# Infrastructure Systems in Theory and Practice
# 11.S953 / Spring 2016 / 2-0-6 [G]

Last updated: January 27, 2016

## 1 Key information

| | |
|---|---|
| Instructor: | Assistant Professor David Hsu, office 9-334, ydh@mit.edu |
| Administrator: | Takeo Kuwabara, 9-332, takeok@mit.edu |
| Time & Place: | Wednesdays, 2-4 pm, room 9-451 |
| Contact: | The best way to reach me is by e-mail.<br>You can expect a reply in 1-2 business days.<br>For anonymous feedback, use anonymouse.org/anonemail.html. |
| Office Hours: | Book an appointment at www.meetme.so/davidhsu, or by e-mail. |
| Website: | Be sure to check Stellar settings for notifications and materials. |

## 2 Learning objectives & norms

Goals are for all of us, together, to:

- read a lot of new theories and ideas
- connect disparate ideas and literatures
- brainstorm how these ideas affects our interests
- be present for, contribute to, and participate in excellent discussions



## 3 Introduction

Infrastructure is hard to define for many reasons: it is built and endures over long periods of time, often over a range of geographic scales; it has physical, technological, social and economic aspects; it is composed of systems, institutions, individuals, behaviors, expectations, and culture; it often takes new forms in new settings and situations; and it has many consequences in cities, both intended and not. Infrastructure is also often invisible to its users, since most people have rarely considered, if ever, where their energy, water, food, or materials come from. However, the pervasive nature of computing technologies paradoxically make physical infrastructures more visible by revealing how information and data can be used to shape the world that everyone lives in.

This class will therefore seek to abstract theories of infrastructure from particular situations, first by reading theory; second, by examining specific case studies that illustrate how these theories manifests themselves; and third, by considering how these infrastructures may be changing with the impact of digital technologies.

The structure of this class is that of a reading seminar, with the main emphasis of our class on learning through active discussions and interaction. The work of the semester will consist largely of reading and preparing for class, participating in class discussions, and then reflecting on those discussions.

## 4 Prerequisites

Permission to take the course will be given in the third week of the course, and mainly depends on (a) you doing the reading, and (b) your attendance.

While I understand that you all need to shop classes, we only have fourteen classes together, and if you do end up taking the class, you will still be responsible for the reading and writing associated with the shopping period classes. Also, reading the material is a good way to see if this class is for you, since much of the class depends on the reading. If you need to miss one of the first three classes, but are still interested in taking this class, then please let me know by e-mail so I can take that into account, and be sure to submit your short writing pieces also.

There are no formal courses required before this one, though I will assume that you are familiar with theories of externalities, public goods, and monopoly at the level of a undergraduate microeconomics or our planning/urban economics sequence (11.202 / 11.203). This is because many of the ideas we will explore this semester are in contrast to economics, which has been the traditional literature for thinking about infrastructure.

## 5 NO laptops in the classroom

We will NOT be using laptops, tablets, or cellphones in the classroom (though Kindles or similar reading devices are allowed if desired). There is a large and robust literature that indicates that the vast majority of people:

- do not read with less comprehension or speed when reading on screens (Dillon, 1992)
- are less productive when multi-tasking and are unable to perceive this: APA summary
- are frequently distracted by the laptops of other people (Hembrooke and Gay, 2003; Sana et al., 2013).

Therefore, please bring paper materials as necessary to refer to the readings during discussion. You are welcome to scan and post your hand-written reflection or notes on documents on the Stellar site as long as they are legible.



## 6 Readings

You should acquire copies of the following books, all are available in paperback or Kindle:

- Hughes (2004), $12 paperback, $12 Kindle
- Gomez-Ibanez (2006), $38 paperback, $17 Kindle
- Light (2003), $28 paperback, $27 Kindle

All other class materials will be on Stellar unless otherwise noted. However, since we will be reading a great deal of material off of Stellar, but not bringing laptops into class, you can also make a course packet at MIT CopyTech (++).

## 7 Class structure & assignments

This class is structured as an active discussion seminar. Each week the syllabus emphasizes a particular issue or question, along with some theory readings to give different perspectives and one of two case studies to ground our discussion. So, all of your work will be to ensure that we collectively have the best discussions possible:

- Before class, you should prepare for each week by doing the readings, and then writing a 300-word analysis of the readings, either consisting of your opinions, insights, disagreements, or questions. You can assume that the readers (your classmates and myself) are already familiar with the material, so there is no need to recap or review the readings.
- During class, each week, we will start with students giving short commentary on the readings. You will select two days of the semester in advance, so in each class two students will present – and one will be selected at random each week – to speak for 5 minutes each (with no slides). Students then take five minutes to write a question or point on the board, and then we will begin discussion.
- After class, you will strengthen your understanding with a 100-word reflection on the discussion and any additional points.

## 8 Class schedule

The bullet points indicate the materials that should be read and commented on before class. All class materials are on Stellar unless otherwise noted.

1. Feb. 3: What is infrastructure?
    - syllabus: note any questions that you'd like to ask in class; any changes and versions will be finalized along with enrollment by week 3
    - theory: Markard (2011), 1-36
    - theory: Estache (2007), 1-43
    - theory: Howe et al. (2015), 1-19
    - acquire book for next week: Hughes (2004), available in paperback or in Kindle edition
2. Feb. 10: Conceptions of cities, technology, and the environment
    - theory: Hughes (2004), all 252 pages
3. Feb. 17: Infrastructure as connection to nature
    - theory: Heidegger (1954), pages 307-342
    - theory: Kidd (1992), pages 1-26
    - theory: Brand (2010), pages 1-23, 51-73
    - cases: Columbia River in White (1995), pages 64-113; New York City water supply in Soll (2013), chapter 1, pages 11-36
    - optional cases: Soll (2013), chapter 2; McPhee (1989), "Atchafalaya", pages 3-94.

4. Feb. 24: System paths & transitions

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Arthur (1989), pages 13-32
    - theory: David (1985), pages 332-337
    - theory: Grubler (1990), pages 259-280
    - theory: Grubler (2012), pages 8-16
    - cases: nuclear power, Madrigal (2011), pages 221-259; LNG, Smil (2010), pages 12-24; cars and air pollution, McCarthy (2007), pages 176-192

5. Mar. 2: Ownership and regulation

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Train (1991), pages 1-17
    - theory: Gomez-Ibanez (2006), pages 1-54
    - cases: municipal waterworks in Jacobson (2000), pages 1-73 and Nickson and Vargas (2002)

6. Mar. 9: Ownership and markets

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Estache et al. (2001), pages 1179-1198
    - theory: Estache (2004), pages 1-43
    - cases: buses, telephones and railways in Eichengreen (1995), pages 75-91 and Gomez-Ibanez (2006), pages 55-108

7. Mar. 16: Control of complex systems

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Light (2003), pages 35-95
    - theory: Kelly (1995), pages ++
    - case: Perrow (2011), pages 32-122
    - case: E-government in China and Singapore in Ramon (2013), pages ++

8. Mar. 30: Size and centralization

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Schumacher (1989), pages 67-83, 181-202
    - Bookchin (1975), pages 85-139
    - theory and case: Altshuler and Luberoff (2003), pages 45-75, description of Central Artery project, pages 76-122
    - theory and case: Ostrom (1990), description of CPR management, pages ++, ++if 1993, pages 127-177

9. Apr. 6: Access, distribution, and fairness

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Graham and Marvin (2001), pages ++

- theory: Gleick (1998), pages 571-579
- theory: Sovacool et al. (2012), pages 715-719
- theory: Bullard (1994), pages 315-351
- case: water in Mumbai, Anand (2011), pages 542-564, and Anand (2012), pages 487-509

10. Apr. 13: Creation of large systems

    - discussants: 1. TBD, 2. TBD, 3. random
    - case: electricity in Hughes (1993), pages 19-46, 140-175 and 201-226
    - theory: Hagiu and Schmalensee (2006), chapter 3, pages 43-80
    - theory: Raymond (1999), pages 1-35
    - case: Caro, pages ++; Internet in Hafner and Lyon (1996), Malik (2015); LaFrance (2015)

11. Apr. 20: Social influences on technology

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Nye (1996), pages 139-184
    - theory: Marvin (1988), pages 63-108
    - theory: Haraway (2000), pages 1-29
    - case: mobile technologies in Turkle (2011), pages 151-210; digital media in protests in Bennett and Segerberg (2011) and Facebook in Johnson (2012), Mirani (2015)

12. Apr. 27: Consumer influences on technology

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Hutchby (2001), pages 441-456
    - theory: MacKenzie and Wajcman (1986), pages ++
    - theory: Grint and Woolgar (1997), pages ++
    - theory: Boorstin (1973), pages ++
    - case: Wright Brothers; Kern.

13. May 4: Hacking existing technologies

    - discussants: 1. TBD, 2. TBD, 3. random
    - Von Hippel (2005), ++
    - Franz (2011), ++
    - case: cars in Edgerton (2011), ++; McCarthy (2007), pages 231-266.

14. May 11: Information, individuals & systems

    - discussants: 1. TBD, 2. TBD, 3. random
    - theory: Zuboff (1988), pages ++
    - theory: Edwards (2004), pages ++
    - theory: Agyeman et al. (2013), pages ++
    - case: Goldsmith and Crawford (2014) , pages ++
    - case:

# 9 Grading

Your grade will consist entirely of the weekly activities described above. The breakdown is:

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|---|---|
| writing: before / after class | 60% |
| presentations | 30% |
| engagement in class | 10% |
| | 100% |

General guidelines: your writing and presentations before class should be aimed at a reader who is already familiar with the material, so there is no need to recap or review. In class, sparking discussion, bringing out unfamiliar points, and synthesizing the material is encouraged.

You should hand in your writing and reflections by simply posting them to a forum on the class Stellar site, so your classmates can also see your writing. I will post grades as we go along on the homework module on the class Stellar site.

## 9.1 Snow days (!):

In the event of a snow day, we will simply omit classes from the end, so we will just continue on with the appointed class schedule.

## 9.2 ADA accommodations

Any student who, because of a disability, may require special arrangements in order to meet course requirements should contact me as soon as possible to make necessary arrangements with MIT's Student Disabilities Services: http://web.mit.edu/uaap/sds/index.html.

## 9.3 Academic integrity

Plagiarism, unauthorized collaboration, cheating, and facilitating academic dishonesty are academic crimes. It is your responsibility as students and scholars to understand the definition of any such activities, and to avoid and discourage them. Engaging in these activities either knowingly or unknowingly may result in severe academic sanctions, and you are therefore expected to familiarize yourself with MIT's policies: https://integrity.mit.edu.

## 9.4 Issues TBD on first day

1. assign class presentation days
2.



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