



SACOG Board of Directors

Item #09-8-10
Consent

August 12, 2009

Authorize Sole-Source Contracts for Caltrans-Sponsored Project to Improve Land Use Transportation Tools

Issue: SACOG needs the assistance of UC Davis and Fehr & Peers to develop modeling tools that will improve land use-transportation planning throughout the state in time to meet SB 375 greenhouse gas emission targets.

Recommendation: Accept the recommendation of the Government Relations & Public Affairs Committee that the Board authorize the Executive Director to execute contracts with UC Davis for \$65,500 and with Fehr & Peers for \$170,000 to assist SACOG in phase 1 of a land use and travel model development study.

Committee Action/Discussion: SACOG has become a leader in the development and application of land use and transportation models through the successful studies in the Blueprint Study and the Metropolitan Transportation Plan for 2035. Other successful model development projects have been carried out by UC Davis on behalf of many small and mid-sized MPOs in their Blueprint planning studies and by Fehr & Peers on behalf of many small to large MPOs as Blueprint planning studies have been conducted throughout California.

Caltrans had an opportunity to continue the development of these models at the end of last fiscal year when some research funds were available. An OWP amendment was executed in June to provide SACOG \$314,775 to begin this effort. The project design with Caltrans staff was to utilize the experience and expertise of UC Davis and Fehr & Peers staff, as the data and model development they worked on was fundamental to the success of earlier Blueprint studies.

This project will develop a set of transportation-land use planning tools to upgrade travel models and land use models across the state. This project's success depends on the ability to utilize the experience of UC Davis and Fehr & Peers in working with these MPOs and their models. Their previous experience will allow them to develop these improvements efficiently, and in as short a schedule as possible, in order to get them into application in regions across the state. The improved models are needed as soon as possible to give MPOs the opportunity to utilize them in their planning to meet the SB375 greenhouse gas emission targets. The unique qualifications of these two organizations are thus critical to this project.

SACOG's objectives for this project are to improve our existing tools by utilizing information in our new activity-based travel model, and to incorporate these improvements into I-PLACE³S. Caltrans will use the SACOG analysis to create a framework for other MPOs to improve their land use and travel models and to make it easier to apply I-PLACE³S in other regions. This will be accomplished by a) development of transportation-land use tools utilizing local data for a set of MPOs across the state, b) then applying these results into their models, and c) developing post-processors to their travel models. Attached are the scopes of work for both of the contracts.

The first phase of this project is funded with a grant from Caltrans for \$314,775. Additional funding is expected to complete the project next year, at a total cost of \$1,151,550.

Approved by:

Mike McKeever
Executive Director

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Attachments

Key Staff: Gordon Garry, Director of Research & Analysis, (916) 340-6230
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Draft
**Statewide Development of
Transportation / Land Use Planning Tools**
Fehr & Peers Scope of Work

Effective local and regional planning requires the assessment of relationships between various land use and transportation strategies to estimate the consequences of potential future scenarios. Caltrans' Regional Blueprint Planning grants program funds for land use and transportation scenario development and evaluation by Metropolitan Planning Organizations (MPOs) throughout California to more effectively develop and implement Regional Transportation Plans (RTPs). Recent California law (SB 375) also requires that MPOs address a set of Sustainable Communities Strategies (SCS) to meet greenhouse gas (GHG) reduction targets, and possibly Alternative Planning Strategies (APS) if the MPO cannot demonstrate that GHG reductions are likely to meet regional GHG targets based on the SCS. The Obama administration is proposing GHG reduction targets similar to California's, and is defining a national climate and energy security strategy. New national policies and programs may include land use and transportation concepts and mitigation options.

Improved capabilities to analyze and quantify the connection between travel generation and detailed, micro-level land use characteristics (density, diversity, design, destination accessibility, demographics, distance to transit, etc.) - generically referred to as "the Ds" - will assist many California regions to meet these requirements. Strengthening the linkages between the improved Ds analysis methods and tools such as I-PLACE³S, UPLAN, and Ds travel model post-processors, will also enhance the capabilities of MPOs and RTPAs, working with their local agency partners, to develop and evaluate Blueprint planning and SCS/APS scenarios during community-participation visioning exercises.

This project will advance and improve the knowledge of Ds land use/transportation relationships, and improve existing analysis tools available for Blueprint planning, development and testing of SCSs/APSs (per SB 375), and other smart growth planning throughout the State. The project team will leverage their prior work with the various regional agencies and their datasets to make these improvements as efficiently and quickly as possible. The project team is in a unique position to accomplish these tasks and deliver the end products to MPOs to assist with timely regional planning processes across the state. The Ds land use/transportation relationships will be assembled through a rigorous literature review, including coordination with work underway by others (see Task 0, below), and

expanded through original research conducted by Fehr & Peers as part of this project (see Tasks 2-4). Analytical tools, software, and user interfaces currently in use for applying the Ds for land use/transportation planning will be improved, based on the research conducted in this project.

Specifically, this project will develop a Ds module that will bring the latest and most relevant research on land use/transportation interactions and effects of smart growth strategies into land use and transportation planning in California. It will also develop the necessary linkages between the Ds module and existing planning tools commonly used in California: UPLAN, I-PLACE³S, and post-processors to conventional travel models. The resulting Ds analysis tools will be especially useful to California's mid-size and smaller MPOs and RTPAs, which may lack the resources to develop more complex methods for integrated land use and transportation planning. It will also provide immediate improvements to planning tools used by major MPOs for developing and assessing long-term growth plans. By making this data available quickly, MPOs will be able to utilize these tools to meet the regional GHG targets established under SB 375 and potential federal laws. Plus, this effort will provide practical tools to local agencies (cities, counties, transit agencies, etc.) for their General and Specific smart-growth planning efforts.

A breakdown of project costs by participant (Caltrans, SACOG, UC Davis, and Fehr & Peers) is provided in the attached table.

Task "A" - Project Administration

- Scope: Administrative duties related to the contract, project schedule, deliverables, invoicing, etc.
- Tasks: SACOG will serve as administrative lead and prime contractor for this project. Fehr & Peers and UC Davis ICE will serve as sub-contractors to SACOG.

Task 1 - Literature Review

- Goal: Update/expand existing literature reviews on the Ds, and integration of existing literature as necessary for this effort.
- Scope: Perform a comprehensive review of recent literature on the topic of travel and the built environment in general and on the latest findings in correlating the Ds characteristics of development with the generation of Vehicle trips (VT), vehicle miles traveled (VMT) per household, and transit and non-

motorized propensity. This review will build on the most recent compilations of relevant research, including those reported in *Growing Cooler: The Evidence on Urban Development and Climate Change*, the national EPA study on *Travel Generation by Mixed-Use Development*, and if completed in time for this study, the research conducted for the Caltrans/ UC Davis *Smart Growth Land Use Projects Trip Rates Spreadsheet* (see also Task 0).

Tasks: Fehr & Peers will lead this task, and perform the majority of work. Other project team partners (Caltrans, UC Davis ICE, and SACOG) will assist, advise, and review deliverables.

Deliverable: The primary findings of the research literature as a whole will be summarized in the form of a report chapter or appendix of the final report on *"Planning Tools for Local and Regional Smart Growth Efforts"*.

Schedule: August - October 2009

Task 0 - "Smart Growth Land Use Projects Trip Rates Spreadsheet" Caltrans/UC Davis (Susan Handy & Richard Lee)

Goal: Coordinate with this separate but related Caltrans-funded project, exchange information and data, and maximize the value and use of research and data assembled.

Scope: The Handy/Lee project expected to begin August 2009 via separate funding, with an extensive literature search/evaluation completed (re: site-specific land uses) by Fall 2009. A meeting or teleconference will be scheduled at the beginning of this project (expected August 2009) to identify key opportunities for coordinated research and information exchange.

Tasks: Caltrans will lead this task and facilitate the initial meeting.

Deliverable: Caltrans staff will provide summary notes of the meeting.

Task 2 - Advisory Committees

Goal: Engage national/ California experts and members of existing planning tools users group in guidance and key decisions on development of Ds elasticities and planning tools.

Scope: The study will be guided and reviewed by two types of experts who will advise the study team on the ultimate selection of Ds elasticities and module capabilities for the planning tools.

Task 2a

Scope: Expert Panel - Between three and five academics and other experts in land use/ transportation. The Expert Panel will focus on the review and advice on the development of robust, statistically valid Ds elasticities, and the extent to which the elasticities vary randomly or by geographic type of region. The Panel will provide input, review, and consensus regarding best use of available research and data. The panel of California and national experts on travel forecasting and the research relationships between travel and the built environment will help define methods and model evaluation criteria and to select benchmarks for validation criteria and elasticity values. A possible alternative to conducting multiple meetings would be to conduct one meeting/ conference call, and to reach agreement on recommendations through a Delphi panel process with the experts group.

Tasks: Fehr & Peers will convene and facilitate each meeting, handle all logistical details related to the meetings, will provide webinar service, and will attend each meeting.

Deliverable: Meeting notes from Expert Panel meeting.

Schedule: August 2009 through March 2010. Meeting will be held during the course of the study. Identification and recruitment of panelists will begin in August 2009. Phase 2, when funded, will have 1-3 additional meetings.

Related tasks being performed by team members:

Caltrans Caltrans project manager will document the meetings, and have final authority on the composition of the Panel.

UC Davis ICE UCD staff will attend each meeting during the course of the study.

SACOG Staff will attend each meeting and will provide the meeting room for the meetings.

Task 2b

Scope: Practitioners Panel(s) - Members: Staff of interested COGs, MPOs, local agencies, consultants, etc. The Practitioner Panel(s) will provide technical input regarding the uses and operations of iPLACE3S/UPLAN Ds modules and analysis tools, as well as on the Ds travel model post-processor. Because these panels will be focused on modules and applications, separate panels may be set up for the I-PLACE3S/UPLAN Ds module, and the Ds travel model post-processor. The first meeting will be available in-person. Subsequent meetings will take place via webinar or teleconference, and may be divided into sub-group sessions targeted to user groups with different experience levels and needs. For example, some of the webinars may be oriented toward representatives of the largest MPOs, others to mid-size MPOs with similar planning processes (such as the San Joaquin Valley counties), and others to small rural counties. Accounting for the possibility of sub-group sessions, the study will include up to eight webinars/teleconferences during the course of the study in addition to the one in-person meeting.

Tasks: Fehr & Peers will attend each panel meeting, and will provide webinar services.

Schedule: August 2009 through March 2010, with 2 meetings/webinars. Phase 2, when funded, will have additional meetings.

Related tasks being performed by team members:

Caltrans The panel(s) will be convened and facilitated and the meetings will be documented by Caltrans' project manager.

UC Davis ICE UCD staff will attend each panel meeting related to I-PLACE3S and/or UPLAN during the course of the study.

SACOG SACOG staff will attend each panel meeting related to I-PLACE3S and/or UPLAN, and will provide the meeting room for the first meeting.

Task 3 - Data Collection

Goal: Gather, compile, and assess travel survey, land use, transportation system, and other data necessary to develop a set of Ds elasticities for a representative cross-section of regions in California. All data will be drawn

from existing surveys and datasets, much of which was originally compiled by Fehr & Peers and UC Davis—no new surveys or primary data compilation will be conducted as part of this project.

Scope: The representative cross-section of regions will include two MPOs/RTPAs. Four classes of regions will be represented in the complete project (Phase 1 plus Phase 2 when funded). Eight regions are envisioned to be included, if the entire project is funded. The four classes include: a) the four major metropolitan areas (SCAG, MTC/ABAG, SANDAG, SACOG), b) the San Joaquin Valley, c) Coastal areas, and d) smaller rural MPOs. At least two of the eight exemplars will be from Southern California, at least two from Central California, and at least two from Northern California. In order to provide sufficient data for smaller MPOs/RTPAs, data may be aggregated from counties within the subject MPO/RTPA and other counties of similar size and urban form. (For example, if Fresno COG were chosen as the case study for San Joaquin Valley MPOs, travel survey data for the case study might include data from Madera, Merced, Tulare and Stanislaus counties as well as Fresno County.) The project team's prior work with the regions and the use of data from that prior work will enhance the quality of the analysis and will allow the data to be available for planning to meet the GHG emissions standards imposed under SB 375 or new federal law. The desired data are: 1) household travel surveys with detailed land use and transportation system data already attached to activity locations; 2) household travel surveys with sufficient locational detail for activities to attach detailed land use and transportation system data; 3) detailed land use data with location or geo-referencing sufficient to be attached to household travel survey locations; and 4) key transportation system data, such as transit station/stop locations, service alignments, frequencies of service, street pattern and pedestrian amenity data, etc.

Tasks: Fehr & Peers will coordinate the efforts at recruiting MPOs/RTPAs, and will take the lead in assembling, integrating and assessing the needed datasets. F&P will also take the lead in assembling available data from SANDAG, SCAG, and/or MTC/ABAG, if one or two are selected as exemplar regions.

Deliverable: Draft integrated dataset combining travel survey, land use, and transportation system for two representative MPOs/RTPAs.

Schedule: August 2009 through March 2010

Related tasks being performed by team members:

UC Davis ICE UCD will provide existing land use data in 50-meter grid cells or equivalent spatial resolution for the 22 counties currently using UPLAN models. The county data will be clustered into six sub-sets, each representing one of the six MPOs selected as case study exemplars. For example, 22 counties' data may be allocated to groupings representative of the following six MPOs: Fresno, Shasta, Amador, Mendocino, San Luis Obispo, and Kern. UC Davis will also provide future land use data for each grid cell for each county's Blueprint baseline scenario and Blueprint forecast year (as available). UC Davis staff will be the primary point of contact with MPO and RTPA GIS and modeling staff responsible for defining the data needs, and for supporting the regional staff as needed to obtain the specified data. Data for each grid cell will include: dwelling units, population, household size, household auto ownership, residential acres, employment acres, retail employment, service employment, office/industrial employment, public/institutional employment, number of roadway intersections, number of bus stops, number of rail stations. UC Davis ICE will also assist Fehr & Peers in recruitment of MPOs/RTPAs in providing data.

SACOG The Year 2000 household travel survey has SACOG's parcel level land use data already attached, and significant analysis of Ds relationships has already been performed. SACOG will provide all of its existing datasets for use in this project. SACOG will also assist Fehr & Peers in recruitment of MPOs/RTPAs in providing data.

Caltrans Caltrans will provide access to available year 2000 Statewide Travel Survey datasets, and will assist Fehr & Peers in acquiring land use and travel survey datasets, especially from MPOs/RTPAs which did augmented travel surveys in Year 2000 based on the Statewide travel survey.

Task 4 - Develop Ds Elasticities

Goal: Develop Ds elasticities for two representative regions of California. Ds elasticities are: statistically-estimated coefficients which specify the range of changes or differences in key travel behaviors, based on changes or differences in the land use or land use/transportation characteristics of the

place of residence or activity locations of the traveler. Validate the Ds elasticities through rigorous statistical testing and reasonableness checks.

Scope: The Ds elasticities will be estimated using the data collected for this project (Task 3), checked for reasonableness, and potentially calibrated using the literature review (Task 1), with input and review by the Expert Panel (Task 2). The Fehr & Peers staff, having extensive experience in developing Ds elasticities in many regions, including SACOG's region, is in a unique position to develop the necessary Ds elasticities efficiently and quickly.

Where statistical evidence suggests differences, the elasticities will be varied by region, taking account of the land use and transportation characteristics of each of the regions. The geographic scale and content of land use data available in each region will also be considered in the development of the Ds elasticities. The geographic scale for the I-PLACE3S module, and for all data provided by SACOG, will be parcel or parcel/point; for the UPLAN module and all data provided by UCD, the scale will be grid-cell, or grid-cell/point; and for the Ds travel model post-processor, the scale will be traffic analysis zone, ideally with parcel or grid-cell data available for development of the post-processor.

Each set of Ds elasticities will quantify the regionally-appropriate relationships between vehicle trips and vehicle miles travelled (VT and VMT), and - if travel data are available - transit and non-motorized travel propensity, as well as the local land use patterns expressed in terms of Ds variables (density, diversity, design, destination accessibility, transit availability, plus others if possible). In each case, primary statistical analysis will be performed to determine the relationships between regional travel and the local land use patterns.

For those regions that have not conducted recent (2000 or later) household travel surveys, the consultant will rely on the 2000 California Statewide Travel Survey (as available) and the most recent American Household Travel Survey. Where travel survey data permit, a sub-set of the survey records will be reserved for use in validating the statistical estimation. For interregional travel, consultant will use either Caltrans Statewide Travel Model and/or networks recently developed for the California High Speed Rail Authority or the statewide PECAS model. Research on Ds relationships in other areas will be included as cross references, reasonableness checks, or "fill-in" values

where local data are insufficient to do locally-based estimates. The deliverable for this task will include guidelines for assigning ranges of Ds elasticities based on region type and available land use data.

Tasks: Fehr & Peers will perform statistical analysis to estimate the Ds elasticities, work with the Expert Panel and project team to adapt the statistical analyses and results for documentation and for use in development of specific applications and modules (Task 5), and prepare a stand-alone document summarizing the analysis and findings.

Deliverable: Report documenting statistically-supported Ds values for available regional datasets.

Schedule: August 2009 through March 2010. Work on readily available datasets (e.g., SACOG) will begin early in project.

Related tasks being performed by team members:

Caltrans Most Caltrans staff participation in this task will be through the Expert Panel and Practitioner Panel. Caltrans staff will also review and comment on the deliverable for this task and track project progress.

UC Davis ICE UCD will participate in the Expert Panel and Practitioner Panel. UCD will review and comment on the deliverable, with emphasis on estimates of Ds applicable to UPLAN land use data files.

SACOG SACOG staff will participate in the Expert Panel and Practitioner Panel. SACOG will review and comment on the deliverable, with emphasis on estimates of Ds applicable to I-PLACE3S land use data files.

Cost Estimate

Work Plan for "Statewide Development of Transportation/Land Use Planning Tools"

Task	Schedule
	August 2009 - March 2010
1. Literature Review	\$30,000
2. Advisory Committees	\$20,000
3. Data Collection	\$25,000
4. Develop Ds Elasticities	\$95,000
Project Totals	\$170,000

APPENDIX
POTENTIAL TASKS FOR FUTURE YEARS FUNDING

Task 5 - Develop Ds Analysis Modules

Goal: Incorporate Ds elasticities into analysis tools for use by regional and local agencies in California in two primary forms: a) iPLACE3S/UPLAN micro-level land use/transportation analysis tools; and b) a Ds-based travel model post-processor.

Task 6 - Testing, Validation & Calibration of the Ds Analysis Modules

Goals: The reasonableness, adaptability, and ease-of-use of the Ds analysis modules will be tested and validated. Through rigorous testing, empirically based guidelines on the use of each module (I-PLACE3S, UPLAN, and Ds travel model post-processor) will be developed.

Scope: **6a) Micro-Level Analysis Tool:** SACOG and Fehr & Peers, with input and assistance from the project team, the Expert Panel, and the Practitioner Panel, will draft a test plan for the micro-level land use/transportation analysis tool. The plan will include test scenarios which vary the size and scope of proposed land use changes, with resulting estimates of changes compared to 1) reasonable expectation based on recent Ds research; and 2) regional model runs of the proposed land use changes. Testing will also verify that the results produced by the Ds algorithms and elasticities when applied independent of each software platform are replicated when they are applied within each analysis tool. From this testing, guidelines and the range of land use changes appropriate for evaluation using the parcel-level land use/transportation analysis tool will be generated. To the extent possible, these maxima and minima will be coded into the I-PLACE3S and UPLAN Ds modules as default maxima and minima in outcome VT and VMT based on empirical data representative regional high- and low-generating neighborhoods, and/or using "flag" variables (i.e. warnings if land use changes exceed the recommended range of appropriate land use changes).

6b) Ds Travel Model Post-Processor: Fehr & Peers - with input and assistance from the project team, the Expert Panel, and the Practitioner Panel - will draft a test plan for the Ds travel model post-processor. The plan will include tests which allow for assessment of the adjustment of Ds

elasticities to work for the eight case-study travel demand models with different capabilities, and for the reasonableness of the adjustments to key travel metrics. Testing will also verify that the results produced by the Ds algorithms and elasticities when applied independent of each modeling platform are replicated when, using the same data, they are applied as post-processors to each form of model. It will also equip the post-processor with controls on the upper range of land use changes appropriate for evaluation and maxima and minima for outcome VT and VMT based on data from representative regional high- and low-generating neighborhoods

Deliverables: Seven deliverables are associated with this task:

- Report summarizing test plan, test results, and guidelines for using the open source micro-level land use/transportation analysis tool.
- Test plan and results for the I-PLACE3S Ds Module.
- Test plan and results for the UPLAN Ds Module.
- Test plan and results for the Ds travel model post-processor.
- Calibrated and range-controlled versions of I-PLACE3S Ds Module.
- Calibrated and range-controlled versions of UPLAN Ds Module.
- Calibrated and range-controlled versions of the Ds travel model post-processor.

Schedule: January 2010 through March 2011. Early work will focus on the micro-level land use/transportation analysis tool.

Task 7 - Documentation, Users' Manuals, and Training

Goals: Provide clearly written users' manuals for the tools developed in this project, including describing the primary research studies and data on which they are based. Provide training to staff of MPOs/RTPAs, local agencies, and other potential users of each tool or module.

Scope: The study team will prepare a users' manual for each of the main tools/modules developed in this project. The manuals will provide a summary of the development of the Ds values for each region, along with detailed instructions and requirements to apply the tools developed in this project: the micro-level land use/transportation analysis tool, the I-PLACE3S Ds Module, the UPLAN Ds Module, and the Ds travel model post-processor. The

guidebook will also include a section about the Ds adjustments, how to apply the Ds component of the modules, and incorporating the Ds into future model improvements. It will also include appendices containing the memoranda prepared under Tasks 1 through 6. The study team will also provide up to 200 hours (60 to 80 for each team member) of training and technical assistance to regional agencies in California regarding Ds application and interpretation in planning processes.

Deliverable: Guidebook on Ds development, users guide, and technical support on application of each Ds module.

Schedule: November 2010 through June 2011.

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**Statewide Development of
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UC Davis Scope of Work**

Effective local and regional planning requires the assessment of relationships between various land use and transportation strategies to estimate the consequences potential future scenarios. Caltrans' Regional Blueprint Planning grants program funds land use and transportation scenario development and evaluation by Metropolitan Planning Organizations (MPOs) throughout California to more effectively develop and implement Regional Transportation Plans (RTPs). Recent California law (SB 375) also requires that MPOs address a set of Sustainable Communities Strategies (SCS) to meet greenhouse gas (GHG) reduction targets, and possibly Alternative Planning Strategies (APS) if the MPO cannot demonstrate that GHG reductions are likely to meet regional GHG targets based on the SCS. The Obama administration is proposing GHG reduction targets similar to California's, and is defining a national climate and energy security strategy. New national policies and programs may include land use and transportation concepts and mitigation options.

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Tasks 2-4). Analytical tools, software, and user interfaces currently in use for applying the Ds for land use/transportation planning will be improved, based on the research conducted in this project.

Specifically, this project will develop a Ds module that will bring the latest and most relevant research on land use/transportation interactions and effects of smart growth strategies into land use and transportation planning in California. It will also develop the necessary linkages between the Ds module and existing planning tools commonly used in California: UPLAN, I-PLACE³S, and post-processors to conventional travel models. The resulting Ds analysis tools will be especially useful to California's mid-size and smaller MPOs and RTPAs, which may lack the resources to develop more complex methods for integrated land use and transportation planning. It will also provide immediate improvements to planning tools used by major MPOs for developing and assessing long-term growth plans. By making this data available quickly, MPOs will be able to utilize these tools to meet the regional GHG targets established under SB 375 and potential federal laws. Plus, this effort will provide practical tools to local agencies (cities, counties, transit agencies, etc.) for their General and Specific smart-growth planning efforts.

Task "A" - Project Administration

- Scope: Administrative duties related to the contract, project schedule, deliverables, invoicing, etc.
- Tasks: SACOG will serve as administrative lead and prime contractor for this project. Fehr & Peers and UC Davis ICE will serve as sub-contractors to SACOG.

Task 1 - Literature Review

- Goal: Update/expand existing literature reviews on the Ds, and integration of existing literature as necessary for this effort.
- Scope: Perform a comprehensive review of recent literature on the topic of travel and the built environment in general and on the latest findings in correlating the Ds characteristics of development with the generation of Vehicle trips (VT), vehicle miles traveled (VMT) per household, and transit and non-motorized propensity. This review will build on the most recent compilations of relevant research, including those reported in *Growing Cooler: The Evidence on Urban Development and Climate Change*, the national EPA study on *Travel Generation by Mixed-Use Development*, and if completed in time

for this study, the research conducted for the Caltrans/ UC Davis *Smart Growth Land Use Projects Trip Rates Spreadsheet* (see also Task 0).

Tasks: UC Davis ICE will assist Fehr & Peers who will lead this task, and perform the majority of work. Other project team partners (Caltrans, and SACOG) will assist, advise, and review deliverables.

Deliverable: The primary findings of the research literature as a whole will be summarized in the form of a report chapter or appendix of the final report on *"Planning Tools for Local and Regional Smart Growth Efforts"*.

Schedule: August - October 2009

Task 0 - "Smart Growth Land Use Projects Trip Rates Spreadsheet" Caltrans/UC Davis (Susan Handy & Richard Lee)

Goal: Coordinate with this separate but related Caltrans-funded project, exchange information and data, and maximize the value and use of research and data assembled.

Scope: The Handy/Lee project expected to begin August 2009 via separate funding, with an extensive literature search/evaluation completed (re: site-specific land uses) by Fall 2009. A meeting or teleconference will be scheduled at the beginning of this project (expected August 2009) to identify key opportunities for coordinated research and information exchange.

Tasks: Caltrans will lead this task and facilitate the initial meeting.

Deliverable: Caltrans staff will provide summary notes of the meeting.

Task 2 - Advisory Committees

Goal: Engage national/ California experts and members of existing planning tools users group in guidance and key decisions on development of Ds elasticities and planning tools.

Scope: The study will be guided and reviewed by two types of experts who will advise the study team on the ultimate selection of Ds elasticities and module capabilities for the planning tools.

Task 2a

Scope: Expert Panel - Between three and five academics and other experts in land use/ transportation. The Expert Panel will focus on the review and advice on the development of robust, statistically valid Ds elasticities, and the extent to which the elasticities vary randomly or by geographic type of region. The Panel will provide input, review, and consensus regarding best use of available research and data. The panel of California and national experts on travel forecasting and the research relationships between travel and the built environment will help define methods and model evaluation criteria and to select benchmarks for validation criteria and elasticity values. A possible alternative to conducting multiple meetings would be to conduct one meeting/ conference call, and to reach agreement on recommendations through a Delphi panel process with the experts group.

Tasks: UC Davis ICE will attend each meeting during the course of the study.

Deliverable: N/A

Schedule: August 2009 through March 2010
One meeting will be held during the course of the study. Identification and recruitment of panelists will begin in August 2009. Phase 2, when funded, will have 1-3 additional meetings.

Related tasks being performed by team members:

Caltrans Caltrans project manager will document the meeting, and have final authority on the composition of the Panel.

Fehr & Peers Fehr & Peers will convene and facilitate the meeting, handle all logistical details related to the meetings, will provide webinar service, and will attend the meeting.

SACOG Staff will attend the meeting and will provide the meeting room for the meetings.

Task 2b

Scope: Practitioners Panel(s) - Members: Staff of interested COGs, MPOs, local agencies, consultants, etc. The Practitioner Panel(s) will provide technical

input regarding the uses and operations of iPLACE3S/UPLAN Ds modules and analysis tools, as well as on the Ds travel model post-processor. Because these panels will be focused on modules and applications, separate panels may be set up for the I-PLACE3S/UPLAN Ds module, and the Ds travel model post-processor. The first meeting will be available in-person. Subsequent meetings will take place via webinar or teleconference, and may be divided into sub-group sessions targeted to user groups with different experience levels and needs. For example, some of the webinars may be oriented toward representatives of the largest MPOs, others to mid-size MPOs with similar planning processes (such as the San Joaquin Valley counties), and others to small rural counties. Accounting for the possibility of sub-group sessions, the study will include up to eight webinars/teleconferences during the course of the study in addition to the one in-person meeting.

Tasks: UCD staff will attend each panel meeting related to I-PLACE3S and/or UPLAN during the course of the study.

Schedule: August 2009 through March 2010 with 2 meetings/webinars. Phase 2, when funded, will have additional meetings.

Related tasks being performed by team members:

Caltrans The panel(s) will be convened and facilitated and the meetings will be documented by Caltrans' project manager.

Fehr & Peers Fehr & Peers will attend each panel meeting, and will provide webinar services.

SACOG SACOG staff will attend each panel meeting related to I-PLACE3S and/or UPLAN, and will provide the meeting room for the first meeting.

Task 3 - Data Collection

Goal: Gather, compile, and assess travel survey, land use, transportation system, and other data necessary to develop a set of Ds elasticities for a representative cross-section of regions in California. All data will be drawn from existing surveys and datasets, much of which was originally compiled by Fehr & Peers and UC Davis —no new surveys or primary data compilation will be conducted as part of this project.

Scope: The representative cross-section of regions will include two MPOs/RTPAs. Four classes of regions will be requested in the complete project (Phase 1 plus Phase 2, when funded). Eight regions are envisioned to be included, if the entire project is funded. The four classes include: a) two of the four major metropolitan areas (SCAG, MTC/ABAG, SANDAG, SACOG), b) the San Joaquin Valley, c) Coastal areas, and d) smaller rural MPOs. At least two of the eight exemplars will be from Southern California, at least two from Central California, and at least two from Northern California. In order to provide sufficient data for smaller MPOs/RTPAs, data may be aggregated from counties within the subject MPO/RTPA and other counties of similar size and urban form. (For example, if Fresno COG were chosen as the case study for San Joaquin Valley MPOs, travel survey data for the case study might include data from Madera, Merced, Tulare and Stanislaus counties as well as Fresno County.) The project team's prior work with the regions and the use of data from that prior work will enhance the quality of the analysis and will allow the data to be available for planning to meet the GHG emissions standards imposed under SB 375 or new federal law. The desired data are: 1) household travel surveys with detailed land use and transportation system data already attached to activity locations; 2) household travel surveys with sufficient locational detail for activities to attach detailed land use and transportation system data; 3) detailed land use data with location or geo-referencing sufficient to be attached to household travel survey locations; and 4) key transportation system data, such as transit station/stop locations, service alignments, frequencies of service, street pattern and pedestrian amenity data, etc.

Tasks: UCD will provide existing land use data in 50-meter grid cells or equivalent spatial resolution for the 22 counties currently using UPLAN models. The county data will be clustered into six sub-sets, each representing one of the six MPOs selected as case study exemplars. For example, 22 counties' data may be allocated to groupings representative of the following six MPOs: Fresno, Shasta, Amador, Mendocino, San Luis Obispo, and Kern. UC Davis will also provide future land use data for each grid cell for each county's Blueprint baseline scenario and Blueprint forecast year (as available). UC Davis staff will be the primary point of contact with MPO and RTPA GIS and modeling staff responsible for defining the data needs, and for supporting the regional staff as needed to obtain the specified data. Data for each grid cell will include: dwelling units, population, household size, household auto

ownership, residential acres, employment acres, retail employment, service employment, office/industrial employment, public/institutional employment, number of roadway intersections, number of bus stops, number of rail stations. UC Davis ICE will also assist Fehr & Peers in recruitment of MPOs/RTPAs in providing data.

Deliverable: Draft integrated dataset combining travel survey, land use, and transportation system for two representative MPOs/RTPAs.

Schedule: August 2009 through March 2010

Related tasks being performed by team members:

Fehr & Peers Fehr & Peers will coordinate the efforts at recruiting MPOs/RTPAs, and will take the lead in assembling, integrating and assessing the needed datasets. F&P will also take the lead in assembling available data from SANDAG, SCAG, and/or MTC/ABAG, if one or two are selected as exemplar regions.

SACOG The Year 2000 household travel survey has SACOG's parcel level land use data already attached, and significant analysis of Ds relationships has already been performed. SACOG will provide all of its existing datasets for use in this project. SACOG will also assist Fehr & Peers in recruitment of MPOs/RTPAs in providing data.

Caltrans Caltrans will provide access to available year 2000 Statewide Travel Survey datasets, and will assist Fehr & Peers in acquiring land use and travel survey datasets, especially from MPOs/RTPAs which did augmented travel surveys in Year 2000 based on the Statewide travel survey.

Task 4 - Develop Ds Elasticities

Goal: Develop Ds elasticities for two representative regions of California. Ds elasticities are: statistically-estimated coefficients which specify the range of changes or differences in key travel behaviors, based on changes or differences in the land use or land use/transportation characteristics of the place of residence or activity locations of the traveler. Validate the Ds elasticities through rigorous statistical testing and reasonableness checks.

Scope: The Ds elasticities will be estimated using the data collected for this project (Task 3), checked for reasonableness, and potentially calibrated using the literature review (Task 1), with input and review by the Expert Panel (Task 2). The Fehr & Peers staff, having extensive experience in developing Ds elasticities in many regions, including SACOG's region, is in a unique position to develop the necessary Ds elasticities efficiently and quickly.

Where statistical evidence suggests differences, the elasticities will be varied by region, taking account of the land use and transportation characteristics of each of the regions. The geographic scale and content of land use data available in each region will also be considered in the development of the Ds elasticities. The geographic scale for the I-PLACE3S module, and for all data provided by SACOG, will be parcel or parcel/point; for the UPLAN module and all data provided by UCD, the scale will be grid-cell, or grid-cell/point; and for the Ds travel model post-processor, the scale will be traffic analysis zone, ideally with parcel or grid-cell data available for development of the post-processor.

Each set of Ds elasticities will quantify the regionally-appropriate relationships between vehicle trips and vehicle miles travelled (VT and VMT), and - if travel data are available - transit and non-motorized travel propensity, as well as the local land use patterns expressed in terms of Ds variables (density, diversity, design, destination accessibility, transit availability, plus others if possible). In each case, primary statistical analysis will be performed to determine the relationships between regional travel and the local land use patterns.

For those regions that have not conducted recent (2000 or later) household travel surveys, the consultant will rely on the 2000 California Statewide Travel Survey (as available) and the most recent American Household Travel Survey. Where travel survey data permit, a sub-set of the survey records will be reserved for use in validating the statistical estimation. For interregional travel, consultant will use either Caltrans Statewide Travel Model and/or networks recently developed for the California High Speed Rail Authority or the statewide PECAS model. Research on Ds relationships in other areas will be included as cross references, reasonableness checks, or "fill-in" values where local data are insufficient to do locally-based estimates. The deliverable for this task will include guidelines for assigning ranges of Ds elasticities based on region type and available land use data.

Tasks: UCD will participate in the Expert Panel and Practitioner Panel. UCD will review and comment on the deliverable, with emphasis on estimates of Ds applicable to UPLAN land use data files.

Deliverable: Report documenting statistically-supported Ds values for available regional datasets.

Schedule: August 2009 through March 2010. Work on readily available datasets (e.g., SACOG) will begin early in project.

Related tasks being performed by team members:

Fehr & Peers Fehr & Peers will perform statistical analysis to estimate the Ds elasticities, work with the Expert Panel and project team to adapt the statistical analyses and results for documentation and for use in development of specific applications and modules (Task 5), and prepare a stand-alone document summarizing the analysis and findings.

Caltrans Most Caltrans staff participation in this task will be through the Expert Panel and Practitioner Panel. Caltrans staff will also review and comment on the deliverable for this task and track project progress.

SACOG SACOG staff will participate in the Expert Panel and Practitioner Panel. SACOG will review and comment on the deliverable, with emphasis on estimates of Ds applicable to I-PLACE3S land use data files.

Cost Estimate

Work Plan for "Statewide Development of Transportation/Land Use Planning Tools"

Task	Schedule
	August 2009 - March 2010
1. Literature Review	\$1,000
2. Advisory Committees	\$2,000
3. Data Collection	\$62,000
4. Develop Ds Elasticities	\$500
Project Totals	\$65,500

APPENDIX
POTENTIAL TASKS FOR FUTURE YEARS FUNDING

Task 5 - Develop Ds Analysis Modules

Goal: Incorporate Ds elasticities into analysis tools for use by regional and local agencies in California in two primary forms: a) iPLACE3S/UPLAN micro-level land use/transportation analysis tools; and b) a Ds-based travel model post-processor.

Task 6 - Testing, Validation & Calibration of the Ds Analysis Modules

Goals: The reasonableness, adaptability, and ease-of-use of the Ds analysis modules will be tested and validated. Through rigorous testing, empirically based guidelines on the use of each module (I-PLACE3S, UPLAN, and Ds travel model post-processor) will be developed.

Scope: **6a) Micro-Level Analysis Tool:** SACOG and Fehr & Peers, with input and assistance from the project team, the Expert Panel, and the Practitioner Panel, will draft a test plan for the micro-level land use/transportation analysis tool. The plan will include test scenarios which vary the size and scope of proposed land use changes, with resulting estimates of changes compared to 1) reasonable expectation based on recent Ds research; and 2) regional model runs of the proposed land use changes. Testing will also verify that the results produced by the Ds algorithms and elasticities when applied independent of each software platform are replicated when they are applied within each analysis tool. From this testing, guidelines and the range of land use changes appropriate for evaluation using the parcel-level land use/transportation analysis tool will be generated. To the extent possible, these maxima and minima will be coded into the I-PLACE3S and UPLAN Ds modules as default maxima and minima in outcome VT and VMT based on empirical data representative regional high- and low-generating neighborhoods, and/or using "flag" variables (i.e. warnings if land use changes exceed the recommended range of appropriate land use changes).

6b) Ds Travel Model Post-Processor: Fehr & Peers - with input and assistance from the project team, the Expert Panel, and the Practitioner Panel - will draft a test plan for the Ds travel model post-processor. The plan will include tests which allow for assessment of the adjustment of Ds

elasticities to work for the eight case-study travel demand models with different capabilities, and for the reasonableness of the adjustments to key travel metrics. Testing will also verify that the results produced by the Ds algorithms and elasticities when applied independent of each modeling platform are replicated when, using the same data, they are applied as post-processors to each form of model. It will also equip the post-processor with controls on the upper range of land use changes appropriate for evaluation and maxima and minima for outcome VT and VMT based on data from representative regional high- and low-generating neighborhoods

Deliverables: Seven deliverables are associated with this task:

- Report summarizing test plan, test results, and guidelines for using the open source micro-level land use/transportation analysis tool.
- Test plan and results for the I-PLACE3S Ds Module.
- Test plan and results for the UPLAN Ds Module.
- Test plan and results for the Ds travel model post-processor.
- Calibrated and range-controlled versions of I-PLACE3S Ds Module.
- Calibrated and range-controlled versions of UPLAN Ds Module.
- Calibrated and range-controlled versions of the Ds travel model post-processor.

Schedule: January 2010 through March 2011. Early work will focus on the micro-level land use/transportation analysis tool.

Task 7 - Documentation, Users' Manuals, and Training

Goals: Provide clearly written users' manuals for the tools developed in this project, including describing the primary research studies and data on which they are based. Provide training to staff of MPOs/RTPAs, local agencies, and other potential users of each tool or module.

Scope: The study team will prepare a users' manual for each of the main tools/modules developed in this project. The manuals will provide a summary of the development of the Ds values for each region, along with detailed instructions and requirements to apply the tools developed in this project: the micro-level land use/transportation analysis tool, the I-PLACE3S Ds Module, the UPLAN Ds Module, and the Ds travel model post-processor. The

guidebook will also include a section about the Ds adjustments, how to apply the Ds component of the modules, and incorporating the Ds into future model improvements. It will also include appendices containing the memoranda prepared under Tasks 1 through 6. The study team will also provide up to 200 hours (60 to 80 for each team member) of training and technical assistance to regional agencies in California regarding Ds application and interpretation in planning processes.

Deliverable: Guidebook on Ds development, users guide, and technical support on application of each Ds module.

Schedule: November 2010 through June 2011.

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