DOCTORAL PROGRAM IN TRANSPORT SYSTEMS (DPTS)

SELF-ASSESSMENT REPORT

Report prepared for the External Advisory Committee of the Doctoral Program

JULY
2017
# TABLE OF CONTENTS

1. INTRODUCTION ...........................................................................................................2
2. PARTICIPATING INSTITUTIONS .................................................................................3
3. MANAGEMENT STRUCTURE ....................................................................................4
4. APPLICATION CHANNELS .......................................................................................4
5. ADMISSION REQUIREMENTS ...................................................................................5
6. SELECTION PROCESS ...............................................................................................5
7. SCHOLARSHIP OPPORTUNITIES ..............................................................................6
8. STUDY PLAN ..............................................................................................................7
9. STUDENT MONITORING ..........................................................................................9
10. PROGRAM FACULTY ...............................................................................................9
11. INTERNATIONAL COLLABORATIONS .................................................................15
12. INDUSTRIAL PARTNERS .......................................................................................15
13. PERFORMANCE METRICS ...................................................................................16
14. STUDENT ASSESSMENTS .....................................................................................19
15. PROGRAM BENCHMARKING .................................................................................20
16. ALUMNI STATEMENTS ........................................................................................20
17. COMPLETED THESISSES ......................................................................................27
1. INTRODUCTION

The Doctoral Program in Transport Systems (DPTS) is a joint organization of the Universities of Coimbra, Porto and Lisbon carried out in collaboration with the Massachusetts Institute of Technology (MIT). It was offered for the first time in the academic year 2010-11 after being approved by the Portuguese Agency for the Accreditation and Assessment of Higher Education (A3ES) in May 31, 2010. The program was evaluated by A3ES in the following manner: “It’s a well organized programme, engages the three top Portuguese institutions in the area of transport systems, most of the more qualified professors and researchers, has the support of important research centres, establishes a healthy integration of facilities of the three schools, has clear, well identified, objectives and fulfils one area being short of 3rd degree technicians that can’t be easily obtained in other countries”. More recently, in June 14, 2013, the DPTS acquired the status of FCT PhD Programme, and the corresponding funding (which includes 10 PhD scholarships per year), after being awarded by FCT the highest rating (9 on 10) among 450 applications (FCT is the National Science Foundation of Portugal).

The creation of the DPTS took place in the framework of the MIT-Portugal Program (MPP). This program was launched in 2006 to “strengthen the country’s knowledge base and international competitiveness through a strategic investment in people, knowledge and ideas in innovative technology sectors”. The MPP was built around four focus areas, being Transport Systems one of them. Since 2007-08, the MPP is offering training in this area at the PhD level, until 2010-11 through the separate programs then available in the Universities of Coimbra, Lisbon and Porto (hereafter designated as predecessors of the DPTS).

The DPTS covers all transport systems topics, from transport policy and planning to infrastructure design and maintenance, at the various spatial levels (from international to local), and for the various modes (air, rail, road, etc.). It has an estimated duration of 3 to 5 years. In the 1st year, students receive advanced training with respect to key subjects in Transport Systems and prepare a thesis project. In the remaining time, they develop their doctoral thesis along the lines established in the thesis project. Upon completion of the DPTS, students are expected to have acquired the knowledge, skills, and competences they need for a transport-related career in academia, including teaching and research, as well as for a high-level professional career in the public or the private sector.

Since 2007-2008, a total of 197 students have been involved in the DPTS or its predecessors, 52 of which of 24 different foreign nationalities. On average, 57 candidates have applied annually to the program and 20 have been admitted. Up to now, 76 students have completed the PhD degree (2 already in 2017). The number of students currently enrolled in the DPTS is 78.

In this document, we provide detailed information and key performance metrics regarding the DPTS, a list of all the theses approved in the program or its predecessors (since 2009), and a collection of statements by some of our alumni about their path in the program and after completing it. We also express some concerns about the program and its future.
2. PARTICIPATING INSTITUTIONS

As stated in the Introduction of this document, the DPTS involves the Universities of Coimbra, Porto and Lisbon, and the MIT. The Universities of Lisbon (www.ulisboa.pt) and Porto (www.up.pt), located in the two main cities of Portugal, are the largest higher-education institutions in the country. According to the latest figures, the University of Lisbon has 3032 (full time equivalent) faculty and research members and is attended by 47,543 students (3,882 at the PhD level). The equivalent figures for the University of Porto are 2,365 and 29,796 (3,277). The University of Coimbra (www.uc.pt), one of the oldest in the World, has 1,255 faculty and research members and 21,093 students (2,376). The MIT does not need to be presented: with 87 Nobel laureates, it is generally recognized to be one of the leading higher-education institutions worldwide, and the very top one in Engineering.

The schools of the three Portuguese universities involved in the DPTS are IST (Lisbon), FEUP (Porto) and FCTUC (Coimbra). These Engineering schools have been collaborating in the area of Transport Systems since the early 1990s, when faculty from the three schools started to teach in the separate MSc Programs they have launched in that period. In part as a consequence of these initiatives, professors from the three schools have engaged in several joint research projects, MSc and PhD supervisions, and industry studies. More recently, the collaboration between the three schools has moved to a much higher level within the framework of MPP, notably – but not solely – because of the organization of the DPTS. In this context, professors from the Universities of Coimbra, Lisbon and Porto have been lecturing the same courses since the academic year 2010-2011, each one teaching the subjects of their expertise. Another important domain of collaboration is the joint supervision of PhD theses (and thesis projects), which have become frequent in recent years, particularly the ones involving professors from one of the Portuguese schools and MIT.

The research in Transport Systems carried out within IST, FEUP, and FCTUC is essentially developed within three research centers: CERIS, INESC-TEC, and CITTA. Altogether, these centers concentrate the vast majority of the Transport Systems research capabilities available in Portugal. CERIS is a center of IST devoted to Civil Engineering, within which the CESUR unit conducts research in Spatial Planning, Transport Planning and Engineering, and Operations Research. INESC-TEC is a Systems Engineering center established in the University of Porto, with a group focusing on Transport, Mobility and Logistics. CITTA is a center of the Universities of Coimbra and Porto specialized in Spatial Planning, Environmental Policy, and Transport Planning and Engineering. These centers are equipped with the computing hardware and software required by cutting-edge research in Transport Systems, as well as with advanced laboratory facilities for experimental studies in Traffic Engineering (e.g. instrumented vehicles and driving simulators) and Transport Infrastructure Engineering.

Concern

The fact that the DPTS involves various institutions certainly has many advantages but also poses some problems. Indeed, these institutions have their own regulations and procedures, and in general they have trouble in dealing with joint programs (for instance, teaching duties are not properly accounted for, student grades cannot be registered in the usual way, quality
control mechanisms do not function adequately). Despite the efforts made and progresses accomplished since the launch of the DPTS to overcome these problems, some of them still subsist and seem difficult to fully eradicate.

3. MANAGEMENT STRUCTURE

The DPTS is managed by a Scientific Committee (SC) and by the Director of the program. The SC is composed of three members, one from each Portuguese school, designated by the Dean of the respective school (after being approved by the school’s Scientific Council). The Director of the DPTS is chosen among the members of the SC on the basis of a rotation principle, each school taking the lead in succession for a period of three years. The SC is in charge of defining the strategic orientations for the program, selecting the students, assigning professors to courses, defining course schedules, approving the evaluation processes adopted in courses, helping the students at choosing courses, and finding supervisors for students’ theses. The Director of the DPTS is in charge of coordinating the meetings of the SC, implementing its decisions with the help of the other members of the committee, coordinating the main decisions with the responsible for the program at MIT, and representing the program externally. The current members of the SC are: Prof. Luís de Picado Santos (IST, Director); Prof. António Pais Antunes (FCTUC); and Prof. Jorge Pinho de Sousa (FEUP). The responsible for the program at MIT is Prof. Chris Zegras.

The activity of the SC is advised by an External Advisory Committee (EAC) composed of world-renowned researchers in Transport Systems. The EAC meets annually with the SC to monitor the performance of the program and discuss strategic orientations for its future. The current members of the EAC are: Prof. José Manuel Viegas (International Transport Forum, Chair); Prof. Eric J. Miller (University of Toronto); Prof. Miguel del Val (Polytechnic University of Madrid); and Prof. Yusak Susilo (Royal Institute of Technology, Stockholm).

4. APPLICATION CHANNELS

The main channel for applying to the DPTS is the 1st MPP call. This call typically runs from late January to mid-April. Only candidates to this call qualify for the scholarships awarded by the DPTS (see section “Scholarship Opportunities” of this document).

The other possible channels are the 2nd MPP call for applications, which runs from mid-April to mid-July, and calls made independently by the universities involved in the program in June or later (the last call takes place as late as in October, thus allowing students who finished their MSc in September to apply).

Candidates from outside the European Union are strongly advised to apply to the 1st MPP call, otherwise it is likely that they will not be able to complete their visa processes in time of arriving to Portugal before the start of the next academic year (which begins in September).

The website for MPP applications is: http://www.mitportugal.org/application/applying.html

For university applications, candidates are referred to the website of the university of their preference.
Concern

Over time, the applications to the DPTS through the 1st MPP Call are taking place progressively later, and close several months after the deadline for applications to the main doctoral programs offered worldwide. This makes it difficult to the DPTS to compete for the best international students willing to pursue advanced training in Transport Systems.

5. ADMISSION REQUIREMENTS

In order to be admitted to the DPTS, candidates are required to meet at least one of the following conditions:

- Hold a pre-Bologna Licentiate diploma (typically corresponding to 5 years of higher education) in Engineering, Management, Economics, Mathematics, Geography, Information Systems, and related areas.
- Hold a post-Bologna Master diploma (second cycle of higher education) in Engineering, Management, Economics, Mathematics, Geography, Information Systems, and related areas.
- Hold a national or foreign qualification deemed, in legal terms, equivalent to one of the above.

Holders of scientific, academic, or professional qualifications or curriculum that the Scientific Committee considers to demonstrate their capacity to complete the DPTS may also be admitted to the program.

In total, up to 20 students can be admitted to the DPTS every year (this is the maximum number of students that is considered compatible with the teaching and supervision capacity of the program).

Concern

The DPTS admits students with a broad range of academic (and professional) backgrounds. The diversity of students, which is increasing over the years, has undoubtedly a positive side but also raises important challenges, requiring that mechanisms be put in place to ensure a better integration especially of students that do not have an Engineering background.

6. SELECTION PROCESS

The selection of candidates starts shortly after the closure of the 1st MPP call for applications, and is carried out according to the following four-stage process:

1) The candidates who comply with the admission requirements are assessed on a 0-75 scale based on the documents they submitted and the rating criteria described below in this section.

2) The candidates ranked in the first 25 positions after the document-based assessment are interviewed in English by the members of the Scientific Committee (through skype or phone in the case of non-residents in Portugal) about their academic and
research/professional path, as well as about their motivation, and their interviews are assessed on a 0-25 scale.

3) The final ranking of candidates is established on a 0-100 scale by adding the document-based rating and the interview-based rating;

4) The candidates ranked in the first 20 positions are selected for the program.

If the 20 candidates selected confirm their willingness to register in the DPTS, the process is closed. Otherwise, candidates can be selected in subsequent calls (2\textsuperscript{nd} MPP call and university calls), until the maximum number of students is reached.

The documents that candidates need to supply for the selection process are:

1) Curriculum vitae (in English);

2) Motivation letter (in English);

3) Digital copies of academic certificates showing the candidate’s final classification, and official transcripts listing the mark/grade of each course/subject studied during each degree program (if the candidate is in the last year of a program, these certificates and official transcripts can be presented in September);

4) Letters of recommendation (two at least).

The criteria taken into account in the document-based assessment are:

1) Academic curriculum (rated 0-50) - Assessment of school and grades/marks for the 1\textsuperscript{st} cycle of higher education (weight = 1) and the 2\textsuperscript{nd} cycle (weight = 2).

2) Path alignment (0-15) - Assessment of alignment of previous education and research/professional activities with the objectives and requirements of the DPTS.

3) GRE Test or similar (0-10) - Verbal (weight = 1) + Quantitative (weight = 2) + Analytical (weight = 1).

Concern

Despite the complex process carried out to assess candidates, in a few cases the DPTS students did not show the preparation, tenacity and/or creativity required to perform research at the doctoral level. The requirement of a thesis project helps detect the lack of these characteristics rather early, but has not been enough to ensure that all admitted students are able to complete their studies.

7. SCHOLARSHIP OPPORTUNITIES

As a FCT PhD Programme, the DPTS has been offering 10 scholarships annually to the 10 best-positioned candidates (who asked for a scholarship) in the 1\textsuperscript{st} MPP call, reinforced in the academic year 2016-2017 with two scholarships from the Norte 2020 Program (which can be granted only to FEUP students). These scholarships include university registration fees (2,750 Euros/year), a possible stay abroad (notably at MIT) for a period of up to two semesters, one-time relocation and trip reimbursements of respectively 1,000 and 600 Euros.
(for stays of 6 months or more), and a monthly stipend of 980 Euros in Portugal and 1,710 Euros during the stay abroad.

In addition to the DPTS scholarships, there are various other scholarships to which students can apply. This is notably the case of the FCT regular PhD scholarships, which are essentially open only to residents in Portugal, and, in the case of foreign candidates, the PhD scholarships awarded by their countries (such as the Brazilian CNPq scholarships). It should be noticed that, unlike DPTS scholarships, these and other scholarships typically require candidates to have already chosen a thesis title, a supervisor and a work plan. Students willing to apply to this kind of scholarships are welcomed to contact the Director of the DPTS in the school of their preference.

Finally, candidates may also be supported by scholarships associated to the research projects in Transport Systems carried out at IST, FEUP and FCTUC, in particular those funded by FCT.

More information on FCT scholarships can be found at:

- FCT-funded research project scholarships - www.eracareers.pt

Concerns

The Portuguese schools involved in the DPST receive from the MIT Portugal Program an annual amount to support PhD activities (e.g., data acquisition, computing hardware and software, participation of students in meetings and conferences). This amount, which is equally divided among the three schools, was 100,000 Euros in 2017. Keeping this type and level of funding is crucial to ensure appropriate working conditions for the 78 students currently involved in the program.

8. STUDY PLAN

The DPTS involves studies with a total minimum duration of 3 years, but typically takes 4 to 5 years to complete (to full-time students). In the 1st year, students make the so-called Doctoral Course. The remaining years are dedicated to the preparation of the PhD thesis.

The Doctoral Course comprises 5 teaching course units and the preparation of a thesis project in Transport Systems. One of the course units, Research Methodologies, is mandatory (M) and the other four are optional (O). At least two of the optional units must be selected among the ones listed in Table 1. The list includes a unit, Transport Innovation and Entrepreneurship, which was offered in the academic year 2016-17 for the first time (this unit is taught by an assistant professor funded by the MIT Portugal Program specifically to teach this type of subject). The remaining units can be selected among any other course.

units offered at the doctoral level in the participating schools or in any schools with which they have doctoral collaboration agreements.

The course units listed in Table 1 are taught in English, desirably by professors of (at least) two Portuguese participating schools. Lectures are given in the school to which professors are affiliated, and broadcast to the other schools by videoconference.

Table 1. Course Units of the Doctoral Course (1st Year of the DPTS)

<table>
<thead>
<tr>
<th>Semester</th>
<th>Course Unit</th>
<th>Type</th>
<th>ECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Research Methodologies</td>
<td>M</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Risk and Decision-Making</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>Road Traffic Management</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Transport Demand Modeling</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Transport Infrastructure and Operations Optimization</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Business Models and Contracts</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Highway and Airport Infrastructure Engineering</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>Railway Infrastructure Design and Maintenance</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Simulation of Land-Use/Transport Systems</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Transport Policies and Institutions</td>
<td>O</td>
<td>6</td>
</tr>
<tr>
<td>1/2</td>
<td>Thesis Project in Transport Systems</td>
<td>M</td>
<td>30</td>
</tr>
</tbody>
</table>

The thesis project that each student needs to develop within the Doctoral Course is supervised by a professor proposed by the Director of the DPTS in the school where the student is enrolled and approved by the Scientific Committee. It should specify the research subject and a work plan for the PhD thesis the student will prepare in the following years. The evaluation of the thesis project is made before a jury of 3 to 5 members.

Once the thesis project is approved, students can proceed to the preparation of the PhD thesis, within which significant advances to the theory and practice of Transport Systems should be accomplished. The evaluation of the PhD thesis takes place in a public defence before a jury of 5 to 9 members.

Concerns

(1) Against the intentions of the Scientific Committee of the DPTS, several course units continue to be taught by professors of just one school, namely Business Models and Contracts, Railway Infrastructure Design and Maintenance, and Transport Policy and Institutions. Until the academic year 2015-16, this also happened with Research Methodologies, but this has changed in 2016-17 with the involvement of professors of the Universities of Coimbra and Porto in this course unit.

(2) Videoconference lectures are now working in general rather well (the situation improved in the academic year 2016-17 after some changes in the videoconference software), but still cannot fully match the teaching and learning environment of conventional lectures.

(3) Despite several initiatives to promote closer contacts between students of the different schools (e.g., attendance of the Research Methodologies course in person by
all students, constitution of working groups in some course units mandatorily involving students of at least two schools, organization of frequent workshops, seminars, and round tables attended in person by students of the three schools, they are still less frequent than the Scientific Committee of the DPTS would like them to be for students that have finished the Doctoral Course.

9. STUDENT MONITORING

Students are monitored throughout their path across the DPTS with a level of intensity that naturally decreases as they advance in the program. During the Doctoral Course, the performance of students is assessed almost continuously through the home assignments and the written exams they are required to make in all teaching course units, as well as in the defense of the thesis project. In relation to the PhD thesis work, the progress of students is essentially monitored by the supervisor(s), in meetings held initially every one or two weeks and, typically, less frequently as the thesis approaches the end. In addition to this, there is an accompanying committee for every student, which meets whenever necessary to assess the evolution of the thesis. This committee includes the supervisor(s), one member of the Scientific Committee, and one representative of a participating school other than the one where the student is enrolled (usually the same that took part in the jury of the thesis project). This monitoring process allows the Scientific Committee to collect detailed information about the performance of the students and to take the measures if it is below expectations.

Concern

The lack of a formal procedure to promote meetings of students’ accompanying committees is making that these meetings are taking place less regularly and frequently than they probably should be.

10. PROGRAM FACULTY

Many faculty members of the Portuguese participating schools have been active in the DPST. Below, we provide essential information about the 14 professors that are currently more strongly involved in the teaching of course units of the Doctoral Course and in the supervision of PhD theses. For each one of them, we include a list of up to 5 papers they have published recently. A substantial part of these professors has a Civil Engineering background (because, in the schools involved in the DPST, Transport Systems are primarily taught in the Departments of Civil Engineering). However, this does not mean that the program focuses especially on Transport Infrastructure. Indeed, over their careers, they have expanded their research interests, and are now investigating subjects that are quite distant from the traditional Civil Engineering areas.

• **Luís de Picado Santos**: PhD in Civil Engineering by the University of Coimbra. Professor at the Department of Civil Engineering of IST. Teaching at DPTS: Research Methodologies, Transport Policies and Institutions, Highway and Airport Infrastructure Engineering. Main research area: Transport Infrastructure. Director of the DPTS in general and at IST.
Recent Papers
http://dx.doi.org/10.1016/j.conbuildmat.2016.11.051

• **António Pais Antunes**: PhD in Applied Sciences by the Catholic University of Louvain (Belgium). Professor at the Department of Civil Engineering of FCTUC. Teaching at DPTS: Optimization of Transport Infrastructure and Operations and Simulation of Land-Use/Transport Systems. Main research area: Transport Planning. Director of the DPTS at FCTUC.

Recent papers

• **Jorge Pinho de Sousa**: PhD in Applied Sciences by the Catholic University of Louvain (Belgium). Professor at the Department of Industrial Engineering and Management of FEUP. Teaching at DPTS: Optimization of Transport Infrastructure and Operations. Main research area: Transport Operations Research. Director of the DPTS at FEUP.

Recent Papers

• Adelino Ferreira: PhD in Civil Engineering by the University of Coimbra. Assistant Professor at the Department of Civil Engineering of FCTUC. Teaching at DPTS: Highway and Airport Infrastructure Engineering. Main research area: Transport Infrastructure.

Recent Papers

• Álvaro Seco: PhD in Civil Engineering by the University of Leeds (UK). Professor at the Department of Civil Engineering of FCTUC. Teaching at DPTS: Road Traffic Management. Main research area: Traffic Engineering.

Recent Papers

• Ana Bastos Silva: PhD in Civil Engineering by the University of Coimbra. Assistant Professor at the Department of Civil Engineering of FCTUC. Teaching at DPTS: Road Traffic Management. Main research area: Traffic Engineering.

Recent Papers

• Anabela Ribeiro: PhD in Civil Engineering by the University of Coimbra. Assistant Professor at the Department of Civil Engineering of FCTUC. Teaching at DPTS: Transport Demand Modeling. Main research area: Transport Planning.
Recent Papers

• Filipe Moura: PhD in Civil Engineering by the University of Lisbon. Assistant Professor at the Department of Civil Engineering of IST. Teaching at DPTS: Transport Demand Modeling and Simulation of Land-Use/Transport Systems. Main research area: Transport Planning.
Recent Papers

• João Abreu e Silva: PhD in Territorial Engineering by the University of Lisbon. Associate Professor at the Department of Civil Engineering of IST. Teaching at DPTS: Transport Demand Modeling and Simulation of Land-Use/Transport Systems. Main research area: Transport Planning.
Recent Papers

- **Oxana Tchepel**: PhD in Environmental Engineering by the University of Aveiro (Portugal). Assistant Professor at the Department of Civil Engineering of FCTUC. Teaching at DPTS: *Simulation of Land-Use/Transport Systems*. Main research area: Transport Planning.

  **Recent Papers**
  
  
  Sá, E., Tchepel, O., Carvalho, A., Borrego, C., “Meteorological driven changes on air quality over Portugal: A KZ filter application”, *Atmospheric Pollution Research* 6(6), 979-989, 2015.
  
  
  

- **Paulo Teixeira**: PhD in Civil Engineering by the Polytechnic University of Catalonia (Spain). Assistant Professor at the Department of Civil Engineering of IST. Teaching at DPTS: *Railway Infrastructure Design and Maintenance*. Main research area: Transport Infrastructure.

  **Recent Papers**
  
  
  
  
  

- **Rosário Macário**: PhD in Transportation by the University of Lisbon. Associate Professor at the Department of Civil Engineering of IST. Teaching at DPTS: *Research Methodologies, Transport Policies and Institutions and Business Models and Contracts*. Main research area: Transport Policy.

  **Recent Papers**
  
  

• **Rui Oliveira**: PhD in Civil Engineering by the University of Lisbon. Associate Professor at the Department of Civil Engineering of IST. Teaching at DPTS: *Risk and Decision-Making*. Main research area: Transport Operations Research.

  **Recent Papers**

• **Sara Ferreira**: PhD in Civil Engineering by the University of Porto. Assistant Professor at the Department of Civil Engineering of FEUP. Teaching at DPTS: *Road Traffic Management*. Main research area: Traffic Engineering.

  **Recent papers**

At MIT, involved faculty includes Professors P. Christopher Zegras, Amedeo Odoni, Carolina Osorio, Cynthia Barnhart, Moshe Ben-Akiva, and Richard de Neufville.

**Concerns**

1. Several young faculty members significantly involved in the program have left Portugal to pursue their careers in foreign institutions (Bruno Santos and Gonçalo Correia at TU Delft, Luis Martinez at OECD’s International Transport Forum, Miguel Santos at Amazon Luxembourg, and Nuno Pinto at U Manchester).

2. Participation of MIT faculty members in the program has been strong relatively to supervision of PhD theses, but weak with respect to teaching, being limited to sporadic talks in some course units.
11. INTERNATIONAL COLLABORATIONS

Since the DPTS was created in the framework of the MPP, the collaboration of MIT in the program is naturally very intense. Over time, this collaboration has had multiple dimensions, being the ones related with the joint supervision of PhD theses (and thesis projects) and student mobility probably the most important.

However, the international involvement of the DPTS is not limited to MIT. Indeed, the program has had collaborations from a large number of prestigious higher-education institutions including Dartmouth College, EPF Lausanne, HU Jerusalem, PU Catalonia, UC Santa Barbara, UI Urbana-Champaign, U Kent, U Leeds, U Toronto, TU Delft, and Virginia Tech. In this context, several DPTS students were or are being co-supervised by professors affiliated with these institutions and/or have spent working periods there (often with a duration of an academic term or more). Furthermore, regular talks, lectures and seminars given by prominent professors and leading transport professionals are organized within the doctoral program. Examples include Ennio Cascetta (U Federico II, Naples), Hamid Zarghampour (Swedish Transport Agency and World Bank), Jonas Eliasson (KTH and Director of the City of Stockholm Transportation Department), Karst Geurs (U Twente), Laurence Wolsey (UC Louvain), Morton O’Kelly (Ohio SU), Nagui Roupahil (North Carolina SU), Nicole Adler (HU Jerusalem), Nikolas Geroliminis (EPF Lausanne), Richard Church (UC Santa Barbara), Stefan van der Speck (TU Delft), Susan Handy (UC Davis), Thomas Linder (Baviera Road Agency), Werner Rothengatter (U Karlsruhe) and Wolfgang Schade (Fraunhofer Institute, Germany).

Finally, international collaborations occur through the involvement of the participating schools in contexts such as SMART (Singapore MIT Alliance for Research and Technology), TransportNet, as well as in numerous EU research projects and COST actions.

12. INDUSTRIAL PARTNERS

A significant part of the research involved in the PhD theses developed within the DPTS has been done in collaboration with government bodies and municipal administrations (e.g. the city councils of Coimbra, Lisbon, and Oporto), as well as with public and private companies with activity in the transport sector, such as ANA (airports), BRISA (motorways), GALP (fuel), IP (road and rail national infrastructure), Mota Engil (public works), Carris, Metro de Lisboa and STCP (transit), CP (rail services), and TAP and SATA (airlines).

Concern

Some of the collaborations mentioned above are now less intense than they were a few years ago because of two main reasons: first, the restructuring processes of some companies have made the contacts with their managerial and technical structures rather difficult; second, the research focus of the MIT Portugal Program is now put on urban transport, making it more difficult to attract the interest of companies predominantly active in intercity transport.
13. PERFORMANCE METRICS

Since the launch of the MPP, a total of 166 students have been admitted to the DPTS or its predecessors, which were selected from a total of 565 candidates (Table 2). The success rate of applications is therefore 29%. Thirty-one students registered in 2007-08 in the predecessor programs also took advantage of the research opportunities created by the MPP. Therefore, the total number of students involved in the DPTS up to now is 197, of which 76 have meanwhile completed it (the titles of the theses are provided in Section 16 of this report). Forty-eight (63%) of these 76 students were admitted in 2007-08 or after, that is, they made their entire program within the MPP. Only 1/3 of these students took 4 years or less to get the PhD degree. Of the 197 students involved in the DPTS, 89 were awarded a MPP scholarship and 46 of these students have enjoyed a stay at MIT.

Table 2. Key Figures of the DPTS

<table>
<thead>
<tr>
<th>Category</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidates since 2007/8</td>
<td>565</td>
</tr>
<tr>
<td>Students admitted since 2007/8</td>
<td>166</td>
</tr>
<tr>
<td>Students registered in 2007/8</td>
<td>31</td>
</tr>
<tr>
<td>Students involved since 2007/2008</td>
<td>197</td>
</tr>
<tr>
<td>Program completed</td>
<td>76</td>
</tr>
<tr>
<td>Start before 2007/8 (37%)</td>
<td>28</td>
</tr>
<tr>
<td>Start in 2007/8 or after (63%)</td>
<td>48</td>
</tr>
<tr>
<td>Time to completion ≤ 4 years (33%)</td>
<td>16</td>
</tr>
<tr>
<td>Program ongoing</td>
<td>79</td>
</tr>
<tr>
<td>Program withdrawal</td>
<td>42</td>
</tr>
<tr>
<td>Students supported by a MPP scholarship</td>
<td>89</td>
</tr>
<tr>
<td>Students with a stay at MIT</td>
<td>46</td>
</tr>
</tbody>
</table>

The evolution over time of the number of candidates and the number of admissions to the DPTS can be seen in Figure 1. After some fluctuation in the initial years, both numbers have remained very stable, around 60 and 18, and in the last year, they were 63 and 22, respectively. The majority of students admitted are Portuguese, but the number of foreign students is significant – 52, that is, approximately 31% of the total (Figure 2). Among the 23 nationalities of foreign students, the most represented are Brazil (12), Iran (6), United States (4), and China and Greece (3 in both cases).

The number of students admitted to the DPTS in each school is naturally different from year to year, but there are some regularities that can be pointed out (Figure 3). First, IST consistently attracts more students than FEUP and FCTUC. The overall result is that the admissions tally for IST since 2007-08, 82 students (8.3 on average per year), is almost the same to that of the two other schools together (36 for FEUP and 48 for FCTUC). Another feature to emphasize is that the number of students admitted by FEUP has always been in the range of 3 to 5 (except in 2007-08 and in the last year). In contrast, at FCTUC, the number of admissions fluctuates significantly from year to year in the range of 3 to 8.
Figure 1. Number of Students Admitted and Non-Admitted to the DPTS

Figure 2. Number of Students Admitted to the DPTS by Nationality

Figure 3. Number of Students Admitted to the DPTS by School
The distribution of the 78 students enrolled in the DPTS in 2016-17 across the number of years of study shows that 20 (26%) did not manage to complete their PhD theses in 4 years, and that 12 (16%) will take 6 years or more to do so (Figure 4). The main reason for the longer PhD completion times is because a significant number of students do not have a PhD scholarship, and therefore have to combine their PhD work with other activities.

![Figure 4. Number of Students Enrolled in the DPTS by Year of Study](image_url)

The first year when students involved in the DPTS obtained a PhD degree was 2009 (Figure 5). The trend for the number of PhD theses completed annually has been globally increasing from 6 in that year to 11 or 12 in 2014, 2015 and 2016.

A positive, clearer upward trend is also observed with respect to the number of articles published by DPTS students in peer-reviewed journals (Figure 6). This number has increased quickly from one in 2007 to 21 in 2011, and then more slowly to 28 in 2015. However, growth in quality deserves to be underlined more than growth in quantity, as a significant number of the most recent articles have appeared in very top Transport Systems journals, including Transportation Research Part A, B, C and F, Transportation Science, and ASCE’s Journal of Transportation Engineering.

![Figure 5. Number of PhD Theses Completed in the DPTS by School](image_url)
The total number of theses completed within the DPTS until the end of 2016 was 76. As shown in Figure 7, the distribution of theses across subject areas is well-balanced – Transport Planning and Transport Operations account both for 36% of the theses, and Transport Infrastructure (construction and maintenance) for 28%. Road Transport is the dominant mode addressed in the theses (50%), followed by Urban Transport (24%). The number of theses dealing with Rail and Air Transport is still significant (16% and 9%), in contrast to Maritime Transport, which has been the focus for only one thesis.

Finally, we provide some information on the current professional activities of the 76 alumni of the DPST (Figure 8). The majority of these alumni (60%) is employed by companies or by the administration either in Portugal (23%) or abroad (37%), notably in France, in the United Kingdom, in Brazil and in the United States. The remaining students (40%) are working in universities or in research centers, half of them in Portugal and the other half in foreign countries.

14. STUDENT ASSESSMENTS

It has been stated earlier in this document that quality control mechanisms available in the schools involved in the program are not designed for programs like the DPTS, which are offered in association by several universities. This is in particular the case of the assessment of programs by students (and also by faculty).
The solution could appear to be program directors organizing these assessment processes. However, this solution is not well seen in the universities involved in the program, as these processes are now carried out centrally by the rectors. In the University of Coimbra, program directors are expressly forbidden to organize such processes.

In these conditions, program assessment processes are different from school to school. In the University of Coimbra, students must provide their assessments of the respective programs, otherwise they cannot register in the following year. In recent years, the DPTS has always been ranked among the top-3 best programs across the almost 40 doctoral programs offered by the university. In the Universities of Lisbon and Porto assessments are optional and the number of responses is too low for the results to be meaningful.

In respect to this issue, it is important to mention that program directors are in close contact with PhD students, and talk to them very often about the problems they face in their daily activities. In this sense, students are permanently giving feedback to the program directors about the performance of the program. This is probably more efficient than a formal assessment process.

15. PROGRAM BENCHMARKING

We would like to benchmark the DPTS against doctoral programs or program branches also focusing on Transport, but the reality is that, especially with regard to performance metrics, we could not find any meaningful information about such programs after a careful Internet search. We believe to have searched in the right places, however it looks like this is not the kind of information that programs consider important to make publicly available.

16. ALUMNI STATEMENTS

Alda Mendes (FEUP)

“When I arrived at MIT Portugal nearly ten years ago, I came from an industry (transport engineering services) in which I was unsure on whether I wanted to continue. Now, I am fortunate to have entered an industry of which I’ve been dreaming – aviation management and policy consultancy. I work for ALG, a management consulting company from INDRA, and so far I have already been involved in several airport transaction projects in Madagascar, Brazil, Colombia and the Dominican Republic. I know that the
experiences and opportunities I had through the program have helped me realize this goal.

Over the past years, I took innumerous classes, visited several countries, organized a few conferences, lectured a couple of courses around the world, and had the privilege of meeting many great people from all sorts of backgrounds. I am lucky to have found so many friends. A heartfelt thank you also goes to my thesis committee and especially to Richard de Neufville. For all his precious professional and life lessons, I shall always be grateful.

Finally, I chose a research topic that I am passionately interested in. I examined how to improve air transport mechanisms and policies for air accessibility of small remote communities. The problem has gained critical importance for countries worldwide as liberalization disrupts traditional regulation for ensuring lifeline services to peripheral areas. My research made a significant contribution to the field because it succeeded in identifying world best practices. I employed a relatively unique research strategy and learnt immensely.”

Ana Laura Costa (FCTUC)

“Worldwide, transport systems are disrupted by the effects of natural hazards, and improving the performance of the infrastructure is essential. This is particularly true considering the criticality of transportation systems and that extreme events are expected to increase in frequency and intensity with climate change. My doctoral research provides a valuable contribution to the development of sustainable systems by investigating this subject and developing integrated approaches to support decision-making.

The MIT Portugal Program provided me the opportunity to discuss my research with renowned researchers in the subject, both at the University of Coimbra where I graduated in December 2013 and at the Massachusetts Institute of Technology where I was supervised by Professor Herbert H. Einstein. Without a doubt, my research has greatly benefited from this and the opportunities to present and discuss findings in conferences worldwide and in prestigious publications.

I am currently investigating uncertain subsurface conditions and related effects for transportation construction cost and time in Abu Dhabi, where a directive exists to implement a major Transport Master Plan. I am a Post-Doctoral Associate at the Masdar Institute, a research-oriented university, developed in collaboration with the Massachusetts Institute of Technology, focused on alternative energy, sustainability and the environment.”

André Alho (IST)

“I was affiliated with Instituto Superior Técnico in Lisbon, Portugal, for the DPTS from 2011 to 2015. During the year of 2014 I carried out my research, and other projects, at the Massachusetts Institute of Technology in Cambridge, United States of America. My doctoral thesis dealt with the assessment of the benefits that can be derived from the optimization of freight-dedicated parking in urban centers. The main goal of my PhD work was to produce a set of multi-disciplinary and multi-contribution research projects
that are relevant from a perspective of policy-making, particularly for policies capable of influencing urban freight operations’ patterns. At the moment, I’m a Postdoctoral Associate at the Singapore-MIT Alliance for Technology and Research in Singapore. I am partaking, among other projects, in the development of an agent-based freight model for the city of Singapore.”

Ashenafi Aregawi (FCTUC)

“I joined MIT Portugal Program while I was trying to identify my career path just after I graduated from college. A couple of years later, after completing the DPTS, the program has provided me with skills, opportunities and confidence to pursue my career as a research scientist in the field of transportation systems.

The program has offered me learning opportunities both inside and outside of classrooms. From the classroom lectures, I have developed my theoretical and analytical skills to deal with new challenges. Moreover, the program enables me to visualize, understand, and solve complex problems in transportation.

During my spell at the MIT Portugal program, I have done a lot of research work in urban transportation planning, which led to my PhD degree. I got wonderful mentorship on my desired topic, access to great research facilities, visit to MIT, and participated in number of international conferences.

Currently I am working as an assistant professor and Deputy Scientific Director at the Ethiopian Institute of Technology – Mekelle (Mekelle University). I owe much of my personal and professional development to the MIT Portugal program.

Diana Jorge (FCTUC)

“I attended the DPTS from 2010 to 2014 at the University of Coimbra. During this period, I had the opportunity to attend also the MIT in the US, which was a very helpful experience. My thesis focused mainly on optimizing one-way carsharing systems operations, aiming at developing methodological approaches to assist one-way carsharing companies to plan and manage their systems in a more profitable way without compromising the level of service; and addressing the process of integrating both types of carsharing: round-trip and one-way. After finishing the PhD, I worked as an Assistant Professor at the University of Coimbra during nine months. My main activity was teaching Operations Research, Spatial Planning (cost-benefit analysis, multi-criteria analysis, community facilities planning, and transport systems planning), and Transport Infrastructure Design. Moreover, I had the opportunity to do some research on expressway tolls optimization. Currently, I am working at ORTEC (in The Netherlands) as a software engineer. ORTEC is an optimization software and analytics solutions company that covers several areas such as routing, loading, warehousing and workforce scheduling. I am integrated in the services algorithmic team, which aims at modifying or extending the existing software functionalities regarding the optimization algorithms according to customer requests.”
Edgar Jimenez (FEUP)

“I have been interested in transportation since my early years as undergrad student. Upon discovering the MIT Portugal Program I thought it a great opportunity to take the most of the expertise and cutting edge developments at MIT with the vision and tradition of European universities. I enrolled in the Transport Systems area first for the CTIS Master and then for the PhD. It was quite an enriching and enjoyable experience, both personally and professionally. The systems approach to transport-related problems is invaluable and certainly the biggest plus for my career, which sets me apart from my peers in my current position. I am Associate Professor at the University of Ibague in Colombia, full researcher at the research group in Modeling and Simulation of Complex Social Systems, and expert adviser to the Mayor’s Office for Transit, Transport and Mobility in Ibague, Colombia, a city of 650,000 inhabitants.

As a student in the MIT Portugal Program Transport Systems area I conducted research on the impact of low-cost carriers growth on airport strategic planning in Europe. I enjoyed and learnt immensely while being advised by professors Richard de Neufville at MIT, and João Claro and Jorge Pinho de Sousa at FEUP. We formed a great work team and developed very interesting research in a rather unexplored area that is still not entirely understood, despite the impact it may have in dealing with similar situations in other parts of the world.”

João Bigotte (FCTUC)

“I earned my PhD in Spatial Planning and Transport Engineering from the University of Coimbra in early 2009. My research focused on how to improve decision-making about the location of social services facilities (health, education, etc.) so as to maximize accessibility to services. I developed a set of optimization models to tackle this problem and was very pleased to have used them in real world applications such as the location of schools in the municipality of Miranda do Corvo and the location of courts of justice across the whole Portuguese territory.

The opportunity to develop parts of my research at the University of Toronto and at MIT has also been of uttermost importance to both my professional and personal development.

In parallel to the PhD I engaged in a year-long “Technology-based Entrepreneurship Course” offered at the University of Coimbra, which has really motivated me to employ entrepreneurial thinking and action throughout my professional life.

After finishing the PhD I moved to the industry and became responsible for managing innovation in a corporate group. In the course of this work I have led the creation of a new business unit and the launch of a new company from ideation to business development.

During this period, I have maintained a link to academia, mainly through the research centers CIEC and CITTA, so it was a natural step to move again, this time, from the industry to the IPN technology transfer and incubation center.

This wide range of experiences in the innovation cycle – from research to technology transfer and innovation management – have led me to my current position of Assistant
Professor of Technological Change and Innovation within the scope of the MIT Portugal Program.

Last but not least, I would like to highlight that the most important step in my entire career was the decision to pursue doctoral studies back in 2004. I cannot imagine how my life would be now if, at that time, I had made a different choice.”

João Pita (FCTUC)

“Since 2013, I have been working at São Paulo International Airport developing the air service, as well as, demand forecasting and the airport master plan. Within the strategic planning team, reporting directly to the CEO, I led the airport delegation to the main route development conferences worldwide serving as the focal points for the airlines willing to operate at the airport. Preparing the demand forecasting every year for budgeting and capacity analysis is one of my key tasks. Moreover, our team is also in charge of the airport master plan, the driving document for the airport development.

The years spent within the MIT Portugal Program have been crucial for my current professional role. The classes, workshops, conferences, talks and discussion held under the program umbrella have developed my analytical, communication and leadership skills. But, most of all, I have been fortunate to have found many friends. I'm deeply thankful of the support and mentorship given by Amedeo Odoni, Cynthia Barnhart and António Antunes.

The usefulness of my research topic - air traffic network design - is indubitable. More and more, airport systems are becoming congested and populations living in remote regions are demanding better accessibility, for which they rely on air transportation. Currently, I use many of the studies developed during the PhD to analyze and develop the business cases for the airlines interested to operate in São Paulo. Moreover, the holistic approach of the PhD program gives me tools to work on related fields, such as demand forecasting and airport master planning.”

Miguel Santos (FCTUC)

“I obtained my PhD on Spatial Planning and Transport Engineering at the University of Coimbra in 2012. My PhD research was conducted under the framework of the AirNets research project of the MIT-Portugal Program (DPTS/ MIT), and addressed the problem faced by aviation authorities when deciding the best way of allocating limited public resources into the expansion and construction of airports. I addressed this problem by applying Operations Research (OR) techniques to formulate it into mathematical models, allowing to identify the optimal airport investment decisions. My PhD gave me the opportunity to learn from people of great expertise on the areas of transportation and OR, which was decisive to build my interest in those areas.

After the completion of my PhD in 2012, I continued my research activity at the University of Coimbra for two more years, first as Post-Doctorate Fellow and then as Assistant Professor. During this time, in addition to my academic activity, I also provided technical consultancy to a Portuguese airline to optimize its scheduling and fleet utilization. This was my first opportunity to put in place the knowledge I built during my PhD to solve a real-world business problem, and created my curiosity in working for a
company faced by interesting OR problems. In 2014, I left the University of Coimbra to enter the on-line retail company Amazon.com as OR Analyst, where I have been developing mathematical and data analysis to support business decisions about the improvement of the company’s supply chain system in Europe. I have been involved in very interesting problems at Amazon, such as warehouse location, inventory placement, and inbound optimization.”

Ryan Allard (IST)

“In the midst of my CTIS program, I determined that I wanted greater depth in the material. I wanted to “specialize” so to speak, particularly since my prior experience was rather broad. So I applied to the PhD program in 2011 and was accepted to attend IST. During one of the MSc courses, I had had an epiphany about connectivity in transportation and was lucky to be accepted by the professor who taught that course for doctoral research. The objective was to identify the value that passengers associate with connectivity, and identify the potential impacts of operator collaboration on their business.

I wanted to approach the problem from a new perspective: that of the operators, which had the additional benefit of being more attractive for companies as well as policy-makers. For completeness, I examined the perspectives of (1) the traveller (with surveys and statistical/econometric analysis), (2) the service operator (with game theory models based on service competition and cooperation) and (3) the public sector authority (with evaluation of market scenarios of the operators).

I was able to create operations research models for examining partnerships between operators, and show that cooperation among operators can benefit both the operators and the society under certain circumstances. I also identified how non-prioritized modes can play key roles in improving transport systems, and confirmed previous literature that passengers negatively perceive integrated services, and suggested ways to improve this.

I enjoyed the experience, which ended in November 2015, and am currently seeking new job opportunities worldwide.”

Rui Gomes (FEUP)

“I did my PhD in Transport Systems from the MIT-Portugal Program (MPP) at the Faculdade de Engenharia da Universidade do Porto (FEUP), between September, 2008 and March, 2013. During the PhD, namely in my thesis, I have addressed the topics of Demand Responsive Transport systems, Intelligent Transportation Systems, Combinatorial Optimization and Metaheuristics. Pursuing these research interests resulted in the publication of several scientific papers in peer-reviewed journals, book chapters and presentations at international conferences, as well as supervision of MSc thesis.

MPP has given me the opportunity of pursuing the PhD, addressing new challenges, meeting new people and finding some research avenues. After the successful conclusion of the PhD, I was a post-doctoral researcher at Faculdade de Ciências e Tecnologia da Universidade de Coimbra (FCTUC) for over two years. Presently, I’m an associate researcher of Centro de Informática e Sistemas da Universidade de Coimbra (CISUC),
invited assistant professor at Escola Superior de Ciências Empresarias do Instituto Politécnico de Viana do Castelo (IPVC) in the areas of Logistics and Transportation, invited assistant professor at Instituto Superior de Engenharia de Coimbra (ISEC) in the area of Informatics Engineering and, also, external consultant at ARMIS ITS in the area of Intelligent Transport Systems.”

Tomás Eiró (IST)

"My research path started in 2008 where I was invited to enter an already on-going MIT-Portugal Project called SCUSSE. This project focused on the modeling of new alternative transport options. I was responsible to develop a strategic tool to plan a Minibus system for the Lisbon Metropolitan Area. This research ended up to be the topic of my masters’ dissertation. This research put me in contact with my future PhD supervisor who invited me to proceed my studies with a PhD. I enrolled in the MPP on 2010.

In my PhD thesis, I developed a simulation tool that allows analyzing the mode choice behavior on the Lisbon Metropolitan Area. This behavior was influenced by the introduction of new more demand responsive transport options (minibus and carsharing). These new transport operators were modeled as small private companies that intended to gain position in an already existent mobility market. The main objective was to develop a decision support tool to guide the LMA mobility market to a more sustainable and efficient configuration. I graduated in 2015.

Currently, I am working on a Portuguese transportation consultancy company called TIS. I have been working on various projects related with urban mobility, namely: parking policies, development of transportation plans, modeling of transportation demand, etc. The work developed on my PhD provided me various tools that are being really useful on my daily job."

Xiao Chen (FCTUC)

“At the beginning of 2010, I was doing my master thesis at KTH, Sweden, and I heard about the MIT Portugal Program from a friend at that time. The competitive program design and the pertinent course arrangements attracted me a lot, so that I decided to apply for the PhD program. Fortunately, I got the offer from the program, and I am very proud to have been part of it from Sep, 2010 to Dec, 2014.

During the four years I spent at the University of Coimbra and MIT, I met so many brilliant people, and I have received countless help from them. My PhD thesis focuses on operational research, in particular, the application of simulation-based optimization approach in urban traffic management. I benefited a lot from both the courses and the research experiences. I have learnt so many things: the cutting edge knowledge, the promising skills, more importantly, the way to conduct research in the future.

Currently, I am an Assistant Professor at Chang’an University in China. Like all other young faculty, I am applying for research funding, teaching several courses, and continually doing my research. I really appreciate the wonderful experiences I had in MIT Portugal Program, which helped me to easily adapt to the new life.”
Yu Shen (IST)

“I started my PhD study at Instituto Superior Técnico, University of Lisbon in 2011. And I graduated and received my doctorate degree in 2015. My doctoral thesis studies the impacts of high-speed rail on urban configurations. The work especially provides a comprehensive modeling structure to analyze the revealed and the prospective impacts of HSR on Spanish and Portuguese cities. After completing my PhD, I continued my academic career. I am currently a postdoctoral associate at Singapore-MIT Alliance for Research and Technology (SMART) center.”

17. COMPLETED THESSES


