**Civil & Environmental Engineering Joseph L. Schofer**

**Northwestern University Fall 2022**

**CEE 371: Introduction to Transportation Planning and Analysis**

**CEE 479: Transportation Systems Planning and Man­agement**

**Syllabus**

# **Overview**

In these merged courses we will study the characteristics, functions, organization, operations, and planning of passenger and freight transportation systems, both urban and intercity facilities and services. We will discuss some history and explore contemporary and emerging transportation issues from the perspective of planning and analysis methods and considering sustainability and resilience. We will learn some useful tools for analysis, problem solving and service design, including elements of travel forecasting, network analysis, data analysis and sources, and transportation service design.

We will devote some time to examining how transportation has been and can be used to allocate benefits – and negative impacts – across different places and demographic groups.

My objective is for you to gain a strong sense of the systems, processes, benefits and costs of transportation, the professional challenges in the field, as well as to ignite your curiosity to learn more. We will find that transportation is more than cars on a freeway or people riding a CTA bus. It facilitates life as we know it, defines where – and how – people live, work, and shop, supporting a diverse and dispersed economy, consuming vast amounts of money, time, energy, and environmental resources in the process.

# **Operations**

We’re bundling CEE 371 (undergrad) and 479 (grad) together to share lecture/discussions, but 479 students will get different homework and exam questions and will be graded separately, and they will have the Friday lab session that will be used for discussions.

The current plan is for the entire class to be held Mondays and Wednesday from 2:00 until 3:50 in Tech LG52. There will be a separate lab session for 479 students only held on selected Fridays, to be announced in advance, from 2:00 until 3:50. In this session we will discuss some relevant research and policy papers, as well as contemporary transportation planning issues. Topics will be announced in advance and all students are welcome to attend.

This class will be interactive – I expect you to answer questions and to ask yours, to bring ideas to class, and to explore and share issues on your own. We will learn together through lectures and discussions, individual and team-based homeworks, and some guest visits.

We will not use a textbook but will assign reading to be posted on Canvas.

# **The Players**

I have studied transportation for a long time, and my curiosity about it has never waned. My own work is in policy analysis, evaluation, performance measurement, resilience, and adaptive design. To understand the workings of transportation systems I track the practice in government and industry, and therefore I work more with practitioners than with academic researchers. I use my podcast, The Infrastructure Show ([www.theinfrastructureshow.com](http://www.theinfrastructureshow.com)), to explore and share an understanding of transportation and other infrastructure systems. Our TA will be named before classes begin.

# **Office hours**

I will generally be available after class in LG52 or my office, Tech A316. To meet at other times, or to discuss an issue virtually, please use e-mail [j-schofer@northwestern.edu]. We can also schedule Zoom meetings. When we have Friday meetings for the 479 group, I’ll be in my office – Tech A316 - between 4:00 and 5:00. Nights and weekends, if you get stuck on something, reach out to me by e-mail.

# **Grading**

There will be about five or six homework assignments. These will involve tasks such as data analysis, reading and answering questions in writing (sometimes including in-class reporting and discussion), as well as a short mid-term exam, and a written final exam. Class engagement will count – I will call on you if you do not volunteer to speak in class. The weights will be approximately these:

Homework and report: 50%

Mid-term exam: 20%

Final exam: 20%

Engagement in classroom discussion: 10%

# **The Schedule**

Below is the tentative schedule for the quarter. It will almost certainly change, mostly through shifts in the schedule of topics. Deliverable dates are due dates. These could change.

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| Date | Topic | Assignments, Deliverables, and Notes |
| 9/21 Wed | Introduction: class organization/meetings; overview of transportation systems and their functions; why do we do transportation planning? All-class exploration of contemporary transportation issues and problems. Who owns them? What can we do about them? How can we go about addressing them? | In-class discussion of transportation problems |
| 9/26 Mon | **ROSH HASHANAH** Transportation planning. what is it, why do it, how is it done? Federal mandates and motivations. Process steps. Moving people vs. moving cars? Or something else? Big city/small city-rural differences. Planning vs. operations. Introduction to Toronto Case study, an end-to-end transportation planning supply chain. Each team will probe a different aspect of the process and report back on 10-19-2022. | Read: The Metropolitan Transportation  Planning Process: Key Issues, Federal Highway Administration |
| 9/28 Wed | Introduction to travel forecasting for transportation planning: prediction or planning? Purposes, approach; traditional 4-step modeling approach. Overview and components: trip generation approaches and uncertainties; gravity model overview of mode choice and assignment – coming soon. | HW1: Gravity model exercise, focus on impacts of key variables, equity analysis, changing level of service (transit vs. auto) and opportunity densities. Discuss likely behavioral outcomes. |
| 10/3 Mon | Continuation of travel forecasting discussion; the extrapolation problem and uncertainties - general, and post-COVID. Overview of activity-based models – behavioral models focused on households. synthetic population, simulation approach, incorporates feedback, demands more behavioral knowledge, who uses? Complexity vs realism. | Post-COVID travel patterns. Sources: transit UITP, TTC, POVs: FHWA VMT trends. |
| 10/5 Wed | **YOM KIPPUR** Passenger travel behavior and forecasting- modeling traveler decisions – Professor Stathopoulos Logit mode choice models. – **Professor Stathopoulos** |  |
| 10/10 Mon | Behavioral travel modeling – logit exercises and applications – Professor Stathopoulos | HW # 2 – discrete choice models |
| 10/12 Wed | Network representation and analysis: minimum path finding and equilibrium assignment. Methods and assumptions.  Data requirements, sources, and collection methods. Use in operations management | HW #3 – network analyses |
| 10/17 Mon | Transportation data – sources, uses, trends. ACS, NHTS, regional travel surveys, freight data (CFS); facility data (POLA), airlines; real-time tracking data, privacy issues, value of data | HW #4 – ACS application JTW travel time distribution by mode |
| 10/19 Wed | Report back on Toronto Metrolinx transit planning process. Bring in Dave Leuchter of Mass Electric on implementation (or defer until 10-24) |  |
| 10/24 Mon | Equity considerations: meaning of equity for transportation: mobility vs. accessibility; allocation of costs and benefits. Discussion of WaPo story on SC freeway expansion. Location of noxious facilities, rail yards, distribution centers, airports. Some history of the Interstate system. Compensation for injury. IIJA Reconnecting Communities (Section 11509) CTA Red Line Extension. | Read “highway runs through Black homes…” and prepare to discuss SC freeway expansion  Dan Ryan design paper. |
| 10/26 Wed | Transit – technologies, roles, and utilization, competitiveness with the auto; scheduled service design process | HW #5 – scheduled service design - NY Ferry  Read McKinsey MTA report |
| 10/31 Mon | Midterm exam |  |
| 11/2 Wed | The freight industry and supply chains – Amazon and beyond structure of the industry. How supply chains work. Who owns what? Who does what? government role? | Supply chain performance exercise – |
| 11/7 Mon | Freight operations, complexity, bottlenecks, and resilience; performance. Freight data, USDOT Flow program |  |
| 11/9 Wed | Measuring and designing for transportation resilience. Restorations vs prevention. Natural hazards, resilience options, metrics. | TRB Presentation |
| 11/14 Mon | New mobility ideas: non-motorized travel, complete streets, App-based services (matching demand and supply), TNCs, Mobility as a Service (MaaS) – the new mass transit: who advances it? UAM, Automation – the killer app? What about urban design, macro and micro; new technologies. | In-class exercise  <https://smartgrowthamerica.org/what-are-complete-streets/>  WSJ on UAM  Place examples |
| 11/16 Wed | Slack day |  |
| 11/21 Mon | Financing transportation – public and private. Sources and costs of money. Tolling and congestion pricing | Eno Center report on transit costs |
| 11/23 Wed | **THANKSGIVING BREAK** | |
| 11/28 Mon | Evaluation and decision making – planning products; performance measurement  Logic models, BCA and limitations |  |
| 11/30 Wed | Wrap up – what did we learn? What should we remember? |  |
| 12/9 Mon | FINAL EXAM 9:00-11:00 |  |
| Interesting topics now excluded | | |
|  | Taste of traffic flow – fundamental diagram, speed, capacity, and safety – this is about goals and what is transportation about. |  |
|  | Demographics and travel – what is stable |  |
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# **Required announcement**

Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact AccessibleNU to move forward with the university’s established accommodation process (e: [accessiblenu@northwestern.edu;](mailto:accessiblenu@northwestern.edu) p: 847-467-5530). If you already have established accommodations with AccessibleNU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.