

## GRADE SEPARATION INSPECTION & RATING

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### Grade Separation Form

- For purpose of this presentation **does not** apply to road alignment above – road alignment and other elements rated in Approach Road section
- Basic rule is alignment **OVER** is rated in Approach Road section and Alignment **UNDER** is rated in Grade Separation or Channel section
- Applies to bridges with traffic going under and culverts going through
- Applies to Animal, Pedestrian or Railway Underpass structures
- Replaces channel section
- Has items specific to under/overpass rather than channels
- Generated automatically
- Can be requested for blank forms (select GS instead of Channel)

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### Grade Separation Form

- Refer to Chapter 10 in BIM Manual for Bridge Grade Separations
- Refer to Chapter 13 – Section 13.8 for Culvert Grade Separations

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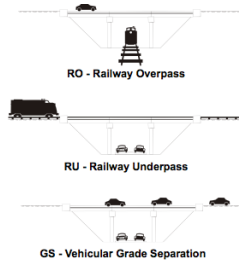
### Grade Separation Form

- Generated from BIS for following usage types:
  - **GS** - vehicle grade separation
  - **PS** - pedestrian grade separation
  - **SP** - wildlife or cattlepass
  - **RO** - railway overpass
  - **RU** - railway underpass
  - All types above can be either bridge or culvert Grade Separation

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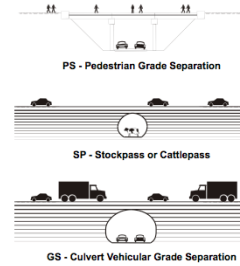
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## Grade Separation - Road Alignment Under

- The Grade Separation section is different for bridges and culverts
- Refers to H & V road alignment passing under Bridge Grade Separations or through Culvert Grade Separations
- Includes road surface condition for bridge GS
- Road surface given separate rating for culvert GS
- Does not refer to road above (rated in Approach Road section)

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## Road Alignment - Rating

Inspection and rating considerations include:

- Evaluating Horizontal Vertical alignment for 1 km each direction, then summarized in a single Road Alignment rating
- vertical and horizontal alignment that may contribute to damage to the bridge
- look for indications of reduced vertical clearance
- Bridge GS includes condition of road that may lead to damage of the bridge
- Railway, pedestrian / stock / animal passes and utilities alignments are rated "X"

If alignment can be safely driven at legal or posted speed limit rate 5 or more.

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## Grade Separation - Bridge

- The grade separation section of the BIM inspection form replaces the channel section for structures that are not over streams.
- Grade Separation Section for a bridge:

	Structure Usage		Explanation of Condition
	Last	Now	
Grade Separation			
Road Alignment	7	7	
Traffic Safety Features	8	8	HTCB at median.
Type	Cable barrier		
Slope Protection	4	4	Minor scaling and delam at SE from deck drainage. Gap at NE allowing drainage to undermine.
(Type: CONCRETE, CONCRETE)			
Bank Stability	8	7	
Drainage	7	7	
Grade Separation General Rating	7	7	

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## Bridge Grade Separation – Road Under

Grade Separation Road Alignment (rating road under)



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## Bridge Grade Separation – Road Under

Grade Separation Road Alignment (rating road under)



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## Grade Separation - Culvert

Grade Separation Section for a culvert carrying vehicles:

	Structure Usage		Explanation of Condition
	Last	Now	
Grade Separation			
Road Alignment	5	5	Curves at both ends.
Roadway Surface	7	7	6m road through structure one-way NB.
(Type: ACP)			
long (Y/N)	No		
Traffic Safety Features	7	7	
Type	Paracets		
Barrel Leakage (Y/N)	4	4	1 light burnt out in mid barrel.
Drainage	7	7	
Structure in Use (Y/N)	Yes		
Grade Separation General Rating	4	4	

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### Culvert Grade Separation

Grade Separation Road Alignment (rating road under)



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### Culvert Grade Separation

Grade Separation Road alignment (rating road under)



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### Bridge or Culvert Grade Separation Pedestrian, Animal, Railroad Underpass

- Refers to Pedestrian, Animal, or Railway underpasses under the Bridge or Culvert Grade Separation
- In these instances, Road Alignment is rated "X".

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### Culvert Grade Separation Form

Wildlife, Cattle, Pedestrian - Road Alignment UNDER Rated X

Culvert Section-Chapter 13 Section 13.8

	Structure Rating		Explanation of Condition
	Least	None	
Grade Separation			
Road Alignment	X	X	
Structure Burden (Type: MRL)	#	#	
Using (Y/N)	No		
Traffic Safety Features	X	X	
Type	None		
Lighting		X	X
Stand Loadage (Y/N)	No		
Drainage	4	4	Average 150mm water and ice in pipe.
Structure In Use (Y/N)	No		Fencing to down.
Grade Separation General Rating	4	4	

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### Culvert Grade Separation – Pedestrian

Grade Separation Road Alignment UNDER Rated X



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### Grade Separation BP – Animal Underpass

Grade Separation Road Alignment UNDER Rated X



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### Bridge Grade Separation Form

Wildlife, Cattle, Pedestrian - Road Alignment UNDER Rated X

Bridge Section—Chapter 10

	Structure Usage		Explanation of Condition
	Last	Now	
<b>Grade Separation</b>			
Road Alignment	X	X	Animal underpass
Traffic Safety Features	X	X	
Type	None		
Slope Protection	7	7	Some CL 1 and 2.
(Type: NATURAL; NATURAL)	7	7	
Bank Stability	7	7	
Drainage	7	7	
<b>Grade Separation General Rating</b>	<b>7</b>	<b>7</b>	

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### Bridge Grade Separation – Wildlife Underpass

Grade Separation Road Alignment UNDER Rated X



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**Bridge Grade Separation – Pedestrian Underpass**  
Grade Separation Road Alignment UNDER Rated X



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**Bridge Grade Separation - RXR UNDER**  
Rail Alignment UNDER Rated X

	Structure Usage		Explanation of Condition
	Last	Now	
Grade Separation			
Road Alignment	X	X	Railroad.
Traffic Safety Features	X	X	
Type			None
Slope Protection	7	7	
(Type - CONCRETE, CONCRETE)			
Bank Stability	7	7	
Drainage	7	7	
Grade Separation General Rating	7	7	

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**Grade Separation – Railroad Overpass**  
Rail Alignment Rated X



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**Culvert Grade Separation – RxR Underpass**  
Rail Alignment UNDER Rated X

	Structure Usage		Explanation of Condition
	Last	Now	
Grade Separation			
Road Alignment	X	X	Roadway.
Handover Surface	7	7	
(Type - GRAVEL)			
Inlet (Y/N)	No		
Traffic Safety Features	X	X	
Type			
Lighting	X	X	
Barrel Leakage (Y/N)	Yes		Leakage at both sidefalls and roof of mgs 15-20.
Drainage	7	7	
Structure in Use (Y/N)	No		Appears to be pedestrian use only.
Grade Separation General Rating	7	7	

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**Grade Separation – Culvert RXR Underpass**  
 Rail Alignment Rated X



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**Bridge or Culvert Grade Separation**  
**Pedestrian, Animal, Railroad Overpass**

- Refers to Pedestrian, Animal, Utility or RxR overpasses over top of roadway
- Road alignment under is rated in Grade Separation section
- Road alignment over is rated in Approach Road section
- In these instances, both Horizontal and Vertical Road Alignment is rated "X"
- Results in General Rating of 5
- Refer to Sections 1.10.1 and 1.10.6

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**Bridge or Culvert Grade Separation Form**  
 Wildlife Overpass – Horizontal & Vertical Alignment Rated X

Bridge Section Chapter 10.3 Culvert Section Chapter 13 Section 13.8

Approach Road / Embankment		
	Limit	New
Horizontal Alignment		X
Vertical Alignment		X
Roadway Width (m)	6.3	
Embankment		7
Sideslope (L...:1)	10:8	
Height of Cover(m...)	1.9	
Guardrail (Y/N)	Y	
Safety/guide fencing both sides over Hwy. 1.		
Approach Road / Embankment General Rating		5

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**Culvert Grade Separation - Wildlife Overpass**  
 Vertical & Horizontal Road Alignment (Over) are Rated X so Gen. Rating = 5



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### Bridge Grade Separation Form – RxR Overpass Rail Alignment OVER Rated X

Bridge Section Chapter 10.3 Culvert Section Chapter 13 Section 13.8

		Approach Road		
		Last	Now	Explanation of Condition
Horizontal Alignment			X	Railway crossing over top of Hwy. 3.
Vertical Alignment			X	
Roadway Width (m)	3.6			
Approach Bump			X	
Guardrail (Y/N)	Y			Steel tube posts and rail along both sides.
Guardrail Length (m)	33.0			
Current Standard (Y/N)	N			Sheet metal ballast shields 1m high along both sides to contain ballast
Termination Type	NONE			
Drainage			5	
Approach Road General Rating			5	

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### Bridge Grade Separation – RxR Overpass

Horizontal and Vertical Alignment of Railway (OVER) Rated X so Gen. Rating = 5



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### Roadway Surface

- Refers to Culvert Grade Separations and Animal/Pedestrian Underpasses
- Purpose is to provide a surface for traffic usage
  - Smooth surface
  - No holes, depressions or projections
  - Not slippery
- Record type of surface
  - Asphalt
  - Concrete
  - Gravel
  - Soil

- Look for defects that might affect high-load vehicles
- Defects that create hazards to traffic or pedestrians
- Record the presence of icing on the roadway or barrel Y/N – comment if Yes. May affect Drainage rating.
- If defects a problem for stock/traffic, rate 4 or less
- If hazardous, rate 2 or less (holes, projections, icing on traffic or pedestrian surfaces)

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### Traffic Safety Features

- Refers to curbs, medians, guardrails, attenuators, high tension cable barriers, advance warning signs, vertical clearance signs, crash protection/attenuators
- Inspect 20 m each direction of guardrails, barriers, HTCB
- Not applicable for stock underpasses
- Indicate type and rate condition and functionality
- If not present record type as "None" and rate "X"

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## Traffic Safety Features

Inspection and rating considerations for safety features are as follows:

- do not rate standard of safety feature, rate functionality and condition as per original design
- rating includes all components of the safety feature, including connections
- if elements are missing but there is evidence that they were previously there, then rate "4" or less
- use "explanation of condition" to further describe features or to indicate concerns, maintenance required, etc.

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## Slope Protection

- Refers to protection system on headslopes of bridges to prevent erosion
- Look for:
  - evidence of settlement
  - cracked, broken or bulging concrete protection
  - Deck drainage away from system
  - voids under concrete slabs
- Note graffiti
- Rate 4 or less for:
  - Significant settlement or moving downwards
  - Significant heaving or cracking of concrete slope protection
  - Voids under concrete slope protection
  - Any maintenance required

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## Bank Stability

This refers to the stability of the headslopes and transitions. It is influenced by factors such as:

- type of backfill material
- construction techniques
- degree of compaction
- drainage system
- underlying soil stratigraphy

Consequences of instability may range from minor settlement to major structural distress.

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## Bank Stability

Refers to stability of bridge headslopes

- Look for:
  - damage or displacement
  - settlement at abutment and piers
  - bulging at toe of slope
  - loss of material at toe of slope
  - wet or slumping areas

Rate 4 or less if:

- Settled and exposing underside of abutment seat
- Instability that affects the Substructure or Superstructure
- Instability requiring monitoring

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## Drainage

Refers to the ability to dispose of water at:

- Toe of headslopes and transitions on bridges
- Roadway surface from Culvert Grade Separations
- Ends and barrel of Pedestrian or Animal underpasses
  - Typ. water sources are deck and approach road drainage, ditch drainage, and weep holes.
  - Some underpasses are also designed for water flow
    - See "Special Comments for Next Inspection"

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## Drainage – Bridge or Culvert GS

On Bridge or Culvert Grade Separations handling vehicle traffic look for:

- Ponding at toe of headslopes and transitions or inside culverts
- Blockage of existing drainage systems
- Damage to embankments
- Record "Yes" if barrel leakage – comment

Ratings:

- If functioning and no damage to slope protection, embankments and no bank instability rate 5 or more
- If damage or slope instability rate 4 or less
- Drainage causing ponding, icing on travel lanes & potential hazard rate 2 or less
- Abutment scour/erosion and pier scour rated X on Bridge Grade Separations

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## Bridge Grade Separation – Poor Drainage



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## Bridge Grade Separation – Poor Drainage



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### Bridge Grade Separation – Poor Drainage



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### Bridge Grade Separation – Poor Drainage



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### Drainage – Ped/Animal Underpass

- On Pedestrian/Animal Underpasses look for:
- Ponding in culvert barrel or at ends
  - Any condition contributing to icing
  - Damage to sideslopes or embankments

Record "Yes" if barrel leakage and provide comment. Rating is not required but if "Yes" leakage may effect rating of Roadway surface and Drainage

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#### Ratings:

- Functioning, no damage to sideslope or embankment rate 5 or more
- If poor drainage causes icing or ponding around animal underpasses rate 4 or less
- If drainage causes ponding or icing and potential hazard on pedestrian underpass 2 or less

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### Animal Underpass – Other Drainage Considerations

- Normally the following are not applicable (rate "X")
  - scour and scour protection at ends
  - fish passage in barrel
  - waterway adequacy in barrel
- If designed to also handle water flow
  - Note in "Special Comments for Next Inspection" (This culvert also handles drainage. 05/06/2016)
  - Inspect and provide ratings for:
    - scour and scour protection at ends
    - fish passage
    - waterway adequacy

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## Animal Underpass – Handles Drainage



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## Lighting

This item refers to the lighting system used in the culvert to enhance visibility and to provide for safe passage through the culvert.

Some considerations for inspection and rating include:

- if the lighting is not operational, rate "4" or less
- check guardrail and safety features for damage as this may indicate visibility problems in the culvert
- check all connections and features to determine condition and functionality
- no lighting (cattlepass) rated "X"
- inadequate lighting or no lighting and hazardous situation for the user should be rated "2" or less with "explanation of condition".

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## Structure In Use

- Refers to whether the Stock underpass is used for it's intended purpose
- Indicate "In Use" by Yes or No
- If there is evidence the structure is no longer in service, then circle "N" and make a note in the "explanation of condition" regarding the circumstances (e.g. guide fence is down)
- Provide comment/explanation if "No" (e.g. guide fencing is down)

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## General Rating – Grade Separations – Road Under

- Governing Elements – (refer to 1.10.5 and 10.7 (Bridges), 1.10.10 and 13.8.7 (Culverts)).
  - Road Alignment rating
  - Roadway Surface rating (Culvert GS only)
  - Traffic Safety Features rating (except improperly lapped guardrail)
  - Bank Stability rating of 4 or less
  - Drainage rating

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### Sample Completed Form Grade Separation – Road Under

		Structure Usage		
		Last	Now	Explanation of Condition
Grade Separation		7	7	
Road Alignment				
Traffic Safety Features		4	4	1 damaged post at W.B median and wrong lap at NW.
Type	GUARDRAIL			
Slope Protection (Type: CONCRETE, CONCRETE)		4	4	Broken around pier columns 200mm at North & 120 mm at South. Sealed 100mm at North top sections. Sealed in some areas, open gaps in others.
Bank Stability		5	5	
Drainage		5	4	Ponding water at west toe of headslope - not affecting driving lanes.
Grade Separation General Rating		4	4	

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### General Rating – Animal or Pedestrian Underpasses

- Governing Elements – (refer to 1.10.10 and 13.8.7)
  - Road Surface rating
  - Drainage rating

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### Sample Completed Form Animal Under Pass

		Structure Usage		
		Last	Now	Explanation of Condition
Grade Separation				
Road Alignment		X	X	
Roadway Surface (Type: ROAD)		6	6	
Using (Y/N)	No			
Traffic Safety Features		X	X	
Type	None			
Lighting		X	X	
Barrel Leakage (Y/N)	No			
Drainage		4	4	Average 100mm water and ice in pipe.
Structure In Use (Y/N)	No			Fencing is down.
Grade Separation General Rating		4	4	

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## Questions?

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