[1]*To Build or Not to Build?*
(Planning for a New Road)

Case Study

[2]*Rosalyn W. Berne, PhD. University of Virginia, Department of Engineering and Society*
Mona Griswold, MSF, MBA - Olympic Region Manager, Retired, Washington State Department of Natural Resources
Rob Tieman, PE, PMP, Professor of Practice, University of Virginia, Department of Civil and Environmental Engineering

Background

There are times when what appears to be a straightforward engineering project is actually replete with nodes of ethical concern that might easily be overlooked. Such is so with this (fictional) case of planning for the construction of a new road in western Washington State. Home to majestic mountains, miles of shorelines, tall trees, a rainforest, and numerous Indian tribes, this is a place where passions run high, especially when it comes to cutting second and third growth stands of trees. In this case, tree stands are among the key factors to be considered in planning the road.

Funds generated from trees harvested by the Washington State Department of Natural Resources (DNR) on land owned by counties, but managed by DNR, go to their beneficiaries including, but not limited to, schools, fire departments, and libraries. Over 50% of these lands have been set aside due to endangered species (e.g. spotted owls, marbled murrelets), slope, old growth trees, landslide potential, and water protection. Conservation groups want to see forests protected for future generations.

Native tribes have a long history of hunting and gathering on the land. In Washington State, tribes are sovereign nations with their own governments and law enforcement. Many tribes have designated reservations, and others have chosen to purchase the land themselves.

There are numerous small towns in western Washington, and tourism is a major source of revenue. The natural beauty attracts all kinds of local and destination outdoor enthusiasts who hike, camp, hunt, fish, bike, photograph, and birdwatch, while enjoying the breathtaking scenery.

---

[1] There are 5 segments to the case (Parts A, B, C, D, and E), which were written to be read and considered sequentially. For discussion and study purposes, key questions are posed at the end of each segment. Teaching notes follow at the end.

[2] The authors of this case have expertise in transportation and project management, transportation planning, forestry management, and engineering ethics.

Tourism has increased tremendously over the last 10 years. Road infrastructure is lacking in key areas, limiting ease of access for outdoor enthusiasts.

Project Description

The Washington State Department of Transportation (WSDOT) is initiating a project to connect Town A and Town B in an area designated for scenic outdoor tourism and recreation. There is not currently a road connecting the two towns. The Washington State DOT believes that a new connecting road is warranted due to current and projected population growth and the growing popularity of the area for tourists. Furthermore, studies have indicated that such a road would boost the economies of local communities, and provide easier access to points of interest, such as the hot springs in Town A, and the salmon stocked river in Town B. The mostly east-west, new road would be a regional two-lane highway with shoulders.

While the proposed new road is welcomed by many, there are multiple and conflicting interests that must be considered in the planning process, with the well-being and prosperity of various parties balanced against potential perceived harms to individuals, tribal communities, and wildlife. Decisions must be made by the project team, and others, as to whether, where, and how to construct the road. Some of those decisions have ethical implications.

Considerations of Significance

a. Tribal Interests and Lands

Tribes with land rights within the state have already been impacted by transportation projects, whereas in the past, they were not consulted on the construction of roads that were built through and across those lands. Tribal input and communication are especially important given the historic pattern of violated treaty rights and disrespect of tribal values. Any new road construction with plans to run through tribal land will require concurrence. (i.e. the road may need to have turns to avoid where tribal remains are buried.)

b. Wildlife

The route is planned in such a way to minimize impact on existing and newly established wildlife. Meaning, the design should not harmfully restrict wildlife's ability to travel to areas needed for food, water, habitat, and genetic diversity.

c. Traffic

It is anticipated this new road would increase vehicular traffic in both Town A and B. Additionally, the anticipated traffic resulting from the planned project would include a higher-than-normal concentration of trucks, RVs, trailers, boats, campers, etc. While this improvement will significantly boost the local economies in Town A and B, there are resulting safety, congestion, and mobility access issues each town may face over time.

d. Environmental Hazards

Landslides are a possible environmental hazard to be considered along the route. Landslides could impact travel and homes situated downslope resulting in safety concerns and a potential lack of potable water.

e. Towns' Support

Both "Town A" and "Town B" strongly support connecting their two towns and are optimistic for resultant economic benefits.

f. Other benefits

Pending the chosen route, the new road could run through an existing state park and provide an additional access point. Another route option would run by a private forest, where the owner is anxious to start selective logging activities and establish new campgrounds.

Planners, Decision Makers, and Community Members Engaged

Road construction projects invariably involve a variety of people, from engineers to community planners to special interest groups and residents of the affected community. In this case, the following individuals are actively engaged and influential in the process.

Project Manager, Washington State Department of Transportation

Gwen Harrison is excited to be assigned to this project as its success will inevitably put her in good stead for a promotion. She holds a Bachelor of Science (B.S.) degree in Civil Engineering from Georgia Tech and is a Professional Engineer with 10 years of experience with the WSDOT. As Project Manager, she is responsible for developing and delivering projects that meet defined success criteria within the constraints of the established budget, scope, and schedule. While the design team does not directly report to her, Gwen is responsible for coordinating their efforts and accountable for the overall project progress. She is the primary contact for this project, which means she is the liaison between executive leadership and the design team. She is also the face of the project and primary liaison with the public.

Design Team Environmental Lead

Angela Morales is the Design Team Environmental Lead, meaning that on this project, she is responsible for assessing impacts to plant and animal life and providing information regarding potential mitigations. She has a master's degree in Natural Resources Management from the University of Washington and is from Washington State. She has 15 years of experience with WSDOT. She enjoys hiking and bird watching and leans toward environmental causes such as preservation and enhancement of threatened and endangered birds.

Design Team Hydraulics Lead

Jeff Osborn is a new hire, and a former summer intern for the WSDOT. He is an outdoorsy guy who rides his bike to work and spends weekends fishing on the nearby lakes. While studying at University of Wyoming for his BS in Civil Engineering, a mentoring professor encouraged Jeff to stay at the University to pursue a master’s degree focused on water resources-hydrology. With the M.S. in hand, he is passionate about his work and excited to be in this job. For this project, Jeff is tasked with design of all permanent and temporary hydraulics improvements, and preparation of all associated reports and studies. This will require close coordination with the Transportation and Environmental disciplines

Design Team Transportation Lead

James (Jimmy) Metcalf has a strong background in civil engineering, transportation engineering specifically. He recently moved to Washington State from Virginia. While in Virginia he gained extensive experience in design and project management in the fast-growing Tidewater area of that state. He has a Professional Engineer (PE) license and 25 years of supervisory experience leading design teams in Virginia, including on roads, in tunnels, and on bridges. Jim is quickly coming up to speed on Washington State natural conditions, transportation regulations, standards, and best practices. Co-workers respect his strong technical skills and his keen ability to review plans, prepare cost estimates, and develop project scopes. Jimmy is a workaholic who

hates wasting time, a disposition he doesn't try to hide. He has little patience with the "tree hugger" types of people, and he prioritizes geometric design and safety while staying within budget.

Tribal Natural Resources Manager

Solomon Grey earned his Associate Degree of Arts and Sciences from Wenatchee Valley College, and a B.A. in Natural Resource Management from Western Washington University. Although he does not currently live on tribal lands, he did so as a child and still has an extended family living on the reservation. In this elected position, Solomon represents the tribe whose land is most likely to be impacted by the construction of the new road. Of particular concern to him is that the tribe be taken seriously and consulted in the decision-making process.

Alliance to Save the Land (ASL)

When Eric Steadfast was 22 years old, he began an organization called Alliance to Save the Land. For the last 10 years he has raised funds for its support and runs the organization with a team of 4 other people. For such a small organization, ASL has had an enormous impact on a variety of Washington projects, including a proposed new road, timber sales planned by the Department of Natural Resources (DNR), permitting for a logging project, and efforts to restore native species flora to commercial development areas.

Scenarios

Parts A-E of this case study represent five separate scenarios to be considered in order. Each part includes an update from the previous part and provides pertinent information to be weighed. Questions posed should be addressed prior to moving on the next part and might be considered from the perspective of each character (planner, decision maker, community member, etc.). For purposes of engineering ethics, the ASCE Code of Ethics could be a consideration for each of the five scenarios. (See chart below.)

American Society for Civil Engineering (ASCE) Code of Ethics

I. Society

Engineers:

a. first and foremost, protect the health, safety, and welfare of the public;

b. enhance the quality of life for humanity;

c. express professional opinions truthfully and only when founded on adequate knowledge and honest conviction;

d. have zero tolerance for bribery, fraud, and corruption in all forms, and report violations to the proper authorities;

e. endeavor to be of service in civic affairs;

f. treat all persons with respect, dignity, and fairness, and reject all forms of discrimination and harassment;

g. acknowledge the diverse historical, social, and cultural needs of the community, and incorporate these considerations in their work;

h. consider the capabilities, limitations, and implications of current and emerging technologies when part of their work; and

i. report misconduct to the appropriate authorities where necessary to protect the health, safety, and welfare of the public.

II. Natural and Built Environment

Engineers:

a. adhere to the principles of sustainable development;

b. consider and balance societal, environmental, and economic impacts, along with opportunities for improvement, in their work;

c. mitigate adverse societal, environmental, and economic effects; and

d. use resources wisely while minimizing resource depletion.

Part A

Per good design practice, and as required by the National Environmental Policy Act (NEPA), the design team has evaluated multiple routes for this new improvement. They have narrowed them down to three alternatives that were evaluated with available information. Gwen prepared the following summary table:

	Alternative A	Alternative B	Alternative C
Description	"Northern" route	Straightest path	"Southern" route
Time to complete	7 years	5 years	6 years
Probable Cost	$45 million	$75 million	$55 million
Economic Development	Access for planned future campgrounds and planned logging	No apparent advantage here	Another potential access to state park
Env. Impact – Trees	Medium impact	Minimal impact	High impact
Env. Impact – Threatened species	Medium impact	Medium impact	High impact
Political Preferences	Town A prefers Town B strongly opposes	Town A strongly prefers Town B opposes	Town A opposes Town B prefers
Right-of-Way Impact	Significant impacts, including private forest land	Least impacts	Significant impacts, including through state park
Utilities Impact	Minimal impact	Would require relocation of a major gas distribution line	No impact
Roadway Design	Longest of proposed paths, hilly and windy road	Preferred – shortest path and least elevation change	Hilly and windy with one very steep decline
Landslide Potential	Two areas prone to landslides	Low	One area prone to landslides
Structures	No bridge needed, smaller structures	Requires major bridge	No bridge needed, smaller structures
Impacts Tribal Lands/Rights	Requires tribal agreement	Potential infringement	No impact

As part of her due diligence as the project manager, Gwen asked her project team for their opinions about the three alternatives. There responses were:

Angela preferred Alternative B as it would produce fewer environmental impacts. She could be okay with A, but strongly opposed to C.

Jeff preferred Alternative A or C, in large part because he would make use of the new campground or new access to the state park.

Jimmy could make any of them work but was outspoken that it made no sense to spend $75 million to build a massive bridge in alternative B. (*See image in Part C.)

Solomon expressed different concerns with each option.

Gwen fully understands that transportation projects are all about trade-offs. As the project manager, she must be a responsible steward of public funds while satisfying the purpose and need of the project in a fair, just, and safe way. Executive leadership is asking for her professional (not personal) recommendation.

Questions

- ✓ Which of the three alternatives should Gwen recommend, and why?
- ✓ What factors of concern ought she prioritize, and why?

Part B

Gwen recommended Alternative C, and it was approved by the secretary of transportation. Design is actively underway.

Gwen received advance notice of preliminary project environmental reports on the alternative she'd recommended. Two of the possible recommendations represent significant schedule and budget risks and need to be addressed:

Recommendation #1:

The selected route (Alternative C) runs directly through a marbled murrelet nesting habitat area. If the forthcoming species survey identifies marbled murrelets, this would significantly impact the project's schedule and budget as subsequent environmental permits would dictate extremely strict Time-of-year-restrictions (TOYR) on tree clearing and construction to protect marbled murrelets during mating season and as the chicks grow.[3]

Gwen's environmental team presents her with two options:

a. Accept the risk of the habitat being occupied: Do nothing and absorb any undefined budget and schedule consequences that come with the TOYR.

b. Mitigate the risks: Perform preliminary "maintenance" activities that could also identify potential marbled murrelets habitats and "urge" them to relocate. If this is strategically scheduled such that the forthcoming species survey did not find any marbled murrelets, this effectively would avoid TOYR on critical path clearing and construction activities (i.e., destroy the nesting environment).

Recommendation #2

In response to the report, the environmental team is recommending two new structures (bridges) for animal crossings to improve human safety as well as wildlife survival rates, genetic diversity and viable population sizes. They will be recommending installation of fencing on both sides of the road one-half mile in each direction at both crossings to encourage wildlife to cross over the new structures. The preliminary cost for the two proposed crossings and fencing would be $2.1 million. These improvements would increase safety by reducing the number of vehicular animal strikes; however, it does mean cutting down many more trees for the structures, new fencing, and associated maintenance easements. The team has presented Gwen with two options: To:

a. build two wildlife crossings, or
b. not to build any crossings.

[3] Time-of-Year is a term relating to seasonal rules to protect sensitive wildlife species and limits construction and lumbering activities to times that are likely not to disturb, i.e. mating, nesting, etc.

Questions

- ✓ Should Gwen proceed with building the two proposed wildlife crossings? Why or why not? If yes, then which should she pursue, and why?

- ✓ Regarding the animal crossings, Gwen must weigh and balance competing values for this project: trees; animals; human life (less animal strike accidents); and the project budget? In the process of determining what to recommend, where should she put the greatest weight and why?

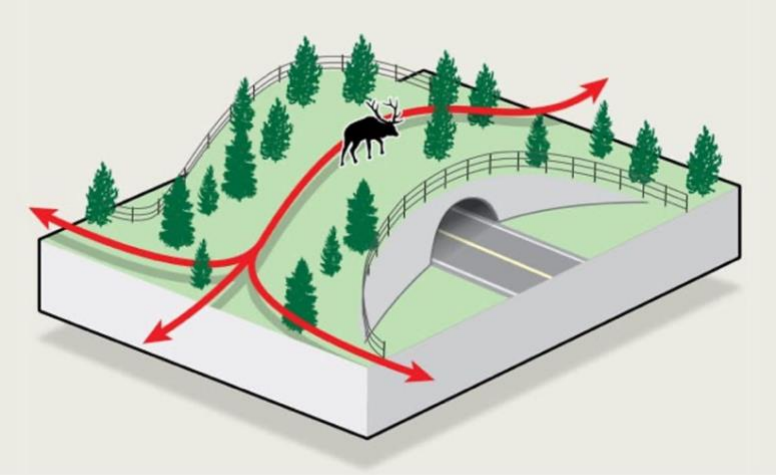
- ✓ In what way might performing recommended habitat maintenance for identified threatened species become a compromise of ethics? *

- ✓ Are the decisions addressed above consistent with Gwen's job responsibilities as the project manager, to develop and deliver the project within the defined budget, scope, and schedule?

Part C

The project moved ahead, having accepted the marbled murrelet risk. And the subsequent survey did identify marbled murrelet and therefore significant Time-Of-Year clearing and construction restrictions were imposed.

It was also decided to install the two proposed animal crossings and associated fencing.
The project holds a Public Hearing to present the plan and to elicit comments from the public. There is a large and engaged turnout at the public forum meeting. Many citizens and citizen groups speak and advocate for a variety of plan changes. Eric Steadfast was particularly vocal during the meeting, insisting that the project had failed to consider a rare and endangered plant community found in the understory of the trees. He wants a survey conducted to find out the exact scope and quality of the plant community before proceeding. The survey would be conducted through the Washington State Natural Heritage Program (WNHP). This would delay the final decision.



*Animal Crossing Bridge. (Source: "Improved Animal Crossings Show a Huge Decline in Wildlife Collisions: Keeping critters off the road and out of your grille," Jeff Sabatini, *Car & Driver Magazine*, Aug 7, 2018.)

Solomon Gray was in attendance and asked for assurance that the project would in no way jeopardize the free and natural movement of cougars, bears, and other native wildlife that normally crosses tribal land. He explained that the tribe has been tracking cougars for a decade and that tracking of bear would be needed before this project could start.

After the event, Gwen collates the hundreds of comments submitted in-person and via various social media platforms. She carefully examines all the comments, removes "bots," and then categorized the comments into five simplified groupings:

- Local business owners and wildlife enthusiasts who strongly advocate for larger curves and wider lanes to more easily support larger recreational vehicles (e.g., RVs, boats, campers, etc.).

- Residents who adamantly oppose any activity that changes the way things are in their residential area (what they hear and see, etc.) and want to be able to maintain a continued quality of life with things remaining as they are.

- Regional and national advocacy groups
    - The Alliance to Save the Land (ASL):
        - Demand a survey be done by the WNHP to determine if the rare plant community would be impacted.
        - Insist on shrinking lane widths, reducing curve radii, and decreasing shoulder widths to save more trees.
        - Advocate installing more wildlife crossings.
        - Are genuinely concerned about the potential for a landslide citing the Oso incident and homes downslope.
    - Bike enthusiasts demand a dedicated bike route along the new road as being part of the plan
    - Truckers strongly advocate for emergency truck run-off lanes to increase safety in case of failed brakes on the steep decline.

- The tribe wants to be sure they being heard and are included in the decision-making process for assurance that wildlife movements are being addressed.

Gwen schedules a meeting with the design team to consider response options. After much discussion, the team agrees that three critical issues need to be addressed before the upcoming summary meeting with the two town mayors. These are:

1. Regarding lane, roadway curve geometry, landslide potential and shoulder widths, whether to:
    a. move the roadway to avoid the potential landslide area,
    b. keep both shoulder and lane widths and curve geometry as designed,
    c. make lane and/or shoulder widths wider and expand curve radii, or
    d. make lane and/or shoulder widths narrower and shrink curve radii.

2. Regarding wildlife concerns, whether to:
    a. deny this request or
    b. add additional wildlife crossing(s).

3. Regarding bike paths, whether to:
    a. deny the request,
    b. stripe shoulders for a bike lane (in which case a subsequent decision must be made as to whether or not widen shoulders), or
    c. maintain vehicular shoulder and build separate bike path.

On the day before the summary meeting with the mayors of Town A and Town B, Jimmy Metcalf announced that the animal tracking the tribe is insisting would be necessary to address tribal concerns about animal movement, will slow the project down. Jimmy is adamantly opposed to any action that would further delay construction and add to the cost of the project, and he insists that the tribal "issues" are "non-issues."

Questions

- ✓ What is the right course of action and what should Gwen prioritize to make these decisions (e.g., safety vs. environmental (tree) conservation vs. economic development vs. construction costs, treaty rights, etc.)?

- ✓ How ought Gwen weigh conflicting citizen and citizen group preferences?

- ✓ What individuals, people, human communities, forest communities, and non-human animals could be impacted and how? What are the value propositions that might be used to maximize good and minimize harm?

- ✓ There is a WNHP database of information about rare plant species in Washington State. This information may or may not suffice for the area between Towns A and B. An additional survey could be conducted (as has been requested). Doing so could add up to 6 months to the project's start date. Not doing so could mean missing significant information about previously unidentified plant communities. What ought to be done?

Part D

Based on recommendations Gwen made, and after a series of conversations and negotiations between project managers, political leadership, and state agencies, several decisions were made:

a. To keep the road location as originally planned with lane widths and roadway curve geometry unchanged while widening the shoulders

b. To install one truck emergency runoff ramp, which increased the environmental impact area and number of trees to be removed

c. Not to wait for the tribe to begin bear tracking

d. To install a separate bike path.

The first decision (a) was largely unpopular among all involved. The fourth decision (d) caused angst for just about everyone on the design team, as the entire footprint of the project expanded and many design elements and permits would need to be adjusted. The team warns Gwen there will be schedule and budget impacts as a result of this change.

As the design is being finalized and the team is moving toward preparation for advertisement of construction, Angela Morales, the environmental team lead, suggests radically changing the Erosion and Sediment Control plans. She also makes a strong argument that a new rare plant survey is overdue in the geographic region of concern, and that a globally imperiled plant community may be at risk.

What had been proposed was a large clearing of trees to install a temporary sediment basin to capture runoff during construction to protect the stream's integrity. When the roadway is completed, the basin will be filled in and grassed. Angela said they could eliminate the sediment basin and install a series of smaller point-source sediment control measures. This would save a significant stand of mature trees. Angela said the regulatory agencies support this alternative as it prioritizes long-term saving of the trees over short-term sediment protection of the stream. Angela also proposes modifying the route to avoid landslide potential.

Gwen is excited about this option as it would also satisfy the very vocal local preservationist groups and may avoid costly repairs needed in the future. She vets this idea with the design team. Jeff strongly opposes the idea, asserting that while the Erosion & Sediment point measures will protect the stream from sediment, the altered flow rates during storms will produce meaningful stream erosion and negatively impact the fishing of this stream during and after construction.

They are also concerned about the excessive cost of rerouting the road to avoid a small area that has been determined to be of minimal risk for a landslide. Complicating matters, Gwen assured the vocal tourism and wildlife enthusiasts contingents at the public hearing that protecting fishing and the integrity of this stream was the top priority as well as citizen safety should a landslide occur.

Jimmy also expressed concern that this plan change would necessitate plan and construction sequencing revisions and an additional Environmental Impact Statement (EIS) that could delay advertisement, which could further strain the project budget.

At this point, multiple factors need to be considered:

- Long-term versus short-term priorities and benefits
- The value and strength of verbal commitments made to the public
- Trees versus fish and humans
- Preservationist versus tourism stakeholder interests

Weighing all these issues, Gwen's primary responsibility is to develop and deliver the project within its established budget, scope, and schedule.

Questions

- ✓ Should Gwen make the suggested Erosion & Sediment plan change or not, and why?

- ✓ What should be decided one about whether to use the existing plant database or conducting a rare plant survey?

Part E

At this point in the process, Gwen stepped up and decided to adopt the suggested Environment & Sediment plan change to eliminate the sediment basin and save the mature stand of trees and reroute the road around the potential landslide area. Recognizing the potential of having to stop the entire project if a rare plant community was identified, Gwen decided to forgo doing the survey and to rely on the existing database.

As the project is quickly approaching advertisement for construction, Gwen is in an exceedingly difficult position. The most recent cost estimate has skyrocketed and now exceeds available funding. Especially with the increased costs associated with the Time-of-Year tree clearing and construction revisions, the project scope cannot accommodate anything extra. For the project to proceed, some hard choices are going to have to be made. Three of the "add ons" must be eliminated, due to cost overruns, according to most recent cost estimates from the design team. Of each "add on" possibility under consideration, the project can only support building one of the following:

- two of the proposed animal crossings,
- a separated bike path,
- a widened roadway shoulder, or,
- a truck emergency runoff ramp.

Questions

- ✓ Which option should Gwen pursue, and why?
- ✓ How can she communicate and justify her decision to stakeholders, both those who support and oppose the decision?
- ✓ What is the value of Gwen's word, as communicated to stakeholder groups along the way?
- ✓ How ought she weigh trees vs animals' vs human safety?
- ✓ How much should Gwen's job responsibilities of developing and delivering the project within the established budget, scope, and schedule influence these decisions?

Teaching Notes

Regarding the question, "In what way might performing recommended habitat maintenance for identified threatened species become a compromise of ethics?" If the intention is to avoid Time-of Year restrictions by doing maintenance to drive the animals away, so they won't be found in the inventory, this is illegal in Washington State. Time of year restrictions are in place to protect the animals.

Before proceeding from one part to the next, students might ponder and discuss whether or not Gwen has made the right decisions.

Sometimes decisions are made that the project manager (or any team member) may not agree with, but those decisions still have to be carried out and supported. It may be important to discuss with students how they would manage such situations, where they are powerless and yet must proceed against their own better judgement or preferences. In this case, for example, Angela was overridden regarding conducting the rare plant survey and had to put her opinion aside to continue working on the project. Perhaps she failed in not being persuasive enough. Or maybe she simply hadn't considered the other factors. Another example is Jeff Osborn, the summer intern, who was shocked and disappointed when the tribal request for wild animal tracking was summarily dismissed. Jeff thought it was disrespectful to the tribe, plus he loves bears, but he didn't speak up.

One helpful resource for teaching this element of the case could be Mary Gentile's Giving Voice to Values (GVV): https://onlineethics.org/gvv-engineering-ethics. The GVV program teaches individuals how to act on their values when ethical conflicts arise. GVV starts from the premise that most people want to act on their values, but they also want their actions to be successful and effective. The GVV approach provides practical guidance to dealing successfully with challenges to your integrity and ethical principles. Its 7 pillar framework helps people build the necessary skills to recognize, speak, and act on their values by focusing on practical strategies and preparation rather than just identifying what is right. For the *To build or Not to Build* case study, students might use GVV to consider the values of key characters, and whether or not those values are upheld in their actions and decisions. And, to think about, script, and rehearse ways in which those values may have been more clearly expressed for better outcomes.

The following videos offer explanations of ethics in civil engineering, and could be useful for students considering this case:

What Are Ethical Dilemmas? - Civil Engineering Explained
https://www.youtube.com/watch?v=s0AXIAzpJXA

How Do You Solve An Ethical Dilemma? - Civil Engineering Explained
https://www.youtube.com/watch?v=2a0BvlsyYrM

Civil Engineering Ethics: Navigating the Moral Landscape
https://www.youtube.com/watch?v=RAFzYfWs3TU