

SUMAPS5690

Environmental Infrastructure Policy for Sustainable Cities: Concepts through Implementation

Fall 2017

Tuesdays, 6:10-8:00 PM

3 Credits

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

Location: TBD

Teaching Assistant: Briana Garcia, bmg2159@columbia.edu

Office Hours: Office hours will be held Tuesdays from 5 to 6 pm before class.

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. The least carbon- and energy-intensive pattern of settlement today is in compact, walkable cities whose integrated networks of infrastructure that allows 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 slow 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 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 the leaders of tomorrow who 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:

- Discuss the importance of infrastructure to improving the environment and creating sustainable cities;
- 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;
- 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.

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 four students that have been “hired” by a public agency or authority to help solve a complex issue. 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 15 minutes with 10 slides.

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:

- Groups formed (random team assignments given 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); 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 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!

General

- American Revitalization and Recovery Act
- Trump Infrastructure “Plan”
- 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 / 91st Street MTS
- Transfer Stations
- Scrap Yards
- Landfills
- Incinerators / Waste to Energy Facilities
- Garbage disposals

Parks, Open Space, Natural Infrastructure

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

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 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:

- 15% Participation
- 35% Group Presentation on an Infrastructure Problem and Potential Solutions (25% on overall group effort, and 10% on preparation and presentation of each individual)
- 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 to100 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).

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.

New York City, *PlaNYC* (2007),

http://www.nyc.gov/html/planyc/downloads/pdf/publications/full_report_2007.pdf.

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

Course Schedule and Calendar

Week 1: September 5

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.

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.

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)

Week 2: September 12

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.

Case studies and readings:

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

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

PlaNYC (pages TBD)

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

QueensWay, <http://thequeensway.org>

Week 3: September 19

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 technological innovations, and the role of information.

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 online poll/survey with aggregate results discussed in class. Freight mobility will also be discussed.

Case studies and readings:

The Works: Anatomy of a City (pages TBD)

PlaNYC (pages TBD)

Bob Graves, *Urban Transportation's Multimodal Future*, in Future Structure (Jan. 18, 2007),
<http://www.govtech.com/fs/perspectives/Urban-Transportations-Multimodal-Future.html>

Regional Plan Association, *Why Goods Movements Matter* (2016),
<http://library.rpa.org/pdf/Why-Goods-Movement-Matters-ENG.pdf>

New York City Economic Development Corporation, *Five Boro Food Flow*,
https://www.nycedc.com/system/files/files/resource/2016_food_supply-resiliency_study_results.pdf

Week 4: September 26

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:

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>

Government Accounting 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

Mckinsey & Co., *How Hong Kong created a self-financing rail system via Rail + Property financing* (June 2016), www.mckinsey.com/industries/capital-projects-and-infrastructure/our-insights/the-rail-plus-property-model

Week 5: October 3

5. Water, Wastewater, Solid Waste, and Electricity

This class will discuss utility-type functions that require government or privately-built infrastructure, including water, solid waste, and electricity infrastructure issues. Discussion topics will include government and regulated private utility arrangements, the economics of land selection and assembly, generation, distribution, collection, treatment, and disposal; closed loop theories and mechanisms; user fees; conservation incentives; and co-generation, renewables, landfills, incinerators, waste to energy, organics and anaerobic digestion, centralized versus distributed systems, and other topics.

Case studies and readings:

Nijhuis, Michelle, *The Abandoned Plan That Could Have Saved America From Drought*, BuzzFeed (Sept. 20, 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 State Comptroller Thomas DiNapoli, *Drinking Water Systems in New York: The Challenges of Aging Infrastructure* (Feb. 2017), <https://www.osc.state.ny.us/localgov/pubs/research/drinkingwatersystems.pdf>

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)

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](#)

Week 6: October 10

6. *Parks and Open Space; Integrated City-Level Infrastructure*

This two-part class will be on (1) parks and open space, 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.

Case studies:

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

American Planning Association, *City Parks Forum Briefing Paper: Green Infrastructure*, <https://www.planning.org/cityparks/briefingpapers/greeninfrastructure.htm>

Trust for Public Land, Center for City Park Excellence, *Economic Value of Urban Park Systems* (2009), <https://www.tpl.org/sites/default/files/cloud.tpl.org/pubs/ccpe-econvalueparks-rpt.pdf>

PlaNYC (pages TBD)

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

Note: Open House New York is the weekend of October 14-15

Week 7: October 17

7. *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 10 slides and 15 minutes, plus 5 minutes for additional discussion.

Week 8: October 24

8. *Group Presentations and Discussions*

Week 9: October 31

9. *Infrastructure Field Trip and Discussion*

Week 10: November 14

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

This class discusses the problems around the 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.

Case studies and readings:

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) (download at <http://thewatervalues.com/2015/04/22/the-envisiontm-ratings-system-with-isi-vp-of-public-education-denise-nelson/>)

Natural Resources Defense Council, *Taking the High Road to More and Better Infrastructure in the United States* (2016), <https://www.nrdc.org/sites/default/files/taking-high-road-more-and-better-infrastructure-ip.pdf>

Week 11: November 21

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

Case studies and readings:

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

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>

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

West Coast Infrastructure Exchange, *Performance Based Infrastructure (PBI) Transportation Project Case Studies*,
<http://westcoastx.com/assets/documents/Transportation%20PBI%20Case%20Studies/WCX%20PBI%20Transportation%20Project%20Case%20Studies.pdf>

Week 12: November 28

12. Individual Presentations and Discussions

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

Note: Fourth Regional Plan to be released on November 30, 2017

Week 13: December 5

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>.