CEE 392/HUM 392/ENV 393/ANT 396)

Engineering Justice and the City

Technologies, Environments, and Power

Princeton University
Department of Civil and Environmental Engineering
Spring 2022: Tuesdays & Thursdays, 3-4:20PM EST

Instructor
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Course Description

From highways that bulldozed through predominantly Black neighborhoods in New York City to aqueducts that wrest water from indigenous farmers for Mexico City's wealthy enclaves, engineers have long played a crucial role in etching inequality into both cities and their rural hinterlands, all in the name of the "public good." This course investigates this history and the contemporary politics of engineering while asking a fundamental question: how do we engineer just cities?

With its grounding in the natural sciences and mathematics, engineering design is often assumed to be a neutral practice. Given constraints, engineers find the objectively best solution to the problem they are given. In this course, we ask where these constraints and problems come from, who reaps the benefits of engineering solutions, and whether we can truly make claims to objectivity in engineering practice. As we will learn, urban infrastructures and technologies hailed as revolutionary advances by some segments of the population have often been seen as crushing setbacks by others.

This course is an opportunity to reimagine engineering as a liberatory and collective practice that challenges – rather than reinforces – systems of domination, inequality, and environmental exploitation in cities. Interdisciplinary readings will examine how social and environmental injustices in cities have been produced or reinforced through engineering

designs while also exploring new frameworks for designing just cities. Students will then put these frameworks into practice by participating in a conceptual design studio, focused on designing interventions that undermine the ability of the powerful to exploit both humans and the environment.

This class is intended to bring together students interested in urban environments and design from across disciplines, from the humanities and architecture to engineering. This interdisciplinarity is crucial given that understanding the relationship between engineering and justice in cities requires not only engineering analysis, both also the open-ended forms of inquiry and critique that humanists offer as and the imaginative practices of planners and architects.

Learning Objectives

This course is fundamentally designed to explore the relationship between engineering, society, and the environment, such that you are better prepared to practice engineering with a critical eye to social and environmental justice concerns and/or to serve as an advocate for communities affected by new engineered infrastructures and technologies.

After completing the course, you should be able to look at *any* engineered object or a conceptual plan and have new questions to ask:

What problem is this the solution to? Whose problem is it – and who is the solution for? Who or what will be affected by its design? How has its design been affected by dominant social norms and politically powerful groups? What ecologies does it draw on, and in what ways (and in whose interests) does it transform those ecologies? Who reaps the benefits, and who suffers the costs of its creation? How might we re-engineer a technology like this such that it is more ecologically and socially just?

At the end of this course you should have new tools and ways to begin answering these questions, as well as being able to:

- Describe the relationship between engineering, political power, and inequality in cities.
- Identify how and why different interests come to dominate engineering design.
- Analyze how engineers' identities and experiences shape their design practice implicitly and explicitly.
- Articulate your own vision of social and environmental justice, and what role engineering might play in achieving that vision.
- Identify key questions to ask about the social and environmental equity implications of new urban technologies and infrastructures.

Accessibility

I want to make this class work for everyone. If you have a disability or chronic medical condition, please meet with me as soon as possible during office hours to discuss your particular learning needs and also contact the Office of Disability Services (ods@princeton.edu, 609-258-8840) to arrange an appointment to discuss your needs. Since accommodations require early planning, please contact the Office and me as soon as possible.

Counter-Engineering Project

Much of the class is dedicated to a *radical critique* of engineering, in the sense of understanding the ways that engineering is intertwined with the roots of social injustice and environmental exploitation. But critique is only one part of what Paolo Freire called *praxis*, "reflection and action upon the world in order to transform it."[1] Engineering is fundamentally a practice trying to transform the world, but as we will find in this class, it has disproportionately transformed the world in the service of the powerful.

What if engineering could be *subversive* – undermining those with power, frustrating their plans to extract the wealth of the poor, the sweat of the colonized, and the bounties of the planet's ecosystems? What if engineers worked in solidarity with the downtrodden, rather than designing the master's steamrollers? Thinking with Audre Lorde, what if socially conscious engineers not only collectively refused to build the master's tools, but worked to *dismantle* them?[2]

This adversarial praxis is what we will tentatively call "counter-engineering" in this class. There is no textbook for counter-engineering, and you won't find it on any ABET-approved engineering curricula. This class is about as close as we're going to get. But our goal is to develop speculative and conceptual models of how engineers might *do* counter-engineering – models that might inspire others.

For this, you'll participate in a *group* project to design an "intervention" that may or may not actually be a tangible design. The project is deliberately open-ended, because there are many creative ways one might use engineering *against* power and *for* a radically different society – and it would be silly for me to pretend to have thought of them all. That is why we are doing this together. I want to learn from you. But that doesn't mean you're on your own. We'll be helping you every step of the way.

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[1] Freire, Paulo. Pedagogy of the Oppressed. Translated by Myra Bergman Ramos. 30th Anniversary. Continuum, 2005, 55.

[2] Lorde, Audre. "The Master's Tools Will Never Dismantle the Master's House." In *Sister Outsider: Essays and Speeches*, 110–14. Berkeley, CA: Crossing Press, 1984.

The goal of the project is to create a series of speculative case studies to show how counter-engineering might work. You'll begin by picking an urban problem you're interested in. This means thinking first about a documented injustice in an urban environment at least one of your group members knows well or you all can visit,[3] which engineers had a role in bringing about and/or that you think engineering could play a role in resolving. Once you've determined this, your goal is to sketch out ways that engineering might be used to challenge this injustice *at the root*. This means – to the extent possible (a determination you'll have to justify) - cutting off the *production* of the injustice, rather than simply making the suffering it causes more tolerable or its devastation less visible. As we will see, figuring this part out is more difficult than it sounds. We'll help you – and you'll help one another, through a series of workshops in class.

The most basic way you'd do this project is by picking an engineered urban infrastructure or technology *currently in use or planned* that is bound up in the production of social or environmental injustice – e.g., a highway expansion project or an oil pipeline running to an urban center by way of indigenous lands. You could then attempt to use engineering tools to radically *redesign it* (at a level of granularity appropriate to the scale of the infrastructure in question) if you thought it was salvageable. Or you might simply try to use your knowledge to find a way to *monkey wrench* the entire thing: to quote Andreas Malm, how could you (figuratively at least) find a way to "blow up the pipeline"?[4] Or you might conceptually design a *new* tool or infrastructure that offers a way to *bypass* or otherwise undermine the unjust infrastructure in question, rendering it useless.

No matter what direction you take, your group will need to produce first a nuanced analysis of the relations of power involved in the production of the injustice you have chosen to intervene in (which you'll write about in your midterm), and then justify how your chosen intervention *undermines* or otherwise scrambles those power relationships. All of this will go in your final report and presentation.

We will talk about this in much more detail, and in many meetings with each group, to help you scope out an approach that is both feasible and appropriate to the issue your group has chosen and to the abilities of those in the group. (We won't expect a Foucauldian discourse analysis from a group of civil engineers, nor will we expect sociologists to do differential equations!)

[3] You might also, of course, pick a seemingly *non*-urban space that is affected by urban centers near and far.
[4] Malm, Andreas. *How to Blow up a Pipeline: Learning to Fight in a World on Fire*, 2021.

Grading

Participation (25%)

This course is fundamentally based on learning from each another. By not attending and participating in class, you both deny yourself the opportunity to learn from other students and the chance for other students to learn from you. With this in mind, to receive full credit, you must complete short weekly reading response assignments, attend and participate actively (in the ways that are most comfortable to you) and respectfully in all classes.

Reading Responses

Reading responses will be short, one paragraph writing exercises that demonstrate your comprehension and reflection on the readings and help seed our discussions. I will provide more details in class, but the point of this exercise is to help you think across the texts we are reading each week and link them with what you have already read, while also giving you a chance to provide your own critical take and questions, which will help guide our discussions in class.

Reading responses are due at 11:59PM Monday nights, to give the teaching team time to read them before class on Tuesday. The only exception is the first week, when the reading response is due at 11:59PM on Wednesday.

Of course, we do understand that things happen. For this reason, every student is granted one "no questions asked" absence and you may omit one reading response (these do not need to be the same day). If you need to miss another day and/or reading response beyond this, you will lose a proportional part of your participation grade unless you have a compelling reason (such as a documented medical emergency or athletic obligation).

Reading Response Rubric

The responses are graded complete/incomplete, but they are an important part of your grade. There are no "right" answers, but there is a complete and incomplete way to do these responses. **Here are the three core things you have to do to get credit:**

1. **Identify a theme across texts.** A complete response will first identify and briefly (!) summarize at least one central theme, issue, or problem that the texts for the week bring up. This doesn't mean a summary of the articles/chapters, but rather a boiling down: what do these readings tell us? It's OK to focus more on one reading than others in doing this and you don't have to address all the themes that come up. You don't have to necessarily 'cover' all the readings, but we do want to see you engage with more than one of the texts assigned each week. Bring them into conversation (i.e. "A and B both point to the fact that technology is...").
2. **Connect to other texts and/or your own life experience and knowledge:** In addition to this, your response should also generally make at least some mention of how the week's readings connect with others you have read in the class. This doesn't

have to be a rigorous analysis - think more a brainstorming of relationships. Alternatively, you can also write about how the readings connect to your own experiences or prior knowledge. I encourage you to do both.

3. **Questions and/or critiques:** Finally, offer a question the readings raise for you, or a critique you might make of them. What doesn't quite make sense, or what seems unaddressed or simply wrong? We'll use all of these in class to discuss.

Counter-engineering Project

Midterm Report (25%)
Your team will first produce an 8-12 page (double-spaced, not counting illustrations) original written analysis of the problem being addressed, which links your outside research about the situation to the readings from the course.

Final Intervention Report (50%)
Your team will then produce a 15-20 page (double spaced, not counting illustrations) final report* detailing the problem addressed, the alternatives considered, and how your team arrived at your chosen conceptual intervention. The report should pay special attention to how the chosen intervention embeds social and environmental justice into – or challenges injustice through - its materials, siting, configuration, and/or operations.

*If you would like to propose a website, video, map, or other format, please get in touch with the teaching team. In such cases, a much shorter report may be acceptable.

Readings

The reading schedule below is subject to change as the course develops and we see what issues need more or less attention. Most of the texts below will be available as PDFs on Canvas, and a few others digitally via the library. There are no required books to purchase for the class.

Individually, the readings in the scheduled below do not all necessarily speak directly about engineering *and* cities together. The nature of our course topic means that there is not a lot of scholarship (or even popular materials) that critically address the intersection of these themes. What I have tried to do here is group readings together that address different dimensions of the problematic to be discussed each week. Together – and in conversation with the other texts – the readings *can* tell us something about our central question of how to engineer just cities. But that is intellectual work that you must do as you read, and we will do together in class.

Lastly, do not be overwhelmed by the reading list. As you'll see, the readings are a mixture of denser, longer academic texts that explicate central concepts and shorter pieces that are brief case studies or polemical arguments that help illustrate the core themes or provoke our

thinking in new directions. Feel free to read the shorter texts first to get warmed up before diving into the longer texts, or vice versa.

Course Schedule

Note: these readings are subject to change; please check Canvas for the most up-to-date list.

Week 1: Engineering (Un)just Cities
January 25th & 27th

Readings:

- Alder, Ken. Engineering the Revolution: Arms and Enlightenment in France, 1763-1815. Princeton, N.J.: Princeton University Press, 1997. (**Introduction**)
- Cohen, B.R. "Public Thinker: Donna M. Riley on Engineering, Ethics, and Social Justice." *Public Books* (blog), February 24, 2020. https://www.publicbooks.org/donna-riley-on-engineering-ethics-and-social-justice/.
- Galeano, Eduardo. "To Be Like Them." In *The Post-Development Reader*, edited by Majid Rahnema and Victoria Bawtree, 214–22. New Jersey: Zed Books, 1997.
- Chahim, Dean. "Engineers Don't Solve Problems." *Logic Magazine*, Fall 2018. https://logicmag.io/failure/engineers-dont-solve-problems/

Project Milestone:

- **Do:** Begin thinking about ideas for project.

Week 2: Technology as Social Order
February 1st & 3rd

Readings:

- Winner, Langdon. "Do Artifacts Have Politics?" *Daedalus* 109, no. 1 (1980): 121–36.
- Faulkner, Wendy. "The Technology Question in Feminism: A View from Feminist Technology Studies." *Women's Studies International Forum* 24, no. 1 (January 1, 2001): 79–95. https://doi.org/10.1016/S0277-5395(00)00166-7.
- Rosenberger, Robert. Callous Objects: Designs Against the Homeless. Minneapolis: Univ of Minnesota Press, 2017. https://doi.org/10.5749/9781452958538 **(Introduction, Ch.1,2,3, and 8 – *these are very short chapters!*)**
- Schnitzler, Antina von. "Citizenship Prepaid: Water, Calculability, and Techno-Politics in South Africa*." *Journal of Southern African Studies* 34, no. 4 (December 1, 2008): 899–917. https://doi.org/10.1080/03057070802456821.

Project Milestone:

- **Do:** Group brainstorm of project ideas, begin to find common interests. Come with ideas!
- **Meet (optional)**: Meet with instructor or AI to brainstorm tentative ideas.

Week 3: Engineered Environments
February 8th & 10th

Readings:
- Illich, Ivan. "Energy and Equity." In *Toward a History of Needs*. New York: Pantheon, 1978.
- Needham, Andrew. *Power Lines: Phoenix and the Making of the Modern Southwest*. Princeton, NJ: Princeton University Press, 2014. **(pp.1-19, 157-182, 246-257)**
- Ottinger, Gwen. "Environmentally Just Technology." *Environmental Justice* 4, no. 1 (March 1, 2011): 81–85. https://doi.org/10.1089/env.2010.0039.

Project Milestones:
- **Do:** Select small groups, based on shared interests.

Week 4: Building for Whom? Engineering, Capital, Power, and Class
February 15th & 17th

Required Readings:
- Marx, Karl. "Capital, Volume One." In *The Marx-Engels Reader*. Edited by Robert C. Tucker. 2nd Revised & Enlarged edition. New York: W. W. Norton & Company. **(pp.302-419)**
- Noble, David F. America by Design: Science, Technology, and the Rise of Corporate Capitalism. Oxford: Oxford University Press, 1979. **(READ pp. xvii-xxvi, 33-49, 257-265, 321-324, SKIM 265-320)**
- Fleming, Mark D. "Mass Transit Workers and Neoliberal Time Discipline in San Francisco." *American Anthropologist* 118, no. 4 (2016): 784–95. https://doi.org/10.1111/aman.12683.

Recommended:
- Graeber, David. "Of Flying Cars and the Declining Rate of Profit." *The Baffler*, no. 19 (2012). http://thebaffler.com/salvos/of-flying-cars-and-the-declining-rate-of-profit.

Project Milestones:
- **Assignment:** Group project idea (one paragraph - what, where, why, how of the project) due by email to teaching team by Monday Feb. 15th at 11:59pm.
- **Meet:** Mandatory meetings with instructor during office hours to discuss and refine idea.

Week 5: Urban Space, Nature, and Capital
February 22th & 25th

- Harvey, David. "The Right to the City." New Left Review, II, no. 53 (October 2008): 23–40.
- Candiani, Vera. Dreaming of Dry Land: Environmental Transformation in Colonial Mexico City. Stanford, California: Stanford University Press, 2014. **(pp. 1-14, 81-120)**

- Danyluk, Martin. "Supply-Chain Urbanism: Constructing and Contesting the Logistics City." *Annals of the American Association of Geographers* 111, no. 7 (2021): 1–16. https://doi.org/10.1080/24694452.2021.1889352.
- Swyngedouw, E. "Power, Nature, and the City. The Conquest of Water and the Political Ecology of Urbanization in Guayaquil, Ecuador: 1880–1990." *Environment and Planning A* 29, no. 2 (February 1, 1997): 311–32. https://doi.org/10.1068/a290311.
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Week 6: Planning, Modernity, and Control
March 1st and 3rd

- Scott, James C. Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed. New Haven: Yale University Press, 1998. (**pp. 1-8, 53-63, 73-83**)
- Davis, Mike. "Fortress L.A." in *City of Quartz: Excavating the Future in Los Angeles*. Reprint edition. New York: Vintage, 1992. (pp. 221-264)
- Mattern, Shannon. "City Console" in *A City Is Not a Computer: Other Urban Intelligences*, 2021. (pp.18-50)

Recommended:

- Baker, Kevin T. "Model Metropolis." *Logic Magazine*, January 1, 2019. https://logicmag.io/play/model-metropolis/.
- Graham, Stephen. "Lessons in Urbicide." *New Left Review*, no. 19 (February 1, 2003): 63–77.

Week 7: Rethinking Expertise
March 15th & 17th

Required Readings:

- Murphy, Michelle. *Sick Building Syndrome and the Problem of Uncertainty: Environmental Politics, Technoscience, and Women Workers*. Durham, N.C.: Duke University Press, 2006. **(pp. 19-34, 81-110, 179-180)**
- Mitchell, Timothy. "Can the Mosquito Speak?" in *Rule of Experts: Egypt, Techno-Politics, Modernity*. Berkeley, CA: University of California Press, 2002. (pp.19-53)
- Scott, James C. "Thin Simplifications and Practical Knowledge: Mētis" in Seeing like a State: How Certain Schemes to Improve the Human Condition Have Failed. New Haven: Yale University Press, 1998. (pp. 309-341)

Recommended:

- Haraway, Donna. "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective." *Feminist Studies* 14, no. 3 (1988): 575–99. https://doi.org/10.2307/3178066.
- Ottinger, Gwen. Refining Expertise: How Responsible Engineers Subvert Environmental Justice Challenges. New York: NYU Press, 2013.

- Schmid, Sonja D. *Producing Power: The Pre-Chernobyl History of the Soviet Nuclear Industry*. Cambridge, Massachusetts: The MIT Press, 2015. **(Chapter 3)**
- Costanza-Chock, Sasha. *Design Justice: Community-Led Practices to Build the Worlds We Need*. Cambridge, MA: MIT Press, 2020**. (Conclusion)**

Week 8: Midterm Presentations
March 22nd & 24th

No Required Readings, instead, read for midterm report.

Due on Monday, March 21st: Midterm Report

Week 9: Optimizing for What?
March 29th & 31st

Readings:
- Illich, Ivan. "Convivial Reconstruction" in *Tools for Conviviality*. London: Marion Boyars, 2001. (pp. 10-45)
- Bernes, Jasper. "Planning and Anarchy." *South Atlantic Quarterly* 119, no. 1 (January 1, 2020): 53–73. https://doi.org/10.1215/00382876-8007653.
- Livingston, Julie. "Prologue: A Planetary Parable" in *Self-Devouring Growth: A Planetary Parable as Told from Southern Africa*. Durham: Duke University Press, 2019. (pp.1-10)

Recommended:
- Graeber, David. "Of Flying Cars and the Declining Rate of Profit." *The Baffler*, no. 19 (2012). http://thebaffler.com/salvos/of-flying-cars-and-the-declining-rate-of-profit.
- Illich, Ivan. *Tools for Conviviality*. London: Marion Boyars, 2001. (remaining pages)
- Hickel, Jason. "The Limits of Clean Energy." *Foreign Policy* (blog). Accessed March 9, 2022. https://foreignpolicy.com/2019/09/06/the-path-to-clean-energy-will-be-very-dirty-climate-change-renewables/.
- Winner, Langdon. *The Whale and the Reactor: A Search for Limits in an Age of High Technology*. Chicago: University of Chicago Press, 1989. (**Ch.3, Ch.10**)
- Wu, Jimmy. "Optimize What?" *Commune*. Accessed March 15, 2020. https://communemag.com/about/.
- Gordon, Aaron. "The Broken Algorithm That Poisoned American Transportation." Accessed August 30, 2020. https://www.vice.com/en_us/article/v7gxy9/the-broken-algorithm-that-poisoned-american-transportation-v27n3.

Project Milestones:
- **Meet:** Mandatory meetings with AI or Instructor during office hours to discuss project.

Week 10: Revolutionary Cities
April 5th & 7th

Readings:

- Bernes, Jasper. "The Belly of the Revolution: Agriculture, Energy, and the Future of Communism." In *Materialism and the Critique of Energy*, edited by Brent Ryan Bellamy and Jeff Diamanti. Chicago: MCM', 2018.
- Bernes, Jasper. "Between the Devil and the Green New Deal." *Commune*, Summer 2019. https://communemag.com/between-the-devil-and-the-green-new-deal/ (Links to an external site.).
- Graeber, David, and D. Wengrow. "Imaginary Cities." In *The Dawn of Everything: A New History of Humanity*. New York: Farrar, Straus and Giroux, 2021.
- Iveson, Kurt. "The Sydney 'Green Bans' Show How We Can Transform Our Cities." *Jacobin*, July 10, 2021. https://jacobinmag.com/2021/07/australia-sydney-urbanism-construction-builders-labourers-federation-nsw-green-labor-militancy.

Week 11: What if we said "no"? Organizing and the Power of Refusal
April 12th & 14th

Readings:

- Tarnoff, Ben. "The Making of the Tech Worker Movement." *Logic Magazine*, May 4, 2020. https://logicmag.io/the-making-of-the-tech-worker-movement/full-text/.
- Banks, David Adam, and Michael Lachney. "Engineered Violence: Confronting the Neutrality Problem and Violence in Engineering." *International Journal of Engineering, Social Justice, and Peace*, August 22, 2017, 1–12. https://doi.org/10.24908/ijesjp.v5i1.6604.
- Wisnioski, Matthew. Engineers for Change: Competing Visions of Technology in 1960s America. Cambridge, Mass: The MIT Press, 2012. (**Ch.5**)

Recommended Readings:

- Vgontzas, Nantina. "Toward Degrowth: Worker Power, Surveillance Abolition, and Climate Justice at Amazon." New Global Studies, February 14, 2022. https://doi.org/10.1515/ngs-2022-0008.
- Molinari, Carmen. "There Is Something Missing from Tech Worker Organizing." *Organizing Work* (blog), December 9, 2020. https://organizing.work/2020/12/there-is-something-missing-from-tech-worker-organizing/.

Week 12: Moving Forward
April 19th & 21st

Readings:

- Zinn, Howard. 2004. "The Optimism of Uncertainty." In *The Impossible Will Take a Little While: A Citizen's Guide to Hope in a Time of Fear,* edited by Paul Loeb. New York: Basic Books. https://www.howardzinn.org/collection/the-optimism-of-uncertainty/.

Assignment: Open Letter
Due Monday, April 18th at midnight (in lieu of reading response)

Instead of a traditional reading response, you will write a reflection in the form of an "open letter" addressed to current and future engineering students* – which is open in the sense that the teaching team, your fellow students in this class, and future students (only with your permission) will be able to read it.

The letter should include a personal narrative that begins with why you took the class, tracing what you have learned (how your thinking has changed and why), what you are taking away from the class (what you plan to do now, what questions you still have, and so on), and finally concludes with the advice (and perhaps inspiration) you would have to other engineering students interested in social and environmental justice.

In order to stimulate your reflection, I would highly recommend taking a few minutes to read your own reading responses and class notes (if you took any) over the course of the semester, in order, and think about how these readings and our class discussions have shaped your thinking. Feel free in the letter to mention particular readings or discussions that were particularly influential to your thinking or talk about your project, but there is no particular requirement to do so.

This does not need to be long: 1-2 pages (in this case, single-spaced) is plenty. Please write this in the form of an actual letter.

*If you are not an engineer, please write to other students in your discipline interested in these topics – or to engineers, from your perspective!

Due on May 3rd (Dean's Day): Final Intervention Deliverable