

Manual

AUTOMATION GUARDRAIL DESIGN



CESS LLC

1/1/2020

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1. INTRODUCTION

1.1 What Is Automation of Guardrail Design (AGRD)

Automation of Guardrail Design (AGRD) is a smart and user-friendly engineering software that was exclusively developed for civil engineers by CESS LLC. Currently, no other software packages that are currently in the marketplace serving similar purposes, **AGRD** Software presents a groundbreaking approach in providing a reliable yet easy-to-use solution that integrates the cutting-edge computer engineering technologies with our extensive experience in guardrail design of numerous civil engineering projects. The powerful features of **AGRD** software have enabled us as well as our clients to maximize efficiency and productivity in a timely and cost-effective manner.

With a framework that was exclusively developed for guardrail design based on local design standards and specifications, **AGRD** Software offers to design guardrail and quantity take-off of all pay items in the guardrail.

1.2 Features of Automation Guardrail Design (AGRD)

- **Automation** – Guardrail can be designed automatically without any manual intervention.
- **Efficiency** - All work and reports can be done in Minutes for one guardrail design.
- **Precision** – Length of Need and Pay Items in one location or the entire project can be calculated with 100% accuracy.
- **Flexibility** - Discrete Random Variables are applied and provides users flexible methods for curb ramp design.
- **Consistency** - All elements for guardrail design are pre-set and keep all work consistent in all projects.
- **WYSIWYG** - Guardrail and all other elements are drawn in MicroStation immediately.
- **No Data Input** - No data needed for entire guardrail design.
- **User-Friendly Design** - The software is a very intuitive and easy to master, even for infrequent users.
- **Fully Integrated with CAD Platforms** - All curb ramp designs can be added, updated, or removed from MicroStation or AutoCAD automatically.

2. NEW GUARDRAIL

The figure below is the interface for new guardrail.

Followings are the descriptions of all parameters. More details can be found in reference book - "Roadside Design Guide".

1. **Project:** Select a project-- all alignments are loaded once a project is selected.
2. **Name:** Name of guardrail
3. **System:** Guardrail system, including Flexible System, Semi-Rigid System, and Rigid System.
4. **Barrier Type:** Type of barriers.
5. **Unit Length:** Unit length of barrier.
6. **Total Length Calculated by Unit Length:** Total length round to total piece of barrier times unit length, instead of Length of Need.
7. **Description:** Description of the guardrail.
8. **ADT:** Average daily traffic Volume.
9. **Design Speed:** Design speed at guardrail location.
10. **Main Alignment:** Main alignment of project, which is applied for begin station and end station.
11. **Edge of Travel Way:** Alignment of edge of travel way.
12. **Runout Length:** The distance from the object being shielded to the location where the vehicle departs from the traveled way. Runout length can be calculated automatically once ADT and design speed are determined.

13. **Clear Zone:** Unobstructed, traversable roadside area that allow a driver to stop safely, or regain control of a vehicle that has left the roadway.
14. **Area of Concern:** Distance from the edge of the traveled way to the far side of the fixed object or to the outside edge of the clear zone of an embankment or a fixed object that extends beyond the clear zone.
15. **Obstacle Type:** Type of obstacle.
16. **Lower Left Point:** Key point for guardrail design and the lower left point of obstacle.
17. **Upper Right Point:** Key point for guardrail design and the upper right point of the obstacle.
18. **Lateral Extent of the Area of Concern:** Distance from the edge of the traveled way to the far side of the fixed object or to the outside edge of the clear zone of an embankment or a fixed object that extends beyond the clear zone. Which can be calculated automatically once Edge of Travel Way and Upper Right Point are set.
19. **Lateral Distance from Barrier to Travel Way:** Distance from barrier to travel way.
20. **Barrier is Beyond Shy Line:** Determine whether barrier is beyond shy line or not.
21. **Installation Type:** Type of installation of barrier
22. **Upstream Treatment:** Upstream treatment of barrier
23. **Downstream Treatment:** Downstream treatment of barrier

Result including following items:

1. **Length of Need (LON):** Minimum length of barrier.
2. **Total Barrier Length:** Total length of real length of barrier.
3. **Lateral offset(X):** From the edge of the traveled way to the beginning of length-of-need.
4. **Total Piece of Barrier:** piece of the barrier required.
5. **Begin Station:** Station of the beginning of barrier.
6. **Offset:** Offset of the beginning of barrier.
7. **End Station:** Station of the end of barrier.
8. **Offset:** Offset of the end of barrier.

Status: Status of guardrail design, including Working, Completed, Checked, and Approval.

Click **Apply** button, the results are generated. Click **Draw** button and the guardrail and treatments are drawn in the MicroStation. Click **Save** button, all guardrail information is saved to database. Click **New** button, a new guardrail is created. IT IS IMPORTANT TO NOTE:

1. **UNROTATED VIEW WHILE DRAWING**
2. **ALIGNMENT OF EDGE OF TRAVEL WAY SHOULD FOLLOW THE TRAFFIC FLOW, AND MAKE SURE LOWER LEFT POINT AND UPPER RIGHT POINT ARE AT RIGHT SIDE OF THE ALIGNMENT.**

Figure below is guardrail summary of projects. Select a project, and all guardrail information is listed in the data grid.

Guardrail Summary

Project: I25 Resurfacing

Name	Length Of Need	Total Length	Description	Begin Station
Bridge C-21-BM EB	89.36	100		24+01.36
C-22-BS EB	58.26	62.5		803+86.17
21-BM WB ET	82.64	100		28+96.28
C-22-BS-WB	83.61	87.5		805+91.54
RD 25 CBC WB	113.62	125		589+84.61
RD 25 CBC EB	42.31	50		589+81.66

Close

Right click on the data grid, a menu with six sub-menu displays. See figure below:

- New
- Edit
- Goto Begin Point
- Goto Key Point
- Report
- Draw Callout

New: Create a new guardrail.

Edit: Edit an existing guardrail, Similar as New function.

Goto Begin Point: Move to beginning point of guardrail.

Goto Key Point: Move to lower left point of obstacle.

Report: Quantity report displays.

Draw Callout: Callout of key points is drawn in MicroStation.

3. REPORT

The figure below is guardrail quantity report.

The screenshot shows a window titled 'Guardrail Report' with a 'Project' dropdown set to 'I25 Resurfacing'. Below the dropdown is a table with the following data:

Item	Quantity	Unit
Type 3 Guardrail	525	LNFT
SRT-350-31	6	EACH
Fleat 350	0	EACH
GRAIL TRANSITION 3G	2	EACH
Max - Tension	0	EACH
MSKT	0	EACH
Soft Stop	0	EACH
End Anchorage Type 3B	0	EACH

At the bottom right of the window are two buttons: 'Export...' and 'Close'.

Click **Export** button, and quantity of guardrail is exported to a spreadsheet.

4. END TREATMENT

The figure below is the End Treatment list. These are applied for guardrail end treatment.

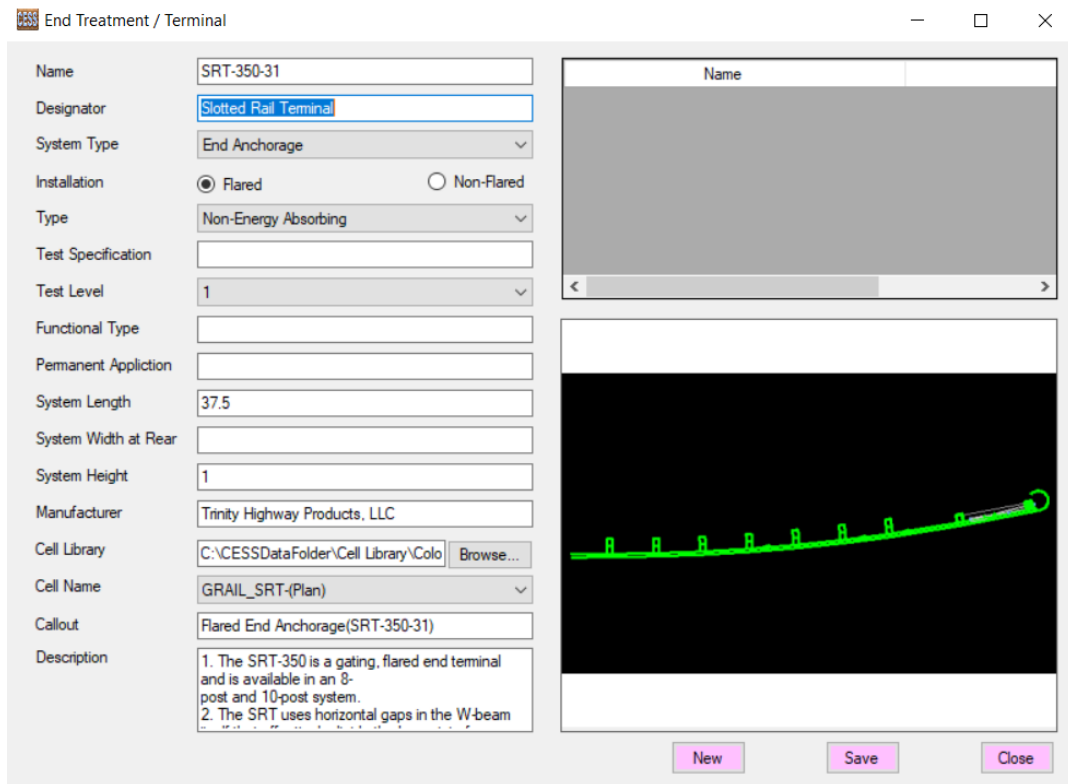
The screenshot shows a window titled 'End Treatment List' with a table containing the following data:

Name	Designator	System Type	Description
SRT-350-31	Slotted Rail Terminal	End Anchorage	1. The SRT-350 is a gating, flared end...
Fleat 350	Flared Energy Absorbing Te...	End Anchorage	1. Straight flared (not parabolic)2. Brea...
GRAIL TRANSITION 3G		Transition	1. Approach transition2. Use at both e...
Max - Tension		End Anchorage	
MSKT		End Anchorage	
Soft Stop		End Anchorage	
End Anchorage Type 3B		End Anchorage	Buried in the Backslope
End Anchorage Type 3D		End Anchorage	Departure terminal
End Anchorage Type 3K		End Anchorage	Departure terminal
Guardrail Transition Type 3H		None	1. Departure transition2. Transition Typ...
Transition Type 3L		None	May be used as a transition to the exist...
GRAIL ANCHOR		End Anchorage	

Right click on data grid, a menu with three menus displays: Add, Edit, and Delete.

<p>New...</p> <p>Edit</p> <p>Delete</p>	<p>New...: Create new end treatment or terminal.</p> <p>Edit: Edit an existing treatment or terminal.</p> <p>Delete: Remove existing treatment or terminal from database.</p>
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Following is the interface for editing treatment/Terminal.



Name: Specify Treatment/Terminal name.

Designator: Designator of Treatment or Terminal.

Cell Library: Cell Library for End Treatment or Terminal.

Cell Name: Cell name of end treatment or terminal.

Description: Description of end treatment or terminal.

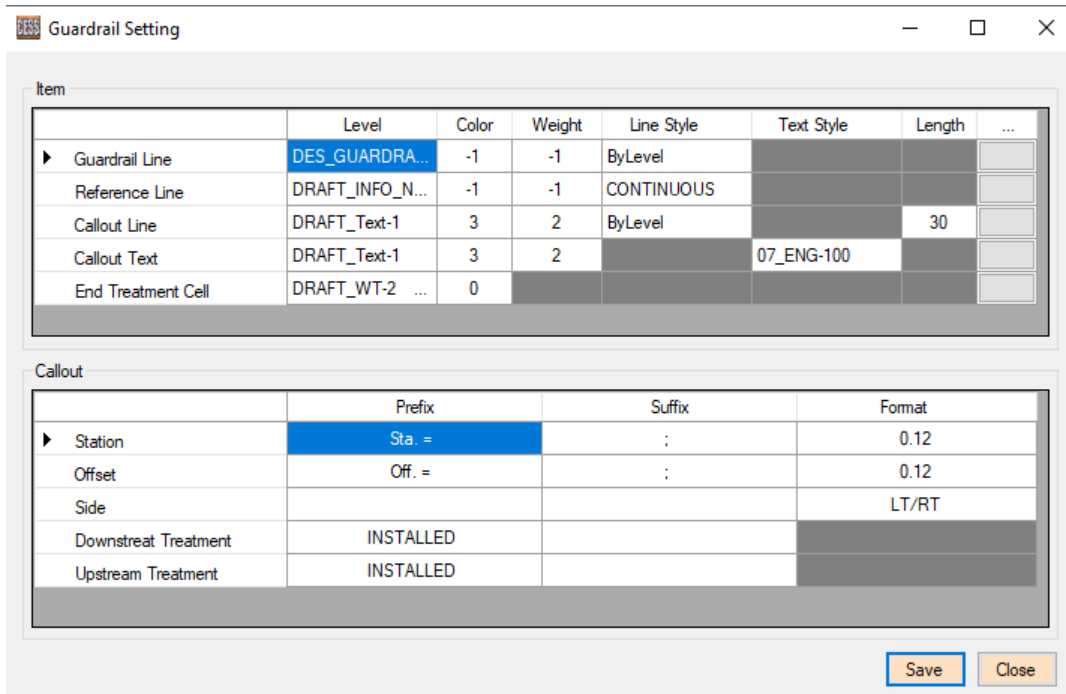
Definition of other items can be found in reference book "Roadside Design Guide".

Click **Save** button to save end treatment or terminal.

5. GUARDRAIL SETTING

The figure below is the guardrail setting interface.

In the data grid above, properties of items can be set by clicking the buttons in the uppermost right, and at the bottom of the data grid. Callout properties for items, including Station, Offset, Side, Downstream Treatment, Upstream Treatment, are set. Prefix, Suffix, and Format can be input directly into the data grid.



Click Save button and guardrail setting is saved.