

SSD
Contractor: UC Berkeley
Contract # 08-420

FUNDING FISCAL YEAR	FY 08/09	
TERM	04/01/09-06/30/11	
PCA	72430	
LINE ITEM/OBJECT	398	TOTAL
DESCRIPTION	Consulting services	

Contract \$	320,000.00	320,000.00
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Total, Contract	320,000.00	320,000.00
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Payments to Contractor:

Inv. #	Inv. Date	Ser Per		C/S
15346-97208	9/14/2009	8/30/2009	5,694.12	5,694.12 C090253
109,663.00	10/13/2009	8/31 - 9/30/11	13,206.95	13,206.95 C090303

①

Total, Payments	18,901.07	18,901.07
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Balance Available to Pay Contractor	301,098.93	301,098.93
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Balance Must Be Spent By: 06/30/11 06/30/12 06/30/13

Notes:

Contract Manager: Paul Milkey

73



University of California Berkeley

Accounting Services Extramural Funds Accounting

2009 SEP 21 10:01

Invoice To:

Air Resources Board
Accounting and Grants
P.O. Box 1436
Sacramento, CA 95812

Date: 9/14/2009

INVOICE NO. 15346 - 97208

Contract/Grant/Agreement/Purchase Order Number: 08-420		PI/Director: Madanat, Samer M	
Project Title Assembly Bill 32 (Measure T-6) and Good Movement		Reference:	
	<i>Period Billed</i> To 8/30/2009		
	<i>Cumulative</i>	<i>Current</i>	
Salaries & Wages	15,445.19	4,895.75	
Employee Benefits	1,114.95	239.10	
Equipment & Facilities	0.00	0.00	
Supplies, Materials, & Services	127.92	41.62	
Travel	-0.00	0.00	
Subcontract	0.00	0.00	
Indirect Cost	1,668.81	517.65	
TOTAL	\$18,356.87	5,694.12	
Amount Now Due			5,694.12
<p>Refer to invoice # 15346 - 97208 and make check payable to: THE REGENTS OF THE UNIVERSITY OF CALIFORNIA Extramural Funds Accounting 2195 Hearst Ave RM 130 MC 1103 Berkeley, California 94720-1103</p> <p>TIN # 94-6002123</p>		<p>It is hereby certified that all expenditures reported (or payment requested) are for appropriate purposes and in accordance with the agreements set forth in the application and award documents.</p> <p style="text-align: center;"><i>Approval attached</i></p> <p style="text-align: center;"><i>Victorino Soriano</i></p>	
<p>Questions regarding this invoice should be directed to:</p>		<p>Victorino Soriano, Award Analyst Phone: (510) 643-6539 FAX: 510-643-8997 Email: vsoriano@berkeley.edu</p>	

Business Unit: 1 -- UC Berkeley
 Fiscal Year: 2009 - 10
 Month: August

CURRENT ACTIVITY DETAIL
 By Fund

Page 1 of 1
 Run Date: 09/14/09
 Run Time: 16:20:22

Selection Criteria: Account Code | Fund Code 15346 | Org Code 00810, 99999 | Program Code | Project No | Flexfield
 Org L2 Node | Org L3 Node | Org L4 Node | Org L5 Node | Org L6 Node | Acct L2 Node: EXPENSES | Acct L3 Node: | Acct L4 Node:

Description	Department Desc.	Date	Doc Id	Reference	Budget	Expenses	Encumbrance	Pre Etcumb
FUND 15346 - CAEPA ARB 08-420-MADANAT 08/09								
<u>DIRECT COSTS</u>								
Academic Salaries HARLEY, ROBERT A	RES__ACAD YR-19TH PAYMT-B/E	08/31/09	PAY0451579	15.79% OLN	0.00	3,059.75	0.00	0.00
Staff Salaries SOOHOO, ERIC	ASSISTANT II	08/31/09	PAY0451579	136 H REG	0.00	3,059.75	0.00	0.00
Employee Benefits HARLEY, ROBERT A	RES__ACAD YR-19TH PAYMT-B/E	08/31/09	PAY0451579		0.00	199.08	0.00	0.00
SOOHOO, ERIC	ASSISTANT II	08/31/09	PAY0451579		0.00	40.02	0.00	0.00
Supplies & Expenses AUG GAEL INS ASSESSMENT		08/31/09	GAEL451411		0.00	239.10	0.00	0.00
TOTAL DIRECT COSTS					0.00	5,176.47	0.00	0.00

<u>INDIRECT COSTS</u>								
Indirect Cost Recovery STATE OH BY FUND BASE B 10.0%		08/31/09	SOH0020008		0.00	517.65	0.00	0.00
TOTAL INDIRECT COSTS					0.00	517.65	0.00	0.00

TOTAL FOR FUND 15346 - CAEPA ARB 08-420-MADANAT 08/09					0.00	5,694.12	0.00	0.00
--	--	--	--	--	-------------	-----------------	-------------	-------------

Harman, Guy@ARB

From: Harman, Guy@ARB
Sent: Tuesday, September 22, 2009 9:51 AM
To: Clymer, Pam@ARB
Subject: Invoice Approvals: UC Berkeley 07-418 #77803-97472, & 08-420 #15346-97208

Attachments: AR-M550U_20090922_090611.pdf



AR-M550U_20090922_090611.pdf (...)

Not approved as of 10/1 per Pam

Please approve attached invoices by 09/22/09 via e-mail.

Thank you

guy

Guy Harman
Accountant I (Specialist)
California Air Resources Board
Phone (916) 322-9390
Fax (916) 322-9612

-----Original Message-----

From: sharpcopier@arb.ca.gov [mailto:sharpcopier@arb.ca.gov]
Sent: Tuesday, September 22, 2009 9:06 AM
To: Harman, Guy@ARB
Subject: Scanned image from Accounting Sharp Copier 20th Floor

DEVICE NAME: Accounting Sharp Copier 20th Floor
DEVICE MODEL: SHARP AR-M550U
LOCATION: 20th floor-South Side-Center

FILE FORMAT: PDF MMR(G4)
RESOLUTION: 300dpi x 300dpi

Attached file is scanned image in PDF format.
This file can be read by Adobe Acrobat Reader.
The reader can be downloaded from the following URL:

<http://www.adobe.com/>

Harman, Guy@ARB

From: Clymer, Pam@ARB
Sent: Wednesday, October 14, 2009 11:47 AM
To: Harman, Guy@ARB
Subject: FW: Invoice Approvals: UC Berkeley 07-418 #77803-97472, & 08-420 #15346-97208

Attachments: AR-M550U_20090922_090611.pdf



AR-M550U_20090922_090611.pdf (...)

Hi Guy,

Invoice #15346-93541, contract number #08-402 has been approved for payment.

Pam

-----Original Message-----

From: Harman, Guy@ARB
Sent: Tuesday, September 22, 2009 9:51 AM
To: Clymer, Pam@ARB
Subject: Invoice Approvals: UC Berkeley 07-418 #77803-97472, & 08-420 #15346-97208

Please approve attached invoices by 09/22/09 via e-mail.

Thank you

guy

Guy Harman
Accountant I (Specialist)
California Air Resources Board
Phone (916) 322-9390
Fax (916) 322-9612

-----Original Message-----

From: sharpcopier@arb.ca.gov [mailto:sharpcopier@arb.ca.gov]
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To: Harman, Guy@ARB
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DEVICE NAME: Accounting Sharp Copier 20th Floor
DEVICE MODEL: SHARP AR-M550U
LOCATION: 20th floor-South Side-Center

FILE FORMAT: PDF MMR(G4)
RESOLUTION: 300dpi x 300dpi

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The reader can be downloaded from the following URL:

<http://www.adobe.com/>



University of California Berkeley
Accounting Services
Extramural Funds Accounting

Invoice To:

Air Resources Board
Accounting and Grants
P.O. Box 1436
Sacramento, CA 95812

Date: 10/13/2009

INVOICE NO. 15346 - 100663

Contract/Grant/Agreement/Purchase Order

PI/Director: Madanat, Samer M

Number: 08-420

Reference:

Project Title Assembly Bill 32 (Measure T-6) and Good Movement

	Period Billed	
	8/31/2009 - 9/30/2009	
	Cumulative	Current
Salaries & Wages	26,202.79	10,757.60
Employee Benefits	2,178.36	1,063.41
Equipment & Facilities	0.00	0.00
Supplies, Materials, & Services	216.23	88.31
Travel	97.00	97.00
Subcontract	0.00	0.00
Indirect Cost	2,869.44	1,200.63
TOTAL	\$31,563.82	13,206.95

Approved
W. T. ...

Amount Now Due

13,206.95

Refer to invoice # 15346 - 100663

and make check payable to:

THE REGENTS OF THE UNIVERSITY OF CALIFORNIA
 Extramural Funds Accounting
 2195 Hearst Ave RM 130 MC 1103
 Berkeley, California 94720-1103

TIN # 94-6002123

It is hereby certified that all expenditures reported (or payment requested) are for appropriate purposes and in accordance with the agreements set forth in the application and award documents.

Victorino Soriano

Questions regarding this invoice should be directed to:

Victorino Soriano, Award Analyst
 Phone: (510) 643-6539 . FAX: 510-643-8997
 Email: vsoriano@berkeley.edu

Business Unit: 1 UC Berkeley
 Fiscal Year: 2009 - 10
 Month: September

CURRENT ACTIVITY DETAIL
 By Fund

Selection Criteria: Account Code | Fund Code 15346 | Org Code 00610 | Program Code | Project No | Flexfield
 Orig L2 Node | Org L3 Node | Org L4 Node | Org L5 Node | Acct L2 Node EXPENSES | Acct L3 Node | Acct L4 Node

FUND 15346 - CAEPA ARB 08-420-Madadnat-06/11

Description	Department Desc.	Date	Doc Id	Reference	Budget	Expenses	Encumbrance	Pre Encumbr
DIRECT COSTS								
Academic Salaries								
GUERRERO, SEBASTIAN E	GRAD STDNT RES-FULL FEE REM	09/31/09	PAY0453940	18.06% REG	0.00	657.84	0.00	0.00
GUERRERO, SEBASTIAN E	GRAD STDNT RES-FULL FEE REM	09/30/09	PAY0453940	49.2% REG	0.00	1,726.56	0.00	0.00
LI, YUWEI	ASST RES - FISCAL YR-B/E	09/30/09	PAY0453940	26% REG	0.00	1,888.58	0.00	0.00
MARTIN, ELLIOT	POSTDOC-EMPLOYEE	09/30/09	PAY0453940	25% REG	0.00	1,432.25	0.00	0.00
MCDONALD, BRIAN CHARLES	GRAD STDNT RES- NO REMISSION	09/31/09	PAY0453940	9.33% REG	0.00	301.27	0.00	0.00
MCDONALD, BRIAN CHARLES	GRAD STDNT RES- NO REMISSION	09/30/09	PAY0453940	24.0% REG	0.00	791.11	0.00	0.00
Staff Salaries								
QUOSS, VAUGHN P	STAFF RESEARCH ASSOC I	09/30/09	PAY0453940	60.23% REG	0.00	1,748.68	0.00	0.00
RODIER, CAROLINE J	R&D ENGINEER 4	09/30/09	PAY0453940	26% REG	0.00	1,841.67	0.00	0.00
Other Employee Compensation								
LI, YUWEI	ASST RES - FISCAL YR-B/E	09/30/09	PAY0453940	0% REG	0.00	212.39	0.00	0.00
RODIER, CAROLINE J	R&D ENGINEER 4	09/30/09	PAY0453940	0% REG	0.00	155.25	0.00	0.00
Employee Benefits								
GUERRERO, SEBASTIAN E	GRAD STDNT RES-FULL FEE REM	09/31/09	PAY0453940		0.00	8.49	0.00	0.00
GUERRERO, SEBASTIAN E	GRAD STDNT RES-FULL FEE REM	09/30/09	PAY0453940		0.00	22.27	0.00	0.00
LI, YUWEI	ASST RES - FISCAL YR-B/E	09/30/09	PAY0453940		0.00	336.43	0.00	0.00
MARTIN, ELLIOT	POSTDOC-EMPLOYEE	09/30/09	PAY0453940		0.00	41.16	0.00	0.00
MCDONALD, BRIAN CHARLES	GRAD STDNT RES- NO REMISSION	09/31/09	PAY0453940		0.00	3.89	0.00	0.00
MCDONALD, BRIAN CHARLES	GRAD STDNT RES- NO REMISSION	09/30/09	PAY0453940		0.00	10.20	0.00	0.00
QUOSS, VAUGHN P	STAFF RESEARCH ASSOC I	09/30/09	PAY0453940		0.00	103.31	0.00	0.00
RODIER, CAROLINE J	R&D ENGINEER 4	09/30/09	PAY0453940		0.00	637.87	0.00	0.00
Supplies & Expenses								
SEP GAEL INS ASSESSMENT		09/30/09	GAEL453938		0.00	1,059.41	0.00	0.00
Domestic Travel								
HARLEY, ROBERT A	Sacramento, CA 9719/09	09/27/09	11662740		0.00	88.31	0.00	0.00
TOTAL DIRECT COSTS								
					0.00	12,006.32	0.00	0.00

INDIRECT COSTS
 Indirect Cost Base
 STATE OH BY FUND BASE 8.100%

09/30/09 SOH0020007

0.00 1,200.63

0.00 0.00

Business Unit: 1 -- UC Berkeley
 Fiscal Year: 2008 - 10
 Month: September

CURRENT ACTIVITY DETAIL
 By Fund

Selection Criteria: Account Code | Fund Code | Org Code | Org Code | Program Code | Project No | Flexfield
 Org L2 Node | Org L3 Node | Org L4 Node | Org L5 Node | Org L6 Node | Acct L2 Node | EXPENSES | Acct L3 Node | Acct L4 Node

Description	Department Desc.	Date	Doc Id	Reference	Budget	Expenses	Encumbrance	Pre Encumb
FUND 15346 - CAEPA ARB 08-420-Madant-08/1								
TOTAL INDIRECT COSTS								
					0.00	1,200.63	0.00	0.00
					0.00	1,200.63	0.00	0.00
TOTAL FOR FUND 15346 - CAEPA ARB 08-420-Madant-08/1					0.00	13,206.98	0.00	0.00

Harman, Guy@ARB

From: Clymer, Pam@ARB
Sent: Monday, November 02, 2009 11:44 AM
To: Harman, Guy@ARB
Subject: FW: Invoice Approval: UC Berkeley 08-420 #15346-100663

Attachments: AR-M550U_20091028_155841.pdf



AR-M550U_200910
28_155841.pdf (...)

Hi Guy,

The attached invoice has been approved for payment.

Pam

-----Original Message-----

From: Harman, Guy@ARB
Sent: Wednesday, October 28, 2009 4:55 PM
To: Clymer, Pam@ARB
Subject: Invoice Approval: UC Berkeley 08-420 #15346-100663

Please approve attached invoice by 11/03/09 via e-mail.

Thanks

Guy Harman
Accountant I (Specialist)
California Air Resources Board
Phone (916) 322-9390
Fax (916) 322-9612

-----Original Message-----

From: sharpcopier@arb.ca.gov [mailto:sharpcopier@arb.ca.gov]
Sent: Wednesday, October 28, 2009 4:59 PM
To: Harman, Guy@ARB
Subject: Scanned image from Accounting Sharp Copier 20th Floor

DEVICE NAME: Accounting Sharp Copier 20th Floor
DEVICE MODEL: SHARP AR-M550U
LOCATION: 20th floor-South Side-Center

FILE FORMAT: PDF MMR(G4)
RESOLUTION: 300dpi x 300dpi

Attached file is scanned image in PDF format.
This file can be read by Adobe Acrobat Reader.
The reader can be downloaded from the following URL:

<http://www.adobe.com/>

STATE OF CALIFORNIA
STANDARD AGREEMENT
 STD 213 (Rev 06/03)

AGREEMENT NUMBER 08-420
REGISTRATION NUMBER

- This Agreement is entered into between the State Agency and the Contractor named below:
 STATE AGENCY'S NAME
Air Resources Board (ARB, CARB, State)
 CONTRACTOR'S NAME
The Regents of the University of California, Berkeley (UC Berkeley, UC, or Contractor)
- The term of this Agreement is: **April 1, 2009 or upon DGS approval through June 30, 2011**
- The maximum amount of this Agreement is: **\$320,000.00**
Three Hundred Twenty Thousand Dollars and No Cents
- The parties agree to comply with the terms and conditions of the following exhibits which are by this reference made a part of the Agreement.

Exhibit A – Scope of Work	1 page
Exhibit A, Attachment 1 - Proposal	52 pages
Exhibit B – Budget Detail and Payment Provisions	2 pages
Exhibit B, Attachment 1 – Budget	12 pages
Exhibit C* – General Terms and Conditions	GIA 101*
Exhibit D – Special Terms and Conditions	1 page
Exhibit E – Additional Provisions	3 pages
Exhibit F – Contract Report Format Guidelines	6 pages

Items shown with an Asterisk (*), are hereby incorporated by reference and made part of this agreement

IN WITNESS WHEREOF, this Agreement has been executed by the parties hereto.

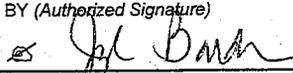
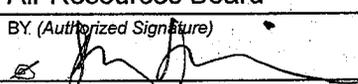
CONTRACTOR		California Department of General Services Use Only
CONTRACTOR'S NAME (if other than an individual, state whether a corporation, partnership, etc.) The Regents of the University of California, Berkeley		
BY (Authorized Signature) 	DATE SIGNED (Do not type) 4/29/09	<div style="border: 2px solid black; padding: 10px; text-align: center;"> <p>APPROVED</p> <p>MAY 12 2009</p> <p>DEPT OF GENERAL SERVICES</p> </div>
PRINTED NAME AND TITLE OF PERSON SIGNING Jyl Baldwin, Associate Assistant Director		
ADDRESS 2150 Shattuck Avenue, Suite 313, Berkeley, CA 94704		
STATE OF CALIFORNIA		
AGENCY NAME Air Resources Board		<input type="checkbox"/> Exempt per:
BY (Authorized Signature) 	DATE SIGNED (Do not type) 5/5/09	
PRINTED NAME AND TITLE OF PERSON SIGNING Socorro Watkins, Chief, Business Management Branch		
ADDRESS P.O. Box 2815, Sacramento, CA 95812		
		 Sharon Simmons Contract Services Section Manager Air Resources Board

EXHIBIT A
SCOPE OF WORK

1. The Regents of the University of California, Berkeley (UC, University, or Contractor) agrees to provide the following services for the project entitled "Assembly Bill 32 (Measure T-6) and Good Movement", which is attached hereto as Exhibit A, Attachment 1, and made a part of this Agreement.
2. The project representatives during the term of this agreement will be:

Requesting Agency: ARB	Providing Agency: Regents of the UC Berkeley
Division: Stationary Source Division	Division: Institute of Transportation Studies
Contact: Paul Milkey	Contact: Samer Madanat
Address: 1001 I Street, Floor 6 Sacramento, CA 95814	Address: 109 McLaughlin Hall Berkeley, CA 94720
Phone: (916) 327-2957	Phone: (510) 642-3585
Fax: (916) 327-6251	Fax: (510) 643-3955
Email: pmilkey@arb.ca.gov	Email: madanat@ce.berkeley.edu

The ARB Contract Administrator is:

The University's Contract Administrator is:

Requesting Agency: ARB	Providing Agency: Regents of the UC Berkeley
Division: Administrative Services	Division: Sponsored Projects Office
Contact: Sue Bayoneta	Contact: Jyl Baldwin
Address: 1001 I Street, Floor 20 Sacramento, CA 95814	Address: 2150 Shattuck Ave., Ste. 313 Berkeley, CA 94704
Phone: (916) 327-8215	Phone: (510) 642-8110
Fax: (916) 327-2940	Fax: (510) 642-8236
Email: sbayonet@arb.ca.gov	Email: jbaldwin@berkeley.edu

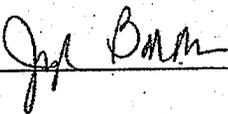
TECHNICAL PROPOSAL

Assembly Bill 32 (Measure T-6) and Good Movement

Principal Investigator: Samer Madanat

Official Authorized to Bind this Proposal:

Name Jyl Baldwin, Assistant Director

Signature  2/26/09

Prepared for:

State of California Air Resources Board
Research Division
PO Box 2815
Sacramento, CA 95812

Prepared by:

University of California, Berkeley
Institute of Transportation Studies
109 McLaughlin Hall
University of California – Berkeley
Berkeley, CA 94720-1720
(916) 451-8088
February 6, 2009

Check if applicable:

Animal subjects

Human subjects X

TABLE OF CONTENTS

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III. Project Objectives.....3

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Appendix A: Curriculum Vitae

Appendix B: Cost Proposal

I. Statement of Significance

Through the Global Warming Solutions Act of 2006 (AB 32), California has committed to reducing greenhouse gas (GHG) emissions to 1990 levels by 2020. As part of a broader scoping plan outlining numerous measures to help achieve this goal, the California Air Resources Board (ARB) has established a specific objective of 3.5 million metric tons of carbon dioxide (CO₂) equivalent (MMTCO₂E) reduction in GHG emissions from the goods movement sector by 2020 (Measure T-6), with larger reductions to follow by 2050 in accordance with Executive Order S-3-05. Additional GHG emissions from goods movement will occur due to the low carbon fuel standard (measure T-2), ship electrification at ports (measure T-5), improved aerodynamic efficiency of heavy-duty vehicles (measure T-7), and MD/HD vehicle hybridization efforts (measure T-8). The proposed research will consider, identify, and evaluate measures to reduce GHG emissions from the goods movement sector that will (1) help achieve the 2020 GHG emissions target; (2) be consistent with longer term (2050) changes needed in goods movement infrastructure, operating practices, and vehicles; and (3) maximize air quality co-benefits by 2020.

II. Abstract

Through the AB 32, California has committed to reducing GHG emissions to 1990 levels by 2020. The ARB has established a specific objective of 3.5 million metric tons of CO₂ equivalent reduction in GHG emissions from the goods movement sector by 2020, with larger reductions to follow by 2050 in accordance with Executive Order S-3-05. The proposed research will consider, identify, and evaluate measures to reduce GHG emissions from the goods movement sector through four key research elements: (1) policy review and stakeholder outreach, (2) equipment and vehicle analysis, (3) lifecycle analysis, and (4) logistics/supply chain analysis.

III. Project Objectives

The objective of the proposed research is to consider, identify, and evaluate measures to reduce GHG emissions from the goods movement sector that will (1) help achieve the 2020 GHG emissions target; (2) be consistent with longer term (2050) changes needed in goods movement infrastructure, operating practices, and vehicles; and (3) maximize air quality co-benefits by 2020. This will be accomplished by four key research area activities: (1) policy review and stakeholder outreach, (2) equipment and vehicle analysis, (3) lifecycle analysis, and (4) logistics/supply chain analysis.

IV. Technical Plan

This technical proposal includes four key elements, outlined below.

(1) Policy Review and Stakeholder Outreach (Susan Shaheen and Caroline Rodier, Transportation Sustainability Research Center)

(a) Literature Review

ARB staff and UC researchers will work collaborative on a general literature search that will be conducted to identify a range of strategies to reduce GHG emissions from goods movement, particularly from Europe, and include land use planning and social marketing efforts to encourage behavioral change. This review will include the identification of best or good practices for the goods movement sectors. As possible from the literature, this review will also identify potential financial and institutional barriers to policy implementation as well as alternative regulatory frameworks to drive policy implementation.

(b) Expert/Stakeholder Interviews

Interviews will be conducted to gather a deeper understanding of the perspectives of experts/stakeholders in the goods movement sectors in California (e.g., from industry, government, nongovernmental organizations, and academics). Approximately 20 to 30 interviews will be conducted in person or via telephone. The interviews will explore strategies, barriers, and opportunities for reducing GHG emissions from the goods movement sector. They also will investigate a range of regulatory frameworks for implementing strategies (e.g., voluntary, regulatory, etc.). ARB staff and UC researchers will jointly identify experts/stakeholders to ensure good representation of the full range of sectors in the goods movement arena and to avoid over or under representations in some sectors. ARB staff will work with researchers to review and comment on the expert interview instruments.

(c) Stakeholder Workshops

Researchers will work closely with ARB to support stakeholder workshops with high-level goods movement professionals in California (e.g., agenda development, meeting facilitation, note taking, etc.). The workshops will consist of a brief introduction to AB 32, potential policy strategies and mechanisms for reducing GHG emissions in the goods movement sectors. For example, researchers can explore the relative difficulty which government would face in implementing various alternatives, due either to technological or organizational constraints, and if constraints are suggested, how might these constraints be overcome. ARB staff and UC researchers will work together to identify the relative roles of ARB staff and UC researchers in the stakeholder workshop process and to develop the workshop instruments.

The results of the literature review, expert interviews, and stakeholder workshops will be summarized and evaluated to identify important strategies and regulatory frameworks including implementation challenges and opportunities. Institution Review Board approval will be obtained for the recruitment and protocol for the expert and stakeholder interviews and workshops.

(2) Vehicle and GHG Emissions Analysis (Robert Harley, Civil and Environmental Engineering Department)

In this area, we will compile and review data on the fuel use, demographics (i.e., vehicle population and age distribution), and emission factors (GHG plus NO_x and PM) of existing and future medium duty (MD) and heavy duty (HD) truck and locomotive engines in California. Current data on the population, age distribution, fuel economy, and emission factors for trucks will be extracted from California's motor vehicle emission factor (EMFAC) model, as well as the most recent Vehicle Inventory and Use Survey (U.S. Census Bureau). We will also search for other relevant data. Locomotive engine emission test results conducted by Southwest Research Institute and others will also be reviewed.

We will build a geographic information system (GIS)-based mapping tool that shows the spatial distribution of GHG emissions from goods movement in California, such that CO₂ and other GHG emissions can be mapped on the same 4 km statewide emission inventory grid that ARB uses for air quality planning and modeling. Not only will this greatly facilitate assessment of air quality co-benefits of GHG reductions, it will also help to visualize the spatial distribution of goods movement activities and relationships to ports, freight terminals, rail corridors, etc. In the first year, we only plan to map emissions from diesel trucks; GHG emissions from other transport modes including railroad locomotives, ships, gasoline-powered MD trucks, aircraft, and crude oil/fuel pipelines will be added later. We will use currently available Caltrans traffic counts (AADT = annual average daily traffic) for many segments of the state highway system to help define the spatial distribution of truck activity, separately for 3, 4, and 5+ axle trucks for which separate counts are available. These trucks are almost all diesel-powered at present. Surrogates such as population and/or traffic count data from urban arterial roadways will be used to map approximately the remaining fraction of on-road diesel fuel use that occurs on non-highway roads.

(3) Lifecycle Analysis (Arpad Horvath, Civil and Environmental Engineering Department)

In this area, we will review existing literature and other data sources (e.g., commercial data bases) for the air emissions from important modes of goods movement in California: marine, rail, and truck transport. Attention will focus specifically on GHG and criteria pollutant emissions per ton-mile on a life-cycle basis. Life cycle is defined as encompassing fuel production and delivery and vehicle/vessel manufacturing. The geographic scope of the analysis is California, but some of the production inputs into these modes may happen outside of California. All supply chains, wherever they happen,

will be included. The unit of analysis will be a ton-mile, i.e., a ton of goods transported one mile between the origin and the destination. Multimodal routing (e.g., utilizing rail and truck transportation in sequence) will be analyzed. We will then assess the opportunities for GHG reductions from mode shifts, potential operational improvements, and introduction of new technologies and systems (e.g., shore power at ports, options to reduce heavy-duty truck idling, etc.) in goods movement in California. The emphasis will be on options that rely mainly on existing infrastructure by 2020, and with potential for new, electrified rail infrastructure by 2050. Electrification of trucks by 2050 (with improving battery and recharging options) will also be studied. The assessment will include emissions from both fuel production and use with total lifecycle GHG emissions (wherever they occur) and in-state emissions of criteria pollutants.

(4) Logistics/supply chain (Yuwei Li, Institute of Transportation Studies)

Passenger travel demand management has been recognized as a critical component in reducing both traffic congestion and GHG emissions. Logistics demand management, on the other hand, has so far received far less attention. Logistics demand management has two principal components. Firstly, on the demand side, it recognizes that goods movement and logistics activities are derived activities, resulting mostly from economic activities of the population. Changes in economic activities affect the intensity and types of logistic activities. For example, product-oriented efforts such as education of consumers to consume locally-produced goods, reduced packaging, greater use of concentrates, and programs to reduce returns of merchandise will affect demand for logistic activities. Process-oriented efforts such as providing incentives to stabilize the economic behavior (e.g. order size and frequencies) of stakeholders in the supply chain will also affect the demand for goods movement. Secondly, on the supply side, the intensity and types of logistic activities are also affected by the logistics cost. The cost breakdown for each mode (truck, rail, etc) and whether environmental cost is explicitly accounted for strongly affect the competition between modes (multimodal) and the integration of modes (intermodal). Policy measures such as carbon fee on fuel would alter the competitive landscape and eventually the GHG emissions outcome.

Our research on logistics demand management explores both the demand-side and the supply-side strategies and policies that could either reduce goods movement demand, or induce better logistics demand patterns (in time and space) that are inductive to GHG reduction, while sustaining and enhancing the economic vitality of a region. During the first year, a comprehensive literature review will establish the state-of-art in logistics demand management over the world. Similarities and differences between passenger travel demand management and logistics demand management will be examined. Strategies and policies that are likely result in significant GHG reductions will be identified.

One key difference between passenger travel demand management and logistics demand management is that the latter involves private enterprises to a much greater extent, and private responses to public policies have ripple effects over the supply chain. This creates not only the need for innovative policies and strategies, but also the need for new analysis

methodologies. In latter part of the first year and in subsequent years of this research, we will develop these methodologies, and use them to analyze select strategies and policies for logistics demand management. For example, inducing consumers to consume locally-produced products through education and cost measures; reducing deadhead (tractor with empty trailer) and bobtail (tractor with no trailer) movements through load matching, route and delivery schedule optimization, and making loading and receiving schedules more flexible. The comparative effectiveness of various measures and how these measures can work together to achieve the same goal will be examined.

(5) Project Reporting and Final Report

Research will draft a comprehensive report on their findings of the research conducted as part of this project.

(6) Technical Support for AB 32 Scoping Plan Process

Researchers will provide technical support to the development of a goods movement strategy for AB 32 as needed within the limitations of the budget.

VI. Project Schedule

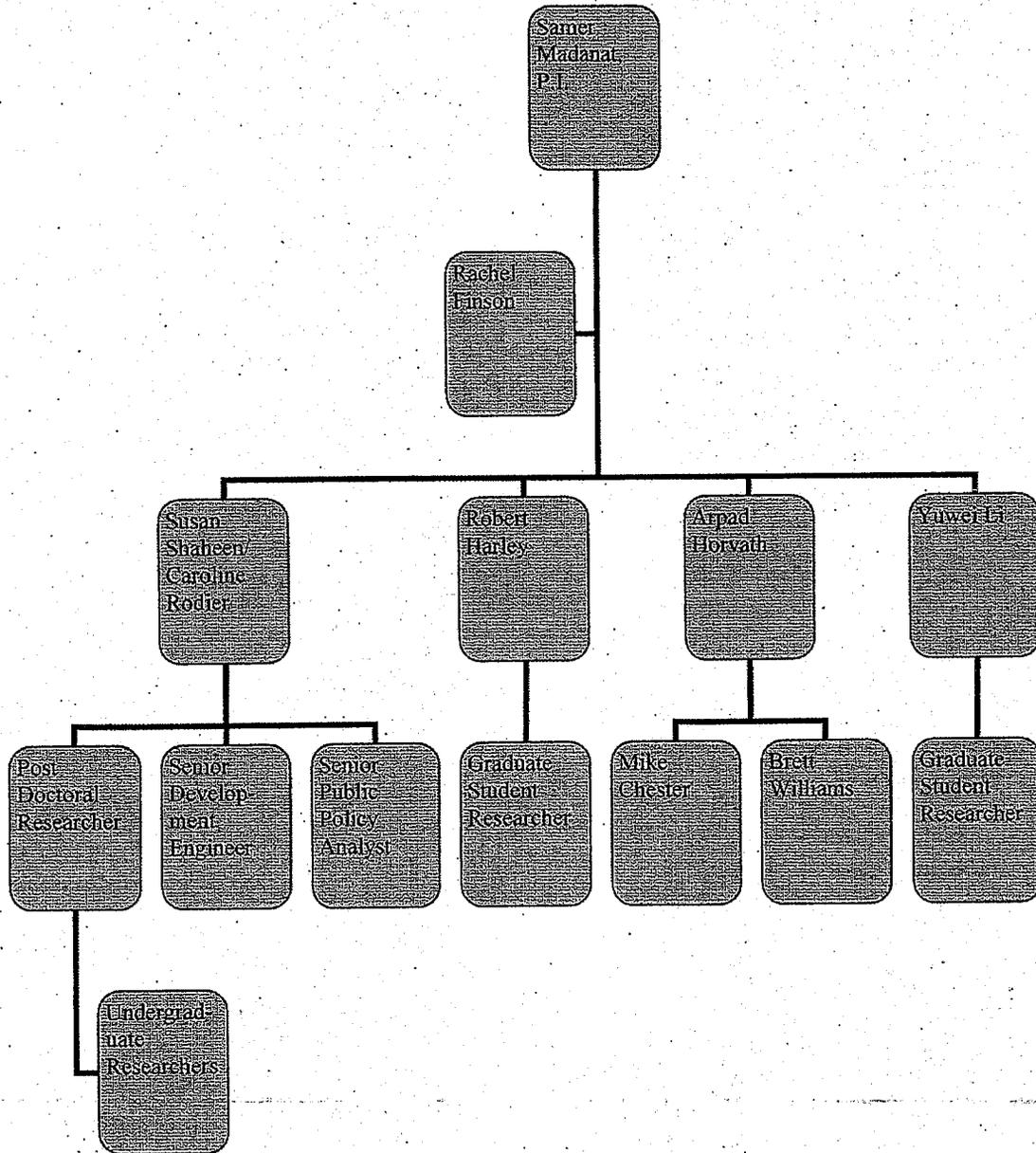
Project Performance Period: April 1, 2009 through March 31, 2010.

Project Components	4/09-6/09 April-June	7/09-9/09 July-Sept	10/09-12/09 Oct-Jan	1/10-3/10 Jan-March	4/10-6/10 April-June	Outcomes/ Deliverables
D) Policy Review and Stakeholder Outreach	→	→	→	→	→	Final Report Chapter
a) Literature Review	→	→	→	→	→	Literature Review
b) Expert/Stakeholder Interviews		→	→	→	→	Summary of Expert Interviews
c) Stakeholder Workshops		→	→	→	→	Stakeholder Workshops
2) Vehicle and GHG Emissions Analysis	→	→	→	→	→	Final Report Chapter
3) Lifecycle Analysis	→	→	→	→	→	Final Report Chapter
4) Logistics/supply chain	→	→	→	→	→	Final Report Chapter
5) Project Reporting and Final Report	Quarterly Report	Quarterly Report	Quarterly Report	Quarterly Report	Draft Final Report →	Final Report
6) Technical Support for AB 32 Scoping Plan Process	→	→	→	→	→	Summary of Efforts (included in final report)

Note: shaded areas indicate periods of major activity for each step.

VII. Project Management Plan

(1) Organizational Chart



(2) Summary Statement of Responsibilities of Key Personnel

- Samer Madanat is the P.I. and will oversee and review all aspects of the research project. Rachel Finson will assist Samer Madanat by providing overall project management and research support.
- Susan Shaheen and Caroline Rodier will oversee the policy review and stakeholder research assisted by a senior public policy analyst, post doctoral researcher, senior development engineer, and undergraduate assistants.
- Robert Harley will oversee the vehicle and GHG emissions analysis research conducted by a graduate student researcher.
- Arpad Horvath will oversee the lifecycle analysis research conducted by post doctoral researchers, Mike Chester and Brett Williams.
- Yuwei Li with the assistance of a graduate student researcher will conduct the logistics/supply chain research.

(3) Management and Coordination

Area research leads will meet regularly with assigned staff to coordinate project tasks with their budgeted amounts and schedule as describe in Part IV above. The entire research team will hold quarterly meetings to coordinate progress and share interim results.

(4) Curricula Vitae (See attached in Appendix A)

VII. Related Research

(1) Samer Madanat

- "Compliance and Commercial Vehicle Operators: A Systems Evaluation of the Problem and Virtual Solutions", PATH Task Order 6105, California Department of Transportation, 2005-08.
- "Development of a Practical Tool for Origin-Destination Matrix Estimation", RTA 51A0317, California Department of Transportation, 2005-07.
- "Research Center of Excellence in Future Urban Transport: The Interplay of Technology and Policy in Urban Transport", co-PI, Volvo Research and Educational Foundations, 2005-09 (PI: Carlos Daganzo, UC Berkeley).
- "Integrated Infrastructure Management and Decision Support", National Science Foundation, Urban Infrastructure Program, Co-Principal Investigator, 1995-1997.

(2) Arpad Horvath

- "Life-cycle Environmental and Economic Decision-Making for Alternative Biofuels"
Position: Co-Principal Investigator (with T. McKone, LBNL)
Source of Funding: Energy Biosciences Institute, UC Berkeley
Period: 01/01/08 – 12/31/10
- "Evaluation of Efficiency Activities in the Industrial Sector Undertaken in Response to Greenhouse Gas Emission Reduction Targets"

Position: Principal Investigator
Source of Funding: California Air Resources Board
Period: 8/01/07 – 1/31/09

- "Life-cycle Environmental Assessment of Passenger Air and Rail Transportation"
Position: Principal Investigator
Source of Funding: UC Transportation Center
Period: 7/01/05 – 9/30/07
- "An Analysis of Policy Mechanisms to Reduce the Life-Cycle Energy Consumption and Greenhouse Gas Emissions of Personal Computers in California"
Position: Principal Investigator
Source of Funding: University of California Energy Institute
Period: 7/01/05 – 6/30/06
- "Center of Excellence: Future of Urban Transportation"
Position: Co-Principal Investigator (with 7 others)
Source of Funding: Volvo Research and Education Foundation
Period: 01/01/05 – 12/31/09
- "Computer-Aided Hybrid Models for Environmental and Economic Life-Cycle Assessment"
Position: Principal Investigator, with two subawards (Carnegie Mellon U., University of Stuttgart, Germany)
Source of Funding: EPA STAR Technology for Sustainable Environment
Period: 01/01/02 – 12/31/04

(3) Robert Harley

- A fuel-based assessment of on-road and off-road mobile source emissions. Sponsored by the Electric Power Research Institute, 2008-2009 (\$99,977).
- On-road measurement of light-duty gasoline and heavy-duty diesel vehicle emissions. Sponsored by the California Air Resources Board, 2006-2009 (\$271,463).
- Emission and air quality impacts of new diesel engine control technologies. Sponsored by the UC Transportation Center, 2006-2009 (\$44,834).
- A seasonal perspective on regional air quality in Central California (Phases 1 and 2). Sponsored by the California Air Resources Board, 2004-2009 (\$300,000).
- Guiding future air quality management in California: sensitivity to changing climate. Sponsored by the U.S. Environmental Protection Agency, 2003-2009 (\$900,000).

(4) Yuwei Li

Description of related research project: Determination of the most progressive options for shifting the freight logistics industry towards more sustainable goals will require careful planning and coordination between multiple parties. Both consumers and government will play roles in influencing industry to consider implementation of solutions which will reduce environmental impacts. The influence of consumers can play a significant role in determining the demand for goods, since they have the potential to incentivize the voluntarily implementation of Green Logistics schemes. Such behaviors should be analyzed from both an economic and sociological viewpoint to determine their potential effects on logistics systems. In addition, government can guide the logistics industry with policies which will induce sustainable practices. Current regulations and policies applied to other industries can provide a menu of feasible options. Within this framework, various tools for analysis, including those of logistics systems analysis and

supply chain management, should be applied towards analyzing the effects of policy options on industry. An interdisciplinary analysis would allow for the concepts of a variety of fields to be incorporated, including transportation engineering, economics, environmental science, operations research and urban planning. As a result the feasibility and practicality of various policy options can be assessed to distinguish their suitability for specific contexts.

(5) Susan Shaheen and Caroline Rodier

- Improved Parking Information and Reservations for Truckers, Federal Highway Administration's Truck Parking Initiative: Application for a Pilot to Address the Shortage of Long-Term Parking for Commercial Motor Vehicles on National Highways, (2009-2015: \$5,455,372)
- Commercial Vehicle Parking in California: Exploratory Evaluation of the Problem and Possible Technology-Based Solutions. California Department of Transportation (2005-2008; \$100, 000)
- Virtual Commercial Vehicle Compliance Stations. California Department of Transportation (2005-2008; \$800, 000)

IX. Publications List

(1) Samer Madanat

- Wang K.C., Madanat S., Nambisan S. and Spring G., Editors, *Applications of Advanced Technologies in Transportation*, Proceedings of the Seventh International Conference, American Society of Civil Engineers, 2002.
- Ben-Akiva M., Humplick F., Madanat S. and Ramaswamy R. "Decision-Making Under Uncertainty In Infrastructure Management: The Latent Performance Approach", *ASCE Journal of Transportation Engineering*, Vol. 119, No. 1, 1993.
- Madanat S. and Ben-Akiva M. "Optimizing infrastructure management decisions under measurement and forecasting uncertainty", *Selected Proceedings of the 6th World Conference on Transport Research*, Vol. 4, 1992.
- Madanat S., Shaheen S., Rodier C., Misener J., Miller M. and Giuliano G., "Virtual Weigh Station: A Systems Evaluation of the Problems and Solutions", *Intellimotion*, Institute of Transportation Studies, University of California, Berkeley, CA Vol. 12, No.1, 2006.
- Madanat S., "State of the Art Research in Intelligent Transportation Systems 4000 Systems", California PATH Research Report 2005-C7, 86 pp, California PATH Program, Institute of Transportation Studies, 2005.
- Aktan, A.E., Dan M. Frangopol, Hamid M. Ghasemi, Masanobu Shinozuka, Samer Madanat and Harry W. Shenton III., "A Problem-Focused Agenda for the Highway Transportation Infrastructure: A Holistic Systems Identification and Integration Approach Using Field Test Sites," Final Report: NSF Grant CMS 0338817, 2004
- "A Bottom-Up System-Level Transportation Infrastructure Management System", Metrans University Transportation Center, University of Southern California, Los Angeles, CA, April 2007.

(2) Arpad Horvath

CURRENT PEER-REVIEWED JOURNAL SUBMISSIONS

- Horvath, A. (2009), "Life-cycle Assessment." In preparation for *Annual Review of Environment and Resources*, 34.
- Vieira, P. and Horvath, A. (2009), "BuiLCA – A Tool for Life-cycle Assessment of Commercial Buildings." In preparation for *Environmental Science & Technology*, ACS.
- Chester, M. and Horvath, A. (2009), "Comparison of Life-cycle Energy and Emissions Footprints of Passenger Transportation in Metropolitan Regions." Submitted for review to *Atmospheric Environment*.
- Stokes, J. and Horvath, A. (2008), "Life-cycle Energy and Greenhouse Gas Effects of Water Supply." Submitted for review to *Environmental Science & Technology*.
- Stokes, J. and Horvath, A. (2008), "Life-cycle Assessment of Urban Water Provision in California." Submitted for review to *J. of Infrastructure Systems*, ASCE.

PEER-REVIEWED ARCHIVAL PUBLICATIONS (PDF versions:

www.ce.berkeley.edu/~horvath/horvath_pub.html)

- Chester, M. and Horvath, A. (2009), "Life-cycle Inventories for Automobiles, Buses, Trains and Aircraft."
- Facanha, C., and Horvath, A. (2007), "Evaluation of Life-cycle Air Emission Factors of Freight Transportation." *Environmental Science & Technology*, 41(20), pp. 7138-7144, DOI: <http://dx.doi.org/10.1021/es070989q>
- Cicas, G., Hendrickson, C. T., Horvath, A., and Matthews, H. S. (2007), "A Regional Version of a U.S. Economic Input-Output Life-cycle Assessment Model." *Int. J. of Life Cycle Assessment*, 12(6), pp. 365-372, DOI: <http://dx.doi.org/10.1065/lca2007.04.318>
- Facanha, C., and Horvath, A. (2006), "Environmental Assessment of Freight Transportation in the U.S." *Int. J. of Life Cycle Assessment*, 11(4), pp. 229-239, DOI: <http://dx.doi.org/10.1065/lca2006.02.244>
- Suh, S., Lenzen, M., Treloar, G. J., Hondo, H., Horvath, A., Huppes, G., Joliet, O., Klann, U., Krewitt, W., Moriguchi, Y., Munksgaard, J., and Norris, G. (2004), "System Boundary Selection in Life-cycle Inventories Using Hybrid Approaches." *Environmental Science & Technology*, ACS, 38(3), pp. 657-664.
- Matthews, H. S., Hendrickson, C. T., and Horvath, A. (2001), "External Costs of Air Emissions from Transportation." *J. of Infrastructure Systems*, ASCE, 7(1), pp. 111-117.
- Hendrickson, C. T., Horvath, A., Joshi, S., and Lave, L. B. (1998), "Economic Input-Output Models for Environmental Life-Cycle Assessment." *Environmental Science & Technology*, ACS, 32(4), pp. 184A-191A.
- Horvath, A., Hendrickson, C. T., Lave, L. B., McMichael, F. C., and Wu, T-S. (1995), "Toxic Emissions Indices for Green Design and Inventory." Cover article, *Environmental Science & Technology*, ACS, 29(2), pp. 86-90.

(3) Robert Harley

- Ban-Weiss, G.A.; McLaughlin, J.P.; Harley, R.A.; Lunden, M.M.; Kirchstetter, T.W.; Kean, A.J.; Strawa, A.W.; Stevenson, E.D.; Kendall, G.R. (2008). Long-Term Changes in Emissions of Nitrogen Oxides and Particulate Matter from On-Road Gasoline and Diesel Vehicles. *Atmospheric Environment* 42, 220-232.
- Millstein, D.E.; Harley, R.A.; Hering, S.V. (2008). Weekly Cycles in Fine Particulate Nitrate. *Atmospheric Environment* 42, 632-641.
- Steiner, A.L.; Cohen, R.C.; Harley, R.A.; Tonse, S.; Goldstein, A.H.; Millet, D.B.; Schade, G.W. (2008). VOC Reactivity in Central California: Comparing an Air Quality Model to Ground-Based Measurements. *Atmospheric Chemistry and Physics* 8, 351-368.
- Jin, L.; Tonse, S.; Cohan, D.S.; Mao, X.; Harley, R.A.; Brown, N.J. (2008). Direct Sensitivity Analysis of Ozone Formation and Transport in California's San Joaquin Valley. *Environmental Science & Technology* 42, 3683-3689.
- Tonse, S.R.; Brown, N.J.; Jin, L.; Harley, R.A. (2008). A Process-Analysis Based Study of the Ozone Weekend Effect. *Atmospheric Environment* 42, 7728-7736.
- Ban-Weiss, G.A.; McLaughlin, J.P.; Harley, R.A.; Kean, A.J.; Grosjean, E.; Grosjean, D. (2008). Carbonyl and Nitrogen Dioxide Emissions from Gasoline- and Diesel-Powered Motor Vehicles. *Environmental Science & Technology* 42, 3944-3950.
- Kean, A.J.; Ban-Weiss, G.A.; Harley, R.A.; Kirchstetter, T.W.; Lunden, M.M. (2009). Trends in On-Road Vehicle Emissions of Ammonia. *Atmospheric Environment* 43, 1565-1570.
- Millstein, D.E.; Harley, R.A. (2009). Effects of climate change on air quality in southern California. *Atmospheric Chemistry and Physics Discussions* 9, 1561-1583.
- Ban-Weiss, G.A.; Lunden, M.M.; Kirchstetter, T.W.; Harley, R.A. (2009). Measurement of Black Carbon and Particle Number Emission Factors from Individual Heavy-Duty Trucks. *Environmental Science & Technology* 43, in press.

(4) Yuwei Li

- Li, Y. and Cassidy, M., *A Generalized and Efficient Algorithm for Estimating Transit Route ODs from Passenger Counts*, Transportation Research Part B: Methodological, Volume 41, Issue 1, January 2007, Pages 114-125
- Miller, M., Novick, L., Li, Y. and Skabardonis, A., San Diego I-15 Integrated Corridor Management (ICM) System: Phase I, California PATH Research Report, UCB-ITS-PRR-2008-33, December 2008

(5) Susan Shaheen

- Shaheen, Susan (2008). Invited Talk on Summary of Expert Interviews and Regional Workshops on Land Use Transportation and Climate Change. 2008 ARB Haagen-Smit Symposium, Aptos, California, April.
- Shaheen, Susan (2007). Invited Talk on Dynamics in Behavioral Response to A Fuel Cell Vehicle Fleet and Hydrogen Fueling Infrastructure: An Exploratory Study. Energy and Resources Group Seminar, Berkeley, California, October.

- Shaheen, Susan (2007). Video Transit Training for Older Travelers: A Case Study of Rossmoor Senior Adult Community, California. Paper # 07-2526. 86th Annual TRB Meeting, Washington, D.C., January.
- Shaheen, Susan, Elliot Martin, and Timothy Lipman (2008). "Dynamics in Behavioral Response to Fuel-Cell Vehicle Fleet and Hydrogen Fueling Infrastructure: An Exploratory Study," *Transportation Research Record*, No. 2058, pp 155-162.
- Martin, Elliot, Susan Shaheen, Timothy Lipman, and Jeffrey Lidicker (2008). "Behavioral Response to Hydrogen Fuel Cell Vehicles and Refueling: A Comparative Analysis of Short- and Long-Term Exposure," Transportation Research Board for 2009 Annual Meeting, Washington, D.C.

(6) Caroline Rodier

- Rodier, Caroline (2009). An International Review of the Modeling Evidence on the Effectiveness of Transit, Land Use, and Auto Pricing Strategies. Transportation Research Record Annual Meeting, January.
- Rodier, Caroline and Susan Shaheen (2007). *Commercial Vehicle Parking in California: Exploratory Evaluation of the Problem and Possible Technology-Based Solutions*. UCB-ITS-PRR-2007-11. Berkeley, California. August, 18 pp.
- Rodier, Caroline, Susan Shaheen, and Ellen Cavanagh (2006). Virtual Commercial Vehicle Compliance Stations: A Review of Legal and Institutional Issues. *Transportation Research Record* No. 1966, pp. 126-132.
- Rodier, C. J. (2007). Verifying the Accuracy of Land Use Models Used in Transportation and Air Quality Planning: A Case Study in the Sacramento, California Region. WCTR Annual Meeting, June.
- Shaheen, S.A. and C.J. Rodier. (2007) Video Transit Training for Older Travelers: A Case Study of the Rossmoor Senior Adult Community, California. *Transportation Research Record* No. 2034, pp. 11-1889-194.
- Rodier, Caroline, Susan Shaheen, and Amanda Eaken (2005). Transit-Based Smart Parking in the San Francisco Bay Area, California: Assessment of User Demand and Behavioral Effects, *Transportation Research Record* No. 1927, pp. 167-173.
- Rodier, C. J. (2004). Verifying the Accuracy of Regional Models Used in Transportation and Air Quality Planning. *Transportation Research Record*, 1898, 45-51.
- Rodier, C. J., R. A. Johnston, and D. R. Shabazian. (2003). Evaluation of advanced transit alternatives using consumer welfare. In *Transportation and Information Systems*. Cheltenham, England: Edward Elgar Publishing, 139-153.
- Rodier, C. J. and R. A. Johnston. (2002). Uncertain socioeconomic projections used in travel and emissions models: could plausible errors result in air quality nonconformity? *Transportation Research A*, 36:613-631.
- Hunt, J. D., R. A. Johnston, J. E. Abraham, C. J. Rodier, G. Garry, S. H. Putnam, and T. de la Barra. (2001). Comparisons from the Sacramento Model Testbed. *Transportation Research Record*, 1780, 53-63.

X. Cost Proposal

1. **Budget Submittal Form (See Attached Appendix B)**
2. **Budget Submittal Form for Subcontractors and Consultants**

Not applicable see Attached Appendix B.

3. Estimated Cost Breakdown by Task

Task	Labor	Subcont. Consultants	Equip	Travel Subsidi	EDP	Copy/Print	Mail, Phone, Fax	Material and Supplies	Analyses	misc	Employee Fringe Benefits	Overhead
1 Policy Review and Outreach	\$52,951.00	\$10,000.00	\$ -	\$3,000.00	\$ -	\$ 1,630.32	\$1,776.39	\$1,835.64	\$ -	\$691.05	\$21,821.63	\$12,874.71
2 Vehicle and GHG Emissions Analysis	\$12,694.00	\$ -	\$ -	\$2,000.00	\$ -	\$ 225.64	\$ 246.23	\$ 143.55	\$ -	\$ 90.26	\$ 3,024.71	\$ 1,729.13
3 Lifecycle Analysis	\$30,595.00	\$ -	\$ -	\$3,000.00	\$ -	\$ 936.76	\$ 584.70	\$ 343.88	\$ -	\$214.89	\$ 7,162.63	\$ 4,166.07
4 Logistics/supply chain	\$33,221.00	\$ -	\$ -	\$2,000.00	\$ -	\$ 582.63	\$ 634.88	\$ 370.14	\$ -	\$232.65	\$ 7,759.53	\$ 4,458.59
5 Project Reporting and Final Report	\$19,652.80	\$ -	\$ -	\$ 500.00	\$ -	\$ 344.77	\$ 378.57	\$ 218.96	\$ -	\$137.85	\$ 4,813.80	\$ 2,637.44
6 Technical Support for AB 32 Scoping Plan Process	\$20,800.00	\$ -	\$ -	\$1,500.00	\$ -	\$ 380.68	\$ 382.22	\$ 222.83	\$ -	\$148.86	\$ 4,566.20	\$ 2,684.15

4. Equipment List

No equipment will be purchased as part of this grant.

Curriculum Vitae

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a. Education

1. Massachusetts Institute of Technology, Civil Engineering, Ph.D., 1991
2. Massachusetts Institute of Technology, Civil Engineering, M.S., 1988
3. University of Jordan, Civil Engineering, B.S., 1986

b. Appointments

1. July 2002-present: Professor, Department of Civil and Environmental Engineering, UC Berkeley
 - October 2006-present: The Xenel Professor of Engineering
 - July 2005-present: Director, Institute of Transportation Studies
 - July 2003-June 2005: Director, PATH (Partners for Advanced Transit and Highways)
 - August 2002 to July 2003: Acting Director, Institute of Transportation Studies
2. 1996-2002: Associate Professor, Department of Civil and Environmental Engineering, UC Berkeley
3. 1992-1996: Assistant Professor, School of Civil Engineering, Purdue University, Indiana
4. 1991-1992: Senior Systems Analyst, Cambridge Systematics Inc., Cambridge, Massachusetts

c. Selected Publications (last five years)

1. Durango-Cohen P. and Madanat S., "Optimization of Inspection and Maintenance Decisions under Performance Model Uncertainty: A Quasi-Bayes Approach", forthcoming in *Transportation Research, Part A*.
2. Nakat Z. and Madanat S., "Stochastic Duration Modeling of Pavement Overlay Crack Initiation", forthcoming in *ASCE Journal of Infrastructure Systems*
3. Robelini C.A. and Madanat S., "History-dependent optimization of bridge maintenance and replacement decisions using Markov decision processes", forthcoming in *ASCE Journal of Infrastructure Systems*.
4. Madanat S., Park S. and Kuhn K., "Adaptive Optimization and Systematic Probing of Infrastructure System Maintenance Policies under Model Uncertainty", *ASCE Journal of Infrastructure Systems*, Vol. 12, No. 3, 2006
5. Ouyang Y. and Madanat S., "Analytical Solution for the Finite-Horizon Pavement Resurfacing Planning Problem", *Transportation Research, Part B*, Vol. 40, No. 9, pp 767-778, 2006.
6. Kuhn K. and Madanat S., "Robust Maintenance Policies for Markovian Systems under Model Uncertainty", *Computer-Aided Civil and Infrastructure Engineering*, Vol. 21, pp 171-178, 2006.
7. Kuhn K. and Madanat S., "Model Uncertainty and the Management of a System of Infrastructure Facilities", *Transportation Research, Part C*, Vol. 13, pp 391-404, 2005.
8. Ouyang Y. and Madanat S., "Optimal Scheduling of Rehabilitation Activities for Multiple Infrastructure Facilities: Exact and Approximate Solutions", *Transportation Research, Part A*, Vol. 38, No. 5, 2004.
9. Prozzi J. and Madanat S., "Development of Pavement Performance Models by Combining Experimental and Field Data", *ASCE Journal of Infrastructure Systems*, Vol. 10, No. 1, 2004.
10. Guillaumot V., Durango P. and Madanat S., "Adaptive Optimization of Infrastructure Maintenance and Inspection Policies under Performance Model Uncertainty", *ASCE Journal of Infrastructure Systems*, Vol. 9, No. 4, 2003.

11. Shin HC and Madanat S., "Development of a Stochastic Model of Pavement Distress Initiation", *Journal of Infrastructure Planning and Management*, No. 744, IV-61, Japan Society of Civil Engineers, 2003.
12. Prozzi J. and Madanat S., "Incremental Nonlinear Model for Predicting Pavement Serviceability", *ASCE Journal of Transportation Engineering*, Vol. 129, No. 6, 2003.
13. Mishalani R. and Madanat S., "Computation of Infrastructure Transition Probabilities using Stochastic Duration Models", *ASCE Journal of Infrastructure Systems*, Vol. 8, No. 4, 2002.
14. Durango P. and Madanat S., "Optimal Maintenance and Repair Policies for Infrastructure Facilities under Uncertain Deterioration Rates: An Adaptive Control Approach", *Transportation Research, Part A*, Vol. 36, No. 9, Elsevier Science, 2002.
15. Mayet J. and Madanat S., "Incorporation of Seismic Considerations in Bridge Management Systems", *Computer-Aided Civil and Infrastructure Engineering*, Vol. 17, pp. 185-193, 2002.
16. Li Y. and Madanat S., "A Steady-State Solution for the Optimal Pavement Resurfacing Problem", *Transportation Research, Part A*, Vol. 36, No. 6, Elsevier Science, 2002.
17. Madanat S., Prozzi J. and Han M., "Effect of Performance Model Accuracy on Optimal Pavement Design", *Computer Aided Civil and Infrastructure Engineering*, Vol. 17, pp. 22-30, 2002.

d. Synergistic Activities (last five years)

1. Editor in Chief, *ASCE Journal of Infrastructure Systems* (June 2001-present).
2. Vice Chair, Topic Manager and Track Chair, World Conference on Transportation Research, held in Berkeley, CA in June 2007.
3. Chair, Special Interest Group (SIG) # 5: "Transport Infrastructure Systems", World Conference on Transportation Research Society, 2006-present.
4. Member of the Board of Directors of CERRA (Civil Engineering Risk and Reliability Association), July 2003 – present.
5. Co-chair, 10th Conference on the Application of Advanced Technologies in Transportation, to be held in Athens, Greece in May 2008.
6. Co-Chair, Technical Committee, the 9th International Conference on Applications of Statistics and Probability in Civil Engineering, San Francisco, CA, July 2003.
7. Member, ASCE Committee on Transportation Infrastructure Management (1993-present).
8. Member of the Visiting Committee for MIT's CEE Department, 2006-08.
9. Member of the Editorial Board, *Jordanian Journal of Civil Engineering*, 2006-present.
10. Member, proposal review panel for the National Science Foundation.

e. Recent Collaborators

(i) PhD Thesis Advisor (last five years)

1. Pablo Durango-Cohen, Department of Civil & Environmental Engineering, Northwestern University.
2. Kenneth Kuhn, NASA Aimes Research Center
3. Da Jie Lin, Department of Transportation Management, Tamkang University, Taiwan, R.O.C.
4. Ziad Nakat, Infrastructure Department, the World Bank.
5. Sejung Park, Entru Consulting Partners, Seoul, Korea.
6. Jorge Prozzi, Department of Civil & Environmental Engineering, University of Texas, Austin
7. Charles-Antoine Robelin, NASA Aimes Research Center
8. Hee Cheol Shin, Pavement Research Center, U.C. Berkeley

(ii) Postgraduate Scholar Advisor (last five years)

1. Yafeng Yin, Department of Civil & Environmental Engineering, University of Florida

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CURRENT RESEARCH

Environmental life-cycle assessment of materials, services, and processes of infrastructure systems for more informed decision- and policy-making. Life-cycle assessment of products and services. Green engineering and management.

GENERAL RESEARCH INTERESTS

Infrastructure systems and the environment. Environmentally-conscious construction and the built environment. Industrial ecology. Environmental management and policy.

EDUCATION

1997	Ph.D., Civil Engineering	<i>Carnegie Mellon University</i> (Advisor: Chris T. Hendrickson)
1995	M.S., Civil Engineering	<i>Carnegie Mellon University</i> (Advisor: Chris T. Hendrickson)
1993	Dipl. Eng. (M.S.), Civil Engineering	<i>Technical University of Budapest, Hungary</i>

EXPERIENCE AND POSITIONS

- Program Group Leader, Engineering and Project Management Program, CEE, UC Berkeley (July 1, 2007 – present)
- Associate Professor, *University of California, Berkeley* (July 2005 – present)
- Assistant Professor, *University of California, Berkeley* (July 1999 – June 2005)
- Director, *Consortium on Green Design and Manufacturing, UC Berkeley* (May 2000 – present)
- Director, “*Engineering and Business for Sustainability*” Certificate Program, *UC Berkeley* (January 2007 – present)
- Research Faculty, *Carnegie Mellon University* (January 1998 – June 1999)
- Postdoctoral Researcher, *Carnegie Mellon University* (July 1997 – December 1997)
- Graduate Research Assistant, *Carnegie Mellon University* (August 1993 – June 1997)
- Engineer-in-Training, *Ministry of Public Works and Transportation, General Office for Roads, Burgos, Spain*, (July 1992)

PROFESSIONAL ACTIVITIES

- Associate Editor, *ASCE Journal of Infrastructure Systems* (May 2002 – present)
- Guest Co-Editor (with H. Scott Matthews), two Special Issues of *ASCE J. of Infrastructure Systems* on Sustainable Development and Infrastructure Systems (September 2004, March 2005)
- Editorial Board Member, *Journal of Industrial Ecology*, the journal of the International Society for Industrial Ecology, Blackwell (March 2005 – present)
- Member, Committee on Environmental Impacts of Wind Energy Projects, National Research Council, The National Academies (August 2005 – May 2007)
- Secretary, Committee on Social and Environmental Concerns in Construction, Construction Institute, American Society of Civil Engineers (2001 – 2005), Member (2005 – present)

- **Board Member**, Center for Energy and Environmental Innovation (CEEI), Haas School of Business, UC Berkeley (June 2007 – present)
- **Member**, Nominating Committee, International Society for Industrial Ecology (2008 – present)
- **Member**, Awards Committee, International Society for Industrial Ecology (2007 – 2008)
- **Panel Reviewer**, National Science Foundation (November 2007, December 2006, November 2006, May 2005, November 2003, April 2003, November 2002)
- **Member**, Committee on Waste Management and Resource Efficiency in Transportation ADC60, Transportation Research Board (2000 – 2006)
- **Member**, Environmental Maintenance Subcommittee A3C01(1), Transportation Research Board (1999 – 2002)
- **Corresponding Member**, ASCE/TAC Subcommittee on Sustainability, American Society of Civil Engineers (2001 – present)
- **Advisory Council Member**, American Center for Life Cycle Assessment (2001 – 2006)
- **Paper reviewer**, *Environmental Science & Technology* (18 manuscripts), *ASCE J. of Construction Engineering and Management* (8), *J. of Industrial Ecology* (8), *International J. of Life Cycle Assessment* (6), *ASCE J. of Transportation Engineering* (4), *Resources, Conservation and Recycling* (3), *Industrial and Engineering Chemistry Research* (3), *Water Research* (2), *Research in Engineering Design* (2), *ASCE J. of Management in Engineering* (2), *ASCE J. of Architectural Engineering* (2), *Ecological Economics* (2), *Atmospheric Environment*, *Proceedings of the IEEE*, *Environmental Research Letters*, *Environmental Engineering Science*, *J. of Environmental Management*, *J. of Transportation and Statistics*, *European J. of Operational Research*, *Int. J. of Sustainable Transportation*, *Automation in Construction*, *Chemosphere*, *Environmental Impact Assessment Review*, *Environmental Management*, *Materials and Structures*, *J. of Green Building*, *Greener Management International*, 2008 World Sustainable Building Conference (15 abstracts, 6 papers), 2007 IEEE International Symposium on Sustainable Systems and Technology (32 abstracts), 9th International Conference on Structural Safety and Reliability ICOSSAR 2005 (5), 2007 World Conference on Transport Research, 2007 Conference of the International Society for Industrial Ecology (3 abstracts), 2007 IEEE International Symposium on Electronics and the Environment (6 abstracts), 2006 IEEE International Symposium on Electronics and the Environment (20 abstracts), 2006 American Society for Engineering Education Annual Conference & Exposition, 2007 Transportation Research Board Conference, 2006 Transportation Research Board Conference, 2005 ASCE Construction Research Congress (17 abstracts, 5 papers), 2005 Transportation Research Board Conference (2), 2004 Transportation Research Board Conference (2), 2003 ASME Design and Manufacturing Conference, 2002 Transportation Research Board Conference, 2001 Transportation Research Board Conference, 2001 IEEE International Symposium on Electronics and the Environment, 2000 IEEE International Symposium on Electronics and the Environment, 1997 ASME Design and Manufacturing Conference
- **Book reviewer**, Wiley (2004, 2007), MIT Press (2003), McGraw-Hill (2003), Springer (2002), Prentice-Hall (2001)
- **Proposal Reviewer**, Science and Technology Foundation (FCT), Ministry of Science, Technology and Higher Education, Portugal (June 2007); Graham Environmental Sustainability Institute, University of Michigan (November 2006); National Science Foundation (July 2006); California Partners for Advanced Transit and Highways – PATH (March 2006, April 2005); University of Rhode Island Transportation Center – URITC (March 2003); Recycled Materials Resource Center, University of New Hampshire (June 2003)
- **Project Report Reviewer**, California Energy Commission – PIER (December 2004), The Automobile of the 21st Century – AUTO 21, Canada (December 2004)
- **Invited participant**, National Science Foundation Workshop “Research Opportunities for Reducing the Impact of Material Flows in the United States.” National Academies, Washington, DC (June 2004)
- **Co-developer**, first free Web-based life-cycle assessment (LCA) software: www.eiolca.net (1997-99)
- **Co-author**, White Paper of TRB Committee on Waste Management in Transportation A1F07 (1999)
- **Co-organizer**, Distinguished Environmental Lecture Series, Carnegie Mellon University (1998-1999)

- **Consultant**, sample application and exercises for *Advanced Engineering Mathematics – 2/e*, Zill and Cullen, Jones & Bartlett Publishers, Sudbury, MA (1999)
- **Expert reviewer**, *Towards a European Solution for the Management of Waste from Electric and Electronic Equipment*, study for the Environment Committee of the European Parliament, Joint Research Centre, Institute for Prospective Technological Studies, European Commission (1998)
- **Consultant and editor**, *Network Scheduling Techniques for Construction Project Management*, Miklos Hajdu (*Technical University of Budapest, Hungary*), Kluwer Scientific Publishing, Amsterdam, Netherlands (1996)
- **Consultant**, *Michael Baker Co.* (construction), Pittsburgh, PA (September 1996)
- **Editorial assistant**, *Fundamental Principles of Systems Analysis and Decision-Making*, textbook by Paul J. Ossenbruggen, John Wiley & Sons, New York (August - December 1992)

AWARDS

- Second Runner-up Award for Best Paper of 2008 – Policy Analysis in *Environmental Science & Technology* for “Assessing the End-of-Life Impacts of Buildings” (2009)
- Walter L. Huber Civil Engineering Research Prize “for original and outstanding contributions to the life-cycle environmental modeling and assessment of infrastructure systems,” American Society of Civil Engineers (2008)
- Laudise Prize “for outstanding achievements in industrial ecology by a young scientist or engineer,” International Society for Industrial Ecology (2005)
- AT&T Foundation Industrial Ecology Faculty Fellowship (2004)
- National Science Foundation CAREER award (2001-2006)
- AT&T Foundation Industrial Ecology Faculty Fellowship (2001)
- AT&T Foundation Industrial Ecology Faculty Fellowship (2000)
- Certificate of Appreciation “in recognition of a substantial contribution to the 1999 SAE International Congress & Exposition” (1999)
- NSF-Lucent Technologies Industrial Ecology Fellowship (1998-2000) (shared with C. Hendrickson and L. Lave, Carnegie Mellon University)
- AT&T Foundation Industrial Ecology Faculty Fellowship (1998)

CONFERENCE ORGANIZATION

- **Program co-chair**, *2009 IEEE International Symposium on Sustainable Systems and Technology*, Tempe, AZ (May 2009)
- **Co-organizer and co-chair**, Platform session “Confronting the Life-Cycle Impacts and Benefits of Biofuels,” *2008 SETAC North America 29th Annual Meeting*, Tampa, FL (November 2008)
- **Program co-chair**, *2008 IEEE International Symposium on Electronics and the Environment*, San Francisco, CA (May 2008)
- **Track chair**, *World Conference on Transport Research*, Berkeley, CA (June 2007)
- **Conference co-chair**, *2007 IEEE International Symposium on Electronics and the Environment*, Orlando, FL (May 2007)
- **Member, Technical Committee**, *4th Conference of the International Society for Industrial Ecology*, Toronto, Canada (June 2007)
- **Program co-chair**, *2006 IEEE International Symposium on Electronics and the Environment*, San Francisco, CA (May 2006)
- **Session chair**, *9th International Conference on Structural Safety and Reliability ICOSSAR 2005*, Rome, Italy (June 2005)

- **Session chair (three sessions), 3rd Conference of the International Society for Industrial Ecology**, Stockholm, Sweden (June 2005)
- **Co-chair, NSF CAREER Workshop Held in Conjunction with the 2005 Construction Research Congress**, San Diego, CA (April 2005)
- **Session chair (two sessions), ASCE Construction Research Congress**, San Diego, CA (April 2005)
- **Member, Organizing Committee, NATO Advanced Research Workshop "Life-cycle Energy and Environmental Implications of Information Technology,"** Budapest, Hungary (September 2003)
- **Session chair (two sessions), ASCE Construction Research Congress**, Honolulu, HI (March 2003)
- **Panel organizer and speaker, 2002 Gordon Research Conference on Industrial Ecology**, New London, NH (June 2002)
- **Conference co-chair, 2001 IEEE International Symposium on Electronics and the Environment**, Denver, CO (May 2001)
- **Co-chair, 2000 UC Berkeley Symposium on Manufacturing and Green Issues in the Electronics Industry**, Berkeley, CA (December 2000)
- **Session chair, The Future 500 Conference on Industrial Ecology**, Berkeley, CA (October 2000)
- **Session chair, 2000 Gordon Research Conference on Industrial Ecology**, New London, NH (June 2000)
- **Conference co-chair, 2000 IEEE International Symposium on Electronics and the Environment**, San Francisco, CA (May 2000)
- **Co-director, NATO Advanced Research Workshop "Green Engineering and Management Methods and Tools for Central and Eastern Europe,"** Budapest, Hungary (May 2000)
- **Short-course organizer and presenter, International Colloquium and Exhibit on Environmentally Preferred Advanced Energy Generation – ICEPAG**, University of California, Irvine (April 2000)
- **Program co-chair, 1999 IEEE International Symposium on Electronics and the Environment**, Danvers, MA (May 1999)
- **Short-course organizer and presenter, International Colloquium and Exhibit on Environmentally Preferred Advanced Energy Generation – ICEPAG**, University of California, Irvine (March 1999)
- **Session co-chair, Carnegie Mellon University, Carnegie Institute of Technology Research Review** (May 1995)

ACADEMIC ADVISING

University of California, Berkeley:

Ph.D. students graduated:

- Mikhail Chester (graduated in August 2008, "Life-cycle Assessment of Passenger Transportation"), currently post-doctoral researcher at UC Berkeley
- Pedro Santos Vieira (graduated in August 2007, "Life-cycle Assessment of Commercial Buildings"), currently with Taoit, Berkeley
- Cristiano Facanha (graduated in August 2006, "Life-cycle Air Emissions Inventory of Freight Transportation in the United States"), currently with ICF International, San Francisco
- Jennifer Stokes (graduated in May 2004, "Life-cycle Assessment of Alternative Water Supply Systems in California"), currently postdoctoral researcher at UC Berkeley
- Eric Masanet (graduated in May 2004 from Mechanical Engineering, "Environmental and Economic Take-back Planning for Plastics from End-of-Life Computers," co-advisor with D. Dornfeld); currently Principal Scientific Engineering Associate, Environmental Energy Technologies Division, Lawrence Berkeley National Laboratory
- Angela Guggemos (graduated in May 2003, "Environmental Impacts of Onsite Construction Processes: Focus on Structural Frames"), currently Assistant Professor, Department of Construction Management, Colorado State University
- Sergio Pacca (graduated in May 2003 from the Energy and Resources Group, "Global Warming Effect Applied to Electricity Generation Technologies," co-advisor with R. Norgaard), currently Assistant Professor, Environmental Management Program, University of Sao Paulo, Brazil

- Erasmia Kitou (graduated in May 2002, "Air Pollution Assessment of Telework: A Design of a Decision-Support Tool"), currently at the European Commission, Environment Directorate General, Climate Change and Air Directorate

Current Ph.D. students:

- Nicholas Santero, Ph.D. candidate (August 2006 – present, co-advised with John Harvey, UC Davis, expected to graduate in May 2009)
- Nakul Sathaye, Ph.D. candidate (August 2005 – present, co-advised with Samer Madanat, expected to graduate in August 2009)
- Arman Shehabi, Ph.D. candidate (January 2004 – present, co-advised with William Nazaroff)
- Sebastien Humbert, Ph.D. candidate (August 2004 – present)
- Petek Gursel, Ph.D. student (August 2007 – present)
- Corinne Scown, Ph.D. student (August 2007 – present)
- Bret Strogen, Ph.D. student (January 2008 – present)

Ph.D. exams and committees:

- Ph.D. thesis reader: Hung Nguyen (2008 – present), Corinne Reich-Weiser (ME, 2008 – present), Ashley Murray (ERG, 2007 – present), Sarah Boyd (ME, 2006 – present), Taihyeong Lee (CEE, UC Davis, 2007), Long Duy Nguyen (CEE, 2007), Aurora Luscher Sharrard (CEE, Carnegie Mellon U., 2007), Chris Cherry (City and Regional Planning, 2007), Ziad Nakat (CEE, 2006), Justin Reginato (CEE, 2005), Agnes Bodnar Lobscheid (Environmental Health Sciences, School of Public Health, 2004)
- Ph.D. "instructor" of Seppo Junnila, Helsinki University of Technology, Finland (September 2002 – September 2004)
- Ph.D. mentor: Michael Toffel, Haas School of Business (Fall 2002 – Spring 2005)
- Chair of Ph.D. qualifying exams: Hung Nguyen (2008), Ying Yi Chih (2008), Richard Plevin (ERG, 2008), Ashley Murray (ERG, 2007), Kunhee Choi (2006), Zofia Rybkowski (2006), Long Duy Nguyen (2006), Min Liu (2005), Seulkee Lee (2004), Colin Milberg (2003), Thais Alves (2003), Ziad Nakat (2003), Justin Reginato (2003), Jan Elfving (2002), James Choo (1999)
- Member of Ph.D. qualifying exams: Johanna Mathieu (ME, 2009), Bret Strogen (2009), Corinne Scown (2009), Fredrich Kahrl (ERG, 2009), Avery Cohn (ESPM, 2008), Eva Agus (2008), Nicholas Santero (2008), Corinne Reich-Weiser (ME, 2008), Arman Shehabi (2007), Nakul Sathaye (2007), Yingchun Yuan (ME, 2006), Sarah Boyd (ME, 2006), Sebastien Humbert (2005), Mikhail Chester (2005), Aurora Luscher Sharrard (Carnegie Mellon U., 2005), Pedro Santos Vieira (2004), Cristiano Facanha (2004), Jennifer Stokes (2003), Sergio Pacca (ERG, 2001), Angela Guggemos (2001), Erasmia Kitou (2000)
- Member of Ph.D. preliminary exams: Seongkyun cho (2009), Corinne Scown (2008), Ilse Ruiz Mercado (2007), Rune Storesund (2007), Nakul Sathaye (2005), Mikhail Chester (2005), Min Chen (2004)

M.S./M.Eng. advising:

- M.S. thesis committee member: Teresa Zhang (ME, 2007), Sarah Boyd (ME, 2007), Asher Ghertner (ERG, 2004), Matthew Dubberley (ME, 2003), Peter Broomes (ME, 2003)
- Advised 4 M.S. students in 2008-09, 5 M.S. students in 2007-08, 5 in Fall 2006, 5 in 2005-06, 6 in 2004-05, 6 in 2003-04, 4 in 2002-03, 7 in 2001-02, 7 in 2000-01, 7 in 1999-2000
- Advised 1 M.Eng. student in 2007-09, 2000-02, 2000-01

Undergraduate advising:

- Advised 18 undergraduate students in Fall 2006, 18 in 2005-06, 18 in 2004-05, 17 in 2003-04, 17 in 2002-03, 17 in 2001-02, 18 in 2000-01, 27 in 1999-00

Carnegie Mellon University:

- Advised 4 M.S. students in 1998-99
- Diploma thesis advising: Matthias Schoettle (U. of Stuttgart, Germany, 1998), Dieter Schwandner (U. of Karlsruhe, Germany, 1998)

TEACHING

Graduate courses:

- CE 268E *Civil Systems and the Environment* (Spring 2000 – Fall 2008)
- CE 293A *Technology and Sustainability* (Fall 2005 – 2006)

- *CE 292A Technologies for Sustainable Societies* (Fall 2001 – 2004, 2008)
- *12-711 Advanced Techniques for Project Management* (Carnegie Mellon University, Spring 1998 – Spring 1999)
- *12-710 Principles and Practices in Environmental Management*, teaching assistant (CMU, Spring 1994)

Undergraduate courses:

- *CE 166 Construction Engineering* (Fall 1999 – 2008)
- *E 11/CE 11 Engineered Systems and Sustainability* (Spring 2006, 2008, 2009)
- *CE 167 Engineering Project Management* (Spring and Fall 2001, Spring 2003 with I. Tommelein, Spring 2002 with A. Guggemos)
- *CE 169A Web-based Systems for Engineering and Management* (Fall 2000 – 2001 with I. Tommelein, Fall 2004 alone)
- *CE 169B Database Systems for Engineering and Management* (Fall 2000 – 2001, Fall 2004)
- *12-611 Project Management for Construction* (CMU, Fall 1997 with Steven Fenves, and Fall 1998 alone)
- *12-611 Project Management for Construction*, teaching assistant (CMU, Fall 1994 – 1996)

Executive education:

- Life-cycle Assessment, *ITT Industries Jabsco Rule Flojet* (Foothill Ranch, CA, July 2002)
- Environmental Impacts of Infrastructure, *Saudi Strategic Storage Project* (UC Berkeley, August-September 2000)
- Life-cycle Assessment, *Hyundai Engineering* (UC Berkeley, August 2000)
- *Green Engineering and Management* (CMU, July 1995 – 1997)

Continuing education:

- UC Extension short course “*Environmental Management for Companies*” (UC Berkeley, April 2002)
- UC Extension short course “*Life-Cycle Assessment and Engineering*” (UC Berkeley, January 2001)

FACULTY ACTIVITIES

University and College Committee Membership:

- Member, Cal Climate Action Plan Steering Committee (to advise the Chancellor and campus policy, 2006 – present)
- Member, Proposal review panel, Office of the Vice Chancellor for Research (October 2007)
- Member, Global Metropolitan Studies Faculty Search Committee (2006)
- Chair, Technology and Sustainability Committee, *College of Engineering* (November 2005 – present)
- Chancellor’s Advisory Committee on Sustainability (September 2003 – June 2007)
- Committee on Management of Technology Administration, UC Berkeley (April 2001 – present)
- Environmental Engineering, Energy, and Resources Committee, *College of Engineering*, UC Berkeley (September 2003 – May 2005)
- Selection Committee for the Toxics Substances Research and Training Program’s Fellowship Program, UC Berkeley (2001 – 2003)

CEE Departmental Committee Membership:

- Executive Committee (Fall 2007 – present)
- Member, Ad Hoc Faculty Appointment Committee (2008)
- Chair, Ad Hoc Tenure Committee (2007)
- Chair, Ecological/Water Resources Engineering Faculty Search Committee (2005 – 2006)
- Curriculum Committee (Spring and Fall 2008)
- Strategic Planning Committee (Fall 2004 – Fall 2006)
- Systems Program Committee (Fall 2002 – present)
- Infrastructure Systems Faculty Search Committee (2003 – 2004)
- Undergraduate Study Committee (Fall 2001 – Spring 2003)
- Committee for Information Technology/Systems Curriculum Development (Fall 2000 – Spring 2001)

Other Faculty Activities:

- Strategic Planning Committee, Energy and Resources Group, UC Berkeley (Fall 2008 – present)
- ASCE Student Chapter Faculty Advisor, UC Berkeley (Fall 2004 – Fall 2006)
- Affiliated Faculty, Energy and Resources Group, UC Berkeley (2000 – present)

- Graduate Admissions Committee, Energy and Resources Group (UC Berkeley, 2001, 2008), Civil and Environmental Engineering (Carnegie Mellon University, 1998 – 1999)

CURRENT PEER-REVIEWED JOURNAL SUBMISSIONS

- Horvath, A. (2009), "Life-cycle Assessment." In preparation for *Annual Review of Environment and Resources*, 34.
- Vieira, P. and Horvath, A. (2009), "BuiLCA – A Tool for Life-cycle Assessment of Commercial Buildings." In preparation for *Environmental Science & Technology*, ACS.
- Chester, M. and Horvath, A. (2009), "Comparison of Life-cycle Energy and Emissions Footprints of Passenger Transportation in Metropolitan Regions." Submitted for review to *Atmospheric Environment*.
- Sathaye, N., Horvath, A., and Madanat, S. (2008), "Unintended Impacts of Increased Truck Loads on Pavement Supply Chain Emissions." Submitted for review to *Transportation Research A*.
- Stokes, J. and Horvath, A. (2008), "Life-cycle Energy and Greenhouse Gas Effects of Water Supply." Submitted for review to *Environmental Science & Technology*.
- Stokes, J. and Horvath, A. (2008), "Life-cycle Assessment of Urban Water Provision in California." Submitted for review to *J. of Infrastructure Systems*, ASCE.

PEER-REVIEWED ARCHIVAL PUBLICATIONS (PDF versions: www.ce.berkeley.edu/~horvath/horvath_pub.html)

32. Chester, M. and Horvath, A. (2009), "Life-cycle Inventories for Automobiles, Buses, Trains and Aircraft."
31. Shehabi, A., Horvath, A., Tschudi, W., Gadgil, A., and Nazaroff, W. W. (2008), "Particle Concentrations in Data Centers." *Atmospheric Environment*, 42(24), pp. 5978-5990, DOI: <http://dx.doi.org/10.1016/j.atmosenv.2008.03.049>
30. Vieira, P., and Horvath, A. (2008), "Assessing the End-of-Life Impacts of Buildings." *Environmental Science & Technology*, 42(13), pp. 4663-4669, DOI: <http://dx.doi.org/10.1021/es0713451>
29. Murray, A., Horvath, A., and Nelson, K. (2008), "Hybrid Life-cycle Environmental and Cost Inventory of Sewage Sludge Treatment and End-Use Scenarios: A Case Study from China." *Environmental Science & Technology*, 42(9), pp. 3163-3169, DOI: <http://dx.doi.org/10.1021/es702256w>
28. Kitou, E., and Horvath, A. (2008), "External Air Pollution Costs of Telework." *Int. J. of Life Cycle Assessment*, 13(2), pp. 155-165, DOI: <http://dx.doi.org/10.1065/lca2007.06.338>
27. Facanha, C., and Horvath, A. (2007), "Evaluation of Life-cycle Air Emission Factors of Freight Transportation." *Environmental Science & Technology*, 41(20), pp. 7138-7144, DOI: <http://dx.doi.org/10.1021/es070989q>
26. Cicas, G., Hendrickson, C. T., Horvath, A., and Matthews, H. S. (2007), "A Regional Version of a U.S. Economic Input-Output Life-cycle Assessment Model." *Int. J. of Life Cycle Assessment*, 12(6), pp. 365-372, DOI: <http://dx.doi.org/10.1065/lca2007.04.318>
25. Humbert, S., Abeck, H., Bali, N., and Horvath, A. (2007), "Leadership in Energy and Environmental Design (LEED): A Critical Evaluation by LCA and Recommendations for Improvement." *Int. J. of Life Cycle Assessment*, Special Issue, pp. 46-57, DOI: <http://dx.doi.org/10.1065/lca2006.12.291>
24. Masanet, E., and Horvath, A. (2007), "Assessing the Benefits of Design for Recycling of Plastics in Electronics: A Case Study of Computer Enclosures." *Materials & Design*, 28(6), pp. 1801-1811, DOI: <http://dx.doi.org/10.1016/j.matdes.2006.04.022>
23. Guggemos, A., and Horvath, A. (2006), "Decision-Support Tool for Assessing the Environmental Effects of Constructing Commercial Buildings." *J. of Architectural Engineering*, ASCE, 12(4), pp. 187-195.
22. Stokes, J., and Horvath, A. (2006), "Life-cycle Energy Assessment of Alternative Water Supply Systems." *Int. J. of Life Cycle Assessment*, 11(5), pp. 335-343, DOI: <http://dx.doi.org/10.1065/lca2005.06.214>
21. Facanha, C., and Horvath, A. (2006), "Environmental Assessment of Freight Transportation in the U.S." *Int. J. of Life Cycle Assessment*, 11(4), pp. 229-239, DOI: <http://dx.doi.org/10.1065/lca2006.02.244>

20. Kitou, E., and Horvath, A. (2006), "Transportation Choices and Air Pollution Effects of Telework." *J. of Infrastructure Systems*, ASCE, 12(2), pp. 121-134.
19. Boughton, B., and Horvath, A. (2006), "Environmental Assessment of Shredder Residue Management." *Resources, Conservation and Recycling*, 47(1), pp. 1-25, DOI: <http://dx.doi.org/10.1016/j.resconrec.2005.09.002>
18. Junnila, S., Horvath, A., and Guggemos, A. (2006), "Life-cycle Assessment of Office Buildings in Europe and the U.S." *J. of Infrastructure Systems*, ASCE, 12(1), pp. 10-17.
17. Guggemos, A., and Horvath, A. (2005), "Comparison of Environmental Effects of Steel- and Concrete-Framed Buildings." *J. of Infrastructure Systems*, ASCE, 11(2), pp. 93-101.
16. Facanha, C., and Horvath, A. (2005), "Environmental Assessment of Logistics Outsourcing." *J. of Management in Engineering*, ASCE, 21(1), pp. 27-37.
15. Horvath, A. (2004), "Construction Materials and the Environment." *Annual Review of Environment and Resources*, 29, pp. 181-204.
14. Toffel, M. W., and Horvath, A. (2004), "Environmental Implications of Wireless Technologies: News Delivery and Business Meetings." *Environmental Science & Technology*, ACS, 38(11), pp. 2961-2970.
13. Suh, S., Lenzen, M., Treloar, G. J., Hondo, H., Horvath, A., Huppes, G., Joliet, O., Klann, U., Krewitt, W., Moriguchi, Y., Munksgaard, J., and Norris, G. (2004), "System Boundary Selection in Life-cycle Inventories Using Hybrid Approaches." *Environmental Science & Technology*, ACS, 38(3), pp. 657-664.
12. Boughton, B., and Horvath, A. (2004), "Environmental Assessment of Used Oil Management Methods." *Environmental Science & Technology*, ACS, 38(2), pp. 353-358.
11. Junnila, S., and Horvath, A. (2003), "Life-cycle Environmental Effects of an Office Building." *J. of Infrastructure Systems*, ASCE, 9(4), pp. 157-166.
10. Kitou, E., and Horvath, A. (2003), "Energy-related Emissions from Telework." *Environmental Science & Technology*, ACS, 37(16), pp. 3467-3475.
9. Guggemos, A., and Horvath, A. (2003), "Strategies of Extended Producer Responsibility for Buildings." *J. of Infrastructure Systems*, ASCE, 9(2), pp. 65-74.
8. Pacca, S., and Horvath, A. (2002), "Greenhouse Gas Emissions from Building and Operating Electric Power Plants in the Upper Colorado River Basin." *Environmental Science & Technology*, ACS, 36(14), pp. 3194-3200.
7. Matthews, H. S., Hendrickson, C. T., and Horvath, A. (2001), "External Costs of Air Emissions from Transportation." *J. of Infrastructure Systems*, ASCE, 7(1), pp. 111-117.
6. Rosenblum, J., Horvath, A., and Hendrickson, C. T. (2000), "Environmental Implications of Service Industries." *Environmental Science & Technology*, ACS, 34(22), pp. 4669-4676.
5. Hendrickson, C. T., and Horvath, A. (2000), "Resource Use and Environmental Emissions of U.S. Construction Sectors." *J. of Construction Engineering and Management*, ASCE, 126(1), pp. 38-44.
4. Horvath, A., and Hendrickson, C. T. (1998), "Steel vs. Steel-Reinforced Concrete Bridges: Environmental Assessment." *J. of Infrastructure Systems*, ASCE, 4(3), pp. 111-117.
3. Horvath, A., and Hendrickson, C. T. (1998), "A Comparison of the Environmental Implications of Asphalt and Steel-Reinforced Concrete Pavements." *Transportation Research Record*, NRC, No. 1626 (Environmental and Social Effects of Transportation), pp. 105-113.
2. Hendrickson, C. T., Horvath, A., Joshi, S., and Lave, L. B. (1998), "Economic Input-Output Models for Environmental Life-Cycle Assessment." *Environmental Science & Technology*, ACS, 32(4), pp. 184A-191A.
1. Horvath, A., Hendrickson, C. T., Lave, L. B., McMichael, F. C., and Wu, T-S. (1995), "Toxic Emissions Indices for Green Design and Inventory." Cover article, *Environmental Science & Technology*, ACS, 29(2), pp. 86-90.

EDITOR-REVIEWED JOURNAL PUBLICATIONS

- Borg, R. F., Gambatese, J., Haines, Jr., K., Hendrickson, C., Hinze, J., Horvath, A., Koehn, E., Moritz, S. L., Mass, M., and Haughney, R. A. (2003), "Rebuilding the World Trade Center." *Practice Periodical on Structural Design and Construction*, ASCE, 8(3), pp. 137-145.
- Hendrickson, C. T., Horvath, A., Lave, L. B., and McMichael, F. C. (1996), "New Markets for Old Materials." *TR News*, NRC, No. 184, pp. 32-35.

PEER-REVIEWED CONFERENCE PUBLICATIONS

- Shehabi, A., Ganguly, S., Traber, K., Price, H., Horvath, A., Nazarooff, W. W., Gadgil, A. J. (2008), "Energy Implications of Economizer Use in California Data Centers." *Proceedings of the ACEEE Conference*, Monterey, CA.
- Horvath, A. (2005), "Incorporating External Cost Valuation into Life-cycle Costing of Office Buildings." *Proceedings of the 9th International Conference on Structural Safety and Reliability (ICOSSAR)*, Rome, Italy.
- Guggemos, A., and Horvath, A. (2005), "Decision Support Tool for Environmental Analysis of Commercial Building Structures." *Proceedings of the 2005 Construction Research Congress*, ASCE, San Diego, CA.
- Stokes, J., and Horvath, A. (2004), "Life-cycle Assessment of a Desalination System in California." *Proceedings of the 2004 A&WMA Annual Meeting*, Indianapolis, IN.
- Guggemos, A., and Horvath, A. (2003), "Framework for Environmental Analysis of Commercial Building Structures." *Proceedings of the 2003 Construction Research Congress*, ASCE, Honolulu, HI.
- Kitou, E., Horvath, A., and Masanet, E. (2002), "Putting in Perspective the Contribution of Transportation to the Environmental Effects of Telework." *81st Transportation Research Board Conference*, Washington, D.C.
- Horvath, A. (2000), "Alternative Fuel Vehicles: Environmental and Economic Effects of Infrastructural Requirements." *Proceedings of the 2000 SAE Total Life Cycle Conference*, Detroit, MI.
- Lave, L., MacLean, H., Lankey, R., Joshi, S., Horvath, A., and Hendrickson, C. (2000), "Life Cycle Inventories of Conventional and Alternative Automobile Fuel/Propulsion Systems: Summary & Conclusions." *Proceedings of the 2000 SAE Total Life Cycle Conference*, Detroit, MI.
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- Weisskoff, R., Englehardt, J. D., Lave, L. B., and Horvath, A. (1998), "An Input-Output Analysis of Ecosystem Restoration: The Missing Piece." Plenary paper, *12th International Input-Output Conference*, New York, NY.
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- Humbert, S. and Horvath, A. (2006), "Characterization Factors for Primary Particulate Matter: Re-evaluation Incorporating Air Pollutant Dynamics." *SETAC North America 27th Annual Meeting*, Montreal, Canada

- Humbert, S. and Horvath, A. (2006), "Geographically Differentiated LCIA in North America: Influence of the Scale for Assessing the Impacts of Power Plant Emissions." *SETAC North America 27th Annual Meeting*, Montreal, Canada
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- Horvath, A., and Stokes, J. (2005), "Evaluating Life-cycle Environmental Implications of Water Supply Systems." *3rd Conference of the International Society for Industrial Ecology*, Stockholm, Sweden
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- Kitou, E., and Horvath, A. (2003), "Telecommuting and Air Pollution." *2nd Conference of the International Society for Industrial Ecology*, Ann Arbor, MI
- Pacca, S., and Horvath, A. (2003), "Life-cycle Assessment of Global Impacts from Electricity Generation Technologies." *2nd Conference of the International Society for Industrial Ecology*, Ann Arbor, MI.
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- Horvath, A. (2002), "Integrating Input-Output Analysis and Process Life-Cycle Assessment." *SETAC Europe 12th Annual Meeting*, Vienna, Austria
- Kitou, E., Horvath, A., and Masanet, E. (2001), "The Environmental Benefits and Costs of Telework." *1st Conference of the International Society for Industrial Ecology "The Science and Culture of Industrial Ecology"*, Leiden, The Netherlands
- Ng, C., Bergman, K., Graham-Brown, C., Farber, R., and Horvath, A. (2001), "Tourism and Environmental Impacts: A Look at Sustainability." *1st Conference of the International Society for Industrial Ecology "The Science and Culture of Industrial Ecology"*, Leiden, The Netherlands

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- Horvath, A. (2006), "Ecoefficiency in Information and Communication Technology: The State of Knowledge in the United States." *The Seventh International Conference on Ecobalance*, Tsukuba, Japan.
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- Hendrickson, C. T. and Horvath, A. (1997), "Infrastructure Obsolescence and Design Service Life." Discussion, *J. of Infrastructure Systems*, ASCE, 3(3), p. 127.
- Lave, L. B., Conway-Schempf, N., and Horvath, A. (1997), "Eastman Kodak - Implementation of Total Quality Environmental Management." Case Study and Teaching Notes, *World Resources Institute – Management Institute for the Environment and Business*, Washington, D.C.

PEER-REVIEWED POSTER PRESENTATIONS

- Humbert, S., and Horvath, A. (2006), "Life-cycle Assessment of Fly Ash Concrete." *SETAC Europe 16th Annual Meeting*, The Hague, The Netherlands.
- Horvath, A., and Vieira, P. (2005), "Life-cycle Assessment of Commercial Buildings: Development of a Comprehensive Tool." *3rd Conference of the International Society for Industrial Ecology*, Stockholm, Sweden.
- Marshall, J., Kyosai, T., Poomontree, C., Kane, M., and Horvath, A. (2001), "The 10 (or 20) Million Dollar Question: Can Airlines Recycle Their Aluminum Beverage Cans?" *1st Conference of the International Society for Industrial Ecology "The Science and Culture of Industrial Ecology."* Leiden, The Netherlands.
- *1994 TRI Data Use Conference*, Boston, MA, December 1994

THESES

- "Estimation of Environmental Implications of Construction Materials and Designs Using Life Cycle Assessment Techniques," Unpublished Ph.D. thesis, *Carnegie Mellon University*, June 1997
- "Toxic Emission Indices for Green Design and Inventories," Unpublished M. S. thesis, *Carnegie Mellon University*, January 1995

INVITED PRESENTATIONS

- "Environmental Life-cycle Assessment." EBI Seminar, UC Berkeley, December 2008
- "Technology for Energy-Efficient Buildings." *ESF-NSF Workshop on the Applications of Adaptive Structures and Materials to Sustainable Energy and the Built Environment*, European Science Foundation-National Science Foundation, Morgon, France (October 2008)
- "Ecological Footprint and Life-cycle Assessment: How to Save the World – Corporate Strategies in the U.S. and Carbon-Constrained Product Development in the European Union." (in Hungarian) *Human-Centered Efficiency Development Conference*, TEQUA – TÜV Akademie, Balatonfüred, Hungary (September 2008)
- "Overview of Fuels LCA Principles." *Measuring and Modeling the Lifecycle GHG Impacts of Transportation Fuels*, EDF-EBI-ERG Workshop, UC Berkeley (July 2008)
- "Carbon Labeling." Closing Plenary Panel, *2008 IEEE International Symposium on Electronics and the Environment*, Burlingame, CA (May 2008)
- "Driving Sustainable Consumption through Environmental Accounting of Retail Goods and Services." *CITRIS Research Exchange*, UC Berkeley (October 2007)
- "Life-cycle Assessment for Retail Climate Change Mitigation." *California Air Resource Board Chair's Air Pollution Seminar Series*, Sacramento, CA (August 2007)
- "Sustainability, Infrastructure, and Communities." Finnish Funding Agency for Technology and Innovation (TEKES), Helsinki (February 2007)
- "Engineering and Management for Sustainability: Ideas for the Way Forward." *CITRIS Research Exchange*, UC Berkeley (January 2007)
- "Byproducts and Industrial Ecology." *2006 Byproducts Beneficial Use Summit*, San Francisco, CA (November 2006)

- "Ecoefficiency in Information and Communication Technology: The State of Knowledge in the United States." *The Seventh International Conference on Ecobalance*, Tsukuba, Japan (November 2006)
- "Roadmaps and Roadblocks: The Present and Future of Infrastructure Materials, Processes, and the Environment." *5th Gordon Research Conference on Industrial Ecology*, Oxford, England (August 2006)
- "Life-cycle Assessment Workshop." *Western Regional Pollution Prevention Network Annual P2 Conference*, Tahoe City, CA (September 2005)
- "Life-cycle Environmental Assessment of Infrastructure Systems." *Institute of Transportation Studies, UC Davis* (February 2005)
- "Life-cycle Assessment." *Bechtel Corporation*, San Francisco (January 2005)
- "Life-cycle Assessment." Departmental Seminar, *Department of Nuclear Engineering, UC Berkeley* (December 2004)
- "Sustainability Education at the University of California, Berkeley." *2003 ASCE Civil Engineering Conference & Exposition*, Nashville, TN (November 2003)
- "Applications of Input-Output Analysis in Industrial Ecology." Panelist, *2nd Conference of the International Society for Industrial Ecology*, Ann Arbor, MI (June 2003)
- "Decision-Support Tool for Life-cycle Assessment of Pavements." *Transportation Research Board Summer Workshop "Beneficial Use, Sustainability, and Pollution Prevention in Transportation Infrastructure"*, Portsmouth, NH (June 2003).
- "Environmental Impacts of Telework." *International Symposium on Information Technology and the Environment*, Tokyo, Japan (September 2002)
- "Sustainable Construction." *Department of Civil and Environmental Engineering, Technical University of Lisbon*, Portugal (July 2002)
- "Hybrid Models for Life-Cycle Assessment." *3rd Gordon Research Conference on Industrial Ecology*, New London, NH (June 2002)
- "Life Cycle Assessment of Civil Infrastructure Systems." General Session address, *2001 Annual Meeting of the Asphalt Emulsion Manufacturers Association and the Asphalt Recycling and Reclaiming Association*, San Diego, CA (February 2001)
- "Life Cycle Assessment of Civil Infrastructure Systems." Keynote address, *Partnerships for Sustainability: A New Approach to Highway Materials Conference*, Houston, TX (October 2000)
- "Life Cycle Assessment of Civil Infrastructure Systems." *Army Environmental Policy Institute*, Atlanta, GA (September 2000)
- "Life Cycle Assessment." *2nd Gordon Research Conference on Industrial Ecology*, New London, NH (June 2000)
- "Life-cycle Economic and Environmental Assessment." *2000 National Manufacturing Week Conference*, Chicago, IL (March 2000)
- "Infrastructure Systems and Environmental Analysis." *Department of Civil and Environmental Engineering, Massachusetts Institute of Technology*, Boston, MA (May 1999)
- "Infrastructure Systems and Environmental Analysis." *Department of Civil and Environmental Engineering, Cornell University*, Ithaca, NY (April 1999)
- "Market Potential for Onboard Data Logs in Passenger Cars." *Bosch GmbH*, Stuttgart, Germany (April 1999)
- "Infrastructure Systems, Construction, and Environmental Analysis." *Department of Civil and Environmental Engineering, University of California, Berkeley*, CA (March 1999)
- "Infrastructure Systems and Environmental Analysis." *Department of Civil and Environmental Engineering, University of Maryland*, College Park, MD (March 1999)
- "Material Flows in the Construction Industry." *1st Gordon Research Conference on Industrial Ecology*, New London, NH (June 1998)

- "Input-Output Analysis-Based Life-Cycle Assessment." *General Electric Corp. Environmental Labs*, Schenectady, NY (February 1998).
- "Materials Embedded in Products." *National Research Council Workshop on Materials Flows Accounting of Natural Resources, Products and Residues*, National Academy of Sciences, Washington, D.C. (January 1998)
- "Life-Cycle Assessment." *AIChE Center for Waste Reduction Technologies, Sustainability Metrics Workshop*, Washington, D.C. (September 1997)
- "Environmental Performance Measurement and Life-Cycle Assessment." *General Electric Corp. Environmental Labs*, Schenectady, NY (February 1997)
- "Environmental Performance Measurement." *1996 IBM Environmental Managers Worldwide Meeting*, Washington, D.C. (March 1996).

CONFERENCE PRESENTATIONS

- "Incorporating External Cost Valuation into Life-cycle Costing of Office Buildings." *Proceedings of the 9th International Conference on Structural Safety and Reliability (ICOSSAR)*, Rome, Italy (June 2005)
- "Evaluating Life-cycle Environmental Implications of Water Supply Systems." *3rd Conference of the International Society for Industrial Ecology*, Stockholm, Sweden (June 2005)
- "Life-cycle Environmental Accounting and Decision-Making for Bridge Structures." *2004 ASCE Structures Congress and Exposition*, Nashville, TN (May 2004)
- "Identifying Environmentally and Economically Sound Take-Back Strategies for Plastics from End-of-Life Electronics." *SETAC Europe 14th Annual Meeting*, Prague, Czech Republic (April 2004)
- "Global Warming Effect Assessment in the Electricity Sector Using Hybrid Life-cycle Inventory Assessment." *International Conference on Life Cycle Assessment/Life Cycle Management*, Seattle, WA (September 2003).
- "Integrating Input-Output Analysis and Process Life-Cycle Assessment." *SETAC Europe 12th Annual Meeting*, Vienna, Austria (May 2002)
- "Life-Cycle Assessment of Pavements." *Beneficial Use of Recycled Materials for Transportation Applications Conference*, Washington, DC (November 2001)
- "Environmental Assessment of Asphalt versus Concrete Pavements." *2nd International Symposium on Transportation Infrastructure Management*, Berkeley, CA (October 2001)
- "Life Cycle Assessment for Transportation Applications." *University of Tottori – UC Berkeley Annual Transportation Conference*, Tottori, Japan (June 2001)
- "Life Cycle Assessment in the Service Industries." *AIChE 2000 Annual Meeting*, Los Angeles, CA (November 2000)
- "LCA in the Service Industries: A Case Study of Telecommunications." *U.S. EPA International Conference on Life Cycle Assessment*, Arlington, VA (April 2000)
- "Alternative Fuel Vehicles: Environmental and Economic Effects of Infrastructural Requirements." *2000 SAE Total Life Cycle Conference*, Detroit, MI (April 2000)
- "Hybrid Models for Life-Cycle Assessment." *1999 SETAC Annual Conference*, Philadelphia, PA (November 1999)
- *1999 IEEE International Symposium on Electronics and the Environment*, Danvers, MA (May 1999)
- *77th Transportation Research Board Conference*, Washington, D.C. (January 1998)
- *1996 IEEE International Symposium on Electronics and the Environment*, Dallas, TX (May 1996)
- *75th Transportation Research Board Conference*, Washington, D.C. (January 1996)
- *1995 ASME International Congress and Exposition*, San Francisco, CA (November 1995)

MEMBERSHIPS

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EDUCATION

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M.A. in Economics, May 1998
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Beijing University, Beijing, P.R. CHINA
B.S. in Physics, July 1996, Graduation with Excellence
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TEACHING

University of California at Berkeley, Department of Civil and Environmental Engineering
CE259: Public Transportation Systems, Lecturer 2005-07

RESEARCH

Deputy Director, Apr. 2006 - Present
Berkeley Center for Future Urban Transport, University of California at Berkeley

Assistant Research Engineer, July 2005 - Present
California Partners for Advanced Transit and Highways, University of California at Berkeley

Visiting Postdoctoral Scholar, Oct. 2004 - Jun. 2005
Institute of Transportation Studies, University of California at Berkeley

INDUSTRY EXPERIENCE

C. H. Robinson Worldwide, Operations & Marketing Research Analyst, Jul. 1997- Apr. 1998

PUBLICATIONS

Refereed Journal Papers

- Li, Y. and Cassidy, M., *A Generalized and Efficient Algorithm for Estimating Transit Route ODs from Passenger Counts*, Transportation Research Part B: Methodological, Volume 41, Issue 1, January 2007, Pages 114-125
- Li, Y. and Madanat, S., *A steady-state solution for the optimal pavement resurfacing problem*, Transportation Research Part A: Policy and Practice, Volume 36, Issue 6, July 2002, Pages 525-535

Refereed Conference Papers

- Ban, X., Li, Y. and Skabardonis, A., *Performance Evaluation of Travel Time Methods for Real Time Traffic Applications*, The 11th World Conference on Transportation Research, Berkeley, CA, USA, June 2007
- Ban, X., Li, Y. and Skabardonis, A., *Local MAD Method for Probe Vehicle Data Processing*, The 14th World Congress on Intelligent Transport Systems, Beijing, China, October 2007

Research Reports

- Miller, M., Novick, L., Li, Y. and Skabardonis, A., *San Diego I-15 Integrated Corridor Management (ICM) System: Phase I*, California PATH Research Report, UCB-ITS-PRR-2008-33, December 2008
- Li, Yue, Koonce, P., Li, M., Zhou, K., Li, Y., Beard, S., Zhang, W.B., Hegen, L., Hu, K., Skabardonis, A., and Sun, Z., *Transit Signal Priority Research Tools*, California PATH Research Report, UCB-ITS-PRR-2008-4, May 2008
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- Daganzo, C.F., Li, Y., Gonzales, E., Geroliminis, N., *City-Scale Transport Modeling: An Approach for Nairobi, Kenya*, Volvo Center Working Paper, UCB-ITS-VWP-2007-4, 2007
- Nakul, S.; Li, Y. ; Horvath, A. ; Madanat, S., *The Environmental Impacts of Logistics Systems and Options for Mitigation*, Volvo Center Working Paper, UCB-ITS-VWP-2006-4, 2006

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EDUCATION

Ph.D., Environmental Engineering Science 1993
California Institute of Technology, Pasadena
Thesis: Mathematical modeling of gas-phase organic air pollutants

M.S., Environmental Engineering Science 1988
California Institute of Technology, Pasadena

B.A.Sc. (with honors), Engineering Science, Chemical Option 1987
University of Toronto

RESEARCH INTERESTS

Atmospheric modeling, measurements, and data analysis. Air quality model sensitivity and uncertainty analysis. Characterization and control of motor vehicle emissions.

AWARDS

Excellence in Review Award, *Environmental Science & Technology* 2006

Visiting Faculty Fellowship, CIRES, University of Colorado and 1999-2000
NOAA Aeronomy Laboratory, Boulder, Colorado

CAREER Development Award, National Science Foundation 1996-2001

PUBLIC AND PROFESSIONAL SERVICE

Member, NRC Committee on Vehicle Emissions Inspection & Maintenance, 2000-2001.

Reviewer, NRC Committee on Ozone-Forming Potential of Reformulated Gasoline, 1999.

Reviewer of Air Quality Management Plans for Los Angeles (1997, 2003, 2007)

Editorial Advisory Board, *Atmospheric Environment*, 1998-2002.

Integrated Human Exposure Committee, Science Advisory Board, U.S. EPA, 1996-2002.

Advisory Council, Bay Area Air Quality Management District, 1996-2003.

RECENT PUBLICATIONS (from 63 in peer-reviewed journals)

Ban-Weiss, G.A.; McLaughlin, J.P.; Harley, R.A.; Lunden, M.M.; Kirchstetter, T.W.; Kean, A.J.; Strawa, A.W.; Stevenson, E.D.; Kendall, G.R. (2008). Long-Term Changes in Emissions of Nitrogen Oxides and Particulate Matter from On-Road Gasoline and Diesel Vehicles. *Atmospheric Environment* **42**, 220-232.

Millstein, D.E.; Harley, R.A.; Hering, S.V. (2008). Weekly Cycles in Fine Particulate Nitrate. *Atmospheric Environment* **42**, 632-641.

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Jin, L.; Tonse, S.; Cohan, D.S.; Mao, X.; Harley, R.A.; Brown, N.J. (2008). Direct Sensitivity Analysis of Ozone Formation and Transport in California's San Joaquin Valley. *Environmental Science & Technology* **42**, 3683-3689.

Tonse, S.R.; Brown, N.J.; Jin, L.; Harley, R.A. (2008). A Process-Analysis Based Study of the Ozone Weekend Effect. *Atmospheric Environment* **42**, 7728-7736.

Ban-Weiss, G.A.; McLaughlin, J.P.; Harley, R.A.; Kean, A.J.; Grosjean, E.; Grosjean, D. (2008). Carbonyl and Nitrogen Dioxide Emissions from Gasoline- and Diesel-Powered Motor Vehicles. *Environmental Science & Technology* **42**, 3944-3950.

Kean, A.J.; Ban-Weiss, G.A.; Harley, R.A.; Kirchstetter, T.W.; Lunden, M.M. (2009). Trends in On-Road Vehicle Emissions of Ammonia. *Atmospheric Environment* **43**, 1565-1570.

Millstein, D.E.; Harley, R.A. (2009). Effects of climate change on air quality in southern California. *Atmospheric Chemistry and Physics Discussions* **9**, 1561-1583.

Ban-Weiss, G.A.; Lunden, M.M.; Kirchstetter, T.W.; Harley, R.A. (2009). Measurement of Black Carbon and Particle Number Emission Factors from Individual Heavy-Duty Trucks. *Environmental Science & Technology* **43**, in press.

Ph.D. STUDENT SUPERVISION

Graduated: G.A. Ban-Weiss (2008), L. Jin (2008), P.T. Martien (2004), A.J. Kean (2002), L.C. Marr (2002), D.R. Black (2000), B.C. Singer (1998), T.W. Kirchstetter (1998).

Current: S.N. Shearer (2009), D.E. Millstein (2009), D. Gentner (2011), T. Dallman (2011), B. McDonald (2012).

SUSAN A. SHAHEEN, Ph.D.
Co-Director & Research Scientist

Transportation Sustainability Research Center (TSRC), University of California (UC), Berkeley;
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Susan Shaheen holds a joint research appointment at the Transportation Sustainability Research Center (TSRC) and at the Institute of Transportation Studies-Davis. She is co-director of the transportation track of the Energy Efficiency Center at UC Davis and was honored as the first Honda Distinguished Scholar in Transportation in 2000. In October 2007, Susan became a Research Director at TSRC. She served as the Policy & Behavioral Research Program Leader at California Partners for Advanced Transit and Highways from 2003 to 2007, and as a special assistant to the Director's Office of the California Department of Transportation from 2001 to 2004. She has a Ph.D. in ecology, focusing on technology management and the environmental aspects of transportation, from the University of California, Davis (1999) and a MS in public policy analysis from the University of Rochester (1990). She completed her post-doctoral studies on advanced public transportation systems at UC Berkeley in July 2001. She has earned a variety of honors, including two national research awards for her contributions to a carsharing pilot program (2001) and a smart parking field test (2005). In May 2007, she received the Berkeley Staff Assembly's "Excellence in Management" award in recognition of her leadership and mentorship. She has co-edited one book and authored over 30 journal articles and over 60 reports and proceedings articles. She is the chair of the Emerging and Innovative Public Transport and Technologies (AP020) Committee of the Transportation Research Board and served as the founding chair of the Carsharing/Station Car TRB Subcommittee from 1999 to 2004.

EDUCATION

Ph.D., University of California, Davis, Ecology with major emphasis on Technology Management and Environmental Aspects of Transportation (3.8 GPA), September 1999.
Dissertation: *Dynamics in Behavioral Adaptation to a Transportation Innovation: A Case Study of CarLink—A Smart Carsharing System.*

Thesis Committee: Daniel Sperling (chair), Ryuichi Kitamura, and Richard Walters.

French Proficiency Certificate, University of Paris, Sorbonne, 1990

MS, University of Rochester, Public Policy Analysis, 1990

Graduate Certificate in Constitutional History, University of Oxford, 1988 (English Speaking Union's Eisenhower Scholarship)

BA, Nazareth College, Political Science and English, 1988 (Magna Cum Laude)

AWARDS AND HONORS

- Madison's Who's Who Among Executives and Professionals, Honor's Edition, 2008-2009
- "Communication with John and Jane Public Competition" of the Transportation Research Board (TRB) for Video Transit Training for Older Travelers: Case Study of Rossmoor Senior Adult Community, January 2008.
- Berkeley Staff Assembly's Excellence in Management for "Leading by Mentorship and Example" Award, May 2007.
- Smart Parking Management Field Test "Best in ITS Research" Award, ITS America, May 2005.
- CarLink II Feature Article in League of California Cities' Magazine, *Western Cities*, Wins 2002 Cappie Award.
- CarLink II Pilot Project, American Association of State Highway Transportation Officials President's Award for Intermodal Transportation, December 2001.
- "Writing the Wrongs" Women's Transportation Seminar Conference Paper Competition, Shaheen's Paper, titled: "Commuter-Based Carsharing Experiments: Examining Market Potential," Featured 1st Among All Submittals for Presentation to Secretary Norman Mineta, May 2001.
- First Honda Distinguished Scholar in Transportation at UC Davis (Endowed Chair), 2000 to Present.
- UCTC Outstanding Graduate Student of the Year, 1995 (among all graduate students in California).

RESEARCH ACTIVITIES AT UNIVERSITY OF CALIFORNIA (1993 TO PRESENT)

- Developing and managing numerous innovative mobility research projects of over \$5 million including: smart parking management (transit and trucks), fuel cell and plug-in hybrid vehicles, carsharing, shared-use low speed modes linked to transit, older mobility, automated speed enforcement, and virtual weigh-in motion.
- Developed and leads behavioral research on alternative fuels, older mobility, and carsharing for BMW, AG, DaimlerBenz, DaimlerChrysler, Nissan, and Toyota Motor Company 1998 to Present.
- Served as the Policy and Behavioral Research program leader for California PATH, a statewide research program on intelligent transportation systems with approximately 20 active projects, on behalf of the the University of California and the California Department of Transportation, 2003 to 2007.
- Provided technical and policy advice to the California Department of Transportation Director's Office in the areas of intelligent transportation systems, carsharing, transit, alternative fuel vehicles, and university relations, 2001 to 2004.
- Designed research methodologies, wrote grant proposals, recruited public and private partners, and managed research and implementation teams for the \$2.5 million CarLink smart carsharing program, including CarLink I and II. Project partners included American Honda Motor Company, Inc.; the California Department of Transportation; the Bay Area Rapid Transit (BART) District; Caltrain; Stanford Business Park; Lawrence Livermore National Laboratory (LLNL); PATH; and the Institute of Transportation Studies-Davis. This project was basis of Shaheen's Ph.D. dissertation. 1998 to 2003.

- Conducted research on alternative fuels, intelligent transportation systems, and air quality conformity as a graduate student researcher at UC Davis from 1993 to 1999.

PROFESSIONAL ACTIVITIES

- Co-Leader of Transportation Track, Energy Efficiency Center, UC Davis, April 2006 to Present
- Research Associate, Mineta Transportation Institute, 2004 to Present
- Chair, Emerging and Innovative Public Transport Systems and Technologies (AP020), Transportation Research Board, 2004 to Present
- Member, Major Activity Circulation Systems and Their Performance (AP040), Transportation Research Board, 2008 to Present
- Mentor, College of Engineering Undergraduate Research Opportunities Program (UROP), 2002 to Present
- Member, Intelligent Transportation Systems (ITS) World Congress Program Committee, 2003 to Present
- Member, Governor's Environmental Action Working Group (California), 2004 to 2005
- Founding Chair, Carsharing and Station Car Subcommittee (AP020), Transportation Research Board, 1999 to 2004
- Scholarship Chair, Women's Transportation Seminar (WTS) Sacramento, 1996 to 1998

PROFESSIONAL EXPERIENCE

Energetics, Inc., Washington, DC, Research Associate (1991 to 1993)

Served as a consultant and a National Environmental Policy Act (NEPA) specialist to the U.S. Department of Energy (DOE) for two years. As a NEPA expert, Shaheen reviewed and prepared NEPA documentation, drafted DOE NEPA regulations, and developed environmental guidance and training materials for headquarters and the field.

ICF, Inc., Fairfax, VA, Research Associate (1990 to 1991)

Helped produce training materials for several offices of the Environmental Protection Agency (EPA) and the Los Alamos National Laboratory, including fact sheets, statistical presentations, and reports; prepared inventory of hazardous waste facilities for EPA's Office of Solid Waste; and compiled Notices of Deficiency in response to RCRA No-Migration Petitions.

University of Rochester, Research Assistant (1988 to 1990)

As research assistant, helped a non-governmental organization (Environmental Data Research Institute) develop and analyze an environmental grantmaking database; modeled gasoline prices for a range of station operators over time to determine the likelihood of price collusion; and developed and taught a resume writing class for graduate program in public policy analysis.

SELECTED PRESENTATIONS

Shaheen, Susan (2008). Invited Keynote Speech on Worldwide Carsharing: Past, Present, and Future. Low-Emission Vehicle and Innovative Urban Transportation Service Conference, Taipei, Taiwan, December.

Shaheen, Susan (2008). Invited Talk on Carbon Footprinting and Ecodriving. 15th ITS World Congress, New York City, New York, November.

Shaheen, Susan (2008). Invited Talk on The Look of Carsharing Today and Across North America and Abroad. The Transportation – Land Use – Environment Connection, Lake Arrowhead, California, October.

Shaheen, Susan (2008). Invited Talk on Summary of Expert Interviews and Regional Workshops on Land Use Transportation and Climate Change. 2008 ARB Haagen-Smit Symposium, Aptos, California, April.

Shaheen, Susan (2007). Invited Talk on Dynamics in Behavioral Response to A Fuel Cell Vehicle Fleet and Hydrogen Fueling Infrastructure: An Exploratory Study. Energy and Resources Group Seminar, Berkeley, California, October.

Shaheen, Susan (2007). Video Transit Training for Older Travelers: A Case Study of Rossmoor Senior Adult Community, California. Paper # 07-2526. 86th Annual TRB Meeting, Washington, D.C., January.

Shaheen, Susan (2006). "Worldwide Carsharing," Caltrans Research Connections Series (presented statewide). Sacramento, California, September.

Shaheen, Susan (2004). "Carsharing & Innovative Mobility Strategies: From Concept to Real-World Results," *Key Note Speeches at Reinventing the Private Car: Changing Personal Mobility in the 21st Century Conferences*. Sydney and Melbourne, Australia, November.

BOOKS, PAPERS, AND REPORTS

Shaheen, Susan, Elliot Martin, and Timothy Lipman (2008). "Dynamics in Behavioral Response to Fuel-Cell Vehicle Fleet and Hydrogen Fueling Infrastructure: An Exploratory Study," *Transportation Research Record*, No. 2058, pp 155-162.

Shaheen, Susan and Charlene Kemmerer (2008). "Smart Parking Linked to Transit: Lessons Learned from Field Test in San Francisco Bay Area of California," *Transportation Research Record*, No. 2063, pp. 73-80.

Rodier, Caroline and Susan Shaheen (2008). "Transit-Based Smart Parking: An Evaluation of the San Francisco Bay Area Field Test," *Transportation Research C*. Publication Forthcoming.

Shaheen, Susan and Kamill Wipyewski (2008). "CarLink—A Commuter Carsharing Model: Conditions for Economic Viability," Submitted to *Transportation Research A*.

Rodier, Caroline and Susan Shaheen (2008). *EasyConnect: Low-Speed Modes Linked to Public Transit Field Test Results*. UCB-ITS-PRR-2008-17. Berkeley, California. October, 72 pp.

Shaheen, Susan, Adam Cohen, and Melissa Chung (2008). "North American Carsharing: A Ten-Year Retrospective," Transportation Research Board for 2009 Annual Meeting, Washington, D.C.

Shaheen, Susan, Denise Allen, and Judy Liu (2008). "Public Transit Training: A Mechanism to Increase Ridership Among Older Adults," Transportation Research Board for 2009 Annual Meeting, Washington, D.C.

Stillwater, Tai, Patricia Mokhtarian, and Susan Shaheen (2008). "Carsharing and the Built Environment: A GIS-Based Study of One U.S. Operator," Transportation Research Board for 2009 Annual Meeting, Washington, D.C.

Martin, Elliot, Susan Shaheen, Timothy Lipman, and Jeffrey Lidicker (2008). "Behavioral Response to Hydrogen Fuel Cell Vehicles and Refueling: A Comparative Analysis of Short- and Long-Term Exposure," Transportation Research Board for 2009 Annual Meeting, Washington, D.C.

Blake, Tagan, Caroline Rodier, and Susan Shaheen (2008). "Smart Parking Pilot on the Coaster Commuter Rail Line in San Diego, California," Transportation Research Board for 2009 Annual Meeting, Washington, D.C.

Caroline Rodier, Susan Shaheen, and Charlene Kemmerer (2008). *Smart Parking Management Field Test: A Bay Area Rapid Transit (BART) District Parking Demonstration Final Report*. UCB-ITS-PRR-2008-5. Berkeley, California. June, 46 pp.

Shaheen, Susan and Elliot Martin (2008). "Demand for Carsharing Services in China: An Assessment of Shared-Use Vehicle Market Potential in Beijing," *International Journal of Sustainable Transportation*, Publication Forthcoming.

Shaheen, Susan and Elliot Martin (2008). "Greenhouse Gas Emission Impacts of Carsharing: Theory, Methodology, and Preliminary Insights," 15th ITS World Congress, New York City, November, 12 pp.

Blake, Tagan, Caroline Rodier, and Susan Shaheen (2008). "Smart Parking Pilot on the Coaster Commuter Rail Line in San Diego, California," 15th ITS World Congress, New York City, November, 12 pp.

Cohen, Adam, Susan Shaheen, and Ryan McKenzie (2008). "Carsharing: A Guide for Local Planners," *American Planning Association PAS Memo*. May/June, 11 pp.

Karash, Karla H., Matthew A. Coogan, Thomas Adler, Chris Cluett, Susan A. Shaheen, Icek Aizen, and Monica Simon (2008). *Understanding How Individuals Make Travel and Location Decisions: Implications for Public Transportation*. TCRP Report 123. Transportation Research Board. Washington, D.C.

Shaheen, Susan and Charlene Kemmerer (2007). "Smarter Parking at Transit Stations," *Access*. Volume 31, Fall, pp. 27-33.

Shaheen, Susan and Caroline Rodier (2007). "Video Transit Training for Older Travelers: Case Study of the Rossmoor Senior Adult Community, Walnut Creek, California," *Transportation Research Record* No. 2034, pp. 11-18.

Shaheen, Susan and Adam Cohen (2007). "Worldwide Carsharing Growth: An International Comparison," *Transportation Research Record* No. 1992, pp. 81-89.

Rodier, Caroline, Susan Shaheen, and Ellen Cavanagh (2007). *Automated Speed Enforcement for California: A Review of Legal and Institutional Issues*. UCB-ITS-PRR-2007-14. Berkeley, California, September, 39 pp.

Bloomenberg, Evelyn, Moira Donahue, Susan Handy, Kristin Lovejoy, Caroline Rodier, Susan Shaheen, and James Volker (2007). *Travel of Diverse Populations: Literature Review*. UCB-ITS-PWP-2007-05. Berkeley, California, September, 105 pp.

Shaheen, Susan and Elliot Martin (2007). "Assessing Early Market Potential for Carsharing in China: Case Study of Beijing," Transportation Research Board for 2008 Annual Meeting, Washington, D.C.

Rodier, Caroline, Susan Shaheen, and Ellen Cavanagh (2007). "Automated Speed Enforcement in the U.S.: A Review of the Literature on Benefits and Implementation," Transportation Research Board for 2008 Annual Meeting, Washington, D.C.

Rodier, Caroline and Susan Shaheen (2007). "Commercial Vehicle Parking in California: Exploratory Evaluation of the Problem and Possible Technology-Based Solutions," Transportation Research Board for 2008 Annual Meeting, Washington, D.C.

Caroline Rodier and Susan Shaheen (2007). *Commercial Vehicle Parking in California: Exploratory Evaluation of the Problem and Possible Technology-Based Solutions*. UCB-ITS-PRR-2007-11. Berkeley, California. August, 18 pp.

Shaheen, Susan and Timothy Lipman (2007). "Reducing Greenhouse Gas Emissions and Fuel Consumption: Sustainable Approaches for Surface Transportation," *Journal of International Association of Traffic and Safety Sciences (IATSS) Research*. Vol. 31, No. 1, pp. 6-20.

Finson, Rachel, Virginia Lingham, and Susan Shaheen (2007). *Innovative Corridors Initiative: Business Model Analysis*. UCB-ITS-CWP-2007-13. Berkeley, California. September, 63 pp.

Finson, Rachel, Cynthia McCormick, and Susan Shaheen (2007). *Innovative Corridors Initiative: Call for Submission Process and Evaluation*. UCB-CWP-2007-10. Berkeley, California. March, 84 pp.

Shaheen, Susan and Caroline Rodier (2007). "Smart Parking Management Linked to Transit," Research Pays Off, *TR News*, No. 251. July - August, pp. 30-31.

Shaheen, Susan and Elliot Martin (2007). "Demand for Carsharing Systems in China: An Assessment of Carsharing Market Potential in Beijing," WCTR Conference, Berkeley, California, June.

Caroline Rodier and Susan Shaheen (2007). "Transit-Based Smart Parking: A Before-And-After Evaluation of Field Test Results," WCTR Conference, Berkeley, California, June.

Shaheen, Susan (2006). "Carsharing Continues to Gain Momentum," *Vital Signs 2006-2007*. New York, New York: Worldwatch Institute.

Shaheen, Susan, Adam Cohen, and J. Darius Roberts (2006). "Carsharing in North America: Market Growth, Current Developments, and Future Potential," *Transportation Research Record* No. 1986, pp. 106-115.

Barth, Matthew, Susan Shaheen, Tuenjai Fukuda, and Atshushi Fukuda (2006). "Carsharing and Station Cars in Asia: An Overview of Japan and Singapore," *Transportation Research Record* No. 1986, pp. 116-124.

Rodier, Caroline, Susan Shaheen, and Ellen Cavanagh (2006). "Virtual Commercial Vehicle Compliance Stations: A Review of Legal and Institutional Issues," *Transportation Research Record* No. 1966, pp. 126-132.

Susan Shaheen and Elliot Martin (2006). "Carsharing Market Potential in China: A Case Study of Beijing," *13th World Congress on Intelligent Transportation Systems*, London, England. October, 8 pp.

Rodier, Caroline, Susan Shaheen, and Megan Smirti (2006). "Transit-Based Smart Parking in the U.S.: Behavioral Analysis of San Francisco Bay Area Field Test," *13th World Congress on Intelligent Transportation Systems*, London, England. October, 8 pp.

Barth, Matthew and Susan Shaheen (2006). "Policy and Behavioral Research at California Partners for Advanced Transit and Highways (PATH)," *9th International IEEE Conference on Intelligent Transportation Systems (ITSC 2006)*, Toronto, Canada, September, 6 pp.

Shaheen, Susan and Caroline Rodier (2006). *Smart Parking Management Field Test: A Bay Area Rapid Transit (BART) District Parking Demonstration Interim Report*. UCB-ITS-PWP-2006-10. Berkeley, California. August, 82 pp.

Shaheen, Susan and Caroline Rodier (2006). *EasyConnect: Low-Speed Modes Linked to Transit Planning Project*. UCB-PWP-2006-7. Berkeley, California. July, 15 pp.

Todd, Michael, Matthew Barth, Michael Eichler, Carlos Daganzo, and Susan Shaheen (2006). *Enhanced Transit Strategies: Bus Lanes with Intermittent Priority and ITS Technology*

Architectures for TOD Enhancements. UCB-ITS-PRR-2006-02. Berkeley, California. February, 108 pp.

Shaheen, Susan and Caroline Rodier (2006). "EasyConnect II: Integrating Transportation, Information, and Energy Technologies at Transit Oriented Developments," *Transportation Research Board 85th Annual Meeting*, Washington, D.C. Paper No. 06-1735.

Rodier, Caroline and Susan Shaheen (2006). "Transit-Based Smart Parking: Early Field Test Results," *Transportation Research Board 85th Annual Meeting*, Washington, D.C. Paper No. 06-2304.

Shaheen, Susan and Linda Novick (2005). "Framework for Testing Innovative Transportation Solutions: Case Study of CarLink, A Commuter Carsharing Program," *Transportation Research Record* No. 1927, pp. 149-157.

Rodier, Caroline, Susan Shaheen, and Amanda Eaken (2005). "Transit-Based Smart Parking in the San Francisco Bay Area, California: Assessment of User Demand and Behavioral Effects," *Transportation Research Record* No. 1927, pp. 167-173.

Shaheen, Susan and Caroline Rodier (2005). "Travel Effects of A Suburban Commuter Carsharing Service: A CarLink Case Study," *Transportation Research Record* No. 1927, pp. 182-188.

Shaheen, Susan, Caroline Rodier, and Amanda Eaken (2005). "Improving Bay Area Rapid Transit District Connectivity and Access with the Segway Human Transporter and Other Low-Speed Mobility Devices," *Transportation Research Record* No. 1927, pp. 189-194.

Rodier, Caroline, Susan Shaheen, and Ellen Cavanagh (2005). *Virtual Commercial Vehicle Control Stations for California: A Review of Legal and Institutional Issues*. UCB-ITS-PRR-2005-33. Berkeley, California. November, 21 pp.

Shaheen, Susan, Adam Cohen, and Darius Roberts (2005). "Carsharing in North America: Market Growth, Current Developments, and Future Potential," *12th World Congress on Intelligent Transportation Systems*, San Francisco, California. November, 12 pp.

Shaheen, Susan, Caroline Rodier, and Joshua Seelig (2005). "EasyConnect II: Integrating Transportation, Information, and Energy Technologies at Transit Oriented Developments" *12th World Congress on Intelligent Transportation Systems*, San Francisco, California. November, 10 pp.

Rodier, Caroline and Susan Shaheen (2005). "Virtual Commercial Vehicle Compliance Stations for California: A Review of Legal and Institutional Barriers," *ITS World Congress*, San Francisco, California. November, 14 pp.

Rodier, Caroline and Susan Shaheen (2005). "Smart Parking: Early Field Test Results," *ITS World Congress*, San Francisco, California. November, 9 pp.

Lipman, Timothy and Susan Shaheen (2005). *Integrated Hydrogen and Intelligent Transportation Systems Evaluation for the California Department of Transportation*. UCB-ITS-PRR-2005-34. Berkeley, California. November, 63 pp.

Shaheen, Susan, Caroline Rodier, and Amanda Eaken (2005). *Smart Parking Management Field Test: A Bay Area Rapid Transit (BART) District Parking Demonstration—Phase One Final Report*. Berkeley, California. UCB-ITS-PRR-2005-05, 124 pp.

Finson, Rachel, Susan Shaheen, and Cynthia McCormick (2004). *Initial Scoping of Bay Area Smart Mobility Corridors and ITS World Congress*. UCB-ITS-PWP-2004-09. Berkeley, California. November, 70 pp.

Shaheen, Susan, Caroline Rodier, and Amanda Eaken (2004). "Applying Integrated ITS Technologies to Parking Management Systems: A Transit-Based Case Study in the San Francisco Bay Area," *11th World Congress on Intelligent Transportation Systems*, Nagoya, Japan. October, 10 pp.

Finson, Rachel, Susan Shaheen, and Cynthia McCormick (2004). "Accelerating Deployment and Commercialization of ITS Technologies: California's Innovative Corridors Initiative," *11th World Congress on Intelligent Transportation Systems*, Nagoya, Japan. October, 8 pp.

Shaheen, Susan, Andrew Schwartz, and Kamill Wipyewski (2004). "Policy Considerations for Carsharing and Station Cars: Monitoring Growth, Trends, and Overall Impacts," *Transportation Research Record* No. 1887, pp. 128-136.

Shaheen, Susan, Kamill Wipyewski, Caroline Rodier, Linda Novick, Molly Anne Meyn, and John Wright (2004). *CarLink II: A Commuter Carsharing Pilot Program Final Report*. UCB-ITS-PRR-2004-23. Berkeley, California. August, 163 pp.

Caroline Rodier, Susan Shaheen, and Linda Novick (2004). *Improving Bay Area Rapid Transit (BART) District Connectivity and Access with the Segway Human Transporter and Other Low Speed Mobility Devices*. UCB-ITS-PRR-2004-27. Berkeley, California. August, 77 pp.

Shaheen, Susan and Rachel Finson (2004). "Intelligent Transportation Systems." *Energy Encyclopedia, Volume 3*, pp. 487-496.

Rodier, Caroline and Susan Shaheen (2003). "Carsharing and Carfree Housing: Predicted Travel, Emission, and Economic Benefits. A Case Study of the Sacramento, California Region," *Transportation Research Board 83rd Annual Meeting*, Washington, D.C.

Rodier, Caroline, Susan Shaheen, and Stephanie Chung (2003). "Unsafe at Any Speed?: What the Literature Says About Low-Speed Modes," *Transportation Research Board 83rd Annual Meeting*, Washington, D.C.

Shaheen, Susan and Kamill Wipyewski (2003). "Applying Integrated ITS Technologies to Carsharing System Management: A CarLink Case Study," *10th World Congress on Intelligent Transportation Systems*. Madrid, Spain. November, 11 pp.

Shaheen, Susan, Caroline Rodier, and Rachel Finson (2003). *University of California, Davis Long-Range Development Plan: A Davis Smart Mobility Model*. UCB-ITS-PRR-2003-28. Berkeley, California. October, 184 pp.

Shaheen, Susan A., MollyAnne Meyn, and Kamill Wipyewski (2003). "U.S. Shared-Use Vehicle Survey Findings: Opportunities and Obstacles for Carsharing and Station Car Growth," *Transportation Research Record* No. 1841, pp. 90-98.

Shaheen, Susan A. and Rachel Finson (2003). "Bridging the Last Mile: Study of Behavioral, Institutional, and Economic Potential of Segway Human Transporter," *Transportation Research Board 82nd Annual Meeting*, Washington, D.C. Paper No. 03-4470.

Barth, Matthew, Michael Todd, and Susan Shaheen (2003). "Examining Intelligent Transportation Technology Elements and Operational Methodologies for Shared-Use Vehicle Systems," *Transportation Research Record* No. 1841, pp. 99- 108.

Shaheen, Susan and Rachel Finson (2003). *Davis Smart Mobility Model: Initial Scoping and Planning Study*. UCB-ITS-PRR-2003-21. Berkeley, California. June, 36 pp.

Shaheen, Susan A., John Wright, and Daniel Sperling (2002). "California's Zero Emission Vehicle Mandate—Linking Clean Fuel Cars, Carsharing, and Station Car Strategies," *Transportation Research Record*. No. 1791, pp. 113-120.

Barth, Matthew and Susan Shaheen (2002). "Shared-Use Vehicle Systems: A Framework for Classifying Carsharing, Station Cars, and Combined Approaches," *Transportation Research Record*. No. 1791, pp. 105-112.

Shaheen, Susan A. (2002). Introduction. *Cool Careers for Girls as Environmentalists*. By Ceel Pasternak. Manassas Park, VA: Impact Publications. 129 pp.

Shaheen, Susan A. and MollyAnne Meyn (2002). "Shared-Use Vehicle Services: A Survey of North American Market Developments," *9th World Congress on Intelligent Transportation Systems*. Chicago, Illinois. October, 12 pp.

Shaheen, Susan and John Wright (2001). *CarLink II: Research Approach and Early Findings*. UCB-ITS-PRR-2001-39. Berkeley, California. December, 27 pp.

Finson, Rachel and Susan Shaheen (2001). *Evaluation of UC Davis Long Range Transportation, Land Use, and Housing Plans: Examining the Potential for Innovative Mobility Pilot Projects*. UCB-ITS-PWP-2001-18. Berkeley, California. December, 16 pp.

Shaheen, Susan A. (2001). "Commuter-Based Carsharing: Market Niche Potential," *Transportation Research Record*. No. 1760, 178-183.

Shaheen, Susan (2001). "Carsharing in the United States: Examining Market Potential," *8th World Congress on Intelligent Transportation Systems*. Sydney, Australia. October, 12 pp.

Shaheen, Susan A. and John Wright (2001). "The CarLink II Pilot Program: Testing A Commuter-Based Carsharing Model," *2001 IEEE Intelligent Transportation Systems Proceedings*. Oakland, California. August, pp. 1067-1072.

Shaheen, Susan and John Wright (2001). "The CarLink II Pilot Program: Examining the Viability of Transit-Based Carsharing," *ITS America Conference Proceedings*. Miami, Florida, May 11 pp.

Shaheen, Susan A. and Debbie Niemeier (2001). "Linking Technology and Design to Human Factors: Minimizing Vehicle Constraints for the Elderly," *Transportation Research Part C: Emerging Technologies*. Volume 9, Issue 3. June, pp. 155-174.

Shaheen, Susan and Robert Uyeki (2000). "CarLink Economics: An Empirically-Based Scenario Analysis," *7th World Congress on Intelligent Transportation Systems*. Turin, Italy. November, 8 pp.

Shaheen, Susan, John Wright, David Dick, and Linda Novick (2000). *CarLink—A Smart Carsharing System Field Test Report*. UCD-ITS-RR-00-4. Davis, California. May, 182 pp.

Shaheen, Susan (2000). "CarLink: A Smart Carsharing System—A Study of Behavioral Adaptation," *79th Annual Transportation Research Board*. Washington, D.C. January, 14 pp.

Sperling, Daniel and Susan Shaheen (1999). "Carsharing: Niche Market or New Pathway," Prepared for the ECMT/OECD *Workshop on Managing Car Use for Sustainable Urban Travel*, Dublin Ireland. December, 25 pp.

Young, Troy, Daniel Sperling, and Susan Shaheen (1999). *Identification and Prioritization of Environmentally Beneficial Intelligent Transportation Technologies: Modeling Effort*. UCB-ITS-PWP-99-20. Berkeley, California. December, 26 pp.

Shaheen, Susan (1999). "Pooled Cars," *Access*. Volume 15, Fall, pp. 20-25.

Shaheen, Susan (1999). *Dynamics in Behavioral Adaptation to a Transportation Innovation: A Case Study of CarLink—A Smart Carsharing System*. UCD-ITS-RR-99-16. Davis, California. October, 232 pp.

Shaheen, Susan (1999). "A Short History of Carsharing in the 90s," *The Journal of World Transport Policy & Practice*. Volume 5, Number 3. September, pp. 18-40.

Shaheen, Susan (1999). "CarLink—A Smart Carsharing System." *The Journal of World Transport Policy & Practice*. Volume 5, Number 3. September, pp. 121-128.

Shaheen, Susan, Daniel Sperling, and Conrad Wagner (1999). "Carsharing and Partnership Management: An International Perspective," *Transportation Research Record*. No. 1666, pp. 118-124.

Shaheen, Susan, Daniel Sperling, and Conrad Wagner (1998). "Carsharing in Europe and North America: Past, Present, and Future," *Transportation Quarterly*, Summer, pp. 35-52.

Wagner, Conrad and Susan Shaheen (1998). "Car Sharing and Mobility Management: Facing New Challenges with Technology and Innovative Business Planning," *World Transport Policy and Practice*. Volume 4, Number 2, pp. 39-43.

Shaheen, Susan, Daniel Sperling, and Victoria Nerenberg (1998). "Smart Car Linking in the San Francisco Bay Area: A Market Evaluation," *8th Annual Meeting of the Intelligent Transportation Society of America*. Detroit, Michigan. May, 12 pp.

Shaheen, Susan A., Troy Young, Daniel Sperling, Daniel Jordan, and Thomas Horan (1998). *Identification and Prioritization of Environmentally Beneficial Intelligent Transportation Technologies Year Two Final Report*. UCD-ITS-RR-98-1. Davis, California. March, 301 pp.

Guensler, Randall, Susan Shaheen, Francisca Mar, and Cameron Yee (1998). *Conformity Policy: Air Quality Impact Assessment for Local Transportation Policy*. UCD-ITS-RR-98-2. Davis, California. March, 149 pp.

Chang, Daniel, Kellie Dougherty, Bill Drumheller, and Susan Shaheen (1997). *Preliminary Assessment of Possible Changes to the National Ambient Air Quality Standards (NAAQS) for Ozone and Particulate Matter: Important Issues, Implications, and Impacts for California's Transportation Community*. Davis, California.

Sperling, Daniel and Susan A. Shaheen, editors. (1995). *Energy Strategies for a Sustainable Transportation System*. Washington, D.C.: American Council for an Energy Efficient Economy. 305 pp.

Shaheen, Susan A., Randall Guensler, and Francisca Mar. (1995). "Concurrent Air Quality Analysis Under the National Environmental Policy Act and Transportation/Air Quality Conformity," *Transportation Quarterly*, Fall, pp. 55-72.

CAROLINE J. RODIER, Ph.D.

CURRENT POSITION

Senior Researcher, Transportation Sustainability Research Center, Institute of Transportation Studies, University of California, Berkeley

EDUCATION

Ph.D., University of California, Davis, Ecology with major emphasis on Environmental Policy Analysis and Transportation Planning, 2000

Dissertation: Uncertainty in Travel and Emissions Models: A Case Study in the Sacramento Region. Dissertation Committee: Robert Johnston, Patricia Mokhtarian, James Cramer & David Layton

M.S., University of California, Davis, Community Development, 1994

B.A., Barnard College, Columbia University, U.S. History, 1989

RESEARCH ACTIVITIES AT UNIVERSITY OF CALIFORNIA (1992 TO PRESENT)

EVALUATION RESEARCH

- Apply research evaluation methods (observational, focus groups, and surveys) and conduct analyses to evaluate the travel, economic, and environmental effects of transportation and environmental policies (e.g., transit access technologies, social marketing, automated speed enforcement, and changeable message signs).
- Conduct analysis of institutional barriers and steps to overcome those barriers (including literature reviews and expert and stakeholder interviews) related to implementation and enforcement of transportation and air quality regulations.
- Investigate the transportation needs and preferences of diverse population groups, such as elderly, immigrants, and Native Americans, and explore innovative transportation programs to address those needs.

URBAN MODELING RESEARCH

- Research support to the California Air Resources Board in their development of the scoping plan for Assembly Bill 32, the *Global Warming Solutions Act*, including an international review of the modeling evidence on the effectiveness of transit, land use, and auto pricing strategies.
- Modeled and evaluated the travel, economic, and air quality effects of intelligent transportation systems technologies, high occupancy vehicle lanes, transit improvements, and road pricing and land use control measures using the Sacramento land use, travel, and emissions models.
- Apply methods of uncertainty analysis to assess errors in land use, travel, and emissions models due to model structure, population projections, and induced travel in the Sacramento region.

SELECTED EXPERT SERVICE/PROFESSIONAL ACTIVITIES

- Research Associate, the Mineta Transportation Institute
- Transportation Research Board, Integrated Transportation and Land-Use Modeling Subcommittee, Member, 2001 to present
- Transportation Research Board, New Public Transportation Technologies Committee, Friend, 2004 to present

SELECTED PUBLICATIONS

Rodier, Caroline (2009). An International Review of the Modeling Evidence on the Effectiveness of Transit, Land Use, and Auto Pricing Strategies. *Transportation Research Record Annual Meeting*. January.

Rodier, Caroline and Susan Shaheen (2007). *Commercial Vehicle Parking in California: Exploratory Evaluation of the Problem and Possible Technology-Based Solutions*. UCB-ITS-PRR-2007-11. Berkeley, California. August, 18 pp.

Rodier, Caroline, Susan Shaheen, and Ellen Cavanagh (2006). Virtual Commercial Vehicle Compliance Stations: A Review of Legal and Institutional Issues. *Transportation Research Record* No. 1966, pp. 126-132.

Rodier, C. J. (2007). Verifying the Accuracy of Land Use Models Used in Transportation and Air Quality Planning: A Case Study in the Sacramento, California Region. WCTR Annual Meeting, June.

Shaheen, S.A. and C.J. Rodier. (2007) Video Transit Training for Older Travelers: A Case Study of the Rossmoor Senior Adult Community, California. *Transportation Research Record* No. 2034, pp. 11-1889-194.

Rodier, Caroline, Susan Shaheen, and Amanda Eaken (2005). Transit-Based Smart Parking in the San Francisco Bay Area, California: Assessment of User Demand and Behavioral Effects, *Transportation Research Record* No. 1927, pp. 167-173.

Rodier, C. J. (2004). Verifying the Accuracy of Regional Models Used in Transportation and Air Quality Planning. *Transportation Research Record*, 1898, 45-51.

Rodier, C. J., R. A. Johnston, and D. R. Shabazian. (2003). Evaluation of advanced transit alternatives using consumer welfare. In *Transportation and Information Systems*. Cheltenham, England: Edward Elgar Publishing, 139-153.

Rodier, C. J. and R. A. Johnston. (2002). Uncertain socioeconomic projections used in travel and emissions models: could plausible errors result in air quality nonconformity? *Transportation Research A*, 36:613-631.

Hunt, J. D., R. A. Johnston, J. E. Abraham, C. J. Rodier, G. Garry, S. H. Putnam, and T. de la Barra. (2001). Comparisons from the Sacramento Model Testbed. *Transportation Research Record*, 1780, 53-63.

EXHIBIT B
BUDGET DETAIL AND PAYMENT PROVISIONS

1. Invoicing

- A. For services satisfactorily rendered in accordance with this Agreement and upon receipt and approval of the invoices which properly detail all charges the ARB agrees to compensate the Regents of the University of California, Berkeley, for actual expenditures incurred in accordance with the amount specified below and in Exhibit B, Attachment 1, which is incorporated into this agreement.

Total Contract amount not to exceed \$320,000.00

- B. Invoices shall include the Agreement Number and shall be submitted in triplicate not more frequently than quarterly in arrears to:

Air Resources Board
Accounting Section
P.O. Box 1436
Sacramento, CA 95812

- C. **BUDGET FLEXIBILITY:** Subject to the prior review and approval of the contract manager, line items shifts of up to \$25,000 or ten percent of the annual contract total, whichever is less, may be made up to a cumulative maximum of \$25,000 or 10%, whichever is less, for all line item shifts over the life of the contract. There must be a substantial business justification for any shifts made. Fund shifts which increase Indirect, Overhead or General Expense line items are prohibited. Line item shifts may be proposed/requested by either the State or the University in writing and must not increase or decrease the total contract amount allocated. Any line item shifts must be approved in writing by the Division Chief of Stationary Source Division or his or her designee, and must be sent to Contracts Section within 10 days of approval for inclusion in contract folder. If the contract is formally amended, any line item shifts agreed to by the parties must be included in the amendment.

2. Budget Contingency Clause

- A. It is mutually agreed that if the Budget Act of the current year and/or any subsequent years covered under this Agreement does not appropriate sufficient funds for the program, this Agreement shall be of no further force and effect. In this event, the State shall have no liability to pay any funds whatsoever to Contractor or to furnish any other considerations under this Agreement and Contractor shall not be obligated to perform any provisions of this Agreement.
- B. If funding for any fiscal year is reduced or deleted by the Budget Act for purposes of this program, the State shall have the option to either cancel this Agreement with no liability occurring to the State, or offer an agreement amendment to Contractor to reflect the reduced amount.

EXHIBIT B
BUDGET DETAIL AND PAYMENT PROVISIONS

3. Payment

- A. Costs for this Agreement shall be computed in accordance with State Administrative Manual Sections 8752 and 8752.1.
- B. Nothing herein contained shall preclude advance payments pursuant to Article 1, Chapter 3, Part 1, Division 3, Title 2 of the Government Code of the State of California.
- C. University will be paid for the payment period completed upon receipt, by ARB, of an invoice and progress report satisfying the requirements of this Agreement. The invoice and progress report must be deemed by ARB to reflect reasonable work performed in accordance with the Agreement.
- D. The amount to be paid to University under this Agreement includes all sales and use taxes incurred pursuant to this Agreement. University shall not receive additional compensation for reimbursement of such taxes and shall not decrease work to compensate therefore.

Budget Submittal Form

This form is supplied for presenting budget detail to the Air Resources Board.

PLEASE TYPE OR PRINT:	
Title of Proposal:	Assembly Bill 32 (Measure 75) and Good Movement
Total Budget Requested:	\$320,000
Period Covered (months):	12
University:	University of California, Berkeley
Address:	2150 Shattuck Avenue, Suite #313, Berkeley, CA 94704-5940
Name of person authorized to bind this bid:	Jyl Baldwin
Title:	Assistant Director
Phone:	(510) 642-8110
Signature of person authorized to bind this bid:	_____

Budget Summary

Budget details must be supplied on pages 3-11 and on additional pages if necessary.
Instructions and definitions of terms are provided in Attachment 1 of the Guidelines for Proposals.

NOTE: Totals in categories in this summary are automatically updated from pages 3-11 when using Excel file.

Direct Costs		
1.	Labor & Employee Fringe Benefits	\$258,440
2.	Subcontractor(s)/Consultant(s)	\$10,000
3.	Equipment	\$0
4.	Travel & Subsistence	\$12,000
5.	Electronic Data Processing	\$0
6.	Photocopying & Printing	\$3,872
7.	Mail, Telephones, and Fax	\$4,000
8.	Materials & Supplies	\$2,332
9.	Analyses	\$0
10.	Miscellaneous	\$1,488
Total Direct Cost		\$291,910

Indirect Costs		
11.	Overhead	\$28,090
Total Indirect Cost		\$28,090

Total Direct and Indirect Cost:		\$320,000
--	--	------------------

Budget Detail I. Direct Costs

1a. Labor Charges for Universities and Other State Agencies

Note: Total Salary Requested cells automatically calculate when using Excel file.

A.	Individual's Name	Work Title	Mo. Salary	Est. Months	% of Effort or % of Salary	Total Salary Requested
B.	Samer Madanat	Professor, ITS Director, PI	\$12956 & \$13215	0.00	0.00%	\$0
C.	Robert Harley	Chancellor's Professor	\$19378 & \$18765	0.00	0.00%	\$0
D.	Arpad Horvath	Assoc. Prof	\$11468 & \$11697	1.00	53.00%	\$6,078
E.	Susan Shaheen	Principal Development Engineer	\$9421 & \$9751	12.00	17.00%	\$19,555
F.	Caroline Rodier	Senior Development Engineer	\$7367 & 7625	12.00	18.00%	\$16,190
G.	1 TBD	Senior Development Engineer	\$7367 & 7625	12.00	25.00%	\$22,488
H.	Tim Lipman	Research Engr.	\$7558 & \$7709	0.00	0.00%	\$0
I.	Yuwei Li	Asst. Researcher	\$7208 & \$7352	12.00	25.00%	\$21,841
J.	Rachel Finson	Project Manager	\$6438 & \$6663	12.00	25.00%	\$19,652
K.	Brett Williams	Postdoc Scholar	\$5428 & \$5537	12.00	19% & 18%	\$12,167
L.	Mike Chester	Postdoc Scholar	\$5994 & \$8114	12.00	17.00%	\$12,350
M.	1 TBD	Postdoc Scholar	\$5428 & \$5537	12.00	25.00%	\$16,447
N.	1 TBD	Sr. Pub. Policy Analyst	\$5833 & \$6037	12.00	15.00%	\$10,663
O.	1 TBD	Graduate Student Res., Step 3, Resident	\$3229 & \$3294	12.00	100% & 49.5%	\$24,264
P.	2 TBN	Asst. III Undergrad student	\$2810 & \$2682	12.00	25% & 100%	\$27,588
Q.						\$0

(use additional page if necessary)

Subtotal: \$209,303

Cost justifications. Describe exactly why each individual listed in the Budget Detail is needed in this project (i.e., their role in the project), why this particular person was chosen for this role, and why their proposed level of effort is necessary. Describe, for each position listed, why the specified rate is reasonable or competitive. (Use additional page if necessary).

Samer Madanat is the Principal Investigator (PI). His knowledge and skills in transportation and environmental policy in California make him uniquely qualified to lead this effort. His rates are reasonable for a PI with his level of experience. Rachel Finson will assist Samer Madanat serving as the overall project manager and research support. She has a very high level of project management experience and is very qualified for this task and her rates are reasonable given her level of experience. Susan Shaheen and Caroline Rodier will oversee the policy review and stakeholder research. Shaheen and Rodier are experts in the area of transportation and environmental policy analysis and uniquely qualified for this research. Their rates are reasonable given their level of experience. Robert Harley is an expert in the area of vehicle and GHG emissions analysis research and thus is uniquely qualified for this research. His rates are reasonable given his level of experience. Arpad Horvath will oversee the lifecycle analysis research conducted by postdoctoral researchers. Mike Chester and Brett Williams will be experts in the area of lifecycle analysis research and thus uniquely qualified to conduct this research. Their rates are reasonable given their level of experience. Yuwei Li will lead the logistics/supply chain research. He is an expert and uniquely qualified to conduct this research. His rates are reasonable given his level of experience in

1b. Fringe Benefits

Note: COST cells automatically calculate when using Excel file.

	Individual's Name	BASE (\$)	RATE (%)	COST
A.	Samer Madanat	\$0.00	12.7%	\$0
B.	Robert Harley	\$0.00	12.7%	\$0
C.	Arpad Horvath	\$6,078.00	12.7%	\$772
D.	Susan Shaheen	\$19,555.00	24.4%	\$4,762
E.	Caroline Rodier	\$16,190.00	35.7%	\$5,771
F.	TBD, Senior Dev Engr.	\$22,488.00	22.0%	\$4,947
G.	Tim Lipman	\$0.00	29.4%	\$0
H.	Yuwei LI	\$21,841.00	28.8%	\$6,299
I.	Rachel Finson	\$19,652.00	18.7%	\$3,679
J.	Brett Williams	\$12,167.00	23.9%	\$2,912
K.	Mike Chester	\$12,350.00	12.0%	\$1,482
L.	1 TBD, Postdoctoral Scholar 1 TBD, Sr. Pub. Policy	\$16,447.00	17.0%	\$2,796
M.	Analyst	\$10,683.00	33.7%	\$3,604
N.	2 TBD, Assistant III & 1 TBD, GSR, Summer Yr.	\$25,347.00	3.0%	\$760
O.	2 TBD, Assistant III & 1 TBD, GSR, Summer Yr.	\$26,505.00	1.3%	\$345
P.	GSR (Residents) Full Fee Remission for 2 semesters	\$11,008.00		\$11,008

(use additional page if necessary)

Subtotal: \$49,137

Cost justifications. Provide the Basis for the Fringe Benefit Rates. (Use additional page if necessary).

The rates for each of the team members are assigned by their position level at UC Berkeley. These rates include benefits (medical, vacation) and are reasonable within the context of those paid in California.

2. Subcontractors & Consultants

List all subcontractors and consultants. Also submit separate Budget Submittal Form for each subcontractor and consultant.

	Subcontractor or consultant	Cost
A.	Stakeholder and Expert Recruitment, Consultant TBD	\$10,000
B.		
C.		
D.		

(use additional page if necessary)

Subtotal: \$10,000

Cost justifications. Describe exactly why each subcontractor is needed in this project (i.e., their role in the project). Describe, for each subcontractor, why the specified rate is reasonable or competitive. (Use additional page if necessary).

A subcontract is needed to recruit stakeholders and experts for the policy outreach task. The rate is reasonable given the unique knowledge and relationships that the consultant would have to enable participation of key stakeholders and experts. Once the subcontractor is defined, then we will submit a Budget Submittal Form for the work.

3. Equipment (Itemize)

	Item	Cost
A.		\$0
B.		
C.		
D.		

Subtotal: \$0

Cost justifications. Describe exactly why each listed equipment item is needed in this project, and why the cost is reasonable. (Use additional page if necessary). (Refer to Exhibit E, page 19)

[Redacted area]

4. Travel and Subsistence (Itemize). Use State Rates (Appendix IV). NO FOREIGN TRAVEL ALLOWED.

Description	Cost
A. Ground transportation	\$3,000
B. Air Transportation	\$3,000
C. Per diem or subsistence	\$3,000
D. Other (Lodging & Parking)	\$3,000

Subtotal: \$12,000

Cost justifications. Describe the purpose and duration of each trip and explain why the travel is necessary. (Use additional page if necessary).

Travel funds have been allocated to support expert and stakeholder interviews and workshops. This will include the train fare, ground transportation, hotel and per diem. The estimate for this is approximately \$3,000. The remaining travel funds will be for in-state meetings (\$2,000) and two to three conferences to present results (\$7,000).

5. Electronic Data Processing (Itemize)

Description	Cost
A.	
B.	
C.	
D.	

Subtotal: \$0

Cost justifications. Explain the need for the expenditure and the basis for the costs. (Use additional page if necessary).

[Redacted]

6. Photocopying & Printing (Itemize)

	Description of product	Cost
A.	Research Communication copying	\$1,900
B.	Research Communication printing	\$1,772

Subtotal: \$3,672

*Cost justifications. Explain the need for the expenditure and the basis for the costs.
(Use additional page if necessary).*



7. Mail, Telephone & Fax (Itemize)

	Item	Cost
A.	Research Communication (includes mailing, shipping, long distance & telephone calls)	2,000
B.	Research Communication faxing	2,000
C.		

Subtotal: \$4,000

*Cost justifications. Explain the need for the expenditure and the basis for the costs.
(Use additional page if necessary).*



B. Materials & Supplies (Itemize)

	Item	Cost
A.	Research related software, office supplies, and other misc expenses	\$832
B.	Workshop materials and shipping	\$1,700
C.		
D.		
E.		
F.		
G.		
H.		
I.		

Subtotal: \$2,332

Cost justifications. Describe exactly why each item listed above is needed in this project. Explain why the proposed cost is reasonable. (Use additional page if necessary):

Software, office supplies, workshop materials, and shipping expenses are related to necessary project research.

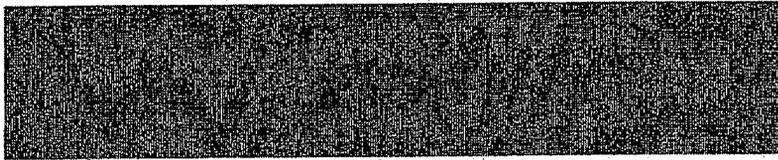


9. Analyses (Itemize)

	Description	Cost
A.		
B.		
C.		
D.		
E.		
F.		
G.		

Subtotal: \$0

Cost justifications. Describe the purpose of each different analysis and explain why it is needed in this project. Explain why the proposed rate is reasonable. (Use additional page if necessary).



10. Miscellaneous (Itemize)

Item	Cost
A. GAEL Insurance	\$1,466
B.	\$0
C.	\$0
D.	\$0
E.	\$0

Subtotal: \$1,466

Cost justifications. Justify all costs not included in the categories above. Explain the need for the expenditure and the basis for the costs. (Use additional page if necessary).

The General and Employment Liability (GAEL) is the insurance premium that the campus pays to the office of the President for the cost of the University's self-insurance and purchased insurance programs. GAEL is an integral part of each campus' costs of doing business and is calculated based on actual payroll expenditures.

Total Direct Costs (add subtotals for categories 1-10): \$291,910

II. Indirect Costs

11. Overhead and Other Indirect Costs

Base (Salaries, total direct costs, etc.) (\$)	Rate (%)	Cost
A. \$280,802	10.00%	\$28,080
B.		\$0
C.		\$0

Subtotal: \$28,090

Total Indirect Costs \$28,090

Total Project Cost: \$320,000

NETCDB

	Monthly Rate	Hourly Rate	# Months	Unit	%	#Hours	03/30/2009 - 09/30/2009	10/01/2009 - 03/29/2010	TOTAL BUDGET
Personnel									
Samer Madanat, Professor, ITS Director, PI	\$12,956 \$13,215	\$74.46 \$75.95	0.00 0.00	Summer Summer	0.0% 0.0%	- -	\$ - \$ -	\$ - \$ -	\$ - \$ -
Robert Harley, Chancellor's Professor	\$19,378 \$19,765	\$111.37 \$113.59	0.00 0.00	Summer Summer	0.0% 0.0%	- -	\$ - \$ -	\$ - \$ -	\$ - \$ -
Arpad Horvath, Assoc. Professor	\$11,468 \$11,697	\$65.91 \$67.23	1.00 0.00	Summer Summer	33.0% 0.0%	92.2 -	\$ 6,078.00 \$ -	\$ - \$ -	\$ 6,078.00 \$ -
Susan Shabana, Principal Development Engineer	\$9,421 \$9,731	\$34.14 \$36.04	6.00 6.00	Cal. Yr Cal. Yr	17.0% 17.0%	177.5 177.5	\$ 9,609.00 \$ 9,946.00	\$ - \$ -	\$ 9,609.00 \$ 9,946.00
Caroline Rodier, Senior Development Engineer	\$7,367 \$7,625	\$42.34 \$43.82	6.00 6.00	Cal. Yr Cal. Yr	18.0% 18.0%	187.9 187.9	\$ 7,956.00 \$ 8,234.00	\$ - \$ -	\$ 7,956.00 \$ 8,234.00
TBD, TSRC Senior Development Engineer	\$7,367 \$7,625	\$42.34 \$43.82	6.00 6.00	Cal. Yr Cal. Yr	25.0% 25.0%	261.0 261.0	\$ 11,051.00 \$ 11,437.00	\$ - \$ -	\$ 11,051.00 \$ 11,437.00
Tim Lipson, Research Engineer	\$7,553 \$7,709	\$43.44 \$44.31	6.00 6.00	Cal. Yr Cal. Yr	0.0% 0.0%	- -	\$ - \$ -	\$ - \$ -	\$ - \$ -
Yuwel LI, Asst. Researcher	\$7,208 \$7,352	\$41.43 \$42.26	6.00 6.00	Cal. Yr Cal. Yr	25.0% 25.0%	261.0 261.0	\$ 10,812.00 \$ 11,029.00	\$ - \$ -	\$ 10,812.00 \$ 11,029.00
Rachel Finson, Project Manager	\$6,438 \$6,663	\$37.00 \$38.29	6.00 6.00	Cal. Yr Cal. Yr	25.0% 25.0%	261.0 261.0	\$ 9,657.00 \$ 9,995.00	\$ - \$ -	\$ 9,657.00 \$ 9,995.00
Brett Williams, Postdoctoral Scholar	\$5,428 \$5,537	\$31.20 \$31.82	6.00 6.00	Cal. Yr Cal. Yr	19.0% 18.0%	194.4 187.9	\$ 6,188.00 \$ 5,979.00	\$ - \$ -	\$ 6,188.00 \$ 5,979.00
Mike Chester, Postdoctoral Scholar	\$5,994 \$6,114	\$34.43 \$35.14	6.00 6.00	Cal. Yr Cal. Yr	17.0% 17.0%	177.5 177.5	\$ 6,114.00 \$ 6,236.00	\$ - \$ -	\$ 6,114.00 \$ 6,236.00
TBD, TSRC Postdoctoral Scholar	\$5,428 \$5,537	\$31.20 \$31.82	6.00 6.00	Cal. Yr Cal. Yr	25.0% 25.0%	261.0 261.0	\$ 8,142.00 \$ 8,305.00	\$ - \$ -	\$ 8,142.00 \$ 8,305.00
TBD, Sr. Public Policy Analyst	\$5,833 \$6,037	\$33.52 \$34.70	6.00 6.00	Cal. Yr Cal. Yr	15.0% 15.0%	156.6 156.6	\$ 5,250.00 \$ 5,433.00	\$ - \$ -	\$ 5,250.00 \$ 5,433.00
1 Graduate Student Research Intern Step 3 (Resident)	\$3,229	\$18.56	2.00	Acad Yr.	49.5%	172.3	\$ 3,197.00	\$ -	\$ 3,197.00
1 Graduate Student Research Intern Step 3 (Resident)	\$3,229	\$18.56	3.00	Summer Yr.	100.0%	322.0	\$ 9,687.00	\$ -	\$ 9,687.00
1 Graduate Student Research Intern Step 3 (Resident)	\$3,229	\$18.56	1.00	Acad Yr.	49.5%	86.1	\$ 1,598.00	\$ -	\$ 1,598.00
1 Graduate Student Research Intern Step 3 (Resident)	\$3,294	\$18.93	6.00	Acad Yr.	49.5%	316.8	\$ 9,782.00	\$ -	\$ 9,782.00
2 TBN, Assistant III (Undergraduate Student)	\$2,610	\$15.00	2.00	Acad Yr.	25.0%	174.0	\$ 2,610.00	\$ -	\$ 2,610.00
2 TBN, Assistant III (Undergraduate Student)	\$2,610	\$15.00	3.00	Summer Yr.	100.0%	1,044.0	\$ 15,660.00	\$ -	\$ 15,660.00
2 TBN, Assistant III (Undergraduate Student)	\$2,662	\$15.30	1.00	Acad Yr.	25.0%	87.0	\$ 1,331.00	\$ -	\$ 1,331.00
2 TBN, Assistant III (Undergraduate Student)	\$2,662	\$15.30	6.00	Acad Yr.	25.0%	522.0	\$ 7,987.00	\$ -	\$ 7,987.00
TOTAL PERSONNEL							\$ 124,940	\$ 292,949.00	\$ 417,889.00
Employee Benefits									
Samer Madanat, Professor, ITS Director, PI					12.7%		\$ -	\$ -	\$ -
Robert Harley, Chancellor's Professor					12.7%		\$ -	\$ -	\$ -
Arpad Horvath, Assoc. Professor					12.7%		\$ 772	\$ -	\$ 772
Susan Shabana, Principal Development Engineer					24.4%		\$ 2,340	\$ 2,422	\$ 4,762
Caroline Rodier, Senior Development Engineer					35.6%		\$ 2,836	\$ 2,938	\$ 5,771
TBD, TSRC Senior Development Engineer					22.0%		\$ 2,431	\$ 2,516	\$ 4,947
Tim Lipson, Research Engineer					29.4%		\$ -	\$ -	\$ -
Yuwel LI, Asst. Researcher					28.8%		\$ 3,118	\$ 3,181	\$ 6,299
Rachel Finson, Project Manager					18.7%		\$ 1,808	\$ 1,871	\$ 3,679
Brett Williams, Postdoctoral Scholar					23.9%		\$ 1,481	\$ 1,431	\$ 2,912
Mike Chester, Postdoctoral Scholar					12.0%		\$ 724	\$ 748	\$ 1,482
TBD, TSRC Postdoctoral Scholar					17.0%		\$ 1,384	\$ 1,412	\$ 2,796
TBD, Sr. Public Policy Analyst					33.7%		\$ 1,771	\$ 1,833	\$ 3,604
CSR & Undergraduate Student, Academic Yr.					1.3%		\$ 114	\$ 231	\$ 345
CSR & Undergraduate Student, Summer Yr.					3.0%		\$ 760	\$ -	\$ 760
1 CSR (Resident), Full Fee Remission for FY 08-09 per semester is \$5,106.75							\$ 2,270	\$ -	\$ 2,270
1 CSR (Resident), Full estimated Fee Remission for FY 09-10 per semester is \$5,107 has been increased by 10.0% = \$5,617.70 for one							\$ 1,248	\$ 7,499	\$ 8,738
TOTAL EMPLOYEE BENEFITS							\$ 23,067	\$ 25,070	\$ 48,137
TOTAL PERSONNEL & BENEFITS							\$ 148,007	\$ 318,019.00	\$ 466,026.00
Other Direct Costs & Supplies									
Research related supplies: Communication research charges (copying, faxing, long distance telephone, printing, mailing & postage, software, office supplies, and other misc expenses).							\$ 1,900	\$ 1,772	\$ 3,672
GAEL Insurance							\$ 2,000	\$ 2,000	\$ 4,000
Workshop Materials							\$ 805	\$ 661	\$ 1,466
Workshop Shipping							\$ 625	\$ 625	\$ 1,250
Workshop Supplies & Communication							\$ 223	\$ 223	\$ 450
TBD consultant, Stakeholder and Expert recruitment							\$ 316	\$ 316	\$ 632
TOTAL SUPPLIES							\$ 10,871	\$ 10,598	\$ 21,469
Travel									
Instate and out of state							\$ 6,000	\$ 6,000	\$ 12,000
TOTAL TRAVEL							\$ 6,000	\$ 6,000	\$ 12,000
Subcontract							\$ 0	\$ 0	\$ 0
TOTAL SUBCONTRACT							\$ 0	\$ 0	\$ 0
TOTAL DIRECT COSTS							\$ 154,878	\$ 334,017.00	\$ 487,495.00
Indirect Costs									
10% of Modified Total Direct Costs							\$ 15,136	\$ 12,954	\$ 28,090
TOTAL INDIRECT COSTS							\$ 15,136	\$ 12,954	\$ 28,090
TOTAL AMOUNT REQUESTED							\$ 170,014	\$ 346,971.00	\$ 515,585.00

1 Current Salary Rate
 2 Salary rate plus a projected 2% cost of living increase effective every October 1st.
 3 Salary rate plus a projected 3.5% cost of living increase effective every October 1st.
 4 Composite Benefit Rate
 5 Benefit rates based upon average of actual costs from November 2008
 6 Modified Total Direct Costs: Indirect costs calculated on first \$25,000 of each subcontract only; subcontracts to other UC campuses are not subject to indirect costs also, tuition remission fees, equipment over \$3,000 and facility rental are excluded.

EXHIBIT D
SPECIAL TERMS AND CONDITIONS

1. Termination

- A. This Agreement may be cancelled at any time by either party, upon thirty (30) days written notice to the other party.
- B. In the case of early termination, the performing agency will submit an invoice in triplicate and a report in triplicate covering services to termination date, following the invoice and progress report requirements of this Agreement. A copy and description of any data collected up to termination date will also be provided to ARB.
- C. Upon receipt of the invoice, progress report, and data, a final payment will be made to the performing agency. This payment shall be for all ARB-approved, actually incurred costs in accordance with Exhibits A and B, and shall include labor, and materials purchased or utilized (including all non-cancellable commitments) to termination date, and pro rata indirect costs as specified in the proposal budget.

2. Disputes

- A. ARB reserves the right to issue an order to stop work in the event that a dispute should arise, or in the event that the ARB gives the performing agency a notice that this Agreement will be terminated. The stop-work order will be in effect until the dispute has been resolved or this Agreement has been terminated.
- B. Any dispute concerning a question of fact arising under the terms of this Agreement which is not disposed of within a reasonable period of time by agency employees normally responsible for the administration of this agreement, shall be brought to the attention of the Executive Officer or designated representative of each agency for joint resolution.

3. Amendments

ARB reserves the right to amend this agreement for additional time and/or additional funding.

EXHIBIT E
ADDITIONAL PROVISIONS

1. Reports and Data Compilations

- A. ***With respect to each invoice period, University shall forward to the ARB Contract Administrator, one (1) electronic copy of the progress report and mail one (1) copy of the progress report along with each invoice. (Do not use Express Mail). When emailing the progress report, the "subject line" should state the contract number and the billing period. Each progress report will begin with the following disclaimer:***

The statements and conclusions in this report are those of the University and not necessarily those of the California Air Resources Board. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.

- B. Each progress report will also include:
1. A brief narrative account of project tasks completed or partially completed since the last progress report;
 2. A brief discussion of problems encountered during the reporting period and how they were or are proposed to be resolved;
 3. A brief discussion of work planned, by project task, before the next progress report; and
 4. A graph or table showing allocation of the budget and amount used to date.
 5. A graph or table showing percent of work completion for each task.
- C. If the project is behind schedule, the progress report must contain an explanation of reasons and how the University plans to resume the schedule.
- D. Six months prior to Agreement termination date, University will deliver to ARB twenty (20) bound copies of a draft final report. The reports may be stapled or spiral bound, depending on size. The draft final report will conform to Exhibit F.
- E. Within forty-five (45) days of receipt of ARB's comments on the draft Final Report (Exhibit F), University will deliver to ARB's Contract Manager two (2) copies of the Final Report incorporating all reasonable alterations and additions requested by ARB. Upon approval of the amended final report approved by ARB in accordance to Exhibit F, University will within two (2) weeks, deliver to ARB two (2) camera ready UNBOUND originals of a Final Report incorporating all final alterations and additions. The final report will conform to the Contract Final Report Format, Exhibit F.
- F. Together with the final report, University will deliver a copy of the report on diskette/CD, using any common word processing software (please specify the software used) and a set of all data compilations as specified by the ARB Contract Manager.

EXHIBIT E
ADDITIONAL PROVISIONS

- G. University's obligation under this Agreement shall be deemed discharged only upon submittal to ARB of an acceptable final report in accordance to Exhibit F, report diskette/CD, all required data compilations, and any other project deliverables.
- H. Prior to completion of this Agreement, University shall be entitled to release or make available reports, information, or other data prepared or assembled by it pursuant to this Agreement, in scientific journals and other publications and at scientific meetings, provided however, that a copy of the publication be submitted to ARB for review and comment 45 days prior to such publication. Further, University shall place the disclaimer statement in a conspicuous place on all such reports or publications. Health related reports should include an acknowledgment to the late Dr. Friedman. Nothing in this provision shall be construed to limit the right of State to release information obtained from the University or to publish reports, information, or data in State publications.

2. Copyrightable Materials

In recognition of the policy of ARB and University to promote and safeguard free and open inquiry by faculty, students and the members of the public and in furtherance of such policy, both parties agree to the following with respect to rights in data and copyrights under this Agreement:

- A. The term "Subject Data" shall mean all original and raw research data, notes, computer programs, writings, sound recordings, pictorial reproductions, drawings or other graphical representations, and works of any similar nature, produced by University in performance of this Agreement, but specifically excluding "Reports," as defined in this Agreement. Subject Data also excludes financial reports, cost analyses, and similar information incidental to contract administration.
- B. The term "Reports" shall have the meaning assigned to it in this Exhibit F of this Agreement.
- C. Ownership of all Subject Data and copyrights arising from Subject Data shall be vested in University while ownership of all Reports and copyrights arising from the Reports delivered under this Agreement shall be vested in ARB. University agrees to make available to the public for public benefit, to the extent the University shall have the legal right to do so, without license or fee, any scholarly articles which are published from the Subject Data.
- D. Nothing in this exhibit or Agreement shall be construed to limit the right of University faculty, students or staff to publish the Subject Data in the form of scholarly articles in academic journals nor to affect, abrogate or limit the right of University faculty, staff or students to make use of the Subject Data.

3. Travel & Per Diem

- A. Any reimbursement for necessary travel and per diem shall be at the University's approved travel rates.

EXHIBIT E
ADDITIONAL PROVISIONS

- B. No foreign travel shall be reimbursed unless prior written authorization is obtained from ARB.

4. Meetings

- A. Initial meeting. Before work on the contract begins, the Principal Investigator and key personnel will meet with the ARB Contract Manager and other staff to discuss the overall plan, details of performing the tasks, the project schedule, items related to personnel or changes in personnel, and any issues that may need to be resolved before work can begin.
- B. Progress review meetings. The Principal Investigator and appropriate members of his or her staff will meet with ARB's Contract Manager at quarterly intervals to discuss the progress of the project. This meeting may be conducted by phone.
- C. Technical Seminar. The Contractor will present the results of the project to ARB staff and a possible webcast at a seminar at ARB facilities in Sacramento or El Monte.

5. Confidentiality

- A. It is understood that in the course of carrying out this Agreement, State may wish to provide University with proprietary or confidential information of State (Proprietary Information). University agrees to use its best efforts to hold proprietary information in confidence and shall return it to State upon the completion of the project.
- B. This obligation shall apply only to proprietary information that is designated or identified as such in writing by State prior to the disclosure thereof. All proprietary information shall be sent only to the Principal Investigator. Moreover, this obligation shall not apply to any proprietary information which: a) is or becomes publicly known through no wrongful or negligent act on the part of University; b) is already known to University at the time of disclosure; c) independently developed by University without breach of this agreement; or d) is generally disclosed to third parties by State without similar restrictions on such third parties.

EXHIBIT F **RESEARCH FINAL REPORT FORMAT**

The research contract Final Report (Report) is as important to the contract as the research itself. The Report is a record of the project and its results, and is used in several ways. Therefore, the Report must be well organized and contain certain specific information. ARB's Research Screening Committee (RSC) reviews all draft Final Reports, paying special attention to the Abstract and Executive Summary. If the RSC finds that the Report does not fulfill the requirements stated in this Appendix, the document will not be approved for release, and final payment for the work completed may be withheld. This Appendix outlines the requirements that must be met when producing the Report.

Note: In partial fulfillment of the Final Report requirements, the Contractor shall submit a copy of the Report on a CD in PDF format and in a word-processing format, preferably in Word - Version 6.0 or later. This is in addition to the submission of any paper copies required. The diskette shall be clearly labeled with the contract title, ARB contract number, the words "Final Report", and the date the report was submitted.

Legibility. Each page of the approved Final Report must be legible and camera-ready.

Binding. The draft Report, including its appendices, must be either spiral bound or stapled, depending on size. The revised Report and its appendices should be spiral bound, except for two unbound, camera-ready originals.

Cover. Do not supply a cover for the Report. ARB will provide its standard cover.

One-sided vs. two-sided. To conserve paper, both the draft Report and the revised Report, except for the unbound camera-ready copies, should be printed on both sides of the page. The unbound camera-ready copies must be printed on only one side of the page.

Title. The title of the Report should exactly duplicate the title of the contract unless a change is approved in writing by the contract manager.

Spacing. In order to conserve paper, copying costs, and postage, please use single or one-line (1) spacing.

Page size. All pages should be of standard size (8 1/2" x 11") to allow for photo-reproduction.

Large tables or figures. Foldout or photo-reduced tables or figures are not acceptable because they cannot be readily reproduced. Large tables and figures should be presented on consecutive 8 1/2" x 11" pages, each page containing one portion of the larger chart.

Color. Color presentations are not acceptable; printing shall be black on white only.

Corporate identification. Do not include corporate identification on any page of the Final Report, except the title page.

Unit notation. Measurements in the Reports should be expressed in metric units. However, for the convenience of engineers and other scientists accustomed to using the British system, values may be

EXHIBIT F **RESEARCH FINAL REPORT FORMAT**

given in British units as well in parentheses after the value in metric units. The expression of measurements in both systems is especially encouraged for engineering reports.

Section order. The Report should contain the following sections, in the order listed below:

Title page
Disclaimer
Acknowledgment (1)
Acknowledgment (2)
Table of Contents
List of Figures
List of Tables
Abstract
Executive Summary
Body of Report
References
List of inventions reported and copyrighted materials produced
Glossary of Terms, Abbreviations, and Symbols
Appendices

Page numbering. Beginning with the body of the Report, pages shall be numbered consecutively beginning with "1", including all appendices and attachments. Pages preceding the body of the Report shall be numbered consecutively, in ascending order, with small Roman numerals.

Title page. The title page should include, at a minimum, the contract number, contract title, name of the principal investigator, contractor organization, date, and this statement: "Prepared for the California Air Resources Board and the California Environmental Protection Agency"

Disclaimer. A page dedicated to this statement must follow the Title Page:

The statements and conclusions in this Report are those of the contractor and not necessarily those of the California Air Resources Board. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products.

Acknowledgment (1). Only this section should contain acknowledgments of key personnel and organizations who were associated with the project. The last paragraph of the acknowledgments must read as follows:

This Report was submitted in fulfillment of [ARB contract number and project title] by [contractor organization] under the [partial] sponsorship of the California Air Resources Board. Work was completed as of [date].

Acknowledgment (2). Health reports should include an acknowledgment to the late Dr. Friedman. Reports should include the following paragraph:

This project is funded under the ARB's Dr. William F. Friedman Health Research Program. During Dr. Friedman's tenure on the Board, he played a major role in guiding ARB's health research

EXHIBIT F

RESEARCH FINAL REPORT FORMAT

program. His commitment to the citizens of California was evident through his personal and professional interest in the Board's health research, especially in studies related to children's health. The Board is sincerely grateful for all of Dr. Friedman's personal and professional contributions to the State of California.

Table of Contents. This should list all the sections, chapters, and appendices, together with their page numbers. Check for completeness and correct reference to pages in the Report.

List of Figures. This list is optional if there are fewer than five illustrations.

List of Tables. This list is optional if there are fewer than five tables.

Abstract. The abstract should tell the reader, in nontechnical terms, the purpose and scope of the work undertaken, describe the work performed, and present the results obtained and conclusions. The purpose of the abstract is to provide the reader with useful information and a means of determining whether the complete document should be obtained for study. The length of the abstract should be no more than about 200 words. Only those concepts that are addressed in the executive summary should be included in the abstract.

Example of an abstract:

A recently developed ground-based instrument, employing light detecting and ranging (lidar) technology, was evaluated and found to accurately measure ozone concentrations at altitudes of up to 3,000 meters. The novel approach used in this study provides true vertical distributions of ozone concentrations aloft and better temporal coverage of these distributions than other, more common methods, such as those using aircraft and ozonesonde (balloon) techniques. The ozone and aerosol measurements from this study, in conjunction with temperature and wind measurements, will provide a better characterization of atmospheric conditions aloft and the processes involved in the formation of unhealthy ozone concentrations than can be achieved with traditional ground-based monitors.

Executive Summary. The function of the executive summary is to inform the reader about the important aspects of the work that was done, permitting the reader to understand the research without reading the entire Report. It should state the objectives of the research and briefly describe the experimental methodology[ies] used, results, conclusions, and recommendations for further study. All of the concepts brought out in the abstract should be expanded upon in the Executive Summary. Conversely, the Executive Summary should not contain concepts that are not expanded upon in the body of the Report.

The Executive Summary will be used in several applications as written; therefore, please observe the style considerations discussed below.

Limit the Executive Summary to two pages, single spaced.

Use narrative form. Use a style and vocabulary level comparable to that in Scientific American or the New York Times.

Do not list contract tasks in lieu of discussing the methodology.

EXHIBIT F

RESEARCH FINAL REPORT FORMAT

Discuss the results rather than listing them.

Avoid jargon.

Define technical terms.

Use passive voice if active voice is awkward.

Avoid the temptation to lump separate topics together in one sentence to cut down on length.

The Executive Summary should contain four sections: Background, Methods, Results, and Conclusions, described below:

THE BACKGROUND SECTION. For the Background, provide a one-paragraph discussion of the reasons the research was needed. Relate the research to the Board's regulatory functions, such as establishing ambient air quality standards for the protection of human health, crops, and ecosystems; the improvement and updating of emissions inventories; and the development of air pollution control strategies.

THE METHODS SECTION. At the beginning of the Methods section, state what was done in general, in one or two sentences.

The methodology should be described in general, nontechnical terms, unless the purpose of the research was to develop a new methodology or demonstrate a new apparatus or technique. Even in those cases, technical aspects of the methodology should be kept to the minimum necessary for understanding the project. Use terminology with which the reader is likely to be familiar. If it is necessary to use

technical terms, define them. Details, such as names of manufacturers and statistical analysis techniques, should be omitted.

Specify when and where the study was performed, if it is important in interpreting the results.

The findings should not be mentioned in the Methods section.

THE RESULTS SECTION. The Results section should be a single paragraph in which the main findings are cited and their significance briefly discussed. The results should be presented as a narrative, not a list. This section must include a discussion of the implications of the work for the Board's relevant regulatory programs.

THE CONCLUSIONS SECTION. The Conclusions section should be a single short paragraph in which the results are related to the background, objectives, and methods. Again, this should be presented as a narrative rather than a list. Include a short discussion of recommendations for further study, adhering to the guidelines for the Recommendations section in the body of the Report.

Body of Report. The body of the Report should contain the details of the research, divided into the following sections:

EXHIBIT F **RESEARCH FINAL REPORT FORMAT**

Introduction. Clearly identify the scope and purpose of the project. Provide a general background of the project. Explicitly state the assumptions of the study.

Clearly describe the hypothesis or problem the research was designed to address. Discuss previous related work and provide a brief review of the relevant literature on the topic.

Materials and Methods. Describe the various phases of the project, the theoretical approach to the solution of the problem being addressed, and limitations to the work. Describe the design and construction phases of the project, materials, equipment, instrumentation, and methodology. Describe quality assurance and quality control procedures used. Describe the experimental or evaluation phase of the project

Results. Present the results in an orderly and coherent sequence. Describe statistical procedures used and their assumptions. Discuss information presented in tables, figures and graphs. The titles and heading of tables, graphs, and figures, should be understandable without reference to the text. Include all necessary explanatory footnotes. Clearly indicate the measurement units used.

Discussion. Interpret the data in the context of the original hypothesis or problem. Does the data support the hypothesis or provide solutions to the research problem? If appropriate, discuss how the results compare to data from similar or related studies. What are the implications of the findings? Identify innovations or development of new techniques or processes. If appropriate, discuss cost projections and economic analyses.

Summary and Conclusions. This is the most important part of the Report because it is the section that will probably be read most frequently. This section should begin with a clear, concise statement of what, why, and how the project was done. Major results and conclusions of the study should then be presented, using clear, concise statements. Make sure the conclusions reached are fully supported by the results of the study. Do not overstate or overinterpret the results. It may be useful to itemize primary results and conclusions. A simple table or graph may be used to illustrate.

Recommendations. Use clear, concise statements to recommend (if appropriate) future research that is a reasonable progression of the study and can be supported by the results and discussion.

References. Use a consistent style to fully cite work referenced throughout the Report and references to closely related work, background material, and publications that offer additional information on aspects of the work. Please list these together in a separate section, following the body of the Report. If the Report is lengthy, you may list the references at the end of each chapter.

List of inventions reported and publications produced. If any inventions have been reported, or publications or pending publications have been produced as a result of the project, the titles, authors, journals or magazines, and identifying numbers that will assist in locating such information should be included in this section.

Glossary of terms, abbreviations, and symbols. When more than five of these items are used in the text of the Report, prepare a complete listing with explanations and definitions. It is expected that every abbreviation and symbol will be written out at its first appearance in the Report, with the abbreviation or symbol following in parentheses [i.e., carbon dioxide (CO₂)]. Symbols listed in table and figure legends need not be listed in the Glossary.

EXHIBIT F
RESEARCH FINAL REPORT FORMAT

Appendices. Related or additional material that is too bulky or detailed to include within the discussion portion of the Report shall be placed in appendices. If a Report has only one appendix, it should be entitled "APPENDIX". If a Report has more than one appendix, each should be designated with a capital letter (APPENDIX A, APPENDIX B). If the appendices are too large for inclusion in the Report, they should be collated, following the binding requirements for the Report, as a separate document. The contract manager will determine whether appendices are to be included in the Report or treated separately. Page numbers of appendices included in the Report should continue the page numbering of the Report body. Pages of separated appendices should be numbered consecutively, beginning at "1".