Planar Deviation Dashboard User Guide

Introduction

The planar deviation dashboard was developed primarily to identify humped grade crossings in the United States where approach grade profiles might pose potential safety concerns. It includes a detailed data visualization interface featuring filters, interactive maps and tables. Figure 1 shows a screenshot of the planar deviation dashboard. The purpose of this user guide is to provide an overview of how to effectively navigate and utilize the dashboard.

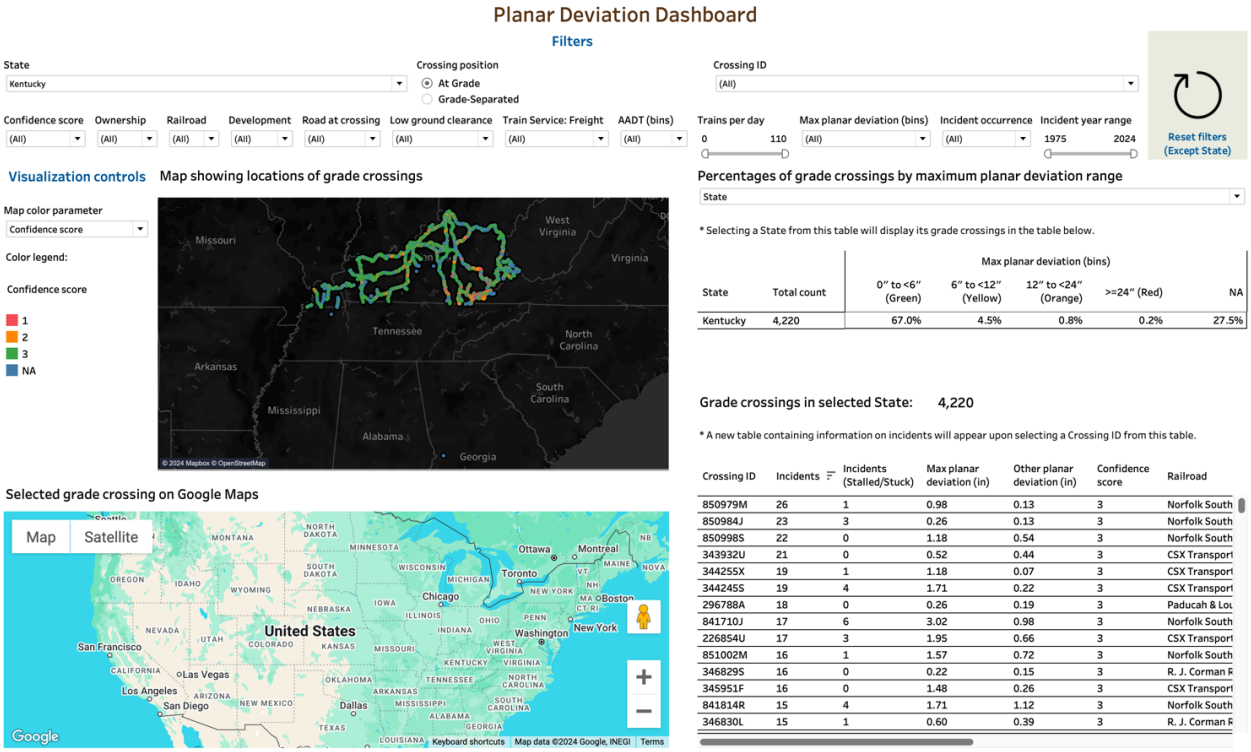


Figure 1: Planar deviation dashboard

Dashboard Structure

Filters

Users can find various filters at the top of the dashboard to customize the displayed data according to specific criteria. These filters can be selected and adjusted using sliders, pull-down menus, and checkboxes. Once applied, the dashboard automatically updates all the calculations and displays to show the filtered results. A reset button allows users to clear all selected filters, enhancing flexibility. Table 1 provides definitions and example field values for the variables used in filtering, while Figures 2 through 13 display the dropdown options for various filters used in the dashboard.

TABLE 1. Variables used in the dashboard for filtering

Variable	Definition	Field values
State	Name of the state where the crossing is located	50 states and District of Columbia
Crossing position	Indicates whether a crossing is at grade or if the railroad passes under or over the roadway or pathway.	At grade, Grade-Separated
Crossing ID	Unique ID to locate each grade crossing	850979M, 344255X, 735682T, etc.
Confidence score	Level of confidence on the calculated planar deviation where 3 corresponds to the highest, and 1 to the lowest confidence	1, 2, 3, NA
Ownership	Indicates whether a crossing is public or private	Public, Private
Railroad	Name of the parent railroad	Alameda Belt Line, Alan Wood Steel etc.
Development	Predominant type of land development in the vicinity of the crossing	Commercial, Industrial, Residential, etc.
Road at crossing	Rural or urban classification of the road at crossing	Rural, Urban, NA
Low ground clearance	Presence of low ground clearance signs	Yes, No
Train service: Freight	Use of the crossing by freight	Yes, No
AADT (bins)	Estimated AADT through the crossing (total both directions) categorized into bins	0 to <500, 500 to <1000, 1000 to <1500, 1500 to < 5000, 5000 to <10000, >= 10000
Trains per day	Total number of trains that operate through the crossing per day during normal railroad operating periods	0 to 856
Max planar deviation (bins)	Maximum planar deviations calculated using the USGS dataset categorized into bins	0” to <6”, 6” to <12”, 12” to <24”, >= 24”
Incident occurrence	Indicates whether an incident between on-track railroad equipment and a highway user occurred at a crossing.	Yes, No
Incident year range	Year of the incident	1975 to 2024

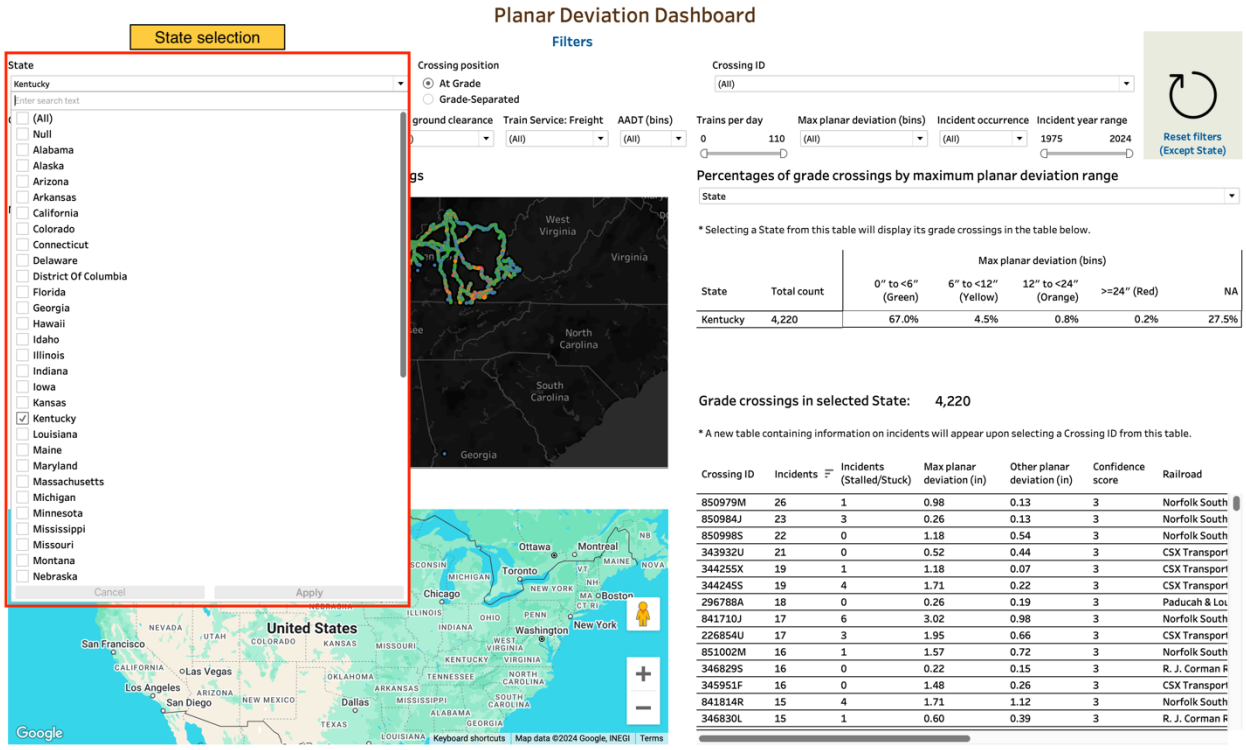


Figure 2: Dropdown options for the state filter

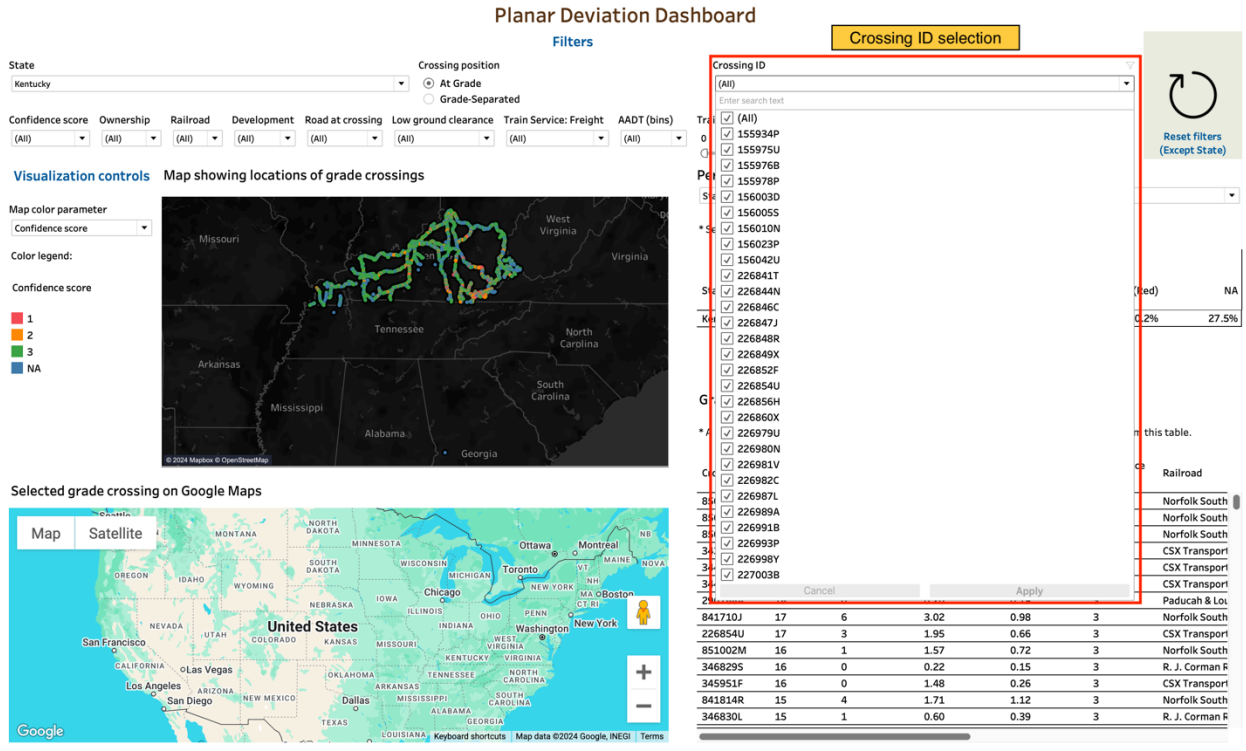
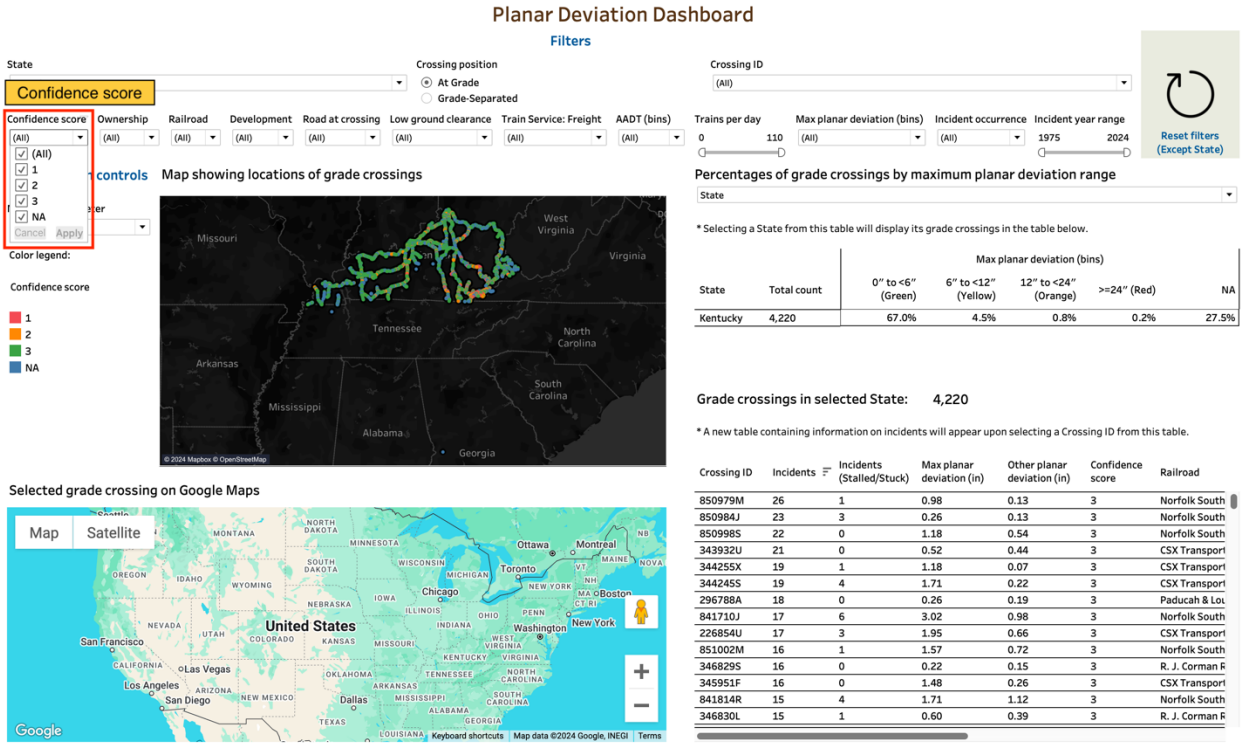


Figure 3: Dropdown options for the crossing ID filter



State	Total count	Max planar deviation (bins) 0″ to <6″ (Green)	6″ to <12″ (Yellow)	12″ to <24″ (Orange)	>=24″ (Red)	NA
Kentucky	4,220	67.0%	4.5%	0.8%	0.2%	27.5%

Crossing ID	Incidents	Incidents (Stalled/Stuck)	Max planar deviation (in)	Other planar deviation (in)	Confidence score	Railroad
850979M	26	1	0.98	0.13	3	Norfolk South
850984J	23	3	0.26	0.13	3	Norfolk South
850998S	22	0	1.18	0.54	3	Norfolk South
343932U	21	0	0.52	0.44	3	CSX Transport
344255X	19	1	1.18	0.07	3	CSX Transport
344245S	19	4	1.71	0.22	3	CSX Transport
296788A	18	0	0.26	0.19	3	Paducah & Lou
841710J	17	6	3.02	0.98	3	Norfolk South
226854U	17	3	1.95	0.66	3	CSX Transport
851002M	16	1	1.57	0.72	3	Norfolk South
346829S	16	0	0.22	0.15	3	R. J. Corman R
345951F	16	0	1.48	0.26	3	CSX Transport
841814R	15	4	1.71	1.12	3	Norfolk South
346830L	15	1	0.60	0.39	3	R. J. Corman R

Figure 4: Dropdown options for the confidence score filter

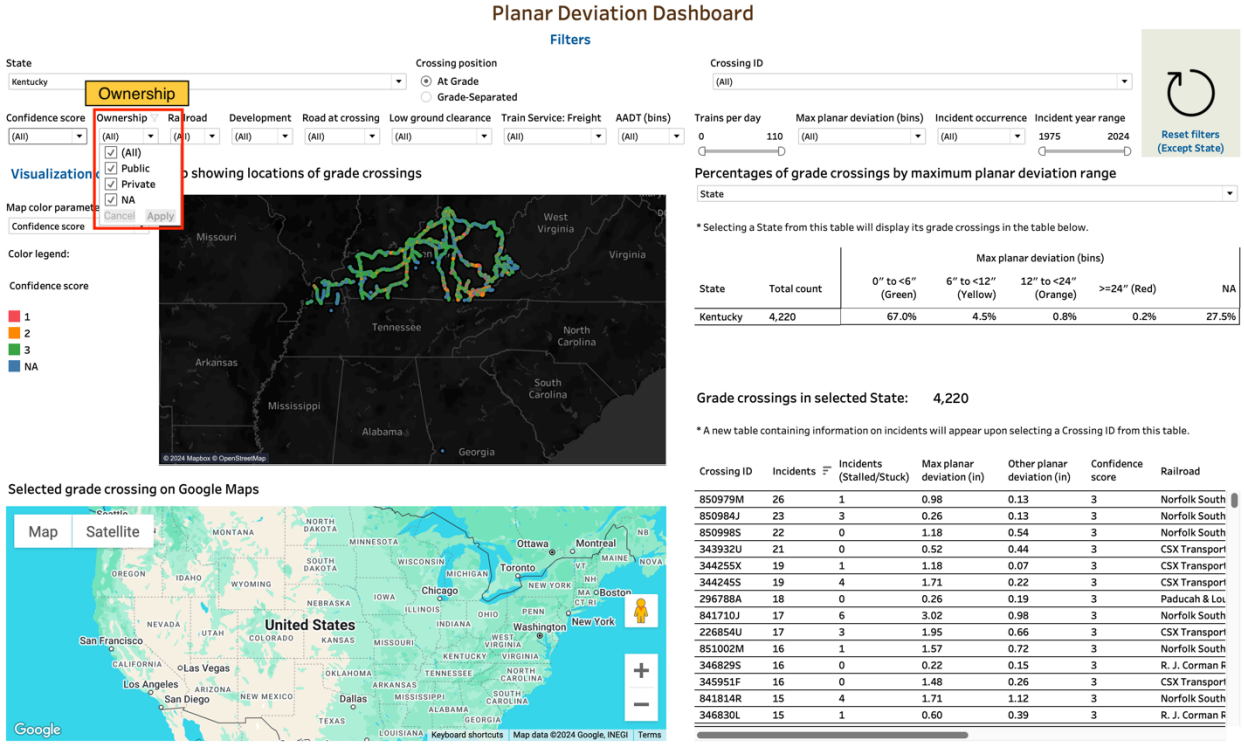


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Figure 5: Dropdown options for the ownership filter

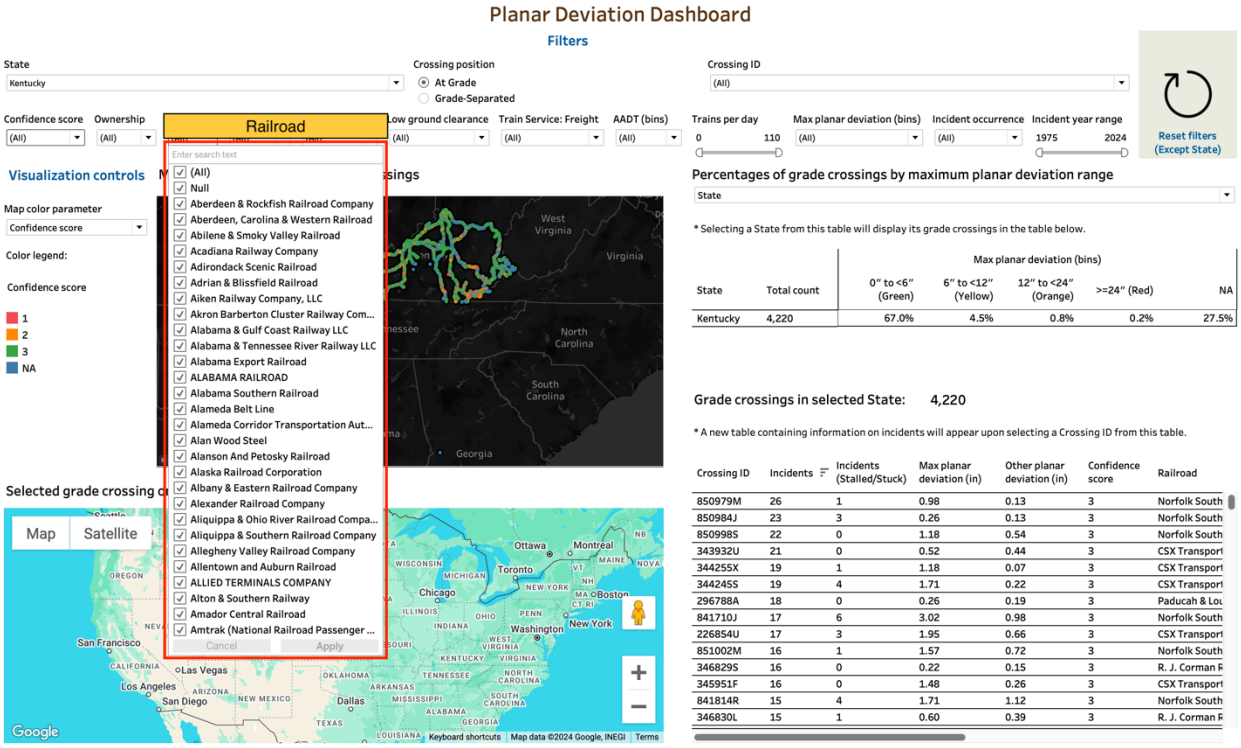

Figure 6: Dropdown options for the railroad name filter

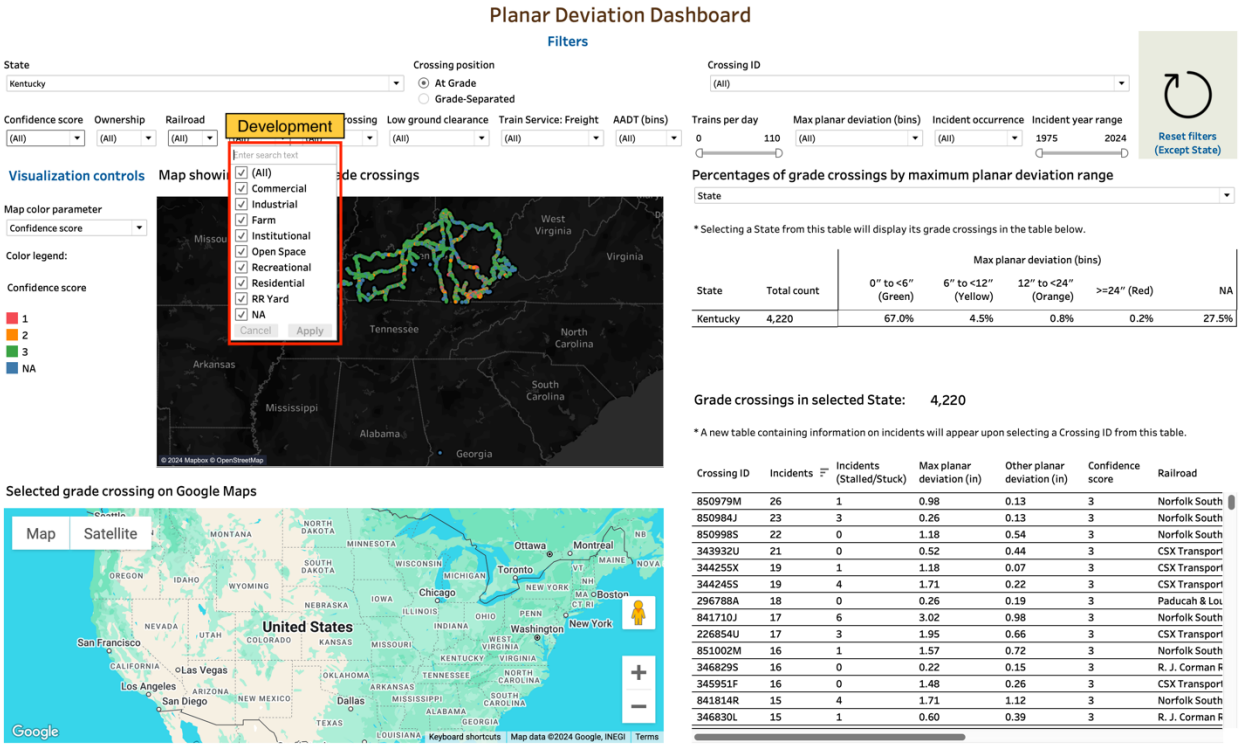

Figure 7: Dropdown options for the development type filter

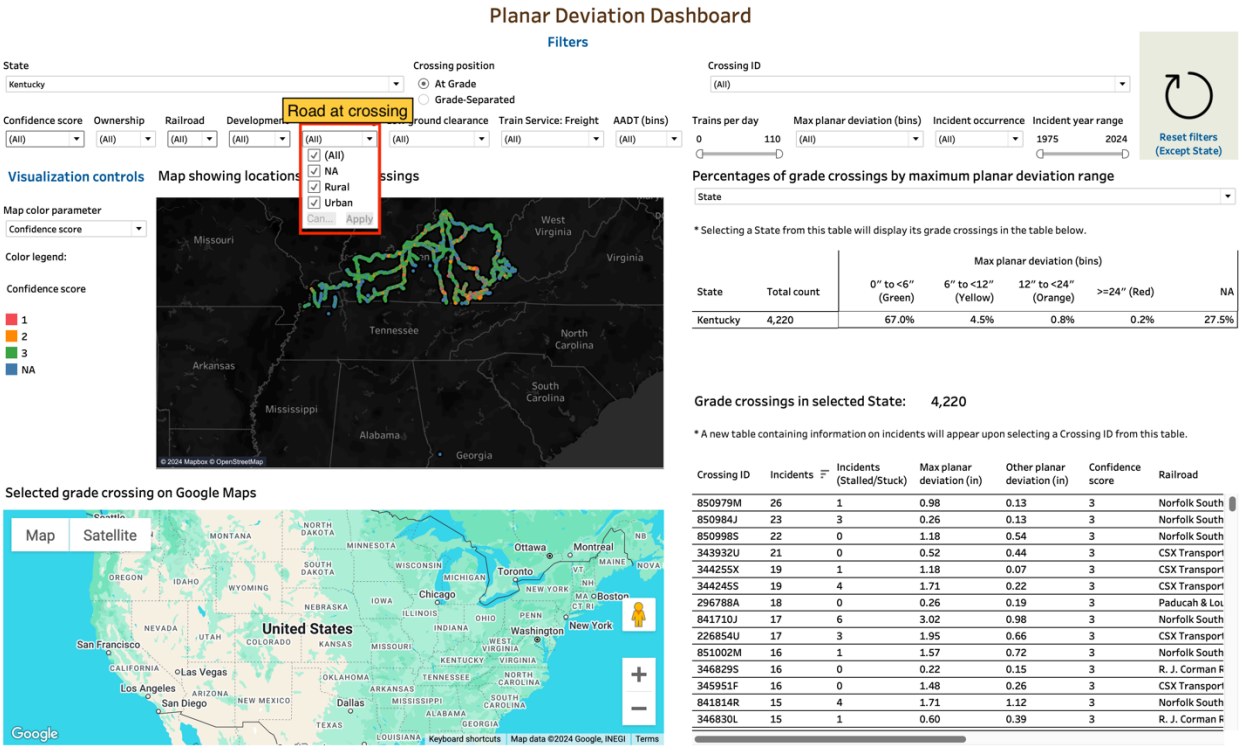

Figure 8: Dropdown options for the road at crossing filter

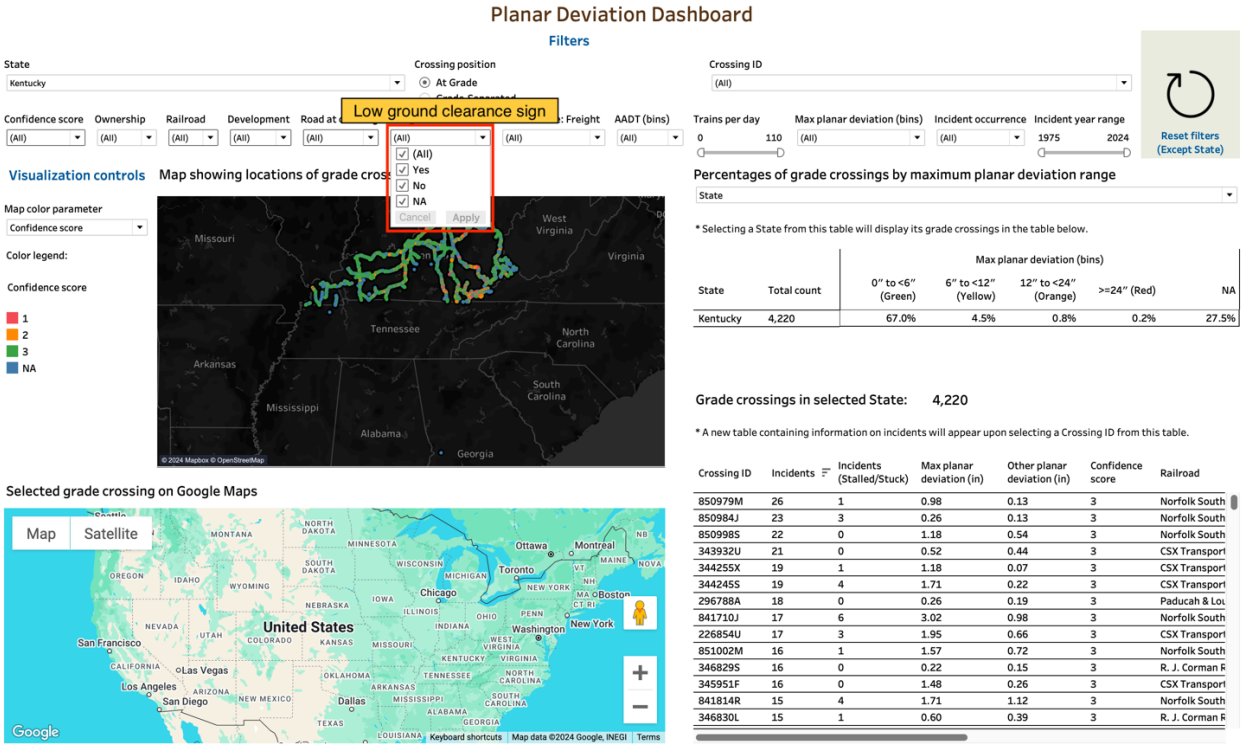

Figure 9: Dropdown options for the presence of low ground clearance sign filter

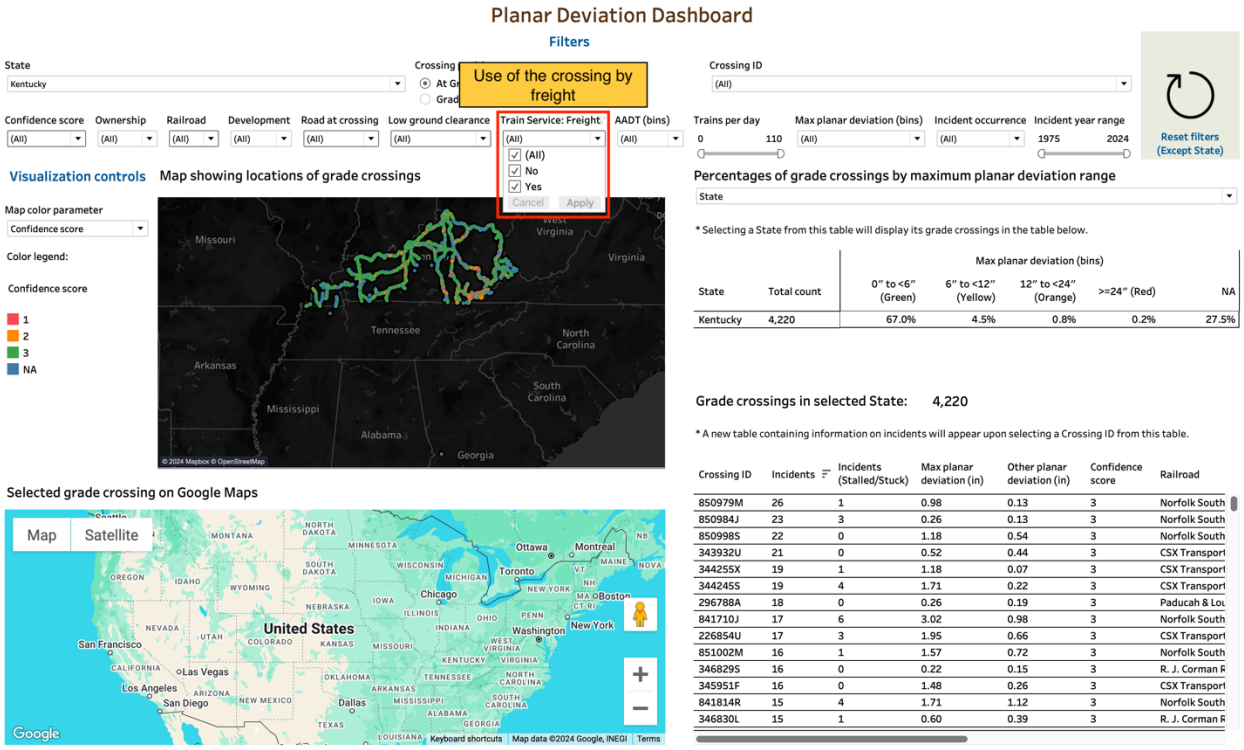

Figure 10: Dropdown options for the freight as train service filter

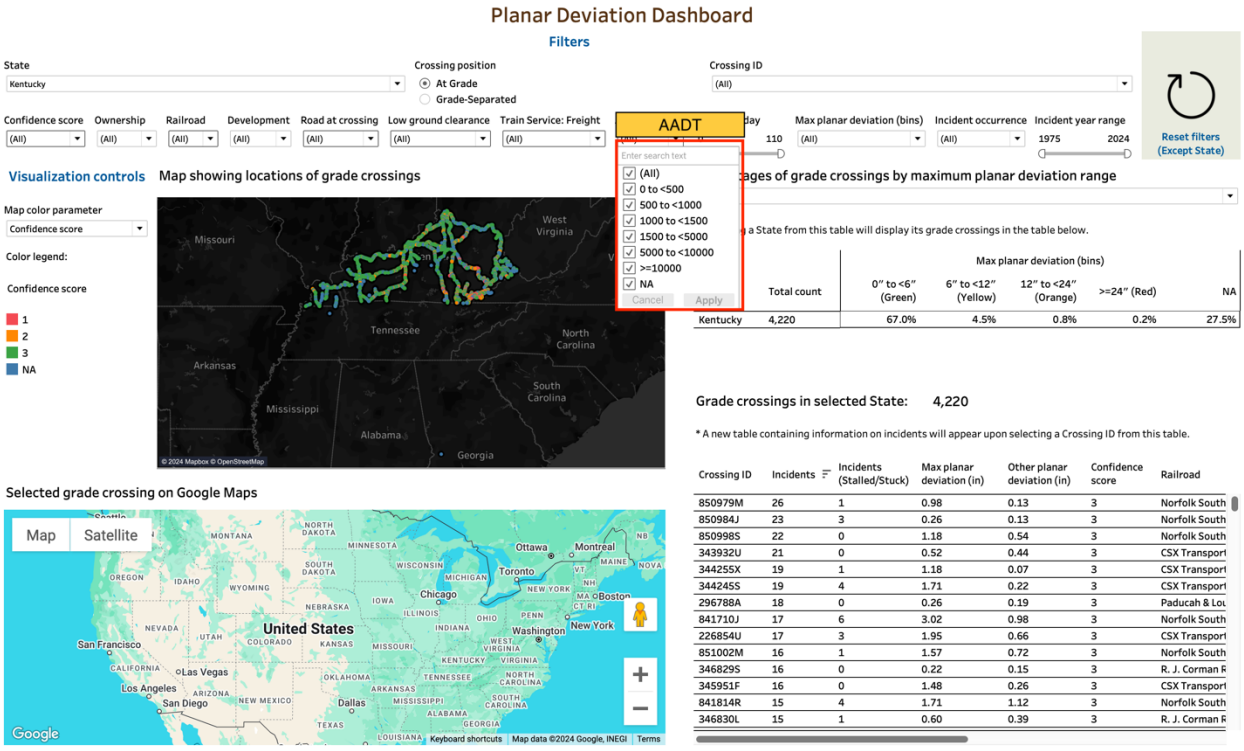

Figure 11: Dropdown options for the AADT filter

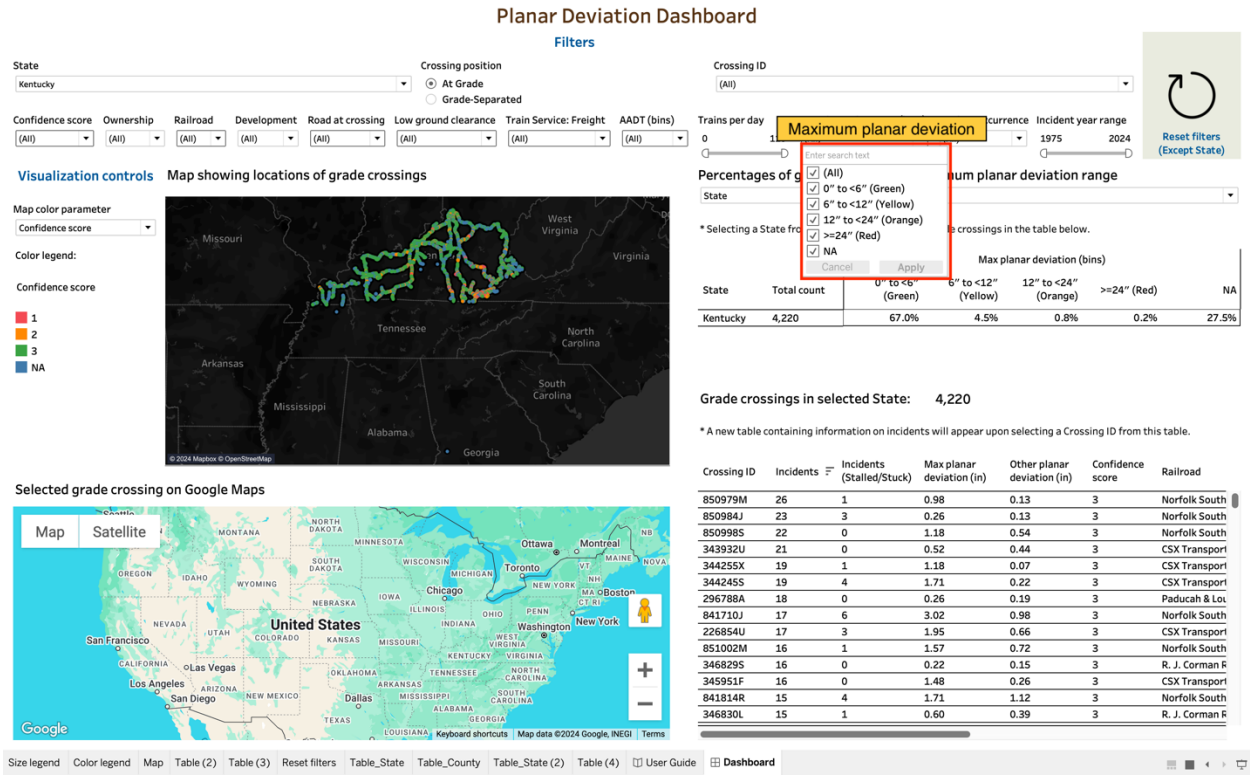

Figure 12: Dropdown options for the maximum planar deviation filter

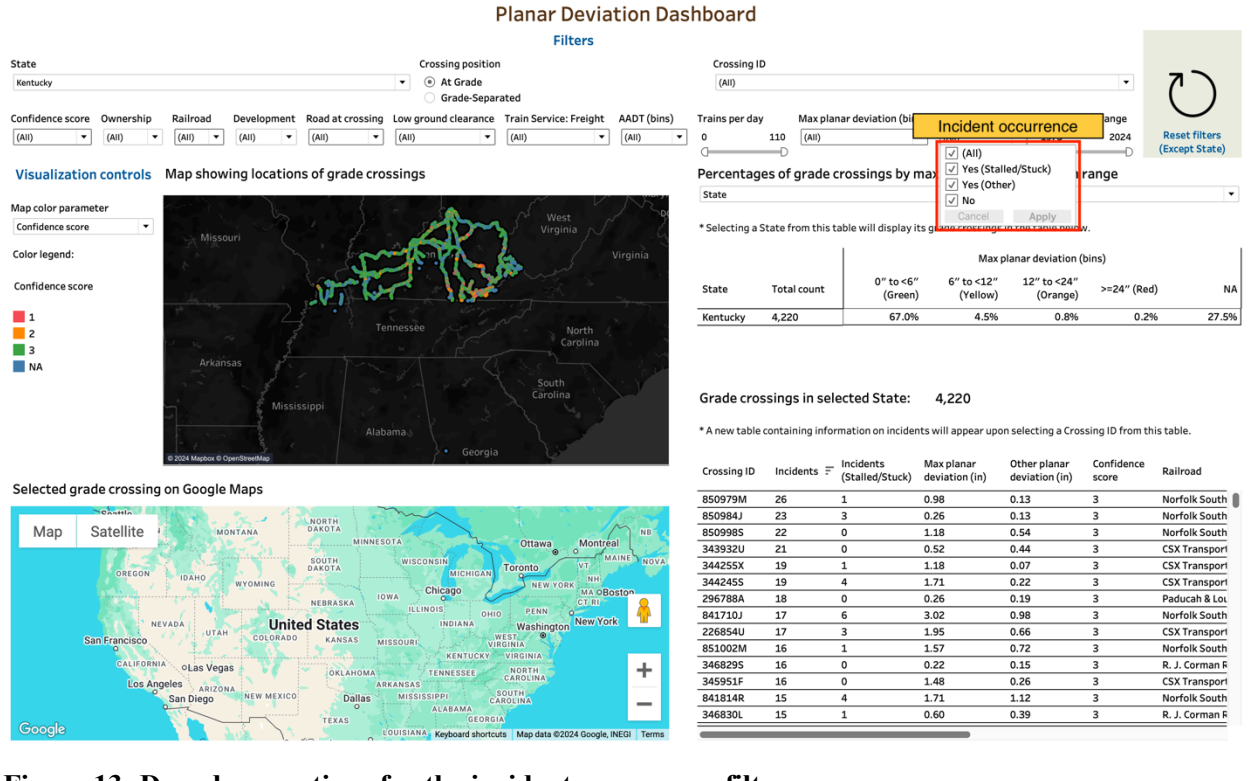

Figure 13: Dropdown options for the incident occurrence filter

Interactive Maps

The dashboard includes two interactive maps. The first map as shown in Figure 14 displays grade crossings nationwide using color-coded markers based on selected parameters, such as confidence score, maximum planar deviation (categorized into bins), development type, AADT (categorized into bins), and estimated truck AADT (categorized into bins). Users can choose a specific parameter to color-code the markers on the map according to that parameter. Hovering over the map reveals a toolbar that offers options to zoom in and out, reset the map, select specific areas, and pan the view. The user can also hover over a marker to see detailed information about a crossing, including the crossing ID, confidence score, maximum planar deviation, ownership, trains per day, maximum timetable speed, and more.

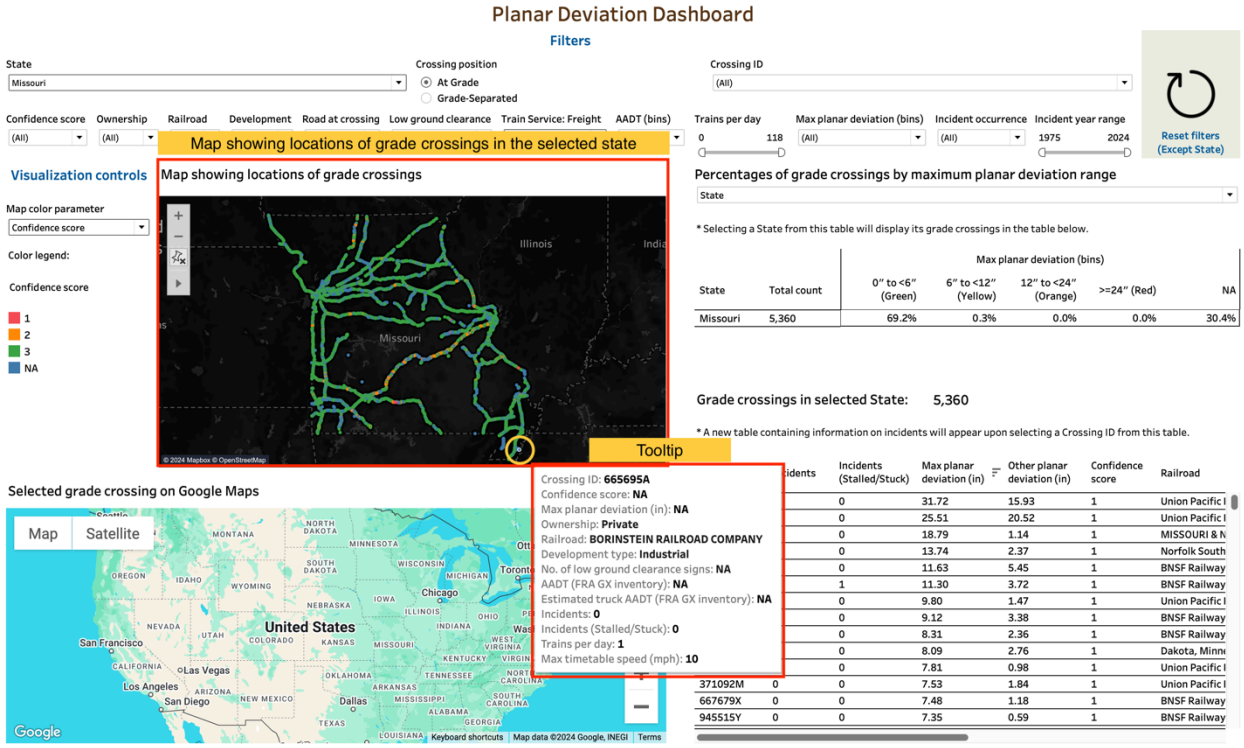

Figure 14: Map displaying grade crossing locations in Missouri, color-coded by confidence score.

Another map on the dashboard displays a Google Maps view of the selected grade crossing with the option to explore street view imagery for further exploration. Users can select a crossing from either the national map or from the table listing detailed grade crossing data to view the location of the crossing on Google Maps. Figures 15 and 16 respectively show the satellite view and the street view of a selected grade crossing on Google Maps.

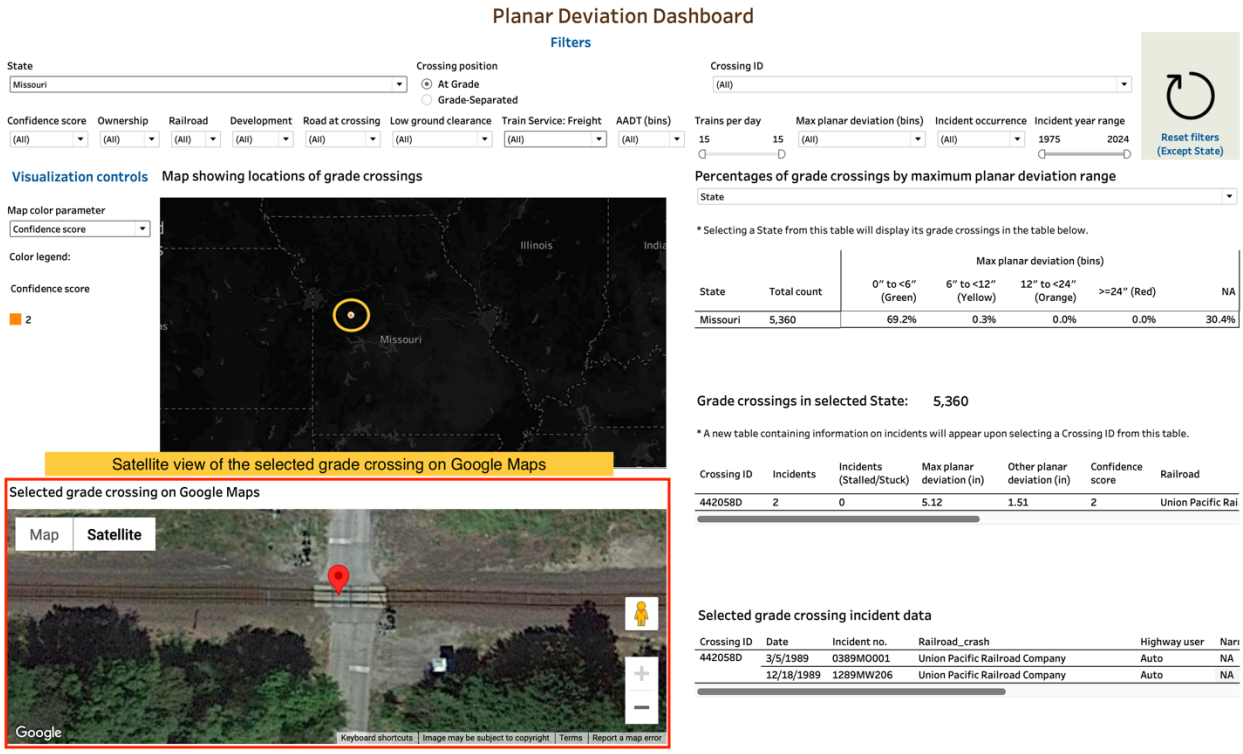

Figure 15: Map displaying the satellite view of the selected grade crossing on Google Maps

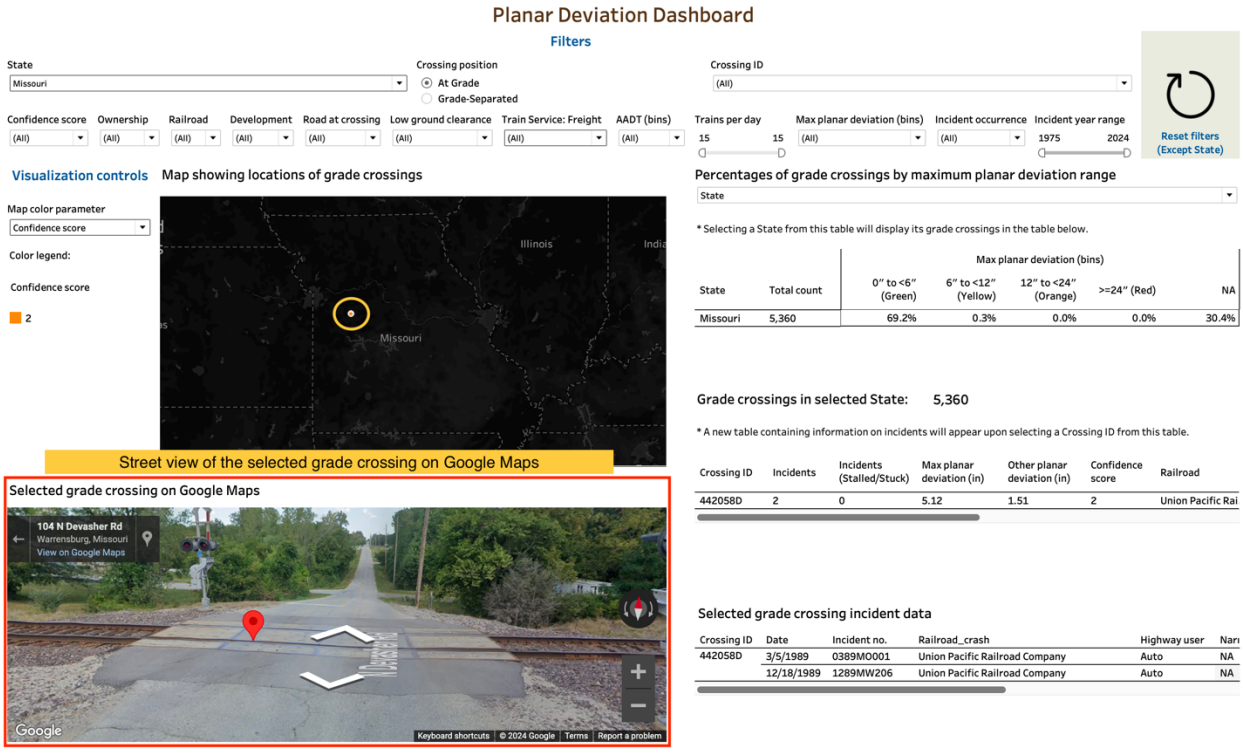

Figure 16: Map displaying the street view of the selected grade crossing on Google Maps

Tables

On the right side of the dashboard, there are three tables. The first table as shown in Figure 17 presents the percentage of crossings within each maximum planar deviation range at either the state or county level, based on user selection via a parameter at the top of the table.

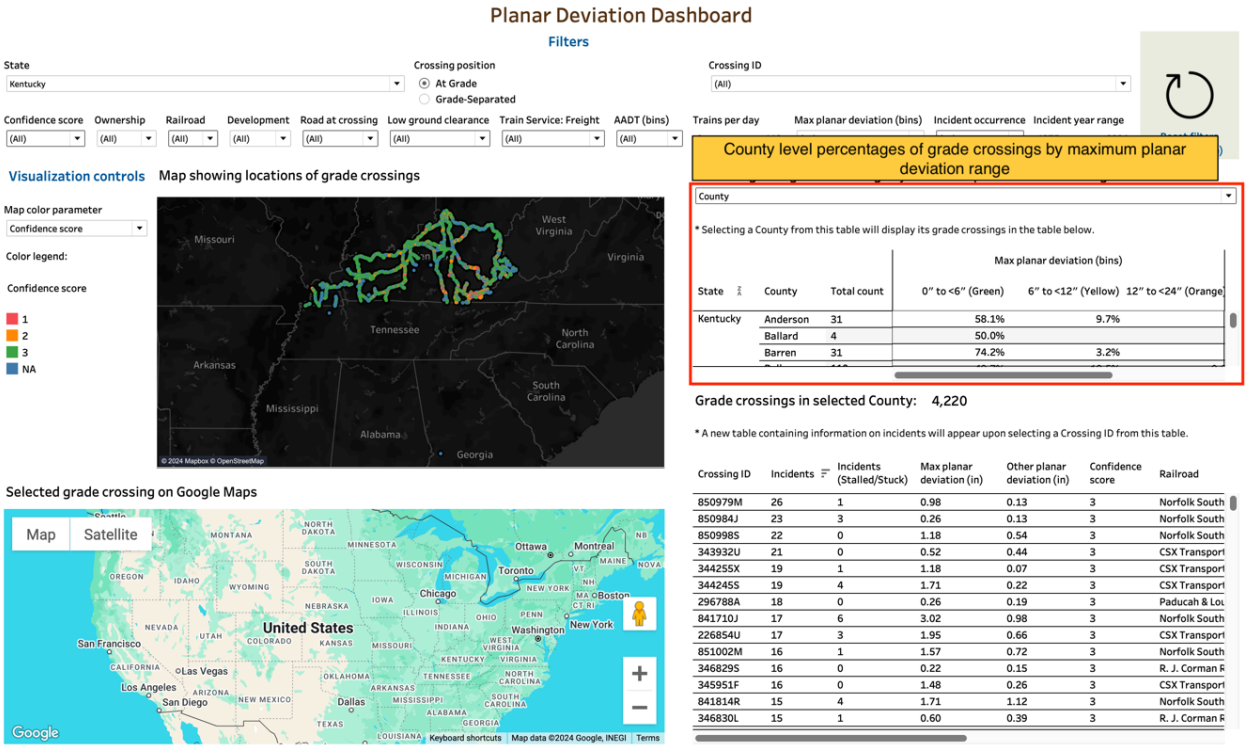

Figure 17: Table showing county level percentages of grade crossings by maximum planar deviation range

The second table as shown in Figure 18 lists the grade crossings in the selected state or county along with relevant attributes, such as the number of incidents, incidents involving vehicles getting stuck or stalled on the crossing, maximum planar deviation, confidence score, the presence of low ground clearance signs and so on. One of the attributes listed in the table is the crossing profile, represented by the letters "a" to "f". The various grade crossing profiles are illustrated in Figure 19. Users can sort this table by any attribute in ascending or descending order. To do so, users need to hover over the desired attribute and click the sort icon that appears. The total number of grade crossings in the selected state or county is also displayed above this table.

When a crossing ID is selected from this table, a third table as shown in Figure 20 appears with detailed incident information, including highway user position and incident narratives. Users can export data from any of these tables as a CSV file. To do so, they should select the table, go to the "Analysis" menu at the top, choose "View Data," and then click "Download."

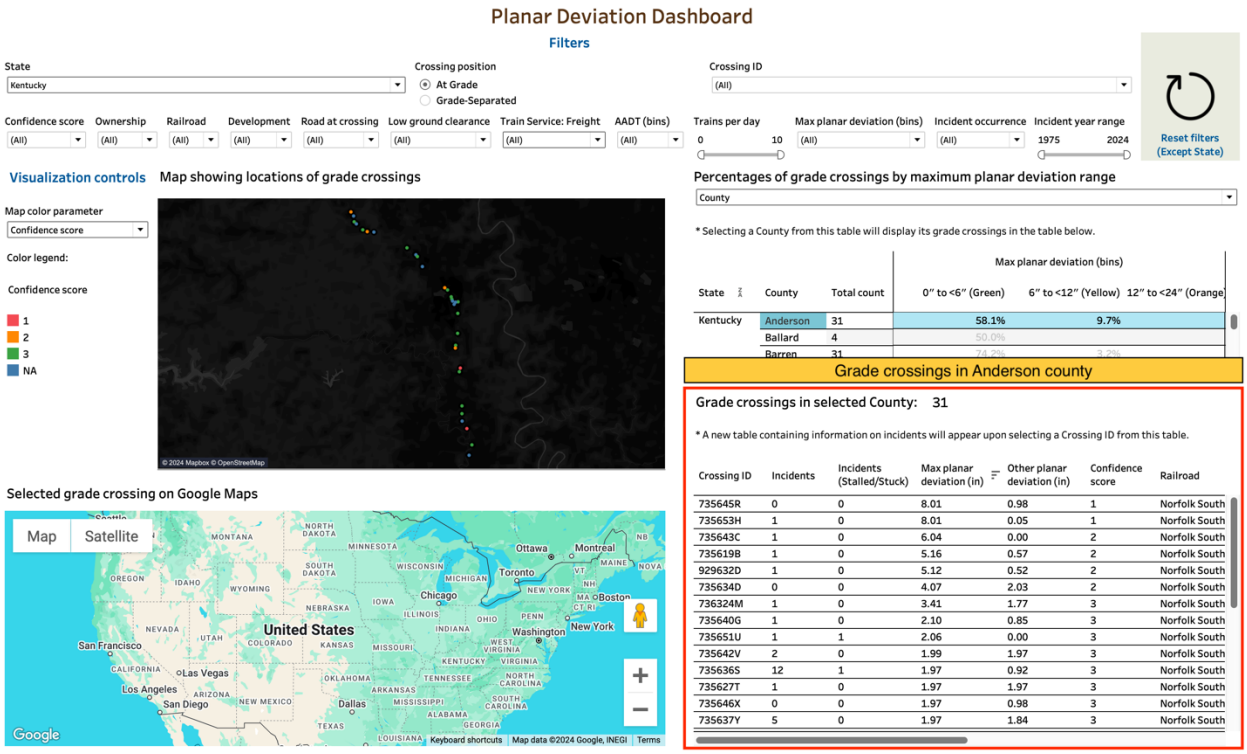

Figure 18: Table showing grade crossings in the Anderson County along with relevant attributes

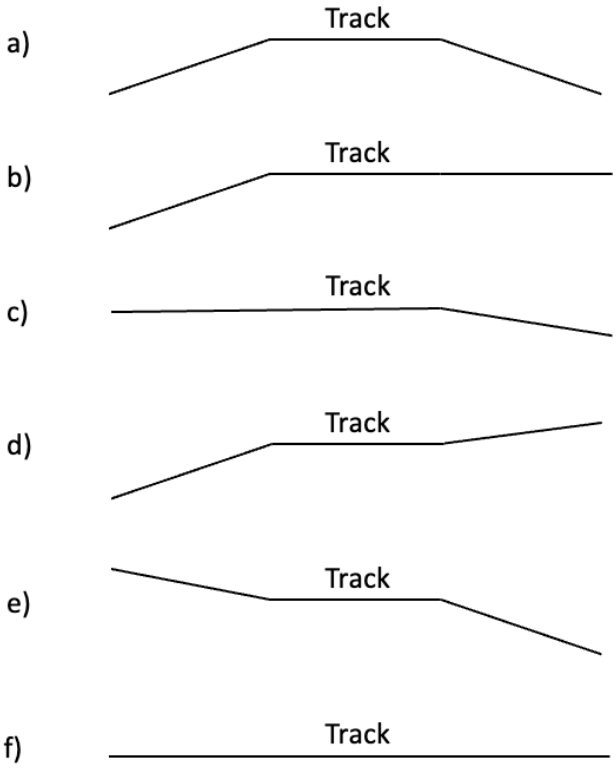

Figure 19: Different grade crossing profiles, denoted by letters "a" through "f"

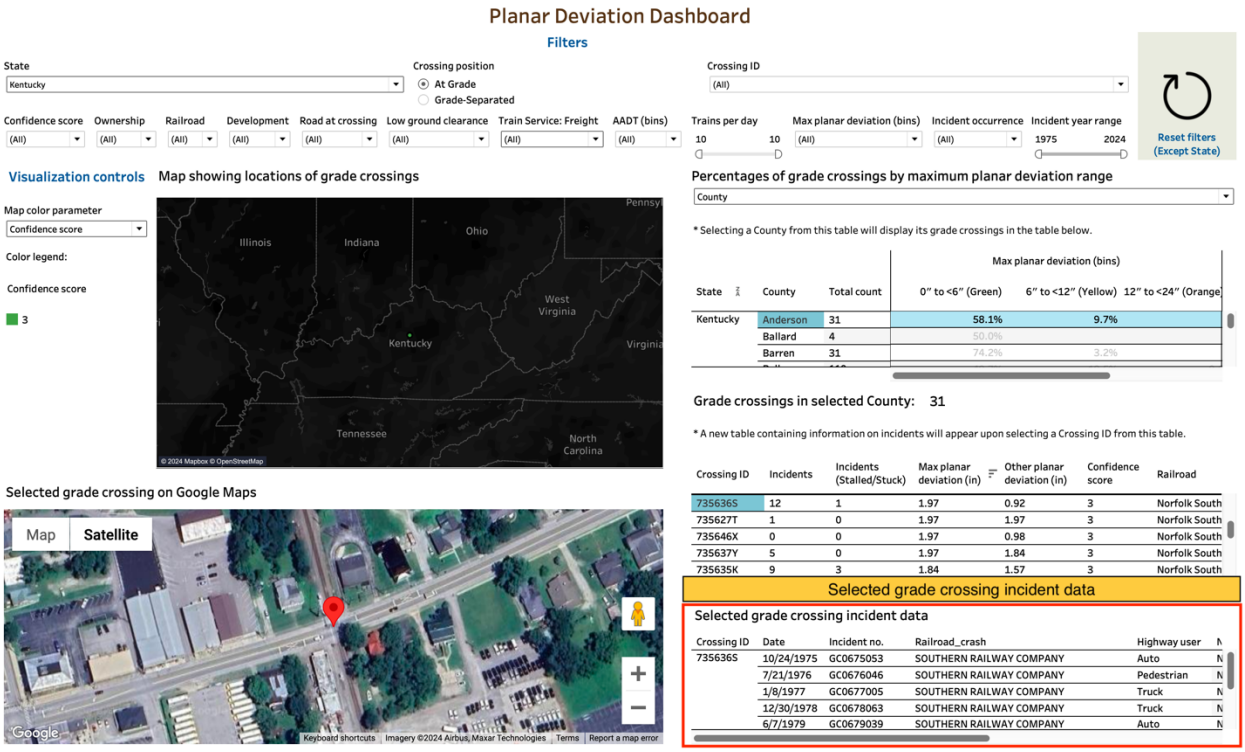

Figure 20: Table showing information on incidents on the selected grade crossing

Use cases of the dashboard

The dashboard can be used for different purposes. One of the primary use cases of the dashboard is to identify grade crossings with high planar deviations within a state. By integrating this information with the presence of low ground clearance signs and the number of incidents related to vehicles getting stalled or stuck on the crossing, users can identify and prioritize grade crossings with a high risk of hangups. The dashboard allows users to utilize Google Maps Street View to verify the approach grade profile, providing a practical tool for assessing and addressing potential safety issues at these crossings.

Figures 21, 22, and 23 illustrate such a use case of the dashboard. First, the user can filter for public grade crossings with confidence scores of 2 or 3 and incidents involving vehicles getting stalled or stuck within the last 10 years. The table on the bottom right displays the crossings that meet these criteria, as shown in Figure 21.

Next, the user can sort the table in ascending order of maximum planar deviations. Figure 22 shows that four incidents occurred at the crossing with Crossing ID 343627J, three of which were due to vehicles getting stalled or stuck on the crossing. This crossing has a maximum planar deviation of 6.3 inches and lacks a low ground clearance sign. Additionally, the table provides detailed information on the incidents at the crossing.

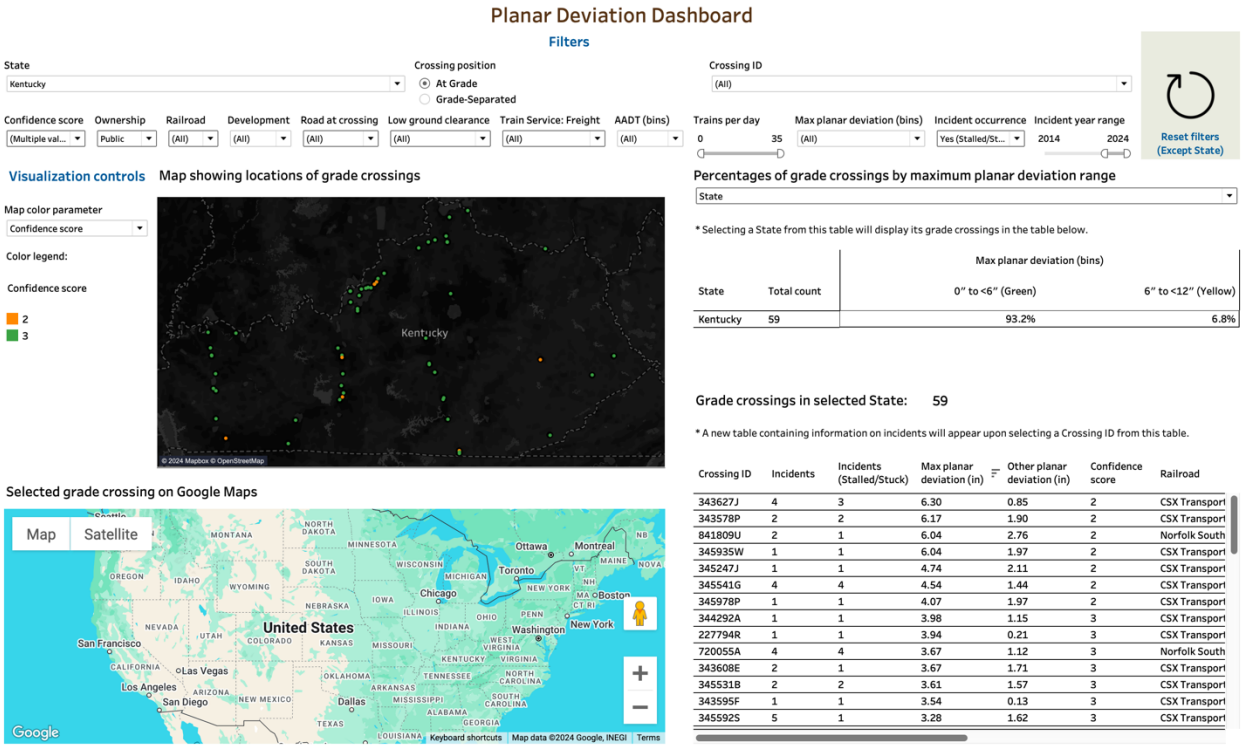

Figure 21: Dashboard displaying at-grade crossings in Kentucky with applied filters

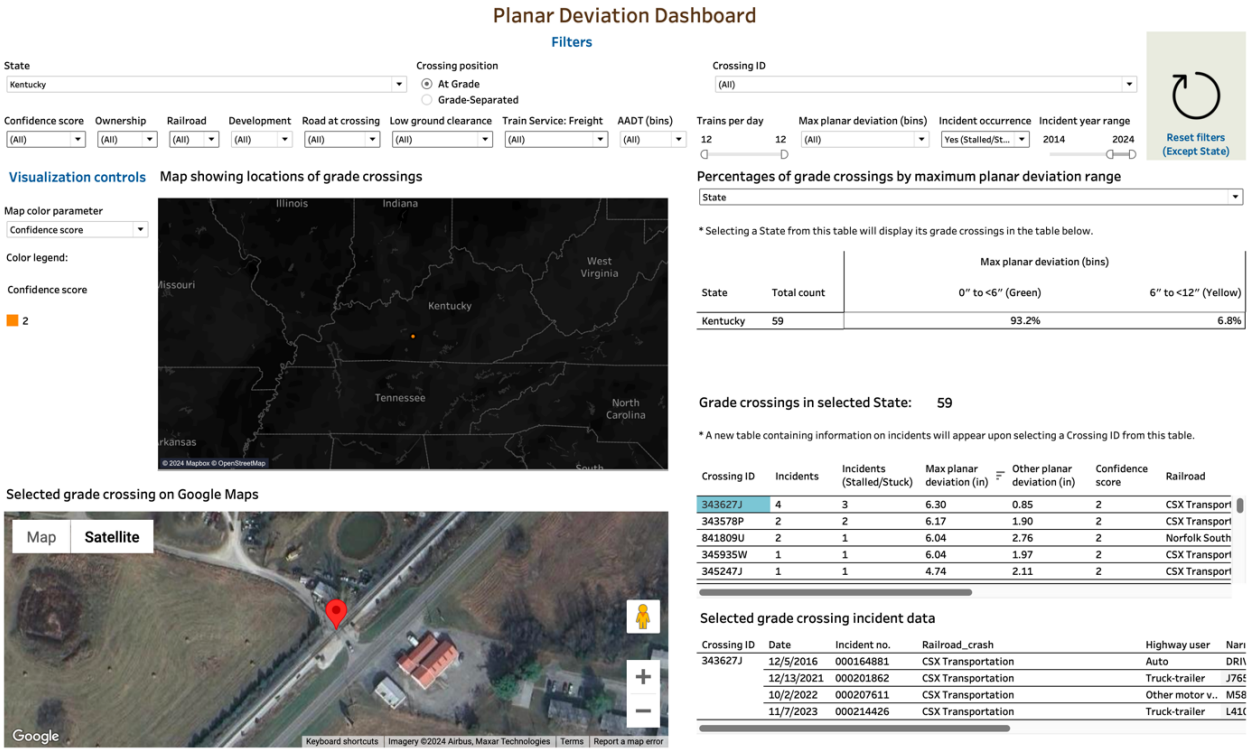

Figure 22: Dashboard with table showing no. of stalled/stuck vehicle-related incidents at Crossing ID 343627J

By selecting the grade crossing on the map, the user can view the street-level image of the crossing on Google Maps, as demonstrated in Figure 23. This functionality enables thorough assessment and prioritization of potential safety issues.

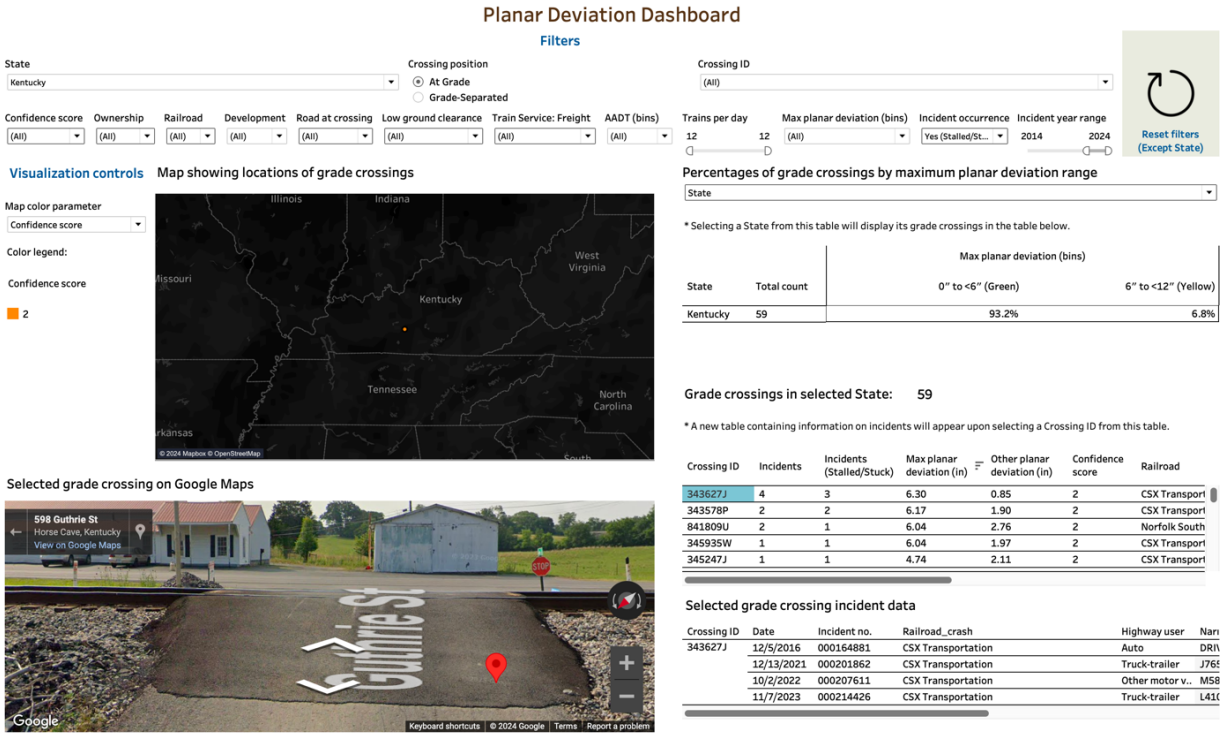

Figure 23: Dashboard displaying google street view image of the selected grade crossing

Another potential use case of the dashboard is validating the locations of grade crossings in the inventory. The confidence score filter in the dashboard provides four options, including the ability to display only those grade crossings for which a confidence score could not be derived based on our methodology. These crossings may have incorrect locations in the grade crossing inventory. By viewing these crossings on Google Maps, the user can determine if location corrections are necessary, thereby ensuring the accuracy and reliability of the grade crossing data.

The following example illustrates this use case. By selecting "NA" from the dropdown filter, the map updates to display only those crossings that lack a confidence score. The user can then choose a specific crossing from the map to view its street-level imagery via Google Maps. As illustrated in Figure 24, there is a discrepancy between the grade crossing inventory's recorded location and the actual location of the crossing. This indicates that the recorded location of this crossing needs to be revised in the inventory.

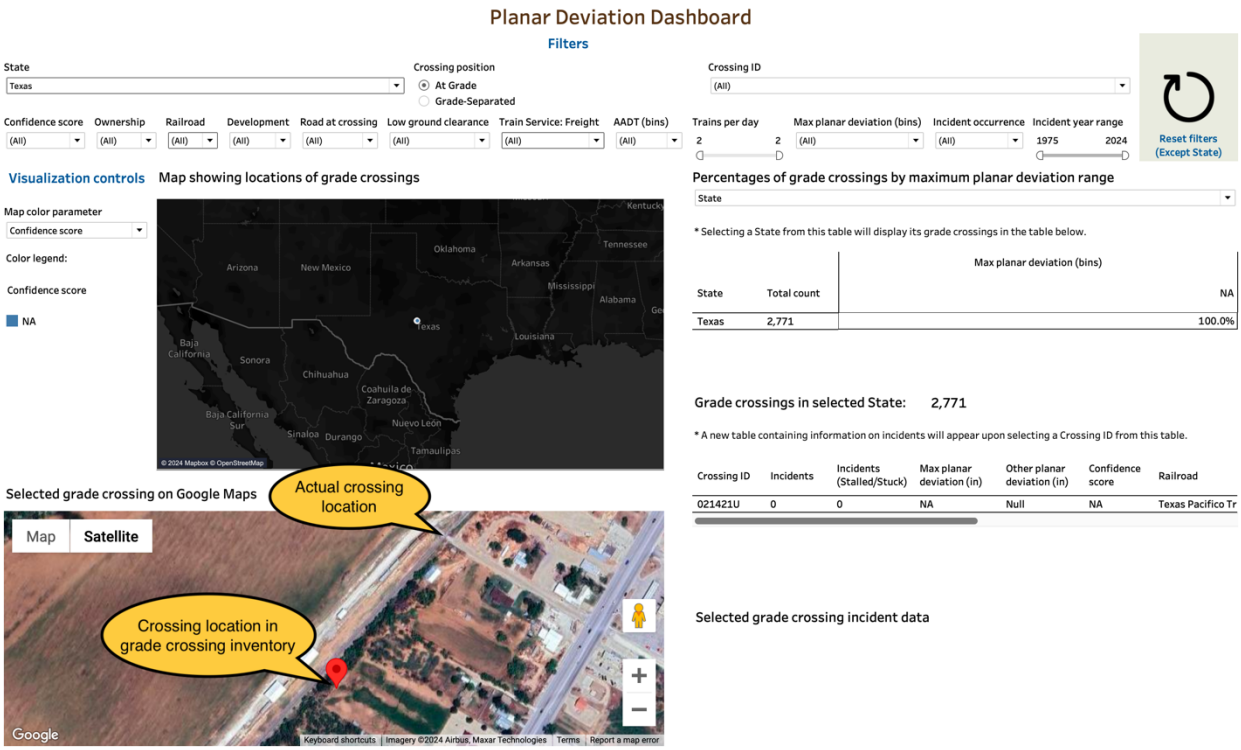

Figure 24: Dashboard showing a grade crossing in Texas with inaccurate location in the inventory