

Transportation Curriculum

Survey Report

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**Incorporating Bicycle and Pedestrian Topics
in University Transportation Courses: A National Scan**

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ABSTRACT

There is a growing focus on context sensitive design in roadway planning, increased support for addressing public health objectives through transportation and land use planning, and concerns about oil dependence and global warming. Combined, these factors have raised expectations for transportation engineering and planning practitioners to possess more knowledge and skills related to pedestrian and bicycle planning and design. This demand requires more education around these topics. This paper reports on the findings of a survey of 86 university faculty about the inclusion of bicycle and pedestrian topics in their transportation courses. Of the 134 transportation courses taught by the respondents, 59% included bicycle and/or pedestrian topics. However, because of potential response bias, the findings might be an optimistic assessment of the coverage of bicycle and pedestrian topics in current curricula. Just over half (52%) of the civil engineering courses only included 1-2 hours of class time on the topics, whereas all of the courses in planning programs offered at least three hours on the topics. The topics covered most often were pedestrian safety, pedestrian and bicycle planning, and pedestrian and bicycle facility design. At least 43% of the faculty were interested in course materials on pedestrian and bicycle topics that they could incorporate into existing courses. Powerpoint and lecture materials were the most commonly requested types of materials.

INTRODUCTION

Since the passage of ISTEA in 1991, the amount of federal funding for bicycle and pedestrian infrastructure has increased significantly (FHWA, 2008). At the same time, the U.S. has experienced a growing focus on context sensitive design in roadway planning, increased support for addressing public health objectives through transportation and land use planning, and concerns about oil dependence and global warming. Combined, these factors have raised expectations for transportation engineering and planning practitioners to possess more knowledge and skills related to pedestrian and bicycle planning and design. This demand requires more education around these topics. In response, the FHWA developed curriculum for a university course on Bicycle and Pedestrian Transportation (FHWA, 2005). However, many university programs may not have room in the curriculum or resources to offer an entire course on the topic. In addition, students that are not already interested in the topic might not take an entire course. Therefore, there is also a need to integrate bicycle and pedestrian topics into existing university transportation courses for civil engineers and urban planners. However, before we can begin to make recommendations for curriculum additions and changes, we must first understand the current state of education around bicycle and pedestrian transportation.

This paper reports on the findings of a survey of university faculty who teach transportation courses. Results of the survey provide a base from which to identify curriculum module topics for development and direction for future course development to more fully integrate bicycle and pedestrian travel into transportation engineering and planning education. By extension, more comprehensive curriculum will help give students the knowledge needed to increase the safety and mode share for bicycle and pedestrian transportation in their professional careers as planners and engineers.

LITERATURE REVIEW

There appears to be a gap between the demand for pedestrian and bicycle planning and engineering skills and knowledge on the job and what universities are teaching students. In a survey of 360 transportation planners, Handy et al (Handy, 2002) examined the gaps between what the professionals felt was important in their job versus what was covered in their university courses. Bicycle and pedestrian planning was rated an average of 3.13 in job importance, on a scale of 1 (“never”) to 5 (“daily”). The highest rated topic, regional transportation planning, rated an average of 3.89. Bicycle and pedestrian planning topic ranked 10th out of 25 topics on the survey. However, 42% of the respondents said that the topic was not covered at all in their courses. The average rating of course coverage of the topic was 1.97 on a scale of 1 (“not enough”) to 5 (“too much”). The authors suggested that the relatively low score for coverage may “reflect the relatively recent priority given to these topics” and that “current students may be getting more exposure to these topics than the respondents” (p. 156). The authors then calculated a “priority score” for all 25 topics based upon the gap between the average rating of coverage and the importance of the topic in the job. Bicycle and pedestrian planning ranked second in priority; public involvement ranked first, with transit planning coming in third.

There is limited research on what is taught in transportation planning and engineering courses, particularly with respect to bicycle and pedestrian topics. In a survey of 32 instructors teaching

transportation planning courses at US universities, Zhou and Soot (Zhou, 2006) found that just over 60% of the courses included the topic of pedestrian and bicycle planning. In addition, about 70% of the professors supported the idea of the US Department of Transportation developing case studies on pedestrian and bicycle transportation to use in the classroom. This ranked 7th out of 18 topics included on the survey. The study did not provide any detail on what was covered under the topic of pedestrian or bicycle planning, nor the amount of coverage.

If transportation engineering and planning curricula do not include pedestrian and bicycle topics, this omission may be affecting the number of planning and civil engineering students attracted to the transportation profession. In a national survey of undergraduate civil engineering students, Agrawal and Dill (2008) found that students who had not chosen a specialization within the field (e.g. transportation, structural, environmental, etc.) and who were leaning against transportation, placed a higher importance on a career that protected the natural environment than those who had chosen transportation. In an open question asking for three things that transportation engineers did, less than five percent of students who had not chosen the field mentioned anything related to pedestrians or bicycles. Masters students in planning completed a similar survey and 21% who had not chosen transportation planning as a specialty mentioned something related to pedestrians, bicyclists, or traffic calming (Agrawal and Dill, 2009). The surveys did not directly address the role of pedestrian and bicycle topics in the career decision making process. However, the authors concluded that many non-transportation students may not be making the connection between transportation and bicycle and pedestrian topics, but that these topics were consistent with career priorities, such as protecting the environment and improving the quality of life in cities and towns.

METHODOLOGY

The web-based survey collected information about the following topics related to teaching bicycle and pedestrian transportation topics in the university setting:

- whether bicycle and pedestrian topics are covered in transportation planning and engineering courses;
- resources used to teach bicycle and pedestrian curriculum;
- faculty interest in availability of course modules on bicycle and pedestrian topics; and
- importance of including bicycle and pedestrian topics in planning and engineering courses.

Respondents were allowed to enter information for up to four transportation courses taught during the current (at the time of the survey, 2007-2008) or most recent (2006-2007) academic year.

To select the survey sample, we reviewed the web sites for accredited planning and civil engineering programs in the U.S. that offered transportation courses and identified 451 faculty members who listed transportation as a teaching or research interest. The survey was sent via email to those faculty members. A total of 86 surveys were completed, representing a 20% response rate.

SURVEY FINDINGS

The majority of respondents (60%) teach in engineering departments, with 26% teaching in planning departments and 12% teaching in both. Similarly, the terminal degree for most of the respondents was civil engineering (69%); 19% had their terminal degree in planning and 12% had a different degree. The primary research interests of the respondents are shown in Table 1.

Table 1: Primary Research Interests of Faculty Survey Respondents

Research topics	Percentage
Transportation Planning	59%
Transportation Operations	47%
Transportation and Land Use	42%
Transportation Policy	41%
Transportation Safety	41%
Travel Behavior	35%
Travel Demand Modeling	33%
Environmental Aspects of Transportation	27%
Freight, Goods Movement, Logistics	24%
Transportation Facility Design	23%
Intelligent Transportation Systems	22%
Transportation Finance	16%
Other	16%
n	86

The respondents provided information on 134 transportation courses. Of those, three were specifically pedestrian/bicycle courses and one was on “alternative transportation” which would presumably include walking and bicycling, in addition to transit and other options. Of the 132 courses that were offered through a university department (not extended studies, professional development, etc), 77% were offered in engineering departments, with 14% offered in planning departments, and seven percent offered in both departments. Most of the planning courses were at the graduate level, while civil engineering courses were more evenly split between graduate, undergraduate and both (Table 2). The civil engineering courses focused on design, operations, and planning, while the planning courses focused on planning and policy.

Table 2: University Transportation Courses Taught by Respondents

	Course Department				
	Civil Engineering	Planning	Both	Other	All
<i>Level of course</i>					
Undergraduate	42%	16%	0%	0%	34%
Graduate	33%	74%	100%	33%	43%
Both	26%	11%	0%	67%	23%
n	101	19	9	3	132
<i>Focus of course (multiple responses allowed)</i>					
Policy	28%	63%	68%	33%	36%
Planning	53%	84%	89%	67%	60%
Design	61%	32%	33%	33%	55%
Operations	56%	21%	44%	33%	50%
Other	8%	21%	22%	67%	13%
n	103	19	9	3	134

When asked if the course included topics related to pedestrian and/or bicycle transportation, 59% of the responses said yes. Planning courses were more likely to cover pedestrian/bicycle topics (79%) compared with 55% of civil engineering courses (Table 3). Courses that focused on policy and design were more likely to cover the topics, while only 49% of operations courses covered pedestrian/bicycle topics. Pedestrian and bicycle topics were most often covered in elective courses. Of the 134 courses, 33 (25%) were required for all civil engineering or planning students, while 25 (19%) were required for students in those degree programs specializing in transportation. Combining those two groups of required courses, 48% included pedestrian and bicycle courses.

Table 3: Inclusion of Pedestrian and Bicycle Topics in University Transportation Courses Taught by Respondents

	Pedestrian and/or Bike Topics included
All courses (n=134)	59%
<i>By Department</i>	
Civil Engineering (n=103)	55%
Planning (n=19)	79%
Both (n=9)	56%
Other (n=3)	67%
<i>By Focus</i>	
Policy (n=48)	73%
Planning (n=81)	64%
Design (n=73)	70%
Operations (n=67)	49%
Other (n=17)	59%
<i>By level</i>	
Undergraduate (n=45)	56%
Graduate (n=57)	53%
Both (n=30)	73%
<i>By Required vs. Elective</i>	
All Civil Engineering/Planning students are required to take course (n=33)	58%
Only students specializing in transportation are required to take course (n=25)	36%
Elective course (n=65)	69%
Other (n=11)	55%

For each transportation course, respondents were asked how many hours a week and how many weeks the course met, along with the amount of class time spent on pedestrian and bicycle topics. Almost three-fourths (73%) of the courses met three hours per week, while 16% met four hours per week. Most of the courses that covered pedestrian and bicycle topics spent five or fewer hours on the topics (Table 4). Courses offered in planning or both planning and civil engineering generally spent more time on the topics. The majority of the pedestrian and bicycle material was taught by the respondent (80%), with 12% splitting the teaching with guest speakers and five percent using another faculty member to teach these topics.

Table 4: Class Time Spent on Pedestrian and Bicycle Topics

	Hours of Class Time			
	1-2	3-5	6-10	11 or more
All courses with the topics covered (n=78)	38%	37%	13%	12%
<i>By Department</i>				
Civil Engineering (n=56)	52%	34%	9%	5%
Planning (n=15)	0%	40%	27%	33%
Both (n=5)	0%	60%	20%	20%
<i>By Focus</i>				
Policy (n=35)	34%	34%	17%	14%
Planning (n=51)	39%	37%	10%	14%
Design (n=50)	44%	32%	8%	16%
Operations (n=32)	50%	28%	6%	16%
<i>By level</i>				
Undergraduate (n=25)	48%	36%	8%	8%
Graduate (n=30)	30%	37%	17%	17%
Both (n=22)	36%	41%	14%	9%
<i>By Required vs. Elective</i>				
All Civil Engineering/Planning students are required to take course (n=19)	53%	37%	11%	0%
Only students specializing in transportation are required to take course (n=9)	22%	33%	11%	33%
Elective course (n=45)	38%	38%	13%	11%

Of the 79 courses that included pedestrian and bicycle topics, 67% included required readings on pedestrian topics and 54% included required readings on bicycle topics. Another 10% and 15%, respectively, had optional readings on pedestrian and bicycle topics and 22% and 28% had neither. Of those that included required or optional readings, academic journal articles and government agency research or guidance documents were the most commonly used (Table 5). The types of readings used were similar for both pedestrian and bicycle topics, with one exception – textbooks were used more often for pedestrian topics (41%) than for bicycle topics (27%).

Table 5: Type of Course Readings Used

Readings (required or optional)	Pedestrian	Bicycle
Academic Journal	49%	51%
Government Agency Research or Guidance Document	49%	51%
Textbook	41%	27%
TRB, including NCHRP and TCRP	41%	38%
Website ^a	36%	29%
Other Academic Publication	25%	33%
Magazine	23%	24%
Other Government Document (including plans)	18%	18%
Interest group publication	18%	16%
Other	7%	6%
<i>n</i>	61	55

^a not including documents available on the web covered by other questions

The most common pedestrian and bicycle topics covered in the transportation courses taught by the respondents related to safety, planning, and facility design (Table 6). Lectures and/or in class discussions are the most common methods used to cover pedestrian and bicycle topics. As expected, there is some variation in what topics are covered depending upon the focus of the course (Table 7).

Table 6: Pedestrian and Bicycle Topics Covered in Transportation Courses

Note: P/B = pedestrian/bicycle	Lecture and/or discussion in class	Lab or exercise	Reading	Written assignment or exam	Other method	Not covered
Pedestrian safety	40%	10%	19%	10%	1%	46%
Pedestrian planning	35%	5%	14%	4%	1%	48%
Bicycle facility design	31%	7%	16%	8%	1%	48%
Bicycle planning	32%	4%	16%	4%	1%	49%
Pedestrian Facility design	35%	10%	14%	10%	2%	49%
Bicycle safety	28%	8%	18%	5%	1%	50%
Intersection design for pedestrians	31%	10%	13%	9%	1%	50%
Policies related to P/B	25%	4%	11%	3%	1%	52%
Pedestrian accessibility	30%	7%	14%	3%	1%	53%
Intersection design for bicyclists	19%	4%	11%	6%	1%	54%
Context sensitive design	22%	3%	9%	3%	1%	54%
Land use planning related to P/B travel	26%	4%	14%	6%	1%	54%
Integration of P/B with transit	22%	3%	10%	2%	1%	55%
Pedestrian level of service	19%	4%	6%	3%	2%	57%
Estimating pedestrian demand	10%	4%	5%	1%	1%	57%
Complete streets	19%	2%	8%	5%	0%	57%
Financing/funding of P/B projects	12%	2%	7%	1%	0%	58%
Estimation of bicycle demand	7%	1%	7%	1%	1%	59%
Trail design	5%	2%	3%	1%	0%	60%
Bicycle level of service	8%	4%	6%	1%	1%	60%

n=134; Note: multiple responses allowed.

Table 7: Pedestrian and Bicycle Topics Covered in Transportation Courses, by Type of Course

Note: P/B = pedestrian/bicycle	Policy	Planning	Design	Operations
Pedestrian safety	71%	61%	60%	48%
Pedestrian planning	73%	61%	56%	42%
Bicycle facility design	67%	57%	64%	48%
Bicycle planning	69%	59%	56%	42%
Pedestrian facility design	65%	56%	63%	45%
Bicycle safety	63%	57%	58%	43%
Intersection design for pedestrians	63%	53%	60%	46%
Policies related to P/B	67%	53%	56%	40%
Pedestrian accessibility	69%	52%	55%	42%
Intersection design for bicyclists	58%	48%	55%	40%
Context sensitive design	63%	54%	55%	45%
Land use planning related to P/B travel	67%	56%	52%	43%
Integration of P/B with transit	63%	54%	51%	42%
Pedestrian level of service	54%	47%	51%	43%
Estimating pedestrian demand	56%	49%	48%	42%
Complete streets	54%	47%	49%	40%
Financing/funding of P/B projects	54%	47%	48%	37%
Estimation of bicycle demand	52%	47%	48%	40%
Trail design	52%	46%	47%	39%
Bicycle level of service	52%	46%	49%	40%
n	48	81	73	67

n=134; Note: multiple responses allowed for both variables.

There are varying levels of interest on the part of faculty members to include more bicycle and/or pedestrian transportation topics in one or more of their current courses. When asked about their interest level, less than one-half (43%) indicated they were interested in including more on these topics, rated a four or five on a one (not at all interested) to five (very interested) scale (Table 8). However, about one-quarter of the respondents (24%) indicated that they were not very interested (rated a one or two), showing a divergence of opinion on this question. Planning faculty were generally more interested than civil engineering faculty. In addition, faculty who already included pedestrian and bicycle topics in at least one course were more interested. There were 22 faculty members who did not include pedestrian and bicycle topics in any of their courses. Of those, none were very interested in including the topics and five (23%) rated their level of interest as a four; 14% were not at all interested, 23% rated their interest a two, and 41% rated it a three.

Table 8: Faculty Interest in Bicycle and Pedestrian Topics

In general, how interested are you in including more bicycle and/or pedestrian transportation topics in one or more of your current courses?	Planning	Civil Engineering	Both	All Respondents ^a
5 (very interested)	33%	12%	0%	15%
4	22%	31%	30%	28%
3	33%	31%	50%	33%
2	0%	20%	10%	14%
1 (not at all interested)	11%	6%	10%	10%
<i>N</i>	18	49	10	79

^a Includes two respondents that are not in planning or civil engineering

When asked about the types of materials they might want to help them include pedestrian and bicycle topics into their courses, powerpoint slides and lecture notes were the most common (Table 9). Only 28% of the survey respondents used the Federal Highway Administration (FHWA) Pedestrian and Bicycle Transportation course materials. Interestingly, 46% of respondents had not reviewed the materials, while 15% had looked at them but were not using them. Of the 22 faculty who have used the materials, 18% rated them very useful (5 on a 1-5 scale) and 32% rated them a 4, while 23% found them not useful at all (rated a 1).

Table 9: Faculty Interest in Course Materials

How interested would you be in receiving the following types of materials on relevant bicycle and/or pedestrian topic(s) that you could insert into one of your existing courses?	5 Very interested	4	3	2	1 Not interested
Powerpoint & lecture notes	54%	19%	8%	7%	12%
Class project or assignment	43%	28%	12%	4%	13%
In-class exercise	42%	25%	11%	7%	15%
Reading list	42%	21%	14%	7%	16%
Course reading materials	42%	24%	12%	7%	15%
Flash simulation	38%	15%	13%	6%	28%
Field based exercise	35%	22%	19%	4%	20%
Notes for Blackboard or web-based software	34%	18%	10%	8%	30%
other	11%	0%	14%	4%	71%

n=79

Faculty were asked “How important is it that transportation students graduating from your department know about the following topics?” The question included a list of bicycle and pedestrian topics. Safety topics were rated the most important (Table 10).

Table 10: Importance of Bicycle and Pedestrian Topics in Student Knowledge

	5 Very imp	4	3	2	1 Not imp	n
Pedestrian safety	43%	21%	20%	10%	6%	77
Bicycle safety	40%	18%	21%	13%	8%	77
Land use planning related to bike/ped travel	32%	22%	19%	22%	5%	73
Pedestrian accessibility	31%	24%	26%	12%	7%	74
Pedestrian planning	28%	23%	26%	15%	8%	75
Policies	24%	20%	25%	24%	7%	74
Bicycle planning	22%	24%	27%	18%	9%	74
Integration with transit	22%	19%	28%	19%	12%	73
Complete streets	19%	20%	35%	19%	7%	74
Context-sensitive solutions	19%	31%	25%	17%	8%	75
Intersection design for pedestrians	18%	33%	32%	8%	9%	76
Pedestrian facility design	17%	28%	35%	9%	11%	76
Bicycle facility design	16%	25%	36%	13%	10%	76
Intersection design for bicycles	15%	32%	34%	10%	9%	76
Finance/funding	15%	11%	27%	31%	16%	74
Estimate of pedestrian demand	12%	26%	24%	23%	15%	74
Pedestrian level of service	10%	23%	37%	18%	12%	73
Estimate of bicycle demand	9%	28%	19%	30%	14%	74
Bicycle level of service	7%	19%	32%	26%	16%	74
Trail design	4%	8%	25%	40%	23%	73

Faculty were also asked “In your opinion, how interested are the transportation students in your department in the pedestrian and bicycle topics?” As shown in Table 11, student interest is only slightly stronger than faculty interest, though 6% of the respondents were not sure of their students’ level of interest.

Table 11: Faculty and Student Interest in Bicycle and Pedestrian Topics, According to Faculty

	Student Interest in Pedestrian Topics	Student Interest in Bicycle Topics	Faculty interest in including more P/B topics
5 (very interested)	19%	21%	15%
4	25%	23%	28%
3	27%	30%	33%
2	18%	15%	14%
1 (not at all interested)	5%	5%	10%
Not sure	6%	6%	n.a.
n	79	79	79

SUMMARY AND CONCLUSIONS

The survey provided a snapshot assessment of the inclusion of pedestrian and bicycle topics in university transportation courses offered in civil engineering and planning departments. Over 80 faculty members responded. Of the 134 transportation courses taught by the respondents, 59% included bicycle and/or pedestrian topics. However, faculty interested in pedestrian and bicycle topics may have been more likely to respond. Therefore, the results might be considered an optimistic assessment of the coverage of bicycle and pedestrian topics in current curricula. In addition, our sampling methodology focused on faculty and likely missed most adjuncts and graduate students who may be teaching transportation courses.

Just over half (55%) of the civil engineering courses included pedestrian and bicycle topics. Just over half (52%) of the civil engineering courses only included 1-2 hours of class time on the topics. Since the average course met for 45 hours, this represents less than 5% of the course time. Faculty designing courses are faced with many competing demands for course time. The appropriate amount of time for each topic depends upon many things, and it is not appropriate to suggest what the right amount of time for bicycle and pedestrian topics would be. However, as attention to these modes grows in response to a wide range of policy concerns, and the growing demand from practitioners, it is necessary for faculty to re-think the coverage of the topics in their courses. Faculty should also discuss collectively as a department updating curricula, so that support for these important topics is widespread.

One of the reasons course curricula may not change as quickly as public priorities is that faculty have many demands upon their time, making the development of new material difficult. In addition, some faculty may lack expertise in these areas, partly because they did not learn about them during their degree programs, or may lack department support or resources for incorporating the topics. Incorporating bicycle and pedestrian topics into university courses could be made easier for faculty if materials were readily available and if standard textbooks included the topics. Of the courses that included readings on pedestrian topics, only 41% used a textbook, while only 27% of the courses with bicycle-related readings used a textbook. This indicates that the traditional textbook is not covering these topics. Of the faculty responding, at least 43% were interested in course materials on pedestrian and bicycle topics that they could incorporate into existing courses. Powerpoint and lecture materials were the most commonly

requested types of materials. These types of resources are available as part of the FHWA course, and nearly half of the faculty had not looked at those materials. Therefore, one recommendation would be to encourage more faculty to review the materials, perhaps emphasizing that individual modules may be used, rather than adopting the entire course.

There is likely a demand for materials in addition to those in the FHWA course. Further research is necessary to determine what is lacking from the FHWA course materials, particularly from those who reviewed by did not choose to use the materials and those that were not satisfied with the materials. The survey asked faculty about the importance of various bicycle and pedestrian topics for their transportation students. It is notable that none of the topics were rated very important (5 on a 1-5 scale) by half or more of the respondents. The highest rated topic was pedestrian safety, with 43% of the respondents rating it very important, followed by 40% for bicycle safety. Put another way, over half of the faculty did not think that it was *very important* for transportation student graduating from their program to know about pedestrian and bicycle safety. The survey did not include non-pedestrian and bicycle topics on this question. Therefore, it is not clear how these topics rate in relation to other topics. It is possible that there might not be any topics that would be rated very important by half or more of the respondents.

As state and local jurisdictions place increasing emphasis on bicycle and pedestrian planning and design, the need for trained professionals will grow. Expanding curriculum on these topics in planning and engineering curriculum could give current and future practitioners the knowledge they need to help their communities integrate bicycle and pedestrian travel into their transportation networks.

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