

# Syllabus for 4.s42: Comfort in Motion

## Design Strategies to Promote Human Powered Mobility through Comfortable Outdoor Spaces



Fall 2014

Department: Architecture

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Time and Location: Monday: Room 5-216  
Lecture: 12:30 PM – 2:00 PM  
Lab (irregular): 11:00 AM – 12:30 PM  
Lab conflicts can be accommodated

Prerequisites: Requires permission of instructors  
Enrollment limited to 15  
Good working knowledge of Rhino 5

*"Walkability is both an end and a means, as well as a measure. While the physical and the social rewards of walking are many, walkability is perhaps most useful as it contributes to urban vitality ... Get walkability right, and so much of the rest will follow."*  
Jeff Speck, (Walkable City, 2012)

*"The goal is to give designers the ability to comprehend the impact of their built environment interventions on human-powered travel behavior from a comfort perspective."*  
The Instructors

### Course Description:

This seminar explores the relationship between outdoor thermal comfort and people's mobility mode choices. The underlying premise is that, if provided with comfortable environments that are suitable for walking and biking, people will choose this option over alternative modes of transportation. We will further investigate what role architects and urban designers can play in creating such spaces. As a semester-long course project we will be investigating the street network between the main MIT and Harvard Campuses in Cambridge with the goal of developing and designing a network of biking paths that will further connect the two communities.

In section I we will review the existing body of research that links outdoor comfort conditions to people being outdoors. We will then introduce theories and assessment methods to evaluate outdoor thermal comfort and explore how to apply them to people in motion. Finally, we will introduce a series of computer-based analysis methods to predict microclimatic conditions such as solar radiation and wind flow around buildings. The outcome of this work will be an annual outdoor comfort map of the focus area. Based on existing literature and personal experience of seminar participants, we will develop a bikeability score index for streets. This analysis will be overlaid on our comfort map to understand where opportunities for urban design intervention lie. Throughout section II and III of the seminar, participants will develop a series of concrete design proposals and strategically placed street and intersection redesigns that serve the overall goal of providing meaningful, comfortable opportunities for human powered inter-campus trips.

	Week / Date	Lecture (12:30 – 2:00 PM)	Lab (11:00 AM – 12:30 PM)	Assignments
Section I  Research and Analysis	1	09/08 <b>"101"</b> An introductory lecture about the seminar with an overview on various issues of thermal comfort, urban microclimate and how this relates to street design and place-making.	No Lab	<b>1. Trip Narrative</b> (Individual) Where did you live? And what makes a place bikeable?
	2	09/15 <b>Designer vs. Engineer</b> Lecture on urban street design principles and standards, with focus on bikeway design. The walkability and bikeability of neighborhoods will be examined from a design perspective.	No Lab	<b>2. Cambridge Model</b> Study space digital model + developing a Bikeability index.
	3	09/22 <b>Brainstorming Session with <a href="#">Dan Burden</a></b> and a walk audit excursion in Cambridge		(Public talk at 5 PM)
	4	09/29 <b>Outdoor Thermal Comfort</b> Lecture on microclimatic design and human thermal comfort. Topics discussed include urban energy balance, heat island effect, air-flow, vegetation and design strategies for resiliency.	<b>Simulation Lab I:</b> Basic tools for solar design and shading strategies (Ecotect)	<b>3. Basic Simulation</b> Studies of solar access and shading in select intersections.
	5	10/06 <b>#ComfortInMotion</b> Resume the previous outdoor thermal comfort discussion with emphasis on the influence of the built environment on travel behavior from a building science perspective.	<b>Simulation Lab II:</b> Advanced simulation for outdoor thermal comfort ( <a href="#">umi</a> ).	<b>4. Microclimatic Design</b> Studies of materiality and geometry's impact on comfort.
Section II  Design and Policy	6	10/13 Columbus Day - No Class		
	7	10/20 <b>The Design of Complete Streets</b> (Guest lecture by <a href="#">Gary Hilderbrand</a> ) Guest lecture on the practice of landscaping and street design through experiences with various projects and clients, with highlight on relevant case studies.	<b>Design Tools</b> Street section design using web-based tools.	<b>5. Section Design</b> (Individual) Propose temporally evolving street section design for site.
	8	10/27 <b>Human-powered Mobility through Policy</b> (Guest Panel from Boston & Cambridge (TBC)) Panel discussion on engagement in real projects sponsored by cities. Implementing principles of walkability / bikeability to neighborhoods through minor and major interventions.	No Lab	<b>6. Policy Interventions</b> Proposing policies to support human powered mobility.
	9	11/03 <b>Midterm Crit with <a href="#">John Massengale</a></b>		(Public talk at 5 PM)
Section III  Energy and Pricing	10	11/10 Veterans Day - No Class		
	11	11/17 <b>Energy Efficient Precedents and Trajectories</b> Lecture on global success stories and their achievement metrics. Emphasis is on climate-specific interventions and energy assessment measures for prioritizing sustainable mobility.	No Lab	<b>7. Metrics</b> Develop and apply assessment measures to project.
	12	11/24 <b>Pricing and Financing Schemes</b> (Flipped Classroom) Participants will receive a set of lectures and readings to be done prior to class. During class time instructors will work with groups to develop pricing and financial calculations, as well as provide support and feedback for the projects before final crit.		
	13	12/01 <b>Final Crit with <a href="#">Mikael Colville-Andersen</a></b>		(Public talk at 5 PM)
	14	12/08 <b>Ambassadors and Activists</b> Review of seminar performance, goals and outcomes. A brief discussion and reflections on skills, lessons learned and steps moving forward.	No Lab	<b>Course Evaluation</b>

## Intended Learning Outcomes:

At the end of the seminar, participants will be able to:

- Illustrate the role architects, planners and designers have in urban livability and sustainability.
- Evaluate existing and new cities using generic sustainable mobility measures and comfort simulation tools.
- Design and plan human-powered-mobility-centric street networks, with emphasis on comfort.

## Course Requirements:

Attendance and active participation in all lectures is mandatory. **Lab sessions are irregular, and therefore participants can be accommodated if partial conflicts exist.** A series of individual and group assignments to practice what has been covered in class will be expected to be timely completed. Assignment types, due dates and grading weights are listed below. Class project presentations will be graded based on the clarity of the project's design objectives, originality and logic of the design analysis techniques used. The comprehensiveness of the final design solutions as well as overall quality will be factored in the evaluation.

Assignment/Requirement	Due Date	Weight Breakdown	Total
Class Participation	N/A		15%
Homework			45%
1. Trip Narrative (Individual)	09/15	5%	
2. Cambridge Model	09/22	5%	
3. Basic Simulation	10/06	10%	
4. Microclimatic Design	10/20	10%	
5. Section Design (Individual)	10/27	5%	
6. Policy Interventions	11/17	5%	
7. Metrics	11/24	5%	
Midterm Crit	11/03		15%
Final Crit	12/01		25%

## Software:

Detailed software installation instructions and support will be provided in class.

- Rhinoceros 5.0 (<http://www.rhino3d.com/>) will be used for modeling.
- Grasshopper (<http://www.grasshopper3d.com/>) will be used for simulation plug-ins.

## Academic Integrity:

If required, please re-familiarize yourself with the MIT Academic Integrity handbook that can be downloaded from <http://web.mit.edu/academicintegrity/>