1.Title / Content Area:	Glenwood Canyon Highway
2. Historic Site:	11.8 miles of the I-70 Interstate through Glenwood Canyon
3. Episode	Glenwood Canyon Highway
3. Developed by:	Sally Purath, Retired Educator, Poudre School District Michelle Pearson, Adams 12 Five Star Schools
4. Grade Level and Standards:	Grade Level: 6th- HS Content in this Document Based Question (DBQ) link to Prepared Graduate Competencies in the Colorado Academic Standards Prepared Graduate Competencies: Understand the nature of historical knowledge as a process of inquiry that examines and analyzes how history is viewed, constructed, and interpreted. *Colorado Standards:* 6th: History Standard 1 8th: History Standard 1 HS: History Standard 1 C3 Standards in Social Studies: D2.His.1.6-8 D3.1.6-8. D2.His.2.6-8 D3.3.6-8 D2.His.3.6-8 D2.His.3.9-12. D2.His.2.9-12. D2.His.1.9-12.
5. Assessment Question:	How did engineers make I-70 work regardless of the challenges with the design of the canyon roadway?

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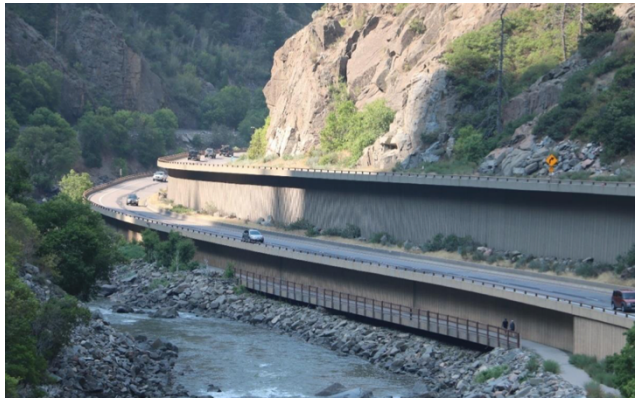
6. Contextual Paragraph	The last segment of interstate highway in Colorado would have to go through 11.8 miles of narrow box canyon next to the Colorado River. Previously, a railroad was blasted through it in 1887 using Mexican and Chinese labor and Italian stonemasons made retaining walls. A single lane gravel wagon road was added in 1902 which was in danger of floods, slides, and snow. Convict labor made it into a two-lane automobile road in 1913 and WPA workers paved it in 1936. But in 1960 when the interstate was chosen to go through Glenwood Canyon, the environmental movement had begun and implementing its concerns took twenty years of planning and input. The usual way to build a mountain road was the cheapest—blast the walls into rubble and then use that to fill in the roadbed—but the box canyon was beautiful and could be used for recreation if not destroyed. Protests, rallies, and hearings occurred in the 1960s about the environmental impact but it wasn't until Nixon passed the National Environmental Policy Act in 1970 that agencies were forced to consider preserving it even if it cost more. In addition, Vail Pass was built in 1973 with methods devised in Swiss mountains using precast concrete retaining walls to blend into the rock and building bridges around obstacles instead of blowing them up, techniques that would be expanded in the box canyon. Construction was from 1980-1992 after twenty years of developing the methods that would preserve the environment. Thirty-nine bridges perched on single column piers raised the road above natural landscapes Each pier took only one hole to drill and hollow concrete road segments were lifted into place with cranes between piers eliminating many heavy construction vehicles from the site, creating cantilevered lanes hanging in the air. Retaining walls were rusticated with grooves and colored to blend in with the natural rock. The two double lanes were terraced when possible so both sides were in the sun not shadows reducing ice formation. Welded steel girders of variable depths allowed the road to follow the curve of the Colorado River and could be manufactured elsewhere and installed in winter weather unlike poured concrete girders. Besides the engineering achievements needed to build in a narrow canyon, the environment was preserved for recreation and aesthetic enjoyment which brought in tourist money to poor rural areas of the state no longer used for mining. Colorado State University professors inventoried all the plants so they could be put back to anchor the soil, and 150,00 new plants were installed. A walking/bicycle path was built next to the river with the traffic overhead and out of sight and sound. Access to the river for boats, picnics, and hiking trails were built, with three of four public restrooms built waterless to preserve river quality. Bighorn sheep who had been removed due to causing accidents on the old road were even brought back to live in the canyon again.	

	Fifteen contractors completed more than forty separate construction contracts over eleven years at a total project cost of $490 million. Awards have been won for its combination of environmental preservation, unique building methods, and cooperation between multiple interests and government agencies.	
7. Connection to Historic Preservation	Parts of the highway are being evaluated for placement on the National Register of Historic Places as a linear historic district, which means that a collection of objects and structures are meaningful in the areas of Transportation, Conservation, Entertainment/Recreation and Landscape Architecture and Engineering, but not the entire highway on its own merit.	

Document Based Question (DBQ)

Document Set

View of terraced highway, retaining wall, cantilevered overhang & recreational bike/walking path below



https://www.codot.gov/programs/environmental/archaeology-and-history/assets/documents/glenwood-canyon-historic-context.pdf

GUIDING QUESTIONS:

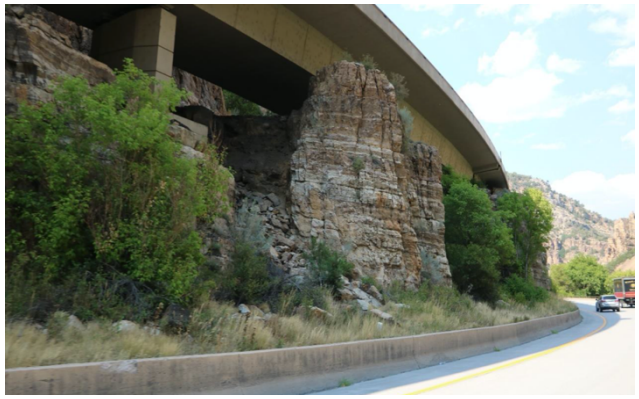
1. Why were the highway lanes terraced rather than save space by building one over the other?
2. What benefits were there by having the lowest lane be a bicycle/walking path?
3. How does this construction show innovative thought in design to allow for different types of use for the highway?
4. What are some of the challenges of having this type of terraced highway system?

Photo of model of Hanging Lake area showing problems of building multiple lanes plus exit ramps in a narrow canyon without blowing up walls  https://www.codot.gov/programs/environmental/archaeology-and-history/assets/documents/glenwood-canyon-historic-context.pdf	GUIDING QUESTIONS: 1. What building techniques would be necessary to allow this much complicated highway to fit in this narrow canyon? 2. How does this design preserve more of the original wild canyon? 3. Based on this image, what types of engineering challenges did the construction crews face while building this highway?

Segmental concrete box girders holding up roadway which is on top of single column piers	GUIDING QUESTIONS: 1. What are the benefits of building with single column piers? 2. What are the benefits of building with concrete box girders? 3. How do these techniques preserve more of the natural canyon?

https://www.codot.gov/programs/environmental/archaeology-and-history/assets/documents/glenwood-canyon-historic-context.pdf

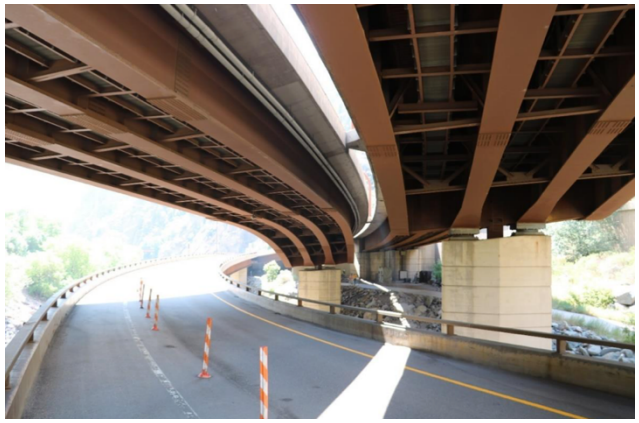
Example of how the highway was integrated into the existing rocks and plants



https://www.codot.gov/programs/environmental/archaeology-and-history/assets/documents/glenwood-canyon-historic-context.pdf

GUIDING QUESTIONS:

1. How were plants and natural rocks used in conjunction with a concrete road to preserve the environment?
2. What benefits occurred for Colorado by spending so much money on preservation of the natural aspects of this road rather than make it as cheaply as possible?

Welded steel plate girders of variable depths enabled the road to follow the curve of the Colorado River  https://www.codot.gov/programs/environmental/archaeology-and-history/assets/documents/glenwood-canyon-historic-context.pdf	GUIDING QUESTIONS: 1. What techniques were used to “hang” the road over the natural canyon? 2. In what ways would winter weather have an impact on these techniques?

Assessment Question
What unusual goals and methods were used to create this segment of interstate through a narrow box canyon?
Response