

Master of Science in Sustainability Management

Environmental Infrastructure for Sustainable Cities: Policy to Plan to Implementation - PS5690 **3 Credits**

Instructor: Carter Strickland

Course Overview

This class is about the physical structures and systems that determine the sustainability of cities and their environmental impact. We call those systems “environmental infrastructure.”

The premise of the class is that compact, walkable cities are the least carbon- and energy-intensive pattern of settlement today because of their integrated networks of infrastructure that allow us to move, eat, drink, play, and survive extreme weather. As our population shifts to urban and coastal areas, we will need to build more infrastructure systems to accommodate growth and to increase sustainability. Yet we are building too little, too slowly to maintain our existing infrastructure, let alone to facilitate next generation systems that will accelerate our society to a truly low-carbon future. Our transportation, water, parks, freight, solid waste, and energy infrastructure systems are crumbling, and new needs such as coastal flood mitigation and resiliency are not being met. With little political will for massive public works programs and current procurement practices that are slow and costly, cities are starting to use innovative ways to deliver these critical assets, including design-build procurement, long-term concessions, private operation, maintenance and financing, and other forms of public-private partnerships. Cities and states are pooling resources to solve problems through infrastructure exchanges and accelerators. They are creatively reimagining and reusing obsolete and neglected land and buildings, and are integrating services to create infrastructure that is multi-purpose, resilient, and sustainable.

This course is designed to create sustainability leaders who will develop the infrastructure policies of today and will build the cities of tomorrow. Using case studies primarily from New York City and other U.S. cities of “environmental infrastructure” – public water, transportation, freight, parks and open space, resiliency, solid waste, and energy infrastructure – this course covers the project life cycle from planning to project delivery and asset management. (Select international examples will be used as appropriate.) Students will discuss the role of infrastructure and different policy approaches towards planning and project conception, cost-benefit analysis, prioritization, alternative delivery and private-public partnerships, coalitions of interested stakeholders and partners, funding and financing, governance, and operations and maintenance. They will apply these lessons to current infrastructure issues in both group and individual formats that mimic the professional settings they will face after graduation, and will learn to receive and provide constructive feedback from and to 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 be able 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;
- Understand the importance of federal, state, and municipal policy to infrastructure development, how policy is created, and how policy can be influenced.
- Discuss and analyze standard infrastructure development stages and requirements, as well as different policy 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;

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- Present analysis and solutions in different formants (group oral presentation with slides/graphics, and a written memorandum and business case); and
- Develop expertise on the subject matters chosen for the group and individual project.

Readings and Resources

Individual readings are included in the course calendar below. The following book and ongoing report are useful for general reference:

Ascher, Kate, and Wendy Marech. *The Works: Anatomy of a City*. New York: Penguin, 2005. Textbook available in Avery Ware and Avery Reserves, and Lehman Reserves (2 copies). New and used copies are also available on Amazon for a reasonable price. (Call Number: HT166 .A786 2005)

The City of New York, PlaNYC (2007), A Greener, Greater New York, http://www.nyc.gov/html/planyc/downloads/pdf/publications/full_report_2007.pdf.

Regional Plan Association, *The Fourth Regional Plan: Making the Region*

Work for All of Us (2017), <http://www.rpa.org/fourth-plan>.

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>.

Course Requirements (Assignments)

1. Readings and Participation in In-Class Discussions

Students are expected to be fully prepared for class by completing all reading and actively thinking about the issues to be discussed. Students are also expected to participate actively in class by enhancing our understanding, and not diverting or dominating the discussion but showing awareness of the flow of thought. Insightful questions count at least as much as insightful comments. Your participation will require that you answer questions, defend your point of view, and challenge the point of view of others.

To assess whether the readings are generally understood, and for the professor to obtain feedback, before each class students will submit a non-graded summary of the readings covering (1) what the students found interesting in the readings and (2) a sentence summarizing the thesis of each reading. Of the 12 classes with readings, students will be expected to submit responses on 8 weeks.

2. Group Presentation on an Infrastructure Problem and Potential Solutions

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. The output will be a PowerPoint and oral presentation during an in-class presentation, designed to inform public officials whether to support an infrastructure project. Students will be challenged to

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explain the issue, to present analysis, and to propose solutions in 15 minutes with 10 slides. The non-presenting students will play the role of the public decision-makers and should be prepared to ask relevant questions. The presenting students should also be prepared to answer questions that might be posed by other stakeholders such as the general public, bondholders, and the business community.

Original issues and approaches are encouraged. The presentation should be developed using the following structure and to answer the following questions:

1. Problem definition: What is the problem? Why is it a problem? For whom is it a problem? What are the economic, environmental, and social costs?
2. Problem analysis: What are the causes of the problem? What role can infrastructure and supporting policy interventions play in solving it? What data exists or can be created to help inform the problem?
3. Solution generation: What is the solution? How does it solve the problem? What is required for its implementation, and is it feasible in a reasonable timeframe? Who should do what and when? What are threats along the way? How can these be dealt with?
4. Solution and alternatives analysis: In which measure does the solution solve the problem? How certain of its effectiveness are we? Do the benefits/advantages outweigh the costs/disadvantages? How can the solution be improved following the assessment?

Progress Milestones:

- Four to six groups formed (team assignments based on general area of interest in Class 3);
- Topics submitted (Class 4); consultation with professor (office hours before Classes 5 and 6);
- Team meetings (outside of class between Classes 4 and 7);
- In-class presentation with questions and feedback from non-presenting students (Classes 8 and 9); and
- Group self-assessment (Class 10).

3. Individual Memorandum and Business Case Evaluation on an Infrastructure Delivery Plan

Following the same structure and questions used to frame the group presentation, each student will prepare a memorandum and business case evaluation for an infrastructure delivery plan to address an historical or current environmental or social issue. 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, how project or program procurement, governance, financing could have been improved, etc. The length should be long enough to inform the audience but not too long to fit into a busy schedule – the target length should be between 10 and 20 pages (or about 2,500 to 5,000 words).

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. 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 with enough dedication!

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General

- American Revitalization and Recovery Act
- Trump Infrastructure “Plan”
- Depression-Era infrastructure initiatives (WPA, CCC, etc.)
- East Midtown Rezoning and infrastructure
- Amazon HQ2 Competition

Transportation

- Gateway tunnel(s) (and/or the original tunnels built by Pennsylvania Railroad)
- East Side Access project
- Airport rail connections (LaGuardia, Denver, JFK)
- LaGuardia Airport renovation (new P3 model that was just announced)
- Stewart Airport renovation, business plan
- California High Speed Rail
- Amtrak NE Corridor (Stations, Penn/Moynihan Station redevelopment, Acela)
- Bike lanes
- Bikeshare/scootershare (docked and undocked)
- Autonomous Vehicles
- Electric Charging Station Networks
- Rapid Bus Transit
- Multi-modal stations
- Brooklyn-Queens light rail system (BQX)
- Uber/Lyft/rideshare
- Electronic tolling/cordon or congestion pricing/MoveNY plan

Water / Wastewater

- Rondout West Branch Tunnel Repair
- Green Infrastructure
- Stormwater Utilities
- Lake Powell Pipeline
- Carlsbad Desalination Plant
- Santa Clara Reuse Plant
- San Antonio Water Purchase Agreement
- Bayonne, NJ O&M Agreement
- Rialto, CA O&M Agreement
- Three Gorges Dams
- 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, Hudson Valley)
- Indian Point Nuclear Plan
- Pipelines (Keystone, Spectra, Constitution, Northeast Energy Direct)
- Vehicle charging stations (Electric, CNG, hydrogen)
- LNG Piers
- Fracking
- Off-shore/On-shore Wind Power farms
- Solar installations (distributed and in solar farms)
- Microgrids / nanogrids
- Anaerobic digester or landfill gas
- Biomass-based liquid fuels
- Distributed generation (microturbines, fuel cells, storage)
- Hydropower

Solid Waste

- Marine Transfer Stations / 91st Street MTS
- Transfer Stations
- Scrap Yards
- Landfills
- Incinerators / Waste to Energy Facilities
- Garbage disposals
- Organic waste systems (collection, composting, biogas)
- Recycling systems and markets
- Bag taxes and other reduction systems

Resiliency

- BIG U (and its variants, including the East Side Coastal Resiliency project)
- Seaport City Multi-Purpose Barrier
- NY Harbor Surge Barrier (and/or surge barriers in Venice, the Thames River, etc.)
- Post-Katrina levees in New Orleans
- Mid-Barataria Barrier
- Buyback and deconstruction / migration programs
- Wetlands restoration programs
- Disaster response systems

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Parks, Open Space, Natural Infrastructure

- QueensWay
- Brooklyn Bridge Park
- Hudson River Park
- Plazas / sidewalks / Greenstreets / green corridors
- Parks
- Marine Park
- Urban trail systems
- Urban forest systems
- Orchard Beach/Pelham Parkway
- Jamaica Bay Wetlands
- Protective Beach Dunes
- Oyster reefs
- Floyd Bennett Field

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Progress Milestones:

- Topics submitted (Class 10 at the absolute latest); and
- Consultation with professor (office hours before Classes 11 and 14).

Evaluation/Grading

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 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.

Grades will be determined from the following allocation:

ASSIGNMENT	% Weight
Readings and Class Participation	15%
Group Presentation on an Infrastructure Problem and Potential Solutions (25% on overall group effort and 10% on preparation and presentation of each individual, informed by the group self-assessment)	35%
Individual Memorandum and Business Case Analysis on an Infrastructure Delivery Plan	50%

Detailed grading rubrics will be distributed before the group and individual assignments.

All assignments are graded on a scale of 0-100. Points awarded to individual assignments translate into letter grades for the course in the follow matter: an A+ is awarded for truly extraordinary work, above and beyond course requirements and even professional standards; an A is awarded for final scores in the 93 to 100 range; an A- for 90 to 92; B+ for 87 to 89; B for 84 to 86; B- for 80 to 83; C+ for 77-79; C for 74 to 76; C- for 70 to 73; D for 66 to 69; and an F for scores of 65 or less.

Course Policies

Attendance

If you need to miss a class for any reason, please discuss the absence with me in advance.

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).

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School Policies

Copyright Policy

Please note—Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

Academic Integrity

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.

SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at <http://sps.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Accessibility

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <http://health.columbia.edu/services/ods/support>.

Course Schedule and Calendar

Overview

Date	Topic	Deliverable
(Class 1)	The Role of Infrastructure in Economic Development, Environmental Protection, and Public Health	
(Class 2)	Making the Case for Infrastructure: Politics, Stakeholders, Planning, and Economics	
(Class 3)	Transportation	
(Class 4)	Governance, Funding, and Financing Infrastructure	Team assignments

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(Class 5)	Water, Wastewater, and Solid Waste	Group topics submitted
(Class 6)	Parks and Open Space	
(Class 7)	Energy	
	NO CLASS	
(Class 8)	Group Presentations	Group Presentations
(Class 9)	Group Presentations	Group Presentations
(Class 10)	Integrated City-Level Infrastructure	Individual topics submitted (at the latest)
(Class 11)	Infrastructure Field Trip and Discussion	
(Class 12)	Sustainable and Resilient Infrastructure	
(Class 13)	Private-Public Partnerships, Public-Public-Private Partnerships, Infrastructure Exchanges and Accelerators Individual Presentations	
(Class 14)	Operations & Maintenance, Asset Management	
	NO CLASS	Final paper due at 5pm

1. The Role of Infrastructure in Economic Development, Environmental Protection, and Public Health

This class focuses on the relationship between infrastructure, the economy, public health, and the environment. We will examine the systems that exist to provide the necessities of life and the permanence of a city, which elements of a city can be provided by the free market (e.g., jobs, economic development, housing), and which typically involve public construction, regulation, or at a minimum a public policy framework.

Discussion topics: Public “environmental infrastructure” and its relationship with social/civic, educational, housing, private facilities, and other infrastructure; patterns of development in an increasingly urban, coastal world; importance of managing infrastructure management to cities, economies, and the environment; public health and environmental metrics; historical interrelationship between infrastructure, economic development and the environment; preservation versus conservation; widespread changes in land use and climate change, how it informs our understanding of the “natural” world; climate change and adaptation; and the historic role of the Gallatin Plan, Erie Canal, and Eisenhower Interstate Highway System in development of the U.S.

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Case Studies and Readings:

Zeynep Tufekci, Why the Post Office Makes America Great, New York Times (Jan. 3, 2016), <http://www.nytimes.com/2016/01/03/opinion/why-the-post-office-makes-america-great.html>

David Owens, Green Manhattan, New Yorker (Oct. 18, 2004), <http://www.davidowen.net/files/green-manhattan.pdf>.

Michael Bloomberg and Rohit T. Aggarwala, Think Locally, Act Globally, American Journal of Preventive Medicine 35.5 414-23, (2008), [http://www.ajpmonline.org/article/S0749-3797\(08\)00705-8/pdf](http://www.ajpmonline.org/article/S0749-3797(08)00705-8/pdf).

2. Making the Case for Infrastructure: Politics, Stakeholders, Planning, and Economics

This class provides an overview of the present state of the U.S. infrastructure and within that context focuses on (1) key decision-makers, the political context of infrastructure, the role of strategic planning, and other methods for creating momentum for investment in infrastructure, (2) the preliminary studies necessary for the development of infrastructure, and (3) the role of community engagement and partnerships.

Discussion topics: (1) The role of politics, interest groups, elected leaders, public opinion, and governmental institutions in the formulation and management of public policy and programs; deciding what, when, and how to build; relationship between strategic plans, master plans, facility plans; agenda setting; stakeholder and citizen participation; setting priorities; understanding and communicating risk; and (3) Planning, Pre-Design, Feasibility Studies, and Site Selection; assessment and management; condition assessment and asset management; benefit-cost analysis; life-cycle analysis; time value of money; business cases; alternatives analysis; environmental review; permitting; site assembly; eminent domain; and (3) community mobilization and engagement; stakeholder meetings and charrettes; siting and environmental justice. City competitions: Olympics, World's Fairs, and Amazon HQ2.

Case studies and readings:

American Society of Civil Engineers, Infrastructure Scorecard (2017), <http://www.infrastructurereportcard.org>

PlaNYC (pages TBD)

Regional Plan Association, The Fourth Regional Plan, <http://www.rpa.org/fourth-plan>

QueensWay, <http://thequeensway.org>

Conrad De Aenlle, World's Fairs and Their Legacies, New York Times (May 1, 2015), <https://www.nytimes.com/2015/05/04/arts/international/worlds-fairs-and-their-legacies.html>.

Paul Goldberger, Eminent Dominion, The New Yorker (Feb. 5, 2007), <http://www.newyorker.com/magazine/2007/02/05/eminent-dominion>.

Gaby Del Valle, Amazon HQ2: the many-layered backlash against the company expansion, explained, Vox (Nov. 6, 2018), <https://www.vox.com/the-goods/2018/11/6/18065666/amazon-hq2-backlash>.

Aaron M. Renn, What Happened After the Last HQ2 Competition, Urbanophile (Aug. 14, 2018), <https://www.urbanophile.com/2018/08/14/what-happened-after-the-last-hq2-competition/>.

3. Transportation

This class will discuss transportation infrastructure issues, including relationship to economic development, urban mobility, freight optimization in the urban context; emergency management provisions, user fees and tolling, rideshare and other

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technological innovations, and the role of information; fueling stations for alternative vehicles (e.g., EV chargers, CNG stations, hydrogen cell refills); parking and space policy for cars, bikes, scooters, car-share, bike docks, and charging stations.

Questions for class: Why do we value mobility? How do we pay for transportation services? What are the alternatives? To personalize this, please keep a record for a week of modes used, distances traveled, purposes, and economic and social value.

Case studies and readings:

The Works: Anatomy of a City (pages TBD)

PlaNYC (pages TBD)

Johnathan English, Why New York City Stopped Building Subways, CityLab (April 16, 2018) <https://www.citylab.com/transportation/2018/04/why-new-york-city-stopped-building-subways/557567/>.

Matthew Flamm, Can Sanitation Go Green?, Crain's New York Business (Sept. 18, 2018) <https://www.craigslist.com/features/can-sanitation-go-green>

New York City Economic Development Corporation, Freight NYC (2018), <https://www.nycedc.com/program/freight-nyc>.

Nate Berg, Lots to lose: how cities around the world are eliminating car parks, The Guardian (Sep. 27, 2016), <https://www.theguardian.com/cities/2016/sep/27/cities-eliminating-car-parks-parking>

Schaller Consulting, The New Automobility: Lyft, Uber and the Future of American Cities (July 25, 2018), <http://www.schallerconsult.com/rideservices/automobility.pdf>

WNYC On the Media Podcast, Whose Streets? (Nov. 23, 2018) <https://www.wnycstudios.org/story/on-the-media-2018-11-23>.

4. Governance, Funding, and Financing Infrastructure

This class presents options for governance and funding and financing infrastructure, i.e., who should pay, how should funds be collected and spent, and related topics, and the critical link between financing, feasibility, and actual design and construction.

Discussion topics: Which level of government sponsors which infrastructure sector projects (e.g., transportation is federal and state, water, wastewater and solid waste are local); the role of special authorities and other efforts to de-politicize the process; taxes; tax increment financing; special improvement districts; user fees, enterprise funds, trust funds, and other income streams; municipal bonds (general obligation, revenue backed); tax exemption for municipal bonds; leveraging public assets; quantifying and monetizing benefits (e.g., naming rights); private financing (equity, debt); Federal Highway Trust Fund; Federal Land and Water Conservation fund; State Revolving Funds; TIFIA and WIFIA; Private Activity Bonds; earmarks. Project life-cycle (design, construction); variety of state and city procurement legislation; anti-corruption reforms; Wicks Law; role of labor unions; Project Labor Agreements; design-bid-build; design build and progressive design build; advanced procurement options; role of technical, procurement, legal, financial, design consultants; risk allocation and costing; guarantees and indemnities; project management; programs versus projects; on-call contracts.

Case studies and readings:

Trump's Infrastructure Plan (Peter Navarro and Wilbur Ross, Trump v. Clinton on Infrastructure (Oct. 27, 2016), <http://peternavarro.com/sitebuildercontent/sitebuilderfiles/infrastructurereport.pdf>)

Congressional Budget Office, Infrastructure Banks and Surface Transportation (July 2012), <https://www.cbo.gov/sites/default/files/112th-congress-2011-2012/reports/07-12-12-infrastructurebanks.pdf>

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Government Accountability Office, Physical Infrastructure: Challenges and Investment Options for the Nation's Infrastructure, Statement of Patricia A. Dalton, Managing Director (May 8, 2008), <http://www.gao.gov/new.items/d08763t.pdf>

Roger C. Altman, Aaron Klein, and Alan B. Krueger, Financing U.S. Transportation Infrastructure in the 21st Century (May 2015), https://www.brookings.edu/wp-content/uploads/2016/06/financing_us_infrastructure_altman_klein_krueger.pdf

New York City Economic Development Corporation, Southern Manhattan Coastal Protection Study: Evaluating the Feasibility of a Multi-Purpose Levee (2014), http://www.nycedc.com/sites/default/files/filemanager/Projects/Seaport_City/Southern_Manhattan_Coastal_Protection_Study_-_Evaluating_the_Feasibility_of_a_Multi-Purpose_Levee.pdf

Lincoln Leong, McKinsey & Co., The 'Rail plus Property' model: Hong Kong's successful self-financing formula (June 2016), www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/the-rail-plus-property-model

5. Water, Wastewater, and Solid Waste

This class will discuss water, wastewater, and solid waste infrastructure issues. Discussion topics will include government and regulated private utility arrangements, generation, distribution, collection, treatment, and disposal; closed loop theories and mechanisms; user fees; conservation incentives; landfills, incinerators, organics and anaerobic digestion and other topics.

Case studies and readings:

Michelle Nijhuis, The Abandoned Plan That Could Have Saved America From Drought, BuzzFeed (Sept. 18, 2015), <http://www.buzzfeed.com/nijhuis/pipe-dreams-the-forgotten-project-that-could-have-saved-amer#.ntGLlzG656>

New York City Department of Environmental Protection, NYC Green Infrastructure Plan. (2010), http://www.nyc.gov/html/dep/pdf/green_infrastructure/NYCGreenInfrastructurePlan_LowRes.pdf (Executive Summary)

New York City Department of Sanitation, Comprehensive Solid Waste Plan (2006), https://www1.nyc.gov/assets/dsny/docs/about_swmp_exec_summary_0815.pdf (Executive Summary)

LA Sanitation, Final Program Environmental Impact Report, Solid Waste Integrated Resources Plan (Dec. 2014), <https://www.lacitiesan.org/san/sandocview?docname=cnt012520> (Executive Summary)

6. Parks and Open Space

Parks and open space in cities have long been a sought-after amenity in cities, and are even built by developers to enhance the value of their residential and commercial property. Now parks are conceived as a first-order intervention for a number of urban issues.

Discussion topics: The public health, recreational, economic, safety and environmental impacts of parks; developer-built parks; waterfront parks and resiliency, the role of conservancies; what needs to change for parks to be considered critical environmental infrastructure; measuring benefits and park progress; the 10-minute walk campaign.

Case studies and readings:

Jeffrey Klinenberg, Palaces for the People (2018) (Introduction, PDF in class file)

Trust for Public Land, 2018 City Park Facts (2018), https://www.tpl.org/sites/default/files/CityParkFacts2018.8_13_18finLO.pdf

Peter Harnik, Trust for Public Land, Urban Parks are Making a Comeback (Oct. 2008), <https://www.tpl.org/sites/default/files/cloud.tpl.org/pubs/ccpe-urban-parks-on-comeback-article.pdf>

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Trust for Public Land, The Economic Benefits of Parks and Recreation in Colorado Springs (Jan. 2017), https://www.tpl.org/sites/default/files/files_upload/CO%20Springs-econ-benefits.pdf

Natural Areas Conservancy and NYC Parks, Forest Management Framework for New York City (2018), <http://naturalareasnyc.org/content/forests/fmf-f6-hires-singles-reduced.pdf> (Executive Summary)

C.J. Hughes, New Parks Sprout Around New York City, New York Times (June 8, 2018), <https://www.nytimes.com/2018/06/08/realestate/new-parks-sprout-around-new-york.html>.

The Trust for Public Land, Public Spaces/Private Money, The Triumphs and Pitfalls of Urban Park Conservancies (Feb. 2015), https://www.tpl.org/sites/default/files/files_upload/ccpe-Parks-Conservancy-Report.pdf .

Gowanus Conservancy, Gowanus Lowlands Blueprint (2018), <https://gowanuscanalconservancy.org/gowanuslowlands/>. Also watch the video here.

New Yorkers for Parks, Open Space Dialogues: A New Perspective (2018),

http://www.ny4p.org/client-uploads/pdf/Other-reports/NY4P_OSD-Report-2018.pdf

7. Energy

This class will discuss energy infrastructure systems, which underlie most other infrastructure systems. Unlike those systems, energy is generally provided by investor-owned utilities in the United States under a regulated monopoly paradigm, but in other counties the public sector has a different role.

Discussion topics: The role of government in shaping energy policy, sustainability, and dependability on a city level; supply versus demand management; energy-efficiency and green building plans; the role of mandates, incentives, and market forces; interdependence with other environmental infrastructure systems (e.g., electric vehicles).

Case studies and readings:

PlaNYC (pages TBD)

C40, Case Study: 98% of Copenhagen City Heating Supplied by Waste Heat (Nov. 3, 2011), http://www.c40.org/case_studies/98-of-copenhagen-city-heating-supplied-by-waste-heat

G. Pepermans et al, Distributed generation: definition, benefits and issues, *Energy Policy*, 33: 787-798 (April 2005), Distributed generation: definition, benefits and issues.

Feargus O'Sullivan, Sweden Will Meet Its 2030 Green Energy Target 12 Years Early (July, 2018), <https://www.citylab.com/environment/2018/07/sweden-will-meet-its-2030-green-energy-target-12-years-early/565709/>

Linda Poon, NYC's Tall Order for Greener Buildings, Citylab (Sep. 26, 2017) <https://www.citylab.com/environment/2017/09/nyc-building-mandate-in-practice/540360/>

Kirchhoff et al., Developing mutual success factors and their application to swarm electrification: microgrids with 100 % renewable energies in the Global South and Germany. (April 7, 2016) PDF file attached separately.

Gerhard Fuchs and Nele Hinderer, Towards a low carbon future: a phenomenology of local electricity experiments in Germany. (April 7, 2016)

Video on basics about microgrid. <https://www.youtube.com/watch?v=c1BKlmtQom8>

8. Group Presentations and Discussions

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Student groups will make a presentation on an economic or environmental issue, present their analysis of alternatives, and propose solutions. Groups are allotted 10 slides and 15 minutes, plus 5 minutes for additional discussion.

9. Group Presentations and Discussions, Cont'd

10. Integrated City-Level Infrastructure

Centuries ago, powerful countries built new cities on new territory; the Romans built Constantinople by the Romans, and the Dutch built New Amsterdam. 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.

Discussion topics: the complex interaction between infrastructure systems in an urban environment in an era of climate change and urban renewal. Discussion topics include urban land use forms and contexts; hierarchies of infrastructure; work and conflicts; legal issues; aggregation versus dispersal; value creation and capture (enhance adjacent areas, intrinsic); resiliency; stormwater management; transportation corridors and transit oriented development.

Case studies and readings:

Emily Nonko, Hudson Yards wants to become NYC's next great neighborhood, Curbed (Sep. 19, 2018), <https://ny.curbed.com/2018/9/19/17861164/hudson-yards-new-york-development-related-companies>

David L.A. Gordon, The Resurrection of Canary Wharf, *Planning Theory & Practice*, 2:2, 149-168 (2001), <https://doi.org/10.1080/14649350120068777>.

David Ee, Humanising and Re-integrating Canary Wharf with London, (2018), <https://www.clc.gov.sg/docs/default-source/reports/bc-2018-05-humanising-and-re-integrating-canary-wharf-with-london.pdf>

Waterfront Toronto, Request for Proposals, Innovation and Funding Partner for the Quayside Development Opportunity (issued March 17, 2017), <https://sidewalktoronto.ca/wp-content/uploads/2018/04/Waterfront-Toronto-RFP-No.-2017-13.pdf>

Alex Bozikovic, Google's Sidewalk Labs signs deal for 'smart city' makeover of Toronto's waterfront, *The Globe and Mail* (June 12, 2018), <https://www.theglobeandmail.com/news/toronto/google-sidewalk-toronto-waterfront/article36612387/#index>

Laura Bliss, How Smart Should a City Be? Toronto Is Finding Out, *CityLab* (Sep. 7, 2018) <https://www.citylab.com/design/2018/09/how-smart-should-a-city-be-toronto-is-finding-out/569116/>

Laura Bliss, Inside a Pedestrian-First 'Superblock', *City Lab* (Aug. 7, 2018), <https://www.citylab.com/transportation/2018/08/inside-a-pedestrian-first-superblock/566864/>. Also watch the video.

Sarah Moser, Marian Swain, and Mohammed H. Alkhabbaz, King Abdullah Economic City: Engineering Saudi Arabia's Post-oil Future, *Cities* 45: 71-80 (2015), *King Abdullah Economic City: Engineering Saudi Arabia's Post-oil Future*

Patrick Sisson, Songdo, South Korea's City of the Future, Has a Green Vision, *Curbed* (Nov. 2, 2015), <https://www.curbed.com/2015/11/2/9904808/songdo-korea-city-planning>.

Philippe Mesmer, Songdo, Ghetto for the Affluent, *Le Monde* (May 29, 2017), http://www.lemonde.fr/smart-cities/article/2017/05/29/songdo-ghetto-for-the-affluent_5135650_4811534.html.

11. Infrastructure Field Trip and Discussion

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TBD. Past trips have included the New York City Department of Sanitation's 59th Street Pier for Recycling and the New York City Department of Environmental Protection's North River Wastewater Treatment Plant.

12. Sustainable and Resilient Infrastructure

This class takes the long view and covers the use of infrastructure to promote sustainability, resiliency, and adaptation to climate change.

Discussion topics: Concepts of sustainability and resiliency; centralized versus decentralized infrastructure; nature-based infrastructure; smart infrastructure; sustainable design and rating systems (LEED, Envision); the role of enduring and predictable subsidies for irrigation projects, solar farms, and wind farms; the ethanol problem; continuity of operations for communities and businesses; community engagement revisited.

Case studies and readings:

City of New Orleans, Resilient New Orleans: Strategic actions to shape our future city (2015), http://resilientnola.org/wp-content/uploads/2015/08/Resilient_New_Orleans_Strategy.pdf

Christopher Kennedy and Jan Corfee-Morlot, Past performance and future needs for low carbon climate resilient infrastructure— An investment perspective, *Energy Policy* 59:773-783 (2013), Past performance and future needs for low carbon climate resilient infrastructure— An investment perspective

Denise Nelson, Institute for Sustainable Infrastructure, The Water Values Podcast (April 22, 2015), <http://thewatervalues.com/2015/04/22/the-envisiontm-ratings-system-with-isi-vp-of-public-education-denise-nelson/>

Rebuild by Design, Safer and Stronger Cities: Strategies for Advocating for Federal Resilience Policy, <http://www.rebuildbydesign.org/data/files/918.pdf> (Executive Summary and Introduction)

Regional Plan Association, The New Shoreline: Integrating Community and Ecological Resilience around Tidal Wetlands (Sept., 2018), <http://www.rpa.org/sites/default/files/RPA-Wetland-Migration-Report%202.pdf>.

13. Private-Public Partnerships, Public-Public-Private Partnerships, Infrastructure Exchanges and Accelerators

Note: guest lecturer Eric Petersen of Hawkins, Delafield & Wood, bio at <https://www.hawkins.com/attorneys/eric-petersen>.

This class discusses creative solutions for financing, developing, and operating infrastructure that involve private or public partners.

Discussion topics: Revisiting stakeholders; advocacy groups; public-public partnerships and intergovernmental agreements; public-private partnerships (P3), public-public-private partnerships (P4); design build through design-build-finance-operate and maintain (DBFOM); international practices and norms where tax exempt financing doesn't exist; concession arrangements and contract oversight; conflict resolution; federal-state-local partnerships and federalism; infrastructure exchanges and accelerators, including the West Coast Exchange and the Intermountain Infrastructure Exchange; Partnerships British Columbia.

Case studies and readings:

Brian Rosenthal, The Most Expensive Mile of Subway Track on Earth, *New York Times*, (Dec. 28, 2017), <https://www.nytimes.com/2017/12/28/nyregion/new-york-subway-construction-costs.html>.

Regional Plan Association, RPA Reveals Underlying Reasons MTA Megaprojects Cost More than Twice as Much Than Peer Cities and Basic Steps to Save Billions (Feb. 6, 2018), <http://www.rpa.org/article/rpa-reveals-underlying-reasons-mta-megaprojects-cost-more-than-twice-as-much-than-peer>

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Eno Center for Transportation, Partnership Financing: Improving Transportation Infrastructure Through Public Private Partnerships (2011), <https://www.enotrans.org/wp-content/uploads/P3-paper-Final.pdf>

Partnerships BC, Understanding Public Private Partnerships (2011), http://www.partnershipsbc.ca/pdf/2011-09-02_Understanding-Public-Private-Partnerships.pdf

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), <http://www.epi.org/files/pdf/121302.pdf>

Homi Kharas and John McArthur, World Economic Forum, Public-Private Problem-Solving for the Sustainable Development Goals (July 2016), http://www3.weforum.org/docs/WEF_GACSD_Knowledge_Hub_Public_Private_Problem_Solving.pdf

14. Operations & Maintenance and Asset Management

This class discusses the problems around the adequate running of infrastructure and problems of institutionalizing investments.

Discussion topics: Asset life cycle; asset performance; level of service; capital versus operational tradeoffs; governance models.

Case studies and readings:

Regional Plan Association, Save our Subways: A Plan to Transform New York City's Rapid Transit System (June, 2018), <http://library.rpa.org/pdf/RPA-Save-Our-Subways.pdf>

Johnathan English, Why Did America Give Up on Mass Transit? (Don't Blame Cars), City Lab (Aug. 31, 2018) <https://www.citylab.com/transportation/2018/08/how-america-killed-transit/568825/>.

The City of Portland, Citywide Asset Overview (Feb. 25, 2015), <https://www.portlandoregon.gov/bps/article/392387>

The City of Portland, 2015 Citywide Assets Report, <https://www.portlandoregon.gov/cbo/article/567961>