

SUMAPS5690

Environmental Infrastructure for Sustainable Cities: Policy to Plan to Implementation

Spring 2024

3 Credits

Day: Mondays, 6:10-8:00

Instructors: Carter Strickland, Carter.Strickland@gmail.com
Vlada Kenniff, Vlada.Kenniff@gmail.com

Location: 516 Hamilton Hall

Faculty Support Assistant: Neera Ravikumar, nr2885@columbia.edu

Office Hours: Mondays, 5:00-6:00 (via Zoom/phone)

Response Policy: Our preferred means of communication is email to the addresses above. Students should expect a response from one of us within 24 hours.

Overview

This class is about the physical infrastructure that determines the capacity and sustainability of cities. Integrated networks of affordable housing, transportation, water, waste, stormwater, energy, park, and communication infrastructure are required for land- and resource-efficient cities that can survive extreme weather. Yet we have been building too little, too slowly to maintain legacy systems, let alone to retrofit our cities with efficient, innovative infrastructure. Recent political breakthroughs have created federal investments and a once-in-a generation opportunity to shift our cities to low-carbon modes – if we adopt better approaches to project planning, funding, and delivering critical assets that include public-private partnerships.

This course is designed to create sustainability leaders who will build the cities of tomorrow, drawing on lessons from the instructor's experience in developing sustainability policies and related capital programs, and by understanding and critiquing the full spectrum of infrastructure development in New York City and other major cities across the project life cycle, from planning to project delivery to asset management.

Course Objectives

Through case studies, field trips, guest lectures, discussions of real-world developments, and readings, students will develop an understanding of the role of infrastructure and different approaches on catalyzing public and political support for system-level policies and funding, cost-benefit analysis and prioritization for program-level planning and for alternative delivery and private-public partnerships project-level implementation. Students will apply these lessons to current infrastructure issues in both team and individual formats that track the professional settings they will face after graduation and will receive constructive feedback from their peers.

This course is approved for the M.S. in Sustainability Management curriculum area requirements Area 1 (Integrated sustainability management) and Area 4 (public policy and legal).

Learning Objectives

By the end of this course, students will have the capacity to be active leaders on infrastructure development teams because they will be able to:

- Discuss the importance of infrastructure to improving the environment and creating sustainable cities and communities, and be familiar with the UN Sustainable Development Goals and implementing systems like the Envision rating system for sustainable infrastructure;
- Understand the importance of federal, state, and municipal policy and funding to infrastructure development, how policy is created, and how policy can be influenced;
- Understand the sustainable and resiliency infrastructure and business opportunities created by the Infrastructure Investment and Jobs Act, the Inflation Reduction Act, and other recent federal, state, and local bond measures.
- Discuss and analyze standard infrastructure development stages and requirements, as well as different procurement approaches;
- Explain the characteristics and benefits of public private partnerships and alternative delivery mechanisms and analyze whether those mechanisms are appropriate for any or all stages of a particular project;
- Present analysis and solutions in different formats (group oral presentation with slides/graphics, and a written business case); and
- Develop expertise on the subject matters chosen for the group and individual projects for professional development and job interviews.

Resources

Readings. Required readings and optional readings are listed for each class in the course calendar below. The following books and reports are useful for general reference but are not required except as indicated:

- New York City, [PlaNYC \(2007\)](#)
- New York City, [PlaNYC \(2011\)](#)
- New York City, [OneNYC \(2015\)](#)
- New York City, [PlaNYC \(2023\)](#)
- Regional Plan Association, [The Fourth Regional Plan \(2017\)](#)
- Ascher, Kate, and Wendy Marech. *The Works: Anatomy of a City*. New York: Penguin, 2005 (or the 2007 copy).

Columbia University Library. Columbia's extensive library system ranks in the top five academic libraries in the nation, with many of its services and resources available online: <http://library.columbia.edu/>.

SPS Academic Resources. The Office of Student Life and Alumni Relations (SLAR) provides students with academic counseling and support services such as online tutoring and career coaching: <http://sps.columbia.edu/student-life-and-alumni-relations/academic-resources>.

Class Policies

Participation and Attendance

This class is designed to facilitate discussion, so full and active participation is a key, and graded, part of the course. So that the whole class benefits, students are expected to be fully prepared for class by completing all reading and actively thinking about the issues to be discussed, and then are expected to participate actively in class through insightful questions count or observations. If you need to miss a class for any reason, please discuss the absence with me in advance.

Zoom will be an option by advance permission for students who are sick, self-quarantining, or traveling for business. Note also these new class norms with respect to online classes that are university-wide:

- Students are expected to participate in each class with your Zoom audio and video on.
- Students may not share the Zoom classroom recordings. The recordings are kept within the Columbia Classes site and are for students enrolled in this course only.

Late Work

There will be no credit granted to any written assignment that is not submitted on the due date noted in the course syllabus without advance notice and permission from the instructor.

Citation & Submission

All written assignments must cite sources and be submitted to the course website (not via email).

Assignments and Evaluation

Grading

Grades will be determined from the following allocation:

- Participation (15%)
- Group Presentation on an Infrastructure Problem and Potential Solutions (35%)
- Individual Memorandum and Business Case Analysis on an Infrastructure Delivery Plan (50%)

1. Participation

Classroom discussion: We will be using a presentation as the backbone of the class but expect and encourage a robust discussion and questions based on the readings, your experience, and your observations.

Discussion board: We will be assigning students each week to lead a discussion on the Courseworks forums by posting their reactions and analysis of readings. As with the in-class discussions, it is our expectation that others will jump in with refinements, disagreements, and other reactions.

Infrastructure tour: An infrastructure tour will also be scheduled per discussion with the class.

2. Group Presentation

Students will form “consultancies” of up to four students that have been “hired” by a public agency or authority to help solve a complex issue through the use in whole or part with infrastructure (i.e., other policy issues that do not require infrastructure solutions are not relevant for this course). The output will be a written and oral presentation to the class and professor (playing the part of public officials and not general stakeholders). Students will be challenged to explain the issue, to present analysis, and to propose solutions in 15 minutes with 10 slides.

The presentation can be developed in any way the group thinks is effective, but should follow a general two-part structure:

1. *Problem definition and analysis:* What is the problem, its economic, environmental, and social costs, and its equitable/inequitable distribution? What are the causes of the problem? What data exists or can be created to help understand the problem?
2. *Solution generation and alternatives analysis:* What is the role of infrastructure (and supporting policy interventions) in generating a range of solutions? How should we rank solutions based on feasibility (economic, environmental, technological readiness, stakeholder acceptance or other criteria), cost-benefit analysis, or other decision frameworks? Is a phased approach with demonstration projects recommended or necessary? What funding and operational needs must be met to implement the solutions

Progress Milestones:

- Groups formed (team assignments based on general area of interest) (Class 6 or earlier)
- Topics submitted (Class 7 or earlier)
- Consultation with lecturers (Classes 6-8)
- Team meetings (Classes 6-8)
- In-class presentation with questions and feedback from non-presenting students (Classes 9 and 10); and
- Group self-assessment (Classes 9 and 10).

3. Individual Paper

Following a similar structure from the group presentation, each student will prepare an in-depth paper exploring an infrastructure problem and solution. If the topic is historical infrastructure, the memorandum should describe what happened, why, and how, and the perceived benefits and costs, and should also include critical analysis, such as whether there were better alternatives, why alternatives were rejected, and how the project or program procurement, governance,

financing could have been improved. The length should be long enough to inform the audience but should be modeled on decision documents in a practical rather than scholarly context.

The target length should be between 15 and 20 pages (or about 3,500 to 5,000 words) with the word count posted at the end. Format shall be normal 1" margins, 12-point font, double spaced, with footnotes on the same page as the text (i.e., not endnotes or scientific, parenthetical citation formats.)

To inspire your selection of a topic for your group and individual project, here are some infrastructure developments or topics, many of which were developed in response to environmental and social problems, but some of which may represent problems in of themselves (e.g., neglected, or underused infrastructure) or innovative delivery approaches. You can also peruse recent capstone topics in the program, but I will not allow you to repeat a topic from your own capstone project. I encourage you to be creative and to pick a topic that interests you to the point of obsession. You can become the world expert on any topic

General

- Infrastructure Investment and Jobs Act/Inflation Reduction Act
- New York Bond Act
- Depression Era infrastructure initiatives (WPA, CCC, etc.)
- Midtown rezoning and infrastructure
- Sunnyside Yards Redevelopment
- Transportation Infrastructure Finance and Innovation Act (TIFIA)
- Water Infrastructure Finance and Innovation Act (WIFIA)

Transportation

- Complete Streets Plan
- Bike lanes / Open Streets Plan / Five Borough Bike Plan
- Bikeshare / scootershare (docked and undocked)
- State Greenways Plan / Empire State Trail / Long Island Greenway
- Better Buses Action Plan / Rapid Bus Transit /Queens Master Bus Plan
- Autonomous Vehicles
- Electric Charging Station Networks
- E-micromobility (e-bikes + e-scooters) charging infrastructure
- Gateway tunnel(s)
- East Side Access project
- Airport rail connections (LaGuardia, Denver, JFK)
- LaGuardia Airport renovation / Public-Private Partnerships

- Tri-Boro Rail/IBX
- California High Speed Rail
- Uber / Lyft / rideshare
- Electronic tolling / cordon or congestion pricing
- LIRR Third Rail

Water / Wastewater

- Rondout West Branch Tunnel Repair
- Green Infrastructure
- Cloudburst Infrastructure
- Stormwater Utilities
- Lake Powell Pipeline
- Carlsbad Desalination Plant
- Santa Clara Reuse Plant
- San Antonio Water Purchase Agreement
- Three Gorges Dams (China)
- Resource recovery from wastewater (phosphorus, Class A biosolids, energy, reusable water)
- Colorado/Texas/California Water Plans
- Lead service lines
- Building water tanks

Energy

- Transmission Lines (HydroQuebec, Clean Path)
- Indian Point Nuclear Plant and alternatives
- Pipelines (Keystone, Spectra, Constitution, Northeast Energy Direct)
- LNG Piers /Fracking
- Off-shore/On-shore Wind Power farms

- Solar installations (distributed and in solar farms)
- Microgrids / nanogrids
- Anaerobic digestors / landfill gas capture
- Biomass-based liquid fuels, sustainable aviation fuel
- Ravenswood Generating Plant
- Utility thermal energy networks
- Domestic heating and hot water generation
- Distributed generation (microturbines, fuel cells, storage)
- Hydropower
- Hydrogen

Solid Waste

- Organic waste recycling systems (collection, composting, biogas)
- Solid Waste Management Plan Update (2026)
- Incinerators / Waste to Energy Facilities
- Anaerobic Digesters
- Garbage disposals
- Recycling systems and markets
- Bag taxes and other reduction systems
- Circular economy

Communications

- Link NYC
- NYC Broadband Plan
- Google Fiber Deployment Plan
- SmartCity Initiatives
- Generative AI

Public Housing

- Fulton-Chelsea Elliot
- Nostrand Houses
- St. Nick Houses
- Preservation

Progress Milestones:

- Topics submitted (Week 12 at the latest);
- Consultation with professor (office hours before Weeks 12 through 14); and
- Submittal of the paper (Week 15)

Student work and progress towards course goals will be evaluated by professional standards, i.e., demonstrating a thorough understanding of applicable concepts, comprehensive research, rigorous analysis, and an unbiased, persuasive, and clear recommendation for action. In other words, a public official would find the presentation or document to be a sound basis to make a

- Development

Resiliency

- NY Climate Leadership and Protection Act, and related Bond Act
- Flood buyout programs / NJ Blue Acres / Buyback and deconstruction / migration programs
- BIG U (and its variants, including the East Side Coastal Resiliency and Lower Manhattan Resiliency projects)
- Seaport City Multi-Purpose Barrier
- NY Harbor Surge Barrier(s) (and/or surge barriers in Venice, the Thames River, Stamford, etc.)
- Post-Katrina levees in New Orleans
- Mid-Barataria Barrier
- Wetlands restoration programs
- Disaster response systems
- Cloudburst Management Plan
- BRIC program
- Heat mitigation
- Decarbonization

Parks, Open Space, Natural Infrastructure

- QueensWay
- Waterfront parks (Brooklyn Bridge Park, Hudson River Park, Governor's Island)
- Right of way parks (plazas, sidewalks, greenstreets, green corridors)
- Land and Water
- Park equity
- Urban trail systems
- Urban forests
- Natural climate solutions (protective beach dunes, oyster reefs, wetlands, etc.)
- Daylighting streams (Tibbetts Brook, etc.)
- Urban agriculture, community gardens

decision. Our emphasis is on the depth of thought, clarity of expression, and brevity, not the number of words. Students are encouraged to spend at least twice as much time thinking and talking through the problem and solutions as in writing. Once students have a clear, logical framing of the problem and solution, the writing will be better and easier.

Students must include an address on the paper if they want it returned with any edits and comments.

Grading Rubrics and Scale

Detailed grading rubrics will be distributed before the group and individual assignments. Letter grades for the entire course will be assigned as follows:

Student grades will be assigned according to the following criteria:

- (A) Excellent: Exceptional work for a graduate student. Work at this level is unusually thorough, well-reasoned, creative, methodologically sophisticated, and professionally written. Work is of exceptional, professional quality.
- (A-) Very good: Very strong work for a graduate student. Work at this level shows signs of creativity, is thorough and well-reasoned, indicates strong understanding of appropriate methodological or analytical approaches, and meets professional standards.
- (B+) Good: Sound work for a graduate student; well-reasoned and thorough, methodologically sound. This is the graduate student grade that indicates the student has fully accomplished the basic objectives of the course.
- (B) Adequate: Competent work for a graduate student even though some weaknesses are evident. Demonstrates competency in the key course objectives but shows some indication that understanding of some important issues is less than complete. Methodological or analytical approaches used are adequate, but the student has not been thorough or has shown other weaknesses or limitations.
- (B-) Borderline: Weak work for a graduate student; meets the minimal expectations for a graduate student in the course. Understanding of salient issues is somewhat incomplete. Methodological or analytical work performed in the course is minimally adequate. Overall performance, if consistent in graduate courses, would not suffice to sustain graduate status in "good standing."
- (C/-/+) Deficient: Inadequate work for a graduate student; does not meet the minimal expectations for a graduate student in the course. Work is inadequately developed or flawed by numerous errors and misunderstanding of important issues. Methodological or analytical work performed is weak and fails to demonstrate knowledge or technical competence expected of graduate students.
- (F) Fail: Work fails to meet even minimal expectations for course credit for a graduate student. Performance has been consistently weak in methodology and understanding, with serious limits in many areas. Weaknesses or limits are pervasive.

Overview of the Semester

Week	Date	Topic	Notes
Week 1	Jan 22	The Role of Infrastructure in Sustainability, Economic Development, and Public Health (Carter and Vlada)	
Week 2	Jan 29	Catalyzing Infrastructure Development; Stakeholders and Public Engagement; (Carter)	
Week 3	Feb 5	Funding, Financing, and Procuring Infrastructure; "Alternative" Delivery and Public-Private Partnerships (Vlada)	
Week 4	Feb 12	Transportation (Carter)	
Week 5	Feb 19	Water & Wastewater (Carter)	Identify area of interest for group project
Week 6	Feb 26	Solid Waste (Vlada)	Teams formed or assigned
Week 7	March 4	Parks & Open Space (Carter)	Group topics submitted
<i>No class during spring break week of March 11-15</i>			
Week 8	March 18	Energy (Vlada)	
Week 9	March 25	Group Presentations	Group presentations /self-assessment
Week 10	April 1	Group Presentations	Group presentations /self-assessment
Week 11	April 8	Housing (Vlada)	
Week 12	April 15	Communications and Integrated City-Level Infrastructure (Vlada)	Final paper topics
Week 13	April 22	Sustainable and Resilient Infrastructure (Carter)	
Week 14	April 29 or TBD	Infrastructure Tour	
Week 15	May 6		Final paper due at 5 pm

Detailed Course Overview

Week 1: The Role of Infrastructure in Sustainability, Economic Development, and Public Health

This class focuses on the relationship between infrastructure, the economy, public health, and the environment. We will examine demographic and climatic trends that intersect to make cities inevitable and sustainable and resilient cities imperative, the historic importance of infrastructure for economic development, and the current importance of networked environmental infrastructure for the necessities of life and public health. We will also introduce concepts of federalism that are unique to delivery of infrastructure in the U.S.

Case Studies and readings

Required

- Zeynep Tufekci, [Why the Post Office Makes America Great](#), New York Times (Jan. 3, 2016)
- David Owens, [Green Manhattan](#), New Yorker (Oct. 18, 2004).
- Michael Bloomberg and Rohit T. Aggarwala, [Think Locally, Act Globally](#), American Journal of Preventive Medicine 35.5 414-23, (2008).
- Thacker, S., Adshear, D., Fay, M. et al. [Infrastructure for sustainable development](#), Nature Sustainability 2: 324–331 (Apr. 1, 2019) (PDF in Classes)

Supplemental

- Catherine Brinkley, [Pandemics Have Actually Made Cities Better](#), Fast Company, (May 19, 2020)
- Darren Anderson, [Future Shock in the Countryside](#), The Atlantic (Nov. 2, 2018)
- [C40 Cities Climate Leadership Group. \(2016\). Good Practice Guide: Climate Change Adaptation in Delta Cities. C40 Cities Climate Leadership Group.](#)
- [COP28 UAE Declaration on Climate and Health \(Dec 3, 2023\)](#)

Week 2: Catalyzing Infrastructure Development; Stakeholders and Public Engagement

In this class we assess the present state of the U.S. infrastructure and past attempts, successful and unsuccessful, to catalyze investment and development. Within that context we will discuss (1) key decision-makers, the political context of infrastructure, and other methods for creating momentum for investment in infrastructure, (2) the role of strategic planning and preliminary studies such as charettes, vision plans, and feasibility studies for catalyzing programs and projects, and (3) the role of community and stakeholder engagement and partnerships, from community mobilization to environmental justice.

Case studies and readings:

Required

- Conrad De Aenlle, [World's Fairs and Their Legacies](#), New York Times (May 1, 2015).
- PlaNYC (2011) Introduction (pp. 3-13)
- OneNYC (2015) Introduction (pp. 14-17, 30-32, 113-119)
- Regional Plan Association, [The Fourth Regional Plan](#) (2017), Executive Summary
- ASCE New York State Council, [Report Card for New York Infrastructure](#) (2022) (skim)
- White House, [Fact Sheet: The American Jobs Plan](#) (March 31, 2021)

- U.S. Senate, Bipartisan Infrastructure Investment and Jobs Act Summary (2022) (read 1-5, skim the rest as interested)
- Rebuild By Design, [Resilient Infrastructure for New York State](#) (2021)
- MetroSydney (September 2016), Sydney Metro City & Southwest Industry Final Business Case Summary

Supplemental

- Vox, [The Green New Deal Explained](#) (video) (June 12, 2019)
- AECOM, [Economic Impacts of the New York State Environmental Bond Act](#) (2022)
- The Washington Post, [The surprisingly simple way to convince people to go green](#) (December 2023)
- UNEP/SFDN, The Consortium Approach to Sustainable Development (December 2023). Attachment only – no link.

Week 3: Funding and Financing Infrastructure; Procurement, Alternative Delivery, and Private-Public Partnerships

In this class we consider different models of funding and financing infrastructure and related structural issues of how funds can be collected and spent, federalism issues in the context of infrastructure funding, the role of special authorities and other efforts to de-politicize the process, and general funding approaches (e.g., taxes, tax increment financing, user fees, enterprise funds, trust funds, municipal bonds, tax credits, private financing with equity and debt). This class also discusses current challenges with current government procurement of infrastructure design and construction, as well as creative solutions for financing, developing, and operating infrastructure that involve private and public partnerships.

Case studies and readings:

Required

- DBIA, [Choosing a Project Delivery Method](#) (April 2015)
- Louis Hyman, [The New Deal Wasn't What You Think](#), The Atlantic (Mar. 6, 2019)
- Congressional Budget Office, [Infrastructure Banks and Surface Transportation](#) (2012).
- Congressional Research Service, Infrastructure Investment, and the Federal Government (2018) (PDF)
- New York City Economic Development Corporation, [Southern Manhattan Coastal Protection Study: Evaluating the Feasibility of a Multi-Purpose Levee](#) (2014).
- Lincoln Leong, McKinsey & Co., [The 'Rail plus Property' model: Hong Kong's successful self-financing formula](#) (June 2016).
- Brian Rosenthal, [The Most Expensive Mile of Subway Track on Earth](#), New York Times, (Dec. 28, 2017).
- New York University Rudin Center for Transportation, [Maximizing the Value of Construction: The Role of Design-Build](#) (2015)
- Partnerships BC, [Understanding Public Private Partnerships](#) (2011).

Supplemental

- Alon Levy, [Why American Costs Are So High \(Work-in-Progress\)](#), Pedestrian Observations Blog (March 3, 2019)
- Jane Margolies, [Climate Law a 'Game Changer' for Highways and Bridges](#), New York Times (September 6, 2022)

- Hunter Blair, Economic Policy Institute, [No Free Bridge: Why public-private partnerships or other 'innovative' financing of infrastructure will not save taxpayers money](#) (Mar. 21, 2017).
- McKinsey and Company, [Financing the Net-Zero Transition: From Planning to Practice](#) (2022)
- UNEP, NetZero Banking Alliance, [Developing Metrics for Transition Finance](#) (December 2023)

Week 4: Transportation

In this first class on a specific infrastructure sector, we will discuss transportation and its relationship to equity and social mobility and economic development, why we value mobility, and the importance of realistic, multi-modal alternatives. We will consider innovations in physical forms (e.g., complete streets, parking policies, transit-oriented development), financing (e.g., user fees and sensor tolling), business models (e.g., rideshares, micromobility), fueling (e.g., EV chargers, CNG stations, hydrogen cell refills), and freight optimization in the urban context.

Case studies and readings:

Required

- PlaNYC 2011, Transportation (pp. 86-99)
- WNYC, [Whose Streets?](#), On the Media Podcast (Nov. 23, 2018).
- Jonathan English, [Why New York City Stopped Building Subways](#), CityLab (Apr. 16, 2018).
- Jonathan English, [Why Did America Give Up on Mass Transit? \(Don't Blame Cars\)](#), City Lab (Aug. 31, 2018).
- S. Griffiths et al, Policy mixes to achieve sustainable mobility after the COVID-19 crisis, Renewable and Sustainable Energy Reviews, Vol. 143:110981 (June 2021) (PDF in class readings)
- Electrify NY, [Electrifying Fleets in Hunts Point](#), (2020) (Note: SUMA capstone project)
- John Seabrook, [The E-Scooters loved by Silicon Valley Roll into New York](#), The New Yorker (Apr. 19, 2021)
- David Zipper, [The High Cost of Bad Sidewalks](#) Bloomberg CityLab (June 16, 2020)
- [The City of Copenhagen Technical and Environmental Administration Traffic Department \(2011\) Good, Better, Best The City of Copenhagen's Bicycle Strategy 2011-2025](#)

Supplemental

- Regional Plan Association, [The Five Borough Bikeway](#) (2020) (skim)
- Video: [New York Streets? Not so Mean Anymore](#) (Ted Talk with Janette Sadik Khan)
- John Surcio, [Can 'Open Streets' Outlast the Pandemic?](#) – Bloomberg CityLab (April 29, 2021)
- [NYC Ferry Overview](#) (read the embedded studies if interested in the topic)
- [America's Transportation Infrastructure -- A Funding Crisis](#), Traffic Technology Today (Nov. 28, 2020)
- Gabby Birenbaum, [The bipartisan infrastructure bill provides historic funding for transit. It's not enough](#), Vox (August 23, 2021)

Week 5: Water and Wastewater

This class will discuss water and wastewater, two critical public health infrastructure systems that have been critical to the very concept of dense development since the earliest cities. We will explore watersheds and other natural systems, green infrastructure for stormwater management, government and regulated private utility arrangements, generation, equitable user fees and rate structures, and incentives to conserve water use.

Case studies and readings:

Required

- PlaNYC (2011), pp. 58-85
- New York Times, [Living City | A Billion Gallons a Day](#) (2014) (Video)
- New York City Department of Environmental Protection, [Wastewater 101](#) (2022) (presentation)
- [Hsien, Law, Fuchen, Han \(2019\) Life cycle assessment of water supply in Singapore](#)
- New York City Department of Environmental Protection, [NYC Green Infrastructure Plan](#) (2010) (Executive Summary)
- Janet Hering et al., [A Changing Framework for Urban Water Systems](#), Environ. Sci. Technol. 47:19, 10721–10726 (May 8, 2013)
- BronxNet, [Daylighting Tibbett's Brook](#) (video)
- Renewable Rikers Coalition, [A Plan for a Renewable Rikers](#) (2022)

Supplemental

- UN Environmental Program, [Sick Water: The Central Role of Wastewater Management in Sustainable Development](#) (2010) (summary)
- MWRA Boston, [How We Cleaned Up the Dirtiest Harbor In America](#) (2012) (Video)
- Michelle Nijhuis, [The Abandoned Plan That Could Have Saved America From Drought](#), BuzzFeed (Sept. 18, 2015).
- ASCE, [Drinking Water Report Card \(2021\)](#)
- ASCE, [Wastewater Report Card \(2021\)](#)

Week 6: Solid Waste

Waste management has an enormous impact on the livability of cities – and upon climate, public health, the environment, and the economy. In this class we will discuss the importance of solid waste management to city carbon reduction goals, the logistics, economics, and failures of composting and recycling, the benefits and disadvantages of various waste management technologies such as incineration, landfilling, recycling, composting, and anaerobic digestion,

Case Studies and Readings:

Required

- PlaNYC (2011), pp. 132-145
- OneNYC, Zero Waste Plan, pp. 176-187
- New York City Department of Sanitation, [Comprehensive Solid Waste Plan](#) (2006). (Executive Summary).
- [EPA/San Francisco Department of the Environment \(August 2019\) Zero Waste Case Study: San Francisco](#)
- Rivka Galchen, The New Yorker, [How South Korea is Composting its Way to Sustainability](#) (March 2, 2020)
- L.J. Dawson, [How Cities Are Turning Food Waste Into Fuel](#), Politico (Nov. 21, 2019)

Supplemental

- Citizen's Budget Commission, [A Better Way to Pay for Solid Waste Management](#) (2015)
- Melanie Burford and Greg Moyer, [Living City | Where Does our Trash Go?](#), The New York Times (Sept. 25, 2014) (Video)
- Nicole Javorsky, [How American Recycling Is Changing After China's National Sword](#), CityLab (Apr. 1, 2019)
- Anne Barnard, [7 Reasons Recycling Isn't Working in NYC](#), The New York Times (Jan. 29, 2020)

Week 7: Parks and Open Space

Parks and open space in cities have long been a sought-after amenity in cities and have been built by developers to enhance the value of their residential and commercial property. This class will discuss the new understanding of parks as critical urban infrastructure and a first-order intervention to improve a broad range of problems: crime, community disinvestment, inequity, poor public health, and climate change. We will discuss models of park development, operations, and measurements of success.

Case studies and readings:

Required

- Peter Harnik, Trust for Public Land, [Urban Parks are Making a Comeback](#) (Oct. 2008).
- PlaNYC (2007), pp. 28-39
- Eric Klinenberg, Palaces for the People (2018) (Introduction, PDF in resources section of course site)
- NYC Council, [Committee Report on Park Equity and Covid-19](#) (2022) (also look at linked report)
- Trust for Public Land, [Parkscore Index](#) (2022)
- Trust for Public Land, [Economic Benefits of Parks in New York City](#) (2022)
- [Black, Richards, Eco-gentrification and who benefits from urban green amenities: NYC's high Line \(December 2020\)](#)

Supplemental

- Natural Areas Conservancy and NYC Parks, [Forest Management Framework for New York City](#) (2018) (Executive Summary)
- Trust for Public Land, [Public Spaces/Private Money, The Triumphs and Pitfalls of Urban Park Conservancies](#) (Feb. 2015)
- C.J. Hughes, [New Parks Sprout Around New York City](#), New York Times (June 8, 2018)
- [Trust for Public Land, The Power of Parks to Promote Public Health \(May 2023\)](#)
- Garca, Cruz, Monterio, Neset, [Designing urban green spaces for climate adaptation](#), (March 2022)
- [The Nature Conservancy, Investing in Nature Private finance for nature-based resilience \(November 2019\)](#)
- [Haas, Hassink, Stuvier, The Role of Urban Green Space in Promoting Inclusion: Experiences from the Netherlands. \(July 2021\)](#)

Spring Break- No Class

Week 8: Energy

This class will discuss energy infrastructure systems, which underlie most other infrastructure systems but are provided by investor-owned utilities in the United States under a regulated monopoly paradigm. We will discuss the role of government and the market in shaping energy policy, sustainability, and dependability on a city level, supply versus demand management, energy-efficiency and green building mandates and incentives, and interdependence with emerging green building and electric vehicle technologies.

Case studies and readings:

Required

- Congressional Research Service, [21st Century U.S. Energy Sources: A Primer](#) (Nov. 5, 2018) (skim)
- D. Tong et al. [Committed emissions from existing energy infrastructure jeopardize 1.5 °C climate target](#), *Nature* 572, 373–377 (2019) (PDF)
- PEAK Coalition, [Dirty Energy. Big Money](#) (2020)
- Kaufman & Tan, [New York City's Building Emissions Law Shows the Importance of Economywide Climate Policy](#), Columbia Center on Global Energy Policy Commentary (Oct. 1, 2020)
- [The Impact of New York's Climate Leadership and Community Protection Act](#). Bloomberg Law (October 23, 2020)
- Vox, [Why the US Isn't Ready for Clean Energy](#) (2021) (video)
- Bipartisan Policy Center, [Inflation Reduction Act's Energy and Climate Provisions](#) (2022)
- Emily S. Rueb, [How New York City Gets Its Electricity](#). *New York Times* (2017)
- A. Dulaimi, R. Hamida, M. Naser, and M. Mawed, [Digital Twin Solution Implemented on Energy Hub to Foster Sustainable Smart Energy Hub](#), *ISPRS Annals of the Photogrammetry, Remote Sensing and Spatial Information Sciences*, Vol. X-4/W3-2022 (October 2022)

Supplemental

- DW, [Smart City: How Amsterdam Revolutionizes Energy](#) (2021) (video)
- C40, [Case Study: 98% of Copenhagen City Heating Supplied by Waste Heat](#) (2011)
- Feargus O'Sullivan, [Sweden Will Meet Its 2030 Green Energy Target 12 Years Early](#) CityLab (July 20, 2018).
- New York City, [One City: Built to Last Technical Working Group Report](#) (2016) (Executive Summary)
- [Who is who in NY Energy Politics](#)
- Reinhard Madlener et al., [Impacts of urbanization on urban structures and energy demand: What can we learn for urban energy planning and urbanization management?](#), *Sustainable Cities and Society*, 1: 45–53 (2011)

Week 9: Group Presentations and Discussions

Student groups will make a presentation on an economic or environmental issue, present their analysis of alternatives, and propose solutions. Groups are allotted 15 minutes, plus 5 minutes for additional discussion.

Week 10: Group Presentations and Discussions, Continued

Week 11: Housing

In the realm of housing infrastructure, the concept of affordable housing stands as a fundamental pillar aimed at addressing the critical need for accessible and reasonably priced shelter within communities. Affordable housing programs play a pivotal role in this endeavor, utilizing various strategies to ensure that individuals and families with limited financial means have access to decent and affordable homes. These programs encompass a spectrum of initiatives, including subsidies, tax incentives, and public-private partnerships, all designed to alleviate the financial burden on low-income households.

We will discuss how the development and preservation of affordable housing further underscore the multifaceted nature of this challenge. Development involves the creation of new housing units that meet specific affordability criteria, often through collaboration between governmental bodies, non-profit organizations, and private developers. Preservation, on the other hand, focuses on maintaining existing affordable housing stock, preventing its conversion to market-rate properties, and safeguarding the social fabric of communities. Balancing these two aspects requires a nuanced understanding of urban planning, policy frameworks, and the economic dynamics of the housing market.

Case studies and readings:

Required

- [Schwartz, A. F. \(2015\). 151 Years of America's Housing History. The Nation](#)
- [Paul Williams \(2021\) Public Housing for All. Noema Magazine](#)
- Victor Bach, Oksana Mironova, and Samuel Stein, [Preserving NYC's Public Housing: Future Choices](#) (2022)
- [Housing New York: A Five-Borough 10-Year Plan](#) (2014)
- [Housing Our Neighbors: A Blueprint for Housing and Homelessness](#) (2022)

Supplemental

- Adam Majendie, [Why Singapore Has One of the Highest Home Ownership Rates](#), Bloomberg (2020)
- Aitor Hernández-Morales, [How Vienna took the stigma out of social housing](#), Politico (2022)
- Erika Pinto, [Housing for Everyone, the Danish Way](#) (2022)
- Alan During, [Yes, Other Countries Do Housing Better, Case 1: Japan](#) (2021)

Week 12

Communications

Communications infrastructure – telephone, mail, telephone and radio, and now broadband – does not directly address pollution or emissions, but can have a dramatic impact on land use patterns, equitable access to jobs, the rapid cross-fertilization of ideas that is one of the core benefits of city living, and even our core rights of privacy and expression. We will discuss the impact of the Covid epidemic on demand and the role of federal, state, and local government in facilitating broadband access and smart infrastructure, as well as the unseen environmental impact of data centers on water/energy demand.

Case studies and readings:

Required

- Office of the Inspector General, [The Postal Service's Role as Infrastructure](#) (2014)
- New York City, [The Internet Master Plan](#), (2020) (Executive Summary only)
- McKinsey Global Institute, [Smart Cities: Digital Solutions for a more Livable Future](#) (2018) (Executive Summary Only)
- Amy Fleming, The Case for Making Low-Tech 'Dumb' Cities Instead of 'Smart' Ones, [The Case for Making Low Tech Dumb Cities Instead of Smart Ones](#) The Guardian (Jan. 15, 2020).
- [Boston Consulting Group. \(February 2023\). Role of ICT in Sustainable Development and Triple Green Win.](#)

Supplemental

- DW Shift, [Smart City: Surveillance or Utopia?](#) (Oct. 2019) (short video)
- Ingrid Burrington, [The Environmental Toll of a Netflix Binge](#), The Atlantic (Dec. 16, 2015)
- Blair Levin and Larry Downes, [Why Google Fiber Is High-Speed Internet's Most Successful Failure](#), Harvard Business Review (2018)
- [World Broadband Association. \(2022\). The Importance of Environmental Sustainability in Telecom Service Providers' Strategy.](#)
- [Ernst & Young Global Limited \(EY\). \(June 2023.\). If Circularity is the Future, How Will It Shape Telecoms?](#)

Integrated City-Level Infrastructure

What if we could build a city from the ground up today, using up to date technology? In fact, city planners and builders are tearing down old ports and decking over railyards to build new neighborhoods and are even building whole cities in reclaimed land and deserts. We will discuss whether these cities are repeating old patterns (or creating unfamiliar problems) or are demonstrating how all cities can be more resilient and sustainable.

Case studies and readings:

Required

- Sarah Moser, Marian Swain, and Mohammed H. Alkhabbaz, [King Abdullah Economic City: Engineering Saudi Arabia's Post-oil Future](#), Cities 45: 71-80 (2015).
- Emily Nonko, [Hudson Yards wants to become NYC's next great neighborhood](#), Curbed (Sep. 19, 2018).
- Zoe Rosenberg, [Sunnyside Yard plan is a utopian vision for an urban future](#), Curbed (Mar. 4, 2020)
- David Ee, [Humanising and Re-integrating Canary Wharf with London](#), (2018).

- Patrick Sisson, Songdo, [South Korea's City of the Future, Has a Green Vision](#), Curbed (Nov. 2, 2015).
- Philippe Mesmer, [Songdo, Ghetto for the Affluent](#), Le Monde (May 29, 2017).
- Laura Bliss, [Inside a Pedestrian-First 'Superblock'](#), City Lab (Aug. 7, 2018) (also watch the video)

Supplemental

- David L.A. Gordon, [The Resurrection of Canary Wharf](#), Planning Theory & Practice, 2:2, 149-168 (2001).
- Alex Bozikovic, [Google's Sidewalk Labs signs deal for 'smart city' makeover of Toronto's waterfront](#), The Globe and Mail (June 12, 2018).
- Laura Bliss, [How Smart Should a City Be? Toronto Is Finding Out](#), CityLab (Sep. 7, 2018).

Week 13: Sustainable and Resilient Infrastructure

This class explores how all infrastructure projects can be made more sustainable in both the construction and operation phases using Envision and other rating systems and other approaches, and then zooms out to a city or regional scale to explore the infrastructure systems that are being developed in the wake of Hurricanes Sandy and Ida to guard against coastal and overland flooding, as well as to adapt to other aspects of climate change, including man-made and nature-based infrastructure.

Case studies and readings:

Required

- New York City, [A Stronger, More Resilient New York](#) (2013) (pp. 9-18, 37-66, one of the infrastructure chapters, and one of the community chapters)
- Denise Nelson, Institute for Sustainable Infrastructure, [The Water Values Podcast](#) (Apr. 22, 2015).
- New York City, [FiDi/Seaport Climate Master Plan](#) (Executive Summary)
- NYC Department of Environmental Protection, [NYC Stormwater Maps](#) (2022) (check your home against the 2080 extreme flooding maps)
- U.S. Army Corps of Engineers, [January 2023 Harbor and Tributary Study Presentation](#)
- [Foss, Rebuilding New Orleans Post-Katrina: gentrification and community identity \(August 2020\)](#)

Supplemental

- Institute for Sustainable Infrastructure, [Sustainable Infrastructure Framework](#), (pp. 1-15)
- [New York is Building "Living" Wave Barriers to Prepare for the Next Superstorm](#). Scientific American. (May 1, 2020)
- [A Map of NYC Before it was a City Could Provide Answers to Today's Flooding](#). Spectrum News NY1 (October 2022)
- Regional Plan Association, [The New Shoreline: Integrating Community and Ecological Resilience around Tidal Wetlands](#) (Sept., 2018).
- B.I.G., [The Big U - B.I.G. Team's Vision for Rebuild By Design](#) (2015) (video)
- [Army Corp of Engineers Releases Details of Long-Awaited Coastal Resiliency Plan](#). The City (September 26, 2022)
- National League of Cities, [What Cities Should Know About Climate Change and Populations on the Move](#) (2022)

- Regional Plan Association, [RPA Comments on the New York-New Jersey Harbor and Tributaries Study Draft Integrated Feasibility and Tier 1 Environmental Impact Statement](#) (March 2023)

Week 14: Infrastructure Tour

TBD based on class input. Some options might include the former Ravenswood Generating Plant in Queens, the Closed Loop recycling facility in Brooklyn, or Central Park in Manhattan.

Week 15: Paper Due