Infrastructure Systems in Theory and Practice

Last updated: January 31, 2017

1 Key information

Instructor: Assistant Professor David Hsu, office 9-434
Time & Place: Wednesdays, 2-4 pm, room 9-451
Contact: Best is by e-mail: ydh@mit.edu, I usually reply in 1-2 business days. For anonymous feedback, use anonymous.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 has become an area of intense intellectual and political focus. If recent campaigns are any indication, we may spend a lot of time over the next few years discussing how to make our nation’s infrastructure great again. But let’s take a step back: what is infrastructure? 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, and third by considering what it means to be physical and digital.

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 only 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 suits 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 an undergraduate microeconomics or the standard 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 devices that only allow reading are allowed if desired). There is a large and robust literature that indicates that the vast majority of people:

- are able to read on screens with similar comprehension or speed (Dillon, 1992), BUT
- are less productive when multi-tasking and are unable to perceive this: APA summary
- are distracted by the laptops of others (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 at the MIT Coop or elsewhere, in paperback:

- Gomez-Ibanez (2006)

All other class materials will be on Stellar unless otherwise noted. You can make a course packet at MIT CopyTech if desired, though students generally find that they only want to lug around a given week’s worth of reading at a time.
7 Class structure & assignments

This class is structured as an active discussion seminar. All of your work will be to ensure that we collectively have the best discussions possible. Therefore, each week we will follow a fairly routine schedule:

- Thursday-Sunday: do the readings. Most weeks are about 150-200 pages, but you should leave some extra time here depending on how you quickly you read and review the material.
- by Monday: write 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. Your goal here is to stimulate the discussion that you want to have about the material.
- on Tuesday: I’ll circulate two of your commentaries for all of us to focus on.
- on Wednesday: at the beginning of class I’ll cold-call two more students to help us set out some discussion goals for the week.

8 Class schedule

All class materials are on Stellar unless otherwise noted.

1. Feb. 8: Introduction to class and infrastructure studies
   - 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
   - acquire book for next week: Hughes (2004), available in paperback or on Kindle
   - theory: Edwards et al. (2009), 1-12
   - theory: Smith (2016), read or watch video
   - theory: Estache (2007), 1-43
   - theory: Markard (2011), 1-36
   - theory: Howe et al. (2015), 1-19

2. Feb. 15: Conceptions of cities, technology, and the environment
   - theory: Hughes (2004), chapters 1-5 (optional, 6)

3. Feb. 22: Infrastructure as connection to nature
   - theory: Kidd (1992), pages 1-26
   - theory: Brand (2010), pages 1-23, 51-73
   - theory: Heidegger (1954), pages 307-342
4. Mar. 1: Creation of large systems: electricity and the Internet

- theory: Nye (1996), pages 139-184
- theory: Raymond (2001), pages 1-35
- case: Internet in Hafner and Lyon (1996), pages 43-81 (optional 11-42, it’s a good MIT story leading into the assigned reading), Malik (2015); LaFrance (2015)

5. Mar. 15: System history, paths & transitions: energy

- theory: David (1985), pages 332-337
- theory: Grubler (1990), pages 259-280
- theory: Grubler (2012), pages 8-16


- theory: Train (1991), pages 1-17
- theory: Gomez-Ibanez (2006), pages 1-54

7. Mar. 29: Ownership and markets: transportation in the developing world

- theory: Estache et al. (2001), pages 1179-1198
- theory: Estache (2004), pages 1-43

8. Apr. 5: Control of complex systems: nuclear power

- theory: Light (2003), pages 35-95
- theory: Kelly (1995), pages 111-150
- case: Perrow (2011), pages 32-122

9. Apr. 12: Size and centralization: transportation

- theory: Bookchin (1975), pages 85-139
- theory and case: Altshuler and Luberoff (2003), pages 45-75, description of Central Artery project, pages 76-122
- case: Woodman (2016)
10. Apr. 19: Access, distribution, and fairness: water
   • theory: Graham and Marvin (2001), pages 90-135
   • theory: Gleick (1998), pages 571-579
   • theory: Sovacool et al. (2012), pages 715-719
   • theory: Bullard (1994), pages 315-351

11. Apr. 26: Social influences on technology: electricity and Internet again
   • theory: Marvin (1988), pages 63-108
   • theory: Haraway (2000), pages 1-29

12. May 3: Market influences on technology: consumption and manufacturing
   • theory: Grint and Woolgar (1997), pages 65-94
   • theory: Hutchby (2001), pages 441-456
   • theory: Thomas (2010), pages 199-221
   • case: consumption in Boorstin (1973), pages 89-135, McCarthy (2007), pages 231-266

13. May 10: Hacking existing technologies: cars
   • theory: Hippel (2005), pages 1-16
   • theory: Fleck (2010), pages 244-257

14. May 17: Information, individuals & systems: smart cities
   • theory: Zuboff (1988), pages 59-96
   • theory: Edwards (2004), pages 251-285
   • theory: Agyeman et al. (2013), pages 1-32
   • case: Goldsmith and Crawford (2014), pages 55-94
9 Grading

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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>writing: before / after class</td>
<td>50%</td>
</tr>
<tr>
<td>engagement in discussions</td>
<td>50%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
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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 have a WebEx video conferencing session (mit.webex.com) at the usual time. If this is not possible, then I will let you know that morning and 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

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References


Mirani, L. (2015). Millions of Facebook users have no idea they’re using the internet.


