

**SUMA K5690 Environmental Infrastructure for Sustainable Cities: Moving from Concept to Reality**  
**Fall 2016**

**Thursdays, 6:10-8:00 PM**  
**3 Credits**

**Instructor:** Carter Strickland, Carter.Strickland@gmail.com

**Office Hours:** Office hours will be held on Thursdays from 4 to 6 PM in 2929 Broadway, 5<sup>th</sup> Floor, or by appointment

**Response Policy:** My preferred means of communication is email to the address above. Students should expect a response from me within 24 hours.

**Course Overview**

Sustainability requires the efficient use of resources. In our modern, highly-developed society the least carbon- and energy-intensive pattern of settlement occurs in compact, walkable cities. The foundation for these cities is the 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 maintain sustainability. Yet we are building too little and too slowly to maintain our existing infrastructure, let alone build 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 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. And project developers are thinking of creative ways to create multiple function infrastructure that is also resilient and sustainable.

This course is designed to create the leaders of tomorrow who will overcome these challenges and build our sustainable cities. Using case studies of “environmental infrastructure” – public water, transportation, freight, parks, resiliency, solid waste, and energy infrastructure – this course covers the project life cycle from planning to asset management and provides the foundation needed for to design and deliver infrastructure services and build cities. Students will be introduced to creative 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 considerations about operations and maintenance. They will apply these lessons to present solutions of 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 3 Physical Dimensions and Area 5 General and Financial Management.

## Learning Objectives

By the end of this course, students will be able to:

- Discuss the importance of infrastructure to improving the environment and creating sustainable cities;
- Discuss and analyze standard infrastructure development stages and requirements;
- 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;
- Structure an infrastructure delivery plan;
- Present analysis and solutions in different formats (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

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 (2 copies). New and used copies are also available on Amazon for a reasonable price.

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

## Resources

### *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. *Group Presentation on an Infrastructure Problem and Potential Solutions*

Students will form “consultancies” of up to 4 students, which have been hired by a public agency or authority to help solve a complex issue. Groups must finalize their case city/region and topic by the second week of the course. The output will be a Powerpoint to inform public officials whether to support an infrastructure project (but be prepared to answer how presentation would be adjusted for meetings with the public financial backers, and other stakeholders). Students will be challenged to explain the issue, to present analysis, and to propose solutions in 10 slides and 15 minutes.

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 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 benefits/disadvantages? How can the solution be improved following the assessment?

Progress Milestones:

- Groups formed (random team assignments given in Class 2);
- topics submitted (Class 3); consultation with professor (office hours before Class 4);
- team meetings (outside of class between Classes 4 and 7); and
- presentation and feedback (during Classes 7 and 8).

### 2. *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 a historic 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 worse 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!*

#### *General*

- American Revitalization and Recovery Act
- Depression-Era initiatives (WPA, CCC, etc.)

#### *Transportation*

- Gateway tunnels (and original tunnels built by Pennsylvania Railroad)
- Airport rail connections (LaGuardia, Denver)
- 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
- Autonomous Vehicles
- Electric Charging Station Networks
- Rapid Bus Transit
- Multi-modal stations
- Brooklyn-Queens light rail system
- Uber
- 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)
- Resiliency projects (Sandy coastal protection around Manhattan, Seaport City Multi-Purpose Barrier, NY Harbor Surge Barrier, Katrina, NOLA Levees)
- Colorado/Texas/California Water Plans

#### *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 / 91<sup>st</sup> Street MTS
- Transfer Stations

- Scrap Yards
- Landfills
- Incinerators / Waste to Energy Facilities
- Garbage disposals
- Plazas / sidewalks / green corridors
- Parks
- Marine Park
- Jamaica Bay Wetlands
- Protective Beach Dunes
- Oyster reefs
- Floyd Bennett Field

*Parks, Open Space, Natural Infrastructure*

- Orchard Beach/Pelham Parkway

Progress Milestones:

- Topics submitted (Class 8);
- Consultation with professor (office hours between Classes 9 and 11); and
- Presentation and feedback (during Classes 12 and 13).

## 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 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:

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

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

### *Participation and Attendance*

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 as 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. 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)

## **Course Schedule and Calendar**

### **Week 1: September 8**

1. *The Role of Infrastructure in Economic Development and Environmental Protection*

This class focuses on the relationship between infrastructure, the economy, public health, and the environment, and presents an overview of past and present infrastructure development in the U.S.

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; historic 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.

Readings:

Tufekci, Zeynep. "Why the Post Office Makes America Great." *New York Times* [New York] 3 Jan. 2016: SR9. <<http://www.nytimes.com/2016/01/03/opinion/why-the-post-office-makes-america-great.html>>

Owens, David. "Green Manhattan." *New Yorker* 18 Oct. 2004: 111. <<http://www.davidowen.net/files/green-manhattan.pdf>>

Macomber, John D. "Building Sustainable Cities." *Harvard Business Review* July-Aug. 2013. <<https://hbr.org/2013/07/building-sustainable-cities>>

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

## Week 2: September 15

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

This two-part class 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, and (2) the preliminary studies necessary for the development of infrastructure.

Discussion topics: (1) The historic role of the Jefferson Plan, Erie Canal, and Eisenhower Interstate Highway System in development of the U.S., present state of U.S. infrastructure; (2) 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; stakeholder meetings and charrettes; siting and environmental justice.

#### Readings:

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

ASCE Infrastructure scorecard. Web. <<http://www.infrastructurereportcard.org/>>

Van Voorhis, Scott, Debra K. Rubin, and Nicholas Zeman. "Canada's Infrastructure Push." *Engineering News-Record* 16 Feb. 2016 (handout)

Berechman, Joseph. *The Politics of Large Infrastructure Investment Decision-Making: The Case of the Second Avenue Subway*. Rep. no. 49111-16-23. University Transportation Research Center - Region 2, Nov. 2013. Web. <<http://www.utrc2.org/sites/default/files/pubs/final-2nd-ave-subway-study.pdf>>.

"All Proposals." *Rebuild by Design*. Web. <<http://www.rebuildbydesign.org/design-opportunities/>>.

### **Week 3: September 22**

#### *3. Financing, Funding and Procuring Infrastructure*

This class presents options for funding and financing infrastructure, i.e., who should pay, how should funding be collecting 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); 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.

#### Readings:

Anachiarco, Frank. *An Overview of the Development of Inspection and Oversight: Blind Alleys and Open Vistas in the Case of American Procurement Policy*. Rep. Cyprus: ECPR, 2006. Web. <<https://ecpr.eu/Filestore/PaperProposal/795f94a8-3402-44b5-8be6-764097d218b3.pdf>>.

*Funding Stormwater Programs*. Rep. Environmental Protection Agency, Apr. 2009. Web. <<http://www3.epa.gov/region1/npdes/stormwater/assets/pdfs/FundingStormwater.pdf>>.

New York City Economic Development Cooperation. *Southern Manhattan Coastal Protection Study: Evaluating The Feasibility Of A Multi-Purpose Levee*. 2014. Web. <[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](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)>

Additional reading TBD

## Week 4: September 29

### 4. *Transportation*

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

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, for uploading (anonymously) to an on-line poll/survey with aggregate results discussed in class. Freight mobility will also be discussed.

Readings:

*The Works*, Moving People and Moving Freight sections

"I-4 Ultimate." *I4 Ultimate*. Web. <<http://i4ultimate.com/>>.

Condit, Richard. "Extracting Environmental Benefits from a New Canal in Nicaragua: Lessons from Panama." *PLOS Biology* *PLoS Biol* 13.7 (2015). Web. <<http://journals.plos.org/plosbiology/article?id=10.1371%2Fjournal.pbio.1002208>>

Kite-Powell, Hauke. *Estimating Economic Benefits from NOAA PORTS® Information: A Case Study of Houston / Galveston*. Rep. THE PORT OF HOUSTON AUTHORITY, Mar. 2007. Web. <[https://www.tidesandcurrents.noaa.gov/publications/EstimatingEconomicBenefitsfromNOAAPORTSInformation\\_Houston-Galveston.pdf](https://www.tidesandcurrents.noaa.gov/publications/EstimatingEconomicBenefitsfromNOAAPORTSInformation_Houston-Galveston.pdf)>.

Yozzo, David J., Pace Wilber, and Robert J. Will. "Beneficial Use of Dredged Material for Habitat Creation, Enhancement, and Restoration in New York–New Jersey Harbor." *Journal of Environmental Management* 73.1 (2004): 39-52. Web. Free access with Columbia log in: [http://ac.els-cdn.com/S0301479704001148/1-s2.0-S0301479704001148-main.pdf?\\_tid=ee1db91c-5270-11e6-895f-00000aacb35d&acdnat=1469455746\\_efddfc75440bdc7b302f7304998646cb](http://ac.els-cdn.com/S0301479704001148/1-s2.0-S0301479704001148-main.pdf?_tid=ee1db91c-5270-11e6-895f-00000aacb35d&acdnat=1469455746_efddfc75440bdc7b302f7304998646cb)

## Week 5: October 6

### 5. *Water, Wastewater, and Solid Waste*

This two-part class will be (1) an advanced discussion of water infrastructure, including state plans recently completed by California, Texas, and Colorado, water trading for financing infrastructure, the role of technology, conservation, prioritization in the regulatory context, the phenomenon of bottled water and the Value of Water coalition, water rates, and privatization; and (2) an advanced discussion of solid waste infrastructure issues, including the economics of collection, recycling and sorting, closed loop theories and mechanisms, landfills, incinerators, waste to energy, organics and anaerobic digestion.

#### Readings:

*The Works, Keeping It Clean* section

Nijhuis, Michelle. "The Abandoned Plan That Could Have Saved America From Drought." BuzzFeed. Web. 20 Sep. 2015. <<http://www.buzzfeed.com/nijhuis/pipe-dreams-the-forgotten-project-that-could-have-saved-amer> #.ntGLlzG656 >

*NYC Green Infrastructure Plan*. Rep. NYC Department of Environmental Protection, Sept. 2010. Web. <[http://www.nyc.gov/html/dep/pdf/green\\_infrastructure/NYCGreenInfrastructurePlan\\_LowRes.pdf](http://www.nyc.gov/html/dep/pdf/green_infrastructure/NYCGreenInfrastructurePlan_LowRes.pdf)>

*RIPPLE EFFECTS: The State of New Jersey's Infrastructure and Why It Matters*. Retrieved from. Rep. New Jersey Future, May 2014. Web. <<http://www.njfuture.org/wp-content/uploads/2014/05/RIPPLE-EFFECTS-Final.pdf>>.

Underwood, Dennis B. *A Case Study: Imperial Valley, California*. Proc. of Western Water: Expanding Uses/Finite Supplies, University of Colorado. Colorado Law Scholarly Commons, 1986. Web. <<http://scholar.law.colorado.edu/cgi/viewcontent.cgi?article=1006&context=western-water-expanding-uses-finite-supplies>>

Doherty, John J. *Comprehensive Solid Waste Plan*. New York City: Department of Sanitation, 2006. Executive Summary Only. Web. <[https://www1.nyc.gov/assets/dsny/docs/about\\_swmp\\_exec\\_summary\\_0815.pdf](https://www1.nyc.gov/assets/dsny/docs/about_swmp_exec_summary_0815.pdf)>

Henry, Rotich K., Zhao Yongsheng, and Dong Jun. "Municipal Solid Waste Management Challenges in Developing Countries – Kenyan Case Study." *Waste Management* 26.1 (2006): 92-100. *ScienceDirect*. Web. <[http://ac.els-cdn.com/S0956053X05001121/1-s2.0-S0956053X05001121-main.pdf?\\_tid=16f1380e-5272-11e6-9ee0-00000aacb361&acdnat=1469456244\\_e80a434137e70cf0c377cb7aa6d439a2](http://ac.els-cdn.com/S0956053X05001121/1-s2.0-S0956053X05001121-main.pdf?_tid=16f1380e-5272-11e6-9ee0-00000aacb361&acdnat=1469456244_e80a434137e70cf0c377cb7aa6d439a2)>

Additional reading TBD

## **Week 6: October 13**

### *6. Energy and Integrated City-Level Infrastructure*

This two-part class will be (1) an advanced discussion of the infrastructure of energy generation and transmission, including utility scale installations, microturbines, transmission lines, microgrids, pipelines, the challenge of integrating renewables, storage, hydro-fracking, nuclear power, oil development and export, the role of innovation, carbon-taxes and trading, the problem of climate change, and (2) an advanced discussion of the complex interaction between infrastructure systems in an urban environment in an era of climate change.

Discussion topics: Urban land use forms and contexts; hierarchies of infrastructure; street work and conflicts; legal issues; aggregation versus dispersal; value creation and capture (enhance adjacent areas, intrinsic); parkland and recreational use; resiliency; stormwater management; transportation corridors and transit oriented development.

Readings:

*The Works*, Power sections

Amitrano, Cristina. "New Smart Cities: A Focus on Some Ongoing Projects." Proc. of Conference of Informatics and Management Sciences. 28 Mar. 2014. Web. <<http://ictic.sk/archive/?vid=1&aid=3&kid=50301-62&q=f1>>.

Christopherson, Susan, and Irene Hung. *Crude Oil Railroad Transport: Community Risk Perception and Emergency Preparation in the Hudson River Valley*. Rep. New York State Water Resources Institute. Web. <[http://greenchoices.cornell.edu/resources/publications/transport/Crude\\_Oil\\_Railroad\\_Transport.pdf](http://greenchoices.cornell.edu/resources/publications/transport/Crude_Oil_Railroad_Transport.pdf)>.

Moser, Sarah, Marian Swain, and Mohammed H. Alkhabbaz. "King Abdullah Economic City: Engineering Saudi Arabia's Post-oil Future." *Cities* 45 (2015): 71-80. *Sciencedirect*. Web. <<http://www.sciencedirect.com/science/article/pii/S026427511500030X>>.

Additional reading TBD

## **Week 7: October 20**

### *7. Group Presentations and Discussion*

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

## **Week 8: October 27**

### *8. Group Presentations and Discussion*

### **Week 9: November 3**

#### 9. *Infrastructure Field Trip and Discussion, Cont'd*

### **Week 10: November 10**

#### 10. *Taking the Long View: Governance, Operations & Maintenance, Asset Management Sustainable Infrastructure and Resiliency*

This class discusses the problems around adequate running of infrastructure and problems of institutionalizing investments, and the use of infrastructure to promote sustainability, resiliency and adaptation to climate change.

Discussion topics: Asset life cycle; asset performance; level of service; concepts of sustainability and resiliency; stakeholder involvement and environmental review revisited; 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.

#### Readings:

*CASE STUDY Infrastructure Services Passaic Valley Sewerage Commission*. Rep. Emtec. Web. <[http://www.emtecinc.com/assets/uploads/recent-work/PVSC\\_Infra\\_DataCenter.pdf](http://www.emtecinc.com/assets/uploads/recent-work/PVSC_Infra_DataCenter.pdf)>.

*Transit Asset Management Practices, a National and International Review*. Review. Federal Transport Association, 2010. Web. <[https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/TAM\\_A\\_National\\_and\\_International\\_Review\\_-\\_6.10\\_FINAL\\_0.pdf](https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/TAM_A_National_and_International_Review_-_6.10_FINAL_0.pdf)>

Erickson, Mitchell. *A Bridge to Prosperity: Resilient Infrastructure Makes a Resilient Nation*. Proc. of Aging Infrastructure Workshop, Columbia University. Web. <[view2.fdu.edu/site-downloads/8162](http://view2.fdu.edu/site-downloads/8162)>.

Robert A. Morton and John A. Barras (2011) Hurricane Impacts on Coastal Wetlands: A Half-Century Record of Storm-Generated Features from Southern Louisiana. *Journal of Coastal Research*: Volume 27, Issue 6A: pp. 27 – 43. [https://www.researchgate.net/publication/261964839\\_Hurricane\\_Impacts\\_on\\_Coastal\\_Wetlands\\_A\\_Half-Century\\_Record\\_of\\_Storm-Generated\\_Features\\_from\\_Southern\\_Louisiana](https://www.researchgate.net/publication/261964839_Hurricane_Impacts_on_Coastal_Wetlands_A_Half-Century_Record_of_Storm-Generated_Features_from_Southern_Louisiana)

Bucci, Steven P., David Inserra, and Jonathan Lesser. *After Hurricane Sandy: Time to Learn and Implement the Lessons in Preparedness, Response, and Resilience*. Rep. no. 144. Heritage Foundation Emergency Preparedness Working Group. Web. <<http://www.heritage.org/research/reports/2013/10/after-hurricane-sandy-time-to-learn-and-implement-the-lessons>>

*Case Study of the Paterson Plank Road Area, Carlstadt and East Rutherford, NJ.* Rep. New Jersey Meadowlands Commission (NJMC), 2004. Web. <<https://rucore.libraries.rutgers.edu/rutgers-lib/17280/>>.

Haraguchi, Masahiko, and Upmanu Lall. "Flood Risks and Impacts: A Case Study Of Thailand's Floods In 2011 And Research Questions For Supply Chain Decision Making". *International Journal of Disaster Risk Reduction* 14 (2015): 256-272. Web. <[http://ac.els-cdn.com/S2212420914000752/1-s2.0-S2212420914000752-main.pdf?\\_tid=b75506b2-526e-11e6-b9a5-00000aab0f01&acdnat=1469454795\\_2ca4f8139dc2205001f5422735ecb1bd](http://ac.els-cdn.com/S2212420914000752/1-s2.0-S2212420914000752-main.pdf?_tid=b75506b2-526e-11e6-b9a5-00000aab0f01&acdnat=1469454795_2ca4f8139dc2205001f5422735ecb1bd)>

Lu, Peiwen, and Dominic Stead. "Understanding The Notion Of Resilience In Spatial Planning: A Case Study Of Rotterdam, The Netherlands". *Cities* 35 (2013): 200-212. Web. <[http://ac.els-cdn.com/S0264275113000851/1-s2.0-S0264275113000851-main.pdf?\\_tid=dd77a84a-526e-11e6-b904-00000aacb361&acdnat=1469454860\\_e9e3930e81a0905eb35f4b1d16642b8a](http://ac.els-cdn.com/S0264275113000851/1-s2.0-S0264275113000851-main.pdf?_tid=dd77a84a-526e-11e6-b904-00000aacb361&acdnat=1469454860_e9e3930e81a0905eb35f4b1d16642b8a)>

## **Week 11: November 17**

### *11. Private-Public Partnerships, Public-Public-Private Partnerships, Infrastructure Exchanges and Accelerators*

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

Readings:

Hachigian, Heather. West Coast Infrastructure Exchange. Carleton Centre for Community Innovation, 2014. Web. <[http://carleton.ca/3ci/wp-content/uploads/WCX-2014-Case-Study\\_Final.pdf](http://carleton.ca/3ci/wp-content/uploads/WCX-2014-Case-Study_Final.pdf)>

KKR, "Bayonne Water And Wastewater Concession: A Public-Private Partnership". 2014. Web. <<http://kkresg.com/assets/uploads/pdfs/case-studies/2014/bwwc.pdf?p=bayonne-water>>

Wong, Siu-Wai, and Bo-Sin Tang. "Challenges to the Sustainability of 'development Zones': A Case Study of Guangzhou Development District, China." *Cities* 22.4 (2005): 303-16. Elsevier. Web. <[http://202.116.197.15/cadalcanton/Fulltext/21153\\_2014319\\_102454\\_47.pdf](http://202.116.197.15/cadalcanton/Fulltext/21153_2014319_102454_47.pdf)>.

Additional reading TBD

## **Week 12: December 1**

### *12. Individual Presentations and Discussion*

Individuals will present their business case evaluations of an economic or environmental issue, present their analysis of alternatives, and to propose solutions. Individuals will be allotted time depending on enrollment.

## **Week 13: December 8**

### *13. Individual Presentations and Discussion, Cont'd*

## **School Policies**

### *Copyright Policy*

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### *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>.