Roadway Engineer

Benjermin Ochsner

General Instructions

1. For each page, synthesize the reading and research by writing in complete sentences in essay format.
   a. Use the green instructions in the notes below each page to focus your research and writing.
   b. Write about each question, prompt, or process provided in those notes.
   c. Write a full page of text with lots of detail (more than 250 words per page).
      i. Don’t generalize so much that your writing is devoid of detail.
      ii. Don’t repeat yourself.
   d. Cite each source by adding a hyperlink in the Title of the Article or law.
   e. Do not change the template:
      i. Text must be 14 point Lato left-justified type.
      ii. Refrain from adding extra margins or double spacing.
      iii. Do not bullet the paragraphs. Write in essay format only.
   f. Add additional pages if you need more room.

2. Add all sources to the Bibliography page.
   a. Include author, year, title, publisher, and URL.
   b. Number or bullet them using the list button.

When in doubt, write to the instructor for clarification using the Canvas Inbox.
The Oregon Department of Transportation (ODOT) is seeking applications for a Roadway Engineer position in the Portland Metro area (2020). The position involves reviewing permit drawings, performing quality control checkups, addressing tort claims, and the general application of engineering expertise, all under the guidance of a “senior roadway manager.” Other tasks the roadway engineer might engage in include testifying in court against litigation claims, training other engineers and technicians, community outreach, and field visits. The work is primarily office-based and requires the use of “computers and software to develop CADD drawings and documents.”

Among the requirements for this position is a PE (professional engineer) license in either civil, structural, or transportation engineering, and a clean driving record. Although the applicant’s driver’s license need not be issued in Oregon, the applicant will have to obtain an Oregon PE license within 6 months of accepting the position, if hired from out of state. The position also prefers that applicants have a BS in civil or transportation engineering along with three years’ work experience in the field. Experience with litigation testimony is also a plus.
Company, position, and requirements

The position is “represented by the Association of Engineering Employees of Oregon (AEE).” Among other things, the AEE negotiates salaries for engineering employees, according to Collective Bargaining Agreement (CBA) (2020). Although Oregon, nominally, is not a right-to-work state, public employees (such as employees of ODOT) may not be forced to either join unions or pay union dues because of the US Supreme Court’s decision in Janus v. AFSCME, as noted in Supreme Court Deals Blow to Government Unions (2018).

Obtaining PE licensure in Oregon generally requires passing two exams: the NCEES FE (fundamentals of engineering) exam and the PE (principles and practice of engineering) exam, according to Licensing Process in Oregon (n.d.). In addition to those requirements, licensure requires a 4-year degree approved by ABET (Accreditation Board for Engineering and Technology) along with 4 years of qualifying experience. Lastly, the PE application must have at least 5 sealed referrals, of which 3 must be licensed PEs.
One software- or data-related problem that I could encounter when working as a roadway engineer are phishing attacks. According to #NewsBytesExplainer: What are phishing attacks and how to avoid them, these attacks work by gaining the confidence of the target individual and tricking them into divulging private information through a fake login or file repository (2020). As a roadway engineer, I would be expected to perform work for large bond projects involving multiple parties, with email being the primary means of communication. Data might be shared through sites such as Smartsheets (similar to Google Sheets) or through software like Bluebeam Studio, which allows access to and editing of shared PDFs. A successful phishing email would allow a bad actor to obtain login information for one or more of these platforms and allow that person access to sensitive information such as background checks, critical site drawings, and confidential litigation documents. The company I’m currently interning for this Summer was subject to a successful phishing attack prior to my starting there, and a large volume of phishing emails have followed in the wake of that attack. Principle 2.9 of the ACM code of ethics describes the means by which computing professionals should design systems that are secure without becoming byzantine or difficult to operate, according to ACM Code of Ethics and Professional Conduct (2018). This might mean a system that heads off or blocks phishing emails, alerts recipients when suspect emails arrive, and provides a straightforward means for those recipients to report emails to the appropriate department.
As a roadway engineer, it would not necessarily be my primary responsibility to monitor for phishing emails and deal with them as needed. However, there are steps I could take to reduce the potential fallout. One step is to earnestly attend any company-required training on information security, which would help me learn to recognize phishing emails and may also include information on what steps to take when I receive them. *Dodge ransomware – learn to spot a phish* states that awareness is a major issue in phishing attacks, which often occurs when companies lack strong IT departments (2020). *Order Out of Chaos: Tackling Phishing Attacks* recommends a comprehensive program for reducing susceptibility to such attacks, which includes “considered staff awareness and [a] training program” (2020). A second step would be to immediately report to all involved stakeholders any incidents of me or my team members succumbing to a phishing attack. This would provide an opportunity for those parties and my department to secure vulnerable information. Such a step would be considered compulsory under Canon 4a of the American Society of Civil Engineers (ASCE) *Code of Ethics*, which states that engineers shall inform their clients of incidents influencing the quality of their work (2020). A third step I could take is to be critical of the software used by my company and offer suggestions when I feel that improvements can be made. Even as a relative layperson in the field of information security, if I feel that some of the platforms in use are vulnerable, I should speak up. If I ultimately determine that my company cannot or will not improve as needed, I may be compelled to complete an ethics violation form (*ASCE, 2020*).
Hardware Dilemma

One way in which a roadway engineer has to take hardware manufacturing into consideration is in the use of technology both in road construction and in the finished product. Technology used during construction might include electronic surveying equipment and tablet PCs for monitoring work progress. Finished roadwork might utilize sensors to monitor traffic and road conditions. Ultimately, both types of hardware have a limited lifespan and decommissioning this hardware needs to be considered. According to UN reports global e-waste production soared beyond 53 million tonnes in 2019, e-waste disposal increased by over 17% in 2019, leading to a new record in disposal (2020). The same article notes that in order to most effectively combat the increasing volume of waste, the fourth industrial revolution should focus on a circular economy to avoid resource depletion. This adherence to a circular economy also aligns with principle 1.1 of the ACM Code of Ethics and Professional Conduct, which states that “computing professionals should promote environmental sustainability both locally and globally” (2018).
One step I could take as a roadway engineer is to ensure proper care of electronic equipment used during a project. This means bringing awareness to how team members physically handle equipment like tablets and total stations, which are used in surveying. By reducing breakages, hardware lifecycles are increased. A second step that can be taken is donating obsolete equipment to education institutions so that it can enjoy a second life as part of a school’s engineering curriculum. Donation of used equipment can be less expensive than processing e-waste, which according to We are throwing away a record 53.6 million metric tons of electronics can have little economic gains, be hazardous to workers, and in some cases be downright impossible due to lack of infrastructure (2020). A third step which I could take is ensuring that during the design phase of a roadway project, specifications are written up detailing the proper decommissioning and disposal of any electronic monitoring equipment used during the roadway’s lifetime. This might mean donating such sensors as previously described or detailing how to contact the appropriate e-waste processing centers for proper disposal, as described in E-waste is a harmful and growing problem. Here's how to recycle your old electronics (2020).
One of the ways in which ODOT “advertises” is by describing the set of outcomes it expects from the completion of a particular road project. Some of these outcomes might be reducing travel time or collision rates, reducing emissions, and so on. As a roadway engineer it may be my responsibility to perform a comprehensive review of a proposed project and use my engineering expertise to determine if a project will meet expectations. Since roadway projects rarely have completely positive or completely negative effects (it’s usually a mix of the two), it’s important to include all members of the local community in discussions regarding proposed roadway projects. If these discussions aren’t carried out in good faith, the project can falter before it even begins, as has recently begun to occur with ODOT’s proposed Rose Quarter Project, described in Governor: Black community support key to I-5 Rose Quarter plan (2020). Part of the goal of this project was to undo some of the harm caused by freeway projects from the 1960s which resulted in hundreds of homes in the Albina neighborhood being destroyed, as described in State’s Rose Quarter freeway project will press on, without support from Portland leaders (2020). However, disagreement exists on whether the project is aiming to meet these goals. Once principle from the ACM Code of Ethics and Professional Conduct which might apply is 1.4, which emphasizes taking steps to avoid discrimination (2018). The freeway constructed in the Albina community in the 1960s was especially harmful to the black community.
The first step I could take in addressing issues like this is to be truthful when communicating a roadway project’s expected outcomes. Truthful messaging would allow stakeholders to discuss actual issues, and can prevent retaliation due to false advertising, as described in Negative Effects of False Advertising (2018). A second step would be to communicate project outcomes across multiple platforms to ensure the widest reach, especially to communities experiencing socio-economic issues. Digital divide persists even as lower-income Americans make gains in tech adoption notes that in poorer neighborhoods, 30-40% of residents lack access to the Internet (2019). Comprehensive outreach or “advertising” of project outcomes is important in order to reach these communities. A final step that I could take is to ensure that the full scope of a project’s effects is more openly disclosed in an accessible fashion. Things like environmental impact, source of materials, and basis for why a particular design alternative was chosen. This can improve community engagement. Lack of messaging on environmental impact was cited as a reason why community members have begun backing out of ODOT’s Rose Quarter project (Maus, 2020).
Access, Equity, or Infrastructure Dilemma

One issue that I could run up against as a roadway engineer employed by ODOT concerns unions, specifically the AEEO (Association of Engineering Employees of Oregon). Currently, Oregon has no right-to-work laws, according to Oregon Right to Work Laws (2016). This means that, in general, prospective employees in Oregon may be forced to either join a union or pay union dues in order to gain employment with a business. However, government unions are a special exception due to the ruling in Janus v. AFSCME, described in Supreme Court Deals Blow To Government Unions (2018). According to this ruling, public employees may not be compelled to either join a union or pay dues. This would include all ODOT employees. On the other hand, the Oregon Worker Freedom act does not allow employers to reprimand workers who don’t attend anti-union gatherings, according to NLRB Challenges Oregon Law Barring 'Captive' Meetings (2020). Between not being required to pay union dues, and not being required to attend anti-union meetings, it’s not a stretch to imagine that tensions in the workplace could arise from disagreements regarding union membership and union benefits. Two principles which might apply from the ACM Code of Ethics and Professional Conduct are 1.1, which acknowledges that everyone has a stake in computing, and 1.4, which emphasizes being fair and having tolerance for others (2018).
Access, Equity, or Infrastructure Dilemma

One step I can take to mitigate this possible issue is to personally refrain from discussing the matter, which could limit opportunities for others to vocalize strong opinions on the subject. A second step I could take is to separate and ignore union membership when considering the value each person brings to the team. Creating a supportive workplace for everyone is indicated as an important step in 6 Ways To Cultivate A Workplace Culture That Inspires Diversity And Inclusion (2020). A third step I could take is to personally hold accountable team members who do not observe workplace rules aimed at promoting an inclusive workplace. This could prevent the debate over union membership from being weaponized against individuals.
Intellectual property, abuse, and privacy laws

As a roadway engineer, I might come across two types of personal data during the course of my work. One type comes in the form of background checks. If working on a bond project that includes improvements adjacent to a school or similar facility, all workers on the project (regardless of company) need to pass a background check, usually administered by the owner representative (ODOT, in this case). These checks contain personal information like social security numbers, addresses, and a self-disclosed criminal history. The second type may come in the form of data collected from drivers using an existing roadway to build a set of traffic and usage statistics. A bad actor could potentially abuse access to this data. The most relevant principle of the ACM Code of Ethics and Professional Conduct is 1.2, which recommends against “unjustified destruction or disclosure of data” (2018).

One step I could take in securing background check data is ensuring that a secure method of storage and transmission is utilized. It’s noted in Many people using email to share files despite lack of security that although email remains a popular means of file-sharing, it’s also lacks security (2020). The article goes on to note that nearly a third of users have fallen for email phishing attacks, which makes them a weak link when sensitive information is being shared. The use of purpose-made file-sharing software with end-to-end encryption would be a more secure alternative.
Another step would be to limit the number of parties who are granted access to such information. Ideally, this would be limited to just the applicant (the worker filling out the background check form) and the agency performing the actual check. The worker could be given a link to a secure file repository to which to send their application, minimizing the number of parties who can access this information. A third step that I can take, especially as it relates to collecting of traffic data, is to collect only those data points relative to the traffic study. Potentially identifying information like type of car, license plate, or number of passengers, is not relevant.
Whistleblowing

One dilemma that would require me to act is if I uncovered unauthorized access to worker background check information, especially if it was intentional. Electronically transmitted background check information may be considered a form of electronic communication. Such communications are protected by the Electronic Communications Privacy Act (ECPA), according to Electronic Communications Privacy Act (ECPA) (2020). Unauthorized access to transmission of these communications is a violation of the ECPA, and violators are subject to “up to five years in prison and fines up to $250,000.” It’s worth noting, however, that information stored on cloud servers may not be protected by the ECPA, and email transmissions older than 180 days are also not covered by the ECPA.

A local district attorney’s office might be a good place to start. At a minimum, their office would be able to indicate to the victim where best to direct their complaints. Furthermore, according to ORS 646A.604, security breaches must be disclosed to affected parties (n.d.). If the person I witnessed illegally accessing background check data was also a civil engineer, they would likely be violating Canon 6 of the ASCE Code of Ethics, which recommends against fraudulent or dishonest behavior (n.d). Such violations would need to be reported to the ASCE for an ethics violation.
Whistleblowing

Consequences for the person committing these acts are two-fold. The legal consequences may very well land them in jail and saddled with heavy fines. From a professional standpoint, a licensed engineer would likely lose their license which would prevent them from “practicing engineering” in the state of Oregon at minimum. This would also prevent them from being able to sign off or seal engineering drawings. If the person was a member of the ASCE, they might be removed from that organization as well.
The ethical approach that would speak the most to me in many work-related situations is the common good approach, which according to *A Framework for Ethical Decision Making* takes into consideration the common elements affecting all people (2015). Roadway engineers typically work on projects which will be used by countless people over the course of several decades. Furthermore, the construction of these roadways leaves an indelible mark on the community, for better or worse. It’s usually not sufficient to judge some roadway project as merely providing a connection to a new community or increasing traffic in a given area. In considering the effects each of these dilemmas might have, I would need to be aware of the wider impact they could also have on the community I’m working in.

The use of vulnerable software resulting in a data breach could undermine the public trust in ODOT and the projects it works on. Improperly discarded hardware has a negative impact on the environment which affects the whole community. Choosing to dispose of old hardware like total stations instead of donating them eliminates a chance to support a school or other educational facility. Failure to disclose the full and truthful scope of a project prevents communities from making decisions that are best for them and can also reduce trust in ODOT. Being unwilling to create an inclusive workplace would ultimately limit ODOT from retaining excellent employees and reduce ODOT’s ability to perform its duties.
If I want to best serve the community and everyone who lives in it, I would be compelled to not only act in deference to the common good, but I would also have to act accordingly when I see others who do not do the right thing in these various dilemmas.


Bibliography


