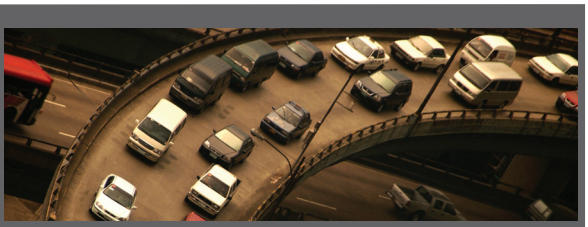
Paving The Way: Recruiting Students into the Transportation Professions

MTI Report 08-03



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MINETA TRANSPORTATION INSTITUTE

The Norman Y. Mineta International Institute for Surface Transportation Policy Studies (MTI) was established by Congress as part of the Intermodal Surface Transportation Efficiency Act of 1991. Reauthorized in 1998, MTI was selected by the U.S. Department of Transportation through a competitive process in 2002 as a national "Center of Excellence." The Institute is funded by Congress through the United States Department of Transportation's Research and Innovative Technology Administration, the California Legislature through the Department of Transportation (Caltrans), and by private grants and donations.

The Institute receives oversight from an internationally respected Board of Trustees whose members represent all major surface transportation modes. MTI's focus on policy and management resulted from a Board assessment of the industry's unmet needs and led directly to the choice of the San José State University College of Business as the Institute's home. The Board provides policy direction, assists with needs assessment, and connects the Institute and its programs with the international transportation community.

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MTI works to provide policy-oriented research for all levels of government and the private sector to foster the development of optimum surface transportation systems. Research areas include: transportation security; planning and policy development; interrelationships among transportation, land use, and the environment; transportation finance; and collaborative labor-management relations. Certified Research Associates conduct the research. Certification requires an advanced degree, generally a Ph.D., a record of academic publications, and professional references. Research projects culminate in a peer-reviewed publication, available both in hardcopy and on TransWeb, the MTI website (http://transweb.sjsu.edu).

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The educational goal of the Institute is to provide graduate-level education to students seeking a career in the development and operation of surface transportation programs. MTI, through San José State University, offers an AACSB-accredited Master of Science in Transportation Management and a graduate Certificate in Transportation Management that serve to prepare the nation's transportation managers for the 21st century. The master's degree is the highest conferred by the California State University system. With the active assistance of the California Department of Transportation, MTI delivers its classes over a state-of-the-art videoconference network throughout the state of California and via webcasting beyond, allowing working transportation professionals to pursue an advanced degree regardless of their location. To meet the needs of employers seeking a diverse workforce, MTI's education program promotes enrollment to under-represented groups.

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MTI REPORT 08-03

PAVING THE WAY: RECRUITING STUDENTS INTO THE TRANSPORTATION PROFESSIONS

June 2009

Asha Weinstein Agrawal, Ph.D. and Jennifer Dill, Ph.D.

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EXECUTIVE SUMMARY

The transportation industry faces a growing shortage of professional engineers and planners. A key strategy in solving this problem will be to encourage more civil engineering and urban planning students to specialize in transportation while completing their degrees, so that employers have a larger pool of likely and qualified recruits. This research examines the factors that lead civil engineering (CE) undergraduates and urban planning masters students to specialize in transportation, as opposed to other sub-disciplines within the two fields. The primary data collection methods were web-based surveys of 1,852 civil engineering undergraduates and 869 planning masters students.

The Critical Need for New Transportation Professionals

Public agencies and private firms face increasing challenges finding transportation engineers and planners to fill job openings. The problem is particularly acute for public agencies. In 2001, nearly half (46%) of all government workers were 45 or older,[1] and a report for the National Cooperative Highway Research Program (NCHRP) found that many state departments of transportation (DOTs) may have even higher percentages of staff nearing retirement because so many of their engineers were hired during the years of the significant growth of the Interstate Highway System.[2] In addition, many public agencies find it difficult to retain pre-retirement age employees. For example, in 2001, state DOTs experienced turnover rates for engineers as high as 10 to 12%. As a result, the NCHRP report authors stated that "there are probably very few industries where workforce concerns are more acute than in the transportation industry."[3] Employee recruitment and retention problems are not new, however—the Transportation Research Board (TRB) started publishing research on this topic in 1984.[4]

Research on how to attract new employees to the transportation field has focused on examining why current transportation professionals chose their jobs. For example, the NCHRP study identified several effective recruitment incentives used by state DOTs, such as schedule flexibility and engineer-in-training programs.[5] The report also surveyed DOT employees to find out what attracted them to their DOT and why they stayed. Similarly, Glagola and Nichols identified methods used by DOTs to recruit engineers, including coop/intern programs and contact with university faculty.[6]

These research results can help DOTs to develop recruitment strategies, but even well-targeted recruitment strategies succeed only when there is an ample pool of qualified applicants. A comprehensive approach to attracting engineers and planners to the transportation profession must also look further back, at the university system, to ensure that plenty of students graduate qualified for—and interested in—a transportation engineering or planning career. We could not identify a single study that specifically examined the process of attracting students to transportation disciplines while they are in the university setting. In a related

finding, we found no studies that directly asked civil engineering or planning students how they choose specializations or what factors matter to them when choosing a specialization. This report begins to fill those gaps by identifying the factors that attract urban planning and civil engineering students into the transportation field. The larger goal of the research is to recommend steps that university faculty and transportation professionals can take to encourage students in professional university degree programs to specialize in transportation.

Overview of the Research Methodology

In order to make such recommendations, we designed a multi-stage research project to discover when and how civil engineering and urban planning students make the decision to specialize in transportation. The research methods included a literature review on career choice, identifying how university curricula are structured in planning and civil engineering departments across the country, interviewing university faculty, holding focus groups with students, and conducting on-line surveys of civil engineering and planning students.

We determined that specialization decisions were most likely made at the undergraduate level for civil engineering students, and at the masters level for students in urban planning. For these two groups, the project investigated the following key questions:

- What factors are important to students in their future careers?
- What factors do students consider when choosing a specialization?
- What sources of information do students use to choose a specialization, and how helpful are these sources?
- How do students perceive the transportation specialization?

The student surveys and focus groups targeted all students in civil engineering and planning programs—not just transportation specialists—to contrast and compare the results for students who do and do not choose to be transportation specialists.

Findings and Recommendations

The results suggest that the transportation profession needs to educate planning and engineering students about the aspects of the field that many don't know about, including those that would be attractive to many students. Many of the students who had not chosen transportation as a specialty were not very familiar with neither the field nor the transportation classes and faculty at their university. In addition, many students had negative or inaccurate impressions of the field. For example, many civil engineering students do not seem to understand the "human" side of transportation engineering, thinking that it does not involve much personal interaction or leading and persuading others. Many planning students did not make connections between transportation planning and transit, bicycling, pedestrians, or environmental protection. In essence, the transportation community needs to communicate the breadth of the field and many opportunities for people of all skill sets to participate, so that students make well-educated choices about whether transportation is or isn't the best fit

for them. If all students were offered this knowledge, more of them would choose transportation than currently do.

The prospects for success through education about the profession are high for two primary reasons. First, it is clear that education is needed. Of course some students in civil engineering and planning will always be more attracted to other specializations for many good reasons, and no amount of education about transportation will change that. However, the research conducted for this report found that many students who don't choose transportation are ignorant of the field, rather than actively opposed to it. The transportation profession thus faces the relatively easier task of educating students about the merits of the transportation field, not the more difficult task of overcoming negative feelings toward the profession.

The second reason to have confidence that educational efforts will attract more students to the transportation field is that the study found students choosing a specialization place more importance on the content of work, compared to factors such as pay or prestige. Employers can therefore successfully help attract new students into the field without having to make major shifts within the workplace, such as dramatically increasing salaries (although such steps would doubtless have a positive impact).

Working in concert, university faculty, employers, and professional transportation organizations all have important roles to play in this outreach and education. Faculty need to improve their teaching methods and do more to communicate with students about the interesting research and professional projects they conduct. Teaching quality was an important factor for many students who had chosen a specialization. Many students who had not yet chosen a specialization and who were not leaning toward transportation did not know whether the transportation courses were interesting or challenging, nor did they know if transportation faculty were excellent teachers or did interesting research. Some, though usually a smaller share, thought that the classes were not interesting or challenging or that faculty were not excellent teachers. Employers need to provide well-structured internships and encourage their more dynamic employees to interact with students on campus, both by giving talks about their work and also by teaching classes when local universities hire part-time faculty. Students who had chosen transportation were more likely to have had an internship that helped influence their decision. Finally, leadership organizations in the transportation field, like the Transportation Research Board, the American Association of State Highway and Transportation Officials (AASHTO), and the Institute of Transportation Engineers (ITE), have critical roles both in disseminating information about the profession and also in providing financial and institutional support to improve the quality of teaching about transportation.

Recommended Methods to Recruit Civil Engineering Undergraduates to Specialize in Transportation

The results of this study suggest that a higher percent of CE undergraduates could be attracted to the transportation profession than the current 12% who have chosen the field as a specialty. Two major findings from the survey suggest this optimistic projection. First, the survey found

that 57% of freshman civil engineers had not yet chosen a specialization, indicating that there is a large pool of students who should be reasonably open to the transportation profession. Second, and even more importantly, most CE majors are relatively ignorant about the transportation engineering profession, rather than actively opposed to the idea of a career in transportation. Three-quarters of all entering CE majors don't know what transportation engineers do; thus, they will not yet have formed strong opinions about the field that might discourage them from a transportation career. Also, large percentages of students in the survey selected "don't know" when asked to characterize the nature of the field and educational opportunities in transportation at their school—again, a sizable portion were ignorant more than opposed.

One key strategy for attracting more CE undergraduates is to introduce freshman and sophomores to the diverse and exciting aspects of transportation engineering through their required classes. This can be done through two implementation strategies:

- Develop course modules on transportation, especially for use in general classes that students will take in the freshman and sophomore year.
- Encourage transportation faculty to teach lower-division basic engineering classes.

A second key strategy to recruit CE undergrads to transportation will be for both transportation professionals and academics to find ways to help instructors improve the quality of transportation courses.

Finally, a third strategy will be to provide more student scholarships and research assistantships. This seems to be effective in the planning field. Transportation planning students were much more likely than students in other planning specializations to have been influenced by a research assistantship or scholarship when choosing their field. This was not a very important factor for CE undergraduates.

Recommended Methods to Recruit Planning Masters Students to Specialize in Transportation

The survey of planning students revealed many of the same themes that showed up in the survey of civil engineering students. Only 12% of the students surveyed had chosen to specialize in transportation, but there is potential to increase that number significantly. Of particular note, planning students often have a limited view of the specialization, and their lack of knowledge is likely a reason some of them don't choose (or even consider) a career in transportation. The central challenge for the transportation community is to communicate facts about careers in transportation that will appeal to students. Key aspects of the field that many students seem not to understand are the breadth of skills required to be a transportation planner, the interdisciplinary nature of the field, and its key role in promoting values that matter to planning students, such as a good quality of life for all community members and more sustainable transportation systems. In addition, about one-fifth of the women planning students who had not chosen transportation did not feel that the field was open to women.

The primary recommendations discussed in the report are to:

- Broaden planning students' view of the transportation profession. This could be accomplished through guest speakers and faculty talks highlighting the less-traditional aspects of the field.
- Develop course modules that highlight the interdisciplinary nature of transportation planning. Such modules could be incorporated into classes focusing on planning history and theory, citizen participation, or negotiation, in order to reach a broad range of students.
- Provide more and better publicized scholarships and research assistantships. As noted above, internships already appear to be an effective recruitment strategy.
- Change women's perception of the transportation profession as unwelcoming to them. Having women transportation planners as guest speakers and mentors could help. Many local chapters of the Women's Transportation Seminar (WTS) already undertake these types of activities.

Recommendations for Both Disciplines

A final set of recommendations apply to both disciplines:

- Maintain dynamic web materials. The web was one of the most important sources of information for both planning and CE students in choosing their specialization. It was used more often and found to be more useful than speaking with faculty for advice. In addition to standard websites, universities and organizations should consider newer forms of electronic communication, such as blogs and social networking sites, to engage students.
- Showcase dynamic guest speakers on campus. Guest speakers were also a common and useful source of information students used to choose a specialization. Transportation professionals could also be invited to more informal networking events. In either case, the guests should provide examples of the breadth and diversity of the transportation field, to help dispel student misperceptions.
- Expose students to faculty research. Most students outside of transportation were either unaware of transportation faculty research, or thought is was not interesting.
- Develop a high-profile, national competition for transportation students. Many CE students compete regularly in the Concrete Canoe and Steel Bridge competitions sponsored by the American Society of Civil Engineers (ACSE). These competitions serve to raise the profile of the profession, along with providing a rewarding educational experience. A similar program could attract more students to transportation.

INTRODUCTION

The transportation industry faces a growing shortage of professional engineers and planners. One key strategy in solving this problem will be to encourage more civil engineering and urban planning students to specialize in transportation while completing their degrees, so that employers have a larger pool of likely recruits. However, very little is known about how these students choose a specialization. To help fill that gap, this report examines the factors that lead civil engineering undergraduates and planning masters students to specialize in transportation, as opposed to other sub-disciplines within the two fields. The primary data collection methods were web-based surveys of 1,852 civil engineering undergraduates and 869 planning masters students. The study results suggest steps the transportation community can take to increase the number of civil engineering and planning students who choose to specialize in transportation.

THE CRITICAL NEED FOR NEW TRANSPORTATION PROFESSIONALS

Public agencies and private firms face increasing challenges finding transportation engineers and planners to fill job openings. The problem is particularly acute for public agencies. In 2001, nearly half (46%) of all government workers were 45 or older,[7] and a report for the National Cooperative Highway Research Program (NCHRP) found that many state departments of transportation (DOTs) may have even higher percentages of staff nearing retirement because so many of their engineers were hired during the years of the significant growth of the Interstate Highway System.[8] In addition, many public agencies find it difficult to retain pre-retirement age employees. For example, in 2001, state DOTs experienced turnover rates for engineers as high as 10 to 12%. As a result, the NCHRP report authors stated that "there are probably very few industries where workforce concerns are more acute than in the transportation industry."[9] Employee recruitment and retention problems are not new, however—the Transportation Research Board started publishing research on this topic in 1984.[10]

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These research results can help DOTs to develop recruitment strategies, but even well-targeted recruitment strategies succeed only when there is an ample pool of qualified applicants. A comprehensive approach to attracting engineers and planners to the transportation profession

must also look further back, at the university system, to ensure that plenty of students graduate qualified for—and interested in—a transportation career. The NCHRP study noted that engineering students today are more attracted to newer fields such as computer engineering, rather than civil engineering. "Hence," warned the authors, "the competition for qualified personnel begins long before a potential applicant even considers future employers."[13] In a 2001 presentation to the Council of University Transportation Centers (CUTC), a Federal Highway Administration (FHWA) representative identified a need to "create a means for attracting more students to civil engineering and ensure that anyone who wants to be a civil engineer has an opportunity to do so."[14]

There is some research on what transportation engineering and planning curricula should cover,[15] knowledge that can help improve the quality of students who choose transportation as a career, and a few other studies look at the personal characteristics of engineering students who succeed in completing their bachelor's degree.[16] However, the authors of this report could not identify a single study that specifically examined the process of attracting students to transportation disciplines while they are in the university setting. In a related finding, no studies were found that directly asked planning or civil engineering students how they choose specializations, or what factors matter to them when choosing a specialization. This report begins to fill those gaps by identifying the factors that attract urban planning and civil engineering students into the transportation field. The larger goal of the research is to recommend steps that university faculty and transportation professionals can take to encourage students in university degree programs to specialize in transportation.

OVERVIEW OF THE RESEARCH METHODOLOGY

In order to make such recommendations, the authors of this report designed a multi-stage research project to discover when and how civil engineering and urban planning students make decisions about their specialization. The research methods included a literature review on career choice, identifying how university curricula are structured in urban planning and civil engineering departments across the country, interviewing university faculty, holding focus groups with students, and conducting online surveys of civil engineering and planning students.

The first step in the project was to identify the university degree programs during which planning and civil engineering students are most likely to make a specialization decision. Because few universities have an undergraduate degree in the urban planning field, it was obvious that the focus should be on masters-level students. For civil engineering, however, the faculty interviews, student focus groups, and curriculum research all indicated that relatively few civil engineering students are still deciding on a specialization after they enter a masters program, because most undergraduate civil engineering majors either allow or require majors to choose a specialization while in school. Therefore, the authors of this report decided to focus on undergraduate students in civil engineering.

For these two groups of students—masters-level students in urban planning and undergraduate students in civil engineering—the project investigated the following key questions:

- What factors are important to students in their future careers?
- What factors do students consider when choosing a specialization?
- What sources of information do students use to choose a specialization, and how helpful are these sources?
- How do students perceive the transportation specialization?

The student surveys and focus groups targeted all students in civil engineering and planning programs—not just transportation specialists—to contrast and compare the results for students who do and do not choose to be transportation specialists.

OVERVIEW OF THE REPORT CONTENTS

The report first reviews relevant literature, primarily from the field of vocational psychology. It then explains the study methods, including Internet surveys of 1,846 undergraduate civil engineering majors and 865 urban planning masters students. The following sections present the findings from the two surveys. The report concludes with recommendations as to how the transportation community can encourage more civil engineering and urban planning students to focus on transportation.

RESEARCH METHODOLOGY

This chapter briefly describes how each step in the research process was conducted. The primary method was to survey undergraduate civil engineering majors and urban planning masters students, asking them about their career goals, why they had chosen any particular specialization within civil engineering or planning, their views on the specialization they had chosen, and their views on the transportation specialization (if they had not chosen it for their own work). Developing the survey questionnaire required understanding the likely factors that might influence students' choice of specialization. To develop this background knowledge, the authors reviewed the literature on career choice, researched the structure of undergraduate civil engineering curricula, conducted interviews with civil engineering faculty, and held focus groups with graduate and undergraduate civil engineering students and with masters-level planning students.

LITERATURE REVIEW

The study began with a review of research on how people choose their careers, with a particular focus on how they might distinguish among different specializations within a single field. The authors looked widely through the research literature, across all disciplines. The great majority of the studies uncovered come from the field of vocational psychology.

The authors found that there is very little literature addressing the choice of specialization within any field, and none of it addresses career specialization within civil engineering or planning. Existing studies mostly examine the correlation between specific careers and certain psychological profiles, or they examine how career choice may be related to socio-demographic characteristics or formative learning experiences. Only a few studies focused on the more subtle question addressed in this report—how students choose a specialization within a larger field—and of these only one looked at engineering in particular. None looked at urban planning.

INTERVIEWS WITH UNIVERSITY FACULTY

The authors interviewed nine civil engineering faculty members from different universities to find out how their undergraduate curriculum is structured with regards to electives and student specializations, as well as to ask their opinions about how students chose specializations. They also investigated how faculty perceive their role as advisors to students choosing a specialization, and whether or not faculty actively seek to recruit students into particular specializations. These interviews were conducted either by phone or in person and each lasted about 45 minutes.

Formal interviews were not conducted with planning faculty, as both authors teach in (different) urban planning masters programs, serve as advisors to many students, and attended planning programs (not where they currently teach). This experience has given the authors considerably knowledge about urban planning curricula and how planning students choose specializations.

CURRICULUM RESEARCH

Another phase of the research involved researching the curriculum in civil engineering undergraduate and urban planning masters programs to find out if and when students could choose a specialization, if transportation was offered as a specialization, and if required courses focused on transportation. The curriculum analysis was conducted for the 99 civil engineering programs and 73 urban planning programs invited to participate in the student surveys. (The process for selecting these programs is discussed below.) The curriculum information was gathered in summer 2007 by reviewing each department's website to identify the program requirements.

For the civil engineering programs, the curriculum analysis assessed how many departments required or allowed students to specialize within civil engineering, whether they offered transportation as a specialization, and whether or not a transportation course was required of all students.

Of the 99 civil engineering undergraduate programs reviewed, 31 required students to specialize and 43 made it optional. Only 25, or about one quarter of the programs, did not provide any specialization option for the students. Among the 74 programs that made a specialization either mandatory or optional, 67 offered transportation engineering as one of the possible specializations.

The authors also checked to see how many of the 99 programs required students to take a class in transportation engineering as part of the core civil engineering undergraduate curriculum, separate from electives. Seventy-six programs, or just over 75%, did require a transportation class. Only six programs required the class in the sophomore year. In 52 programs students took the class in their junior year (usually in the second semester or second or third quarter) and in another 10 programs students took the class in their senior year. Of the other seven programs requiring a transportation class, either students had flexibility to take it in different years (two programs) or it was unclear from the department's published materials on the web when students took the class (five programs).

In summary, students in over two-thirds of civil engineering programs have the option to specialize in transportation, and students in over three-quarters of programs were required to take a class in transportation, though in most cases not until they were in the last few semesters of school.

Virtually all urban planning masters programs either require or recommend that students specialize, so the relevant point of curriculum review was to check whether or not transportation was offered as one of the options. Only 36 programs, or just over half, had transportation as one of the listed options.

FOCUS GROUPS

Four student focus groups were conducted in winter 2007: one session with seven undergraduate civil engineering students at the University of California, Berkeley (UC Berkeley); one session with nine masters students in transportation engineering at UC Berkeley; one session with six undergraduate civil engineering students at Portland State University (PSU); and one session with 11 graduate planning masters students at PSU.

The focus group participants were recruited through flyers posted around campus and email sent to student lists. Students from all specializations within civil engineering and urban planning were encouraged to join, and the recruitment materials did not mention any particular interest in the transportation specialization. As compensation, focus group participants received a meal and a cash payment of $15.

The focus groups lasted 90 minutes and an assistant took notes. During the focus groups, students discussed topics such as their impressions of different specializations within civil engineering or planning, what types of careers they hoped to have, their work experience in the field, and their impressions of the transportation specialization. Appendix B presents the scripts used to guide the focus group sessions.

WEB-BASED SURVEYS

The final set of data for this project was collected by developing and implementing Web-based surveys that asked civil engineering undergraduate and urban planning masters students about factors likely to have influenced their choice of specialization.

The questionnaires were designed in response to what the faculty interviews, curriculum evaluation, and focus groups taught us about planning and engineering curricula and student priorities. In addition, the authors used the literature review on career choice theories and assessment instruments used by career counselors to develop questions addressing those theories. Finally, the questionnaire also included open-ended sections so that students could add their own comments if the questionnaire missed factors important to them. The questionnaires for the planning and engineering students were similar, though they varied slightly to account for expected differences between the two groups of students. (Appendix C and Appendix D contain the full texts of the two questionnaires.)

The topics covered in the survey included:

- Students' familiarity with the major specializations in their field (planning or civil engineering).
- Whether or not students had chosen a specialization and, if they had, when they did so.
- Students' opinions about whether or not a list of different factors had influenced their choice of specialization.
- Students' opinions about their chosen specialization (if they had one), including faculty, classes, and careers in that field.
- Students' opinions about transportation planning/engineering, including courses, faculty, and what types of work transportation planners/engineers do.
- The type of work and work environment that is important to them in their future career.
- Basic socio-demographic information.

The survey was conducted over the web, and respondents were recruited entirely through email. Students received an email inviting them to participate in the survey. To encourage participation, students were told that upon completing the survey they would be entered into a drawing to win $300 or $100 gift certificates to Amazon.com. The email included a link to the survey web site, which was a commonly-used, commercial on-line survey provider. To reduce the potential for bias in the responses, the invitations (to both the faculty and students) did not mention that the focus of the survey was transportation.

To reach students, we emailed faculty and program administrators at selected university departments and asked them to forward the survey recruitment email to students in the appropriate degree program. This initial email was sent to faculty in 99 civil engineering departments and 73 planning departments in U.S. universities.

The 99 civil engineering programs invited to participate were selected in several ways. The authors sent the survey to 46 of the civil engineering programs listed by the American Society for Engineering Education (ASEE) as the 50 institutions granting the largest number of civil engineering bachelor's degrees.[17] (Of the 50 institutions, excluded were two universities located in Puerto Rico, one that did not offer any formal or informal specialization in transportation [University of California at Los Angeles], and Virginia Tech, which had just experienced a tragic mass shooting.) Second, the authors sent the survey to those universities listed by the ASEE as offering a bachelor of science degree in civil engineering and at which the department website indicated that transportation engineering was available as an informal or formal specialization. Third, the authors used a list of members of the Council of University Transportation Centers to identify additional civil engineering schools at universities likely to have an emphasis on transportation.

The planning survey was emailed to program administrators at all 73 planning masters programs in the U.S. that were accredited by the Planning Accreditation Board.

It is impossible to calculate a precise response rate for either survey. It is not known for certain how many program administrators forwarded the survey invitation email, the total number of

students enrolled in the degree programs whose administrators did forward the survey invitation to their students, or even how many enrolled students received the emails sent by program administrators (department email lists are often incomplete or contain incorrect email addresses). However, it is estimated that the 865 responding planning masters students represent about 20% of all students enrolled in a planning masters program for the 2006-07 academic year, based on the number of enrolled urban planning master students reported in the *Association of Collegiate Schools of Planning's Guide to Undergraduate and Graduate Education in Urban and Regional Planning*.[18] As for the survey of civil engineering students, it yielded 1,852 valid responses from undergraduate students who were majoring in civil engineering (1,846 responses) or who intended to (six responses). The 1,852 responses for majors represent just under 4% of all full-time and part-time undergraduate students enrolled in civil and civil/environmental engineering programs in 2006. [19]

FINDINGS FROM THE LITERATURE ON VOCATIONAL PSYCHOLOGY

To begin this study, the authors reviewed research on how people choose their careers, with a particular focus on how they might distinguish among different specializations within a single field. The authors looked across all disciplines, as well as looking intensively through the engineering literature. The great majority of the studies uncovered come from the field of vocational psychology. The authors found that there is very little literature addressing the choice of specialization within any field, and none of it addresses career specialization within civil engineering or urban planning. Existing studies mostly examine the correlation between specific careers and certain psychological profiles, or else they examine how career choice may be related to socio-demographic characteristics or formative learning experiences. Only a few studies focused on the more subtle question addressed in this publication—how students choose a specialization within a larger field—and of these only one looked at engineering in particular and none looked at planning.

Researchers in the field of vocational psychology have developed many theories of how people choose a profession, with an objective of matching people with the best career path. The trait and factor approach to career selection is the oldest, most researched, and most prevalent way that career counselors assess whether a career path is a good fit for someone.[20] This approach emphasizes personal characteristics such as aptitudes, interests, values and personality in relation to work environments. John Holland developed a widely tested and used typology to match people to careers based on six personality/interest types: realistic, investigative, artistic, social, enterprising, and conventional.[21] Under this typology, transportation engineers are more likely to be investigative, social, and realistic (ISR),[22] meaning they tend to value fostering welfare in others and social service (S), development or acquisition of knowledge (I), and material rewards for tangible accomplishments (R). This grouping is unusual, as the social and realistic codes usually do not show up on the same profession.

The trait and factor approach is commonly used as the basis for assessment instruments that career counselors use to connect a person with the best fit of a career and work environment. The Myers Briggs Type Indicator and the Strong Interest Inventory are two commonly used assessment instruments. However, some research shows that the model of matching people with a career "works better in distinguishing between people in different career fields than in distinguishing between people in the same career field," such as trying to match doctors with a particularly specialty.[23]

Other career theorists have taken a developmental perspective, looking at people's life histories to explain career decisions.[24] Developmental theorists are often interested in whether a person had early exposure to occupational information and whether parental relationships have a bearing on career choice and success.[25] Several researchers have found that role models are

important, both over a life span and in the current context.[26] This is especially the case for women and cultural minorities who have chosen a non-traditional career path.

Forms of human learning theory, including social learning theory and social cognitive career theory, also play an important role in career theory.[27] These theories indicate that both internal and external factors influence career selection, including personal cognitive processes (knowing and thinking) and beliefs about the external world. Career preferences are particularly influenced by learning experiences, including associative learning, when a stimulus that was previously neutral is paired with another stimulus that is already considered negative or positive.[28] Social learning career theory states that reinforcement, role models, role playing, and simulations all help career seekers with their decision-making process. Social cognitive career theory is concerned with the strength of an individual's belief that he or she can successfully accomplish something.[29] These theorists also find that contextual influences affect career choices, such as one's desire to study in the same area as one's peer group, the level of faculty engagement with students, and specific program strengths.

Researchers have also focused on career indecision. Germeijs and De Boeck outline three key sources of indecision—lack of information, valuation problems, and uncertainty about outcomes.[30] The lack of information includes not knowing what possible alternatives exist, not knowing the attributes of alternatives, and not knowing the possible outcomes of the alternatives. For example, in the case of transportation engineering, students might not know that the field exists (particularly before entering college), they might not know what transportation engineers do (or have incorrect impressions of that work), or they might not know the types of employers that hire transportation engineers, the hiring prospects, salary range, or potential for upward mobility.

Much of the career theory research focuses on differentiating between a broad range of careers, such as doctor vs. teacher vs. mechanic. A small amount of literature focuses on the choice of a specialization within a broader career path, particularly in the field of medicine.[31] Although several studies have found associations between personality factors and medical specialties, one review of the research concluded that "in terms of personality characteristics, most medical specialties generally require the same pattern of personality characteristics, with tolerance wide enough to allow a variety of personality types in each specialty."[32] The authors found more variation in personality traits within specialties than between them. Nevertheless, they recommended continuing the use of personality assessment in counseling medical students choosing a specialty, to narrow the choices, for example. In addition, Borges and Savickas noted that jobs consist of two components, one related to the technical competencies to perform specific tasks, and the other related to the context of performing those tasks, such as the social and organizational network of a work environment. They suggested that personality traits might relate more to contextual performance than task performance. Savickas et al. looked specifically at indecision among medical students in choosing a specialty.[33] A key factor influencing indecision was the lack of information about specialties and ones' interests and abilities.

The authors identified only one study of this type related to engineering. Shivy and Sullivan explored engineering students' perceptions of 11 engineering specialties, such as mechanical, civil, electrical, and so on, using a survey of 129 undergraduates.[34] They found that "attributes that individuals commonly use to make distinctions among occupations (i.e. people, things, data, ideas, gender, and prestige) did not seem to be used by students in making distinctions among the 11 engineering specialties."[35] They suggested that engineering specialties shared many features and that once students chose engineering as a career, they used more novel and perhaps idiosyncratic attributes to choose a specialty within engineering. They identified three dimensions that distinguished students' perceptions of the engineering fields: (1) microlevel and inert materials vs. macrolevel and human systems; (2) job availability after graduation; and (3) clear paths toward management positions. They also found that gender, ethnicity, and vocation exploration and commitment may influence perceptions.

FINDINGS FROM THE CIVIL ENGINEERING STUDENT SURVEY

SURVEY RESPONDENTS

The survey yielded 1,852 valid responses from undergraduate students who were majoring in civil engineering (1,846 responses) or who intended to (6 responses). As explained in the previous chapter, it is impossible to calculate a response rate, since it is not known exactly how many students received the invitation to participate in the survey. However, the 1,852 response for civil engineering majors represent just under 4% of all full-time and part-time undergraduate students enrolled in civil and civil/environmental engineering programs in 2006.[36]

The responding students attended 56 different universities, with no single university representing more than 6% of the responses (Table 1). Ninety-five percent of the respondents were full-time students. One-fifth (20%) expected to graduate in spring or summer 2007 (seniors), while 33% expected to graduate the following year (juniors), 26% in 2008–09 (sophomores), and the remaining 21% in 2009–10 or later (freshman).

Table 2 shows basic demographic information for the students who responded to the survey, breaking down the results by students who said they had selected transportation as their specialization, students who had chosen a specialization other than transportation, students who were undecided on a specialization, and the total population of respondents.

The demographics of the survey respondents were roughly parallel to the demographic breakdown of all students who received bachelors degrees in civil engineering in 2005–06, though there were some small differences. For example, 30% of the survey respondents were women, somewhat higher than the share of bachelor's degrees in civil engineering awarded to women in 2005–06 (22%).[37] Three-quarters of the respondents identified themselves as being white/Caucasian only, 9% were Asian, 6% were Hispanic, 3% were multi-racial/ethnic, 2% declined to state, and 1% were African American. This compares to 67% of all engineering degrees awarded to Caucasians in 2006, 14% to Asians, and 6% to Hispanics, and 5% to African-Americans.[38] Eleven percent of the responding students were married or living in a domestic partnership, and 5% had children under 18 living with them. There were no major differences in demographics between transportation students, students who chose another specialization, and students who had not yet chosen a specialization.

Table 1 Universities From Which At Least One Civil Engineering Undergraduate Student Responded

University	
Arizona State University	Texas A&M University
Auburn University	University of Akron
California Polytechnical Pomona	University of Arizona
California Polytechnical San Luis Obispo	University of California, Berkeley
Citadel	University of California, Davis
City College of New York	University of California, Irvine
City University New York	University of Florida
Clarkson University	University of Idaho
Clemson University	University of Illinois, Chicago
Colorado State University	University of Illinois, Urbana-Champaign
FAMU-FSU	University of Kentucky
Georgia Institute of Technology	University of Maryland, College Park
Illinois Institute of Technology	University of Memphis
Louisiana State University	University of Minnesota, Twin Cities
Massachusetts Institute of Technology	University of Missouri, Rolla
Michigan Technological University	University of North Carolina, Charlotte
North Dakota State University	University of Oklahoma
Northeastern University	University of Pittsburgh
Ohio State University	University of South Florida
Oklahoma State University	University of Texas, Austin
Oregon Institute of Technology	University of Texas, El Paso
Oregon State University	University of Utah
Pennsylvania State University	University of Vermont
Polytechnic University	University of Virginia
Portland State University	University of Washington
Rensselaer Polytechnic Institute	University of Wisconsin, Madison
Rowan University	University of Louisville
Rutgers University	West Virginia University

Table 2 Civil Engineering Student Survey Respondent Demographics

Demographic Category	Students, by Specialization: Transportation (%)	Other Specializations[a] (%)	Undecided (%)	All (%)
Gender				
Female	33	31	28	30
Male	67	69	72	70
Age				
18–20 years	28	26	48	35
21–24 years	58	63	42	54
25+ years	14	11	10	11
Race				
White	71	77	75	75
Asian	9	8	9	9
Hispanic	7	6	6	6
Multi-racial	4	3	3	3
Other	2	2	2	2
African American	2	1	2	1
Native American	1	<1	1	1
Pacific Islander	2	1	<1	1
Refused	2	2	2	2
White[b]	73	78	76	77
Non-white[b]	27	22	24	23
Married/in a domestic partnership	13	13	9	11
Living w/children 18 or under	8	5	4	5
n (varies depending upon non-responses)	*212 to 217*	*907 to 926*	*697 to 708*	*1,816 to 1,851*

Note: There are no significant differences between the three groups of students, $p<0.05$, two-tailed test.

a. Includes students who have chosen another specialization, including generalists.
b. Does not include students who did not answer, coded as "refused."

IF AND WHEN STUDENTS CHOOSE A SPECIALIZATION

Nearly one-third (30%) of the students stated that their program required them to select a formal specialization or focus area, while 62% said that they could choose to specialize informally by taking several electives within one of the civil engineering subfields. Those respondents were asked if they had chosen a specialization for their studies. The remaining 8% were asked if they had identified a specialty that they hoped to work in after graduation.

Overall, 62% of the survey respondents had chosen a specialization for their program or career. The most popular specialization chosen was structural, followed by transportation, construction/project management, environmental, geotechnical, and hydraulics/hydrology

(Table 3). Three percent of students who had made a decision indicated that they had chosen to be generalists. For this analysis, these generalists were categorized as having chosen a "specialization," since they had made a decision, even if one to focus broadly rather than on a specific area. For students who had not yet chosen a specialization, structural, transportation and construction/project management were still the most popular likely choices. Being a generalist was favored by 17% of those who were undecided. This difference in percentage between those who had chosen to be generalists and those who were likely to do so reveals a flaw in the survey design, which did not include the generalist option as a specialization choice. Those students indicating it as their chosen specialization had chosen "other" and wrote in "generalist." Therefore, some students who had decided on being a generalist (an unknown portion of those indicating they were very likely to be a generalist) are not included in later analysis that includes generalists as a specialization choice.

Table 3 Civil Engineering Students' Chosen or Likely Specializations

	Students Who Have Decided on a Specialization: % Who Chose This Specialization	Undecided Students: % Very Likely to Choose This Specialization
Structural	37	31
Transportation	19	25
Construction/Project Management	14	19
Environmental	13	9
Geotechnical	6	8
Hydraulics/Hydrology	5	8
General	3	17
Other	2	-
Materials	<1	3
n	*1,143*	*703*

Of the students who had chosen a specialization, 72% were very sure that they would finish their degree with that specialization, with 25% somewhat sure (Table 4).

Table 4 Civil Engineering Students' Certainty That They Will Finish Their Degree Focusing on Their Chosen Specialization

	Structural (%)	Transportation (%)	Construction/ Project Mgt. (%)	Environmental (%)	Other or Generalist (%)
Very sure	74	70	68	77	67
Somewhat sure	23	27	28	20	26
Somewhat unsure	2	2	3	2	5
Very unsure	<1	1	1	1	2
n	*425*	*217*	*158*	*153*	*180*

Fifteen percent of all students, or 25% of those who had chosen a specialization, stated that they had decided on their specialty before they started college. Students focusing on environmental engineering and structural engineering were more likely to have chosen their

focus before starting college (33% and 31% of all students who had chosen a specialization, respectively), compared to transportation (22%) or construction/project management (17%). For most students, the decision to specialize occurs by the end of their sophomore year. Of those that expected to graduate in the next few months, 84% had decided on a specialization, compared to 67% of those who would graduate in 2007–08 (juniors), 53% of those who would graduate in 2008–09 (sophomores), and 43% of those who would graduate in 2009–10 or later (freshman).

Transportation engineering succeeds in attracting students during their undergraduate years at a higher rate than do other specializations. Of the students who expected to graduate in 2009–10 or later (freshman), 7% intended to focus on transportation, compared to 18% of those graduating in spring or summer 2007 (seniors), a 168% increase (Table 5). This is a much higher rate of growth than for construction/project management, environmental, or structural, indicating that transportation engineering students, to a larger extent than other civil engineering students, are learning about and deciding on their subfield while in school.

Table 5 Civil Engineering Students' Choice of Specialization, By Year in School

	% of students, by year, that have chosen the specialization						
Expected Graduation Date	Undecided (%)	Construction/ Project Mgt. (%)	Environmental (%)	Structural (%)	Transportation (%)	Other or Generalist (%)	*n*
2009–10 or later (freshman)	57	9	6	16	7	6	*390*
2008–09 (sophomore)	47	8	8	23	9	7	*480*
2007–08 (junior)	33	9	9	24	14	12	*605*
Spring or summer 2007 (senior)	17	9	11	29	18	18	*375*
Percentage change from freshman to senior year	–71%	+1%	+85%	+79%	+168%	+212%	

Students' chosen specializations are consistent with their level of familiarity with that field. Only 6% of the students were not at all familiar with structural engineering, compared with over one-quarter of students being unfamiliar with the fields of geotechnical, materials, and hydraulics/hydrology (Table 6). Nearly half of the students (49%) were very familiar with transportation, with only 10% indicating no familiarity with the field. While level of familiarity with the specializations was generally higher among seniors and juniors compared to freshmen and sophomores, only 13% of the freshmen were unfamiliar with transportation (Table 7). However, even students who indicate that they are familiar with the transportation specialization may have inaccurate impressions of the field.

Table 6 Civil Engineering Students' Familiarity With Each Specialization[a]

	Not at All Familiar (%)	Somewhat Familiar (%)	Very Familiar (%)	*n*
Structural	6	40	54	*1,842*
Transportation	10	41	49	*1,842*
Construction/Project Management	11	50	39	*1,841*
Environmental	18	56	26	*1,843*
Geotechnical	25	48	27	*1,839*
Materials	25	56	19	*1,836*
Hydraulics/Hydrology	29	48	23	*1,836*

a. Students were asked "How familiar are you with [specialization]?" The question was asked of each specialization, with the specializations listed in alphabetical order. The questions were introduced with the following statement: "Many civil engineers work primarily in a specialized sub-field of civil engineering. Common specialties include Construction/Project Management, Environmental, Geotechnical, Hydraulics/Hydrology, Materials, Structural, and Transportation."

Table 7 Percent of Civil Engineering Students Unfamiliar With Each Specialization, By Year in School

	% of Students, By Year, Who Are Not At All Familiar with Specialization				
Expected Graduation Date	Structural (%)	Transportation (%)	Construction/ Project Mgt. (%)	Environmental (%)	*n*
2009–10 or later (freshman)	7	13	11	23	*376*
2008–09 (sophomore)	6	11	13	21	*602*
2007–08 (junior)	4	8	11	15	*476*
Spring or summer 2007 (senior)	7	7	7	15	*387*

CHOICE FACTORS

Students were asked how important various factors were in making their specialization decision. The most important factor for all students was the contribution the specialization makes to improving the quality of life in cities and towns. The vast majority of all transportation students (83%) rated this factor as "important," defined as a 4 or 5 on a scale of 1 to 5, with 1 being not important at all and 5 being very important (Table 8). This response rate among transportation students was almost 10 percentage points higher than the share of non-transportation students rating the factor as important.

There were only a few other differences between transportation and non-transportation students. Transportation students were more swayed by the ability to be involved in public policy decisions, and less influenced by potential salary. Transportation students were also less likely to indicate that the contribution the specialization makes to improving the natural environment was an important factor in their decision. However, these differences are primarily due to the very high importance students focusing on environmental engineering

placed on this factor. Transportation students rated it about the same in importance as those choosing structural or construction/project management.

Several of the factors examined are under the direct control of civil engineering departments. For example, at least two-thirds of both transportation and non-transportation students said that what they learned about their specialization in classes they took was an important factor in their choice. This was the fifth most important factor. On the other hand, few students were influenced by the availability of research assistantships or scholarships.

VIEWS ON THEIR SPECIALIZATION

The survey also asked students if they agreed or disagreed with several statements describing their specialization. The statements fell into three broad categories. One set of questions related to factors the student experiences while at the university, including faculty, classes, financial support, and internships. The second set covered the perceived nature of the work within the specialization; these factors were drawn from the vocational psychology literature. The third set covered topics related to jobs within the field, including salary, prestige, and potential for acceptance, particularly for women and people of color. Some of the statements were similar to those asked in the questions about how important factors were in deciding upon their specialization. The survey was designed to ask students about the factor in both sections because there may be cases where students agree with a statement, even though it was not an important factor in choosing their specialization.

Regarding their experiences at the university related to their specialization, civil engineering students focusing on transportation were less likely than non-transportation students to feel that their specialization was a strength of their school's engineering department (Table 9). Just over half (52%) of the transportation students agreed with that statement, compared to 61% of non-transportation students. Structural engineering students were the most likely to agree with that statement. In addition, transportation students were most likely to indicate that they didn't know whether their specialization was a strength of their school—15% compared to 10% of non-transportation students. This may be related to the level of knowledge about faculty research among all students. Less than half of either transportation or non-transportation students agreed that the faculty were doing interesting research, but about one-quarter of students did not know whether their facultys' research was interesting.

Table 8 Importance of Factors in Civil Engineering Students' Choice of Specialization

Factor[a]		Transportation	Other Specialization[b]	% Point Difference (Trans. – Other)
The contribution the specialization makes to improving the quality of life in cities and towns	% rating 4 or 5	**83**	**74**	**9**
	mean score[c]	**4.3**	**4.1**	
The likelihood of getting a job in the specialization	% rating 4 or 5	79	76	3
	mean score	4.2	4.1	
Job security and stability	% rating 4 or 5	73	71	2
	mean score	4.0	3.9	
The type of work environments for people in the specialization	% rating 4 or 5	73	74	–1
	mean score	4.0	4.0	
What I learned about the specialization from classes I have already taken	% rating 4 or 5	67	72	–5
	mean score	3.9	4.0	
The potential for upward mobility	% rating 4 or 5	65	70	–5
	mean score	3.8	3.9	
Teaching quality of faculty who teach within the specialization	% rating 4 or 5	59	59	0
	mean score	3.6	3.6	
The likelihood that a job in my specialization will fit well with my family responsibilities	% rating 4 or 5	53	50	3
	mean score	**3.5**	**3.3**	
Being able to work in a field where I get to be involved in public policy decisions	% rating 4 or 5	**53**	**42**	**11**
	mean score	**3.5**	**3.1**	
The salary I will likely earn	% rating 4 or 5	**49**	**60**	**–11**
	mean score	**3.4**	**3.6**	
The likelihood of me being accepted by other people working in the field	% rating 4 or 5	50	44	6
	mean score	3.3	3.1	
The contribution the specialization makes to improving the natural environment	% rating 4 or 5	**47**	**57**	**–10**
	mean score	**3.3**	**3.6**	
Professional reputation of faculty who teach in specialization	% rating 4 or 5	43	47	–4
	mean score	3.2	3.3	
Availability of classes within the specialization (e.g. the times of the day/week or whether they have space)	% rating 4 or 5	36	31	5
	mean score	**2.9**	**2.6**	
Availability of research assistantships working with faculty in specialization	% rating 4 or 5	21	20	1
	mean score	2.3	2.3	
Availability of scholarships or other financial support for students in specialization	% rating 4 or 5	14	13	1
	mean score	2.1	2.0	
n (varies depending upon non-responses)		*205 to 212*	*839 to 895*	

Note: **Bold** indicates that the difference in the percentages or the means between the two groups is significantly different, two-tailed test, $p<0.05$.

a. Students were asked "How important for you were the following factors in choosing your specialization?" and they were given a 5-point scale for the response (1 = not important at all, 5 = very important), plus a "Don't Know" option.
b. Includes students who have chosen another specialization, including generalists.
c. Mean scores were calculated excluding "don't know" responses.

On a positive note, 70% of all students, both transportation and non-transportation specialists, agreed that the faculty teaching in their specialization were excellent teachers. Over 80% of all students also felt that classes within their specialization were interesting. Transportation students were significantly less likely to think that classes within their specialization were challenging, which could be viewed either negatively or positively. Of the largest specializations, transportation students were the least likely to feel that their classes were challenging (62%), compared to 79% of all non-transportation students, 88% of structural students, 78% of environmental students, 77% of geotechnical students, and 67% of construction/project management students.

Transportation students were significantly more likely than non-transportation students to agree that there were good internships available to students in transportation.

The nature of the type of work each subfield involves is likely to influence which students are attracted to which specialty. Students with certain personality traits are more likely to be attracted to fields that are compatible with those traits. Some of the questions on the survey were intended to match the personality types defined by Holland and described in the *Dictionary of Holland Occupational Codes*. Holland asserts that transportation engineers are most likely to exhibit traits of "social," "investigative," and "realistic" personality types and not the "enterprising" type. However, we found that transportation engineering students are more likely to be "enterprising" than "realistic" in their preferences for activities within their occupation. The survey found that only 44% of transportation students agreed that their specialty involved working with machines, tools, and materials (Table 10). A preference for working with machines and tools is consistent with Holland's "realistic" personality type. In contrast, 71% of transportation students agreed that their specialty involved leading and persuading others, an attribute of the "enterprising" personality type.

Consistent with Holland's typology, most transportation students felt that their field involved exploring, understanding and predicting natural or social phenomena. This is consistent with the "investigative" personality type. The finding is also consistent with the nature of transportation engineering, which involves humans interacting with the transportation system. In contrast, 59% of structural and construction/project management students agreed with that statement. About two-thirds of transportation students and a similar percent of non-transportation students agreed that their specialization involved helping and serving others through personal interaction, an attribute consistent with the "social" personality type.

Table 9 Civil Engineering Students' Views on Their Specialization—University Experiences

Views About Specialization[a]		Transportation	Other Specialization[b]	% Point Difference (Trans. – Other)
The classes in my chosen specialization are interesting	% agreeing	83	88	–5
	% don't know	7	6	1
	mean score[c]	4.4	4.5	
There are good internships for students in my chosen specialization	% agreeing	**77**	**64**	**13**
	% don't know	9	13	–4
	mean score	**4.3**	**4.0**	
The faculty teaching classes in my chosen specialization are excellent teachers	% agreeing	70	70	0
	% don't know	9	8	1
	mean score	4.1	4.1	
The classes in my chosen specialization are challenging	% agreeing	**62**	**79**	**–17**
	% don't know	8	5	3
	mean score	**3.8**	**4.2**	
My chosen specialization is a strength of my school's engineering department	% agreeing	**52**	**61**	**–9**
	% don't know	15	10	5
	mean score	**3.7**	**3.8**	
The faculty teaching classes in my specialization are doing interesting research	% agreeing	42	49	–7
	% don't know	23	25	–2
	mean score	**3.6**	**3.8**	
There are scholarships targeted at students in my chosen specialization	% agreeing	30	28	2
	% don't know	26	28	–2
	mean score	3.1	3.0	
n (varies depending upon non-responses)		*208 to 214*	*903 to 910*	

Note: **Bold** indicates that the difference in the percentages or the means between the two groups is significantly different, two-tailed test, $p<0.05$.

a. Students were asked whether they agreed or disagreed, on a scale of 1 to 5, with 1=strongly disagree and 5=strongly agree, plus a "Don't Know" option. "% agreeing" indicates the percent who responded a 4 or 5.
b. Includes students who have chosen another specialization, including generalists.
c. Mean scores were calculated excluding "don't know" responses.

Table 10 Civil Engineering Students' Views on Their Specialization—Nature of The Job Tasks

Views About Specialization[a]		Transportation	Other Specialization[b]	% Point Difference (Trans. – Other)
My chosen specialization will allow me to use skills at which I excel	% agreeing	86	86	0
	% don't know	4	5	–1
	mean score[c]	4.4	4.4	
Working in my specialization involves analyzing data to solve problems	% agreeing	86	85	1
	% don't know	3	6	–3
	mean score	4.5	4.5	
Working in my specialization involves creating and using new knowledge	% agreeing	77	80	–3
	% don't know	2	4	–2
	mean score	**4.2**	**4.3**	
Working in my specialization involves exploring, understanding and predicting natural or social phenomena	% agreeing	**74**	**64**	**10**
	% don't know	3	5	–2
	mean score	4.0	3.9	
Working in my specialization involves leading and persuading others	% agreeing	71	71	–1
	% don't know	4	4	0
	mean score	4.0	4.1	
Working in my specialization involves helping and serving others through personal interaction	% agreeing	66	64	2
	% don't know	4	5	–1
	mean score	3.9	3.9	
Working in my specialization involves machines, tools, and materials	% agreeing	**44**	**58**	**–14**
	% don't know	3	3	0
	mean score	**3.3**	**3.7**	
n (varies depending upon non-responses)		*208 to 214*	*903 to 910*	

Note: **Bold** indicates that the difference in the percentages or the means between the two groups is significantly different, two-tailed test, $p<0.05$.

a. Students were asked whether they agreed or disagreed, on a scale of 1 to 5, with 1=strongly disagree and 5=strongly agree, plus a "Don't Know" option. "% agreeing" indicates the percent who responded a 4 or 5.
b. Includes students who have chosen another specialization, including generalists.
c. The mean scores were calculated excluding "don't know" responses.

The third set of questions about the students' specialization focused on aspects of the jobs and work environment (Table 11). The majority of all students felt that it would be easy to get a job in their specialty after graduation. However, their impressions about prestige varied. Transportation students were significantly less likely to agree that a career in their specialization was prestigious—58% versus 68% of non-transportation students. Structural engineering students were most likely to agree with that statement (80%), which largely accounts for the difference between transportation and non-transportation students. Transportation students were about equally likely as environmental and construction/project management students to feel that their career was prestigious.

Several of the questions in this section attempted to address the possibility that students might feel discriminated against or not accepted within the field. On a positive note, significantly more transportation engineering students felt that their field was open to women (75% versus 64% of non-transportation students). Construction/project management and structural engineering students were least likely to think their field was open to women (42% and 66%, respectively). A clear majority (72%) of transportation students also felt that the field was open to people of color. Transportation students were less likely than the other students to feel that there is a common identity among people in the field (40% versus 49%), though a large share of transportation students (22%) did not know. Overall, these findings indicate that transportation students perceive their field as diverse to a greater extent than do non-transportation students. That diversity may be with respect to gender, but also may include factors such as personality types or backgrounds that can form people's identities.

Table 11 Civil Engineering Students' Views on Their Specialization—Job-Related Features

Views About Specialization[a]		Transportation	Other Specialization[b]	% Point Difference (Trans. – Other)
A career in my specialization is prestigious	% agree	**58**	**68**	**–10**
	% don't know	5	6	–1
	mean score[c]	**3.8**	**4.0**	
It will be easy to get a job in my chosen specialization after I graduate	% agree	80	74	6
	% don't know	8	10	–2
	mean score	4.4	4.3	
My specialization seems open to women	% agree	**74**	**64**	**10**
	% don't know	13	12	1
	mean score	**4.3**	**4.0**	
My specialization seems open to people of color	% agree	72	69	3
	% don't know	16	16	0
	mean score	4.4	4.3	
I am like other people who have chosen this specialization	% agree	52	53	–1
	% don't know	18	14	4
	mean score	3.7	3.7	
There is a common identity among people working in my chosen specialization	% agree	**40**	**49**	**–9**
	% don't know	**22**	**16**	**6**
	mean score	**3.4**	**3.6**	
n (varies depending upon non-responses)		*208 to 214*	*903 to 910*	

Note: **Bold** indicates that the difference in the percentages or the means between the two groups is significantly different two-tailed test, p<0.05.

a. Students were asked whether they agreed or disagreed, on a scale of 1 to 5, with 1=strongly disagree and 5=strongly agree, plus a "Don't Know" option. "% agreeing" indicates the percent who responded a 4 or 5.
b. Includes students who have chosen another specialization, including generalists.
c. The mean scores were calculated excluding "don't know" responses.

SOURCES OF INFORMATION

Students were asked about several sources of information they may have used to help choose their specialization. For each item they used, they were asked how helpful it was in choosing a specialization. Table 12 shows these findings, sorted by the share of students using the source (highest to lowest).

Table 12 Sources of Information Used by Civil Engineering Students to Choose Their Specialization

Source of Information[a]		Transportation	Other Specialization[b]	% Points Difference (Trans. – Other)
A class I took in my chosen specialization	% using	82	87	–5
	level of helpfulness[b]	4.3	4.2	
Information I read on the web about my chosen specialization	% using	78	75	3
	level of helpfulness	3.5	3.7	
An internship or job within my chosen specialization	% using	**71**	**60**	**11**
	level of helpfulness	4.4	4.3	
Attending a career fair organized at my university	% using	66	68	–2
	level of helpfulness	3.4	3.3	
Someone working in my chosen specialization who spoke in one of my classes or at an event I attended	% using	65	59	6
	level of helpfulness	3.5	3.5	
Books or magazine I read about my chosen specialization	% using	61	65	–4
	level of helpfulness	3.5	3.5	
Speaking with a faculty member for advice on choosing a specialization	% using	60	66	–6
	level of helpfulness	3.5	3.7	
Before I started college, I learned about the specialization from someone that I knew who worked in that field	% using	38	37	1
	level of helpfulness	3.8	3.8	
Speaking with someone at my university's career center or a career counselor	% using	38	43	–5
	level of helpfulness	2.6	2.6	
n (varies depending upon non-responses)		*207 to 211*	*872 to 896*	

Note: **Bold** indicates that the difference in the percentages or the means between the two groups is significantly different, two-tailed test, $p<0.05$.

a. Students were asked about sources of information they may have used to help decide on their spcialization. For each listed source, the student could rate it on a scale of 1 to 5, with 1 = "did not help at all" and 5 = "very helpful." The student could also indicate that they did not use that source or that they did not know if it was helpful. The level of helpfulness is the mean score for those that used the source and indicated how useful it was on the 1-5 scale. Don't know responses are not included.

b. Includes students who have chosen another specialization, including generalists.

Internships and jobs were the most useful source of information to transportation students, averaging a 4.4 on a 5-point scale (5 is "very helpful" and 1 is "not at all helpful"). Transportation students were also more likely to have used this source of information (71%) than non-transportation students (60%).

There were no significant differences between transportation and non-transportation students in which other sources of information were more or less helpful. For all students, classes within the specialization were the most often used source of information, with 82% of transportation students indicating that they had used that source. The courses were also useful to students in their decision, averaging 4.3 in level of helpfulness for transportation students. A majority of students spoke with a faculty member for advice. Students found this moderately helpful, averaging 3.5 and 3.7, respectively. Speaking with faculty was as helpful as information students found on the Web, through reading books and magazines, and through guest speakers in class or other events. Career centers and counselors were used by a minority of students and, when used, were not rated as very helpful.

The survey also explored the possibility that students may be influenced by extracurricular activities. Many civil engineering schools participate in events sponsored by the American Society of Civil Engineers (ASCE), including the Concrete Canoe and Steel Bridge competitions. Overall, 30% of the students had participated in one or both of these events. Transportation students were less likely to have participated than non-transportation students (23% versus 32%).

The most similar event focusing on transportation engineering is the "Traffic Bowl" competition sponsored by some chapters of the Institute of Transportation Engineers (ITE). The event tests knowledge of transportation engineering and follows a quiz show format. Only 1% of the transportation students had participated in a Traffic Bowl, and only 9% indicated that students on their campus had participated.

Although the ITE Traffic Bowls attracted few participants, the ITE chapters on campus did reach much bigger numbers of students, even if well less than half had ever participated in an event. Sixty percent of transportation students stated that there was an ITE student chapter on campus, and 26% indicated that they had participated in some kind of event organized by the chapter.

PERCEPTIONS OF THE TRANSPORTATION FIELD

What students think they know about the transportation field likely affects their specialization decisions. Lack of information can be a source of career indecision. In addition, inaccurate information could result in students making a poor match between their career choice and personality and values. The survey gauged the perceptions of all respondents regarding transportation engineering. For students who had chosen transportation as a specialization, the questions about their specialization (as described in the sections above) were used. For students choosing another specialization or undecided, the survey included a similar

set of questions, except that "transportation engineering" substituted for "my specialization" in the questionnaire wording. The results presented here divide the students who were undecided on a specialization into two categories—those who indicated that they were somewhat or very likely to choose transportation ("undecided-likely") and those who were not ("undecided-unlikely"). Of the 708 undecided students, 400 were likely to choose transportation.

The results from these questions about the transportation field are shown in Table 13, Table 14, and Table 15. Each table shows the share of students in each category who agree with the statement and the percent who responded "don't know." For those who did have an opinion, the mean score is presented, with higher scores on the one-to-five scale indicating a higher level of agreement. Finally, the tables also include the percent who disagreed either somewhat or strongly, among those with an opinion.

One consistent finding is that students who had not yet chosen a specialization and who were not leaning toward transportation were the most likely to respond that they "don't know" about transportation engineering. This was particularly true regarding their university experiences (Table 13). For example, 57% of the undecided-unlikely students did not know if transportation engineering faculty were doing interesting research, compared to 48% of those who had decided on another specialization, 47% of the undecided-likely students, and 23% of the transportation students. In fact, for all of the questions related to the university experience, at least one-third of the undecided-unlikely students responded "don't know."

The share of the undecided-unlikely students who did not know about transportation engineering is smallest for the statements describing the nature of the work (Table 14). For these questions, from 12% to 22% of those students chose "don't know." This indicates that most students in every category (at least three-quarters) have at least some very broad perceptions about transportation engineering. (These may or may not be accurate, of course.)

Looking only at the students who had an opinion (excluding the "don't know" responses) reveals some significant differences in opinions about transportation engineering, particularly regarding their experiences at the university. The undecided-unlikely students were the least likely to agree that transportation engineering was a strength of their school's engineering department, that transportation engineering faculty were excellent teachers or doing interesting research, and that transportation engineering classes were challenging or interesting. The differences were not due to being "on the fence" and responding in the middle of the one to five scale. These students had the most negative opinions of transportation engineering classes and faculty, even more so than students who had chosen another specialization. For example, 21% of the undecided-unlikely students disagreed with the statement that faculty teaching the transportation classes are excellent teachers, compared to 14% of the students who had chosen another specialization and 5% of the transportation students. Perhaps most startling is that nearly half (47%) of the undecided-unlikely students did not think that the transportation engineering classes were interesting, compared to only 30% of the non-transportation students. The only university experience statement for which

this group of students did not disagree the most was "there are scholarships targeted at transportation students." Of those respondents with an opinion on this topic, transportation students were actually the least likely to agree with the statement.

Differences in levels of agreement with the statements about the nature of the work involved in transportation engineering (Table 14) reveals some potential misperceptions of the field. For example, of those respondents with an opinion ("don't know" responses excluded), 24% of the undecided-unlikely students disagreed with the statement that "working in transportation engineering involves helping and serving others through personal interaction." This compares with 5% of the transportation students, 7% of the undecided-likely students, and 13% of the students who had chosen another specialization. Similarly, the undecided-unlikely students were the least likely to agree that working in transportation involves leading and persuading others, though only 11% disagreed with that statement.

Non-transportation students, both those who had decided on another specialization and the undecided-unlikely students, were significantly less likely to think that a career in transportation engineering is prestigious (Table 15). In fact, over one-third (36%) of the undecided-unlikely students disagreed that a transportation engineering career is prestigious, compared to 22% of the students who had chosen another specialization and 8% of the transportation students. Large shares of the non-transportation and undecided-unlikely students (33% and 42%, respectively) also disagreed with the statement that "I am like other people who work in transportation engineering." The fact that many non-transportation students do not identify with transportation engineers may indicate either negative opinions about people in the field or a lack of interaction with transportation engineers.

The students who had not chosen transportation as a specialization were also asked whether they agreed with two unique statements: (1) "Before I started college, I knew what transportation engineers do"; and (2) "Most transportation engineers work in public agencies." These questions were intended to gauge non-transportation students' knowledge of the field. Only 14% of the undecided-unlikely students agreed that before college they knew what transportation engineers do, and 58% disagreed, while only 4% didn't know. Of the students who had chosen another specialization, 27% agreed and 43% disagreed with the statement. These finding indicate a lack of knowledge upon entering college.

Most of the students also thought that most transportation engineers work for public agencies, though sizable shares indicated that they did not know. Of the undecided-unlikely students, 50% agreed with the statement that "most transportation engineers work in public agencies," while 25% did not know. Or, to look at the results another way, only 25% knew that many transportation engineers work in the private sector. The students who had chosen a non-transportation specialization were even more likely to agree with the (incorrect) statement (57%), while 21% of them did not know.

To further gauge non-transportation students' knowledge of the profession, the survey included the following open-ended question: "Please list up to three things that you think

transportation engineers do." Over three-quarters of the non-transportation students (1,226) wrote at least one answer. All of the answers were coded into categories. By far the most often noted task that non-transportation students thought transportation engineers do is to build, design, or construct roads or highways. This was listed by 65% of those providing an answer. In addition, 7% of the students indicated that transportation engineers planned or laid out roads and/or highways and 7% indicated that they maintained, operated, repaired, inspected, or managed roads/highways. The second most cited response included tasks such as traffic impact analyses, level of service evaluation, and analyzing or predicting traffic; 29% of the students listed these types of activities. In addition, 18% of the students said that traffic engineers designed, directed, or managed traffic. The same share (18%) listed something to do with traffic signals or lights. No other category of responses was listed by more than 10% of the students. Six additional categories were listed by at least five percent of the students: "plan," "design," or "build" without being specific about what was planned, designed, or built (9%); pavement, asphalt, cement, and materials (8%); bridges (7%); safety (7%); transit (6%); and public policy, public, government (5%). Less than two percent of the responses included something overtly negative, such as "sit around," "boring," or "a lot of busy work." In contrast, 12% included a statement with a positive verb, most commonly "improve" or "solve."

Table 13 Civil Engineering Students' Views on Transportaion Engineering—University Experiences

Statement		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[a]
Transportation classes are interesting	% agreeing[b]	83	**51**	**13**	**32**
	% don't know	7	**28**	**38**	**26**
	mean score[c]	**4.4**	**3.9**	**2.6**	**3.2**
	% with opinion who disagree[d]	1	5	**47**	**30**
There are good internships for students in transportation engineering	% agreeing	77	**59**	**36**	**47**
	% don't know	9	**25**	**48**	**39**
	mean score	4.3	4.1	3.9	4.1
	% with opinion who disagree	4	5	8	6
The faculty teaching the transportation classes are excellent teachers	% agreeing	70	**50**	**25**	**43**
	% don't know	9	**29**	**41**	**29**
	mean score	4.1	3.9	**3.3**	**3.7**
	% with opinion who disagree	5	8	**21**	**14**
Transportation engineering classes are challenging	% agreeing	62	**35**	**20**	**31**
	% don't know	8	**32**	**42**	**30**
	mean score	**3.8**	**3.5**	**3.0**	**3.3**
	% with opinion who disagree	5	**12**	**31**	**24**
Transportation engineering is a strength of my school's engineering department	% agreeing	52	47	**24**	**40**
	% don't know	15	**23**	**33**	**25**
	mean score	3.7	3.7	**3.1**	3.5
	% with opinion who disagree	12	9	**29**	17
The faculty teaching transportation classes are doing interesting research	% agreeing	42	34	**18**	**30**
	% don't know	**23**	**47**	**57**	**48**
	mean score	3.6	3.7	**3.2**	3.6
	% with opinion who disagree	12	10	**26**	17
There are scholarships targeted at transportation students	% agreeing	30	26	**21**	28
	% don't know	26	**49**	**58**	**51**
	mean score	3.1	3.4	3.6	3.5
	% with opinion who disagree	28	23	**17**	**16**
n (varies depending upon non-responses)		*208 to 214*	*391 to 397*	*299 to 304*	*886 to 913*

Note: For percentages, **bold** indicates that the difference in the percentage is significantly different from the percentage of transportation students, two-tailed test, $p<0.05$. For means, **bold** indicates that the mean is significantly different from all three other categories, as indicated by an ANOVA and Bonferroni post-hoc test, $p<0.05$

a. Includes students who have chosen another specialization, including generalists.
b. Students were asked whether they agreed or disagreed, on a scale of 1 to 5, with 1=strongly disagree and 5=strongly agree, plus a "Don't Know" option. "% agreeing" indicates the percent who responded a 4 or 5.
c. The mean scores were calculated excluding "don't know" responses.
d. "% disagreeing" indicates the percent who responded a 1 or 2.

Table 14 Civil Engineering Students' Views on Transportation Engineering—Nature of the Job Tasks

Statement		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[a]
Working in transportation engineering involves analyzing data to solve problems	% agreeing[b]	86	86	**76**	**77**
	% don't know	3	6	**12**	**12**
	mean score[c]	4.5	4.4	4.3	4.4
	% with opinion who disagree[d]	1	1	3	2
Transportation engineering uses skills at which I excel	% agreeing	86	**49**	**20**	**34**
	% don't know	4	**26**	**39**	**27**
	mean score	**4.4**	**3.8**	**3.1**	**3.3**
	% with opinion who disagree	0	3	**27**	**22**
Working in transportation engineering involves creating and using new knowledge	% agreeing	77	75	**54**	**60**
	% don't know	2	6	**16**	**13**
	mean score	4.2	4.1	3.8	3.9
	% with opinion who disagree	4	5	**10**	**9**
Working in transportation engineering involves exploring, understanding, and predicting natural or social phenomena	% agreeing	74	70	**53**	**62**
	% don't know	3	**8**	**17**	**13**
	mean score	4.0	4.0	3.8	4.0
	% with opinion who disagree	10	7	12	8
Working in transportation engineering involves leading and persuading others	% agreeing	71	68	**45**	**60**
	% don't know	4	7	**19**	**15**
	mean score	4.0	3.9	**3.6**	3.9
	% with opinion who disagree	7	6	11	7
Working in transportation engineering involves helping and serving others through personal interaction	% agreeing	66	61	**32**	**48**
	% don't know	4	**9**	**22**	**16**
	mean score	3.9	3.8	**3.2**	**3.6**
	% with opinion who disagree	5	7	**24**	**13**
Working in transportation engineering involves machines, tools, and materials	% agreeing	44	50	37	46
	% don't know	3	**7**	**16**	**14**
	mean score	3.3	3.5	3.2	3.5
	% with opinion who disagree	28	**17**	27	**20**
n (varies depending upon non-responses)		*208 to 214*	*391 to 397*	*299 to 304*	*886 to 913*

Note: For percentages, **bold** indicates that the difference in the percentage is significantly different from the percentage of transportation students, two-tailed test, $p<0.05$. For means, **bold** indicates that the mean is significantly different from all three other categories, as indicated by an ANOVA and Bonferroni post-hoc test, $p<0.05$

a. Includes students who have chosen another specialization, including generalists.
b. Students were asked whether they agreed or disagreed, on a scale of 1 to 5, with 1=strongly disagree and 5=strongly agree, plus a "Don't Know" option. "% agreeing" indicates the percent who responded a 4 or 5.
c. The mean scores were calculated excluding "don't know" responses.
d. "% disagreeing" indicates the percent who responded a 1 or 2.

Table 15 Civil Engineering Students' Views on Transportation Engineering—Job-Related Features

Statement		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[a]
It would be easy to get a job in transportation engineering	%agreeing[b]	80	**51**	**44**	**58**
	% don't know	8	**17**	**28**	**26**
	mean score[c]	**4.4**	3.7	3.8	**4.1**
	% with opinion who disagree[d]	1	**10**	**7**	**4**
Transportation engineering seems open to women	%agreeing	74	**65**	**53**	**56**
	% don't know	13	**20**	**32**	**24**
	mean score	4.3	4.1	4.1	4.1
	% with opinion who disagree	1	**6**	**6**	**7**
Transportation engineering seems open to people of color	%agreeing	72	68	**54**	**58**
	% don't know	16	23	**33**	**27**
	mean score	4.4	4.3	4.2	4.2
	% with opinion who disagree	1	3	3	**5**
A career in transportation engineering is prestigious	%agreeing	58	49	**19**	**37**
	% don't know	5	9	**18**	**17**
	mean score	3.8	3.6	**2.9**	**3.3**
	% with opinion who disagree	8	**13**	**36**	**22**
I am like other people who work in transportation engineering	%agreeing	52	**30**	**11**	**22**
	% don't know	18	**37**	**50**	**37**
	mean score	**3.7**	**3.4**	**2.7**	**3.0**
	% with opinion who disagree	14	17	**42**	**33**
There is a common identity among people who work in transportation engineering	%agreeing	40	**27**	**12**	**26**
	% don't know	22	**35**	**52**	**41**
	mean score	3.4	3.2	**2.9**	3.3
	% with opinion who disagree	21	20	**34**	18
n (varies depending upon non-responses)		*208 to 214*	*391 to 397*	*299 to 304*	*886 to 913*

Note: For percentages, **bold** indicates that the difference in the percentage is significantly different from the percentage of transportation students, two-tailed test, $p<0.05$. For means, **bold** indicates that the mean is significantly different from all three other categories, as indicated by an ANOVA and Bonferroni post-hoc test, $p<0.05$.

a. Includes students who have chosen another specialization, including generalists.
b. Students were asked whether they agreed or disagreed, on a scale of 1 to 5, with 1=strongly disagree and 5=strongly agree, plus a "Don't Know" option. "% agreeing" indicates the percent who responded a 4 or 5.
c. The mean score calculation excludes the students responding "don't know."
d. "% disagreeing" indicates the percent who responded a 1 or 2.

CAREER AND JOB PRIORITIES

The survey asked all respondents about the importance they placed on various characteristics of their future occupation or job. The first set of occupational characteristics were based on descriptors commonly found in the vocational psychology literature. Some of the questions are similar to those asked about the student's chosen specialization. However, these questions were asked of all respondents, whether or not they had chosen a specialization, and were worded more broadly. For example, students were asked "How important is it to you to have an occupation that allows you to help, teach, counsel or serve others through personal interaction?" Table 16 presents the results from these questions.

The most important characteristic for all of the students was being able to "improve the quality of life in cities and towns." This was slightly more important to transportation students and those who were undecided-likely. On the other hand, protecting the natural environment was slightly less important to the transportation students than all of the other students.

Overall, the differences between the four groups—students who had chosen transportation as a specialization, those who were likely to, those who were not likely to, and those who had chosen another specialization—were small, though sometimes statistically significant. This is consistent with the studies from the vocational psychology literature that suggested the differences between specialties within a discipline such as engineering or medicine may be small, compared to differences between disciplines (for example, students choosing engineering versus business or history as a major).

The next set of questions focused on more specific job characteristics, including the type of employer (government, private company, and non-profit organization). All of the students were most interested in working for private companies, with mean scores above 4.0 on a one to five scale, with five being "very important." Transportation students, along with those likely to choose transportation, were significantly more interested in working for a government agency than were the other students. Over 60% of the students who had chosen transportation, or were likely to, rated working for a government agency a four or five, compared to only 43% of the undecided students who were not likely to choose transportation.

Comparing the results from these questions to similar questions about students' specializations reveals several differences. For example, transportation students were significantly less likely to feel that a career in their specialization was prestigious; 58% of them agreed with that statement, compared to 68% of the students choosing other specializations (Table 11). However, the difference in how important prestige was to the students was not as large. Only 51% of transportation students rated a prestigious job a four or five in importance, compared to 57% of the non-transportation students (Table 17).

Table 16 Importance of Job Tasks Characteristics to Civil Engineering Students

Occupational Characteristic[a]		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[b]
Help, teach, counsel, or serve others through personal interaction	% rating 4 or 5	44	**58**	**60**	**58**
	mean score[c]	3.4	**3.6**	**3.7**	**3.7**
Explore, understand, and predict natural and social phenomena	% rating 4 or 5	54	58	49	55
	mean score	3.5	3.6	3.5	3.6
Lead and persuade other to attain personal or organizational goals	% rating 4 or 5	59	59	52	62
	mean score	3.6	3.7	3.5	3.7
Work with machines, tools, and materials	% rating 4 or 5	36	**52**	**52**	**49**
	mean score	3.0	**3.5**	**3.4**	**3.4**
Create and use new knowledge	% rating 4 or 5	68	**77**	**80**	**78**
	mean score	3.9	4.1	4.1	**4.1**
Analyze data to solve problems	% rating 4 or 5	76	79	74	77
	mean score	4.0	4.1	4.0	4.1
Improve the quality of life in cities and towns	% rating 4 or 5	89	91	85	84
	mean score	4.4	4.5	4.3	4.3
Protect the natural environment	% rating 4 or 5	59	**78**	**76**	**72**
	mean score	3.7	**4.1**	**4.1**	**4.0**
Develop or acquire new knowledge	% rating 4 or 5	79	85	84	85
	mean score	4.1	4.2	4.2	**4.3**
Contribute to the creation of large physical structures	% rating 4 or 5	61	**70**	65	68
		3.7	3.9	3.8	**3.9**
n (varies depending upon non-responses)		*209 to 212*	*389 to 394*	*303 to 304*	*902 to 909*

Note: For percentages, **bold** indicates that the difference in the percentage is significantly different from the percentage of transportation students, two-tailed test, $p<0.05$. For means, bold indicates that the mean is significantly different from all three other categories, as indicated by an ANOVA and Bonferroni post-hoc test, $p<0.05$.

a. Students were asked "How important is it to you to have an occupation that allows you to" or "How important is it to you to have a job where your work will" and they were given a five-point scale for the response (1 = not important at all, 5 = very important).
b. Includes students who have chosen another specialization, including generalists.
c. The mean score calculation excludes the students responding "don't know."

Table 17 Importance of Employer and Employment Characteristics to Civil Engineering Students

Job Characteristic [a]		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[b]
A government agency	% rating 4 or 5	64%	62%	**43%**	**51%**
	mean score[c]	3.8	3.7	**3.2**	**3.3**
A private company	% rating 4 or 5	84	88	86	88
	mean score	4.4	4.3	4.3	4.4
A non-profit organization	% rating 4 or 5	27	27	32	**34**
	mean score	2.7	2.8	2.9	2.9
Is prestigious	% rating 4 or 5	51	57	50	57
	mean score	3.5	3.6	3.4	3.6
Is flexible so that you can pursue other activities (e.g. travel or hobbies)	% rating 4 or 5	74	77	74	77
	mean score	4.0	4.1	4.0	4.1
Fits with your family responsibilities	% rating 4 or 5	80	**87**	81	81
	mean score	4.2	4.4	4.2	4.2
n (varies depending upon non-responses)		*209 to 212*	*389 to 394*	*303 to 304*	*902 to 909*

Note: For percentages, **bold** indicates that the difference in the percentage is significantly different from the percentage of transportation students, two-tailed test, $p<0.05$. For means, bold indicates that the mean is significantly different from all three other categories, as indicated by an ANOVA and Bonferroni post-hoc test, $p<0.05$.

a. Students were asked "After you graduate, how interested would you be to work for" or "After you graduate, how important is it to you to get a job that" and they were given a five point scale for the response (1 = not important at all, 5 = very important).
b. Includes students who have chosen another specialization, including generalists.
c. The mean score calculation excludes the students responding "don't know."

INFLUENCE OF SOCIO-DEMOGRAPHIC FACTORS ON CHOICE OF SPECIALIZATION

Women were about equally likely to choose transportation as a specialization as men (13% and 11%, respectively). However, of the women who had not decided on a specialization, 51% were leaning toward transportation, compared to 59% of the men who had not decided.

Women are presumably more likely to choose a career where they feel accepted. Of the women who had chosen transportation, none of them disagreed with the statement that "transportation engineering seems open to women" (rated a 1 or 2 on a scale of 1 to 5). However, 12% of the students who had chosen another specialization and 15% of those who were undecided and not leaning toward transportation disagreed with the statement. While these are not large shares— about two-thirds of those students agreed with the statement— the significant differences do indicate that some women may be deciding against transportation because they do not feel welcomed by the profession.

Regarding occupational preferences, women placed more importance on having a job where their work would protect the natural environment compared to men (80% vs. 70%,

respectively, rated this a 4 or 5) and less importance on working with machines, tools and materials (39% vs. 53%) or contributing to the creation of large physical structures (59% vs. 70%). Consistent with this, women were more likely than men to choose environmental engineering as a specialty (12% vs. 7%).

Non-white students were equally likely to choose transportation as white students (13% and 11%, respectively). In addition, among the undecided students, white and non-whites were equally likely to be leaning toward transportation. In contrast to the women students, very few of the non-white students feel unwelcome by the transportation engineering field. Of the 120 non-white students who had not yet decided on a specialization, only two disagreed with the statement "transportation engineering seems open to people of color" and both of them were leaning toward transportation as a specialty. Of those who had decided on another specialization, 9% disagreed with the statement.

SUMMARY OF KEY FINDINGS

The survey gathered a large amount of data from over 1,800 undergraduate civil engineering students at 56 different U.S. universities. Key findings from the survey are summarized below.

What are the most popular specializations?

Transportation is the second most popular specialization, following structural engineering. Of the students who had decided on a specialization, 37% chose structural engineering and 19% chose transportation, followed by construction/project management (14%) and environmental (13%).

When do students choose their specializations?

Most students made their specialization decision while in school. More specifically:

- Only one-quarter of students who had chosen a specialization did so before starting their degree. Most students decide on a specialization before their junior year. This implies that the first two years in a program can be very influential in the decision process.
- Transportation engineering succeeds in attracting students during their undergraduate years at a higher rate than other specializations.

What priorities influence students' choice of specialization?

Overall, transportation and non-transportation students are motivated by very similar concerns and factors. However, some differences emerged:

- Transportation students are highly motivated by the contribution their profession will make to improving the quality of life in cities and towns. This was the highest rated factor when asked about the importance of various factors in choosing their specialization within civil engineering, and was significantly higher than for non-transportation students.

- Transportation students are more motivated in their choice of a specialization by the likelihood of influencing public policy, but less motivated by the contribution the specialization makes to improving the natural environment.
- In choosing their specialization, transportation students were motivated less by potential salary both relative to other factors and when compared to non-transportation students. The transportation students were similar to other students, however, in placing high importance on the likelihood of getting a job, and job security and stability.
- The availability of scholarships or research assistantships is not a significant factor in students' choice of a specialization.

What sources of information do students use to make their decision?

- Transportation students were significantly more likely to have had an internship. Students who had an internship in their specialization (transportation or something else), indicated that this was the most helpful source of information in making a decision.
- What students learned in classes about their specialization was a very important factor in most students' decision.
- At least one-third of the students did not speak with a faculty member for advice in their specialization decision. Students were more likely to have used information they found on the web in the decision, and they found that source as helpful as speaking with faculty.
- Career centers were used by very few students in this decision and, when used, were not rated as being very helpful.

Do students know about the transportation specialization within their university programs?

Overall, only 10% of the students said they were unfamiliar with transportation engineering, with freshmen and sophomores slightly less familiar. However, when asked about specific facets of the transportation specialization at their university program or within the profession, higher shares of students responded that they did not know. For example:

- One-quarter of transportation students don't know if their transportation faculty are doing interesting research.
- A significant share of the undecided students who are not leaning toward transportation don't know much about transportation engineering classes or faculty.
- Of the students with opinions, undecided students who are not leaning toward transportation had the most negative views of transportation engineering courses and faculty.

Do students understand the nature of the transportation engineering profession?

Many non-transportation students may have negative or inaccurate impressions of the transportation engineering field. More specifically:

- Students who have chosen another specialization or who are undecided and not leaning toward transportation may not understand some of the characteristics of the field, particularly the "human" side of transportation engineering. These students were less likely to think that transportation engineering involved helping and serving through personal interaction and leading and persuading others.
- Many non-transportation students do not think transportation engineering is prestigious.
- Undecided students who are not leaning toward transportation place relatively high importance on protecting the natural environment and less importance on working for a government agency.
- A small, but significant share of women who had not chosen transportation did not think that the field seemed "open to women."

FINDINGS FROM THE PLANNING STUDENT SURVEY

SURVEY RESPONDENTS

A total of 869 masters students in planning who attended 61 universities responded to the survey. Table 18 lists the universities these students attended, which collectively enrolled 87% of all students enrolled in planning masters programs in the U.S in 2006–07.[39] Students from no single program dominate the results, as no program's students represent more than 5% of the total responses. As noted in the methodology chapter above, we could not calculate a precise response rate but estimate that these 869 students represent about 20% of all students enrolled in a planning masters program for the 2006–07 academic year.

Table 19 shows basic demographic information for the students who responded to the survey, breaking down the results by students who said they had selected transportation as their specialization, students who had chosen a specialization other than transportation, students who were undecided on a specialization, and the total population of respondents. Overall, the respondents were slightly more likely to be female (60%), and 80% of respondents were between 20 and 30 years of age. Racially the majority self-identified as white (74%), 12% as Asian, 6% as multi-racial, 4% as Africa-American, 3% as Hispanic, and less than 1% as either Native American or Pacific Islander. Eight percent of the respondents were attending the university on international student visas. About one-third of the students were married or living in a domestic partnership (34%), but only 10% had children living at home with them.

There were few major differences between the transportation students and either the undecided students or those who had chosen a specialization other than transportation. For example, looking at ethnicity, the difference between the transportation students and the other groups was insignificant, and an equal proportion were on international student visas.

However, the transportation students were slightly more likely to be male (48%), compared to students who chose a specialization other than transportation (38%). Given the reputation of the transportation field to be predominantly male, it was noteworthy to see roughly equal numbers of male and female transportation students, even if the proportion of female students was still somewhat lower than for planning students overall.

Another difference between the transportation students and their peers was that the transportation students were slightly more likely to fall into the youngest age grouping—7 percentage points more likely to fall into the 20–25 year old group and 6 percentage points less likely to fall into the 26–30 year-old group, compared to the non-transportation students. A similar percentage of transportation and non-transportation students fell into the oldest group, the 31+ year old category.

Table 18 Universities from Which at Least One Planning Masters Student Responded

University	
Arizona State University	University of Arizona
Auburn University	University of Buffalo, the State University of New York
Ball State University	University of California Berkeley
Cal Poly Polytechnic University, Pomona	University of California Irvine
Cal Poly State University, San Luis Obispo	University of California Los Angeles
Clemson University	University of Cincinnati
Cleveland State University	University of Colorado, Denver
Columbia University	University of Florida
Cornell University	University of Illinois, Chicago
Eastern Michigan University	University of Illinois, Urbana-Champaign
Eastern Washington University	University of Iowa
Florida State University	University of Kansas
Georgia Institute of Technology	University of Louisville
Harvard University	University of Maryland, College Park
Hunter College of the CUNY	University of Michigan
Iowa State University	University of Nebraska-Lincoln
Jackson State University	University of New Orleans
Kansas State University	University of North Carolina
Massachusetts Institute of Technology	University of Oregon
Michigan State University	University of Southern California
Morgan State University	University of Southern Maine
New York University	University of Texas, Austin
Other/No answer	University of Toledo
Portland State University	University of Utah
Rutgers	University of Virginia
San Diego State University	University of Wisconsin-Madison
San José State University	University of Wisconsin-Milwaukee
Texas A&M University	Virginia Commonwealth University
Texas Southern University	Virginia Polytechnic Institute and State University
The Ohio State University	Wayne State University
Tufts University	

Table 19 Planning Student Survey Respondent Demographics

Demographic Category	Students, by Specialization			All Students (%)
	Transportation (%)	Other Specialization[a] (%)	Undecided (%)	
Gender				
Female	52	62	58	60
Male	48	38	42	41
Age				
20–25 years	47	40	48	43
26–30 years	34	40	30	37
31+ years	19	20	22	20
Race				
White	76	71	75	73
Asian	10	12	12	11
Multi-racial	7	7	4	6
African American	4	4	3	4
Hispanic	3	4	3	3
Other	1	1	1	1
Native American	0	< 1	0	< 1
Pacific Islander	0	0	< 1	< 1
Refused	0	2	2	1
White[b]	76	72	76	74
Non-white[b]	24	28	24	26
On an international student visa	7	8	7	8
Married/in a domestic partnership	25	**38**	31	34
Living w/children 18 or under	7	10	10	10
n (varies due to non-responses on individual questions)	*104 to 105*	*517 to 523*	*228 to 231*	*850 to 859*

Note: **Bold** indicates a significant difference in that percentage from the percentage of transportation students, p<0.05, two-tailed test.

a. All students who have chosen another specialization, including generalists.
b. Excludes students who did not answer the question (these were coded as "refused").

Finally, the only statistically significant difference was that transportation students were less likely to be married—25% compared to 38% for non-transportation students—though there was little difference in the percent of transportation and non-transportation students who had children living at home.

The survey also asked students to name the field in which they had earned their undergraduate degree (see Table 20). For transportation students, the most common fields were political science, public policy, or international studies/relations; engineering, math, or computer science; and urban studies or planning. There were two significant differences between the transportation students and others. Transportation students were 10 percentage points more likely to have a degree in engineering/math/computer science and six percentage points less

likely to have a degree in environmental studies, science, or planning, compared to students in other specializations, with similar differences compared to the undecided students.

Table 20 Planning Masters Students' Undergraduate Degrees

Undergraduate Degree	Transportation Students (%)	Students in Other Specialization[a] (%)	Undecided (%)
Political science, public policy, international studies/relations	18	13	18
Engineering, math, computer science	15	**5**	**4**
Urban studies or planning	14	11	11
Environmental design (architecture, landscape architecture, urban design, etc.)	9	12	5
Geography	9	6	9
Sociology and anthropology	9	9	6
Liberal arts (history, American studies, classics, philosophy, ethnic studies, etc.)	6	6	7
Business and economics	5	7	9
Other	5	5	8
Double major	5	4	4
Environmental studies, science, or planning	4	**10**	**10**
English, journalism, writing, literature	3	4	4
Fine arts (art, graphics, art history, design, film, etc.)	0	4	4
Biological and health sciences	0	4	2
n	*105*	*524*	*231*

Note: **Bold** indicates a significant difference in that percentage from the percentage of transportation students, $p<0.05$, two-tailed test.

a. All students who have chosen another specialization, including generalists.

IF AND WHEN STUDENTS CHOOSE A SPECIALIZATION

Virtually all students said they were either required or allowed to choose a specialization within their masters program. When asked about this, 70% said they were required to specialize and 27% said they were allowed to. Only 2% of respondents said they did not know if a specialization was required or optional. However, there were several schools where the students did not agree on whether or not a specialization was required, indicating that not all of the other 98% of students knew the correct answer to this question. Of all of the students surveyed, 72% have chosen a specialization, whether this was required or optional.

The first data column of Table 21 shows the specializations chosen by those planning students who had already decided upon a specialization. Of those students who had chosen a specialization, housing/community development was the most common (20%). Transportation was second, with 17% of the students who had made a choice and 12% of all

students. This was followed by environmental planning (16%), urban design (11%), economic development (9%), land use/physical planning (8%), and international development (5%). All the other specializations had been chosen by fewer than 5% of the students who had chosen a specialization.

Table 21 Planning Students' Chosen or Likely Specializations[a]

Specialization Chosen (If Any)	Students Who Have Decided on a Specialization, % Who Chose This Specialization[a]	Undecided Students: % Very Likely to Choose This Specialization[b]
Housing/community development	20	26
Transportation	17	10
Environmental planning	16	20
Urban design, architecture	11	19
Economic development	9	14
Land use (including physical planning, growth management)	8	22
Other	8	
International development	5	10
Historic Preservation	2	6
Technology/GIS	2	7
Regional planning	1	12
Health	1	3
General	1	23
n	*630*	*236*

a. In response to the questions, "Have you chosen a specialization yet?" and "What is your chosen specialization?"
b. Respondents who had not chosen a specialization were asked "How likely are you to choose each of the following specializations?"

The second column of Table 21 shows the specializations that the undecided students said they were very likely to choose at some future point. Transportation did not rank highly among these undecided students, even though it was the second most popular specialization among those students who *had* already chosen a specialization. Only 10% of the undecided students indicated that they were very likely to choose transportation. All but four of the other options (international development, historic preservation, technology/GIS, and health) had higher shares of undecided students very likely to choose that specialization. This may indicate that transportation students choose their specialization quickly, without considering other options, or that students who are ultimately likely to choose other specializations take longer to decide for some reason.

The survey also asked students when they had chosen their specialization (see Table 22). The most likely time period that they made this decision was between finishing their undergraduate degree and beginning the planning masters degree—45% for transportation

students and 50% of other students. However, 28% of transportation students and about one-third of students in other specializations chose while studying in their current masters program. Thus, somewhere around one-third of students overall choose a specialization while in the masters program and are likely highly influenced by their experiences during those years.

When we looked at the time of decision by each specialization, the students most likely to choose a specialization while in the masters program were those choosing economic development (48%), land use planning (45%), and urban design (41%). In contrast, transportation students were significantly more likely to have chosen their specialization during or before their undergraduate degree (28% vs. 17%).

Table 22 Planning Students' Choice of Specialization, By Stage in the Educational Cycle

Stage in the Educational Cycle[a]	Transportation Students (%)	Students in Other Specializations[b] (%)
Before I started my undergraduate degree	5	2
While I was an undergraduate student	**23**	**15**
After I finished my undergrad degree, but before I joined my current master in planning program	45	50
While I was a student in this masters program	28	34
n	*105*	*525*

Note: **Bold** indicates a significant difference in the percentages, p<0.05, two-tailed test.

a. Students were asked "When did you decide to specialize in this field?"
b. Includes students who have chosen to be "generalists."

Another question in the survey attempted to identify *when* during the masters program students usually choose a specialization. Table 23 shows how many students had chosen each specialization according to their expected graduation date.[41] Overall, 20% more of those closest to graduation had decided on a specialization than those farthest from graduation. Looking specifically at transportation, 11% of the students newest to the masters program (the students who said they would graduate in 2009–10 or later) had decided to specialize in transportation. This percentage was essentially the same as for the most senior group of students answering the survey, those graduating in 2007–08, among whom 13% had chosen a transportation specialization. Looking across all specializations, one sees they all experienced a similarly small growth rate measured as the percentage point change in students likely to select that specialization—no one specialization was particularly likely to attract a large group of new students. However, the change measured as percent growth showed much more variation, with transportation one of the slower-growing specializations. Economic development, land use, and the "other" categories grew very fast, by more than 75%;

environmental planning grew by 30%; transportation and housing/community development grew just a few percent; and urban design actually lost students.

Table 23 Planning Students' Choice of Specialization, By Expected Graduation Date

	Percent of Students, By Graduation Date, Who Chose the Specialization (%)			Change from 2007–08 to 2008–09 (%)	*n*
	2007–08 (through summer 2008)	2008–09	2009–10 or later		
Undecided	15	36	37	–35	*232*
Transportation	13	12	11	+6	*105*
Economic Development	10	5	4	+86	*59*
Environmental Planning	14	11	11	+30	*102*
Housing/Community Development	15	14	12	+8	*125*
Land Use	10	6	3	+79	*62*
Urban Design	8	9	8	–7	*72*
Other (including generalist)	15	8	15	+88	*104*

One measure of students' commitment to their specialization is their level of certainty that they will stay with it throughout the masters program. Three-quarters of the transportation students said they were "very sure" that they would finish their degree specializing in transportation and another 20% were somewhat sure; only 8% were unsure (Table 24). This level of certainly is similar to that held by students with a specialty other than transportation.

Table 24 Planning Students' Certainty That They Will Finish Their Degree Focusing on Their Chosen Specialization[a]

Level of Certainty	Transportation Students (%)	Non-Transportation Students (%)
Very unsure	3	1
Somewhat unsure	5	4
Somewhat sure	20	28
Very sure	72	67
n	*525*	*105*

a. Students were asked, "How sure are you that you will finish your degree focusing on this specialization?"

In order to test how well informed students might be when choosing a specialization, one question in the survey asked students how familiar they were with what planners do in each of the major specializations within the field (see Table 25). Only 16% of respondents said they were "not at all familiar" with what transportation planners do, which was roughly in the middle of the rankings for the other specializations. Among just the undecided students, 20% were "not at all" familiar with transportation. Looking instead at the specializations with

which students said they were "very familiar," one sees that land use planning was the specialization with which the most students were "very" familiar: 50%. Transportation was the third most familiar specialization; 39% of respondents said they were very familiar with the specialization. This was quite similar to the percentages who were "very" familiar with community development, regional planning, housing, and technology/GIS. Overall, these responses show transportation to be one of the most familiar specializations, but even so that leaves 62% of students who were less than "very" familiar with the field and potentially might feel more favorable to the specialization if they knew more about it.

Table 25 Planning Students' Familiarity with Each Specialization

Specialization[a]	Not At All Familiar (%)	Somewhat Familiar (%)	Very Familiar (%)	*n*
Land use	**7**	43	50	*868*
Community development	**7**	52	41	*866*
Regional planning	**9**	52	38	*866*
Housing	**11**	51	38	*868*
Environmental planning	**12**	54	34	*867*
Economic development	13	56	31	*868*
Transportation	16	46	39	*867*
Urban design	16	49	35	*868*
Technology/GIS	19	44	37	*863*
Historic preservation	**24**	49	27	*868*
International development	**42**	42	16	*868*
Health planning	**60**	35	5	*868*

Note: **Bold** indicates that the percentage of students not at all familiar with that specialization is significantly different from the percentage not at all familiar with transportation (16%), $p<0.05$, two-tailed test.

a. The question wording was as follows: "Many planners work primarily in a specialized sub-field of planning. Common specialties include land use, environmental planning, economic development, housing, and transportation. How familiar are you with what planners do in each of the following specializations?" The specializations were listed on the survey in alphabetical order.

CHOICE FACTORS

As in the civil engineering survey, the planning students who had chosen a specialization were asked how important various factors were in helping them decide on their specialization. One set of questions asked students about the importance of factors related to their experience within the masters program or other experiences where they might have learned about transportation systems and the transportation profession (see Table 26). Among these factors, the most important for transportation students were experiences traveling or living outside of the United States—62% of students rated there as somewhat or very important in helping them choose transportation as a specialization. The professional reputation and teaching quality of faculty teaching transportation classes in their program were important to almost half of students. What they learned from a job or internship was important to 43%. Of importance to around a third of students were what they learned in classes in either their

masters or undergraduate degree programs, the availability of internships in the field for masters students, and the availability of research assistantships working with faculty in the specialization. The availability of scholarship or other financial support for students in the specialization was important to a quarter, the smallest percent for any factor except the timing of classes in the masters program, which was important for only 10% of students.

Table 26 Importance of Educational and Other Learning Factors That Helped Planning Students Choose a Specialization

Factor[a]		Transportation (%)	Other Specializations[b] (%)	% Point Difference (Trans. – Other)
Things I observed or learned while traveling or living outside the US	% rating 4 or 5	62	51	9
	mean score[c]	3.6	3.3	
Professional reputation of faculty who teach in specialization	% rating 4 or 5	49	41	8
	mean score	**3.3**	**3.0**	
Teaching quality of faculty who teach within specialization in my masters program	% rating 4 or 5	47	49	-2
	mean score	3.3	3.2	
What I learned about the specialization from working in a job in that specialization	% rating 4 or 5	43	44	-1
	mean score	2.9	3.0	
What I learned about the specialization from classes I have taken in the masters program	% rating 4 or 5	**34**	**49**	**-15**
	mean score	**2.9**	**3.2**	
What I learned about the specialization from classes I took in my undergraduate program	% rating 4 or 5	34	36	-1
	mean score	2.5	2.7	
Availability in my masters program of internships for students in the specialization	% rating 4 or 5	**33**	**21**	**12**
	mean score	**2.6**	**2.1**	
Availability of research assistantships working with faculty in specialization	% rating 4 or 5	**32**	**18**	**14**
	mean score	**2.6**	**2.1**	
Availability in my masters program of scholarships or other financial support for students in specialization	% rating 4 or 5	**27**	**12**	**15**
	mean score	**2.3**	**1.7**	
How well the times and/or day of week that classes in the specialization fit with my personal or work schedule	% rating 4 or 5	10	18	-8
	mean score	**1.6**	**2.0**	
n (varies depending upon non-responses)		*94 to 105*	*498 to 525*	

Note: **Bold** indicates that the percentage or mean of that group is significantly different than the percentage or mean of transportation students, two-tailed test, p<0.05.

a. Students were asked "How important for you were the following factors in choosing your specialization?" and they were given a five-point scale for the response (1 = not important at all, 5 = very important), plus a "Don't Know" option. Table includes students who rated the factor a 4 or 5.
b. Includes students who have chosen another specialization, including generalists.
c. Mean scores were calculated excluding "don't know" responses.

A second set of questions asked students about the extent to which they chose their specialization because of the importance they placed on different characteristics of the planning work they would expect to do on the job in their specialization (see Table 27).

Virtually all students among all specializations (91%) said that they placed importance on the contribution the specialization would make to improving the quality of life in cities and towns. (In terms of the mean rating, this factor received a mean 4.5 or higher rating from all students.) Very high percentages of transportation and other students also said it was important to them to choose a specialization where their work would improve the quality of life for disadvantaged populations and improve the natural environment.

For four-fifths of transportation students it was also important to plan at the city or regional level, much higher than the proportion who placed importance on working at the national level (53%), directly with community members (44%), or at the neighborhood level (39%) or international level (35%). Their responses were notably and statistically significantly different from some of the responses of the non-transportation students; fewer of the latter prioritized working at the city or regional level, but more prioritized working at the neighborhood level and working directly with community members.

Table 27 Importance of Job Characteristics in Helping Planning Students to Choose a Specialization

Statement of Interests/Values[a]		Transportation Students (%)	Students in Other Specializations[b] (%)	% Point Difference (Trans. – Other)
The contribution the specialization makes to improving the quality of life in cities and towns	% rating 4 or 5	91	91	0
	mean score[c]	4.5	4.6	
Being able to plan at the city or regional level	% rating 4 or 5	**82**	**69**	**13**
	mean score	**4.2**	**3.8**	
The contribution the specialization makes to improving the quality of life for disadvantaged populations	% rating 4 or 5	77	71	6
	mean score	4.0	4.0	
The contribution the specialization makes to improving the natural environment	% rating 4 or 5	74	69	5
	mean score	4.0	4.0	
Being able to plan at the state or national level	% rating 4 or 5	53	47	6
	mean score	**3.6**	**3.2**	
Being able to work directly with residents and members of the community	% rating 4 or 5	**44**	**60**	**-17**
	mean score	**3.3**	**3.7**	
Being able to plan at the neighborhood level	% rating 4 or 5	**39**	**58**	**-19**
	mean score	**3.1**	**3.6**	
Being able to plan at an international level	% rating 4 or 5	35	36	1
	mean score	2.9	2.8	
n (varies depending upon non-responses)		*101 to 104*	*503 to 524*	

Note: **Bold** indicates that the percentage or mean of that group is significantly different than the percentage or mean of transportation students, two-tailed test, $p<0.05$.

a. Students were asked "How important for you were the following factors in choosing your specialization?" and they were given a five point scale for the response (1 = not important at all, 5 = very important), plus a "Don't Know" option. Table includes students who rated the factor a 4 or 5.
b. Includes students who have chosen another specialization, including generalists.
c. Mean scores were calculated excluding "don't know" responses.

Finally, students were asked about the importance they placed on different job-related features as part of the specialization decision. Not surprisingly, the likelihood of getting a job was important to more than half of all students, including 63% of the transportation students. Slightly more than half of the transportation students also noted as important job security and the potential for upward mobility. These factors were important to fewer of the non-transportation students. Salary was also more important to the transportation students than the others, although less than half of transportation students rated it as important. As for the type of work environment, this was important to 40% of transportation students, significantly fewer than the percent of non-transportation students who said it was important.

Table 28 Importance of Job-Related Features to Planning Students in Choosing a Specialization

Statement of Interests/Values[a]		Transportation (%)	Other Specialization[b] (%)	% Point Difference (Trans. – Other)
The likelihood of getting a job in the specialization	% rating 4 or 5	63	55	8
	mean score [c]	3.7	3.5	
Job security and stability	% rating 4 or 5	**54**	**37**	**17**
	mean score	**3.5**	**3.0**	
The potential for upward mobility	% rating 4 or 5	**53**	**42**	**11**
	mean score	**3.5**	**3.1**	
The salary I will likely earn	% rating 4 or 5	**41**	**29**	**12**
	mean score	**3.2**	**2.7**	
The type of work environments for people in the specialization	% rating 4 or 5	**40**	**57**	**-17**
	mean score	**3.1**	**3.5**	
The likelihood of me being accepted by other people working in the field	% rating 4 or 5	36	31	4
	mean score	2.8	2.7	
The likelihood that a job in my specialization will fit well with my family responsibilities	% rating 4 or 5	21	27	-6
	mean score	2.3	3.6	
n (varies depending upon non-responses)		*98 to 104*	*517 to 521*	

Note: **Bold** indicates that the percentage of that group is significantly different than the percentage of transportation students, two-tailed test, p<0.05.

a. Students were asked "How important for you were the following factors in choosing your specialization?" and they were given a five point scale for the response (1 = not important at all, 5 = very important), plus a "Don't Know" option.
b. Includes students who have chosen another specialization, including generalists.
c. Mean scores were calculated excluding "don't know" responses.

An open-ended question in the survey asked students to note other factors they considered when choosing a specialization. No response showed up among more than a few people, indicating that the categories listed in the tables in this section are the most common factors.

VIEWS ON THEIR SPECIALIZATION

The questionnaire asked students with a specialization a series of questions about how they perceived their specialization. One set of questions focused on the university experience (see

Table 29). The transportation and non-transportation specialists had some marked differences in their responses to these questions, with the transportation students in all cases responding more positively. Among transportation students, 76% agreed that there are good internships for their specialization, which is 30 percentage points higher than the response among the other students. The difference was similar for agreement to the statement that there are scholarships in the specialization; 45% of transportation students agreed compared to just 11% of the other students. The transportation students were also more likely to say that the faculty in their specialization were doing interesting research and/or projects and that their specialization is a strength of their program. Finally, it is worth noting that although the non-transportation specialists had slightly higher "don't know" response rates, these were not so much higher as to explain the difference in views between the two groups. Overall, the transportation students were definitely more likely to agree with the statements posed in the survey.

Table 29 Planning Students' Views on Their Specialization—University Experiences

Statement of Interests/Values[a]		Transportation Students (%)	Students in Other Specialization[b] (%)	% Point Difference (Trans. – Other)
The classes in my chosen specialization are interesting	% agreeing	81	82	-1
	% don't know	9	5	4
	mean score[c]	4.2	4.3	
There are good internships for students in my chosen specialization	% agreeing	**76**	**46**	**30**
	% don't know	11	16	-5
	mean score	**4.3**	**3.4**	
The faculty teaching classes in my chosen specialization are doing interesting research and/or projects	% agreeing	**72**	**61**	**11**
	% don't know	**4**	**11**	**-7**
	mean score	4.0	3.9	
The faculty teaching classes in my chosen specialization are excellent teachers	% agreeing	71	68	3
	% don't know	6	7	-1
	mean score	4.0	4.0	
The classes in my chosen specialization are challenging	% agreeing	60	60	0
	% don't know	14	8	6
	mean score	3.8	3.8	
My chosen specialization is a strength of my school's planning department	% agreeing	**57**	**45**	**12**
	% don't know	6	9	3
	mean score	**3.7**	**3.4**	
There are scholarships targeted at students in my chosen specialization	% agreeing	**45**	**11**	**34**
	% don't know	20	27	-7
	mean score	**3.4**	**2.2**	
n (varies depending upon non-responses)		*103 to 105*	*522 to 524*	

Note: **Bold** indicates that the percentage of that group or the mean score is significantly different than the percentage of transportation students, two-tailed test, $p<0.05$.

a. Students were asked "Please indicate whether you agree or disagree with the following statements" and they were given a five-point scale for the response (1 = strongly disagree, 5 = strongly agree), plus a "Don't Know" option. "Agreeing" includes students who answered 4 or 5.
b. Includes students who have chosen another specialization, including generalists.
c. Mean scores were calculated excluding "don't know" responses.

Table 30 Planning Students' Views on Their Specialization—Nature of the Job Tasks

Statement of Interests/Values[a]		Transportation (%)	Other Specialization[b] (%)	% Point Difference (Trans. – Other)
Working in my specialization involves analyzing data to solve problems	% agreeing	**95**	**85**	**10**
	% don't know	1	1	0
	mean score[c]	**4.6**	**4.3**	
People working in my specialization have to use quantitative methods a lot	% agreeing	**90**	**62**	**28**
	% don't know	4	4	0
	mean score	**4.6**	**3.8**	
Working in my specialization involves creating and using new knowledge	% agreeing	89	88	1
	% don't know	2	1	1
	mean score	4.4	4.4	
My specialization is multi-disciplinary	% agreeing	88	91	-3
	% don't know	3	1	2
	mean score	4.5	4.6	
Working in my specialization involves exploring, understanding, and predicting natural or social phenomena	% agreeing	82	84	2
	% don't know	1	1	0
	mean score	4.1	4.3	
Working in my specialization involves leading and persuading others	% agreeing	81	86	-5
	% don't know	2	1	1
	mean score	4.2	4.3	
My specialization is broad, not narrow	% agreeing	**74**	**86**	**-12**
	% don't know	2	1	1
	mean score	**4.1**	**4.4**	
My chosen specialization will allow me to use skills at which I excel	% agreeing	74	80	-6
	% don't know	4	3	1
	mean score	4.1	4.2	
Working in my specialization involves helping and serving others through personal interaction	% agreeing	**52**	**72**	**-20**
	% don't know	5	2	3
	mean score	**3.7**	**4.0**	
People in my specialization often work alone rather than in teams	% agreeing	4	5	-1
	% don't know	13	9	4
	mean score	1.8	1.9	
n (varies depending upon non-responses)		522 to 524	104 to 105	

Note: **Bold** indicates that the percentage of that group is significantly different than the percentage of transportation students, two-tailed test, p<0.05.

a. Students were asked "Please indicate whether you agree or disagree with the following statements" and they were given a five-point scale for the response (1 = strongly disagree, 5 = strongly agree), plus a "Don't Know" option. Table includes students who agreed (4 or 5).
b. Includes students who have chosen another specialization, including generalists.
c. Mean scores were calculated excluding don't know" responses.

Table 30 presents students' views on the nature of the job tasks within their specialization. The transportation students were somewhat more likely to agree that their specialization involves analyzing data (95% versus 85%), and more than 25 percentage points more likely to agree that people in their specialization use quantitative methods a lot (90% versus 62%). The

two other significant differences between the groups were that the transportation students were less likely to agree that their specialization is "broad, not narrow" (74% versus 86%) and that working in their specialization involves helping and serving others through personal interaction (52% versus 72%).

A final set of questions assessed students' views on issues related to the likelihood of getting a job and other employment-related factors (see Table 31). Among all students, fewer than half felt their specialization offered a prestigious career, though the mean response value for the transportation students was slightly higher than for the non-transportation specialists (3.5 versus 3.2). The transportation students were, however, significantly more likely to agree that it would be "easy" to get a job in their specialization after graduation (68% versus 43%) and also that they could get a job outside their specialization (74% versus 55%).

The transportation students were less likely to see the field as open to diverse employees or to perceive themselves as sharing an identify with other people working in their specialization. Only around half of the transportation students agreed that the field seems open to women or people of color, and in both cases this was 12 percentage points lower than the response among students specializing in other areas. Although 68% of transportation students did agree that they "get along well with other students in my specialization," this was 11 percentage points lower than the agreement among other students. And fewer than half of the transportation students agreed that they are "like" other people who have chosen their specialization (40%), again 11 percentage points lower than the level of agreement among other students.

SOURCES OF INFORMATION

As with the engineering students, the survey asked those planning masters students who had chosen a specialization about the sources of information that helped them to make that decision. Overall, students relied most heavily on reading either web or print-based materials,[42] with classes in the specialization and speaking with faculty members also helpful to 70% or more. Smaller majorities also made use of someone they spoke to either before or during college, an internship, or a class taken prior to graduate school. The only statistically significant difference between the transportation and non-transportation specialists was that the mean response about the helpfulness of an internship was slightly higher for the transportation students—4.5 as opposed to 4.2 for the non-transportation students.

Table 31 Planning Students' Views on Their Specialization—Job-Related Features

Views on Specialization[a]		Transportation (%)	Other Specialization[b] (%)	% Point Difference (Trans. – Other)
A career in my specialization is prestigious	% agreeing	43	35	8
	% don't know	9	13	-4
	mean score[c]	**3.5**	**3.2**	
It will be easy to get a job in my chosen specialization after I graduate	% agreeing	**68**	**43**	**25**
	% don't know	16	16	0
	mean score	**4.3**	**3.5**	
Students choosing my specialization could easily get a planning job outside of that specialization	% agreeing	**74**	**55**	**19**
	% don't know	10	16	-6
	mean score	**4.2**	**3.8**	
My specialization seems open to women	% agreeing	**58**	**70**	**-12**
	% don't know	13	12	1
	mean score	**3.9**	**4.2**	
My specialization seems open to people of color	% agreeing	**51**	**63**	**-12**
	% don't know	15	15	0
	mean score	**3.8**	**4.1**	
I get along well with other students in my specialization	% agreeing	**68**	**81**	**-11**
	% don't know	6	13	-7
	mean score	4.1	4.3	
I am like other people who have chosen this specialization	% agreeing	**40**	**51**	**-11**
	% don't know	16	15	1
	mean score	3.5	3.7	
There is a common identity among people working in my chosen specialization	% agreeing	40	45	-5
	% don't know	19	16	3
	mean score	3.6	3.5	
n (varies depending upon non-responses)		*517 to 524*	*104 to 105*	

Note: **Bold** indicates that the percentage of that group is significantly different than the percentage of transportation students, two-tailed test, $p<0.05$.

a. Students were asked "Please indicate whether you agree or disagree with the following statements" and they were given a five-point scale for the response (1 = strongly disagree, 5 = strongly agree), plus a "Don't Know" option. "% agreeing" is the percent of students who responded with a 4 or 5.
b. All students who have chosen another specialization, including self-declared generalists.
c. Mean scores were calculated excluding "don't know" responses.

Table 32 Sources of Information Planning Students Use to Choose Their Specialization

Source of Information		Transportation Students (%)	Students in Other Specializations[a] (%)
Information I read on the web about my chosen specialization	% using	86	84
	level of helpfulness[b]	3.9	3.9
Books or magazine I read about my chosen specialization	% using	79	80
	level of helpfulness	3.9	3.9
A class I took in my chosen specialization while in graduate school	% using	73	78
	level of helpfulness	3.6	3.9
Speaking with a faculty member for advice on choosing a specialization	% using	71	70
	level of helpfulness	3.7	3.6
Before I started graduate school, I learned about the specialization from someone that I knew who worked in that field	% using	63	55
	level of helpfulness	3.9	3.7
An internship or job within my chosen specialization	% using	62	62
	level of helpfulness	**4.5**	**4.2**
Someone working in my chosen specialization who spoke in one of my classes or at an event I attended	% using	61	60
	level of helpfulness	3.7	3.5
A class I took in my chosen specialization before graduate school	% using	51	59
	level of helpfulness	3.9	4.0
Attending a career fair organized at my university	% using	29	33
	level of helpfulness	2.3	2.0
Speaking with someone at my university's career center or a career counselor	% using	26	32
	level of helpfulness	2.0	2.2
n (varies depending upon non-responses)		*92 to 105*	*497 to 523*

Note: **Bold** indicates that the difference in the percentages or the means between the two groups is significantly different, two-tailed test, p<0.05.

a. Includes students who have chosen another specialization, including generalists.
b. Students were asked about sources of information they may have used to help decide on their specialization. For each listed source, the student could rate it on a scale of 1 to 5, with 1 = "did not help at all" and 5 = "very helpful." The student could also indicate that they did not use that source or that they did not know if it was helpful. The level of helpfulness is the mean score for those that used the source and indicated how useful it was on the 1-5 scale. Don't know responses are not included.

Perceptions of the Transportation Field

Of the students who had not chosen transportation, 28% said that they had seriously considered specializing in it. Students who had ended up choosing land use (41%), urban

design (36%), and environmental planning (35%) were more likely to have considered it than were students specializing in other areas. Only 12% of those choosing housing or community development seriously considered transportation. Among undecided students, 42% had seriously considered transportation.

The survey asked students a number of questions about how they perceived the transportation planning professional in order to gauge how much these perceptions may influence the choice of specialization. In particular, the authors were interested to know if students had negative or incorrect perceptions that might be leading some students to reject the field, even though it could be a good fit for them. To test this theory, non-transportation students were asked near the end of the survey if they agreed with a range of statements about the transportation specialization. These responses are shown in Table 33, Table 34, and Table 35. Each table also shows the response of students who chose other specializations, as well as those who were undecided and either likely or unlikely to choose transportation. In addition, the tables show the responses that transportation students gave when asked the same questions about "their" specialization.

Table 33 reveals responses to questions about factors related to students' experiences in their masters program. Among the transportation students, large majorities agreed that transportation planning classes are interesting (81%) and that there are good internships in transportation (76%). Transportation faculty were also rated highly, with 72% agreeing that the faculty are doing interesting research/projects and 71% agreeing that they are excellent teachers. Majorities also responded that the transportation planning classes are challenging and that transportation planning is a strength of their program. Slightly fewer than half agreed that there are scholarships for transportation students (45%).

As might be expected, the responses from transportation specialists differed significantly from the other students' answers. For example, the transportation students were far more likely to agree that transportation classes are interesting than any of the other groups of students described in the table—those undecided but who said they were likely to choose transportation, those undecided who said they were unlikely to choose transportation, and students who had already chosen a specialization other than transportation. While 81% of transportation students agreed that the transportation classes are interesting, only a third or fewer of any other group shared that opinion. However, the key difference between the groups was not so much that the non-transportation students had negative feelings about the specialization as that they simply didn't know much about it. For example, while 9% of the transportation students said they didn't know if transportation planning classes are interesting, over 50% among the other three groups responded with "don't know." The pattern was similar for the other questions asked, with many fewer of the non-transportation students agreeing with positive statements about the specialization, but with "don't know" percentages near 50% in most cases.

Table 33 Planning Students' Views on Transportation Planning—University Experiences

Statement of Interests/Values		Transportation	Undecided, But *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[a]
Transportation planning classes are interesting	% agreeing[b]	81	**34**	**19**	**24**
	% don't know	9	**52**	**63**	**60**
	mean score[c]	4.2	3.9	**3.3**	**3.6**
	% with opinion who disagree[d]	1	5	**23**	16
There are good internships for students in transportation	% agreeing	76	**37**	**25**	**35**
	% don't know	11	**51**	**59**	**55**
	mean score	4.3	4.1	**3.8**	4.1
	% with opinion who disagree	3	5	11	5
The faculty teaching classes in transportation are doing interesting research and/or projects	% agreeing	72	**38**	**21**	**35**
	% don't know	4	**48**	**61**	**51**
	mean score	4.0	3.9	3.6	3.9
	% with opinion who disagree	12	13	10	13
The faculty teaching classes in transportation are excellent teachers	% agreeing	71	**39**	**26**	**35**
	% don't know	6	**44**	**58**	**47**
	mean score	4.0	3.8	3.6	3.8
	% with opinion who disagree	5	12	**17**	**13**
Transportation planning classes are challenging	% agreeing	60	**28**	**25**	**20**
	% don't know	14	**61**	**66**	**67**
	mean score	3.8	3.9	3.8	3.8
	% with opinion who disagree	10	9	10	13
Transportation planning is a strength of my school's planning department	% agreeing	57	44	**26**	**38**
	% don't know	6	**30**	**32**	**25**
	mean score	3.7	3.7	**3.0**	3.4
	% with opinion who disagree	17	22	**35**	**28**
There are scholarships targeted at transportation planning students	% agreeing	45	**15**	**13**	**19**
	% don't know	20	**63**	**68**	**67**
	mean score	3.4	3.1	2.9	3.5
	% with opinion who disagree	29	41	43	24
n (varies depending upon non-responses)		*103 to 105*	*87 to 91*	*132 to 139*	*489 to 522*

Notes: For percentages, **bold** indicates that the difference in the percentage is significantly different from the percentage of transportation students, two-tailed test, $p<0.05$. For means, **bold** indicates that the mean is significantly different from all three other categories, as indicated by an ANOVA and Bonferroni post-hoc test, $p<0.05$.

a. Includes students who have chosen another specialization, including generalists.
b. Students were asked whether they agreed or disagreed, on a one to five scale, with 1=strongly disagree and 5=strongly agree, plus a "Don't Know" option. "% agreeing" indicates the percent who responded a 4 or 5.
c. The mean scores were calculated excluding "don't know" responses.
d. "% disagreeing" indicates the percent who responded a 1 or 2.

Students also were asked a series of questions that probed their perception of the tasks a transportation planner might work on (Table 34). The transportation students were overwhelmingly likely to agree with all the statements, except that only about 50% agreed the field involved helping and serving others through personal interaction. Transportation students were more likely than the other groups to agree with these statements, with the difference between transportation specialists and students in other specializations ranging from 9 to 31 percentage points. These differences were partly explained by higher percentages of "don't know" responses among the students not specializing in transportation planning, rather than by outright disagreement. However, in many cases the non-transportation students were also more likely to disagree. The starkest difference was agreement with the statement, "Transportation planning uses skills at which I excel," with 74% of transportation students agreeing, but only 17% of other specialists agreeing. Other statements with sharp differences in agreement (from 24 to 31 percentage points) were that the students who had already chosen other specializations were much less likely to agree that transportation planning is multidisciplinary or that the field is "broad, not narrow"; to agree that transportation planning involves exploring natural or social phenomena; or to agree that transportation planning involves helping and serving others through personal interaction.

The responses for the two types of undecided students show that these groups are usually more similar to the students who have chosen other specializations than to the transportation specialists.

Table 34 Planning Students' Views on Transportation Planning—Nature of the Job Tasks

Statement		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[a]
Transportation planning involves analyzing data to solve problems	% agreeing[b]	95	**85**	**86**	**86**
	% don't know	1	6	7	9
	mean score[c]	4.6	**4.4**	4.5	4.6
	% with opinion who disagree[d]	0	1	1	1
People working in transportation planning have to use quantitative methods a lot	% agreeing	91	**71**	**79**	**80**
	% don't know	4	**13**	**13**	**13**
	mean score	4.6	**4.2**	4.5	4.5
	% with opinion who disagree	0	0	1	1
Transportation planning involves creating and using new knowledge	% agreeing	89	**71**	**68**	**69**
	% don't know	2	8	**10**	**12**
	mean score	4.4	4.1	4.1	**4.1**
	% with opinion who disagree	2	5	7	5
Transportation planning is multi-disciplinary	% agreeing	89	**74**	**70**	**62**
	% don't know	3	**10**	**10**	**12**
	mean score	4.5	4.2	**4.0**	**3.9**
	% with opinion who disagree	0	4	5	**9**
Transportation planning involves exploring, understanding, and predicting natural or social phenomena	% agreeing	82	**64**	**60**	**58**
	% don't know	1	**12**	**10**	**15**
	mean score	4.1	3.9	3.9	**3.8**
	% with opinion who disagree	8	9	7	10
Transportation planning involves leading and persuading others	% agreeing	81	**66**	**54**	**57**
	% don't know	2	**10**	**9**	**14**
	mean score	4.2	4.0	**3.6**	**3.9**
	% with opinion who disagree	1	0	**11**	**7**
Transportation planning is broad, not narrow	% agreeing	74	**58**	**54**	**44**
	% don't know	2	**12**	**10**	**13**
	mean score	4.1	3.9	**3.6**	**3.4**
	% with opinion who disagree	8	11	**18**	**21**
Transportation planning uses skills at which I excel	% agreeing	74	**25**	**12**	**17**
	% don't know	4	**60**	**67**	**58**
	mean score	4.1	3.7	**3.0**	**3.3**
	% with opinion who disagree	3	6	**30**	**23**
Transportation planning involves helping and serving others through personal interaction	% agreeing	52	**30**	**21**	**21**
	% don't know	5	**22**	**19**	**22**
	mean score	3.7	**3.2**	**2.8**	**2.9**
	% with opinion who disagree	11	21	44	38
n (varies depending upon non-responses)		*103 to 105*	*87 to 91*	*132 to 139*	*489 to 522*

Notes: For percentages, **bold** indicates that the difference in the percentage is significantly different from the percentag of transportation students, two-tailed test, $p<0.05$. For means, **bold** indicates that the mean is significantly different from all three other categories, as indicated by an ANOVA and Bonferroni post-hoc test, $p<0.05$.

a. Includes students who have chosen another specialization, including generalists.
b. Students were asked whether they agreed or disagreed, on a one to five scale, with 1=strongly disagree and 5=strongly agree, plus a "Don't Know" option. "% agreeing" indicates the percent who responded a 4 or 5.

c. The mean scores were calculated excluding "don't know" responses
d. "% disagreeing" indicates the percent who responded a 1 or 2.

In an open-ended question on the same topic, the survey asked students, "Please list up to three things you think transportation planners do." A total of 611 students wrote at least one answer. Many students wrote responses related to planning for particular modes, with all modes mentioned by at least one fifth of those who wrote a comment. For example, 28% of the people who answered this question mentioned a task related to designing or planning roads, bridges, or other road infrastructure, and 30% mentioned something related to planning or managing traffic flows. Thirty percent mentioned some task related to planning, managing, or promoting public transit. Also fairly popular were responses related to planning for nonmotorized road users; 21% wrote something related to planning for pedestrians, cyclists, and traffic calming.

In addition to mode-specific responses, some students mentioned types of analysis or job tasks that transportation planners might do. Sixteen percent wrote something related to creating projects or models, 8% wrote something abstract about analyzing data, 7% wrote about coordinating among different types of stakeholders, 6% mentioned finance-related work, and 5% mentioned work coordinating transportation and land-use planning. Finally, 6% of people mentioned some task related to studying or mitigating the environmental impacts of transportation.

Another set of questions asked students' views on job-related features of the transportation planning field, such as the prospect of getting a job, prestige, and the types of people who work in transportation (Table 35). The responses showed significant differences between the transportation students and their peers, with the differences ranging from a low of six percentage points to a high of 36 points. The transportation students were particularly more likely to agree that they are like other people working in transportation, that transportation planning seems open to women, that they get along well with students in transportation planning, and that they could get jobs outside of transportation,

Finally, the survey also asked an open-ended questions to test whether non-transportation specialists might have specific perceptions of the transportation field that influenced their decision, but which the closed-answer questions missed. The survey asked "If you did consider specializing in transportation but decided not to, why did you decide against transportation? If you have never considered transportation, why not?"

The results turned up no new decision factors that the survey had missed. The answers did, however, suggest that students are likely to choose other fields on the basis of interest and, to a lesser extent, because they didn't want to work in a quantitative or engineering-related field. Among the 612 students who responded to this open-ended question, the most common set of

responses related to their level of interest in the field. A total of 212 students (35% of those who answered the question, or 24% of all survey respondents) responded in this vein, with 75 writing something to the effect that transportation was uninteresting to them and another 137 responding to the effect that some other specialization was more interesting. The only other type of response that was made by more than 50 students was responses equating transportation with quantitative skills and engineering. In these comments, 63 students said they either didn't like or didn't have quantitative skills, or that they didn't like the "engineering" aspect of the field. Smaller numbers of students also mentioned that transportation was too "narrow" or "inflexible," apparently believing that the specialization would prepare them for only a limited range of jobs; said that transportation was too car-oriented; or said that their school didn't have a strong (or any) program in transportation.

Table 35 Planning Students' Views on Transportation Planning—Job-Related Features

Statement		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[a]
Students choosing transportation planning could easily get a planning job outside of that specialization	% agreeing[b]	82	**58**	**60**	**54**
	mean score	4.2	**3.7**	**3.7**	**3.6**
	% disagreeing[c]	4	5	7	8
Students specializing in transportation are able to find jobs in transportation planning	% agreeing	81	68	**60**	**66**
	mean score	4.3	**3.9**	**3.8**	**3.9**
	% disagreeing	1	0	4	4
I am like other people who work in transportation planning	% agreeing	79	**51**	**47**	**43**
	mean score	4.1	**3.6**	**3.5**	**3.4**
	% disagreeing	1	6	**9**	**12**
Transportation planning seems open to women	% agreeing	67	**51**	**36**	**37**
	mean score	3.9	3.6	**3.3**	**3.3**
	% disagreeing	8	7	16	**17**
Transportation planning seems open to people of color	% agreeing	60	52	**44**	**38**
	mean score	3.8	3.6	**3.4**	**3.3**
	% disagreeing	6	6	12	**15**
There is a common identity among people working in transportation planning	% agreeing	50	**30**	**14**	**26**
	mean score	3.6	3.2	**3.0**	**3.1**
	% disagreeing	14	13	19	20
I get along well with students in transportation planning	% agreeing	48	**31**	**18**	**19**
	mean score	3.5	3.1	**2.7**	**2.7**
	% disagreeing	16	19	**37**	**40**
A career in transportation planning is prestigious	% agreeing	47	37	**24**	**28**
	mean score	3.5	3.3	**2.9**	**3.1**
	% disagreeing	18	15	27	24
People in transportation planning often work alone rather than in teams	% agreeing	5	8	9	**11**
	mean score	1.8	**2.3**	**2.3**	**2.4**
	% disagreeing	77	**56**	**62**	**51**
n (varies depending upon non-responses)		*103 to 105*	*87 to 91*	*132 to 139*	*489 to 522*

Notes: For percentages, **bold** indicates that the difference in the percentage is significantly different from the percentag of transportation students, two-tailed test, $p<0.05$. For means, **bold** indicates that the mean is significantly different from all three other categories, as indicated by an ANOVA and Bonferroni post-hoc test, $p<0.05$.

a. Includes students who have chosen another specialization, including generalists.
b. Students were asked whether they agreed or disagreed, on a 1 to 5 scale, with 1=strongly disagree and 5=strongly agree. (A "don't know" option was not given.) "% agreeing" indicates the percent who responded a 4 or 5.
c. "% disagreeing" indicates the percent who responded a 1 or 2.

CAREER AND JOB PRIORITIES

The survey investigated the general factors that students prioritize in their career. One set of questions probed the types of impact students wanted to have through their work, as well as the geographic scale at which they want to work (Table 36). All students overwhelmingly wanted to "improve the quality of life in cities and towns," with protecting the environment and improving the quality of life for disadvantaged students important to almost as many. There was little significant difference between the transportation specialists and other groups of students. The groups did differ somewhat in terms of the scale at which students wished to work, however. The transportation students were more likely to wish to work at the city/regional and national scales (rated a 4 of 5 by 89% and 66%, respectively) than at the neighborhood or international level.

Table 36 Importance pf Work Outcomes to Planning Students

Occupational Characteristic[a]		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[b]
Improve the quality of life in cities and towns	% rating 4 or 5	95	92	97	95
	mean score	4.9	4.8	4.9	4.9
Protect the natural environment	% rating 4 or 5	88	81	84	81
	mean score	4.7	4.5	4.6	4.5
Improve the quality of life for disadvantaged populations	% rating 4 or 5	84	77	**70**	79
	mean score	4.6	4.4	4.2	4.5
Work directly with residents and members of the community	% rating 4 or 5	56	64	63	64
	mean score	3.9	3.9	3.9	4.0
Affect planning at the city or regional level	% rating 4 or 5	89	84	**78**	**79**
	mean score	4.7	4.6	4.5	4.5
Affect planning at a state or national level	% rating 4 or 5	66	**48**	**40**	**55**
	mean score	4.1	**3.5**	**3.4**	3.7
Affect planning at the neighborhood level	% rating 4 or 5	58	71	63	70
	mean score	3.9	4.2	4.0	4.2
Affect planning at an international level	% rating 4 or 5	46	**32**	**32**	39
	mean score	3.3	2.8	2.8	3.0
n (varies depending upon non-responses)		*104 to 105*	*90 to 91*	*138 to 139*	*516 to 521*

Note: **Bold** indicates that there is a significant difference between the percentage for that group and the percentage of transportation students, $p<0.05$, two-tailed test. For means, bold indicates that the mean is significantly different from all three other categories, as indicated by ANOVA and Bonferroni post-hoc tests, $p<0.05$.

a. Students were asked "How important is it to you to have a job where your work will" and given a five-point scale for the response (1 = not important at all, 5 = very important).
b. Includes students who have chosen another specialization, including generalists.

Students also rated the importance of a variety of types of job tasks (Table 37). The factors important to the largest number of transportation students were to work on a broad variety of things (87%) and to create and use new knowledge (86%). Also important to 70% or more

were analyzing data to solve problems and exploring natural and social phenomena. Majorities mentioned more interpersonal tasks, too, such as leading and persuading others (64%) and helping others through personal interaction (57%). Generally speaking, the transportation students did not significantly differ from the other groups of students, though they did place more emphasis on using quantitative methods than any of the other three groups.

Table 37 Importance of Job Task Characteristics to Planning Students

Occupational Characteristic[a]		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[b]
Work on a broad variety of things, not a narrow range	% rating 4 or 5	87	78	77	86
	mean score	4.7	4.5	4.5	4.7
Create and use new knowledge	% rating 4 or 5	86	82	**73**	84
	mean score	4.7	4.6	4.4	4.6
Analyze data to solve problems	% rating 4 or 5	75	64	66	69
	mean score	4.4	4.0	4.0	42
Explore, understand, and predict natural and social phenomena	% rating 4 or 5	70	66	59	77
	mean score	4.3	4.1	4.0	4.4
Lead and persuade other to attain personal or organizational goals	% rating 4 or 5	64	54	**46**	65
	mean score	4.1	3.7	**3.5**	4.0
Help, teach, counsel, or serve others through personal interaction	% rating 4 or 5	57	58	62	63
	mean score	3.7	3.9	3.9	4.0
Use quantitative methods	% rating 4 or 5	52	**33**	**35**	**41**
	mean score	3.7	3.2	**3.0**	3.0
Work more alone, rather than in teams	% rating 4 or 5	12	16	13	10
	mean score	1.8	2.3	2.2	2.0
n (varies depending upon non-responses)		*103 to 105*	*90 to 91*	*137 to 139*	*519 to 522*

Note: **Bold** indicates that there is a significant difference between the percentage for that group and the percentage of transportation students, $p<0.05$, two-tailed test. For means, bold indicates that the mean is significantly different from all three other categories, as indicated by ANOVA and Bonferroni post-hoc tests, $p<0.05$.

a. Students were asked "How important is it to you to have an occupation that allows you to" and given a five-point scale for the response (1 = not important at all, 5 = very important).
b. Includes students who have chosen another specialization, including generalists.

Table 38 shows the results of questions asking students the types of employers they would like to work for and other employment characteristics. Transportation students were most likely to say they wanted to work for a private company (83%), though working for a city or county or regional agency also interested more than three-quarters (76%). At least a majority also were interested in working for a state, federal, or international agency. The only employer type to interest fewer than half the transportation students was a non-profit organization (43%). The transportation students' employer priorities were similar to those among the other students

groups, though the students with other specializations were significantly less likely to want to work for a regional or state agency, and more likely to want to work for a non-profit.

The questions on job characteristics revealed no statistically significant differences among the student groups. A majority of all students wanted a job flexible enough to accommodate other activities and a job that fit with family responsibilities. Working internationally or in a prestigious job was important to a bit more than a third (35% to 42%).

Table 38 Importance of Employer and Employment Characteristics to Planning Students[a]

Job Characteristic[a]		Transportation	Undecided, *Likely* to Choose Transportation	Undecided, *Not Likely* to Choose Transportation	Other Specializations[b]
A private company	% rating 4 or 5	83	**71**	77	77
	mean score	4.6	4.2	4.3	4.4
A city or county	% rating 4 or 5	76	73	75	38
	mean score	4.3	4.2	4.2	4.0
A regional government agency	% rating 4 or 5	76	70	**65**	**60**
	mean score	4.4	4.1	4.0	**3.8**
A state government agency	% rating 4 or 5	61	55	**48**	**50**
	mean score	3.8	3.7	3.6	3.5
An international agency or organization	% rating 4 or 5	61	47	53	56
	mean score	3.8	3.4	3.5	3.6
A federal government agency	% rating 4 or 5	59	53	50	**48**
	mean score	3.7	3.6	3.4	3.4
A non-profit organization	% rating 4 or 5	43	52	50	**64**
	mean score	3.4	3.7	3.4	**3.9**
Is flexible so that you can pursue other activities (e.g. travel or hobbies)	% rating 4 or 5	64	62	68	70
	mean score	4.0	4.1	4.2	4.2
Fits with your family responsibilities	% rating 4 or 5	58	71	67	66
	mean score	3.7	4.2	4.0	4.0
Allows you to work internationally	% rating 4 or 5	42	37	35	37
	mean score	3.2	2.8	2.9	2.9
Is prestigious	% rating 4 or 5	38	39	35	39
	mean score	3.3	3.2	3.1	3.2
n (varies depending upon non-responses)		*104 to 105*	*89 to 91*	*138 to 139*	*521 to 524*

Note: **Bold** indicates that there is a significant difference between the percentage for that group and the percentage of transportation students, $p<0.05$, two-tailed test. For means, bold indicates that the mean is significantly different from all three other categories, as indicated by ANOVA and Bonferroni post-hoc tests, $p<0.05$.

a. Students were asked "After you graduate, how interested would you be to work for" or "After you graduate, how important is it to you to get a job that" and they were given a five point scale for the response (1 = not important at all, 5 = very important).
b. Includes students who have chosen another specialization, including generalists.

INFLUENCE OF SOCIO-DEMOGRAPHIC FACTORS ON CHOICE OF SPECIALIZATION

Women were about equally likely to choose transportation as a specialization as men (11% and 14%, respectively). In addition, of the women who had not decided on a specialization, 42% were leaning toward transportation, compared to 46% of the men who had not decided.

Women are presumably more likely to choose a career where they feel accepted. Of the women who had chosen transportation, only 9% disagreed with the statement that "transportation planning seems open to women" (rated a 1 or 2 on a scale of 1 to 5). However, 22% of the students who had chosen another specialization and 21% of those who were undecided and unlikely to choose transportation disagreed with the statement. Moreover, only about one-third of the women who had or were likely to choose another specialization agreed that transportation planning seems open to women. These numbers suggest that some women may be deciding against transportation planning because they do not feel welcomed by the profession.

Regarding occupational preferences, there were only a few differences between women and men. Women placed less importance on having a job where they would analyze data to solve problems (66% versus 73% of men). In addition, women were less likely to place importance on an occupation that used quantitative methods; 38% of women rated this important, compared to 44% of men. However, this difference is not statistically significant. Over 90% of all students agreed that transportation planning involved analyzing data and used quantitative methods a great deal. If conventional stereotypes that women are less attracted to quantitative professions are true, some women may be less attracted to the field because of its association with quantitative data analysis. Women placed greater importance on jobs that improved the quality of life for disadvantaged populations and working for a non-profit organization. The survey did not test whether students thought transportation planning jobs fit these descriptors well.

As with women, it is possible that minority students might avoid transportation planning if they do not feel welcomed, but the survey results did not generally support such a hypothesis. Non-white students were equally likely to choose transportation as white students (11% and 13%, respectively). Also, among the undecided students, 54% of non-whites were likely to choose transportation, compared to 41% of whites, though this difference was not significant, due to the small number of undecided non-white students (56). Compared to the women students, a smaller share of the non-white students felt unwelcome by the transportation planning field. Of the 53 non-white students who had not yet decided on a specialization, only three (6%) disagreed with the statement "transportation planning seems open to people of color" and two of them were leaning toward transportation as a specialty. However, of those who had decided on another specialization, 20% disagreed with the statement.

SUMMARY OF KEY FINDINGS

The survey gathered a large amount of data from 869 students in urban planning masters program at 61 U.S. universities. Key findings from the survey are summarized below.

What are the most popular specializations?

Transportation was the second most popular choice among students who had already selected a specialization (17%), with similar numbers of students choosing housing/community development (20%) and environmental planning (16%). Among students who had not yet picked a specialization, transportation was one of the less popular choices, with only 10% saying they were "very likely" to specialize in the field.

When do students choose their specializations?

Most students who had already selected a specialization reported doing so before they entered the masters program, but 28% of transportation students and 34% of other specialists did choose while they were in the masters program. This number of students, combined with the 30% of respondents who had not yet chosen a specialization at all, suggest that a large percent of students will make a decision while in a planning masters program.

What priorities influence their choice of specialization?

A series of questions asked students what factors mattered to them when choosing their specialization. Transportation students were more motivated by the impact their work would have than by practical matters such as salary, the ease of finding a job, or flexibility.

- The factors that the largest numbers of transportation students said mattered to them in choosing their specialization were the impact the specialization has on improving quality of life in cities and towns (91%), being able to plan at the city or regional level (82%), and the contributions they could make to improving the quality of life for disadvantaged populations (77%) and improving quality of the natural environment (74%).
- Being able to work at the neighborhood level, or directly with residents, was important to fewer transportation students (44% and 29%).
- While 63% of transportation students said the likelihood of getting a job in the field was important to them to choose a specialization, only about half said that job security or the potential for upward mobility was important (53%) and less than half said salary was important (41%) or that the likelihood of the specialization fitting well with family responsibilities was important (21%).

Overall, transportation and non-transportation students are motivated by very similar concerns and factors. However, some differences emerged:

- The other students were more likely to place importance on working with community members and at the neighborhood level.
- The other students were even less influenced by practical job-related features like security and salary, though they were more likely to place importance on the "type of work environments."

What sources of information do students use to choose a specialization?

There were few differences between the students specializing in transportation or other fields. All students relied most heavily on materials they read, either on the web or in print formats. In addition, more than 70% used what they learned from taking a class in the specialization, and almost as many spoke with a faculty member for advice.

What do students know about the transportation specialization within their university programs?

Students reported being moderately familiar with the transportation programs in their universities, with most transportation students generally quite positive on their university experiences. Among the main findings on the topic:

- Large numbers of transportation students viewed their university programs positively. They are likely to agree that transportation planning classes are interesting and that faculty do interesting research or projects and teach well.
- Seventy-six percent of transportation specialists agreed that there are good internships for transportation students, though only about a third of other students agreed with this.
- Only 45% of transportation students (and far fewer other students) agreed that there are scholarships targeted at transportation planning students.
- Overall, students specializing in transportation were much more likely to agree with positive statements about the transportation program than other students, but this difference was in great part explained by much higher numbers of students responding "don't know" (often close to 50%), rather than by high numbers of students holding negative views of the transportation profession.

What do students know and think about the nature of the transportation planning profession?

Questions throughout the survey tested respondents' knowledge of and opinions about the transportation field. Among the main findings on this topic:

- The student body as whole was only moderately likely to feel "familiar" with what transportation planners do. Thirty-nine percent reported being "very" familiar with the field, and only 16% said they were "not at all" familiar. Overall, 62% of students who responded to this question were either "somewhat" or "not at all" familiar with the field; a definite majority thus did not feel they know what transportation planners do.

- Large majorities of all students agreed that transportation planning involves data analysis and using quantitative methods.
- Students are especially likely see a transportation planner's duties as related to planning road infrastructure and traffic flow, but sizable minorities also see the transportation field as involving planning for transit, bicyclists, pedestrians, and traffic calming.
- Only 6% of the students mentioned that transportation planners' work relates to the environmental impacts of the transportation system.
- Transportation planning specialists see their field as multidisciplinary and broad, as involving the exploration of natural or social phenomena, and as involving leading and persuading others. However, significantly fewer of the other students share these perspectives. The difference is partially explained by a higher percent of the other students saying they "don't know" and partly by active disagreement.
- Less than half the students outside the transportation planning field agree that it is open to women or people of color, although about two-thirds of transportation specialists agree with these statements (67% and 60%, respectively).
- Among all respondents, about 24% said that transportation was either uninteresting to them or that it was less interesting than other specializations.

SUMMARY AND COMPARISON OF FINDINGS BETWEEN ENGINEERING AND PLANNING STUDENTS

The two preceding chapters present detailed findings from surveys of undergraduate civil engineering and graduate urban planning students. This chapter summarizes the key findings and provides a comparative analysis across the two groups of students.

Demographics

There are some distinct, though not unexpected, differences between the undergraduate transportation engineering and graduate transportation planning students. Only one-third (33%) of the transportation engineering students were women, compared to 52% of the transportation planning students. Transportation planning attracts fewer women than the other planning specializations (62%), but in contrast, transportation engineering attracts about the same share of women as the other specializations (33% vs. 31%). For both the engineers and planners, about three-quarters of the students identified themselves as white/Caucasian. As would be expected, the planning students were older and more likely to be married or in a domestic partnership and living with children.

If and When Students Choose a Specialization

The vast majority of both civil engineering undergraduate and planning graduate students were either required to or could choose to specialize while in their program. Transportation was the second most popular specialization among both sets of students, attracting 19% of the civil engineers and 17% of the planners who had made a choice.

One notable difference between the planning and engineering students is that a smaller percentage of the undecided planning students were very likely to choose transportation—10% of undecided planners compared to 25% of the undecided civil engineering students. In addition, while transportation's share of the civil engineering students by year in school grew 168% between the freshman and senior year, transportation planning saw little growth between the first and second years in what is typically a two-year graduate program. The difference is not explained entirely by the shorter length of the typical masters degree program; there were other specializations within planning that grew significantly in popularity between the first and second years. These findings indicate that within planning, many transportation students make their choice earlier in their career, and that the graduate planning school experience is not attracting many new students to the field. In contrast, among undergraduate civil engineering students, transportation is attracting students to the field while they are in school.

Factors Influencing Choice of Specialization

The most important factor motivating both the transportation engineering and planning students to choose transportation was the contribution the specialization makes to improving the quality of life in cities and towns; 83% of the transportation engineering and 91% of the transportation planning students cited this as an important factor. However, the two groups differed in several ways on other factors that motivated them to choose a particular specialization (see Table 39). In particular, about twice the share of engineering students rated what they learned in classes as important (67% versus 34% of planning students). This is consistent with the finding above that planning students appear to be influenced less in their decision during their time in the program.

The transportation engineering students appear to be more concerned than the planning students about practical job-related features, such as the likelihood of getting a job, job security, and work environment. The smallest difference came in rating the importance of salary—49% of transportation engineering students rated that important compared to 41% of transportation planning students. This convergence is also notable because transportation engineering students were *less* likely to place importance on salary compared to other civil engineering students, while transportation planning students were *more* likely to place importance on salary compared to other planning students. This may reflect the perception that transportation planners earn higher salaries than other planners, while transportation engineers may earn less than other civil engineers, particularly structural engineers. A 2008 survey found that for planners with less than five years of experience, the median salary for transportation planners ($47,000) was higher than all other specializations except for planners in management/budgeting/finance ($47,700). However, this relative advantage appears to disappear with experience; among all planners, transportation planners are in the middle among 15 different subfields in terms of median income. The focus group discussions with undergraduate civil engineers and graduate planning students were consistent with the survey findings that civil engineering students are more concerned about salary. Several of those students mentioned checking websites and other sources for salary information; this activity was not mentioned by the planning students.

The availability of research assistantships, scholarships, and other financial support appears to be attracting students to transportation planning, but not transportation engineering. Significantly larger shares of transportation planning students said that such assistance was an important factor in choosing a specialization, compared to other planning students. However, there were no differences between transportation engineering students and other civil engineering students. This may reflect differences between the two disciplines with respect to research and other funding sources. Relative to other planning fields, transportation has the reputation for attracting more research funding, particularly at campuses with federally-funded university transportation centers (UTCs). Transportation engineering, on the other hand, does not stand out among civil engineering fields with respect to research funding.

Table 39 Comparison of Factors Influencing the Choice of Transportation as a Specialization, Engineering and Planning Students

Factor[a]	% of Students Stating This Was an Important Factor in Choosing Specialization	
	Transportation Engineering	Transportation Planning
Educational and other learning factors		
What I learned about the specialization from classes[a]	67	34
Teaching quality of faculty who teach within the specialization	59	47
Professional reputation of faculty who teach in specialization	43	49
Availability of classes within the specialization (e.g. the times of the day/week or whether they have space)	36	10
Availability of research assistantships working with faculty in specialization	21	32
Availability of scholarships or other financial support for students in specialization	14	27
Job characteristics		
The contribution the specialization makes to improving the quality of life in cities and towns	83	91
The contribution the specialization makes to improving the natural environment	47	74
Job-related features		
The likelihood of getting a job in the specialization	79	63
Job security and stability	73	54
The type of work environments for people in the specialization	73	40
The potential for upward mobility	65	53
The likelihood that a job in my specialization will fit well with my family responsibilities	53	21
The likelihood of me being accepted by other people working in the field	50	36
The salary I will likely earn	49	41
n (varies depending upon non-responses)	*205 to 212*	*94 to105*

a. Civil engineering students were asked about "classes I have already taken." Planning students were asked about both classes "I took in my undergraduate program" and "classes I have taken in the masters program." The shares were the same for both versions of the planning question.

Sources of Information

The differences in sources of information that students used to inform their specialization decision reflects, in part, differences between the undergraduate and graduate experience and age of students. For example, 63% of the transportation planning students said that they had learned about their specialization from someone they met in the field before they started their masters program. Only 38% of the transportation engineering students had met someone in

their field before starting college. However, for both groups of students who had met someone, that person was helpful in informing their decision.

The most used source of information for the transportation engineering students was a class they took in transportation; 82% of the students had done so, and they rated its helpfulness an average of 4.3 on a 1-to-5 scale, 5 being very helpful. Just under three-quarters (73%) of the transportation planning students said that a class taken during graduate school informed their decision, and of those who did, they rated it an average of 3.6 in helpfulness. For transportation planning students, the web was the most often cited source of information (86%).

For both groups of students, an internship in their specialization was the most helpful source of information (as opposed to the most frequently used source).

Transportation Students' Views on Transportation

In most cases, transportation engineers and planners had very similar views of their chosen specialization. For example, 81% of transportation planners and 83% of transportation engineers said that classes in their specialization were interesting, and 60% and 62%, respectively, said the classes were challenging. Almost identical shares said that there were good internships available (76% and 77%, respectively).

There were a few notable differences between the groups, however. A higher share of transportation planning students said that there were scholarships targeted at students in their specialization—45% compared to 30% of transportation engineering students. Similarly, more transportation planning students said that faculty in transportation were doing interesting research—72% of transportation planning students versus only 42% of transportation engineering students. The latter difference is largely explained by a lack of knowledge among undergraduates regarding faculty research; 23% of the transportation engineering students responded that they didn't know, compared to only 4% of the transportation planning students. However, of the students who did express an opinion, the planners were more likely to agree; the mean score on the "strongly disagree" to "strongly agree" (1 to 5) scale for transportation planners was 4.0, compared to 3.6 for transportation engineers.

Transportation planning students were more likely to think that their specialization was open to women and people of color (74% and 72%, respectively), compared to transportation engineering students (58% and 51%, respectively). However, despite these lower numbers, transportation engineering students were *more* likely than students in other engineering specializations to feel that their specialization was open to women (74% versus 64%). For planners the opposite relationship was found (58% versus 70%).

Finally, there was also a contrasting pattern in the students' views on whether "a career in my specialization is prestigious." Civil engineers were less likely than students in other civil

engineering specializations to agree with that statement, while transportation planners were more likely to agree than students in other specializations.

All Students' Views on Transportation

Most students in both fields (over 80%) indicated that they were at least somewhat familiar with the subfield of transportation. However, a slightly higher share of the planners were "not at all familiar" with transportation, 16% of planning students compared to 10% of the civil engineering students.

All of the students were asked specific questions about their views on transportation. For this analysis, students were divided into four groups: those who had chosen transportation, those who were undecided but likely to choose transportation, those who were undecided but unlikely to choose transportation, and those who had chosen another specialization.

With regard to university experiences, the patterns and relationships among those four groups were similar for both the engineers and planners. The main difference was that the planning students who had not chosen transportation were more likely to state that they "didn't know" when asked about transportation classes, faculty, and other university experiences related to transportation. For example, more than half of the planning students who had not chosen transportation said that they didn't know if the transportation planning classes were interesting, compared to 23% to 33% of the engineering students who had not chosen transportation. The fact that the planning students were less likely to have knowledge of these factors is probably explained, at least in part, by the limited amount of time graduate planning students have in their program. Many planning graduate students are in school for only two years, a time frame which can limit their ability to take classes to explore different fields or as electives. Similarly, 58% to 67% of the planners who had not chosen transportation didn't know whether transportation planning used skills at which they excelled. Only 26% to 39% of the engineering students who had not chosen transportation said they didn't know when asked a similar question.

For both the planning and engineering students who had not chosen transportation, about half stated that they didn't know whether the faculty teaching transportation were doing interesting research.

Consistent with the findings discussed above, the planning students, particularly those who were not leaning toward transportation and those who had chosen another specialization, were less likely to agree that transportation planning seems open to women, compared to transportation engineering students in the same categories.

RECOMMENDATIONS

This report concludes by laying out a set of strategies the transportation community can use to increase the number of civil engineering and urban planning students choosing to specialize in transportation. The central challenge is to educate students about the aspects of the field that many don't know about, but which would be attractive to many students. In essence, the transportation community needs to communicate the breadth of the field and many opportunities for people of all skill sets to participate, so students make well-educated choices about whether transportation is or isn't the best fit for them. If all students had this knowledge, more of them would choose transportation than currently do.

The prospects for success through education about the profession are high for two primary reasons. First, it is clear that education is needed. Of course, some students in civil engineering and planning will always be more attracted to other specializations for many good reasons, and no amount of education about transportation will change that. However, the research conducted for this report found that many students who don't choose transportation are ignorant of the field, more than actively opposed to it. The transportation profession thus faces the relatively easier task of educating students about the merits of the transportation field, not the more difficult task of overcoming negative feelings toward the profession.

The second reason to have confidence that educational efforts will attract more students to the transportation field is that the study found students choosing a specialization place strong importance on the content of work they think they would do in that field. Factors such as pay or prestige were less important. Employers can therefore successfully help attract new students into the field without having to make major shifts within the workplace, such as dramatically increasing salaries (although such steps would doubtless have impact, as well).

Working in concert, university faculty, employers, and professional transportation organizations all have important roles to play in this outreach and education. Faculty need to improve their teaching methods and do more to communicate with students about the interesting research and professional projects they conduct. Employers need to provide well-structured internships and encourage their more dynamic employees to interact with students on campus, both by giving talks about their work and also by teaching classes when local universities hire part-time faculty. Finally, leadership organizations in the transportation field, like the Transportation Research Board, AASHTO, and ITE, have critical roles both in disseminating information about the profession and also in providing financial and institutional support to improve the quality of teaching about transportation.

RECOMMENDED METHODS TO RECRUIT CIVIL ENGINEERING UNDERGRADUATES TO SPECIALIZE IN TRANSPORTATION

The results of this study suggest that a higher percent of CE undergraduates could be attracted to the transportation profession than the current 12% who have chosen the field as a specialty. Two major findings from the survey suggest this optimistic projection. First, the survey found that 57% of freshman civil engineers had not yet chosen a specialization, indicating that there is a large pool of students who should be reasonably open to the transportation profession. Second, and even more importantly, most CE majors are relatively ignorant about the transportation engineering profession, rather than actively opposed to the idea of a career in transportation. Three-quarters of all entering CE majors don't know what transportation engineers do; thus, they will not yet have formed strong opinions about the field that might discourage them from a transportation career. Also, large percentages of students in the survey selected "don't know" when asked to characterize the nature of the field and educational opportunities in transportation at their school—again, a sizable portion were ignorant more than opposed.

Introduce freshman and sophomores to the diverse and exciting aspects of transportation engineering through their required classes

The survey found that many non-transportation students did not know much about the transportation faculty, courses, or profession. Many of the students in our survey did not understand the full range of topics addressed by transportation engineers. The faculty interviews and focus groups also found that many students enter a civil engineering program thinking mainly about structural engineering. If students do not understand the full range of opportunities in the profession, particularly emerging areas such as intelligent transportation systems, context sensitive solutions, and multi-modal planning, they may not give it serious consideration.

The survey and focus groups results suggest that educating civil engineering students on the following points about transportation engineering are particularly likely to sway undergraduates:

- Transportation engineers have many opportunities to have a positive impact on the natural environment, including reducing greenhouse gas emissions. Specific areas to teach students about include engineering facilities that improve the safety for biking and walking and encourage more use of those modes, context sensitive solutions, transit facilities, and integrated transportation and land use modeling. Introducing students to ways that transportation engineers work to protect the environment may be particularly likely to attract students who otherwise would have specialized in environmental engineering.
- Transportation engineering involves challenging and interesting quantitative analysis, including sophisticated math. Some students may see transportation engineering as relatively simplistic and routine work that involves collecting vehicle counts and making

simple calculations. Introducing students to the highly sophisticated analysis in cutting-edge transportation engineering may attract new students, especially those who might otherwise go into structural engineering, which is perceived by many students as the more intellectually rigorous branch of civil engineering.

- Many transportation engineering jobs include more interaction with people than does work in other branches of civil engineering. Leadership, and other "soft skills" are especially critical to the work done by transportation engineers.. Many students are unaware of these people-related aspects of transportation engineering, factors which may be attractive to some students.
- There are a variety of employment opportunities for transportation engineers, both private as well as public sector jobs.

The timing of *when* civil engineering undergraduates learn about the transportation field is critical; it is important that this happen early in students' university programs, because many students choose a specialization in the first two years.

Most undergraduate civil engineering programs have few courses specific to civil engineering during the freshman and sophomore years, so it is unrealistic to advocate for having required or optional courses just on transportation engineering in these years. Thus, transportation professionals must be creative about finding ways to incorporate exciting education about transportation engineering into other types of lower-division courses. For example, many programs have a survey-type course that introduces students to the field of civil engineering. Also, most programs have core engineering methods courses all students must take, and these could include examples drawn from cutting-edge transportation engineering work.

We suggest two implementation strategies for this recommendation.

Develop course modules on transportation, especially for use in general classes that students will take in the freshman and sophomore year. These modules would use transportation as an example of a more basic engineering concept, so that the modules can be incorporated into introductory courses that all civil engineering students take, such as statistics, engineering problem solving, surveying, or graphics. The modules could include lecture materials, assignments, readings, and/or in-class exercises. Whatever the instructional method, the critical feature is that the course module introduce students to aspects of the transportation field that will excite them, stressing the type of content discussed above.

There are already several good examples of transportation engineering curriculum modules that have been designed for use in lower-division courses. At the University of Idaho, Professors Kyte and Dixon developed a traffic signal game that they use in a first-year introduction to civil engineering course with freshman. The game uses real traffic signal heads, controllers, and a laptop connection. Small groups of students use time space diagrams and other techniques to figure out how to race a remote-controlled car through the signals without running any red lights. In another example, faculty at the Texas Transportation Institute developed two course modules for use in university courses.[43] One set of materials

introduces the transportation profession and highlights the broad opportunities available, while another focuses on intelligent transportation systems. The materials were used at several Texas universities, but are available to be used nationally. Finally, the National Science Foundation has funded the development of tools for more advanced classes. For example, Professor David Levinson at University of Minnesota developed "STREET: Simulating Transportation for Realistic Engineering and Education." The module was designed for an undergraduate transportation engineering course and uses web-based simulation. [44] Evaluations found that the simulations did enhance students' learning and helped the development of some key skill, such as problem-solving.[45] Similarly, Professors Levinson and Kevin Krizek developed a laboratory segment for a course on integrated land use and transportation for a graduate students in planning.[46]

Given faculty time constraints, particularly for new faculty who may be assigned to teach the introductory courses, we believe that the materials will be welcomed by instructors, as long as they are of high quality, with clear descriptions and explanations.

These types of course modules take time and resources to develop. The U.S. Department of Transportation (U.S. DOT), University Transportation Centers (UTCs), NSF, and the Institute of Transportation Engineers may be appropriate sources of financial support. Funders could encourage top teaching faculty to develop course modules by providing summer salary to do so or by providing money that allows faculty to reduce their teaching load for a semester.

Another method to encourage faculty to develop teaching modules is to ensure that these faculty will be publicly acknowledged as making critical contributions to the field. Organizing conference sessions that showcase new course modules and featuring the modules in prominent academic and professional publications would send faculty a clear message that developing the modules will bring them respect and recognition equivalent to that they gain from time spent on more traditional research projects.

However, simply developing good course modules is not enough. Once developed, tested, and evaluated, successful modules must be distributed widely and on an on-going basis. Distribution could occur through the USDOT, UTCs, and ITE. However, it will be most useful if there is a central place to find such materials that is widely known to all civil engineering faculty, not just transportation faculty. The American Society for Engineering Education could be a key partner in this effort, perhaps hosting and regularly advertising a website that compiles all these teaching resources.

Encourage transportation faculty to teach lower-division basic engineering classes. Our survey, focus groups, and interviews all found that faculty can influence students decisions, in both positive and negative ways. Having engaged and dynamic transportation faculty teach required freshman and sophomore courses would likely provide more students with a favorable impression of the profession. Also, even transportation engineering faculty who are not necessarily master teachers are still more likely than other engineering faculty to incorporate

transportation examples into their teaching, thus exposing students to the field more than would likely happen with instructors from other specialties.

Implementation of this strategy is, unfortunately, difficult. First, teaching assignments are made at a department level, usually balancing multiple interests, and transportation faculty may not be assigned these courses. A more likely problem, however, is that transportation faculty will avoid teaching these lower-division courses. In general, many university faculty prefer teaching upper-division courses, because students are often more motivated and experienced, and faculty tend to find it more interesting to teach advanced material.

There are several strategies that transportation academics and professionals could pursue to overcome these challenges and convince transportation faculty to teach more lower-division, basic engineering classes. Incentives such as summer salary, teaching assistants, or research support could entice faculty to teach these course. However, such incentives would normally come from a department chair or dean, whose responsibility is not necessarily to promote transportation as a profession. Therefore, it may be up to leaders within the transportation professionals to educate faculty on the importance of offering to teach such courses. One final alternative would be to tie grants to develop the course modules discussed above with a commitment by the grant recipient to teach for a semester or two one of the core, lower-division courses that uses the module. This strategy might well pay off over the longer term, too, as once faculty develop teaching materials for a course, they are often willing to continue teaching that course over time.

Improve the quality of courses on transportation

In theory students take elective courses because the "field" appeals to them, but in reality they often get interested in the field because the classes have a good reputation and, after enrolling, they come to like the material. Courses can develop a good reputation if they are taught by popular faculty who are good teachers and include up-to-date content that is discussed in connection with current policy issues. Faculty members who are excited about what they are doing and convey that to students in the classroom can greatly influence students' decisions about a specialization. In addition, some undergraduate CE programs require all students to take at least one transportation engineering course. If that course makes a great impression, some students may decide to pursue the field.

Professional organizations and public and private employers can partner with university departments and faculty to encourage universities to offer top-notch transportation classes in a variety of ways:

- Fund faculty to develop course materials. Faculty often lack time to develop good materials. Funding summer salary or teaching reductions to give faculty focused time to develop new materials can help overcome this barrier. Also, this kind of funding sends faculty the signal that curriculum development is valued by the profession, just as research would be. Receiving grant funding to develop new teaching pedagogies becomes something faculty can include on their CVs as evidence of their accomplishments and

academic productivity. As an added benefit, the materials developed for these transportation electives could then be shared with other faculty, similar to the distribution of the modules discussed above. Faculty can also evaluate the effectiveness of the materials and publish those findings, thus expanding the effort to the scholarship of teaching.

- In regions where a civil engineering department hires outside lecturers to teach, local employers can give their more dynamic staff members time off to teach. These instructors are very influential because many students in both planning and engineering are excited to take classes from practitioners, whom they perceive as especially likely to teach the "real world" skills that help students get jobs.
- Offer funding or other assistance to help faculty incorporate community-based projects into transportation classes. These projects make classes more interesting for students, as well as for the faculty teaching them. For example, a transportation engineering design course at Portland State University solicits projects from various community partners for groups of students to work on. One semester, students in that course designed a bicycle path through a steep and constrained corridor.
- Fund teaching assistants so that the classes become easier to teach and, thus, attract good faculty to teach them.

Promote good internships

Employers and university departments should work together to provide plentiful, high-quality internships for students. The survey found that internships and jobs were the most useful source of information for students in deciding on a specialization. (Interviews with faculty also identified internships as important.) Transportation students were most likely to have had an internship or job in their specialization, suggesting that the profession is already doing fairly well in this regard. However, there is still room for improvement.

Since not all internships are equal, employers must ensure that they manage interns well, to promote a positive view of the profession, not to mention a good image of their organization. Just as good internships can inspire students to enter the transportation field, a poor internship experience may discourage a student from pursuing transportation as a career. The experience should be interesting, educational, and challenging for the intern. Good internships provide students with intellectually stimulating and worthwhile work, not just menial tasks. Successful internship programs also include a clear definition of duties, sufficient supervision, meaningful assignments, training and support, agreement of objectives by both parties, established performance criteria, constructive feedback, a welcoming environment, and exit interviews. An example of a firm with a well-designed internship program is Kittleson and Associates, a transportation planning and engineering firm with offices nationally. The firm's internship program includes mentors, lunch hour "tech" sessions, site visits, client presentations, and individual teaching sessions.[47]

A final benefit of internships is that they can indirectly function to recruit even those students who don't hold the internship position. Students talk with their peers, so students with

positive internship experiences in the transportation field will serve as unofficial ambassadors, explaining to other students the benefits of a career in transportation.

Provide more student scholarships and research assistantships, and advertise these heavily

Currently, scholarships and research assistantships do not seem to influence many civil engineering students' choices. However, it may be that more scholarships or research assistantships—or better advertised ones—could change this. One useful avenue might be to target scholarships toward specific demographic groups, to improved the diversity of the field. Also, targeting some scholarships to women and/or ethnic minorities might help students perceive the field as more welcoming to those groups.

RECOMMENDED METHODS TO RECRUIT URBAN PLANNING MASTERS STUDENTS TO SPECIALIZE IN TRANSPORTATION

The survey of planning students revealed many of the same themes that showed up in the survey of civil engineering students. Only 12% of the students surveyed had chosen to specialize in transportation, but there is potential to increase that number significantly. Of particular note, planning students often have a limited view of the specialization, and their lack of knowledge is likely a reason some of them don't choose (or even consider) a career in transportation. The central challenge for the transportation community is to communicate facts about careers in transportation that will appeal to students. Key aspects of the field that many students seem not to understand are the breadth of skills required to be a transportation planner, the interdisciplinary nature of the field, and its key role in promoting values that matter to planning students, such as a good quality of life for all community members and more sustainable transportation systems.

Broaden planning students' view of the transportation profession

The survey results show that a majority of planning students do not know the field of transportation planning very well. Of particular concern, many planning students who have not chosen transportation have a narrow view of the profession. Students overwhelmingly think that transportation planning involves data analysis and quantitative methods, and this conception may be discouraging some students from the field. The following are key lessons that need to be more clearly communicated to students in planning masters programs in order to attract a more diverse set of students into transportation:

- While it may be true that transportation planning *in general* is more quantitative than most other planning specialties, there are many transportation planners who spend little of their time performing quantitative data analyses. The transportation profession needs to dispel the belief that all transportation planners work on modeling and other highly specialized quantitative methods.

- Students should be made aware of the wide range of jobs available within transportation planning, at all levels of government. Students who want to work directly with community members at a neighborhood level were less likely to choose transportation. These students may not have realized that there are many transportation planners who work on neighborhood-based projects, including pedestrian and bicycle planning, traffic calming, and safe-routes-to-school programs.
- Students need to be exposed to all the facets of transportation planning, so that they understand that the profession is broad, multi-faceted, and draws upon a wide range of skills. Many planning students see transportation as a narrow field that is less interdisciplinary than other planning subfields. Many also don't know that it involves interpersonal skills, such as leading and persuading others. As with other planning fields, transportation planning needs professionals with strong skills in communications and public involvement.

Develop course modules that highlight the interdisciplinary nature of transportation planning

The transportation community should support transportation educators to develop course modules that highlight the interdisciplinary nature of transportation planning. These modules could be used in core planning methods and theory courses. Modules that could be inserted into quantitative methods and GIS courses are obvious targets. However, that may reinforce the perception that transportation planning is all about quantitative methods. A broader set of modules would be most effective. A module on transportation and equity, for example, might be incorporated into a core theory course. Such a module could cover the topics like access to jobs for welfare recipients, the civil rights implications of various transit and highway investments, and equity planning practice. A case study and in-class exercise involving negotiation over a transportation project in a neighborhood could highlight various aspects of the profession, while teaching a core skill of negotiation and communication. For example, at San José State University, a transportation planning course incorporated a community-based project where students used hand-held PDAs equipped with mapping software to collect data on walking conditions in a low-income neighborhood. The students then produced maps showing their block-by-block analysis of walking conditions and needed improvements. In this case, the instructor received money to hire student assistants who programmed the PDAs and offered organizational support for the project.

As with the recommendation for modules in undergraduate civil engineering course, these types of course modules take time and resources to develop. The U.S. Department of Transportation, University Transportation Centers (UTCs), TRB, ITE, and WTS may be appropriate sources of support. Once developed, tested, and evaluated, successful modules must be distributed widely. Given faculty time constraints, particularly for new faculty who may be assigned to teach the introductory courses, we believe that the materials will be welcomed as long as they are of high quality, with clear descriptions and explanations. Distribution could also occur through the DOT and UTCs. However, it will be most useful if

there is a central place to find such materials that is widely known to all planning faculty, not just transportation faculty. The Association of Collegiate Schools of Planning could be a key partner in this effort.

Develop courses that highlight the connection between transportation and other disciplines

These could include courses such as transportation and land use, transportation and the environment, sustainable transportation, and transportation and social equity. Such courses would likely attract students who have selected or are leaning toward other specializations like land use, environmental planning, or community development.

Provide more and better publicized scholarships and research assistantships

Scholarships and research assistantships had more of an influence over transportation planning students' choice of a specialization than for students in other planning fields. However, fewer than half of the transportation students, and far fewer non-transportation students, agreed that there are scholarships targeted at transportation planning students. Therefore, UTCs and transportation organizations that offer scholarships and fellowships should increase their visibility. This includes both local scholarships and national programs, such as the U.S. DOT's Eisenhower Fellowship program and WTS scholarships. Additional scholarships, or increasing the number of existing scholarships, may also encourage more students to focus on transportation. Research assistantships, particularly if they include tuition support, may also attract more students to the field.

Change women's perception of the transportation profession as unwelcoming to them

Women planning students, in particular, need to be welcomed into the profession. A sizable share of planning students who had not chosen transportation felt that the field was not very open to women. Professional organizations such as the Women's Transportation Seminar (WTS) and employers can all help in this area. For example, women transportation planners can offer to speak in classes and mentor students.

RECOMMENDATIONS FOR BOTH DISCIPLINES

Maintain dynamic Web materials

Most students, both engineers and planners, use the web to learn about their profession, including potential specialties. Both within the university and in the professional world, the transportation community should maintain an ongoing commitment to presenting the field in the best light.

University departments and individual faculty could enhance students' knowledge of the transportation field by including information on their web sites that highlights the strengths of the profession—particularly those topics where students may have misconceptions of the field. Transportation faculty can highlight their research and course content. Web sites should also provide links to examples of "real world" projects that transportation engineers and planners were involved in; examples with alumni may be particularly effective.

Outside the university, national transportation organizations like the Transportation Research Board, Institute of Transportation Engineers, Association of State Highway and Transportation Officials, Federal Highway Administration, and state departments of transportation can develop compelling web materials aimed at educating students about career options in the profession. The on-line efforts should be prioritized over more traditional print materials.

Showcase dynamic guest speakers on campus

Guest speakers may be an effective way to expose students to the field. University faculty can facilitate guest visits to campus by inviting professionals to visit their classes and by encouraging regular series of talks by professionals, held outside of classes. Public and private employers can help by offering employees the time to prepare for and undertake guest speaking opportunities.

As several faculty interviewed for this research noted, the key is to find dynamic speakers. To be compelling to students, speakers should emphasize some of the points discussed in this report, e.g. the many broad topics addressed by transportation engineers and planners and the impact the profession has on the natural environment and the quality of life in urban areas.

Expose students to faculty research

Many non-transportation students from both fields, and even many transportation planning and engineering students, don't know whether transportation faculty are doing interesting research. Sharing with students the cutting-edge research conducted by transportation faculty may convince more students to consider transportation as a career. Showing how the research helps solve real world problems will also appeal to students. This education can be accomplished through one-time seminars (e.g. at lunchtime or other informal settings), having transportation faculty speak in other classes, sharing research on faculty web sites, involving more students in research, or publicizing faculty research in department newsletters or websites.

Develop a high-profile, national competition for transportation students

Many civil engineering students compete regularly in the Concrete Canoe and Steel Bridge competitions sponsored by the American Society of Civil Engineers (ACSE). These competitions serve to raise the profile of the profession, along with providing a rewarding educational experience. ITE or other organizations could explore developing something

similar that focuses on transportation engineering. On the planning side, some schools participate in student competitions such as the Bank of America Low Income Housing Challenge, the National Association of Industrial and Office Parks' Real Estate Challenge, and the U.S. Environmental Protection Agency's People, Prosperity and the Planet (P3) Student Design Competition for Sustainability. These three competitions attract multi-disciplinary teams of students, including planners. A new transportation-focused competition that demonstrated the broad aspects of the field could succeed in attracting to the transportation field students with varied interests.

RECOMMENDATIONS FOR FUTURE RESEARCH

The recommendations presented here are based upon the findings from the two surveys, along with the focus groups and interviews. They are based on existing situations for current students and how those factors have influenced students' decisions. The authors can only speculate on the effectiveness of the recommendations, if implemented. Therefore, research is necessary that tests various interventions aimed at encouraging more students to consider and select transportation as a career. This would require before and after studies. Such research would be very appropriate for evaluating new courses and course modules.

APPENDIX A
FACULTY INTERVIEWS

List of Interviewees

We interviewed civil engineering nine faculty members at different universities and asked them how their undergraduate curriculum is structured with regards to electives and student specializations and their opinions about how students chose specializations. These interviews were conducted either by phone or in person and lasted about 45 minutes each. The faculty interviewed were:

- Jan Botha, Department of Civil and Environmental Engineering, San José State University
- Donald P. Coduto, Civil Engineering Department, Cal Poly Pomona
- Michael Kyte, Department of Civil Engineering, University of Idaho
- David Levinson, Department of Civil Engineering, University of Minnesota
- Richard W. Lyles, Department of Civil and Environmental Engineering, Michigan State University
- Samer Madanat, Department of Civil and Environmental Engineering, University of California, Berkeley
- David McLean, Department of Civil & Environmental Engineering, Washington State University
- Essam Radwan, Civil and Environmental Engineering Department, University of Central Florida
- Nikiforos Stamatiadis, Department of Civil Engineering, University of Kentucky

Interview Questionnaire

Before we start, let me also go over the information about confidentiality that was in the email you received, to make sure you understand it and are comfortable with it.

- First, let me explain that this conversation is not being audio taped, but that I will take written notes as we talk.
- I also want to explain that we may include some or all of the information you provide in our report, and, where your comments are especially insightful, we may quote you and identify you by name. We will assume that your comments are on-the-record and that you agree to being quoted, unless you instruct us otherwise. If you wish to share any comments off-the-record, simply let me know, and we will treat that information confidentially. Is that acceptable?

- If we decide that we wish to quote you by name in the report, we will email you a draft of these sections of the report so that you can review them and make sure that we have not made any errors in reporting what you said. Is this acceptable?
- Finally, regardless of whether or not we quote you by name in the report, we plan to include your name and affiliation in an appendix to the report, which lists all our interviewees. Is that acceptable?

Let me begin by asking you a few questions about yourself.

How long have you been a faculty member with your current department?

What responsibilities do you have with regards to the undergraduate CE program?

What responsibilities do you have with regards to the masters program in transportation?

My first questions are going to focus on the undergraduate CEE program. Later, I'll ask about the graduate program in transportation engineering.

How early are students exposed to transportation engineering within curriculum?

[Describe how.]

[Do any of the early required courses include transportation examples, topics, etc.?]

[UCB: Are there Freshman/Sophomore seminar electives in transportation engineering?]

When during their program do students choose the specialization?

[How MANY students choose a specialization?]

How do you think students choose their specialization?

[Do students consult with an advisor before choosing a specialization? Does the department to provide written materials or workshops that help students pick among the specializations?]

What are the most popular specializations in your program?

[Why do you think these are so popular?]

About how many students in each year's graduating class specialize in transportation?

[And that's out of how many, total?]

Do most of them enter the program already determined to specialize in transportation or do they make that decision that while they're in the department?

Do many of your undergraduate students find jobs or internships in the transportation field while they are students?

Graduate program

Why do you think the students in your program are pursuing graduate work in transportation?

[What are they getting out of it?]

Do the students you admit usually have an undergrad degree that specialized in transportation engineering?

[Do they have a CE degree at all?]

Do they usually have work experience in transportation engineering prior to entering the masters program?

[How many of your students are new to the transportation field?]

How important is funding to attracting students to your graduate program?

[What share of the graduate students receive support and how much?]

[How does the level of support compare with other graduate students in engineering?]

[Does the funding come from general department or university budgets, from a special research institute with a transportation focus, or from individual research projects?]

What are the issues that the graduate students are most interested in studying?

[Follow-up prompts? Transportation and land use interactions, transportation modeling, reducing the environmental impacts of the transportation system, reducing traffic congestion, improving conditions for bikers and walkers, improving freight delivery options.]

We're interested in learning about programs and activities that aim to attract more students to the transportation field.

Has your department or individual faculty engaged in any activities to try to attract more students to the undergraduate specialty or the graduate program? If so, please tell me about them and how successful you thought they were.

[Career fairs, talks by transportation professionals, and so on]

[Questions below could be asked if they didn't come up above.]

Do your students participate in an ITE student chapter? [clarify grad vs. undergrad]

Do your students participate in an ITS America student chapter? [clarify grad vs. undergrad]

Do your students participate in any other transportation-related student groups?

[clarify graduate versus undergraduate students]

How do you think these programs have helped your transportation program?

[Do they help attract students to the specialty?]

Does your campus have a university transportation center? What role has it played in helping to recruit and support students in transportation?

Do you have any ideas that you haven't tried to attract more students to transportation?

If transportation employers such as the state department of transportation, consulting firms, or local transportation agencies wanted to do something to recruit students into the transportation field, what are the most effective things these employers could do?

Aside from what we've already talked about, what do you think are the factors that influence students' decision to specialize in or get a graduate degree in transportation?

[Follow-up prompts: personal interest in transportation issues, availability of scholarships, availability of research assistantships, internship opportunities, popularity of faculty teaching the transportation classes, awareness of number and pay rates of jobs in the transportation field.]

Do you have any final thoughts or comments on recruiting students into the transportation field?

Can you recommend other people in your department with whom I might want to speak?

Thank you very much for your time. I expect the draft report to be completed by August 2007, at which time I will email you any sections quoting you, so you can review them.

Also, I may follow up today's conversation with an email or telephone call to clarify some points.

And of course, please feel free to call or email me at any time if you have any questions or additional information you would like to share.

APPENDIX B
FOCUS GROUPS

Three student focus groups were conducted in winter 2007: one session with seven undergraduates civil engineering students at the University of California (UC), Berkeley, one session with six undergraduate civil engineering students at Portland State University, and one session with eleven graduate planning students at Portland State University. The focus group participants were recruited through flyers posted around campus and email sent to student lists. Students from all specializations within civil engineering or planning were encouraged to join. (The recruitment materials did not mention any particular interest in the transportation specialization.) As compensation, students received a meal and a cash payment of $15. The focus groups lasted 90 minutes and an assistant took notes.

Script for undergraduate civil engineering students at UC Berkeley and Portland State University

Introductions

Introduction to study:

- Researching how students in planning and engineering degree programs at universities choose specializations within those larger fields
- I'm working with [Jennifer Dill, a professor at Portland State, who got her Ph.D. at UC Berkeley, as I did OR Asha Weinstein, a professor at San José State University, who got her Ph.D. at UC Berkeley, as I did]
- Confidentiality: Your names will not be listed anywhere in the final report. When we finish our notes, we'll replace your names with fake ones.

Student introductions: Name, year in program

Non-transportation questions

Try to remember when you first heard about civil engineering as a profession. At that point in time, what did you think civil engineers did? *{trying to elicit first impressions of the career, for example, building bridges or traffic engineering, and so on.}*

UC Berkeley civil engineering students can take classes in various different specialties: hydrology, environmental engineering, structural engineering, transportation systems engineering, engineering project management, geotechnical & geoenvironmental engineering. I'm interested to learn what your impressions are of each of these specialties. I'll ask about each in turn.

{Prompts, if necessary: what people do with work in these areas, or what kind of people are likely to be good at these fields, or what the job prospects are in these fields}

First, let's start with hydrology. What are your impressions of this field of CE?

Now, let me ask about Environmental Engineering.

Now, let me ask about Structural Engineering.

Now, let me ask about Transportation Systems Engineering.

Now, let me ask about Engineering Project Management.

Now, let me ask about Geotechnical & Geoenvironmental Engineering.

While Berkeley's program does not have students choose a formal specialization, you do choose among different CE electives during your junior and senior years. So, you can decide to focus on one field by taking several electives offered in it. When choosing your electives, are you likely to focus on one specialty (e.g. transportation, water, structures), or take a class in each area so that you can be more of a "generalist"?

If you are focusing on a particular area within CE, what **information** did you use to make that decision? Or, if you're in the process of deciding, what sources of information are you using to help make that decision? *{prompts: web sites, books, career center, faculty, other students, and so on.}*

Follow-up questions:

- Have you asked faculty for help/advice? If so, what did they say or advise?
- Have you attended a career fair?
- Have you sought information at a campus career center?
- Talking to someone in field? Mentoring?

Have you had a job or internship in civil engineering? If so, what was the focus?

Are you involved in any civil engineering related student groups? *{Prompts: ASCE, ITE, ITS}*

If so, what activities have you done? *{listen for concrete canoe, steel bride, traffic bowl, others}*

- Have these activities influenced your decisions to focus on any one area within CE?

What would be the ideal job for you when you graduate?

- *Follow-up questions:* How important are these factors: Intellectual challenge, substantive topic/focus of work, money, location, interactions with public

Transportation-specific questions

Now I'm going to ask you some questions that focus more specifically on your impressions and interest in transportation systems engineering.

Freshman year you call took CE 92, Intro to Civil and Environmental Engineering. What did you learn about transportation engineering from that course?

- Did this exposure to transportation get you more or less interested in transportation as a career or focus within CE?

During your first two years in the program (Freshman and Sophomore), have any of your other CEE courses include transportation topics? *{Probe for examples, e.g. exercises, guest lectures, and so on.}*

- Did this exposure to transportation get you more or less interested in transportation as a career or focus within CE?

UC: How many of you have taken CE155, Transportation Systems Engineering? (raise hands or otherwise indicate who)

- For those of you who have not taken it, why not? Do you plan to take it?

PSU: During your junior year, you take CE315, the CEE Profession Seminar. What did you learn about transportation engineering from that course?

- Did this exposure to transportation get you more or less interested in transportation as a career or focus within CE?

PSU: How many of you have taken CE351, Transportation Systems? (raise hands or otherwise indicate who)

- How did this class effect your views of transportation as a focus within CEE?

How many of you plan to take the other transportation elective courses?

- Why or why not?

For those of you focusing on transportation what *specifically* about the field attracted you to it? *{Prompts: type of work you would do with this specialization, job opportunities, interest in the classes, and so on.}*

If you're focusing on something else, did you at some point consider transportation as a focus? Why or why not?

- Is there something about the field that you don't like?

{If this hasn't been brought up yet} What is the reputation of the transportation courses in your program? *{prompts: easy, challenging, interesting?}*

Transportation engineering is a field that tends to involve people more than some engineering fields. For one thing, human behavior is an important factor in engineering and design. (People drive cars, or cross at sidewalks.) Transportation also involves people big projects, such as designing new freeways or transit systems go through a lot of public comment. Do you find this these "people" aspects of the profession attractive? *{Why or why not?}*

For those of you who are not focused on transportation, when you start looking for a job after graduation, would you still apply to transportation engineering jobs? Why or why not?

What ideas do you have for encouraging more students to choose transportation as a specialization and career?

Script for Graduate Civil Engineering Students at UC Berkeley

Introductions

Introduction to study:

- Researching how students in planning and engineering degree programs at universities choose specializations within those larger fields
- I'm working with Jennifer Dill, a professor at Portland State, who get her Ph.D. at UC Berkeley, as I did.
- Confidentiality: Your names will not be listed anywhere in the final report. When we finish our notes, we'll replace your names with fake ones.

Student introductions: Name, year in program

Questions

What was your undergraduate degree? (engineering or something else?)

When you were doing your undergrad work, did you have an internship in engineering or a related field?

- What field?

When you were an undergrad, did you ever work on campus as a research assistant?

- For what kind of project?

Prior to entering the masters program here, did you work as engineer? How long? What type of engineering did you do?

- Did you work in the field of transportation? If so, what type of transportation work were you doing?

What motivated you to pursue the graduate degree?

Follow-up questions:

- Did you have a mentor as a professional or student? If so, did he/she influence your decision?
- Did you consider a graduate degree in another engineering discipline (besides transportation)?
- If so, what? What made you decide on transportation?

What was the first time you considered transportation as a career? What prompted that?

What do you like about the transportation field?

Are there things you don't like about the field?

Transportation engineering is a field that tends to involve people more than some engineering fields. The engineering work involves people directly, in that people drive cars and human behavior is an important factor in engineering and design. It also involves people through public involvement processes for large projects, such as designing new freeways or transit systems. Do you find this aspect of the profession attractive? *{Why or why not?}*

What role did funding play in your decision to attend graduate school? (for example, having a research assistantship, fellowship, etc.)

What do you think is the reputation of transportation engineers among other CE students?

What ideas do you have for encouraging more students to choose transportation as a specialization and career?

The focus group script for graduate planning students

Introductions

Introduction to study:

- Researching how students in planning and engineering degree programs at universities choose specializations within those larger fields
- I'm working with Asha Weinstein, a professor at San José State University.
- Confidentiality: Your names will not be listed anywhere in the final report. When we finish our notes, we'll replace your names with fake ones.

Student introductions: Name, year in program

Questions

When did you decide to get a masters degree in planning?

What motivated you to pursue the graduate degree?

Have you chosen a specialization? If so, what?

When did you make this decision?

What **information** are you using (did you use) to make that decision? (prompts: web sites, books, career center, faculty, other students, etc.)

Follow-up questions:

- Have you asked faculty for help/advice in choosing a specialization?
- Have you had a job or internship in civil engineering? If so, what was the focus?
- Are you involved in any planning related student groups? (Prompts: APA?) If so, what activities have you done?
- What is the reputation of the transportation courses in your program? (prompts: easy, challenging, interesting?
- What is the reputation of the transportation faculty in your program?
- Have you attended a career fair?
- Have you sought information at a campus career center?
- Talking to someone in field? Mentoring?

What **factors** were/are important to you in choosing a specialization? (Prompts: type of work you would do with this specialization, job opportunities, interest in the classes, etc.)

What are your impressions of what transportation planners do?

What would be the ideal job for you when you graduate?

Follow-up questions:

- How important are these factors: Intellectual challenge, substantive topic/focus of work, money, location, interactions with public

What ideas do you have for encouraging more students to choose transportation as a specialization and career?

APPENDIX C
CIVIL PLANNING STUDENT SURVEY

Civil Engineering Student Survey

1 Dear Civil Engineering student:

Participation in the survey is completely voluntary. Your answers will be confidential and will not be reported to your university or department. The results of this study may be published, but no information that could identify you will be included.

Before voluntarily deciding to participate in this survey, please review the information below. Clicking on the **I agree** button at the bottom of this page indicates your willingness to participate.

You may only complete the survey and enter the random drawing once.

If you have any questions about the survey either now or later, contact Dr. Asha Weinstein at asha.weinstein@sjsu.edu or 408-924-5853.

Thank you very much for your assistance.

Best regards,

Asha Weinstein
Assistant Professor
San José State University

1. You have been asked to participate in a study researching how students in planning and engineering degree programs at universities choose their specializations.

2. You will be asked to participate in an on-line survey that will take about 15 minutes to complete. You will be asked questions about what factors are important to you in choosing a career within civil engineering, as well as your impressions of different specializations within civil engineering.

3. There is no anticipated risk to you from participating in this project.

4. The anticipated direct benefits to you from participating in this project are (a) the extent to which you value contributing your knowledge and expertise to this research project, (b) the possibility that you might win one of the gifts given through a random drawing of all survey respondents who wish to participate in the drawing.

5. The results of this study may be published, but no information that could identify you will be included.

6. You will not be compensated in any way for your participation in this research.

7. Questions about this research may be addressed to Asha Weinstein at 408-924-5853. Complaints about the research may be presented to Michael Pogodzinski, Acting Chair, Department of Urban and Regional Planning, SJSU, at 408-924-5421. Questions about a research subjects' rights or research-related injury may be presented to Pamela Stacks, Ph.D., Associate Vice President, Graduate Studies and Research, SJSU, at 408-924-2480.

8. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to "not participate" in the study.

9. Your consent is being given voluntarily. You may refuse to participate in the

entire survey or in any part of the survey. You have the right to not answer questions you do not wish to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with San José State University or with any other participating institutions or agencies.

- I agree
- I do not wish to take this survey

SUBMIT

Survey Page 1

Civil Engineering Student Survey

First, we have some questions about you as a student.

2 **Are you currently an undergraduate student majoring in Civil Engineering?**

- Yes
- No, but I'm an undergraduate and intend to declare Civil Engineering as my major
- No, I'm an undergraduate student majoring in something else
- No, I'm a graduate student

3 **What university do you currently attend?**

4 If you chose Other, please list your university here:

5 **When do you expect to graduate?** *Please choose the answer that best fits.*

- Spring or Summer 2007
- 2007-08 academic year
- 2008-09 academic year
- 2009-10 academic year
- 2010-11 academic year or later

6 **Are you currently attending the university part-time or full-time?**

- Part-time
- Full-time

SUBMIT

Survey Page 2

Civil Engineering Student Survey

7 Many civil engineers work primarily in a specialized sub-field of civil engineering. Common specialties include Construction/Project Management, Environmental, Geotechnical, Hydraulics/Hydrology, Materials, Structural, and Transportation.

How familiar you are with what engineers do in each of the following specialties?

	1 Not at all familiar	2 Somewhat familiar	3 Very familiar
Construction/Project Management	1	2	3
Environmental	1	2	3
Geotechnical	1	2	3
Hydraulics/Hydrology	1	2	3
Materials	1	2	3
Structural	1	2	3
Transportation	1	2	3

8 **Does your civil engineering program *require* you to select a formal specialization or focus area?**

- Yes
- No
- Don't know

Civil Engineering Student Survey

9 If your program does not ***require*** you to specialize, can you ***choose*** to specialize informally by taking several electives in one of the civil engineering subfields?

- Yes
- No
- Don't know

SUBMIT

Survey Page 4

Civil Engineering Student Survey

10 **How likely are you to choose each of the following specializations for your future career?**

Please answer for every specialization.

	1 Very unlikely	2 Somewhat unlikely	3 Somewhat likely	4 Very likely	Not available at my school
Construction/Project Management	1	2	3	4	
Environmental	1	2	3	4	
Geotechnical	1	2	3	4	
Hydraulics/Hydrology	1	2	3	4	
Materials	1	2	3	4	
Structural	1	2	3	4	
Transportation	1	2	3	4	

Civil Engineering Student Survey

11 Even though you cannot specialize in a sub-discipline of civil engineering while in school, have you identified the specialty that you hope to work in when you graduate?

- Yes
- No, I intend to be a generalist
- No, I have not decided

SUBMIT

Survey Page 6

Civil Engineering Student Survey

12 Have you chosen a specialization yet?

YES NO

SUBMIT

Survey Page 7

Civil Engineering Student Survey

13 What is your chosen specialization? *Please choose just one.*

- Construction/Project Management
- Environmental
- Geotechnical
- Hydraulics/Hydrology
- Materials
- Structural
- Transportation
- Other

Civil Engineering Student Survey

14 You chose "Other." Please list your chosen specialization.

SUBMIT

Survey Page 9

Civil Engineering Student Survey

15 **How likely are you to choose each of the following specializations?**

	1 Very unlikely	2 Somewhat unlikely	3 Somewhat likely	4 Very likely	Not available at my school
Construction/Project Management	1	2	3	4	
Environmental	1	2	3	4	
Geotechnical	1	2	3	4	
Hydraulics/Hydrology	1	2	3	4	
Materials	1	2	3	4	
Structural	1	2	3	4	
Transportation	1	2	3	4	
None of the above - I want to be a generalist	1	2	3	4	

Civil Engineering Student Survey

16 How sure are you that you will finish your degree focusing on this specialization?

- Very sure
- Somewhat sure
- Somewhat unsure
- Very unsure

SUBMIT

Survey Page 11

Civil Engineering Student Survey

17 When did you decide to specialize in this field?

- Before I came to college
- After I started college

SUBMIT

Survey Page 12

Civil Engineering Student Survey

18 **How important for you were the following factors in choosing your specialization?**

1 Not at all important	2	3	4	5 Very Important	6 Don't know
What I learned about the specialization from classes I have already taken	1	2	3	4	5	6
The teaching quality of the faculty who teach within the specialization						

1 2 3 4 5 6

The professional reputation of the faculty who teach within the specialization

1 2 3 4 5 6

The availability of classes within the specialization (e.g. the times of the day/week they are offered, or whether they have space for me)

1 2 3 4 5 6

Availability of scholarships or other financial support for students in the specialization

1 2 3 4 5 6

Availability of research assistantships working with faculty in the specialization

1 2 3 4 5 6

19 How important for you were the following factors in choosing your specialization?

1 Not at all important	2	3	4	5 Very important	6 Don't know

The likelihood of getting a job in the specialization

1 2 3 4 5 6

The salary I will likely earn in this specialization

1 2 3 4 5 6

Job security and stability for people working in the specialization

1 2 3 4 5 6

The potential for upward mobility for people working in the specialization

1 2 3 4 5 6

The likelihood of me being accepted by other people working in the field

1 2 3 4 5 6

The likelihood that a job in my specialization will fit well with my family responsibilities

1 2 3 4 5 6

The type of work environments for people in the specialization

1 2 3 4 5 6

The contribution the specialization makes to improving the quality of life in cities and towns

1 2 3 4 5 6

The contribution the specialization makes to improving the natural environment

1 2 3 4 5 6

Being able to work in a field where I get to be involved in public policy decisions

1 2 3 4 5 6

20 Please describe any other important factors that helped you to choose your specialization.

SUBMIT

Survey Page 13

Civil Engineering Student Survey

21 **Please indicate whether you agree or disagree with the following statements.**

1 Strongly disagree	2	3	4	5 Strongly agree	6 Don't know

My chosen specialization is a strength of my school's engineering department

1 2 3 4 5 6

The faculty teaching the classes in my chosen specialization are excellent teachers

1 2 3 4 5 6

The faculty teaching the classes in my chosen specialization are doing interesting research

1 2 3 4 5 6

The classes in my chosen specialization are challenging

1 2 3 4 5 6

The classes in my chosen specialization are interesting

1 2 3 4 5 6

My chosen specialization will allow me to use skills at which I excel

1 2 3 4 5 6

There are scholarships targeted at students in my chosen specialization

1 2 3 4 5 6

There are good internships for students in my chosen specialization

1 2 3 4 5 6

22 Please indicate whether you agree or disagree with the following statements.

1 Strongly disagree	2	3	4	5 Strongly agree	6 Don't know

Working in my specialization involves helping and serving others through personal interaction

1 2 3 4 5 6

Working in my specialization involves machines, tools, and materials

1 2 3 4 5 6

Working in my specialization involves exploring, understanding, and predicting natural or social phenomena

1 2 3 4 5 6

Working in my specialization involves analyzing data to solve problems

1 2 3 4 5 6

Working in my specialization involves leading and persuading others

1 2 3 4 5 6

Working in my specialization involves creating and using new knowledge.

1 2 3 4 5 6

A career in my specialization is prestigious

1 2 3 4 5 6

It will be easy to get a job in my chosen specialization after I graduate

1 2 3 4 5 6

My specialization seems open to women

1 2 3 4 5 6

My specialization seems open to people of color

1 2 3 4 5 6

I am like other people who have chosen this specialization

1 2 3 4 5 6

There is a common identity among people working in my chosen specialization

1 2 3 4 5 6

SUBMIT

Survey Page 14

Civil Engineering Student Survey

Now we would like to know about the sources of information you may have used to help you decide on your specialization.

23 Before I started college, I learned about the specialization from someone that I knew who worked in that field

Did not help at all				Very helpful	Before I started college, I did not know anyone who worked in my specialization	Don't know
1	2	3	4	5	6	7

24 Someone working in my chosen specialization who spoke as a guest in one of my classes or at an event I attended

Did not help at all				Very helpful	Nobody from my chosen specialization spoke in one of my classes or at an event	
1	2	3	4	5	6	7

25 Speaking with a faculty member for advice on choosing a specialization

Did not help at all				Very helpful	I did not speak with a faculty member	Don't know

1 2 3 4 5 6 7

26 Speaking with someone at my university's career center or a career counselor

Did not help at all — Very helpful — I did not speak with a career counselor — Don't know

1 2 3 4 5 6 7

27 Attending a career fair organized at my university

Did not help at all — Very helpful — I did not attend a career fair — Don't know

1 2 3 4 5 6 7

28 A class I took in my chosen specialization

Did not help at all — Very helpful — I did not take a class in my specialization — Don't know

1 2 3 4 5 6 7

29 An internship or job within my chosen specialization

Did not help at all — Very helpful — I did not have a job or internship in my specialization — Don't know

1 2 3 4 5 6 7

30 Information I read on the web about my chosen specialization

Did not help at all — Very helpful — I did not read about my specialization on the web — Don't know

1 2 3 4 5 6 7

31 Books or magazines I read about my chosen specialization

Did not help at all				Very helpful	I didn't read books/magazines about my specialization	Don't know
1	2	3	4	5	6	7

32 If you found reading books, magazines, or websites helpful, what were the most useful things you read?

33 Were there other sources of information, not mentioned above, that influenced your specialization decision

Civil Engineering Student Survey

We have a few questions about activities and groups at your school.

34 There is an ITE student chapter active on my campus.

- Yes
- No
- Don't know

35 I have participated in event organzied by the ITE student chapter on my campus.

- Yes
- No
- Don't know
- Not applicable. There is no ITE chapter on campus.

36 I have participated in a Concrete Canoe or Steel Bridge competition.

- Yes
- No
- Don't know

37 Students on campus have participated in a Traffic Bowl competition.

- Yes
- No
- Don't know

38 I have participated in a Traffic Bowl competition.

- Yes
- No
- Don't know

Civil Engineering Student Survey

Now we would like to learn what you think about the field of transportation engineering.

39 **Please indicate whether you agree or disagree with the following statements.**

1 Strongly disagree	2	3	4	5 Strongly agree	6 Don't know

Transportation engineering is a strength of my school's engineering department

1 2 3 4 5 6

The faculty teaching transportation classes are excellent teachers

1 2 3 4 5 6

The faculty teaching transportation classes are doing interesting research

1 2 3 4 5 6

Transportation engineering classes are challenging

1 2 3 4 5 6

Transportation engineering classes are interesting

1 2 3 4 5 6

Transportation engineering uses skills at which I excel

1 2 3 4 5 6

There are scholarships targeted at transportation engineering students

1 2 3 4 5 6

There are good internships for students in transportation engineering

1 2 3 4 5 6

40 **Please indicate whether you agree or disagree with the following statements.**

1 Strongly disagree	2	3	4	5 Strongly agree	6 Don't know

Before I started college, I knew what transportation engineers do

1 2 3 4 5 6

Working in transportation engineering involves helping and serving others through personal interaction

1 2 3 4 5 6

Working in transportation engineering involves machines, tools, and materials

1 2 3 4 5 6

Working in transportation engineering involves exploring, understanding, and predicting natural or social phenomena

1 2 3 4 5 6

Working in transportation engineering involves analyzing data to solve problems

1 2 3 4 5 6

Working in transportation engineering involves leading and persuading others

1 2 3 4 5 6

Working in transportation engineering involves creating and using new knowledge.

1 2 3 4 5 6

A career in transportation engineering is prestigious

1 2 3 4 5 6

It would be easy to get a job in transportation engineering

1 2 3 4 5 6

Transportation engineering seems open to women

1 2 3 4 5 6

Transportation engineering seems open to people of color

1 2 3 4 5 6

Most transportation engineers work in public agencies

1 2 3 4 5 6

I am like other people who work in transportation engineering

1 2 3 4 5 6

There is a common identity among people working in transportation engineering

1 2 3 4 5 6

41 **Please list up to three things that you think transportation engineers do.**

1.
2.
3.

Civil Engineering Student Survey

Now we would like to know more generally what is important to you in your career and work.

42 **How important is it to you to have an occupation that allows you to:**

	1 Not at all important	2	3	4	5 Very important
Help, teach, counsel, or serve others through personal interaction	1	2	3	4	5
Explore, understand and predict natural and social phenomena	1	2	3	4	5
Lead and persuade others to attain personal or organizational goals	1	2	3	4	5
Work with machines, tools, and materials	1	2	3	4	5
Create and use new knowledge	1	2	3	4	5
Analyze data to solve problems	1	2	3	4	5

43 **How important is it to you to have a job where your work will:**

	1 Not at all important	2	3	4	5 Very important
Improve the quality of life in cities and towns	1	2	3	4	5
Protect the natural environment	1	2	3	4	5
Develop or acquire new knowledge	1	2	3	4	5
Contribute to the creation of large physical structures	1	2	3	4	5

44 **After you graduate, how interested would you be to work for:**

	1 Not at all interested	2	3	4	5 Very interested
A government agency	1	2	3	4	5
A private company	1	2	3	4	5
A non-profit organization	1	2	3	4	5

45 **After you graduate, how important is it to you to get a job that:**

	1 Not at all important	2	3	4	5 Very important
Is prestigious	1	2	3	4	5
Is flexible so that you can pursue other activities (e.g. travel or hobbies)	1	2	3	4	5
Fits with your family responsibilities	1	2	3	4	5

SUBMIT

Survey Page 18

Civil Engineering Student Survey

Finally, we have a few questions about you.

46 What is your gender?

- Female
- Male

47 What is your age? *Please enter the number, e.g. 22.*

48 What is your ethnicity or race? *Check all that apply.*

- ☐ African American
- ☐ Asian
- ☐ Hispanic
- ☐ Native American
- ☐ Pacific Islander
- ☐ White
- ☐ Other, please specify

49 Are you currently married or living in a domestic partnership?

YES NO

50 Do you currently have children 18 or under living with you?

YES NO

SUBMIT

Survey Page 19

Civil Engineering Student Survey

51 How sure are you that you will finish your degree focusing on this specialization?

- ☐ Very sure
- ☐ Somewhat sure
- ☐ Somewhat unsure
- ☐ Very unsure

52 When did you decide to specialize in this field?

- Before I came to college
- After I started college

SUBMIT

Survey Page 21

Civil Engineering Student Survey

53 **How important for you were the following factors in choosing your specialization?**

	1 Not at all important	2	3	4	5 Very Important	6 Don't know
What I learned about the specialization from classes I have already taken	1	2	3	4	5	6
The teaching quality of the faculty who teach within the specialization	1	2	3	4	5	6
The professional reputation of the faculty who teach within the specialization	1	2	3	4	5	6
The availability of classes within the specialization (e.g. the times of the day/week they are offered, or whether they have space for me)	1	2	3	4	5	6
Availability of scholarships or other financial support for students in the specialization	1	2	3	4	5	6
Availability of research assistantships working with faculty in the specialization	1	2	3	4	5	6

54 **How important for you were the following factors in choosing your specialization?**

	1 Not at all important	2	3	4	5 Very important	6 Don't know
The likelihood of getting a job in the specialization	1	2	3	4	5	6
The salary I will likely earn in this specialization						

1 2 3 4 5 6

Job security and stability for people working in the specialization

1 2 3 4 5 6

The potential for upward mobility for people working in the specialization

1 2 3 4 5 6

The likelihood of me being accepted by other people working in the field

1 2 3 4 5 6

The likelihood that a job in my specialization will fit well with my family responsibilities

1 2 3 4 5 6

The type of work environments for people in the specialization

1 2 3 4 5 6

The contribution the specialization makes to improving the quality of life in cities and towns

1 2 3 4 5 6

The contribution the specialization makes to improving the natural environment

1 2 3 4 5 6

Being able to work in a field where I get to be involved in public policy decisions

1 2 3 4 5 6

55 Please describe any other important factors that helped you to choose your specialization.

Civil Engineering Student Survey

56 **Please indicate whether you agree or disagree with the following statements.**

1 Strongly disagree	2	3	4	5 Strongly agree	6 Don't know

My chosen specialization is a strength of my school's engineering department

1 2 3 4 5 6

The faculty teaching the classes in my chosen specialization are excellent teachers

1 2 3 4 5 6

The faculty teaching the classes in my chosen specialization are doing interesting research

1 2 3 4 5 6

The classes in my chosen specialization are challenging

1 2 3 4 5 6

The classes in my chosen specialization are interesting

1 2 3 4 5 6

My chosen specialization will allow me to use skills at which I excel

1 2 3 4 5 6

There are scholarships targeted at students in my chosen specialization

1 2 3 4 5 6

There are good internships for students in my chosen specialization

1 2 3 4 5 6

57 **Please indicate whether you agree or disagree with the following statements.**

1 Strongly disagree	2	3	4	5 Strongly agree	6 Don't know

Working in my specialization involves helping and serving others through personal interaction

1 2 3 4 5 6

Working in my specialization involves machines, tools, and materials

1 2 3 4 5 6

Working in my specialization involves exploring, understanding, and predicting natural or social phenomena

1 2 3 4 5 6

Working in my specialization involves analyzing data to solve problems

1 2 3 4 5 6

Working in my specialization involves leading and persuading others

1 2 3 4 5 6

Working in my specialization involves creating and using new knowledge.

1 2 3 4 5 6

A career in my specialization is prestigious

1 2 3 4 5 6

It will be easy to get a job in my chosen specialization after I graduate

1 2 3 4 5 6

My specialization seems open to women

1 2 3 4 5 6

My specialization seems open to people of color

1 2 3 4 5 6

I am like other people who have chosen this specialization

1 2 3 4 5 6

There is a common identity among people working in my chosen specialization

1 2 3 4 5 6

SUBMIT

Survey Page 23

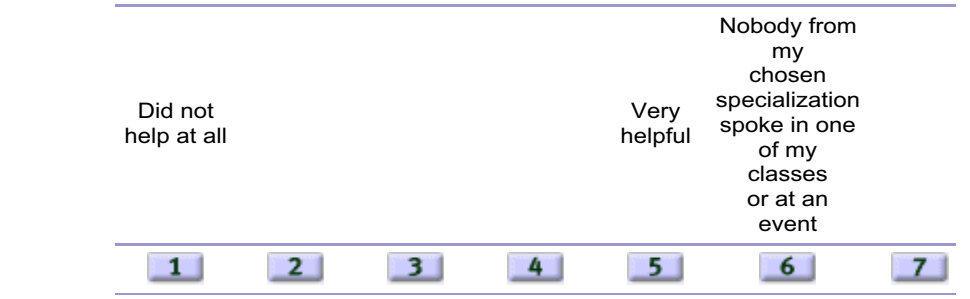
Civil Engineering Student Survey

Now we would like to know about the sources of information you may have used to help you decide on your specialization.

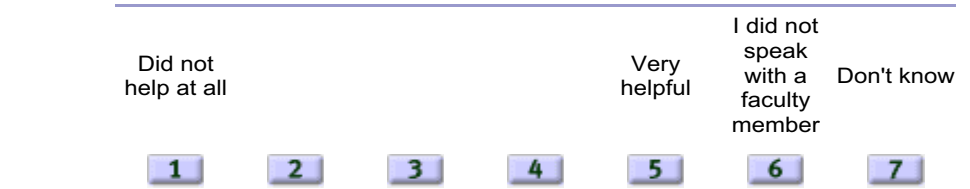
58 Before I started college, I learned about the specialization from someone that I knew who worked in that field

Did not help at all					Very helpful	Before I started college, I did not know	Don't know

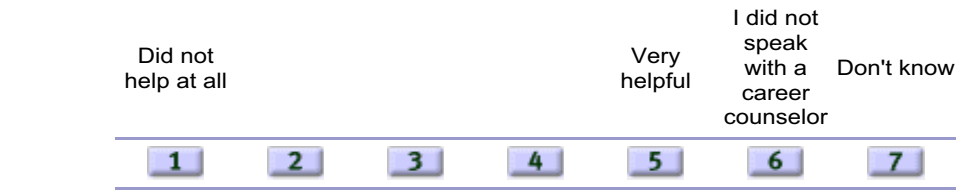
59 Someone working in my chosen specialization who spoke as a guest in one of my classes or at an event I attended



60 Speaking with a faculty member for advice on choosing a specialization

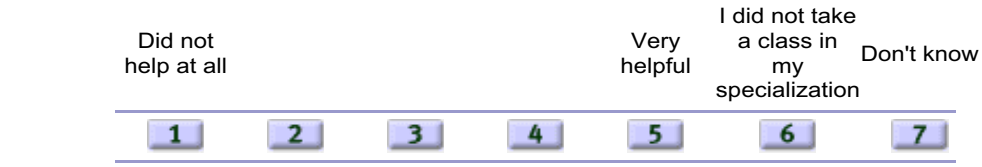


61 Speaking with someone at my university's career center or a career counselor

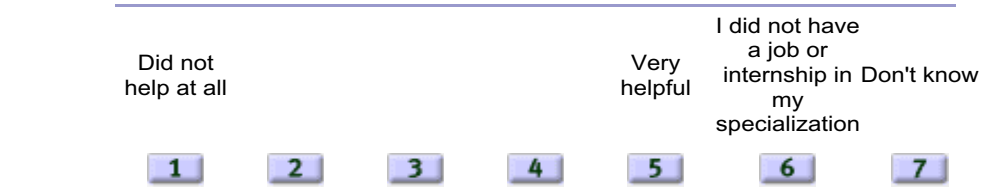


62 Attending a career fair organized at my university

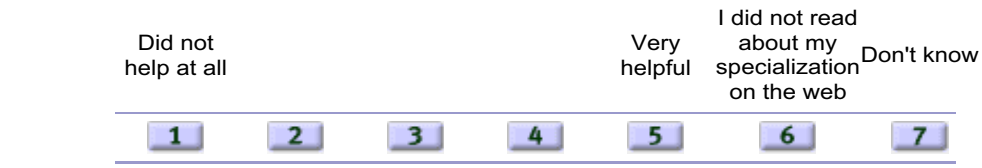
63 A class I took in my chosen specialization



64 An internship or job within my chosen specialization



65 Information I read on the web about my chosen specialization



66 Books or magazines I read about my chosen specialization

67 If you found reading books, magazines, or websites helpful, what were the most useful things you read?

68 Were there other sources of information, not mentioned above, that influenced your specialization decision

SUBMIT

Survey Page 24

Civil Engineering Student Survey

We have a few questions about activities and groups at your school.

69 There is an ITE student chapter active on my campus.

- Yes
- No
- Don't know

70 I have participated in event organzied by the ITE student chapter on my campus.

- Yes
- No
- Don't know
- Not applicable. There is no ITE chapter on campus.

71 I have participated in a Concrete Canoe or Steel Bridge competition.

- Yes
- No
- Don't know

72 Students on campus have participated in a Traffic Bowl competition.

- Yes
- No
- Don't know

73 I have participated in a Traffic Bowl competition.

- Yes
- No
- Don't know

SUBMIT

Survey Page 25

Civil Engineering Student Survey

Now we would like to know more generally what is important to you in your career and work.

74 **How important is it to you to have an occupation that allows you to:**

	1 Not at all important	2	3	4	5 Very important
Help, teach, counsel, or serve others through personal interaction	1	2	3	4	5
Explore, understand and predict natural and social phenomena	1	2	3	4	5
Lead and persuade others to attain personal or organizational goals	1	2	3	4	5
Work with machines, tools, and materials	1	2	3	4	5
Create and use new knowledge	1	2	3	4	5
Analyze data to solve problems	1	2	3	4	5

75 **How important is it to you to have a job where your work will:**

	1 Not at all important	2	3	4	5 Very important
Improve the quality of life in cities and towns	1	2	3	4	5
Protect the natural environment	1	2	3	4	5
Develop or acquire new knowledge	1	2	3	4	5
Contribute to the creation of large physical structures	1	2	3	4	5

76 **After you graduate, how interested would you be to work for:**

	1 Not at all interested	2	3	4	5 Very interested
A government agency	1	2	3	4	5
A private company	1	2	3	4	5
A non-profit organization					

1 2 3 4 5

77 **After you graduate, how important is it to you to get a job that:**

	1 Not at all important	2	3	4	5 Very important
Is prestigious	1	2	3	4	5
Is flexible so that you can pursue other activities (e.g. travel or hobbies)	1	2	3	4	5
Fits with your family responsibilities	1	2	3	4	5

SUBMIT

Survey Page 26

Civil Engineering Student Survey

Finally, we have a few questions about you.

78 What is your gender?

- Female
- Male

79 What is your age? *Please enter the number, e.g. 22.*

80 What is your ethnicity or race? *Check all that apply.*

- African American
- Asian
- Hispanic
- Native American
- Pacific Islander
- White
- Other, please specify

81 Are you currently married or living in a domestic partnership?

YES NO

82 Do you currently have children 18 or under living with you?

YES NO

SUBMIT

Survey Page 27

Civil Engineering Student Survey

83 Is there anything else you would like to tell us?

84 **We appreciate the time you have taken to answer this survey.**

You may now enter your name in a drawing for one of four gift certificates to Amazon.com: one for $300 and three for $100.

Your name and email will *not* be associated with your responses to the survey questions.

Name

email address

APPENDIX D
CIVIL ENGINEERING STUDENT SURVEY

Planning Student Survey

1 Dear planning graduate student:

Participation in the survey is completely voluntary. Your answers will be confidential and will not be reported to your university or department. The results of this study may be published, but no information that could identify you will be included.

Before voluntarily deciding to participate in this survey, please review the information below. Clicking on the **I agree** button at the bottom of this page indicates your willingness to participate.

You may only complete the survey and enter the random drawing once.

If you have any questions about the survey either now or later, contact Dr. Asha Weinstein Agrawal at asha.weinstein.agrawal@sjsu.edu or 408-924-5853.

Thank you very much for your assistance.

Best regards,

Asha Weinstein Agrawal
Assistant Professor
San JosÃ© State University

1. You have been asked to participate in a study researching how students in planning and engineering degree programs at universities choose their specializations.

2. You will be asked to participate in an on-line survey that will take about 15 minutes to complete. You will be asked questions about what factors are important to you in choosing a career within planning, as well as your impressions of different specializations within planning.

3. There is no anticipated risk to you from participating in this project.

4. The anticipated direct benefits to you from participating in this project are (a) the extent to which you value contributing your knowledge and expertise to this research project, (b) the possibility that you might win one of the gifts given through a random drawing of all survey respondents who wish to participate in the drawing.

5. The results of this study may be published, but no information that could identify you will be included.

6. You will not be compensated in any way for your participation in this research.

7. Questions about this research may be addressed to Asha Weinstein Agrawal at 408-924-5853. Complaints about the research and questions about a research subjectsâ€™ rights or research-related injury may be presented to Pamela Stacks, Ph.D., Associate Vice President, Graduate Studies and Research, SJSU, at 408-924-2480.

8. No service of any kind, to which you are otherwise entitled, will be lost or jeopardized if you choose to â€œnot participateâ€ in the study.

9. Your consent is being given voluntarily. You may refuse to participate in the entire survey or in any part of the survey. You have the right to not answer

questions you do not wish to answer. If you decide to participate in the study, you are free to withdraw at any time without any negative effect on your relations with San JosÃ© State University or with any other participating institutions or agencies.

- I agree
- I do not wish to take this survey

SUBMIT

Survey Page 1

Planning Student Survey

First, we have some questions about you as a student.

2 **Are you currently a masters-level graduate student in urban, regional, or city planning?**

- Yes
- No, Iâ€™m a graduate student in another field
- No, Iâ€™m an undergraduate or PhD student
- I don't fit in any of these categories

3 **What university do you currently attend?**

4 **If you chose Other, please list your university here:**

5 **When do you expect to graduate?** Please choose the answer that best fits.

- 2007-08 academic year (through summer 2008)
- 2008-09 academic year
- 2009-10 academic year or later

6 **Are you currently attending the university part-time or full-time?**

- Part-time
- Full-time

SUBMIT

Survey Page 2

Planning Student Survey

7 Many planners work primarily in a specialized sub-field of planning. Common specialties include land use, environmental planning, economic development, housing, and transportation.

How familiar are you with what planners do in each of the following specialties?

	1 Not at all familiar	2 Somewhat familiar	3 Very familiar
Community development	1	2	3
Economic development	1	2	3
Environmental planning	1	2	3
Health planning	1	2	3
Historic preservation	1	2	3
Housing	1	2	3
International development	1	2	3
Land use	1	2	3
Regional planning	1	2	3
Technology/GIS	1	2	3
Transportation	1	2	3

Urban design

1 2 3

SUBMIT

Survey Page 3

Planning Student Survey

8 Does your planning program *require* you to select a formal specialization or focus area?

- Yes
- No
- Don't know

SUBMIT

Survey Page 4

Planning Student Survey

9 If your program does not ***require*** you to specialize, can you ***choose*** to specialize informally by taking several electives in one of the planning subfields?

- Yes
- No
- Don't know

SUBMIT

Survey Page 5

Planning Student Survey

10 Even though you cannot specialize in a sub-discipline of planning while in school, have you identified the specialty that you hope to work in when you graduate?

- Yes
- No, I intend to be a generalist

- No, I have not decided

SUBMIT

Survey Page 6

Planning Student Survey

11 **Have you chosen a specialization yet?**

YES NO

SUBMIT

Survey Page 7

Planning Student Survey

12 **What is your chosen specialization?** Please choose just one.

- Economic development
- Environmental planning
- Health
- Historic preservation
- Housing and/or community development
- International development
- Land use
- Regional planning
- Technology/GIS
- Transportation
- Urban design
- General
- Other

13 **You chose "Other." Please list your chosen specialization.**

SUBMIT

Survey Page 9

Planning Student Survey

14 **How likely are you to choose each of the following specializations?**

	1 Very unlikely	2 Somewhat unlikely	3 Somewhat likely	4 Very likely	Not available at my school
Economic development	1	2	3	4	
Environmental planning	1	2	3	4	
Health	1	2	3	4	
Historic preservation	1	2	3	4	
Housing and/or community development	1	2	3	4	
International development	1	2	3	4	
Land use	1	2	3	4	
Regional planning	1	2	3	4	
Technology/GIS	1	2	3	4	
Transportation	1	2	3	4	
Urban design	1	2	3	4	
None of the above - I want to be a generalist	1	2	3	4	

Planning Student Survey

15 How sure are you that you will finish your degree focusing on this specialization?

- Very sure
- Somewhat sure
- Somewhat unsure
- Very unsure

SUBMIT

Survey Page 11

Planning Student Survey

16 When did you decide to specialize in this field?

- Before I started my undergraduate degree
- While I was an undergraduate student
- After I finished my undergraduate degree, but before I joined my current masters in planning program
- While I was a student in this masters program

SUBMIT

Survey Page 12

Planning Student Survey

17 How important were the following factors in helping you to decide on your specialization?

1 Not at all important	2	3	4	5 Very Important	Don't know

What I learned about the specialization from working in a job in that specialization

1 2 3 4 5

What I learned about the specialization from classes I have taken in the masters program

1 2 3 4 5

What I learned about the specialization from classes I took in my undergraduate program

1 2 3 4 5

The teaching quality of the faculty who teach within the specialization in my masters program

1 2 3 4 5

The professional/academic reputation of the faculty who teach within the specialization in my masters program

1 2 3 4 5

How well the times and/or day of week that classes in the specialization fit with my personal or work schedule (for my masters program)

1 2 3 4 5

Availability in my masters program of scholarships or other financial support for students in the specialization

1 2 3 4 5

Availability in my masters program of internships for students in the specialization

1 2 3 4 5

Availability in my masters program of research assistantships working with faculty in the specialization

1 2 3 4 5

Things I observed or learned while traveling or living outside the U.S.

1 2 3 4 5

18 How important were the following factors in helping you to decide on your specialization?

1 Not at all important	2	3	4	5 Very important	Don't know

The likelihood of getting a job in the specialization

1 2 3 4 5

The salary I will likely earn in this specialization

1 2 3 4 5

Job security and stability for people working in the specialization

1 2 3 4 5

The potential for upward mobility for people working in the specialization

1 2 3 4 5

The likelihood of me being accepted by other people working in the field

1 2 3 4 5

The likelihood that a job in my specialization will fit well with my family responsibilities

1 2 3 4 5

The type of work environments for people in the specialization

1 2 3 4 5

The contribution the specialization makes to improving the quality of life in cities and towns

1 2 3 4 5

The contribution the specialization makes to improving the natural environment

1 2 3 4 5

The contribution the specialization makes to improving the quality of life for disadvantaged populations

1 2 3 4 5

Being able to work directly with residents and members of the community

1 2 3 4 5

Being able to plan at the neighborhood level

1 2 3 4 5

Being able to plan at the city or regional level

1 2 3 4 5

Being able to plan at a state or national level

1 2 3 4 5

Being able to plan at an international level

1 2 3 4 5

19 **Please describe any other important factors that helped you to decide on your specialization.**

Planning Student Survey

20 Please indicate whether you agree or disagree with the following statements.

1 Strongly disagree	2	3	4	5 Strongly agree	Don't know
My chosen specialization is a strength of my schoolâ€™s planning department	1	2	3	4	5	
The faculty teaching the classes in my chosen specialization are excellent teachers	1	2	3	4	5	
The faculty teaching the classes in my chosen specialization are doing interesting research and/or projects	1	2	3	4	5	
The classes in my chosen specialization are challenging	1	2	3	4	5	
The classes in my chosen specialization are interesting	1	2	3	4	5	
My chosen specialization will allow me to use skills at which I excel	1	2	3	4	5	

There are scholarships targeted at students in my chosen specialization

1 2 3 4 5

There are good internships for students in my chosen specialization

1 2 3 4 5

21 Please indicate whether you agree or disagree with the following statements.

1 Strongly disagree	2	3	4	5 Strongly agree	Don't know

Working in my specialization involves helping and serving others through personal interaction

1 2 3 4 5

Working in my specialization involves exploring, understanding, and predicting natural or social phenomena

1 2 3 4 5

Working in my specialization involves analyzing data to solve problems

1 2 3 4 5

Working in my specialization involves leading and persuading others

1 2 3 4 5

Working in my specialization involves creating and using new knowledge.

1 2 3 4 5

People working in my specialization have to use quantitative methods a lot

1 2 3 4 5

My specialization is multi-disciplinary

1 2 3 4 5

My specialization is broad, not narrow

1 2 3 4 5

A career in my specialization is prestigious

1 2 3 4 5

It will be easy to get a job in my chosen specialization after I graduate

1 2 3 4 5

People working in my specialization often work alone, rather than in teams

1 2 3 4 5

My specialization seems open to women

1 2 3 4 5

My specialization seems open to people of color

1 2 3 4 5

I get along well with other students in my specialization

1 2 3 4 5

I am like other people who have chosen this specialization

1 2 3 4 5

There is a common identity among people working in my chosen specialization

1 2 3 4 5

Students choosing my specialization could easily get a planning job outside of that specialization

1 2 3 4 5

SUBMIT

Survey Page 14

Planning Student Survey

Now we would like to know if the following sources of information helped you decide on your specialization.

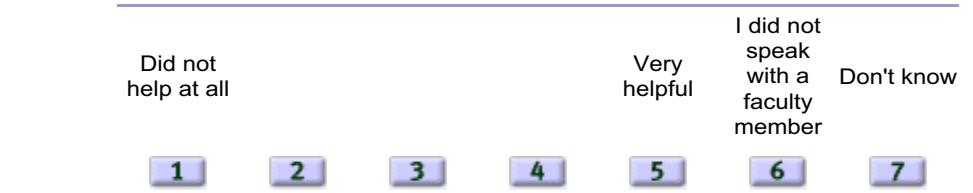
22 Before I started graduate school, I learned about the specialization from someone that I knew who worked in that field

Did not help at all				Very helpful	Before I started grad school, I did not know anyone who worked in my specialization	Don't know
1	2	3	4	5	6	7

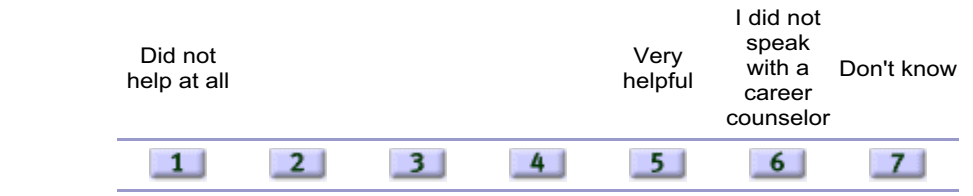
23 Someone working in my chosen specialization who spoke as a guest in one of my classes or at an event I attended

Did not help at all				Very helpful	Nobody from my chosen specialization spoke in one of my classes	Don't know

24 Speaking with a faculty member for advice on choosing a specialization



25 Speaking with someone at my universityâ€™s career center or a career counselor



26 Attending a career fair organized at my university

27 A class I took in my chosen specialization while in graduate school

28 A class I took in my chosen specialization before graduate school

1 2 3 4 5 6 7

29 An internship or job within my chosen specialization

Did not help at all | Very helpful | I did not have a job or internship in my specialization | Don't know

1 2 3 4 5 6 7

30 Information I read on the web about my chosen specialization

Did not help at all | Very helpful | I did not read about my specialization on the web | Don't know

1 2 3 4 5 6 7

31 Books or magazines I read about my chosen specialization

Did not help at all | Very helpful | I didn't read books/magazines about my specialization | Don't know

1 2 3 4 5 6 7

32 If you found reading books, magazines, or websites helpful, what were the most useful things you read?

33 Were there other sources of information, not mentioned above, that influenced your specialization decision?

SUBMIT

Survey Page 15

Planning Student Survey

We have a few questions about activities at your school.

34 **My department/program organizes a mentorship program that matches up students with professional planners.**

- Yes
- No
- Don't know

35 **I have participated in a mentorship program involving professional planners that is organized by my department/program.**

- Yes
- No
- Don't know

36 **My program requires me to complete an internship before graduating.**

- Yes
- No
- Don't know

SUBMIT

Survey Page 16

Planning Student Survey

Now we would like to know more generally what is important to you in your career and work.

37 **How important is it to you to have an occupation that allows you to:**

	1 Not at all important	2	3	4	5 Very important
Help, teach, counsel, or serve others through personal interaction	1	2	3	4	5
Explore, understand, and predict natural and social phenomena	1	2	3	4	5
Lead and persuade others to attain personal or organizational goals	1	2	3	4	5
Create and use new knowledge	1	2	3	4	5
Analyze data to solve problems	1	2	3	4	5
Use quantitative methods	1	2	3	4	5
Work on a broad variety of things, not a narrow range	1	2	3	4	5
Work more alone, rather than in teams	1	2	3	4	5

38 **How important is it to you to have a job where your work will:**

	1 Not at all important	2	3	4	5 Very important
Improve the quality of life in cities and towns	1	2	3	4	5
Protect the natural environment	1	2	3	4	5
Improve the quality of life for disadvantaged populations	1	2	3	4	5
Work directly with residents and members of the community	1	2	3	4	5
Affect planning at the neighborhood level	1	2	3	4	5
Affect planning at the city or regional level	1	2	3	4	5
Affect planning at a state or national level	1	2	3	4	5
Affect planning at an international level	1	2	3	4	5

39 **After you graduate, how interested would you be to work for:**

	1 Not at all interested	2	3	4	5 Very interested
A federal government agency	1	2	3	4	5
A state government agency	1	2	3	4	5
A regional government agency	1	2	3	4	5
A city or county	1	2	3	4	5
A private company	1	2	3	4	5
A non-profit organization	1	2	3	4	5
An international agency or organization	1	2	3	4	5

40 **After you graduate, how important is it to you to get a job that:**

	1 Not at all important	2	3	4	5 Very important
Is prestigious	1	2	3	4	5
Is flexible so that you can pursue other activities (e.g. travel or hobbies)	1	2	3	4	5
Fits with your family responsibilities	1	2	3	4	5
Allows you to work internationally	1	2	3	4	5

SUBMIT

Survey Page 17

Planning Student Survey

Now we would like to learn what you think about the field of transportation planning.

41 **Please indicate whether you agree or disagree with the following statements.**

	1 Strongly disagree	2	3	4	5 Strongly agree	Don't know
Transportation planning is a strength of my schoolâ€™s planning department	1	2	3	4	5	
The faculty teaching transportation classes are excellent teachers	1	2	3	4	5	
The faculty teaching transportation classes are doing interesting research and/or projects	1	2	3	4	5	
Transportation planning classes are challenging	1	2	3	4	5	
Transportation planning classes are interesting	1	2	3	4	5	

Transportation planning uses skills at which I excel

1 2 3 4 5

There are scholarships targeted at transportation planning students

1 2 3 4 5

There are good internships for students in transportation planning

1 2 3 4 5

There are research assistantships for students in transportation planning

1 2 3 4 5

42 Please indicate whether you agree or disagree with the following statements.

1 Strongly disagree	2	3	4	5 Strongly agree	Don't know

Before I started college, I knew what transportation planners do

1 2 3 4 5

Transportation planning involves helping and serving others through personal interaction

1 2 3 4 5

Transportation planning involves exploring, understanding, and predicting natural or social phenomena

1 2 3 4 5

Transportation planning involves analyzing data to solve problems

1 2 3 4 5

Transportation planning involves leading and persuading others

1 2 3 4 5

Transportation planning involves creating and using new knowledge

1 2 3 4 5

People working in transportation planning use quantitative methods a lot

1 2 3 4 5

Transportation planning is multi-disciplinary

1 2 3 4 5

Transportation planning is broad, not narrow.

1 2 3 4 5

Transportation planning improves the quality of life in cities and towns

1 2 3 4 5

Transportation planning protects the natural environment

1 2 3 4 5

Transportation planning improves the quality of life for disadvantaged populations

1 2 3 4 5

Transportation planners work directly with residents and members of the community

1 2 3 4 5

Transportation planners plan at the neighborhood level

1 2 3 4 5

Transportation planners plan at the city or regional level

1 2 3 4 5

Transportation planners plan at a state or national level

1 2 3 4 5

Transportation planners plan at an international level

1 2 3 4 5

SUBMIT

Survey Page 18

Planning Student Survey

43 Please indicate whether you agree or disagree with the following statements.

	1 Strongly disagree	2	3	4	5 Strongly agree
Students specializing in transportation are able to find jobs in transportation planning	1	2	3	4	5
Students in transportation planning could also get a planning job outside of transportation	1	2	3	4	5
A career in transportation planning is prestigious	1	2	3	4	5
Transportation planners often work alone, rather than in teams	1	2	3	4	5
Transportation planning seems open to women	1	2	3	4	5
Transportation planning seems open to people of color	1	2	3	4	5
I am like other people who work in transportation planning					

1 2 3 4 5

I get along well with other students in transportation

1 2 3 4 5

There is a common identity among people working in transportation planning

1 2 3 4 5

44 **Please list up to three things that you think transportation planners do.**

1.
2.
3.

45 **Did you ever seriously consider specializing in transportation planning?**

- Yes
- No

46 **If you did consider specializing in transportation but decided not to, why did you decide against transportation?**

If you never considered transportation, why not?

Planning Student Survey

47 How sure are you that you will finish your degree focusing on this specialization?

- Very sure
- Somewhat sure
- Somewhat unsure
- Very unsure

SUBMIT

Survey Page 20

Planning Student Survey

48 When did you decide to specialize in this field?

- Before I started my undergraduate degree
- While I was an undergraduate student
- After I finished my undergraduate degree, but before I joined my current masters in planning program
- While I was a student in this masters program

SUBMIT

Survey Page 21

Planning Student Survey

49 How important were the following factors in helping you to decide on your specialization?

	1 Not at all important	2	3	4	5 Very Important	Don't know
What I learned about the specialization from working in a job in that specialization	1	2	3	4	5	
What I learned about the specialization from classes I have taken in the masters program	1	2	3	4	5	

What I learned about the specialization from classes I took in my undergraduate program

1 2 3 4 5 ____

The teaching quality of the faculty who teach within the specialization in my masters program

1 2 3 4 5 ____

The professional reputation of the faculty who teach within the specialization in my masters program

1 2 3 4 5 ____

How well the times and/or day of week that classes in the specialization fit with my personal or work schedule (for my masters program)

1 2 3 4 5 ____

Availability in my masters program of scholarships or other financial support for students in the specialization

1 2 3 4 5 ____

Availability in my masters program of internships for students in the specialization

1 2 3 4 5 ____

Availability in my masters program of research assistantships working with faculty in the specialization

1 2 3 4 5 ____

Things I observed or learned while traveling outside the U.S.

1 2 3 4 5 ____

50 How important for you were the following factors in choosing your specialization?

1 Not at all important	2	3	4	5 Very important	Don't know

The likelihood of getting a job in the specialization

1 2 3 4 5 ____

The salary I will likely earn in this specialization

1 2 3 4 5 ____

Job security and stability for people working in the specialization

1 2 3 4 5 ____

The potential for upward mobility for people working in the specialization

1 2 3 4 5 ____

The likelihood of me being accepted by other people working in the field

1 2 3 4 5 ____

The likelihood that a job in my specialization will fit well with my family responsibilities

1 2 3 4 5

The type of work environments for people in the specialization

1 2 3 4 5

The contribution the specialization makes to improving the quality of life in cities and towns

1 2 3 4 5

The contribution the specialization makes to improving the natural environment

1 2 3 4 5

The contribution the specialization makes to improving the quality of life for disadvantaged populations

1 2 3 4 5

Being able to work directly with residents and members of the community

1 2 3 4 5

Being able to plan at the neighborhood level

1 2 3 4 5

Being able to plan at the city or regional level

1 2 3 4 5

Being able to plan at a state or national level

1 2 3 4 5

Being able to plan at an international level

1 2 3 4 5

51 **Please describe any other important factors that helped you to choose your specialization.**

Planning Student Survey

52 **Please indicate whether you agree or disagree with the following statements.**

1 Strongly disagree	2	3	4	5 Strongly agree	Don't know

My chosen specialization is a strength of my schoolâ€™s planning department

1 2 3 4 5

The faculty teaching the classes in my chosen specialization are excellent teachers

1 2 3 4 5

The faculty teaching the classes in my chosen specialization are doing interesting research and/or projects

1 2 3 4 5

The classes in my chosen specialization are challenging

1 2 3 4 5

The classes in my chosen specialization are interesting

1 2 3 4 5

My chosen specialization will allow me to use skills at which I excel

1 2 3 4 5

There are scholarships targeted at students in my chosen specialization

1 2 3 4 5

There are good internships for students in my chosen specialization

1 2 3 4 5

53 **Please indicate whether you agree or disagree with the following statements.**

1 Strongly disagree	2	3	4	5 Strongly agree	Don't know

Working in my specialization involves helping and serving others through personal interaction

1 2 3 4 5

Working in my specialization involves exploring, understanding, and predicting natural or social phenomena

1 2 3 4 5 ____

Working in my specialization involves analyzing data to solve problems

1 2 3 4 5 ____

Working in my specialization involves leading and persuading others

1 2 3 4 5 ____

Working in my specialization involves creating and using new knowledge

1 2 3 4 5 ____

Working in my specialization involves quantitative methods

1 2 3 4 5 ____

My specialization is multi-disciplinary

1 2 3 4 5 ____

My specialization is broad, not narrow

1 2 3 4 5 ____

A career in my specialization is prestigious

1 2 3 4 5 ____

It will be easy to get a job in my chosen specialization after I graduate

1 2 3 4 5 ____

People working in my specialization often work alone, rather than in teams

1 2 3 4 5 ____

My specialization seems open to women

1 2 3 4 5 ____

My specialization seems open to people of color

1 2 3 4 5 ____

I get along well with other students in my specialization

1 2 3 4 5 ____

I am like other people who have chosen this specialization

1 2 3 4 5 ____

There is a common identity among people working in my chosen specialization

1 2 3 4 5 ____

Students choosing my specialization could also get a planning job outside of that specialization

1 2 3 4 5 ____

Planning Student Survey

Now we would like to know what sources of information helped you decide on your specialization.

54 Before I started graduate school, I learned about the specialization from someone that I knew who worked in that field

Did not help at all				Very helpful	Before I started grad school, I did not know anyone who worked in my specialization	Don't know
1	2	3	4	5	6	7

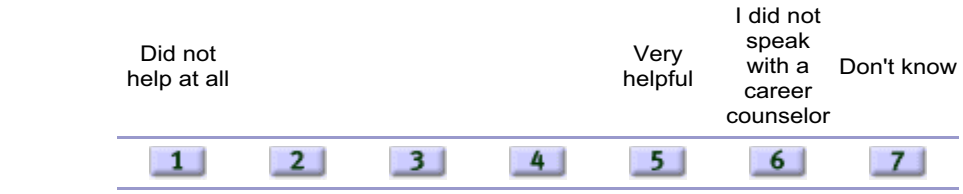
55 Someone working in my chosen specialization who spoke as a guest in one of my classes or at an event I attended

Did not help at all				Very helpful	Nobody from my chosen specialization spoke in one of my classes or at an event	
1	2	3	4	5	6	7

56 Speaking with a faculty member for advice on choosing a specialization

Did not help at all				Very helpful	I did not speak with a faculty member	Don't know
1	2	3	4	5	6	7

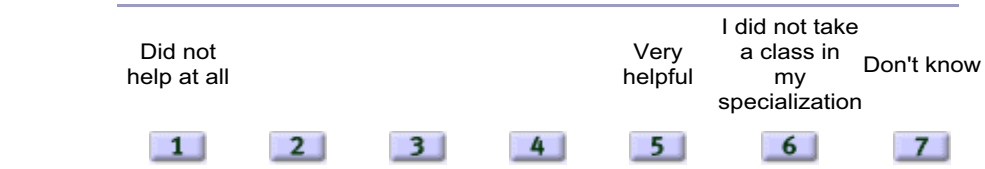
57 Speaking with someone at my universityâ€™s career center or a career counselor



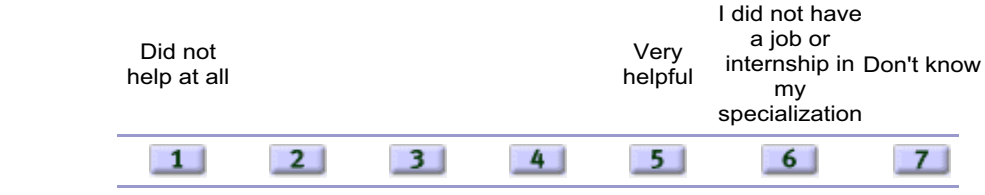
58 Attending a career fair organized at my university

59 A class I took in my chosen specialization while in graduate school

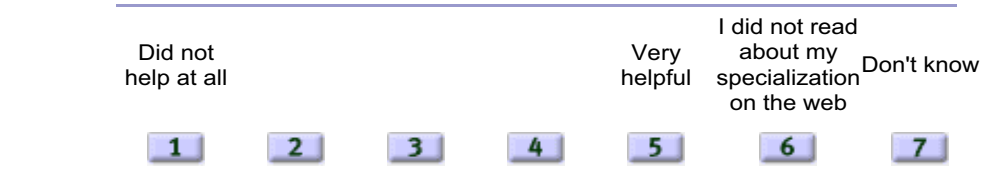
60 A class I took in my chosen specialization before graduate school



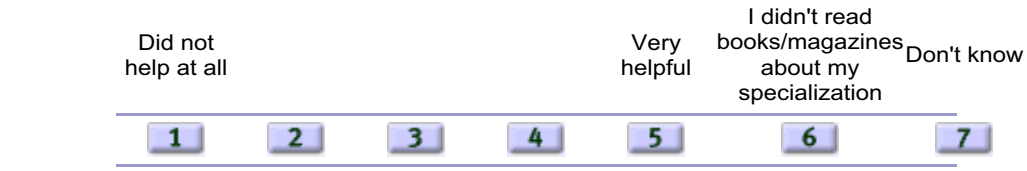
61 An internship or job within my chosen specialization



62 Information I read on the web about my chosen specialization



63 Books or magazines I read about my chosen specialization



64 If you found reading books, magazines, or websites helpful, what were the most useful things you read?

65 Please note any other sources of information, not mentioned above, that influenced your specialization decision.

Planning Student Survey

We have a few questions about activities at your school.

66 **My department/program organizes a mentorship program that matches up students with professional planners.**

- Yes
- No
- Don't know

67 **I have participated in a mentorship program involving professional planners that is organized by my department/program.**

- Yes
- No
- Don't know

68 **My program requires me to complete an internship before graduating.**

- Yes
- No
- Don't know

SUBMIT

Survey Page 25

Planning Student Survey

Now we would like to know more generally what is important to you in your career and work.

69 **How important is it to you to have an occupation that allows you to:**

	1 Not at all important	2	3	4	5 Very important
Help, teach, counsel, or serve others through personal interaction	1	2	3	4	5
Explore, understand, and predict natural and social phenomena	1	2	3	4	5
Lead and persuade others to attain personal or organizational goals	1	2	3	4	5
Create and use new knowledge	1	2	3	4	5
Analyze data to solve problems	1	2	3	4	5
Use quantitative methods	1	2	3	4	5
Work on a broad variety of things, not a narrow range	1	2	3	4	5
Work more alone, rather than in teams	1	2	3	4	5

70 **How important is it to you to have a job where your work will:**

1 Not at all important	2	3	4	5 Very important

Improve the quality of life in cities and towns

1 2 3 4 5

Protect the natural environment

1 2 3 4 5

Improve the quality of life for disadvantaged populations

1 2 3 4 5

Work directly with residents and members of the community

1 2 3 4 5

Affect planning at the neighborhood level

1 2 3 4 5

Affect planning at the city or regional level

1 2 3 4 5

Affect planning at a state or national level

1 2 3 4 5

Affect planning at an international level

1 2 3 4 5

71 **After you graduate, how interested would you be to work for:**

1 Not at all interested	2	3	4	5 Very interested

A federal government agency

1 2 3 4 5

A state government agency

1 2 3 4 5

A regional government agency

1 2 3 4 5

A city or county

1 2 3 4 5

A private company

1 2 3 4 5

A non-profit organization

1 2 3 4 5

An international agency or organization

1 2 3 4 5

72

After you graduate, how important is it to you to get a job that:

1 Not at all important	2	3	4	5 Very important
Is prestigious				
1	2	3	4	5
Is flexible so that you can pursue other activities (e.g. travel or hobbies)				
1	2	3	4	5
Fits with your family responsibilities				
1	2	3	4	5
Allows you to work internationally				
1	2	3	4	5

SUBMIT

Survey Page 26

Planning Student Survey

Finally, we have a few questions about you.

73 What is your gender?

- Female
- Male

74 What is your age? Please enter the number, e.g. 22.

75 What is your ethnicity or race? Check all that apply.

- African American
- Asian
- Hispanic
- Native American
- Pacific Islander
- White
- Other, please specify

76 **Are you on an international student visa?**

- Yes
- No

77 **Are you currently married or living in a domestic partnership?**

YES NO

78 **Do you currently have children 18 or under living with you?**

YES NO

SUBMIT

Survey Page 27

Planning Student Survey

79 **What was your undergraduate degree?** Please choose the closest answer or Other, and specify.

- Anthropology
- Architecture
- Art, Art history
- Biology
- Business, business administration
- Community development
- Economics
- Engineering (civil, mechanical, environmental, etc.)
- English, journalism, writing
- Environmental studies, science, or planning
- History
- Geography
- International studies, relations
- Landscape architecture
- Political science
- Public policy
- Psychology
- Sociology

- Urban studies or planning
- Other, please specify

80 **Are you currently in a joint graduate degree program?**

- Yes
- No

SUBMIT

Survey Page 28

Planning Student Survey

81 **What is the other department/degree?**

- Business
- Law
- Public health
- Transportation, civil, or environmental engineering
- Other, please specify

82 **Which program did you enroll in first?**

- Planning
- The other program
- Both at the same time

SUBMIT

Survey Page 29

Planning Student Survey

83 **Is there anything else you would like to tell us?**

84 **We appreciate the time you have taken to answer this survey.**

You may now enter your name in a drawing for one of two gift certificates to Amazon.com: one for $300 and two for $100.

Your name and email will *not* be associated with your responses to the survey questions.

Name

Email address

SUBMIT

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39. This percentage is calculated based on the number of masters students reported at each school in the *Guide to Undergraduate and Graduate Education in Urban and Regional Planning* (ACSP 2007).
40. The survey does not indicate how long respondents had already been in their masters program before taking the survey. Some part-time students would have been in the program at least a year before taking the survey, even if they expect to graduate in 2009–10 or later. The share of students in each graduation date category who were part-time students is as follows: 15% expecting to graduate in 2007–08, 13% expecting to graduate in 2008–09, and 53% expecting to graduate in 2009–10.
41. An open-ended question asked students to note the main sources of information they read. Two-hundred seventy people wrote a response. No single website or other source was mentioned by even 10% of respondents. However, the most common responses included the Planetizen and American Planning Association websites, as well as the author Jane Jacobs.

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ABBREVIATIONS AND ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
APA	American Planning Association
ASEE	American Society for Engineering Education
CE	Civil Engineering
CUTC	Council of University Transportation Centers
DOT	Department of Transportation
FHWA	Federal Highway Administration
ITE	Institute of Transportation Engineers
GIS	Geographic Information System
NCHRP	National Cooperative Highway Research Program
NSF	National Science Foundation
PSU	Portland State University
STREET	Simulating Transportation for Realistic Engineering and Education
TRB	Transportation Research Board
UTCs	University Transportation Centers
WTS	Women's Transportation Seminar

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