San Jose State University
SJSU ScholarWorks

Mineta Transportation Institute Publications

4-1-2011

Bicycling Access and Egress to Transit: Informing the Possibilities

Kevin J. Krizek

Follow this and additional works at: https://scholarworks.sjsu.edu/mti_publications

 Part of the Transportation Commons

Recommended Citation

Kevin J. Krizek. "Bicycling Access and Egress to Transit: Informing the Possibilities" *Mineta Transportation Institute Publications* (2011).

This Report is brought to you for free and open access by SJSU ScholarWorks. It has been accepted for inclusion in Mineta Transportation Institute Publications by an authorized administrator of SJSU ScholarWorks. For more information, please contact scholarworks@sjsu.edu.

San Jose State University
SJSU ScholarWorks

All Mineta Transportation Institute Publications | Mineta Transportation Institute Publications

4-1-2011

Bicycling Access and Egress to Transit: Informing the Possibilities

Kevin J. Krizek

Follow this and additional works at: http://scholarworks.sjsu.edu/mti_all

Recommended Citation
Krizek, Kevin J., "Bicycling Access and Egress to Transit: Informing the Possibilities" (2011). *All Mineta Transportation Institute Publications*. Book 8.
http://scholarworks.sjsu.edu/mti_all/8

This Research Report is brought to you for free and open access by the Mineta Transportation Institute Publications at SJSU ScholarWorks. It has been accepted for inclusion in All Mineta Transportation Institute Publications by an authorized administrator of SJSU ScholarWorks. For more information, please contact scholarworks@sjsu.edu.

Bicycling Access and Egress to Transit: Informing the Possibilities







MTI Report 10-07





MINETA TRANSPORTATION INSTITUTE
MTI

MINETA TRANSPORTATION INSTITUTE

The Norman Y. Mineta International Institute for Surface Transportation Policy Studies was established by Congress in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). The Institute's Board of Trustees revised the name to Mineta Transportation Institute (MTI) in 1996. 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.

MTI's transportation policy work is centered on three primary responsibilities:

Research

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).

Education

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.

Information and Technology Transfer

MTI promotes the availability of completed research to professional organizations and journals and works to integrate the research findings into the graduate education program. In addition to publishing the studies, the Institute also sponsors symposia to disseminate research results to transportation professionals and encourages Research Associates to present their findings at conferences. The World in Motion, MTI's quarterly newsletter, covers innovation in the Institute's research and education programs. MTI's extensive collection of transportation-related publications is integrated into San José State University's world-class Martin Luther King, Jr. Library.

DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the information presented herein. This document is disseminated under the sponsorship of the U.S. Department of Transportation, University Transportation Centers Program and the California Department of Transportation, in the interest of information exchange. This report does not necessarily reflect the official views or policies of the U.S. government, State of California, or the Mineta Transportation Institute, who assume no liability for the contents or use thereof. This report does not constitute a standard specification, design standard, or regulation.

MTI REPORT 10-07

BICYCLING ACCESS AND EGRESS TO TRANSIT: INFORMING THE POSSIBILITIES

Kevin J. Krizek, Ph.D.
Eric Stonebraker, M.S.
Seth Tribbey

April 2011

A publication of
Mineta Transportation Institute
Created by Congress in 1991

College of Business
San José State University
San José, CA 95192-0219

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. CA-MTI-11-2825	**2. Government Accession No.**	**3. Recipients Catalog No.**
4. Title and Subtitle Bicycling Access and Egress to Transit: Informing the Possibilities		**5. Report Date** April 2011 **6. Performing Organization Code**
7. Authors Kevin J. Krizek, Ph.D.; Eric Stonebraker, M.S.; and Seth Tribbey		**8. Performing Organization Report No.** MTI Report: 10-07
9. Performing Organization Name and Address Mineta Transportation Institute College of Business San José State University San Jose, CA 95192-0219		**10. Work Unit No.** **11. Contract or Grant No.** DTRT07-G-0054
12. Sponsoring Agency Name and Address California Department of Transportation Sacramento, CA 94273-0001 U.S. Department of Transportation Research and Innovative Technology Administration (RITA) Office of University Programs 1200 New Jersey Avenue, SE Washington, DC 20590		**13. Type of Report and Period Covered** Final Report **14. Sponsoring Agency Code**

15. Supplementary Notes

16. Abstract

When effectively integrated with transit services, considerable room exists for bicycling to realize various benefits to communities. A successful marriage between bicycling and transit will likely increase the use and efficiency of both modes. A core problem, however, exists in that the predominant approach for integrating bicycles and transit—bicycles aboard transit vehicles—frequently runs up against capacity restraints. Integrating bicycling and transit requires analysis of a broad range of alternatives that considers both the travel patterns and needs of individuals but also accompanying urban form characteristics. What are the most cost effective strategies likely to generate the largest number of cyclists accessing transit?

To aid in developing a framework to evaluate the cost effectiveness of different strategies to integrate transit and bicycling this project: (1) reviews the state of the knowledge, (2) proposes an analysis framework for communities and transit agencies to consider in efforts to maximize the integration of bicycling and transit, (3) conducts focus groups with cyclists from five case study communities to gauge preferences for bicycle and transit integration strategies, and (4) develops a preliminary application to evaluate four bicycle and transit integration strategies based on focus group discussions and use of the Analytic Hierarchy Process (AHP). These evaluation measures are applied to five communities.

A CTU index provides an initial attempt to understand transit stops that have a higher likelihood to attract CTUs. The Analytic Hierarchy Process ranked cyclists' preferences for four bicycle and transit integration strategies in order of preference: (1) "Bike ON transit" (transporting the owner's bicycle aboard(inside or outside) the transit vehicle) (0.471), (2) "Bike TO transit" (using and parking the owner's bicycle at a transit access location) (0.185), (3) "Shared bike" (sharing a bicycle, which would be based at either the transit access or egress point) (0.185), and (4) "Two bike" (using an owner's two bicycles at the access and egress location) (0.159). Results of the cost effectiveness assessment suggest that "Bike ON transit" ranked most cost effective overall, followed by "Bike to transit," "Two bike," and "Shared bike" strategies.

17. Key Words Bicycle facilities; Bicycling; Multimodal transportation	**18. Distribution Statement** No restrictions. This document is available to the public through The National Technical Information Service, Springfield, VA 22161		
19. Security Classif. (of this report) Unclassified	**20. Security Classifi. (of this page)** Unclassified	**21. No. of Pages** 128	**22. Price** $15.00

Form DOT F 1700.7 (8-72)

Copyright © 2011
by Mineta Transportation Institute
All rights reserved

Library of Congress Catalog Card Number:
2011924061

To order this publication, please contact:
Mineta Transportation Institute
College of Business
San José State University
San José, CA 95192-0219

Tel: (408) 924-7560
Fax: (408) 924-7565
Email: mineta-institute@sjsu.edu
www.transweb.sjsu.edu

ACKNOWLEDGMENTS

The authors thank the following contributors for their work in leading focus groups in five case study communities: Kelly Clifton, Ph.D., Portland State University; Ann Forsyth, Ph.D., Cornell University; and Peter Haas, Ph.D., San José State University. The focus groups would not have been possible without the organizational support of the following: Scott McCarey and Hannah Polow, Boulder County Transportation; Marni Ratzel, GO Boulder/ City of Boulder (Boulder, Colorado); Arline Welty, Active Transportation Alliance (Chicago, Illinois); Kent Johnson, City of Ithaca and Andrejs Ozolins, Bike and Walk Ithaca (Ithaca, New York); Gerik Kransky, Bicycle Transportation Alliance (Portland, Oregon); and Michelle DeRobertis, Santa Clara Valley Transportation Authority (San José, California). Additional statistical assistance was provided by Loren Cobb, Ph.D., University of Colorado Denver Mathematics Department. Jeffrey Jefferson, Masters of Public Administration student at San José State University, assisted transcribing the focus group discussions.

The authors also thank MTI staff, including Research Director Karen Philbrick, Ph.D.; Director of Communications and Special Projects Donna Maurillo; Research Support Manager Meg A. Fitts; Student Publications Assistant Sahil Rahimi; Student Research Support Assistant Joey Mercado; Student Graphic Artist JP Flores; and Webmaster Frances Cherman.

Additional editing and publication production services were performed by Editorial Associate Catherine Frazier.

TABLE OF CONTENTS

EXECUTIVE SUMMARY **1**

BICYCLE AND TRANSIT INTEGRATION **3**

State of the Knowledge 3
Bicycle Parking Costs 8
A Framework to Analyze CTU Potential 9

APPROACH TO GATHERING AND ANALYZING DATA **11**

Case Study Communities 11
Predicting CTU Potential 18
Case Study Focus Gropus: Understanding Cycilsts' Preferences 29
Analytic Hierarchy Process 36
Preferred Integration Strategies 38

COST EFFECTIVENESS: ANALYSIS AND CONCLUSIONS **41**

Results and Summary 42
Discussion 46
Lessons Learned and Future Research 47

APPENDIX A: BICYCLE PARKING COSTS **49**

APPENDIX B: BICYCLE PARKING EQUIPMENT AVERAGE COSTS **53**

APPENDIX C: CONSENT FORM **55**

APPENDIX D: FOCUS GROUP TRANSCRIPTS **57**

Boulder/Denver, Colorado 57
Chicago, Illinois 74
Ithaca, New York 81
Portland, Oregon 94
Santa Clara County, California 100

APPENDIX E: BICYCLE AND TRANSIT INTEGRATION STRATEGIES PREFERENCES SURVEY FORM **103**

APPENDIX F: PROTOCOL GUIDE FOR FOCUS GROUP FACILITATORS **109**

ENDNOTES **117**

ABBREVIATIONS AND ACRONYMS **121**

REFERENCES **123**

ABOUT THE AUTHORS **125**

PEER REVIEW **127**

LIST OF FIGURES

1. Bicycle Corral Prototype 13

2. Ithaca Bikeway Route Network 15

3. Boulder/Longmont CTU Index Analysis 20

4. Chicago CTU Index Analysis 23

5. Ithaca CTU Index Analysis 24

6. Portland CTU Index Analysis 26

7. Santa Clara County CTU Index Analysis 28

8. Analytic Hierarchy Schematic 37

LIST OF TABLES

1. Anecdotal Assessment of Options 6
2. Considerations for Bicycle and Transit Integration, by Transit Mode 7
3. Average Bicycle Parking Costs 8
4. Factor Analysis of Boulder CTU 20
5. Boulder CTU Index Example 21
6. Regression Model of Predicting CTUs 22
7. Factor Analysis of Chicago CTU 23
8. Chicago CTU Index Analysis 24
9. Ithaca Factor Analysis 25
10. Ithaca CTU Index Analysis 25
11. Portland Factor Analysis 26
12. Portland CTU Index Analysis 27
13. Factor Analysis of Santa Clara County 28
14. Santa Clara CTU Index Analysis 29
15. Focus Group Characteristics 30
16. Trip #1 Scenario Results 35
17. Trip #2 Scenario Results 35
18. Trip #3 Scenario Results 35
19. Trip #4 Scenario Results 36
20. Importance Criteria for 4 Factors 38
21. Integration Strategy Priority by Case Study Community 39
22. AHP Consistency Ratios 39
23. Cost Effectiveness Assessment 41
24. Average Trip Scenario Rankings 44
25. Importance Criteria for 4 Factors 44
26. Integration Strategy Priority Averages 45
27. Community Cost Effectiveness Assessment 45

28. Average Cost Effectiveness Assessment 46

29. Bicycle Parking Types and Average Cost 53

EXECUTIVE SUMMARY

When effectively integrated, bicycling and transit help advance various environmental, health, and congestion-mitigating benefits for communities. A successful integration between the two will likely increase: (a) the catchment area and subsequent patronage of transit, (b) the efficiency of transit by reducing the necessity of feeder bus services, and (c) the overall demand for cycling.

Increasingly, bicycling and transit are receiving attention in planning circles in their own right. Many countries are experiencing rising levels of cycling[1] and available reports of transit ridership suggest that the United States had the highest transit patronage in 52 years in absolute terms in 2008 despite falling gas prices.[2] Several studies suggest that the growth in both modes may in small part be a result of the integration of the two modes.[3] The global recession of 2008 may also have played a role in the growth of these modes. Cycling is a top contender as a mode to enhance such access to (and egress from) transit trunk lines. According to a national survey, almost one-half of Americans live within 0.25 miles (0.4 kilometers) of a transit stop.[4] To date, there is a minimal but growing amount of published material that comprehensively documents knowledge of how bicycling can best be integrated with transit and methodologies for systematically approaching this marriage.

A core challenge in realizing bicycle and transit integration is that the predominant approach for integrating the two modes in the United States—bicycles aboard the transit vehicle—frequently runs up against capacity restraints (typically two or three bicycles for each bus on a front rack or three to four bicycles per light rail car). While existing transit capacity for bicycles could be adjusted at the margins using this approach (e.g., through incentives, exploiting technology to enhance communication between riders), the opportunity is ripe to consider broader solutions—about which there is a dearth of information.

Effectively integrating bicycling and transit requires analysis of a broad set of alternatives. Such alternatives would fully consider: (1) the travel behavior of individuals, (2) the accompanying urban form characteristics, (3) individual preferences related to cycle-transit facilities, and (4) economic costs and technological feasibility. This research project is organized around three tasks. First, the research team identified the state of the knowledge on bicycle and transit integration with specific regards to identifying transit types and locations with the potential to generate CTUs. This step included reviewing the academic literature on cycle-transit integration and gathering costs of bicycle parking from industry representatives.

Second, the authors described the approach to data collection and analysis that centers on five case study communities (Boulder/Denver, Colorado; Chicago, Illinois; Ithaca, New York; Portland, Oregon; and Santa Clara County, California). For each community, planning efforts, policies, and innovative case studies provide the context for the evaluative efforts. An evaluative framework and multicriteria decision-making tool help understand the complex factors that (1) predict cycle-transit user generation at transit stops and (2) distill the factors most important in determining cyclists' preferences for bicycle and transit

integration strategies. The authors apply this index to five case study communities to gauge CTU generation along case study routes.

Third, the research team conducted focus groups with cyclists from the five case study communities to gauge cyclists' preferences for bicycle and transit integration strategies (hereby referred to as integration strategies). Seven focus groups were conducted in the communities during the spring of 2010.

This research relies on a variety of analytic tools. The CTU index provides a first cut to understand transit stops that have a higher likelihood to attract CTUs. Variables from the CTU index proved significant in predicting where CTU events would occur in a multiple regression analysis according to observed data provided by a local transportation authority. The Analytic Hierarchy Process, a multicriteria decision-making tool ranked cyclists' preferences for the four bicycle and transit integration strategies in order of preference: (1) "Bike ON transit" (0.471), (2) "Bike TO transit" (0.185), (3) "Shared bike" (0.185), and (4) "Two bike" (0.159). These results form the basis for the cost effectiveness assessment, including costs of different alternatives, number of CTUs per unit, and the likely effectiveness of each alternative (a measure of the degree to which a common aim is reached). Results of the cost effectiveness assessment suggests that "Bike TO transit" ranked most cost effective overall, followed by "Bike ON transit," "Two bike," and "Shared bike" strategies. This project provides a baseline understanding of the effectiveness of different bicycle and transit integration strategies and makes an initial attempt at identifying transit stops on specific routes more likely to generate CTUs.

BICYCLE AND TRANSIT INTEGRATION

Background information on bicycle and transit integration comes from a variety of sources. This literature provides an overview of contemporary research from United States and international sources. Conversations with representatives from the majority of the commercial bicycle parking manufacturers (and price lists when available) inform the section on pricing and parking technology.

STATE OF THE KNOWLEDGE

The existing knowledge base of cycling and transit integration is relatively thin and recent, but appears to be growing. In addition to a few write-ups from various agencies, at least two research reports exist (focused primarily on U.S. practices), as well as a handful of peer reviewed publications based on research predominantly from the Netherlands, Germany, the United Kingdom, and Denmark. A common goal in most of these studies aims to describe issues, behaviors, and hurdles related to what is introduced in this report as cycling-transit users (CTUs). Upon surveying the literature, the authors of this study distinguished four factors affecting the share of CTUs: (a) transport mode, (b) location in the urban fabric, (c) egress catchment area, and (d) trip purpose. While other factors inform the literature on inducing bicycle mode share, this paper focuses on factors specifically related to CTUs.

Consistent with prevailing knowledge of transit use, the literature on CTUs suggests transit mode is significant in determining the ability to recruit CTUS from a greater or lesser access catchment area. Transit services that quickly transport users relatively long distances (i.e., 48 kilometers (30 miles)) with few stops (e.g., commuter rail or express buses) tend to draw a larger share of CTUs than slower and shorter-distance routes.[5] The larger share of CTUs associated with rail and higher speed routes may be explained by frequent transit users who seek out faster travel modes and are willing to accept a longer access trip in return for shorter overall commute time.[6] Conversely, it is widely acknowledged that relatively shorter distances (i.e., less than five miles) can often be cycled more quickly than local transit.[7] A study of three European countries showed that the majority of CTUs ride between two and five kilometers (1.2 to 3.1 miles) to access faster modes of transit, whereas for slower modes of transit, CTUs generally prefer not to ride more than two to three kilometers (1.2 to 1.9 miles).[8] The National Center for Transit Research confirmed similar access catchment area sizes in a study of transit agencies in Florida and elsewhere in the U.S.[9]

Where and how a transit stop is situated relative to the surrounding urban form is important in CTU generation. The results of two European found that suburbs generate higher levels of CTUs than cities.[10] In transit-rich, compact cities, transit and walking are attractive alternatives to the bicycle.[11] Travel distances between common origins and destinations are relatively shorter in cities as compared to suburban locations, enabling greater pedestrian activity. Relatively higher densities in cities also makes possible a high-quality feeder bus service with short headways, making transit without bicycles more convenient. Access distance is relatively short in cities as local bus service is characterized by shorter distances, lower speeds and more stops closer together. On the other hand, in suburbs

with less frequent transit service and greater access and egress distances, bicycles provide a more efficient mode. Brojns et al.'s customer satisfaction survey of rail users revealed that improving transit access would increase ridership at the periphery of transit systems and be more cost effective.[12] Correspondingly, in urban areas with well-established transit systems, increasing the level of service would be more likely to increase ridership.

Across all transit modes in countries studied, egress distance from transit to activity end appears to be relatively consistent. Egress catchment area is small and a majority of trips are less than two kilometers (1.2 miles). Egress distances of up to 2.2 kilometers (1.4 miles) are dominated by walking, followed by additional transit trips and cycling. Distances farther than 2.2 kilometers (1.4 miles) are dominated by transit and cycling.[13] While one's personal bicycle is usually available for the access trip from home, for those who have a bicycle, transit capacity limits the availability of bicycles at the activity end of the trip.[14] Even when CTUs travel with bicycles aboard transit, one study determined that 80 percent of egress distances were less than 1.6 kilometers (1 mile) and almost 50 percent of survey respondents replied that their egress distance was less than 0.4 kilometers (0.25 miles).[15] These findings suggest that transit ridership decreases with egress distances greater than a quarter mile or five minute walk. Another important pattern of CTUs is that most are combining bicycle and transit trips for work and education purposes [16]—not surprising considering that trips for work and education comprise the most frequent transit use. CTUs for work-related travel tend to prefer transit modes and routes that more quickly transport users long distances and by more expensive modes than education-related trips. As work-related CTUs are more likely to have an automobile at their disposal, they seek out the fastest and most efficient routes, often bypassing inefficient feeder systems.[17] In contrast, students tend to make shorter, less expensive trips and frequently do not have an automobile.[18]

While the four factors summarize key aspects of bicycling and transit integration, existing research on CTUs remains minimal and spotty. Since some central issues related to CTUs vary dramatically by transit mode, key differences are summarized between six different modes in Table 1. Within each measure there may exist considerable variability due in part to differences in bicycle culture and level of bicycle-friendly infrastructure; future research may be able to better provide more precise estimations of the potential for capturing CTUs based on a number of local variables.

A core issue is that the predominant approach to integrate the two modes—bicycles aboard the transit vehicle—frequently runs up against capacity restraints (typically two or three bicycles for each bus on a front rack or three to four bicycles per light rail car). While existing cycling-transit capacity could be nominally adjusted using these approaches (e.g., through incentives, exploiting technology to enhance communication between riders), the opportunity is ripe to consider broader solutions—solutions around which there is a dearth of information. Broadly speaking, effectively integrating bicycling and transit requires analysis of a broad range of alternatives; such alternatives would fully consider both the travel patterns and needs of individuals but also accompanying urban form characteristics. In terms of a traveler's decision-making, the four most common strategies worthy of consideration:

1. “Bike ON transit,” transporting the owner’s bicycle aboard (inside or outside) the transit vehicle;
2. “Bike TO transit,” using and parking the owner’s bicycle at a transit access location;
3. “Two bike,” using an owner’s two bicycles at the access and egress location; and
4. “Shared bike,” sharing a bicycle, which would be based at either the transit access or egress point.

Each alternative carries many different considerations from the perspective of cost (to the user or the community), convenience, infrastructure needs, and benefits (to the user or the community). Furthermore, such considerations are complicated by the variety of types of users, their frequency, and the variety of urban form characteristics.

Access catchment area increases from slower modes with more stops to faster modes with fewer stops (moving across the table from left to right) (see Table 2). The estimated return on investment (ROI) compares the potential for capturing CTUs on particular transit modes based on improving bicycle parking and bicycle infrastructure (bicycle lanes, paths). The authors propose that with scarce funding typical of transit agencies, infrastructure investments of bicycle parking facilities (racks, lockers and bicycle stations) could be targeted at commuter rail and express buses on longer distance routes. Research findings support these ideas as CTUs are likely to substitute slower local bus service with walking and cycling.[19]

Recent findings from a national rail customer satisfaction survey in the Netherlands suggest that guarded bicycle parking (lockers and bicycle stations) are not preferred by regular CTUs.[20] The study found that upgrading to guarded bicycle parking frequently increased the distance to the station due to the locker’s larger space requirements. Respondents reported that investing in better unguarded bicycle parking facilities, improving connections, and higher capacity park and rides would do more to increase ridership. Finally, bicycle capacity is limited with all types of transit. Several studies highlighted successful programs that allowed additional bicycles on buses (either inside or in the undercarriage of the bus, where available), dedicated more bicycle capacity on trains, or converted car spaces on ferries to bicycle parking, without substantial problems and were likely to increase transit ridership.[21] Some transit agencies even allow an additional 10 bicycles aboard buses in the priority seating for elderly and disabled when available.[22]

Table 1. Anecdotal Assessment of Options

	Advantages		Disadvantages	
	To the user	**To the agency or community**	**To the user**	**To the agency or community**
Increase bicycle capacity on the transit vehicle	Limited increase in flexibility, security, guarantee	Potential for limited gain in ridership, reduced automobile parking needs	Depending on transit type—excess capacity may be quickly used up, limited growth potential (mode dependent)	Extensive costs, limited gain in ridership, potential to increase transit stop dwell time, costs, liability, limited ROI
Enhance parking at transit stop	Potential to increase security, weather protection, ease crowding, if short egress distance	Potential to decrease dwell time, increase CTUs, to discourage "Bike ON transit	Some bicycle parking facilities (e.g., lockers and corrals) may increase access distance to transit	Secure parking options such as bicycle lockers or corrals may present moderate to high costs
Bicycle sharing at either the access or egress location	Potential to address capacity limitations of "Bike ON transit," address final mile problem	Potential to decrease dwell time, increase CTUs, to discourage "Bike ON transit"	May not be of interest to user, additional expenses for program	Significant capital costs, difficulty in implementation
Employ user's second bicycle at egress location	Potential to address capacity limitations of "Bike ON transit," address final mile problem	Potential to decrease dwell time, increase CTUs, to discourage "Bike ON transit	Security concerns, costs may vary from low to high	Secure parking options such as bicycle lockers or corrals may present moderate to high costs

Table 2. Considerations for Bicycle and Transit Integration, by Transit Mode

	City bus	Rapid Transit (Underground rail / Metro)	Light rail	Regional bus	Commuter rail	Ferry
Access catchment area[a]	Small	Small	Medium	Large	Large	Medium
Estimated Return on Investment	Low	Low	Medium	High	High	High
Bicycle facility improvements	Racks	Racks and lockers	Racks and lockers	Racks and lockers	Racks, lockers, bicycle stations	Racks, lockers
Issues affecting widespread adoption[b]	CTUs likely to substitute bus trip with bicycle trip or walking	Grade separation may present large obstacle for CTUs and safety hazard	Limited bicycle capacity, possible grade separation challenges	Limited bicycle capacity, although undercarriage storage may be available	Grade separation may present difficulty for bicycle loading/unloading	Few
Bicycle Capacity[c]	2–3 bicycles per bus	2–4 bicycles per car	2–4 bicycles per car	2–3 bicycles per car, some buses have luggage bins (+6 bicycles)	20–40 bicycle capacity[d]	Often no limit

a. Karl Martens, The bicycle as a feedering mode: experiences from three European countries," Transportation Research Part D, vol. 9 (2004): 281–294; Michael Replogle, "Bicycles and Public Transportation: New Links to Suburban Transit Markets," The Bicycle Federation, Washington, DC (1983); P.J.A.M. Veeke, and P.H.L.Bovy, "Attractiviteit Combinatie Fiets en Trein," OSPA Onderzoeksinstituut voor Stedebouw, Planologie en Architectuur, Delft. 1990.

b. Chris Hagelin, "A Return on Investment Analysis of Bicycles-on-Bus Programs," National Center for Transit Research, Center for Urban Transportation Research, University of South Florida, 2005.

c. Replogle; Robert Schneider, "TCRP Synthesis of Transit Practice," *Transportation Research Board* 62 (2005).

d. Eisen Letunic, "Caltrain Bicycle Parking and Access Plan," prepared by in association with Fehr and Peers Transportation Consultants (October 2, 2008), http://www.Caltrain.com/pdf/ Caltrain_bicycle_plan_DRAFT_09-29-08_BODY.pdf, accessed July 25, 2009.

BICYCLE PARKING COSTS

This section summarizes costs associated with the integration of bicycles and transit. The complete section may be found in Appendix A. Transit-related equipment includes bicycle racks on or in buses and trains.

Common Bicycle Parking Configurations

According to information gathered from the five largest bicycle parking manufacturers, the majority sell a select number of common designs in addition to their own unique racks. The most common racks include the two-bicycle "U" or "staple" rack, single pole bollard racks or hitch racks, serpentine, and hanging loop racks. Average prices are calculated for common bicycle rack configurations (see Table 3).

Table 3. Average Bicycle Parking Costs

Type of Rack (bicycle capacity)	Average Cost ($) (# of companies)
U-rack/staple rack (2 bicycles)	129 (5)
Bollard type (2 bicycles)	172 (4)
Serpentine (5 bicycles)	343 (4)
Serpentine (9 bicycles)	528 (4)
Hanging loop (5 bicycles)	472 (4)
Hanging loop (10/11 bicycles)	822 (4)

Note: Information gathered September 2009.

Bicycle Infrastructure Costs on Transit Vehicles

The most common (and most popular) equipment on transit for bicycles is the front-end folding bicycle rack. Manufacturer Sportworks, who holds a patent for the most common bicycle-on-bus rack, quoted the cost for bicycle-on-bus racks to be between $467 (two bicycles, galvanized steel) to $1,332 (three bicycles, stainless steel). In general, pricing for each bicycle rack varies, depending on capacity and materials. According to personal communication with Sportworks in the spring of 2010, its most popular two-bicycle rack sells for $720. In addition to the cost of the racks, buses require an additional custom bus rack adapter that ranges in price from $200 up to $400.

The bicycle parking equipment manufacturers also provided anecdotal information about rack types. Several companies expressed security concerns about hanging loop racks. Despite their popularity, they are more easily vandalized due to the nature of the welds. As one company explained, welds between various diameter tubes compromise the structural integrity of the materials thereby increasing the risk of theft. Another consideration voices concerns the quality of materials. Manufacturers preferred stainless steel over galvanized steel to increase the durability of bicycle racks, and powdercoating over rubber coating for similar reasons. This description is a bit simplistic but necessary, because it would be prohibitively difficult to incorporate all costs associated with the integration strategies,

such as the cost to transit agencies of removing seats on transit vehicles for bicycle storage or real estate costs for increased bicycle parking, among other concerns.

Appendix B provides more detailed information on parking pricing as well as information on bicycle infrastructure on rail and bicycle lockers.

A FRAMEWORK TO ANALYZE CTU POTENTIAL

As previously described, a framework to effectively plan for CTUs must consider a variety of alternatives. Each alternative carries considerably different costs, convenience, infrastructure, security levels, and benefits to consider. These considerations, however, are complicated by the variety of types of users, their frequency of use, and the variety of urban form characteristics. Evaluation studies are useful in such circumstances because they typically distill the myriad factors into a common framework. For example, benefit cost analysis weighs the total expected costs of any alternatives against the total expected benefits of one or more actions—placing both in consistent monetary terms—in order to choose the best or most profitable option. Optimization studies obtain "best available" values of some prescribed objective function given a defined set of conditions. Arguably the most applicable evaluation for the applications described herein, *cost effectiveness,* considers a micro-view of a particular program's activities, outputs, or outcomes and informs the degree to which competing programs maximize said effectiveness versus costs.

Frameworks for cost effectiveness analysis (evaluation) come in many shapes and sizes but typically require considering four broad factors: (a) the costs of different alternatives; (b) likely effectiveness of each alternative (a measure of the degree to which a common aim is reached, e.g., number of CTUs at either the access or egress location); (c) potential externalities (positive or negative); and (d) degree to which the three considerations are weighted for (e.g., different perspectives or interest groups). Each factor could be assessed in monetary terms or through a variety of indices; when considering relatively intangible phenomena, analysts find the latter more useful. Any such research that captures these dimensions will provide much needed and necessary inputs to inform necessary parameters. The aim is to evaluate different programs and inform alternatives that contribute maximally to goal attainment within the various constraints of reality (i.e., costs and other). The alternatives for how to address various CTU planning issues and analyze them under the developed framework are as follows:

Costs: Gathering data on costs is relatively straightforward and was measured in per unit terms (dollars per expected CTU) for various alternatives; cost estimates were gathered for bicycle parking facilities from industry representatives of the five major companies who build bicycle parking structures: Bikeparking.com, Dero, Huntco, Madrax, and Saris.

Values for inputs other than costs previously mentioned were arrived at by employing several methods, triangulating among varying approaches to help arrive at consistent values. Given the dearth of available data on the subject, such estimates could be gathered from interviews with focus groups to better understand how different groups prefer various alternatives (thereby affecting the overall effectiveness), how they weight different factors

(costs, effectiveness, externalities), and other relevant information (additional information on focus groups provided below). For example, cost estimates for specific bicycle racks across the major brands yielded an interesting result concerning security. While most of the companies carried a similar model of a multiple bicycle, hanging loop rack, one company suggested that they are easy to vandalize due to inherent weakness of the welds.

Effectiveness: Two approaches have informed measures of effectiveness, primary among them is an exploratory analysis of transit stops vis-à-vis the built environment. A preliminary index is developed as a means to predict cycle-transit user (CTU) generation at transit stops. High or low amounts of CTU activity could be predicted as a function of independent variables such as demographics, supply of transportation services, urban form characteristics (employment or residential density) and geography. For example, a network area of two miles—often considered the cyclist's "sweet spot"—around all transit stops could be used as an example unit of analysis. Thresholds could then be used to inform station-specific estimates on the likelihood of attracting high, medium or low amount of CTUs, given a variety of sources of information. These estimates could then feed measures of effectiveness and costs for different alternatives. Calculations of the two measures of effectiveness follow this section. The second approach is developed through the use of an Analytic Hierarchy Process (AHP) conducted in focus groups in five case study communities. The AHP was constructed to gauge cyclists' preferences for bicycle and transit integration strategies.

Externalities: Any analyzed alternative needs to take into account any externalities that may be imposed on other populations. For example, a relaxed policy about bringing bicycles aboard light rail cars may impact other users; during rush hours, it may even decrease capacity. Alternatively, increasing the attractiveness of bicycles on transit has increased overall ridership for the Caltrain route from San Francisco to Gilroy, California, in a corridor with relatively long egress distances. Or, CTUs would have to wait for the next train/bus because capacity has already been reached. Externalities are difficult to quantify, though reflections from the focus groups provide initial reactions for key issues.

APPROACH TO GATHERING AND ANALYZING DATA

Five case study communities provide settings for the bulk of the data and analysis in this report. The five communities—Denver/Boulder, Colorado; Chicago, Illinois; Ithaca, New York; Portland, Oregon; and Santa Clara County, California were chosen because they represent a variety of settings, including a variety of transit services (light rail, heavy rail, buses).

Each case study reviews the current setting of the community's bicycle planning efforts with particular focus on bicycle and transit integration. As a proof of concept application in each setting, each case study focuses on a particular route in each community to demonstrate stops more likely to attract CTUs. The selected routes agree with the state of the knowledge for likelihood to maximize bicycle and transit integration. The CTU index is initially calibrated using data from the Boulder/Denver setting—because this is the only setting that the authors are aware of that has precise data for the stops for CTU loadings and unloadings—and then applied to routes in the four other communities.

The research team conducted focus groups in each setting. Facilitators convened an additional focus group in Boulder and Ithaca (two in each location) due to high response rates, for a total of seven. The purpose of the focus groups was to: (1) gather cyclists' preferences on four integration strategies, and (2) collect survey data to use in a cost effectiveness analysis. The authors first report on the discussions from each focus group and then analyze the data using AHP and report the results for each setting followed by a section comparing the results across settings.

CASE STUDY COMMUNITIES

Boulder/Denver, Colorado

Boulder is part of the fast-growing Denver metropolitan area. Both Boulder and Denver pride themselves on their emphasis on alternative modes of transportation, particularly regional transit and bicycle infrastructure, for which the Denver Regional Transportation District (RTD) has received national awards. Boulder is one of three communities in the U.S. to receive the award as a Platinum-level Bicycle Friendly Community, the League of American Bicyclist's highest level of achievement. Boulder is known for its dedication to environmental issues and purchase of open space through a voter-initiated tax.

The Boulder Bicycle System Plan was included as an element of the 1995 Transportation Master Plan update. The bicycle element is based on creating a continuous network of cross-town corridors allowing for safe and convenient bicycle travel throughout the community.[23] Boulder's efforts include on- and off-street facilities to accommodate bicyclists of varying levels of experience and comfort levels.

With the completion of the bicycle element, an additional 92 miles of bicycle lanes, routes, and shoulders will be added to complete a grid-based system of primary and secondary bicycle corridors. In addition, enhanced crossings, overpasses and underpasses will be added to prioritized intersections.

The plan includes the following goals: (1) increase bicycle mode share by at least four percent by 2020; (2) establish effective public participation and partnerships with surrounding city entities to develop and improve the bicycle system; (3) develop and maintain a continuous bicycle system with access to major destination areas; (4) design and construct bicycle facilities in ways that encourage bicycle riding, provide for safer interaction with other modes, and better integrate bicyclists into the roadway system; (5) develop an urban form which is characterized by people-oriented land use patterns and which enables people to walk or ride their bicycles to destination areas;(6) complete the missing links in the regional system and to provide continuous bicycle facilities and good bicycle-transit integration between the City of Boulder and neighboring cities; (7) develop local recognition of the bicycle as a legitimate form of transportation; and (8) increase transportation safety for all modes through education and enforcement efforts.

In doing so, the plan encourages the development of a seamless connection between bicycle and transit by requiring all transit centers and park and rides be serviced by primary and secondary bicycle corridors. The plan required that all buses include bicycle racks by 1996. The plan also outlined goals of working with Boulder County, the Denver Regional Council of Governments (DRCOG), and other city governments to provide for direct bicycle access from the corridor network to the bicycle parking area at all transit centers and park and ride facilities throughout the region and transit stops throughout the city.

A more recent innovation in bicycle and transit innovation stems from an initiative to address what is commonly referred to as the final or last mile problem. Boulder County Transportation Department recently received funding to increase CTUs with their “Final Mile Initiative,” aimed at reducing traffic congestion along a highly congested state highway through a bicycle adoption program. Highway 119, linking the towns of Boulder and Longmont (located approximately 15 miles [24 kilometers] to the northeast) experiences the highest hours of congestion in Boulder County. Traffic forecasts for this corridor show expected traffic volume growth of 23 to 56 percent by 2020.

The bicycle adoption program provides commuters with an adopted bicycle (or space for their own bicycle) and secure bicycle corral at their egress location. The program envisions corrals to be covered structures with secure entrance for a limited number of users. The corral may use smart technology for efficient and convenient use. The Boulder-Longmont corridor is a practical location for a bicycle-bus initiative because it links several thousand employment sites all within a few miles of the targeted route. The provision of bicycles to this transit route (called the BOLT and the focus of the CTU index described later) provides riders at strategic egress locations and is intended to mitigate the final mile problem. The relatively low density development around Boulder (at least outside the downtown area), precludes bus lines from efficiently accessing many regional work locations. The provision of the bicycle loaner program is that many offices in Boulder are within easy cycling distance from a transit stop.

Funds from the Colorado Department of Transportation (CDOT) Congestion Mitigation and Air Quality (CMAQ) grant will purchase up to 200 bicycles and bicycle corrals that will be placed at busy egress areas in the city of Boulder along two longer-distance 22- and 26- mile (35- and 42- kilometer) regional bus routes with 15-minute peak commute hour headways. Bicycle service will be available at a locally contracted bicycle shop.



Figure 1. Bicycle Corral Prototype
(Courtesy of Ann Forsyth)

Boulder County initially planned on using bicycle lockers for the Final Mile Initiative. However, they chose enclosed corrals instead, variably sized protected space for a number of bicycles, to protect bicycles from the elements and the added benefits of cost and space savings. Bicycle lockers were determined to be too expensive (more than $1700 per locker) and also consume too much space per unit. Given that they are trying to locate the corrals in higher activity areas, space saving is critical. A local design firm is running a competition for designing the corrals to increase the program's appeal. Program managers at Boulder County deem it important to have an attractive layout as a way to market the program and encourage use.

Boulder County is currently in the process of selecting bicycle corral locations based on a combination of sources, including (1) popular boarding and alighting locations based on on-bus surveys, (2) online surveys of CTUs, (3) online surveys of non-CTU bus users, (4) recommendations from the cities of Boulder and Longmont, and (5) depending on the available public space for an approximately 15 by 20 foot structure to secure 10 to 15 bicycles. Several other factors which may determine placement of the corrals is access to a power source. Otherwise, solar panels are being considered as a way to bypass that need.

In addition to addressing issues surrounding vehicle miles traveled (VMT), congestion and air quality, ancillary goals of the Boulder project are to find alternatives to the traditional bicycle-on-bus model that is limited by low bicycle capacity, increased dwell time associated with undercarriage storage, and weak feeder bus services typical of U.S. residential development. By reducing the number of bicycle boardings and alightings and the associated dwell time, this project also hopes to improve bus service. The Denver Regional Transportation District

(RTD) service planners have noted increased delays of up to two minutes per bicycle on regional routes as a result of bicycle storage in luggage bins on the undercarriage and on the front bicycle racks. Through mitigating inefficient transfers, travel time may be decreased and bus frequency increased, improving service to relatively lower density residential areas with the potential to make the transit trip more attractive.

Chicago, Illinois

The City of Chicago is the largest city in the Midwest with over 2.8 million residents in the city.[24] The Chicago 2015 Bike Plan, approved in 2006, is a follow-up to the 2000 Chicago Bike Plan. It builds on the success of the 2000 plan that has already achieved establishment of a network of 100 miles of on-street and 50 miles of off-street trails; installation of 10,000 bicycle racks (the most of any U.S. city), allowing bicycles on Chicago Transit Authority (CTA) trains and equipping their fleet of 2,000 buses with bicycle racks; developing numerous educational and outreach materials; and organizing outreach programs.

The 2015 Bike Plan sets two overall goals—the first to increase bicycle use to five percent of all trips less than five miles in length, and the second to reduce the number of bicycle injuries by 50 percent from current levels. The plan includes strategies for implementation, performance measures, examples of best practices from specific U.S. and international cities, and possible funding sources. The plan sets out three main approaches: (1) incorporate cyclists' needs in the planning, design, and operation of trains and stations, (2) establish bikeways to popular train stations, and (3) provide bicycle parking inside and outside stations.

The chapters on bicycle parking and transit are most closely aligned to this study's research topic. The transit chapter sets as a goal to increase the number of bicycle-transit trips by 10 percent per year. The plan references the integration of bicycling with transit as a competitor to the single-occupant vehicle as the combination of the two increases the travel range, flexibility, and speed of the bicycle. The bicycle plan's authors suggest that the combination of trips can be as convenient as car trips and are often quicker and more relaxing with less environmental impact. The main objectives of the transit chapter are to: (1) improve bicycle access to CTA stations and trains to encourage bicycling and increase transit use, (2) increase capacity and publicize bicycle racks on CTA and PACE (local transit authority for Chicago suburbs) in order to increase usage, (3) provide secure bicycle parking at train stations, and (4) market the bicycle-transit connection.

The plan advises the preparation of a feasibility study to determine the best locations for establishing large, weather-protected bicycle parking areas at CTA and Metra train stations. One of the considered locations includes inside CTA stations. While not providing direct supervision of the bicycles, locating bicycle racks in high-traffic areas inside a paid entrance has increased the use of bicycle racks at CTU stations, due in part to perceived security. Anecdotal evidence suggests that the vandalized bicycles left at racks and the fear of vandalism has been a deterrent to the use of bicycle racks. The Chicago plan also encourages improving bicycle access to CTA stations as a way to induce bicycling and transit use.

Ithaca, New York

Ithaca, a small town in upstate New York, is home to Cornell University and Ithaca College. Ithaca registers a population of 30,627 residents and nearly doubles with the student population.[25] The Ithaca Bicycle Master Plan was approved March, 1997 by the Department of Planning and Development. It continues a tradition of bicycle planning in Ithaca that dates back to 1975 when a graduate planning class developed the first Bikeway Study. In 1990, the city appointed a Bicycle Advisory Council which later developed into the present day Bicycle/Pedestrian Advisory Council.

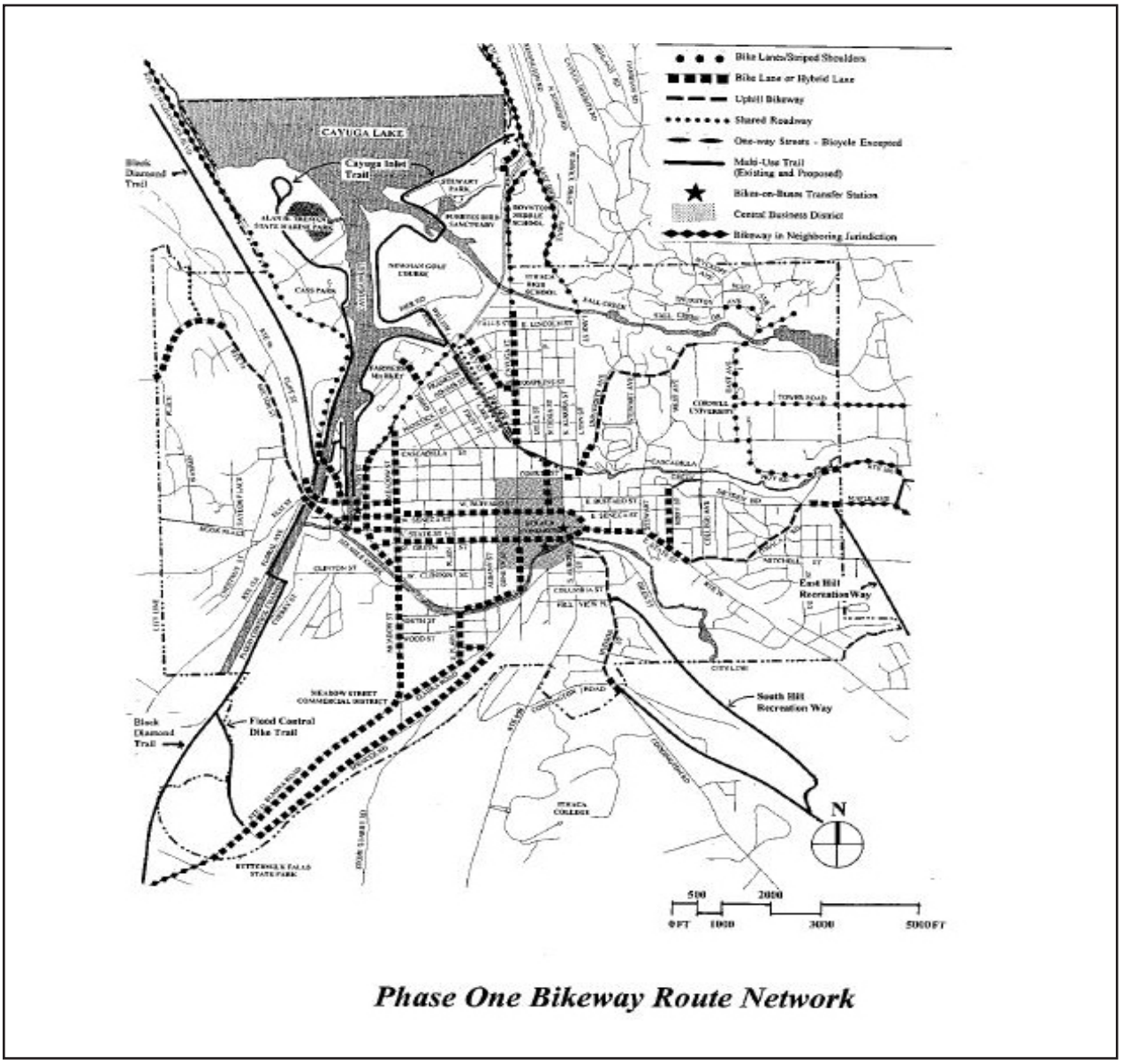


Figure 2. Ithaca Bikeway Route Network
(Source: Ithaca Bicycle Master Plan)

The overarching goals of the plan are to double current percentage of total trips made by bicycles within the City of Ithaca and reduce the number of bicycle injuries and deaths by 10 percent. The plan was developed to achieve two objectives—the first, to develop

bicycle facilities to most effectively spend the Intermodal Surface Transportation Efficiency Act (ISTEA) funds allocated by the State of New York, and the second to outline a long-term vision to increase bicycle use and safety. The plan includes the following sections: (1) goals, objectives, and related bicycle policies, (2) identifying a bikeway network, (3) developing bicycle parking standards and ordinances, (4) developing education, enforcement and encouragement programs, and (5) identifying implementation strategies and maintenance issues.

The plan outlines efforts to improve the integration of bicycles and other modes of transportation (i.e., bicycles on buses, etc.) in the main objectives. Additionally, the plan prioritizes the placement of bicycle racks at "well-used buildings" and at transit stops. At the time of the development of the plan, Ithaca claimed to have the first comprehensive bicycles-on-bus program in the state of New York with all 64 buses in the Tompkins Consolidated Area Transit (TCAT) fleet outfitted with bicycle racks. While the plan generally does not distinguish between transit stops that are more or less likely to generate CTUs, it prioritizes three bicycle-on-bus transfer stops located at the bottom of hills, anticipated to generate greater CTU demand. The bicycle-on-bus transfer points are designed to accommodate cyclists waiting to catch the bus at the base of steep hills, highlighted by TCAT as the "ultimate hill climbing gear." The plan directs the bicycle and bus stops to include covered off-street waiting areas and additional bicycle parking if the racks are already full.

Portland, Oregon

Portland, Oregon (population 551,226) is widely considered one of the country's most bicycle-friendly cities with a long history of bicycle planning. It is also one of the three communities to receive the Platinum-level Bicycle Friendly Community.[26] The city has a strong legacy of environmental actions and dedication to alternative modes of transportation.

Portland created their first bicycle plan in 1973, followed shortly by the creation of the Portland Office of Transportation Bicycle Program and the Bicycle Advisory Committee, a city council appointed group of residents. Portland has passed multiple plans with the most recent one in early 2010. The Portland Bicycle Plan addresses six key elements: (1) attract new riders, (2) strengthen bicycle policies, (3) form a denser bikeway network, (4) increase bicycle parking, (5) expand program to support bicycling, and (6) increase funding for bicycle facilities. In addition, the plan stresses the need to plan and design for people who are not yet riding and making bicycling more attractive than driving for short trips.

The Portland Bicycle Plan for 2030 includes a section on integrating bicycling and other modes. To achieve this goal, the plan outlines four main components: (1) allowing bicycles on transit, (2) offering bicycle parking at transit locations, (3) improving bicycle access to transit, and (4) encouraging usage of bicycle and transit programs. The plan defines encouragement as including providing a bikeway network, end-of-trip facilities, and bicycle-transit services, providing incentives, and providing information and/or maps with recommended cycling routes.

The plan views the bicycle-transit connection as a means to increase bicycle mode share as well as Tri-Met ridership, Portland's public transportation provider. The plan recognizes the challenges of incorporating increased transit, specifically the potential for increased dwell times and transit efficiency, but states that with the expected increase in bus and rail lines anticipated to be in service in the next twenty years, the Tri-Met system should be able to accommodate increased bicycle-on-transit use.

Santa Clara County, California

Santa Clara County contains the largest city in the San Francisco Bay area, San José, with a population of 905,180 residents.[27] The county is recognized for its large number of high technology businesses and is considered to be the hub of Silicon Valley. In August 2008, the Santa Clara County Valley Transportation Authority (VTA) adopted the Santa Clara Countywide Bicycle Plan 2020 (CBP), the bicycle element of the Valley Transportation Plan 2020. The CBP guides the development of major bicycling facilities by identifying cross county bicycle corridors and other projects of countywide or intercity significance. The CBP focuses on a regional level, while local jurisdictions' bicycle plans cover their communities in greater detail.

The central vision of the plan is to establish, protect and enhance bicycling and to assure that it remains a practical and safe mode of travel. The plan includes five goal areas under which the plan lists desired policies: (1) transportation planning and programming, (2) land use/ transportation integration, (3) local ordinances and guidelines, (4) design and construction, and (5) complementary policies that encourage cycling.

Central to the discussion of integrating bicycling and transit, this plan includes an overarching goal of establishing a seamless bicycle and pedestrian network, composed of both on-street and off-street facilities, that integrates bicycle access to and within the transit system. The plan maintains an emphasis on safe routes to transit in transportation funding priorities, originally initiated in 2000. To achieve their goal of integrating bicycling and transit, the plan focuses on increasing access across barrier, (i.e., roads, rivers, etc., and improving roadway crossings for increased bicycle safety and ease of travel.)

Similarly, the plan details the importance of bicycle parking. The plan distinguishes three types of parking and their different requirements: short term (less than two hours), long term (four to 24 hours) and overnight (24 hours to two weeks). The plan distinguishes three different levels of bicycle parking security-Class I: secure bicycle parking; Class II: bicycle racks; and Class III: inadequate bicycle racks. The plan provides location criteria for each of the classes of bicycle racks.

The Caltrain route from San Francisco to Gilroy, California serves as an example of how a transit agency and bicycle advocacy group have mutually benefited from addressing bicycle capacity limitations. The program began in 1992 to increase ridership and satisfy CTU demand. As many of the egress distances to employment centers along the route are greater than comfortable walking distances, the efficiency and speed of bicycles were seen as a way to attract ridership from those would not otherwise consider Caltrain. According to a Caltrain survey, 40 percent of trips from home or work to a Caltrain station are less

than 10 minutes by bicycle, and 80 percent are less than 20 minutes.[28] In addition to allowing bicycles aboard, Caltrain has also established shuttle buses to access major employment centers. The program proved to be so successful that the demand for space quickly outpaced the available bicycle parking on the train. Since 1992, bicycle capacity has steadily increased to accommodate up to 24 or 40 bicycles on two different train car models and 34 of the 90 daily trains include two bicycle cars per train with a capacity of 48 bicycles.

Over the years, both Caltrain and the San Francisco Bicycle Coalition (SFBC), a local bicycle advocacy group, have taken steps to improve the efficiency of bicycles aboard Caltrain. SFBC has established a Twitter message board for regular Caltrain users to share real-time information on the availability of bicycle parking on particular trains. During a recent one-month period, CTUs posted 135 messages on Twitter.[29] To supplement the limited data collected by Caltrain, SFBC set up a protocol for regular commuters to count bicycles on trains, as well as to report when a bicycle was bumped due to lack of capacity. Another initiative to increase bicycle capacity focuses on folding bicycles, since these do not require special bicycle parking on the train. The Caltrain Bicycle Park and Access Plan has recommended providing a $200 subsidy to commuters toward the purchase of a folding bicycle.

At the current level of ridership and train car configuration, increasing bicycle capacity will come at the price of increased dwell times thereby diminishing the train's express appeal.[30] As Caltrain considers a forecasted 100 percent increase in ridership by 2030, they initiated a comprehensive plan in March of 2010 to study access capacity. Caltrain realizes the need to maximize access capacity by increasing walking, riding transit, and biking to improve service and to be able to handle the expected increased ridership.

PREDICTING CTU POTENTIAL

With a growing desire to enhance cycling and transit use, yet recognizing the challenge of tight budgets, a central issue is that planners do not have good information about where to focus efforts. Which routes are more likely to increase bicycle and transit integration? Are some stops more likely to generate CTUs? As an effort to shed light on this issue, this study's authors developed an analytical index to predict where along a transit route more CTUs may be expected to occur. The authors selected routes from each of the case study settings to uncover stops that are more likely to produce CTUs. The selection prioritized regional, relatively higher speed routes with good frequency and fewer stops. The selected routes are typically anchored in a central city and service relatively lower-density areas.

The CTU index incorporates readily available U.S. Census demographic and commuting data coupled with digitized bicycle facilities (trails, lanes, etc.) typically available from localities. A CTU index is provided for all five case study communities.

The CTU index comprises a network buffer for transit stops on a given route, determined by the area served by the road system, within two miles of each stop.[31] Existing knowledge on cyclist behavior suggests that several factors would lead to higher CTU potential;

these measures include: (1) median household income (on average, though this is certainly not always the case), (2) percent population between the ages of 20 and 39, (3) average net density as measured by number of dwelling units per acre in each network buffer, (4) percent of the employed population who commute by transit at least three days per week, (5) percent who commute by bicycle at least three days per week, and (6) kilometers of bicycle lanes. After measuring these attributes for each stop along the route within each buffer area, the authors employed factor analysis using SPSS 18.0 to arrive at a standardized score for each stop. Factor scores from the analysis comprise the CTU index. Seven stops were selected across each route spaced relatively evenly to represent the entire route.

Pilot in Boulder/Denver, Colorado

The research team piloted the index on the Boulder County Final Mile regional bus route, described previously as RTD, had provided data on the number of bicycle loadings and unloadings by stop. While the available data was limited, it provided the only data of its type that this study's authors were aware of (quite simply, transit agencies nationwide had a dearth of data specifically recording the transit stop that bicycles were loaded). RTD collected the data over an eight-hour, cumulative, weekday period. A bicycle event was defined as when one or more bicycles were loaded or unloaded at a particular stop. Neither the direction of the bus at stop locations nor the number of bicycles were recorded, however. In addition to the available boarding and alighting data for the BOLT route, this transit route meets the criteria for being a strong candidate for bicycle and transit integration as it is a regional route servicing a surrounding suburb with relatively few stops and traveling at relatively higher speeds.[32]

Figure 3 displays the Bolt Route with the calculated CTU index depicted for each stop. For example, transit stops that ranked highest by the CTU index are Canyon Boulevard and 28th Street, and Walnut Street and 14th Street—areas that rank relatively high in terms of kilometers of bicycle routes, percent that commute by bicycle, and density. Such calculations represent an analytical approach to identify transit stops with potential for increased CTUs. The lowest ranked stops are Oxford Road and Highway 119, and Niwot Road and Highway 119, located in the rural area between Boulder and Longmont, where the buffers consist of lower densities, fewer bicycle facilities and subsequently fewer commuters principally using bicycle and transit. While Boulder scores higher on the CTU index than Longmont, efforts to increase the CTUs in Longmont would yield greater results as more people travel from Longmont to Boulder's employment center.

A single factor (eigenvalue of greater than 4.5) explained more than 75 percent of the variance across all six measures; all six measures load heavily on the factor. Eigenvalues refer to the variance accounted or explained by an individual factor. Factor analysis considers 1 as a minimum for a significant factor. See Table 4 for factor loadings and Table 5 for comparisons of CTU scores.

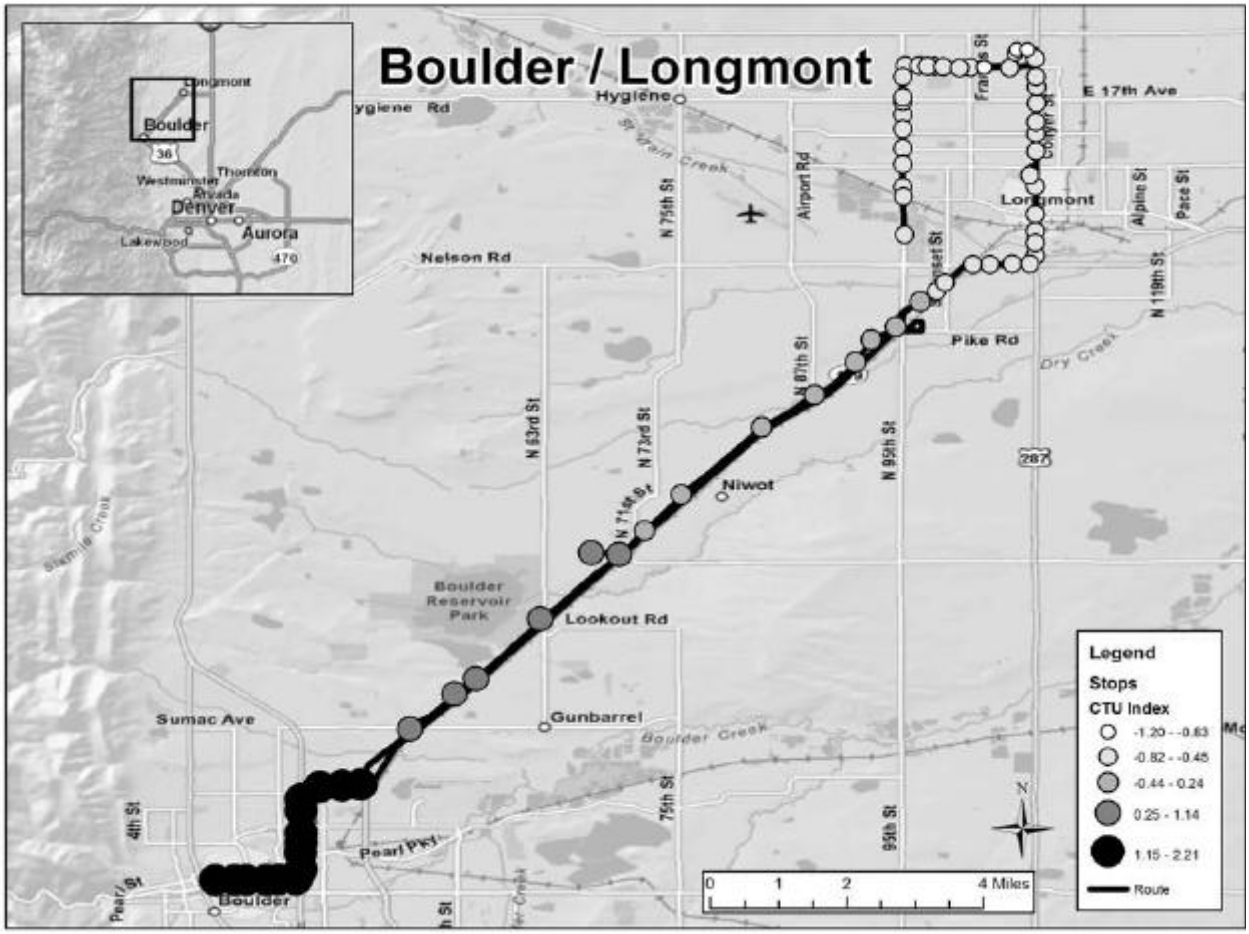


Figure 3. Boulder/Longmont CTU Index Analysis

Table 4. Factor Analysis of Boulder CTU

Component Matrix	
Variables	**Factor Loading**
Median household income	-0.640
Percent population (age 20-39)	0.931
Density (dwelling units/acre)	0.797
Percent transit (commuting three times or more per week)	0.912
Percent bicycle (commuting three times or more per week)	0.945
Bicycle facilities (kilometers of bicycle routes)	0.947

Note: Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.

Table 5. Boulder CTU Index Example

	Median Household Income	Percent Population (20–39)	Density (gross dwelling units per acre)	Percent Commute by Transit (3 or more days per week)	Percent Commute by Bicycle (3 or more days per week)	BicycleRoutes (km)	CTU Index Score	*CTU by Dwelling Unit	*CTU by Pop 20-39	*CTUs predicted by Multiple Linear Regression
Oxford Road and Hwy 119	$79,087	0.24	0.32	0.02	0.01	2.29	-1.00	-0.32	-0.24	0.61
Main St and 6th St	$46,774	0.31	2.21	0.02	0.01	62.20	-0.87	-1.92	-0.27	2.16
Hover Rd and Mtn.View Rd	$56,776	0.28	2.23	0.02	0.01	46.91	-0.68	-1.51	-0.19	-0.04
Niwot Rd and Hwy 119	$82,712	0.24	0.28	0.03	0.02	14.48	-0.57	-0.16	-0.14	0.89
Iris Ave and 28th St	$52,251	0.42	3.92	0.07	0.06	73.53	0.83	3.25	0.35	0.87
Walnut St and 14th St	$48,926	0.39	3.27	0.06	0.07	84.95	0.87	2.84	0.34	5.63
Canyon Blvd and 28th St	$37,413	0.50	3.87	0.08	0.08	67.19	1.42	5.49	0.71	-0.34

* *Note:* These variables are used only for regression analysis in addition to the first six CTU variables.

To compare the degree to which the CTU index predicts cyclists accessing transit along the BOLT route, a multiple regression analysis was conducted to determine how well the six CTU variables and two interaction variables (shown in Table 5) predicted the RTD observed data. This combination of variables significantly predicted RTD observed data at the 0.05 level with an adjusted *R* squared value of 0.225. Given the relatively coarse phenomenon being predicted together with the relatively low "N," the authors were comfortable accepting significance values close to the 0.10 level. Results of the regression analysis are listed in Table 6. Upon completion of the initial CTU index in Boulder, a CTU index was created in the remaining case study communities.

Table 6. Regression Model of Predicting CTUs

Variables	Coef.	t-stat.	Sig.
Constant	12.660	1.418	0.161
Median Household Income	0.000	-1.637	0.107
Percent Population between 20 and 39 years	-19.302	-1.314	0.194
Dwelling Units Per Acre (Gross)	-1.284	-1.232	0.223
Transit Commuter (Percent of population that commutes by transit at least three days per week)	0.168	0.268	0.790
Bicycle Commuter (Percent of population that rides bicycles to work at least three days per week)	1.579	1.800	0.077
Kilometers of Bicycle Trails	0.059	1.686	0.097
CTU Score by Dwelling Units/Per Acre (Gross)	-0.552	-0.694	0.491
CTU Score by Population (20-39)	-4.483	-0.480	0.633
Summary Statistics			
N		70	
Adjusted R^2		0.225	

Chicago, Illinois



Figure 4. Chicago CTU Index Analysis

A single factor (eigenvalue of 3.5) explained more than 58 percent of the variance across all six measures for Chicago; four of the six measures load heavily on the factor. Three factors load heavily on the second factor. See Table 7 for factor loadings and Table 8 for comparisons of CTU scores.

Table 7. Factor Analysis of Chicago CTU

Component Matrix		
Variables	**Factor Loading Components**	
	1	**2**
Median household income	-0.419	0.766
Percent population (age 20–39)	0.966	-0.046
Density (dwelling units/acre)	0.938	-0.232
Percent transit (commuting three times or more per week)	0.919	-0.058
Percent bicycle (commuting three times or more per week)	0.791	0.594
Bicycle facilities (kilometers of bicycle routes)	0.180	0.930

Note: Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.

Table 8. Chicago CTU Index Analysis

	Median Household Income	Percent Population (20–39)	Density (gross dwelling units per acre)	Percent Commute by Transit (3 or more days per week)	Percent Commute by Bicycle (3 or more days per week)	Bicycle Routes (km)	CTU Index Score
Union Station	$50,635	0.46	10.30	0.27	0.008	8.40	0.87
Western Ave	$23,741	0.35	7.73	0.24	0.004	4.50	1.42
Clyde	$41,592	0.32	6.56	0.09	0.003	6.70	0.83
Berwyn	$47,951	0.29	5.39	0.10	0.001	4.30	-0.57
Riverside	$51,315	0.27	3.54	0.10	0.002	5.10	-1.00
Brookfield	$52,176	0.27	3.34	0.10	0.005	9.80	-0.68
LaGrange	$69,852	0.24	3.29	0.13	0.004	7.60	-0.87

Ithaca, New York

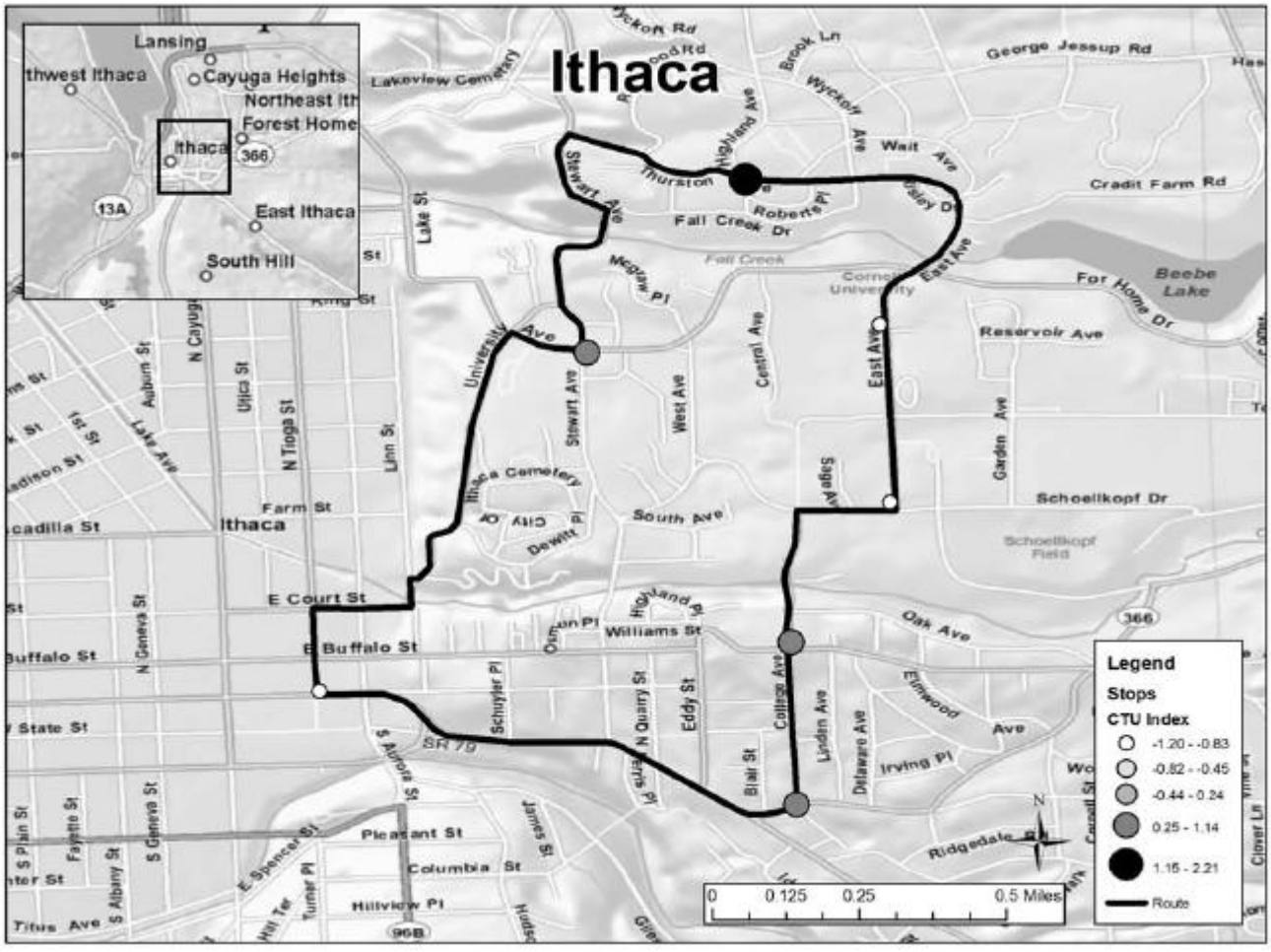


Figure 5. Ithaca CTU Index Analysis

A single factor (eigenvalue of 3) explained more than 50 percent of the variance across all six measures for Ithaca. Three of the six factors load heavily on the first factor. See Table 9 for factor loadings and Table 10 for comparisons of CTU scores.

Table 9. Ithaca Factor Analysis

Component Matrix		
Variables	**Factor Loading Components**	
	1	**2**
Median household income	0.964	-0.116
Percent population (age 20-39)	-0.483	0.848
Density (dwelling units / acre)	-0.975	-0.058
Percent transit (commuting three times or more per week)	0.859	0.494
Percent bicycle (commuting three times or more per week)	-0.226	-0.884
Bicycle facilities (kilometers of bicycle routes)	0.132	0.743

Note: Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.

Table 10. Ithaca CTU Index Analysis

	Median Household Income ($)	Percent Population (20–39)	Density (gross dwelling units per acre)	Percent Commute by Transit (3 or more days per week)	Percent Commute by Bicycle (3 or more days per week)	Bicycle Routes (km)	CTU Index Score
Seneca and Commons	$22,415	0.57	6.36	0.01	0.11	5.00	-1.20
Highland and Thurston	$44,851	0.46	0.68	0.03	0.09	2.63	1.20
Goldwin Smith Hall	$36,135	0.63	0.21	0.04	0.04	5.59	0.77
College and Dryden	$27,895	0.68	7.06	0.02	0.03	3.77	-0.99
University and Stewart	$36,413	0.55	2.02	0.03	0.05	3.94	0.51
College and Mitchell	$27,101	0.64	6.78	0.02	0.06	3.00	-0.93
Sage Hall	$37,033	0.65	1.70	0.04	0.01	6.51	0.64

Portland, Oregon

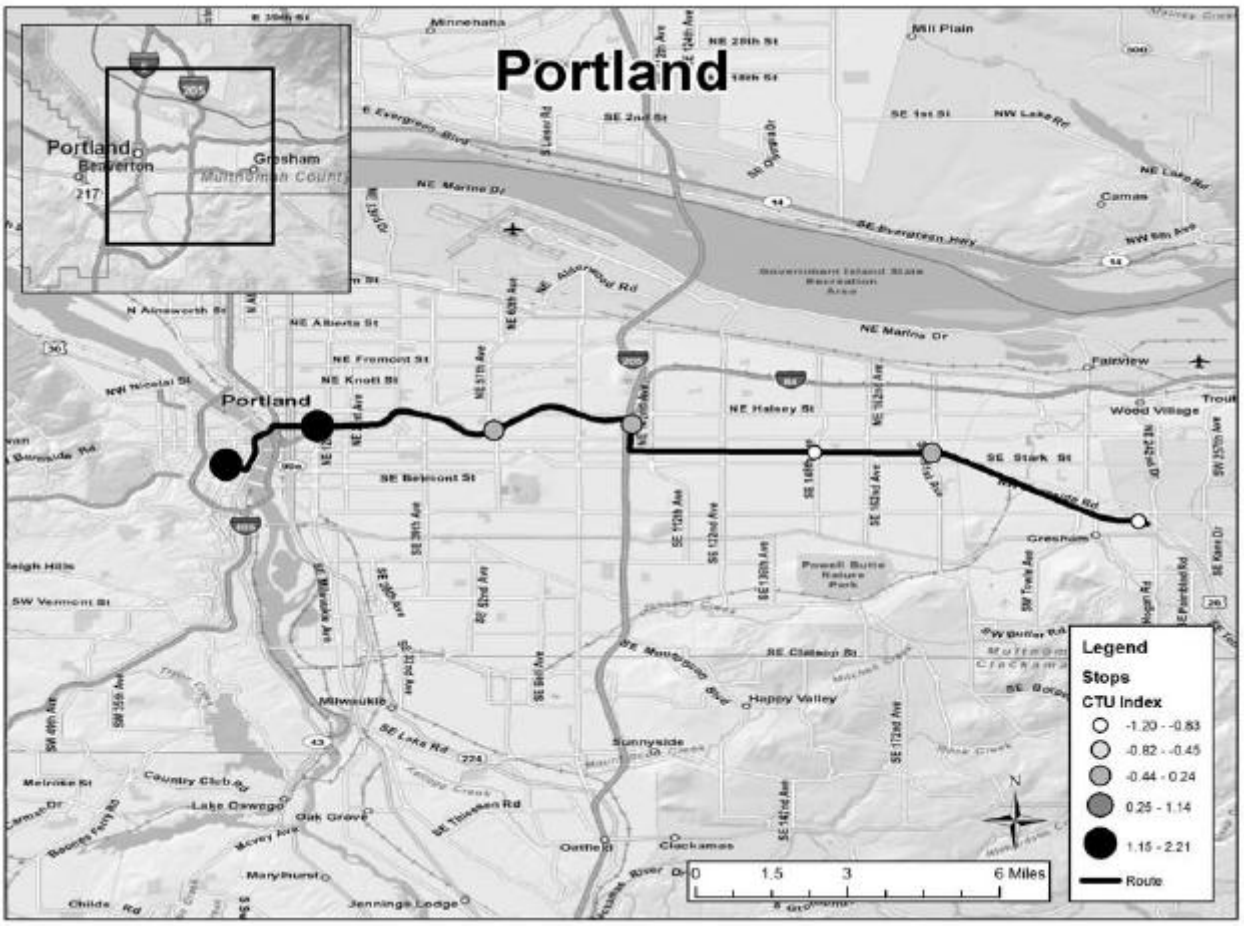


Figure 6. Portland CTU Index Analysis

A single factor (eigenvalue of 4.9) explained 82 percent of the variance across all six measures for Portland; all of the six measures load heavily on the factor. See Table 11 for factor loadings and Table 12 for comparisons of CTU scores.

Table 11. Portland Factor Analysis

Component Matrix	
Variables	**Factor Loadings**
Median household income	-0.509
Percent population (age 20–39)	0.979
Density (dwelling units/acre)	0.889
Percent transit (commuting three times or more per week)	0.983
Percent bicycle (commuting three times or more per week)	0.984
Bicycle facilities (kilometers of bicycle routes)	0.977

Note: Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.

Table 12. Portland CTU Index Analysis

	Median Household Income	Percent Population (20–39)	Density (gross dwelling units per acre)	Percent Commute by Transit (3 or more days per week)	Percent Commute by Bicycle (3 or more days per week)	Bicycle Routes (km)	CTU Index Score
Gateway/NE 99th Ave TC MAX Station	$39,743	0.30	3.61	0.01	0.10	70.47	-0.32
Pioneer Square South MAX Station	$37,784	0.46	5.73	0.05	0.19	160.55	1.25
NE 60th Ave MAX Station	$46,777	0.34	5.18	0.02	0.13	88.28	-0.07
Cleveland Ave MAX Station	$45,656	0.30	2.54	0.00	0.06	69.68	-1.04
E 181st Ave MAX Station	$37,877	0.32	3.22	0.01	0.11	70.80	-0.33
E 148th Ave MAX Station	$38,568	0.29	3.80	0.00	0.09	64.83	-0.96
Lloyd Center/NE 11th Ave MAX Station	$36,475	0.43	5.32	0.06	0.20	141.97	1.49

Santa Clara County, California

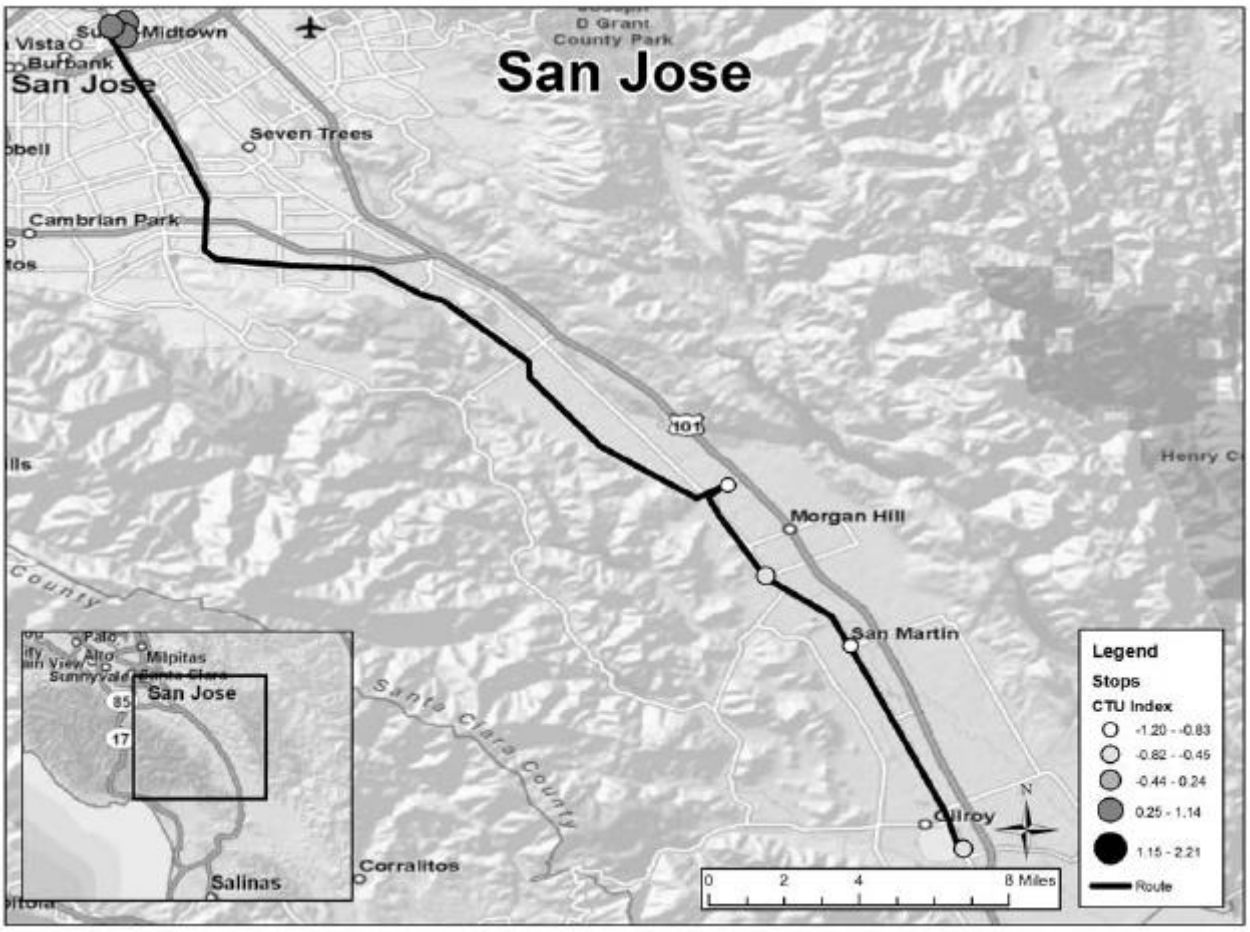


Figure 7. Santa Clara County CTU Index Analysis

A single factor (eigenvalue of 3.8) explained 63 percent of the variance across all six measures for Santa Clara County; three of the six measures load heavily on the factor. See Table 13 for factor loadings and Table 14 for comparisons of CTU scores.

Table 13. Factor Analysis of Santa Clara County

Component Matrix		
Variables	**Factor Loading Components**	
	1	**2**
Median household income	-0.916	-0.388
Percent population (age 20-39)	0.992	0.064
Density (dwelling units / acre)	0.032	0.999
Percent transit (commuting three times or more per week)	-0.023	0.999
Percent bicycle (commuting three times or more per week)	0.964	-0.255
Bicycle facilities (kilometers of bicycle routes)	0.994	-0.057

Note: Extraction Method: Principal Component Analysis, Rotation Method: Varimax with Kaiser Normalization.

Table 14. Santa Clara CTU Index Analysis

	Median Household Income	Percent Population (20 - 39)	Density (gross dwelling units per acre)	Percent Commute by Transit (3 or more days per week)	Percent Commute by Bicycle (3 or more days per week)	Bicycle Routes (km)	CTU Index Score
Almaden	$48,296	0.41	4.64	1.62	9.82	72.61	0.99
San Fernando	$46,758	0.42	4.67	1.72	10.44	78.44	1.14
Market	$47,246	0.41	4.63	1.61	10.03	73.62	1.03
Sutter	$84,676	0.28	0.79	0.67	3.61	13.81	-0.89
San Martin	$82,372	0.24	0.28	0.02	4.04	1.26	-1.06
Tennant	$80,356	0.27	1.15	0.45	4.35	20.94	-0.75
Depot	$55,623	0.31	24.44	10.39	3.05	20.93	-0.46

The CTU index provides a first cut to understand transit stops that have a higher likelihood to attract CTUs. The CTU index incorporates available data about socio-demographics from the U.S. Census, bicycling facilities, and transit use. It is further confirmed by the results of the regression analysis. However, it is still important to understand the local context within which the bus route is located. Many other subjective factors come into play, some of which include existing levels of bicycle ridership, cost of parking, level of transit service, and individual perceptions of transit. Projected levels of CTUs may greatly differ between cities and may change over time.

CASE STUDY FOCUS GROUPS: UNDERSTANDING CYCLISTS' PREFERENCES

The CTU index provides a first measure to understand the likelihood of CTUs at specific stops along transit routes; understanding preferences from cyclists regarding different integration strategies provides an alternative approach. Cyclists' preferences for each of the integration strategies provide important information for practitioners to understand where infrastructural enhancements might be most effective to generate CTUs. The lack of available data on cyclists' preferences necessitated conducting a series of focus groups to better understand how different groups prefer the four integration strategies and indirectly, the overall effectiveness of the strategies.

Participants were solicited through a convenience sample. Local contacts provided names of organizations and email list serves of bicycle advocacy groups, cycling groups, and neighborhood list serves through which participants were solicited in each of the five communities. Facilitators convened an additional focus group in Boulder and Ithaca due to high response rates. Attendance at each of the seven focus groups ranged from five to ten cyclists with a combined total of 50 participants.[33] While results from the brief survey showed that the cyclists tended to either drive a car or ride as a passenger in the car during the past week, their results also showed that they used transit, bicycled for utilitarian trips and walked for utilitarian trips on a regular basis. Many of the participants had one car per household or drove infrequently, and approximately six participants were either car-free or belonged to a car share program.

Table 15. Focus Group Characteristics

Focus Group location	Number of participants	Gender (% male)	Mean age (year)	Minimum age (years)	Maximum age (years)	Average number of days accessed transit by bicycle during last seven	Average number of days bicycled to work/school during the last seven
City of Boulder	6	67	45	40	51	1.3	2.6
Boulder County	6	83	44	35	55	2.2	4.5
Chicago	8	38	34	22	48	0.1	2.0
Ithaca 1	9	67	40	22	56	1.8	3.4
Ithaca 2	5	100	37	24	54	2.6	4.4
Portland	10	80	45	31	57	2.4	1.1
Santa Clara County	6	100	47	34	57	3.0	4.0

Relying on these sources allowed the authors to find experienced cyclists willing to participate in the focus groups, many of whom combined cycling and transit on a regular basis. The sample was comprised of experienced and knowledgeable cyclists from which to gather information, however, generalizations from this subset are best to be confined to avid cyclists (it is hard to apply such findings so the general population at this point). As the population of interest comprised a niche group of citizens, a random sample would not have yielded the knowledge base or the turnout that the avid cyclists afforded.

The research team chose focus groups to understand cyclists' preferences as little is known on the subject, the issues are relatively complex and focus group discussions can typically gather richer dialogue than surveys.

The group discussion centered on the pros and cons of the four common bicycle and transit integration strategies: (1) "Bike ON transit," (2) "Bike TO transit," (3) "Two bike," and (4) "Shared bike." Complete transcriptions from the group discussion are provided in Appendix D. The guided surveys included four common bicycle trip scenarios that required participants to rank cycle transit facilities according to their preferences. Four common trip scenarios tested how and if cyclists' preferences for integration strategies would change with different trip purposes. The scenarios included common trips that cyclists often make including commute trips, social visits, and shopping trips. For each trip scenario, respondents were asked to rank in order from one to three or four (1 = most preferred; 4 = least preferred), their preferred strategies. The "Two bike" method was only available for the commute trip scenario #1 as shared bicycles are typically only appropriate for repetitive trips where one would make the extra effort to place a second bicycle at the egress location of the journey. Descriptions of the proposed trip scenarios and results of the scenarios follow. See Appendix E for the focus group survey form. Additional materials provided to focus group facilitators to assist them are located in Appendix F.

Cyclists' Preferences for Bicycle and Transit Integration Strategies

"Bike ON transit"

The majority of the participating cyclists preferred the "Bike ON transit" integration strategy the most of all four strategies. Common themes from the seven focus groups suggest that cyclists prefer riding their own bicycles and having their bicycle with them for the egress trip. A cyclist's own bicycle fits the rider well and may be accessorized with lights, fenders and other items according to their wishes. Respondents cited security issues, flexibility to change plans, and the need for a bicycle to make egress trip as reasons for their decisions.

While "Bike ON transit" was heavily favored, respondents recognized the limitations of this strategy. Several comments resonating with groups considered the demand for "Bike ON transit" as a design flaw in how we live and that more accessible destinations would be required to change the demand for "Bike ON transit" as well as for any mode. Another respondent commented on how the countries with the highest bicycle use and transit use frequently do not allow for bicycles on transit.

Other sentiments included capacity limitations and the likelihood of getting "bumped," the inability to scale capacity and the increased dwell time associated with transporting bicycles on transit. The difficulty of loading a bicycle on to a bus was also cited as a deterrent to the "Bike ON transit" strategy. While this response was infrequently cited among our group of respondents, novice cyclists frequently share this concern with traveling with bicycles on transit. Several respondents in Portland suggested that they would prefer to walk for the egress trip if the distances were reasonable. When bicycle capacity on bus is met, respondents suggested that overall CTU use will decrease due to the risk of getting bumped.

Several unique comments about the cons of transporting bicycles on transit concerned the inconvenience to other passengers. Respondents expressed concern that the light rail frequently is too crowded with people to try to put bicycles on the train. Even if increasing capacity were an option for bicycles, it would not help much because of the train overcrowding. These respondents suggested that only an increase in train frequency would ease the overcrowding of trains make "Bike ON transit" more feasible or separation of cyclists and other passengers. There was overwhelming support for the idea if there were more frequent and less crowded trains, more CTUs would be generated. Several respondents expressed concern about this strategy as it required one to keep an eye on the bicycle for security concerns and perception that the bicycle may fall.

While not a formal part of the focus group discussions, respondents frequently offered solutions to the capacity issue. Respondents from communities with bicycles transported inside train cars (i.e., Portland's MAX light rail system and Silicon Valley's Caltrain) encouraged the separation of bicycles from passengers through the use of dedicated bicycle cars or parts of cars with dedicated bicycle entrances. Similarly, in Boulder, where "Bike ON transit" is heavily favored, suspected in part due to the relatively low density nature of the region, respondents proposed a separate bicycle bus to allow bicycles on board a particular bus on a route heavily utilized by bicycle and transit integration. Likewise,

limiting stops where bicycles are allowed on buses was suggested as a means to limit dwell time increases due to bicycle loadings and unloadings.

A long-term solution regarding limited bicycle on bus capacity from the Boulder County focus group concerned redesigning buses to accommodate bicycles in the undercarriage in an upright position. Denver's RTD uses coach-type buses for longer distance routes. These buses are equipped with undercarriage bins, presumably for luggage. Respondents suggested that with just a little extra clearance, bicycles would be able to be stored vertically with bicycle racks, allowing more bicycles to be stored underneath.

One focus group proposed an economic solution to the capacity problem that would charge users for the use of the rack. A flat fee would serve to discourage short distance users freeing up more rack space for travelers on longer trips or with longer access/egress trips. Otherwise, congestion pricing could free up space during the commute hours for CTUs presumably in greater need of covering longer egress distances. As another respondent commented, too high a price for the service might discourage users from taking transit in the first place.

"Bike TO transit"

"Bike TO transit" consistently ranked as the second most preferred strategy behind "Bike ON transit" and was most preferred in Chicago and Santa Clara County, California. On a number of occasions, respondents believed the availability of bicycle parking to increase ridership of both modes—cycling and transit. As previously discussed, respondents prefer "Bike TO transit" in part due to the inconvenience of traveling with the bicycle and due to worries of inconveniencing other passengers on transit (dwell time, busy trains). Some respondents found traveling without a bicycle to be less worrisome and with fewer hassles. Respondents preferred this option in Portland, an area with relatively higher density and widespread use of bicycle lockers. Respondents in Chicago preferred other alternatives due to security concerns and fewer secure bicycle parking options.

Those respondents not in favor of "Bike to transit" commonly expressed the need for a bicycle for the final mile, or to continue on as part of trip chaining. Respondents found the final mile to be a concern in relatively lower density areas (Boulder/Denver), or in small communities where distances were short enough that cyclists would prefer to bicycle the entire distance (Ithaca). The favorability of "Bike TO transit" depended upon the availability of secure bicycle parking. Many respondents expressed concern about leaving a bicycle unattended for extended periods. When discussing secure parking, respondents offered the following qualities on several occasions: well lit, clean or orderly, secure, and the presence of some sort of deterrence, either camera monitoring or frequent foot traffic. Respondents frequently cited the presence of bicycles with stolen parts or abandoned bicycles to be a strong deterrent to parking a bicycle at that location.

Respondents also offered a number of solutions to parking challenges. While lockers were not a necessary feature to insure secure parking, many cyclists preferred them, especially in Portland. Lockers offer a secure, weather protected shelter where users may leave a change of clothes. Cyclists preferred bicycle lockers over bicycle lids or "clam

shells" as they prevented people from slashing tires and provide fuller coverage. Several respondents from Chicago claimed that since the attacks of September 11, 2001, bicycle lockers have become less favorable with government officials due to security concerns associated with storage spaces in public locations. Other comments about bicycle lockers concerned insufficient numbers and desire for "coin operated" lockers or smart technology that could accommodate multiple users and not be held "hostage" for extended periods via an ongoing subscription process.

Cyclists in Chicago expressed interest in the Chicago Transit Authority's (CTA) recent efforts to provide indoor bicycle parking at CTA stations. Installing bicycle parking indoors provides weather protection and informal eyes on the bicycle by other transit riders and transit officers. The location of the racks also requires users to pay to get in, another barrier to potential thieves.

Several respondents suggested that making bicycle parking more attractive and easier to find would increase their use. Along those lines, respondents similarly suggested encouraging covered bicycle parking. Another way to make bicycle parking more secure is to increase traffic around the bicycle parking location. Several respondents in Boulder suggested the co-location of a bicycle repair facility, coffee shops and similar retail at a popular park and ride as other communities have developed.

"Shared bike"

A third alternative strategy is the shared bicycle system. Shared bicycle systems are increasingly popular, domestically as well as internationally. Many cities are building modern versions with advanced technology allowing for quick registration and wireless reservations. Interest by respondents was also high, however, they frequently didn't see how shared bicycle systems would improve upon their own commutes. Several themes were consistent throughout the discussions on bicycle sharing.

Respondents preferred this option less than "Bike ON transit" and "Bike TO transit" for their own personal commute trips. Many respondents expressed interest in the shared bicycle system for tourists, students, and infrequent cyclists. Respondents also saw value in a shared bicycle trip for infrequent and non-work trips, or when bicycle capacity on transit is full. They expressed interest in using a shared bicycle system on their own vacations or other travel.

Those respondents not in favor of shared bicycle systems expressed an attachment to their own bicycle, how it fits, the type of bicycle, and accessories. Some of the respondents' reservations about bicycle sharing concerned system functionality. Commonly expressly concerns included worries about unreliability, responsibility for a very expensive bicycle, the need to carry a helmet, or that the bicycle wouldn't fit them properly. Some of the participants were unaware of the third generation bicycle share systems that address some of their concerns of program functionality.

“Two bike”

Respondents saw some value in the “Two bike” integration method and its ability to improve the transit experience, but several respondents considered the option inappropriate for their city, too insecure, or too difficult to organize.

Several key points were repeated across the focus groups concerning the “Two bike” integration method. First, security concerns were raised every time. Respondents suggested that the success of a “Two bike” system depended upon the availability of secure parking. Even if one places a heavily-used bicycle of little value at the destination transit stop, a guarantee is needed that the bicycle will be there. One respondent presciently reflected that the viability of this option relied on the development of a culture where bicycles became so commonplace that theft was less of a threat. Similar to the possibility of getting “bumped” from transit when bicycle capacity is reached, a second issue frequently repeated concerned the risk of the second bicycle being vandalized or have a mechanical breakdown that was unappealing to some. A third concern that arose in these dialogues concerned the fact that managing two bicycles seemed overwhelming.

A final response to the “Two bike” strategy concerned the fact that the option seemed unnecessary in their local environment. From Ithaca, several respondents saw their community as too small to require this integration. They generally would prefer to ride the entire way given the relatively short distances needed to travel. In Portland, several respondents similarly thought this approach was unnecessary given the frequently-cited short egress distances commonly found in the downtown business district, with its relatively higher density. These respondents were similarly in favor of “Bike TO transit” and especially of bicycle lockers for security and weather protection.

Trip Scenario Exercise

Facilitators guided focus group participants through each of four trip scenarios which required respondents to rank their preferred integration strategy between one (most preferred) and three or four (least preferred), The “Two bike” strategy was blocked out for the last three scenarios because it generally is not an option for infrequent trips.

The focus groups included the trip scenarios to understand if and how cyclists’ preferences for the four strategies changed based on type of trip. The trip scenarios and the results from each of seven focus groups follow.

Table 16. Trip #1 Scenario Results

Trip #1: You are a regular commuter to work on transit (~10 to 15 miles) and bicycling to transit is an option for you at both ends of the trip; distance to and from transit stop is ~ two miles at origin and destination. Because you are going to work, time is an issue; weather is uncertain.

	Boulder (City)	Boulder (County)	Chicago	Ithaca 1	Ithaca 2	Portland	Santa Clara (County)	**Average Score**
“Bike ON transit”	1	1	1	1	1	1	1	1
“Bike TO transit”	2	3	3	2	2	2	2	2
“Shared bike”	2	2	2	3	3	2	2	3
“Two bike”	2	2	4	4	4	3	3	4

Table 17. Trip #2 Scenario Results

Trip #2: You are visiting a friend for a social visit on a nice, warm day. Transit distance (eight miles); distance to and from transit stop is ~ two miles at origin and destination. Time is not a factor.

	Boulder (City)	Boulder (County)	Chicago	Ithaca 1	Ithaca 2	Portland	Santa Clara (County)	**Average Score**
“Bike ON transit”	1	1	1	1	1	1	1	1
“Bike TO transit”	3	3	2	2	2	2	2	2
“Shared bike”	2	2	2	3	3	3	2	3
“Two bike”								

Table 18. Trip #3 Scenario Results

Trip #3: You are making a routine grocery shopping trip. Time is not a factor. Weather uncertain. Transit distance (eight miles); distance to and from transit stop is ~ two miles at origin and destination.

	Boulder (City)	Boulder (County)	Chicago	Ithaca 1	Ithaca 2	Portland	Santa Clara (County)	**Average Score**
“Bike ON transit”	1	1	1	1	1	1	1	1
“Bike TO transit”	3	3	2	2	2	2	2	2
“Shared bike”	2	2	3	3	3	3	3	3
“Two bike”								

Table 19. Trip #4 Scenario Results

Trip #4: You are going out to dinner together with a friend on a nice, warm weekend evening. Transit distance (eight miles); distance to and from transit stop is ~ two miles at origin and destination. Time is not an issue.

	Boulder (City)	Boulder (County)	Chicago	Ithaca 1	Ithaca 2	Portland	Santa Clara (County)	**Average Score**
"Bike ON transit"	1	3	2	1	1	1	1	1
"Bike TO transit"	3	2	1	2	2	2	2	2
"Shared bike"	2	1	3	3	3	3	3	3
"Two bike"								

Anecdotal Responses from Trip Scenarios

To ease the query for the focus group respondents, the authors aimed to provide limits around the available options to assure consistency in responses, (e.g., providing distance and weather information); however, some respondents expressed concern with the limited options. A number of respondents preferred to ride the entire way, despite efforts to prevent that by increasing the distance. Several respondents thought it unrealistic to bicycle eight miles to go grocery shopping, or to go grocery shopping and carry groceries on a bicycle and load the bicycle on transit. Future studies of this nature might better control by requesting up front that these options are the only options. Additionally, changing the errand for trip three from grocery shopping to some other errand might reduce the chance of these questions.

The trip scenario ranking reflected the findings of the focus group discussions. "Bike ON transit" ranked on average, the overall favorite for all responses for all scenarios. "Bike TO transit" ranked second, followed by "Shared bike." The "Two bike" strategy ranked least favorite for trip scenario number one, the only trip with this option.

The tables generally show consistency of results across focus groups. The top two overall preferences ("Bike ON transit" and "Bike TO transit") showed less variation than the bottom two ("Shared bike" and "Two bike"). The consistency may vary more for the lower two responses as most people were less aware of these strategies and may have greater difficulty evaluating them.

ANALYTIC HIERARCHY PROCESS

The complexity of factors that inform a cyclist's preference for one strategy over another—coupled with the inherent challenges and opportunities presented by each of the strategies—makes it to objectively select prioritize CTU strategies. A second quantitative measure of effectiveness employs the Analytic Hierarchy Process (AHP) to evaluate cyclists' preferences for bicycle and transit integration strategies. AHP, a multicriteria decision-making tool, prioritizes and weights different factors associated with a complex

issue. It reduces a complex issue into key elements, individually compared in a pairwise fashion on a numeric, reciprocal scale from one to nine. The tool quantifies which strategy is most attractive to the group of interest providing a clear rationale for selecting one pathway. AHP provides a measure of consistency, may be replicated, and is suitable for group decision-making.[34] While the calculations are somewhat complex for the organizer, participants in an experimental study ranked AHP as the most trustworthy and least difficult among methods studied.[35]

The goal of the analysis is to determine preferred bicycle and transit integration strategies and understand central characteristics that were most important in their decision. Each participant at the focus groups completed the pairwise comparisons for use in the AHP. The responses were averaged by community. Figure 8 provides a schematic of the AHP framework. The AHP decision model in this study consists of three levels. In the first level, the goal of the analysis is presented. The second level consists of the main decision criteria: security, guarantee, flexibility, and cost to user. Security refers to the threat of vandalism or theft; guarantee—how likely the integration strategy will be available upon demand; flexibility—how well an integration strategy affords the CTU the ability to change plans as needed; and cost—cost to user for use of the integration strategy. The third level consists of the four predominant methods of bicycle and transit integration strategies: (1) “Bike ON transit,” (2) “Bike TO transit,” (3) “Shared bike,” and (4) “Two bike.”



Figure 8. Analytic Hierarchy Schematic

Criteria Weights

Table 20 shows the criteria weights, or the relative weight that respondents assigned to each level two criterion. Criteria weights are calculated from the pairwise comparisons borrowing from linear algebra and eigenvectors. They can be thought of as percentages that range from zero to one with one representing 100 percent favor of a selected criterion. Based on the calculations, security ranks as the most important criterion across all seven focus groups in making decisions about cycle transit facilities; with an importance weight of 0.347 it influences more than a third of the decision. Guarantee (0.278) ranked as the second most important criterion and flexibility (0.210) third most. Cost (0.082) was the least important criterion ranking low on the scale. Individual criterion weights and the following overall performance weights are calculated using the principle eigenvector method. For more information on eigenvectors and the functionality of AHP in general, please refer to the literature and online software packages.[36]

Table 20. Importance Criteria for 4 Factors

Factor	Average	Range	Standard Deviation
Security	0.347	0.189– 0.560	0.135
Guarantee	0.278	0.152– 0.342	0.082
Flexibility	0.210	0.188– 0.426	0.041
Cost	0.082	0.152– 0.342	0.010

A closer look at the individual communities indicates that security ranges from a low of 0.189 in Boulder up to 0.560 in Chicago. The high score in Chicago is likely a reflection of the fear of bicycle theft. Guarantee, was less critical, but ranked high in Boulder, perhaps reflecting the need for a bicycle to cover a final mile.

PREFERRED INTEGRATION STRATEGIES

Results from six of the seven focus groups suggest enhancing capacity on transit is the most preferred integration strategy, with the exception of Portland, Oregon that preferred “Bike TO transit” (Table 21). Composite weights, or the preferred integration strategies, provide a proportional ranking of each of the strategies. The composite weight is calculated based on the weights of levels one and two gathered from the pairwise comparisons. Pairwise comparison values are averaged by focus group. “Bike TO transit” scored below “Bike ON transit,” distantly followed by “Two bike” and “Shared bike” strategies. Boulder County, Portland, and Santa Clara County only slightly favored “Bike ON transit” over “Bike TO transit.” Boulder County and Santa Clara both heavily favored the security of “Bike ON transit” over “Bike TO transit,” whereas Portland considered “Bike TO transit” to be more secure. The security concerns of unsecured bicycle parking were repeatedly expressed in the focus group discussions, as was Portland’s preference for bicycle lockers. These findings suggest that increasing the security of bicycle parking would make “Bike TO transit” more competitive.

Table 21. Integration Strategy Priority by Case Study Community

	Boulder	Boulder County	Chicago	Ithaca 1	Ithaca 2	Portland	Santa Clara (County)	**Average**
"Bike ON transit"	0.544	0.369	0.472	0.640	0.623	0.322	0.326	0.471
"Bike TO transit"	0.129	0.209	0.127	0.114	0.184	0.324	0.211	0.185
"Shared bike"	0.206	0.231	0.273	0.134	0.096	0.124	0.229	0.185
"Two bike"	0.120	0.190	0.128	0.111	0.097	0.231	0.233	0.159

Consistency Ratio

Consistency ratios provide a measure of the logic behind the pairwise comparisons and level of uniformity of response. It follows that if one prefers A over B, and B over C, that the individual should logically prefer A over C. Consistency ratios at 10 percent or below are considered acceptable as a rule of thumb, much beyond 0.10, and the results of the pairwise become more random. The consistency ratios for each focus group are calculated based on simple averages of all respondents per focus group (Table 22).

Table 22. AHP Consistency Ratios

	City of Boulder	Boulder County	Chicago	Ithaca 1	Ithaca 2	Portland	San José
Level 1 Comparison							
(Security/Guarantee / Flexibility/Cost)	0.12	0.09	0.01	0.12	0.01	0.10	0.12
Comparing Integration Strategies while thinking of level 1 criteria							
Security	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Guarantee	0.19	0.50	0.05	0.07	0.22	0.05	0.03
Flexibility	0.05	0.05	0.02	0.12	0.05	0.05	0.09
Cost	0.05	0.04	0.04	0.10	0.11	0.10	0.01

The ratios reflect consistency in the responses averaged by groups with 26 of the 35 ratios within the 10 percent threshold. It reflects consistency in a group's response. Several groups with ratios of up to 50 percent would be worth further investigation by looking at the individual responses for common patterns. The highest consistency ratios all fall within the guarantee criterion. Communication with the other group facilitators suggests that there were some misunderstandings about the meaning of guarantee. Some respondents considered guarantee to mean that the integration strategy was guaranteed to be available, while the study's authors intended to question the guarantee of the strategies such that the guarantee of "Bike ON transit" may be limited by the lack of capacity on a bus or light rail.

COST EFFECTIVENESS: ANALYSIS AND CONCLUSIONS

The framework used to assess cost effectiveness relied on three broad factors: (a) the costs of different alternatives, (b) a projected number of CTUs per unit, and (c) the likely effectiveness of each alternative (a measure of the degree to which a common aim is reached). The aim could be measured in terms of number of travelers using transit with bicycle use at either the access or egress location. Costs and number of CTUs accommodated per unit were gathered from contacting industry representatives. The focus groups gathered cyclists' preferences through SP surveys, applied in the AHP process. The overall cost effectiveness is calculated as the composite weight divided by the per CTU cost, or impact per dollar. Cost effectiveness assessments are replicated for all four strategies and for all seven focus groups.

Results from the seven focus groups suggest that on average, enhancing bicycle parking is most cost effective, however, cost effective assessments for only three of the of the focus groups weighed in favor of "Bike TO transit" (Boulder County, Portland, and Santa Clara County) while the remaining four favored "Bike ON transit" (Table 23). "Two bike" and "Shared bike" strategies distantly followed the "Bike TO transit" and "Bike ON transit" strategies. Boulder County and Santa Clara County both heavily favored the security of "Bike ON transit" over "Bike TO transit," whereas Portland considered "Bike TO transit" to be more secure. The security concerns of unsecured bicycle parking were repeatedly expressed in the focus group discussions as was Portland's preference for bicycle lockers. These findings suggest that increasing the security of bicycle parking would make "Bike TO transit" more competitive.

Further examination of the figures yielded some nuances in the overall rankings. The cost per CTU figure for "Bike ON transit" is based on the average cost of a bus-mounted three-bicycle rack paid by a large U.S. municipality. Bicycles on buses is just one type of "Bike ON transit" integration strategy. Reviewing costs of other bicycle and vehicle integration strategies suggests that the overall cost effectiveness of the top two strategies, "Bike TO transit" and "Bike ON transit" are not clear cut. For example, the cost for a bicycle rack inside a light rail vehicle averages $172 per CTU. Using this integration strategy, "Bike ON transit" proves more cost effective than "Bike TO transit."

Table 23. Cost Effectiveness Assessment

Integration Strategy	Composite Weight	Cost ($)/CTU	Overall Score	Overall Ranking
"Bike TO transit" (Bike rack on light rail)	0.471	172	0.00273	(1)
"Bike TO transit"	0.185	97	0.00191	1
"Bike ON transit" (Bike rack on bus)	0.471	323	0.00146	2
"Two bike"	0.159	194	0.00082	3
"Shared bike"	0.185	3,500	0.00005	4

RESULTS AND SUMMARY

CTU Index

The CTU index comprises a calculated network buffer for transit stops on a given route using network analysis to determine the area served by the road system. Factor scores from the analysis comprise the CTU index. A single factor (eigenvalue of greater than 4.5) explained more than 75 percent of the variance across all six measures for the pilot case in Boulder; all six measures load heavily on the factor. To compare the degree to which the CTU index predicts cyclists accessing transit along the BOLT route, we regressed RTD observed data on the six CTU variables and two interaction variables. Correlation between CTU index and RTD observed data were highly significant at the 95 percent level with an adjusted R-squared value of 0.225. Upon completion of the initial CTU index in Boulder, the process was applied to all case study communities. The results of the CTU index proved to be of variable strength. Results from the Chicago, Ithaca, and Santa Clara County factor suggest that the results were not as clear cut. In each of these three factor analyses, a possible second factor was involved. Ithaca's results were not surprising in that the chosen route did not comport with the literature on routes most likely to generate CTUs. However, Portland's CTU index clearly mirrored the results from Boulder. Data that specifically collects CTU boardings and alightings at stops could help further calibrate and confirm our findings in multiple settings.

Focus Groups

Preliminary results suggest that experienced CTUs prefer the "Bike ON transit" and "Bike TO transit" strategies, despite the risks of limited bicycle capacity. The relative lack of experience in the U.S. with shared bicycle programs and using a CTU's two bicycles at both ends of the transit journey may influence the lower value placed on these two modes that tend to enjoy greater use in Europe.

The focus groups provided much feedback on the pros and cons of the four bicycle and transit integration strategies.

"Bike ON transit"

The majority of the participating cyclists preferred the "Bike ON transit" integration strategy the most of all four strategies, however, the "Bike TO transit" strategy was the second most preferred strategy overall and was most preferred in Chicago and Santa Clara County, California. Respondents repeated several common themes at the focus groups. Cyclists prefer riding their own bicycles and having their bicycle with them for the egress trip. Respondents cited security issues, flexibility to change plans, and need for bicycle to make egress trip as reasons for their decisions. Respondents frequently offered solutions to the capacity issue that included separation of bicycles from passengers through the use of dedicated bicycle cars or parts of cars with dedicated bicycle entrances, limiting stops where bicycles are allowed on buses as a means to limit dwell time, due to bicycle loadings and unloadings, a longer-term solution requiring redesigning buses to accommodate bicycles in the undercarriage in an upright position, and economic solutions that would charge users for the use of the rack to discourage short distance users.

“Bike TO transit”

“Bike TO transit” consistently ranks as the second most preferred strategy behind “Bike ON transit” or less frequently as the most preferred strategy. On a number of occasions, respondents believed the availability of bicycle parking to increase ridership of both modes—cycling and transit. As previously discussed, respondents prefer “Bike TO transit” due in part to the inconvenience of traveling with the bicycle, and due to worries of inconveniencing other passengers on transit (dwell time, busy trains).Some respondents found traveling without a bicycle to be less worrisome and with fewer hassles. Respondents preferred this option in Portland, an area with relatively higher density and plentiful bicycle lockers. Respondents in Chicago preferred other alternatives due to security concerns and fewer secure bicycle parking options.

Those respondents not in favor of “Bike to transit” commonly expressed the need for a bicycle to cover the final mile, or to continue on as part of trip chaining. Respondents found the final mile to be a concern in relatively lower density areas (Boulder/Denver), or in small communities where distances were short enough that cyclists would prefer to bicycle the entire distance (Ithaca). The favorability of “Bike TO transit” depended upon the availability of secure bicycle parking. Many respondents expressed concern about leaving a bicycle unattended for extended periods.

“Shared bike”

A third alternative strategy is the shared bicycle system. Shared bicycle systems are increasingly popular, domestically as well as internationally. Many cities are building modern versions with advanced technology allowing for quick registration and wireless reservations. Interest by respondents was also high, however, they frequently didn’t see how shared bicycle systems would improve upon their commutes. Many respondents expressed interest in the shared bicycle system for tourists, students, and infrequent cyclists. Respondents also saw value in a shared bicycle trip for infrequent and non-work trips, or when bicycle capacity on transit is full. They expressed interest in using a shared bicycle system on their own vacations or other travel.

Those respondents not in favor of shared bicycle systems expressed attachment to their own bicycle, how it fits, the type of bicycle, and accessories. It follows that the respondents were mostly avid bicyclists with strong attachments to their bicycles.

“Two bike”

Respondents saw some value of the “Two bike” integration method and its ability to improve the transit experience, but several considered the option inappropriate for their city, too insecure, or too difficult to organize. Respondents raised security concerns were raised every time and the success of a “Two bike” system depended upon the availability of secure parking. Several respondents saw their community as too small to require this integration. They generally would prefer to ride the entire way given the relatively short distances needed to travel, or because the egress distances were short enough to walk.

Trip Scenario Results

The trip scenario ranking confirmed the findings of the focus group discussions. “Bike ON transit” ranked on average, the overall favorite for all responses for all scenarios. “Bike TO transit” ranked second, followed by “Shared bike.” The “Two bike” strategy ranked least favorite for trip scenario number one, the only trip with this option (Table 24). The tables generally show consistency of results across focus groups. The top two overall preferences (“Bike ON transit” and “Bike TO transit”) had smaller standard deviations than the bottom two (“Shared bike” and “Two bike”). The consistency may vary more for the lower two responses as most people were less aware of these strategies and may have greater difficulty evaluating them.

Table 24. Average Trip Scenario Rankings

	“Bike ON transit”	“Bike TO transit”	“Shared bike”	“Two bike”
Trip #1: Commute trip by transit	1	2	3	4
Trip #2: Social trip	1	2	3	
Trip #3: Routine grocery shopping trip.	1	2	3	
Trip #4: Dinner out on a weekend	1	2	3	

Analytic Hierarchy Process

The research team evaluated cyclists’ preferences for bicycle and transit integration strategies with the Analytic Hierarchy Process (AHP). Of the four importance criteria (security, guarantee, flexibility, and cost), security ranked most important and informed 35 percent of the decision for the four bicycle and transit integration strategies. Guarantee ranked second and comprised 28 percent of the decision (Table 25). Overall, cyclists preferred “Bike ON transit,” with the exception of Portland, where “Bike TO transit” was most preferred (Table 26) “Bike TO transit” consistently ranked second overall, followed by “Two bike” and lastly, “Shared bike.”

Table 25. Importance Criteria for 4 Factors

Factor	Average	Standard Deviation
Security	0.35	0.14
Guarantee	0.28	0.08
Flexibility	0.21	0.04
Cost	0.08	0.01

Table 26. Integration Strategy Priority Averages

	Average	Range
“Bike ON transit”	0.471	0.32 – 0.64
“Bike TO transit”	0.185	0.11 – 0.33
“Shared bike”	0.185	0.09 – 0.23
“Two bike”	0.159	0.10 – 0.23

Cost Effectiveness Assessment

“Bike TO transit” proved most cost effective on average across all seven focus groups (Table 27 and Table 28). However, in four of the seven focus group communities (City of Boulder, Chicago, Ithaca 1 and Ithaca 2), “Bike ON transit” is most cost effective. Boulder County, Portland, OR, and Santa Clara County preferred “Bike TO transit”. On average, “Two bike” was third most preferred integration strategy with the exception of Portland, where it ranked second. “Shared bike” strategy was least preferred in all focus groups. These findings suggest that increasing the security of bicycle parking would make “Bike TO transit” more competitive.

Table 27. Community Cost Effectiveness Assessment

Priority Weighting of Integration Strategy (Overall Cost Effectiveness Weighting)*							
	Boulder	Boulder County	Chicago	Ithaca 1	Ithaca 2	Portland	Santa Clara (County)
“Bike ON transit”	0.544 (1)	0.369 (2)	0.472 (1)	0.64 (1)	0.623 (1)	0.322 (3)	0.326 (2)
Cost effectiveness score (CES)	0.00168	0.00114	0.00146	0.00198	0.00193	0.00100	0.00101
“Bike TO transit”	0.129 (2)	0.209 (1)	0.127 (2)	0.114 (2)	0.184 (2)	0.324 (1)	0.211 (1)
CES	0.00133	0.00215	0.00131	0.00118	0.00190	0.00334	0.00218
“Shared bike”	0.206 (4)	0.231 (4)	0.273 (4)	0.134 (4)	0.096 (4)	0.124 (4)	0.229 (4)
CES	0.00006	0.00007	0.00008	0.00004	0.00003	0.00004	0.00007
“Two bike”	0.12 (3)	0.19 (3)	0.128 (3)	0.111 (3)	0.097 (3)	0.231 (2)	0.233 (3)
CES	0.00062	0.00098	0.00066	0.00057	0.00050	0.00119	0.00120

*Boxes around cells denotes most cost effective integration strategy for individual community

Table 28. Average Cost Effectiveness Assessment

CTF Strategy	Composite Weight	Cost ($) / CTU	Overall Score	Overall Ranking
“Bike ON transit”	0.471	323	0.00146	2
“Bike TO transit”	0.185	97	0.00191	1
“Shared bike”	0.185	3,500	0.00005	4
“Two bike”	0.159	194	0.00082	3

DISCUSSION

This research project conducted a preliminary cost effectiveness assessment comprising costs and cyclists’ preferences for each integration strategy. The preferences were gathered through stated preference surveys from focus groups in five case study communities and calculated with the Analytic Hierarchy Process, a multicriteria decision-making tool.

The results from the AHP, focus group discussions, and the cost effectiveness assessment suggest some disagreement between cyclists’ general preferences and cost effectiveness of the four integration strategies. Cyclists generally preferred “Bike ON transit,” while “Bike TO transit” proved most cost-effective for the most common “Bike ON transit” configuration, front-mounted bicycle racks on buses. When the cost effectiveness was calculated with costs for a bicycle rack installed in a light rail vehicle the findings favored “Bike ON transit.” This alternative does not consider the limited expansion capacity associated with “Bike ON transit.” In summary, “Bike TO transit” and “Bike ON transit” proved most cost effective.

While the cost effectiveness measure does not suggest brilliant insights to address this challenge, it provides enhanced understanding on how to increase the cost effectiveness of the three additional strategies. Much of the concern about the lesser preferred options, “Bike TO transit,” “Shared bike,” and “Two bike,” center on security issues. Security ranked highest of the four factors comprising 35 percent of the decision on average (Table 25). Minor adjustments in terms of security could address the current challenge of “Bike ON transit” capacity limitations and make the less cost effective strategies comparable to “Bike ON transit.” Anecdotal responses from the focus group in Portland suggest that the added security provided by the bicycle lockers and the short egress distances increased the favorability of “Bike TO transit.” As an example of elasticity of the composite weight of “Bike TO transit,” for every 1 percent gain in security, the overall favorability of “Bike TO transit” goes up by 0.8 percent.

This research revealed several examples of secure bicycle parking efforts. Chicago has built bicycle parking inside transit stations and several communities have integrated bicycle lockers as part of their bicycle parking. Boulder County is developing bicycle corrals at transit access and egress points in an attempt to increase transit ridership and reduce congestion on a state highway. The corrals will afford weather and security protection for 20 bicycles with smart card technology without the cost, space, and “hostage” taking

concerns associated with bicycle lockers. The Boulder corrals represent an approach to provide an alternative to the “Bike ON transit” capacity limitation problem while addressing security and weather concerns associated with the latter three strategies. The bicycle corral may be relevant to either a “Bike TO transit” or a “Shared bike” strategy. New approaches such as these may help to overcome the apparent challenges of security that plague the three less preferred strategies and help to increase bicycle and transit integration.

LESSONS LEARNED AND FUTURE RESEARCH

Being the first of its kind as far as its authors were aware, this research on bicycle-transit integration was forced to pave new ground. Doing so limited the scope and range of issues that could be examined. For example, this study warrants future research using the cost effectiveness assessment approach in two general respects: (1) conducting additional focus groups with beginner or potential cyclists, and (2) conducting focus groups with targeted cyclists who use secure bicycle parking facilities. Focus group participants tended to be knowledgeable and experienced cyclists. While the focus group composition helped to understand the preferences of avid cyclists, the participants were able to comment less on the preferences of beginner or latent cyclists, where considerable room for CTU growth exists.

Several follow up questions might be explored at future focus groups as well. While this research generally showed the preferences of cyclists for the “Bike ON transit” strategy, the research did not specifically ask what it would take to make other alternatives more attractive. Examples of such questions include, “By ‘secure bicycle parking,’ what do cyclists mean?” “Does it vary from big city to small town?” “How would improvements to the security of different strategies improve the overall effectiveness of that strategy?”

While the CTU index proved successful in predicting where CTU events are likely to occur, the model could perhaps be improved upon in future research with the addition of several variables. Measures of traffic such as Average Daily Traffic (ADT), type of bicycle lanes (on-street vs. off-street), and intersection density might provide additional insight into the CTU generation based on actual or perceived bicycle safety.

Experience from the use of the AHP in the focus groups suggests that respondents experienced some difficulty in understanding the concepts. “Guarantee” was not always interpreted to mean that it varies across the four strategies, but rather that somehow, all four strategies were guaranteed to be available. This confusion led to intolerably high consistency ratios on a number of occasions. Further research would be needed to understand if there were significant differences in the responses of the individuals, or if this was a result of a misunderstanding. Similarly, the majority of respondents considered the guarantee of “Bike ON transit” more favorably than expected given the limited bicycle capacity on buses and likelihood of being “bumped” from transit.

Targeting cyclists who use secure parking comprises a second area worthy of future research. The costs of different strategies may change as may people’s preferences. The “Two bike” program, while the least preferred, could be enhanced through secured bicycle parking. Anecdotal evidence suggests that bicycle corrals that employ smart card technology, protect from the weather and vandalism, could prove to be an effective and

affordable way to integrate bicycles and transit. Finally, this report did not systematically capture externalities of the local communities that might influence cyclists' preferences. As it is difficult to work with hypothetical options; once these strategies become better utilized, their impressions will be better formed. For instance, SP surveys would be helpful with users of the Chicago indoor bicycle parking facilities or the forthcoming Boulder County bicycle corrals

Much is to be gained from developing a variety of integration strategies for users as well as for communities. Providing reliable insight into the formation of cyclists' preferences for integration strategies could yield larger gains in bicycle and transit integration levels and begin to address ongoing environmental, health, and congestion-mitigation concerns. For communities, gains in this field could also yield decreased need for automobile parking at park-and-rides.

APPENDIX A:
BICYCLE PARKING COSTS

Common Bicycle Parking Configurations

The five largest bicycle parking manufacturers were contacted during late 2009 to gather current average costs of bicycle parking. These companies were targeted as they sell primarily to municipalities and for public use. While other retail stores may sell bicycle racks, they were not included in this survey as the chain stores typically sell equipment designed for private use. While each company may have bicycle racks unique to their company, there are a number of similar designs that the majority of companies sell. The most common types of racks include the two-bicycle "U" or "staple" rack, single pole bollard racks or hitch racks, serpentine, and hanging loop racks. The "U" or "staple" racks, named for their resemblance to the upside down letter "U" or a common staple, are popular for their affordability and ability to keep bicycle upright with their two vertical posts. Serpentine and hanging loop racks come in various sizes to accommodate from three to 12 bicycles that attach on two sides of a main cross bar on a serpentine rack or to a hanging loop off the cross bar. They are also sized for smaller spaces. The serpentine rack looks like a series of connected "s"s on their side.

Average Bicycle Parking Costs

While it is difficult to provide a completely accurate price as companies often provide bulk discounts, it is possible to broadly generalize to several of the more common bicycle rack configurations. The average price across the five major companies for the "U" and "Staple" racks is $126 for a basic galvanized rack with flange that is secured by bolts to concrete. In addition, most of the companies provide a range of upgrades in quality which includes powdercoating, thermoplastic coatings, and even stainless steel options. Other security upgrades include thicker metals and square shapes. The upgrades can increase the base price of the rack up to an average of 20 percent above base price for all upgrades except stainless steel. The more durable stainless steel option triples the cost on average for the "U" and "Staple" racks. While Cora-type racks vary in available sizes from company to company, most companies have racks with five- and ten-bicycle capacities. For simple cost comparisons, these two sizes are selected. The five-bicycle capacity rack averages $471.72 with per bicycle costs of $94, while the 10 or 11 bicycle capacity rack averaged $822 with a per bicycle cost of $75.

Other Considerations

Several companies expressed security concerns about certain racks. While hanging loop racks are popular in some communities, they are more readily vandalized due to the nature of the welds. As one company explained, a weld between a small diameter tube and a large tube isn't as structurally sound as a weld of two equal diameters. Apparently, welds on the hanging loops are prone to failing from the force of an eight pound hammer. Another consideration concerns the quality of materials. While the rubber coating may look nice and protect bicycle paint jobs, it will wear more quickly in the sun and elements and leave

a mess on the rack. While stainless steel racks are approximately three times as expensive as galvanized steel, the lifespan of stainless is considerably longer and increases lifespan of the units, saving organizations costs over the long term.

Bicycle Infrastructure Costs on Transit Vehicles

The most popular equipment on transit for bicycles is the front end folding bicycle rack. Department of Transportation (DOT), Congestion Mitigation and Air Quality (CEMAQ) grants, and Federal Transportation Agency (FTA) grants were commonly used to initially acquire bicycle racks. With the widespread installation of bicycle racks on buses nationwide (73 percent), it is more common to purchase new buses with bicycle racks pre-installed using capital funds. One company, Sportworks, holds a patent to the most distributed rack which few companies have been able to improve upon without infringing on their patent. It follows that bus manufacturers are Sportworks' biggest customer base. Recently, due to the popularity of the Sportworks two-bicycle rack, they now offer a three-bicycle version.

Original costs of bicycle on bus racks were collected from surveys completed by Hagelin which revealed that the nine Florida agencies spent an average of $465 per racks on 4,799 racks and a majority of the racks being purchased between the years of 1994 and 1998.[37] Sportworks revealed the pricing for bicycle on bus racks ranging from $467 (two bicycle) up to $1,332 (3 bicycles) for stainless steel. Pricing for each bicycle rack capacity, two or three bicycle racks, varies depending on materials, the most popular two bicycle rack sells for $720 38 Recently, King County Metro, Washington, retrofitted the majority of buses with three bicycle racks for an average of $970.[38] In addition to the cost of the racks, buses require an additional custom bus rack adapter that ranges in price of $200 to $400.

Bicycle Infrastructure on Rail

Some transit agencies allow bicycles on rail and have specific vertical or horizontal racks for them. While there seem to be a number of bicycle rack configurations on rail lines, only one of the major bicycle rack manufacturers offers one for $350. As racks are not that well-distributed on rail in the United States, it is feasible that these are after market custom racks for a particular rail car.

Bicycle Lockers

Bicycle lockers offer the most secure parking and protection from the elements, while also are the most expensive of the parking options. They are especially attractive to professionals who frequent commute by bicycle because they protect bicycles from theft of parts from the bicycle and keep the bicycle out of the elements. Of the five major companies consulted for this study, four offer lockers at an average price of $1,730 for a two-door, two-bicycle locker.

While lockers may be very attractive to cyclists, they present challenges in managing them. Some key considerations include: (1) cost /benefit ratio, (2) low turnover rates, and (3) misuse of lockers. Lockers are expensive to purchase, consume large amounts of space, and in the case of a two-bicycle locker, only two people benefit at any given time.

Municipalities have also expressed concerns that users may inappropriately use lockers for storage other than bicycles.[39]

Smart Lockers

The application of new technology to bicycle lockers is beginning to change the perceptions and management practices of lockers. “Smart lockers” use a variety of wireless communication tools (cell phones or Internet) to allow the user to interface with the lockers to make reservations and check pricing, thus increasing turnover. Smart lockers also offer the convenience of an initial online registration system and use cellular technology to access individual lockers. This application also guarantees that a space will be available, an important feature for regular bicycle commuters. Smart lockers may also be used for bicycle rentals.

There are generally two variations of the smart lockers, the first being an electronic lock version and the second an Internet-based version. The lockers feature battery-operated electronic lockers with a numerical keypad that have the ability to be programmed and master coded.

Internet–based technology reduces the need for keys, tokens, credit cards or other devices. One company provides web and email support, 24-hour phone support, and a free taxi ride home in case of being stranded. The wireless reservation system assures users of guaranteed availability on demand, but also allows sharing of one bicycle between several users. If payment for usage of the lockers is desired, administration can be handled electronically at the time of initial registration and can be structured like vehicle parking to encourage turnover rates and more efficient use of lockers. The smart lockers also allow for greatly expanded monitoring capabilities to ensure efficiency of the system. The limitation of smart locker technology is the relatively high expense. Smart lockers are typically sold as part of a system of networked lockers.

Internet-based technology works as follows:

1. A user of the system becomes a member by registering online. All users are eligible to use any available locker in the system.
2. The user reserves a locker by interfacing with a locker-integrated computer or remotely with a computer or Internet enabled hand-held device or telephone.
3. The central computer database recognize the user as valid, provides a five-digit combination to allow access for the available locker in the system.
4. The central computer database tracks the usage and charges accordingly.

Alternatives to Lockers

Although lockers are valued for their security and weather protection, given the costs associated with lockers, potential for low turnover rates, and the amount of space needed per unit, communities are exploring the use of bicycle corrals or cages. The bicycle cage may be as simple as a locked and fenced area that may be protected from the elements. It allows for a controlled number of cyclists to access the area for bicycle storage. Bicycle

corrals can be fitted with smart card technology for planners to understand usage levels. The benefit of the bicycle corral is that it takes up less space per bicycle and costs less than bicycle lockers. It is less organized than a bicycle station and doesn't require the establishment of a bicycle shop or other affiliated retail.

APPENDIX B:
BICYCLE PARKING EQUIPMENT AVERAGE COSTS

Table 29. Bicycle Parking Types and Average Costs

Bicycle Rack Type	Specifications	Average Cost ($)	Average Cost ($)/CTU
Bicycle hitch (Inside transit car)		172	172
Inverted “U” rack	Galvanized	120	60
	Powder coat	106	53
	Thermoplastic	131	66
	Black rubber	131	66
	Stainless	315	158
“Heavy” U rack	Galvanized	172	86
	Powder coat	193	97
	Thermoplastic	193	97
	Rubber	214	107
	Stainless	390	195
“Staple shaped” U rack	Galvanized	142	71
	Powder coat	169	85
	Powder coat and e-steel	179	90
	Stainless steel and powder coat	459	230
	Heavy grade	148	74
Serpentine	5 bicycle	343	69
	9 bicycle	528	59
Five- bicycle “hanging loop” type	Galvanized	377	75
	Powder coat	486	97
	Thermoplastic	564	113
	Stainless steel and powder coat	1,399	280
Ten-bicycle “hanging loop” type	Galvanized	553	55
	Powder coat, stainless	1,679	168
11-bicycle “hanging loop” type	Galvanized	815	408
	Powder coat	828	74
	Thermoplastic	891	446
Bicycle Locker		1,730	865

APPENDIX C:
CONSENT FORM

Date: 2/10/10 **Valid for Use Through:** 5/31/10

Study Title: Bicycling and Transit: A Marriage Unrealized

Principal Investigator: Kevin Krizek
HSRC No: 10-0120
Version Date: 2/10/10
Version No: 1

You are being asked to be in a research study. This form provides you with information about the study. A member of the research team will describe this study to you and answer all of your questions. Please read the information below and ask questions about anything you don't understand before deciding whether or not to take part.

Why is this study being done?
This study plans to learn more about cyclists' preference for the integration of bicycles and transit. We will also obtain survey information from a brief survey.

You are being asked to be in this research study because you have experience with integrating bicycles and transit.

Up to 40 people will participate in the study.

What happens if I join this study?
If you join the study, you will participate in a focus group that encourages discussion with other cyclists. The focus group will take no longer than two hours.

What are the possible discomforts or risks?
The risks or discomforts associated with this study are minimal to none.

What are the possible benefits of the study?
No benefits are associated with participation in this study.

This study is designed for the researcher to learn more about bicycle transit integration.

Who is paying for this study?
This research is being paid for by the Mineta Transportation Institute.

Will I be paid for being in the study? Will I have to pay for anything?
You will not be paid to be in the study. It will not cost you anything to be in the study.

Is my participation voluntary?
Taking part in this study is voluntary. You have the right to choose not to take part in this study. If you choose to take part, you have the right to stop at any time. If you refuse or decide

to withdraw later, you will not lose any benefits or rights to which you are entitled.

Who do I call if I have questions?
The researcher carrying out this study is Dr. Kevin Krizek. You may ask any questions you have now. If you have questions later, you may call Kevin Krizek at (303) 315-2422**.**

You may have questions about your rights as someone in this study. You can call Kevin Krizek with questions. You can also call the Human Subject Research Committee (HSRC). You can call them at 303-315-2732.

Who will see my research information?
We will do everything we can to keep your records a secret. It cannot be guaranteed.
Both the records that identify you and the consent form signed by you may be looked at by others. They are:

Federal agencies that monitor human subject research
Human Subject Research Committee
The group doing the study
The group paying for the study
Regulatory officials from the institution where the research is being conducted who want to make sure the research is safe.
The results from the research may be shared at a meeting. The results from the research may be in published articles. Your name will be kept private when information is presented.

An audio recording will be made of the focus group and stored under lock and key for 2 years, then erased.

Agreement to be in this study
I have read this paper about the study or it was read to me. I understand the possible risks and benefits of this study. I know that being in this study is voluntary. I choose to be in this study: I will get a copy of this consent form.

Signature:_____Date:_____

Print Name:_____

Consent form explained by:_____Date:_____

Print Name:_____

Investigator:_____Date:_____

APPENDIX D:
FOCUS GROUP TRANSCRIPTS

BOULDER/DENVER, COLORADO

Boulder Focus Group #1: City of Boulder

Your Local Cycle to Transit Trips/Discussion of Pros and Cons

Subject: Increase Capacity on Transit

FACILITATOR: This is when we get to hear from you guys and have a loose discussion about these different options. The pros and cons of these different integration methods. How do you feel about increasing the capacity on bicycles on transit?

R: It would be preferred option because I like my bike, it fits me if you're not the typical size, if you carry stuff on your bike, and there are a lot of limitations.

R: My preferred too, the problem with a larger city like San Francisco is there is so much theft that you can't keep a second bike overnight in downtown San Francisco, unless you have a locker.

R: I would hesitate to leave a bike that I valued, pieces would be stolen off of it or vandalism.

R: As a matter of fact, I know that that has been a big problem in Paris with the rental bikes being vandalized

R: Isn't it the same situation in Copenhagen? Lots of people got their second bikes stolen, but no one really cares because it's understood that if your bike gets stolen you just steal someone else's.

FACILITATOR: Do you see any challenges with increasing capacity on transit?

R: Diminished capacity for people

R: I use to live in SF for 4–5 years and took my bike on the train for a couple years because I was a big train commuter. Caltrain had two dedicated commuter trains they fill up and people get bumped, if it is commuter train it doesn't run that often and can be a big problem. Trains don't stop long enough for people to lock up their bikes if they happen to get bumped.

R: Some of the bus drivers I've had have become impatient and don't want to wait for you to pick a spot and lock your bike. It doesn't even have to really fill up to discourage you, just the possibility. You're not going to invest in the whole trip if there is even a slight possibility that you are going to get bumped. Especially if you need your bike at the other end, only the most dedicated or constrained people who get rid of their cars and have no other choice will take this risk.

R: That happened to me, I got on the bus to go to Golden with my bike and there was no room for my bike so I just rode my bike home and drove. I wasn't going to leave my bike chained up somewhere so I just bailed on riding the bus all together.

R: After that happens a couple times you're not even going to try anymore, even though it doesn't happen too many times you are still worried that it may happen again.

FACILITATOR: Have you guys been bumped before?

(much of group says "yes" to this question)

R: The route I get bumped most often on is the 225, it's not considered regional so it has undercarriage and only has 2 racks for bikes. Once in a while I will get a driver who will help you get on board but its often standing room because the ride is pretty full anyway.

R: I have been riding the bus to Denver for a bunch of years and it pretty rare that a you get bumped from a bus, the buses are pretty frequent, on a day you do get bumped it will be for something like Bike to Work Day. This time of year when people are really starting to get into riding, it's surprisingly rare because it happens so infrequently.

R: I don't have much trouble with the B (Incomplete thought)

FACILITATOR: I also take that train and part of the research we are looking at for on bus capacity and something I've seen on the B-the regional bus to Denver is that people will bring scooters instead. On the train in DC, where you're not allowed to have bikes on Metro during rush hour so I have seen people with folding bikes with the small size wheels and those you can bring on any time of day and with those you have to be super die hard and without all other options.

Another question I have is you all comfortable with putting bikes on buses the track?

R: Yes, it is easier than I thought it was going to be.

FACILITATOR: Did you have any hesitation?

R: The only time I was hesitant was I didn't want to have my bike out because it was really bad weather. If its icy out and you're standing in the street trying to put up your bike on there and traffic is going fast. The first time I tried it I made sure to go to the end of the route so I had plenty of time 15 minutes to try it out. On Caltrain it could be a big issue because it was the kind of car that carried more bikes unfortunately (Bombardier); there was a huge transit bicycle campaign that they still had enough bikes slots available. We had to do a lot of advocacy there to make sure bikes could stay on Caltrain. On the old style cars I had to life my bike almost completely above my head to get it on to the train and it was a challenge.

FACILITATOR: That is one of our studies on a paper we had written on Caltrain. They can carry up to 80 bikes on a given train; they have two cars (they've just expanded it) and they've seen it as a way increase ridership the campus style employment centers off the

route are up to 2 miles away from the train station and so to increase ridership it benefited Caltrain to increase bike capacity to a point.

R: And they still fill up every time right? I know that they are using Twitter a lot. Somebody comes on the train and says “Okay there are 15 spots left, I just go ton at this station” if you’re the next one some people would know whether or not they will be able to get on or not. This takes some of the risk away.

FACILITATOR: Any other challenges, pros or cons that you think of when you think of increasing capacity?

R: The shared bicycle idea, I don’t think it’s useful for me. I have a mild commute when I get off the bus in Denver, so I could easily walk or take a shuttle. The shared bicycle thing would be handy if I was for example staying downtown and didn’t want to have a bike in Denver there’s certain time sit might be really useful. If you down there without a bike, it seems like a brilliant scheme if you learn the system and know where to drop your bike off.

R: Nothing beats having your bike, the flexibility. There are times when it’s a long day and I will have biked a lot that day I’ll put my bike on the skip and take it all the way North. But I don’t have to worry about getting home or how long it will take me because I have my bike.

FACILITATOR: In a sense having a bike is almost like a car because you don’t have to worry about the schedule of a bus and it’s more convenient and gives you flexibility.

Subject: Enhance Parking at Transit Station

FACILITATOR: Enhancing parking at transit stations and stops. That suggests that your bike is locked dup and you don’t have it with you at the far end of the journey. What are your thoughts? Do any of you do that, leave your bikes and go down town or elsewhere?

R: I work on the campus; I prefer to make that trips of short distance.

R: Instead of enhanced parking I would like secure parking, I need to feel that confident that my bike isn’t going to be vandalized with nothing missing. This is the key thing for me, I have done that and would do that.

FACILITATOR: What makes a bike parking area feel secure to you?

R: Deterrents, such as if the bike area is monitored by a camera or appears to be monitored by a camera so people would be reluctant to vandalize a bike. It would be well lit, not dark at night, places to lock your bike. I want a sense that it’s monitored and watched.

R: When I bike train commuted where I had to get on the train at 2 in the morning and it was deserted. I could not leave my bike there, that wasn’t going to happen. That is the only reason I took my bike on the train because on the other end I just had to go 2 blocks and

it would have been a lot easier to leave my bike. If I don't need my bike on the other end, and I feel secure in leaving it I will. I don't want to have to deal with it and I can just walk around and don't have to worry about finding a place to put it.

FACILITATOR: There is kind of a hassle, if you don't need your bike on the distant end to carry it with you on the bus.

R: If you don't need it on the other end, it would be great to just leave it and go get it when I need it again.

R: I also use to have a really short trip on the other end, really close to Market St. Station in Denver and I had a locker at Table Mesa Park 'n' Ride I would still often bring my bike to Denver, but when it was really snowy it was nice to leave my bike in a locker, get on the bus, and not have to deal with it.

FACILITATOR: Do you mind telling me how much you paid for your bike locker?

R: It was free, it was always free for a while and now it's like $50–$60 per year. It's not very costly, there's just not a lot of them available.

R: They have them at light rail stations too, but aren't they more expensive? Like in the hundreds?

FACILITATOR: In a sense it should be, because it is very expensive—$1500 to $1700 for one locker that holds two bikes. There is a new technology that costs even more but you pay per hour where there is a graduated fee structure that encourages turn over and its not just one person who can keep a locker hostage for a long time. There's turnover and someone else can use it while you are not. You could reserve it through your cell phone or something. Any other thoughts on enhancing parking at transits pros or cons.

R: One thing that turns me off is a bunch of abandoned bikes, they take up space and it shows that no one is monitoring the place. I think that is doesn't have a lot to do with the riders, but my understanding is that the police department in Boulder are the ones. I called RTD and often want to leave my bike at 28th and Canyon, but the only bike racks around are on the stop itself. It is just two little bars, which if people would think about it they could get a couple in there but they don't and if you have a U-lock like mine it's difficult. This one abandoned bike has been taking up a spot for months now I called BPD and they said it's not our responsibility and they've got better stuff to do than worry about abandoned bikes. In the mean time it's discouraging to me, I am pretty motivated to do this and there's really not that much of an alternative. You could find some trees or stick your bike in the bushes.

Subject: Provide a Shared Bicycle at Either End of the Transit Trip

FACILITATOR: Have any of you ever used the shared bike program before? What are your thoughts good or bad?

R: I am kind of selfish, so I want the bike when I want it and my whole concept of I might not get one so I should bring my own bike, the issue is how inconvenient is it going to be for me to do this? It's much more efficient if I can use my own stuff.

FACILITATOR: What if you could reserve a bike on your cell phone and know a bike would be there when you go to the specific shared rental location?

R: If that actually worked the first time I would trust the system, and then the whole issue of what do you do when you're in a restaurant and having dinner. Does someone borrow the bike when you have it or how does that work?

R: What if there's not a bike lock area or a bike station before that?

R: And as mentioned before, I have a physical constraint just because I am 6'5". I wouldn't be able to share a bike comfortably.

R: I am 6'5" too and I don't think that would comfortably work for me either.

R: When I first started biking, actually for years and years I always rode a girls bike and I couldn't handle the top bar and that freaked me out. That would be an impediment if that is the kind of bikes there were.

R: In Denver have there is no top bike it goes all the way down to the Bottom racket so you can easily step over or through. I have never used it looks like the new design they try to get over a lot of those issues, like with availability because I think you have choices. You can sign up for a day or a week I think, once you're a member you get unlimited use of a bike for up to an hour and there's an urgency to get to your destination and get your bike to a rack so that somebody can use it again. The racks are really full all the time but if you want to hang on to it longer you can lock it up and pay a dollar per hour extra. It seems like the program is trying to solve those concerns.

FACILITATOR: 3rd or 4th generation bike share programs are getting better in terms of the ease of getting them, ease of signing up on line, credit card based.

R: A lot of it is enhanced with the use of cell phones or debit cards, but if you're a person who doesn't have or want those capabilities then it would be a little harder if you weren't electronically connected.

R: One angle to the whole alternative transportation issue is to, there are some social justice issues that can be raised and it is a little regressive in some ways that can make it easier when it's all based on membership that are connected to credit cards or getting reservations on phone. It favors a portion of the population than the other portion.

R: I would love a bike share program that I could use in other cities that are going somewhere else.

R: That's how I feel, here I think about my own usage pattern and I'll know exactly what

my options are. Having a shared bike on the other end, it's unlikely to affect my decision. If I am going to be in Denver I am likely to be there until after the buses stop running, so there is not much point and most likely I will have to drive.

FACILITATOR: Is some of that perhaps because a lot of cyclist feel like "I like my bike, I want to have it with me, and for my regular trips it's just what I do," but for something out of the ordinary in other cities it would be more useful for you?

(Group shows agreement)

R: If it's something I am doing every day, I'm not going to want to sign up every day. It doesn't make sense, because it's not my bike.

R: Maybe they should be advertising it at the airport, for people who are coming in to Denver visiting. It would be a cool way for them to get around.

FACILITATOR: Boulder Outlook Hotel has one advertisement so that people can take the Super Shuttle from the airport to the hotel and when you're in town you can use bike or bus to get around. It's not much, but the city is trying to do things to make it easier so that travelers don't have to rent a car here when they are in town.

Subject: Use Owners 1st and 2nd Bicycle at Beginning and End of the Trip

FACILITATOR: What are your thoughts on owners using 1st and 2nd bicycle at beginning and end of the trip?

R: My thoughts would be my 2nd bike… (respondent is laughing as she speaks, cannot understand) because my life isn't organized enough to where I have a specific end of a trip, I can ride my bike all the way to work on a bike path, I don't need a bus so I won't get on the bus for that.

R: This definitely seems what would be best for regular trips; there wouldn't really be a situation where you have extra distance on both ends that you need two bikes.

R: It's a routine thing typically for work trips it's the same shift every day 5 days a week.

R: I know a bunch of Caltrain people who do this and its can get tough depending on where your stations are; can you leave a bike there safely? That's the big issue.

R: To me it seems raises all the issues associated with B, are you leaving a bike in a place you trust?

R: For me it's more about the time, overnight doesn't so much concern me, or the weekend a lot of my work trips are out of town. In fact recently I had to go to Boston, I have a travel bike that comes apart, and I sent it there so it is actually there and I don't have to deal with the hassle of carrying the bike on my trip. But I don't feel comfortable leaving my bike there for 10 days and for me I would feel comfortable with one of those boxes for 10 days.

(Group shows a humorous interest in this answer)

R: I lapsed on my membership that has to be renewed every 6 months, they cut my lock off.

R: No one has mentioned bike stations; they finally put a bike station in a bike train community for about a year. I would still take my bike to the city because I couldn't leave it in a station, but I would just roll it into a bike station and have them park it instead of taking it.

FACILITATOR: Some have bike shops affiliated with it, I saw the ones in San Francisco and [Washington] DC, a challenge there is finding location or space for it in downtown areas. Chicago has one that is underneath Millennium Park. So the question is how do you do it cost efficiently, finding space, location, organizational capacity.

R: The other thing is, I have a couple bikes but just keeping two bikes, when I'm actively commuting, and in working order is just another thing to think about, so maintenance.

R: I have several bikes too, but they are for different purposes. I wouldn't want to leave on in Denver and not have it accessible when I wasn't commuting.

R: Agree, I have a designated commuter, but to get another bike and have to maintain that too it can get expensive, though cheaper than a car. If something goes wrong, like a flat tire will you be able to fix it?

FACILITATOR: I think part of it is the culture is just not here for that. Like in the Netherlands everyone does it, I spent quite a lot of time in Europe and the Copenhagen train station has double decker bike racks that are just packed. Hundreds of bikes and a lot of times they don't lock them too anything, they will just lock the back wheel and that is good enough because everyone has their bike and you don't need someone else's bike, they trust that there.

R: In Amsterdam and Netherland everyone had that kind of cruiser bike, so conforming to that standard type of bike makes it less likely to stand out and draw attention. You are not going to steal the same bike you already have.

FACILITATOR: Overall, to sum up these conflicting ideas of integration, is it consistent to say that everyone like the first option, increased capacity on transit?

(Group agrees)

R: I see potential pit falls but at the same time.

FACILITATOR: Do we also see that there is limiting room for growth without current technology?

R: I imagine there is a thousand legalities, but it would be something that could be added

to it you wouldn't have to get new dedicated buses. [followed by unclear statement]

FACILITATOR: Our cities thoughts on that are it delays boarding of passengers and others are paying for it when you're at the stop and it decreases reliability because other riders if the bus is held up, so there are other issues there.

R: If there was truly a trailer dedicated to the quick exiting of cyclists it could be something like the mall buses, you would have a little half seat next to it so you can get right off. On the way over I was talking to the driver and he said that the traffic doesn't hold them up on routes, its people paying fares. It sounds like a priority issue, how much does RTD really want to accommodate cyclists or not? This a matter of changing schedules not some impossibility.

R: As far as the train goes, a lot depends on the technology the train chooses, when Caltrain chose this technology that piles bikes next to each other. The one on the inside better be going he farthest because if not everyone is going to have to pull their bikes off. They put in some stop gap measures where you can put a tag on your bike to help people get into the right order but I've seen other trains where you just out your bike on the rack and it's not an issue.

R: I have noticed a range of responses from the drivers, some couldn't be nicer and others are impatient. There needs to be some training maybe, train these guys to be prepared to deal with cyclists so they aren't under so much pressure to get going.

FACILITATOR: But they have to meet that schedule too, because if they don't they lose their potty break. So they are personally motivated to stay on schedule.

Boulder Focus Group #2: Boulder County

Your Local Cycle to Transit Trips/Discussion of Pros and Cons

Subject: Increase Capacity on Transit

FACILITATOR: This is the section where you talk about the pros and cons about these different integration modes and just want your impressions, pros and cons starting with increasing capacity on transits.

R: That would be my number one priority, most mornings as I am sitting on the bus I am thinking of different ways to get more bikes on the bus? It doesn't seem like that should be the limiting factor but it is. Using undercarriage can beat up your bike or get your bike hooked on someone else's bike. If you get a slot in the front it's not a problem, but everything about it is a challenge and you're always battling. If you have fenders like I do, they get beat. It is not something that fundamentally supports riding a bike. The undercarriage specifically, so to me to increase transit capacity would be the best thing to not damage your bicycle.

R: The other issue is that you have to have some certainty that you'll be able to do it. If you make the decision in the morning to go ride down there and do it and there isn't any space, what do you do? Maybe your job will be flexible but if not then that becomes a problem.

R: When I use to go to work I would ride my skateboard because I knew I could get my skateboard on the bus.

R: I have 3 suggestions: 1. folding bikes; 2. have only certain bus stops take on bikes which would, and 3. help the route run more efficiently time wise. Big deal that you have to ride another ½ mile to get to the bikes stop, especially with regional trips. Design a bus that can take bikes underneath by slipping a bike in, not just take whatever's on the shelf and modify it but actually have a manufacturer come up with a worldwide bus.

R: Or you can just raise the passenger portion and just place your bikes underneath.

R: I think it's only another two feet that they would need, it might be a problem for elderly people.

R: You'd also have to check to see how high you can go with bridges.

R: If you had a RTD at grade loading then the platform height could be the same as the bus. Then you would go down to put in the bike.

R: You guys are really radical. I have always wondered why there aren't five more bike trays on the back of that bus. It just seems so obvious to me.

R: Because they will just get filled up.

R: It still would be better, if you can get 5 more on without having to go under the bus or whatever. You see VW vans with bikes attached to them. People get lots of bikes on to little cars. Two small cars can take 5/6 bikes but the bus can only take two and then you have to start jamming them under. It seems to me like a very simple solution and would utilize the buses space better.

R: Let me present another challenge to the group, why do we have to take our bikes on the bus anyway? There is a design flaw in how we live in this country. I'd like to just be able to take a bus if I want to and not have to ride two miles to my destination. I could enjoy the walk to that destination or not two miles away.

R: You could take it step further and say that you wouldn't need to take the bus at all if you actually lived where you worked.

R: I think I will stick with my folding bikes suggestion because it's the least obtrusive.

FACILITATOR: I should add that Caltrain has provided some discounts to users to actually buy folding bikes like $200 discounts to increase the bike capacity. They just bring the bikes on and in [Washington] DC on the Metro they don't allow bikes during rush hour but you can bring folding bikes with a small wheel and so I was at a conference this year and saw a couple people with folding bikes and skateboards, and I've also seen scooters on the bus that you can fold up and out above. This is professionals, not just little kids so.

What do you guys think about congestion pricing for bicycles, like if you have an additional fee if you want to bring your bike on the bus? I asked this because there are probably people who are bringing their bikes on the bus right now who don't really have to. Since there's no actual friction to doing it, so people just do it. And when other people who are in line to do it and have to put it on for the final mile can't.

R: What would you do with that money? What would be the purpose? Just be some incentive?

R: The money could be used to provide other kinds of facilities for bike transit.

R: Politically you might say that but actual revenue you generate would be nothing compared to what it costs to put new bike capacity on buses.

FACILITATOR: What do you guys think about that?

R: The answer to that is, if I'm being charged more to take my bike I would rather just drive.

R: Isn't that what every American does?

FACILITATOR: There's a threshold there.

R: But you're already paying presumably to take the bus in some sense.

R: I think the bigger issue is uncertainty, if you weren't sure that you were going to be able to get on you wouldn't even take the bus.

R: But what's the difference percentage wise as far as the number of people that are bringing their bike that wouldn't have to. It turns out to not be a big percentage, so what's the benefit?

R: I always think it's a huge pain to take your bike on the bus.

R: Unless I really have to.

R: I'll get on the B to Denver and grab a cab instead of driving down.

R: We build all of these park and rides at the cost of tens of millions of dollars, what are we trying to incent here? I think the last thing you would want to do is dissuade someone from riding their bike, everything to me should be geared towards supporting that and you couldn't put sever enough measures on driving. Stop investing in park and rides and start investing in infrastructure to bicycling or last mile strategy instead of not so impactful in all respects.

(Group agrees)

R: Or at least the real price for parking.

FACILITATOR: This may be disincentive for RTD because if you have to pay $5–10 at the Table Mesa park and ride people will just drive to Denver.

R: To that point, now that you have to pay for parking for example when I go to airport now I just take the bus. I usually don't take my bike because I've got my suitcase, either my wife will drop me off or I'll drive the car and leave it there. Now that you have to pay I will have her drop me and have her pick me up and instead of two trips now you have four. If we are talking about something that is really going to work for people, if you start charging people to park a lot then they may be more likely to drive.

R: It's not what you want to do either and I know they are looking at another revenue source, maybe there was a problem that there wasn't enough spaces and that's how you control it. I imagine that RTD needs a certain percentage of ridership and that percentage probably does not come from people that are biking, it probably comes from people who are just taking the bus and they drive to the park and ride. So they have the route that then people who use bikes can actually utilize as well. So I am sure it is a numbers game and they have to make sure they have enough people there too so their probably balancing making it easy enough for people driving their car to take the bus. It gets complicated, but the things you are thinking about they seem like very viable alternatives.

R: When you increase the ability to have more bikes on a bus and there is a real cost just like there would be a cost for parking, people might bear that cost so that if you use the bike rack underneath that you pay for that.

R: It probably depends on the row, like on the skip you have to wait an extra five minutes for another bike rack to empty. I waited half an hour once for Dash on Sunday, the rack was full and I was coming from Lafayette and the bus driver was really strict about having no bikes on the bus, I asked him to wait so I can lock my bike up and can at least get home (its 10:00 at night). They next day I go and get my bike, it's probably route specific, these things can be different for each route.

R: I think it goes back to number one, too, though it seems like it is a big issue.

R: I just want to reiterate, part of me thinks this is not such a big problem for RTD but RTD makes it a big problem. Why don't they have more bike racks on the bus?

FACILITATOR: I know they have three bike racks now but there are questions and concerns with it because it extends the turning radius of the bus and then also, just the way the roads are will bottom out. They crush bike racks and bikes so there may be ways got around it like having a trailer in the back, there's also the delay factor for buses and we want the buses on time and the uncertainty that you have with that…

R: I am not saying it's easy, but my first suggestion would be to try and get more bikes easily on buses before we go in any other direction that's prohibitive to people. To me that just seems obvious that it would be the first thing you tried to do if that's what you wanted as an outcome, it doesn't always feel like that is the desired outcome. RTD recently did a survey similar to this one that felt very much like it was moving in a direction of what if we cut a phase to this out of our operation?

FACILITATOR: You could probably speak to that, don't they want to phase out bikes?

R: Yes, at one point they talked about on the Bolt at the new rolling stop the undercarriages would be too small to fit bikes so they could only have two bikes, so they didn't them. I was with the service providers when we went up to transport we were looking at the new flex route which is the Fort Collins route– Longmont route that's going to start June 5th and transport has three installed bike racks on the front and sticks out just as far, but they're staggered a little bit so that would be a 50 percent increase right there if they just change the style of racks.

(Group agrees this would be a huge deal)

FACILITATOR: That must be a different type of rack, since some planners in Madison are saying it sticks out more. So maybe they stagger more?

R: Yes, they stagger more so the handle bar doesn't get caught on the other bikes.

R: Another suggestion would be a bike only bus; it would be more accommodating and willing to wait for people to get their bikes on and off because that's what they are doing. Then you could have the bus maybe not have so many seats on the bus, its bike only and that was you're not impacting other people.

R: That could be good on the regional routes where its much more of an eight-to-five crowd that has one destination instead of people having to get off at every little stop along the way.

R: What can you do short-term versus long-term? Because long-term is seems like if you could design a bus and you have to see what the heights are, just increase the bike bin heights and you could just slide them into stalls. You can get more bikes in there and it would be faster to get them in and out. You don't have to worry about untangling them, this could deal with the height issue and that would cost money and that would be a design. The problem is we are dealing with buses that were designed to hold baggage, that don't hold baggage, so it's really the wrong technology.

R: How frequently do they turn the vehicles? If you actually wanted to get all those into play that is actually long-term as well. I think thing is you end up having short term, long term, midterm strategies and you start putting all those together, so to your point when you have the two buses together it's another way of doing it as well. But there is always going to be an inconvenience for people that don't have bikes so why would they want to put up with it? People that have the bikes would be more accommodating.

R: Has anybody taken the N bus to Nederland on the weekend? There is a ton of bikes packed into the undercarriage but luckily, most people get off at the same place, no big deal, unless you have a really fancy bike and you don't want to do that so you'd take your old bike.

R: I find it interesting that obviously there are geographic and cultural differences but the countries with the most use of bicycles and transit do not generally allow bikes on transit. In Japan, where I lived for a couple of years, no trains or buses had bikes on them and nobody would even think of it. It's a different kind of place, it's just interesting that here we are trying to go toward more bikes on transit because there is a need for it and yet somehow these other countries have none and yet there is still enormous bike usage and transit usage.

R: Don't you think that is because of density and concentration where things are so much more spread out?

R: I think the first problem is the hardest of the three out of the four to solve.

Subject: Enhance Parking at Transit Station

FACILITATOR: What are your thoughts on that? Pros and cons?

R: It depends how you define enhancements, sometimes you just need a pole or something to lock up your bike, though bike lockers are nice they take up a lot of space and most times you just want something to lock it to.

R: But I think safety is important often the reason why I haven't done it is because I don't feel comfortable leaving my bike at Boulder Station.

R: So what is enhanced exactly?

FACILITATOR: It's kind of vague; it could be just raw numbers of bike racks, lockers, more secure facilities, bike stations, and think a coffee shop that has a bike shop and bike storage, like a double up of bike storage of bikes all in one convenient location right next to the transit stop. So someone could open up a little shop at the Table Mesa parking lot that would have absolutely secure parking, things like that.

R: That's what Table Mesa park and a ride need is some retail.

R: I think having some sort of bike repair maintenance place would be great because I tend not to take my bike to the bike shop because I take it there and then what do I do? They're not going to work on it right away, so then I have to walk home or find a bus home and I'd rather just skip all that and work on it myself. But if I am leaving it for the day anyway, it would be a perfect time to get whatever done.

R: Or even at the minimum a pump, with a chain attached to it.

R: Have you seen that they have kiosks at University of Colorado with an air compressor? A couple of tools you can borrow. That's really simple, so it's just a compressor.

(Group shows excitement and approval at this discovery)

R: What kind of tools?

R: Tools for like changing your tire things like that.

R: There is a business opportunity though, if someone is watching your bike or repairing it, there probably going to be selling baked goods or whatever.

R: That's the most effective form of your own security besides the U-Lock.

FACILITATOR: Everyone like option A, but B requires you to leave your bike at a location unattended all day, do you have concerns about that? You raised some security issues, does anybody else feel that?

R: When I ride I would only take a junk bike and pull off all accessories and computer. The problem that I have too is on my bike I have all my stuff for rain which doesn't happen often, but if it does I want to be prepared. There are a whole lot of things in there that I leave on my bike, and if I was leaving it there all day I'd be concerned. When I come to downtown Boulder for three or four hours at night, I'm always concerned. But I think your're right, I think you can take a bike that's of lesser value but there are certain things you just need to keep with your bike. It's a risk.

R: There are all sorts of things that come into play when you leave your bike long enough and you can't get it out or somebody locked their bike up to your bike by mistake.

R: I think a lot of those things you would probably put up with if you had a place that was more or less secure but you knew you would be able to get on the bus and do what you want to do from a commuting stand point you are probably more willing to accept some risk you start to add all these things up that are negative and you are less likely to.

FACILITATOR: If the bus, like the BX, is super reliable, super-fast…Once they implement the new BRT system that may be that much more desirable that I'm never going to drive and I'm willing to leave my bike there because there's not that much capacity so there are other factors that may help decide whether you want to leave you bike there.

R: Isn't there some level of infrastructure that you might need to be able to do it? You might only be able to use a junker at a regular bike rack but if you had this nice box with a key card you'd probably leave your computer on there right?

(Group agrees)

R: I thought about getting one of the locker from the park and ride when I was going there every day but didn't because it seemed like it was a pain in the butt.

Subject: Provide a Shared Bicycle at Either End of the Transit Trip

R: I think that one is all about availability, you got to know that they will be there, if you know that they'll be there and can trust that they'll be there you'll know it's working.

FACILITATOR: If you had that option would you prefer to use a shared bike or would you rather have your bike?

R: If I don't have to cart/schlepp it onto the bottom of the bus and worry if I'm going to make my bus if it's not there. I'd rather do that.

R: Isn't that just shifting the concern about being able to get your bike on the bus? If you're getting a bike at the other end.

R: I think generally the experience with the shared bikes is that there is always a large supply of bikes, unless there some big crazy happens. It seems like it's easier to provide a sufficient number of bikes in that case then provide a sufficient number of spaces on the bus.

R: Its much more convenient than the old ones, the bikes are getting better, its automated, I think it's going to be interesting to see Market St. Station how many of those bikes are going to be used by 7:30 in the morning.

R: They are gone, just this morning I rode by there and they were all gone except for maybe one or two left at 6:30 a.m. The outliers are packed, the downtown ones, empty.

FACILITATOR: They do have cars to redistribute bikes. It hasn't been running long enough to know what needs to be fixed with it yet.

R: This building might have been special though because my wife was on some b-cycle tour, WTS, a whole bunch of them were going and trying out b-cycles and they might have taken them all.

FACILITATOR: If you regularly commute I'd like to hear from you because b-cycle is now looking at a final mile solution a more short-term penetration through high density area. Because you put a bike station right at the transit stop you're going to use it as a final mile station. The liability is vanished. So with our program we're actually doing more of an adoption program so that you can reserve the shared bike either for a week or two weeks at a time and the other half is actually your own bike and because we are doing this whole online whole tracking system like 30 percent of the cost of the whole project is for the actual tracking of it. Many times when people use it we find that Joe Smith uses it once a week, we kick him out and he gets his bike back. That's how we are going to do it, you sign up for it it's your bike you just have to guarantee that you're going to use it this many times per week and if we see that you're not we'll out somebody else in there instead. But it's more of a one-on-one personal adoption program where you actually sign an adoption certificate.

R: That's good because it creates accountability.

R: Yes accountability, we have money for two years and then were hoping the marketing we put on the bikes themselves would pay for the operating.

R: Most people like to drive because they don't know how to take packages and equipment on their bikes, I take a lot of stuff on my bike occasionally, would this work for me or would it be hassle for me to get off the bus with all my stuff and put it on one of these shared bikes. Can they carry the same stuff that I can carry on my own bike?

R: There are other issues too, I am 6'5" and a lot of bikes are not big enough for me and my knees hit the handle bars, I am one inch too tall for b-cycles.

R: Are really short people able to use them?

R: I'm not sure what the lower threshold is, 5'2 I think.

Subject: Use Owners 1St and 2Nd Bicycle at Beginning and End of the Trip

R: I don't have a long commute, but if you are doing that it seems like you want some certainty that you're going to be able to get back home when you want to. Other than a shared bike, that seems like a good alternative if you're comfortable with your own bike.

R: And that's only useful for your every day regular commute. If you're going on occasion to wherever then you're not going to have a bike at every possible station.

R: So Boulder and Denver tie in together people feel comfortable leaving a second bike is its safer at night, that's the only reason I don't leave my second bike out because I don't want my spokes kicked in by someone else.

R: And even just the potential for there to be a flat if it's something you're not using often it just sits there and you don't have opportunities to maintain it or fix it as often as you should. If you leave it over the weekend and come back Monday, is it even rideable? I think that would be the biggest problem you would have.

FACILITATOR: You might imagine me asking this question in Chicago and the answer is "Hell no I'm not leaving my bike overnight" or even enhancing parking transit stations, they said it's just too difficult to get space and the other thing is just the fear of vandalism is crazy, it's also a reality. What CTA has done recently is they are now installing bike racks inside CTA Station, once you get in to CTA and pass through the turnstiles its right next to the security office so there are unofficial eyes on the bike. Not all the time but having that protection and to have to pay to get in keeps homeless out. So there's the fear that maybe it is the homeless who is vandalizing, who knows but you'd have to pay to steal a bike. They have seen more people bring bikes into CTA stations. Any other thoughts?

R: I think the only other thought I might add to that, definitely in Europe you see the two bike system. It is cultural and you see that ubiquitous black bike, I've never seen one here in the U.S. but they are cheap, you get the impression, and they're everywhere. So I think part of it may be that there isn't this market for a very basic bicycle that people feel comfortable just leaving out in droves. That would change some things, I don't have a bike, nor would I know where to purchase a bike that I'd feel comfortable leaving in Denver even if it was totally secure, it just wouldn't feel right. But if there was a $99 relative quality bike that you could purchase that might change that or some price point and that is what I have observed in Europe, that one bike that is utterly utilitarian is everywhere and I don't even know where you buy those. It's a great bike.

R: There are a couple bikes that we bought at work that can just be checked out during the day and they are the European type and it was some they are nice because they are real simple, they seem to be reliable, and durable. I don't know where they got them but I agree that something reliable and inexpensive is needed.

R: It feels a little un-American though. Because we have my bike, my car, my ski's, whatever you can doll them up and people want their individuality expressed through their riding.

R: But it depends what you're doing, like if it's just at work, what they are trying to do is just get people to not use their cars during lunch or for errands, and making that available it gets used a lot. So people that wouldn't bring a bicycle to work, but drive, don't really care what it looks like.

R: In terms of having a bicycle that you can leave some place and not worry about it being vandalized I think your right that there's something about the consistency and conformity of those bikes. People don't go around and vandalize the grass, because it's everywhere, maybe it would be the same if everywhere everyone had the same bikes. Like the situation in Japan, the bikes are different, it's a women's style but everybody rides them, cool young teenage guys riding around on these one-speed women's frame bikes because that's what you ride and how you get places. They're very uniform in their style; even if it's not by design the happy result is that they are less likely to be vandalized because they are part of the background of urban landscape.

CHICAGO, ILLINOIS

Your Local Cycle to Transit Trips/Discussion of Pros and Cons

Subject: Increase Capacity on Transit

FACILITATOR: Focus your attention to the pro and cons to the different approaches moving bikes and people on public transit? What do you think are the good, bad, or anything else about increasing capacity on transits?

R: When I look at these questions, and I'm sure this is the same for all my colleagues here, we are thinking about the community we serve, not ourselves. My responses will be for "What can Active Trans do to encourage more capacity on transit. Is this something the public would demand?

R: The problem is, you've got to know if you can get on the train, because if I live in the suburbs and I have to come home at night ride my bike home 30 miles home that would be bad.

(Group laughs and agrees with this statement)

R: A lot of trains that see the capacity met are not going to take their bikes because they know it's likely that their bike wouldn't be able to get on.

FACILITATOR: Right, if that's happened to you once where you were bumped from a train once, you won't be doing it again.

(Positive reception; group agrees with statement)

FACILITATOR: Do you see nuances between the different types of transit and the ability to increase capacity?

R: Yes, and it depend what type of transit is it? Is it CTA, The Metro? I have seen the argument with the mother in the strollers and the people in the wheel chair, just everybody in the same spot together I foresee it becoming a problem.

R: On the CTA, the strollers and the wheelchair share the same space. It's a matter of who was there first and then the controller comes on board and you know that someone is going have to move.

FACILITATOR: If you were trying to increase capacity here that would be the focus. By increasing capacity we will increase more cycle user doing the cycle transit but use, but not as many transit users starting to use bikes. You might increase cycling and the transit trips used by those cyclists more than you would the reverse.

R: Yes, I frequently ride in the Fox River Valley but I don't want to be stuck there after I have been riding all day. So my wife and I put the bikes in the car and drive all the way up there if we want to take a trip, but we definitely take Metro to work.

FACILITATOR: Would you like to have a place to hang your bike?

(Group agrees with this statement)

FACILITATOR: Are you familiar with Caltrain? The San Francisco to San José and beyond, this is a poster child of bikes on trains; they have up to 80 bikes on one train and two cars now, there are two kinds of trains, Bombardier vs. the Pullman, they have now dedicated two cars because in the past ridership was a little lower and they had to encourage bike users to use transit, by increasing capacity.

R: So did they add another car?

FACILITATOR: They added two cars now for bikes and it is a challenge because over the last year and a half with the rise in fuel prices and the economy, their ridership of non-CTU users went up as well and now they are struggling to meet the needs of cyclists and transit users. They realized the need, given the low density of major employment centers that are less than two miles away. There were some studies done that a large percentage of employment centers that we less than two miles away and are perfect for accessing by bike and more cost effective than having bus feeder services. The point is that different transits have different options and possibilities.

Are they able to increase or decrease headway, like increase the number of trains or are the tracks at capacity?

R: It shares some of the tracks with other trains and also chooses the number of plain cars …(illegible). So they don't have a lot of extra capacity to bring trains in and they have to balance competing demands for lines as well.

Subject: Enhance Parking at Transit Station

FACILITATOR: What do you think about enhancing parking at transit station stops instead of an increase capacity at transits?

R: This is huge actually, If we increase the building convenience of bike parking at stations, it will get a lot more people to utilize it. There are peak issues here around bike parking in the communities, especially in the suburbs. Some of the stations have huge racks.

R: Better capacity, better quality, A lot of folks who live in the 'burbs don't feel secure in leaving their bikes parked outside with or without a shelter or basic generic rack all day long with few secure eyes on that location.

R: Especially after 9/11, bike lockers became taboo. There was a push to increase bike lockers until 9/11 happened and it stopped.

R: For example how big bike stations are in California, on all transit lines. The ownership of the property at the Metro station is often owned by the city, not by the train or conductor or engineer, so you're working with 200+ municipalities in this region. You are trying to

negotiate separately who's a champion and who is not. Municipalities are much need of cash than other governmental agencies who are not willing to not repave a road but pay for a real fancy bus station, it's all these politics that you have to go through to convince somebody to build a top of the line shelter at Naperville for example or somewhere where you have tons of bike parking already.

FACILITATOR: What do they have at Naperville?

R: Well they don't have what I'm talking about, which would be a really nice facility.

R: There was one train I used to take that had really nice racks at the station that would capture your whole bike, captures both wheels and the frame it is much more secure than just putting the U-lock. Leaving your bike there, you're pretty confident you're not going to lose a wheel. Even that is safer, even though it is not covered.

R: It gives me a good feeling about leaving my bike in a really nice place, not a reject where the racks are banged up. CTA is investing in some kind of innovative bike parking solutions at certain high occupancy stations.

R: Security is a much better inside the station.

FACILITATOR: So there is parking inside, I know CTA has started doing that. It is good for weather, but does it feel more secure?

(Group agrees)

R: It has way less to do with weather than it has to do with security. There is not one train station within miles of where I live where I would ever park my bike outside…ever, because it would be stolen.

R: That is a big part of it, that there are eyes on it, it seems a lot safer.

R: I think it would be harder for someone to steal a bike indoors than outdoors, you have a customer service person there 24 hours, although they may not be responsible for watching it, it is good to know that they are there and you have to pay to get in.

R: And you have to go through the turnstile and then get to the racks. The indoor racks are in front of the train operator being guarded all day. Outside the station are the graveyards of bike racks, skeletons.

R: I have never gone in to Metro station and not seen at least two bikes inside, at any time of day.

FACILITATOR: Are you familiar with the indoor parking at CTA? Has it been a big hit would anyone know feedback?

R: I don't know about the feedback, but personally I have used the indoor parking and it's

the double sense of the customer assistance, but that train stations are more frequently used so there is “good citizen surveillance.”

FACILITATOR: There is some informal eyes on the bikes as well as the fact that you have to pay to get in and it is indoors, it is a psychological reaction that it’s safer than outdoors.

Though it is just hearsay from the Netherlands, that bikes are stolen all the time, but if you have seen the bike racks there are hundreds of bike racks at the different stations but their all junked bikes, and people don’t really care about bikes getting stolen because they just get used bikes and it is not really an issue. Here, do you know if people using junked bikes stripped down, basic things, just as transport.

R: Not in general, the cultural difference between the way people approach cycling and see it as part of their life and other ones in here is just so vast. I have heard that too, that people in countries like that have their crappy bike that is their commuter bike that they will leave parked places and then also have their really nice bike that stays in the house and comes out for recreation or when they are going to have it with them the whole time. I don’t think that would ever occur to anybody except for the most diehard commuter here.

R: …there are shops available that have hundreds and hundreds of bikes, those 25 or 30 dollar bikes that you could sell back to them the next day for the same price. This helps serve the campus community.

R: Are the bike prices here really that low? Here people want to buy “junky bikes” at places like “Working Bikes” but still have to pay up to $150, which is a lot of money to spend on a “junky bike.”

(Group shows agreement)

R: Also, in the city of Chicago you can go to “Working Bikes” or the recyclery, the point is there are very few places to buy used bicycles. Near the university there are a number of shops you can go where you pay $25 or $30 and you can sell it for almost the entire value of the bike at the end of the school year if you want to, it was real easy to get that type of bike, that’s not the nicest but still works. Here it is not that easy to do.

R: To me as an advocate, it is a pretty big nut to crack to convince CTA or the Metro [train system] to allow more capacity on the trains themselves during high commute times. It is a big job that will take a few years and require a lot of money to solve, and in the interim we have got to improve the parking situation, and if you improve the parking situation you can get people through a transitional phase until we get to that nirvana of being able to take tons and tons of bikes onto trains.

The Millennium Station/McDonalds, it is at capacity and has a waitlist and is close to downtown. It has this “panache factor,” high-class, cool-looking facility that has showers, lockers, and a bike shop in it. It’s not in the most convenient spot, a convenient place at all. It services only one train station because Metro electric is the only transit that it services, which is only a sliver of the commuter traffic coming downtown. I think people

would be sold on the social factor of bike riding if we had more cool things like that. And it is relatively affordable and not too expensive to have a membership there.

R: The bike parking in Denmark is a very simple aluminum structure with parts of glass on top of it, which can be affordable as long as the land next door to the structure is available too.

FACILITATOR: Installation ease and finding space available is a big issue, from the lens of planners and advocates, it is really tough to get that land.

R: Getting the land is tough, but with the right municipality, the right city/village such as Naperville which is a prime target. We have not done all that we can to target this kind of stuff, because the federal grants are out there, the CMAQ, JARC [Job Access Reverse Commute] etc…We have approached from different angles, but federal funding is there the calling for projects is right now. So if we could find the right municipality that has low-income folks that are going out there for jobs, we can give low-income folks free bikes at a bike station to use to get to and from employment sectors, then open the rest of it up to the wealthier more affluent residents who could pay to sustain the place. There is so much that we can do, but we just haven't gotten there yet.

R: I see security as being a big factor; even if we had a sheltered area we would still need a person.

Subject: Provide a Shared Bicycle at Either End of the Transit Trip

FACILITATOR: What do you think of shared bike programs as a way to solve this problem?

R: The city is behind it politically, but not economically.

FACILITATOR: But how do you personally feel about shared bicycles, if you had the option to get to your transit station from here?

R: A good idea, I would use it I'm scared it might get stolen so I don't know how that would work, but I like the idea.

R: It wouldn't compare to having my own bike, I have a relationship with my bike, it fits me right, I like taking care of it and that's what I would want to ride all the time. So if I were to compare it with these, Id' say it's really good, but I'd rather see parking capacity.

R: Yeah, the shared bike program would have to be so efficient and convenient and everything would have to work out so perfectly for all those factors to be positive. I would rather focus on train capacity and parking.

R: Maybe it would be better for people who aren't huge bikers who haven't been riding forever or have never ridden, hey would see this row of fabulous bikes and enjoy that.

(Group agrees with this thought)

R: I could see it poaching transit customers if I were standing at a stop at a station and two trains have gone by and I see that there is a bike here, I would just take it and go. Though I know it's not necessarily designed for that purpose.

R: I think there is some data out there that suggests that increases in transit, in some of the literature I have seen about existing bike share programs.

R: Ridership has increased in Paris, but most of that increase has come from the shared program. It feels more different now in Paris that more people are riding bikes it feels safer.

R: If I am looking at it from my own personal perspective, shared bike program is only going to be useful to me when I cannot take my own bike and my destination is on a train stop where I cannot take my bike with me and there is a bike share station there, maybe. I am always going to look to find a way to put my bike on a bus, I am more likely to put my own bike on a bus to a train stop and grab a shared bike. This comes from a person who has commuted for a while. I f I am a person who has never done a bike transit trip and I got off and saw one I would probably grab it.

R: This could be a reason to include people who don't use bike and transit in to these focus groups, because we are all saying the same thing.

R: I am wondering, who benefits from shared programs, those who just walk? It doesn't seem to be those that ride their own bikes; I like it when enclosed communities like college campuses have bike sharing programs, St. Xavier. It's a different situation though because these people are walking anyways, not taking cabs to their dorms.

R: Sometimes when I take public transit, I have someone pick me up from the stop and I will have to wait. I could see myself just jumping on the bike and heading home, and even when I am getting off the train I come I see a lot of cars with people waiting to get off the train. I could see those people using a shared bike to just hop on and go home.

R: The other concern is I would feel very nervous about being responsible for that shared bike, especially if it s one of these high end ultra computerized GPS bikes that cost $5,000, that will charge my credit card if something happens to it. Don't like that. In Paris they are throwing them in the river, but I am not interested in taking that risk.

R: That was a problem with the adopt-a-bike, is that you are responsible for it and. We did a test in Washington, DC with 250 bikes, and people said it wasn't really a true tested program because you can only have a few bikes at a few stations; it doesn't really test how well they were utilized. In Paris they have 20,000 bikes now so if they lose half of them they will still have 10,000 bikes out there. But you're not responsible for the bike all day because there are a ton of transit stations that you can drop them off at during the day, it would increase the appeal.

Subject: Use Owners 1St and 2Nd Bicycle at Beginning and End of the Trip

FACILITATOR: Any other pros or cons of this that you see as critical?

R: If I had a trip like that, it would be contingent upon the good parking, even if it's a beater bike that is fine, but it has to be a beater bike with a seat and a wheel.

R: This is over the head, it is too much for me.

R: If I am commuting 90 minutes every day on a train from Milwaukee, and I ride my bike to Milwaukee station and get off and ride my bike to Union station and walk to work, that is golden.

FACILITATOR: So there is security, this option is usually used for commute trips that, as you know there are only so many bike spots you can out on bus, until you're taking seats away from passengers and for a good part of the day where you don't have many passengers. For cyclists it's usually the peak travel times and then during the rest of the day you have a bike that is half empty with fewer passengers as well, but you are still taking away capacity so it's not ideal.

ITHACA, NEW YORK

Ithaca Focus Group #1

Your Local Cycle to Transit Trips/ Discussion of Pros and Cons

Subject: Increase Capacity on Transit

Audio failed; the recording goes right into enhanced parking; cannot tell when it starts.

Subject: Enhance Parking at Transit Station

FACILITATOR: Actually, you were saying, you had started off when I think we lost it, that biking to the bus stop was the problem was not having bus stops in rural areas. Someone else had said something brilliant. So, some other aspect about bicycle parking, that actually really helped.

R: Well I was thinking about this the other day, like this new thing that just won an award, the scaffolding in New York with the little umbrella—they're really cute. It's like this pretty scaffolding covers. Scaffolding in New York is ever present, so they made something pretty and portable and easy to put up and take down—and she won this design award.

R: And I thought, a lot of times, like with parking, you don't know. It holds three, it holds four, you don't know where they are…so I was thinking if you had a rack of a dozen, something pretty and ubiquitous and not that nasty plastic coating that gets all scratched up that they use for bus stops, not that. But something like that pretty scaffolding thing, then everyone will know. It will be higher and you can spot it and you can see where it is.

FACILITATOR: So visible sort of parking spaces.

R: Yeah. Something that everybody knows what it is, like if you see that particular color or that particular shape—like the blue light lights, you know what they are and you know to make a beeline for them.

R: So first line of thinking, I think safe bicycle, from a policy perspective, is something I grade really high as meeting a lot of people's needs. Obviously you can't do it everywhere so you need to pick key transit locations.

R: And the second thing I would say is I ride a winter bike and a summer bike. The winter bike I wouldn't care. It's concern about the condition of the bike and the theft problem, but my nicer bike, it would have to be very secure before I'd feel comfortable leaving it somewhere.

R: You know, I hadn't really even thought about this, but I bike to work and there's no rack at my office or building even. It's private property, it's the college and they haven't got any covered areas. So that doesn't really fall under transportation systems, that's my employer and there's no place to put a bike. It's real disincentive—I know people that I work with

won't bike in because there's no place to put their bikes.

R: So covered parking. I go year round and I have several bikes depending on what the weather is like, but if I had outdoor covered parking for my bike, that would be fantastic and more people—they said they would—bike to work or bike to the bus.

R: I'm all for covered parking and bike racks but I'll lock my bike to anything. I don't think it really holds me back from anything. I get annoyed when there's no bike rack or there are no trees nearby. I think the nicer the bike parking is—it's good but it's not a major thing for me. I think rural areas are different too. Like downtown Cornell.

FACILITATOR: Do you have a really expensive bike too?

R: I have a solid bike but it's not that new. But I lock my bike outside my house and I've never had a problem at all. I feel like if you bike is locked with a decent lock, there aren't that many unsafe places (someone knocks on wood).

R: If people want your bike they'll snip.

R: I've lost five bikes.

R: I'm with you. I've had so many bikes stolen.

R: I've locked it to a wooden railing and the railing was broken so the bike could be stolen.

R: We had somebody come into our house, through a gate, up the stairs, across the porch in a house.

R: Yeah, I mean I've never had a problem and I leave my bike in my front yard like feet from the sidewalk locked to a railing day in day out.

R: I think the biggest thing is like having racks because a lot of us do have a bike that you might race on or a bike that you might commute on when it's raining and you really don't care if it gets beat up, like a beater bike and just having the place there so someone can make that decision, I think it's a huge huge issue. If you don't know there's a place to lock it—you don't know there's a safe bike rack there then you're probably not even going to try in the first place.

R: I was going to say, going back to covered bike places—I'm absolutely on your side, riding as much as the weather will permit and the worst is when you get to where you're going on a sunny day and it starts raining in the middle of the day and your bike's outside and it's soaked through. Covered bike parking is fantastic. I've gotten yelled at for bringing it in the building and locking it to a fire escape stairwell. Outdoor bike parking that's covered is brilliant.

R: I was going to say that if you trying to encourage people that are sort of hesitant about doing it, they want to do it, they want to be good for the environment, they want the exercise and all that. Their personalities might make it where they want to wait for the

right time. They're accustom to parking in lines—this will transfer to the bike—they'll look around for the place they're supposed to park…

R: And who's watching them because most parking lots are monitored so if you are parked where the are other bikes there are other people so it's better observed than just having it. They feel safer.

R: True.

R: And if they feel safer, they're going to be more inclined to us it.

R: That's good or bad. If you put a bike rack out in the country and someone know there are bikes there…

R: Well I know at Cornell, some of the buildings have covered parking, they're under an overhang. Maybe if the bus maps had an indicator that said there's bike chain areas—this one's covered, this one's not? Because then I know I can go here—and this one's covered.

R: If someone's listening to this and thinking about designing—the thing I would stress is it's not like every bike rack would need to be covered. People here are saying they have problems putting their bikes ON the bus. They'll walk over to Green St. which is at the front of the line just to try to get on. People who are biking are already a little more active so there's a bike rack two blocks down that is covered, then you don't need one for another three blocks. Strategically covering them.

R: So if there's a cost problem, integrating covers into building structures so you don't need to build a separate building that's fancy and expensive like some of the best covered bike racks that I've used in cities and around here where there's just an awning on the building. The bike rack ended up under that awning. There's probably not any planning for that awning to be built for a bike rack.

R: When I think about this particularly with the transit connection it seems there's certain places where it's more important to have good facilities than others. I don't ride the rural routes that much so I'll defer to you guys but it seems there's probably some collector points where people just ride to and get on the bus and I think in the city, a lot of times it's the bottom of the hills of critical routes because a lot of people want to ride there and if they're going to take a bus, it's going to be to get over the hill.

Subject: Provide a Shared Bicycle at Either End of the Transit Trip

FACILITATOR: Well that sounds as if you're generally in favor of enhancing parking. What happens about providing a shared bicycle at either end of the transit trip? Is that any use to you?

R: Could you define shared bicycle again?

FACILITATOR: So that's a bicycle that's a public bicycle that you can share. Either you just rent out or you borrow it.

R: I think I like to ride my own bike and if I can put my bike on the bus then that's by far better for me.

R: Plus from a logistics standpoint, for the person organizing the shared bicycles, it doesn't seem like it works very well that often. Maybe it can work. In Ithaca, there's the problem of the hill. People have talked about this before.

FACILITATOR: The geography?

R: Cornell is starting a bike sharing program as well. All the bikes are going to end up downtown and someone's has to bring them back up. Things like that.

R: And then the other is when I ride someone else's bike, something just doesn't feel right. There's always your attachment to your bike because you know it fits and it's set up for you. Sharing bicycles becomes a little wishy-washy.

R: I think everybody in this room bikes quite a bit – so maybe the people who aren't as "my bike feels like my bike and it's perfect in every way?"

R: But if you're talking about people who…Conceivably it could work, I just feel like it wouldn't put out as much as would have to be put into it.

R: For the cost benefit for Ithaca, maybe it's not that great. There's not a critical mass of people who are going to be using it.

R: I have a friend who routinely does this—leaves a bike in town. Inevitably it ends up being somewhere he is not it ends up being one direction from where she gets off the bus. It will end up at someone's house—it's there for a week before she gets back to their house to get the bike. If you went from point to point to point—maybe if you're commuting and doing that.

FACILITATOR: Well then that's close to the second one, having two bicycles, one on each end. So you'd have a bike in town. This would be at one or the other of each end there'd be a shared bicycle.

R: I personally think there's potential for doing this but I don't really see it as being critically linked into transit. If you're going to develop that kind of program I wouldn't think about trying to build it around transit stops. I would think about potential for what they're trying to do at Cornell, and I agree—I think it has to be highly organized. With pick ups and some kind of electronic monitoring you swipe your credit card before you can take it away. So there's a way to keep track of things. There are problems with them, but I wouldn't want to give up on that idea because I think that for people who don't own a bike, particularly around campus environments I think it has potential to help out.

R: I know it works in DC, but mainly it works because it's huge, it's flat, and there's a lot of tourists. It's a lot of distance to be covered in a short amount of time and that's not really the situation in Ithaca. Once you're down town, you can get to a lot of things. If you work

down town, you can get to the post office and other places, you're not really biking during your day. It's a great idea—I think he is right, it would be great on the campuses.

R: For the Cornell bike share program here, it will probably function more like checking a bike out. You would have the bike for however long you need it, two weeks, a month, and then you give it back because you don't want to actually purchase a bike. As opposed to other programs where you use it for fifteen minutes, get to where I need to go, and then I'm going to leave it and I'm not going to ever use this bike again.

R: Another version that I've seen in Boulder one or two summers ago which was a bike rental system, a little like this. It was run out of a hotel, so I could image a hotel doing that, like private sector. They offer it as a benefit for hotel guests. If it were successful, they could market it as a way to get from downtown to the farmers' market.

R: Building it around the transit notion seems pretty far-fetched in this community at least.

R: I think it would be interesting to know, who are the people who would want a bike share program. From my experience talking to people I know (not everyone by any means) it's the people like us who dream up the ideas like, "everybody should be able to have a bike." Maybe there's some sort of understanding of who might or who would want to use bikes that wouldn't want to have their own bike but would prefer to use someone else's. I don't know who those people are.

R: I was just going to say parents.

R: When my daughter was home we were watching the Travel Channel and Sam was in some country where they have a bike share program which the state runs. So I'm listening to very European models but they were talking about what a great idea this was and wondering why they don't do this in the States. They were talking about why they didn't do it in the states and they were talking about the geography, the fact that most people own cars, or have already established a way for getting from point a to point b. They didn't have that there.

R: There are definitely places in Europe with geography and weather like Ithaca that have bike share programs.

R: Bike shops rent bikes so you can rent a bike here. I would think that a priority would be bike infrastructure—so you build infrastructure and then encourage hotels and bike shops to be a place where you could rent or access a bike when visiting rather than having to invest in bikes on the roads.

R: And then you can get them the transit map with the covers on it.

R: Like the Bike Ithaca Map or the Chat Map will tell you where you can rent a bike. Like when parents come here—I know people I have directed to go down to the outdoor store to rent a bike and it's worked pretty well.

R: I like the idea of the car share. The idea is not everybody needs to own a car, but everybody needs to own a bike. We could share a car.

R: Just another thought, we have a proposal in the city that John Novar(?) has made to develop [housing] on State St., putting roughly 600 new graduate students where the old hospital was, on Quarry St. To privatize, the developer should have available bikes for people that live there that they could put on the bus or they could ride directly if they wanted to. But I don't see the public sector doing that really.

R: Paris does it right? Where they have some kind of triangle where they provide the bikes to the city and there's a billboard company that does public service announcements on their billboards but they bought the bikes. It's like a triangular system.

FACILITATOR: But in general, this is not really your top priority?

(Many in the group answer "no.)"

Subject: Use Owners 1St and 2Nd Bicycle at Beginning and End of the Trip

FACILITATOR: I just noticed we're going slowly and we need to get through two other sections. To have a second bike on the trip, does it make any sense?

R: I think it's a great idea. I mean as long as you have a spot to keep your bike. I used to keep a bike down town just so I'd have a bike to ride around downtown. It seemed to work great.

R: Two things. One, I would prefer to bring my bike on the bus and use my same bike if I can. That would be my top choice.

Two, sometimes bike racks are full of bikes people left behind. Sometime they left them there every day or they leave them there for months on end and never come back for them. So there would have to be increased bike parking for it not to impinge on other people's bike riding.

R: I end up leaving bikes in different places and when am I going to get it? How am I going to deal with the bike? There's always something that comes up that interferes with the plan.

R: Not to mention just knowing the bike is somewhere else and holding my breath when I get there hoping it's still there.

R: I think you'd need some kind of established bike parking garage type concept for that to be really effective for large numbers of people to start using them.

R: Like parking garage sounds like a great idea.

(Group laughs)

FACILITATOR: So overall, what do you think your preference is? Increased capacity on transit, parking at transit stations, shared bicycles, second bikes. I can guess, but what do you think it is?

R: The first one for me.

(Others agree)

R: It's the second one for me.

FACILITATOR: So most of you it's the first. And for the other…

R: I think one would drive, too.

FACILITATOR: One or two. For most people, it's increasing capacity—for a few people a good second is the parking for particular kinds of commutes.

R: I think you find more people would use it if you had parking.

FACILITATOR: So. Then we have to prioritize these facilities and this was actually was where we have to start using the survey.

R: Wait a minute. What do you mean—important for what? Because I was thinking important for transit but if it's important to get people to ride their bikes, then the second one is more important.

FACILITATOR: Fine. So this is where we have to start using the survey. I'm going to show you—we have to rank which of these approaches, the bike on transit, the bike to transit with more parking, shared bikes, and so on is defined. And I'm going to show you four trip scenarios—this is on page two of your survey. So I'll show you trip one. (STOP).

Ithaca Focus Group #2

Your Local Cycle to Transit Trips/Discussion of Pros and Cons

Subject: Increase Capacity on Transit

FACILITATOR: What are the pros and cons of increasing capacity on transit? Either inside the bus, or the front of the bus/back of the bus?

R: I think one of the big cons, which I don't really deal with because people who work at Cornell have a free bus pass, but I think if I didn't have a free bus pass— I don't know if I would be that apt to use the buses that much so increasing would only benefit those who want to use it or can't pay to use the buses.

R: It seems like there's also a trade off there—the more capacity you have for bikes, the less capacity you have for passengers. The kind of people who take the bus aren't cyclists and if you started filling the bus with bikes, you might be taking away passenger capacity.

R: To what you said, even if you don't have a free pass, or free transportation you get a ride one way and you ride the other way, then you're still on your bike and now you just go the other way for free. So it's still kind of half an advantage— it could save you money.

R: I love the picture of the bikes inside the bus. I think it would be a good safety thing. I've seen people try to get their bikes on and off the bike rack and if they're not physically strong or capable, or haven't done it a lot, it can be a safety issue.

R: Also there have been times when the bus driver is parked to close and I have had very little room to maneuver my bike onto the rack.

R: The bike racks often freeze in the winter so there's a lot of little detailed issues…For me that would be a pro to have covered bicycle transportation. I think if you bring a bike on public transportation, it should be free. Like in a hilly area—one of the reasons I'll do it is when the road conditions are poor on the hills and I just need that assist.

FACILITATOR: What's stopping you [from] using…?

R: I understand very well that our public transit in this area, especially given our population, is quite good. For example, I thought I would ride my bike from work to the bus at Seneca St. to here, but then the only way I could get up here on that bus would leave me about a minute and a half window so if I left work a minute and a half late, then I was going to miss that bus there and there was going to be no other way to get here so I made alternate arrangement so I would not be late. That seems to happen to me about 90 percent of the time I try to do this so I usually just bike and walk or just bike.

FACILITATOR: So you've done bikes on transit, have either of you done bikes on transit?

R: Both respond yes.

R: The greatest thing they've ever done is the number ten shuttle which is supposed to run every ten minutes then you don't have to think about that problem generally as long as you know the general route and where you can pick up that ten downtown. I always go for the ten when I am not concerned about time. I just know that I have to wait about ten minutes or so.

R: Right. My mission was that I was only just going to be able to catch the ten or if I missed it, I was going to be at the bottom of the hill with 18 minutes to get here—which is probably enough time, but it was going to be more work than I wanted to do.

R: So to explain that, for the people at Colorado—the 10 bus runs about every ten minutes from downtown Cornell to downtown Ithaca to Cornell University and between 7:00 to 9:00 it runs every five minutes.

R: At night?

R: No, in the morning during rush hour.

R: Another issue is it's kind of frustrating to show up at the bus and there are two bikes already on the bus rack and then you have to wait for another bus.

(Others agree that this has happened to them before as well)

R: I actually tend to shy away from the 10 for that very reason. So many other people do tend to take it that I feel like I get locked out of that one more often. I take the bus a lot so I know the routes pretty well. I go to stops that aren't where a lot of people are or before, like if you go down to Fulton St., catch it before it gets downtown, you can get your bike on a little easier. But I think the capacity is definitely limiting in the summer.

FACILITATOR: So increasing capacity on transit somehow would help you?

(Group response: Absolutely)

R: Yes.

R: Like some places have trailers, then you could have more capacity with a trailer?

R: Which could be covered.

R: Yeah!

Subject: Enhance Parking at Transit Station

FACILITATOR: Well let's go to the next one enhancing parking at transit stations and stops.

R: Parking for what?

FACILITATOR: For the bikes. So instead of taking your bike to work, or where ever you were going, you could just park it there and take the transit.

R: Definitely it's improved here in Ithaca recently. I think it has room for a lot more improvement. I think all bike parking should be covered. It should be well lit in the evening, very secure. Out in the open, not back in the corner behind a building or anything. Bike theft is an issue in Ithaca like most large cities.

R: I think increasing parking at transit for bicycles would be valuable—it might even solve, or partially solve the issues I've been having. Like the issues you were discussing: if you have a well lit, convenient, secure place where I can catch the bus, come up here, come back down and my bike's right there, as opposed to having to hunt for a parking space where it's going to get rained on, kicked and covered in snow from a plow. That would make it a whole lot more desirable to use that as a storage spot.

FACILITATOR: Do all of you live in Ithaca?

(Several participants respond "yes")

FACILITATOR: Any other comments on this?

R: I don't really park at the bus stops personally. I usually put my bike on the bus, travel to another stop then get off and travel some more. Maybe if there were nicer facilities, I might do something like that—but I usually have to continue my journey after.

R: I actually work at the outskirts of campus where the buses don't go so I really want my bike when I get up here.

Subject: Provide a Shared Bicycle at Either End of the Transit Trip

FACILITATOR: Well that does it. So—shared bicycle at either end of the trip.

R: The Big Red Bike thing might be an interesting aspect of this thing. One at the top and bottom of the hill, or at different points because, well, I think Ithaca might be a bit small for it. I could see it being a huge asset to places with a large population, people moving from residential to work areas.

FACILITATOR: Do think it might help others or do you think it's…

R: I think if Ithaca's going to big red bikes like the Cornell shared bike project, I think it may help a lot with students who want to go somewhere on campus, get on a bus, end up on the flat part of Ithaca and then go somewhere else. It's going to increase their sense of connectedness to the Waterfront Trail which is clear across town—10 or 11 blocks—really far. It can be seen as a deterrent. Having a bike would be a help.

FACILITATOR: You'll have to speak up to speak over the heating system.

(Person comes in late and facilitator brings him up to speed)

FACILITATOR: We're just actually talking about pros and cons of a few different options for increasing bicycle transit. We talked about enhancing parking and now we're talking about shared bicycles.

R: On campus, a number of the parking lots for cars are quite a ways from central campus. That might be an interesting aspect if they have a shared program for people who drove their cars to bicycle to their places of work.

FACILITATOR: So we're talking about cars AND bicycles.

R: I think if it's a really strong community program, where the bicycles are maintained, there's enough of them, there's no room for vandalism or neglect, it could be helpful. Especially to new students who are coming to the campus for the first time.

R: The only thing I want to say is there's a bike culture—most people that ride bikes ride them for some various personal reasons and there's a strong bike culture that almost says "we don't need that" to a certain extent. And that's kind of why we ride our bikes—because we don't need a car, we don't need a bus. But, for myself, and I think I'm of that bike culture, I welcome that as long as it's done in a really committed way. Without looking forward to Big Red Bikes to see how they do it—how organized it is, how well thought out it is, and that it's available to ALL the people.

R: I keep a lot of bikes around so I probably wouldn't actually, because I have a few at home, a few at work (group laughs) but it all works out well.

R: There's two main things that I think need to happen to make a successful program. One, especially with the topography here, there has to be a huge incentive for people to bring bikes back. I would imagine if you have shared bikes on campus and people bring them downtown, their likeliness to want to bring them back up is almost nothing. I guess with this system, if it is tied up to their library card or there is some sort of charge or deposit, then that might solve that issue.

R: The second thing that I've seen with college clubs and organizations—students are really excited in it—usually they're juniors or seniors and their gone in a year or two and then who's running it afterwards? It's great if you can get grant funding to buy the bikes, but if you don't have interest a few years later then the whole thing flops and it's a lot of wasted money. Anyone who tries to do it in the future would say, "Oh yeah, we heard there was a bike program but it didn't work." They may or may not know why it didn't work. So I think you need some faculty, or people involved who are staying around longer than just four years.

FACILITATOR: So something like shared bicycles may work for certain things, but it doesn't sound like you're very enthusiastic about it? For you, in terms of how it would make your transit use different.

(Group responds it would not change their use)

R: I could see how it would help a lot of people. I mean, if they're mostly just trying to get around campus, a shared bike would be great for that. I don't know if providing it becomes a commuter option for others—if they take a bike home every night then take it back to get to the trains that stop. I haven't heard of that being a big priority before.

R: If you do the training thing for the dogs where you have collar if you go past a certain point you get zapped it can't go downhill.

FACILITATOR: Or you could just pay a couple bucks and someone goes down to the next…

R: Yeah, a work study job for driving.

R: I kind of assumed they'd have to have a truck to go and get the bikes and bring them back here.

R: I feel like every Saturday morning they'd all be down there.

R: Probably.

R: I think this is great. The shared bicycle at the end of public transit would be definitely oriented toward the, at least here, recreational pursuits. It wouldn't be people walking five blocks to hop on bike then get on the bus.

R: The bikes that I saw—I talked to the people putting this together—the bikes that they were planning to get were fairly heavy—they're not like a commuter bike that you just want to jump on and ride up the hill. It's more like a "I'd like to get around campus". This bike was just fine for that. It wasn't something you'd be necessarily going fast or up hill with.

Subject: Use Owners 1St and 2Nd Bicycle at Beginning and End of the Trip

FACILITATOR: Well the next thing about the other one, having a second bike at the end of the trip. I guess that comes along with enhanced parking to manage it. Do any of you do this already? Does it seem attractive to you?

R: I don't do this.

R: Yeah, I feel like it's too short, at least here. I mean, it's like a longer trip I'd be more interested in it. Like in a bigger city. It's only a mile or so from here to downtown.

R: I've known some faculty where they've done it and they've been able to keep their bike in their office and then if they have to meet somebody for lunch on the other side of the campus, and it's a nice day then they'll jump on their bike. But at the very minimal, you have to have that convenience of storage.

FACILITATOR: So this isn't exciting for anyone? Do any of you have a lot of bikes?

R: Well I have bikes for different purposes, but it works really well for some of my commuting things. There's a bike that I generally call my commuter bike, its good year round. But I also have two other bikes that are (illegible) depending on the day I'll chose what bike I take. If it's a nice day, I'll take the lighter faster bike, if it's rainy or snowy I'll take the heavier bike with fenders and that works. And I just have an old bike that I keep in the office so if I just have to go around town for something. It's mostly I don't want to lock up a nice bike downtown or on campus if I don't have to so that's why I just have a cheap bike that I just use for those things.

FACILITATOR: (Inaudible statement) So, overall, which would you prefer—increasing capacity on transit, parking, shared bike, or a second bicycle? What do you think overall?

R: I think increased capacity on transit.

FACILITATOR: That's at the (inaudible) of the bus, or at the beginning of the bus?

R: Okay, I missed that, so you mean capacity of bikes that you can take on trains?

FACILITATOR: Yeah.

R: I would definitely go for that too.

R: I agree.

R: I used to take bikes on the bus, I was helping out in a class at Ithaca College and at that same time every day, even thought there was only ten people on the bus, there would always be two bikes on the front before I got there. So it wasn't that there were too many people on the bus, it was just that the bike rack was full and it could only hold two—and then I'd bike up the hill. So, definitely increasing capacity on transit would have helped me in that situation.

FACILITATOR: Oh that's good. So now we have the scenario where we actually have to look at the survey. And what that's actually going to be is I am going to go through four trip scenarios—different kinds of trips. (STOP)

PORTLAND, OREGON

Your Local Cycle to Transit Trips/Discussion of Pros and Cons

Subject: Increase Capacity on Transit

FACILITATOR: What I am going to ask is the pros and cons, in terms of your own preferences, which of these four strategies and which would accommodate you the best in your daily transit.

R: I don't take my bike on Max because the times I would have to go on there are so crowded. It's so crowded, as a mom and cyclist, some other way to make riders not so intrusive would be good. Make capacity more useable.

FACILITATOR: So the pros would be it wouldn't be so crowded for you with your bike?

R: It would be easier during crowded times.

R: I agree, I feel like I am inconveniencing people on a busy bus.

R: I don't like to take my bike on the train during rush hour and you feel you're causing a bunch of hassle for everybody, especially when it's wet. Having more bike capacity wouldn't make me bring my bike on the train.

R: So when we are talking about increase capacity on transit, do you have a concept about what this could be? Like a dedicated bike car?

FACILITATOR: It could be a dedicated, more space, standing room space for passengers, it could take a variety of forms.

R: Sometimes you just don't know, even if you're standing on a train, I just don't bother with it because I don't know if I'm going to be stuck and miss two or three stops. Town, if I get on somewhere else like PGE park or Goose Hollow you don't know how long your gonna stand around and wait to get on train, depending on whether people with bikes are already on there or if it's just too crowded.

R: And it's the same with the bus bike racks, you get two people and you have to wait for the next bus.

FACILITATOR: So having more capacity would solve those problems?

R: I don't think it would as long as it is still a shared space. It can get really packed, especially If you get off schedule then suddenly every car is packed. People are generally courteous in moving out of your way, but you still feel like a big inconvenience for them.

R: If they had some creative solution, like an outdoor thing to attach it to, that would be good. Possibly if there was a way like the bus, where you can put it on without inconveniencing people, you might hold them up for a minute.

R: I think the concept of suggested passenger standing room, if you were to ask non-cycling train passengers to stand to make room for cycling passengers, would cause a blow back.

R: Yeah, an idea would be like a dedicated car.

R: I worry about the security of my bicycle; I want to watch over my bicycle at all times. When I get on public transit, I want to take a nap.

R: Sometime when I'm hanging there too, if a cyclist isn't nearby they swing and hang.

FACILITATOR: Do you think there are more cons?

R: The dedicated car is hard for me to imagine, it seems like a luxury to me. But if there was a dedicated car I would use it if I could somehow be assured that I could be on there or someone would be watching it.

R: A car that had spaces for the bike and then for the cyclist themselves, to stand, I would give up the luxury of sitting if I knew for sure I could take my bike on and it would be safe. One side with hooks or racks would alleviate the concerns about security and would eliminate the tensions between passengers and cyclists.

R: I came here from California, and there they had half the train dedicated to bicycles.

FACILITATOR: Pros of having your bike with you on the train, as oppose to the other strategies. Is this a plus?

R: The ride from the station to your stop, it's good to have a bike, but if I can easily get from the other end to where I have to go that would be preferred.

R: I come from the suburbs and once I am down here I can walk to everywhere I need to go, I don't need my bike. Having the bike down here isn't the easiest because I have to take it down from the train, take it up to the office and put it somewhere.

FACILITATOR: Any other thoughts?

R: I need that bike with me because I have to go down to Lake Grove and they cut some routes there and I need to get places so I can't just have a borrowed bike, I need my bike.

FACILITATOR: So that would definitely be a positive of this strategy.

R: It gives you a lot more flexibility, if you need to go to a meeting somewhere or if it is a really nice day and you want to ride your bike home, or even if you are just stuck somewhere. Even just taking one specific route you are stuck with that, which is why I started riding my bike, in case I wanted to take a different route home and utilizing some of the other route times that are available.

FACILITATOR: Any other thoughts about increasing bike capacity at transits?

Subject: Enhance Parking at Transit Station

R: I love my bike box.

(Whole group agrees)

FACILITATOR: So why do you love it so much?

R: It's safe, dry, you can put other stuff/gear in there.

R: I ride into the station but get a ride home at night hand I don't worry about leaving my bike there overnight and I can just come and get it in the morning.

R: You don't have to carry your lock with you just the key.

FACILITATOR: Any downside to the bike boxes?

R: There are not enough of them. There are not single use boxes, I like the flexibility, I can only go to this one station but if they had them at other stations, that were coin operated I could have more flexibility.

FACILITATOR: So the ones now are subscription based, you're assigned one.

R: Good thing about that is you know it's going to be there, but having a coin operated one would be a nice option.

R: I imagine the demand is much higher in the winter than the summer obviously.

FACILITATOR: So because the bike boxes are subscription only, people wouldn't want to subscribe for a whole year?

R: Sometimes you don't need it, there are times that I will leave my bike and drive and leave my bike in my car, or put my bike in the box and get a ride in knowing I will want to ride it home. There are odd combinations if I have a secure place that I know are safe temporarily.

R: At PGE Park they have the hoods that come down over is that open or dedicated?

R: They are open.

R: Something like that open and available you won't have to carry your lock and chain, it hides the bike and keeps it dry. Good idea, wish there were more.

R: My stop is the end of the line and there are 6 clamshells and they are first come first serve, you padlock them they are not as safe as the box because they are 19" off the floor and your tires stick out.

R: Security is not as good as a box.

R: I've seen sliced tires.

FACILITATOR: What about increasing conventional parking, not just boxes but racks, covered racks?

R: I don't like leaving my bike for hours, even with a U-lock because then you have to deal with 3 lights and my road fix kit, seats, attachments.

FACILITATOR: So you end up having to carry more with conventional parking?

R: Security is an issue.

FACILITATOR: Do you take a separate lock as well as putting your lock on the bike locker?

R: No, they are totally garages for your bike.

R: If I stop at a store on the way home or something then I will.

FACILITATOR: Any other pros or cons of conventional parking?

R: I heard some people complain that capacity issues are very severe. I waited 1 ½ to 2 years to get a bike locker at the transit station before they started charging a nominal fee. Because people would get them wanting to ride their bike more and just be sitting on it.

R: I have to say that nominal fee is way too low, assuming money from charging rent for bike lockers could contribute to more bike lockers, the fee is $50, that's really low considering the benefit.

FACILITATOR: You're willing to pay more?

R: Depends on good location, if it's in a good location it would be worth it.

R: This is only if charging more for bike lockers are lead to creating more bike lockers, once enough money was brought in. I don't want to be funding other operations.

FACILITATOR: Aside from the lack of supply, any downside to the bike box?

R: Had a duel with some wasps, build a nest they wouldn't give up and I couldn't find the right person to talk to. I asked some drivers at the station, but no one really knew.

FACILITATOR: Final thoughts?

Subject: Provide a Shared Bicycle at Either End of the Transit Trip

R: Not helpful, don't want to rely on someone to bring it back when I need it tomorrow.

FACILITATOR: Ideally the concept is to be like a shared car program, instead of dedicated bicycles there would be bikes there for you to choose from. You can take any bicycle on any given day. The risk being that you might get there and they could all be taken.

R: They have a system like this in Paris, every half mile there's a stop and you bring bike back. In terms of traveling it's a great way to get around, you get rid of the bike and you don't have that responsibility anymore. Something like that downtown, leaving my bike at the station and taking the train and I wanted to go somewhere far it would be nice.

R: I would use it for additional cycling, not as a replacement. Just to come downtown with my kids and ride around the river front, as recreation. It's an extra thing, I would participate.

R: It doesn't seem viable in the suburbs, you are riding longer and you want to have your own gear and bike but if you were downtown or something it would be really great.

FACILITATOR: So with the bike sharing one option would be to ride your bike into the transit stain, take transit and get on a shared bike for the last leg of your trip that is one scenario.

R: I wouldn't use it for that, if I didn't have my bike downtown and had to go to a meeting across town, instead of getting on the bus I would bike.

R: Even downtown I just catch another bus or so, if I had to go somewhere out of the way of public transit but not in downtown.

R: Suburb and commuting, if you're going 10–20 miles you have to deal with flats, tip-overs, etc…

FACILITATOR: Positives are compliments to current commuting, also allows you to access a broader range of trips. Downside, you prefer having your own bike, it's another expense**.**

R: Depending on how far you were traveling, if you wanted to have a helmet you would have to carry your helmet with you wherever you go.

(Group agrees)

FACILITATOR: So none of you have ridden on a shared bike? Except for in Paris?

R: I'm pretty tall, I don't know if the bike would fit me.

FACILITATOR: Yeah so making sure a bike was available that was the right size. Other thoughts about shared biking?

R: Well not so much for commuting, but for visitors it would be great. You can't take your bike on the plane, so to get here and be able to get around and sight see it is a great thing for them.

R: Yeah, that would probably be the best use of that program.

Subject: Use Owners 1St and 2Nd Bicycle at Beginning and End of the Trip

FACILITATOR: Park your bike, get on transit, get off you have a 2nd bike. Has anyone done this?

R: That only works with people who have more than one bike, a bike that they can leave somewhere and not worry about needing it on the weekend.

FACILITATOR: So some people can't afford two bikes.

R: It's the gear issue; you could have two bikes if you had two secure garages with lights, a rack, it seems like more logistics.

R: Especially coming into Portland, again you can get on Tri-Met. It seems like a hassle and excessive.

R: It depends, if you lived far enough away from one stop and had to get on another stop to get to work I could see that. I do keep a second bike at work, in a bike locker at work but it's more recreational.

R: Portland suffers from excellent transit service.

R: I think this is true, some of us who take bikes on to transit more than we do right now. It is hard for me to imagine Tri-Met adding a bike car onto the Max train, so really it would just be adding more trains or buses so that there is always space. Then you wouldn't be so concerned about being able to get on or displacing people.

R: I think there would be a tipping point to adding more cars on to the train that you' d have to have so many more people riding. Right now they are projecting like six percent but they would need to project like 25 percent, maybe in the future I could see use for a second dedicated car.

SANTA CLARA COUNTY, CALIFORNIA

Your Local Cycle to Transit Trips/Discussion of Pros and Cons

Subject: Increase Capacity on Transit

FACILITATOR: We are going to do a pros and cons discussion, instead of talking about what I want or you want the most, we've done a little bit of this already, but just to ensure we cover this base. Increasing capacity on transit, what are the pros and cons of that?

R: There seems to be no con if you're not paying for it.

R: Unless it decreases the frequency of service.

R: In most of the Bay Area, that's not a problem just because there is not that many riders, on BART for example it would be a problem, because BART is already at capacity.

FACILITATOR: And Caltrain has been at least on some occasions.

R: For passengers?

FACILITATOR: No, for cyclists.

R: I am talking about the cons of increasing for passengers. I have never seen Caltrain, VTA, or Amtrak at capacity but I see BART consistently at capacity. If the transit would be at capacity, it would be a problem to increase ridership because you are taking away.

FACILITATOR: From a personal standpoint, as long as it's there and it's free your fine with it?

R: Yes, the only challenge dwell time is a big challenge for operators, particularly Caltrain. You have 20–30 bikes getting off at Palo Alto, it takes longer and the train becomes late. The way that impacts me personally, if I am waiting for that train to get to my station and they have more and more bikes they're dwell time is delayed getting to each station it screws up the schedule and increases my dwell time and my train becomes late.

FACILITATOR: Any other comments about bike on transit?

Subject: Enhance Parking at Transit Station

FACILITATOR: Enhance bicycle parking at transit stops.

R: It works really well in a Japanese-type model, where a lot of people live less dense suburbs and tend to commute into the city where there is a great dense network where you don't need a bike. Out here, since we have a pretty even distribution of medium density (besides Downtown San Francisco & Downtown San José).

FACILITATOR: As long as the cost is not a factor there is no downside.

FACILITATOR: So we'd all prefer to have more transit parking for bikes?

R: If it is free and unlimited, sure, there's no doubts.

R: In this area with the transit agency in all the cities being members driving the transportation agency, they need to make sure there is bike parking at destinations because people get to their destination and there's no place to put their bike, they maybe won't take their bike next time. Or they aren't going get the clue if they drove to that destination that "Hey I could ride my bike here," they wouldn't know that they could do bike transit because there's no bikes anywhere.

R: You can lock your bike up to a tree or no parking sign.

FACILITATOR: As long as there is something to get your bike on to, security on this option is not a huge factor?

R: Actually it is because you could have new time riders that don't know how to lock their bike up properly and having proper bike parking facility can make a difference.

FACILITATOR: Prefer to have better lock parking is what we're saying right?

R: Yes, bike stations or e-lockers.

R: Some bikes tend to get stripped of all kinds of parts that you wouldn't expect to be taken off a bike.

Subject: Provide a Shared Bicycle at Either End of the Transit Trip

FACILITATOR: I'm thinking this is a commuting scenario.

R: Not necessarily, I see It more valuable for when I am running into downtown to run errands or something, I am not in my regular daily routine.

R: I have a son that lives in Montreal and they have a new bike share program there and that's how he primarily uses it, running off routines.

R: In this question are you saying again is there any downside to having more of it?

FACILITATOR: I guess, what are the cons if any?

R: It seems to fix some of the problems of accessibility being guaranteed that you have a bike there and a place to park it at your destination.

R: For those who just want to use their own bike and take it on the train, the bike share lets someone else not have to take their bike on the train which in turn creates more room for us.

R: If you get bumped at one end of the transit train, at least you have bike share at the other end.

R: I guess you could look at it this way, what's the downside of doing each individual at the current state of affair? So the downside of bike on transit is the fact that you can be left out. The downside of leaving bike at transit point is that is that it can be vandalized and stolen. In that regard, the shared bike has the least amount of cons, the only con I can see is if you get into a situation where there is no bike there.

R: One downside I can think, if I had to, is two things, sometimes I want to go grocery shopping and I might have a saddle bag that works on my bike. The public bike share may have a basket but won't let me take lots of groceries, so this is a reach on the downside. Another reach is sometimes I want to go for a workout in the hills and the bike shares are super heavy, but I would take my own personal bike for that so I'm really stretching here to find a downside.

R: One of my sons complains with the bike program in Montreal, is Montreal has a lot of hills and the share bikes all end up at the bottom of the hills.

R: To actually do the pricing, if you return it to a station at the top of the gill you pay less than if you drop it at the bottom, which they do in Paris as well.

Subject: Use Owners 1St and 2Nd Bicycle at Beginning and End of the Trip

FACILITATOR: This one is a commuting thing I think, right? Has anybody tried this option?

R: I've thought about it, the current downside is that there not secure bike parking on each end. So there might be a bike rack post, but those can be stripped or stolen if you don't use a good lock. Also for people who don't own a second bike, you will have to get one.

R: You would need to have really secure bike lockers if you are going to do this.

FACILITATOR: It almost seems like you need B to achieve D, better parking to have a second bike option.

R: You'd need to have at least one bike exposed 24 hours per day.

R: Palo Alto has the bike station, but you pay for that so the downside would be increase cost in addition to having the extra bike.

FACILITATOR: I think we've had the discussions they wanted us to have so thank you, you have all brought really great ideas.

APPENDIX E:
BICYCLE AND TRANSIT INTEGRATION STRATEGIES PREFERENCES SURVEY FORM

Part I:

1. General travel questions

Type of Travel	Last 7 Days	Last Month	Last 3 Months	Last Year	Not Used in the Last Year
a) Passenger or driver in a vehicle (for example, a car, truck, motorcycle, or taxi)	☐	☐	☐	☐	☐
b) Public transit (for example, bus, train, or ferry)	☐	☐	☐	☐	☐
c) Bicycle to or from public transit	☐	☐	☐	☐	☐
d) Bicycle to a destination OTHER THAN public transit (for example, to a job, store, park, or friend's house)	☐	☐	☐	☐	☐
e) Bicycle for recreation or exercise (do not include riding a stationary bicycle)	☐	☐	☐	☐	☐
f) Walk to or from public transit	☐	☐	☐	☐	☐
g) Walk to a destination OTHER THAN public transit (for example, to a job, store, park, or friend's house)	☐	☐	☐	☐	☐
h) Walk for recreation, exercise, or to walk the dog	☐	☐	☐	☐	☐

2. Questions about HOW OFTEN you BICYCLED in the last 7 days

In the last 7 days (up to yesterday), on how many days did you:

i) Bicycle to OR from public transit (for example, to a bus or train stop) . . . Number of days ___

j) Bicycle to OR from work or school.. . . . . Number of days ___

k) Bicycle to get somewhere OTHER than work, school, or public transit. (For example, to go shopping, see a friend, or eat a meal. Do NOT include trips with no destination, such as a bike ride solely for exercise.) . . Number of days ___

l) Ride a bicycle for exercise or recreation, without having a destination for the trip . . . Number of days ___

3. In the last 7 days, did you have access to a working MOTOR VEHICLE like a car, truck, or motorcycle that you can use either as a driver or passenger? (Exclude taxis.)

☐ Always ☐ Most of the time ☐ Sometimes ☐ Rarely ☐ Never

4. In what year were you born? _____

5. What is your legal gender?
   ☐ Male ☐ Female

6. What two streets intersect closest to your home?
   _____ and _____
   (First street name) (Second street name)

7. What is your zip code? _____

Part II:

Cycle Transit Integration Method	Description
Bike On Transit	User travels with bike on transit.
Bike To Transit	User travels by bike to the transit stop and locks the bike at the stop.
Shared Bike	A shared bicycle program is available at either end or both ends of the trip.
Two bike Program	User has two private bicycles; one to access the transit stop and one at the destination stop.

Rank cycle–transit integration strategies from 1–4 or 1–3

1 = most preferred, 3 or 4 = least preferred

Strategies	Trip 1	Trip 2	Trip 3	Trip 4
A: Bike on Transit				
B: Bike to Transit				
C: Shared Bike				
D: Two bikes				

Part III:

In this section, you will be asked to weigh two factors at a time against each other. The factors are listed in the table below.

Factors	Description
Security	Security from theft or vandalism
Guarantee	A bicycle is guaranteed to be available when needed; guaranteed that you won't be bumped.
Flexibility	Flexibility to change plans as needed because bicycle is with rider at all times
Cost	The cost to user in accessing various integration possibilities.

We will use the scale below:

Factor A 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 Factor B

Where 1 – is neutral and 9 is extremely in favor of one factor or another.

The Fundamental Scale for Pairwise Comparisons		
Intensity of Importance	**Definition**	**Explanation**
1	Equal importance	Two elements contribute equally to the objective
3	Moderate importance	Experience and judgment slightly favor one element over another
5	Strong importance	Experience and judgment strongly favor one element over another
7	Very strong importance	One element is favored very strongly over another; its dominance is demonstrated in practice
9	Extreme importance	The evidence favoring one element over another is of the highest possible order of affirmation
Intensities of 2, 4, 6 and 8 can be used to express intermediate values. Intensities 1.1, 1.2, 1.3, etc. can be used for elements that are very close in importance.		

For example: Compare Light Rail with Express Buses

I equally like light rail and express buses, therefore the value is “1.”

Light Rail 9 8 7 6 5 4 3 2 1 (2) 3 4 5 6 7 8 9 Express Bus
More Important Equal More Important

SECURITY 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 GUARANTEE

SECURITY 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 FLEXIBILITY

SECURITY 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 COST

GUARANTEE 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 FLEXIBILITY

GUARANTEE 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 COST

FLEXIBILITY 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 COST

We’ll now compare two factors with regard to a third, unrelated example:

For example: Touring bicycles with Road Bicycles with regard to their Functionality

I strongly favor touring bicycles over road bicycles based on their functionality. Therefore the value could be “7” in favor of Touring Bike.

Touring Bike 9 8 7 6 5 4 (3) 2 1 2 3 4 5 6 7 8 9 Road Bike

Security

Please indicate which bike/transit option you favor with regard to **security** features of the various integration options:

Bike on transit 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 Bike to transit

Bike on transit 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 Shared bike

Bike on transit 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 Two bike

Bike to transit 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 Shared bike

Bike to transit 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 Two bike

Shared bike 9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9 Two bike

Guarantee

Please indicate which bike/transit option you favor with regard to the **guarantee that a bicycle will be available for your use**—either your personal bicycle or a shared bicycle.

Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Bike to transit
Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Shared bike
Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program
Bike to transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Shared bike
Bike to transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program
Shared bike	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program

Flexibility

Please indicate which bike/transit option you favor with regard to the **flexibility** that the integration features of the various options.

Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Bike to transit
Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Shared bike
Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program
Bike to transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Shared bike
Bike to transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program
Shared bike	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program

Cost to user

Please indicate which bike/transit option you favor with regard to the **cost to user** of the various integration features.

Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Bike to transit
Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Shared bike
Bike on transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program
Bike to transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Shared bike
Bike to transit	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program
Shared bike	9 8 7 6 5 4 3 2 1 2 3 4 5 6 7 8 9	Two bike program

8. Do you consider yourself to be an experienced bicycling and transit user?
   - ☐ Yes (for example, you find yourself combining bicycling and transit once a month or once every other month)
   - ☐ No (I rarely, if ever, find myself combining bicycling and transit)
   - ☐ Other

If other, please explain:

_____

9. If you were asked to advise your city on which strategies would be best for increasing bicycling and transit, which of the four would you suggest?

(Please indicate your top two choices: **1 = Most favorite and 2 = Second favorite.)**

Bike on Transit _____
Bike to Transit _____
Shared Bike _____
Two bike Program _____

10. Are there other issues/strategies you feel are important to consider related to bicycling and transit?

APPENDIX F:
PROTOCOL GUIDE FOR FOCUS GROUP FACILITATORS

Exploring Cyclists' Preferences for Cycling Transit Facilities

Protocol Guide

Introduction

Thank you for agreeing to facilitate the focus group on cyclists' preferences for cycle transit facilities. This guide provides detailed instructions on how to lead the focus group in your community with the assistance of the Active Communities Transportation (ACT) Research Group at the University of Colorado. This study is organized and led by Dr. Kevin Krizek, Eric Stonebraker (PhD student), and Seth Tribbey (MS/MBA student) and funded with support from the Mineta Transportation Institute.

Background Information

The purpose of this focus group is to better understand cyclists' preferences for the integration of bicycles and transit with a goal of increasing ridership of both modes. The focus group will query participants on their personal preferences related to the integration of cycling and transit in a group setting as well as ask you to complete a brief survey of your cycling and transit behavior and preferences.

Focus groups are being conducted in five cities across the U.S.: Chicago, IL; Ithaca, NY; Portland, OR; Santa Clara Co., CA; and Boulder, CO. The focus groups are part of a larger study focused on the integration of cycling and transit. A forthcoming paper in TRB, "Cycling and Transit: A Marriage Unrealized" includes: (1) state of the knowledge of cycling and transit integration, (2) innovative examples of enhancing capacity of bicycles on transit, (3) a tool for projecting cycle-transit users (CTUs) at various stops, and (4) proposes a cost effectiveness strategy for various cycle transit facilities.

Format

The focus group consists of general discussion questions and a brief survey to gauge personal preferences. **The response form is to be filled out coinciding with the presentation!** Please encourage: active participation, the sharing of ideas, and listening to others. There are neither right answers nor wrong answers. As we are recording this, please ask people not to speak over one another.

The focus group will consist of 7–12 participants and can be conducted in approximately 1.5 hours.

In Advance

The Active Communities/Transportation (ACT) Research Group in Colorado has already completed a number of steps toward organizing the focus group. At a minimum, a host, a public location with audio/visual aids, and potential participants have been identified prior to your involvement. We will work with your schedule to arrange a convenient time at which the focus group can be organized. Ideally, an early weekday evening time is preferred.

The focus group facilitator will be responsible for the following steps:

- Purchase light snacks and beverages (e.g., gallon of apple juice, and an ample supply of snacks—cookies, etc.—approximately $20) You may be reimbursed for up to $25 for each focus group by adding specified amount to your billable hours.
- Communicate with Eric Stonebraker, estonebr@uwalumni.com or 303-525-1959 (with at least 2 weeks notice) to arrange for shipping of:
  - Small tokens of appreciation (ankle bands for cyclists for participants, and Park tool bottle opener for host site organizer)
  - Voice recorder – if necessary
  - Consent Forms
  - Surveys
- Establish communication with host site organizer (TBD) to confirm details

Day of Focus Group Procedure

1. **Introductions (5 minutes after start)**
   a. Welcome participants
   b. Introduce yourself (Institutional affiliation, connection to cycling research, etc)
   c. Ask each of the participants to introduce themselves—and share a fact about their bicycle/transit useage.

2. **Pass out Consent Form (10–15 minutes after start)** and collect them
3. **Pass out Survey and ask them to fill out SECTION I and wait for further instruction**.
4. **Start PowerPoint presentation (15-20 minutes after start)** The PowerPoint has all of the necessary descriptions for the study and should be self-explanatory; below are some tips for specific slides.

Notes on PowerPoint:

The focus group is not meant to be powerpoint intensive. Its purpose is to:

1. assist the facilitator introduce the topic,
2. describe the different types of bicycle / transit integration,
3. guide participants through the (1) trip scenarios and (2) pairwise comparisons that is to be simultaneously filled out with the presentation

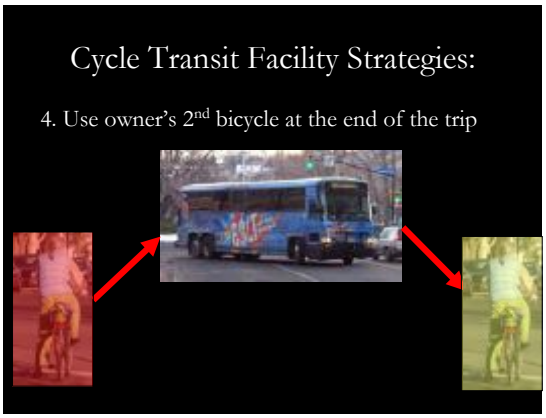
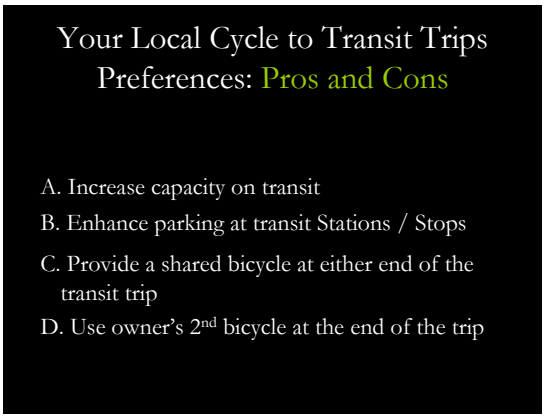
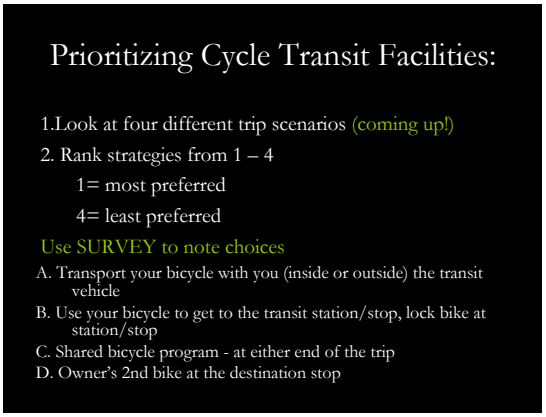
Your task is more as a task master to help guide them through the following main goals:

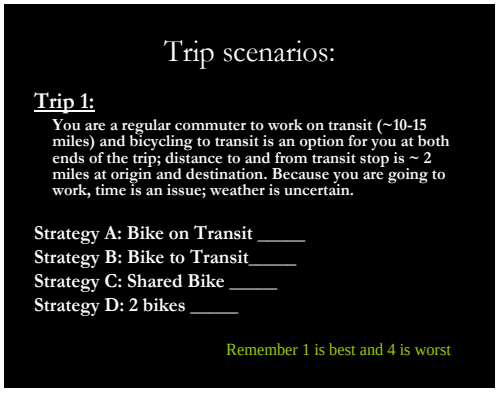
1. Convene dialogue on the pros and cons of different integration strategies
2. Gather specific preferences of bicycle /transit integration for four different trip scenarios
3. Gather specific weightings from pairwise comparisons of factors related to bicycle/ transit integration

Guide for PowerPoint:

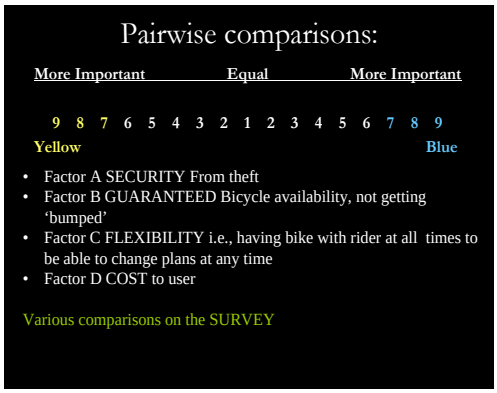
Exploring Cyclists' Preferences for Cycling Transit Facilities Please have a seat and fill in the: • Consent form • Part 1 of the Survey (stop there as we'll work through the rest of the survey in the group)	**TIMING:** **Hand out** **1) consent form** **2) survey (complete section I)**
 **Exploring Cyclists' Preferences for Cycling Transit Facilities** Funding provided by Mineta Transportation Institute Kevin J. Krizek & Eric Stonebraker University of Colorado www.kevinjkrizek.org Active Communities / Transportation Research Group	**Intros**
Purpose Understand cyclists' preferences for the integration of bicycles and transit - to – Increase ridership of both modes	**Describe Purpose**
Format 1. Discussion based • Cycle Transit Facility Strategies--preferences • Trip Scenarios • Trade-offs 2. Survey of preferences	**Describe Format**

Ground Rules We encourage: – Active participation – Sharing of ideas – Thinking outside the bike box There are no wrong answers Try not to speak over one another (for high fidelity) Focus group will last about 90 minutes*	**Lay Ground Rules (Place audio device in the middle of the group)**
Your Local Cycle to Transit Trips Preferences A. Increase capacity on transit B. Enhance parking at transit Stations / Stops C. Provide a shared bicycle at either end of the transit trip D. Use owner's 2nd bicycle at the end of the trip What do these look like?	**Overview of types of Cycle – Transit Intergration**
Cycle Transit Facility Strategies: 1. Increase capacity on transit  	**Some examples**
Cycle Transit Facility Strategies: 2. Enhance parking at transit stations/stops  	**Some examples**

	**Some examples**
	**Some examples (stress 2 different bikes)**
	**For these series of slides, encourage sequential discussion about their preferences of each of A – D… You may need to encourage covering likes and dislikes of each system** Spend about 5-10 minutes discussing the pros and cons of the various strategies. From our experience, strategy A is especially popular, but also has limited room for growth in capacity. You may need to help steer the discussion to bring up the downsides of each approach.
	**You will be walking the participants through each of the 4 scenarios. The 2 bike option is blacked out for the last three because it generally is not an option for infrequent trips.**



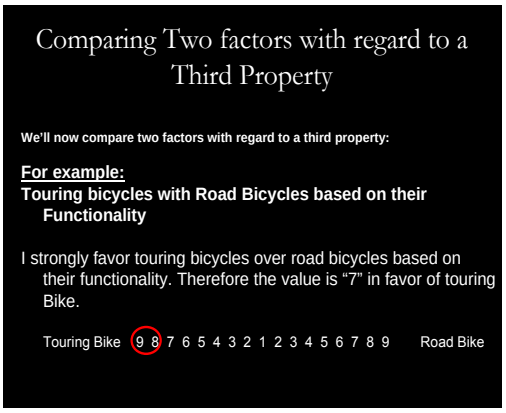
Have the participants fill out their preferences on PART II



Have the participants fill out their preferences on PART III

The pairwise comparisons are not always intuitive:

There's no zero value – 1 = equally important
There's no negative – just like a traditional scale – greater importance of one factor over another…



For the majority of pairwise comparisons, you will be asked to compare two items based on a third property.

This example is supposed to clarify – i.e., Road bikes are FASTER than touring bikes, but touring bikes can handle rougher terrain, steeper terrain, etc… So they are more functional…

HAVE THE PARTICIPANTS FILL OUT THE REST OF THE SURVEY ONCE THEY COMPLETE THE PAIRWISE COMPARISONS.

Concluding the Focus Group

Several wrap-up thoughts:

1) There are lots of competing factors to consider when discussing bicycle and transit integration;
2) There is no single solution to integration of bicycles and transit, however, there are inherent capacity constraints associated with bikes on transit;
3) There is considerable room for bicycles to play a larger role in accessing transit under many conditions;
4) Thank them for their time
5) If participants are interested in learning more about this issue, suggest they visit www.kevinjkrizek.org (if they forget—tell them to "Google Kevin Krizek"—and they will happen upon his Web site.)

At the Chicago focus group, the participants were eager to keep discussing the topic. You will likely find similar interest as the participants tend to be bicycle zealots.

Make sure you collect the surveys and consent forms. Please check that both sides of the survey have been completed.

And thank YOU for working with us on this project! It is much appreciated…

ENDNOTES

1. T*ransport Statistics Bulletin—Road Statistics 2008: Traffic, Speeds and Congestion*, UK Department for Transport. June 2009; National Sporting Goods Association, "2008 Participation Ranked by Percent Change," http://www.nsga.org/files/public/20082008RankedbyPercentChange22_4Web_080423.pdf, accessed July 24, 2009.

2. "10.7 Billion Trips Taken On U.S. Public Transportation In 2008—Highest Level in 52 Years; Ridership Increased as Gas Prices Decline and Jobs Were Lost," American Public Transportation Agency, http://www.apta.com/mediacenter/pressreleases/2009/Pages/090309_ridership.aspx, accessed on March 15, 2010.

3. J. Pucher, and R. Buehler, "Integrating bicycles and public transport in North America," *Journal of Public Transportation*, vol 3 12(2009); TCRP, "Integration of Bicycling and Transit," *TCRP Synthesis Report 62*, Washington, DC: National Resources Council; U.S. DOT, "Bicycles and transit: a partnership that works," U.S. Department of Transportation, Federal Transit Administration (1998).

4. National Sporting Goods Association.

5. K. Martens, "The bicycle as a feedering mode: experiences from three European countries," *Transportation Research Part D*, vol. 9 (2004): 281–294; K. Martens, "Promoting bicycle-and-ride: The Dutch experience," *Transportation Research Part A*, vol. 41 (2007): 326–338.

6. D. Taylor, and H. Mahmassani, "Analysis of stated preferences for intermodal bicycle-transit interfaces," *Transportation Research Record*, no. 1556 (1996): 87–95.

7. P. Rietveld, F.R. Bruinsma, and D.J. Van Vuuren, "Coping with unreliability in public transport chains: A case study for Netherlands," *Transportation Research Part A*, vol. 35 (2001): 539–559.

8. Martens, "Bicycle as Feedering Mode."

9. C. Hagelin, "A Return on Investment Analysis of Bicycles-on-Bus Programs," National Center for Transit Research, Center for Urban Transportation Research. University of South Florida, 2005, NCTR 576-05, FDOT BD549-04.

10. Martens, "Bicycle as Feedering Mode."

11. M. Keijer, and P. Rietveld, "How do people get to the railway station? The Dutch experience," *Transportation Planning and Technology*, vol. 23 (2000): 215–235.

12. Pucher and Buehler, "Integrating Bicycles"; M. Brojns, M. Givoni, and P. Rietveld, "Access to railway stations and its potential in increasing rail use," *Transportation Research Part A* 45 (2009): 136–149.

13. P. Rietveld, "The accessibility of railway stations: the role of the bicycle in the Netherlands," *Transportation Research Part D: Transport and Environment*, vol. 5 (2000): 71–75.

14. Keijer and Rietveld, "How Do People Get to Railway Station"; Reitveld, "Accessibility of Railway Stations."

15. Hagelin, "A Return on Investment."

16. Hagelin, "A Return on Investment"; C.D. Van Goeverden, and B. Egeter, "Gecombineerd Gebruik van Fiets en Openbaar Vervoer: Verwachte Effecten op de Vervoerwijzekeuze van Optimale Fietsbeschikbaarheid in Voor- en Natransport," TU Delft, Faculteit der Civiele Techniek, Delft (1993); M. Givoni and P. Rietveld, "The access journey to the railway station and its role in passengers' satisfaction with rail travel," *Transport Policy* vol. 14 (2007): 357–365.

17. Keijer and Rietveld, "How Do People Get to Railway Station"; J. Brunsing, "Public transport and cycling: experience of modal integration in Germany," in: R. Tolley (Ed.) *The Greening of Urban Transport: Planning for Walking and Cycling in Western Cities* (Chichester: Wiley, 1998).

18. Martens,"Bicycle as Feedering Mode."

19. Martens, "Promoting bicycle-and-ride."

20. Brojns, Givoni and Reitveld, "Access to Railway Stations."

21. R. Schneider, "TCRP Synthesis of Transit Practice," *Transportation Research Board* 62 (2005): 1073-4880; "A Return on Investment Analysis of Bicycles-on-Bus Programs," National Center for Transit Research, Center for Urban Transportation Research, University of South Florida (2005); Eisen Letunic, Fehr and Peers, "Caltrain Bicycle Access and Parking Plan," October 2, 2008, http://www.caltrain.com/pdf/Caltrain_bike_plan_DRAFT_09-29-08_BODY.pdf, accessed March 15, 2010.

22. "A Return on Investment."

23. (1995). Transportation Master Plan. City of Boulder.

24. American Community Survey, 2006–2008.

25. Ibid.

26. Ibid.

27. Ibid.

28. Letunic, "Caltrain Bicycle Access."

29. http://twitter.com/bikecar, accessed Mach 15, 2010.

30. Personal Communication with Christine Dunn, Caltrain, San Francisco, California, March 9, 2010.

31. Network buffers provide a more accurate depiction of the true area serviced by a facility when compared to a "crow-flies" distance-based buffer as the actual area of the buffer may vary dramatically according to the urban form.

32. Martens, "Bicycle as Feedering Mode"; Martens, "Promoting bicycle-and-ride."

33. Human subjects approval was obtained from the University of Colorado Denver Institutional Review Board (Protocol # 10-0120). Consent form included in Appendix C.

34. J.E. de Steiguer, Jennifer Duberstein, and Vicente Lopes, "The Analytic Hierarchy Process as a Means for Integrated Watershed Management," in Kenneth G Renard, *First Interagency Conference on Research on the Watersheds* (Benson, Arizona: U.S. Department of Agriculture, Agricultural Research Service, October 2003), 736–740.

35. P. J. H. Schoemaker, and C. C. Waid, "An experimental comparison of different approaches to determining weights in additive utility models," *Management Science* (28)2 (February 1982): 182–196.

36. T.L. Saaty, "How to make a decision: the analytic hierarchy process," *Eur J Oper Res* 48 (1990): 9–26; T.L. Saaty, "Decision-making with the AHP: why is the principal eigenvector necessary?" *European Journal of Operations Research* 145 (2003): 85–91.

37. Hagelin, "A Return on Investment."

38. Personal communication with Sportsworks

39. Ibid.

ABBREVIATIONS AND ACRONYMS

AHP	Analytic Hierarchy Process
BOLT	Boulder-Longmont Bicycle Transit Route
CBP	Santa Clara Countywide Bicycle Plan
CDOT	Colorado Department of Transportation
CMAQ	Congestion Mitigation and Air Quality
CTA	Chicago Transit Authority
CTU	Cycle Transit User
DRCOG	Denver Council of Regional Governments
IGERT	Integrative Graduate Education and Research Traineeship
ISTEA	Intermodal Surface Transportation Efficiency Act
NSF	National Science Foundation
ROI	Return On Investment
RTD	Denver's Regional Transportation District
SFBC	San Francisco Bicycle Coalition
TCAT	Tompkins County Area Transit
VMT	Vehicle Miles Traveled
VTA	Santa Clara County Valley Transportation Authority

REFERENCES

"10.7 Billion Trips Taken On U.S. Public Transportation In 2008—Highest Level in 52 Years; Ridership Increased as Gas Prices Decline and Jobs Were Lost." American Public Transportation Agency. Accessed March 15, 2010. http://www.apta.com/mediacenter/pressreleases/2009/Pages/090309_ridership.aspx.

"A Return on Investment Analysis of Bicycles-on-Bus Programs." National Center for Transit Research, Center for Urban Transportation Research, University of South Florida, 2005.

Brojns, M., M. Givoni, and P. Rietveld. "Access to railway stations and its potential in increasing rail use." *Transportation Research Part A* 45 (2009): 136–149.

Brunsing, J. "Public transport and cycling: experience of modal integration in Germany." In: R. Tolley (Ed.) *The Greening of Urban Transport: Planning for Walking and Cycling in Western Cities* (Chichester: Wiley, 1998).

de Steiguer, J.E., Jennifer Duberstein, and Vicente Lopes. "The Analytic Hierarchy Process as a Means for Integrated Watershed Management." In Kenneth G Renard, *First Interagency Conference on Research on the Watersheds* (Benson, Arizona: U.S. Department of Agriculture, Agricultural Research Service, October 2003), 736–740.

Givoni M. and P. Rietveld. "The access journey to the railway station and its role in passengers' satisfaction with rail travel." *Transport Policy,* vol. 14 (2007): 357–365.

Hagelin, C. "A Return on Investment Analysis of Bicycles-on-Bus Programs." National Center for Transit Research, Center for Urban Transportation Research. University of South Florida, 2005, NCTR 576-05, FDOT BD549-04.

"Integration of Bicycling and Transit." *TCRP Synthesis Report 62*; Washington, DC: National Resources Council.

Keijer, M. and P. Rietveld. "How do people get to the railway station? The Dutch experience." *Transportation Planning and Technology*, vol. 23 (2000): 215–235.

Letunic, Eisen. "Caltrain Bicycle Access and Parking Plan." Fehr and Peers. October 2, 2008. Accessed March 15, 2010. http://www.caltrain.com/pdf/Caltrain_bike_plan_DRAFT_09-29-08_BODY.pdf.

Martens, K. "Promoting bicycle-and-ride: The Dutch experience." *Transportation Research Part A*, vol. 41 (2007): 326–338.

———. "The bicycle as a feedering mode: experiences from three European countries." *Transportation Research Part D*, vol. 9 (2004): 281–294.

National Sporting Goods Association, “2008 Participation Ranked by Percent Change.” Accessed July 24, 2009. http://www.nsga.org/files/public/20082008RankedbyPercentChange22_4Web_080423.pdf.

Pucher, J. and R. Buehler. “Integrating bicycles and public transport in North America.” *Journal of Public Transportation*, vol 3 12 (2009).

P. Rietveld. “The accessibility of railway stations: the role of the bicycle in the Netherlands.” *Transportation Research Part D: Transport and Environment*, vol. 5 (2000): 71–75.

Rietveld, R., F.R. Bruinsma, and D.J. Van Vuuren. “Coping with unreliability in public transport chains: A case study for Netherlands.” *Transportation Research Part A*, vol. 35 (2001): 539–559.

T.L. Saaty, “Decision-making with the AHP: why is the principal eigenvector necessary?” *European Journal of Operations Research* 145 (2003): 85–91.

———. “How to make a decision: the analytic hierarchy process.” *Eur J Oper Res* 48 (1990): 9–26.

Schneider, R. “TCRP Synthesis of Transit Practice.” *Transportation Research Board* 62 (2005): 1073-4880.

Schoemaker, P. J. H. ,and C. C. Waid. “An experimental comparison of different approaches to determining weights in additive utility models,” *Management Science* (28)2 (February 1982): 182–196.

Taylor, D. and H. Mahmassani. “Analysis of stated preferences for intermodal bicycle-transit interfaces.” *Transportation Research Record*, no. 1556 (1996): 87–95.

Transport Statistics Bulletin—Road Statistics 2008: Traffic, Speeds and Congestion. UK Department for Transport. June 2009.

U.S. DOT. “Bicycles and transit: a partnership that works.” U.S. Department of Transportation, Federal Transit Administration, 1998.

Van Goeverden, C.D., and B. Egeter. “Gecombineerd Gebruik van Fiets en Openbaar Vervoer: Verwachte Effecten op de Vervoerwijzekeuze van Optimale Fietsbeschikbaarheid in Voor- en Natransport.” TU Delft, Faculteit der Civiele Techniek, Delft (1993).

ABOUT THE AUTHORS

KEVIN KRIZEK, Ph.D.

Kevin J. Krizek is an associate professor of Planning, Design, and Civil Engineering at the University of Colorado. He serves as director of the Ph.D. program in Design and Planning and heads the Active Communities/Transportation (ACT) Research Group. His research focuses on travel behavior (specializing in cycling), neighborhood accessibility, health and planning, and sustainable development. Krizek is a founding editor of the Journal of Transport and Land Use, serves as chair of the Transportation Research Board Committee on Telecommunications and Travel, and is on the editorial board of the Journal of the American Planning Association. For more information, see www.kevinjkrizek.org.

ERIC STONEBRAKER, M.S.

Eric W. Stonebraker is a doctoral student in the College of Architecture and Planning at the University of Colorado. He is a National Science Foundation (NSF) fellow in the Integrative Graduate Education and Research Traineeship (IGERT) program focused on sustainable urban infrastructure. His research interests focus on travel behavior and the built environment.

SETH TRIBBEY

Seth Tribbey is a graduate student and GIS professional pursuing a dual degree in urban and regional planning and business administration from the Urban and Regional Planning Program at the University of Colorado Denver.

PEER REVIEW

San José State University, of the California State University system, and the MTI Board of Trustees have agreed upon a peer review process required for all research published by MTI. The purpose of the review process is to ensure that the results presented are based upon a professionally acceptable research protocol.

Research projects begin with the approval of a scope of work by the sponsoring entities, with in-process reviews by the MTI Reseach Director and the Research Associated Policy Oversight Committee (RAPOC). Review of the draft research product is conducted by the Research Committee of the Board of Trustees and may include invited critiques from other professionals in the subject field. The review is based on the professional propriety of the research methodology.

MTI FOUNDER

Hon. Norman Y. Mineta

MTI BOARD OF TRUSTEES

Honorary Chairman
John L. Mica (Ex-Officio)
Chair
House Transportation and Infrastructure Committee
House of Representatives

Honorary Co-Chair, Honorable Nick Rahall (Ex-Officio)
Vice Chairman
House Transportation and Infrastructure Committee
House of Representatives

Chair, Mortimer Downey (TE 2013)
Senior Advisor
PB Consult Inc.

Vice Chair, Steve Heminger (TE 2013)
Executive Director
Metropolitan Transportation Commission

Executive Director
Rod Diridon* (TE 2011)
Mineta Transportation Institute

Barron, Thomas E. (TE 2013)
President
Parsons Transportation Group

Barron de Angoiti, Ignacio (Ex-Officio)
Director Passenger and High Speed Department
International Union of Railways (UIC)

Boardman, Joseph (Ex-Officio)
Chief Executive Officer
Amtrak

Camph, Donald H. (TE 2012)
President
California Institute for Technology Exchange

Canby, Anne P. (TE 2011)
President
Surface Transportation Policy Project

Cunningham, Julie (TE 2013)
Executive Director/CEO
Conference of Minority Transportation Officials

Dorey, William (TE 2012)
President/CEO
Granite Construction Inc.

Fernandez, Nuria I. (TE 2013)
Senior Vice President
Major Programs Group CHRMHill

Guilbault, Rose (TE 2012)
Vice President
American Automobile Association

Hamberger, Ed (Ex-Officio)
President/CEO
Association of American Railroads

Horsley, John (Ex-Officio)*
Executive Director
American Association of State Highway and Transportation Officials (AASHTO)

Kempton, Will (TE 2012)
CEO
Orange County Transportation Authority

McKim, Cindy (Ex-Officio)
Acting Director
California Department of Transportation

Millar, William* (Ex-Officio)
President
American Public Transportation Association (APTA)

Mineta, Norman Y. (Ex-Officio)
Vice Chairman
Hill & Knowlton
Secretary of Transportation (ret.)

Pinson, Stephanie L. (TE 2013)
President/COO
Gilbert Tweed Associates, Inc.

Steele, David (Ex-Officio)
Dean, College of Business
San José State University

Toliver, Paul* (TE 2013)
President
New Age Industries

Townes, Michael S. (TE 2011)
President/CEO (ret.)
Transportation District Commision of Hampton Roads

Turney, David L.* (TE 2012)
Chairman, President & CEO
Digital Recorders, Inc.

Wytkind, Edward (Ex-Officio)
President
Transportation Trades Department, AFL-CIO

** Honorary
* Chair
^ Vice Chair
# Past Chair

Directors

Hon. Rod Diridon, Sr.
Executive Director

Karen E. Philbrick, Ph.D.
Research Director

Peter Haas, Ph.D.
Education Director

Donna Maurillo
Communications Director

Brian Michael Jenkins
National Transportation Security Center

Asha Weinstein Agrawal, Ph.D.
National Transportation Finance Center

Research Associates Policy Oversight Committee

Asha Weinstein Agrawal, Ph.D.
Urban and Regional Planning
San José State University

Jan Botha, Ph.D.
Civil & Environmental Engineering
San José State University

Katherine Kao Cushing, Ph.D.
Enviromental Science
San José State University

Dave Czerwinski, Ph.D.
Marketing and Decision Science
San José State University

Frances Edwards, Ph.D.
Political Science
San José State University

Taeho Park, Ph.D.
Organization and Management
San José State University

Diana Wu
Martin Luther King, Jr. Library
San José State University

MINETA
TRANSPORTATION INSTITUTE
MTI



SAN JOSÉ STATE
UNIVERSITY

Funded by U.S. Department of
Transportation and California
Department of Transportation