MIT'S MASTER OF SCIENCE IN TRANSPORTATION (MST) PROGRAM

November 3, 2016

The interdepartmental Master of Science in Transportation (MST) degree program emphasizes the complexity of transportation and its dependence on the interaction of technology, operations, planning, management and policy-making. For this reason, the MST program is interdepartmental. Faculty members and research staff from several centers, departments and divisions within MIT are affiliated with the program and serve as Research Supervisors and mentors to MST students.

1. REQUIREMENTS

The requirements for the MST degree consist of the following:

(1) a core of two 12-unit subjects;

(2) a) an individually designed program area comprised of 3 subjects, totaling at least 30 units.

b) at least one Policy or Technology subject;

(3) a computer programming requirement;

(4) a thesis and research requirement.

The degree requires a total of 66 graduate units exclusive of a thesis.

1.1. The Core

The MST core consists of two 12-unit subjects, which are taught in the Fall semester:

1.200 Transportation Systems Analysis: Performance and Optimization (*C. Osorio)*

Problem-motivated introduction to methods, models and tools for the analysis and design of transportation networks including their planning, operations and control. Capacity of critical elements of transportation networks. Traffic flows and deterministic and probabilistic delay models. Formulation of optimization models for planning and scheduling of freight, transit and airline systems, and their solution using software packages. User- and system-optimal traffic assignment. Control of traffic flows on highways, urban grids, and airspace.

1.201 Transportation Systems Analysis: Demand and Economics (*M. Ben-Akiva)*

Introduces transportation systems analysis, stressing demand and economic aspects. Covers the key

principles governing transportation planning, investment, operations and maintenance. Introduces the microeconomic concepts central to transportation systems. Economic theories of the firm, the consumer and the market, disaggregate and aggregate demand models, discrete choice analysis, cost models and production functions for passenger and freight demand, pricing theory and application to transportation systems including the theory and practice of congestion pricing, technological change, resource allocation, market structure and regulation in the transportation industry, and project evaluation for transportation systems. Applications include passenger and freight, urban public transportation, aviation and intelligent transportation systems

The core reflects the interdisciplinary, systems-oriented nature of our educational approach.

1.2. The Program

The program requires each student to select three or more subjects which further their educational objectives in the field of transportation. For some students this will mean building their depth of understanding in a selected area of interest. For other students the program may emphasize breadth rather than depth in a single area. At least two of the designated subjects should be clearly focused on transportation, while the other(s) can be in a field which supports transportation- for example, a subject covering methods that are used in transportation, drawn from fields such as economics, operations research, political science, management, project evaluation and others.

Depth is provided in the following areas:

- Air Transportation
- Analysis and Planning Methods Data Sciences for Transportation
- Intelligent Transportation Systems, Safety and Security
- Logistics and Supply Chain Management
- Transportation Policy, Planning and Sustainability
- Urban Transportation

Three subjects selected from any subset of the above areas will achieve breadth. At least one of the subjects should be either a Policy or a Technology course.

Advising and Space: Student should consult their *Academic Advisor* when preparing their program. Any proposed change to an approved program is subject to review and approval by the *Academic Advisor*. During the first year of graduate studies, students are assigned both an *Academic Advisor* and a *Research Supervisor*. The *Research Supervisor* will help the student at every education and research stage, will provide space (shared or otherwise) with his/her research group and all necessary conditions for carrying out the planned research, and will ensure that the work meets MIT standards. After the first year, the *Research Supervisor* also takes on the role of *Academic Advisor*.

The Appendix lists subjects that fulfill the program requirements. Students may propose subjects not listed in the Appendix to the Transportation Education Committee (TEC). The TEC may approve or deny such proposals.

1.3. The Computer Programming Requirement

Graduates of the MST program are expected to have working knowledge of computer programming and information technology. The Computer Programming requirement can be satisfied by taking a subject from the following list:

- 1.001 Engineering Computation and Data Science (G credit, 12 units)
- 1.000 Computer Programming for Scientific and Engineering Applications (U credit, 12 units)
- 6.149 Introduction to Programming Using Python (U credit, 6 units, IAP)
- 6.0001 Introduction to Computer Science Programming in Python (U credit, 6 units)

Only 1.001 provides graduate credit. The other subjects may qualify for graduate credit if the student obtains permission from the TEC Executive Director and the Dean for Graduate Education. To seek graduate credit, students must coordinate with their Academic Advisor and the subject instructor to determine what extra work is required. Then, students must complete the ODGE Graduate Student Petition Form available at: http://odge.mit.edu/wp-content/uploads/2011/09/Petition_Form.pdf

Students may petition to waive the Computer Programming requirement based on previous coursework. Students should submit a waiver request as early as possible to the TEC and preferably at the same time they submit their MST Program Approval form.

(http://cee.mit.edu/wp-content/uploads/2016/07/MST-Program-Approval-Form_FINAL.pdf)

The waiver request must include the course description and transcript grade. An approved waiver of the Computer Programming requirement **does not** reduce the overall number of credits to be taken. Students with approved waivers still need to fulfill the 66 credits requirement). Waiver requests should be submitted to tec@mit.edu.

1.4. Thesis and Research Requirement

Students must complete a research-based thesis on a topic of their choice that has been approved by their Research Supervisor. Research plays an integral role in the MST degree and it is tracked academically through enrollment in 1.THG. Students are required to register for 1.THG during the Fall and Spring terms. Students typically register for 12 units of 1.THG during the Fall and Spring terms. The number of credits is determined in consultation with your Research Supervisor.

During the Summer term, students may enroll in 1.THG if working on research at MIT. Students may

also pursue transportation-related internships. For international students, internships in the US must be carried out according to the International Students Office guidelines for Optional Practical Training. Summer plans should be approved by the Research Supervisor and communicated to the TEC by the end of the Spring term. Through enrollment in 1.THG, students are formally graded on research performance each semester, in accordance with MIT Faculty Rules and Regulations 2.62.3 http://web.mit.edu/faculty/governance/rules/2.60.html.

Thesis and research units **do not** count toward the 66 units required to complete the MST degree.

APPENDIX
SUBJECT AREAS

A. POLICY SUBJECTS

There are three types of subjects that relate to policy:

I. Transportation policy subjects:

11.478	Behavior and Policy: Connections in Transportation
11.S956	Mobility Management in China: Transportation Research Seminar
SUP-651	Transportation Policy and Planning (at Harvard's Kennedy School)

II. Transportation subjects with substantial policy content (nominally half):

11.526J/1.251J	Comparative Land-Use and Transportation Planning
16.71	The Airline Industry

III. Policy subjects with modest or no transportation content:

IDS.521	Energy Systems and Climate Change Mitigation
IDS.411	Concepts and Research in Technology and Policy
IDS.412J/17.310J/STS.482J	Science, Technology, and Public Policy (IDS.401)
12.848J/15.023J	Global Climate Change: Economics, Science and Policy
IDS.435	Law, Technology and Public Policy
6.805JJ/STS.085J	Foundations of Information Policy
11.255	Negotiations and Dispute Resolution In the Public Sector
11.481J/1.284J	Analyzing and Accounting for Regional Economic Change
11.482J/1.285J	Regional Socioeconomic Impact Analyses and Modeling

B. TECHNOLOGY SUBJECTS

Subjects that satisfy the program technology requirement include:

IDS.521	Energy Systems and Climate Change Mitigation
2.65J/1.818J/10.391J/ 11.371J/22.811J	Sustainable Energy
6.268	Network Science and Models
16.422	Human Supervisory Control of Automated Systems
16.453J/HST.518J	Human Factors Engineering
16.72	Air Traffic Control
MAS.552J/4.557J	City Science
MAS.836	Sensor Technologies for Interactive Environments

C. TRANSPORTATION SUBJECTS – LISTED BY AREA

Air Transportation:

16.71J (P)	The Airline Industry (1.232J,15.054J)
16.72 (T)	Air Traffic Control
16.75J	Airline Management (1.234J)
16.763J	Air Transportation Operations Research (1.233J)
16.781J	Planning and Design of Airport Systems (1.231J, IDS.670J)
16.886J	Air Transportation Systems Architecting

Analysis and Planning Methods:

1.202	Demand Modeling
1.203J	Logistical & Transportation Planning Methods (15.073, 16.76)
1.205J	Advanced Demand Modeling

Data Sciences for Transportation:

6.268 (T)	Network Science and Models
11.205	Introduction to Spatial Analysis
15.060	Data, Models, and Decisions
15.077J	Statistical Learning and Data Mining (IDS.147J)
15.082	Network Optimization

Intelligent Transportation Systems, Safety and Security:

1.208	Resilient Infrastructure Networks
6.805J	Foundations of Information Policy (STS.085J)
16.413 (T)	Principles of Autonomy and Decision Making
16.422J (T)	Human Supervisory Control of Automated Systems
IDS.340J	System Safety Concepts (16.863J)
16.413 (T)	Principles of Autonomy and Decision Making
16.412J (T)	Cognitive Robotics (6.834J)

Logistics and Supply Chain Management:

1.203J Logistical & Transportation Planning Methods (15.073J, 16.76J)

1.260J Logistics Systems (15.770J, IDS.730J, SCM.260J)

1.261J Case Studies in Logistics and Supply Chain Management (15.771J, SCM.260J)

1.265J Global Supply Chain Management (2.965J, 15.765J, SCM.265J)

1.271J The Theory of Operations Management (15.764J, IDS.250J)

1.273J Supply Chain Planning (15.762J, IDS.735J)

Transportation Planning, Policy and Sustainability:

2.65J (T) Sustainable Energy (1.818J, 10.391J, 11.371J, 22.811J)

11.478 (P) Behavior and Policy: Connections in Transportation

11.527 Advanced Seminar in Transportation Finance

IDS.430 (P) Environmental Law, Policy, and Economics: Pollution Prevention and Control (1.811, 11.630)

SUP-651 (P) Transportation Policy and Planning (at Harvard's Kennedy School)

IDS.521 (P, T) Energy Systems and Climate Change Mitigation

Urban Transportation:

1.251J (P) Comparative Land Use and Transportation Planning (11.526J)

11.433J Real Estate Economics (15.021J)

11.434J Tools for Analysis: Design for Real Estate and Infrastructure Development (15.428J, IDS.720J)

11.250 Transportation Research Design

(T) – Indicates subject satisfies Technology requirement

(P) – Indicates subject satisfies Policy requirement