TPS Image Processing User Manual

For the

Transportation Corridor Agencies

Contract No. K001063

Prepared By:

BRiC-TPS, LLC

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Table of Contents

Table of Figures

Version Control

Revision	Description of Change(s)	Author	Date
1.0	Initial Version	F. Begum	11/08/2019
1.1	Initial Review	R. Carrier	11/24/2019
1.2	Internal Revision	U. Fritz	12/16/2019
1.3	Incorporated TCA-requested changes	F. Begum	12/16/2019
1.3	Accepted changes and finalized document	R. Carrier	12/17/2019

1 Introduction

1.1 Overview

Image processing is a fundamental operation of the CSC System. Vehicle license plate images are captured at each toll point for all transactions. If a valid FasTrak transponder is not identified, the images associated with that transaction will be available to the CSC System as an image set. Up to 24 images can be provided in each image set (explained below):

- Two front and four rear full images per lane (a total of 6)
- Vehicles that straddle lanes produce images from each lane (producing 12 full images)
- A region of interest image can be provided for each full image (for a total of 24)

The toll point equipment uses two Optical Character Recognition (OCR) engines to enable automatic extraction of plate data. Vehicle Signature Recognition (VSR) software provides additional plate and state information based on historical image review data.

There are instances that require manual image review. TCA uses a third-party service provider for manual image review. Image review personnel examine the images to determine the license plate characters and state, or a reject code if the license plate results cannot be determined. The plate number and state or reject code are shared with the CSC System. The CSC System will update the Host and the VSR system with the image review results.

This system includes reports to measure the productivity, accuracy, and service levels.

1.2 Multiple Pass Processing

In multiple pass image processing, the users view the images for a transaction and enter license plate data (for legible plates) or a code-off value (for unreadable plates) into the system. The system uses double-blind manual and audit reviews for quality control.

The following is an example of a 2-review pass configuration:

Level 1 Review
Image processors perform the Level 1 review by reviewing the image and entering license plate information or a code-off reason. The system ensures that a Level 1 review is performed by two separate reviewers without the knowledge of one another. Based on the Level 1 review the following action may be taken on the transaction:

- If the plate information entered by the first image reviewer matches the plate information by the second reviewer, the transaction is queued for appropriate processing and no further image review is performed.
- If the results by the two Level 1 reviewers do not match, the transaction is queued for a Level 2 review.

Level 2 Review

A Level 2 review is performed only by a Level 2 reviewer. The plate information entered at Level 2 supersedes the information entered at Level 1 in all cases and is used to queue the transaction for appropriate processing. Level 2 review is the final review.

1.3 Image Access

While a user is reviewing a set of images, other users cannot access those same images. A timed lockout mechanism allows data entry personnel enough time to complete data entry for a set but does not allow an endless lockout.

1.4 Other Resources

1.4.1 TPS Image Processing Reports Manual for the Transportation Corridor Agencies

The Image Processing Reports manual describes how to use TPS image processing report functionality to browse and run image processing reports

1.4.2 TPS Image Processing Training Guide

Provides an overview and trains users on the image processing and fingerprint audit modules of the system. Completion of the training will allow the trainees to:

- Use the imaging quality assurance
- Review images

2 Image Review System

The image review system allows authorized users to enter license place and state information and/or an image reject code for each set of images selected for image review audit. The image enhancement tools help improve image readability during image review audit.

2.1 Logging into Image Review System

Image processing works from within the TPS System. The first step is to login to the TPS system using the username and password assigned to you.

2.1.1 Login to TPS

TPS is a password-protected system that is controlled by the rights assigned to the individual or the individual's work group by the TCA Active Directory system. The login process verifies users' rights to access the authorized data and functions.

If you are logged in to the TPS system and your workstation remains inactive for an extended period of time, you will be required to login again to continue.

2.1.1.1 Username Requirements

The TCA Information Technology (IT) Department assigns the usernames. Usernames are a combination of the employee's first initial and last name.

2.1.1.2 Password Requirements

Passwords are assigned by the TCA IT department. Password requirements can be found in the TCA Acceptable Use policy.

To log in to the TPS system:

1. Open a browser to the URL for the TPS application.
2. The login page opens with the cursor in the Username field.

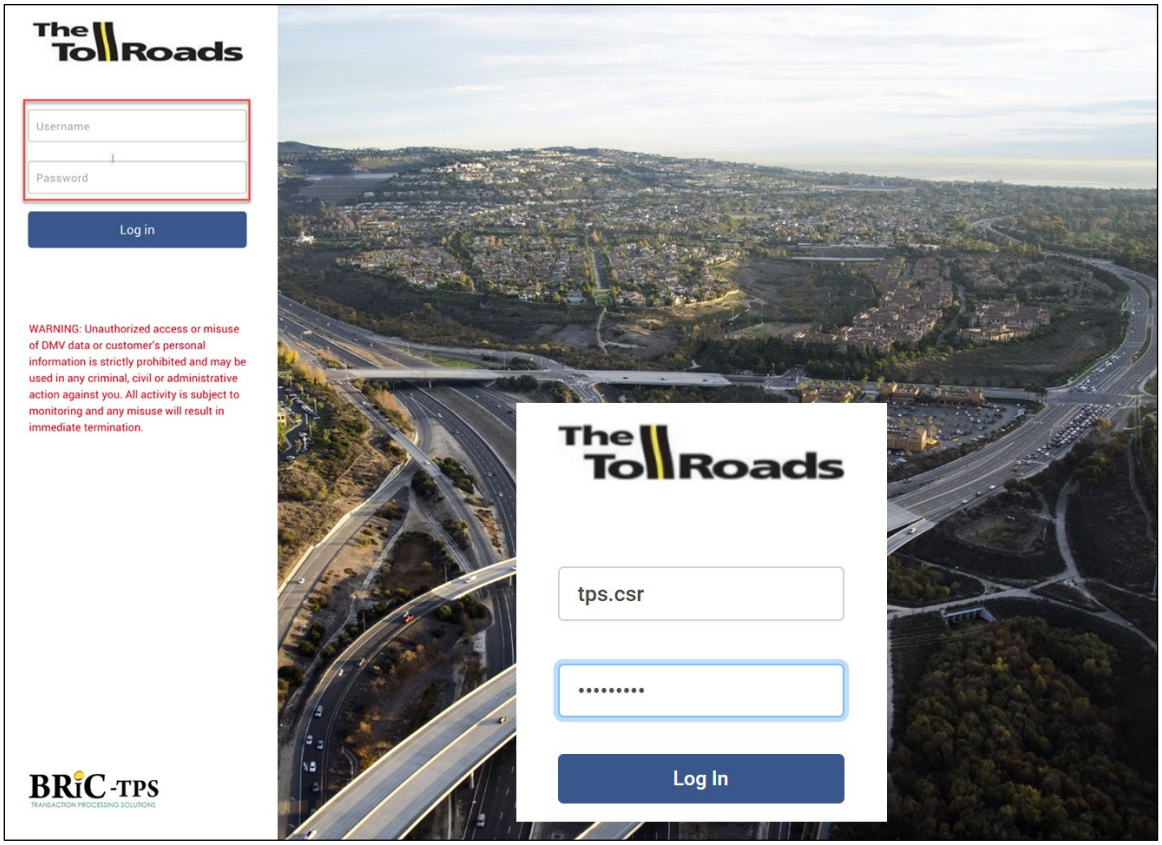


Figure 1 TPS System Login Page

3. Enter your username and password in their respective fields and click **Log In**. A Search page appears.

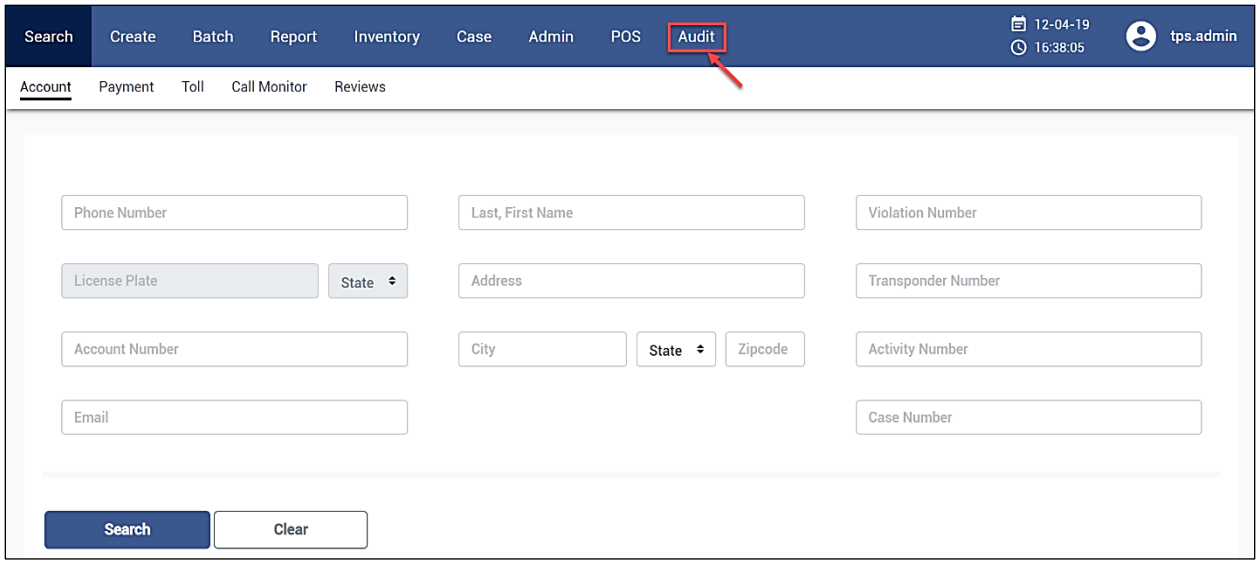


Figure 2 Search Page

4. On the Search page header, click **Audit**.

5. The Review Queues screen is displayed. An authorized user can use the Review Queues screen to perform image review audits.

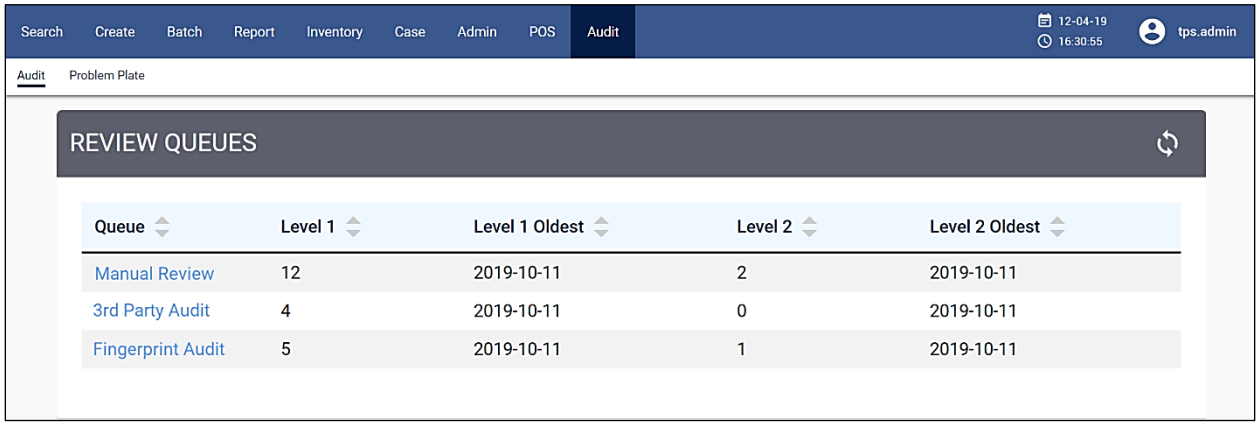


Figure 3 Review Queues Screen

2.1.2 Tabs and Sub Tabs

Image Review Audit Tabs and Subtabs

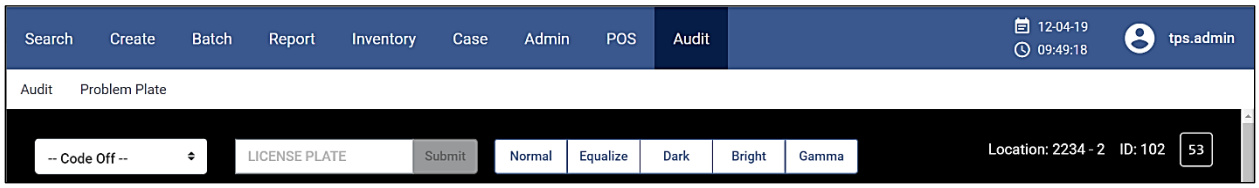


Figure 4 Image Review Audit Tabs and Subtabs

2.2 Logging out of TPS

To log out of the TPS system:

1. In the main menu bar, click the logged-in icon located in the top right corner and click **Log Out**. The system takes you back to the login screen.

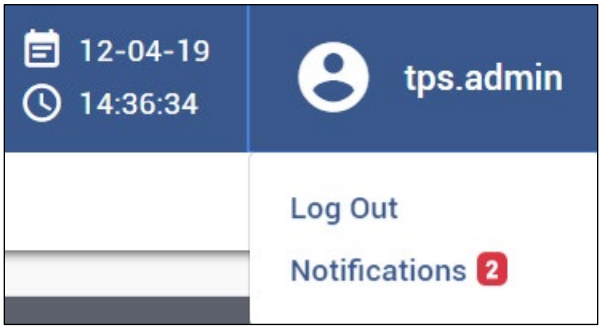


Figure 5 Log Out

2. To continue working in the TPS system, log in again.

3. To close the application, close the window.

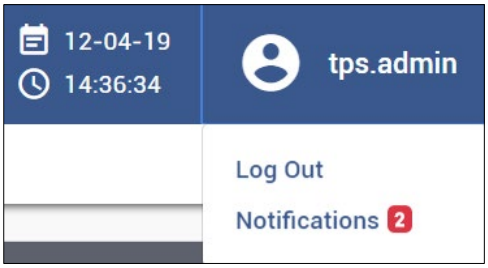
Icon	Description
	Logged-In icon – Clicking on the icon opens the **Log Out** and **Notification** options Number in red – CSR-specific notifications Calendar icon – Displays today's date Clock icon – Displays current time

Figure 6 TPS Dashboard Top-right Header Elements

2.3 Image Review Procedure

Using the image review application, an authorized user can review images and enter license plate data. If none of the images are readable, the reviewer enters a code-off reason instead of license plate information. Transactions that are coded off are not passed to the image processing system for additional processing.

The *Image Audit Review* chapter details the image review procedures.

3 Image Audit Review

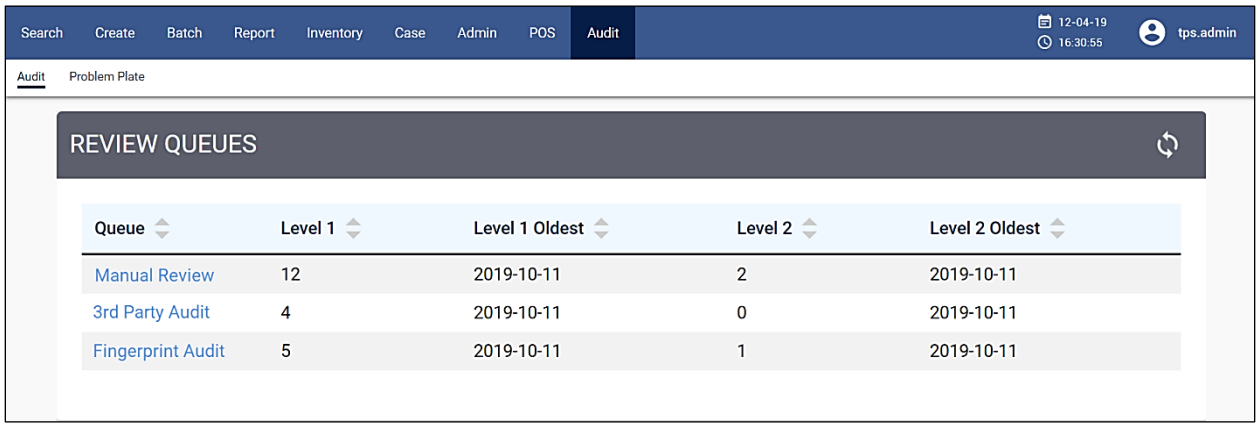
TPS System image processing capability includes an Audit Review function that enables authorized users to verify the accuracy of an individual image reviewer's work. The Audit Review option allows a supervisor (Administrator Authorization Level) to review the data entry of an individual image processor for quality control.

The Image Audit task is a scheduled process that randomly selects a configurable percentage of toll transactions for audit based on conditions defined by TCA.

The system's standard reports track hourly, daily, and monthly productivity by individual and for the department, as well as identify the quantity of images available for review. Reports are designed to manage all aspects of the image review process, in addition, the TPS system has the capability to search by certain fields.

To audit image review results:

1. In the main TPS menu, select **Audit**. The Review Queues grid displays with review queues and review levels, and number of images to be reviewed in each queue.



Queue	Level 1	Level 1 Oldest	Level 2	Level 2 Oldest
Manual Review	12	2019-10-11	2	2019-10-11
3rd Party Audit	4	2019-10-11	0	2019-10-11
Fingerprint Audit	5	2019-10-11	1	2019-10-11

Figure 7 Review Queues

2. **Manual Review**, **3rd Party Audit**, and **Fingerprint Audit** use the same image review procedures. Authorized users can click on the desired category to start reviewing the images.

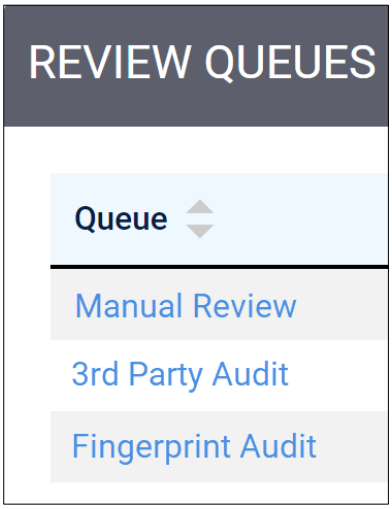
Review Queues Image	Review Type	Description
	Manual Review	This is an internal review at the Transportation Corridor Agencies (TCA) by their own staff who review the raw images. Using a multiple pass image processing, the users view the images and enter license plate data (for legible plates) or a code-off value (for unreadable plates) into the system. The process uses double-blind manual reviews for quality control.
	3rd Party Audit	Displays images reviewed by a third-party image review service provider. The agency reviews 10% of the images returned by the service provider as a QA check. The final auditors can change the results if desired and the service provider gets a report of how well they performed. The process uses double-blind manual reviews for quality control.
	Fingerprint Audit	Displays images sent to the Vehicle Signature Recognition (VSR) application for identification by a non-OCR engine. This is the first queue and the first thing TPS System does with images sent from the lane that do not match both OCR reads. The process uses double-blind manual reviews for quality control.

Figure 8 Review Queues Description

3. Click **Fingerprint Audit** link in the REVIEW QUEUES grid. The image application loads a set of images and displays images for the first transaction. These are images that were sent to the VSR application for identification by a non-OCR engine.

   Note: In the following screenshots, legible license plates have been masked for information privacy. In normal operation, the plate numbers would display.

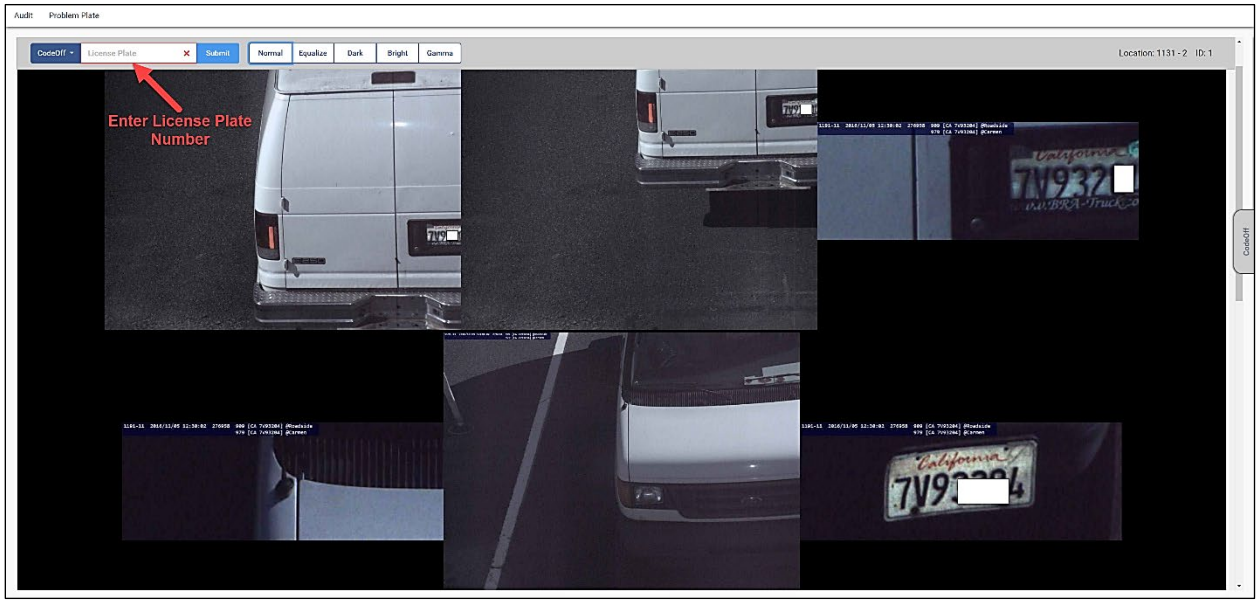


Figure 9 First Set of Images

4. There are two Code-Off dropdowns: one from the top panel and the other on the right sidebar.

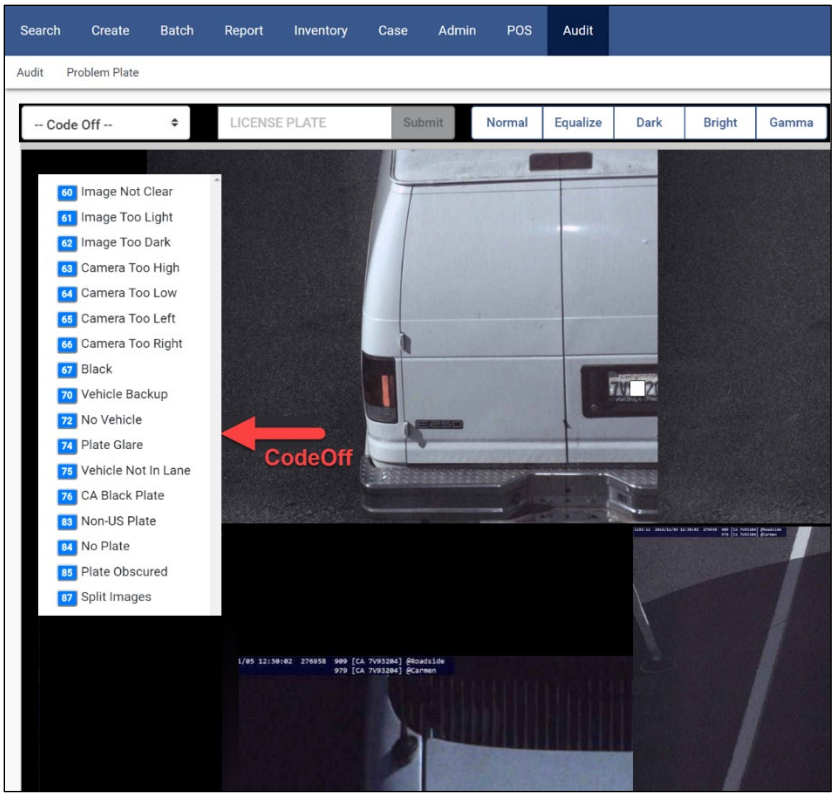


Figure 10 Code-Off Dropdown Left

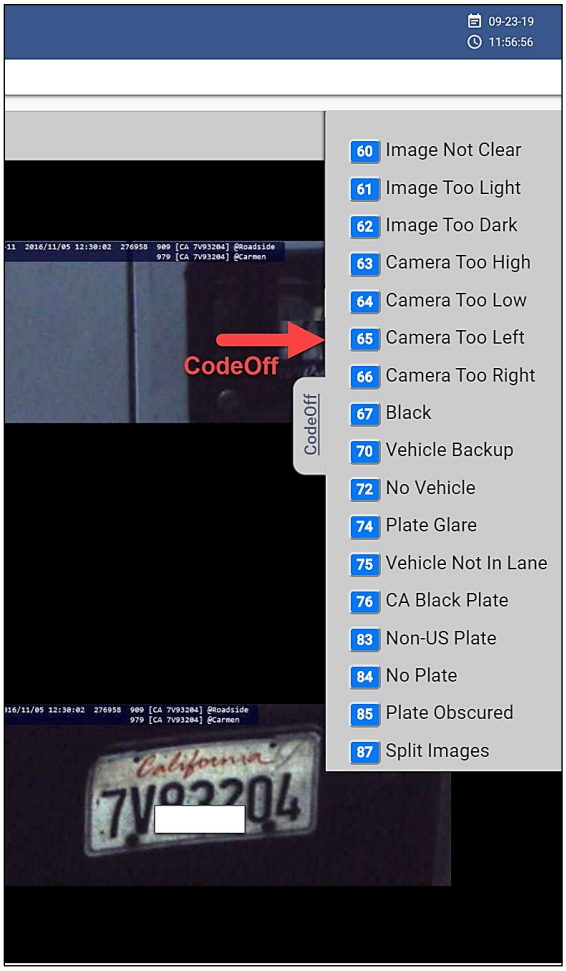


Figure 11 Code-Off Dropdown Right Sidebar

5. A panel displays on top of the images. This is where you will enter the license plate information or the two-digit code-off value to indicate the reason the plate could not be read.

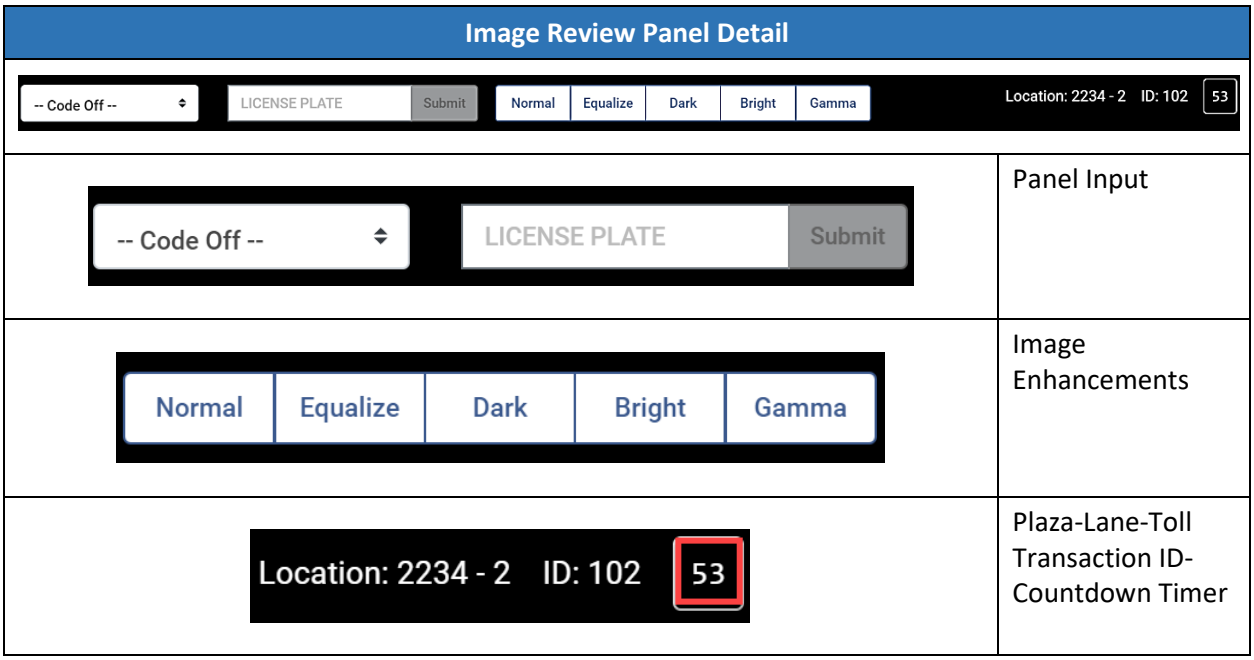


Figure 12 Image Review Panel Detail

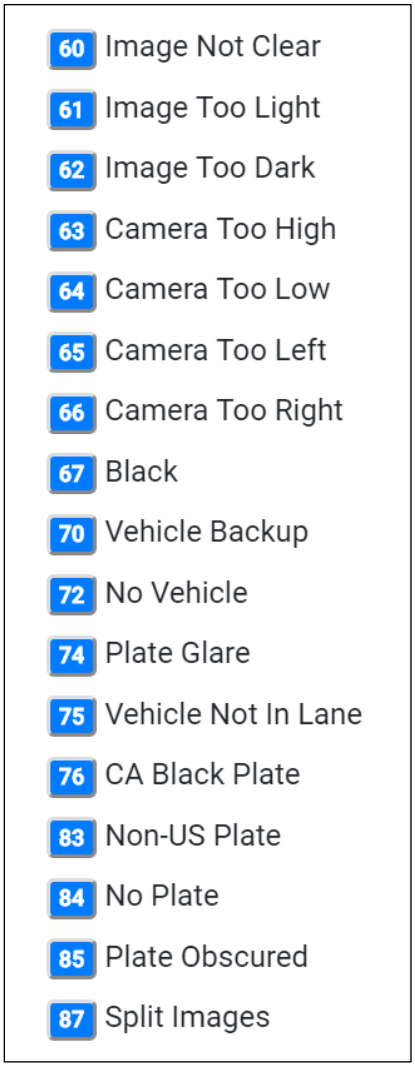


Figure 13 Code-Off Meaning

The image review panel has the following features:

Option	Result
Code-Off	For unreadable images, the image processing application provides 2-digit write-off codes to be entered into the system.
License Plate Field	This is where an authorized user enters the license plate or a 2-digit code to write it off.
Normal	Resets the image display to the default (no enhancement settings)
Equalize	Equalizes the distribution of darks and lights to maximize image detail
Dark	Darkens the image
Bright	Brightens the image by one increment (bright)
Gamma	Softens the overall image so that the plate detail improves
Location	This area displays plaza, lane, and road event IDs
Submit	This button submits the user input.

Figure 14 Image Review Panel Description

6. In the panel, enter one of the following:
   - If it is a California plate, enter the license plate number only, with no spaces (e.g., 6AAA111).
   - If it is an out-of-state plate, enter the two-character abbreviation for the state, followed by a space and then the license plate number with no spaces (e.g., AZ AAA123)
   - If there are no readable images for the transaction, enter a code using the Code-Off dropdown on the panel or enter the 2-digit code in the data field.
7. Press **Enter** or click **Submit**. The data for the transaction will be submitted and the images for the next transaction will display.
8. The application continues to display images for transactions until all transactions have been processed in the current set.
9. The user reviews images within the timeframe provided by the Image Countdown Timer.

Figure 15 Image Countdown Timer

Image Countdown Timer

This countdown timer located on the top right panel allows users 60 seconds to process a set of images.

- Once the timer expires, the image set goes back into the queue and becomes available for other image reviewers.
- The timed-out user screen does not change at this point; it still shows the expired images.
- Once the user comes back, they may enter the license plate or just hit the **Enter** key at which point, the image set disappears from the screen and another image set is loaded from the queue.
- If the user enters the license plate after it's timed-out, the software ignores the input without the user's knowledge.

3.1 Image Enhancement Options

The image review application provides various enhancement options to improve readability of images while using the image review function. Note that these enhancements do not alter the original image file that is stored in the system. Enhancements are applied to the image displays only.

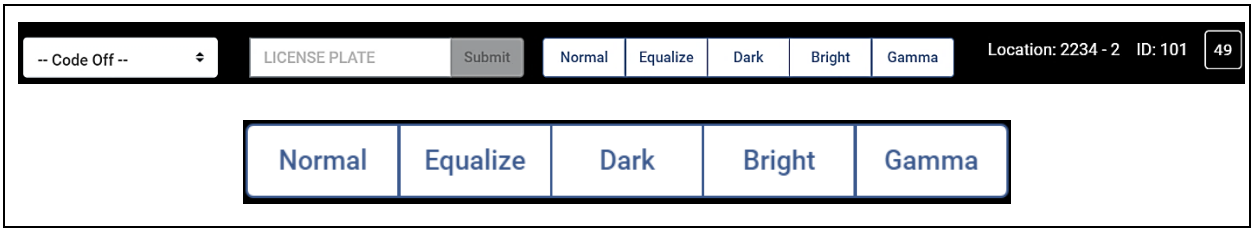


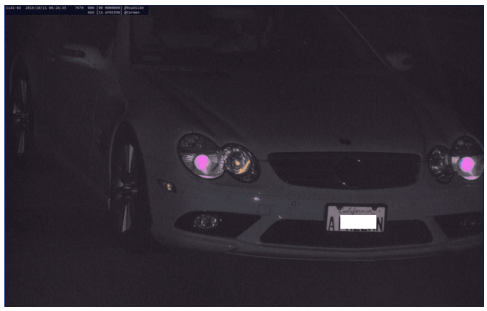
Figure 16 Image Enhancements

The top panel displays the enhancement options.

- If you select an enhancement option when all images are displayed, the enhancement is applied to all.
- Once an enhancement has been applied, use the **Normal** option to display the image(s) in their original state (remove the enhancement).

3.1.1 Image Enhancement Examples

Legible license plates have been masked for information privacy.

Enhancement	Image
Normal	
Equalize	
Dark	
Bright	

Enhancement	Image
Gamma	

Figure 17 Image Enhancement Examples

4 Problem Plate List

The image review application allows the supervisor to add or delete license plates from the problem plate database. A “problem plate” is one that has been previously misidentified due to similarities between certain letters. This type of misidentification is often caused by a license plate frame that partially obscures a letter, so that “E” is identified as “F”, for example. Plates with repeated customer disputes are also considered as problem plates.

If a transaction is sent to the application that has a plate in the problem plate database (based on automated or human review), the transaction will be queued for a supervisor-level review before it is forwarded to the CSC System for posting.

4.1 Add Plate to the Problem Plate Database

To add a license plate to the Problem Plate database:

1. Click **Audit** in the Menu options. The Audit screen displays with **Audit** and **Problem Plate** links.

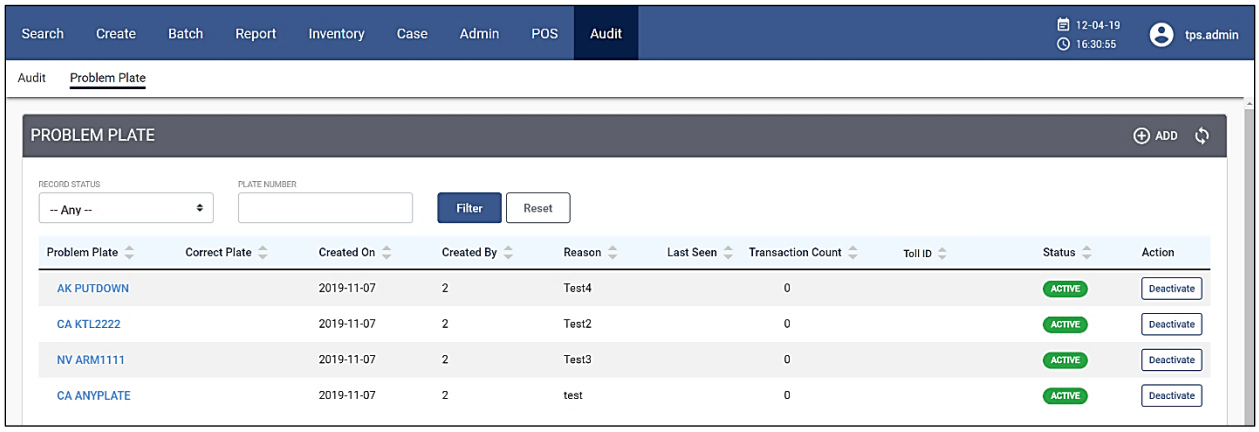


Figure 18 Problem Plate Screen

2. Click the **Problem Plate** link. The PROBLEM PLATE grid displays.

The Problem Plate grid has the following fields:

Field Name	Description
Problem Plate	Problem Plate number
Correct Plate	Correct Plate number
Created On	Date of transaction creation
Created By	User ID who added the problem plate to the list
Reason	The reason that identified the problem
Last Seen	When the plate was seen last

Field Name	Description
Transaction Count	Number of transactions
Toll ID	Road Event ID
Status	Active/Inactive
Action	Type of action (Activate/Deactivate)

Figure 19 Problem Plate Grid Field Description

3. Click **+ADD** on the header of the Problem Plate grid. Add Problem Plate appears with add problem plate data fields.

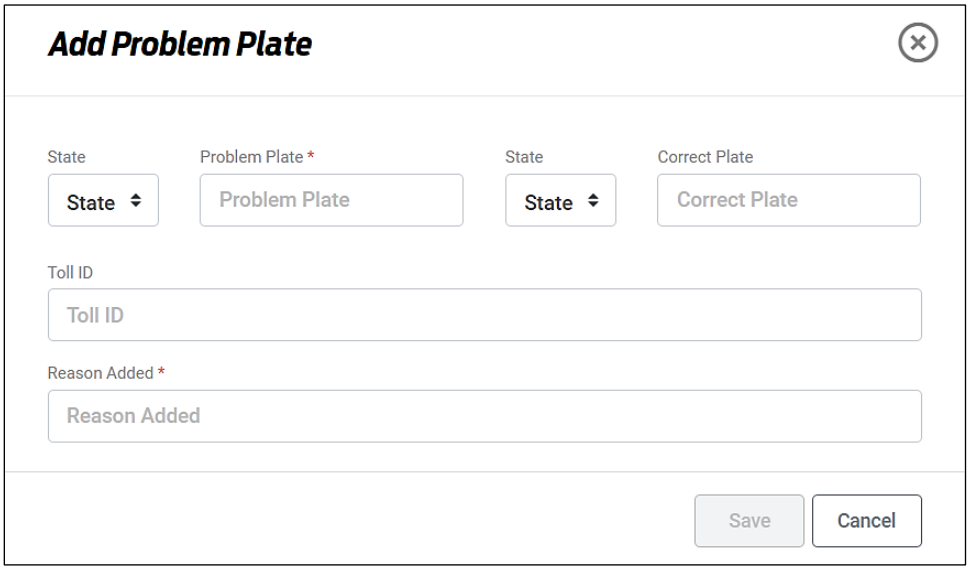


Figure 20 Add Problem Plate Box

4. Select the problem state from the dropdown and enter the Problem Plate (required) number.
5. Optionally, select the correct state and enter the correct plate number in the respective field. Although the problem state and the correct state may be the same, the correct state is optional.
6. Enter the Toll ID (optional) if known and add a reason in the Reason Added field.
7. Click **Save**.
8. The problem plate is added to the Problem Plate database.

4.2 Edit Problem Plate

To edit a problem plate:

1. From the Problem Plate grid, click on the problem plate link.

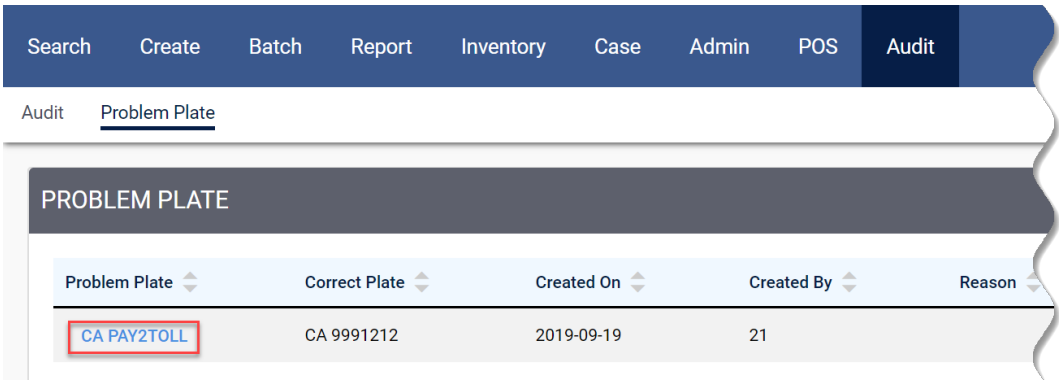


Figure 21 Problem Plate Link

2. Edit Problem Plate dialog box displays.

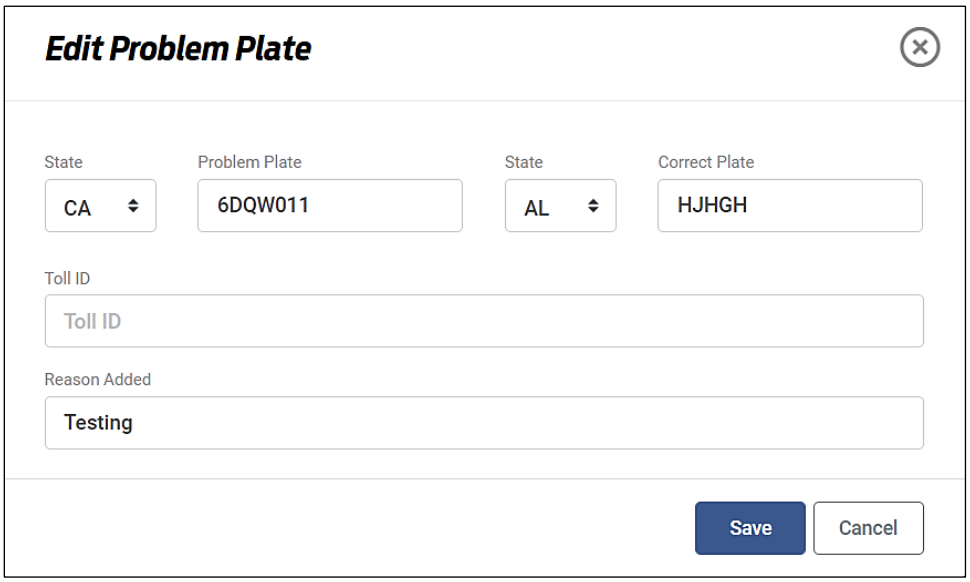


Figure 22 Edit Problem Plate Box

3. Make necessary changes and then click **Save**. The Problem Plate grid now reflects your changes.

4.3 Deactivate Plate from the Problem Plate Database

To deactivate a license plate from the Problem Plate database:

1. From the Problem Plate grid, on the existing plate, click **Deactivate** under Action.

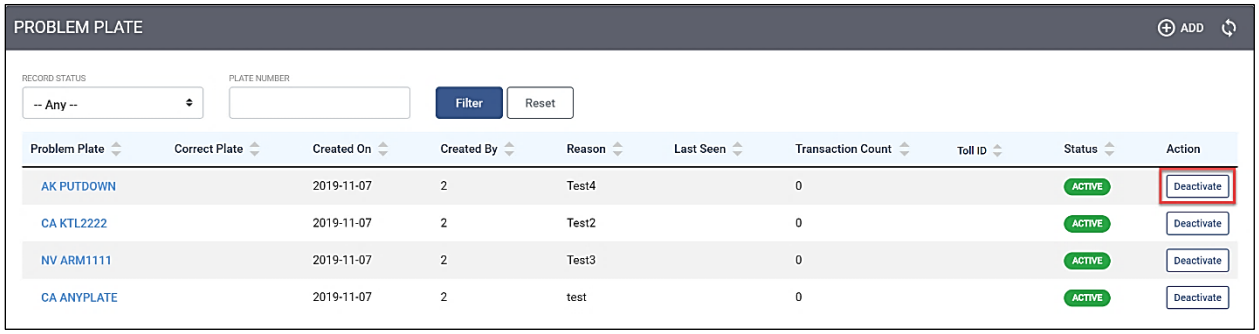


Figure 23 Deactivate Problem Plate

2. The problem plate record's status is updated in the grid as **Inactive**, in red.

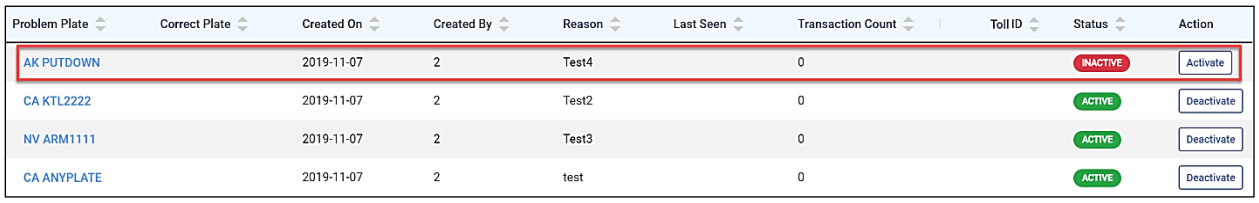


Figure 24 Problem Plate Inactive

3. To activate the deactivated plate, click **Activate** under Action.
4. The license plate status changes to Active and appears green.

4.4 Search Problem Plate

The problem plate search function allows users to filter the list of plates by Active or Inactive status or locate a specific problem plate by license plate number.

To view problem plates by status:

1. From the Record Status dropdown, select Active or Inactive and click **Filter**.
2. Problem plate grid displays only the filtered list.
3. Click **Reset** to return to the previous screen.

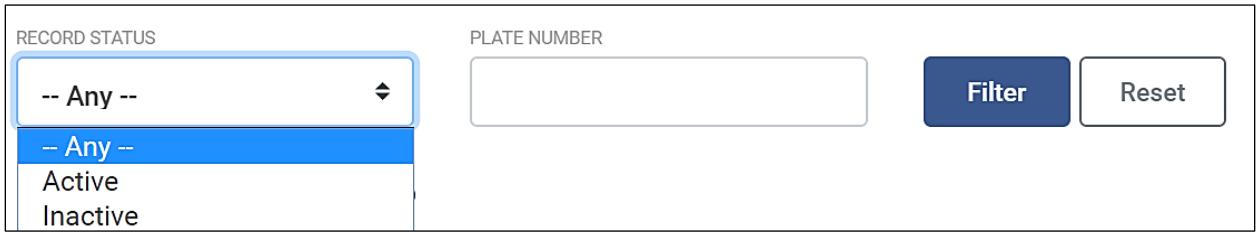


Figure 25 Problem Plate Search

To locate a specific problem plate:

1. In the Plate Number field, enter the license plate number without the state code and click **Filter**.
2. All other plates are hidden from the grid as it displays the desired problem plate info.
3. Click **Reset** to return to the previous screen.

5 Image Search

TPS Image Processing allows authorized users to search for and retrieve images using the following criteria:

- State/jurisdiction
- Plate/number
- Road
- Toll Point
- Date/time
- Image review status
- OCR confidence level ranges
- Reject codes

5.1 Road Event Review Search

The Road Event Review Search section details the image search process.

To perform a Road Event Review Search:

1. From the TPS menu bar, click **Reviews**. The Road Event Review Search page displays.

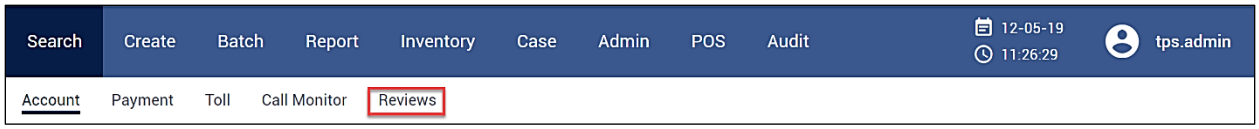


Figure 26 Search Reviews

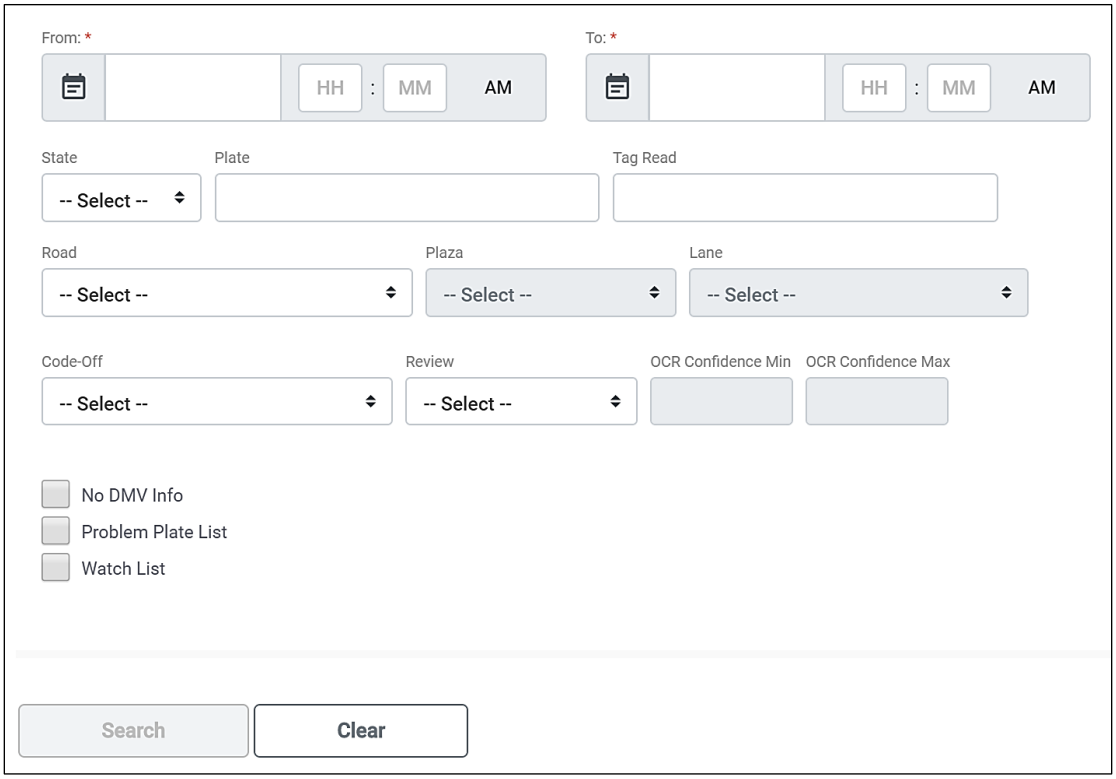


Figure 27 Road Event Review Search

2. Select the **From/To** dates of the transaction from the calendar and enter time.
3. The search range must not exceed 15 minutes, or the system will display “Search range exceeds maximum threshold” message.
4. For searches with available State/Plate and Tag Read information, the system will ignore the 15-minute search range limit.
5. Depending on the information available to you, conduct your searches using various parameters such as State/Plate, Tag Read, Road/Plaza/Lane, Code-Off values, and Review type.
6. Once you’ve decided on the type of search you wish to perform, click **Search**. The system displays the search results in the POSSIBLE MATCHES table.

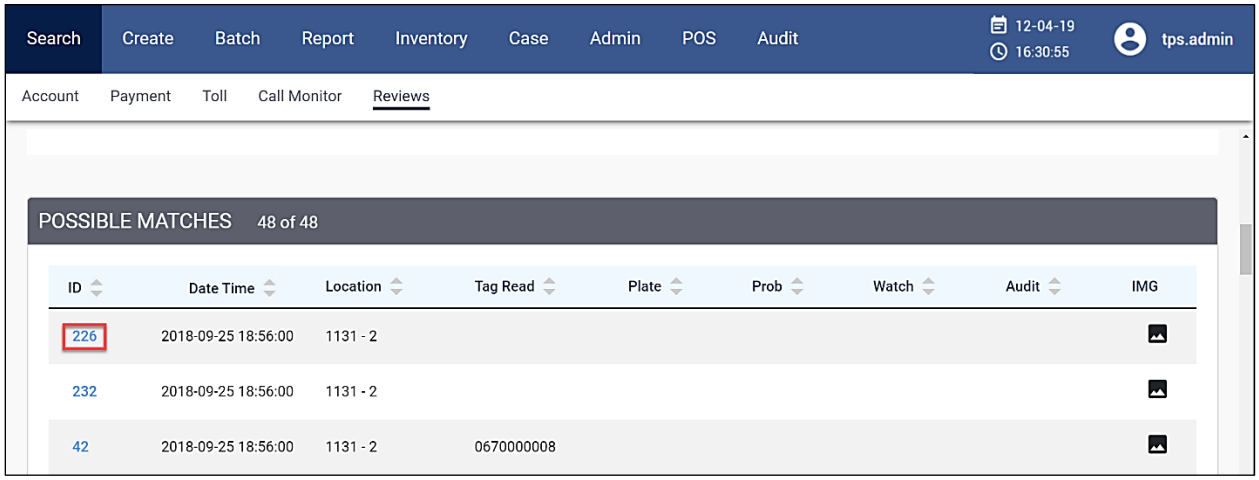


Figure 28 Road Event Search Possible Matches

7. Click on the image icon on the right. A set of vehicle images shows up for that transaction.

Figure 29 Transaction Related Images

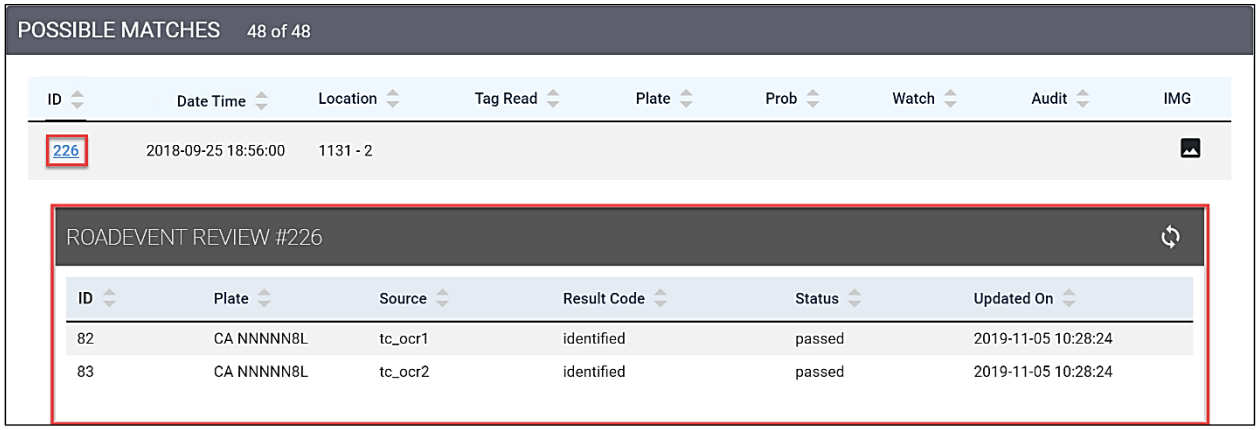


Figure 30 Road Event Review Details Screen

8. Click on the Road Event ID to view the details. A separate grid within, details the specific road event. The details include road event review ID, plate number, transaction source, result code, status (pass/fail), and the date of updates.
9. Click on the same Road Event ID (such as #226 in this case) to close the inside grid.

Appendix A State Abbreviations

State	Abbrev.	State	Abbrev.
Alabama	AL	Montana	MT
Alaska	AK	Nebraska	NE
Arizona	AZ	Nevada	NV
Arkansas	AR	New Hampshire	NH
California	CA	New Jersey	NJ
Canada	CN	New Mexico	NM
Colorado	CO	New York	NY
Connecticut	CT	North Carolina	NC
Delaware	DE	North Dakota	ND
District of Columbia	DC	Ohio	OH
Florida	FL	Oklahoma	OK
Georgia	GA	Oregon	OR
Guam	GU	Other Foreign Country	XX
Hawaii	HI	Pennsylvania	PA
Idaho	ID	Rhode Island	RI
Illinois	IL	South Carolina	SC
Indiana	IN	South Dakota	SD
Iowa	IA	Tennessee	TN
Kansas	KS	Texas	TX
Kentucky	KY	US Government	US
Louisiana	LA	US Virgin Islands	VI
Maine	ME	Utah	UT
Maryland	MD	Vermont	VT
Massachusetts	MA	Virginia	VA
Mexico	MX	Washington	WA

State	Abbrev.	State	Abbrev.
Michigan	MI	West Virginia	WV
Minnesota	MN	Wisconsin	WI
Mississippi	MS	Wyoming	WY
Missouri	MO		

Appendix B Code-off Values

Code-off Values	Meaning
60	Image not clear
61	Image too light
62	Image too dark
63	Camera too high (use only on single lanes)
64	Camera too low (use only on single lanes)
65	Camera too left (use only on single lanes)
66	Camera too right (use only on single lanes)
67	Black image
70	Images are unreadable due to hatching
71	No image available
72	No vehicle in image
73	Approved funeral procession
74	Plate glare or shadow
75	Vehicle not in lane
76	California unreadable black plate
83	Non-US (foreign) plate
84	No license plate; dealer paper plate
85	License plate obscured (e.g., by trailer hitch)
87	Plate is covered with blue or white shield (Split images)
99	Unreviewable

Appendix C Plaza Code

Plaza	Lane	Statement Description (22-character limit)
1131	01	La Paz On-Lane 1
1131	02	La Paz On-Lane 2
1133	02	La Paz Off-Lane 2
1141	01	Aliso Creek Off -Lane 1
1141	02	Aliso Creek Off-lane 2
1143	02	Aliso Creek On-Lane 2
1162	02	El Toro Off-Lane 2
1162	03	El Toro Off-Lane 3
1163	02	El Toro On-Lane 2
1163	03	El Toro On-Lane 3
1190	10	Catalina View South-Lane 10
1190	11	Catalina View South-Lane 11
1190	12	Catalina View South-Lane 12
1190	13	Catalina View South-Lane 13
1191	10	Catalina View North-Lane 10
1191	11	Catalina View North-Lane 11
1191	12	Catalina View North-Lane 12
1191	13	Catalina View North-Lane 13
1215	02	Newport Coast Off-Lane 2
1217	01	Newport Coast On–Lane 1
1217	02	Newport Coast On–Lane 2
1226	02	Ford Road Off-Lane 2
1227	02	Bonita Canyon On–Lane 2
2143	11	Oso Bridge Mainline North-Lane 11
2143	12	Oso Bridge Mainline North-Lane 12
2144	01	Oso Parkway On-Lane 1
2144	02	Oso Parkway On-Lane 2
2145	01	Oso Parkway Off-Lane 1
2145	02	Oso Parkway Off-Lane 2
2146	11	Oso Bridge Mainline South-Lane 11
2146	12	Oso Bridge Mainline South-Lane-12

Plaza	Lane	Statement Description (22-character limit)
2177	01	Antonio Parkway Off-Lane 1
2177	02	Antonio Parkway Off-Lane 2
2178	01	Antonio Parkway On-Lane 1
2178	02	Antonio Parkway On-Lane 2
2199	02	Los Alisos Blvd Off-Lane 2
2200	02	Los Alisos Blvd On-Lane 2
2216	02	Portola Parkway South Off - Lane 2
2217	01	Portola Parkway South On - Lane 1
2217	02	Portola Parkway South On - Lane 2
2234	02	Alton Parkway Off - Lane 2
2235	01	Alton Parkway On - Lane 1
2235	02	Alton Parkway On - Lane 2
2248	02	Portola Parkway North Off - Lane 2
2249	02	Portola Parkway North On - Lane 2
2257	11	Tomato Springs – North Lane 11
2257	12	Tomato Springs – North Lane 12
2257	13	Tomato Springs – North Lane 13
2260	11	Tomato Springs South – Lane 11
2260	12	Tomato Springs – South Lane 12
2260	13	Tomato Springs – South Lane 13
3042	02	Irvine Blvd. - East Off Lane 2
3043	01	Irvine Blvd. - East On Lane 1
3043	02	Irvine Blvd. - East On Lane 2
3057	11	Orange Grove South Lane 11
3057	12	Orange Grove South Lane 12
3058	11	Orange Grove North Lane 11
3058	12	Orange Grove North Lane 12
3145	10	Windy Ridge South Lane 10
3145	11	Windy Ridge South Lane 11
3145	12	Windy Ridge South Lane 12
3145	13	Windy Ridge South Lane 13
3150	10	Windy Ridge North Lane 10
3150	11	Windy Ridge North Lane 11

Plaza	Lane	Statement Description (22-character limit)
3150	12	Windy Ridge North Lane 12
3150	13	Windy Ridge North Lane 13
3482	01	Irvine Blvd. - West SB On Lane 1
3482	02	Irvine Blvd. - West SB On Lane 2
3486	02	Irvine Blvd. - West NB Off Lane 2
3490	01	Irvine Blvd. – West NB On – Lane 1
3490	11	Irvine Ranch North Lane 11
3490	12	Irvine Ranch North- Lane 12
3491	01	Portola Parkway West SB On – Lane 1
3491	11	Irvine Ranch South- Lane 11
3491	12	Irvine Ranch South- Lane 12
3497	02	Portola Parkway West NB On - Lane 2
3498	02	Portola Parkway West SB Off - Lane 2

Appendix D Image Processing Workflow Chart