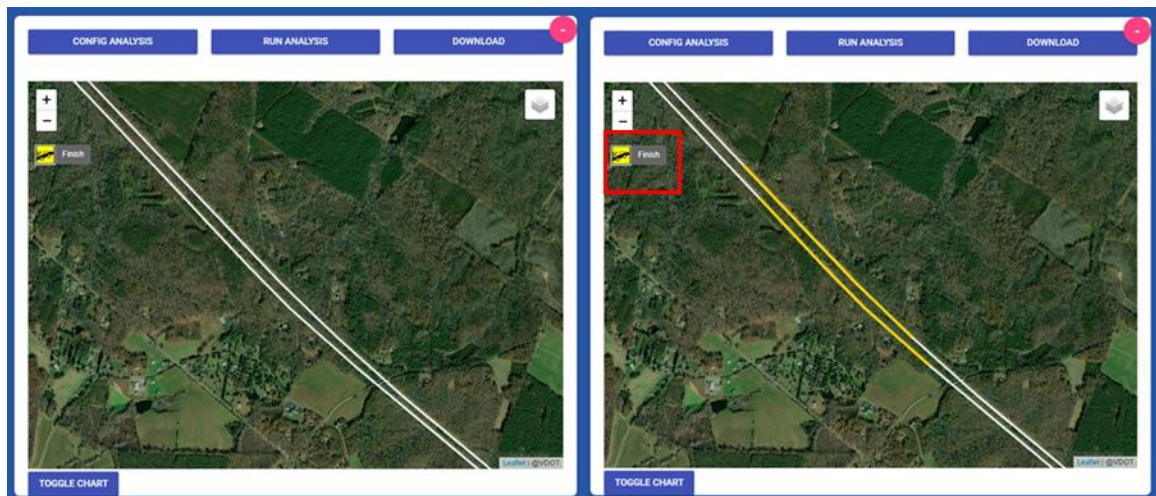
4. Crashes Display and Download

Users can check and download crash data to understand how crashes have been involved in calculations. Meanwhile, the downloaded crash attributes provide insightful information to planners.

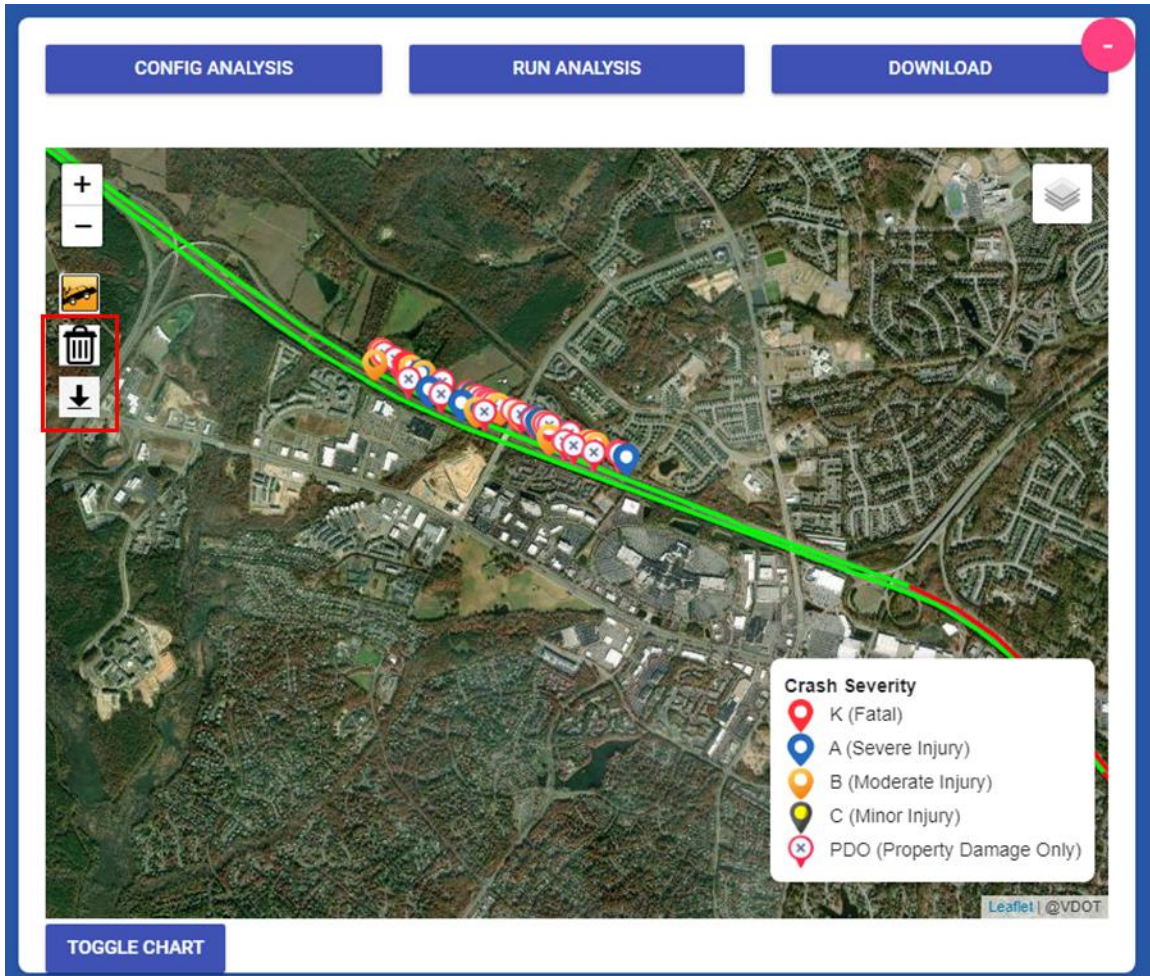
4-1. A crash button will be displayed when users finish the EPDO / EPDO Rate analysis on the right-side map.



4-2. When clicking on the “Crash” button, the map will turn on “Selection Mode”. Click on any corridor link to toggle selection (yellow: selected; white: unselected). Then click “Finish” to complete the selection process.



4-3. Relevant crashes on selected corridors will be displayed as points on the map. The crash layer is categorized by crash severity using different symbols. As highlighted, a “Delete” button and a “Download” button are available. Clicking the “Delete” button will remove the crash layer, allowing the user to start a new crash selection. Clicking the “Download” button will export the crash layer as a CSV file with detailed attributes.



Use Cases

1. Before-After Analysis?

Before-after analysis compares performance measures between before- and after-time periods.

- 1-1. After selecting a route name, follow Step 3~6 for the first map (e.g., I64, PHD, 2019~2019) and Step 3~6 for the second map (e.g., I64, PHD, 2021~2021).

The screenshot displays the VDOT Planning Data Warehouse interface. At the top, the route name is 'R-VA IS00064' and the milepost range is 'from: 0 to 301'. Below this, there are two side-by-side configuration panels. Each panel has buttons for 'CONFIG ANALYSIS', 'RUN ANALYSIS', and 'DOWNLOAD'. The left panel is configured for 'PHD' performance measure, 'From Year: 2019', and 'To Year: 2019'. The right panel is configured for 'PHD' performance measure, 'From Year: 2021', and 'To Year: 2021'. Both panels have a 'Milepost' field and a '+ Add another milepost range' button. At the bottom of each panel, there is a 'TOGGLE CHART' button and a small map preview showing the route from milepost 172.

- 1-2. Click “Run Analysis” button for both maps.

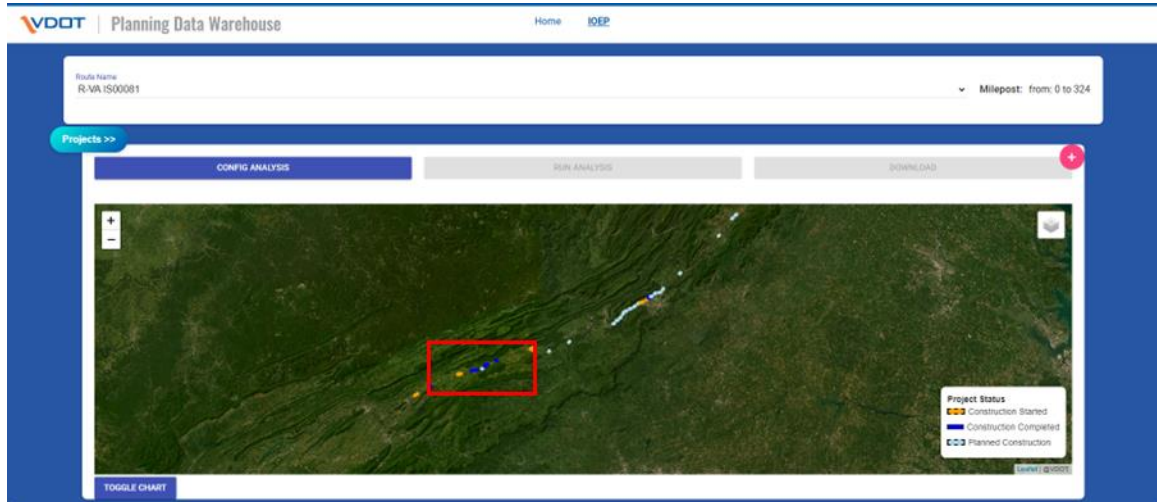
The screenshot shows the VDOT Planning Data Warehouse interface after the analysis has been run. The route name remains 'R-VA IS00064' and the milepost range is 'from: 0 to 301'. The interface now displays two side-by-side analysis results panels. Each panel has buttons for 'CONFIG ANALYSIS', 'RUN ANALYSIS', and 'DOWNLOAD'. The left panel shows a map of the route with a green line indicating the PHD EB and PHD WB values. Below the map is a bar chart with a y-axis ranging from 0 to 400,000. The right panel shows a similar map and bar chart. The y-axis for both charts is labeled with values 0, 100000, 200000, 300000, and 400000. The x-axis for both charts is labeled with milepost values from 0 to 300 in increments of 30. A 'TOGGLE CHART' button is located at the bottom of each panel.

Note: The charts displayed for both maps share the same limit on the y-axis.

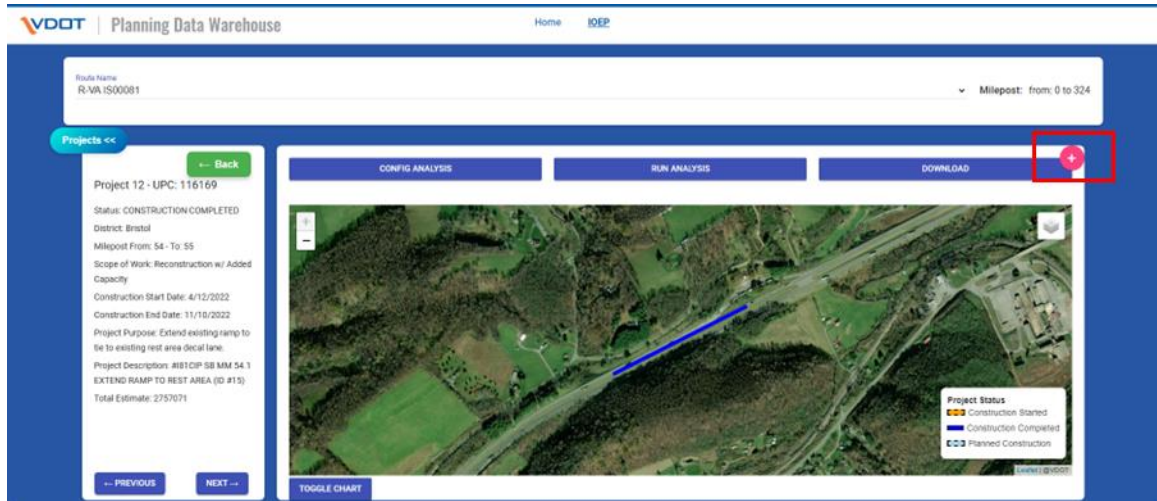
2. Project Impact Analysis

After a corridor enhancement project is completed, planners can evaluate improvements based on multiple performance measures.

- 2-1. After selecting a route name (e.g., I81), zoom in to locations to find a project with the status of “construction completed”. Then click on the project line.



- 2-2. Open the Projects sidebar, detailed information will be displayed, and the map will be zoomed to the project’s boundary. Then click the highlighted “Add” button to open the second map.



2-3. Let's hide the transportation project layer for now by unchecking the highlighted map control on map 1. Then conduct EPDO Rate analysis on both map 1 and map 2 with the following configurations:

Map 1

Map 2

Performance Measure: EPDO Rate

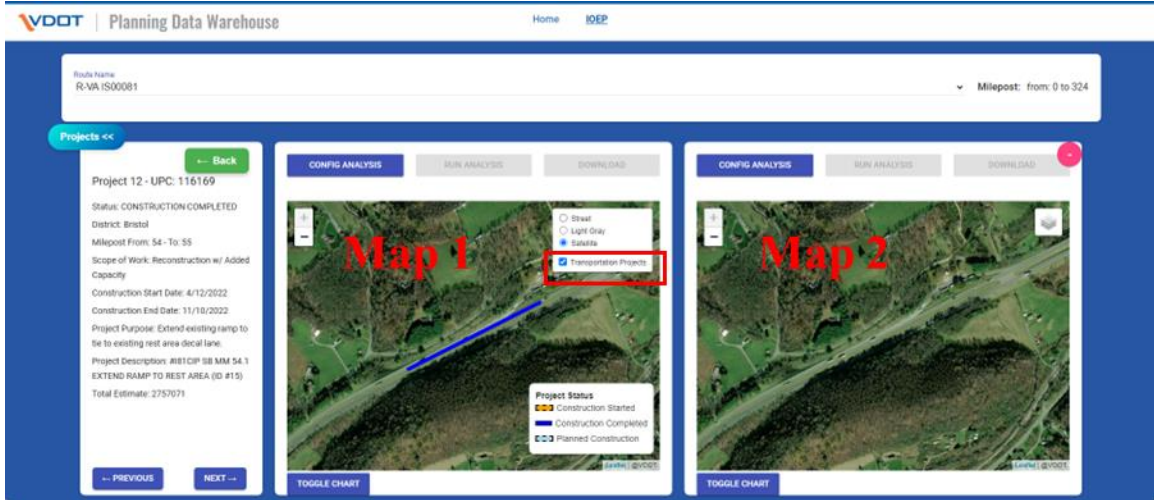
Performance Measure: EPDO Rate

From Year: 2019

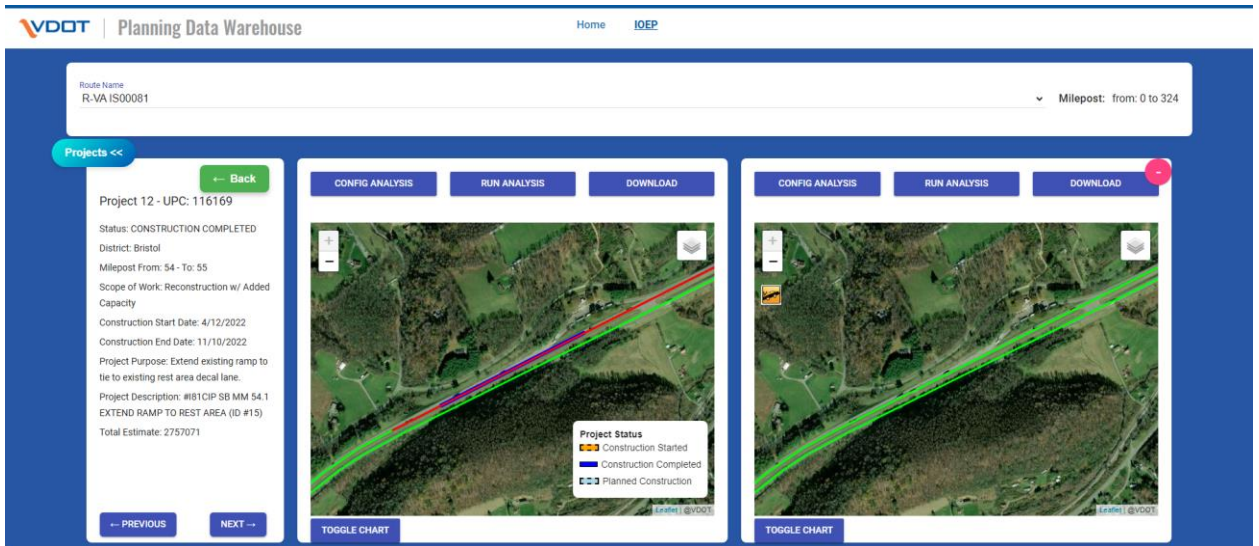
To Year: 2019

From Year: 2023

To Year: 2023



2-4. Check analytic results.



1. Then, after conducting analysis with all types of performance measures, the final results are summarized below.

Project Info

UPC: 116169

Status: Construction completed

Construction

Start Date: 4/12/2022

End Date: 11/10/2022

Milepost: 54 to 55

Cost: \$2,757,071

Scope: Adding capacity

Purpose: Extend existing ramp to tie to existing rest area decal lane.

Project Description: #I81CIP SB MM 54.1 extend ramp to rest area (ID #15)

Analytic Report

	2019		2023	
	PM Value	Rank	PM Value	Rank
EPDO	160	83.5%	2	15.6%
EPDO Rate	2573.5	95.0%	28.7	25.2%
PHD	6263.6	47.0%	1106.2	22.6%
IPHD	869.8	21.2%	213.7	15.9%

Therefore, we can see significant improvements in the project based on EPDO, EPDO Rate, PHD, and IPHD.

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